Introduction

The 78L series is a three terminal positive voltage linear regulator with fixed voltage output. It has a wide input voltage range. The maximum input voltage can reach 30V (or 35V). At the same time, it can also provide 100mA output current under the condition of good heat dissipation. The 78L series adopts fixed voltage output without peripheral resistance, which improves the space utilization efficiency of printed circuit board (PCB). In addition, the 78L series also integrates internal current limit, short-circuit protection and thermal shutdown, so that it is basically not affected by overload. Therefore, the 78L series is widely used in various scenarios, such as card supervision, to eliminate the noise and distribution problems related to single point supervision. When used as a substitute for Zener-diode resistor combination, it can effectively improve the output impedance and reduce the bias current.

Features

- Available Output Voltage:
  5.0V, 6.0V, 8.0V, 9.0V, 12V and 15V
- Maximum Input Voltage:
  30V for V_{OUT} < 10V
  35V for V_{OUT} > 10V
- Maximum Output Current:
  Exceed 100mA
- Output Tolerances:
  ±3% at T_J = 25℃
  ±5% over the Operating T_J
- Build-in Current Limit
- Thermal Shutdown Protection
- Short Circuit Protection
- No External Components

Applications

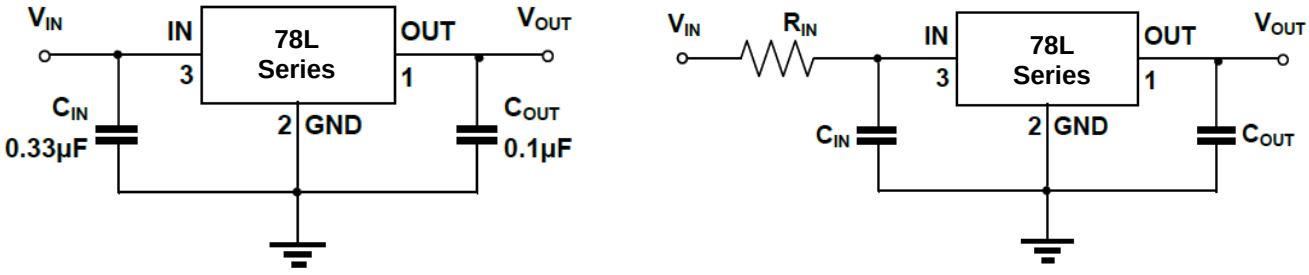
- TV Board
- Air Conditioner
- Vehicle Mounted Radar
- Charging Device

Available Packages

PART NUMBER	PACKAGES
78L Series	SOT-23
	SOT-23-3L
	SOT-89-3L
	TO-92

Note: For more detailed packaging information, see the part Pin Configuration and Function and the part Mechanical Information.

Pb-Free RoHS Halogen-Free



(1) Conventional Circuit

(2) Resistance are used at IN

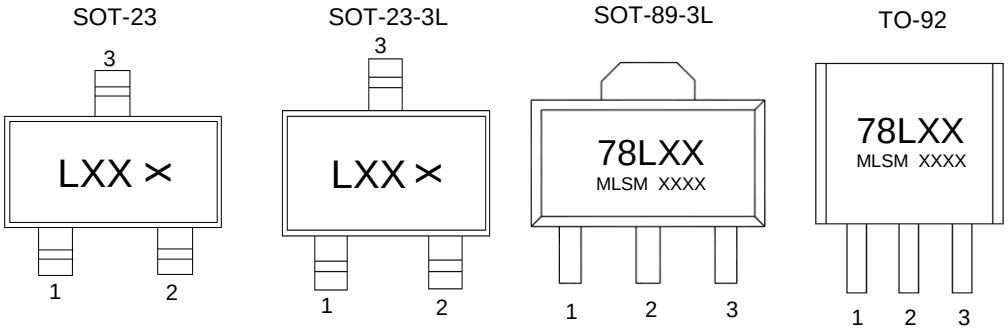
Typical Application Circuit

Ordering Information

Model	Device	Package	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
78LXX	78LXX	SOT-23	3,000	45,000	180,000	7"reel
78LXX	78LXX	SOT-23-3L	3,000	45,000	180,000	7"reel
78LXX	78LXX	SOT-89-3L	1,000	10,000	40,000	7"reel
78LXX	78LXX	TO-92	1,000	10,000	100,000	/

Pin Configuration and Marking Information

Pin Configuration and Function

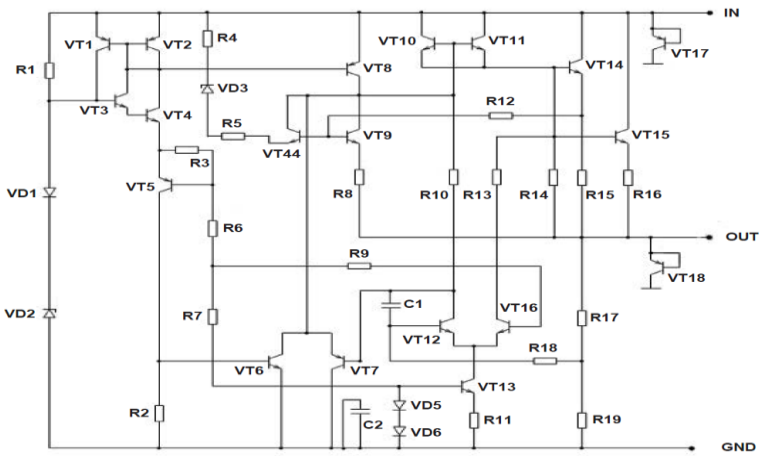


Package Top View

Pin Name	MLS78L Series				I / O	Description
	SOT-23	SOT-23-3L	SOT-89-3L	TO-92		
IN	2	2	3	3	I	Input to the device.
GND	3	3	2	2	-	Regulator ground.
OUT	1	1	1	1	O	Output of the regulator.

"78LXX ": Product number, the "XX" in the "78LXX" or "LXX" represents the output voltage, for example, if VOUT = 5.0V, "XX" is "05".
"✕ " "XXXX": Code.

Representative Schematic Diagram



Specifications

Absolute Maximum Ratings(1)

Characteristic		Symbol	Value	Unit
Maximum input voltage(2)	78L05	V_{IN}	30	V
	78L06			
	78L08			
	78L09			
	78L12		35	
	78L15			
Maximum power dissipation	SOT-23	$P_{D\ Max}$	Internally Limited(3)	W
	SOT-23-3L			
	SOT-89-3L			
	TO-92			
Maximum junction temperature		$T_{J\ Max}$	150	°C
Storage temperature		T_{stg}	- 65 ~ 150	°C
Soldering temperature & time		T_{solder}	260°C, 10s	-

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to network ground terminal.

(3) Refer to Thermal Information for details.

