

7810

DATASHEET

Specification Revision History:

Version	Date	Description
V1.0	2019/12	New
V1.1	2021/10	Modify Ordering Information
V1.2	2025/02	Modify Ordering Information
V1.3	2025/03	Add application precautions and overall typesetting.

General Description

The 78XX series of three-terminal positive regulator are available in the TO 220-3/TO 252-2 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 1 . 5 A output current . Although designed primarily as fixed voltage regulators , these devices can be used with external components to obtain adjustable voltage s and currents .

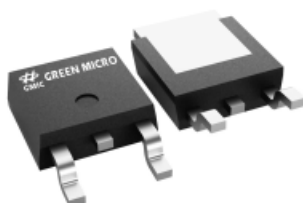
FEATURES

- Output Current up to 1 . 5 A
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection
- Output Voltages: 7805: 5V 7806: 6 V 7808: 8 V
 7809: 9V 7810: 10V 7812: 12V 7815: 15V

The appearance of the product



TO-220



TO-252

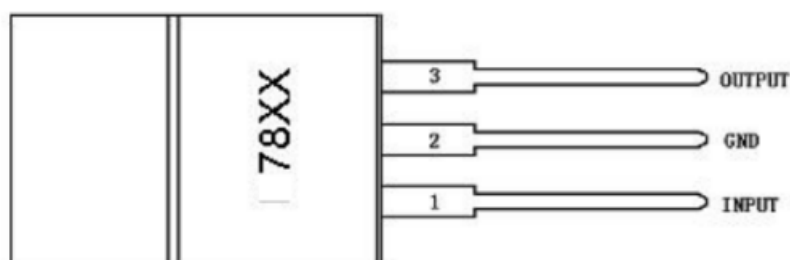


TO-263

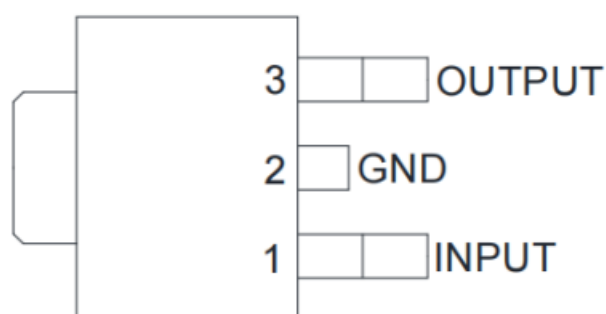
Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
L7810CT(GMIC)	TO-263-2	L7810 268	编带	1000只/盘
L7810CV(GMIC)	TO-220	L7810 268	管装	1000只/盒
78M10(GMIC)	TO-252	78M10 268	编带	2500只/盘
L7810(GMIC)	TO-263-2	L7810 68	编带	1000只/盘
L7810(GMIC)	TO-220	L7810 68	管装	1000只/盒
78M10(GMIC)	TO-252	78M10 68	编带	2500只/盘

