

5A Low Dropout Fast Response Positive Adjustable Regulator and Fixed 3.3V

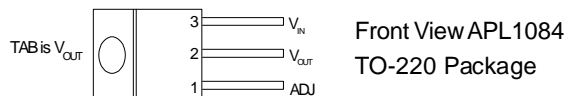
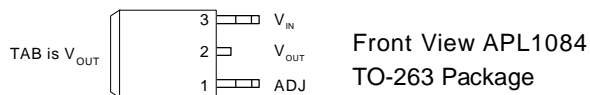
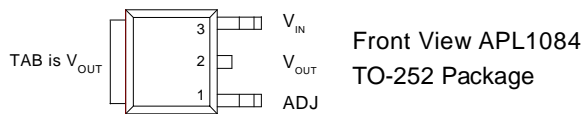
Features

- **Fast Transient Response**
- **Guaranteed Dropout Voltage at Multiple Currents**
- **Load Regulation :0.05% Typ.**
- **Line Regulation : 0.03% Typ.**
- **Low Dropout Voltage: 1.3V Typ. at $I_{OUT}=5A$**
- **Trimmed Current Limit : 5A Typ. at $T_J=125^{\circ}C$**
- **On-Chip Thermal Limiting : 150 $^{\circ}C$ Typ.**
- **Standard 3-pin TO-220, TO-252, and TO-263 Power Packages**
- **Lead Free and Green Devices Available (RoHS Compliant)**

General Description

The APL1084 is a low dropout three-terminal adjustable regulator with 5A output current capability. In order to obtain lower dropout voltage and speed up transient response, which is critical for low voltage applications, the APL1084 has been optimized. The output available voltage range of adjustable version is from 1.25 to 5.75V with an input supply below 7V, and the fixed 3.3V output voltage device is also available. Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperatures. The APL1084 is available in both the through-hole and surface mount versions of the industry standard 3-pin TO-220, TO-252, and TO-263 power packages.

Pin Configuration

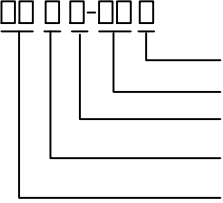




Applications

- **Pentium™ Processor Supplies**
- **PowerPC™ Supplies**
- **Low Voltage Logic Supplies**
- **Battery-Powered Circuitry**
- **Post Regulator for Switching Power Supply**

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

Ordering and Marking Information

APL1084 - 	Package Code F : TO-220 G : TO-263 U : TO-252 Operating Ambient Temperature Range C : 0 to 70 °C Handling Code TR : Tape & Reel TU : Tube Voltage Code : 33 : 3.3V Blank : Adjustable Version Assembly Material L : Lead Free Device G : Halogen And Lead Free Device
APL1084 : 	XXXXX - Date Code
APL1084- 33 : 	XXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020C for MSL classification at lead-free peak reflow temperature. ANPEC defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
V_I	Input Voltage	7	V
T_J	Operating Junction Temperature Range Control Section Power Transistor	0 to 125 0 to 150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_{SDR}	Maximum Lead Soldering Temperature, 10 Seconds	260	°C

Note 1 : Absolute Maximum Ratings are those values beyond which the life of a device may be impaired. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics

Symbol	Parameter	Test Conditions	APL1084			Unit
			Min.	Typ.	Max.	
V_{REF}	Reference Voltage APL1084	$1.5V \leq (V_{IN} - V_{OUT}) \leq 5.75V$, $10mA \leq I_{OUT} \leq 5A$, $T_J = 0 \sim 125^\circ C$	1.225 (-2%)	1.250	1.275 (+2%)	V
V_{OUT}	Output Voltage APL1084-3.3	$10mA \leq I_{OUT} \leq 5A$, $4.75V \leq V_{IN} \leq 7V$, $T_J = 0 \sim 125^\circ C$	3.235 (-2%)	3.300	3.365 (+2%)	V
REG_{LINE}	Line Regulation APL1084 APL1084-3.3	$T_J = 0 \sim 125^\circ C$, (Note 2) $2.75V \leq V_{IN} \leq 7V$, $I_{OUT} = 10mA$, $4.75V \leq V_{IN} \leq 7V$, $I_{OUT} = 0mA$,	-	0.03	0.2	%
REG_{LOAD}	Load Regulation APL1084 APL1084-3.3	$T_J = 25^\circ C$, (Notes 2) $(V_{IN} - V_{OUT}) = 3V$, $10mA \leq I_{OUT} \leq 5A$ $V_{IN} = 5V$, $0mA \leq I_{OUT} \leq 5A$	-	0.05 0.05	0.3 0.5	%
V_D	Dropout Voltage	$\Delta V_{REF} = 1\%$, $I_{OUT} = 3A$, $T_J = 0 \sim 125^\circ C$ $\Delta V_{REF} = 1\%$, $I_{OUT} = 5A$, $T_J = 0 \sim 125^\circ C$	-	1.2 1.3	1.4 1.5	V

Electrical Characteristics (Cont.)

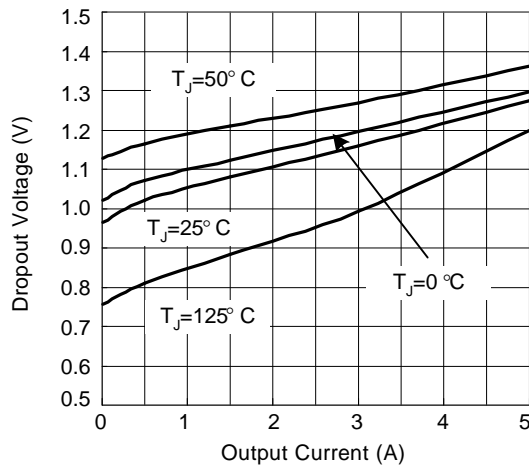
Symbol	Parameter	Test Conditions	APL1084			Unit
			Min.	Typ.	Max.	
I_{LIMIT}	Current Limit	$(V_{IN}-V_{OUT})=1.7V$, $T_J=25^{\circ}C$ $T_J=125^{\circ}C$ $(V_{IN}-V_{OUT})=3V$, $T_J=25^{\circ}C$ $T_J=125^{\circ}C$	6.0 5.0 6.5 5.5	7.6 6.0 8.2 6.5	-	A
I_{ADJ}	Adjust Pin Current APL1084	$(V_{IN}-V_{OUT})=3V$, $I_{OUT}=10mA$, $T_J=0\sim 125^{\circ}C$	-	60	120	μA
ΔI_{ADJ}	Adjust Pin Current Change APL1084	$1.5V \leq (V_{IN}-V_{OUT}) \leq 5.75V$, $10mA \leq I_{OUT} \leq 5A$	-	0.2	5	μA
I_{LMIN}	Minimum Load Current APL1084	$1.5V \leq (V_{IN}-V_{OUT}) \leq 5.75V$, $T_J=0\sim 125^{\circ}C$	-	2	10	mA
I_Q	Quiescent Current APL1084-3.3	$V_{IN}=5V$	-	8	13	mA
PSRR	Ripple Rejection APL1084 APL1084-3.3	$F=120Hz$, $C_{OUT}=22\mu F$, Tant., $(V_{IN}-V_{OUT})=3V$, $I_{OUT}=5A$ $F=120Hz$, $C_{OUT}=22\mu F$, Tant., $(V_{IN}=6.3V)$, $I_{OUT}=5A$	60	-	-	dB
L_S	Long -Term Stability	$T_J=125^{\circ}C$, 1000Hrs.	-	0.03	1.0	%
V_N	RMS Output Noise (% of V_{OUT})	$T_J=25^{\circ}C$, $10Hz \leq F \leq 10kHz$	-	0.003	-	%
$\theta_{th,J-TAB}$	Thermal Resistance Junction-to-Case, at TAB	(Note 3)	-	6.0	-	$^{\circ}C/W$
$\theta_{th,J-AMB}$	Thermal Resistance Junction-to-Ambient	TO-263 TO-252	-	50 62.5	-	$^{\circ}C/W$

Note 2: See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulations are measured at a constant junction temperature by low duty cycle pulse testing.

