

GL78XX Series

POSITIVE VOLTAGE REGULATOR

Description

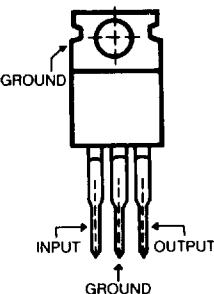
The GL78XX Series are monolithic integrated circuits designed as fixed-voltage regulator. These regulators employ internal current limiting, thermal shutdown, and safe-area compensation. With adequate heatsinking they can deliver over 1.5A output currents. They are intended as fixed voltage regulators in a wide range of applications.

Features

- No External Components Required
- High Line Regulation
- High Load Regulation
- Good Ripple Rejection (70dB)
- Low Temperature Coefficient of Output (1.0mV/°C)
- Wide Range Input Voltage
- Low Input Bias Current
- Low Output Noise
- Output Current in Excess of 1.5A

Pin Configuration

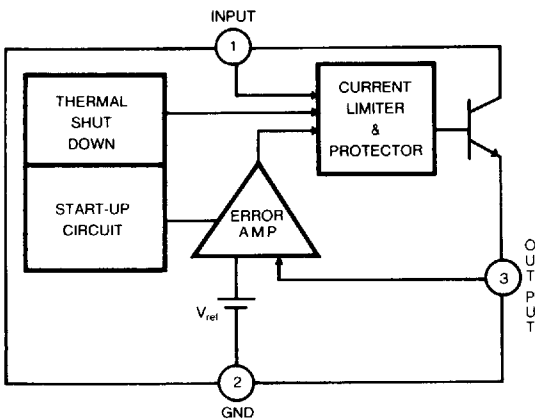
(Top View)



Type No/Voltage

GL7805	5.0 Volts
GL7806	6.0 Volts
GL7808	8.0 Volts
GL7809	9.0 Volts
GL7812	12.0 Volts
GL7815	15.0 Volts
GL7824	24.0 Volts

Block Diagram



Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$)

- Input Voltage (5V Through 15V) 35V (24V) 40V
- Output Current 3.3A
- Power Dissipation 15W
- Operating Junction Temp. 0°C to $+125^\circ\text{C}$
- Storage Temp. -65°C to $+150^\circ\text{C}$
- Lead Temp. (Soldering, 10S) 230°C

GL7805 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 10V, I _o = 500mA	4.8	5.2	V
Output Voltage (2)	V _{O2}	7V ≤ V _{in} ≤ 20V, 5.0mA ≤ I _o ≤ 1.0A	4.75	5.25	V
Line Regulation	ΔV _{O1}	T _J = 25°C	7 ≤ V _{in} ≤ 25V, I _o = 500mA		50 mV
	ΔV _{O2}		8V ≤ V _{in} ≤ 12V, I _o = 500mA		25 mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5.0mA ≤ I _o ≤ 1.5A, V _{in} = 10V		50 mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 10V		25 mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 10V, I _o = 500mA		8	mA
Quiescent Current Change	ΔI _{Q1}	7V ≤ V _{in} ≤ 25V, I _o = 500mA		1.3	mA
	ΔI _{Q2}	5.0mA ≤ I _o ≤ 1.0A, V _{in} = 10V		0.5	mA
Output Noise Voltage	N _o	V _{in} = 10V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz	40(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) 120Hz, I _o = 20mA, 8V ≤ V _{in} ≤ 18V	62		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A	2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND		1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 12V, V _O = 4.75V	1.5	3.3	A

GL7806 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN.	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 11V, I _o = 500mA	5.75	6.25	V
Output Voltage (2)	V _{O2}	8V ≤ V _{in} ≤ 21V, 5.0mA ≤ I _o ≤ 1.0A	5.7	6.3	V
Line Regulation	ΔV _{O1}	T _J = 25°C	8 ≤ V _{in} ≤ 25V, I _o = 500mA		60 mV
	ΔV _{O2}		9V ≤ V _{in} ≤ 13V, I _o = 500mA		30 mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5mA ≤ I _o ≤ 1.5A, V _{in} = 11V		60 mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 11V		30 mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 11V, I _o = 500mA		8.0	mA
Quiescent Current Change	ΔI _{Q1}	8V ≤ V _{in} ≤ 25V, I _o = 500mA		1.3	mA
	ΔI _{Q2}	V _{in} = 11V, 5mA ≤ I _o ≤ 1.0A		0.5	mA
Output Noise Voltage	N _o	V _{in} = 11V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz	45(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) 120Hz, I _o = 20mA, 9V ≤ V _{in} ≤ 19V	57		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A	2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND		1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 13V, V _O = 5.7V	1.5	3.3	A

