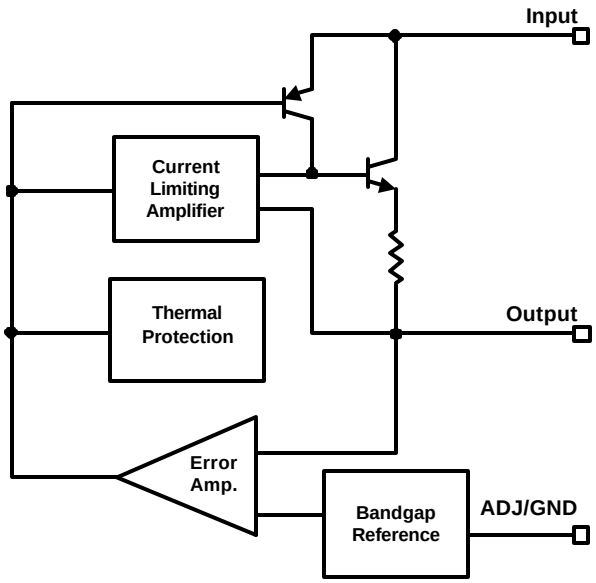
■ General Description

The AME1084 is a 5A low-dropout positive voltage regulator. It is available in fixed and adjustable output voltage versions. Overcurrent and thermal protection are integrated onto the chip. Output current will limit as it reaches the pre-set current or temperature limit. At full rated output current the dropout voltage is 1.4V (max.). AME1084 series regulators provide excellent regulation over line, load and temperature variations.

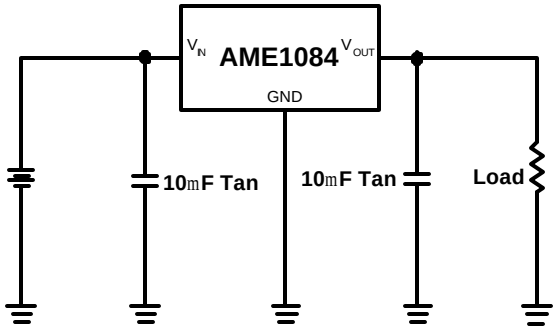
■ Functional Block Diagram



■ Features

- Low dropout voltage ----- 1.4V at 5A
- Adjustable or 3.3V fixed voltage
- Line regulation typically 0.015%
- Load regulation typically 0.05%
- Adjust pin (ADJ) current less than 90μA
- Overcurrent protection
- Thermal protection
- Available in TO-220, TO-263, TO-252

■ Typical Application

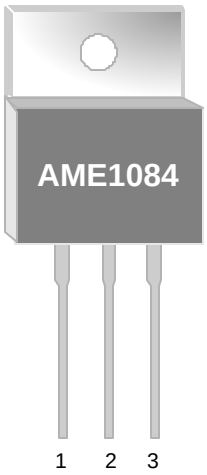


■ Applications

- High Efficiency Linear Regulators
- Post Regulators for Switching Supplies
- 5V to 3.3V Voltage Converter
- Battery Charger

■ Pin Configuration

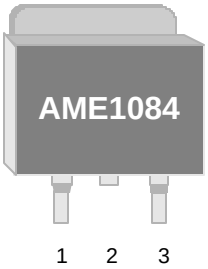
TO-220
Front View



AME1084
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

*** Die Attach:**
Soft Solder

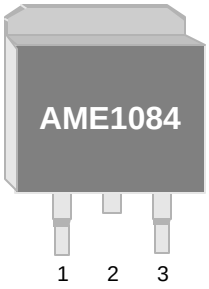
TO-252
Front View



AME1084
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

*** Die Attach:**
Soft Solder

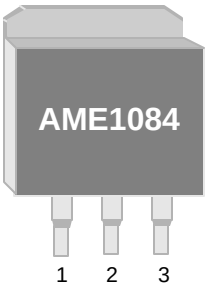
TO-263-2
Front View



AME1084
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

*** Die Attach:**
Soft Solder

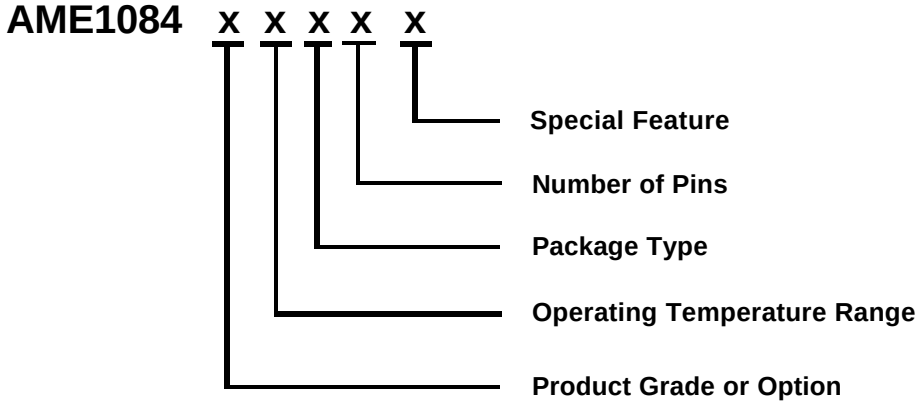
TO-263-3
Front View



AME1084
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

*** Die Attach:**
Soft Solder

■ Ordering Information



Product Grade or Option	Operating Temperature Range	Package Type	Number of Pins	Special Feature
A: ADJ B: 1.5V C: 2.5V D: 3.3V E: 1.8V	C: 0^{O}C to 70^{O}C	B: TO-220 C: TO-252 (D PACK) D: TO-263	S: 2 T: 3	Z: Lead Free

■ Ordering Information (contd.)

