3-TERMINAL POSITIVE LINEAR REGULATOR AZ78LXX

General Description

The AZ78LXX series are three terminal positive regulators with several fixed output voltages. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The AZ78LXX can be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. When used as a Zener diode/resistor combination replacement, the AZ78LXX usually results an effective output impedance improvement of two orders of magnitude, and lower quiescent current.

With adequate heat sinking the AZ78LXX can deliver 100mA output current. Current limiting is included to limit the peak output current to a safe value. Thermal protection is also provided. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

The AZ78LXX are available in the plastic TO-92 (bulk or ammo packing), SOT-223 and SOT-89 packages.

Features

- Output Current up to 100mA
- Fixed Output Voltages of 5V, 8V, 9V and 12V
- Output Voltage Tolerances of ±5% over the Full Temperature Range
- Internal Short Circuit Current-limiting
- Internal Thermal Overload Protection
- No External Components

Applications

- High Efficiency Linear Regulator
- Post Regulation for Switching Supply
- Microprocessor Power Supply
- Mother Board I/O Power Supply

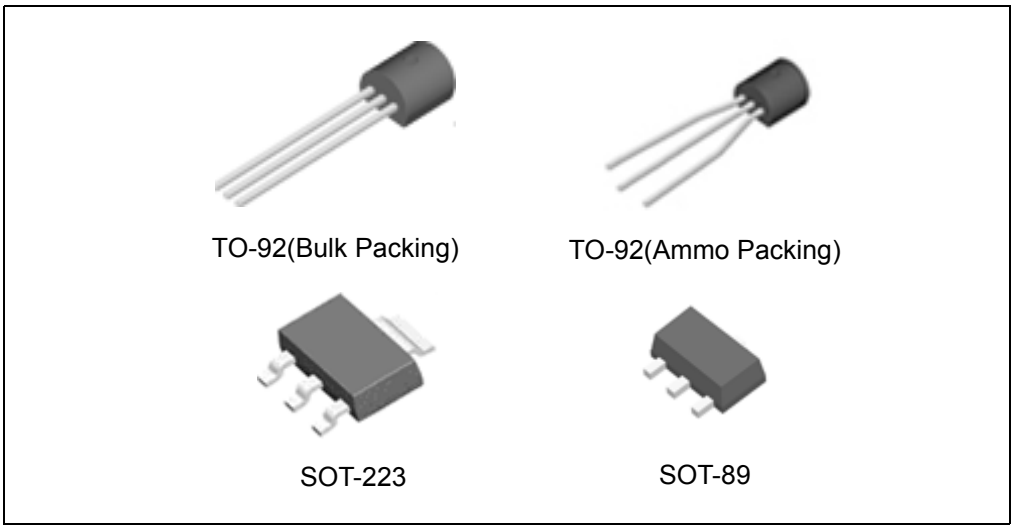
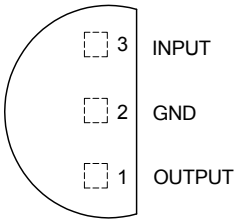


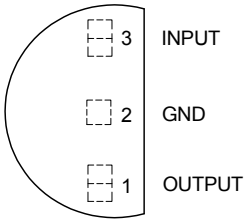
Figure 1. Package Types of the AZ78LXX

Pin Configuration

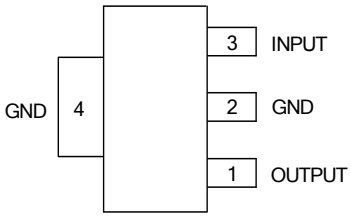
Z Package
(TO-92(Bulk Packing))



Z Package
(TO-92(Ammo Packing))



H Package
(SOT-223)



Connect pin 4 to pin 2 or leave
pin 4 electrically isolated

R Package
(SOT-89)

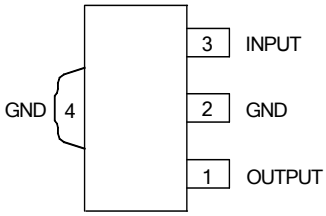


Figure 2. Pin Configuration of the AZ78LXX (Top View)

