

## QUAD/DUAL SUPERCAPACITOR AUTO BALANCING (SAB™) MOSFET ARRAY

### GENERAL DESCRIPTION

The ALD810030/ALD910030 are additional members of the ALD8100xx (quad) and ALD9100xx (dual) family of Supercapacitor Auto Balancing MOSFETs, or SAB™ MOSFETs. SAB MOSFETs are built with production proven EPAD® technology and are designed to address voltage and leakage-current balancing of supercapacitors connected in series. Supercapacitors, also known as ultracapacitors or supercaps, connected in series can be leakage-current balanced by using a combination of one or more devices connected across each supercapacitor stack to prevent overvoltages.

The ALD810030 offers a set of unique, precise operating voltage and current characteristics for each of four SAB MOSFET devices, as shown in its Operating Electrical Characteristics table. It can be used to balance up to four supercapacitors connected in series. The ALD910030 has its own set of unique precision Operating Electrical Characteristics for each of its two SAB MOSFET devices, suitable for up to two series-connected supercapacitors.

Each SAB MOSFET features a precision gate threshold voltage in the Vt mode, which is 3.00V when the gate-drain source terminals (VGS = VDS) are connected together at a drain-source current of  $\dot{I}_{DS(ON)} = 1\mu A$ . In this mode, input voltage  $V_{IN} = V_{GS} = V_{DS}$ . Different V<sub>IN</sub> produces an Output Current I<sub>OUT</sub> = I<sub>DS(ON)</sub> characteristic and results in an effective variable resistor that varies in value exponentially with V<sub>IN</sub>. This V<sub>IN</sub>, when connected across each supercapacitor in a series, balances each supercapacitor to within its voltage and current limits.

When  $V_{IN}$  = 3.00V is applied to an ALD810030/ALD910030, its  $I_{OUT}$  is  $1\mu A.$  For a 100mV increase in  $V_{IN},$  to 3.10V,  $I_{OUT}$  increases by about tenfold. For an additional increase in VIN to 3.22V for the ALD910030 (3.24V for the ALD810030), I<sub>OUT</sub> increases one hundredfold, to 100  $\mu A$ . Conversely, for a 100 mV decrease in V<sub>IN</sub> to 2.90V, IOUT decreases to one tenth of its previous value, to 0.1μA. Another 100mV decrease in input voltage would reduce IOUT to 0.01µA. Hence, when an ALD810030/ALD910030 SAB MOSFET is connected across a supercapacitor that charges to less than 2.80V, it would dissipate essentially no power.

(Continued on next page)

### PRODUCT FAMILY SPECIFICATIONS

For more information on supercapacitor balancing, how SAB MOSFETs achieve automatic supercapacitor balancing, the device characteristics of the SAB MOSFET family, product family product selection guide, applications, configurations, and package information, please download from www.aldinc.com the document:

"ALD8100xx/ALD9100xx Family of Supercapacitor Auto Balancing (SAB™) MOSFET ARRAYs"

### ORDERING INFORMATION ("L" suffix denotes lead-free (RoHS))

	Operating Temperature Range				
Package	0°C to +70°C	-40°C to +85°C			
	(Commercial)	(Industrial)			
16-Pin SOIC	N/A	ALD810030SCLI			
8-Pin SOIC	N/A	ALD910030SALI			

### **FEATURES & BENEFITS**

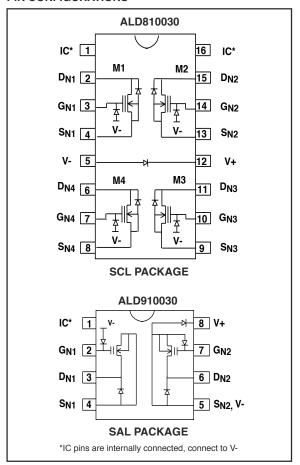
- · Simple and economical to use
- · Precision factory trimmed
- Automatically regulates and balances leakage currents
- Effective for supercapacitor charge-balancing
- Balances up to 4 supercaps with a single IC package
- Balances 2-cell, 3-cell, 4-cell series-connected supercaps
- Scalable to larger supercap stacks and arrays
  Near zero additional leakage currents
  Zero leakage at 0.3V below rated voltages

- Balances series and/or parallel-connected supercaps
- Leakage currents are exponential function of cell voltages
- Active current ranges from <0.3nA to >1000μA
- · Always active, always fast response time
- · Minimizes leakage currents and power dissipation

