# 150mA, Adjustable CMOS LDO Regulator

***REV: 00***

## General Description

The LD6914 is a micropower linear regulator, featuring low-dropout and high ripple rejection ratio. The precision of feedback reference voltage is within ±1% and output current is up to 150mA. As well, the LD6914 can be stable with an output capacitor of 1μF which reduces the board space and cost.

The LD6914 is available in a space saving SOT25 or SC70-5 package.

## Features

- Shutdown current <1μA
- Low quiescent current :40μA(typ)
- Thermal Shutdown
- Current Limiting Protection
- $V_{OUT}$ Discharge Function
- Stable with 1μF Output Capacitor
- Adjustable Output Voltage
- ±1% Feedback Reference
- Output Short Current Protection.

## Applications

- Battery-Powered Equipment
- Hand-Held Instruments

## Typical Application

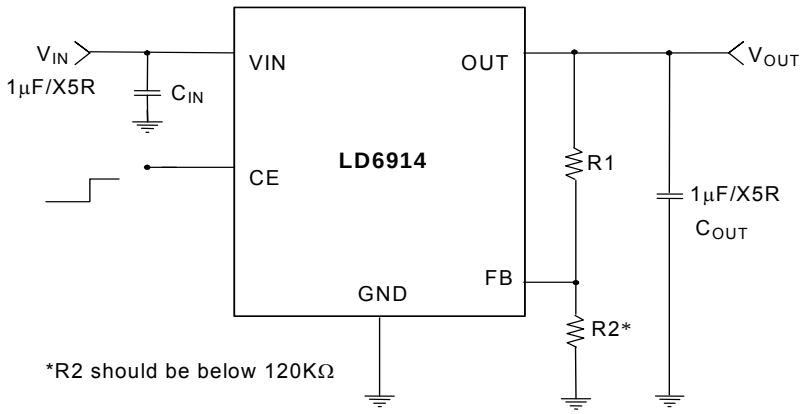
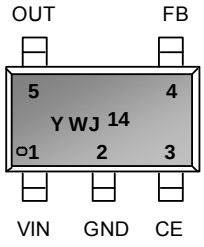



Fig.1 Typical Application Circuit

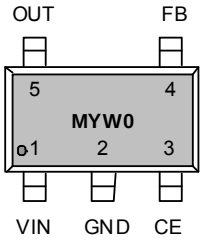
## Pin Configuration

SOT-23-5 (TOP VIEW)




Y : Year code (E: 2005, F: 2006…)
W : Week code
J14 : LD6914

SC70-5 (TOP VIEW)




M : Product Code (M: LD6914)
Y : Year code (E: 2005, F: 2006…)
W : Week code
0 : Voltage code (0: adjustable)

## Ordering Information

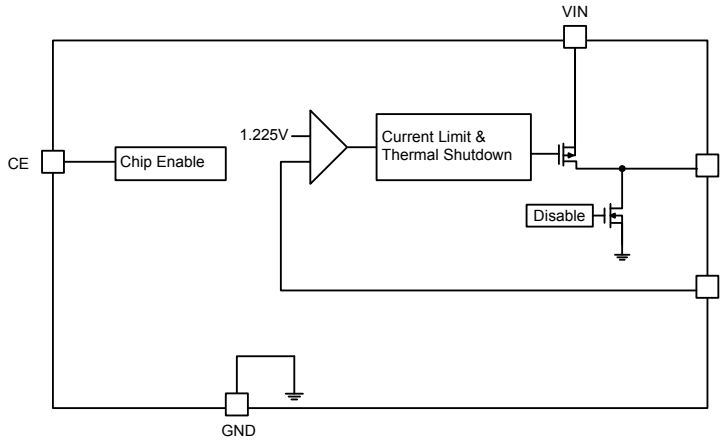
| Part number | Package | | TOP MARK | Shipping |
|---|---|---|---|---|
| LD6914 GL | SOT25 | Green Package | YWJ14 | 3000 /tape & reel |
| LD6914 GU | SC70-5 | Green Package | MYW0 | 3000 /tape & reel |

The LD6914 is ROHS compliant.

