

100mA Positive Voltage Regulator

General Description

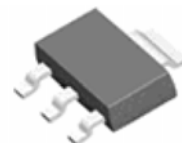
- The TCI LM78LXX family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 100mA.
- The LM78L is available in TO-92, SOT-89, SOT-223 and SOP-8 packages.



TO-92



SOT-89



SOT-223



SOP-8



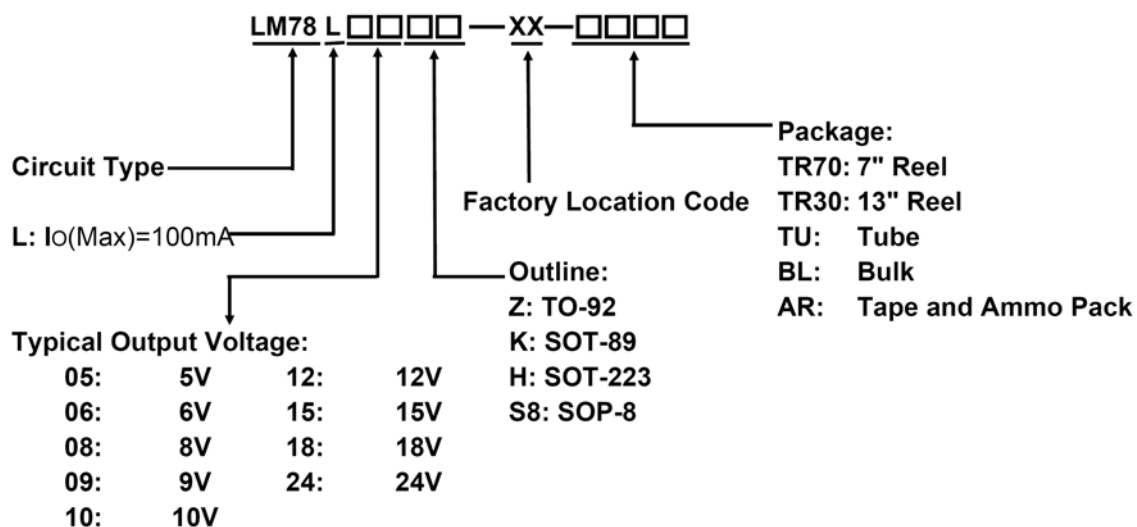
Features

- Output Current up to 100mA
- Fixed output voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
- Thermal overload shutdown protection
- Short circuit current limiting
- RoHS Compliance

