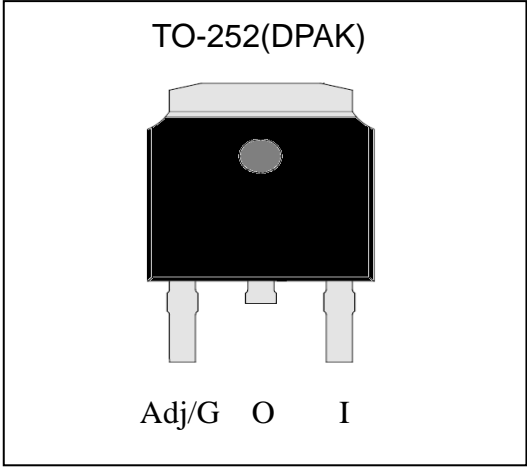


# 3A Low Dropout Positive Voltage Regulator

## LM1085-XXXJ3

### Features

- Dropout Voltage 1.4V at 3A Output Current.
- Fast Transient Response.
- Extremely Tight Line and Load Regulation.
- Built-in Thermal Shutdown Protection.
- Adjustable Output Voltage or Fixed 1.5V, 1.8V, 2.5V, 3.3V, 5.0V.
- Output Current Limiting.



### Description

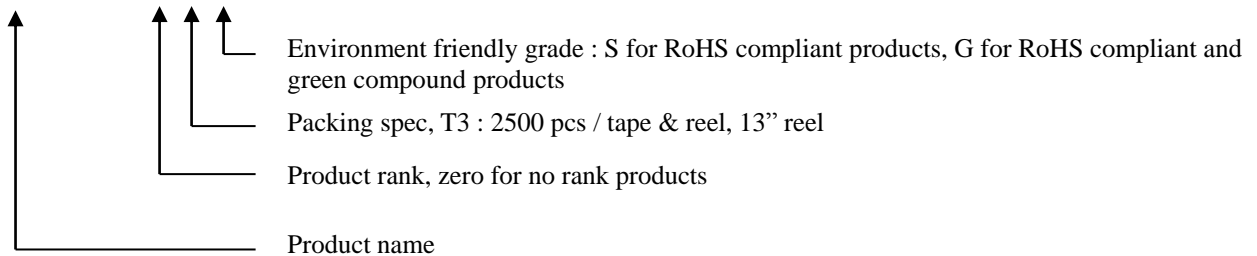
The LM1085-XXXJ3 is a low dropout three terminal regulator with 3A output current capability. The output voltage is adjustable with the use of a resistor divider or fixed 1.5V, 1.8V, 2.5V, 3.3V and 5.0V. Dropout voltage is guaranteed to be at maximum of 1.4V with the maximum output current. Its low dropout voltage and fast transient response make it ideal for low voltage microprocessor applications. Current limit and thermal protection provide protection against any overload condition that would create excessive junction temperatures.

### Applications

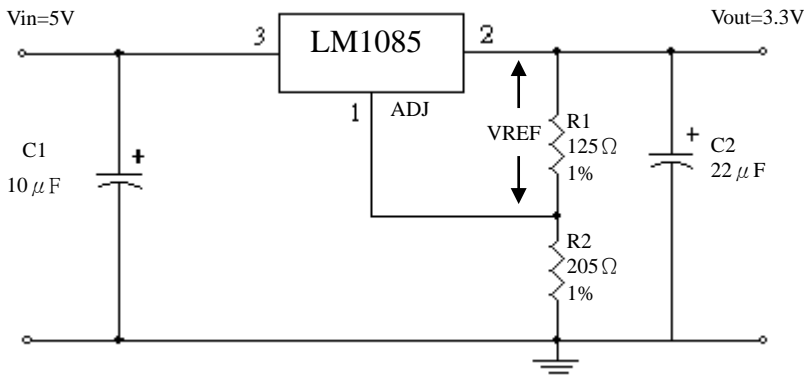
- Mother Board I/O Power Supplies.
- Microprocessor Power Supplies.
- High Current Regulator.
- Post Regulator for Switching Supply.