Functional Block Diagram

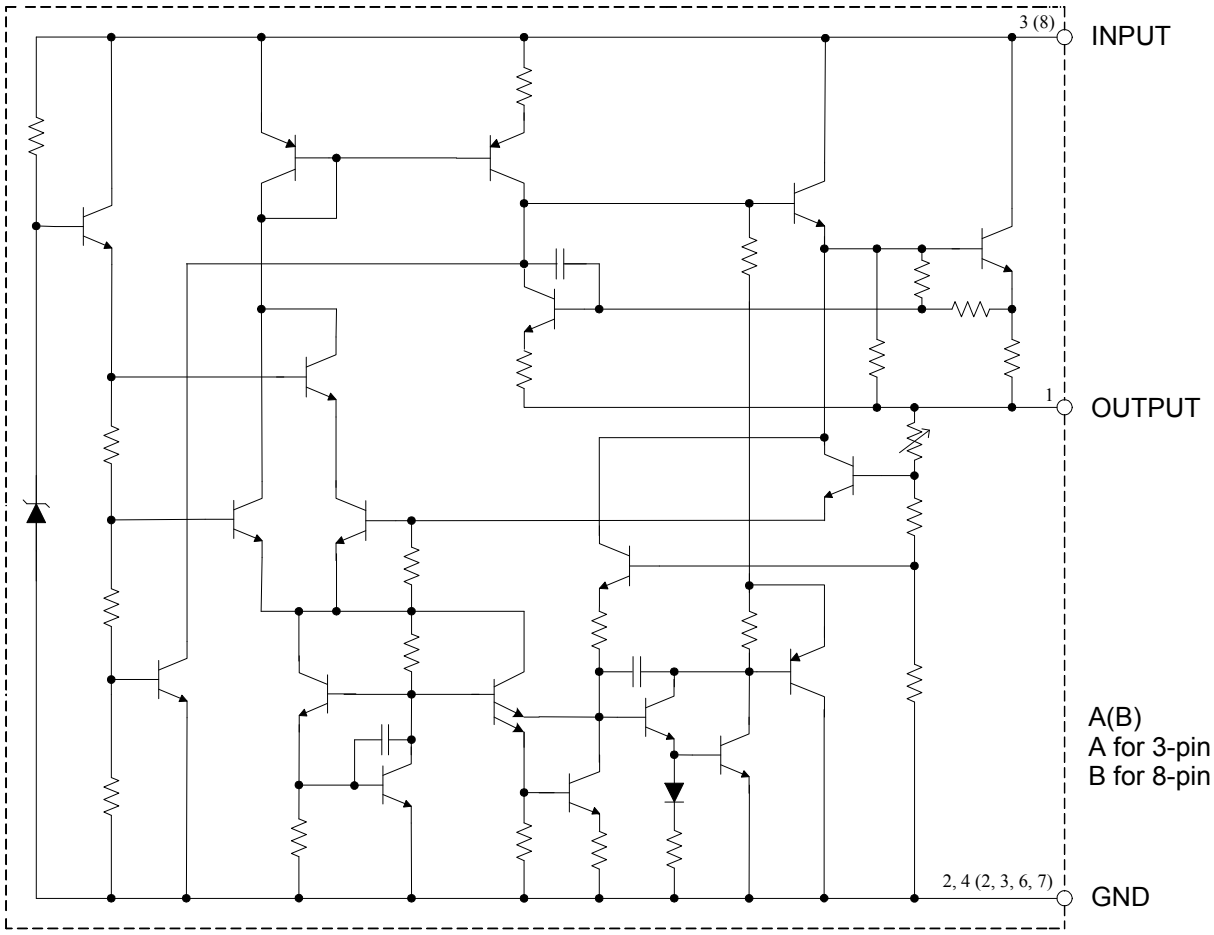
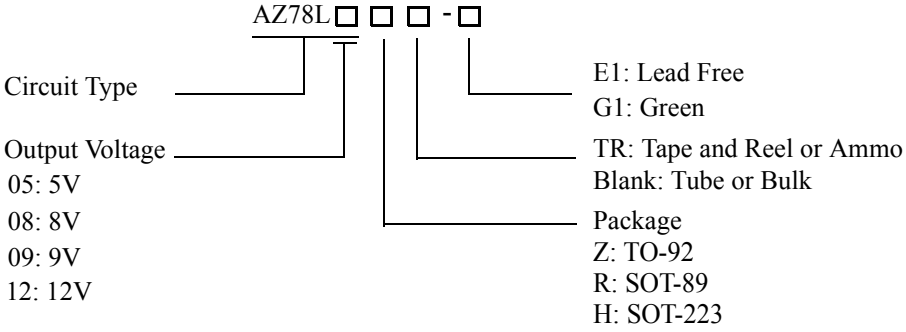


