April 1999
Revised October 2005

LM7805 • LM7806 • LM7808 • LM7809 • LM7810 • LM7812 • LM7815 • LM7818 • LM7824 • LM7805A • LM7806A • LM7808A •LM7809A • LM7810A • LM7812A • LM7815A • LM7818A • LM7824A

3-Terminal 1A Positive Voltage Regulator (Preliminary)

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.

Features

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

Ordering Code:

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

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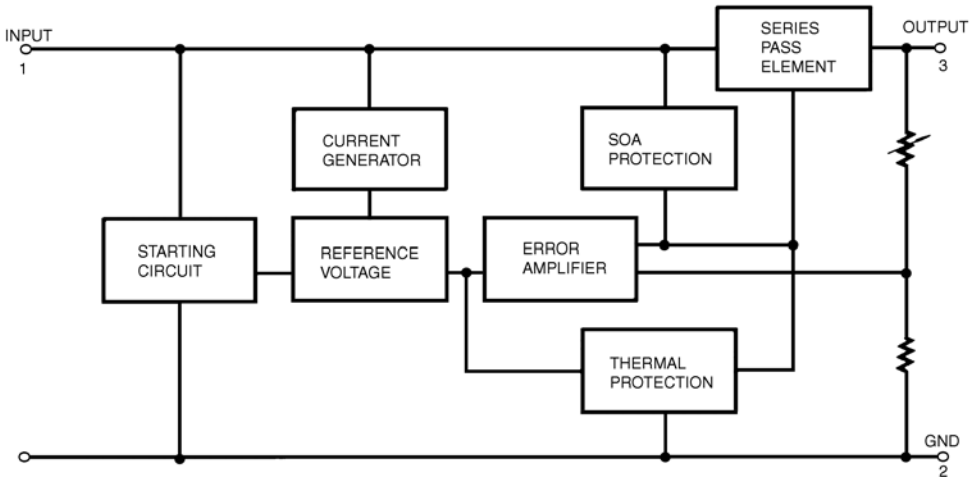
TO-220

Internal Block Diagram



Absolute Maximum Ratings(Note 1)

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

Note 1: 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.

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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_O = 7V to 25V	–	4.0	100	mV
(Note 2)			V_I = 8V to 12V	–	1.6	50.0	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	9.0	100	mV
			I_O = 250mA to 750mA	–	4.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	0.03	0.5	mA
		V_I = 7V to 25V		–	0.3	1.3	
Output Voltage Drift (Note 3)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−0.8	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	42.0	–	μV/V_O
Ripple Rejection (Note 3)	RR	f = 120Hz, V_O = 8V to 18V		62.0	73.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 3)	rO	f = 1KHz		–	15.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	230	–	mA
Peak Current (Note 3)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 2: 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.

Note 3: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7806)

(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)

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

Note 4: 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.

Note 5: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7808)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 10.5V to 25V	–	5.0	160	mV
(Note 6)			V_I = 11.5V to 17V	–	2.0	80.0	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	10.0	160	mV
(Note 6)			I_O = 250mA to 750mA	–	5.0	80.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	0.05	0.5	mA
		V_I = 10.5V to 25V		–	0.5	1.0	
Output Voltage Drift (Note 7)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−0.8	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	52.0	–	μV/V_O
Ripple Rejection (Note 7)	RR	f = 120Hz, V_O = 11.5V to 21.5V		56.0	73.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 7)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	230	–	mA
Peak Current (Note 7)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 6: 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.

Note 7: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7809)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 11.5V to 25V	–	6.0	180	mV
(Note 8)			V_I = 12V to 17V	–	2.0	90.0	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	12.0	180	mV
(Note 8)			I_O = 250mA to 750mA	–	4.0	90.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 11.5V to 26V		–	–	1.3	
Output Voltage Drift (Note 9)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	58.0	–	μV/V_O
Ripple Rejection (Note 9)	RR	f = 120Hz, V_O = 13V to 23V		56.0	71.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 9)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 9)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 8: 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.