### Ordering Information

Device	Package	Shipping
LM1085-XXXJ3-0-T3-G	TO-252 (Pb-free lead plating and halogen-free package)	2500 pcs / tape & reel

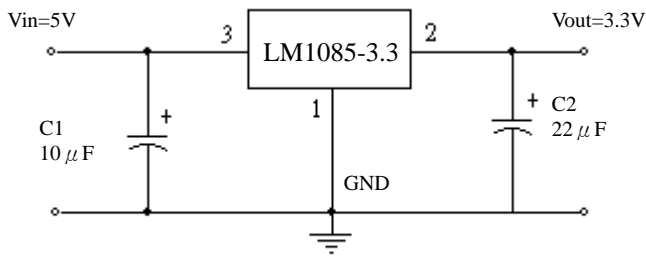


### Typical Application Circuit



**Adjustable Voltage Regulator**

$V_{REF} = V_{OUT} - V_{ADJ} = 1.25V(\text{typ})$   
 $V_{OUT} = V_{REF}(1 + R1/R2) + I_{ADJ} \times R2$   
 $I_{ADJ} = 55\mu A(\text{typ.})$   
 (1) C1 needed if device is far away from filter capacitors.  
 (2) C2 minimum value required for stability.



**Fixed Voltage Regulator**

### Absolute Maximum Ratings

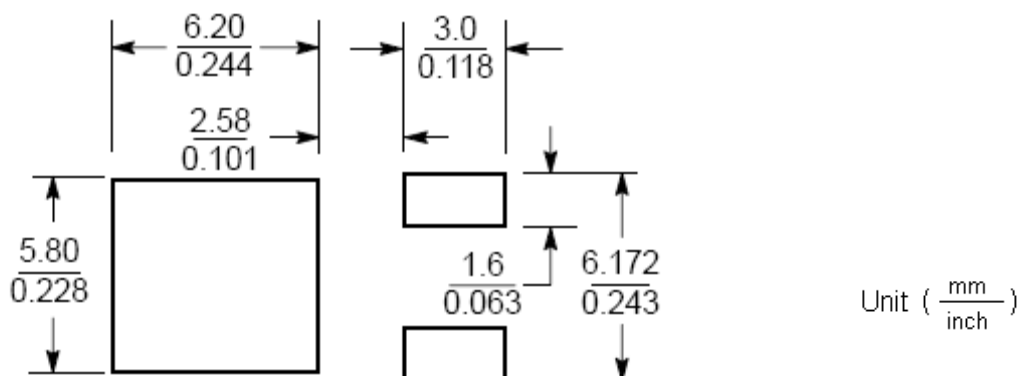
Symbol	Parameter	Ratings	Unit
$V_{in}$	DC supply voltage	15	V
$P_D$	Power Dissipation	Internally Limited	W
$T_{STG}$	Storage Temperature Range	-65 ~ +150	°C
$T_{OPR}$	Operation Junction Temperature Range	-40 ~ +125	°C
$T_{LEAD}$	Lead Temperature(Soldering 10 seconds)	300	°C

