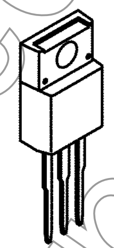
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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 drive up to 0.5 A of output current.



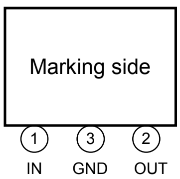
HSIP3-P-2.54A

Weight: 1.7 g (typ.)

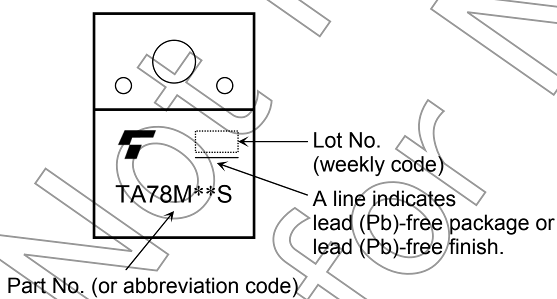
Features

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

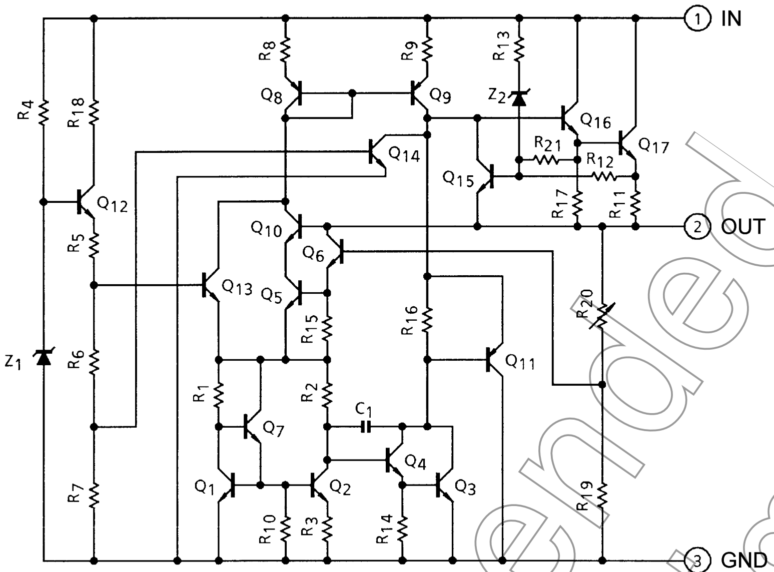
Pin Assignment



Marking



Equivalent Circuit



Absolute 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		$R_{th\ (j\text{-}c)}$	6.25	°C/W
		$R_{th\ (j\text{-}a)}$	62.5	

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

TA78M05S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 10 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−0.6	—	mV/°C

TA78M06S

Electrical Characteristics

(Unless otherwise specified, V_{IN} = 11 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−0.7	—	mV/°C

TA78M08S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−1.0	—	mV/°C

TA78M09S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 15 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−1.1	—	mV/°C

TA78M10S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−1.3	—	mV/°C

TA78M12S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 19 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−1.6	—	mV/°C

TA78M15S

Electrical Characteristics

(Unless otherwise specified, V_{IN} = 23 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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
			T_j = 25°C, 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
			T_j = 25°C, 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
Quiescent current change — Load	ΔI_{BO}	1	T_j = 25°C, 5 mA ≤ I_{OUT} ≤ 350 mA	—	—	0.5	mA
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_{CVO}	1	I_{OUT} = 5 mA	—	−2.0	—	mV/°C

TA78M18S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 27 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−2.5	—	mV/°C

TA78M20S
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 29 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−3.0	—	mV/°C

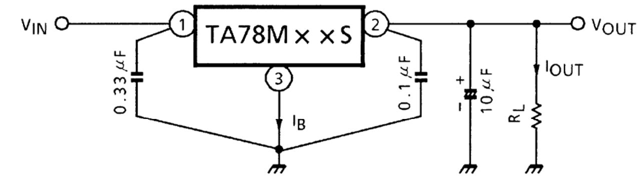
TA78M24S

Electrical Characteristics

(Unless otherwise specified, V_{IN} = 33 V, I_{OUT} = 350 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