## Pin Descriptions

| PIN | NAME | FUNCTION |
|---|---|---|
| 1 | VIN | Input Voltage |
| 2 | GND | IC GND |
| 3 | CE | Chip Enable, High=Enable, Low=Disable<br>Note that this pin is high impedance. There should be a pull low resistor connected to GND, when this pin is floating. |
| 4 | FB | Adjustable Output Feedback. Refer to Fig.1, R2<120KΩ is recommended. |
| 5 | OUT | Regulator output |

## Block Diagram




## Absolute Maximum Ratings

| | |
|---|---|
| VIN, VOUT Pin | -0.3V~6.5V |
| FB, CE Pin | -0.3V~($V_{IN}$+0.3)V |
| Power dissipation SOT23-5@$T_A$=25°C | 400mW |
| Power dissipation SC70-5@$T_A$=25°C | 300mW |
| Operating Temperature Range | -40°C to 85°C |
| Package Thermal Resistance SOT23-5 | 250°C/W |
| Package Thermal Resistance SC70-5 | 333°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

($V_{IN}$=$V_{OUT}$+1V, $T_A$ = -40°C to +85°C, unless otherwise stated. $C_{IN}$=$C_{OUT}$=1μF. Typical values are at $T_A$ =+25°C; the LD6914 is tested with 2.5V output, unless otherwise stated.) (Note 1)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| **INPUT POWER** | | | | | |
| Input Voltage | | 2.5 | - | 6 | V |
| Quiescent Current | EN>1.5V, $I_{OUT}$=0mA | - | 40 | 80 | μA |
| | $V_{IN}$=$V_{OUT}$ (nom)-0.1V, $I_{OUT}$=0mA | | 220 | 500 | μA |
| Shutdown Supply Current | CE=GND | - | 0.1 | 1 | μA |
| **Dropt Voltage** | | | | | |
| Dropt Voltage (Note2) | $I_{OUT}$=80mA, $V_{OUT}$≥3.0V | | 80 | 170 | mV |
| | $I_{OUT}$=150mA, $V_{OUT}$ ≥3.0V | | 150 | | mV |
| | $I_{OUT}$=80mA, 2.5V≤$V_{OUT}$<3.0V | | 90 | 200 | mV |
| | $I_{OUT}$=150mA, 2.5V≤$V_{OUT}$<3.0V | | 170 | | mV |
| | $I_{OUT}$=80mA, 2.0V≤$V_{OUT}$<2.5V | | 120 | 250 | mV |
| | $I_{OUT}$=150mA, 2.0V≤$V_{OUT}$<2.5V | | 225 | | mV |
| **FB** | | | | | |
| Feedback Reference | FB=OUT<br>$V_{IN}$=2.5V to 6V, $I_{LOAD}$ =1mA | | 1.225 | | V |
| Reference Voltage Tolerance | $T_A$ =+25°C; | -1 | | +1 | % |
| Reference Voltage Temperature Characteristics | $T_A$ = -40°C to +85 °C | - | ±100 | - | ppm/°C |
| FB Pin Bias Current | $V_{IN}$=5.5V, $V_{FB}$=1.3V, $T_A$ =25°C | - | 0.006 | 0.1 | μA |
| | $V_{IN}$=5.5V, $V_{FB}$=1.3V, $T_A$ =85°C | | 0.01 | | |
| **OUTPUT** | | | | | |
| Output Current Limit | $R_{LOAD}$=1Ω | 200 | 250 | - | mA |
| Short Circuit Current Limit | | | 60 | - | mA |
| Line Regulation | $V_{IN}$=$V_{OUT}$+1V, to 5.5V,<br>$I_{OUT}$=1mA | - | 0.04 | 0.2 | %/V |
| Load Regulation | 1mA<$I_{OUT}$<150mA | - | 0.001 | 0.003 | %/mA |

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Ripple Rejection | F=1KHz, eIN=1Vp-p, $I_{OUT}$=10mA | - | 70 | - | dB |
| | F=10KHz, eIN=1Vp-p, $I_{OUT}$=10mA | | 60 | | |
| | F=100KHz, eIN=1Vp-p, $I_{OUT}$=10mA | | 45 | | dB |
| Output Noise Voltage | $V_{OUT}$=2.5V,100Hz~100KHz $I_{OUT}$=0mA | - | 100 | - | μVrms |
| Discharge Resistance in shutdown | CE=High to Low | - | 60 | - | Ω |
| **CE** | | | | | |
| CE Pin Input bias current | CE=0V or 5.5V | | 0.01 | | μA |
| 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 guaranteed by design.

