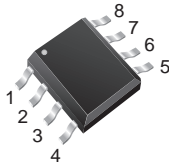


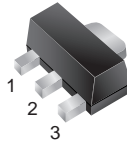
Three-Terminal Low Current Positive Voltage Regulators

SOP-8



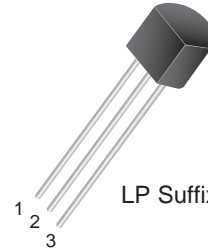
U Suffix

SOT-89



X Suffix

TO-92

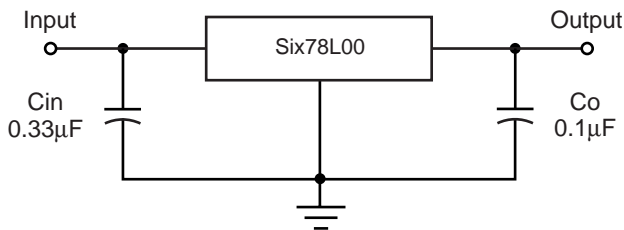


LP Suffix

Features

- Wide selection of available fixed output voltages
- Available in space saving SOT-89 package
- Low cost
- Internal short circuit current limiting
- Internal thermal overload protection
- No external components required
- Complementary negative voltage regulators also available (Six79L00)
- Accurate, $\pm 2\%$ output voltage tolerance

Standard Application Circuit



Description

The Six78L00 series of positive voltage regulators are designed to provide a range of regulated power supply voltages for low current applications of up to 100mA.

They are low cost, rugged, easy to use, three terminal devices with internal current limiting and thermal shut-down protection and are the low current members of the popular Six78M00 and Six7800 family.

No external components are required with the Six78L00 in most applications.

These products offer an improved replacement for the traditional zener-resistor combination, providing better output impedance, lower internal power dissipation and lower quiescent current.

Mechanical Data

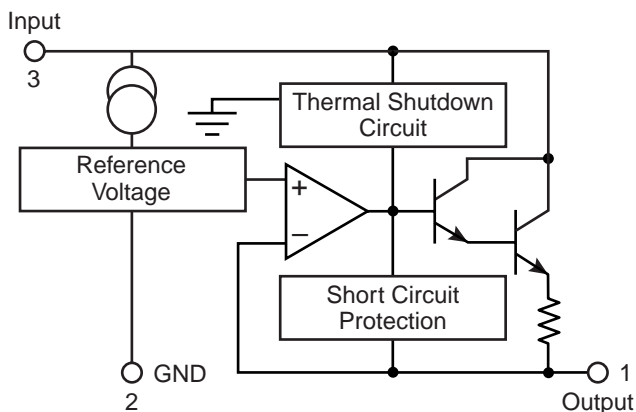
Case: SO-8, SOT-89, TO-92

High temperature soldering guaranteed:

260°C/10 seconds at terminals

Case outlines are on the back pages

Representative Schematic Diagram



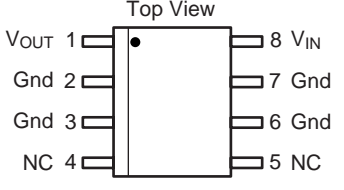
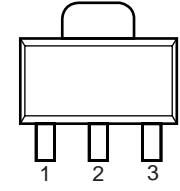
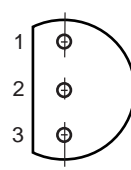
Ordering Information

Six78Lxx xx xx

↑ Package Code
 SO-8: D
 SOT-89: X
 SOT-23: LP

 ↑ Temperature Range
 AB: -40°C to +125°C
 AC: 0°C to +125°C

 ↑ Output Voltage
 05: 5V 15: 15V
 08: 8V 18: 18V
 09: 9V 24: 24V
 12: 12V

SO-8	<p>Top View</p> 
SOT-89	<p>Top View</p> <p>1. V_{OUT} 2. Gnd (tab) 3. V_{IN}</p> 
TO-92	<p>Top View</p> <p>1. V_{OUT} 2. Gnd 3. V_{IN}</p> 

