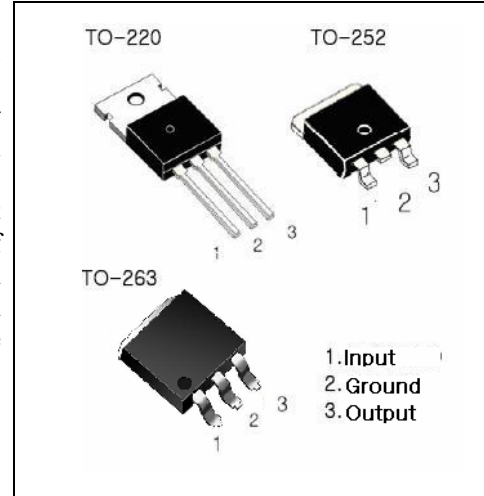


# POSITIVE VOLTAGE REGULATOR

## 3- TERMINAL 1A POSITIVE VOLTAGE REGULATORS

**IL78xx**

The IL78xx series of three-terminal positive regulators are available in the TO-220, TO-252, TO-263 package and with several fixed output voltage, marking them useful in a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single point regulation with single point regulation. In addition, they can be used with power pass elements to make high current voltage regulators. If adequate heat sinking is provided, each of these regulator can deliver over 1A of output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.



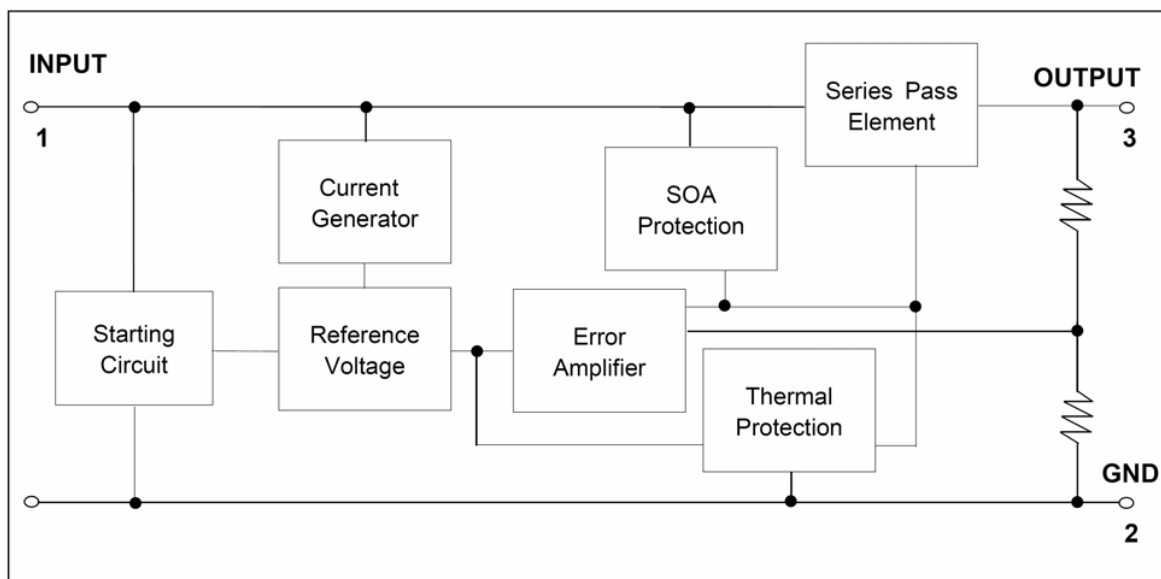
### FEATURES

- Output current up to 1A
- No external components required
- Internal short circuit current limiting
- Internal thermal overload protection
- Output transistor safe-area compensation
- Output voltage offered in 4% tolerance

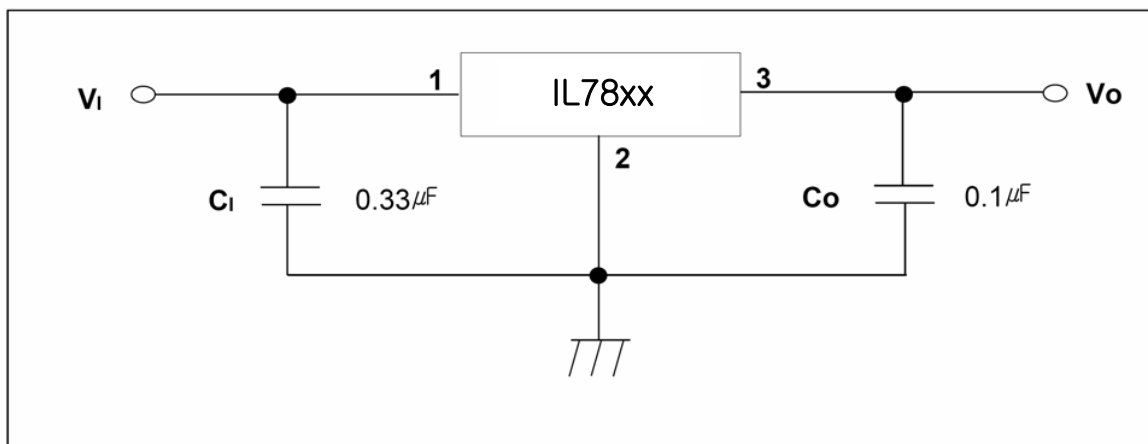
### ABSOLUTE MAXIMUM RATINGS

Characteristics		Symbol	Value	Unit
Input Voltage	IL7805 ~ IL7818	VI	35	V
	IL7824	VI	40	
Junction temperature		Tj	+150	° C
Power Dissipation (Tc=25° C)		PD	20	W
Power Dissipation (Without Heatsink)		PD	1.2	W
Operating temperature		Topr	-40 ~ +125	° C
Storage temperature		Tstg	-60 ~ +150	° C

1. BLOCK DIAGRAM



2. TYPICAL APPLICATIONS



Notes :

- (1) To specify an output voltage, substitute voltage value for "XX"
- (2)  $C_i$  is required if regulator is located in appreciable distance from power supply filter.
- (3)  $C_o$  improves stability and transient response.

