

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.

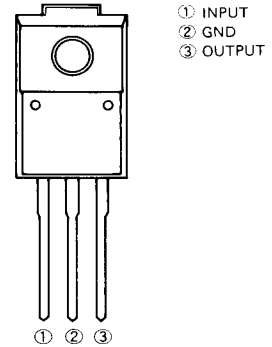
FEATURES

- 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

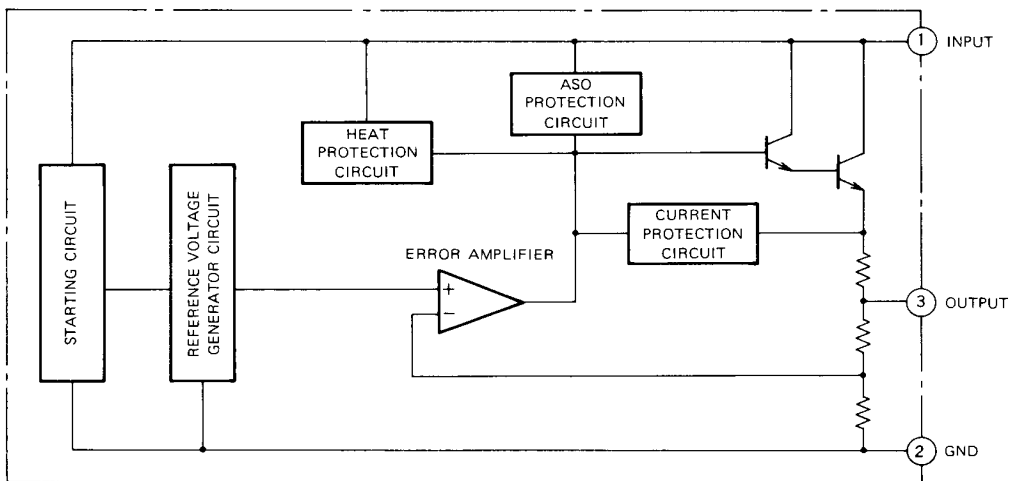
For general power supply of various types of electronic equipment such as VCR, CD

PIN CONFIGURATION(TOP VIEW)



Outline 3P9

BLOCK DIAGRAM



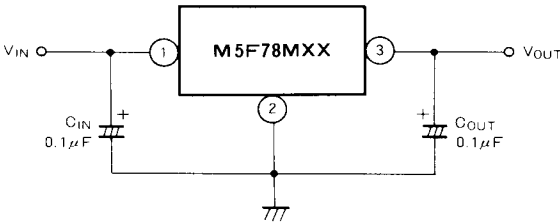
FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
VIN	Input voltage		35/40*	V
Pd	Power dissipation		2 (no heat sink) 20 (with infinite heat sink)	W
Ta	Operating temperature		−20 ~ +85	°C
TJ	Junction temperature		−20 ~ +150	°C
Tstg	Storage temperature		−55 ~ +150	°C

* M5F78M24

STANDARD CONNECTION



ELECTRIC CHARACTERISTICS

M5F78M05 (VIN = 10V, IO = 350mA, 0°C ≤ TJ ≤ 125°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
VOUT	Output voltage	TJ = 25°C 7V ≤ VIN ≤ 20V, 5mA ≤ IO ≤ 350mA	4.8	5.0	5.2	V
△VO Line	Input stability	TJ = 25°C, 7V ≤ VIN ≤ 25V TJ = 25°C, 8V ≤ VIN ≤ 25V		3	100	mV
△VO Load	Load stability	TJ = 25°C, 5mA ≤ IO ≤ 500mA TJ = 25°C, 5mA ≤ IO ≤ 200mA		4	100	mV
ICC	Operating current	TJ = 25°C		3	5	mA
△ICC	Operating current change	8V ≤ VIN ≤ 25V, IO = 200mA 5mA ≤ IO ≤ 350mA			0.8	mA
VN	Output noise voltage	TJ = 25°C, 10Hz ~ 100kHz		50		µVrms
R.R	Ripple rejection ratio	f = 120Hz, 8V ≤ VIN ≤ 18V	72	90		dB
VDROP	Input output voltage difference	TJ = 25°C		2		V
RO	Output resistance	f = 1kHz		5		mΩ
IOS	Output short current	TJ = 25°C, VIN = 35V		200		mA
IOP	Output peak current	TJ = 25°C		0.7		A
△VO/△TJ	Output voltage temperature coefficient	IO = 5mA		0.2		mV/°C

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M5F78M06 ($V_{IN} = 11V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

M5F78M07 ($V_{IN} = 13V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES

M5F78M08 ($V_{IN} = 14V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

M5F78M09 ($V_{IN} = 15V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES**M5F78M10** ($V_{IN} = 17V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

M5F78M12 ($V_{IN} = 19V$, $I_O = 350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES**M5F78M15** ($V_{IN}=23V$, $I_O=350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

M5F78M18 ($V_{IN}=27V$, $I_O=350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

FIXED POSITIVE OUTPUT 3-TERMINAL REGULATOR SERIES**M5F78M20** ($V_{IN}=30V$, $I_O=350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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

M5F78M24 ($V_{IN}=33V$, $I_O=350mA$, $0^\circ C \leq T_J \leq 125^\circ C$)

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