2、Pin Configurations

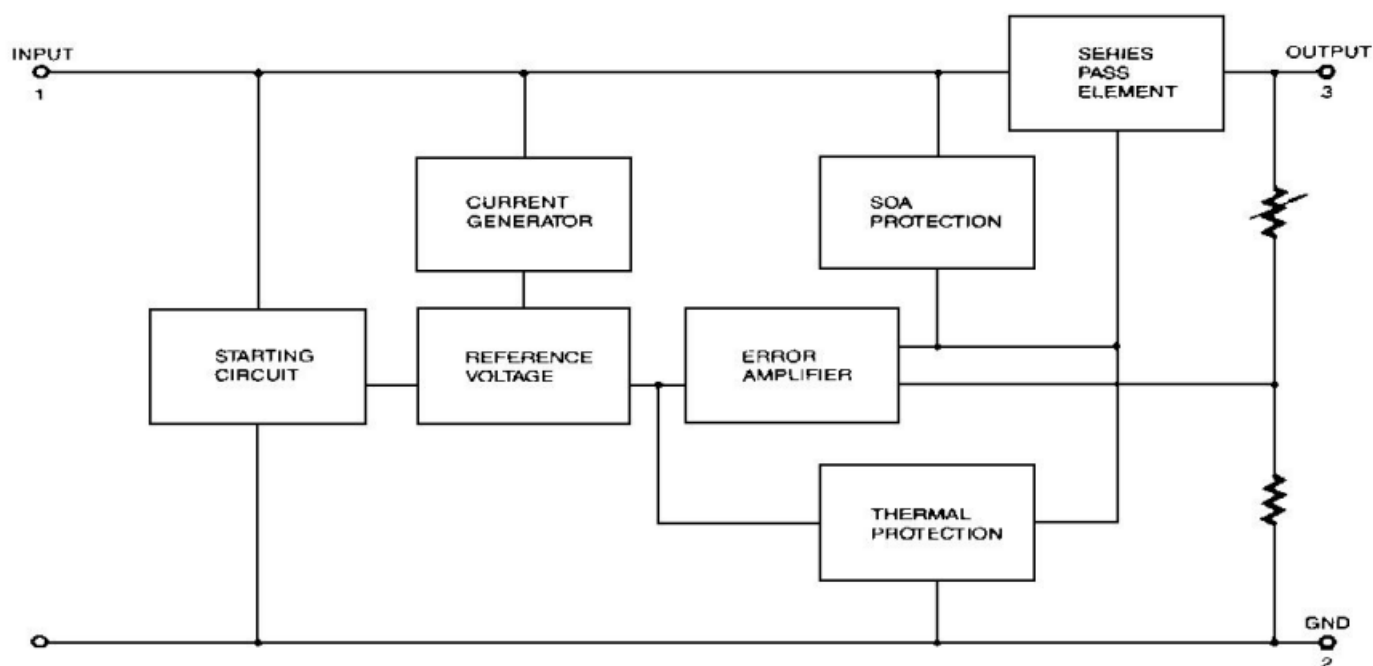


78XX(TO220-3)



78XX (TO252-2)

Block Diagram



Absolute Maximum Ratings (Ta=25 °C)

Characteristics	Symbol	Value	Units
Input Voltage	V_i	35	V
Thermal Resistance Junction-Case	$R_{\theta_{JC}}$	(TO220-3)5	°C/W
		(TO252-2)12	
Thermal Resistance Junction-Air	$R_{\theta_{JA}}$	(TO220-3)65	°C/W
		(TO252-2)112	
Operating Temperature Range	T_{OPR}	-40 ~ +125	°C
Storage Temperature Range	T_{STG}	-55 ~ +150	°C

7805 Electrical Characteristics

(Refer to the test circuit, $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o=500\text{mA}$, $V_i=10\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$	4.8	5.0	5.2	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 7\text{V to } 20\text{V}$	4.75	5.0	5.25	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$		4.0	100	mV
		$V_i = 7\text{V to } 25\text{V}$ $V_i = 8\text{V to } 12\text{V}$		1.6	50	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$		15	100	mV
		$I_o = 5.0\text{mA to } 1.5\text{A}$ $I_o = 250\text{mA to } 750\text{mA}$		4	50	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$		5.0	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$		0.03	0.5	mA
		$V_i = 7\text{V to } 25\text{V}$		0.3	1.3	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$		-0.8		mV/°C
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$		42		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$ $V_i = 8\text{V to } 18\text{V}$	62	73		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$		2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$		230		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$		2.2		A

*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.

7806 Electrical Characteristics

(Refer to the test circuit , $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o=500\text{mA}$, $V_i=11\text{V}$, $C_i=0.33\mu\text{F}$, $C_o=0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		5.75	6.0	6.25	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 8\text{V to } 21\text{V}$		5.7	6.0	6.3	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 8\text{V to } 25\text{V}$		5.0	120	mV
			$V_i = 9\text{V to } 13\text{V}$		1.5	60	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		9	120	mV
			$I_o = 250\text{mA to } 750\text{mA}$		3	60	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$				0.5	mA
		$V_i = 8\text{V to } 25\text{V}$				1.3	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			45		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$	$V_i = 9\text{V to } 19\text{V}$	59	75		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			250		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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.

