

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA78M05S,TA78M06S,TA78M08S,TA78M09S,TA78M10S, TA78M12S,TA78M15S,TA78M18S,TA78M20S,TA78M24S

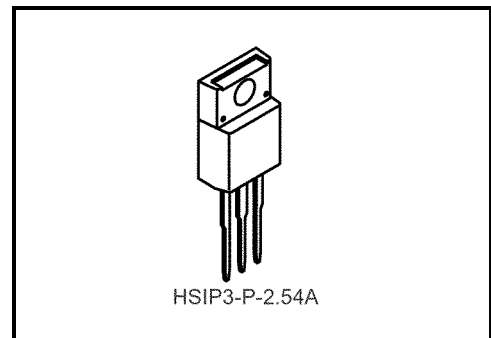
Output Current of 0.5 A, Three-Terminal Positive Voltage Regulators

5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V, 18 V, 20 V, 24 V

The TA78M××S 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 driver up to 0.5 A of output current.

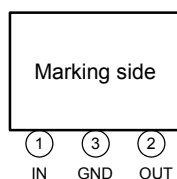
Features

- Suitable for CMOS, TTL and the other digital IC's power supply.
- Maximum output current of 0.5 A.
- Internal thermal overload protection.
- Internal short circuit current limiting.
- Package in the plastic case TO-220NIS.

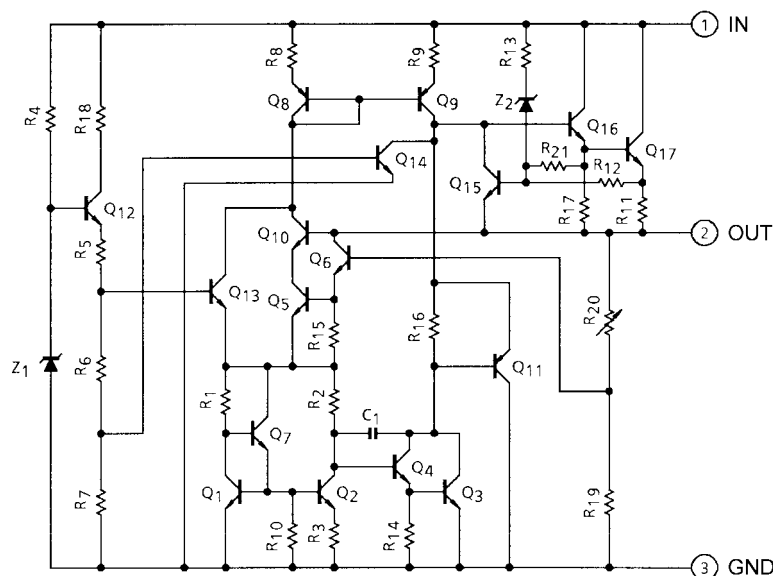


Weight: 1.7 g (typ.)

Pin Assignment



Equivalent Circuit



Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Input voltage	TA78M05S	V _{IN}	35	V
	TA78M06S			
	TA78M08S			
	TA78M09S			
	TA78M10S			
	TA78M12S			
	TA78M15S			
	TA78M18S		40	
	TA78M20S			
	TA78M24S			
Power dissipation	(Ta = 25°C)	P _D	2	W
	(Tc = 25°C)		20	
Operating temperature		T _{opr}	-30~85	°C
Storage temperature		T _{stg}	-55~150	°C
Junction temperature		T _j	150	°C
Thermal resistance		R _{th (j-c)}	6.25	°C/W
		R _{th (j-a)}	62.5	

TA78M05S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 10\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		4.8	5.0	5.2	V
Line regulation	Reg-line	1	T _j = 25°C	7 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	4	100	mV	
				8 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	2	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	25	100	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	50		
Output voltage		V _{OUT}	1	T _j = 25°C	7 V ≤ V _{IN} ≤ 20 V, 5 mA ≤ I _{OUT} ≤ 350 mA	4.75	—	5.25	V
Quiescent current		I _B	1	T _j = 25°C		—	4.5	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	8.5 V ≤ V _{IN} ≤ 25.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	50	200	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 8 V ≤ V _{IN} ≤ 18 V, T _j = 25°C		62	69	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−0.6	—	mV/°C

