

# MC78LXXA/LM78LXXA/MC78L05AA

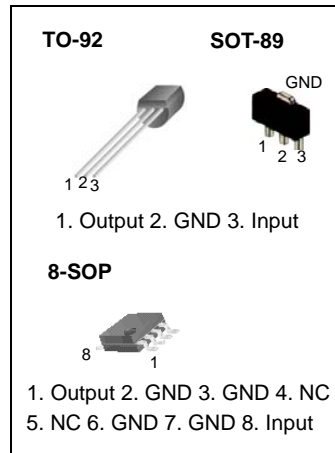
## 3-Terminal 0.1A Positive Voltage Regulator

### Features

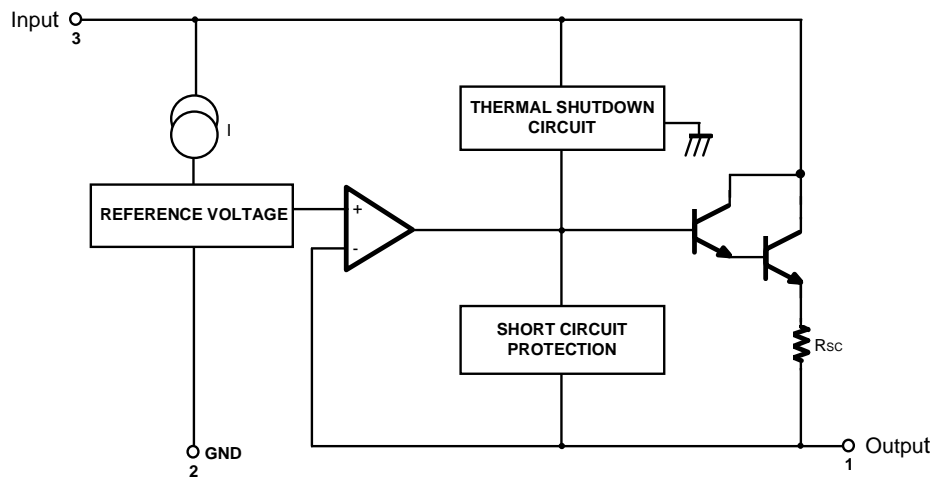
- Maximum Output Current of 100mA
- Output Voltage of 5V, 6V, 8V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in  $\pm 5\%$  Tolerance

### Description

The MC78LXXA/LM78LXXA/MC78L05AA 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 $V_O = 5V$ to $8V$ ) (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
Thermal Resistance Junction-Case TO-92	$R_{\theta JC}$	50	°C/W
Thermal Resistance Junction-Air TO-92 SOT-89 8-SOP	$R_{\theta JA}$	150 225 160	°C/W °C/W °C/W

## Electrical Characteristics(MC78L05A/LM78L05A)

( $V_I = 10V$ ,  $I_O = 40mA$ ,  $0^\circ C \leq T_J \leq 125^\circ C$ ,  $C_I = 0.33\mu F$ ,  $C_O = 0.1\mu F$ , 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 (Note1)	$\Delta V_O$	$T_J = 25^\circ C$					
		$7V \leq V_I \leq 20V$	-	8	150	mV	
Load Regulation (Note1)	$\Delta V_O$	$T_J = 25^\circ C$					
		$1mA \leq I_O \leq 100mA$	-	11	60	mV	
Output Voltage	$V_O$	$7V \leq V_I \leq 20V$	-	-	5.25	V	
		$7V \leq V_I \leq V_{MAX}$ (Note2)	$1mA \leq I_O \leq 70mA$	4.75	-	5.25	V
Quiescent Current	$I_Q$	$T_J = 25^\circ C$	-	2.0	5.5	mA	
Quiescent Current Change	With Line	$\Delta I_Q$	$8V \leq V_I \leq 20V$	-	-	1.5	mA
	With Load	$\Delta I_Q$	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA
Output Noise Voltage	$V_N$	$T_A = 25^\circ C$ , $10Hz \leq f \leq 100kHz$	-	40	-	$\mu V/V_O$	
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	

### Note:

- 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.
- Power dissipation  $P_D \leq 0.75W$ .