Part Number	Marking*	Output Voltage	Package	Operating Temp. Range
AME1084ACBT	AME1084 ACBT yyww	ADJ	TO-220	0°C to 70°C
AME1084ACBTZ	AME1084 ACBT yyww	ADJ	TO-220	0°C to 70°C
AME1084BCBT	AME1084 BCBT yyww	1.5	TO-220	0°C to 70°C
AME1084BCBTZ	AME1084 BCBT yyww	1.5	TO-220	0°C to 70°C
AME1084CCBT	AME1084 CCBT yyww	2.5	TO-220	0°C to 70°C
AME1084CCBTZ	AME1084 CCBT yyww	2.5	TO-220	0°C to 70°C
AME1084DCBT	AME1084 DCBT yyww	3.3	TO-220	0°C to 70°C
AME1084DCBTZ	AME1084 DCBT yyww	3.3	TO-220	0°C to 70°C
AME1084ECBT	AME1084 ECBT yyww	1.8	TO-220	0°C to 70°C
AME1084ECBTZ	AME1084 ECBT yyww	1.8	TO-220	0°C to 70°C
AME1084ACDT-3	AME1084 ACDT-3 yyww	ADJ	TO-263-3	0°C to 70°C
AME1084ACDT-3Z	AME1084 ACDT-3 yyww	ADJ	TO-263-3	0°C to 70°C

Note: yyww represents the date code
* A line on top of the first letter represents lead free plating such as $\overline{A}$ME1084
Please consult AME sales office or authorized Rep./Distributor for the availability of voltage and package type .

■ Ordering Information (contd.)

Part Number	Marking*	Output Voltage	Package	Operating Temp. Range
AME1084BCDT-3	AME1084 BCDT-3 yyww	1.5	TO-263-3	0°C to 70°C
AME1084BCDT-3Z	AME1084 BCDT-3 yyww	1.5	TO-263-3	0°C to 70°C
AME1084CCDT-3	AME1084 CCDT-3 yyww	2.5	TO-263-3	0°C to 70°C
AME1084CCDT-3Z	AME1084 CCDT-3 yyww	2.5	TO-263-3	0°C to 70°C
AME1084DCDT-3	AME1084 DCDT-3 yyww	3.3	TO-263-3	0°C to 70°C
AME1084DCDT-3Z	AME1084 DCDT-3 yyww	3.3	TO-263-3	0°C to 70°C
AME1084ECDT-3	AME1084 ECDT-3 yyww	1.8	TO-263-3	0°C to 70°C
AME1084ECDT-3Z	AME1084 ECDT-3 yyww	1.8	TO-263-3	0°C to 70°C
AME1084ACDT	AME1084 ACDT yyww	ADJ	TO-263-2	0°C to 70°C
AME1084ACDTZ	AME1084 ACDT yyww	ADJ	TO-263-2	0°C to 70°C
AME1084BCDT	AME1084 BCDT yyww	1.5	TO-263-2	0°C to 70°C
AME1084BCDTZ	AME1084 BCDT yyww	1.5	TO-263-2	0°C to 70°C
AME1084CCDT	AME1084 CCDT yyww	2.5	TO-263-2	0°C to 70°C
AME1084CCDTZ	AME1084 CCDT yyww	2.5	TO-263-2	0°C to 70°C

■ Ordering Information

Part Number	Marking*	Output Voltage	Package	Operating Temp. Range
AME1084DCDT	AME1084 DCDT yyww	3.3	TO-263-2	0°C to 70°C
AME1084DCDTZ	AME1084 DCDT yyww	3.3	TO-263-2	0°C to 70°C
AME1084ECDT	AME1084 ECDT yyww	1.8	TO-263-2	0°C to 70°C
AME1084ECDTZ	AME1084 ECDT yyww	1.8	TO-263-2	0°C to 70°C
AME1084ACCT	AME1084 ACCT yyww	ADJ	TO-252	0°C to 70°C
AME1084ACCTZ	AME1084 ACCT yyww	ADJ	TO-252	0°C to 70°C
AME1084BCCT	AME1084 BCCT yyww	1.5	TO-252	0°C to 70°C
AME1084BCCTZ	AME1084 BCCT yyww	1.5	TO-252	0°C to 70°C
AME1084CCCT	AME1084 CCCT yyww	2.5	TO-252	0°C to 70°C
AME1084CCCTZ	AME1084 CCCT yyww	2.5	TO-252	0°C to 70°C
AME1084DCCT	AME1084 DCCT yyww	3.3	TO-252	0°C to 70°C
AME1084DCCTZ	AME1084 DCCT yyww	3.3	TO-252	0°C to 70°C
AME1084ECCT	AME1084 ECCT yyww	1.8	TO-252	0°C to 70°C
AME1084ECCTZ	AME1084 ECCT yyww	1.8	TO-252	0°C to 70°C

■ Absolute Maximum Ratings

Parameter			Symbol	Maximum	Unit
Input Voltage			V_{IN}	12	V
Thermal Resistance* (Junction to Case)	TO-220	Soft Solder	θ_{JC}	5	°C/W
	TO-252			3	
	TO-263			4	
Thermal Resistance (Junction to Ambient)	TO-220	Soft Solder	θ_{JA}	55	
	TO-252			90	
	TO-263			85	
Internal Power Dissipation ($\Delta T = 100^oC$)	TO-220	Soft Solder	P_D	2100	mW
	TO-252			1200	
	TO-263			1600	
Operating Junction Temperature Range			T_J	0 to 125	°C
Storage Temperature Range			T_{STG}	- 65 to 150	
Lead Temperature (10 Sec)			T_{LEAD}	260	

* Measure θ_{JC} on backside center of tab.

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device

■ Electrical Specifications

AME1084Axxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Reference voltage (adjustable voltage)	V_{REF}	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA	T_J = 25°C	1.238	1.250	1.262	V
			0°C~70°C	1.225		1.275	
Line regulation	Reg_{LINE}	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA	0°C~70°C	-	0.015	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA~5A	0°C~70°C	-	0.05	0.3	%
Dropout voltage ΔVOUT, ΔVREF = 1%	V_D	I_O = 10mA ~ 5A	0°C~70°C	-	1.2	1.4	V
Current limit	I_S	V_{IN} = V_{OUT} +1.5V~12V	0°C~70°C	5.0	-	-	A
Temperature Coefficient	T_C	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA~5A		-	0.005	-	%/°C
Adjust pin current	I_{ADJ}	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA~5A	0°C~70°C	-	55	120	μA
Adjust pin current change	ΔI_{ADJ}	V_{IN} = V_{OUT} +1.5V~12V, I_O = 10mA~5A	0°C~70°C	-	0.2	5	
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA	0°C~70°C	-	0.5	-	%
Minimum load current	I_O	V_{IN} = 5V		10	-	-	mA
RMS output noise	V_N	T_J = 25°C		-	0.003	-	%V_O
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 5A	0°C~70°C	-	72	-	dB

