200mA Positive Voltage Regulator

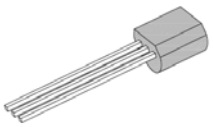
General Description

- 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

RoHS Compliant

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

LM78LM□□□□—XX—□□□□

Circuit Type

L: Io(Max)=200mA

Typical Output Voltage:

05:	5V	12:	12V
06:	6V	15:	15V
08:	8V	18:	18V
09:	9V	24:	24V
10:	10V		

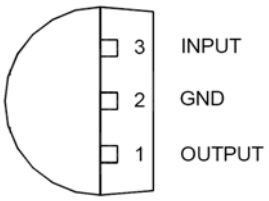
Outline:
Z: TO-92
LZ: TO-92L
K: SOT-89
H: SOT-223
S8: SOP-8

Factory Location Code

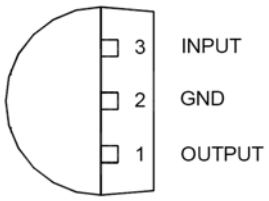
Package:
TR70: 7" Reel
TR30: 13" Reel
TU: Tube
BL: Bulk
AR: Tape and Ammo Pack

Tel: (800)-TAITRON (800)-824-8766 (661)-257-6060
Fax: (800)-TAITFAX (800)-824-8329 (661)-257-6415

