

KA78LXXA

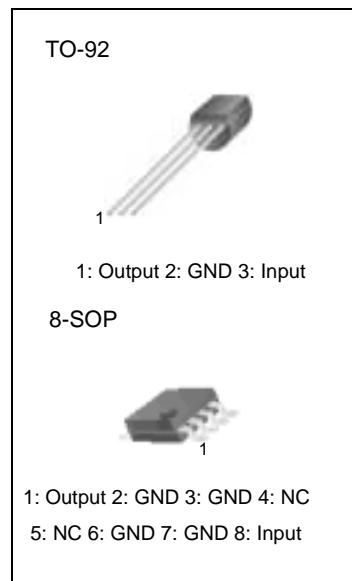
3-terminal 0.1A positive voltage regulator

Features

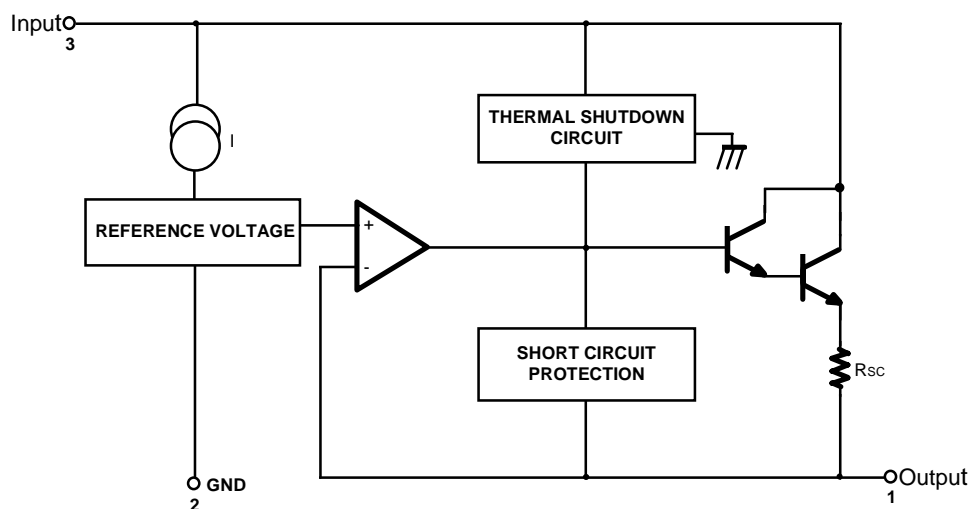
- Maximum Output Current of 100mA
- Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in $\pm 5\%$ Tolerance

Description

The KA78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply current up to 100mA.



Internal Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for $V_O = 5V, 8V$) (for $V_O = 12V$ to $18V$) (for $V_O = 24V$)	V_I	30 35 40	V V V
Operating Junction Temperature Range	T_J	0 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics(KA78L05A)

($V_I = 10V, I_O = 40mA, 0^\circ C \leq T_J \leq 125^\circ C, C_I = 0.33 \mu F, C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V_O	$T_J = 25^\circ C$	4.8	5.0	5.2	V	
Line Regulation	ΔV_O	$T_J = 25^\circ C$	$7V \leq V_I \leq 20V$	-	8	150	mV
			$8V \leq V_I \leq 20V$	-	6	100	mV
Load Regulation	ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	11	60	mV
			$1mA \leq I_O \leq 40mA$	-	5.0	30	mV
Output Voltage	V_O	$7V \leq V_I \leq 20V$	$1mA \leq I_O \leq 40mA$	-	-	5.25	V
		$7V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	4.75	-	5.25	V
Quiescent Current	I_Q	$T_J = 25^\circ C$	-	2.0	5.5	mA	
Quiescent Current Change	with line	ΔI_Q	$8V \leq V_I \leq 20V$	-	-	1.5	mA
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA
Output Noise Voltage	V_N	$T_A = 25^\circ C, 10Hz \leq f \leq 100KHz$	-	40	-	μV	
Temperature Coefficient of V_O	$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-0.65	-	mV/°C	
Ripple Rejection	RR	$f = 120Hz, 8V \leq V_I \leq 18V, T_J = 25^\circ C$	41	80	-	dB	
Dropout Voltage	V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L06A)

