MICRO ELECTRONICS

ML78L00 SERIES

3-TERMINAL POSITIVE VOLTAGE REGULATOR

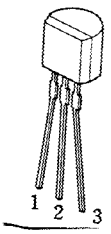
The ML78L00 series of 3-Terminal Positive Voltage Regulators. These regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The ML78L00 series used as a Zener diode/resistor combination replacement, offers an effective output impedance improvement of typically two orders of magnitude, along with lower quiescent current and lower noise.

■ Absolute Maximum Ratings (Ta=25°C)

Input Voltage	V_{IN} (78L02A~78L09A)	30V
"	V_{IN} (78L12A~78L15A)	35V
"	V_{IN} (78L18A~78L24A)	40V
Output Current	I_O	100mA
Power Dissipation	P_D	500mW
Operating Temperature Range	T_{OPR}	−30~+75°C
Storage Temperature Range	T_{stg}	−40~+125°C

■ Package Outline

(TO-92)



78L00A

1. OUT
2. GND
3. IN

■ Electrical Characteristics (C_{IN}=0.33μf, C_O=0.1μF. T_j=25°C)

Measurement is to be conducted in pulse testing.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
78L02A						
Output Voltage	V_O	V_{IN}=9V, I_O=40mA	2.47	2.6	2.73	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=4.75~20V, I_O=40mA	—	—	125	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=5~20V, I_O=40mA	—	—	100	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=9V, I_O=1~40mA	—	—	25	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=9V, I_O=1~100mA	—	—	50	mV
Quiescent Current	I_Q	V_{IN}=9V, I_O=0mA	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=9V, I_O=1mA	—	0.2	—	mV/°C
Ripple Rejections	RR	6V<V_{IN}<16V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	43	73	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=9V, I_O=40mA	—	35	—	μV
78L05A						
Output Voltage	V_O	V_{IN}=10V, I_O=40mV	4.75	5	5.25	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=7~20V, I_O=40mA	—	—	200	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=8~20V, I_O=40mA	—	—	150	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=10V, I_O=1~40mA	—	—	30	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=10V, I_O=1~100mA	—	—	60	mV
Quiescent Current	I_Q	V_{IN}=10V, I_O=0mA	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=10V, I_O=1mA	—	0.4	—	mV/°C
Ripple Rejections	RR	8V<V_{IN}<18V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	40	69	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=10V, I_O=40mA	—	70	—	μV

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■ Electorical Characteristics (C_{IN}=0.33μF, C_O=0.1μF, T_j=25°C)

