

## 3-Terminal 1 A Positive Voltage Regulator

### Description

The LM78MxxA series of three-terminal positive regulators are available in the TO-252-2L package with several fixed output voltages making it useful in a wide range of applications.

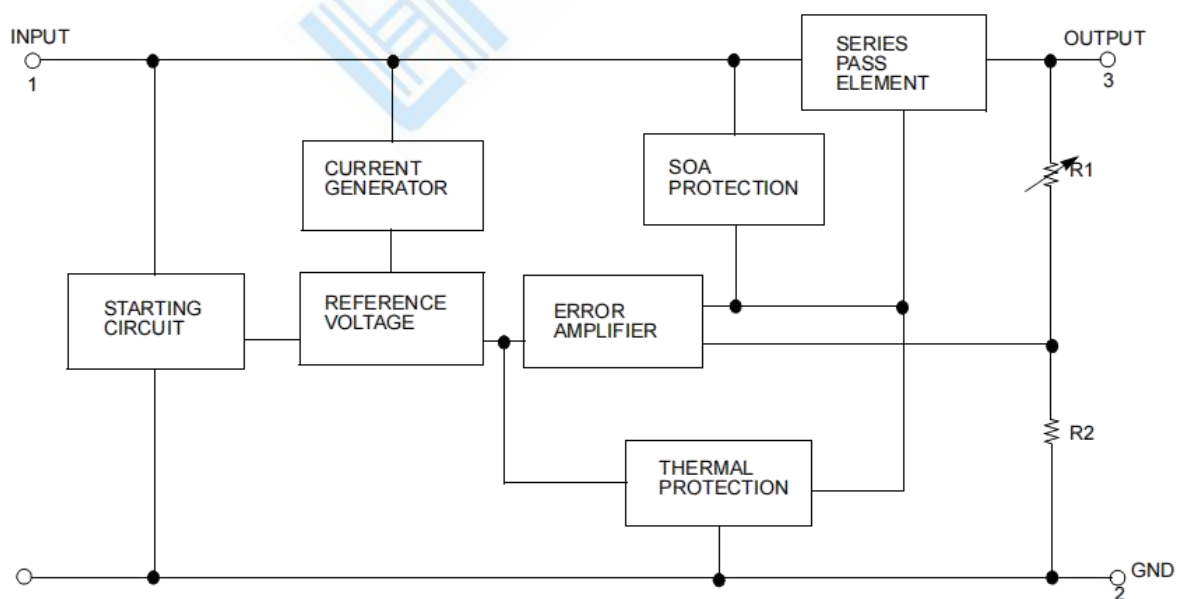
### Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area (SOA) Protection

### ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78M05ACKTPRG	TO-252-2	LM78M05	REEL	2000pcs/reel
LM78M06ACKTPRG	TO-252-2	LM78M06	REEL	2000pcs/reel
LM78M08ACKTPRG	TO-252-2	LM78M08	REEL	2000pcs/reel
LM78M12ACKTPRG	TO-252-2	LM78M12	REEL	2000pcs/reel
LM78M15ACKTPRG	TO-252-2	LM78M15	REEL	2000pcs/reel
LM78M18ACKTPRG	TO-252-2	LM78M18	REEL	2000pcs/reel
LM78M24ACKTPRG	TO-252-2	LM78M24	REEL	2000pcs/reel

### Internal Block Diagram



## 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-Case TO-252-2 ( $T_c = +25^\circ C$ )	$R_{\theta JC}$	2.5	$^\circ C/W$
Thermal Resistance Junction-Air TO-252-2 ( $T_a = +25^\circ C$ )	$R_{\theta JA}$	92	$^\circ C/W$
Operating Junction Temperature Range	TOPR	-40 ~ +85	$^\circ C$
Storage Temperature Range	TSTG	-65 ~ +150	$^\circ C$