Note 9: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7810)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 12.5V to 25V	–	10.0	200	mV
(Note 10)			V_I = 13V to 25V	–	3.0	100	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	12.0	200	mV
(Note 10)			I_O = 250mA to 750mA	–	4.0	400	
Quiescent Current	I_Q	T_J = +25°C		–	5.1	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 12.5V to 29V		–	–	1.0	
Output Voltage Drift (Note 11)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	58.0	–	μV/V_O
Ripple Rejection (Note 11)	RR	f = 120Hz, V_O = 13V to 23V		56.0	71.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 11)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 11)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 10: 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.

Note 11: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7812)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 14.5V to 30V	–	10.0	240	mV
(Note 12)			V_I = 16V to 22V	–	3.0	120	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	11.0	240	mV
(Note 12)			I_O = 250mA to 750mA	–	5.0	120	
Quiescent Current	I_Q	T_J = +25°C		–	5.1	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	0.1	0.5	mA
		V_I = 14.5V to 30V		–	0.5	1.0	
Output Voltage Drift (Note 13)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	76.0	–	μV/V_O
Ripple Rejection (Note 13)	RR	f = 120Hz, V_I = 15V to 25V		55.0	71.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 13)	rO	f = 1KHz		–	18.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	230	–	mA
Peak Current (Note 13)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 12: 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.

Note 13: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7815)

(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)

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

Note 14: 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.

Note 15: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7818)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 21V to 33V	–	15.0	360	mV
(Note 12)			V_I = 24V to 30V	–	5.0	180	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	15.0	360	mV
(Note 12)			I_O = 250mA to 750mA	–	5.0	180	
Quiescent Current	I_Q	T_J = +25°C		–	5.2	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	–	0.5	mA
		V_I = 21V to 33V		–	–	1.0	
Output Voltage Drift (Note 17)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	110	–	μV/V_O
Ripple Rejection (Note 17)	RR	f = 120Hz, V_I = 22V to 32V		53.0	69.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 17)	rO	f = 1KHz		–	22.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 17)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 16: 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.

Note 17: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7824)

(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)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	T_J = +25°C	V_I = 27V to 38V	–	17.0	480	mV
(Note 18)			V_I = 30V to 36V	–	6.0	240	
Load Regulation	Regload	T_J = +25°C	I_O = 5mA to 1.5mA	–	15.0	480	mV
(Note 18)			I_O = 250mA to 750mA	–	5.0	240	
Quiescent Current	I_Q	T_J = +25°C		–	5.2	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1A		–	0.1	0.5	mA
		V_I = 27V to 38V		–	0.5	1.0	
Output Voltage Drift (Note 19)	$\Delta V_O/\Delta T$	I_O = 5mA		–	−1.5	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	60.0	–	μV/V_O
Ripple Rejection (Note 19)	RR	f = 120Hz, V_I = 28V to 38V		50.0	67.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 19)	rO	f = 1KHz		–	28.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	230	–	mA
Peak Current (Note 19)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 18: 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.

Note 19: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7805A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 7.5V to 25V, I_O = 500mA		–	5.0	50.0	mV
(Note 20)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	9.0	100	mV
(Note 20)		I_O = 5mA to 1mA		–	9.0	100	
		I_O = 250mA to 750mA		–	4.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 21)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–0.8	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	µV/V_O
Ripple Rejection (Note 21)	RR	f = 120Hz, I_O = 500mA, V_I = 8V to 18V		–	68.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 21)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 21)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 20: 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.

Note 21: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7806A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 8.6V to 25V, I_O = 500mA		–	5.0	60.0	mV
(Note 22)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	9.0	100	mV
(Note 22)		I_O = 5mA to 1mA		–	4.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	4.3	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 23)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–0.8	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	µV/V_O
Ripple Rejection (Note 23)	RR	f = 120Hz, I_O = 500mA, V_I = 9V to 19V		–	65.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 23)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 23)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 22: 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.

Note 23: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7808A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 10.6V to 25V, I_O = 500mA		–	6.0	80.0	mV
(Note 24)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	12.0	100	mV
(Note 24)		I_O = 5mA to 1mA		–	12.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 25)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–0.8	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 25)	RR	f = 120Hz, I_O = 500mA, V_I = 11.5V to 21.5V		–	62.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 25)	rO	f = 1KHz		–	18.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 25)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 24: 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.

