300mA, Low Noise, Ultra-Fast CMOS LDO Regulator with Soft Start Function

REV: 00

General Description

The LD6915 is a micropower linear regulator, featuring low-noise, low-dropout and high ripple rejection ration. The precision of feedback reference voltage is within ±2% and output current is up to 300mA. As well, the LD6915 can be stable with an output capacitor of 1μF which reduces the board space and cost.

The LD6915 is available in a space saving SOT23-5, SC70-5 and SC82-4 package.

+Patented

Features

- Shutdown current <1μA
- Ultra-Fast Response in Load Transient
- High PSRR 65dB@1kHz
- Thermal Shutdown and Current Limiting Protection
- V_{OUT} Discharge Function
- Stable with 1μF Output Capacitor
- Soft Start Operation
- Output Voltage: 1.5V to 3.3V

Applications

- Battery-Powered Equipment
- Hand-Held Instruments

Typical Application

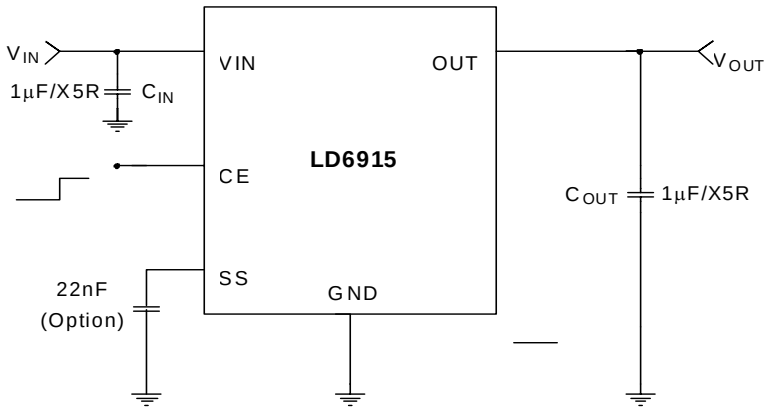
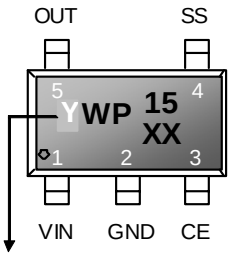


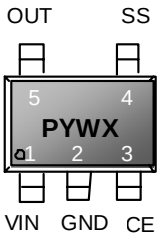
Fig.1 Typical Application Circuit

Pin Configuration

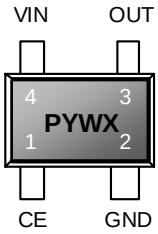
SOT-23-5 (TOP VIEW)



SC70-5 (TOP VIEW)



SC82-4 (TOP VIEW)



Y The PB free package is identified in embossed font

YY, Y : Year code (E: 2005, F: 2006…..)
WW, W: Week code
P: LD69..
(Product family code)
XX: Output Voltage

P: Product code: LD6915
Y: Year code (E: 2005, F: 2006…..)
W: Week code
X: Output Voltage (h~z:1.5V~3.3V)

Ordering Information

Part number	Package		TOP MARK	Shipping
LD6915 GL-XX	SOT23-5	Green Package	YWP/15XX	3000 /tape & reel
LD6915 GU-XX	SC70-5	Green Package	PYWX	3000 /tape & reel
LD6915 GF-XX	SC82-4	Green Package	PYWX	3000 /tape & reel

Note 1: The LD6915 is ROHS compliant.

Note 2: Part number XX: Output voltage, ex: 15:1.5V, …. 33:3.3V (step 0.1V)

Pin Descriptions

SOT23-5

PIN	NAME	FUNCTION
1	VIN	Input Voltage
2	GND	IC GND
3	CE	Chip Enable, High=Enable, Low=Disable
4	SS	This pin combines noise reduction and soft start function. Connect a capacitor to GND to adjust soft start time. For soft start operation Css>1nF is recommended. Open this pin to disable soft start function.
5	OUT	Regulator output

