SEAWARD ELECTRONICS

SE1084
5A Low Dropout Linear Regulator

General Description

SE1084 is a low dropout positive adjustable or fixed-mode regulator with minimum of 5.0A output current capability. The product is specifically designed to provide well-regulated supply for low voltage IC applications such as high-speed bus termination and low current 3.3V logic supply. SE1084 is also well suited for other applications such as VGA cards.SE1084 is guaranteed to have lower than 1.5V dropout at full load current making it ideal to provide well-regulated outputs of 1.25Vto 3.3V with 4.8Vto 12V input supply.

Features

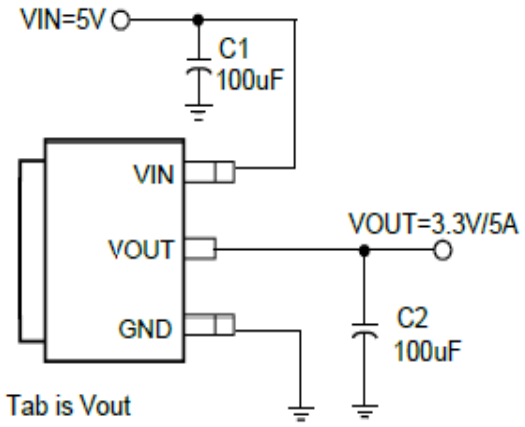
- 5V maximum dropout at full load current
- Built-in thermal shutdown
- Output current limiting
- Adjustable and1.5V/1.8V/2.5V/3.3V/5.0V fixed output voltages
- Fast transient response
- Good noise rejection
- Package: TO252, TO263, TO220

Applications

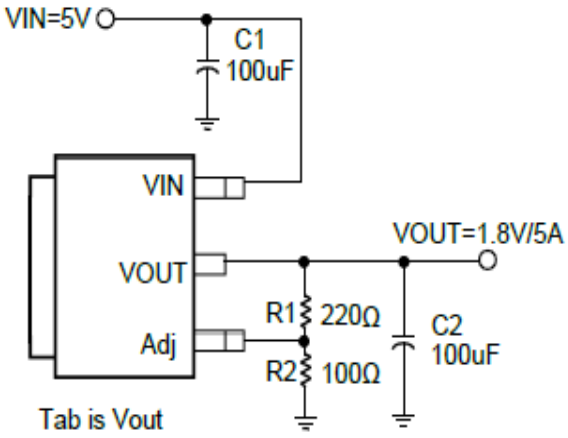
- High Efficiency Linear Regulators
- Battery Chargers
- Post Regulation for Switching Supply
- Microprocessor Supply
- Desktop PCs, RISC and Embedded Processors' Supply

Typical Application

5.0V to 3.3V Fixed Mode Regulator



Adjustable Regulator



$$V_{OUT} = V_{REF} * (1 + \frac{R_2}{R_1})$$

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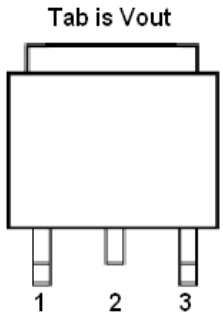
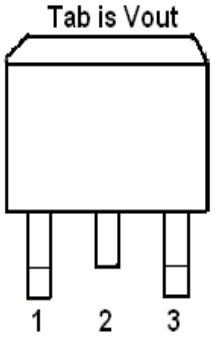
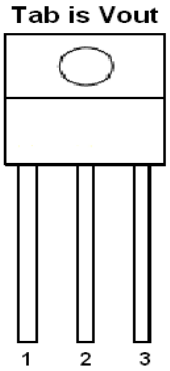
Pin Configuration



