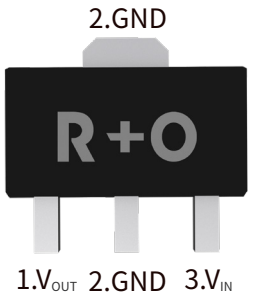
100/150mA Three Teminal Regulator

Features

- Quiescent Current: 4.3mA(V_{OUT}=10V);5.5mA(V_{OUT}=3.3V);6mA (V_{OUT}=5,6,8,9,12,15V)
- Input Voltage: 30V(V_{OUT}=3.3,9V); 35V(V_{OUT}=5,6,8,10,12,15V)
- Output Current: 100mA(V_{OUT}=5~15V); 150mA(V_{OUT}=3.3V)
- Low Dropout Voltage: 1.7V(Max.)@80mA (V_{OUT}=3.3V)
- Thermal overload protection
- Short circuit current limiting

Output Current
100/150mA
Input Voltage
30/35V

SOT-89



Applications

- Battery Power Supply Equipment
- Communication Equipment
- Audio/Video Equipment
- Monitor Equipment

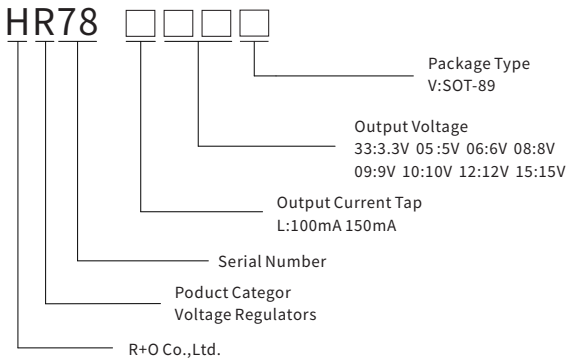
General Description

The HR78 Series is three-terminal positive regulators. One of these regulators can deliver up to 150mA of output current. The internal limiting and thermal-shutdown features of the regulator make them essentially immune to overload. When used as are placement for a zener diode-resistor Combination, an effective improvement in output impedance can be obtained, together with lower quiescent current.

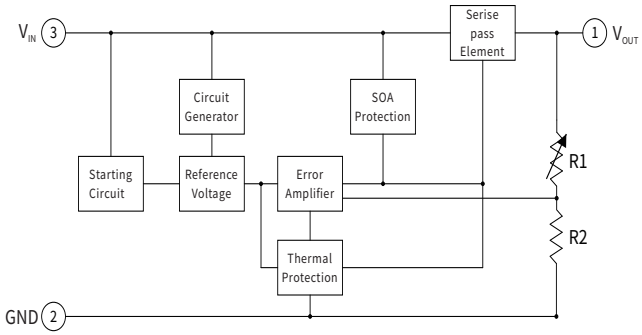
Reference News

SOT-89 Marking:
HR78L33V: 78L33 HR78L05V: 78L05
HR78L06V: 78L06 HR78L08V: 78L08
HR78L09V: 78L09 HR78L10V: 78L10
HR78L12V: 78L12 HR78L15V: 78L15

Part Numbering



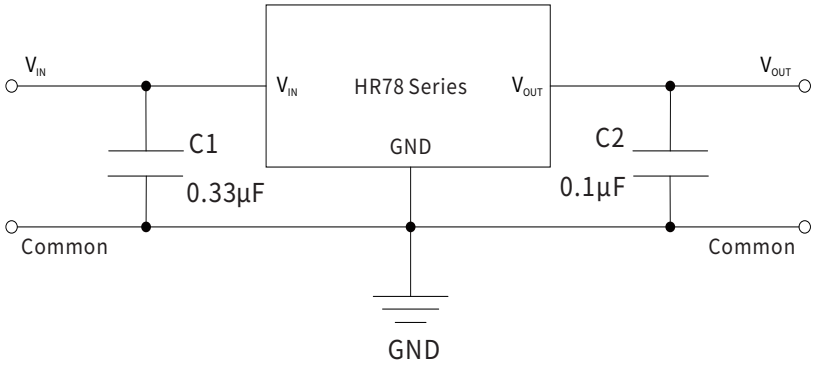
Block Diagram



Ordering Information

Package	Package Code	Unit Weight(g)	Reel(pcs)	Box(pcs)	Carton(pcs)	Delivery Mode	MSL
SOT-89	R1	0.045	1000	8000	48000	7''	3