## Electrical Characteristics (I<sub>o</sub>=10mA, T<sub>j</sub>=25°C, unless otherwise noted)

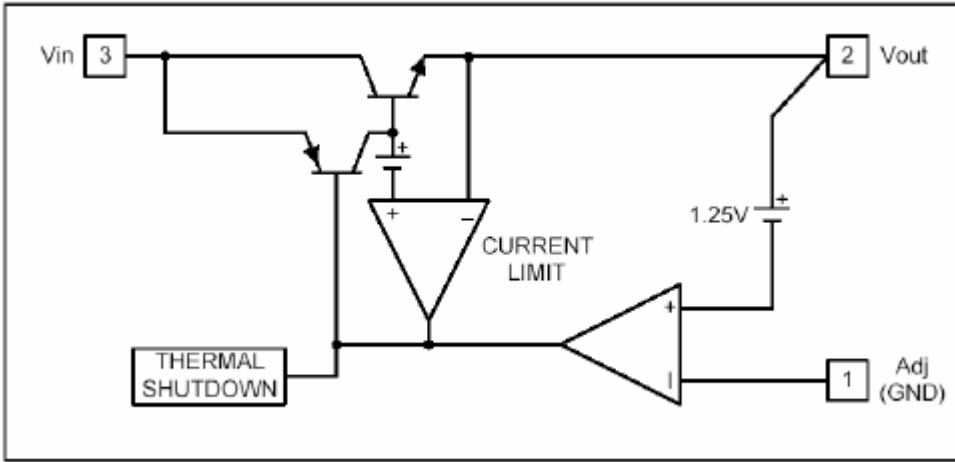
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V <sub>REF</sub>	Reference Voltage	LM1085-Adj, V <sub>in</sub> =5V	1.225	1.250	1.275	V
V <sub>o</sub>	Output Voltage (fixed versions)	LM1085-1.5, 3.0V ≤ V <sub>in</sub> ≤ 12V LM1085-1.8, 3.3V ≤ V <sub>in</sub> ≤ 12V LM1085-2.5, 4.0V ≤ V <sub>in</sub> ≤ 12V LM1085-3.3, 4.8V ≤ V <sub>in</sub> ≤ 12V LM1085-5.0, 6.5V ≤ V <sub>in</sub> ≤ 12V	1.470 1.764 2.450 3.235 4.900	1.500 1.800 2.500 3.300 5.000	1.530 1.836 2.550 3.365 5.100	V
ΔV <sub>o</sub>	Line Regulation	Adj : 2.75V ≤ V <sub>in</sub> ≤ 12V Fixed : 1.5 + V <sub>out</sub> ≤ V <sub>in</sub> ≤ 12V	-	-	0.2	%
ΔV <sub>o</sub>	Load Regulation	LM1085-Adj, V <sub>in</sub> = 3.3V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2) LM1085-1.5, V <sub>in</sub> = 3.0V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2) LM1085-1.8, V <sub>in</sub> = 3.3V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2) LM1085-2.5, V <sub>in</sub> = 4.0V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2) LM1085-3.3, V <sub>in</sub> = 5.0V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2) LM1085-5.0, V <sub>in</sub> = 8.0V, 10mA ≤ I <sub>o</sub> ≤ 3A (Note 1, 2)	-	- 12 15 20 26 40	1 15 18 25 33 50	% mV mV mV mV mV
I <sub>s</sub>	Current Limit	V <sub>in</sub> - V <sub>out</sub> = 5V	3	4.5	-	A
I <sub>Adj</sub>	Adjust Pin Current	Adjustable model, V <sub>in</sub> = 12V, I <sub>out</sub> = 10mA	-	40	100	μA
I <sub>Q</sub>	Quiescent Current	Fixed model, V <sub>in</sub> = 12V, I <sub>o</sub> = 10mA	-	7	12	mA
T <sub>s</sub>	Temperature Stability	I <sub>o</sub> = 10mA, 0°C ≤ T <sub>j</sub> ≤ 125°C	-	0.5	-	%
I <sub>L</sub>	Minimum Load Current	Adjustable model, V <sub>in</sub> = 5V	-	3	10	mA
RR	Ripple Rejection Ratio	V <sub>IN</sub> - V <sub>OUT</sub> = 3V, I <sub>o</sub> = 3A, f = 120Hz, C <sub>OUT</sub> = 25μF, tantalum	60	65	-	dB
V <sub>D</sub>	Dropout Voltage	I <sub>o</sub> = 3A (ΔV <sub>OUT</sub> = 1% V <sub>OUT</sub> )	-	1.3	1.4	V
R <sub>th, j-a</sub>	Thermal Resistance, Junction to Ambient	No heat sink, no air flow	-	98	-	°C/W
R <sub>th, j-c</sub>	Thermal Resistance, Junction to Case	Control Circuitry/Power Transistor	-	15	-	°C/W

Note : 1. See thermal regulation specifications for changes in output voltage due to heating effects. Line and load regulation are measured at a constant junction temperature by low duty cycle pulse testing. Load regulation is measured at the output lead 1/18" from the package.  
 2. Line and load regulation are guaranteed up to the maximum power dissipation of 15W. Power dissipation is determined by the difference in input and output and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range.

## Recommended soldering footprint



**Block Diagram**



**Functional Description**

**Introduction**

The LM1085 adjustable or fixed-mode Low Dropout(LDO) regulator is a 3 terminal device which can easily be programmed by internal mask change to any voltage within the range of 1.25V to  $V_{in}-1.4V$ . The LM1085 only needs 1.4V differential between  $V_{in}$  and  $V_{out}$  to maintain output regulation. In addition, the output voltage tolerances are also extremely tight and they include the transient response as part of the specification. For example, Intel VRE specification calls for a total of  $\pm 100mV$  including initial tolerance, load regulation and 0 to 3A load step. The LM1085 is specifically designed to meet the fast current transient needs as well as providing an accurate initial voltage, reducing the overall system cost with the need for fewer output capacitors.

