

## High Current, High Speed LDO Regulators, Voltage Detector Function

## ■ GENERAL DESCRIPTION

The XC6403/04 series are highly precise, low noise, high current, positive voltage low dropout regulators with built-in voltage detector. They are fabricated using Torex's CMOS process. Performance features of the series includes high ripple rejection and low dropout voltage, and the series features a voltage reference, an error amplifier, a current limiter and a phase compensation circuit plus a driver transistor.

Detect voltage is selectable in 100mV increments within the range of 0.9V to 5.6V and the LDO output voltage is selectable within a range of 0.9V to 5.6V (XC6403) 0.9V to 5.1V (XC6404), also in 100mV increments. The series is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series. The current limiter's foldback circuit also operates as a short circuit protection for the output current limiter and the output pin. The series provides options to the user to select from a variety of circuit features, such as detector monitoring, detector output logic, CE and EN pin input logic, internal pull-up / down resistance, and power ready. The IC's internal regulator circuit can be placed in stand-by mode via the EN function (XC6403/04 A to C series). The whole IC can be put in to stand-by mode via the CE function with the XC6403/04D series (semi-custom). In the stand-by mode, power consumption is greatly reduced. The XC6403/04A and B series features the toggle operation function. The regulator output can be OFF when the XC6403/04B series detects voltage (semi-custom). The XC6403/04E series can monitor another power source by using the VSEN pin (semi-custom). The XC6403/04F series can delay the detector output: the delay time can be controlled by the use of an external capacitor (semi-custom).

## ■ APPLICATIONS

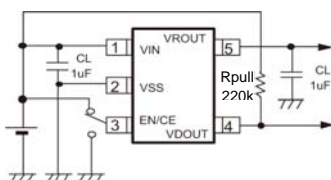
- CD-ROM, CD-R / RW drive
- DVD drive
- HDD drive
- Cameras, Video recorders
- Portable AV equipment
- Battery powered equipment

## ■ FEATURES

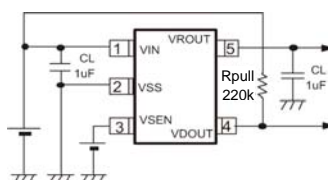
|                                     |                                                                                                                                                               |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maximum Output Current</b>       | : More than 300mA (380mA limit)<br>( $1.8 \leq V_{ROUT} \leq 5.3V$ ) [XC6403]<br>More than 500mA (600mA limit)<br>( $2.5V \leq V_{ROUT} \leq 4.9V$ ) [XC6404] |
| <b>Dropout Voltage</b>              | : 200mV @ 100mA                                                                                                                                               |
| <b>Operating Voltage Range</b>      | : 2.0V ~ 6.0V                                                                                                                                                 |
| <b>VR Output Voltage</b>            | : 0.9V ~ 5.6V [XC6403]<br>0.9V ~ 5.1V [XC6404]                                                                                                                |
| <b>Detect Voltage</b>               | : 0.9V ~ 5.5V ( $\pm 2\%$ )<br>More than 2.0V ( $V_{IN}$ sensing)                                                                                             |
| <b>VR.VD Temp. Coefficient</b>      | : $\pm 100\text{ppm}/^\circ\text{C}$ (TYP.)                                                                                                                   |
| <b>Low Power Consumption</b>        | : 35 $\mu\text{A}$ (TYP.)                                                                                                                                     |
| <b>High Ripple Rejection</b>        | : 65dB @ 10kHz                                                                                                                                                |
| <b>Highly Accurate</b>              | : $\pm 2\%$                                                                                                                                                   |
| <b>Operating Temperature</b>        | : - 40 ~ 85 $^\circ\text{C}$                                                                                                                                  |
| <b>Low ESR Capacitor Compatible</b> |                                                                                                                                                               |
| <b>Ultra Small Packages</b>         | : SOT-25<br>SOT-89-5<br>USP-6B                                                                                                                                |

**Environmentally Friendly**: EU RoHS Compliant, Pb Free

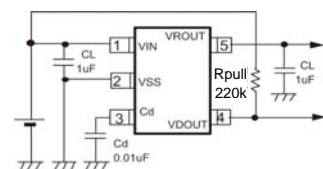
## ■ TYPICAL APPLICATION CIRCUITS



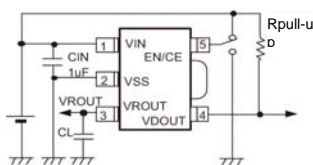
XC6403A ~ D Series



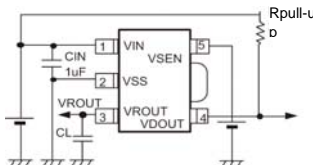
XC6403E Series



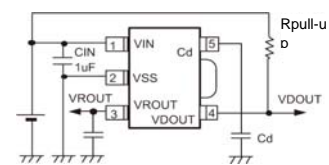
XC6403F Series



XC6404A ~ D Series



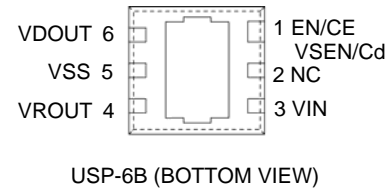
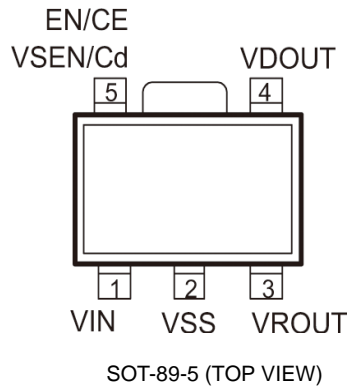
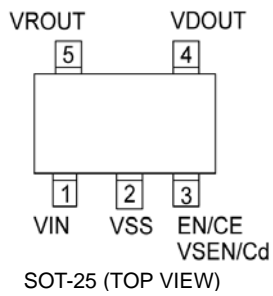
XC6404E Series



XC6404F Series

# XC6403/XC6404 Series

## PIN CONFIGURATION



## PIN ASSIGNMENT

| PIN NUMBER |          |        | PIN NAME | FUNCTION                   |
|------------|----------|--------|----------|----------------------------|
| SOT-25     | SOT-89-5 | USP-6B |          |                            |
| 1          | 1        | 3      | VIN      | Power Input                |
| 2          | 2        | 5      | VSS      | Ground                     |
| 3          | 5        | 1      | EN       | VR ON / OFF Control        |
| 3          | 5        | 1      | CE       | ON / OFF Control           |
| 3          | 5        | 1      | VSEN     | VD Monitoring              |
| 3          | 5        | 1      | Cd       | Delay Capacitor Connection |
| 4          | 4        | 6      | VDOUT    | VD Output                  |
| 5          | 3        | 4      | VROUT    | VR Output                  |
| -          | -        | 2      | NC       | No connection              |

\*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release. If the pad needs to be connected to other pins, it should be connected to the Vss pin.

## PRODUCT CLASSIFICATION

### ● Selection Guide

#### 1. TOGGLE FUNCTION, VD SELF-SATURATION AS OPTION

| SERIES         | TOGGLE FUNCTION (BUILT-IN)                  |
|----------------|---------------------------------------------|
| XC6403/04A     | VD with Toggle Function                     |
| XC6403/04B     | VD with Toggle Function and Self-Saturation |
| XC6403/04C ~ F | VD with No Toggle Function                  |

#### 2. STAND-BY MODE FUNCTION AS OPTION

| SERIES         | STAND-BY MODE FUNCTION         |
|----------------|--------------------------------|
| XC6403/04A ~ C | VR with Stand-By Mode Function |
| XC6403/04D     | Chip Stand-By Mode Function    |
| XC6403/04E, F  | No Stand-By Mode Function      |

#### 3. CE / EN INPUT LOGIC, INTERNAL PULL-UP/DOWN AS OPTION (\*A ~ D Series)

| SERIES            | CE INPUT LOGIC                |
|-------------------|-------------------------------|
| XC6403/04 * A ~ D | High Active with Pull Down    |
| XC6403/04 * E ~ K | High Active with No Pull Down |
| XC6403/04 * L ~ P | Low Active with Pull Up       |
| XC6403/04 * R ~ U | Low Active with No Pull Up    |

#### 4. VD SENSE AS OPTION (\*A ~ D and F Series)

| SERIES                                   | VD SENSE PIN |
|------------------------------------------|--------------|
| XC6403/04 * A, B, E, F, L, M, R, S, V, X | VIN          |
| XC6403/04 * C, D, H, K, N, P, T, U, Y, Z | VOUT         |
| XC6403/04 E V ~ Z                        | VSEN         |

#### 5. VD OUTPUT LOGIC AS OPTION

| SERIES         | VD OUTPUT LOGIC FUNCTION |
|----------------|--------------------------|
| XC6403/04A ~ F | Detect L or Detect H     |

#### 6. VD DELAY FUNCTION AS OPTION

| SERIES         | DELAY FUNCTION                         |
|----------------|----------------------------------------|
| XC6403/04A ~ E | No Delay                               |
| XC6403/04F     | Delay Time Adjustable by Connecting Cd |

## ■ PRODUCT CLASSIFICATION (Continued)

### ● Ordering Information

XC6403/XC6404 ①②③④⑤⑥-⑦<sup>(\*)</sup>

| DESIGNATOR | DESCRIPTION                         | SYMBOL | DESCRIPTION                                                                                                                                                                                                                                                          |
|------------|-------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①          | Operational Function                | A      | Toggle and EN function (preliminary)                                                                                                                                                                                                                                 |
|            |                                     | B      | Toggle, EN function, VD signal/VR OFF function (preliminary)                                                                                                                                                                                                         |
|            |                                     | C      | EN function                                                                                                                                                                                                                                                          |
|            |                                     | D      | CE function                                                                                                                                                                                                                                                          |
|            |                                     | E      | VSEN Pin                                                                                                                                                                                                                                                             |
|            |                                     | F      | Cd pin                                                                                                                                                                                                                                                               |
| ②          | Type of Regulator                   | -      | As in the chart below.                                                                                                                                                                                                                                               |
| ③④         | Output Voltage & Detect Voltage     | -      | Internally set sequential number relating to output voltage and detect voltage (refer to the chart below)<br>VR setting output voltage range: 0.9V~5.6V [XC6403]<br>0.9V~5.1V [XC6404]<br>Detect voltage setting range: 0.9V ~5.5V<br>100mV increments are available |
| ⑤⑥-⑦       | Packages Taping Type <sup>(*)</sup> | MR     | SOT-25                                                                                                                                                                                                                                                               |
|            |                                     | MR-G   | SOT-25                                                                                                                                                                                                                                                               |
|            |                                     | PR     | SOT-89-5                                                                                                                                                                                                                                                             |
|            |                                     | PR-G   | SOT-89-5                                                                                                                                                                                                                                                             |
|            |                                     | DR     | USP-6B                                                                                                                                                                                                                                                               |
|            |                                     | DR-G   | USP-6B                                                                                                                                                                                                                                                               |

<sup>(\*)</sup> The "-G" suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

<sup>(2)</sup> The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ⑤R-⑦, Reverse orientation: ⑤L-⑦)

### PIN NUMBER : ② Types

| ② | EN / CE FUNCTION | EN / CE LOGIC | PULL UP/DOWN RESISTANCE | VD SENSE PIN | VD OUTPUT LOGIC | PIN NUMBER①  |
|---|------------------|---------------|-------------------------|--------------|-----------------|--------------|
| A | Function         | High Active   | Pull-down Function      | VIN          | Detect L        | A ~ D Series |
| B | Function         | High Active   | Pull-down Function      | VIN          | Detect H        |              |
| C | Function         | High Active   | Pull-down Function      | VROUT        | Detect L        |              |
| D | Function         | High Active   | Pull-down Function      | VROUT        | Detect H        |              |
| E | Function         | High Active   | Nonfunctional           | VIN          | Detect L        |              |
| F | Function         | High Active   | Nonfunctional           | VIN          | Detect H        |              |
| H | Function         | High Active   | Nonfunctional           | VROUT        | Detect L        |              |
| K | Function         | High Active   | Nonfunctional           | VROUT        | Detect H        |              |
| L | Function         | Low Active    | Pull-up Function        | VIN          | Detect L        |              |
| M | Function         | Low Active    | Pull-up Function        | VIN          | Detect H        |              |
| N | Function         | Low Active    | Pull-up Function        | VROUT        | Detect L        |              |
| P | Function         | Low Active    | Pull-up Function        | VROUT        | Detect H        |              |
| R | Function         | Low Active    | Nonfunctional           | VIN          | Detect L        |              |
| S | Function         | Low Active    | Nonfunctional           | VIN          | Detect H        |              |
| T | Function         | Low Active    | Nonfunctional           | VROUT        | Detect L        |              |
| U | Function         | Low Active    | Nonfunctional           | VROUT        | Detect H        |              |
| V | Nonfunctional    | -             | -                       | VIN / VSEN   | Detect L        | E & F Series |
| X | Nonfunctional    | -             | -                       | VIN / VSEN   | Detect H        |              |
| Y | Nonfunctional    | -             | -                       | VROUT        | Detect L        | F Series     |
| Z | Nonfunctional    | -             | -                       | VROUT        | Detect H        |              |

\*The XC6403/04A and XC6403/04B series are under development. For further detail, please ask your sales contacts.

## ■ PRODUCT CLASSIFICATION (Continued)

### ● Ordering Information (Continued)

● Pin Number    ③, ④ Type    (80 ~ 99 : Standard voltage products)

### ● XC6403 Series

| ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT |
|----|-------|-------|----|-------|-------|----|-------|-------|----|-------|-------|
| 01 | 1.80  | 2.40  | 21 | 3.30  | 3.10  | -  | -     | -     | 80 | 1.80  | 1.60  |
| 02 | 1.80  | 2.90  | 22 | 2.80  | 3.10  | -  | -     | -     | 81 | 2.80  | 3.10  |
| 03 | 1.60  | 1.80  | 23 | -     | -     | -  | -     | -     | 82 | 1.80  | 2.00  |
| 04 | 1.80  | 2.00  | 24 | 1.80  | 2.40  | -  | -     | -     | 83 | 2.50  | 2.80  |
| 05 | 3.00  | 3.30  | 25 | 3.20  | 2.80  | -  | -     | -     | 84 | 2.85  | 3.20  |
| 06 | 1.80  | 2.40  | 26 | -     | -     | -  | -     | -     | 85 | 3.00  | 3.30  |
| 07 | 1.80  | 2.90  | 27 | -     | -     | -  | -     | -     | 86 | 3.50  | 3.80  |
| 08 | 1.80  | 2.00  | 28 | -     | -     | -  | -     | -     | 87 | 3.00  | 4.20  |
| 09 | 3.00  | 3.30  | 29 | -     | -     | -  | -     | -     | 88 | 3.30  | 4.00  |
| 10 | 2.80  | 3.10  | 30 | 4.00  | 4.30  | -  | -     | -     | 89 | -     | -     |
| 11 | 1.80  | 1.70  | 31 | 2.85  | 2.70  | -  | -     | -     | 90 | -     | -     |
| 12 | 3.00  | 4.20  | 32 | 2.60  | 2.40  | -  | -     | -     | 91 | -     | -     |
| 13 | 1.80  | 3.00  | 33 | 2.70  | 2.80  | -  | -     | -     | 92 | -     | -     |
| 14 | 1.80  | 3.00  | 34 | 2.85  | 2.55  | -  | -     | -     | 93 | -     | -     |
| 15 | 1.80  | 2.40  | 35 | -     | -     | -  | -     | -     | 94 | -     | -     |
| 16 | 2.50  | 2.90  | 36 | -     | -     | -  | -     | -     | 95 | -     | -     |
| 17 | 1.80  | 2.30  | 37 | -     | -     | -  | -     | -     | 96 | -     | -     |
| 18 | 2.80  | 3.40  | 38 | -     | -     | -  | -     | -     | 97 | -     | -     |
| 19 | -     | -     | 39 | -     | -     | -  | -     | -     | 98 | -     | -     |
| 20 | 3.30  | 3.00  | 40 | -     | --    | -  | -     | -     | 99 | -     | -     |

34 : Hysteresis Range 3.0% (TYP.) for an error flag  
 For the other voltages, please ask your sales contacts.

### ● XC6404 Series

| ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT | ③④ | VROUT | VDOUT |
|----|-------|-------|----|-------|-------|----|-------|-------|----|-------|-------|
| 01 | 2.70  | 4.20  | 21 | 1.80  | 3.60  | -  | -     | -     | 80 | 1.80  | 1.60  |
| 02 | 2.70  | 4.20  | 22 | 1.80  | 4.20  | -  | -     | -     | 81 | 2.80  | 3.10  |
| 03 | 2.50  | 2.60  | 23 | 2.50  | 2.90  | -  | -     | -     | 82 | 1.80  | 2.00  |
| 04 | 3.30  | 4.30  | 24 | 2.50  | 3.60  | -  | -     | -     | 83 | 2.50  | 2.80  |
| 05 | 3.30  | 4.40  | 25 | 2.50  | 4.20  | -  | -     | -     | 84 | 2.85  | 3.20  |
| 06 | 3.30  | 4.00  | 26 | 4.30  | 4.00  | -  | -     | -     | 85 | 3.00  | 3.30  |
| 07 | 3.30  | 5.20  | 27 | 2.50  | 3.90  | -  | -     | -     | 86 | 3.50  | 3.80  |
| 08 | 2.80  | 4.30  | 28 | 3.30  | 3.70  | -  | -     | -     | 87 | 3.00  | 4.20  |
| 09 | 4.30  | 2.80  | 29 | 2.60  | 3.90  | -  | -     | -     | 88 | 3.30  | 4.00  |
| 10 | 3.30  | 3.60  | 30 | 3.30  | 4.20  | -  | -     | -     | 89 | -     | -     |
| 11 | 2.80  | 2.10  | 31 | 3.30  | 4.50  | -  | -     | -     | 90 | -     | -     |
| 12 | 2.80  | 2.80  | 32 | 2.85  | 2.60  | -  | -     | -     | 91 | -     | -     |
| 13 | 3.30  | 3.60  | 33 | 3.30  | 2.80  | -  | -     | -     | 92 | -     | -     |
| 14 | 3.30  | 3.60  | 34 | 3.40  | 4.20  | -  | -     | -     | 93 | -     | -     |
| 15 | 3.30  | 3.60  | 35 | -     | -     | -  | -     | -     | 94 | -     | -     |
| 16 | 3.00  | 2.70  | 36 | -     | -     | -  | -     | -     | 95 | -     | -     |
| 17 | 2.80  | 2.50  | 37 | -     | -     | -  | -     | -     | 96 | -     | -     |
| 18 | 3.00  | 2.70  | 38 | -     | -     | -  | -     | -     | 97 | -     | -     |
| 19 | 2.80  | 2.50  | 39 | -     | -     | -  | -     | -     | 98 | -     | -     |
| 20 | 1.80  | 2.90  | 40 | -     | -     | -  | -     | -     | 99 | -     | -     |

For the other voltages, please ask your sales contacts.

## ■ PRODUCT CLASSIFICATION (Continued)

● Ordering Example (Standard Products)

| PRODUCT NAME    | PRODUCT DESCRIPTION                                         | VOLTAGE           |                   |
|-----------------|-------------------------------------------------------------|-------------------|-------------------|
|                 |                                                             | V <sub>ROUT</sub> | V <sub>DOUT</sub> |
| XC6403/04CH80MR | EN Function, High Active, V <sub>ROUT</sub> Sense, Detect L | 1.80              | 1.60              |
| XC6403/04CE81MR | EN Function, High Active, V <sub>IN</sub> Sense, Detect L   | 2.80              | 3.10              |
| XC6403/04DE82MR | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 1.80              | 2.00              |
| XC6403/04DE83MR | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 2.50              | 2.80              |
| XC6403/04DE84MR | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 2.85              | 3.20              |
| XC6403/04DE85MR | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 3.00              | 3.30              |
| XC6403/04DE86MR | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 3.50              | 3.80              |
| XC6403/04FV87MR | Cd Function, V <sub>IN</sub> Sense, Detect L                | 3.00              | 4.20              |
| XC6403/04FV88MR | Cd Function, V <sub>IN</sub> Sense, Detect L                | 3.30              | 4.00              |
| XC6404DE89MR    | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 1.20              | 2.00              |
| XC6404DE90MR    | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 1.30              | 2.00              |
| XC6404DE91MR    | CE Function, High Active, V <sub>IN</sub> Sense, Detect L   | 1.50              | 2.00              |

## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                              |          | SYMBOL                                     | RATINGS                                      | UNITS |
|--------------------------------------------------------|----------|--------------------------------------------|----------------------------------------------|-------|
| Input Voltage                                          |          | V <sub>IN</sub>                            | 7.0                                          | V     |
| VR Output Current                                      |          | V <sub>R</sub> OUT                         | 700                                          | mA    |
| VR Output Voltage                                      |          | V <sub>R</sub> OUT                         | V <sub>SS</sub> -0.3 ~ V <sub>IN</sub> + 0.3 | V     |
| VD Output Current                                      |          | V <sub>D</sub> OUT                         | 50                                           | mA    |
| VD Output Voltage                                      |          | V <sub>D</sub> OUT                         | V <sub>SS</sub> -0.3 ~ 7.0                   | V     |
| V <sub>CE</sub> / V <sub>SEN</sub> / Cd<br>Pin Voltage |          | V <sub>CE</sub> /<br>V <sub>SEN</sub> / Cd | V <sub>SS</sub> -0.3 ~ V <sub>IN</sub> + 0.3 | V     |
| Power Dissipation                                      | SOT-25   | P <sub>d</sub>                             | 250                                          | mW    |
|                                                        | SOT-89-5 |                                            | 500                                          |       |
|                                                        | USP-6B   |                                            | 100                                          |       |
| Operating Temperature Range                            |          | T <sub>opr</sub>                           | - 40 ~ + 85                                  | °C    |
| Storage Temperature Range                              |          | T <sub>stg</sub>                           | - 55 ~ + 125                                 | °C    |

## ■ ELECTRICAL CHARACTERISTICS

XC6403/04 Series

T<sub>a</sub>=25°C

|                                          | PARAMETER                                           | SYMBOL                                                                                                  | CONDITIONS                                                                                                                                                                                                                                                                                 | MIN.   | TYP.                  | MAX.   | UNITS    | CIRCUIT |
|------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------|--------|----------|---------|
| VOLTAGE REGULATOR                        | Output Voltage (*2, 3)                              | V <sub>R</sub> OUT(E)                                                                                   | I <sub>R</sub> OUT=30mA                                                                                                                                                                                                                                                                    | × 0.98 | V <sub>R</sub> OUT(T) | × 1.02 | V        | ①       |
|                                          | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>R</sub> OUTMAX                                                                                   | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                                                                     | 150    | -                     | -      | mA       | ①       |
|                                          | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>R</sub> OUTMAX                                                                                   | V <sub>IN</sub> =3.1V @ V <sub>R</sub> OUT ≤ 2.1V                                                                                                                                                                                                                                          | 300    | -                     | -      | mA       | ①       |
|                                          | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>R</sub> OUTMAX                                                                                   | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+2.0V                                                                                                                                                                                                                                                | 400    | -                     | -      | mA       | ①       |
|                                          | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>R</sub> OUTMAX                                                                                   | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+2.0V<br>When V <sub>R</sub> OUT(T) ≥ 4.0V, V <sub>IN</sub> =6.0V                                                                                                                                                                                    | 500    | -                     | -      | mA       | ①       |
|                                          | Load Regulation                                     | ΔV <sub>R</sub> OUT                                                                                     | 1mA ≤ I <sub>R</sub> OUT ≤ 100mA                                                                                                                                                                                                                                                           | -      | 15                    | 50     | mV       | ①       |
|                                          | Dropout Voltage (*4)                                | V <sub>dif1</sub>                                                                                       | I <sub>R</sub> OUT=30mA                                                                                                                                                                                                                                                                    | E-1    |                       |        | mV       | ①       |
|                                          |                                                     | V <sub>dif2</sub>                                                                                       | I <sub>R</sub> OUT=100mA                                                                                                                                                                                                                                                                   | E-2    |                       |        | mV       | ①       |
|                                          | Supply Current<br>(No Pull-up Resistor)             | I <sub>DD</sub>                                                                                         | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+1.0V,<br>V <sub>EN</sub> /CE=ON V <sub>R</sub> OUT ≤ 0.9V,<br>V <sub>IN</sub> =2.0V, V <sub>EN</sub> /CE =V <sub>IN</sub> or V <sub>SS</sub>                                                                                                        | -      | 35                    | 70     | μA       | ②       |
|                                          | Supply Current<br>(With Pull-up Resistor)           | I <sub>DD</sub>                                                                                         | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+1.0V,<br>V <sub>EN</sub> /CE=ON V <sub>R</sub> OUT ≤ 0.9V,<br>V <sub>IN</sub> =2.0V, V <sub>EN</sub> /CE =V <sub>IN</sub> or V <sub>SS</sub>                                                                                                        | -      | 40                    | 75     | μA       | ②       |
|                                          | Line Regulation                                     | $\frac{\Delta V_{R}OUT}{\Delta V_{IN} \cdot V_{R}OUT}$                                                  | V <sub>R</sub> OUT(T)+1.0V ≤ V <sub>IN</sub> ≤ 6.0V<br>When V <sub>R</sub> OUT ≤ 0.9V,<br>2.0V ≤ V <sub>IN</sub> ≤ 6.0V,<br>I <sub>R</sub> OUT=30mA,<br>When V <sub>R</sub> OUT ≤ 1.75V,<br>I <sub>R</sub> OUT=10mA                                                                        | -      | 0.01                  | 0.20   | % / V    | ①       |
|                                          | Input Voltage                                       | V <sub>IN</sub>                                                                                         | -                                                                                                                                                                                                                                                                                          | 2.0    | -                     | 6.0    | V        | -       |
|                                          | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{R}OUT}{\Delta T_{opr} \cdot V_{R}OUT}$                                                 | I <sub>R</sub> OUT=30mA<br>-40°C ≤ T <sub>opr</sub> ≤ 85°C                                                                                                                                                                                                                                 | -      | ± 100                 | -      | ppm / °C | ①       |
|                                          | Ripple Rejection Rate                               | PSRR                                                                                                    | V <sub>IN</sub> =[V <sub>R</sub> OUT(T)+1.0]V+0.5V <sub>p-p</sub> AC<br>When V <sub>R</sub> OUT(T) ≤ 1.25V<br>→ V <sub>IN</sub> =2.25V+0.5V <sub>p-p</sub> AC<br>When V <sub>R</sub> OUT(T) ≥ 4.75V<br>→ V <sub>IN</sub> =5.75V+0.5V <sub>p-p</sub> AC<br>I <sub>R</sub> OUT=50mA, f=10kHz | -      | 65                    | -      | dB       | ③       |
|                                          | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>R</sub> lim                                                                                      | V <sub>IN</sub> =3.1V @ V <sub>R</sub> OUT ≤ 2.1V                                                                                                                                                                                                                                          | 300    | 380                   | -      | mA       | ①       |
| Current Limiter<br>XC6403 (1.7V or less) | I <sub>R</sub> lim                                  | V <sub>IN</sub> =3.1V                                                                                   | -                                                                                                                                                                                                                                                                                          | 380    | -                     | mA     | ①        |         |
| XC6403<br>Short-Circuit Current          | I <sub>R</sub> short                                | V <sub>IN</sub> =3.1V @ V <sub>R</sub> OUT ≤ 2.1V                                                       | -                                                                                                                                                                                                                                                                                          | 50     | -                     | mA     | ①        |         |
| Current Limiter<br>XC6404 (2.4V or less) | I <sub>R</sub> lim                                  | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+2.0V                                                             | -                                                                                                                                                                                                                                                                                          | 600    | -                     | mA     | ①        |         |
| Current Limiter<br>XC6404 (2.5V or more) | I <sub>R</sub> lim                                  | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+2.0V<br>When V <sub>R</sub> OUT(T) ≥ 4.0V, V <sub>IN</sub> =6.0V | 500                                                                                                                                                                                                                                                                                        | 600    | -                     | mA     | ①        |         |
| XC6404<br>Short-Circuit Current          | I <sub>R</sub> short                                | V <sub>IN</sub> =V <sub>R</sub> OUT(T)+2.0V<br>When V <sub>R</sub> OUT(T) ≥ 4.0V, V <sub>IN</sub> =6.0V | -                                                                                                                                                                                                                                                                                          | 50     | -                     | mA     | ①        |         |

## ■ ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 Series (Continued)

Ta=25°C

|                                            | PARAMETER                     | SYMBOL                                        | CONDITIONS                                             | MIN.             | TYP.             | MAX.             | UNITS  | CIRCUIT |   |
|--------------------------------------------|-------------------------------|-----------------------------------------------|--------------------------------------------------------|------------------|------------------|------------------|--------|---------|---|
| VOLTAGE DETECTOR                           | Detect Voltage (*7, 8)        | VDF(E)                                        | -                                                      | × 0.98           | VDF(T)           | × 1.02           | V      | ④       |   |
|                                            | Hysteresis Range (*7)         | VHYS                                          | -                                                      | VDF(T)<br>× 0.02 | VDF(T)<br>× 0.05 | VDF(T)<br>× 0.08 | V      | ④       |   |
|                                            | Supply Current                | IDDVD                                         |                                                        | VIN = 2.0V       | -                | 6.5              | 14.5   | μA      | ② |
|                                            |                               |                                               |                                                        | VIN = 3.0V       | -                | 7.0              | 15.0   |         |   |
|                                            |                               |                                               |                                                        | VIN = 4.0V       | -                | 7.5              | 15.5   |         |   |
|                                            |                               |                                               |                                                        | VIN = 5.0V       | -                | 8.0              | 16.0   |         |   |
|                                            |                               |                                               |                                                        | VIN = 6.0V       | -                | 9.0              | 17.0   |         |   |
|                                            | Output Current (*9)           | IDOUT                                         | VDOUT = 0.5V                                           | VIN = 2.0V       | 3.0              | 6.0              | -      | mA      | ⑤ |
|                                            |                               |                                               |                                                        | VIN = 3.0V       | 4.0              | 8.0              | -      |         |   |
|                                            |                               |                                               |                                                        | VIN = 4.0V       | 5.0              | 10.0             | -      |         |   |
| VIN = 5.0V                                 |                               |                                               |                                                        | 7.0              | 12.0             | -                |        |         |   |
| VIN = 6.0V                                 |                               |                                               |                                                        | 10.0             | 15.0             | -                |        |         |   |
| Detect Voltage Temperature Characteristics |                               | $\frac{\Delta VDF}{\Delta T_{opr} \cdot VDF}$ | -40°C ≤ Topr ≤ 85°C                                    | -                | ± 100            | -                | ppm/°C | ④       |   |
| <b>SWITCH (NO PULL-UP RESISTOR)</b>        |                               |                                               |                                                        |                  |                  |                  |        |         |   |
|                                            | CE/EN<br>"High" Level Voltage | VCE/EN H                                      | -                                                      | 1.60             | -                | VIN              | V      | ①       |   |
|                                            | CE/EN<br>"Low" Level Voltage  | VCE/EN L                                      | -                                                      | -                | -                | 0.25             | V      | ①       |   |
|                                            | CE/EN<br>"High" Level Current | ICE/EN H                                      | VCE/EN=VIN=VROUT(T)+1.0V                               | -0.10            | -                | 5.00             | μA     | ②       |   |
|                                            | CE/EN<br>"Low" Level Current  | ICE/EN L                                      | VIN=VROUT(T)+1.0V, VCE/EN=VSS                          | -0.10            | -                | 0.10             | μA     | ②       |   |
| <b>OPTION</b>                              |                               |                                               |                                                        |                  |                  |                  |        |         |   |
|                                            | Delay Resistance              | Rdelay                                        | VIN=6.0V, Cd=0V<br>Delay Resistance=6.0V/Delay Current | 1.0              | 2.0              | 3.5              | MΩ     | ⑥       |   |

NOTE:

- \*1 : Unless otherwise stated, VIN=VOUT(T)+1.0V
- \*2 : VROUT(T)=Specified VR output voltage
- \*3 : VOUT(E)=Effective VR output voltage  
(i.e. the VR output voltage when "VROUT(T)+1.0V" is provided at the VIN pin while maintaining a certain IROUT value).
- \*4 : Vdif={VIN1<sup>(6)</sup>-VROUT1<sup>(5)</sup>}
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized VROUT1=IROUT{VROUT(T)+1.0V} is input.
- \*6 : VIN1=The input voltage when VOUT1, which appears as input voltage is gradually decreased.
- \*7 : VDF(T) : Specified detect voltage value
- \*8 : VDF(E) : Effective detect voltage value. Refer to the E-0 chart for VDF(T) values less than 1.5V.
- \*9 : VD output current value of Detect 'L' type equal to current value during detection and that of Detect 'H' type equal to current value before detection.

## ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 AA / AD / AE / AH Series

Ta=25°C

|                                               | PARAMETER                                           | SYMBOL                                                                                                                           | CONDITIONS                                                                                                                                                                                                                                      | MIN.                         | TYP.                         | MAX.                         | UNITS    | CIRCUIT |   |
|-----------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|----------|---------|---|
| VOLTAGE REGULATOR                             | Output Voltage (*2, 3)                              | V <sub>ROUT(E)</sub>                                                                                                             | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                         | × 0.98                       | V <sub>ROUT(T)</sub>         | × 1.02                       | V        | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>ROUTMAX</sub>                                                                                                             | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                          | 150                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>ROUTMAX</sub>                                                                                                             | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                                                                                                                 | 300                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>ROUTMAX</sub>                                                                                                             | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                     | 400                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>ROUTMAX</sub>                                                                                                             | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                                                                                                                                           | 500                          | -                            | -                            | mA       | ①       |   |
|                                               | Load Regulation                                     | ΔV <sub>ROUT</sub>                                                                                                               | 1mA≤I <sub>ROUT</sub> ≤100mA                                                                                                                                                                                                                    | -                            | 15                           | 50                           | mV       | ①       |   |
|                                               | Dropout Voltage (*4)                                | V <sub>dif1</sub>                                                                                                                | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                         | E-1                          |                              |                              | mV       | ①       |   |
|                                               |                                                     | V <sub>dif2</sub>                                                                                                                | I <sub>ROUT</sub> =100mA                                                                                                                                                                                                                        | E-2                          |                              |                              | mV       | ①       |   |
|                                               | Supply Current<br>(AA / AD Series)                  | I <sub>DD</sub>                                                                                                                  | V <sub>IN</sub> =V <sub>EN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤0.9V, V <sub>IN</sub> =2.0V                                                                                                                            | -                            | 40                           | 75                           | μA       | ②       |   |
|                                               | Supply Current<br>(AE / AH Series)                  | I <sub>DD</sub>                                                                                                                  | V <sub>IN</sub> =V <sub>EN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤0.9V, V <sub>IN</sub> =2.1V                                                                                                                            | -                            | 35                           | 70                           | μA       | ②       |   |
|                                               | Line Regulation                                     | $\frac{\Delta V_{ROUT}}{\Delta V_{IN} \cdot V_{ROUT}}$                                                                           | V <sub>ROUT(T)</sub> +1.0V≤V <sub>IN</sub> ≤6.0V<br>When V <sub>ROUT</sub> ≤0.9V,<br>2.0V≤V <sub>IN</sub> ≤6.0V, I <sub>ROUT</sub> =30mA<br>When V <sub>ROUT</sub> ≤1.75V,<br>I <sub>ROUT</sub> =10mA                                           | -                            | 0.01                         | 0.20                         | % / V    | ①       |   |
|                                               | Input Voltage                                       | V <sub>IN</sub>                                                                                                                  | -                                                                                                                                                                                                                                               | 2.0                          | -                            | 6.0                          | V        | -       |   |
|                                               | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{ROUT}}{\Delta T_{opr} \cdot V_{ROUT}}$                                                                          | I <sub>ROUT</sub> =30mA<br>-40°C≤T <sub>opr</sub> ≤85°C                                                                                                                                                                                         | -                            | ±100                         | -                            | ppm / °C | ①       |   |
|                                               | Ripple Rejection Rate                               | PSRR                                                                                                                             | V <sub>IN</sub> =[V <sub>ROUT(T)</sub> +1.0]V+0.5Vp-pAC<br>When V <sub>ROUT(T)</sub> ≤1.25V<br>→ V <sub>IN</sub> =2.25V+0.5Vp-pAC<br>When V <sub>ROUT(T)</sub> ≤4.75V<br>→ V <sub>IN</sub> =5.75V+0.5Vp-pAC<br>I <sub>ROUT</sub> =50mA, f=10kHz | -                            | 65                           | -                            | dB       | ③       |   |
|                                               | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>Rlim</sub>                                                                                                                | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V<br>V <sub>EN</sub> = V <sub>IN</sub>                                                                                                                                                            | 300                          | 380                          | -                            | mA       | ①       |   |
| Current Limiter<br>XC6403 (1.7V or less)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =3.1V, V <sub>EN</sub> =V <sub>IN</sub>                                                                          | -                                                                                                                                                                                                                                               | 380                          | -                            | mA                           | ①        |         |   |
| XC6403<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V, V <sub>EN</sub> =V <sub>IN</sub><br>V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V | -                                                                                                                                                                                                                                               | 50                           | -                            | mA                           | ①        |         |   |
| Current Limiter<br>XC6404 (2.4V or less)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                      | -                                                                                                                                                                                                                                               | 600                          | -                            | mA                           | ①        |         |   |
| Current Limiter<br>XC6404 (2.5V or more)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                            | 500                                                                                                                                                                                                                                             | 600                          | -                            | mA                           | ①        |         |   |
| XC6404<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                            | -                                                                                                                                                                                                                                               | 50                           | -                            | mA                           | ①        |         |   |
| VOLTAGE DETECTOR                              | Detect Voltage (*7, 8)                              | V <sub>DF(E)</sub>                                                                                                               | -                                                                                                                                                                                                                                               | × 0.98                       | V <sub>DF(T)</sub>           | × 1.02                       | V        | ④       |   |
|                                               | Hysteresis Range (*8)                               | V <sub>HYS</sub>                                                                                                                 | -                                                                                                                                                                                                                                               | V <sub>DF(T)</sub><br>× 0.02 | V <sub>DF(T)</sub><br>× 0.05 | V <sub>DF(T)</sub><br>× 0.08 | V        | ④       |   |
|                                               | Supply Current (*9)                                 | I <sub>DDVD</sub>                                                                                                                |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 2.0V       | -                            | 6.5                          | 14.5     | μA      | ② |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 3.0V       | -                            | 7.0                          | 15.0     |         |   |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 4.0V       | -                            | 7.5                          | 15.5     |         |   |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 5.0V       | -                            | 8.0                          | 16.0     |         |   |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 6.0V       | -                            | 9.0                          | 17.0     |         |   |
|                                               | Output Current (*10)                                | I <sub>DOUT</sub>                                                                                                                | V <sub>DOUT</sub> = 0.5V                                                                                                                                                                                                                        | V <sub>IN</sub> = 2.0V       | 3.0                          | 6.0                          | -        |         |   |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 3.0V       | 4.0                          | 8.0                          | -        |         |   |
|                                               |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | V <sub>IN</sub> = 4.0V       | 5.0                          | 10.0                         | -        |         |   |
| V <sub>IN</sub> = 5.0V                        |                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                 | 7.0                          | 12.0                         | -                            |          |         |   |
| Detect Voltage<br>Temperature Characteristics | $\frac{\Delta V_{DF}}{\Delta T_{opr} \cdot V_{DF}}$ | -40°C≤T <sub>opr</sub> ≤85°C                                                                                                     | -                                                                                                                                                                                                                                               | ±100                         | -                            | ppm / °C                     | ④        |         |   |



## ■ ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 AA / AD / AE / AH Series (Continued)

Ta=25°C

|               | PARAMETER                                | SYMBOL | CONDITIONS                 | MIN.  | TYP. | MAX. | UNITS | CIRCUIT |
|---------------|------------------------------------------|--------|----------------------------|-------|------|------|-------|---------|
| <b>SWITCH</b> | EN "High" Level Voltage                  | VENH   | -                          | 1.60  | -    | VIN  | V     | ①       |
|               | EN "Low" Level Voltage                   | VENL   | -                          | -     | -    | 0.25 | V     | ①       |
|               | EN "High" Level Current (AA / AD Series) | IENH   | VEN=VIN=VROUT(T)+1.0V      | -0.10 | -    | 5.00 | μA    | ②       |
|               | EN "High" Level Current (AE / AH Series) | IENH   | VEN=VIN=VROUT(T)+1.0V      | -0.10 | -    | 0.10 | μA    | ②       |
|               | EN "Low" Level Current                   | IENL   | VIN=VROUT(T)+1.0V, VEN=VSS | -0.10 | -    | 0.10 | μA    | ②       |

**NOTE:**

- \*1 : Unless otherwise stated, VIN=VOUT(T)+1.0V
- \*2 : VROUT(T)=Specified VR output voltage
- \*3 : VOUT(E)=Effective VR output voltage  
(i.e. the VR output voltage when "VROUT(T)+1.0V" is provided at the VIN pin while maintaining a certain IROUT value).
- \*4 :  $V_{dif}=\{V_{IN1}^{(6)}-V_{ROUT1}^{(5)}\}$
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized VROUT1=IROUT{VROUT(T)+1.0V} is input.
- \*6 : VIN1=The input voltage when VOUT1, which appears as input voltage is gradually decreased.
- \*7 : VDF(T) : Specified detect voltage value
- \*8 : VDF(E) : Effective detect voltage value. Refer to the E-0 chart for VDF(T) values less than 1.5V.
- \*9 : VD supply current = supply current when VEN=VSS
- \*10: VD output current = sink current during detection.

## ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 CA / CD / CE / CH Series

Ta=25°C

|                                               | PARAMETER                                           | SYMBOL                                                                                                | CONDITIONS                                                                                                                                                                                                                                 | MIN.                         | TYP.                         | MAX.                         | UNITS    | CIRCUIT |
|-----------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|----------|---------|
| VOLTAGE REGULATOR                             | Output Voltage (*2, 3)                              | V <sub>ROUT(E)</sub>                                                                                  | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                    | × 0.98                       | V <sub>ROUT(T)</sub>         | × 1.02                       | V        | ①       |
|                                               | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                     | 150                          | -                            | -                            | mA       | ①       |
|                                               | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                                                                                                            | 300                          | -                            | -                            | mA       | ①       |
|                                               | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                | 400                          | -                            | -                            | mA       | ①       |
|                                               | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                                                                                                                                      | 500                          | -                            | -                            | mA       | ①       |
|                                               | Load Regulation                                     | ΔV <sub>ROUT</sub>                                                                                    | 1mA≤I <sub>ROUT</sub> ≤100mA                                                                                                                                                                                                               | -                            | 15                           | 50                           | mV       | ①       |
|                                               | Dropout Voltage (*4)                                | V <sub>dif1</sub>                                                                                     | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                    | E-1                          |                              |                              | mV       | ①       |
|                                               |                                                     | V <sub>dif2</sub>                                                                                     | I <sub>ROUT</sub> =100mA                                                                                                                                                                                                                   | E-2                          |                              |                              | mV       | ①       |
|                                               | Supply Current<br>(CA / CD Series)                  | I <sub>DD</sub>                                                                                       | V <sub>IN</sub> =V <sub>EN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤0.9V, V <sub>IN</sub> =2.0V                                                                                                                       | -                            | 40                           | 75                           | μA       | ②       |
|                                               | Supply Current<br>(CE / CH Series)                  | I <sub>DD</sub>                                                                                       | V <sub>IN</sub> =V <sub>EN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤0.9V, V <sub>IN</sub> =2.0V                                                                                                                       | -                            | 35                           | 70                           | μA       | ②       |
|                                               | Line Regulation                                     | $\frac{\Delta V_{ROUT}}{\Delta V_{IN} \cdot V_{ROUT}}$                                                | V <sub>ROUT(T)</sub> +1.0V≤V <sub>IN</sub> ≤6.0V<br>When V <sub>ROUT</sub> ≤0.9V,<br>2.0V≤V <sub>IN</sub> ≤6.0V, I <sub>ROUT</sub> =30mA<br>When V <sub>ROUT</sub> ≤1.75V,<br>I <sub>ROUT</sub> =10mA                                      | -                            | 0.01                         | 0.20                         | % / V    | ①       |
|                                               | Input Voltage                                       | V <sub>IN</sub>                                                                                       | -                                                                                                                                                                                                                                          | 2.0                          |                              | 6.0                          | V        | -       |
|                                               | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{ROUT}}{\Delta T_{opr} \cdot V_{ROUT}}$                                               | I <sub>ROUT</sub> =30mA<br>-40°C≤T <sub>opr</sub> ≤85°C                                                                                                                                                                                    | -                            | ±100                         | -                            | ppm / °C | ①       |
|                                               | Ripple Rejection Rate                               | PSRR                                                                                                  | V <sub>IN</sub> =[V <sub>ROUT(T)</sub> +1.0]V+0.5V<br>When V <sub>ROUT(T)</sub> ≤1.25V<br>→ V <sub>IN</sub> =2.25V+0.5Vp-pAC<br>When V <sub>ROUT(T)</sub> ≥4.75V<br>→ V <sub>IN</sub> =5.75V+0.5Vp-pAC<br>I <sub>ROUT</sub> =50mA, f=10kHz | -                            | 65                           | -                            | dB       | ③       |
|                                               | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V<br>V <sub>EN</sub> =V <sub>IN</sub>                                                                                                                                                        | 300                          | 380                          | -                            | mA       | ①       |
|                                               | Current Limiter<br>XC6403 (1.7V or less)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =3.1V, V <sub>EN</sub> =V <sub>IN</sub>                                                                                                                                                                                    | -                            | 380                          | -                            | mA       | ①       |
|                                               | XC6403<br>Short-Circuit Current                     | I <sub>Rshort</sub>                                                                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V, V <sub>EN</sub> =V <sub>IN</sub><br>V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                           | -                            | 50                           | -                            | mA       | ①       |
| Current Limiter<br>XC6404 (2.4V or less)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                           | -                                                                                                                                                                                                                                          | 600                          | -                            | mA                           | ①        |         |
| Current Limiter<br>XC6404 (2.5V or more)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V | 500                                                                                                                                                                                                                                        | 600                          | -                            | mA                           | ①        |         |
| XC6404<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V | -                                                                                                                                                                                                                                          | 50                           | -                            | mA                           | ①        |         |
| VOLTAGE DETECTOR                              | Detect Voltage (*7, 8)                              | V <sub>DF(E)</sub>                                                                                    | -                                                                                                                                                                                                                                          | × 0.98                       | V <sub>DF(T)</sub>           | × 1.02                       | V        | ④       |
|                                               | Hysteresis Range (*8)                               | V <sub>HYS</sub>                                                                                      | -                                                                                                                                                                                                                                          | V <sub>DF(T)</sub><br>× 0.02 | V <sub>DF(T)</sub><br>× 0.05 | V <sub>DF(T)</sub><br>× 0.08 | V        | ④       |
|                                               | Supply Current (*9)                                 | I <sub>DDVD</sub>                                                                                     | V <sub>IN</sub> = 2.0V                                                                                                                                                                                                                     | -                            | 6.5                          | 14.5                         | μA       | ②       |
|                                               |                                                     |                                                                                                       | V <sub>IN</sub> = 3.0V                                                                                                                                                                                                                     | -                            | 7.0                          | 15.0                         |          |         |
|                                               |                                                     |                                                                                                       | V <sub>IN</sub> = 4.0V                                                                                                                                                                                                                     | -                            | 7.5                          | 15.5                         |          |         |
|                                               |                                                     |                                                                                                       | V <sub>IN</sub> = 5.0V                                                                                                                                                                                                                     | -                            | 8.0                          | 16.0                         |          |         |
|                                               |                                                     |                                                                                                       | V <sub>IN</sub> = 6.0V                                                                                                                                                                                                                     | -                            | 9.0                          | 17.0                         |          |         |
|                                               | Output Current (*10)                                | I <sub>DOUT</sub>                                                                                     | V <sub>DOUT</sub> = 0.5V                                                                                                                                                                                                                   | V <sub>IN</sub> = 2.0V       | 3.0                          | 6.0                          | -        |         |
|                                               |                                                     |                                                                                                       |                                                                                                                                                                                                                                            | V <sub>IN</sub> = 3.0V       | 4.0                          | 8.0                          | -        |         |
|                                               |                                                     |                                                                                                       |                                                                                                                                                                                                                                            | V <sub>IN</sub> = 4.0V       | 5.0                          | 10.0                         | -        |         |
| V <sub>IN</sub> = 5.0V                        |                                                     |                                                                                                       |                                                                                                                                                                                                                                            | 7.0                          | 12.0                         | -                            |          |         |
| V <sub>IN</sub> = 6.0V                        |                                                     |                                                                                                       |                                                                                                                                                                                                                                            | 10.0                         | 15.0                         | -                            |          |         |
| Detect Voltage<br>Temperature Characteristics | $\frac{\Delta V_{DF}}{\Delta T_{opr} \cdot V_{DF}}$ | -40°C≤T <sub>opr</sub> ≤85°C                                                                          | -                                                                                                                                                                                                                                          | ±100                         | -                            | ppm / °C                     | ④        |         |

## ■ ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 CA / CD / CE / CH Series (Continued)

Ta=25°C

|               | PARAMETER                                   | SYMBOL | CONDITIONS                 | MIN.  | TYP. | MAX. | UNITS | CIRCUIT |
|---------------|---------------------------------------------|--------|----------------------------|-------|------|------|-------|---------|
| <b>SWITCH</b> | EN "High" Level Voltage                     | VENH   | -                          | 1.6   | -    | VIN  | V     | ①       |
|               | EN "Low" Level Voltage                      | VENL   | -                          | -     | -    | 0.25 | V     | ①       |
|               | EN "High" Level Current<br>(CA / CD Series) | IENH   | VEN=VIN=VROUT(T)+1.0V      | -0.10 | -    | 5.00 | μA    | ②       |
|               | EN "High" Level Current<br>(CE / CH Series) | IENH   | VEN=VIN=VROUT(T)+1.0V      | -0.10 | -    | 0.10 | μA    | ②       |
|               | EN "Low" Level Current                      | IENL   | VIN=VROUT(T)+1.0V, VEN=VSS | -0.10 | -    | 0.10 | μA    | ②       |

**NOTE:**

- \*1 : Unless otherwise stated,  $V_{IN}=V_{OUT(T)}+1.0V$
- \*2 :  $V_{ROUT(T)}$ =Specified VR output voltage
- \*3 :  $V_{OUT(E)}$ = Effective VR output voltage  
(i.e. the VR output voltage when " $V_{ROUT(T)}+1.0V$ " is provided at the VIN pin while maintaining a certain IROUT value).
- \*4 :  $V_{dif}=\{V_{IN1}^{(6)}-V_{ROUT1}^{(5)}\}$
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized  $V_{ROUT1}=I_{ROUT}\{V_{ROUT(T)}+1.0V\}$  is input.
- \*6 :  $V_{IN1}$ =The input voltage when  $V_{OUT1}$ , which appears as input voltage is gradually decreased.
- \*7 :  $V_{DF(T)}$ : Specified detect voltage value
- \*8 :  $V_{DF(E)}$ : Effective detect voltage value. Refer to the E-0 chart on page 15 for  $V_{DF(T)}$  values less than 1.5V.
- \*9 : VD supply current = supply current when  $V_{EN}=V_{SS}$
- \*10 : VD output current = sink current during detection.

## ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 DA / DD / DE / DH Series

Ta=25°C

|                                               | PARAMETER                                           | SYMBOL                                                                                                  | CONDITIONS                                                                                                                                                                                                                                                                            | MIN.                         | TYP.                         | MAX.                         | UNITS    | CIRCUIT |   |
|-----------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|----------|---------|---|
| VOLTAGE REGULATOR                             | Output Voltage (*2, 3)                              | V <sub>ROUT(E)</sub>                                                                                    | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                                               | × 0.98                       | V <sub>ROUT(T)</sub>         | × 1.02                       | V        | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>ROUTMAX</sub>                                                                                    | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                                                                | 150                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>ROUTMAX</sub>                                                                                    | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V                                                                                                                                                                                                                                      | 300                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>ROUTMAX</sub>                                                                                    | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                                                           | 400                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>ROUTMAX</sub>                                                                                    | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V                                                                                                                                                                                | 500                          | -                            | -                            | mA       | ①       |   |
|                                               | Load Regulation                                     | ΔV <sub>ROUT</sub>                                                                                      | 1mA ≤ I <sub>ROUT</sub> ≤ 100mA                                                                                                                                                                                                                                                       | -                            | 15                           | 50                           | mV       | ①       |   |
|                                               | Dropout Voltage (*4)                                | V <sub>dif1</sub>                                                                                       | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                                               | E-1                          |                              |                              | mV       | ①       |   |
|                                               |                                                     | V <sub>dif2</sub>                                                                                       | I <sub>ROUT</sub> =100mA                                                                                                                                                                                                                                                              | E-2                          |                              |                              | mV       | ①       |   |
|                                               | Supply Current<br>(DA / DD Series)                  | I <sub>DD</sub>                                                                                         | V <sub>IN</sub> =V <sub>VCE</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤ 0.9V, V <sub>IN</sub> =2.0V                                                                                                                                                                | -                            | 40                           | 75                           | μA       | ②       |   |
|                                               | Supply Current<br>(DE / DH Series)                  | I <sub>DD</sub>                                                                                         | V <sub>IN</sub> =V <sub>VCE</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤ 0.9V, V <sub>IN</sub> =2.0V                                                                                                                                                                | -                            | 35                           | 70                           | μA       | ②       |   |
|                                               | Stand-by Current<br>(DA / DD / DE / DH Series)      | I <sub>DD</sub>                                                                                         | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V, V <sub>VCE</sub> =0V,<br>When V <sub>ROUT</sub> ≤ 0.9V, V <sub>IN</sub> =2.0V                                                                                                                                                            | -                            | 0.01                         | 0.10                         | % / V    | ②       |   |
|                                               | Line Regulation                                     | $\frac{\Delta V_{ROUT}}{\Delta V_{IN} \cdot V_{ROUT}}$                                                  | V <sub>ROUT(T)</sub> +1.0V ≤ V <sub>IN</sub> ≤ 6.0V<br>When V <sub>ROUT</sub> ≤ 0.9V,<br>2.0V ≤ V <sub>IN</sub> ≤ 6.0V, I <sub>ROUT</sub> =30mA<br>When V <sub>ROUT</sub> ≤ 1.75V,<br>I <sub>ROUT</sub> =10mA                                                                         | -                            | 0.01                         | 0.20                         | % / V    | ①       |   |
|                                               | Input Voltage                                       | V <sub>IN</sub>                                                                                         | -                                                                                                                                                                                                                                                                                     | 2.0                          | -                            | 6.0                          | V        | -       |   |
|                                               | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{ROUT}}{\Delta T_{opr} \cdot V_{ROUT}}$                                                 | I <sub>ROUT</sub> =30mA<br>-40°C ≤ T <sub>opr</sub> ≤ 85°C                                                                                                                                                                                                                            | -                            | ± 100                        | -                            | ppm / °C | ①       |   |
|                                               | Ripple Rejection Rate                               | PSRR                                                                                                    | V <sub>IN</sub> =[V <sub>ROUT(T)</sub> +1.0]V+0.5V <sub>p-pAC</sub><br>When V <sub>ROUT(T)</sub> ≤ 1.25V<br>→ V <sub>IN</sub> =2.25V+0.5V <sub>p-pAC</sub><br>When V <sub>ROUT(T)</sub> ≥ 4.75V<br>→ V <sub>IN</sub> =5.75V+0.5V <sub>p-pAC</sub><br>I <sub>ROUT</sub> =50mA, f=10kHz | -                            | 65                           | -                            | dB       | ③       |   |
|                                               | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>Rlim</sub>                                                                                       | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V<br>V <sub>VCE</sub> = V <sub>IN</sub>                                                                                                                                                                                                | 300                          | 380                          | -                            | mA       | ①       |   |
|                                               | Current Limiter<br>XC6403 (1.7V or less)            | I <sub>Rlim</sub>                                                                                       | V <sub>IN</sub> =3.1V, V <sub>VCE</sub> = V <sub>IN</sub>                                                                                                                                                                                                                             | -                            | 380                          | -                            | mA       | ①       |   |
|                                               | XC6403<br>Short-Circuit Current                     | I <sub>Rshort</sub>                                                                                     | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V, V <sub>VCE</sub> = V <sub>IN</sub><br>V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V                                                                                                                                                   | -                            | 50                           | -                            | mA       | ①       |   |
| Current Limiter<br>XC6404 (2.4V or less)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                             | -                                                                                                                                                                                                                                                                                     | 600                          | -                            | mA                           | ①        |         |   |
| Current Limiter<br>XC6404 (2.5V or more)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V,<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V | 500                                                                                                                                                                                                                                                                                   | 600                          | -                            | mA                           | ①        |         |   |
| XC6404<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V,<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V | -                                                                                                                                                                                                                                                                                     | 50                           | -                            | mA                           | ①        |         |   |
| VOLTAGE DETECTOR                              | Detect Voltage (*7, 8)                              | V <sub>DF(E)</sub>                                                                                      | -                                                                                                                                                                                                                                                                                     | × 0.98                       | V <sub>DF(T)</sub>           | × 1.02                       | V        | ④       |   |
|                                               | Hysteresis Range (*8)                               | V <sub>HYS</sub>                                                                                        | -                                                                                                                                                                                                                                                                                     | V <sub>DF(T)</sub><br>× 0.02 | V <sub>DF(T)</sub><br>× 0.05 | V <sub>DF(T)</sub><br>× 0.08 | V        | ④       |   |
|                                               | Supply Current (*9)                                 | I <sub>DOUT</sub>                                                                                       | V <sub>DOUT</sub> = 0.5V                                                                                                                                                                                                                                                              | V <sub>IN</sub> = 2.0V       | 3.0                          | 6.0                          | -        | mA      | ⑤ |
|                                               |                                                     |                                                                                                         |                                                                                                                                                                                                                                                                                       | V <sub>IN</sub> = 3.0V       | 4.0                          | 8.0                          | -        |         |   |
|                                               |                                                     |                                                                                                         |                                                                                                                                                                                                                                                                                       | V <sub>IN</sub> = 4.0V       | 5.0                          | 10.0                         | -        |         |   |
| V <sub>IN</sub> = 5.0V                        |                                                     |                                                                                                         |                                                                                                                                                                                                                                                                                       | 7.0                          | 12.0                         | -                            |          |         |   |
| Detect Voltage<br>Temperature Characteristics | $\frac{\Delta V_{DF}}{\Delta T_{opr} \cdot V_{DF}}$ | -40°C ≤ T <sub>opr</sub> ≤ 85°C                                                                         | -                                                                                                                                                                                                                                                                                     | ± 100                        | -                            | ppm / °C                     | ④        |         |   |

## ■ ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 DA / DD / DE / DH Series (Continued)

Ta=25°C

|               | PARAMETER                                   | SYMBOL           | CONDITIONS                                                                    | MIN.  | TYP. | MAX.            | UNITS | CIRCUIT |
|---------------|---------------------------------------------|------------------|-------------------------------------------------------------------------------|-------|------|-----------------|-------|---------|
| <b>SWITCH</b> | CE "High" Level Voltage                     | V <sub>CEH</sub> | -                                                                             | 1.6   | -    | V <sub>IN</sub> | V     | ①       |
|               | CE "Low" Level Voltage                      | V <sub>CEL</sub> | -                                                                             | -     | -    | 0.25            | V     | ①       |
|               | CE "High" Level Current<br>(DA / DD Series) | I <sub>CEH</sub> | V <sub>CE</sub> =V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V                  | -0.10 | -    | 5.00            | μA    | ②       |
|               | CE "High" Level Current<br>(DE / DH Series) | I <sub>CEH</sub> | V <sub>CE</sub> =V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V                  | -0.10 | -    | 0.10            | μA    | ②       |
|               | CE "Low" Level Current                      | I <sub>CEL</sub> | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V, V <sub>CE</sub> =V <sub>SS</sub> | -0.10 | -    | 0.10            | μA    | ②       |

**NOTE:**

- \*1 : Unless otherwise stated, V<sub>IN</sub>=V<sub>OUT(T)</sub>+1.0V
- \*2 : V<sub>ROUT(T)</sub>=Specified VR output voltage
- \*3 : V<sub>OUT(E)</sub>= Effective VR output voltage  
(i.e. the VR output voltage when "V<sub>ROUT(T)</sub>+1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>ROUT</sub> value).
- \*4 : V<sub>dif</sub>={V<sub>IN1</sub><sup>(6)</sup>-V<sub>ROUT1</sub><sup>(5)</sup>}
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized V<sub>ROUT1</sub>=I<sub>ROUT</sub>{V<sub>ROUT(T)</sub>+1.0V} is input.
- \*6 : V<sub>IN1</sub>=The input voltage when V<sub>OUT1</sub>, which appears as input voltage is gradually decreased.
- \*7 : V<sub>DF(T)</sub>: Specified detect voltage value
- \*8 : V<sub>DF(E)</sub>: Effective detect voltage value. Refer to the E-0 chart for V<sub>DF(T)</sub> values less than 1.5V.
- \*9 : V<sub>D</sub> output current = sink current during detection.

## ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 EV / EX Series

Ta=25°C

|                                               | PARAMETER                                           | SYMBOL                                                                                                 | CONDITIONS                                                                                                                                                                                                                                                    | MIN.                         | TYP.                         | MAX.                         | UNITS  | CIRCUIT |   |
|-----------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|--------|---------|---|
| VOLTAGE REGULATOR                             | Output Voltage                                      | V <sub>ROUT(E)</sub>                                                                                   | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                       | × 0.98                       | V <sub>ROUT(T)</sub>         | × 1.02                       | V      | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>ROUTMAX</sub>                                                                                   | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                                        | 150                          | -                            | -                            | mA     | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>ROUTMAX</sub>                                                                                   | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V                                                                                                                                                                                                              | 300                          | -                            | -                            | mA     | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>ROUTMAX</sub>                                                                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                                   | 400                          | -                            | -                            | mA     | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>ROUTMAX</sub>                                                                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V                                                                                                                                                        | 500                          | -                            | -                            | mA     | ①       |   |
|                                               | Load Regulation                                     | ΔV <sub>ROUT</sub>                                                                                     | 1mA ≤ I <sub>ROUT</sub> ≤ 100mA                                                                                                                                                                                                                               | -                            | 15                           | 50                           | mV     | ①       |   |
|                                               | Dropout Voltage                                     | V <sub>dif1</sub>                                                                                      | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                       | E-1                          |                              |                              | mV     | ①       |   |
|                                               |                                                     | V <sub>dif2</sub>                                                                                      | I <sub>ROUT</sub> =100mA                                                                                                                                                                                                                                      | E-2                          |                              |                              | mV     | ①       |   |
|                                               | Supply Current<br>(EV / EX Series)                  | I <sub>DD</sub>                                                                                        | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤ 0.9V, V <sub>IN</sub> =2.0V                                                                                                                                                          | -                            | 35                           | 70                           | μA     | ②       |   |
|                                               | Line Regulation                                     | $\frac{\Delta V_{ROUT}}{\Delta V_{IN} \cdot V_{ROUT}}$                                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>V <sub>ROUT(T)</sub> +1.0V ≤ V <sub>IN</sub> ≤ 6.0V<br>When V <sub>ROUT</sub> ≤ 0.9V,<br>2.0V ≤ V <sub>IN</sub> ≤ 6.0V, I <sub>ROUT</sub> =30mA<br>When V <sub>ROUT</sub> ≤ 1.75V,<br>I <sub>ROUT</sub> =10mA | -                            | 0.01                         | 0.20                         | % / V  | ①       |   |
|                                               | Input Voltage                                       | V <sub>IN</sub>                                                                                        | -                                                                                                                                                                                                                                                             | 2.0                          | -                            | 6.0                          | V      | -       |   |
|                                               | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{ROUT}}{\Delta T_{opr} \cdot V_{ROUT}}$                                                | I <sub>ROUT</sub> =30mA<br>-40°C ≤ T <sub>opr</sub> ≤ 85°C                                                                                                                                                                                                    | -                            | ±100                         | -                            | ppm/°C | ①       |   |
|                                               | Ripple Rejection Rate                               | PSRR                                                                                                   | V <sub>IN</sub> =[V <sub>ROUT(T)</sub> +1.0]V+0.5Vp-pAC<br>When V <sub>ROUT(T)</sub> ≤ 1.25V<br>→ V <sub>IN</sub> =2.25V+0.5Vp-pAC<br>When V <sub>ROUT(T)</sub> ≥ 4.75V<br>→ V <sub>IN</sub> =5.75V+0.5Vp-pAC<br>I <sub>ROUT</sub> =50mA, f=10kHz             | -                            | 65                           | -                            | dB     | ③       |   |
|                                               | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>Rlim</sub>                                                                                      | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V                                                                                                                                                                                                              | 300                          | 380                          | -                            | mA     | ①       |   |
|                                               | Current Limiter<br>XC6403 (1.7V or less)            | I <sub>Rlim</sub>                                                                                      | V <sub>IN</sub> =3.1V                                                                                                                                                                                                                                         | -                            | 380                          | -                            | mA     | ①       |   |
|                                               | XC6403<br>Short-Circuit Current                     | I <sub>Rshort</sub>                                                                                    | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V<br>V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤ 2.1V                                                                                                                                                               | -                            | 50                           | -                            | mA     | ①       |   |
| Current Limiter<br>XC6404 (2.4V or less)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                            | -                                                                                                                                                                                                                                                             | 600                          | -                            | mA                           | ①      |         |   |
| Current Limiter<br>XC6404 (2.5V or more)      | I <sub>Rlim</sub>                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V | 500                                                                                                                                                                                                                                                           | 600                          | -                            | mA                           | ①      |         |   |
| XC6404<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥ 4.0V, V <sub>IN</sub> =6.0V | -                                                                                                                                                                                                                                                             | 50                           | -                            | mA                           | ①      |         |   |
| VOLTAGE DETECTOR                              | Detect Voltage                                      | V <sub>DF(E)</sub>                                                                                     | -                                                                                                                                                                                                                                                             | × 0.98                       | V <sub>DF(T)</sub>           | × 1.02                       | V      | ④       |   |
|                                               | Hysteresis Range                                    | V <sub>HYS</sub>                                                                                       | -                                                                                                                                                                                                                                                             | V <sub>DF(T)</sub><br>× 0.02 | V <sub>DF(T)</sub><br>× 0.05 | V <sub>DF(T)</sub><br>× 0.08 | V      | ④       |   |
|                                               | Supply Current (*9)                                 | I <sub>DOUT</sub>                                                                                      | V <sub>DOUT</sub> = 0.5V                                                                                                                                                                                                                                      | V <sub>IN</sub> = 2.0V       | 3.0                          | 6.0                          | -      | mA      | ⑤ |
|                                               |                                                     |                                                                                                        |                                                                                                                                                                                                                                                               | V <sub>IN</sub> = 3.0V       | 4.0                          | 8.0                          | -      |         |   |
|                                               |                                                     |                                                                                                        |                                                                                                                                                                                                                                                               | V <sub>IN</sub> = 4.0V       | 5.0                          | 10.0                         | -      |         |   |
| V <sub>IN</sub> = 5.0V                        |                                                     |                                                                                                        |                                                                                                                                                                                                                                                               | 7.0                          | 12.0                         | -                            |        |         |   |
| Detect Voltage<br>Temperature Characteristics | $\frac{\Delta V_{DF}}{\Delta T_{opr} \cdot V_{DF}}$ | -40°C ≤ T <sub>opr</sub> ≤ 85°C                                                                        | -                                                                                                                                                                                                                                                             | ±100                         | -                            | ppm/°C                       | ④      |         |   |

NOTE:

- \*1 : Unless otherwise stated, V<sub>IN</sub>=V<sub>OUT(T)</sub>+1.0V
- \*2 : V<sub>ROUT(T)</sub>=Specified VR output voltage
- \*3 : V<sub>OUT(E)</sub>=Actual VR output voltage.  
(i.e. the VR output voltage when "V<sub>ROUT(T)</sub>+1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>ROUT</sub> value).
- \*4 : V<sub>dif</sub>={V<sub>IN1</sub><sup>(6)</sup>-V<sub>ROUT1</sub><sup>(5)}</sup>
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized V<sub>ROUT1</sub>=I<sub>ROUT</sub>(V<sub>ROUT(T)</sub>+1.0V) is input.
- \*6 : V<sub>IN1</sub>=The input voltage when V<sub>OUT1</sub>, which appears as input voltage is gradually decreased.
- \*7 : V<sub>DF(T)</sub> : Specified detect voltage value
- \*8 : V<sub>DF(E)</sub> : Actual detect voltage value. Refer to the E-0 chart for V<sub>DF(T)</sub> less than 1.5V.
- \*9 : V<sub>D</sub> output current = sink current during detection.

## ELECTRICAL CHARACTERISTICS (Continued)

XC6403/04 FV / FX / FY / FZ Series

Ta=25°C

|                                               | PARAMETER                                           | SYMBOL                                                                                                | CONDITIONS                                                                                                                                                                                                                                                                          | MIN.                         | TYP.                         | MAX.                         | UNITS    | CIRCUIT |   |
|-----------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|----------|---------|---|
| VOLTAGE REGULATOR                             | Output Voltage (*2, 3)                              | V <sub>ROUT(E)</sub>                                                                                  | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                                             | × 0.98                       | V <sub>ROUT(T)</sub>         | × 1.02                       | V        | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (0.9~1.7V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> = 3.1V                                                                                                                                                                                                                                                              | 150                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6403 (1.8~5.3V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                                                                                                                                                     | 300                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (0.9~2.4V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                                                         | 400                          | -                            | -                            | mA       | ①       |   |
|                                               | Maximum Output Current<br>XC6404 (2.5~4.9V product) | I <sub>ROUTMAX</sub>                                                                                  | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                                                                                                                                                                               | 500                          | -                            | -                            | mA       | ①       |   |
|                                               | Load Regulation                                     | ΔV <sub>ROUT</sub>                                                                                    | 1mA≤I <sub>ROUT</sub> ≤100mA                                                                                                                                                                                                                                                        | -                            | 15                           | 50                           | mV       | ①       |   |
|                                               | Dropout Voltage (*4)                                | V <sub>dif1</sub>                                                                                     | I <sub>ROUT</sub> =30mA                                                                                                                                                                                                                                                             | E-1                          |                              |                              | mV       | ①       |   |
|                                               |                                                     | V <sub>dif2</sub>                                                                                     | I <sub>ROUT</sub> =100mA                                                                                                                                                                                                                                                            | E-2                          |                              |                              | mV       | ①       |   |
|                                               | Supply Current<br>(FV / FX / FY / FZ Series)        | I <sub>DD</sub>                                                                                       | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>When V <sub>ROUT</sub> ≤0.9V, V <sub>IN</sub> =2.0V                                                                                                                                                                                 | -                            | 35                           | 70                           | μA       | ②       |   |
|                                               | Line Regulation                                     | $\frac{\Delta V_{ROUT}}{\Delta V_{IN} \cdot V_{ROUT}}$                                                | V <sub>ROUT(T)</sub> +1.0V≤V <sub>IN</sub> ≤6.0V<br>When V <sub>ROUT</sub> ≤0.9V,<br>2.0V≤V <sub>IN</sub> ≤6.0V, I <sub>ROUT</sub> =30mA<br>When V <sub>ROUT</sub> ≤1.75V,<br>I <sub>ROUT</sub> =10mA                                                                               | -                            | 0.01                         | 0.20                         | % / V    | ①       |   |
|                                               | Input Voltage                                       | V <sub>IN</sub>                                                                                       | -                                                                                                                                                                                                                                                                                   | 2.0                          | -                            | 6.0                          | V        | -       |   |
|                                               | Output Voltage<br>Temperature Characteristics       | $\frac{\Delta V_{ROUT}}{\Delta T_{opr} \cdot V_{ROUT}}$                                               | I <sub>ROUT</sub> =30mA<br>-40°C≤T <sub>opr</sub> ≤85°C                                                                                                                                                                                                                             | -                            | ±100                         | -                            | ppm / °C | ①       |   |
|                                               | Ripple Rejection Rate                               | PSRR                                                                                                  | V <sub>IN</sub> =[V <sub>ROUT(T)</sub> +1.0]V+0.5V <sub>p-pAC</sub><br>When V <sub>ROUT(T)</sub> ≤1.25V<br>→ V <sub>IN</sub> =2.25V+0.5V <sub>p-pAC</sub><br>When V <sub>ROUT(T)</sub> ≥4.75V<br>→ V <sub>IN</sub> =5.75V+0.5V <sub>p-pAC</sub><br>I <sub>ROUT</sub> =50mA, f=10kHz | -                            | 65                           | -                            | dB       | ③       |   |
|                                               | Current Limiter<br>XC6403 (1.8V or more)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                                                                                                                                                     | 300                          | 380                          | -                            | mA       | ①       |   |
|                                               | Current Limiter<br>XC6403 (1.7V or less)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =3.1V                                                                                                                                                                                                                                                               | -                            | 380                          | -                            | mA       | ①       |   |
|                                               | XC6403<br>Short-Circuit Current                     | I <sub>Rshort</sub>                                                                                   | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +1.0V,<br>V <sub>IN</sub> =3.1V @ V <sub>ROUT</sub> ≤2.1V                                                                                                                                                                                     | -                            | 50                           | -                            | mA       | ①       |   |
|                                               | Current Limiter<br>XC6404 (2.4V or less)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V                                                                                                                                                                                                                                         | -                            | 600                          | -                            | mA       | ①       |   |
|                                               | Current Limiter<br>XC6404 (2.5V or more)            | I <sub>Rlim</sub>                                                                                     | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V                                                                                                                                                                               | 500                          | 600                          | -                            | mA       | ①       |   |
| XC6404<br>Short-Circuit Current               | I <sub>Rshort</sub>                                 | V <sub>IN</sub> =V <sub>ROUT(T)</sub> +2.0V<br>When V <sub>ROUT(T)</sub> ≥4.0V, V <sub>IN</sub> =6.0V | -                                                                                                                                                                                                                                                                                   | 50                           | -                            | mA                           | ①        |         |   |
| VOLTAGE DETECTOR                              | Detect Voltage (*7, 8)                              | V <sub>DF(E)</sub>                                                                                    | -                                                                                                                                                                                                                                                                                   | × 0.98                       | V <sub>DF(T)</sub>           | × 1.02                       | V        | ④       |   |
|                                               | Hysteresis Range (*8)                               | V <sub>HYS</sub>                                                                                      | -                                                                                                                                                                                                                                                                                   | V <sub>DF(T)</sub><br>× 0.02 | V <sub>DF(T)</sub><br>× 0.05 | V <sub>DF(T)</sub><br>× 0.08 | V        | ④       |   |
|                                               | Output Current (*9)                                 | I <sub>DOUT</sub>                                                                                     | V <sub>DOUT</sub> =<br>0.5V                                                                                                                                                                                                                                                         | V <sub>IN</sub> = 2.0V       | 3.0                          | 6.0                          | -        | mA      | ⑤ |
|                                               |                                                     |                                                                                                       |                                                                                                                                                                                                                                                                                     | V <sub>IN</sub> = 3.0V       | 4.0                          | 8.0                          | -        |         |   |
|                                               |                                                     |                                                                                                       |                                                                                                                                                                                                                                                                                     | V <sub>IN</sub> = 4.0V       | 5.0                          | 10.0                         | -        |         |   |
| V <sub>IN</sub> = 5.0V                        |                                                     |                                                                                                       |                                                                                                                                                                                                                                                                                     | 7.0                          | 12.0                         | -                            |          |         |   |
| Detect Voltage<br>Temperature Characteristics | $\frac{\Delta V_{DF}}{\Delta T_{opr} \cdot V_{DF}}$ | -40°C≤T <sub>opr</sub> ≤85°C                                                                          | -                                                                                                                                                                                                                                                                                   | ±100                         | -                            | ppm/°C                       | ④        |         |   |
| Delay Resistance                              | R <sub>delay</sub>                                  | V <sub>IN</sub> =6.0V, C <sub>d</sub> =0V<br>Delay Resistance=6.0V/Delay<br>Current                   | 1.0                                                                                                                                                                                                                                                                                 | 2.0                          | 3.5                          | MΩ                           | ⑥        |         |   |

NOTE:

- \*1 : Unless otherwise stated, V<sub>IN</sub>=V<sub>OUT(T)</sub>+1.0V
- \*2 : V<sub>ROUT(T)</sub>=Specified VR output voltage
- \*3 : V<sub>OUT(E)</sub>=Actual VR output voltage  
(i.e. the VR output voltage when "V<sub>ROUT(T)</sub>+1.0V" is provided at the V<sub>IN</sub> pin while maintaining a certain I<sub>ROUT</sub> value).
- \*4 : V<sub>dif</sub>={V<sub>IN1</sub><sup>(6)</sup>-V<sub>ROUT1</sub><sup>(5)</sup>}
- \*5 : A voltage equal to 98% of the VR output voltage whenever a stabilized V<sub>ROUT1</sub>=I<sub>ROUT</sub>{V<sub>ROUT(T)</sub>+1.0V} is input.
- \*6 : V<sub>IN1</sub>=The input voltage when V<sub>OUT1</sub>, which appears as Input voltage is gradually decreased.
- \*7 : V<sub>DF(T)</sub>: Specified detect voltage value
- \*8 : V<sub>DF(E)</sub>: Actual detect voltage value. Refer to the E-0 chart for V<sub>DF(T)</sub> values less than 1.5V.
- \*9 : V<sub>D</sub> supply current = sink current during detection.

## ■ ELECTRICAL CHARACTERISTICS (Continued)

### ● VR Dropout Voltage 1

XC6403/6404

| SYMBOL                                        |           | E-0                                     |       | E-1                                                |                   | E-1                                                 |                   |
|-----------------------------------------------|-----------|-----------------------------------------|-------|----------------------------------------------------|-------------------|-----------------------------------------------------|-------------------|
| SPECIFIED<br>DETECT VOLTAGE<br>OUTPUT VOLTAGE | PARAMETER | OUTPUT VOLTAGE<br>DETECT VOLTAGE<br>(V) |       | DROPOUT VOLTAGE 1<br>(mV) (I <sub>OUT</sub> =30mA) |                   | DROPOUT VOLTAGE 2<br>(mV) (I <sub>OUT</sub> =100mA) |                   |
|                                               |           |                                         |       | Ta=25°C                                            |                   | Ta=25°C                                             |                   |
|                                               |           | V <sub>ROUT</sub> / V <sub>DF</sub>     |       | V <sub>dif1</sub>                                  | V <sub>dif1</sub> | V <sub>dif2</sub>                                   | V <sub>dif2</sub> |
| V <sub>ROUT(T)</sub><br>V <sub>DF(T)</sub>    |           | MIN.                                    | MAX.  | TYP.                                               | MAX.              | TYP.                                                | MAX.              |
| 0.90                                          |           | 0.870                                   | 0.930 | 1050                                               | 1100              | 1150                                                | 1200              |
| 1.00                                          |           | 0.970                                   | 1.030 | 1000                                               | 1100              | 1050                                                | 1200              |
| 1.10                                          |           | 1.070                                   | 1.130 | 900                                                | 1000              | 950                                                 | 1100              |
| 1.20                                          |           | 1.170                                   | 1.230 | 800                                                | 900               | 850                                                 | 1000              |
| 1.30                                          |           | 1.270                                   | 1.330 | 700                                                | 800               | 750                                                 | 900               |
| 1.40                                          |           | 1.370                                   | 1.430 | 600                                                | 700               | 650                                                 | 800               |
| 1.50                                          |           | 1.470                                   | 1.530 | 500                                                | 600               | 550                                                 | 700               |
| 1.60                                          |           | 1.568                                   | 1.632 | 400                                                | 500               | 500                                                 | 600               |
| 1.70                                          |           | 1.666                                   | 1.734 | 300                                                | 400               | 400                                                 | 500               |
| 1.80                                          |           | 1.764                                   | 1.836 | 200                                                | 300               | 300                                                 | 400               |
| 1.90                                          |           | 1.862                                   | 1.938 | 120                                                | 150               | 280                                                 | 380               |
| 2.00                                          |           | 1.960                                   | 2.040 | 80                                                 | 120               | 240                                                 | 350               |
| 2.10                                          |           | 2.058                                   | 2.142 | 80                                                 | 120               | 240                                                 | 330               |
| 2.20                                          |           | 2.156                                   | 2.244 | 80                                                 | 120               | 240                                                 | 330               |
| 2.30                                          |           | 2.254                                   | 2.346 | 80                                                 | 120               | 240                                                 | 310               |
| 2.40                                          |           | 2.352                                   | 2.448 | 80                                                 | 120               | 240                                                 | 310               |
| 2.50                                          |           | 2.450                                   | 2.550 | 70                                                 | 100               | 220                                                 | 290               |
| 2.60                                          |           | 2.548                                   | 2.652 | 70                                                 | 100               | 220                                                 | 290               |
| 2.70                                          |           | 2.646                                   | 2.754 | 70                                                 | 100               | 220                                                 | 290               |
| 2.80                                          |           | 2.744                                   | 2.856 | 70                                                 | 100               | 220                                                 | 270               |
| 2.90                                          |           | 2.842                                   | 2.958 | 70                                                 | 100               | 220                                                 | 270               |
| 3.00                                          |           | 2.940                                   | 3.060 | 60                                                 | 90                | 200                                                 | 270               |
| 3.10                                          |           | 3.038                                   | 3.162 | 60                                                 | 90                | 200                                                 | 250               |
| 3.20                                          |           | 3.136                                   | 3.264 | 60                                                 | 90                | 200                                                 | 250               |
| 3.30                                          |           | 3.234                                   | 3.366 | 60                                                 | 90                | 200                                                 | 250               |
| 3.40                                          |           | 3.332                                   | 3.468 | 60                                                 | 90                | 200                                                 | 250               |
| 3.50                                          |           | 3.430                                   | 3.570 | 60                                                 | 90                | 200                                                 | 250               |
| 3.60                                          |           | 3.528                                   | 3.672 | 60                                                 | 90                | 200                                                 | 250               |
| 3.70                                          |           | 3.626                                   | 3.774 | 60                                                 | 90                | 200                                                 | 250               |
| 3.80                                          |           | 3.724                                   | 3.876 | 60                                                 | 90                | 200                                                 | 250               |
| 3.90                                          |           | 3.822                                   | 3.978 | 60                                                 | 90                | 200                                                 | 250               |
| 4.00                                          |           | 3.920                                   | 4.080 | 60                                                 | 80                | 180                                                 | 230               |
| 4.10                                          |           | 4.018                                   | 4.182 | 60                                                 | 80                | 180                                                 | 230               |
| 4.20                                          |           | 4.116                                   | 4.284 | 60                                                 | 80                | 180                                                 | 230               |
| 4.30                                          |           | 4.214                                   | 4.386 | 60                                                 | 80                | 180                                                 | 230               |
| 4.40                                          |           | 4.312                                   | 4.488 | 60                                                 | 80                | 180                                                 | 230               |
| 4.50                                          |           | 4.410                                   | 4.590 | 60                                                 | 80                | 180                                                 | 230               |



■ **ELECTRICAL CHARACTERISTICS (Continued)**

● VR Dropout Voltage 2

XC6403

| SYMBOL                                        |                                     | E-0                                     |       | E-1                                                |                   | E-1                                                 |                   |
|-----------------------------------------------|-------------------------------------|-----------------------------------------|-------|----------------------------------------------------|-------------------|-----------------------------------------------------|-------------------|
| SPECIFIED<br>DETECT VOLTAGE<br>OUTPUT VOLTAGE | PARAMETER                           | OUTPUT VOLTAGE<br>DETECT VOLTAGE<br>(V) |       | DROPOUT VOLTAGE 1<br>(mV) (I <sub>OUT</sub> =30mA) |                   | DROPOUT VOLTAGE 2<br>(mV) (I <sub>OUT</sub> =100mA) |                   |
|                                               |                                     |                                         |       | Ta=25°C                                            |                   | Ta=25°C                                             |                   |
| V <sub>ROUT(T)</sub><br>V <sub>DF(T)</sub>    | V <sub>ROUT</sub> / V <sub>DF</sub> |                                         |       | V <sub>dif1</sub>                                  | V <sub>dif1</sub> | V <sub>dif2</sub>                                   | V <sub>dif2</sub> |
|                                               |                                     | MIN.                                    | MAX.  | TYP.                                               | MAX.              | TYP.                                                | MAX.              |
| 4.60                                          |                                     | 4.508                                   | 4.692 | 60                                                 | 80                | 180                                                 | 230               |
| 4.70                                          |                                     | 4.606                                   | 4.794 | 60                                                 | 80                | 180                                                 | 230               |
| 4.80                                          |                                     | 4.704                                   | 4.896 | 60                                                 | 80                | 180                                                 | 230               |
| 4.90                                          |                                     | 4.802                                   | 4.998 | 60                                                 | 80                | 180                                                 | 230               |
| 5.00                                          |                                     | 4.900                                   | 5.100 | 50                                                 | 70                | 160                                                 | 210               |
| 5.10                                          |                                     | 4.998                                   | 5.202 | 50                                                 | 70                | 160                                                 | 210               |
| 5.20                                          |                                     | 5.096                                   | 5.304 | 50                                                 | 70                | 160                                                 | 210               |
| 5.30                                          |                                     | 5.194                                   | 5.406 | 50                                                 | 70                | 160                                                 | 210               |
| 5.40                                          |                                     | 5.292                                   | 5.508 | 50                                                 | 70                | 160                                                 | 210               |
| 5.50                                          |                                     | 5.390                                   | 5.610 | 50                                                 | 70                | 160                                                 | 210               |
| 5.60                                          |                                     | 5.488                                   | 5.712 | 50                                                 | 70                | 160                                                 | 210               |

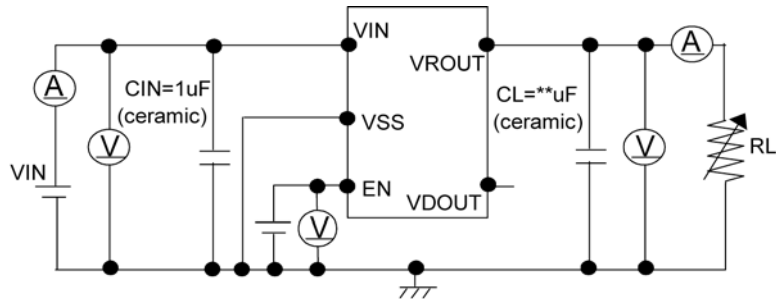
XC6404

| SYMBOL                                        |                                     | E-0                                     |       | E-1                                                |                   | E-1                                                 |                   |
|-----------------------------------------------|-------------------------------------|-----------------------------------------|-------|----------------------------------------------------|-------------------|-----------------------------------------------------|-------------------|
| SPECIFIED<br>DETECT VOLTAGE<br>OUTPUT VOLTAGE | PARAMETER                           | OUTPUT VOLTAGE<br>DETECT VOLTAGE<br>(V) |       | DROPOUT VOLTAGE 1<br>(mV) (I <sub>OUT</sub> =30mA) |                   | DROPOUT VOLTAGE 2<br>(mV) (I <sub>OUT</sub> =100mA) |                   |
|                                               |                                     |                                         |       | Ta=25°C                                            |                   | Ta=25°C                                             |                   |
| V <sub>ROUT(T)</sub><br>V <sub>DF(T)</sub>    | V <sub>ROUT</sub> / V <sub>DF</sub> |                                         |       | V <sub>dif1</sub>                                  | V <sub>dif1</sub> | V <sub>dif2</sub>                                   | V <sub>dif2</sub> |
|                                               |                                     | MIN.                                    | MAX.  | TYP.                                               | MAX.              | TYP.                                                | MAX.              |
| 4.60                                          |                                     | 4.508                                   | 4.692 | 60                                                 | 80                | 180                                                 | 230               |
| 4.70                                          |                                     | 4.606                                   | 4.794 | 60                                                 | 80                | 180                                                 | 230               |
| 4.80                                          |                                     | 4.704                                   | 4.896 | 60                                                 | 80                | 180                                                 | 230               |
| 4.90                                          |                                     | 4.802                                   | 4.998 | 60                                                 | 80                | 180                                                 | 230               |
| 5.00                                          |                                     | 4.900                                   | 5.100 | 50                                                 | 70                | 160                                                 | 210               |
| 5.10                                          |                                     | 4.998                                   | 5.202 | 50                                                 | 70                | 160                                                 | 210               |
| 5.20                                          |                                     | 5.096                                   | 5.304 |                                                    |                   |                                                     |                   |
| 5.30                                          |                                     | 5.194                                   | 5.406 |                                                    |                   |                                                     |                   |
| 5.40                                          |                                     | 5.292                                   | 5.508 |                                                    |                   |                                                     |                   |
| 5.50                                          |                                     | 5.390                                   | 5.610 |                                                    |                   |                                                     |                   |
|                                               |                                     |                                         |       |                                                    |                   |                                                     |                   |

