



3-Terminal 150mA Positive Voltage Regulator

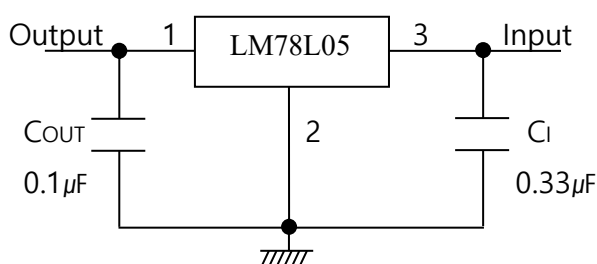
DESCRIPTION

LM78LXX a series of positive voltage regulators are inexpensive, easy-to-use devices suitable for a multitude of applications that require a regulated supply of up to 150 mA. These devices offer a substantial performance advantage over the traditional Zener Diode–Resistor combination, as output impedance and quiescent current are substantially reduced.

FEATURES

- Low Cost
- No external components required
- Output voltages (5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V)
- Internal Thermal shutdown and SOA protection
- Output voltage offered in 4% Tolerance
- Pb-Free Packages are available
- High ESD Level (HBM>5,000V, MM>500V)

Standard Application

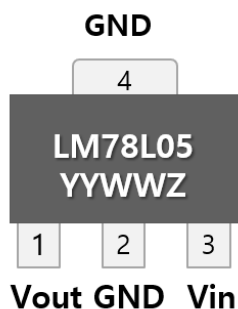


The input voltage must remain typically 2.0V above the output voltage even during the Low point on the ripple voltage.

- C_I is required if regulator is located an appreciable distance from power filter.
- C_O improves transient response. Value of $\leq 0.1\mu F$ could cause instability.



Package Information



Ordering Information

Part No	Package	Packing	Finish	Halogen	REEL Q'TY	Remark
LM78LXXS	SOP-8	Reel & Tape	Sn	Free	2,500	*XX : Output Voltage Option
LM78LXXQ	SOT-89	Reel & Tape	Sn	Free	1,000	*XX : Output Voltage Option

XX : Output Voltage Option
05=5V, 06=6V, 08=8V, 10=10V, 15=15V, 18=18V



Maximum Ratings

Rating	Symbol	Value	Unit
		SOT-89	
Input Voltage 5V~18V 24V	V _I	35	V
		40	
Power Dissipation	P _D	Internally Limited	W
Thermal Resistance of Junction to Case	R _{θJC}	15	°C/W
Storage Temperature	T _{STG}	-55~150	°C
Operating Junction Temperature	T _J	150	°C
Operating Temperature	T _{OPR}	-40~125	°C

Stresses exceeding Maximum ratings may damage the device. Maximum ratings are stress ratings. Functional operation above the recommended operating conditions is not implied. Extended exposure to stresses the above the recommended operating conditions may affect device reliability.



Electrical Characteristics LM78L05

($T_J = 0$ to 125°C , $V_{IN}=10.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	4.8	5.0	5.2	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	4.75	5.0	5.25	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$7.0\text{V} \leq V_{IN} \leq 20.0\text{V}$		8.0	150	mV
		$8.0\text{V} \leq V_{IN} \leq 20.0\text{V}$		6.0	100	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		11	60	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		5.0	30	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		2.0	5.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$8.0\text{V} \leq V_{IN} \leq 20.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-0.65		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		40		$\mu\text{V}/V_O$
Ripple rejection	RR	$8.0\text{V} \leq V_{IN} \leq 18.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	41	80		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used.



Electrical Characteristics LM78L06

($T_J = 0$ to 125°C , $V_{IN}=12.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	5.76	6.0	6.24	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	5.7	6.0	6.3	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$8.5\text{V} \leq V_{IN} \leq 20.0\text{V}$		64	175	mV
		$9.0\text{V} \leq V_{IN} \leq 20.0\text{V}$		54	110	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		12.8	70	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		5.8	35	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$			5.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$9.0\text{V} \leq V_{IN} \leq 20.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.75		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		40		$\mu\text{V}/V_O$
Ripple rejection	RR	$10.0\text{V} \leq V_{IN} \leq 20.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	40	46		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used.



Electrical Characteristics LM78L08

($T_J = 0$ to 125°C , $V_{IN}=14.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	7.7	8.0	8.3	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	7.6	8.0	8.4	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$10.5\text{V} \leq V_{IN} \leq 23.0\text{V}$		10	175	mV
		$11.0\text{V} \leq V_{IN} \leq 23.0\text{V}$		8.0	125	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		15	80	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		8.0	40	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		2.0	5.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$11.0\text{V} \leq V_{IN} \leq 23.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-0.8		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		60		$\mu\text{V}/V_O$
Ripple rejection	RR	$11.0\text{V} \leq V_{IN} \leq 21.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	39	70		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used.