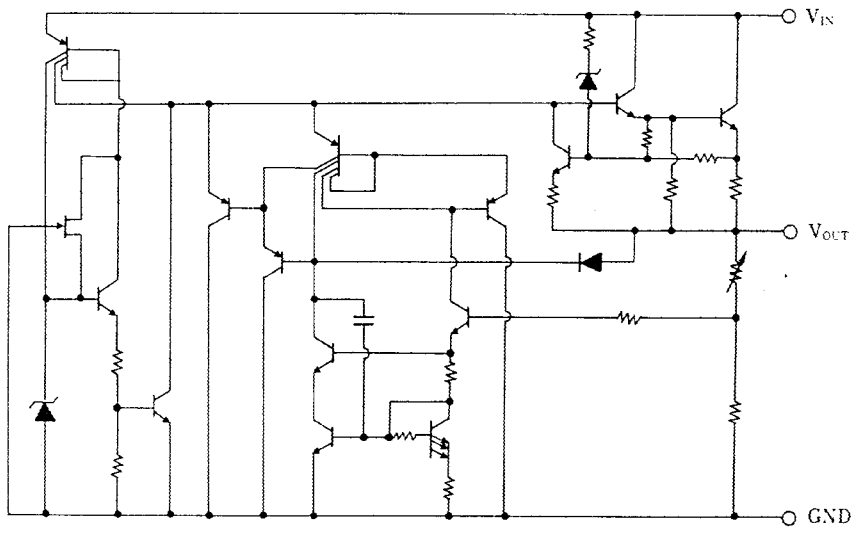
Measurement is to be conducted in pulse testing.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
78L06A						
Output Voltage	V_O	V_{IN}=12V, I_O=40mA	5.7	6	6.3	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=8.5~20V, I_O=40mA	—	—	200	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=9~20V, I_O=40mA	—	—	150	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=12V, I_O=1~40mA	—	—	40	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=12V, I_O=1~100mA	—	—	80	mV
Quiescent Current	I_Q	V_{IN}=12V, I_O=0mA	—	2.0	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=12V, I_O=1mA	—	0.5	—	mV/℃
Ripple Rejections	RR	9V<V_{IN}<20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	40	67	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=12V, I_O=40mA	—	80	—	μV
78L08A						
Output Voltage	V_O	V_{IN}=14V, I_O=40mA	7.6	8	8.4	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=10.5~23V, I_O=40mA	—	—	225	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=11~23V, I_O=40mA	—	—	175	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=14V, I_O=1~40mA	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=14V, I_O=1~100mA	—	—	100	mV
Quiescent Current	I_Q	V_{IN}=14V, I_O=0mA	—	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=14V, I_O=1mA	—	0.6	—	mV/℃
Ripple Rejections	RR	11V<V_{IN}<20V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	39	66	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=14V, I_O=40mA	—	115	—	μV
78L09A						
Output Voltage	V_O	V_{IN}=15V, I_O=40mA	8.55	9	9.45	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=11.5~23V, I_O=40mA	—	—	250	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=12~23V, I_O=40mA	—	—	200	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=15V, I_O=1~40mA	—	—	50	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=15V, I_O=1~100mA	—	—	100	mV
Quiescent Current	I_Q	V_{IN}=15V, I_O=0mA	—	2.1	6	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=15V, I_O=1mA	—	0.65	—	mV/℃
Ripple Rejections	RR	12V<V_{IN}<21V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	38	65	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=15V, I_O=40mA	—	125	—	μV
78L12A						
Output Voltage	V_O	V_{IN}=19V, I_O=40mA	11.4	12	12.6	V
Line Regulation 1	ΔV_O V_{IN1}	V_{IN}=14.5~27V, I_O=40mA	—	—	250	mV
Line Regulation 2	ΔV_O V_{IN2}	V_{IN}=16~27V, I_O=40mA	—	—	200	mV
Load Regulation 1	ΔV_O I_{O1}	V_{IN}=19V, I_O=1~40mA	—	—	50	mV
Load Regulation 2	ΔV_O I_{O2}	V_{IN}=19V, I_O=1~100mA	—	—	100	mV
Quiescent Current	I_Q	V_{IN}=19V, I_O=0mA	—	2.1	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=19V, I_O=1mA	—	0.9	—	mV/℃
Ripple Rejections	RR	15V<V_{IN}<25V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	37	62	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=19V, I_O=40mA	—	160	—	μV

■ Electorical Characteristics (C_{IN}=0.33μF, C_O=0.1μF, T_j=25℃) Measurement is to be conducted in pulse testing.

