

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($V_{OUT}=5\sim 15V$); 150mA($V_{OUT}=3.3V$)
- Low Dropout Voltage: 1.7V(Max.)@80mA ($V_{OUT}=3.3V$)
- Thermal overload protection
- Short circuit current limiting

Applications

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

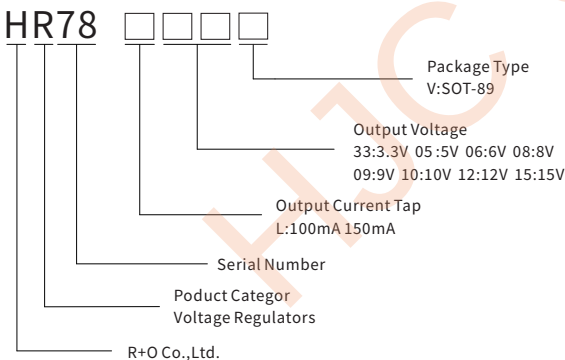
General Description

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

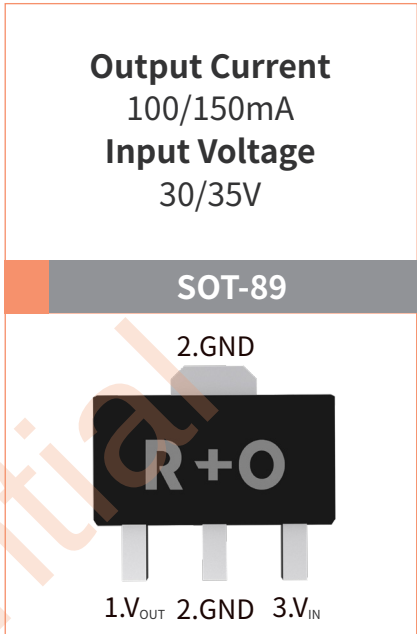
SOT-89 Marking:
HR78L33V: 78L33 HR78L05V: 78L05
HR78L06V: 78L06 HR78L08V: 78L08
HR78L09V: 78L09 HR78L10V: 78L10
HR78L12V: 78L12 HR78L15V: 78L15

