



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# LM78MXX

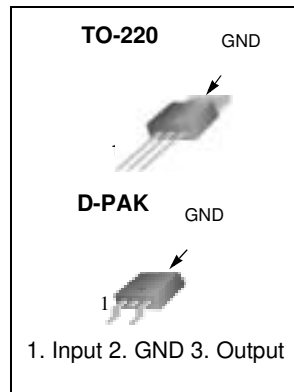
## 3-Terminal 0.5A Positive Voltage Regulator

### Features

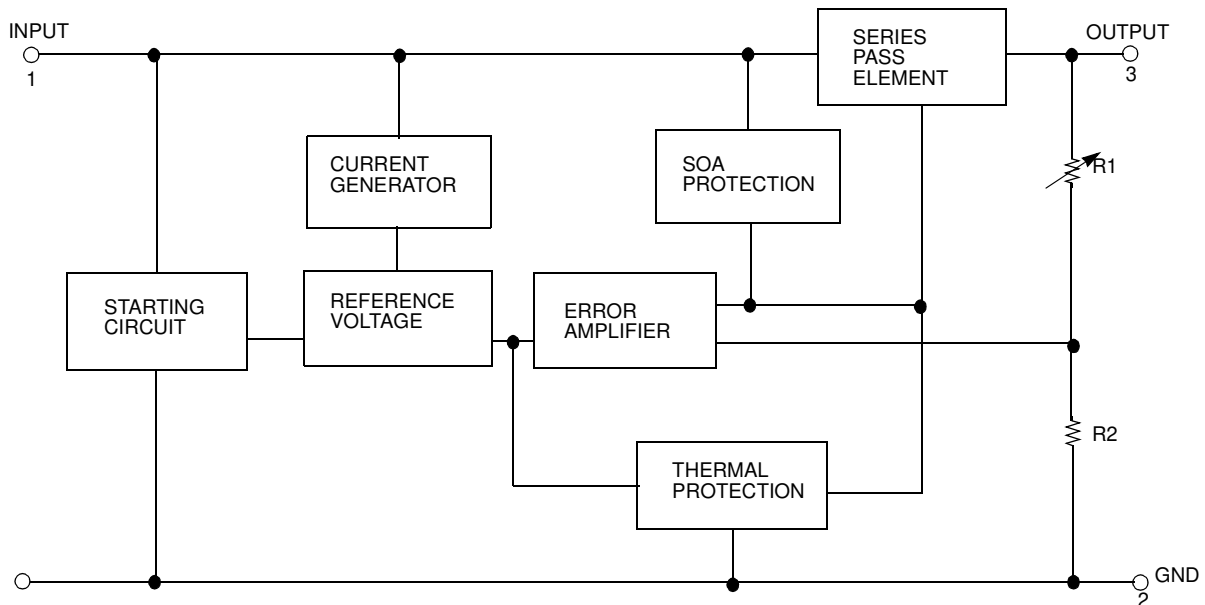
- Output Current up to 0.5A
- Output Voltages of 5, 6, 8, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area (SOA) Protection

### Description

The LM78MXX series of three-terminal positive regulators are available in the TO-220/D-PAK package with several fixed output voltages making it useful in a wide range of applications.



### Internal Block Diagram



## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for $V_O = 5V$ to $18V$ ) (for $V_O = 24V$ )	$V_I$	35	V
	$V_I$	40	V
Thermal Resistance Junction-Case (Note1) TO-220 ( $T_c = +25^\circ C$ )	$R_{\theta JC}$	2.5	$^\circ C/W$
Thermal Resistance Junction-Air (Note1, 2) TO-220 ( $T_a = +25^\circ C$ ) D-PAK ( $T_a = +25^\circ C$ )	$R_{\theta JA}$	66 92	$^\circ C/W$
Operating Junction Temperature Range	TOPR	0 ~ +150	$^\circ C$
Storage Temperature Range	TSTG	-65 ~ +150	$^\circ C$

### Note:

- Thermal resistance test board  
Size: 76.2mm \* 114.3mm \* 1.6mm(1S0P)  
JEDEC standard: JESD51-3, JESD51-7
- Assume no ambient airflow