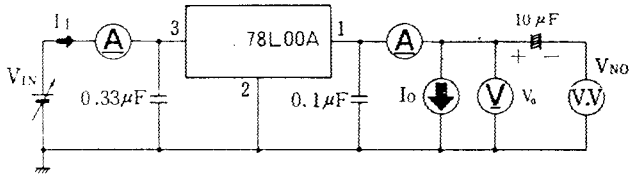
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
78L15A						
Output Voltage	V_O	V_{IN}=23V, I_O=40mA	14.3	15	15.7	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=17.5~30V, I_O=40mA	—	—	300	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=20~30V, I_O=40mA	—	—	250	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=23V, I_O=1~40mA	—	—	75	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=23V, I_O=1~100mA	—	—	150	mV
Quiescent Current	I_Q	V_{IN}=23V, I_O=0mA	—	2.2	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=23V, I_O=1mA	—	1.0	—	mV/℃
Ripple Rejections	RR	18.5V<V_{IN}<28.5V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	34	60	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=23V, I_O=40mA	—	190	—	μV
78L18A						
Output Voltage	V_O	V_{IN}=27V, I_O=40mA	17.1	18	18.9	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=22~33V, I_O=40mA	—	—	320	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=23~33V, I_O=40mA	—	—	270	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=27V, I_O=1~40mA	—	—	80	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=27V, I_O=1~100mA	—	—	160	mV
Quiescent Current	I_Q	V_{IN}=27V, I_O=0mA	—	2.2	6.5	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=27V, I_O=1mA	—	1.1	—	mV/℃
Ripple Rejections	RR	27V<V_{IN}<33V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	33	59	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=27V, I_O=40mA	—	230	—	μV
78L20A						
Output Voltage	V_O	V_{IN}=29V, I_O=40mA	19.0	20	21	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=23~34V, I_O=40mA	—	—	330	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=24~34V, I_O=40mA	—	—	280	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=29V, I_O=1~40mA	—	—	90	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=29V, I_O=1~100mA	—	—	180	mV
Quiescent Current	I_Q	V_{IN}=29V, I_O=1mA	—	2.3	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=29V, I_O=1mA	—	1.2	—	mV/℃
Ripple Rejections	RR	29V<V_{IN}<34V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	32	58	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=29V, I_O=40mA	—	250	—	μV
78L24A						
Output Voltage	V_O	V_{IN}=33V, I_O=40mA	22.8	24	25.2	V
Line Regulation 1	ΔV_O-V_{IN1}	V_{IN}=27~38V, I_O=40mA	—	—	350	mV
Line Regulation 2	ΔV_O-V_{IN2}	V_{IN}=28~38V, I_O=40mA	—	—	300	mV
Load Regulation 1	ΔV_O-I_{O1}	V_{IN}=33V, I_O=1~40mA	—	—	100	mV
Load Regulation 2	ΔV_O-I_{O2}	V_{IN}=33V, I_O=1~100mA	—	—	200	mV
Quiescent Current	I_Q	V_{IN}=33V, I_O=0mA	—	2.3	7	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	V_{IN}=33V, I_O=1mA	—	1.4	—	mV/℃
Ripple Rejections	RR	27.5V<V_{IN}<37.5V, I_O=40mA, e_{in}=1V_{P-P}, f=120Hz	32	57	—	dB
Output Noise Voltage	V_{NO}	BW=10Hz~100kHz, V_{IN}=33V, I_O=40mA	—	280	—	μV

■ Equivalent Circuit



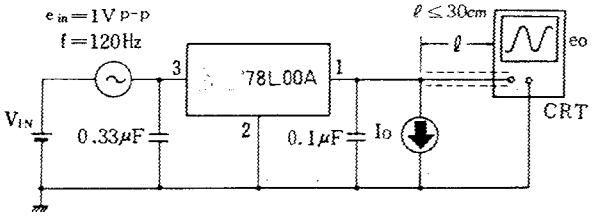
■ Test Circuit

1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average Temperature Coefficient of Output Voltage, Output Noise Voltage, Peak Output/Short-Circuit Current



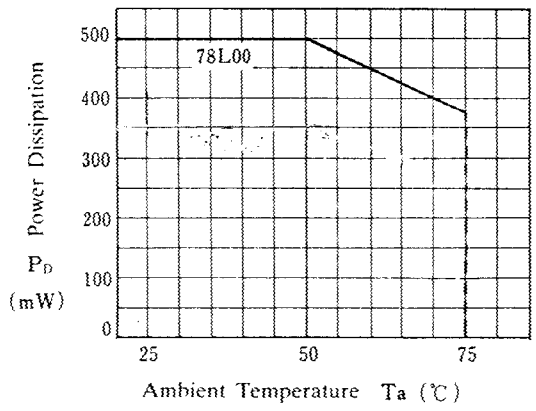
○ Measurement is to be conducted in pulse testing.
○ $I_Q = I_I - I_O$

