

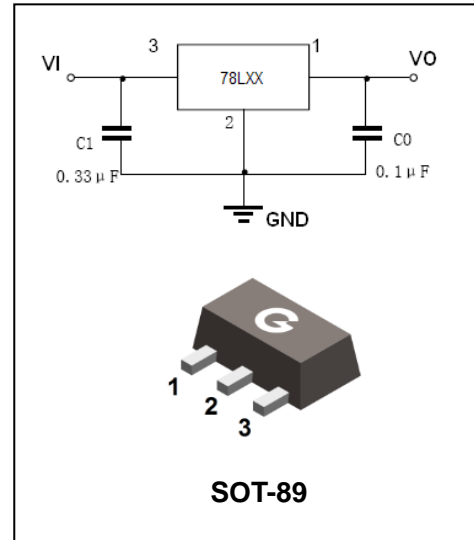
Three-Terminal Low Current Positive Voltage Regulators

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
$R_{th\ j-c}$	Thermal Resistance, Junction to Case	250	$^{\circ}C/W$
P_D	Power dissipation	500	mW
T_{OPR}	Operating junction temperature	-40 to +125	$^{\circ}C$
T_{STG}	Storage temperature range	-65 to +150	$^{\circ}C$

Three-Terminal Low Current Positive Voltage Regulators

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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	$T_J=25^{\circ}C$	3.168	3.3	3.432	V
		$5.8V \leq V_i \leq 20V, I_O=1mA-40mA$	3.135	-	3.465	
		$V_i=8.3V, I_O=1mA-70mA$	3.135	-	3.465	
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$	-	-	60	mV
		$T_J=25^{\circ}C, I_O=1mA-40mA$	-	-	30	
Line regulation	Reg_{line}	$5.8V \leq V_i \leq 20V, T_J=25^{\circ}C$	-	-	150	mV
		$6.3V \leq V_i \leq 20V, T_J=25^{\circ}C$	-	-	100	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$	-	-	6.0	mA
		$T_J=125^{\circ}C$	-	-	5.5	
Input Bias Current Change	ΔI_{IB}	$6.3V \leq V_i \leq 20V$	-	-	1.5	mA
		$1mA \leq I_O \leq 40mA$	-	-	0.1	
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	$T_J=25^{\circ}C$	4.8	5.0	5.2	V
		$7V \leq V_i \leq 20V, I_O=1mA-40mA$	4.75	-	5.25	
		$V_i=10V, I_O=1mA-70mA$	4.75	-	5.25	
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$	-	11	60	mV
		$T_J=25^{\circ}C, I_O=1mA-40mA$	-	5	30	
Line regulation	Reg_{line}	$7V \leq V_i \leq 20V, T_J=25^{\circ}C$	-	55	150	mV
		$8V \leq V_i \leq 20V, T_J=25^{\circ}C$	-	45	100	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$	-	3.8	6.0	mA
		$T_J=125^{\circ}C$	-	-	5.5	
Input Bias Current Change	ΔI_{IB}	$8V \leq V_i \leq 20V$	-	-	1.5	mA
		$1mA \leq I_O \leq 40mA$	-	-	0.1	
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	$T_j=25^{\circ}C$	5.75	6.0	6.25	V
		$V_i=8.5V-20V, I_o=1mA-40mA$	5.7	-	6.3	
		$V_i=8.5V, I_o=1mA-70mA$	5.7	-	6.3	
Load regulation	Reg_{load}	$T_j=25^{\circ}C, I_o=1mA-100mA$	-	12.8	80	mV
		$T_j=25^{\circ}C, I_o=1mA-70mA$		5.8	40	
Line regulation	Reg_{line}	$8.5V \leq V_i \leq 20V, T_j=25^{\circ}C$	-	64	175	mV
		$9V \leq V_i \leq 20V, T_j=25^{\circ}C$		54	125	
Input Bias Current	I_{IB}	$T_j=25^{\circ}C, V_{IN}=12V, I_o=40mA$	-	-	5.5	mA
		$T_j=125^{\circ}C, V_{IN}=12V, I_o=40mA$	-	3.9	6.0	
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	$T_j=25^{\circ}C$	7.7	8.0	8.3	V
		$10.5V \leq V_i \leq 23V, I_o=1mA-40mA$	7.6	-	8.4	
		$V_i=14V, I_o=1mA-70mA$	7.6	-	8.4	
Load regulation	Reg_{load}	$T_j=25^{\circ}C, I_o=1mA-100mA$	-	15	80	mV
		$T_j=25^{\circ}C, I_o=1mA-40mA$		8.0	40	
Line regulation	Reg_{line}	$10.5V \leq V_i \leq 23V, T_j=25^{\circ}C$	-	20	175	mV
		$11V \leq V_i \leq 23V, T_j=25^{\circ}C$		12	125	