Marking Information

SOT-89

78 x xx

↑ Output Voltage
 05: 5V 15: 15V
 08: 8V 18: 18V
 09: 9V 24: 24V
 12: 12V

 ↑ Temperature Range
 AB: -40°C to +125°C
 AC: 0°C to +125°C

**Maximum Ratings** $T_A = 25^\circ\text{C}$ unless otherwise noted.

Parameter	Symbol	Six78L00 Series	Unit
Input Voltage	$V_i^{(1)}$	30	V
Input Voltage	$V_i^{(2)}$	40	V
Storage Junction Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$
Operating Junction Temperature Range	T_j	-40 to +150 0 to +150	$^\circ\text{C}$

Notes: (1) Six78L05 to Six78L18
(2) Six78L24

• To maintain the specified junction temperature, low duty cycle pulse testing is required for most parameters. All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

Six78L05 AB/AC Electrical Characteristics

$V_i = 10\text{V}$, $I_o = 40\text{mA}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, $-40^\circ\text{C} < T_j < 125^\circ\text{C}$ (Six78L05AB), $0^\circ\text{C} < T_j < 125^\circ\text{C}$ (Six78L05AC) unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_j = 25^\circ\text{C}$)	V_o	4.9	5.0	5.1	Vdc
Line Regulation ($T_j = 25^\circ\text{C}$, $I_o = 40\text{mA}$)	REGline	$7.0\text{V} \leq V_i \leq 20\text{V}$ $8.0\text{V} \leq V_i \leq 20\text{V}$	32 26	150 100	mV
Load Regulation ($T_j = 25^\circ\text{C}$)	REGload	$1.0\text{mA} \leq I_o \leq 100\text{mA}$ $1.0\text{mA} \leq I_o \leq 40\text{mA}$	15 8	60 30	mV
Output Voltage $7.0\text{V} \leq V_i \leq 20\text{V}$, $1.0\text{mA} \leq I_o \leq 40\text{mA}$ $V_i = 10\text{V}$, $1.0\text{mA} \leq I_o \leq 70\text{mA}$	V_o	4.8 (4.75)* 4.8 (4.75)*		5.2 (5.25)* 5.2 (5.25)*	V
Quiescent Current $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	I_q		3.8	6.0 5.5	mA
Quiescent Current Change $8.0\text{V} \leq V_i \leq 20\text{V}$ $1.0\text{mA} \leq I_o \leq 40\text{mA}$	ΔI_q			1.5 0.1	mA
Output Noise Voltage ($T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 100\text{KHz}$)	V_n		40		μV
Ripple Rejection ($I_o = 40\text{mA}$, $f = 120\text{Hz}$, $8.0\text{V} \leq V_i \leq 18\text{V}$, $T_j = 25^\circ\text{C}$)	RR		40		dB
Dropout Voltage	V_{drop}		1.7		Vdc

* Limits in parenthesis apply for Six78L05AB

Six78L08 AB/AC Electrical Characteristics

$V_i = 14V$, $I_o = 40mA$, $C_i = 0.33\mu F$, $C_o = 0.1\mu F$, $-40^\circ C < T_J < 125^\circ C$ (Six78L08AB), $0^\circ C < T_J < 125^\circ C$ (Six78L08AC) unless otherwise noted..

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = 25^\circ C$)	V_O	7.8	8.0	8.2	Vdc
Line Regulation ($T_J = 25^\circ C$, $I_o = 40mA$)	REGline	$10.5V \leq V_i \leq 23V$ $11V \leq V_i \leq 23V$	42 36	175 125	mV
Load Regulation ($T_J = 25^\circ C$)	REGload	$1.0mA \leq I_o \leq 100mA$ $1.0mA \leq I_o \leq 40mA$	18 10	80 40	mV
Output Voltage $10.5V \leq V_i \leq 23V$, $1.0mA \leq I_o \leq 40mA$ $V_i = 14V$, $1.0mA \leq I_o \leq 70mA$	V_O	7.65 (7.6)* 7.65 (7.6)*		8.3 (8.4)* 8.3 (8.4)*	V
Quiescent Current $T_J = 25^\circ C$ $T_J = 125^\circ C$	I_q		3.0	6.0 5.5	mA
Quiescent Current Change $11V \leq V_i \leq 23V$ $1.0mA \leq I_o \leq 40mA$	ΔI_q			1.5 0.2	mA
Output Noise Voltage ($T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$)	V_n		54		μV
Ripple Rejection ($I_o = 40mA$, $f = 120Hz$, $12V \leq V_i \leq 23V$, $T_J = 25^\circ C$)	RR	36	45		dB
Dropout Voltage ($T_J = 25^\circ C$)	V_{drop}		1.7		Vdc

