FAIRCHILD SEMICONDUCTOR®

February 2013

KA78LXXA / KA78L05AA
3-Terminal 0.1 A Positive Voltage Regulator

Features

- Maximum Output Current of 100 mA
- Output Voltage of 5 V, 6 V, 8 V, 9 V,10 V, 12 V, 15 V and 18 V
- Thermal Overload Protection
- Short-Circuit Current Limiting
- Output Voltage Offered in ± 5% Tolerance

Description

The KA78LXXA / KA78L05AA series of fixed-voltage, monolithic, integrated circuit, voltage regulators are suitable for applications that require supply current up to 100 mA.

TO-92 **SOT-89**

1. Output 2. GND 3. Input

8-SOIC

1. Output 2. GND 3. GND 4. NC
5. NC 6. GND 7. GND 8. Input

Ordering Information

Product Number	Package	Packing Method	Output Voltage Tolerance	Operating Temperature
KA78L05AZTA	TO-92	Ammo	± 5%	0 ~ +125 °C
KA78L05AZBU		Bulk		
KA78L06AZTA		Ammo		
KA78L08AZTA		Ammo		
KA78L09AZTA		Ammo		
KA78L10AZTA		Ammo		
KA78L12AZTA		Ammo		
KA78L15AZTA		Ammo		
KA78L18AZTA		Ammo		
KA78L05AMTF	SOT-89	Tape & Reel		
KA78L08AMTF		Tape & Reel		
KA78L12AMTF		Tape & Reel		
KA78L05ADTF	8-SOIC	Tape & Reel		
KA78L05AAZTA	TO-92	Ammo	± 3%	

Block Diagram

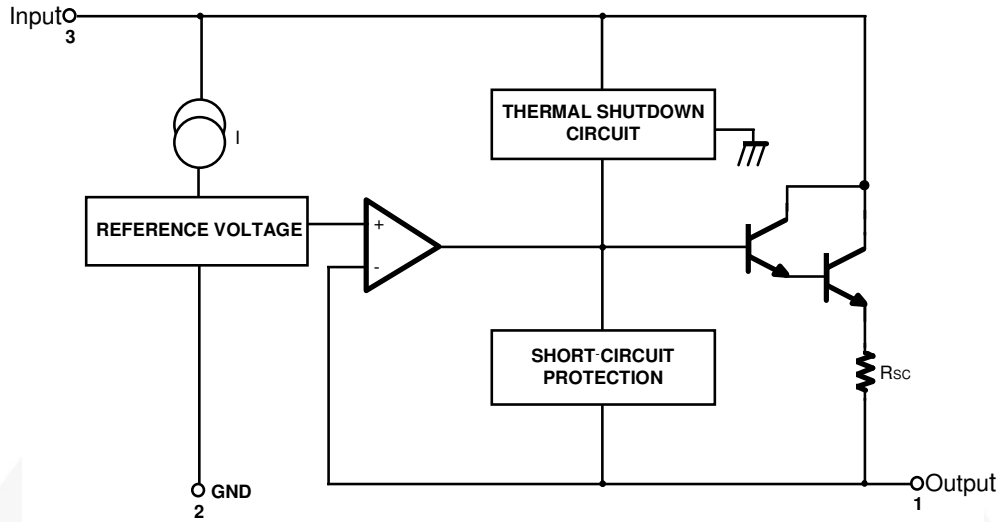


Figure 1. Block Diagram

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°C unless otherwise noted.

Symbol	Parameter		Value	Unit
V_I	Input Voltage	V_O = 5 V to 8 V	30	V
		V_O = 12 V to 18 V	35	V
T_J	Operating Junction Temperature Range		0 to +150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C
$R_{\theta JC}$	Thermal Resistance, Junction-Case	TO-92	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-Air	TO-92	150	°C/W
		SOT-89	225	°C/W
		8-SOIC	160	°C/W

Electrical Characteristics (KA78L05A)