## Electrical Characteristics (LM78M05A)

(Refer to the test circuits,  $-40 < T_J < +85^\circ C$ ,  $I_O = 1A$ ,  $V_I = 10V$ , unless otherwise specified,  $C_I = 0.33\mu F$ ,  $C_O = 0.1\mu F$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ C$	4.8	5	5.2	V
		$I_O = 5mA$ to $1A$ $V_I = 7V$ to $20V$	4.75	5	5.25	
Line Regulation (Note3)	$\Delta V_O$	$I_O = 200mA$ $V_I = 7V$ to $25V$	-	-	100	mV
		$T_J = +25^\circ C$ $V_I = 8V$ to $25V$	-	-	50	
Load Regulation (Note3)	$\Delta V_O$	$I_O = 5mA$ to $0.5A$ , $T_J = +25^\circ C$	-	-	100	mV
		$I_O = 5mA$ to $200mA$ , $T_J = +25^\circ C$	-	-	50	
Quiescent Current	$I_Q$	$T_J = +25^\circ C$	-	4.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5mA$ to $350mA$	-	-	0.5	mA
		$I_O = 200mA$ $V_I = 8V$ to $25V$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5mA$ $T_J = -40$ to $+85^\circ C$	-	-0.5	-	mV/ $^\circ C$
Output Noise Voltage	$V_N$	$f = 10Hz$ to $100kHz$	-	40	-	$\mu V/V_O$
Ripple Rejection	RR	$f = 120Hz$ , $I_O = 300mA$ $V_I = 8V$ to $18V$ , $T_J = +25^\circ C$	-	80	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ C$ , $I_O = 500mA$	-	2	-	V
Short Circuit Current	$I_{SC}$	$T_J = +25^\circ C$ , $V_I = 35V$	-	300	-	mA
Peak Current	IPK	$T_J = +25^\circ C$	-	700	-	mA

### Note:

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 (LM78M06A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85\text{ }^\circ\text{C}$ ,  $I_O=1\text{A}$ ,  $V_I=11\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	5.75	6	6.25	V
		I <sub>O</sub> = 5mA to 1A V <sub>I</sub> = 8V to 21V	5.7	6	6.3	
Line Regulation (Note1)	ΔV <sub>O</sub>	I <sub>O</sub> = 200mA	-	-	V <sub>I</sub> = 8V to 25V	100
		T <sub>J</sub> = +25°C			V <sub>I</sub> = 9V to 25V	50
Load Regulation (Note1)	ΔV <sub>O</sub>	I <sub>O</sub> = 5mA to 0.5A, T <sub>J</sub> = +25°C	-	-	120	mV
		I <sub>O</sub> = 5mA to 200mA, T <sub>J</sub> = +25°C	-	-	60	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	4.0	6.0	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 350mA	-	-	0.5	mA
		I <sub>O</sub> = 200mA V <sub>I</sub> = 9V to 25V	-	-	0.8	
Output Voltage Drift	ΔV/ΔT	I <sub>O</sub> = 5mA T <sub>J</sub> = -40 to +85°C	-	-0.5	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz	-	45	-	μV/V <sub>O</sub>
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA V <sub>I</sub> = 9V to 19V, T <sub>J</sub> = +25°C	-	80	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C, I <sub>O</sub> = 500mA	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = 35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	700	-	mA

**Note:**

 1. Load and line regulation are specified at constant junction temperature. Change in V<sub>O</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used.

**Electrical Characteristics (LM78M08A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85\text{ }^\circ\text{C}$ ,  $I_O=1\text{A}$ ,  $V_I=14\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V <sub>O</sub>	T <sub>J</sub> = +25°C	7.7	8	8.3	V
		I <sub>O</sub> = 5mA to 1A V <sub>I</sub> = 10.5V to 23V	7.6	8	8.4	
Line Regulation (Note1)	ΔV <sub>O</sub>	I <sub>O</sub> = 200mA	-	-	V <sub>I</sub> = 10.5V to 25V	100
		T <sub>J</sub> = +25°C			V <sub>I</sub> = 11V to 25V	50
Load Regulation (Note1)	ΔV <sub>O</sub>	I <sub>O</sub> = 5mA to 0.5A, T <sub>J</sub> = +25°C	-	-	160	mV
		I <sub>O</sub> = 5mA to 200mA, T <sub>J</sub> = +25°C	-	-	80	
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> = +25°C	-	4.0	6.0	mA
Quiescent Current Change	ΔI <sub>Q</sub>	I <sub>O</sub> = 5mA to 350mA	-	-	0.5	mA
		I <sub>O</sub> = 200mA V <sub>I</sub> = 10.5V to 25V	-	-	0.8	
Output Voltage Drift	RR	I <sub>O</sub> = 5mA T <sub>J</sub> = -40 to +85°C	-	0.5	-	mV/°C
Output Noise Voltage	V <sub>N</sub>	f = 10Hz to 100kHz	-	52	-	V/V <sub>O</sub>
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 300mA V <sub>I</sub> = 11.5V to 21.5V, T <sub>J</sub> = +25°C	-	80	-	dB
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> = +25°C, I <sub>O</sub> = 500mA	-	2	-	V
Short Circuit Current	I <sub>SC</sub>	T <sub>J</sub> = +25°C, V <sub>I</sub> = 35V	-	300	-	mA
Peak Current	I <sub>PK</sub>	T <sub>J</sub> = +25°C	-	700	-	mA