Note 25: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7809A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 11.7V to 25V, I_O = 500mA		–	6.0	90.0	mV
(Note 26)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.0mA		–	12.0	100	mV
(Note 26)		I_O = 5mA to 1mA		–	12.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 27)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 27)	RR	f = 120Hz, I_O = 500mA, V_I = 12V to 22V		–	62.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 27)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 27)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 26: 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.

Note 27: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7810A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 12.8V to 26V, I_O = 500mA		–	8.0	100	mV
(Note 28)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	12.0	100	mV
(Note 28)		I_O = 5mA to 1mA		–	12.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.0	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 29)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 29)	RR	f = 120Hz, I_O = 500mA, V_I = 14V to 24V		–	62.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 29)	rO	f = 1KHz		–	17.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 29)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 28: 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.

Note 29: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7812A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 14.8V to 30V, I_O = 500mA		–	10.0	120	mV
(Note 30)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	12.0	100	mV
(Note 30)		I_O = 5mA to 1mA		–	12.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.1	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 31)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 31)	RR	f = 120Hz, I_O = 500mA, V_I = 14V to 24V		–	60.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 31)	rO	f = 1KHz		–	18.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 31)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 30: 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.

Note 31: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7815A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 17.4V to 30V, I_O = 500mA		–	10.0	150	mV
(Note 32)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	12.0	100	mV
(Note 32)		I_O = 5mA to 1mA		–	12.0	100	
		I_O = 250mA to 750mA		–	5.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.2	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 33)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	µV/V_O
Ripple Rejection (Note 33)	RR	f = 120Hz, I_O = 500mA, V_I = 18.5V to 28.5V		–	58.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 33)	rO	f = 1KHz		–	19.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 33)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 32: 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.

Note 33: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7818A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 21V to 33V, I_O = 500mA		–	15.0	180	mV
(Note 34)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	15.0	100	mV
(Note 34)		I_O = 5mA to 1mA		–	15.0	100	
		I_O = 250mA to 750mA		–	7.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.2	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 35)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.0	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 35)	RR	f = 120Hz, I_O = 500mA, V_I = 22V to 32V		–	57.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 35)	rO	f = 1KHz		–	19.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 35)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 34: 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.

Note 35: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (LM7824A)

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

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Output Voltage	V_O	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	
Line Regulation	Regline	V_I = 27V to 38V, I_O = 500mA		–	18.0	240	mV
(Note 36)		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	
Load Regulation	Regload	T_J = +25°C, I_O = 5mA to 1.5mA		–	15.0	100	mV
(Note 36)		I_O = 5mA to 1mA		–	15.0	100	
		I_O = 250mA to 750mA		–	7.0	50.0	
Quiescent Current	I_Q	T_J = +25°C		–	5.2	6.0	mA
Quiescent Current Change	ΔI_Q	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	
Output Voltage Drift (Note 37)	$\Delta V_O/\Delta T$	I_O = 5mA		–	–1.5	–	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A = +25°C		–	10.0	–	$\mu V/V_O$
Ripple Rejection (Note 37)	RR	f = 120Hz, I_O = 500mA, V_I = 28V to 38V		–	54.0	–	dB
Dropout Voltage	V_{DROP}	I_O = 1A, T_J = +25°C		–	2.0	–	V
Output Resistance (Note 37)	rO	f = 1KHz		–	20.0	–	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A = +25°C		–	250	–	mA
Peak Current (Note 37)	I_{PK}	T_J =+25°C		–	2.2	–	A

Note 36: 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.

Note 37: These parameters, although guaranteed, are not 100% tested in production.

