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July 2015

MC78LXXA / LM78LXXA

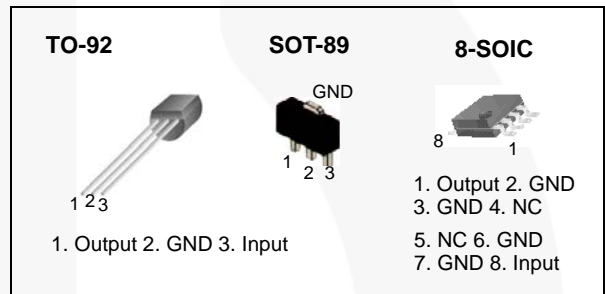
3-Terminal 0.1 A Positive Voltage Regulator

Features

- Maximum Output Current of 100 mA
- Output Voltage of 5 V, 6 V, 8 V, 12 V, and 15 V
- Thermal Overload Protection
- Short-Circuit Current Limiting
- Output Voltage Offered in $\pm 5\%$ Tolerance

Description

The MC78LXXA / LM78LXXA series of fixed-voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply current up to 100 mA.



Ordering Information

Product Number	Package	Packing Method	Output Voltage Tolerance	Operating Temperature
LM78L05ACZ	TO-92	Bulk	$\pm 5\%$	-40 to +125°C
LM78L05ACZX		Tape & Reel		
LM78L05ACZXA		Ammo		
LM78L12ACZ		Bulk		
LM78L12ACZX		Tape & Reel		
MC78L05ACP		Bulk		
MC78L05ACPXA		Ammo		
MC78L06ACP		Bulk		
MC78L08ACP		Bulk		
MC78L15ACP		Bulk		
MC78L15ACPXA		Ammo		
MC78L05ACD		8-SOIC		
MC78L05ACDX	Tape & Reel			
MC78L05ACHX	SOT-89	Tape & Reel		
MC78L08ACHX		Tape & Reel		

MC78LXXA / LM78LXXA — 3-Terminal 0.1 A Positive Voltage Regulator

Block Diagram

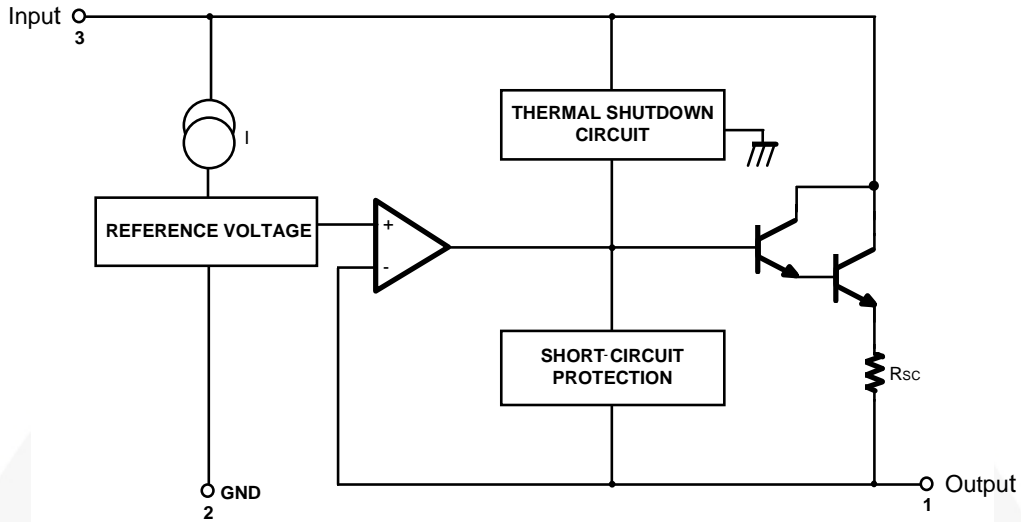


Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter		Value	Unit
V_I	Input Voltage	$V_O = 5\text{ V to }8\text{ V}$	30	V
		$V_O = 12\text{ V to }15\text{ V}$	35	V
T_{OPR}	Operating Temperature Range		-40 to +125°C	°C
$T_{\text{J(MAX)}}$	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C
$R_{\theta\text{JC}}$	Thermal Resistance, Junction-Case	TO-92	50	°C/W
$R_{\theta\text{JA}}$	Thermal Resistance, Junction-Air	TO-92	150	°C/W
		SOT-89	225	°C/W
		8-SOIC	160	°C/W

