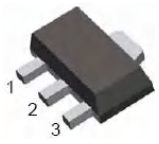
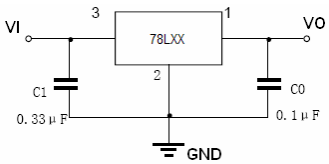
Features

- Wide range of available,fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No extermal components required.
- Complementary negative regulators offered

78LXX



SOT-89



Absolute Maximum Ratings(Tc=25℃)

Symbol	Parameter	Value	Units
V_I	Input voltage(3.3V-9V) (10V-15V) (18V-24V)	30 35 40	V
I_{CM}	Maximum output current	150	mA
P_D	Power dissipation	500	mW
T_{OPR}	Operating junction temperature	0 to +125	℃
T_j, T_{stg}	Storage temperature range	-40 to +150	℃

Electrical Characteristics

(V_{IN}=10V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1μF,unless otherwise specified)

Parameter	Symbol	Test conditions	78L05			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ 7V≤V_i≤20V,I_O=1mA-40mA V_1=10V,I_O=1mA-70mA	4.8 4.75 4.75	5.0	5.2 5.25 5.25	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		11 5	60 30	mV
Line regulation	Reg_{line}	7V≤V_i≤20V, T_j=25℃ 8V≤V_i≤20V, T_j=25℃		55 45	150 100	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃		3.8	6.0 5.5	mA
Input Bias Current Change	$\triangle I_{IB}$	8V≤V_i≤20V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	10Hz ≤f≤100KHz		40		μV
Ripple rejection	RR	I_O=40mA,8V≤V_i≤18V,f=120Hz ,T_j=25℃	41	49		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

Electrical Characteristics

(V_{IN}=10V,I_O=40mA,0℃<T_j<125℃,C_i=0.33μF,C_O=0.1μF,unless otherwise specified)

Parameter	Symbol	Test conditions	78L33			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ 5.3V≤V_i≤20V,I_O=1mA-40mA V_1=8.3V,I_O=1mA-70mA	3.168 3.135 3.135	3.3	3.432 3.465 3.465	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA			60 30	mV
Line regulation	Reg_{line}	5.3V≤V_i≤20V, T_j=25℃ 6.3V≤V_i≤20V, T_j=25℃			150 100	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃			6.0 5.5	mA
Input Bias Current Change	△I_{IB}	6.3V≤V_i≤20V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	10Hz ≤f≤100KHz		40		μV
Ripple rejection	RR	I_O=40mA,6.3V≤V_i≤16.3V f=120Hz,T_j=25℃	41	49		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

(V_{IN}=12V,I_O=40mA,0℃<T_j<125℃,C_i=0.33μF,C_O=0.1μF,unless otherwise specified)

Parameter	Symbol	Test conditions	78L06			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_1=8.5V-20V,I_O=1mA-40mA V_1=8.5V,I_O=1mA-70mA	5.75 5.7 5.7	6.0	6.25 6.3 6.3	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-70mA		12.8 5.8	80 40	mV
Line regulation	Reg_{line}	8.5V≤V_i≤20V, T_j=25℃ 9V≤V_i≤20V, T_j=25℃		64 54	175 125	mV
Input Bias Current	I_{IB}	T_j=25℃, V_{IN}=12V,I_O=40mA T_j=125℃, V_{IN}=12V,I_O=40mA		 3.9	5.5 6.0	mA
Input Bias Current Change	△I_{IB}	9V≤V_i≤20V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	10Hz ≤f≤100KHz		40		μV/V_O
Ripple rejection	RR	I_O=40mA,10V≤V_i≤20V,f=120Hz, T_j=25℃	40	46		dB
Dropout voltage	V_D	T_j=25℃		1.7		V

Electrical Characteristics

ELECTRICAL CHARACTERISTICS

(V_I=14V,I_O=40mA,0℃<T_j<125℃,C_i=0.33μF,C_O=0.1Mf,unless otherwise specified)