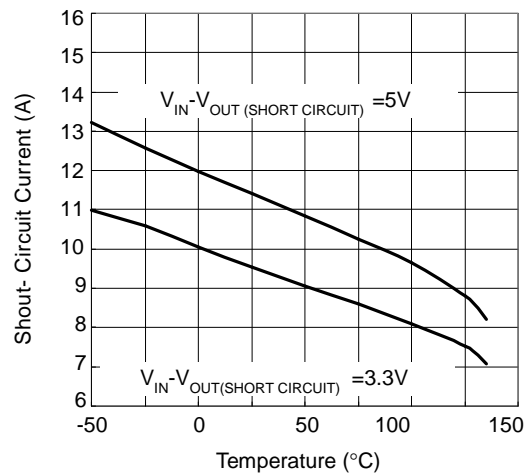
Note 3 :The value could be varied when heat sink size is different. Use larger heat sink or larger PCB size, which improves $\theta_{th,TAB-A}$ to improve overall thermal resistance ($\theta_{th,J-A}$).

Typical Operating Characteristics

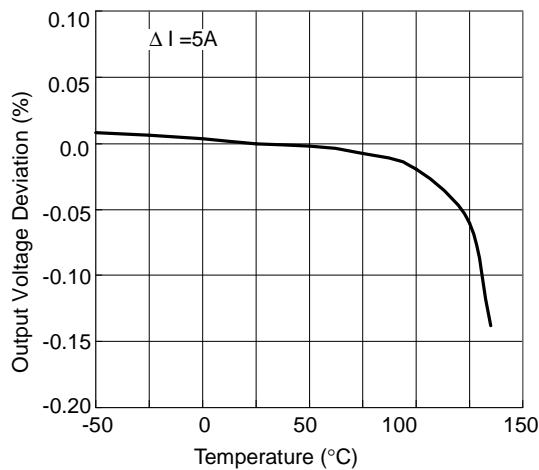
Dropout Voltage vs. Output Current



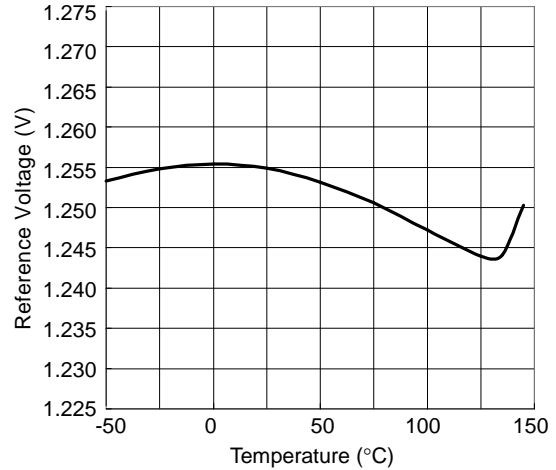
