TOP ONE SEMI CONDUCTOR

SP78LXX SERIES

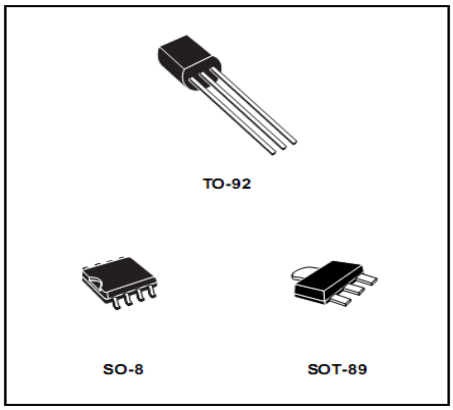
POSITIVE VOLTAGE REGULATORS

DESCRIPTION

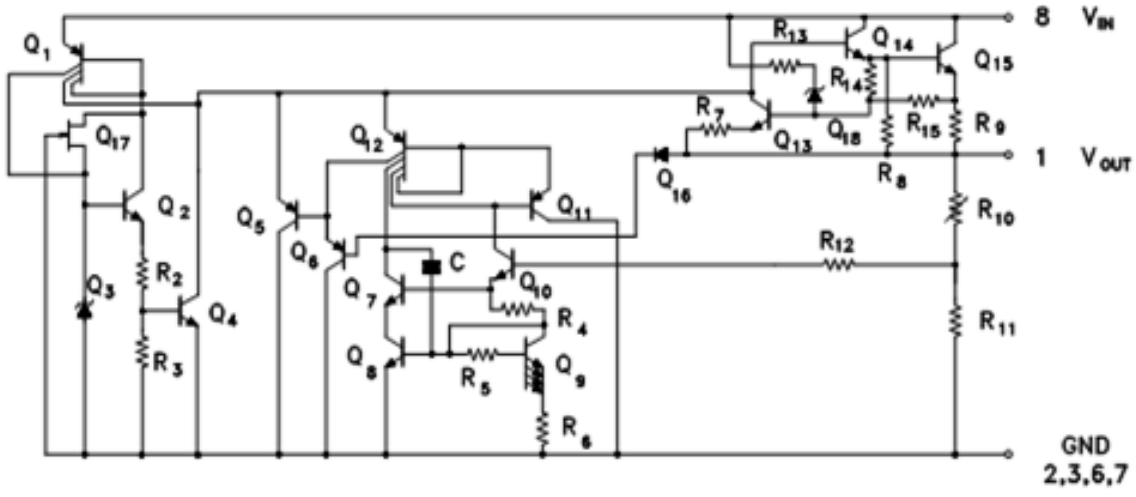
The SP78LXX series of three-terminal positive Regulators employ internal current limiting and Thermal shutdown, making them essentially indestructible. If adequate heat-sink is provided, they can deliver up to100 mA output current. They are intended as fixed voltage regulators in a wide range of applications 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 SP78LXX 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.

FEATURES

- Output current up to 100 mA
- Output voltages of 3.3; 5; 8; 9; 12; V
- Thermal overload protection
- Short circuit protection
- No external components are required
- Output Voltage Accuracy of ±5% over the Full Temperature Range



SCHEMATICDIAGRAM



ABSOLUTEMAXIMUMRATINGS

Symbol	Parameter²		Value	Unit
VI	DC Input Voltage	V_O = 3.3 to 9 V	30	V
		V_O =12to15V	35	
		V_O =18to24V	40	
IO	Output Current		100	mA
Ptot	Power Dissipation		Internally Limited (*)	
Tstg	Storage Temperature Range		-40 to 150	° C
Top	Operating Junction Temperature Range	SP78LXXAC	0 to 125	℃

