TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

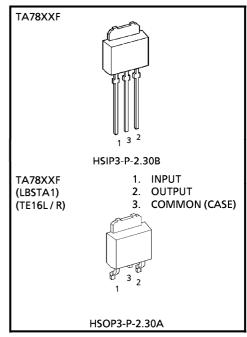
TA78M05F, TA78M06F, TA78M08F, TA78M09F, TA78M10F TA78M12F, TA78M15F, TA78M18F, TA78M20F, TA78M24F

0.5 A THREE TERMINAL POSITIVE VOLTAGE REGULATORS 5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V, 18 V, 20 V, 24 V

The TA78M x x F series of fixed-voltage monolithic integrated circuit voltage regulators is designed for a wide range of applications. These regulators employ internal current-limiting, thermal-shutdown and safe-area compensation, making them essentially indestructible. One of these regulators can drive up to 0.5 A of output current.

FEATURES

- Suitable for CMOS, TTL and the other Digital IC's Power Supply.
- Output Current in Excess of 0.5 A
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Packaged in POWER MOLD.



Weight HSIP3-P-2.30B : 0.36 g (Typ.) HSOP3-P-2.30A : 0.36 g (Typ.)

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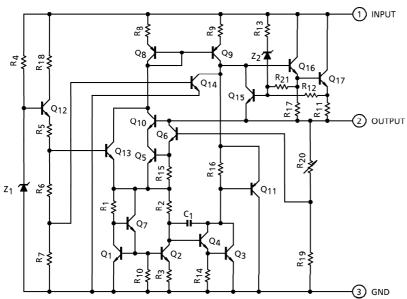
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EQUIVALENT CIRCUIT



MAXIMUM RATINGS (Ta = 25°C)

CHARACTER	ISTIC	SYMBOL	RATING	UNIT
	TA78M05F			
	TA78M06F			
	TA78M08F			
	TA78M09F		35	
nput Voltage	TA78M10F	V/		V
input voitage	TA78M12F	V_{IN}		'
	TA78M15F			
	TA78M18F	_		1
	TA78M20F		40	
	TA78M24F			
Dannan Dissination	(Ta = 25°C)	D-	1	\0/
Power Dissipation	(Tc = 25°C)	PD	10	W
Operating Temperat	ure	T _{opr}	- 30~75	°C
Storage Temperature	9	T _{stg}	- 55∼150	°C
Junction Temperatur	e	Tj	150	°C
Thormal Desistance		R _{th (j-c)}	12.5	°C /\\
Thermal Resistance		R _{th (j-a)}	125	°C/W

TA78M05F ELECTRICAL CHARACTERISTICS

(V_{IN} = 10 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

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CHARACTERIST	TIC	SYMBOL	TEST CIR- CUIT	T	EST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	T _j = 25°C		4.8	5.0	5.2	V
Line Regulation		Reg.Line	1		$7 \text{ V} \le \text{V}_{\text{IN}} \le 25 \text{ V}$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$ $8 \text{ V} \le \text{V}_{\text{IN}} \le 25 \text{ V}$		4	100	mV
Line Regulation		Neg.Line	'		I _{OUT} = 200 mA	1	2	50	1110
Lood Population		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	25	100	mV
Load Regulation		Reg.Load	'	1 _j = 23 C	$5 \text{ mA} \leq I_{OUT} \leq 200 \text{ mA}$		10	50	IIIV
Output Voltage		V _{OUT}	1	T _j = 25°C	$7 \text{ V} \le \text{V}_{\text{IN}} \le 20 \text{ V}$ $5 \text{ mA} \le \text{I}_{\text{OUT}} \le 350 \text{ mA}$	4.75	_	5.25	٧
Quiescent Current		ΙΒ	1	$T_j = 25^{\circ}C$		_	4.5	8.0	mA
Quiescent	Line	⊿IBI	1	$8.5 \text{ V} \leq \text{V}_{\text{I}}$ $I_{\text{OUT}} = 20$	$_{ m IN} \le 25.5 m V,$ $_{ m 00 mA}$	_	_	0.8	mA
Current Change	Load	∆l _{BO}	1		OUT ≦ 350 mA	_	_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°C	, 10 Hz ≦ f ≦ 100 kHz	_	50	200	μ V _{rms}
Ripple Rejection		R.R.	3		z , $I_{OUT} = 50 \text{ mA}$ $\leq 18 \text{ V}$, $T_j = 25 ^{\circ}\text{C}$	60	67	_	dB
Short Circuit Current Limit		Isc	1	T _j = 25°C		1	960		mA
Dropout Voltage		٧ _D	1	Ta = 25°C		_	1.7	_	V
Average Tempera Coefficient Of Ou Voltage		Tcvo	1	I _{OUT} = 5	mA		- 0.6	_	mV/°C

