TAITRON
components incorporated

100mA Positive Voltage Regulator
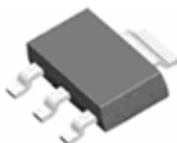
General Description

- 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.

.

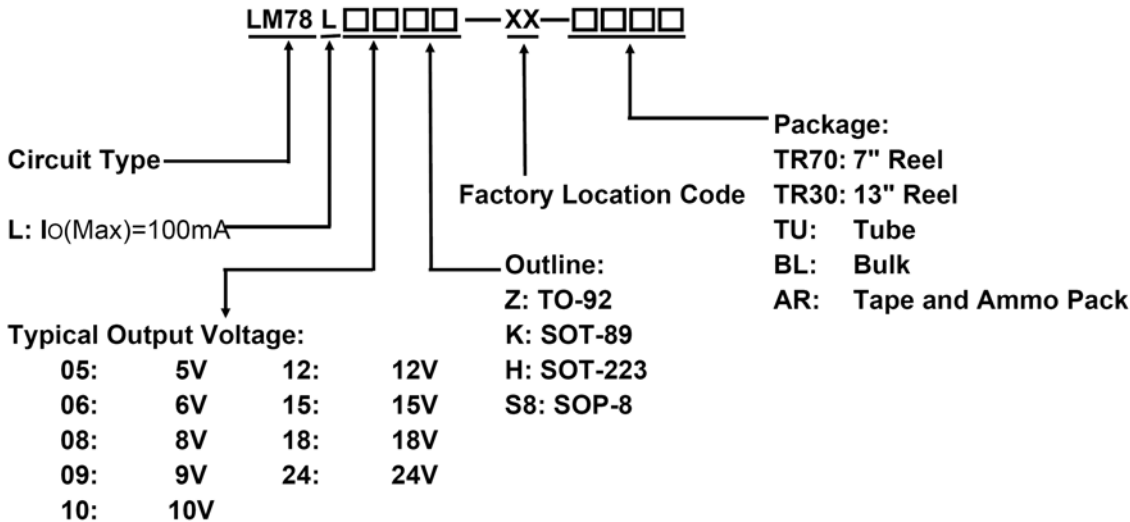**TO-92** **SOT-89**

SOT-223 **SOP-8**

RoHS Compliant

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

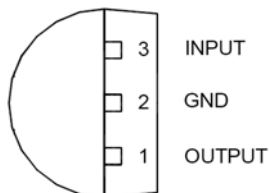- Consumer Electronics
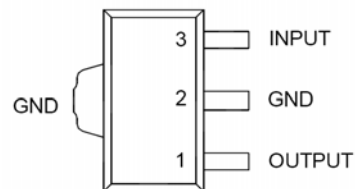- Microprocessor Power Supply
- Mother Board

Ordering Information

LM78 L □□□□ — XX — □□□□

Circuit Type

L: Io(Max)=100mA

Typical Output Voltage:

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

Factory Location Code

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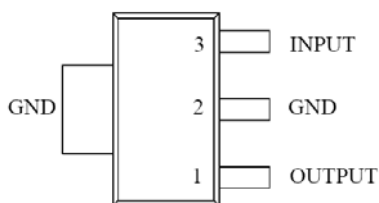S8: SOP-8

