

## 1A 3-Terminal Positive Voltage Regulator

### ❖ GENERAL DESCRIPTION

The AX7805/09/12 series are three terminal positive voltage regulators designed for a wide variety of applications including local, on-card regulation.

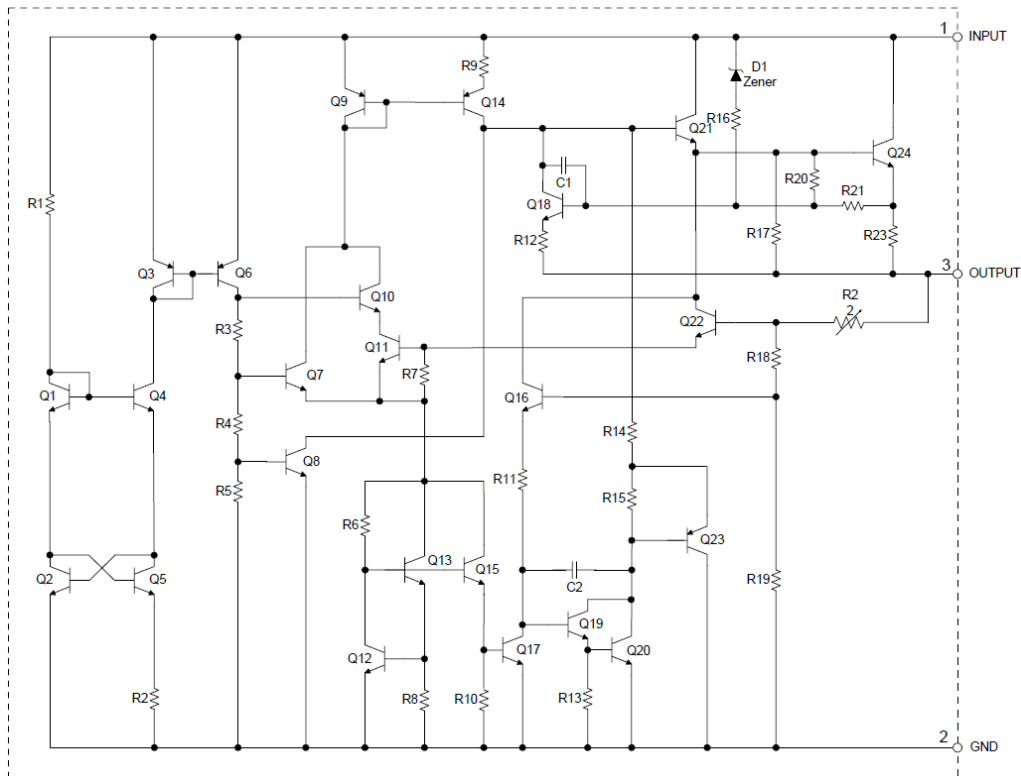
The AX7805/09/12 is complete with internal current limiting, thermal shutdown protection, and safe-area compensation which make them virtually immune from output overload. If adequate heat sinking is provided, these regulators can deliver output currents up to 1A.

The AX7805/09/12 are available in TO220-3L and TO252-3L packages.

