

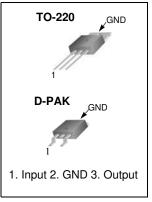
# MC78MXX/LM78MXX 3-Terminal 0.5A Positive Voltage Regulator

Features

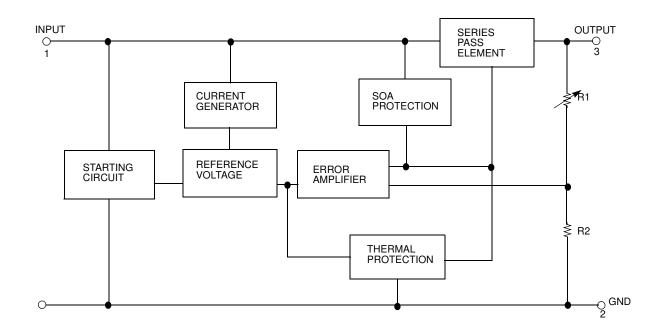
- Output Current up to 0.5A
- Output Voltages of 5, 6, 8, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area (SOA)Protection

## Description

The MC78MXX/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 Digram



### **Absolute Maximum Ratings**

Parameter	Symbol	Value	Unit
Input Voltage (for $V_O = 5V$ to $18V$ ) (for $V_O = 24V$ )	VI VI	35 40	V V
Thermal Resistance Junction-Case (Note1) TO-220 (Tc = $+25^{\circ}$ C)	R <sub>θJC</sub>	2.5	°C/W
Thermal Resistance Junction-Air (Note1, 2) TO-220 (Ta = $+25^{\circ}$ C) D-PAK (Ta = $+25^{\circ}$ C)	Reja	66 92	°C/W
Operating Junction Temperature Range	TOPR	0 ~ +150	°C
Storage Temperature Range	TSTG	-65 ~ +150	٥C

Note:

1. Thermal resistance test board Size: 76.2mm \* 114.3mm \* 1.6mm(1S0P) JEDEC standard: JESD51-3, JESD51-7

2. Assume no ambient airflow

## Electrical Characteristics (MC78M05/LM78M05)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI=10V, unless otherwise specified, CI =  $0.33\mu$ F, CO= $0.1\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit		
		$T_J = +25^{\circ}C$		$T_J = +25^{\circ}C$		4.8	5	5.2	
Output Voltage	Vo	IO = 5mA to 35 VI = 7V to 20V	0mA	4.75	5	5.25	V		
Line Regulation (Note3)	ΔVο	IO = 200mA	VI = 7V to 25V	-	-	100	mV		
	200	TJ =+25°C ∖	VI = 8V to 25V	-	-	50	111 V		
Load Regulation (Note3)	ΔVο	IO = 5mA  to  0.5	6A, TJ =+25°C	-	-	100	mV		
Load Regulation (Notes)	200	IO = 5mA to 200	0mA, TJ =+25 °C	-	-	50	IIIV		
Quiescent Current	lQ	TJ =+25°C		-	4.0	6.0	mA		
		IO = 5mA to 350mA		-	-	0.5			
Quiescent Current Change	ΔlQ	IO = 200mA VI = 8V to 25V	-		-	0.8	mA		
Output Voltage Drift	ΔV/ΔΤ	IO = 5mA TJ = 0 to +125°	IO = 5mA TJ = 0 to +125°C		-0.5	-	mV/°C		
Output Noise Voltage	VN	f = 10Hz to 100	kHz	-	40	-	μV/Vo		
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 8V to 18V, TJ =+25 °C		-	80	-	dB		
Dropout Voltage	VD	T <sub>J</sub> =+25°C, I <sub>O</sub> = 500mA		-	2	-	V		
Short Circuit Current	Isc	TJ =+25°C, VI = 35V		-	300	-	mA		
Peak Current	lрк	TJ =+25°C		-	700	-	mA		

#### Note:

3. Load and line regulation are specified at constant junction temperature. Change in V<sub>0</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (MC78M06) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI =11V, unless otherwise specified, CI=0.33\muF, CO=0.1 $\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit
		TJ = +25°C		5.75	6	6.25	
Output Voltage	Vo	IO = 5mA to 3 VI = 8V to 21		5.7	6	6.3	V
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 8V to $25V$	-	-	100	mV
	200	TJ = +25°C	VI = 9V to 25V	-	-	50	111V
Load Regulation (Note1)	ΔVο	$I_{O} = 5mA$ to $C$	).5A, TJ = +25°C	-	-	120	mV
Load Regulation (Note1)	ΔνΟ	$I_{O} = 5mA$ to 2	200mA, TJ = +25°C	-	-	60	111V
Quiescent Current	lQ	TJ = +25°C		-	4.0	6.0	mA
	ΔlQ	IO = 5mA to 350mA		-	-	0.5	
Quiescent Current Change		IO = 200mA VI = 9V to 25	V	-	-	0.8	mA
Output Voltage Drift	ΔV/ΔΤ	IO = 5mA TJ = 0 to +125°C		-	-0.5	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 10	00kHz	-	45	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 9V to 19V, TJ =+25 °C		-	80	-	dB
Dropout Voltage	VD	TJ =+25°C, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25°C, VI= 35V		-	300	-	mA
Peak Current	IPK	TJ =+25°C		-	700	-	mA

