



**THE DATASHEET OF  
AS78L05CZTR-E1**



## Description

The AS78LXX series are three terminal positive regulators designed 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 100mA.

The AS78LXX series are available in TO-92 (bulk or ammo packing), SOT-89 and SOIC-8 packages.

## Features

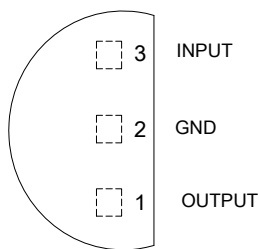
- Output Current up to 100mA
- Fixed Output Voltages of 5V, 12V and 15V
- Output Voltage Accuracy of  $\pm 5\%$  over the Full Temperature Range
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- No External Components
- Output Transistor Safe-area Protection

## Applications

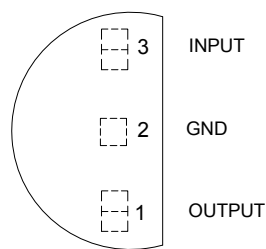
- Consumer Electronics
- Microprocessor Power Supply
- Mother Board

## Pin Assignments

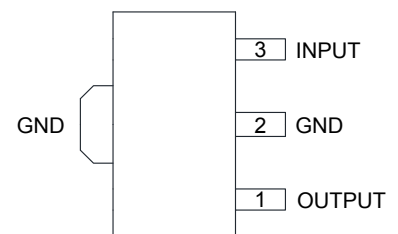
Z Package  
(TO-92(Bulk Packing))



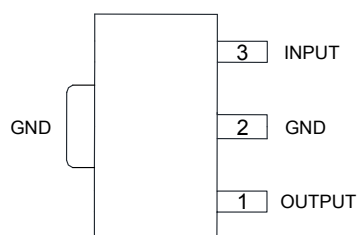
Z Package  
(TO-92(Ammo Packing))



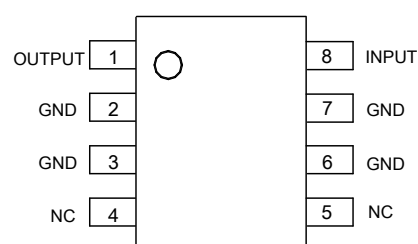
R Package  
(SOT-89 Option 1)



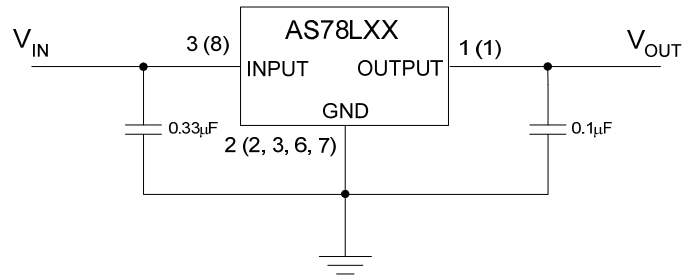
R Package  
(SOT-89 Option 2)



M Package  
(SOIC-8)

