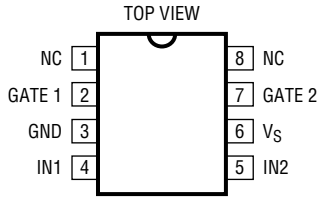
ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... –0.3V to 7V
Any Input Voltage ..... (V_S + 0.3V) to (GND – 0.3V)
Any Output Voltage ..... (V_S + 12V) to (GND – 0.3V)
Current (Any Pin) 50mA

Operating Temperature Range
LTC1157C ..... 0°C to 70°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

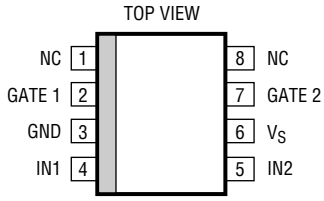
PACKAGE/ORDER INFORMATION



N8 PACKAGE
8-LEAD PLASTIC DIP

T_{JMAX} = 100°C, θ_{JA} = 130°C/W

ORDER PART NUMBER
LTC1157CN8



S8 PACKAGE
8-LEAD PLASTIC SO

T_{JMAX} = 100°C, θ_{JA} = 150°C/W

ORDER PART NUMBER	S8 PART MARKING
LTC1157CS8	1157

ELECTRICAL CHARACTERISTICS

V_S = 2.7V to 5.5V, T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		LTC1157C MIN	LTC1157C TYP	LTC1157C MAX	UNITS
I_Q	Quiescent Current OFF	V_S = 3.3V, V_{IN1} = V_{IN2} = 0V (Note 1)			3	10	µA
	Quiescent Current ON	V_S = 3.3V, V_{IN} = 3.3V (Note 2)			80	160	µA
		V_S = 5V, V_{IN} = 5V (Note 2)			180	400	µA
V_{INH}	Input High Voltage		●	70% × V_S			V
V_{INL}	Input Low Voltage		●			15% × V_S	V
I_{IN}	Input Current	0V ≤ V_{IN} ≤ V_S	●			±1	µA
C_{IN}	Input Capacitance				5		pF
$V_{GATE} – V_S$	Gate Voltage Above Supply	V_S = 3V	●	4.0	4.7	6.5	V
		V_S = 3.3V	●	4.5	5.4	7.0	V
		V_S = 5V	●	7.5	8.8	12.0	V
t_{ON}	Turn-ON Time	V_S = 3.3V, C_{GATE} = 1000pF					
		Time for V_{GATE} > V_S + 1V		30	130	300	µs
		Time for V_{GATE} > V_S + 2V		75	240	750	µs
		V_S = 5V, C_{GATE} = 1000pF					
		Time for V_{GATE} > V_S + 1V		30	85	300	µs
		Time for V_{GATE} > V_S + 2V		75	230	750	µs
t_{OFF}	Turn-OFF Time	V_S = 3.3V, C_{GATE} = 1000pF					
		Time for V_{GATE} < 0.5V		10	36	60	µs
		V_S = 5V, C_{GATE} = 1000pF					
		Time for V_{GATE} < 0.5V		10	31	60	µs

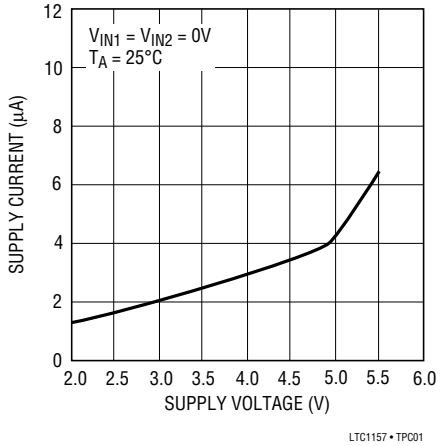
The ● denotes specifications which apply over the full operating temperature range.

Note 1: Quiescent current OFF is for both channels in OFF condition.

Note 2: Quiescent current ON is per driver and is measured independently.