AME1084Bxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	Vo	V_{IN} = 3V, I_O = 0A	T_J =25°C	1.485	1.500	1.515	V
			0°C~70°C	1.470		1.530	
Line regulation	Reg_{LINE}	V_{IN} = 3V~12V, I_O = 0A	0°C~70°C	-	0.015	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 3V~12V I_O = 0A~5A	0°C~70°C	-	0.05	0.3	%
Dropout voltage ΔVOUT, ΔVREF = 1%	V_D	I_O = 0A ~ 5A	0°C~70°C	-	1.2	1.4	V
Current limit	I_S	V_{IN} = 3V~12V	0°C~70°C	5.0	-	-	A
Quiescent current (fixed model)	I_Q	V_{IN} = 5V, I_O = 0A~5A	0°C~70°C	-	12	13	mA
Temperature Coefficient	T_C	V_{IN} = 3V~12V, I_O = 0A~5A		-	0.005	-	%/°C
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA	0°C~70°C	-	0.5	-	%
RMS output noise	V_N	T_J = 25°C		-	0.003	-	%V_O
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 5A	0°C~70°C	-	72	-	dB

■ Electrical Specifications (contd.)

AME1084Cxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	Vo	V_{IN} = 4V~12V, I_O = 0A	T_J = 25°C	2.475	2.500	2.525	V
			0°C~70°C	2.450		2.550	
Line regulation	Reg_{LINE}	V_{IN} = 4V~12V, I_O = 0A	0°C~70°C	-	0.015	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 4V~12V I_O = 0A~5A	0°C~70°C	-	0.05	0.3	%
Dropout voltage ΔVOUT, ΔVREF = 1%	V_D	I_O = 0A ~ 5A	0°C~70°C	-	1.2	1.4	V
Current limit	I_S	V_{IN} = 4V~12V	0°C~70°C	5.0	-	-	A
Quiescent current (fixed model)	I_Q	V_{IN} = 5V, I_O = 0A~5A	0°C~70°C	-	12	13	mA
Temperature Coefficient	T_C	V_{IN} = 4V~12V, I_O = 0A~5A		-	0.005	-	%/°C
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA	0°C~70°C	-	0.5	-	%
RMS output noise	V_N	T_J = 25°C		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 5A	0°C~70°C	-	72	-	dB

AME1084Dxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	Vo	V_{IN} = 4.8V~12V, I_O = 0A	T_J = 25°C	3.267	3.300	3.333	V
			0°C~70°C	3.234		3.366	
Line regulation	Reg_{LINE}	V_{IN} = 4.8V~12V, I_O = 0A	0°C~70°C	-	0.015	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 4.8V~12V I_O = 0A~5A	0°C~70°C	-	0.05	0.3	%
Dropout voltage ΔVOUT, ΔVREF = 1%	V_D	I_O = 0A ~ 5A	0°C~70°C	-	1.2	1.4	V
Current limit	I_S	V_{IN} = 4.8V~12V	0°C~70°C	5.0	-	-	A
Quiescent current (fixed model)	I_Q	V_{IN} = 5V, I_O = 0A~5A	0°C~70°C	-	12	13	mA
Temperature Coefficient	T_C	V_{IN} = 4.8V~12V, I_O = 0A~5A		-	0.005	-	%/°C
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA	0°C~70°C	-	0.5	-	%
RMS output noise	V_N	T_J = 25°C		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 5A	0°C~70°C	-	72	-	dB

■ Electrical Specifications (contd.)

AME1084Exxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage	V_O	V_{IN} = 3.3V~12V, I_O = 0A	T_J = 25°C	1.782	1.800	1.818	V
			0°C~70°C	1.764	1.800	1.836	
Line regulation	Reg_{LINE}	V_{IN} = 3.3V~12V, I_O = 0A	0°C~70°C	-	0.015	0.2	%
Load regulation	Reg_{LOAD}	V_{IN} = 3.3V~12V I_O = 0A~5A	0°C~70°C	-	0.05	0.3	
Dropout voltage	V_D	I_O = 0A~5A,	0°C~70°C	-	1.2	1.4	V
Current limit	I_S	V_{IN} = 3.3V~12V	0°C~70°C	5.0	-	-	A
Quiescent Current	I_Q	V_{IN} = 5V, I_O = 0A~5A	0°C~70°C	-	12	13	mA
Temp. Coefficient	T_C	V_{IN} = 3.3V~12V, I_O = 0A~5A		-	0.005	-	%/°C
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA	0°C~70°C	-	0.5	-	%
RMS output noise	V_N	T_J = 25°C		-	0.003	-	$\%V_O$
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 5A	0°C~70°C	-	72	-	dB

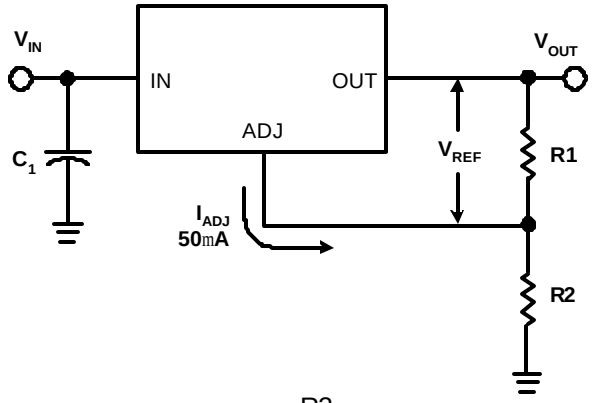
■ Application Description

1. Output voltage adjustment

Like most regulators, the AME1084 regulates the output by comparing the output voltage to an internally generated reference voltage. On the adjustable version, the V_{REF} is available externally as 1.25V between V_{OUT} and ADJ. The voltage ratio formed by R1 and R2 should be set to conduct 10mA (minimum output load). The output voltage is given by the following equation:

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

On fixed versions of AME1084, the voltage divider is provided internally.