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

Pin Configuration

Outline: Z
TO-92

Outline: K
SOT-89

Outline: H
SOT-223
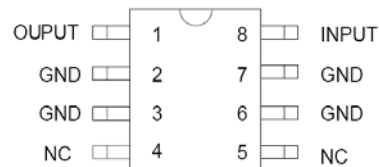
Outline: S8
SOP-8

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		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° C<T$_J$<125° C, C1=0.33µF, C$_O$ =0.1µF, 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℃
		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-70mA Power Dissipation<0.5W
∆V$_{OUT}$	Load Regulation	-	11	60	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤100mA
		-	5.0	30	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤40mA
∆V$_{OUT}$	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	V$_{IN}$=10V, I$_{OUT}$=0mA, T$_J$=25℃
∆I$_Q$	Quiescent Current Change	-	-	1.5	mA	8V≤V$_{IN}$≤20V
		-	-	0.1	mA	1mA≤I$_{IN}$≤40mA
eN	Output Noise Voltage	-	40	-	µV	10Hz≤f≤100KHz
∆V$_O$/∆$_T$	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 LM78L06 (V_{IN}=12V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33µF, C_O =0.1µF, 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℃
		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-70mA 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	V_{IN}=12V, I_{OUT}=0mA, T_J=25℃
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 LM78L08 (V_{IN}=14V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33µF, C_O=0.1µF, 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℃
		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-70mA 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	V_{IN}=14V, I_{OUT}=0mA, T_J=25℃
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 LM78L09 (V$_{IN}$=15V, I$_{OUT}$=40mA, 0° C<T$_J$<125° C, C1=0.33µF, C$_O$=0.1µF, 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℃
		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-70mA Power Dissipation<0.5W
∆**V$_{OUT}$**	Load Regulation	-	20	90	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤100mA
		-	10	45	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤40mA
∆**V$_{OUT}$**	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	V$_{IN}$=15V, I$_{OUT}$=0mA, T$_J$=25℃
∆**I$_Q$**	Quiescent Current Change	-	-	1.5	mA	13V≤V$_{IN}$≤24V
		-	-	0.1	mA	1mA≤I$_{IN}$≤40mA
eN	Output Noise Voltage	-	70	-	µV	10Hz≤f≤100KHz
∆**V$_O$/∆$_T$**	Temperature coefficient of V$_{OUT}$	-	-0.75	-	mV/℃	I$_{OUT}$=5mA
RR	Ripple Rejection	38	44	-	dB	12V≤V$_{IN}$≤24V, f=120Hz, T$_J$=25℃
V$_D$	Dropout Voltage	-	1.7	-	V	T$_J$=25℃

For LM78L10 (V$_{IN}$=16V, I$_{OUT}$=40mA, 0° C<T$_J$<125° C, C1=0.33µF, C$_O$=0.1µF, 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℃
		9.5	-	10.5	V	12.5V≤V$_{IN}$≤25V, I$_{OUT}$=1mA-40mA
		9.5	-	10.5	V	12.5V≤V$_{IN}$≤V$_{MAX}$, I$_{OUT}$=1mA-70mA Power Dissipation<0.5W
∆**V$_{OUT}$**	Load Regulation	-	20	94	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤100mA
		-	10	47	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤70mA
∆**V$_{OUT}$**	Line Regulation	-	100	200	mV	T$_J$=25℃, 12.5V≤V$_{IN}$≤25V
		-	100	170	mV	T$_J$=25℃, 14V≤V$_{IN}$≤25V
I$_Q$	Quiescent Current	-	2.0	6.0	mA	V$_{IN}$=17V, I$_{OUT}$=0mA, T$_J$=25℃
∆**I$_Q$**	Quiescent Current Change	-	-	1.5	mA	12.5V≤V$_{IN}$≤25V
		-	-	0.1	mA	1mA≤I$_{IN}$≤40mA
eN	Output Noise Voltage	-	74	-	µV	10Hz≤f≤100KHz
∆**V$_O$/∆$_T$**	Temperature coefficient of V$_{OUT}$	-	-0.8	-	mV/℃	I$_{OUT}$=5mA
RR	Ripple Rejection	38	43	-	dB	15V≤V$_{IN}$≤25V, f=120Hz, T$_J$=25℃
V$_D$	Dropout Voltage	-	1.7	-	V	T$_J$=25℃

For LM78L12 (V$_{IN}$=19V, I$_{OUT}$=40mA, 0° C<T$_J$<125° C, C1=0.33μF, C$_O$=0.1μF, 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℃
		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-70mA Power Dissipation<0.5W
Δ**V$_{OUT}$**	Load Regulation	-	25	150	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤100mA
		-	12	75	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤40mA
Δ**V$_{OUT}$**	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	V$_{IN}$=19V, I$_{OUT}$=0mA, T$_J$=25℃
Δ**I$_Q$**	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
Δ**V$_O$/Δ$_T$**	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 LM78L15 (V$_{IN}$=23V, I$_{OUT}$=40mA, 0° C<T$_J$<125° C, C1=0.33μF, C$_O$=0.1μF, 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℃
		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-70mA Power Dissipation<0.5W
Δ**V$_{OUT}$**	Load Regulation	-	20	150	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤100mA
		-	25	150	mV	T$_J$=25℃, 1mA≤I$_{OUT}$≤70mA
Δ**V$_{OUT}$**	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	V$_{IN}$=23V, I$_{OUT}$=0mA, T$_J$=25℃
Δ**I$_Q$**	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
Δ**V$_O$/Δ$_T$**	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 LM78L18 (V_{IN}=27V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		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-70mA 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	V_{IN}=27V, I_{OUT}=0mA, T_J=25℃
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/℃	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 LM78L24 (V_{IN}=33V, I_{OUT}=40mA, 0° C<T_J<125° C, C1=0.33μF, C_O=0.1μF, 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℃
		22.8	-	25.2	V	27V≤V_{IN}≤38V, I_{OUT}=1mA-40mA
		22.8	-	25.2	V	27V≤V_{IN}≤V_{MAX}, I_{OUT}=1mA-70mA 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	V_{IN}=33V, I_{OUT}=0mA, T_J=25℃
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/℃	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.

