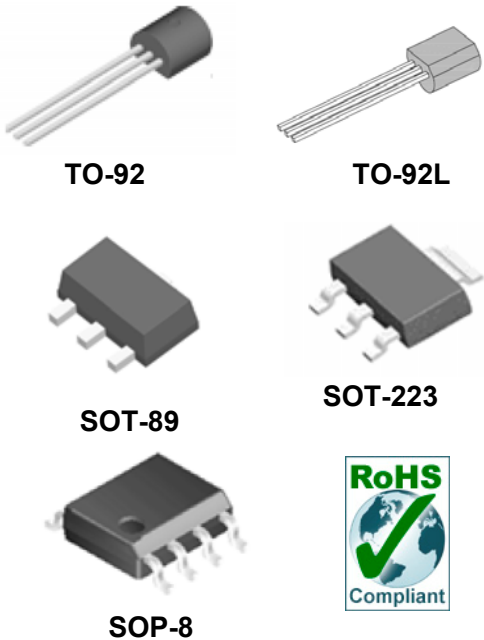


200mA Positive Voltage Regulator

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.



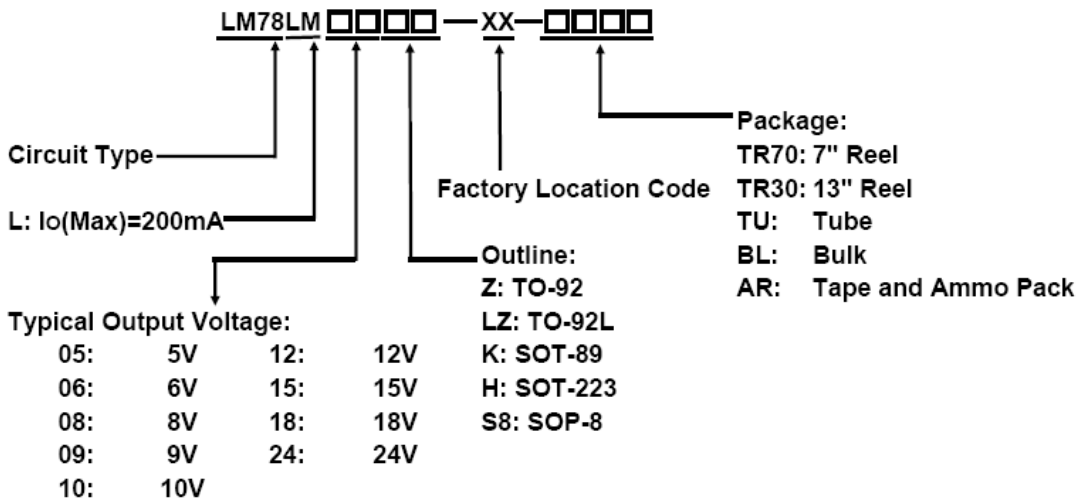
Features

- 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

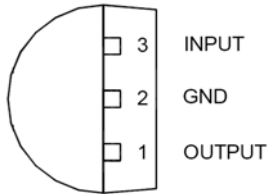
Ordering Information



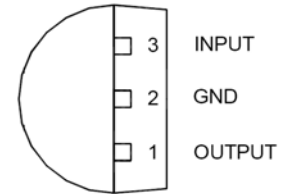
200mA Positive Voltage Regulator

LM78LM

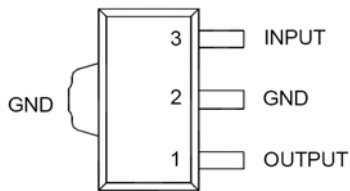
Pin Configuration



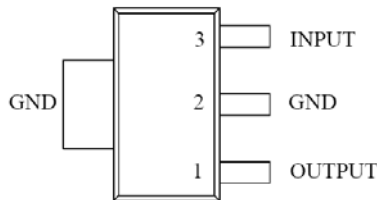
**Outline: Z
TO-92**



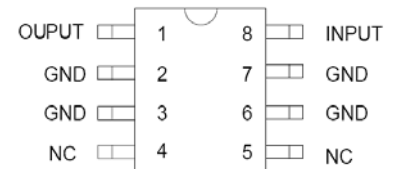
**Outline: LZ
TO-92L**



**Outline: K
SOT-89**

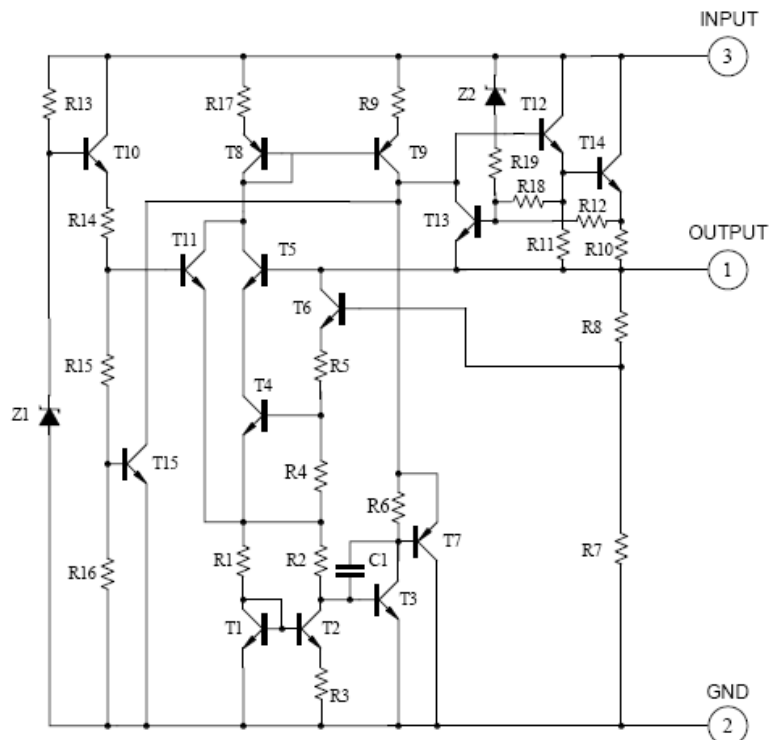


**Outline: H
SOT-223**



**Outline: S8
SOP-8**

Block Diagram



200mA Positive Voltage Regulator

LM78LM

Absolute Maximum Ratings

Symbol	Description	Ratings	Unit	
V _{IN}	Input Voltage	V _{OUT} =5~9V	30	V
		V _{OUT} =12~24V	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° C<T_J<125° C, C₁=0.33μF, C_o =0.1μF, 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°C
		4.75	-	5.25	V	7V≤V _{IN} ≤20V, I _{OUT} =1mA-40mA
		4.75	-	5.25	V	7V≤V _{IN} ≤V _{MAX} , I _{OUT} =1mA-200mA Power Dissipation<0.5W
ΔV _{OUT}	Load Regulation	-	11	60	mV	T _J =25°C, 1mA≤I _{OUT} ≤100mA
		-	5.0	30	mV	T _J =25°C, 1mA≤I _{OUT} ≤40mA
ΔV _{OUT}	Line Regulation	-	8	150	mV	T _J =25°C, 7V≤V _{IN} ≤20V
		-	6	100	mV	T _J =25°C, 8V≤V _{IN} ≤20V
I _Q	Quiescent Current	-	2.0	5.5	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	8V≤V _{IN} ≤20V
		-	-	0.1	mA	1mA≤I _{IN} ≤40mA
e _N	Output Noise Voltage	-	40	-	μV	10Hz≤f≤100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-0.65	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	41	80	-	dB	8V≤V _{IN} ≤20V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		5.70	-	6.30	V	8.5V ≤ V _{IN} ≤ 20V, I _{OUT} =1mA-40mA
		5.70	-	6.30	V	8.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	12.8	80	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	5.8	40	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 70mA
ΔV _{OUT}	Line Regulation	-	64	175	mV	T _J =25°C, 8.5V ≤ V _{IN} ≤ 20V
		-	54	125	mV	T _J =25°C, 9V ≤ V _{IN} ≤ 20V
I _Q	Quiescent Current	-	3.9	6.0	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	9V ≤ V _{IN} ≤ 20V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	49	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-0.75	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	40	46	-	dB	10V ≤ V _{IN} ≤ 20V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		7.60	-	8.40	V	10.5V ≤ V _{IN} ≤ 23V, I _{OUT} =1mA-40mA
