

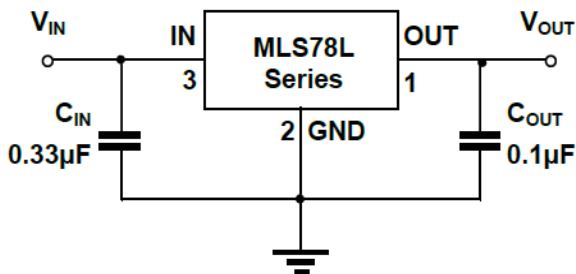
Introduction

The 78Lxx 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 78Lxx series adopts fixed voltage output without peripheral resistance, which improves the space utilization efficiency of printed circuit board (PCB). In addition, the 78Lxx series also integrates internal current limit, short-circuit protection and thermal shutdown, so that it is basically not affected by overload. Therefore, the 78Lxx 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.

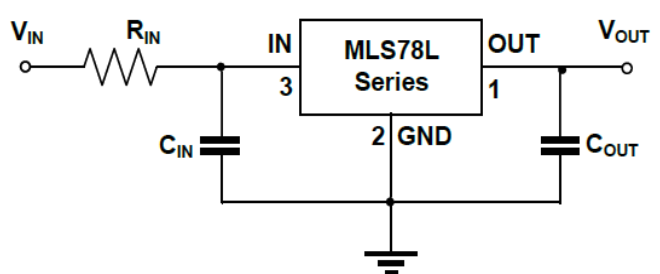
Available Packages

PART NUMBER	PACKAGES
MLS78L Series	SOT-23
	SOT-89-3L

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



(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
MLS78L-5.0	MLS78L05	SOT-23	3,000	45,000	180,000	7"reel
MLS78L-5.0	MLS78L05	SOT-89-3L	1,000	10,000	40,000	7"reel
MLS78L-6.0	MLS78L06	SOT-89-3L	1,000	10,000	40,000	7"reel
MLS78L-8.0	MLS78L08	SOT-89-3L	1,000	10,000	40,000	7"reel
MLS78L-9.0	MLS78L09	SOT-89-3L	1,000	10,000	40,000	7"reel
MLS78L-12	MLS78L12	SOT-89-3L	1,000	10,000	40,000	7"reel
MLS78L-15	MLS78L15	SOT-89-3L	1,000	10,000	40,000	7"reel

Features

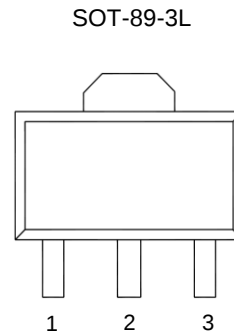
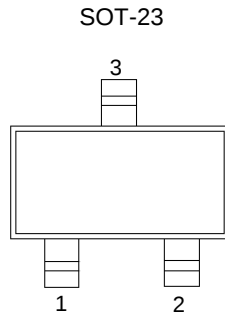
- Available Output Voltage:
5.0V, 6.0V, 8.0V, 9.0V, 12V and 15V
- Maximum Input Voltage:
30V for $V_{OUT} < 10V$
35V for $V_{OUT} > 10V$
- Maximum Output Current:
Exceed 100mA
- Output Tolerances:
 $\pm 3\%$ at $T_J = 25^\circ C$
 $\pm 5\%$ over the Operating T_J
- Build-in Current Limit
- Thermal Shutdown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

Applications

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

Pin Configuration and Marking Information

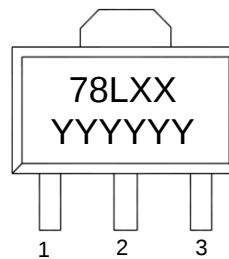
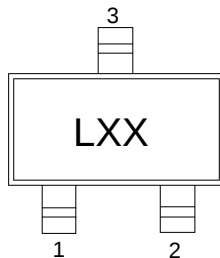
Pin Configuration and Function



Package Top View

Pin Name	78Lxx Series		I/O	Description
	SOT-23	SOT-89-3L		
IN	2	3	I	Input to the device.
GND	3	2	-	Regulator ground.
OUT	1	1	O	Output of the regulator.

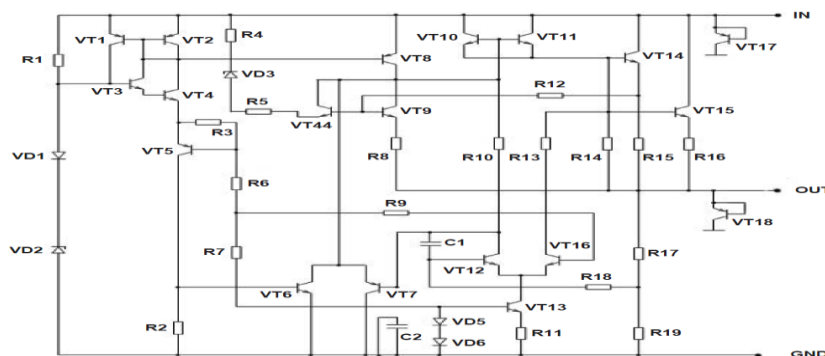
Marking Information



"78LXX or LXX": Product number, the "XX" in the "78LXX" or "LXX" represents the output voltage, for example, if $V_{OUT} = 5.0V$, "XX" is "05".