TO252:1 Adj(GND) 2 Vout 3 Vin



TO263:1 Adj(GND) 2 Vout 3 Vin

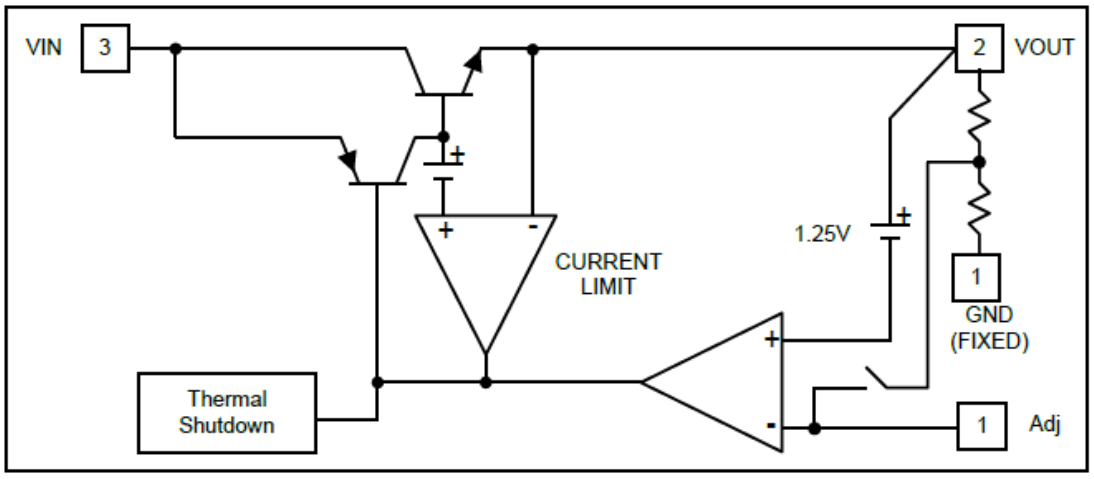


TO220:1 Adj(GND) 2 Vout 3 Vin

Pin Description

NO.	Pin Name	Pin Function Description
1	**Adj (GND)**	Adjustable (Ground only for fixed version) A resistor divider from this pin to the VOUT pin and ground sets the output voltage.
2	**VOUT**	The output of the regulator. A minimum of 100uF (0.15Ω ≤ESR ≤10Ω) capacitor must be connected from this pin to ground to insure stability.
3	**VIN**	The input pin of regulator. Typically a large storage capacitor (0.15Ω ≤ESR ≤10Ω) is connected from this pin to ground to insure that the input voltage does not sag below the minimum dropout voltage during the load transient response. This pin must always be 1.4V higher than VOUT in order for the device to regulate properly.

Functional Block Diagram



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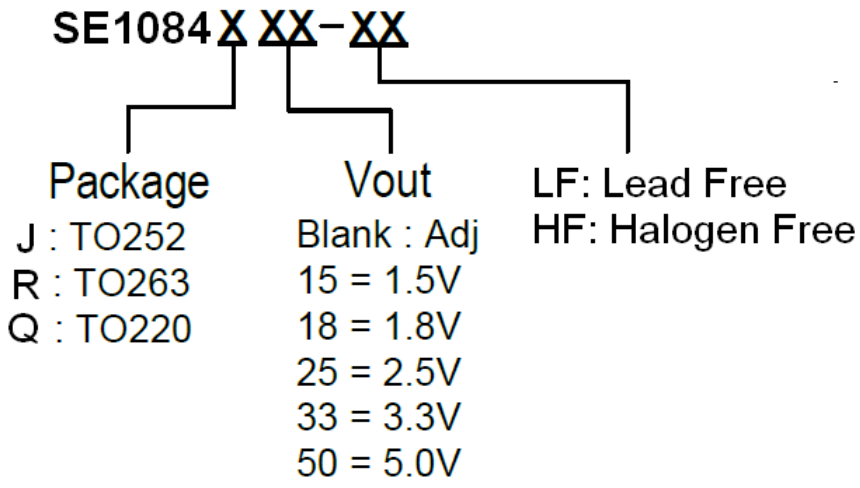
Ordering Information



Part Number	Marking Information	Package	Remarks
SE1084J-LF	SE1084J YYWW-LF	TO252	YYWW means Production batch Adjustable output voltage.
SE1084R-LF	SE1084R YYWW-LF	TO263	
SE1084Q-LF	SE1084Q YYWW-LF	TO220	
SE1084JXX-LF	SE1084JXX YYWW-LF	TO252	YYWW means Production batch Fixed output voltages; XX denotes voltage options (1.5V,1.8V, 2.5V,3.3V and 5.0V).
SE1084RXX-LF	SE1084RXX YYWW-LF	TO263	
SE1084QXX-LF	SE1084QXX YYWW-LF	TO220	

