

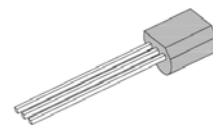
200mA Positive Voltage Regulator

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, TO-92L, SOT-89, SOT-223 and SOP-8 packages.



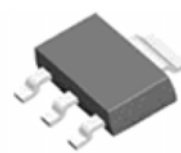
TO-92



TO-92L



SOT-89



SOT-223



SOP-8



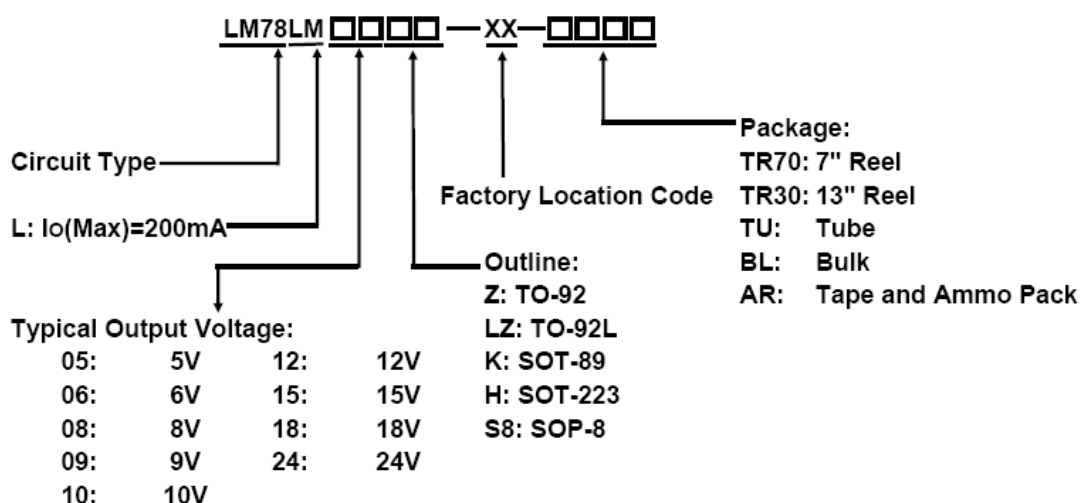
Features

- Output Current up to 200mA
- 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

