M5F78MXX

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

DESCRIPTION

M5F78MXX is a semiconductor integrated circuit which is designed for 3 terminal regulator which is available for maximum load current 500mA class positive output.

An over current protection circuit, heat protection circuit and ASO protection circuit are included.

Especially, the characteristics of Ripple rejection ratio and output impedance are 5 to 10 times superior to the original ones, which make the device suitable for use in a wide range of power supplies such as microcomputer power supply.

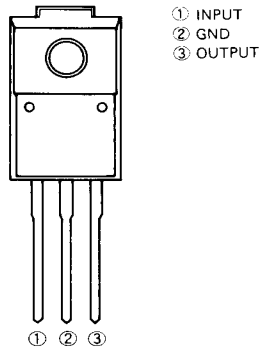
FEATURES

- No need for external connecting parts
- Ripple rejection ratio 90dB
- Output impedance 5mΩ
- Variety of output voltage ranks
  (5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V)

APPLICATION

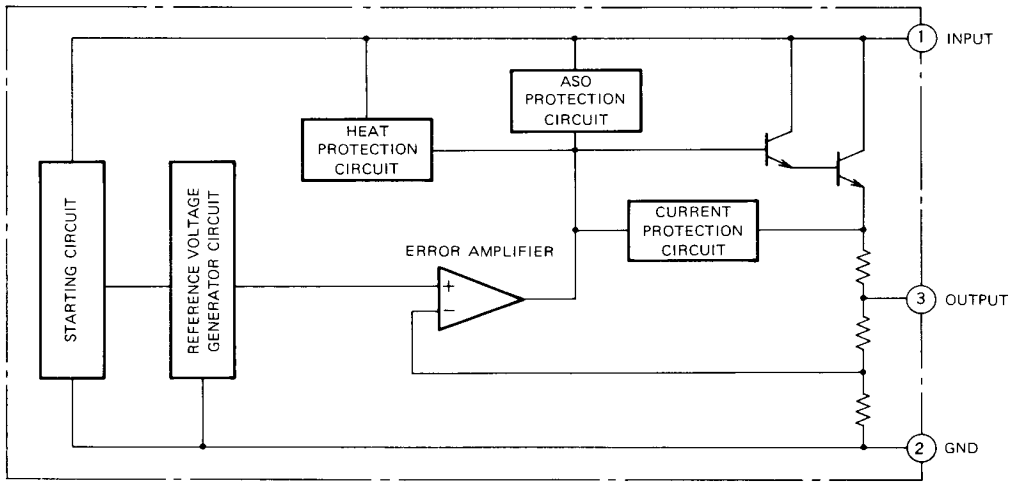
For general power supply of various types of electronic equipment such as VCR, CD

PIN CONFIGURATION (TOP VIEW)



Outline 3P9

BLOCK DIAGRAM



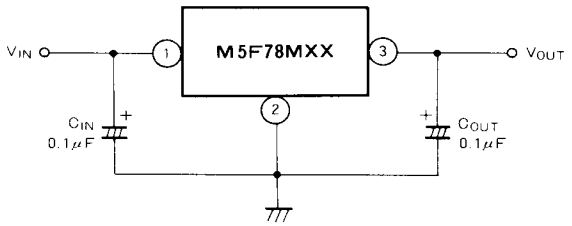
FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

ABSOLUTE MAXIMUM RATINGS (T_a = 25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{IN}	Input voltage		35／40*	V
P_d	Power dissipation		2 (no heat sink)	W
			20 (with infinite heat sink)	
T_a	Operating temperature		−20 ~ +85	℃
T_j	Junction temperature		−20 ~ +150	℃
T_{stg}	Storage temperature		−55 ~ +150	℃

* M5F78M24

STANDARD CONNECTION



ELECTRIC CHARACTERISTICS

M5F78M05 (V_{IN} = 10V, I_O = 350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j = 25℃	4.8	5.0	5.2	V
		7V ≦ V_{IN} ≦ 20V, 5mA ≦ I_O ≦ 350mA	4.75		5.25	
$\triangle V_O$ Line	Input stability	T_j = 25℃, 7V ≦ V_{IN} ≦ 25V		3	100	mV
		T_j = 25℃, 8V ≦ V_{IN} ≦ 25V		1	50	
$\triangle V_O$ Load	Load stability	T_j = 25℃, 5mA ≦ I_O ≦ 500mA		4	100	mV
		T_j = 25℃, 5mA ≦ I_O ≦ 200mA		2	50	
I_{CC}	Operating current	T_j = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	8V ≦ V_{IN} ≦ 25V, I_O = 200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j = 25℃, 10Hz ~ 100kHz		50		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 8V ≦ V_{IN} ≦ 18V	72	90		dB
V_{DROP}	Input output voltage difference	T_j = 25℃		2		V
R_O	Output resistance	f = 1kHz		5		mΩ
I_{OS}	Output short current	T_j = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_j = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.2		mV/℃

