

## ■ 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.

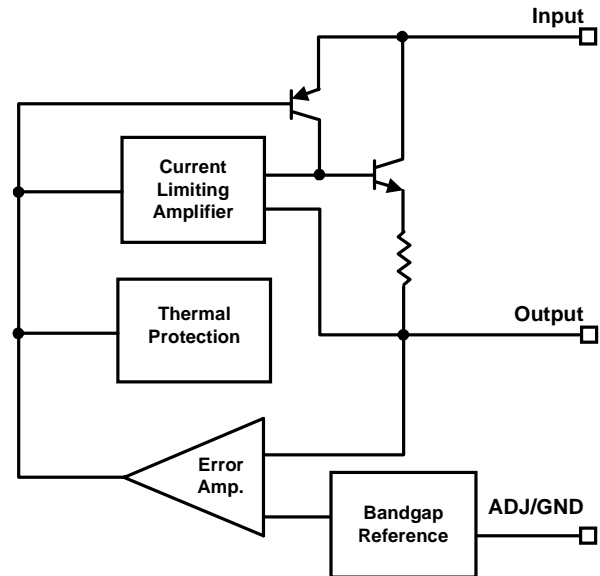
## ■ Features

- 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 90 $\mu$ A
- Overcurrent protection
- Thermal protection
- Available in TO-220, TO-263, TO-252

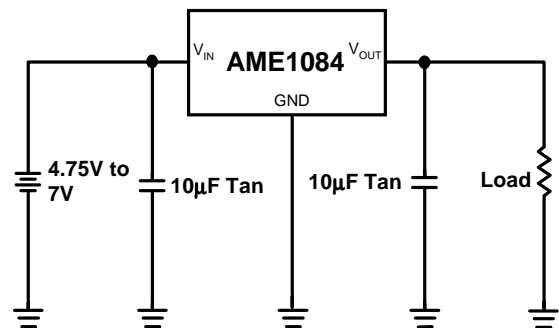
## ■ Applications

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

## ■ Functional Block Diagram



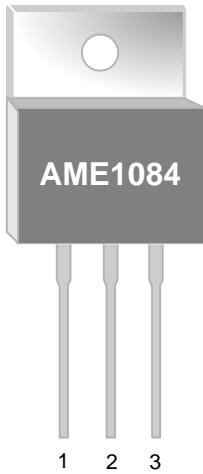
## ■ Typical Application





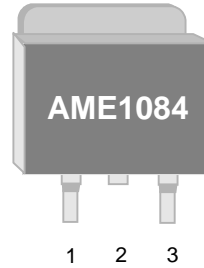
■ Pin Configuration

TO-220  
Front View



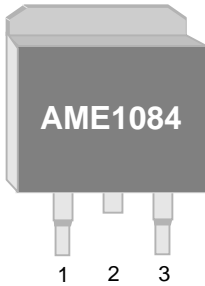
- AME1084**
1. ADJ/GND
  2.  $V_{OUT}$
  3.  $V_{IN}$

TO-252  
Front View



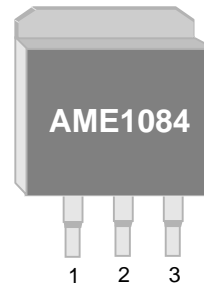
- AME1084**
1. ADJ/GND
  2.  $V_{OUT}$
  3.  $V_{IN}$