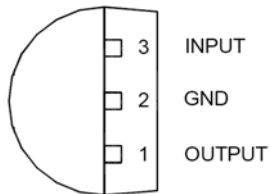
Ordering Information



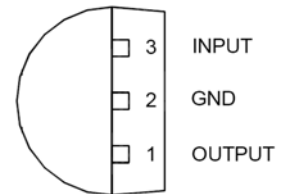
200mA Positive Voltage Regulator

LM78LM

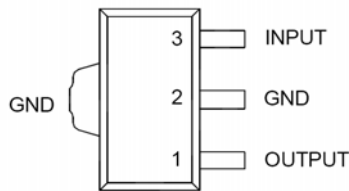
Pin Configuration



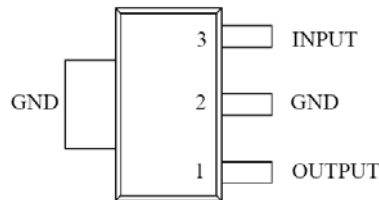
Outline: Z
TO-92



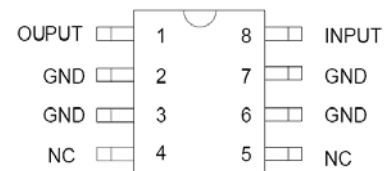
Outline: LZ
TO-92L



Outline: K
SOT-89

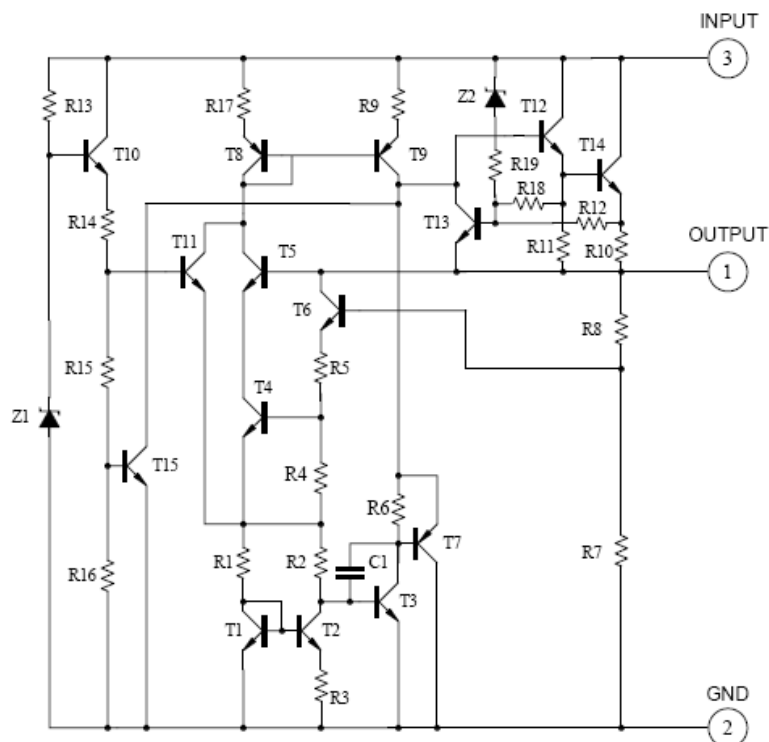


Outline: H
SOT-223



Outline: S8
SOP-8

Block Diagram



200mA Positive Voltage Regulator

LM78LM

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		200	mA
P_D	Power Dissipation	SOP-8	300	mW
		SOT-223	350	
		SOT-89	350	
		TO-92	500	
		TO-92L	500	
T_{OPR}	Operating Junction Temperature Range		-20 ~ 150	° 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 LM78LM05 ($V_{IN}=10V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM05			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	$7V \leq V_{IN} \leq 20V$, $I_{OUT}=1mA\sim 40mA$
		4.75	-	5.25	V	$7V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA\sim 200mA$ 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	
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	$T_J=25^{\circ}C$

200mA Positive Voltage Regulator

LM78LM

For LM78LM06 ($V_{IN}=12V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM06			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	$8.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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 LM78LM08 ($V_{IN}=14V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM08			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	$10.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$ 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	
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	$T_J=25^{\circ}C$

200mA Positive Voltage Regulator

LM78LM

For LM78LM09 ($V_{IN}=15V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM09			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	$11.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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	-	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	38	44	-	dB	$12V \leq V_{IN} \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

For LM78LM10 ($V_{IN}=16V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM10			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	$12.5V \leq V_{IN} \leq 23V$, $I_{OUT}=1mA-40mA$
		9.5	-	10.5	V	$12.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	$T_J=25^{\circ}C$, $12.5V \leq V_{IN} \leq 23V$
		-	100	170	mV	$T_J=25^{\circ}C$, $14V \leq V_{IN} \leq 23V$
I_q	Quiescent Current	-	4.2	6.5	mA	
ΔI_q	Quiescent Current Change	-	-	1.5	mA	$12.5V \leq V_{IN} \leq 23V$
		-	-	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}	-	-0.95	-	mV/ $^{\circ}C$	$I_{OUT}=5mA$
RR	Ripple Rejection	38	43	-	dB	$15V \leq V_{IN} \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$
V_D	Dropout Voltage	-	1.7	-	V	$T_J=25^{\circ}C$

200mA Positive Voltage Regulator

LM78LM

For LM78LM12 ($V_{IN}=19V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM12			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	$14.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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 LM78LM15 ($V_{IN}=23V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM15			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	$17.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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	$T_J=25^{\circ}C$

200mA Positive Voltage Regulator

LM78LM

For LM78LM18 ($V_{IN}=27V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM18			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	$21V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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 LM78LM24 ($V_{IN}=33V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 125^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

Symbol	Description	LM78LM24			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{OUT}	Output Voltage	23.04	24.00	24.96	V	$T_J=25^{\circ}C$
		22.80	-	25.20	V	$27V \leq V_{IN} \leq 38V$, $I_{OUT}=1mA-40mA$
		22.80	-	25.20	V	$27V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-200mA$, 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	
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. The data above represent pulse test conditions with junction temperatures specified at the initiation of test.