Electrical Characteristics (MC78L05A / LM78L05A)

$V_I = 10\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	4.8	5.0	5.2	V	
ΔV_O	Line Regulation ⁽¹⁾	$T_J = 25^\circ\text{C}$	$7\text{ V} \leq V_I \leq 20\text{ V}$		8	150	mV
			$8\text{ V} \leq V_I \leq 20\text{ V}$		6	100	mV
ΔV_O	Load Regulation ⁽¹⁾	$T_J = 25^\circ\text{C}$	$1\text{ mA} \leq I_O \leq 100\text{ mA}$		11	60	mV
			$1\text{ mA} \leq I_O \leq 40\text{ mA}$		5.0	30.0	mV
V_O	Output Voltage	$7\text{ V} \leq V_I \leq 20\text{ V}$	$1\text{ mA} \leq I_O \leq 40\text{ mA}$			5.25	V
		$7\text{ V} \leq V_I \leq V_{\text{MAX}}^{(2)}$	$1\text{ mA} \leq I_O \leq 70\text{ mA}$	4.75		5.25	V
I_Q	Quiescent Current	$T_J = 25^\circ\text{C}$		2.0	5.5	mA	
ΔI_Q	Quiescent Current Change	With Line	$8\text{ V} \leq V_I \leq 20\text{ V}$			1.5	mA
ΔI_Q		With Load	$1\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
V_N	Output Noise Voltage	$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		$\mu\text{V}/V_O$	
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O	$I_O = 5\text{ mA}$		-0.65		$\text{mV}/^\circ\text{C}$	
RR	Ripple Rejection	$f = 120\text{ Hz}$, $8\text{ V} \leq V_I \leq 18\text{ V}$, $T_J = 25^\circ\text{C}$	41	80		dB	
V_D	Dropout Voltage	$T_J = 25^\circ\text{C}$		1.7		V	

Notes:

1. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L06A)

$V_I = 12\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	5.75	6.0	6.25	V
ΔV_O	Line Regulation ⁽³⁾	$T_J = 25^\circ\text{C}$ $8.5\text{ V} \leq V_I \leq 20\text{ V}$		64	175	mV
		$9\text{ V} \leq V_I \leq 20\text{ V}$		54	125	mV
ΔV_O	Load Regulation ⁽³⁾	$T_J = 25^\circ\text{C}$ $1\text{ mA} \leq I_O \leq 100\text{ mA}$		12.8	80.0	mV
		$1\text{ mA} \leq I_O \leq 70\text{ mA}$		5.8	40.0	mV
V_O	Output Voltage	$8.5\text{ V} \leq V_I \leq 20\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$	5.7		6.3	V
		$8.5\text{ V} \leq V_I \leq V_{MAX}^{(4)}$, $1\text{ mA} \leq I_O \leq 70\text{ mA}$	5.7		6.3	V
I_Q	Quiescent Current	$T_J = 25^\circ\text{C}$			5.5	mA
		$T_J = 125^\circ\text{C}$		3.9	6.0	mA
ΔI_Q	Quiescent Current Change	With Line $9\text{ V} \leq V_I \leq 20\text{ V}$			1.5	mA
ΔI_Q		With Load $1\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
V_N	Output Noise Voltage	$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		$\mu\text{V}/V_O$
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O	$I_O = 5\text{ mA}$		0.75		$\text{mV}/^\circ\text{C}$
RR	Ripple Rejection	$f = 120\text{ Hz}$, $10\text{ V} \leq V_I \leq 20\text{ V}$, $T_J = 25^\circ\text{C}$	40	46		dB
V_D	Dropout Voltage	$T_J = 25^\circ\text{C}$		1.7		V

Notes:

- The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L08A)