		7.60	-	8.40	V	10.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	15	80	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	8.0	40	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 70mA
ΔV _{OUT}	Line Regulation	-	10	175	mV	T _J =25°C, 10.5V ≤ V _{IN} ≤ 23V
		-	8	125	mV	T _J =25°C, 11V ≤ V _{IN} ≤ 23V
I _Q	Quiescent Current	-	2.0	5.5	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	11V ≤ V _{IN} ≤ 23V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	49	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-0.75	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	39	70	-	dB	11V ≤ V _{IN} ≤ 23V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		8.55	-	9.45	V	11.5V ≤ V _{IN} ≤ 24V, I _{OUT} =1mA-40mA
		8.55	-	9.45	V	11.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	20	90	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	10	45	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 40mA
ΔV _{OUT}	Line Regulation	-	90	200	mV	T _J =25°C, 11.5V ≤ V _{IN} ≤ 24V
		-	100	150	mV	T _J =25°C, 13V ≤ V _{IN} ≤ 24V
I _Q	Quiescent Current	-	2.0	6.0	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	13V ≤ V _{IN} ≤ 24V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	49	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-0.75	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	38	44	-	dB	12V ≤ V _{IN} ≤ 23V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		9.5	-	10.5	V	12.5V ≤ V _{IN} ≤ 23V, I _{OUT} =1mA-40mA
		9.5	-	10.5	V	12.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	20	94	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	10	47	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 70mA
ΔV _{OUT}	Line Regulation	-	100	200	mV	T _J =25°C, 12.5V ≤ V _{IN} ≤ 23V
		-	100	170	mV	T _J =25°C, 14V ≤ V _{IN} ≤ 23V
I _Q	Quiescent Current	-	4.2	6.5	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	12.5V ≤ V _{IN} ≤ 23V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	74	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-0.95	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	38	43	-	dB	15V ≤ V _{IN} ≤ 23V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		11.40	-	12.60	V	14.5V ≤ V _{IN} ≤ 27V, I _{OUT} =1mA-40mA
		11.40	-	12.60	V	14.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	25	150	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	12	75	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 40mA
ΔV _{OUT}	Line Regulation	-	25	300	mV	T _J =25°C, 14.5V ≤ V _{IN} ≤ 27V
		-	20	250	mV	T _J =25°C, 16V ≤ V _{IN} ≤ 27V
