Positive Voltage Regulator

Lead(Pb)-Free

General Description:

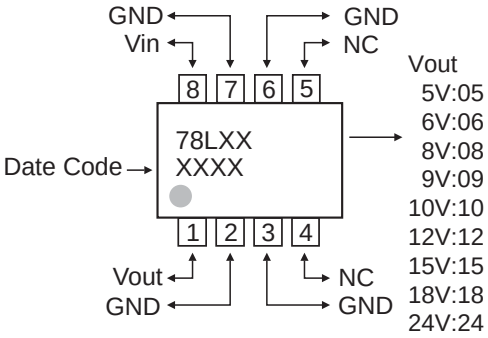
The WT78LXX series of positive regulators are available in the SOP-8 package and with 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 100mA output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents. WT78LXX is characterized for operation from 0°C to +125°C.

Features:

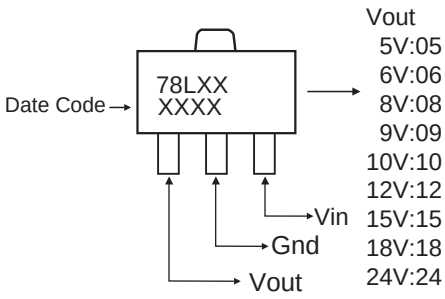
* Internal Short-Circuit Current Limiting.
* Internal Thermal Overload Protection.
* No External Components Required.

Connection Diagrams

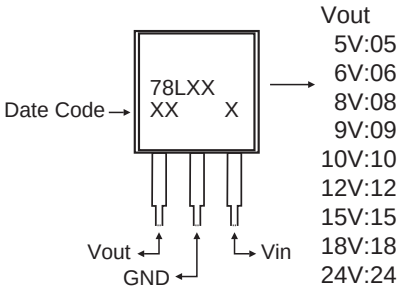
SOP-8 Package (Top View)



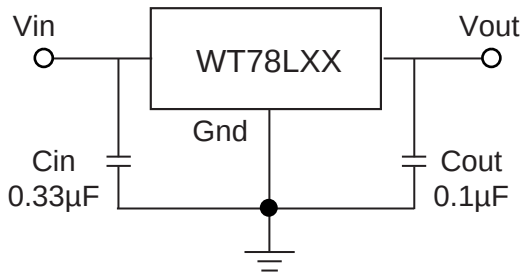
SOT-89 Package (Top View)



TO-92 Package (Top View)



Typical Application



Ordering Information

Ordering Number	Output Voltage	Package	Shipping
WT78L05G	5V	TO-92	500 Units/Bag
WT78L05K	5V	SOT-89	1,000 Units/Tape&Reel
WT78L05M	5V	SOP-8	3,000 Units/Tape&Reel
WT78L06G	6V	TO-92	500 Units/Bag
WT78L06K	6V	SOT-89	1,000 Units/Tape&Reel
WT78L06M	6V	SOP-8	3,000 Units/Tape&Reel
WT78L08G	8V	TO-92	500 Units/Bag
WT78L08K	8V	SOT-89	1,000 Units/Tape&Reel
WT78L08M	8V	SOP-8	3,000 Units/Tape&Reel
WT78L09G	9V	TO-92	500 Units/Bag
WT78L09K	9V	SOT-89	1,000 Units/Tape&Reel
WT78L09M	9V	SOP-8	3,000 Units/Tape&Reel
WT78L10G	10V	TO-92	500 Units/Bag
WT78L10K	10V	SOT-89	1,000 Units/Tape&Reel
WT78L10M	10V	SOP-8	3,000 Units/Tape&Reel
WT78L12G	12V	TO-92	500 Units/Bag
WT78L12K	12V	SOT-89	1,000 Units/Tape&Reel
WT78L12M	12V	SOP-8	3,000 Units/Tape&Reel
WT78L15G	10V	TO-92	500 Units/Bag
WT78L15K	10V	SOT-89	1,000 Units/Tape&Reel
WT78L15M	10V	SOP-8	3,000 Units/Tape&Reel
WT78L18G	12V	TO-92	500 Units/Bag
WT78L18K	12V	SOT-89	1,000 Units/Tape&Reel
WT78L18M	12V	SOP-8	3,000 Units/Tape&Reel
WT78L24G	24V	TO-92	500 Units/Bag
WT78L24K	24V	SOT-89	1,000 Units/Tape&Reel
WT78L24M	24V	SOP-8	3,000 Units/Tape&Reel

Absolute Maximum Ratings

Parameter		Ratings	Unit
Input Voltage	WT78L05~10	30	V
	WT78L12~18	35	
	WT78L24	40	
Output Current		100	mA
Power Dissipation		750*	mW
Operating Junction Temperature Range		0 ~ +125	°C
Storage temperature range		-55 ~ +150	°C

*When test in free air confition, without heat sinking.