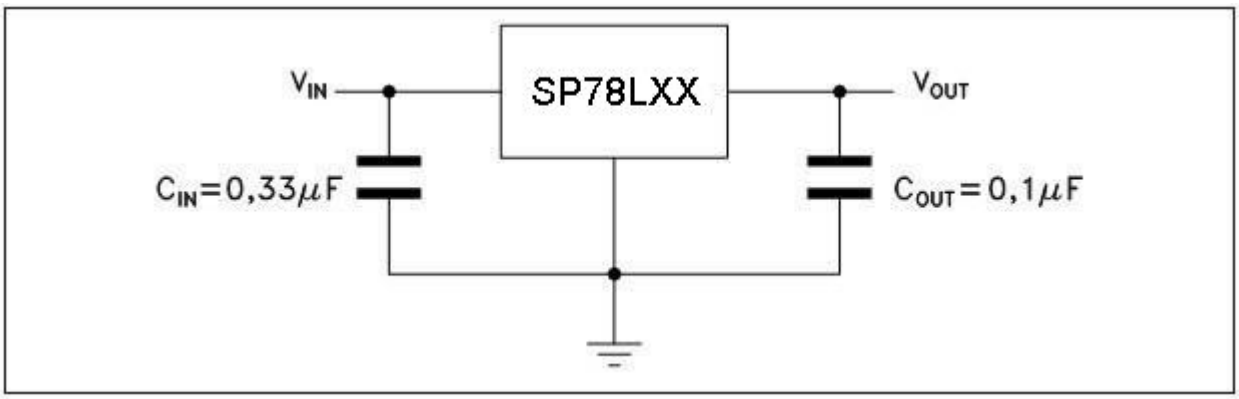
(*)OurSO-8packageusedforVoltageRegulatorsismodifiedinternallytohavepins2,3,6 and 7 electrically communed to the die attach flag.This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appro-priate are a of copper on the printed circuit board is available for heat-sinking.The external dimensions are the same as for the standard SO-8.

THERMALDATA

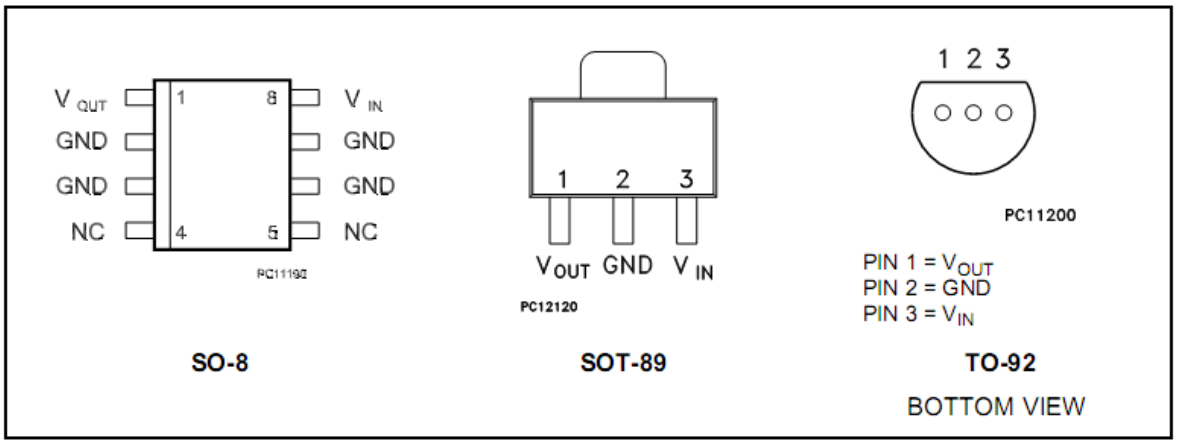
Symbol	Parameter	SO-8	TO-92	SOT-89	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case Max	20		15	℃/W
$R_{thj\text{-}amb}$	Thermal ResistanceJunction-ambient Max	55(*)	200		℃/W

(*)Considering 6 cm2 copper Board hea-sink

TESTCIRCUITS



CONNECTIONDIAGRAM (top view)



SO-8 SOT-89 TO-92

BOTTOM VIEW

ORDERINGCODES

TYPE	SO-8 (TUBE)*	TO-92 (TUBE)**	SOT-89 (T&R)	OUTPUT VOLTAGE
SP78L33AC	SP78L33ACD	SP78L33ACZ	SP78L33ACUTR	3.3 V
SP78L05AC	SP78L05ACD	SP78L05ACZ	SP78L05ACUTR	5 V
SP78L08AC	SP78L08ACD	SP78L08ACZ	SP78L08ACUTR	8 V
SP78L09AC	SP78L09ACD	SP78L09ACZ	SP78L09ACUTR	9 V
SP78L12AC	SP78L12ACD	SP78L12ACZ	SP78L12ACUTR	12 V

(*) Available in Tape & Reel with the suffix "13TR".

(**) Available in Ammopak with the suffix "-AP" or in Tape & Reel with the suffix "TR".

