MC78MXX (LM78MXX) (KA78MXX)

3-Terminal 0.5A Positive Voltage Regulators

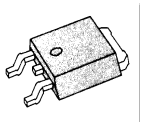
Features

- 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

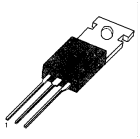
Description

The MC78MXX (LM78MXX) (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.

TO-220



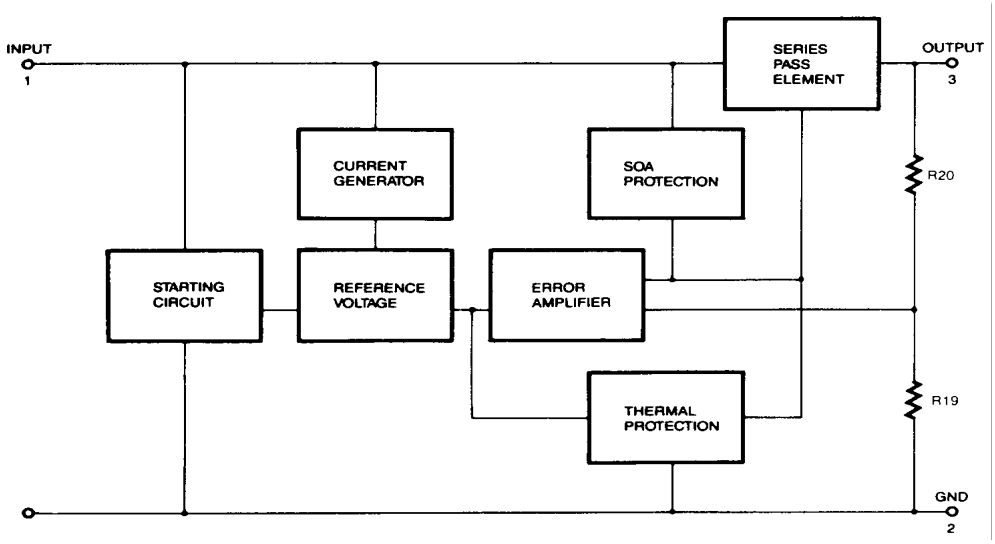
D-PAK



1. Input 2. GND 3. Output

Fixed Voltage Regulator (Positive)

Internal Block Diagram



Fixed Voltage Regulator (Positive)

Absolute Maximum Ratings (Ta=+25°C, Unless otherwise specified)

Parameter	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	°C/W
Thermal Resistance Junction-Air	$R_{\theta JA}$	65	°C/W
Operating Temperature Range KA78MXXI/RI KA78MXX/R	T_{OPR}	-40~ + 125 0~ + 125	°C °C
Storage Temperature Range	T_{STG}	-65~ + 150	°C

KA78M05/I/R/RI Electrical Characteristics

(Refer to the test circuits, $T_{MIN} \le T_J \le +125°C$, I_O=350mA, V_I=10V, unless otherwise specified, C_I = 0.33mF, C_O=0.1mF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25°C		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 T_J =+25°C	V_I= 7 to 25V	-	-	100	mV
			V_I = 8 to 25V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	100	mV
		I_O = 5mA to 200mA, T_J =+25 °C		-	-	50	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	40	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 8 to 18V		62	-	-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J=+25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. $T_{MIN}<T_J<T_{MAX}$
   KA78MXX/RI: T_{MIN}= -40°C, T_{MAX} = +125°C
   KA78MXX/R: T_{MIN}= 0°C, T_{MAX} = +125°C
2. 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/R/RI Electrical Characteristics

(Refer to the test circuits, $T_{MIN} \leq T_J \leq +125°C$, I_O=350mA, V_I =11V, unless otherwise specified, C_I = 0.33mF, C_O=0.1mF)(

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	TJ=+25°C		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 T_J =+25°C	V_I= 8 to 25V	-	-	100	mV
			V_I = 9 to 25V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	120	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	60	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	45	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9 to 19V		59	-	-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J= +25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25 °C		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 T_J =+25°C	V_I= 10.5 to 25V	-	-	100	mV
			V_I = 11 to 25V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	160	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	80	
Quiescent Current	I_Q	T_J=+25°C		-	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	RR	I_O = 5mA T_J = 0 to +125°C		-	- 0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	52	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9 to 19V		56	-	-	dB
Dropout Voltage	V_D	T_J =+25°C,I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J =+25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI Electrical Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J= +25°C		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 T_J =+25°C	V_I= 12.5 to 25V	-	-	100	mV
			V_I = 13 to 25V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	200	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	100	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	65	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 13 to 23V		55	-	-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J= +25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI Electrical Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25°C		11.5	12	12.5	V
		I_O = 5 to 350mA V_I= 14.5 to 27V		11.5	12	12.6	
Line Regulation	ΔV_O	I_O = 200mA T_J =+25°C	V_I= 14.5 to 30V	-	-	100	mV
			V_I = 16 to 30V	-	-	50	
Load Regulation	ΔV^O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	240	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	120	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 0.5	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	75	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 15 to 25V		55		-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J= +25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25°C		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 T_J =+25°C	V_I= 17.5 to 30V	-	-	100	mV
			V_I = 20 to 30V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	300	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	150	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 1	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	100	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 18.5 to 28.5V		54			dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J= +25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J = + 25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI Electrical Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25°C		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°C	V_I = 24 to 33V	-	-	50	
Load Regulation	ΔVO	I_O = 5mA to 0.5A, T_J =+25°C		-	-	360	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	180	
Quiescent Current	I_Q	T_J =+25°C		-	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	$\Delta V/\Delta T$	I_O =5mA T_J =0 to 125°C		-	-1.1	-	mV/°C
Output Noise Voltage	V_N	f=10Hz to 100KHz			100	-	$\mu V/V_O$
Ripple Rejection	RR	f=120Hz, I_O=300mA		53		-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O=500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J =+25°C, V_I=35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/R: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI Electrical Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J= +25°C		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 T_J =+25°C	V_I= 23 to 35V	-	-	100	mV
			V_I = 24 to 35V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	400	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	200	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	-1.1	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	110	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 24 to 34V		53	-	-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J = +25°C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J = +25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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/R/RI Electrical Characteristics

