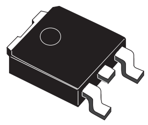
LM78Mxx Precision 500 mA regulators

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
- ± 2 % output voltage tolerance
- Guaranteed in extended temperature range

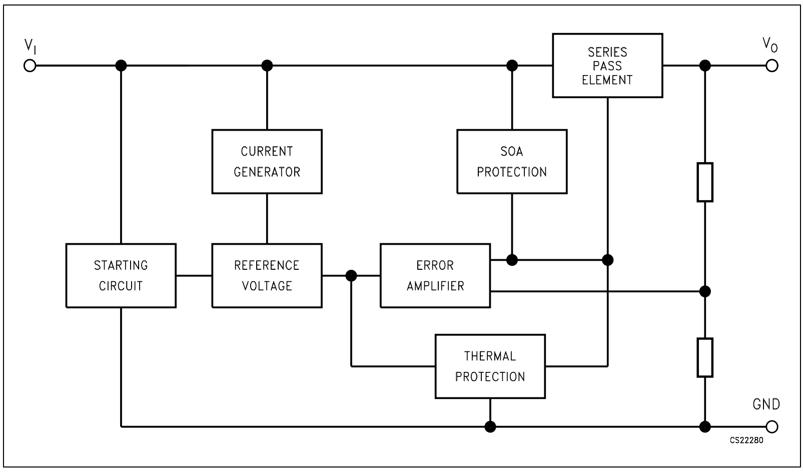


DPAK

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.

Figure 1. Block diagram



ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM78M05CDT/TR	TO252-2L	LM78M05	REEL	2000pcs/reel
LM78M06CDT/TR	TO252-2L	LM78M06	REEL	2000pcs/reel
LM78M08CDT/TR	TO252-2L	LM78M08	REEL	2000pcs/reel
LM78M09CDT/TR	TO252-2L	LM78M09	REEL	2000pcs/reel
LM78M10CDT/TR	TO252-2L	LM78M10	REEL	2000pcs/reel
LM78M12CDT/TR	TO252-2L	LM78M12	REEL	2000pcs/reel
LM78M15CDT/TR	TO252-2L	LM78M15	REEL	2000pcs/reel
LM78M24CDT/TR	TO252-2L	LM78M24	REEL	2000pcs/reel
LM78M05IDT/TR	TO252-2L	LM78M05	REEL	2000pcs/reel
LM78M06IDT/TR	TO252-2L	LM78M06	REEL	2000pcs/reel
LM78M08IDT/TR	TO252-2L	LM78M08	REEL	2000pcs/reel
LM78M09IDT/TR	TO252-2L	LM78M09	REEL	2000pcs/reel
LM78M10IDT/TR	TO252-2L	LM78M10	REEL	2000pcs/reel
LM78M12IDT/TR	TO252-2L	LM78M12	REEL	2000pcs/reel
LM78M15IDT/TR	TO252-2L	LM78M15	REEL	2000pcs/reel
LM78M24IDT/TR	TO252-2L	LM78M24	REEL	2000pcs/reel

3 Maximum ratings

Table 2. Absolute maximum ratings

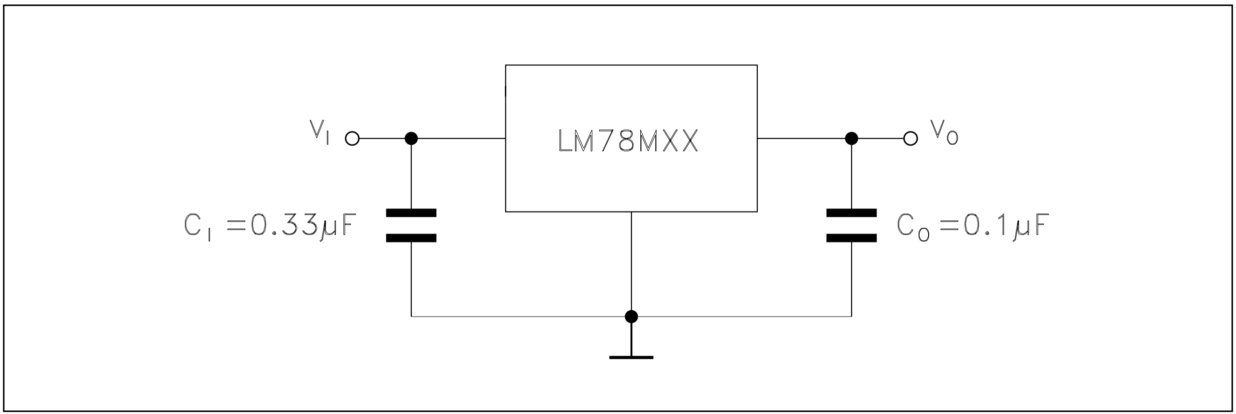
Symbol	Parameter		Value	Unit
V_I	DC input voltage	for V_O = 5 to 18 V	35	V
		for V_O = 20, 24 V	40	
I_O	Output current		Internally limited	mA
P_D	Power dissipation		Internally limited	mW
T_{STG}	Storage temperature range		-65 to 150	°C
T_{OP}	Operating junction temperature range	for LM78MxxC	0 to 70	°C
		for LM78MxxI	-40 to 85	