Electrical Characteristics LM78L09

($T_J = 0$ to 125°C , $V_{IN}=15.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	8.64	9.0	9.36	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	8.55	9.0	9.45	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$11.4\text{V} \leq V_{IN} \leq 24.0\text{V}$		90	200	mV
		$12\text{V} \leq V_{IN} \leq 24.0\text{V}$		100	150	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		20	90	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		10	45	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		2.1	6.0	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$11.5\text{V} \leq V_{IN} \leq 24.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-0.9		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		70		$\mu\text{V}/V_O$
Ripple rejection	RR	$12.0\text{V} \leq V_{IN} \leq 22.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	38	44		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		2.0		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Electrical Characteristics LM78L10

($T_J = 0$ to 125°C , $V_{IN}=16.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	9.6	10.0	10.4	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	9.5	10.0	10.5	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$12.5\text{V} \leq V_{IN} \leq 25.0\text{V}$		100	220	mV
		$13.0\text{V} \leq V_{IN} \leq 25.0\text{V}$		100	170	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		20	94	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		10	47	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$			6.0	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$12.5\text{V} \leq V_{IN} \leq 25.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		0.95		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		74		$\mu\text{V}/V_O$
Ripple rejection	RR	$15.0\text{V} \leq V_{IN} \leq 25.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	38	43		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Electrical Characteristics LM78L12

($T_J = 0$ to 125°C , $V_{IN}=19.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	11.5	12.0	12.5	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	11.4	12.0	12.6	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$14.5\text{V} \leq V_{IN} \leq 27.0\text{V}$		120	250	mV
		$16.0\text{V} \leq V_{IN} \leq 27.0\text{V}$		100	200	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		20	100	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		10	50	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		3.2	6.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$16.0\text{V} \leq V_{IN} \leq 27.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-1.0		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		80		$\mu\text{V}/V_O$
Ripple rejection	RR	$15.0\text{V} \leq V_{IN} \leq 25.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	36	41		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Electrical Characteristics LM78L15

($T_J = 0$ to 125°C , $V_{IN}=23.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	14.4	15.0	15.6	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	14.2	15.0	15.7	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$17.5\text{V} \leq V_{IN} \leq 30.0\text{V}$		130	300	mV
		$20.0\text{V} \leq V_{IN} \leq 30.0\text{V}$		110	250	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		25	150	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		12	75	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		3.3	6.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$20.0\text{V} \leq V_{IN} \leq 30.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-1.3		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		90		$\mu\text{V}/V_O$
Ripple rejection	RR	$18.5\text{V} \leq V_{IN} \leq 28.5\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	34	40		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Electrical Characteristics LM78L18

($T_J = 0$ to 125°C , $V_{IN}=27.0\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	17.3	18.0	18.7	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	17.1	18.0	18.9	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$21.0\text{V} \leq V_{IN} \leq 33.0\text{V}$		32	325	mV
		$22.0\text{V} \leq V_{IN} \leq 33.0\text{V}$		27	275	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$1.0\text{ mA} \leq I_O \leq 100\text{ mA}$		30	170	mV
		$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$		15	75	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		3.3	6.5	mA
Quiescent current change	ΔI_Q	$1.0\text{ mA} \leq I_O \leq 40\text{ mA}$			0.1	mA
		$21.0\text{V} \leq V_{IN} \leq 33.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-1.5		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		150		$\mu\text{V}/V_O$
Ripple rejection	RR	$23.0\text{V} \leq V_{IN} \leq 33.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	32	38		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Electrical Characteristics LM78L24