TA78M06F
ELECTRICAL CHARACTERISTICS

(V_{IN} = 11 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

CHARACTERIST	ΓΙC	SYMBOL	TEST CIR- CUIT	Τ	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		5.75	6.0	6.25	٧
Line Regulation		Reg.Line	1	T: - 25°C	$\begin{array}{l} 8 \text{ V} \leq \text{ V}_{IN} \leq 25 \text{ V} \\ \text{I}_{OUT} = 200 \text{ mA} \\ 9 \text{ V} \leq \text{ V}_{IN} \leq 25 \text{ V} \end{array}$	_	4	100	mV
Line Regulation					$I_{OUT} = 200 mA$	_	2	50	1110
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	25	120	mV
Load Regulation		Reg.Load	'	1 = 23 C	$5\text{mA} \le I_{\mbox{OUT}} \le 200\text{mA}$	_	10	60	1110
Output Voltage		Vout	1	T _j = 25°C	$T_j = 25$ °C $8 \text{ V} \leq V_{IN} \leq 21 \text{ V}$ $5 \text{ mA} \leq I_{OUT} \leq 350 \text{ mA}$		_	6.3	V
Quiescent Current		ΙΒ	1	$T_j = 25^{\circ}C$		_	4.5	8.0	mA
Quiescent	Line	∆lBI	1		$9.5 \text{ V} \le \text{V}_{\text{IN}} \le 25.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆lBO	1		OUT ≦ 350 mA	_	_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	55	220	μ V _{rms}
Ripple Rejection		R.R.	3		Iz , $I_{OUT} = 50 \text{ mA}$ $I_{A} \le 19 \text{ V}$, $I_{j} = 25 ^{\circ}\text{C}$	58	65	_	dB
Short Circuit Current Limit		^I sc	1	T _j = 25°C		_	960	_	mA
Dropout Voltage		V_{D}	1	Ta = 25°0	C	_	1.7	_	V
Average Temperature Coefficient Of Output Voltage		^T CVO	1	I _{OUT} = 5	mA	_	- 0.7	_	mV/°C

TA78M08F
ELECTRICAL CHARACTERISTICS

(V_{IN} = 14 V, I_{OUT} = 350 mA, 0° C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

(*IIV ***, *OOT		<u> </u>		, -,,	1137 /117 1001			•	
CHARACTERIS ⁻	ΓΙC	SYMBOL	TEST CIR- CUIT	ד	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		7.7	8.0	8.3	V
Line Population		Reg.Line	1	T 25°C	$10.5 \text{ V} \le \text{V}_{\text{IN}} \le 25 \text{ V}$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$ $11 \text{ V} \le \text{V}_{\text{IN}} \le 25 \text{ V}$	_	5	100	mV
Line Regulation		Neg.Line			I _{OUT} = 200 mA	_	3	50	IIIV
Land Domilation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	26	160	mV
Load Regulation		Reg.Load				_	10	80	1110
Output Voltage		Vout	1	T _j = 25°C	$10.5 \text{ V} \le \text{V}_{\text{IN}} \le 23 \text{ V}$ $5 \text{ mA} \le \text{I}_{\text{OUT}} \le 350 \text{ mA}$	7.6	_	8.4	V
Quiescent Current		ΙΒ		T _j = 25°C		_	4.6	8.0	mA
Quiescent	Line	∆lBI	1		$11 \text{ V} \le \text{ V}_{\text{IN}} \le 25.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆lBO	1		OUT ≦ 350 mA	_	_	0.5	1
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	60	250	μ V _{rms}
Ripple Rejection		R.R.	3		Iz , $I_{OUT} = 50 \text{ mA}$ $V_{IN} \le 21.5 \text{ V}$, $T_j = 25^{\circ}\text{C}$	55	62	_	dB
Short Circuit Current Limit		1	T _j = 25°C		_	960	_	mA	
Dropout Voltage		٧ _D	1	Ta = 25°0	<u> </u>	_	1.7	_	V
Average Tempera Coefficient Of Ou Voltage		Tcvo	1	I _{OUT} = 5	mA	_	- 1.0	_	mV/°C

