SC700WLTRC/SC700HWLTRC

4A Low V_{IN}, Low Rdson Load Switch

POWER MANAGEMENT

Features

- Input voltage range — 0.75V to 5.25V
- 4A continuous output current
- Low Rdson —17mOhm
- Constant Rdson over wide V_{IN} range
- Optional output discharge circuit
  - SC700WLTRC — Automatic output discharge
  - SC700HWLTRC — No output discharge circuit
- Low shutdown current
- Package: MLPD — 2mm x 2mm , 6 LEAD

Applications

- Battery powered equipment
- Smart Phones/Tablet PCs
- Consumer electronics
- STB/Audio/Video
- Industrial/Network equipment
- Other Portable Devices

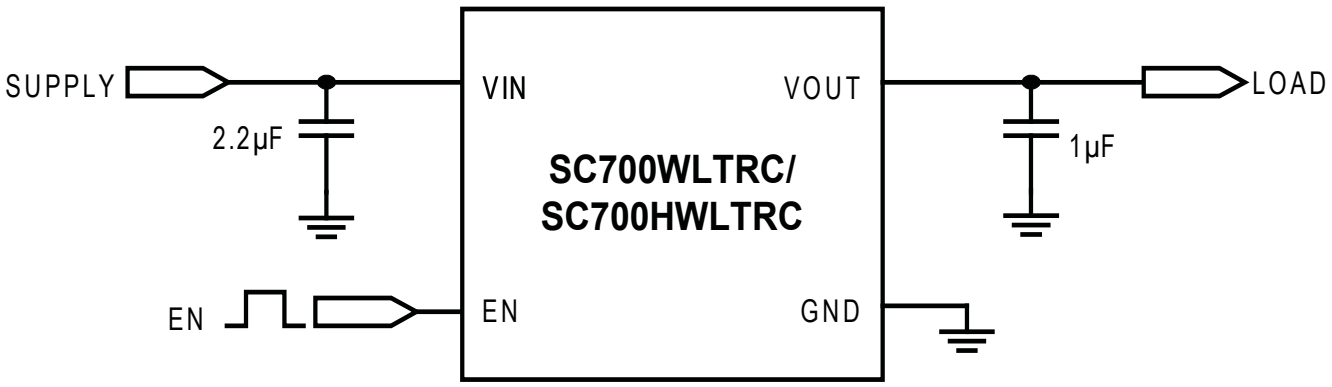
Description

The SC700WLTRC/SC700HWLTRC is a very low input voltage and low Rdson load switch optimized for use in battery powered applications. SC700WLTRC/ SC700HWLTRC supports up to 4A continuous output current. Sophisticated integrated circuitry maximizes Vgs of the power NMOS to minimize Rdson resistance over a wide range of operating conditions.

The device provides a controlled soft-start to limit inrush current. SC700WLTRC features an automatic discharge circuit which discharges the output when the SC700WLTRC is disabled. SC700HWLTRC does not include automatic output discharge circuitry.

The SC700WLTRC/SC700HWLTRC is offered in MLPD package which enables very small board area implementations. SC700WLTRC/ SC700HWLTRC has an operating temperature range of -40C to +85C.

Typical Application Circuit



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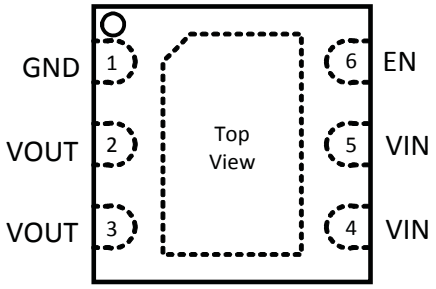
Pin Configuration



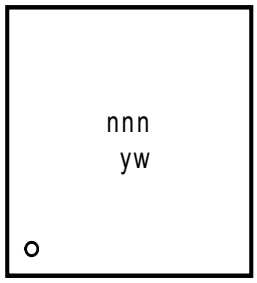
MLPD 2mm x 2mm, 6 LEAD

Ordering Information

Device	Package
SC700WLTRC[1],[2]	MLPD 2mm × 2mm, 6-LEAD
SC700HWLTRC[1],[2]	MLPD 2mm × 2mm, 6-LEAD
SC700WLTRC/SC700HWLTRC EVB	Evaluation Board

Notes:
(1) Available in tape and reel only. A reel contains 3,000 devices.
(2) Lead-free package only. Device is WEEE and RoHS compliant.

Marking Information



- nnn = Part No. Code — SC700WLTRC: NCU
- nnn = Part No. Code — SC700HWLTRC: NCH
- yw = Datecode

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Absolute Maximum Ratings

VIN (V) . . . . . -0.3 to +5.5
EN (V) . . . . . -0.3 to +5.5
EN falltime--maximum (µs). 1
*NOTE: See Figure 1 for EN falltime specifications
Vout (V) . . . . . .-0.3 to (V_{VIN} + 0.3)
ESD HBM Protection Level[1] (kV) . . . . . Class 1C

Recommended Operating Conditions

Ambient Temperature Range (°C) . . . . . $-40 \leq T_A \leq +85$
V_{VIN} (V) . . . . . 0.75 to 5.25
V_{VOUT} (V) . . . . . 0 to VIN
Maximum Output Current (A) 4

Thermal Information

Thermal Resistance, Junction to Ambient[2] (°C/W) . . . 56
Maximum Junction Temperature (°C) . . . . . +150
Storage Temperature Range (°C) . . . . . -65 to +150
Peak IR Reflow Temperature (10s to 30s) (°C) . . . . . +260

Exceeding the above specifications may result in permanent damage to the device or device malfunction. Operation outside of the parameters specified in the Electrical Characteristics section is not recommended.

NOTES:
(1) Tested according to JEDEC standard JESD22-A114-B.
(2) Calculated from package in still air, mounted to 3 x 4.5 (in), 4 layer FR4 PCB with thermal vias under the exposed pad per JESD51 standards.