Part Numbering

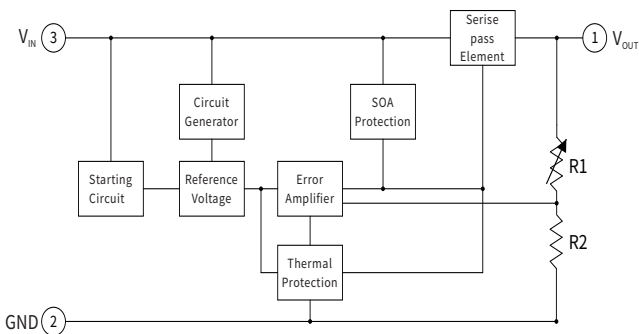


Ordering Information

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



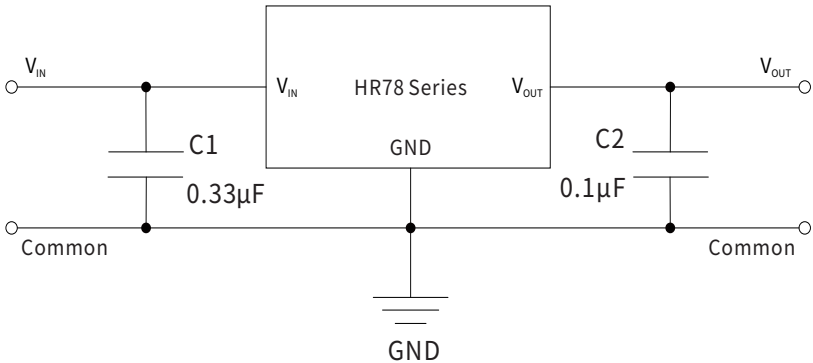
Block Diagram



HR78 Series

Three Terminal Regulator

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 _{θJA}	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)** ($V_i=8.3V$ $I_o=80mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$5.3V \leq V_{IN} \leq 20V$ $1mA \leq I_{OUT} \leq 80mA$	3.135	—	3.465	V
Output Voltage	V_{OUT}	$V_{IN}=8.3V$ $1mA \leq I_{OUT} \leq 140mA$	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	ΔI_Q	$6.3V \leq V_{IN} \leq 20V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 80mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=80mA$ $5.3V \leq V_{IN} \leq 20V$	—	7	150	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=80mA$ $6.3V \leq V_{IN} \leq 20V$	—	4	100	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 190mA$ $V_{IN}=10V$	—	10	60	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 80mA$ $V_{IN}=10V$	—	7	30	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	40	—	$\mu V/V_{OUT}$
Ripple Rejection	RR	$6.3V \leq V_{IN} \leq 16.3V$ $f=120Hz$	40	49	—	dB

● **Electrical Characteristics(HR78L05V)** ($V_i=10V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$7V \leq V_{IN} \leq 25V$ $1mA \leq I_{OUT} \leq 40mA$	4.8	—	5.2	V
Output Voltage	V_{OUT}	$7V \leq V_{IN} \leq 25V$ $1mA \leq I_{OUT} \leq 100mA$	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	ΔI_Q	$8V \leq V_{IN} \leq 25V$	—	—	1.0	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	1.0	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=10mA$ $7V \leq V_{IN} \leq 25V$	—	18	75	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=10mA$ $9V \leq V_{IN} \leq 25V$	—	10	54	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=10V$	—	20	60	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=10V$	—	5	30	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	40	—	$\mu V/V_{OUT}$
Ripple Rejection	RR	$8V \leq V_{IN} \leq 16V$ $f=120Hz$	47	62	—	dB

● **Electrical Characteristics(HR78L06V)** ($V_i=11V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$8V \leq V_{IN} \leq 20V$ $1mA \leq I_{OUT} \leq 40mA$	5.7	—	6.3	V
Output Voltage	V_{OUT}	$8V \leq V_{IN} \leq 20V$ $1mA \leq I_{OUT} \leq 70mA$	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	ΔI_Q	$9V \leq V_{IN} \leq 20V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $8V \leq V_{IN} \leq 20V$	—	35	175	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $9V \leq V_{IN} \leq 20V$	—	29	125	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=11V$	—	16	80	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=11V$	—	9	40	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	46	—	$\mu V/V_{OUT}$
Ripple Rejection	RR	$9V \leq V_{IN} \leq 19V$ $f=120Hz$	40	48	—	dB

● **Electrical Characteristics(HR78L08V)** ($V_i=14V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$10.5V \leq V_{IN} \leq 23V$ $1mA \leq I_{OUT} \leq 40mA$	7.6	8	8.4	V
Output Voltage	V_{OUT}	$V_{IN}=14V$ $1mA \leq I_{OUT} \leq 70mA$	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	ΔI_Q	$11V \leq V_{IN} \leq 23V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $10.5V \leq V_{IN} \leq 23V$	—	42	175	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $11V \leq V_{IN} \leq 23V$	—	36	125	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=14V$	—	18	80	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=14V$	—	10	40	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	54	—	$\mu V/V_{OUT}$
Ripple Rejection	RR	$13V \leq V_{IN} \leq 23V$ $f=120Hz$	37	46	—	dB

● **Electrical Characteristics(HR78L09V)** ($V_i=15V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$11V \leq V_{IN} \leq 24V$ $1mA \leq I_{OUT} \leq 40mA$	8.55	9	9.45	V
Output Voltage	V_{OUT}	$V_{IN}=15V$ $1mA \leq I_{OUT} \leq 70mA$	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	ΔI_Q	$12V \leq V_{IN} \leq 23V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $11.5V \leq V_{IN} \leq 23V$	—	18	225	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $12V \leq V_{IN} \leq 23V$	—	9	150	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=15V$	—	27	80	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=15V$	—	18	40	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	70	—	$\mu V/V_{OUT}$
Temperature coefficient of V_o	$\Delta V_{OUT} / \Delta T$	$I_{OUT}=5mA$	—	0.85	—	$mV/^\circ C$
Ripple Rejection	RR	$12V \leq V_{IN} \leq 23V$ $f=120Hz$	36	44	—	dB