Absolute Maximum Ratings

Symbol	Parameter	Maximum	Units
V_{IN}	DC Supply Voltage	-0.3 to 12	V
P_D	Power Dissipation	Internally Limited	
T_{ST}	Storage Temperature	-65 to +150	℃
T_{OPJ}	Operating Junction Temperature Range	-40to +125	℃

Electrical Characteristics

（Vin =3.6V ; Tj=25℃ unless otherwise specified）

Symbol	Characteristics	Test Conditions	Min	Typ	Max	Unit
V_{REF}	Reference Voltage	I_{OUT}=10mA, T_J=25℃, (V_{IN}-V_{OUT})=1.5V	1.225	1.250	1.275	V
V_{OUT}	Output Voltage (Fixed Version)	I_{OUT}= 10mA, T_J= 25℃, 3V≦V_{IN}≦12V	1.470	1.500	1.530	V
		I_{OUT}= 10mA, T_J= 25℃, 3.3V≦V_{IN}≦12V	1.764	1.800	1.836	V
		I_{OUT}= 10mA, T_J= 25℃, 4V≦V_{IN}≦12V	2.450	2.500	2.550	V
		I_{OUT}= 10mA, T_J= 25℃, 4.8V≦V_{IN}≦12V	3.235	3.300	3.365	V
		I_{OUT}= 10mA, T_J= 25℃, 6.5V≦V_{IN}≦12V	4.900	5.000	5.100	V
V_{LINE}	Line Regulation	I_{OUT}=10mA, V_{OUT}+1.5V<V_{IN}<12V, T_J=25℃		0.2	0.5	%
V_{LOAD}	Load Regulation	V_{IN}=3V, 10mAI_{OUT}<5A, T_J=25℃(Note 1,2), ADJ Version			1	%
		V_{IN}=3V, 10mA<I_{OUT}<5A, T_J=25℃(Note 1,2), V_{OUT}=1.5V Fixed Version		12	15	mV
		V_{IN}=3.3V,10mA<I_{OUT}<5A, T_J=25℃ (Note 1,2), V_{OUT}=1.8V Fixed Version		15	18	mV
		V_{IN}=4V, 10mA<I_{OUT}<5A, T_J=25℃ (Note 1,2), V_{OUT}=2.5V Fixed Version		20	25	mV
		V_{IN} =5V,10mA<I_{OUT}<5A, T_J=25℃(Note 1,2), V_{OUT}=3.3V Fixed Version		26	33	mV

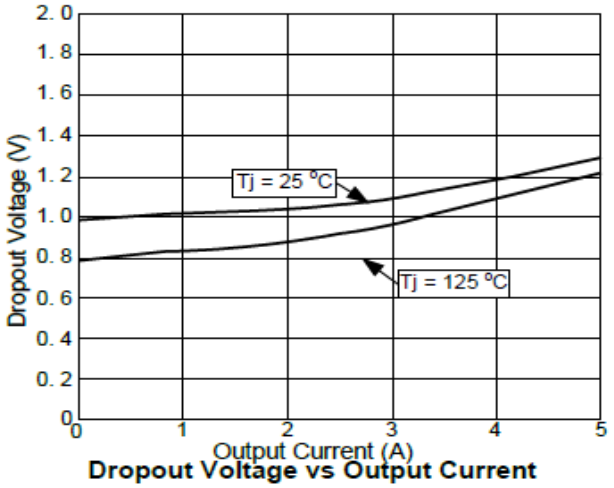
		V_{IN} =6.5V,10mA<I_{OUT}<5A, T_J=25℃ (Note 1,2), V_{OUT}=5V Fixed Version		40	50	mV
□ △Vo	Dropout Voltage	I_{OUT}=5.0A (V_{OUT}=1% V_{OUT})		1.3	1.5	V
I_L	Current Limit	V_{IN}-V_{OUT}=3V	5.1			A
Io	Minimum Load Current			5	10	mA
	Temperature Stability	I_{OUT}=10mA		0.5		%
θ_{JA}	Thermal Resistance Junction-to-Ambient (No heat sink ;No air flow)	TO-252 TO-263 TO-220		98 83 83		℃/W
	Thermal Resistance Junction-to-Ambient (Note 3)	TO-252 TO-263 TO-220		55 45 45		
θ_{JC}	Thermal Resistance Junction-to-Case	TO-252: Control Circuitry/Power Transistor TO-263: Control Circuitry/Power Transistor TO-220: Control Circuitry/Power Transistor		10 0.65/2.7 0.65/2.7		℃/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.

