

**100mA POSITIVE VOLTAGE REGULATOR****AS78LXX****General 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, 15V, 18V and 24V
- 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

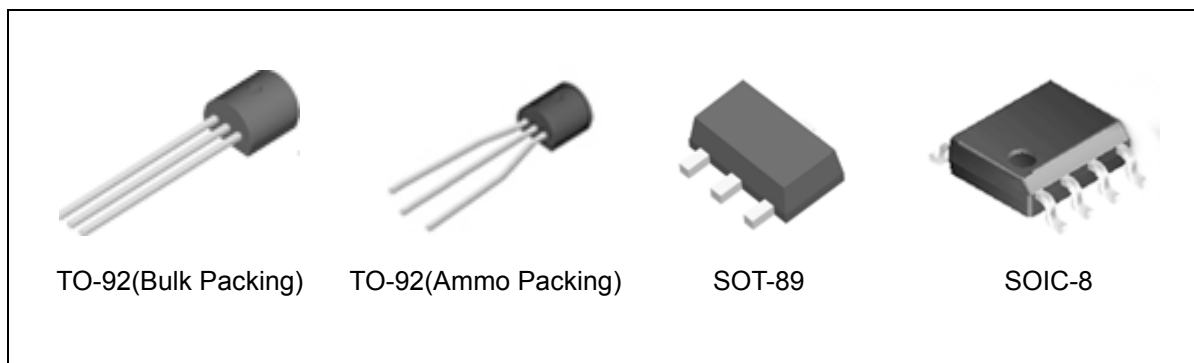


Figure 1. Package Types of AS78LXX

**Pin Configuration**

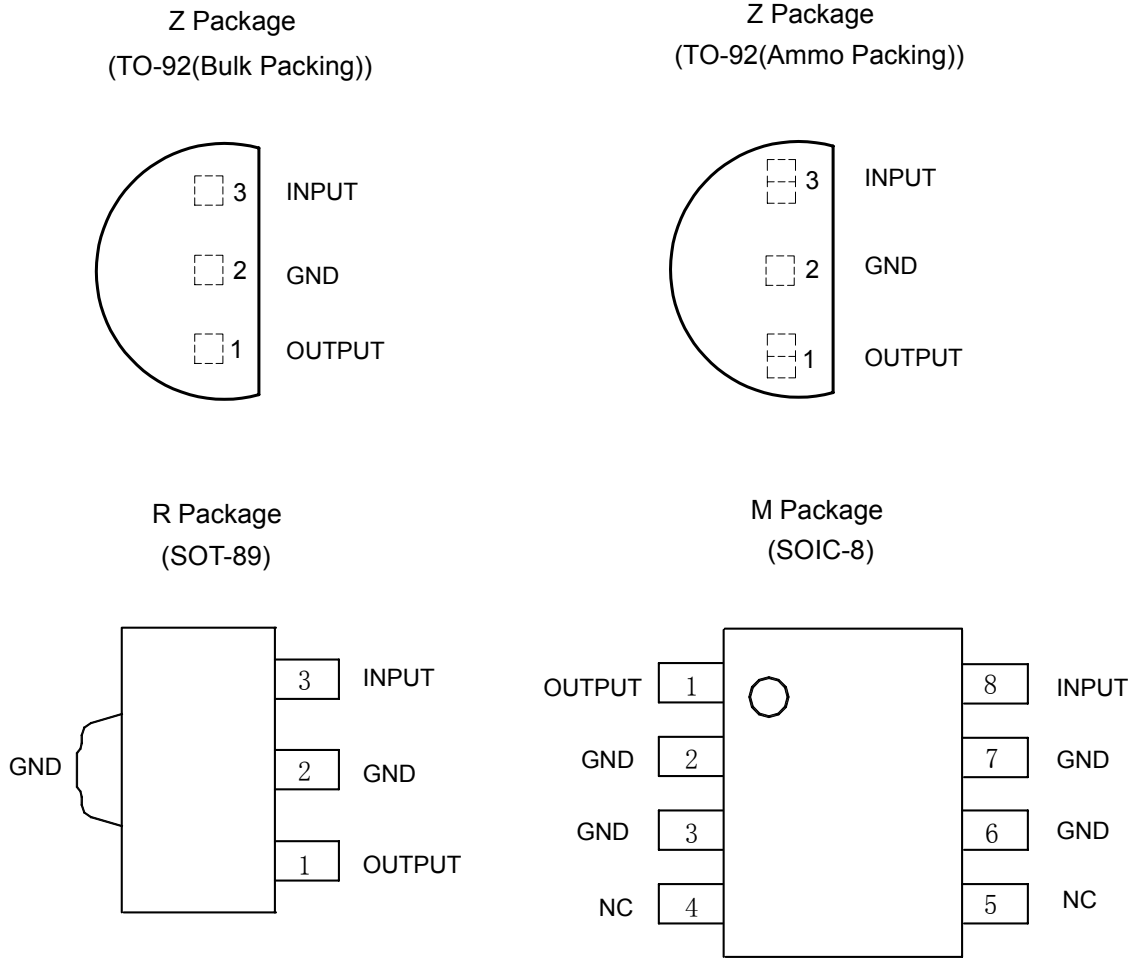