TO-263-2  
Front View



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

TO-263-3  
Front View

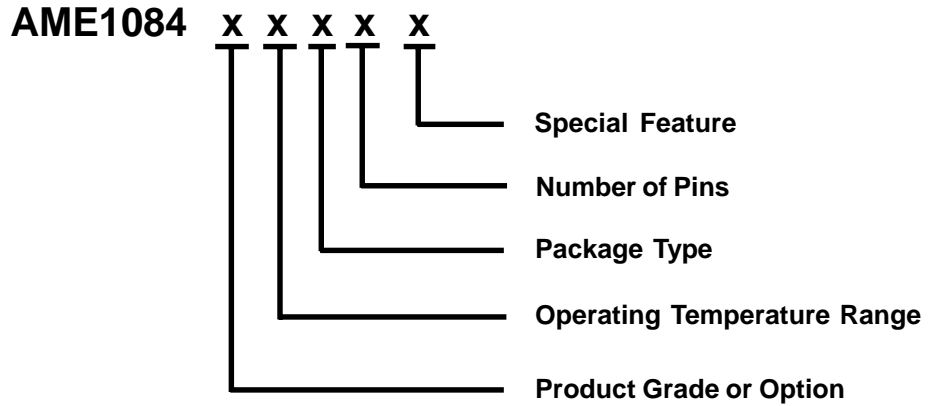


- AME1084**
1. ADJ/GND
  2.  $V_{OUT}$
  3.  $V_{IN}$



AME1084

■ 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	C: 0°C to 70°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
AME1084BCBT	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
AME1084DCBT	AME1084 DCBT yyww	3.3	TO-220	0°C to 70°C
AME1084ACDT-3	AME1084 ACDT-3 yyww	ADJ	TO-263-3	0°C to 70°C
AME1084BCDT-3	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
AME1084DCDT-3	AME1084 DCDT-3 yyww	3.3	TO-263-3	0°C to 70°C
AME1084ACDT	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
AME1084CCDT	AME1084 CCDT yyww	2.5	TO-263-2	0°C to 70°C
AME1084DCDT	AME1084 DCDT yyww	3.3	TO-263-2	0°C to 70°C
AME1084ACCS	AME1084 ACCS yyww	ADJ	TO-252	0°C to 70°C



AME1084

■ Ordering Information (contd.)

Part Number	Marking	Output Voltage	Package	Operating Temp. Range
AME1084BCCS	AME1084 BCCS yyww	1.5	TO-252	0°C to 70°C
AME1084CCCS	AME1084 CCCS yyww	2.5	TO-252	0°C to 70°C
AME1084DCCS	AME1084 DCCS yyww	3.3	TO-252	0°C to 70°C

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	$\theta_{JC}$	3	°C/W
	TO-252		5	
	TO-263		3	
Thermal Resistance (Junction to Ambient)	TO-220	$\theta_{JA}$	50	
	TO-252		90	
	TO-263		50	
Internal Power Dissipation ( $\Delta T = 100^\circ\text{C}$ )	TO-220	$P_D$	3000	mW
	TO-252		1200	
	TO-263		2800	
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	

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 <sub>REF</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 10mA	T <sub>J</sub> = 25°C	1.238	1.250	1.262	V
			Over temp.	1.225		1.275	
Line regulation	Reg <sub>LINE</sub>	V <sub>IN</sub> = 2.75 - 7V I <sub>O</sub> = 10mA	T <sub>J</sub> = 25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg <sub>LOAD</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 10mA - 5A	T <sub>J</sub> = 25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV <sub>OUT</sub> , ΔV <sub>REF</sub> = 1%	V <sub>D</sub>	I <sub>O</sub> = 10mA - 5A	T <sub>J</sub> = 25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I <sub>S</sub>	V <sub>IN</sub> = 2.75 - 7V, Over temp.	5.0	-	-	A	
Temperature Coefficient	T <sub>C</sub>	V <sub>IN</sub> = 2.75 - 7V, I <sub>O</sub> = 10mA - 5A	-	0.005	-	%/°C	
Adjust pin current	I <sub>ADJ</sub>	V <sub>IN</sub> = 2.75 - 7V I <sub>O</sub> = 10mA - 5A	T <sub>J</sub> = 25°C	-	55	-	μA
			Over temp.	-	-	120	
Adjust pin current change	ΔI <sub>ADJ</sub>	V <sub>IN</sub> = 2.75 - 7V, I <sub>O</sub> = 10mA - 5A Over temp.	-	0.2	5		
Temperature stability	T <sub>S</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 500mA, Over temp.	-	0.5	-	%	
Minimum load current	I <sub>O</sub>	V <sub>IN</sub> = 5V	10	-	-	mA	
RMS output noise	V <sub>N</sub>	T <sub>J</sub> = 25°C	-	0.003	-	%V <sub>O</sub>	
Ripple rejection ratio	R <sub>A</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 5A, Over temp.	-	72	-	dB	

