100mA, Ultra Low Quiescent Current CMOS LDO Regulator

REV: 03

General Description

The LD6969 is a micropower linear regulator, featuring ultra low quiescent current. The precision of feedback reference voltage is within ±2% and output current is up to 100mA. As well, the LD6969 can be stable with a 1μF output capacitor, which reduces the board space and cost. It is suitable for the battery-powered portable equipment, especially for those that require standby power.

The LD6911 is available in a space saving SOT23-5, SC70-3, SC70-6 or DFN-6L package.

Features

- Shutdown current <1μA
- Ultra-Low Quiescent Current:5μA
- Low Dropout: 350mV @50mA
- Thermal Shutdown and Current Limiting Protection
- Wide Operating Voltage Range
- Stable with 1μF Output Capacitor
- Output Voltage: 1.5V to 3.4V (step 0.1V)

Applications

- Battery-Powered Equipment
- Hand-Held Instruments

Typical Application

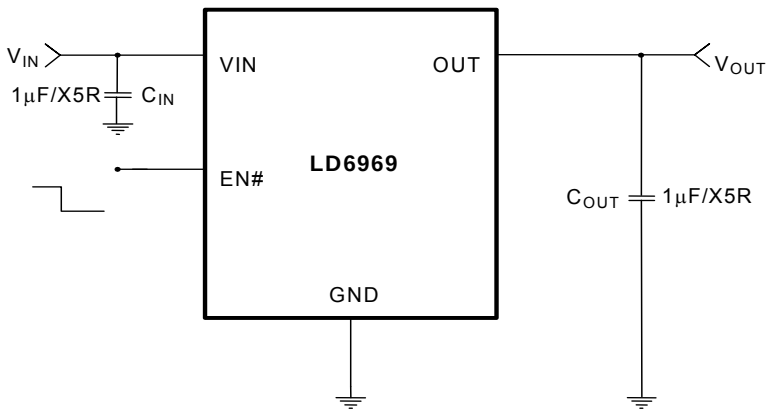
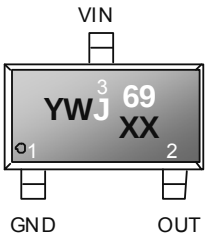


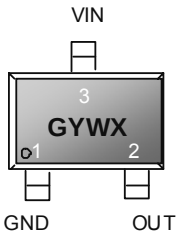
Fig.1 Typical Application Circuit

Pin Configuration

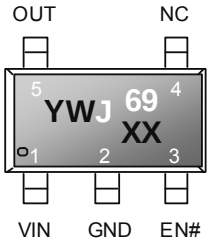
SOT-23 (TOP VIEW)



SC-70-3 (TOP VIEW)

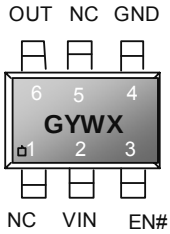


SOT-25



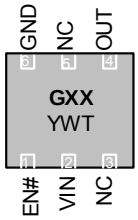
YY, Y : Year code (E: 2005, F: 2006.....)
WW, W: Week code
J69: LD6969
XX: Output Voltage

SC-70-6



G: Product code: LD6969
Y: Year code (E: 2005, F: 2006.....)
W: Week code
X: Output Voltage (1~9: 1.5V~2.3V, a~k: 2.4V~ 3.4V)

DFN-6L (1.6x1.6)



Y, YY: Year code (D: 2004, E: 2005.....)
W, WW: Week code
PP: Production code
G : LD6969
XX: Voltage code

T: Thickness
V: 0.85~0.9mm
W: 0.75mm (normal)
U: 0.55mm
X: 0.4mm

Ordering Information

Part number	Package		TOP MARK	Shipping
LD6969 GL-XX	SOT25	Green Package	YWJ69XX	3000 /tape & reel
LD6969 GK-XX	SOT23	Green Package	YWJ69XX	3000 /tape & reel
LD6969 GU-XX	SC70-6	Green Package	GYWX	3000 /tape & reel
LD6969 GH-XX	SC70-3	Green Package	GYWX	3000 /tape & reel
LD6969G DAW-XX	DFN-6L 1.6×1.6	Green Package	GXX (W)	3000 /tape & reel