**Note:**

 1. Load and line regulation are specified at constant junction temperature. Change in V<sub>O</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used.

**Electrical Characteristics (LM78M12A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85^{\circ}\text{C}$ ,  $I_O=1\text{A}$ ,  $V_I=19\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^{\circ}\text{C}$	11.5	12	12.5	V
		$I_O = 5\text{mA to } 1\text{A } V_I = 14.5\text{V to } 27\text{V}$	11.4	12	12.6	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^{\circ}\text{C}$	-	-	100	mV
		$V_I = 14.5\text{V to } 30\text{V}$ $V_I = 16\text{V to } 30\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}, T_J = +25^{\circ}\text{C}$	-	-	240	mV
		$I_O = 5\text{mA to } 200\text{mA}, T_J = +25^{\circ}\text{C}$	-	-	120	
Quiescent Current	$I_Q$	$T_J = +25^{\circ}\text{C}$	-	4.1	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 14.5\text{V to } 30\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = -40 \text{ to } +85^{\circ}\text{C}$	-	-0.5	-	mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	75	-	$\mu\text{V}/V_O$
Ripple Rejection	RR	$f = 120\text{Hz}, I_O = 300\text{mA}$ $V_I = 15\text{V to } 25\text{V}, T_J = +25^{\circ}\text{C}$	-	80	-	dB
Dropout Voltage	$V_D$	$T_J = +25^{\circ}\text{C}, I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^{\circ}\text{C}, V_I = 35\text{V}$	-	300	-	mA
Peak Current	IPK	$T_J = +25^{\circ}\text{C}$	-	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 (LM78M15A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85^{\circ}\text{C}$ ,  $I_O=1\text{A}$ ,  $V_I=23\text{V}$ , unless otherwise specified,  $C_I=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^{\circ}\text{C}$	14.4	15	15.6	V
		$I_O = 5\text{mA to } 1\text{A } V_I = 17.5\text{V to } 30\text{V}$	14.25	15	15.75	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = +25^{\circ}\text{C}$	-	-	100	mV
		$V_I = 17.5\text{V to } 30\text{V}$ $V_I = 20\text{V to } 30\text{V}$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5\text{mA to } 0.5\text{A}, T_J = +25^{\circ}\text{C}$	-	-	300	mV
		$I_O = 5\text{mA to } 200\text{mA}, T_J = +25^{\circ}\text{C}$	-	-	150	
Quiescent Current	$I_Q$	$T_J = +25^{\circ}\text{C}$	-	4.1	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA to } 350\text{mA}$	-	-	0.5	mA
		$I_O = 200\text{mA}$ $V_I = 17.5\text{V to } 30\text{V}$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5\text{mA}$ $T_J = -40 \text{ to } +85^{\circ}\text{C}$	-	-1	-	mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz to } 100\text{kHz}$	-	100	-	V/ $V_O$
Ripple Rejection	RR	$f = 120\text{Hz}, I_O = 300\text{mA}$ $V_I = 18.5\text{V to } 28.5\text{V}, T_J = +25^{\circ}\text{C}$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^{\circ}\text{C}, I_O = 500\text{mA}$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^{\circ}\text{C}, V_I = 35\text{V}$	-	300	-	mA
Peak Current	IPK	$T_J = +25^{\circ}\text{C}$	-	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 (LM78M18A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85$  °C,  $I_O=1A$ ,  $V_I=26V$ , unless otherwise specified,  $C_I=0.33\mu F$ ,  $C_O=0.1\mu F$ )