Electrical Characteristics

78L05 (V_{OUT} = 5.0V, V_{IN} = 10V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	4.85	5.00	5.15	V
		V_{IN} = 7 to 20V, I_{OUT} = 1 to 40mA	4.75	5.00	5.25	V
		I_{OUT} = 1 to 70mA	4.75	5.00	5.25	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	3.8	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 8 to 20V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 7 to 20V, T_J = 25°C	-	32.0	150	mV
		V_{IN} = 8 to 20V, T_J = 25°C	-	26.0	100	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	15.0	60	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	8.0	30	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	42	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 8 to 20V, f = 120Hz	41	49	-	dB

78L06 (V_{OUT} = 6.0V, V_{IN} = 11V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	5.82	6.00	6.18	V
		V_{IN} = 8 to 20V, I_{OUT} = 1 to 40mA	5.70	6.00	6.30	V
		I_{OUT} = 1 to 70mA	5.70	6.00	6.30	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	3.9	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 9 to 20V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 8 to 20V, T_J = 25°C	-	35	175	mV
		V_{IN} = 9 to 20V, T_J = 25°C	-	29	125	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	16	80	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	9	40	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	46	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 8 to 20V, f = 120Hz	40	48	-	dB

78L08 (V_{OUT} = 8.0V, V_{IN} = 14V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	7.76	8.00	8.24	V
		V_{IN} = 8 to 20V, I_{OUT} = 1 to 40mA	7.60	8.00	8.40	V
		I_{OUT} = 1 to 70mA	7.76	8.00	8.40	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	4	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 11 to 23V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 10.5 to 23V, T_J = 25°C	-	42	175	mV
		V_{IN} = 11 to 23V, T_J = 25°C	-	36	125	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	18	80	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	10	40	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	54	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 13 to 23V, f = 120Hz	37	46	-	dB

78L09 (V_{OUT} = 9.0V, V_{IN} = 16V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	30	V
Output voltage	V_{OUT}	T_J = 25°C	8.73	9.00	9.27	V
		V_{IN} = 12 to 24V, I_{OUT} = 1 to 40mA	8.55	9.00	9.45	V
		I_{OUT} = 1 to 70mA	8.55	9.00	9.45	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	4.1	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 13 to 24V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 12 to 24V, T_J = 25°C	-	45	175	mV
		V_{IN} = 13 to 24V, T_J = 25°C	-	40	125	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	19	90	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	11	40	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	58	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 15 to 25V, f = 120Hz	37	45	-	dB

78L12 (V_{OUT} = 12.0V, V_{IN} = 19V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	11.64	12.00	12.36	V
		V_{IN} = 14 to 27V, I_{OUT} = 1 to 40mA	11.40	12.00	12.60	V
		I_{OUT} = 1 to 70mA	11.40	12.00	12.60	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	4.3	6.0	mA
Quiescent current change	ΔI_Q	V_{IN} = 14.5 to 27V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 14.5 to 27V, T_J = 25°C	-	55	250	mV
		V_{IN} = 16 to 27V, T_J = 25°C	-	49	200	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	22	100	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	13	50	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	70	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 15 to 25V, f = 120Hz	37	42	-	dB

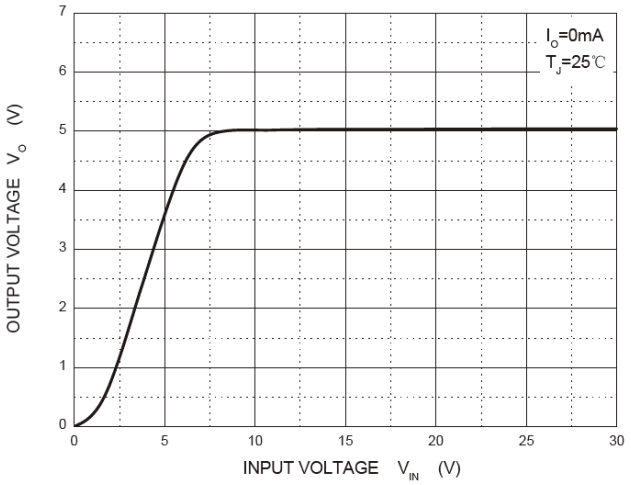
78L15 (V_{OUT} = 15.0V, V_{IN} = 23V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	35	V
Output voltage	V_{OUT}	T_J = 25°C	14.55	15.00	15.45	V
		V_{IN} = 17.5 to 30V, I_{OUT} = 1 to 40mA	14.25	15.00	15.75	V
		I_{OUT} = 1 to 70mA	14.25	15.00	15.75	V
Output current	I_{OUT}	T_J = 25°C	100	-	-	mA
Quiescent current	I_Q	I_{OUT} = 0mA	-	4.6	6.5	mA
Quiescent current change	ΔI_Q	V_{IN} = 19 to 30V	-	-	1.5	mA
		I_{OUT} = 1 to 40mA	-	-	0.1	mA
Dropout voltage	V_{DO}	T_J = 25°C	-	1.7	-	V
Line regulation	ΔV_{LINE}	V_{IN} = 17.5 to 30V, T_J = 25°C	-	65	300	mV
		V_{IN} = 19 to 30V, T_J = 25°C	-	58	250	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 1 to 100mA, T_J = 25°C	-	25	150	mV
		I_{OUT} = 1 to 40mA, T_J = 25°C	-	15	75	mV
Output noise voltage	V_N	f = 10 to 100kHz, T_J = 25°C	-	82	-	μV/V_{OUT}
Ripple rejection	RR	V_{IN} = 18.5 to 28.5V, f = 120Hz	34	39	-	dB

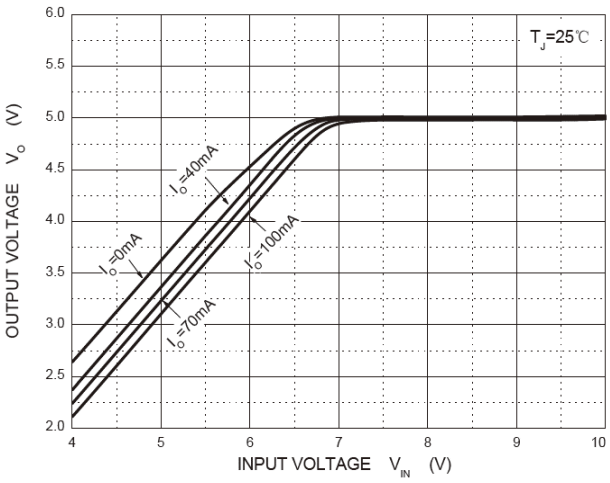
Typical Characteristics

78L05 (V_{OUT} = 5.0V, T_J = 25℃, unless otherwise specified)