* Limits in parenthesis apply for Six78L08AB

Six78L09 AB/AC Electrical Characteristics

$V_i = 16V$, $I_o = 40mA$, $C_i = 0.33\mu F$, $C_o = 0.1\mu F$, $-40^\circ C < T_J < 125^\circ C$ (Six78L09AB), $0^\circ C < T_J < 125^\circ C$ (Six78L09AC) unless otherwise noted..

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = 25^\circ C$)	V_O	8.8	9.0	9.2	Vdc
Line Regulation ($T_J = 25^\circ C$, $I_o = 40mA$)	REGline	$11.5V \leq V_i \leq 24V$ $12V \leq V_i \leq 24V$	45 40	175 125	mV
Load Regulation ($T_J = 25^\circ C$)	REGload	$1.0mA \leq I_o \leq 100mA$ $1.0mA \leq I_o \leq 40mA$	19 11	90 40	mV
Output Voltage $11.5V \leq V_i \leq 24V$, $1.0mA \leq I_o \leq 40mA$ $V_i = 15V$, $1.0mA \leq I_o \leq 70mA$	V_O	8.6 (8.5)* 8.6 (8.5)*		9.4 (9.5)* 9.4 (9.5)*	Vdc
Quiescent Current $T_J = 25^\circ C$ $T_J = 125^\circ C$	I_q		3.0	6.0 5.5	mA
Quiescent Current Change $11V \leq V_i \leq 23V$ $1.0mA \leq I_o \leq 40mA$	ΔI_q			1.5 0.1	mA
Output Noise Voltage ($T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$)	V_n		58		μV
Ripple Rejection ($I_o = 40mA$, $f = 120Hz$, $12V \leq V_i \leq 23V$, $T_J = 25^\circ C$)	RR	37	45		dB
Dropout Voltage	V_{drop}		1.7		Vdc

* Limits in parenthesis apply for Six78L09AB

**Six78L12 AB/AC Electrical Characteristics**

Vi = 19V, Io = 40mA, Ci = 0.33μF, Co = 0.1μF, -40°C < Tj < 125°C (Six78L08AB), 0°C < Tj < 125°C (Six78L08AC) unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage (Tj = 25°C)	Vo	11.75	12	12.25	Vdc
Line Regulation (Tj = 25°C, Io = 40mA)	REGline	14.5V ≤ Vi ≤ 27V 16V ≤ Vi ≤ 27V	55 49	250 200	mV
Load Regulation (Tj = 25°C)	REGload	1.0mA ≤ Io ≤ 100mA 1.0mA ≤ Io ≤ 40mA	22 13	100 50	mV
Output Voltage	Vo	14.5V ≤ Vi ≤ 27V, 1.0mA ≤ Io ≤ 40mA Vi = 19V, 1.0mA ≤ Io ≤ 70mA	11.5 (11.4)* 11.5 (11.4)*	12.5 (12.6)* 12.5 (12.6)*	V
Quiescent Current	Iq	Tj = 25°C Tj = 125°C	42	6.5 6.0	mA
Quiescent Current Change	ΔIq	16V ≤ Vi ≤ 27V 1.0mA ≤ Io ≤ 40mA		1.5 0.2	mA
Output Noise Voltage (TA = 25°C, 10Hz ≤ f ≤ 100KHz)	Vn		70		μV
Ripple Rejection (Io = 40mA, f = 120Hz, 15V ≤ Vi ≤ 25V, Tj = 25°C)	RR	36	42		dB
Dropout Voltage (Tj = 25°C)	Vdrop		1.7		Vdc