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	$V_O$	$T_J = +25^\circ C$	17.3	18	18.7	V
		$I_O = 5mA$ to $1A$ $V_I = 20.5V$ to $33V$	17.1	18	18.9	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200mA$ $V_I = 21V$ to $33V$	-	-	100	mV
		$T_J = +25^\circ C$ $V_I = 24V$ to $33V$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5mA$ to $0.5A$ , $T_J = +25^\circ C$	-	-	360	mV
		$I_O = 5mA$ to $200mA$ , $T_J = +25^\circ C$	-	-	180	
Quiescent Current	$I_Q$	$T_J = +25^\circ C$	-	4.2	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5mA$ to $350mA$	-	-	0.5	mA
		$I_O = 200mA$ $V_I = 21V$ to $33V$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5mA$ $T_J = -40$ to $85^\circ C$	-	-1.1	-	mV/°C
Output Noise Voltage	$V_N$	$f = 10Hz$ to $100kHz$	-	100	-	V/ $V_O$
Ripple Rejection	RR	$f = 120Hz$ , $I_O = 300mA$ , $V_I = 22V$ to $32V$ $T_J = +25^\circ C$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ C$ , $I_O = 500mA$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^\circ C$ , $V_I = 35V$	-	300	-	mA
Peak Current	IPK	$T_J = +25^\circ C$	-	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 (LM78M24A)** (Continued)

 (Refer to the test circuits,  $-40 < T_J < +85$  °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	$V_O$	$T_J = +25^\circ C$	23	24	25	V
		$I_O = 5mA$ to $1A$ $V_I = 27V$ to $38V$	22.8	24	25.2	
Line Regulation (Note1)	$\Delta V_O$	$I_O = 200mA$ $V_I = 27V$ to $38V$	-	-	100	mV
		$T_J = +25^\circ C$ $V_I = 28V$ to $38V$	-	-	50	
Load Regulation (Note1)	$\Delta V_O$	$I_O = 5mA$ to $0.5A$ , $T_J = +25^\circ C$	-	-	480	mV
		$I_O = 5mA$ to $200mA$ , $T_J = +25^\circ C$	-	-	240	
Quiescent Current	$I_Q$	$T_J = +25^\circ C$	-	4.2	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5mA$ to $350mA$	-	-	0.5	mA
		$I_O = 200mA$ $V_I = 27V$ to $38V$	-	-	0.8	
Output Voltage Drift	$\Delta V/\Delta T$	$I_O = 5mA$ $T_J = -40$ to $+85^\circ C$	-	-1.2	-	mV/°C
Output Noise Voltage	$V_N$	$f = 10Hz$ to $100kHz$	-	170	-	$\mu V/V_O$
Ripple Rejection	RR	$f = 120Hz$ , $I_O = 300mA$ $V_I = 28V$ to $38V$ , $T_J = +25^\circ C$	-	70	-	dB
Dropout Voltage	$V_D$	$T_J = +25^\circ C$ , $I_O = 500mA$	-	2	-	V
Short Circuit Current	ISC	$T_J = +25^\circ C$ , $V_I = 35V$	-	300	-	mA
Peak Current	IPK	$T_J = +25^\circ C$	-	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.

