AMC DOC. #: AMC7588_E (LF)
Feb. 2005

ADD MICROTECH CORP.

AMC7588

ADJUSTABLE 3A LOW DROPOUT REGULATOR

DESCRIPTION

The AMC7588 is a high performance low dropout regulator rated for 3A output current. It is designed for use in applications requiring low dropout characteristics as well as fast transient response over the rated current range.

These features are ideal for low voltage micro- processor applications requiring a regulated 2.5V to 3.6V power supply. On chip trimming adjusts the reference voltage to 1%.

In addition, the AMC7588 provides the device protections including over current and thermal shutdown. Also, reverse battery protection scheme limits the reverse current when the input voltage falls below the output

FEATURES

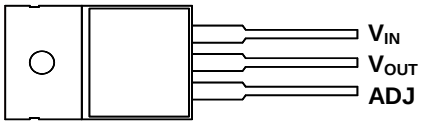
- **Input-Output differential of typical 1.1V at 3A and low quiescent current**
- **Output current is excess of 3A**
- Reverse battery protection
- Fast transient response
- Short circuit protection
- Internal thermal overload protection
- Available in 3L plastic TO-220, surface mount 3L TO-263 and 3L TO-252 packages
- Pin assignment identical to EZ158XB and LT158XA series.

APPLICATIONS

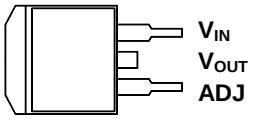
- Pentium® Processor Supplies
- PowerPC™ Supplies
- Computer Add-On Cards
- Other Applications Requiring Low Dropout Voltage Over Rated Current.

- Voltage Options:
  AMC7588-ADJ -- Adjustable

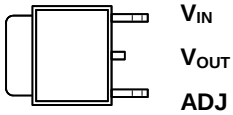
PACKAGE PIN OUT



3-Pin Plastic TO-220
(Top View)



3-Pin Plastic TO-263
Surface Mount
(Top View)



3-Pin Plastic TO-252
Surface Mount
(Top View)

ORDER INFORMATION

T_A (°C)	T	Plastic TO-220 3-pin	ST	Plastic TO-263 3-pin	SJ	Plastic TO-252 3-pin
0 to 70	**AMC7588-ADJT**		**AMC7588-ADJST**		**AMC7588-ADJSJ**	
0 to 70	**AMC7588-ADJTF(Lead Free)**		**AMC7588-ADJSTF(Lead Free)**		**AMC7588-ADJSJF(Lead Free)**	

Note: 1.All surface-mount packages are available in Tape & Reel. Append the letter "T" to part number (i.e., AMC7588-ADJTT, AMC7588-ADJSTT or AMC7588-ADJSJT).
2. The letter "F" is marked for Lead Free process.

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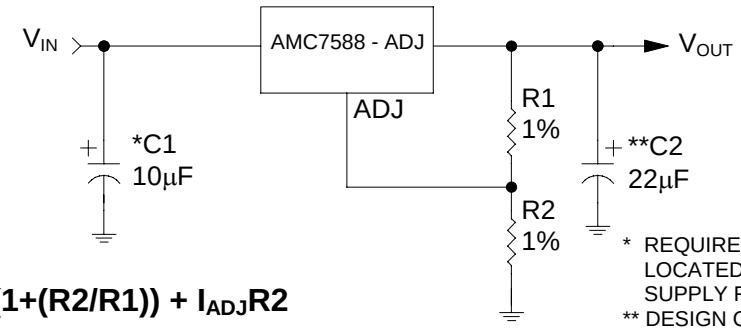
ADJUSTABLE 3A LOW DROPOUT REGULATOR

TYPICAL APPLICATION



$V_{OUT} = V_{REF} (1+(R2/R1)) + I_{ADJ}R2$

* REQUIRED IF REGULATOR IS LOCATED FAR FROM POWER SUPPLY FILTER
** DESIGN C2 AS CLOSE TO V_{OUT} PIN AS POSSIBLE

ABSOLUTE MAXIMUM RATINGS (Note 1)	
Input Voltage (V_{IN})	7V
Operating Junction temperature	150 °C
Storage Temperature Range	-65 °C to 150 °C
Lead temperature (Soldering, 10 seconds)	300 °C

Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

POWER DISSIPATION TABLE

Package	θ_{JA} (°C /W)	De-rating factor (mW/°C) $T_A \geq 25$ °C	$T_A \leq 25$ °C Power rating(mW)	T_A=70 °C Power rating(mW)	T_A= 85 °C Power rating (mW)
T	45	22.2	2775	1776	1443
TF	45	22.2	2775	1776	1443
ST	45	22.2	2775	1776	1443
STF	45	22.2	2775	1776	1443
SJ	80	12.5	1562	1000	812
SJF	80	12.5	1562	1000	812

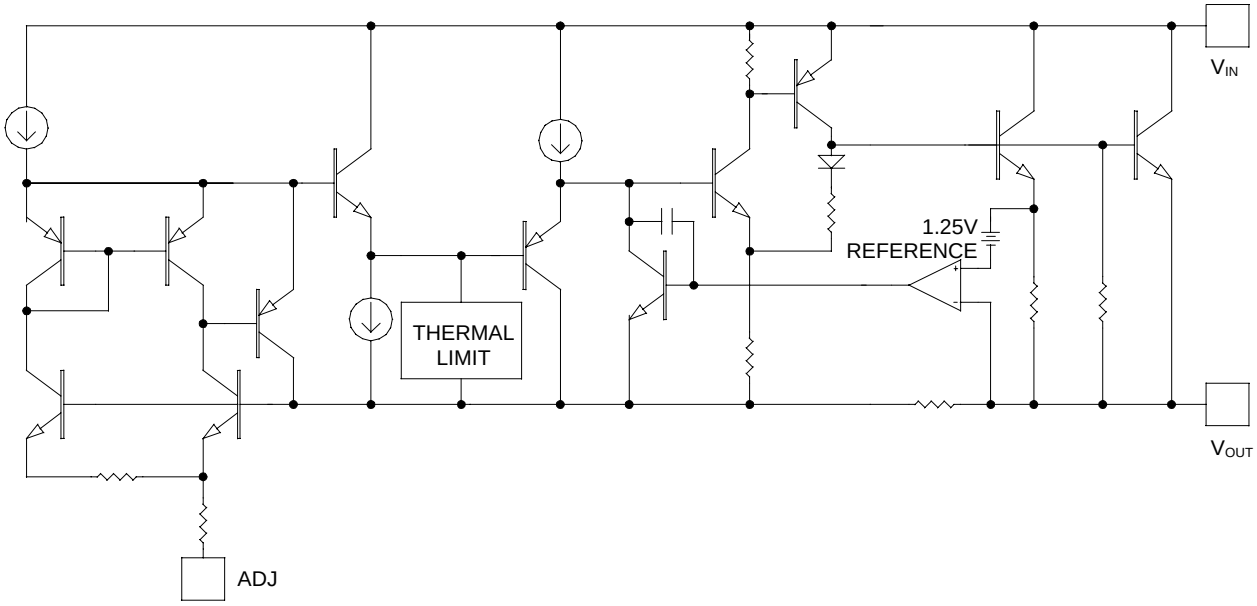
Note :

1. $\theta_{JA:}$ Thermal Resistance-Junction to Ambient, D_F : De-rating factor, Po: Power consumption.
   Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$, $Po = D_F \times (T_J - T_A)$
   The θ_{JA} numbers are guidelines for the thermal performance of the device/PC-board system.
   All of the above assume no ambient airflow.

2. $\theta_{JT:}$ Thermal Resistance-Junction to Tab, T_C: case(Tab) temperature, $T_J = T_C + (P_D \times \theta_{JT})$
   For T and ST packages, θ_{JT} = 3.0 °C / W.
   For SJ, packages, θ_{JT} = 7.0 °C / W.