Typical Application Circuit



Absolute Maximum Ratings (Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL		Value	UNIT
Input Voltage Limit	V_{IN}	HR78L33V HR78L09V	30	V
		HR78L05V HR78L06V HR78L08V HR78L10V HR78L12V HR78L15V	35	
Operating Current	I_O	HR78L05V HR78L06V HR78L08V HR78L09V HR78L10V HR78L12V HR78L15V	100	mA
		HR78L33V	150	mA
Power Dissipation	P_D	HR78L33V HR78L08V HR78L09V HR78L10V	500	mW
		HR78L05V HR78L06V HR78L12V HR78L15V	600	mW
Thermal Resistance Junction-Ambient	$R_{\theta JA}$	HR78L33V HR78L08V HR78L09V HR78L10V	250	°C /W
		HR78L05V HR78L06V HR78L12V HR78L15V	208	°C /W
Solder Temperature/Time	T_d		260/10	°C /S
Operating Ambient Temperature	T_A		-20~+125	°C
Junction Temperature	T_J		-55~+150	°C
Storage Temperature	T_{stg}		-55~+150	°C

Electrical Characteristics(HR78L33V) (Vi=8.3V Io=80mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=80mA,V_{IN}=8.3V	3.168	3.3	3.432	V
Output Voltage	V_{OUT}	5.3V ⩽ V_{IN} ⩽ 20V 1mA ⩽ I_{OUT} ⩽ 80mA	3.135	—	3.465	V
Output Voltage	V_{OUT}	V_{IN}=8.3V 1mA ⩽ I_{OUT} ⩽ 140mA	3.135	—	3.465	V
Output Current	I_O	V_{IN}=8.3V	—	150	—	mA
Dropout Voltage	V_D	I_{OUT}=80mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=8.3V I_{OUT}=0mA	—	2	5.5	mA
Quiescent Current Change	$\triangle I_Q$	6.3V ⩽ V_{IN} ⩽ 20V	—	—	1.5	mA
Quiescent Current Change	$\triangle I_Q$	1mA ⩽ I_{OUT} ⩽ 80mA	—	—	0.1	mA
Line Regulation	$\triangle V_{OUT}$	I_{OUT}=80mA 5.3V ⩽ V_{IN} ⩽ 20V	—	7	150	mV
Line Regulation	$\triangle V_{OUT}$	I_{OUT}=80mA 6.3V ⩽ V_{IN} ⩽ 20V	—	4	100	mV
Load Regulation	$\triangle V_{OUT}$	1mA ⩽ I_{OUT} ⩽ 200mA V_{IN}=10V	—	10	60	mV
Load Regulation	$\triangle V_{OUT}$	1mA ⩽ I_{OUT} ⩽ 80mA V_{IN}=10V	—	7	30	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	40	—	uV/V_{OUT}
Ripple Rejection	RR	6.3V ⩽ V_{IN} ⩽ 16.3V f=120Hz	40	49	—	dB

