

78L33

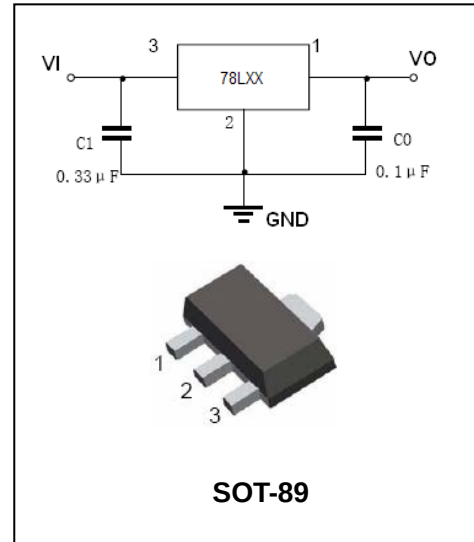
Three-Terminal Low Current Positive Voltage Regulators

Product Specification

FEATURES

- Wide range of available, fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No external components required.
- MSL3
- ESD:HBM(Class 1C)
- Complementary negative regulators offered (79LXX series).

HF



APPLICATIONS

- Three-terminal positive voltage regulator.

ORDERING INFORMATION

Type No.	Marking	Package Code
78LXX	78LXX	SOT-89

MAXIMUM RATING operating temperature range applies unless otherwise specified

Symbol	Parameter	Value	Units
V_I	Input voltage(78L33-78L09)	30	V
	(78L10-78L15)	35	
	(78L18-78L24)	40	
I_{CM}	Maximum output current	100	mA
$R_{th\ j-c}$	Thermal Resistance, Junction to Case	250	°C/W
P_D	Power dissipation	500	mW
T_J	Operating junction temperature	0 to +125	°C
T_{STG}	Storage temperature range	-65 to +150	°C

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=8.3V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L33			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $5.8V \leq V_I \leq 20V, I_O=1mA-40mA$ $V_I=8.3V, I_O=1mA-70mA$	3.168 3.135 3.135	3.3 - -	3.432 3.465 3.465	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	-	60 30	mV
Line regulation	Reg_{line}	$5.8V \leq V_I \leq 20V, T_J=25^{\circ}C$ $6.3V \leq V_I \leq 20V, T_J=25^{\circ}C$	-	-	150 100	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	-	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$6.3V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz$	-	40	-	μV
Ripple rejection	RR	$I_O=40mA, 6.3V \leq V_I \leq 16.3V$ $f=120Hz, T_J=25^{\circ}C$	41	49	-	dB
Dropout voltage	V_I-V_O	$T_J=25^{\circ}C$	-	2.5	-	V

ELECTRICAL CHARACTERISTICS

($V_{IN}=10V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L05			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $7V \leq V_I \leq 20V, I_O=1mA-40mA$ $V_I=10V, I_O=1mA-70mA$	4.8 4.75 4.75	5.0 - -	5.2 5.25 5.25	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	11 5	60 30	mV
Line regulation	Reg_{line}	$7V \leq V_I \leq 20V, T_J=25^{\circ}C$ $8V \leq V_I \leq 20V, T_J=25^{\circ}C$	-	55 45	150 100	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	- -	3.8 -	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$8V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz$	-	40	-	μV
Ripple rejection	RR	$I_O=40mA, 8V \leq V_I \leq 18V, f=120Hz, T_J=25^{\circ}C$	41	49	-	dB
Dropout voltage	V_I-V_O	$T_J=25^{\circ}C$	-	1.7	-	V

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=12V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L06			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=8.5V-20V, I_O=1mA-40mA$ $V_I=8.5V, I_O=1mA-70mA$	5.75 5.7 5.7	6.0 - -	6.25 6.3 6.3	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-70mA$	-	12.8 5.8	80 40	mV
Line regulation	Reg_{line}	$8.5V \leq V_I \leq 20V, T_J=25^\circ C$ $9V \leq V_I \leq 20V, T_J=25^\circ C$	-	64 54	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C, V_{IN}=12V, I_O=40mA$ $T_J=125^\circ C, V_{IN}=12V, I_O=40mA$	- -	- 3.9	5.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$9V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz$	-	40	-	μV
Ripple rejection	RR	$I_O=40mA, 10V \leq V_I \leq 20V, f=120Hz, T_J=25^\circ C$	40	46	-	dB
Dropout voltage	V_D	$T_J=25^\circ C$	-	1.7	-	V