$V_I = 14\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	7.7	8.0	8.3	V	
ΔV_O	Line Regulation ⁽⁵⁾	$T_J = 25^\circ\text{C}$	$10.5\text{ V} \leq V_I \leq 23\text{ V}$		10	175	mV
			$11\text{ V} \leq V_I \leq 23\text{ V}$		8	125	mV
ΔV_O	Load Regulation ⁽⁵⁾	$T_J = 25^\circ\text{C}$	$1\text{ mA} \leq I_O \leq 100\text{ mA}$		15	80	mV
			$1\text{ mA} \leq I_O \leq 40\text{ mA}$		8	40	mV
V_O	Output Voltage	$10.5\text{V} \leq V_I \leq 23\text{V}$	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	7.6		8.4	V
		$10.5\text{V} \leq V_I \leq V_{\text{MAX}}^{(6)}$	$1\text{ mA} \leq I_O \leq 70\text{ mA}$	7.6		8.4	V
I_Q	Quiescent Current	$T_J = 25^\circ\text{C}$		2.0	5.5	mA	
ΔI_Q	Quiescent Current Change	With Line	$11\text{ V} \leq V_I \leq 23\text{ V}$			1.5	mA
ΔI_Q		With Load	$1\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
V_N	Output Noise Voltage	$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		60		$\mu\text{V}/V_O$	
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O	$I_O = 5\text{ mA}$		-0.8		$\text{mV}/^\circ\text{C}$	
RR	Ripple Rejection	$f = 120\text{ Hz}$, $11\text{ V} \leq V_I \leq 21\text{ V}$, $T_J = 25^\circ\text{C}$	39	70		dB	
V_D	Dropout Voltage	$T_J = 25^\circ\text{C}$		1.7		V	

Notes:

5. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
6. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L12A / LM78L12A)

$V_I = 19\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_O	Output Voltage	$T_J = 25^\circ\text{C}$	11.5	12.0	12.5	V	
ΔV_O	Line Regulation ⁽⁷⁾	$T_J = 25^\circ\text{C}$	$14.5\text{ V} \leq V_I \leq 27\text{ V}$		20	250	mV
			$16\text{ V} \leq V_I \leq 27\text{ V}$		15	200	mV
ΔV_O	Load Regulation ⁽⁷⁾	$T_J = 25^\circ\text{C}$	$1\text{ mA} \leq I_O \leq 100\text{ mA}$		20	100	mV
			$1\text{ mA} \leq I_O \leq 40\text{ mA}$		10	50	mV
V_O	Output Voltage	$14.5\text{ V} \leq V_I \leq 27\text{ V}$	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	11.4		12.6	V
		$14.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(8)}$	$1\text{ mA} \leq I_O \leq 70\text{ mA}$	11.4		12.6	V
I_Q	Quiescent Current	$T_J = 25^\circ\text{C}$		2.1	6.0	mA	
ΔI_Q	Quiescent Current Change	With Line	$16\text{ V} \leq V_I \leq 27\text{ V}$		1.5	mA	
ΔI_Q		With Load	$1\text{ mA} \leq I_O \leq 40\text{ mA}$		0.1	mA	
V_N	Output Noise Voltage	$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		80		$\mu\text{V}/V_O$	
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O	$I_O = 5\text{ mA}$		-1.0		$\text{mV}/^\circ\text{C}$	
RR	Ripple Rejection	$f = 120\text{ Hz}$, $15\text{ V} \leq V_I \leq 25\text{ V}$, $T_J = 25^\circ\text{C}$	37	65		dB	
V_D	Dropout Voltage	$T_J = 25^\circ\text{C}$		1.7		V	

Notes:

7. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
8. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L15A)

