TS78L00 Series

3-Terminal 100mA Positive Voltage Regulator

Thermal Performance

Parameter		Symbol	Limit	Unit
Thermal Resistance - Junction to Case	TO-92	$R_{\Theta JC}$	--	°C/W
	SOT-23		120	
	SOT-89		15	
	SOP-8		20	
Thermal Resistance - Junction to Ambient	TO-92	$R_{\Theta JA}$	230	°C/W
	SOT-23		330	
	SOT-89		55	
	SOP-8		55	

Note: Considering 6 cm^2 of copper board heat-sink

TS78L03 Electrical Characteristics

(V_{IN}=8.3V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		3.173	3.3	3.432	V
		5.8V≤V_{IN}≤20V, 5mA≤I_{OUT}≤100mA		3.142	3.3	3.465	
Line Regulation	REG_{LINE}	T_J=25°C	5.8V≤Vin≤20V I_{OUT}=40mA	--	50	150	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤ I_{OUT}≤100mA	--	15	60	
			5mA≤I_{OUT}≤40mA	--	5	30	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	3	6	mA
Quiescent Current Change	ΔI_Q	5.8V≤Vin≤20V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	40	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 5.8V≤Vin≤20V		41	49	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	2	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-0.2	--	mV/ °C

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

TS78L00 Series

3-Terminal 100mA Positive Voltage Regulator

TS78L05 Electrical Characteristics

(V_{IN}=10V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		4.80	5	5.20	V
		7.5V≤Vin≤20V, 5mA≤I_{OUT}≤100mA		4.75	5	5.25	
Line Regulation	REG_{LINE}	T_J=25°C	7.5V≤Vin≤20V I_{OUT}=100mA	--	50	150	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤I_{OUT}≤100mA	--	20	60	
			5mA≤I_{OUT}≤40mA	--	10	30	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	3	6	mA
Quiescent Current Change	ΔI_Q	7.5V≤Vin≤20V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	40	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 7.5V≤Vin≤20V		41	49	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	1.7	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-0.65	--	mV/°C

TS78L09 Electrical Characteristics

(V_{IN}=15V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		8.65	9	9.36	V
		11.5V≤Vin≤23V, 5mA≤I_{OUT}≤100mA		8.57	9	9.45	
Line Regulation	REG_{LINE}	T_J=25°C	11.5V≤Vin≤23V I_{OUT}=40mA	--	90	180	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤I_{OUT}≤100mA	--	30	90	
			5mA≤I_{OUT}≤40mA	--	15	45	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	3	6	mA
Quiescent Current Change	ΔI_Q	11.5V≤Vin≤23V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	60	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 11.5V≤Vin≤23V		37	57	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	1.7	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-0.9	--	mV/°C

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

TS78L00 Series

3-Terminal 100mA Positive Voltage Regulator

TS78L12 Electrical Characteristics

(V_{IN}=19V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		11.53	12	12.48	V
		14.5V≤Vin≤27V, 5mA≤I_{OUT}≤100mA		11.42	12	12.60	
Line Regulation	REG_{LINE}	T_J=25°C	14.5V≤Vin≤27V I_{OUT}=40mA	--	120	240	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤I_{OUT}≤100mA	--	40	120	
			5mA≤I_{OUT}≤40mA	--	20	60	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	3	6.5	mA
Quiescent Current Change	ΔI_Q	14.5V≤Vin≤27V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	80	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 14.5V≤Vin≤27V		37	42	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	1.7	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-1.0	--	mV/°C

TS78L15 Electrical Characteristics

(V_{IN}=23V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		14.42	15	15.60	V
		17.5V≤Vin≤30V, 5mA≤I_{OUT}≤100mA		14.28	15	15.75	
Line Regulation	REG_{LINE}	T_J=25°C	17.5V≤Vin≤30V I_{OUT}=40mA	--	150	300	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤I_{OUT}≤100mA	--	50	150	
			5mA≤I_{OUT}≤40mA	--	25	75	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	3	6.6	mA
Quiescent Current Change	ΔI_Q	17.5V≤Vin≤30V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	90	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 17.5V≤Vin≤30V		34	39	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	1.7	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-1.3	--	mV/°C