* Limits in parenthesis apply for Six78L12AB

Six78L15 AB/AC Electrical Characteristics

Vi = 23V, Io = 40mA, Ci = 0.33μF, Co = 0.1μF, -40°C < Tj < 125°C (Six78L09AB), 0°C < Tj < 125°C (Six78L09AC) unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage (Tj = 25°C)	Vo	14.7	15	15.3	Vdc
Line Regulation (Tj = 25°C, Io = 40mA)	REGline	17.5V ≤ Vi ≤ 30V 20V ≤ Vi ≤ 30V	65 58	300 250	mV
Load Regulation (Tj = 25°C)	REGload	1.0mA ≤ Io ≤ 100mA 1.0mA ≤ Io ≤ 40mA	25 12	150 75	mV
Output Voltage	Vo	17.5V ≤ Vi ≤ 30V, 1.0mA ≤ Io ≤ 40mA Vi = 23V, 1.0mA ≤ Io ≤ 70mA	14.40 (14.25)* 14.40 (14.25)*	15.60 (15.75)* 15.60 (15.75)*	Vdc
Quiescent Current	Iq	Tj = 25°C Tj = 125°C	4.4	6.5 6.0	mA
Quiescent Current Change	ΔIq	20V ≤ Vi ≤ 30V 1.0mA ≤ Io ≤ 40mA		1.5 0.2	mA
Output Noise Voltage (TA = 25°C, 10Hz ≤ f ≤ 100KHz)	Vn		82		μV
Ripple Rejection (Io = 40mA, f = 120Hz, 18.5V ≤ Vi ≤ 28.5V, Tj = 25°C)	RR	33	39		dB
Dropout Voltage	Vdrop		1.7		Vdc

* Limits in parenthesis apply for Six78L15AB

Six78L12 AB/AC Electrical Characteristics

$V_i = 19V$, $I_o = 40mA$, $C_i = 0.33\mu F$, $C_o = 0.1\mu F$, $-40^\circ C < T_J < 125^\circ C$ (Six78L08AB), $0^\circ C < T_J < 125^\circ C$ (Six78L08AC) unless otherwise noted..

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = 25^\circ C$)	V_o	11.75	12	12.25	Vdc
Line Regulation ($T_J = 25^\circ C$, $I_o = 40mA$)	REGline	$14.5V \leq V_i \leq 27V$ $16V \leq V_i \leq 27V$	55 49	250 200	mV
Load Regulation ($T_J = 25^\circ C$)	REGload	$1.0mA \leq I_o \leq 100mA$ $1.0mA \leq I_o \leq 40mA$	22 13	100 50	mV
Output Voltage $14.5V \leq V_i \leq 27V$, $1.0mA \leq I_o \leq 40mA$ $V_i = 19V$, $1.0mA \leq I_o \leq 70mA$	V_o	11.5 (11.4)* 11.5 (11.4)*		12.5 (12.6)* 12.5 (12.6)*	V
Quiescent Current	I_q	$T_J = 25^\circ C$ $T_J = 125^\circ C$	42	6.5 6.0	mA
Quiescent Current Change	ΔI_q	$16V \leq V_i \leq 27V$ $1.0mA \leq I_o \leq 40mA$		1.5 0.2	mA
Output Noise Voltage ($T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$)	V_n		70		μV
Ripple Rejection ($I_o = 40mA$, $f = 120Hz$, $15V \leq V_i \leq 25V$, $T_J = 25^\circ C$)	RR	36	42		dB
Dropout Voltage ($T_J = 25^\circ C$)	V_{drop}		1.7		Vdc

* Limits in parenthesis apply for Six78L12AB

Six78L15 AB/AC Electrical Characteristics

$V_i = 23V$, $I_o = 40mA$, $C_i = 0.33\mu F$, $C_o = 0.1\mu F$, $-40^\circ C < T_J < 125^\circ C$ (Six78L09AB), $0^\circ C < T_J < 125^\circ C$ (Six78L09AC) unless otherwise noted..

