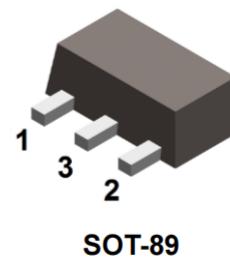


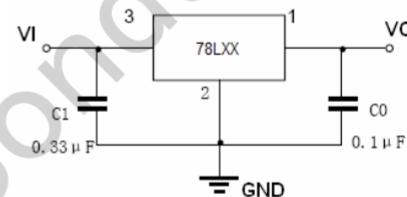
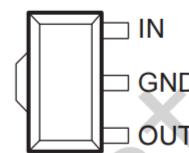
FEATURES

- Wide range of available, fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No external components required.



APPLICATIONS

- Three-terminal positive voltage regulator.



MAXIMUM RATING operating temperature range applies unless otherwise specified

Symbol	Parameter	Value	Units
V _I	Input voltage(3.3V-9V) (10V-15V) (18V-24V)	30 35 40	V
I _{CM}	Maximum output current	100	mA
P _D	Power dissipation	500	mW
T _{OPR}	Operating junction temperature	0 to +125	°C
T _j , T _{stg}	Storage temperature range	-40 to +150	°C

ELECTRICAL CHARACTERISTICS

($V_{IN}=10V, I_O=40mA, 0^\circ C < T_j < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

($V_{IN}=10V, I_O=40mA, 0^\circ C < T_j < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

 ($V_{IN}=12V, I_O=40mA, 0^\circ C < T_j < 125^\circ C, C_i=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

 ($V_i=14V, I_O=40mA, 0^\circ C < T_j < 125^\circ C, C_i=0.33\mu F, C_o=0.1Mf$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

 ($V_i=15V, I_o=40mA, 0^\circ C < T_j < 125^\circ C, C_i=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

 ($V_{IN}=16V$, $I_O=40mA$, $C_{IN}=0.33\mu F$, $C_O=0.1\mu F$, $T_j=0$ to $125^\circ C$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L10			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$	9.6	10	10.4	V
Load regulation(Note1)	$\triangle R_{Reg,load}$	$I_O = 1$ to $100mA$, $T_j = 25^\circ C$	-	17	90	mV
		$I_O = 1$ to $40mA$, $T_j = 25^\circ C$	-	9	45	mV
Line regulation(Note1)	$\triangle R_{Reg,line}$	$V_I = 12.5$ to $25V$, $T_j = 25^\circ C$	-	100	210	mV
		$V_I = 13$ to $25V$, $T_j = 25^\circ C$	-	90	160	mV
Input Bias Current	I_{IB}	$T_j = 25^\circ C$	-	2.0	3.0	mA
Input Bias Current Change	$\triangle I_{IB}$	$V_I = 13$ to $25V$, $T_j = 25^\circ C$	-	-	1.0	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz$	-	70	-	μV
Ripple Rejection	RR	$V_I = 13$ to $23V$, $I_O = 40mA$, $f = 120Hz$	42	52	-	dB
Dropout Voltage	V_D	$T_J=25^\circ C$	-	1.7	-	V
Dropout voltage	$V_I - V_O$	$I_O = 5mA$, $T_j = 0$ to $125^\circ C$	-	0.9	-	$mV/^\circ C$

ELECTRICAL CHARACTERISTICS(V_i=19V,I_O=40mA,0°C< T_j<125°C,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°C	11.5	12	12.5	V
		V _i =14.5V-27V, I _O =1mA-40mA	11.4		12.6	
		V _i =19V, I _O =1mA-70mA	11.4		12.6	
Load regulation	Reg _{load}	T _j =25°C, I _O =1mA-100mA T _j =25°C, I _O =1mA-40mA		20 10	100 50	mV
Line regulation	Reg _{line}	14.5V≤V _i ≤27V, T _j =25°C		120	250	mV
		16V≤V _i ≤27V, T _j =25°C		100	200	
Input Bias Current	I _{IB}	T _j =25°C T _j =125°C		4.2	6.5 6.0	mA
Input Bias Current Change	△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°C		80		μV
Ripple rejection	RR	I _O =40mA,15V≤V _i ≤25V,f=120Hz, T _j =25°C	37	42		dB
Dropout voltage	V _I -V _O	T _j =25°C		1.7		V

ELECTRICAL CHARACTERISTICS(V_{IS}=23V,I_O=40mA,0°C< T_j<125°C,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°C	14.4	15	15.6	V
		V _i =17.5V-30V,I _O =1mA-40mA	14.25		15.75	
		V _i =23V,I _O =1mA-70mA	14.25		15.75	
Load regulation	△Reg _{load}	T _j =25°C, I _O =1mA-100mA T _j =25°C, I _O =1mA-40mA		25 12	150 75	mV
Line regulation	△Reg _{line}	17.5V≤V _i ≤30V, T _j =25°C		130	300	mV
		20V≤V _i ≤30V, T _j =25°C		110	250	
Input Bias Current	I _{IB}	T _j =25°C T _j =125°C		4.4	6.5 6.0	mA
Input Bias Current Change	△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°C		90		μV
Ripple rejection	RR	I _O =40mA,18.5V≤V _i ≤28.5V, f=120Hz, T _j =25°C	34	39		dB
Dropout voltage	V _I -V _O	T _j =25°C		1.7		V