3. If power consumption is over above rating, adequate heat sink is required to dissipate heat.

BLOCK DIAGRAM



RECOMMENDED OPERATING CONDITIONS					
Parameter	Symbol	Recommended Operating Conditions			Units
		Min.	Typ.	Max.	
Input Voltage	V_{IN}	2.5		7	V
Load Current (with adequate heatsinking)	I_O	0.010		3	A
Input Capacitor (V_{IN} to GND)		10			µF
Output Capacitor with ESR of 10Ω max., (V_{OUT} to GND)		22			µF
Junction temperature	T_J			125	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, these specifications apply over the operating ambient temperature of T_A = 25°C for AMC7588-ADJ; I_O = 10mA, C_{OUT} = 10 μF, and are for DC characteristics only. (Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Symbol	Test Conditions	AMC7588-ADJ			Units
			Min.	Typ.	Max.	
Reference Voltage	V_{REF}	$(V_{IN} - V_{OUT}) = 1.5V$, I_O = 10mA	1.238	1.250	1.262	V
		3.3V ≤ V_{IN} ≤ 5.5V, 10mA ≤ I_O ≤ 3A	1.230	1.250	1.270	
Line Regulation (Note 2)	$\triangle V_{OI}$	2.75V ≤ V_{IN} ≤ 7V		0.05	0.2	%
Load regulation (Note 2)	$\triangle V_{OL}$	$(V_{IN} - V_{OUT}) = 3V$, 10mA ≤ I_O ≤ 3A		0.08	0.3	%
Dropout Voltage	$\triangle V$	I_O = 10mA		1.150	1.300	V
		I_O = 3A		1.200	1.400	
Adjust Pin Current	I_{ADJ}			50	120	μA
Current Limit	I_{CL}	$(V_{IN} - V_{OUT}) = 3V$	3.3	5.0		A
Minimum Load Current	I_{MIM}	1.5V ≤ $(V_{IN} - V_{OUT})$		5	10	mA
Long Term Stability (Note 3)				20		mV/1000hr
Ripple rejection (Note 3)	R_R	f_O = 120Hz, 1V_{RMS}, I_O = 100mA	66	80		dB

Note 2: Line and load regulations are guaranteed up to maximum power dissipation determined by input/output differential and the output current. However, the maximum power will not be available over the full input/output voltage range.

Note 3: These parameters, although guaranteed, are not tested in production.

Application Note:

Maximum Power Calculation:

$$P_{D(MAX)} = \frac{T_{J(MAX)} - T_{A(MAX)}}{\theta_{JA}}$$

T_J(°C): Maximum recommended junction temperature

T_A(°C): Ambient temperature of the application

θ_{JA}(°C/W): Junction-to-junction temperature thermal resistance of the package, and other heat dissipating materials.

The maximum power dissipation of a single-output regulator :

$P_{D(MAX)} = [(V_{IN(MAX)} - V_{OUT(NOM)})] \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_Q$

Where: $V_{OUT(NOM)}$ = the nominal output voltage
$I_{OUT(NOM)}$ = the nominal output current, and
I_Q = the quiescent current the regulator consumes at $I_{OUT(MAX)}$
$V_{IN(MAX)}$ = the maximum input voltage

Then $\theta_{JA} = (150\,^{O}C - T_A) / P_D$

Thermal consideration:

When power consumption is over about 1.2W the devices using TO-220/263 packages (687 mW for TO-252 packages), additional heat sink is required to control the junction temperature below 125 °C.

The junction temperature is: $T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$

P_D : Dissipated power.

θ_{JT} : Thermal resistance from the junction to the mounting tab of the package.

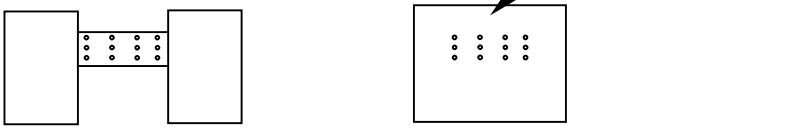
θ_{CS} :Thermal resistance through the interface between the IC and the surface on which it is mounted. (typically,θ_{CS} < 1.0°C / W)

θ_{SA} : Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with several through hole vias.

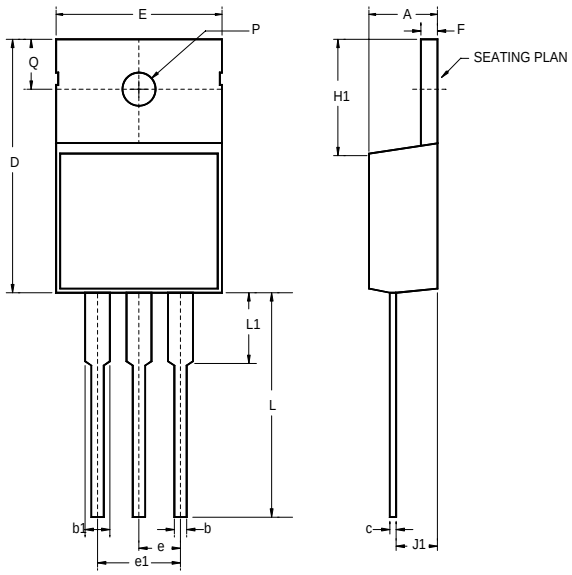
PCB θ_{SA} (°C / W)	59	45	38	33	27	24	21
PCB heat sink size (mm^2)	500	1000	1500	2000	3000	4000	5000

Recommended figure of PCB area used as a heat sink.