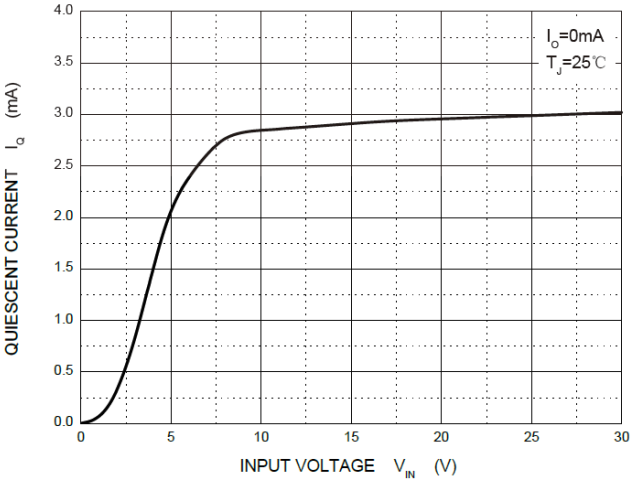
Output Characteristics



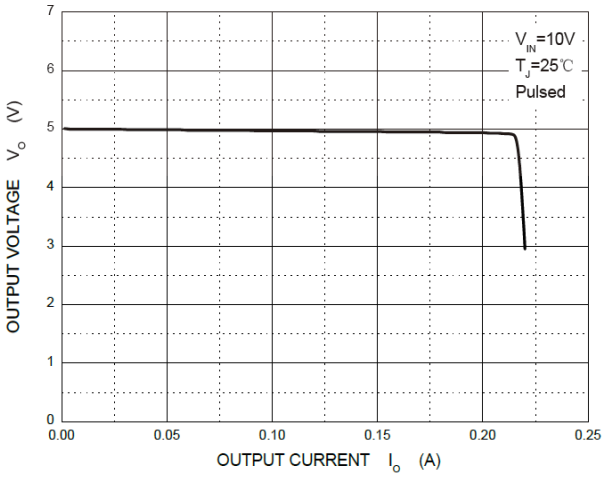
Dropout Characteristics



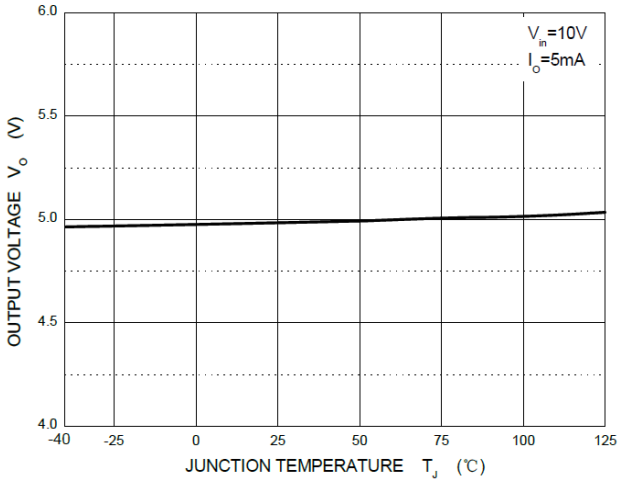
Quiescent Current vs Input Voltage



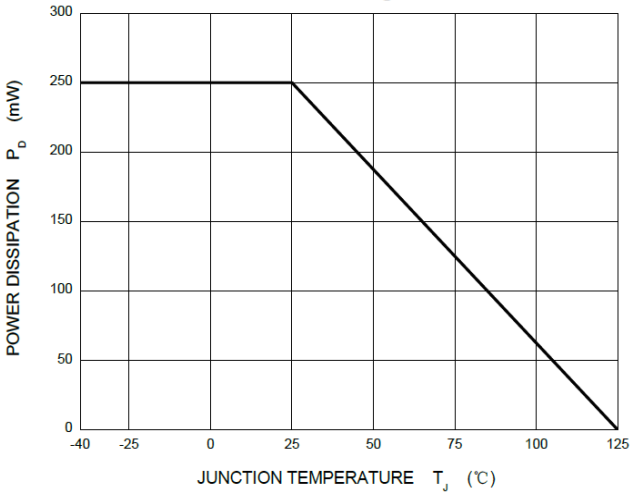
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

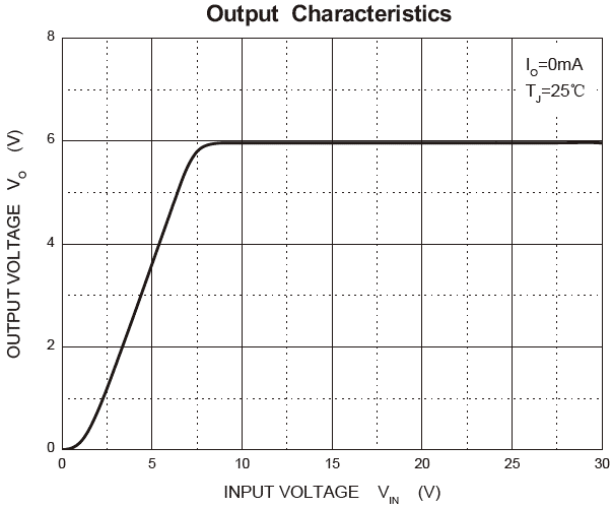


Power Derating Curve

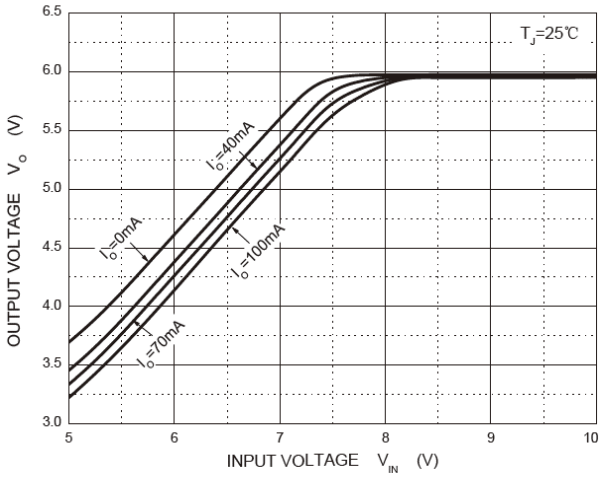


78L06 (V_{OUT} = 6.0V, T_J = 25℃, unless otherwise specified)

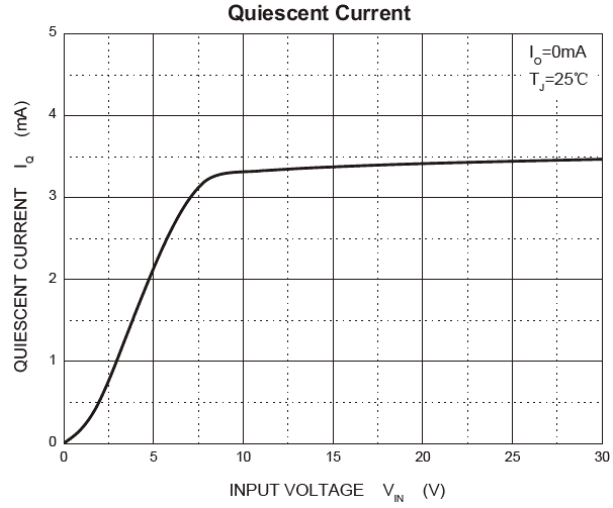
Output Characteristics



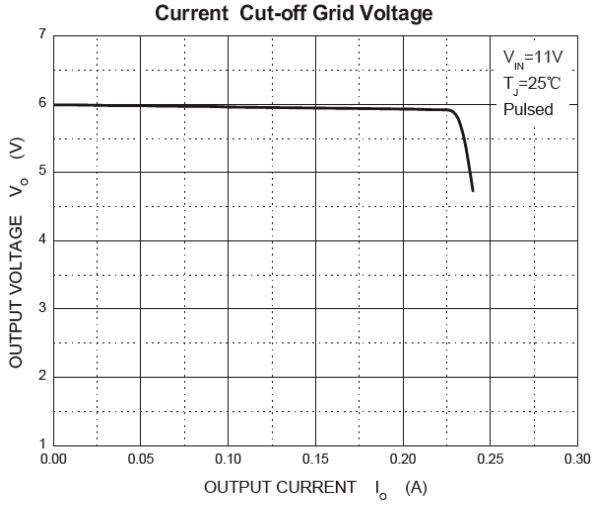
Dropout Characteristics



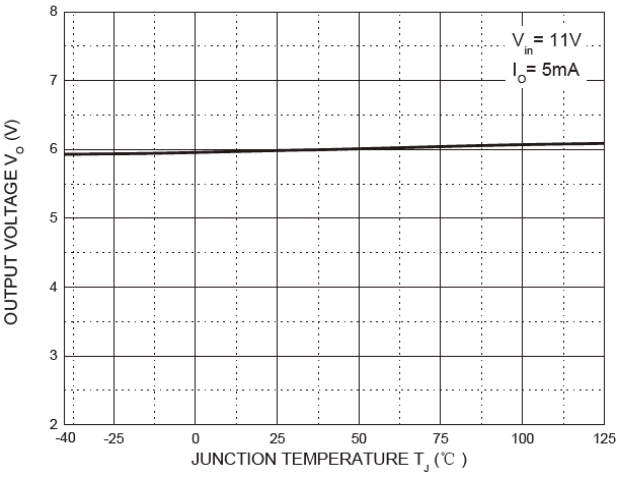
Quiescent Current



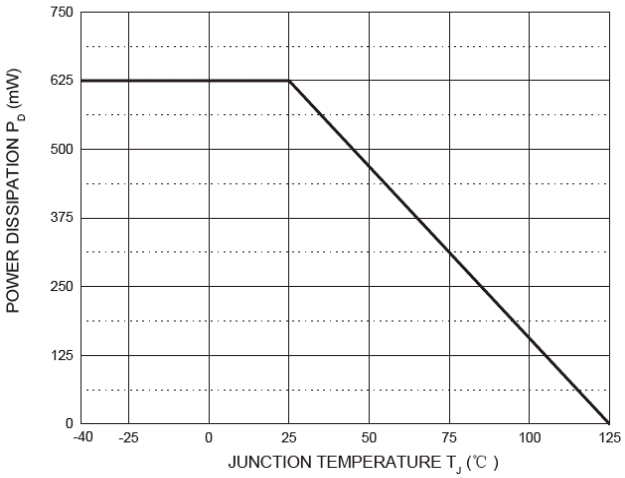
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

