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April 2015

# MC78XXE

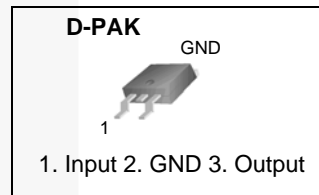
## 3-Terminal 1A Positive Voltage Regulator

### Features

- Output Current up to 1 A
- Output Voltages of 5 V, 12 V
- Thermal Overload Protection
- Short-Circuit Protection
- Output Transistor Safe Operating Area Protection

### Description

The MC78XXE series of three terminal positive regulators are available in the D-PAK 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 A 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	Marking	Package	Packing Method	Output Voltage Tolerance	Operating Temperature
MC7805ECDTX	MC7805	TO-252 3L (D-PAK)	Tape and Reel	±4%	-40 to +125°C
MC7812ECDTX	MC7812	TO-252 3L (D-PAK)	Tape and Reel		

MC78XXE — 3-Terminal 1A Positive Voltage Regulator

## Block Diagram

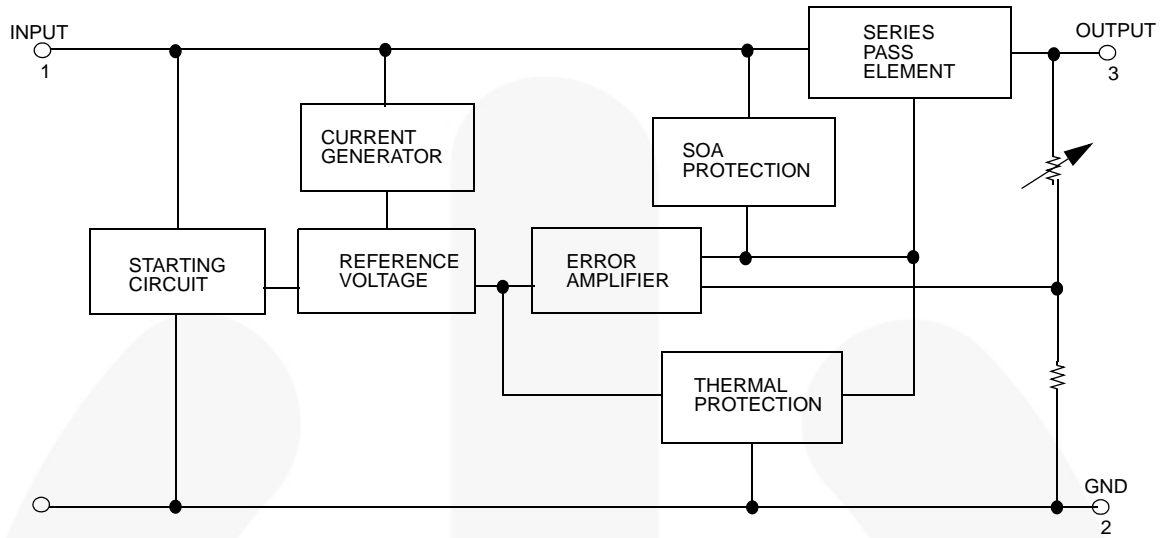


Figure 1. Block Diagram

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter		Value	Unit
$V_I$	Input Voltage	$V_O = 5\text{ V to }18\text{ V}$	35	V
$T_{\text{OPR}}$	Operating Temperature Range		-40 to +125	$^\circ\text{C}$
$T_{\text{STG}}$	Storage Temperature Range		-65 to +150	$^\circ\text{C}$

