

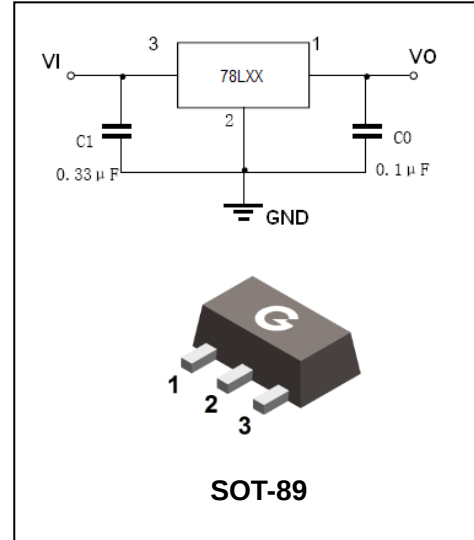
Three-Terminal Low Current Positive Voltage Regulators

BL78LXX

FEATURES

- Wide range of available, fixed output voltage.
- Low cost.
- Internal short-circuit current limiting.
- Internal thermal overload protection.
- No external components required.
- Complementary negative regulators offered (BL79LXX series).

HF



APPLICATIONS

- Three-terminal positive voltage regulator.

ORDERING INFORMATION

Type No.	Marking	Package Code
BL78LXX	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
$R_{\theta JA}$	Thermal Resistance Junction-to-Air	250	°C/W
P_D	Power dissipation ($T_A = 25^{\circ}\text{C}$)	500	mW
T_{OPR}	Operating Temperature Range	-40 ~ +125	°C
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-65 ~ +150	°C

Three-Terminal Low Current Positive Voltage Regulators

BL78LXX

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	BL78L33			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	BL78L05			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

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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	BL78L06			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	BL78L08			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

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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	BL78L09			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

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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	BL78L10			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	-	$mV/^\circ C$

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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	BL78L12			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	BL78L15			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	ΔReg_{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	ΔReg_{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
Dropout voltage	V_I-V_O	$T_J=25^{\circ}C$	-	1.7	-	V

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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	BL78L18			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	BL78L24			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

Three-Terminal Low Current Positive Voltage Regulators

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

Figure 1. Dropout Characteristics

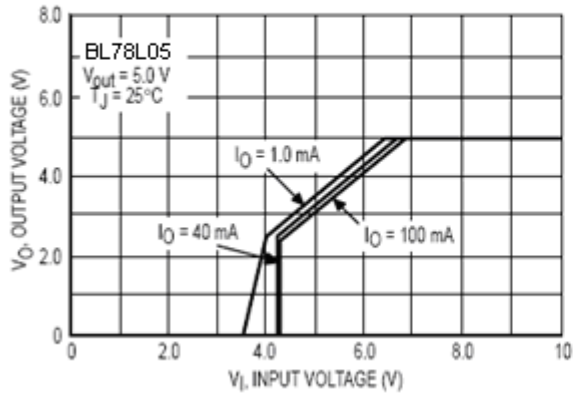


Figure 2. Dropout Voltage versus Junction Temperature

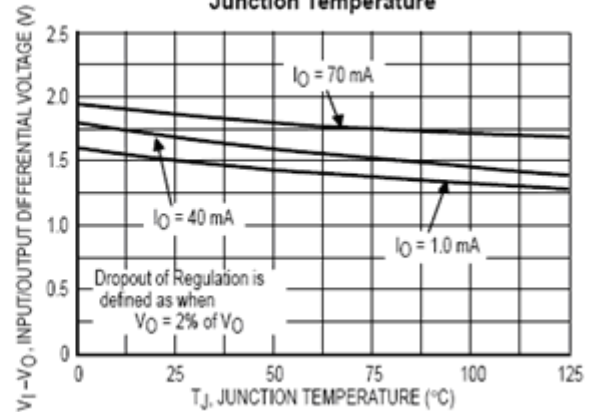


Figure 3. Input Bias Current versus Ambient Temperature

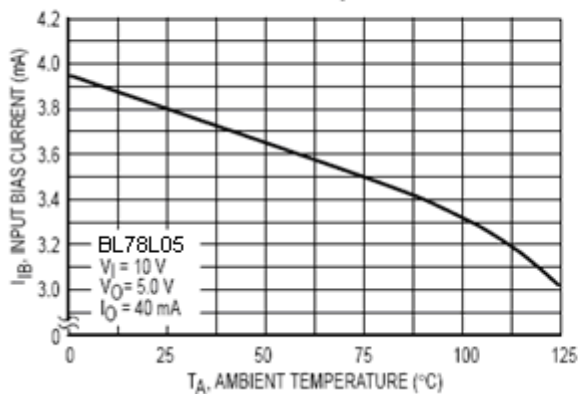
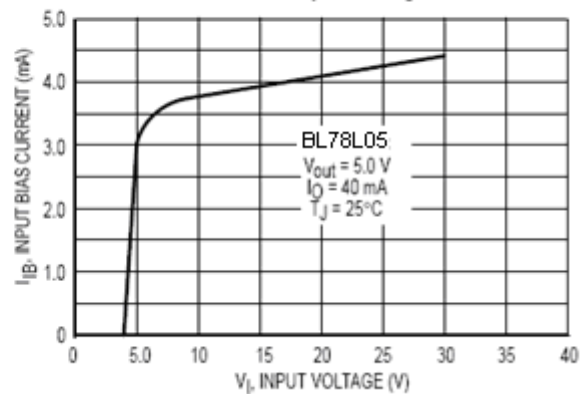


