FAIRCHILD SEMICONDUCTOR®

August 2012

LM78XX/LM78XXA
3-Terminal 1A Positive Voltage Regulator

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

General Description

The LM78XX series of three terminal positive regulators are available in the TO-220 package and with several fixed output voltages, making them useful in a wide range of applications. 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 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

Ordering Information

Product Number	Output Voltage Tolerance	Package	Operating Temperature
LM7805CT	±4%	TO-220 (Single Gauge)	-40°C to +125°C
LM7806CT			
LM7808CT			
LM7809CT			
LM7810CT			
LM7812CT			
LM7815CT			
LM7818CT			
LM7824CT			
LM7805ACT	±2%		0°C to +125°C
LM7806ACT			
LM7808ACT			
LM7809ACT			
LM7810ACT			
LM7812ACT			
LM7815ACT			
LM7818ACT			
LM7824ACT			

Block Diagram

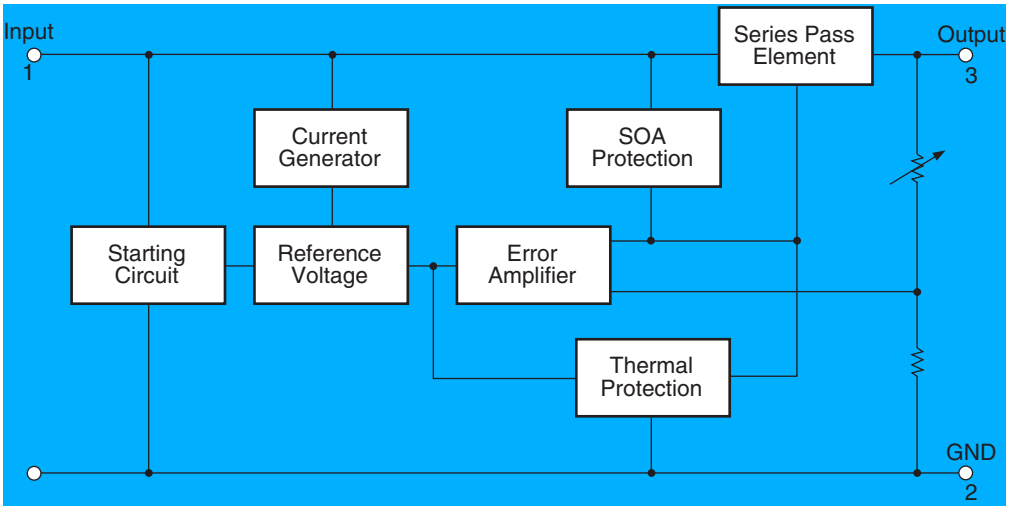


Figure 1.

Pin Assignment

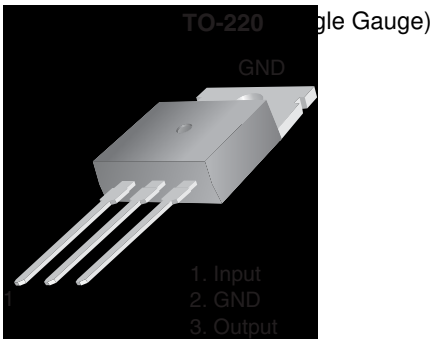


Figure 2.

Absolute Maximum Ratings

Absolute maximum ratings are those values beyond which damage to the device may occur. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

Symbol	Parameter		Value	Unit
V_I	Input Voltage	V_O = 5V to 18V	35	V
		V_O = 24V	40	V
$R_{\theta JC}$	Thermal Resistance Junction-Cases (TO-220)		5	°C/W
$R_{\theta JA}$	Thermal Resistance Junction-Air (TO-220)		65	°C/W
T_{OPR}	Operating Temperature Range	LM78xx	-40 to +125	°C
		LM78xxA	0 to +125	
T_{STG}	Storage Temperature Range		-65 to +150	°C

Electrical Characteristics (LM7805)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 10V, C_I = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		4.8	5.0	5.2	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 7V to 20V		4.75	5.0	5.25	
Regline	Line Regulation(1)	T_J = +25°C	V_O = 7V to 25V	–	4.0	100	mV
			V_I = 8V to 12V	–	1.6	50.0	
Regload	Load Regulation(1)	T_J = +25°C	I_O = 5mA to 1.5A	–	9.0	100	mV
			I_O = 250mA to 750mA	–	4.0	50.0	
I_Q	Quiescent Current	T_J = +25°C		–	5.0	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	0.03	0.5	mA
		V_I = 7V to 25V		–	0.3	1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift(2)	I_O = 5mA		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	42.0	–	µV/V_O
RR	Ripple Rejection(2)	f = 120Hz, V_O = 8V to 18V		62.0	73.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(2)	f = 1kHz		–	15.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	230	–	mA
I_{PK}	Peak Current(2)	T_J = +25°C		–	2.2	–	A

Notes:

1. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7806) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 11V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		5.75	6.0	6.25	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 8.0V to 21V		5.7	6.0	6.3	
Regline	Line Regulation(3)	T_J = +25°C	V_I = 8V to 25V	–	5.0	120	mV
			V_I = 9V to 13V	–	1.5	60.0	
Regload	Load Regulation(3)	T_J = +25°C	I_O = 5mA to 1.5A	–	9.0	120	mV
			I_O = 250mA to 750mA	–	3.0	60.0	
I_Q	Quiescent Current	T_J = +25°C		–	5.0	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 8V to 25V		–	–	1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift(4)	I_O = 5mA		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	45.0	–	µV/V_O
RR	Ripple Rejection(4)	f = 120Hz, V_O = 8V to 18V		62.0	73.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(4)	f = 1kHz		–	19.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	250	–	mA
I_{PK}	Peak Current(4)	T_J = +25°C		–	2.2	–	A

Notes:

3. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
4. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7808) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 14V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		7.7	8.0	8.3	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 10.5V to 23V		7.6	8.0	8.4	
Regline	Line Regulation(5)	T_J = +25°C	V_I = 10.5V to 25V	–	5.0	160	mV
			V_I = 11.5V to 17V	–	2.0	80.0	
Regload	Load Regulation(5)	T_J = +25°C	I_O = 5mA to 1.5A	–	10.0	160	mV
			I_O = 250mA to 750mA	–	5.0	80.0	
I_Q	Quiescent Current	T_J = +25°C		–	5.0	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	0.05	0.5	mA
		V_I = 10.5V to 25V		–	0.5	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(6)	I_O = 5mA		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	52.0	–	µV/V_O
RR	Ripple Rejection(6)	f = 120Hz, V_O = 11.5V to 21.5V		56.0	73.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(6)	f = 1kHz		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	230	–	mA
I_{PK}	Peak Current(6)	T_J = +25°C		–	2.2	–	A

Notes:

5. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
6. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7809) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 15V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		8.65	9.0	9.35	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 11.5V to 24V		8.6	9.0	9.4	
Regline	Line Regulation(7)	T_J = +25°C	V_I = 11.5V to 25V	–	6.0	180	mV
			V_I = 12V to 17V	–	2.0	90.0	
Regload	Load Regulation(7)	T_J = +25°C	I_O = 5mA to 1.5A	–	12.0	180	mV
			I_O = 250mA to 750mA	–	4.0	90.0	
I_Q	Quiescent Current	T_J = +25°C		–	5.0	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 11.5V to 26V		–	–	1.3	
$\Delta V_O/\Delta T$	Output Voltage Drift(8)	I_O = 5mA		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	58.0	–	µV/V_O
RR	Ripple Rejection(8)	f = 120Hz, V_O = 13V to 23V		56.0	71.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(8)	f = 1kHz		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	250	–	mA
I_{PK}	Peak Current(8)	T_J = +25°C		–	2.2	–	A

Notes:

7. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
8. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7810) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 16V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		9.6	10.0	10.4	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 12.5V to 25V		9.5	10.0	10.5	
Regline	Line Regulation(9)	T_J = +25°C	V_I = 12.5V to 25V	–	10.0	200	mV
			V_I = 13V to 25V	–	3.0	100	
Regload	Load Regulation(9)	T_J = +25°C	I_O = 5mA to 1.5A	–	12.0	200	mV
			I_O = 250mA to 750mA	–	4.0	400	
I_Q	Quiescent Current	T_J = +25°C		–	5.1	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 12.5V to 29V		–	–	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(10)	I_O = 5mA		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	58.0	–	µV/V_O
RR	Ripple Rejection(10)	f = 120Hz, V_O = 13V to 23V		56.0	71.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(10)	f = 1kHz		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	250	–	mA
I_{PK}	Peak Current(10)	T_J = +25°C		–	2.2	–	A

Notes:

9. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
10. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7812) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 19V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		11.5	12.0	12.5	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 14.5V to 27V		11.4	12.0	12.6	
Regline	Line Regulation(11)	T_J = +25°C	V_I = 14.5V to 30V	–	10.0	240	mV
			V_I = 16V to 22V	–	3.0	120	
Regload	Load Regulation(11)	T_J = +25°C	I_O = 5mA to 1.5A	–	11.0	240	mV
			I_O = 250mA to 750mA	–	5.0	120	
I_Q	Quiescent Current	T_J = +25°C		–	5.1	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	0.1	0.5	mA
		V_I = 14.5V to 30V		–	0.5	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(12)	I_O = 5mA		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	76.0	–	µV/V_O
RR	Ripple Rejection(12)	f = 120Hz, V_I = 15V to 25V		55.0	71.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(12)	f = 1kHz		–	18.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	230	–	mA
I_{PK}	Peak Current(12)	T_J = +25°C		–	2.2	–	A

Notes:

11. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
12. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7815) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 23V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		14.4	15.0	15.6	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 17.5V to 30V		14.25	15.0	15.75	
Regline	Line Regulation(13)	T_J = +25°C	V_I = 17.5V to 30V	–	11.0	300	mV
			V_I = 20V to 26V	–	3.0	150	
Regload	Load Regulation(13)	T_J = +25°C	I_O = 5mA to 1.5A	–	12.0	300	mV
			I_O = 250mA to 750mA	–	4.0	150	
I_Q	Quiescent Current	T_J = +25°C		–	5.2	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 17.5V to 30V		–	–	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(14)	I_O = 5mA		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	90.0	–	µV/V_O
RR	Ripple Rejection(14)	f = 120Hz, V_I = 18.5V to 28.5V		54.0	70.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(14)	f = 1kHz		–	19.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	250	–	mA
I_{PK}	Peak Current(14)	T_J = +25°C		–	2.2	–	A

Notes:

13. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
14. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7818) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 27V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		17.3	18.0	18.7	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 21V to 33V		17.1	18.0	18.9	
Regline	Line Regulation(15)	T_J = +25°C	V_I = 21V to 33V	–	15.0	360	mV
			V_I = 24V to 30V	–	5.0	180	
Regload	Load Regulation(15)	T_J = +25°C	I_O = 5mA to 1.5A	–	15.0	360	mV
			I_O = 250mA to 750mA	–	5.0	180	
I_Q	Quiescent Current	T_J = +25°C		–	5.2	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 21V to 33V		–	–	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(16)	I_O = 5mA		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	110	–	µV/V_O
RR	Ripple Rejection(16)	f = 120Hz, V_I = 22V to 32V		53.0	69.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
r_O	Output Resistance(16)	f = 1kHz		–	22.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	250	–	mA
I_{PK}	Peak Current(16)	T_J = +25°C		–	2.2	–	A

Notes:

15. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
16. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7824) (Continued)