Electrical Characteristics

Unless otherwise noted V_{IN} = 5.25V, C_{IN} = 2.2µF, C_{OUT} = 1µF, $V_{EN} \geq V_{IH}$, T_A = -40°C to +85°C. Typical values are at T_A = 25°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
ON-state Resistance	R_{DSON}	I_{OUT} = 500mA, V_{IN} = 1.7V		17		mΩ
		I_{OUT} = 500mA, V_{IN} = 2.5V		17		
		I_{OUT} = 500mA, V_{IN} = 3.3V		17		
		I_{OUT} = 500mA, V_{IN} = 3.6V		17		
		I_{OUT} = 500mA, V_{IN} = 5.25V		17		
		I_{OUT} = 500mA, $0.75V \leq V_{IN} \leq 5.25V$			27	
Shutdown Current	I_{SD}	EN = 0V, $0.75V \leq V_{IN} \leq 3.6V$		0.1	1	µA
		EN = 0V, $3.6V < V_{IN} \leq 5.25V$		0.5	60	
Quiescent Current `	I_Q	$0.75V \leq V_{IN} \leq 2.2V$		350	900	µA
		$2.2V < V_{IN} \leq 5.25V$		150	400	µA
Pull Down Resistance[1]	R_{PD}	SC700WLTRC		1.5		kΩ

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Electrical Characteristics (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Turn On Time	T_{ON}	From rising edge of EN to 50% of VOUT, V_{IN} = 0.9V, Load = 10 Ω		190		µs
		From rising edge of EN to 50% of VOUT, V_{IN} = 3.6V, Load = 10 Ω		206		
		From rising edge of EN to 50% of VOUT, V_{IN} = 5.25V, Load = 10 Ω		230		
Rise Time	T_R	From 10% to 90% of VOUT, V_{IN} = 0.9V, Load = 10 Ω		70		µs
		From 10% to 90% of VOUT, V_{IN} = 3.6V, Load = 10 Ω		167		
		From 10% to 90% of VOUT, V_{IN} = 5.25V, Load = 10 Ω		224		
Turn Off Time	T_{OFF}	From falling edge of EN to 50% of VOUT, V_{IN} = 0.9V, Load = 10 Ω		16		µs
		From falling edge of EN to 50% of VOUT, V_{IN} = 3.6V, Load = 10 Ω		14		
		From falling edge of EN to 50% of VOUT, V_{IN} = 5.25V, Load = 10 Ω		14		
Fall Time	T_F	From 90% to 10% of VOUT, V_{IN} = 0.9V, Load = 10 Ω		15		µs
		From 90% to 10% of VOUT, V_{IN} = 3.6V, Load = 10 Ω		22		
		From 90% to 10% of VOUT, V_{IN} = 5.25V, Load = 10 Ω		23		
EN Digital Input						
EN Input High Threshold	V_{IH}			0.9	1.05	V
EN Input Low Threshold	V_{IL}		0.4			V
Logic Input High Current	I_{IH}				0.1	µA
Logic Input Low Current	I_{IL}				0.1	µA

Note:
(1) See Output Pull Down operation in Applications Information section.

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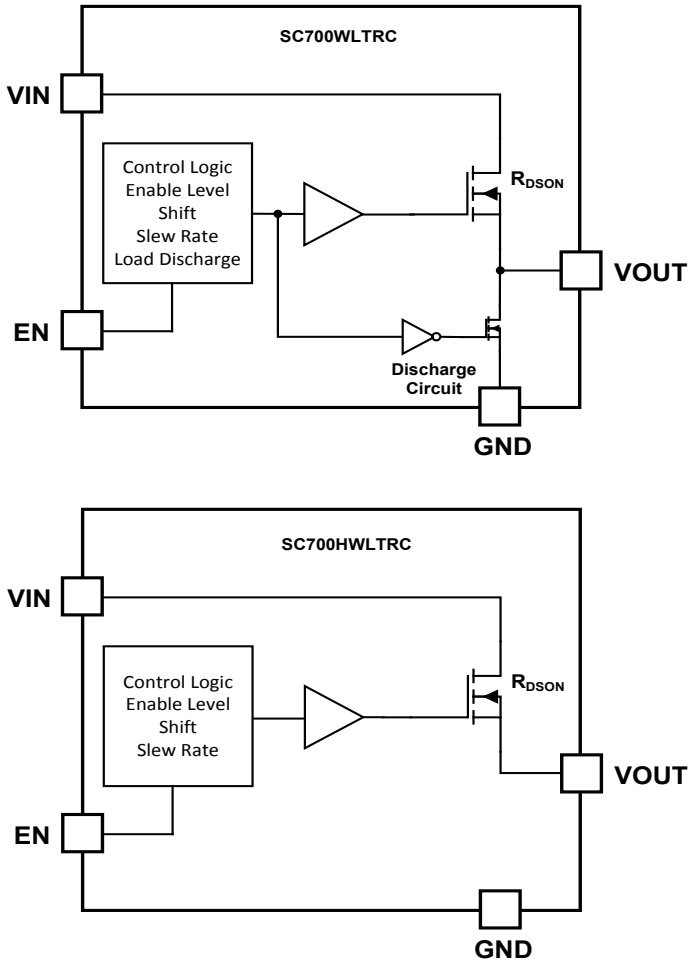
Block Diagram



Pin Descriptions

Pin #	Pin Name	Pin Function
1	GND, PAD	Ground reference for SC700WLTRC/SC700HWLTRC.
2,3	VOUT	Switch output - connect a bypass capacitor of at least 0.1uF to the GND pin. Minimize the PCB layout path inductance for this bypass capacitor between the VOUT pins and the GND pin.
4,5	VIN	Switch input - connect a bypass capacitor of at least 1uF to the GND pin. Minimize the PCB layout path inductance for this bypass capacitor between the VIN pins and the GND pin.
6	EN	Enable/disable the SC700WLTRC/SC700HWLTRC. See figure 1 for disable specification requirement.

Key Components

Component	Value	Manafacture	Part Number	Website
Input Capacitor	2.2uF/0603/X5R/10V	Murata	GRM188R61A225KE34D	www.murata.com
Output Capacitor	1uF/0603/X5R/10V	Murata	GRM188R61A105KA61J	www.murata.com