## Electrical Characteristics (LM78M05)

(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ C$ ,  $I_O = 350mA$ ,  $V_I = 10V$ , unless otherwise specified,  $C_I = 0.33\mu F$ ,  $C_O = 0.1\mu F$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ C$	4.8	5	5.2	V
		$I_O = 5mA$ to $350mA$ $V_I = 7V$ to $20V$	4.75	5	5.25	
Line Regulation (Note3)	$\Delta V_O$	$I_O = 200mA$ $T_J = +25^\circ C$	-	-	100	mV
		$V_I = 7V$ to $25V$ $V_I = 8V$ to $25V$	-	-	50	
Load Regulation (Note3)	$\Delta V_O$	$I_O = 5mA$ to $0.5A$ , $T_J = +25^\circ C$	-	-	100	mV
		$I_O = 5mA$ to $200mA$ , $T_J = +25^\circ C$	-	-	50	
Quiescent Current	$I_Q$	$T_J = +25^\circ C$	-	4.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5mA$ to $350mA$	-	-	0.5	mA
		$I_O = 200mA$ $V_I = 8V$ to $25V$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5mA$ $T_J = 0$ to $+125^\circ C$	-	-0.5	-	mV/ $^\circ C$
Output Noise Voltage	$V_N$	$f = 10Hz$ to $100kHz$	-	40	-	$\mu V/V_O$
Ripple Rejection	RR	$f = 120Hz$ , $I_O = 300mA$ $V_I = 8V$ to $18V$ , $T_J = +25^\circ C$	-	80	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ C$ , $I_O = 500mA$	-	2	-	V
Short Circuit Current	$I_{SC}$	$T_J = +25^\circ C$ , $V_I = 35V$	-	300	-	mA
Peak Current	$I_{PK}$	$T_J = +25^\circ C$	-	700	-	mA

### Note:

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

**Electrical Characteristics (LM78M06)** (Continued)(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=11\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	5.75	6	6.25	V
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 8\text{V to } 21\text{V}$	5.7	6	6.3	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	-	-	100	mV
		$V_I = 8\text{V to } 25\text{V}$ $V_I = 9\text{V to } 25\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$	-	-	120	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$	-	-	60	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 9\text{V to } 25\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = 0 \text{ to } +125^\circ\text{C}$	-	-0.5	-	mV/ $^\circ\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	45	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ $V_I = 9\text{V to } 19\text{V}$ , $T_J = +25^\circ\text{C}$	-	80	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA
Peak Current	IPK	$T_J = +25^\circ\text{C}$	-	700	-	mA

**Note:**

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

**Electrical Characteristics (LM78M08)** (Continued)

(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=14\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	7.7	8	8.3	V	
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 10.5\text{V to } 23\text{V}$	7.6	8	8.4		
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	$V_I = 10.5\text{V to } 25\text{V}$	-	-	100	mV
			$V_I = 11\text{V to } 25\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$		-	-	160	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$		-	-	80	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.0	6.0	mA	
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$		-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 10.5\text{V to } 25\text{V}$		-	-	0.8	
Output Voltage Drift	RR	$I_O = 5\text{mA}$ $T_J = 0 \text{ to } +125^\circ\text{C}$	-	-0.5	-	mV/ $^\circ\text{C}$	
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	52	-	$\mu\text{V}/V_O$	
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ $V_I = 11.5\text{V to } 21.5\text{V}$ , $T_J = +25^\circ\text{C}$	-	80	-	dB	
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V	
Short Circuit Current	ISC	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA	
Peak Current	IPK	$T_J = +25^\circ\text{C}$	-	700	-	mA	

**Note:**

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

**Electrical Characteristics (LM78M12)** (Continued)

(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=19\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	11.5	12	12.5	V
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 14.5\text{V to } 27\text{V}$	11.4	12	12.6	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	-	-	100	mV
		$V_I = 14.5\text{V to } 30\text{V}$ $V_I = 16\text{V to } 30\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$	-	-	240	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$	-	-	120	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.1	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 14.5\text{V to } 30\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = 0 \text{ to } +125^\circ\text{C}$	-	-0.5	-	mV/ $^\circ\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	75	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ $V_I = 15\text{V to } 25\text{V}$ , $T_J = +25^\circ\text{C}$	-	80	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	$I_{SC}$	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA
Peak Current	$I_{PK}$	$T_J = +25^\circ\text{C}$	-	700	-	mA