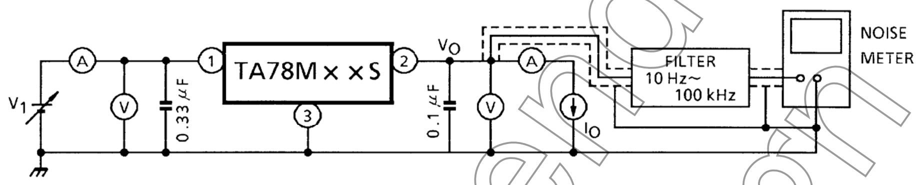
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Output voltage		V_{OUT}	1	T_j = 25°C		23.0	24.0	25.0	V
Line regulation		Reg·line	1	T_j = 25°C	27 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA	—	12	100	mV
					28 V ≤ V_{IN} ≤ 38 V, I_{OUT} = 200 mA	—	7	50	
Load regulation		Reg·load	1	T_j = 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	Ta = 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_{CVO}	1	I_{OUT} = 5 mA		—	−3.5	—	mV/°C

Test Circuit 1/Standard Application



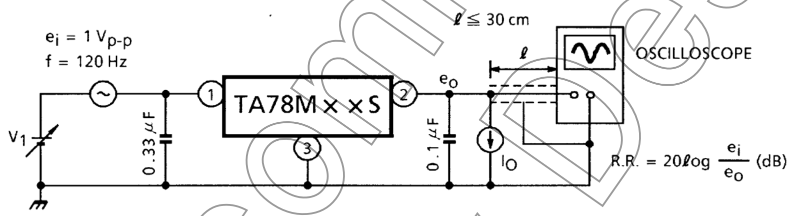
Test Circuit 2

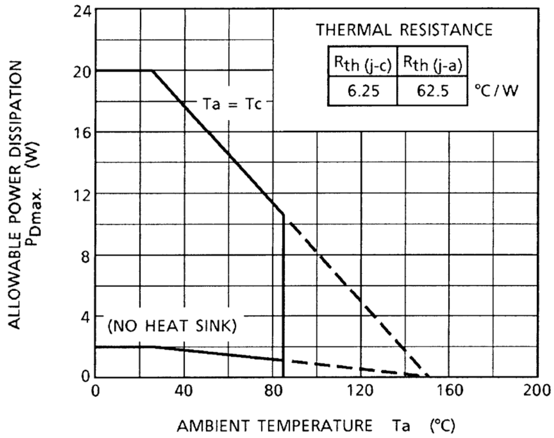
V_{NO}



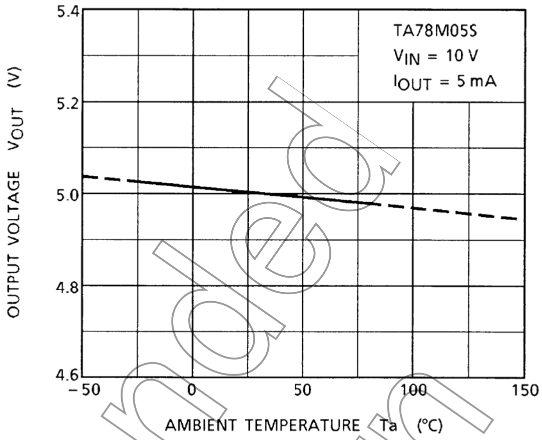
Test Circuit 3

R.R.