Parameter	Symbol	Test conditions	78L08			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ 10.5V≤V_i≤23V,I_O=1mA-40mA V_1=14V,I_O=1mA-70mA	7.7 7.6 7.6	8.0	8.3 8.4 8.4	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		15 8.0	80 40	mV
Line regulation	Reg_{line}	10.5V≤V_i≤23V, T_j=25℃ 11V≤V_i≤23V, T_j=25℃		20 12	175 125	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃		3	6.0 5.5	mA
Input Bias Current Change	△I_{IB}	11V≤V_i≤23V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	T_A=25℃,10Hz≤f≤100KHz		60		μV
Ripple rejection	RR	I_O=40mA,12V≤V_i≤23V,f=120Hz,T_j=25℃	37	57		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

(V_I=15V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1uF,unless otherwise specified)

Parameter	Symbol	Test conditions	78L09			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_I=11.5V-24V,I_O=1mA-40mA V_I=15V,I_O=1mA-70mA	8.6 8.5 8.5	9.0	9.4 9.5 9.5	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		15 8.0	90 40	mV
Line regulation	Reg_{line}	11.5V≤V_i≤24V, T_j=25℃ 12V≤V_i≤24V, T_j=25℃		20 12	175 125	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃		3.0	6.0 5.5	mA
Input Bias Current Change	△I_{IB}	11V≤V_i≤23V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	T_A=25℃,10Hz≤f≤100KHz		60		μV
Ripple rejection	RR	I_O=40mA,13V≤V_i≤24V,f=120Hz,T_j=25℃	37	57		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

Electrical Characteristics

(V_I=19V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1μf,unless otherwise specified)

Parameter	Symbol	Test conditions	78L12			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_I=14.5V-27V, I_O=1mA-40mA V_I=19V, I_O=1mA-70mA	11.5 11.4 11.4	12	12.5 12.6 12.6	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		20 10	100 50	mV
Line regulation	Reg_{line}	14.5V≤V_i≤27V, T_j=25℃ 16V≤V_i≤27V, T_j=25℃		120 100	250 200	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃		4.2	6.5 6.0	mA
Input Bias Current Change	$\triangle I_{IB}$	16V≤V_i≤27V 1mA≤I_O≤40mA			1.5 0.1	mA
Output Noise Voltage	V_N	10Hz≤f≤100KHz,T_A=25℃		80		μV
Ripple rejection	RR	I_O=40mA,15V≤V_i≤25V,f=120Hz, T_j=25℃	37	42		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

(V_{IS}=23V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1μf,unless otherwise specified)

Parameter	Symbol	Test conditions	78L15			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_i=17.5V-30V,I_O=1mA-40mA V_i=23V,I_O=1mA-70mA	14.4 14.25 14.25	15	15.6 15.75 15.75	V
Load regulation	$\triangle Reg_{load}$	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		25 12	150 75	mV
Line regulation	$\triangle Reg_{line}$	17.5V≤V_i≤30V, T_j=25℃ 20V≤V_i≤30V, T_j=25℃		130 110	300 250	mV
Intput Bias Current	I_{IB}	T_j=25℃ T_j=125℃		4.4	6.5 6.0	mA
Intput Bias Current Change	$\triangle I_{IB}$	20V≤V_i≤30V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	10Hz≤f≤100KHz,T_A=25℃		90		μV
Ripple rejection	RR	I_O=40mA,18.5V≤V_i≤28.5V, f=120Hz, T_J=25℃	34	39		dB
Dropout voltage	V_I-V_O	T_J=25℃		1.7		V

Electrical Characteristics

(V_I=27V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1μf,unless otherwise specified)

Parameter	Symbol	Test conditions	78L18			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_I=20.7V-33V, I_O=1mA-40mA V_I=27V, I_O=1mA-70mA	17.3 17.1 17.1	18	18.7 18.9 18.9	V
Load regulation	Reg_{load}	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		30 15	170 85	mV
Line regulation	Reg_{line}	20.7V≤V_i≤33V, T_j=25℃ 21V≤V_i≤33V, T_j=25℃		45 35	325 275	mV
Input Bias Current	I_{IB}	T_j=25℃ T_j=125℃		3.1	6.5 6.0	mA
Input Bias Current Change	$\triangle I_{IB}$	21V≤V_i≤33V 1mA≤I_O≤40mA			1.5 0.1	mA
Output Noise Voltage	V_N	10Hz≤f≤100KHz,T_A=25℃		150		μV
Ripple rejection	RR	I_O=40mA,23V≤V_i≤33V,f=120Hz, T_j=25℃	33	48		dB
Dropout voltage	V_I-V_O	T_j=25℃		1.7		V