**Electrical Characteristics(MC78L06A)** (Continued)(V<sub>I</sub> = 12V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note 1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C	5.75	6.0	6.25	V	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	8.5V ≤ V <sub>I</sub> ≤ 20V	-	64	175	mV
			9V ≤ V <sub>I</sub> ≤ 20V	-	54	125	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	12.8	80	mV
			1mA ≤ I <sub>O</sub> ≤ 70mA	-	5.8	40	mV
Output Voltage	V <sub>O</sub>	8.5 ≤ V <sub>I</sub> ≤ 20V, 1mA ≤ I <sub>O</sub> ≤ 40mA	5.7	-	6.3	V	
		8.5 ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note), 1mA ≤ I <sub>O</sub> ≤ 70mA	5.7	-	6.3	V	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C	-	-	5.5	mA	
		T <sub>J</sub> = 125°C	-	3.9	6.0	mA	
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	9 ≤ V <sub>I</sub> ≤ 20V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz	-	40	-	μV/V <sub>O</sub>	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	0.75	-	mV/°C	
Ripple Rejection	RR	f = 120Hz, 10V ≤ V <sub>I</sub> ≤ 20V, T <sub>J</sub> = 25°C	40	46	-	dB	
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C	-	1.7	-	V	

**Note:**

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 P<sub>D</sub> ≤ 0.75W.

**Electrical Characteristics(MC78L08A)** (Continued)(V<sub>I</sub> = 14V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note 1)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C		7.7	8.0	8.3	V
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	10.5V ≤ V <sub>I</sub> ≤ 23V	-	10	175	mV
			11V ≤ V <sub>I</sub> ≤ 23V	-	8	125	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	15	80	mV
			1mA ≤ I <sub>O</sub> ≤ 40mA	-	8.0	40	mV
Output Voltage	V <sub>O</sub>	10.5V ≤ V <sub>I</sub> ≤ 23V	1mA ≤ I <sub>O</sub> ≤ 40mA	7.6	-	8.4	V
		10.5V ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note2)	1mA ≤ I <sub>O</sub> ≤ 70mA	7.6	-	8.4	V
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C		-	2.0	5.5	mA
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	11V ≤ V <sub>I</sub> ≤ 23V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz		-	60	-	μV/V <sub>O</sub>
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA		-	-0.8	-	mV/°C
Ripple Rejection	RR	f = 120Hz, 11V ≤ V <sub>I</sub> ≤ 21V, T <sub>J</sub> = 25°C		39	70	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C		-	1.7	-	V

**Note:**

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 P<sub>D</sub> ≤ 0.75W.

**Electrical Characteristics(MC78L12A/LM78L12A)** (Continued)(V<sub>I</sub> = 19V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33 μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C	11.5	12	12.5	V	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	14.5V ≤ V <sub>I</sub> ≤ 27V	-	20	250	mV
			16V ≤ V <sub>I</sub> ≤ 27V	-	15	200	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	20	100	mV
			1mA ≤ I <sub>O</sub> ≤ 40mA	-	10	50	mV
Output Voltage	V <sub>O</sub>	14.5V ≤ V <sub>I</sub> ≤ 27V	1mA ≤ I <sub>O</sub> ≤ 40mA	11.4	-	12.6	V
		14.5V ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note2)	1mA ≤ I <sub>O</sub> ≤ 70mA	11.4	-	12.6	V
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C	-	2.1	6.0	mA	
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	16V ≤ V <sub>I</sub> ≤ 27V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz	-	80	-	μV/V <sub>O</sub>	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1.0	-	mV/°C	
Ripple Rejection	RR	f = 120Hz, 15V ≤ V <sub>I</sub> ≤ 25V, T <sub>J</sub> = 25°C	37	65	-	dB	
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C	-	1.7	-	V	

**Note:**

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 P<sub>D</sub> ≤ 0.75W.