TAITRON
components incorporated

Typical Characteristics Curves

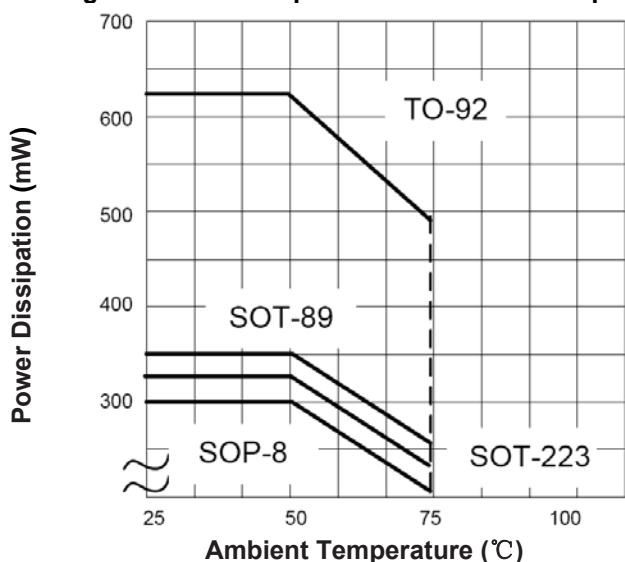**Fig.1- Ambient temperature vs. Power dissipation**
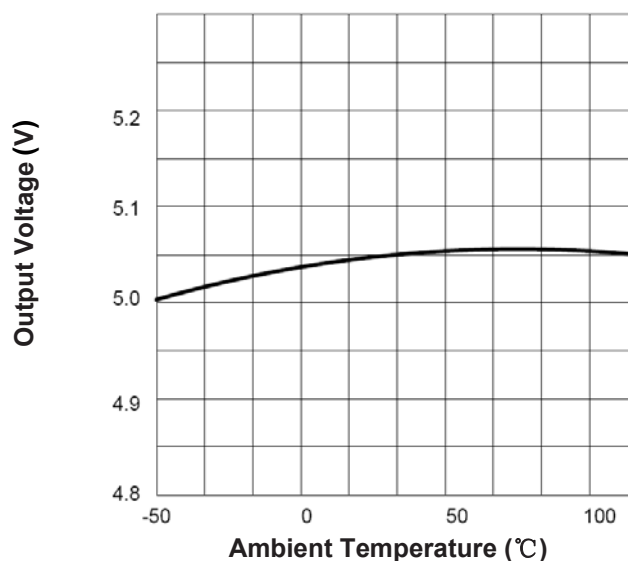

Fig.2- LM78L05 Output Voltage vs. Ambient Temperature

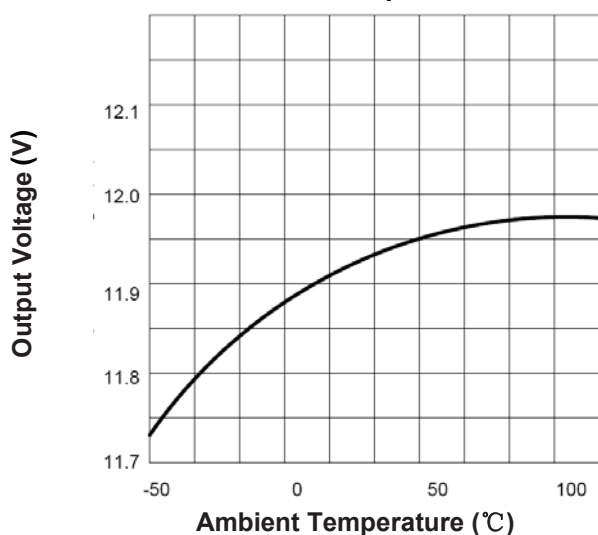**Fig.3- LM78L12 Output Voltage vs. Ambient Temperature**