TA78M06S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 11\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		5.75	6.0	6.25	V
Line regulation	Reg-line	1	T _j = 25°C	8 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	4	100	mV	
				9 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	2	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	25	120	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	60		
Output voltage		V _{OUT}	1	T _j = 25°C	8 V ≤ V _{IN} ≤ 21 V, 5 mA ≤ I _{OUT} ≤ 350 mA	5.7	—	6.3	V
Quiescent current		I _B	1	T _j = 25°C		—	4.5	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	9.5 V ≤ V _{IN} ≤ 25.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	55	220	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 9 V ≤ V _{IN} ≤ 19 V, T _j = 25°C		59	66	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−0.7	—	mV/°C

TA78M08S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 14\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		7.7	8.0	8.3	V
Line regulation	Reg-line	1	T _j = 25°C	10.5 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	5	100	mV	
				11 V ≤ V _{IN} ≤ 25 V, I _{OUT} = 200 mA	—	3	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	26	160	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	80		
Output voltage		V _{OUT}	1	T _j = 25°C	10.5 V ≤ V _{IN} ≤ 23 V, 5 mA ≤ I _{OUT} ≤ 350 mA	7.6	—	8.4	V
Quiescent current		I _B	1	T _j = 25°C		—	4.6	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	11 V ≤ V _{IN} ≤ 25.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	60	250	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 11.5 V ≤ V _{IN} ≤ 21.5 V, T _j = 25°C		56	63	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−1.0	—	mV/°C

TA78M09S

Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 15\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		8.64	9.0	9.36	V
Line regulation	Reg-line	1	T _j = 25°C	11.5 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 200 mA	—	5	100	mV	
				13 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 200 mA	—	3	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	26	180	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	90		
Output voltage		V _{OUT}	1	T _j = 25°C	11.5 V ≤ V _{IN} ≤ 24 V, 5 mA ≤ I _{OUT} ≤ 350 mA	8.55	—	9.45	V
Quiescent current		I _B	1	T _j = 25°C		—	4.6	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	12 V ≤ V _{IN} ≤ 26.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	60	270	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 12.5 V ≤ V _{IN} ≤ 22.5 V, T _j = 25°C		56	63	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−1.1	—	mV/°C

TA78M10S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 16\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		9.6	10.0	10.4	V
Line regulation	Reg-line	1	T _j = 25°C	12.5 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 200 mA	—	6	100	mV	
				14 V ≤ V _{IN} ≤ 26 V, I _{OUT} = 200 mA	—	3	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	26	200	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	100		
Output voltage		V _{OUT}	1	T _j = 25°C	12.5 V ≤ V _{IN} ≤ 25 V, 5 mA ≤ I _{OUT} ≤ 350 mA	9.5	—	10.5	V
Quiescent current		I _B	1	T _j = 25°C		—	4.7	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	13 V ≤ V _{IN} ≤ 26.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	65	280	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 13.5 V ≤ V _{IN} ≤ 23.5 V, T _j = 25°C		55	62	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−1.3	—	mV/°C

TA78M12S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 19\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		11.5	12.0	12.5	V
Line regulation	Reg-line	1	T _j = 25°C	14.5 V ≤ V _{IN} ≤ 30 V, I _{OUT} = 200 mA	—	7	100	mV	
				16 V ≤ V _{IN} ≤ 30 V, I _{OUT} = 200 mA	—	3	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	27	240	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	120		
Output voltage		V _{OUT}	1	T _j = 25°C	14.5 V ≤ V _{IN} ≤ 27 V, 5 mA ≤ I _{OUT} ≤ 350 mA	11.4	—	12.6	V
Quiescent current		I _B	1	T _j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	15 V ≤ V _{IN} ≤ 30.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	70	300	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 15 V ≤ V _{IN} ≤ 25 V, T _j = 25°C		55	62	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−1.6	—	mV/°C