GL7808 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN.	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 14V, I _o = 500mA	7.7	8.3	V
Output Voltage (2)	V _{O2}	10.5V ≤ V _{in} ≤ 23V, 5.0mA ≤ I _o ≤ 1.0A	7.6	8.4	V
Line Regulation	ΔV _{O1}	T _J = 25°C	10.5V ≤ V _{in} ≤ 25V, I _o = 500mA	80	mV
	ΔV _{O2}			40	mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5.0mA ≤ I _o ≤ 1.5A, V _{in} = 14V	80	mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 14V	40	mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 14V, I _o = 500mA		8.0	mA
Quiescent Current Change	ΔI _{Q1}	10.5V ≤ V _{in} ≤ 25V, I _o = 500mA		1.0	mA
	ΔI _{Q2}	5mA ≤ I _o ≤ 1.0A, V _{in} = 14V		0.5	mA
Output Noise Voltage	N _o	V _{in} = 14V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz	52(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) , 120Hz, I _o = 20mA, 11.5V ≤ V _{in} ≤ 21.5V	55		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A	2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND		1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 15V, V _O = 7.6V	1.5	3.3	A

GL7809 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN.	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 15V, I _o = 500mA	8.64	9.36	V
Output Voltage (2)	V _{O2}	11.5V ≤ V _{in} ≤ 24V, 5.0mA ≤ I _o ≤ 1.0A	8.55	9.45	V
Line Regulation	ΔV _{O1}	T _J = 25°C	11.5V ≤ V _{in} ≤ 26V, I _o = 500mA	90	mV
	ΔV _{O2}			45	mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5.0mA ≤ I _o ≤ 1.5A, V _{in} = 15V	90	mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 15V	45	mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 15V, I _o = 500mA		8	mA
Quiescent Current Change	ΔI _{Q1}	11.5V ≤ V _{in} ≤ 26V, I _o = 500mA		1.0	mA
	ΔI _{Q2}	V _{in} = 15V, 5mA ≤ I _o ≤ 1.5A		0.5	mA
Output Noise Voltage	N _o	V _{in} = 15V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz	60(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) , 120Hz, I _o = 20mA, 12.5V ≤ V _{in} ≤ 22.5V	55		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A	2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND		1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 16V, V _O = 8.55V	1.5	3.3	A

GL7812 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNIT
				MIN.	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 19V, I _o = 500mA		11.5	12.5	V
Output Voltage (2)	V _{O2}	14.5V ≤ V _{in} ≤ 27.0V, 5.0mA ≤ I _o ≤ 1.0A		11.4	12.6	V
Line Regulation	ΔV _{O1}	T _J = 25°C	14.5V ≤ V _{in} ≤ 30V, I _o = 500mA		120	mV
	ΔV _{O2}		16.0V ≤ V _{in} ≤ 22V, I _o = 500mA		60	mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5.0mA ≤ I _o ≤ 1.5A, V _{in} = 19V		120	mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 19V		60	mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 19V, I _o = 500mA			8.0	mA
Quiescent Current Change	ΔI _{Q1}	14.5V ≤ V _{in} ≤ 30V, I _o = 500mA			1.0	mA
	ΔI _{Q2}	5.0mA ≤ I _o ≤ 1.0A, V _{in} = 19V			0.5	mA
Output Noise Voltage	No	V _{in} = 19V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz		75(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) , 120Hz, I _o = 20mA, 15V ≤ V _{in} ≤ 25V		55		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A		2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND			1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 19V, V _O = 11.4V		1.5	3.3	A

GL7815 Electrical Characteristics (T_A = 25°C)