#### Note:

1. Load and line regulation are specified at constant junction temperature. Change in  $V_0$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (MC78M08) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI=14V, unless otherwise specified, CI =  $0.33\mu$ F, CO= $0.1\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit
		TJ =+25°C		7.7	8	8.3	
Output Voltage	Vo	IO = 5mA to 350 VI = 10.5V to 23		7.6	8	8.4	V
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 10.5V to 25V	-	-	100	mV
Line Regulation (Note1)	ΔνΟ	TJ =+25°C	VI = 11V to 25V	-	-	50	111 V
Load Population (Noto1)	ΔVο	IO = 5mA to 0.5	A, TJ =+25°C	-	-	160	mV
Load Regulation (Note1)	ΔνΟ	IO = 5mA to 200	0mA, TJ =+25°C	-	-	80	111 V
Quiescent Current	lQ	TJ = +25°C		-	4.0	6.0	mA
		IO = 5mA to 350	)mA	-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 10.5V to 25	5V	-	-	0.8	mA
Output Voltage Drift	RR	IO = 5mA TJ = 0 to +125°C		-	-0.5	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 100	kHz	-	52	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 11.5V to 21.5V, TJ =+25 °C		-	80	-	dB
Dropout Voltage	VD	TJ = +25°C, IO = 500mA		-	2	-	V
Short Circuit Current	Isc	TJ = +25°C, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25°C		-	700	-	mA

#### Note:

1. Load and line regulation are specified at constant junction temperature. Change in V<sub>O</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (MC78M12) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}C$ , IO=350mA, VI=19V, unless otherwise specified, CI =  $0.33\mu$ F, CO= $0.1\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit		
		$T_J = +25^{\circ}C$		T <sub>J</sub> = +25°C		11.5	12	12.5	
Output Voltage	Vo	IO = 5mA to 35 VI = 14.5V to 27	-	11.4	12	12.6	V		
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 14.5V to 30V	-	-	100	mV		
	200	TJ = +25°C	VI = 16V to 30V	-	-	50	111V		
Load Population (Note1)	ΔVo	IO = 5mA to 0.5	5A, TJ = +25°C	-	-	240	mV		
Load Regulation (Note1)		I <sub>O</sub> = 5mA to 20	0mA, TJ = +25°C	-	-	120	mv		
Quiescent Current	lq	TJ =+25°C		-	4.1	6.0	mA		
	ΔlQ	$I_{O} = 5mA \text{ to } 350$	IO = 5mA to 350mA		-	0.5			
Quiescent Current Change		IO = 200mA VI = 14.5V to 30V		-	-	0.8	mA		
Output Voltage Drift	$\Delta V / \Delta T$	IO = 5mA TJ = 0 to +125°C		-	-0.5	-	mV/°C		
Output Noise Voltage	VN	f = 10Hz to 100	kHz	-	75	-	μV/Vo		
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 15V to 25V, TJ =+25 °C		-	80	-	dB		
Dropout Voltage	VD	TJ =+25°C, IO = 500mA		-	2	-	V		
Short Circuit Current	ISC	TJ = +25°C, VI = 35V		-	300	-	mA		
Peak Current	IPK	TJ = +25°C		-	700	-	mA		