ELECTRICAL CHARACTERISTICS

 ($V_i=27V, I_o=40mA, 0^\circ C < T_j < 125^\circ C, C_i=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)

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

ELECTRICAL CHARACTERISTICS

 ($V_{IS}=33V, I_o=40mA, 0^\circ C < T_j < 125^\circ C, C_i=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L24			UNIT
			MIN	TYP	MAX	
Output voltage	V_o	$T_j=25^\circ C$	23	24	25	V
		$V_i=27V-38V, I_o=1mA-40mA$	22.8		25.2	
		$V_i=27V-33V, I_o=1mA-70mA$	22.8		25.2	
Load regulation	$\Delta \text{Reg}_{\text{load}}$	$T_j=25^\circ C, I_o=1mA-100mA$		40	200	mV
		$T_j=25^\circ C, I_o=1mA-40mA$		20	100	
Line regulation	$\Delta \text{Reg}_{\text{line}}$	$28V \leq V_i \leq 80V, T_j=25^\circ C$		50	300	mV
		$27V \leq V_i \leq 38V, T_j=25^\circ C$		60	350	
Input Bias Current	I_{IB}	$T_j=25^\circ C$		3.1	6.5	mA
		$T_j=125^\circ C$			6.0	
Input Bias Current Change	ΔI_{IB}	$28V \leq V_i \leq 38V$			1.5	mA
		$1mA \leq I_o \leq 40mA$			0.1	
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		200		μV
Ripple rejection	RR	$I_o=40mA, 29V \leq V_i \leq 35V, f=120Hz, T_j=25^\circ C$	31	45		dB
Dropout voltage	V_i-V_o	$T_j=25^\circ C$		1.7		V

TYPICAL CHARACTERISTICS @ $T_a = 25^\circ\text{C}$ unless otherwise specified

Figure 1. Dropout Characteristics

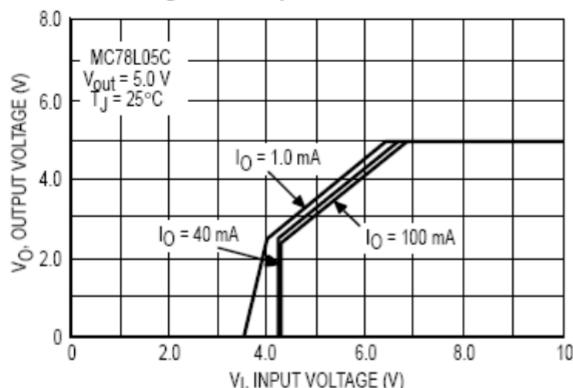


Figure 2. Dropout Voltage versus Junction Temperature

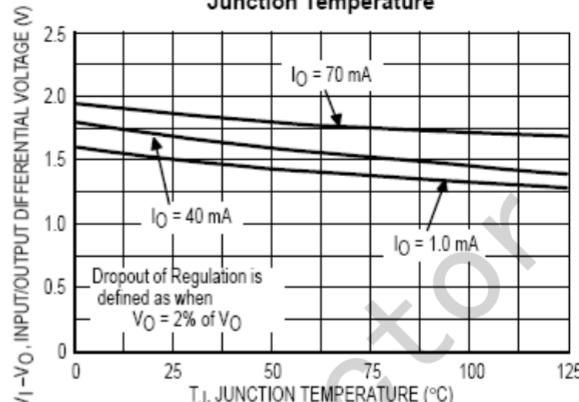


Figure 3. Input Bias Current versus Ambient Temperature

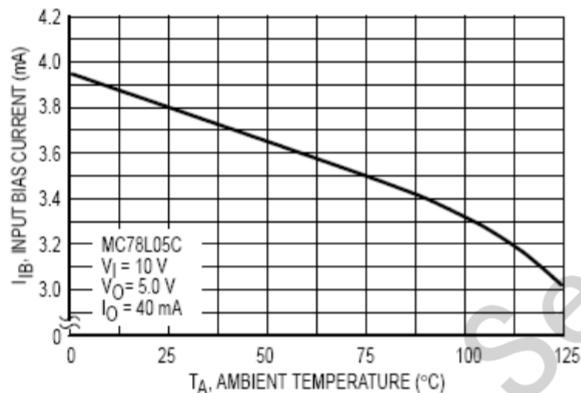


Figure 4. Input Bias Current versus Input Voltage

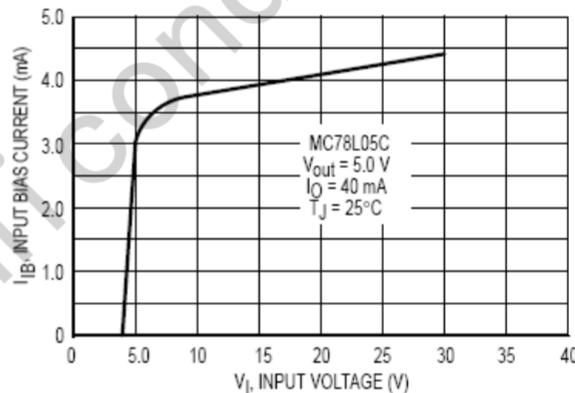


Figure 5. Maximum Average Power Dissipation versus Ambient Temperature – TO-92 Type Package