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNIT
				MIN.	MAX.	
Output Voltage (1)	V _{O1}	T _J = 25°C, V _{in} = 23V, I _o = 500mA		14.4	15.6	V
Output Voltage (2)	V _{O2}	17.5V ≤ V _{in} ≤ 30V, 5.0mA ≤ I _o ≤ 1.0A		14.25	15.75	V
Line Regulation	ΔV _{O1}	T _J = 25°C	17.5V ≤ V _{in} ≤ 30V, I _o = 500mA		150	mV
	ΔV _{O2}		20V ≤ V _{in} ≤ 26V, I _o = 500mA		75	mV
Load Regulation	ΔV _{O3}	T _J = 25°C	5mA ≤ I _o ≤ 1.5A, V _{in} = 23V		150	mV
	ΔV _{O4}		250mA ≤ I _o ≤ 750mA, V _{in} = 23V		75	mV
Quiescent Current	I _Q	T _J = 25°C, V _{in} = 23V, I _o = 500mA			8.0	mA
Quiescent Current Change	ΔI _{Q1}	17.5V ≤ V _{in} ≤ 30V, I _o = 500mA			1.0	mA
	ΔI _{Q2}	5.0mA ≤ I _o ≤ 1.0A, V _{in} = 23V			0.5	mA
Output Noise Voltage	No	V _{in} = 23V, I _o = 500mA, 10Hz ≤ f ≤ 100KHz		90(TYP)		μV
Ripple Rejection	R _R	T _J = 25°C, V _i = 1V _(rms) , 120Hz, I _o = 20mA, 18.5V ≤ V _{in} ≤ 28.5V		54		dB
Input-Output Voltage Differential	V _d	T _J = 25°C, I _o = 1.0A		2(TYP)		V
Short-Circuit Limit	I _{sc}	V _{in} = 35V, Output-GND			1.0	A
Peak Output Current	I _{peak}	T _J = 25°C, V _{in} = 22V, V _O = 14.25V		1.5	3.3	A

GL7818 Electrical Characteristics ($T_A = 25^\circ\text{C}$)

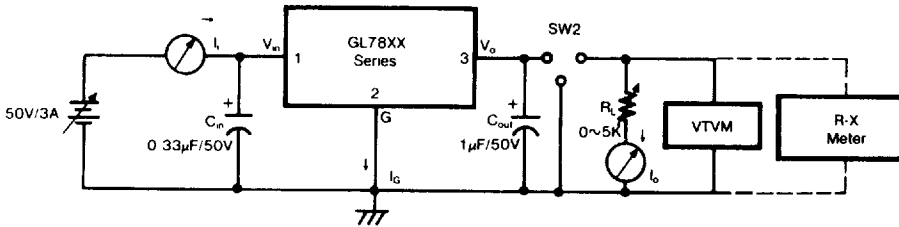
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN	MAX	
Output Voltage(1)	V_{O1}	$T_J = 25^\circ\text{C}$, $V_{in} = 25\text{V}$, $I_o = 500\text{mA}$	17.3	18.7	V
Output Voltage(2)	V_{O2}	$20.5\text{V} \leq V_{in} \leq 33\text{V}$, $5.0\text{mA} \leq I_o \leq 1.0\text{A}$	17.1	18.9	V
Line Regulation	ΔV_{O1}	$T_J = 25^\circ\text{C}$	$20.5\text{V} \leq V_{in} \leq 33\text{V}$, $I_o = 500\text{mA}$		180 mV
	ΔV_{O2}		$24.0\text{V} \leq V_{in} \leq 30\text{V}$, $I_o = 500\text{mA}$		90 mV
Load Regulation	ΔV_{O3}	$T_J = 25^\circ\text{C}$	$5.0\text{mA} \leq I_o \leq 1.5\text{A}$, $V_{in} = 21\text{V}$		180 mV
	ΔV_{O4}		$250\text{mA} \leq V_{i10} \leq 750\text{mA}$, $V_{in} = 25\text{V}$		90 mV
Quiescent Current	I_Q	$T_J = 25^\circ\text{C}$, $V_{in} = 25\text{V}$, $I_o = 50\text{mA}$		8.0	mA
Quiescent Current Change	ΔI_{Q1}	$20.5\text{V} \leq V_{in} \leq 33\text{V}$, $I_o = 500\text{mA}$		1.0	mA
	ΔI_{Q2}	$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $V_{in} = 25\text{V}$		0.5	mA
Output Noise Voltage	N_o	$V_{in} = 25\text{V}$, $I_o = 500\text{mA}$, $10\text{Hz} \leq f \leq 100\text{KHz}$	110(TYP)		μV
Ripple Rejection	R_R	$T_J = 25^\circ\text{C}$, $V_i = 1V_{(rms)}$, 120Hz , $I_o = 20\text{mA}$ $21\text{V} \leq V_{in} \leq 33\text{V}$	59		dB
Input-Output Voltage Differential	V_d	$T_J = 25^\circ\text{C}$, $I_o = 1.0\text{A}$	2(TYP)		V
Short-Circuit Limit	I_{sc}	$V_{in} = 25\text{V}$, Output-GND		1.0	A
Peak Output Current	I_{peak}	$T_J = 25^\circ\text{C}$, $V_{in} = 25\text{V}$, $V_o = 17.1\text{V}$	1.5	3.3	A