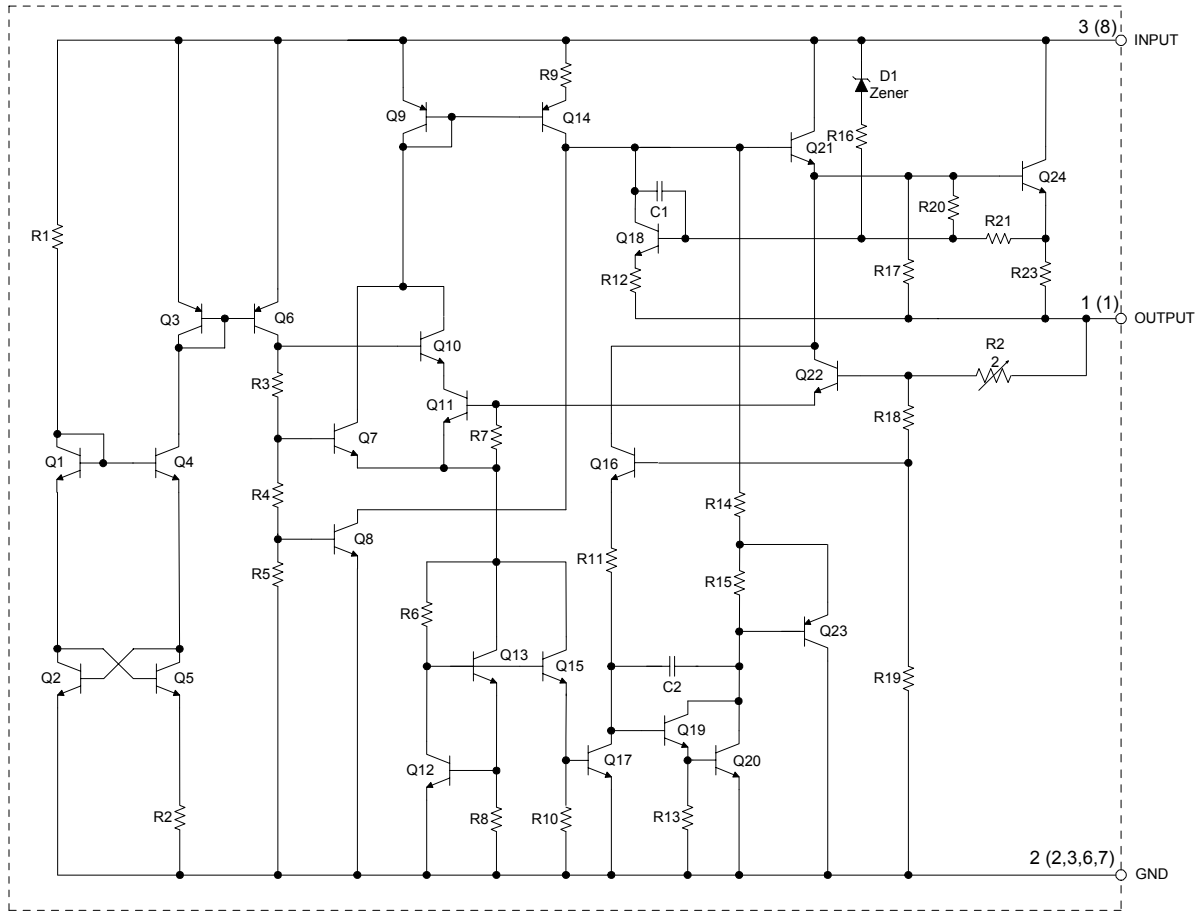
Figure 2. Pin Configuration of AS78LXX (Top View)



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Functional Block Diagram**



A (B)

A for 3-pin    B for 8-pin

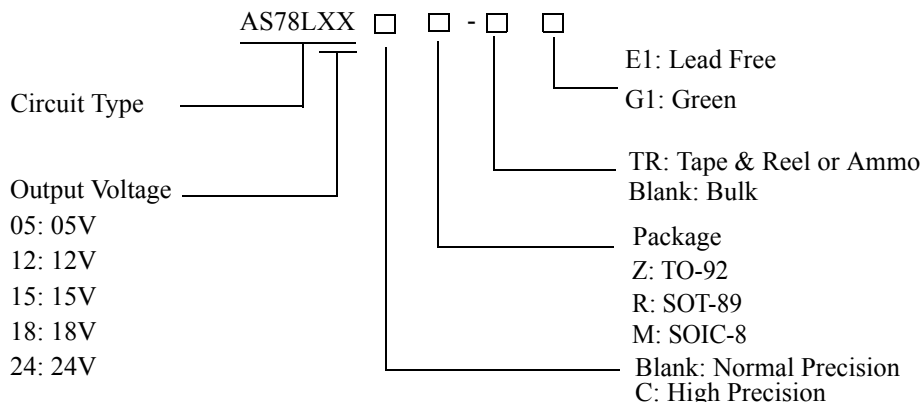
Figure 3. Functional Block Diagram of AS78LXX