**Electrical Characteristics (MC7805E)**

Refer to test circuit,  $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{ mA}$ ,  $V_I = 10\text{ V}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$V_O$	Output Voltage	$T_J = +25^{\circ}\text{C}$	4.80	5.00	5.20	V	
		$5.0\text{ mA } I_O \text{ 1.0 A, } P_O \text{ 15 W, } V_I = 7\text{ V to } 20\text{ V}$	4.75	5.00	5.25		
Regline	Line Regulation <sup>(1)</sup>	$T_J = +25^{\circ}\text{C}$	$V_I = 7\text{ V to } 25\text{ V}$		4	100	mV
			$V_I = 8\text{ V to } 12\text{ V}$		1.6	50	
Regload	Load Regulation <sup>(1)</sup>	$T_J = +25^{\circ}\text{C}$	$I_O = 5.0\text{ mA to } 1.5\text{ A}$		9	100	mV
			$I_O = 250\text{ mA to } 750\text{ mA}$		4	50	
$I_Q$	Quiescent Current	$T_J = +25^{\circ}\text{C}$		5	8	mA	
$\Delta I_Q$	Quiescent Current Change	$I_O = 5\text{ mA to } 1.0\text{ A}$		0.03	0.50	mA	
		$V_I = 7\text{ V to } 25\text{ V}$		0.3	1.3		
$\Delta V_O/\Delta T$	Output Voltage Drift <sup>(2)</sup>	$I_O = 5\text{ mA}$		-0.8		mV/ $^{\circ}\text{C}$	
$V_N$	Output Noise Voltage	$f = 10\text{ Hz to } 100\text{ kHz, } T_A = +25^{\circ}\text{C}$		42		$\mu\text{V}$	
RR	Ripple Rejection <sup>(2)</sup>	$f = 120\text{ Hz, } V_O = 8\text{ V to } 18\text{ V}$	62	73		dB	
$V_{\text{Drop}}$	Dropout Voltage	$I_O = 1\text{ A, } T_J = +25^{\circ}\text{C}$		2		V	
$r_O$	Output Resistance <sup>(2)</sup>	$f = 1\text{ kHz}$		15		m $\Omega$	
$I_{\text{SC}}$	Short Circuit Current	$V_I = 35\text{ V, } T_A = +25^{\circ}\text{C}$		230		mA	
$I_{\text{PK}}$	Peak Current <sup>(2)</sup>	$T_J = +25^{\circ}\text{C}$		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 (MC7812E)**

Refer to test circuit,  $-40^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{ mA}$ ,  $V_I = 19\text{ V}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$V_O$	Output Voltage	$T_J = +25^{\circ}\text{C}$	11.5	12.0	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	12.0	12.6		
Regline	Line Regulation <sup>(3)</sup>	$T_J = +25^{\circ}\text{C}$	$V_I = 14.5\text{ V to } 30\text{ V}$		10	240	mV
			$V_I = 16\text{ V to } 22\text{ V}$		3	120	
Regload	Load Regulation <sup>(3)</sup>	$T_J = +25^{\circ}\text{C}$	$I_O = 5\text{ mA to } 1.5\text{ A}$		11	240	mV
			$I_O = 250\text{ mA to } 750\text{ mA}$		5	120	
$I_Q$	Quiescent Current	$T_J = +25^{\circ}\text{C}$		5.1	8.0	mA	
$\Delta I_Q$	Quiescent Current Change	$I_O = 5\text{ mA to } 1.0\text{ A}$ $V_I = 14.5\text{ V to } 30\text{ V}$		0.1	0.5	mA	
				0.5	1.0		
$\Delta V_O/\Delta T$	Output Voltage Drift <sup>(4)</sup>	$I_O = 5\text{ mA}$		-1		mV/ $^{\circ}\text{C}$	
$V_N$	Output Noise Voltage	$f = 10\text{ Hz to } 100\text{ kHz}$ , $T_A = +25^{\circ}\text{C}$		76		$\mu\text{V}$	
RR	Ripple Rejection <sup>(4)</sup>	$f = 120\text{ Hz}$ , $V_I = 15\text{ V to } 25\text{ V}$	55	71		dB	
$V_{\text{Drop}}$	Dropout Voltage	$I_O = 1\text{ A}$ , $T_J = +25^{\circ}\text{C}$		2		V	
$r_O$	Output Resistance <sup>(4)</sup>	$f = 1\text{ kHz}$		18		m $\Omega$	
$I_{\text{SC}}$	Short Circuit Current	$V_I = 35\text{ V}$ , $T_A = +25^{\circ}\text{C}$		230		mA	
$I_{\text{PK}}$	Peak Current <sup>(4)</sup>	$T_J = +25^{\circ}\text{C}$		2.2		A	