SC70-5

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1	VIN	Input Voltage
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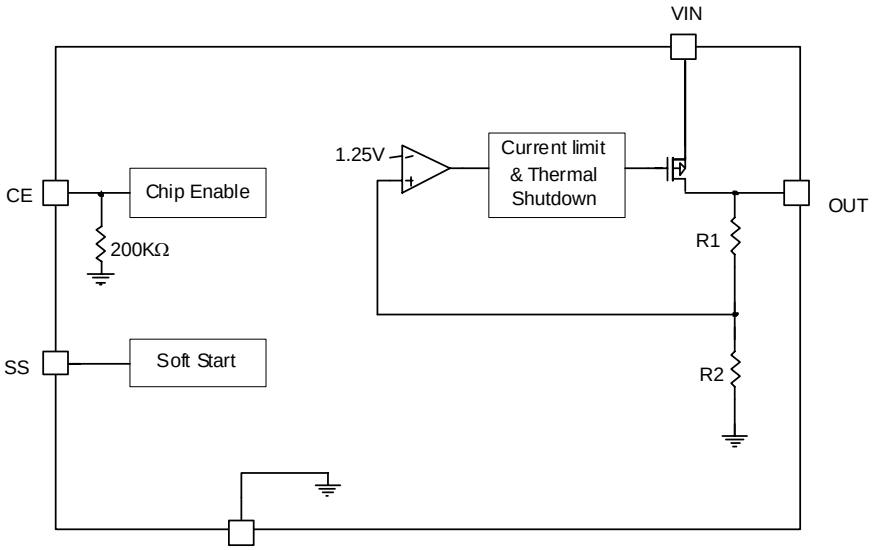
5	OUT	Regulator output

SC82-4

PIN	NAME	FUNCTION
1	CE	Chip Enable, High=Enable, Low=Disable
2	GND	IC GND
3	OUT	Regulator output
4	VIN	Input Voltage

Block Diagram



Absolute Maximum Ratings

VIN, VOUT Pin	-0.3V~6V
SS, CE Pin	-0.3V~ (VIN+0.3)V
Power dissipation SOT23-5@Ta=25°C	400mW
Power dissipation SC70-5, SC82-4@Ta=25°C	300mW
Operating Temperature Range	-40°C to 85°C
Package Thermal Resistance SOT23-5	250°C/W
Package Thermal Resistance SC70-5, SC82-4	333°C/W
Junction Temperature	150°C
Storage Temperature Range	-55°C to 125°C
Lead temperature (Soldering, 10sec)	260°C
ESD Level (Human Body Model)	2kV
ESD Level (Machine Model)	200V

Caution:

Stresses beyond the ratings specified in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Characteristics

(V_{IN}=V_{OUT}+1V, T_A = 25 °C, unless otherwise stated. C_{IN}=C_{OUT}=1μF, C_{SS}=22nF; the LD6915 is tested with 3.3V output, unless other stated.) (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT POWER					
Input Voltage		2.8	-	5.5	V
Quiescent Current	CE>1.5V, I_{OUT}=0mA	-	270	330	μA
Shutdown Supply Current	CE=GND	-	0.1	1	μA
Dropt Voltage					
Dropt Voltage (Note2)	I_{OUT}=200mA, V_{OUT}≥3.0V		170	220	mV
	I_{OUT}=300mA, V_{OUT} ≥3.0V		240		mV
	I_{OUT}=200mA, 2.5V≤V_{OUT}<3.0V		190	250	mV
	I_{OUT}=300mA, 2.5V≤V_{OUT}<3.0V		270		mV
	I_{OUT}=200mA, 2.0V≤V_{OUT}<2.5V		255	330	mV
	I_{OUT}=300mA, 2.0V≤V_{OUT}<2.5V		350		mV
Soft Start					
Soft Start Current		-	7.5	-	μA
OUTPUT					
OUTPUT					
Output Current Limit	R_{LOAD}=1Ω	330	420	-	mA
Output Voltage Accuracy	I_{OUT}=1mA	-2		+2	%
Line Regulation	V_{IN}=Vout+1V, to 5.5V, I_{OUT}=1mA	-	0.05	0.2	%/V
Load Regulation	1mA<I_{OUT}<300mA	-		0.6	%
Ripple Rejection	F=1kHz, EIN=1Vrms, I_{OUT}=10mA		65	-	dB
	F=10kHz, EIN=1Vrms, I_{OUT}=10mA	-	55	-	dB
Output Noise Voltage	V_{OUT}=3.3V,100Hz~100kHz I_{OUT}=0mA, Css=22nF	-	100	-	μVrms
Discharge Resistance in shutdown	CE=High to Low	-	120	250	Ω

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
CE					
Impedance to GND			200		kΩ
CE Input Level	Enable, V_{IN}=2.8V~5.5V	1.5	-	-	V
	Disable, V_{IN}=2.8V~5.5V	-	-	0.6	V
THERMAL PROTECTION					
Thermal Shutdown	V_{OUT} short to GND		145		°C
Hysteresis			30		°C

Note1: Limits are 100% tested at T_A =+25°C. Limits over operating range are guarantee by design.