Fig.4- Output Characteristics (Ip=0mA, Tj=25℃)
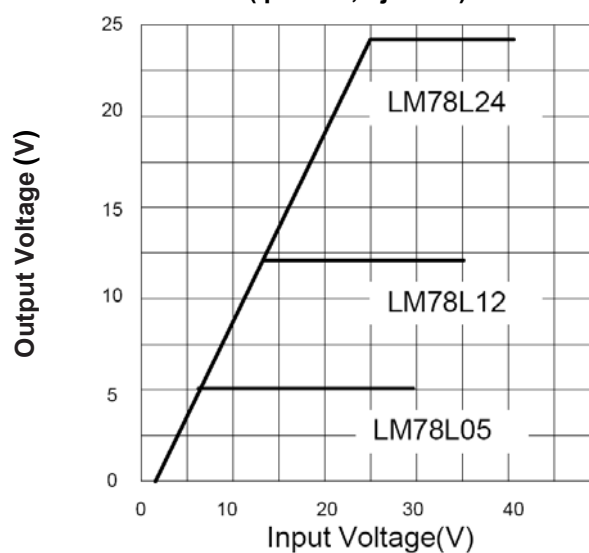
Typical Characteristics Curves (Continued)

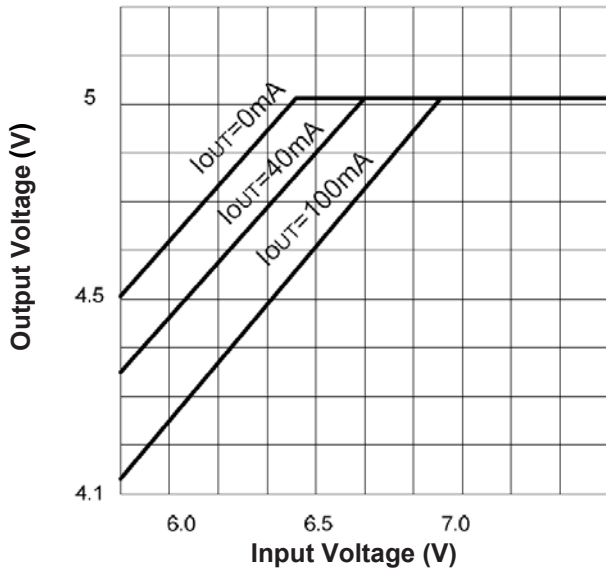**Fig.5- LM78L05 Dropout Characteristics (Tj=25℃)**
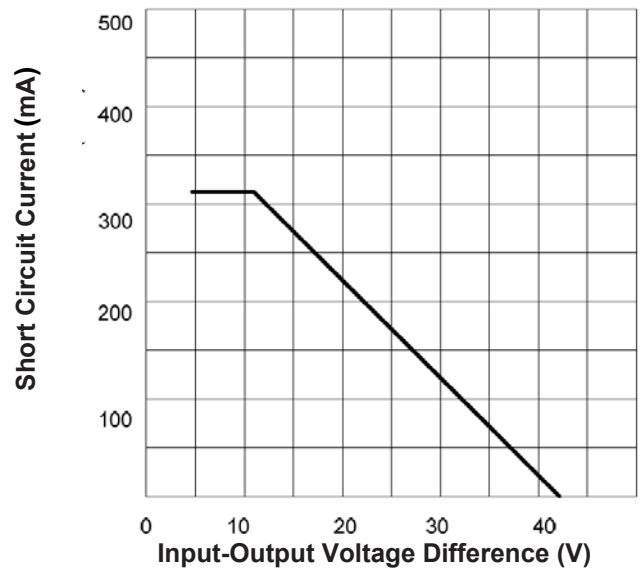

Fig.6- Short Circuit Output Current (Tj=25℃)
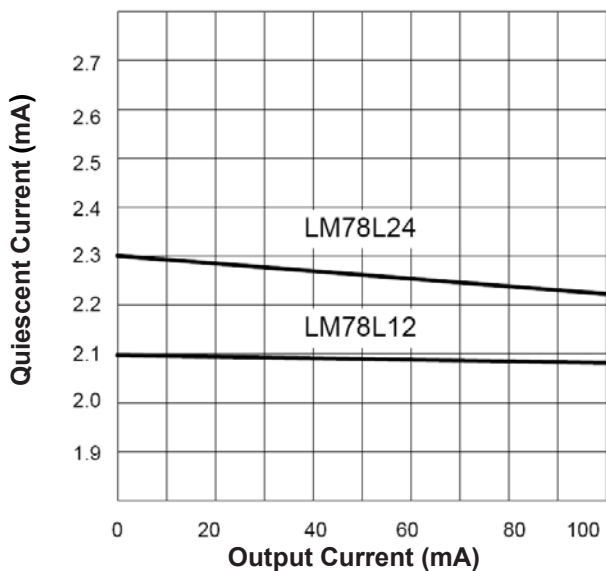

