DATA SHEET

PS78Lxx

POSITIVE VOLTAGE REGULATOR

GENERAL DESCRIPTION

The PS78Lxx series voltage monolithic integrated circuit voltage regulator designed for a wide range of applications. These applications include local and on-card regulation for elimination of noise and distribution problems associated with single-point regulation.

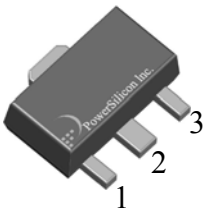
This device of voltage regulator is available in TO-92 and SOT-89 packages. With adequate heat-sinking, this voltage regulator can deliver in excess of 100mA output current.

This voltage regulator employ built-in current limiting, thermal shutdown protection which makes the device essentially immune to damage from output overloads.

FEATURES

- Output Current Up to 100mA
- Internal Thermal Overload Protection
- Internal Short-circuit Current Limiting
- Output Voltage Of 5V,6V,8V,9V,10V,12V,15V,18V,24V
- Lead Free and Halogen-Free

PIN CONFIGURATION

PIN	SYMBOL	FUNCTION	TO-92	SOT-89
			T92	T89
1	V_{OUT}	Fixed Output Voltage		
2	V_{SS}	Ground		
3	V_{IN}	Input Power Supply		

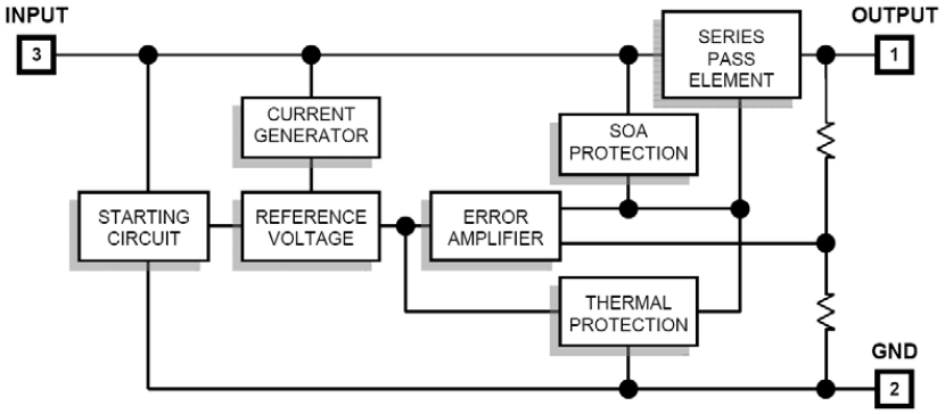
ORDERING INFORMATION

Part Number	Output Accuracy	Output Voltage	Package		Shipping
PS78LxxA-T92	±1%	xx	TO-92	Straight Leads	Bulk
PS78LxxA-T92B	±1%	xx		Bending Leads	Tape Box
PS78LxxA-T92L	±1%	xx		Straight Leads	Tape Box
PS78LxxA-T89R	±1%	xx	SOT-89		Tape Reel
PS78LxxB-T92	±2%	xx	TO-92	Straight Leads	Bulk
PS78LxxB-T92B	±2%	xx		Bending Leads	Tape Box
PS78LxxB-T92L	±2%	xx		Straight Leads	Tape Box
PS78LxxB-T89R	±2%	xx	SOT-89		Tape Reel
PS78Lxx-T92	±4%	xx	TO-92	Straight Leads	Bulk
PS78Lxx-T92B	±4%	xx		Bending Leads	Tape Box
PS78Lxx-T92L	±4%	xx		Straight Leads	Tape Box
PS78Lxx-T89R	±4%	xx	SOT-89		Tape Reel