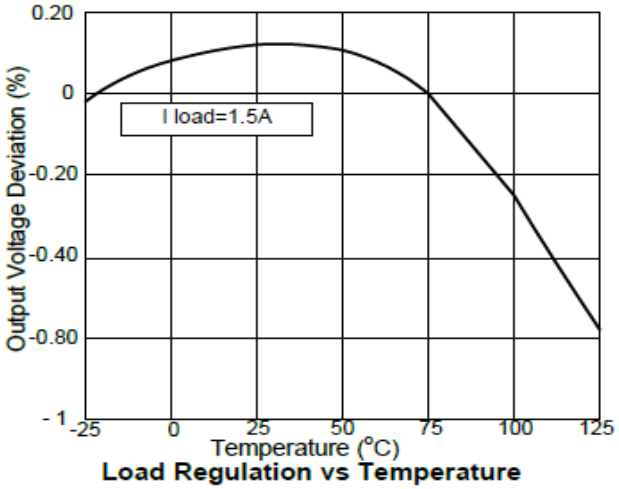
Note 2: Line and load regulation are guaranteed up to the maximum power dissipation of 15W. Power dissipation is determined by the difference between input and output and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range.

Note 3: Output is connected to the multi-layer PCB cupper area 10mm*5.5mm separately. If you need large PD or lower Tc and Tj, please connect to the large cupper area >>10mm*5.5mm (like 10mm*10mm).