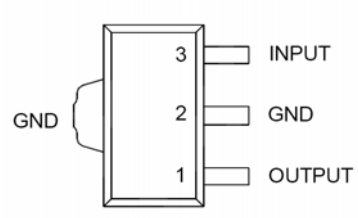
Pin Configuration



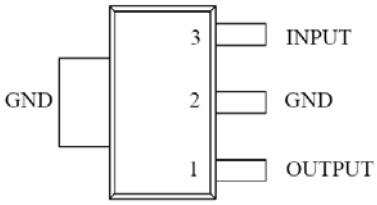
Outline: Z
TO-92



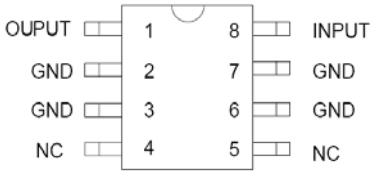
Outline: LZ
TO-92L



Outline: K
SOT-89

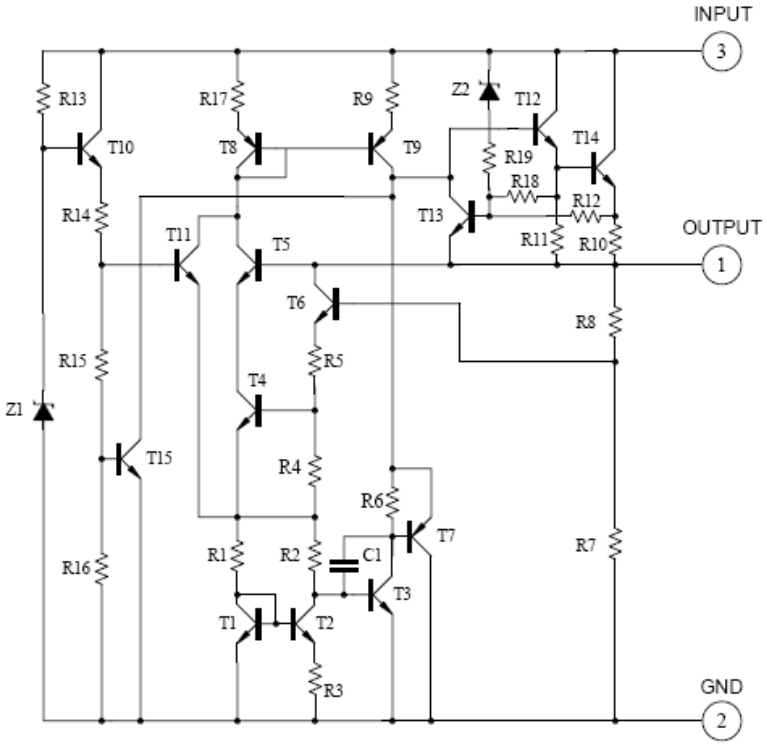


Outline: H
SOT-223



Outline: S8
SOP-8

Block Diagram



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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	5.0	30	mV	T_J=25℃, 1mA≤I_{OUT}≤40mA
ΔV_{OUT}	Line Regulation	-	8	150	mV	T_J=25℃, 7V≤V_{IN}≤20V
		-	6	100	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.65	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	41	80	-	dB	8V≤V_{IN}≤20V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM06 (V_{IN}=12V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O =0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	5.8	40	mV	T_J=25℃, 1mA≤I_{OUT}≤70mA
ΔV_{OUT}	Line Regulation	-	64	175	mV	T_J=25℃, 8.5V≤V_{IN}≤20V
		-	54	125	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	40	46	-	dB	10V≤V_{IN}≤20V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM08 (V_{IN}=14V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	8.0	40	mV	T_J=25℃, 1mA≤I_{OUT}≤70mA
ΔV_{OUT}	Line Regulation	-	10	175	mV	T_J=25℃, 10.5V≤V_{IN}≤23V
		-	8	125	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	39	70	-	dB	11V≤V_{IN}≤23V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM09 (V_{IN}=15V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	10	45	mV	T_J=25℃, 1mA≤I_{OUT}≤40mA
ΔV_{OUT}	Line Regulation	-	90	200	mV	T_J=25℃, 11.5V≤V_{IN}≤24V
		-	100	150	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.75	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	38	44	-	dB	12V≤V_{IN}≤23V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM10 (V_{IN}=16V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	10	47	mV	T_J=25℃, 1mA≤I_{OUT}≤70mA
ΔV_{OUT}	Line Regulation	-	100	200	mV	T_J=25℃, 12.5V≤V_{IN}≤23V
		-	100	170	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-0.95	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	38	43	-	dB	15V≤V_{IN}≤23V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

LM78LM

For LM78LM12 (V_{IN}=19V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	12	75	mV	T_J=25℃, 1mA≤I_{OUT}≤40mA
ΔV_{OUT}	Line Regulation	-	25	300	mV	T_J=25℃, 14.5V≤V_{IN}≤27V
		-	20	250	mV	T_J=25℃, 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
eN	Output Noise Voltage	-	80	-	μV	10Hz≤f≤100KHz
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.0	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	37	65	-	dB	15V≤V_{IN}≤25V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM15 (V_{IN}=23V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	25	150	mV	T_J=25℃, 1mA≤I_{OUT}≤70mA
ΔV_{OUT}	Line Regulation	-	25	150	mV	T_J=25℃, 17.5V≤V_{IN}≤30V
		-	15	75	mV	T_J=25℃, 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
eN	Output Noise Voltage	-	90	-	μV	10Hz≤f≤100KHz
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.3	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	34	63	-	dB	18.5V≤V_{IN}≤28.5V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM18 (V_{IN}=27V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	15	85	mV	T_J=25℃, 1mA≤I_{OUT}≤40mA
ΔV_{OUT}	Line Regulation	-	145	300	mV	T_J=25℃, 21V≤V_{IN}≤33V
		-	135	250	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-1.8	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	34	48	-	dB	23V≤V_{IN}≤33V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

For LM78LM24 (V_{IN}=33V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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℃, 1mA≤I_{OUT}≤100mA
		-	20	100	mV	T_J=25℃, 1mA≤I_{OUT}≤40mA
ΔV_{OUT}	Line Regulation	-	160	300	mV	T_J=25℃, 27V≤V_{IN}≤38V
		-	150	250	mV	T_J=25℃, 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
$\Delta V_O/\Delta T$	Temperature coefficient of V_{OUT}	-	-2.0	-	mV/℃	I_{OUT}=5mA
RR	Ripple Rejection	34	45	-	dB	27V≤V_{IN}≤38V, f=120Hz, T_J=25℃
V_D	Dropout Voltage	-	1.7	-	V	T_J=25℃

