■ General Description

The AME1085 is a 3A 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.). AME1085 series regulators provide excellent regulation over line, load and temperature variations.

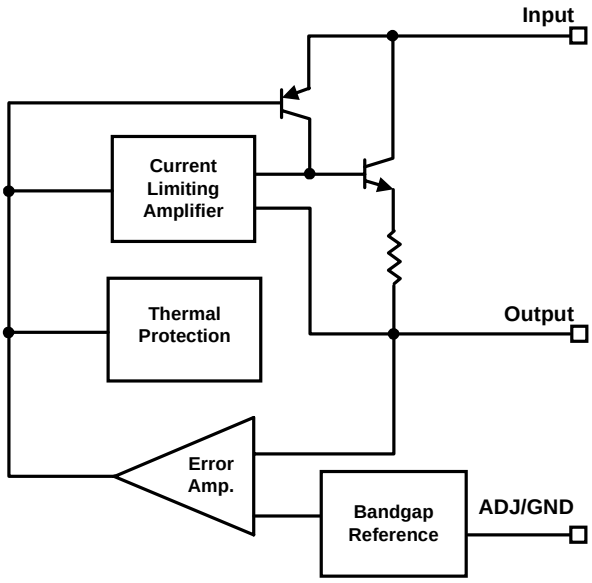
■ Features

- Low dropout voltage 1.2V typically at 3A
- 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-263, TO-252, TO-220

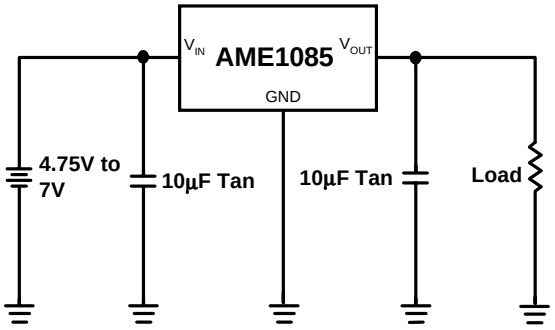
■ Applications

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

■ Functional Block Diagram

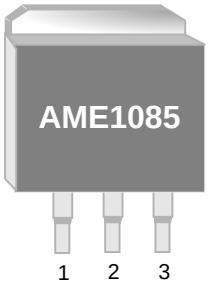


■ Typical Application



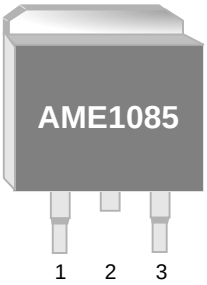
■ Pin Configuration

TO-263-3
Front View



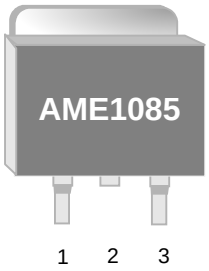
AME1085
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-263-2
Front View



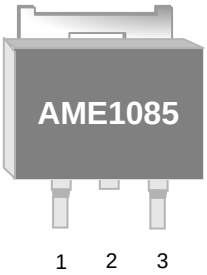
AME1085
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-252-2
Front View



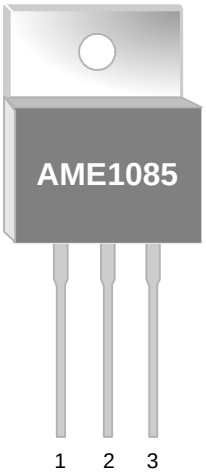
AME1085
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-252-2
Front View



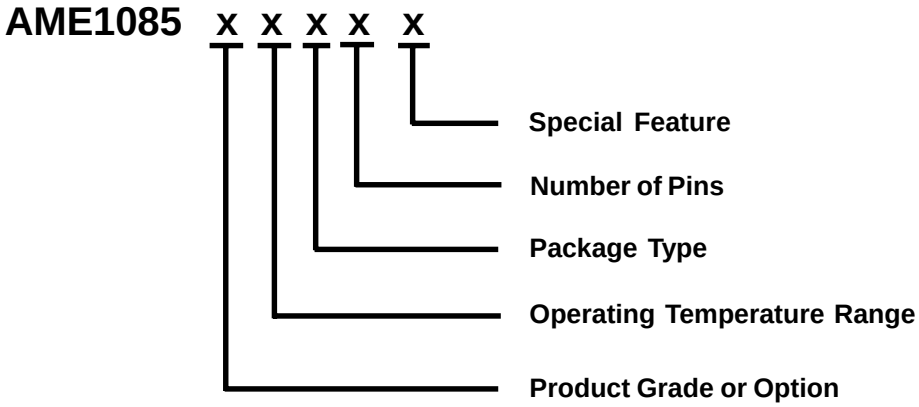
AME1085
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