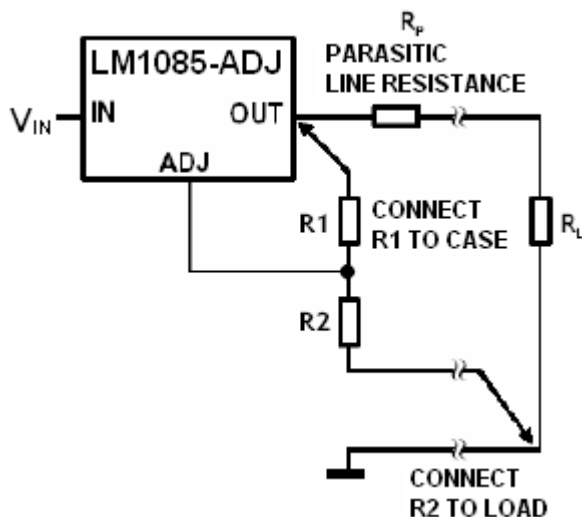
The LM1085 series of adjustable and fixed regulators are easy to use and have all the protection features expected in high performance voltage regulators : short circuit protection and thermal shutdown.

**Load Regulation**

Since the LM1085 is only a 3 terminal device, it is not possible to provide true remote sensing of output voltage at the load. The resistance of the wire connecting the regulator to the load will limit the load regulation.

The data sheet specification for load regulation is measured at the bottom of the package. Negative side sensing is a true Kelvin connection, with the bottom of the output divider returned to the negative side of the load.

The best load regulation is obtained when the top of the resistor divider R1 is connected directly to the case, not to the load. If R1 is connected to the load, the effective resistance between the regulator and the load would be :



$$\frac{R_p \times (R_1 + R_2)}{R_1}, \text{ RP=Parasitic Line Resistance}$$

Using 16-gauge wire, the parasitic line resistance is about  $0.004 \Omega$  per feet, translating to 4mV/ft at 1A load current.

It is important to keep the positive lead between regulator and load as short as possible and use large wire or PC board traces.



## Stability

The LM1085 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. For most applications, the addition of 150 $\mu$ F aluminum electrolytic capacitor or a 22 $\mu$ F solid tantalum on the output will ensure stability for all operating conditions.

When the adjustment terminal is bypassed with a capacitor to improve the ripple rejection, the requirement for an output capacitor increases. The value of 22 $\mu$ F tantalum or 150 $\mu$ F aluminum covers all cases of bypassing the adjustment terminal. Without bypassing the adjustment terminal smaller capacitors can be used with equally good results. To ensure good transient response with heavy load current changes capacitor values on the order of 100 $\mu$ F are used in the output of many regulators. To further improve stability and transient response of these devices larger values of output capacitor can be used.

## Protection Diodes

Unlike older regulators, the LM1085 family does not need any protection diodes between the adjustment pin and the output and from the output to the input to prevent over-stressing the die.

Internal resistors are limiting the internal current paths on the adjustment pin, therefore even with capacitors on the adjustment pin, no protection diode is needed to ensure device safety under short-circuit conditions.

If high value output capacitors are used, such as 1000 $\mu$ F to 5000 $\mu$ F, and the input pin is instantaneously shorted to ground, damage can occur. A diode from output to input is recommended, when a crowbar circuit at the input of the LM1085 is used. Normal power supply cycling or even plugging and unplugging in the system will not generate current large enough to do any damage.

## Thermal Design

The LM1085 incorporates an internal power and thermal limiting circuitry designed to protect the device under overload conditions. However maximum junction temperature ratings should not be exceeded under continuous normal load conditions.

Careful consideration must be given to all sources of thermal resistance from junction to ambient, including junction-to-case, case to heat sink interface and heat sink resistance itself. To ensure safe operating temperatures and reflect more accurately the device temperature, new thermal resistance specifications have been developed.

Junction-to-case thermal resistance is specified from the IC junction to the bottom of the case directly below the die. This is the lowest resistance path for the heat flow. In order to ensure the best possible thermal flow from this area of the package to the heat sink, proper mounting is required. Thermal compound at the case-to-heat sink interface is recommended. A thermally conductive spacer can be used, if the case of the device must be electrically isolated, but its added contribution to thermal resistance has to be considered.