ELECTRICAL CHARACTERISTICS

($V_{IN}=14V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L08			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $10.5V \leq V_I \leq 23V, I_O=1mA-40mA$ $V_I=14V, I_O=1mA-70mA$	7.7 7.6 7.6	8.0 - -	8.3 8.4 8.4	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$	-	15 8.0	80 40	mV
Line regulation	Reg_{line}	$10.5V \leq V_I \leq 23V, T_J=25^\circ C$ $11V \leq V_I \leq 23V, T_J=25^\circ C$	-	20 12	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$	-	3 -	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$11V \leq V_I \leq 23V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$T_A=25^\circ C, 10Hz \leq f \leq 100KHz$	-	60	-	μV
Ripple rejection	RR	$I_O=40mA, 12V \leq V_I \leq 23V, f=120Hz, T_J=25^\circ C$	37	57	-	dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$	-	1.7	-	V

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=15V$, $I_O=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_i=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L09			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $V_i=11.5V-24V$, $I_O=1mA-40mA$ $V_i=15V$, $I_O=1mA-70mA$	8.6 8.5 8.5	9.0 - -	9.4 9.5 9.5	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C$, $I_O=1mA-100mA$ $T_J=25^{\circ}C$, $I_O=1mA-40mA$	-	15 8.0	90 40	mV
Line regulation	Reg_{line}	$11.5V \leq V_i \leq 24V$, $T_J=25^{\circ}C$ $12V \leq V_i \leq 24V$, $T_J=25^{\circ}C$	-	20 12	175 125	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.0 -	6.0 5.5	mA
Input Bias Current Change	ΔI_{IB}	$11V \leq V_i \leq 23V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$T_A=25^{\circ}C$, $10Hz \leq f \leq 100KHz$	-	60	-	μV
Ripple rejection	RR	$I_O=40mA$, $13V \leq V_i \leq 24V$, $f=120Hz$, $T_J=25^{\circ}C$	37	57	-	dB
Dropout voltage	V_i-V_O	$T_J=25^{\circ}C$	-	1.7	-	V

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=16V, I_O=40mA, C_{IN}=0.33\mu F, C_O=0.1\mu f, T_j = 0$ to $125^\circ C$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L10			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_j=25^\circ C$	9.6	10	10.4	V
Load regulation(Note1)	ΔReg_{load}	$I_O = 1$ to $100mA$, $T_j = 25^\circ C$	-	17	90	mV
		$I_O = 1$ to $40mA$, $T_j = 25^\circ C$	-	9	45	mV
Line regulation(Note1)	ΔReg_{line}	$V_i = 12.5$ to $25V$, $T_j = 25^\circ C$	-	100	210	mV
		$V_i = 13$ to $25V$, $T_j = 25^\circ C$	-	90	160	mV
Input Bias Current	I_{IB}	$T_j = 25^\circ C$	-	2.0	3.0	mA
Input Bias Current Change	ΔI_{IB}	$V_i = 13$ to $25V$, $T_j = 25^\circ C$	-	-	1.0	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz$	-	70	-	μV
Ripple Rejection	RR	$V_i = 13$ to $23V$, $I_O = 40mA$, $f = 120Hz$	42	52	-	dB
Dropout Voltage	V_D	$T_j=25^\circ C$	-	1.7	-	V
Dropout voltage	V_i-V_O	$I_O = 5mA, T_j = 0$ to $125^\circ C$	-	0.9	-	$mV/^\circ C$