Refer to the test circuits. -40°C < T_J < 125°C, I_O = 500mA, V_I = 33V, C_I = 0.33µF, C_O = 0.1µF, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	T_J = +25°C		23.0	24.0	25.0	V
		5mA ≤ I_O ≤ 1A, P_O ≤ 15W, V_I = 27V to 38V		22.8	24.0	25.25	
Regline	Line Regulation(17)	T_J = +25°C	V_I = 27V to 38V	–	17.0	480	mV
			V_I = 30V to 36V	–	6.0	240	
Regload	Load Regulation(17)	T_J = +25°C	I_O = 5mA to 1.5A	–	15.0	480	mV
			I_O = 250mA to 750mA	–	5.0	240	
I_Q	Quiescent Current	T_J = +25°C		–	5.2	8.0	mA
ΔI_Q	Quiescent Current Change	I_O = 5mA to 1A		–	0.1	0.5	mA
		V_I = 27V to 38V		–	0.5	1.0	
$\Delta V_O/\Delta T$	Output Voltage Drift(18)	I_O = 5mA		–	-1.5	–	mV/°C
V_N	Output Noise Voltage	f = 10Hz to 100kHz, T_A = +25°C		–	60.0	–	µV/V_O
RR	Ripple Rejection(18)	f = 120Hz, V_I = 28V to 38V		50.0	67.0	–	dB
V_{DROP}	Dropout Voltage	I_O = 1A, T_J = +25°C		–	2.0	–	V
rO	Output Resistance(18)	f = 1kHz		–	28.0	–	mΩ
I_{SC}	Short Circuit Current	V_I = 35V, T_A = +25°C		–	230	–	mA
I_{PK}	Peak Current(18)	T_J = +25°C		–	2.2	–	A

Notes:

17. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.
18. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7805A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 10V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = +25°C$		4.9	5.0	5.1	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 7.5V$ to $20V$		4.8	5.0	5.2	
Regline	Line Regulation[19]	$V_I = 7.5V$ to $25V$, $I_O = 500mA$		–	5.0	50.0	mV
		$V_I = 8V$ to $12V$		–	3.0	50.0	
		$T_J = +25°C$	$V_I = 7.3V$ to $20V$	–	5.0	50.0	
			$V_I = 8V$ to $12V$	–	1.5	25.0	
Regload	Load Regulation[19]	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	9.0	100	mV
		$I_O = 5mA$ to $1A$		–	9.0	100	
		$I_O = 250mA$ to $750mA$		–	4.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.0	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 8V$ to $25V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 7.5V$ to $20V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift[20]	$I_O = 5mA$		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection[20]	$f = 120Hz$, $I_O = 500mA$, $V_I = 8V$ to $18V$		–	68.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance[20]	$f = 1kHz$		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current[20]	$T_J = +25°C$		–	2.2	–	A

Notes:

19. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

20. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7806A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 11V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = +25°C$		5.58	6.0	6.12	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 8.6V$ to $21V$		5.76	6.0	6.24	
Regline	Line Regulation[21]	$V_I = 8.6V$ to $25V$, $I_O = 500mA$		–	5.0	60.0	mV
		$V_I = 9V$ to $13V$		–	3.0	60.0	
		$T_J = +25°C$	$V_I = 8.3V$ to $21V$	–	5.0	60.0	
			$V_I = 9V$ to $13V$	–	1.5	30.0	
Regload	Load Regulation[21]	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	9.0	100	mV
		$I_O = 5mA$ to $1A$		–	9.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	4.3	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 19V$ to $25V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 8.5V$ to $21V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift[22]	$I_O = 5mA$		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection[22]	$f = 120Hz$, $I_O = 500mA$, $V_I = 9V$ to $19V$		–	65.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance[22]	$f = 1kHz$		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current[22]	$T_J = +25°C$		–	2.2	–	A

Notes:

21. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

22. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7808A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 14V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_O	Output Voltage	$T_J = +25°C$		7.84	8.0	8.16	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 10.6V$ to $23V$		7.7	8.0	8.3	
Regline	Line Regulation(23)	$V_I = 10.6V$ to $25V$, $I_O = 500mA$		–	6.0	80.0	mV
		$V_I = 11V$ to $17V$		–	3.0	80.0	
		$T_J = +25°C$	$V_I = 10.4V$ to $23V$	–	6.0	80.0	
			$V_I = 11V$ to $17V$	–	2.0	40.0	
Regload	Load Regulation(23)	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	12.0	100	mV
		$I_O = 5mA$ to $1A$		–	12.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.0	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 11V$ to $25V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 10.6V$ to $23V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift(24)	$I_O = 5mA$		–	-0.8	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection(24)	$f = 120Hz$, $I_O = 500mA$, $V_I = 11.5V$ to $21.5V$		–	62.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance(24)	$f = 1kHz$		–	18.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current(24)	$T_J = +25°C$		–	2.2	–	A

Notes:

23. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

24. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7809A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 15V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		8.82	9.0	9.16	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 11.2V$ to $24V$		8.65	9.0	9.35	
Regline	Line Regulation[25]	$V_I = 11.7V$ to $25V$, $I_O = 500mA$		–	6.0	90.0	mV
		$V_I = 12.5V$ to $19V$		–	4.0	45.0	
		$T_J = +25°C$	$V_I = 11.5V$ to $24V$	–	6.0	90.0	
			$V_I = 12.5V$ to $19V$	–	2.0	45.0	
Regload	Load Regulation[25]	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	12.0	100	mV
		$I_O = 5mA$ to $1A$		–	12.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.0	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 12V$ to $25V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 11.7V$ to $25V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift[26]	$I_O = 5mA$		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection[26]	$f = 120Hz$, $I_O = 500mA$, $V_I = 12V$ to $22V$		–	62.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance[26]	$f = 1kHz$		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current[26]	$T_J = +25°C$		–	2.2	–	A

Notes:

25. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

26. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7810A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 16V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		9.8	10.0	10.2	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 12.8V$ to $25V$		9.6	10.0	10.4	
Regline	Line Regulation(27)	$V_I = 12.8V$ to $26V$, $I_O = 500mA$		–	8.0	100	mV
		$V_I = 13V$ to $20V$		–	4.0	50.0	
		$T_J = +25°C$	$V_I = 12.5V$ to $25V$	–	8.0	100	
			$V_I = 13V$ to $20V$	–	3.0	50.0	
Regload	Load Regulation(27)	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	12.0	100	mV
		$I_O = 5mA$ to $1A$		–	12.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.0	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 12.8V$ to $25V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 13V$ to $26V$, $T_J = +25°C$		–	–	0.5	
$\Delta V_O/\Delta T$	Output Voltage Drift(28)	$I_O = 5mA$		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection(28)	$f = 120Hz$, $I_O = 500mA$, $V_I = 14V$ to $24V$		–	62.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance(28)	$f = 1kHz$		–	17.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current(28)	$T_J = +25°C$		–	2.2	–	A

