

LM78Mxx Precision 500mA regulators

Features

- Output current to 0.5 A
- Output voltages of 5; 6; 8; 9; 10; 12; 15; 24 V
- Thermal overload protection
- Short circuit protection
- Output transition SOA protection
- $\pm 2\%$ output voltage tolerance
- Guaranteed in extended temperature range



Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78M05KTPRG	TO-252-2	78M05	REEL	2500pcs/reel
LM78M06KTPRG	TO-252-2	78M06	REEL	2500pcs/reel
LM78M08KTPRG	TO-252-2	78M08	REEL	2500pcs/reel
LM78M09KTPRG	TO-252-2	78M09	REEL	2500pcs/reel
LM78M12KTPRG	TO-252-2	78M12	REEL	2500pcs/reel
LM78M15KTPRG	TO-252-2	78M15	REEL	2500pcs/reel
LM78M18KTPRG	TO-252-2	78M18	REEL	2500pcs/reel
LM78M24KTPRG	TO-252-2	78M24	REEL	2500pcs/reel
LM78M05DCYRG	SOT-223	78M05	REEL	2500pcs/reel
LM78M06DCYRG	SOT-223	78M06	REEL	2500pcs/reel
LM78M08DCYRG	SOT-223	78M08	REEL	2500pcs/reel
LM78M09DCYRG	SOT-223	78M09	REEL	2500pcs/reel
LM78M12DCYRG	SOT-223	78M12	REEL	2500pcs/reel
LM78M15DCYRG	SOT-223	78M15	REEL	2500pcs/reel
LM78M18DCYRG	SOT-223	78M18	REEL	2500pcs/reel
LM78M24DCYRG	SOT-223	78M24	REEL	2500pcs/reel

Description

The LM78Mxx series of three-terminal positive regulators is available in DPAK .packages and with several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shutdown and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

Pin Configuration

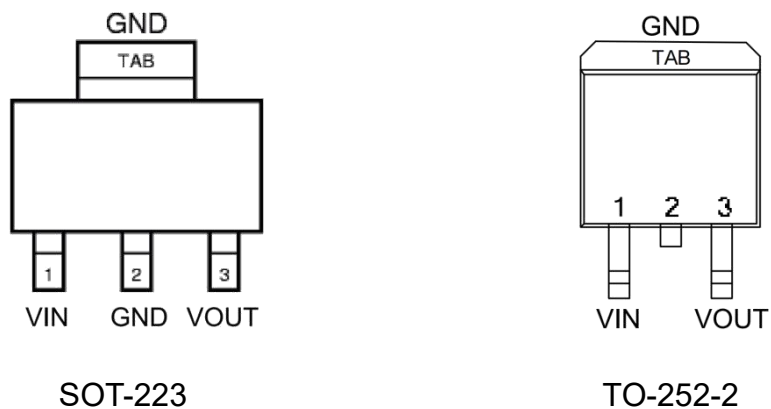
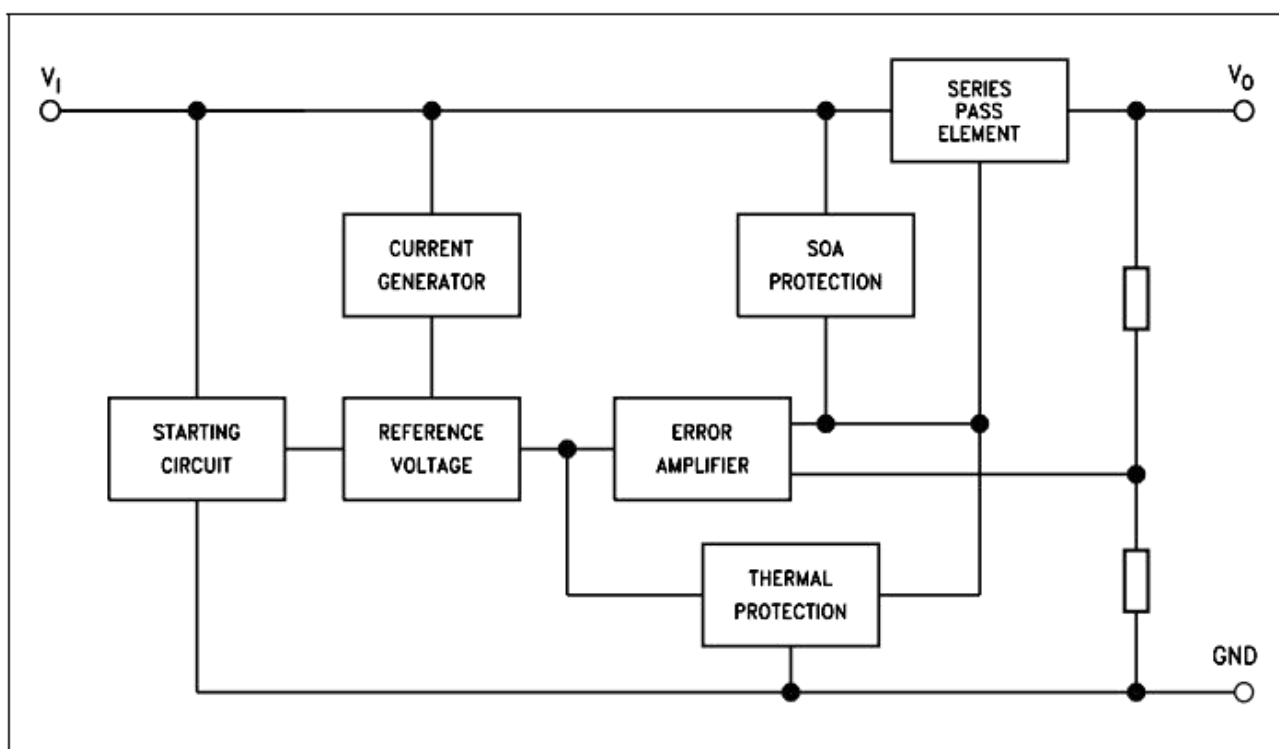