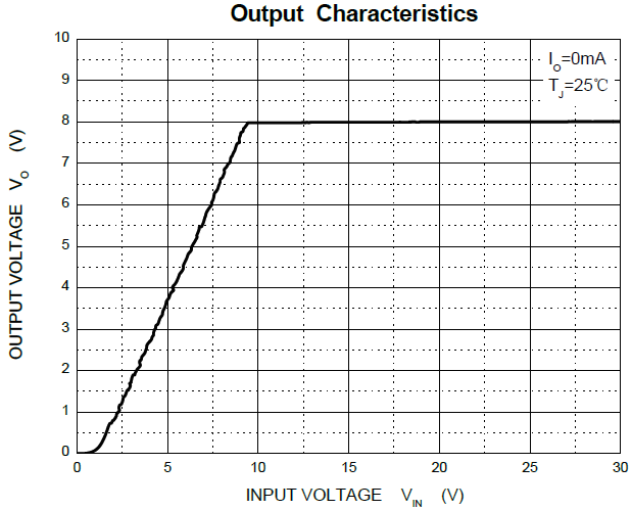


Power Derating Curve

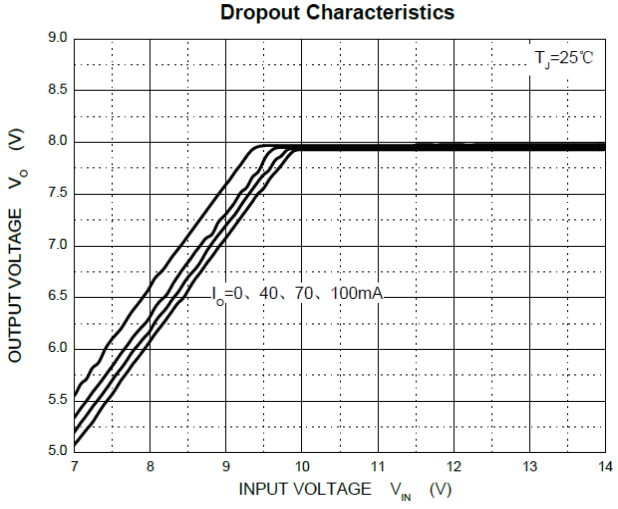


78L08 (V_{OUT} = 8.0V, T_J = 25℃, unless otherwise specified)

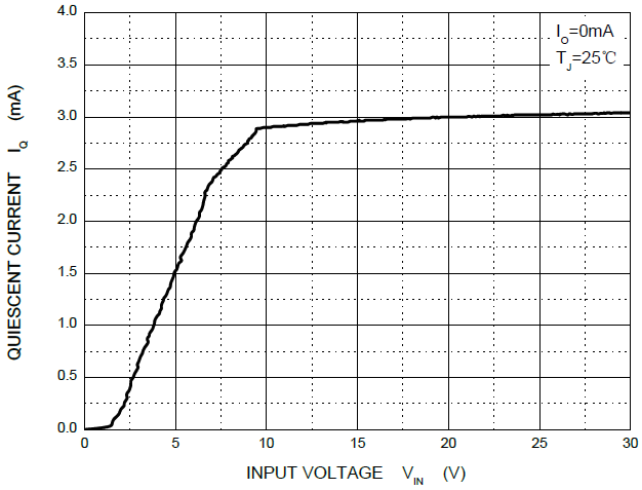
Output Characteristics



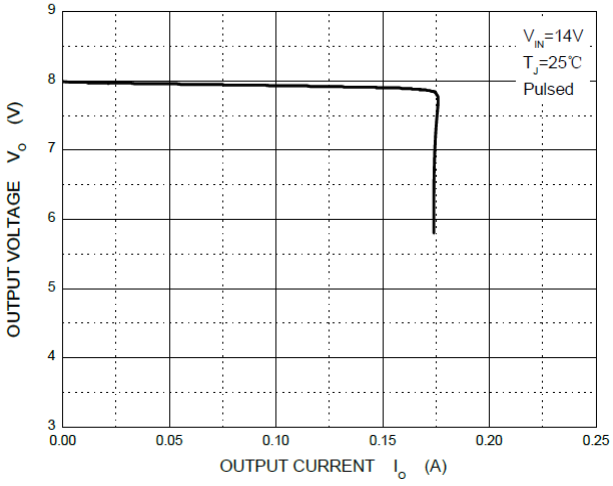
Dropout Characteristics



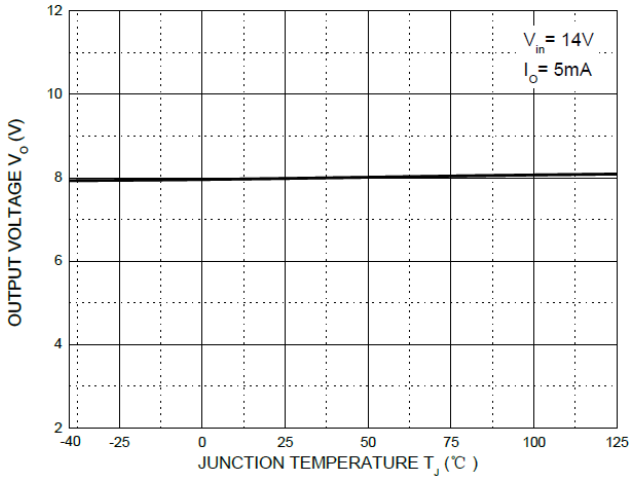
Quiescent Current vs Input Voltage



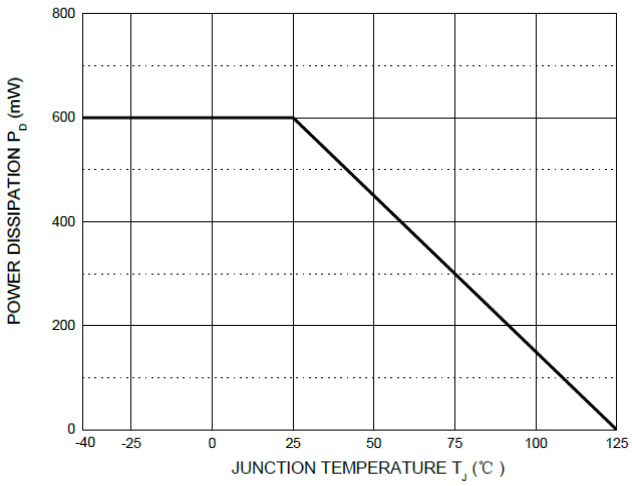
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

