3-Terminal 1 A Positive Voltage Regulator

Description

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

TO-252-2

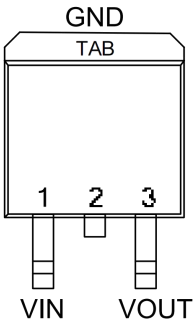
Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10,12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area (SOA)Protection

Ordering Information

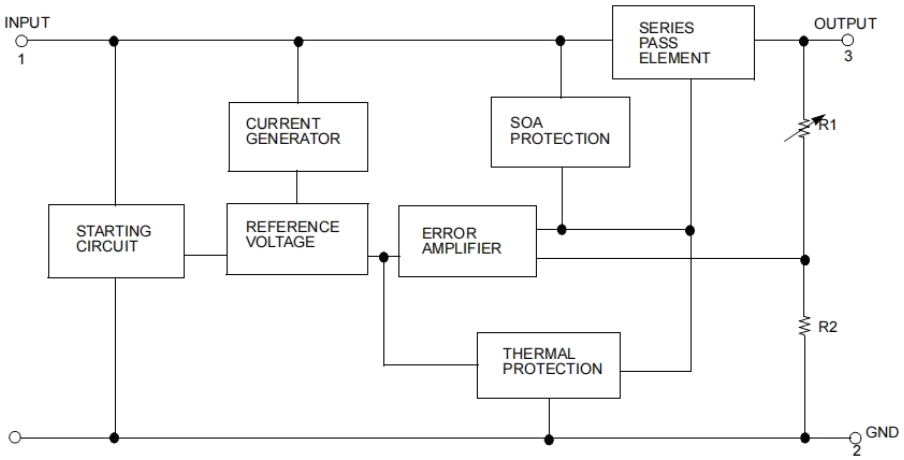
DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78M05ADT/TR	TO-252-2	78M05A	REEL	2500pcs/reel
LM78M06ADT/TR	TO-252-2	78M06A	REEL	2500pcs/reel
LM78M08ADT/TR	TO-252-2	78M08A	REEL	2500pcs/reel
LM78M09ADT/TR	TO-252-2	78M09A	REEL	2500pcs/reel
LM78M10ADT/TR	TO-252-2	78M10A	REEL	2500pcs/reel
LM78M12ADT/TR	TO-252-2	78M12A	REEL	2500pcs/reel
LM78M15ADT/TR	TO-252-2	78M15A	REEL	2500pcs/reel
LM78M18ADT/TR	TO-252-2	78M18A	REEL	2500pcs/reel
LM78M24ADT/TR	TO-252-2	78M24A	REEL	2500pcs/reel

Pin Configuration



TO-252-2

Internal Block Digram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V) (for V_O = 24V)	V_I V_I	35 40	V V
Thermal Resistance Junction-Case TO-252-2 (Tc = +25 ℃)	$R\theta_{JC}$	2.5	℃/W
Thermal Resistance Junction-Air TO-252-2 (Ta = +25 ℃)	$R\theta_{JA}$	92	℃/W
Operating Junction Temperature Range	T_{OPR}	0 ~ +125	℃
Storage Temperature Range	T_{STG}	-65 ~ +150	℃
Lead Temperature (Soldering, 10 seconds)	T_L	260	℃

Note:Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

Electrical Characteristics (LM78M05A)

(Refer to the test circuits, -40< TJ < +85℃, IO=1A, VI=10V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃	4.8	5	5.2	V
		IO=5mA to 1A VI=7V to 20V	4.75	5	5.25	
Line Regulation (Note3)	ΔVO	IO = 200mA VI = 7V to 25V	-	-	100	mV
		TJ =+25℃ VI = 8V to 25V	-	-	50	
Load Regulation (Note3)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃	-	-	100	mV
		IO = 5mA to 200mA, TJ =+25℃	-	-	50	
Quiescent Current	IQ	TJ =+25℃	-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA	-	-	0.5	mA
		IO = 200mA VI = 8V to 25V	-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃	-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz	-	40	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 8V to 18V, TJ =+25℃	-	80	-	dB
Dropout Voltage	VD	TJ =+25℃, IO = 500mA	-	2	-	V
Short Circuit Current	ISC	TJ =+25℃, VI = 35V	-	300	-	mA
Peak Current	IPK	TJ =+25℃	-	700	-	mA

