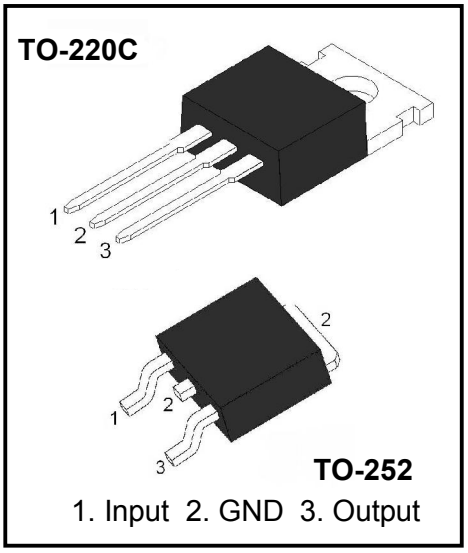
3-Terminal 1A Positive Voltage Regulator



1. Input 2. GND 3. Output

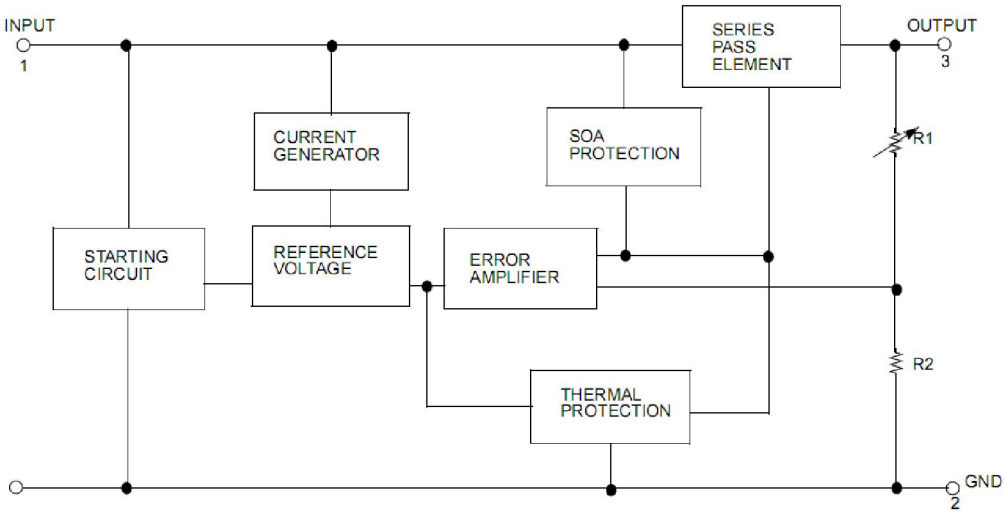
Description

The 78MXX series of three-terminal positive regulators are available in the TO-220C/TO-252 package with several fixed output voltages making it useful in a wide range of applications.

Features

- Output Current up to 1A
- Output Voltages of 5,6,8,10,12,15,18,20,24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating area (SOA)Protection

Internal Block Digram



Absolute Maximum Ratings

Parameter		Symbol	Value	Unit
Input Voltage	V_O = 5V~18V	V_{IN}	35	V
	V_O = 24V		40	
Thermal Resistance Junction-Cases (TO-220C)		$R_{\theta JC}$	5	℃/W
Thermal Resistance Junction-Air	TO-220C	$R_{\theta JA}$	65	℃/W
	TO-252		92	
Operating Temperature Range		T_{OPR}	0 ~ + 125	℃
Storage Temperature Range		T_{STG}	-55 ~ + 150	℃

Note1 .Absolute maximum ratings are those values beyond which damage to the device may occur. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

Electrical Characteristics (78M05)