**IL7805 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_I = 10V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	4.8	5.0	5.2	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_I = 7V$ to $20V$ $V_I = 8V$ to $20V$	4.75	5.0	5.25		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_I = 7V$ to $25V$		4.0	100	mV
			$V_I = 8V$ to $12V$		1.6	50	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		9	100	
			$I_o = 250mA$ to $750mA$		4	50	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$		0.03	0.5	mA
			$V_I = 7V$ to $25V$		0.3	1.3	
			$V_I = 8V$ to $25V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-0.8		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		42		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_I = 8V$ to $18V$	62	73		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		15		$m\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		230		mA	

\* 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.

**IL7806 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 11V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise sprcified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	5.75	6.0	6.25	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 8V$ to $21V$ $V_i = 9V$ to $21V$	5.7	6.0	6.3		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 8V$ to $25V$		5	120	mV
			$V_i = 9V$ to $13V$		1.5	60	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		9	120	
			$I_o = 250mA$ to $750mA$		3	60	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$			0.5	mA
			$V_i = 8V$ to $25V$			1.3	
			$V_i = 9V$ to $25V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-0.8		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		45		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 9V$ to $19V$	59	75		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		19		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		250		mA	

\* Load and lone 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.

**IL7808 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 14V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit
Output Voltage	$V_o$	$T_j = 25^\circ C$	7.7	8.0	8.3	V
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 10.5V$ to $23V$ $V_i = 11.5V$ to $23V$	7.6	8.0	8.4	
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 10.5V$ to $25V$	5.0	160	mV
			$V_i = 11.5V$ to $17V$	2.0	80	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$	10	160	
			$I_o = 250mA$ to $750mA$	5	80	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5	8	mA
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$	0.05	0.5	mA
			$V_i = 10.5V$ to $25V$	0.5	1.0	
			$V_i = 11.5V$ to $25V$			
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-0.8		mV/°C
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		52		$\mu V$
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 11.5V$ to $21.5V$	56	73		dB
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A
Output Resistance	$R_o$	$f = 1KHz$		17		m $\Omega$
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		230		mA

\* 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.

**IL7809 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 15V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	8.65	9.0	9.35	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 11.5V$ to $24V$ $V_i = 12.5V$ to $24V$	8.6	9.0	9.4		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 11.5V$ to $25V$		6.0	180	mV
			$V_i = 12V$ to $25V$		2	90	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		12	180	
			$I_o = 250mA$ to $750mA$		4	90	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.0	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$			0.5	mA
			$V_i = 11.5V$ to $26V$			1.3	
			$V_i = 12.5V$ to $26V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1		$mV / ^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		58		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 13V$ to $23V$	56	71		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		17		$m\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		250		mA	

\* Load and lone 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.

**IL7810 ELECTRICAL CHARACTERISTICS**

 (Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 16V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	9.6	10.0	10.4	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 12.5V$ to $25V$ $V_i = 13.5V$ to $25V$	9.5	10.0	10.5		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 12.5V$ to $25V$		10	200	mV
			$V_i = 13V$ to $25V$		3	100	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		12	200	
			$I_o = 250mA$ to $750mA$		4	400	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.1	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$			0.5	mA
			$V_i = 12.5V$ to $29V$			1	
			$V_i = 13.5V$ to $29V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		58		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 13V$ to $23V$	56	71		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		17		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		250		mA	

\* Load and lone 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.

**IL7812 ELECTRICAL CHARACTERISTICS**

 (Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 19V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	11.5	12	12.5	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 14.5V$ to $27V$ $V_i = 15.5V$ to $27V$	11.4	12	12.6		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 14.5V$ to $30V$		10	240	mV
			$V_i = 16V$ to $22V$		3	120	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		11	240	
			$I_o = 250mA$ to $750mA$		5	120	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.1	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$		0.1	0.5	mA
			$V_i = 14.5V$ to $30V$		0.5	1.0	
			$V_i = 15V$ to $30V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		76		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 15V$ to $25V$	55	71		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		17		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		230		mA	

\* Load and lone 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.



**IL7815 ELECTRICAL CHARACTERISTICS**

 (Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 23V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	14.4	15	15.6	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 17.5V$ to $30V$ $V_i = 18.5V$ to $30V$	14.25	15	15.75		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 17.5V$ to $30V$		11	300	mV
			$V_i = 20V$ to $26V$		3	150	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		12	300	
			$I_o = 250mA$ to $750mA$		4	150	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.2	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$			0.5	mA
			$V_i = 17.5V$ to $30V$			1.0	
			$V_i = 18.5V$ to $30V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		90		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 18.5V$ to $28.5V$	54	70		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		19		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		250		mA	

\* Load and lone 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.

**IL7818 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 27V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	17.3	18	18.7	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 21V$ to $33V$ $V_i = 22V$ to $33V$	17.1	18	18.9		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 21V$ to $33V$		15	360	mV
			$V_i = 24V$ to $30V$		5	180	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		15	360	
			$I_o = 250mA$ to $750mA$		5	180	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.2	8	mA	
Quiescent current Change	$\Delta I_q$		$I_o = 5mA$ to $1A$			0.5	mA
			$V_i = 21V$ to $33V$			1.0	
			$V_i = 22V$ to $33V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		110		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 22V$ to $32V$	53	69		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		22		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		250		mA	

\* Load and lone 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.

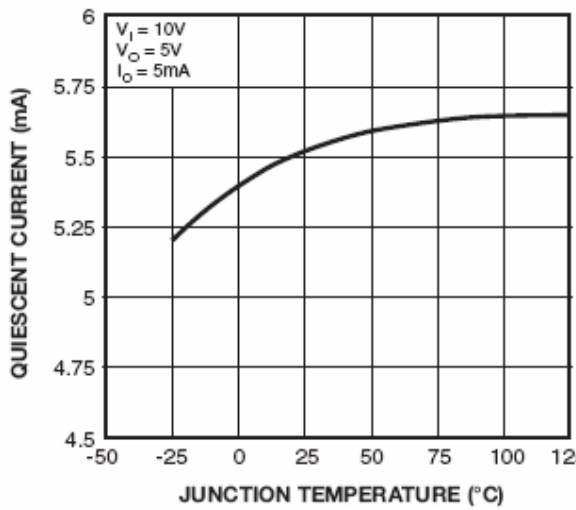
**IL7824 ELECTRICAL CHARACTERISTICS**

(Refer to test circuit,  $T_{min} < T_j < T_{max}$ ,  $I_o = 500mA$ ,  $V_i = 33V$ ,  $C_i = 0.33 \mu F$ ,  $C_o = 0.1 \mu F$ , unless otherwise specified)