ELECTRICAL CHARACTERISTICS OF SP78L33AC(refer to the test circuits, V_I=8.3V,I_O =40mA,C_I=0.33µF,C_O =0.1µF,T = 0 to 125°C for SP78L33AC, T = -40 to 125°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = 25°C	3.168	3.3	3.432	V
V_O	Output Voltage	I_O = 1 to 40 mA V_I = 5.3 to 20 V	3.135		3.465	V
		I_O = 1 to 70 mA V_I = 8.3 V	3.135		3.465	
ΔV_O	Line Regulation	V_I = 5.3 to 20 V T_J = 25°C			150	mV
		V_I = 6.3 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 =1to 40mA 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 =1to 40mA			0.1	mA
		V_I = 6.3 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 = 6.3 to 16.3 V f = 120Hz I_O =40 mA T_J = 25°C	41	49		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF SP78L05AC

(refer to the test circuits, V_I= 10V, I_O =40mA,C_I=0.33μF,C_O =0.1μF,T_J = 0 to 125°C for SP78L05AC, 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 =1to 40mA 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 =1to 40mA			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 SP78L08AC

(refer to the test circuits, V_I= 14V, I_O =40mA,C_I=0.33μF,C_O =0.1μF,T = 0 to 125°C for SP78L08AC, 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 = 11to23 V T_J = 25°C			125	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			80	mV
		I_O =1to 40mA 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 =1to 40mA			0.1	mA
		V_I = 11to23 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz TJ = 25°C		60		μV
SVR	Supply Voltage Rejection	VI = 12 to 23 V f = 120Hz IO =40 mA TJ = 25°C	37	45		dB
V_d	Dropout Voltage			1.7		V

ELECTRICAL CHARACTERISTICS OF SP78L09AC

(refer to the test circuits, V_I= 15V, I_O =40mA,C_I=0.33μF,C_O =0.1μF,T_J = 0 to 125°C for SP78L09AC, 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 to23 V T_J = 25°C			150	
ΔV_O	Load Regulation	I_O = 1 to 100 mA T_J = 25°C			80	mV
		I_O =1to 40mA 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 =1to 40mA			0.1	mA
		V_I =12 to23 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 SP78L12AC

(refer to the test circuits, V_I= 19V, I_O =40mA,C_I=0.33μF,C_O =0.1μF,T_J = 0 to 125°C for SP78L12AC, 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 VI = 14.5 to 27 V	11.4		12.6	V
		I_O = 1 to 70 mA VI = 19 V	11.4		12.6	
ΔV_O	Line Regulation	V_I = 14.5 to 27 V TJ = 25°C			250	mV
		V_I =16 to27 V TJ = 25°C			200	
ΔV_O	Load Regulation	I_O = 1 to 100 mA TJ = 25°C			100	mV
		IO =1to 40mA TJ = 25°C			50	
I_d	Quiescent Current	TJ = 25°C			6.5	mA
		TJ = 125°C			6	mA
ΔI_d	Quiescent Current Change	IO =1to 40mA			0.1	mA
		VI =16 to27 V			1.5	
eN	Output Noise Voltage	B =10Hz to 100KHz TJ = 25°C		80		μV
SVR	Supply Voltage Rejection	VI = 15 to 25 V f = 120Hz IO =40 mA TJ = 25°C	37	42		dB
V_d	Dropout Voltage			1.7		V