Applications

- Consumer Electronics
- Microprocessor Power Supply
- Mother Board

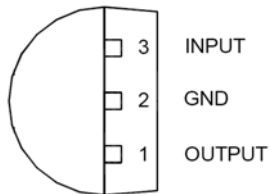
Ordering Information



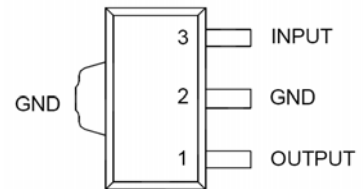
100mA Positive Voltage Regulator

LM78L

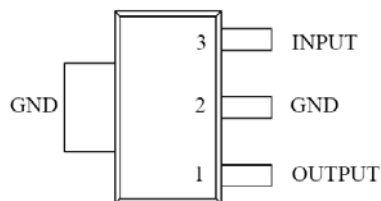
Pin Configuration



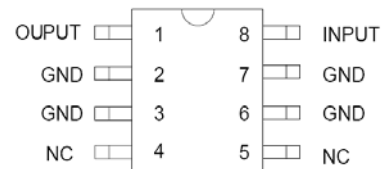
Outline: Z
TO-92



Outline: K
SOT-89

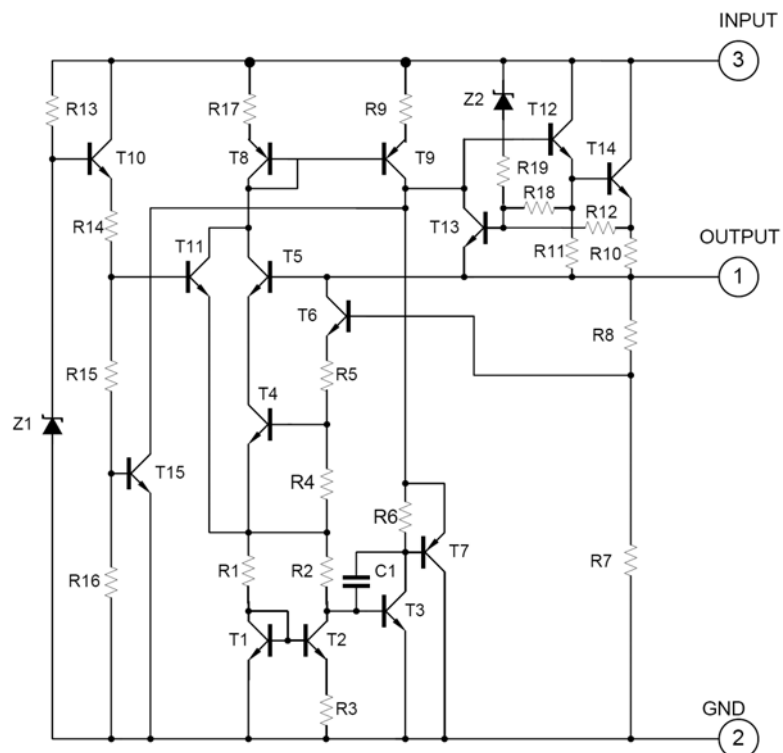


Outline: H
SOT-223



Outline: S8
SOP-8

Block Diagram



100mA Positive Voltage Regulator

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Absolute Maximum Ratings

Symbol	Description		Ratings	Unit
V_{IN}	Input Voltage	$V_{OUT}=5\sim 9V$	30	V
		$V_{OUT}=12\sim 24V$	35	
I_{OUT}	Output Current		100	mA
P_D	Power Dissipation	SOP-8	300	mW
		SOT-223	325	
		SOT-89	350	
		TO-92	625	
T_J	Junction Temperature		125	°C
T_{OPR}	Operating Temperature Range		0 ~ 125	°C
T_{STG}	Storage Temperature Range		-55 ~ 150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics

For LM78L05 ($V_{IN}=10V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L05			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	4.80	5.0	5.20	V	$T_J=25^{\circ}C$
		4.75	-	5.25	V	$7V \leq V_{IN} \leq 20V$, $I_{OUT}=1mA-40mA$
		4.75	-	5.25	V	$7V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $<0.5W$
ΔV_{OUT}	Load Regulation	-	11	60	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	5.0	30	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$
ΔV_{OUT}	Line Regulation	-	8	150	mV	$T_J=25^{\circ}C$, $7V \leq V_{IN} \leq 20V$
		-	6	100	mV	$T_J=25^{\circ}C$, $8V \leq V_{IN} \leq 20V$
I_Q	Quiescent Current	-	2.0	5.5	mA	$V_{IN}=10V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_Q	Quiescent Current Change	-	-	1.5	mA	$8V \leq V_{IN} \leq 20V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	40	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.65	-	mV/°C	$I_{OUT}=5mA$
RR	Ripple Rejection	41	80	-	dB	$8V \leq V_{IN} \leq 20V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

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For LM78L06 ($V_{IN}=12V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L06			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	5.76	6.0	6.24	V	$T_J=25^{\circ}C$
		5.70	-	6.30	V	$8.5V \leq V_{IN} \leq 20V$, $I_{OUT}=1mA-40mA$
		5.70	-	6.30	V	$8.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	12.8	80	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	5.8	40	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 70mA$
ΔV_{OUT}	Line Regulation	-	64	175	mV	$T_J=25^{\circ}C$, $8.5V \leq V_{IN} \leq 20V$
		-	54	125	mV	$T_J=25^{\circ}C$, $9V \leq V_{IN} \leq 20V$
I_Q	Quiescent Current	-	3.9	6.0	mA	$V_{IN}=12V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_Q	Quiescent Current Change	-	-	1.5	mA	$9V \leq V_{IN} \leq 20V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	49	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	40	46	-	dB	$10V \leq V_{IN} \leq 20V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

For LM78L08 ($V_{IN}=14V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L08			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	7.68	8.0	8.32	V	$T_J=25^{\circ}C$
		7.60	-	8.40	V	$10.5V \leq V_{IN} \leq 23V$, $I_{OUT}=1mA-40mA$
		7.60	-	8.40	V	$10.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	15	80	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	8.0	40	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 70mA$
ΔV_{OUT}	Line Regulation	-	10	175	mV	$T_J=25^{\circ}C$, $10.5V \leq V_{IN} \leq 23V$
		-	8	125	mV	$T_J=25^{\circ}C$, $11V \leq V_{IN} \leq 23V$
I_Q	Quiescent Current	-	2.0	5.5	mA	$V_{IN}=14V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_Q	Quiescent Current Change	-	-	1.5	mA	$11V \leq V_{IN} \leq 23V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	49	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	39	70	-	dB	$11V \leq V_{IN} \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

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For LM78L09 ($V_{IN}=15V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L09			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	8.64	9.0	9.36	V	$T_J=25^{\circ}C$
		8.55	-	9.45	V	$11.5V \leq V_{IN} \leq 24V$, $I_{OUT}=1mA-40mA$
		8.55	-	9.45	V	$11.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	20	90	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	10	45	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$
ΔV_{OUT}	Line Regulation	-	90	200	mV	$T_J=25^{\circ}C$, $11.5V \leq V_{IN} \leq 24V$
		-	100	150	mV	$T_J=25^{\circ}C$, $13V \leq V_{IN} \leq 24V$
I_q	Quiescent Current	-	2.0	6.0	mA	$V_{IN}=15V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_q	Quiescent Current Change	-	-	1.5	mA	$13V \leq V_{IN} \leq 24V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	70	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_o/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	38	44	-	dB	$12V \leq V_{IN} \leq 24V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