TA78M15S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 23\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		14.4	15.0	15.6	V
Line regulation	Reg-line	1	T _j = 25°C	17.5 V ≤ V _{IN} ≤ 30 V, I _{OUT} = 200 mA	—	8	100	mV	
				20 V ≤ V _{IN} ≤ 30 V, I _{OUT} = 200 mA	—	4	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	27	300	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	150		
Output voltage		V _{OUT}	1	T _j = 25°C	17.5 V ≤ V _{IN} ≤ 30 V, 5 mA ≤ I _{OUT} ≤ 350 mA	14.25	—	15.75	V
Quiescent current		I _B	1	T _j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	18 V ≤ V _{IN} ≤ 30.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	Ta = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	80	450	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 18.5 V ≤ V _{IN} ≤ 28.5 V, T _j = 25°C		54	61	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−2.0	—	mV/°C

TA78M18S
Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 27\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		17.3	18.0	18.7	V
Line regulation	Reg-line	1	T _j = 25°C	21 V ≤ V _{IN} ≤ 33 V, I _{OUT} = 200 mA	—	9	100	mV	
				24 V ≤ V _{IN} ≤ 33 V, I _{OUT} = 200 mA	—	5	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	28	360	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	180		
Output voltage		V _{OUT}	1	T _j = 25°C	21 V ≤ V _{IN} ≤ 33 V, 5 mA ≤ I _{OUT} ≤ 350 mA	17.1	—	18.9	V
Quiescent current		I _B	1	T _j = 25°C		—	4.8	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	21.5 V ≤ V _{IN} ≤ 33.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	90	490	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 22 V ≤ V _{IN} ≤ 32 V, T _j = 25°C		53	60	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−2.5	—	mV/°C

TA78M20S

Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 29\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		19.2	20.0	20.8	V
Line regulation	Reg-line	1	T _j = 25°C	23 V ≤ V _{IN} ≤ 35 V, I _{OUT} = 200 mA	—	10	100	mV	
				24 V ≤ V _{IN} ≤ 35 V, I _{OUT} = 200 mA	—	6	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	28	400	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	200		
Output voltage		V _{OUT}	1	T _j = 25°C	23 V ≤ V _{IN} ≤ 35 V, 5 mA ≤ I _{OUT} ≤ 350 mA	19.0	—	21.0	V
Quiescent current		I _B	1	T _j = 25°C		—	4.9	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	23.5 V ≤ V _{IN} ≤ 35.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	95	540	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 24 V ≤ V _{IN} ≤ 34 V, T _j = 25°C		53	60	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−3.0	—	mV/°C

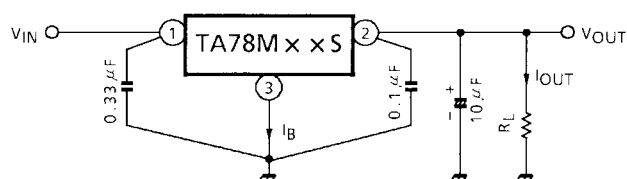
TA78M24S

Electrical Characteristics

(Unless otherwise specified, $V_{IN} = 33\text{ V}$, $I_{OUT} = 350\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