**Note:**

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

**Electrical Characteristics (LM78M15)** (Continued)

(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=23\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	14.4	15	15.6	V
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 17.5\text{V to } 30\text{V}$	14.25	15	15.75	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	-	-	100	mV
		$V_I = 17.5\text{V to } 30\text{V}$ $V_I = 20\text{V to } 30\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$	-	-	300	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$	-	-	150	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.1	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 17.5\text{V to } 30\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = 0 \text{ to } +125^\circ\text{C}$	-	-1	-	mV/ $^\circ\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	100	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ $V_I = 18.5\text{V to } 28.5\text{V}$ , $T_J = +25^\circ\text{C}$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	$I_{SC}$	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA
Peak Current	$I_{PK}$	$T_J = +25^\circ\text{C}$	-	700	-	mA

**Note:**

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

**Electrical Characteristics (LM78M18)** (Continued)(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=26\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	17.3	18	18.7	V
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 20.5\text{V to } 33\text{V}$	17.1	18	18.9	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	-	-	100	mV
		$V_I = 21\text{V to } 33\text{V}$ $V_I = 24\text{V to } 33\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$	-	-	360	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$	-	-	180	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.2	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 21\text{V to } 33\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \text{ to } 125^\circ\text{C}$	-	-1.1	-	mV/ $^\circ\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	100	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ , $V_I = 22\text{V to } 32\text{V}$ $T_J = +25^\circ\text{C}$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	$I_{SC}$	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA
Peak Current	$I_{PK}$	$T_J = +25^\circ\text{C}$	-	700	-	mA

**Note:**

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

**Electrical Characteristics (LM78M24)** (Continued)

(Refer to the test circuits,  $0 \leq T_J \leq +125^\circ\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=33\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ\text{C}$	23	24	25	V
		$I_O = 5\text{mA to } 350\text{mA}$ $V_I = 27\text{V to } 38\text{V}$	22.8	24	25.2	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^\circ\text{C}$	-	-	100	mV
		$V_I = 27\text{V to } 38\text{V}$ $V_I = 28\text{V to } 38\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}$ , $T_J = +25^\circ\text{C}$	-	-	480	mV
		$I_O = 5\text{mA to } 200\text{mA}$ , $T_J = +25^\circ\text{C}$	-	-	240	
Quiescent Current	$I_Q$	$T_J = +25^\circ\text{C}$	-	4.2	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 27\text{V to } 38\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = 0 \text{ to } +125^\circ\text{C}$	-	-1.2	-	mV/ $^\circ\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	170	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $I_O = 300\text{mA}$ $V_I = 28\text{V to } 38\text{V}$ , $T_J = +25^\circ\text{C}$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ\text{C}$ , $I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^\circ\text{C}$ , $V_I = 35\text{V}$	-	300	-	mA
Peak Current	IPK	$T_J = +25^\circ\text{C}$	-	700	-	mA

**Note:**

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

## Typical Applications

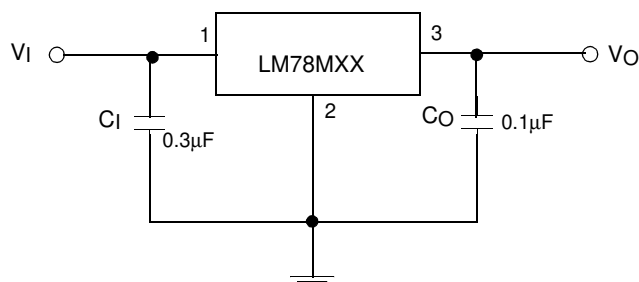


Figure 1. Fixed Output Regulator

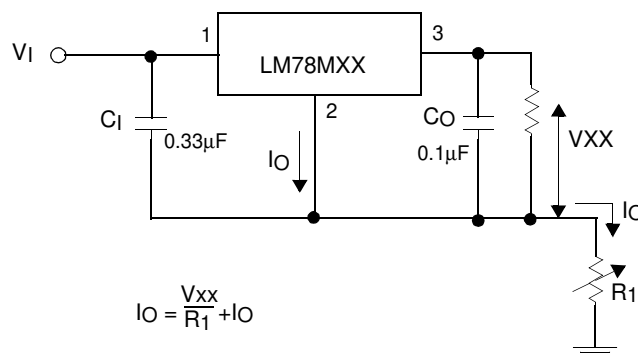


Figure 2. Constant Current Regulator

### Notes:

1. To specify an output voltage, substitute voltage value for "XX"
2. Although no output capacitor is needed for stability, it does improve transient response.
3.  $C_1$  is required if regulator is located an appreciable distance from power Supply filter