Electrical Characteristics(HR78L05V) (Vi=10V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=10V	4.85	5	5.15	V
Output Voltage	V_{OUT}	7V ⩽ V_{IN} ⩽ 25V 1mA ⩽ I_{OUT} ⩽ 40mA	4.8	—	5.2	V
Output Voltage	V_{OUT}	7V ⩽ V_{IN} ⩽ 25V 1mA ⩽ I_{OUT} ⩽ 100mA	4.75	—	5.25	V
Output Current	I_O	V_{IN}=10V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=10V I_{OUT}=0mA	—	3.75	6	mA
Quiescent Current Change	$\triangle I_Q$	8V ⩽ V_{IN} ⩽ 25V	—	—	1.0	mA
Quiescent Current Change	$\triangle I_Q$	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	1.0	mA
Line Regulation	$\triangle V_{OUT}$	I_{OUT}=10mA 7V ⩽ V_{IN} ⩽ 25V	—	18	75	mV
Line Regulation	$\triangle V_{OUT}$	I_{OUT}=10mA 9V ⩽ V_{IN} ⩽ 25V	—	10	54	mV
Load Regulation	$\triangle V_{OUT}$	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=10V	—	20	60	mV
Load Regulation	$\triangle V_{OUT}$	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=10V	—	5	30	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	40	—	uV/V_{OUT}
Ripple Rejection	RR	8V ⩽ V_{IN} ⩽ 16V f=120Hz	47	62	—	dB

Electrical Characteristics(HR78L06V) (Vi=11V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=11V	5.82	6	6.18	V
Output Voltage	V_{OUT}	8V ⩽ V_{IN} ⩽ 20V 1mA ⩽ I_{OUT} ⩽ 40mA	5.7	—	6.3	V
Output Voltage	V_{OUT}	8V ⩽ V_{IN} ⩽ 20V 1mA ⩽ I_{OUT} ⩽ 70mA	5.7	—	6.3	V
Output Current	I_O	V_{IN}=11V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=11V I_{OUT}=0mA	—	3.9	6	mA
Quiescent Current Change	△I_Q	9V ⩽ V_{IN} ⩽ 20V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 8V ⩽ V_{IN} ⩽ 20V	—	35	175	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 9V ⩽ V_{IN} ⩽ 20V	—	29	125	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=11V	—	16	80	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=11V	—	9	40	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	46	—	uV/V_{OUT}
Ripple Rejection	RR	9V ⩽ V_{IN} ⩽ 19V f=120Hz	40	48	—	dB

Electrical Characteristics(HR78L08V) (Vi=14V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=14V	7.76	8	8.24	V
Output Voltage	V_{OUT}	10.5V ⩽ V_{IN} ⩽ 23V 1mA ⩽ I_{OUT} ⩽ 40mA	7.6	8	8.4	V
Output Voltage	V_{OUT}	V_{IN}=14V 1mA ⩽ I_{OUT} ⩽ 70mA	7.76	8	8.4	V
Output Current	I_O	V_{IN}=14V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=14V I_{OUT}=0mA	—	4	6	mA
Quiescent Current Change	△I_Q	11V ⩽ V_{IN} ⩽ 23V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 10.5V ⩽ V_{IN} ⩽ 23V	—	42	175	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 11V ⩽ V_{IN} ⩽ 23V	—	36	125	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=14V	—	18	80	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=14V	—	10	40	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	54	—	uV/V_{OUT}
Ripple Rejection	RR	13V ⩽ V_{IN} ⩽ 23V f=120Hz	37	46	—	dB

Electrical Characteristics(HR78L09V) (Vi=15V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=15V	8.64	9	9.36	V
Output Voltage	V_{OUT}	11V ⩽ V_{IN} ⩽ 24V 1mA ⩽ I_{OUT} ⩽ 40mA	8.55	9	9.45	V
Output Voltage	V_{OUT}	V_{IN}=15V 1mA ⩽ I_{OUT} ⩽ 70mA	8.55	9	9.45	V
Output Current	I_O	V_{IN}=15V	100	—	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=15V I_{OUT}=0mA	—	2	5.5	mA
Quiescent Current Change	△I_Q	12V ⩽ V_{IN} ⩽ 23V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 11.5V ⩽ V_{IN} ⩽ 23V	—	18	225	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 12V ⩽ V_{IN} ⩽ 23V	—	9	150	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=15V	—	27	80	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=15V	—	18	40	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	70	—	uV/V_{OUT}
Temperature coefficient of Vo	△V_{OUT}/△T	I_{OUT}=5mA	—	0.85	—	mV/°C
Ripple Rejection	RR	12V ⩽ V_{IN} ⩽ 23V f=120Hz	36	44	—	dB