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = 25^\circ C$)	V_o	14.7	15	15.3	Vdc
Line Regulation ($T_J = 25^\circ C$, $I_o = 40mA$)	REGline	$17.5V \leq V_i \leq 30V$ $20V \leq V_i \leq 30V$	65 58	300 250	mV
Load Regulation ($T_J = 25^\circ C$)	REGload	$1.0mA \leq I_o \leq 100mA$ $1.0mA \leq I_o \leq 40mA$	25 12	150 75	mV
Output Voltage $17.5V \leq V_i \leq 30V$, $1.0mA \leq I_o \leq 40mA$ $V_i = 23V$, $1.0mA \leq I_o \leq 70mA$	V_o	14.40 (14.25)* 14.40 (14.25)*		15.60 (15.75)* 15.60 (15.75)*	Vdc
Quiescent Current	I_q	$T_J = 25^\circ C$ $T_J = 125^\circ C$	4.4	6.5 6.0	mA
Quiescent Current Change	ΔI_q	$20V \leq V_i \leq 30V$ $1.0mA \leq I_o \leq 40mA$		1.5 0.2	mA
Output Noise Voltage ($T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$)	V_n		82		μV
Ripple Rejection ($I_o = 40mA$, $f = 120Hz$, $18.5V \leq V_i \leq 28.5V$, $T_J = 25^\circ C$)	RR	33	39		dB
Dropout Voltage	V_{drop}		1.7		Vdc

* Limits in parenthesis apply for Six78L15AB

**Six78L18 AB/AC Electrical Characteristics**

Vi = 27V, Io = 40mA, Ci = 0.33μF, Co = 0.1μF, 0°C < Tj < 125°C unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage (Tj = 25°C)	Vo	17.64	18	18.36	Vdc
Line Regulation (Tj = 25°C, Io = 40mA)	REGline	20.7V ≤ Vi ≤ 33V 22V ≤ Vi ≤ 33V	70 64	325 275	mV
Load Regulation (Tj = 25°C)	REGload	1.0mA ≤ Io ≤ 100mA 1.0mA ≤ Io ≤ 40mA	30 15	170 85	mV
Output Voltage	Vo	20.7V ≤ Vi ≤ 33V, 1.0mA ≤ Io ≤ 40mA Vi = 27V, 1.0mA ≤ Io ≤ 70mA	17.4 (17.1)* 17.4 (17.1)*	18.6 (18.9)* 18.6 (18.9)*	V
Quiescent Current	Iq	Tj = 25°C Tj = 125°C	3.1	6.5 6.0	mA
Quiescent Current Change	ΔIq	22V ≤ Vi ≤ 33V 1.0mA ≤ Io ≤ 40mA		1.5 0.2	mA
Output Noise Voltage (TA = 25°C, 10Hz ≤ f ≤ 100KHz)	Vn		150		μV
Ripple Rejection (Io = 40mA, f = 120Hz, 23V ≤ Vi ≤ 33V, Tj = 25°C)	RR		32	46	dB
Dropout Voltage (Tj = 25°C)	Vdrop		1.7		Vdc

* Limits in parenthesis apply for Six78L18AB

Six78L24 AB/AC Electrical Characteristics

Vi = 33V, Io = 40mA, Ci = 0.33μF, Co = 0.1μF, 0°C < Tj < 125°C unless otherwise noted.

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage (Tj = 25°C)	Vo	23.5	24	24.5	Vdc
Line Regulation (Tj = 25°C, Io = 40mA)	REGline	27.0V ≤ Vi ≤ 38V 28V ≤ Vi ≤ 38V	35 30	350 300	mV
Load Regulation (Tj = 25°C)	REGload	1.0mA ≤ Io ≤ 100mA 1.0mA ≤ Io ≤ 40mA	40 20	200 100	mV
Output Voltage	Vo	27V ≤ Vi ≤ 38V, 1.0mA ≤ Io ≤ 40mA Vi = 33V, 1.0mA ≤ Io ≤ 70mA	23.3 (22.8)* 23.3 (22.8)*	24.7 (25.2)* 24.7 (25.2)*	Vdc
Quiescent Current	Iq	Tj = 25°C Tj = 125°C	3.1	6.5 6.0	mA
Quiescent Current Change	ΔIq	28V ≤ Vi ≤ 38V 1.0mA ≤ Io ≤ 40mA		1.5 0.2	mA
Output Noise Voltage (TA = 25°C, 10Hz ≤ f ≤ 100KHz)	Vn		200		μV
Ripple Rejection (Io = 40mA, f = 120Hz, 29V ≤ Vi ≤ 35V, Tj = 25°C)	RR		30	43	dB
Dropout Voltage	Vdrop		1.7		Vdc