### **APPLICATIONS**

- · Series-connected supercapacitor cell leakage balancing
- Energy harvesting
- Long term backup battery with supercapacitor outputs
- Zero-power voltage divider at selected voltages
- Matched current mirrors and current sources
- Zero-power mode maximum voltage limiter
- · Scaled supercapacitor stacks and arrays

### **PIN CONFIGURATIONS**



### **GENERAL DESCRIPTION (CONT.)**

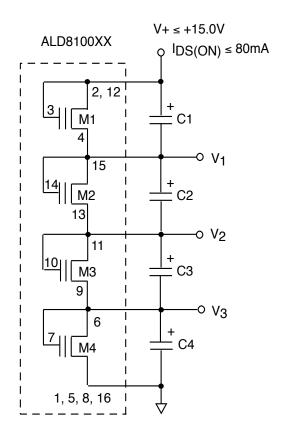
The voltage dependent characteristic of the ALD810030/ ALD910030 on-resistance is effective in controlling excessive voltage rise across a supercapacitor when connected across it. In series-connected supercapacitor stacks, when one supercapacitor voltage rises, the voltage of the other supercapacitors drops, with the ones that have the highest leakage currents having the lowest supercapacitor voltages. The SAB MOSFETs connected across these supercapacitors would exhibit complementary opposing current levels, resulting in little additional leakage currents other than those caused by the supercapacitors themselves.

For technical assistance, please contact ALD technical support at techsupport@aldinc.com.

### APPLYING THE ALD810030/ALD910030:

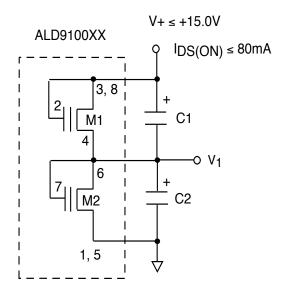
- 1) Select a maximum supercapacitor leakage current limit for any supercapacitor used in the stack. This is the same as output current,  $I_{OUT} = I_{DS(ON)}$ , of the ALD810030/ALD910030. Test that each supercapacitor leakage current meets this maximum current limit before use in the stack.
- 2) Determine whether the input voltage  $V_{IN}$  ( $V_{GS} = V_{DS}$ ) at that  $I_{OUT}$  is acceptable for the intended application. This voltage is the same voltage as the maximum desired operating voltage of the supercapacitor. For example, with the ALD810030,  $I_{OUT} = 1.0 \mu A$  corresponds to  $V_{IN} = 3.00 V$ .
- 3) Determine that the operating voltage margin, due to various tolerances and/or temperature effects, is adequate for the intended operating environment of the supercapacitor.

# SCHEMATIC DIAGRAM OF A TYPICAL CONNECTION FOR A FOUR-SUPERCAP STACK



1-16 DENOTES PACKAGE PIN NUMBERS C1-C4 DENOTES SUPERCAPACITORS

# SCHEMATIC DIAGRAM OF A TYPICAL CONNECTION FOR A TWO-SUPERCAP STACK



1-8 DENOTES PACKAGE PIN NUMBERS C1-C2 DENOTES SUPERCAPACITORS

### **ABSOLUTE MAXIMUM RATINGS**

V+ to V- voltage	15.0V
Drain-Source voltage, V <sub>DS</sub>	10.6V
Gate-Source voltage, V <sub>GS</sub>	10.6V
Operating Current	80mA
Power dissipation	500mW
Operating temperature range SCL	0°C to +70°C
Operating temperature range SCLI	-40°C to +85°C
Storage temperature range	65°C to +150°C
Lead temperature, 10 seconds	+260°C

CAUTION: ESD Sensitive Device. Use static control procedures in ESD controlled environment.

## **OPERATING ELECTRICAL CHARACTERISTICS**

V+ = +5V, V- = GND,  $T_A = 25^{\circ}C$ ,  $V_{IN} = V_{GS} = V_{DS}$ ,  $I_{OUT} = I_{DS}(ON)$  unless otherwise specified