**Electrical Characteristics(MC78L15A)** (Continued)(V<sub>I</sub> = 23V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33 μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C	14.4	15	15.6	V	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	17.5V ≤ V <sub>I</sub> ≤ 30V	-	25	300	mV
			20V ≤ V <sub>I</sub> ≤ 30V	-	20	250	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	25	150	mV
			1mA ≤ I <sub>O</sub> ≤ 40mA	-	12	75	mV
Output Voltage	V <sub>O</sub>	17.5V ≤ V <sub>I</sub> ≤ 30V	1mA ≤ I <sub>O</sub> ≤ 40mA	14.25	-	15.75	V
		17.5V ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note2)	1mA ≤ I <sub>O</sub> ≤ 70mA	14.25	-	15.75	V
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C	-	2.1	6.0	mA	
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	20V ≤ V <sub>I</sub> ≤ 30V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz	-	90	-	μV/V <sub>O</sub>	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1.3	-	mV/°C	
Ripple Rejection	RR	f = 120Hz, 18.5V ≤ V <sub>I</sub> ≤ 28.5V, T <sub>J</sub> = 25°C	34	60	-	dB	
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C	-	1.7	-	V	

**Note:**

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 P<sub>D</sub> ≤ 0.75W.

**Electrical Characteristics(MC78L18A)** (Continued)(V<sub>I</sub> = 27V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C	17.3	18	18.7	V	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	21V ≤ V <sub>I</sub> ≤ 33V	-	145	300	mV
			22V ≤ V <sub>I</sub> ≤ 33V	-	135	250	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	30	170	mV
			1mA ≤ I <sub>O</sub> ≤ 40mA	-	15	85	mV
Output Voltage	V <sub>O</sub>	21V ≤ V <sub>I</sub> ≤ 33V	1mA ≤ I <sub>O</sub> ≤ 40mA	17.1	-	18.9	V
		21V ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note2)	1mA ≤ I <sub>O</sub> ≤ 70mA	17.1	-	18.9	V
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C	-	2.2	6.0	mA	
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	21V ≤ V <sub>I</sub> ≤ 33V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz	-	150	-	μV/V <sub>O</sub>	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-1.8	-	mV/°C	
Ripple Rejection	RR	f = 120Hz, 23V ≤ V <sub>I</sub> ≤ 33V, T <sub>J</sub> = 25°C	34	48	-	dB	
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C	-	1.7	-	V	

**Note:**

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 P<sub>D</sub> ≤ 0.75W.

**Electrical Characteristics(MC78L24A)** (Continued)(V<sub>I</sub> = 33V, I<sub>O</sub> = 40mA, 0°C ≤ T<sub>J</sub> ≤ 125°C, C<sub>I</sub> = 0.33μF, C<sub>O</sub> = 0.1μF, unless otherwise specified. (Note1))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = 25°C	23	24	25	V	
Line Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	27V ≤ V <sub>I</sub> ≤ 38V	-	160	300	mV
			28V ≤ V <sub>I</sub> ≤ 38V	-	150	250	mV
Load Regulation (Note1)	ΔV <sub>O</sub>	T <sub>J</sub> = 25°C	1mA ≤ I <sub>O</sub> ≤ 100mA	-	40	200	mV
			1mA ≤ I <sub>O</sub> ≤ 40mA	-	20	100	mV
Output Voltage	V <sub>O</sub>	27V ≤ V <sub>I</sub> ≤ 38V	1mA ≤ I <sub>O</sub> ≤ 40mA	22.8	-	25.2	V
		27V ≤ V <sub>I</sub> ≤ V <sub>MAX</sub> (Note2)	1mA ≤ I <sub>O</sub> ≤ 70mA	22.8	-	25.2	V
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = 25°C	-	2.2	6.0	mA	
Quiescent Current Change	With Line	ΔI <sub>Q</sub>	28V ≤ V <sub>I</sub> ≤ 38V	-	-	1.5	mA
	With Load	ΔI <sub>Q</sub>	1mA ≤ I <sub>O</sub> ≤ 40mA	-	-	0.1	mA
Output Noise Voltage	V <sub>N</sub>	T <sub>A</sub> = 25°C, 10Hz ≤ f ≤ 100kHz	-	200	-	μV/V <sub>O</sub>	
Temperature Coefficient of V <sub>O</sub>	ΔV <sub>O</sub> /ΔT	I <sub>O</sub> = 5mA	-	-2.0	-	mV/°C	
Ripple Rejection	RR	f = 120Hz, 28V ≤ V <sub>I</sub> ≤ 38V, T <sub>J</sub> = 25°C	34	45	-	dB	
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = 25°C	-	1.7	-	V	

**Note:**

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 P<sub>D</sub> ≤ 0.75W.



## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for $V_O = 5V$ to $8V$ ) (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(MC78L05AA) (Continued)

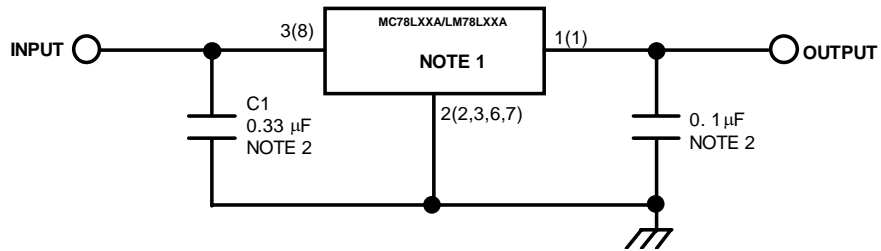
( $V_I = 10V$ ,  $I_O = 40mA$ ,  $0^\circ C \leq T_J \leq 125^\circ C$ ,  $C_I = 0.33\mu F$ ,  $C_O = 0.1\mu F$ , unless otherwise specified. (Note))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage	$V_O$	$T_J = 25^\circ C$	4.9	5.0	5.1	V	
Line Regulation (Note1)	$\Delta V_O$	$T_J = 25^\circ C$	$7V \leq V_I \leq 20V$	-	8	150	mV
			$8V \leq V_I \leq 20V$	-	6	100	mV
Load Regulation (Note1)	$\Delta V_O$	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	-	11	50	mV
			$1mA \leq I_O \leq 40mA$	-	5.0	25	mV
Output Voltage	$V_O$	$7V \leq V_I \leq 20V$	$1mA \leq I_O \leq 40mA$	-	-	5.15	V
		$7V \leq V_I \leq V_{MAX}$ (Note2)	$1mA \leq I_O \leq 70mA$	4.75	-	5.15	V
Quiescent Current	$I_Q$	$T_J = 25^\circ C$	-	2.0	5.5	mA	
Quiescent Current Change	With Line	$\Delta I_Q$	$8V \leq V_I \leq 20V$	-	-	1.5	mA
	With Load	$\Delta I_Q$	$1mA \leq I_O \leq 40mA$	-	-	0.1	mA
Output Noise Voltage	$V_N$	$T_A = 25^\circ C$ , $10Hz \leq f \leq 100kHz$	-	40	-	$\mu V/V_O$	
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	

### Note:

- 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.
- Power dissipation  $P_D \leq 0.75W$ .