#### Note:

1. Load and line regulation are specified at constant junction temperature. Change in  $V_0$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (MC78M15) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI=23V, unless otherwise specified, CI =0.33 $\mu$ F, CO=0.1 $\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit	
		$T_J = +25^{\circ}C$		14.4	15	15.6		
Output Voltage	Vo	$I_O = 5mA$ to 3 VI = 17.5V to		14.25	15	15.75	V	
Line Regulation (Note1)	ΔVo	IO = 200mA	VI = 17.5V to 30V	-	-	100	mV	
		TJ =+25°C	VI = 20V to 30V	-	-	50	111V	
Load Population (Noto1)	ΔVo	IO = 5mA to 0	0.5A, TJ =+25°C	-	-	300	mV	
Load Regulation (Note1)		$I_{O} = 5mA$ to 2	200mA, TJ =+25°C	-	-	150	111V	
Quiescent Current	lq	TJ = +25°C		-	4.1	6.0	mA	
		$I_{O} = 5mA to 3$	IO = 5mA to 350mA		350mA -	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 17.5V to	30V	-	-	0.8	mA	
Output Voltage Drift	$\Delta V / \Delta T$	IO = 5mA TJ = 0 to +12	:5°C	-	-1	-	mV/°C	
Output Noise Voltage	VN	f = 10Hz to 1	00kHz	-	100	-	μV/Vo	
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 18.5V to 28.5V, TJ =+25 °C		-	70	-	dB	
Dropout Voltage	VD	TJ =+25°C, IO = 500mA		-	2	-	V	
Short Circuit Current	Isc	TJ = +25°C, VI = 35V		-	300	-	mA	
Peak Current	IPK	TJ = +25°C		-	700	-	mA	

#### Note:

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

## Electrical Characteristics (MC78M18) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI=26V, unless otherwise specified, CI =0.33 $\mu$ F, CO=0.1 $\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit
	Т	$T_{J} = +25^{\circ}C$		17.3	18	18.7	
Output Voltage	Vo	IO = 5mA to 350 VI = 20.5V to 33		17.1	18	18.9	V
Line Regulation (Note1)	ΔVo	IO = 200mA	VI = 21V to 33V	-	-	100	mV
Line Regulation (Note1)		TJ = +25°C	VI = 24V to 33V	-	-	50	
Lood Pogulation (Note1)	ΔVO	IO = 5mA to 0.5	A, TJ = +25°C	-	-	360	mV
Load Regulation (Note1)	ΔνΟ	$I_{O} = 5mA \text{ to } 200$	)mA, TJ = +25°C	-	-	180	mv
Quiescent Current	lq	TJ = +25°C		-	4.2	6.0	mA
		I <sub>O</sub> = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 21V to 33V	,	-	-	0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	IO = 5mATJ = 0	to 125°C	-	-1.1	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 100	kHz	-	100	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO= 300mA , VI = 22V to 32V TJ =+25 $^\circ\text{C}$		-	70	-	dB
Dropout Voltage	VD	TJ = +25°C, IO = 500mA		-	2	-	V
Short Circuit Current	Isc	$T_J = +25^{\circ}C, V_I = 35V$		-	300	-	mA
Peak Current	lрк	$T_J = +25^{\circ}C$		-	700	-	mA

#### Note:

1. Load and line regulation are specified at constant junction temperature. Change in V<sub>O</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (MC78M24) (Continued)

(Refer to the test circuits,  $0 \le T_J \le +125^{\circ}$ C, IO=350mA, VI=33V, unless otherwise specified, CI =  $0.33\mu$ F, CO= $0.1\mu$ F)

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit
		TJ =+25°C		23	24	25	
Output Voltage	Vo	$I_{O} = 5mA to$ $V_{I} = 27V to 3$		22.8	24	25.2	V
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 27V to 38V	-	-	100	mV
	200	TJ =+25°C	VI = 28V to 38V	-	-	50	IIIV
Lood Dogulation (Nato1)	11/0	IO = 5mA to	0.5A, TJ =+25°C	-	-	480	mV
Load Regulation (Note1)	ΔVO	I <sub>O</sub> = 5mA to	200mA, TJ =+25°C	-	-	240	IIIV
Quiescent Current	lQ	TJ = +25°C		-	4.2	6.0	mA
		I <sub>O</sub> = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 27V to 3	IO = 200mA VI = 27V to 38V		-	0.8	mA
Output Voltage Drift	$\Delta V / \Delta T$	IO = 5mA TJ = 0 to +125°C		-	-1.2	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 1	00kHz	-	170	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 28V to 38V, TJ =+25 °C		-	70	-	dB
Dropout Voltage	VD	$T_J = +25^{\circ}C, I_O = 500mA$		-	2	-	V
Short Circuit Current	ISC	TJ = +25°C,	VI = 35V	-	300	-	mA
Peak Current	IPK	TJ = +25°C		-	700	-	mA

#### Note:

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

## **Typical Applications**

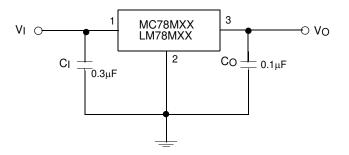


Figure 1. Fixed Output Regulator

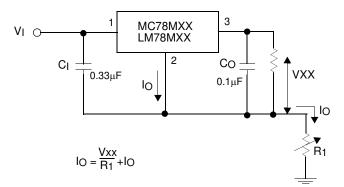


Figure 2. Constant Current Regulator

#### 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. Cl is required if regulator is located an appreciable distance from power Supply filter