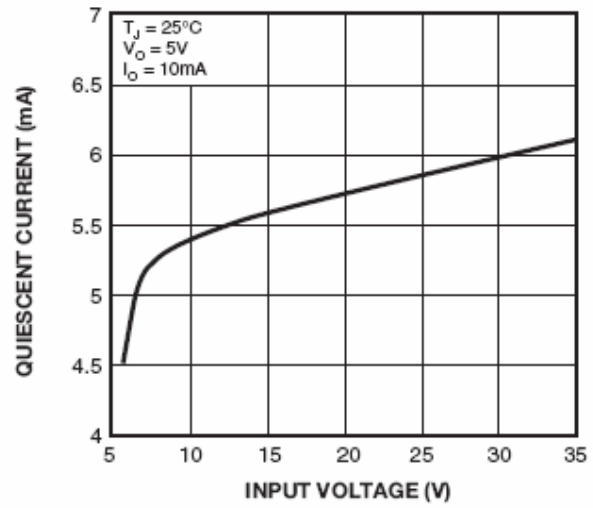
Characteristic	Symbol	Test condition	Min.	Typ.	Max.	Unit	
Output Voltage	$V_o$	$T_j = 25^\circ C$	23	24	25	V	
		$5.0mA \leq I_o \leq 1.0A$ , $PD \leq 15W$ $V_i = 27V$ to $38V$ $V_i = 28V$ to $38V$	22.8	24	25.25		
Line Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$V_i = 27V$ to $38V$		17	480	mV
			$V_i = 30V$ to $36V$		6	240	
Load Regulation	$\Delta V_o$	$T_j = 25^\circ C$	$I_o = 5.0mA$ to $1.5A$		15	480	
			$I_o = 250mA$ to $750mA$		5	240	
Quiescent current	$I_q$	$T_j = 25^\circ C$		5.2	8	mA	
Quiescent current Change	$\Delta I_q$	$T_j = 25^\circ C$	$I_o = 5mA$ to $1A$		0.1	0.5	mA
			$V_i = 27V$ to $38V$		0.5	1.0	
			$V_i = 28V$ to $38V$				
Output voltage Drift	$\Delta V_o / \Delta T$	$I_o = 5mA$		-1.5		mV/ $^\circ C$	
Output noise voltage	$V_n$	$f = 10Hz$ to $100KHz$ , $T_a = 25^\circ C$		60		$\mu V$	
Ripple Rejection	RR	$f = 120Hz$ , $V_i = 28V$ to $38V$	50	67		dB	
Dropout voltage	$V_d$	$I_o = 1A$ , $T_j = 25^\circ C$		2		V	
Peak current	$I_{pk}$	$T_j = 25^\circ C$		2.2		A	
Output Resistance	$R_o$	$f = 1KHz$		28		m $\Omega$	
Short circuit current	$I_{sc}$	$V_i = 35V$ , $T_a = 25^\circ C$		230		mA	

\* 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.

