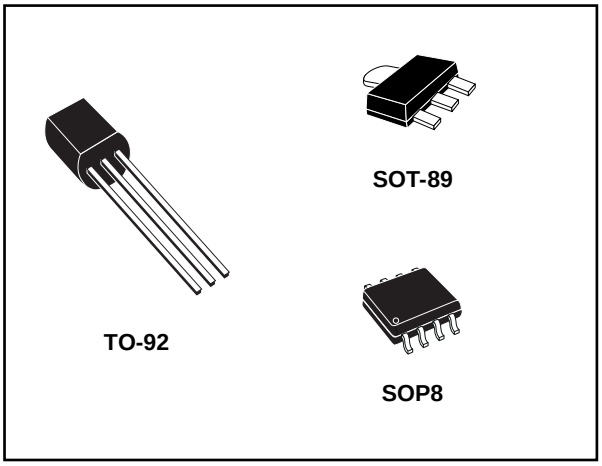
POSITIVE VOLTAGE REGULATORS

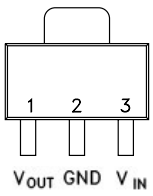
- OUTPUT CURRENT UP TO 100 mA
- OUTPUTVOLTAGESOF 5; 6; 8; 9; 10; 12; 15; 18; 20; 24; 33V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- NO EXTERNAL COMPONENTS ARE REQUIRED
- AVAILABLEINEITHER±5%



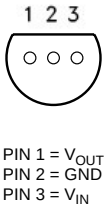
DESCRIPTION

The LM78Lxx series of three-terminal positive regulators employ internal current limiting and thermal shutdown, making them essentially indestructible. If adequate heat-sink is provided, they can deliver up to 100 mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The LM78Lxx series used as Zener diode/resistor combination replacement, offers an effective output impedance improvement of typically two orders of magnitude, along with lower quiescent current and lower noise.

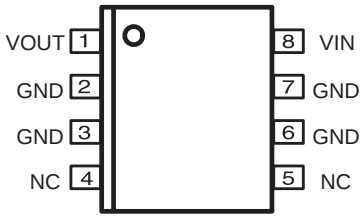
CONNECTION DIAGRAM (top view)



SOT-89



TO-92



SOP8

ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78L05MK/TR	SOT-89	78L05	REEL	2500/reel
LM78L06MK/TR		78L06	REEL	2500/reel
LM78L08MK/TR		78L08	REEL	2500/reel
LM78L09MK/TR		78L09	REEL	2500/reel
LM78L10MK/TR		78L10	REEL	2500/reel
LM78L12MK/TR		78L12	REEL	2500/reel
LM78L15MK/TR		78L15	REEL	2500/reel
LM78L18MK/TR		78L18	REEL	2500/reel
LM78L20MK/TR		78L20	REEL	2500/reel
LM78L24MK/TR		78L24	REEL	2500/reel
LM78L33MK/TR		78L33	REEL	2500/reel

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78L05Z	TO-92	78L05	BAG	1000/bag
LM78L06Z		78L06	BAG	1000/bag
LM78L08Z		78L08	BAG	1000/bag
LM78L09Z		78L09	BAG	1000/bag
LM78L10Z		78L10	BAG	1000/bag
LM78L12Z		78L12	BAG	1000/bag
LM78L15Z		78L15	BAG	1000/bag
LM78L18Z		78L18	BAG	1000/bag
LM78L20Z		78L20	BAG	1000/bag
LM78L24Z		78L24	BAG	1000/bag
LM78L33Z		78L33	BAG	1000/bag
LM78L05M/TR	SOP8L	78L05	REEL	2500/reel
LM78L06M/TR		78L06	REEL	2500/reel
LM78L08M/TR		78L08	REEL	2500/reel
LM78L09M/TR		78L09	REEL	2500/reel
LM78L10M/TR		78L10	REEL	2500/reel
LM78L12M/TR		78L12	REEL	2500/reel
LM78L15M/TR		78L15	REEL	2500/reel
LM78L18M/TR		78L18	REEL	2500/reel
LM78L20M/TR		78L20	REEL	2500/reel
LM78L24M/TR		78L24	REEL	2500/reel
LM78L33M/TR		78L33	REEL	2500/reel