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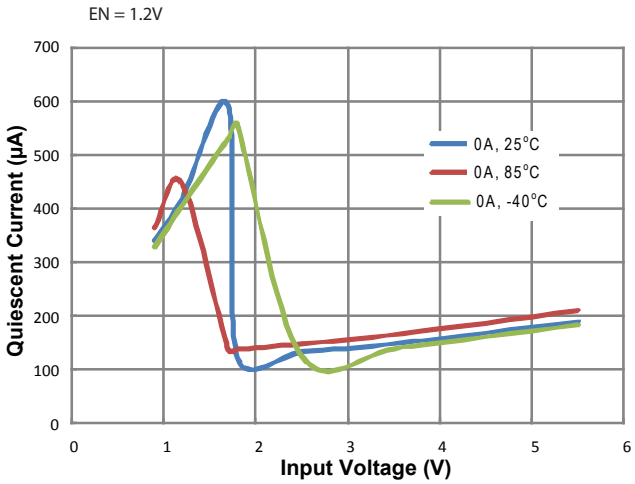
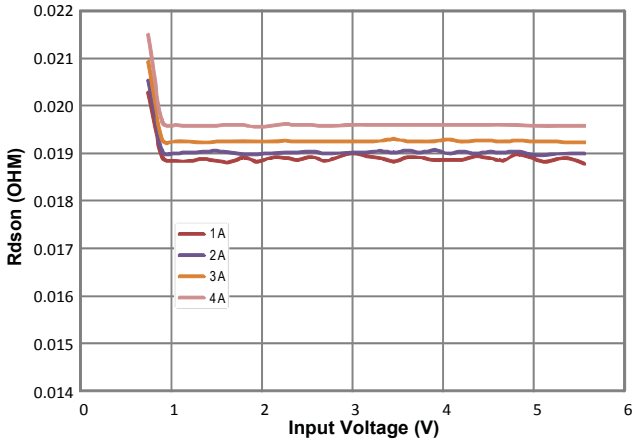
Typical Characteristics

Characteristics in this section are based upon using SC700WLTRC in the Typical Application Circuit (C_{IN} = 2.2µF, C_{OUT} = 1µF).