V_I = 10 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		4.8	5.0	5.2	V
ΔV_O	Line Regulation (1)		T_J = 25°C	7 V ≤ V_I ≤ 20 V		8	150	mV
				8 V ≤ V_I ≤ 20 V		6	100	mV
ΔV_O	Load Regulation (1)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		11	60	mV
				1 mA ≤ I_O ≤ 40 mA		5.0	30	mV
V_O	Output Voltage		7 V ≤ V_I ≤ 20 V	1 mA ≤ I_O ≤ 40 mA			5.25	V
			7 V ≤V_I ≤ V_{MAX} (2)	1 mA ≤ I_O ≤ 70 mA	4.75		5.25	V
I_Q	Quiescent Current		T_J = 25°C			2.0	5.5	mA
ΔI_Q	Quiescent Current Change	With Line	8 V ≤V_I ≤ 20 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			40		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-0.65		mV/°C
RR	Ripple Rejection		f = 120 Hz, 8 V ≤ V_I ≤ 18 V, T_J = 25°C		41	80		dB
V_D	Dropout Voltage		T_J = 25°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 ≤ 0.75 W.

Electrical Characteristics (KA78L06A)

V_I = 12 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 μF, C_O = 0.1 μF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		5.75	6.00	6.25	V
ΔV_O	Line Regulation (3)		T_J = 25°C	8.5 V ≤ V_I ≤ 20 V		64	175	mV
				9 V ≤ V_I ≤ 20 V		54	125	mV
ΔV_O	Load Regulation (3)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		12.8	80.0	mV
				1 mA ≤ I_O ≤ 70 mA		5.8	40.0	mV
V_O	Output Voltage		8.5 V ≤ V_I ≤ 20 V, 1 mA ≤ I_O ≤ 40 mA				6.3	V
			8.5 V ≤ V_I ≤ V_{MAX} (4), 1 mA ≤ I_O ≤ 70 mA		5.7		6.3	V
I_Q	Quiescent Current		T_J = 25°C				5.5	mA
			T_J = 125°C			3.9	6.0	mA
ΔI_Q	Quiescent Current Change	With Line	9 V ≤ V_I ≤ 20 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			40		μV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			0.75		mV/°C
RR	Ripple Rejection		f = 120 Hz, 10 V ≤ V_I ≤ 20 V, T_J = 25°C		40	46		dB
V_D	Dropout Voltage		T_J = 25°C			1.7		V

Notes:

3. 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.
4. Power dissipation: P_D ≤ 0.75 W.

Electrical Characteristics (KA78L08A)

V_I = 14 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		7.7	8.0	8.3	V
ΔV_O	Line Regulation (5)		T_J = 25°C	10.5 V ≤ V_I ≤ 23 V		10	175	mV
				11 V ≤ V_I ≤ 23 V		8	125	mV
ΔV_O	Load Regulation (5)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		15	80	mV
				1 mA ≤ I_O ≤ 40 mA		8	40	mV
V_O	Output Voltage		10.5 V ≤ V_I ≤ 23 V	1 mA ≤ I_O ≤ 40 mA	7.6		8.4	V
			10.5 V ≤ V_I ≤ V_{MAX} (6)	1 mA ≤ I_O ≤ 70 mA	7.6		8.4	V
I_Q	Quiescent Current		T_J = 25°C			2.0	5.5	mA
ΔI_Q	Quiescent Current Change	With Line	11 V ≤ V_I ≤ 23 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤100 kHz			60		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-0.8		mV/°C
RR	Ripple Rejection		f = 120 Hz, 11 V ≤ V_I ≤ 21 V, T_J = 25°C		39	70		dB
V_D	Dropout Voltage		T_J = 25°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 ≤ 0.75 W.

Electrical Characteristics (KA78L09A)

V_I = 15 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		8.64	9.00	9.36	V
ΔV_O	Line Regulation (7)		T_J = 25°C	11.5 V ≤ V_I ≤ 24 V		90	200	mV
				13 V ≤ V_I ≤ 24 V		100	150	mV
ΔV_O	Load Regulation (7)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		20	90	mV
				1 mA ≤ I_O ≤ 40 mA		10	45	mV
V_O	Output Voltage		11.5 V ≤ V_I ≤ 24 V	1 mA ≤ I_O ≤ 40 mA	8.55		9.45	V
			11.5 V ≤ V_I ≤ V_{MAX} (8)	1 mA ≤ I_O ≤ 70 mA	8.55		9.45	V
I_Q	Quiescent Current		T_J = 25°C			2.1	6.0	mA
ΔI_Q	Quiescent Current Change	With Line	13 V ≤ V_I ≤ 24 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			70		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-0.9		mV/°C
RR	Ripple Rejection		f = 120 Hz, 12 V ≤ V_I ≤ 22 V, T_J = 25°C		38	44		dB
V_D	Dropout Voltage		T_J = 25°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 ≤ 0.75 W.