Notes:

27. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

28. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7812A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 19V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		11.75	12.0	12.25	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 14.8V$ to $27V$		11.5	12.0	12.5	
Regline	Line Regulation(29)	$V_I = 14.8V$ to $30V$, $I_O = 500mA$		–	10.0	120	mV
		$V_I = 16V$ to $22V$		–	4.0	120	
		$T_J = +25°C$	$V_I = 14.5V$ to $27V$	–	10.0	120	
			$V_I = 16V$ to $22V$	–	3.0	60.0	
Regload	Load Regulation(29)	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	12.0	100	mV
		$I_O = 5mA$ to $1A$		–	12.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.1	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 14V$ to $27V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 15V$ to $30V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift(30)	$I_O = 5mA$		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection(30)	$f = 120Hz$, $I_O = 500mA$, $V_I = 14V$ to $24V$		–	60.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance(30)	$f = 1kHz$		–	18.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current(30)	$T_J = +25°C$		–	2.2	–	A

Note:

29. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

30. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7815A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 23V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		14.75	15.0	15.3	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 17.7V$ to $30V$		14.4	15.0	15.6	
Regline	Line Regulation(31)	$V_I = 17.4V$ to $30V$, $I_O = 500mA$		–	10.0	150	mV
		$V_I = 20V$ to $26V$		–	5.0	150	
		$T_J = +25°C$	$V_I = 17.5V$ to $30V$	–	11.0	150	
			$V_I = 20V$ to $26V$	–	3.0	75.0	
Regload	Load Regulation(31)	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	12.0	100	mV
		$I_O = 5mA$ to $1A$		–	12.0	100	
		$I_O = 250mA$ to $750mA$		–	5.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.2	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 17.5V$ to $30V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 17.5V$ to $30V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift(32)	$I_O = 5mA$		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection(32)	$f = 120Hz$, $I_O = 500mA$, $V_I = 18.5V$ to $28.5V$		–	58.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance(32)	$f = 1kHz$		–	19.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current(32)	$T_J = +25°C$		–	2.2	–	A

Notes:

31. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

32. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7818A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 27V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		17.64	18.0	18.36	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 21V$ to $33V$		17.3	18.0	18.7	
Regline	Line Regulation(33)	$V_I = 21V$ to $33V$, $I_O = 500mA$		–	15.0	180	mV
		$V_I = 21V$ to $33V$		–	5.0	180	
		$T_J = +25°C$	$V_I = 20.6V$ to $33V$	–	15.0	180	
			$V_I = 24V$ to $30V$	–	5.0	90.0	
Regload	Load Regulation(33)	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	15.0	100	mV
		$I_O = 5mA$ to $1A$		–	15.0	100	
		$I_O = 250mA$ to $750mA$		–	7.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.2	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 12V$ to $33V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 12V$ to $33V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift(34)	$I_O = 5mA$		–	-1.0	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection(34)	$f = 120Hz$, $I_O = 500mA$, $V_I = 22V$ to $32V$		–	57.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance(34)	$f = 1kHz$		–	19.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current(34)	$T_J = +25°C$		–	2.2	–	A

Notes:

33. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

34. These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7824A) (Continued)

Refer to the test circuits. $0°C < T_J < 125°C$, $I_O = 1A$, $V_I = 33V$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_O	Output Voltage	$T_J = +25°C$		23.5	24.0	24.5	V
		$I_O = 5mA$ to $1A$, $P_O \leq 15W$, $V_I = 27.3V$ to $38V$		23.0	24.0	25.0	
Regline	Line Regulation[35]	$V_I = 27V$ to $38V$, $I_O = 500mA$		–	18.0	240	mV
		$V_I = 21V$ to $33V$		–	6.0	240	
		$T_J = +25°C$	$V_I = 26.7V$ to $38V$	–	18.0	240	
			$V_I = 30V$ to $36V$	–	6.0	120	
Regload	Load Regulation[35]	$T_J = +25°C$, $I_O = 5mA$ to $1.5A$		–	15.0	100	mV
		$I_O = 5mA$ to $1A$		–	15.0	100	
		$I_O = 250mA$ to $750mA$		–	7.0	50.0	
I_Q	Quiescent Current	$T_J = +25°C$		–	5.2	6.0	mA
ΔI_Q	Quiescent Current Change	$I_O = 5mA$ to $1A$		–	–	0.5	mA
		$V_I = 27.3V$ to $38V$, $I_O = 500mA$		–	–	0.8	
		$V_I = 27.3V$ to $38V$, $T_J = +25°C$		–	–	0.8	
$\Delta V_O/\Delta T$	Output Voltage Drift[36]	$I_O = 5mA$		–	-1.5	–	mV/°C
V_N	Output Noise Voltage	$f = 10Hz$ to $100kHz$, $T_A = +25°C$		–	10.0	–	$\mu V/V_O$
RR	Ripple Rejection[36]	$f = 120Hz$, $I_O = 500mA$, $V_I = 28V$ to $38V$		–	54.0	–	dB
V_{DROP}	Dropout Voltage	$I_O = 1A$, $T_J = +25°C$		–	2.0	–	V
r_O	Output Resistance[36]	$f = 1kHz$		–	20.0	–	mΩ
I_{SC}	Short Circuit Current	$V_I = 35V$, $T_A = +25°C$		–	250	–	mA
I_{PK}	Peak Current[36]	$T_J = +25°C$		–	2.2	–	A

Notes:

35. Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

36. These parameters, although guaranteed, are not 100% tested in production.

Typical Performance Characteristics

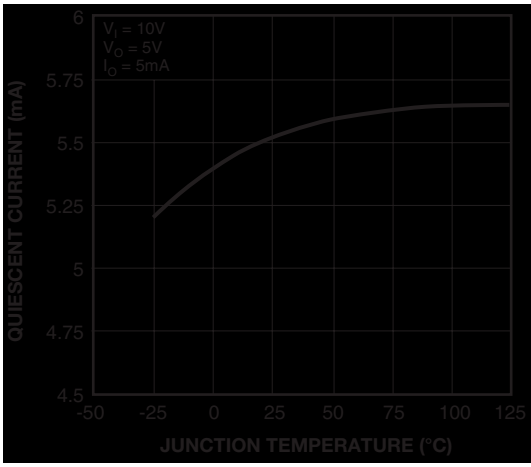


Figure 3. Quiescent Current

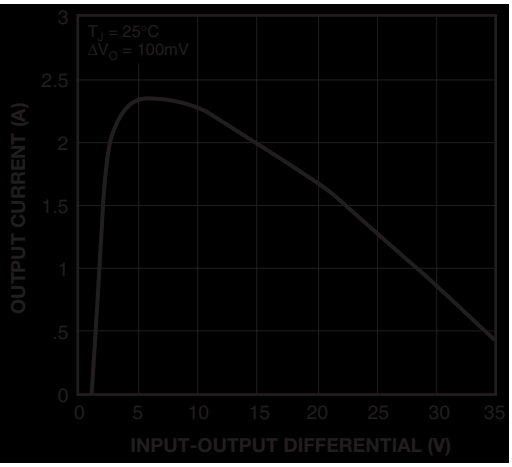


Figure 4. Peak Output Current

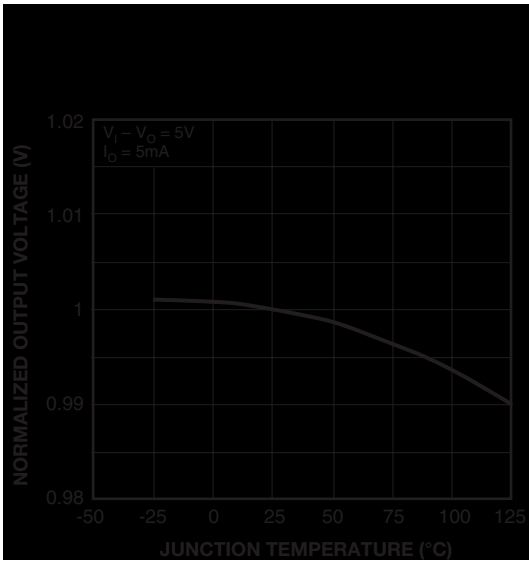


Figure 5. Output Voltage

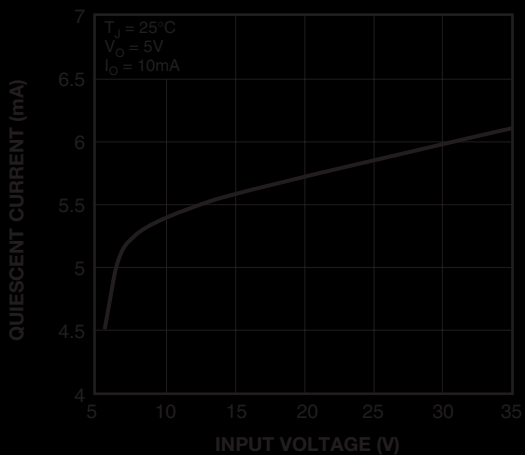


Figure 6. Quiescent Current

Typical Applications

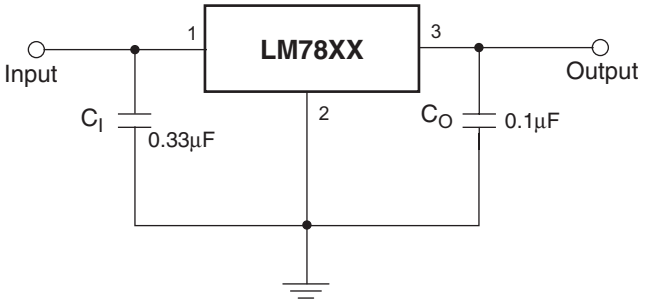


Figure 7. DC Parameters

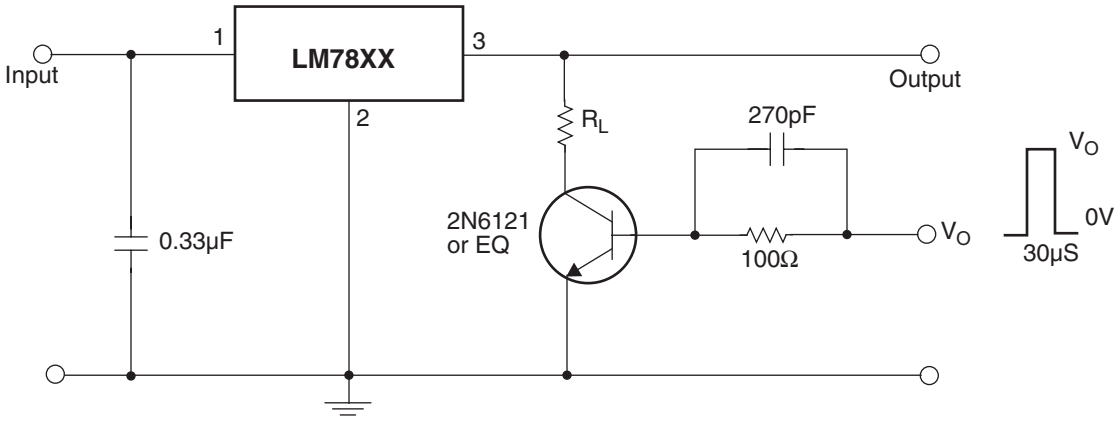


Figure 8. Load Regulation

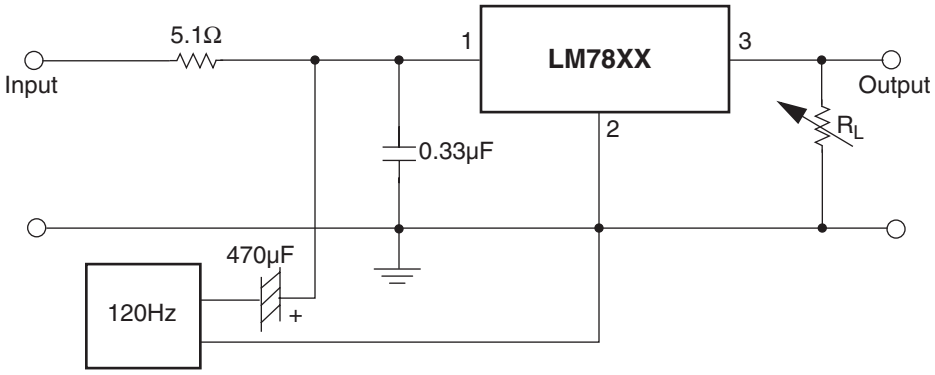