### ❖ FEATURES

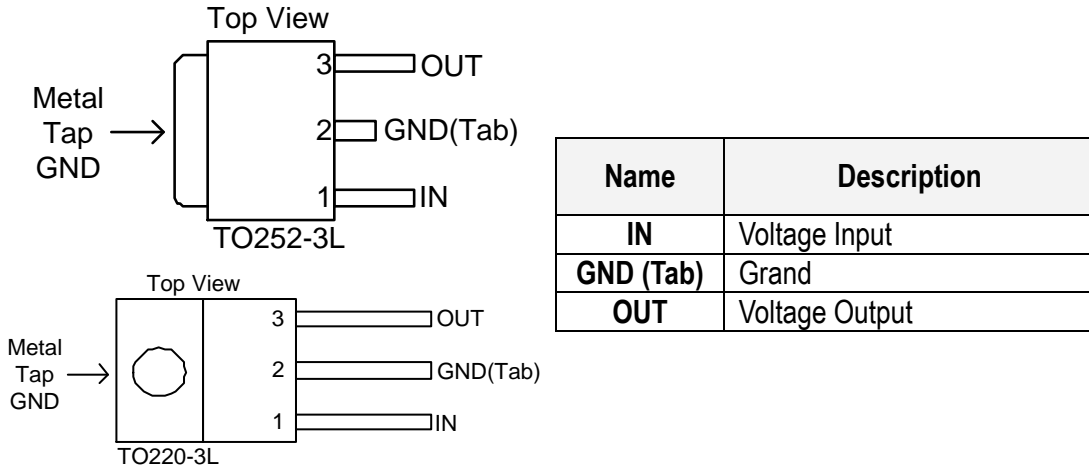
- Output Current up to 1A
- Fixed Output Voltages of 5V, 9V and 12V
- Output Voltage Accuracy of  $\pm 4\%$  over the Full Temperature Range
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- Output Transistor Safe-area Protection
- Low Load Regulation
- Stable Performance in High Temperature

### ❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The packages of AX7805/09/12 are TO220-3L and TO252-3L; the pin assignment is given by:



❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
<p><b>AX78XX XX</b></p> <pre>       AX78XX XX       /     \   Product Package Packing   05: AX7805 D : TO252-3L Blank : Tube   09: AX7809 T : TO220-3L A : Taping   12: AX7812           </pre>	<p>Logo ← <b>AX</b> 7 8 X X → Part number            05: AX7805            09: AX7809            12: AX7812</p> <p>YYWWX            ID code: internal            WW: 01~52            Year : 11 = 2011                  12 = 2012</p>

❖ ABSOLUTE MAXIMUM RATINGS

(T<sub>A</sub> = 25°C unless otherwise noted)

Characteristics	Symbol	Rating	Unit
Input Voltage	V <sub>IN</sub>	36	V
Lead Temperature (Soldering, 10sec)	T <sub>LEAD</sub>	260	°C
Power Dissipation	P <sub>D</sub>	Internal Limited	W
Operating Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature Range	T <sub>STG</sub>	-65~+150	°C
Thermal Resistance - Junction to Case	TO220-3L	5	°C/W
	TO252-3L	10	
Thermal Resistance - Junction to Ambient	TO220-3L	45	°C/W
	TO252-3L	55	

**Note:** Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

**❖ ELECTRICAL CHARACTERISTICS**

<b>AX7805 Electrical Characteristics</b> ( $V_{IN}=10V$ , $I_{OUT}=1A$ , $T_J=-40$ to $125^{\circ}C$ ; unless otherwise specified.)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output voltage	$V_{OUT}$	$T_J=25^{\circ}C$	4.9	5	5.1	V
		$I_{OUT}=5mA$ to $1A$ , $V_{IN}=7.5V$ to $20V$ , $PD \leq 15W$	4.8	-	5.2	
Line Regulation	$V_{RLINE}$	$V_{IN}=7.5V$ to $20V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	25	50	mV
Load Regulation	$V_{RLOAD}$	$V_{IN}=10V$ , $I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	20	50	
Quiescent Current	$I_q$	$V_{IN}=10V$ , $I_{OUT}=0$	-	3.2	6	mA
Quiescent Current Change	$\Delta I_q$	$V_{IN}=8V$ to $25V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	0.08	0.5	mA
Ripple Rejection	PSRR	$V_{IN}=8V$ to $18V$ , $f=120Hz$ , $I_{OUT}=500mA$	-	70	-	dB
Dropout Voltage	$V_{DROP}$	$\Delta V_{OUT}=1\%$ , $I_{OUT}=1A$ , $T_J=25^{\circ}C$	-	2	-	V
Output Noise Voltage	$N_{OUT}$	$f=10Hz$ to $100kHz$ , $T_A=25^{\circ}C$	-	10	-	$\mu V/V_o$
Output Resistance	$R_{OUT}$	$f=1KHz$	-	10	-	$m\Omega$
Short Circuit Current	$I_{SC}$	$V_{IN}=35V$ , $T_A=25^{\circ}C$	-	0.05	-	A
Peak Output Current	$I_{PK}$	$V_{IN}=10V$ , $T_J=25^{\circ}C$	-	2.2	-	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$		-	0.4	-	$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$		-	80	-	$ppm/^{\circ}C$