TA78M09F **ELECTRICAL CHARACTERISTICS**

(V_{IN} = 15 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

CHARACTERIST	ΓΙC	SYMBOL	TEST CIR- CUIT	Т	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		8.64	9.0	9.36	V
Line Regulation		Reg.Line	1	T 25°C	$11.5 \text{ V} \le \text{V}_{IN} \le 26 \text{ V}$ $I_{OUT} = 200 \text{ mA}$ $13 \text{ V} \le \text{V}_{IN} \le 26 \text{ V}$	_	5	100	mV
Line Regulation					$I_{OUT} = 200 mA$	-	3	50	IIIV
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	26	180	mV
Load Regulation		Reg.Load				_	10	90	IIIV
Output Voltage		Vout	1	T _j = 25°C	$T_j = 25^{\circ}C$		_	9.45	٧
Quiescent Current		ΙΒ	1	$T_j = 25^{\circ}C$		_	4.6	8.0	mA
Quiescent	Line	∆lBI	1		$12 \text{ V} \le \text{V}_{\text{IN}} \le 26.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆l _{BO}	1		OUT ≦ 350 mA	_	_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	60	270	μ V _{rms}
Ripple Rejection		R.R.	3		$Iz, I_{OUT} = 50 \text{ mA}$ $V_{IN} \le 22.5 \text{ V}, T_j = 25^{\circ}\text{C}$	54	61	_	dB
Short Circuit Current Limit		^I sc	1	T _j = 25°C		1	960		mA
Dropout Voltage		V_{D}	1	Ta = 25°0	2	_	1.7	_	٧
Average Temperature Coefficient Of Output Voltage		^T CVO	1	I _{OUT} = 5	mA		- 1.1	_	mV/°C

TA78M10F ELECTRICAL CHARACTERISTICS

(V_{IN} = 16 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

CHARACTERIST	ΓΙC	SYMBOL	TEST CIR- CUIT	7	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$	•	9.6	10.0	10.4	V
Line Regulation		Reg.Line	1	T: = 25°C	$12.5 \text{ V} \le \text{V}_{\text{IN}} \le 26 \text{ V}$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$ $14 \text{ V} \le \text{V}_{\text{IN}} \le 26 \text{ V}$	_	6	100	mV
Line Regulation		Neg.Line			Jour = 200 mA	_	3	50	IIIV
Load Population		Reg.Load	1	T 25°C	$5 \text{ mA} \leq 100\text{ T} \leq 500 \text{ mA}$ $5 \text{ mA} \leq 100\text{ T} \leq 200 \text{ mA}$	_	26	200	mV
Load Regulation		Reg.Load	'		31117 - 1001 - 2001117	_	10	100	1110
Output Voltage		Vout	1	T _j = 25°C	$T_{j} = 25^{\circ}C$		_	10.5	V
Quiescent Current		ΙΒ	1	$T_j = 25^{\circ}C$		_	4.7	8.0	mA
Quiescent	Line	∆lBI	1		$13 \text{ V} \le \text{ V}_{\text{IN}} \le 26.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆l _{BO}	1		$5 \text{ mA} \leq I_{OUT} \leq 350 \text{ mA}$		_	0.5	1
Output Noise Vol	tage	V _{NO}	2	Ta = 25°	C, 10 Hz ≦ f ≦ 100 kHz	_	65	280	μ V _{rms}
Ripple Rejection		R.R.	3		$V_{IN} \le 23.5 \text{ V}, T_j = 25^{\circ}\text{C}$	52	59	_	dB
Short Circuit Current Limit		Isc	1	T _j = 25°C		_	960	_	mA
Dropout Voltage		V_{D}	1	Ta = 25°	С	_	1.7	_	٧
Average Temperature Coefficient Of Output Voltage		^T CVO	1	I _{OUT} = 5	5 mA	_	- 1.3	_	mV/°C

