KA78MXX
## 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 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 GND

1

D-PAK GND

1

1. Input 2. GND 3. Output
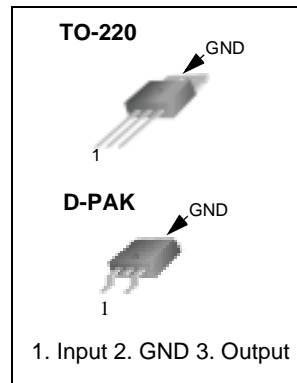
Internal Block Diagram

Rev. 1.0.5
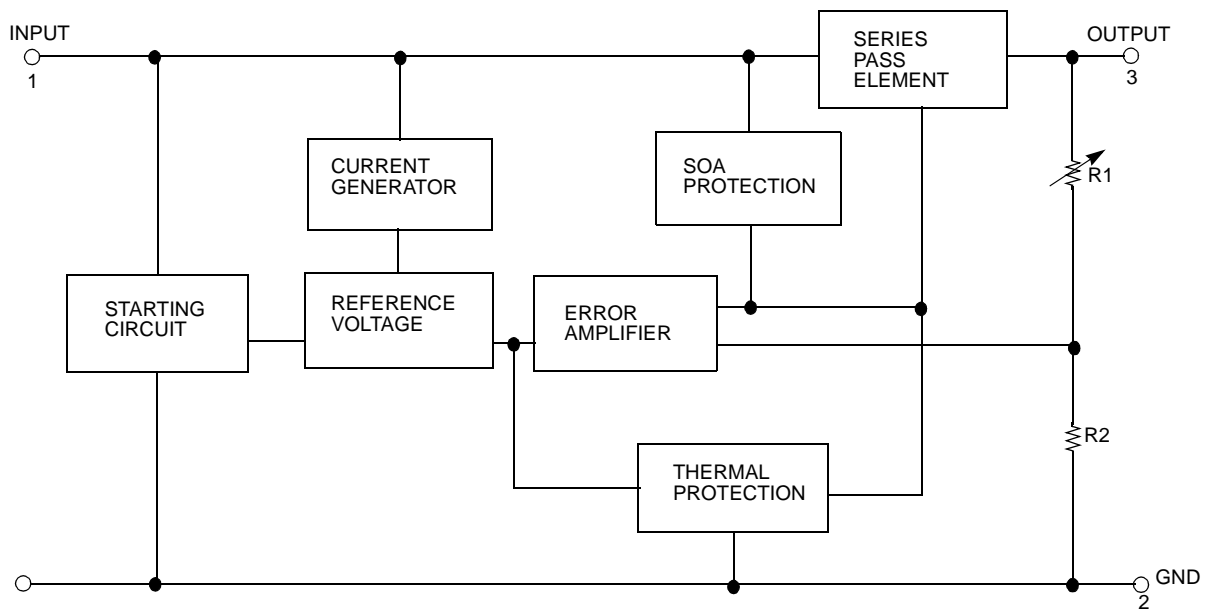
Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V)	V_I	35	V
(for V_O = 24V)	V_I	40	V
Thermal Resistance Junction-Cases (Note1) TO-220 (Tc = +25°C)	$R_{\theta JC}$	2.5	°C/W
Thermal Resistance Junction-Air (Note1,2) TO-220 (Ta = +25°C) D-PAK (Ta = +25°C)	$R_{\theta JA}$	66 92	°C/W
Operating Junction Temperature Range	T_{OPR}	0 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

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, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=10V, unless otherwise specified, C_I =0.33μF, C_O=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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 (Note3)	ΔV_O	I_O = 200mA T_J =+25°C	V_I= 7 to 25V	-	-	100	mV
			V_I = 8 to 25V	-	-	50	
Load Regulation (Note3)	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	6.0	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	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 8 to 18V, T_J = +25°C		-	80	-	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:

3. 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 (KA78M06/KA78M06R) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=11V, unless otherwise specified, C_I =0.33µF, C_O=0.1µF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J = +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 (Note1)	ΔV_O	I_O = 200mA T_J =+25°C	V_I = 8 to 25V	-	-	100	mV
			V_I = 9 to 25V	-	-	50	
Load Regulation (Note1)	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	6.0	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	-	µV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 9 to 19V, T_J = +25°C		-	80	-	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. 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 (KA78M08/KA78M08R) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=14V, unless otherwise specified, C_I =0.33μF, C_O=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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 (Note1)	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 (Note1)	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	6.0	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	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 11.5 to 21.5V, T_J = +25°C		-	80	-	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. 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 (KA78M12/KA78M12R) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=19V, unless otherwise specified, C_I =0.33μF, C_O=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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		11.4	12	12.6	
Line Regulation (Note1)	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 (Note1)	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	6.0	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	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 15 to 25V, T_J = +25°C		-	80	-	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. 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.

5

Electrical Characteristics (KA78M15) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=23V, unless otherwise specified, C_I =0.33μF, C_O=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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 (Note1)	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 (Note1)	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	6.0	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	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 300mA V_I = 18.5 to 28.5V, T_J = +25°C		-	70	-	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. 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 (KA78M18) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, I_O=350mA, V_I=26V, unless otherwise specified, C_I =0.33µF, C_O=0.1µF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
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 (Note1)	ΔV_O	I_O = 200mA T_J =+25°C	V_I = 21 to 33V	-	-	100	mV
			V_I = 24 to 33V	-	-	50	
Load Regulation (Note1)	ΔV_O	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	6.0	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	-	µV/Vo
Ripple Rejection	RR	f = 120Hz, I_O=300mA , V_I=22 to 32V T_J = +25°C		-	70	-	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. 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.
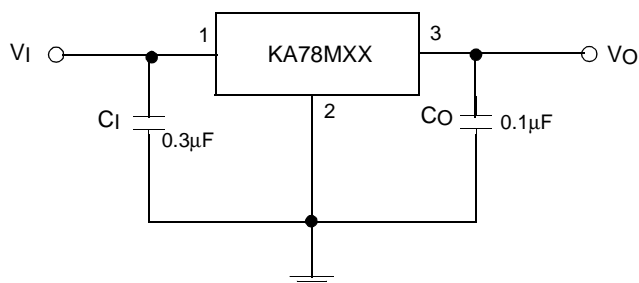
7

Electrical Characteristics (KA78M24) (Continued)

(Refer to the test circuits, $0 \leq T_J \leq +125°C$, $I_O=350mA$, $V_I=33V$, 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	$T_J = +25°C$		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	-	μV
Ripple Rejection	RR	$f = 120Hz$, $I_O = 300mA$ $V_I = 28$ to $38V$, $T_J = +25°C$		-	70	-	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. 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.

8

Typical Applications

Figure 1. Fixed Output Regulator
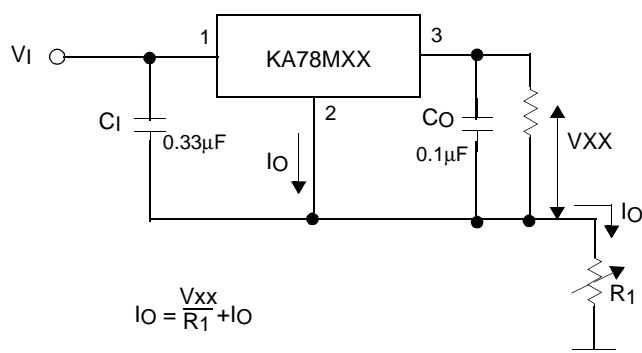

$$I_O = \frac{V_{xx}}{R_1} + I_O$$

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
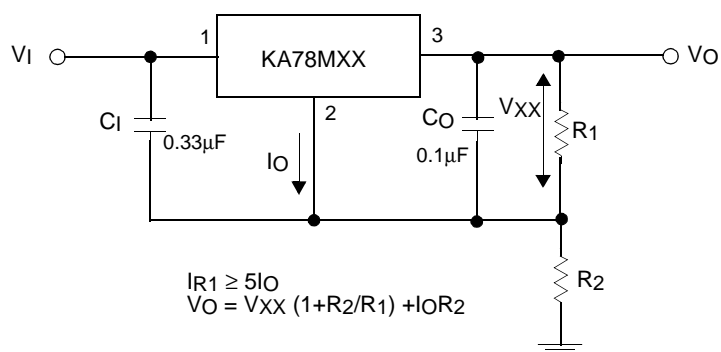