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

TS78L24 Electrical Characteristics

(V_{IN}=33V, I_{OUT}=40mA, 0°C≤T_J≤125°C, C_{IN}=0.33μF, C_{OUT}=0.1μF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	V_{OUT}	T_J=25°C		23.07	24	24.96	V
		27V≤Vin≤38V, 5mA≤I_{OUT}≤100mA		22.85	24	25.20	
Line Regulation	REG_{LINE}	T_J=25°C	27≤Vin≤38V, I_{OUT}=40mA	--	200	400	mV
Load Regulation	REG_{LOAD}	T_J=25°C	5mA≤I_{OUT}≤100mA	--	80	240	
			5mA≤I_{OUT}≤40mA	--	40	120	
Quiescent Current	I_Q	I_{OUT}=0, T_J=25°C		--	4	7	mA
Quiescent Current Change	ΔI_Q	27V≤Vin≤38V		--	--	1.5	
		5mA≤I_{OUT}≤40mA		--	--	0.1	
Output Noise Voltage	V_N	10Hz≤f≤100KHz, T_J=25°C		--	200	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 27V≤Vin≤38V		31	45	--	dB
Voltage Drop	V_{DROP}	I_{OUT}=100mA, T_J=25°C		--	1.7	--	V
Peak Output Current	Io peak	T_J=25°C		--	0.15	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_J$	I_{OUT}=5mA, 0°C≤T_J≤150°C		--	-2.0	--	mV/°C

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

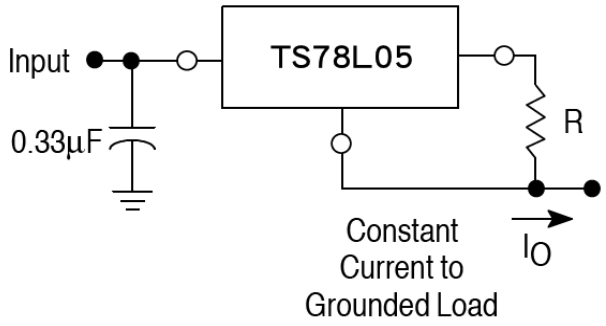
Application Information

Design Considerations

The TS78L00 Series of fixed voltage regulators are designed with Thermal Overload Protection that shuts down the circuit when subjected to an excessive power overload condition. Internal Short Circuit protection Limits the maximum current the circuit will pass.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. The input bypass capacitor should be selected to provide good high-frequency characteristics to insure stable operation under all load conditions. A 0.33µF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead. Bypassing the output is also recommended.

FIGURE 1 – Current Regulator



The TS78L00 regulators can also be used as a current source when connected as above. In order to minimize dissipation the TS78L05 is chosen in this application. Resistor R determines the current as follows:

$$Io = \frac{5.0V}{R} + I_B$$

I_{IB}=3.8mA over lined and load changes

For example, a 100mA current source would require R to be a 50Ω. 1/2W resistor and the output voltage compliance would be the input voltage less 7V.