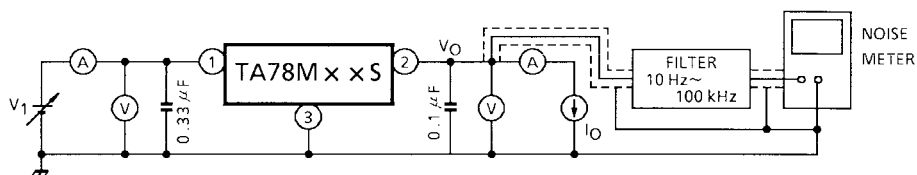
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V _{OUT}	1	T _j = 25°C		23.0	24.0	25.0	V
Line regulation	Reg-line	1	T _j = 25°C	27 V ≤ V _{IN} ≤ 38 V, I _{OUT} = 200 mA	—	12	100	mV	
				28 V ≤ V _{IN} ≤ 38 V, I _{OUT} = 200 mA	—	7	50		
Load regulation	Reg-load	1	T _j = 25°C	5 mA ≤ I _{OUT} ≤ 500 mA	—	30	480	mV	
				5 mA ≤ I _{OUT} ≤ 200 mA	—	10	240		
Output voltage		V _{OUT}	1	T _j = 25°C	27 V ≤ V _{IN} ≤ 38 V, 5 mA ≤ I _{OUT} ≤ 350 mA	22.8	—	25.2	V
Quiescent current		I _B	1	T _j = 25°C		—	5.0	8.0	mA
Quiescent current change	Line	ΔI _{BI}	1	T _j = 25°C	27.5 V ≤ V _{IN} ≤ 38.5 V, I _{OUT} = 200 mA	—	—	0.8	mA
	Load	ΔI _{BO}	1		5 mA ≤ I _{OUT} ≤ 350 mA	—	—	0.5	
Output noise voltage		V _{NO}	2	T _a = 25°C, 10 Hz ≤ f ≤ 100 kHz		—	115	650	μV _{rms}
Ripple rejection		R.R.	3	f = 120 Hz, I _{OUT} = 100 mA, 28 V ≤ V _{IN} ≤ 38 V, T _j = 25°C		50	57	—	dB
Short circuit current limit		I _{SC}	1	T _j = 25°C		—	960	—	mA
Dropout voltage		V _D	1	T _j = 25°C		—	1.7	—	V
Average temperature coefficient of output voltage		T _{CV0}	1	I _{OUT} = 5 mA		—	−3.5	—	mV/°C