Figure 1. Block diagram



Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_I	DC input voltage	for $V_O = 5$ to 18 V	35	V
		for $V_O = 20, 24$ V	40	
I_O	Output current		Internally limited	mA
P_D	Power dissipation		Internally limited	mW
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range		0 to 125	°C
T_L	Lead Temperature (Soldering, 10 seconds)		245	°C

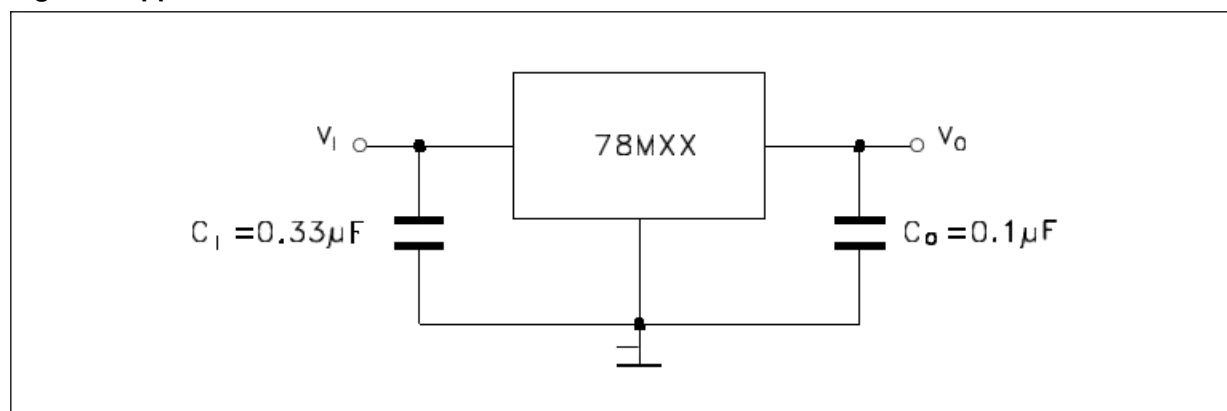
Note: Absolute maximum ratings are those values beyond which damage to the device may occur.

Functional operation under these condition is not implied.

Table 3. Thermal data

Symbol	Parameter	DPAK	Unit
R_{thJC}	Thermal resistance junction-case	8	°C/W
R_{thJA}	Thermal resistance junction-ambient	100	°C/W

Figure 4. Application circuit



Electrical characteristics

Table 4. Electrical characteristics of LM78M05

Refer to the test circuits, $V_I = 10\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
VO	Output voltage	$T_J = 25^\circ\text{C}$	4.9	5	5.1	V
VO	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 7\text{ to }20\text{ V}$	4.8	5	5.2	V
ΔV_O	Line regulation	$V_I = 7\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 8\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			50	
VO	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			50	
Id	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 8\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 8\text{ to }18\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	62			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		40		μV
Vd	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
Isc	Short circuit current	$T_J = 25^\circ\text{C}$, $V_I = 35\text{ V}$		300		mA
Iscp	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 5. Electrical characteristics of LM78M06