**Notes:**

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

Typical Performance Characteristics

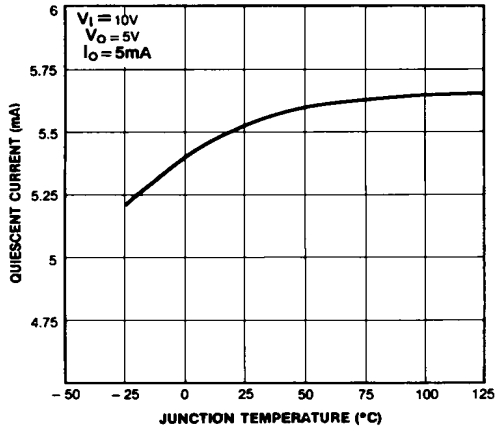


Figure 2. Quiescent Current

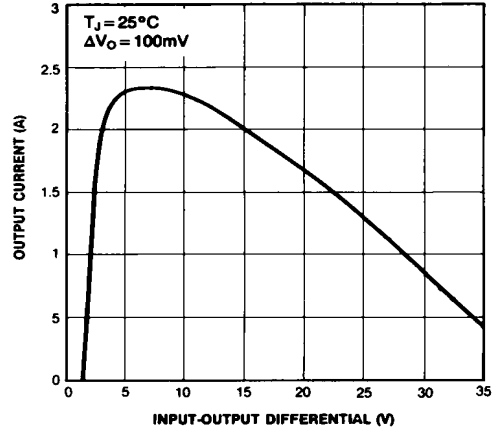


Figure 3. Peak Output Current

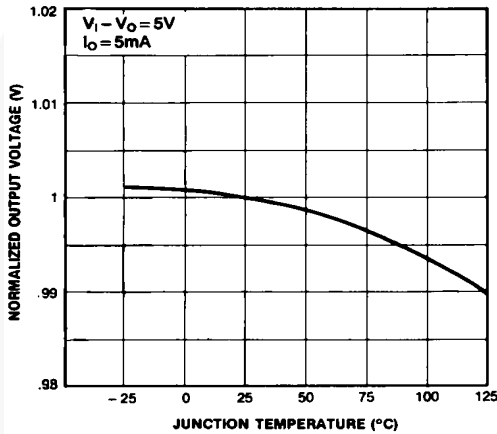


Figure 4. Output Voltage