**Note1:** Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.

**Note 2:** This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**❖ ELECTRICAL CHARACTERISTICS (CONTINUE)**

<b>AX7809 Electrical Characteristics</b> ( $V_{IN}=15V$ , $I_{OUT}=1A$ , $T_J=-40$ to $125^{\circ}C$ ; unless otherwise specified.)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output voltage	$V_{OUT}$	$T_J=25^{\circ}C$	8.82	9	9.18	V
		$I_{OUT}=5mA$ to $1A$ , $V_{IN}=11.5V$ to $23V$ , $PD \leq 15W$	8.65	-	9.35	
Line Regulation	$V_{RLINE}$	$V_{IN}=11.5V$ to $23V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	25	90	mV
Load Regulation	$V_{RLOAD}$	$V_{IN}=14V$ , $I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	25	100	
Quiescent Current	$I_q$	$V_{IN}=15V$ , $I_{OUT}=0$	-	3.2	6	mA
Quiescent Current Change	$\Delta I_q$	$V_{IN}=11.5V$ to $23V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	0.08	0.5	mA
Ripple Rejection	PSRR	$V_{IN}=11.5V$ to $21.5V$ , $f=120Hz$ , $I_{OUT}=500mA$	-	61	-	dB
Dropout Voltage	$V_{DROP}$	$\Delta V_{OUT}=1\%$ , $I_{OUT}=1A$ , $T_J=25^{\circ}C$	-	2	-	V
Output Noise Voltage	$N_{OUT}$	$f=10Hz$ to $100kHz$ , $T_A=25^{\circ}C$	-	10	-	$\mu V/V_o$
Output Resistance	$R_{OUT}$	$f=1KHz$	-	10	-	$m\Omega$
Short Circuit Current	$I_{SC}$	$V_{IN}=35V$ , $T_A=25^{\circ}C$	-	0.2	-	A
Peak Output Current	$I_{PK}$	$V_{IN}=15V$ , $T_J=25^{\circ}C$	-	2.2	-	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$		-	0.72	-	$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$		-	80	-	ppm/ $^{\circ}C$

**Note1:** Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.

**Note 2:** This specification applies only for DC power dissipation permitted by absolute maximum ratings.

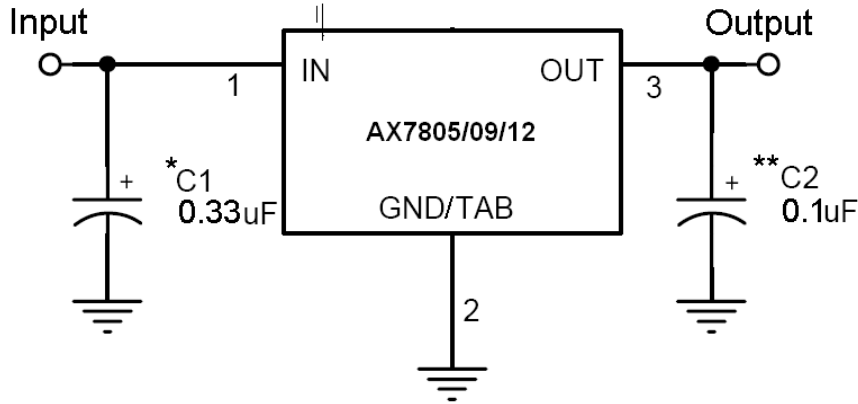
**❖ ELECTRICAL CHARACTERISTICS (CONTINUE)**

