

**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR****AZ78MXX****General Description**

The AZ78MXX series are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation.

This series of regulators are complete with internal current limiting, thermal shutdown protection, and safe-area compensation which make them virtually immune from output overload. If adequate heat sinking are provided, these regulators can deliver output currents up to 0.5A.

The AZ78MXX series are available in two standard plastic packages: TO-220 and TO-252.

**Features**

- Output Current up to 0.5A
- Fixed Output Voltages of 5V, 6V, 8V, 9V and 12V
- Output Voltage Tolerances of  $\pm 5\%$  over the Full Temperature Range
- Internal Short Circuit Current-Limiting
- Internal Thermal Overload Protection

**Applications**

- Consumer Electronics
- Microprocessor Power Supply
- Mother Board I/O Power Supply

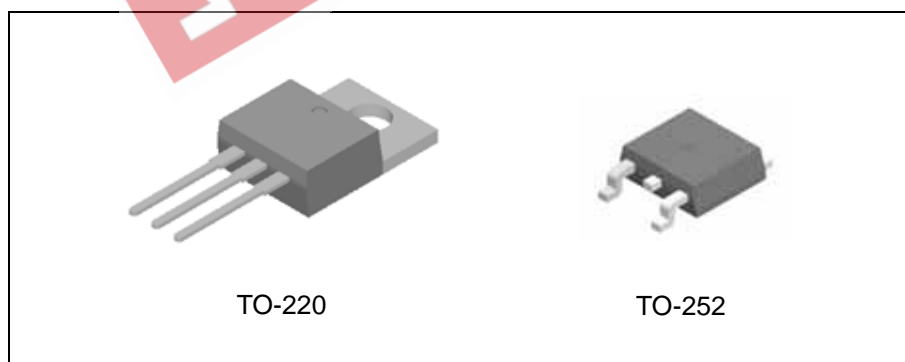


Figure 1. Package Types of AZ78MXX



**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Pin Configuration**

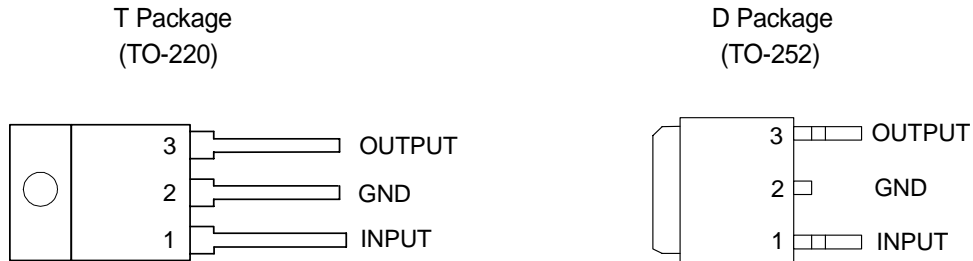


Figure 2. Pin Configuration of AZ78MXX (Top View)



**Pin Description**

Pin Number	Pin Name	Function
1	INPUT	Voltage Input
2	GND	Ground
3	OUTPUT	Voltage Output