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



5 Electrical characteristics

Table 4.Electrical characteristics of 78M05

Refer to the test circuits, V_I = 10 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

Table 5.Electrical characteristics of 78M06

Refer to the test circuits, V_I = 11 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

Table 6.Electrical characteristics of 78M08

Refer to the test circuits, V_I = 14 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T = 0 to 125 °C (AC) unless otherwise specified).

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

Table 7.Electrical characteristics of 78M09

Refer to the test circuits, V_I = 15 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified).

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

Table 8.Electrical characteristics of 78M10

Refer to the test circuits, V_I = 16 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

Table 9.Electrical characteristics of 78M12

Refer to the test circuits, V_I = 19 V, I_O = 350 mA, C_I = 0.33 µF, C_O = 0.1 µF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

Table 10.Electrical characteristics of 78M15

Refer to the test circuits, V_I = 23 V, I_O = 350 mA, C_I = 0.33 μF, C_O = 0.1 μF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

Table 11.Electrical characteristics of 78M24

Refer to the test circuits, V_I = 33 V, I_O = 350 mA, C_I = 0.33 μF, C_O = 0.1 μF, T_J = -40 to 125 °C (AB), T_J = 0 to 125 °C (AC) unless otherwise specified.

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

6 Typical performance

Figure 8. Dropout voltage vs. junction temp.