Short-Circuit Current vs. Temperature



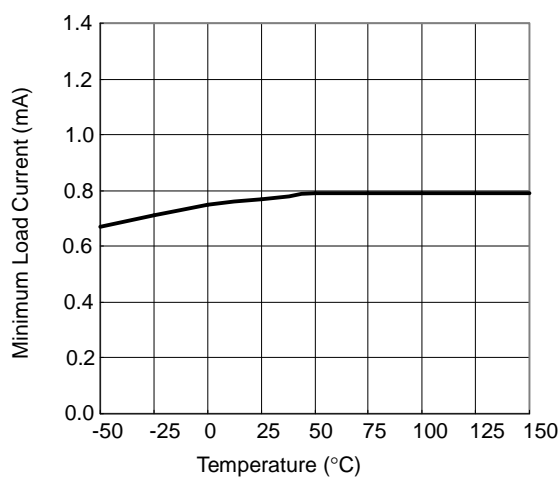
Load Regulation vs. Temperature



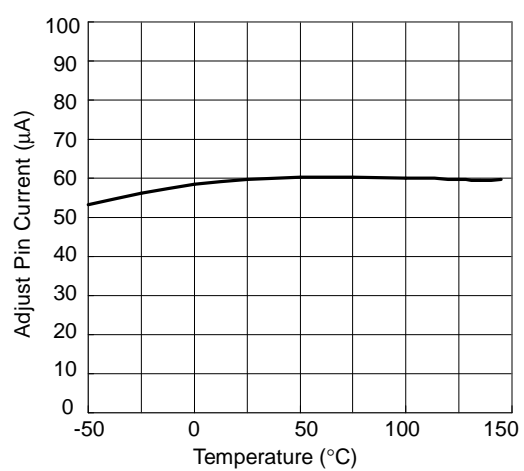
Reference Voltage vs. Temperature



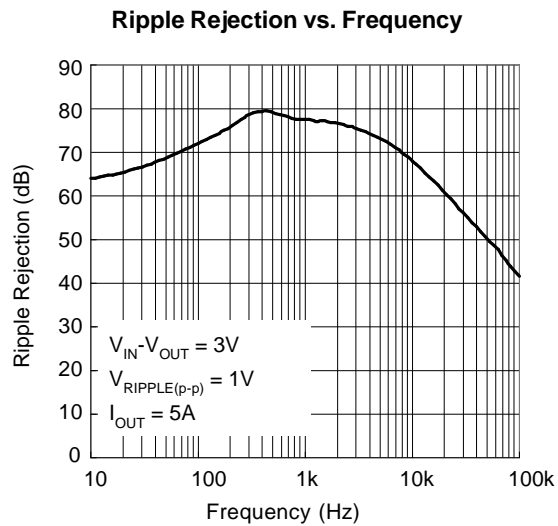
Minimum Load Current vs. Temperature



Adjust Pin Current vs. Temperature

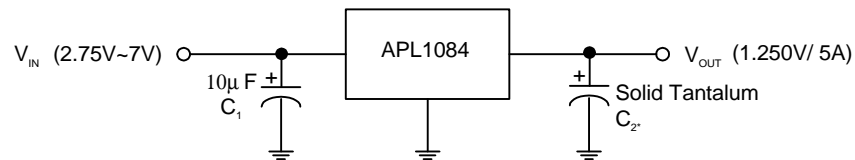


Typical Operating Characteristics (Cont.)