**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Functional Block Diagram**

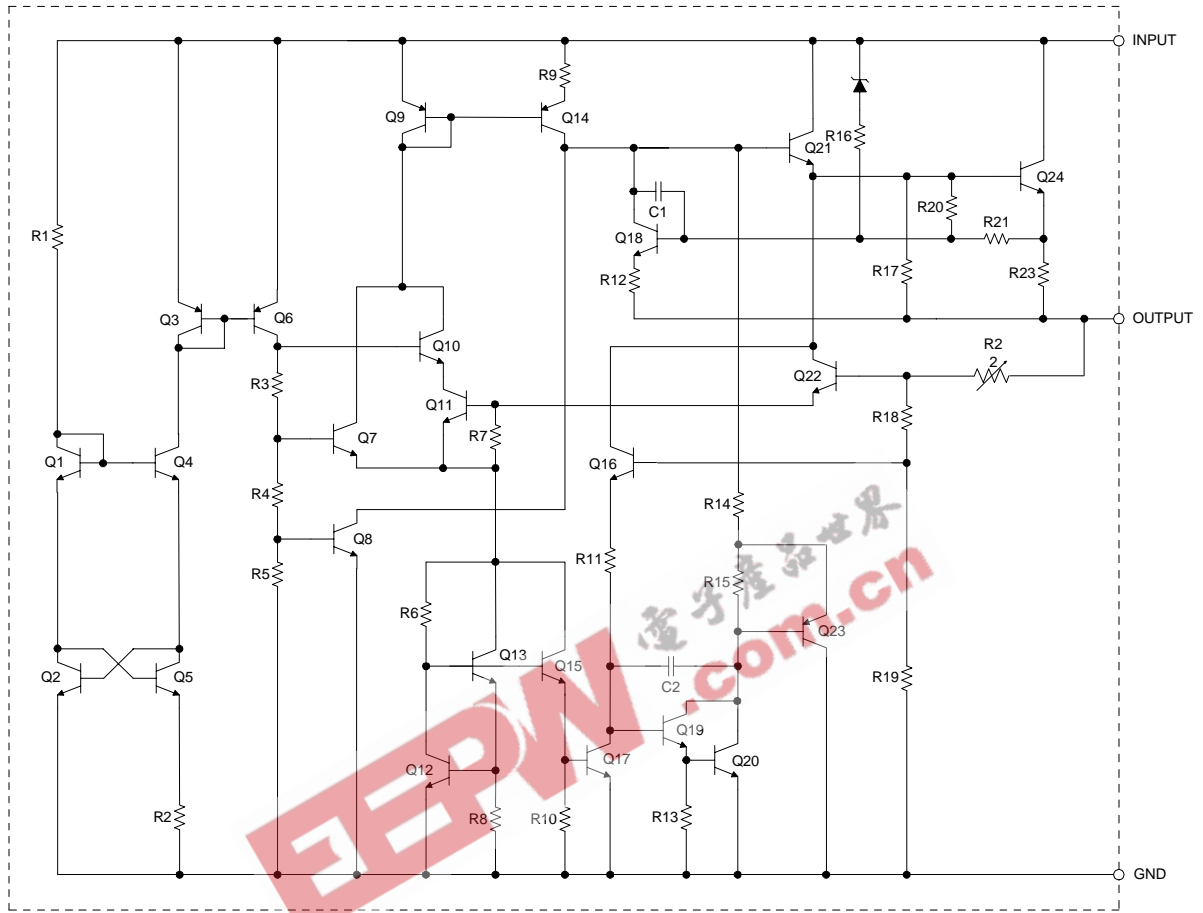


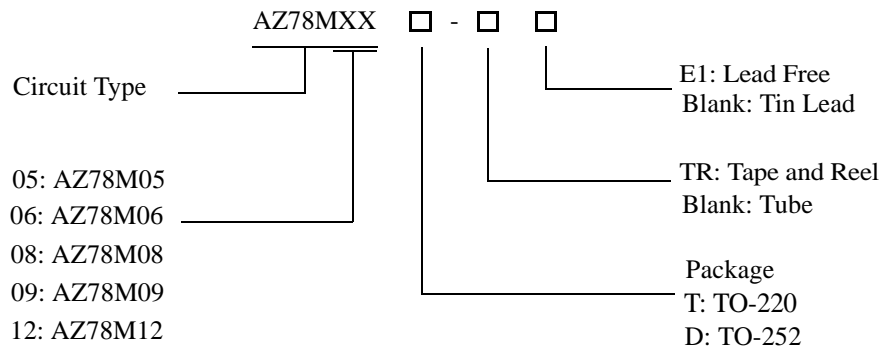
Figure 3. Functional Block Diagram of AZ78MXX