Figure 3. Functional Block Diagram of the AZ78LXX

Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
TO-92	-40 to 125°C	AZ78L05Z-E1	AZ78L05Z-G1	AZ78L05Z-E1	AZ78L05Z-G1	Bulk
		AZ78L05ZTR-E1	AZ78L05ZTR-G1	AZ78L05Z-E1	AZ78L05Z-G1	Ammo
		AZ78L08Z-E1	AZ78L08Z-G1	AZ78L08Z-E1	AZ78L08Z-G1	Bulk
		AZ78L08ZTR-E1	AZ78L08ZTR-G1	AZ78L08Z-E1	AZ78L08Z-G1	Ammo
		AZ78L09Z-E1	AZ78L09Z-G1	AZ78L09Z-E1	AZ78L09Z-G1	Bulk
		AZ78L09ZTR-E1	AZ78L09ZTR-G1	AZ78L09Z-E1	AZ78L09Z-G1	Ammo
		AZ78L12Z-E1	AZ78L12Z-G1	AZ78L12Z-E1	AZ78L12Z-G1	Bulk
		AZ78L12ZTR-E1	AZ78L12ZTR-G1	AZ78L12Z-E1	AZ78L12Z-G1	Ammo
SOT-89	-40 to 125°C	AZ78L05RTR-E1	AZ78L05RTR-G1	E78A	G78A	Tape & Reel
		AZ78L08RTR-E1	AZ78L08RTR-G1	E78B	G78B	Tape & Reel
		AZ78L09RTR-E1	AZ78L09RTR-G1	E78C	G78C	Tape & Reel
		AZ78L12RTR-E1	AZ78L12RTR-G1	E78D	G78D	Tape & Reel
SOT-223	-40 to 125°C	AZ78L05HTR-E1	AZ78L05HTR-G1	EH78A	GH78A	Tape & Reel
		AZ78L08HTR-E1	AZ78L08HTR-G1	EH78B	GH78B	Tape & Reel
		AZ78L09HTR-E1	AZ78L09HTR-G1	EH78C	GH78C	Tape & Reel
		AZ78L12HTR-E1	AZ78L12HTR-G1	EH78D	GH78D	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Input Voltage	V_{IN}	20		V
Operating Junction Temperature	T_J	150		°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260		°C
Power Dissipation (T_A=25°C)	P_D	TO-92	0.65	W
		SOT-223	0.7	
		SOT-89	0.65	
Storage Temperature Range	T_{STG}	-65 to 150		°C
ESD (Human Body Model)	ESD	2000		V
ESD (Machine Model)	ESD	200		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
Input Voltage	AZ78L05	V_{IN}		15	V
	AZ78L08			18	
	AZ78L09			18	
	AZ78L12			18	
Operating Junction Temperature		T_J	-40	125	°C

Electrical Characteristics

AZ78L05 Electrical Characteristics

Limits in standard typeface are for T_J=25°C, **Bold typeface applies over -40°C to 125°C,** I_{OUT}=40mA, C_{IN} =0.33μF, C_{OUT}=0.1μF, V_{IN}=10V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}		4.8	5	5.2	V
		7.0V ≤ V_{IN} ≤ 15V 1.0mA ≤ I_{OUT} ≤ 40mA (Note 2)	**4.75**		**5.25**	
Line Regulation	V_{RLINE}	7.0V ≤ V_{IN} ≤ 15V		18	75	mV
Load Regulation	V_{RLOAD}	1.0mA ≤ I_{OUT} ≤ 100mA		20	60	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}	T_J=25°C		150		mA
Quiescent Current	I_Q	I_{OUT}=0		3	5	mA
Quiescent Current Change	ΔI_Q	8.0V ≤ V_{IN} ≤ 15V			**1.0**	mA
		1.0mA ≤ I_{OUT} ≤ 40mA			**0.1**	
Output Noise Voltage	N_O	10Hz ≤ f ≤ 100kHz (Note 3)		40		μV
Ripple Rejection	PSRR	f=120Hz, 8.0V ≤ V_{IN} ≤ 15V	47	62		dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5.0mA		0.65		mV/°C
Minimum Value of Input Voltage Required to Maintain Line Regulation	V_{IN} (Min)			6.7	7	V
Thermal Resistance	θ_{JC}	TO-92		81		°C/W
		SOT-89		29.8		
		SOT-223		71		

Note 2: Power Dissipation ≤ 0.6W

Note 3: Recommended minimum load capacitance of 0.01μF to limit high frequency noise.

Electrical Characteristics (Continued)

AZ78L08 Electrical Characteristics

Limits in standard typeface are for T_J=25°C, **Bold typeface applies over -40°C to 125°C,** I_{OUT}=40mA, C_{IN} =0.33μF, C_{OUT}=0.1μF, V_{IN}=14V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}		7.7	8.0	8.3	V
		11V ≤ V_{IN} ≤ 18V 1.0mA ≤ I_{OUT} ≤ 40mA (Note	**7.6**		**8.4**	
Line Regulation	V_{RLINE}	11V ≤ V_{IN} ≤ 18V		18	75	mV
Load Regulation	V_{RLOAD}	1.0mA ≤ I_{OUT} ≤ 100mA		20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}	T_J=25°C		150		mA
Quiescent Current	I_Q	I_{OUT}=0		3	5	mA
Quiescent Current Change	ΔI_Q	11V ≤ V_{IN} ≤ 18V			**1.5**	mA
		1.0mA ≤ I_{OUT} ≤ 40mA			**0.1**	
Output Noise Voltage	N_O	10Hz ≤ f ≤ 100kHz (Note 3)		60		μV
Ripple Rejection	PSRR	f=120Hz, 11V ≤ V_{IN} ≤ 18V	39	45		dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$	I_{OUT}= 5.0mA		0.8		mV/°C
Minimum Value of Input Voltage Required to Maintain Line Regulation	V_{IN} (Min)			9.7		V
Thermal Resistance	θ_{JC}	TO-92		81		°C/W
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation ≤ 0.6W

Note 3: Recommended minimum load capacitance of 0.01μF to limit high frequency noise.