	ALD810030					
Parameter	Symbol	Min	Тур	Max	Unit	Test Conditions
Gate Threshold Voltage	Vt	2.98	3.00	3.02	V	VGS = VDS; IDS(ON) = 1μA
Offset Voltage	Vos		5	20	mV	Vt1 - Vt2 or Vt3 - Vt4
Offset Voltage Tempco	TCVOS		5		μV/C	V <sub>t1</sub> - V <sub>t2</sub> or V <sub>t3</sub> - V <sub>t4</sub>
Gate Threshold Voltage Tempco	TCVt		-2.2		mV/C	$V_{GS} = V_{DS}; I_{DS(ON)} = 1\mu A$
Output Current Drain Source On Resistance	IOUT RDS(ON)		0.0001 26000		μ <b>Α</b> ΜΩ	V <sub>IN</sub> = 2.60V
Output Current Drain Source On Resistance	IOUT RDS(ON)		0.001 2700		μA MΩ	V <sub>IN</sub> = 2.70V
Output Current Drain Source On Resistance	IOUT RDS(ON)		0.01 280		μA MΩ	V <sub>IN</sub> = 2.80V
Output Current Drain Source On Resistance	IOUT RDS(ON)		0.1 29		μA MΩ	V <sub>IN</sub> = 2.90V
Output Current Drain Source On Resistance	I <sub>OUT</sub> R <sub>DS(ON)</sub>		1 3.0		μ <b>Α</b> ΜΩ	V <sub>IN</sub> = 3.00V
Output Current Drain Source On Resistance	IOUT RDS(ON)		10 0.31		μ <b>Α</b> ΜΩ	V <sub>IN</sub> = 3.10V
Output Current Drain Source On Resistance	IOUT RDS(ON)		100 32.4		μ <b>Α</b> ΚΩ	V <sub>IN</sub> = 3.24V
Output Current Drain Source On Resistance	IOUT RDS(ON)		300 11.1		μ <b>Α</b> ΚΩ	V <sub>IN</sub> = 3.34V
Output Current Drain Source On Resistance	IOUT RDS(ON)		1000 3.52		μ <b>Α</b> ΚΩ	V <sub>IN</sub> = 3.52V
Output Current Drain Source On Resistance	IOUT RDS(ON)		3000 1.27		μA kΩ	V <sub>IN</sub> = 3.82V
Output Current Drain Source On Resistance	IOUT RDS(ON)		10000 0.442		μ <b>Α</b> ΚΩ	V <sub>IN</sub> = 4.42V
Drain Source Breakdown Voltage	BVDSX	10.6			V	
Drain Source Leakage Current <sup>1</sup>	IDS(OFF)		10	400	pA nA	V <sub>IN</sub> = V <sub>GS</sub> = V <sub>DS</sub> = V <sub>t</sub> - 1.0 V <sub>IN</sub> = V <sub>GS</sub> = V <sub>DS</sub> = V <sub>t</sub> - 1.0, T <sub>A</sub> = +125°C
Gate Leakage Current <sup>1</sup>	IGSS		5	200	pA nA	VGS = 5.0V, VDS = 0V VGS = 5.0V, VDS = 0V, TA = +125°C
Input Capacitance	CISS		15		pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 5.0V
Turn-on Delay Time	ton		10		ns	
Turn-off Delay Time	t <sub>off</sub>		10		ns	
Crosstalk			60		dB	f = 100KHz

### **ABSOLUTE MAXIMUM RATINGS**

V+ to V- voltage	15.0V
Drain-Source voltage, V <sub>DS</sub>	10.6V
Gate-Source voltage, V <sub>GS</sub>	10.6V
Operating Current	80mA
Power dissipation	500mW
Operating temperature range SAL	0°C to +70°C
Operating temperature range SALI	40°C to +85°C
Storage temperature range	65°C to +150°C
Lead temperature, 10 seconds	+260°C

CAUTION: ESD Sensitive Device. Use static control procedures in ESD controlled environment.

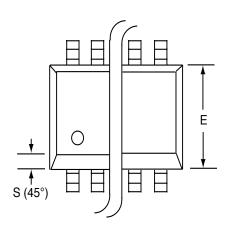
## OPERATING ELECTRICAL CHARACTERISTICS

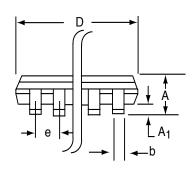
## V+ = +5V, V- = GND, $T_A = 25^{\circ}C$ , $V_{IN} = V_{GS} = V_{DS}$ , $I_{OUT} = I_{DS(ON)}$ unless otherwise specified