GL7824 Electrical Characteristics ($T_A = 25^\circ\text{C}$)

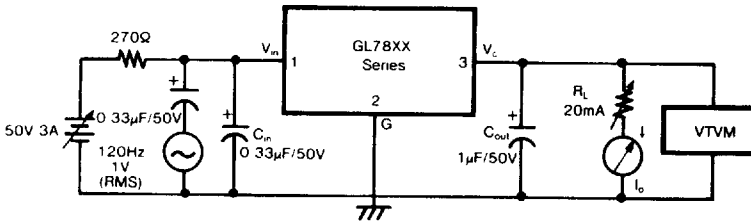
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT
			MIN	MAX	
Output Voltage (1)	V_{O1}	$T_J = 25^\circ\text{C}$, $V_{in} = 33\text{V}$, $I_o = 500\text{mA}$	23	25	V
Output Voltage (2)	V_{O2}	$27\text{V} \leq V_{in} \leq 38\text{V}$, $5.0\text{mA} \leq I_o \leq 1.0\text{A}$	22.8	25.2	V
Line Regulation	ΔV_{O1}	$T_J = 25^\circ\text{C}$	$27\text{V} \leq V_{in} \leq 38\text{V}$, $I_o = 500\text{mA}$		240 mV
	ΔV_{O2}		$30\text{V} \leq V_{in} \leq 36\text{V}$, $I_o = 500\text{mA}$		120 mV
Load Regulation	ΔV_{O3}	$T_J = 25^\circ\text{C}$	$5\text{mA} \leq I_o \leq 1.5\text{A}$, $V_{in} = 33\text{V}$		240 mV
	ΔV_{O4}		$250\text{mA} \leq I_o \leq 750\text{mA}$, $V_{in} = 33\text{V}$		120 mV
Quiescent Current	I_Q	$T_J = 25^\circ\text{C}$, $V_{in} = 33\text{V}$, $I_o = 500\text{mA}$		8.0	mA
Quiescent Current Change	ΔI_{Q1}	$27\text{V} \leq V_{in} \leq 38\text{V}$, $I_o = 500\text{mA}$		1.0	mA
	ΔI_{Q2}	$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $V_{in} = 33\text{V}$		0.5	mA
Output Noise Voltage	N_o	$V_{in} = 33\text{V}$, $I_o = 500\text{mA}$, $10\text{Hz} \leq f \leq 100\text{KHz}$	170(TYP)		μV
Ripple Rejection	R_R	$T_J = 25^\circ\text{C}$, $V_i = 1V_{(rms)}$, 120Hz , $I_o = 20\text{mA}$, $28\text{V} \leq V_{in} \leq 38\text{V}$	56		dB
Input-Output Voltage Differential	V_d	$T_J = 25^\circ\text{C}$, $I_o = 1.0\text{A}$	2(TYP)		V
Short-Circuit Limit	I_{sc}	$V_{in} = 35\text{V}$, Output-GND		1.0	A
Peak Output Current	I_{peak}	$T_J = 25^\circ\text{C}$, $V_{in} = 31\text{V}$, $V_o = 22.8\text{V}$	1.5	3.3	A