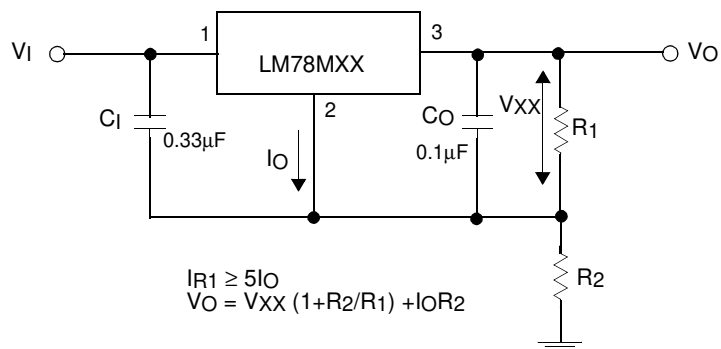


Figure 3. Circuit for Increasing Output Voltage

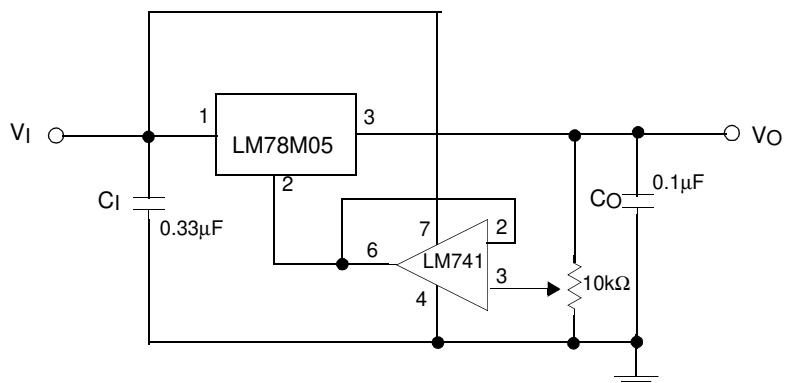


Figure 4. Adjustable Output Regulator (7 to 30V)