Typical Performance Characteristics

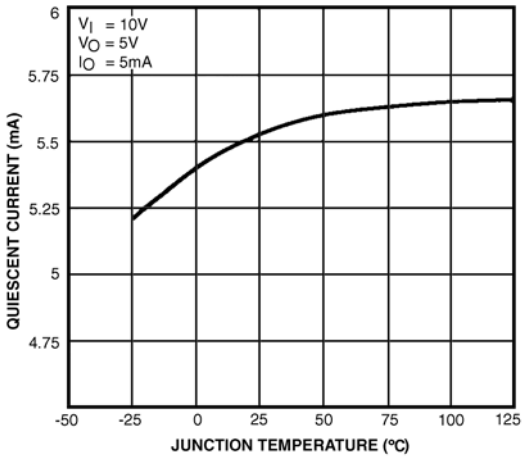


FIGURE 1. Quiescent Current

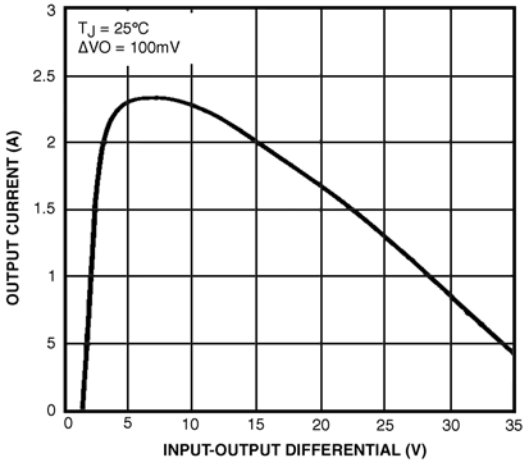


FIGURE 2. Peak Output Current

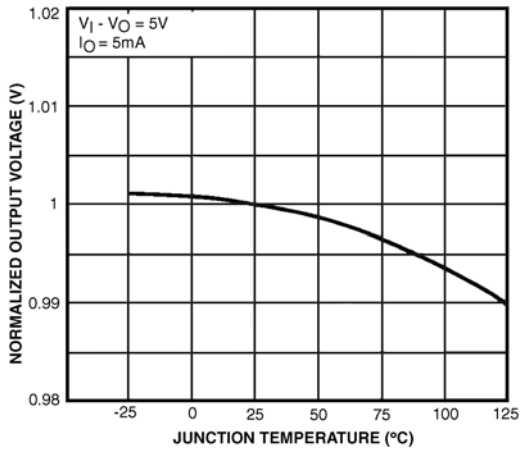


FIGURE 3. Output Voltage

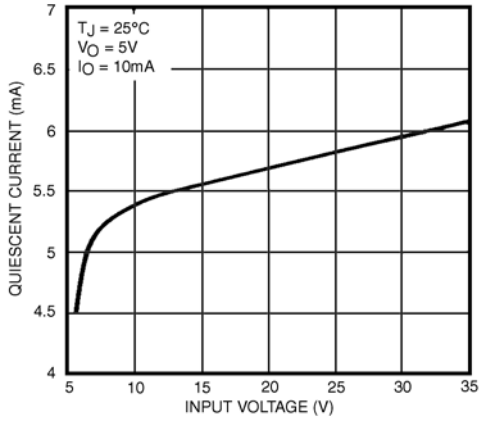


FIGURE 4. Quiescent Current

Typical Applications

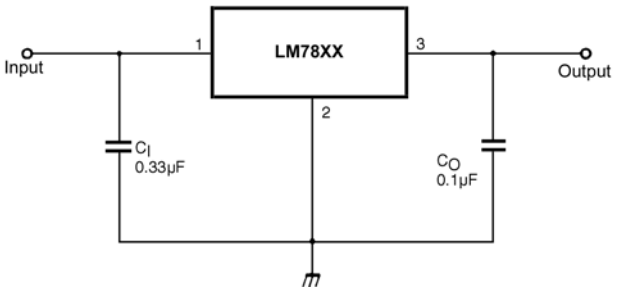


FIGURE 5. DC Parameters

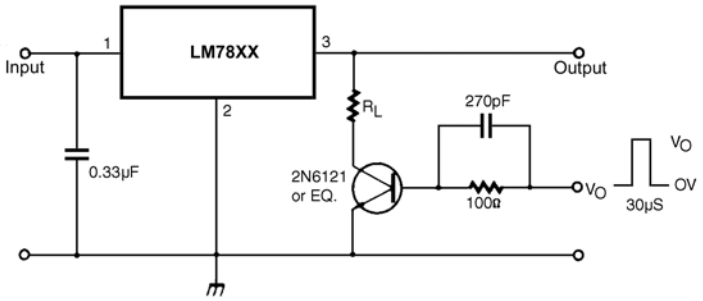


FIGURE 6. Load Regulation

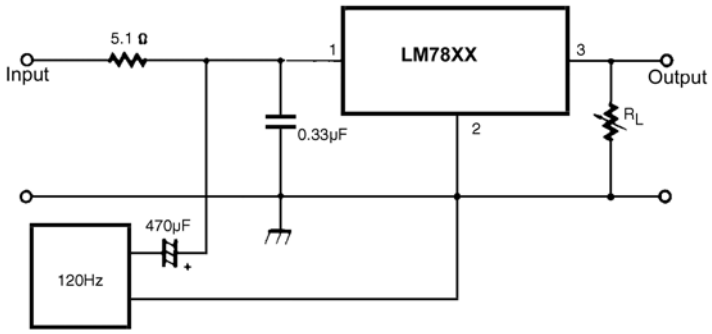


FIGURE 7. Ripple Rejection

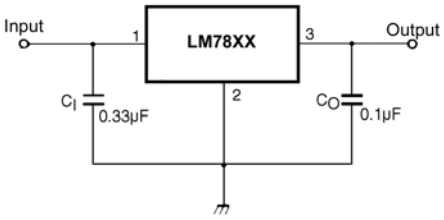
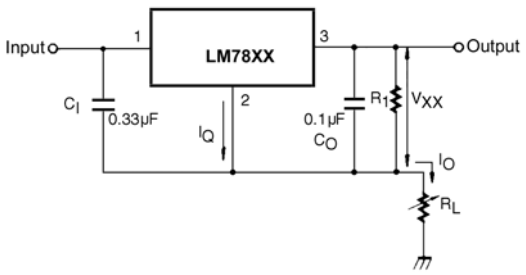


FIGURE 8. Fixed Output Regulator