TA78M12F ELECTRICAL CHARACTERISTICS

(V_{IN} = 19 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

1-111 1-1-1-1-1-1-1		·		, -	1100 / 1001				
CHARACTERIS ⁻	ГІС	SYMBOL	TEST CIR- CUIT	ד	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		11.5	12.0	12.5	V
Line Regulation		Reg.Line	1	T 25°C	$14.5 \text{ V} \le \text{V}_{\text{IN}} \le 30 \text{ V}$ $I_{\text{OUT}} = 200 \text{ mA}$ $16 \text{ V} \le \text{V}_{\text{IN}} \le 30 \text{ V}$	_	7	100	mV
Line Regulation		Neg.Eme	'		I _{OUT} = 200 mA	_	3	50	IIIV
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	27	240	mV
Load Regulation		Reg.Load	'	$I_{\rm J} = 23$ C	$5 \text{ mA} \leq I_{OUT} \leq 200 \text{ mA}$	_	10	120	1110
Output Voltage		Vout	1	T _j = 25°C	$14.5 \text{ V} \le \text{V}_{\text{IN}} \le 27 \text{ V}$ $5 \text{ mA} \le \text{I}_{\text{OUT}} \le 350 \text{ mA}$	11.4	_	12.6	V
Quiescent Current		ΙΒ	1	T _j = 25°C		_	4.8	8.0	mA
Quiescent	Line	∆lBI	1		$15 \text{ V} \le \text{ V}_{\text{IN}} \le 30.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	⊿I _{BO}	1		$5 \text{ mA} \leq I_{OUT} \leq 350 \text{ mA}$		_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	70	300	μ V _{rms}
Ripple Rejection		R.R.	3		Iz , $I_{OUT} = 50 \text{ mA}$ $IN \leq 25 \text{ V}$, $T_j = 25 ^{\circ}\text{C}$	50	57	_	dB
Short Circuit Current Limit		1	T _j = 25°C		_	960	_	mA	
Dropout Voltage		V _D	1	Ta = 25°0	<u> </u>	_	1.7	_	V
Average Tempera Coefficient Of Ou Voltage		Tcvo	1	I _{OUT} = 5	mA	_	- 1.6	_	mV / °C

TA78M15F
ELECTRICAL CHARACTERISTICS

(V_{IN} = 23 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

CHARACTERIST	ГІС	SYMBOL	TEST CIR- CUIT	Τ	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		14.4	15.0	15.6	V
Line Regulation		Reg.Line	1	T 25°C	$17.5 \text{ V} \le \text{V}_{\text{IN}} \le 30 \text{ V}$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$ $20 \text{ V} \le \text{V}_{\text{IN}} \le 30 \text{ V}$	_	8	100	mV
Line Regulation		9	'		$I_{OUT} = 200 mA$	_	4	50	IIIV
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	27	300	mV
Load Regulation		Reg.Load				_	10	150	IIIV
Output Voltage		Vout	1	T _j = 25°C	$T_j = 25^{\circ}C$ 17.5 V $\leq V_{IN} \leq 30 \text{ V}$ 5 mA $\leq I_{OUT} \leq 350 \text{ mA}$		_	15.75	V
Quiescent Current		ΙΒ	1		$T_j = 25^{\circ}C$		4.8	8.0	mA
Quiescent	Line	⊿IBI	1		$18 \text{ V} \le \text{V}_{\text{IN}} \le 30.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆l _{BO}	1		OUT ≦ 350 mA	_	_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	80	450	μ V _{rms}
Ripple Rejection		R.R.	3		$Iz, I_{OUT} = 50 \text{ mA}$ $V_{IN} \le 28.5 \text{ V}, T_j = 25^{\circ}\text{C}$	48	55	_	dB
Short Circuit Current Limit		Isc	1	T _j = 25°C		_	960		mA
Dropout Voltage		V_{D}	1	Ta = 25°0	C	_	1.7	_	٧
Average Temperature Coefficient Of Output Voltage		^T CVO	1	I _{OUT} = 5	mA	_	- 2.0	_	mV/°C