Test Circuit 1/Standard Application



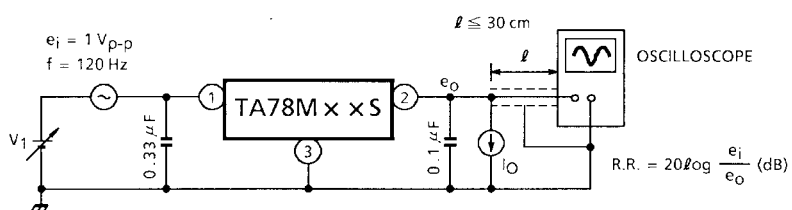
Test Circuit 2

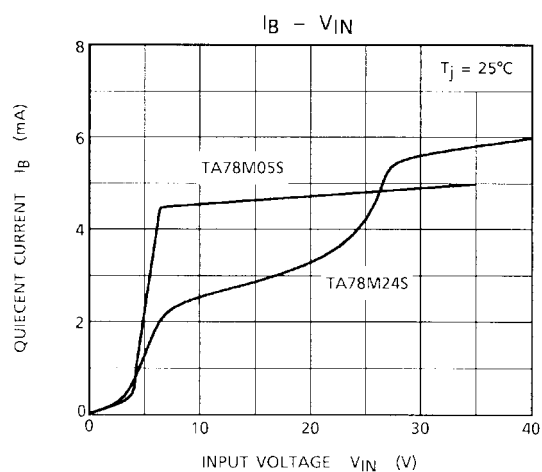
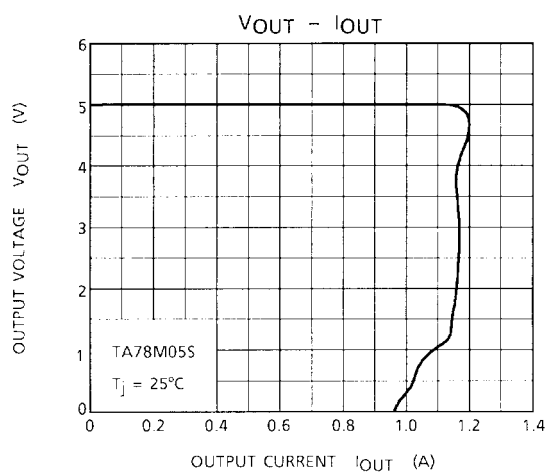
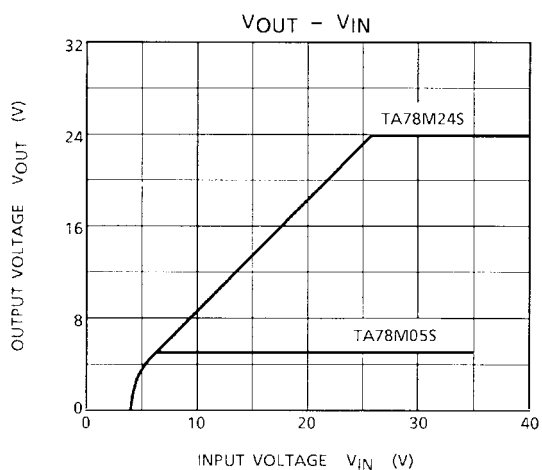
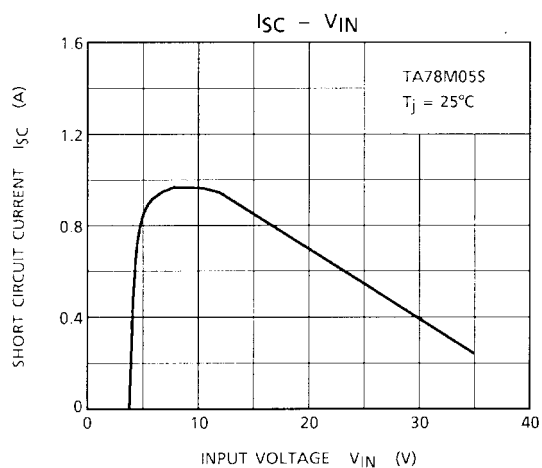
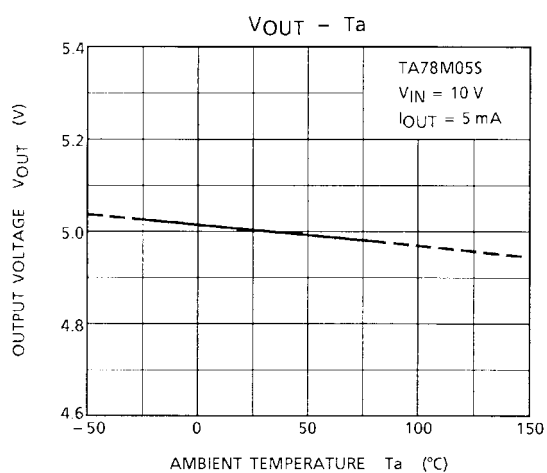
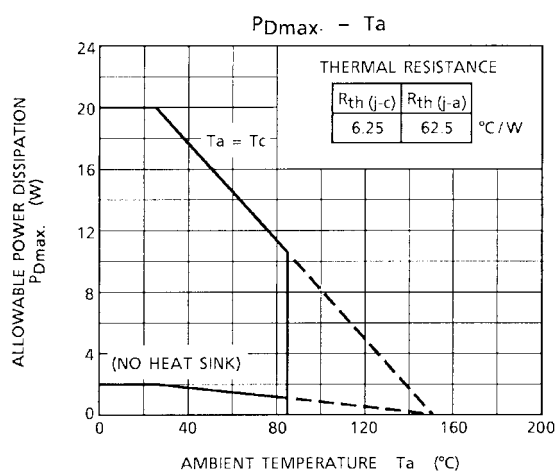
V_{NO}