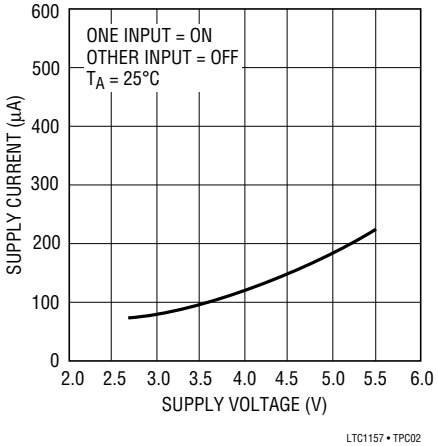
TYPICAL PERFORMANCE CHARACTERISTICS

Standby Supply Current



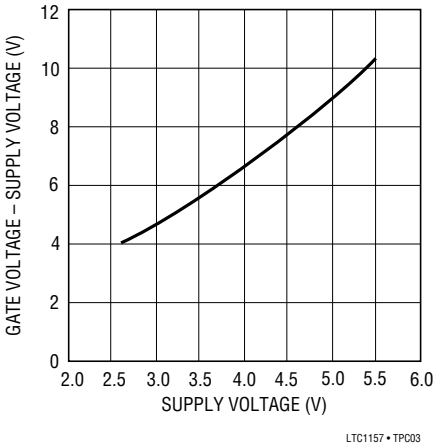
LTC1157 • TPC01

Supply Current per Driver ON



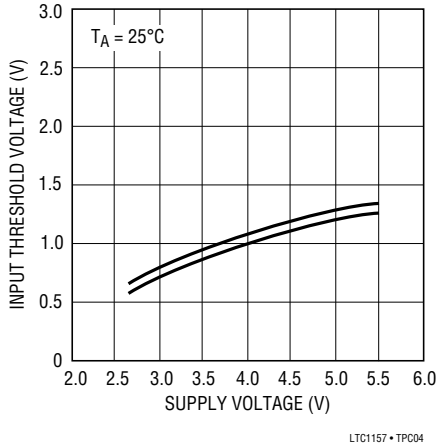
LTC1157 • TPC02

Gate Voltage Above Supply



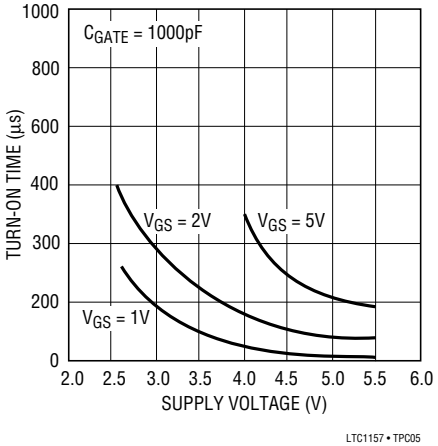
LTC1157 • TPC03

Input Threshold Voltage



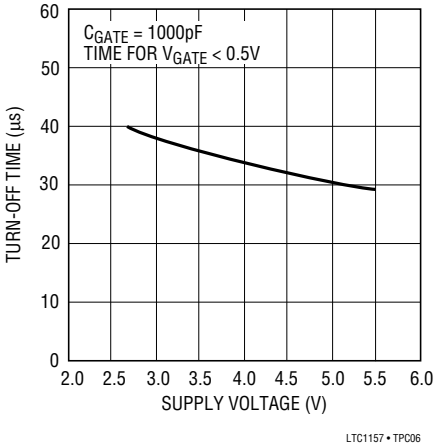
LTC1157 • TPC04

Turn-ON Time



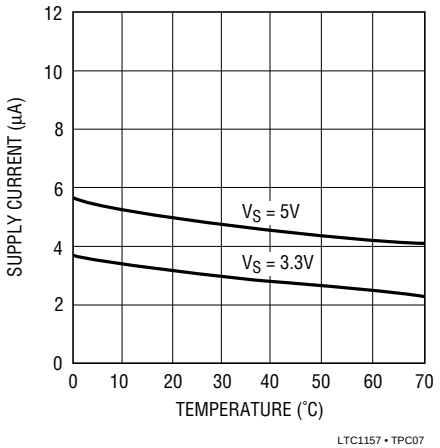
LTC1157 • TPC05

Turn-OFF Time



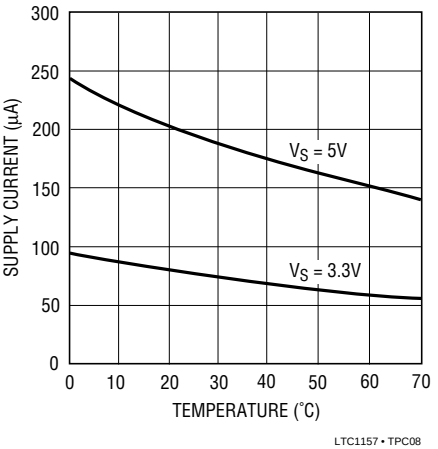
LTC1157 • TPC06

Standby Supply Current



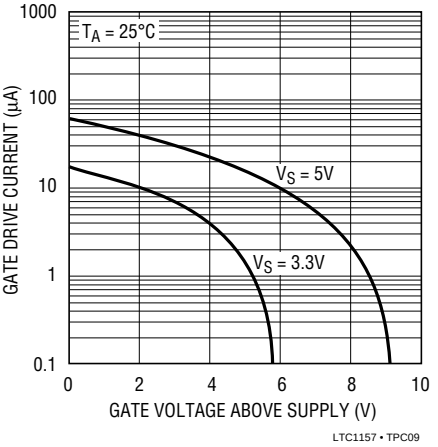
LTC1157 • TPC07

Supply Current per Driver ON



LTC1157 • TPC08

Gate Drive Current



LTC1157 • TPC09

PIN FUNCTIONS

Input Pins: The LTC1157 input pins are active high and activate the charge pump circuitry when switched ON. The LTC1157 logic inputs are high impedance CMOS gates with ESD protection diodes to ground and supply and therefore should not be forced beyond the power supply rails.

Gate Drive Pins: The gate drive pin is either driven to ground when the switch is turned OFF or driven above the supply rail when the switch is turned ON. This pin is a relatively high impedance when driven above the rail (the equivalent of a few hundred kΩ). Care should be taken to minimize any loading of this pin by parasitic resistance to ground or supply.