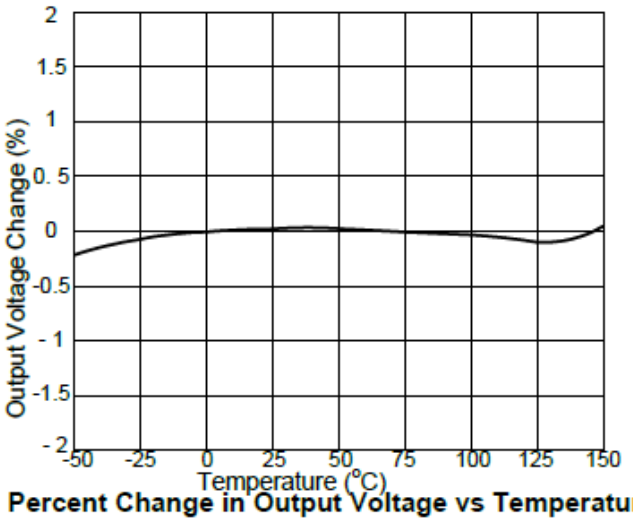
Typical Performance Characteristics



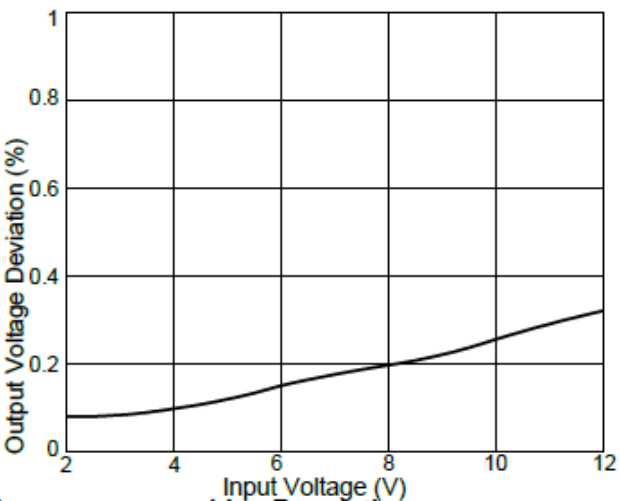
Dropout Voltage vs Output Current



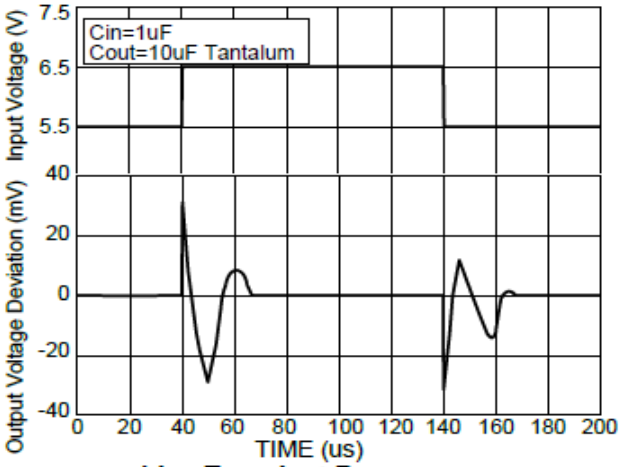
Load Regulation vs Temperature



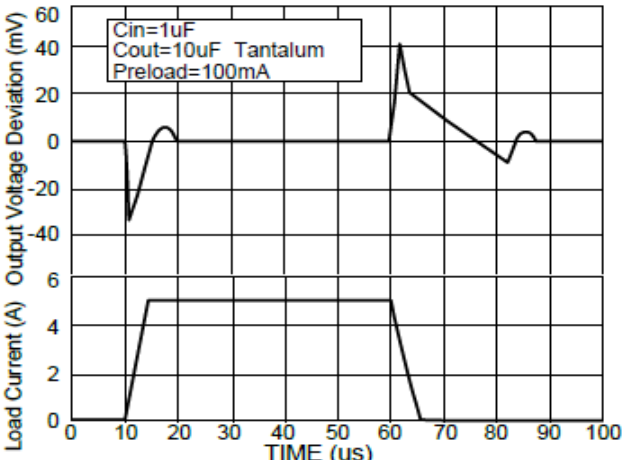
Percent Change in Output Voltage vs Temperature



Line Regulation



Line Transient Response



Load Transient Response

Applications Information

Introduction

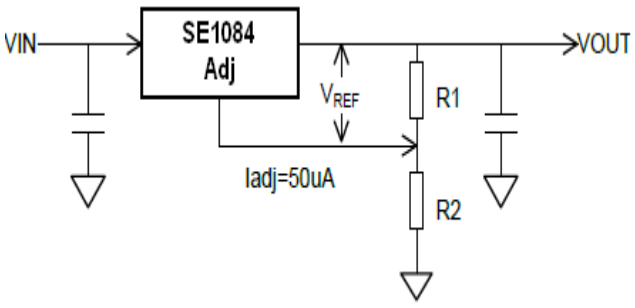
The SE1084 adjustable Low Dropout (LDO) regulator is a 3 terminal device that can easily be programmed with the addition of two external resistors to any voltages within the range of 1.25V to V_{IN}-1.5V. The SE1084 only needs 1.5V differential between V_{IN} and V_{OUT} to maintain output regulation. 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 +/-100mV including initial tolerance, load regulation and 0 to 5.0A load step.

The SE1084 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 SE1084 can be programmed to any voltages in the range of 1.25V to V_{IN}-1.5V with the addition of R1 and R2 external resistors according to the following formula:

$V_{OUT} = V_{REF} (1+ R2/R1) + Iadj * R2$, where V_{REF} = 1.25 typically, Iadj = 50uA typically R1 and R2 as shown at below



The SE1084 keeps a constant 1.25V between the output pin and the adjust pin. By placing a resistor R1 across these two pins a constant current flows through R1, adding to the Iadj current and into the R2 resistor producing a voltage equal to the (1.25/R1)*R2+Iadj*R2 which will be added to the 1.25V to set the output voltage. This is summarized in the above equation. Since the minimum load current requirement of the SE1084 is 10mA, R1 is typically selected to be 121Ω resistor so that it automatically satisfies the minimum current requirement. Notice that since Iadj is typically in the range of 50uA 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 R1=121Ω and R2=200Ω the error due to Iadj is only 0.3% of the nominal set point.