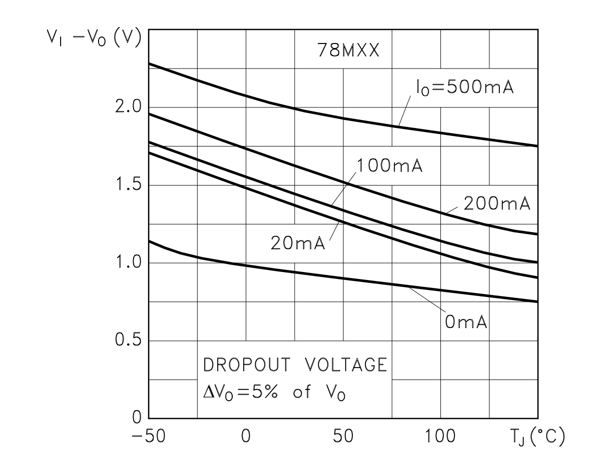


Figure 9. Dropout characteristics

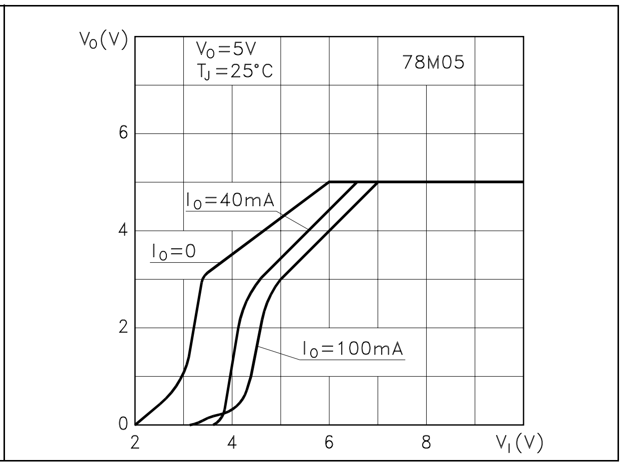


Figure 10. Peak output current vs. input-output differential voltage

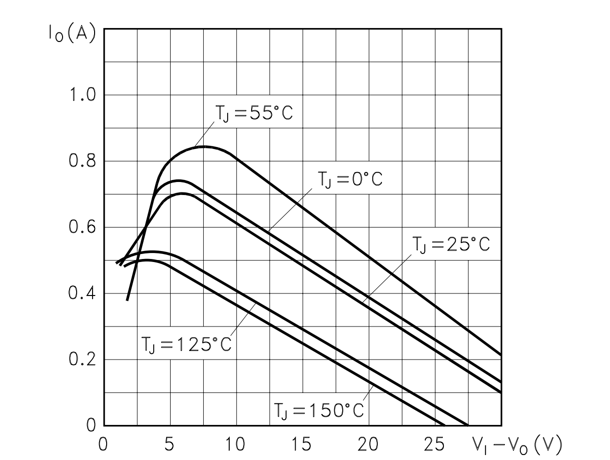


Figure 11. Output voltage vs. junction temperature

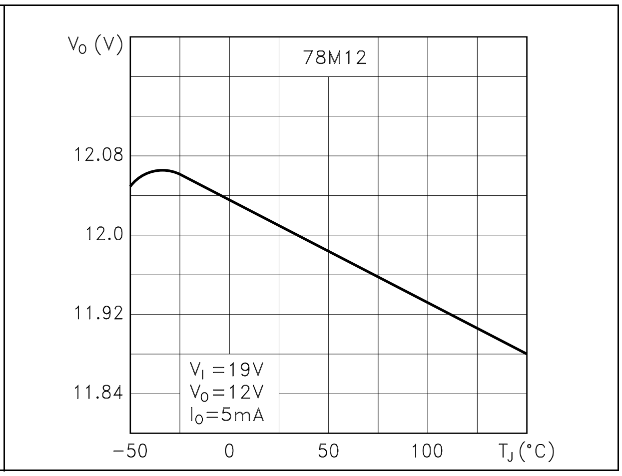


Figure 12. Supply voltage rejection vs. frequency

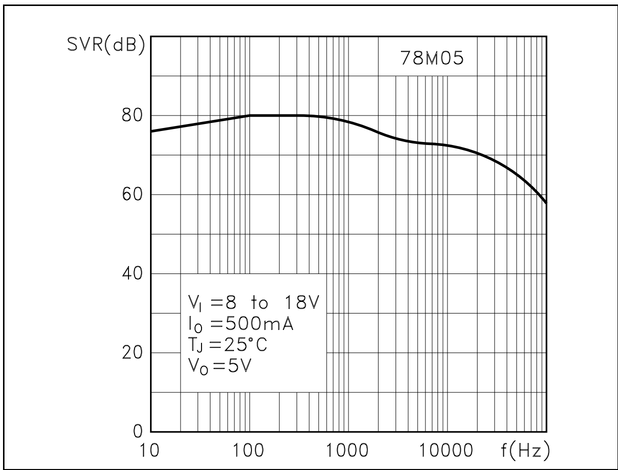


Figure 13. Quiescent current vs. junction temperature

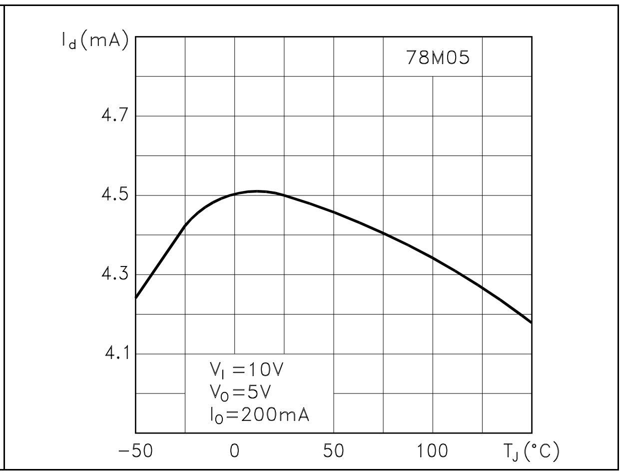


Figure 14. Load transient response

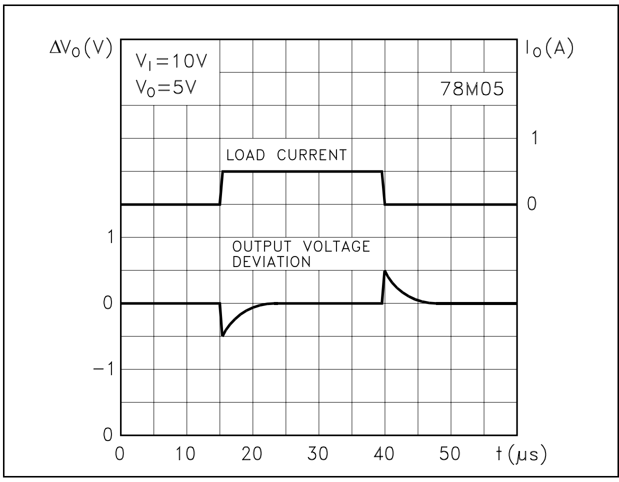