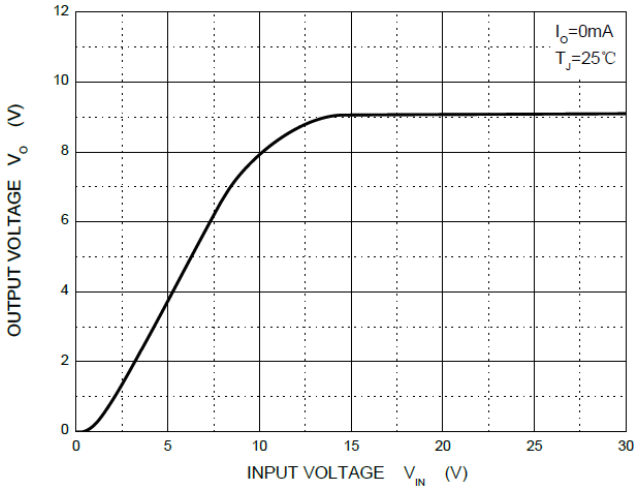


Power Derating Curve

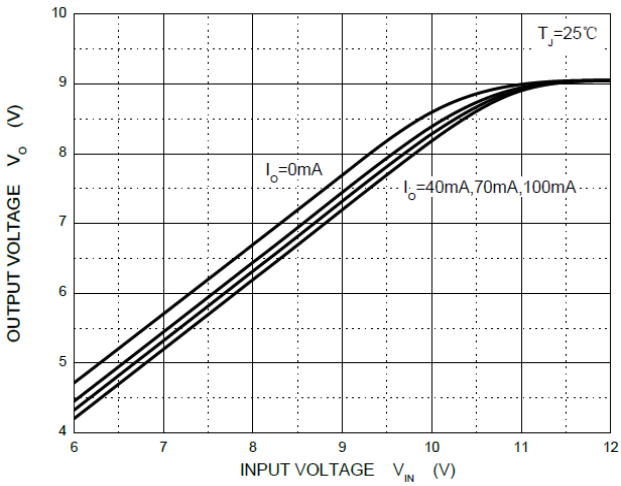


78L09 (V_{OUT} = 9.0V, T_J = 25℃, unless otherwise specified)

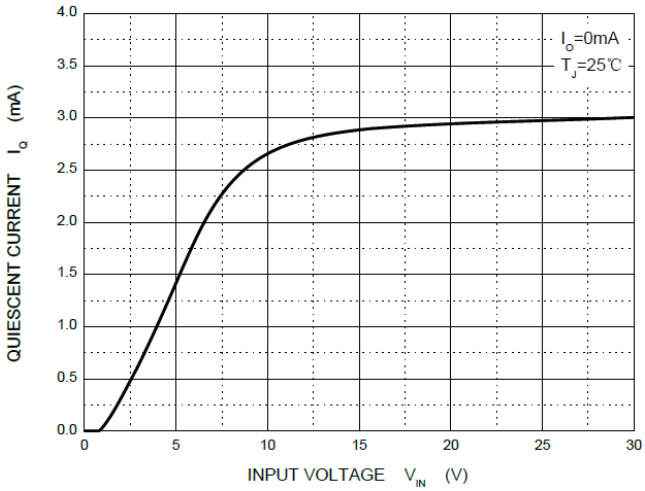
Output Characteristics



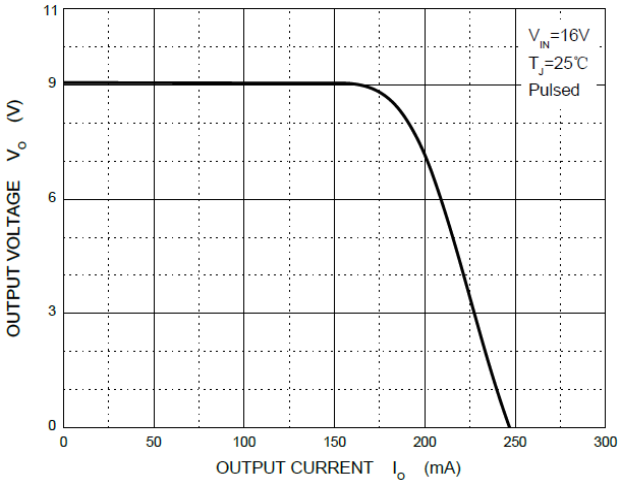
Dropout Characteristics



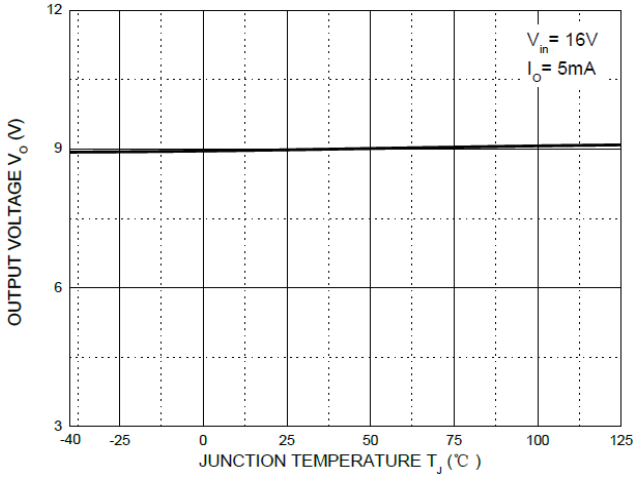
Quiescent Current vs Input Voltage



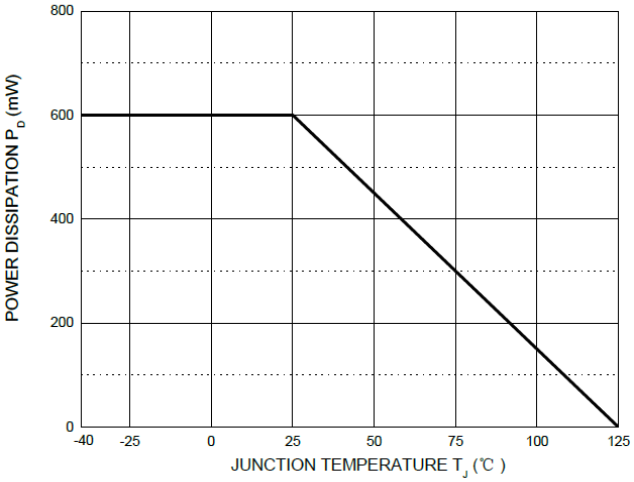
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

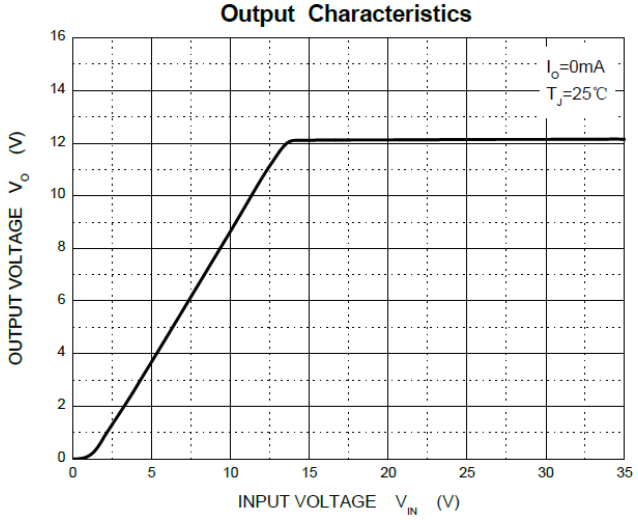


Power Derating Curve

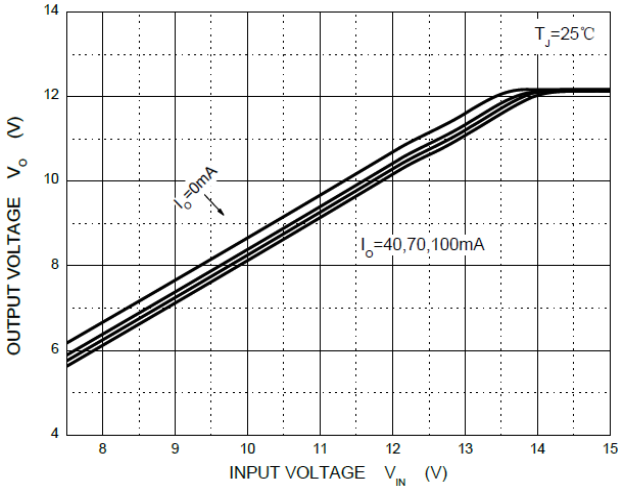


78L12 (V_{OUT} = 12V, T_J = 25℃, unless otherwise specified)