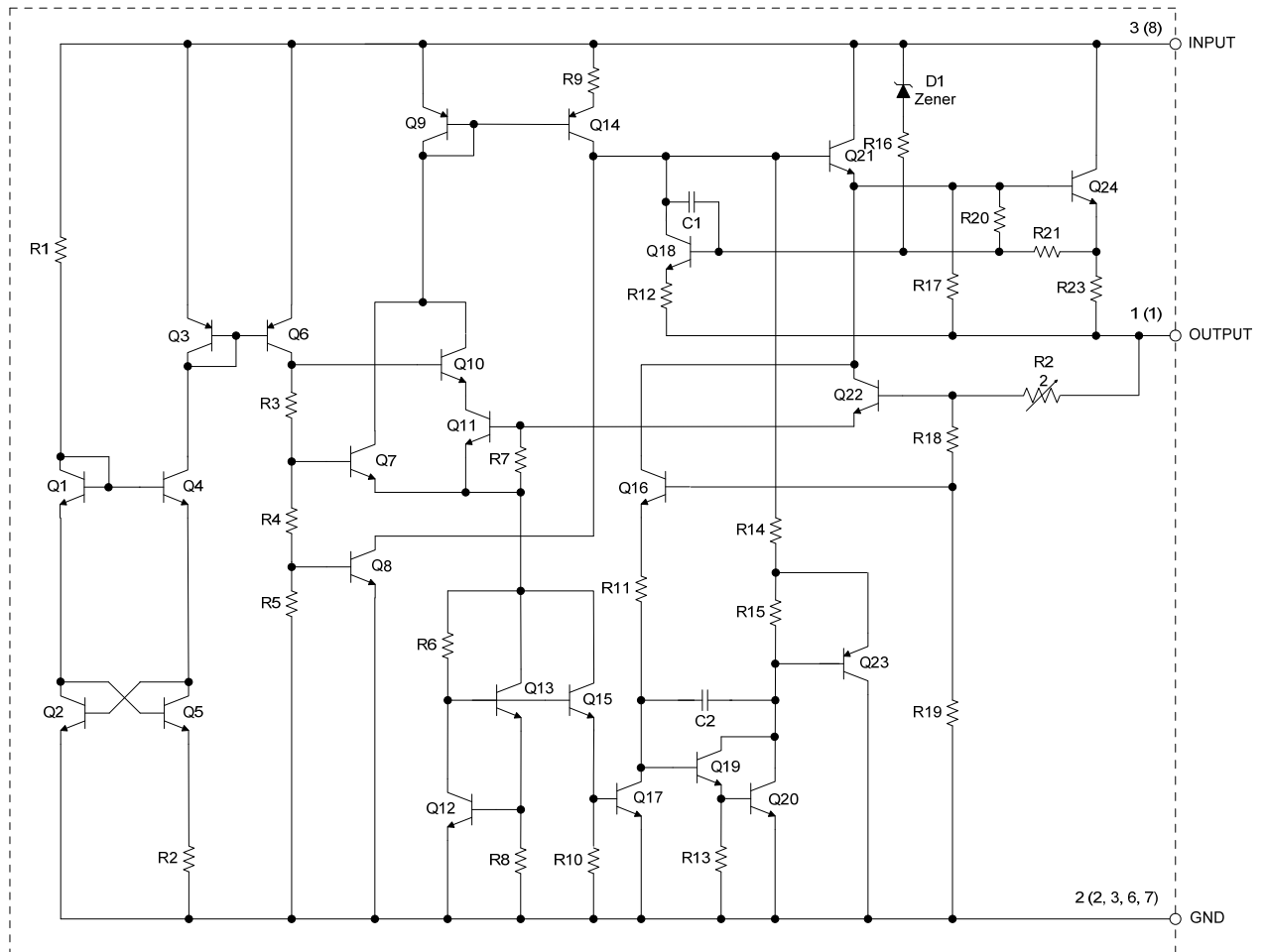


**Typical Applications Circuit**



A (B)  
A for 3-pin    B for 8-pin

**Functional Block Diagram**



A (B)  
A for 3-pin    B for 8-pin

## Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating		Unit
$V_{IN}$	Input Voltage	36		V
$T_J$	Operating Junction Temperature	150		°C
$T_{LEAD}$	Lead Temperature (Soldering, 10sec)	260		°C
$P_D$	Power Dissipation	750		mW
$T_{STG}$	Storage Temperature Range	-65 to 150		°C
$\theta_{JA}$	Thermal Resistance	TO-92	180	°C/W
ESD	ESD (Human Body Model)	2000		V
ESD	ESD (Machine Model)	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

Symbol	Parameter		Min	Max	Unit
$V_{IN}$	Input Voltage	AS78L05		30	V
		AS78L12		36	
		AS78L15		36	
$T_J$	Operating Junction Temperature Range		-40	125	°C

## Electrical Characteristics

**AS78L05** (@  $V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage		4.8	5.0	5.2	V
		$7V \leq V_{IN} \leq 20V$ , $1mA \leq I_{OUT} \leq 100mA$ , $P_D \leq 0.75W$	<b>4.75</b>		<b>5.25</b>	
$V_{RLINE}$	Line Regulation	$7V \leq V_{IN} \leq 20V$		8	150	mV
$V_{RLOAD}$	Load Regulation	$1mA \leq I_{OUT} \leq 100mA$		10	60	mV
$I_Q$	Quiescent Current			3	5.5	mA
$\Delta I_Q$	Quiescent Current Change	$8V \leq V_{IN} \leq 20V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
PSRR	Ripple Rejection	$f=120Hz$ , $8V \leq V_{IN} \leq 18V$	<b>47</b>	62		dB
$V_{DROP}$	Dropout Voltage	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
$N_O$	Output Noise Voltage	$10Hz \leq f \leq 100kHz$ (Note 2)		40		$\mu V$
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	$I_{OUT}=5mA$		0.42		$mV/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$				84		ppm/ $^\circ C$
$\theta_{JC}$	Thermal Resistance	TO-92		40		$^\circ C/W$
		SOT-89		28.3		
		SOIC-8		62		

Note 2: 0.01 $\mu F$  minimum load capacitance is recommended to limit high frequency noise.