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter[2]		Value	Unit
V_I	DC Input Voltage	V_O = 5 to 9 V	30	V
		V_O = 12 to 15 V	35	
		V_O = 18 to 33 V	40	
I_O	Output Current		100	mA
P_{tot}	Power Dissipation		Internally Limited (*)	
T_{stg}	Storage Temperature Range		-40 to 150	°C
T_{op}	Operating Junction Temperature Range	for L78LxxC	0 to 125	°C
		for L78LxxI	-40 to 125	

ELECTRICAL CHARACTERISTICS OF LM78L05

(refer to the test circuits, V_I = 10V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L05C, T_J = -40 to 125°C for LM78L05I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	4.8	5	5.2	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 7 to 20 V	4.75		5.25	V
		I_O = 1 to 70 mA V_I = 10 V	4.75		5.25	
ΔV_O	Line Regulation	V_I = 7 to 20 V T_J = 25°C			150	mV
		V_I = 8 to 20 V T_J = 25°C			100	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			60	mV
		I_O = 1 to 40 mA T_J = 25°C			30	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 8 to 20 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		40		µV
SVR	Supply Voltage Rejection	V_I = 8 to 18 V f = 120Hz I_O = 40 mA T_J = 25°C	41	49		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L06

(refer to the test circuits, V_I = 12V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L06C, T_J = -40 to 125°C for LM78L06I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	5.76	6	6.24	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 8.5 to 20 V	5.7		6.3	V
		I_O = 1 to 70 mA V_I = 12 V	5.7		6.3	
ΔV_O	Line Regulation	V_I = 8.5 to 20 V T_J = 25°C			150	mV
		V_I = 9 to 20 V T_J = 25°C			100	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			60	mV
		I_O = 1 to 40 mA T_J = 25°C			30	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 9 to 20 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		50		µV
SVR	Supply Voltage Rejection	V_I = 9 to 20 V f = 120Hz I_O = 40 mA T_J = 25°C	39	46		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L08

(refer to the test circuits, V_I = 14V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L08C, T_J = -40 to 125°C for LM78L08I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	7.68	8	8.32	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 10.5 to 23 V	7.6		8.4	V
		I_O = 1 to 70 mA V_I = 14 V	7.6		8.4	
ΔV_O	Line Regulation	V_I = 10.5 to 23 V T_J = 25°C			175	mV
		V_I = 11 to 23 V T_J = 25°C			125	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			80	mV
		I_O = 1 to 40 mA T_J = 25°C			40	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 11 to 23 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		60		µV
SVR	Supply Voltage Rejection	V_I = 12 to 23 V f = 120Hz I_O = 40 mA T_J = 25°C	37	45		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L09

(refer to the test circuits, V_I = 15V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for L78L09C, T_J = -40 to 125°C for L78L09I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	8.64	9	9.36	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 11.5 to 23 V	8.55		9.45	V
		I_O = 1 to 70 mA V_I = 15 V	8.55		9.45	
ΔV_O	Line Regulation	V_I = 11.5 to 23 V T_J = 25°C			225	mV
		V_I = 12 to 23 V T_J = 25°C			150	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			80	mV
		I_O = 1 to 40 mA T_J = 25°C			40	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 12 to 23 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		70		µV
SVR	Supply Voltage Rejection	V_I = 12 to 23 V f = 120Hz I_O = 40 mA T_J = 25°C	37	44		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L10

(refer to the test circuits, V_I = 16V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L10C, T_J = -40 to 125°C for LM78L10I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	9.6	10	10.4	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I =12.5 to 23 V	9.5		10.5	V
		I_O = 1 to 70 mA V_I = 16 V	9.5		10.5	
ΔV_O	Line Regulation	V_I = 12.5 to 23 V T_J = 25°C			230	mV
		V_I = 13 to 23 V T_J = 25°C			170	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			80	mV
		I_O = 1 to 40 mA T_J = 25°C			40	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 13 to 23 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		60		µV
SVR	Supply Voltage Rejection	V_I = 14 to 23 V f = 120Hz I_O = 40 mA T_J = 25°C	37	45		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L12

(refer to the test circuits, V_I = 19V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L12C, T_J = -40 to 125°C for LM78L12I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	11.5	12	12.5	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 14.5 to 27 V	11.4		12.6	V
		I_O = 1 to 70 mA V_I = 19 V	11.4		12.6	
ΔV_O	Line Regulation	V_I = 14.5 to 27 V T_J = 25°C			250	mV
		V_I = 16 to 27 V T_J = 25°C			200	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			100	mV
		I_O = 1 to 40 mA T_J = 25°C			50	
I_d	Quiescent Current	T_J = 25°C			6.5	mA
		T_J = 125°C			6	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 16 to 27 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		80		µV
SVR	Supply Voltage Rejection	V_I = 15 to 25 V f = 120Hz I_O = 40 mA T_J = 25°C	37	42		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L15