Gate Threshold Voltage         V1         2.98         3.00         3.02         V         VGS = VDS; IDS(ON) = 1µA           Offset Voltage         VOS         5         20         mV         Vt1 · Vt2           Offset Voltage Tempco         TCVoS         5         µViC         Vt1 · Vt2           Gate Threshold Voltage Tempco         TCVt         -2.2         mV/C         VgS = VDS; IDS(ON) = 1µA           Output Current Drain Source On Resistance         IQUT RDS(ON)         26000         M2         VIN = 2.60V           Output Current Drain Source On Resistance         IQUT RDS(ON)         20001         µA         VIN = 2.70V           Output Current Drain Source On Resistance         IQUT RDS(ON)         200         M2         VIN = 2.80V           Output Current Drain Source On Resistance         IQUT RDS(ON)         29         MA         VIN = 2.80V           Output Current Drain Source On Resistance         IQUT RDS(ON)         3.00         M2         VIN = 2.80V           Output Current Drain Source On Resistance         IQUT RDS(ON)         3.00         MA         VIN = 3.00V           Output Current Drain Source On Resistance         IQUT RDS(ON)         3.00         IA         VIN = 3.10V           Output Current Drain Source On Resistance         IQUT RDS(ON)				ALD910030			
Offset Voltage         VOS         5         20         mV         V <sub>11</sub> - V <sub>12</sub> Offset Voltage Tempco         TCVOS         5         µVIC         V <sub>11</sub> - V <sub>12</sub> Gate Threshold Voltage Tempco         TCVt         -2.2         mV/C         V <sub>11</sub> - V <sub>12</sub> Output Current Drain Source On Resistance         IOUT RDS(ON)         2,000         µA         VIN = 2.60V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2,000         µA         VIN = 2.70V           Output Current Train Source On Resistance         IOUT RDS(ON)         2,800         MQ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2,800         MQ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2,900         MQ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3,000         µA         VIN = 2.90V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3,300         µA         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         32         µA         VIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3,44	Parameter	Symbol	Min	Тур	Max	Unit	Test Conditions
Offset Voltage Tempco         TCVOS         5         μ/VC         Vt1 · Vt2           Gate Threshold Voltage Tempco         TCVt         -2.2         mV/C         Vt1 · Vt2           Output Current Drain Source On Resistance         IOUT RDS(ON)         280000         μA         VIN = 2.60V           Output Current Drain Source On Resistance         IOUT RDS(ON)         20000         μA         VIN = 2.70V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2.001         μA         VIN = 2.70V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2.800         MQ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2.9         μA         VIN = 2.90V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.00         MQ         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         0.31         μA         VIN = 3.10V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.2         μA         VIN = 3.30V           Drain Source On Resistance         IOUT RDS(ON)         3.44         KQ         VIN = 3.30V           Drain Source On Resistance         IOUT RDS(ON)         3.44         KQ <t< td=""><td>Gate Threshold Voltage</td><td>Vt</td><td>2.98</td><td>3.00</td><td>3.02</td><td>٧</td><td><math>V_{GS} = V_{DS}; I_{DS(ON)} = 1\mu A</math></td></t<>	Gate Threshold Voltage	Vt	2.98	3.00	3.02	٧	$V_{GS} = V_{DS}; I_{DS(ON)} = 1\mu A$
Gate Threshold Voltage Tempco   TCVt   -2.2   mV/C   VGS = VDS; IDS(ON) = 1µA   VIN = 2.60V	Offset Voltage	Vos		5	20	mV	V <sub>t1</sub> - V <sub>t2</sub>
Output Current Drain Source On Resistance         IOUT RDS(ON)         0.0001 26000         μA MΩ         VIN = 2.60V           Output Current Drain Source On Resistance         IOUT RDS(ON)         0.001         μA MΩ         VIN = 2.70V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2.700         μA MΩ         VIN = 2.70V           Output Current Drain Source On Resistance         IOUT RDS(ON)         2.80         μA MΩ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.1         μA MΩ         VIN = 2.90V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.0         μA MΩ         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.0         μA MΩ         VIN = 3.10V           Drain Source On Resistance         IOUT RDS(ON)         3.2         KΩ         VIN = 3.30V           Drain Source On Resistance         IOUT RDS(ON)         3.2         KΩ         VIN = 3.30V           Drain Source On Resistance         IOUT RDS(ON)         11.0         μA MΩ         VIN = 3.30V           Drain Source On Resistance         IOUT RDS(ON)         3.44         KΩ         VIN = 3.44V           Drain Source On Resistance         IOUT RDS(ON)         3.44	Offset Voltage Tempco	TCVOS		5		μV/C	V <sub>t1</sub> - V <sub>t2</sub>