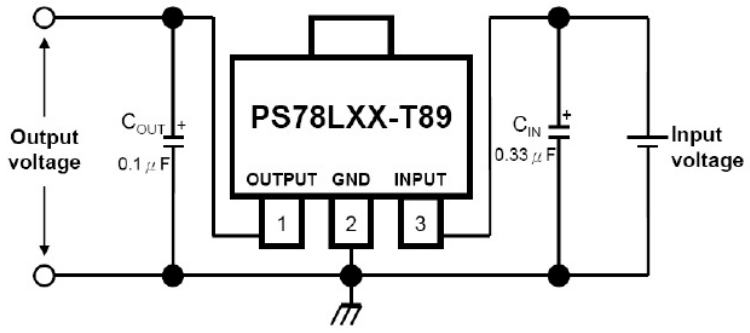
Note:

1. xx: Fixed Output Voltage Of 5V,6V,8V,9V,10V,12V,15V,18V,24V
   (PS78L05A-T92: 5.0V; PS78L06A-T92: 6.0V; PS78L24A-T92: 24V)

SCHEMATIC DIAGRAM



TYPICAL APPLICATION



Notes:

Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

ABSOLUTE MAXIMUM RATING

T_A=25°C, unless otherwise noted (Note.1)

Parameter		Symbol	Value	Unit
Input Voltage	PS78L05~PS78L10	V_I	30	V
	PS78L12~PS78L18		35	
	PS78L24		40	
Power Dissipation (Note.2)	SOT-89	P_D	0.5	W
	TO-92		0.625	
Thermal Resistance, Junction to Ambient	SOT-89 (Note.3)	$R_{\theta JA}$	200	°C/W
	TO-92		160	
Thermal Resistance, Junction to Case	SOT-89 (Note.3)	$R_{\theta JC}$	51	°C/W
	TO-92		60	
Junction Temperature		T_J	125	°C
Operating Junction Temperature Range		T_{OPR}	0 to +125	°C
Storage Temperature Range		T_{STG}	-55 to + 150	°C

Note:

1. Absolute Maximum Ratings are those values beyond which the device could be permanently damaged. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. Maximum power dissipation is a function of $T_{J(max)}$, $R_{\theta JA}$ and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A)/ R_{\theta JA}$. Operating at the absolute maximum T_J of 125°C can affect reliability. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal-overload protection may be activated at power levels slightly above or below the rated dissipation.
3. (2-layer board) 114.3×76.2 mm2, thickness 1.57 mm, FR4, refer to the JEDEC JESD51-7.