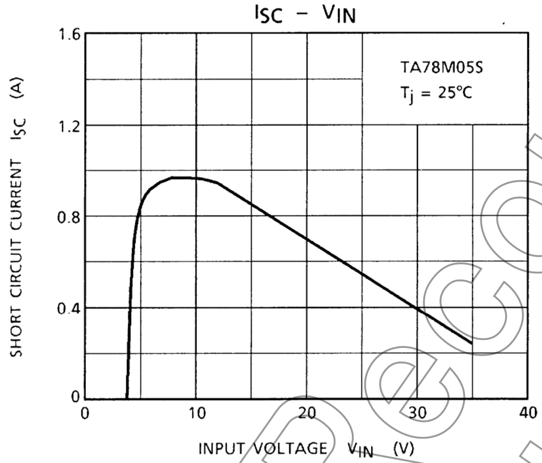




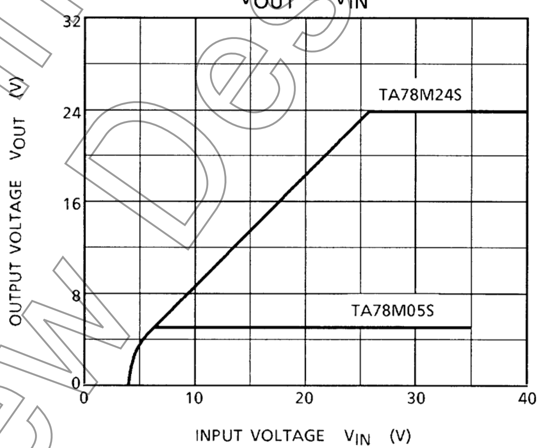
P_{Dmax} – Ta



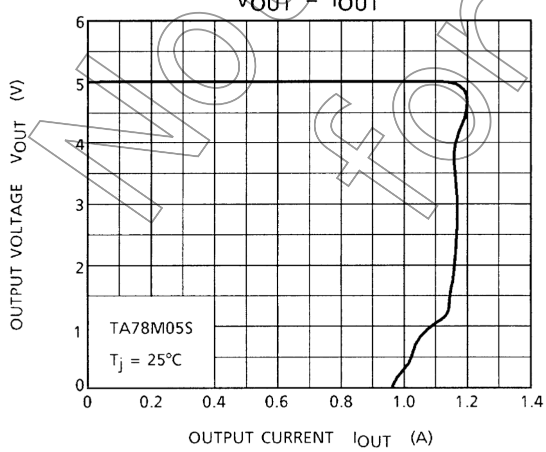
V_{OUT} – Ta



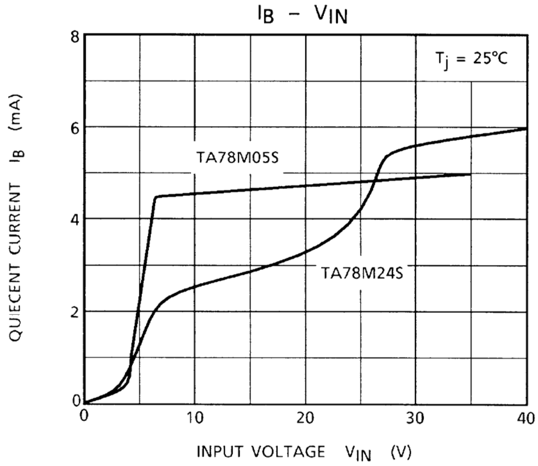
I_{SC} – V_{IN}



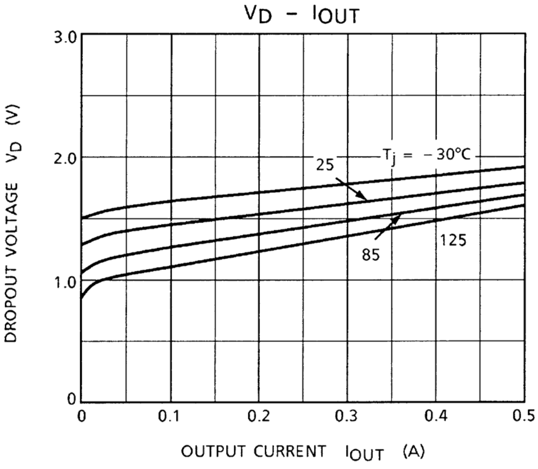
V_{OUT} – V_{IN}



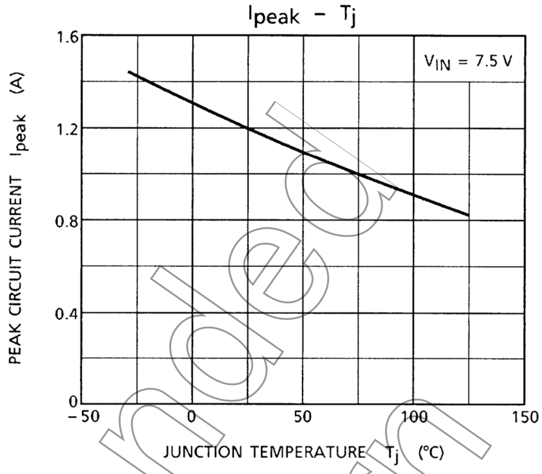
V_{OUT} – I_{OUT}



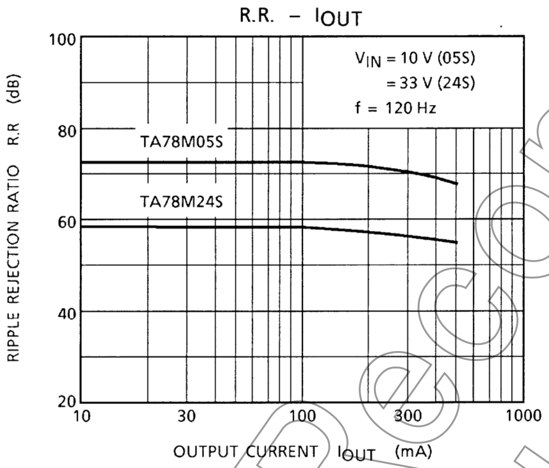
I_B – V_{IN}



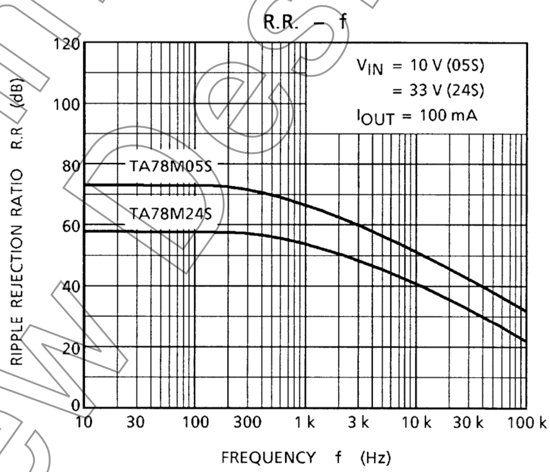
VD – IOUT
DROPOUT VOLTAGE VD (V)
OUTPUT CURRENT IOUT (A)
Tj = −30°C
25
85
125



Ipeak – Tj
PEAK CIRCUIT CURRENT Ipeak (A)
JUNCTION TEMPERATURE Tj (°C)
VIN = 7.5 V



R.R. – IOUT
RIPPLE REJECTION RATIO R.R (dB)
OUTPUT CURRENT IOUT (mA)
VIN = 10 V (05S)
= 33 V (24S)
f = 120 Hz
TA78M05S
TA78M24S

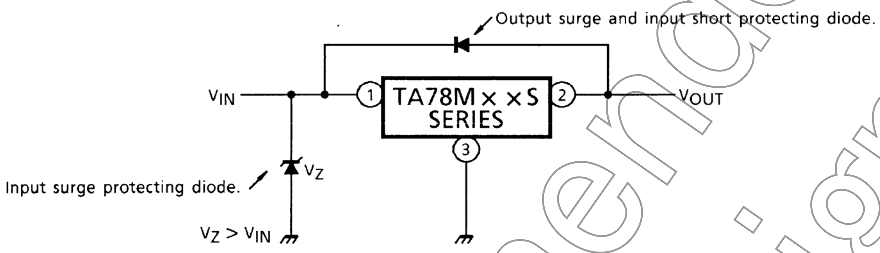


R.R. – f
RIPPLE REJECTION RATIO R.R (dB)
FREQUENCY f (Hz)
VIN = 10 V (05S)
= 33 V (24S)
IOUT = 100 mA
TA78M05S
TA78M24S

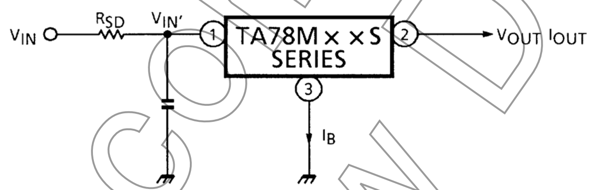
Precautions on Application

(1) In regard to GND, be careful not to apply a negative voltage to the input/output terminal. Further, special care is necessary in the case of a voltage boost application.

(2) If a surge voltage exceeding the maximum rating is applied to the input terminal or if a voltage in excess of the input terminal voltage is applied to the output terminal, the circuit may be destroyed. Particular care is necessary in the case of the latter.
Circuit destruction may also occur if the input terminal shorts to GND in a state of normal operation, causing the output terminal voltage to exceed the input voltage (GND potential) and the electrical charge of the chemical capacitor connected to the output terminal to flow into the input side.
Where these risks exist, take steps such as connecting zener and general silicon diodes to the circuit, as shown in the figure below.