Figure 9. Ripple Rejection

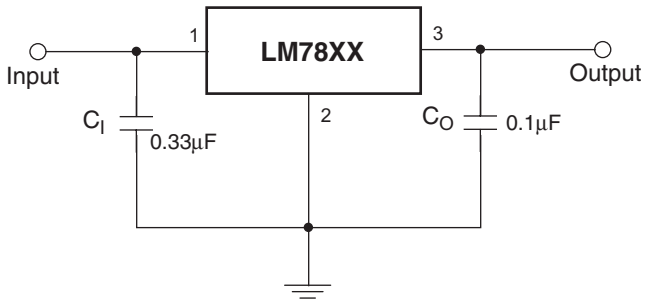
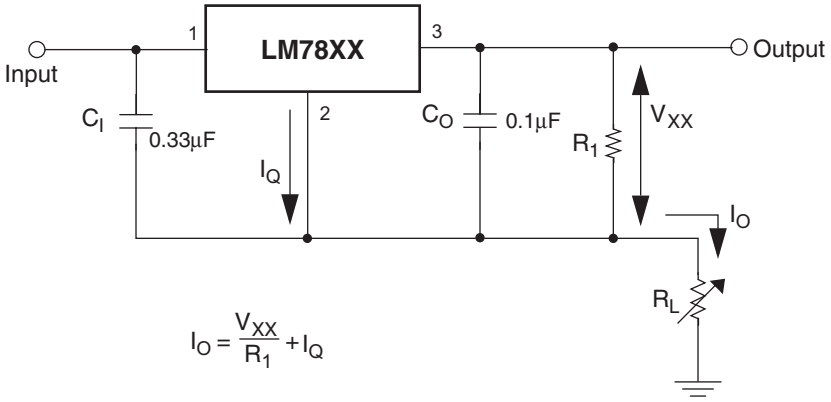


Figure 10. Fixed Output Regulator



Notes:

1. To specify an output voltage, substitute voltage value for "XX." A common ground is required between the input and the output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.
2. C_I is required if regulator is located an appreciable distance from power supply filter.
3. C_O improves stability and transient response.

Figure 11.

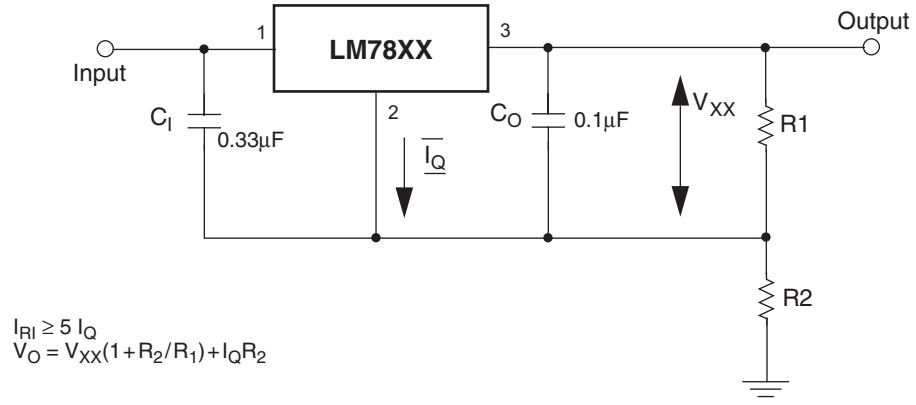


Figure 12. Circuit for Increasing Output Voltage

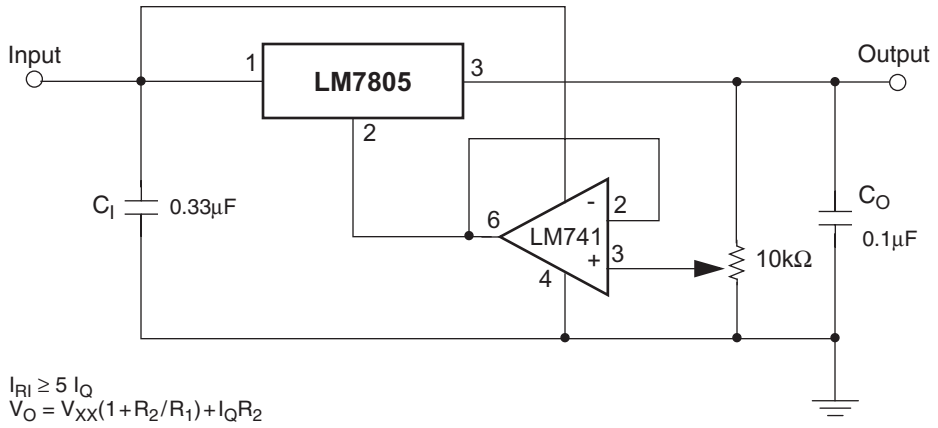


Figure 13. Adjustable Output Regulator (7V to 30V)

