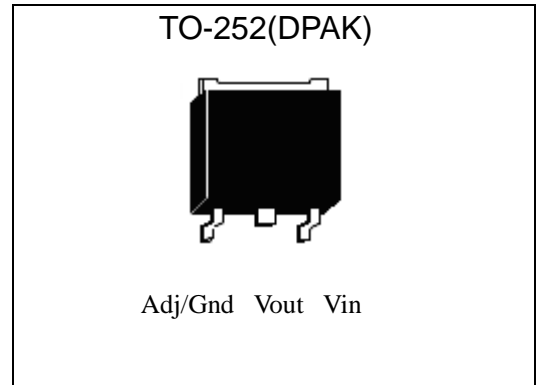


# 5A Low Dropout Positive Voltage Regulator

## PL1084J3



### Features

- Maximum Dropout Voltage 1.5V at 5A Output Current.
- Fast Transient Response.
- Extremely Tight Line and Load Regulation.
- Current Limiting and Thermal Protection.
- Adjustable Output Voltage or Fixed 1.5V, 1.8V, 2.5V, 3.3V, 5.0V.
- Standard 3-Pin Power Packages.

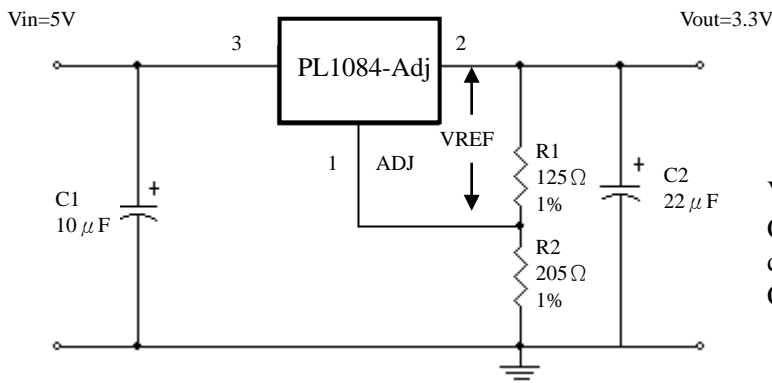
### Description

The PL1084J3 is a low dropout three terminal regulator with 5A 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 1.5V 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.

### Typical Application Circuit

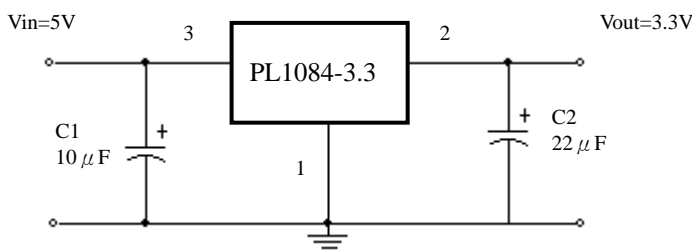


**Adjustable Voltage Regulator**

$$V_{OUT} = V_{REF} \times (1 + R2/R1) + I_{ADJ} \times R2$$

C1 is required if device is far from filter capacitance.

C2 minimum value required for stability.



**Fixed Voltage Regulator**

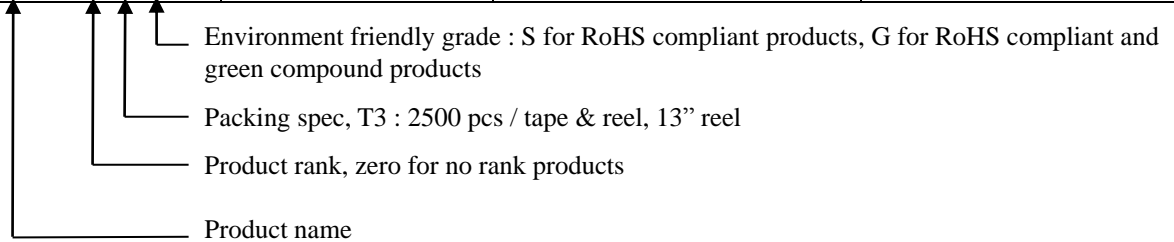
C1 is required if device is far from filter capacitance.

