

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.

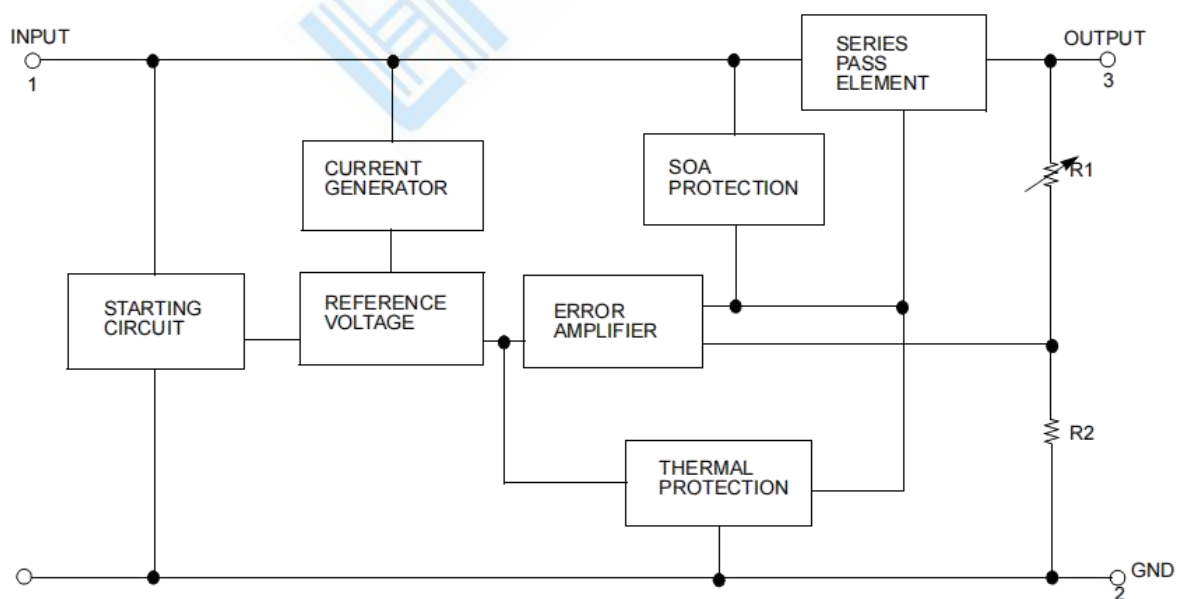
Features

- 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) | ΔV_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) | ΔV_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 | ΔI_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 _O | T _J = +25°C | 5.75 | 6 | 6.25 | V |
| | | I _O = 5mA to 1A V _I = 8V to 21V | 5.7 | 6 | 6.3 | |
| Line Regulation (Note1) | ΔV _O | I _O = 200mA | - | - | 100 | mV |
| | | T _J = +25°C | | | 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 = 9V to 25V | - | - | 0.8 | |
| Output Voltage Drift | ΔV/ΔT | I _O = 5mA T _J = -40 to +85°C | - | -0.5 | - | mV/°C |
| Output Noise Voltage | V _N | f = 10Hz to 100kHz | - | 45 | - | μV/V _O |
| Ripple Rejection | RR | f = 120Hz, I _O = 300mA V _I = 9V 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 (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 _O | T _J = +25°C | 7.7 | 8 | 8.3 | V |
| | | I _O = 5mA to 1A V _I = 10.5V to 23V | 7.6 | 8 | 8.4 | |
| Line Regulation (Note1) | ΔV _O | I _O = 200mA | - | - | 100 | mV |
| | | T _J = +25°C | | | 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 = 10.5V to 25V | - | - | 0.8 | |
| Output Voltage Drift | RR | I _O = 5mA T _J = -40 to +85°C | - | 0.5 | - | mV/°C |
| Output Noise Voltage | V _N | f = 10Hz to 100kHz | - | 52 | - | V/V _O |
| Ripple Rejection | RR | f = 120Hz, I _O = 300mA V _I = 11.5V 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 (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) | ΔV_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) | ΔV_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 | ΔI_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) | ΔV_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) | ΔV_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 | ΔI_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) | ΔV_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) | ΔV_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 | ΔI_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) | ΔV_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) | ΔV_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 | ΔI_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.