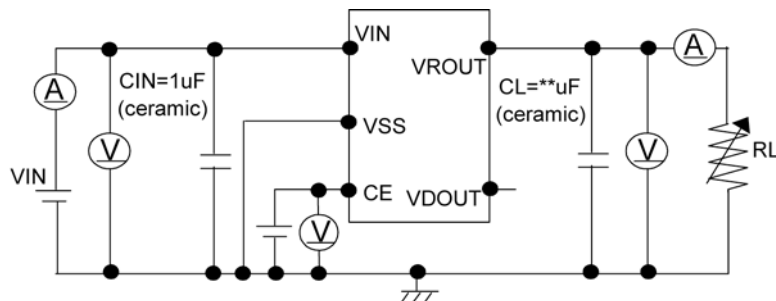
## TEST CIRCUITS

### ● Circuit ①

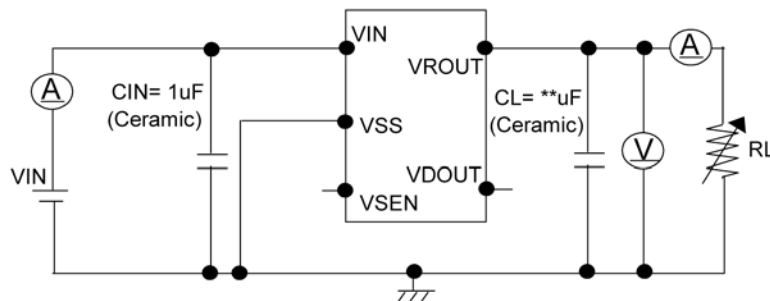
XC6403/04A ~ C Series



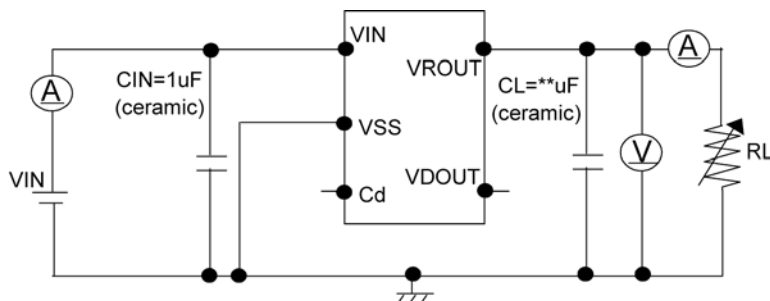
XC6403/04D Series



XC6403/04E Series



XC6403/04F Series



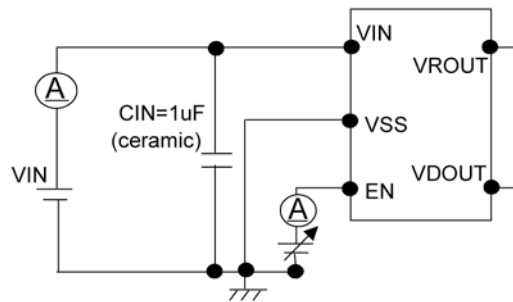
Output Capacitor Corresponding Chart

| VROUT | 0.9 ~ 1.2V            | 1.3 ~ 1.7V            | 1.8V ~                |
|-------|-----------------------|-----------------------|-----------------------|
| CL    | More Than 4.7 $\mu$ F | More Than 2.2 $\mu$ F | More Than 1.0 $\mu$ F |

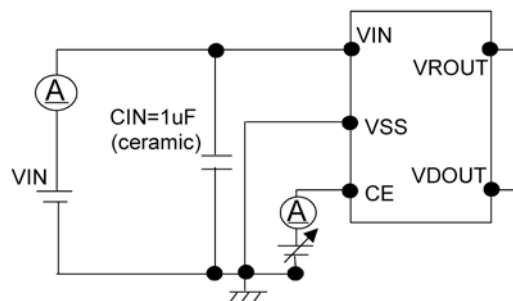
## ■ TEST CIRCUITS (Continued)

● Circuit ②

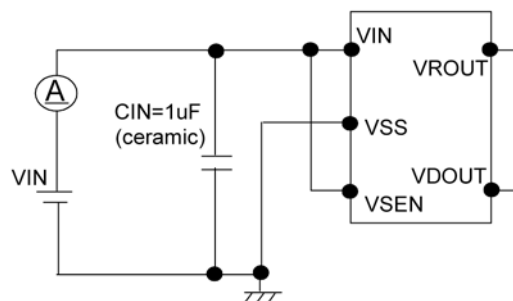
XC6403/04A ~ C Series



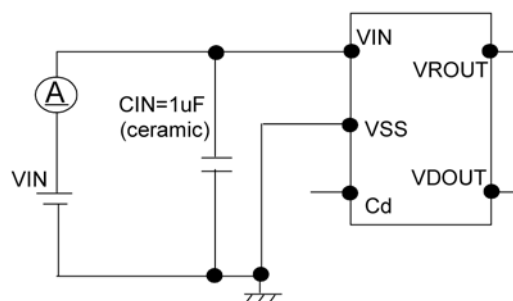
XC6403/04D Series



XC6403/04E Series



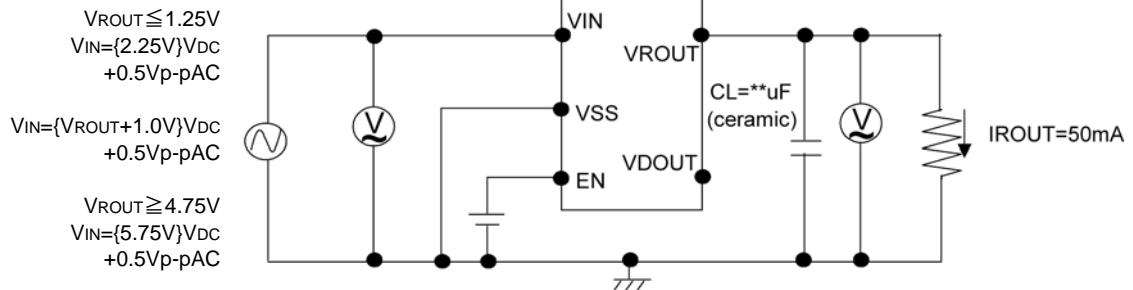
XC6403/04F Series



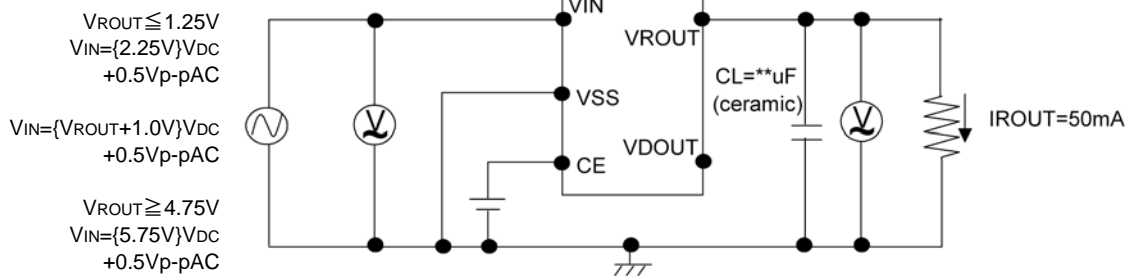
## TEST CIRCUITS (Continued)

### ● Circuit ③

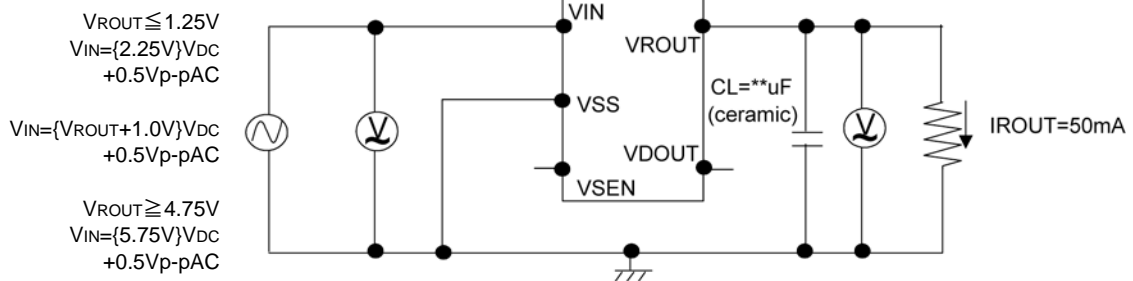
#### XC6403/04A ~ C Series



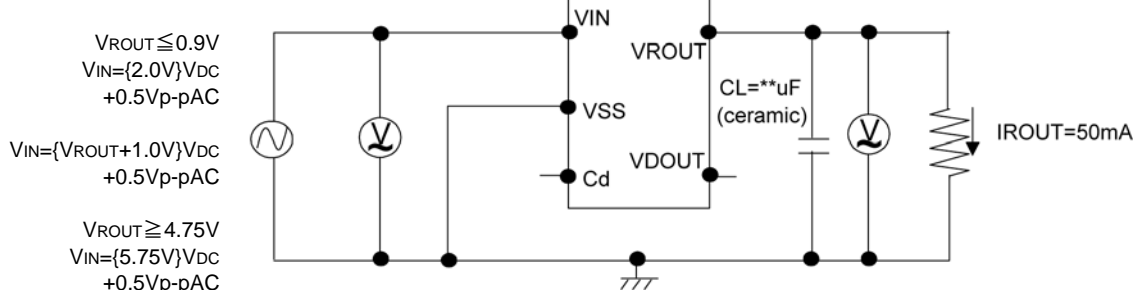
#### XC6403/04D Series



#### XC6403/04E Series



#### XC6403/04F Series



#### Output Capacitor Corresponding Chart

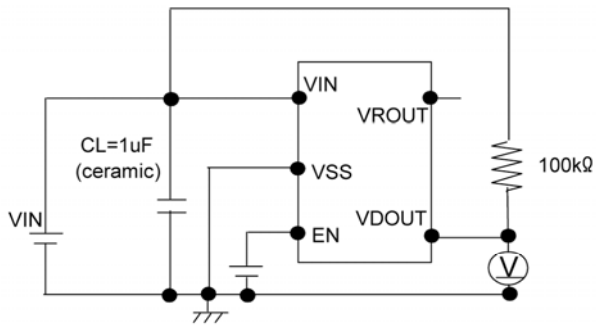
| $V_{ROUT}$ | 0.9 ~ 1.2V            | 1.3 ~ 1.7V            | 1.8 ~                 |
|------------|-----------------------|-----------------------|-----------------------|
| CL         | More Than $4.7 \mu F$ | More Than $2.2 \mu F$ | More Than $1.0 \mu F$ |

## TEST CIRCUITS (Continued)

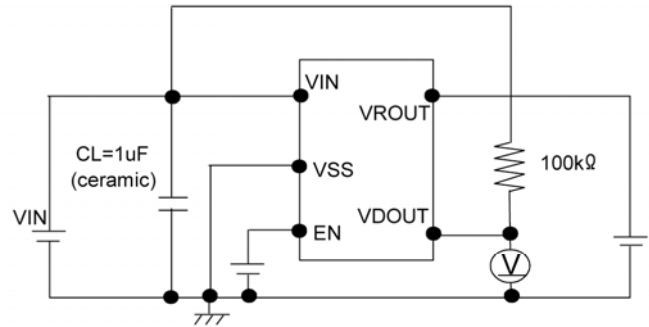
### ● Circuit ④

XC6403/04A ~ C Series

[VD Sense, VIN Type]

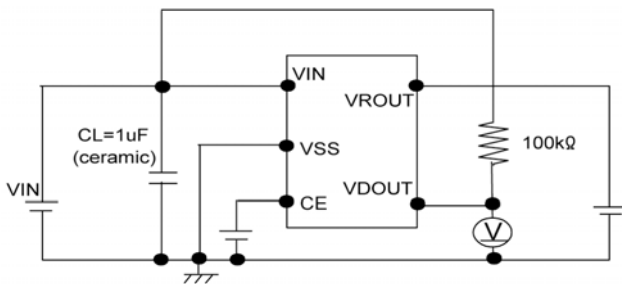


[VD Sense, VROUT Type]

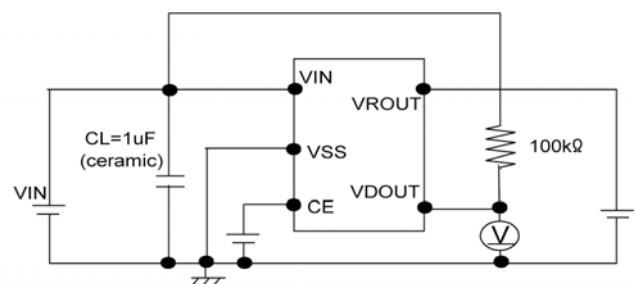


XC6403/04D Series

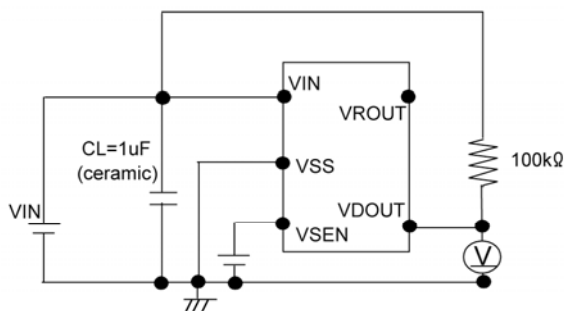
[VD Sense, VIN Type]



[VD Sense, VROUT Type]

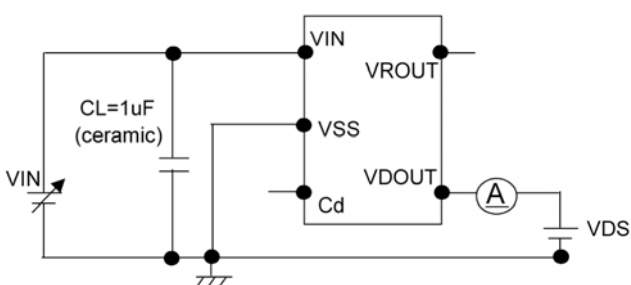


XC6403/04E Series

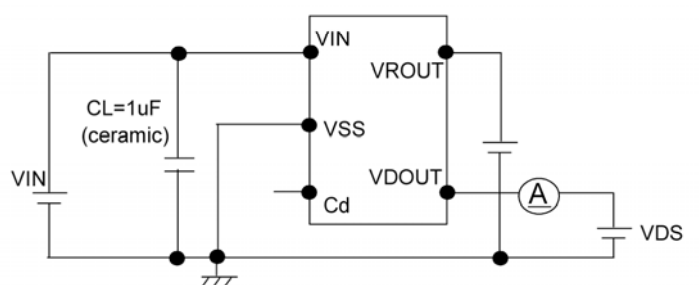


XC6403/04F Series

[VD Sense, VIN Type]



[VD Sense, VROUT Type]

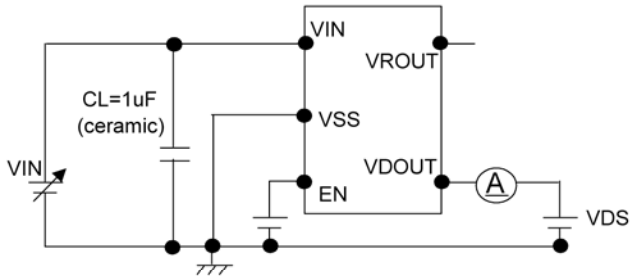


## TEST CIRCUITS (Continued)

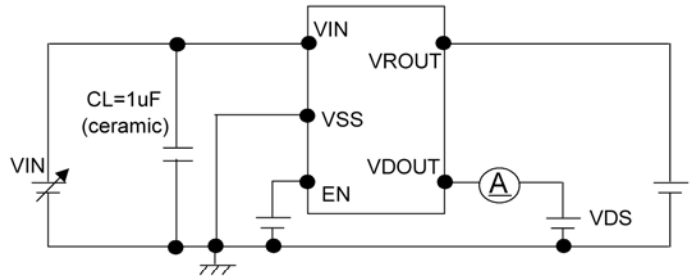
### ● Circuit ⑤

XC6403/04A ~ C Series

[VD Sense, VIN Type]

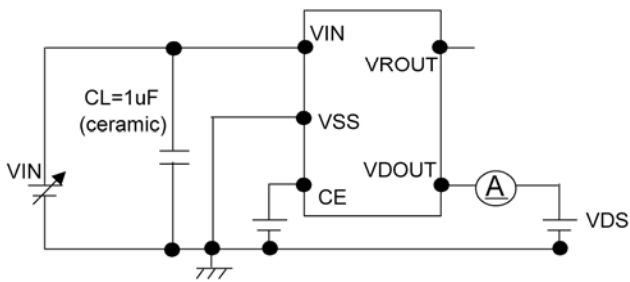


[VD Sense, VROUT Type]

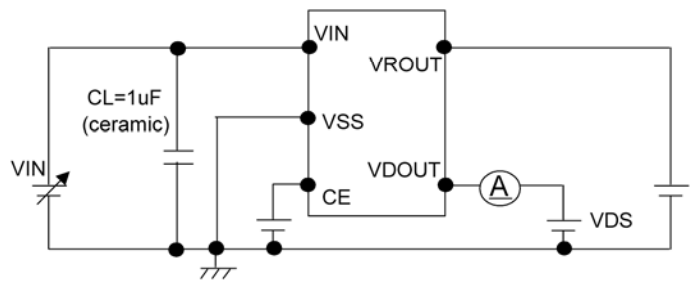


XC6403/04D Series

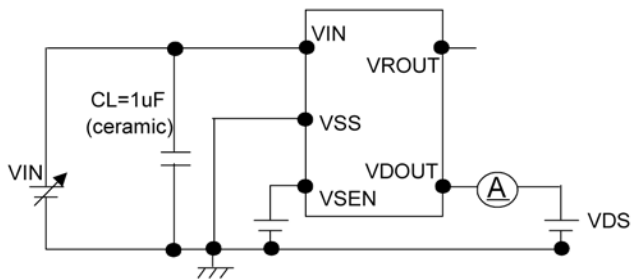
[VD Sense, VIN Type]



[VD Sense, VROUT Type]

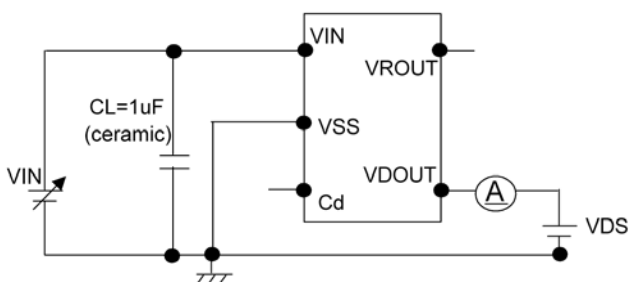


XC6403/04E Series

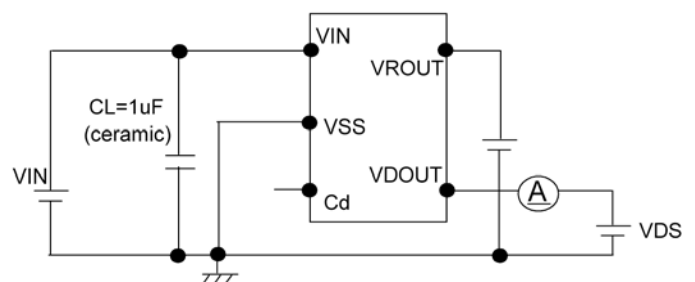


XC6403/04F Series

[VD Sense, VIN Type]



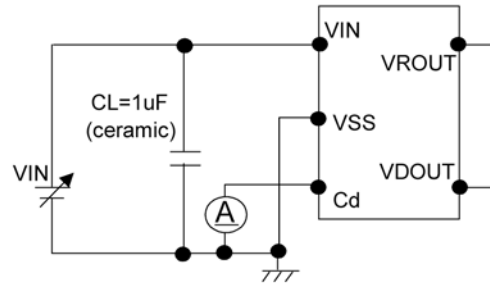
[VD Sense, VROUT Type]



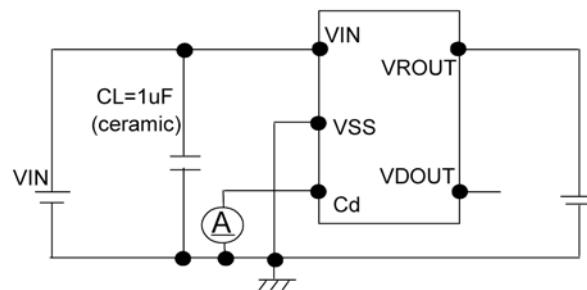
## ■ TEST CIRCUITS (Continued)

● Circuit ⑥

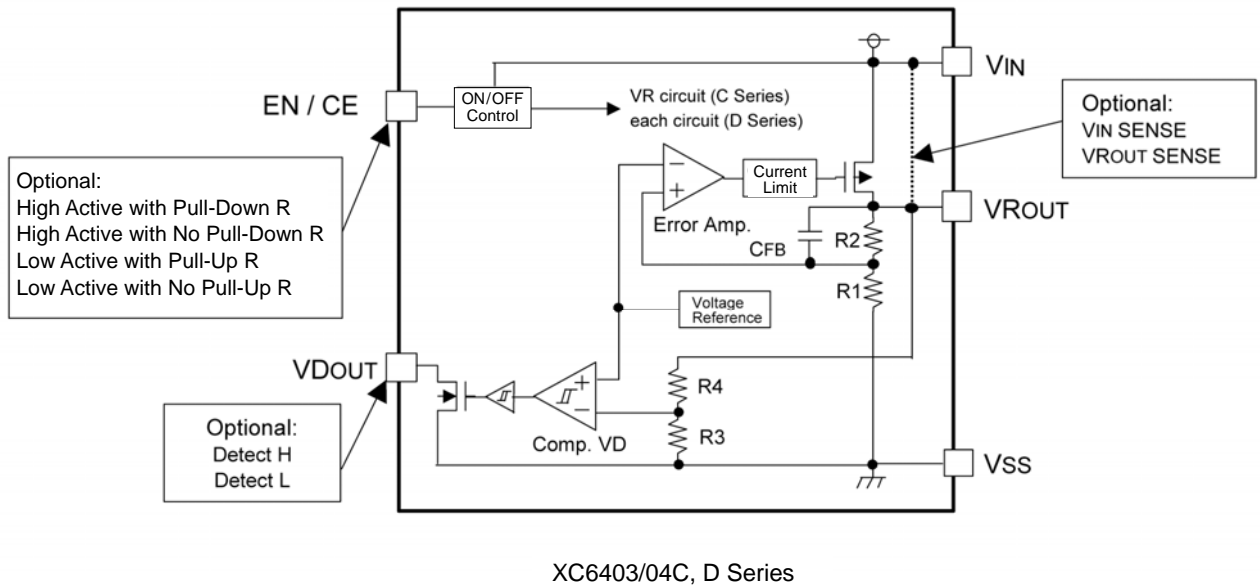
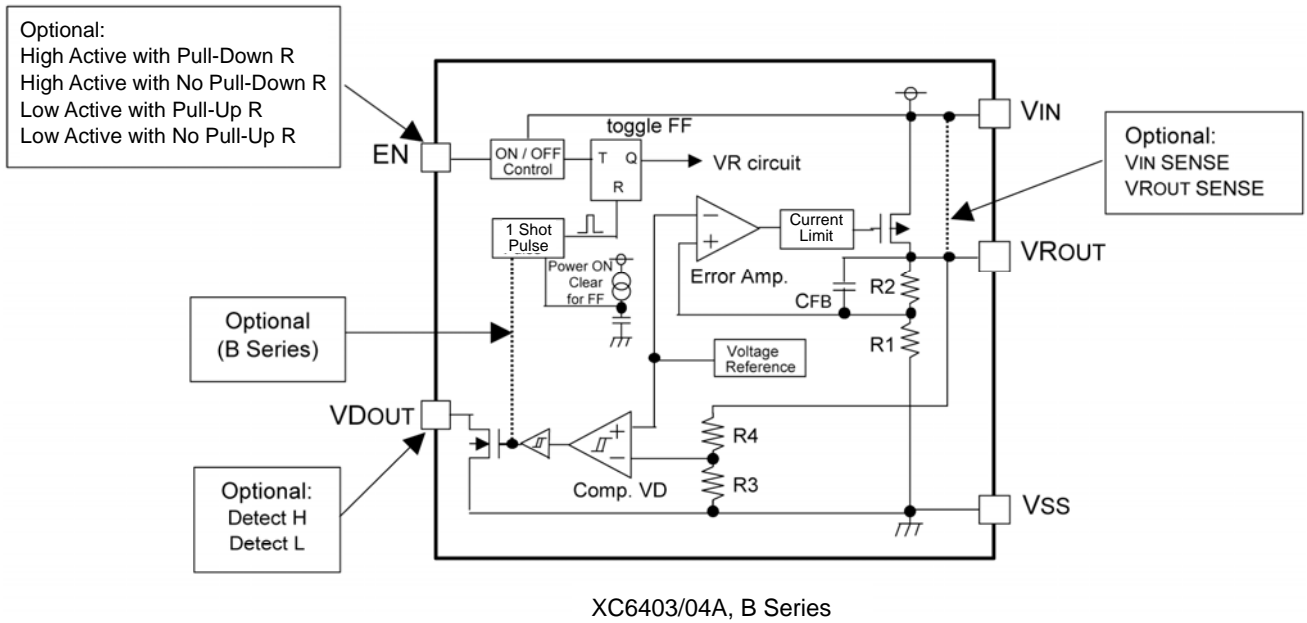
XC6403/04F Series  
[VD Sense, VIN Type]



[VD Sense, VROUT Type]

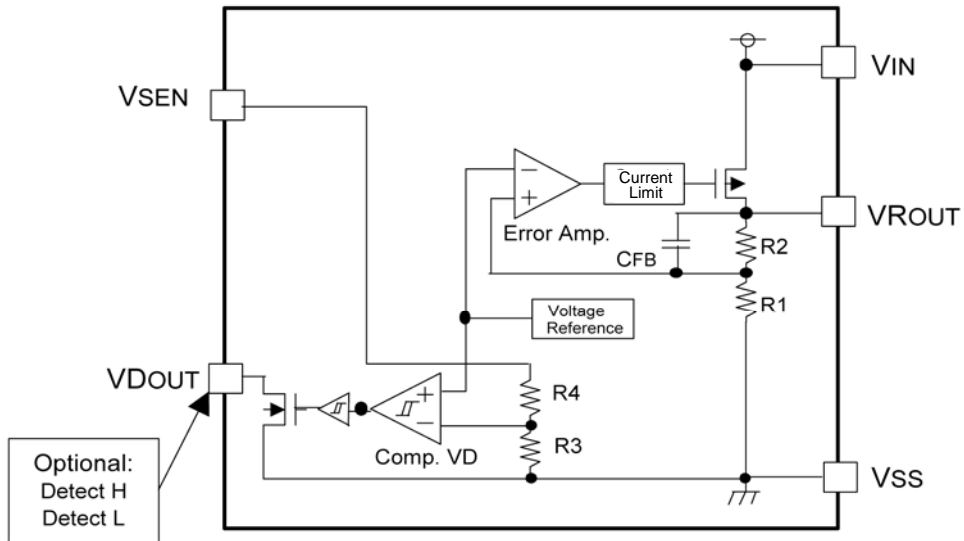


## ■ BLOCK DIAGRAMS

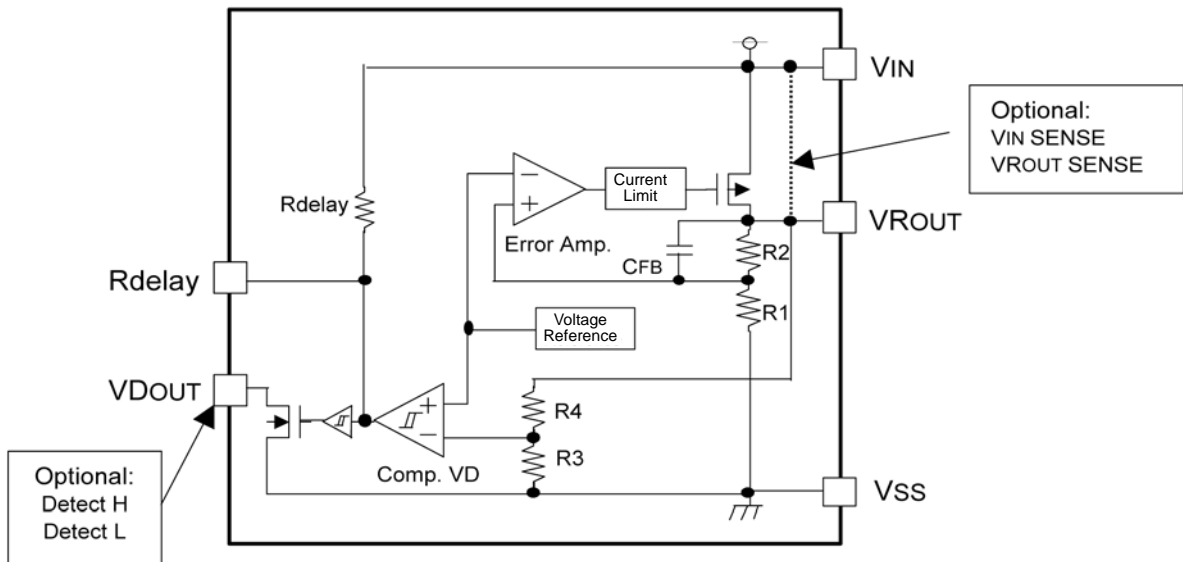




■ BLOCK DIAGRAMS (Continued)



XC6403/04E Series



XC6403/04F Series

## OPERATIONAL EXPLANATION

### <Output Voltage Regulator Control>

The voltage, divided by resistors R1 & R2 which are connected to the V<sub>ROUT</sub> pin is compared with the internal reference voltage by the error amplifier. The P-channel MOSFET, which is connected to the V<sub>ROUT</sub> pin, is then driven by the subsequent output signal. The output voltage at the V<sub>ROUT</sub> pin is controlled & stabilized by negative feedback. The current limit circuit and short circuit protection operate in relation to the level of output current. Further, the voltage regulator's internal circuitry can be shutdown via the EN or CE pin's signal.