**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Ordering Information**



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
TO-220	-40 to 125°C	AZ78M05T	AZ78M05T-E1	AZ78M05T	AZ78M05T-E1	Tube
		AZ78M06T	AZ78M06T-E1	AZ78M06T	AZ78M06T-E1	Tube
		AZ78M08T	AZ78M08T-E1	AZ78M08T	AZ78M08T-E1	Tube
		AZ78M09T	AZ78M09T-E1	AZ78M09T	AZ78M09T-E1	Tube
		AZ78M12T	AZ78M12T-E1	AZ78M12T	AZ78M12T-E1	Tube
TO-252	-40 to 125°C	AZ78M05D	AZ78M05D-E1	AZ78M05D	AZ78M05D-E1	Tube
		AZ78M05DTR	AZ78M05DTR-E1	AZ78M05D	AZ78M05D-E1	Tape & Reel
		AZ78M06D	AZ78M06D-E1	AZ78M06D	AZ78M06D-E1	Tube
		AZ78M06DTR	AZ78M06DTR-E1	AZ78M06D	AZ78M06D-E1	Tape & Reel
		AZ78M08D	AZ78M08D-E1	AZ78M08D	AZ78M08D-E1	Tube
		AZ78M08DTR	AZ78M08DTR-E1	AZ78M08D	AZ78M08D-E1	Tape & Reel
		AZ78M09D	AZ78M09D-E1	AZ78M09D	AZ78M09D-E1	Tube
		AZ78M09DTR	AZ78M09DTR-E1	AZ78M09D	AZ78M09D-E1	Tape & Reel
		AZ78M12D	AZ78M12D-E1	AZ78M12D	AZ78M12D-E1	Tube
		AZ78M12DTR	AZ78M12DTR-E1	AZ78M12D	AZ78M12D-E1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR****AZ78MXX****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	20	V
Lead Temperature (Soldering, 10 sec.)		300	°C
Power Dissipation	$P_D$	Internally Limited	
Storage Temperature Range	$T_{STG}$	-65 to 150	°C
ESD (Machine Model)	ESD	450	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	$V_{CC}$	7.5	18	V
Operating Junction Temperature Range	$T_J$	-40	125	°C



**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Electrical Characteristics**

**AZ78M05** ( $V_{IN}=10V$ ,  $I_{OUT}=350mA$ ,  $T_J=-40^{\circ}C$  to  $125^{\circ}C$ ,  $P_D \leq 5W$ , unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	4.8	5	5.2	V
		$V_{IN}=7V$ to $15V$ , $I_{OUT}=5mA$ to $350mA$	4.75	5	5.25	V
Line Regulation	$V_{RLINE}$	$T_J=25^{\circ}C$ , $V_{IN}=7V$ to $15V$ , $I_{OUT}=200mA$		3	50	mV
Load Regulation	$V_{RLOAD}$	$T_J=25^{\circ}C$ , $I_{OUT}=5mA$ to $500mA$		20	100	mV
Quiescent Current	$I_Q$	$T_J=25^{\circ}C$		3.2	6	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=8V$ to $15V$ , $I_{OUT}=200mA$			0.8	mA
		$I_{OUT}=5mA$ to $350mA$			0.5	
Ripple Rejection	$\Delta V_{IN}/\Delta V_{OUT}$	$V_{IN}=8V$ to $15V$ , $f=120Hz$ , $I_{OUT}=200mA$	62	73		dB
Dropout Voltage	$V_{IN}-V_{OUT}$	$\Delta V_{OUT}=1\%$ , $T_J=25^{\circ}C$		2		V
Output Noise Voltage	$N_O$	$T_A=25^{\circ}C$ , $f=10Hz$ to $100KHz$		40		$\mu V$
Short Circuit Current	$I_{SC}$	$T_J=25^{\circ}C$ , $V_{IN}=15V$		350		mA
Peak Output Current	$I_{PK}$	$T_J=25^{\circ}C$		700		mA
Output Voltage Drift	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		$\pm 0.2$		$mV/^{\circ}C$