Electrical Characteristics (KA78L10A)

V_I = 16 V, I_O = 40 mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		9.6	10.0	10.4	V
ΔV_O	Line Regulation(9)		T_J = 25°C	12.5 V ≤ V_I ≤ 25 V		100	220	mV
				14 V ≤ V_I ≤ 25 V		100	170	mV
ΔV_O	Load Regulation(9)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		20	94	mV
				1 mA ≤ I_O ≤ 70 mA		10	47	mV
V_O	Output Voltage		12.5 V ≤ V_I ≤ 25 V, 1 mA ≤ I_O ≤ 40 mA		9.5		10.5	V
			12.5 V ≤ V_I ≤ V_{MAX}(10) 1 mA ≤ I_O ≤ 70 mA		9.5		10.5	
I_Q	Quiescent Current		T_J = 25°C				6.0	mA
			T_J =125°C			4.2	6.5	
ΔI_Q	Quiescent Current Change	With Line	12.5 V ≤ V_I ≤ 25 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			74		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			0.95		mV/°C
RR	Ripple Rejection		f = 120 Hz, 15 V ≤ V_I ≤ 25 V, T_J = 25°C		38	43		dB
V_D	Dropout Voltage		T_J = 25°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 ≤ 0.75 W.

Electrical Characteristics (KA78L12A)

V_I = 19 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		11.5	12.0	12.5	V
ΔV_O	Line Regulation (11)		T_J = 25°C	14.5 V ≤ V_I ≤ 27 V		20	250	mV
				16 V ≤ V_I ≤ 27 V		15	200	mV
ΔV_O	Load Regulation (11)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		20	100	mV
				1 mA ≤ I_O ≤ 40 mA		10	50	mV
V_O	Output Voltage		14.5 V ≤ V_I ≤ 27 V	1 mA ≤ I_O ≤ 40 mA	11.4		12.6	V
			14.5 V ≤ V_I ≤ V_{MAX} (12)	1 mA ≤ I_O ≤ 70 mA	11.4		12.6	V
I_Q	Quiescent Current		T_J = 25°C			2.1	6.0	mA
ΔI_Q	Quiescent Current Change	With Line	16 V ≤ V_I ≤ 27 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			80		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-1.0		mV/°C
RR	Ripple Rejection		f = 120 Hz, 15 V ≤ V_I ≤ 25 V, T_J = 25°C		37	65		dB
V_D	Dropout Voltage		T_J = 25°C			1.7		V

Notes:

11. 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.
12. Power dissipation: P_D ≤ 0.75 W.

Electrical Characteristics (KA78L15A)

V_I = 23 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		14.4	15.0	15.6	V
ΔV_O	Line Regulation(13)		T_J = 25°C	17.5 V ≤ V_I ≤ 30 V		25	300	mV
				20 V ≤ V_I ≤ 30 V		20	250	mV
ΔV_O	Load Regulation(13)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		25	150	mV
				1 mA ≤ I_O ≤ 40 mA		12	75	mV
V_O	Output Voltage		17.5 V ≤ V_I ≤ 30 V	1 mA ≤ I_O ≤ 40 mA	14.25		15.75	V
			17.5 V ≤ V_I ≤ V_{MAX}(14)	1 mA ≤ I_O ≤ 70 mA	14.25		15.75	V
I_Q	Quiescent Current		T_J = 25°C			2.1	6.0	mA
ΔI_Q	Quiescent Current Change	With Line	20 V ≤ V_I ≤ 30 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			90		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-1.3		mV/°C
RR	Ripple Rejection		f = 120 Hz, 18.5 V ≤ V_I ≤ 28.5 V, T_J=25°C		34	60		dB
V_D	Dropout Voltage		T_J = 25°C			1.7		V

Notes:

13. 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.
14. Power dissipation: P_D ≤ 0.75 W.