● **Electrical Characteristics(HR78L10V)** ($V_i=16V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$12.5V \leq V_{IN} \leq 25V$ $1mA \leq I_{OUT} \leq 40mA$	9.3	—	10.7	V
Output Voltage	V_{OUT}	$13V \leq V_{IN} \leq 25V$ $1mA \leq I_{OUT} \leq 50mA$	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	ΔI_Q	$13V \leq V_{IN} \leq 25V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $12.5V \leq V_{IN} \leq 25V$	—	25	230	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $13V \leq V_{IN} \leq 25V$	—	20	170	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=16V$	—	25	90	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=16V$	—	12	75	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	80	—	$\mu V/V_{OUT}$
Temperature coefficient of V_o	$\Delta V_{OUT} / \Delta T$	$I_{OUT}=5mA$	—	-1.0	—	$mV/^\circ C$
Ripple Rejection	RR	$13V \leq V_{IN} \leq 24V$ $f=120Hz$	—	43	—	dB

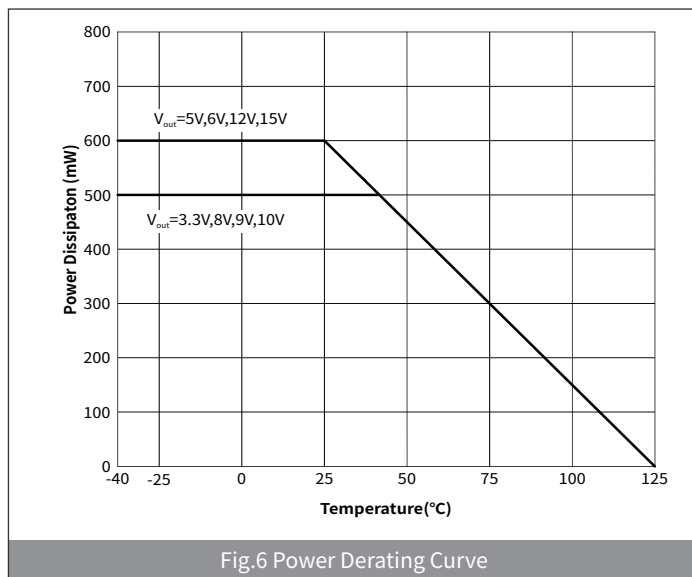
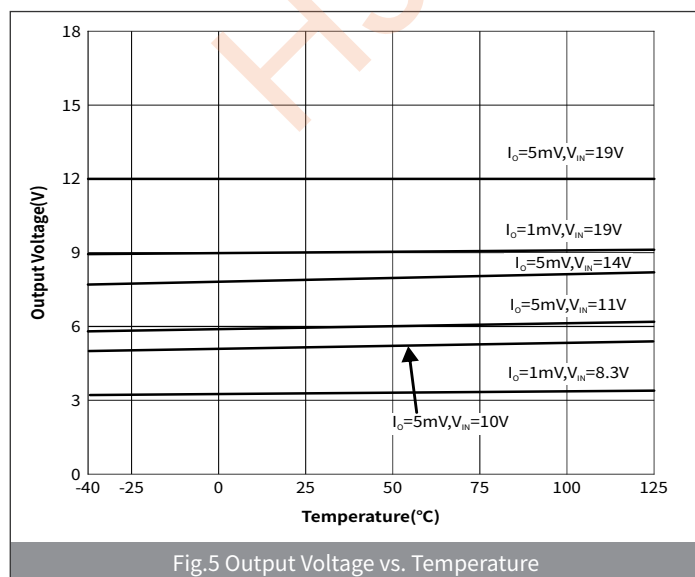
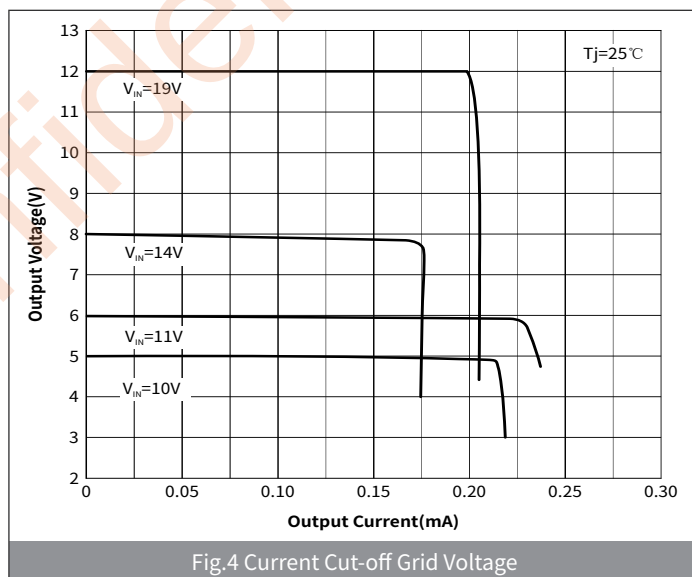
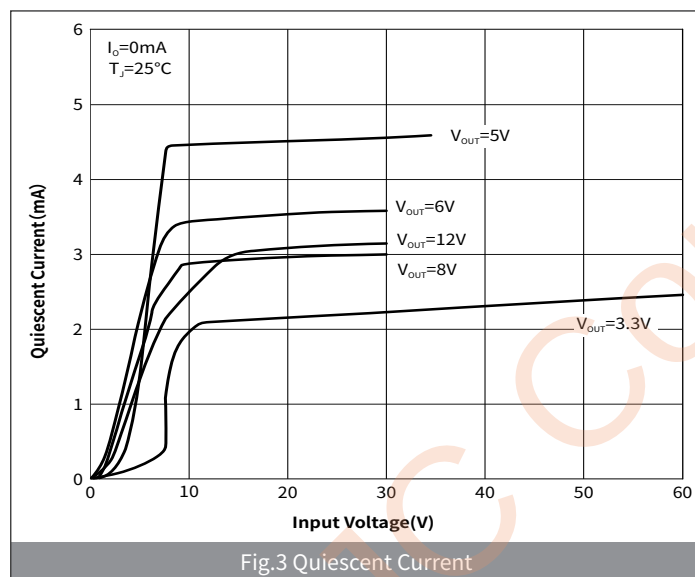
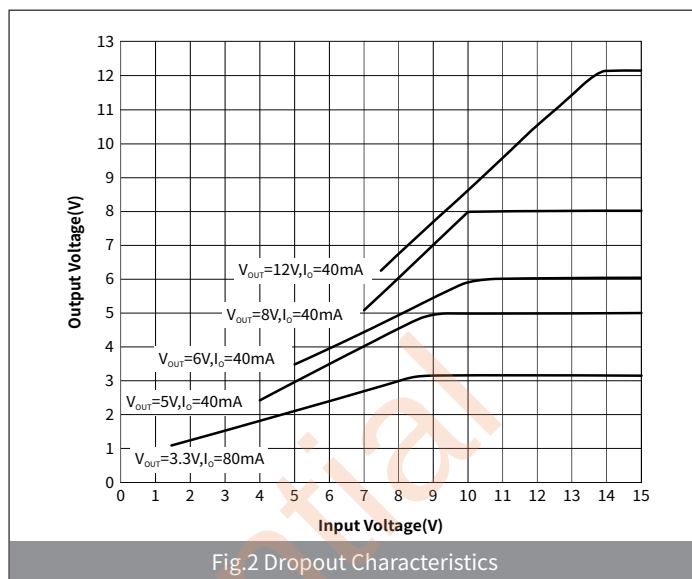
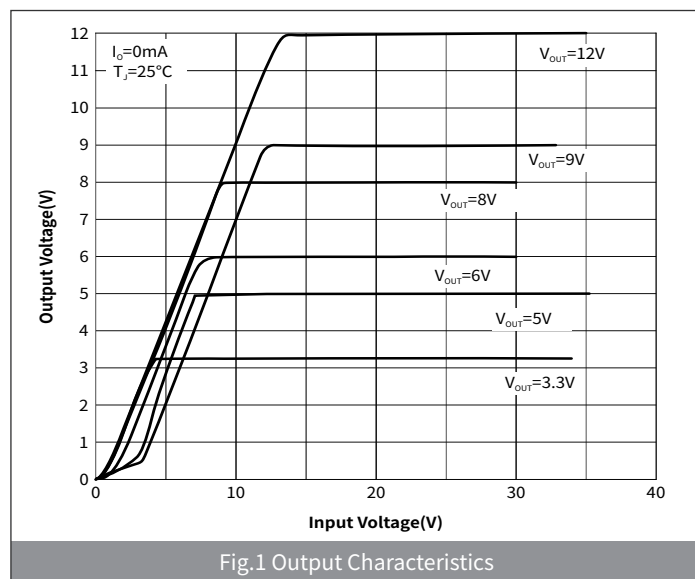
● **Electrical Characteristics(HR78L12V)** ($V_i=19V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ Unless otherwise specified)