ELECTRICAL CHARACTERISTICS

PS78L05 (0°C≤T_J≤125°C, V_{IN}=10V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L05A	4.95	5	5.05	V
			PS78L05B	4.9		5.1	
			PS78L05	4.8		5.2	
		7.0≤V_I≤20V, Io=1mA~40mA		4.75		5.25	
		Io=1mA~70mA, V_{IN}=10V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	11	60	mV
		T_J=25°C, Io=1mA~40mA		-	5	30	
Line Regulation	ΔV_{LINE}	T_J=25°C, 7.0V≤V_I≤20V		-	32	150	mV
		T_J=25°C, 8.0V≤V_I≤20V		-	26	100	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	8.0V≤V_I≤20V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	42	-	uV
Ripple Rejection	RR	T_J=25°C, 8.0V≤V_I≤18V,f=120Hz		41	49	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L06 (0°C≤T_J≤125°C, V_{IN}=11V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L06A	5.94	6	6.06	V
			PS78L06B	5.88		6.12	
			PS78L06	5.76		6.24	
		8.0≤V_I≤20V, Io=1mA~40mA		5.7		6.3	
		Io=1mA~70mA, V_{IN}=11V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	15	80	mV
		T_J=25°C, Io=1mA~40mA		-	10	40	
Line Regulation	ΔV_{LINE}	T_J=25°C, 8.0V≤V_I≤20V		-	35	175	mV
		T_J=25°C, 9.0V≤V_I≤20V		-	25	125	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	9.0V≤V_I≤20V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	46	-	uV
Ripple Rejection	RR	T_J=25°C, 9.0V≤V_I≤19V,f=120Hz		41	48	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L08 (0°C≤T_J≤125°C, V_{IN}=14V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L08A	7.92	8	8.08	V
			PS78L08B	7.84		8.16	
			PS78L08	7.7		8.3	
		10.5≤V_I≤23V, Io=1mA~40mA		7.6		8.4	
		Io=1mA~70mA, V_{IN}=14V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	18	80	mV
		T_J=25°C, Io=1mA~40mA		-	10	40	
Line Regulation	ΔV_{LINE}	T_J=25°C, 10.5V≤V_I≤23V		-	42	175	mV
		T_J=25°C, 13V≤V_I≤23V		-	36	125	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	11V≤V_I≤23V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	54	-	uV
Ripple Rejection	RR	T_J=25°C, 13V≤V_I≤23V,f=120Hz		36	46	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L09 (0°C≤T_J≤125°C, V_{IN}=16V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L09A	8.91	9	9.09	V
			PS78L09B	8.82		9.18	
			PS78L09	8.6		9.4	
		12≤V_I≤24V, Io=1mA~40mA		8.55		9.45	
		Io=1mA~70mA, V_{IN}=16V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	19	90	mV
		T_J=25°C, Io=1mA~40mA		-	11	40	
Line Regulation	ΔV_{LINE}	T_J=25°C, 12V≤V_I≤24V		-	45	175	mV
		T_J=25°C, 13V≤V_I≤24V		-	40	125	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	13V≤V_I≤24V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	58	-	uV
Ripple Rejection	RR	T_J=25°C, 15V≤V_I≤25V,f=120Hz		36	45	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L10 (0°C≤T_J≤125°C, V_{IN}=17V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L10A	9.9	10	10.1	V
			PS78L10B	9.8		10.2	
			PS78L10	9.6		10.4	
		13≤V_I≤25V, Io=1mA~40mA		9.5		10.5	
		Io=1mA~70mA, V_{IN}=17V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	19	90	mV
		T_J=25°C, Io=1mA~40mA		-	11	40	
Line Regulation	ΔV_{LINE}	T_J=25°C, 12V≤V_I≤24V		-	51	175	mV
		T_J=25°C, 13V≤V_I≤24V		-	41	125	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	14V≤V_I≤25V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	60	-	uV
Ripple Rejection	RR	T_J=25°C, 15V≤V_I≤25V,f=120Hz		36	44	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L12 ($0°C \le T_J \le 125°C$, V_{IN}=19V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L12A	11.88	12	12.12	V
			PS78L12B	11.76		12.24	
			PS78L12	11.5		12.4	
		14≤V_I≤27V, Io=1mA~40mA		11.4		12.6	
		Io=1mA~70mA, V_{IN}=19V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	22	100	mV
		T_J=25°C, Io=1mA~40mA		-	13	50	
Line Regulation	ΔV_{LINE}	T_J=25°C, 14.5V≤V_I≤27V		-	55	250	mV
		T_J=25°C, 16V≤V_I≤27V		-	49	200	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	14V≤V_I≤25V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	70	-	uV
Ripple Rejection	RR	T_J=25°C, 15V≤V_I≤25V,f=120Hz		36	42	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L15 ($0°C \le T_J \le 125°C$, V_{IN}=23V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L15A	14.85	15	15.15	V
			PS78L15B	14.7		15.3	
			PS78L15	14.4		15.6	
		17.5≤V_I≤30V, Io=1mA~40mA		14.25		15.75	
		Io=1mA~70mA, V_{IN}=23V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	22	150	mV
		T_J=25°C, Io=1mA~40mA		-	13	75	
Line Regulation	ΔV_{LINE}	T_J=25°C, 17.5V≤V_I≤30V		-	60	300	mV
		T_J=25°C, 19V≤V_I≤30V		-	55	250	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	19V≤V_I≤30V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	82	-	uV
Ripple Rejection	RR	T_J=25°C, 18.5V≤V_I≤28.5V,f=120Hz		32	39	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L18 ($0°C \le T_J \le 125°C$, V_{IN}=26V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