**AZ78M06** ( $V_{IN}=11V$ ,  $I_{OUT}=350mA$ ,  $T_J=-40^{\circ}C$  to  $125^{\circ}C$ ,  $P_D \leq 5W$ , unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	5.75	6	6.25	V
		$V_{IN}=8V$ to $15V$ , $I_{OUT}=5mA$ to $350mA$	5.7	6	6.3	V
Line Regulation	$V_{RLINE}$	$T_J=25^{\circ}C$ , $V_{IN}=8V$ to $15V$ , $I_{OUT}=200mA$		5	50	mV
Load Regulation	$V_{RLOAD}$	$T_J=25^{\circ}C$ , $I_{OUT}=5mA$ to $500mA$		20	120	mV
Quiescent Current	$I_Q$	$T_J=25^{\circ}C$		3.2	6	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=9V$ to $15V$ , $I_{OUT}=200mA$			0.8	mA
		$I_{OUT}=5mA$ to $350mA$			0.5	
Ripple Rejection	$\Delta V_{IN}/\Delta V_{OUT}$	$V_{IN}=9V$ to $15V$ , $f=120Hz$ , $I_{OUT}=200mA$	59	65		dB
Dropout Voltage	$V_{IN}-V_{OUT}$	$\Delta V_{OUT}=1\%$ , $T_J=25^{\circ}C$		2		V
Output Noise Voltage	$N_O$	$T_A=25^{\circ}C$ , $f=10Hz$ to $100KHz$		45		$\mu V$
Short Circuit Current	$I_{SC}$	$T_J=25^{\circ}C$ , $V_{IN}=15V$		350		mA
Peak Output Current	$I_{PK}$	$T_J=25^{\circ}C$		700		mA
Output Voltage Drift	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		$\pm 0.2$		$mV/^{\circ}C$



**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Electrical Characteristics (Continued)**

**AZ78M08** ( $V_{IN}=14V$ ,  $I_{OUT}=350mA$ ,  $T_J=-40^{\circ}C$  to  $125^{\circ}C$ ,  $P_D \leq 5W$ , unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	7.7	8	8.3	V
		$V_{IN}=10.5V$ to $15V$ , $I_{OUT}=5mA$ to $350mA$	7.6	8	8.4	V
Line Regulation	$V_{RLINE}$	$T_J=25^{\circ}C$ , $V_{IN}=10.5V$ to $15V$ , $I_{OUT}=200mA$		6	50	mV
Load Regulation	$V_{RLOAD}$	$T_J=25^{\circ}C$ , $I_{OUT}=5mA$ to $500mA$		25	160	mV
Quiescent Current	$I_Q$	$T_J=25^{\circ}C$		3.2	6	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=10.5V$ to $15V$ , $I_{OUT}=200mA$			0.8	mA
		$I_{OUT}=5mA$ to $350mA$			0.5	
Ripple Rejection	$\Delta V_{IN}/\Delta V_{OUT}$	$V_{IN}=11V$ to $15V$ , $f=120Hz$ , $I_{OUT}=200mA$	56	62		dB
Dropout Voltage	$V_{IN}-V_{OUT}$	$\Delta V_{OUT}=1\%$ , $T_J=25^{\circ}C$		2		V
Output Noise Voltage	$N_O$	$T_A=25^{\circ}C$ , $f=10Hz$ to $100KHz$		52		$\mu V$
Short Circuit Current	$I_{SC}$	$T_J=25^{\circ}C$ , $V_{IN}=15V$		350		mA
Peak Output Current	$I_{PK}$	$T_J=25^{\circ}C$		700		mA
Output Voltage Drift	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		$\pm 0.2$		mV/ $^{\circ}C$

**AZ78M09** ( $V_{IN}=15V$ ,  $I_{OUT}=350mA$ ,  $T_J=-40^{\circ}C$  to  $125^{\circ}C$ ,  $P_D \leq 5W$ , unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	8.65	9	9.35	V
		$V_{IN}=11.5V$ to $15V$ , $I_{OUT}=5mA$ to $350mA$	8.55	9	9.45	V
Line Regulation	$V_{RLINE}$	$T_J=25^{\circ}C$ , $V_{IN}=11.5V$ to $15V$ , $I_{OUT}=200mA$		6	50	mV
Load Regulation	$V_{RLOAD}$	$T_J=25^{\circ}C$ , $I_{OUT}=5mA$ to $500mA$		25	180	mV
Quiescent Current	$I_Q$	$T_J=25^{\circ}C$		3.2	6	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=11.5V$ to $15V$ , $I_{OUT}=200mA$			0.8	mA
		$I_{OUT}=5mA$ to $350mA$			0.5	
Ripple Rejection	$\Delta V_{IN}/\Delta V_{OUT}$	$V_{IN}=12V$ to $15V$ , $f=120Hz$ , $I_{OUT}=200mA$	56	61		dB
Dropout Voltage	$V_{IN}-V_{OUT}$	$\Delta V_{OUT}=1\%$ , $T_J=25^{\circ}C$		2		V
Output Noise Voltage	$N_O$	$T_A=25^{\circ}C$ , $f=10Hz$ to $100KHz$		52		$\mu V$
Short Circuit Current	$I_{SC}$	$T_J=25^{\circ}C$ , $V_{IN}=15V$		350		mA
Peak Output Current	$I_{PK}$	$T_J=25^{\circ}C$		700		mA
Output Voltage Drift	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		$\pm 0.2$		mV/ $^{\circ}C$