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}	$14.5V \leq V_{IN} \leq 27V$ $1mA \leq I_{OUT} \leq 40mA$	11.4	—	12.6	V
Output Voltage	V_{OUT}	$14.5V \leq V_{IN} \leq 27V$ $1mA \leq I_{OUT} \leq 70mA$	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	ΔI_Q	$16V \leq V_{IN} \leq 27V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $14.5V \leq V_{IN} \leq 27V$	—	25	300	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $16V \leq V_{IN} \leq 27V$	—	20	250	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=19V$	—	25	150	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 40mA$ $V_{IN}=19V$	—	12	75	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	80	—	$\mu V/V_{OUT}$
Temperature coefficient of Vo	$\Delta V_{OUT} / \Delta T$	$I_{OUT}=5mA$	—	-1.0	—	$mV/^\circ C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V$ $f=120Hz$	37	65	—	dB

● **Electrical Characteristics(HR78L15V)** ($V_i=23V$ $I_o=40mA$ $C_i=0.33\mu F$ $C_o=0.1\mu F$ $T_a=25^\circ C$ 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}	$17.5V \leq V_{IN} \leq 30V$ $1mA \leq I_{OUT} \leq 50mA$	14.25	—	15.75	V
Output Voltage	V_{OUT}	$17.5V \leq V_{IN} \leq 30V$ $1mA \leq I_{OUT} \leq 100mA$	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	ΔI_Q	$20V \leq V_{IN} \leq 30V$	—	—	1.5	mA
Quiescent Current Change	ΔI_Q	$1mA \leq I_{OUT} \leq 40mA$	—	—	0.1	mA
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $17.5V \leq V_{IN} \leq 30V$	—	25	250	mV
Line Regulation	ΔV_{OUT}	$I_{OUT}=40mA$ $25V \leq V_{IN} \leq 30V$	—	20	250	mV
Load Regulation	ΔV_{OUT}	$1mA \leq I_{OUT} \leq 100mA$ $V_{IN}=23V$	—	25	150	mV
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$	—	90	—	$\mu V/V_{OUT}$
Temperature coefficient of Vo	$\Delta V_{OUT} / \Delta T$	$I_{OUT}=5mA$	—	1.25	—	$mV/^\circ C$
	$\Delta V_{OUT} / (V_{OUT} \cdot \Delta T)$		—	84	—	$pmm/^\circ C$
Ripple Rejection	RR	$18.5V \leq V_{IN} \leq 28.5V$ $f=120Hz$	34	39	—	dB

● Ratings And Characteristics Curves ($T_a=25^{\circ}\text{C}$ Unless otherwise specified)



● 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°