200mA Positive Voltage Regulator

LM78LM

Typical Characteristics Curves

Fig.1- Ambient temperature vs. Power dissipation

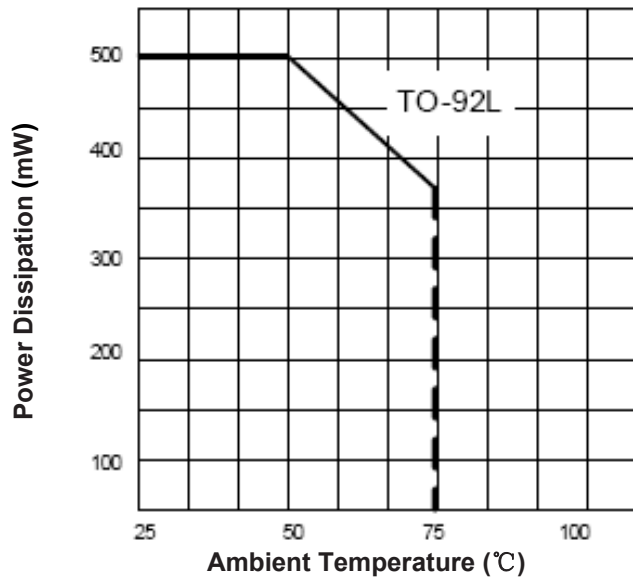


Fig.2- LM78LM05 Output Voltage vs. Ambient Temperature

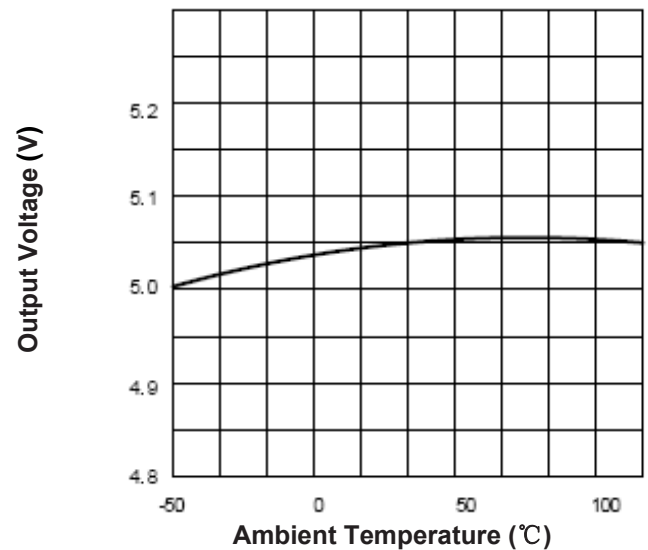


Fig.3- LM78LM12 Output Voltage vs. Ambient Temperature

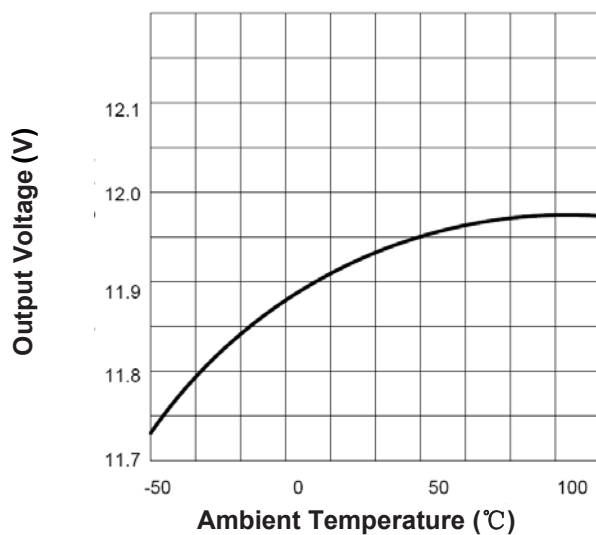
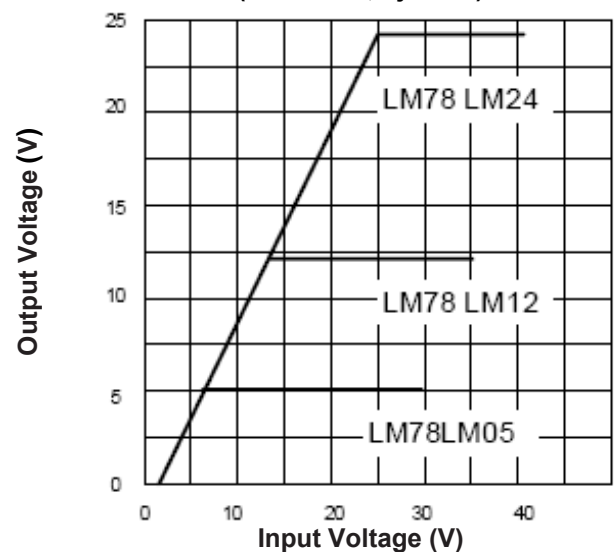


Fig.4- Output Characteristics (I_{OUT}=0mA, T_J=25°C)



200mA Positive Voltage Regulator

LM78LM

Typical Characteristics Curves (Continued)

Fig.5- LM78LM05 Dropout Characteristics
($T_j=25^\circ\text{C}$)