"YYY": 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		35	
	78L12			
	78L15			
Maximum power dissipation	SOT-23	P _{D Max}	Internally Limited ⁽³⁾	W
	SOT-89-3L			
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 ($V_{\text{OUT}} = 5.0\text{V}$, $V_{\text{IN}} = 10\text{V}$, $I_{\text{OUT}} = 40\text{mA}$, $C_{\text{IN}} = 0.33\mu\text{F}$, $C_{\text{OUT}} = 0.1\mu\text{F}$, $T_J = 25^\circ\text{C}$, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions	Min	Typ	Max	Uuit
Input voltage	V_{IN}	-	-	-	30	V
Output voltage	V_{OUT}	$T_J = 25^\circ\text{C}$	4.85	5.00	5.15	V
		$V_{\text{IN}} = 7 \text{ to } 20\text{V}$, $I_{\text{OUT}} = 1 \text{ to } 40\text{mA}$	4.75	5.00	5.25	V
		$I_{\text{OUT}} = 1 \text{ to } 70\text{mA}$	4.75	5.00	5.25	V
Output current	I_{OUT}	$T_J = 25^\circ\text{C}$	100	-	-	mA
Quiescent current	I_Q	$I_{\text{OUT}} = 0\text{mA}$	-	3.8	6.0	mA
Quiescent current change	ΔI_Q	$V_{\text{IN}} = 8 \text{ to } 20\text{V}$	-	-	1.5	mA
		$I_{\text{OUT}} = 1 \text{ to } 40\text{mA}$	-	-	0.1	mA
Dropout voltage	V_{DO}	$T_J = 25^\circ\text{C}$	-	1.7	-	V
Line regulation	ΔV_{LINE}	$V_{\text{IN}} = 7 \text{ to } 20\text{V}$, $T_J = 25^\circ\text{C}$	-	32.0	150	mV
		$V_{\text{IN}} = 8 \text{ to } 20\text{V}$, $T_J = 25^\circ\text{C}$	-	26.0	100	mV
Load regulation	ΔV_{LOAD}	$I_{\text{OUT}} = 1 \text{ to } 100\text{mA}$, $T_J = 25^\circ\text{C}$	-	15.0	60	mV
		$I_{\text{OUT}} = 1 \text{ to } 40\text{mA}$, $T_J = 25^\circ\text{C}$	-	8.0	30	mV
Output noise voltage	V_N	$f = 10 \text{ to } 100\text{kHz}$, $T_J = 25^\circ\text{C}$	-	-	0.2	$\mu\text{V}/V_{\text{OUT}}$
Ripple rejection	RR	$V_{\text{IN}} = 8 \text{ to } 20\text{V}$, $f = 120\text{Hz}$	-	100	-	dB

78L06 ($V_{\text{OUT}} = 6.0\text{V}$, $V_{\text{IN}} = 11\text{V}$, $I_{\text{OUT}} = 40\text{mA}$, $C_{\text{IN}} = 0.33\mu\text{F}$, $C_{\text{OUT}} = 0.1\mu\text{F}$, $T_J = 25^\circ\text{C}$, unless otherwise specified)

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

78L08 ($V_{OUT} = 8.0V$, $V_{IN} = 14V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = 25^\circ C$, unless otherwise specified)

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

78L09 ($V_{OUT} = 9.0V$, $V_{IN} = 16V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = 25^\circ C$, unless otherwise specified)

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

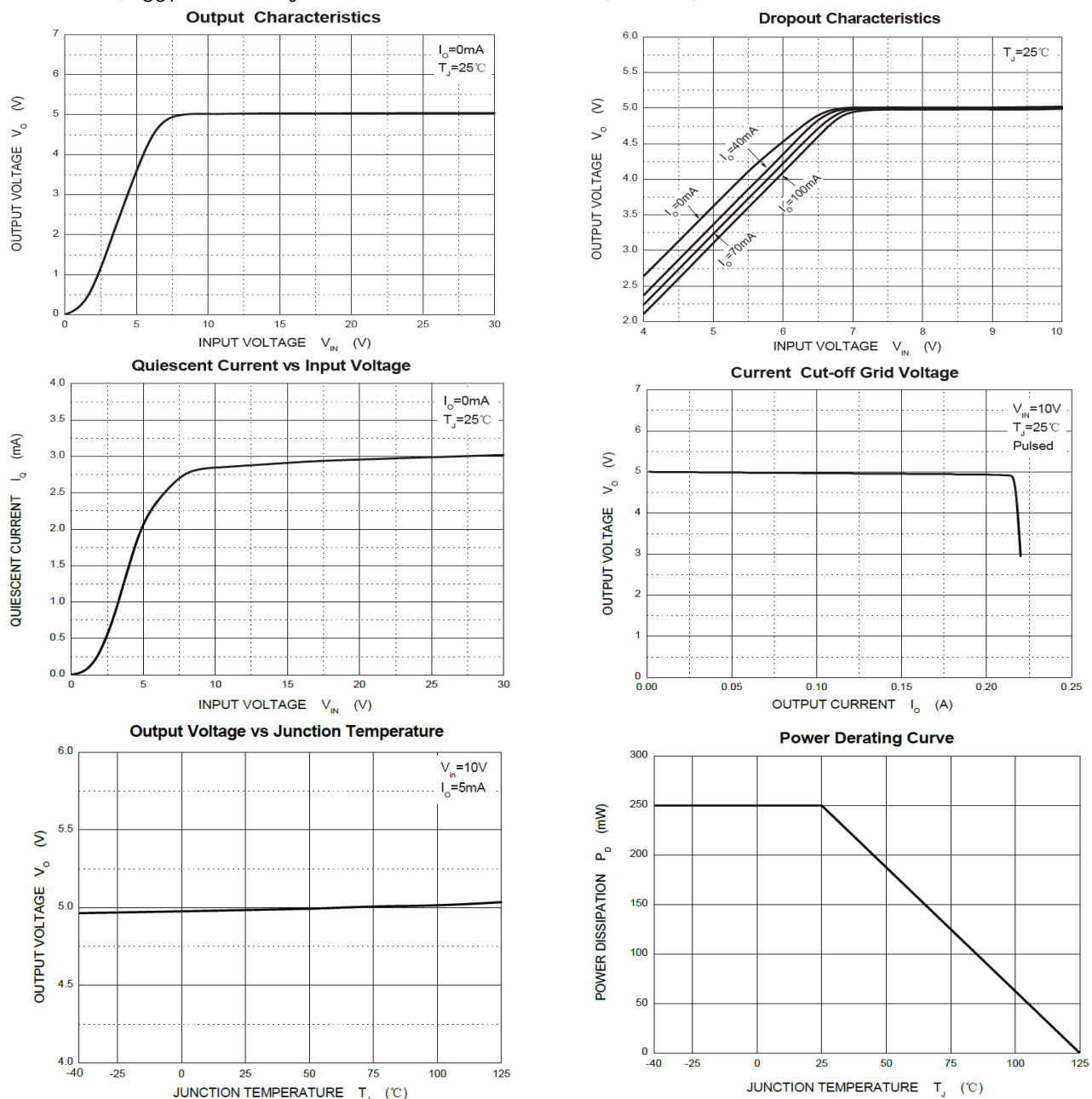
78L12 ($V_{OUT} = 12.0V$, $V_{IN} = 19V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = 25^\circ C$, unless otherwise specified)