*GL78XX Series Test Circuit (AC & DC)

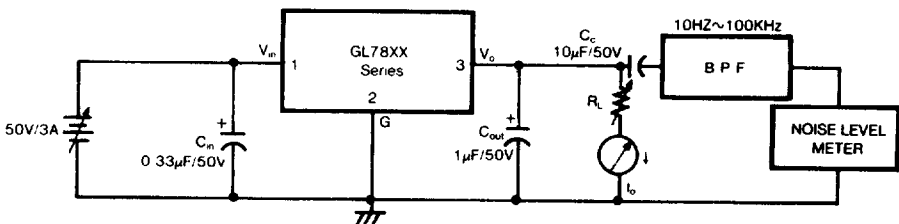
1 V_{O1} , V_{O2} , ΔV_o , I_Q , ΔI_Q , V_d , I_{SC} , I_{peak}



2 Ripple Rejection



3 Output Noise Voltage



* C_{in} , C_{out} , C_c is Tantalum Capacitor

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$ unless otherwise noted)

FIGURE 1 - AVERAGE POWER DISSIPATION
versus AMBIENT TEMPERATURE

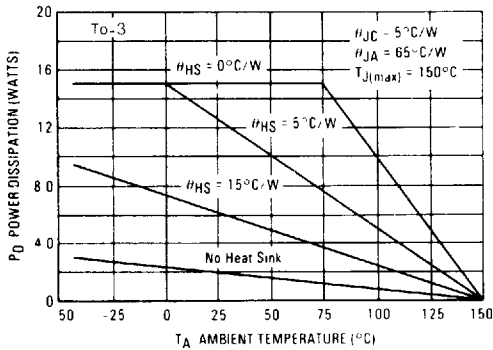


FIGURE 2 - INPUT OUTPUT DIFFERENTIAL AS A
FUNCTION OF JUNCTION TEMPERATURE

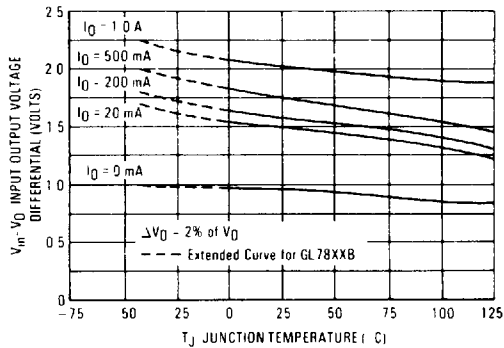


FIGURE 3 - INPUT OUTPUT DIFFERENTIAL AS A
FUNCTION OF JUNCTION TEMPERATURE

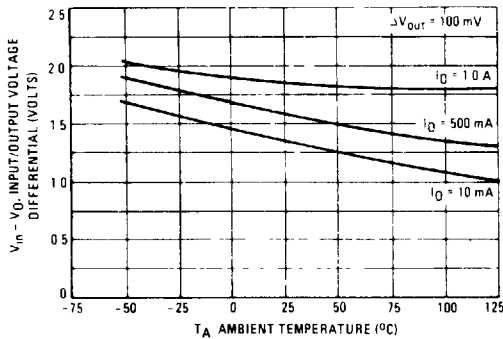


FIGURE 4 - PEAK OUTPUT CURRENT AS A FUNCTION
OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

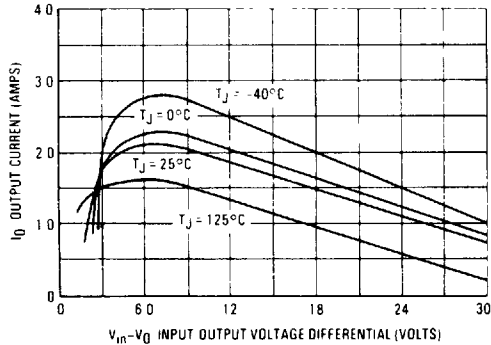


FIGURE 5 - PEAK OUTPUT CURRENT AS A
FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