(V_{IS}=33V,I_O=40mA,0℃<T_j<125℃,C_I=0.33μF,C_O=0.1μf,unless otherwise specified)

Parameter	Symbol	Test conditions	78L24			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	T_j=25℃ V_i=27V-38V,I_O=1mA-40mA V_i=27V-33V,I_O=1mA-70mA	23 22.8 22.8	24	25 25.2 25.2	V
Load regulation	$\triangle Reg_{load}$	T_j=25℃, I_O=1mA-100mA T_j=25℃, I_O=1mA-40mA		40 20	200 100	mV
Line regulation	$\triangle Reg_{line}$	27.5V≤V_i≤38V, T_j=25℃ 28V≤V_i≤38V, T_j=25℃		35 30	350 300	mV
Intput Bias Current	I_{IB}	T_j=25℃ T_j=125℃		3.1	6.5 6.0	mA
Intput Bias Current Change	$\triangle I_{IB}$	28V≤V_i≤38V 1mA≤I_O≤40mA			1.5 0.1	mA
Output noise voltage	V_N	10Hz≤f≤100KHz,T_A=25℃		200		μV
Ripple rejection	RR	I_O=40mA,29V≤V_i≤35V, f=120Hz, T_J=25℃	31	45		dB
Dropout voltage	V_I-V_O	T_J=25℃		1.7		V