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

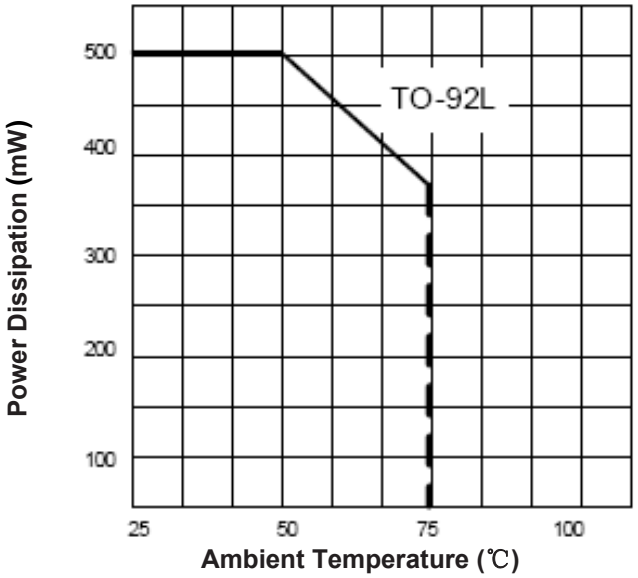


Fig.2- LM78LM05 Output Voltage vs. Ambient Temperature

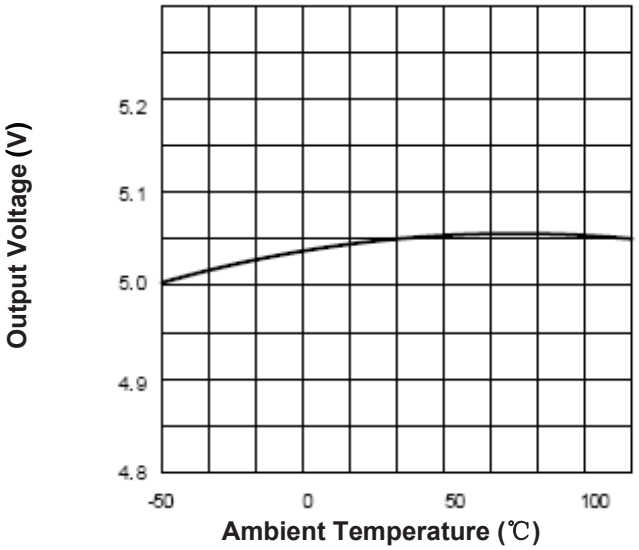


Fig.3- LM78LM12 Output Voltage vs. Ambient Temperature

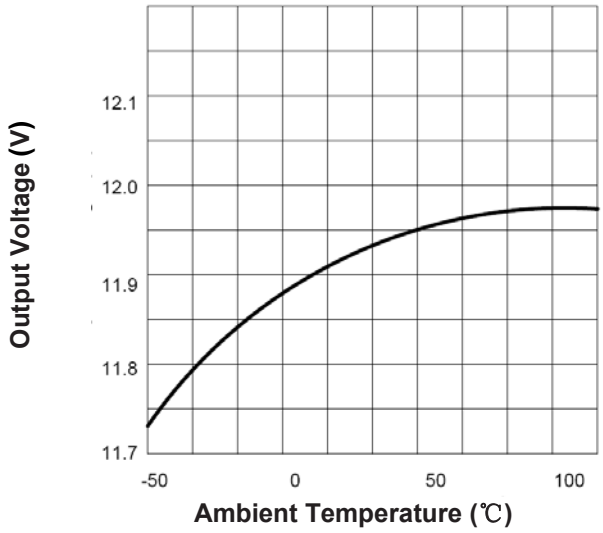
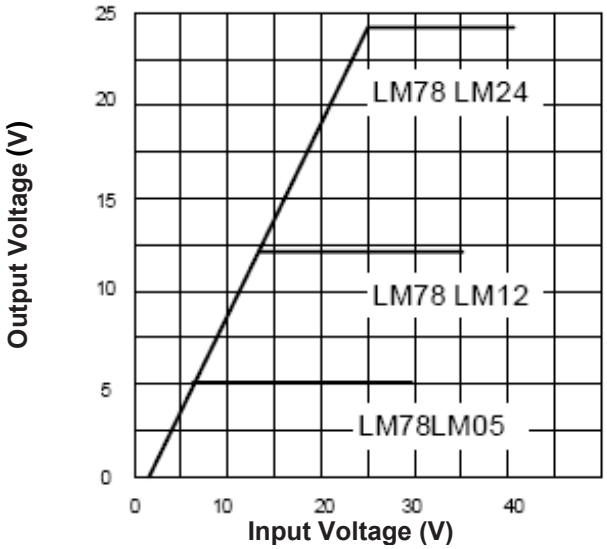


Fig.4- Output Characteristics (IOUT=0mA, Tj=25℃)



Typical Characteristics Curves (Continued)

Fig.5- LM78LM05 Dropout Characteristics (Tj=25℃)

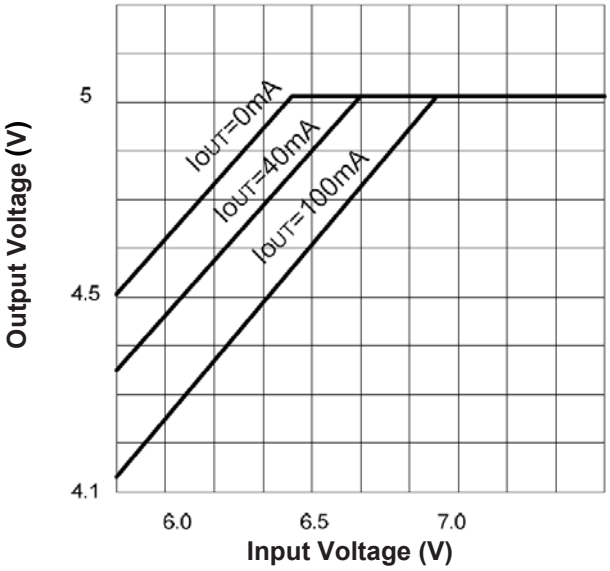


Fig.6- Short Circuit Output Current (Tj=25℃)