* Limits in parenthesis apply for Six78L24AB

Vishay
formerly General Semiconductor

Ratings and Characteristic Curves ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Fig. 1 – Dropout Characteristics

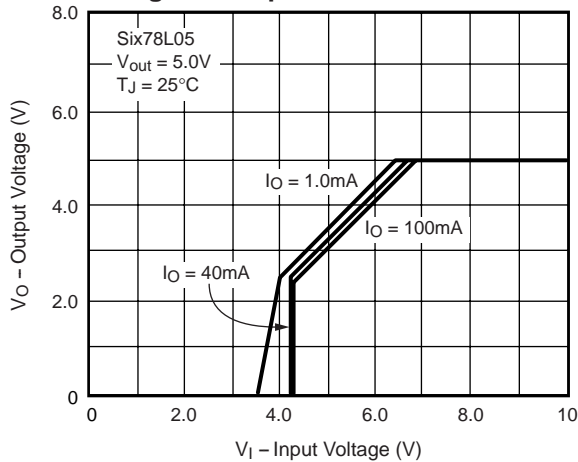


Fig. 2 – Dropout Voltage vs. Junction Temperature

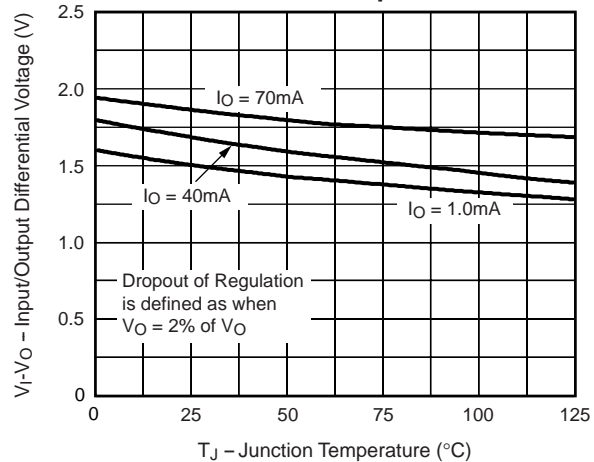


Fig. 3 – Input Bias Current vs. Ambient Temperature

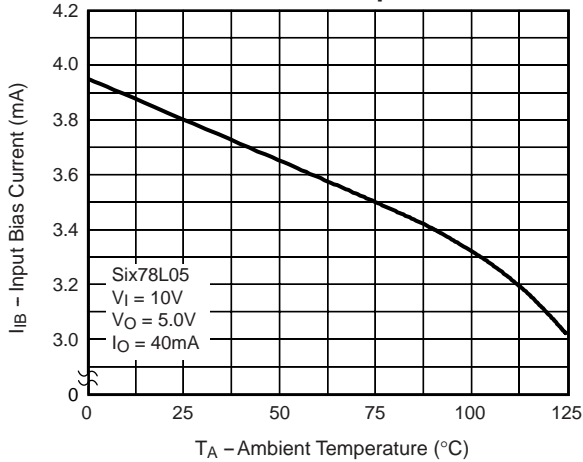