C2 minimum value required for stability.



**Ordering Information**

Device	Output Voltage	Package	Shipping
PL1084-AdjJ3-0-T3-G	Adjustable	TO-252 (Pb-free lead plating and halogen-free package)	2500 pcs/Tape & Reel
PL1084-1.5J3-0-T3-G	1.5V		
PL1084-1.8J3-0-T3-G	1.8V		
PL1084-2.5J3-0-T3-G	2.5V		
PL1084-3.3J3-0-T3-G	3.3V		
PL1084-5.0J3-0-T3-G	5.0V		



**Absolute Maximum Ratings**

Symbol	Parameter	Ratings	Unit
V <sub>in</sub>	DC supply voltage	+15	V
P <sub>D</sub>	Power Dissipation	Internally Limited	
T <sub>STG</sub>	Storage Temperature	-65 ~ +150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-40 ~ +125	°C
T <sub>LEAD</sub>	Lead Temperature (Soldering 10 sec)	300	°C
V <sub>ESD</sub>	Minimum ESD rating (HBM)	2000	V

**Electrical Characteristics** (I<sub>LOAD</sub>=0mA, T<sub>j</sub>=25°C, unless otherwise noted)

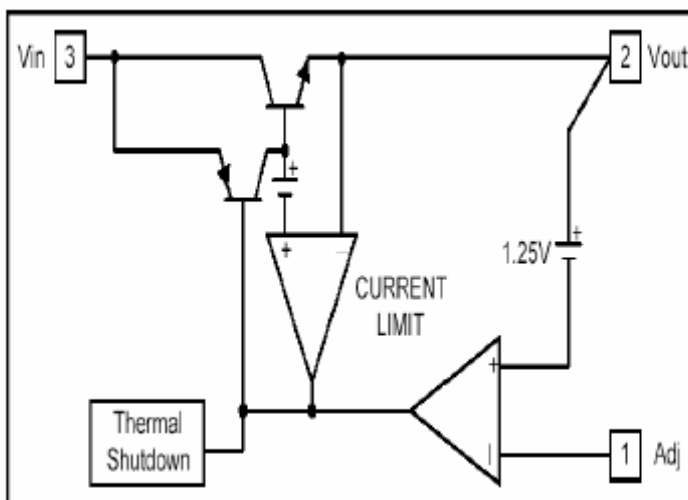
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V <sub>REF</sub>	Reference Voltage (adjustable model)	V <sub>IN</sub> =5V, I <sub>LOAD</sub> =10mA	1.238	1.250	1.262	V
		V <sub>IN</sub> =2.75V to 10V, I <sub>LOAD</sub> =10mA to 5A	1.225	1.250	1.275	
V <sub>O</sub>	Output Voltage (fixed model)	PL1084-1.5 V <sub>IN</sub> =3.0V	1.485	1.500	1.515	V
		PL1084-1.8 V <sub>IN</sub> =3.3V	1.782	1.800	1.818	
		PL1084-2.5 V <sub>IN</sub> =4.0V	2.475	2.500	2.525	
		PL1084-3.3 V <sub>IN</sub> =4.8V	3.267	3.300	3.333	
		PL1084-5.0 V <sub>IN</sub> =6.5V	4.950	5.000	5.050	
V <sub>O</sub>	Output Voltage (fixed model)	I <sub>LOAD</sub> =0mA to 5A				V
		PL1084-1.5 V <sub>IN</sub> =3.0V to 11.5V	1.470	1.500	1.530	
		PL1084-1.8 V <sub>IN</sub> =3.3V to 11.8V	1.764	1.800	1.836	
		PL1084-2.5 V <sub>IN</sub> =3.8V to 12.5V	2.450	2.500	2.550	
		PL1084-3.3 V <sub>IN</sub> =4.8V to 13.3V	3.234	3.300	3.366	
ΔV <sub>O</sub>	Line Regulation (All version)	I <sub>LOAD</sub> =10mA	-	0.04	0.2	%
		V <sub>IN</sub> -V <sub>OUT</sub> =1.5V to 10V				