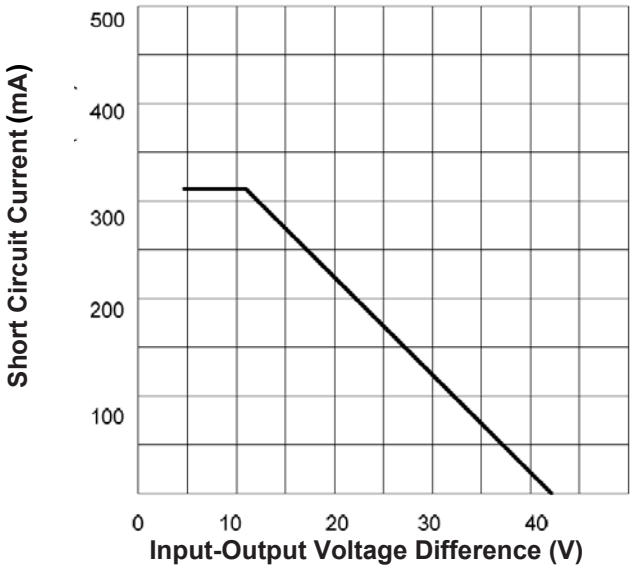


Fig.7- LM78L12/24 Quiescent Current vs. Output Current (Tj=25℃)

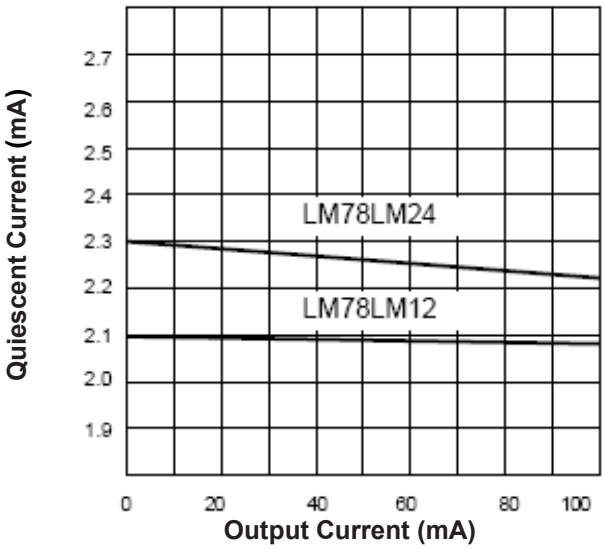
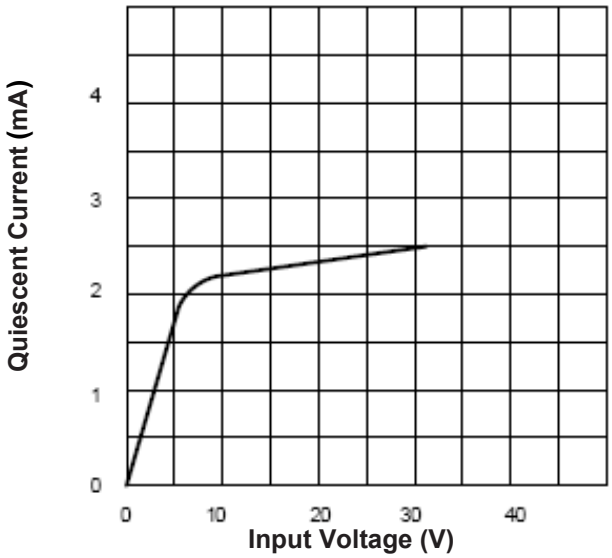
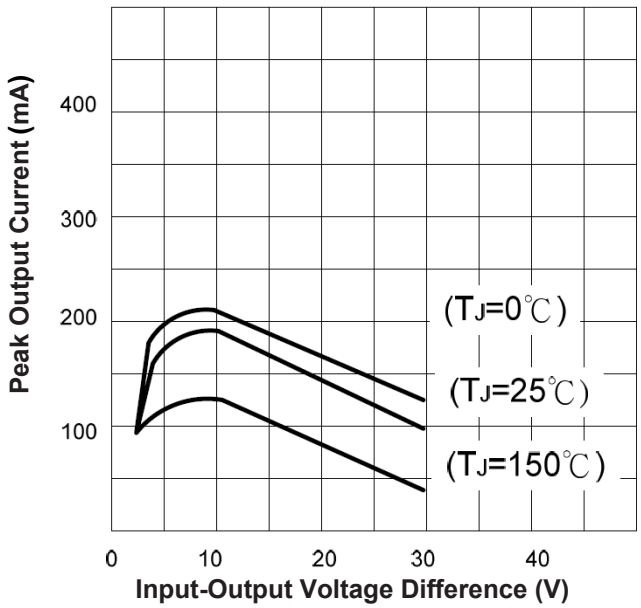