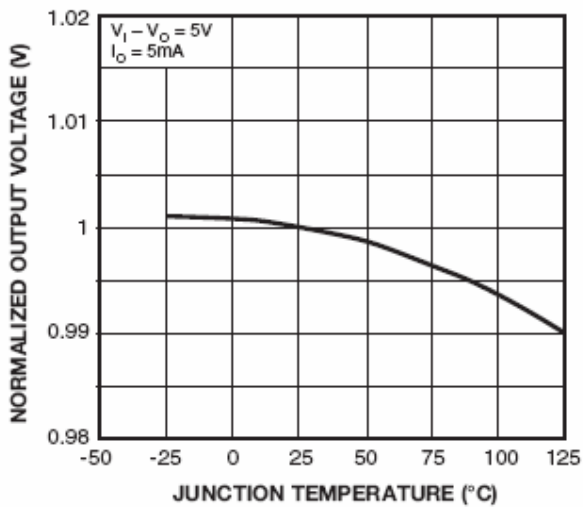
TYPICAL PERFORMANCE CHARACTERISTICS



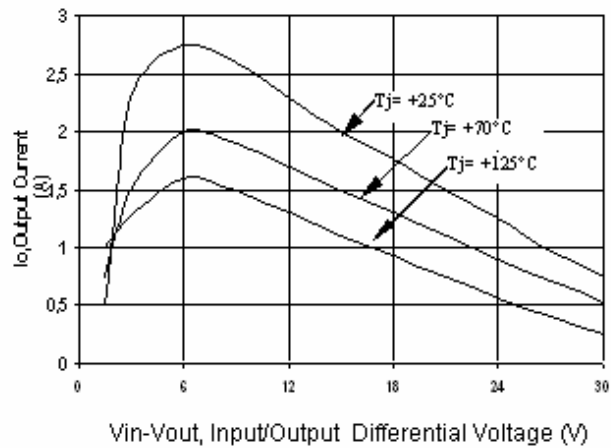
Quiescent Current



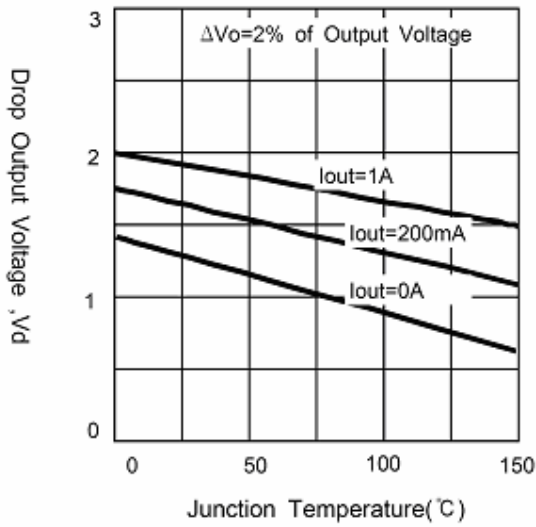
Quiescent Current



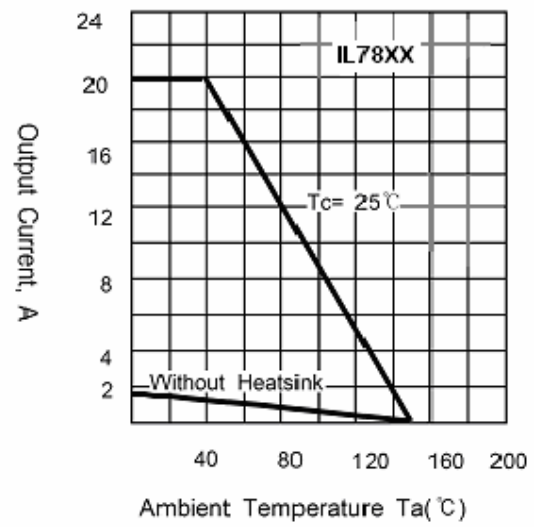
Output Voltage



Peak Output Current

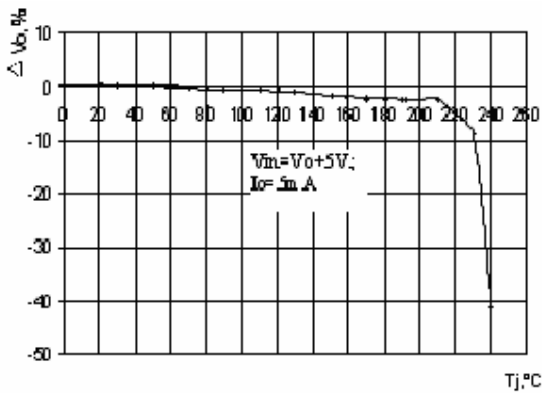


Drop Output Voltage



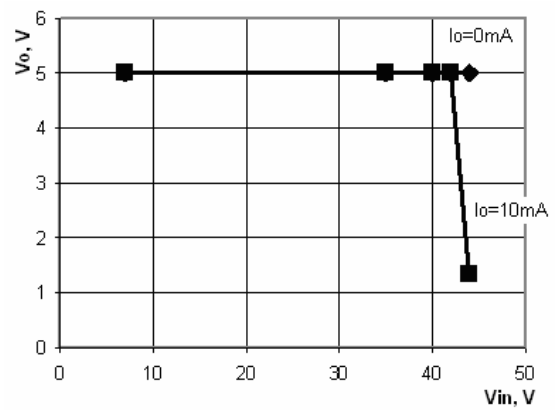
Power Dissipation

Output Voltage Change vs. Junction Temperature



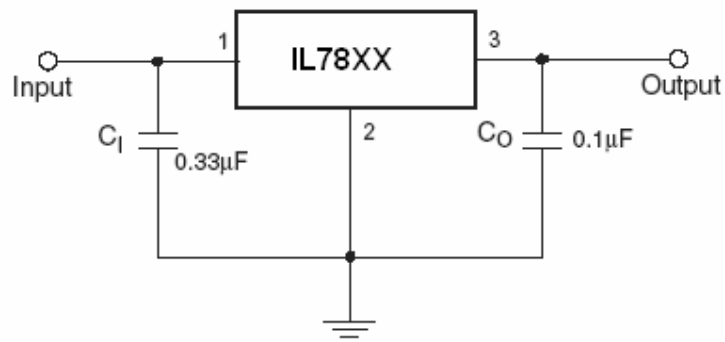
