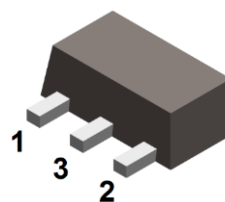


## FEATURES

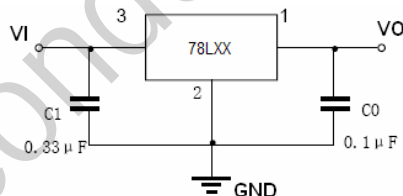
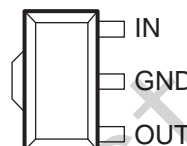
- Wide range of available, fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No external components required.



SOT-89

## 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	$V_O$	$T_J=25^{\circ}C$ $5.3V \leq V_i \leq 20V, I_O=1mA-40mA$ $V_i=8.3V, I_O=1mA-70mA$	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	$\Delta I_{IB}$	$6.3V \leq V_i \leq 20V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	$V_N$	$10Hz \leq f \leq 100KHz$		40		$\mu V$
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	$V_i-V_O$	$T_J=25^{\circ}C$		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	$V_O$	$T_J=25^{\circ}C$ $7V \leq V_i \leq 20V, I_O=1mA-40mA$ $V_i=10V, I_O=1mA-70mA$	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	$\Delta I_{IB}$	$8V \leq V_i \leq 20V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	$V_N$	$10Hz \leq f \leq 100KHz$		40		$\mu V$
Ripple rejection	RR	$I_O=40mA, 8V \leq V_i \leq 18V, f=120Hz$ $T_J=25^{\circ}C$	41	49		dB
Dropout voltage	$V_i-V_O$	$T_J=25^{\circ}C$		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	$V_O$	$T_J=25^{\circ}C$ $V_I=8.5V-20V, I_O=1mA-40mA$ $V_I=8.5V, I_O=1mA-70mA$	5.75 5.7 5.7	6.0	6.25 6.3 6.3	V
Load regulation	$Reg_{load}$	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-70mA$		12.8 5.8	80 40	mV
Line regulation	$Reg_{line}$	$8.5V \leq V_I \leq 20V, T_J=25^{\circ}C$ $9V \leq V_I \leq 20V, T_J=25^{\circ}C$		64 54	175 125	mV
Input Bias Current	$I_{IB}$	$T_J=25^{\circ}C, V_{IN}=12V, I_O=40mA$ $T_J=125^{\circ}C, V_{IN}=12V, I_O=40mA$		3.9	5.5 6.0	mA
Input Bias Current Change	$\Delta I_{IB}$	$9V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	$V_N$	$10Hz \leq f \leq 100KHz$		40		$\mu V/V_O$
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**

 ( $V_I=14V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu F$ , unless otherwise specified)

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

 ( $V_{IN}=16V, I_O=40350mA, C_{IN}=0.33\mu F, C_O=0.1\mu f, T_j = 0$  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)	$\Delta Reg_{load}$	$I_O = 1$ 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)	$\Delta Reg_{line}$	$V_I = 12.5$ 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	$\Delta I_{IB}$	$V_I = 13$ to $25V$ , $T_j = 25^\circ C$	-	-	1.0	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$	-	70	-	$\mu V$
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**

 ( $V_I=19V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$ , unless otherwise specified)

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

**ELECTRICAL CHARACTERISTICS**

 ( $V_{IS}=23V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$ , unless otherwise specified)

Parameter	Symbol	Test conditions	78L15			UNIT
			MIN	TYP	MAX	
Output voltage	$V_O$	$T_J=25^\circ C$ $V_I=17.5V-30V, I_O=1mA-40mA$ $V_I=23V, I_O=1mA-70mA$	14.4 14.25 14.25	15	15.6 15.75 15.75	V
Load regulation	$\Delta Reg_{load}$	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$		25 12	150 75	mV
Line regulation	$\Delta Reg_{line}$	$17.5V \leq V_I \leq 30V, T_J=25^\circ C$ $20V \leq V_I \leq 30V, T_J=25^\circ C$		130 110	300 250	mV
Input Bias Current	$I_{IB}$	$T_J=25^\circ C$ $T_J=125^\circ C$		4.4	6.5 6.0	mA
Input Bias Current Change	$\Delta I_{IB}$	$20V \leq V_I \leq 30V$ $1mA \leq I_O \leq 40mA$			1.5 0.1	mA
Output noise voltage	$V_N$	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		90		$\mu V$
Ripple rejection	RR	$I_O=40mA, 18.5V \leq V_I \leq 28.5V,$ $f=120Hz, T_J=25^\circ C$	34	39		dB
Dropout voltage	$V_I-V_O$	$T_J=25^\circ C$		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	$V_o$	$T_j=25^\circ C$ $V_i=20.7V-33V, I_o=1mA-40mA$ $V_i=27V, I_o=1mA-70mA$	17.3 17.1 17.1	18	18.7 18.9 18.9	V
Load regulation	$Reg_{load}$	$T_j=25^\circ C, I_o=1mA-100mA$ $T_j=25^\circ C, I_o=1mA-40mA$		30 15	170 85	mV
Line regulation	$Reg_{line}$	$20.7V \leq V_i \leq 33V, T_j=25^\circ C$ $21V \leq V_i \leq 33V, T_j=25^\circ C$		45 35	325 275	mV
Input Bias Current	$I_{IB}$	$T_j=25^\circ C$ $T_j=125^\circ C$		3.1	6.5 6.0	mA
Input Bias Current Change	$\Delta I_{IB}$	$21V \leq V_i \leq 33V$ $1mA \leq I_o \leq 40mA$			1.5 0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$		150		$\mu V$
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**