### Electrical Characteristics (Cont.)

**AS78L05C** (@  $V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage		5.0		5.1	V
$V_{RLINE}$	Line Regulation	$7V \leq V_{IN} \leq 20V$		8	150	mV
$V_{RLOAD}$	Load Regulation	$1mA \leq I_{OUT} \leq 100mA$		10	60	mV
$I_Q$	Quiescent Current			3	5.5	mA
$\Delta I_Q$	Quiescent Current Change	$8V \leq V_{IN} \leq 20V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
PSRR	Ripple Rejection	$f=120Hz$ , $8V \leq V_{IN} \leq 18V$	47	62		dB
$V_{DROP}$	Dropout Voltage	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
$N_O$	Output Noise Voltage	$10Hz \leq f \leq 100kHz$ (Note 2)		40		$\mu V$
$\frac{\Delta V_{OUT}}{\Delta T}$	Output Voltage Temperature Coefficient	$I_{OUT}=5mA$		0.42		mV/ $^\circ C$
$\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$				84		ppm/ $^\circ C$
$\theta_{JC}$	Thermal Resistance	TO-92		40		$^\circ C/W$
		SOT-89		28.3		
		SOIC-8		62		

Note 2: 0.01 $\mu F$  minimum load capacitance is recommended to limit high frequency noise.

**Electrical Characteristics** (Cont.)

**AS78L12** (@  $V_{IN}=19V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage		11.5	12.0	12.5	V
		$14.5V \leq V_{IN} \leq 27V$ , $1mA \leq I_{OUT} \leq 100mA$ , $P_D \leq 0.75W$	<b>11.4</b>		<b>12.6</b>	
$V_{RLINE}$	Line Regulation	$14.5V \leq V_{IN} \leq 27V$		20	250	mV
$V_{RLOAD}$	Load Regulation	$1mA \leq I_{OUT} \leq 100mA$		20	100	mV
$I_Q$	Quiescent Current			3	6	mA
$\Delta I_Q$	Quiescent Current Change	$16V \leq V_{IN} \leq 27V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
PSRR	Ripple Rejection	$f=120Hz$ , $15V \leq V_{IN} \leq 25V$	37	42		dB
$V_{DROP}$	Dropout Voltage	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
$N_O$	Output Noise Voltage	$10Hz \leq f \leq 100kHz$ (Note 2)		80		$\mu V$
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	$I_{OUT}=5mA$		1		$mV/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$				84		ppm/ $^\circ C$
$\theta_{JC}$	Thermal Resistance	TO-92		40		$^\circ C/W$
		SOT-89		28.3		
		SOIC-8		62		

Note 2: 0.01 $\mu F$  minimum load capacitance is recommended to limit high frequency noise.

**Electrical Characteristics** (Cont.)

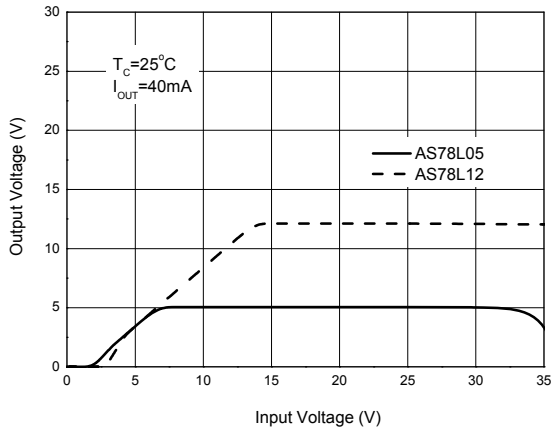
**AS78L15** (@  $V_{IN}=23V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT}$	Output Voltage		14.4	15.0	15.6	V
		$17.5V \leq V_{IN} \leq 30V$ , $1mA \leq I_{OUT} \leq 100mA$ , $P_D \leq 0.75W$	<b>14.25</b>		<b>15.75</b>	
$V_{RLINE}$	Line Regulation	$17.5V \leq V_{IN} \leq 30V$		25	250	mV
$V_{RLOAD}$	Load Regulation	$1mA \leq I_{OUT} \leq 100mA$		25	150	mV
$I_Q$	Quiescent Current			3	6	mA
$\Delta I_Q$	Quiescent Current Change	$20V \leq V_{IN} \leq 30V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
PSRR	Ripple Rejection	$f=120Hz$ , $18.5V \leq V_{IN} \leq 28.5V$	34	39		dB
$V_{DROP}$	Dropout Voltage	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
$N_O$	Output Noise Voltage	$10Hz \leq f \leq 100kHz$ (Note 2)		90		$\mu V$
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient	$I_{OUT}=5mA$		1.25		$mV/^\circ C$
$(\Delta V_{OUT}/V_{OUT})/\Delta T$				84		ppm/ $^\circ C$
$\theta_{JC}$	Thermal Resistance	TO-92		40		$^\circ C/W$
		SOT-89		28.3		
		SOIC-8		62		

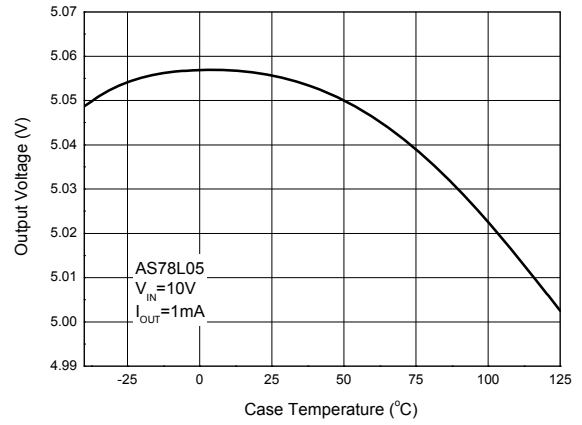
Note 2: 0.01 $\mu F$  minimum load capacitance is recommended to limit high frequency noise.