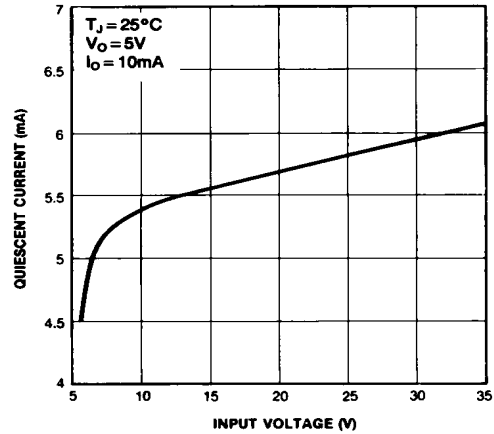


Figure 5. Quiescent Current

Typical Applications

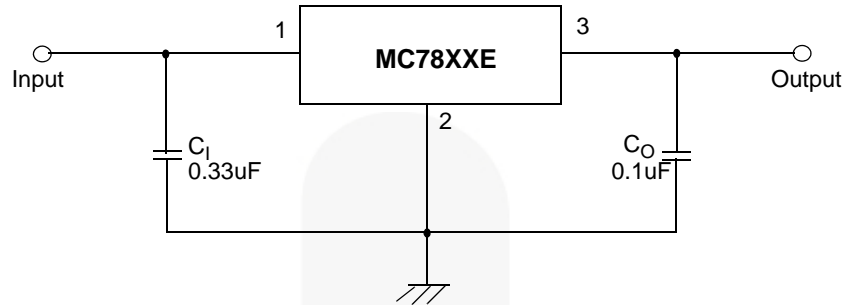


Figure 6. DC Parameters

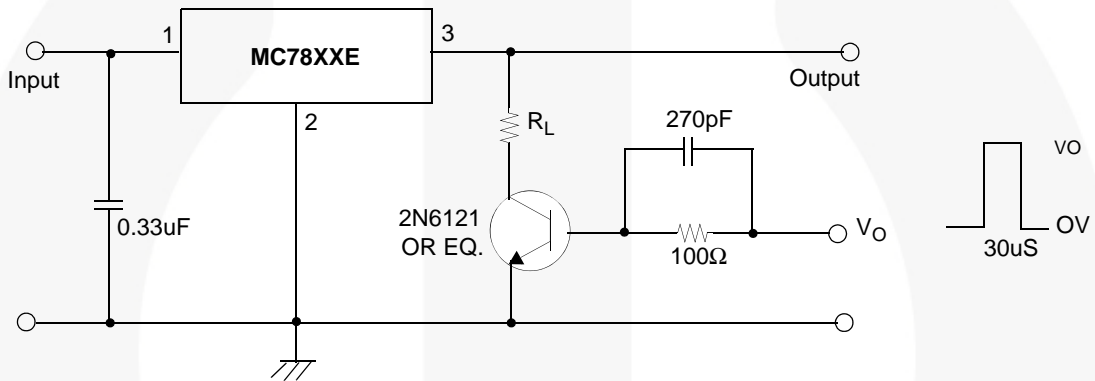


Figure 7. Load Regulation

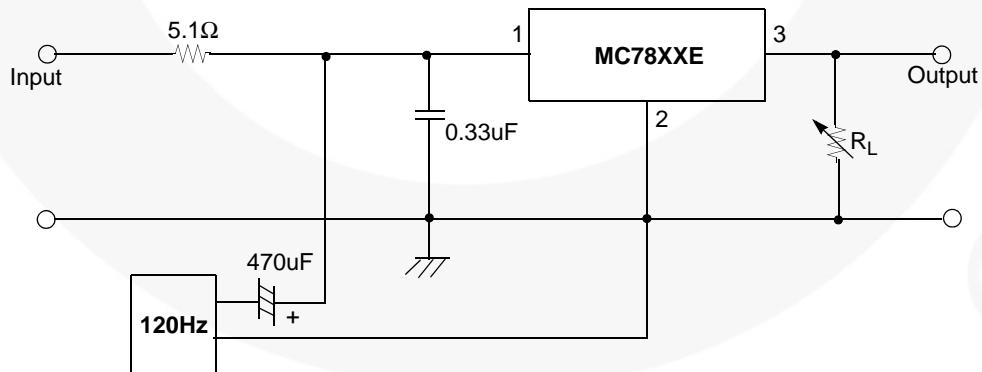
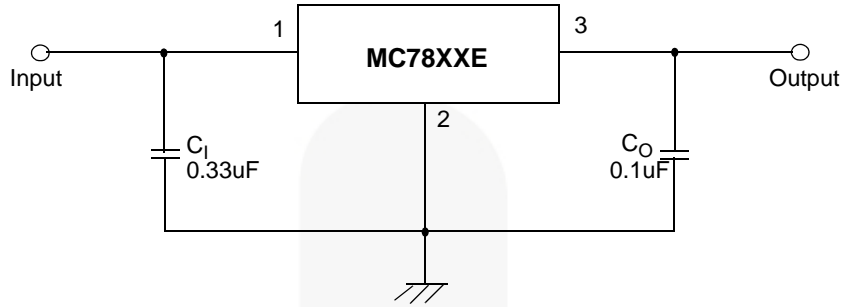
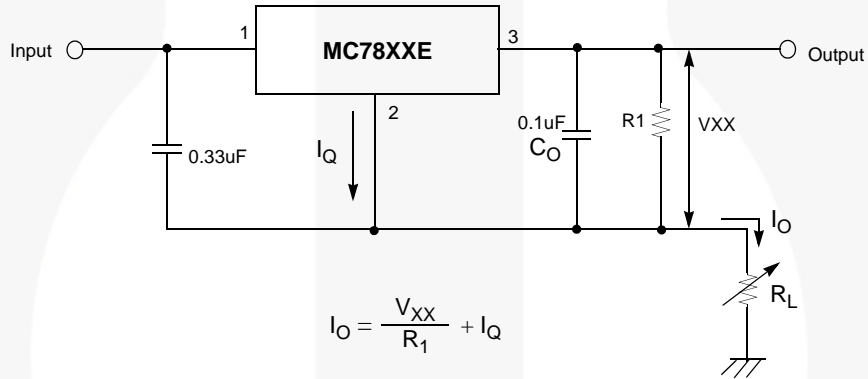