Figure 4. Input Bias Current versus Input Voltage

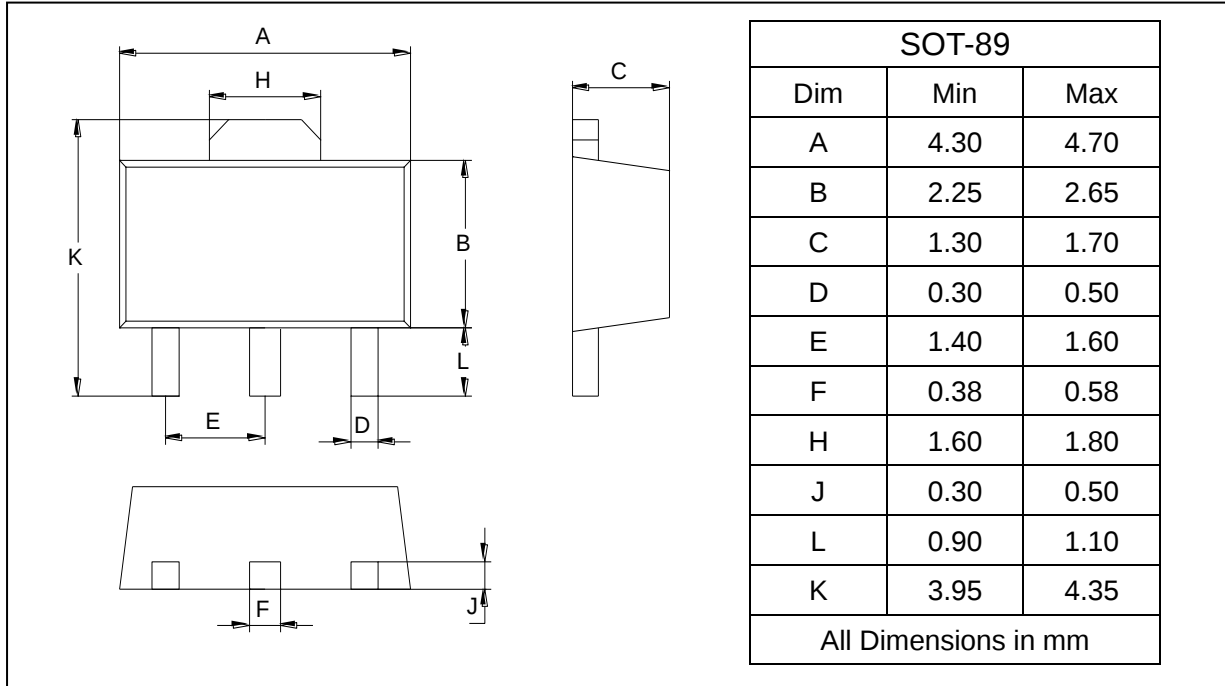


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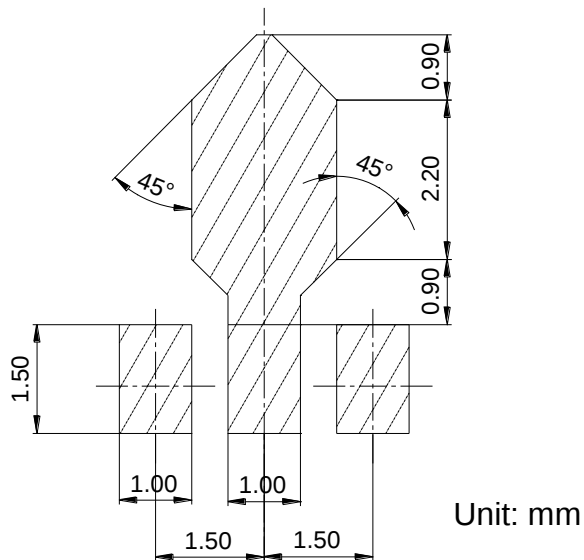
PACKAGE OUTLINE

Plastic surface mounted package

SOT-89



SOLDERING FOOTPRINT



PACKAGE INFORMATION

Device	Package	Shipping
BL78LXX	SOT-89	1000 pcs / Tape & Reel