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

## Typical Performance Characteristics

($V_{IN}$=$V_{OUT}$+1V, $C_{IN}$=1μF, $C_{OUT}$=1μF, $V_{OUT}$=2.5V, R1=105KΩ, R2=100KΩ,$T_A$ =+25°C, unless otherwise stated.)

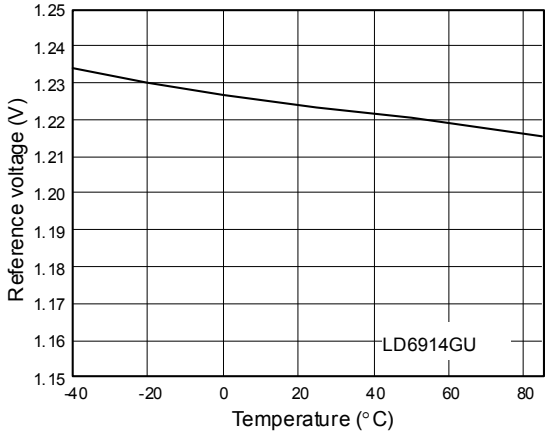



Fig. 2 Reference voltage vs. Temperature

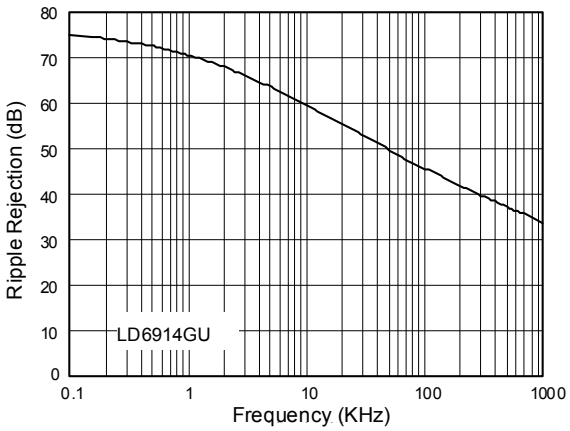



Fig. 3 Ripple Rejection vs. Frequency

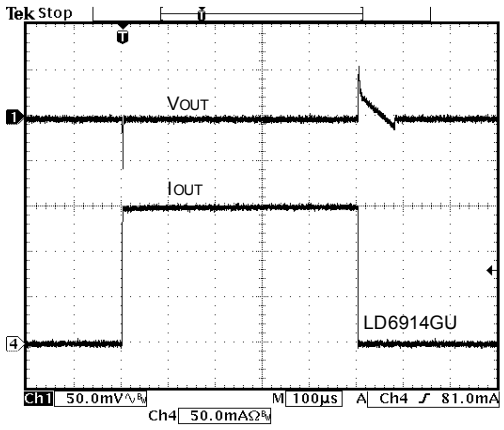



Fig.4 Load Transient Response

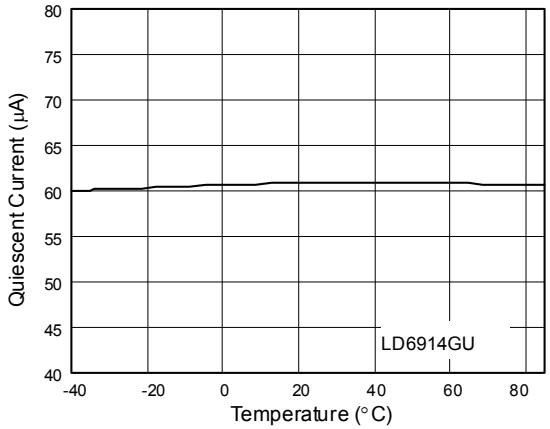



Fig. 5 Quiescent Current vs. Temperature