Electrical Characteristics(HR78L10V) (Vi=16V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=19V	9.5	10	10.5	V
Output Voltage	V_{OUT}	12.5V ⩽ V_{IN} ⩽ 25V 1mA ⩽ I_{OUT} ⩽ 40mA	9.3	—	10.7	V
Output Voltage	V_{OUT}	13V ⩽ V_{IN} ⩽ 25V 1mA ⩽ I_{OUT} ⩽ 50mA	9.3	—	10.7	V
Output Current	I_O	V_{IN}=16V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=16V I_{OUT}=0mA	—	2	4.3	mA
Quiescent Current Change	△I_Q	13V ⩽ V_{IN} ⩽ 25V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 12.5V ⩽ V_{IN} ⩽ 25V	—	25	230	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 13V ⩽ V_{IN} ⩽ 25V	—	20	170	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=16V	—	25	90	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=16V	—	12	75	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	80	—	uV/V_{OUT}
Temperature coefficient of Vo	△V_{OUT}/△T	I_{OUT}=5mA	—	-1.0	—	mV/°C
Ripple Rejection	RR	13V ⩽ V_{IN} ⩽ 24V f=120Hz	—	43	—	dB

Electrical Characteristics(HR78L12V) (Vi=19V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=19V	11.64	12	12.36	V
Output Voltage	V_{OUT}	14.5V ⩽ V_{IN} ⩽ 27V 1mA ⩽ I_{OUT} ⩽ 40mA	11.4	—	12.6	V
Output Voltage	V_{OUT}	14.5V ⩽ V_{IN} ⩽ 27V 1mA ⩽ I_{OUT} ⩽ 70mA	11.4	—	12.6	V
Output Current	I_O	V_{IN}=19V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=19V I_{OUT}=0mA	—	2	6	mA
Quiescent Current Change	△I_Q	16V ⩽ V_{IN} ⩽ 27V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 14.5V ⩽ V_{IN} ⩽ 27V	—	25	300	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 16V ⩽ V_{IN} ⩽ 27V	—	20	250	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=19V	—	25	150	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 40mA V_{IN}=19V	—	12	75	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	80	—	uV/V_{OUT}
Temperature coefficient of Vo	△V_{OUT}/△T	I_{OUT}=5mA	—	-1.0	—	mV/°C
Ripple Rejection	RR	15V ⩽ V_{IN} ⩽ 25V f=120Hz	37	65	—	dB

Electrical Characteristics(HR78L15V) (Vi=23V Io=40mA Ci=0.33uF Co=0.1uF Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	Conditions	Min.	Typ.	Max.	UNIT
Output Voltage	V_{OUT}	I_{OUT}=40mA,V_{IN}=23V	14.55	15	15.45	V
Output Voltage	V_{OUT}	17.5V ⩽ V_{IN} ⩽ 30V 1mA ⩽ I_{OUT} ⩽ 50mA	14.25	—	15.75	V
Output Voltage	V_{OUT}	17.5V ⩽ V_{IN} ⩽ 30V 1mA ⩽ I_{OUT} ⩽ 100mA	14.25	—	15.75	V
Output Current	I_O	V_{IN}=23V	—	100	—	mA
Dropout Voltage	V_D	I_{OUT}=40mA	—	1.7	—	V
Quiescent Current	I_Q	V_{IN}=23V I_{OUT}=0mA	—	3	6	mA
Quiescent Current Change	△I_Q	20V ⩽ V_{IN} ⩽ 30V	—	—	1.5	mA
Quiescent Current Change	△I_Q	1mA ⩽ I_{OUT} ⩽ 40mA	—	—	0.1	mA
Line Regulation	△V_{OUT}	I_{OUT}=40mA 17.5V ⩽ V_{IN} ⩽ 30V	—	25	250	mV
Line Regulation	△V_{OUT}	I_{OUT}=40mA 25V ⩽ V_{IN} ⩽ 30V	—	20	250	mV
Load Regulation	△V_{OUT}	1mA ⩽ I_{OUT} ⩽ 100mA V_{IN}=23V	—	25	150	mV
Output Noise Voltage	V_N	10Hz ⩽ f ⩽ 100kHz	—	90	—	uV/V_{OUT}
Temperature coefficient of Vo	△V_{OUT}/△T	I_{OUT}=5mA		1.25		mV/°C
	△V_{OUT}/（V_{OUT}·△T）		—	84	—	pmm/°C
Ripple Rejection	RR	18.5V ⩽ V_{IN} ⩽ 28.5V f=120Hz	34	39	—	dB