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

2. Thermal protection

AME1084 has thermal protection which limits junction temperature to 150°C. However, device functionality is only guaranteed to a maximum junction temperature of +125°C.

The power dissipation and junction temperature for AME1084 in TO-220 package are given by

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

$$T_{JUNCTION} = T_{AMBIENT} + (P_D \times \theta_{JA})$$

Note: $T_{JUNCTION}$ must not exceed 125°C

3. Current limit protection

AME1084 is protected against overload conditions. Current protection is triggered at typical 7.5A.

4. Stability and load regulation

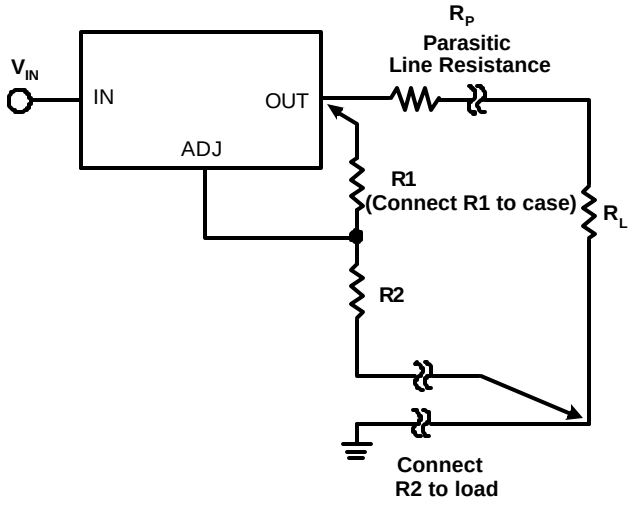
AME1084 requires a capacitor from V_{OUT} to GND to provide compensation feedback to the internal gain stage. This is to ensure stability at the output terminal. Typically, a 10µF tantalum or 50µF aluminum electrolytic is sufficient.

(Note: It is important that the ESR for this capacitor does not exceed 0.5W.)

The output capacitor does not have a theoretical upper limit and increasing its value will increase stability. C_{OUT} = 100µF or more is typical for high current regulator design.

For the adjustable version, the best load regulation is accomplished when the top of the resistor divider (R1) is connected directly to the output pin of the AME1084. When so connected, R_P is not multiplied by the divider ratio.

For fixed output versions, the top of R1 is internally connected to the output. The ground pin can be connected to low side of the load to eliminate ground loop errors.



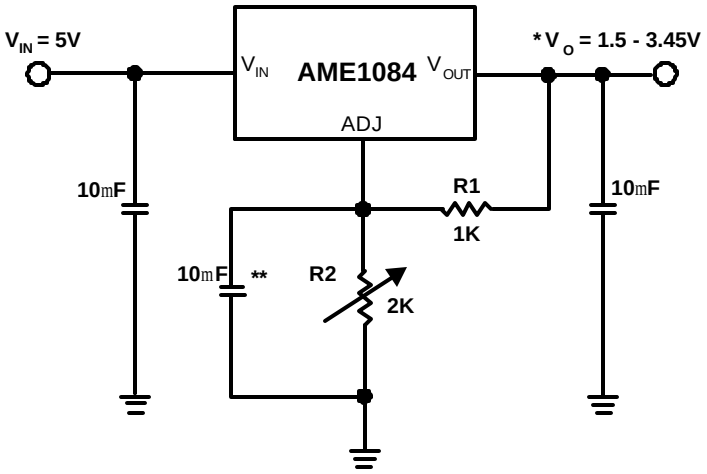
5. Thermal consideration

The AME1084 series contain thermal limiting circuitry designed to protect itself for over-temperature conditions. Even for normal load conditions, maximum junction temperature ratings must not be exceed. As mention in thermal protection section, we need to consider all sources of thermal resistance between junction and ambient. It includes junction-to-case, case-to-heat-sink interface and heat sink thermal resistance itself.

Junction-to-case thermal resistance is specified from the IC junction to the bottom of the case directly below the die. Proper mounting is required to ensure the best possible thermal flow from this area of the package to the heat sink. The case of all devices in this series is electrically connected to the output. Therefore, if the case of the device must be electrically isolated, a thermally conductive spacer is recommended.