Drain Source On Resistance         RDS(ON)         26000         MΩ           Output Current Drain Source On Resistance         IOUT RDS(ON)         0.001         μA MΩ         VIN = 2.70V           Output Current Drain Source On Resistance         IOUT RDS(ON)         280         μA MΩ         VIN = 2.80V           Output Current Drain Source On Resistance         IOUT RDS(ON)         29         μA MΩ         VIN = 2.90V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1         μA MΩ         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         10         μA MΩ         VIN = 3.10V           Output Current Drain Source On Resistance         IOUT RDS(ON)         100         μA MΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         320         μA MΩ         VIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         11.0         μA MΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.44         MΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         KΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)	Gate Threshold Voltage Tempco	TC <sub>Vt</sub>		-2.2		mV/C	$V_{GS} = V_{DS}; I_{DS(ON)} = 1\mu A$
Drain Source On Resistance         RDS(ON)         2700         MΩ           Output Current Drain Source On Resistance         IQUT RDS(ON)         0.01 MΩ         IAM MΩ         V(N = 2.80V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         0.1 MΩ         IAM MΩ         V(N = 2.90V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         1 MΩ         IAM MΩ         V(N = 3.00V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         10 MΩ         IAM MΩ         V(N = 3.10V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         100 MΩ         IAM MΩ         V(N = 3.22V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         300 MΩ         IAM MΩ         V(N = 3.30V)           Output Current Drain Source On Resistance         IQUT RDS(ON)         11.0         IAM MΩ         V(N = 3.30V)           Output Current Drain Source On Resistance         IRDS(ON)         3.44         IAM MΩ         V(N = 3.44V)           Output Current Drain Source On Resistance         IRDS(ON)         1.17         IAM MΩ         V(N = 3.50V)           Output Current Drain Source On Resistance         IRDS(ON)         1.17         IAM MΩ         V(N = 4.00V)           Drain Source Draesidance         IRDS(ON) <td>Output Current Drain Source On Resistance</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>V<sub>IN</sub> = 2.60V</td>	Output Current Drain Source On Resistance						V <sub>IN</sub> = 2.60V
Drain Source On Resistance         RDS(ON)         280         MΩ            Output Current Drain Source On Resistance         IOUT RDS(ON)         0.1         μA MΩ         VIN = 2.99V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1         μA MΩ         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         10         μA MΩ         VIN = 3.10V           Output Current Drain Source On Resistance         IOUT RDS(ON)         100         μA MΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         32         μA MΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         11.0         μA MΩ         VIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.44         KΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         μA MΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         KΩ         VIN = 4.00V           Drain Source On Resistance         IOUT RDS(ON)         0.40         μA MΩ         VIN = 4.00V           Drain Source Breakdown Voltage         BVDSX         10.6	Output Current Drain Source On Resistance						V <sub>IN</sub> = 2.70V
Drain Source On Resistance         RDS(ON)         29         MΩ         MΩ           Output Current Drain Source On Resistance         IOUT RDS(ON)         1 3.00         IµA MΩ         VIN = 3.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         10 0 µA MΩ         IµA MΩ         VIN = 3.10V           Output Current Drain Source On Resistance         IOUT RDS(ON)         32         IµA MΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         300 µA MΩ         IµA MΩ         VIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         11.0         IµA MΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.44         IAA MΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         IAA MΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         IAA MΩ         VIN = 4.00V           Output Current Drain Source Breakdown Voltage         BVDSX         10.6         V         V           Drain Source Breakdown Voltage         BVDSX         10.6         V         VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = V	Output Current Drain Source On Resistance						V <sub>IN</sub> = 2.80V
Drain Source On Resistance         RDS(ON)         3.00         MΩ           Output Current Drain Source On Resistance         IOUT RDS(ON)         10 μA MΩ         VIN = 3.10V           Output Current Drain Source On Resistance         IOUT RDS(ON)         100 μA MΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         300 μA MΩ         IVIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         11.0         IOUT MΩ         IVIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.44         IVIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         IVIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         IVIN = 4.00V           Drain Source On Resistance         RDS(ON)         0.40         IVIN = 4.00V           Drain Source On Resistance         RDS(ON)         0.40         IVIN = 4.00V           Drain Source	Output Current Drain Source On Resistance						V <sub>IN</sub> = 2.90V