### <Detector Function with the XC6403/04 Series>

The series' detector function monitors the voltage divided by resistors R3 & R4 which are connected to the V<sub>ROUT</sub> pin or the V<sub>IN</sub> pin or the V<sub>SEN</sub> pin, as well as monitoring the voltage of the internal reference voltage source via the comparator. The V<sub>DSEN</sub> pin has options (please refer to the Selection Guide, item 4). A 'High' or 'Low' signal level can be output from the V<sub>DOUT</sub> pin when the V<sub>D</sub> pin voltage level goes below the detect voltage. The V<sub>D</sub> output logic has options (please refer to the Selection Guide, item 5). As V<sub>DOUT</sub> is an open-drain N-channel output, a pull-up resistor of about 220kΩ is needed to achieve a voltage output. Because of hysteresis at the detector function, output at the V<sub>DOUT</sub> pin will invert when the detect voltage level increases above the release voltage (105% of the detect voltage). Even when the XC6403/04A, B, C, series are in stand-by mode, the voltage detector function operates and the output voltage at V<sub>DOUT</sub> will output according to the voltage level at V<sub>DSENSE</sub> voltage.

For the XC6403/04A, B, C types, in stand-by, if a voltage of the recovery voltage is present at the V<sub>ROUT</sub> pin (from another power source), the V<sub>DOUT</sub> pin will be high impedance mode, and the pull up voltage will be output at V<sub>DOUT</sub>. By connecting the C<sub>delay</sub> pin to a capacitor (C<sub>d</sub>), the XC6403/04F series can apply a delay time to V<sub>DOUT</sub> voltage when releasing voltage. The delay time can be calculated from the internal resistance, R<sub>delay</sub> (2MΩ fixed) and the value of C<sub>d</sub> as per the following equation.

$$Delay\ Time = C_{delay} \times R_{delay} \times 0.7$$

| Delay Time         | R <sub>delay</sub> standard : 1.0 ~ 3.5MΩ | TYP : 2.0MΩ         |
|--------------------|-------------------------------------------|---------------------|
| C <sub>delay</sub> | DELAY TIME (TYP.)                         | DELAY TIME (TYP.)   |
| 0.01 μF            | 14 msec                                   | 7.0 ~ 24.5 msec     |
| 0.022 μF           | 30.8 msec                                 | 15.4 ~ 53.9 msec    |
| 0.047 μF           | 65.8 msec                                 | 32.9 ~ 115.15 msec  |
| 0.1 μF             | 140 msec                                  | 70.0 ~ 245.0 msec   |
| 0.22 μF            | 308 msec                                  | 154.0 ~ 539.0 msec  |
| 0.47 μF            | 658 msec                                  | 329.0 ~ 1151.5 msec |
| 1 μF               | 1400 msec                                 | 700.0 ~ 2450.0 msec |

### <Low ESR Capacitors>

With the XC6403/04 series regulator, a stable output voltage is achievable even if low ESR capacitors are used, as a phase compensation circuit is built-in to the regulator. In order to ensure the effectiveness of the phase compensation, we suggest that an output capacitor (C<sub>L</sub>) be connected as close as possible, between the output pin (V<sub>ROUT</sub>) and the V<sub>SS</sub> pin. Please use an output capacitor (C<sub>L</sub>) with a capacitance, based on the chart below. We also suggest an input capacitor (C<sub>IN</sub>) of 1 μF : this should be connected between V<sub>IN</sub> and V<sub>SS</sub> in order to stabilize input power source.

### Output Capacitor

| V <sub>ROUT</sub> | 0.9 ~ 1.2V       | 1.3 ~ 1.7V       | 1.8 ~            |
|-------------------|------------------|------------------|------------------|
| C <sub>L</sub>    | More Than 4.7 μF | More Than 2.2 μF | More Than 1.0 μF |

### <Current Limiter, Short-Circuit Protection>

The XC6403/04 series regulator offers a combination of current limit and circuit protection by means of a built-in fixed current limiter circuit and a foldback circuit. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, the output voltage drops further and output current decreases. When the output pin is shorted, a current of about 50mA flows.

## ■ OPERATIONAL EXPLANATION (Continued)

### <EN / CE Pin>

The IC's internal regulator circuitry can be shut down via the signal from the EN pin with the XC6403/04A, B, C series. In shutdown mode, output at the V<sub>ROUT</sub> pin will be pulled down to the V<sub>SS</sub> level via R1 & R2. The whole IC's circuitry can be shut down via CE pin with the XC6403/04D series and power consumption can be reduced to around 0 μA (TYP.). While the voltage detector is in shutdown mode, the voltage detector output is in a post-detection state. When choosing Detect L, input current can be set by using the following formula.

$$\text{Input Current} = V_{IN} \text{ voltage} / \text{Pull-Up Resistance}$$

In stand-by mode, the above input current can be reduced by connecting a pull-up resistor between V<sub>ROUT</sub> and V<sub>DOUT</sub>.

Note that as the XC6403/04\*E to K types of the XC6404A to D series are 'High Active / No Pull-Down' and XC6403/04\*R to U types of the XC6404A to D series are 'Low Active / No Pull-Up', operations will become unstable with the CE pin open (See the chart below).

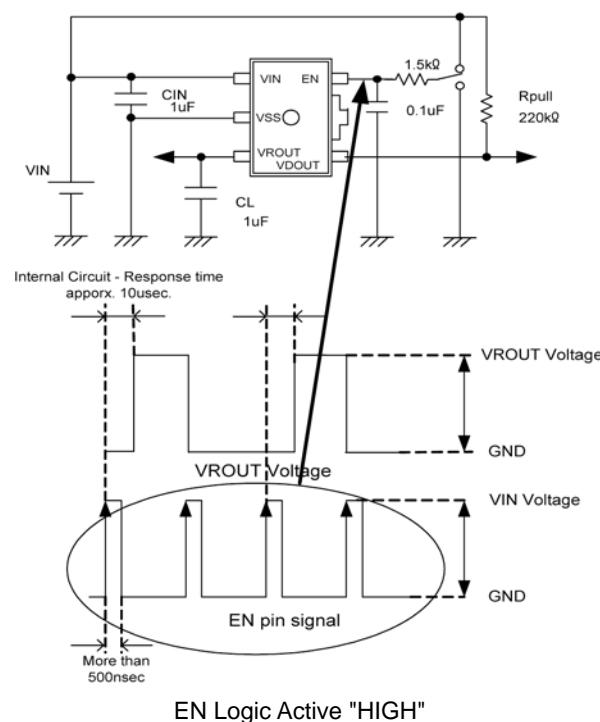
| SERIES            | EN/CE INPUT LOGIC             |
|-------------------|-------------------------------|
| XC6403/04 * A ~ D | High Active with Pull-Down    |
| XC6403/04 * E ~ K | High Active with No Pull-Down |
| XC6403/04 * L ~ P | Low Active with Pull-Up       |
| XC6403/04 * R ~ U | Low Active with No Pull-Up    |

(\* A ~ D Series)

We suggest that you use this IC with either a V<sub>IN</sub> voltage or a V<sub>SS</sub> voltage input at the EN or CE pin. If this IC is used with the correct specifications for the EN or CE pin, the IC will operate normally. However, supply current may increase as a result of through current in the IC's internal circuitry if a voltage other than V<sub>IN</sub> or V<sub>SS</sub> is applied.

### <Toggle Operation>

The XC6403/04 A and B series have a built-in toggle ON/OFF switch which repeats an on/off operation via the EN pin's leading edge signal when the EN logic is Active HIGH, and via the EN pin's falling edge signal when the EN logic is Active LOW (Please also refer the figure below). The EN input signal duration should be over 500nsec. If the EN input signal is less than 500nsec, it is possible that the circuit fails to respond and the toggle function does not operate. To operate the toggle function properly when the EN pin voltage noise is large, a RC filter should be used to reduce the noise in the signal to the EN pin. In the case where input delay time is required, it is possible to set the time constant by connecting an RC network to the EN pin.



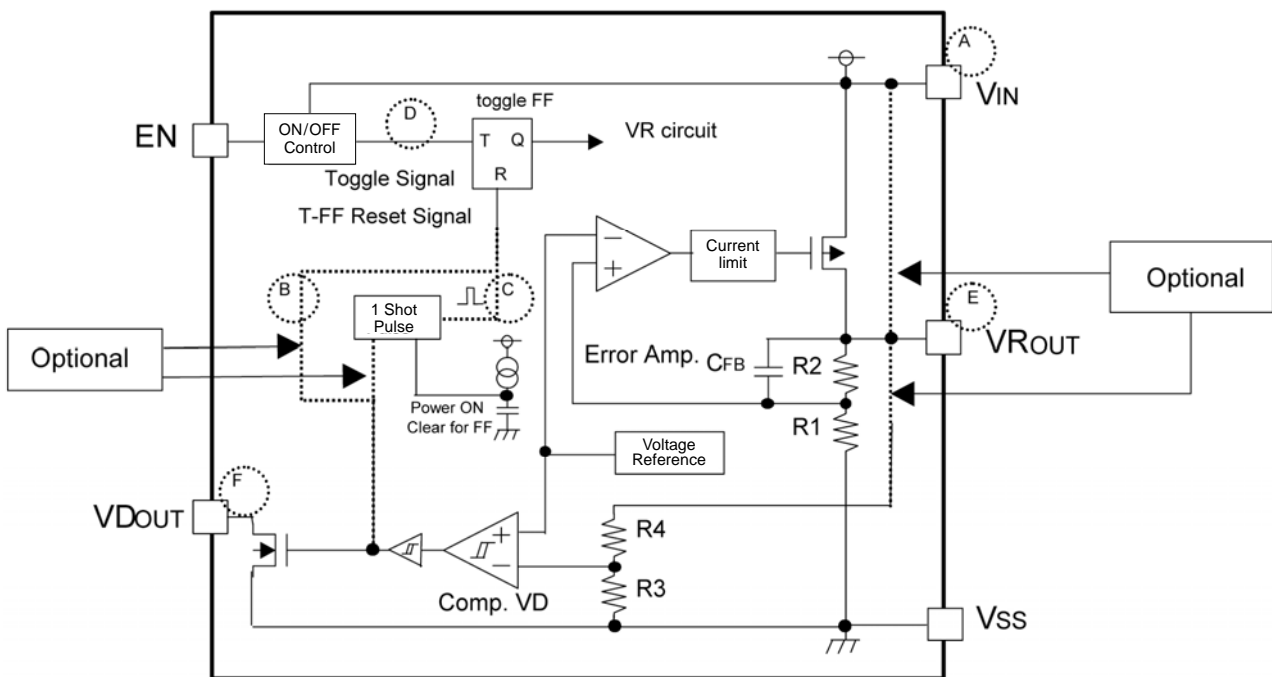
## OPERATIONAL EXPLANATION (Continued)

### <Toggle Operation> (Continued)

For the XC6403/04B series, there are two types of toggle selection; one is a T-type flip-flop (T-FF) used for toggle operation which can be reset internally by a signal directly from the voltage detector ( $V_{IN}$  Sense type only. See also the Selection Guide). The other type is where the reset is applied internally through a one shot pulse circuit

( $V_{IN}$ ,  $V_{ROUT}$  type only. See also the Selection Guide). The type, which applies the reset directly via the signal from the voltage detector function, applies the voltage detector comparator's output signal (reset signal) to the reset of T-FF reset, and turns the VR output OFF when the input voltage decreases below the detect voltage due to battery consumption, etc.. In order to return the VR output, apply a voltage larger than the release voltage to  $V_{IN}$  and input a toggle signal to the T-FF. In the case where input voltage is below the release voltage, the VR output does not return even though the toggle signal is input into the T-FF.

The type which applies the reset signal to the T-FF internally via a one-shot pulse circuit changes the voltage detector comparator output signal to a one-shot signal internally. Like the type which applies the reset directly via the signal from voltage detector function, this type also applies the reset to the T-FF and sets the VR output to OFF when the input voltage ( $V_{IN}$  Sense type) and output voltage ( $V_{ROUT}$  Sense type) drop below the detect voltage level. This type can return the VR output by inputting a toggle signal, even when the Sense pin voltage ( $V_{IN}$  or  $V_{ROUT}$  pin voltage) is below the release voltage. Please refer to the block diagram below and the timing chart on the following page. Please choose the option suitable to the application.

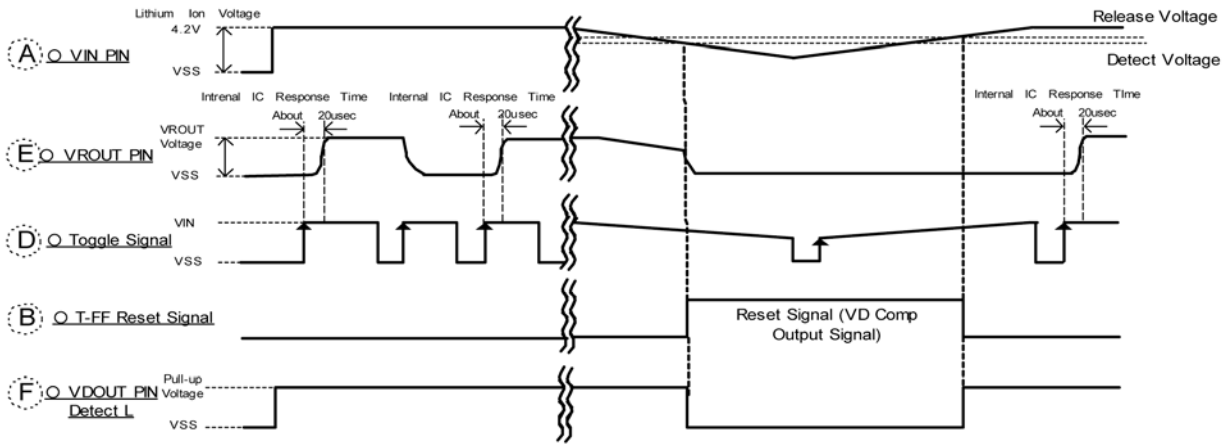


Block Diagram for XC6403/04B series Timing Chart

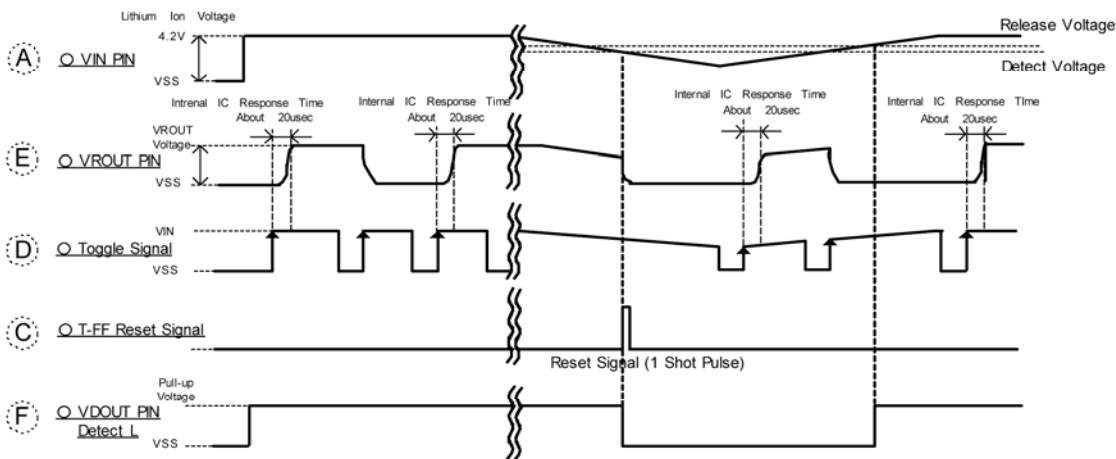
## TIMING CHART

XC6403/04B Series

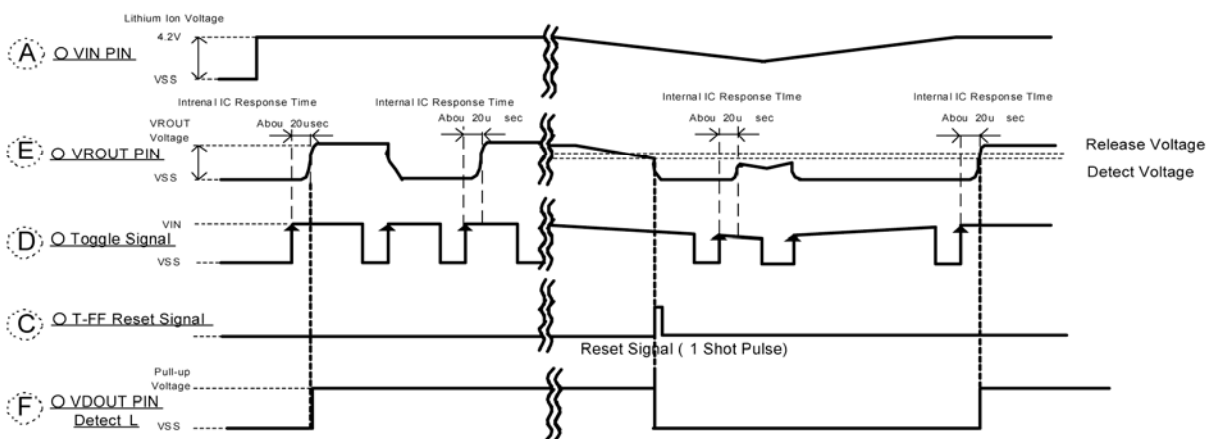
- Using the VD output level signal as the reset signal of T-FF (VD Sense = VIN PIN)



- Changing the VD output level signal into a one shot pulse to use T-FF as the reset signal (VD Sense = VIN PIN)



- Changing the VD output level signal into a one shot pulse to use T-FF as the reset signal (VD Sense = VROUT PIN)



The circled letters correspond to those shown on the block diagrams.

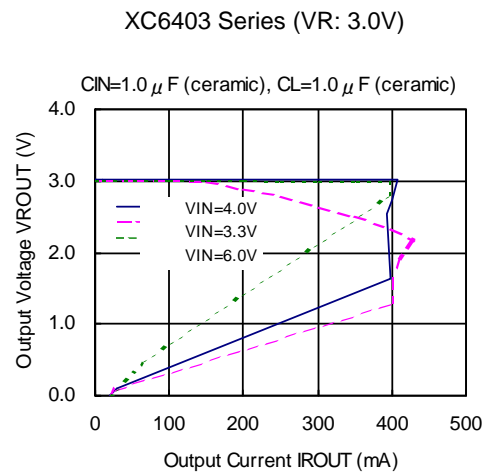
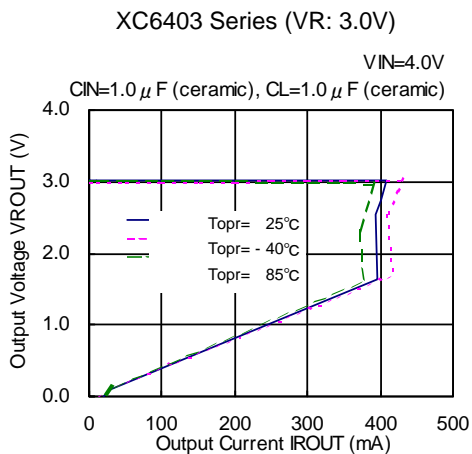
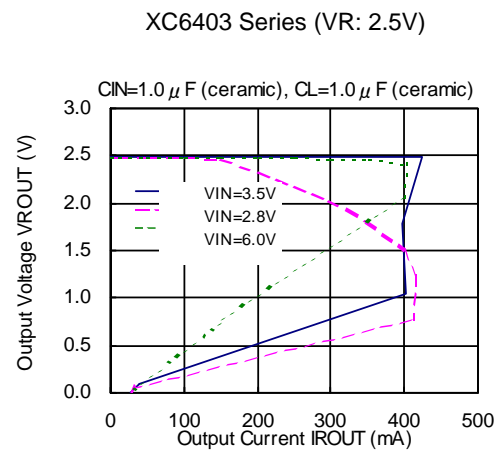
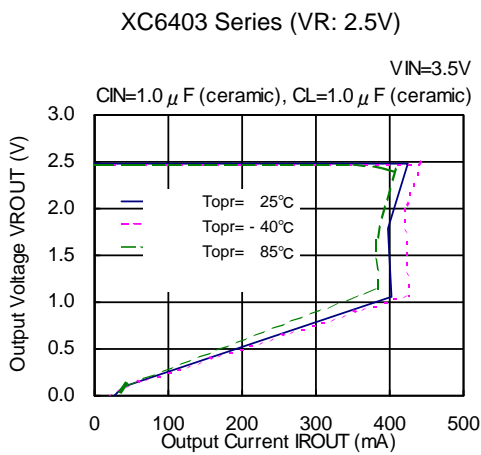
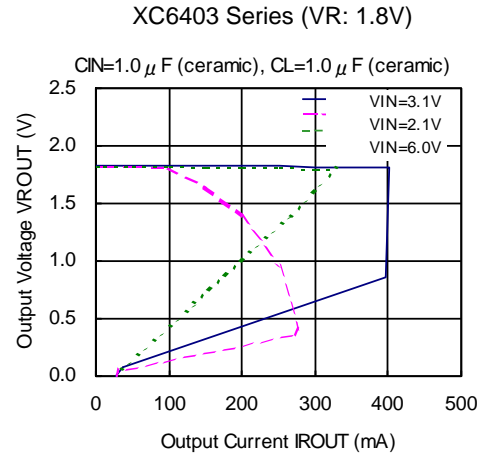
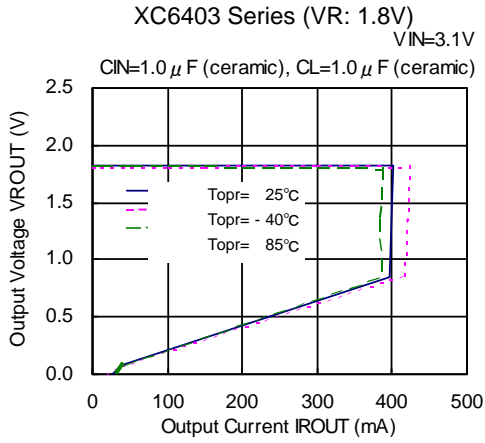
## ■ NOTES ON USE

1. Please use this IC within the stated absolute maximum ratings. The IC is liable to malfunction should the ratings be exceeded.
2. Where wiring impedance is high, operations may become unstable due to noise and/or phase lag depending on output current. Please strengthen  $V_{IN}$  and  $V_{SS}$  wiring in particular.
3. Please wire the input capacitor ( $C_{IN}$ ) and the output capacitor ( $C_L$ ) as close to the IC as possible.  
Should rapid input fluctuation or load fluctuation occur, please increase the capacitor value such as  $C_{IN}$  or  $C_L$  to stabilize the operation.

## TYPICAL PERFORMANCE CHARACTERISTICS

### ●XC6403 Series

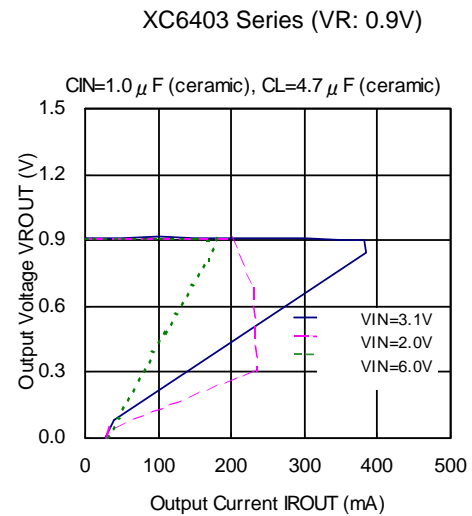
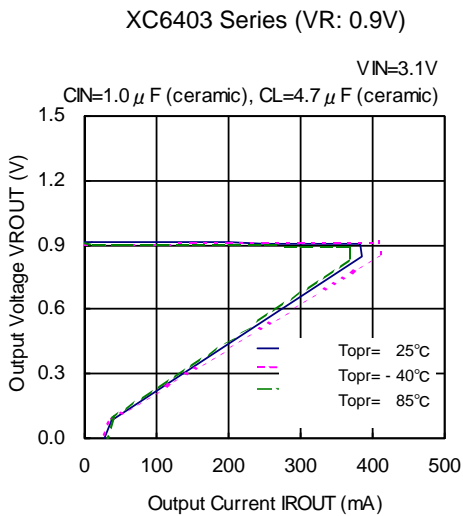
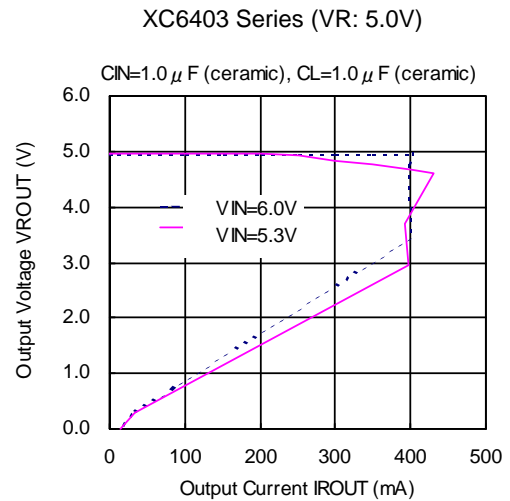
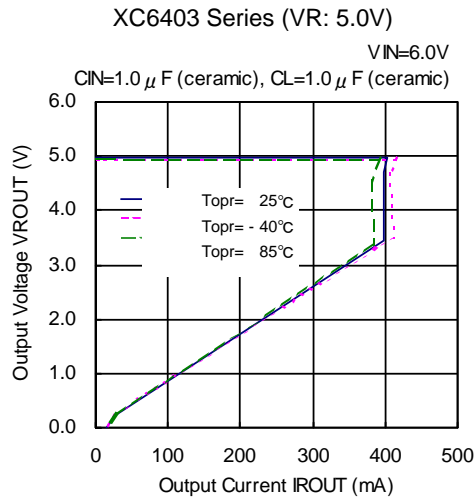
#### (1) VR Output Voltage vs. VR Output Current



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### ● XC6403 Series (Continued)