(refer to the test circuits, V_I = 19V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L15C, T_J = -40 to 125°C for LM78L15I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	14.4	15	15.6	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 17.5 to 30 V	14.25		15.75	V
		I_O = 1 to 70 mA V_I = 23 V	14.25		15.75	
ΔV_O	Line Regulation	V_I = 17.5 to 30 V T_J = 25°C			300	mV
		V_I = 20 to 30 V T_J = 25°C			250	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			150	mV
		I_O = 1 to 40 mA T_J = 25°C			75	
I_d	Quiescent Current	T_J = 25°C			6.5	mA
		T_J = 125°C			6	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 20 to 30 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		90		µV
SVR	Supply Voltage Rejection	V_I = 18.5 to 28.5 V f = 120Hz I_O = 40 mA T_J = 25°C	34	39		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L18

(refer to the test circuits, V_I = 27V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L18C, T_J = -40 to 125°C for LM78L18I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	17.3	18	18.7	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 22 to 33 V	17.1		18.9	V
		I_O = 1 to 70 mA V_I = 27 V	17.1		18.9	
ΔV_O	Line Regulation	V_I = 21 to 33 V T_J = 25°C			320	mV
		V_I = 22 to 33 V T_J = 25°C			270	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			170	mV
		I_O = 1 to 40 mA T_J = 25°C			85	
I_d	Quiescent Current	T_J = 25°C			6.5	mA
		T_J = 125°C			6	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 23 to 33 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		120		µV
SVR	Supply Voltage Rejection	V_I = 23 to 33 V f = 120Hz I_O = 40 mA T_J = 25°C	33	38		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L20

(refer to the test circuits, V_I = 29V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L20C, T_J = -40 to 125°C for LM78L20I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	19.2	20	20.8	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 24 to 33 V	19		21	V
		I_O = 1 to 70 mA V_I = 29 V	19		21	
ΔV_O	Line Regulation	V_I = 22.5 to 34 V T_J = 25°C			330	mV
		V_I = 24 to 34 V T_J = 25°C			280	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			180	mV
		I_O = 1 to 40 mA T_J = 25°C			90	
I_d	Quiescent Current	T_J = 25°C			6.5	mA
		T_J = 125°C			6	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 25 to 33 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		120		µV
SVR	Supply Voltage Rejection	V_I = 25 to 35 V f = 120Hz I_O = 40 mA T_J = 25°C	32	38		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L24

(refer to the test circuits, V_I = 27V, I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L24C, T_J = -40 to 125°C for LM78L24I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	23	24	25	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 27 to 38 V	22.8		25.2	V
		I_O = 1 to 70 mA V_I = 33 V	22.8		25.2	
ΔV_O	Line Regulation	V_I = 27 to 38 V T_J = 25°C			350	mV
		V_I = 28 to 38 V T_J = 25°C			300	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			200	mV
		I_O = 1 to 40 mA T_J = 25°C			100	
I_d	Quiescent Current	T_J = 25°C			6.5	mA
		T_J = 125°C			6	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 28 to 38 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J = 25°C		200		µV
SVR	Supply Voltage Rejection	V_I = 23 to 33 V f = 120Hz I_O = 40 mA T_J = 25°C	31	37		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF LM78L33

(refer to the test circuits, V_I = 3 6 V , I_O = 40 mA, C_I = 0.33 µF, C_O = 0.1 µF,
T_J = 0 to 125°C for LM78L33C, T_J = -40 to 125°C for LM78L33I, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	31.68	33	34.32	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 36 to 40 V	31.35		34.65	V
		I_O = 1 to 70 mA V_I = 38 V	31.35		34.65	
ΔV_O	Line Regulation	V_I = 36 to 40 V T_J = 25°C			150	mV
		V_I = 37 to 40 V T_J = 25°C			100	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			60	mV
		I_O = 1 to 40 mA T_J = 25°C			30	
I_d	Quiescent Current	T_J = 25°C			6	mA
		T_J = 125°C			5.5	mA
ΔI_d	Quiescent Current Change	I_O = 1 to 40 mA			0.1	mA
		V_I = 36 to 40 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz T_J= 25°C		120		µV
SVR	Supply Voltage Rejection	V_I = 36 to 40 V f = 120Hz I_O = 40 mA T_J = 25°C	41	49		dB
V_d	Dropout Voltage			1.7		V