Over Temperature Protection

Output Voltage as a Function of Input Voltage

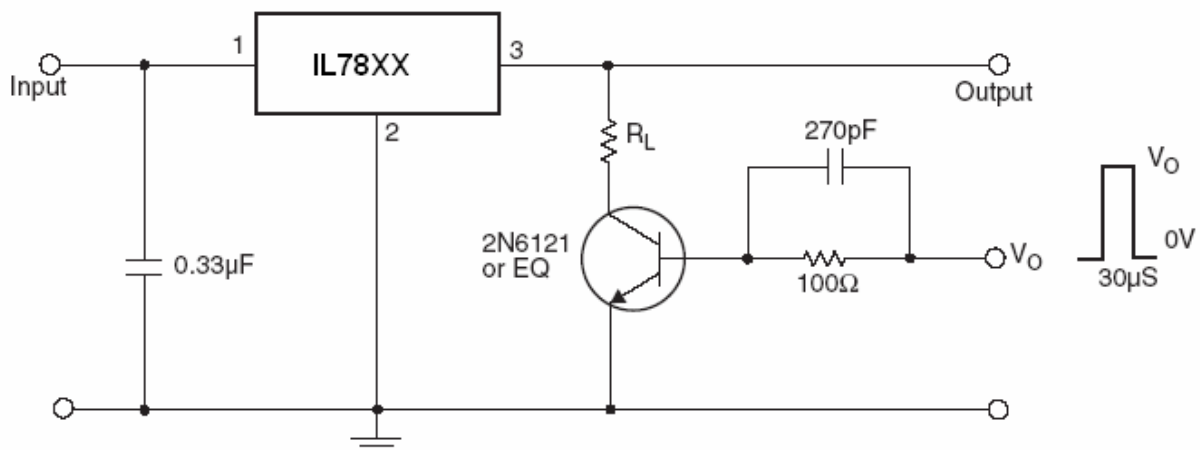


Over Voltage Protection

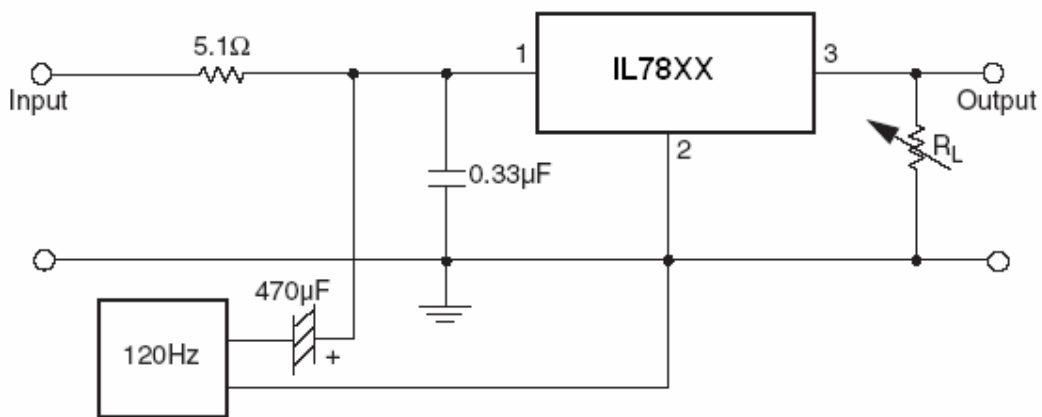
TYPICAL APPLICATIONS



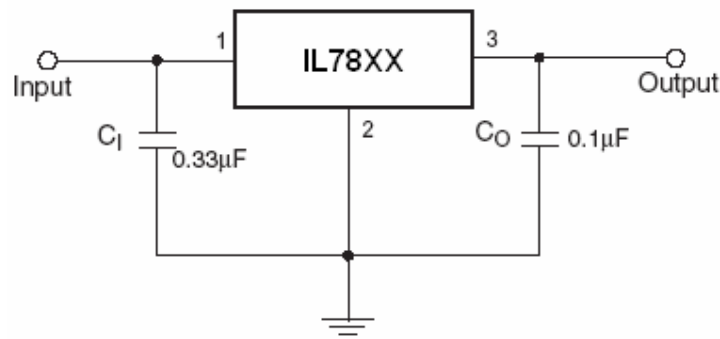
DC Parameters



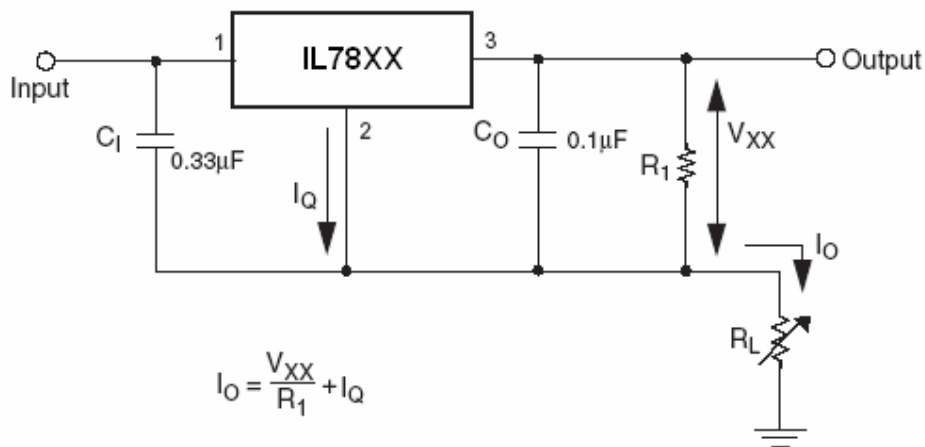
Load Regulation



Ripple Rejection

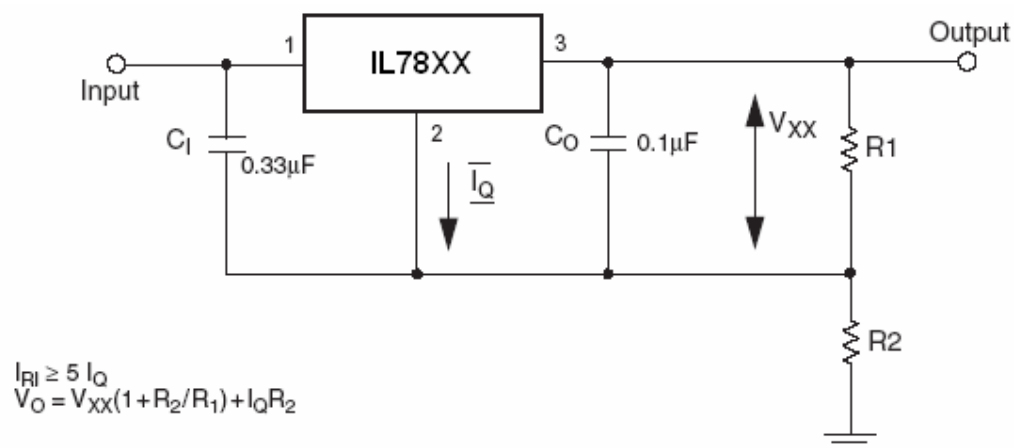


Fixed Output Regulator

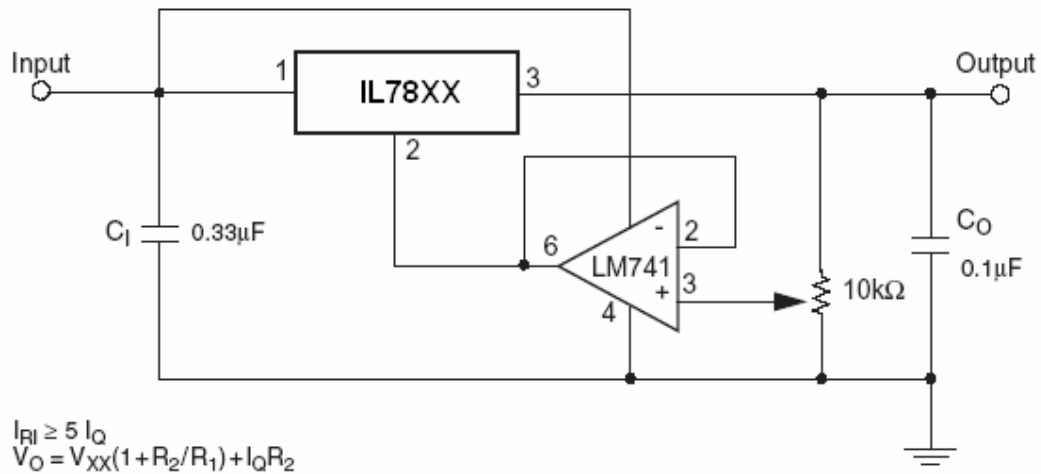