Note2: the drop voltage is defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} is V_{OUT} (normal)-100mV.

Typical Performance Characteristics

(V_{IN}=V_{OUT}+1V, C_{IN}==1μF , C_{OUT}=1μF, C_{SS}=22nF, T_A =+25°C, unless otherwise stated.)

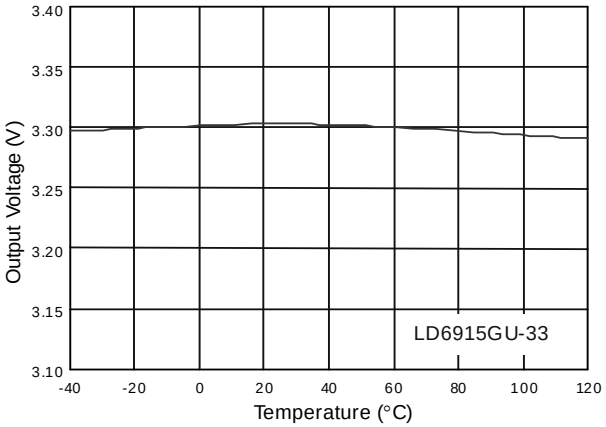


Fig.2 Output Voltage vs. Temperature

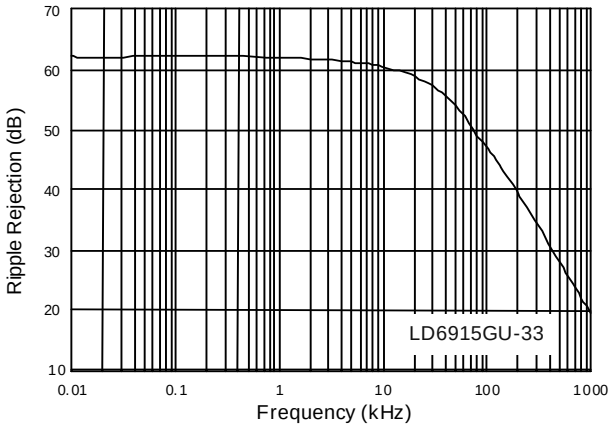


Fig.3 Ripple Rejection vs. Frequency

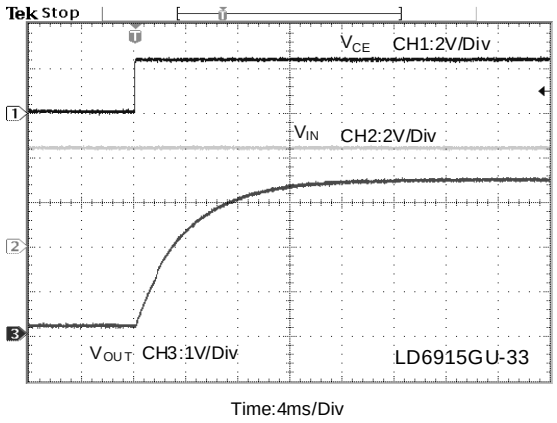


Fig.4 Start Up Waveform Css=22nF

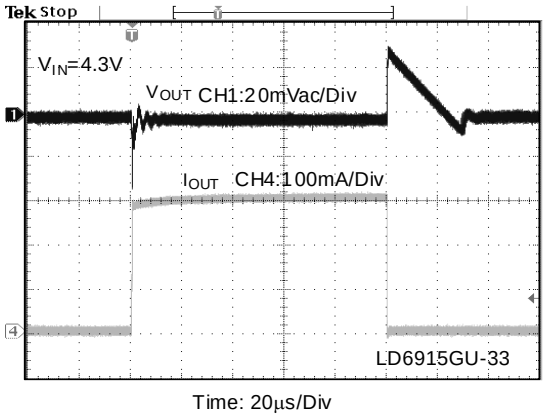


Fig.5 Load Transient Response

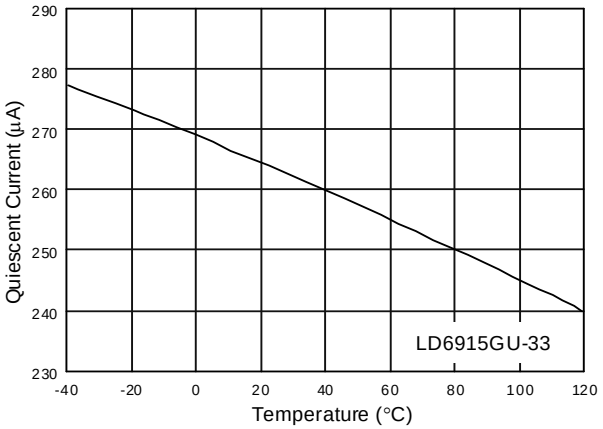


Fig. 6 Quiescent Current vs. Temperature

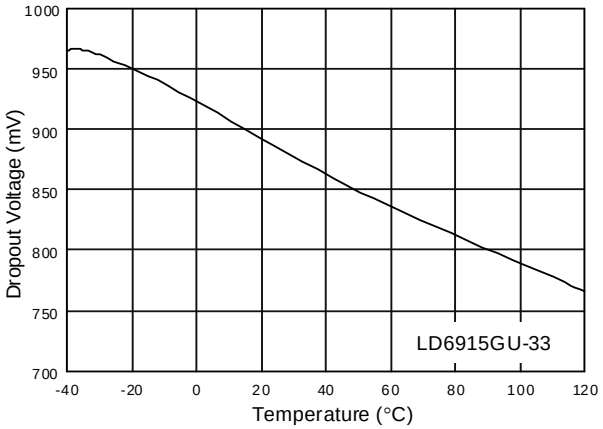


Fig. 7 Dropout voltage vs. Temperature (I_{OUT}=300mA)