Electrical Characteristics (KA78L18A)

V_I = 27V, I_O = 40mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		17.3	18.0	18.7	V
ΔV_O	Line Regulation (15)		T_J = 25°C	21 V ≤ V_I ≤ 33 V		145	300	mV
				22 V ≤ V_I ≤ 33 V		135	250	mV
ΔV_O	Load Regulation (15)		T_J = 25°C	1 mA ≤ I_O≤100 mA		30	170	mV
				1 mA ≤ I_O ≤ 40 mA		15	85	mV
V_O	Output Voltage		21 V ≤ V_I ≤ 33 V	1 mA ≤ I_O ≤ 40 mA	17.1		18.9	V
			21V ≤ V_I ≤ V_{MAX} (16)	1 mA ≤ I_O ≤ 70 mA	17.1		18.9	V
I_Q	Quiescent Current		T_J = 25°C			2.2	6.0	mA
ΔI_Q	Quiescent Current Change	With Line	21 V ≤ V_I ≤ 33 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			150		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-1.8		mV/°C
RR	Ripple Rejection		f = 120 Hz, 23 V ≤ V_I ≤ 33V, T_J = 25°C		34	48		dB
V_D	Dropout Voltage		T_J = 25°C			1.7		V

Notes:

15. 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.
16. Power dissipation: P_D ≤ 0.75 W.

Electrical Characteristics (KA78L05AA)

V_I = 10 V, I_O = 40 mA, 0°C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1 µF, unless otherwise specified.

Symbol	Parameter		Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage		T_J = 25°C		4.9	5.0	5.1	V
ΔV_O	Line Regulation (17)		T_J = 25°C	7 V ≤ V_I ≤ 20 V		8	150	mV
				8 V ≤ V_I ≤ 20 V		6	100	mV
ΔV_O	Load Regulation (17)		T_J = 25°C	1 mA ≤ I_O ≤ 100 mA		11	50	mV
				1 mA ≤ I_O ≤ 40 mA		5.0	25	mV
V_O	Output Voltage		7 V ≤V_I ≤ 20 V	1 mA ≤ I_O ≤ 40 mA			5.15	V
			7 V ≤V_I ≤ V_{MAX} (18)	1 mA ≤ I_O ≤ 70 mA	4.85		5.15	V
I_Q	Quiescent Current		T_J = 25°C			2.0	5.5	mA
ΔI_Q	Quiescent Current Change	With Line	8 V ≤V_I ≤ 20 V				1.5	mA
ΔI_Q		With Load	1 mA ≤ I_O ≤ 40 mA				0.1	mA
V_N	Output Noise Voltage		T_A = 25°C, 10 Hz ≤ f ≤ 100 kHz			40		µV/Vo
$\Delta V_O/\Delta T$	Temperature Coefficient of V_O		I_O = 5 mA			-0.65		mV/°C
RR	Ripple Rejection		f = 120 Hz, 8 V ≤ V_I ≤ 18 V, T_J = 25°C		41	80		dB
V_D	Dropout Voltage		T_J = 25°C			1.7		V

Notes:

17. 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.
18. Power dissipation: P_D ≤ 0.75 W.