#### (1) VR Output Voltage vs. VR Output Current (Continued)

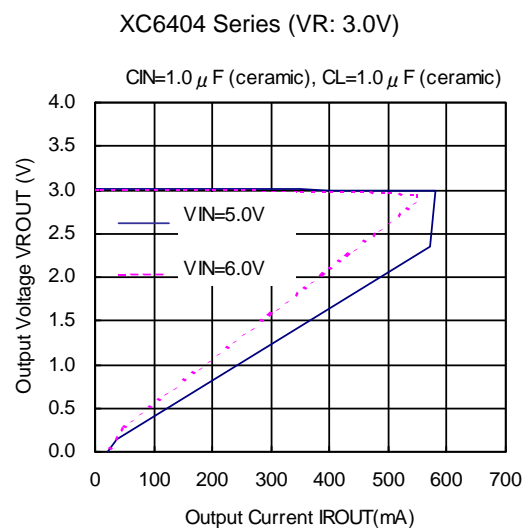
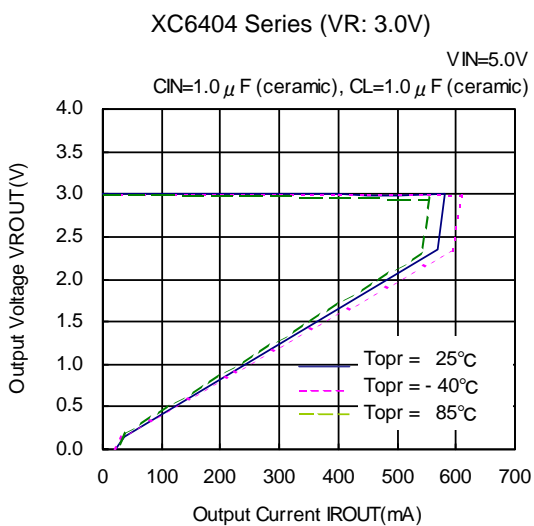
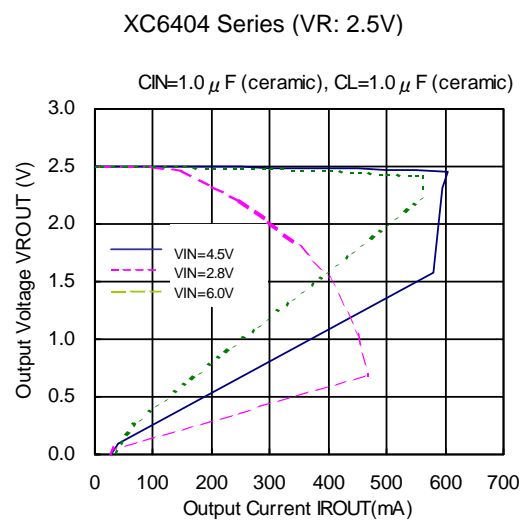
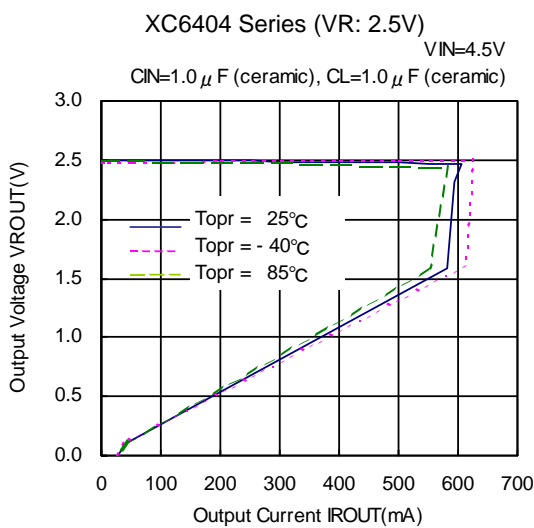
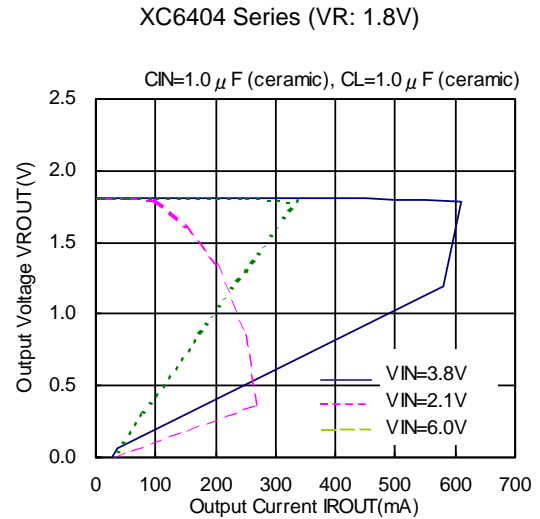
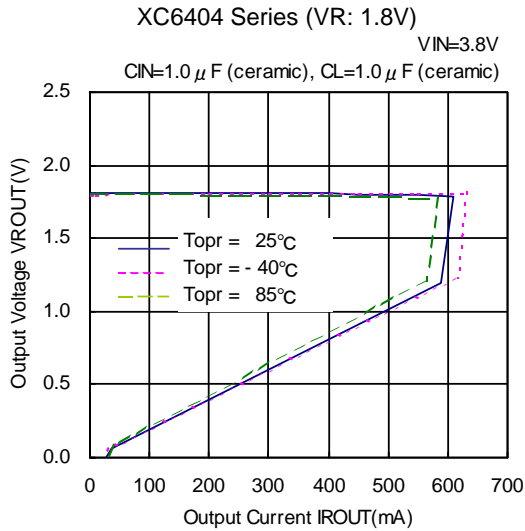




## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● XC6404 Series

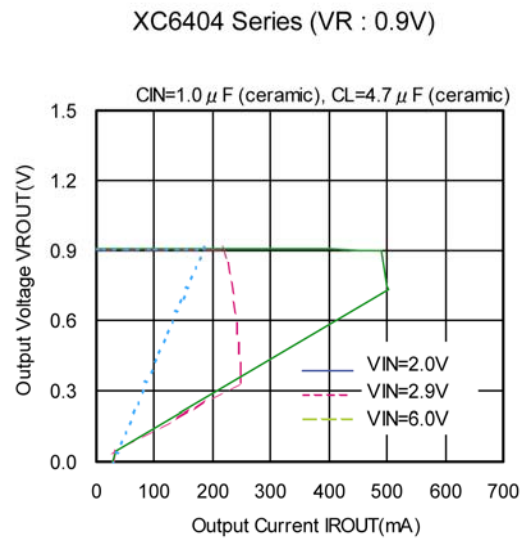
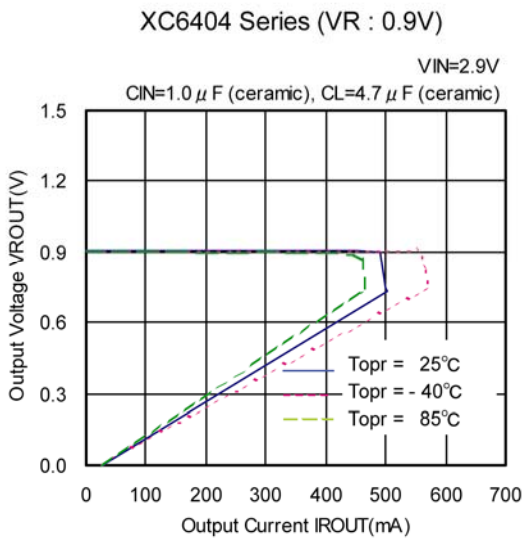
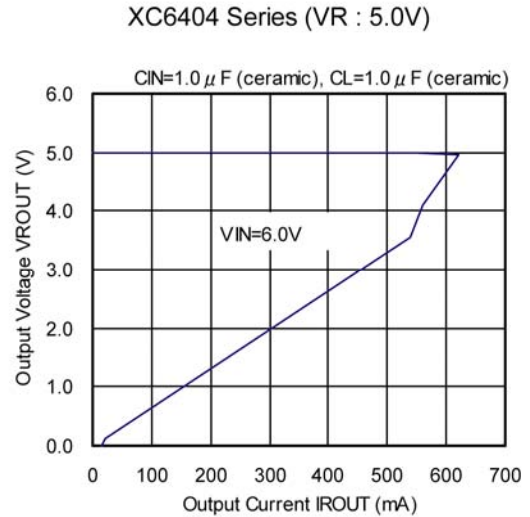
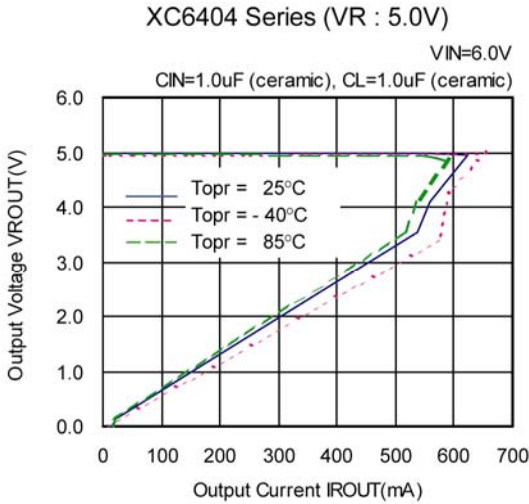
(1) VR Output Voltage vs. VR Output Current



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### XC6404 Series (Continued)

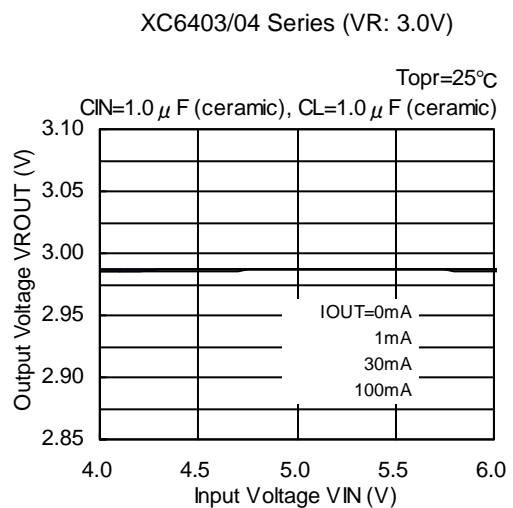
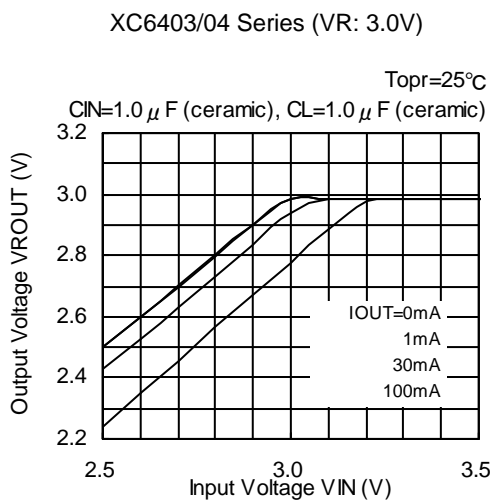
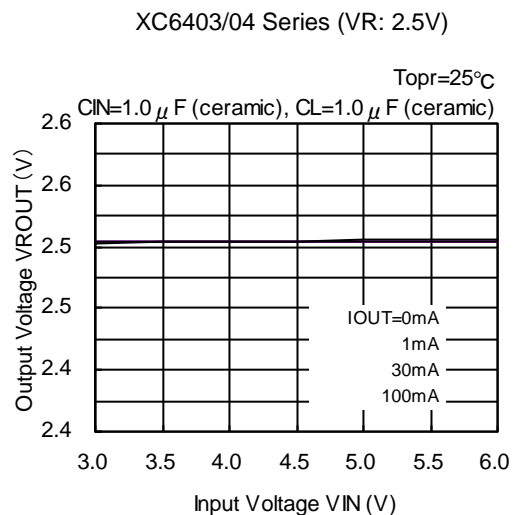
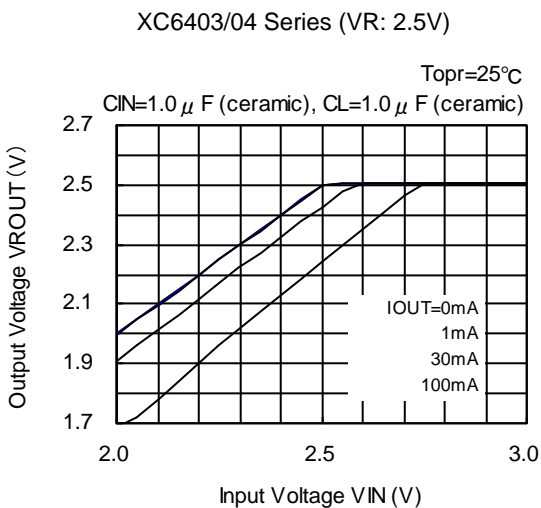
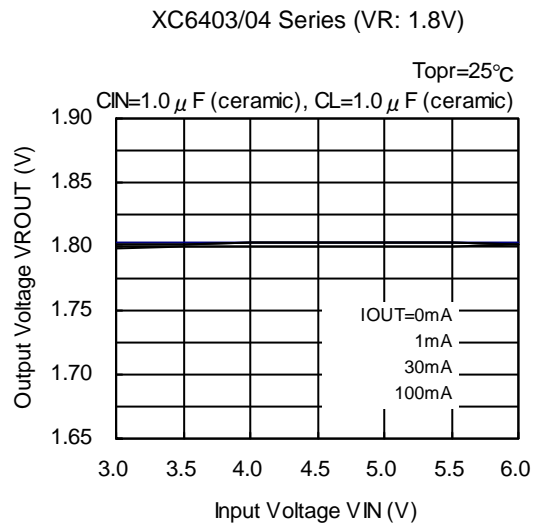
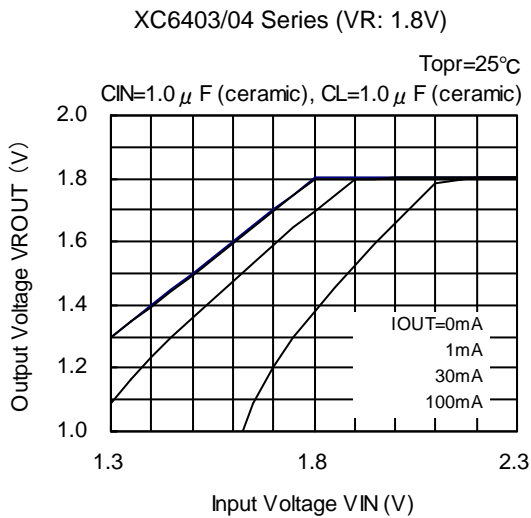
(1) VR Output Voltage vs. VR Output Current (Continued)



## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### ● XC6403/04 Series

#### (2) VR Output Voltage vs. Input Voltage

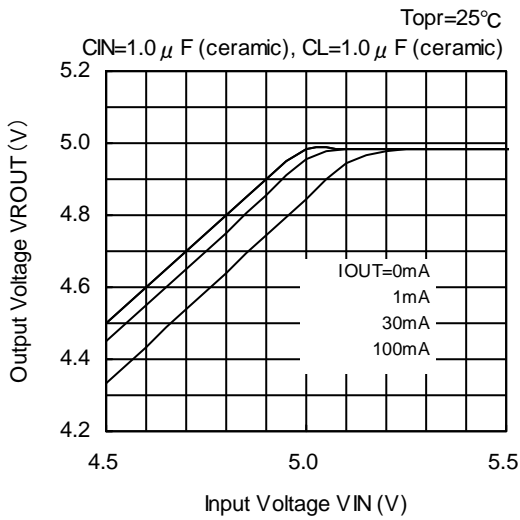


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

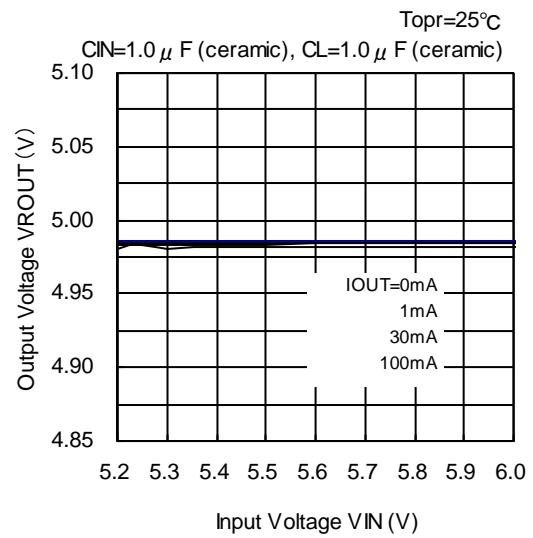
### ●XC6403/04 Series (Continued)

#### (2) VR Output Voltage vs. Input Voltage (Continued)

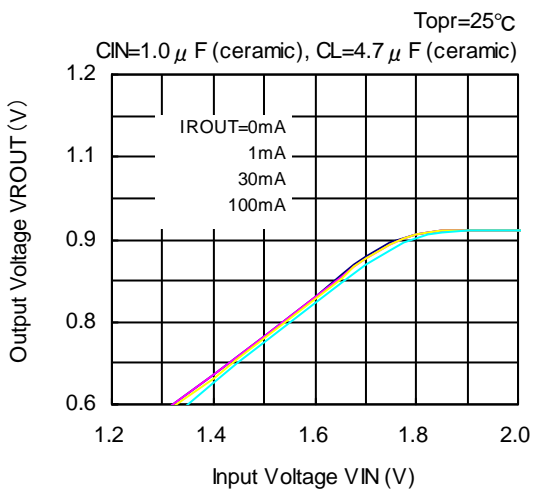
XC6403/04 Series (VR: 5.0V)



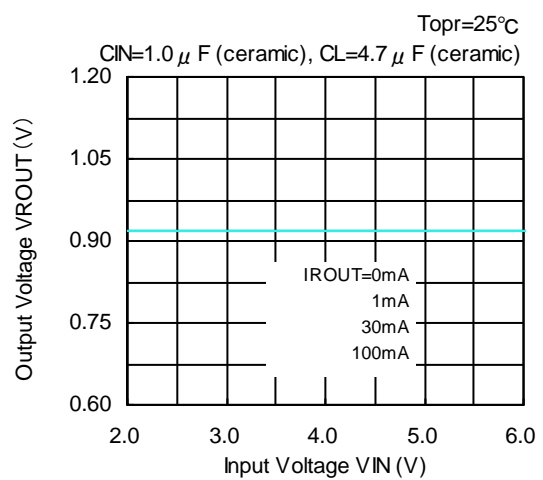
XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)

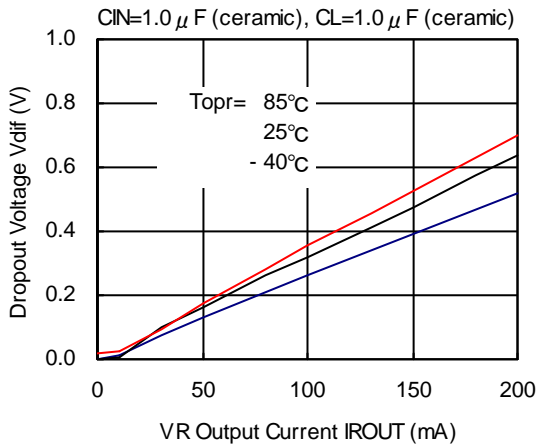


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

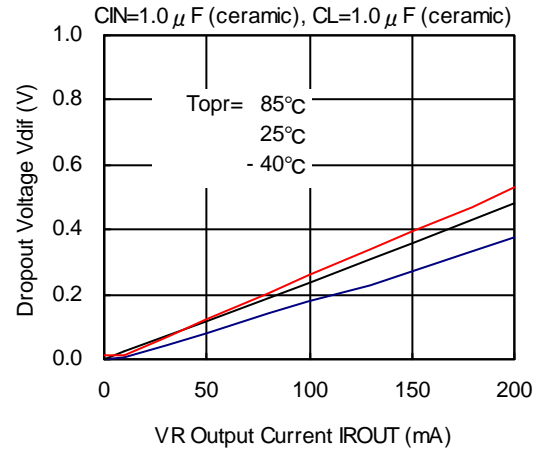
### ●XC6403/04 Series (Continued)

#### (3) Dropout Voltage vs. VR Output Current

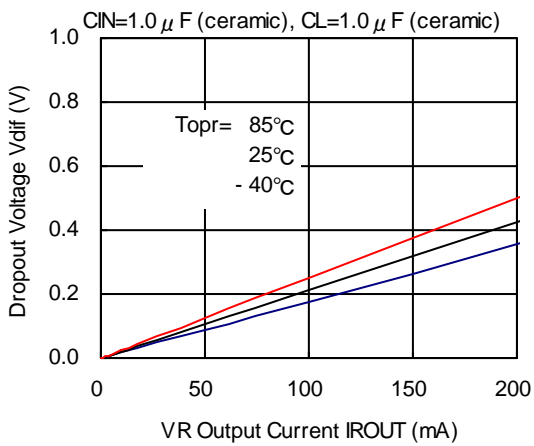
XC6403/04 Series (VR: 1.8V)



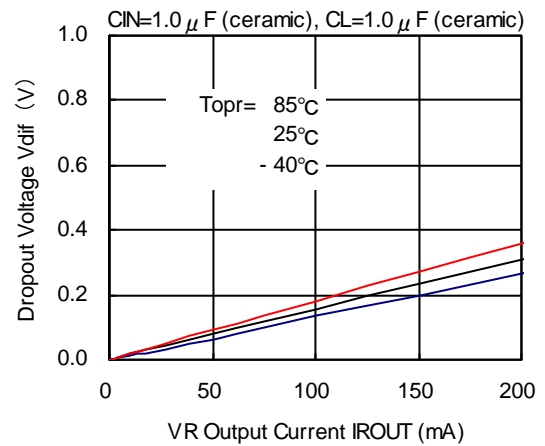
XC6403/04 Series (VR: 2.5V)



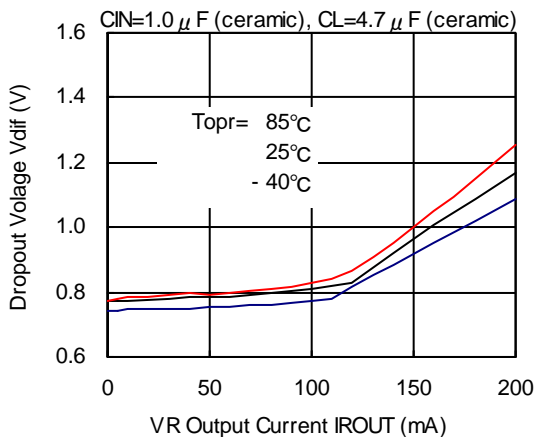
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

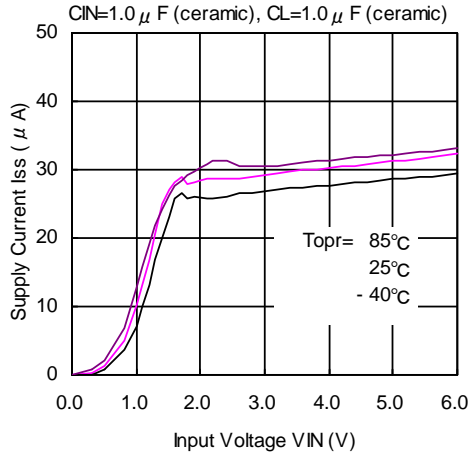


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

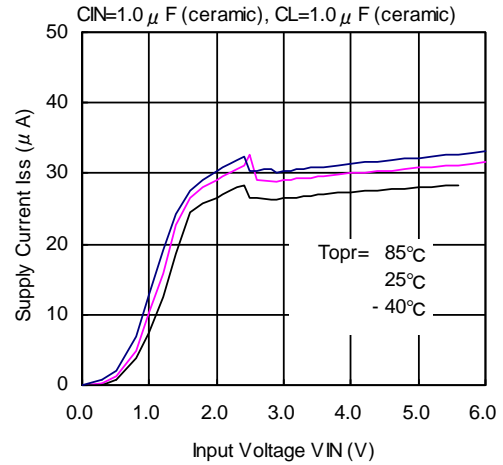
### ●XC6403/04 Series (Continued)

#### (4) Supply Current vs. Input Voltage

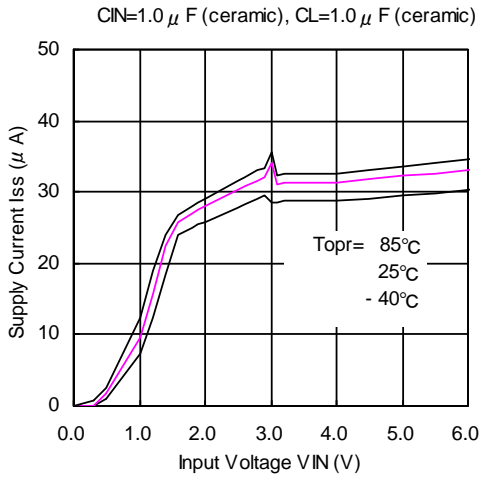
XC6403/04 Series (VR: 1.8V)



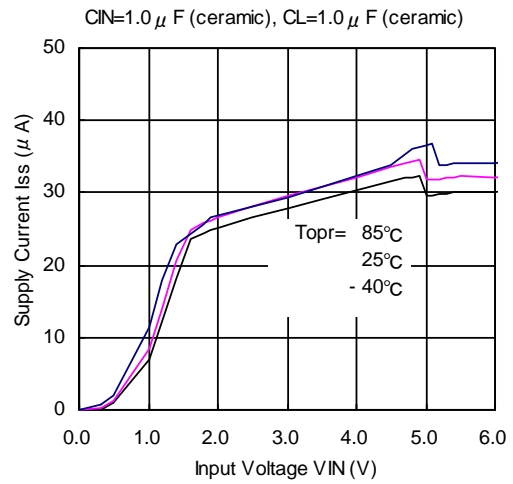
XC6403/04 Series (VR: 2.5V)



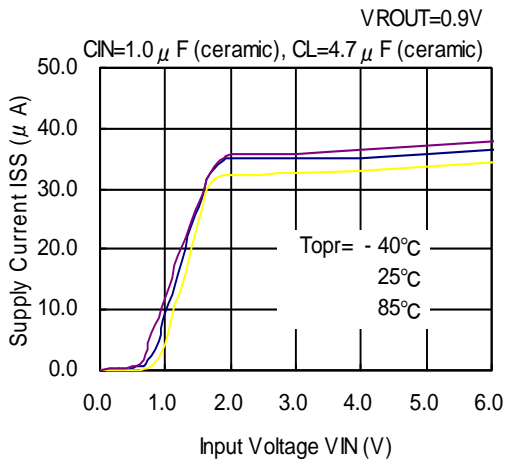
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

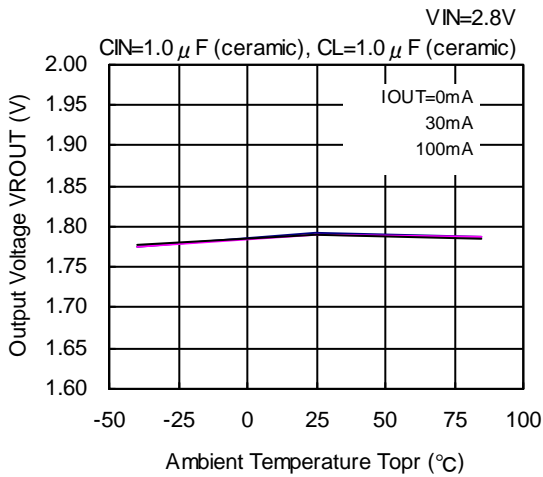


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

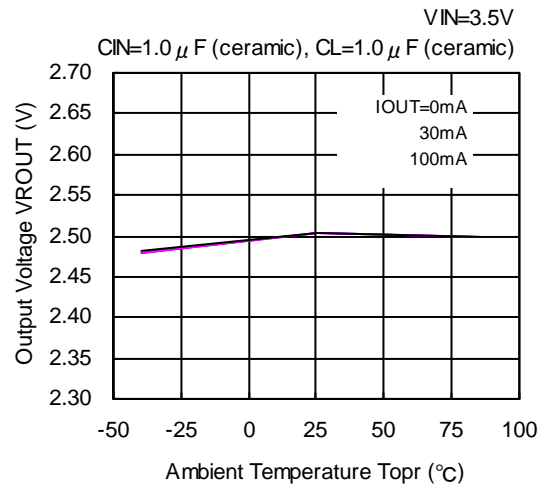
### ● XC6403/04 Series (Continued)

#### (5) VR Output Voltage vs. Ambient Temperature

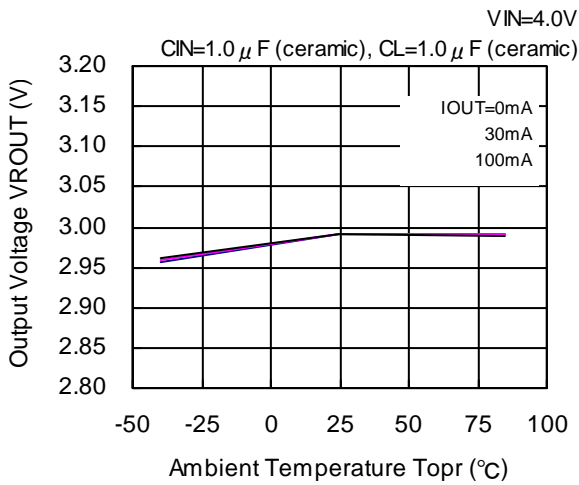
XC6403/04 Series (VR: 1.8V)



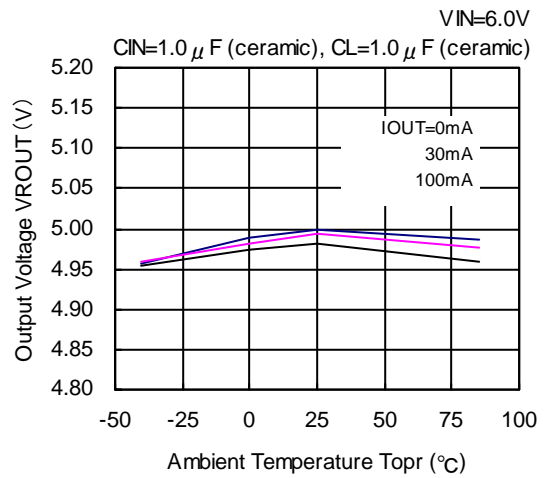
XC6403/04 Series (VR: 2.5V)



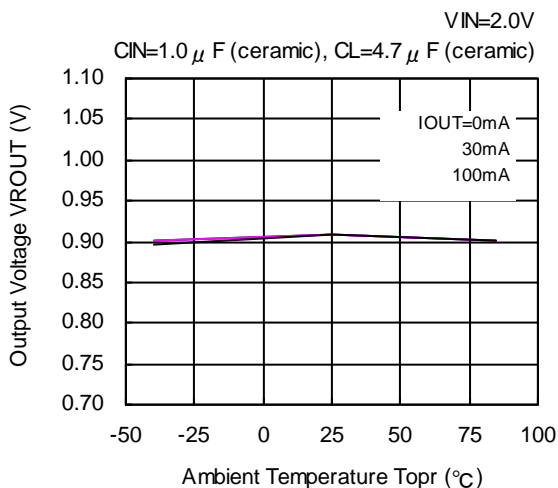
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