■ Advanced Applications

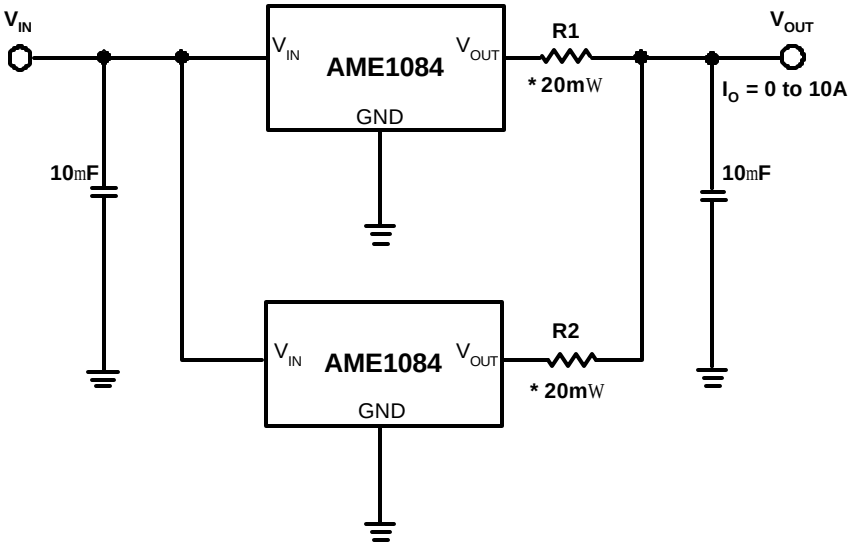
Adjustable Output Voltage



Note: * $V_{OUT} = V_{REF} (1 + \frac{R2}{R1}) + I_{ADJ} \times R2$

** Optional for improved ripple rejection

Paralleling Regulators

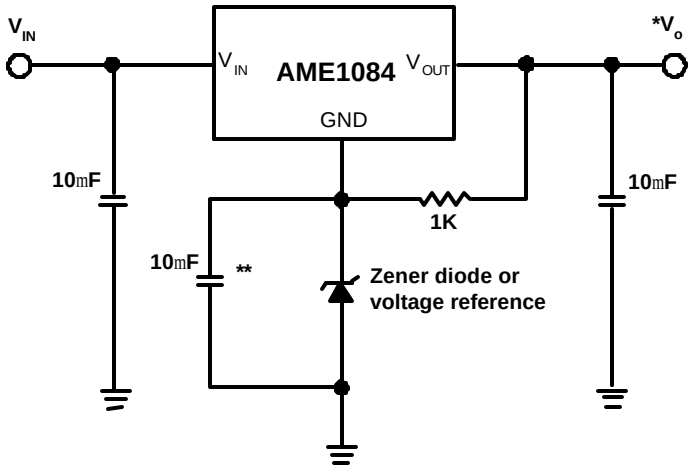


Note: * 20mΩ is ballast resistance

The inter - connection of #18 wire could act as ballast resistance

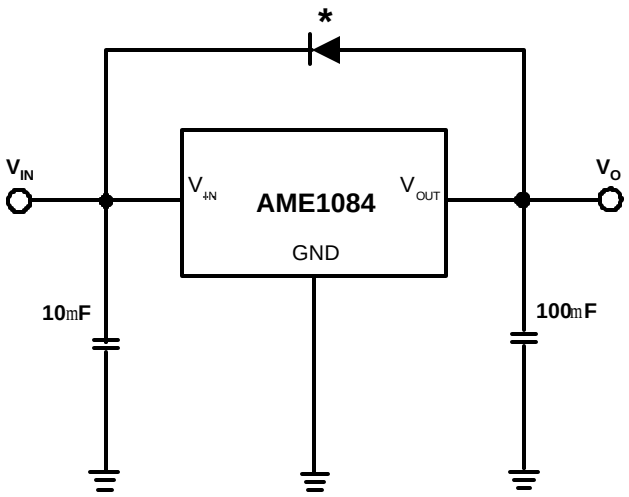
■ Advanced Applications (contd.)

Regulator with Reference



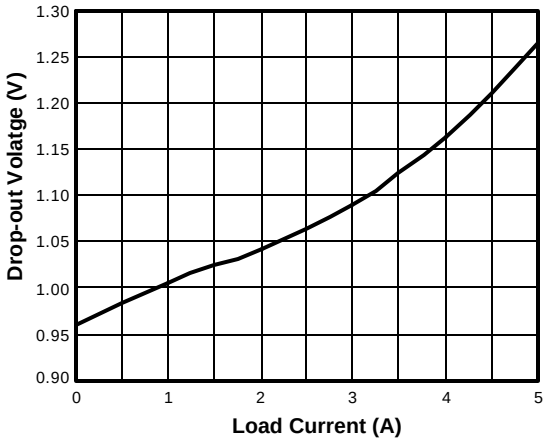
Note: * $V_O = V_{REF} + V_Z$ (V_Z: breakdown voltage of Zener diode)
** Optional for improved ripple rejection