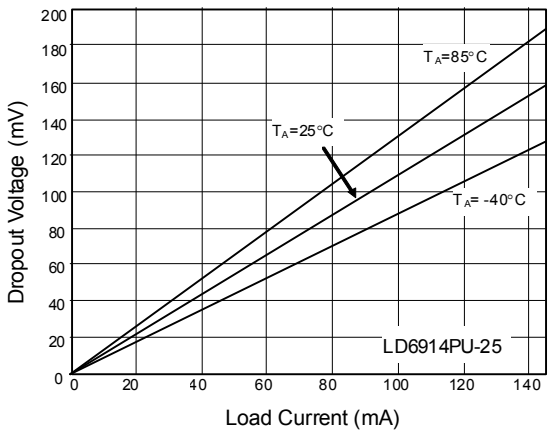



Fig.6 Dropout Voltage vs. Load Current

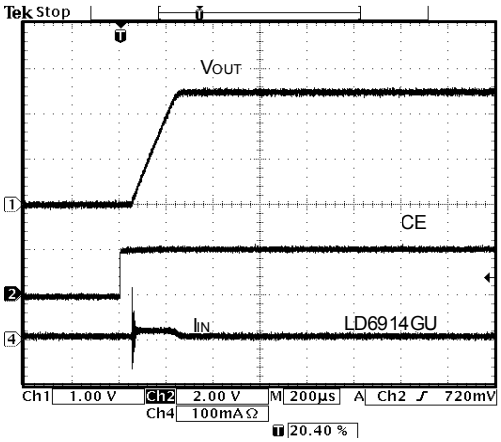



Fig.7 Startup Waveform

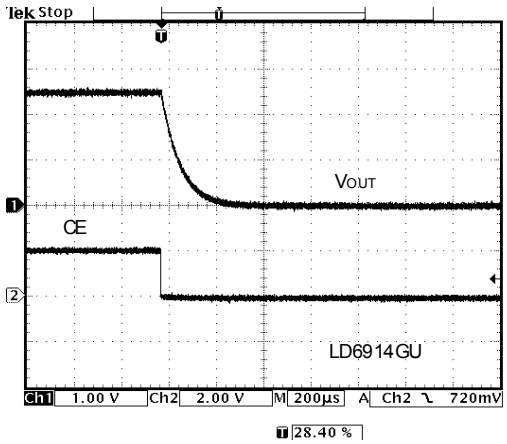



Fig.8 EN Pin Shutdown Response

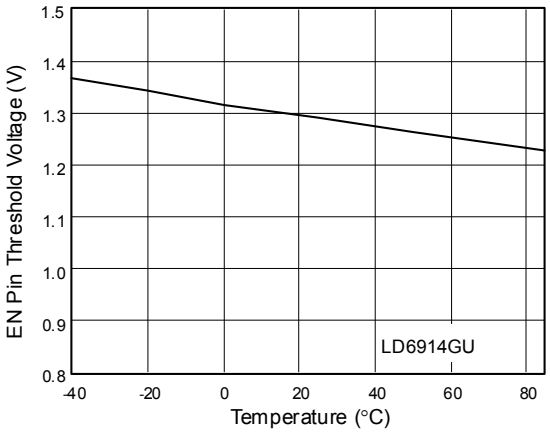



Fig.9 EN Pin Threshold Voltage vs. Temperature

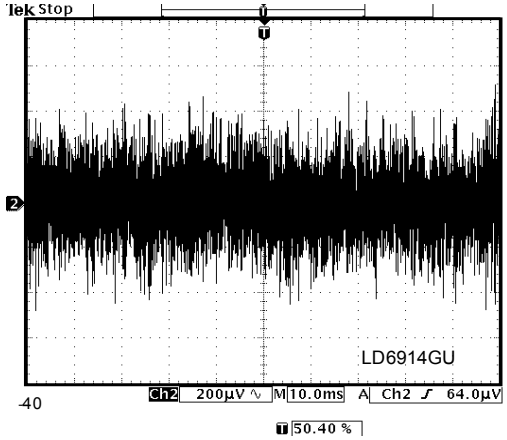



Fig.10 Output Noise

# 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 of 5mm from the VIN pin.

For stable operation, 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.