TO-220
Front View



AME1085
1. ADJ / GND
2. V_{OUT}
3. V_{IN}

■ Ordering Information



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

■ Ordering Information

Part Number	Marking	Output Voltage	Package	Operating Temp. Range
AME1085ACBT	AME1085 ACBT yyww	ADJ	TO-220	0°C to 70°C
AME1085DCBT	AME1085 DCBT yyww	3.3	TO-220	0°C to 70°C
AME1085ACDT-3	AME1085 ACDT-3 yyww	ADJ	TO-263-3	0°C to 70°C
AME1085DCDT-3	AME1085 DCDT-3 yyww	3.3	TO-263-3	0°C to 70°C
AME1085ACDT	AME1085 ACDT yyww	ADJ	TO-263-2	0°C to 70°C
AME1085DCDT	AME1085 DCDT yyww	3.3	TO-263-2	0°C to 70°C
AME1085AMCT	AME1085 AMCT yyww	ADJ	TO-252-2	0°C to 70°C
AME1085MCT*	AME1085 MCT yyww	3.3	TO-252-2	0°C to 70°C

* This differs from our standard part numbering scheme due to historical precedent.

Please consult AME sales office or authorized Rep./Distributor for other voltage accuracy and package type availability.

■ Absolute Maximum Ratings

Parameter		Symbol	Maximum	Unit
Input Voltage		V_{IN}	7	V
Thermal Resistance (Junction to Case)	TO-220	θ_{JC}	2.5	$^oC/W$
	TO-263		2.5	
	TO-252		5	
Thermal Resistance (Junction to Ambient)	TO-220	θ_{JA}	50	
	TO-263		60	
	TO-252		90	
Operating Junction Temperature Range		T_J	0 to 125	^oC
Storage Temperature Range		T_{STG}	- 65 to 150	
Lead Temperature (10 Sec)		T_{LEAD}	260	
Internal Power Dissipation ($\Delta T = 100^oC$)	TO-220	P_D	3000	mW
	TO-252		1200	
	TO-263		2800	

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

■ Electrical Specifications

AME1085Axxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Reference voltage (adjustable voltage)	V_{REF}	V_{IN} = 5V, I_O = 10mA	T_J =25°C	1.238	1.250	1.262	V
			Over temp.	1.225		1.275	
Line regulation	Reg_{LINE}	V_{IN} = 2.75 - 7V, I_O = 10mA	T_J =25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 10mA - 3A	T_J =25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV_{OUT}, ΔV_{REF} = 1%	V_D	I_O = 10mA - 3A	T_J =25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 2.75 - 7V, Over temp.		3.0	-	-	A
Temperature Coefficient	T_C	V_{IN} = 2.75 - 7V, I_O = 10mA - 3A		-	0.005	-	%/°C
Adjust pin current	I_{ADJ}	V_{IN} = 2.75~7V, I_O = 10mA~3A	T_J = 25°C	-	55	-	μA
			Over Temp.	-		120	
Adjust pin current change	ΔI_{ADJ}	V_{IN} = 2.75~7V, I_O = 10mA~3A, Over Temp.		-	0.2	5	
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA, Over temp.		-	0.5	-	%
Minimum load current	I_O	V_{IN} = 5V		10	-	-	mA
RMS output noise	V_N	T_J =25°C		-	0.003	-	%V_0
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 3A, Over temp.		-	72	-	dB