Refer to the test circuits, $V_I = 11\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _O	Output voltage	$T_J = 25^\circ\text{C}$	5.88	6	6.12	V
V _O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 8\text{ to }21\text{ V}$	5.75	6	6.3	V
ΔV_O	Line regulation	$V_I = 8\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 9\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			120	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			60	
Id	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 9\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 9\text{ to }19\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	59			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$		45		μV
Vd	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
Isc	Short circuit current	$T_J = 25^\circ\text{C}$, $V_I = 35\text{ V}$		270		mA
Iscp	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 6. Electrical characteristics of LM78M08

Refer to the test circuits, $V_I = 14\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	7.84	8	8.16	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 10.5\text{ to }23\text{ V}$	7.7	8	8.3	V
ΔV_O	Line regulation	$V_I = 10.5\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 11\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			160	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			80	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 10.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 11.5\text{ to }21.5\text{ V}$, $f = 120\text{ Hz}$ $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		52		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
I_{sc}	Short circuit current	$T_J = 25^\circ\text{C}$, $V_I = 35\text{ V}$		250		mA
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 7. Electrical characteristics of LM78M09

Refer to the test circuits, $V_I = 15\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	8.82	9	9.18	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 11.5\text{ to }24\text{ V}$	8.64	9	9.36	V
ΔV_O	Line regulation	$V_I = 11.5\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 12\text{ to }25\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			180	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			90	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 11.5\text{ to }25\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 12.5\text{ to }23\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		52		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		250		mA
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 8. Electrical characteristics of LM78M010

Refer to the test circuits, $V_I = 16\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	9.8	10	10.2	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 12.5\text{ to }25\text{ V}$	9.6	10	10.4	V
ΔV_O	Line regulation	$V_I = 12.5\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 13\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			200	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 12.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-0.5		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 13.5\text{ to }24\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	56			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		64		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
Isc	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		245		mA
Iscp	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 9. Electrical characteristics of LM78M012

Refer to the test circuits, $V_I = 19\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	11.75	12	12.25	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 14.5\text{ to }27\text{ V}$	11.5	12	12.5	V
ΔV_O	Line regulation	$V_I = 14.5\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 16\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			240	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			120	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 14.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 15\text{ to }25\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	55			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		75		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
Isc	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		240		mA
Iscp	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 10. Electrical characteristics of LM78M015

Refer to the test circuits, $V_I = 23\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	14.7	15	15.3	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 17.5\text{ to }30\text{ V}$	14.4	15	15.6	V
ΔV_O	Line regulation	$V_I = 17.5\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 20\text{ to }30\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			300	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			150	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 17.5\text{ to }30\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 18.5\text{ to }28.5\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	54			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		90		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		240		mA
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Table 11. Electrical characteristics of LM78M024

Refer to the test circuits, $V_I = 33\text{ V}$, $I_O = 350\text{ mA}$, $C_I = 0.33\mu\text{F}$, $C_O = 0.1\mu\text{F}$, $T_J = 0\text{ to }125^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_O	Output voltage	$T_J = 25^\circ\text{C}$	23.5	24	24.5	V
V_O	Output voltage	$I_O = 5\text{ to }350\text{ mA}$, $V_I = 27\text{ to }38\text{ V}$	23	24	25	V
ΔV_O	Line regulation	$V_I = 27\text{ to }38\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			100	mV
		$V_I = 28\text{ to }38\text{ V}$, $I_O = 200\text{ mA}$, $T_J = 25^\circ\text{C}$			30	
ΔV_O	Load regulation	$I_O = 5\text{ to }500\text{ mA}$, $T_J = 25^\circ\text{C}$			480	mV
		$I_O = 5\text{ to }200\text{ mA}$, $T_J = 25^\circ\text{C}$			240	
I_d	Quiescent current	$T_J = 25^\circ\text{C}$			6	mA
ΔI_d	Quiescent current change	$I_O = 5\text{ to }350\text{ mA}$			0.5	mA
		$I_O = 200\text{ mA}$, $V_I = 27\text{ to }38\text{ V}$			0.8	
$\Delta V_O/\Delta T$	Output voltage drift	$I_O = 5\text{ mA}$		-1.2		mV/ $^\circ\text{C}$
SVR	Supply voltage rejection	$V_I = 28\text{ to }38\text{ V}$, $f = 120\text{ Hz}$, $I_O = 300\text{ mA}$, $T_J = 25^\circ\text{C}$	50			dB
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ kHz}$, $T_J = 25^\circ\text{C}$		170		μV
V_d	Dropout voltage	$T_J = 25^\circ\text{C}$		2		V
I_{sc}	Short circuit current	$V_I = 35\text{ V}$, $T_J = 25^\circ\text{C}$		240		mA
I_{scp}	Short circuit peak current	$T_J = 25^\circ\text{C}$		700		mA

Typical performance

Figure 8. Dropout voltage vs. junction temp.