Figure 8. Ripple Rejection

**Typical Applications** (Continued)



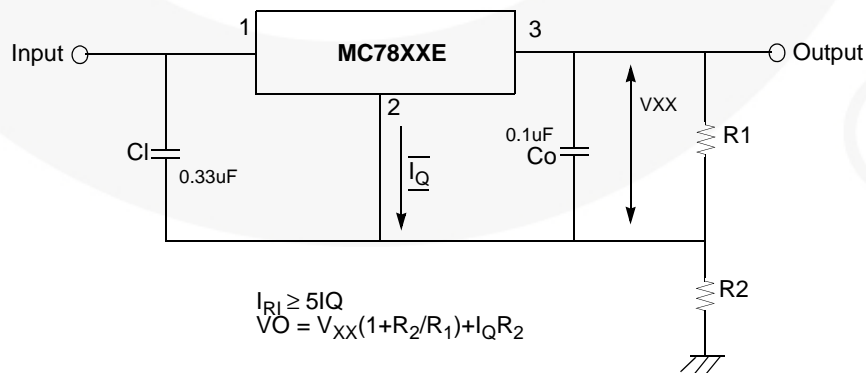
**Figure 9. Fixed Output Regulator**



**Figure 10. Constant Current Regulator**

**Notes:**

- 5. 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.
- 6. C<sub>1</sub> is required if regulator is located an appreciable distance from power Supply filter.
- 7. C<sub>0</sub> improves stability and transient response.



**Figure 11. Circuit for Increasing Output Voltage**



Typical Applications (Continued)

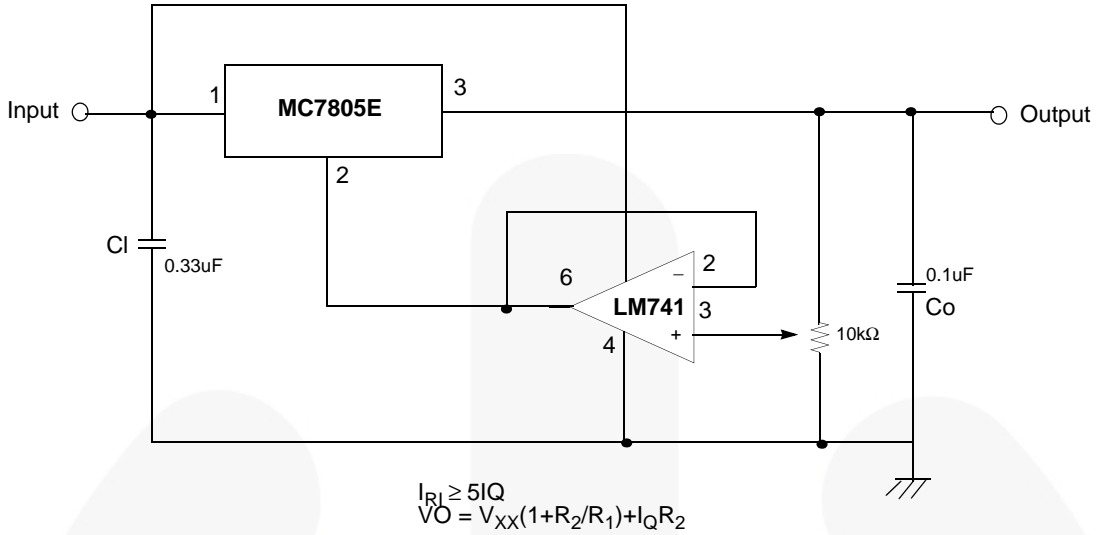


Figure 12. Adjustable Output Regulator (7 to 30V)