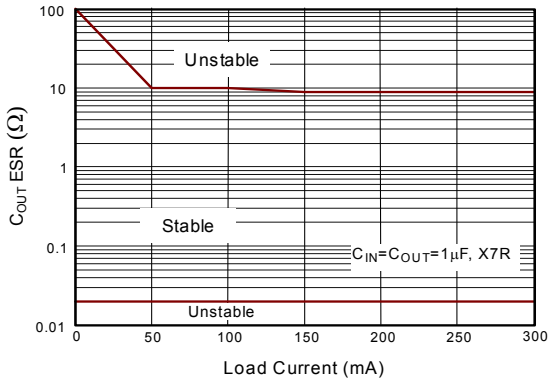



Fig. 7 Region of Stable $C_{OUT}$ ESR vs. Load Current

Larger output capacitor produces less noise and improves load transient response, stability and PSRR. The output capacitor should be located in the distance of 5mm from the OUT pin. With the dielectrics such as Z5U and Y5V, it's necessary to use an output capacitor of at least 2.2μF or larger to ensure stability at temperature below -10°C. X5R or X7R types of capacitors are recommended for the input and output capacitors in full range of operation temperature.

## Output Voltage Setting

The LD6914 features a user-adjustable output through an external feedback network (see Fig.1)

To set the output of LD6914, refer to the following equation.

$$V_{OUT} = \frac{(R1+R2)}{R2} V_{REF}$$

where R2 is chosen less than 120KΩ and $V_{REF}$=1.225V. Use a 1% or better resistor for it.

## Current Limit and Short Circuit Protection

Output current is limited to 250mA (typical). When current limit engages, current limit circuit operates and output voltage drops. Output voltage drops further and output current decrease. When the output pin is shorted, a current of about 60mA flows. 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.

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

$\theta_{JA}$: Package Thermal Resistance

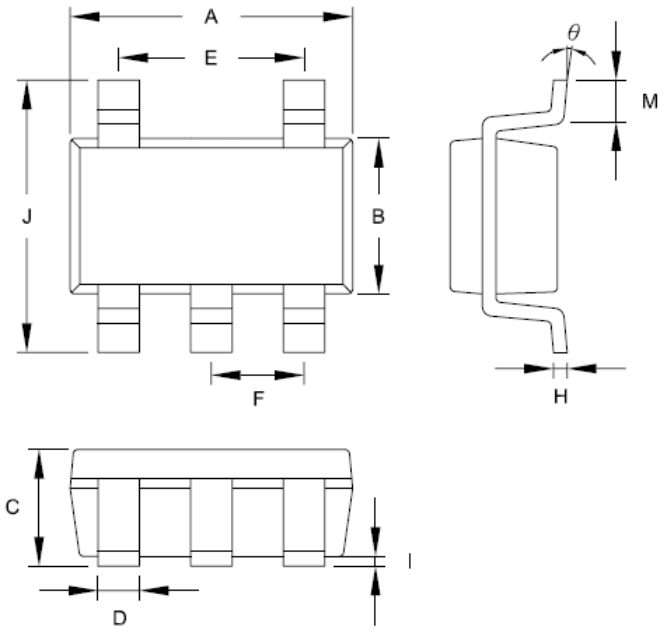
The maximum power dispassion at Ta=25°C can be obtained by above formula.