7808 Electrical Characteristics

(Refer to the test circuit , $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o = 500\text{mA}$, $V_i = 14\text{V}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		7.7	8.0	8.3	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 10.5\text{V to } 23\text{V}$		7.6	8.0	8.4	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 10.5\text{V to } 25\text{V}$		5.0	160	mV
			$V_i = 11.5\text{V to } 17\text{V}$		2.0	80	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		10	160	mV
			$I_o = 250\text{mA to } 750\text{mA}$		5.0	80	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$			0.05	0.5	mA
		$V_i = 10.5\text{V to } 25\text{V}$			0.5	1.0	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			52		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$	$V_i = 11.5\text{V to } 21.5\text{V}$	56	73		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			230		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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.

7809 Electrical Characteristics

(Refer to the test circuit , $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o = 500\text{mA}$, $V_i = 15\text{V}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		8.68	9.0	9.32	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 11.5\text{V to } 26\text{V}$		8.55	9.0	9.45	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 11.5\text{V to } 26\text{V}$		5.0	150	mV
			$V_i = 12.5\text{V to } 18\text{V}$		2.0	80	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		10	160	mV
			$I_o = 250\text{mA to } 750\text{mA}$		5.0	80	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$			0.05	0.5	mA
		$V_i = 11.5\text{V to } 26\text{V}$			0.5	1.0	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			52		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$	$V_i = 11.5\text{V to } 21.5\text{V}$	56	73		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			230		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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 .

7810 Electrical Characteristics

(Refer to the test circuit , $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o = 500\text{mA}$, $V_i = 17\text{V}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		9.6	10	10.4	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 11.5\text{V to } 26\text{V}$		9.5	10	10.5	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 12.5\text{V to } 26\text{V}$		5.0	150	mV
			$V_i = 13.5\text{V to } 18\text{V}$		2.0	80	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		10	160	mV
			$I_o = 250\text{mA to } 750\text{mA}$		5.0	80	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.0	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$			0.05	0.5	mA
		$V_i = 12.5\text{V to } 26\text{V}$			0.5	1.0	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			52		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$	$V_i = 12.5\text{V to } 21.5\text{V}$	56	73		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			230		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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 .

7812 Electrical Characteristics

(Refer to the test circuit , $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o = 500\text{mA}$, $V_i = 19\text{V}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, unless otherwise specified)

Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		11.5	12	12.5	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 14.5\text{V to } 27\text{V}$		11.4	12	12.6	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 14.5\text{V to } 30\text{V}$		10	240	mV
			$V_i = 16\text{V to } 22\text{V}$		3.0	120	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		11	240	mV
			$I_o = 250\text{mA to } 750\text{mA}$		5.0	120	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.1	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$			0.1	0.5	mA
		$V_i = 14.5\text{V to } 30\text{V}$			0.5	1.0	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-1		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			76		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$	$V_i = 15\text{V to } 25\text{V}$	55	71		dB
Dropout Voltage	V_{Drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			230		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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 .

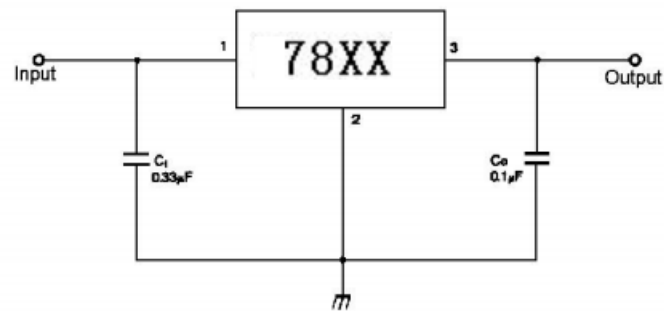
7815 Electrical Characteristics

(Refer to the test circuit, $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$, $I_o = 500\text{mA}$, $V_i = 23\text{V}$, $C_i = 0.33\mu\text{F}$, $C_o = 0.1\mu\text{F}$, unless otherwise specified)