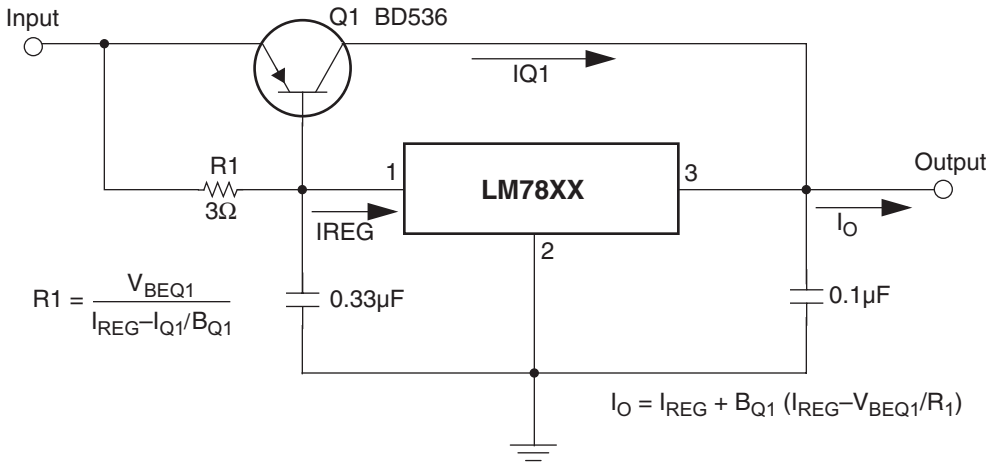


Figure 14. High Current Voltage Regulator

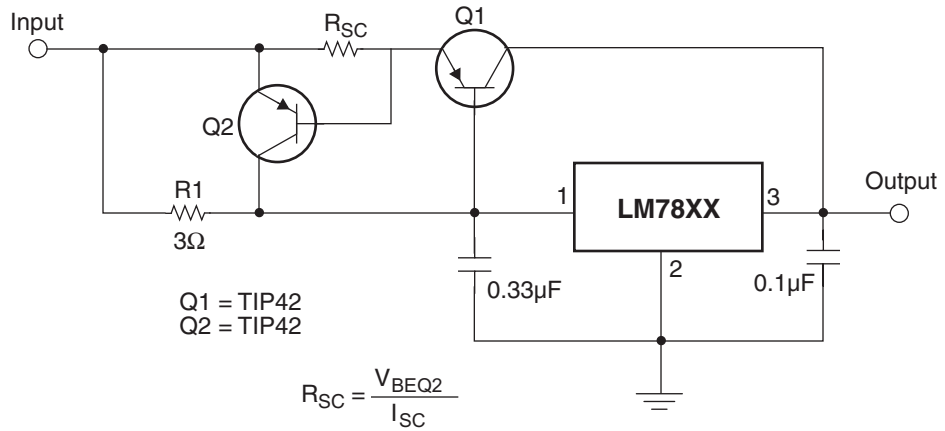


Figure 15. High Output Current with Short Circuit Protection

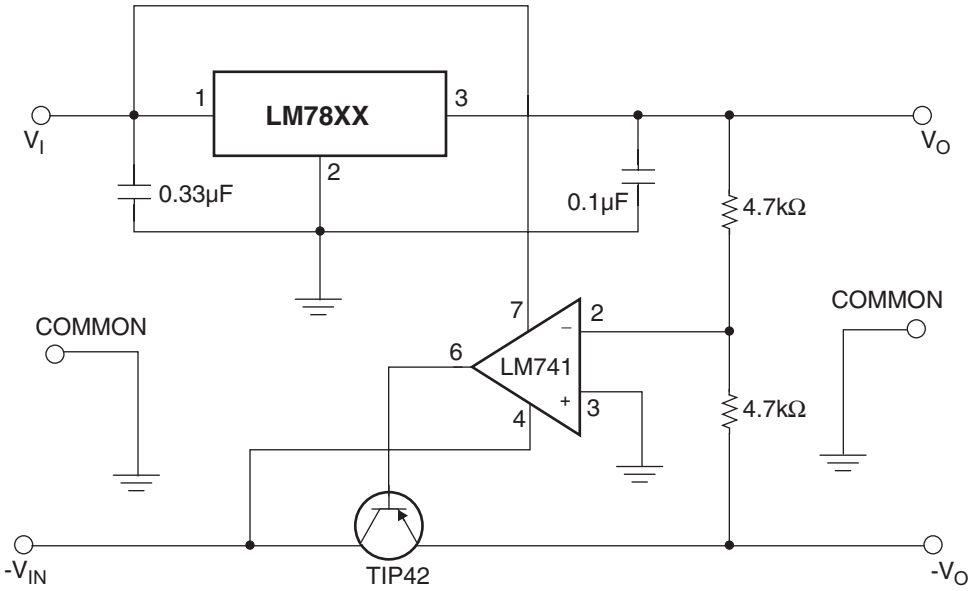


Figure 16. Tracking Voltage Regulator

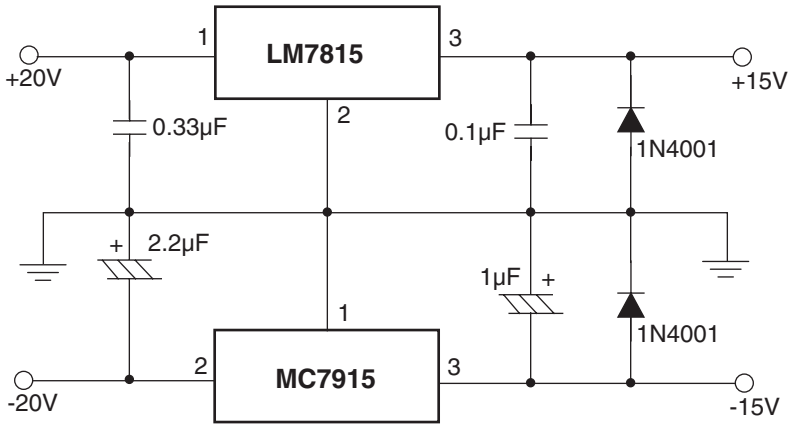


Figure 17. Split Power Supply (±15V – 1A)

