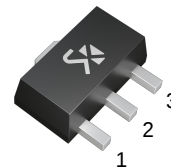


3-Terminal Positive Voltage Regulator

FEATURE

- Maximum output current of 200mA
- Output voltage of 5V/6V/8V/9V/10V/12V/15V
- Thermal overload protection
- Short circuit current limiting



1: OUT 2: GND 3: IN

SOT-89 PLASTIC PACKAGE

ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified)

Characteristic	Symbol	Value	Units
Input voltage	V_{IN}	30	V
Output Current	I_{OUT}	200	mA
Junction Temperature	T_J	+125	°C
Operating Temperature	T_{OPR}	-40~+120	°C
Storage Temperature Range	T_{STG}	-40~+150	°C

Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 10\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	4.8	5.0	5.2	V
		$7\text{ V} \leq V_I \leq 20\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	4.75		5.25	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	4.75		5.25	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		15	60	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		10	30	mV
Line regulation	ΔV_O	$7\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$		10	150	mV
		$8\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$		5	100	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$8\text{ V} \leq V_I \leq 20\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		40		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.65		mV/°C
Ripple Rejection	RR	$8\text{ V} \leq V_I \leq 18\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	40	49		dB
Dropout Voltage	V_d			1.7		V

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Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 12\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	5.75	6.0	6.25	V
		$8\text{ V} \leq V_I \leq 21\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	5.7		6.3	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	5.7		6.3	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		18	60	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		12	30	mV
Line regulation	ΔV_O	$8.5\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$		12	150	mV
		$9\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$		6	100	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$9\text{ V} \leq V_I \leq 20\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		50		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.75		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$9\text{ V} \leq V_I \leq 20\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	38	46		dB
Dropout Voltage	V_d			1.7		V

Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 14\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	7.7	8.0	8.3	V
		$10\text{ V} \leq V_I \leq 23\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	7.6		8.4	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	7.6		8.4	V (Note1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		24	80	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		16	40	mV
Line regulation	ΔV_O	$10.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		16	175	mV
		$11\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		8	125	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$11\text{ V} \leq V_I \leq 23\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		60		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.8		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$12\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	36	45		dB
Dropout Voltage	V_d			1.7		V

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Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 15\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	8.64	9.0	9.36	V
		$11\text{ V} \leq V_I \leq 24\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	8.55		9.45	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	8.55		9.45	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		27	80	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		18	40	mV
Line regulation	ΔV_O	$11.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		18	225	mV
		$12\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		9	150	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$12\text{ V} \leq V_I \leq 23\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		70		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.85		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$12\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	36	44		dB
Dropout Voltage	V_d			1.7		V

Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 16\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	9.6	10.0	10.4	V
		$12\text{ V} \leq V_I \leq 25\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	9.5		10.5	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	9.5		10.5	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		30	90	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		20	45	mV
Line regulation	ΔV_O	$12.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		20	230	mV
		$13\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$		10	170	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$13\text{ V} \leq V_I \leq 23\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		60		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.9		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$14\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	36	45		dB
Dropout Voltage	V_d			1.7		V

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Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 19\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

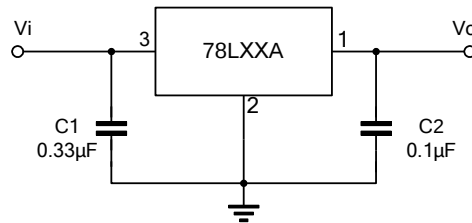
Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	11.5	12	12.6	V
		$14\text{ V} \leq V_I \leq 27\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	11.4		12.6	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	11.4		12.6	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		36	100	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		24	50	mV
Line regulation	ΔV_O	$14.5\text{ V} \leq V_I \leq 27\text{ V}, T_J = 25^\circ\text{C}$		24	250	mV
		$16\text{ V} \leq V_I \leq 27\text{ V}, T_J = 25^\circ\text{C}$		12	200	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$16\text{ V} \leq V_I \leq 27\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		80		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		1.0		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$15\text{ V} \leq V_I \leq 25\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	36	42		dB
Dropout Voltage	V_d			1.7		V