MITSUBISHI ELECTRIC

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

M5F78M06 (V_{IN} = 11V, I_O = 350mA, 0℃ ≤ T_j ≤ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j = 25℃	5.75	6.0	6.25	V
		8V ≤ V_{IN} ≤ 21V, 5mA ≤ I_O ≤ 350mA	5.7		6.3	
$\triangle V_O$ Line	Input stability	T_j = 25℃, 8V ≤ V_{IN} ≤ 25V		3	100	mV
		T_j = 25℃, 9V ≤ V_{IN} ≤ 25V		1	50	
$\triangle V_O$ Load	Load stability	T_j = 25℃, 5mA ≤ I_O ≤ 500mA		5	120	mV
		T_j = 25℃, 5mA ≤ I_O ≤ 200mA		2	60	
I_{CC}	Operating current	T_j = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	9V ≤ V_{IN} ≤ 25V, I_O = 200mA			0.8	mA
		5mA ≤ I_O ≤ 350mA			0.5	
V_N	Output noise voltage	T_j = 25℃, 10Hz ~ 100kHz		60		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 9V ≤ V_{IN} ≤ 19V	70	88		dB
V_{DROP}	Input output voltage difference	T_j = 25℃		2		V
R_O	Output resistance	f = 1kHz		5		mΩ
I_{OS}	Output short current	T_j = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_j = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.2		mV/℃

M5F78M07 (V_{IN} = 13V, I_O = 350mA, 0℃ ≤ T_j ≤ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j = 25℃	6.7	7.0	7.3	V
		9V ≤ V_{IN} ≤ 22V, 5mA ≤ I_O ≤ 350mA	6.65		7.35	
$\triangle V_O$ Line	Input stability	T_j = 25℃, 9V ≤ V_{IN} ≤ 25V		4	100	mV
		T_j = 25℃, 10V ≤ V_{IN} ≤ 25V		2	50	
$\triangle V_O$ Load	Load stability	T_j = 25℃, 5mA ≤ I_O ≤ 500mA		6	140	mV
		T_j = 25℃, 5mA ≤ I_O ≤ 200mA		3	70	
I_{CC}	Operating current	T_j = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	10V ≤ V_{IN} ≤ 25V, I_O = 200mA			0.8	mA
		5mA ≤ I_O ≤ 350mA			0.5	
V_N	Output noise voltage	T_j = 25℃, 10Hz ~ 100kHz		71		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 10V ≤ V_{IH} ≤ 20V	69	87		dB
V_{DROP}	Input output voltage difference	T_j = 25℃		2		V
R_O	Output resistance	f = 1kHz		5		mΩ
I_{OS}	Output short current	T_j = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_j = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.3		mV/℃

M5F78M08 (V_{IN} = 14V, I_O = 350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j = 25℃	7.7	8.0	8.3	V
		10.5V ≦ V_{IN} ≦ 23V, 5mA ≦ I_O ≦ 350mA	7.6		8.4	
$\triangle V_O$ Line	Input stability	T_j = 25℃, 10.5V ≦ V_{IN} ≦ 25V		5	100	mV
		T_j = 25℃, 11V ≦ V_{IN} ≦ 25V		2	50	
$\triangle V_O$ Load	Load stability	T_j = 25℃, 5mA ≦ I_O ≦ 500mA		6	160	mV
		T_j = 25℃, 5mA ≦ I_O ≦ 200mA		3	80	
I_{CC}	Operating current	T_j = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	10.5V ≦ V_{IN} ≦ 25V, I_O = 200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j = 25℃, 10Hz ~ 100kHz		81		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 11.5V ≦ V_{IN} ≦ 21.5V	68	86		dB
V_{DROP}	Input output voltage difference	T_j = 25℃		2		V
R_O	Output resistance	f = 1kHz		5		mΩ
I_{OS}	Output short current	T_j = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_j = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.3		mV/℃