FIGURE 2 – ±15V Tracking Voltage Regulator

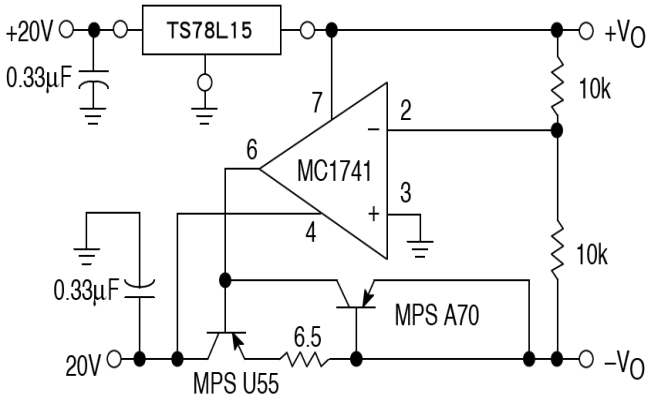
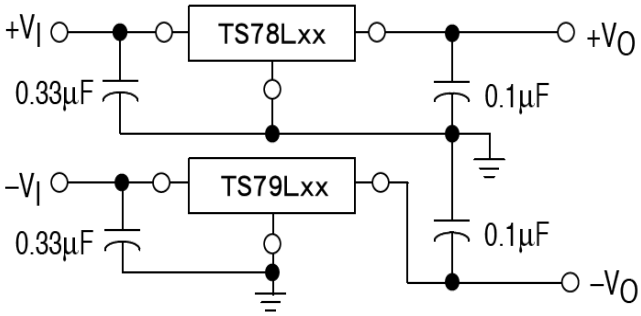


FIGURE 3 – ±15V Tracking Voltage Regulator



TS78L00 Series

3-Terminal 100mA Positive Voltage Regulator

Ordering information

Voltage	TO-92	SOT-89	SOP-8	SOT-23
3.3V	TS78L03CT B0 TS78L03CT A3	TS78L03ACY RM	TS78L03CS RL	TS78L03CX RF
5V	TS78L05CT B0 TS78L05CT A3	TS78L05ACY RM	TS78L05CS RL	TS78L05CX RF
9V	TS78L09CT B0 TS78L09CT A3	TS78L09ACY RM	TS78L09CS RL	TS78L09CX RF
12V	TS78L12CT B0 TS78L12CT A3	TS78L12ACY RM	TS78L12CS RL	
15V	TS78L15CT B0 TS78L15CT A3	TS78L15ACY RM	TS78L15CS RL	
24V			TS78L24CS RL	

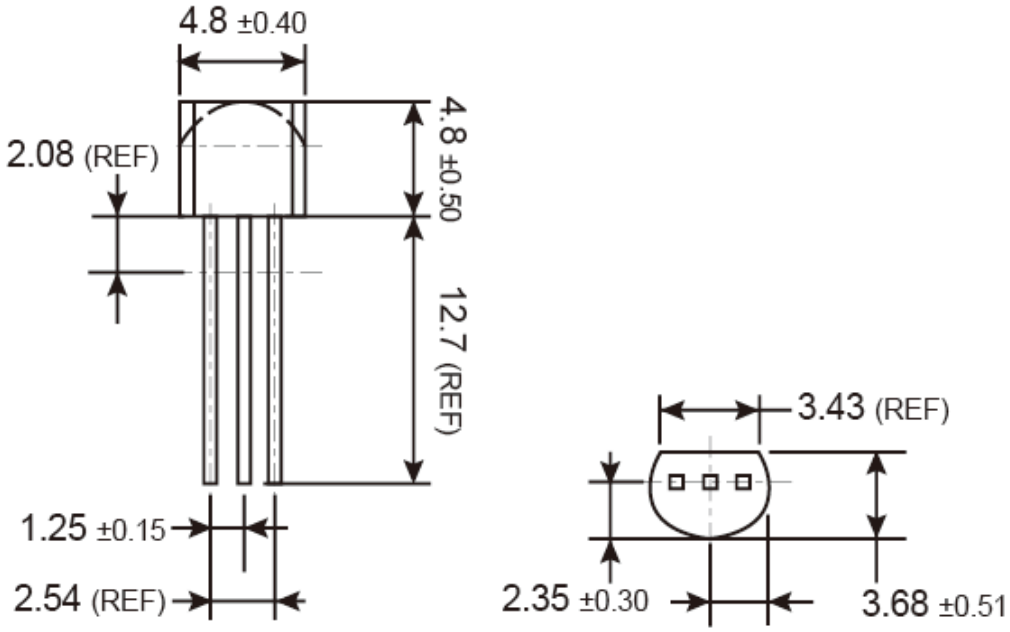
Packing code information

Packing	B0: 1kpcs / Bulk A3: 2kpcs / Ammo	1kpcs / 7" Reel	2.5kpcs / 13" Reel	3kpcs / 7"Reel