Supply Pin: *The supply pin of the LTC1157 should never be forced below ground as this may result in permanent damage to the device.* A 300Ω resistor should be inserted in series with the ground pin if negative supply voltage transients are anticipated.

OPERATION

The LTC1157 is a dual micropower MOSFET driver designed specifically for operation at 3.3V and 5V and includes the following functional blocks:

3.3V Logic Compatible Inputs

The LTC1157 inputs have been designed to accommodate a wide range of 3.3V and 5V logic families. Approximately 50mV of hysteresis is provided to ensure clean switching.

An ultra low standby current voltage regulator provides continuous bias for the logic-to-CMOS converter. The logic-to-CMOS converter output enables the rest of the circuitry. In this way the power consumption is kept to an absolute minimum in the standby mode.

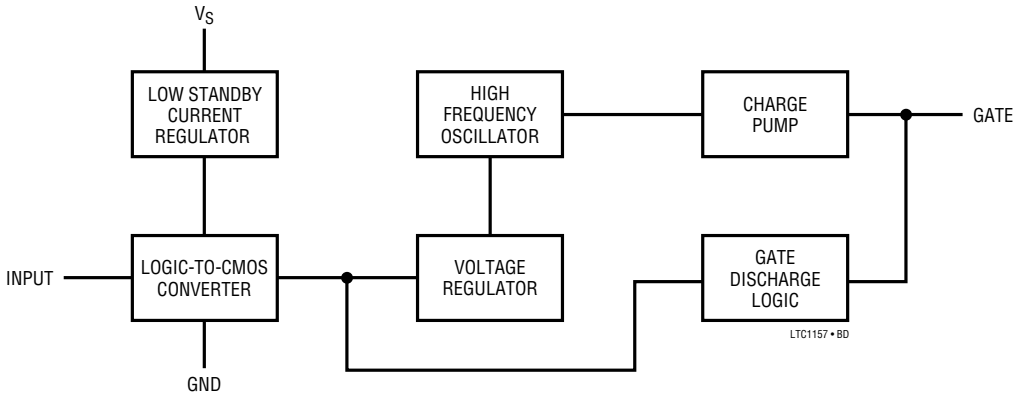
Gate Charge Pump

Gate drive for the power MOSFET is produced by an internal charge pump circuit which generates a gate voltage substantially higher than the power supply voltage. The charge pump capacitors are included on-chip and therefore no external components are required to generate the gate drive.