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**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
		AS78L18Z-E1	AS78L18Z-G1	AS78L18Z-E1	AS78L18Z-G1	Bulk
		AS78L18ZTR-E1	AS78L18ZTR-G1	AS78L18Z-E1	AS78L18Z-G1	Ammo
		AS78L24Z-E1	AS78L24Z-G1	AS78L24Z-E1	AS78L24Z-G1	Bulk
		AS78L24ZTR-E1	AS78L24ZTR-G1	AS78L24Z-E1	AS78L24Z-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
		AS78L18RTR-E1	AS78L18RTR-G1	E78H	G78H	Tape & Reel
		AS78L24RTR-E1	AS78L24RTR-G1	E78I	G78I	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
		AS78L18M-E1	AS78L18M-G1	AS78L18M-E1	AS78L18M-G1	Tube
		AS78L18MTR-E1	AS78L18MTR-G1	AS78L18M-E1	AS78L18M-G1	Tape & Reel
		AS78L24M-E1	AS78L24M-G1	AS78L24M-E1	AS78L24M-G1	Tube
AS78L24MTR-E1	AS78L24MTR-G1	AS78L24M-E1	AS78L24M-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.

**100mA POSITIVE VOLTAGE REGULATOR****AS78LXX****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value		Unit
Input Voltage	$V_{IN}$	36		V
Operating Junction Temperature	$T_J$	150		°C
Lead Temperature (Soldering, 10sec)	$T_{LEAD}$	260		°C
Power Dissipation	$P_D$	750		mW
Storage Temperature Range	$T_{STG}$	-65 to 150		°C
Thermal Resistance	$\theta_{JA}$	TO-92	180	°C/W
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	AS78L05	$V_{IN}$		30	V
	AS78L12			36	
	AS78L15			36	
	AS78L18			36	
	AS78L24			36	
Operating Junction Temperature Range		$T_J$	-40	125	°C



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**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.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		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>	
Line Regulation	$V_{RLINE}$	$7V \leq V_{IN} \leq 20V$		8	150	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		10	60	mV
Quiescent Current	$I_Q$			3	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$8V \leq V_{IN} \leq 20V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $8V \leq V_{IN} \leq 18V$	47	62		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		40		$\mu V$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		0.42		mV/ $^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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

**100mA POSITIVE VOLTAGE REGULATOR****AS78LXX****Electrical Characteristics**

**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.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		5.0		5.1	V
Line Regulation	$V_{RLINE}$	$7V \leq V_{IN} \leq 20V$		8	150	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		10	60	mV
Quiescent Current	$I_Q$			3	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$8V \leq V_{IN} \leq 20V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $8V \leq V_{IN} \leq 18V$	47	62		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		40		$\mu V$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		0.42		mV/ $^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Electrical Characteristics (Continued)**

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.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		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>	
Line Regulation	$V_{RLINE}$	$14.5V \leq V_{IN} \leq 27V$		20	250	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		20	100	mV
Quiescent Current	$I_Q$			3	6	mA
Quiescent Current Change	$\Delta I_Q$	$16V \leq V_{IN} \leq 27V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $15V \leq V_{IN} \leq 25V$	37	42		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		80		$\mu V$
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T}$	$I_{OUT}=5mA$		1		mV/ $^\circ C$
	$(\frac{\Delta V_{OUT}}{V_{OUT}})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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



**100mA POSITIVE VOLTAGE REGULATOR****AS78LXX****Electrical Characteristics (Continued)**

**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.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		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>	
Line Regulation	$V_{RLINE}$	$17.5V \leq V_{IN} \leq 30V$		25	250	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		25	150	mV
Quiescent Current	$I_Q$			3	6	mA
Quiescent Current Change	$\Delta I_Q$	$20V \leq V_{IN} \leq 30V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $18.5V \leq V_{IN} \leq 28.5V$	34	39		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		90		$\mu V$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		1.25		$mV/^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Electrical Characteristics (Continued)**

AS78L18 ( $V_{IN}=27V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		17.3	18.0	18.7	V
		$22V \leq V_{IN} \leq 33V$ , $1mA \leq I_{OUT} \leq 100mA$ , $P_D \leq 0.75W$	<b>17.1</b>		<b>18.9</b>	
Line Regulation	$V_{RLINE}$	$22V \leq V_{IN} \leq 33V$		30	300	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		30	170	mV
Quiescent Current	$I_Q$			3	6	mA
Quiescent Current Change	$\Delta I_Q$	$23V \leq V_{IN} \leq 33V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $23V \leq V_{IN} \leq 33V$	33	38		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		150		$\mu V$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		1.5		mV/ $^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Electrical Characteristics (Continued)**