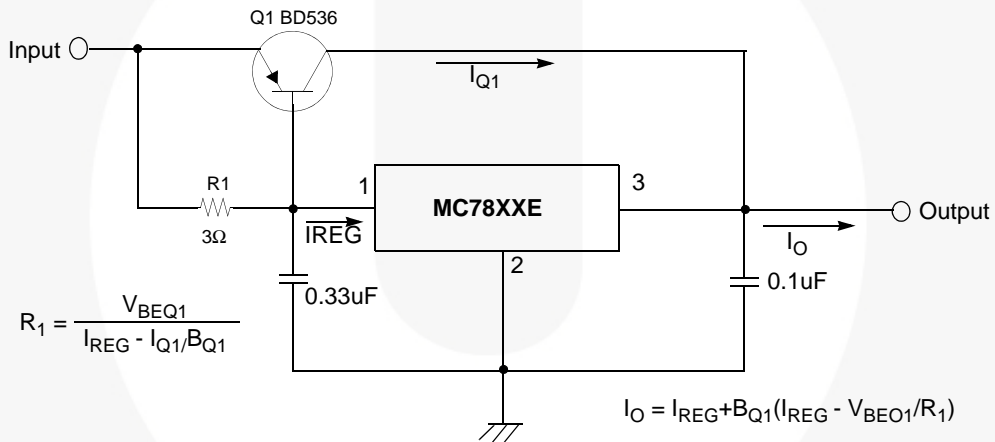


Figure 13. High Current Voltage Regulator

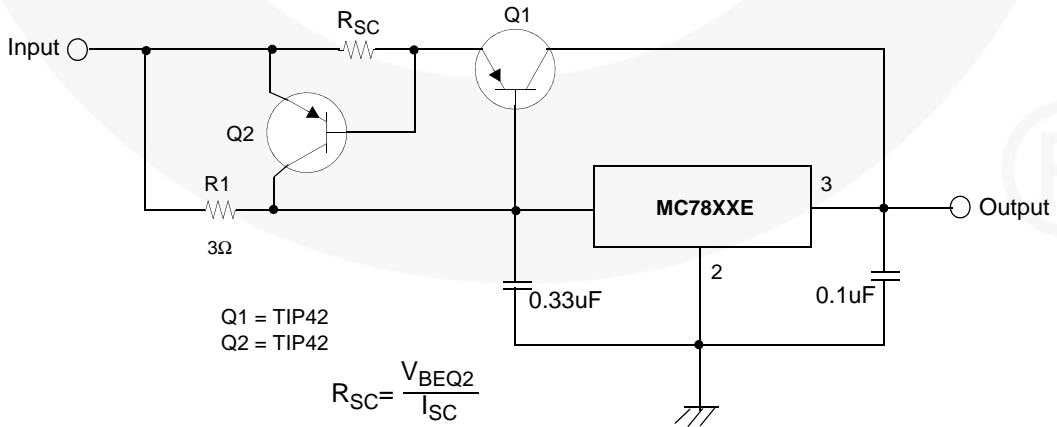


Figure 14. High Output Current with Short Circuit Protection

Typical Applications (Continued)