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=19V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L12			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=14.5V-27V, I_O=1mA-40mA$ $V_I=19V, I_O=1mA-70mA$	11.5 11.4 11.4	12 - -	12.5 12.6 12.6	V
Load regulation	Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$	-	20 10	100 50	mV
Line regulation	Reg_{line}	$14.5V \leq V_I \leq 27V, T_J=25^\circ C$ $16V \leq V_I \leq 27V, T_J=25^\circ C$	-	120 100	250 200	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$	-	4.2 -	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$16V \leq V_I \leq 27V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$	-	80	-	μV
Ripple rejection	RR	$I_O=40mA, 15V \leq V_I \leq 25V, f=120Hz,$ $T_J=25^\circ C$	37	42	--	dB
Dropout voltage	V_I-V_O	$T_J=25^\circ C$	-	1.7	-	V

ELECTRICAL CHARACTERISTICS

($V_{IN}=23V, I_O=40mA, 0^\circ C < T_J < 125^\circ C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L15			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ C$ $V_I=17.5V-30V, I_O=1mA-40mA$ $V_I=23V, I_O=1mA-70mA$	14.4 14.25 14.25	15 - -	15.6 15.75 15.75	V
Load regulation	Δ Reg_{load}	$T_J=25^\circ C, I_O=1mA-100mA$ $T_J=25^\circ C, I_O=1mA-40mA$	-	25 12	150 75	mV
Line regulation	Δ Reg_{line}	$17.5V \leq V_I \leq 30V, T_J=25^\circ C$ $20V \leq V_I \leq 30V, T_J=25^\circ C$	-	130 110	300 250	mV
Input Bias Current	I_{IB}	$T_J=25^\circ C$ $T_J=125^\circ C$	-	4.4 -	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$20V \leq V_I \leq 30V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^\circ C$	-	90	-	μV
Ripple rejection	RR	$I_O=40mA, 18.5V \leq V_I \leq 28.5V,$ $f=120Hz, T_J=25^\circ C$	34	39	-	dB
	V_I-V_O	$T_J=25^\circ C$	-	1.7	-	V

78L33

Three-Terminal Low Current Positive Voltage Regulators

ELECTRICAL CHARACTERISTICS

($V_{IN}=27V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L18			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $V_I=20.7V-33V, I_O=1mA-40mA$ $V_I=27V, I_O=1mA-70mA$	17.3 17.1 17.1	18 - -	18.7 18.9 18.9	V
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	30 15	170 85	mV
Line regulation	Reg_{line}	$20.7V \leq V_I \leq 33V, T_J=25^{\circ}C$ $21V \leq V_I \leq 33V, T_J=25^{\circ}C$	-	45 35	325 275	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.1 -	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$21V \leq V_I \leq 33V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^{\circ}C$	-	150	-	μV
Ripple rejection	RR	$I_O=40mA, 23V \leq V_I \leq 33V, f=120Hz,$ $T_J=25^{\circ}C$	33	48	-	dB
Dropout voltage	V_I-V_O	$T_J=25^{\circ}C$	-	1.7	-	V

ELECTRICAL CHARACTERISTICS

($V_{IN}=33V, I_O=40mA, 0^{\circ}C < T_J < 125^{\circ}C, C_I=0.33\mu F, C_O=0.1\mu f$, unless otherwise specified)

Parameter	Symbol	Test conditions	78L24			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^{\circ}C$ $V_I=27V-38V, I_O=1mA-40mA$ $V_I=27V-33V, I_O=1mA-70mA$	23 22.8 22.8	24 - -	25 25.2 25.2	V
Load regulation	Δ Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	40 20	200 100	mV
Line regulation	Δ Reg_{line}	$28V \leq V_I \leq 80V, T_J=25^{\circ}C$ $27V \leq V_I \leq 38V, T_J=25^{\circ}C$	-	50 60	300 350	mV
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.1 -	6.5 6.0	mA
Input Bias Current Change	ΔI_{IB}	$28V \leq V_I \leq 38V$ $1mA \leq I_O \leq 40mA$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10Hz \leq f \leq 100KHz, T_A=25^{\circ}C$	-	200	-	μV
Ripple rejection	RR	$I_O=40mA, 29V \leq V_I \leq 35V,$ $f=120Hz, T_J=25^{\circ}C$	31	45	-	dB
Dropout voltage	V_I-V_O	$T_J=25^{\circ}C$	-	1.7	-	V