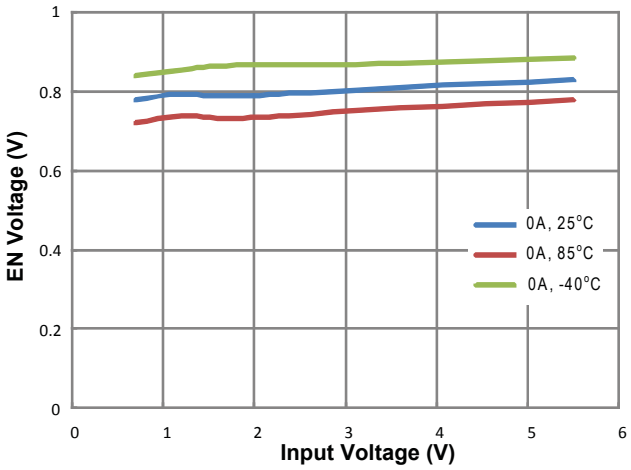
Quiescent Current at No Load



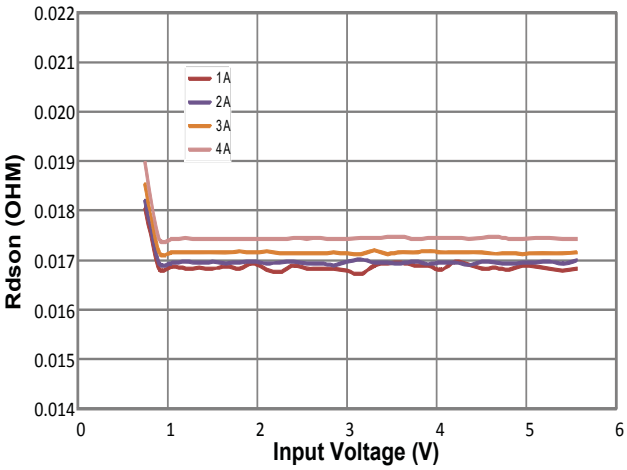
Rdson at 85°C



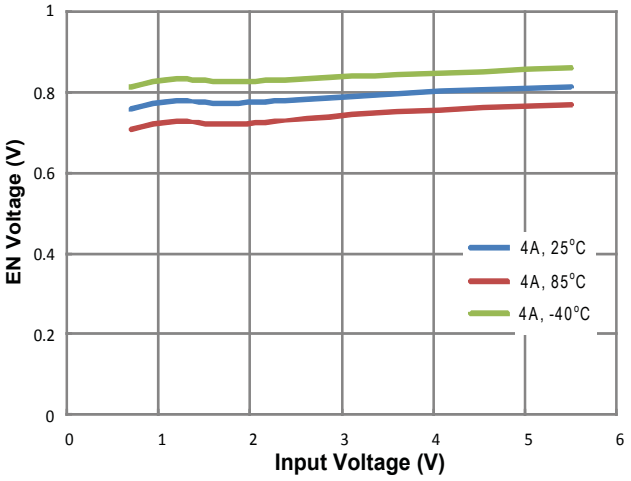
EN Voltage Threshold at No Load



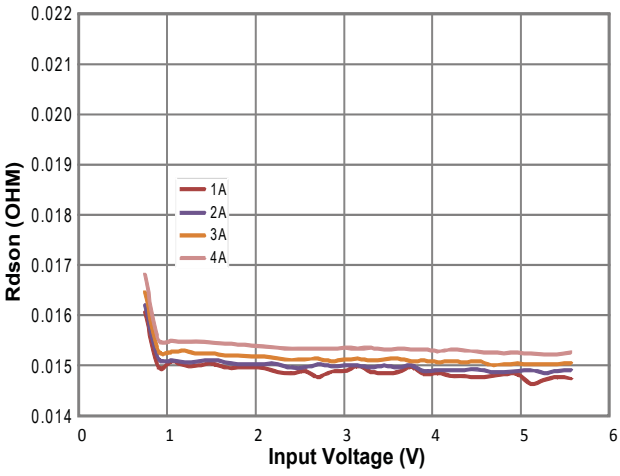
Rdson at 25°C



EN Voltage Threshold at 4A Load



Rdson at -40°C



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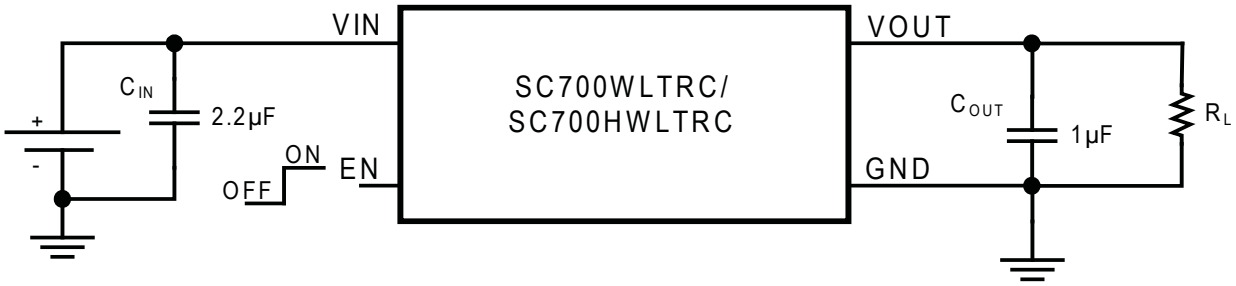
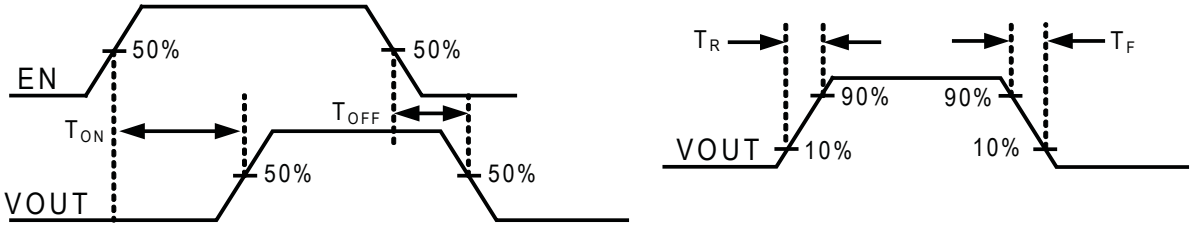
Parameter Measurement Information



TEST CIRCUIT



T_{ON}, T_{OFF}, T_R, T_F WAVEFORMS

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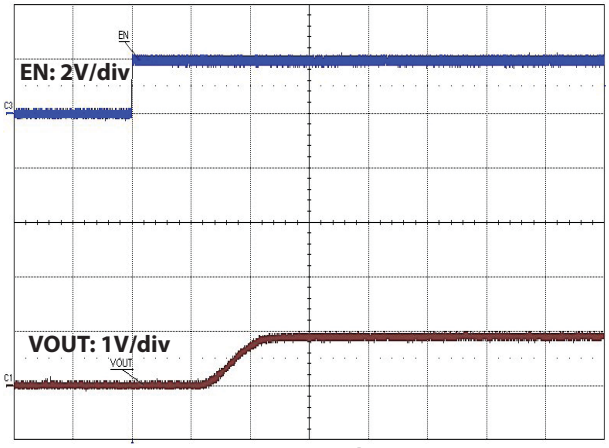
Typical Characteristics

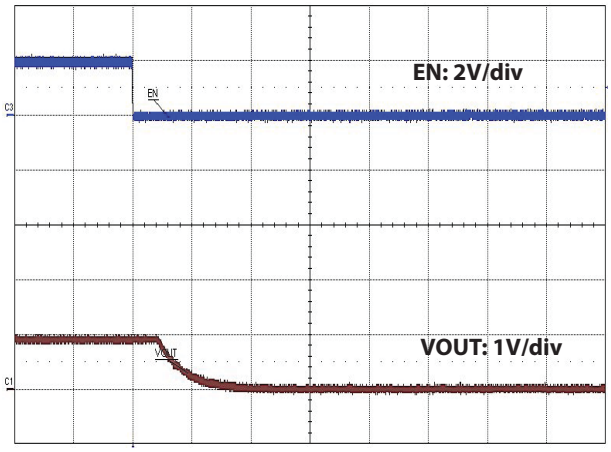
Characteristics in this section are based upon using SC700WLTRC in the Typical Application Circuit (C_{IN} = 2.2µF, C_{OUT} = 1µF).

Turn-On Response at 10 Ohm Load, 0.9V, 25°C



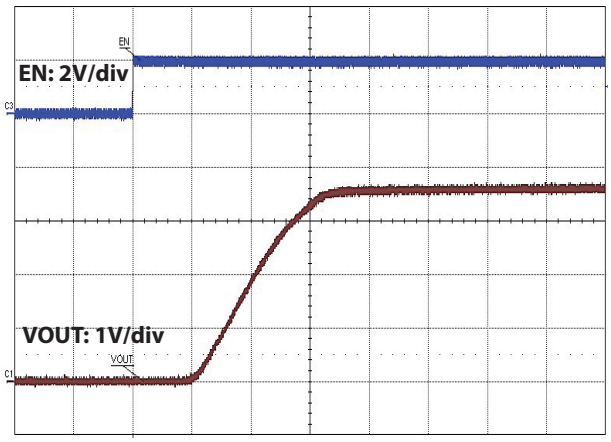
Time (100µs/div)

Turn-Off Response at 10 Ohm Load, 0.9V, 25°C



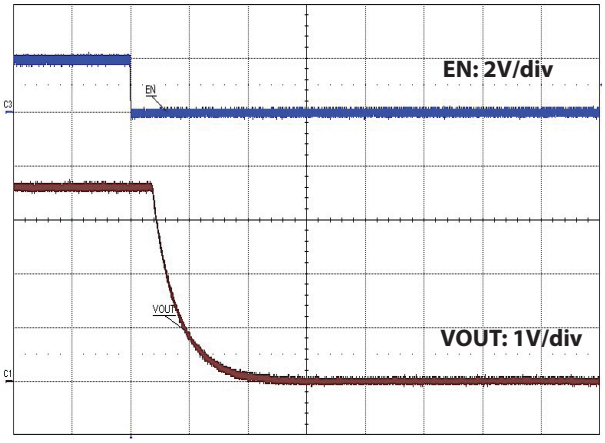
Time (20µs/div)

Turn-On Response at 10 Ohm Load, 3.6V, 25°C



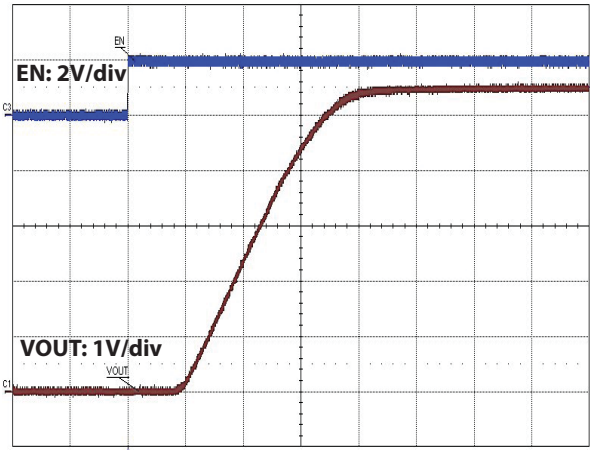
Time (100µs/div)