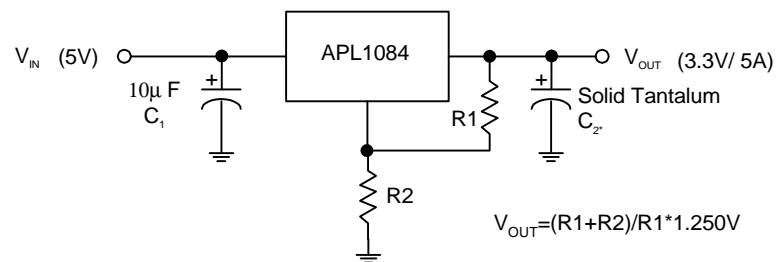


Typical Application Circuits

Typical Regulator



5V to 3.3V Regulator



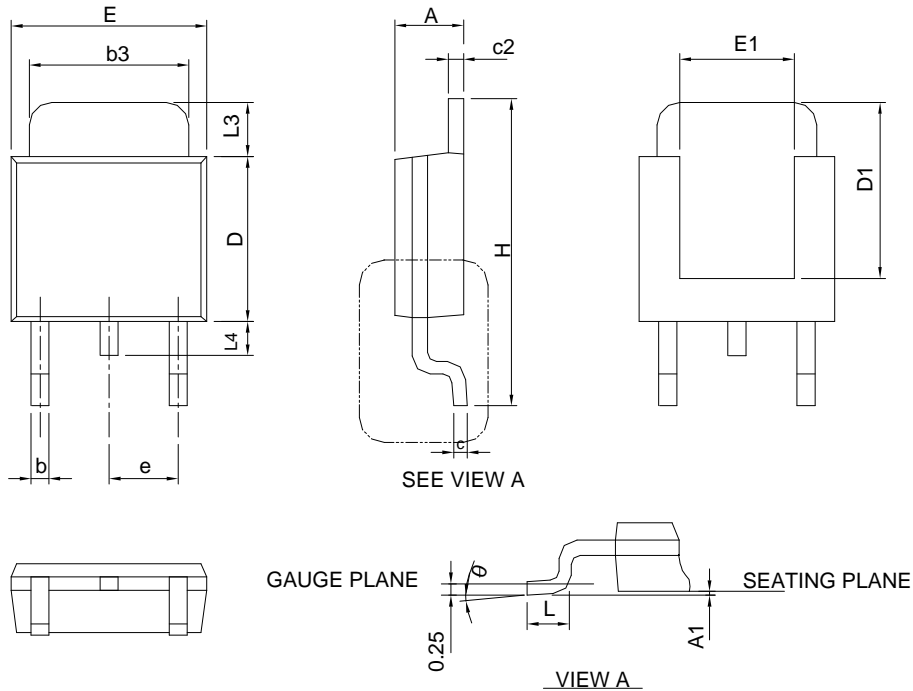
* Required for stability

APL1084: $C_2 = 10\mu F$

* R1 is typically in range of 100Ω to 120Ω

Package Information

TO-252

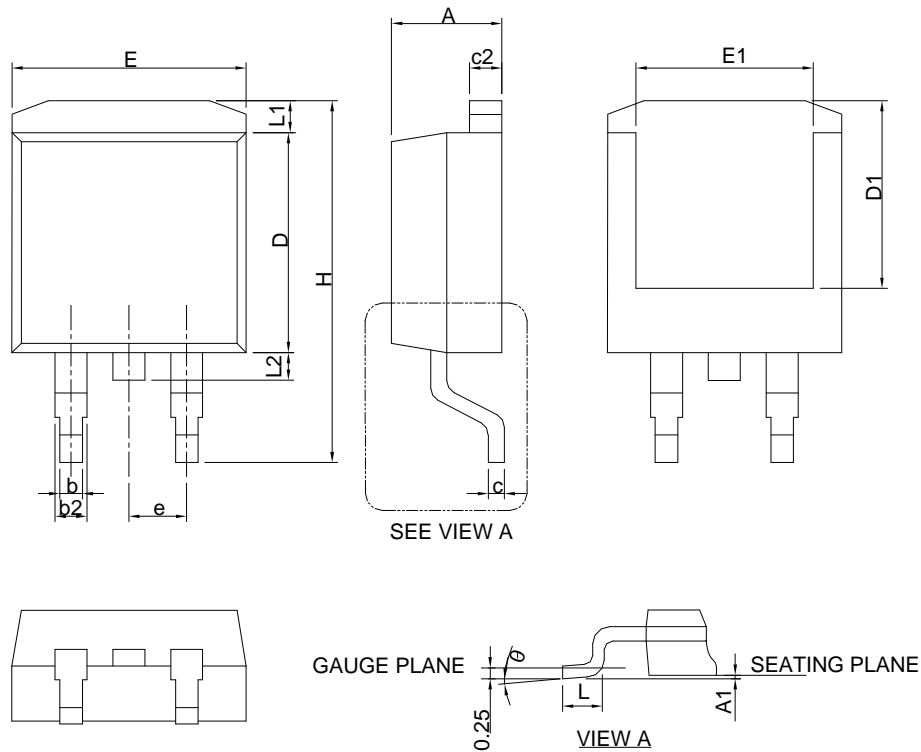


SYMBOL	TO-252			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	0.90	1.78	0.035	0.070
L3	0.89	2.03	0.035	0.080
L4		1.02		0.040
θ	0°	8°	0°	8°

Note : Follow JEDEC TO-252 .