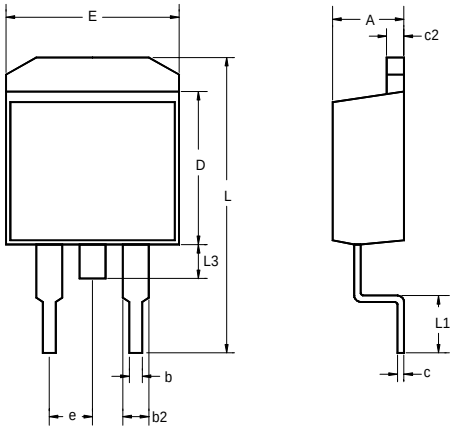
(Top View) (Bottom View)

3-Pin Plastic TO-220



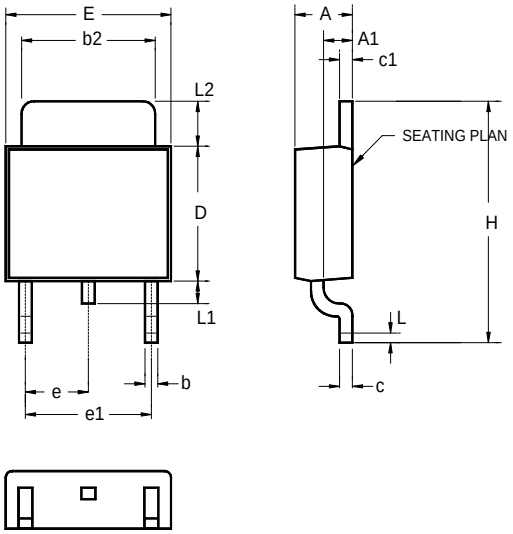
	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.140	-	0.190	3.56	-	4.83
b1	0.045	-	0.070	1.14	-	1.78
b	0.020	-	0.045	0.51	-	1.14
c	0.012	-	0.045	0.30	-	1.14
D	0.560	-	0.650	14.22	-	16.51
E	0.380	-	0.420	9.65	-	10.67
e	0.090	-	0.110	2.29	-	2.79
e1	0.190	-	0.210	4.83	-	5.33
F	0.020		0.055	0.51	-	1.40
H1	0.230	-	0.270	5.84	-	6.86
J1	0.080	-	0.115	2.03	-	2.92
L	0.500	-	0.580	12.7	-	14.73
P	0.139	-	0.161	3.53	-	4.09
Q	0.100	-	0.135	2.54	-	3.43
L1	-	-	0.250	-	-	6.35

3-Pin Surface Mount TO-263 (ST)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.160	-	0.190	4.06	-	4.83
b	0.020	-	0.039	0.51	-	0.99
b2	0.045	-	0.055	1.14	-	1.40
c	0.015 TYP.			0.38 TYP.		
c2	0.045	-	0.055	1.14	-	1.40
D	0.340	-	0.380	8.64	-	9.65
E	0.380	-	0.405	9.65	-	10.29
e	0.100 BSC			2.54 BSC		
L	0.575	-	0.625	14.61	-	15.88
L1	0.090	-	0.110	2.29	-	2.79
L2	-	-	0.115	-	-	2.92
L3	0.050	-	0.070	1.27	-	1.78

3-Pin Surface Mount TO-252



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.086	-	0.094	2.18	-	2.39
A1	0.040	-	0.050	1.02	-	1.27
b	-	0.024	-	-	0.61	-
b2	0.205	-	0.215	5.21	-	5.46
c	0.018	-	0.023	0.46	-	0.58
c1	0.018	-	0.023	0.46	-	0.58
D	0.210	-	0.220	5.33	-	5.59
E	0.250	-	0.265	6.35	-	6.73
e	0.090 BSC			2.29 BSC		
e1	0.180 BSC			4.58 BSC		
H	0.370	-	0.410	9.40	-	10.41
L	0.020	-	-	0.51	-	-
L1	0.025	-	0.040	0.64	-	1.02
L2	0.060	-	0.080	1.52	-	2.03

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