78L33

Three-Terminal Low Current Positive Voltage Regulators

TYPICAL CHARACTERISTICS @ $T_a=25^\circ\text{C}$ unless otherwise specified

Figure 1. Dropout Characteristics

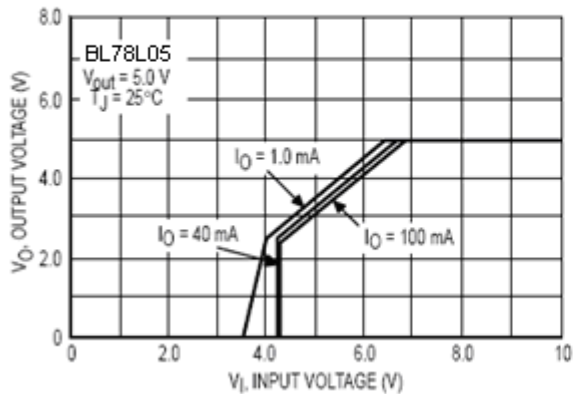


Figure 2. Dropout Voltage versus Junction Temperature

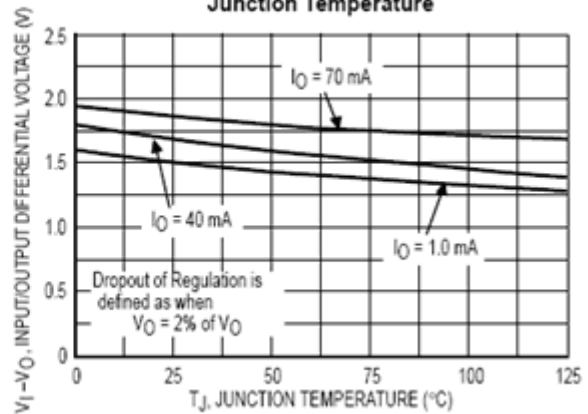


Figure 3. Input Bias Current versus Ambient Temperature

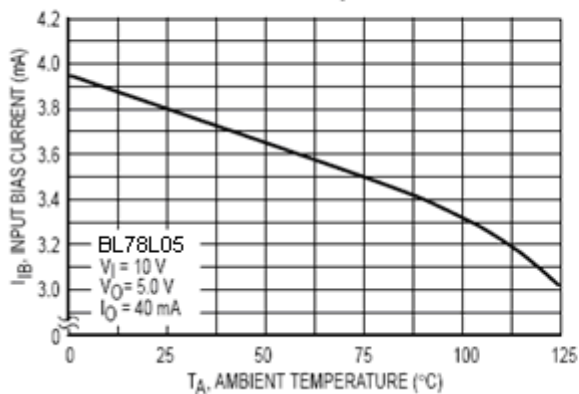
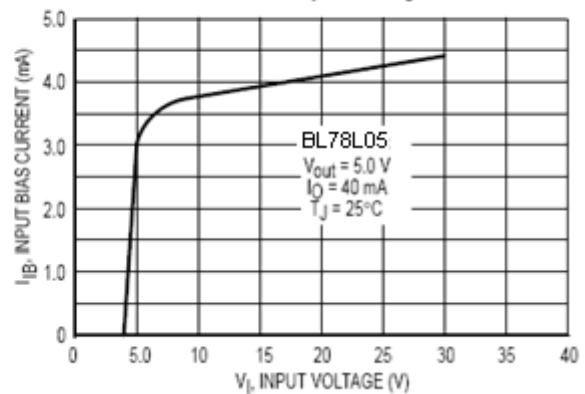