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Output Voltage	V_O	T_J=+25°C		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 T_J =+25°C	V_I= 27 to 38V	-	-	100	mV
			V_I = 28 to 38V	-	-	50	
Load Regulation	ΔV_O	I_O = 5mA to 0.5A, T_J =+25°C		-	-	480	mV
		I_O = 5mA to 200mA, T_J =+25°C		-	-	240	
Quiescent Current	I_Q	T_J=+25°C		-	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	$\Delta V/\Delta T$	I_O = 5mA T_J = 0 to +125°C		-	- 1.2	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz		-	170	-	mV/V_O
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 28 to 38V		50	-	-	dB
Dropout Voltage	V_D	T_J =+25°C, I_O = 500mA		-	2	-	V
Short Circuit Current	I_{SC}	T_J= +25 °C, V_I= 35V		-	300	-	mA
Peak Current	I_{PK}	T_J =+25°C		-	700	-	mA

NOTE:

1. T_{MIN}:
   KA78MXX/RI: T_{MIN} = -40°C
   KA78MXX/R: T_{MIN} = 0°C
2. 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

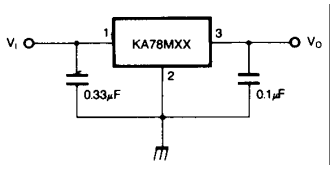


Figure 1. Fixed Output Regulator

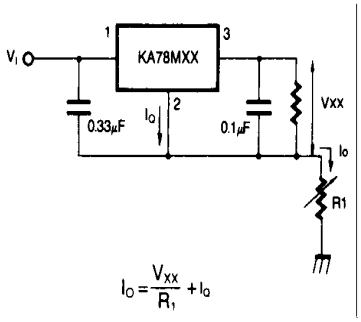


Figure 2. Constant Current Regulator

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

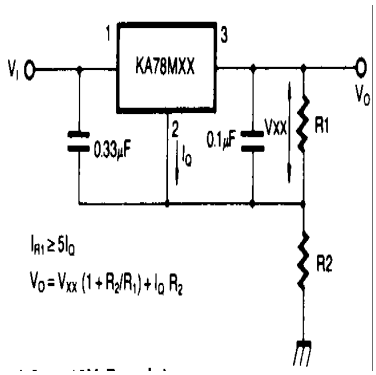


Figure 3. Circuit for Increasing Output Voltage

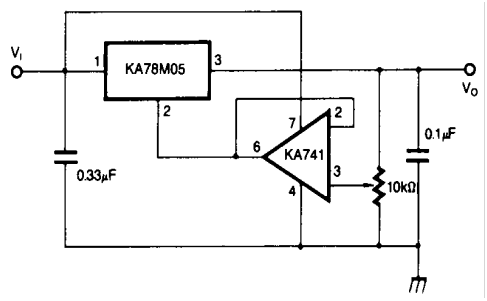


Figure 4. Adjustable Output Regulator (7 to 30V)