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

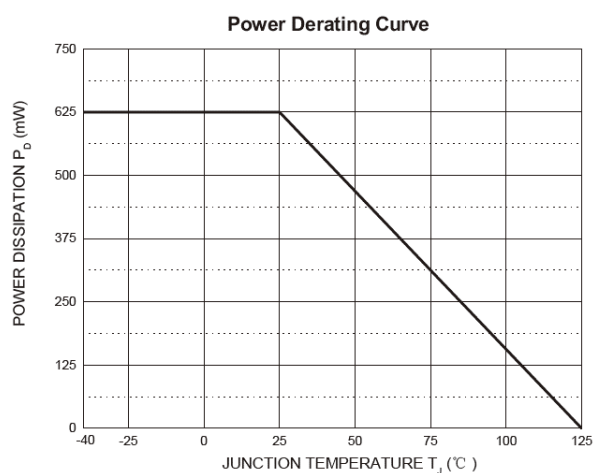
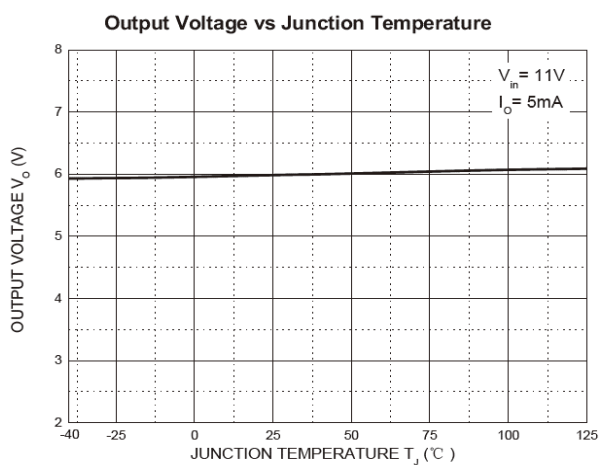
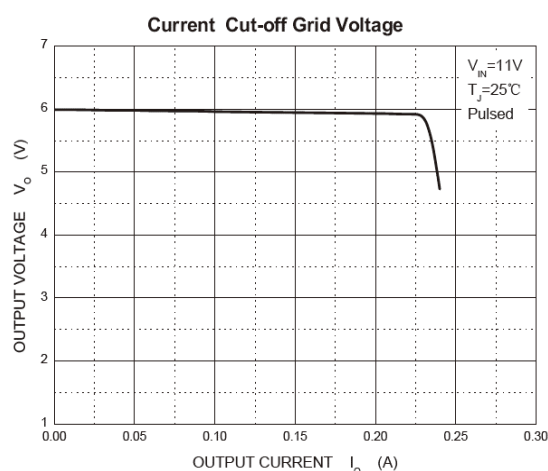
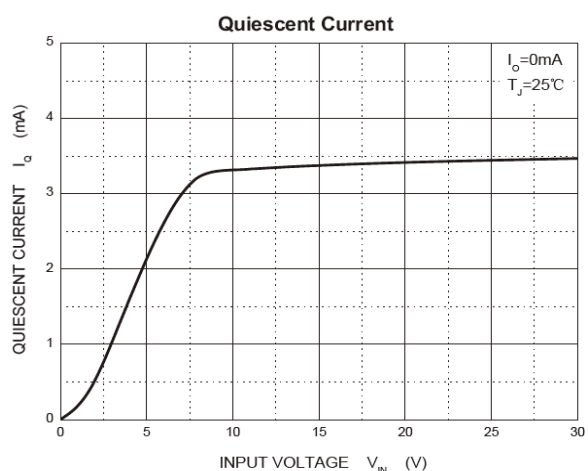
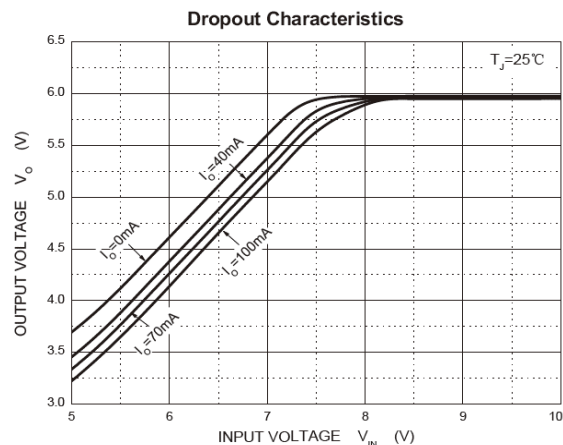
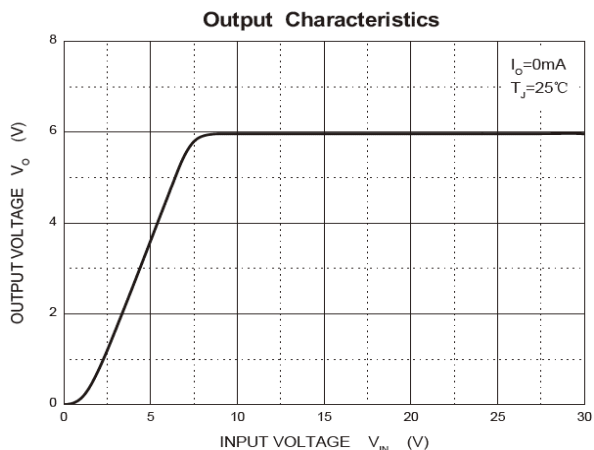
78L15 ($V_{OUT} = 15.0V$, $V_{IN} = 23V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = 25^\circ C$, unless otherwise specified)