Typical Applications (continued)



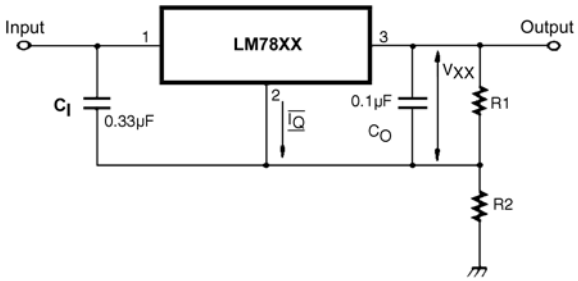
$$I_O = \frac{V_{XX}}{R_1} + I_Q$$

FIGURE 9.

Note: 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.

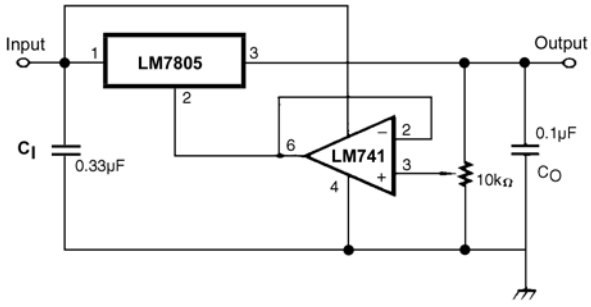
Note: C_I is required if regulator is located an appreciable distance from the power supply filter.

Note: C_O improves stability and transient response.



$$I_{RI} \geq 5\, I_Q$$
$$V_O = V_{XX}\,(1\, R_2 / R_1) + I_Q\, R_2$$

FIGURE 10. Circuit for Increasing Output Voltage



$$I_{RI} \geq 5\, I_Q$$
$$V_O = V_{XX}\,(1\, R_2 / R_1) + I_Q\, R_2$$

FIGURE 11. Adjustable Output Regulator (7V to 30V)

Typical Applications (continued)