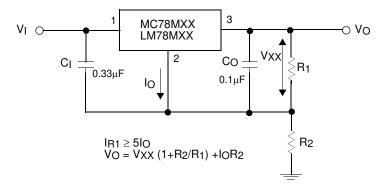


Figure 3. Circuit for Increasing Output Voltage

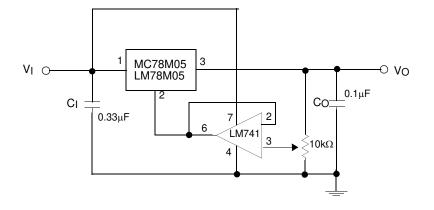


Figure 4. Adjustable Output Regulator (7 to 30V)

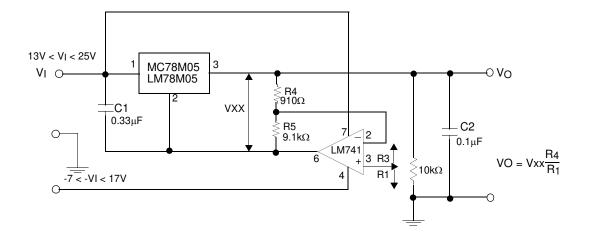


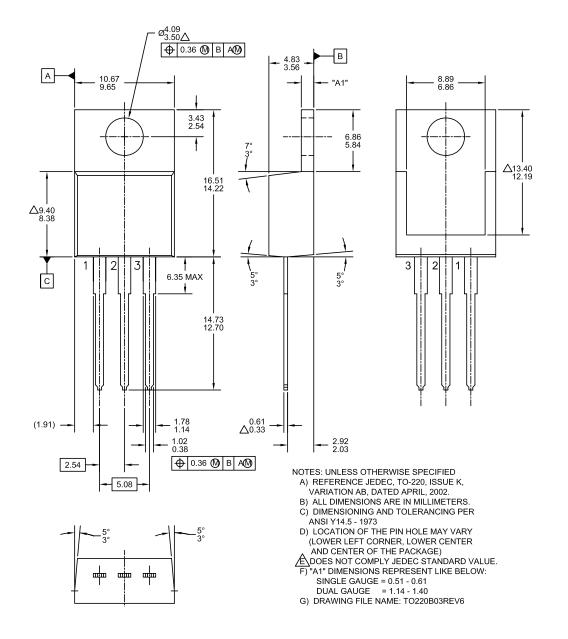
Figure 5. 0.5 to 10V Regulator

### **Mechanical Dimensions**

#### Package

#### **Dimensions in millimeters**

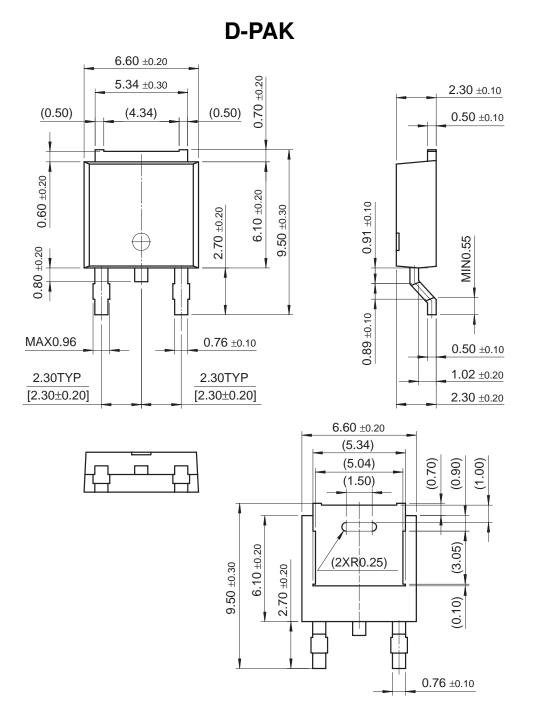
# TO-220 [ SINGLE GAUGE ]



## Mechanical Dimensions (Continued)

#### Package

**Dimensions in millimeters** 



## **Ordering Information**

Product Number	Package	Operating Temperature				
LM78M05CT	TO-220	0 ~ +125°C				
Product Number	Package	Operating Temperature				
MC78M05CT						
MC78M06CT						
MC78M08CT	-					
MC78M12CT	TO-220					
MC78M15CT						
MC78M18CT		0 ~ +125°C				
MC78M24CT	-					
MC78M05CDT		1				
MC78M06CDT	D-PAK					
MC78M08CDT	D-PAK					
MC78M12CDT						

#### 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:

- 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.

www.fairchildsemi.com