AS78L24 ( $V_{IN}=33V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $T_J=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq 125^\circ C$ , unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$		23	24.0	25	V
		$27V \leq V_{IN} \leq 36V$ , $1mA \leq I_{OUT} \leq 100mA$ , $P_D \leq 0.75W$	<b>22.8</b>		<b>25.2</b>	
Line Regulation	$V_{RLINE}$	$27V \leq V_{IN} \leq 36V$		50	300	mV
Load Regulation	$V_{RLOAD}$	$1mA \leq I_{OUT} \leq 100mA$		40	200	mV
Quiescent Current	$I_Q$			3	6	mA
Quiescent Current Change	$\Delta I_Q$	$28V \leq V_{IN} \leq 36V$			<b>1.5</b>	mA
		$1mA \leq I_{OUT} \leq 40mA$			<b>0.1</b>	
Ripple Rejection	PSRR	$f=120Hz$ , $29V \leq V_{IN} \leq 35V$	31	37		dB
Dropout Voltage	$V_{DROP}$	$I_{OUT}=40mA$		1.7		V
		$I_{OUT}=100mA$		1.8		
Output Noise Voltage	$N_O$	$10Hz \leq f \leq 100kHz$ (Note 2)		200		$\mu V$
Output Voltage Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		2		mV/ $^\circ C$
	$(\Delta V_{OUT}/V_{OUT})/\Delta T$			84		ppm/ $^\circ C$
Thermal Resistance	$\theta_{JC}$	TO-92		200		$^\circ C/W$
		SOT-89		165		
		SOIC-8		180		

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



**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Typical Performance Characteristics**

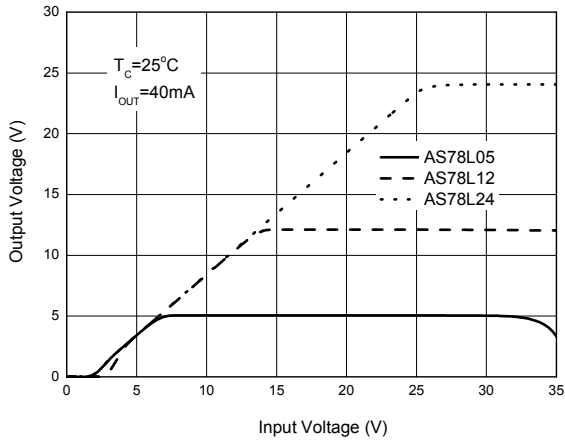


Figure 4. Output Voltage vs. Input Voltage

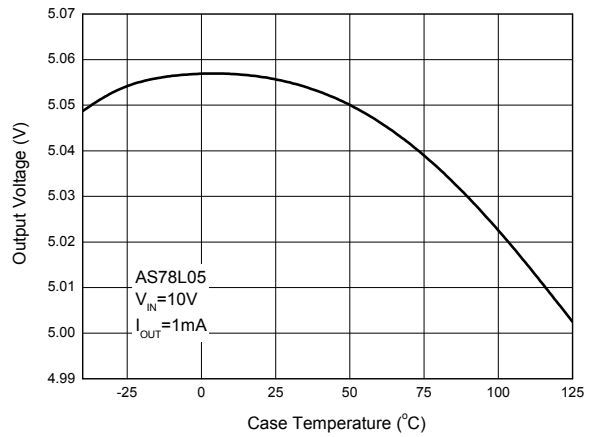


Figure 5. Output Voltage vs. Case Temperature

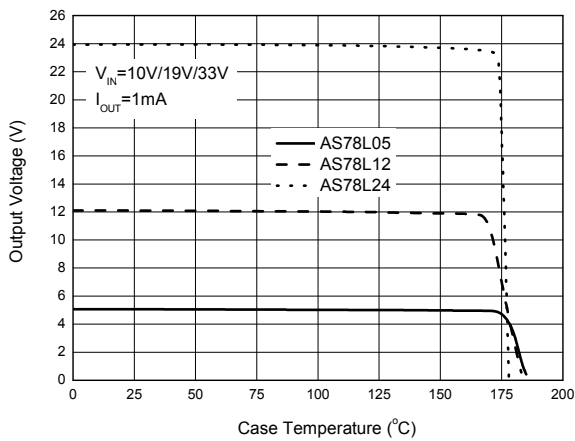


Figure 6. Over Temperature Protection

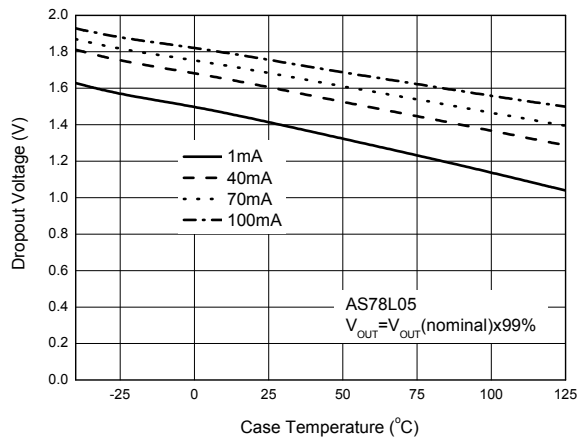


Figure 7. Dropout Voltage vs. Case Temperature



100mA POSITIVE VOLTAGE REGULATOR

AS78LXX

Typical Performance Characteristics (Continued)