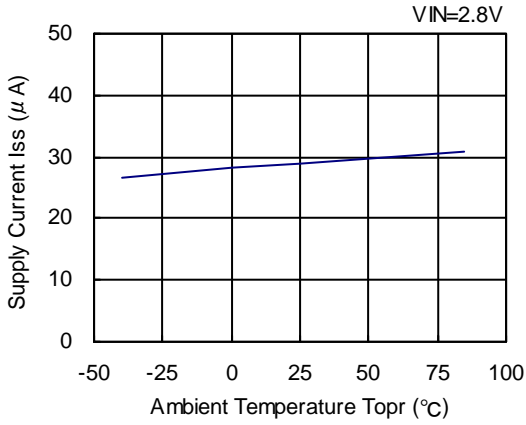


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

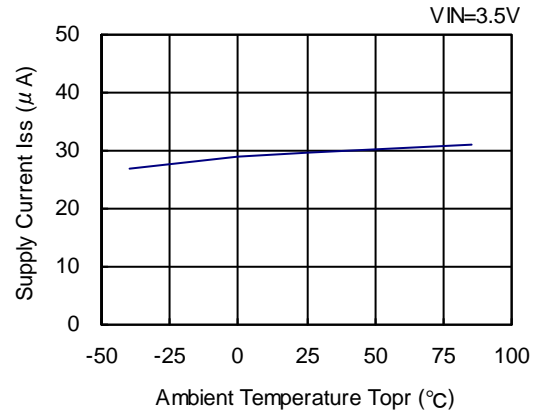
### ●XC6403/04 Series (Continued)

#### (6) Supply Current vs. Ambient Temperature

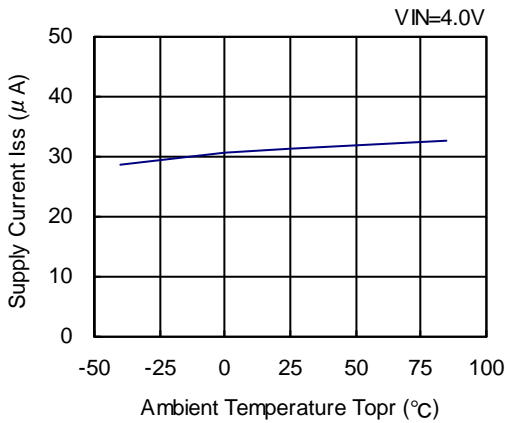
XC6403/04 Series (VR: 1.8V)



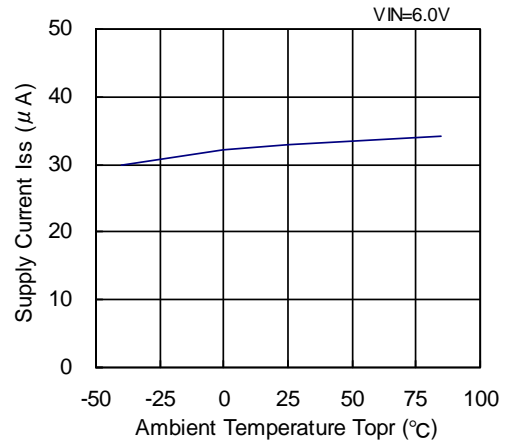
XC6403/04 Series (VR: 2.5V)



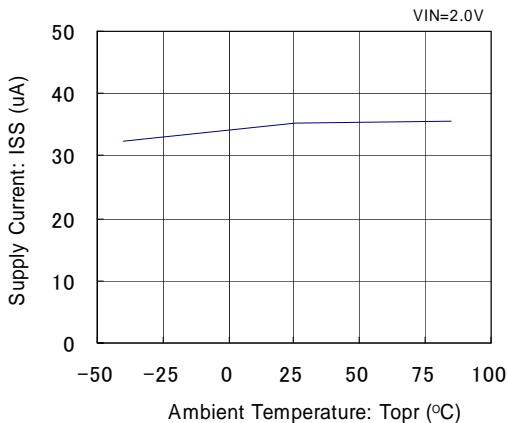
XC6403/04 Series (VR: 3.0V)



XC6403/04 Series (VR: 5.0V)



XC6403/04 Series (VR: 0.9V)

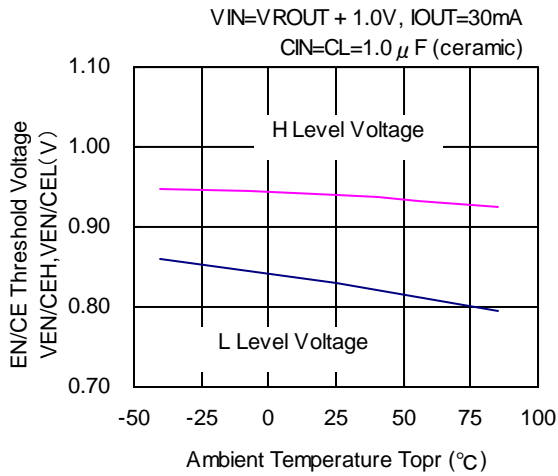




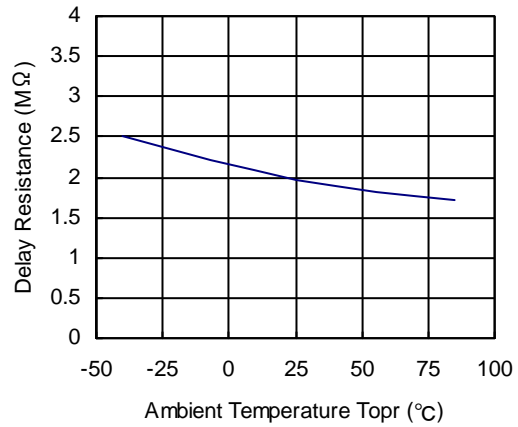
## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### ●XC6403/04 Series (Continued)

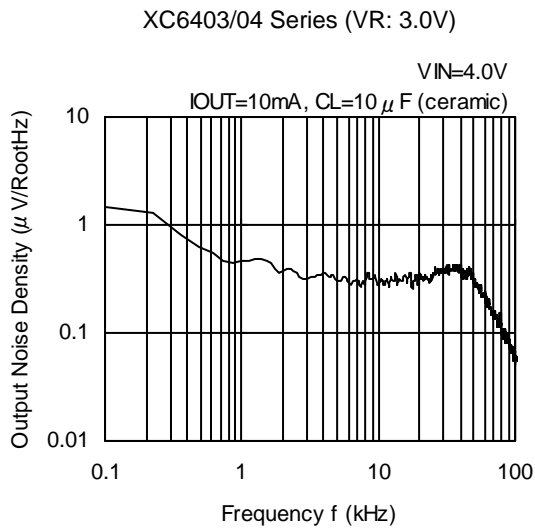
(7) EN/CE Threshold Voltage vs. Ambient Temperature



(8) Rdelay vs. Ambient Temperature



(9) Output Noise Density

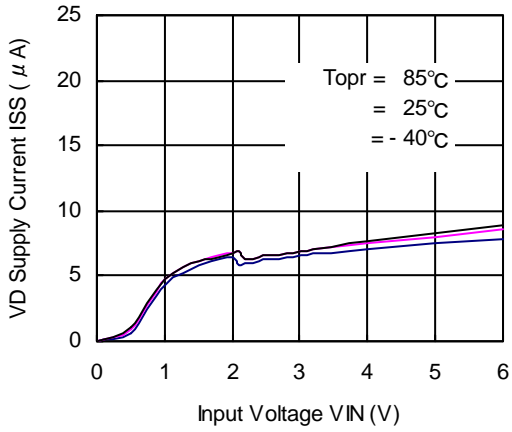


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

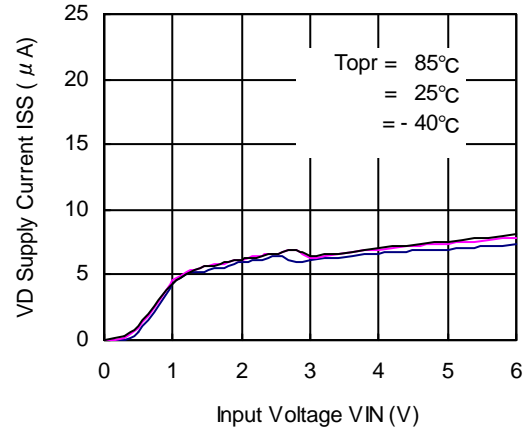
### ●XC6403/04 Series (Continued)

(10) VD Supply Current vs. Input Voltage (Only A ~ C Types)

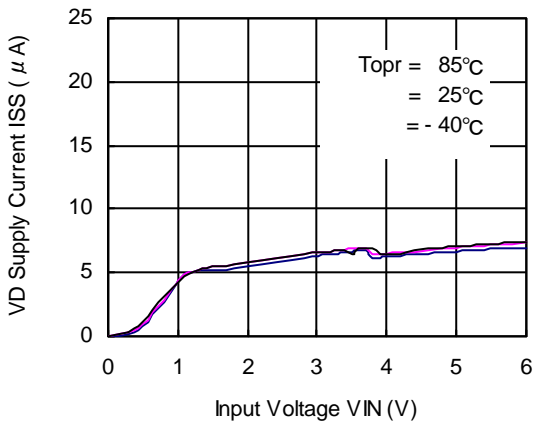
XC6403/04 Series (VD: 2.0V)



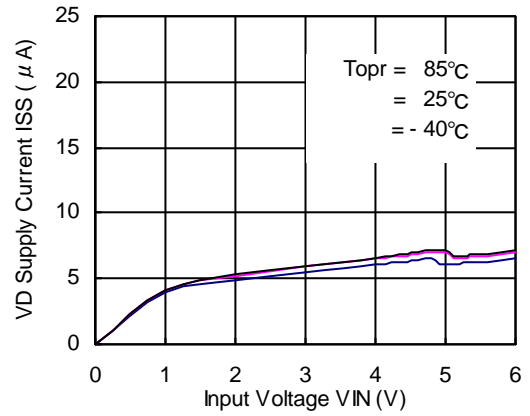
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD:5.0V)

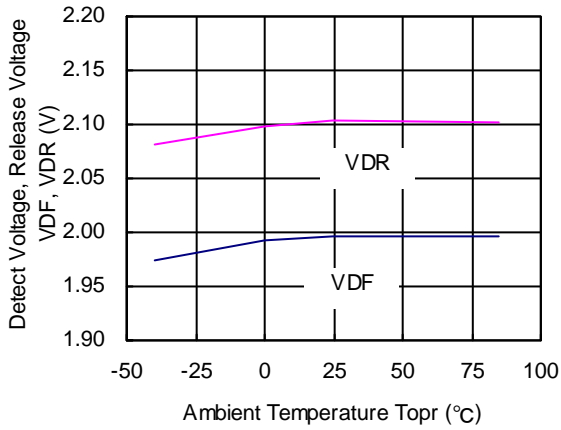


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

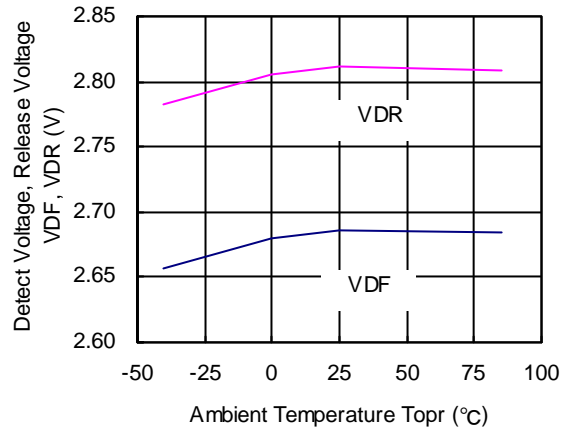
### ●XC6403/04 Series (Continued)

(11) Detect Voltage, Release Voltage vs. Ambient Temperature

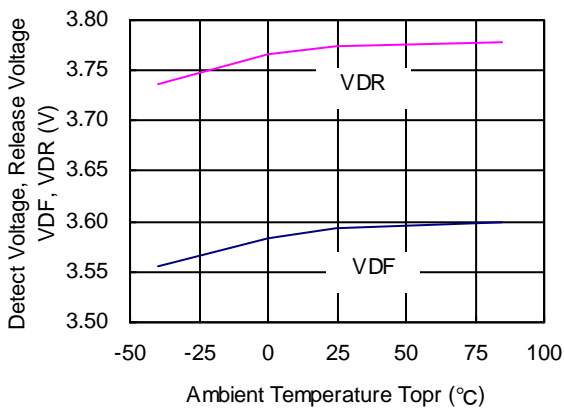
XC6403/04 Series (VD: 2.0V)



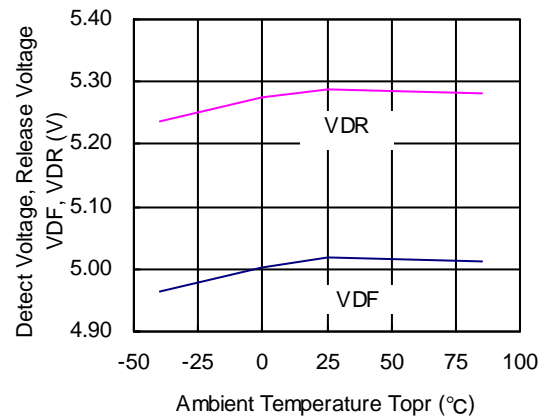
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

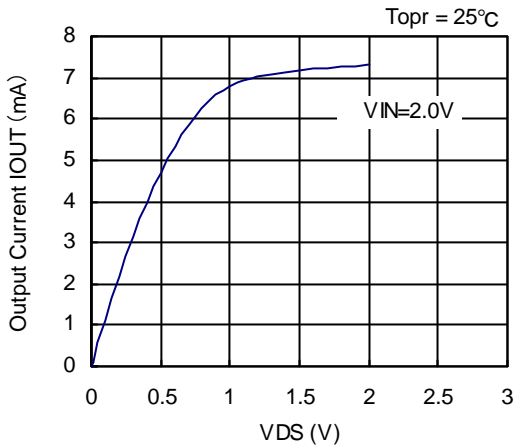


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

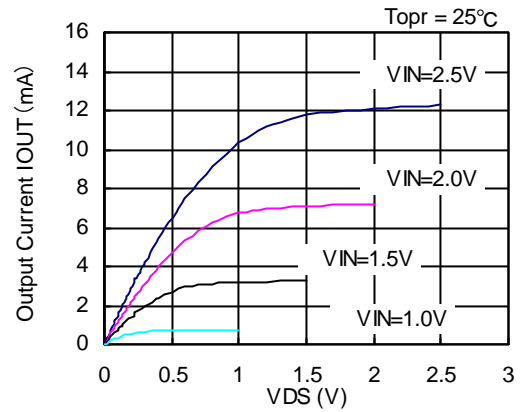
### ● XC6403/04 Series (Continued)

(12) VD N-ch Driver Output Current vs. VDS

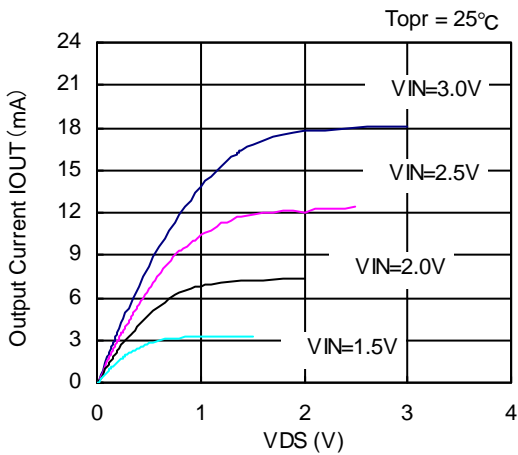
XC6403/04 Series (VD: 2.4V)



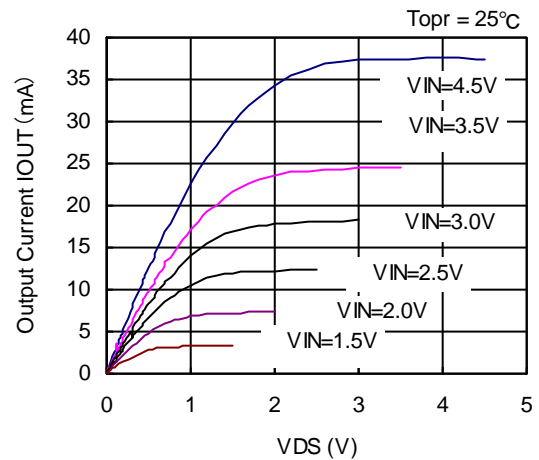
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

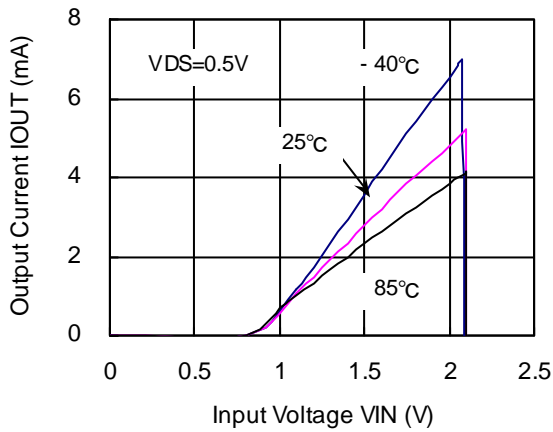


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

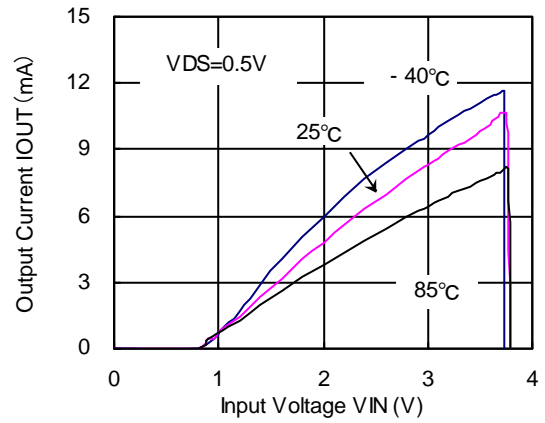
### ● XC6403/04 Series (Continued)

(13) VDN N-ch Driver Output Current vs. Input Voltage

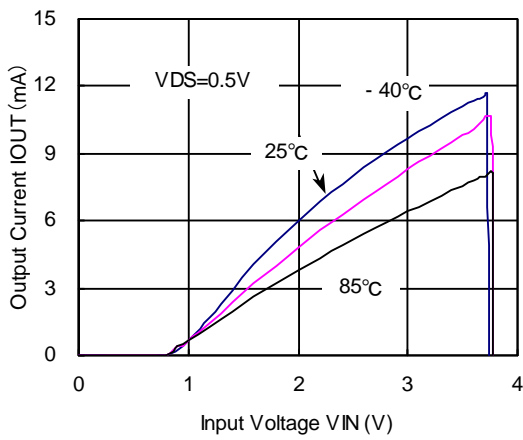
XC6403/04 Series (VD: 2.0V)



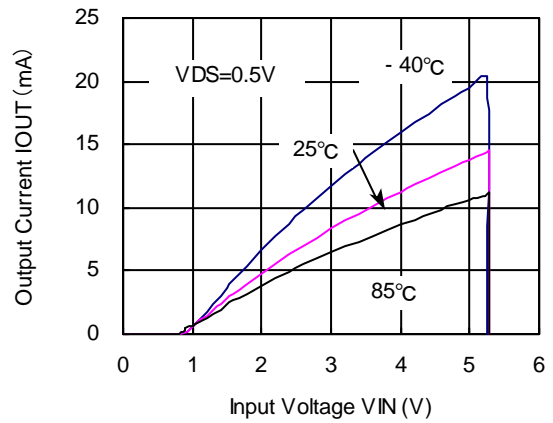
XC6403/04 Series (VD: 2.7V)



XC6403/04 Series (VD: 3.6V)



XC6403/04 Series (VD: 5.0V)

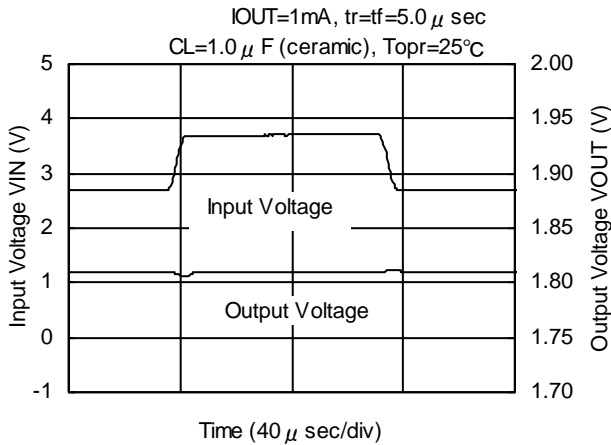


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

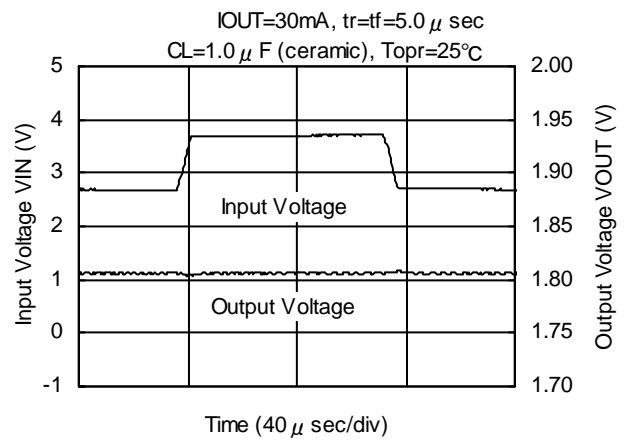
### ●XC6403/04 Series (Continued)

#### (14) Input Transient Response

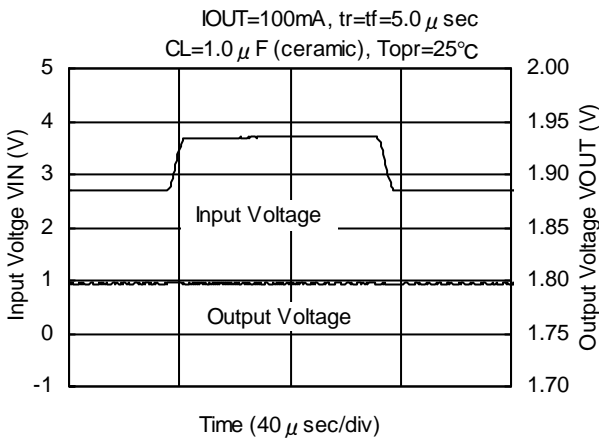
XC6403/04 Series (VR: 1.8V)



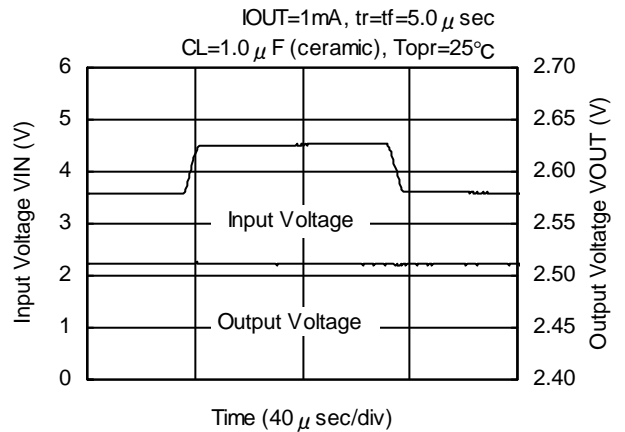
XC6403/04 Series (VR: 1.8V)



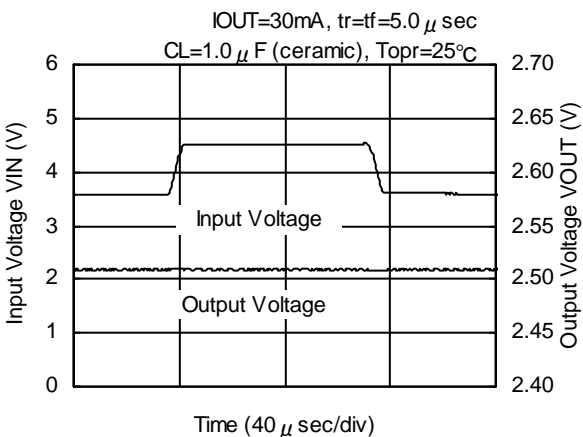
XC6403/04 Series (VR: 1.8V)



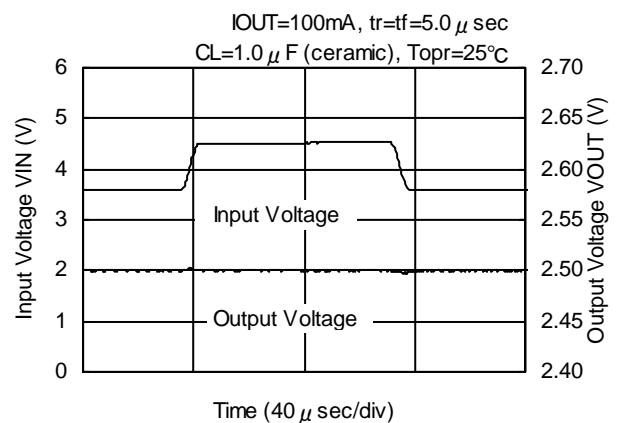
XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 2.5V)



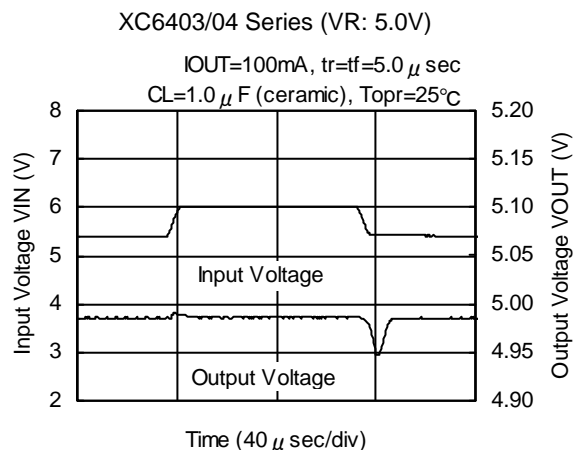
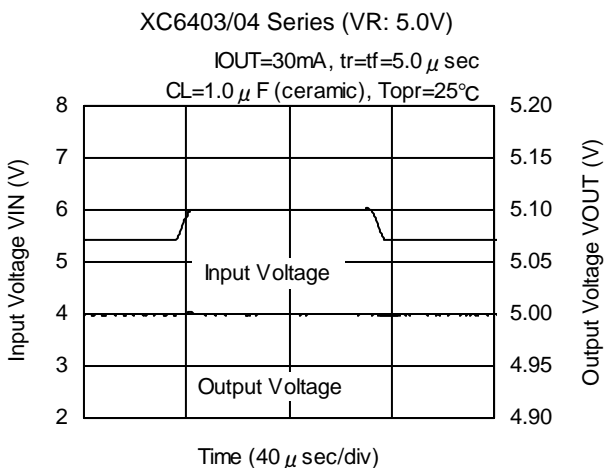
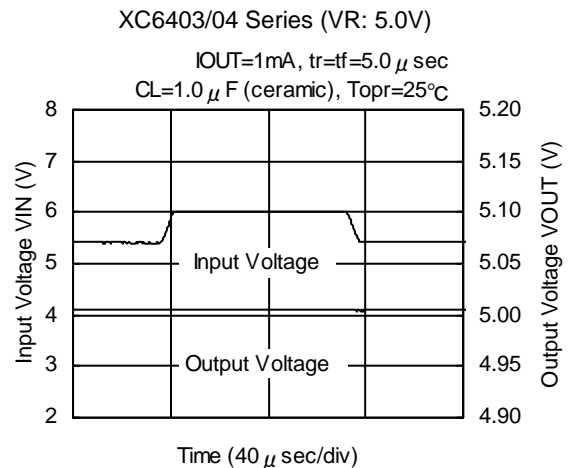
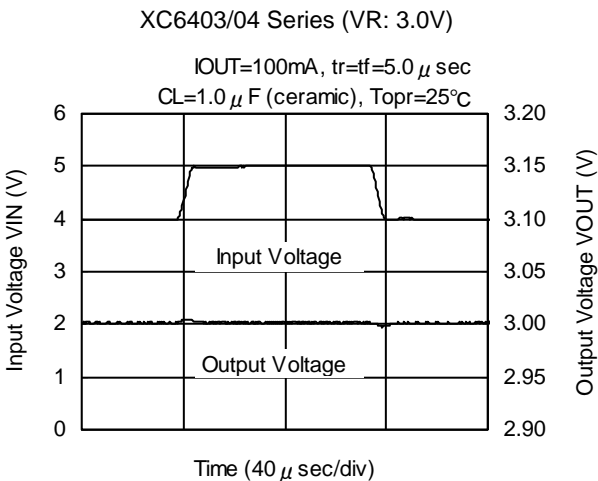
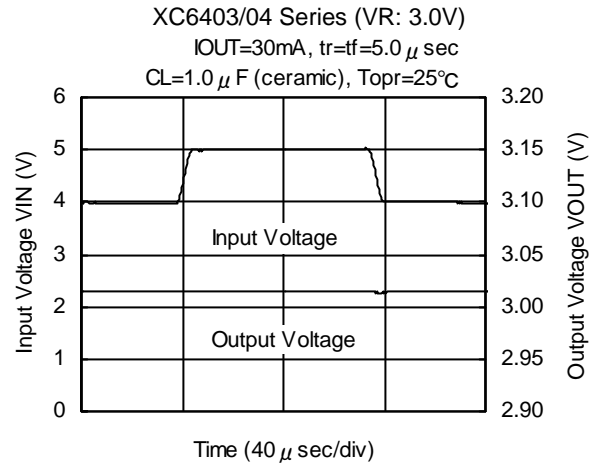
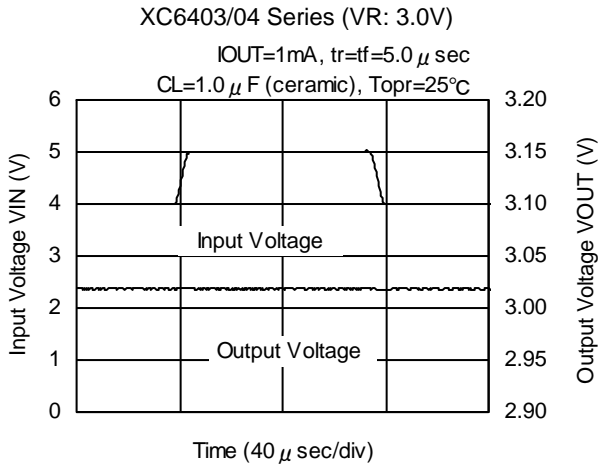
XC6403/04 Series (VR: 2.5V)