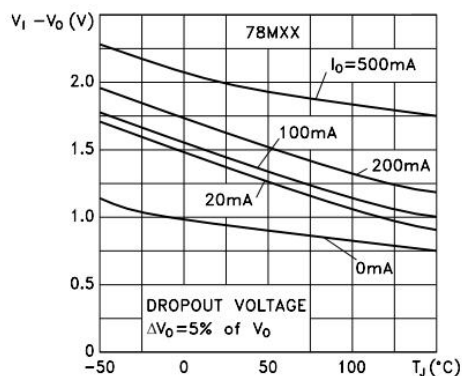


Figure 9. Dropout characteristics

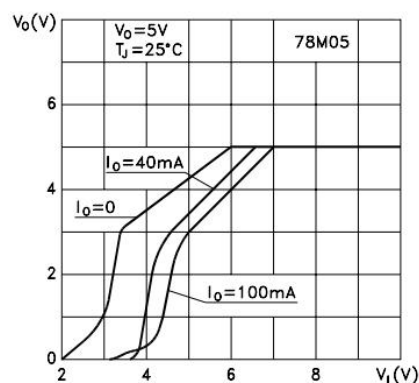


Figure 10. Peak output current vs. input/output differential voltage

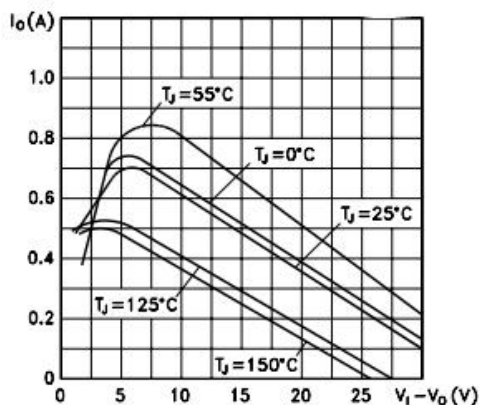


Figure 11. Output voltage vs. junction temperature

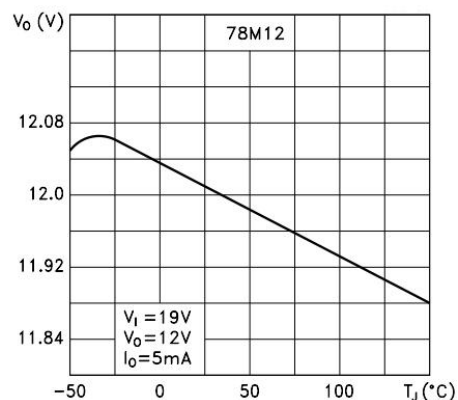


Figure 12. Supply voltage rejection vs. frequency

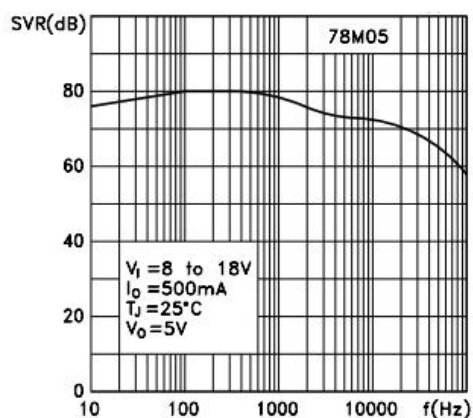
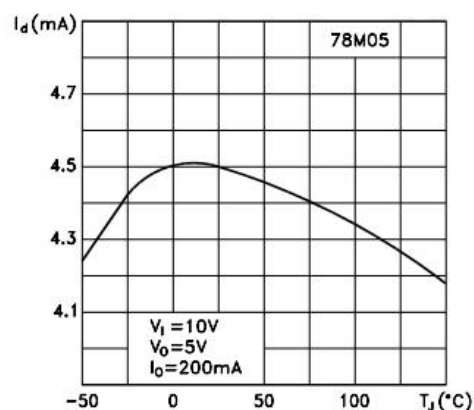