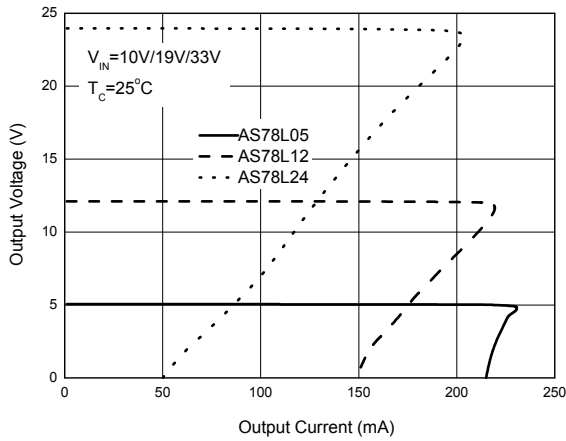


Figure 8. Output Voltage vs. Output Current

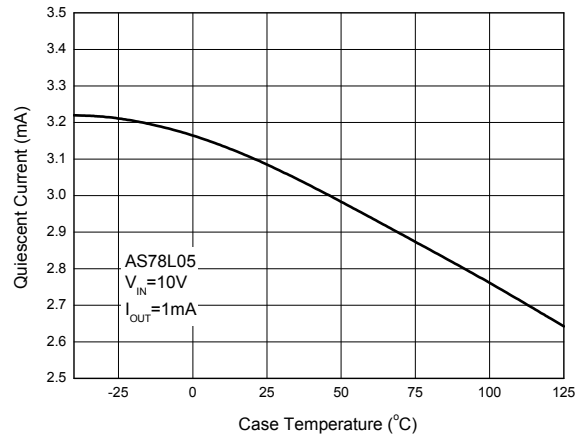


Figure 9. Quiescent Current vs. Case Temperature

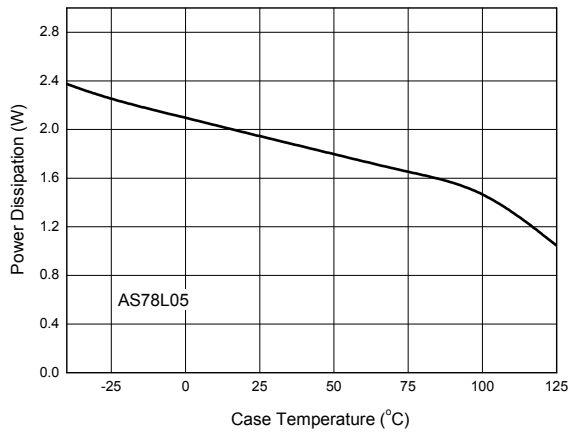


Figure 10. Power Dissipation vs. Case Temperature

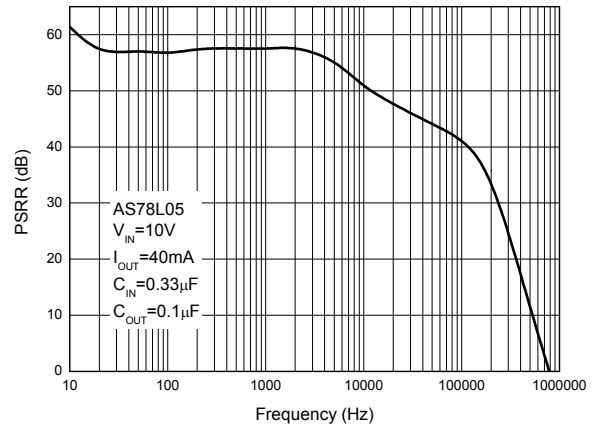


Figure 11. PSRR vs. Frequency

**Typical Performance Characteristics (Continued)**

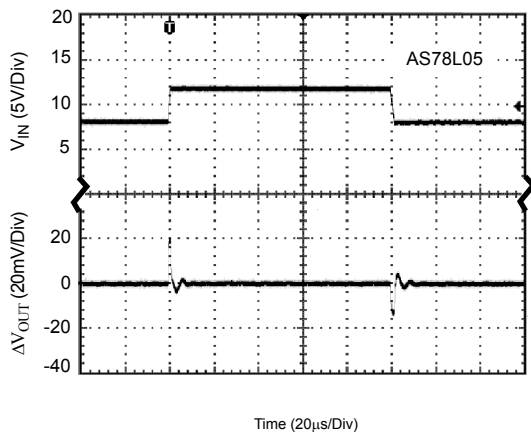


Figure 12. Line Transient  
(Conditions:  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ )

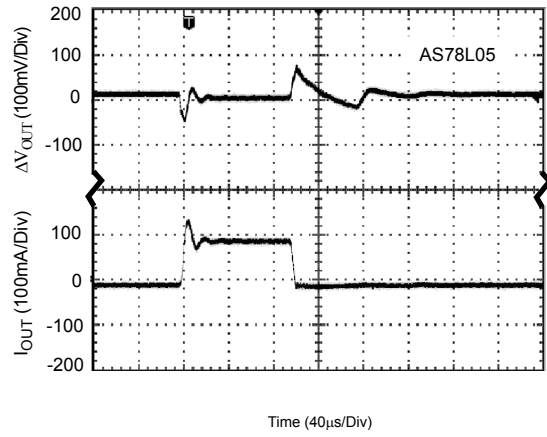


Figure 13. Load Transient  
(Conditions:  $V_{IN}=10V$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ )

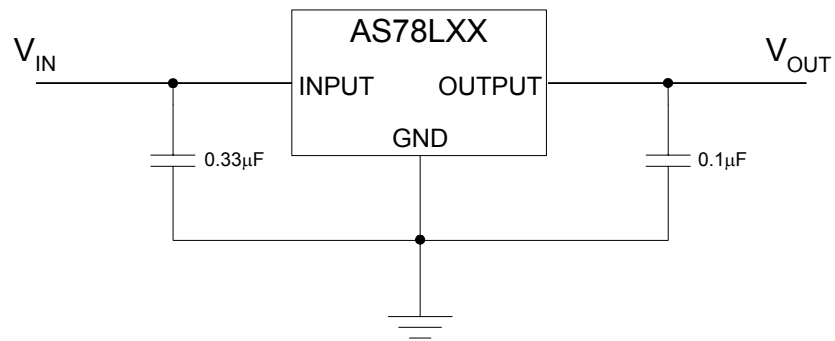
**Typical Application**

Figure 14. Typical Application of AS78LXX



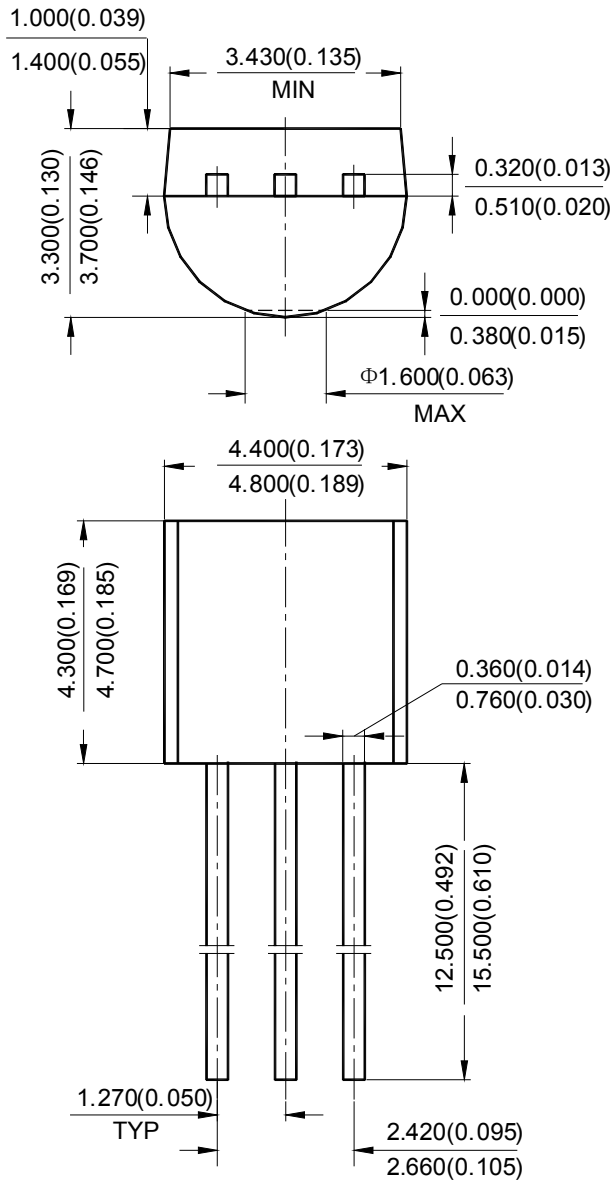
**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Mechanical Dimensions**