Fig.7- LM78L12/24 Quiescent Current vs. Output Current (Tj=25℃)

Fig.8- LM78L05 Quiescent Current vs. Input Voltage (Iout=0mA, Tj=25℃)
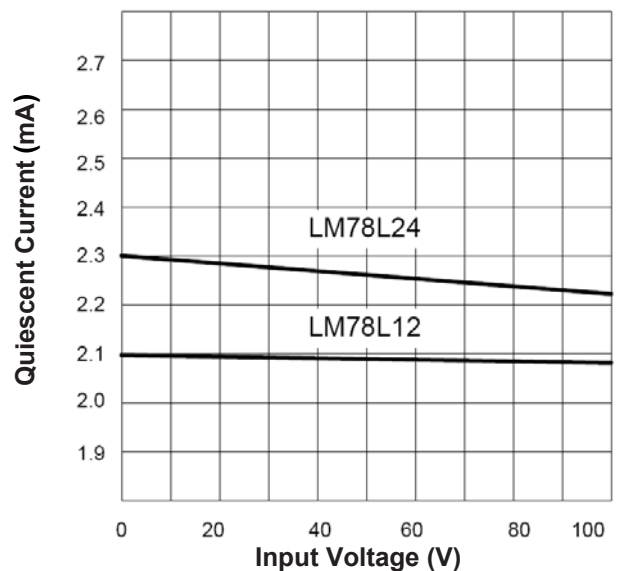
Typical Characteristics Curves (Continued)

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

Peak Output Current (mA)

$(T_J=0°C)$

$(T_J=25°C)$

$(T_J=150°C)$

Input-Output Voltage Difference (V)

Fig.10- Dropout Voltage

Input Output Different ional (V)

$I_{OUT}=70mA$

$I_{OUT}=40mA$

$I_{OUT}=1.0mA$

DROPOUT CONDITIONS
$\Delta V_{OUT}=2\%$ of V_{OUT}

Junction Temperature (°C)
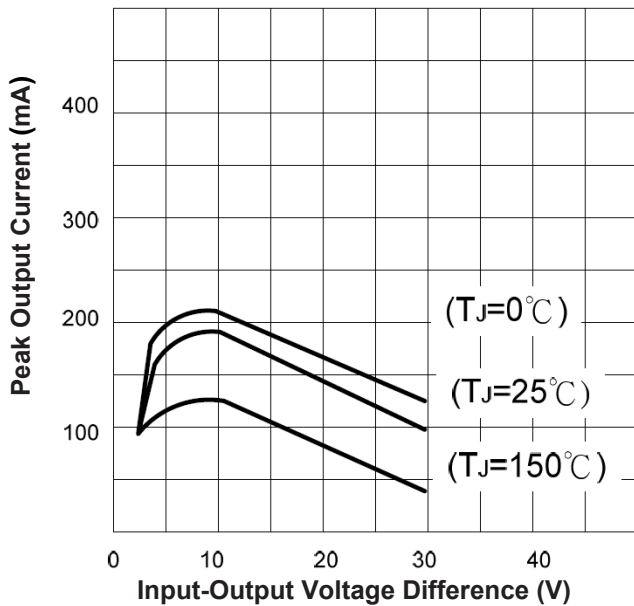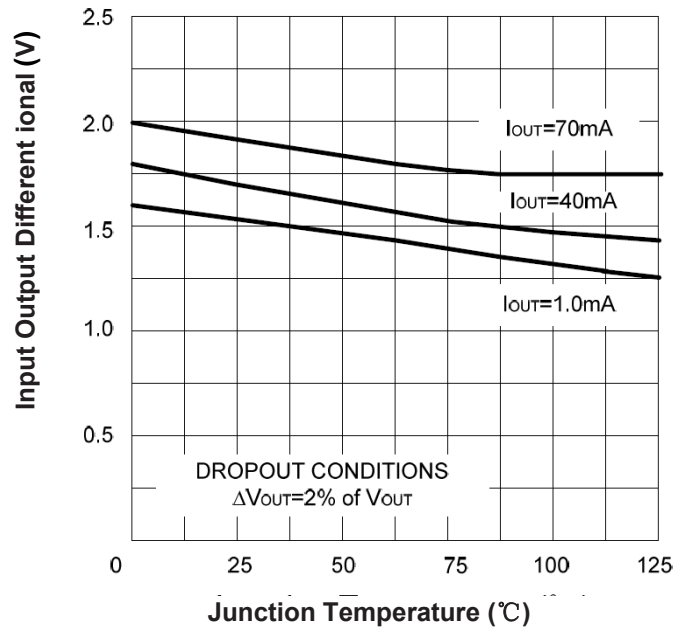
Typical Application