Electrical Characteristics

WT78L05 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=10V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=10V, I_O=40mA, T_j=25°C 7V ≤ V_{in} ≤ 20V, 1mA ≤ I_O ≤ 40mA 7V ≤ V_{in} ≤ V_{max}, 1mA ≤ I_O ≤ 70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	4.85 4.75	5.0 -	5.15 5.25	V
Line Regulation 7V ≤ V_{in} ≤ 20V, I_O=40mA, T_j=25°C 8V ≤ V_{in} ≤ 20V, I_O=40mA, T_j=25°C	ΔV_O		- -	18 10	75 54	mV
Load Regulation V_{in} = 10V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 10V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	20 5	60 30	mV
Quiescent Current V_{in} = 10V, I_O =0mA, T_j=25°C	I_Q		-	3.0	5.0	mA
Quiescent Current Change V_{in} = 10V, 1mA ≤ I_O ≤ 40mA 8V ≤ V_{in} ≤ 20V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.0	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	40	-	μV
Ripple Rejection 8V ≤ V_{in} ≤ 20V, f=120Hz, T_j=25°C	RR		47	62	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	-0.65	-	mV/°C

WT78L06 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=12V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=12V, I_O=40mA, T_j=25°C 8.5V ≤ V_{in} ≤ 20V, 1mA ≤ I_O ≤ 40mA 8.5V ≤ V_{in} ≤ V_{max}, 1mA ≤ I_O ≤ 70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	5.82 5.70	6.0 -	6.18 6.30	V
Line Regulation 8.5V ≤ V_{in} ≤ 20V, I_O=40mA, T_j=25°C 9V ≤ V_{in} ≤ 20V, I_O=40mA, T_j=25°C	ΔV_O		- -	64 54	175 125	mV
Load Regulation V_{in} = 12V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 12V, 1mA ≤ I_O ≤ 70mA, T_j=25°C	ΔV_O		- -	12.8 5.8	80 40	mV
Quiescent Current V_{in} = 12V, I_O =0mA, T_j=25°C	I_Q		-	3.9	6.0	mA
Quiescent Current Change V_{in} = 12V, 1mA ≤ I_O ≤ 40mA 9V ≤ V_{in} ≤ 20V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	49	-	μV
Ripple Rejection 10V ≤ V_{in} ≤ 20V, f=120Hz, T_j=25°C	RR		40	46	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	$\Delta V_O / \Delta T_j$		-	0.75	-	mV/°C

WT78L08 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=14V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=14V, I_O=40mA, T_j=25°C 10.5V ≤ V_{in} ≤ 23V, 1mA ≤ I_O ≤ 40mA 10.5V≤ V_{in} ≤ V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	7.76 7.60	8.0 -	8.24 8.40	V
Line Regulation 10.5V ≤ V_{in} ≤ 23V, I_O=40mA, T_j=25°C 11V ≤ V_{in} ≤ 23V, I_O=40mA, T_j=25°C	ΔV_O		- -	10 8	175 125	mV
Load Regulation V_{in} = 14V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 14V, 1mA ≤ I_O ≤ 70mA, T_j=25°C	ΔV_O		- -	15 8	80 40	mV
Quiescent Current V_{in} = 14V, I_O = 0mA, T_j=25°C	I_Q		-	2.0	5.5	mA
Quiescent Current Change V_{in} = 14V, 1mA ≤ I_O ≤ 40mA 11V ≤ V_{in} ≤ 23V, I_O = 40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	49	-	μV
Ripple Rejection 11V ≤ V_{in} ≤ 21V, f=120Hz, T_j=25°C	RR		39	45	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	$\Delta V_O / \Delta T_j$		-	0.75	-	mV/°C