Electrical Characteristics (Continued)

AZ78L09 Electrical Characteristics

Limits in standard typeface are for T_J=25°C, **Bold typeface applies over -40°C to 125°C,** I_{OUT}=40mA, C_{IN} =0.33μF, C_{OUT}=0.1μF, V_{IN} =15V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}		8.6	9	9.4	V
		12V ≤ V_{IN} ≤ 18V 1.0mA ≤ I_{OUT} ≤ 40mA (Note 2)	**8.55**		**9.45**	
Line Regulation	V_{RLINE}	12V ≤ V_{IN} ≤ 18V		18	75	mV
Load Regulation	V_{RLOAD}	1.0mA ≤ I_{OUT} ≤ 100mA		20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}	T_J=25°C		150		mA
Quiescent Current	I_Q	I_{OUT}=0		3	5	mA
Quiescent Current Change	ΔI_Q	12V ≤ V_{IN} ≤ 18V			**1.5**	mA
		1.0mA ≤ I_{OUT} ≤ 40mA			**0.1**	
Output Noise Voltage	N_O	10Hz ≤ f ≤ 100kHz (Note 3)		70		μV
Ripple Rejection	PSRR	f=120Hz, 12V ≤ V_{IN} ≤ 18V	38	44		dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$	I_{OUT}= 5.0mA		0.9		mV/°C
Minimum Value of Input Voltage Required to Maintain Line Regulation	V_{IN} (Min)			10.7		V
Thermal Resistance	θ_{JC}	TO-92		81		°C/W
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation ≤ 0.6W

Note 3: Recommended minimum load capacitance of 0.01μF to limit high frequency noise.

Electrical Characteristics (Continued)

AZ78L12 Electrical Characteristics

Limits in standard typeface are for T_J=25°C, **Bold typeface applies over -40°C to 125°C,** I_{OUT}=40mA, C_{IN} =0.33μF, C_{OUT}=0.1μF, V_{IN}=18V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}		11.5	12	12.5	V
		15V ≤ V_{IN} ≤ 18V 1.0mA ≤ I_{OUT} ≤ 40mA (Note 2)	**11.4**		**12.6**	
Line Regulation	V_{RLINE}	15V ≤ V_{IN} ≤ 18V		18	75	mV
Load Regulation	V_{RLOAD}	1.0mA ≤ I_{OUT} ≤ 100mA		20	90	mV
Dropout Voltage	V_{DROP}			1.6		V
Current Limit	I_{LIMIT}	T_J=25°C		150		mA
Quiescent Current	I_Q	I_{OUT}=0		3	5	mA
Quiescent Current Change	ΔI_Q	15V ≤ V_{IN} ≤ 18V			**1.5**	mA
		1.0mA ≤ I_{OUT} ≤ 40mA			**0.1**	
Output Noise Voltage	N_O	10Hz ≤ f ≤ 100kHz (Note 3)		80		μV
Ripple Rejection	PSRR	f=120Hz, 15V ≤ V_{IN} ≤ 18V	40	54		dB
Peak Output Current	I_{PK}			150		mA
Average Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5.0mA		1.0		mV/°C
Minimum Value of Input Voltage Required to Maintain Line Regulation	V_{IN} (Min)			13.7		V
Thermal Resistance	θ_{JC}	TO-92		81		°C/W
		SOT-89		84		
		SOT-223		71		

Note 2: Power Dissipation ≤ 0.6W

Note 3: Recommended minimum load capacitance of 0.01μF to limit high frequency noise.