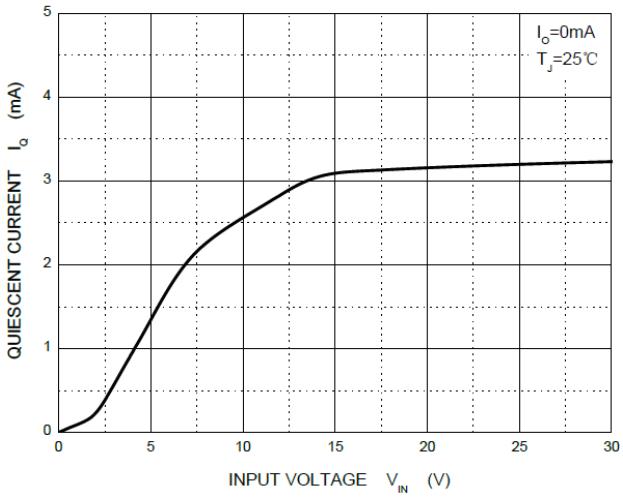
Output Characteristics



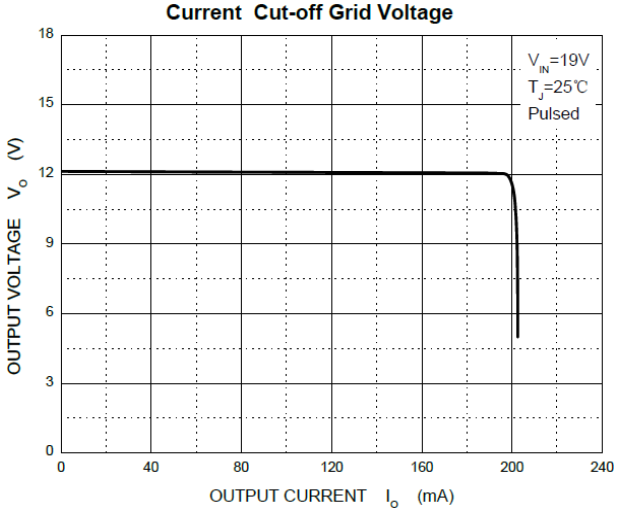
Dropout Characteristics



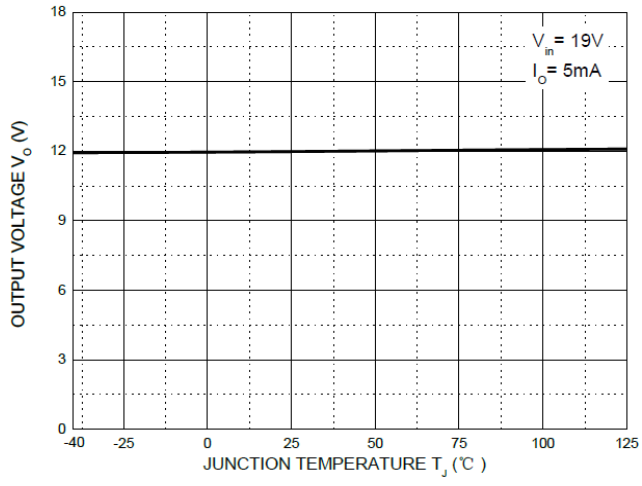
Quiescent Current



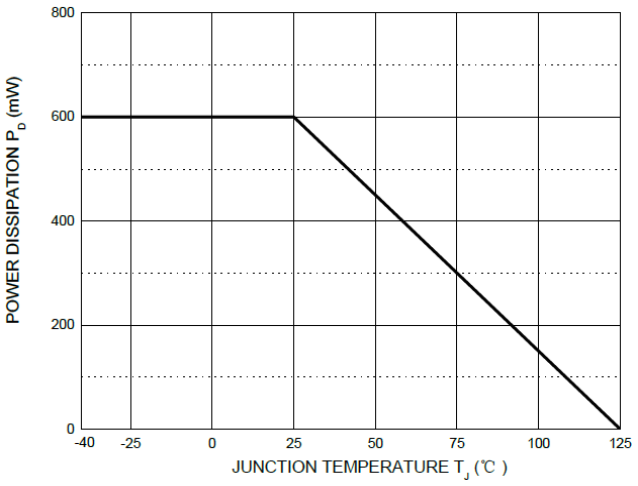
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

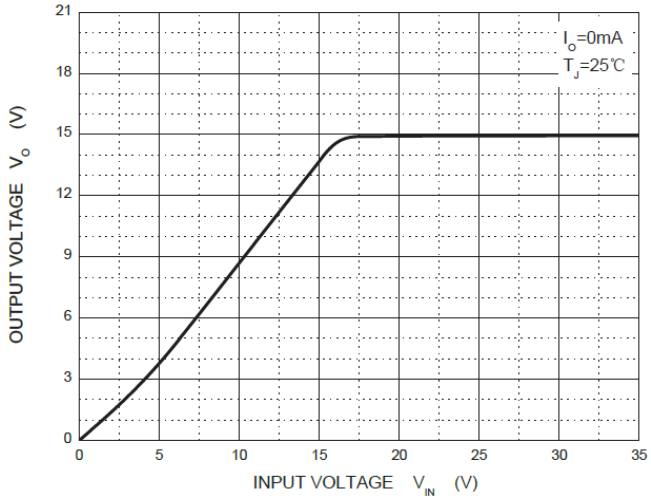


Power Derating Curve

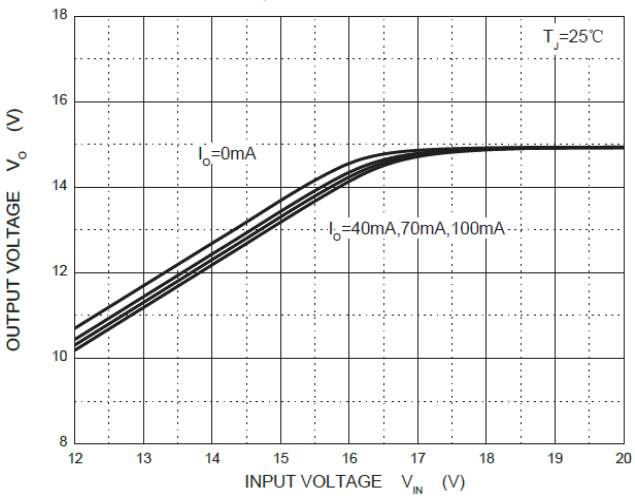


78L15 (V_{OUT} = 15V, T_J = 25℃, unless otherwise specified)