AME1085Dxxx

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	Vo	V_{IN} = 5V, I_O = 0A	T_J =25°C	3.267	3.300	3.333	V
			Over temp.	3.234		3.366	
Line regulation	Reg_{LINE}	V_{IN} =4.5 - 7V, I_O = 0A	T_J =25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg_{LOAD}	V_{IN} = 5V, I_O = 0A - 3A	T_J =25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV_{OUT}, ΔV_{REF} = 1%	V_D	V_{IN} = 4.5 - 7V, I_O = 0A - 3A	T_J =25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I_S	V_{IN} = 4.5 - 7V, Over temp.		3.0	-	-	A
Quiescent current (fixed model)	I_Q	V_{IN} = 5V, Io=0A - 3A, Over temp.		-	12	13	mA
Temperature Coefficient	T_C	V_{IN} = 4.5 - 7V, I_O = 0A - 3A		-	0.005	-	%/°C
Temperature stability	T_S	V_{IN} = 5V, I_O = 500mA, Over temp.		-	0.5	-	%
RMS output noise	V_N	T_J =25°C		-	0.003	-	%V_0
Ripple rejection ratio	R_A	V_{IN} = 5V, I_O = 3A, Over temp.		60	72	-	dB

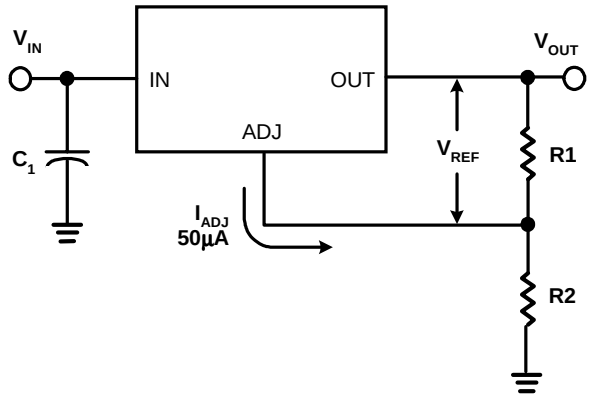
■ Application Description

1. Output voltage adjustment

Like most regulators, the AME1085 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 AME1085, the voltage divider is provided internally.



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

2. Thermal protection

AME1085 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 AME1085 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

AME1085 is protected against overload conditions. Current protection is triggered at typical 4.5A.

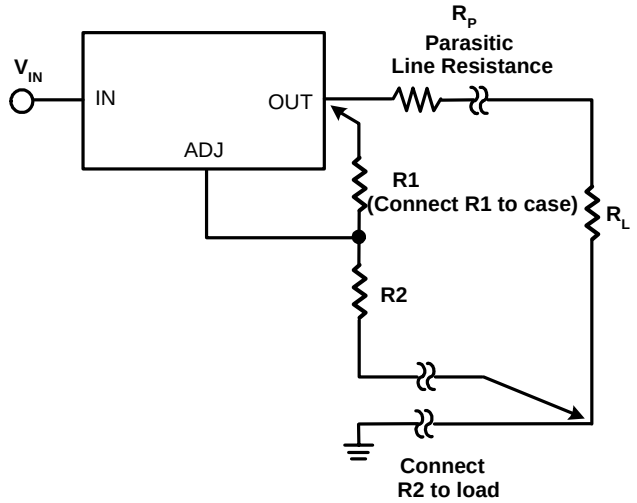
4. Stability and load regulation

AME1085 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 0.5Ω.)

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 AME1085. 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 and ground pin can be connected to low side of the load.