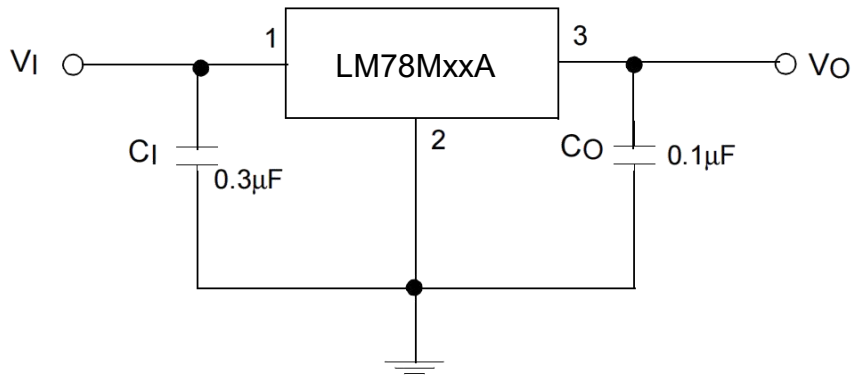
Typical Applications


Figure 1. Fixed Output Regulator

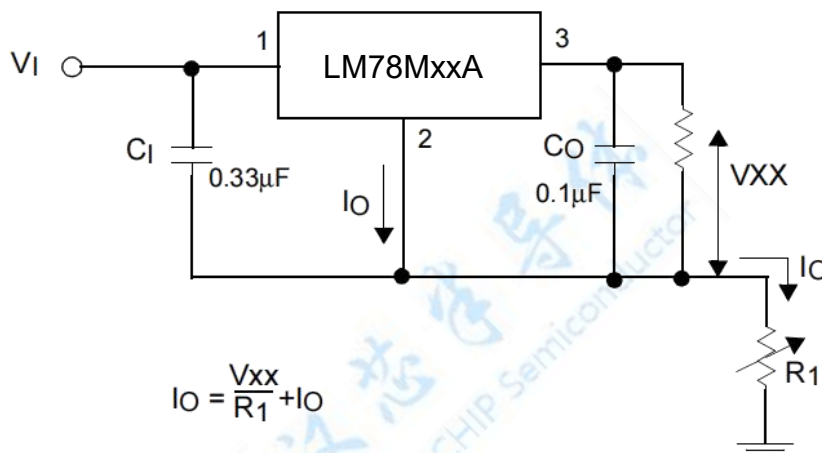


Figure 2. Constant Current Regulator

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

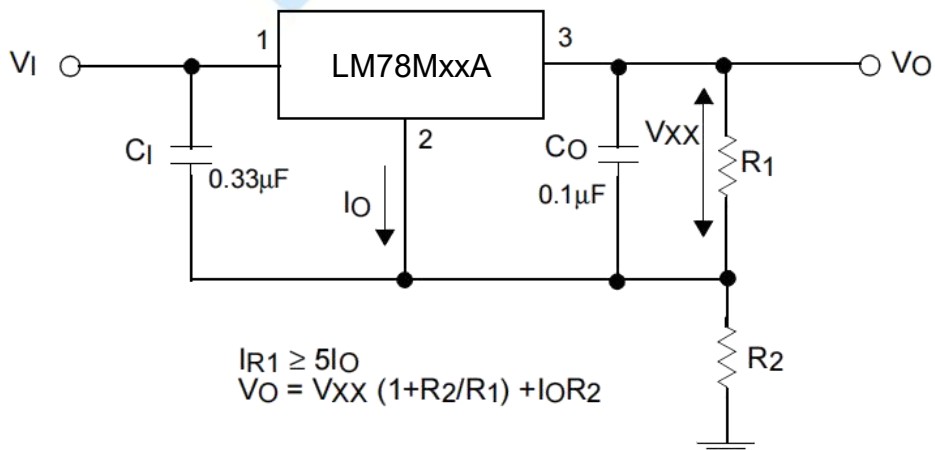


Figure 3. Circuit for Increasing Output Voltage

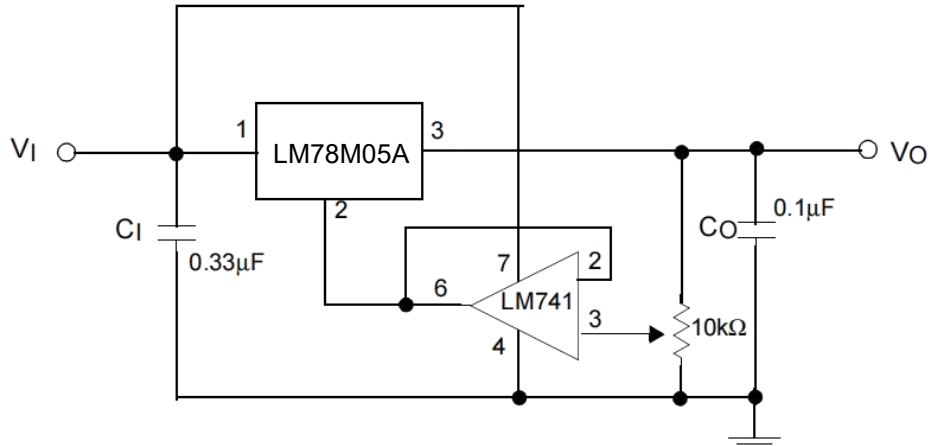


Figure 4. Adjustable Output Regulator (7 to 30V)