Controlled Gate Rise and Fall Times

When the input is switched ON and OFF, the gate is charged by the internal charge pump and discharged in a controlled manner. The charge and discharge rates have been set to minimize RFI and EMI emissions.

BLOCK DIAGRAM (One Channel)



APPLICATIONS INFORMATION

MOSFET Selection

The LTC1157 is designed to operate with both standard and logic level N-channel MOSFET switches. The choice of switch is determined primarily by the operating supply voltage.

Logic Level MOSFET Switches at 3.3V

Logic level switches should be used with the LTC1157 when powered from 2.7V to 4V. Although there is some variation among manufacturers, logic level MOSFET switches are typically rated with V_{GS} = 4V with a maximum continuous V_{GS} rating of ±10V. $R_{DS(ON)}$ and maximum V_{DS} ratings are similar to standard MOSFETs and there is generally little price differential. Logic level MOSFETs are frequently designated by an "L" and are usually available in surface mount packaging. Some logic level MOSFETs are rated up to ±15V and can be used in applications which require operation over the entire 2.7V to 5.5V range.

Standard MOSFET Switches at 5V

Standard N-channel MOSFET switches should be used with the LTC1157 when powered from 4V to 5.5V supply as the built-in charge pump produces ample gate drive to fully enhance these switches when powered from a 5V nominal supply. Standard N-channel MOSFET switches are rated with V_{GS} = 10V and are generally restricted to a maximum of ±20V.

Powering Large Capacitive Loads

Electrical subsystems in portable battery-powered equipment are typically bypassed with large filter capacitors to reduce supply transients and supply induced glitching. If not properly powered however, these capacitors may themselves become the source of supply glitching.

For example, if a 100µF capacitor is powered through a switch with a slew rate of 0.1V/µs, the current during start-up is:

$$I_{START} = C(dV/dt)$$
$$= (100 \times 10^{-6})\ (1 \times 10^{5})$$
$$= 10A$$

Obviously, this is too much current for the regulator (or output capacitor) to supply and the output will glitch by as much as a few volts.

The start-up current can be substantially reduced by limiting the slew rate at the gate of an N-channel switch as shown in Figure 1. The gate drive output of the LTC1157

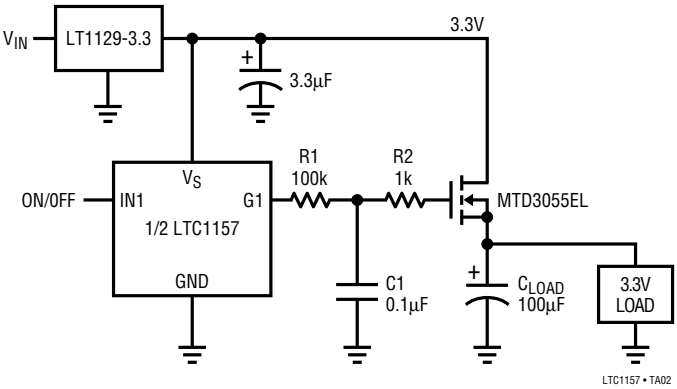


Figure 1. Powering a Large Capacitive Load

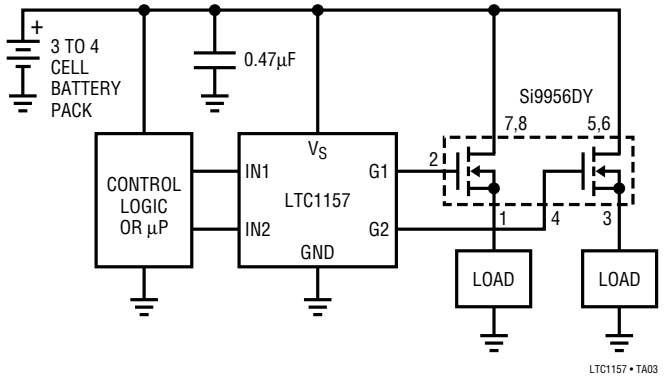
is passed through a simple RC network, R1 and C1, which substantially slows the slew rate of the MOSFET gate to approximately 1.5×10^{-4}V/µs. Since the MOSFET is operating as a source follower, the slew rate at the source is essentially the same as that at the gate, reducing the start-up current to approximately 15mA which is easily managed by the system regulator. R2 is required to eliminate the possibility of parasitic MOSFET oscillations during switch transitions. Also, it is good practice to isolate the gates of paralleled MOSFETs with 1k resistors to decrease the possibility of interaction between switches.