For LM78L10 ($V_{IN}=16V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L10			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	9.6	10.0	10.4	V	$T_J=25^{\circ}C$
		9.5	-	10.5	V	$12.5V \leq V_{IN} \leq 25V$, $I_{OUT}=1mA-40mA$
		9.5	-	10.5	V	$12.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	20	94	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	10	47	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 70mA$
ΔV_{OUT}	Line Regulation	-	100	200	mV	$T_J=25^{\circ}C$, $12.5V \leq V_{IN} \leq 25V$
		-	100	170	mV	$T_J=25^{\circ}C$, $14V \leq V_{IN} \leq 25V$
I_q	Quiescent Current	-	2.0	6.0	mA	$V_{IN}=17V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_q	Quiescent Current Change	-	-	1.5	mA	$12.5V \leq V_{IN} \leq 25V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	74	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_o/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.8	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	38	43	-	dB	$15V \leq V_{IN} \leq 25V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

100mA Positive Voltage Regulator

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For LM78L12 ($V_{IN}=19V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L12			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	11.52	12.00	12.48	V	$T_J=25^{\circ}C$
		11.40	-	12.60	V	$14.5V \leq V_{IN} \leq 27V$, $I_{OUT}=1mA-40mA$
		11.40	-	12.60	V	$14.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	25	150	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	12	75	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$
ΔV_{OUT}	Line Regulation	-	25	300	mV	$T_J=25^{\circ}C$, $14.5V \leq V_{IN} \leq 27V$
		-	20	250	mV	$T_J=25^{\circ}C$, $16V \leq V_{IN} \leq 27V$
I_Q	Quiescent Current	-	2.0	6.0	mA	$V_{IN}=19V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_Q	Quiescent Current Change	-	-	1.5	mA	$16V \leq V_{IN} \leq 27V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	80	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.0	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	37	65	-	dB	$15V \leq V_{IN} \leq 25V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

For LM78L15 ($V_{IN}=23V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L15			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	14.40	15.00	15.60	V	$T_J=25^{\circ}C$
		14.25	-	15.75	V	$17.5V \leq V_{IN} \leq 30V$, $I_{OUT}=1mA-40mA$
		14.25	-	15.75	V	$17.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	20	150	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	25	150	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 70mA$
ΔV_{OUT}	Line Regulation	-	25	150	mV	$T_J=25^{\circ}C$, $17.5V \leq V_{IN} \leq 30V$
		-	15	75	mV	$T_J=25^{\circ}C$, $20V \leq V_{IN} \leq 30V$
I_Q	Quiescent Current	-	2.2	6.5	mA	$V_{IN}=23V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_Q	Quiescent Current Change	-	-	1.5	mA	$20V \leq V_{IN} \leq 30V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	90	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.3	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	34	63	-	dB	$18.5V \leq V_{IN} \leq 28.5V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

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For LM78L18 ($V_{IN}=27V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L18			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	17.28	18.00	18.72	V	$T_J=25^{\circ}C$
		17.10	-	18.90	V	$21V \leq V_{IN} \leq 33V$, $I_{OUT}=1mA-40mA$
		17.10	-	18.90	V	$21V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	30	170	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	15	85	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$
ΔV_{OUT}	Line Regulation	-	145	300	mV	$T_J=25^{\circ}C$, $21V \leq V_{IN} \leq 33V$
		-	135	250	mV	$T_J=25^{\circ}C$, $22V \leq V_{IN} \leq 33V$
I_q	Quiescent Current	-	2.0	6.0	mA	$V_{IN}=27V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_q	Quiescent Current Change	-	-	1.5	mA	$21V \leq V_{IN} \leq 33V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	150	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_o/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.8	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	34	48	-	dB	$23V \leq V_{IN} \leq 33V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

For LM78L24 ($V_{IN}=33V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78L24			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	23.04	24.00	24.96	V	$T_J=25^{\circ}C$
		22.8	-	25.2	V	$27V \leq V_{IN} \leq 38V$, $I_{OUT}=1mA-40mA$
		22.8	-	25.2	V	$27V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$ Power Dissipation $< 0.5W$
ΔV_{OUT}	Load Regulation	-	40	200	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 100mA$
		-	20	100	mV	$T_J=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$
ΔV_{OUT}	Line Regulation	-	160	300	mV	$T_J=25^{\circ}C$, $27V \leq V_{IN} \leq 38V$
		-	150	250	mV	$T_J=25^{\circ}C$, $28V \leq V_{IN} \leq 38V$
I_q	Quiescent Current	-	2.2	6.0	mA	$V_{IN}=33V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$
ΔI_q	Quiescent Current Change	-	-	1.5	mA	$27V \leq V_{IN} \leq 38V$
		-	-	0.1	mA	$1mA \leq I_{IN} \leq 40mA$
e_N	Output Noise Voltage	-	200	-	μV	$10Hz \leq f \leq 100KHz$
$\Delta V_o/\Delta T$	Temperature coefficient of V_{OUT}	-	-2.0	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	34	45	-	dB	$27V \leq V_{IN} \leq 38V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

Note: The maximum steady state usable output current is dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB.