Note 1: The LD6969 is ROHS compliant. (Green Package)

Note 2: Part number XX: Output voltage, ex: 15:1.5V, …. 34:3.4V (step 0.1V)

Pin Descriptions

SOT-23/SC70-3

PIN	NAME	FUNCTION
1	GND	IC GND
2	OUT	Regulator output
3	VIN	Input Voltage

SOT-25

PIN	NAME	FUNCTION
1	VIN	Input Voltage
2	GND	IC GND
3	EN#	Chip Enable, Low=Enable, High=Disable
4	NC	No connection
5	OUT	Regulator output

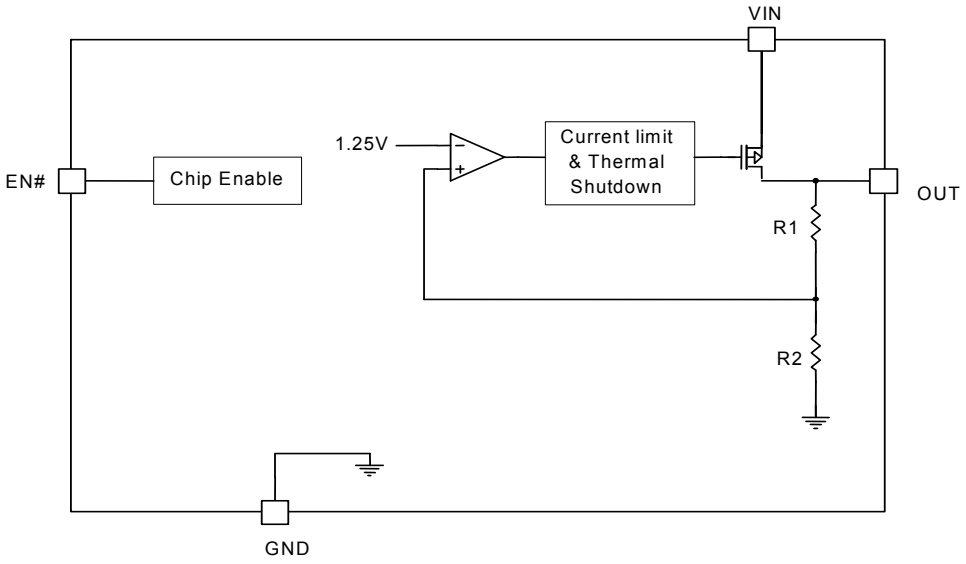
SC70-6

PIN	NAME	FUNCTION
1	NC	No connection
2	VIN	Input Voltage
3	EN#	Chip Enable, Low=Enable, High=Disable
4	GND	IC GND
5	NC	No connection
6	OUT	Regulator output

DFN-6L (1.6 x 1.6)

PIN	NAME	FUNCTION
1	EN#	Chip Enable, Low=Enable, High=Disable
2	VIN	Input Voltage
3	NC	No connection
4	OUT	Regulator output
5	NC	No connection
6	GND	IC GND
EP	GND	Exposed pad should be connected to GND plane to provide efficient heat path soldered directly to the PCB.

Block Diagram



Absolute Maximum Ratings

VIN, VOUT Pin	-0.3V~7V
EN# Pin	-0.3V~(VIN+0.3)V
Power dissipation SOT23/SOT25@Ta=25°C	400mW
Power dissipation SC70-3/SC70-6@Ta=25°C	300mW
Power dissipation DFN-6L 1.6×1.6 @TA=25°C	571mW
Operating Temperature Range	-30°C to 85°C
Package Thermal Resistance SOT23/SOT25	250°C/W
Package Thermal Resistance SC70-3/SC70-6	333°C/W
Package Thermal Resistance DFN-6L 1.6 x 1.6	175°C/W
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