$\Delta V_o$	Load Regulation (Note 1, 2)	Adj $V_{IN}=2.75V, 10mA \leq I_o \leq 5A$	-	2.5	10	mV
		PL1084-1.5 $V_{IN}=3.0V, 10mA \leq I_o \leq 5A$	-	3	12	
		PL1084-1.8 $V_{IN}=3.3V, 10mA \leq I_o \leq 5A$	-	3.6	15	
		PL1084-2.5 $V_{IN}=4.0V, 10mA \leq I_o \leq 5A$	-	5	20	
		PL1084-3.3 $V_{IN}=4.8V, 10mA \leq I_o \leq 5A$	-	6.6	26	
		PL1084-5.0 $V_{IN}=6.5V, 10mA \leq I_o \leq 5A$	-	10	40	
$I_L$	Minimum Load Current	$V_{IN}=5V, V_{ADJ}=0V$ (adjustable model)	-	3	7	mA
$I_{Adj}$	Adjust Pin Current	$V_{IN}=2.75V$ to 10V, $I_{LOAD}=10mA$ (adjustable model)	-	40	90	$\mu A$
$I_Q$	Ground Pin Current	$V_{IN}-V_{OUT}=1.5V, I_{LOAD}=10mA$ to 5A (fixed model)	-	7	10	mA
$I_s$	Current Limit(All version)	$V_{IN}-V_{OUT}=1.5V$	5	6.5	-	A
RR	Ripple Rejection (All version)	$V_{IN}-V_{OUT}=3V, I_{LOAD}=5A$	60	65	-	dB
VD	Dropout Voltage(All version)	$I_{LOAD}=5A (\Delta V_{out}=1\% V_{out})$	-	1.3	1.5	V
TC	Temperature Coefficient	$V_{IN}-V_{OUT}=1.5V, I_{LOAD}=10mA$	-	0.005	-	%/°C
$\theta_{JA}$	Thermal Resistance, Junction to Ambient(No Heat Sink; No air flow)		-	98	-	°C/W
$\theta_{JC}$	Thermal Resistance, Junction to Case		-	15	-	

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 between input and output and the output current. Guaranteed maximum power dissipation will not be over the full input/output range.

## Block Diagram





## Functional Description

### Introduction

The PL1084 adjustable Low Dropout(LDO) regulator is a 3 terminal device that can easily be programmed with the addition of two external resistors to any voltages within the range of 1.25V to 2.5V. The PL1084 only needs 1.5V 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  $\pm 100\text{mV}$  including initial tolerance, load regulation and 0 to 5A load step. The PL1084 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.

### Output Voltage Setting

The PL1084 can be programmed to any voltages in the range of 1.25V to 5V with the addition of  $R_1$  and  $R_2$  external resistors according to the following formula:

$V_{out} = V_{ref}(1 + R_2/R_1) + I_{adj} * R_2$ , where  $V_{ref} = 1.25\text{V}$  typically,  $I_{adj} = 40\mu\text{A}$  typically

The PL1084 keeps a constant 1.25V between the output pin and the adjust pin. By placing a resistor  $R_1$  across these two pins, a constant current flows through  $R_1$ , adding to the  $I_{adj}$  current requirement of the PL1084.  $R_1$  is typically selected to be  $121\ \Omega$  resistor so that it automatically satisfies the minimum current requirement. Notice that since  $I_{adj}$  is typically in the range of  $40\mu\text{A}$ , it only adds a small error to the output voltage and should only be considered when a very precise output voltage setting is required. For example, in a typical 3.3V application where  $R_1 = 121\ \Omega$  and  $R_2 = 200\ \Omega$ , the error due to  $I_{adj}$  is only 0.3% of the nominal set point.