Note:

Load and line regulation are specified at constant junction temperature. Change in Vo 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 < TJ < +85 ℃, IO=1A, VI =11V, unless otherwise specified, CI=0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃	5.75	6	6.25	V
		IO = 5mA to 1AVI = 8V to 21V	5.7	6	6.3	
Line Regulation (Note1)	ΔVO	IO = 200mA VI = 8V to 25V	-	-	100	mV
		TJ = +25℃ VI = 9V to 25V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ = +25℃	-	-	120	mV
		IO = 5mA to 200mA, TJ = +25℃	-	-	60	
Quiescent Current	IQ	TJ = +25℃	-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA	-	-	0.5	mA
		IO = 200mA VI = 9V to 25V	-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃	-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz	-	45	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 9V to 19V, TJ =+25℃	-	80	-	dB
Dropout Voltage	VD	TJ =+25℃, IO = 500mA	-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI= 35V	-	300	-	mA
Peak Current	IPK	TJ =+25℃	-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in Vo 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 < TJ < +85℃, IO=1A, VI=14V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ =+25℃		7.7	8	8.3	V
		IO = 5mA to 1A VI = 10.5V to 23V		7.6	8	8.4	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ =+25℃	VI = 10.5V to 25V	-	-	100	mV
			VI = 11V to 25V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃		-	-	160	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	80	
Quiescent Current	IQ	TJ = +25℃		-	4.0	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 10.5V to 25V		-	-	0.8	
Output Voltage Drift	RR	IO = 5mA TJ = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	52	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 11.5V to 21.5V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	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 (LM78M09A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=15V, unless otherwise specified, CI = 0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ =+25℃		8.65	9	9.35	V
		IO = 5mA to 1A VI = 11.5V to 25V		8.55	9	9.45	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ =+25℃	VI = 11.5V to 25V	-	-	100	mV
			VI = 12V to 25V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃		-	-	180	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	90	
Quiescent Current	IQ	TJ = +25℃		-	4.6	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 11.5V to 25V		-	-	0.8	
Output Voltage Drift	RR	IO = 5mA TJ = -40 to +85℃		-	-0.8	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	60	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 11.5V to 21.5V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	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 (LM78M10A) (Continued)

(Refer to the test circuits, -40 < TJ < +85℃, IO=1A, VI=16V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃		9.8	10	10.2	V
		IO = 5mA to 1A VI = 12.5V to 27V		9.6	10	10.4	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ = +25℃	VI = 12.5V to 30V	-	-	100	mV
			VI = 13V to 30V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ = +25℃		-	-	200	mV
		IO = 5mA to 200mA, TJ = +25℃		-	-	100	
Quiescent Current	IQ	TJ =+25℃		-	4.1	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 12.5V to 30V		-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	75	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 13.5V to 25V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ =+25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	245	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in Vo 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 < TJ < +85℃, IO=1A, VI=19V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃		11.5	12	12.5	V
		IO = 5mA to 1A VI = 14.5V to 27V		11.4	12	12.6	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ = +25℃	VI = 14.5V to 30V	-	-	100	mV
			VI = 16V to 30V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ = +25℃		-	-	240	mV
		IO = 5mA to 200mA, TJ = +25℃		-	-	120	
Quiescent Current	IQ	TJ =+25℃		-	4.1	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 14.5V to 30V		-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃		-	-0.5	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	75	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 15V to 25V, TJ =+25℃		-	80	-	dB
Dropout Voltage	VD	TJ =+25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	700	-	mA