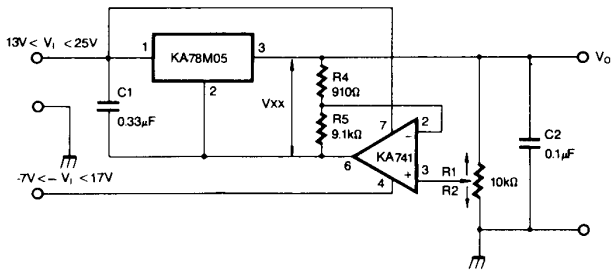


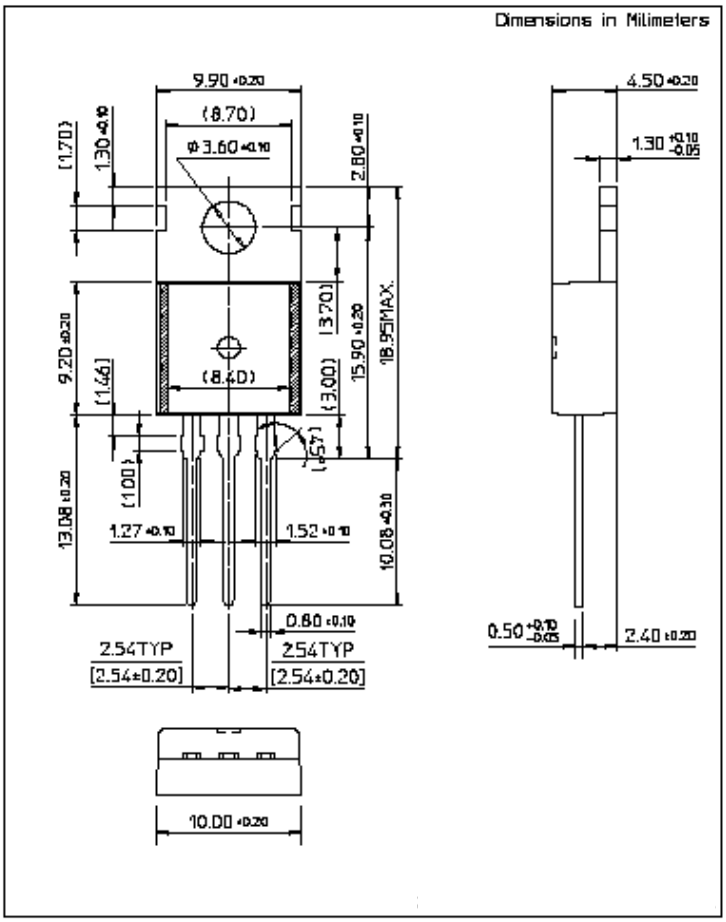
Figure 5. 0.5 to 10V Regulator

Ordering Information

Device	Package	Operating Temperature
MC78MXXCT (LM78XXCT) (KA78MXX)	TO-220	0 ~ + 125°C
KA78MXXI		-40 ~ +125°C
MC78MXXCDT (KA78MXXR)	D-PAK	0 ~ + 125°C
KA78MXXRI		-40 ~ + 125°C

Package Dimensions

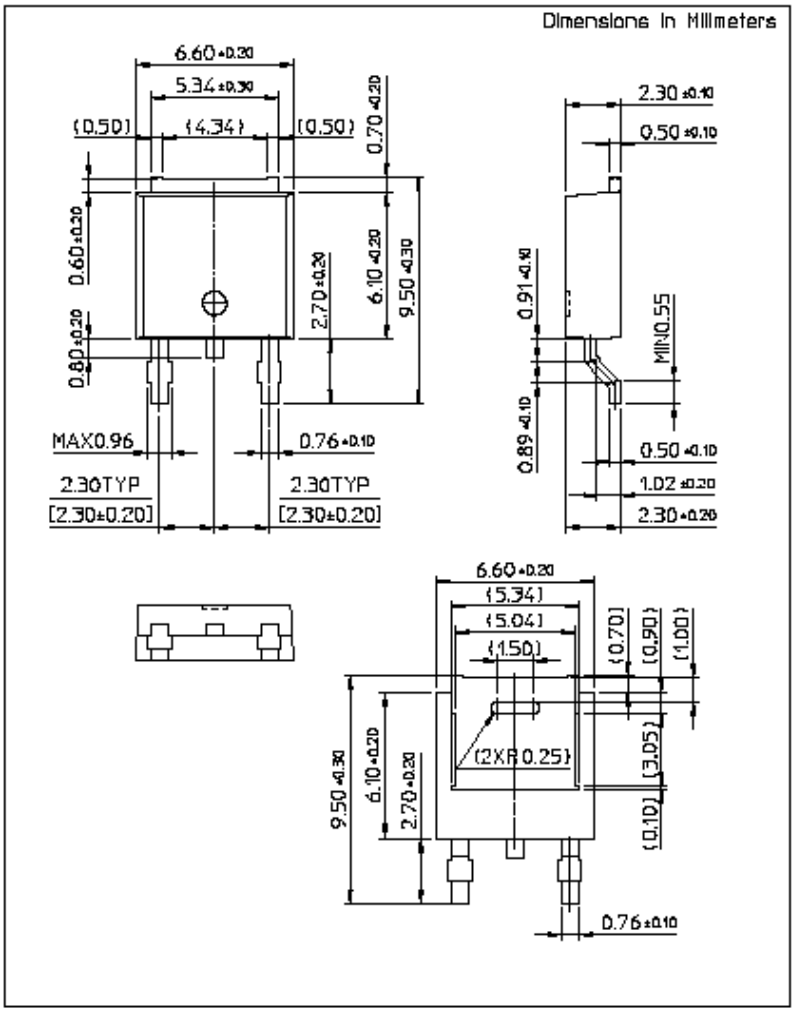
TO-220



Package Dimensions (Continued)

Fixed Voltage Regulator (Positive)

D-PAK



Fixed Voltage Regulator (Positive)

Fixed Voltage Regulator (Positive)

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.

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