Electrical Characteristics ($T_a = 25^\circ\text{C}$) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_I = 21\text{ V}$, $I_O = 80\text{ mA}$, $C_1 = 0.33\text{ }\mu\text{F}$, $C_2 = 0.1\text{ }\mu\text{F}$)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	Unit
Output Voltage	V_O	$T_J = 25^\circ\text{C}$	14.4	15	15.6	V
		$17\text{ V} \leq V_I \leq 30\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$	14.25		15.75	V
		$I_O = 1\text{ mA} \sim 140\text{ mA}$	14.25		15.75	V (Note 1)
Load Regulation	ΔV_O	$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$		45	150	mV
		$T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$		30	75	mV
Line regulation	ΔV_O	$17.5\text{ V} \leq V_I \leq 30\text{ V}, T_J = 25^\circ\text{C}$		30	300	mV
		$20\text{ V} \leq V_I \leq 30\text{ V}, T_J = 25^\circ\text{C}$		15	250	mV
Quiescent Current	I_q	$T_J = 25^\circ\text{C}$		2.2	6.0	mA
Quiescent Current Change	ΔI_q	$20\text{ V} \leq V_I \leq 30\text{ V}$			1.5	mA
	ΔI_q	$1\text{ mA} \leq V_I \leq 80\text{ mA}$			0.1	mA
Output Noise Voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$		90		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		1.3		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$18.5\text{ V} \leq V_I \leq 28.5\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$	33	39		dB
Dropout Voltage	V_d			1.7		V

Note 1: Power dissipation $< 0.75\text{ W}$.

TYPICAL APPLICATION



Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 78L33A Output Voltage vs Ambient Temperature

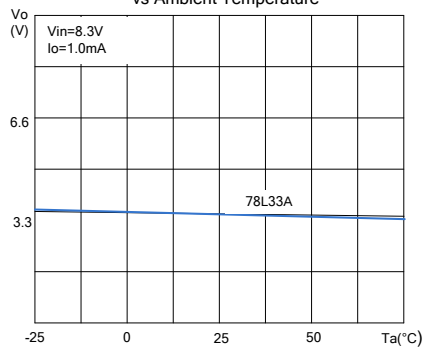


Fig.2 78L33A Quiescent Current vs Output Current

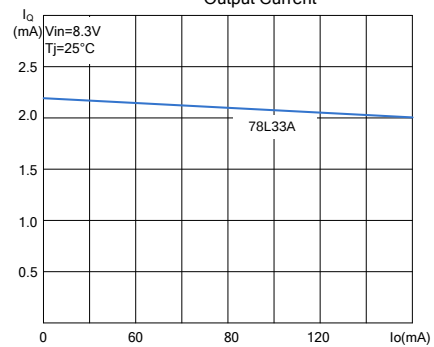


Fig.3 78L33A Quiescent Current vs Input

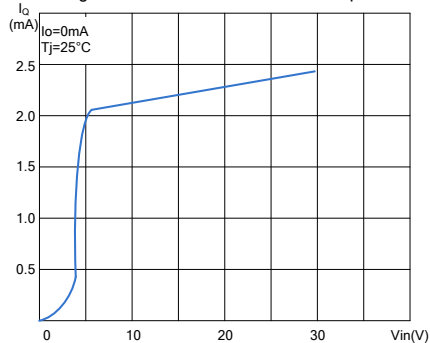


Fig.4 78L33A Thermal Shutdown

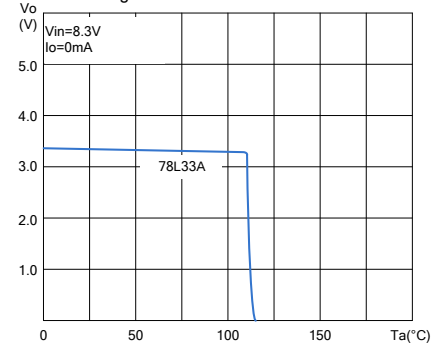


Fig.5 78L33A Output Characteristics

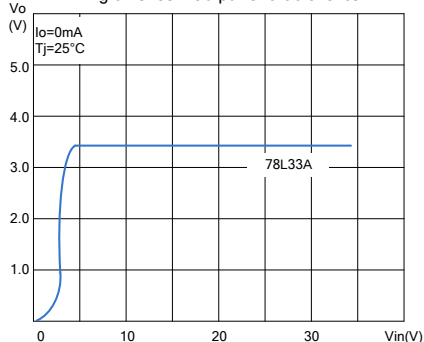


Fig.6 78L33A Dropout Characteristics