Package Information

TO-263

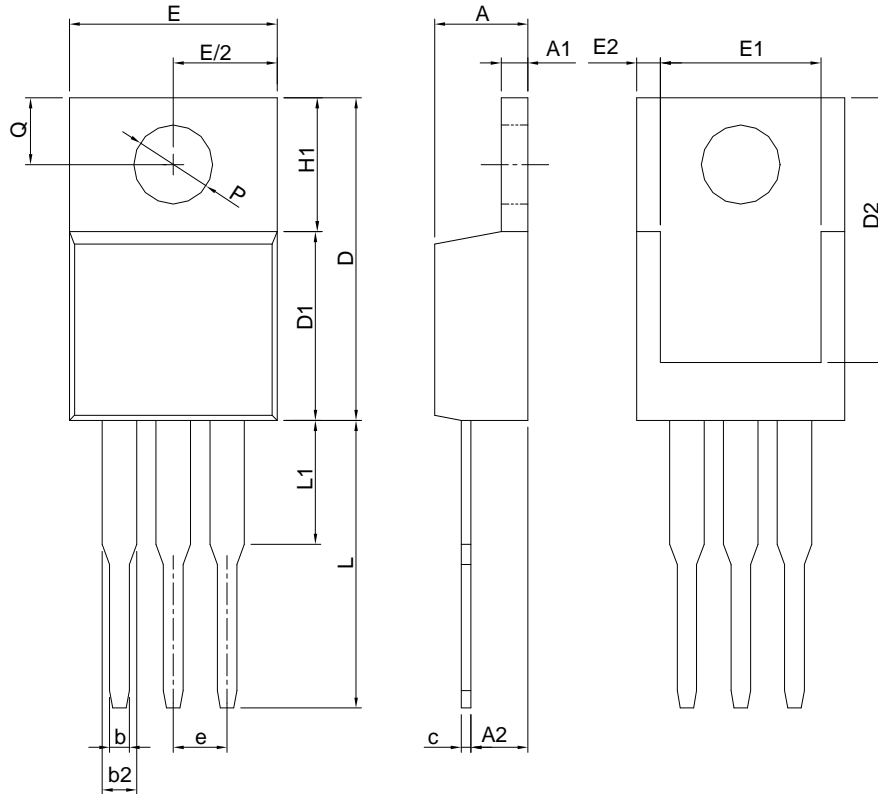


SYMBOL	TO-263			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b2	1.14	1.78	0.045	0.070
c	0.38	0.74	0.015	0.029
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380
D1	6.00	9.00	0.236	0.354
E	9.65	11.43	0.380	0.450
E1	6.22	9.00	0.245	0.354
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1		1.68		0.066
L2		1.78		0.070
θ	0°	8°	0°	8°

Note : Follow JEDEC TO-263 AB.