I _Q	Quiescent Current	-	2.0	6.0	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	16V ≤ V _{IN} ≤ 27V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	80	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-1.0	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	37	65	-	dB	15V ≤ V _{IN} ≤ 25V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		14.25	-	15.75	V	17.5V ≤ V _{IN} ≤ 30V, I _{OUT} =1mA-40mA
		14.25	-	15.75	V	17.5V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	20	150	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	25	150	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 70mA
ΔV _{OUT}	Line Regulation	-	25	150	mV	T _J =25°C, 17.5V ≤ V _{IN} ≤ 30V
		-	15	75	mV	T _J =25°C, 20V ≤ V _{IN} ≤ 30V
I _Q	Quiescent Current	-	2.2	6.5	mA	
ΔI _Q	Quiescent Current Change	-	-	1.5	mA	20V ≤ V _{IN} ≤ 30V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	90	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-1.3	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	34	63	-	dB	18.5V ≤ V _{IN} ≤ 28.5V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		17.10	-	18.90	V	21V ≤ V _{IN} ≤ 33V, I _{OUT} =1mA-40mA
		17.10	-	18.90	V	21V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	30	170	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	15	85	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 40mA
ΔV _{OUT}	Line Regulation	-	145	300	mV	T _J =25°C, 21V ≤ V _{IN} ≤ 33V
		-	135	250	mV	T _J =25°C, 22V ≤ V _{IN} ≤ 33V
I _q	Quiescent Current	-	2.0	6.0	mA	
ΔI _q	Quiescent Current Change	-	-	1.5	mA	21V ≤ V _{IN} ≤ 33V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	150	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-1.8	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	34	48	-	dB	23V ≤ V _{IN} ≤ 33V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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°C
		22.80	-	25.20	V	27V ≤ V _{IN} ≤ 38V, I _{OUT} =1mA-40mA
		22.80	-	25.20	V	27V ≤ V _{IN} ≤ V _{MAX} , I _{OUT} =1mA-200mA, Power Dissipation < 0.5W
ΔV _{OUT}	Load Regulation	-	40	200	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 100mA
		-	20	100	mV	T _J =25°C, 1mA ≤ I _{OUT} ≤ 40mA
ΔV _{OUT}	Line Regulation	-	160	300	mV	T _J =25°C, 27V ≤ V _{IN} ≤ 38V
		-	150	250	mV	T _J =25°C, 28V ≤ V _{IN} ≤ 38V
I _q	Quiescent Current	-	2.2	6.0	mA	
ΔI _q	Quiescent Current Change	-	-	1.5	mA	27V ≤ V _{IN} ≤ 38V
		-	-	0.1	mA	1mA ≤ I _{IN} ≤ 40mA
e _N	Output Noise Voltage	-	200	-	μV	10Hz ≤ f ≤ 100KHz
ΔV _O /ΔT	Temperature coefficient of V _{OUT}	-	-2.0	-	mV/°C	I _{OUT} =5mA
RR	Ripple Rejection	34	45	-	dB	27V ≤ V _{IN} ≤ 38V, f=120Hz, T _J =25°C
V _D	Dropout Voltage	-	1.7	-	V	T _J =25°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.