TS78L00 Series

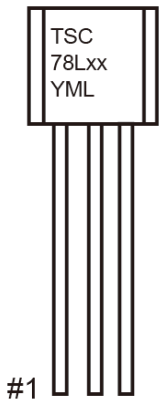
3-Terminal 100mA Positive Voltage Regulator

TO-92 Mechanical Drawing



Unit: Millimeters

Marking Diagram



XX = Output Voltage
(03=3.3V, 05=5V, 09=9V, 12=12V, 15=15V)

Y = Year Code

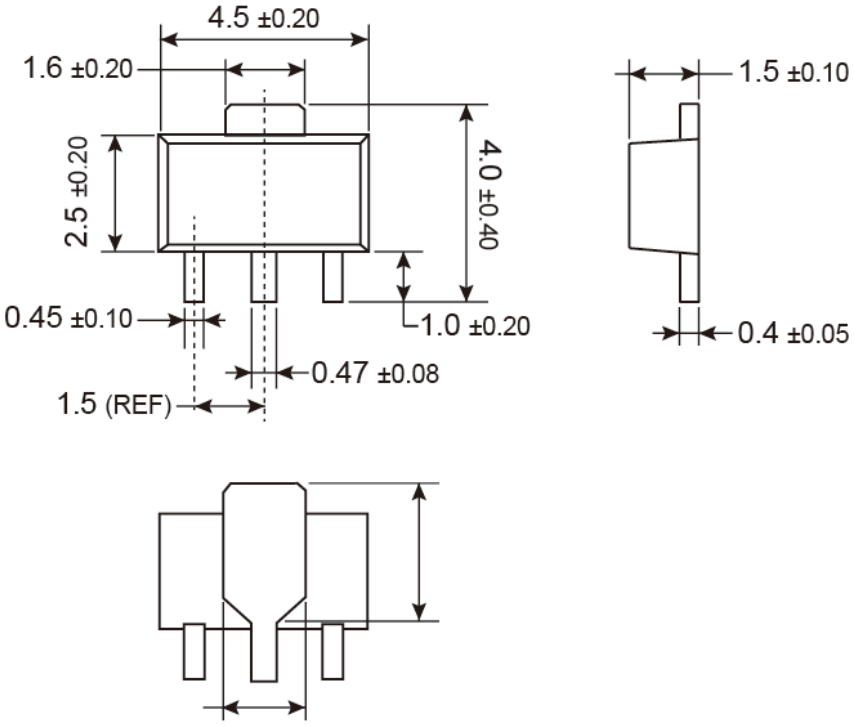
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)

L = Lot Code

TS78L00 Series

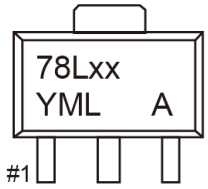
3-Terminal 100mA Positive Voltage Regulator