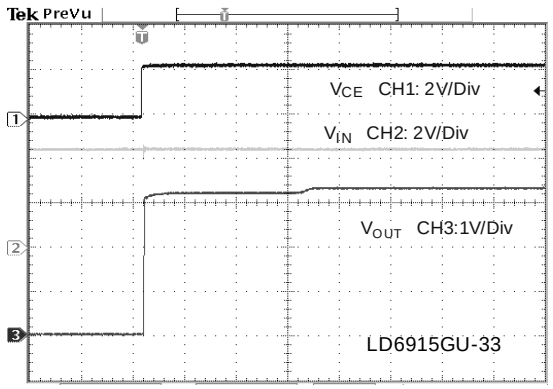


Fig. 8 Start Up Waveform C_{SS}=NC

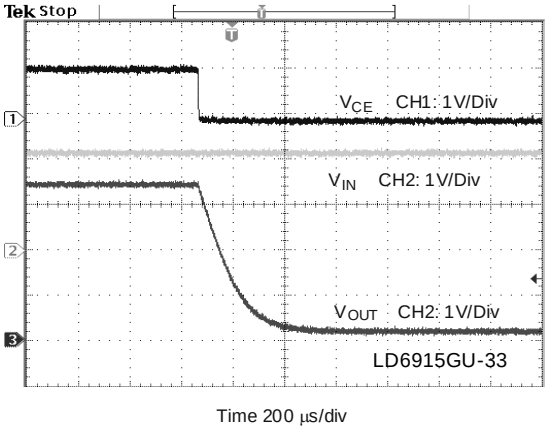


Fig. 9 EN Pin Shutdown Response

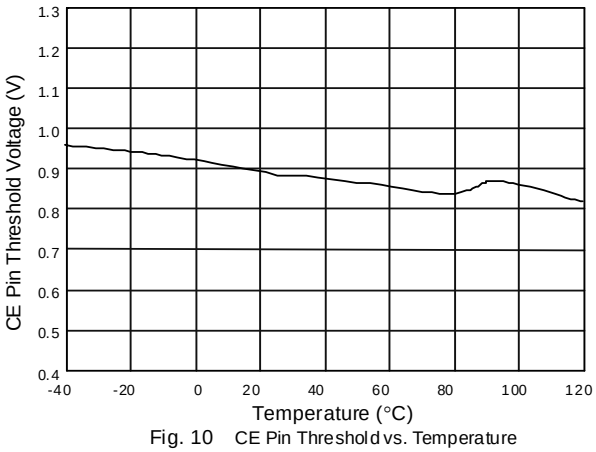


Fig. 10 CE Pin Threshold vs. Temperature

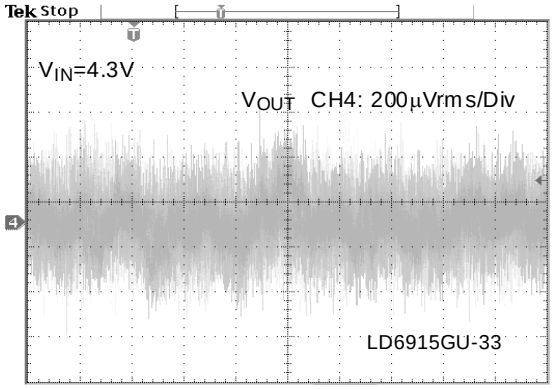


Fig.11 Output Noise

Application Information

Operation Overview

An input capacitor is necessary to place between the input and GND to stabilize V_{IN}. The input capacitor should be at least 1μF to obtain beneficial effect. Besides, the input capacitor should be located in the distance within 5mm from the VIN pin.

The output capacitor must meet both requirements of minimum amount capacitance and ESR in all LDO applications. For the application of V_{OUT} =1.5V~3.3V, the output capacitor should be at least 1μF with ESR >25 mΩ. The figure 1 shows the curves of the allowable ESR range as a function of load current for C_{OUT}=1μF.

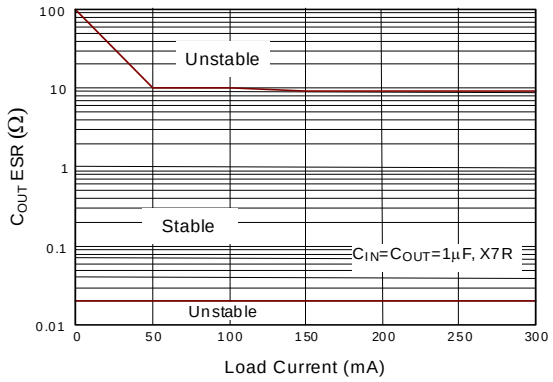


Fig. 12 Region of Stable C_{OUT} ESR vs. Load Current

Larger output capacitor produces less noise and improves load transient response, stability and PSRR. The output capacitor should be located in the distance within 5mm from the OUT pin. X5R or X7R types of capacitors are recommended for the input and output capacitors in full range of operation temperature.