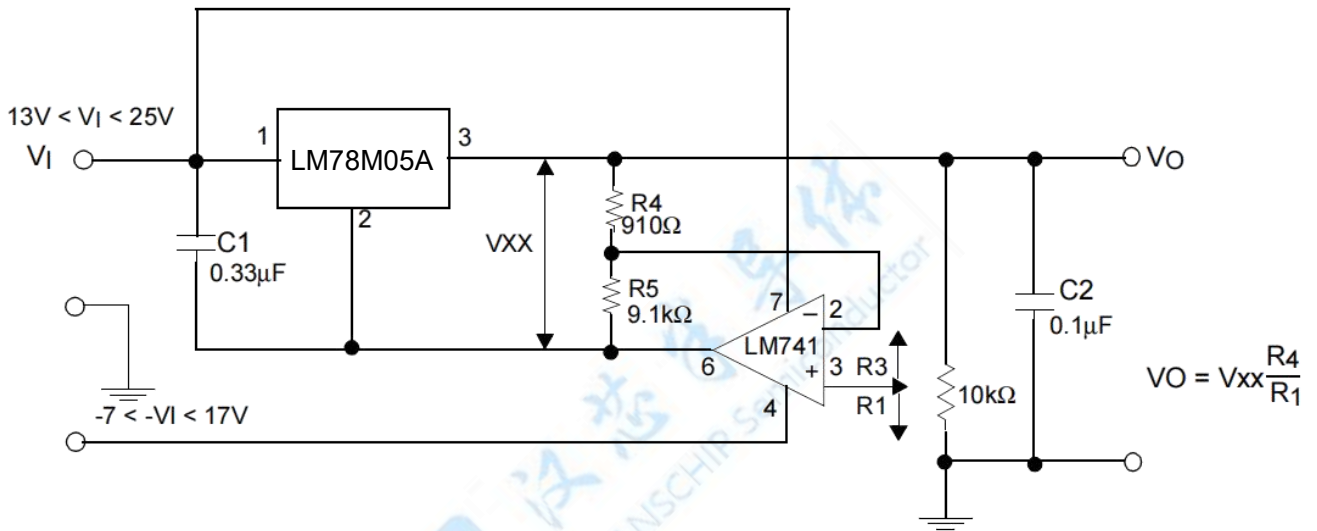
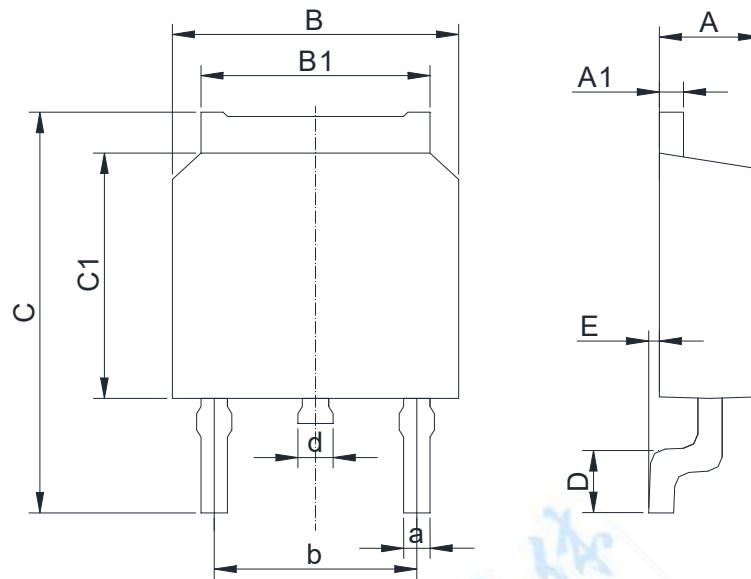


Figure 5. 0.5 to 10V Regulator

Physical Dimensions

TO252-2


Dimensions In Millimeters(TO252-2)

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

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