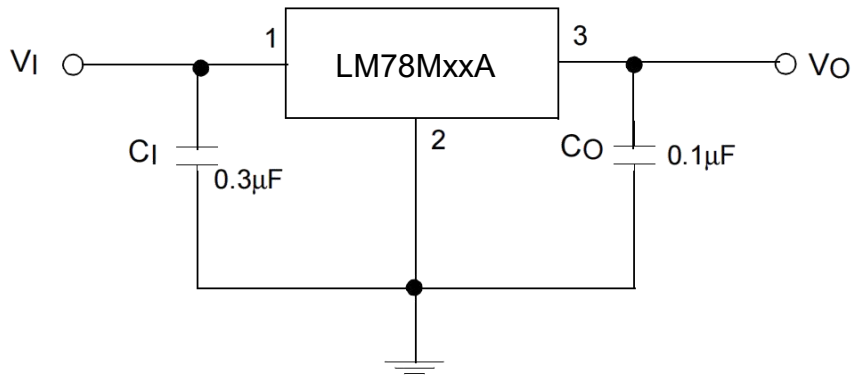
**Typical Applications**


Figure 1. Fixed Output Regulator

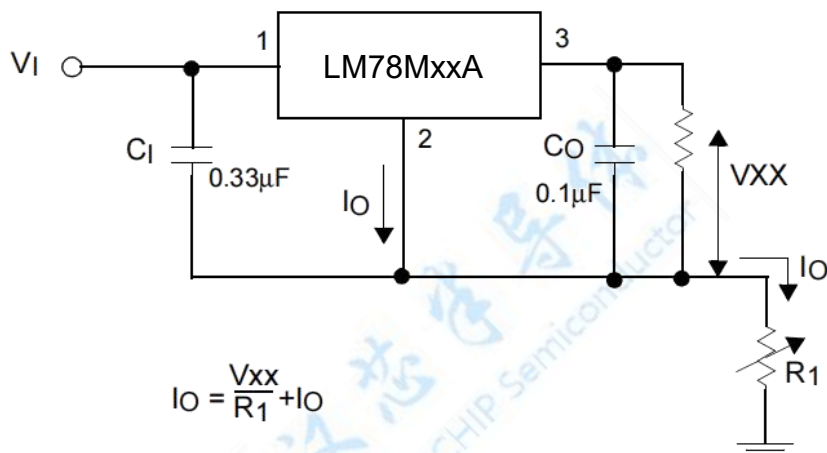


Figure 2. Constant Current Regulator

**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. CI is required if regulator is located an appreciable distance from power Supply filter

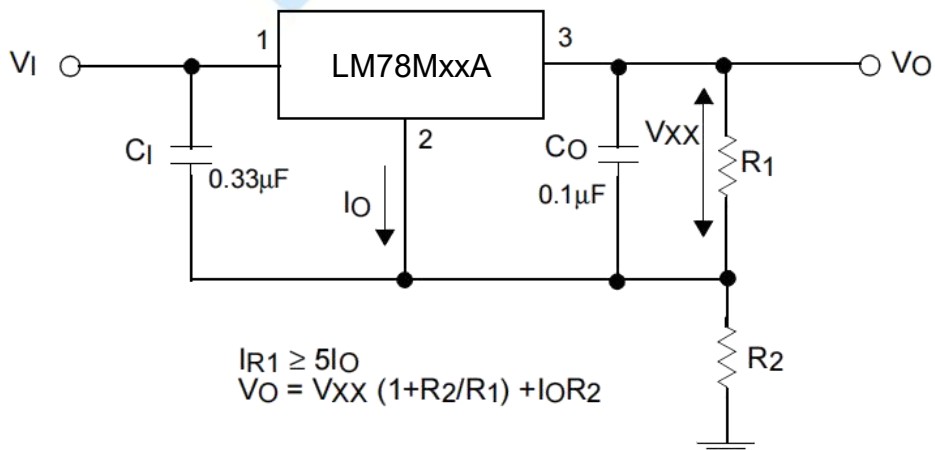


Figure 3. Circuit for Increasing Output Voltage

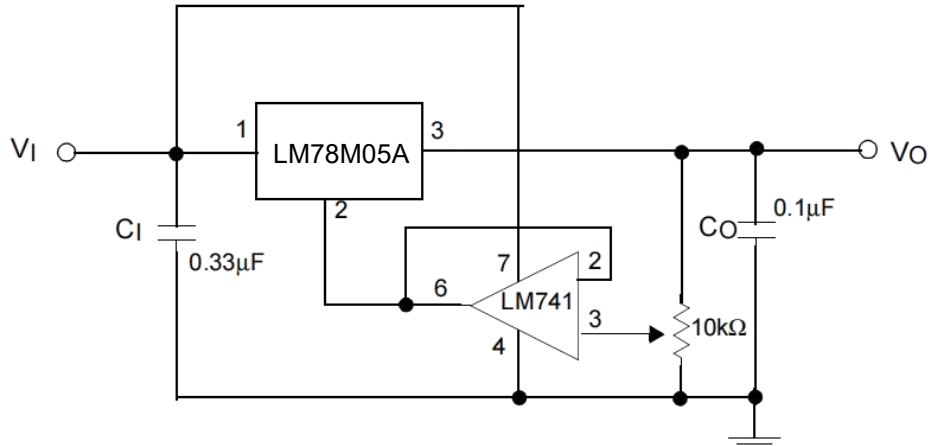


Figure 4. Adjustable Output Regulator (7 to 30V)