M5F78M09 (V_{IN} = 15V, I_O = 350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j = 25℃	8.6	9.0	9.4	V
		11.5V ≦ V_{IN} ≦ 24V, 5mA ≦ I_O ≦ 350mA	8.55		9.45	
$\triangle V_O$ Line	Input stability	T_j = 25℃, 12V ≦ V_{IN} ≦ 25V		5	100	mV
		T_j = 25℃, 13V ≦ V_{IN} ≦ 25V		2	50	
$\triangle V_O$ Load	Load stability	T_j = 25℃, 5mA ≦ I_O ≦ 500mA		7	180	mV
		T_j = 25℃, 5mA ≦ I_O ≦ 200mA		3	90	
I_{CC}	Operating current	T_j = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	12V ≦ V_{IN} ≦ 28V, I_O = 200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j = 25℃, 10Hz ~ 100kHz		91		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 12.5V ≦ V_{IN} ≦ 22.5V	67	85		dB
V_{DROP}	Input output voltage difference	T_j = 25℃		2		V
R_O	Output resistance	f = 1kHz		5		mΩ
I_{OS}	Output short current	T_j = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_j = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.4		mV/℃

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

M5F78M10 (V_{IN} = 17V, I_O = 350mA, 0℃ ≦ T_J ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_J = 25℃	9.6	10.0	10.4	V
		12.5V ≦ V_{IN} ≦ 25V, 5mA ≦ I_O ≦ 350mA	9.5		10.5	
$\triangle V_O$ Line	Input stability	T_J = 25℃, 12.5V ≦ V_{IN} ≦ 28V		6	100	mV
		T_J = 25℃, 14V ≦ V_{IN} ≦ 28V		2	50	
$\triangle V_O$ Load	Load stability	T_J = 25℃, 5mA ≦ I_O ≦ 500mA		8	200	mV
		T_J = 25℃, 5mA ≦ I_O ≦ 200mA		4	100	
I_{CC}	Operating current	T_J = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	12.5V ≦ V_{IN} ≦ 28V, I_O = 200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_J = 25℃, 10Hz ~ 100kHz		100		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 13V ≦ V_{IN} ≦ 23V	66	84		dB
V_{DROP}	Input output voltage difference	T_J = 25℃		2		V
R_O	Output resistance	f = 1kHz		6		mΩ
I_{OS}	Output short current	T_J = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_J = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.4		mV/℃

M5F78M12 (V_{IN} = 19V, I_O = 350mA, 0℃ ≦ T_J ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_J = 25℃	11.5	12.0	12.5	V
		14.5V ≦ V_{IN} ≦ 27V, 5mA ≦ I_O ≦ 350mA	11.4		12.6	
$\triangle V_O$ Line	Input stability	T_J = 25℃, 14.5V ≦ V_{IN} ≦ 30V		7	100	mV
		T_J = 25℃, 16V ≦ V_{IN} ≦ 30V		2	50	
$\triangle V_O$ Load	Load stability	T_J = 25℃, 5mA ≦ I_O ≦ 500mA		9	240	mV
		T_J = 25℃, 5mA ≦ I_O ≦ 200mA		5	120	
I_{CC}	Operating current	T_J = 25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	15V ≦ V_{IN} ≦ 31V, I_O = 200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_J = 25℃, 10Hz ~ 100kHz		120		μVrms
R.R	Ripple rejection ratio	f = 120Hz, 15V ≦ V_{IN} ≦ 25V	64	82		dB
V_{DROP}	Input output voltage difference	T_J = 25℃		2		V
R_O	Output resistance	f = 1kHz		6		mΩ
I_{OS}	Output short current	T_J = 25℃, V_{IN} = 35V		200		mA
I_{OP}	Output peak current	T_J = 25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O = 5mA		0.5		mV/℃

M5F78M15 (V_{IN}=23V, I_O=350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j=25℃	14.4	15.0	15.6	V
		17.5V ≦ V_{IN} ≦ 30V, 5mA ≦ I_O ≦ 350mA	14.25		15.75	
$\triangle V_O$ Line	Input stability	T_j=25℃, 17.5V ≦ V_{IN} ≦ 30V		9	100	mV
		T_j=25℃, 20V ≦ V_{IN} ≦ 30V		3	50	
$\triangle V_O$ Load	Load stability	T_j=25℃, 5mA ≦ I_O ≦ 500mA		12	300	mV
		T_j=25℃, 5mA ≦ I_O ≦ 200mA		6	150	
I_{CC}	Operating current	T_j=25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	17.5V ≦ V_{IN} ≦ 30V, I_O=200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j=25℃, 10Hz ~ 100kHz		150		μVrms
R.R	Ripple rejection ratio	f=120Hz, 18.5V ≦ V_{IN} ≦ 28.5V	62	80		dB
V_{DROP}	Input output voltage difference	T_j=25℃		2		V
R_O	Output resistance	f=1kHz		7		mΩ
I_{OS}	Output short current	T_j=25℃, V_{IN}=35V		200		mA
I_{OP}	Output peak current	T_j=25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O=5mA		0.6		mV/℃