AME1084Bxxx

Parameter	Symbol	Test Condition	Min	Typ	Max	Units	
Output voltage (fixed voltage)	V <sub>O</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	1.485	1.500	1.515	V
			Over temp.	1.470		1.530	
Line regulation	Reg <sub>LINE</sub>	V <sub>IN</sub> = 4.5 - 7V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg <sub>LOAD</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV <sub>OUT</sub> , ΔV <sub>REF</sub> = 1%	V <sub>D</sub>	I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I <sub>S</sub>	V <sub>IN</sub> = 4.5 - 7V, Over temp.	5.0	-	-	A	
Quiescent current (fixed model)	I <sub>Q</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 0-5A, Over temp.	-	12	13	mA	
Temperature Coefficient	T <sub>C</sub>	V <sub>IN</sub> = 4.5 - 7V, I <sub>O</sub> = 0A - 5A	-	0.005	-	%/°C	
Temperature stability	T <sub>S</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 500mA, Over temp.	-	0.5	-	%	
RMS output noise	V <sub>N</sub>	T <sub>J</sub> = 25°C	-	0.003	-	%V <sub>O</sub>	
Ripple rejection ratio	R <sub>A</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 5A, Over temp.	-	72	-	dB	

**AME1084**
**■ Electrical Specifications (contd.)**
**AME1084Cxxx**

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	V <sub>O</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	2.475	2.500	2.525	V
			Over temp.	2.450		2.550	
Line regulation	Reg <sub>LINE</sub>	V <sub>IN</sub> = 4.5 - 7V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg <sub>LOAD</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV <sub>OUT</sub> , ΔV <sub>REF</sub> = 1%	V <sub>D</sub>	I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I <sub>S</sub>	V <sub>IN</sub> = 4.5 - 7V, Over temp.		5.0	-	-	A
Quiescent current (fixed model)	I <sub>Q</sub>	V <sub>IN</sub> =5V, I <sub>O</sub> =0-5A, Over temp.		-	12	13	mA
Temperature Coefficient	T <sub>C</sub>	V <sub>IN</sub> = 4.5 - 7V, I <sub>O</sub> = 0A - 5A		-	0.005	-	%/°C
Temperature stability	T <sub>S</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 500mA, Over temp.		-	0.5	-	%
RMS output noise	V <sub>N</sub>	T <sub>J</sub> = 25°C		-	0.003	-	%V <sub>O</sub>
Ripple rejection ratio	R <sub>A</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 5A, Over temp.		-	72	-	dB

**AME1084Dxxx**

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
Output voltage (fixed voltage)	V <sub>O</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	3.267	3.300	3.333	V
			Over temp.	3.234		3.366	
Line regulation	Reg <sub>LINE</sub>	V <sub>IN</sub> = 4.5 - 7V I <sub>O</sub> = 0A	T <sub>J</sub> = 25°C	-	0.015	0.2	%
			Over temp.	-	0.035	0.2	
Load regulation	Reg <sub>LOAD</sub>	V <sub>IN</sub> = 5V I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	0.05	0.3	%
			Over temp.	-	0.2	0.4	
Dropout voltage ΔV <sub>OUT</sub> , ΔV <sub>REF</sub> = 1%	V <sub>D</sub>	I <sub>O</sub> = 0A - 5A	T <sub>J</sub> = 25°C	-	1.2	1.4	V
			Over temp.	-	1.3	-	
Current limit	I <sub>S</sub>	V <sub>IN</sub> = 4.5 - 7V, Over temp.		5.0	-	-	A
Quiescent current (fixed model)	I <sub>Q</sub>	V <sub>IN</sub> =5V, I <sub>O</sub> =0-5A, Over temp.		-	12	13	mA
Temperature Coefficient	T <sub>C</sub>	V <sub>IN</sub> = 4.5 - 7V, I <sub>O</sub> = 0A - 5A		-	0.005	-	%/°C
Temperature stability	T <sub>S</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 500mA, Over temp.		-	0.5	-	%
RMS output noise	V <sub>N</sub>	T <sub>J</sub> = 25°C		-	0.003	-	%V <sub>O</sub>
Ripple rejection ratio	R <sub>A</sub>	V <sub>IN</sub> = 5V, I <sub>O</sub> = 5A, Over temp.		-	72	-	dB