**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR****AZ78MXX****Electrical Characteristics (Continued)**AZ78M12 ( $V_{IN}=17V$ ,  $I_{OUT}=350mA$ ,  $T_J=-40^{\circ}C$  to  $125^{\circ}C$ ,  $P_D \leq 5W$ , unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	11.5	12	12.5	V
		$V_{IN}=14.5V$ to $17V$ , $I_{OUT}=5mA$ to $350mA$	11.4	12	12.6	V
Line Regulation	$V_{RLINE}$	$T_J=25^{\circ}C$ , $V_{IN}=14.5V$ to $17V$ , $I_{OUT}=200mA$		8	50	mV
Load Regulation	$V_{RLOAD}$	$T_J=25^{\circ}C$ , $I_{OUT}=5mA$ to $500mA$		25	240	mV
Quiescent Current	$I_Q$	$T_J=25^{\circ}C$		3.2	6	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=14.5V$ to $17V$ , $I_{OUT}=200mA$			0.8	mA
		$I_{OUT}=5mA$ to $350mA$			0.5	
Ripple Rejection	$\Delta V_{IN}/\Delta V_{OUT}$	$V_{IN}=15V$ to $17V$ , $f=120Hz$ , $I_{OUT}=200mA$	55	60		dB
Dropout Voltage	$V_{IN}-V_{OUT}$	$\Delta V_{OUT}=1\%$ , $T_J=25^{\circ}C$		2		V
Output Noise Voltage	$N_O$	$T_A=25^{\circ}C$ , $f=10Hz$ to $100KHz$		75		$\mu V$
Short Circuit Current	$I_{SC}$	$T_J=25^{\circ}C$ , $V_{IN}=17V$		350		mA
Peak Output Current	$I_{PK}$	$T_J=25^{\circ}C$		700		mA
Output Voltage Drift	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		$\pm 0.3$		mV/ $^{\circ}C$