RATING AND CHARACTERISTIC CURVES

Figure 1. Dropout Characteristics

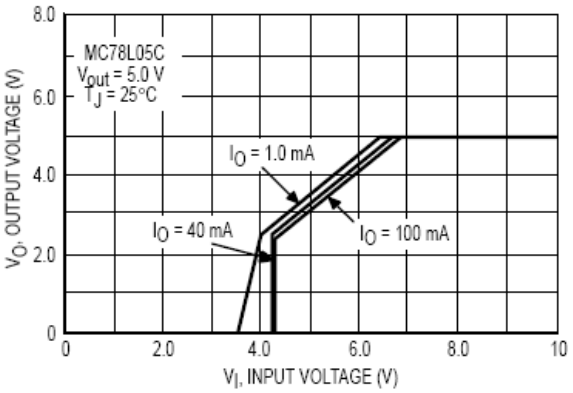


Figure 2. Dropout Voltage versus Junction Temperature

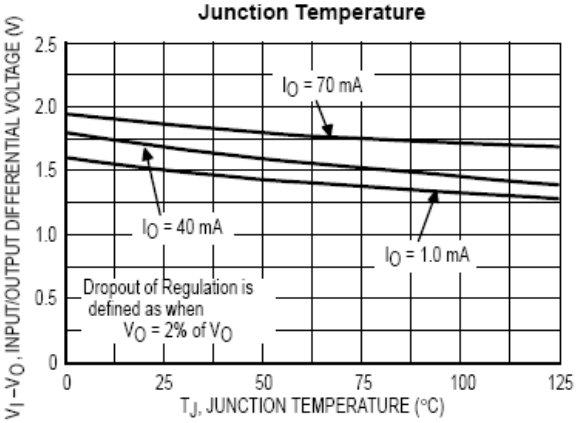


Figure 3. Input Bias Current versus Ambient Temperature

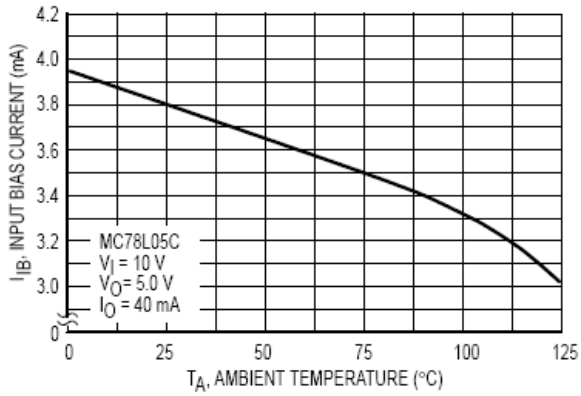


Figure 4. Input Bias Current versus Input Voltage

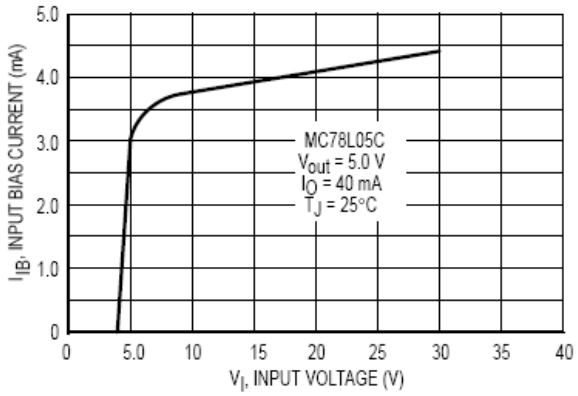


Figure 5. Maximum Average Power Dissipation versus Ambient Temperature – TO–92 Type Package

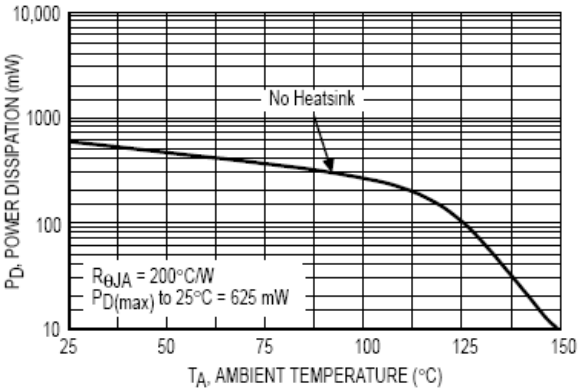
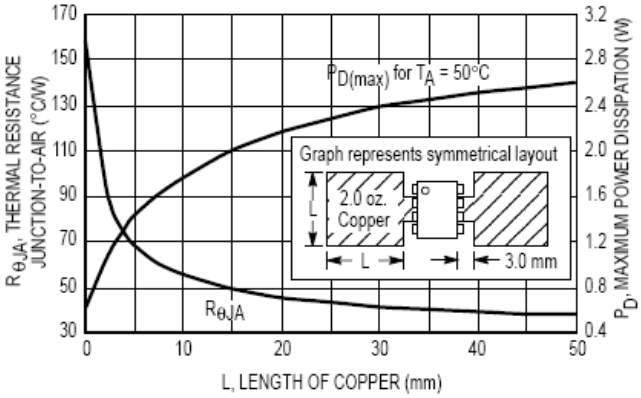


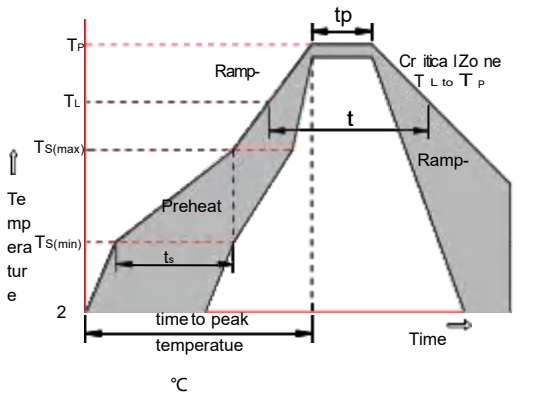
Figure 6. SOP–8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length



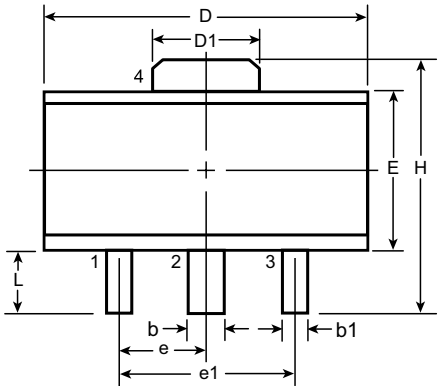
Soldering parameters

Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150℃
	-Temperature Max($T_{s(max)}$)	+200℃
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3℃/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3℃/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217℃
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_p)		+260(+0/-5)℃
Time within 5℃ of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6℃/sec. Max
Time 25℃ to Peak Temp (T_P)		8 min. Max
Do not exceed		+260℃