V_{IN} — 3 — LM78LXX — 1 — V_{OUT}

C1 0.33 μF

2

C0 0.1 μF
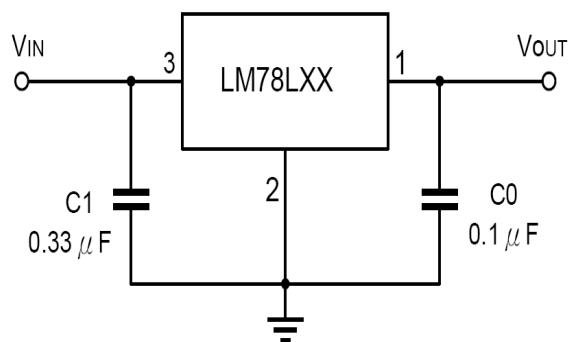
Note 1.To specify an output voltage, substitute voltage value for "XX".

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

Dimensions in mm (inches)
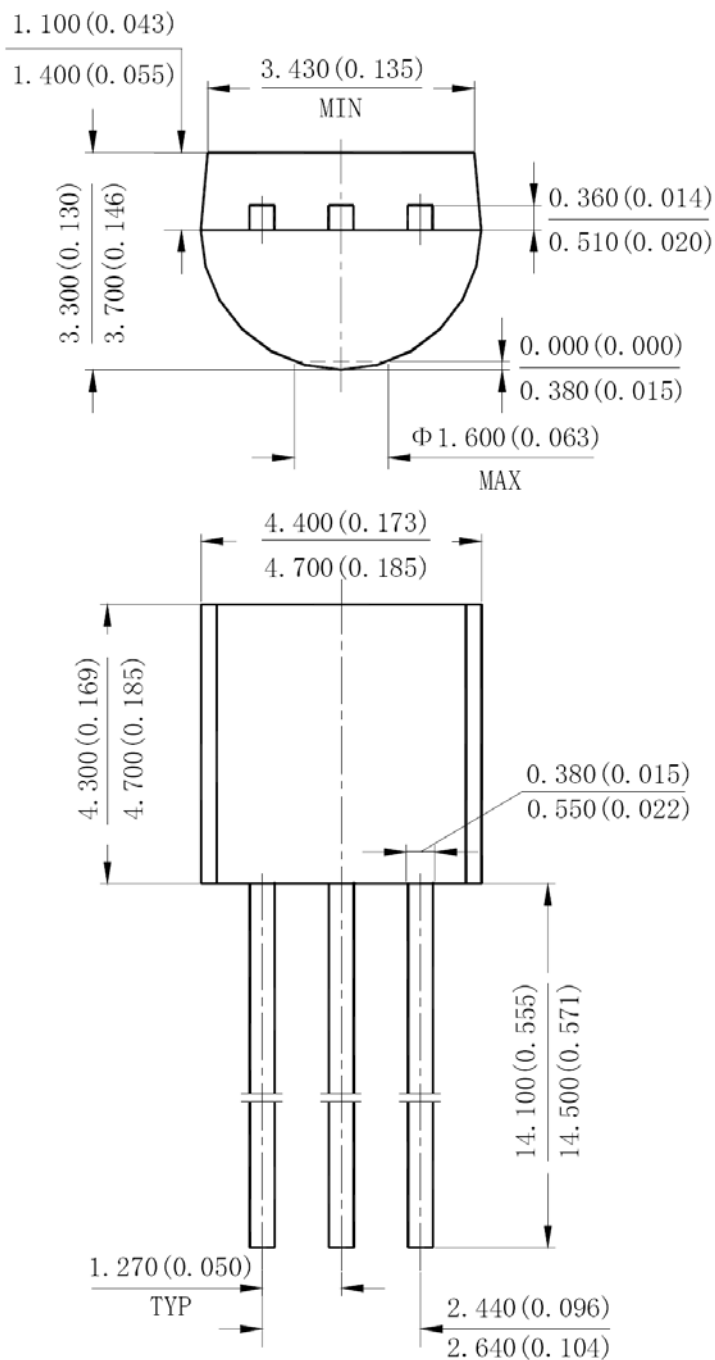
TO-92
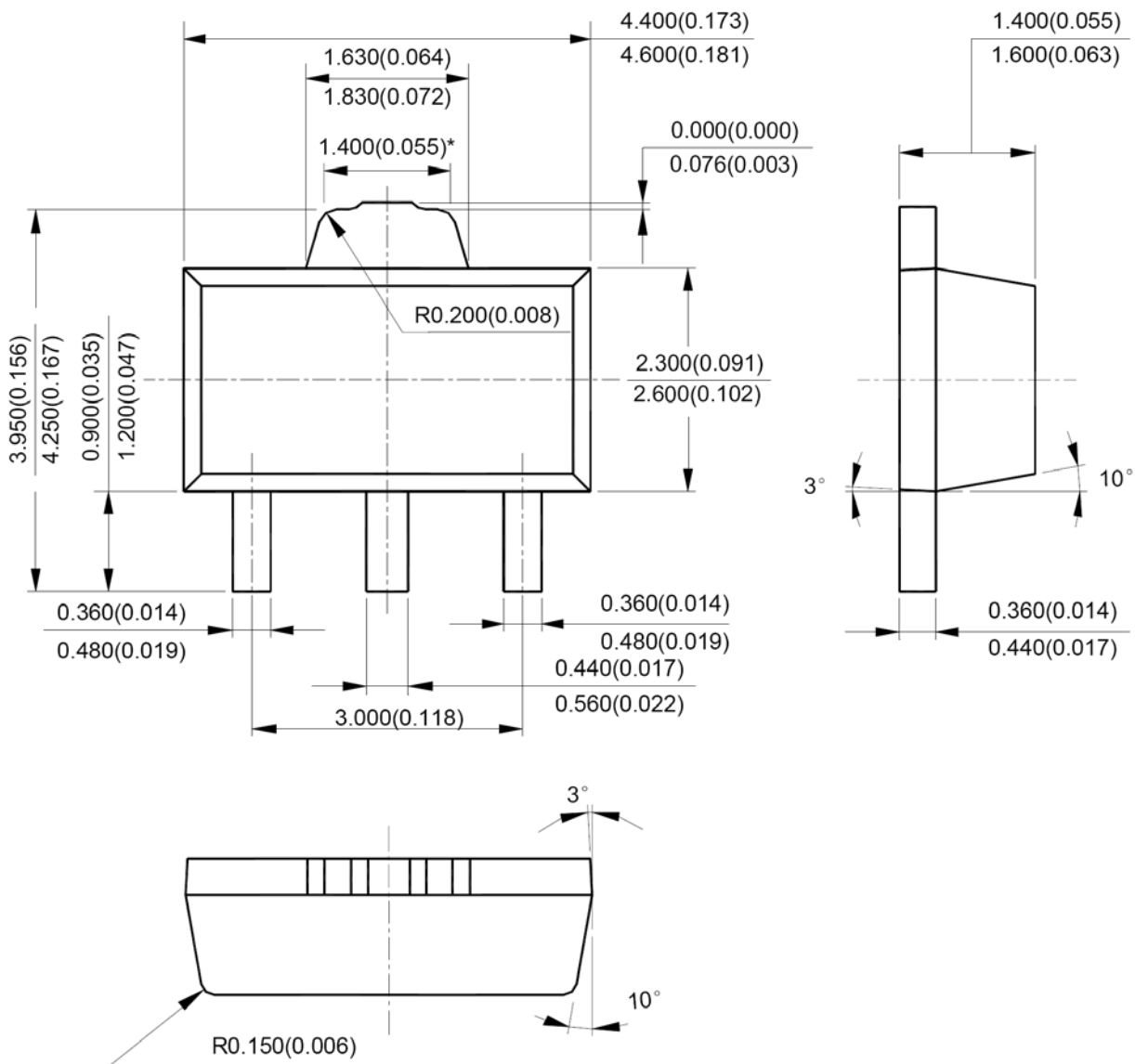
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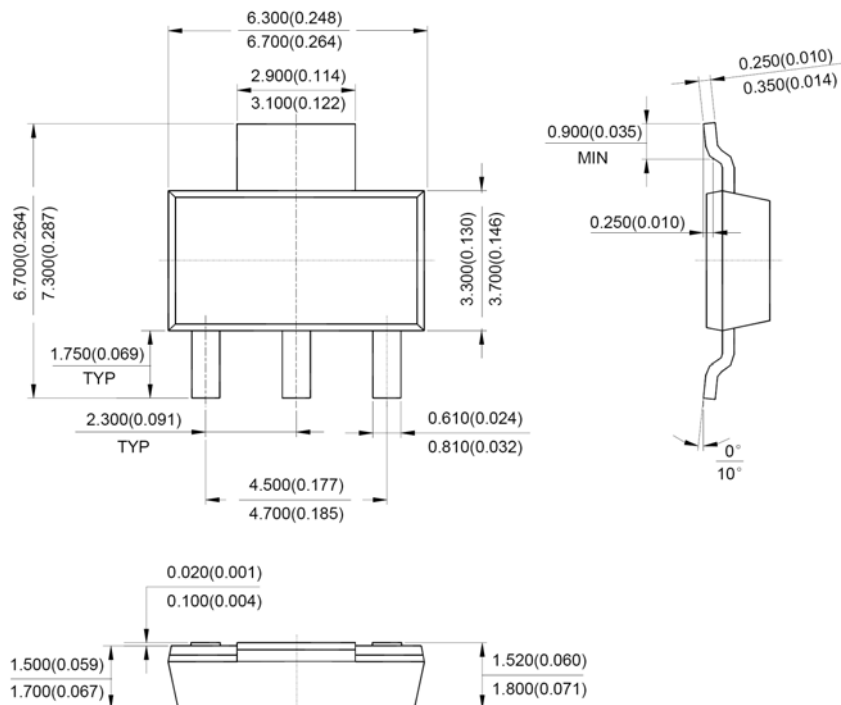
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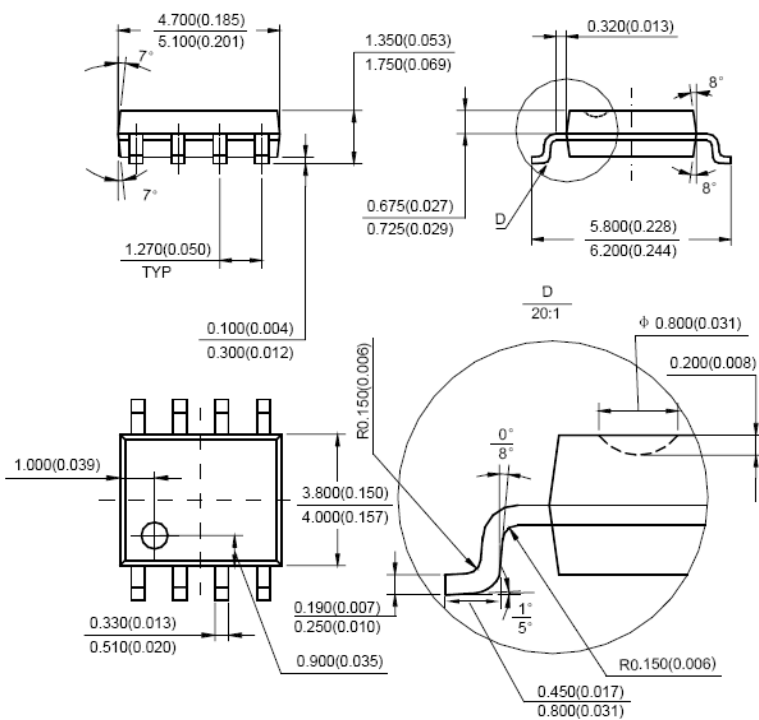
SOP-8