($V_I = 12V$, $I_O = 40mA$, $0\text{ }^\circ\text{C} \leq T_J \leq 125\text{ }^\circ\text{C}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25\text{ }^\circ\text{C}$	5.75	6.0	6.25	V	
Line Regulation		ΔV_O	$T_J = 25\text{ }^\circ\text{C}$	$8.5V < V_I < 20V$	-	64	175	mV
				$9V \geq V_I \geq 20V$	-	54	125	mV
Load Regulation		ΔV_O	$T_J = 25\text{ }^\circ\text{C}$	$1mA < I_O < 100mA$	-	12.8	80	mV
				$1mA < I_O < 70mA$	-	5.8	40	mV
Output Voltage		V_O	$8.5 < V_I < 20V, 1mA < I_O < 40mA$	5.7	-	6.3	V	
			$8.5 < V_I < V_{MAX}(\text{Note}), 1mA < I_O < 70mA$	5.7	-	6.3	V	
Quiescent Current		I_Q	$T_J = 25\text{ }^\circ\text{C}$	-	-	5.5	mA	
			$T_J = 125\text{ }^\circ\text{C}$	-	3.9	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$9 < V_I < 20V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA < I_O < 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25\text{ }^\circ\text{C}, 10\text{Hz} \leq f \leq 100\text{KHz}$	-	40	-	μV	
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	$I_O = 5mA$	-	0.75	-	mV/ $^\circ\text{C}$	
Ripple Rejection		RR	$f = 120\text{Hz}, 10V < V_I < 20V, T_J = 25\text{ }^\circ\text{C}$	40	46	-	dB	
Dropout Voltage		V_D	$T_J = 25\text{ }^\circ\text{C}$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L08A)

($V_I = 14V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	7.7	8.0	8.3	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$10.5V \leq V_I \leq 23V$	-	10	175	mV
				$11V \leq V_I \leq 23V$	-	8	125	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	15	80	mV
				$1mA \leq I_O \leq 40mA$	-	8.0	40	mV
Output Voltage		V_O	$10.5V \leq V_I \leq 23V$	$1mA \leq I_O \leq 40mA$	7.6	-	8.4	V
			$10.5V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	7.6	-	8.4	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.0	5.5	mA	
Quiescent Current Change	with line	ΔI_Q	$11V \leq V_I \leq 23V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	60	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-0.8	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $11V \leq V_I \leq 21V$, $T_J = 25^\circ C$	39	70	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L09A)

($V_I = 15V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	8.64	9.0	9.36	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$11.5V \leq V_I \leq 24V$	-	90	200	mV
				$13V \leq V_I \leq 24V$	-	100	150	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	20	90	mV
				$1mA \leq I_O \leq 40mA$	-	10	45	mV
Output Voltage		V_O	$11.5V \leq V_I \leq 24V$	$1mA \leq I_O \leq 40mA$	8.55	-	9.45	V
			$11.5V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	8.55	-	9.45	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.1	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$13V \leq V_I \leq 24V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	70	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-0.9	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $12V \leq V_I \leq 22V$, $T_J = 25^\circ C$	38	44	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L10A)

($V_I = 16V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	9.6	10.0	10.4	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$12.5 < V_I < 25V$	-	100	220	mV
				$14V \geq V_I \geq 25V$	-	100	170	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	20	94	mV
				$1mA \leq I_O \leq 70mA$	-	10	47	mV
Output Voltage		V_O	$12.5V < V_I < 25V$, $1mA < I_O < 40mA$	9.5	-	10.5	V	
			$12.5V < V_I < V_{MAX}$ (Note2) $1mA < I_O < 70mA$	9.5	-	10.5		
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	-	6.0	mA	
			$T_J = 125^\circ C$	-	4.2	6.5		
Quiescent Current Change	with line	ΔI_Q	$12.5 < V_I < 25V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA < I_O < 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz < f < 100KHz$	-	74	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	0.95	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $15V < V_I < 25V$, $T_J = 25^\circ C$	38	43	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L12A)