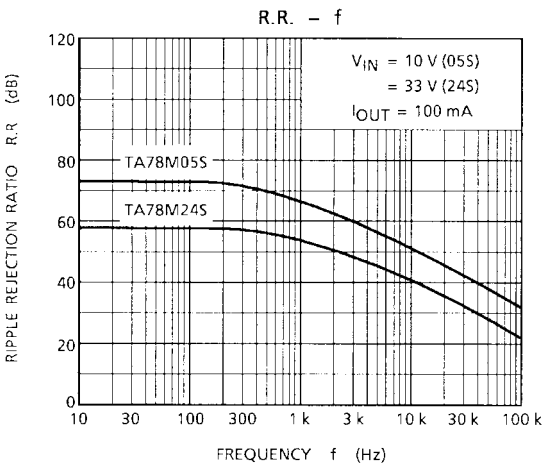
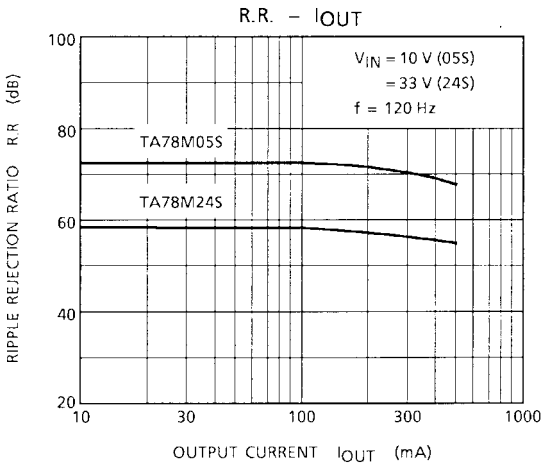
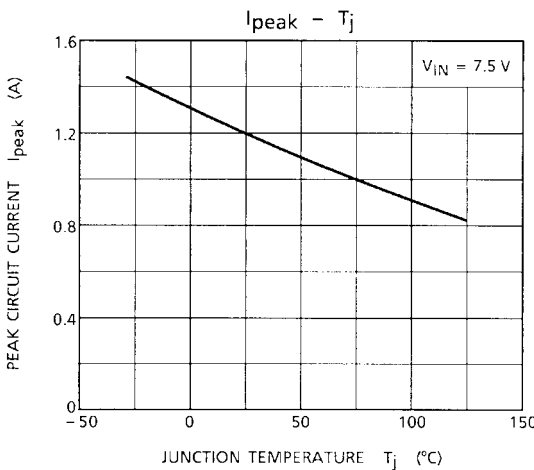
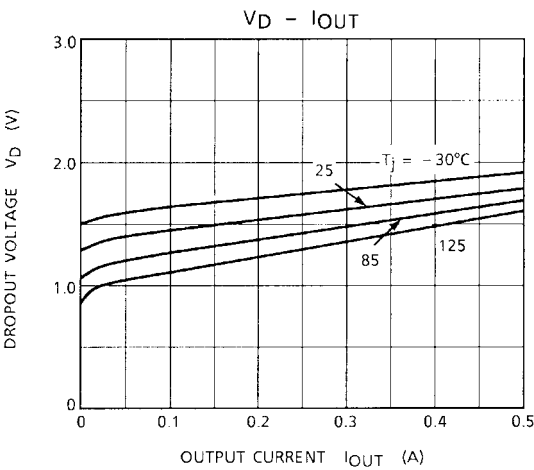


Test Circuit 3

R.R.

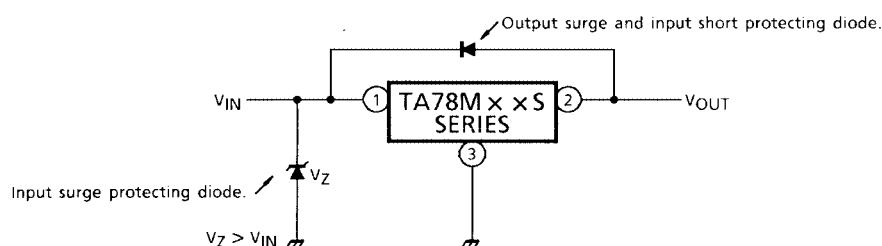




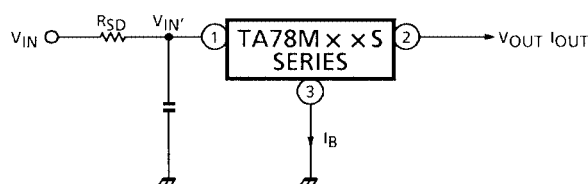


Precautions on Application

- (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 P_D 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 determining 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 printed circuit board patterns. In particular, adequate investigation should be made so that there is no problem even at time of high or low temperature.
- (5) Installation of IC for power supply
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 ($T_j \text{ max}$).
Further, full consideration should be given to the installation of IC to the heat sink.
 - (a) Heat sink design
The thermal resistance of IC itself is required from the viewpoint of the design of elements, but the thermal resistance from the IC package to the open air varies with the contact thermal resistance.