(3) When the input voltage is too high, the power dissipation of the three-terminal regulator, which is a series regulator, increases, causing the junction temperature to rise. In such a case, it is recommended to reduce the power dissipation, and hence the junction temperature, by inserting a power-limiting resistor R_{SD} in the input terminal.



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

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

Reducing $V_{IN'}$ below the lowest voltage necessary for the IC will cause ripple, deterioration in output regulation and, in certain circumstances, parasitic oscillation.
To determine the resistance value of R_{SD}, design with a margin, referring to the following equation.

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

(4) Be sure to connect a capacitor near the input terminal and output terminal between both terminals and GND. The capacitances should be determined experimentally because they depend on printed circuit board patterns. In particular, adequate investigation should be made to ensure there is no problem even in high or low temperatures.

(5) Installation of IC for power supply
To obtain high reliability on the heat sink design of a regulator IC, it is generally required to derate more than 20% of maximum junction temperature (T_j max).
Further, full consideration should be given to the installation of the IC on a heat sink.

(a) Heat sink design
The thermal resistance of the 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 for when there is no grease.

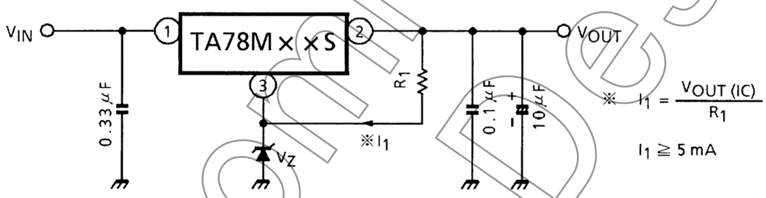
(b) Silicon grease
In the design of a circuit not exceeding the maximum rating, grease should be used if possible. If it is necessary to reduce the contact thermal resistance for the sake of circuit design, the following methods are recommended.
A: If using grease, use YG6260 (TOSHIBA SILICON CORPORATION).

(c) Torque
When installing the IC on a heat sink or the like, tighten the IC with a torque of less than the rated value. Tightening in excess of the rated value may cause internal elements of the IC to be adversely affected. Therefore, great care should be given to the installation procedure.

Application Circuits

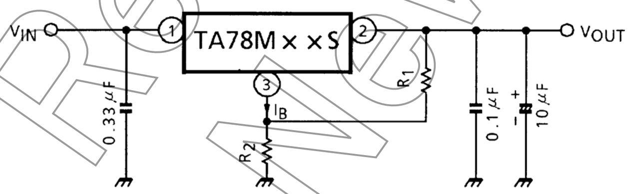
(1) Voltage Boost Regulator

(a) Voltage boost by use of zener diode



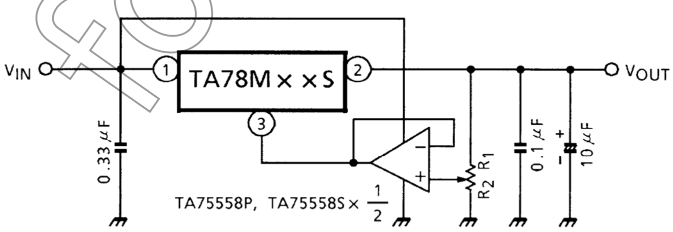
$V_{OUT} = V_{OUT\,(IC)} + V_Z$

(b) Voltage boost by use of resistor



$V_{OUT} = V_{OUT\,(IC)} \left(1 + \frac{R_2}{R_1}\right) + R_2 \cdot I_B$

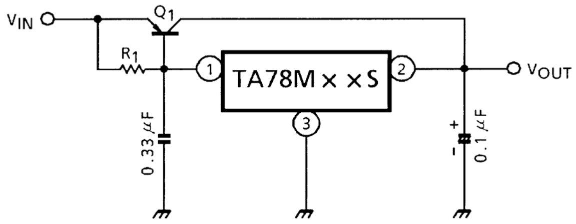
(c) Adjustable output regulator



$V_{OUT} = V_{OUT\,(IC)} \left(1 + \frac{R_2}{R_1}\right)$

(2) Current Boost Regulator

(a) Current boost voltage regulator



Heat sink is needed for Q_1

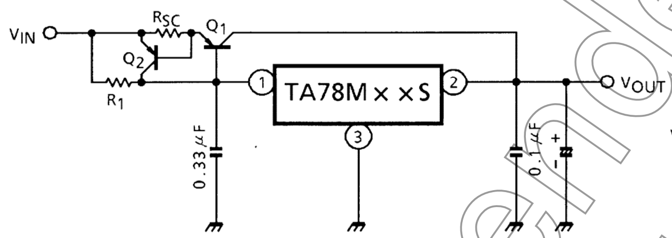
$R_1 \leq \frac{V_{BE1}}{I_{B\ MAX}}$

where,

V_{BE1} : V_{BE} of external transistor Q_1.