Input Bias Current	I_{IB}	$T_j=25^{\circ}C$	-	3	6.0	mA
		$T_j=125^{\circ}C$	-	-	5.5	
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	$T_j=25^{\circ}C$	8.6	9.0	9.4	V
		$V_i=11.5V-24V, I_o=1mA-40mA$	8.5	-	9.5	
		$V_i=15V, I_o=1mA-70mA$	8.5	-	9.5	
Load regulation	Reg_{load}	$T_j=25^{\circ}C, I_o=1mA-100mA$	-	15	90	mV
		$T_j=25^{\circ}C, I_o=1mA-40mA$	-	8.0	40	
Line regulation	Reg_{line}	$11.5V \leq V_i \leq 24V, T_j=25^{\circ}C$	-	20	175	mV
		$12V \leq V_i \leq 24V, T_j=25^{\circ}C$	-	12	125	
Input Bias Current	I_{IB}	$T_j=25^{\circ}C$	-	3.0	6.0	mA
		$T_j=125^{\circ}C$	-	-	5.5	
Input Bias Current Change	ΔI_{IB}	$11V \leq V_i \leq 23V$	-	-	1.5	mA
		$1mA \leq I_o \leq 40mA$	-	-	0.1	
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	12	12.5	V
			11.4	-	12.6	
			11.4	-	12.6	
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	20	100	mV
			-	10	50	
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	250	mV
			-	100	200	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	4.2	6.5	mA
			-	-	6.0	
Input Bias Current Change	ΔI_{IB}	$16V \leq V_i \leq 27V$ $1mA \leq I_O \leq 40mA$	-	-	1.5	mA
			-	-	0.1	
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	15	15.6	V
			14.25	-	15.75	
			14.25	-	15.75	
Load regulation	ΔReg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$ $T_J=25^{\circ}C, I_O=1mA-40mA$	-	25	150	mV
			-	12	75	
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	300	mV
			-	110	250	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	4.4	6.5	mA
			-	-	6.0	
Input Bias Current Change	ΔI_{IB}	$20V \leq V_i \leq 30V$ $1mA \leq I_O \leq 40mA$	-	-	1.5	mA
			-	-	0.1	
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	$T_J=25^{\circ}C$	17.3	18	18.7	V
		$V_i=20.7V-33V, I_O=1mA-40mA$	17.1	-	18.9	
		$V_i=27V, I_O=1mA-70mA$	17.1	-	18.9	
Load regulation	Reg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$	-	30	170	mV
		$T_J=25^{\circ}C, I_O=1mA-40mA$	-	15	85	
Line regulation	Reg_{line}	$20.7V \leq V_i \leq 33V, T_J=25^{\circ}C$	-	45	325	mV
		$21V \leq V_i \leq 33V, T_J=25^{\circ}C$	-	35	275	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$	-	3.1	6.5	mA
		$T_J=125^{\circ}C$	-	-	6.0	
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	$T_J=25^{\circ}C$	23	24	25	V
		$V_i=27V-38V, I_O=1mA-40mA$	22.8	-	25.2	
		$V_i=27V-33V, I_O=1mA-70mA$	22.8	-	25.2	
Load regulation	ΔReg_{load}	$T_J=25^{\circ}C, I_O=1mA-100mA$	-	40	200	mV
		$T_J=25^{\circ}C, I_O=1mA-40mA$	-	20	100	
Line regulation	ΔReg_{line}	$28V \leq V_i \leq 80V, T_J=25^{\circ}C$	-	50	300	mV
		$27V \leq V_i \leq 38V, T_J=25^{\circ}C$	-	60	350	
Input Bias Current	I_{IB}	$T_J=25^{\circ}C$	-	3.1	6.5	mA
		$T_J=125^{\circ}C$	-	-	6.0	
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