(V_I = 10V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40℃ to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		4.80	5.0	5.20	V
		V_I = 7V ~ 20V, I_O=5mA ~ 1A		4.75	5.0	5.25	V
Line Regulation ②	ΔV_O	T_j = 25℃	V_I = 7V ~ 25V			100	mV
			V_I = 8V ~ 12V			50	
Load Regulation ②	ΔV_O	T_j = 25℃	I_O= 5mA ~ 1A			100	mV
			I_O= 0.25A ~ 0.75A			50	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 7V ~ 25V				1.3	
Output Voltage Drift ③	$\Delta V / \Delta T$	I_O = 5mA			-0.8		mV/℃
Output Noise Voltage	V_N	10H_Z ≤ f ≤ 100KH_Z			42		μV/V_O
Ripple Rejection ③	RR	f = 120Hz, V_I = 8V ~ 18V		62	73		dB
Output Resistance ③	R_O	f = 1kHz			15		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ③	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O=1A			2.0		V

Note 2: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 3: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M06)

(V_I = 11V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j=-40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		5.76	6.0	6.24	V
		V_I = 8V ~ 12V, I_O= 5mA ~ 1A		5.70	6.0	6.30	V
Line Regulation ④	ΔV_O	T_j = 25℃	V_I = 8V ~ 25V			120	mV
			V_I = 9V ~ 13V			60	
Load Regulation ④	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			120	mV
			I_O= 0.25A ~ 0.75A			60	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 8V ~ 25V				1.3	
Output Voltage Drift ⑤	$\Delta V / \Delta T$	I_O = 5mA			-0.8		mV/℃
Output Noise Voltage	V_N	10H_Z ≤ f ≤ 100KH_Z			76		μV/V_O
Ripple Rejection ⑤	RR	f = 120Hz,V_I = 8V ~ 18V		55	71		dB
Output Resistance ⑤	R_O	f = 1kHz			19		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ⑤	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O=1A			2.0		V

Note 4: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 5: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M08)

(V_I = 14V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		7.68	8.0	8.32	V
		V_I = 10.5V ~ 23V, I_O= 5mA ~ 1A		7.60	8.0	8.40	V
Line Regulation ⑥	ΔV_O	T_j = 25℃	V_I = 10.5V ~ 25V			160	mV
			V_I = 11.5V ~ 17V			80	
Load Regulation ⑥	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			160	mV
			I_O= 0.25A ~ 0.75A			80	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 10.5V ~ 25V				1.0	
Output Voltage Drift ⑦	$\Delta V / \Delta T$	I_O = 5mA			-0.8		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			52		μV/V_O
Ripple Rejection ⑦	RR	f = 120Hz, V_I = 11.5V ~21.5V		56	73		dB
Output Resistance ⑦	R_O	f = 1kHz			17		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ⑦	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 6: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 7: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M09)

(V_I = 15V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		8.64	9.0	9.36	V
		V_I = 11.5V ~ 24V, I_O= 5mA ~ 1A		8.55	9.0	9.45	V
Line Regulation ⑧	ΔV_O	T_j = 25℃	V_I = 11.5V ~ 25V			180	mV
			V_I = 12V ~ 17V			90	
Load Regulation ⑧	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			180	mV
			I_O= 0.25A ~ 0.75A			90	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA ~ 1A				0.5	mA
		V_I = 11.5V ~ 26V				1.3	
Output Voltage Drift ⑨	$\Delta V / \Delta T$	I_O = 5mA			-1.0		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			52		$\mu V/V_O$
Ripple Rejection ⑨	RR	f = 120Hz, V_I = 13V ~23V		56	71		dB
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Output Resistance ⑨	R_O	f = 1kHz			17		mΩ
Peak Out Current ⑨	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 8: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 9: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M10)

(V_I = 16V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		9.60	10.0	10.40	V
		V_I = 12.5V ~ 25V, I_O= 5mA ~ 1A		9.50	10.0	10.50	V
Line Regulation ⑩	ΔV_O	T_j = 25℃	V_I = 12.5V ~ 25V			200	mV
			V_I = 13V ~ 25V			100	
Load Regulation ⑩	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			200	mV
			I_O= 0.25A ~ 0.75A			100	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA ~ 1A				0.5	mA
		V_I = 12.5V ~ 29V				1.0	
Output Voltage Drift ⑪	$\Delta V / \Delta T$	I_O = 5mA			-1.0		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			58		μV/V_O
Ripple Rejection ⑪	RR	f = 120Hz, V_I = 13V ~23V		56	71		dB
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Output Resistance ⑪	R_O	f = 1kHz			17		mΩ
Peak Out Current ⑪	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 10: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 11: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M12)