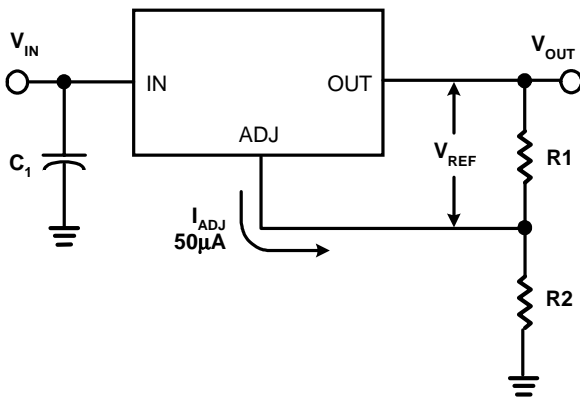
## ■ Application Description

### 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.



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

### 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

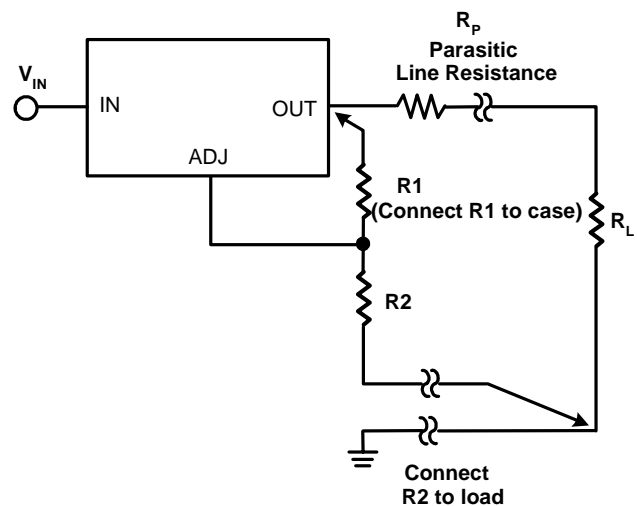
AME1084 requires a capacitor from  $V_{OUT}$  to GND to provide compensation feedback to the internal gain stage. This is to ensure stability at the output terminal. Typically, a 10µF tantalum or 50µF aluminum electrolytic is sufficient.

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

The output capacitor does not have a theoretical upper limit and increasing its value will increase stability.  $C_{OUT} = 100\mu\text{F}$  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.







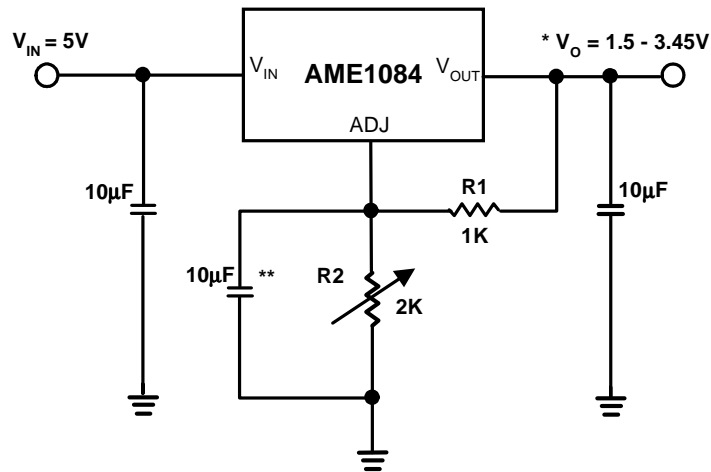
**AME1084**

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**5. Thermal consideration**