**TO-92(Bulk Packing)**

**Unit: mm(inch)**







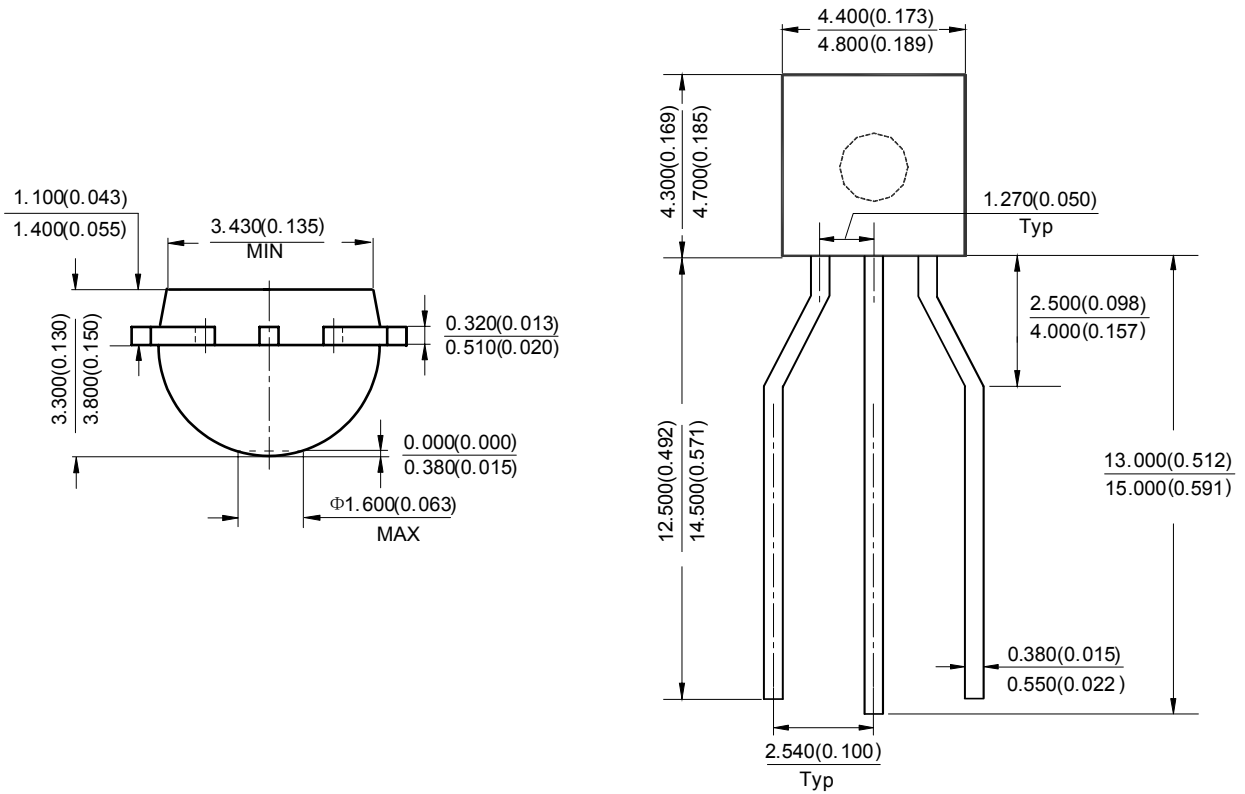
**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Mechanical Dimensions (Continued)**

**TO-92(Ammo Packing)**

**Unit: mm(inch)**





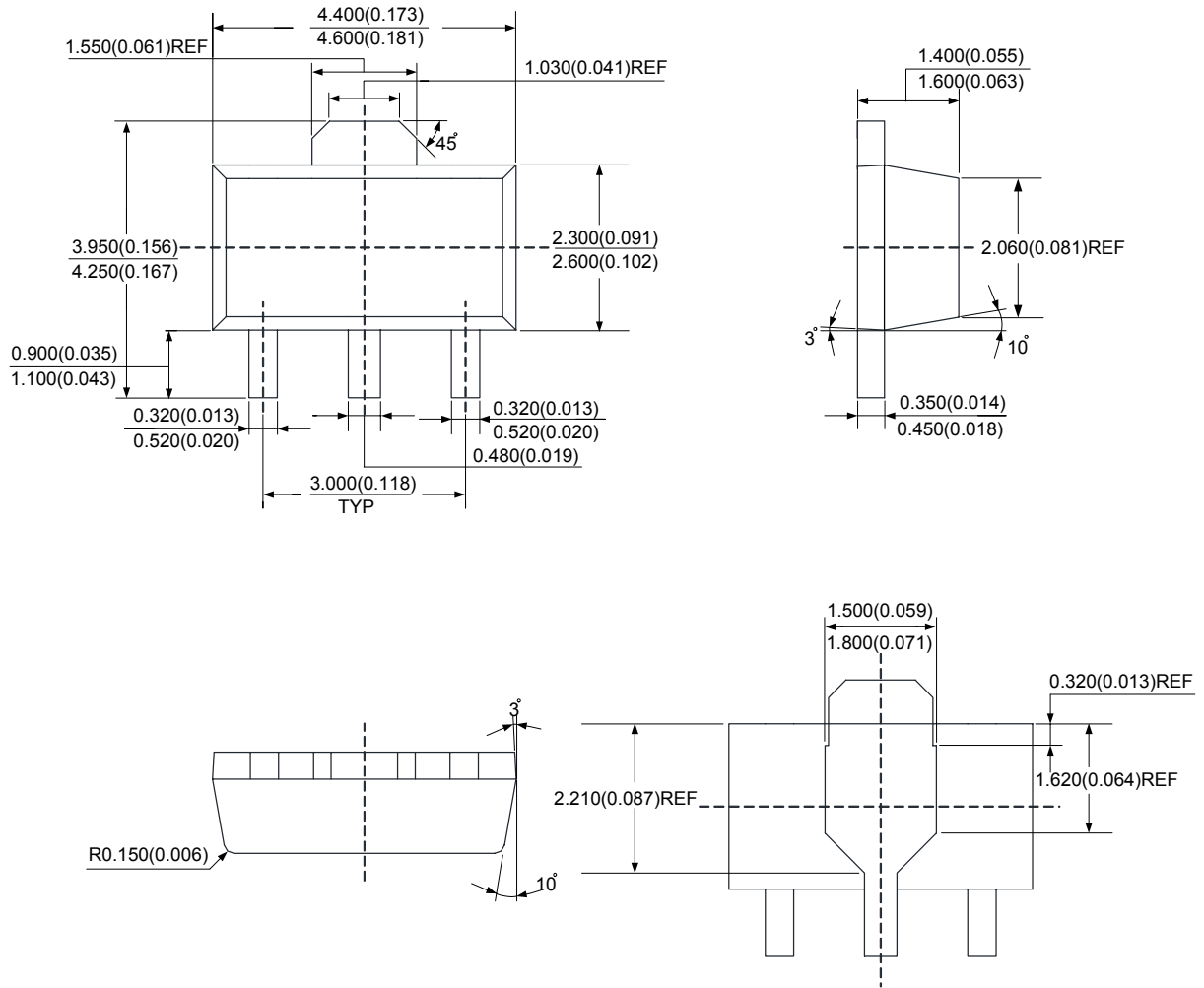
**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Mechanical Dimensions (Continued)**