$V_I = 23\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

Symbol	Parameter		Conditions	Min.	Typ.	Max.	Unit	
V_O	Output Voltage		$T_J = 25^\circ\text{C}$	14.4	15.0	15.6	V	
ΔV_O	Line Regulation ⁽⁹⁾		$T_J = 25^\circ\text{C}$	$17.5\text{ V} \leq V_I \leq 30\text{ V}$		25	300	mV
				$20\text{ V} \leq V_I \leq 30\text{ V}$		20	250	mV
ΔV_O	Load Regulation ⁽⁹⁾		$T_J = 25^\circ\text{C}$	$1\text{ mA} \leq I_O \leq 100\text{ mA}$		25	150	mV
				$1\text{ mA} \leq I_O \leq 40\text{ mA}$		12	75	mV
V_O	Output Voltage		$17.5\text{ V} \leq V_I \leq 30\text{ V}$	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	14.25		15.75	V
			$17.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(10)}$	$1\text{ mA} \leq I_O \leq 70\text{ mA}$	14.25		15.75	V
I_Q	Quiescent Current		$T_J = 25^\circ\text{C}$		2.1	6.0	mA	
ΔI_Q	Quiescent Current Change	With Line	$20\text{ V} \leq V_I \leq 30\text{ V}$			1.5	mA	
ΔI_Q		With Load	$1\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA	
V_N	Output Noise Voltage		$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$		90		$\mu\text{V}/V_O$	
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		$I_O = 5\text{ mA}$		-1.3		$\text{mV}/^\circ\text{C}$	
RR	Ripple Rejection		$f = 120\text{ Hz}$, $18.5\text{ V} \leq V_I \leq 28.5\text{ V}$, $T_J = 25^\circ\text{C}$	34	60		dB	
V_D	Dropout Voltage		$T_J = 25^\circ\text{C}$		1.7		V	

Notes:

- 9. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- 10. Power dissipation $P_D \leq 0.75\text{ W}$.

Typical Application

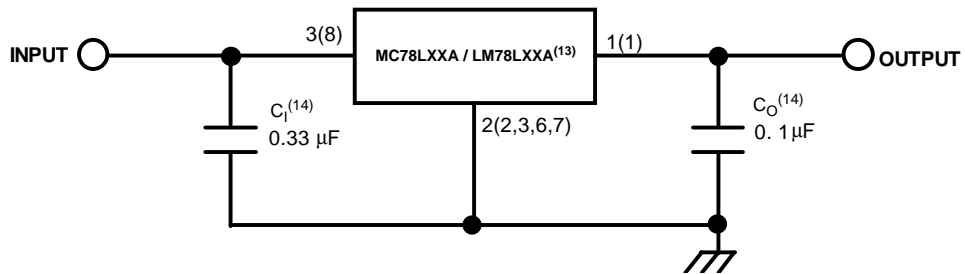
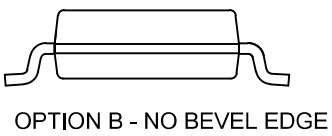
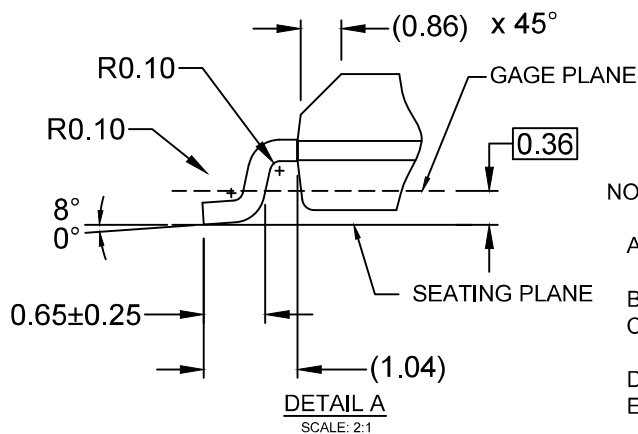
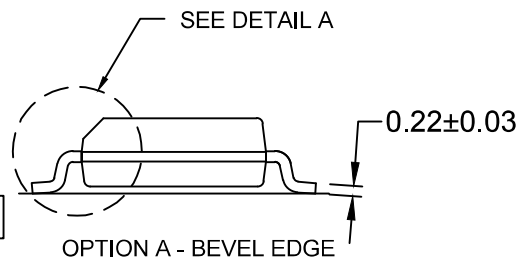
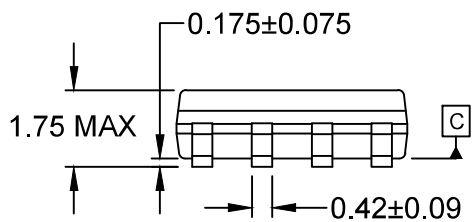
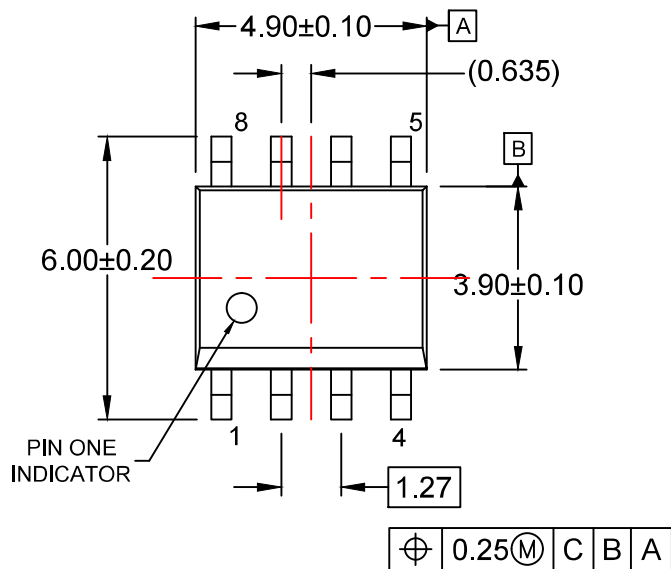