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

(b) Short-circuit protection

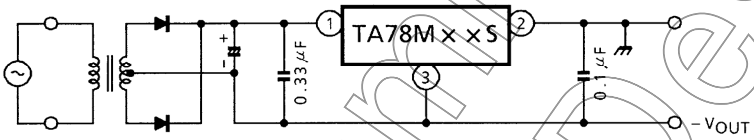


$R_{SC} = \frac{V_{BE2}}{I_{SC}}$

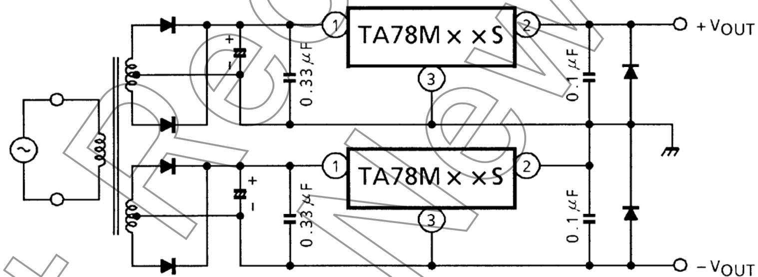
where,

I_{SC} : Short-circuit current

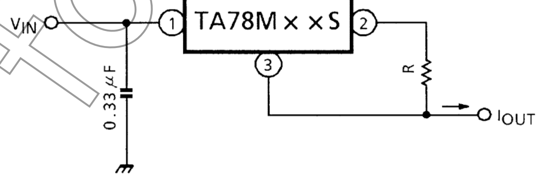
(3) Negative Regulator



(4) Positive and Negative Regulator



(5) Current Regulator

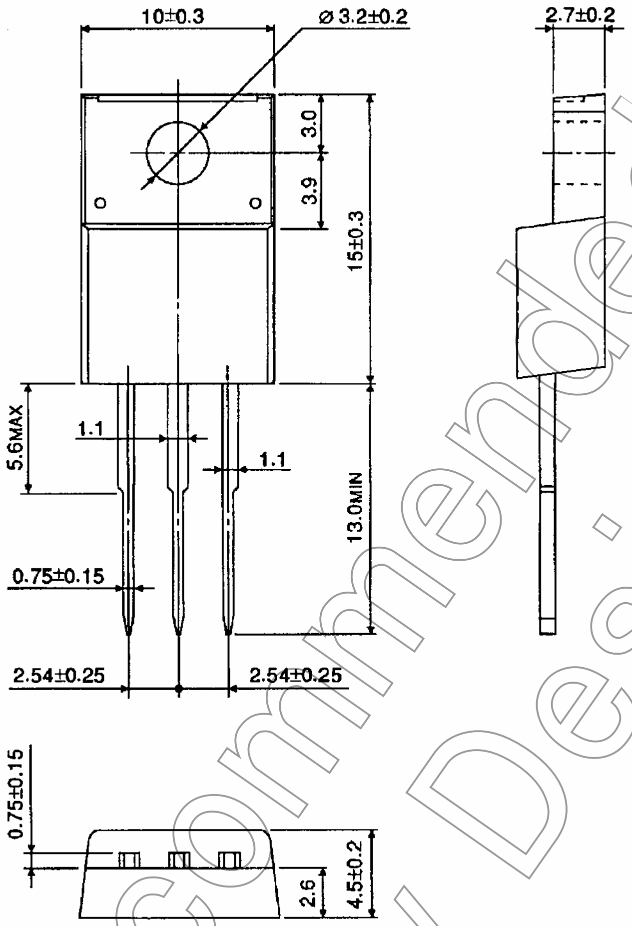


$I_{OUT} = \frac{V_{OUT}}{R} + I_B$

Package Dimensions

HSIP3-P-2.54A

Unit: mm



Weight: 1.7 g (typ.)