Figure1: SP78L05/08 Output Voltage vs Ambient Temperature

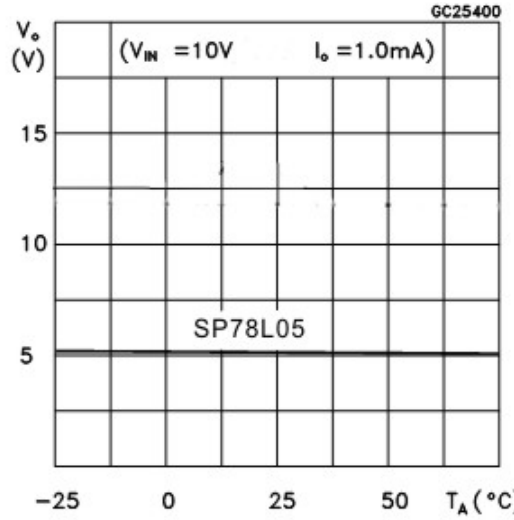


Figure2: SP78L05/12/24 Load Characteristics

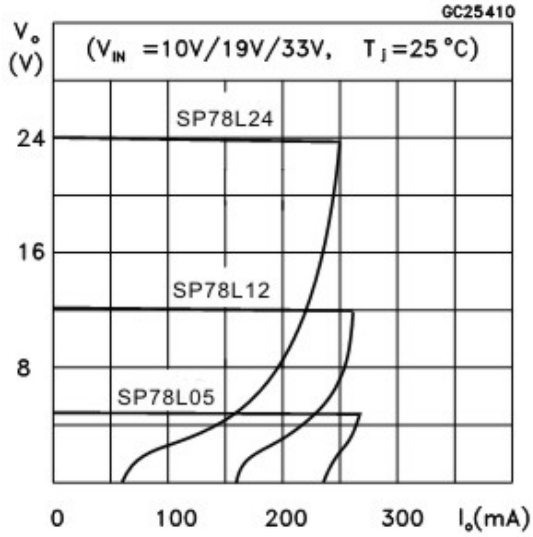


Figure3: SP78L05/12/24 Thermal Shutdown

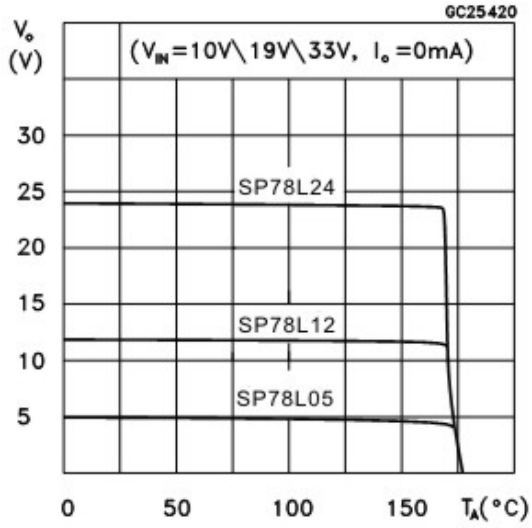


Figure4: SP78L05/08 Quiescent Current vs Output Current

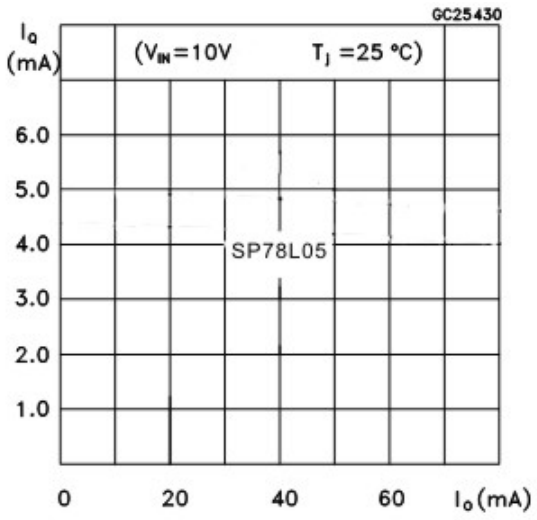