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

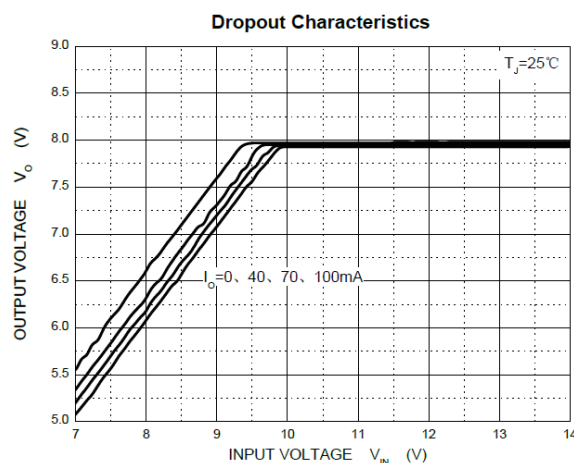
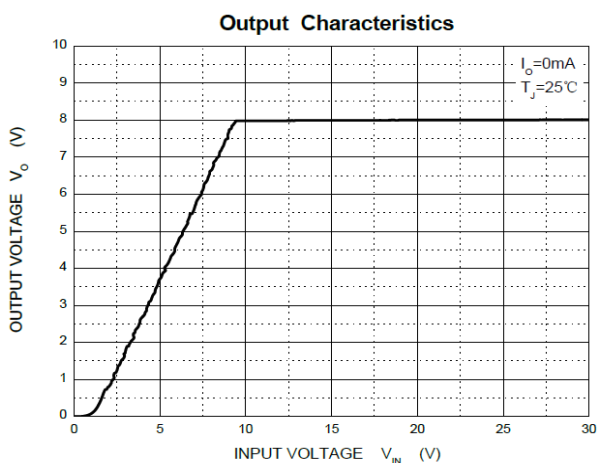
Typical Characteristics

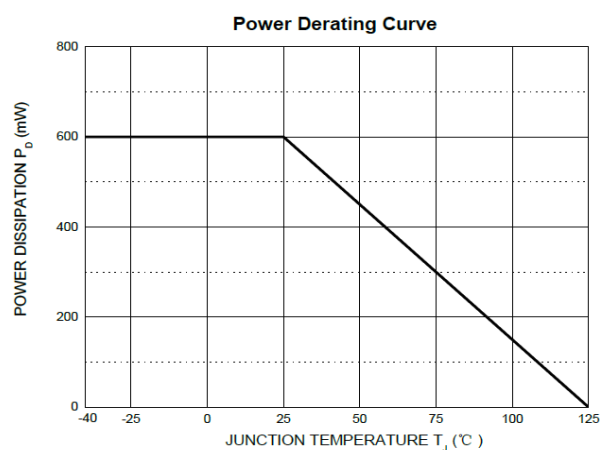
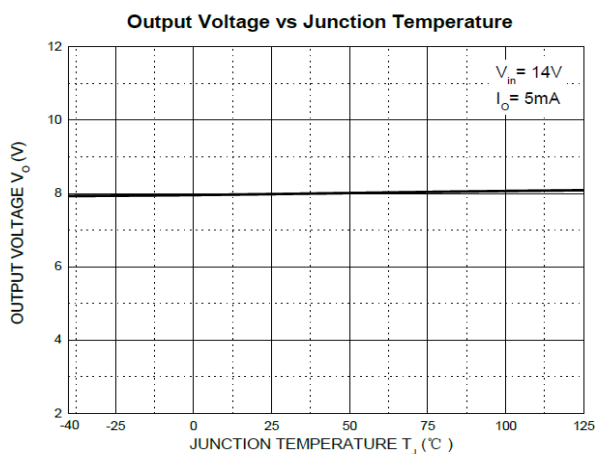
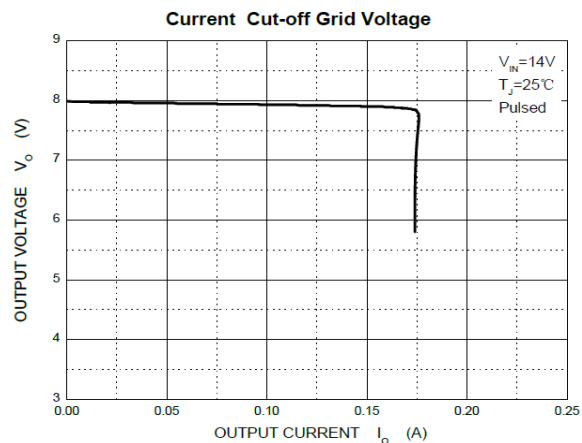
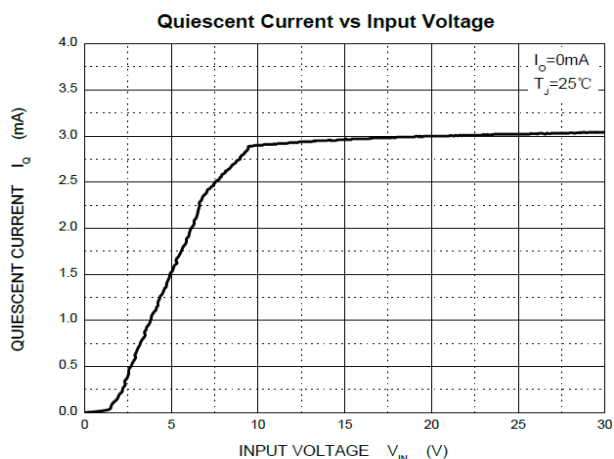
78L05 ($V_{OUT} = 5.0V$, $T_J = 25^\circ C$, unless otherwise specified)