Figure 2. Typical Application

Notes:

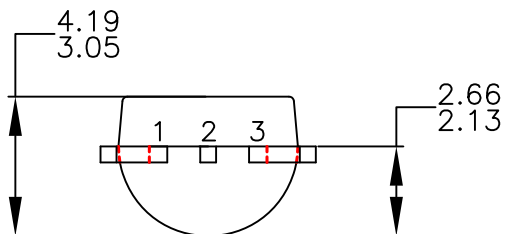
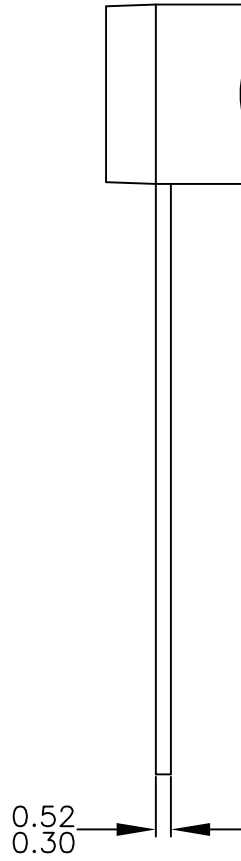
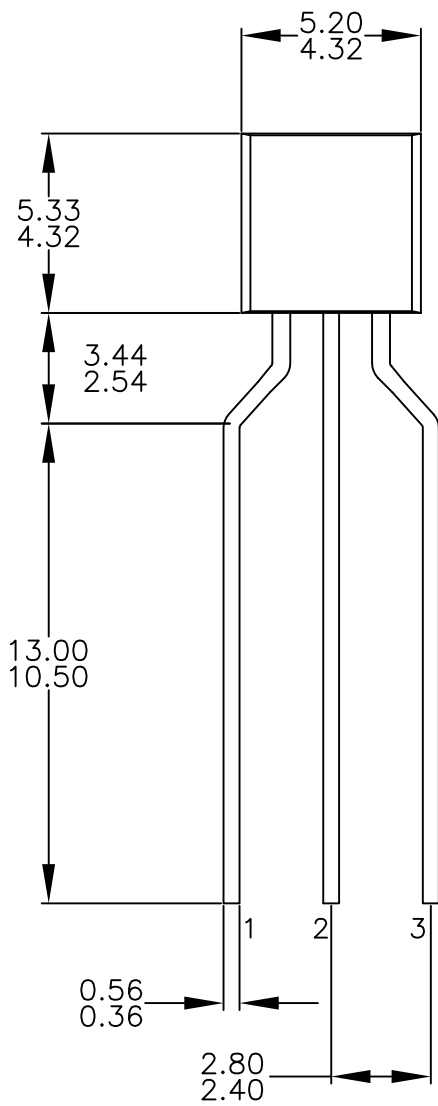
13. To specify an output voltage, substitute voltage value for "XX".
14. C_1 is required if the regulator is located an appreciable distance from the power supply filter. Though C_0 is not needed for stability, it improves transient response. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.