Figure5: SP78L05 Quiescent Current vs Input Voltage

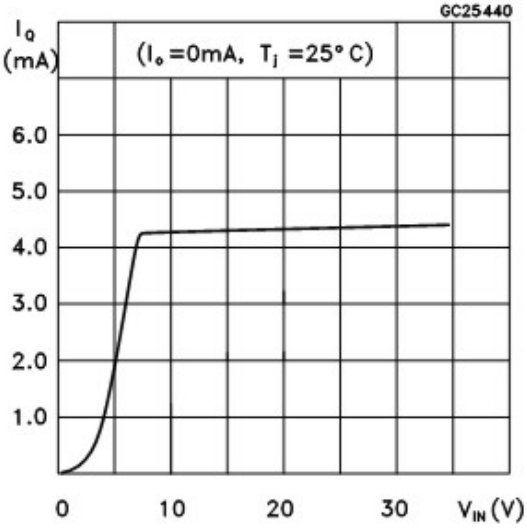


Figure6: SP78L05/12/24 Output Characteristics

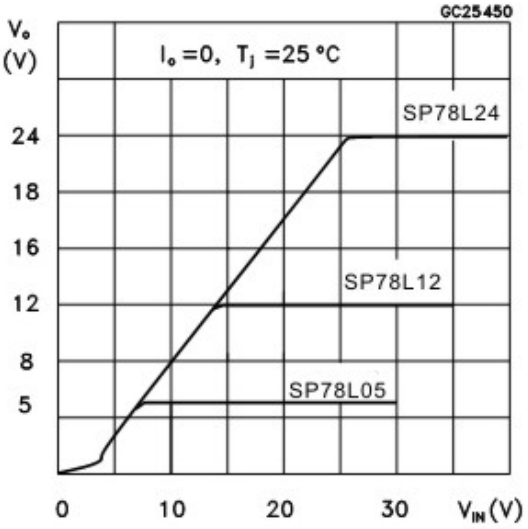


Figure7: SP78L05/12/24 Ripple Rejection

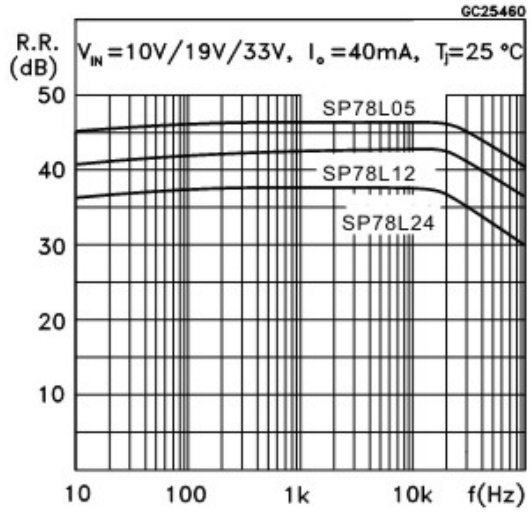


Figure8: SP78L05 Dropout Characteristics

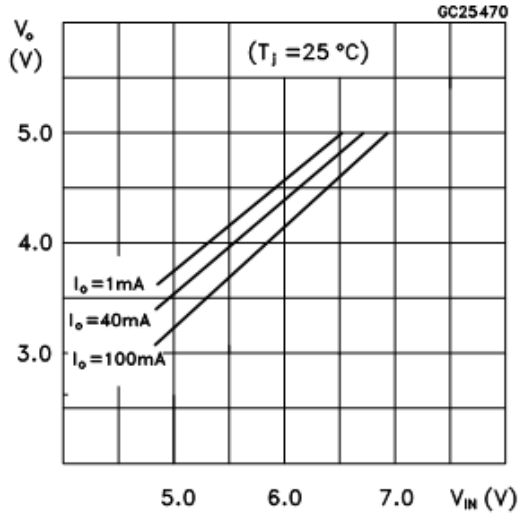
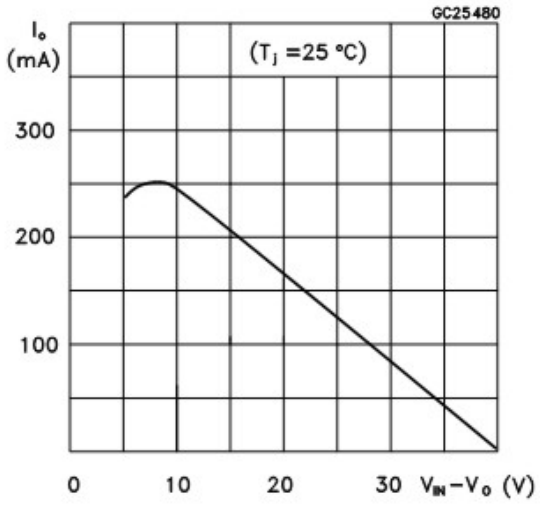


