

LM7800 Series 3-Terminal Fixed Voltage Regulators



THREE-TERMINAL POSITIVE VOLTAGE REGULATORS

These voltage regulators are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area

- Output Current in Excess of 1.5 Ampere
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Output Voltage Offered in 2% Tolerance

FEATURES

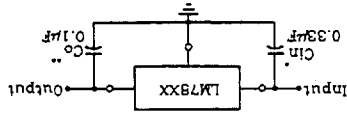
compensation. With adequate heatsinking they can deliver output currents in excess of 1.5 ampere. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

PIN ARRANGEMENT



- PIN 1. INPUT
 - PIN 2. GROUND
 - PIN 3. OUTPUT
- (Heatsink surface connected to Pin 2.)

TYPICAL CONNECTING CIRCUIT



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

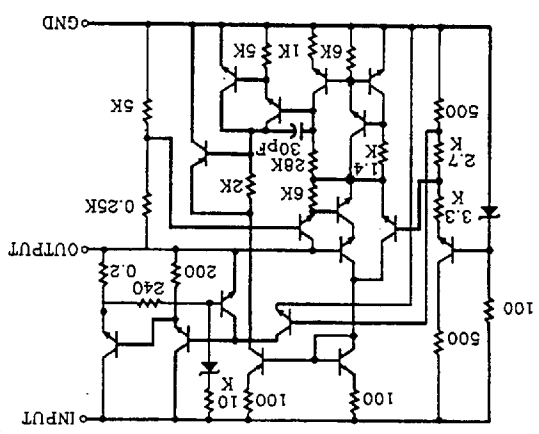
Input ripple voltage.

XX = these two digits of the type number indicate approximate ripple voltage.

Input ripple voltage.

Input ripple voltage.

REPRESENTATIVE SCHEMATIC DIAGRAM



CIRCUIT SCHEMATIC

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Item	Symbol	LM7800 Series	Unit
Input Voltage	V _{in} *	30	V
Input Voltage	V _{in} **	40	V
Power Dissipation	P _d ***	15	W
Operating Ambient Temperature	T _{opr}	-20 to +75	°C
Operating Junction Temperature	T _j	-20 to +125	°C
Storage Temperature	T _{stg}	-55 to +125	°C

Note: *LM7805 to LM7818

** LM7824

***Follow the derating curve

LM7805 ELECTRICAL CHARACTERISTICS

(V_{in}=10V, I_{out}=500mA, 0°C ≤ T_j ≤ 125°C, C_{in}=0.33μF, C_{out}=0.1μF; unless otherwise specified.)

Item	Symbol	Test Conditions			min.	typ.	max.	unit
Output Voltage	V _{out}	7V ≤ V _{in} ≤ 25V, 5mA ≤ I _{out} ≤ 1.0A, P _s ≤ 15W			4.85	--	5.15	V
		T _j = 25°C			4.90	5.0	5.10	V
Line Regulation	REG _{line}	7V ≤ V _{in} ≤ 25V			--	3	100	mV
		8V ≤ V _{in} ≤ 12V			--	1	50	mV
		5mA ≤ I _{out} ≤ 1.5A			--	15	100	mV
Load Regulation	REG _{load}	T _j = 25°C			--	5	50	mV
		250mA ≤ I _{out} ≤ 750mA			--	5	50	mV
Quiescent Current	I _q	T _j = 25°C, I _{out} = 0			--	4.2	8.0	mA
		7V ≤ V _{in} ≤ 25V			--	--	1.3	mA
Quiescent Current Change	Δ I _q	5mA ≤ I _{out} ≤ 1.0A			--	--	0.5	mA
		T _a = 25°C, 10Hz ≤ f ≤ 100KHz			--	40	--	μV
Output Noise Voltage	V _n	f = 120Hz			62	78	--	dB
Ripple Rejection Ratio	RR	f = 120Hz			62	78	--	dB
Voltage Drop	V _{drop}	I _{out} = 1.0A, T _j = 25°C			--	2.0	--	V
Output Resistance	R _{out}	f = 1KHz			--	17	--	mΩ
Output Short Circuit Current	I _{os}	T _j = 25°C			--	750	--	mA
Peak Output Current	I _{o peak}	T _j = 25°C			--	2.2	--	A
Temperature Coefficient of Output Voltage	Δ V _{out} / Δ T _j	I _{out} = 5mA, 0°C ≤ T _j ≤ 125°C			--	-1.1	--	mV/°C