(V_I = 19V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		11.52	12.0	12.48	V
		V_I = 14.5V ~ 27V, I_O=5mA ~ 1A		11.40	12.0	12.60	V
Line Regulation ⑫	$\triangle V_O$	T_j = 25℃ I_O= 0.5A	V_I = 14.5V ~ 30V			240	mV
			V_I = 11.5V ~ 24V			120	
Load Regulation ⑫	$\triangle V_O$	T_j = 25℃,	I_O= 5mA ~ 1A			240	mV
			I_O= 0.25A ~ 0.75A			120	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	$\triangle I_Q$	I_O=5mA ~ 1A				0.5	mA
		V_I = 14.5V ~ 30V				1.0	
Output Voltage Drift ⑬	$\triangle V / \triangle T$	I_O = 5mA			-1.0		mV/℃
Output Noise Voltage	V_N	10H_Z ≤ f ≤ 100KH_Z			76		μV/V_O
Ripple Rejection ⑬	RR	f = 120Hz, V_I = 15V ~ 25V		55	71		dB
Output Resistance ⑬	R_O	f = 1kHz			18		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ⑬	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 12: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 13: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M15)

(V_I = 23V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		14.40	15.0	15.60	V
		V_I = 17.5V ~ 30V, I_O=5mA ~ 1A		14.25	15.0	15.75	V
Line Regulation ⑭	ΔV_O	T_j = 25℃ I_O= 0.5A	V_I = 17.5V ~ 30V			300	mV
			V_I = 20V ~ 26V			150	
Load Regulation ⑭	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			300	mV
			I_O= 0.25A ~ 0.75A			150	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 17.5V ~ 30V				1.0	
Output Voltage Drift ⑮	$\Delta V / \Delta T$	I_O = 5mA			-1.0		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			90		μV/V_O
Ripple Rejection ⑮	RR	f = 120Hz, V_I = 18.5V ~ 28.5V		54	70		dB
Output Resistance ⑮	R_O	f = 1kHz			19		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ⑮	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 14: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 15: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M18)

(V_I = 27V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		17.28	18.0	18.72	V
		V_I = 21V ~ 30V, I_O=5mA ~ 1A		17.10	18.0	18.90	V
Line Regulation ⑯	ΔV_O	T_j = 25℃ I_O= 0.5A	V_I = 21V ~ 30V			360	mV
			V_I = 24V ~ 26V			180	
Load Regulation ⑯	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			300	mV
			I_O= 0.25A ~ 0.75A			150	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 21V ~ 30V				1.0	
Output Voltage Drift ⑰	$\Delta V / \Delta T$	I_O = 5mA			-1.0		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			110		μV/V_O
Ripple Rejection ⑰	RR	f = 120Hz, V_I = 22V ~ 30V		53	69		dB
Output Resistance ⑰	R_O	f = 1kHz			22		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 30V			230		mA
Peak Out Current ⑰	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 16: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 17: These parameters, although guaranteed, are not 100% tested in production.

Electrical Characteristics (78M24)