(T_A = +25°C unless otherwise stated, V_{IN}=V_{OUT}+1.5V, C_{IN}=C_{OUT}=1μF)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT POWER					
Input Voltage		2.0	-	6	V
Quiescent Current	V_{IN}=5.5V, I_{OUT}=0mA	-	5	8	μA
Shutdown Supply Current	EN#=V_{IN}	-	-	1	μA
Dropt Voltage					
Dropt Voltage	I_{OUT}=1mA, V_{IN}>3.6V		10	25	mV
	I_{OUT}=50mA, V_{IN}>3.6V		350	550	mV
OUTPUT					
Output Current Limit		100	200	-	mA
Output Voltage Accuracy	I_{OUT}=1mA	-2		+2	%
Line Regulation	V_{IN}=Vout+1V, to 5.5V, I_{OUT}=1mA	-	0.1	0.2	%/V
Load Regulation	1mA<I_{OUT}<50mA	-	0.02	0.04	%/mA
Ripple Rejection	F=1KHz, EIN=1Vrms, I_{OUT}=10mA	-	40	-	dB
EN#					
EN# Input Level	Enable	-	-	0.4	V
	Disable	1.6	-	-	V
THERMAL PROTECTION					
Thermal Shutdown	V_{OUT} short to GND		145		°C
Hysteresis			30		°C

Typical Performance Characteristics (C_{IN}=I_{OUT}=1μF, V_{OUT}=3.0V, V_{IN}=V_{OUT}+1V)