LM7800 Series 3-Terminal Fixed Voltage Regulators



LM7806 ELECTRICAL CHARACTERISTICS

($V_{in}=11V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			unit
		min.	typ.	max.	
Output Voltage	V_{out}	$8V \leq V_{in} \leq 21V$, $5mA \leq I_{out} \leq 1.0A$, $P_{D} \leq 15W$	5.83	--	6.17
		$T_j=25^\circ C$	5.88	6.0	6.12
Line Regulation	Δ REGline	$T_j=25^\circ C$	--	1.5	60
		$8V \leq V_{in} \leq 25V$	--	5	120
Load Regulation	Δ REGload	$T_j=25^\circ C$	--	4.0	60
		$250mA \leq I_{out} \leq 750mA$	--	4.3	8.0
Quiescent Current	I_q	$T_j=25^\circ C$, $I_{out}=0$	--	4.3	8.0
		$8V \leq V_{in} \leq 25V$	--	--	1.3
Quiescent Current Change	ΔI_q	$5mA \leq I_{out} \leq 1.0A$	--	--	0.5
		$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	45	--
Output Noise Voltage	V_n	$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	45	μV
Ripple Rejection Ratio	RR	$f=120Hz$	59	75	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^\circ C$	--	2.0	V
Output Resistance	R_{out}	$f=1KHz$	--	19	m Ω
Output Short Circuit Current	I_{os}	$T_j=25^\circ C$	--	550	mA
Peak Output Current	$I_{o peak}$	$T_j=25^\circ C$	--	2.2	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$, $0^\circ C \leq T_j \leq 125^\circ C$	--	-0.8	mV/ $^\circ C$

LM7808 ELECTRICAL CHARACTERISTICS

($V_{in}=14V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			unit
		min.	typ.	max.	
Output Voltage	V_{out}	$10.5V \leq V_{in} \leq 23V$, $5mA \leq I_{out} \leq 1.0A$, $P_{D} \leq 15W$	7.74	--	8.26
		$T_j=25^\circ C$	7.84	8.0	8.16
Line Regulation	Δ REGline	$T_j=25^\circ C$	--	2.0	80
		$10.5V \leq V_{in} \leq 25V$	--	6	160
Load Regulation	Δ REGload	$T_j=25^\circ C$	--	4	80
		$250mA \leq I_{out} \leq 750mA$	--	4.3	8.0
Quiescent Current	I_q	$T_j=25^\circ C$, $I_{out}=0$	--	4.3	8.0
		$10.5V \leq V_{in} \leq 25V$	--	--	1.0
Quiescent Current Change	ΔI_q	$5mA \leq I_{out} \leq 1.0A$	--	--	0.5
		$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	52	--
Output Noise Voltage	V_n	$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	52	μV
Ripple Rejection Ratio	RR	$f=120Hz$	56	72	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^\circ C$	--	2.0	V
Output Resistance	R_{out}	$f=1KHz$	--	16	m Ω

LM7800 Series 3-Terminal Fixed Voltage Regulators



LM7809 ELECTRICAL CHARACTERISTICS

($V_{in}=15V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	V_{out}	$10.5V \leq V_{in} \leq 27V$, $5mA \leq I_{out} \leq 1.0A$, $P_p \leq 15W$	8.77	--	9.23	V
Line Regulation	Δ REGline	$T_j=25^\circ C$ $11.5V \leq V_{in} \leq 30V$ $12V \leq V_{in} \leq 18V$	--	2.0	6	mV
Load Regulation	Δ REGload	$T_j=25^\circ C$ $5mA \leq I_{out} \leq 1.5A$ $250mA \leq I_{out} \leq 750mA$	--	4	80	mV
Quiescent Current	I_q	$T_j=25^\circ C$, $I_{out}=0$	--	4.3	1.0	mA
Quiescent Current Change	ΔI_q	$5mA \leq I_{out} \leq 1.0A$	--	--	0.5	mA
Output Noise Voltage	V_n	$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	52	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$	55	72	--	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^\circ C$	--	2.0	--	V
Output Resistance	R_{out}	$f=1KHz$	--	16	--	m Ω
Output Short Circuit Current	I_{os}	$T_j=25^\circ C$	--	450	--	mA
Peak Output Current	$I_{o\ peak}$	$T_j=25^\circ C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$	$I_{out}=5mA$, $0^\circ C \leq T_j \leq 125^\circ C$	--	-1.8	--	mV/ $^\circ C$