Load Regulation

Since the SE1084 is only a 3 terminal device, it is not possible to provide true remote sensing of the output voltage at the load. The best load regulation is achieved when the bottom side of R2 is connected to the load and the top-side of R1 resistor 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 re-present 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 SE1084 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. For most applications a minimum of 100uF aluminum electrolytic capacitor insures both stability and good transient response.

Thermal Design

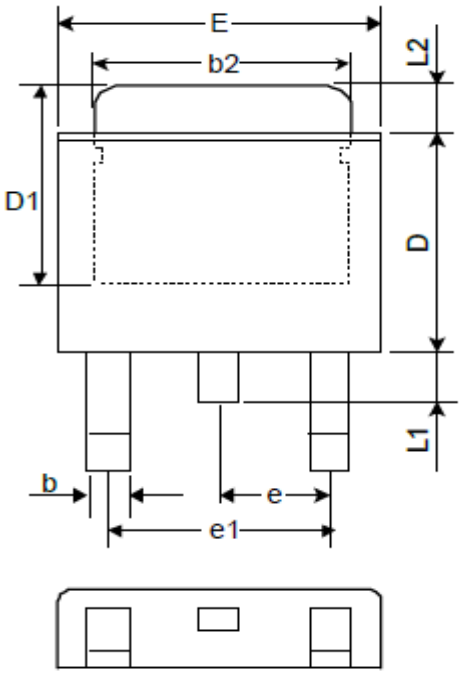
The SE1084 incorporates an internal thermal shutdown that protects the device when the junction temperature exceeds the maximum allowable junction temperature. Although this device can operate with junction temperatures in the range of 150℃, it is recommended that the selected heat sink be chosen such that during maximum continuous load operation the junction temperature is kept below the temperature.

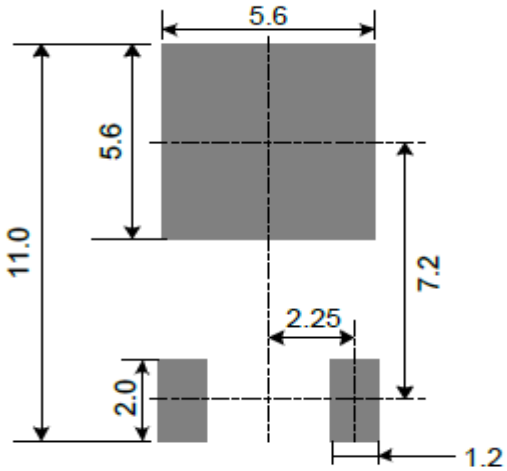
Layout Consideration

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 excessive trace inductance.

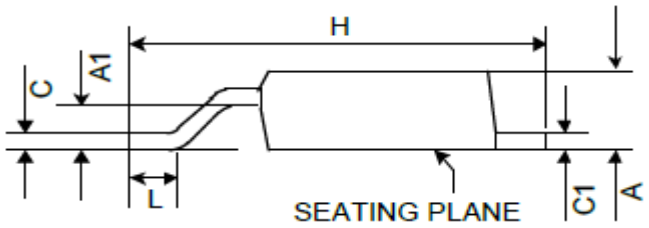
Outline Drawing For SE1084

(1) **TO252**





Land Pattern Recommendation (Unit: mm)



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	2.18	2.29	2.39	0.086	0.09	0.094
A1	-	-	0.13	-	-	0.005
b	0.51	0.71	0.89	0.02	0.028	0.035
b2	4.95	5.21	5.46	0.195	0.205	0.215
C	0.46	0.53	0.61	0.018	0.021	0.024
C1	0.46	0.53	0.58	0.018	0.021	0.023
D	5.33	5.46	6.22	0.21	0.215	0.245
D1	4.57	-	-	0.18	-	-
E	6.35	6.55	6.73	0.25	0.258	0.265
e	2.29 BSC			0.090 BSC.		
e1	4.58 BSC			0.180 BSC.		
H	9.4	9.7	10.4	0.37	0.382	0.41
L	1.4	1.6	1.78	0.055	0.063	0.07
L1	-	-	1.02	-	-	0.04
L2	1.52	1.78	2.03	0.06	0.07	0.08