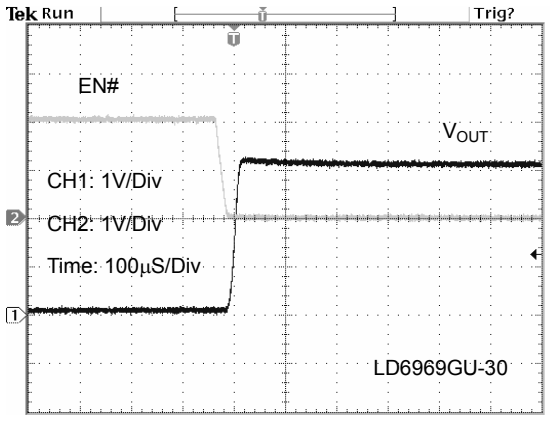


Fig. 2 Load Transient Response

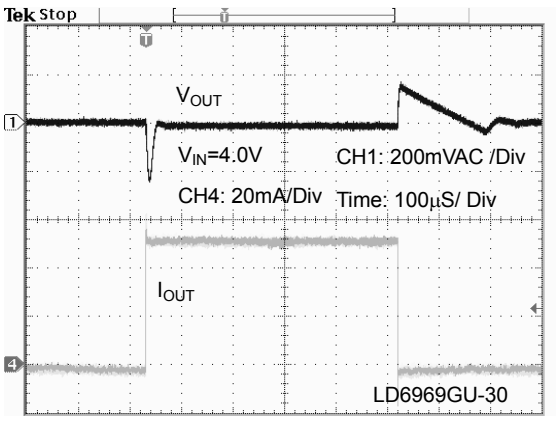


Fig. 3 Load Transient Response

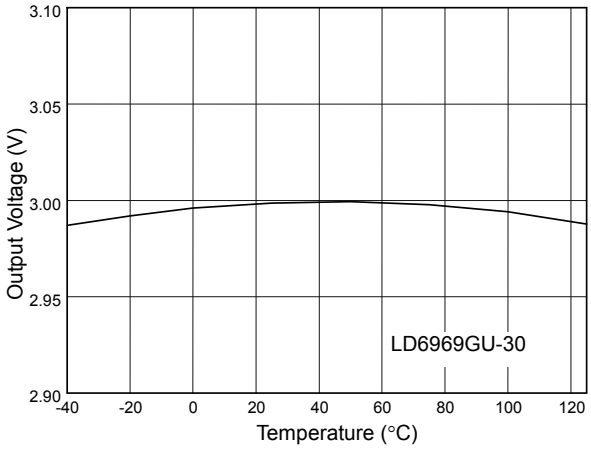


Fig. 4 Output Voltage vs. Temperature

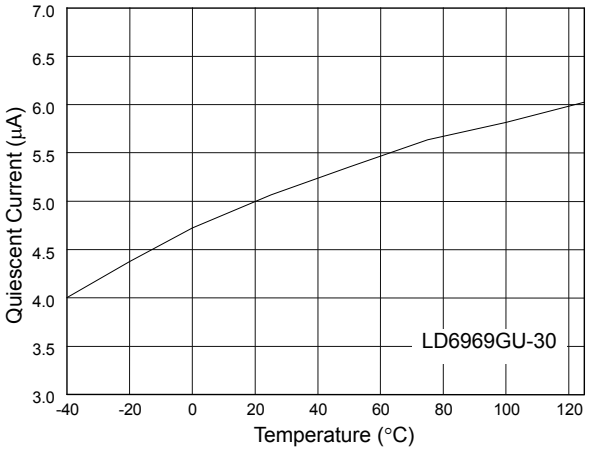


Fig. 5 Quiescent Current vs. Temperature

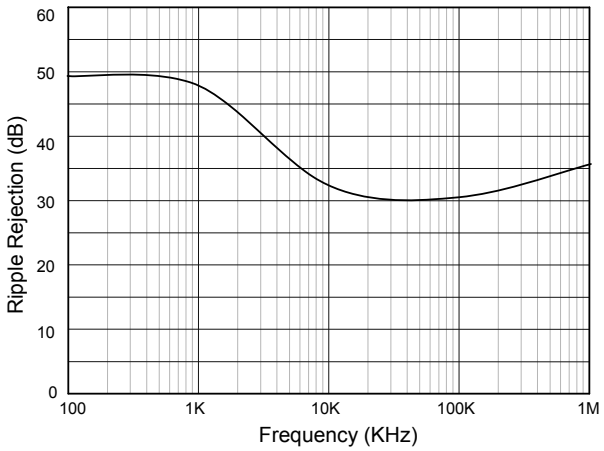


Fig. 6 Ripple Rejection vs. Frequency

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 larger than 1μF to obtain beneficial effect. Besides, the input capacitor should be located in the distance of 5 mm from the VIN pin.

For stable operation, the output capacitor should be in the range between 1μF and 10μF 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.

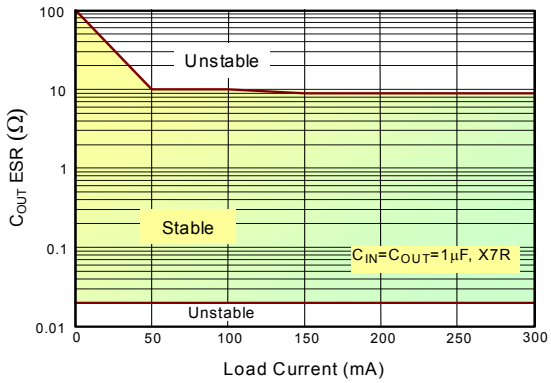


Fig. 7 Region of Stable C_{OUT} ESR vs. Load Current

The output capacitor of larger capacitance can reduce noise and improve load transient response, stability and PSRR. The output capacitor should be located in the distance of 5mm from the OUT pin.

.

X5R or X7R types of capacitors are recommended for the input and output capacitors.

Current Limit

Output current is limited to 200mA (typical). When current limit engages, the output voltage scales back linearly until the over-current condition come to an end. Take care not to exceed the power dispassion ratings of the package.

Thermal Consideration

The thermal sensor would disable the pass transistor as soon as it detects the junction temperature over the limit of 145°C. It remains disable until it's cooled down to about 30°C (typ.). For continuous operation, it's not recommended to operate while the maximum junction temperature is above 125°C. The maximum power dissipation is determined according to the 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.

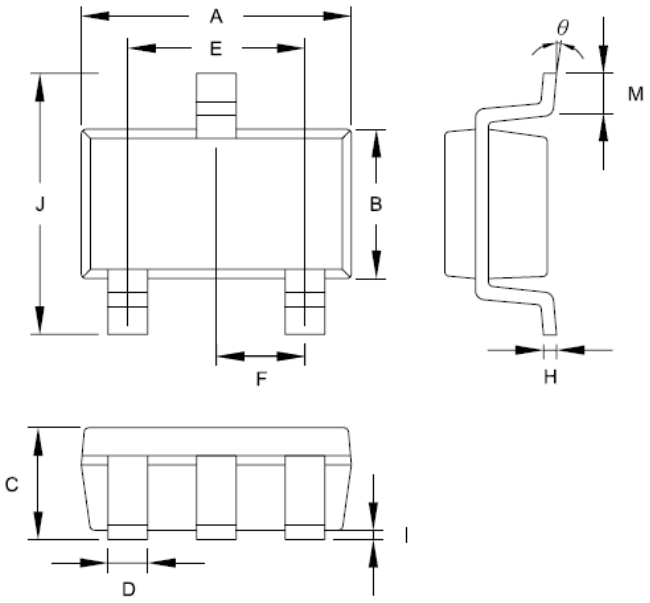
P_{DMAX}=(125°C-25°C)/250=400mW
……(SOT23/ SOT25 package)