### Load Regulation

Since the PL1084 is only a 3 terminal device, it is not possible to provide true remote sensing of output voltage at the load. The best load regulation is achieved when the bottom side of  $R_2$  is connected to the load and the top side of  $R_1$  is connected directly to the case or the  $V_{out}$  pin of the regulator and not to the load. It is important to note that for high current applications, this can represent a significant percentage of the overall load regulation and one must keep the path from the regulator to the load as short as possible to minimize this effect.

### Stability

The PL1084 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. The addition of  $150\mu\text{F}$  aluminum electrolytic or a  $22\mu\text{F}$  solid tantalum capacitor 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  $22\mu\text{F}$  tantalum or  $150\mu\text{F}$  aluminum covers all cases of bypassing the adjustment terminal. Without bypassing the adjustment terminal, smaller capacitor can be used with equally good result.

To ensure good transient response with heavy load current changes, capacitor values on the order of  $100\mu\text{F}$  are used in the output of many regulators. To further improve stability and transient response of these devices, larger values of output capacitors can be used.

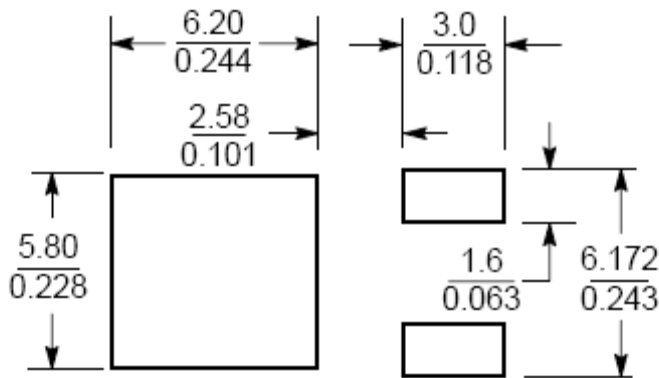
### Thermal Design

The PL1084 incorporates an internal shutdown that protects the device when the junction temperature exceeds the maximum allowable junction temperature. Although this device can operate with junction temperatures in the range of  $150^\circ\text{C}$ , it is recommended that the selected heat sink be chosen such that during maximum continuous load operation, the junction temperature is kept below the temperature.