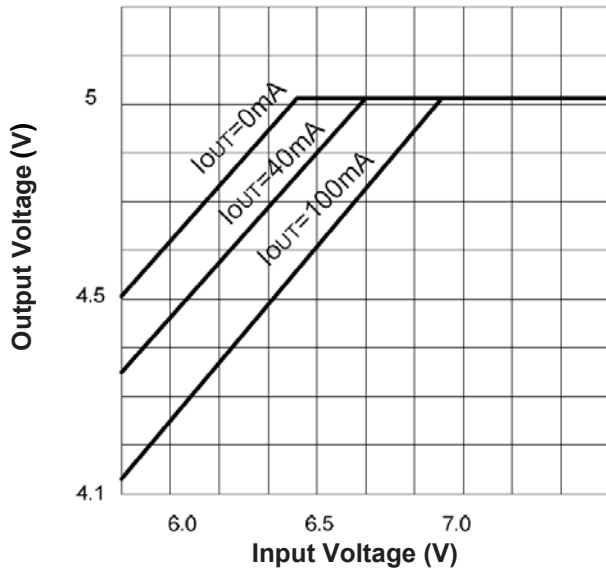


Fig.6- Short Circuit Output Current
($T_j=25^\circ\text{C}$)

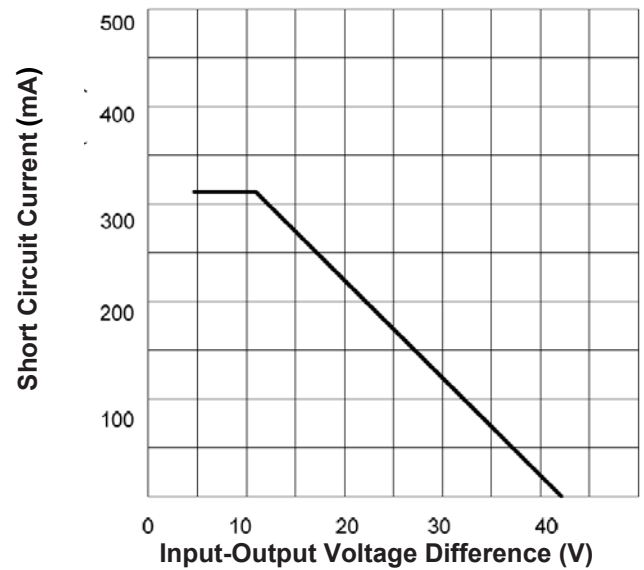


Fig.7- LM78LM12/24 Quiescent Current vs.
Output Current ($T_j=25^\circ\text{C}$)

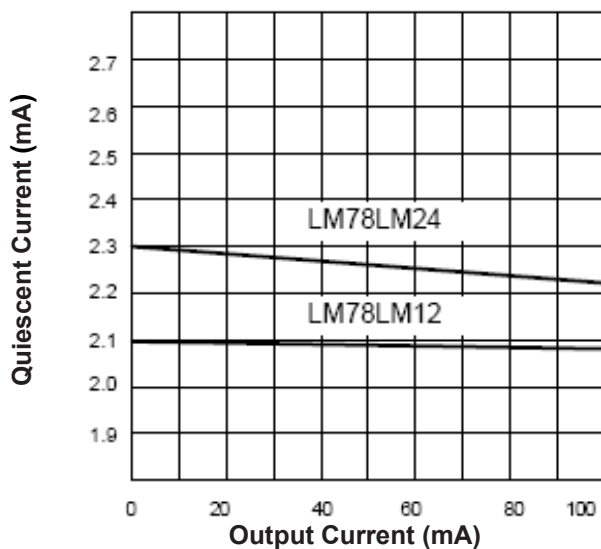
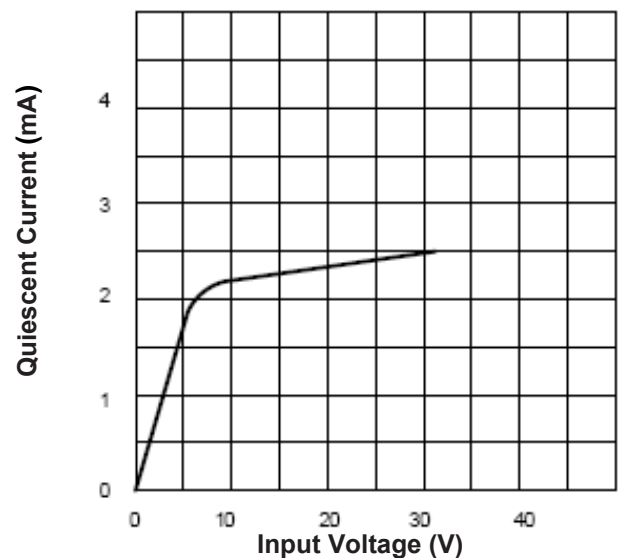