**Performance Characteristics**

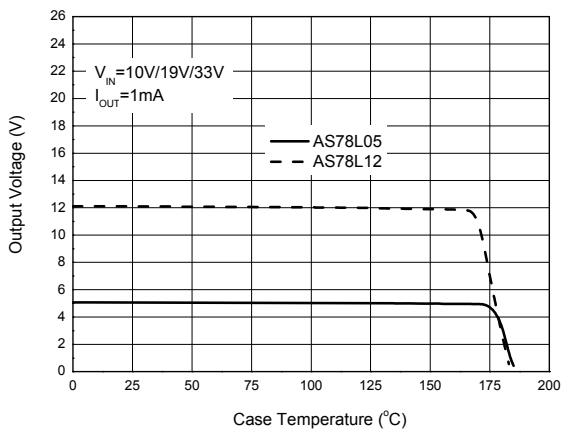
**Output Voltage vs. Input Voltage**



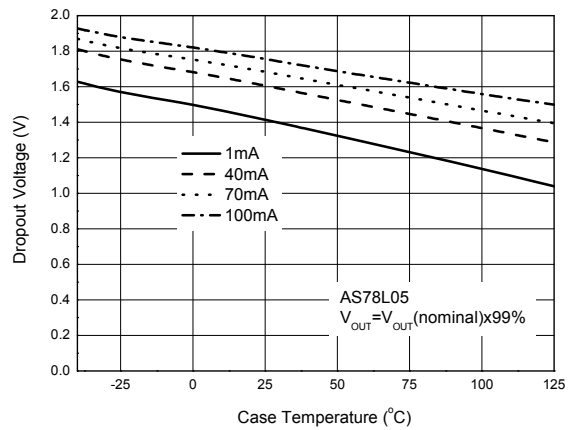
**Output Voltage vs. Case Temperature**



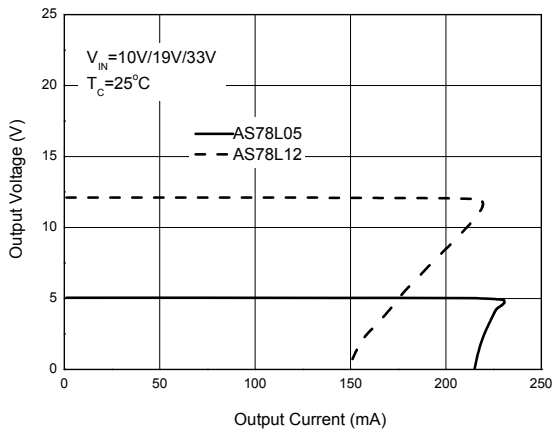
**Over Temperature Protection**



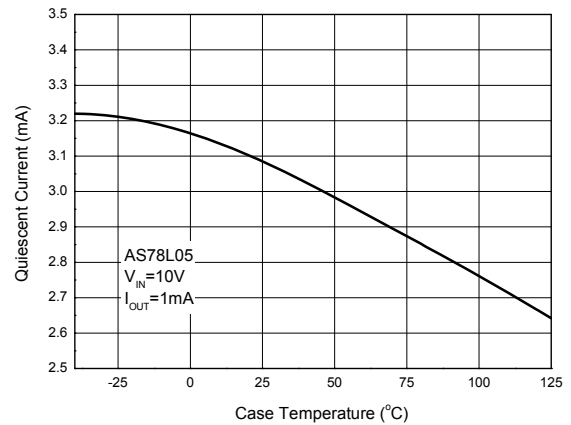
**Dropout Voltage vs. Case Temperature**