Table 1 shows how much the value of the contact thermal resistance ($\theta_c + \theta_s$) is changed by heat sink grease.

Table 1 Unit: °C/W

Package	Model No	Torque	Mica	$\theta_c + \theta_s$
TO-220NIS	TA78M××S	0.6 N·m	Not provided	0.3~0.5 (1.5~2.0)

The figures given in parentheses denote the values at time of no grease.

(b) Silicon grease

When a circuit not exceeding maximum rating is designed, it is to be desired that the grease should be used if possible. If it is required that the contact thermal resistance is reduced from the viewpoint of the circuit design, it is recommended that the following methods be adopted.

A: Use YG6260 (TOSHIBA SILICON CORPORATION), if grease is used.

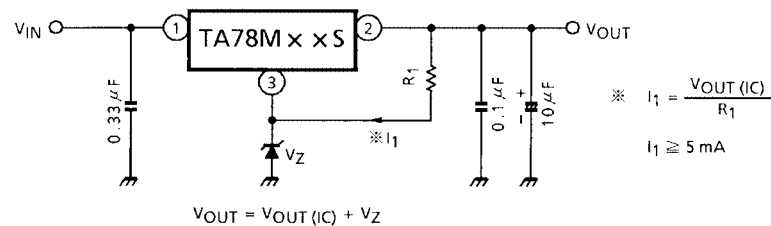
(c) Torque

When installing IC on a heat sink or the like, tighten the IC with the torque of less than the rated value. If it is tightened with the torque in excess of the rated value, sometimes the internal elements of the IC are adversely affected. Therefore, great care should be given to the installing operation.

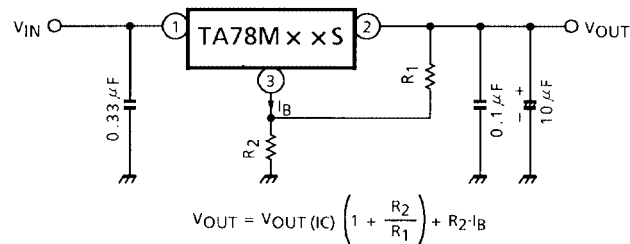
Application Circuits

(1) Voltage Boost Regulator

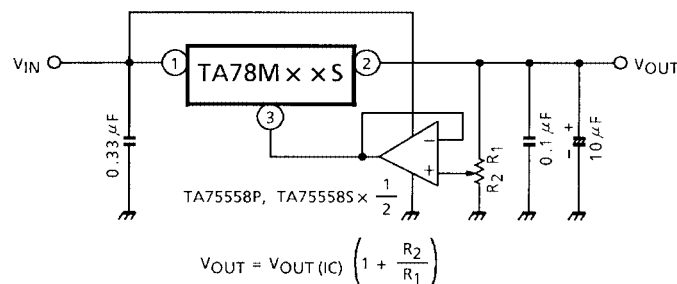
(a) Voltage boost by use of zener diode



(b) Voltage boost by use of resistor

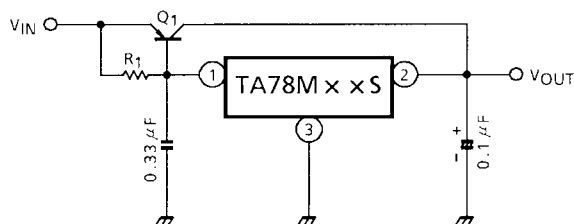


(c) Adjustable output regulator



(2) Current Boost Regulator

(a) Current boost voltage regulator



Heat sink is needed for Q₁

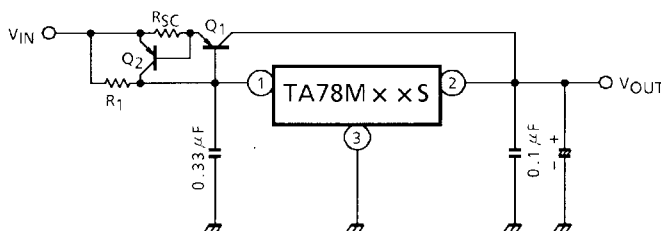
$$R_1 \approx \frac{V_{BE1}}{I_{B \text{ MAX}}}$$

where,

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

$I_{B \text{ MAX}}$: Quiescent current of IC.