### Layout Consideration

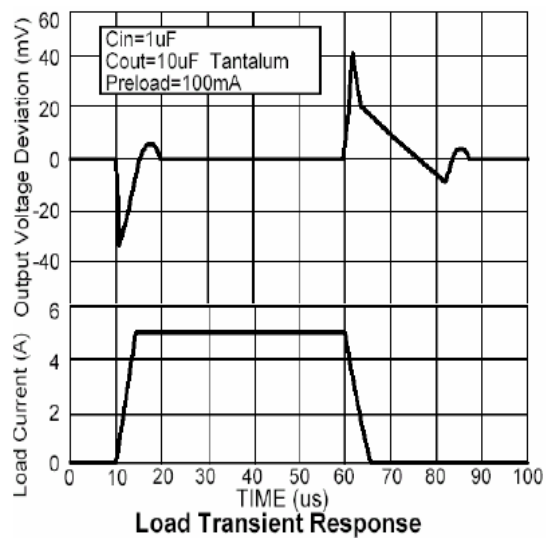
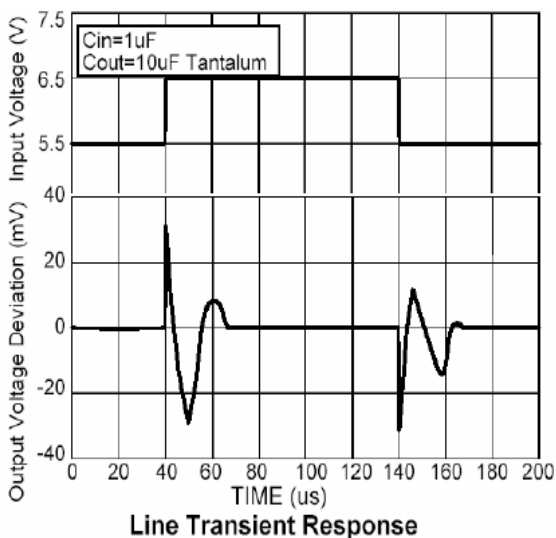
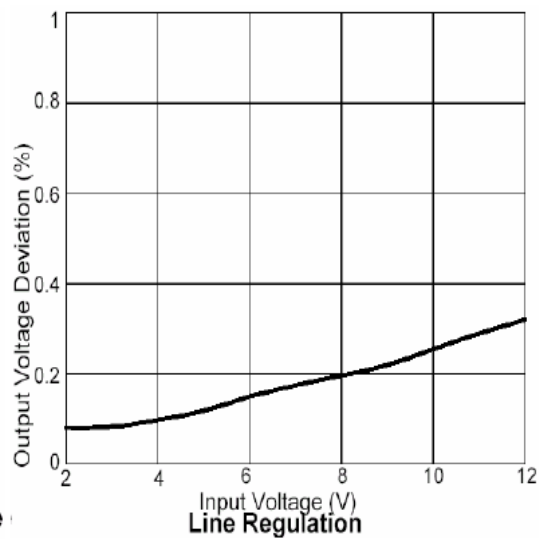
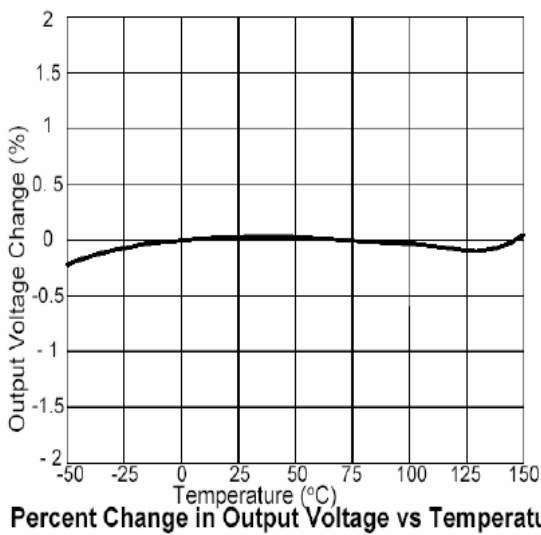
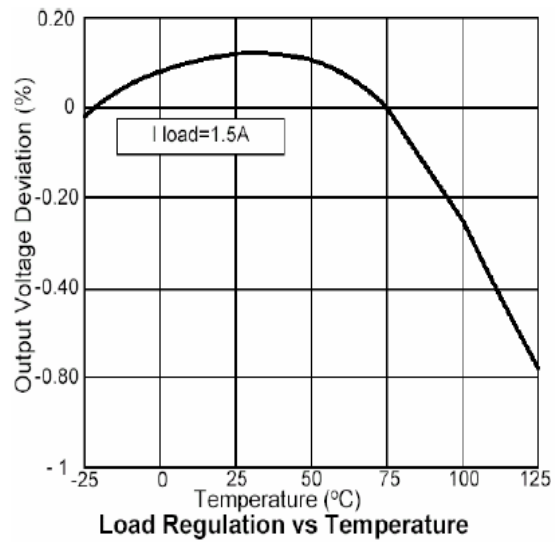
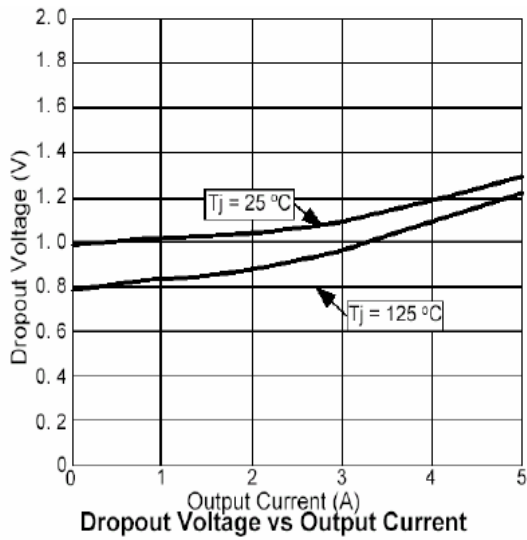
The output capacitors must be located as close to the  $V_{out}$  terminal of the device as possible. It is recommended to use a section of a layer of the PC board as a plane to connect the  $V_{out}$  pin to the output capacitors to prevent any high frequency oscillation that may result due to excess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