Typical Characteristics Curves

Fig.1- Ambient temperature vs. Power dissipation

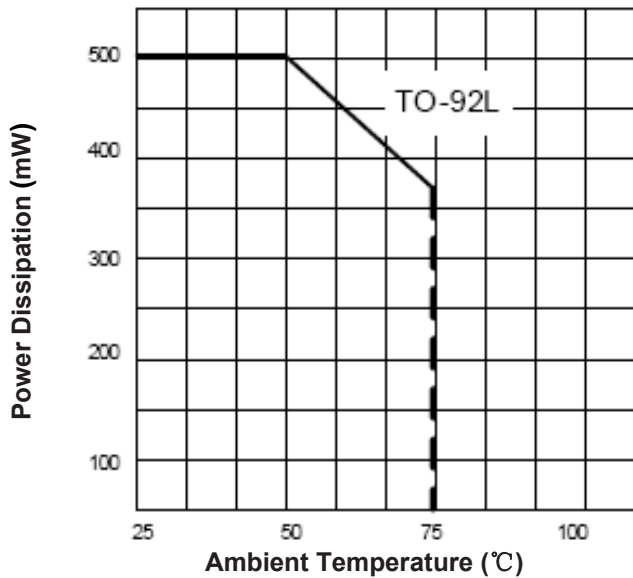


Fig.2- LM78LM05 Output Voltage vs. Ambient Temperature

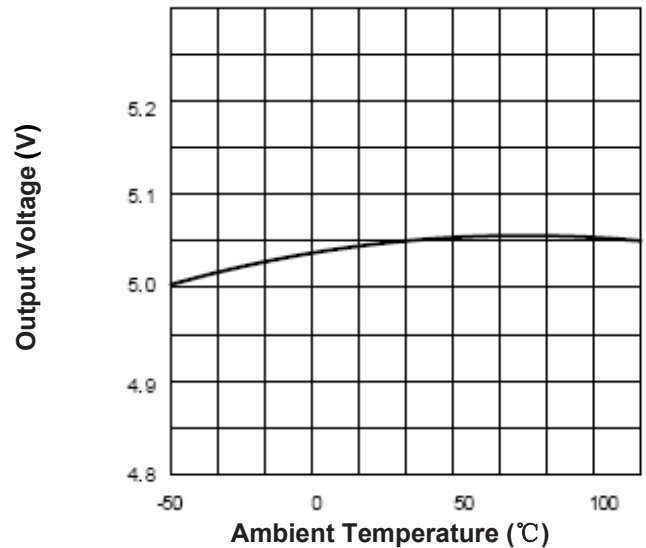


Fig.3- LM78LM12 Output Voltage vs. Ambient Temperature

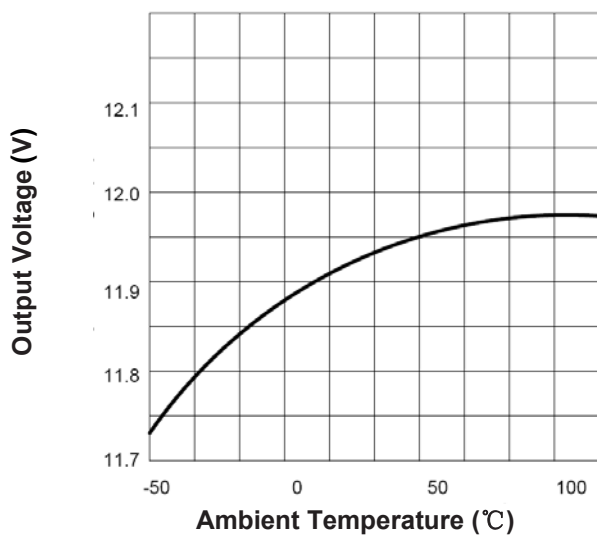
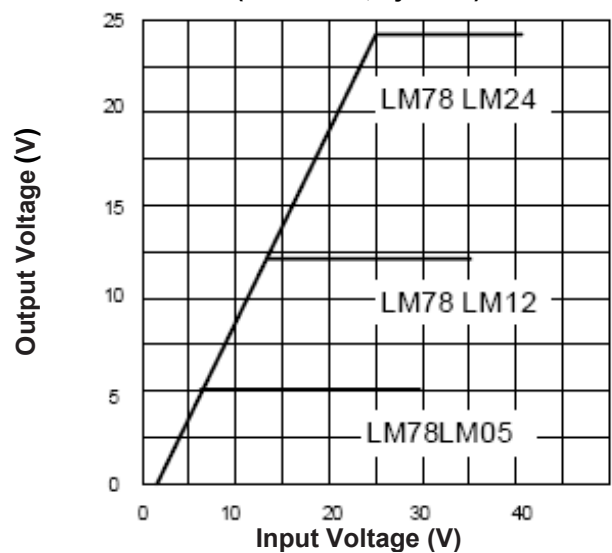


Fig.4- Output Characteristics (I_{OUT}=0mA, T_J=25°C)



Typical Characteristics Curves (Continued)

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

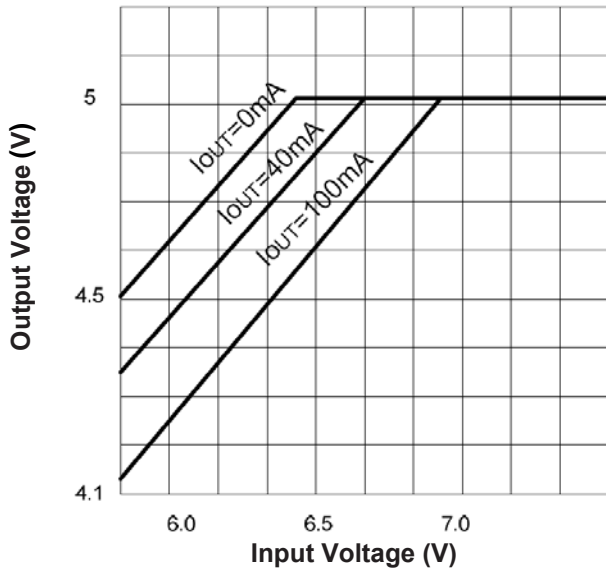


Fig.6- Short Circuit Output Current
($T_j=25^\circ\text{C}$)