Typical Application

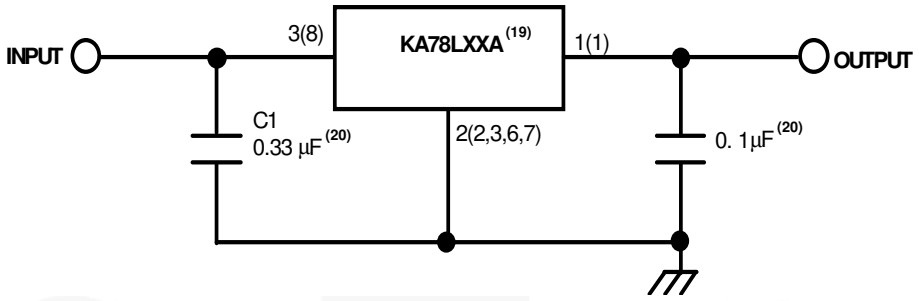


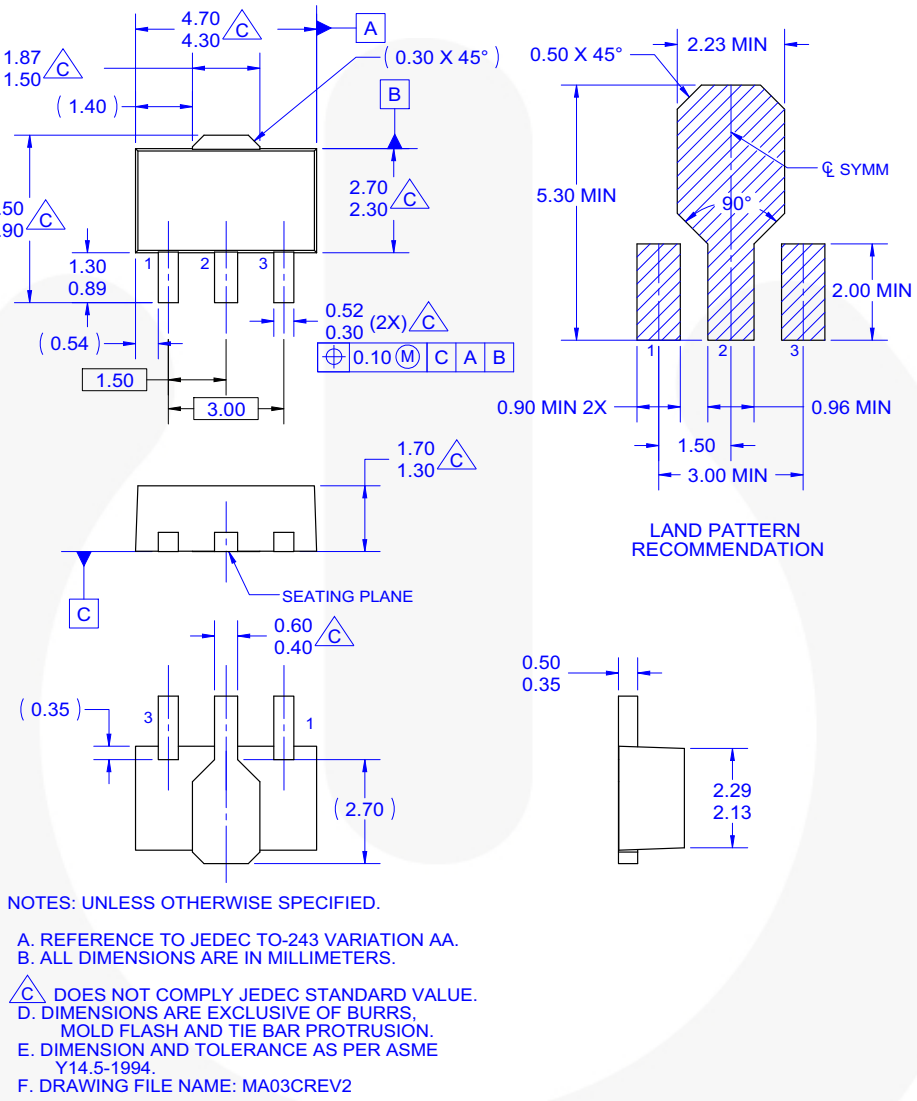
Figure 2. Typical Application

Notes:

19. To specify an output voltage, substitute voltage value for “XX”.
20. Bypass capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator.

Physical Dimensions

SOT-89



NOTES: UNLESS OTHERWISE SPECIFIED.

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

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: MA03CREV2

Figure 3. 3-Lead, SOT-89, JEDEC TO-243, Option AA

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
http://www.fairchildsemi.com/packaging/.

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:
http://www.fairchildsemi.com/packaging/tr/sot89_tr.pdf.