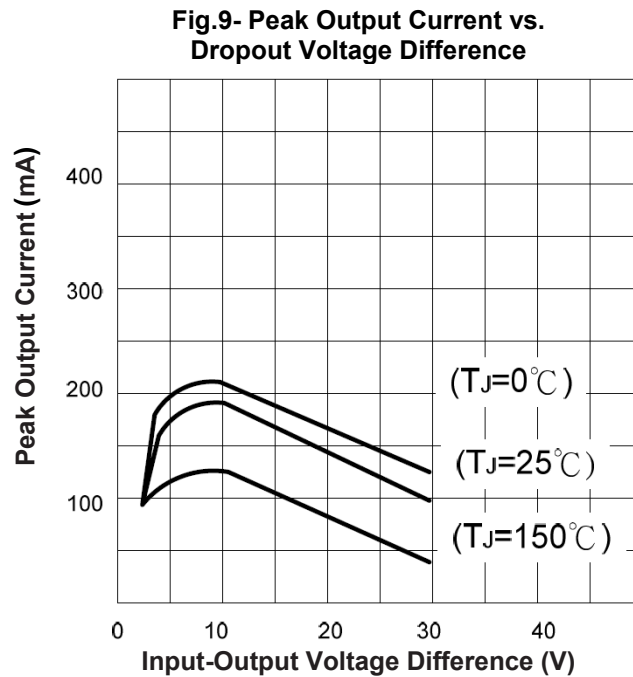
Fig.8- LM78LM05 Quiescent Current vs.
Input Voltage ($I_{OUT}=0\text{mA}$, $T_j=25^\circ\text{C}$)



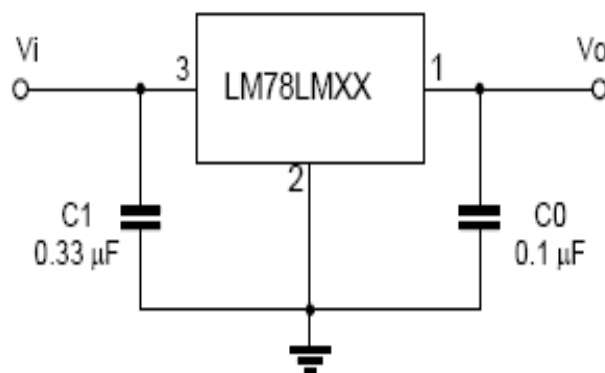
200mA Positive Voltage Regulator

LM78LM

Typical Characteristics Curves (Continued)



Typical Application



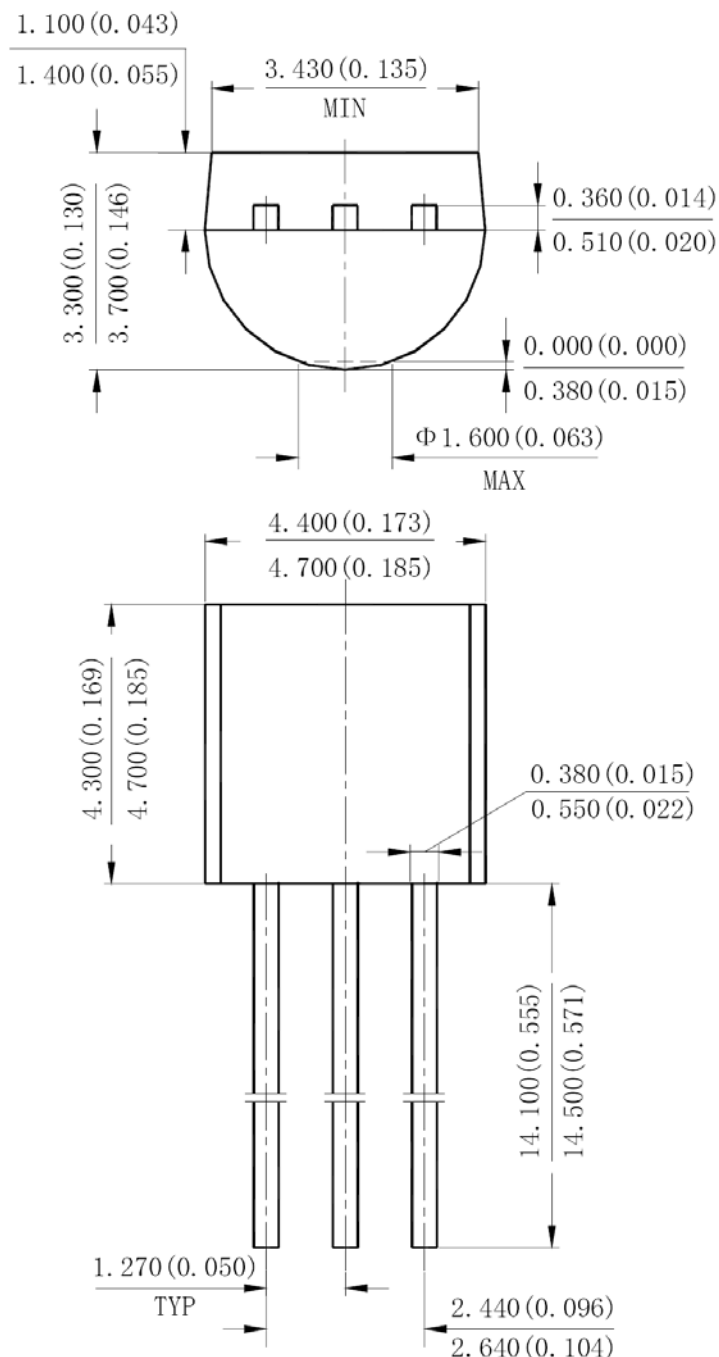
Note 1: To specify an output voltage, substitute voltage value for "XXM".