(V_I = 33V, I_O = 0.5A,C_I = 0.33μF, C_O = 0.1μF, T_j= -40 to 125℃, unless otherwise specified)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Output Voltage	V_O	T_j = 25℃, I_O=5mA ~ 1A		23.04	24.0	24.96	V
		V_I = 27V ~ 38V, I_O=5mA ~ 1A		22.80	24.0	25.20	V
Line Regulation ⑱	ΔV_O	T_j = 25℃ I_O= 0.5A	V_I = 27V ~ 38V			480	mV
			V_I = 30V ~ 36V			240	
Load Regulation ⑱	ΔV_O	T_j = 25℃,	I_O= 5mA ~ 1A			480	mV
			I_O= 0.25A ~ 0.75A			240	
Quiescent Current	I_Q	T_j = 25℃				8.0	mA
Quiescent Current Change	ΔI_Q	I_O=5mA ~ 1A				0.5	mA
		V_I = 27V ~ 38V				1.0	
Output Voltage Drift ⑲	$\Delta V / \Delta T$	I_O = 5mA			-1.5		mV/℃
Output Noise Voltage	V_N	$10H_Z \le f \le 100KH_Z$			60		μV/V_O
Ripple Rejection ⑲	RR	f = 120Hz, V_I = 28V ~ 38V		50	67		dB
Output Resistance ⑲	R_O	f = 1kHz			28		mΩ
Short Circuit Current	I_{SC}	T_j=25℃ , V_I= 35V			230		mA
Peak Out Current ⑲	I_{PK}	T_j=25℃			1.8		A
Dropout Voltage	V_d	T_j=25℃, I_O = 1A			2.0		V

Note 18: Load and line regulation are specified at constant junction temperature. Changes in V_O due to heating effects must be taken into account separately. Pulse testing with low duty is used.

Note 19: These parameters, although guaranteed, are not 100% tested in production.