WT78L09 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=15V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=15V, I_O=40mA, T_j=25°C 11.5V ≤ V_{in} ≤ 24V, 1mA ≤ I_O ≤ 40mA 11.5V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	8.73 8.55	9.0 -	9.27 9.45	V
Line Regulation 11.5V ≤ V_{in} ≤ 24V, I_O=40mA, T_j=25°C 13V ≤ V_{in} ≤ 24V, I_O=40mA, T_j=25°C	ΔV_O		- -	90 100	200 150	mV
Load Regulation V_{in} = 15V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 15V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	20 10	90 45	mV
Quiescent Current V_{in} = 15V, I_O =0mA, T_j=25°C	I_Q		-	2.0	6.0	mA
Quiescent Current Change V_{in} = 15V, 1mA ≤ I_O ≤ 40mA 13V ≤ V_{in} ≤ 24V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	49	-	μV
Ripple Rejection 12V ≤ V_{in} ≤ 23V, f=120Hz, T_j=25°C	RR		38	44	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	0.75	-	mV/°C

WT78L10 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=17V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=17V, I_O=40mA, T_j=25°C 13V ≤ V_{in} ≤ 25V, 1mA ≤ I_O ≤ 40mA 13V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	9.70 9.50	10.0 -	10.30 10.50	V
Line Regulation 13V ≤ V_{in} ≤ 25V, I_O=40mA, T_j=25°C 14V ≤ V_{in} ≤ 25V, I_O=40mA, T_j=25°C	ΔV_O		- -	51 42	175 125	mV
Load Regulation V_{in} = 17V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 17V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	20 11	90 40	mV
Quiescent Current V_{in} = 17V, I_O =0mA, T_j=25°C	I_Q		-	4.2	6.0	mA
Quiescent Current Change V_{in} = 17V, 1mA ≤ I_O ≤ 40mA 14V ≤ V_{in} ≤ 25V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	62	-	μV
Ripple Rejection 15V ≤ V_{in} ≤ 25V, f=120Hz, T_j=25°C	RR		37	44	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V

WT78L12 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=19V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=19V, I_O=40mA, T_j=25°C 14.5V ≤ V_{in} ≤ 27V, 1mA ≤ I_O ≤ 40mA 14.5V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	11.64 11.40	12.0 -	12.36 12.60	V
Line Regulation 14.5V ≤ V_{in} ≤ 27V, I_O=40mA, T_j=25°C 16V ≤ V_{in} ≤ 27V, I_O=40mA, T_j=25°C	ΔV_O		- -	25 20	300 250	mV
Load Regulation V_{in} = 19V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 19V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	25 12	150 75	mV
Quiescent Current V_{in} = 19V, I_O =0mA, T_j=25°C	I_Q		-	2.0	6.0	mA
Quiescent Current Change V_{in} = 19V, 1mA ≤ I_O ≤ 40mA 16V ≤ V_{in} ≤ 27V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	80	-	μV
Ripple Rejection 15V ≤ V_{in} ≤ 25V, f=120Hz, T_j=25°C	RR		37	65	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	-1.0	-	mV/°C

WT78L15 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=23V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=23V, I_O=40mA, T_j=25°C 17.5V ≤ V_{in} ≤ 30V, 1mA ≤ I_O ≤ 40mA 17.5V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	14.55 14.25	15.0 -	15.45 15.75	V
Line Regulation 17.5V ≤ V_{in} ≤ 30V, I_O=40mA, T_j=25°C 20V ≤ V_{in} ≤ 30V, I_O=40mA, T_j=25°C	ΔV_O		- -	25 15	150 75	mV
Load Regulation V_{in} = 23V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 23V, 1mA ≤ I_O ≤ 70mA, T_j=25°C	ΔV_O		- -	20 25	150 150	mV
Quiescent Current V_{in} = 23V, I_O =0mA, T_j=25°C	I_Q		-	2.2	6.5	mA
Quiescent Current Change V_{in} = 23V, 1mA ≤ I_O ≤ 40mA 20V ≤ V_{in} ≤ 30V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	90	-	μV
Ripple Rejection 18.5V ≤ V_{in} ≤ 28.5V, f=120Hz, T_j=25°C	RR		34	63	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	-1.3	-	mV/°C

