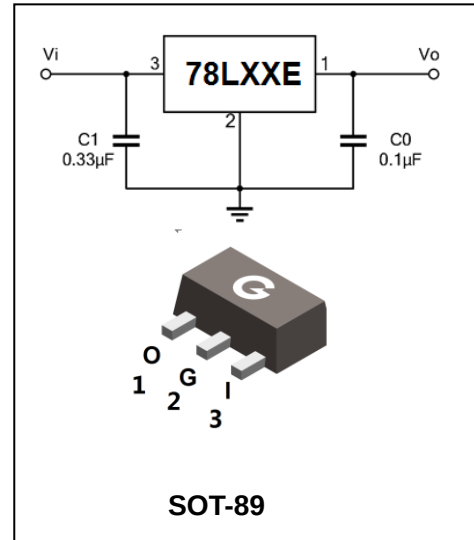


Three-Terminal Low Current Positive Voltage Regulators BL78LXXE

FEATURES

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

HF



APPLICATIONS

- Three-terminal positive voltage regulator.

ORDERING INFORMATION

Type No.	Marking	Package Code
BL78L33E	78L33	SOT-89
BL78L05E	78L05	SOT-89
BL78L06E	78L06	SOT-89
BL78L08E	78L08	SOT-89
BL78L09E	78L09	SOT-89
BL78L10E	78L10	SOT-89
BL78L12E	78L12	SOT-89
BL78L15E	78L15	SOT-89
BL78L18E	78L18	SOT-89
BL78L24E	78L24	SOT-89

Three-Terminal Low Current Positive Voltage Regulators

BL78LXXE

MAXIMUM RATING operating temperature range applies unless otherwise specified

Symbol	Parameter	Value	Units
V_I	Input voltage(BL78L33E-BL78L09E)	30	V
	(BL78L10E-BL78L15E)	35	
	(BL78L18E-BL78L24E)	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

ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Test conditions	BL78L33E			UNIT
			MIN	TYP	MAX	
Output voltage	V_O	$T_J=25^\circ\text{C}$ $5.8\text{V}\leq V_I\leq 20\text{V}$, $I_O=1\text{mA}-40\text{mA}$ $V_I=8.3\text{V}$, $I_O=1\text{mA}-70\text{mA}$	3.168 3.135 3.135	3.3 - -	3.432 3.465 3.465	V
Load regulation	Reg_{load}	$T_J=25^\circ\text{C}$, $I_O=1\text{mA}-100\text{mA}$ $T_J=25^\circ\text{C}$, $I_O=1\text{mA}-40\text{mA}$	-	-	60 30	mV
Line regulation	Reg_{line}	$5.8\text{V}\leq V_I\leq 20\text{V}$, $T_J=25^\circ\text{C}$ $6.3\text{V}\leq V_I\leq 20\text{V}$, $T_J=25^\circ\text{C}$	-	-	150 100	mV
Quiescent Current	I_Q	$T_J=25^\circ\text{C}$ $T_J=125^\circ\text{C}$	-	-	6.0 5.5	mA
Quiescent Current Change	ΔI_Q	$6.3\text{V}\leq V_I\leq 20\text{V}$ $1\text{mA}\leq I_O\leq 40\text{mA}$	-	-	1.5 0.1	mA
Output noise voltage	V_N	$10\text{Hz}\leq f\leq 100\text{KHz}$	-	40	-	μV
Ripple rejection	RR	$I_O=40\text{mA}$, $6.3\text{V}\leq V_I\leq 16.3\text{V}$ $f=120\text{Hz}$, $T_J=25^\circ\text{C}$	41	49	-	dB
Dropout voltage	V_I-V_O	$T_J=25^\circ\text{C}$, $V_{IN}=8.3\text{V}$, $I_O=40\text{mA}$	-	2.5	-	V