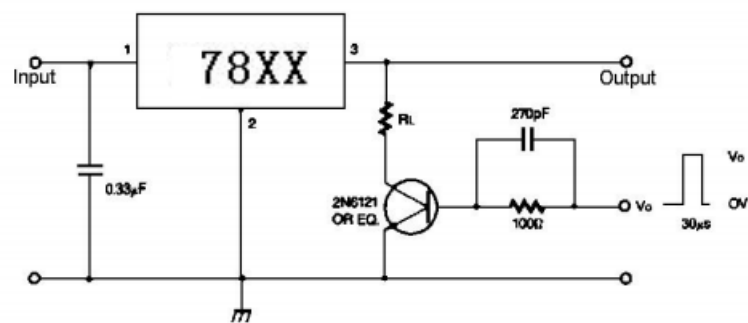
Characteristics	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_o	$T_J = +25^{\circ}\text{C}$		14.4	15	15.6	V
		$5.0\text{mA} \leq I_o \leq 1.0\text{A}$, $P_o \leq 15\text{W}$ $V_i = 17.5\text{V to } 30\text{V}$		14.25	15	15.75	
Line Regulation *	Regline	$T_J = +25^{\circ}\text{C}$	$V_i = 17.5\text{V to } 30\text{V}$		11	300	mV
			$V_i = 20\text{V to } 26\text{V}$		3.0	150	
Load Regulation *	Regload	$T_J = +25^{\circ}\text{C}$	$I_o = 5.0\text{mA to } 1.5\text{A}$		12	300	mV
			$I_o = 250\text{mA to } 750\text{mA}$		4.0	150	
Quiescent Current	I_Q	$T_J = +25^{\circ}\text{C}$			5.2	8.0	mA
Quiescent Current Change	ΔI_Q	$I_o = 5.0\text{mA to } 1.0\text{A}$				0.5	mA
		$V_i = 17.5\text{V to } 30\text{V}$				1.0	
Output Voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5.0\text{mA}$			-1		mV/ $^{\circ}\text{C}$
Output Noise Voltage	V_N	$f = 10\text{Hz to } 100\text{KHz}$, $T_A = +25^{\circ}\text{C}$			90		$\mu\text{V}/V_o$
Ripple Rejection	RR	$f = 120\text{Hz}$ $V_i = 18.5\text{V to } 28.5\text{V}$		54	70		dB
Dropout Voltage	V_{drop}	$I_o = 1\text{A}$, $T_J = +25^{\circ}\text{C}$			2		V
Short Circuit Current	I_{SC}	$V_i = 35\text{V}$, $T_A = +25^{\circ}\text{C}$			250		mA
Peak Current	I_{PK}	$T_J = +25^{\circ}\text{C}$			2.2		A

*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.