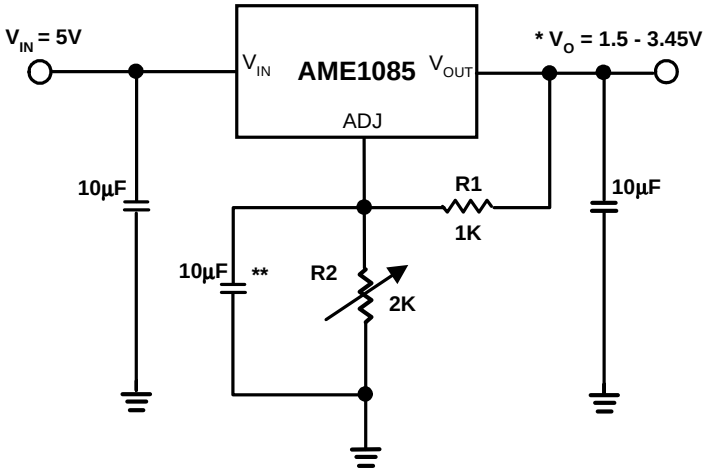
5. Thermal consideration

The AME1085 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

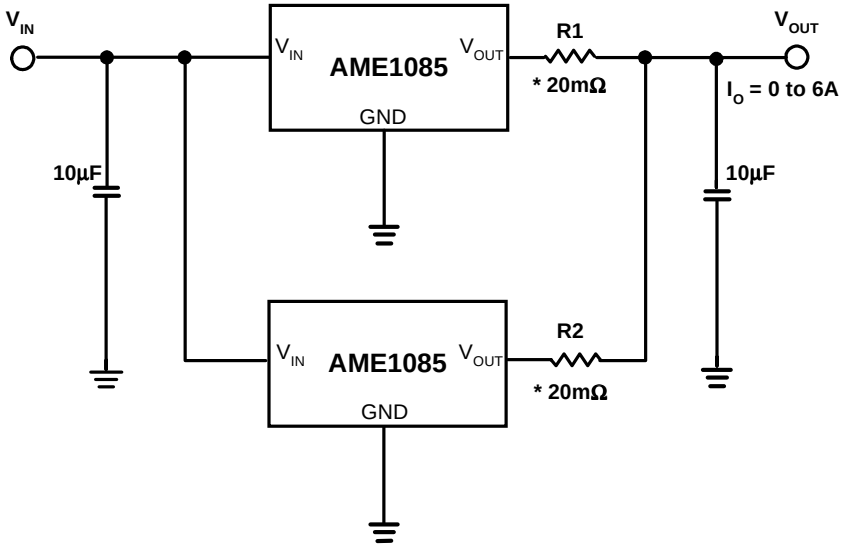
Adjustable Output Voltage



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

** Optional for improved ripple rejection

Paralleling Regulators

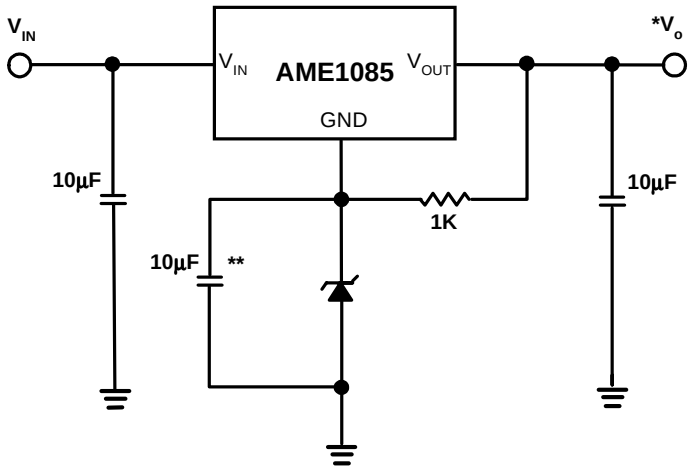


Note: * 20mΩ is ballast resistance

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

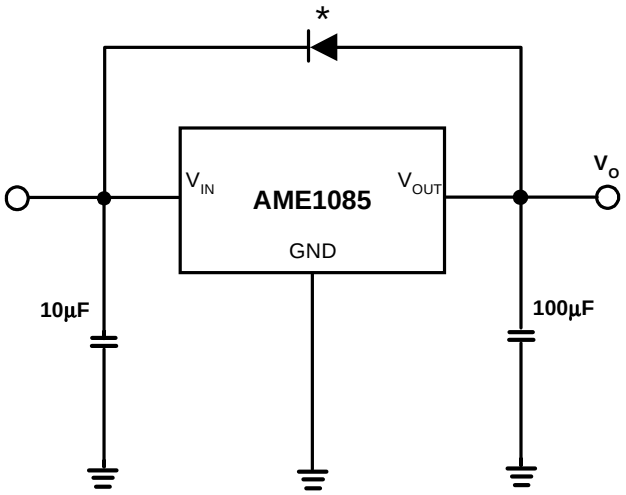
■ Advanced Applications (contd.)