**SOT-89**

**Unit: mm(inch)**





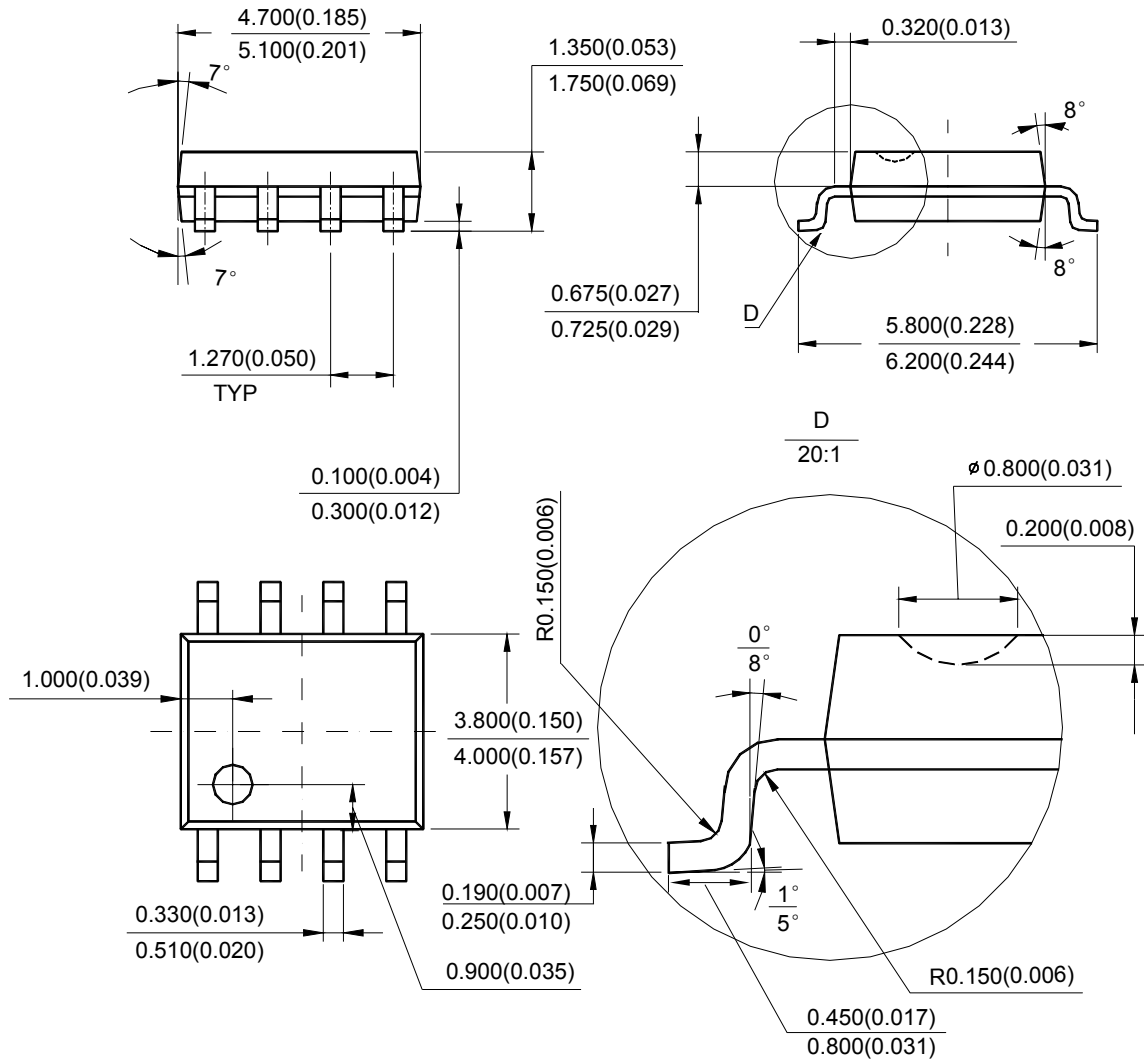
**100mA POSITIVE VOLTAGE REGULATOR**

**AS78LXX**

**Mechanical Dimensions (Continued)**

**SOIC-8**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



## **BCD Semiconductor Manufacturing Limited**

<http://www.bcdsemi.com>

### **IMPORTANT NOTICE**

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