Turn-Off Response at 10 Ohm Load, 3.6V, 25°C



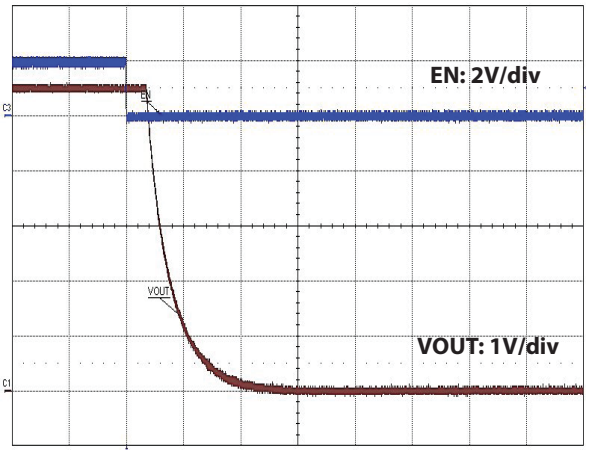
Time (20µs/div)

Turn-On Response at 10 Ohm Load, 5.5V, 25°C



Time (100µs/div)

Turn-Off Response at 10 Ohm Load, 5.5V, 25°C



Time (20µs/div)

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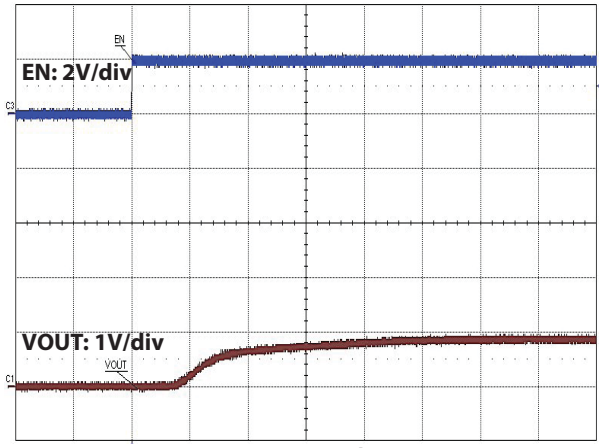
Typical Characteristics

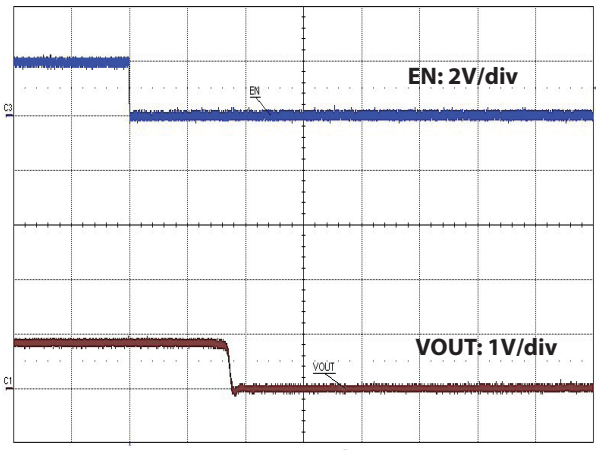
Characteristics in this section are based upon using SC700WLTRC in the Typical Application Circuit (C_{IN} = 2.2µF, C_{OUT} = 1µF).

Turn-On Response at 4A Load, 0.9V, 25°C



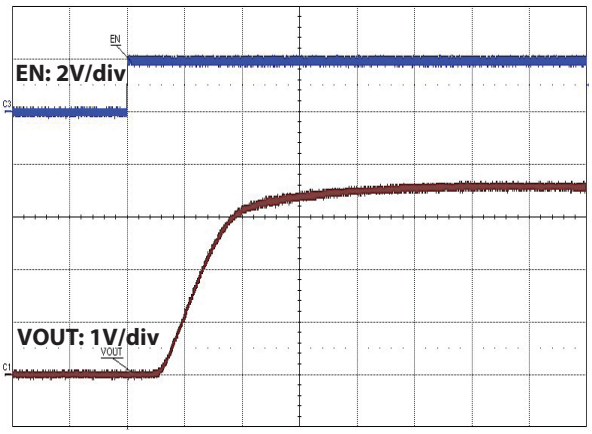
Time (200µs/div)

Turn-Off Response at 4A Load, 0.9V, 25°C



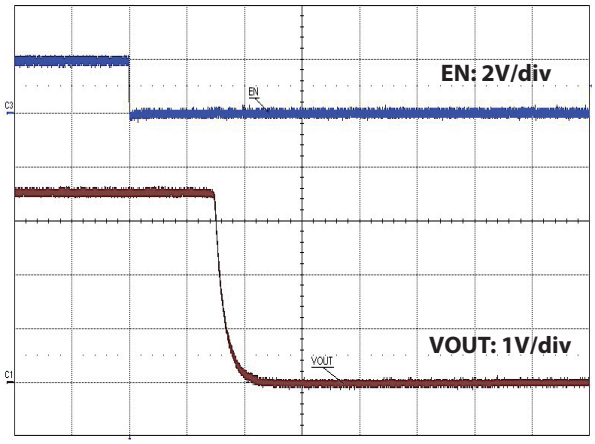
Time (5µs/div)

Turn-On Response at 4A Load, 3.6V, 25°C



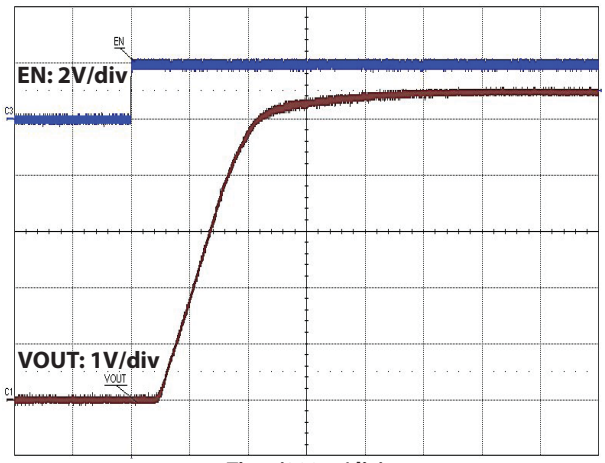
Time (200µs/div)