78L06 ($V_{OUT} = 6.0V$, $T_J = 25^\circ C$, unless otherwise specified)

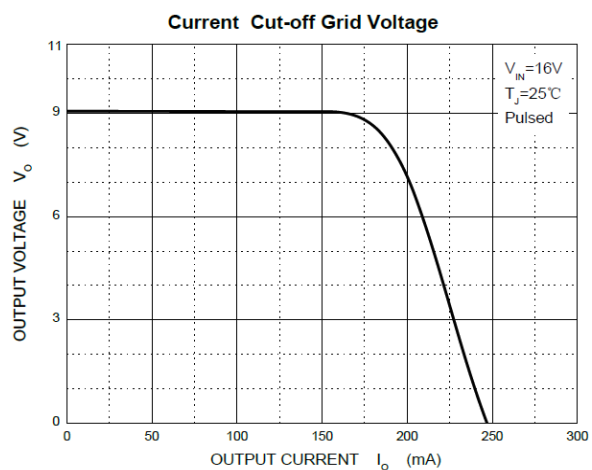
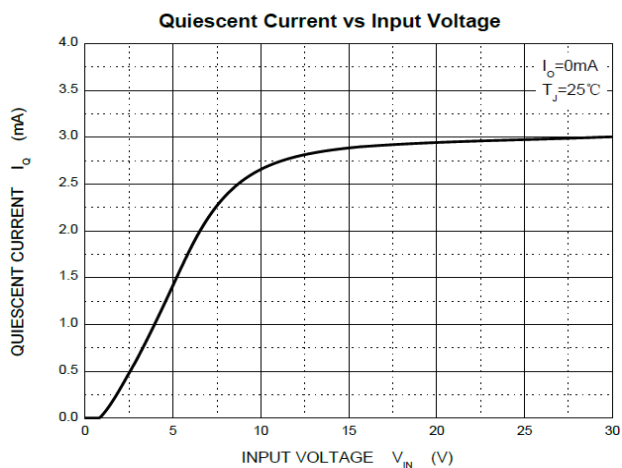
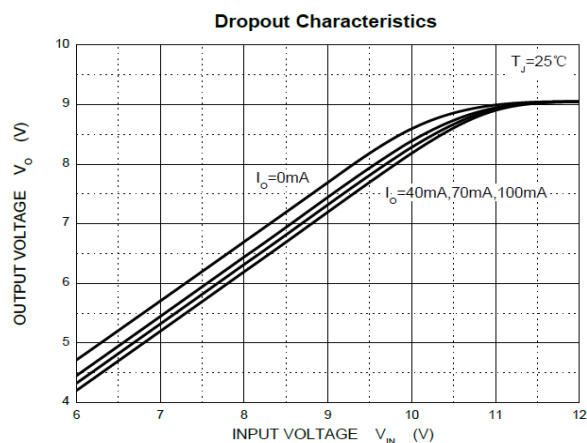
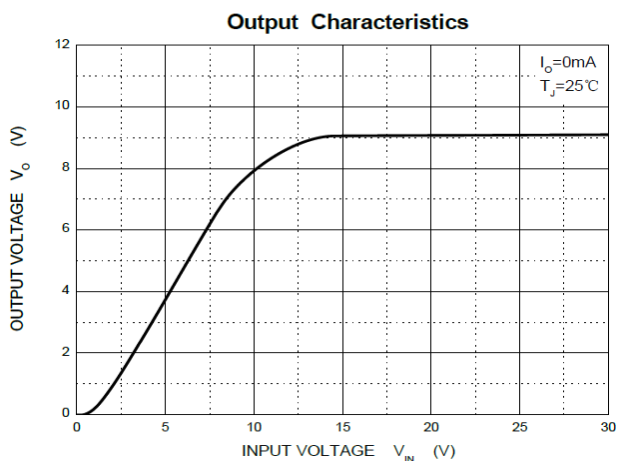


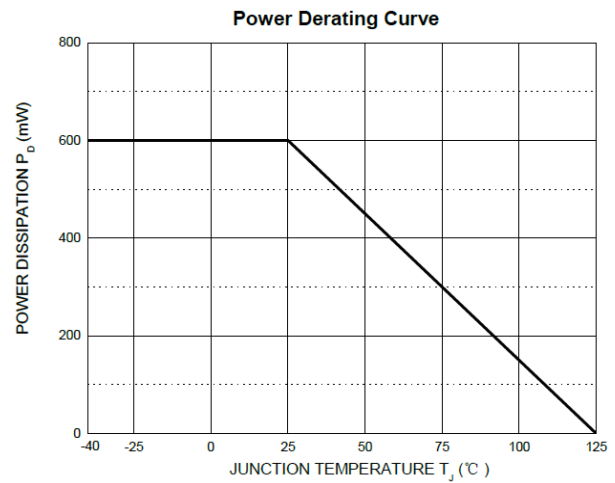
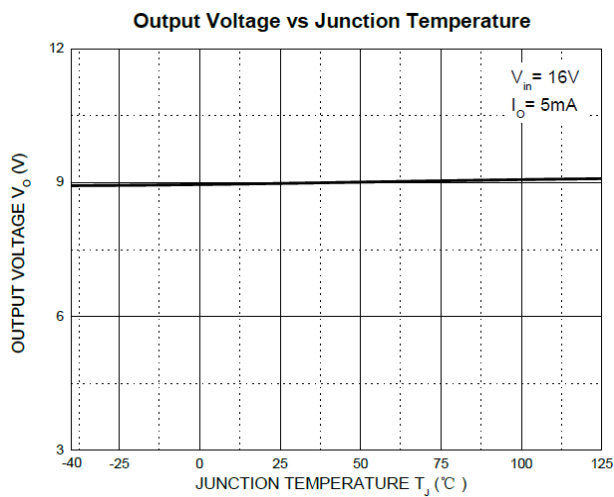
78L08 ($V_{OUT} = 8.0V$, $T_J = 25^\circ C$, unless otherwise specified)