**Output Voltage vs. Output Current**

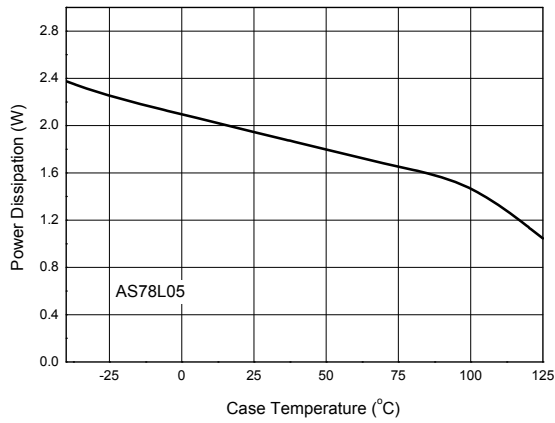


**Quiescent Current vs. Case Temperature**

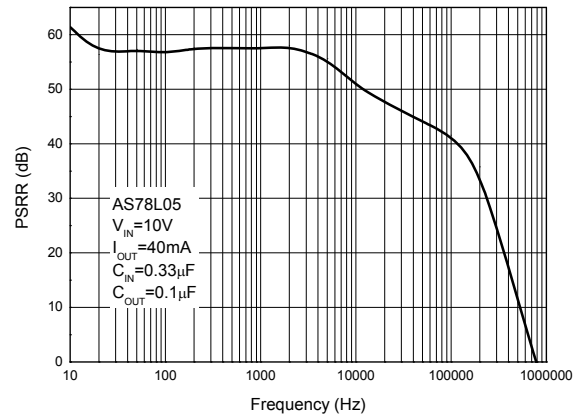


**Performance Characteristics (Cont.)**

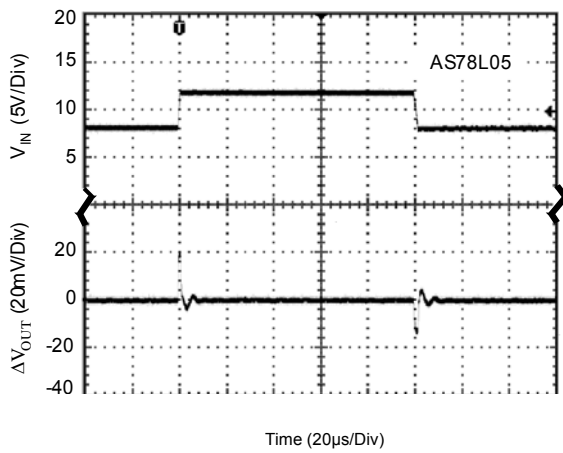
**Power Dissipation vs. Case Temperature**



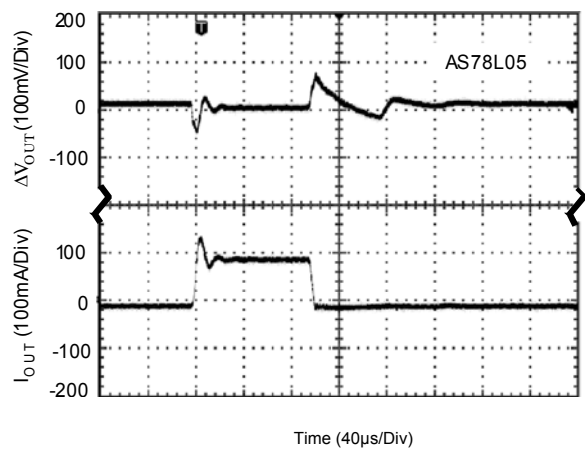
**PSRR vs. Frequency**



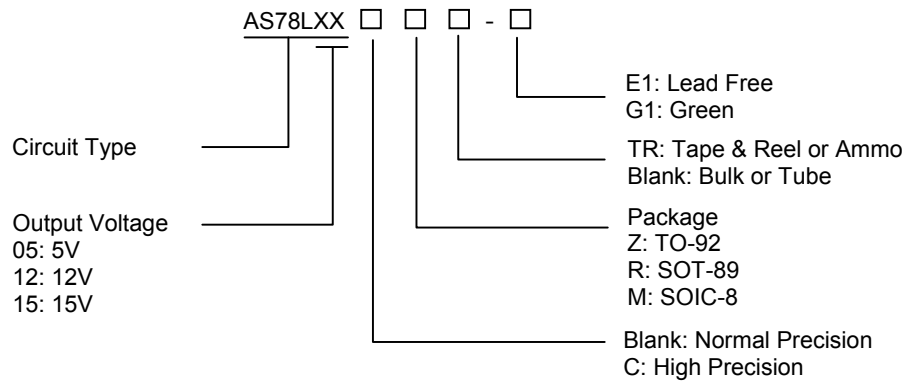
**Line Transient**  
(Conditions:  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ )



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



## Ordering Information

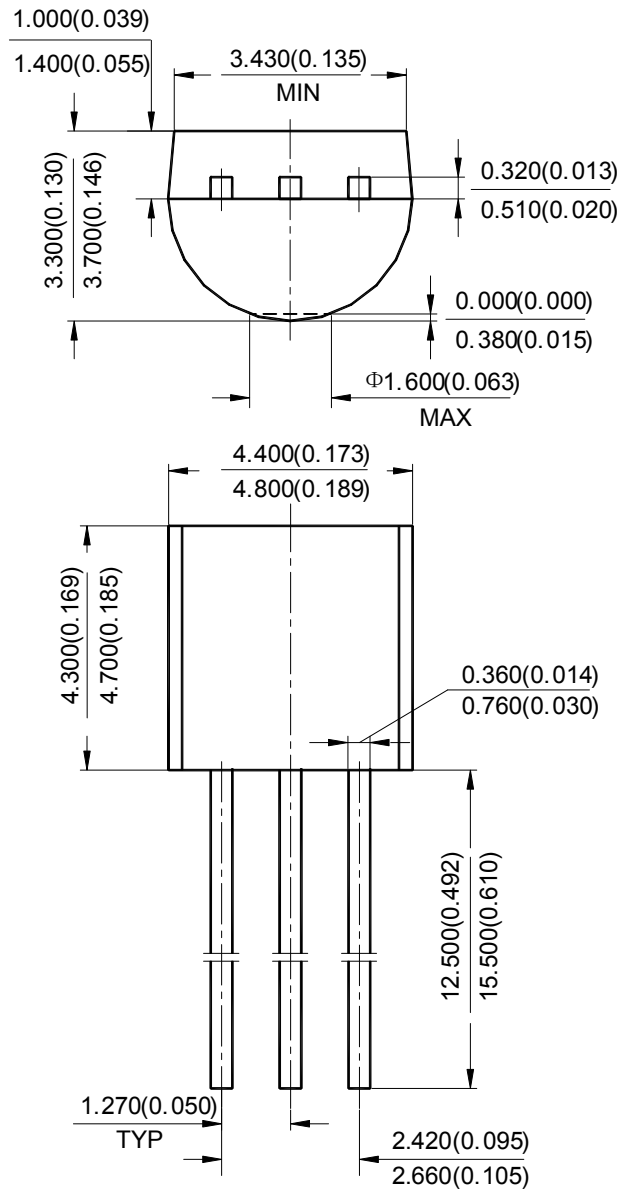


Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
TO-92	-40 to 125°C	AS78L05Z-E1	AS78L05Z-G1	AS78L05Z-E1	AS78L05Z-G1	Bulk
		AS78L05ZTR-E1	AS78L05ZTR-G1	AS78L05Z-E1	AS78L05Z-G1	Ammo
		AS78L05CZTR-E1	AS78L05CZTR-G1	AS78L05Z-E1	AS78L05Z-G1	Ammo
		AS78L12Z-E1	AS78L12Z-G1	AS78L12Z-E1	AS78L12Z-G1	Bulk
		AS78L12ZTR-E1	AS78L12ZTR-G1	AS78L12Z-E1	AS78L12Z-G1	Ammo
		AS78L15Z-E1	AS78L15Z-G1	AS78L15Z-E1	AS78L15Z-G1	Bulk
		AS78L15ZTR-E1	AS78L15ZTR-G1	AS78L15Z-E1	AS78L15Z-G1	Ammo
SOT-89	-40 to 125°C	AS78L05RTR-E1	AS78L05RTR-G1	E78E	G78E	Tape & Reel
		AS78L12RTR-E1	AS78L12RTR-G1	E78F	G78F	Tape & Reel
		AS78L15RTR-E1	AS78L15RTR-G1	E78G	G78G	Tape & Reel
SOIC-8	-40 to 125°C	AS78L05M-E1	AS78L05M-G1	AS78L05M-E1	AS78L05M-G1	Tube
		AS78L05MTR-E1	AS78L05MTR-G1	AS78L05M-E1	AS78L05M-G1	Tape & Reel
		AS78L12M-E1	AS78L12M-G1	AS78L12M-E1	AS78L12M-G1	Tube
		AS78L12MTR-E1	AS78L12MTR-G1	AS78L12M-E1	AS78L12M-G1	Tape & Reel
		AS78L15M-E1	AS78L15M-G1	AS78L15M-E1	AS78L15M-G1	Tube
		AS78L15MTR-E1	AS78L15MTR-G1	AS78L15M-E1	AS78L15M-G1	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.