$$I_{R1} \geq 5I_O$$
$$V_O = V_{XX} (1+R_2/R_1) + I_O R_2$$

Figure 3. Circuit for Increasing Output Voltage

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

$$V_O = Vxx \frac{R4}{R1}$$

Figure 5. 0.5 to 10V Regulator

10

Mechanical Dimensions

Package

Dimensions in millimeters

TO-220
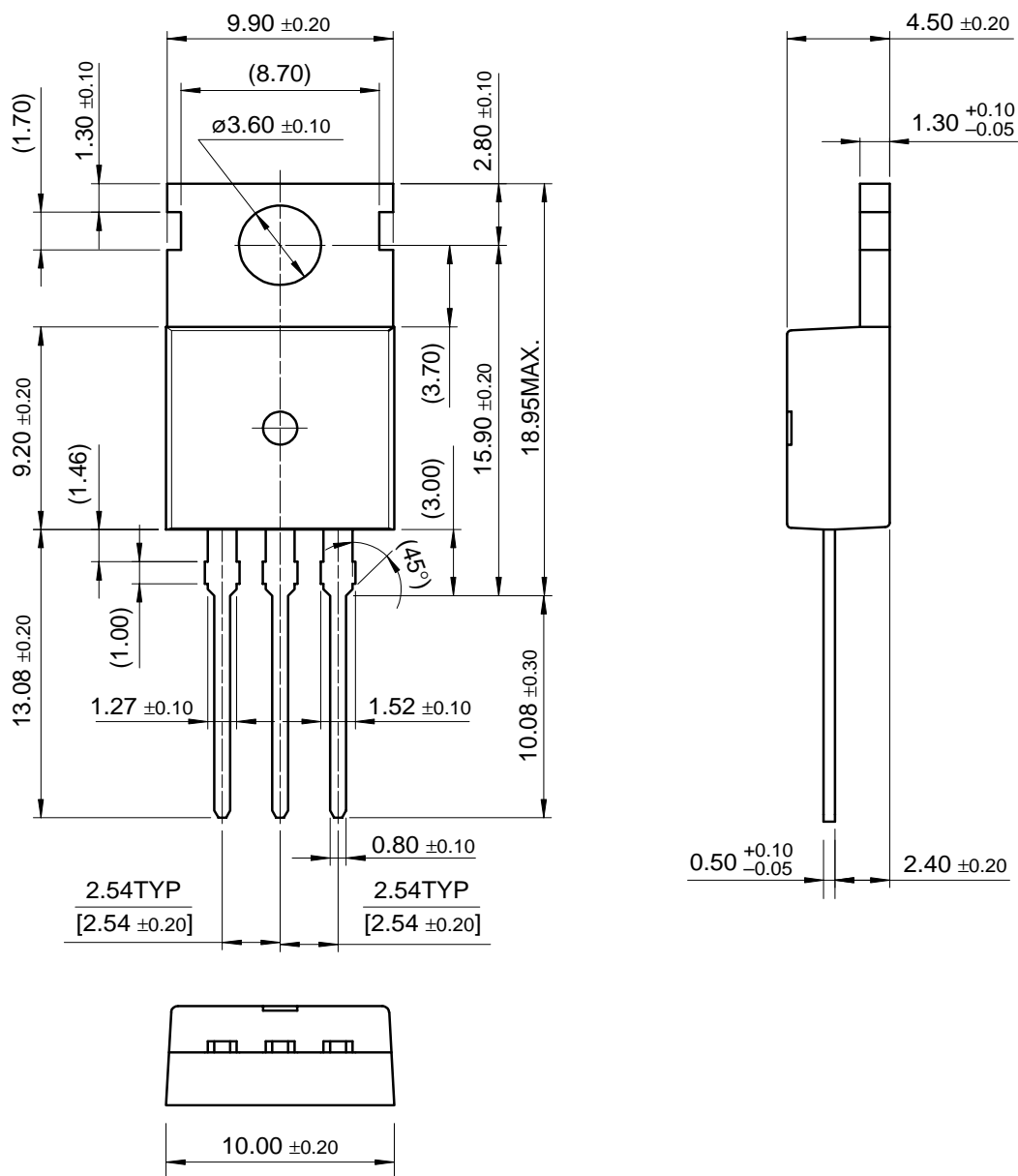
Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