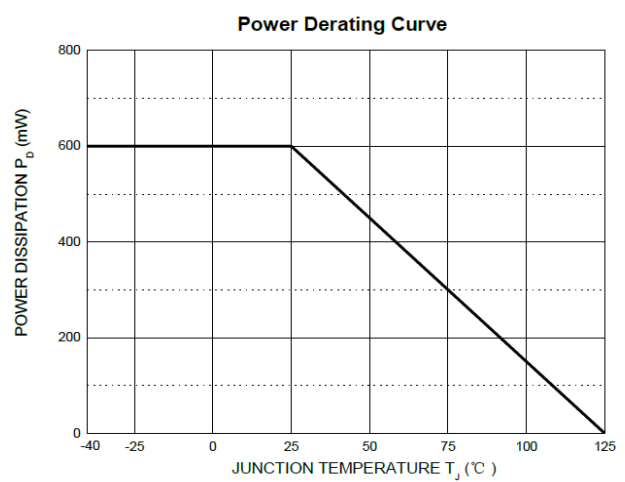
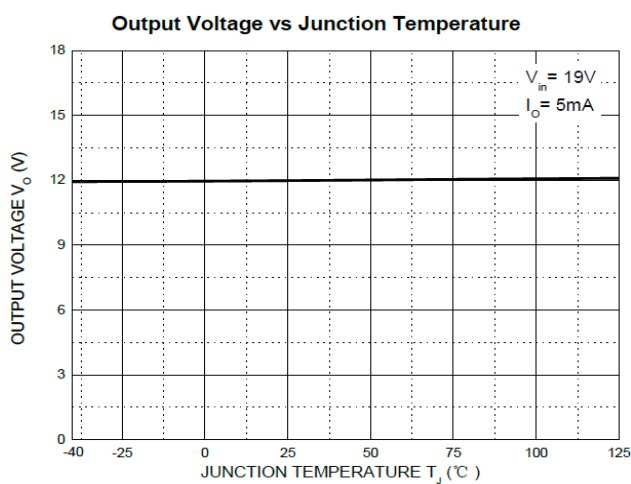
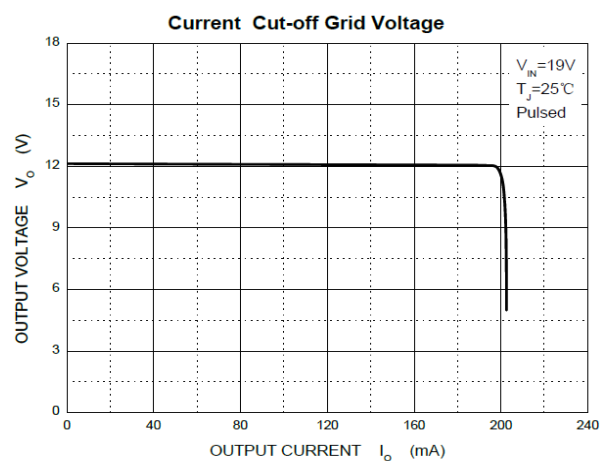
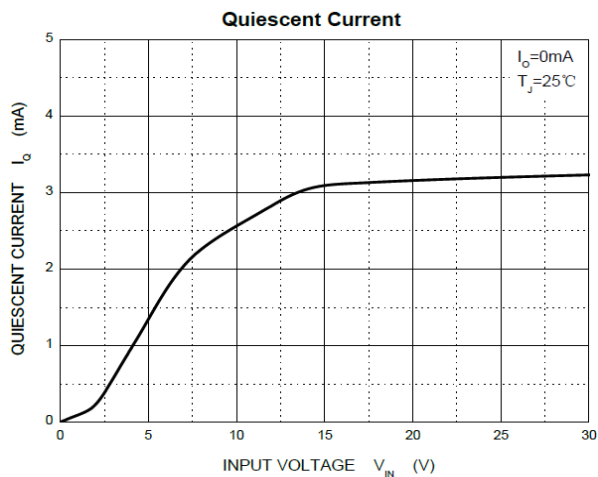
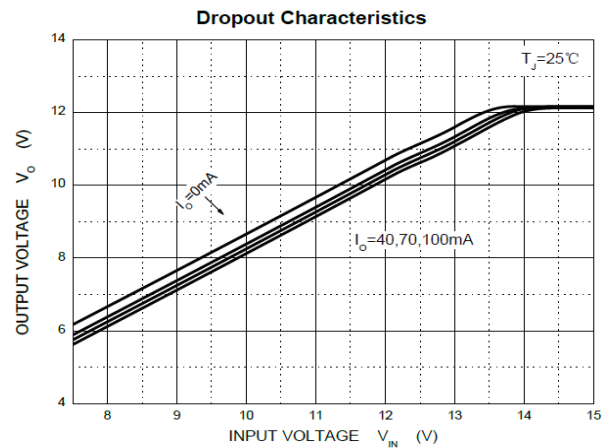
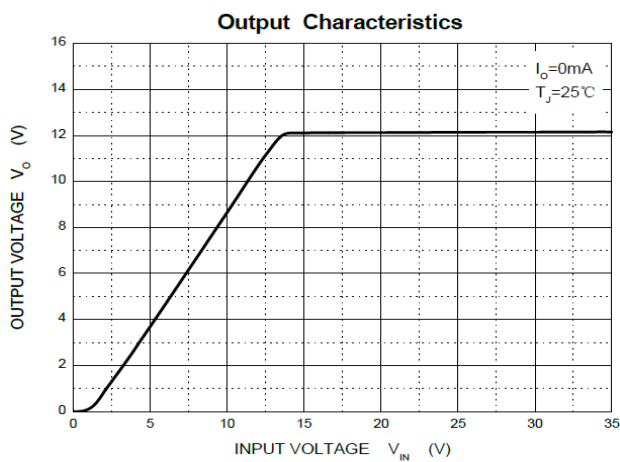