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



■ External Resistor Divider Table for Customized Voltage

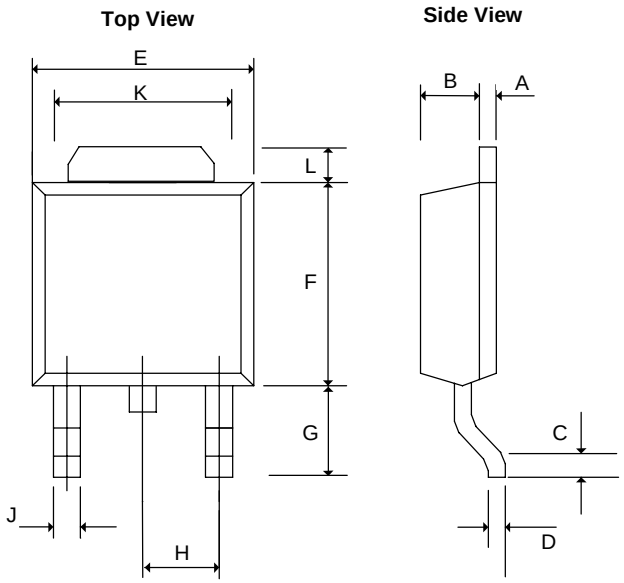
R1 (Ohm)	100	102	105	107	110	113	115	118	121	124
Vout	R2(Ohm)=(Vout-1.25)*R1/(1.25+50u*R1)									
1.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.30	3.984	4.063	4.182	4.262	4.381	4.500	4.579	4.698	4.817	4.936
1.35	7.968	8.127	8.365	8.524	8.761	8.999	9.158	9.396	9.633	9.871
1.40	11.95	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

■ Package Dimension

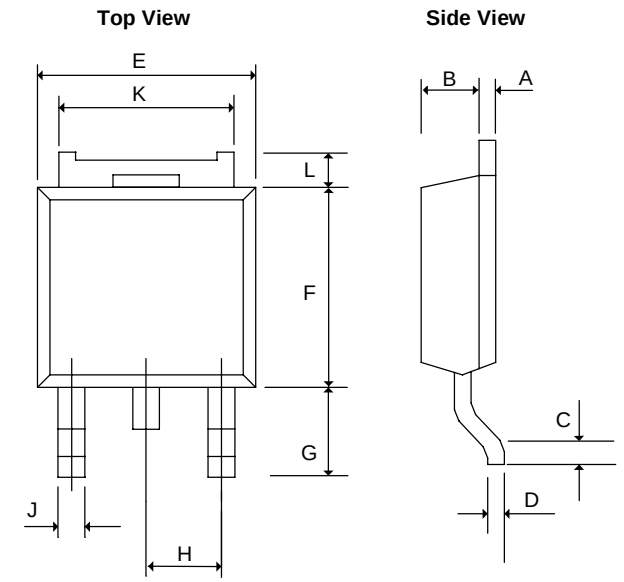
TO-252(DPAK)-EIAJ



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.45	0.58	0.0177	0.0230
B	1.60	1.95	0.0630	0.0768
C	0.51	1.50	0.0201	0.0591
D	0.45	0.60	0.0177	0.0236
E	6.40	6.80	0.2520	0.2677
F	5.40	7.20	0.2126	0.2835
G	2.20	2.85	0.0866	0.1122
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