Ratings And Characteristics Curves (Ta=25°C Unless otherwise specified)

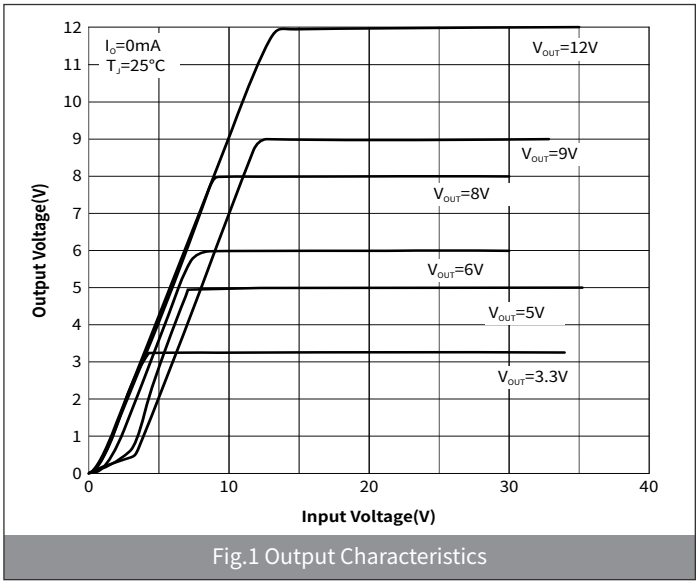


Fig.1 Output Characteristics

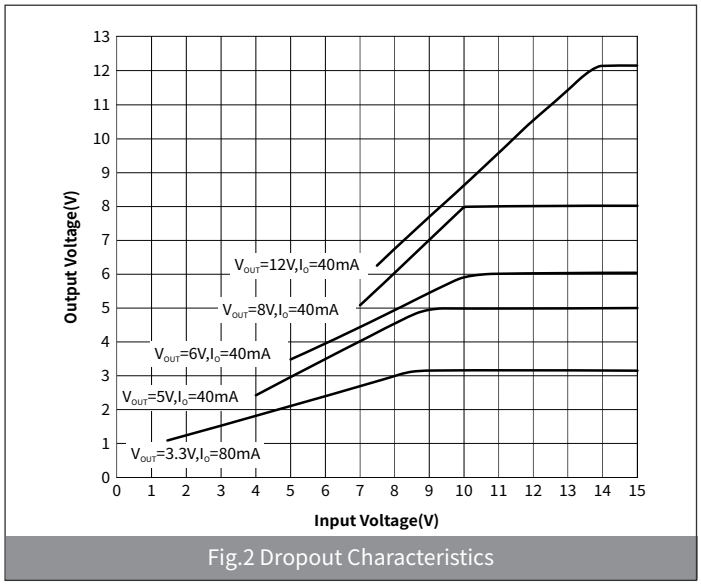


Fig.2 Dropout Characteristics

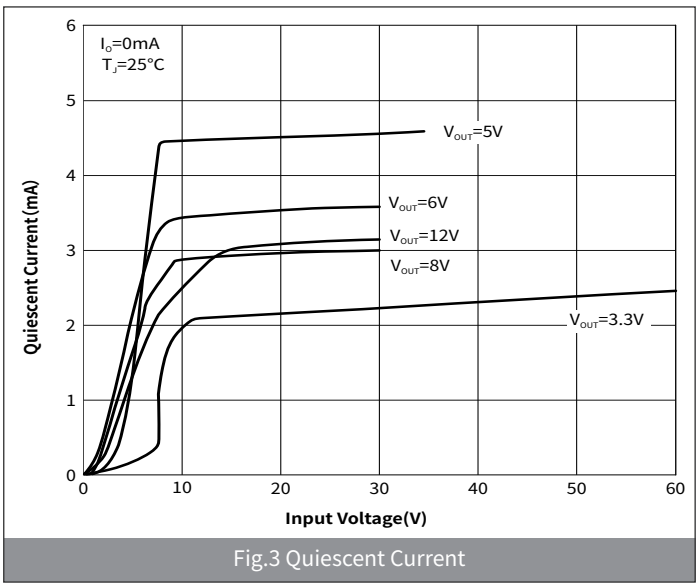


Fig.3 Quiescent Current

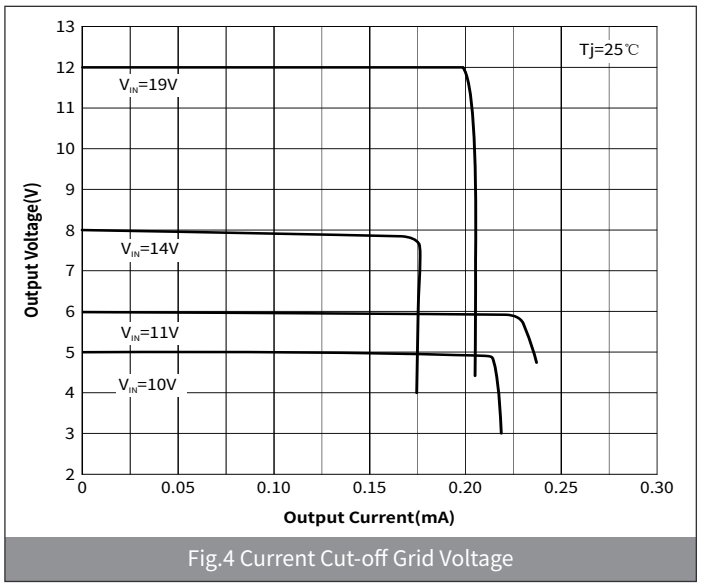


Fig.4 Current Cut-off Grid Voltage

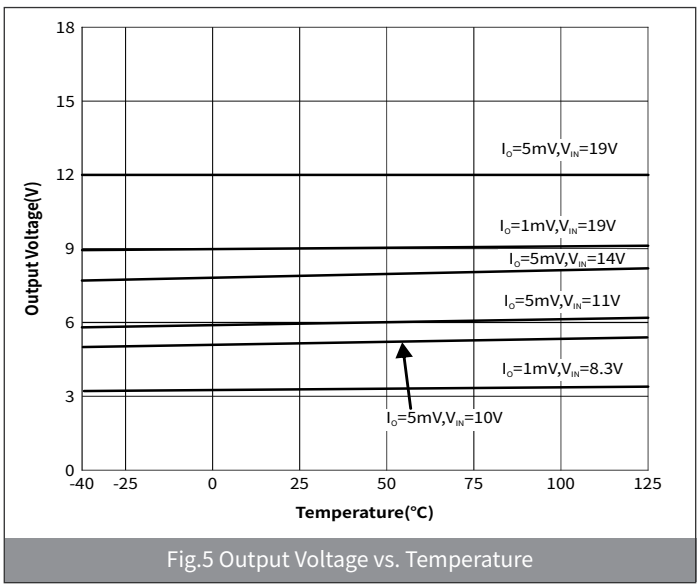