78L09 ($V_{OUT} = 9.0\text{V}$, $T_J = 25^\circ\text{C}$, unless otherwise specified)



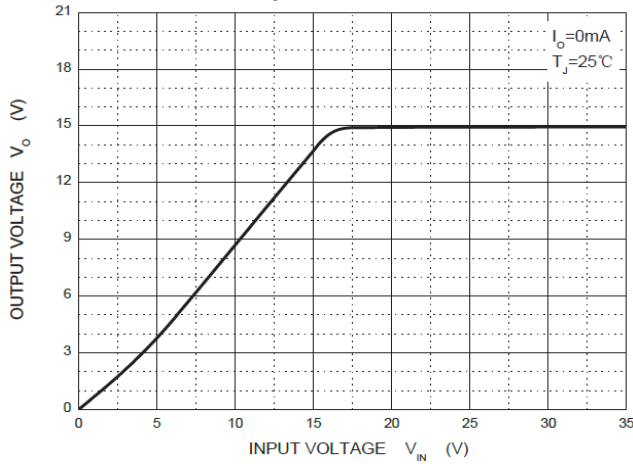


78L12 ($V_{OUT} = 12V$, $T_J = 25^\circ C$, unless otherwise specified)

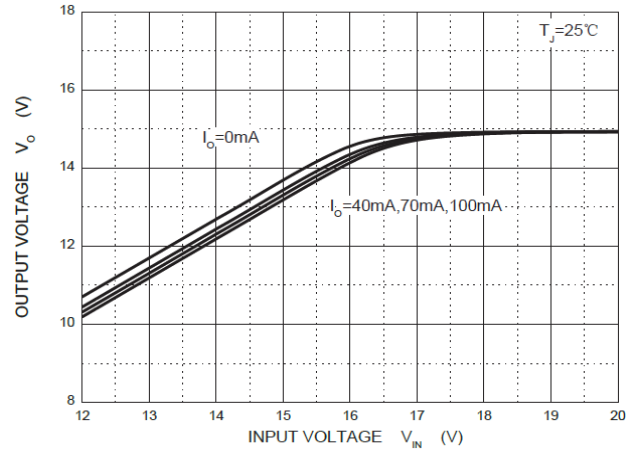


78L15 ($V_{OUT} = 15V$, $T_J = 25^\circ C$, unless otherwise specified)