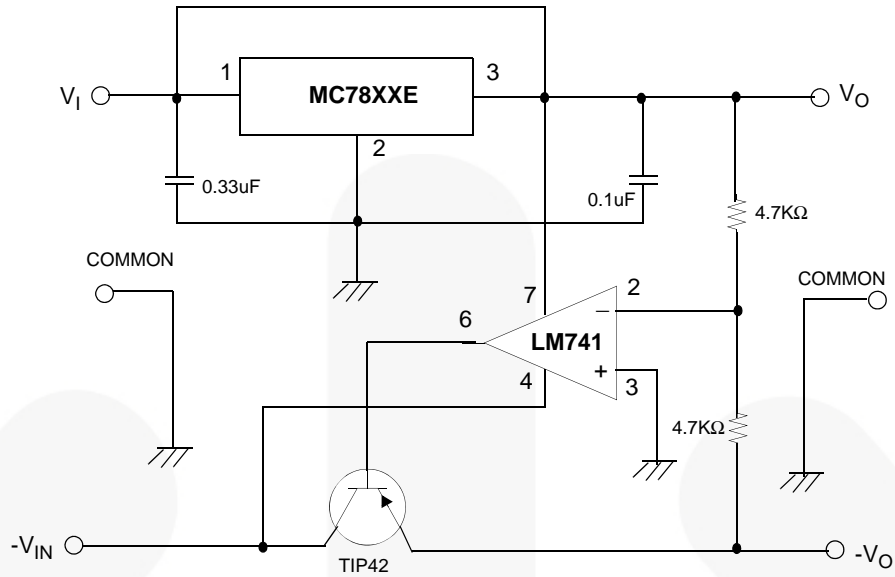


Figure 15. Tracking Voltage Regulator

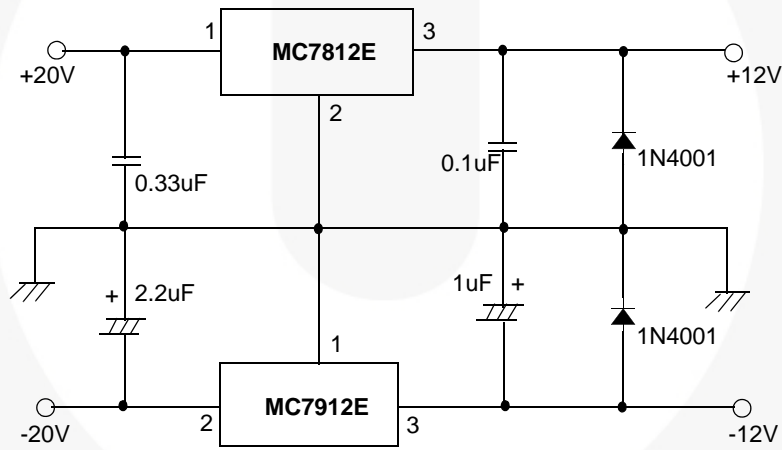


Figure 16. Split Power Supply ( $\pm 12\text{ V} - 1\text{ A}$ )

Typical Applications (Continued)