Fig.8- LM78LM05 Quiescent Current vs. Input Voltage (Iout=0mA, Tj=25℃)

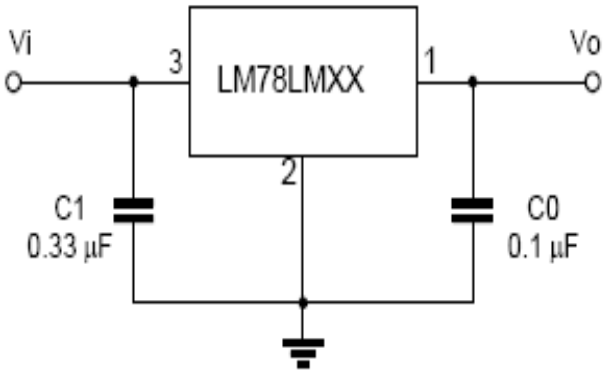


Typical Characteristics Curves (Continued)

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



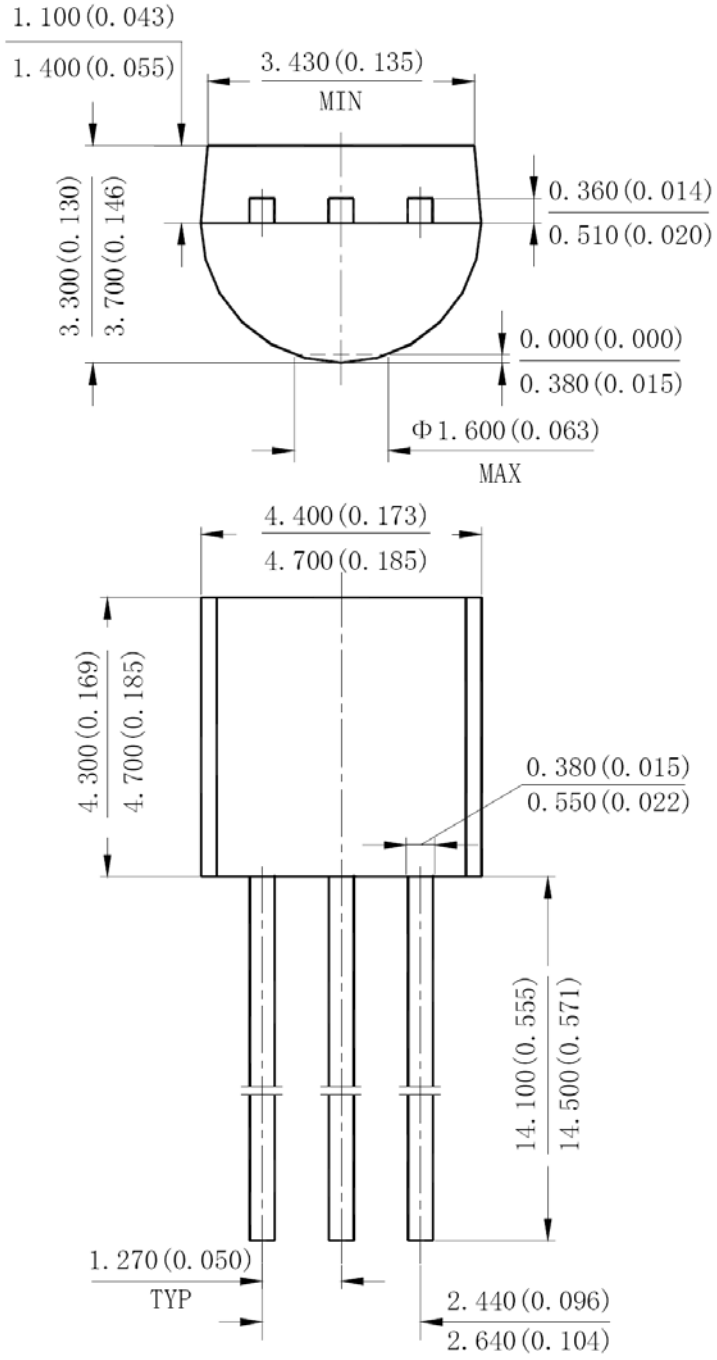
Typical Application



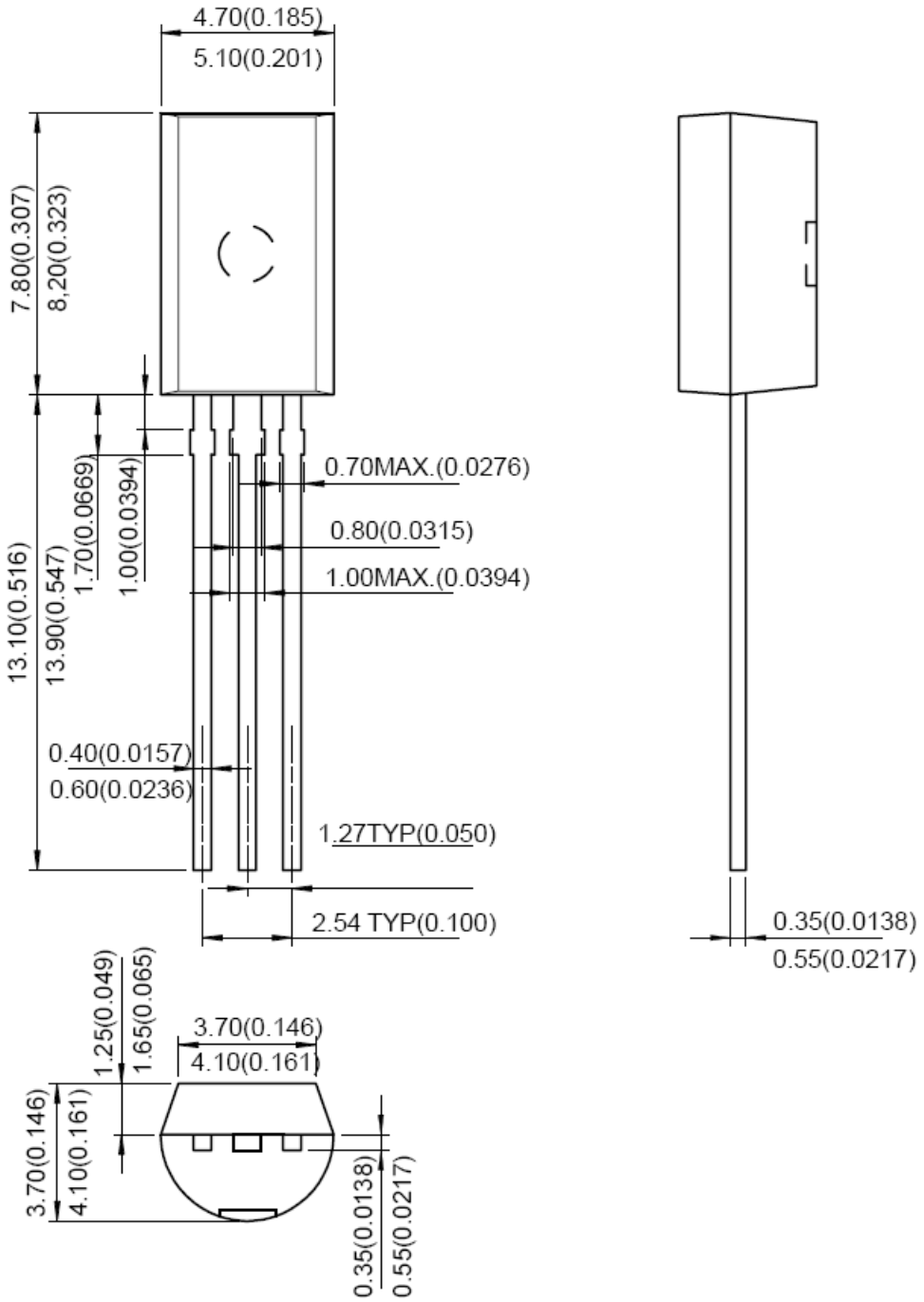
Note 1: To specify an output voltage, substitute voltage value for "XXM".