**Typical Performance Characteristics**

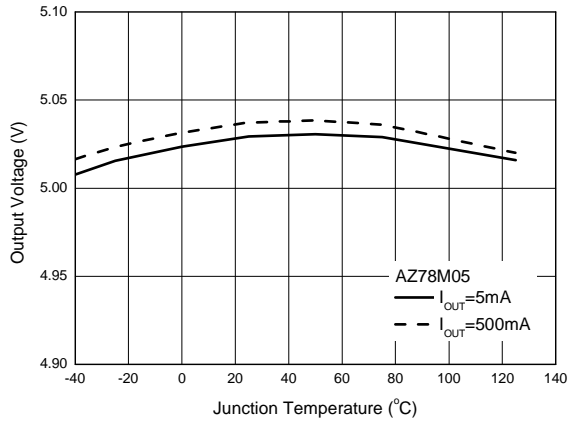


Figure 4. Output Voltage vs. Junction Temperature

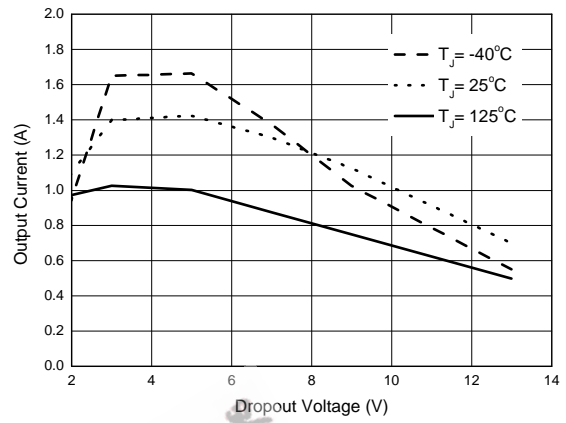


Figure 5. Peak Output Current vs. Dropout Voltage

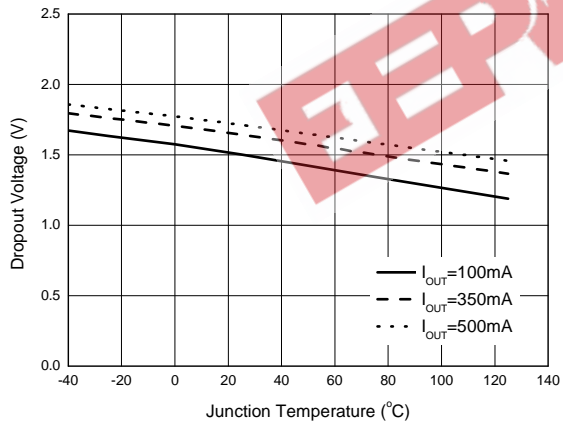


Figure 6. Dropout Voltage vs. Junction Temperature

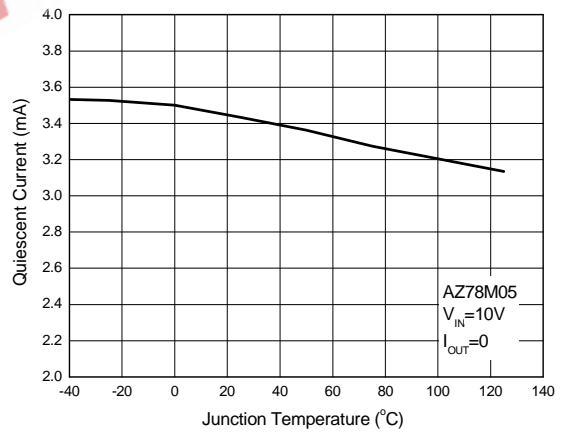


Figure 7. Quiescent Current vs. Junction Temperature