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

200mA Positive Voltage Regulator

LM78LM

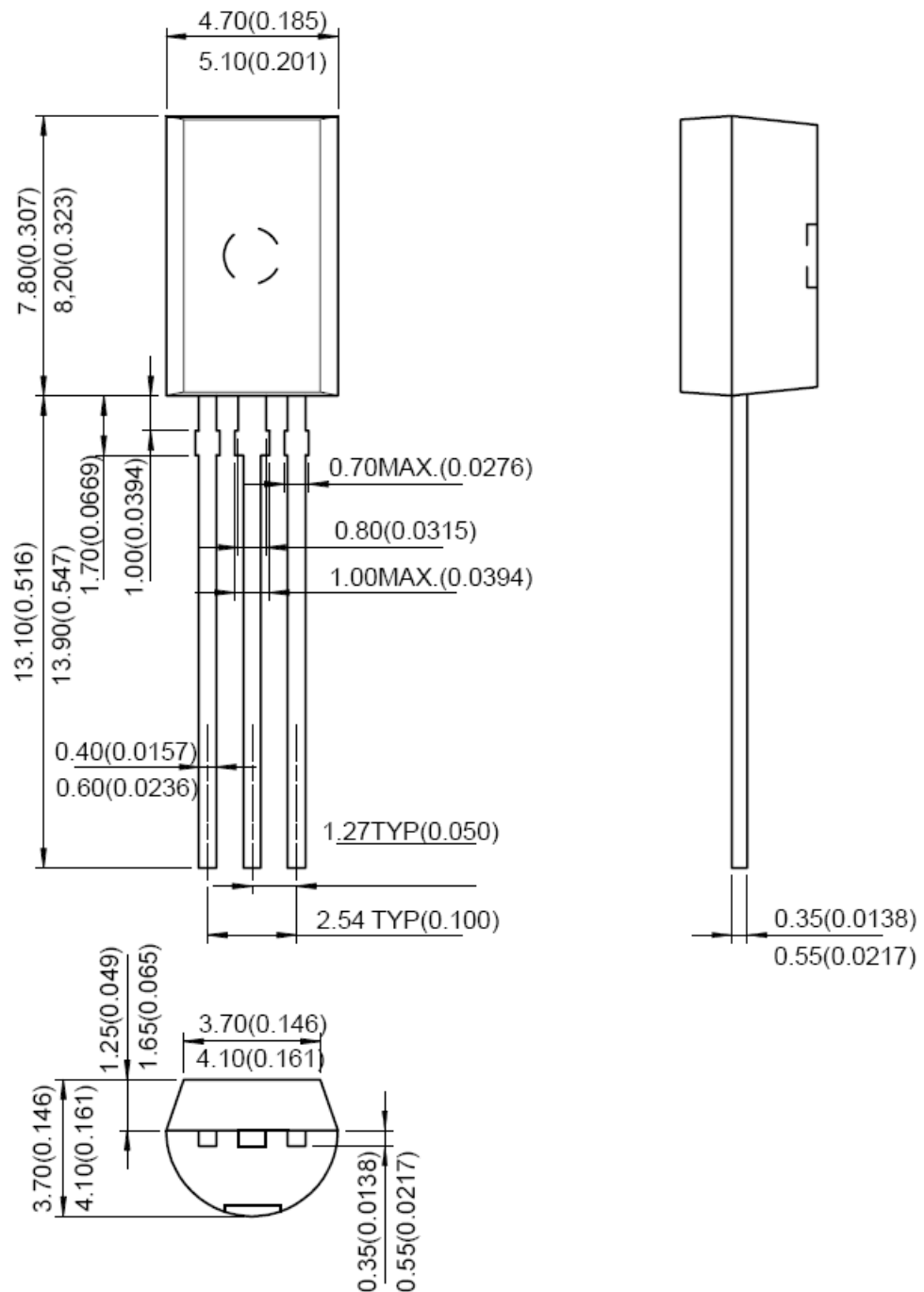
Dimensions in mm (inches)