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

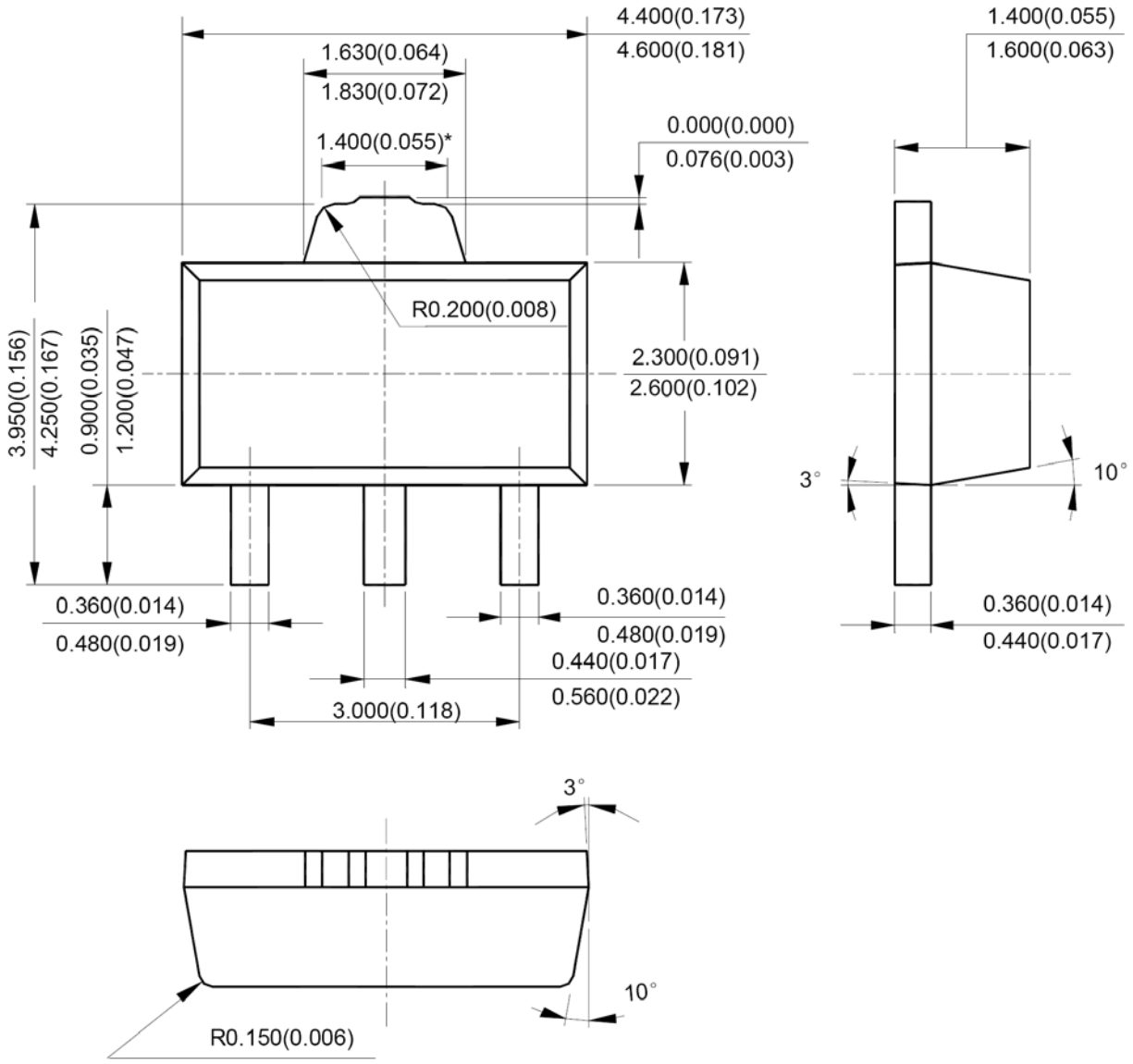
Dimensions in mm (inches)