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

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

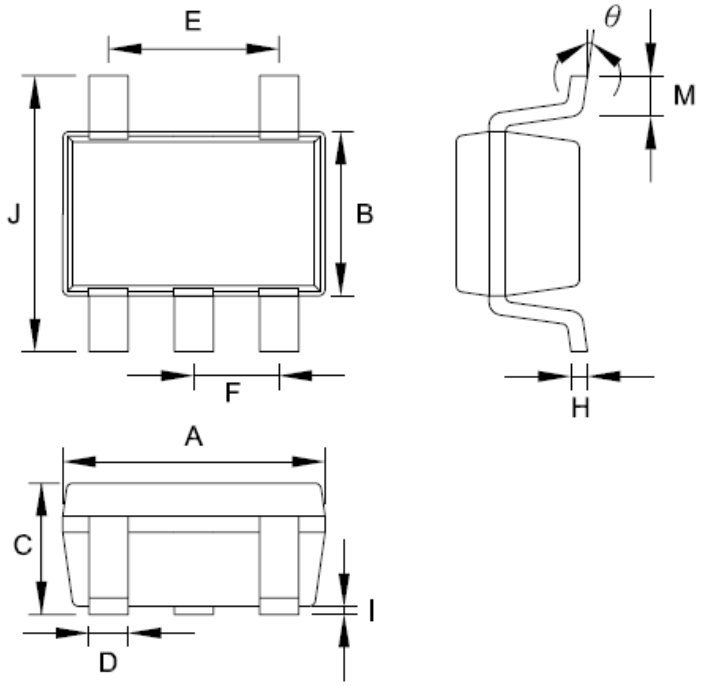
## Package Information

### 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 | x | 1.450 | x | 0.057 |
| 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**

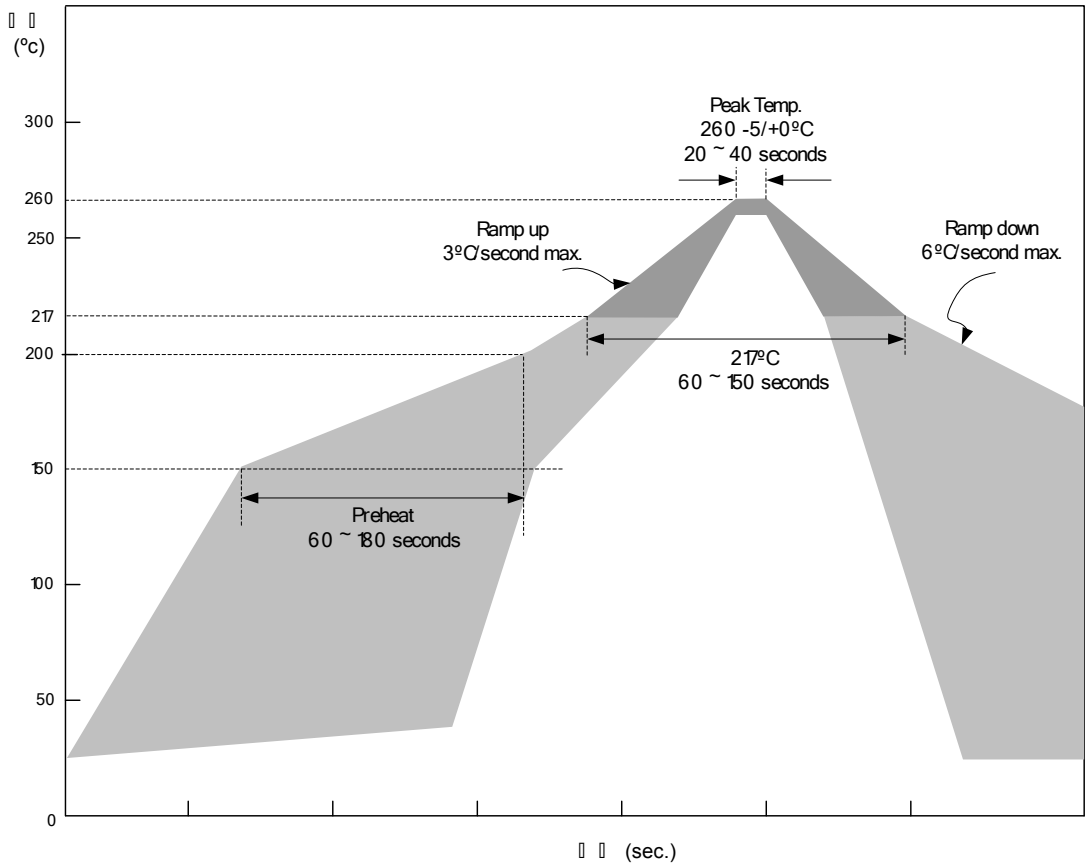



| Symbol | Dimension in Millimeters | | Dimensions in Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.800 | 2.200 | 0.071 | 0.087 |
| B | 1.150 | 1.350 | 0.045 | 0.053 |
| C | 0.800 | 1.100 | 0.031 | 0.043 |
| D | 0.150 | 0.400 | 0.006 | 0.016 |
| E | 1.300 TYP. | | 0.051 TYP. | |
| 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° |

**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 | 7/22/2008 | Original Specification. |