Three-Terminal Low Current Positive Voltage Regulators

BL78LXXE

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	BL78L05E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	- -	3.8 -	6.0 5.5	mA
Quiescent Current Change	ΔI_Q	$8V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=10V, I_O=40mA$	-	1.7	-	V

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	BL78L06E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C, V_{IN}=12V, I_O=40mA$ $T_J=125^{\circ}C, V_{IN}=12V, I_O=40mA$	- -	- 3.9	5.5 6.0	mA
Quiescent Current Change	ΔI_Q	$9V \leq V_I \leq 20V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=12V, I_O=40mA$	-	1.7	-	V

Three-Terminal Low Current Positive Voltage Regulators

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ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Test conditions	BL78L08E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3 -	6.0 5.5	mA
Quiescent Current Change	ΔI_Q	$11V \leq V_I \leq 23V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C$, $V_{IN}=14V$, $I_O=40mA$	-	1.7	-	V

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	BL78L09E			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}	$11.5V \leq V_I \leq 24V$, $T_J=25^{\circ}C$ $12V \leq V_I \leq 24V$, $T_J=25^{\circ}C$	-	10 8	175 125	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.0 -	6.0 5.5	mA
Quiescent Current Change	ΔI_Q	$11V \leq V_I \leq 23V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C$, $V_{IN}=15V$, $I_O=40mA$	-	1.7	-	V

Three-Terminal Low Current Positive Voltage Regulators

BL78LXXE

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	BL78L10E			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
Quiescent Current	I_Q	$T_j = 25^\circ C$	-	2.0	3.0	mA
Quiescent Current Change	ΔI_Q	$V_i = 13$ 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	$T_j=25^\circ C$ $V_{IN}=16V, I_O=40mA$	-	1.7	-	V
Dropout voltage	V_I-V_O	$I_O = 5mA$, $T_j = 0$ to $125^\circ C$	-	0.9	-	$mV/^\circ C$

Three-Terminal Low Current Positive Voltage Regulators

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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	BL78L12E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	4.2 -	6.5 6.0	mA
Quiescent Current Change	ΔI_Q	$16V \leq V_I \leq 27V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=19V, I_O=40mA$	-	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	BL78L15E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	4.4 -	6.5 6.0	mA
Quiescent Current Change	ΔI_Q	$20V \leq V_I \leq 30V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=23V, I_O=40mA$	-	1.7	-	V

Three-Terminal Low Current Positive Voltage Regulators

BL78LXXE

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	BL78L18E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.1 -	6.5 6.0	mA
Quiescent Current Change	ΔI_Q	$21V \leq V_I \leq 33V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=27V, I_O=40mA$	-	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	BL78L24E			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
Quiescent Current	I_Q	$T_J=25^{\circ}C$ $T_J=125^{\circ}C$	-	3.1 -	6.5 6.0	mA
Quiescent Current Change	ΔI_Q	$28V \leq V_I \leq 38V$ $1mA \leq I_O \leq 40mA$	-	-	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	$T_J=25^{\circ}C, V_{IN}=33V, I_O=40mA$	-	1.7	-	V