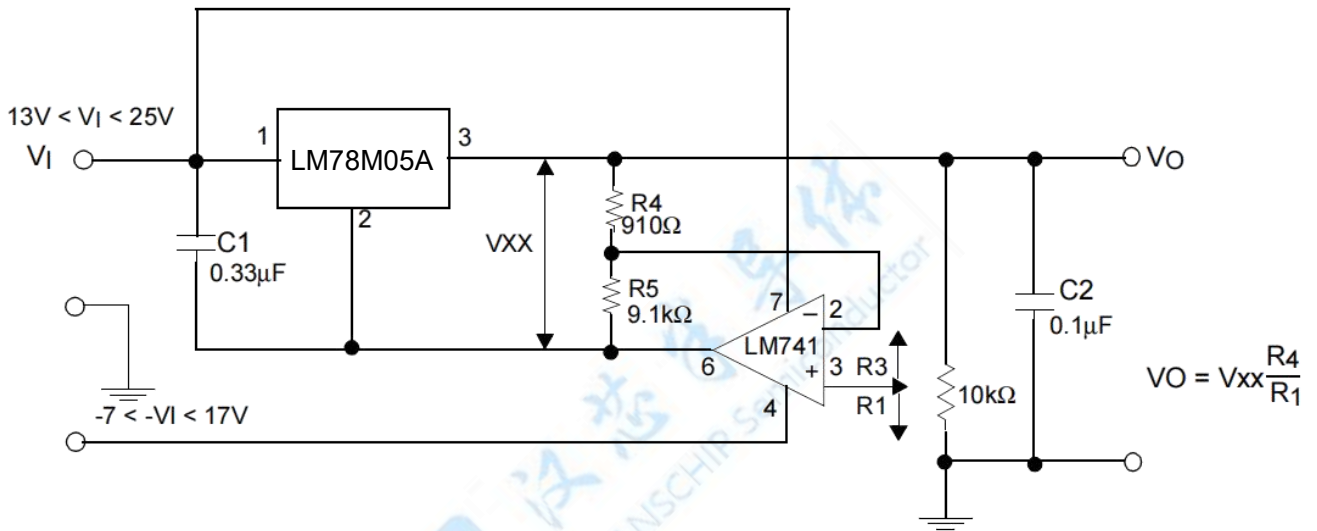
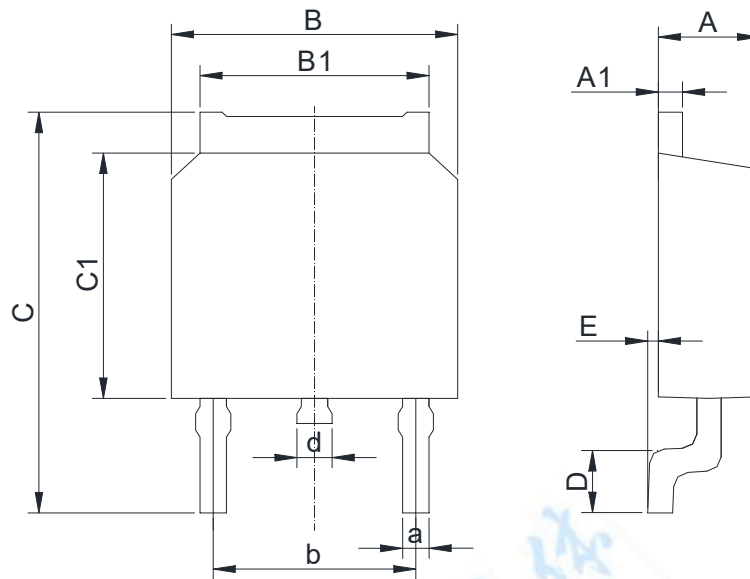


Figure 5. 0.5 to 10V Regulator

**Physical Dimensions**

TO252-2


**Dimensions In Millimeters(TO252-2)**

Symbol:	A	A1	B	B1	C	C1	D	E	a	b	d
<b>Min:</b>	2.10	0.45	6.30	5.10	9.20	5.30	0.90	0	0.50	4.45	0.70
<b>Max:</b>	2.50	0.70	6.75	5.50	10.6	6.30	1.75	0.23	0.80	4.75	1.20



**IMPORTANT STATEMENT:**

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