



I²C Programmable 3A DVS Buck Converter

Features

- Input Voltage Range: 2.5V~5.5V
- Programmable Output Voltage:
 - 0.600V to 1.394V in 6.25 mV Steps
- Maximum Output Current: 3A
- 2.4 MHz PWM with Seamless PWM/PFM Switching for Light-load Efficiency
- Dynamic Voltage Scaling (DVS) with Programmable Voltage Slew Rate
- Excellent Load and Line Transient
- Quiescent Current in PFM Tristate: 48μA
- I²C Interface with SM, FM, FM⁺ and HS Modes

- Comprehensive Protection
 - Input Under-Voltage Lockout (UVLO)
 - Input Over-Voltage Protection (OVP)
 - Over Current and Short-Circuit Protection
 - Thermal Shut-down
- 2.01mm x 1.21mm 15-Bump WLCSP

Applications

- Application Processors
- Memory, Hard Disk Drive and SSD
- Smart Phones
- Tablets
- Handheld Devices

Order Information

| Part Number | Default V _{OUT} after POR | | Default mode after POR | | I ² C Address | Package | Packing Method |
|-------------|------------------------------------|--------|------------------------|------------|--------------------------|---------|----------------|
| | VSEL=0 | VSEL=1 | VSEL=0 | VSEL=1 | | | |
| HL7593WL01 | 0.600V | 0.600V | Auto PFM | Forced PWM | 1010 000 | WLCSP | Tape & Reel |
| HL7593WL02 | 1.125V | 1.125V | Auto PFM | Forced PWM | 1010 111 | WLCSP | Tape & Reel |
| HL7593WL03 | 1.125V | 1.125V | Auto PFM | Forced PWM | 1100 000 | WLCSP | Tape & Reel |
| HL7593WL04 | 0.600V | 0.600V | Auto PFM | Forced PWM | 1100 000 | WLCSP | Tape & Reel |
| HL7593WL05 | 1.150V | 0.800V | Forced PWM | Auto PFM | 1100 000 | WLCSP | Tape & Reel |
| HL7593WL06 | 1.150V | 0.800V | Forced PWM | Auto PFM | 1100 001 | WLCSP | Tape & Reel |
| HL7593WL07 | 1.200V | 1.200V | Auto PFM | Forced PWM | 1100 000 | WLCSP | Tape & Reel |



Typical Application Diagram

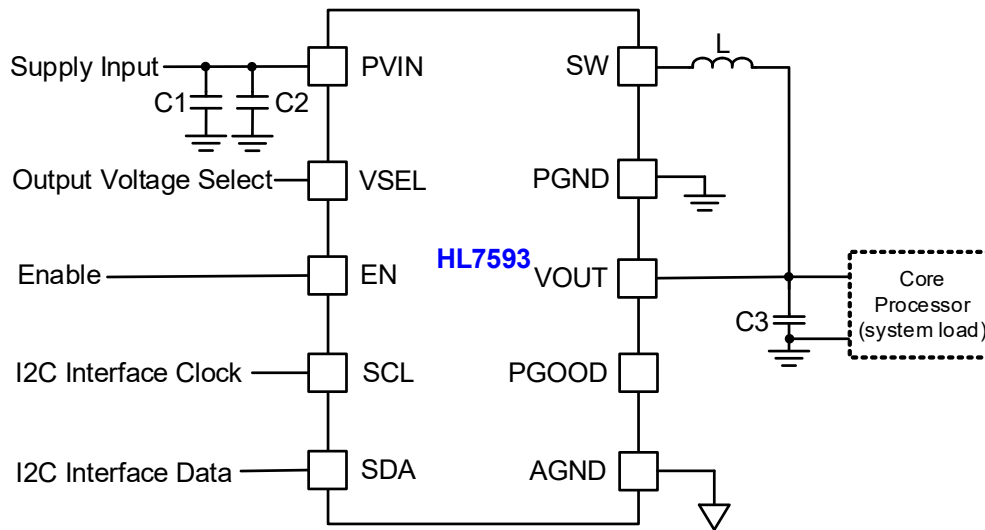


Figure 1 HL7593 Typical Application Diagram

| Component | Part Number | Value | Size | Vendor |
|-----------|----------------|-----------------|------|------------|
| L1 | See Table2 | 470 or 330 nH | 2016 | See Table2 |
| C1, C2 | C1608X5R1A475K | 4.7 μ F/10V | 0603 | TDK |
| C3 | C1608X5R0J226M | 22 μ F/6.3V | 0603 | TDK |

Table 1 Recommended External Components

| Manufacturer | Part Number | L (nH) | DCR(m Ω) | $I_{MAXDC}^{(1)}$ | Component Dimensions | | |
|--------------|---------------------|--------|------------------|-------------------|----------------------|-----|-----|
| | | | | | L | W | H |
| Toko | DFR201612C-R33N | 330 | 23 | 4.2 | 2 | 1.6 | 1.2 |
| Cyntek | PIFE20161B-R33MS | 330 | 27 | 3.5 | 2 | 1.6 | 1.2 |
| Toko | DFE201612C-R47N | 470 | 40 | 3.2 | 2 | 1.6 | 1.2 |
| Cyntek | PIFE20161B-R47MS-39 | 470 | 30 | 3.1 | 2 | 1.6 | 1.2 |
| SEMCO | CIGT201610UMR47MNE | 470 | 30 | 4 | 2 | 1.6 | 0.9 |

Table 2 Recommended Inductors

Notes:

- I_{MAXDC} is the smaller current to produce 40°C temperature rise or 30% effective inductance reduction.



Description

HL7593 is a synchronous buck converter optimized to supply different sub systems of portable applications. Its input voltage range is 2.5V to 5.5V. Its output voltage range is 0.600V to 1.394V in 6.25mV steps, programmed through an I²C interface. Its output voltage can be adjusted on the fly to provide Dynamic Voltage Scaling (DVS) function with a programmable slew rate.

HL7593 can deliver up to 3A with 80% efficiency, while maintaining over 80% efficiency at load currents as low as 10mA. It operates at fixed frequency of 2.4MHz, which reduces the value of the external components. A wide range of output capacitors can be used to optimize V_{OUT} stability during load transients. Inductors from 0.33uH to 1.0uH may be used without affecting loop stability.

At moderate to light loads, Pulse Frequency Modulation (PFM) is used to maintain conversion efficiency with a typical non-switching quiescent current of 48μA. Even

with such a low quiescent current, HL7593 maintains excellent load and line transient responses. At higher loads, the system automatically switches to fixed-frequency Pulse Width Modulation (PWM) operation at 2.4MHz for minimum V_{OUT} ripple and optimal load transient response. In Shutdown Mode, the supply current drops below 1μA, reducing power consumption. PFM Mode can be disabled if needed through I²C registers.

HL7593 supports V_{OUT} remote sensing. It's feedback signal V_{OUT} can be connected close to the power supply pin of the load for a true point-of-load operation without affecting control loop stability.

The HL7593 is available in a 15-bump, 0.4mm pitch, 2.01mm x 1.21mm WLCSP.