TA78M18F ELECTRICAL CHARACTERISTICS

(V_{IN} = 27 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

(*IIV =: */ *OOT		<u> </u>		, - ₁	1100 7 117			•	
CHARACTERIS ⁻	ΓΙC	SYMBOL	TEST CIR- CUIT	7	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$	· ·	17.3	18.0	18.7	V
Line Population		Reg.Line	1	T 25°C	$21 \text{ V} \le \text{V}_{\text{IN}} \le 33 \text{ V}$ $I_{\text{OUT}} = 200 \text{ mA}$ $24 \text{ V} \le \text{V}_{\text{IN}} \le 33 \text{ V}$	_	9	100	mV
Line Regulation		Reg.Line			lour = 200 mA	_	5	50	IIIV
Lood Domilation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	28	360	mV
Load Regulation		Reg.Load	'		3	_	10	180	1110
Output Voltage		Vout	1	T _j = 25°C	$21 \text{ V} \le \text{V}_{\text{IN}} \le 33 \text{ V}$ $5 \text{ mA} \le \text{I}_{\text{OUT}} \le 350 \text{ mA}$	17.1	_	18.9	V
Quiescent Current		ΙΒ	1	T _j = 25°C		_	4.8	8.0	mA
Quiescent	Line	∆lBI	1		$21.5 \text{ V} \le \text{V}_{\text{IN}} \le 33.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆I _{BO}	1	+	OUT ≦ 350 mA	_	_	0.5	1
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≦ f ≦ 100 kHz	_	90	490	μV_{rms}
Ripple Rejection		R.R.	3		Hz , $I_{OUT} = 50 \text{ mA}$ $IN \leq 32V$, $T_j = 25^{\circ}C$	46	53	_	dB
Short Circuit Current Limit		1	T _j = 25°C		_	960	_	mA	
Dropout Voltage		V _D	1	Ta = 25°0	С	_	1.7	_	V
Average Tempera Coefficient Of Ou Voltage		Tcvo	1	I _{OUT} = 5	imA	_	- 2.5	_	mV / °C

TA78M20F ELECTRICAL CHARACTERISTICS

(V_{IN} = 29 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

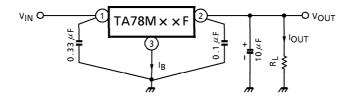
CHARACTERIST	ΓΙC	SYMBOL	TEST CIR- CUIT	Т	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		19.2	20.0	20.8	V
Line Regulation		Reg.Line	1	T· = 25°C	$23 \text{ V} \le \text{ V}_{\text{IN}} \le 35 \text{ V}$ $I_{\text{OUT}} = 200 \text{ mA}$ $24 \text{ V} \le \text{ V}_{\text{IN}} \le 35 \text{ V}$	_	10	100	mV
Line Regulation		Neg.Line			$I_{OUT} = 200 mA$	_	6	50	IIIV
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	28	400	mV
Load Regulation		Reg.Load	'	1 = 23 C	$5\text{mA} \le I_{\mbox{OUT}} \le 200\text{mA}$	_	10	200	IIIV
Output Voltage		Vout	1	T _j = 25°C	$T_j = 25^{\circ}C$ $23 \text{ V} \le \text{V}_{IN} \le 35 \text{ V} 5 \text{ mA} \le \text{I}_{OUT} \le 350 \text{ mA}$		_	21.0	٧
Quiescent Current		ΙΒ	1	T _j = 25°C		_	4.9	8.0	mA
Quiescent	Line	∆lBI	1		$23.5 \text{ V} \le \text{V}_{\text{IN}} \le 35.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	0.8	mA
Current Change	Load	∆l _{BO}	1		OUT ≦ 350 mA	_	_	0.5	
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	95	540	μ V _{rms}
Ripple Rejection		R.R.	3		Iz, $I_{OUT} = 50 \text{ mA}$ $I_{IN} \le 34 \text{ V}$, $T_j = 25 ^{\circ}\text{C}$	46	53	_	dB
Short Circuit Current Limit		Isc	1	T _j = 25°C		_	960	_	mA
Dropout Voltage		V _D	1	Ta = 25°0	C	_	1.7	_	V
Dropout Voltage Average Temperature Coefficient Of Output Voltage		Tcvo	1	I _{OUT} = 5	mA	_	- 3.0	_	mV/°C