Regulator with Reverse Diode Protection

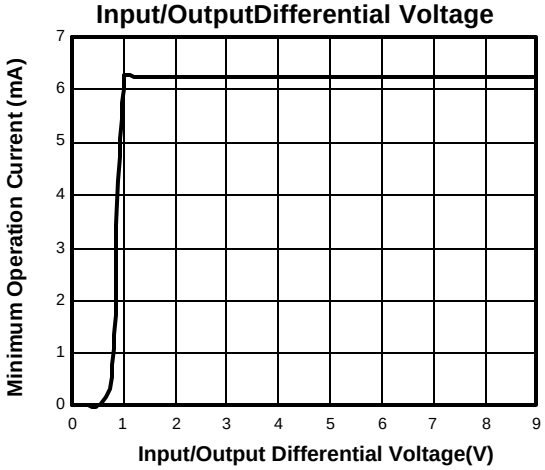


■ Performance Characteristics

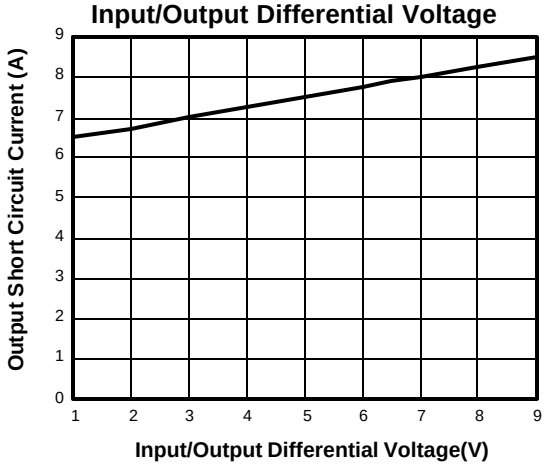
Drop Out Voltage vs. Load Current



Minimum Operation Current vs. Input/OutputDifferential Voltage



Output Short Circuit Current vs. Input/Output Differential Voltage



■ External Resistor Divider Table for Customized Voltage

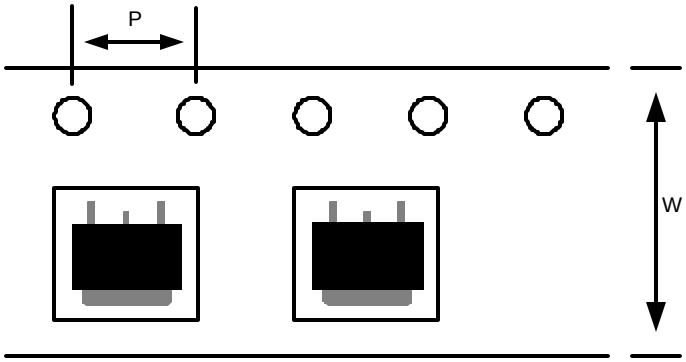
R1 (Ohm)	100	102	105	107	110	113	115	118	121	124
Vout	R2(Ohm)=(Vout-1.25)*R1/(1.25+50u*R1)									
1.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.30	3.984	4.063	4.182	4.262	4.381	4.500	4.579	4.698	4.817	4.936
1.35	7.968	8.127	8.365	8.524	8.761	8.999	9.158	9.396	9.633	9.871
1.40	11.95	12.19	12.55	12.79	13.14	13.50	13.74	14.09	14.45	14.81
1.45	15.94	16.25	16.73	17.05	17.52	18.00	18.32	18.79	19.27	19.74
1.50	19.92	20.32	20.91	21.31	21.90	22.50	22.89	23.49	24.08	24.68
1.55	23.90	24.38	25.09	25.57	26.28	27.00	27.47	28.19	28.90	29.61
1.60	27.89	28.44	29.28	29.83	30.67	31.50	32.05	32.88	33.72	34.55
1.65	31.87	32.51	33.46	34.09	35.05	36.00	36.63	37.58	38.53	39.48
1.70	35.86	36.57	37.64	38.36	39.43	40.50	41.21	42.28	43.35	44.42
1.75	39.84	40.63	41.82	42.62	43.81	45.00	45.79	46.98	48.17	49.36
1.80	43.82	44.70	46.01	46.88	48.19	49.50	50.37	51.68	52.98	54.29
1.85	47.81	48.76	50.19	51.14	52.57	54.00	54.95	56.37	57.80	59.23
1.90	51.79	52.82	54.37	55.40	56.95	58.50	59.53	61.07	62.62	64.16
1.95	55.78	56.89	58.55	59.66	61.33	63.00	64.11	65.77	67.43	69.10
2.00	59.76	60.95	62.74	63.93	65.71	67.49	68.68	70.47	72.25	74.03
2.05	63.75	65.01	66.92	68.19	70.09	71.99	73.26	75.17	77.07	78.97
2.10	67.73	69.08	71.10	72.45	74.47	76.49	77.84	79.86	81.88	83.90
2.15	71.71	73.14	75.28	76.71	78.85	80.99	82.42	84.56	86.70	88.84
2.20	75.70	77.21	79.47	80.97	83.23	85.49	87.00	89.26	91.52	93.77
2.25	79.68	81.27	83.65	85.24	87.61	89.99	91.58	93.96	96.33	98.71
2.30	83.67	85.33	87.83	89.50	92.00	94.49	96.16	98.65	101.2	103.6
2.35	87.65	89.40	92.01	93.76	96.38	98.99	100.7	103.4	106.0	108.6
2.40	91.63	93.46	96.20	98.02	100.8	103.5	105.3	108.1	110.8	113.5
2.45	95.62	97.52	100.4	102.3	105.1	108.0	109.9	112.7	115.6	118.5
2.50	99.60	101.6	104.6	106.5	109.5	112.5	114.5	117.4	120.4	123.4
2.55	103.6	105.6	108.7	110.8	113.9	117.0	119.1	122.1	125.2	128.3
2.60	107.6	109.7	112.9	115.1	118.3	121.5	123.6	126.8	130.1	133.3
2.65	111.6	113.8	117.1	119.3	122.7	126.0	128.2	131.5	134.9	138.2
2.70	115.5	117.8	121.3	123.6	127.0	130.5	132.8	136.2	139.7	143.1
2.75	119.5	121.9	125.5	127.9	131.4	135.0	137.4	140.9	144.5	148.1
2.80	123.5	126.0	129.7	132.1	135.8	139.5	141.9	145.6	149.3	153.0
2.85	127.5	130.0	133.8	136.4	140.2	144.0	146.5	150.3	154.1	157.9
2.90	131.5	134.1	138.0	140.6	144.6	148.5	151.1	155.0	159.0	162.9
2.95	135.5	138.2	142.2	144.9	148.9	153.0	155.7	159.7	163.8	167.8
3.00	139.4	142.2	146.4	149.2	153.3	157.5	160.3	164.4	168.6	172.7
3.05	143.4	146.3	150.6	153.4	157.7	162.0	164.8	169.1	173.4	177.7
3.10	147.4	150.3	154.8	157.7	162.1	166.5	169.4	173.8	178.2	182.6

■ External Resistor Divider Table for Customized Voltage (contd.)