## Layout Consideration

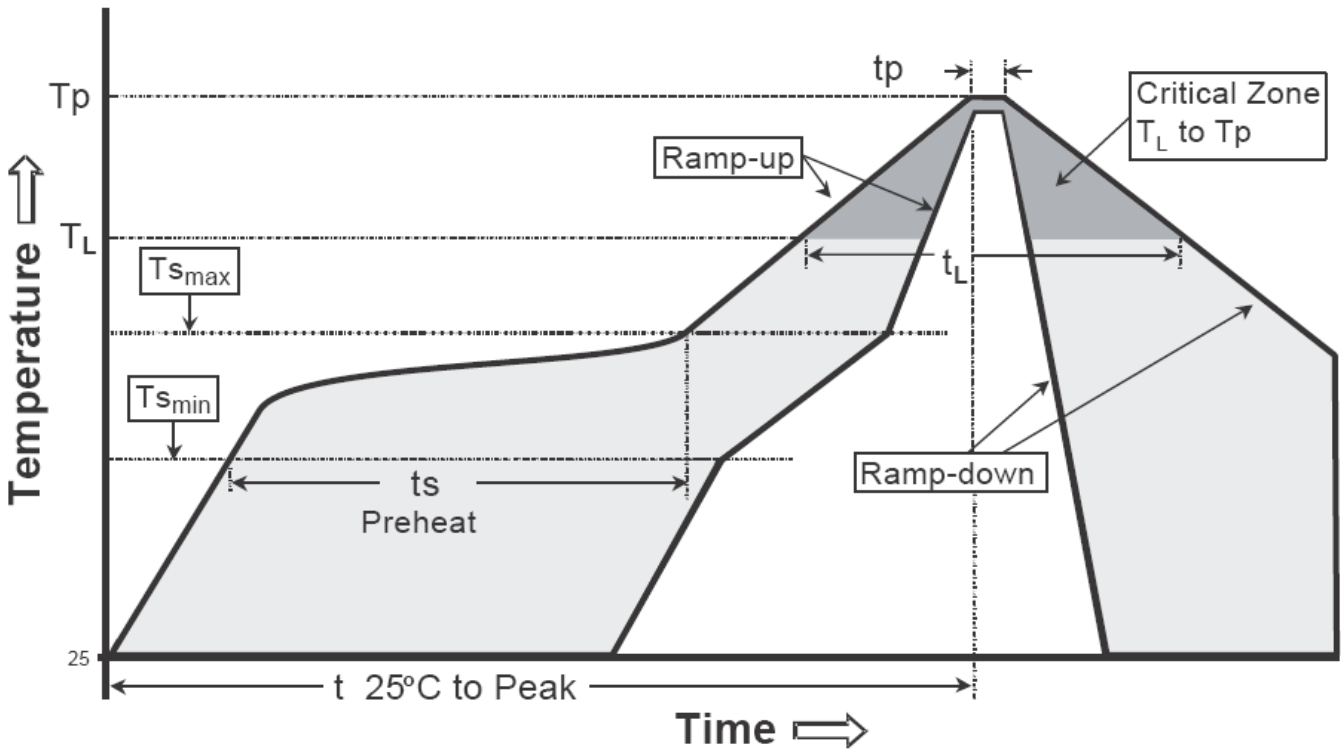
The output capacitors must be located as close to the Vout terminal of the device as possible. It is recommended to use a section of a layer of the PC board as a plane to connect the Vout pin to the output capacitors to prevent any high frequency oscillation that may result due to excess trace inductance.