Fig.5 Output Voltage vs. Temperature

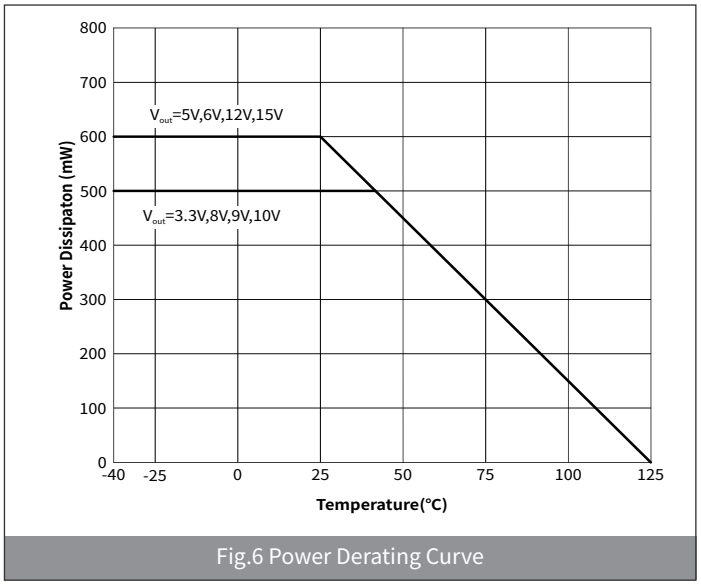
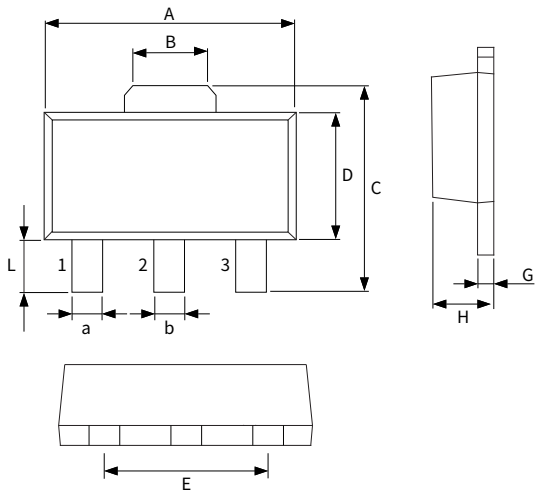


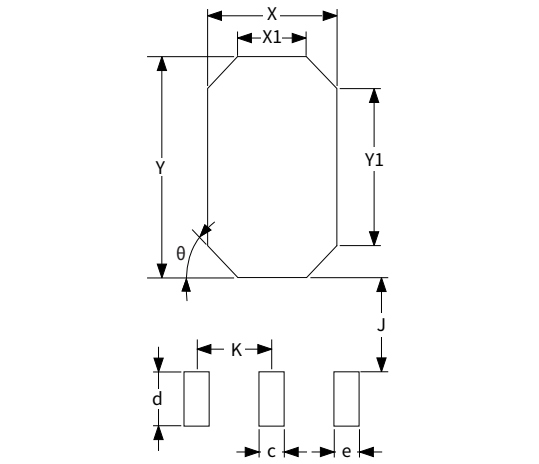
Fig.6 Power Derating Curve

Package Outline Dimensions (SOT-89)



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	1.35	1.83	0.053	0.072
C	3.75	4.25	0.148	0.167
D	2.29	2.60	0.090	0.102
E	2.95	3.05	0.116	0.120
a	0.35	0.48	0.014	0.019
b	0.40	0.56	0.016	0.022
L	0.80	1.20	0.031	0.047
G	0.35	0.44	0.014	0.017
H	1.40	1.60	0.055	0.063

Suggested Pad Layout



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
c	0.80	1.00	0.032	0.04
d	1.30	1.50	0.052	0.060
e	0.70	0.90	0.028	0.036
J	1.80	2.00	0.072	0.080
K	1.40	1.60	0.056	0.064
X	2.50	2.70	0.100	0.108
X1	1.30	1.50	0.052	0.060
Y	4.30	4.50	0.172	0.180
Y1	3.10	3.30	0.124	0.132
θ	-	45°	-	45°