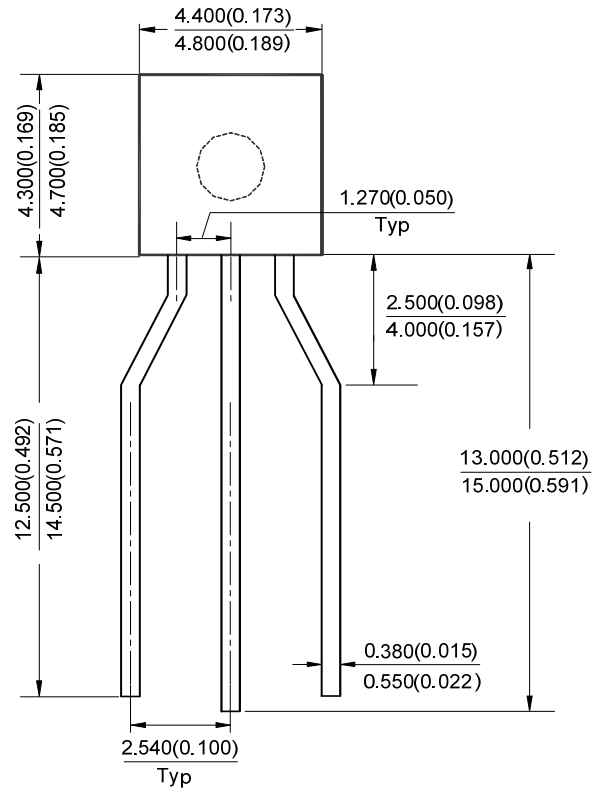
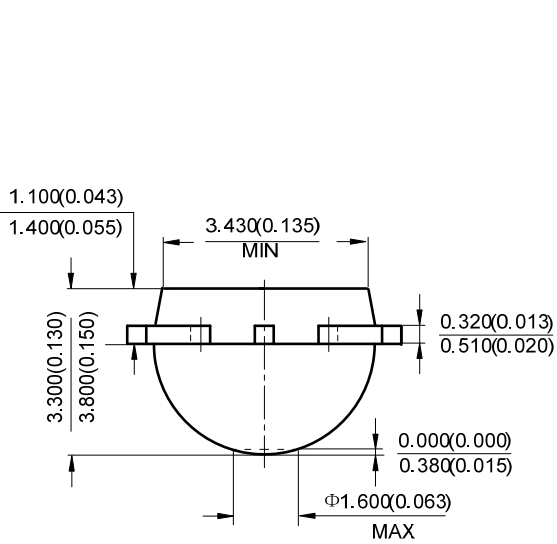
**Package Outline Dimensions** (All dimensions in mm(inch).)

**TO-92 (Bulk Packing)**



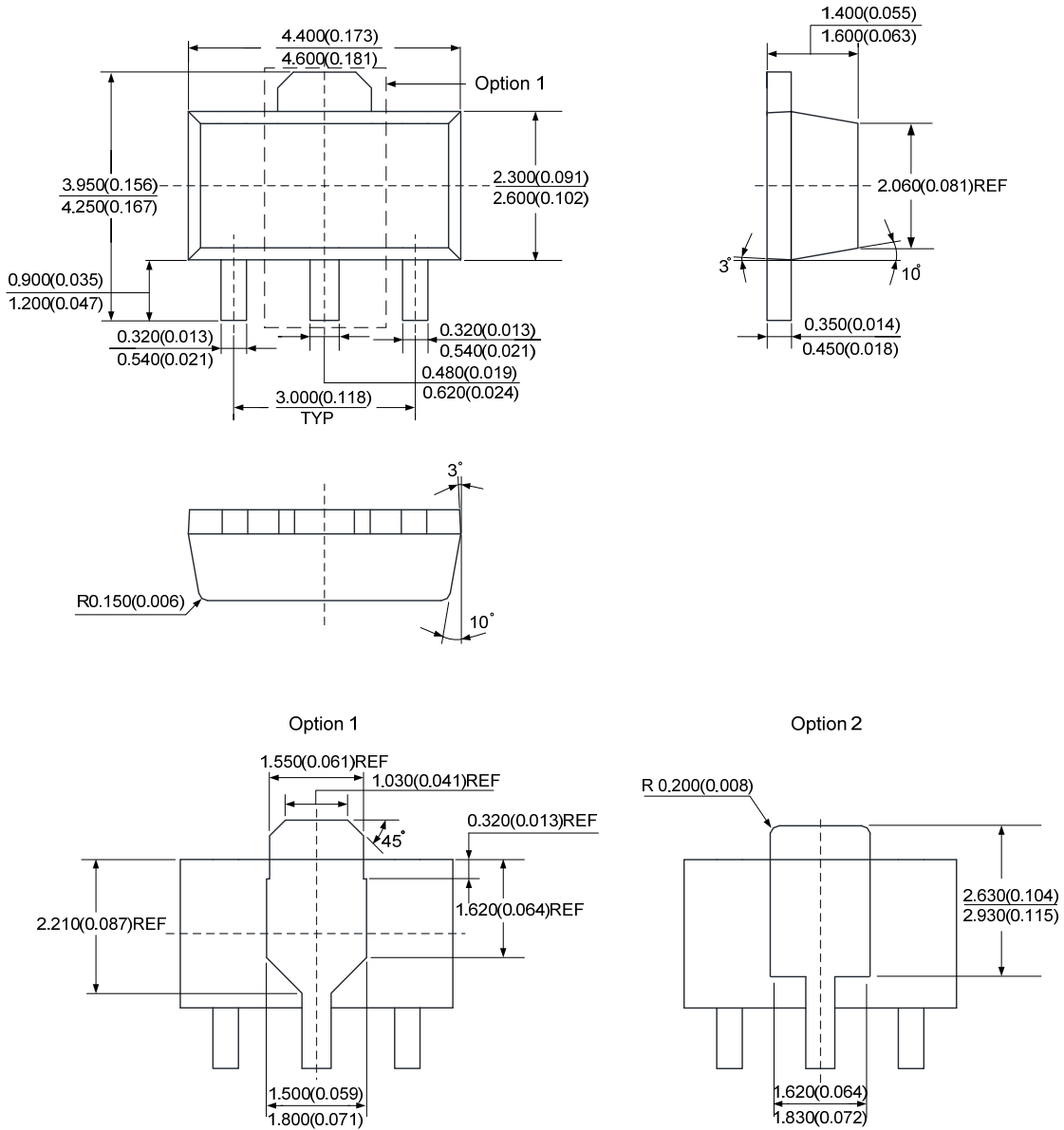
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