M5F78M18 (V_{IN}=27V, I_O=350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j=25℃	17.3	18.0	18.7	V
		21V ≦ V_{IN} ≦ 33V, 5mA ≦ I_O ≦ 350mA	17.1		18.9	
$\triangle V_O$ Line	Input stability	T_j=25℃, 21V ≦ V_{IN} ≦ 33V		10	100	mV
		T_j=25℃, 24V ≦ V_{IN} ≦ 33V		3	50	
$\triangle V_O$ Load	Load stability	T_j=25℃, 5mA ≦ I_O ≦ 500mA		14	360	mV
		T_j=25℃, 5mA ≦ I_O ≦ 200mA		7	180	
I_{CC}	Operating current	T_j=25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	21V ≦ V_{IN} ≦ 35V, I_O=200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j=25℃, 10Hz ~ 100kHz		180		μVrms
R.R	Ripple rejection ratio	f=120Hz, 22V ≦ V_{IN} ≦ 32V	61	79		dB
V_{DROP}	Input output voltage difference	T_j=25℃		2		V
R_O	Output resistance	f=1kHz		7		mΩ
I_{OS}	Output short current	T_j=25℃, V_{IN}=35V		200		mA
I_{OP}	Output peak current	T_j=25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O=5mA		0.7		mV/℃

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

M5F78M20 (V_{IN}=30V, I_O=350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j=25℃	19.2	20.0	20.8	V
		23V ≦ V_{IN} ≦ 35V, 5mA ≦ I_O ≦ 350mA	19.0		21.0	
$\triangle V_O$ Line	Input stability	T_j=25℃, 23V ≦ V_{IN} ≦ 35V		12	100	mV
		T_j=25℃, 24V ≦ V_{IN} ≦ 35V		4	50	
$\triangle V_O$ Load	Load stability	T_j=25℃, 5mA ≦ I_O ≦ 500mA		16	400	mV
		T_j=25℃, 5mA ≦ I_O ≦ 200mA		8	200	
I_{CC}	Operating current	T_j=25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	23V ≦ V_{IN} ≦ 35V, I_O=200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j=25℃, 10Hz ~ 100kHz		200		μVrms
R.R	Ripple rejection ratio	f=120Hz, 24V ≦ V_{IN} ≦ 34V	60	78		dB
V_{DROP}	Input output voltage difference	T_j=25℃		2		V
R_O	Output resistance	f=1kHz		8		mΩ
I_{OS}	Output short current	T_j=25℃, V_{IN}=35V		200		mA
I_{OP}	Output peak current	T_j=25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O=5mA		0.8		mV/℃

M5F78M24 (V_{IN}=33V, I_O=350mA, 0℃ ≦ T_j ≦ 125℃)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{OUT}	Output voltage	T_j=25℃	23.0	24.0	25.0	V
		27V ≦ V_{IN} ≦ 38V, 5mA ≦ I_O ≦ 350mA	22.8		25.2	
$\triangle V_O$ Line	Input stability	T_j=25℃, 27V ≦ V_{IN} ≦ 38V		14	100	mV
		T_j=25℃, 28V ≦ V_{IN} ≦ 38V		5	50	
$\triangle V_O$ Load	Load stability	T_j=25℃, 5mA ≦ I_O ≦ 500mA		19	480	mV
		T_j=25℃, 5mA ≦ I_O ≦ 200mA		9	240	
I_{CC}	Operating current	T_j=25℃		3	5	mA
$\triangle I_{CC}$	Operating current change	27V ≦ V_{IN} ≦ 38V, I_O=200mA			0.8	mA
		5mA ≦ I_O ≦ 350mA			0.5	
V_N	Output noise voltage	T_j=25℃, 10Hz ~ 100kHz		240		μVrms
R.R	Ripple rejection ratio	f=120Hz, 28V ≦ V_{IH} ≦ 38V	58	76		dB
V_{DROP}	Input output voltage difference	T_j=25℃		2		V
R_O	Output resistance	f=1kHz		10		mΩ
I_{OS}	Output short current	T_j=25℃, V_{IN}=35V		200		mA
I_{OP}	Output peak current	T_j=25℃		0.7		A
$\triangle V_O/\triangle T_j$	Output voltage temperature coefficient	I_O=5mA		1		mV/℃