TA78M24F ELECTRICAL CHARACTERISTICS

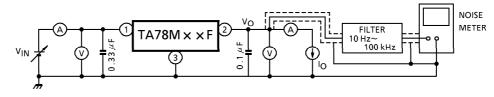
(V_{IN} = 33 V, I_{OUT} = 350 mA, 0°C \leq T_j \leq 125°C, C_{IN} = 0.33 μ F, C_{OUT} = 0.1 μ F, unless otherwise specified)

CHARACTERIST	ΓΙC	SYMBOL	TEST CIR- CUIT	Т	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage		Vout	1	$T_j = 25^{\circ}C$		23.0	24.0	25.0	V
Line Regulation		Reg.Line	1	T· = 25°C	$\begin{array}{l} 27 \text{ V} \leq \text{ V}_{IN} \leq 38 \text{ V} \\ \text{I}_{OUT} = 200 \text{ mA} \\ 28 \text{ V} \leq \text{ V}_{IN} \leq 38 \text{ V} \end{array}$	_	12	100	mV
Line Regulation		Neg.Ellie			$I_{OUT} = 200 mA$	_	7	50	IIIV
Load Regulation		Reg.Load	1	T 25°C	$5 \text{ mA} \le I_{OUT} \le 500 \text{ mA}$ $5 \text{ mA} \le I_{OUT} \le 200 \text{ mA}$	_	30	480	mV
Load Regulation		Reg.Load	'	= 25 C	$5 \text{ mA} \leq I_{OUT} \leq 200 \text{ mA}$	_	10	240	IIIV
Output Voltage		Vout	1	T _j = 25°C	$T_j = 25$ °C $27 \text{ V} \le \text{V}_{IN} \le 38 \text{ V} $ $5 \text{ mA} \le \text{I}_{OUT} \le 350 \text{ mA}$		_	25.2	>
Quiescent Current I		ΙΒ	1	T _j = 25°C		_	5.0	8.0	mA
Quiescent	Line	∆lBI	1	$27.5 \text{ V} \le \text{V}_{\text{IN}} \le 38.5 \text{ V},$ $\text{I}_{\text{OUT}} = 200 \text{ mA}$		_	_	0.8	mA
Current Change	Load	∆lBO	1		OUT ≦ 350 mA	_	_	0.5	1
Output Noise Vol	tage	V _{NO}	2	Ta = 25°0	C, 10 Hz ≤ f ≤ 100 kHz	_	115	650	μ V _{rms}
Ripple Rejection		R.R.	3		Iz , $I_{OUT} = 50 \text{ mA}$ $IN \leq 38 \text{ V}$, $T_j = 25 ^{\circ}\text{C}$	46	53	_	dB
Short Circuit Current Limit		Isc	1	T _j = 25°C		_	960	_	mA
Dropout Voltage		V_{D}	1	Ta = 25°0	C	_	1.7	_	٧
Dropout Voltage Average Temperature Coefficient Of Output Voltage		Tcvo	1	I _{OUT} = 5	mA	_	- 3.5	_	mV/°C