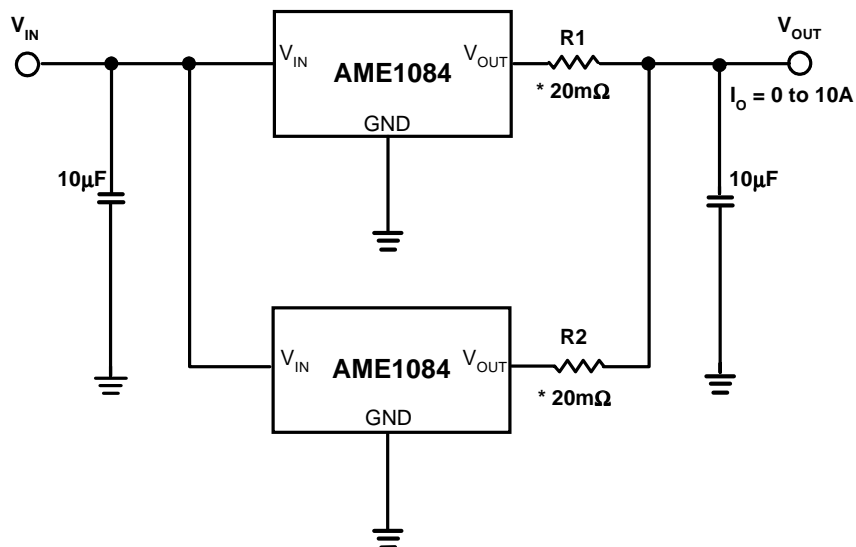
The AME1084 series contain thermal limiting circuitry designed to protect itself for over-temperature conditions. Even for normal load conditions, maximum junction temperature ratings must not be exceeded. As mention in thermal protection section, we need to consider all sources of thermal resistance 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:  $* V_{OUT} = V_{REF} \left( 1 + \frac{R2}{R1} \right) + I_{ADJ} \times R2$

\*\* Optional for improved ripple rejection

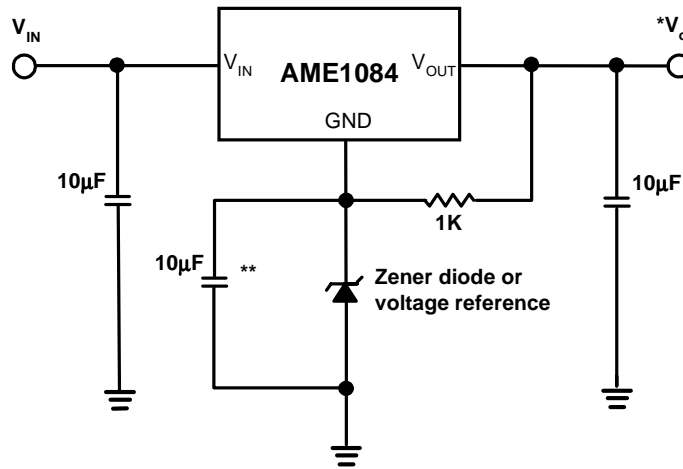
**Paralleling Regulators**


Note: \* 20mΩ is ballast resistance  
The inter - connection of #18 wire could act as ballast resistance



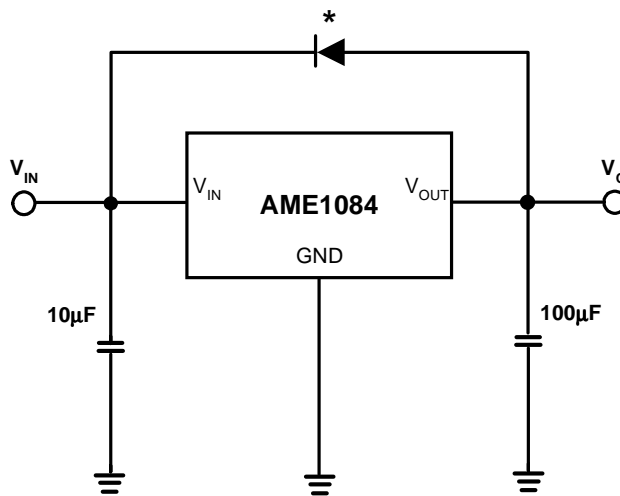
■ Advanced Applications (contd.)