Figure9: SP78LXX Series Short Circuit Output Current



TYPICALAPPLICATIONS

Table10: High Output Current Short Circuit Protected

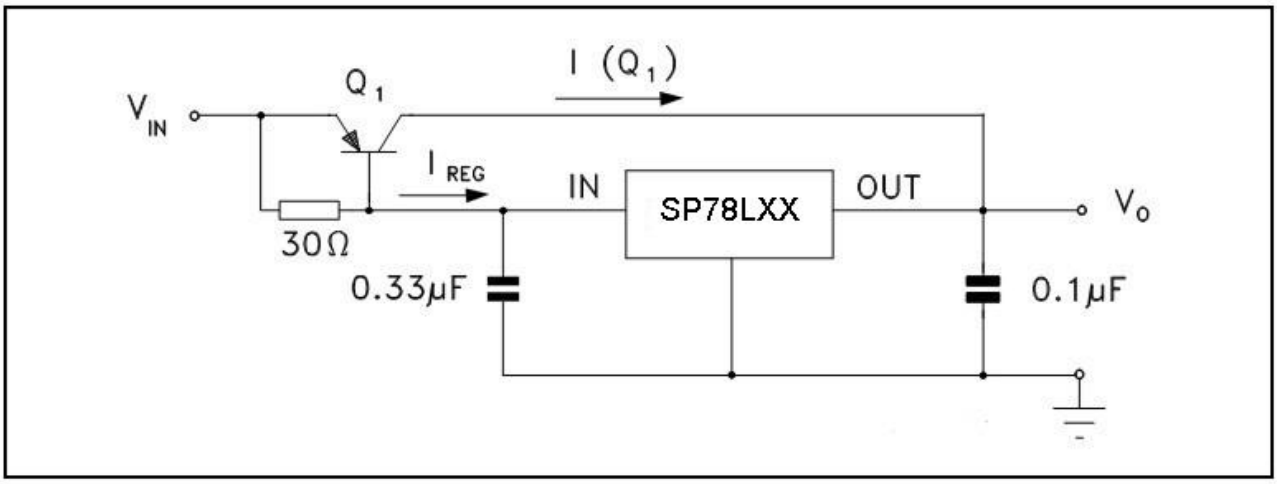


Figure11: Edit Boost Circuit