**Typical Performance Characteristics (Continued)**

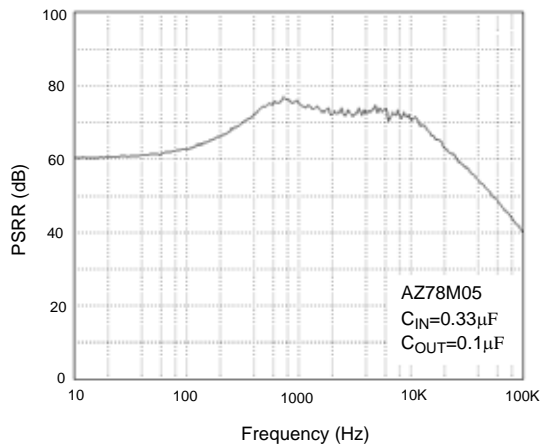


Figure 8. PSRR vs. Frequency





**Typical Application**

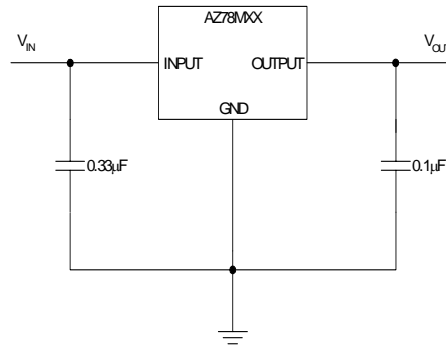


Figure 9. Typical Application of AZ78MXX

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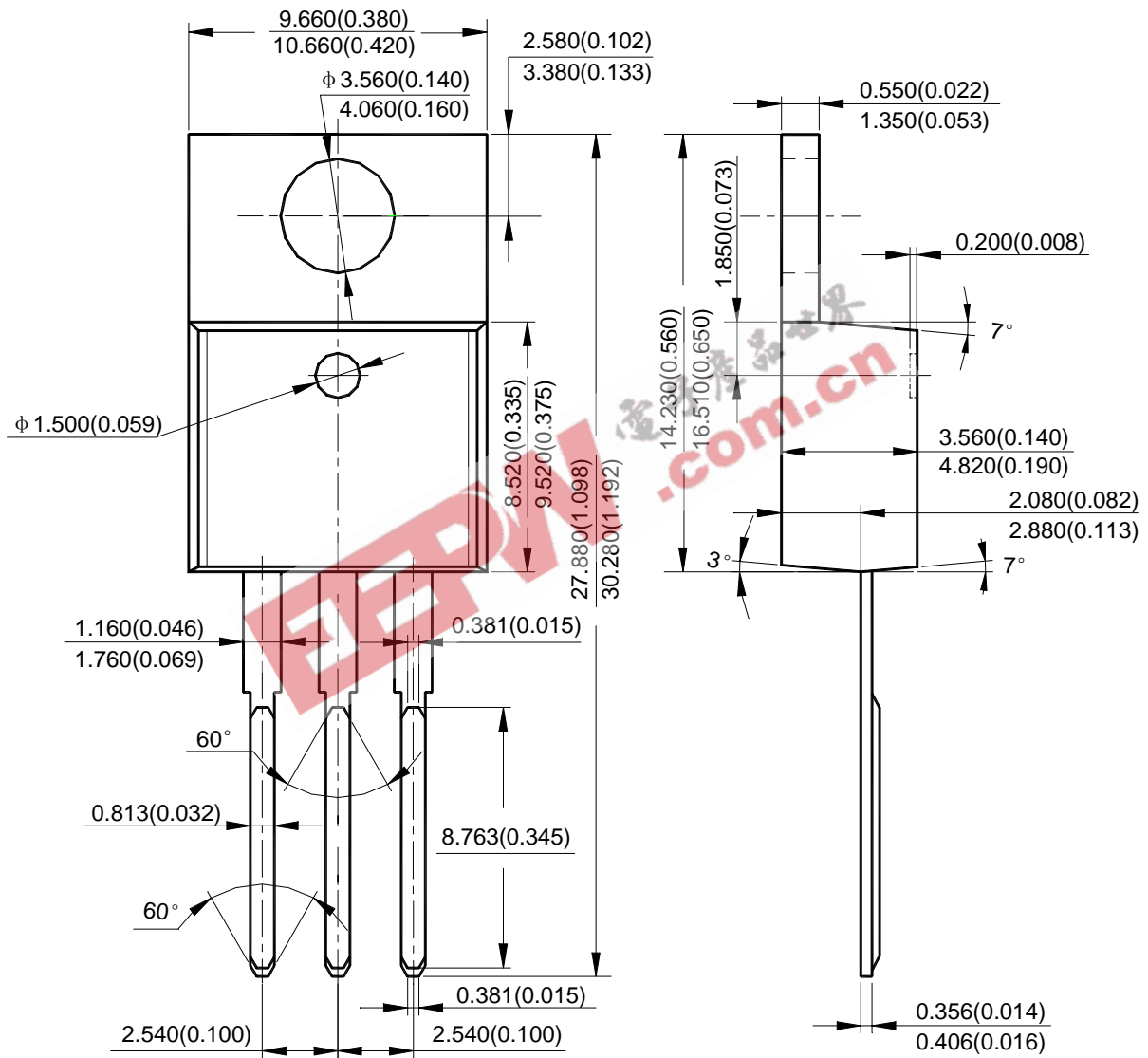
**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Mechanical Dimensions**