Typical Performance Characteristics

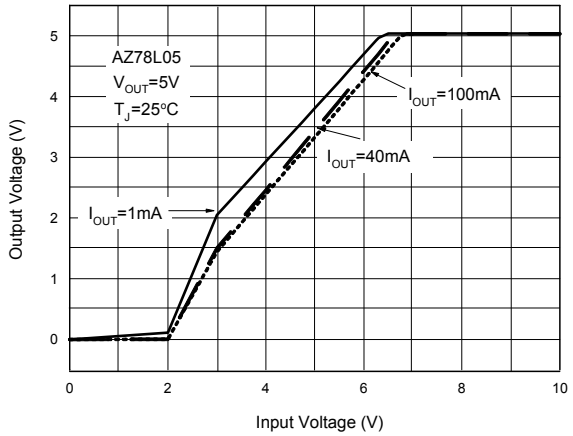


Figure 4. Dropout Characteristics

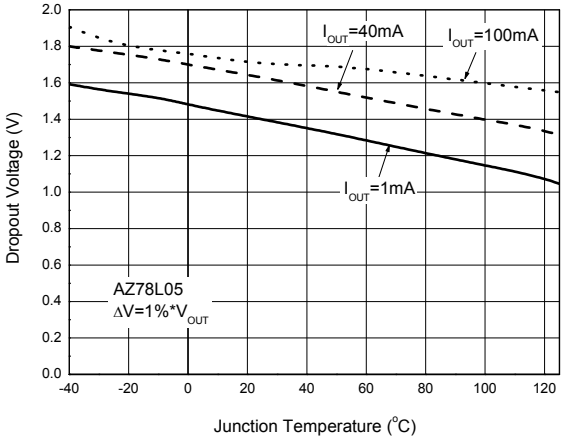


Figure 5. Dropout Voltage vs. Junction Temperature

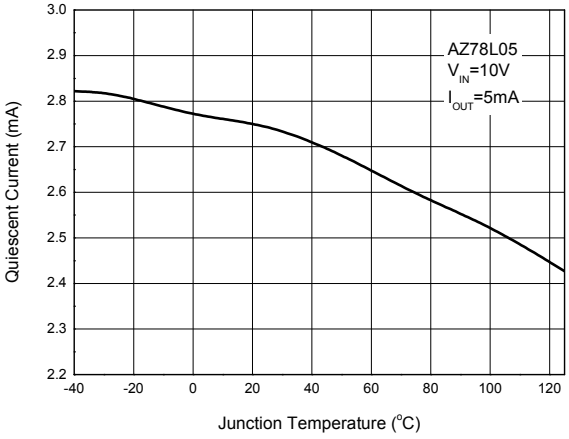


Figure 6. Quiescent Current vs. Junction Temperature

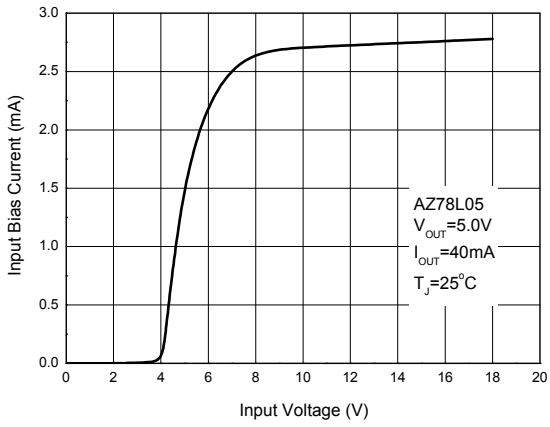


Figure 7. Input Bias Current vs. Input Voltage

Typical Performance Characteristics (Continued)

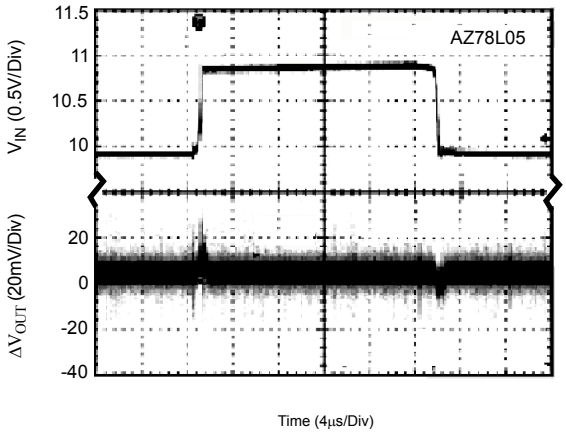


Figure 8. Line Transient Response
(Conditions: V_{IN}=10 to 11V, V_{OUT}=5V, I_{OUT}=40mA)

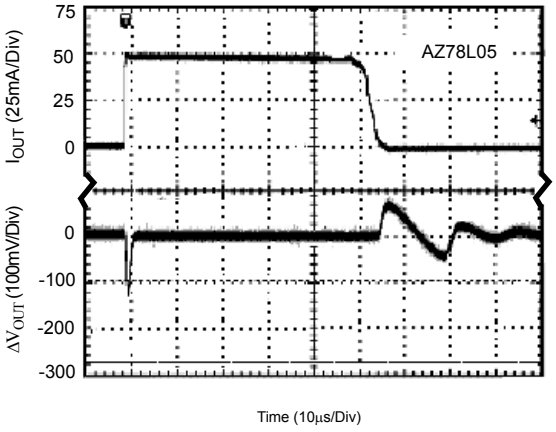
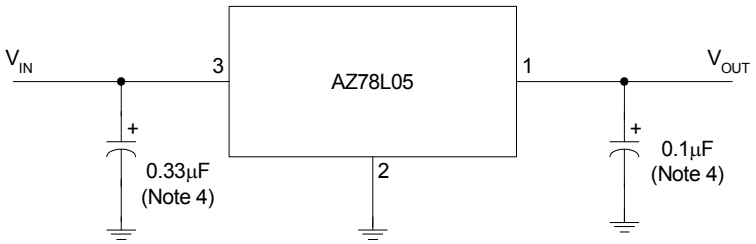