NOTES:

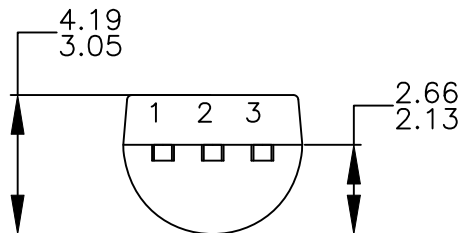
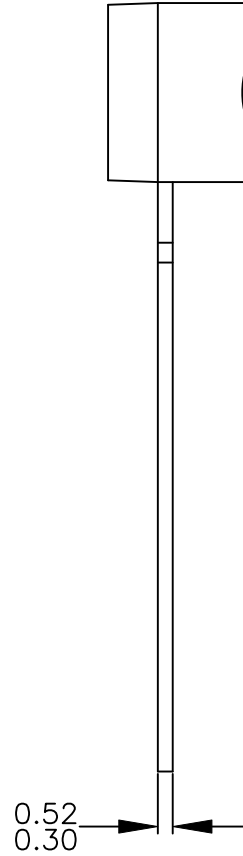
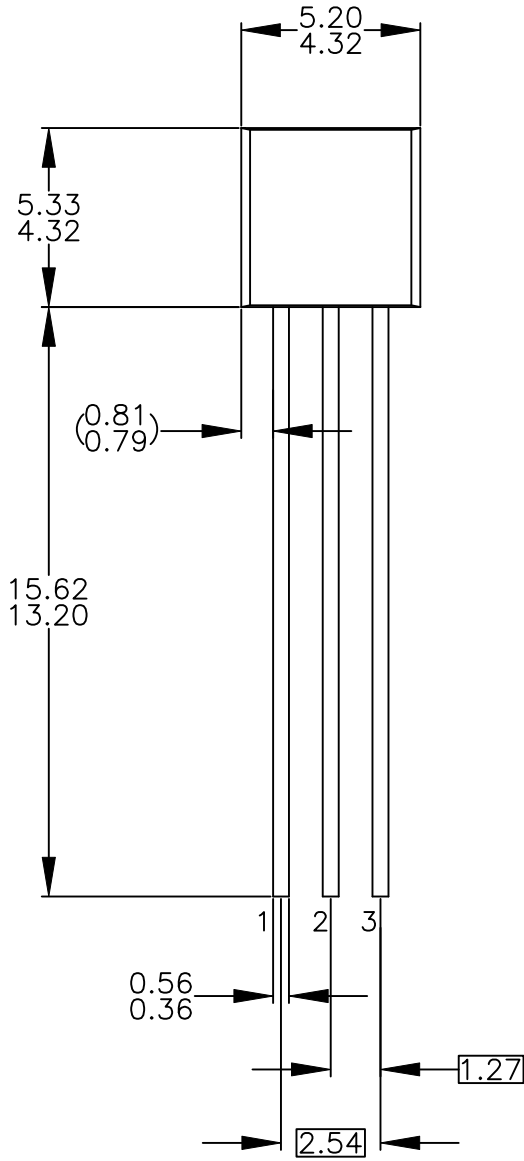
- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M
- E) DRAWING FILENAME: M08Arev16