Soft Start Operation and Noise Reduction

For LD6915, the external 22nF soft start capacitor located between SS pin and GND can provide soft start operation and reduce output noise dramatically. Open this pin will achieve V_{OUT} to quick start up.

Current Limit

Output current is limited to 420mA (typical). When current limit engages, the output voltage scales back linearly until the over-current condition ends. Take care not to exceed the power dispassion ratings of the package.

Thermal Consideration

When the junction temperature exceeds Tj=145°C, the thermal sensor will turn off the pass transistor and cool down the IC. The thermal sensor turns the pass transistor on after the IC's junction temperature falls by 30°C (typical) For continuous operation, do not exceed absolute maximum operation junction temperature of 125°C. The maximum power dissipation is determined according to following equation.

$$P_{D(MAX)} = \frac{(T_{J(MAX)} - T_A)}{\theta_{JA}}$$

θ_{JA}: Package Thermal Resistance

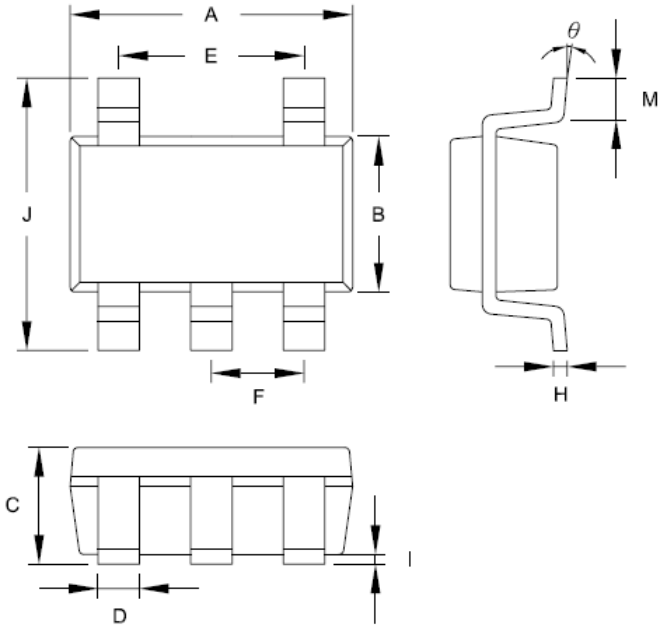
The maximum power dispassion at Ta=25°C can be obtained by above formula.