<b>AX7812 Electrical Characteristics</b> ( $V_{IN}=19V$ , $I_{OUT}=1A$ , $T_J=-40$ to $125^{\circ}C$ ; unless otherwise specified.)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output voltage	$V_{OUT}$	$T_J=25^{\circ}C$	11.75	12	12.25	V
		$I_{OUT}=5mA$ to $1A$ , $V_{IN}=14.8V$ to $27V$ , $PD \leq 15W$	11.5	-	12.5	
Line Regulation	$V_{RLINE}$	$V_{IN}=14.8V$ to $27V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	25	120	mV
Load Regulation	$V_{RLOAD}$	$V_{IN}=19V$ , $I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	40	120	
Quiescent Current	$I_q$	$V_{IN}=19V$ , $I_{OUT}=0$	-	3.4	6	mA
Quiescent Current Change	$\Delta I_q$	$V_{IN}=14.8V$ to $30V$ , $I_{OUT}=500mA$ , $T_J=25^{\circ}C$	-	0.3	0.8	mA
		$I_{OUT}=5mA$ to $1A$ , $T_J=25^{\circ}C$	-	0.08	0.5	mA
Ripple Rejection	PSRR	$V_{IN}=15V$ to $25V$ , $f=120Hz$ , $I_{OUT}=500mA$	-	60	-	dB
Dropout Voltage	$V_{DROP}$	$\Delta V_{OUT}=1\%$ , $I_{OUT}=1A$ , $T_J=25^{\circ}C$	-	2	-	V
Output Noise Voltage	$N_{OUT}$	$f=10Hz$ to $100kHz$ , $T_A=25^{\circ}C$	-	10	-	$\mu V/V_o$
Output Resistance	$R_{OUT}$	$f=1KHz$	-	11	-	$m\Omega$
Short Circuit Current	$I_{SC}$	$V_{IN}=35V$ , $T_A=25^{\circ}C$	-	0.2	-	A
Peak Output Current	$I_{PK}$	$V_{IN}=18V$ , $T_J=25^{\circ}C$	-	2.2	-	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$		-	0.96	-	$mV/^{\circ}C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$		-	80	-	ppm/ $^{\circ}C$

**Note1:** Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.

**Note 2:** This specification applies only for DC power dissipation permitted by absolute maximum ratings

❖ APPLICATION CIRCUIT



**Note1:** A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the Input ripple voltage.

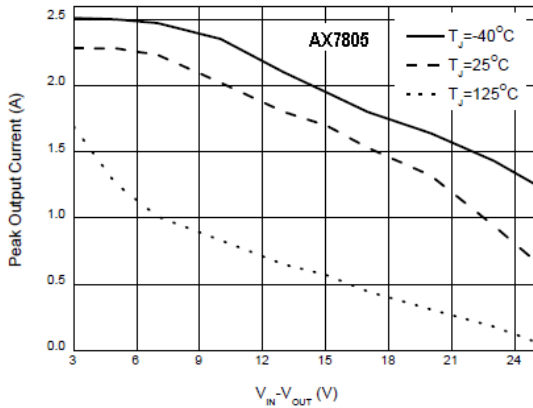
**Note2:** XX = these two digits of the type number indicate voltage.

\* = Cin is required if regulator is located an appreciable distance from power supply filter.

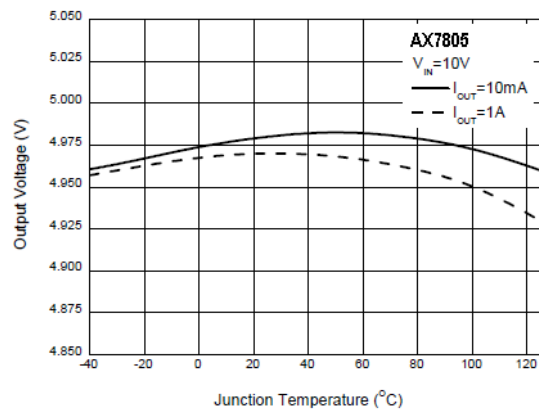
\*\* = Co is not needed for stability; however, it does improve transient response.