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### ●XC6403/04 Series (Continued)

#### (14) Input Transient Response (Continued)

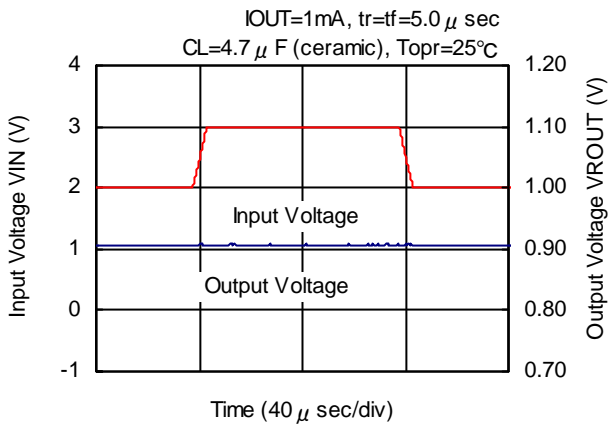


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

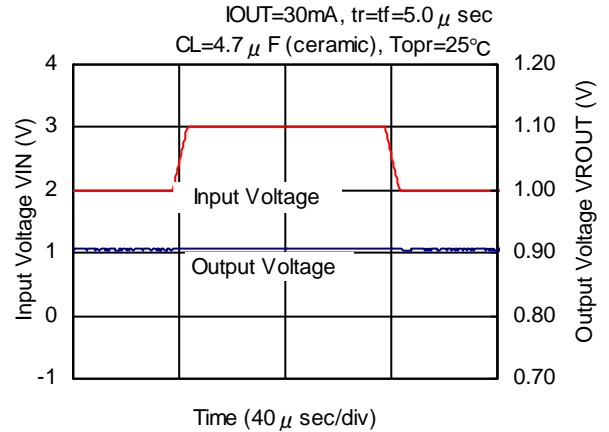
### XC6403/04 Series (Continued)

#### (14) Input Transient Response (Continued)

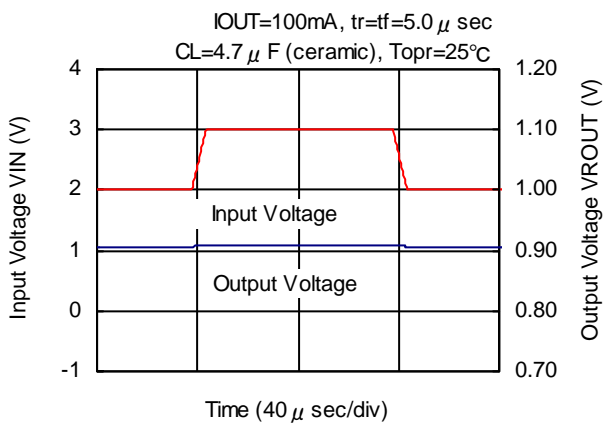
XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)



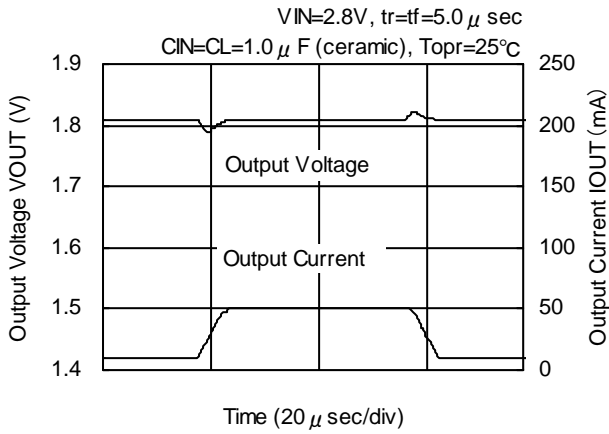


## ■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

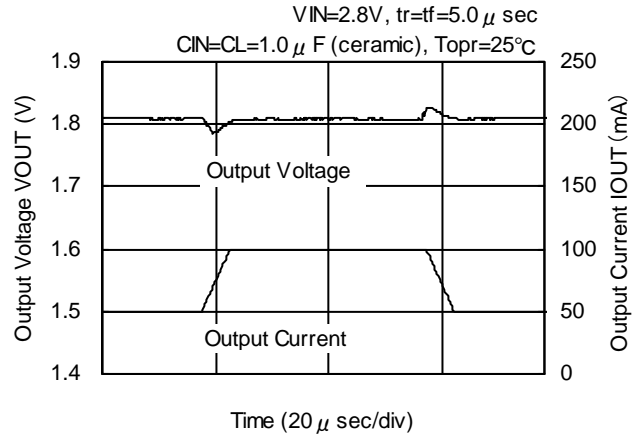
### ● XC6403/04 Series (Continued)

#### (15) Load Transient Response

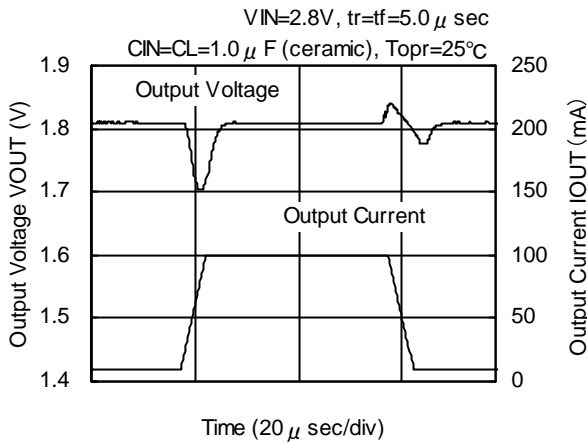
XC6403/04 Series (VR: 1.8V)



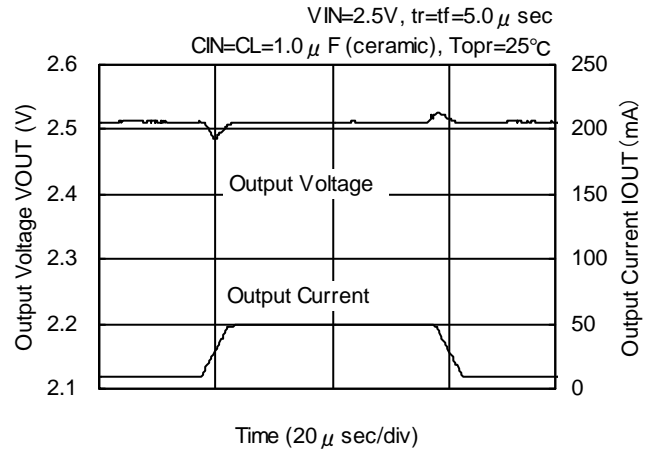
XC6403/04 Series (VR: 1.8V)



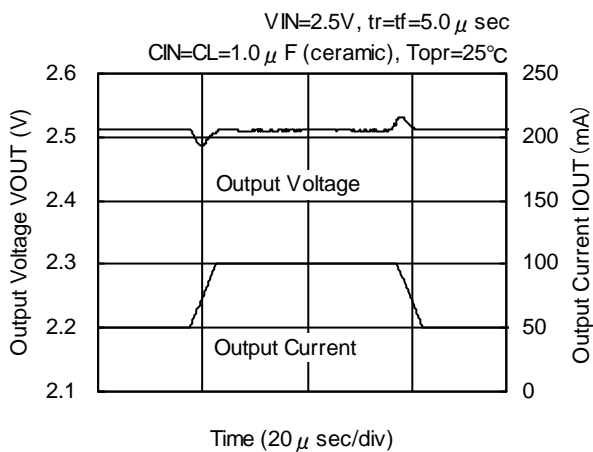
XC6403/04 Series (VR: 1.8V)



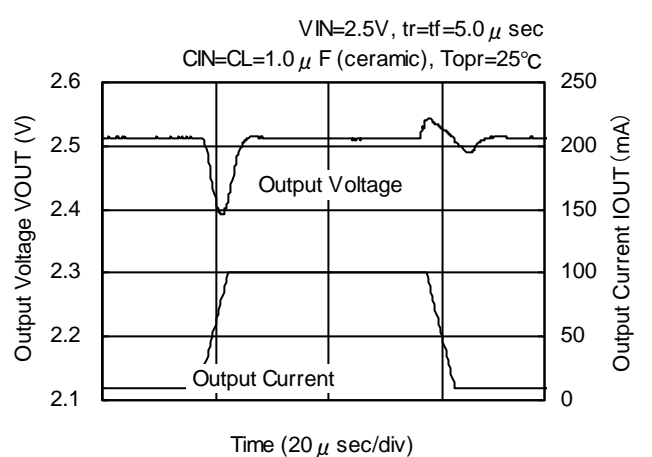
XC6403/04 Series (VR: 2.5V)



XC6403/04 Series (VR: 2.5V)



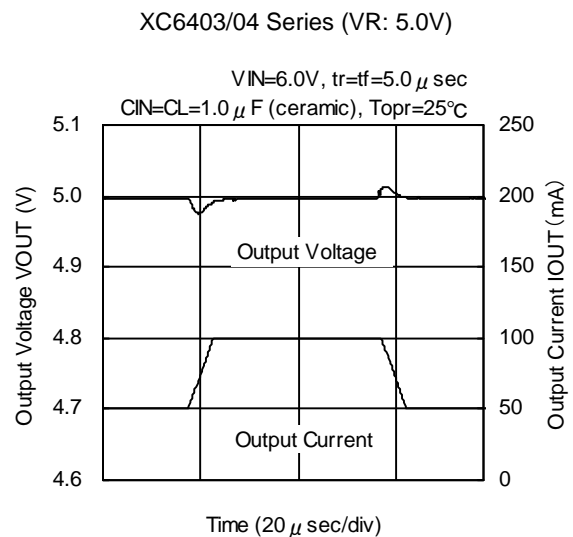
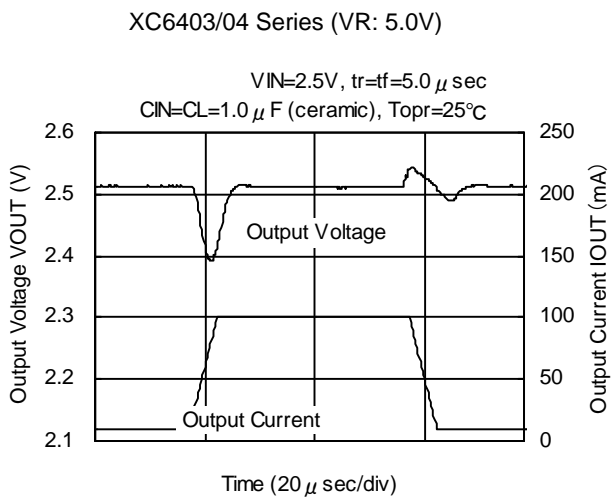
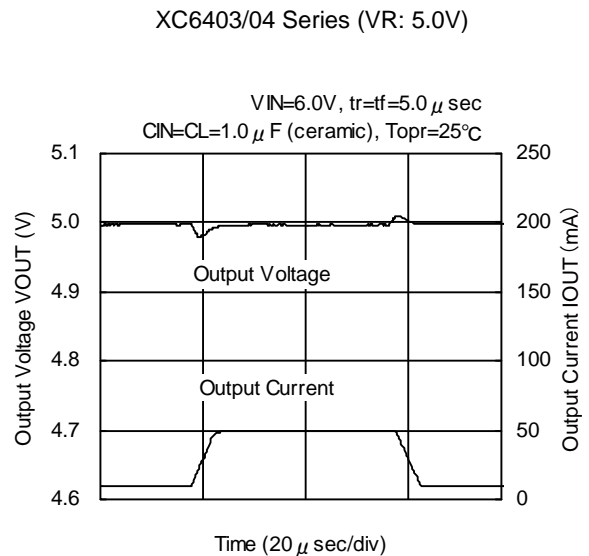
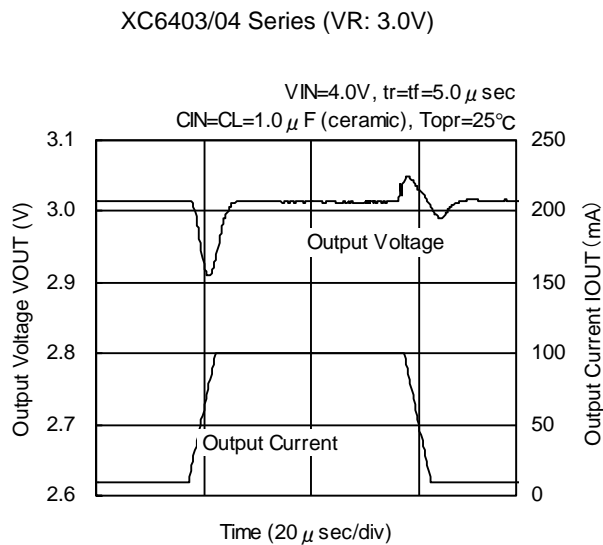
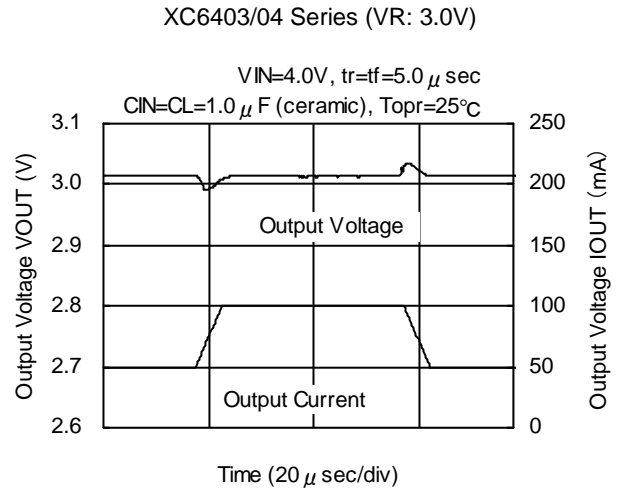
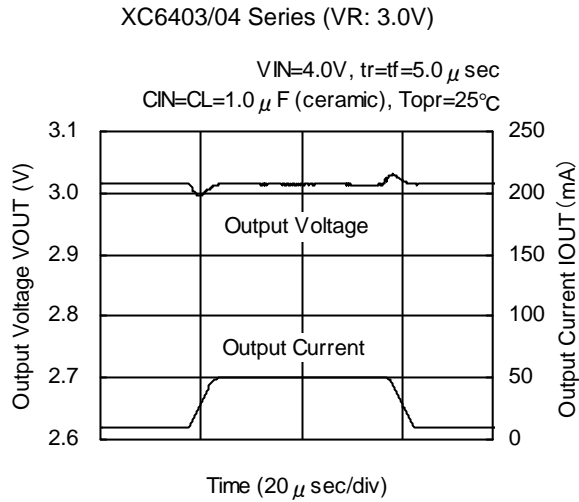
XC6403/04 Series (VR: 2.5V)



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

### XC6403/04 Series (Continued)

#### (15) Load Transient Response (Continued)

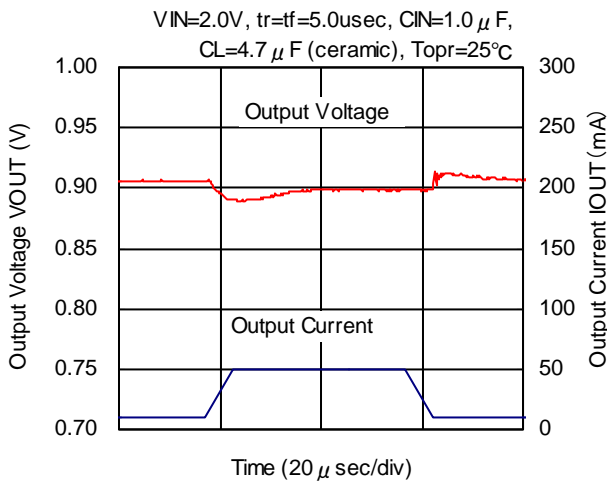


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

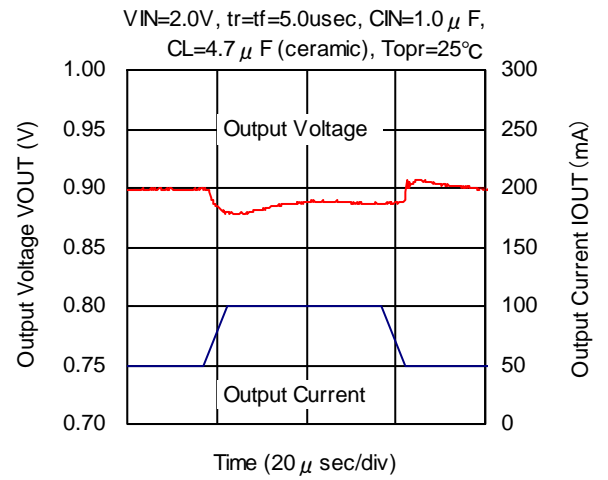
### ●XC6403/04 Series (Continued)

#### (15) Load Transient Response (Continued)

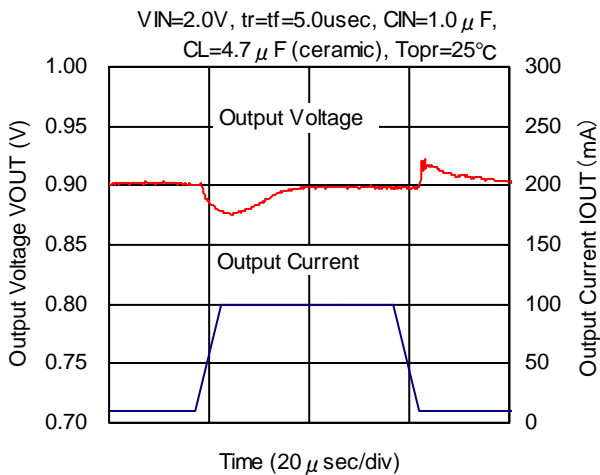
XC6403/04 Series (VR: 0.9V)



XC6403/04 Series (VR: 0.9V)

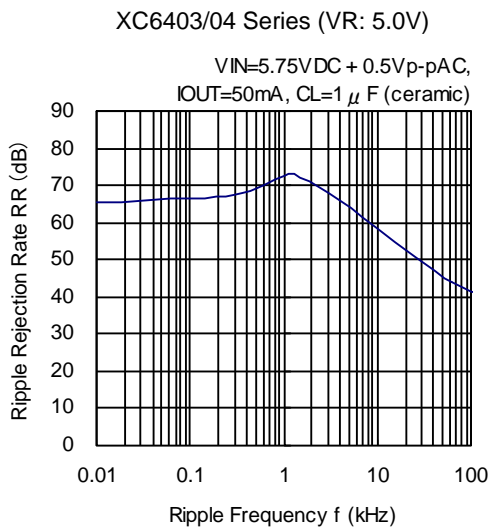
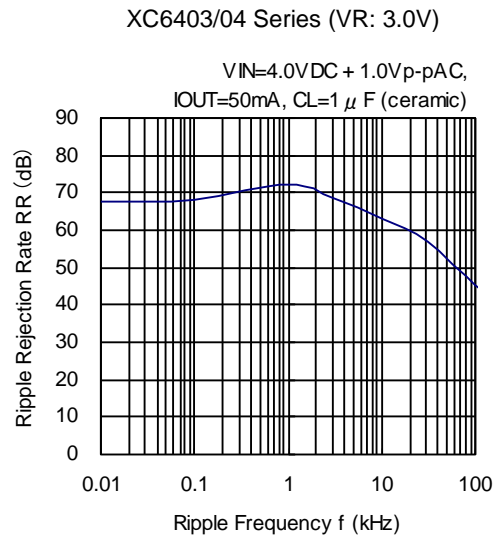
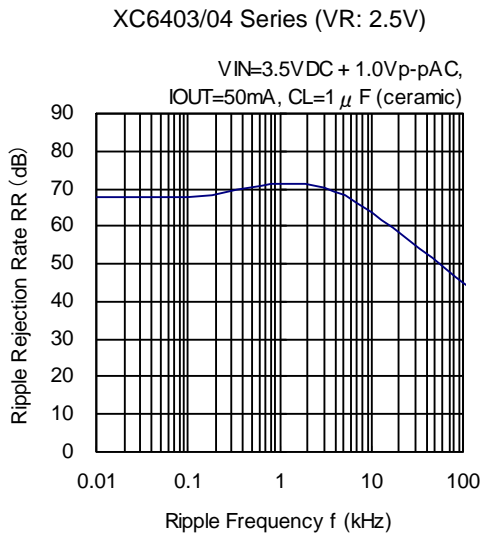
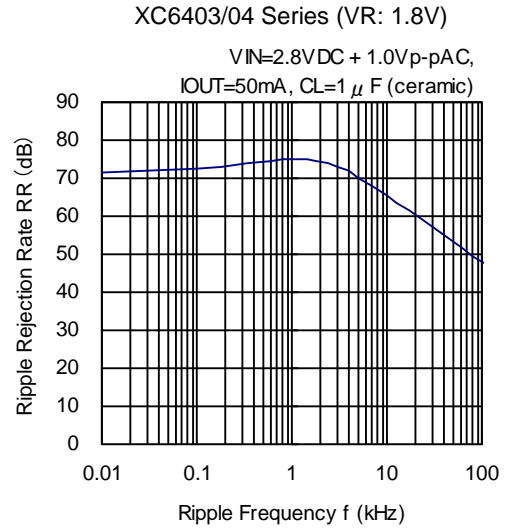
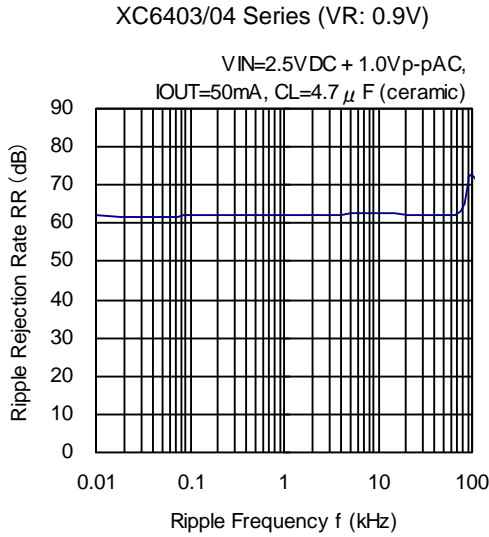


XC6403/04 Series (VR: 0.9V)



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

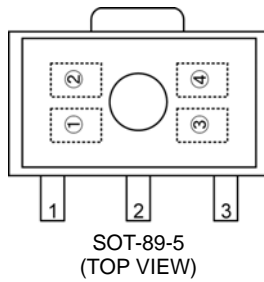
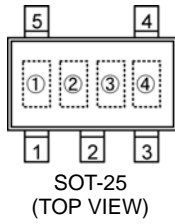
### (16) Ripple Rejection Rate





## MARKING RULE

### ● SOT-25 / SOT-89-5



① represents product series

| MARK     | PRODUCT SERIES |
|----------|----------------|
| <u>3</u> | XC6403xxxxxx   |
| <u>4</u> | XC6404xxxxxx   |

②③ represents internal sequential number  
Sequential numbering rule

1) Order

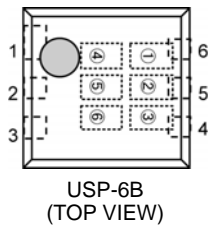
| MARK | NUMBERING RULE |
|------|----------------|
| 1    | 01~09          |
| 2    | 10~99          |
| 3    | A0~A9          |
| 4    | B0~B9          |
| 5    | ~Z9            |

\*G, I, J, O, Q, W excluded

2) The same marking is printed on the product with same optional functions, product type, detect voltage, and output voltage although packages are different.

④ represents production lot number  
0 to 9, A to Z reverse character 0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

### ● USP-6B



① represents product series

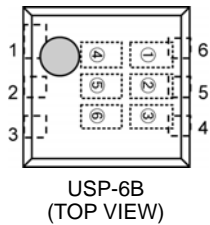
| MARK | PRODUCT SERIES |
|------|----------------|
| 2    | XC6403xxxxDx   |
| 3    | XC6404xxxxDx   |

② represents optional functions

| MARK | OPTIONAL FUNCTIONS                             | PRODUCT SERIES |
|------|------------------------------------------------|----------------|
| A    | Toggle and EN Function                         | XC6403/04AxxDx |
| B    | Toggle, EN Function, VD signal/VR OFF Function | XC6403/04BxxDx |
| C    | EN Function                                    | XC6403/04CxxDx |
| D    | CE Function                                    | XC6403/04DxxDx |
| E    | VSEN Pin                                       | XC6403/04ExxDx |
| F    | Cd Pin                                         | XC6403/04FxxDx |

## MARKING RULE (Continued)

### ● USP-6B (Continued)



③ represents product type

| MARK | CE/EN FUNCTION | EN / CE LOGIC | PULL-UP/DOWN RESISTANCE | VD SENSE PIN                        | VD OUTPUT LOGIC | PRODUCT SERIES  |
|------|----------------|---------------|-------------------------|-------------------------------------|-----------------|-----------------|
| A    | Function       | High Active   | Pull-Down Function      | V <sub>IN</sub>                     | Detect L        | XC6403/04xAxxDx |
| B    | Function       | High Active   | Pull-Down Function      | V <sub>IN</sub>                     | Detect H        | XC6403/04xBxxDx |
| C    | Function       | High Active   | Pull-Down Function      | V <sub>ROUT</sub>                   | Detect L        | XC6403/04xCxxDx |
| D    | Function       | High Active   | Pull-Down Function      | V <sub>ROUT</sub>                   | Detect H        | XC6403/04xDxxDx |
| E    | Function       | High Active   | Nonfunctional           | V <sub>IN</sub>                     | Detect L        | XC6403/04xExxDx |
| F    | Function       | High Active   | Nonfunctional           | V <sub>IN</sub>                     | Detect H        | XC6403/04xFxxDx |
| H    | Function       | High Active   | Nonfunctional           | V <sub>ROUT</sub>                   | Detect L        | XC6403/04xHxxDx |
| K    | Function       | High Active   | Nonfunctional           | V <sub>ROUT</sub>                   | Detect H        | XC6403/04xKxxDx |
| L    | Function       | Low Active    | Pull-Up Function        | V <sub>IN</sub>                     | Detect L        | XC6403/04xLxxDx |
| M    | Function       | Low Active    | Pull-Up Function        | V <sub>IN</sub>                     | Detect H        | XC6403/04xMxxDx |
| N    | Function       | Low Active    | Pull-Up Function        | V <sub>ROUT</sub>                   | Detect L        | XC6403/04xNxxDx |
| P    | Function       | Low Active    | Pull-Up Function        | V <sub>ROUT</sub>                   | Detect H        | XC6403/04xPxxDx |
| R    | Function       | Low Active    | Nonfunctional           | V <sub>IN</sub>                     | Detect L        | XC6403/04xRxxDx |
| S    | Function       | Low Active    | Nonfunctional           | V <sub>IN</sub>                     | Detect H        | XC6403/04xSxxDx |
| T    | Function       | Low Active    | Nonfunctional           | V <sub>ROUT</sub>                   | Detect L        | XC6403/04xTxxDx |
| U    | Function       | Low Active    | Nonfunctional           | V <sub>ROUT</sub>                   | Detect H        | XC6403/04xUxxDx |
| V    | Nonfunctional  | -             | -                       | V <sub>IN</sub> / V <sub>SEN</sub>  | Detect L        | XC6403/04xVxxDx |
| X    | Nonfunctional  | -             | -                       | V <sub>ROUT</sub> /V <sub>SEN</sub> | Detect H        | XC6403/04xXxxDx |
| Y    | Nonfunctional  | -             | -                       | V <sub>ROUT</sub> /V <sub>SEN</sub> | Detect L        | XC6403/04xYxxDx |
| Z    | Nonfunctional  | -             | -                       | V <sub>ROUT</sub> /V <sub>SEN</sub> | Detect H        | XC6403/04xZxxDx |

④,⑤ represents output voltage and detect voltage  
ex.)

| MARK |   | OUTPUT VOLTAGE        |                       | PRODUCT SERIES  |
|------|---|-----------------------|-----------------------|-----------------|
| ④    | ⑤ | V <sub>ROUT</sub> (V) | V <sub>DOUT</sub> (V) |                 |
| 3    | 0 | 4.0                   | 4.3                   | XC6403/04**30D* |

⑥ represents production lot number  
0 to 9,A to Z repeated (G, I, J, O, Q, W excluded)  
Note: No character inversion used.