P_{DMAX}=(125°C-25°C)/250=400mW (SOT23-5 package)

P_{DMAX}=(125°C-25°C)/333=300mW(SC70-5,SC82-4 package)

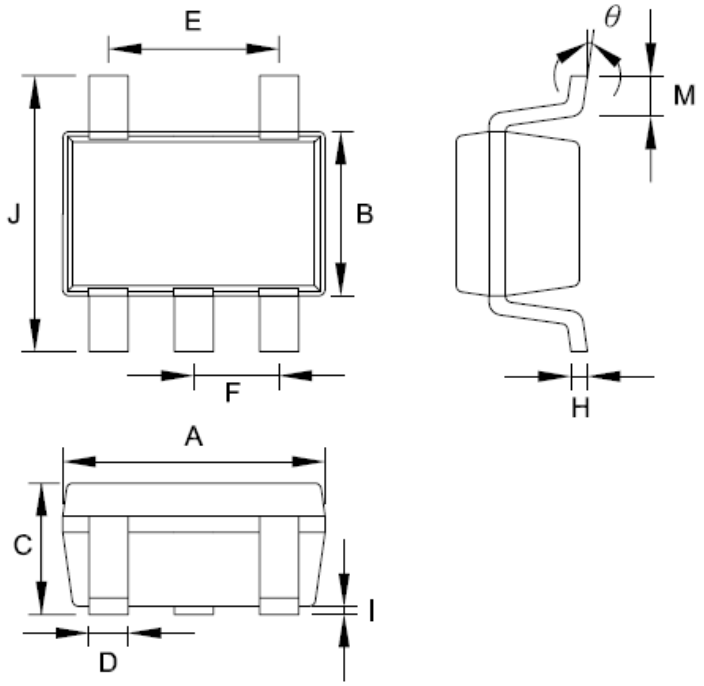
Package Information

SOT23-5



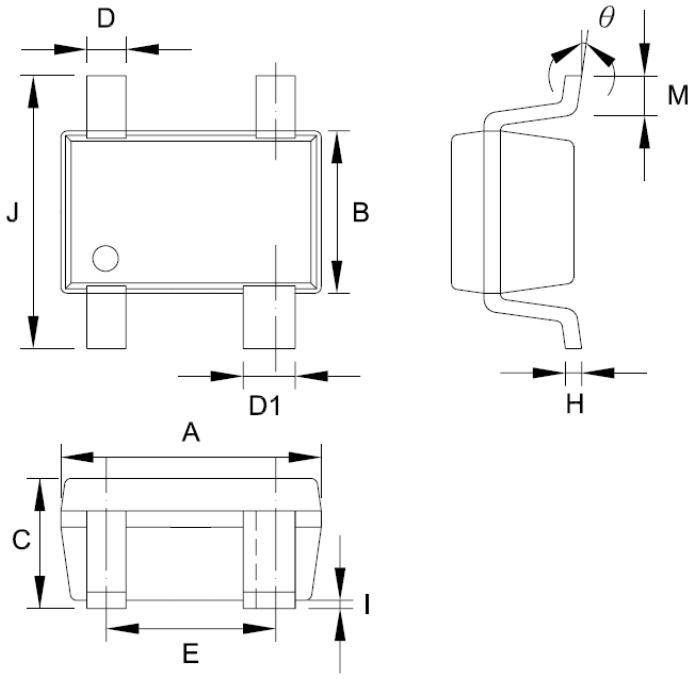
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-------	1.450	-------	0.058
D	0.300	0.550	0.012	0.022
E	1.900 TYP.		0.075 TYP.	
F	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102	0.118
M	0.300	0.600	0.012	0.024
θ	0°	10°	0°	10°