❖ TYPICAL CHARACTERISTICS

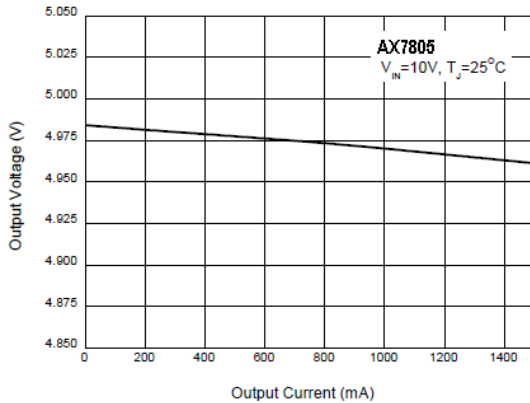
Peak Output Current vs. Input/Output Differential Voltage



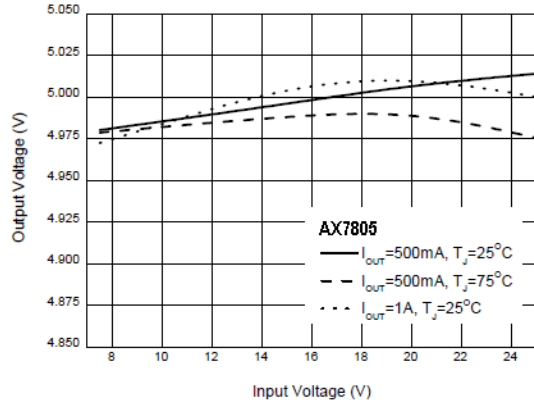
Output Voltage vs. Junction Temperature



Output Voltage vs. Output Current

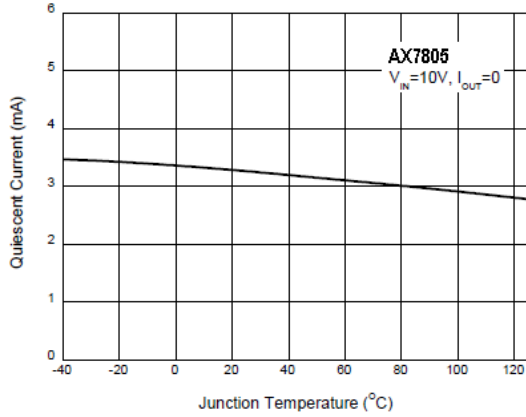


Output Voltage vs. Input Voltage

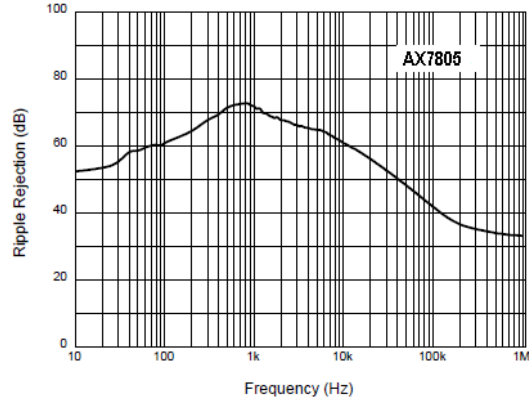


❖ TYPICAL CHARACTERISTICS (CONTINUE)

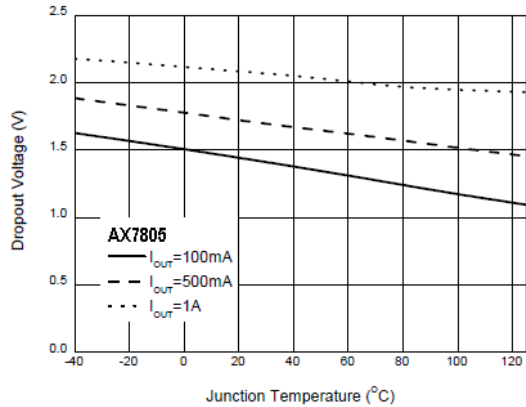
Quiescent Current vs. Junction Temperature