2. Ripple Rejection



$$RR = 20\log_{10}\left(\frac{e_{in}}{e_O}\right) \quad (dB)$$

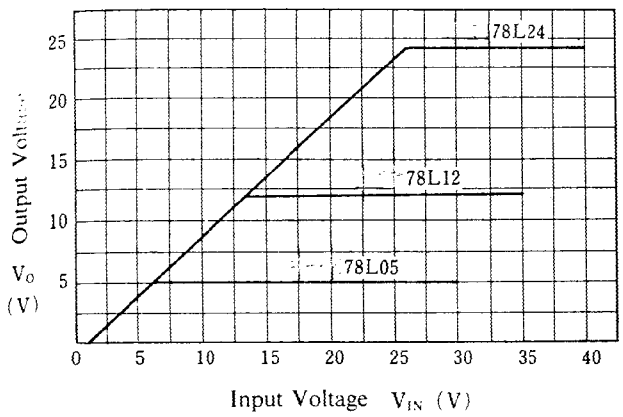
■ Ambient Temperature vs. Power Dissipation



■ Typical Characteristics

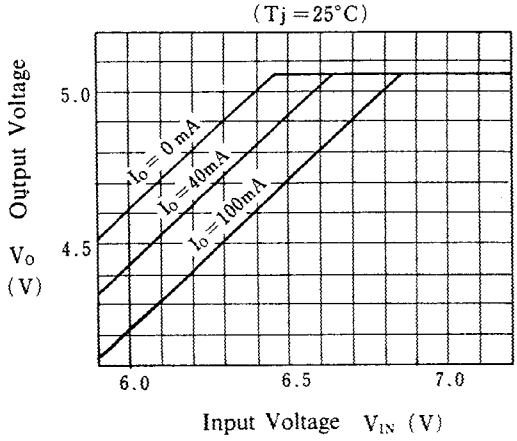
78L05/L12/L24 Output Characteristics

(I_O = 0 mA, Tj = 25°C)



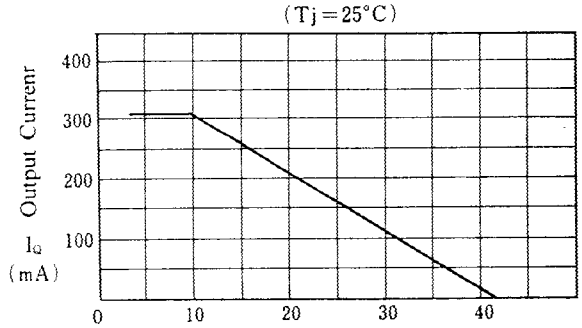
78L05 Dropout Characteristics

(Tj = 25°C)



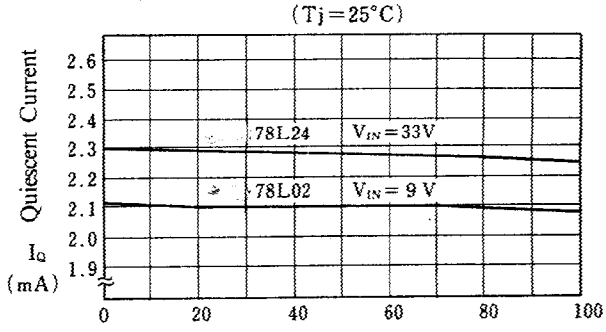
78L00 Series Short Circuit Output Current

(Tj = 25°C)



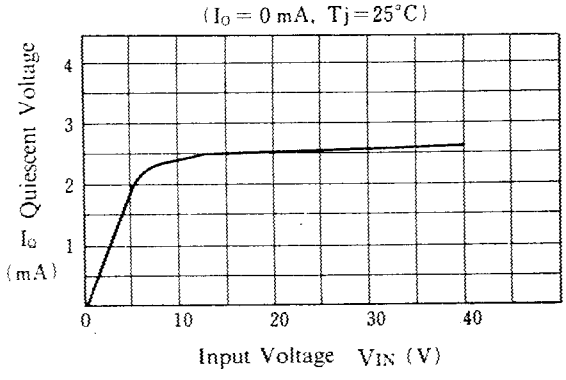
78L02/L24 Quiescent Current vs. Output Current

(Tj = 25°C)