TO-92

200mA Positive Voltage Regulator

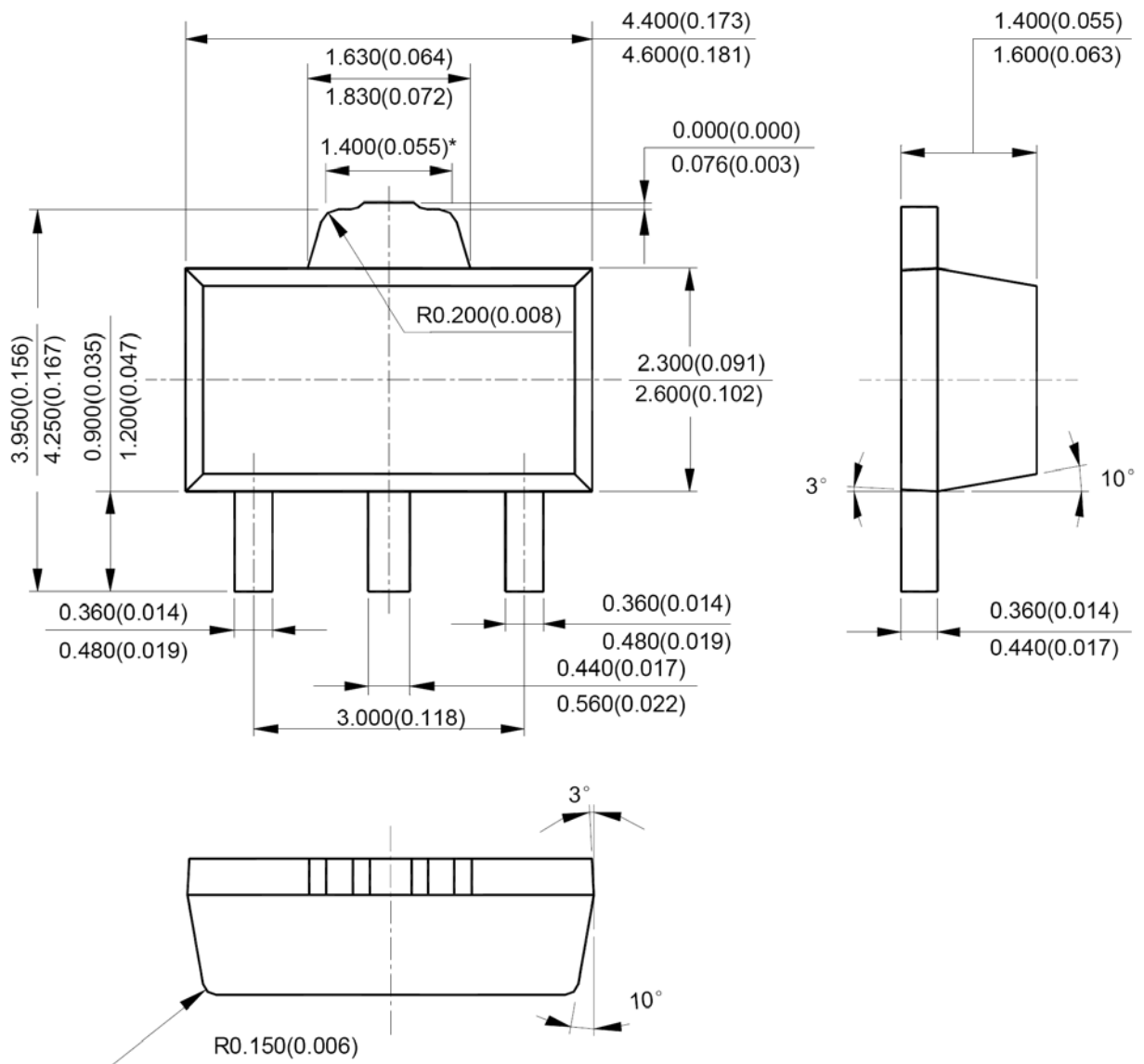
LM78LM



TO-92L

200mA Positive Voltage Regulator

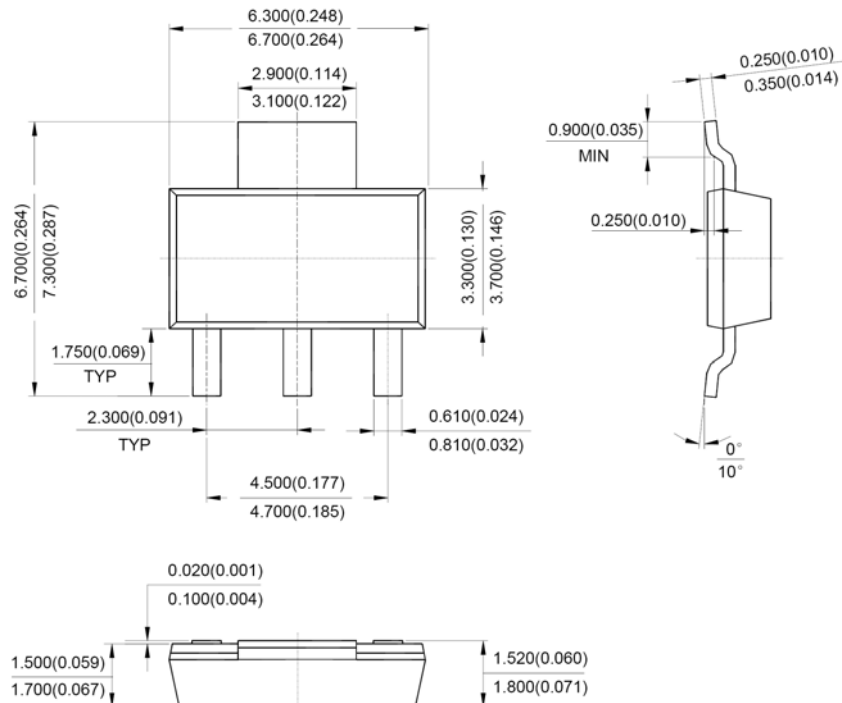
LM78LM