Three-Terminal Low Current Positive Voltage Regulators

BL78LXXE

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

Figure 1. Dropout Characteristics

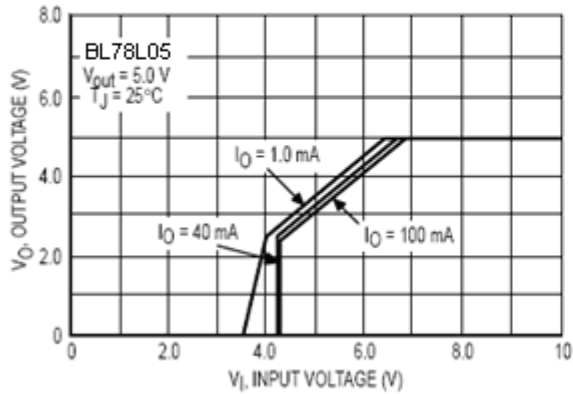


Figure 2. Dropout Voltage versus Junction Temperature

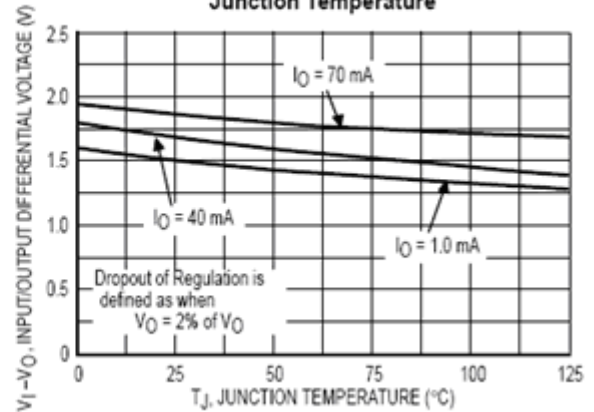


Figure 3. Input Bias Current versus Ambient Temperature

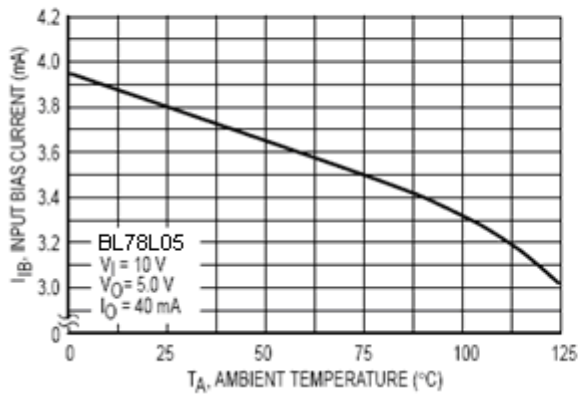


Figure 4. Input Bias Current versus Input Voltage

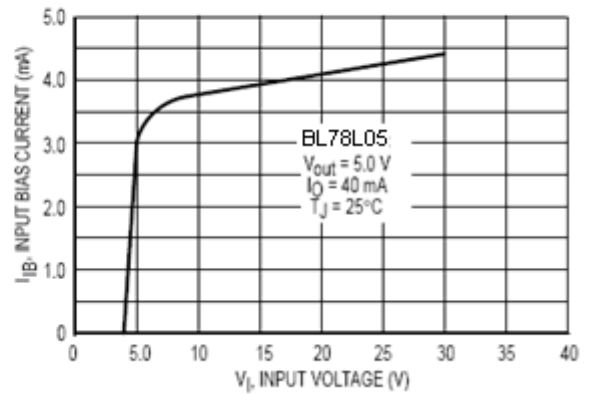
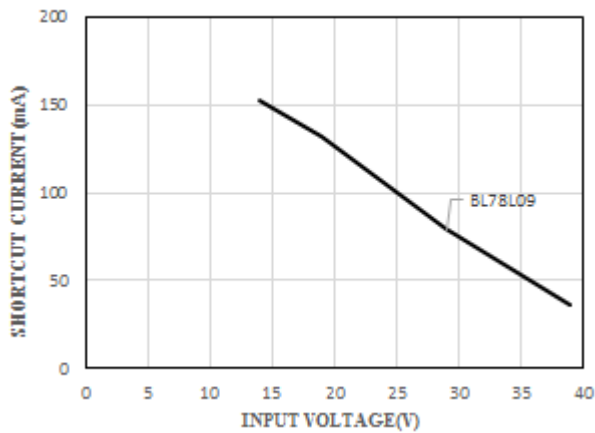