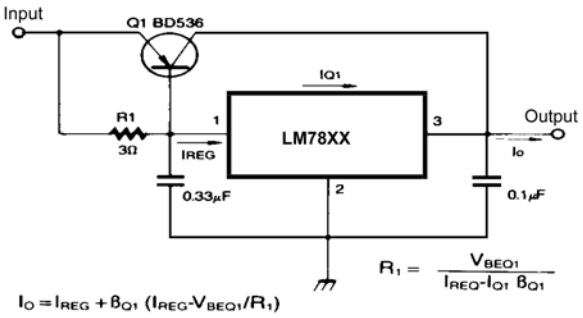


FIGURE 12. High Current Voltage Regulator

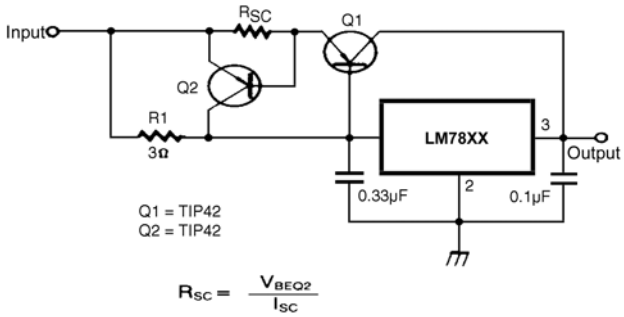


FIGURE 13. High Output Current with Short Circuit Protection

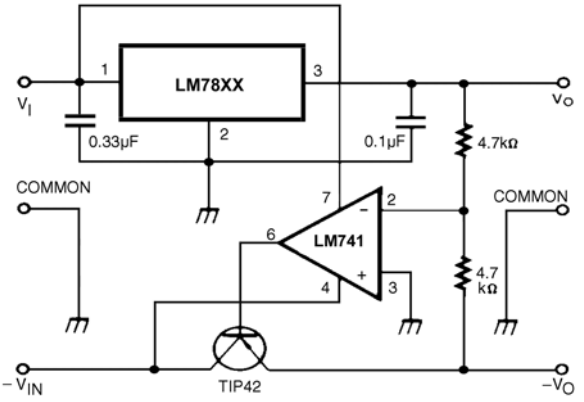


FIGURE 14. Tracking Voltage Regulator

Typical Applications (continued)

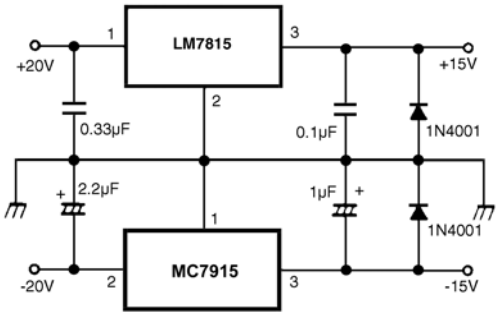


FIGURE 15. Split Power Supply (±15V - 1A)