Turn-Off Response at 4A Load, 3.6V, 25°C



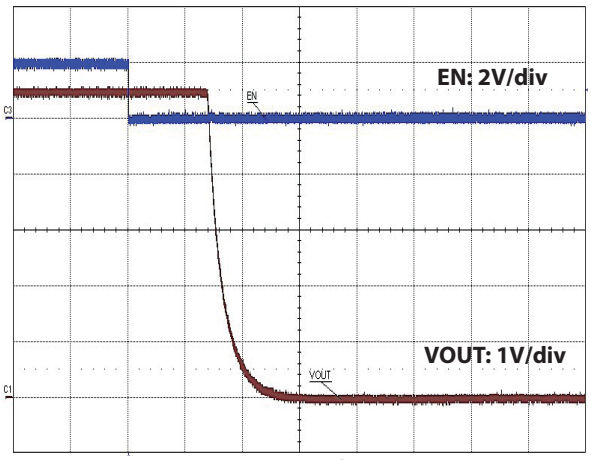
Time (5µs/div)

Turn-On Response at 4A Load, 5.5V, 25°C



Time (200µs/div)

Turn-Off Response at 4A Load, 5.5V, 25°C



Time (5µs/div)

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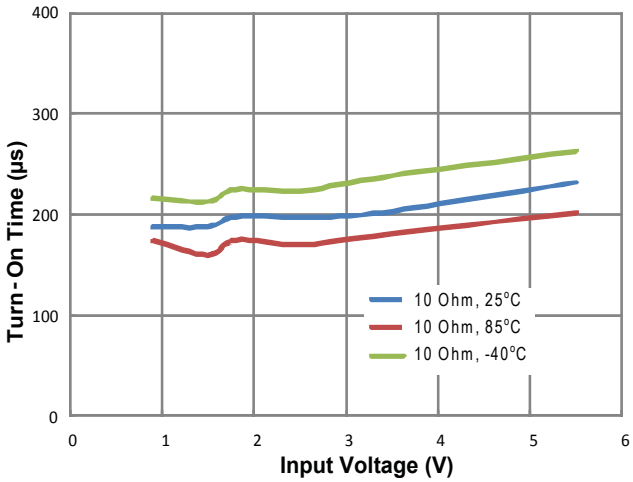
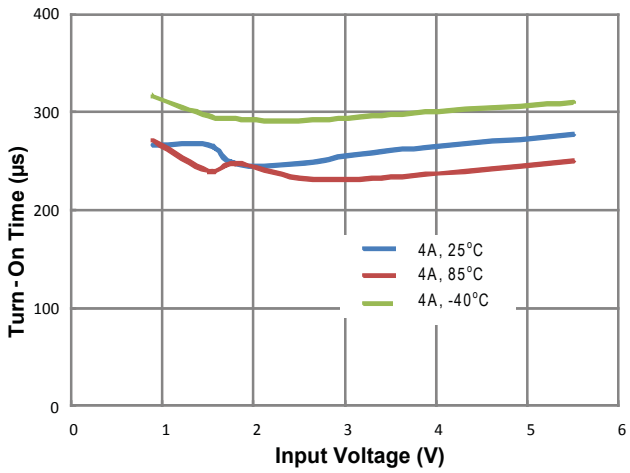
Typical Characteristics

Characteristics in this section are based upon using SC700WLTRC in the Typical Application Circuit (C_{IN} = 2.2µF, C_{OUT} = 1µF).