($V_I = 19V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	11.5	12	12.5	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$14.5V \leq V_I \leq 27V$	-	20	250	mV
				$16V \leq V_I \leq 27V$	-	15	200	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	20	100	mV
				$1mA \leq I_O \leq 40mA$	-	10	50	mV
Output Voltage		V_O	$14.5V \leq V_I \leq 27V$	$1mA \leq I_O \leq 40mA$	11.4	-	12.6	V
			$14.5V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	11.4	-	12.6	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.1	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$16V \leq V_I \leq 27V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	80	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-1.0	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $15V \leq V_I \leq 25V$, $T_J = 25^\circ C$	37	65	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L15A)

($V_I = 23V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	14.4	15	15.6	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$17.5V \leq V_I \leq 30V$	-	25	300	mV
				$20V \leq V_I \leq 30V$	-	20	250	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	25	150	mV
				$1mA \leq I_O \leq 40mA$	-	12	75	mV
Output Voltage		V_O	$17.5V \leq V_I \leq 30V$	$1mA \leq I_O \leq 40mA$	14.25	-	15.75	V
			$17.5V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	14.25	-	15.75	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.1	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$20V \leq V_I \leq 30V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	90	-	μV	
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	$I_O = 5mA$	-	-1.3	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $18.5V \leq V_I \leq 28.5V$, $T_J = 25^\circ C$	34	60	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L18A)

($V_I = 27V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	17.3	18	18.7	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$21V \leq V_I \leq 33V$	-	145	300	mV
				$22V \leq V_I \leq 33V$	-	135	250	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	30	170	mV
				$1mA \leq I_O \leq 40mA$	-	15	85	mV
Output Voltage		V_O	$21V \leq V_I \leq 33V$	$1mA \leq I_O \leq 40mA$	17.1	-	18.9	V
			$21V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	17.1	-	18.9	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.2	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$21V \leq V_I \leq 33V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	150	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-1.8	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $23V \leq V_I \leq 33V$, $T_J = 25^\circ C$	34	48	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Electrical Characteristics(KA78L24A)

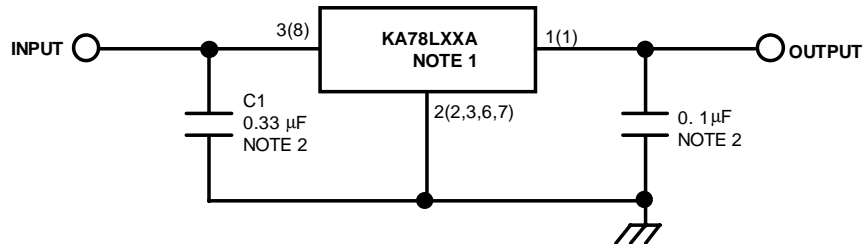
($V_I = 33V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33 \mu F$, $C_O = 0.1 \mu F$, unless otherwise specified. (Note 1))

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage		V_O	$T_J = 25^\circ C$	23	24	25	V	
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$27V \leq V_I \leq 38V$	-	160	300	mV
				$28V \leq V_I \leq 38V$	-	150	250	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	40	200	mV
				$1mA \leq I_O \leq 40mA$	-	20	100	mV
Output Voltage		V_O	$27V \leq V_I \leq 38V$	$1mA \leq I_O \leq 40mA$	22.8	-	25.2	V
			$27V \leq V_I \leq V_{MAX}$ (Note 2)	$1mA \leq I_O \leq 70mA$	22.8	-	25.2	V
Quiescent Current		I_Q	$T_J = 25^\circ C$	-	2.2	6.0	mA	
Quiescent Current Change	with line	ΔI_Q	$28V \leq V_I \leq 38V$	-	-	1.5	mA	
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA	
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$	-	200	-	μV	
Temperature Coefficient of V_O		$\Delta V_O / \Delta T$	$I_O = 5mA$	-	-2.0	-	mV/ $^\circ C$	
Ripple Rejection		RR	$f = 120Hz$, $28V \leq V_I \leq 38V$, $T_J = 25^\circ C$	34	45	-	dB	
Dropout Voltage		V_D	$T_J = 25^\circ C$	-	1.7	-	V	