Fig. 4 – Input Bias Current vs. Input Voltage

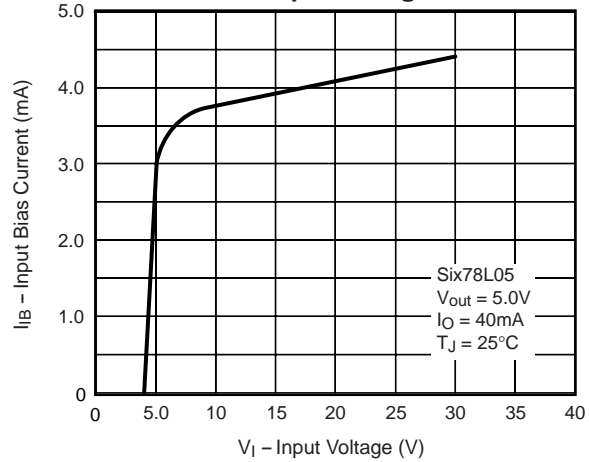


Fig. 5 – Max. Average Power Dissipation vs. Ambient Temperature – TO-92

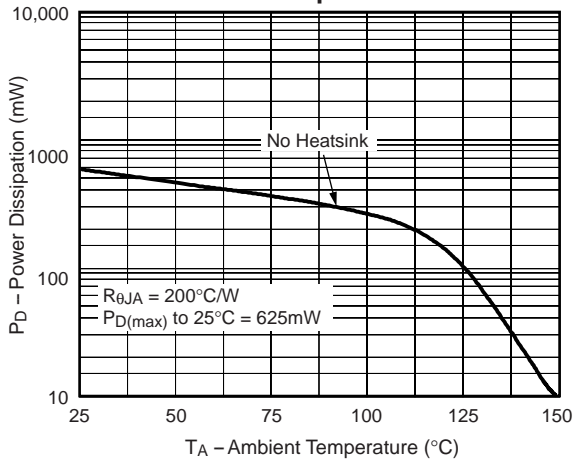
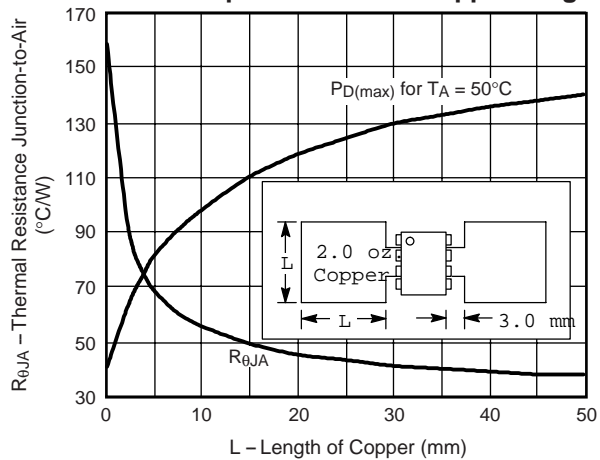
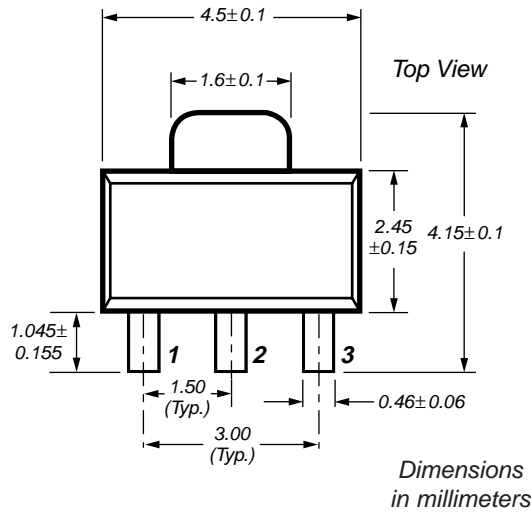
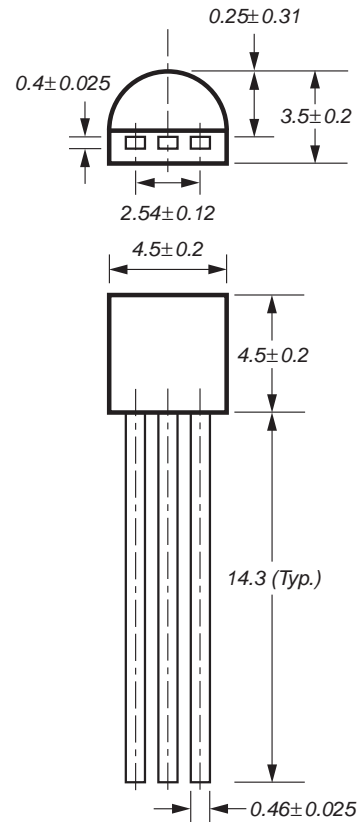


Fig. 6 – SOP-8 Thermal Resistance & Max. Power Dissipation vs. P.C.B. Copper Length



Case Outlines
SOT-89

TO-92

SOP-8