78L05 Quiescent Voltage vs. Input Voltage

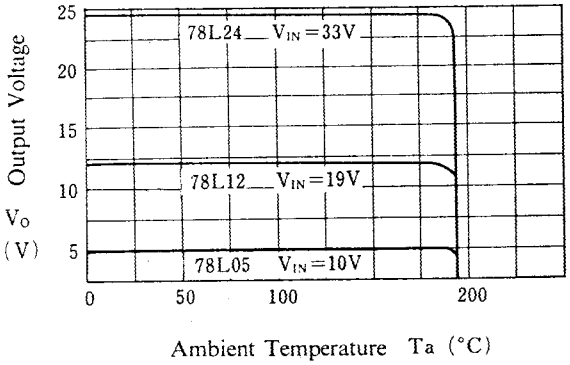
(I_O = 0 mA, Tj = 25°C)



■ Typical Characteristics

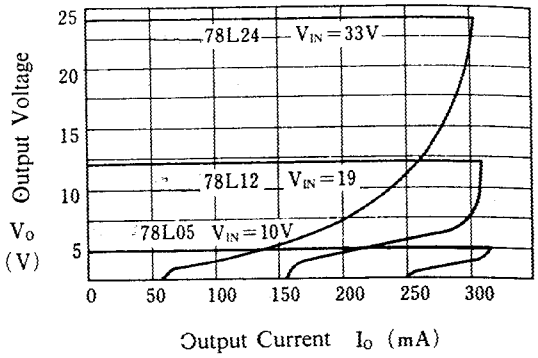
78L05/L12/L24 Thermal Shutdown Characteristics

(I_O = 0 mA)



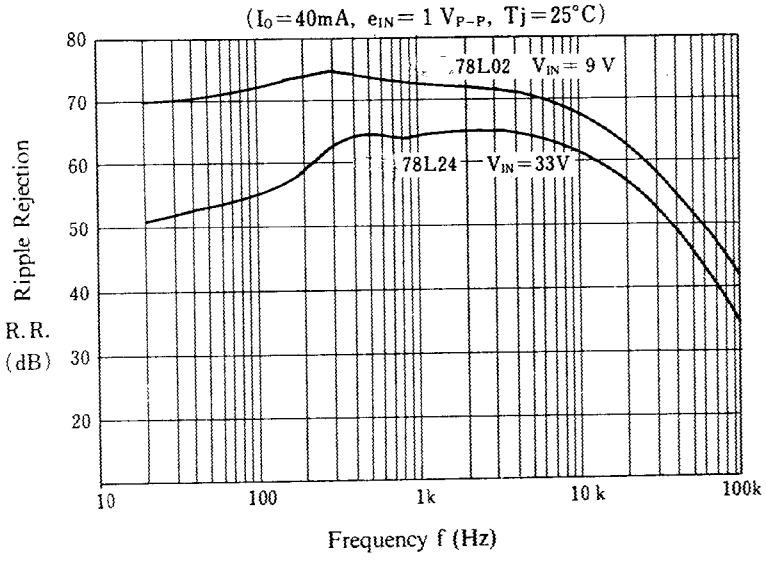
78L05/L12/L24 Load Characteristics

(Tj = 25°C)

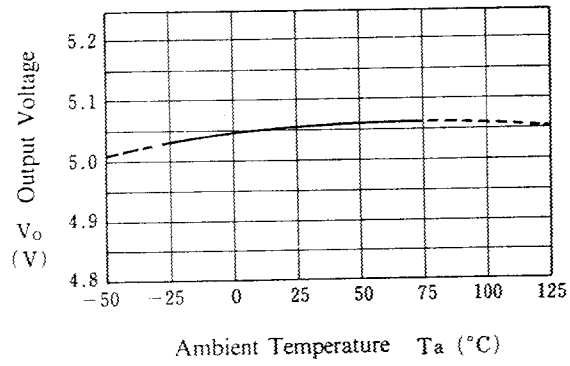


78L02/L24 Ripple Rejection

(I_O = 40mA, e_{IN} = 1 V_{P-P}, Tj = 25°C)



78L05 Output Voltage vs. Temperature



78L12 Output Voltage vs. Temperature