**Notes:**

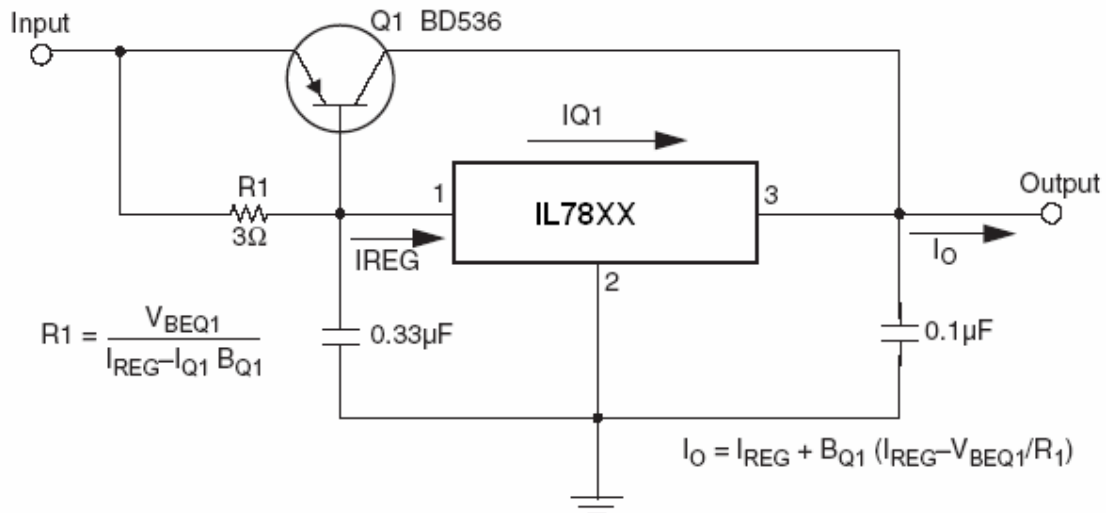
1. To specify an output voltage, substitute voltage value for “XX.” A common ground is required between the input and the output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.
2. C1 is required if regulator is located an appreciable distance from power supply filter.
3. C0 improves stability and transient response.



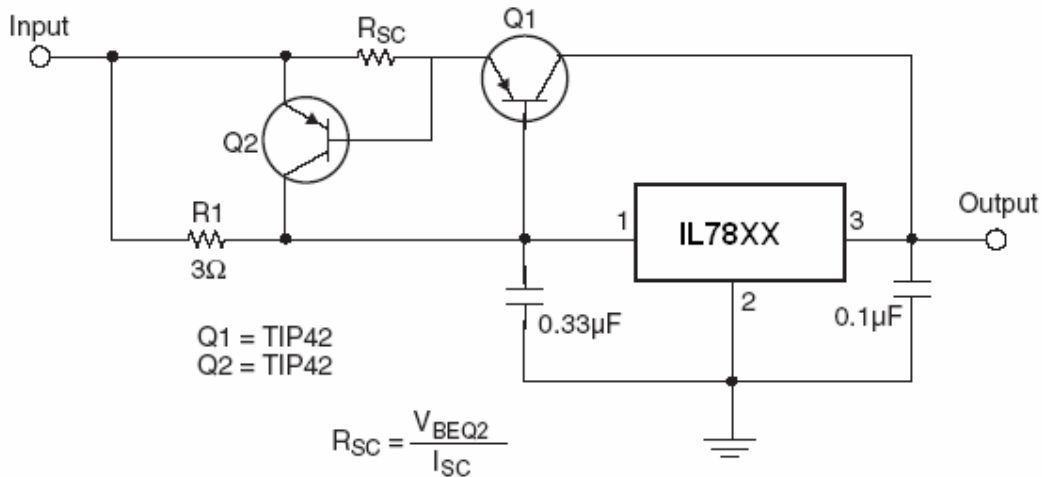
Circuit for Increasing Output Voltage



Adjustable Output Regulator (7V to 30V)