**Recommended soldering footprint**



Unit (  $\frac{\text{mm}}{\text{inch}}$  )

## Characteristic Curves

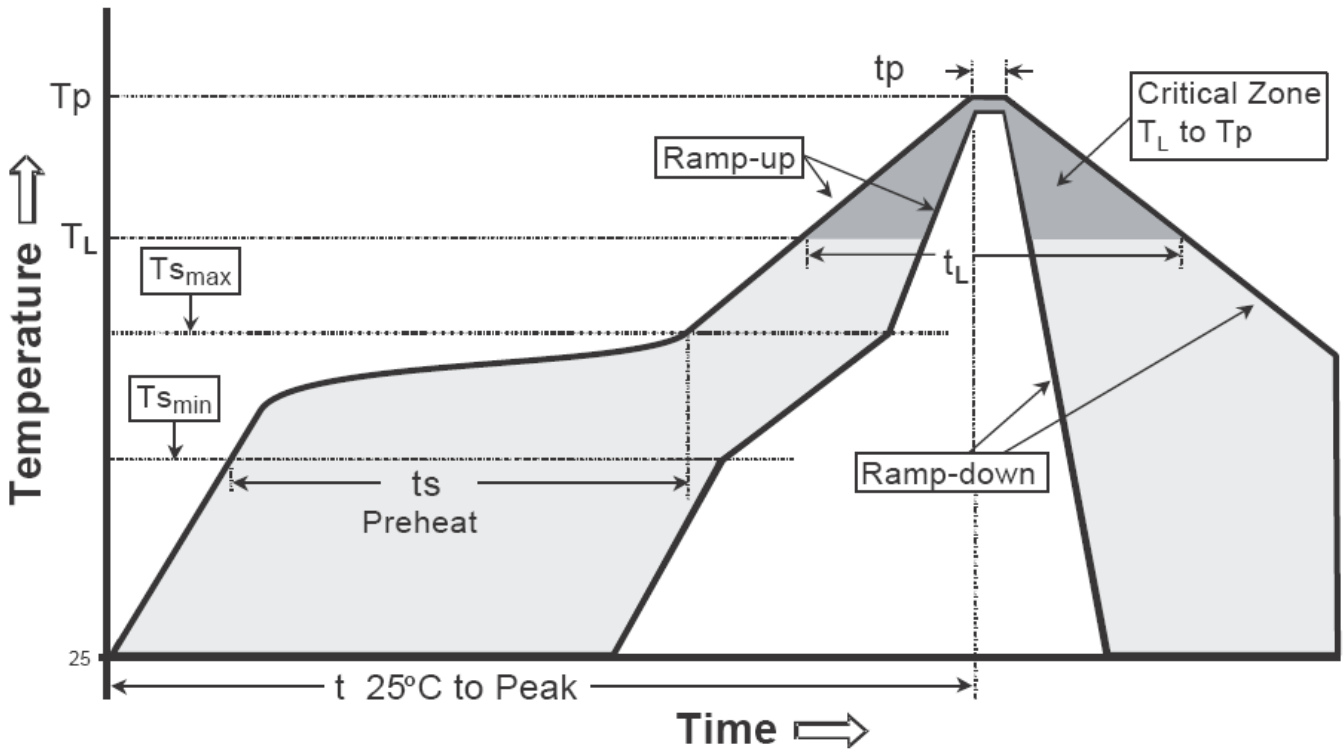




Recommended wave soldering condition

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

Recommended temperature profile for IR reflow

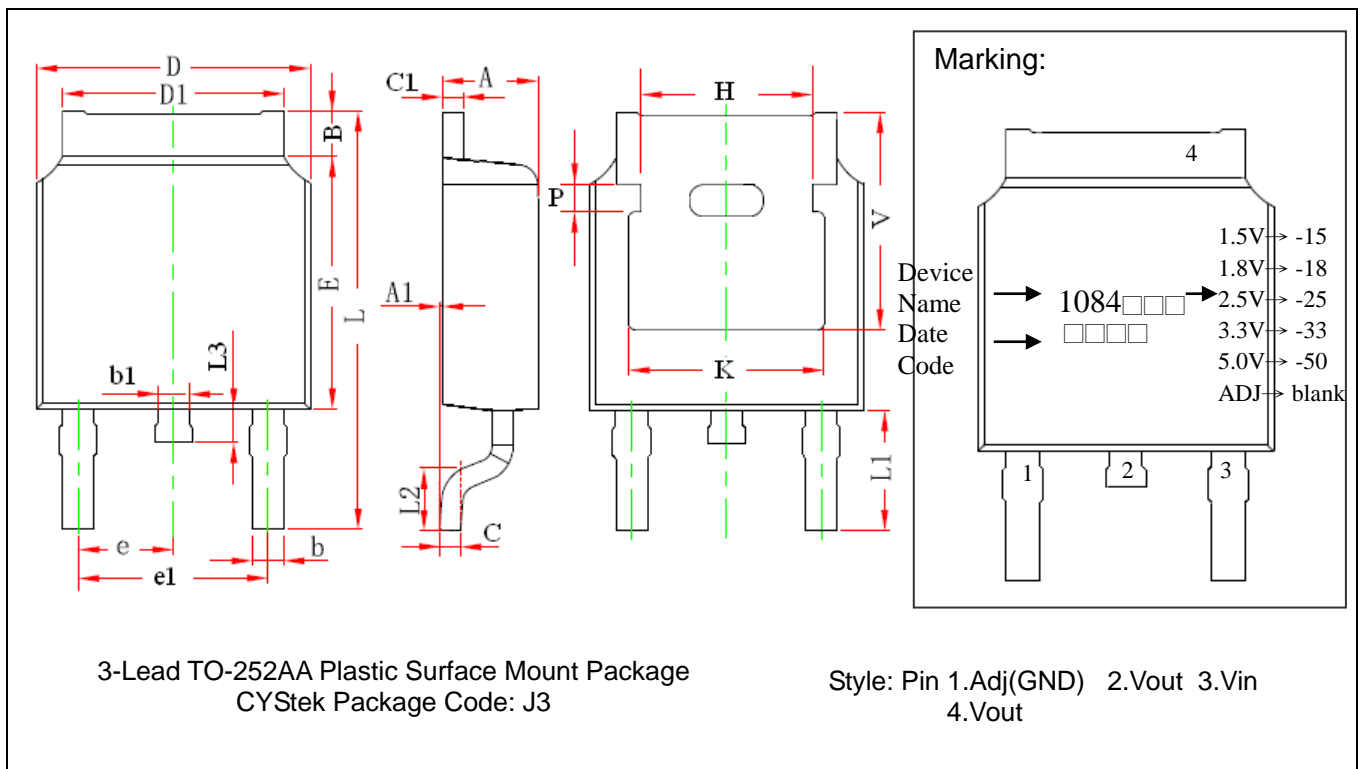


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (TL)	183°C	217°C
- Time (tL)	60-150 seconds	60-150 seconds
Peak Temperature(Tp)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	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-252AA 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.

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