**TO-220**

**Unit: mm(inch)**





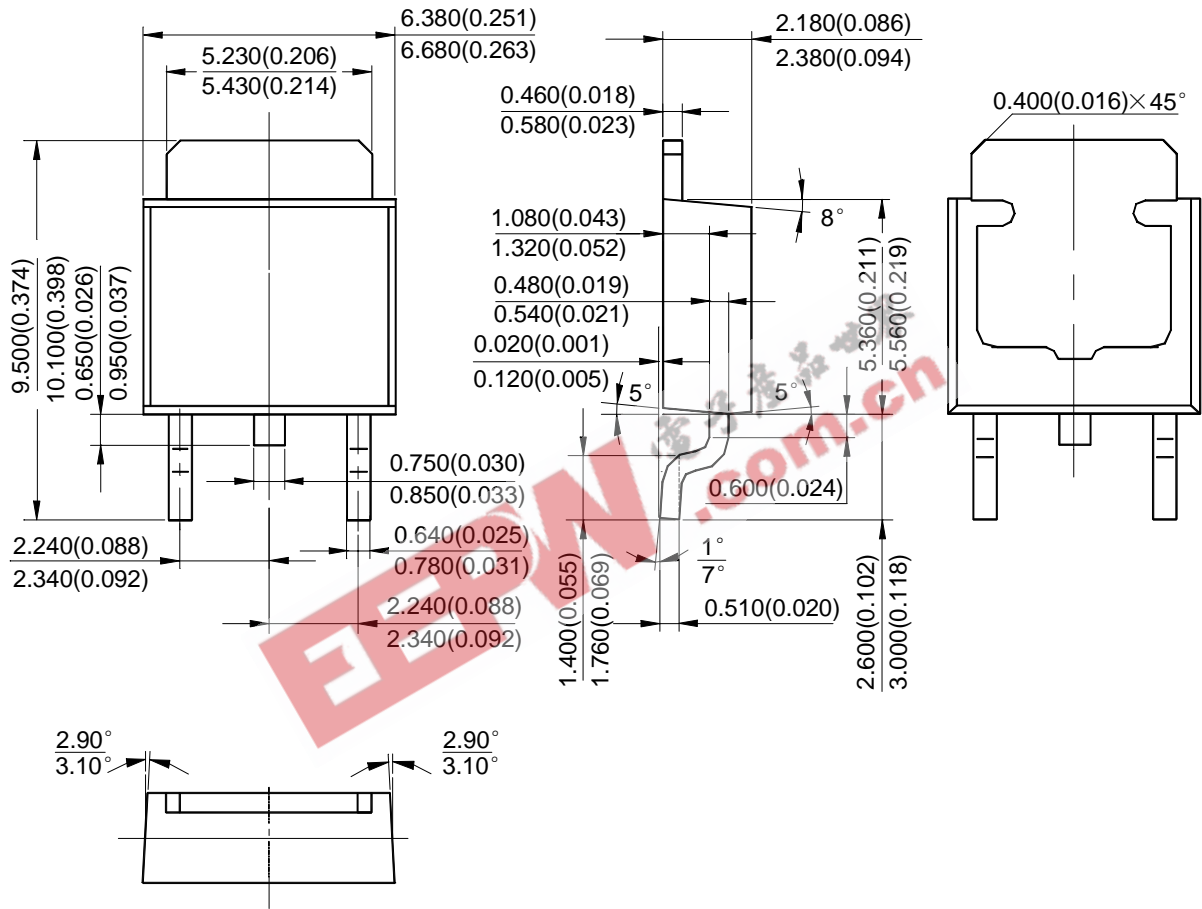
**500mA 3-TERMINAL POSITIVE VOLTAGE REGULATOR**

**AZ78MXX**

**Mechanical Dimensions (Continued)**

**TO-252**

**Unit: mm(inch)**





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**BCD Semiconductor Corporation**

3170 De La Cruz Blvd, Suite # 105 Santa Clara, CA 95054-2411, U.S.A

Tel: +1-408-988 6388, Fax: +1-408-988 6386

**Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.**

800 Yi Shan Road, Shanghai 200233, PRC

Tel: +86-21-6485-1491, Fax: +86-21-5450-0008

**Advanced Analog Circuits (Shanghai) Corporation**

8F, B Zone, 900 Yi Shan Road, Shanghai 200233, PRC

Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

**BCD Semiconductor (Taiwan) Company Limited**

Room 2210, 22nd Fl, 333, Keelung Road, Sec. 1, TaiPei (110), Taiwan

Tel: +886-2-2758 6828, Fax: +886-2-2758 6892

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