($T_J = 0$ to 125°C , $V_{IN}=33\text{V}$, $I_O=40\text{ mA}$, $C_I=0.33\text{ }\mu\text{F}$, $C_O=0.1\text{ }\mu\text{F}$, unless otherwise noted)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Output voltage	V_O	$T_J=25^\circ\text{C}$	23.0	24.0	25.0	V
		$1\text{mA} \leq I_O \leq 70\text{ mA}$, $P_D \leq 0.75\text{W}$	22.8	24.0	25.2	
Line regulation ($T_J=25^\circ\text{C}$) (Note 1)	LIR	$27.0\text{V} \leq V_{IN} \leq 38.0\text{V}$		35	350	mV
		$28.0\text{V} \leq V_{IN} \leq 38.0\text{V}$		30	300	
Load regulation ($T_J=25^\circ\text{C}$) (Note 1)	LOR	$5.0\text{ mA} \leq I_O \leq 1.5\text{A}$		40	200	mV
		$250\text{ mA} \leq I_O \leq 750\text{ mA}$		20	100	
Quiescent current	I_Q	$T_J=25^\circ\text{C}$		3.5	6.5	mA
Quiescent current change	ΔI_Q	$5.0\text{ mA} \leq I_O \leq 1.0\text{ A}$			0.1	mA
		$28.0\text{V} \leq V_{IN} \leq 38.0\text{V}$			1.5	
Output Voltage Drift	$\Delta V_O / \Delta T$	$I_O = 5\text{ mA}$		-2.0		mV/ $^\circ\text{C}$
Output noise voltage	V_N	$10\text{ Hz} \leq f \leq 100\text{ KHz}$, $T_A=25^\circ$		200		$\mu\text{V}/V_O$
Ripple rejection	RR	$28.0\text{V} \leq V_{IN} \leq 38.0\text{V}$, $f=120\text{ Hz}$ $T_J=25^\circ\text{C}$	31	35		dB
Dropout voltage	V_{DROP}	$T_J=25^\circ\text{C}$		1.7		V
Short circuit current limit	I_{SC}	$V_{IN} = 35\text{V}$, $T_A=25^\circ\text{C}$		230		mA
Peak output current	I_{PK}	$T_J=25^\circ\text{C}$		0.55		A

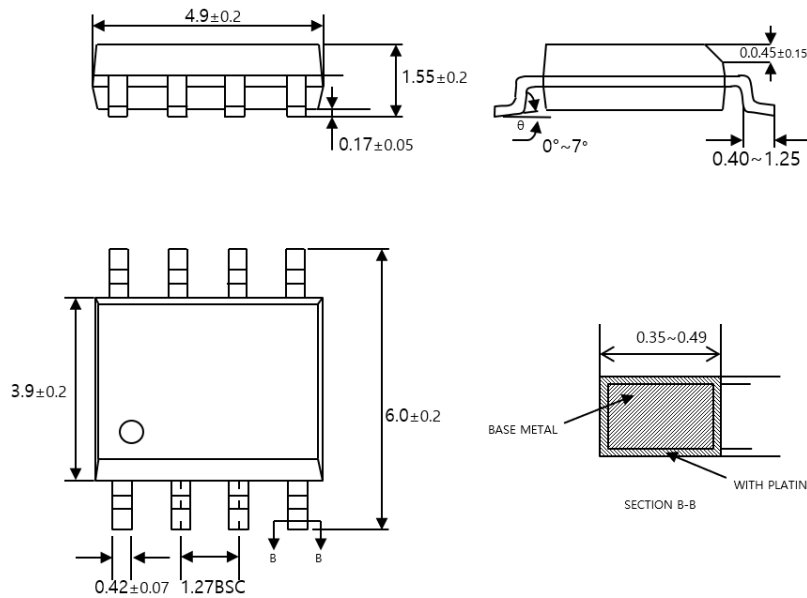
Note 1 Line and Load regulation are specified at constant junction temperature. Changes of V_O due to heating effects must be taken into account separately. Pulse testing with low duty circle is used



Package Dimension

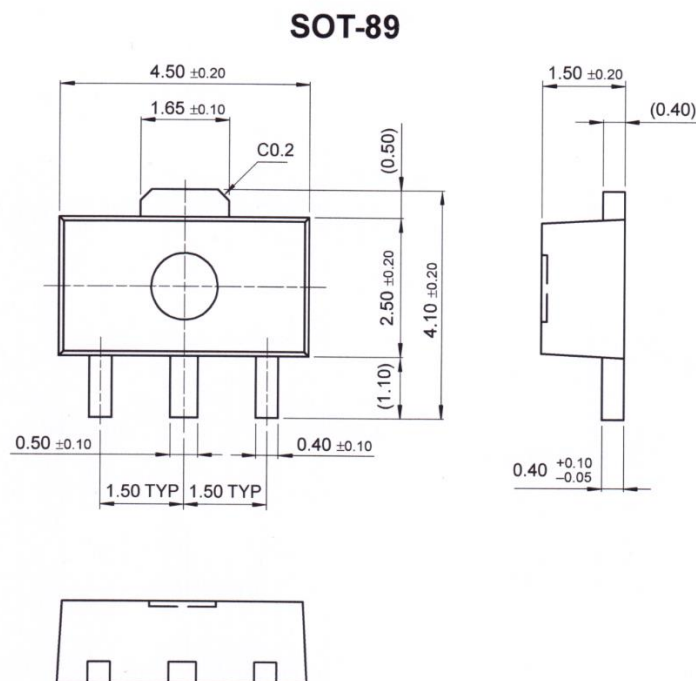
SOP-8

Unit : mm



SOT-89

Unit : mm





Revision History

No	Date	Contents
1	2015-01-30	Initial Brief Datasheet Release
2	2015-06-22	ESD Level Update
3	2022-10-20	Add SOP-8 Package

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