Figure 13. Quiescent current vs. junction temperature



Typical performance

Figure 14. Load transient response

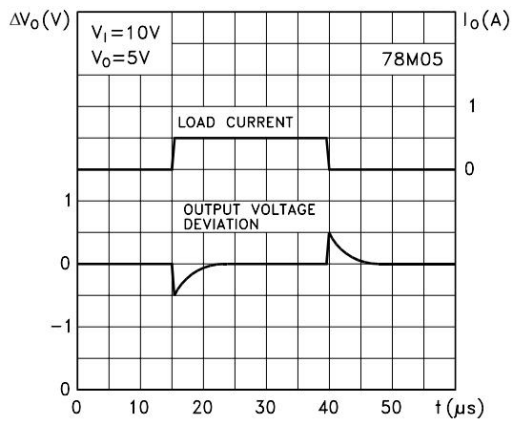


Figure 15. Line transient response

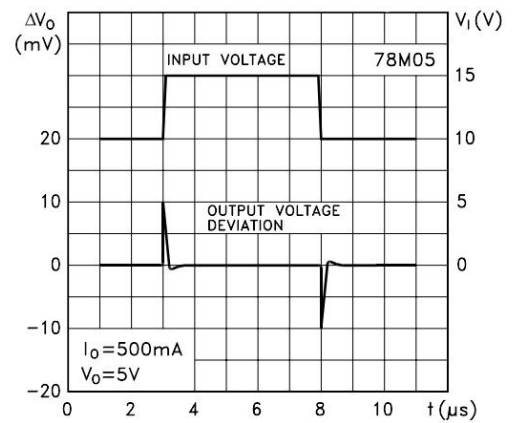
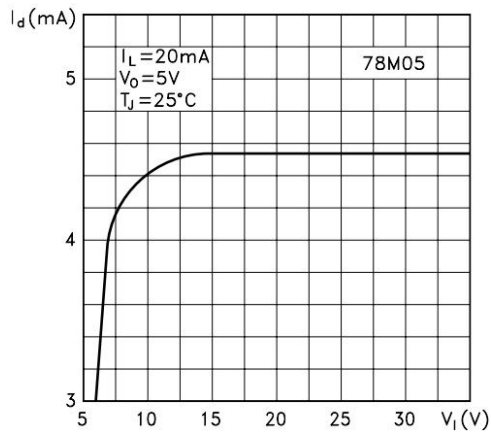
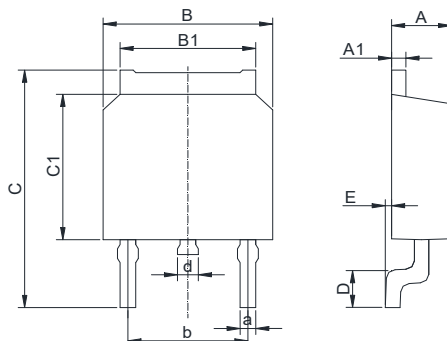


Figure 16. Quiescent current vs. input voltage



Physical Dimensions

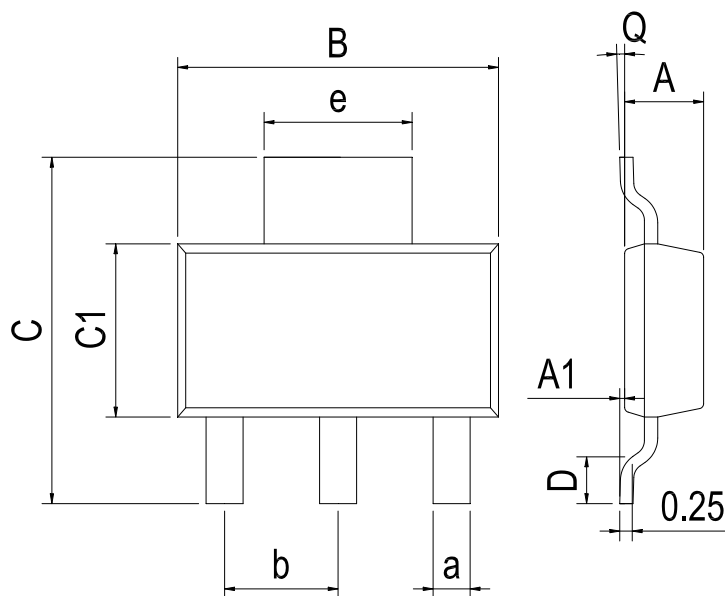
TO-252-2



Dimensions In Millimeters(TO-252-2)

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

SOT-223



Dimensions In Millimeters(SOT-223)

Symbol:	A	A1	B	C	C1	D	Q	a	b	e
Min:	1.50	0.05	6.30	6.70	3.30	0.65	0°	0.66	2.30 BSC	3.00 BSC
Max:	1.70	0.20	6.70	7.30	3.70	1.10	8°	0.84		

Revision History

DATE	REVISION	PAGE
2014-6-8	New	1-12
2023-7-24	Update encapsulation type、 Update Lead Temperature	1、 3

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