Figure 5. Shortcut Current vs. Input Voltage

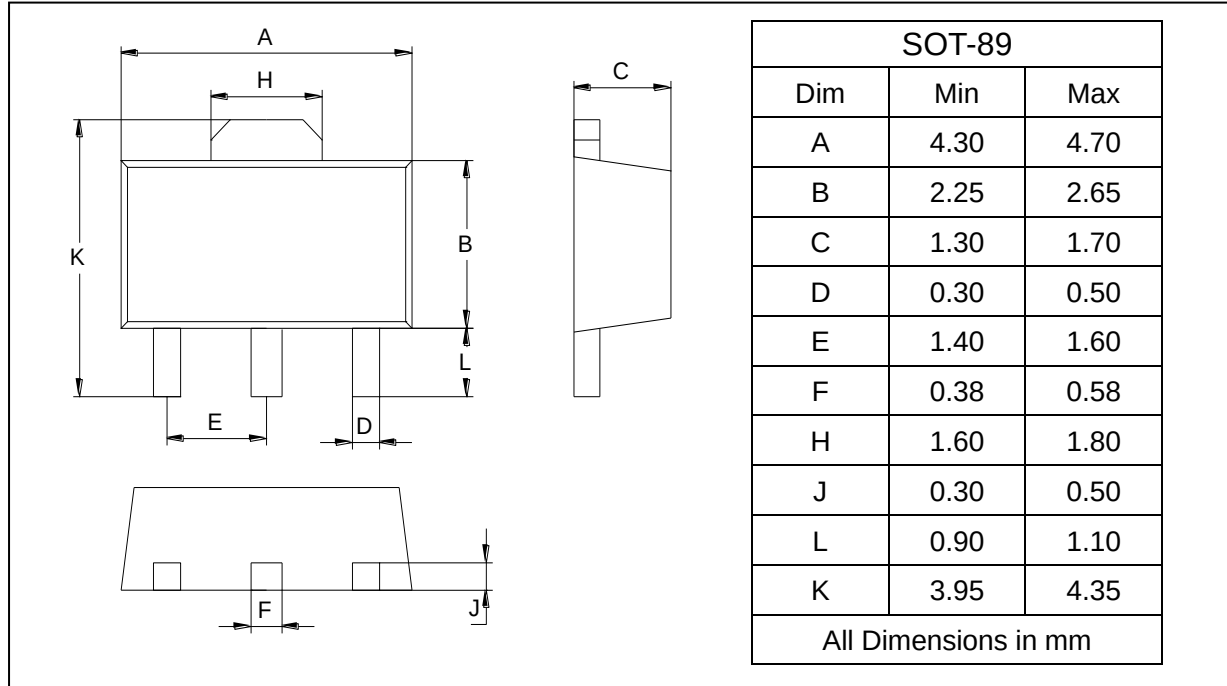


Three-Terminal Low Current Positive Voltage Regulators BL78LXXE

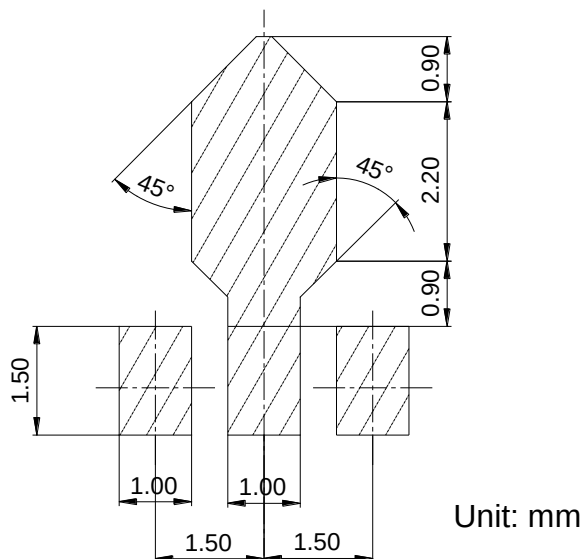
PACKAGE OUTLINE

Plastic surface mounted package

SOT-89



SOLDERING FOOTPRINT



PACKAGE INFORMATION

Device	Package	Shipping
BL78LXXE	SOT-89	1000 pcs / Tape & Reel