LM7810 ELECTRICAL CHARACTERISTICS

($V_{in}=16V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions	min.	typ.	max.	unit
Output Voltage	V_{out}	$17.5V \leq V_{in} \leq 30V$, $5mA \leq I_{out} \leq 1.0A$, $P_p \leq 15W$	9.75	-	12.25	V
Line Regulation	Δ REGline	$T_j=25^\circ C$ $10.5V \leq V_{in} \leq 30V$ $13V \leq V_{in} \leq 9V$	--	3.0	10	mV
Load Regulation	Δ REGload	$T_j=25^\circ C$ $5mA \leq I_{out} \leq 1.5A$ $250mA \leq I_{out} \leq 750mA$	--	4.0	120	mV
Quiescent Current	I_q	$T_j=25^\circ C$, $I_{out}=0$	--	4.3	8.0	mA
Quiescent Current Change	ΔI_q	$14.5V \leq V_{in} \leq 30V$ $5mA \leq I_{out} \leq 1.0A$	--	--	1.0	mA
Output Noise Voltage	V_n	$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$	--	52	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$	54	72	--	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^\circ C$	--	2.0	--	V

LM7800 Series 3-Terminal Fixed Voltage Regulators



LM7812 ELECTRICAL CHARACTERISTICS

($V_{in}=19V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			min.	typ.	max.	unit
Output Voltage	V_{out}	$14.5V \leq V_{in} \leq 30V$, $5mA \leq I_{out} \leq 1.0A$, $P_{Diss} 15W$			11.76	12.0	12.24	V
					11.66	--	12.34	V
Line Regulation	$\Delta V_{REGline}$	$T_j=25^\circ C$	$14.5V \leq V_{in} \leq 30V$		--	10	240	mV
			$16V \leq V_{in} \leq 22V$		--	3.0	120	mV
			$5mA \leq I_{out} \leq 1.5A$		--	12	240	mV
Load Regulation	$\Delta V_{REGload}$	$T_j=25^\circ C$	$250mA \leq I_{out} \leq 750mA$		--	4.0	120	mV
			$I_{out}=0$		--	4.3	8.0	mA
Quiescent Current	I_q				--	8.0	1.0	mA
Quiescent Current Change	ΔI_q		$5mA \leq I_{out} \leq 1.0A$		--	--	0.5	mA
Output Noise Voltage	V_n		$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$		--	75	--	μV
Ripple Rejection Ratio	RR		$f=120Hz$		55	71	--	dB
Voltage Drop	V_{drop}		$I_{out}=1.0A$, $T_j=25^\circ C$		--	2.0	--	V
Output Resistance	R_{out}		$f=1KHz$		--	18	--	m Ω
Output Short Circuit Current	I_{os}		$T_j=25^\circ C$		--	350	--	mA
Peak Output Current	$I_{o peak}$		$T_j=25^\circ C$		--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$		$I_{out}=5mA$, $0^\circ C \leq T_j \leq 125^\circ C$		--	-1.0	--	mV/ $^\circ C$

LM7815 ELECTRICAL CHARACTERISTICS

($V_{in}=23V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			min.	typ.	max.	unit
Output Voltage	V_{out}	$17.5V \leq V_{in} \leq 30V$, $5mA \leq I_{out} \leq 1.0A$, $P_{Diss} 15W$			14.7	15.0	15.3	V
					14.55	--	15.45	V
Line Regulation	$\Delta V_{REGline}$	$T_j=25^\circ C$	$17.5V \leq V_{in} \leq 30V$		--	11	300	mV
			$20V \leq V_{in} \leq 26V$		--	3.0	150	mV
			$5mA \leq I_{out} \leq 1.5A$		--	12	300	mV
Load Regulation	$\Delta V_{REGload}$	$T_j=25^\circ C$	$250mA \leq I_{out} \leq 750mA$		--	4	150	mV
			$I_{out}=0$		--	4.4	8.0	mA
Quiescent Current	I_q				--	8.0	1.0	mA
Quiescent Current Change	ΔI_q		$5mA \leq I_{out} \leq 1.0A$		--	--	0.5	mA
Output Noise Voltage	V_n		$T_a=25^\circ C$, $10Hz \leq f \leq 100KHz$		--	90	--	μV
Ripple Rejection Ratio	RR		$f=120Hz$		54	70	--	dB
Voltage Drop	V_{drop}		$I_{out}=1.0A$, $T_j=25^\circ C$		--	2.0	--	V
Output Resistance	R_{out}		$f=1KHz$		--	18	--	m Ω
Output Short Circuit Current	I_{os}		$T_j=25^\circ C$		--	350	--	mA
Peak Output Current	$I_{o peak}$		$T_j=25^\circ C$		--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out}/\Delta T_j$		$I_{out}=5mA$, $0^\circ C \leq T_j \leq 125^\circ C$		--	-1.0	--	mV/ $^\circ C$