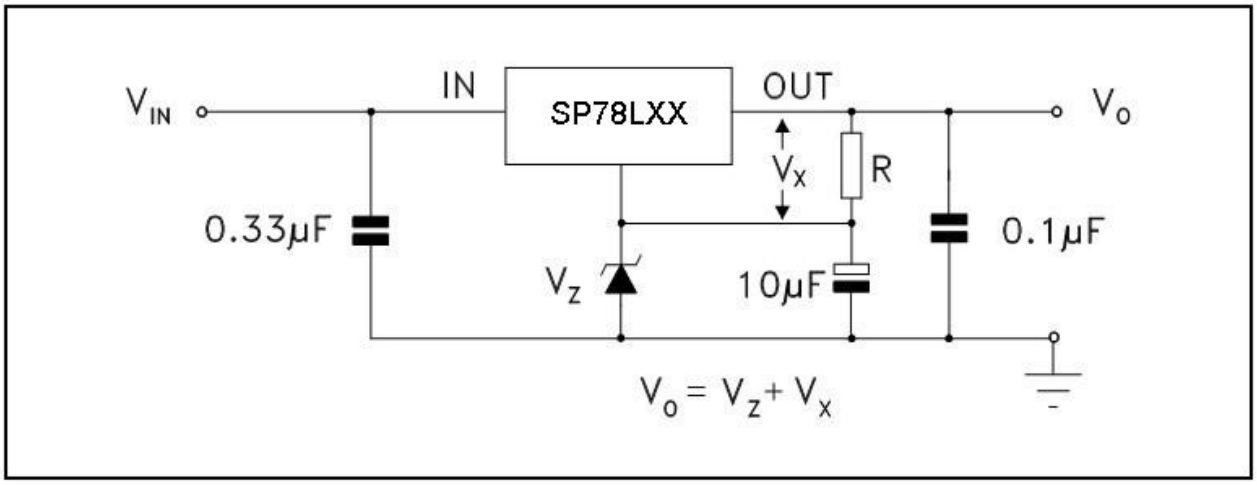


Figure12: Current Regulator

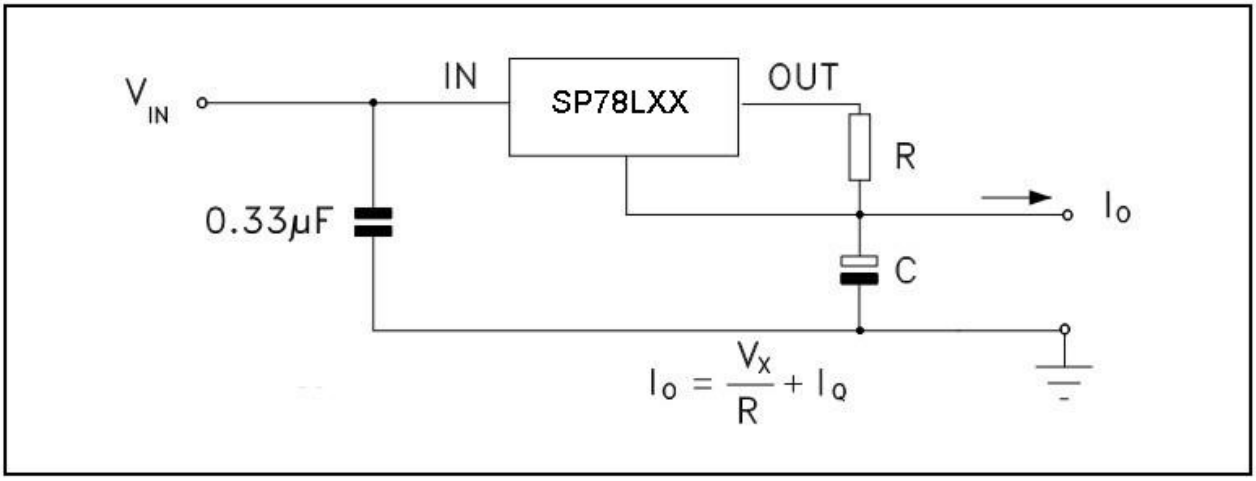
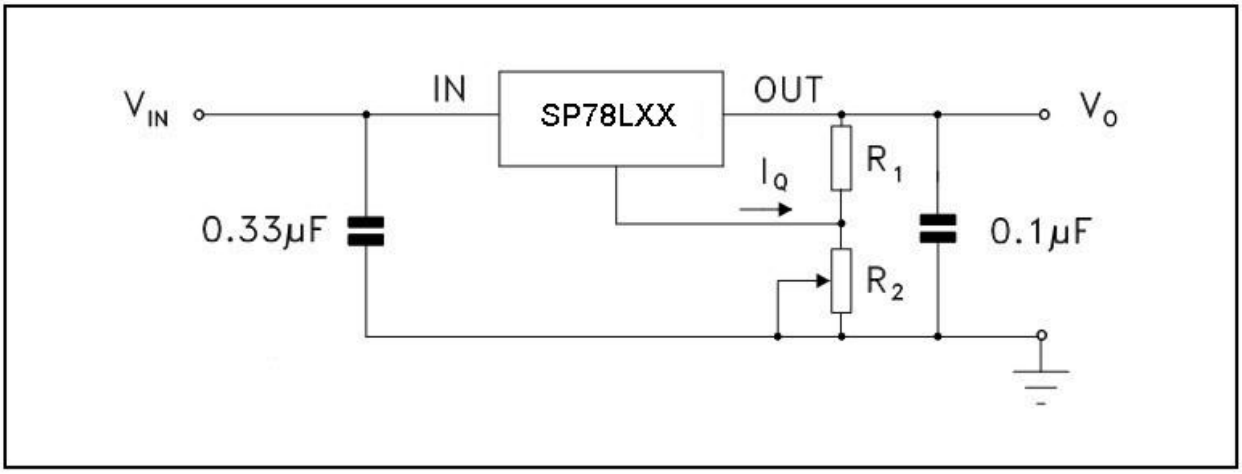
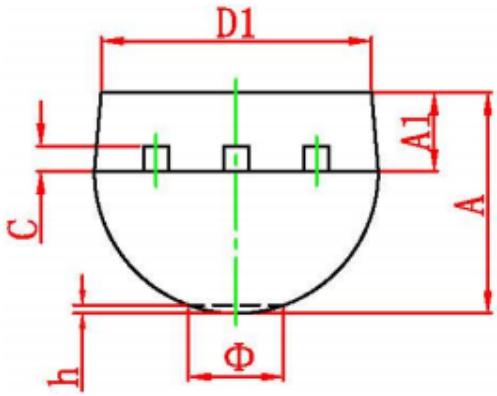