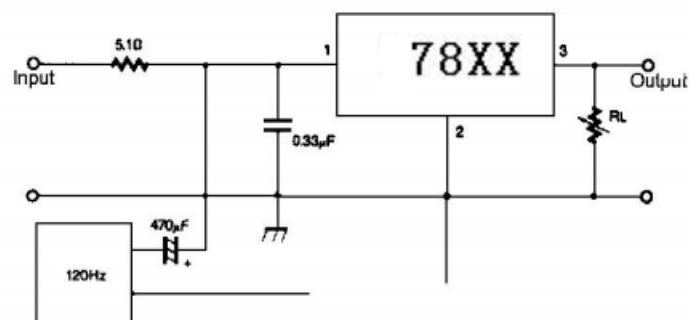
Application Circuit



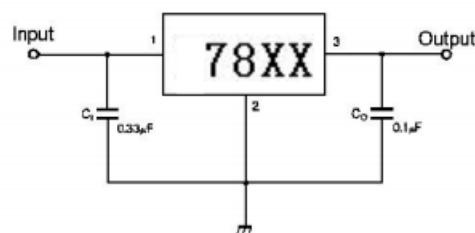
DC Parameters



Load Regulation



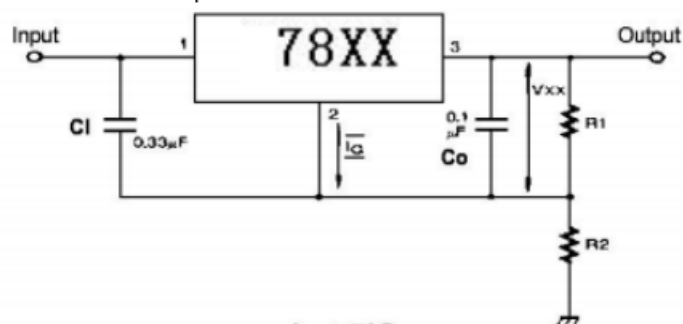
Ripple Rejection



Fixed Output Regulator

Notes:

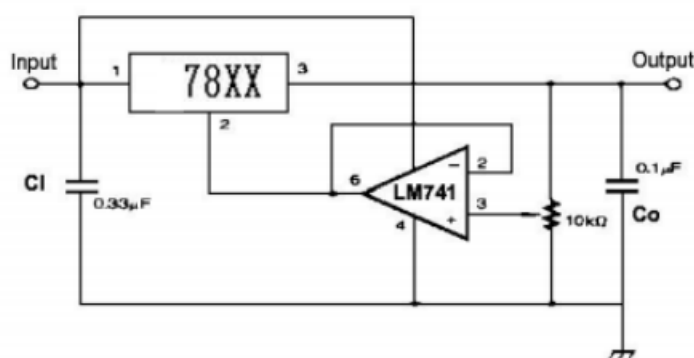
- (1) To specify an output voltage, substitute voltage value for "XX." A common ground is required between the input and the Output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.
- (2) C_i is required if regulator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