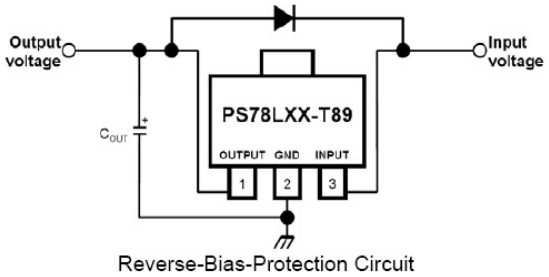
Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L18A	17.82	18	18.18	V
			PS78L18B	17.64		18.36	
			PS78L18	17.3		18.7	
		20.5≤V_I≤33V, Io=1mA~40mA		17.1		18.9	
		Io=1mA~70mA, V_{IN}=26V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	25	180	mV
		T_J=25°C, Io=1mA~40mA		-	13	90	
Line Regulation	ΔV_{LINE}	T_J=25°C, 20.5V≤V_I≤33V		-	70	360	mV
		T_J=25°C, 22V≤V_I≤33V		-	60	300	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	22V≤V_I≤33V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	89	-	uV
Ripple Rejection	RR	T_J=25°C, 21.5V≤V_I≤31.5V,f=120Hz		32	36	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

PS78L24 ($0°C \le T_J \le 125°C$, V_{IN}=32V, I_{OUT}=40mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, unless otherwise noted)

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	UNIT
Output Voltage	V_O	T_J=25°C	PS78L24A	23.76	24	24.24	V
			PS78L24B	23.52		24.48	
			PS78L24	23		25	
		26.5≤V_I≤39V, Io=1mA~40mA		22.8		25.2	
		Io=1mA~70mA, V_{IN}=32V					
Load Regulation	ΔV_{LOAD}	T_J=25°C, Io=1mA~100mA		-	40	240	mV
		T_J=25°C, Io=1mA~40mA		-	25	120	
Line Regulation	ΔV_{LINE}	T_J=25°C, 26.5V≤V_I≤39V		-	90	480	mV
		T_J=25°C, 29V≤V_I≤39V		-	75	400	
Quiescent Current	I_Q	T_J=25°C		-	3.8	6	mA
Quiescent Current Change	ΔI_Q	28V≤V_I≤39V		-	-	1.5	mA
		1mA≤I_O≤40mA		-	-	0.1	mA
Output Noise Voltage	V_N	10Hz≤ f ≤100KHz		-	97	-	uV
Ripple Rejection	RR	T_J=25°C, 27.5V≤V_I≤37.5V,f=120Hz		30	33	-	dB
Dropout Voltage	V_D	T_J=25°C		-	1.7	-	V

Note:

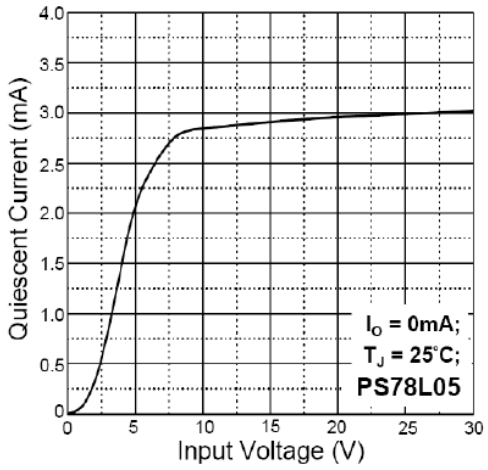
1. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
2. Reverse-Bias Protection: Occasionally, the input voltage to the regulator can collapse faster than the output voltage. This can occur, for example, when the input supply is crowbarred during an output overvoltage condition. If the output voltage is greater than approximately 7V, the emitter-base junction of the series-pass element (internal or external) could break down and be damaged. To prevent this, a diode shunt can be employed as shown in the below.