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Typical Characteristics Curves

Fig.1- Ambient temperature vs. Power dissipation

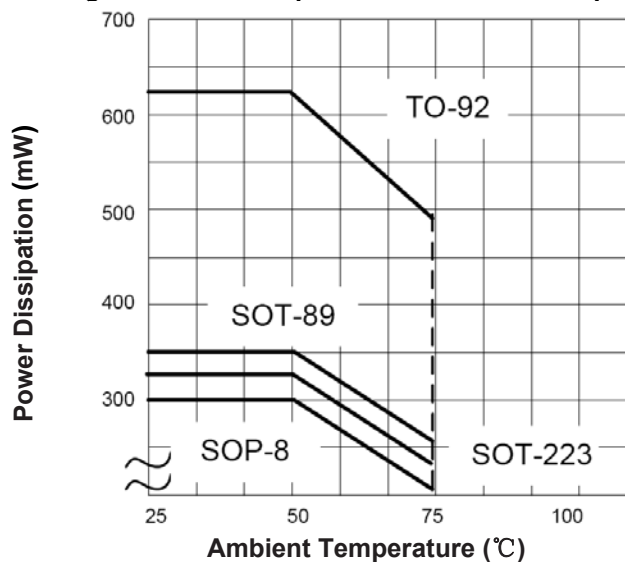


Fig.2- LM78L05 Output Voltage vs. Ambient Temperature

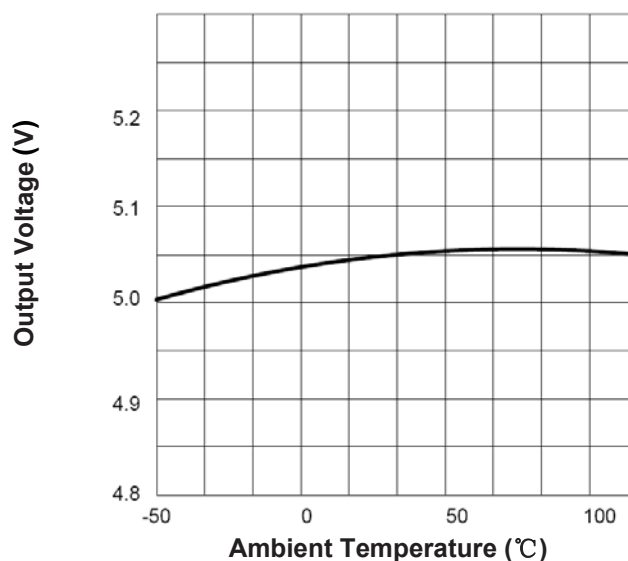


Fig.3- LM78L12 Output Voltage vs. Ambient Temperature

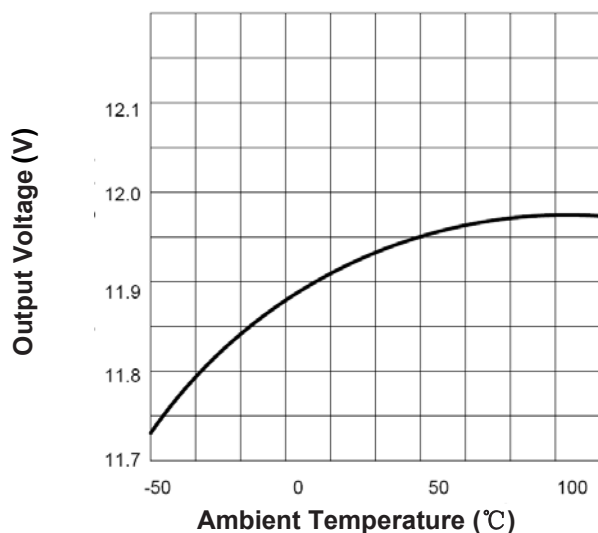
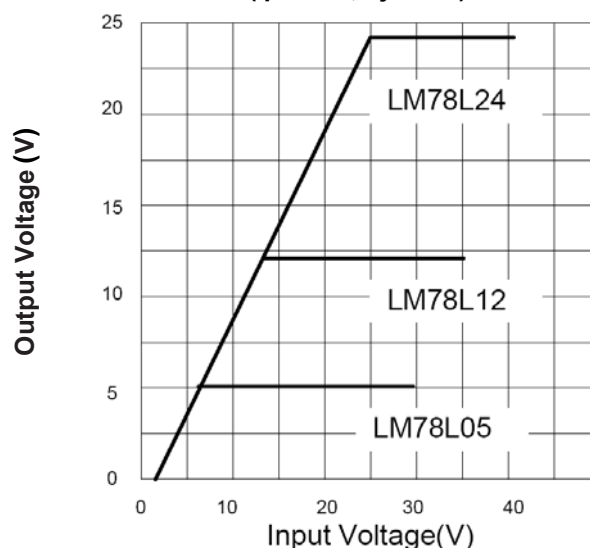


Fig.4- Output Characteristics (I_p=0mA, T_j=25°C)