Physical Dimensions (Continued)

TO-92 Straight Lead for Bulk Packing

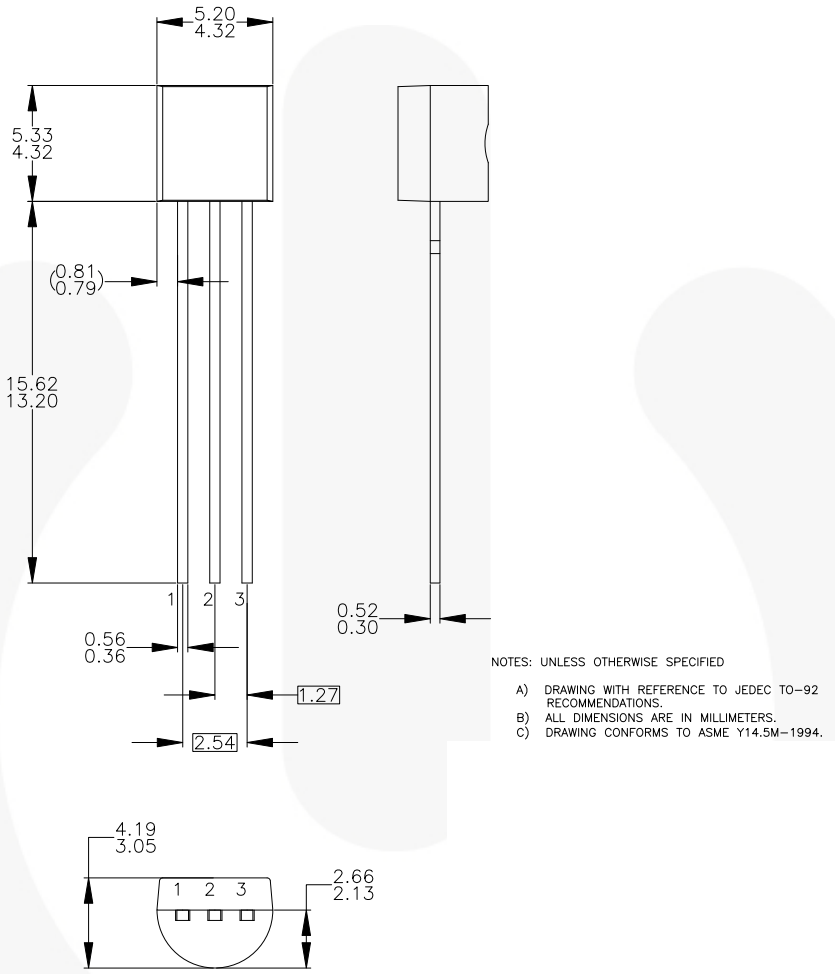


Figure 4. 3LD, TO-92, MOLDED STD STRAIGHT LD(NO EOL CODE)

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For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:
http://www.fairchildsemi.com/packaging/tr/to92pdd_tr.pdf.

Physical Dimensions (Continued)