Figure 4. Input Bias Current versus Input Voltage



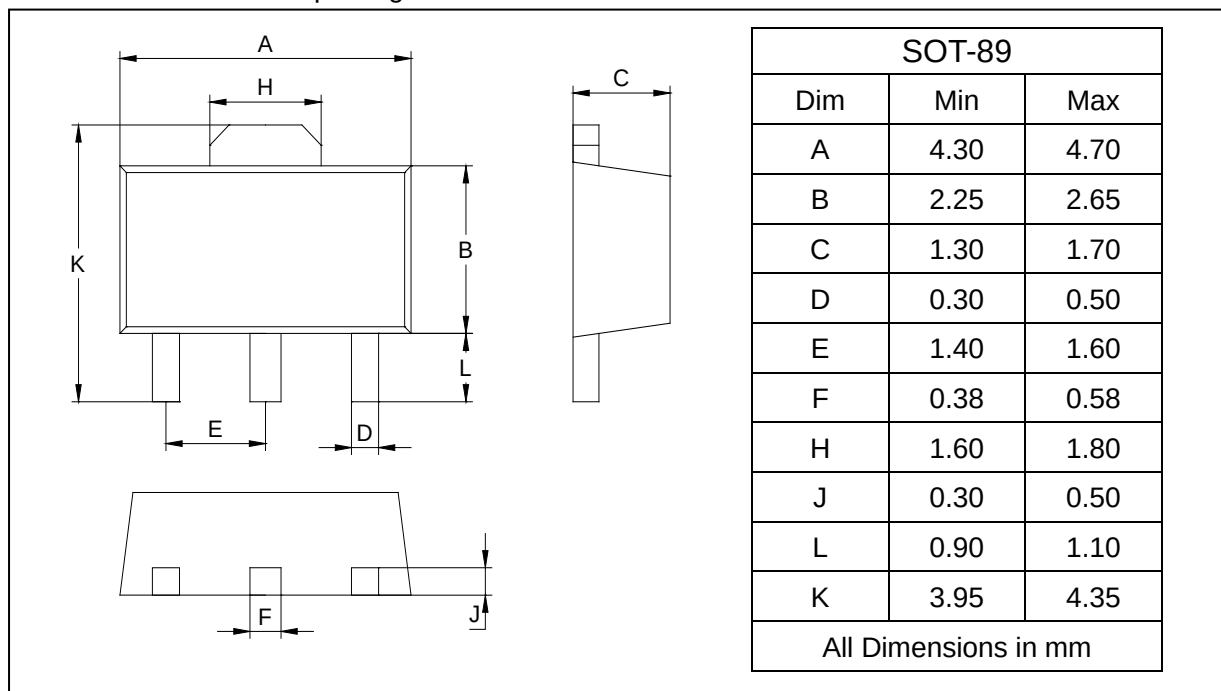
78L33

Three-Terminal Low Current Positive Voltage Regulators

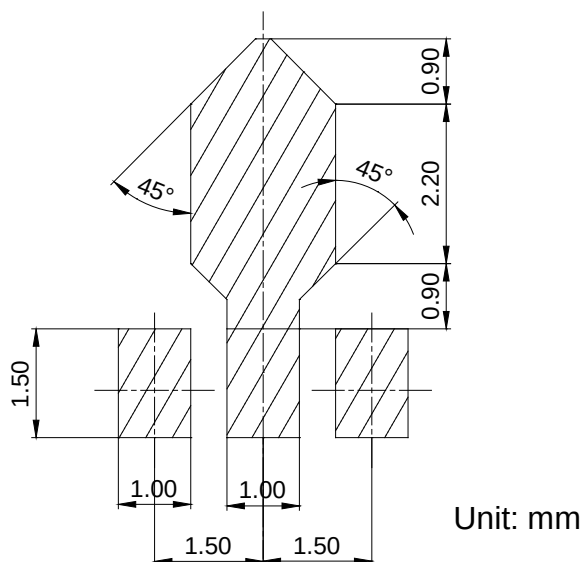
PACKAGE OUTLINE

Plastic surface mounted package

SOT-89



SOLDERING FOOTPRINT



PACKAGE INFORMATION

Device	Package	Shipping
78LXX	SOT-89	1000 pcs / Tape & Reel