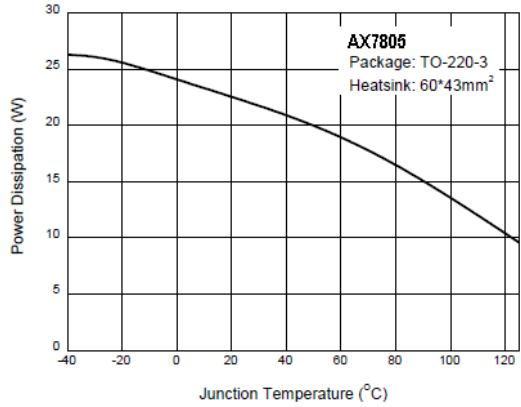
Ripple Rejection vs. Frequency



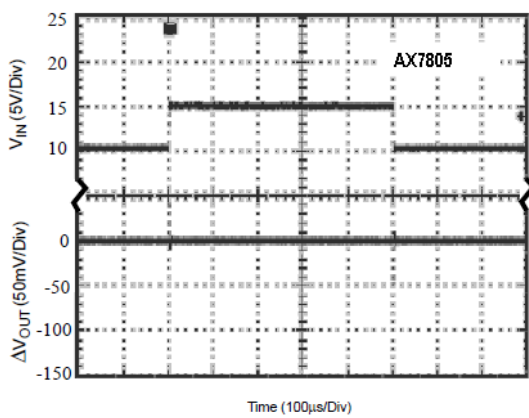
Dropout Voltage vs. Junction Temperature



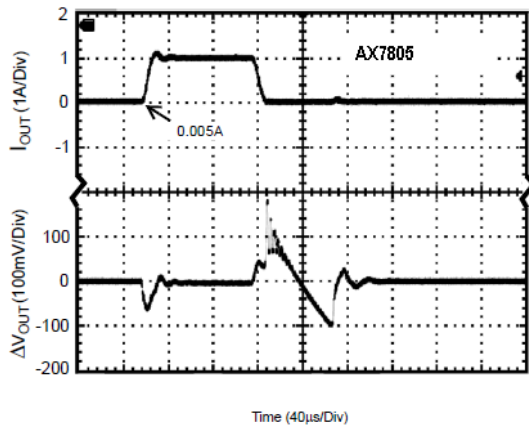
Power Dissipation vs. Junction Temperature



Line Transient  
(Conditions:  $I_{OUT}=500\text{mA}$ ,  $C_{OUT}=0.1\mu\text{F}$ )