P_{DMAX}=(125°C-25°C)/333=300mW
……..(SC70-3/ SC70-6 package)

P_{DMAX}=(125°C-25°C)/175=571mW
……..(DFN-6L 1.6x1.6 package)

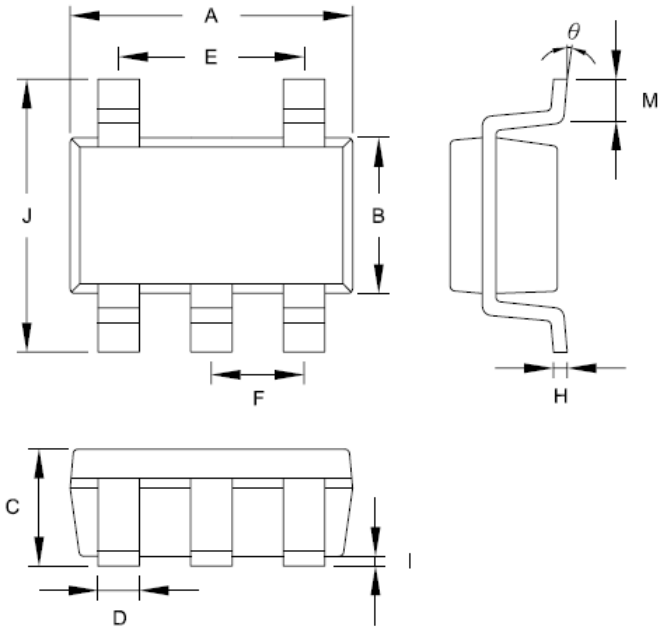
Package Information

SOT-23



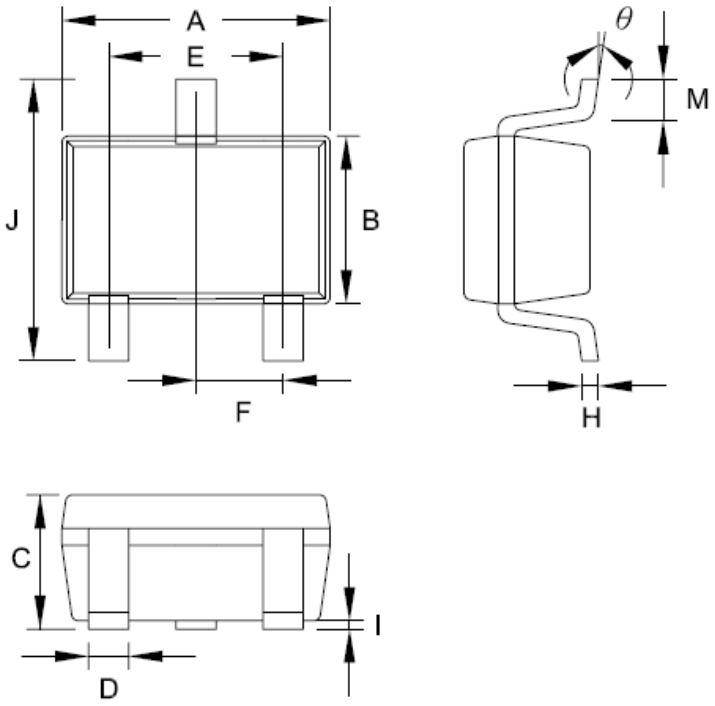
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-------	1.450	-------	0.058
D	0.300	0.550	0.012	0.022
E	1.900 TYP.		0.075 TYP.	
F	1.803	2.007	0.070	0.079
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102	0.118
M	0.300	0.600	0.012	0.024
θ	0°	10°	0°	10°