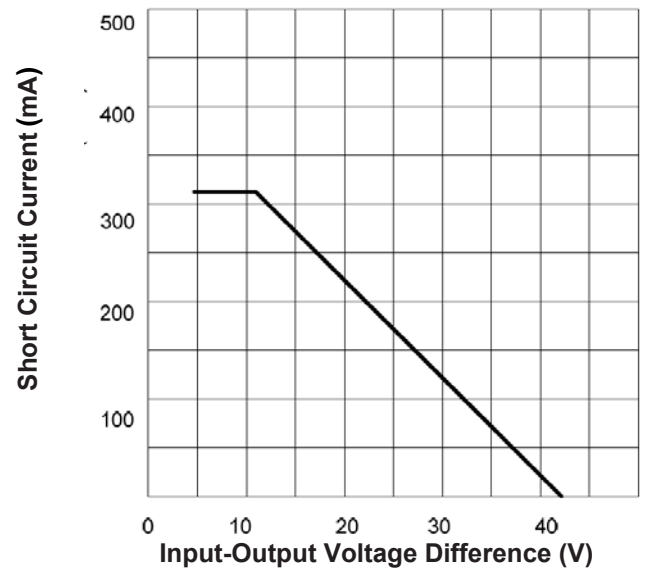


Fig.7- LM78L12/24 Quiescent Current vs.
Output Current ($T_j=25^\circ\text{C}$)

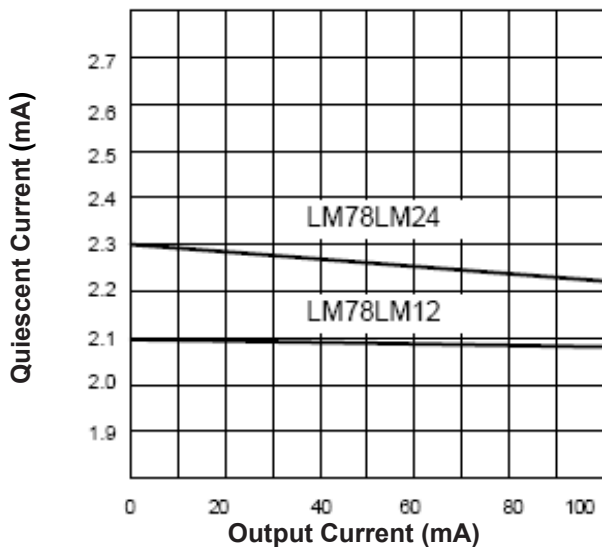
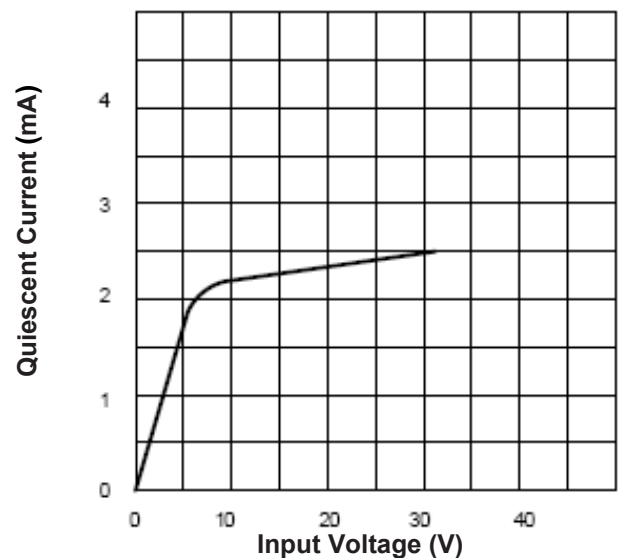
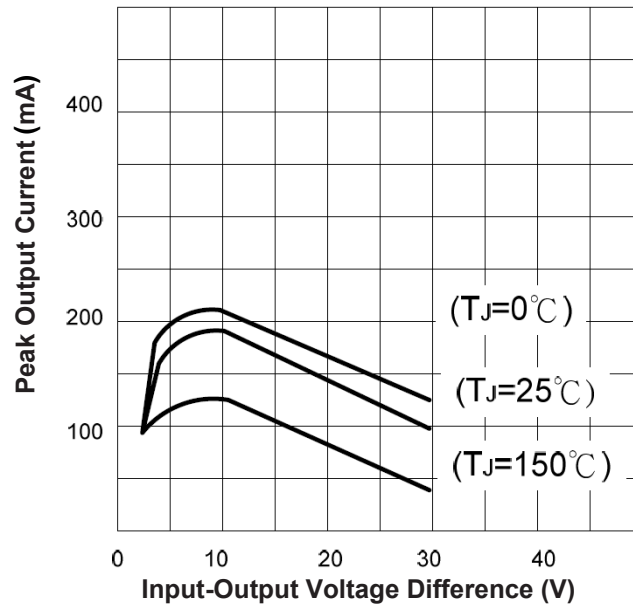


Fig.8- LM78LM05 Quiescent Current vs.
Input Voltage ($I_{OUT}=0\text{mA}$, $T_j=25^\circ\text{C}$)

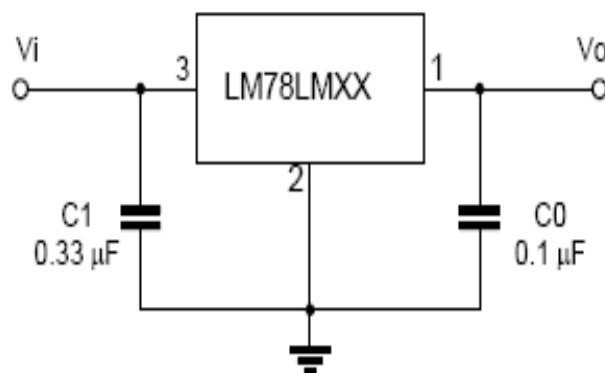


Typical Characteristics Curves (Continued)