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

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

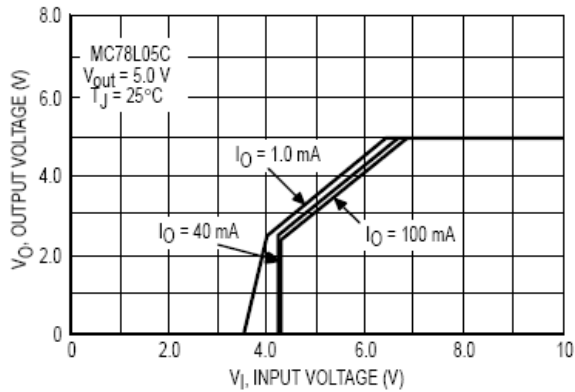


Figure 2. Dropout Voltage versus Junction Temperature

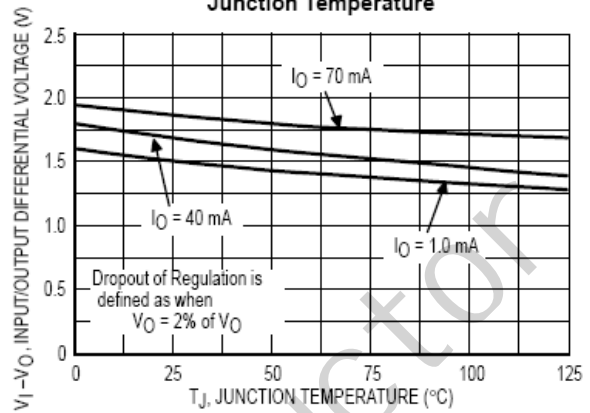


Figure 3. Input Bias Current versus Ambient Temperature

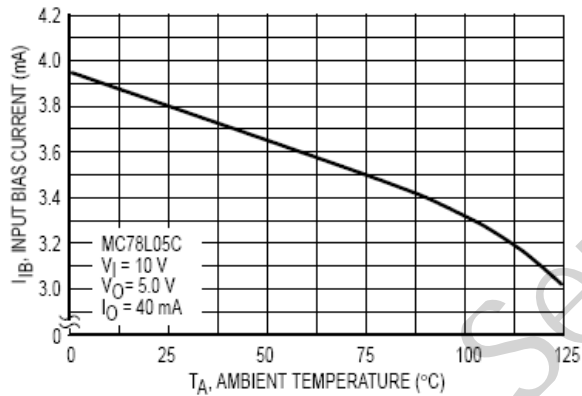


Figure 4. Input Bias Current versus Input Voltage

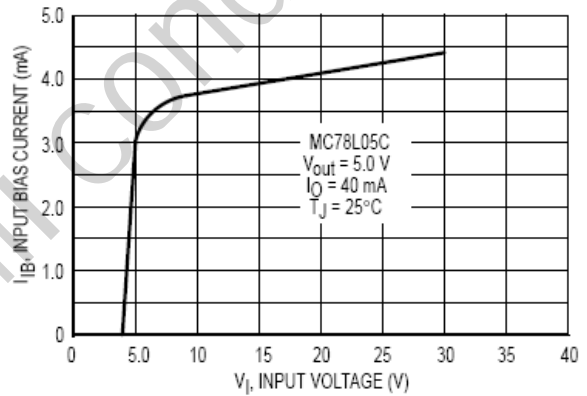


Figure 5. Maximum Average Power Dissipation versus Ambient Temperature – TO-92 Type Package