Typical Characteristics

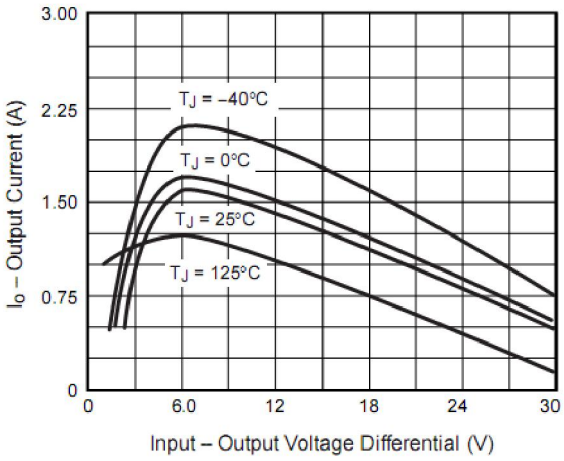


Figure 1. Peak Output Current

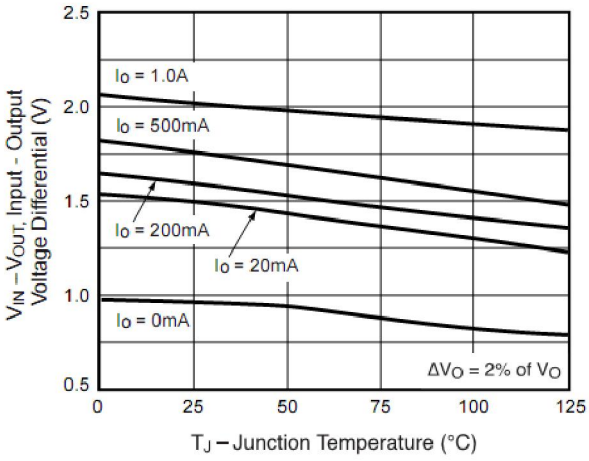


Figure 2. Dropout Voltage vs. Junction Temperature

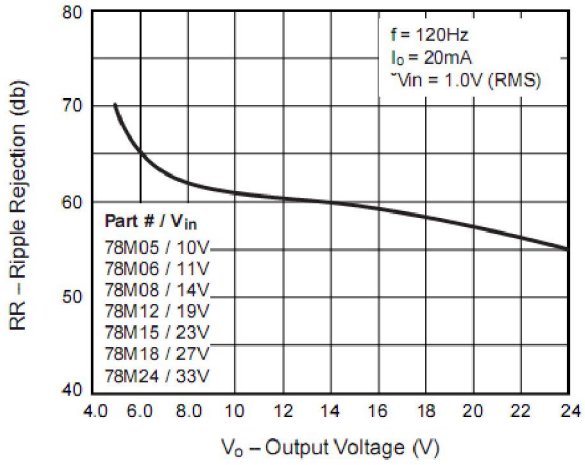


Figure 3. Ripple Rejection Ratio vs. Output Voltage

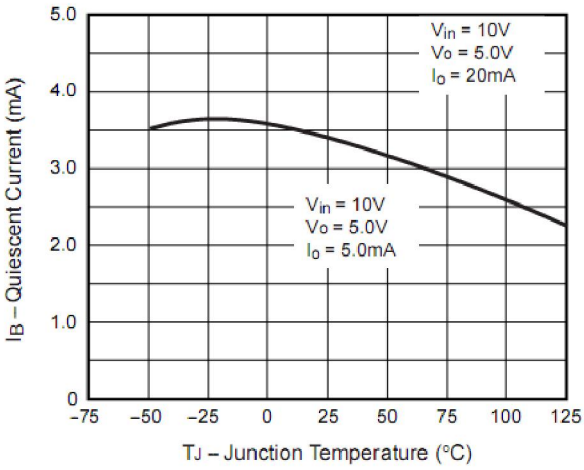


Figure4. Quiescent Current vs. Junction Temperature

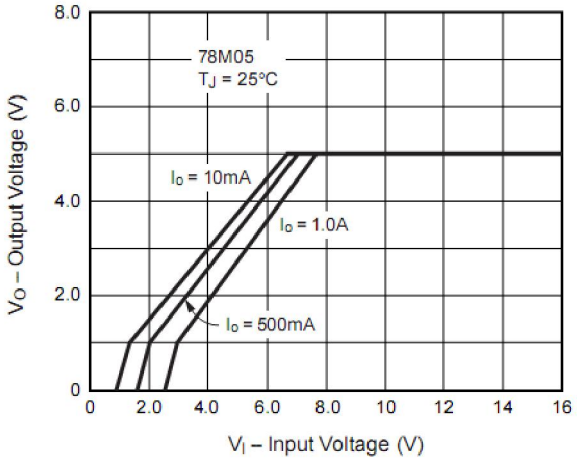


Figure 8. Output Voltage vs. Input Voltage

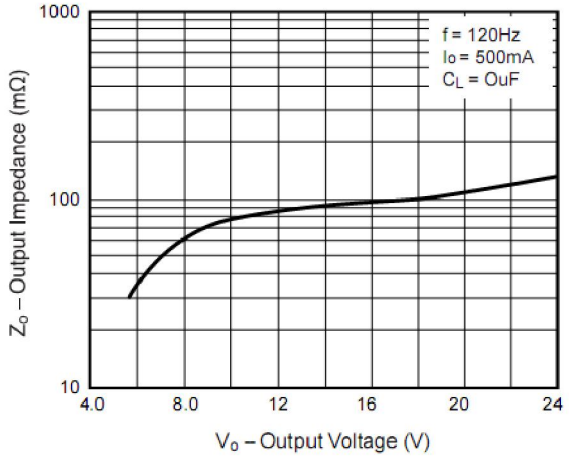
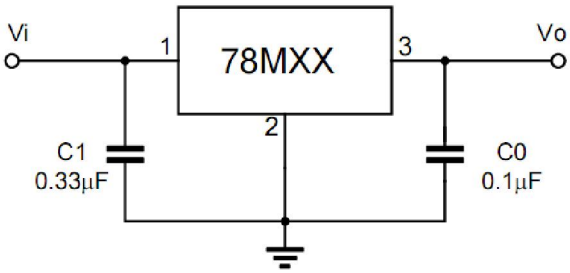