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LM78L

Typical Characteristics Curves (Continued)

Fig.5- LM78L05 Dropout Characteristics
($T_j=25^\circ\text{C}$)

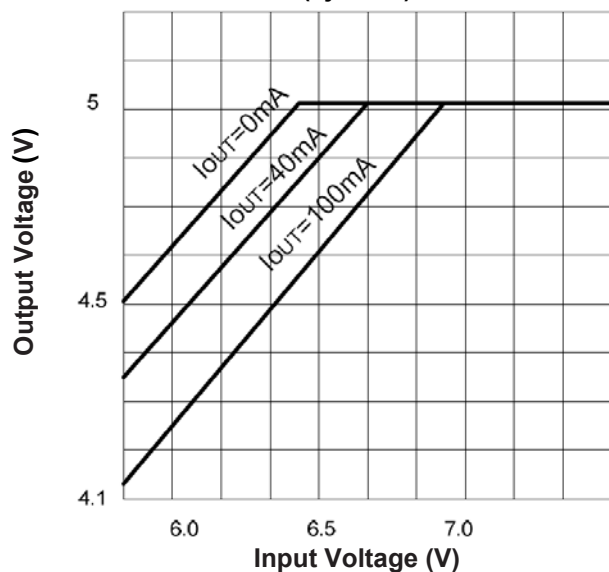


Fig.6- Short Circuit Output Current
($T_j=25^\circ\text{C}$)

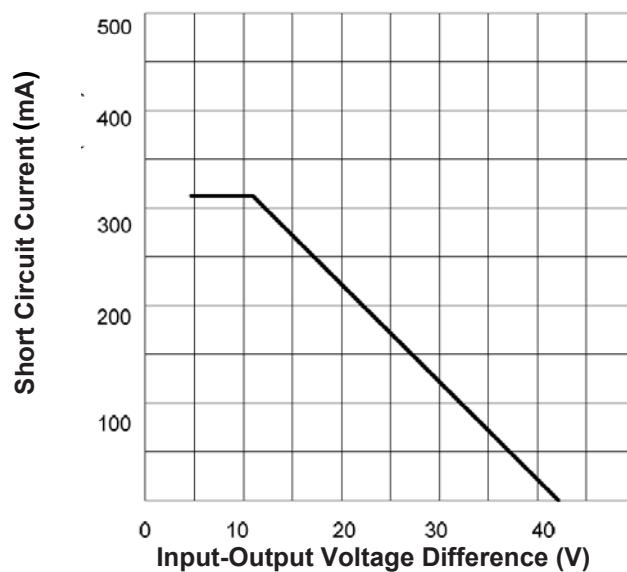


Fig.7- LM78L12/24 Quiescent Current vs.
Output Current ($T_j=25^\circ\text{C}$)

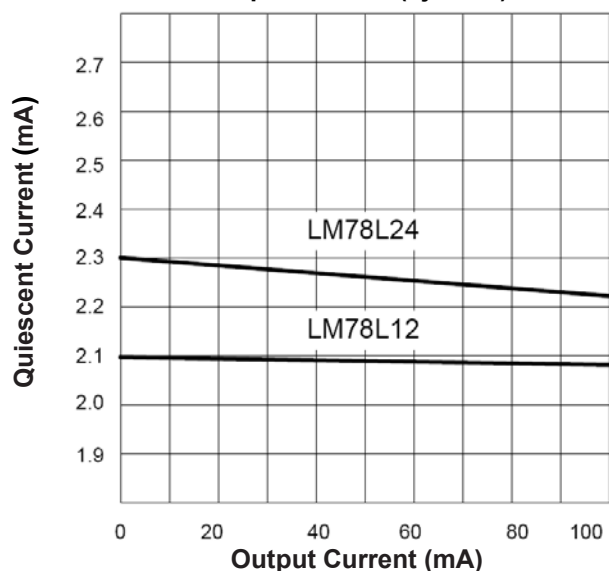
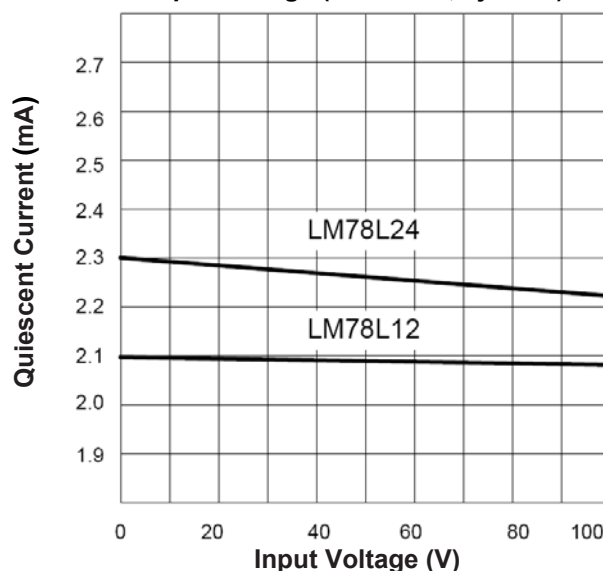