SOT-89 Mechanical Drawing



Unit: Millimeters

Marking Diagram

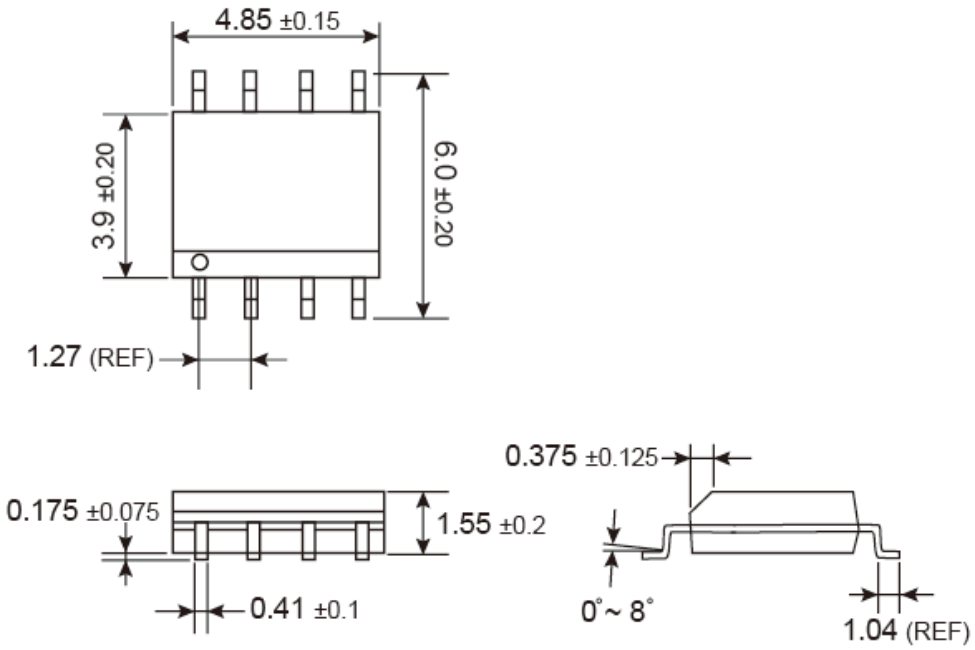


XX = Output Voltage
(03=3.3V, 05=5V, 09=9V, 12=12V, 15=15V)
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code
A = TS78LxxACY

TS78L00 Series

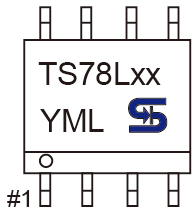
3-Terminal 100mA Positive Voltage Regulator

SOP-8 Mechanical Drawing



Unit: Millimeters

Marking Diagram



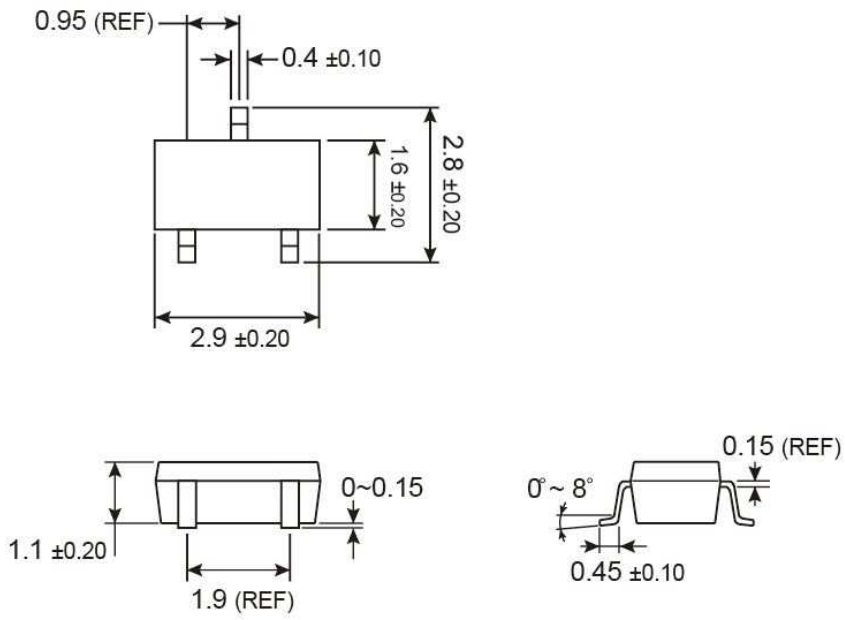
XX = Output Voltage
(03=3.3V, 05=5V, 09=9V, 12=12V, 15=15V, 24=24V)

Y = Year Code

M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)