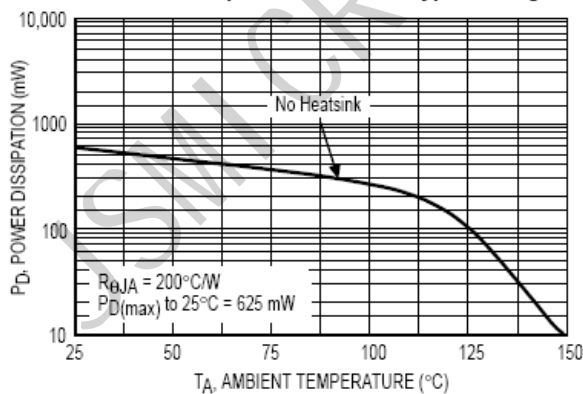
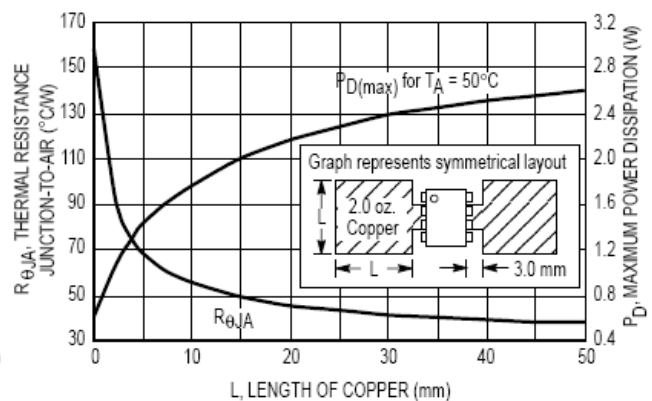


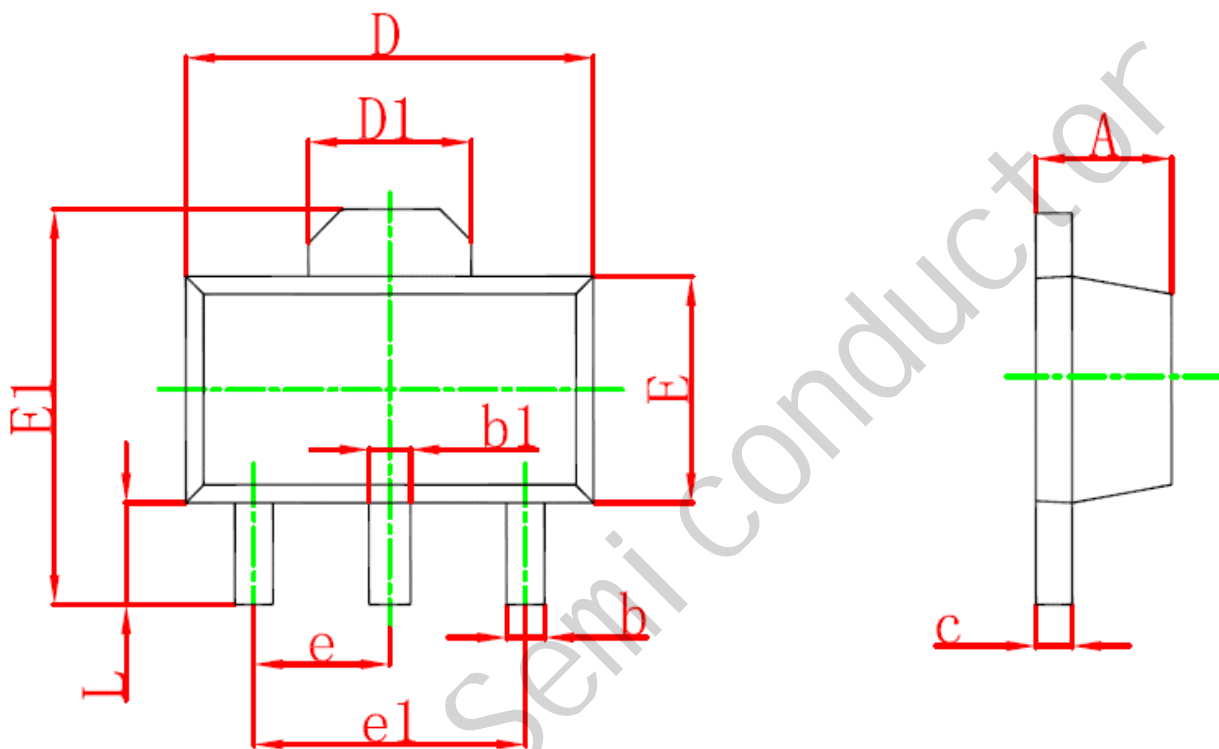
Figure 6. SOP-8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length





## 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