Reverse Battery Protection

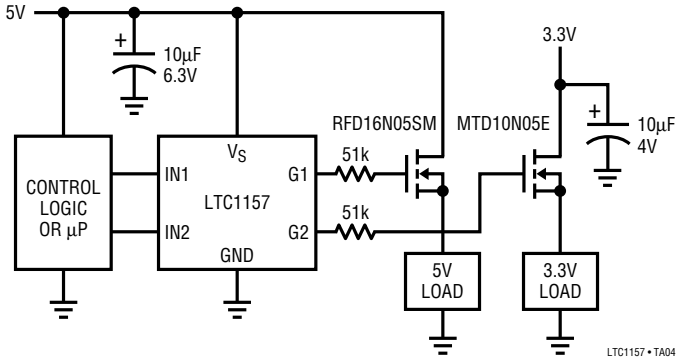
The LTC1157 can be protected against reverse battery conditions by connecting a 300Ω resistor in series with the ground pin. The resistor limits the supply current to less than 12mA with –3.6V applied. Since the LTC1157 draws very little current while in normal operation, the drop across the ground resistor is minimal. The 3.3V µP (or control logic) can be protected by adding 10k resistors in series with the input pins.

TYPICAL APPLICATIONS

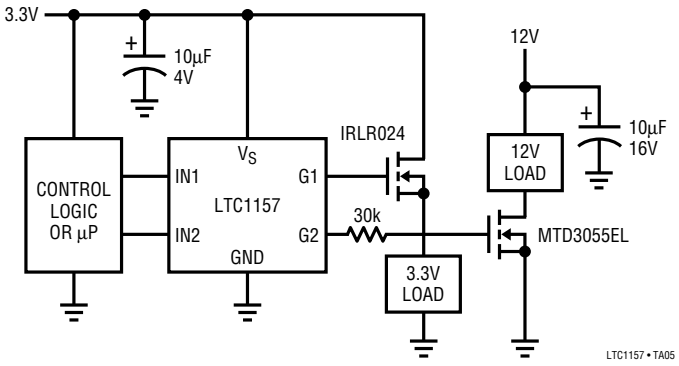
Ultra Low Drop 3 to 4 Cell Dual High-Side Switch