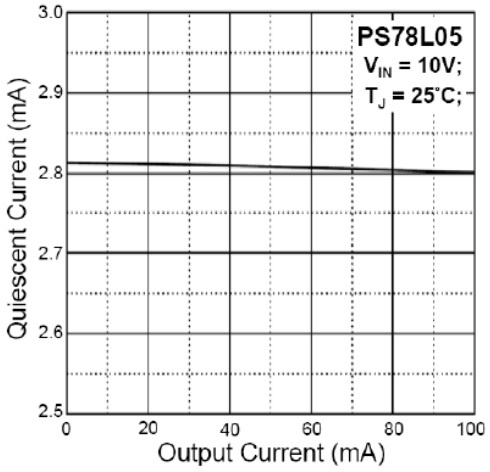
Reverse-Bias-Protection Circuit

TYPICAL PERFORMANCE CHARACTERISTICS

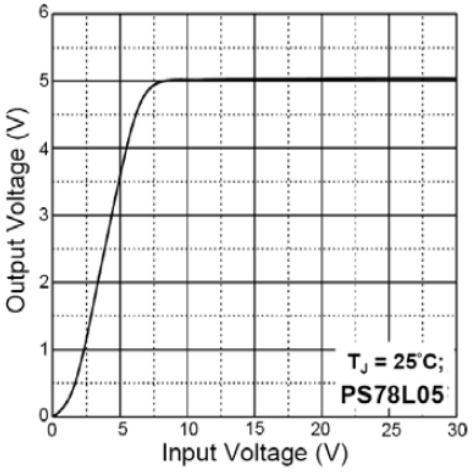
(1) Quiescent Current vs. Input Voltage



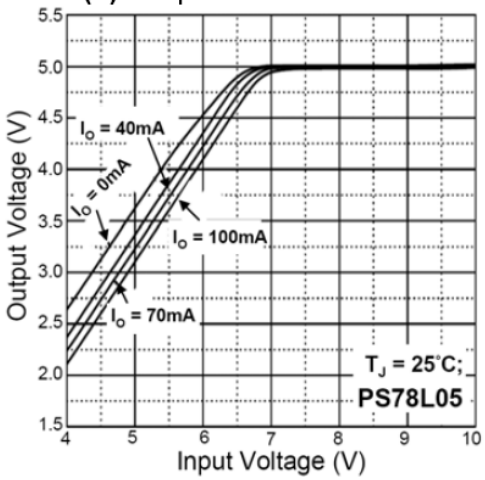
(2) Quiescent Current vs. Output Current