Notes:

1. The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $\leq 0.75W$.

Typical Application



'()' : 8SOP Type

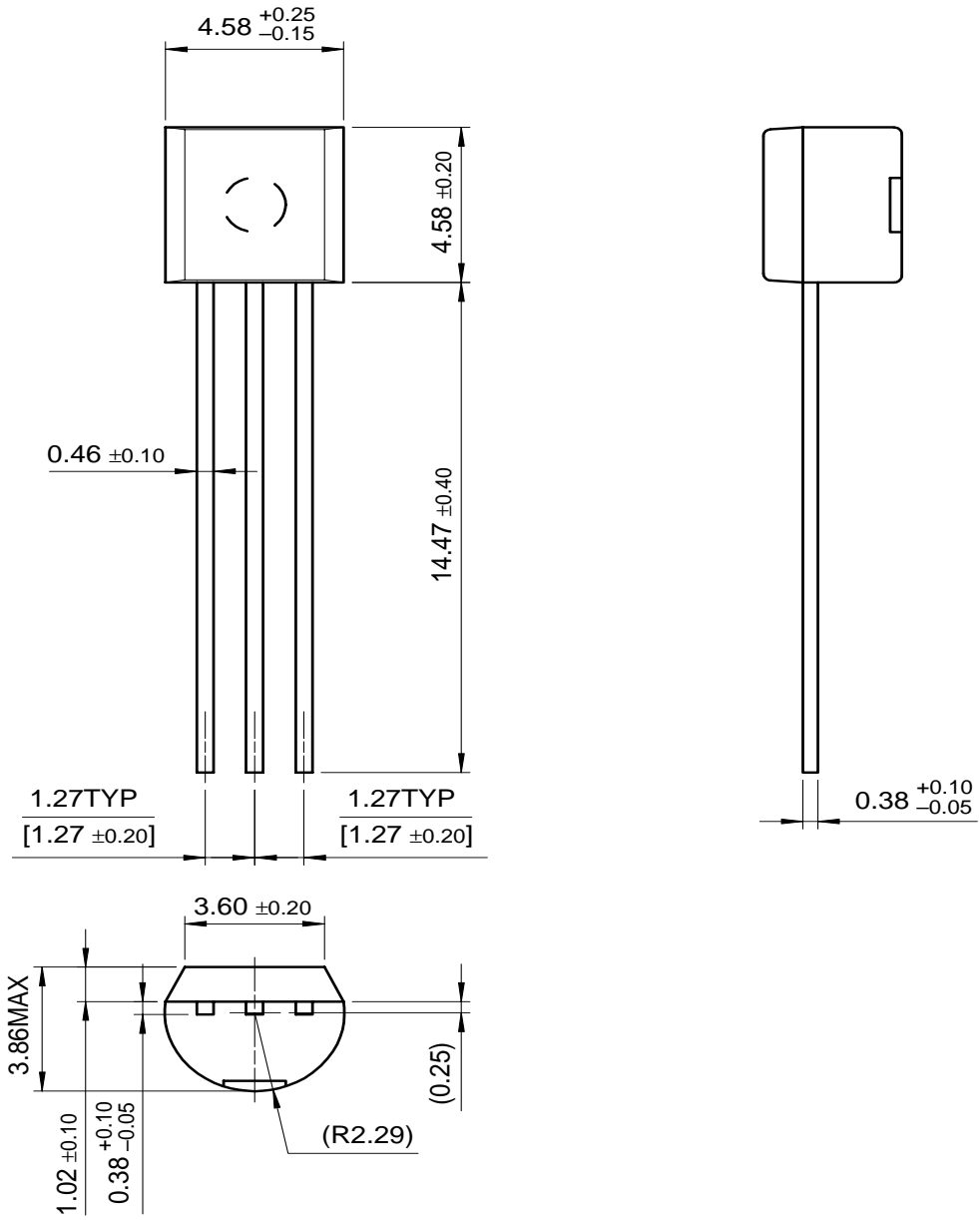
Notes:

1. To specify an output voltage, substitute voltage value for "XX".
2. Bypass Capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator

Mechanical Dimensions

Package

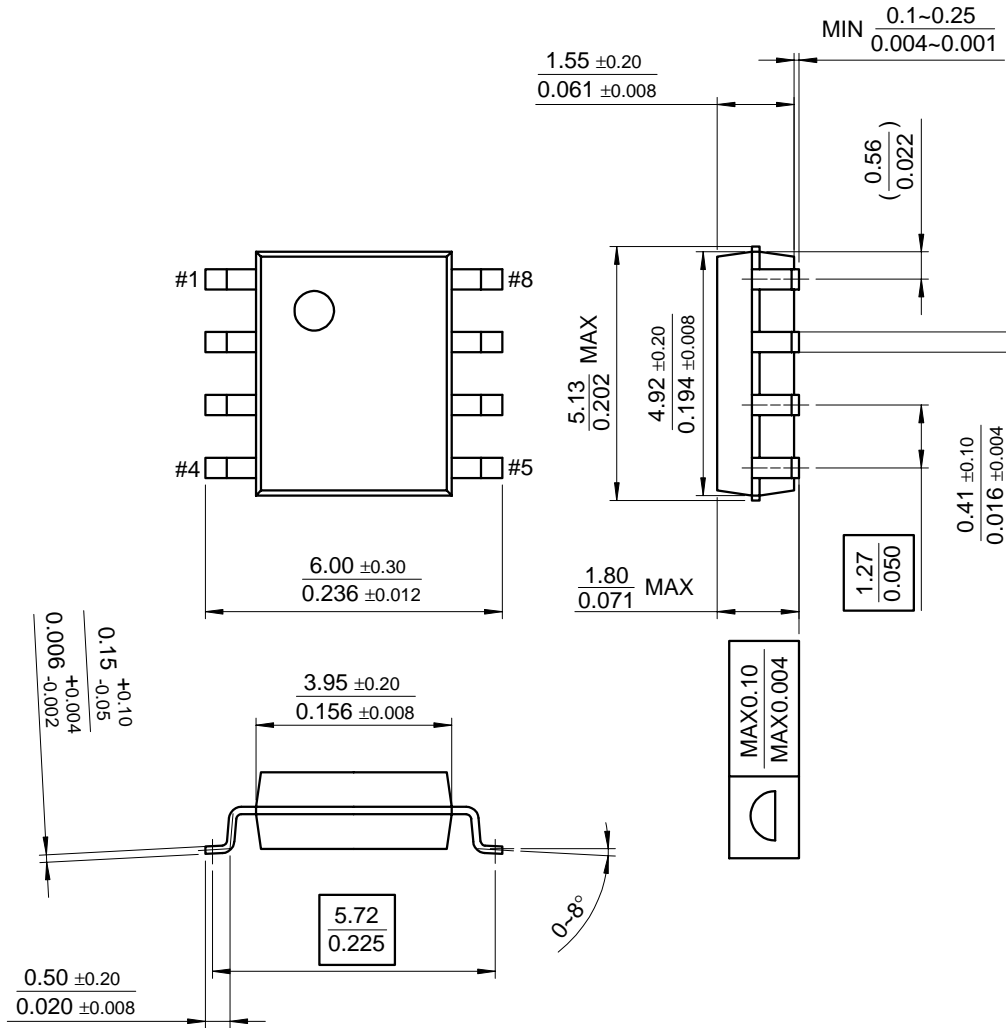
TO-92



Mechanical Dimensions (Continued)

Package

8-SOP



Ordering Information

Product Number	Package	Operating Temperature
KA78L05AZ	TO-92	0 ~ + 125 °C
KA78L06AZ		
KA78L08AZ		
KA78L09AZ		
KA78L10AZ		
KA78L12AZ		
KA78L15AZ		
KA78L18AZ		
KA78L24AZ		
KA78L05AD		
KA78L08AD	8 SOP	
KA78L12AD		
KA78L24AD		
KA78L24AD		

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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.