Mold flash shall not exceed 0.005inch per side
JEDEC outline: TO-252

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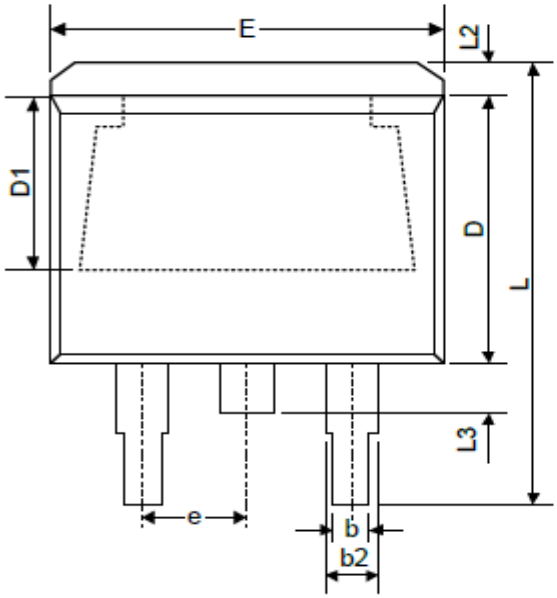
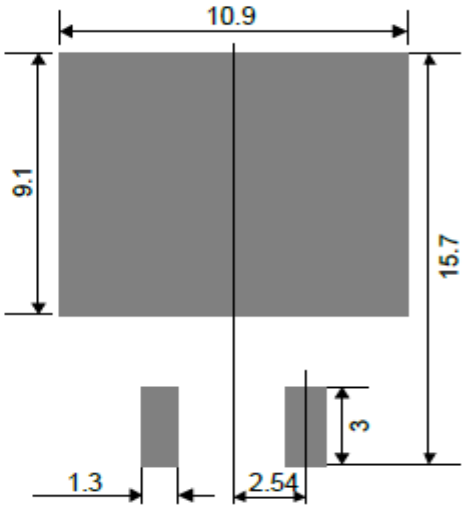
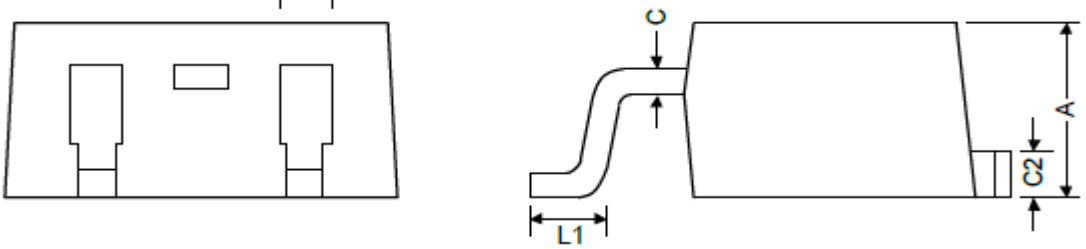
(2) **TO263**