Figure 9. Load Transient Response
(Conditions: V_{IN}=10V, V_{OUT}=5V, I_{OUT}=1 to 50mA)

Typical Application

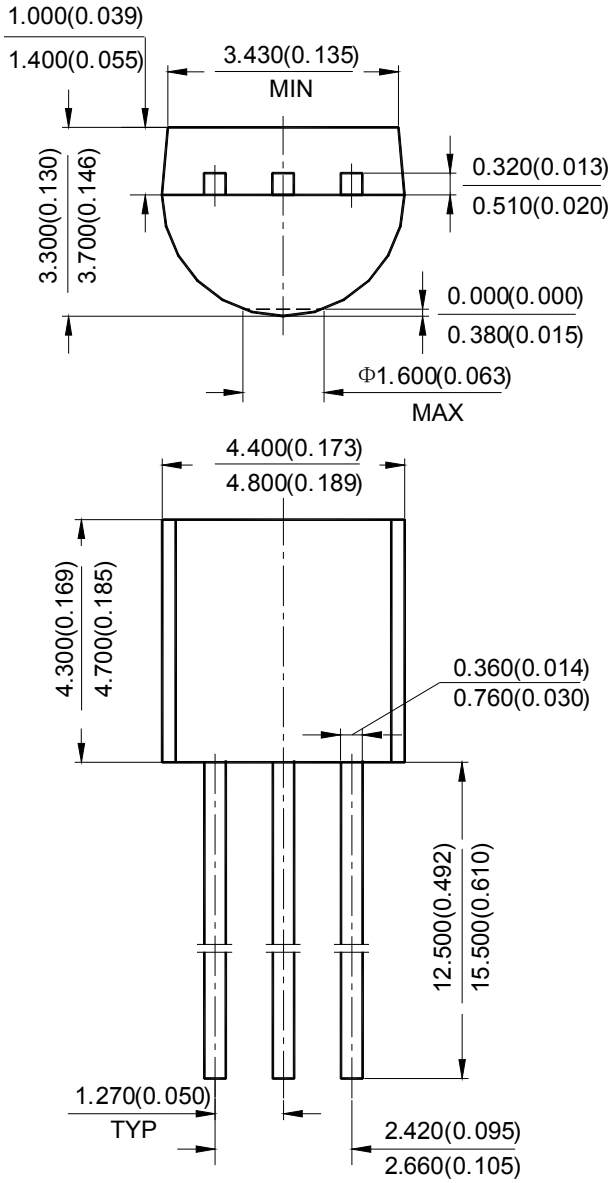


Note 4: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.