Figure 1 : 78L05/12 Output Voltage vs Ambient Temperature

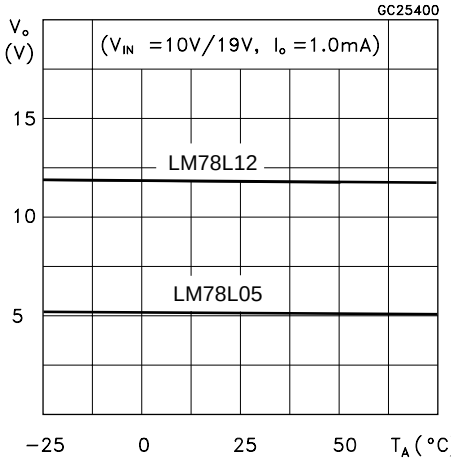
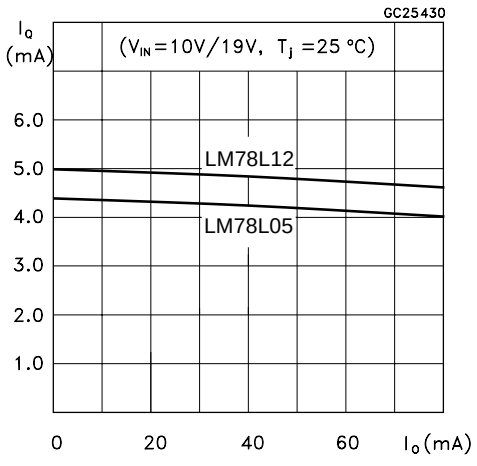
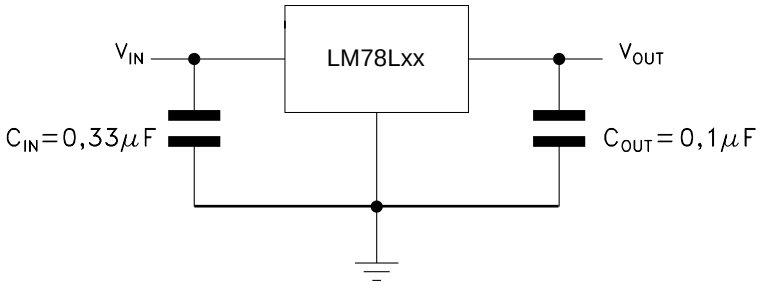


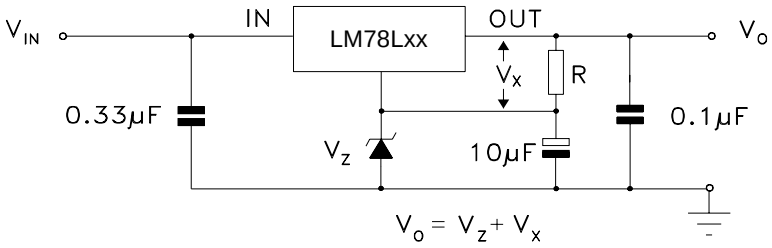
Figure 2: 78L05/12 Quiescent Current vs Output Current