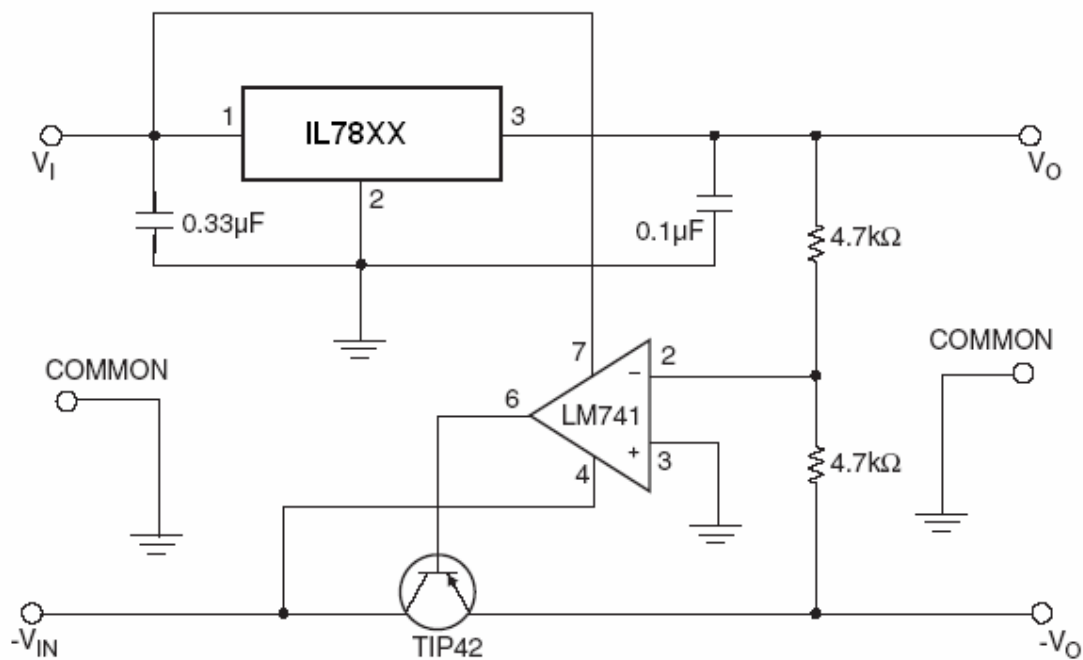


High Current Voltage Regulator

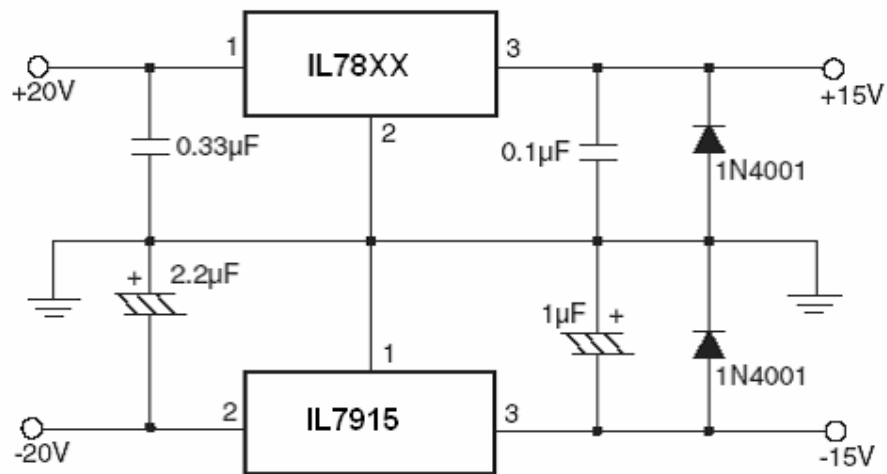


High Output Current with Short Circuit Protection

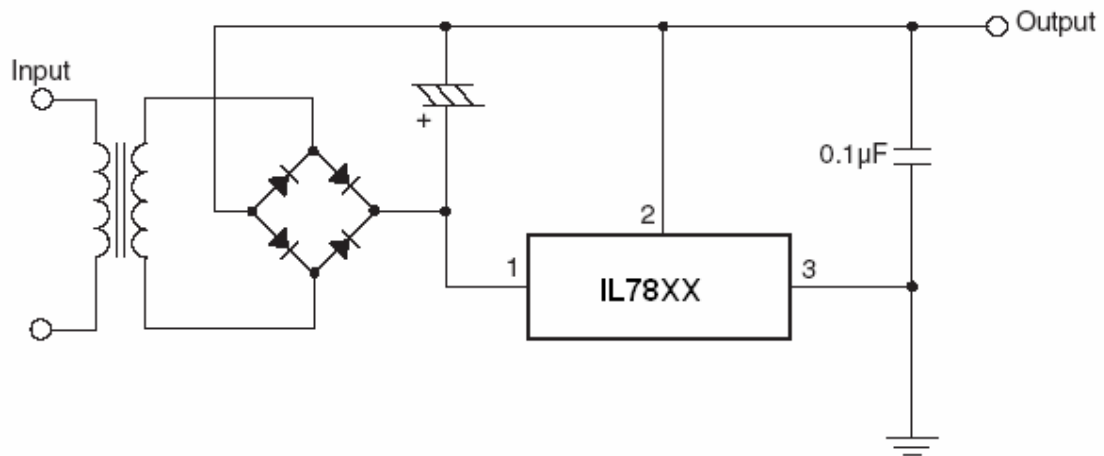




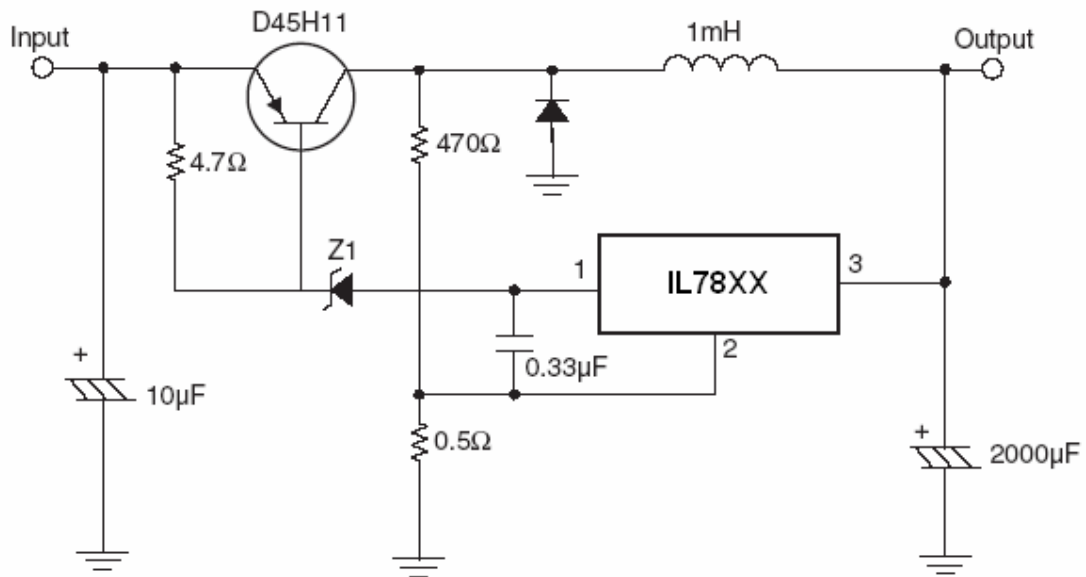
Tracking Voltage Regulator



Split Power Supply ( $\pm 15V - 1A$ )