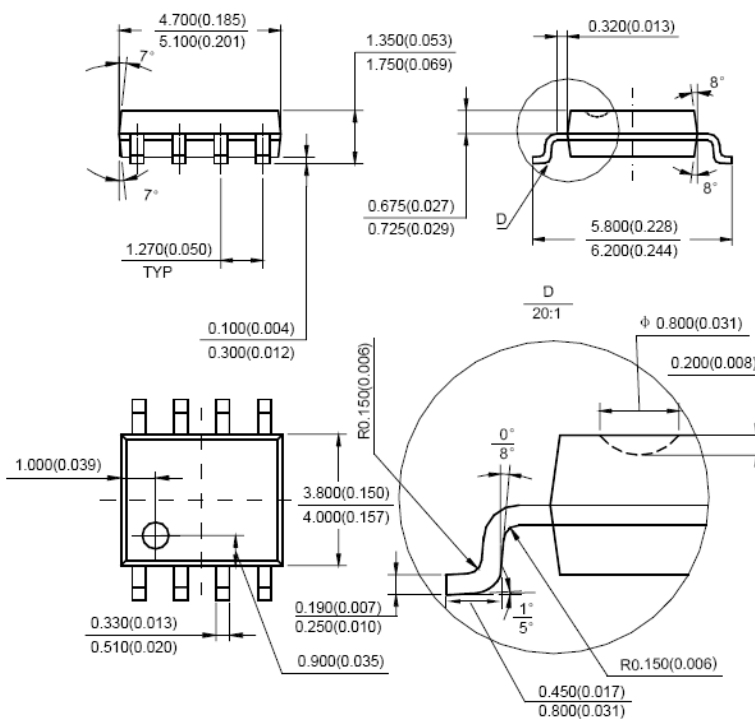
SOT-89

200mA Positive Voltage Regulator

LM78LM



SOT-223



SOP-8

200mA Positive Voltage Regulator

LM78LM

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