Figure 15. Line transient response

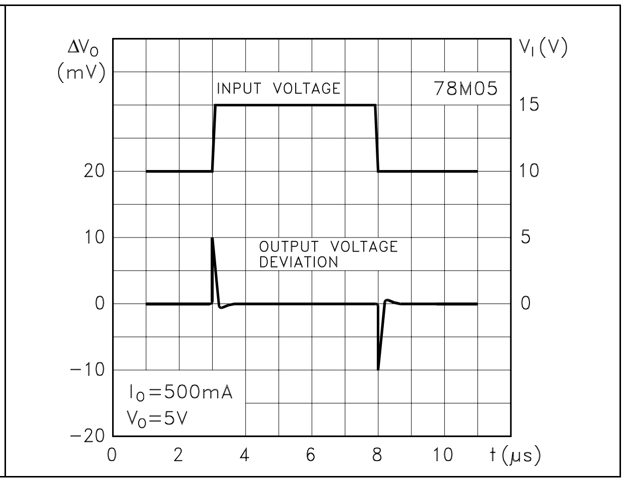
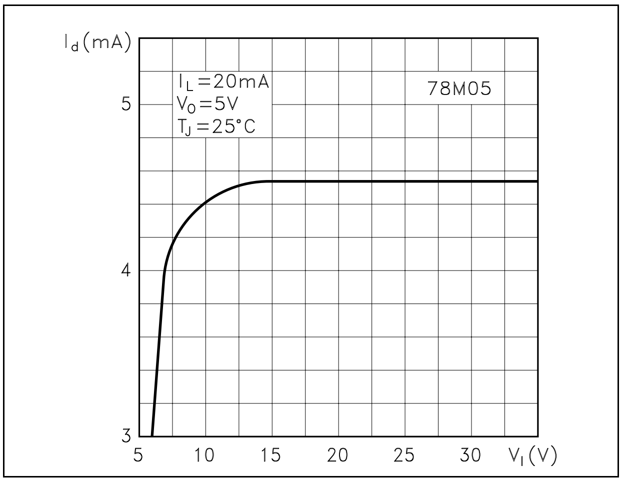
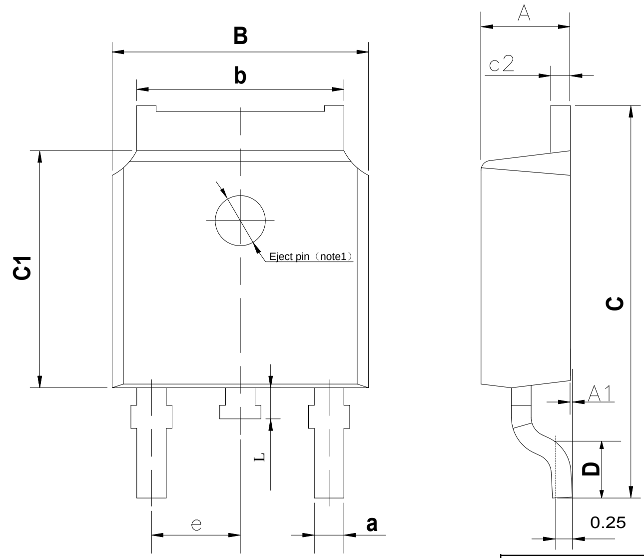


Figure 16. Quiescent current vs. input voltage



PACKAGE

T0252-2



Dimensions In Millimeters					
Symbol：	**Min：**	**Max：**	**Symbol：**	**Min：**	**Max：**
A	2.100	2.500	**D**	1.400	1.700
A1	0.000	0.150	L	0.600	1.000
B	6.300	6.900	**a**	0.760 TYP	
C	9.600	10.60	**e**	2.300 TYP	
C1	5.800	6.400	**b**	5.330 TYP	
C2	0.4500	0.650			

Important statement:

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