Regulator with Reference



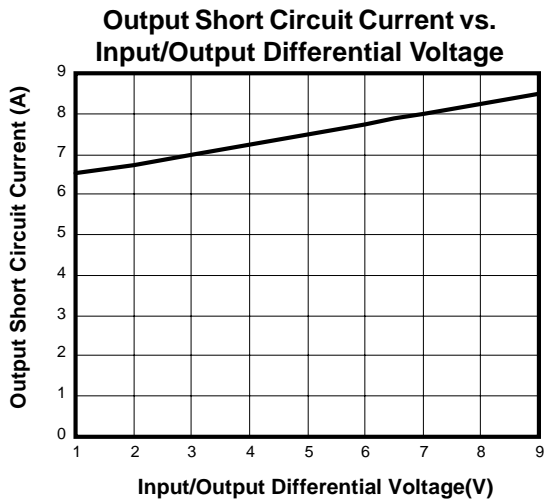
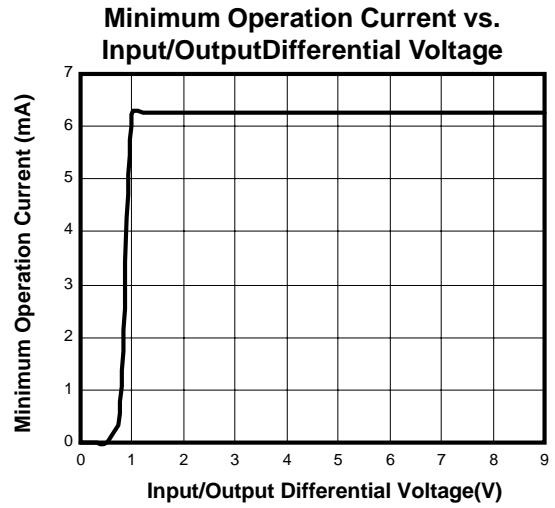
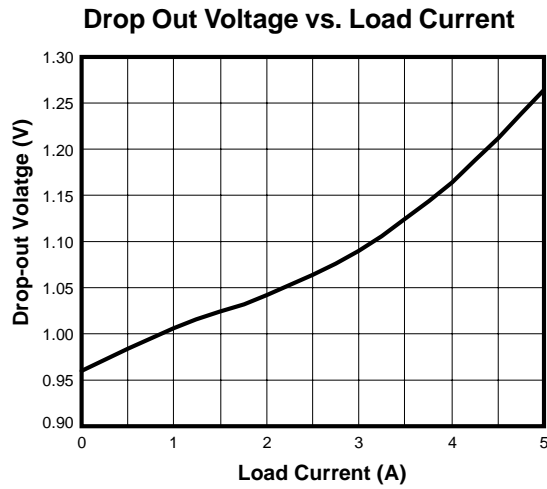
Note: \*  $V_o = V_{REF} + V_Z$  ( $V_Z$ : breakdown voltage of Zener diode)  
\*\* Optional for improved ripple rejection