Fig.8- LM78L05 Quiescent Current vs.
Input Voltage ($I_{OUT}=0\text{mA}$, $T_j=25^\circ\text{C}$)



100mA Positive Voltage Regulator

LM78L

Typical Characteristics Curves (Continued)

Fig.9- Peak Output Current vs. Dropout Voltage Difference

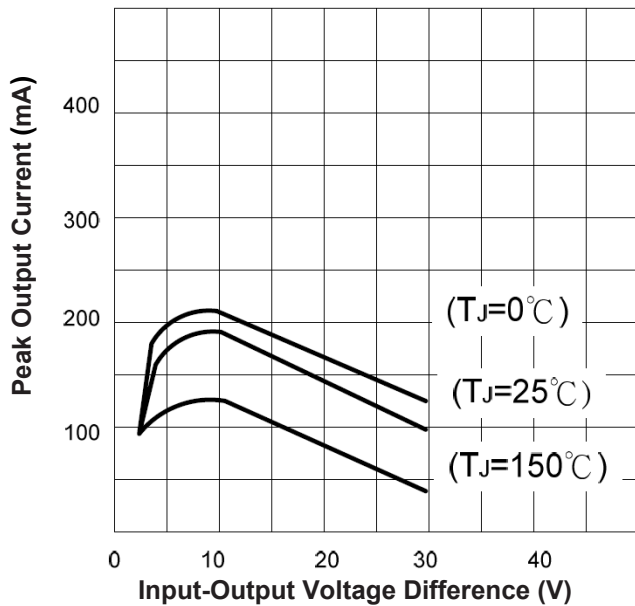
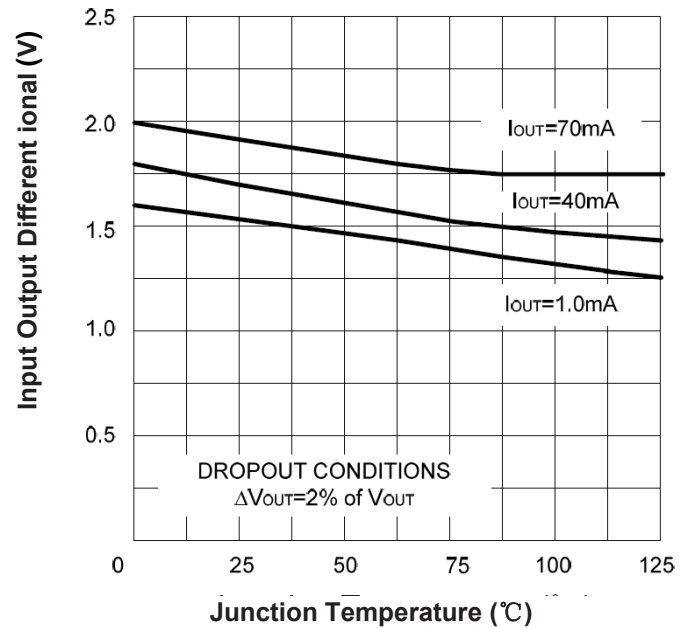
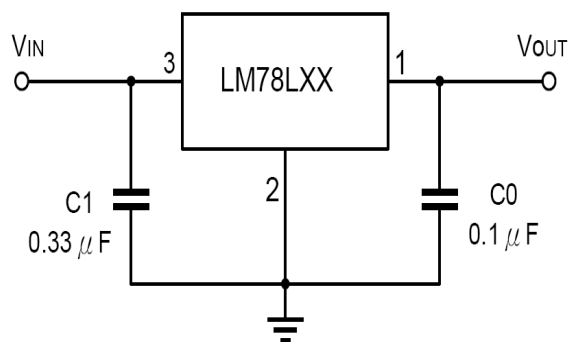