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



Typical Application



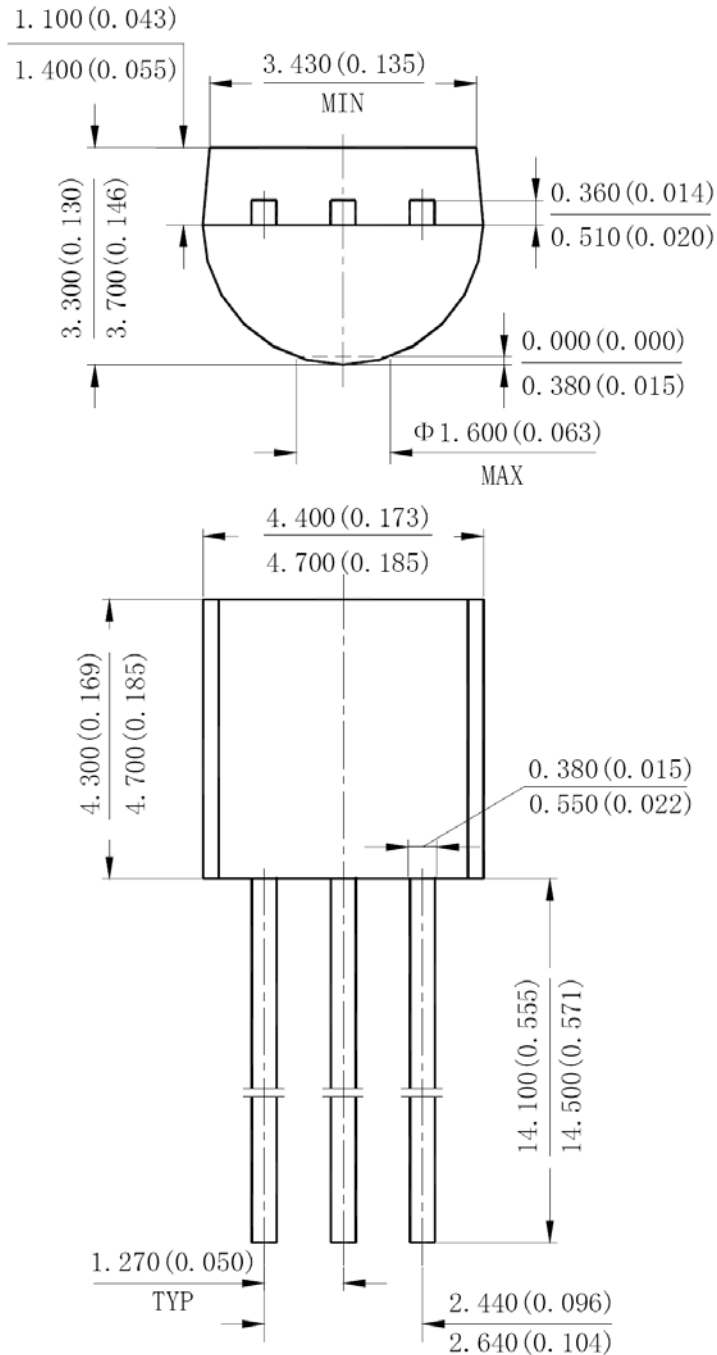
Note 1: To specify an output voltage, substitute voltage value for "XXM".