WT78L18 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=27V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=27V, I_O=40mA, T_j=25°C 21V ≤ V_{in} ≤ 33V, 1mA ≤ I_O ≤ 40mA 21V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	17.46 17.10	18.0 -	18.54 18.90	V
Line Regulation 21V ≤ V_{in} ≤ 33V, I_O=40mA, T_j=25°C 22V ≤ V_{in} ≤ 33V, I_O=40mA, T_j=25°C	ΔV_O		- -	145 135	300 250	mV
Load Regulation V_{in} = 27V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 27V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	30 15	170 85	mV
Quiescent Current V_{in} = 27V, I_O =0mA, T_j=25°C	I_Q		-	2.0	6.0	mA
Quiescent Current Change V_{in} = 27V, 1mA ≤ I_O ≤ 40mA 21V ≤ V_{in} ≤ 33V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	150	-	μV
Ripple Rejection 23V ≤ V_{in} ≤ 33V, f=120Hz, T_j=25°C	RR		34	48	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	-1.8	-	mV/°C

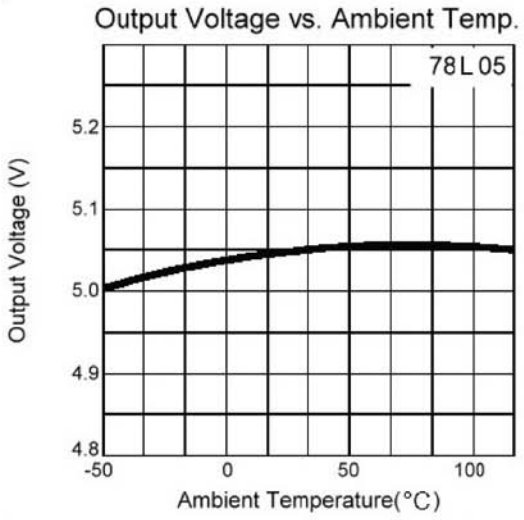
WT78L24 (Refer to the test circuits, Tj=0~125°C, I_O=40mA, V_{in}=33V, C_{in}=0.33μF, C_O=0.1μF unless otherwise specified)

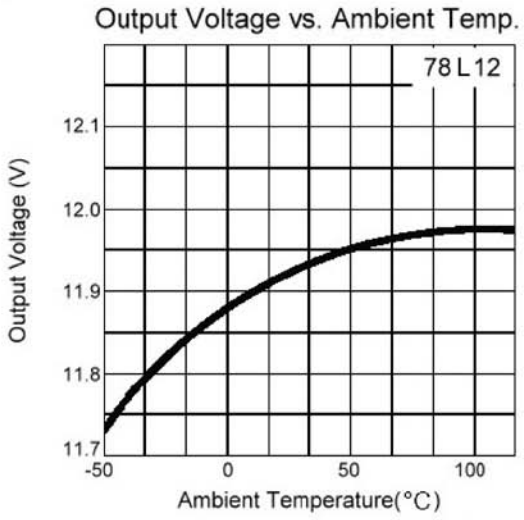
Parameter	Symbol		Min	Typ	Max	Unit
Output Voltage V_{in}=33V, I_O=40mA, T_j=25°C 27V ≤ V_{in} ≤ 38V, 1mA ≤ I_O ≤ 40mA 27V≤ V_{in} ≤V_{max}, 1mA≤ I_O ≤70mA (Note2)	V_O	A-Rank(3%) B-Rank(5%)	23.28 22.80	24.0 -	24.72 25.20	V
Line Regulation 27V ≤ V_{in} ≤ 38V, I_O=40mA, T_j=25°C 28V ≤ V_{in} ≤ 38V, I_O=40mA, T_j=25°C	ΔV_O		- -	160 150	300 250	mV
Load Regulation V_{in} = 33V, 1mA ≤ I_O ≤ 100mA, T_j=25°C V_{in} = 33V, 1mA ≤ I_O ≤ 40mA, T_j=25°C	ΔV_O		- -	40 20	200 100	mV
Quiescent Current V_{in} = 33V, I_O =0mA, T_j=25°C	I_Q		-	2.2	6.0	mA
Quiescent Current Change V_{in} = 33V, 1mA ≤ I_O ≤ 40mA 27V ≤ V_{in} ≤ 38V, I_O=40mA	ΔI_Q		- -	- -	0.1 1.5	mA
Output Noise Voltage 10Hz ≤ f ≤ 100KHz	V_n		-	200	-	μV
Ripple Rejection 27V ≤ V_{in} ≤ 38V, f=120Hz, T_j=25°C	RR		34	45	-	dB
Dropout Voltage I_O = 100mA, T_j=25°C	V_D		-	1.7	-	V
Temperature Coefficient of Output Voltage I_O = 5mA, 0°C ≤ T_j ≤ 125°C	ΔV_O / ΔT_j		-	-2.0	-	mV/°C

