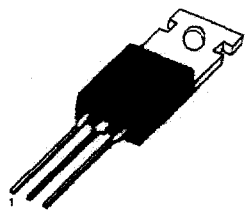
KA78MXX/I FIXED VOLTAGE REGULATOR (POSITIVE)

3-TERMINAL 0.5A POSITIVE VOLTAGE REGULATORS

The KA78MXXC/I series of three-terminal positive regulators are available in the TO-220 package with several fixed output voltages making it useful in a wide range of applications.

TO-220



1:Input 2: GND 3: Output

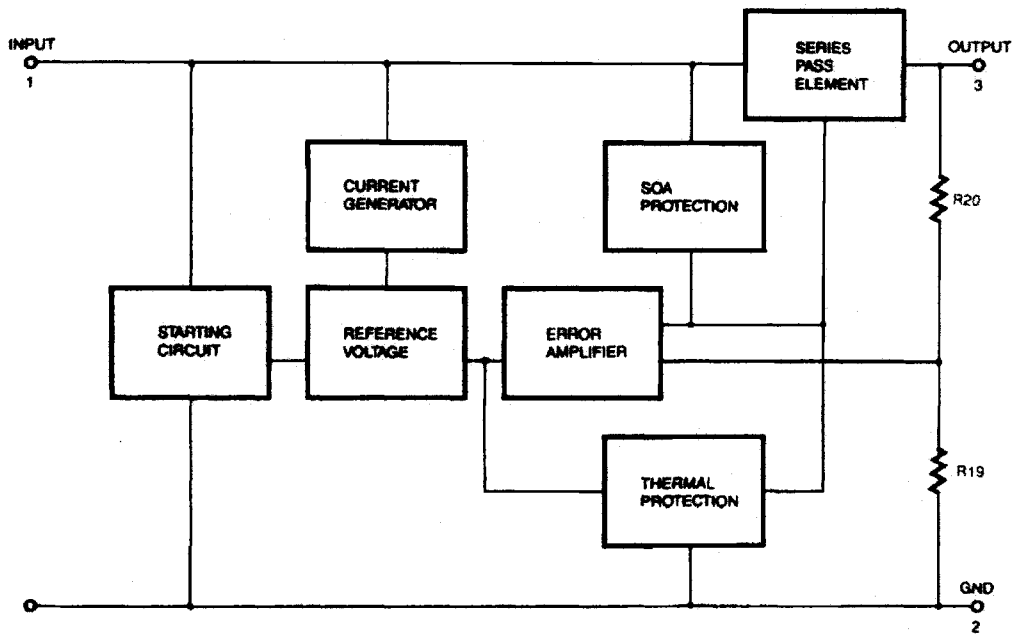
FEATURES

- Output Current up to 0.5A
- Output Voltages of 5; 6; 8; 10; 12; 15; 18; 20; 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor SOA Protection
- Industrial and commercial temperature range

ORDERING INFORMATION

Device	Package	Operating Temperature
KA78MXX	TO-220	0 ~ + 125℃
KA78MXXI	TO-220	- 40 ~ +125℃

BLOCK DIAGRAM



SAMSUNG ELECTRONICS

ABSOLUTE MAXIMUM RATINGS (T_A=25℃, unless otherwise specified)

Characteristic	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V) (for V_O = 24V)	V_I V_I	35 40	V V
Thermal Resistance Junction-Cases	$R_{\theta JC}$	5	℃/W
Thermal Resistance Junction-Air	$R_{\theta JA}$	65	℃/W
Operating Temperature Range KA78XXI KA78XX	T_{OPR}	-40~ + 125 0~ + 125	℃ ℃
Storage Temperature Range	T_{STG}	-65~ + 150	℃

KA78M05/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=10V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		4.8	5	5.2	V
		I_O = 5 to 350mA V_I= 7 to 20V		4.75	5	5.25	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 7 to 25V			100	mV
		T_J = 25℃	V_I = 8 to 25V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				100	mV
		I_O = 5mA to 200mA, T_J = 25℃				50	
Quiescent Current	I_Q	T_J= 25℃			4.0	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 8 to 25V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 0.5		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			40		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 8 to 18V		62			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

* $T_{MIN} < T_J < T_{MAX}$
KA78MXXI : T_{MIN}=-40℃, T_{MAX} = +125℃
KA78MXX : T_{MIN}=0℃, T_{MAX} = +125℃

* 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.