Fig.10- Dropout Voltage



Typical Application



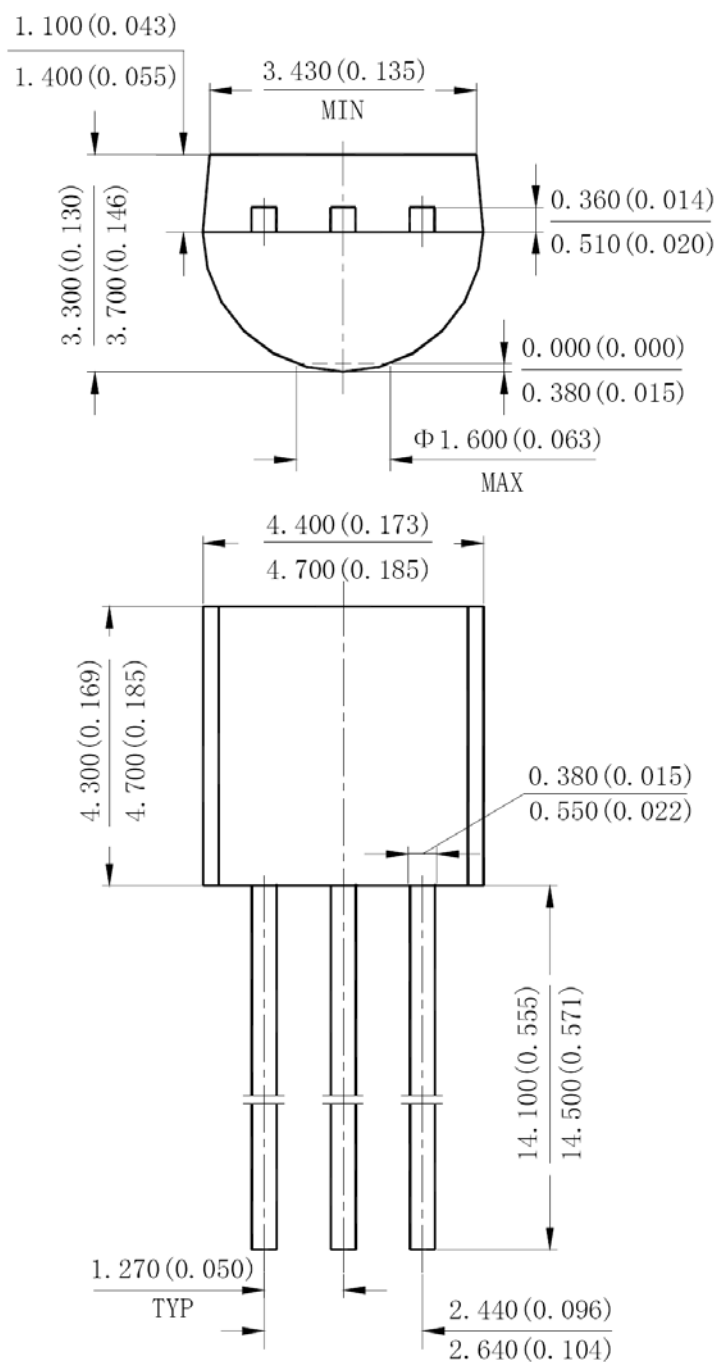
Note 1. To specify an output voltage, substitute voltage value for "XX".

2. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

100mA Positive Voltage Regulator

LM78L

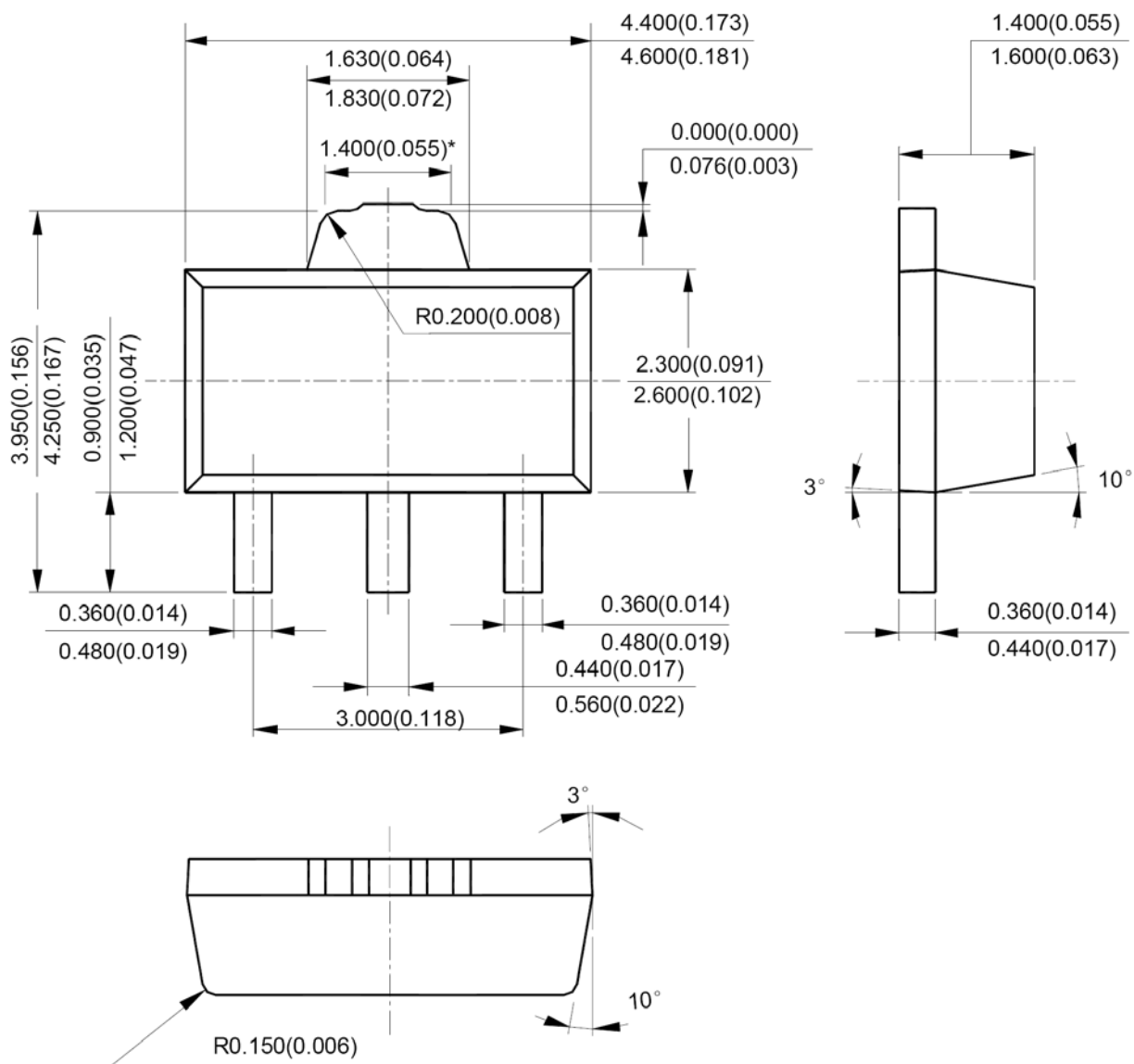
Dimensions in mm (inches)