Drain Source On Resistance         RDS(ON)         0.31         MΩ            Output Current Drain Source On Resistance         IOUT RDS(ON)         100 32         μA ΚΩ         VIN = 3.22V           Output Current Drain Source On Resistance         IOUT RDS(ON)         300 11.0         μA ΚΩ         VIN = 3.30V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.44         ΚΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3.000 1.17         μA ΚΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.17         ΚΩ         VIN = 4.00V           Output Current Drain Source On Resistance         IOUT RDS(ON)         1.0000 0.40         μA ΚΩ         VIN = 4.00V           Drain Source Breakdown Voltage         BVDSX         10.6         V         V           Drain Source Leakage Current¹         IDS(OFF)         10         400 pA VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = S.0V, VDS = 5.0V, VDS = 5.0V           Gate Leakage Current¹         IGSS         30         pF         VGS = 5.0V, VDS = 5.0V           Input Capacitance         CISS         30         pF         VGS = 5.0V, VDS = 5.0V	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.00V
Drain Source On Resistance         RDS(ON)         32         KΩ	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.10V
Drain Source On Resistance         RDS(ON)         11.0         KΩ           Output Current Drain Source On Resistance         IOUT RDS(ON)         1000 3.44         μΑ ΚΩ         VIN = 3.44V           Output Current Drain Source On Resistance         IOUT RDS(ON)         3000 1.17         μΑ ΚΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         10000 0.40         μΑ ΚΩ         VIN = 4.00V           Drain Source Breakdown Voltage         BVDSX         10.6         V         V           Drain Source Leakage Current¹         IDS(OFF)         10         400         pA         VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VDS = V	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.22V
Drain Source On Resistance         RDS(ON)         3.44         KΩ            Output Current Drain Source On Resistance         IOUT RDS(ON)         3000 1.17         μA KΩ         VIN = 3.50V           Output Current Drain Source On Resistance         IOUT RDS(ON)         10000 0.40         μA KΩ         VIN = 4.00V           Drain Source Breakdown Voltage         BVDSX         10.6         V         V           Drain Source Leakage Current¹         IDS(OFF)         10         400 pA yA	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.30V
Drain Source On Resistance         RDS(ON)         1.17         KΩ           Output Current Drain Source On Resistance         IOUT RDS(ON)         10000 0.40         μA KΩ         VIN = 4.00V           Drain Source Breakdown Voltage         BVDSX         10.6         V           Drain Source Leakage Current¹         IDS(OFF)         10         400 pA VIN = VGS = VDS = Vt - 1.0 vIN = VGS = VDS = VT = V	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.44V
Drain Source On Resistance         RDS(ON)         0.40         KΩ           Drain Source Breakdown Voltage         BVDSX         10.6         V           Drain Source Leakage Current¹         IDS(OFF)         10         400         pA         VIN = VGS = VDS = Vt - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VT - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VDS = VT - 1.0 VIN = VGS = VT - 1.0 VIN = VGS = VT - 1.0 VIN = VGS = VT - 1.0 VIN	Output Current Drain Source On Resistance						V <sub>IN</sub> = 3.50V
Drain Source Leakage Current1	Output Current Drain Source On Resistance						V <sub>IN</sub> = 4.00V
A	Drain Source Breakdown Voltage	BV <sub>DSX</sub>	10.6			٧	
Gate Leakage Current1	Drain Source Leakage Current <sup>1</sup>	IDS(OFF)		10			$V_{IN} = V_{GS} = V_{DS} = V_t - 1.0,$
Input Capacitance         CISS         30         pF         VGS = 0V, VDS = 5.0V           Turn-on Delay Time         ton         10         ns           Turn-off Delay Time         toff         10         ns	Gate Leakage Current <sup>1</sup>	IGSS		5	200	рА	VGS = 5.0V, VDS = 0V VGS = 5.0V, VDS = 0V,
Turn-on Delay Time         ton         10         ns           Turn-off Delay Time         toff         10         ns	Input Capacitance	CISS		30		pF	
	Turn-on Delay Time			10		ns	
Crosstalk 60 dB f = 100KHz	Turn-off Delay Time	toff		10		ns	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Crosstalk			60		dB	f = 100KHz

## **SOIC-16 PACKAGE DRAWING**

## 16 Pin Plastic SOIC Package





	Millim	eters	Inches		
Dim	Min	Max	Min	Max	
Α	1.35	1.75	0.053	0.069	
A <sub>1</sub>	0.10	0.25	0.004	0.010	
b	0.35	0.45	0.014	0.018	
С	0.18	0.25	0.007	0.010	
D-16	9.80	10.00	0.385	0.394	
E	3.50	4.05	0.140	0.160	
е	1.27	BSC	0.050 BSC		
н	5.70	6.30	0.224	0.248	
L	0.60	0.937	0.024	0.037	
Ø	0°	8°	0°	8°	
s	0.25	0.50	0.010	0.020	