NOTES: UNLESS OTHERWISE SPECIFIED

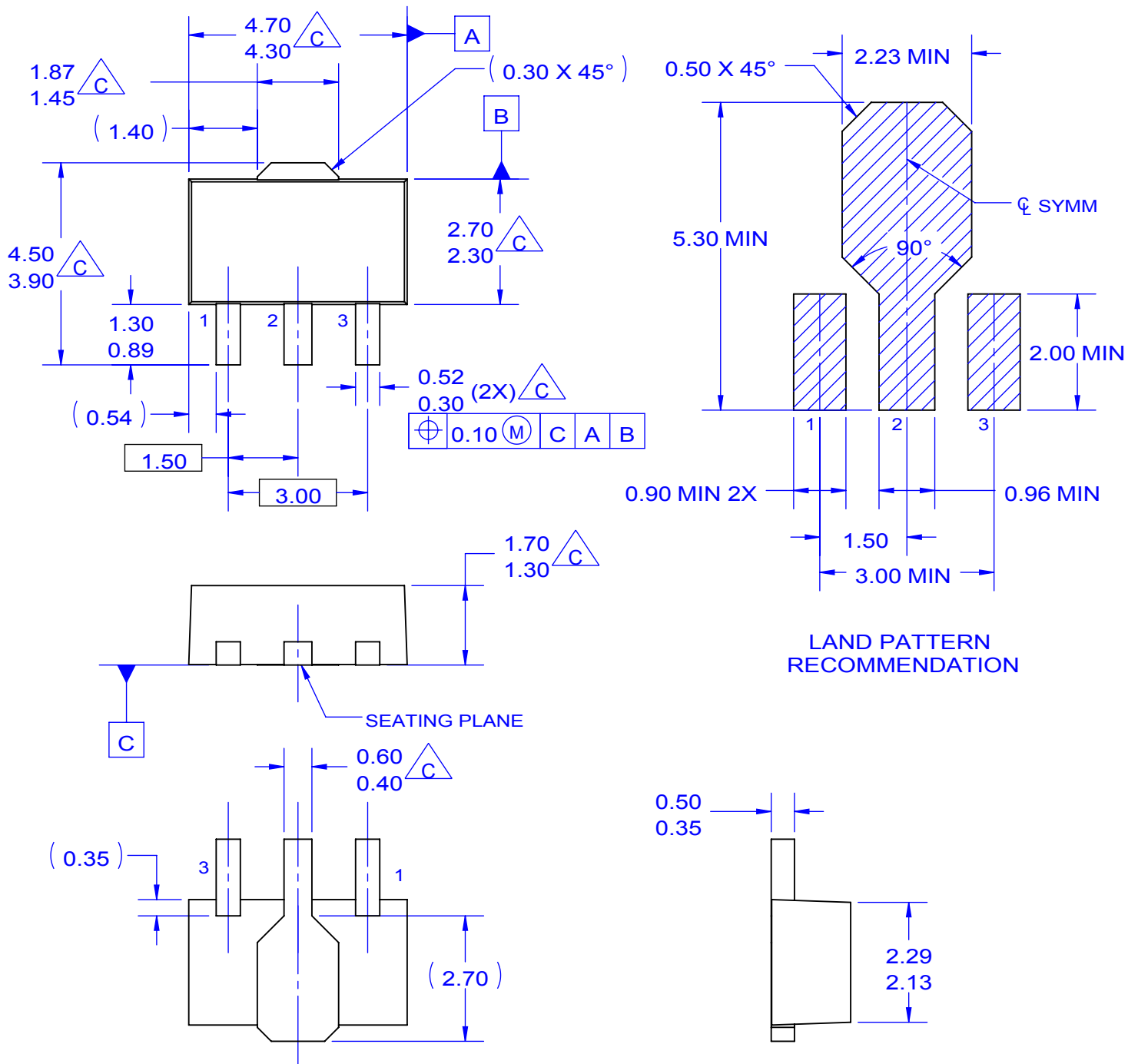
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- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5M-2009.
- D. DRAWING FILENAME: MKT-ZA03FREV3.
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- D) DRAWING FILENAME: MKT-ZA03DREV4.





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A. REFERENCE TO JEDEC TO-243 VARIATION AA.
 B. ALL DIMENSIONS ARE IN MILLIMETERS.

$\triangle C$ DOES NOT COMPLY JEDEC STANDARD VALUE.
 D. DIMENSIONS ARE EXCLUSIVE OF BURRS,
 MOLD FLASH AND TIE BAR PROTRUSION.
 E. DIMENSION AND TOLERANCE AS PER ASME
 Y14.5-1994.

F. DRAWING FILE NAME: MA03CREV3

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