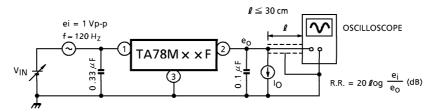
TEST CIRCUIT 1/STANDARD APPLICATION

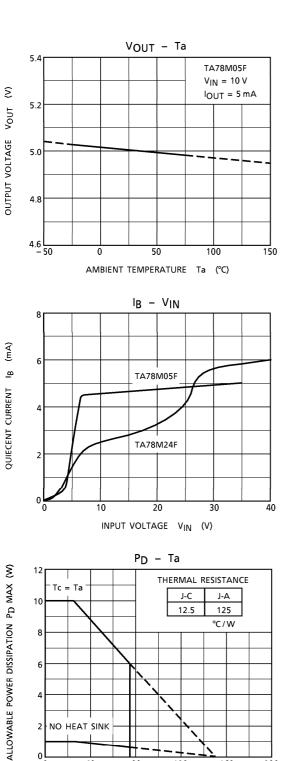


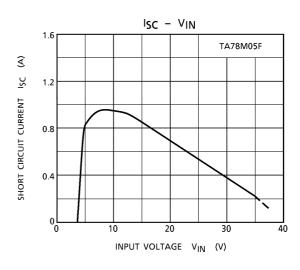
TEST CIRCUIT 2 VNO

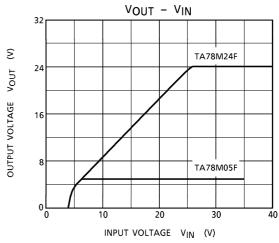


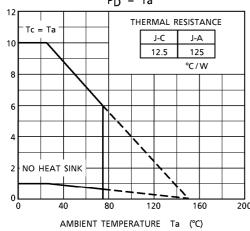
TEST CIRCUIT 3 R.R.

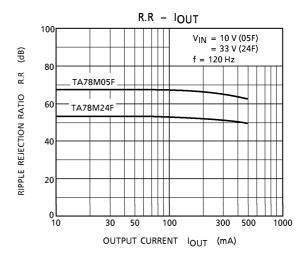


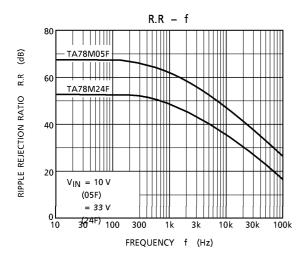












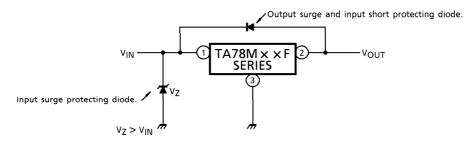
PRECAUTIONS ON APPLICATION

- (1) In regard to GND, be careful not to apply a negative voltage to the input/output terminal. Further, special care is necessary in case of a voltage boost application.
- (2) When a surge voltage exceeding maximum rating is applied to the input terminal or when a voltage in excess of the input terminal voltage is applied to the output terminal, the circuit may be destroyed.

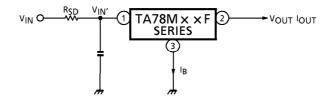
Specially, in the latter case, great care is necessary.

Further, if the input terminal sorts to GND in a state of normal operation, the output terminal voltage becomes higher than the input voltage (GND potential), and the electric charge of a chemical capacitor connected to the output terminal flows into the input side, which may cause the destruction of circuit.

In these cases, take such steps as a zener diode and a general silicon diode are connected to the circuit, as shown in the following figure.



(3) When the input voltage is too high, the power dissipation of three terminal regulator increases because of series regulator, so that the junction temperature rises. In such a case, it is recommended to reduce the power dissipation by inserting the power limiting resistor R_{SD} in the input terminal, and to reduce the junction temperature as a result.



The power dissipation PD of IC is expressed in the following equation.

$$P_D = (V_{IN'} - V_{OUT}) \cdot I_{OUT} + V_{IN'} \cdot I_B$$

If $V_{IN'}$ is reduced below the lowest voltage necessary for the IC, the parasitic oscillation will be caused according to circumstances.