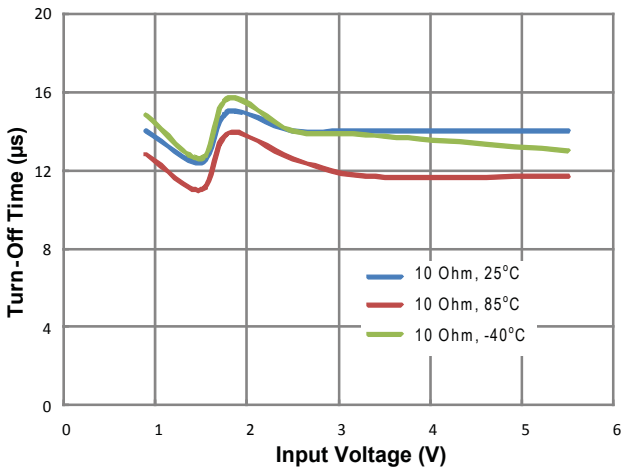
Turn-On Time at 10 Ohm Load



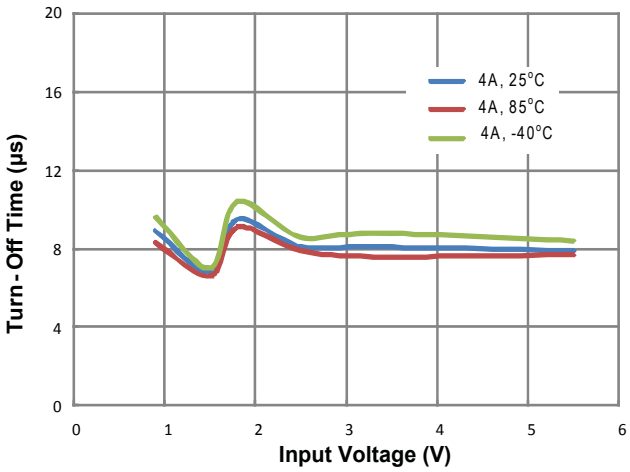
Turn-On Time at 4A Load



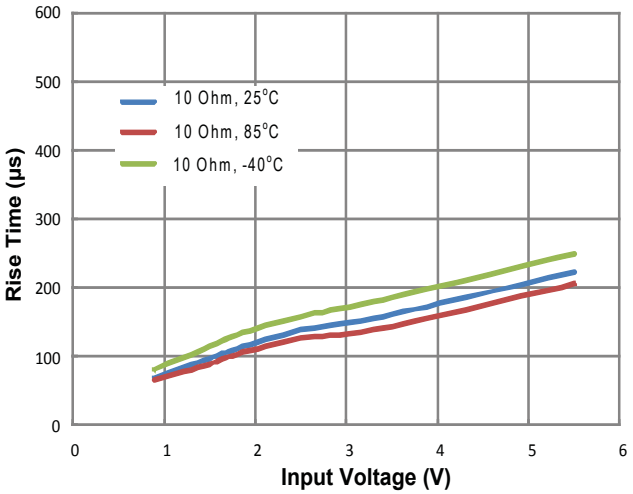
Turn-Off Time at 10 Ohm Load



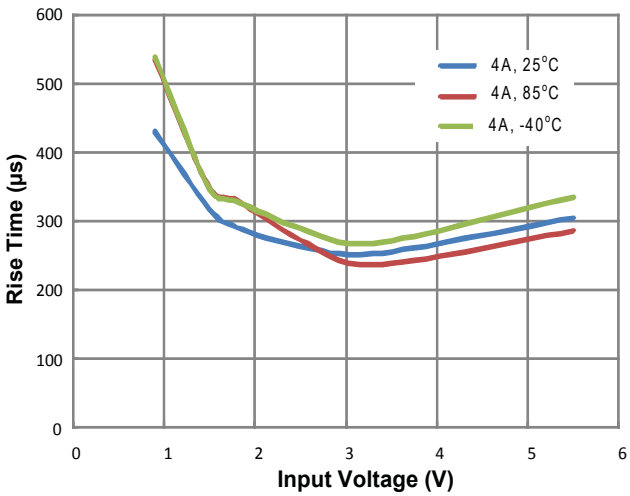
Turn-Off Time at 4A Load



Rise Time at 10 Ohm Load



Rise Time at 4A Load



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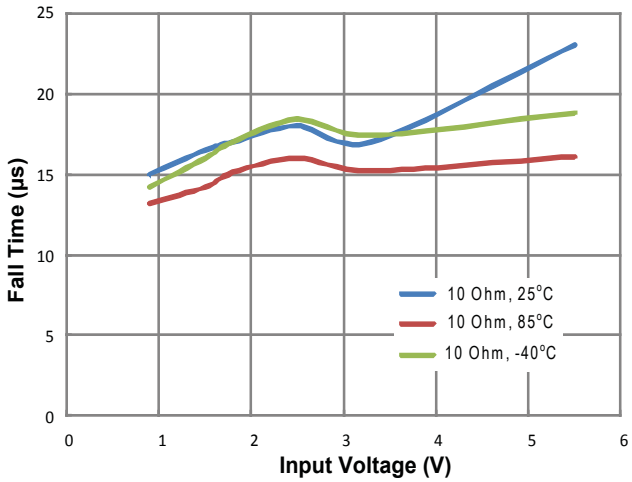
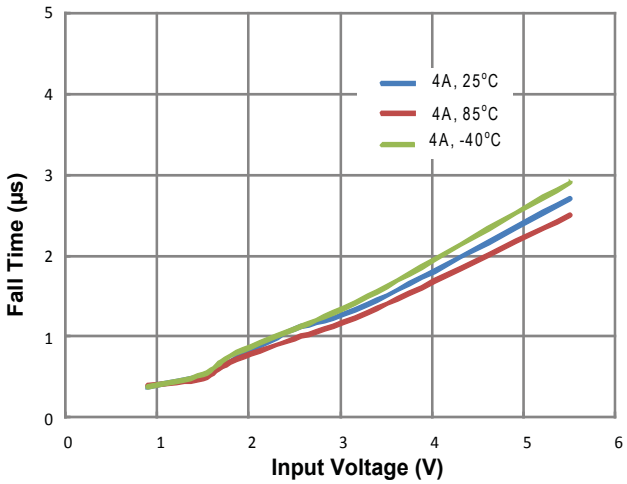
Typical Characteristics

Characteristics in this section are based upon using SC700WLTRC in the Typical Application Circuit (C_{IN} = 2.2µF, C_{OUT} = 1µF).

Fall Time at 10 Ohm Load



Fall Time at 4A Load



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Applications Information

4A Load Switch

The SC700WLTRC/SC700HWLTRC is a very low input voltage and low Rdson load switch optimized for use in battery powered applications. SC700WLTRC/SC700HWLTRC supports up to 4A continuous output current. Sophisticated integrated circuitry maximizes Vgs of the power NMOS to minimize Rdson resistance over a wide range of operating conditions.

EN Requirements

The SC700WLTRC/SC700HWLTRC requires the falling edge timing of the EN signal as shown in figure 1. There is no requirement for the rising edge timing. The EN voltage thresholds are listed in the electrical characteristics table.

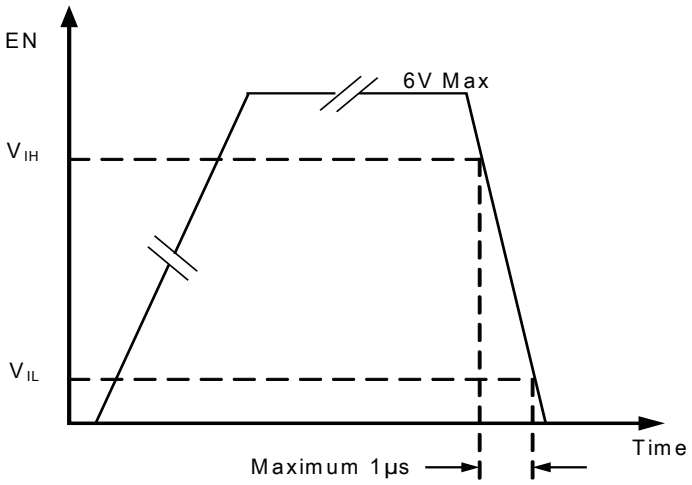

Figure 1 — EN Falling Time Requirement

Turn Off Time

Maximum turn-off times are normally close to typical values stated in the electrical specification table. However, for applications with VIN less than 1.2V, internal circuitry can cause the maximum turn-off time to be extended to up to 30ms.

Input Capacitor

The primary purpose of input capacitance for SC700WLTRC/SC700HWLTRC is to hold the voltage at VIN pins constant when the switch is transitioning between open and closed. When the switch is closing, the input capacitor prevents the voltage at VIN from dropping. When the switch is opening, the input capacitor limits voltage spikes.

Ceramic capacitors should be derated for temperature and bias. As a result, applications up to 3.6V should use capacitors rated 6.3V. Applications up to 5.25V should use capacitors rated 10V.

Output Capacitor

The purpose of output capacitance is to absorb transients on the output. Cin should be selected to be higher in value than Cout. This is because the integrated body diode of the SC700WLTRC/SC700HWLTRC does not have reverse voltage protection. If the input supply is removed while the switch is closed, Cin higher than Cout helps prevent reverse bias of the integrated body diode. Use the same voltage rating criteria for the output capacitor as the input capacitor.

Output Voltage Pulldown

The SC700WLTRC has an internal pull-down resistor. When the SC700WLTRC is disabled, the output pull-down resistor discharges the output capacitor through 1.5 kΩ. When the output voltage reaches a few hundred millivolts above ground, the discharge resistor is disconnected. SC700HWLTRC does not have the discharge circuit.