Note:

1. Load and line regulation are specified at constant junction temperature. Change in Vo 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 < TJ < +85℃, IO=1A, VI=23V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃		14.4	15	15.6	V
		IO = 5mA to 1A VI = 17.5V to 30V		14.25	15	15.75	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ =+25℃	VI = 17.5V to 30V	-	-	100	mV
			VI = 20V to 30V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃		-	-	300	mV
		IO = 5mA to 200mA, TJ =+25℃		-	-	150	
Quiescent Current	IQ	TJ = +25℃		-	4.1	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 17.5V to 30V		-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃		-	-1	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	100	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 18.5V to 28.5V, TJ =+25℃		-	70	-	dB
Dropout Voltage	VD	TJ =+25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	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 < TJ < +85 ℃, IO=1A, VI=26V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ = +25℃		17.3	18	18.7	V
		IO = 5mA to 1A VI = 20.5V to 33V		17.1	18	18.9	
Line Regulation (Note1)	ΔVO	IO = 200mA TJ = +25℃	VI = 21V to 33V	-	-	100	mV
			VI = 24V to 33V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ = +25℃		-	-	360	mV
		IO = 5mA to 200mA, TJ = +25℃		-	-	180	
Quiescent Current	IQ	TJ = +25℃		-	4.2	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA		-	-	0.5	mA
		IO = 200mA VI = 21V to 33V		-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mATJ = -40 to 85℃		-	-1.1	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz		-	100	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO= 300mA , VI = 22V to 32VTJ =+25℃		-	70	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA		-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V		-	300	-	mA
Peak Current	IPK	TJ = +25℃		-	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 < TJ < +85℃, IO=350mA, VI=33V, unless otherwise specified, CI =0.33μF, CO=0.1μF)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	VO	TJ =+25℃	23	24	25	V
		IO = 5mA to 1AVI = 27V to 38V	22.8	24	25.2	
Line Regulation (Note1)	ΔVO	IO = 200mA VI = 27V to 38V	-	-	100	mV
		TJ =+25℃ VI = 28V to 38V	-	-	50	
Load Regulation (Note1)	ΔVO	IO = 5mA to 0.5A, TJ =+25℃	-	-	480	mV
		IO = 5mA to 200mA, TJ =+25℃	-	-	240	
Quiescent Current	IQ	TJ = +25℃	-	4.2	6.0	mA
Quiescent Current Change	ΔIQ	IO = 5mA to 350mA	-	-	0.5	mA
		IO = 200mA VI = 27V to 38V	-	-	0.8	
Output Voltage Drift	ΔV/ΔT	IO = 5mA TJ = -40 to +85℃	-	-1.2	-	mV/℃
Output Noise Voltage	VN	f = 10Hz to 100kHz	-	170	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, IO = 300mA VI = 28V to 38V, TJ =+25℃	-	70	-	dB
Dropout Voltage	VD	TJ = +25℃, IO = 500mA	-	2	-	V
Short Circuit Current	ISC	TJ = +25℃, VI = 35V	-	300	-	mA
Peak Current	IPK	TJ = +25℃	-	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