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

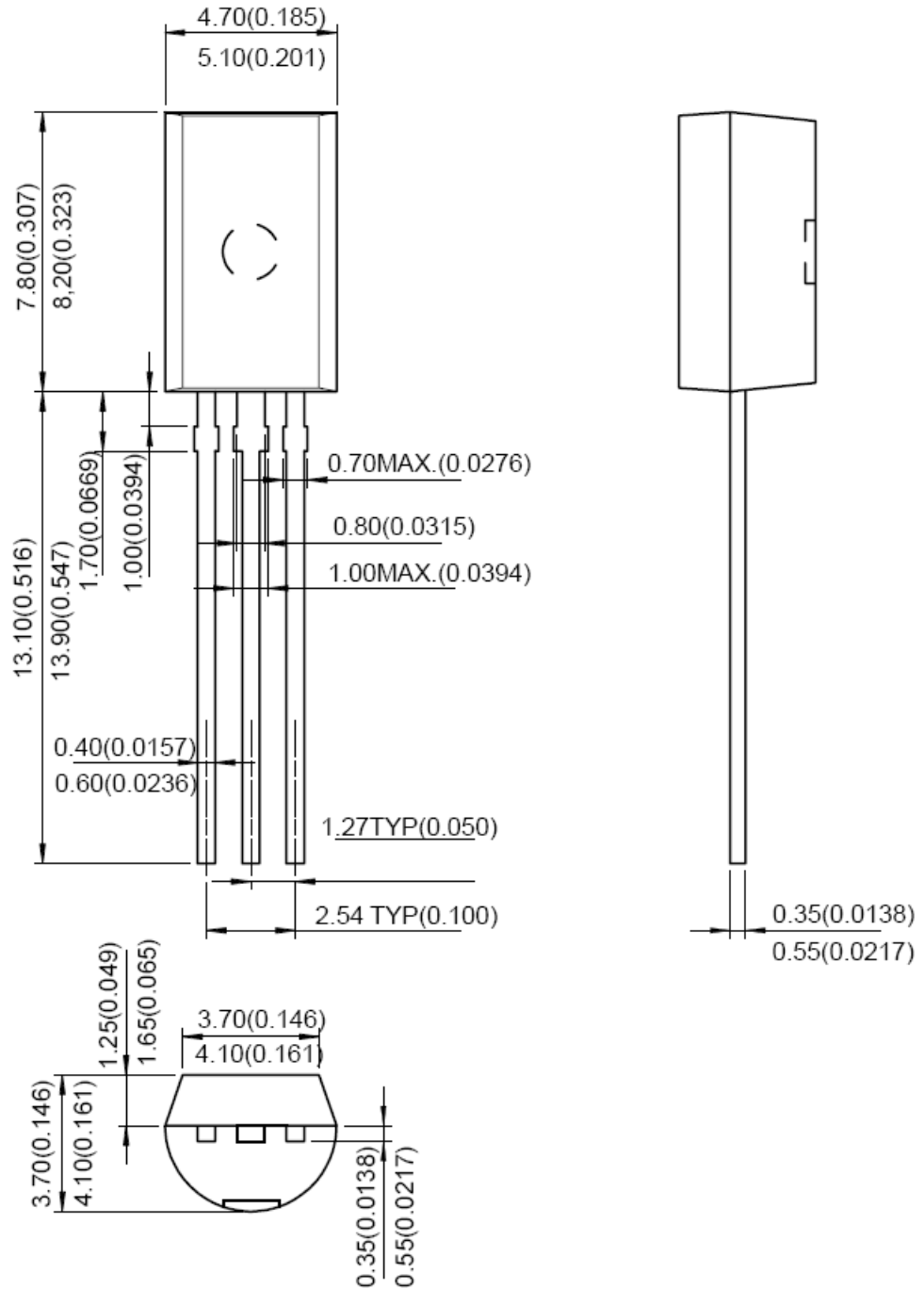
Dimensions in mm (inches)