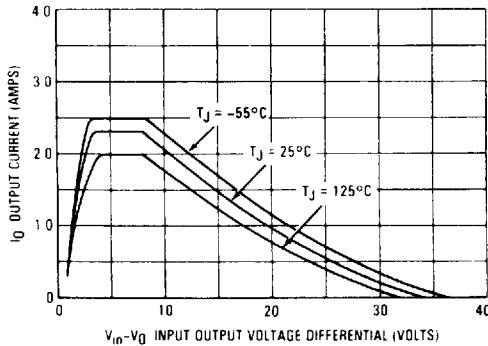
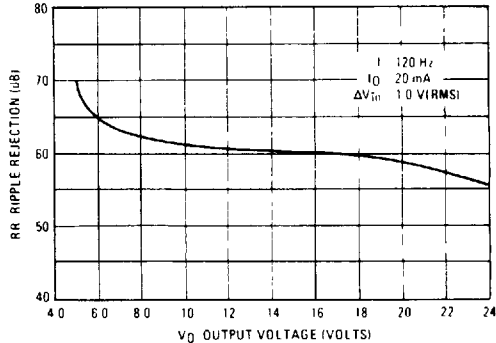


FIGURE 6 - RIPPLE REJECTION AS A FUNCTION
OF OUTPUT VOLTAGES



TYPICAL CHARACTERISTICS (continued)
($T_A = 25^{\circ}\text{C}$ unless otherwise noted.)

FIGURE 7 — RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

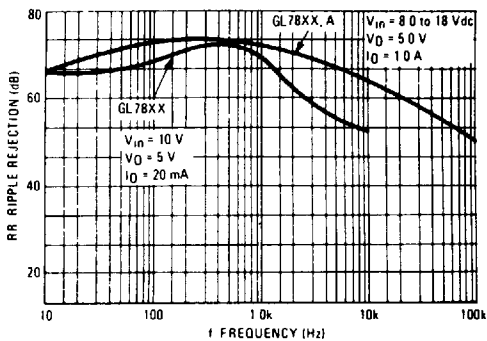


FIGURE 8 — OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

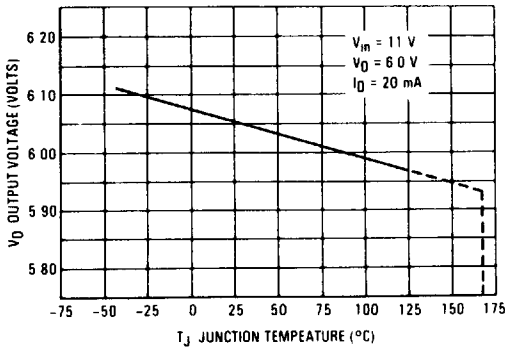


FIGURE 9 — OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE

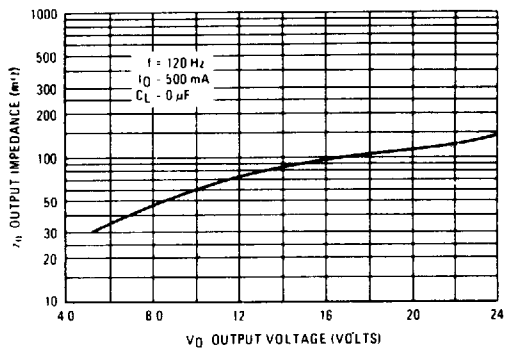


FIGURE 10 — QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE

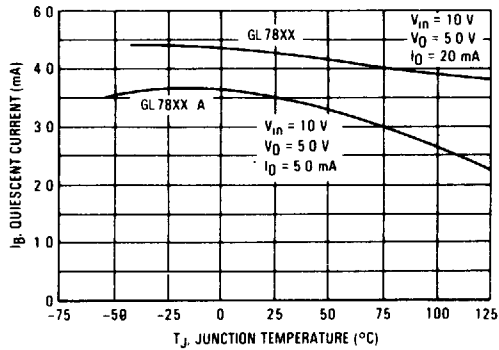


FIGURE 11 — DROPOUT CHARACTERISTICS