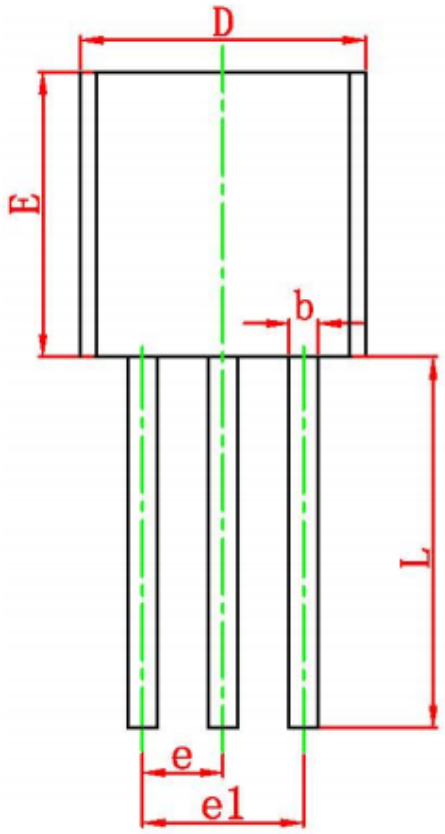
Figure13: Adjust able Output Regulator



PACKAGE DESCRIPTION

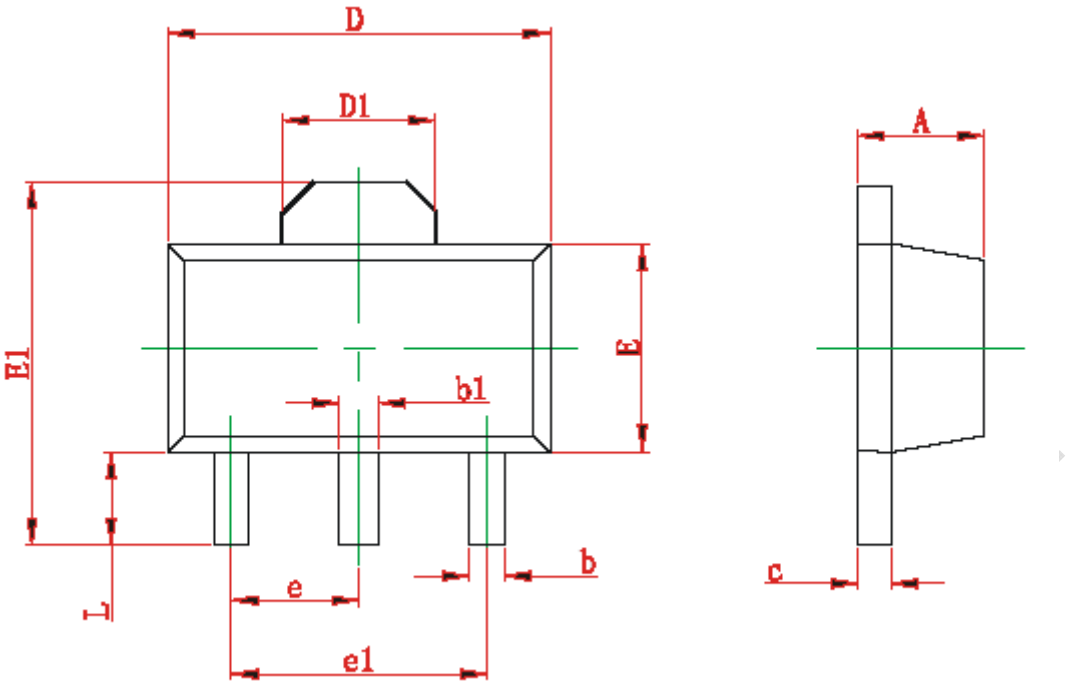
TO-92 PACKAGE OUTLINE DIMENSIONS





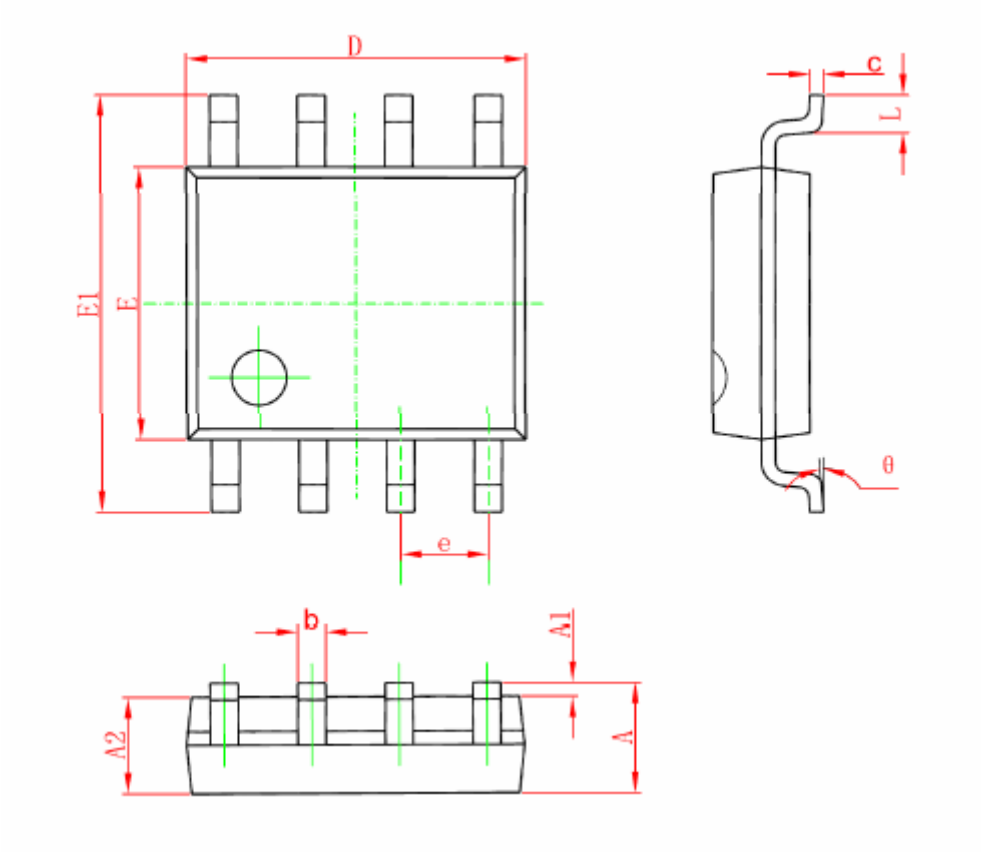
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.148
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270TYP		0.050TYP	
e l	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.5721
		1.600		0.063
h	0.000	0.380	0.000	0.015

SOT-89-3L package outline dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550REF		0.061REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	3.000TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

SOP8 package outline dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°