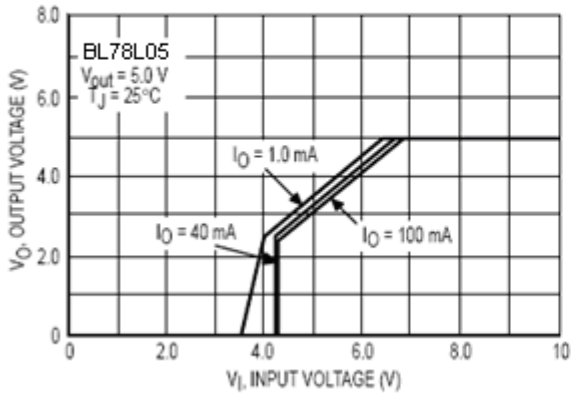


Figure 2. Dropout Voltage versus Junction Temperature

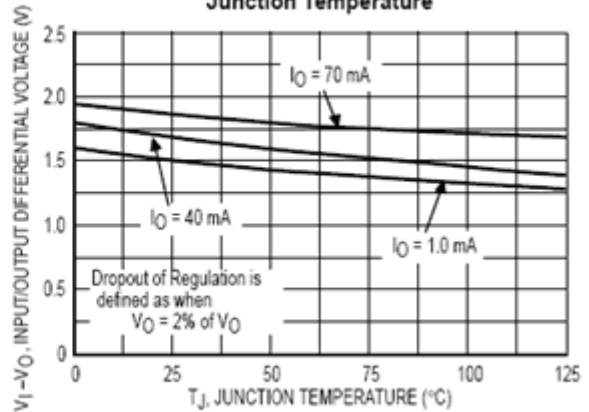


Figure 3. Input Bias Current versus Ambient Temperature

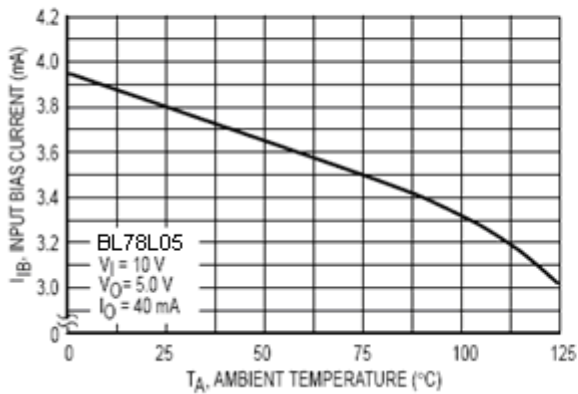
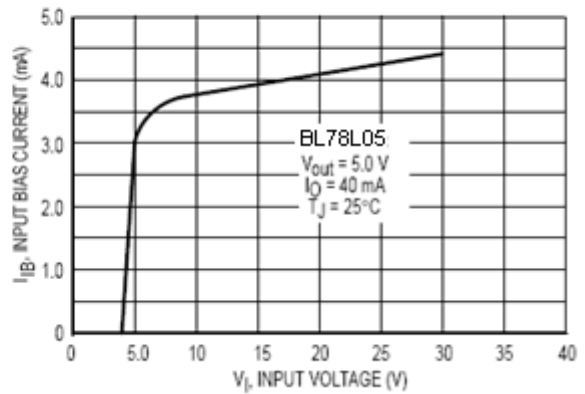