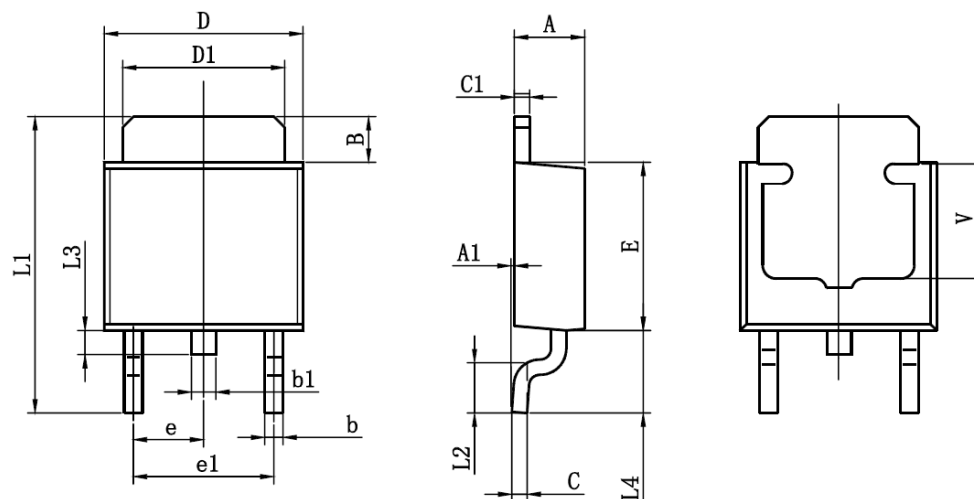


Negative Output Voltage Circuit



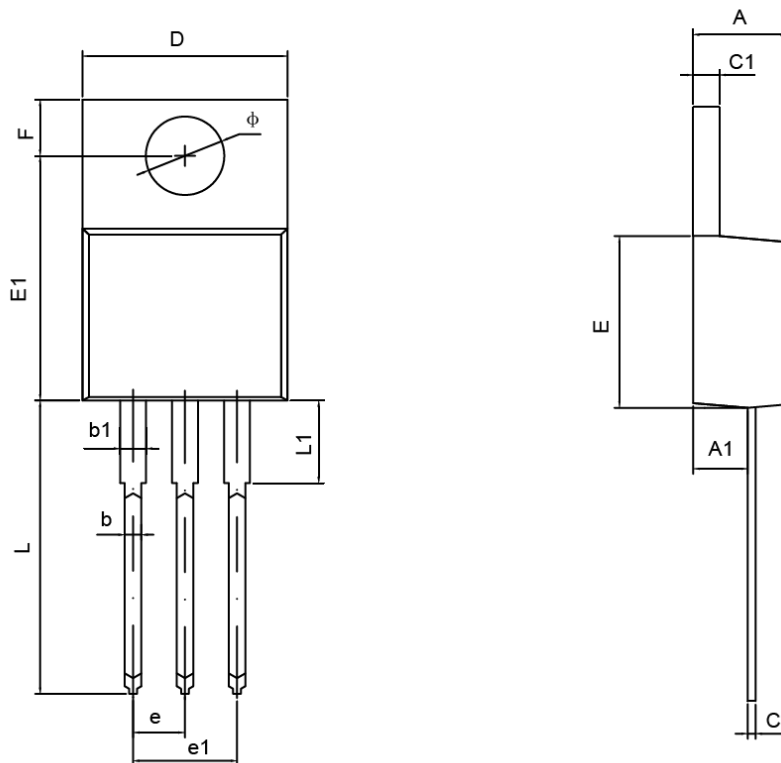
Switching Regulator

TO-252-2L PACKAGE OUTLINE DIMENSIONS



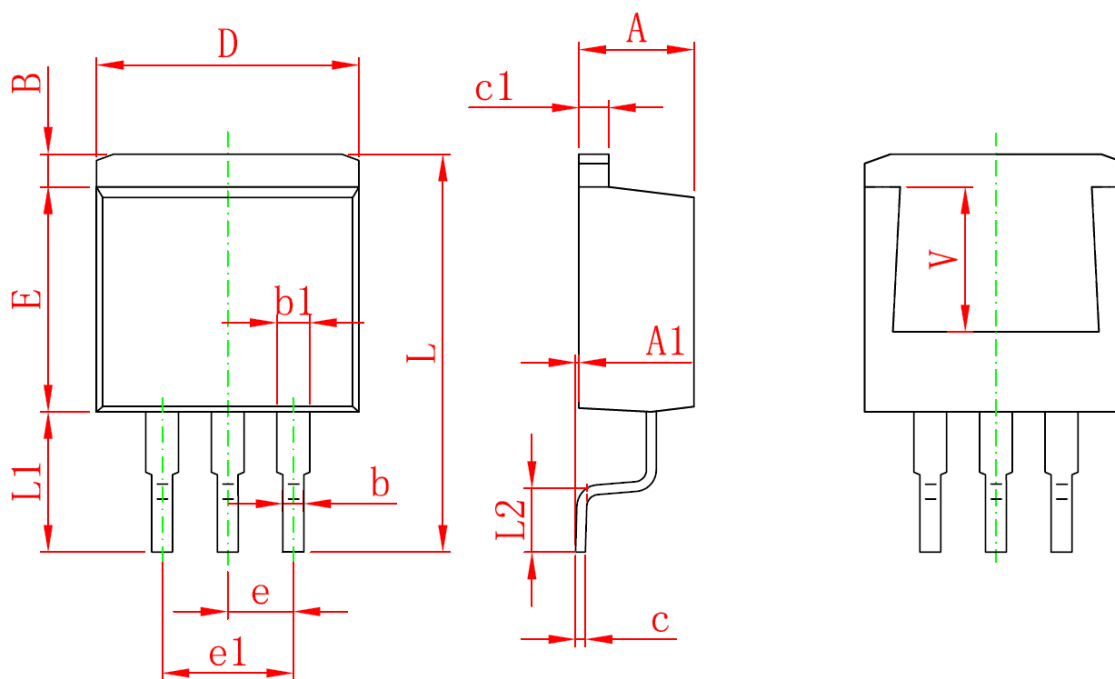
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300TYP		0.091TYP	
e1	4.500	4.700	0.177	0.185
L1	9.500	9.900	0.374	0.390
L2	1.400	1.780	0.055	0.070
L3	0.650	0.950	0.026	0.037
L4	2.550	2.900	0.100	0.114
V	3.80REF		0.150REF	

TO-220-3L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	1.176	0.184
A1	2.520	2.820	0.099	0.111
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.710	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
E1	12.060	12.460	0.475	0.491
e	2.540TYP		0.100TYP	
e1	4.980	5.180	0.196	0.204
F	2.590	2.890	0.102	0.114
L	13.400	13.800	0.528	0.543
L1	3.560	3.960	0.140	0.156
$\phi$	3.790	3.890	0.149	0.153

TO-263-3L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP		0.100 TYP	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
V	5.600 REF		0.220 REF	