SOT-25



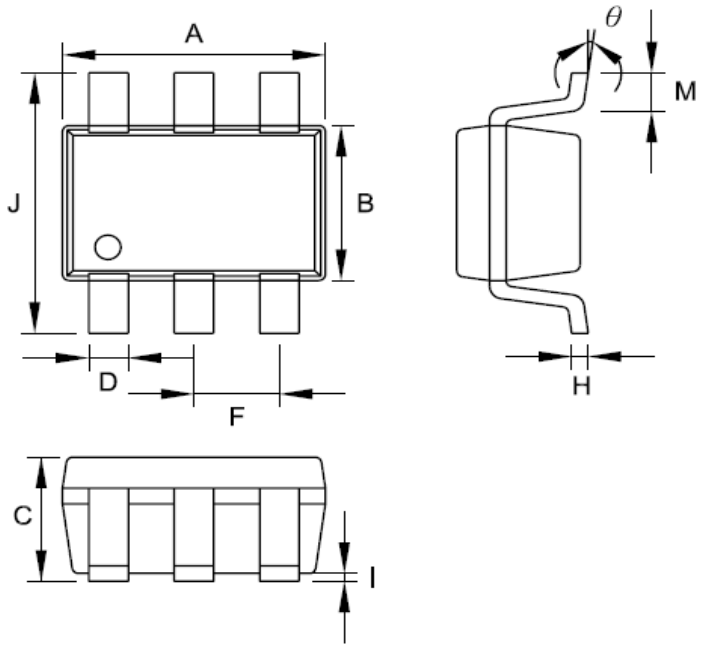
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-------	1.450	-------	0.058
D	0.300	0.550	0.012	0.022
E	1.900 TYP.		0.075 TYP.	
F	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102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

SC70-3



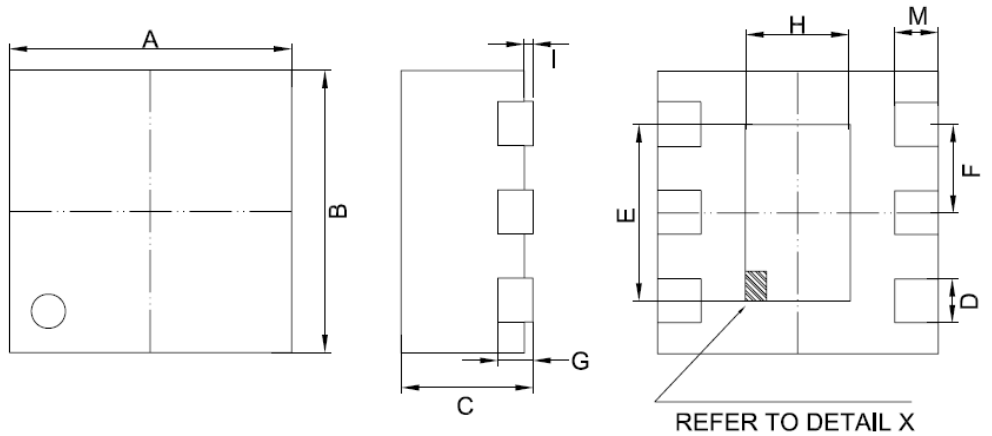
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.80	2.20	0.071	0.087
B	1.15	1.35	0.045	0.053
C	0.80	1.10	0.031	0.043
D	0.15	0.40	0.006	0.016
E	1.300 TYP.		0.051 TYP.	
F	0.650 TYP.		0.026 TYP.	
H	0.08	0.25	0.003	0.010
I	0.00	0.10	0.001	0.004
J	1.80	2.40	0.071	0.094
M	0.10	0.46	0.004	0.018
θ	0°	12°	0°	12°

SC70-6



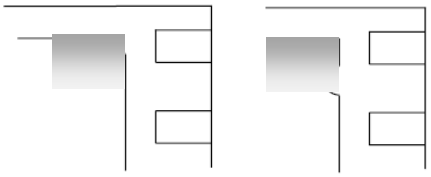
Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.80	2.20	0.071	0.087
B	1.15	1.35	0.045	0.053
C	0.80	1.10	0.031	0.043
D	0.15	0.40	0.006	0.016
F	0.650 TYP.		0.026 TYP.	
H	0.08	0.25	0.003	0.010
I	0.00	0.10	0.000	0.004
J	1.80	2.40	0.071	0.094
M	0.10	0.46	0.004	0.018
θ	0°	12°	0°	12°

DFN-6L (1.6x1.6)



DETAIL X

THE CONFIGURATION OF THE PIN 1 IDENTIFIER IS OPTIONAL AS SHOWN HERE.