## Typical Application



'()' : 8SOP Type

### Notes:

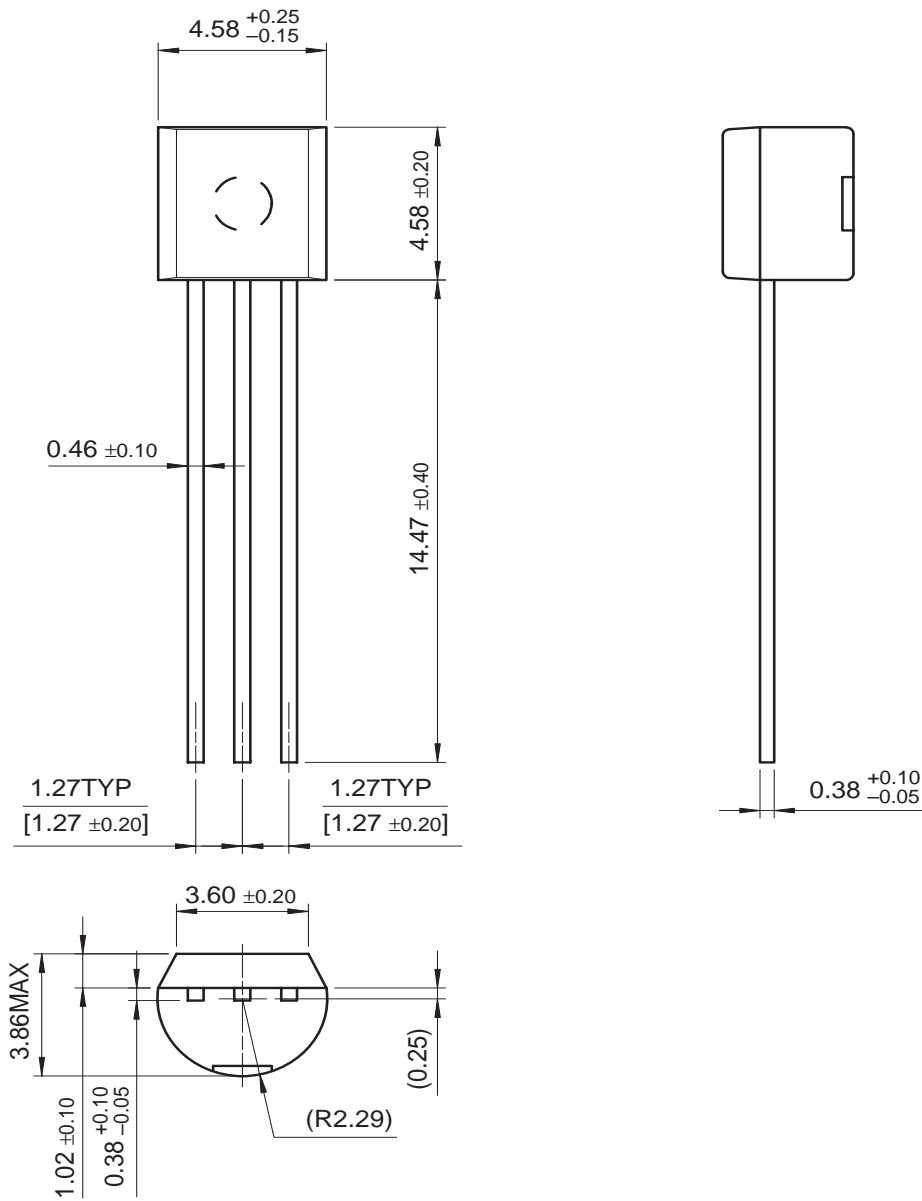
1. To specify an output voltage, substitute voltage value for "XX".
2. Bypass Capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator

## Mechanical Dimensions

### Package

Dimensions in millimeters

### TO-92

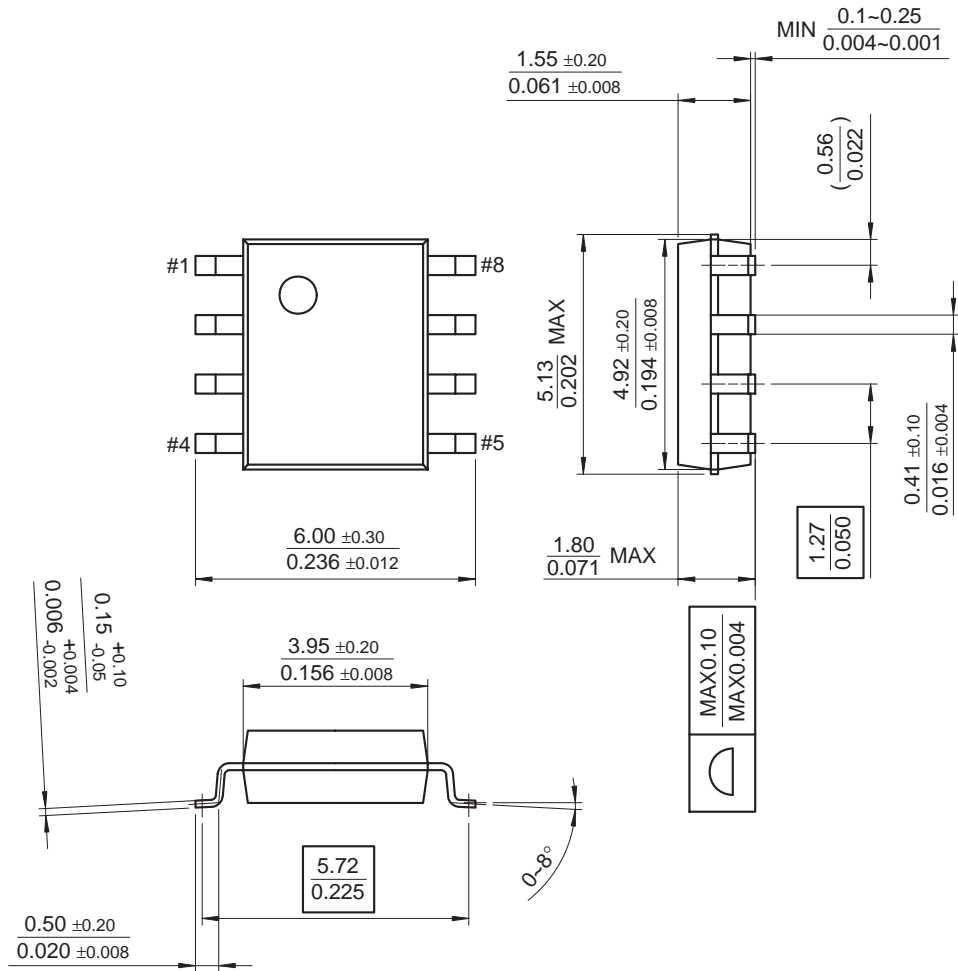


**Mechanical Dimensions** (Continued)

Package

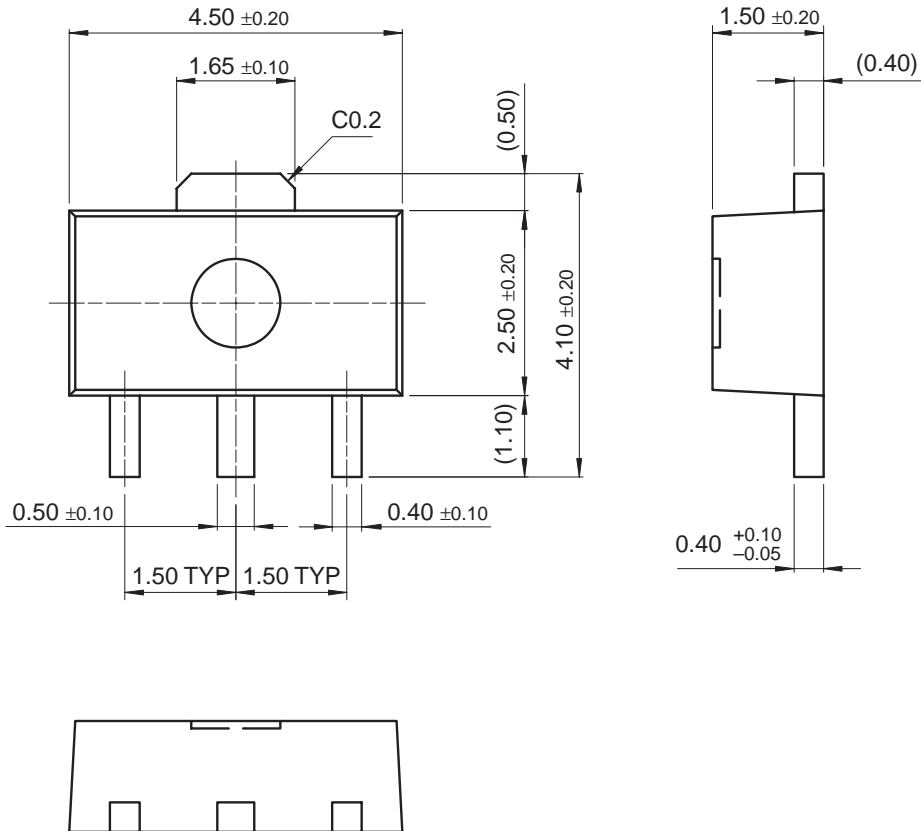
Dimensions in millimeters

**8-SOP**



**Mechanical Dimensions** (Continued)**Package**

Dimensions in millimeters

**SOT-89**

## Ordering Information

Product Number	Package	Output Voltage Tolerance	Operating Temperature
LM78L05ACZ	TO-92	5%	0 ~ +125°C
LM78L12ACZ			
Product Number	Package	Output Voltage Tolerance	Operating Temperature
MC78L05ACP	TO-92	5%	0 ~ +125°C
MC78L06ACP			
MC78L08ACP			
MC78L12ACP			
MC78L15ACP			
MC78L18ACP			
MC78L24ACP			
MC78L05ACD	8-SOP	5%	0 ~ +125°C
MC78L08ACD			
MC78L12ACD			
MC78L05ACH	SOT-89	5%	0 ~ +125°C
MC78L08ACH			
MC78L12ACH			
MC78L05AACP	TO-92	2%	

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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.