LM7800 Series 3-Terminal Fixed Voltage Regulators



LM7818 ELECTRICAL CHARACTERISTICS

($V_{in}=27V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			min.	typ.	max.	unit
Output Voltage	V_{out}	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$, $P_o \leq 15W$	$T_j = 25^\circ C$	17.64	18.0	18.36	V
				$0^\circ C \leq T_j \leq 125^\circ C$	17.44	--	18.56	V
Line Regulation	ΔV_o line	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.5A$	$T_j = 25^\circ C$	--	5.0	180	mV
				$0^\circ C \leq T_j \leq 125^\circ C$	--	12	360	mV
Load Regulation	ΔV_o load	$250mA \leq I_{out} \leq 750mA$	$5mA \leq I_{out} \leq 1.5A$	$T_j = 25^\circ C$	--	4.0	180	mV
				$0^\circ C \leq T_j \leq 125^\circ C$	--	4.5	180	mV
Quiescent Current	I_q	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$, $I_{out} = 0$	--	8.0	mA	
Quiescent Current Change	ΔI_q	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$	--	1.0	mA	
				$0^\circ C \leq T_j \leq 125^\circ C$	--	0.5	mA	
Output Noise Voltage	V_n	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$T_a = 25^\circ C$, $10Hz \leq f \leq 100KHz$	--	110	μV	
Ripple Rejection Ratio	RR	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$f = 120Hz$	53	69	dB	
Voltage Drop	V_{drop}	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$f = 120Hz$	--	2.0	V	
Output Resistance	R_{out}	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$f = 1KHz$	--	22	m Ω	
Output Short Circuit Current	I_{os}	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$	--	200	mA	
Peak Output Current	$I_{o peak}$	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$	--	2.1	A	
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$21.0V \leq V_{in} \leq 33V$	$5mA \leq I_{out} \leq 1.0A$	$0^\circ C \leq T_j \leq 125^\circ C$	--	-1.0	mV/ $^\circ C$	

LM7824 ELECTRICAL CHARACTERISTICS

($V_{in}=33V$, $I_{out}=500mA$, $0^\circ C \leq T_j \leq 125^\circ C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Item	Symbol	Test Conditions			min.	typ.	max.	unit
Output Voltage	V_{out}	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$, $P_o \leq 15W$	$T_j = 25^\circ C$	23.52	24.0	24.48	V
				$0^\circ C \leq T_j \leq 125^\circ C$	23.32	--	24.68	V
Line Regulation	ΔV_o line	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.5A$	$T_j = 25^\circ C$	--	6.0	240	mV
				$0^\circ C \leq T_j \leq 125^\circ C$	--	12	480	mV
Load Regulation	ΔV_o load	$250mA \leq I_{out} \leq 750mA$	$5mA \leq I_{out} \leq 1.5A$	$T_j = 25^\circ C$	--	4.0	240	mV
				$0^\circ C \leq T_j \leq 125^\circ C$	--	4.6	240	mV
Quiescent Current	I_q	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$, $I_{out} = 0$	--	8.0	mA	
Quiescent Current Change	ΔI_q	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$T_j = 25^\circ C$	--	1.0	mA	
				$0^\circ C \leq T_j \leq 125^\circ C$	--	0.5	mA	
Output Noise Voltage	V_n	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$T_a = 25^\circ C$, $10Hz \leq f \leq 100KHz$	--	170	μV	
Ripple Rejection Ratio	RR	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$f = 120Hz$	50	66	dB	
Voltage Drop	V_{drop}	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$f = 120Hz$	--	2.0	V	
Output Resistance	R_{out}	$27.0V \leq V_{in} \leq 38V$	$5mA \leq I_{out} \leq 1.0A$	$f = 1KHz$	--	28	m Ω	

LM7800 Series 3-Terminal Fixed Voltage Regulators



FIGURE 1 - WORST CASE POWER DISSIPATION versus AMBIENT TEMPERATURE (Case 221A)

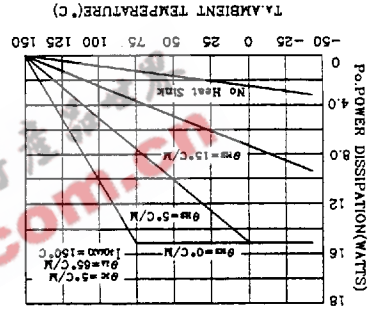


FIGURE 2 - WORST CASE POWER DISSIPATION versus AMBIENT TEMPERATURE (Case 1)