SC70-5



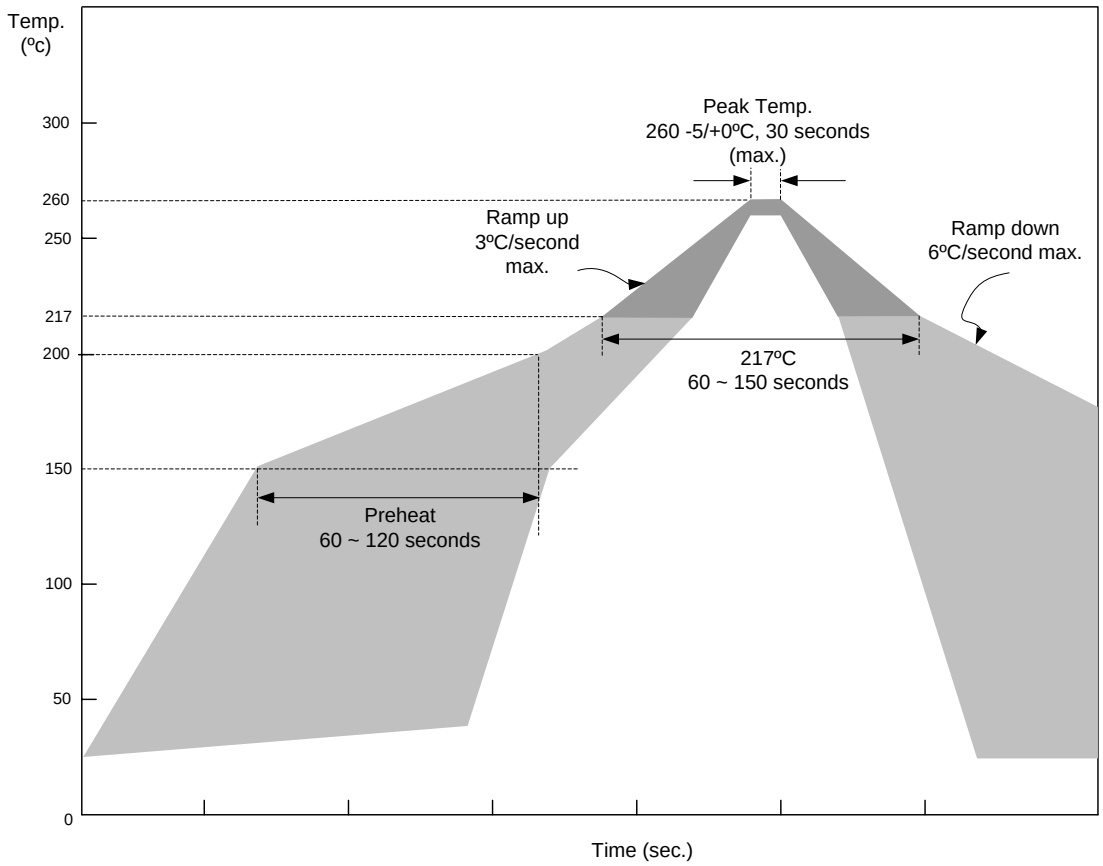
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.800	2.200	0.071	0.087
B	1.150	1.350	0.045	0.053
C	0.800	1.100	0.031	0.043
D	0.150	0.400	0.006	0.016
E	1.300 TYP.		0.051 TYP.	
F	0.650 TYP.		0.026 TYP.	
H	0.080	0.250	0.003	0.010
I	0.000	0.100	0.000	0.004
J	1.800	2.400	0.071	0.094
M	0.100	0.460	0.004	0.018
θ	0°	8°	0°	8°

SC82-4



Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.800	2.200	0.071	0.087
B	1.150	1.350	0.045	0.053
C	0.800	1.100	0.031	0.043
D	0.250	0.400	0.010	0.016
D1	0.350	0.500	0.014	0.020
E	1.300 TYP.		0.051 TYP.	
H	0.100	0.260	0.004	0.010
I	0.000	0.100	0.000	0.004
J	1.800	2.400	0.071	0.094
M	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

IR Profile for SMD Devices



Item	Average Ramp-up Rate	Pre-heat (150 ~ 200°C)	Time Maintained Above 217°C	Peak Temp.	Ramp-down Rate
Required	3°C(max) /sec	60~120 sec	60~150 seconds	260 +0/-5°C 30 seconds	6°C (max) /sec

Important Notice

Leadtrend Technology Corp. reserves the right to make changes or corrections to its products at any time without notice. Customers should verify the datasheets are current and complete before placing order.

Revision History

Rev.	Date	Change Notice
00	6/6/2008	Original Specification.