FIG5: Reflow condition

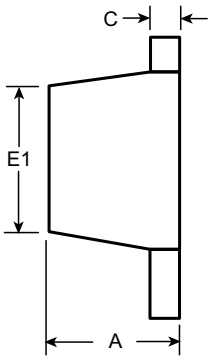


Package Dimensions & Suggested Pad Layout

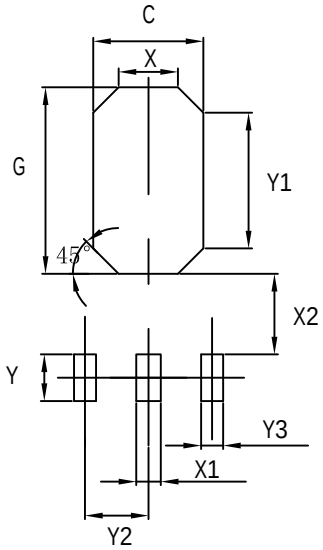


Top View

SOT89



Side View

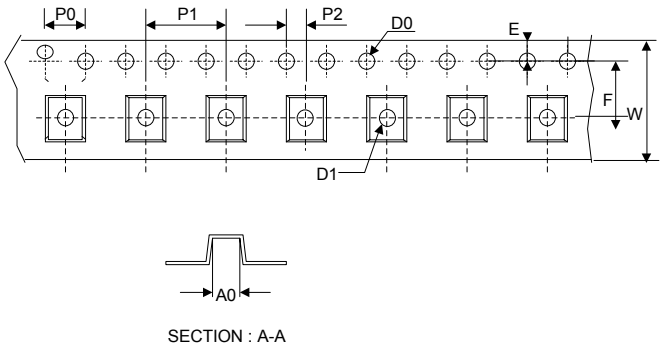


Symbol		A	b	b1	C	D	D1	E	E1	e	e1	H	L
Dimensions (mm)	MIN	1.40	0.44	0.36	0.3	4.40	1.50	2.29	2.00†	1.50 BSC	3.00 BSC	3.94	0.89
	NOM	-	-	-	-	-	-	-	-			-	-
	MAX	1.60	0.56	0.48	0.5	4.60	1.75	2.60	2.29			4.25	1.20

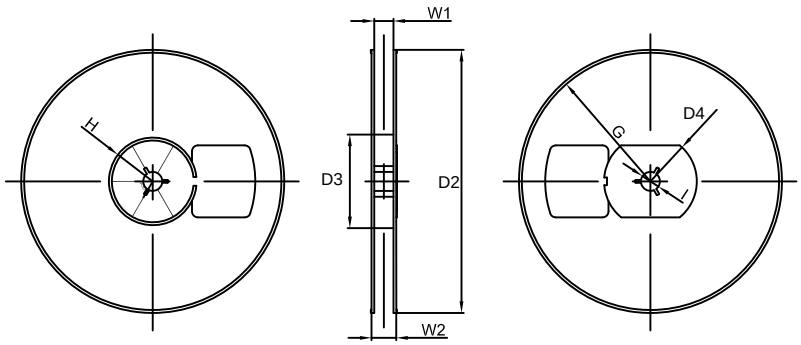
Dimensions	Value (in mm)
C	2.50
G	3.60
X	1.40
X1	0.90
X2	0.90
Y	1.40
Y1	2.60
Y2	1.50
Y3	0.90

Soldering parameters

Tape



13” Reel



Symbol	Dimension (mm)
P0	4.00±0.20
P1	8.00±0.20
P2	2.00±0.20
D0	1.60±0.20
D1	1.60±0.20
E	1.75±0.20
F	7.50±0.15
W	16.00±0.20
A0	6.30±0.20
B0	8.25±0.20
K0	2.60±0.20
T	0.23±0.10
D2	180.0±5.0
D3	60Min.
D4	R32.0±2.0
G	R86.5±2.0
H	R30.0±2.0
I	13.0±2.0
W1	13.20±2.0
W2	16.50±2.0
Quantity: 1000PCS	

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