TO-92

100mA Positive Voltage Regulator

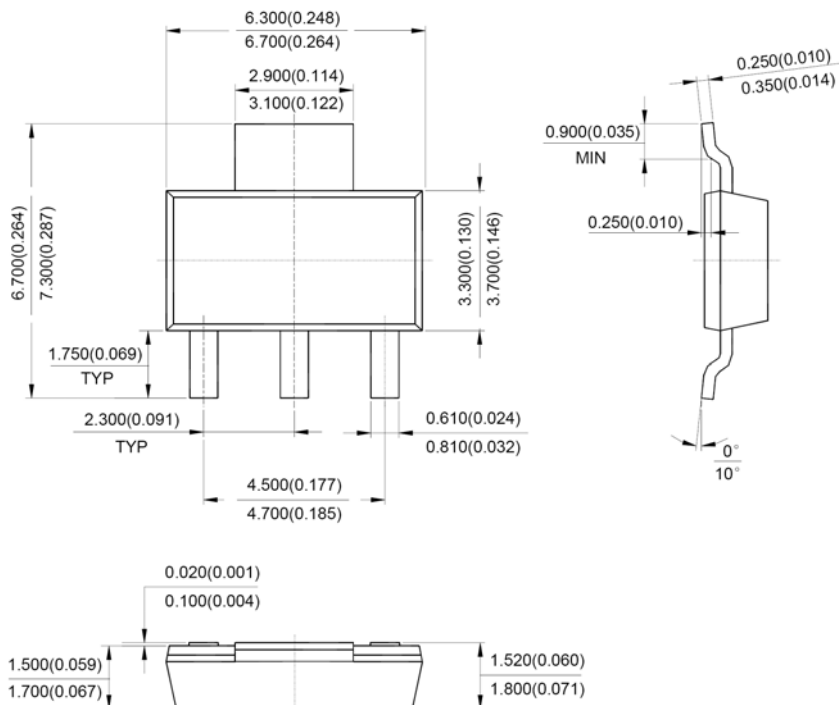
LM78L



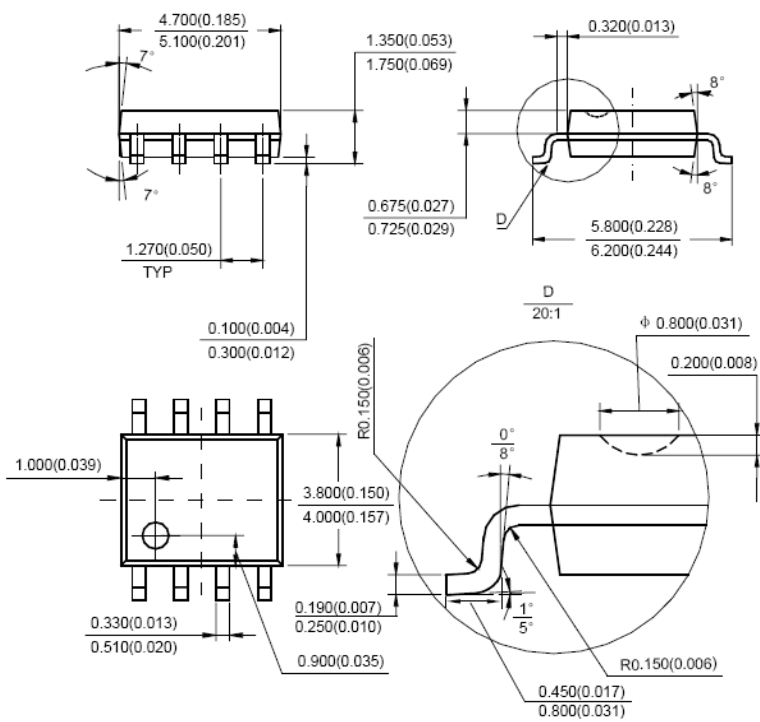
SOT-89

100mA Positive Voltage Regulator

LM78L



SOT-223



SOP-8

100mA Positive Voltage Regulator

LM78L

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