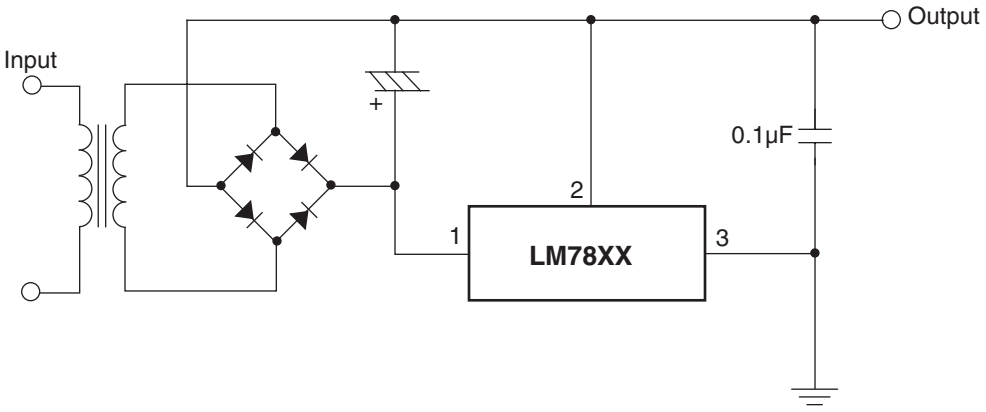


Figure 18. Negative Output Voltage Circuit

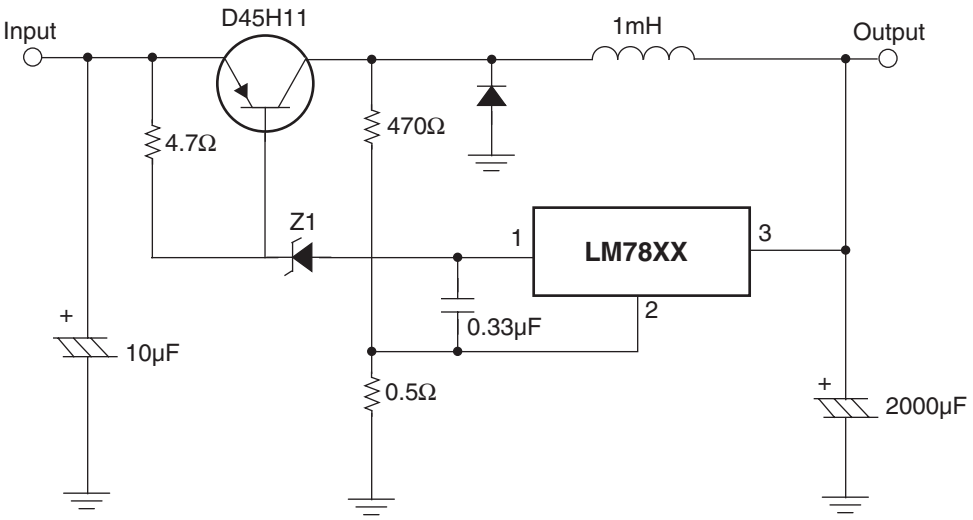
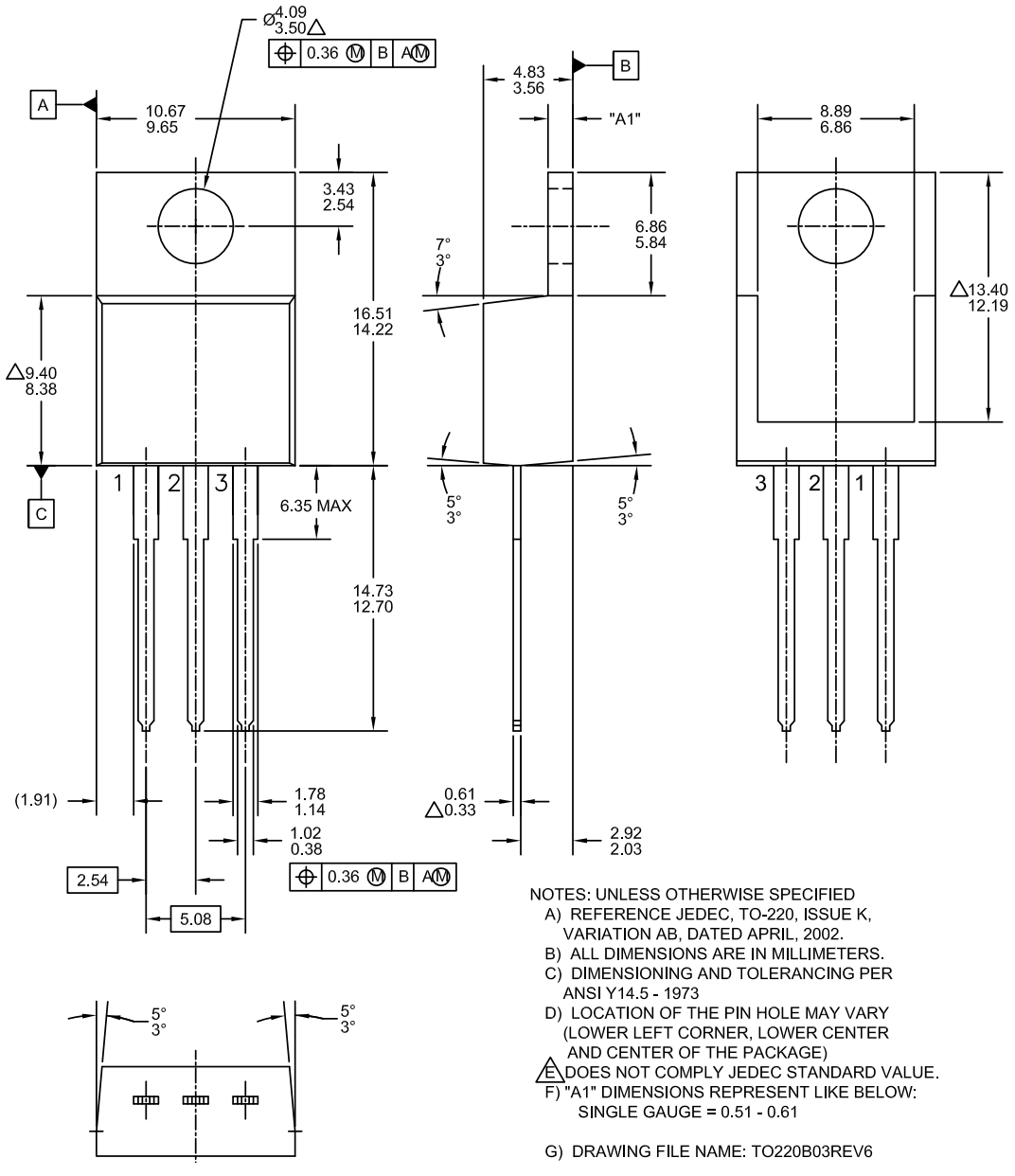


Figure 19. Switching Regulator

Mechanical Dimensions

Dimensions in millimeters

TO-220 [SINGLE GAUGE]



NOTES: UNLESS OTHERWISE SPECIFIED

A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973

D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)

△E DOES NOT COMPLY JEDEC STANDARD VALUE.

F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61

G) DRAWING FILE NAME: TO220B03REV6

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