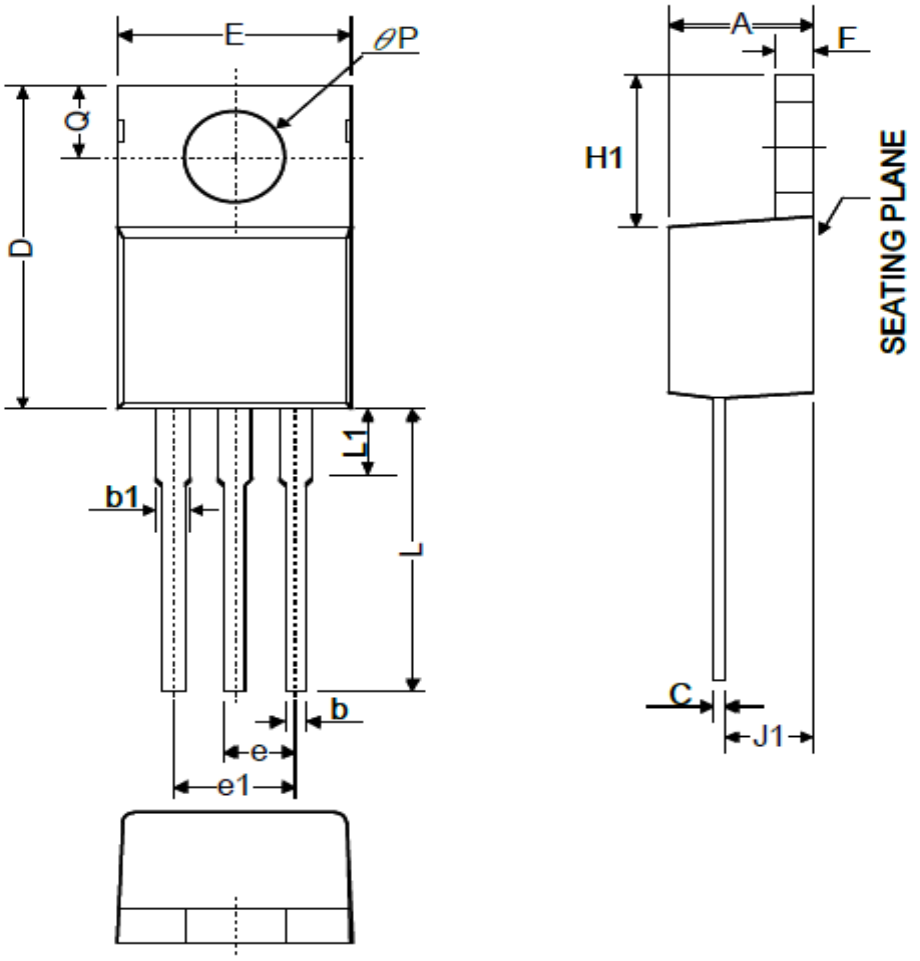
Land Pattern Recommendation (Unit: mm)



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.06	4.45	4.83	0.16	0.175	0.19
b	0.51	0.76	0.99	0.02	0.03	0.039
b2	1.14	1.47	1.78	0.045	0.058	0.07
C	0.38	0.56	0.74	0.015	0.022	0.029
C2	1.14	1.4	1.65	0.045	0.055	0.065
D	8.38	9.02	9.65	0.33	0.355	0.38
D1	5.08	-	-	0.2	-	-
E	9,65	10.2	10.7	0.38	0.4	0.42
e	2.54 BSC			0.1 BSC		
L	14.6	15.2	15.9	0.575	0.6	0.625
L1	1.78	2.29	2.79	0.07	0.09	0.11
L2	-	-	1.68	-	-	0.066
L3	-	-	1.78	-	-	0.07

Mold flash shall not exceed 0.005inch per side
JEDEC outline: TO-263 AB

(3) **TO220**



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	3.55	4.19	4.83	0.14	0.165	0.19
b1	1.14	1.45	1.78	0.045	0.057	0.07
b	0.38	0.69	1.02	0.015	0.027	0.04
C	0.36	0.48	0.61	0.014	0.019	0.024
D	14.2	15.4	16.5	0.56	0.605	0.65
E	9.7	10.2	10.7	0.38	0.4	0.42
e		2.54BSC			0.1BSC	
e1		5.08BSC			0.2BSC	
F	0.51	0.95	1.397	0.02	0.038	0.055
H1	5.84	6.35	6.86	0.23	0.25	0.27
J1	2.03	2.48	2.92	0.08	0.098	0.115
L	12.7	13.7	14.73	0.5	0.54	0.58
L1			6.35			0.25
θP	3.53	3.81	4.09	0.139	0.15	0.161
Q	2.54	2.98	3.43	0.1	0.118	0.135

Mold flash shall not exceed 0.005inch per side
JEDEC outline: TO-220 AB

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