R1 (Ohm)	100	102	105	107	110	113	115	118	121	124
Vout	R2(Ohm)=(Vout-1.25)*R1/(1.25+50u*R1)									
3.15	151.4	154.4	158.9	161.9	166.5	171.0	174.0	178.5	183.0	187.5
3.20	155.4	158.5	163.1	166.2	170.8	175.5	178.6	183.2	187.9	192.5
3.25	159.4	162.5	167.3	170.5	175.2	180.0	183.2	187.9	192.7	197.4
3.30	163.3	166.6	171.5	174.7	179.6	184.5	187.7	192.6	197.5	202.4
3.35	167.3	170.7	175.7	179.0	184.0	189.0	192.3	197.3	202.3	207.3
3.40	171.3	174.7	179.8	183.3	188.4	193.5	196.9	202.0	207.1	212.2
3.45	175.3	178.8	184.0	187.5	192.8	198.0	201.5	206.7	211.9	217.2
3.50	179.3	182.9	188.2	191.8	197.1	202.5	206.1	211.4	216.8	222.1
3.55	183.3	186.9	192.4	196.0	201.5	207.0	210.6	216.1	221.6	227.0
3.60	187.3	191.0	196.6	200.3	205.9	211.5	215.2	220.8	226.4	232.0
3.65	191.2	195.0	200.8	204.6	210.3	216.0	219.8	225.5	231.2	236.9
3.70	195.2	199.1	204.9	208.8	214.7	220.5	224.4	230.2	236.0	241.8
3.75	199.2	203.2	209.1	213.1	219.0	225.0	228.9	234.9	240.8	246.8
3.80	203.2	207.2	213.3	217.3	223.4	229.5	233.5	239.6	245.7	251.7
3.85	207.2	211.3	217.5	221.6	227.8	234.0	238.1	244.3	250.5	256.6
3.90	211.2	215.4	221.7	225.9	232.2	238.5	242.7	249.0	255.3	261.6
3.95	215.1	219.4	225.9	230.1	236.6	243.0	247.3	253.7	260.1	266.5
4.00	219.1	223.5	230.0	234.4	240.9	247.5	251.8	258.4	264.9	271.5
4.05	223.1	227.6	234.2	238.7	245.3	252.0	256.4	263.1	269.7	276.4
4.10	227.1	231.6	238.4	242.9	249.7	256.5	261.0	267.8	274.6	281.3
4.15	231.1	235.7	242.6	247.2	254.1	261.0	265.6	272.5	279.4	286.3
4.20	235.1	239.7	246.8	251.4	258.5	265.5	270.2	277.2	284.2	291.2
4.25	239.0	243.8	250.9	255.7	262.8	270.0	274.7	281.9	289.0	296.1
4.30	243.0	247.9	255.1	260.0	267.2	274.5	279.3	286.6	293.8	301.1
4.35	247.0	251.9	259.3	264.2	271.6	279.0	283.9	291.3	298.6	306.0
4.40	251.0	256.0	263.5	268.5	276.0	283.5	288.5	296.0	303.5	310.9
4.45	255.0	260.1	267.7	272.8	280.4	288.0	293.1	300.7	308.3	315.9
4.50	259.0	264.1	271.9	277.0	284.7	292.5	297.6	305.4	313.1	320.8
4.55	262.9	268.2	276.0	281.3	289.1	297.0	302.2	310.1	317.9	325.7
4.60	266.9	272.2	280.2	285.5	293.5	301.5	306.8	314.8	322.7	330.7
4.65	270.9	276.3	284.4	289.8	297.9	306.0	311.4	319.5	327.5	335.6
4.70	274.9	280.4	288.6	294.1	302.3	310.5	315.9	324.2	332.4	340.6
4.75	278.9	284.4	292.8	298.3	306.7	315.0	320.5	328.8	337.2	345.5
4.80	282.9	288.5	297.0	302.6	311.0	319.5	325.1	333.5	342.0	350.4
4.85	286.9	292.6	301.1	306.8	315.4	324.0	329.7	338.2	346.8	355.4
4.90	290.8	296.6	305.3	311.1	319.8	328.5	334.3	342.9	351.6	360.3
4.95	294.8	300.7	309.5	315.4	324.2	333.0	338.8	347.6	356.4	365.2
5.00	298.8	304.8	313.7	319.6	328.6	337.5	343.4	352.3	361.3	370.2

■ Tape and Reel Dimension

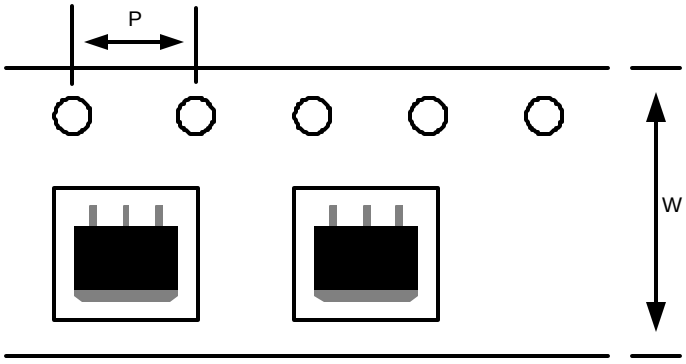
TO-252



Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
TO-252	16.0±0.1 mm	4.0±0.1 mm	2500pcs	330±1 mm

TO-263

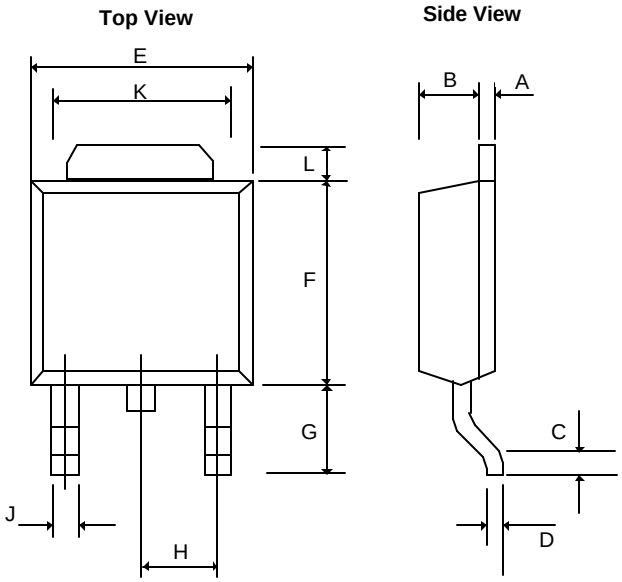


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
TO-263-3L	24.0±0.1 mm	4.0±0.1 mm	800pcs	330±1 mm
TO-263-2L	24.0±0.1 mm	4.0±0.1 mm	800pcs	330±1 mm

■ Package Dimension

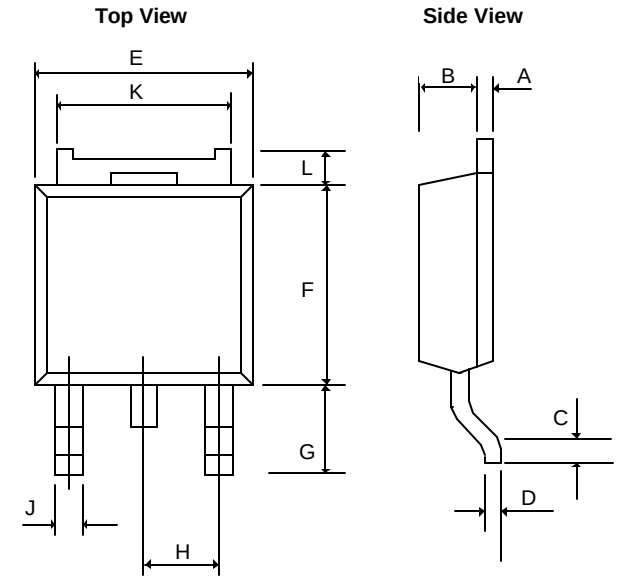
TO-252(DPAK)-EIAJ



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.43	0.58	0.0169	0.0230
B	1.60	1.95	0.0630	0.0768
C	0.51	1.78	0.0200	0.0701
D	0.43	0.60	0.0169	0.0236
E	6.35	6.80	0.2500	0.2677
F	5.36	7.20	0.2110	0.2835
G	2.20	3.00	0.0866	0.1181
H	-	* 2.30	-	*0.0906
J	-	0.97	-	0.0380
K	5.20	5.50	0.2047	0.2165
L	1.40REF		0.055REF	