(b) Short.circuit protection

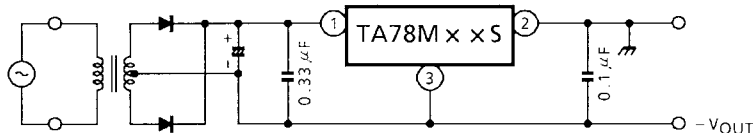


$$R_{SC} = \frac{V_{BE2}}{I_{SC}}$$

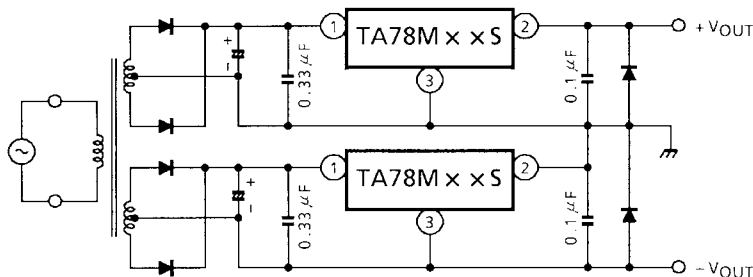
where,

I_{SC} : Short-circuit current

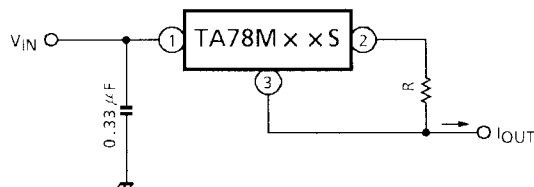
(3) Negative Regulator



(4) Positive and Negative Regulator



(5) Current Regulator

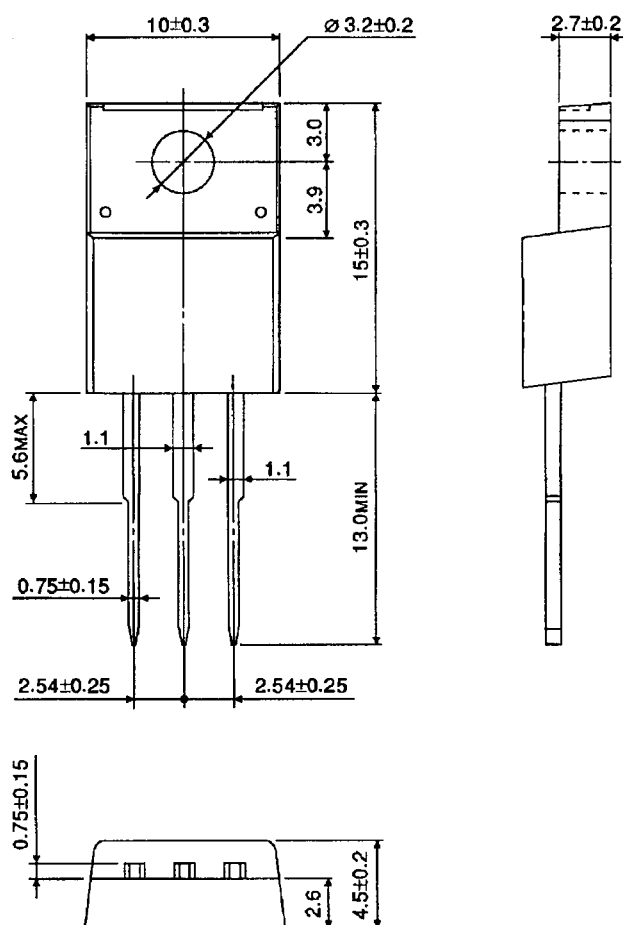


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

Package Dimensions

HSIP3-P-2.54A

Unit: mm



Weight: 1.7 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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