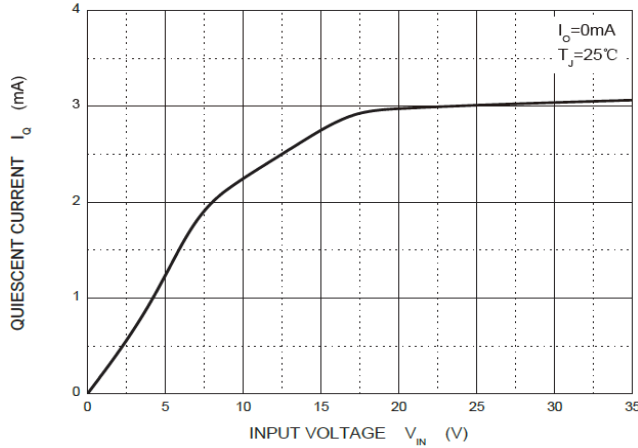
Output Characteristics



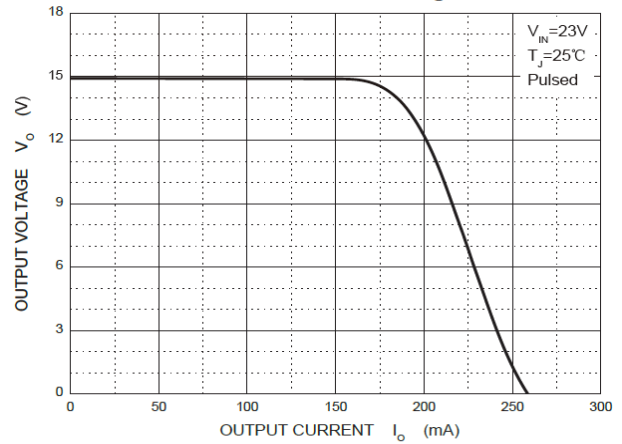
Dropout Characteristics



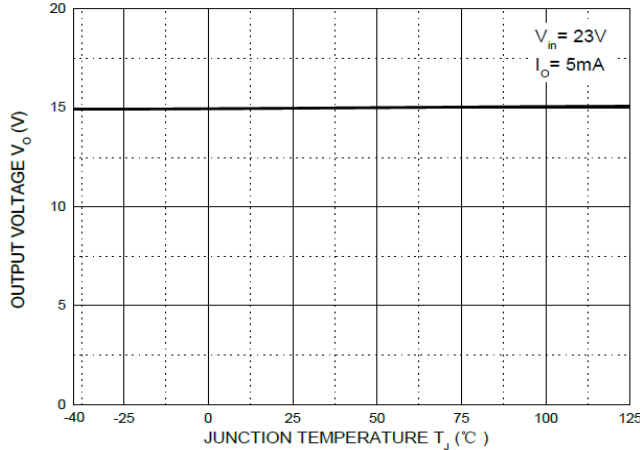
Quiescent Current vs Input Voltage



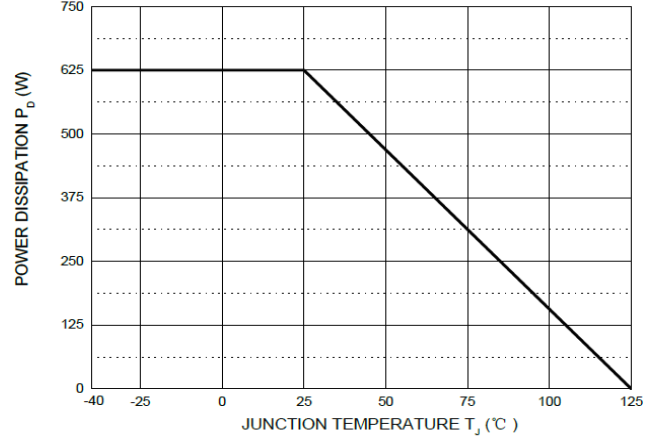
Current Cut-off Grid Voltage



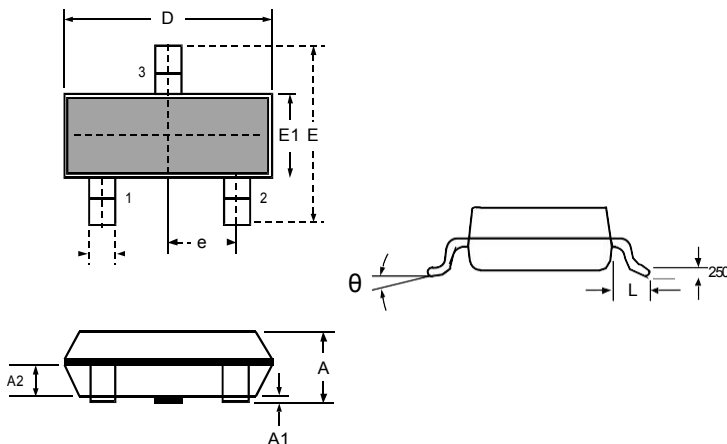
Output Voltage vs Junction Temperature



Power Derating Curve



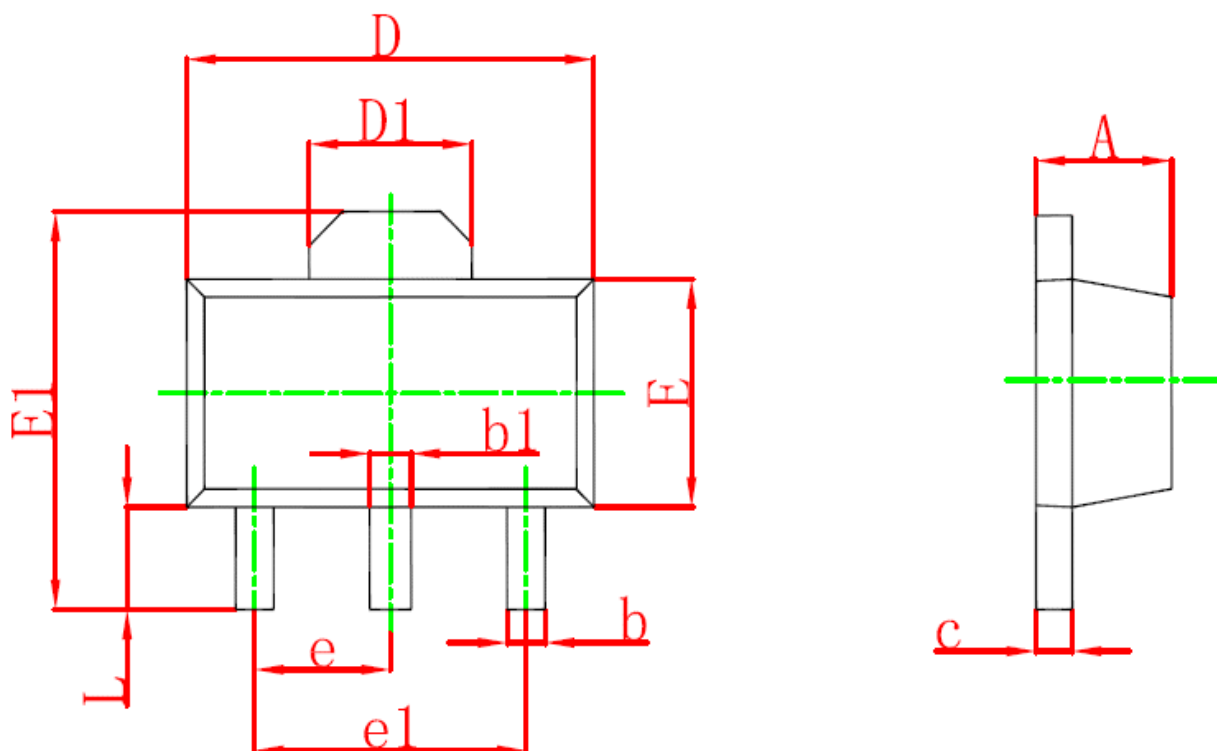
Package Outline Dimensions: SOT-23



DIMENSIONS

SYMBOL	MILLIMETER		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
D	2.800	3.000	0.110	0.118
b	0.300	0.500	0.012	0.020
E	2.250	2.550	0.089	0.100
E1	1.200	1.400	0.047	0.055
e	0.950 BSC		0.037 BSC	
L	0.300	0.500	0.012	0.020
θ	0	8°	0	8°

Package Outline Dimensions: 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