***: Typical Value**
Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

TO-252(DPAK)-JEDC

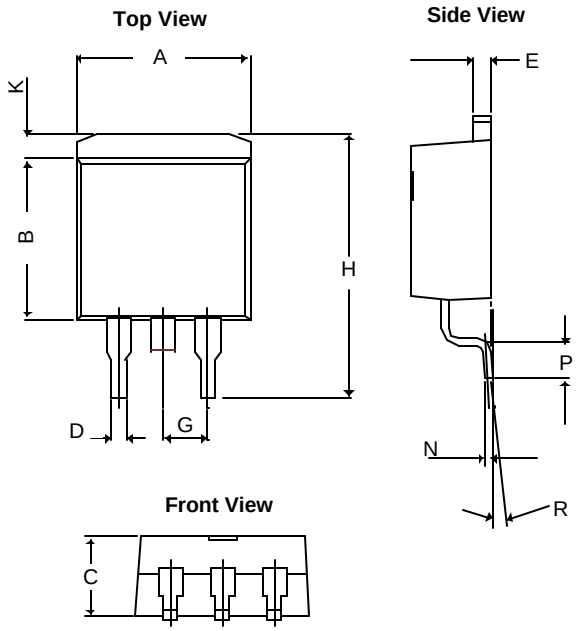


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.49	0.51	0.0192	0.0201
B	1.79	1.81	0.0704	0.0713
C	0.55	-	0.0216	-
D	0.49	0.51	0.0192	0.0201
E	6.58	6.62	0.2590	0.2606
F	6.08	6.12	0.2393	0.2409
G	2.68	2.72	0.1055	0.1071
H	* 2.30REF		* 0.0906REF	
J	0.96		0.0377	
K	5.31	5.37	0.2090	0.2114
L	0.68	0.72	0.0267	0.0283

***: Typical Value**
Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

■ Package Dimension

TO-263-2(D²PAK)

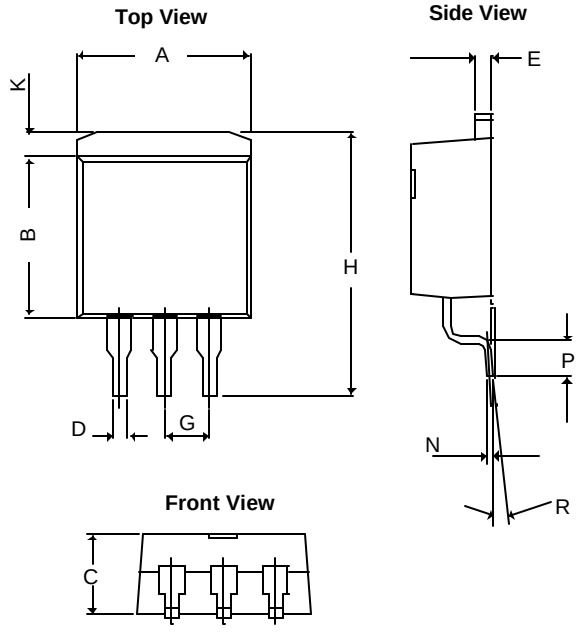


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.65	10.668	0.380	0.420
B	8.28	9.66	0.326	0.380
C	4.06	4.83	0.160	0.190
D	0.50	1.36	0.020	0.054
E	1.14	1.45	0.045	0.057
G	*2.54		*0.100	
H	14.60	15.875	0.5748	0.625
K	0.99	2.93	0.03898	0.11535
N	0.381REF		0.015REF	
P	2.28	2.80	0.08976	0.11024
R	0°	8°	0°	8°

***: Typical Value**

Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

TO-263-3(D²PAK)



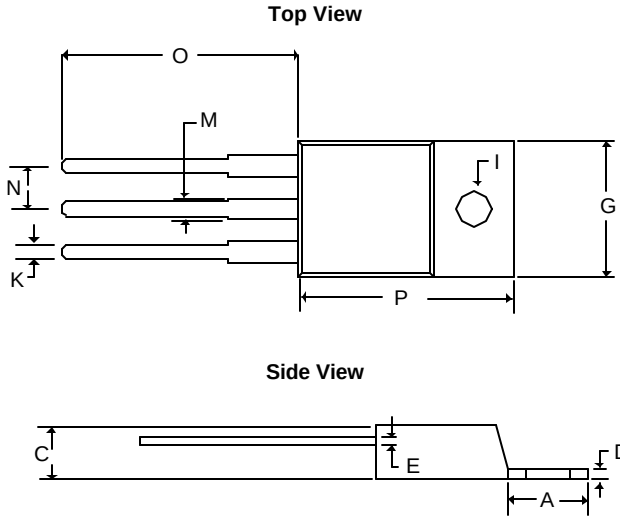
SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.65	10.42	0.380	0.410
B	8.28	9.66	0.326	0.380
C	4.06	4.83	0.160	0.190
D	0.50	1.36	0.020	0.054
E	1.14	1.45	0.045	0.057
G	*2.54		*0.100	
H	14.60	15.60	0.5748	0.61417
K	0.99	2.93	0.03898	0.11535
N	0.381REF		0.015REF	
P	2.28	2.80	0.08976	0.11024
R	0°	8°	0°	8°

***: Typical Value**

Notes:
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness Minimum lead thickness is the minimum thickness of base material.

■ Package Dimension

TO-220



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.58	7.49	0.2197	0.2949
C	2.03	4.83	0.0800	0.1902
D	0.50	1.40	0.0197	0.0550
E	0.30	1.15	0.0118	0.0453
G	9.65	10.67	0.3799	0.4200
I	3.53	4.09	0.1390	0.1610
K	0.50	1.15	0.0197	0.0453
M	1.14	1.78	0.0449	0.0700
N	2.28	2.80	0.0898	0.1102
O	12.70	14.74	0.5000	0.5803
P	14.22	16.51	0.5600	0.6500

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