In determing the resistance value of R_{SD}, design with margin should be made by making reference to the following equation.

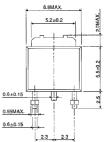
$$R_{SD} < \frac{V_{IN} - V_{IN'}}{I_{OUT} + I_{B}}$$

- (4) Connect the input terminal and GND, and the output terminal and GND, by capacitor respectively. The capacitances should be determined experimentally because they depend on prented patterns. In particular, adequate investigation should be made so that there is no problem even at time of high or low temperature.
- (5) The molded plastic portion of this unit, measuring 5.5 mm (L) by 6.5 mm (W) by 2.3 mm (T), is more compact compared to its equivalents TO-220.

The collector fin extends directly out of the main body, and can be soldered directly to the ceramic circuitboard, to significantly increase the collector power dissipation of the collector

For obtaining high reliability on the heat sink design of the regulator IC, it is generally required to derate more than 20% of maximum junction temperature (T_i MAX.).

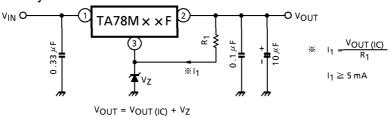
Further, full consideration should be given to the installation of IC to the heat sink.



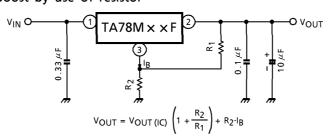


APPLICATION CIRCUITS

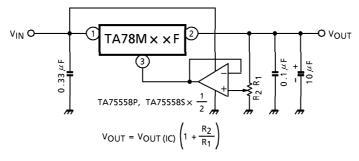
- (1) VOLTAGE BOOST REGULATOR
 - (a) Voltage boost by use of zener diode



(b) Voltage boost by use of resistor

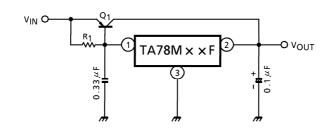


(c) Adjustable output regulator



(2) CURRENT BOOST REGULATOR

(a) CURRENT BOOST VOLTAGE REGULATOR



Heat sink is needed for Q_1

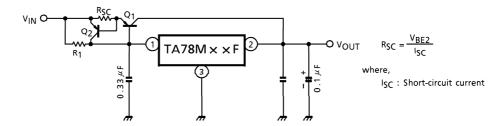
$$R_1 \le \frac{V_{BE1}}{I_{B MAX}}$$

where,

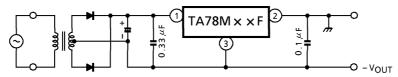
V_{BE1} : V_{BE} of external transistor Q₁.

IB MAX : Quiescent current of IC.

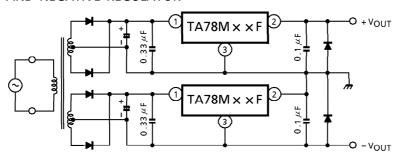
(b) SHORT-CIRCUIT PROTECTION



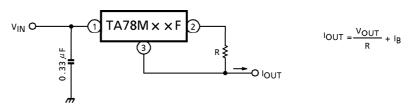
(3) NEGATIVE REGULATOR



(4) POSITIVE AND NEGATIVE REGULATOR



(5) CURRENT REGULATOR



OUTLINE DRAWING HSIP3-P-2.30B 0.95MAX 0.95MAX 0.6±0.15 0.6MAX 0.6MAX 0.6MAX

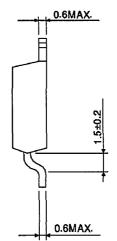
1.1±0.2

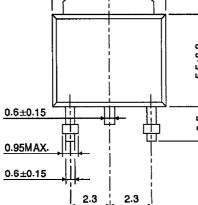
Weight: 0.36 g (Typ.)

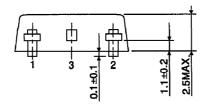
Unit: mm

OUTLINE DRAWING HSOP3-P-2.30A

6.8MAX. 5.2±0.2 XVW0.2i







Weight: 0.36 g (Typ.)

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