$$I_{R1} \geq 5I_Q$$

$$V_O = V_{XX}(1+R_2/R_1)+I_Q R_2$$

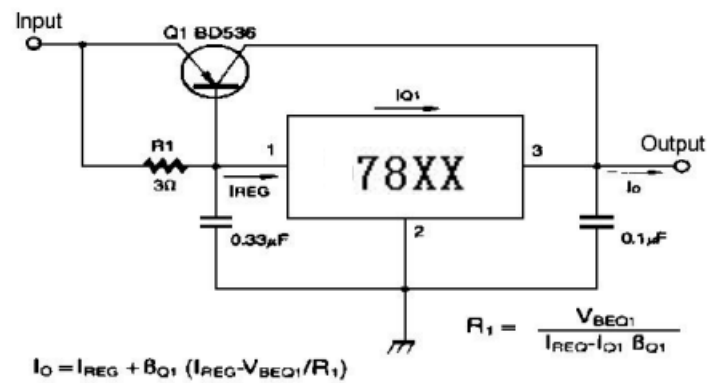
Circuit for Increasing Output Voltage



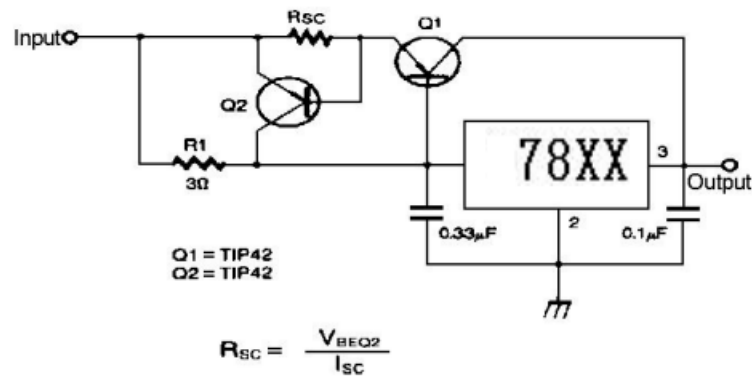
$$I_{R1} \geq 5I_Q$$

$$V_O = V_{XX}(1+R_2/R_1)+I_Q R_2$$

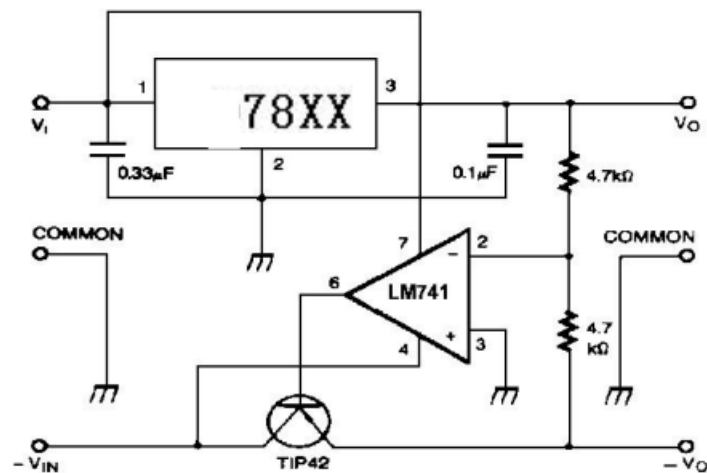
Adjustable Output Regulator (7 to 30V)



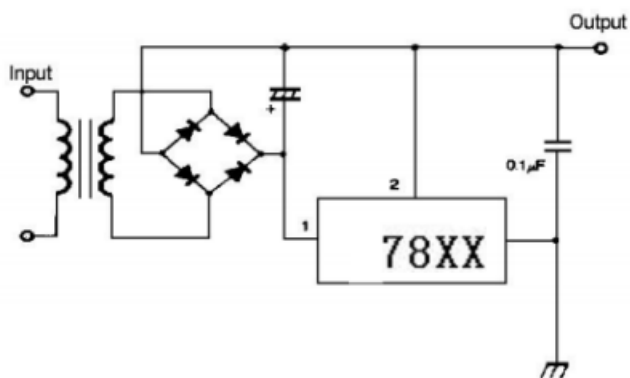
High Current Voltage Regulator



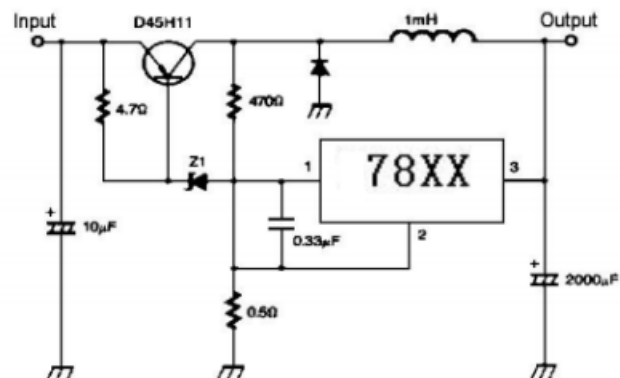
High Output Current with Short Circuit Protection