PCB Layout

Figure 2 shows the typical application circuit with PCB inductance on the circuit board. An important objective of the layout is to minimize the PCB inductance by reducing the length and increasing the width of the traces. The input and output capacitors need to be placed close to the SC700WLTRC/SC700HWLTRC. The PCB inductance only effects the performance during the turn-on, turn-off and load transients. Figure 2 shows three current loops during the opening or closing of the switch. The magnitude of the voltage ringing at VIN or VOUT pin depends on the value of PCB inductance and placement of the capacitors. It is important to keep the voltage below the maximum rating of the SC700WLTRC/SC700HWLTRC.

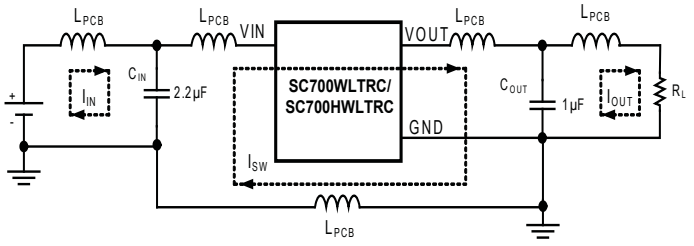

Figure 2 — Parasitic PCB Inductance Circuit

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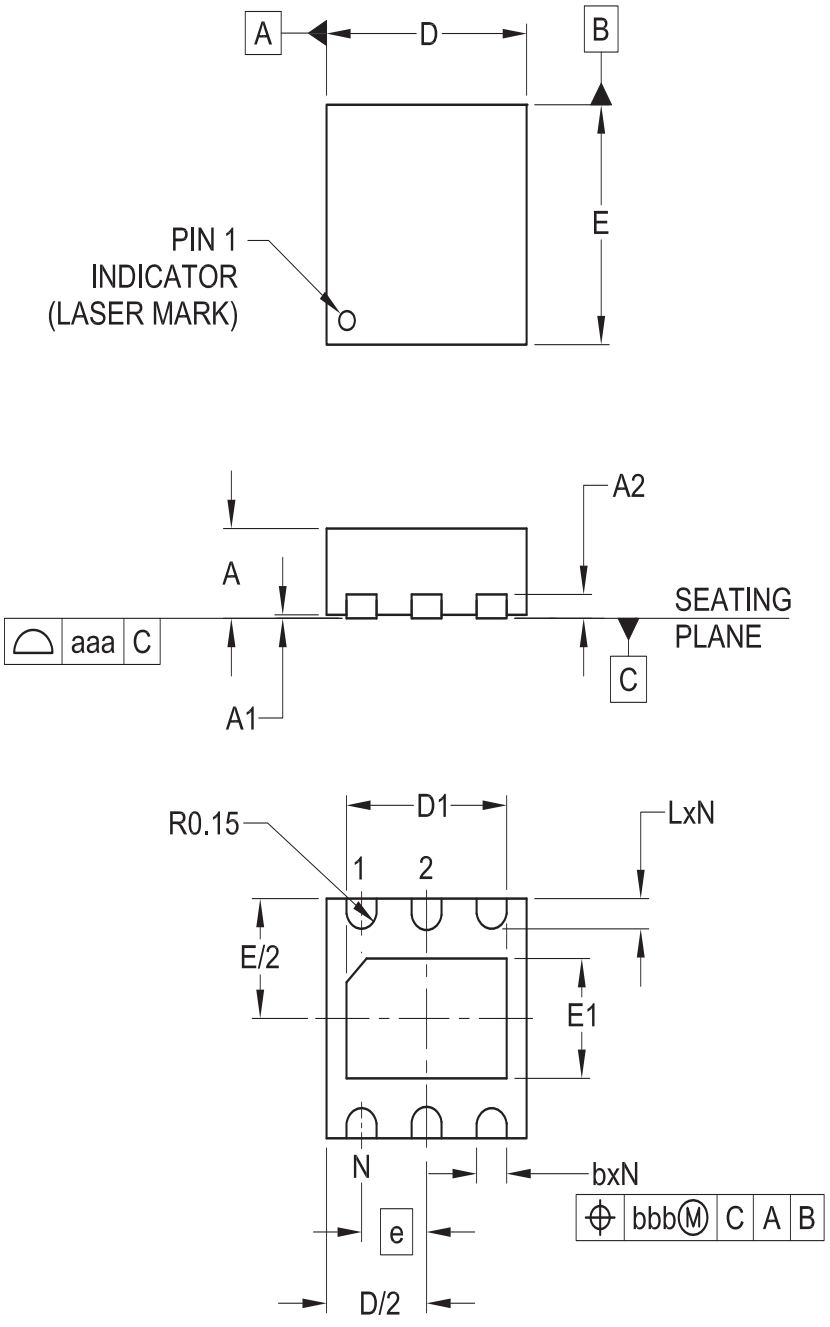
Outline Drawing — MLPD 2mm x 2mm, 6-LEAD



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2		(0.20)	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
D1	1.45	1.60	1.70
E	1.90	2.00	2.10
E1	0.85	1.00	1.10
e		0.65 BSC	
L	0.20	0.25	0.30
N		6	
aaa		0.08	
bbb		0.10	

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS TERMINALS.

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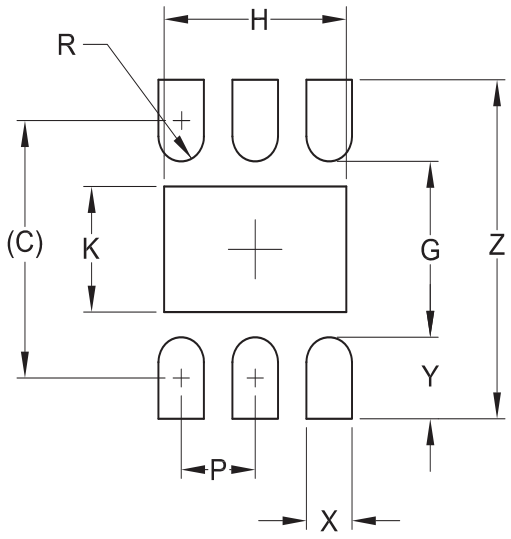
Land Pattern Drawing — MLPD 2mm x 2mm, 6-LEAD



DIMENSIONS	
DIM	MILLIMETERS
C	(2.05)
G	1.40
H	1.60
K	1.00
P	0.65
R	0.20
X	0.40
Y	0.65
Z	2.70

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
3. THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD SHALL BE CONNECTED TO A SYSTEM GROUND PLANE. FAILURE TO DO SO MAY COMPROMISE THE THERMAL AND/OR FUNCTIONAL PERFORMANCE OF THE DEVICE.

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