D-PAK
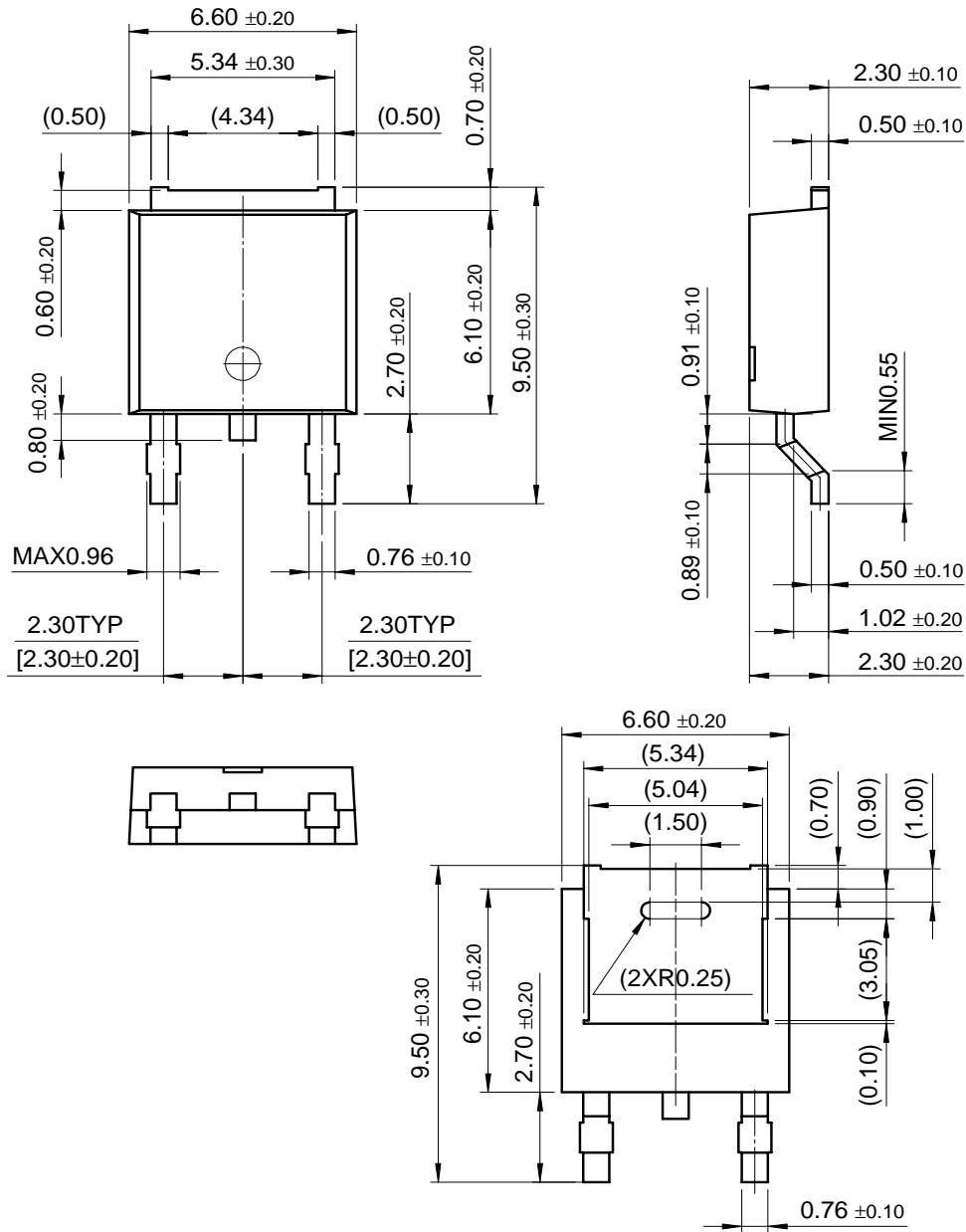
Ordering Information

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

www.fairchildsemi.com