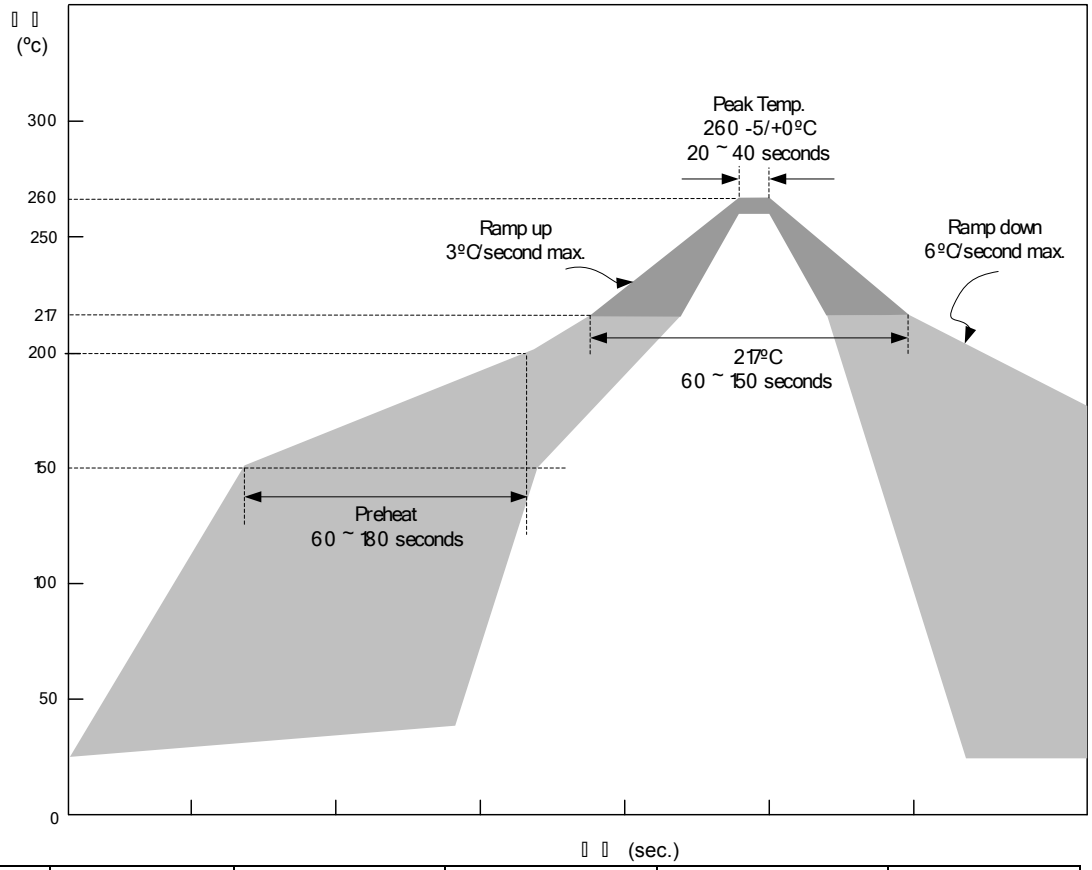


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.500	1.700	0.059	0.066
B	1.500	1.700	0.059	0.066
C	0.700	0.800	0.027	0.031
D	0.200	0.300	0.007	0.011
E	0.500	0.700	0.020	0.028
F	0.500 TYP.		0.019 TYP.	
G	0.203 REF.		0.008 REF.	
H	0.900	1.100	0.035	0.043
I	0.000	0.050	0.000	0.002
M	0.200	0.300	0.008	0.012

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.

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 second max.	60~180 seconds	60~150 seconds	260 +0/-5°C 20~40 seconds	6°C second max.

Revision History

Rev.	Date	Change Notice
00	2/14/2007	Original Specification.
01	4/17/2007	Ordering Information
02	4/26/2007	Ripple Rejection vs. Frequency
03	11/18/2008	Package option: DFN-6L