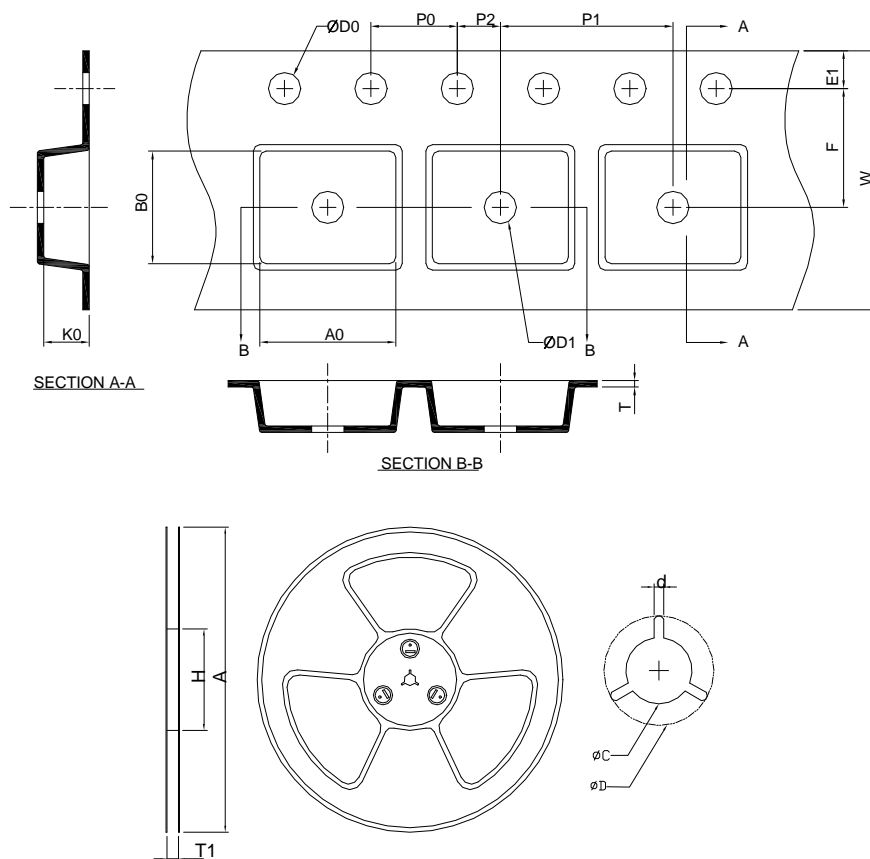
Package Information

TO-220



SYMBOL	TO-220			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	3.56	4.83	0.140	0.190
A1	0.51	1.40	0.020	0.055
A2	2.03	2.92	0.080	0.115
b	0.38	1.02	0.015	0.040
b2	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.22	16.51	0.560	0.650
D1	8.38	9.02	0.330	0.355
D2	12.19	12.88	0.480	0.507
E	9.65	10.67	0.380	0.420
E1	6.86	8.89	0.270	0.350
E2		0.76		0.030
e	2.54 BSC		0.100 BSC	
H1	5.84	6.86	0.230	0.270
L	12.70	14.73	0.500	0.580
L1		6.35		0.250
P	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
TO-263	330.0 ±0.00	50 MIN.	24.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	24.0 ±0.30	1.75 ±0.10	11.5 ±0.10
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	16.0 ±0.10	2.0 ±0.10	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	10.8 ±0.20	16.1 ±0.20	5.2 ±0.20
Application	A	H	T1	C	d	D	W	E1	F
TO-252	330.0 ±0.00	50 MIN.	16.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	16.0 ±0.30	1.75 ±0.10	7.50 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	8.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.80 ±0.20	10.40 ±0.20	2.50 ±0.20

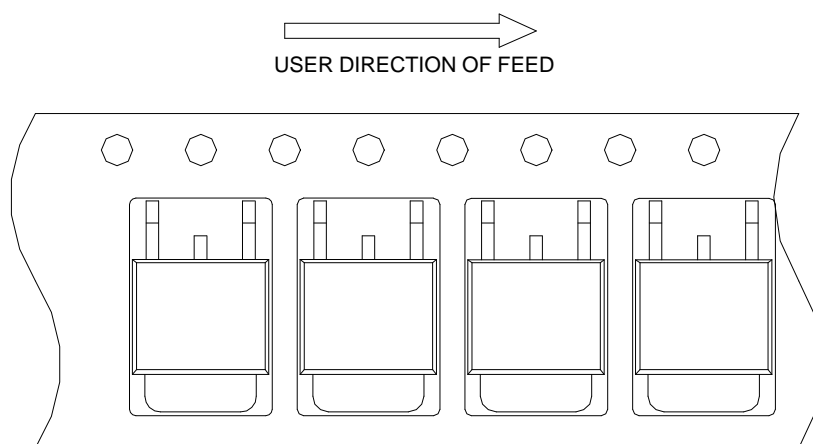
(mm)