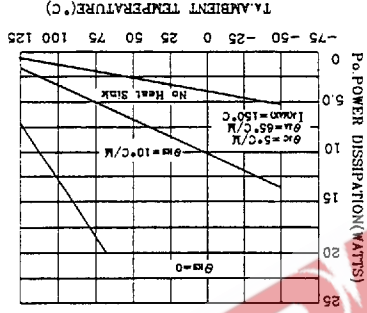


FIGURE 3 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

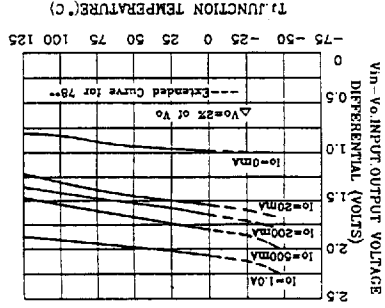


FIGURE 4 - INPUT OUTPUT DIFFERENTIAL AS A FUNCTION OF JUNCTION TEMPERATURE

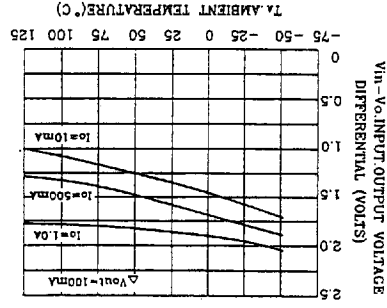


FIGURE 5 - PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

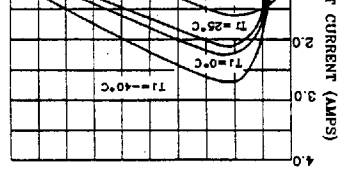


FIGURE 6 - PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE

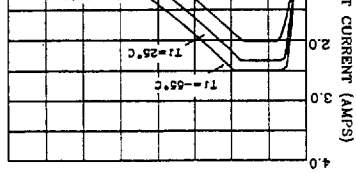


FIGURE 7 - RIPPLE REJECTION AS A FUNCTION OF OUTPUT VOLTAGE

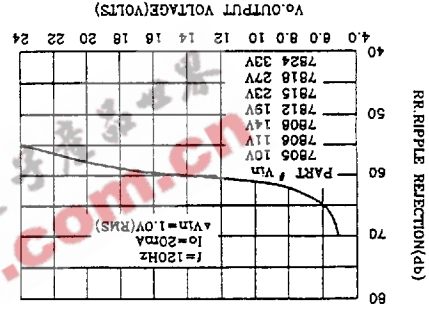


FIGURE 8 - RIPPLE REJECTION AS A FUNCTION OF FREQUENCY

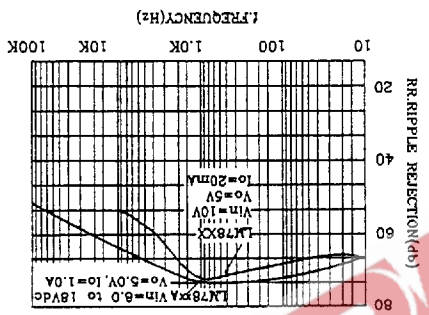


FIGURE 9 - OUTPUT VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

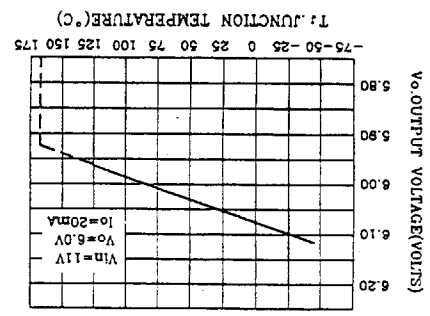


FIGURE 10 - OUTPUT IMPEDANCE AS A FUNCTION OF OUTPUT VOLTAGE

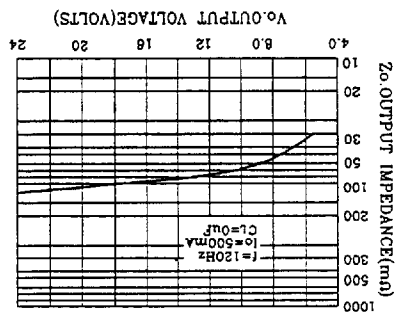


FIGURE 11 - QUIESCENT CURRENT AS A FUNCTION OF TEMPERATURE

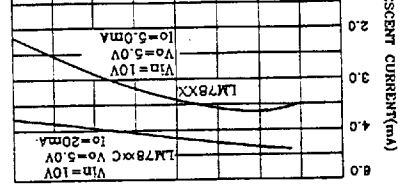


FIGURE 12 - DROPOUT CHARACTERISTICS