Figure 9. Output Impedance (mΩ) vs. Output Voltage

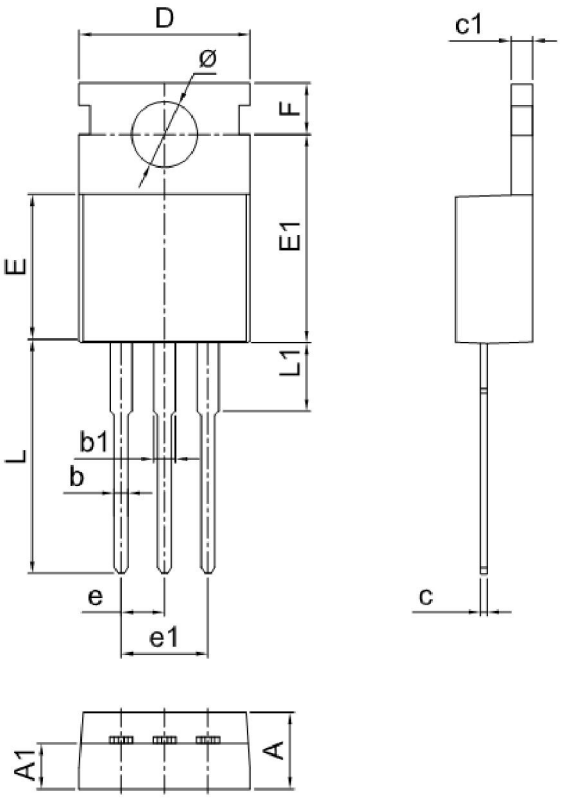
Application circuit



Note 1: To specify an output voltage, substitute voltage value for "MXX".
Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

Package Dimensions

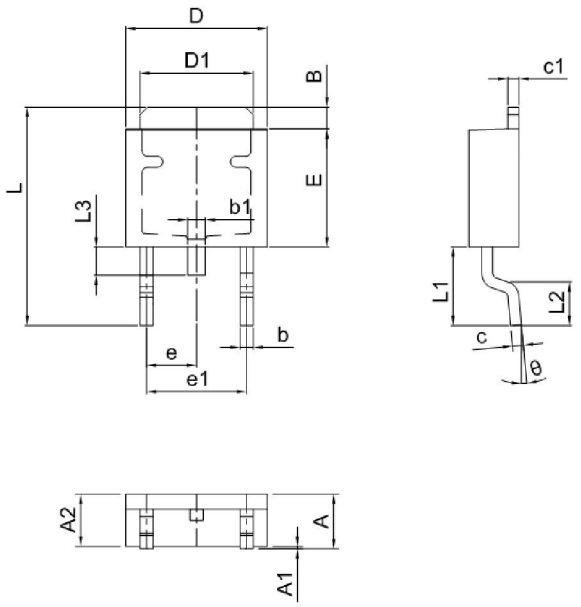
TO-220C



Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.34	4.67	0.171	0.184
A1	2.52	2.82	0.099	0.111
b	0.71	0.91	0.028	0.036
b1	1.17	1.37	0.046	0.054
c	0.30	0.50	0.012	0.020
c1	1.17	1.37	0.046	0.054
D	9.90	10.20	0.390	0.402
E	8.50	8.90	0.335	0.350
E1	12.00	12.50	0.472	0.492
e	2.44	2.64	0.096	0.104
e1	4.88	5.28	0.192	0.208
F	2.60	2.80	0.102	0.110
L	13.20	13.80	0.520	0.543
L1	3.80	4.20	0.150	0.165
Φ	3.60	3.96	0.142	0.156

Package Dimensions

TO-252



Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.50	0.087	0.098
A1	0.00	0.12	0.000	0.005
A2	2.20	2.40	0.087	0.094
B	1.20	1.60	0.047	0.063
b	0.50	0.70	0.020	0.028
b1	0.70	0.90	0.028	0.035
c	0.40	0.60	0.016	0.024
c1	0.40	0.60	0.016	0.024
D	6.35	6.65	0.250	0.262
D1	5.20	5.40	0.205	0.213
E	5.40	5.70	0.213	0.224
e	2.20	2.40	0.087	0.094
e1	4.40	4.80	0.173	0.189
L	9.60	10.20	0.378	0.402
L1	2.70	3.10	0.106	0.122
L2	1.40	1.80	0.055	0.071
L3	0.90	1.50	0.035	0.059