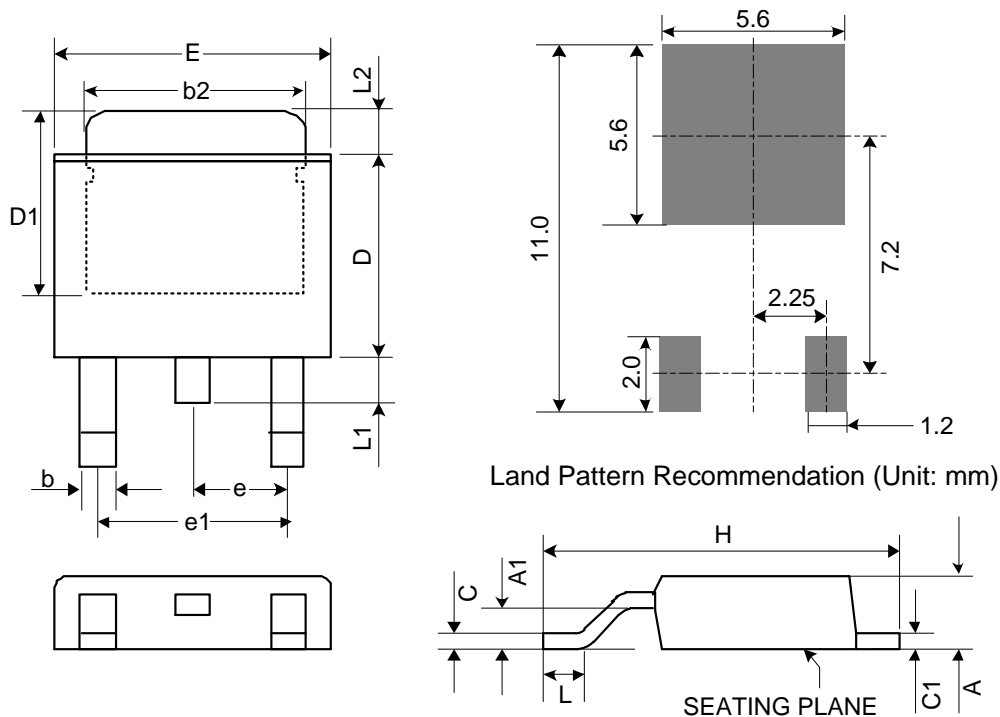


Load Transient  
(Conditions:  $V_{IN}=10\text{V}$ ,  $C_{IN}=0.33\mu\text{F}$ ,  $C_{OUT}=0.1\mu\text{F}$ )



❖ PACKAGE OUTLINES

(1) TO252-3L



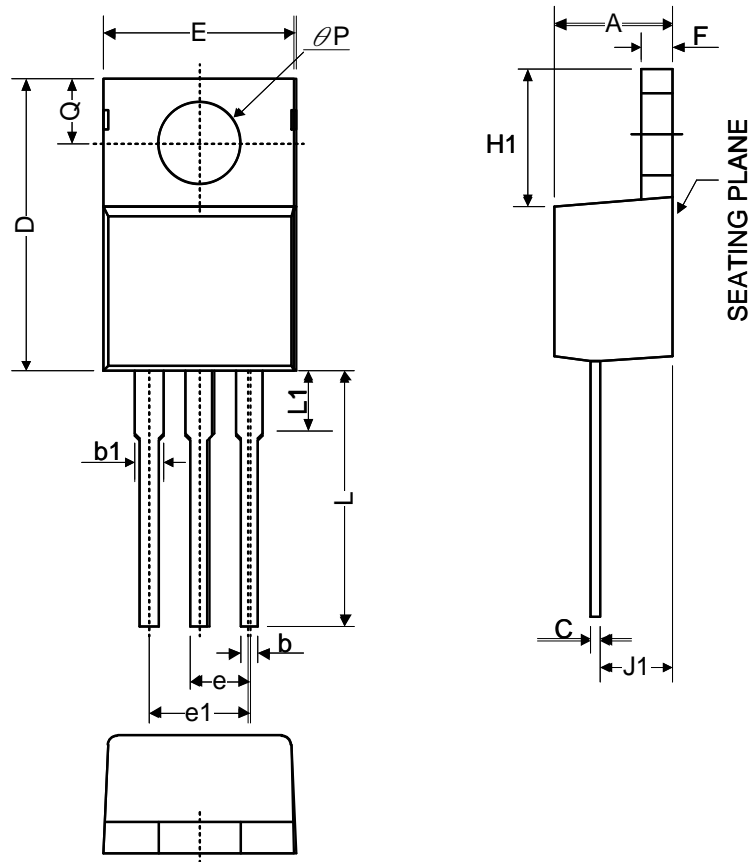
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	2.18	2.29	2.39	0.086	0.09	0.094
A1	-	-	0.13	-	-	0.005
b	0.51	0.71	0.89	0.02	0.028	0.035
b2	4.95	5.21	5.46	0.195	0.205	0.215
C	0.46	0.53	0.61	0.018	0.021	0.024
C1	0.46	0.53	0.58	0.018	0.021	0.023
D	5.33	5.46	6.22	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



(2) TO220-3L



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
$\theta P$	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