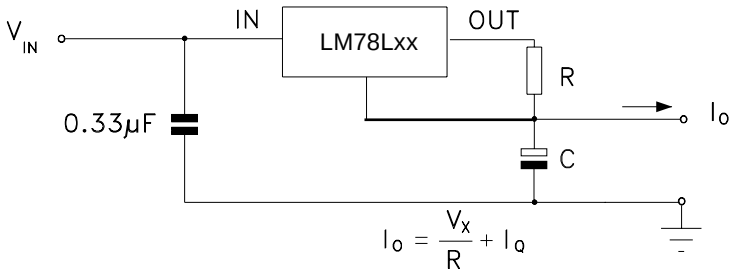
TEST CIRCUITS



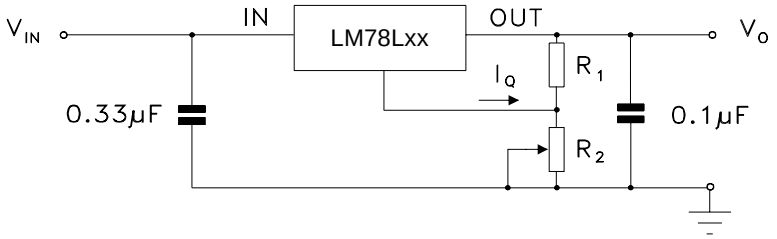
Edit Boost Circuit



Current Regulator



Adjustable Output Regulator



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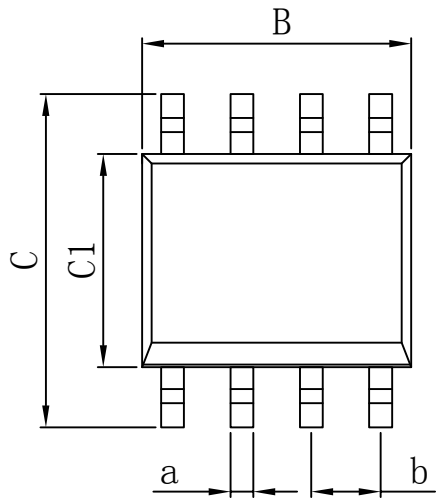
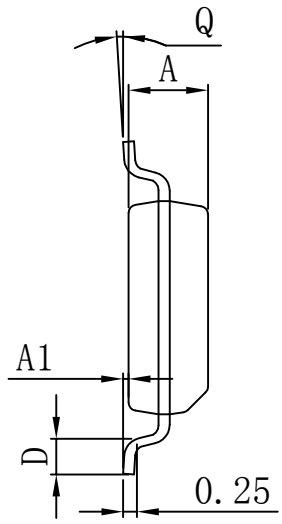
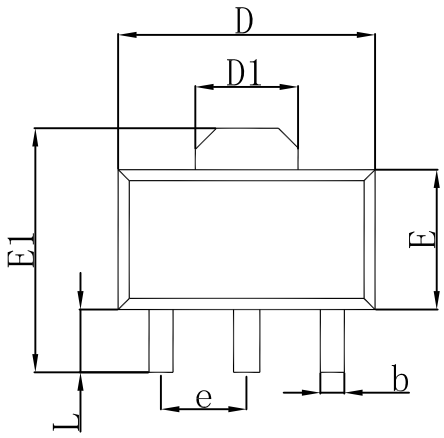
SOP8

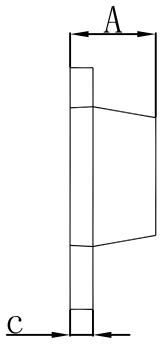




Dimensions In Millimeters					
Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	1.225	1.570	D	0.400	0.950
A1	0.100	0.250	Q	0°	8°
B	4.800	5.100	a	0.420 TYP	
C	5.800	6.250	b	1.270 TYP	
C1	3.800	4.000			

SOT89-3L

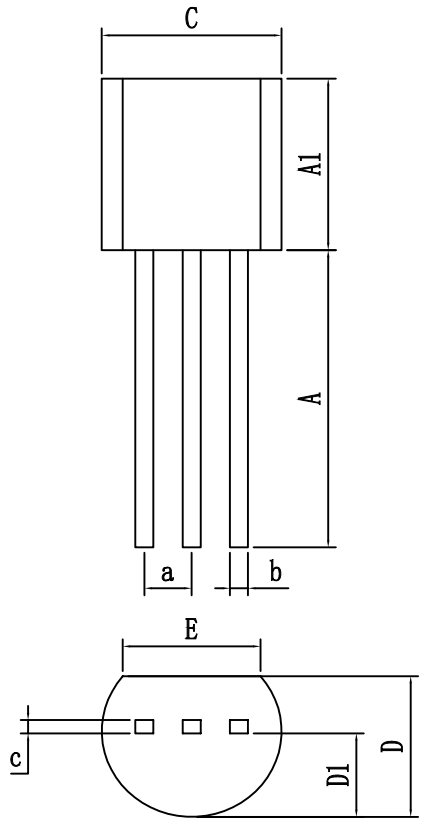




Dimensions In Millimeters					
Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	1.400	1.600	c	0.350	0.440
E	2.300	2.600	D1	1.550 REF	
E1	3.940	4.250	b	0.450 TYP	
D	4.400	4.600	e	1.500 TYP	
L	0.900	1.200			

PACKAGE

TO-92



Dimensions In Millimeters					
Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	11.200	12.700	E	3.430	3.830
A1	4.320	5.340	a	1.270 TYP	
C	4.440	5.210	b	0.485 TYP	
D	3.170	4.190	c	0.380 TYP	
D1	2.030	2.670			

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