TO-92

200mA Positive Voltage Regulator

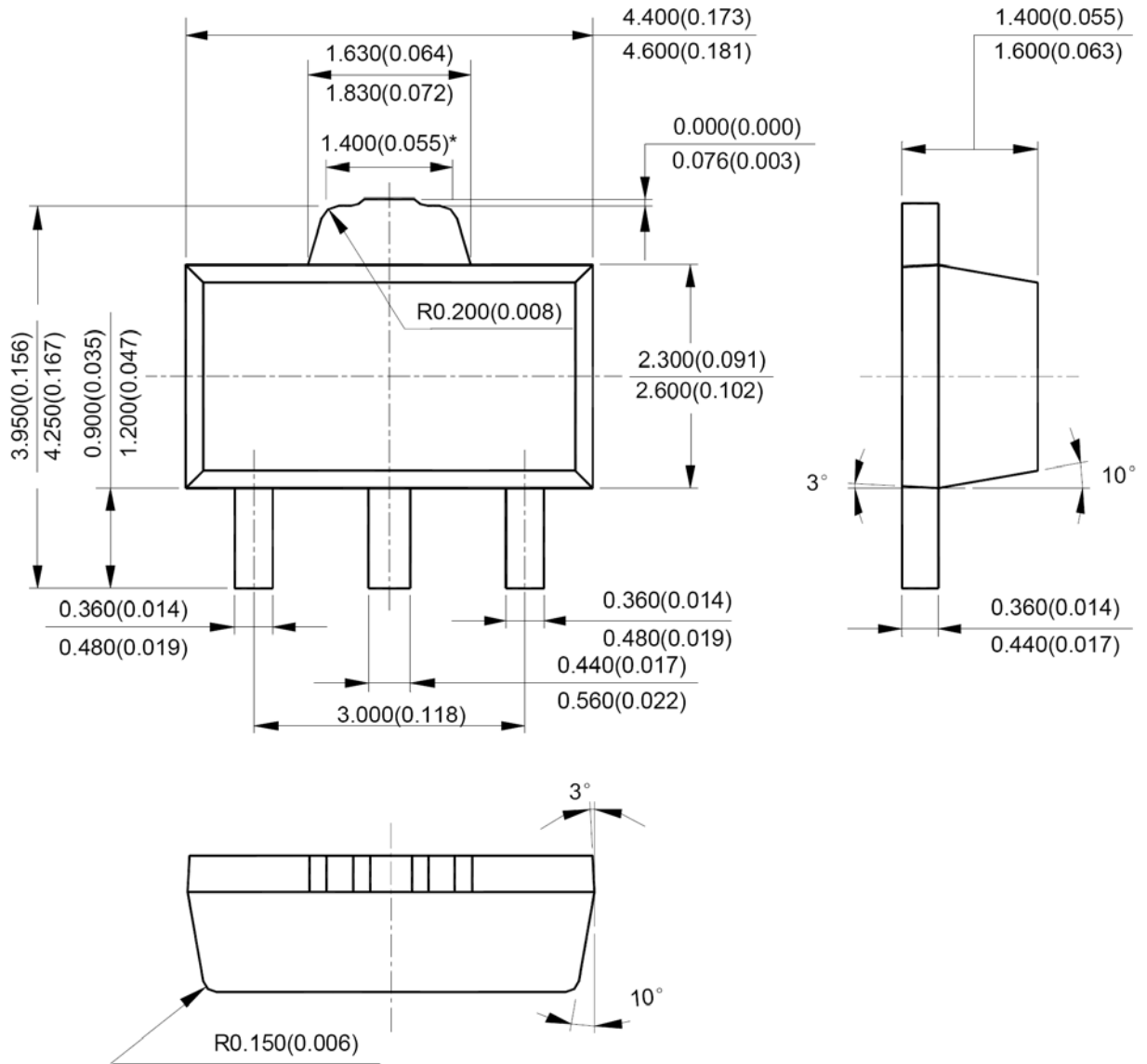
LM78LM



TO-92L

200mA Positive Voltage Regulator

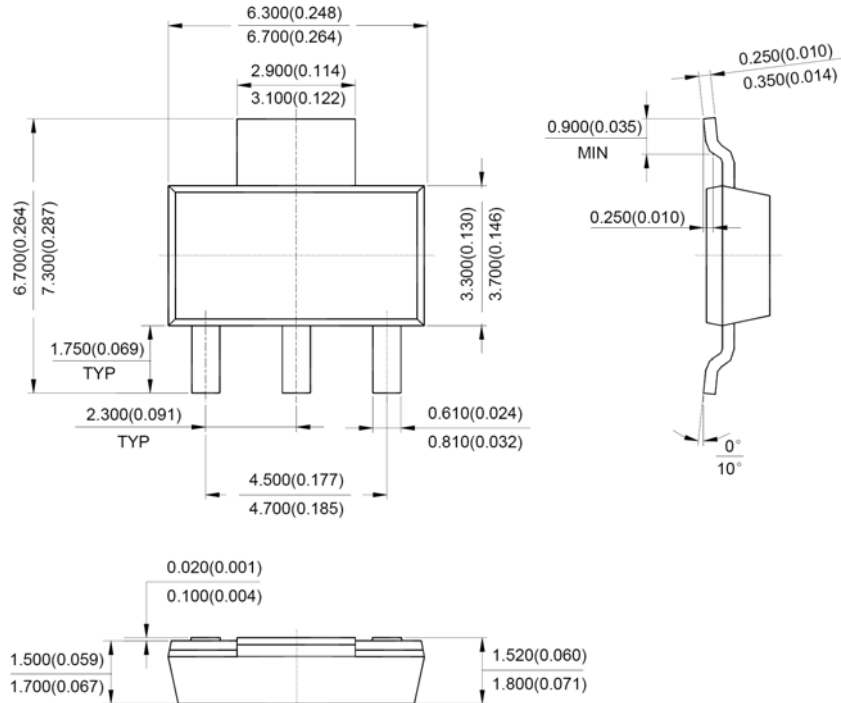
LM78LM



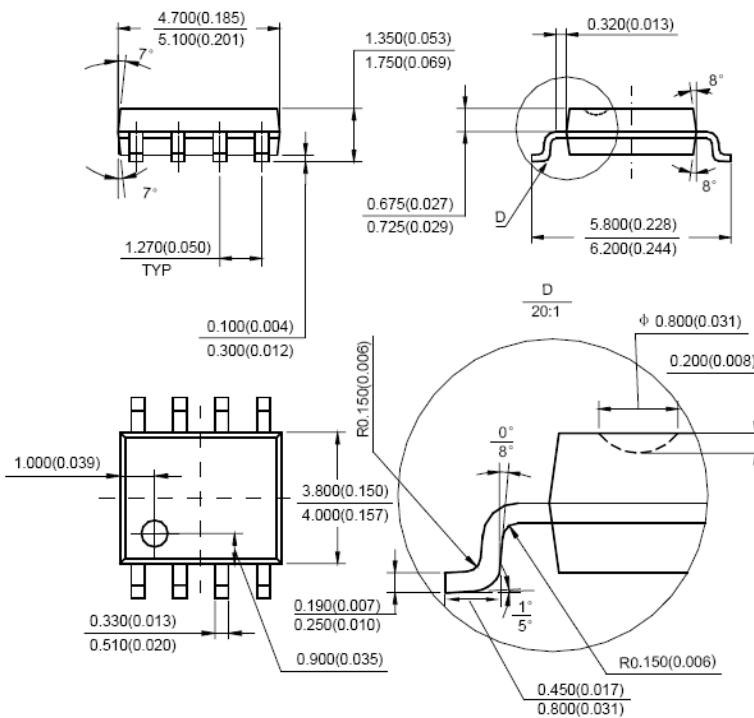
SOT-89

200mA Positive Voltage Regulator

LM78LM



SOT-223



SOP-8

200mA Positive Voltage Regulator

LM78LM

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