Figure 10. Typical Application of the AZ78LXX

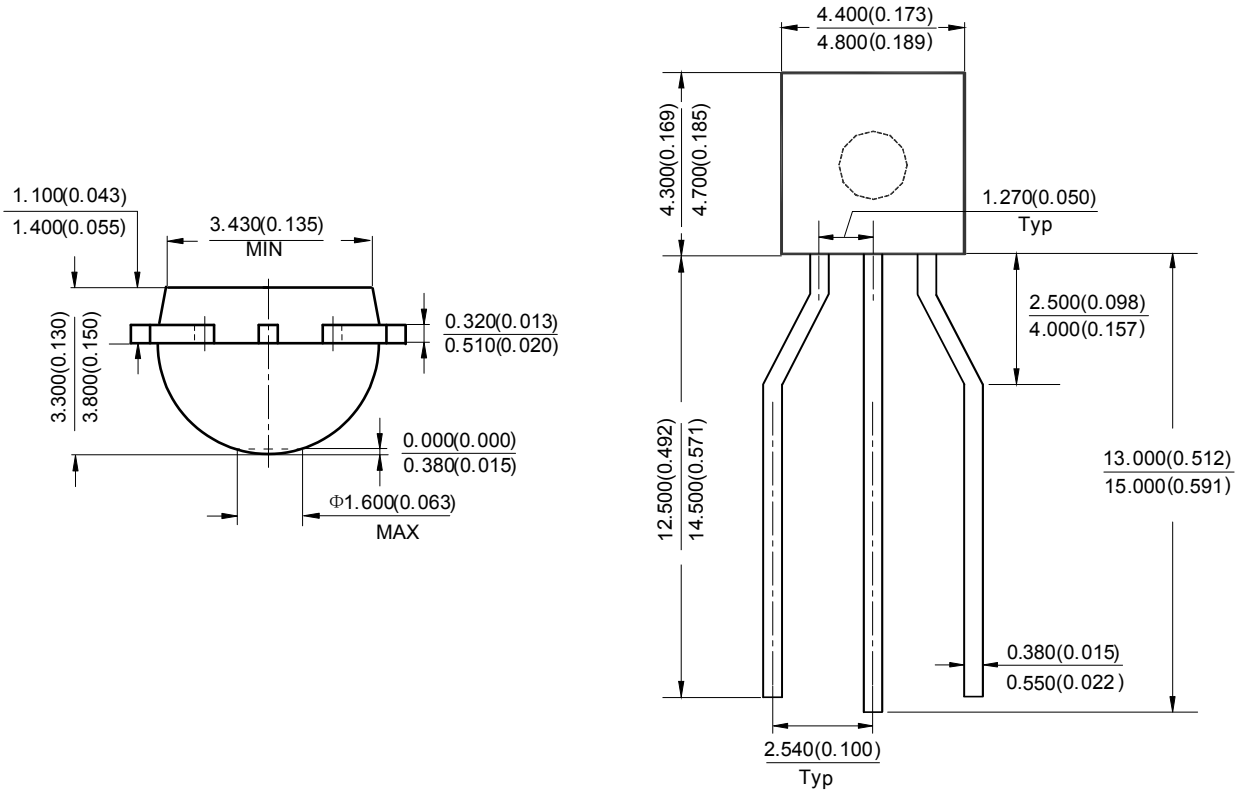
Mechanical Dimensions

TO-92(Bulk Packing) **Unit: mm(inch)**



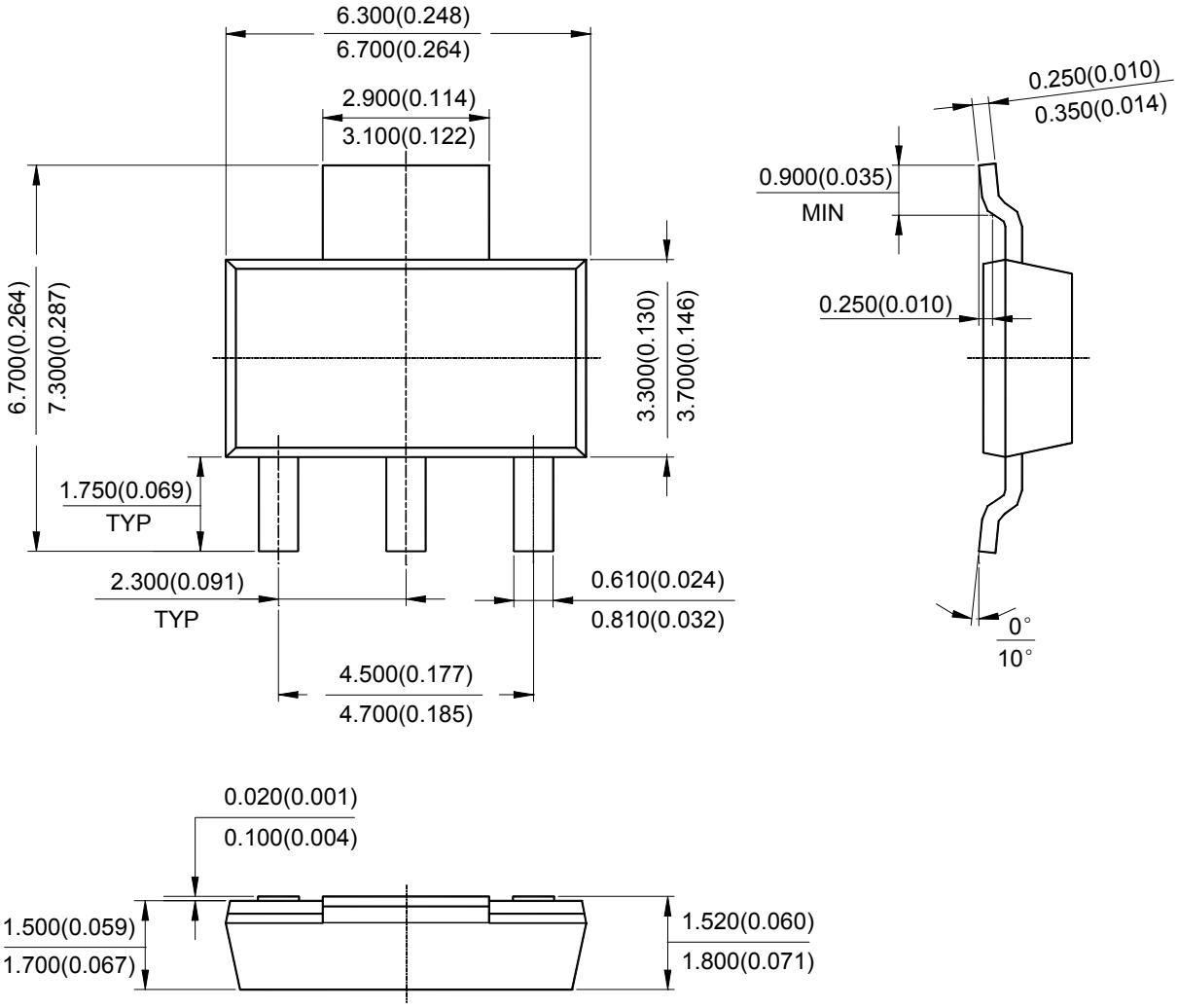
Mechanical Dimensions (Continued)