Mixed 5V and 3.3V Dual High-Side Switch

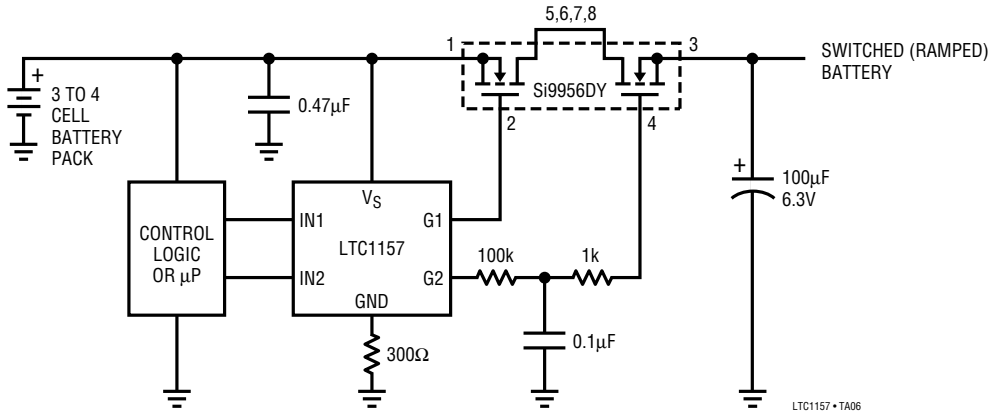


Mixed 3.3V and 12V High- and Low-Side Switching

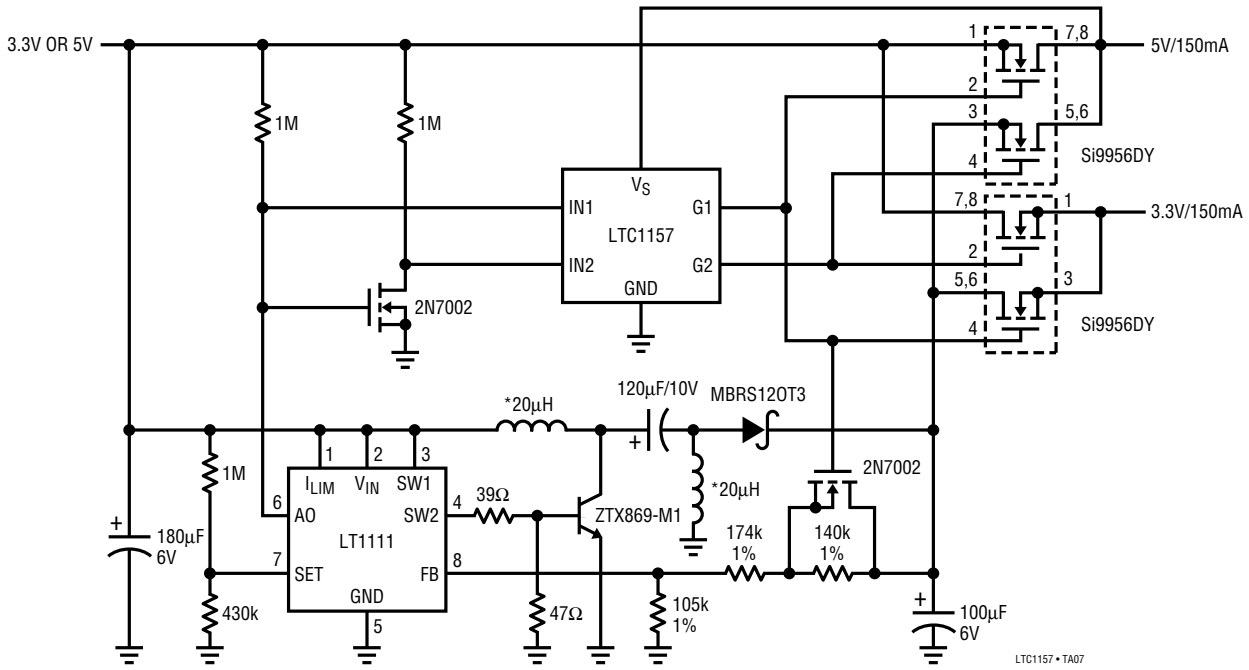


TYPICAL APPLICATIONS

Ultra Low Voltage Drop Battery Switch with Reverse Battery Protection, Ramped Output and 3μA Standby Current



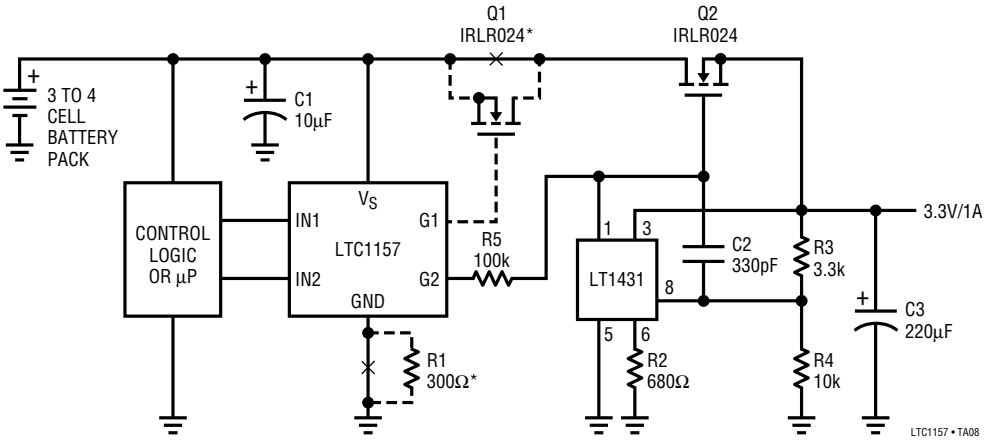
Generating 3.3V and 5V from a 3.3V or 5V Source (Automatic Switching)