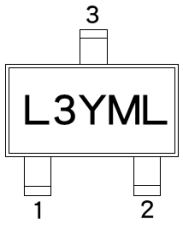
L = Lot Code

SOT-23 Mechanical Drawing



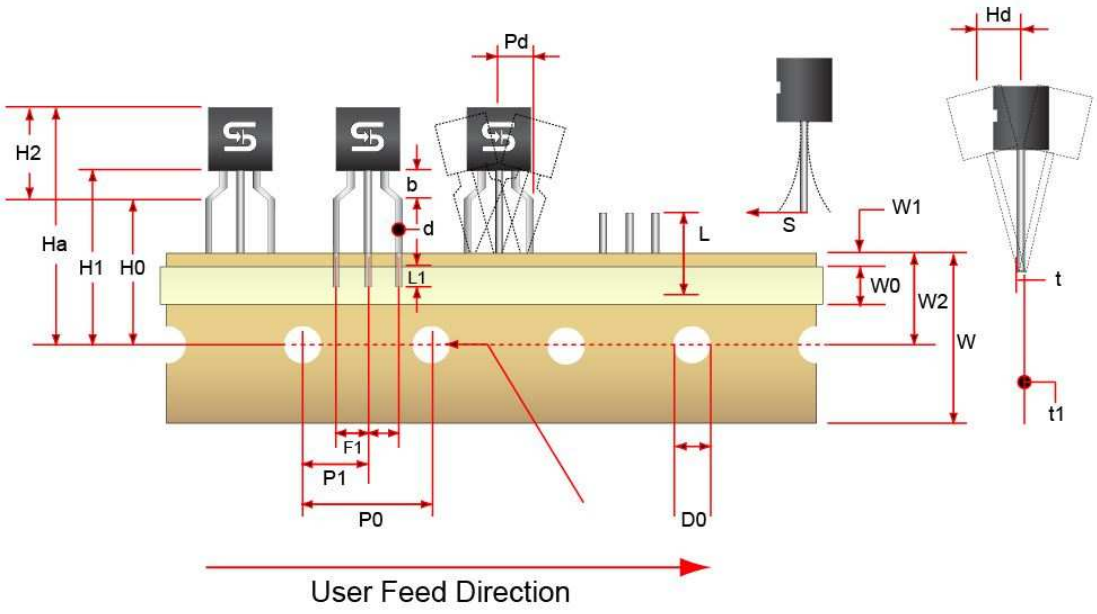
Unit: Millimeters

Marking Diagram



L = Device Voltage Code
3 (L3=3.3V, L5=5V, L9=9V)
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code

TO-92 Ammo Pack Mechanical Drawing



Tape Dimension

Item Description	Symbol	Dimension
Base of Package to Lead Bend	b	3.0 (typ.)
Component Height	Ha	23.57 (typ.)
Lead Clinch Height	H0	16.0 ±0.5
Component Base Height	H1	19.0 ±0.5
Component Top to Lead Bend	H2	8.0 (max)
Component Alignment (side / side)	Pd	1.02 (max)
Component Alignment (front / back)	Hd	0.79 (max)
Feed Hole Pitch	P0	12.7 ±0.3
Hole Center to Component Center	P1	6.25 ±0.4
Lead Spread	F1	2.5 ±0.3
Lead Thickness	d	0.46 (typ.)
Cut Lead Length	L	10.9 (max)
Taped Lead Length	L1	5.31 (typ.)
Taped Lead Thickness	t	0.81 ±0.2
Carrier Tape Thickness	t1	0.5 ±0.2
Carrier Tape Width	W	18.0 ±0.5
Hold – down Tape Width	W0	0.5 ±0.2
Hold – down Tape position	W1	9.0 ±0.7
Feed Hole Position	W2	6.0 ±0.2
Sprocket Hole Diameter	D0	4.0 ±0.2
Lead Spring Out	S	0.1 (max)

Note: All dimensions are in millimeter.

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