Figure 4. Input Bias Current versus Input Voltage



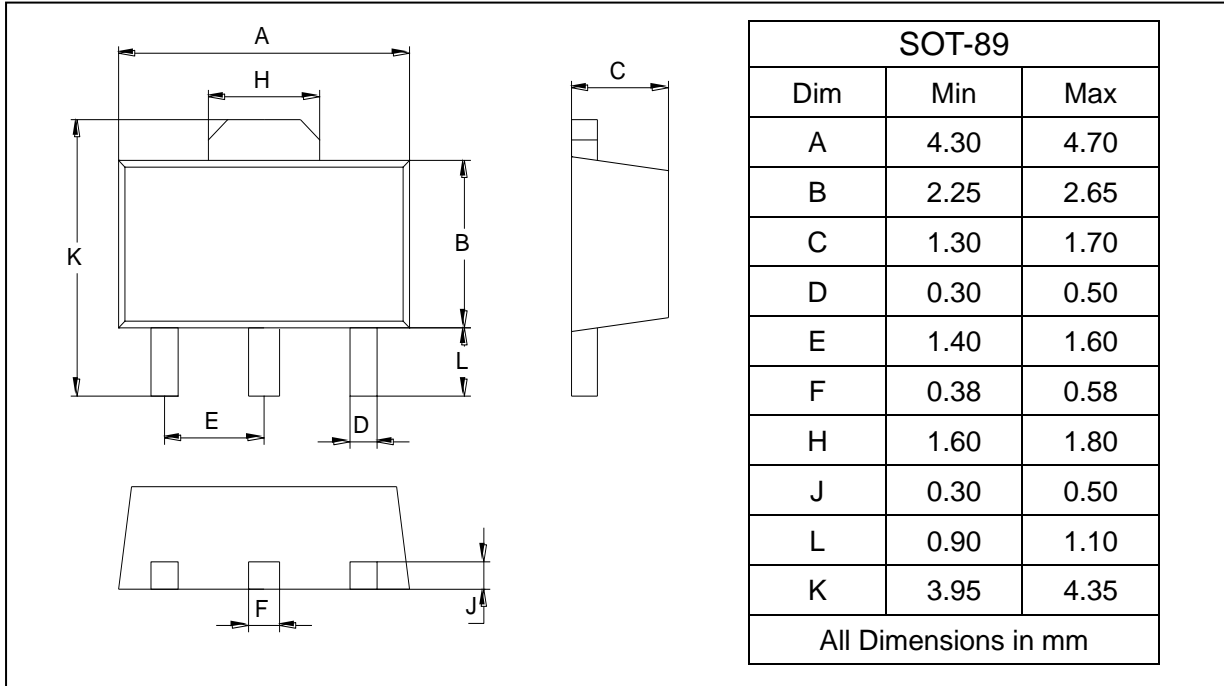
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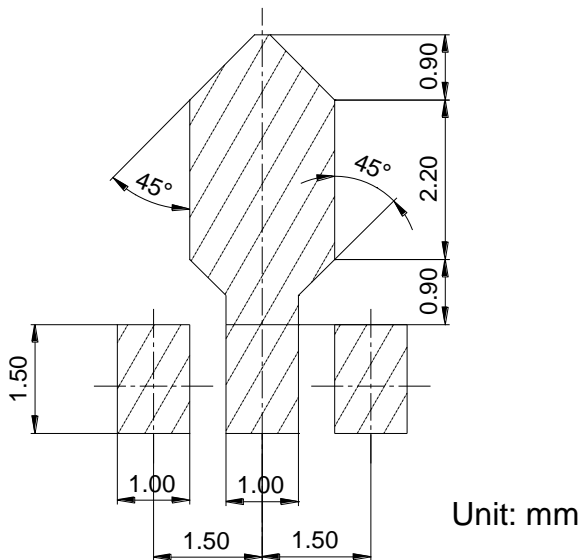
PACKAGE OUTLINE

Plastic surface mounted package

SOT-89



SOLDERING FOOTPRINT



PACKAGE INFORMATION

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