*CTX20-3 COILTRONICS

TYPICAL APPLICATIONS

3.3V Ultra Low Voltage Drop Regulator with Optional Reverse Battery Protection and 3μA Standby Current

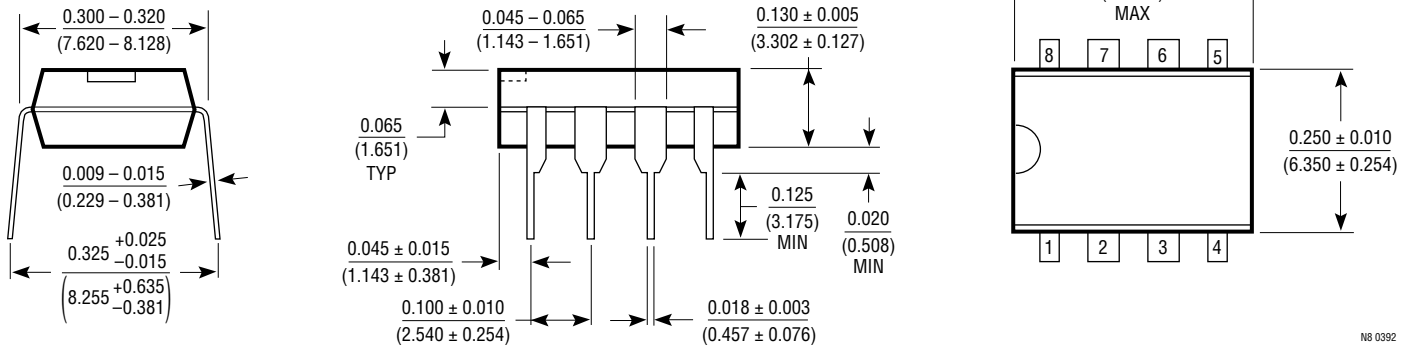


*OPTIONAL REVERSE BATTERY PROTECTION. ADD R1 IN SERIES WITH THE GROUND LEAD AND ADD Q1 IN SERIES WITH THE BATTERY AS SHOWN.

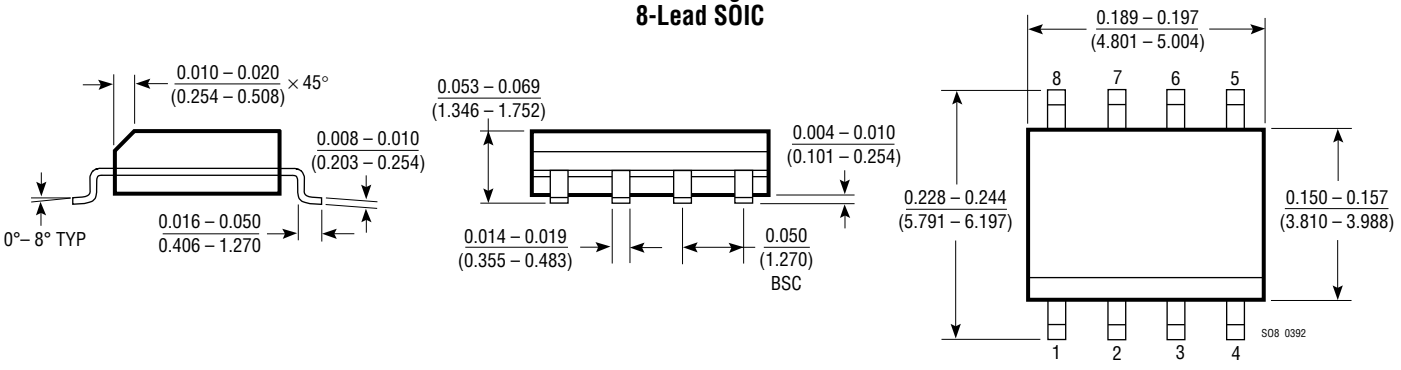
PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

N Package
8-Lead Plastic DIP



S Package
8-Lead SOIC



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