**TO-92 (Ammo Packing)**



**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

**SOT-89**

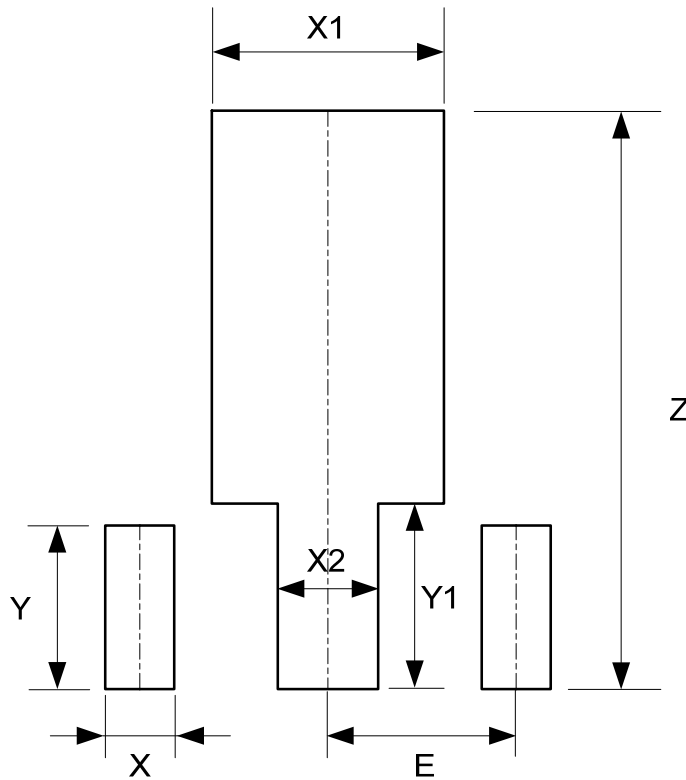


DATA SHEET



**Suggested Pad Layout**

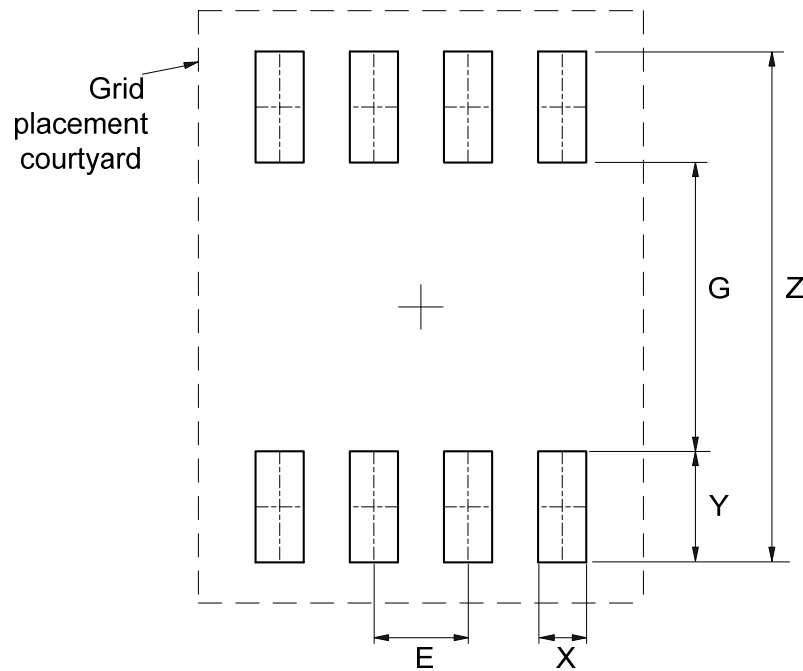
**SOT-89**



Dimensions	Z (mm)/(inch)	X (mm)/(inch)	X1 (mm)/(inch)	X2 (mm)/(inch)	Y (mm)/(inch)	Y1 (mm)/(inch)	E (mm)/(inch)
Value	4.600/0.181	0.550/0.022	1.850/0.073	0.800/0.031	1.300/0.051	1.475/0.058	1.500/0.059

**Suggested Pad Layout (Cont.)**

**SOIC-8**



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

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