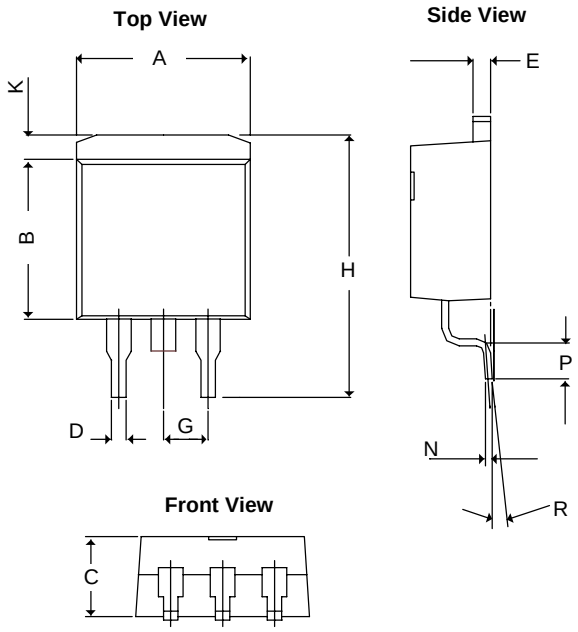


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.49	0.51	0.0192	0.0201
B	1.79	1.81	0.0704	0.0713
C	0.55	-	0.0216	-
D	0.49	0.51	0.0192	0.0201
E	6.58	6.62	0.259	0.2606
F	6.08	6.12	0.2393	0.2409
G	2.68	2.72	0.1055	0.1071
H	* 2.30REF		* 0.0906REF	
J	0.96		0.0377	
K	5.31	5.37	0.2090	0.2114
L	0.68	0.72	0.0267	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)



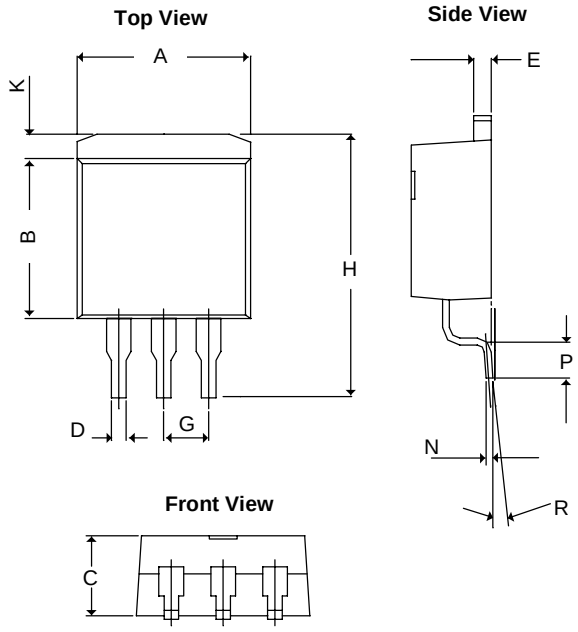
SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.65	10.42	0.380	0.410
B	8.28	9.66	0.326	0.380
C	4.06	4.83	0.160	0.190
D	0.50	1.02	0.020	0.040
E	1.14	1.40	0.045	0.055
G	*2.54		*0.100	
H	14.60	15.60	0.5748	0.61417
K	0.99	2.93	0.03898	0.11535
N	0.381REF		0.015REF	
P	2.28	2.80	0.08976	0.11024
R	0°	8°	0°	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.

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	1.02	0.020	0.040
E	1.14	1.40	0.045	0.055
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°

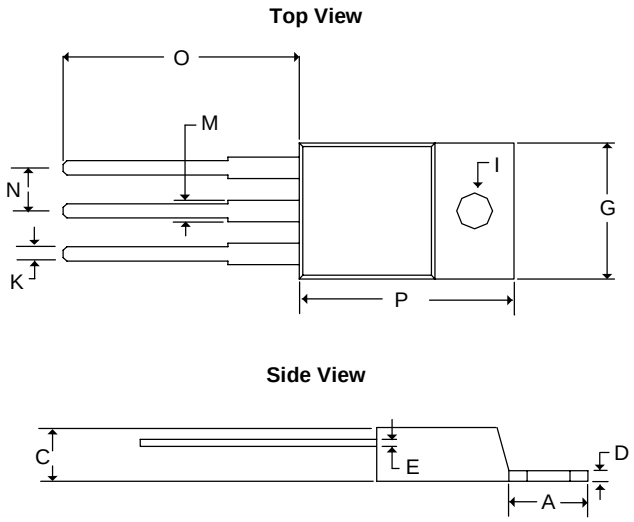
***: Typical Value**

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	3.55	4.83	0.1398	0.1900
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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