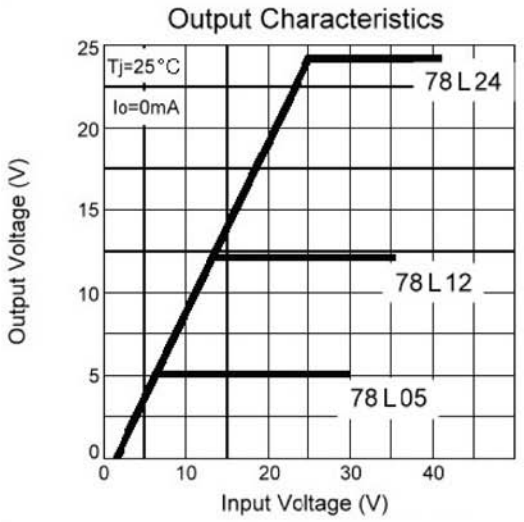
Note1: The Maximum steady state usable output current is dependent on input voltage, heat sinking, lead length of the package and copper of PCB .The data above represent pulse test conditions with junction temperatures specified at the initiation of test.

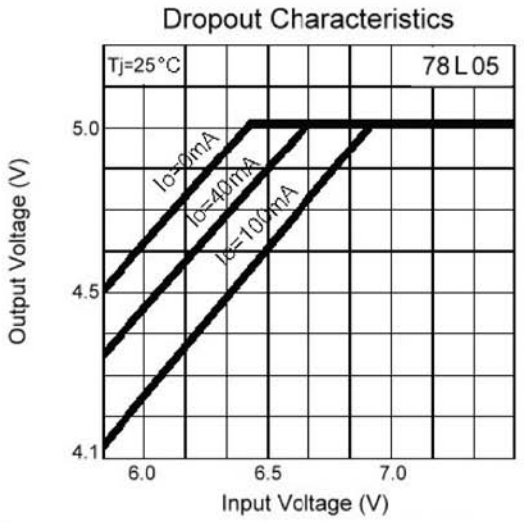
Note2: Power dissipation<0.75W

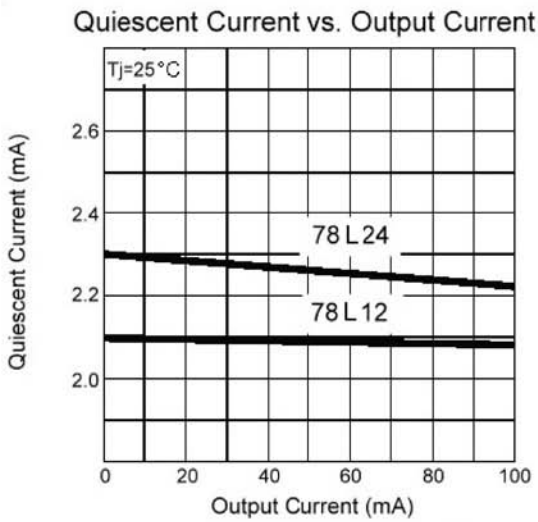
Typical Performance Characteristics

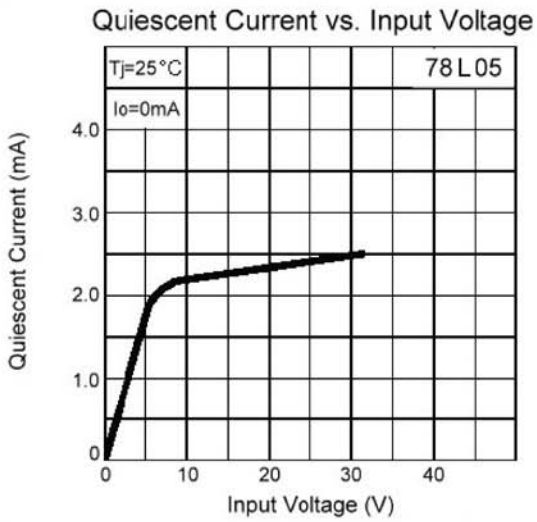




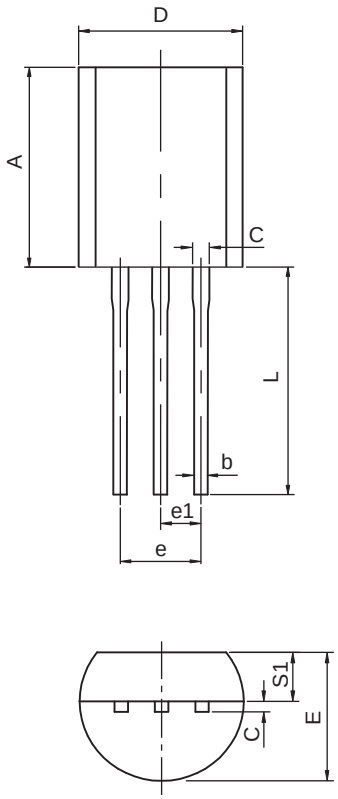






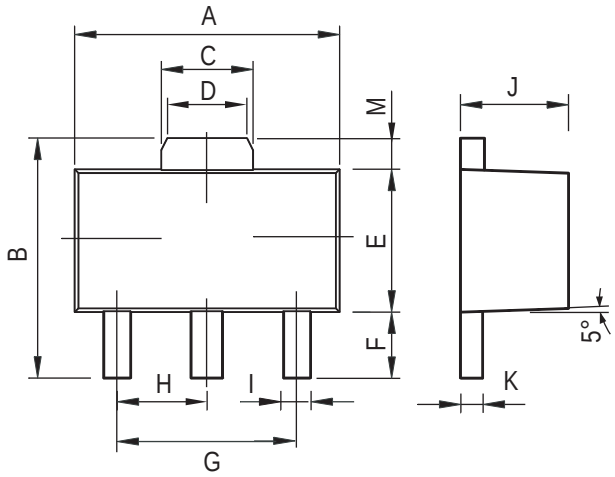


TO-92 PACKAGE OUTLINE DIMENSIONS(Unit:mm)



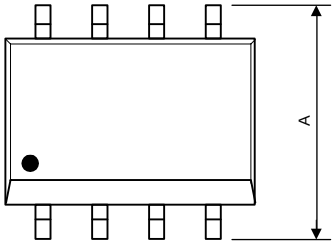
TO-92		
Dim	**Min**	**Max**
A	**4.45**	**4.70**
C	**0.36**	**0.51**
D	**4.44**	**4.70**
E	**3.30**	**3.81**
L	**12.70**	**-**