KA78M06/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=11V, unless otherwise specified, $C_I = 0.33\mu F$, C_O=0.1 μ F)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		5.75	6	6.25	V
		I_O = 5 to 350mA V_I= 8 to 21V		5.7	6	6.3	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 8 to 25V			100	mV
		T_J = 25℃	V_I = 9 to 25V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				120	mV
		I_O = 5mA to 200mA, T_J = 25℃				60	
Quiescent Current	I_Q	T_J= 25℃			4.0	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 9 to 25V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 0.5		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			45		μ V
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9 to 19V		59			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M08/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=14V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		7.7	8	8.3	V
		I_O = 5 to 350mA V_I= 10.5 to 23V		7.6	8	8.4	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 10.5 to 25V			100	mV
		T_J = 25℃	V_I = 11 to 25V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				160	mV
		I_O = 5mA to 200mA, T_J = 25℃				80	
Quiescent Current	I_Q	T_J= 25℃			4.0	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 10.5 to 25V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 0.5		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			52		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9 to 19V		56			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M10/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=17V, unless otherwise specified, C_I= 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		9.6	10	10.4	V
		I_O = 5 to 350mA V_I= 12.5 to 25V		9.5	10	10.5	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 12.5 to 25V			100	mV
		T_J = 25℃	V_I = 13 to 25V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				200	mV
		I_O = 5mA to 200mA, T_J = 25℃				100	
Quiescent Current	I_Q	T_J= 25℃			4.1	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 12.5 to 25V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 0.5		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			65		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 13 to 23V		55			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M12/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=19V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		11.5	12	12.5	V
		I_O = 5 to 350mA V_I= 14.5 to 27V		11.5	12	12.6	
Lines Regulation	ΔV_O	I_O = 200mA	V_I= 14.5 to 30V			100	mV
		T_J = 25℃	V_I = 16 to 30V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				240	mV
		I_O = 5mA to 200mA, T_J = 25℃				120	
Quiescent Current	I_Q	T_J= 25℃			4.1	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 14.5 to 30V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 0.5		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			75		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 15 to 25V		55			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M15/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=23V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		14.4	15	15.6	V
		I_O = 5 to 350mA V_I= 17.5 to 30V		14.25	15	15.75	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 17.5 to 30V			100	mV
		T_J = 25℃	V_I = 20 to 30V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				300	mV
		I_O = 5mA to 200mA, T_J = 25℃				150	
Quiescent Current	I_Q	T_J= 25℃			4.1	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 17.5 to 30V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 1		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			100		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 18.5 to 28.5V		54			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M18/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=26V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		17.3	18	18.7	V
		I_O = 5 to 350mA V_I= 20.5 to 33V		17.1	18	18.9	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 21 to 33V			100	mV
		T_J = 25℃	V_I = 24 to 33V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				360	mV
		I_O = 5mA to 200mA, T_J = 25℃				180	
Quiescent Current	I_Q	T_J= 25℃			4.2	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 21 to 33V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 1.1		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			100		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 22 to 32V		53			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M20/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=29V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		19.2	20	20.8	V
		I_O = 5 to 350mA V_I= 23 to 35V		19	20	21	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 23 to 35V			100	mV
		T_J = 25℃	V_I = 24 to 35V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				400	mV
		I_O = 5mA to 200mA, T_J = 25℃				200	
Quiescent Current	I_Q	T_J= 25℃			4.2	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 23 to 35V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 1.1		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			110		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 24 to 34V		53			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