Regulator with Reverse Diode Protection





■ Performance Characteristics





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



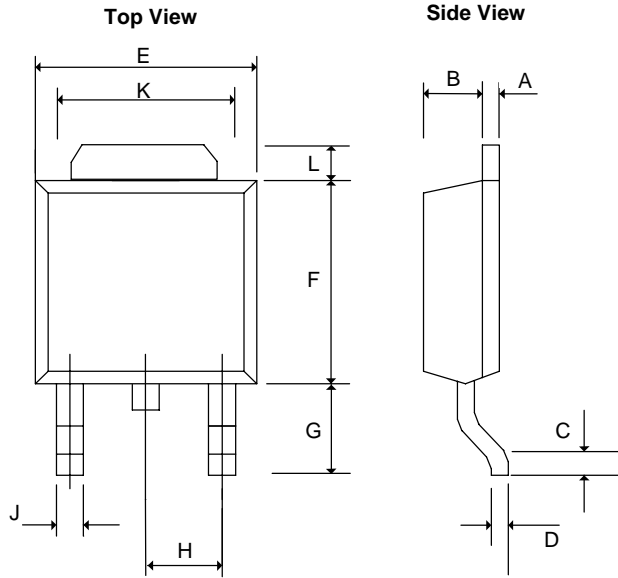
■ External Resistor Divider Table for Customized Voltage (contd.)

R1 (Ohm)	100	102	105	107	110	113	115	118	121	124
Vout	$R2(\text{Ohm})=(V_{\text{out}}-1.25)*R1/(1.25+50u*R1)$									
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



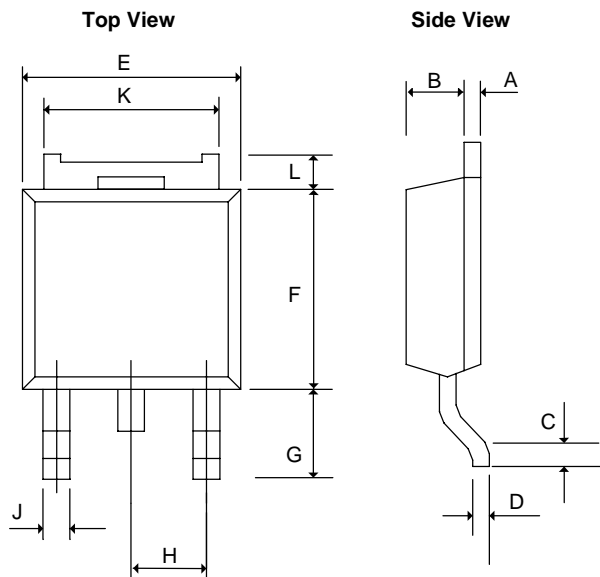
SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.45	0.58	0.0177	0.0230
B	1.60	1.95	0.0630	0.0768
C	0.51	1.50	0.0201	0.0591
D	0.45	0.60	0.0177	0.0236
E	6.40	6.80	0.2520	0.2677
F	5.40	7.20	0.2126	0.2835
G	2.20	2.85	0.0866	0.1122
H	-	* 2.30	-	* 0.0906
J	-	0.97	-	0.0380
K	5.20	5.50	0.2047	0.2165
L	1.40REF		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

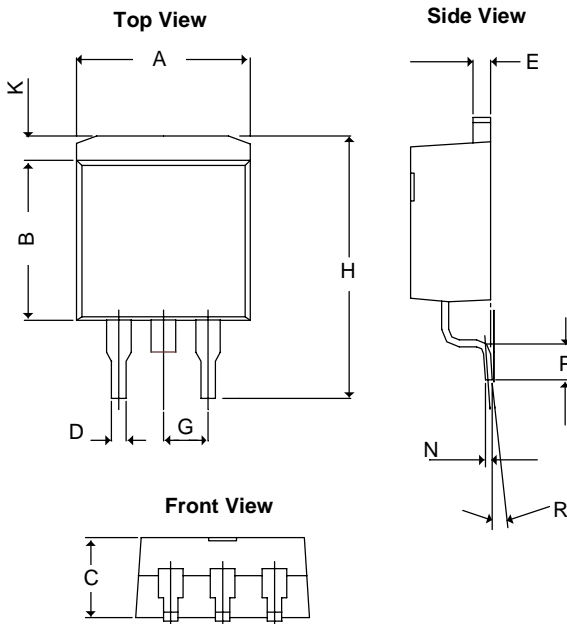


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.49	0.51	0.0192	0.0201
B	1.79	1.81	0.0704	0.0713
C	0.55	-	0.0216	-
D	0.49	0.51	0.0192	0.0201
E	6.58	6.62	0.259	0.2606
F	6.08	6.12	0.2393	0.2409
G	2.68	2.72	0.1055	0.1071
H	* 2.30REF		* 0.0906REF	
J	0.96		0.0377	
K	5.31	5.37	0.2090	0.2114
L	0.68	0.72	0.0267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