Devices Per Unit

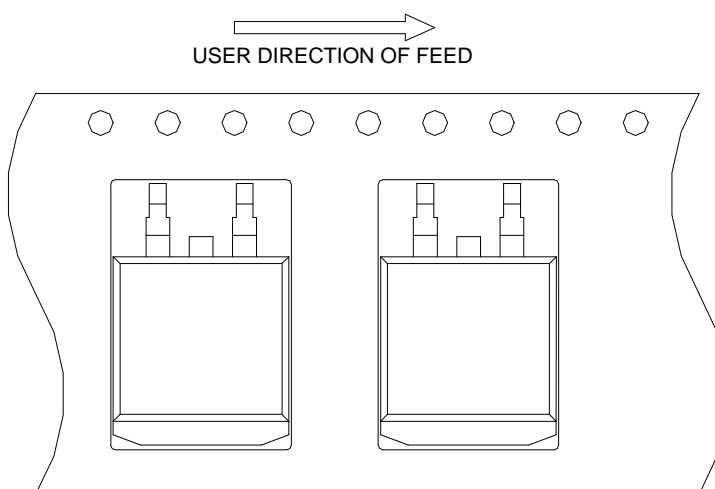
Package Type	Unit	Quantity
TO-263	Tape & Reel	800
TO-252		2500
TO-220	Tube	50

Taping Direction Information

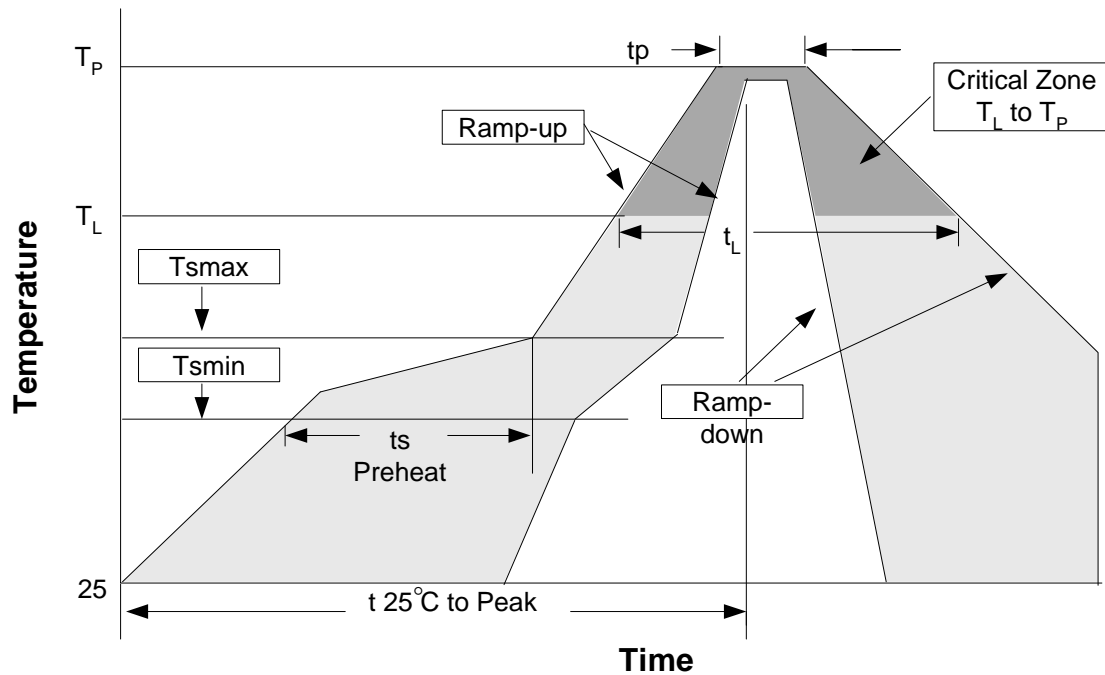
TO-252



TO-263



Reflow Condition (IR/Convection or VPR Reflow)



Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 sec
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @125°C
PCT	JESD-22-B, A102	168 Hrs, 100%RH, 121°C
TST	MIL-STD-883D-1011.9	-65°C~150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms, 1 _{tr} > 100mA

Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T _L to T _P)	3°C/second max.	3°C/second max.
Preheat <ul style="list-style-type: none"> - Temperature Min (T_{smin}) - Temperature Max (T_{smax}) - Time (min to max) (ts) 	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: <ul style="list-style-type: none"> - Temperature (T_L) - Time (t_L) 	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature (T _p)	See table 1	See table 2
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.

Notes: All temperatures refer to topside of the package. Measured on the body surface.

Classification Reflow Profiles (Cont.)

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

Customer Service

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