b	**0.36**	**0.51**
b1	**0.36**	**0.76**
e	**2.42**	**2.66**
e1	**1.15**	**1.39**
S1	**1.02**	**-**

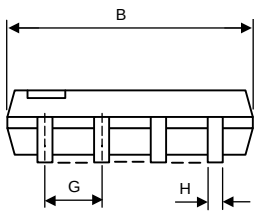
SOT-89 PACKAGE OUTLINE DIMENSIONS(Unit:mm)

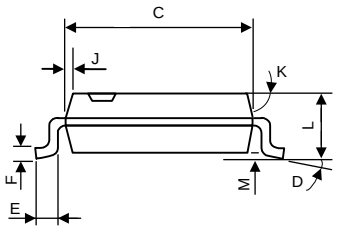


SOT-89		
Dim	**Min**	**Max**
A	**4.40**	**4.60**
B	**4.05**	**4.25**
C	**1.50**	**1.70**
D	**1.30**	**1.50**
E	**2.40**	**2.60**
F	**0.89**	**1.20**
G	**3.00 REF**	
H	**1.50 REF**	
I	**0.40**	**0.52**
J	**1.40**	**1.60**
K	**0.35**	**0.41**
M	**0.70 REF**	

SOP-8 PACKAGE OUTLINE DIMENSIONS(Unit:mm)







SOP-8		
Dim	**Min**	**Max**
A	**5.80**	**6.20**
B	**4.80**	**5.00**
C	**3.80**	**4.00**
D	**0º**	**8º**
E	**0.40**	**0.90**
F	**0.19**	**0.25**
M	**0.10**	**0.25**
H	**0.35**	**0.49**
L	**1.35**	**1.75**
J	**0.375 REF**	
K	**45º**	
G	**1.27 TYP**	