KA78M24/I ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, $T_{MIN} \leq T_J \leq 125℃$, I_O=350mA, V_I=33V, unless otherwise specified, C_I = 0.33 μF, C_O=0.1 μF)

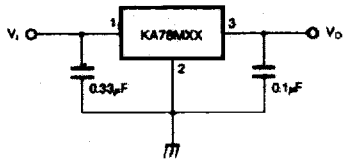
Characteristic	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_J= 25℃		23	24	25	V
		I_O = 5 to 350mA V_I= 27 to 38V		22.8	24	25.2	
Line Regulation	ΔV_O	I_O = 200mA	V_I= 27 to 38V			100	mV
		T_J = 25℃	V_I = 28 to 38V			50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J = 25℃				480	mV
		I_O = 5mA to 200mA, T_J = 25℃				240	
Quiescent Current	I_Q	T_J= 25℃			4.2	6	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 350mA				0.5	mA
		I_O = 200mA V_I = 27 to 38V				0.8	
Output Voltage Drift	$\frac{\Delta V_O}{\Delta T}$	I_O = 5mA T_J = 0 to 125℃			- 1.2		mV/℃
Output Noise Voltage	V_N	f = 10Hz to 100KHz			170		μV
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 28 to 38V		50			dB
Dropout Voltage	V_D	T_J = 25℃, I_O = 500mA			2		V
Short Circuit Current	I_{SC}	T_J= 25℃, V_I= 35V			300		mA
Peak Current	I_{PK}	T_J = 25℃			700		mA

*T_{MIN}
KA78MXXI:T_{MIN}=-40℃
KA78MXX:T_{MIN}=0℃

* 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.

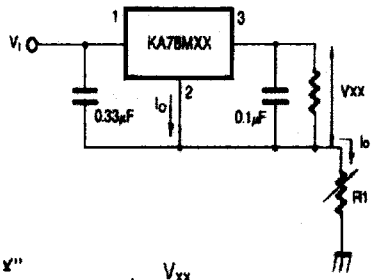
APPLICATION CIRCUIT

Fig. 1 Fixed output 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.

Fig. 2 Constant current regulator



$$I_O = \frac{V_{XX}}{R_1} + I_O$$

Fig. 3 Circuit for Increasing output voltage

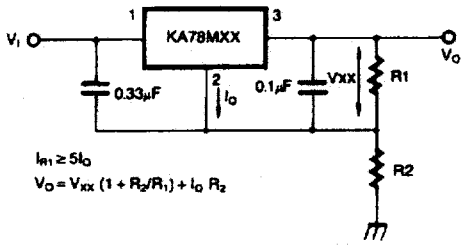


Fig. 4 Adjustable output regulator (7 to 30V)

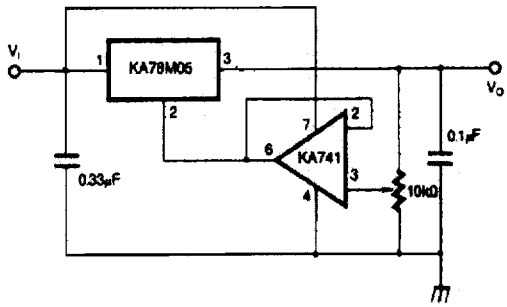
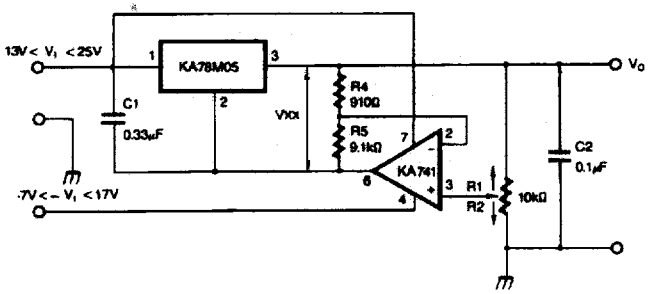


Fig. 5 0.5 to 10V Regulator



$$V_O = V_{XX}\frac{R_4}{R_1}$$