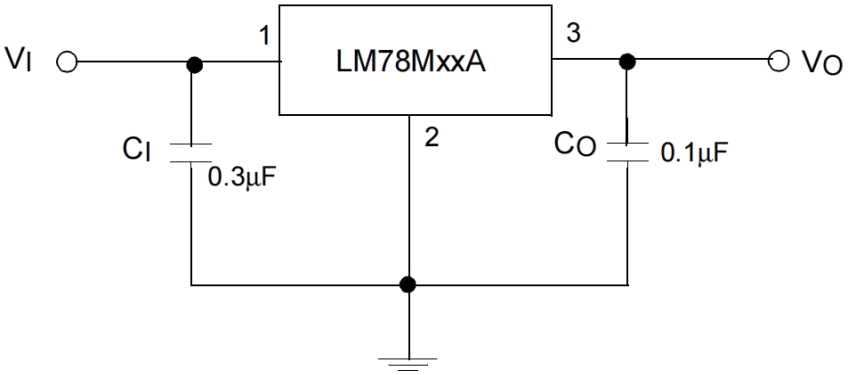


Figure 1. Fixed Output Regulator

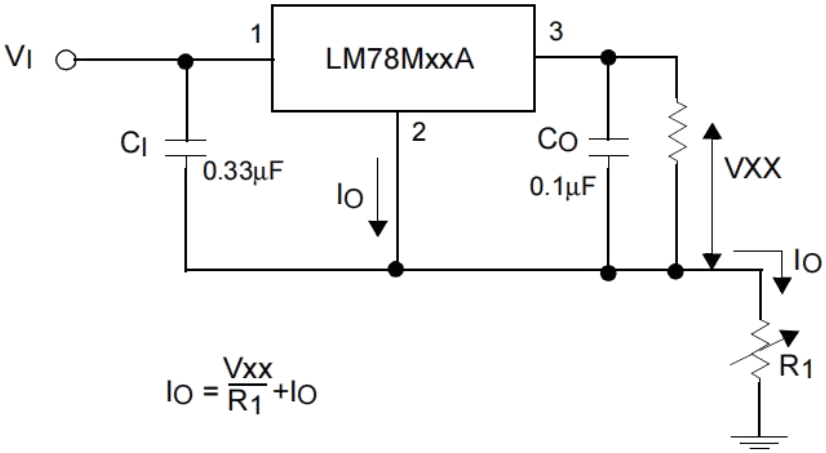


Figure 2. Constant Current Regulator

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

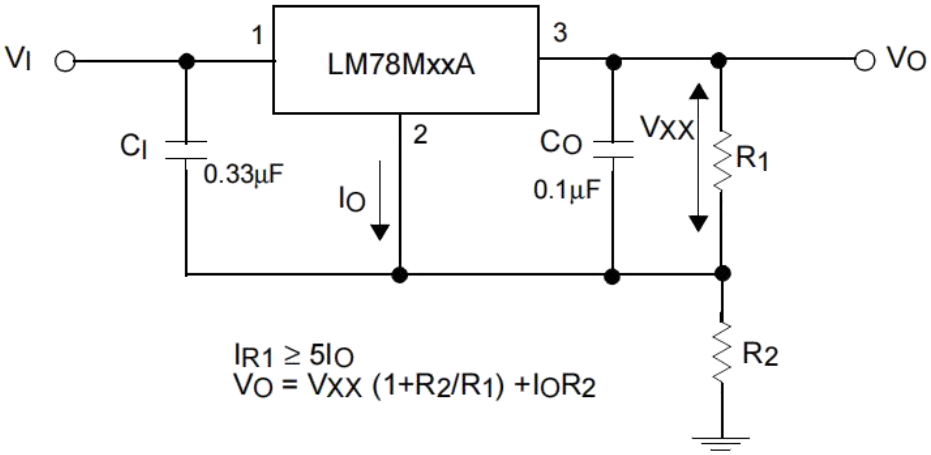


Figure 3. Circuit for Increasing Output Voltage

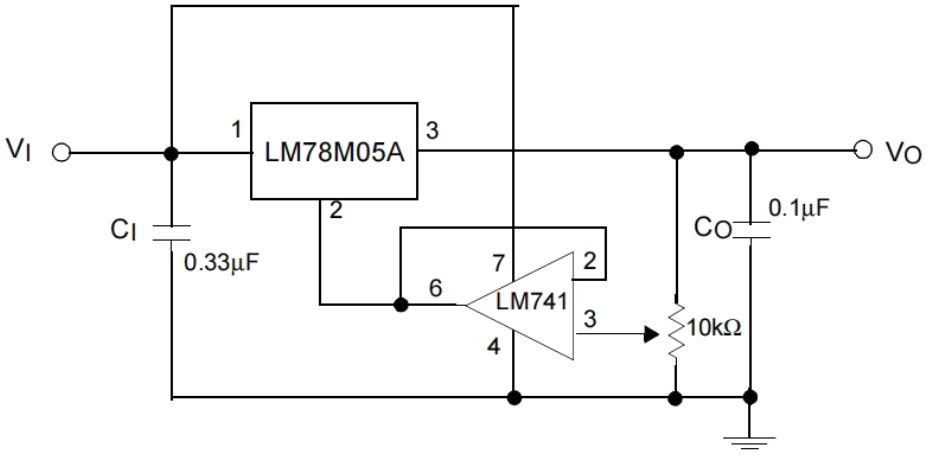


Figure 4. Adjustable Output Regulator (7 to 30V)

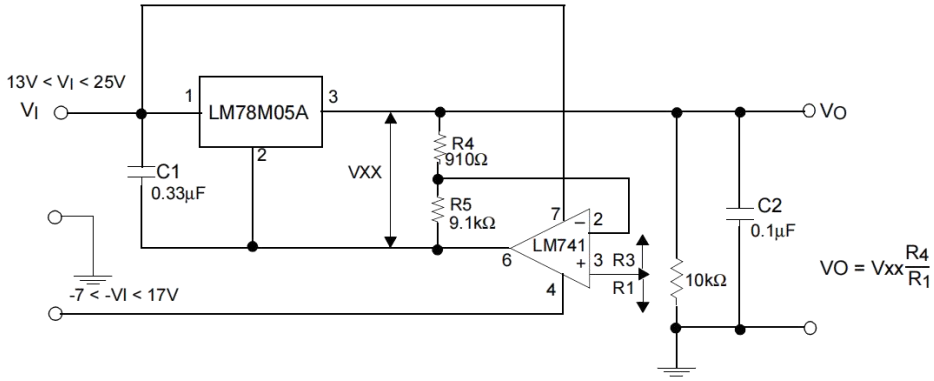
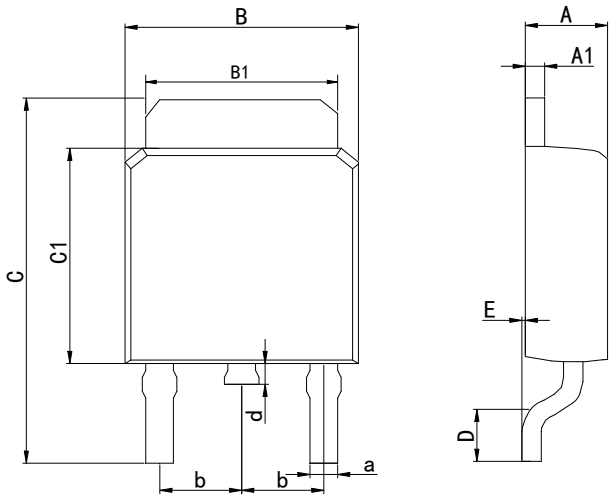


Figure 5. 0.5 to 10V Regulator

Physical Dimensions

TO-252-2



Dimensions In Millimeters(TO-252-2)											
Symbol:	A	A1	B	B1	C	C1	D	E	a	d	b
Min:	2.10	0.45	6.40	5.10	9.20	5.30	0.90	0	0.50	0.60	2.28
Max:	2.50	0.70	6.80	5.50	10.6	6.30	1.75	0.23	0.80	1.20	BSC

Revision History

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2014-8	New	1-11
V1.1	2018-9	Update encapsulation type、Add annotation for Maximum Ratings.	1、2
V1.2	2024-10	Update Lead Temperature	2
V1.3	2025-12	Update important statements	12

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