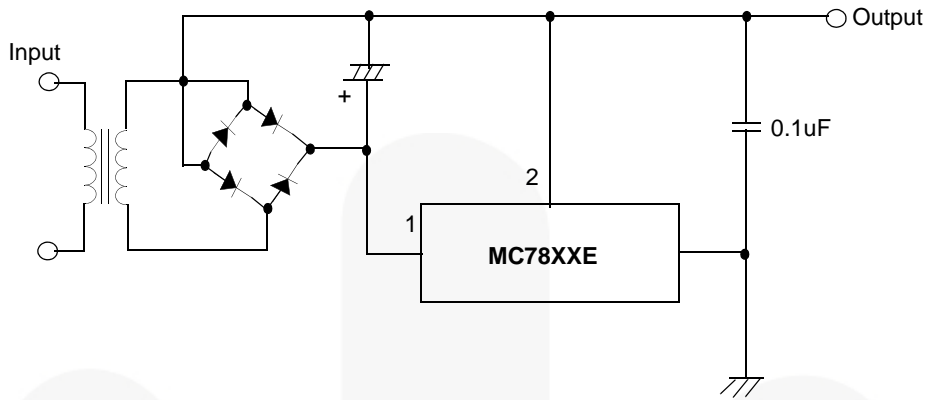


Figure 17. Negative Output Voltage Circuit

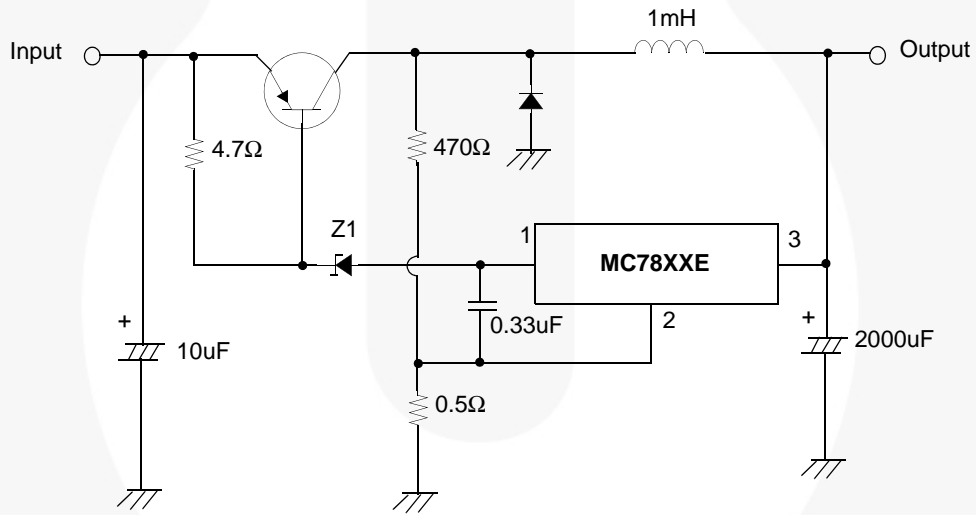


Figure 18. Switching Regulator

Physical Dimensions

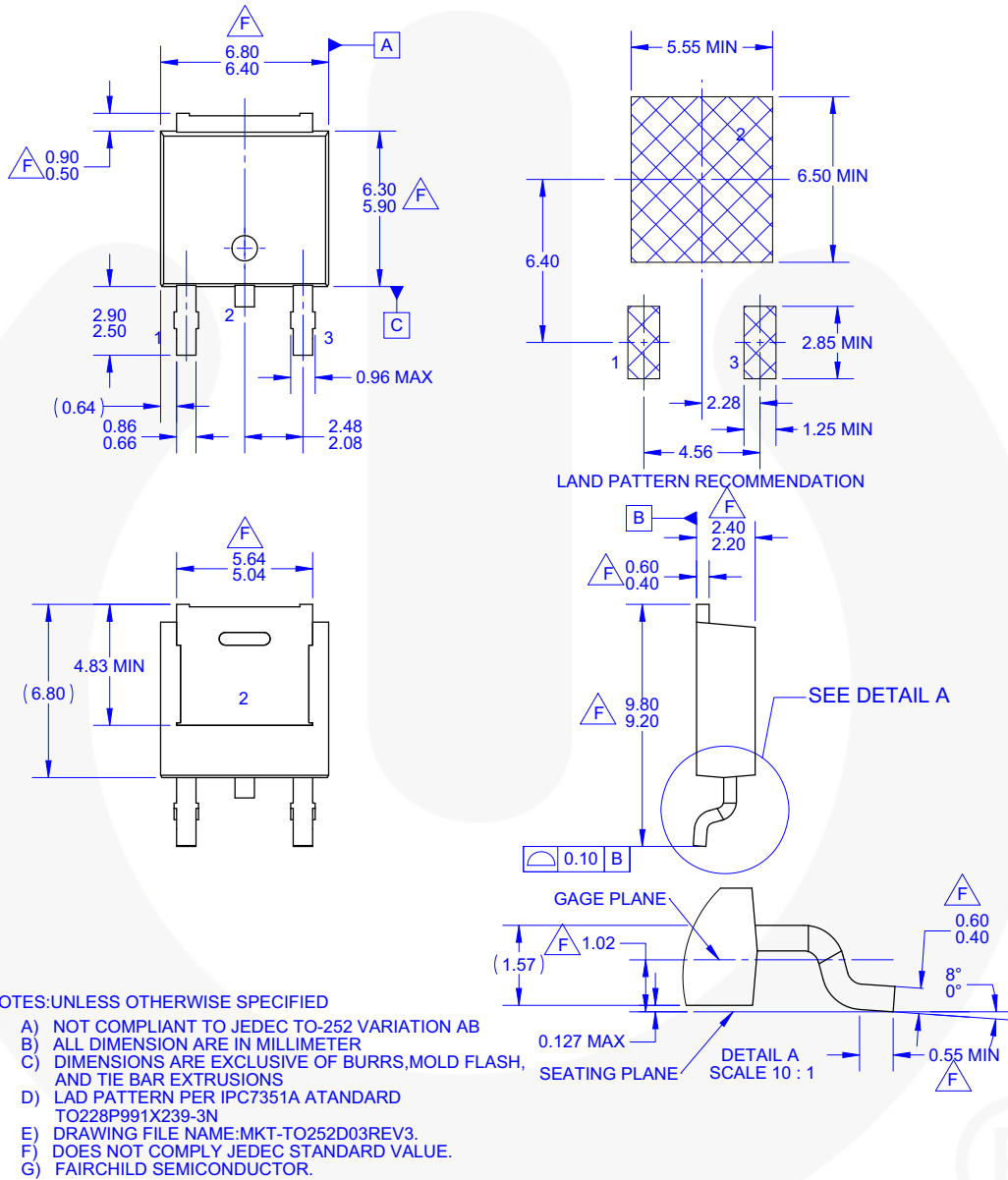



Figure 19. 3LEAD, TO-252, NOT COMPLIANT JEDEC TO-252 VAR. AB, SURFACE MOUNT (DPAK)





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[MD52E15QA3](#) [MD52E21QA3](#) [MD52E25QA3](#)