Tracking Voltage Regulator

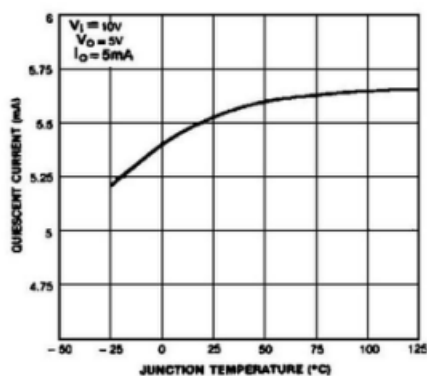


Negative Output Voltage Circuit

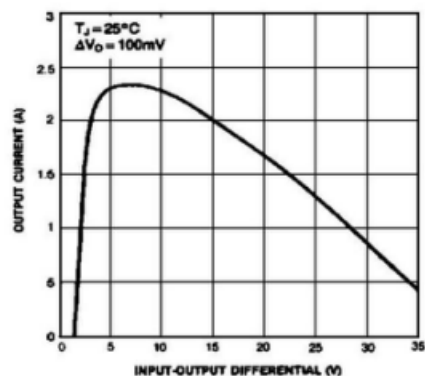


Switching Regulator

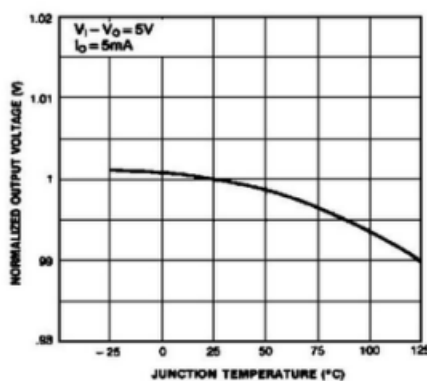
Characteristic Curves



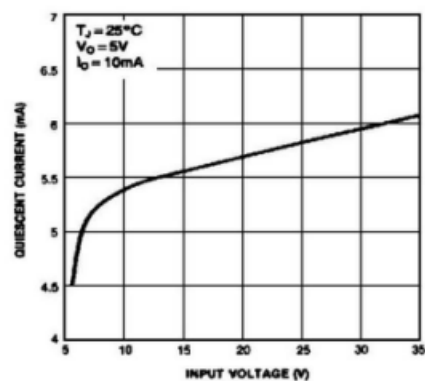
Quiescent Current



Peak Output Current



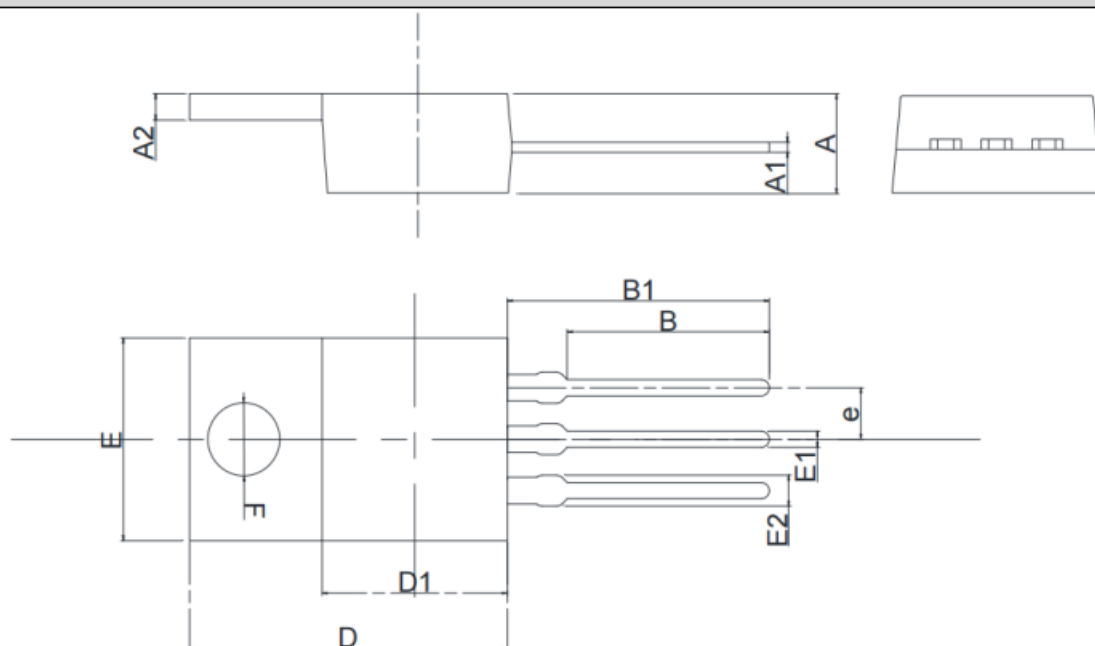
Output Voltage



Quiescent Current

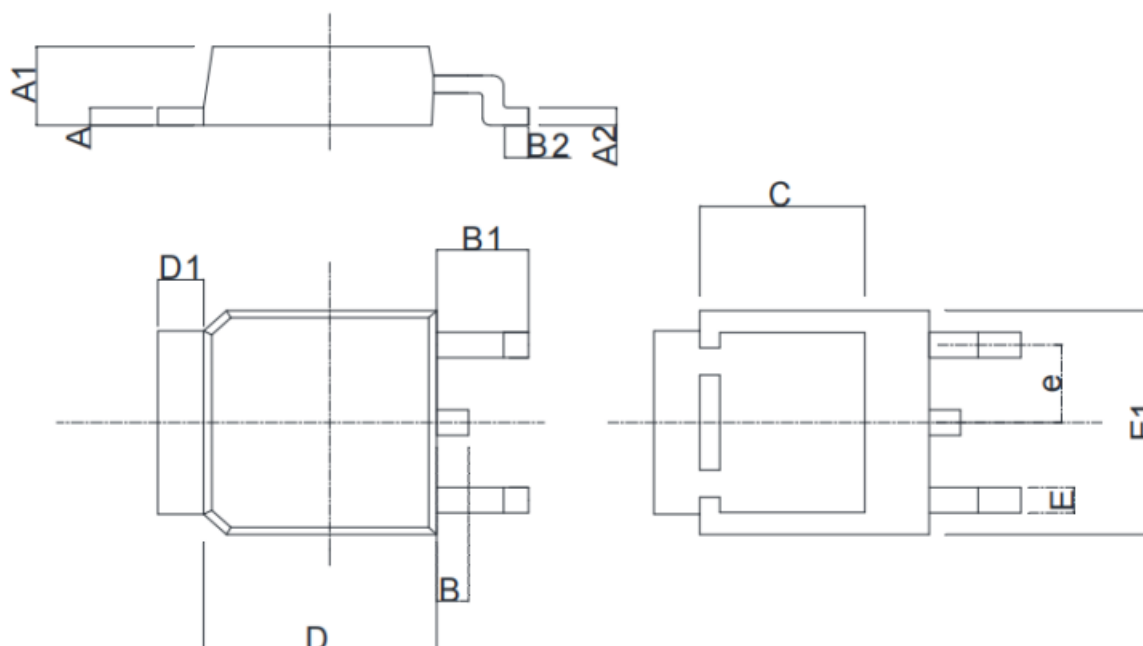
Outline Dimensions

TO220-3



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.300	4.800	0.169	0.189
A1	0.340	0.600	0.013	0.023
A2	1.220	1.400	0.047	0.055
B	9.460	10.380	0.372	0.408
B1	12.880	13.760	0.507	0.541
D	14.410	15.900	0.567	0.626
D1	8.000	9.000	0.314	0.354
E	9.700	10.400	0.381	0.409
E1	0.700	0.900	0.027	0.036
E2	1.220	1.400	0.048	0.055
e	2.540 (BSC)		0.984 (BSC)	
F	Φ3.800	Φ3.900	Φ0.149	Φ0.153

T0252-2



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.470	0.570	0.018	0.023
A1	2.220	2.380	0.087	0.094
A2	0.470	0.570	0.018	0.023
B	0.820	0.840	0.032	0.033
B1	2.380	2.480	0.093	0.098
B2	0.500	0.520	0.019	0.021
C	4.250	4.450	0.167	0.176
D	6.000	6.200	0.236	0.245
D1	1.150	1.250	0.045	0.050
E	0.650	0.850	0.025	0.034
E1	6.450	6.750	0.253	0.266
e	2.285 (BSC)		0.090 (BSC)	

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