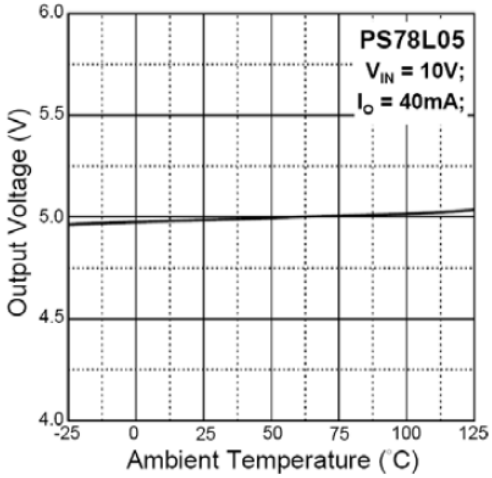
(3) Output Characteristics



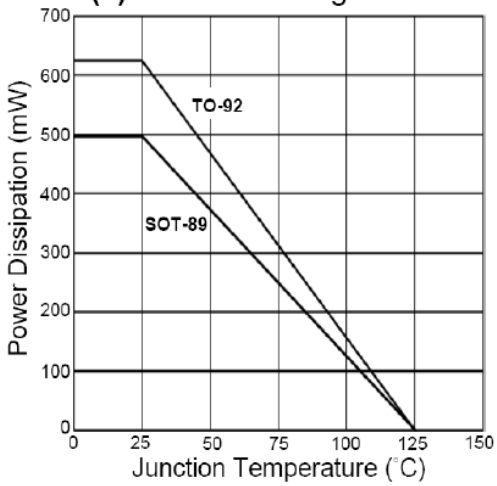
(4) Dropout Characteristics



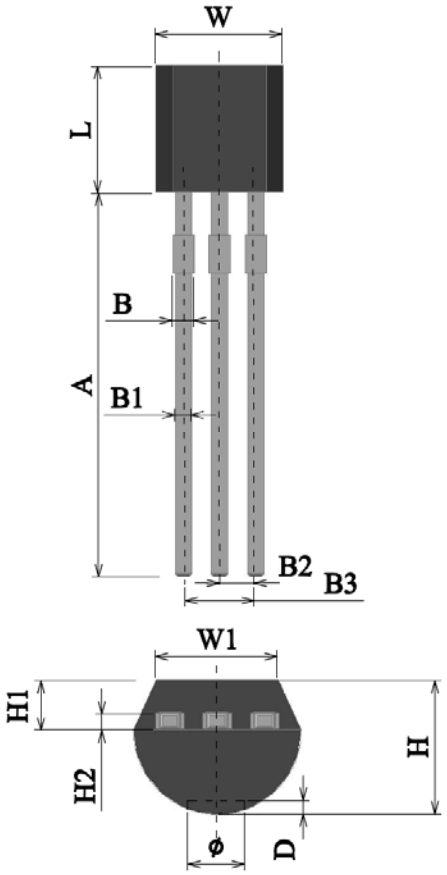
Output Voltage vs. Ambient Temperature



(6) Power Derating Curve

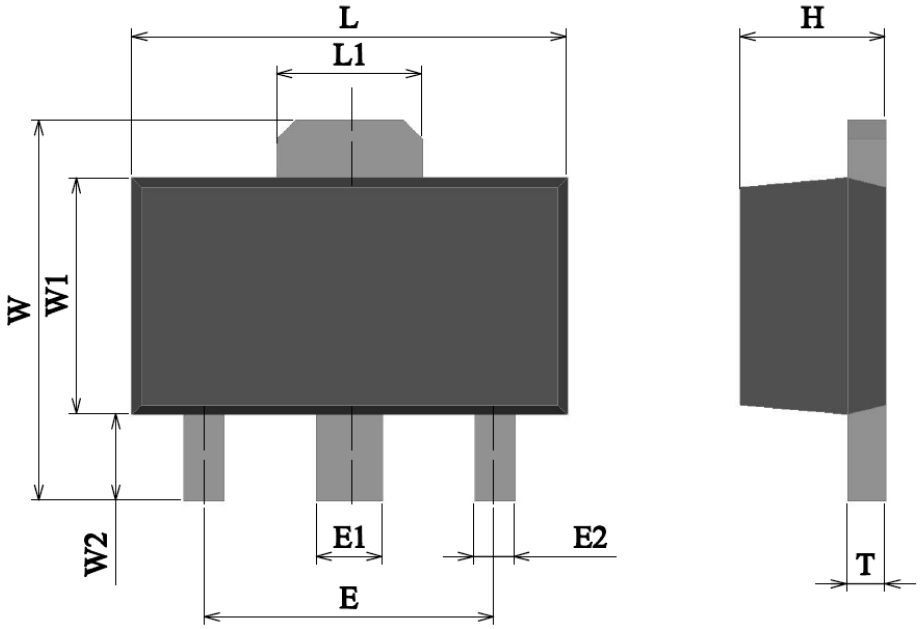


TO-92 DIMENSION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
L	4.30	4.70	0.169	0.185
W	4.40	4.70	0.173	0.185
W1	3.43	-	0.135	-
A	13.80	14.20	0.543	0.559
B	0.40	0.60	0.016	0.024
B1	0.38	0.55	0.015	0.022
B2	1.27 TYP		0.050 TYP	
B3	2.44	2.64	0.096	0.104
H	3.30	3.70	0.130	0.146
H1	1.10	1.40	0.043	0.055
H2	0.36	0.51	0.014	0.020
D	0.38	-	0.015	-
φ	1.60	-	0.063	-

SOT-89 DIMENSION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
L	4.40	4.70	0.173	0.185
L1	1.55	1.75	0.061	0.069
E	3.00 TYP		0.118 TYP	
E1	0.40	0.58	0.016	0.023
E2	0.32	0.52	0.013	0.020
W	3.94	4.25	0.155	0.167
W1	2.30	2.60	0.091	0.102
W2	0.90	1.20	0.035	0.047
H	1.45	1.60	0.057	0.063
T	0.35	0.44	0.014	0.017