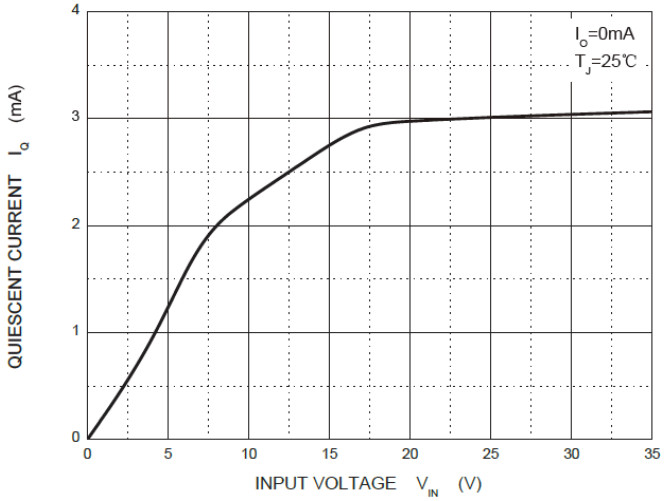
Output Characteristics



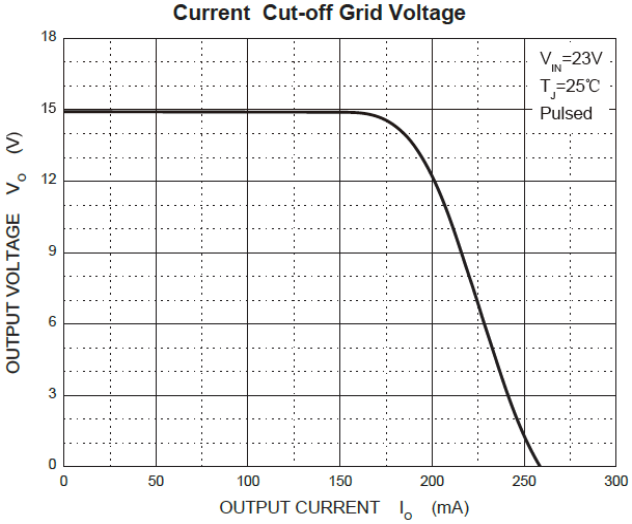
Dropout Characteristics



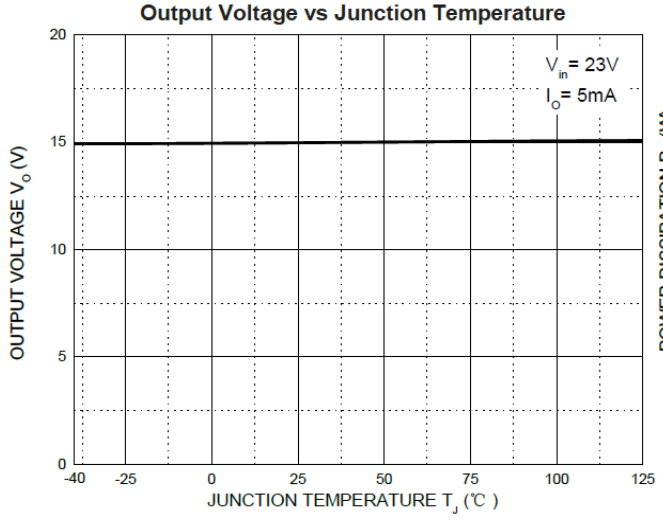
Quiescent Current vs Input Voltage



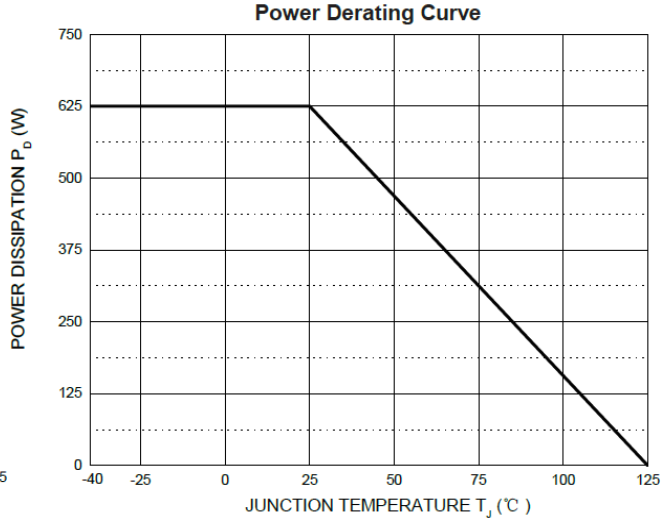
Current Cut-off Grid Voltage



Output Voltage vs Junction Temperature

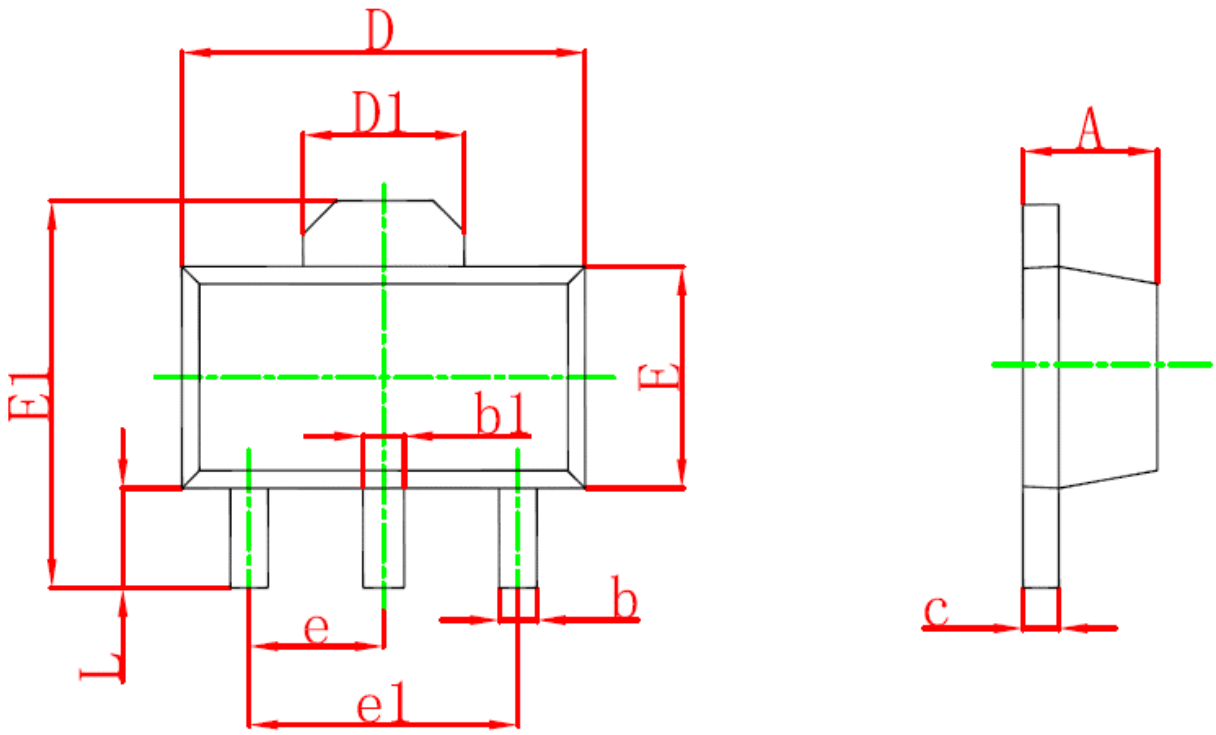


Power Derating Curve



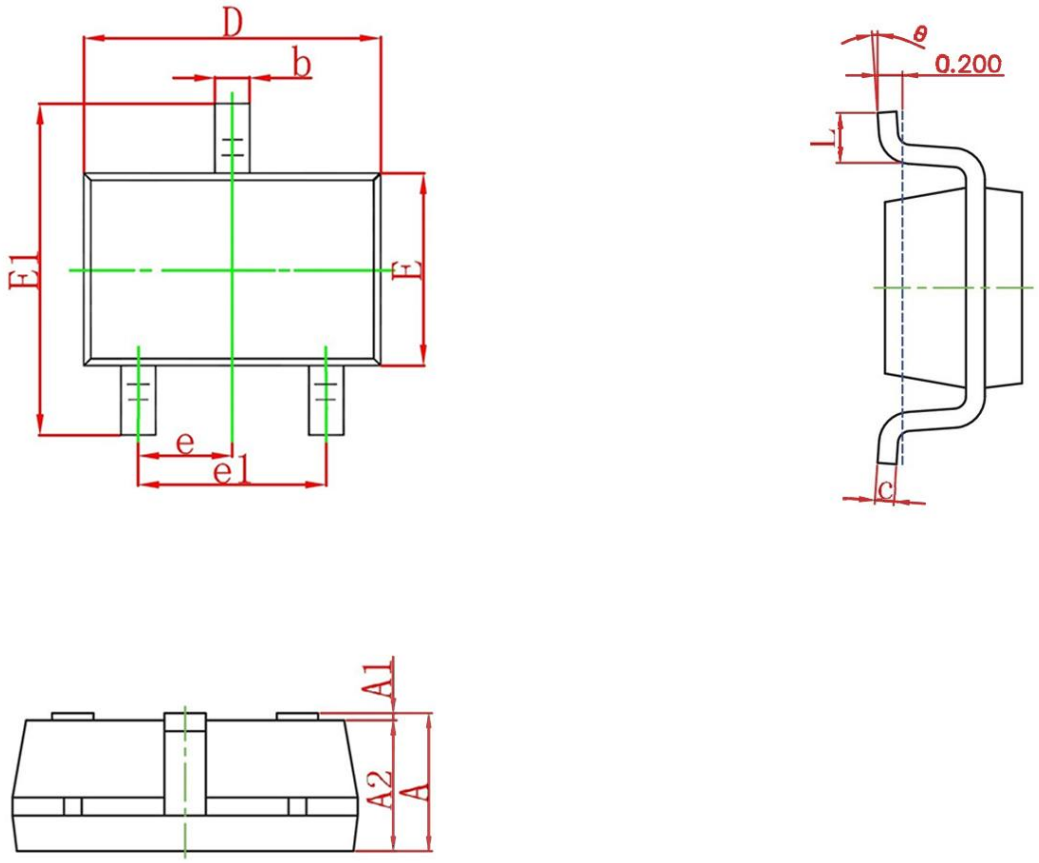
Mechanical Information

SOT-89 Package information



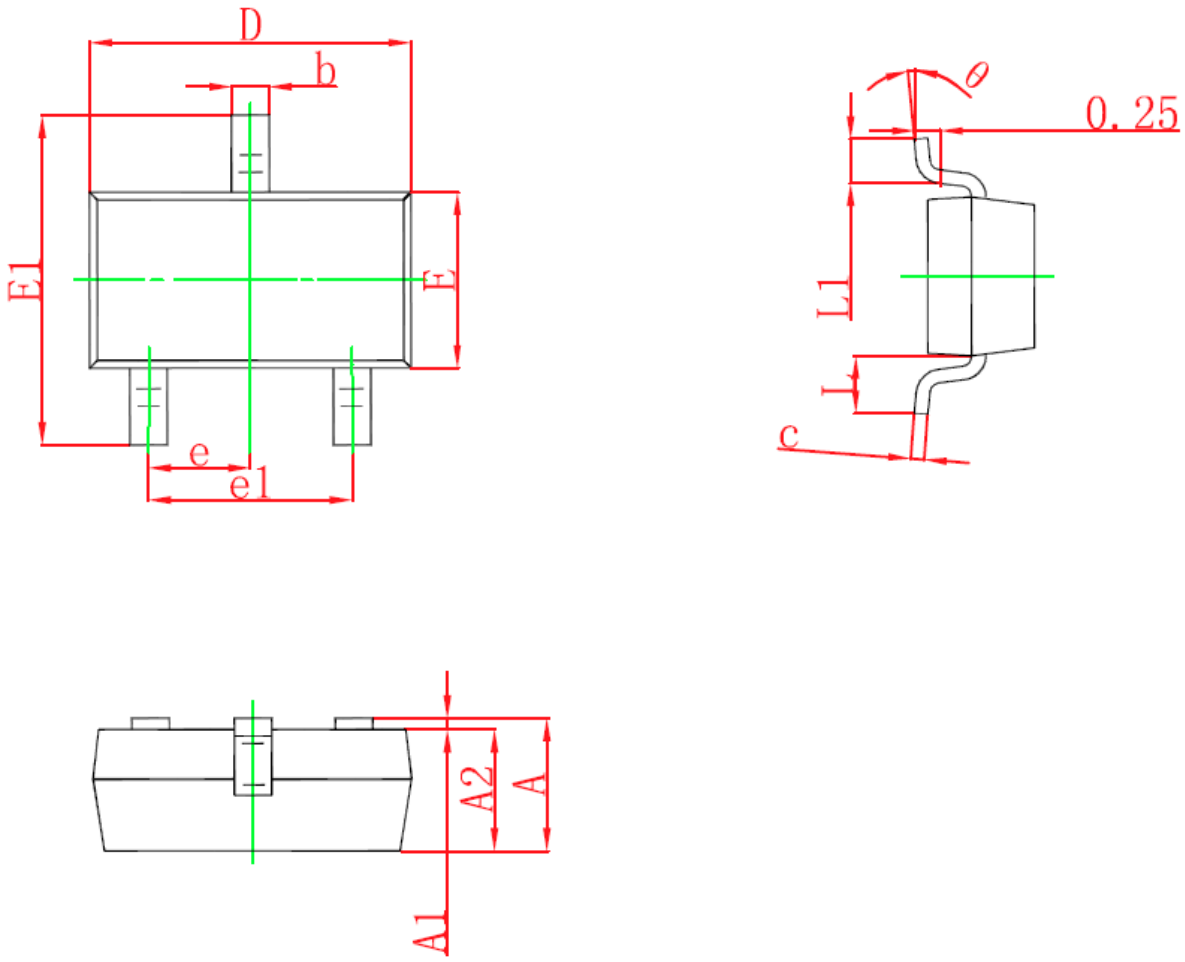
Symbol	Dimensions in Millimeters(mm)		Dimensions in Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

SOT-23-3L Package information



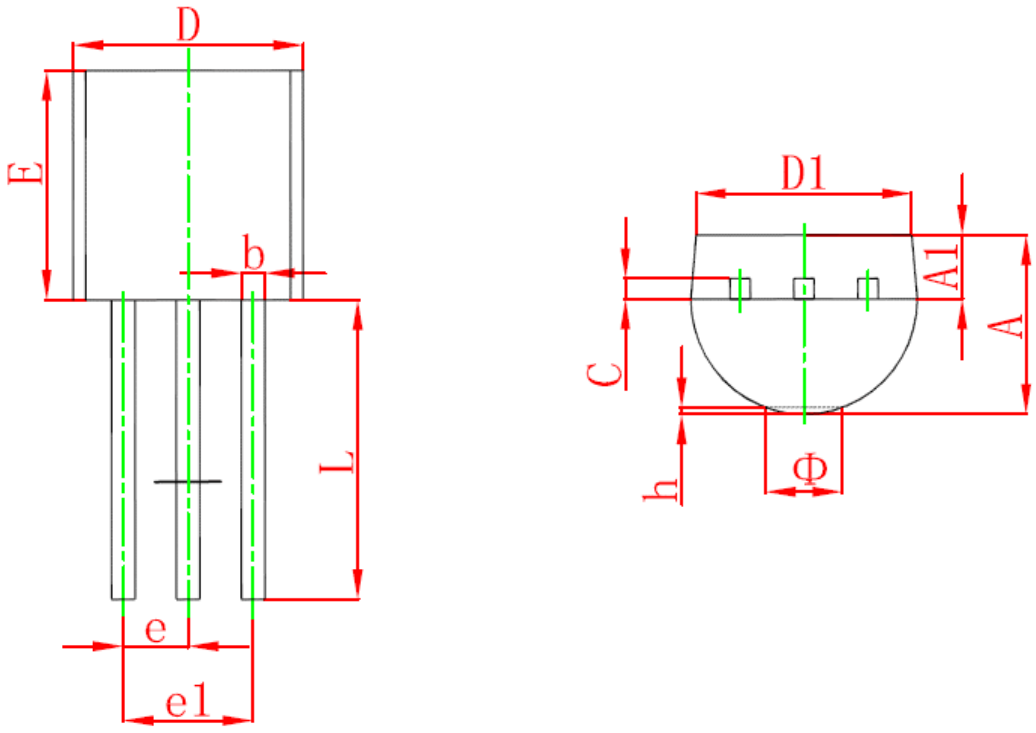
Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.042	0.050
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.042	0.046
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.112	0.120
E	1.500	1.700	0.060	0.068
E1	2.650	2.950	0.106	0.118
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT-23 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E1	2.250	2.550	0.088	0.100
E	1.200	1.400	0.047	0.055
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

TO-92 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.300	4.700	0.169	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270TYP		0.050TYP	
e1	2.440	2.640	0.096	0.104
L	13.000	15.000	0.555	0.571
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015