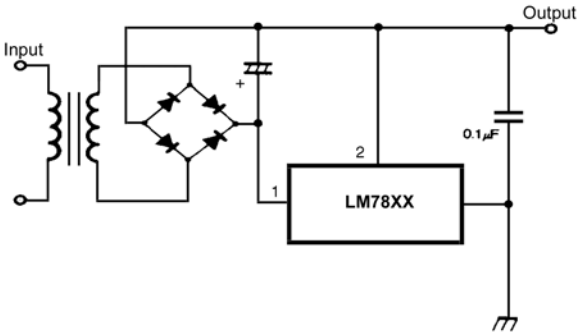


FIGURE 16. Negative Output Voltage Circuit

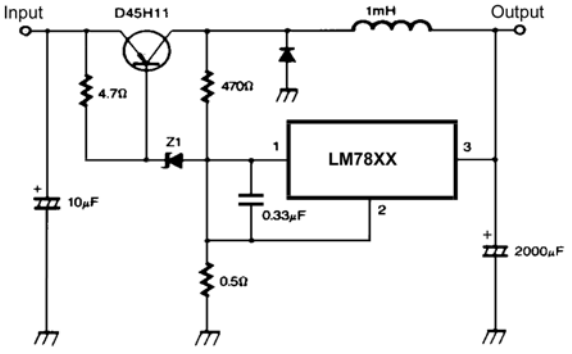
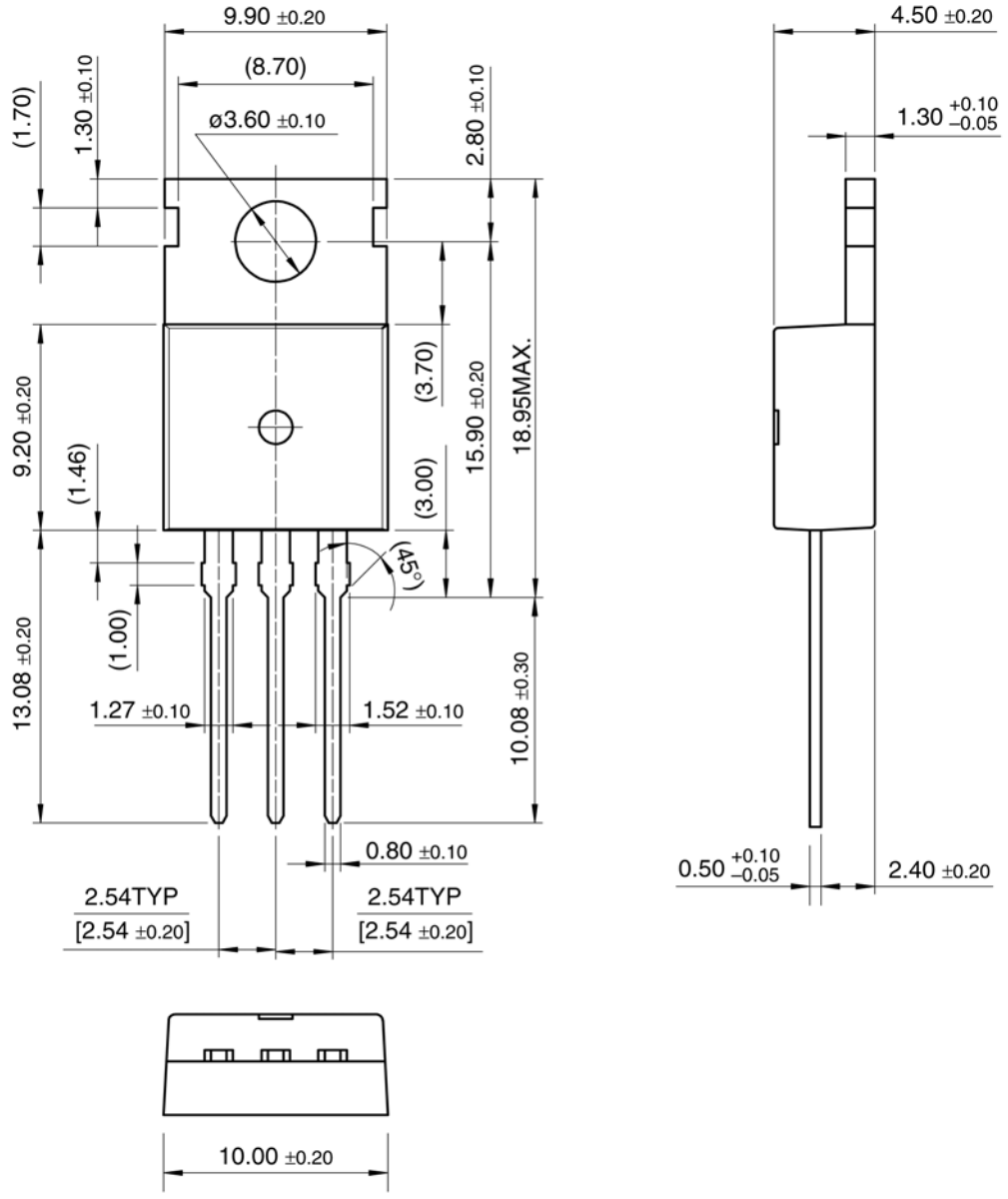


FIGURE 17. Switching Regulator

Physical Dimensions inches (millimeters) unless otherwise noted

TO-220



Package Number TO-220

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