**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

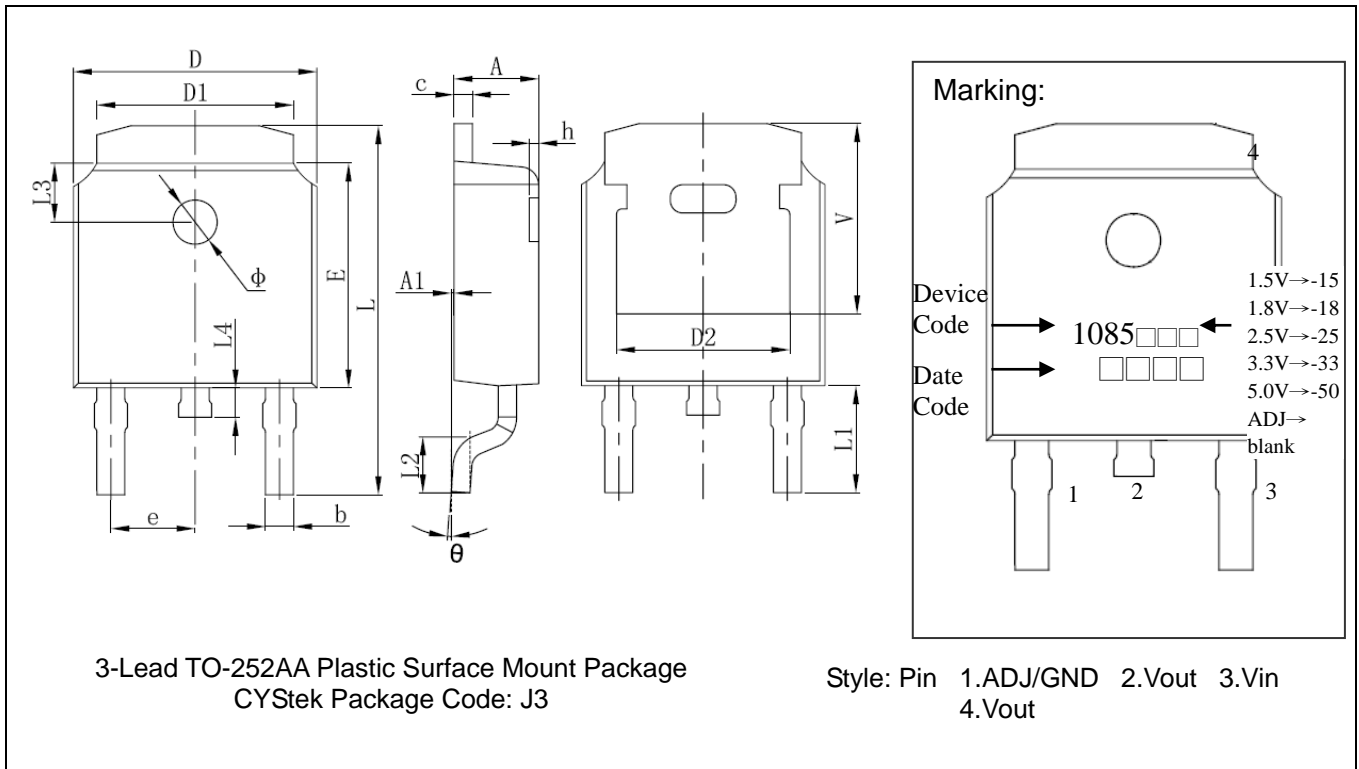
**Recommended temperature profile for IR reflow**



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T <sub>s min</sub> )	100°C	150°C
-Temperature Max(T <sub>s max</sub> )	150°C	200°C
-Time(t <sub>s min</sub> to t <sub>s max</sub> )	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T <sub>L</sub> )	183°C	217°C
- Time (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak Temperature(T <sub>p</sub> )	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(t <sub>p</sub> )	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

**TO-252 Dimension**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.087	0.094	2.200	2.400	e	0.086	0.094	2.186	2.386
A1	0.000	0.005	0.000	0.127	e1	0.172	0.188	4.372	4.772
B	0.039	0.048	0.990	1.210	H	0.163	REF	4.140	REF
b	0.026	0.034	0.660	0.860	K	0.190	REF	4.830	REF
b1	0.026	0.034	0.660	0.860	L	0.386	0.409	9.800	10.400
C	0.018	0.023	0.460	0.580	L1	0.114	REF	2.900	REF
C1	0.018	0.023	0.460	0.580	L2	0.055	0.067	1.400	1.700
D	0.256	0.264	6.500	6.700	L3	0.024	0.039	0.600	1.000
D1	0.201	0.215	5.100	5.460	P	0.026	REF	0.650	REF
E	0.236	0.244	6.000	6.200	V	0.211	REF	5.350	REF

Notes: 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead : Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

**Important Notice:**

- All rights are reserved. Reproduction in whole or in part is prohibited without the prior written approval of CYStek.
- CYStek reserves the right to make changes to its products without notice.
- CYStek **semiconductor products are not warranted to be suitable for use in Life-Support Applications, or systems.**
- CYStek assumes no liability for any consequence of customer product design, infringement of patents, or application assistance.