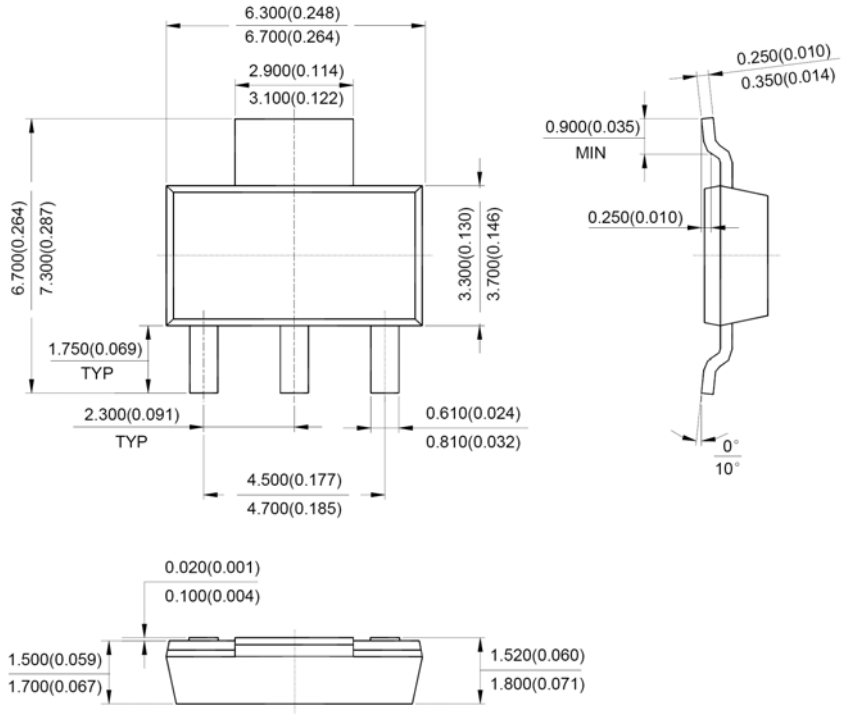
TO-92


4.70(0.185)
5.10(0.201)
7.80(0.307)
8.20(0.323)
0.70MAX.(0.0276)
0.80(0.0315)
1.00MAX.(0.0394)
1.70(0.0669)
1.00(0.0394)
13.10(0.516)
13.90(0.547)
0.40(0.0157)
0.60(0.0236)
1.27TYP(0.050)
2.54 TYP(0.100)
0.35(0.0138)
0.55(0.0217)
1.25(0.049)
1.65(0.065)
3.70(0.146)
4.10(0.161)
3.70(0.146)
4.10(0.161)
0.35(0.0138)
0.55(0.0217)

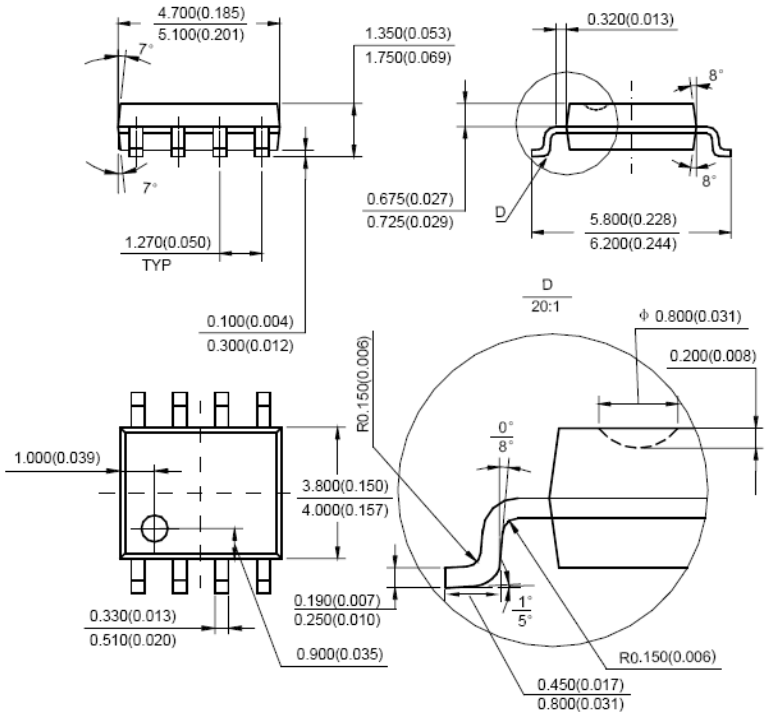
TO-92L


4.400(0.173)
4.600(0.181)
1.630(0.064)
1.830(0.072)
1.400(0.055)*
0.000(0.000)
0.076(0.003)
R0.200(0.008)
2.300(0.091)
2.600(0.102)
3.950(0.156)
4.250(0.167)
0.900(0.035)
1.200(0.047)
0.360(0.014)
0.480(0.019)
0.360(0.014)
0.480(0.019)
0.440(0.017)
0.560(0.022)
3.000(0.118)
1.400(0.055)
1.600(0.063)
3°
10°
0.360(0.014)
0.440(0.017)
3°
10°
R0.150(0.006)

SOT-89


6.300(0.248)
6.700(0.264)
2.900(0.114)
3.100(0.122)
6.700(0.264)
7.300(0.287)
3.300(0.130)
3.700(0.146)
1.750(0.069)
TYP
2.300(0.091)
TYP
0.610(0.024)
0.810(0.032)
4.500(0.177)
4.700(0.185)
0.250(0.010)
0.350(0.014)
0.900(0.035)
MIN
0.250(0.010)
0°
10°
0.020(0.001)
0.100(0.004)
1.500(0.059)
1.700(0.067)
1.520(0.060)
1.800(0.071)

SOT-223


4.700(0.185)
5.100(0.201)
7°
7°
1.350(0.053)
1.750(0.069)
1.270(0.050)
TYP
0.100(0.004)
0.300(0.012)
0.320(0.013)
8°
8°
0.675(0.027)
0.725(0.029)
D
5.800(0.228)
6.200(0.244)
D
20:1
Φ 0.800(0.031)
0.200(0.008)
R0.150(0.006)
0°
8°
1.000(0.039)
3.800(0.150)
4.000(0.157)
0.190(0.007)
0.250(0.010)
1°
5°
0.330(0.013)
0.510(0.020)
0.900(0.035)
R0.150(0.006)
0.450(0.017)
0.800(0.031)

SOP-8

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