

## Features

- Output Current up to 0.5A
- Output Voltages of 5, 6, 8, 12, 15, 18, 24V
- Thermal Overload Protection

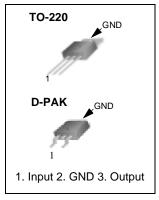
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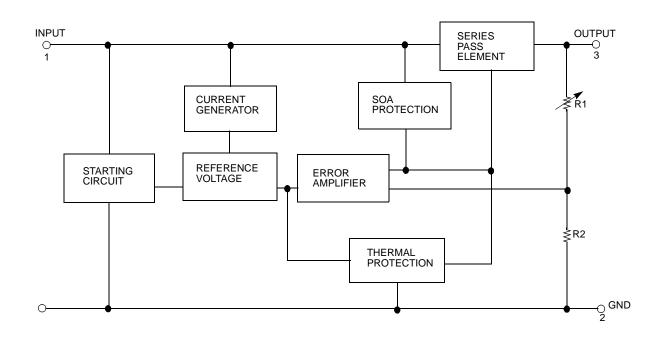
- Short Circuit Protection
- Output Transistor Safe Operating Area (SOA) Protection

## Description

The KA78MXX 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 $V_O = 24V$ )	VI VI	35 40	V V
Thermal Resistance Junction-Cases (Note1) TO-220 (Tc = +25°C)	R <sub>θ</sub> JC	2.5	°C/W
Thermal Resistance Junction-Air (Note1,2) TO-220 (Ta = +25°C) D-PAK (Ta = +25°C)	R <sub>θJA</sub>	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 (KA78M05/KA78M05R)

(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
		TJ =+25°C IO = 5 to 350mA VI = 7 to 20V		4.8	5	5.2	
Output Voltage	Vo			4.75	5	5.25	V
Line Regulation (Note3)	ΔVο	IO = 200mA	V <sub>I</sub> = 7 to 25V	-	-	100	mV
	200	TJ =+25°C	VI = 8 to 25V	-	-	50	IIIV
Load Regulation (Nate2)	11/0	$I_{O} = 5 mA to 0.5A$	∧, TJ = +25°C	-	-	100	mV
Load Regulation (Note3)	ΔVo	IO = 5mA to 200	mA, TJ =+25°C	-	-	50	mv
Quiescent Current	lQ	TJ = +25°C		-	4.0	6.0	mA
		IO = 5mA to 350mA IO = 200mA VI = 8 to 25V		-	-	0.5	
Quiescent Current Change	ΔlQ			-	-	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 100k	Hz	-	40	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 8 to 18V, TJ = +25°C		-	80	-	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	Iрк	TJ = +25°C		-	700	-	mA

#### Note:

# Electrical Characteristics (KA78M06/KA78M06R) (Continued)

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

Parameter	Symbol	Conditions		Min.	Тур.	Max.	Unit
		$T_J = +25^{\circ}C$ IO = 5 to 350mA VI = 8 to 21V		5.75	6	6.25	
Output Voltage	Vo			5.7	6	6.3	V
Line Regulation (Note1)		IO = 200mA	VI = 8 to 25V	-	-	100	mV
Line Regulation (Note1)	ΔVo	TJ =+25°C	VI = 9 to 25V	-	-	50	IIIV
Load Population (Noto1)		IO = 5mA  to  0.3	5A, TJ =+25°C	-	-	120	mV
Load Regulation (Note1)	ΔVO	IO = 5mA to 20	00mA, TJ =+25°C	-	-	60	IIIV
Quiescent Current	lQ	TJ =+25°C		-	4.0	6.0	mA
		IO = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	I <sub>O</sub> = 200mA V <sub>I</sub> = 9 to 25V		-	-	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 100	)kHz	-	45	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 9 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	lрк	TJ =+25°C		-	700	-	mA

### Note:

## Electrical Characteristics (KA78M08/KA78M08R) (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 = 5 to 350mA VI= 10.5 to 23V		7.6	8	8.4	V
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 10.5 to 25V	-	-	100	mV
Line Regulation (Note1)	200	TJ =+25°C	VI = 11 to 25V	-	-	50	IIIV
Load Regulation (Note1)		IO = 5mA  to  0.5a	A, TJ = +25°C	-	-	160	mV
Load Regulation (Note1)	ΔVO	IO = 5mA to 200	)mA, TJ = +25°C	-	-	80	mv
Quiescent Current	lQ	TJ = +25°C		-	4.0	6.0	mA
		IO = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 10.5 to 25V	,	-	-	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 100k	κHz	-	52	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 11.5 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:

## Electrical Characteristics (KA78M12/KA78M12R) (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		
		TJ = +25°C		T <sub>J</sub> = +25°C		11.5	12	12.5	
Output Voltage	Vo	IO = 5 to 350mA VI = 14.5 to 27V		11.4	12	12.6	V		
Line Regulation (Note1)		IO = 200mA	VI= 14.5 to 30V	-	-	100	mV		
Line Regulation (Note1)	ΔVO	TJ = +25°C	VI = 16 to 30V	-	-	50			
Load Pagulation (Noto1)		IO = 5mA  to  0.5	A, TJ = +25°C	-	-	240	mV		
Load Regulation (Note1)	ΔVo	IO = 5mA to 200	)mA, TJ =+25°C	-	-	120			
Quiescent Current	lq	TJ=+25°C		-	4.1	6.0	mA		
		IO = 5mA to 350mA		-	-	0.5			
Quiescent Current Change	ΔlQ	IO = 200mA VI = 14.5 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 100k	κHz	-	75	-	μV/Vo		
Ripple Rejection	RR	f = 120Hz, Io = 300mA VI = 15 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:

# Electrical Characteristics (KA78M15) (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		
		TJ =+25°C		TJ =+25°C		14.4	15	15.6	
Output Voltage	Vo	IO = 5 to 350m VI = 17.5 to 30		14.25	15	15.75	V		
Line Regulation (Note1)	ΔVο	IO = 200mA	VI = 17.5 to 30V	-	-	100	mV		
	200	TJ = +25°C	VI = 20 to 30V	-	-	50	IIIV		
Load Regulation (Note1)	ΔVο	IO = 5mA to 0.	5A, TJ =+25°C	-	-	300	mV		
	200	$I_{O} = 5mA$ to 20	00mA, TJ =+25°C	-	-	150	IIIV		
Quiescent Current	lQ	TJ =+25°C		-	4.1	6.0	mA		
		IO = 5mA to 350mA		-	-	0.5			
Quiescent Current Change	ΔlQ	IO = 200mA VI = 17.5 to 30V			0.8	mA			
Output Voltage Drift	ΔV/ΔΤ	IO = 5mA TJ = 0 to +125°C		-	-1	-	mV/°C		
Output Noise Voltage	VN	f = 10Hz to 100	OkHz	-	100	-	μV/Vo		
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA VI = 18.5 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	lрк	TJ = +25°C		-	700	-	mA		

### Note:

## Electrical Characteristics (KA78M18) (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		
		TJ = +25°C	$T_J = +25^{\circ}C$		$T_J = +25^{\circ}C$		18	18.7	
Output Voltage	Vo	IO = 5 to 350m/ VI = 20.5 to 33V		17.1	18	18.9	V		
Line Regulation (Note1)	ΔVo	IO = 200mA	VI = 21 to 33V	-	-	100	mV		
		TJ =+25°C	VI = 24 to 33V	-	-	50	IIIV		
Load Population (Note1)	ΔVΟ	IO = 5mA to 0.5	A, TJ = +25°C	-	-	360	mV		
Load Regulation (Note1)	ΔνΟ	IO = 5mA to 200	0mA, TJ = +25°C	-	-	180	ΠV		
Quiescent Current	lq	TJ =+25°C		-	4.2	6.0	mA		
		IO = 5mA to 350mA		IO = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 21 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=22 to 32V 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:

# Electrical Characteristics (KA78M24) (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	IO = 5 to 350n VI = 27 to 38V		22.8	24	25.2	V
Lino Pogulation		IO = 200mA	VI = 27 to 38V	-	-	100	mV
Line Regulation	ΔVo	TJ = +25°C	VI = 28 to 38V	-	-	50	IIIV
Load Pogulation	ΔVο	IO = 5mA  to  0	.5A, TJ =+25°C	-	-	480	mV
Load Regulation	200	$I_{O} = 5mA$ to 2	00mA, TJ =+25°C	-	-	240	mv
Quiescent Current	lQ	TJ = +25°C		-	4.2	6	mA
		IO = 5mA to 350mA		-	-	0.5	
Quiescent Current Change	ΔlQ	IO = 200mA VI = 27 to 38V		-	-	0.8	mA
Output Voltage Drift	ΔV/ΔΤ	IO = 5mA TJ = 0 to +125°C		-	-1.2	-	mV/°C
Output Noise Voltage	VN	f = 10Hz to 10	0kHz	-	170	-	μV
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 28 to 38V, 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:

## **Typical Applications**

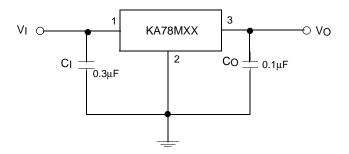


Figure 1. Fixed Output Regulator

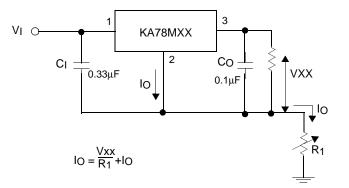


Figure 2. Constant Current Regulator

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

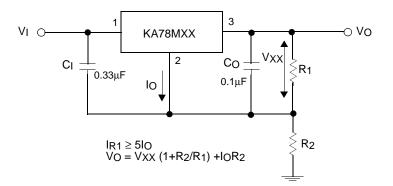


Figure 3. Circuit for Increasing Output Voltage

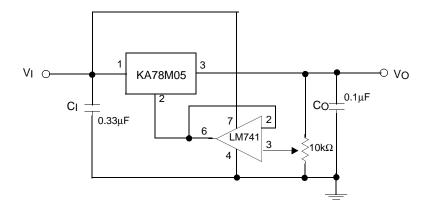


Figure 4. Adjustable Output Regulator (7 to 30V)

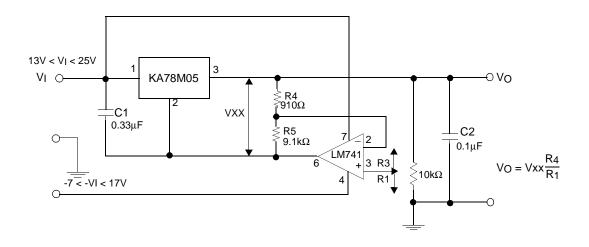


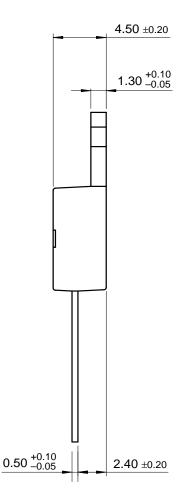
Figure 5. 0.5 to 10V Regulator

## **Mechanical Dimensions**

### Package

# $9.90{\scriptstyle~\pm 0.20}$ .30 ±0.10 (8.70) **2.80** ±0.10 (1.70) ø3.60 ±0.10 (3.70) 18.95MAX. $15.90 \pm 0.20$ 9.20 ±0.20 (1.46) (3.00) (A5°) (1.00) $13.08 \pm 0.20$ $10.08 \pm 0.30$ 1.27 ±0.10 1.52 ±0.10 0.80 ±0.10 2.54TYP 2.54TYP [2.54 ±0.20] $\textbf{[2.54 \pm 0.20]}$ <u>\_\_\_\_\_</u>

 $10.00 \pm 0.20$ 



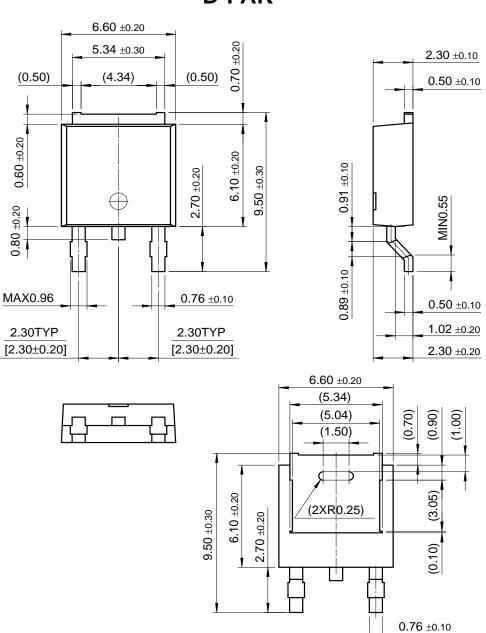
**Dimensions in millimeters** 

**TO-220** 

### Mechanical Dimensions (Continued)

### Package





**D-PAK** 

# **Ordering Information**

Product Number	Package	Operating Temperature	
KA78M05			
KA78M06			
KA78M08			
KA78M12	TO-220 D-PAK		
KA78M15			
KA78M18			0 ~ +125°C
KA78M24			
KA78M05R			
KA78M06R			
KA78M08R			
KA78M12R			

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- 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.

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