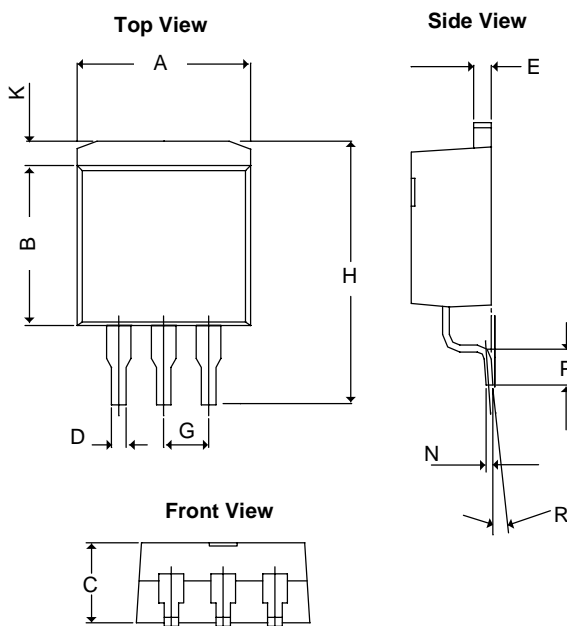
**■ Package Dimension**
**TO-263-2(D<sup>2</sup>PAK)**


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	1.40	0.045	0.055
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(D<sup>2</sup>PAK)**


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	1.40	0.045	0.055
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:

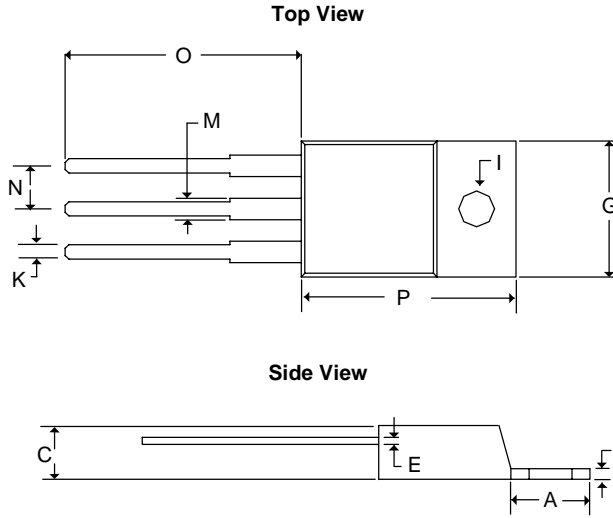
1. Controlling dimension: Millimeters.
2. Maximum lead thickness includes lead finish thickness. Minimum lead thickness is the minimum thickness of base material.





■ Package Dimension

TO-220



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
<b>A</b>	5.58	7.49	0.2197	0.2949
<b>C</b>	2.032	4.83	0.0800	0.1900
<b>D</b>	0.50	1.40	0.0197	0.0550
<b>E</b>	0.30	1.15	0.0118	0.0453
<b>G</b>	9.65	10.67	0.3799	0.4200
<b>I</b>	3.53	4.09	0.1390	0.1610
<b>K</b>	0.50	1.15	0.0197	0.0453
<b>M</b>	1.14	1.78	0.0449	0.0700
<b>N</b>	2.28	2.80	0.0898	0.1102
<b>O</b>	12.70	14.74	0.5000	0.5803
<b>P</b>	14.22	16.51	0.5600	0.6500



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