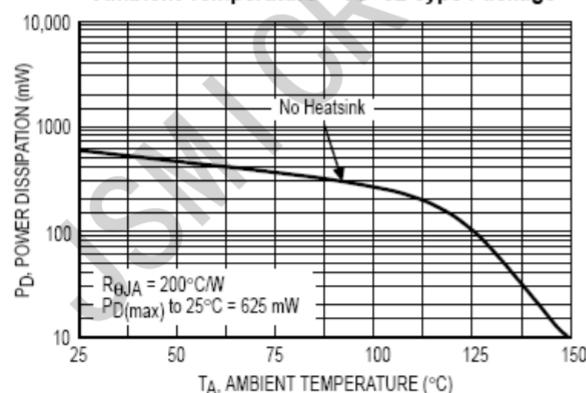
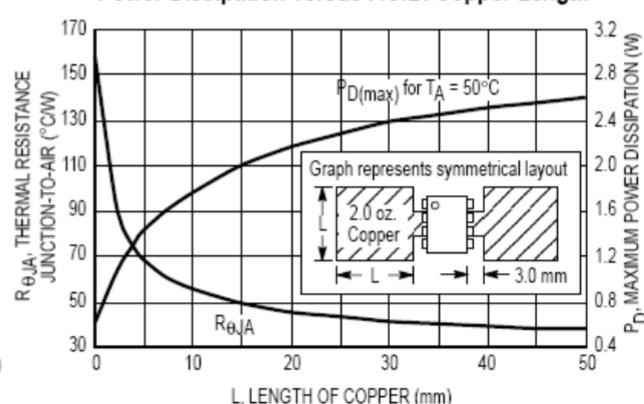
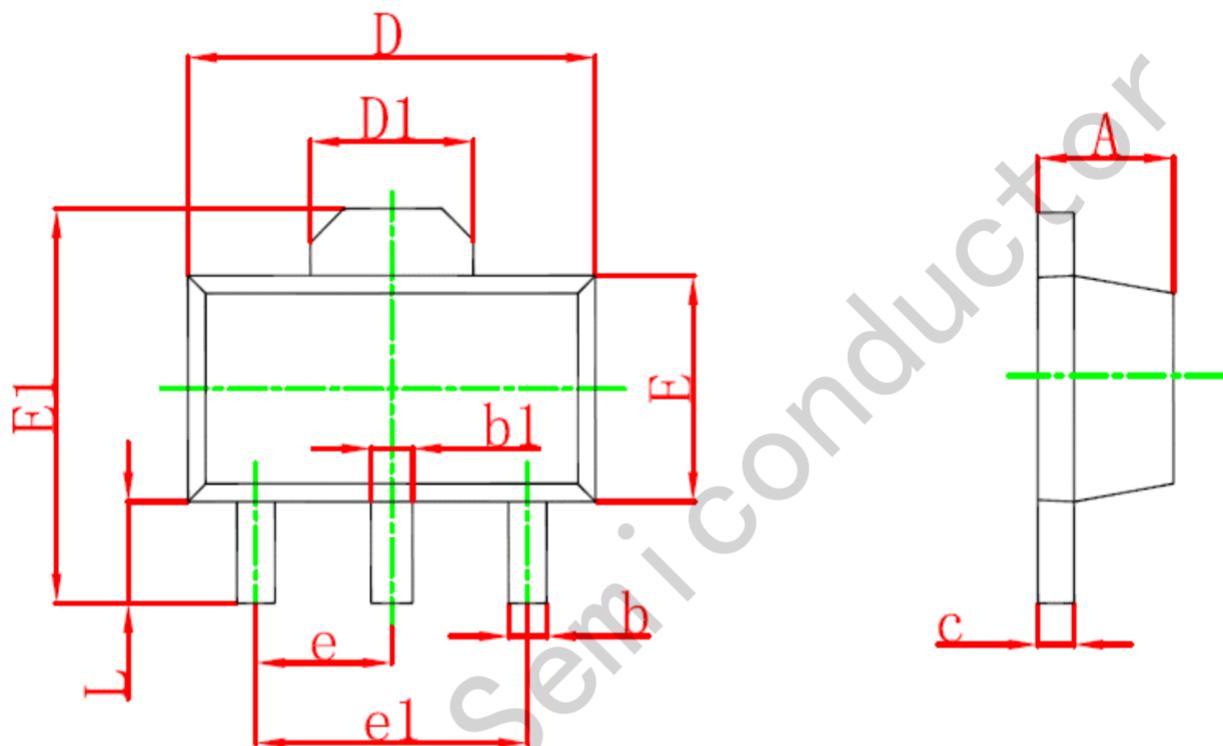


Figure 6. SOP-8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length



Package Information

SOT-89



Symbol	Dimensions in Millimeters(mm)		Dimensions in Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
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	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047