TO-92(Ammo Packing) **Unit: mm(inch)**



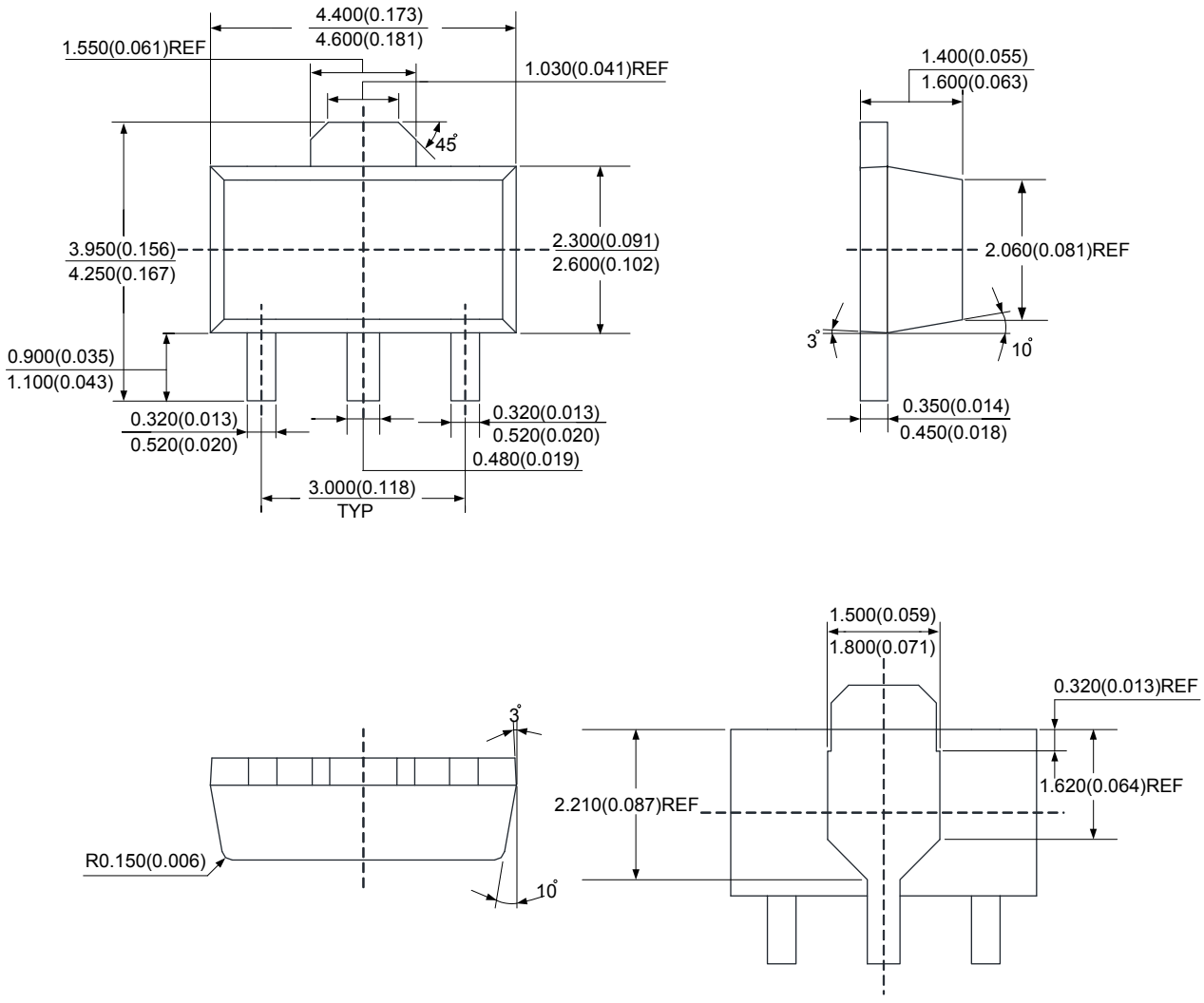
Mechanical Dimensions (Continued)

SOT-223 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

SOT-89 **Unit: mm(inch)**



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