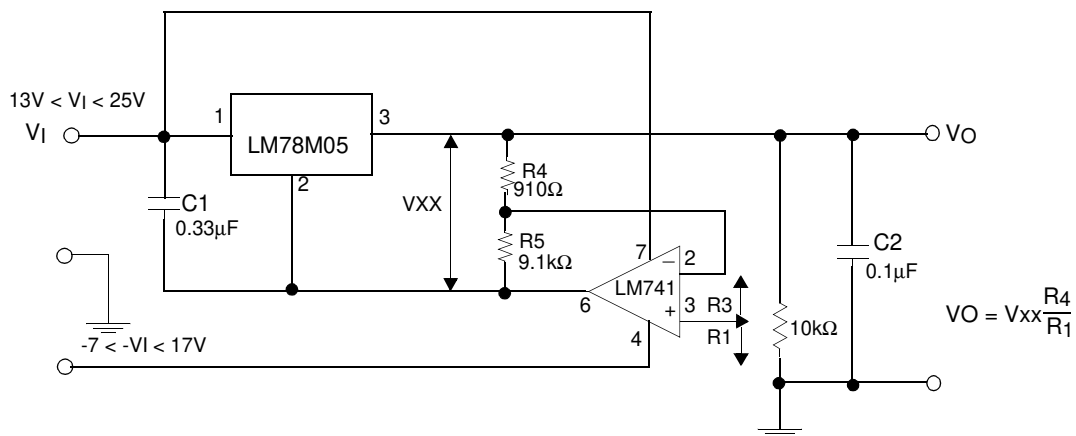


Figure 5. 0.5 to 10V Regulator

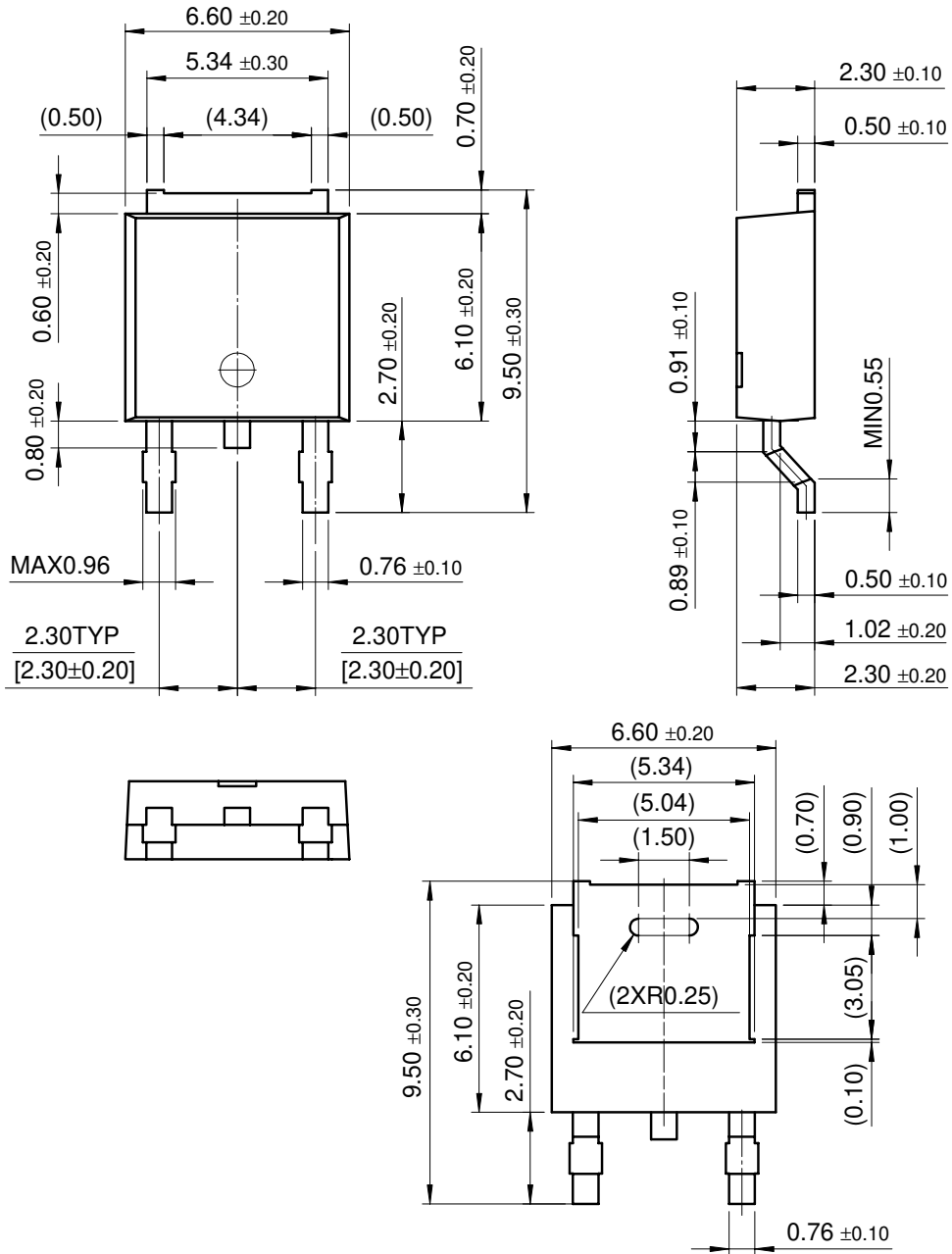


**Mechanical Dimensions** (Continued)

**Package**

Dimensions in millimeters

**D-PAK**



---

**Ordering Information**

Product Number	Package	Operating Temperature
LM78M05CT	TO-220	0 ~ +125°C <sub>L</sub>
LM78M06CT		
LM78M08CT		
LM78M12CT		
LM78M15CT		
LM78M18CT		
LM78M24CT		
LM78M05CDT	D-PAK	
LM78M06CDT		
LM78M08CDT		
LM78M12CDT		

**DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.