TO-92 Formed Lead For T&R and Ammo Packing

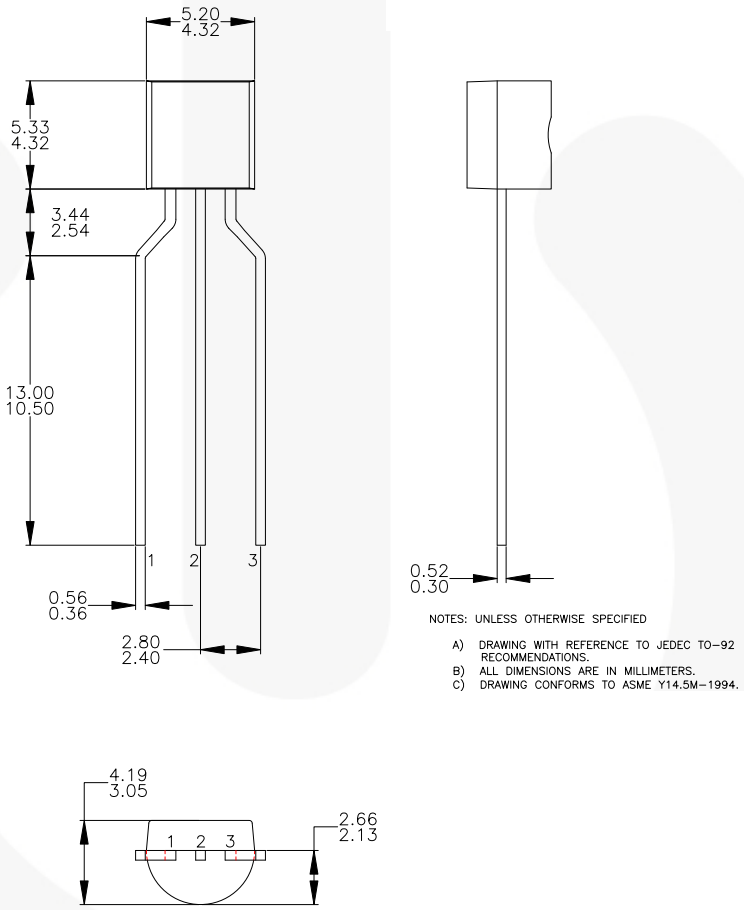

Figure 5. 3LD, TO-92, MOLDED 0.200 IN LINE SPACING LD FORM (J61Z OPTION)

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For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:

http://www.fairchildsemi.com/packaging/tr/to92_tr.pdf.

Physical Dimensions (Continued)

8-SOIC

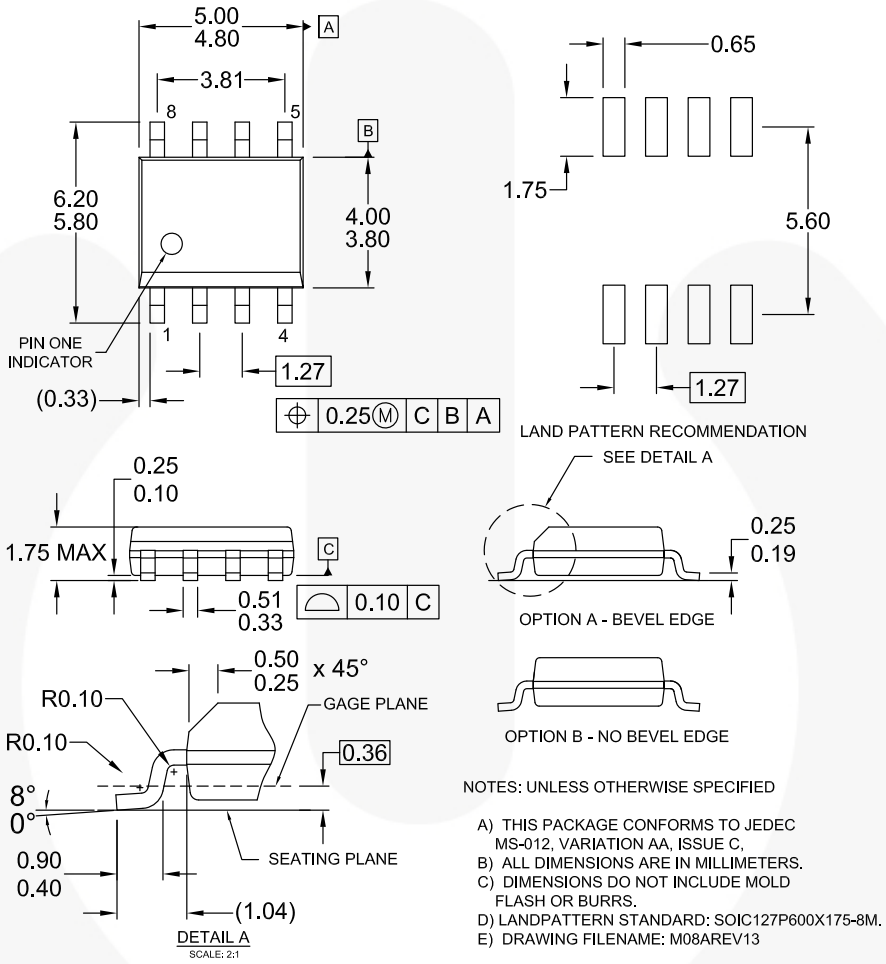

Figure 6. 8LD, SOIC, JEDEC MS-012, 0.150" NARROW BODY

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