TAITRON
components incorporated

How to contact us:

US HEADQUARTERS

28040 WEST HARRISON PARKAWAY, VALENCIA, CA 91355-4162
Tel: (800) TAITRON (800) 824-8766 (661) 257-6060
Fax: (800) TAITFAX (800) 824-8329 (661) 257-6415
Email: taitron@taitroncomponents.com
Http://www.taitroncomponents.com

TAITRON COMPONENTS MEXICO, S.A .DE C.V.

BOULEVARD CENTRAL 5000 INTERIOR 5 PARQUE INDUSTRIAL ATITALAQUIA, HIDALGO C.P.
42970 MEXICO
Tel: +52-55-5560-1519
Fax: +52-55-5560-2190

TAITRON COMPONETS INCORPORATED E REPRESENTAÇÕES DO BRASIL LTDA

RUA DOMINGOS DE MORAIS, 2777, 2.ANDAR, SALA 24 SAÚDE - SÃO PAULO-SP 04035-001 BRAZIL
Tel: +55-11-5574-7949
Fax: +55-11-5572-0052

TAITRON COMPONETS INCORPORATED, SHANGHAI REPRESENTATIVE OFFICE

CROSS REGION PLAZA, 899 LINGLING ROAD, SUITE 18C, SHANGHAI, 200030, CHINA
Tel: +86-21-5424-9942
Fax: +86-21-5424-9931