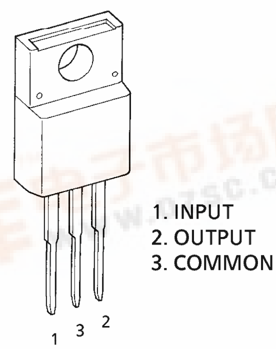
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

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

0.5A THREE TERMINAL POSITIVE VOLTAGE REGULATORS

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

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 0.5A of output current.



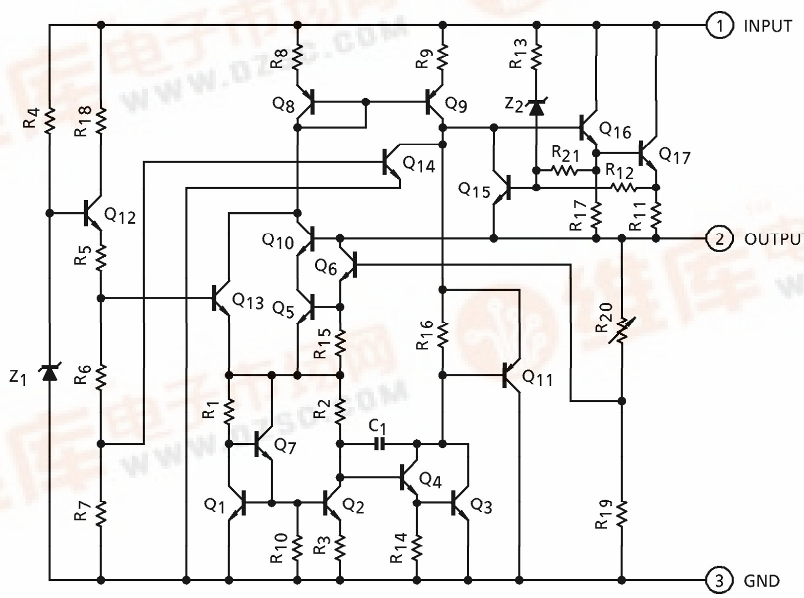
HSIP3-P-2.54A

Weight : 1.7g (Typ.)

FEATURES

- Suitable for CMOS, TTL and the other Digital IC's Power Supply.
- Output Current in Excess of 0.5A
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Package in the Plastic Case TO-220NIS

EQUIVALENT CIRCUIT



961001EBA2

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		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}	−30~75	°C
Storage Temperature		T_{stg}	−55~150	°C
Operating Junction Temperature		T_j	−30~150	°C
Thermal Resistance		$R_{th\ (j\text{-}c)}$	6.25	°C / W
		$R_{th\ (j\text{-}a)}$	62.5	

TA78M05S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 10V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC	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, 7V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	4	100	mV
Line Regulation	Reg.line	1	T_j = 25°C, 8V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	2	50	mV
Load Regulation	Reg.load	1	T_j = 25°C, 5mA ≦ I_{OUT} ≦ 500mA	—	25	100	mV
Load Regulation	Reg.load	1	T_j = 25°C, 5mA ≦ I_{OUT} ≦ 200mA	—	10	50	mV
Output Voltage	V_{OUT}	1	T_j = 25°C, 7V ≦ V_{IN} ≦ 20V, 5mA ≦ I_{OUT} ≦ 350mA	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	8.5V ≦ V_{IN} ≦ 25.5V, I_{OUT} = 200mA	—	—	0.8	mA
Quiescent Current Change — Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA	—	—	0.5	mA
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz	—	50	200	μV_{rms}
Ripple Rejection	R.R.	3	f = 120Hz, I_{OUT} = 100mA, 8V ≦ V_{IN} ≦ 18V, 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	Ta = 25°C	—	1.7	—	V
Average Temperature Coefficient Of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA	—	−0.6	—	mV / °C

TA78M06S

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC		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	8V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	4	100	mV
					9V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	2	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	25	120	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	60	
Output Voltage		V_{OUT}	1	T_j = 25°C	8V ≦ V_{IN} ≦ 21V, 5mA ≦ I_{OUT} ≦ 350mA	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	9.5V ≦ V_{IN} ≦ 25.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	55	220	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 9V ≦ V_{IN} ≦ 19V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	−0.7	—	mV / °C

TA78M08S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 14V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		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	10.5V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	5	100	mV
					11V ≦ V_{IN} ≦ 25V, I_{OUT} = 200mA	—	3	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	26	160	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	80	
Output Voltage		V_{OUT}	1	T_j = 25°C	10.5V ≦ V_{IN} ≦ 23V, 5mA ≦ I_{OUT} ≦ 350mA	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	11V ≦ V_{IN} ≦ 25.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	60	250	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 11.5V ≦ V_{IN} ≦ 21.5V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	−1.0	—	mV / °C

TA78M09S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 15V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	11.5V ≦ V_{IN} ≦ 26V, I_{OUT} = 200mA	—	5	100	mV
					13V ≦ V_{IN} ≦ 26V, I_{OUT} = 200mA	—	3	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	26	180	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	90	
Output Voltage		V_{OUT}	1	T_j = 25°C	11.5V ≦ V_{IN} ≦ 24V, 5mA ≦ I_{OUT} ≦ 350mA	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	12V ≦ V_{IN} ≦ 26.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	60	270	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 12.5V ≦ V_{IN} ≦ 22.5V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	− 1.1	—	mV / °C

TA78M10S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 16V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	12.5V ≦ V_{IN} ≦ 26V, I_{OUT} = 200mA	—	6	100	mV
					14V ≦ V_{IN} ≦ 26V, I_{OUT} = 200mA	—	3	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	26	200	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	100	
Output Voltage		V_{OUT}	1	T_j = 25°C	12.5V ≦ V_{IN} ≦ 25V, 5mA ≦ I_{OUT} ≦ 350mA	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	13V ≦ V_{IN} ≦ 26.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	65	280	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 13.5V ≦ V_{IN} ≦ 23.5V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	− 1.3	—	mV / °C

TA78M12S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 19V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	14.5V ≦ V_{IN} ≦ 30V I_{OUT} = 200mA	—	7	100	mV
					16V ≦ V_{IN} ≦ 30V I_{OUT} = 200mA	—	3	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	27	240	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	120	
Output Voltage		V_{OUT}	1	T_j = 25°C	14.5V ≦ V_{IN} ≦ 27V 5mA ≦ I_{OUT} ≦ 350mA	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	15V ≦ V_{IN} ≦ 30.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	70	300	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA 15V ≦ V_{IN} ≦ 25V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	– 1.6	—	mV / °C

TA78M15S

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	17.5V ≦ V_{IN} ≦ 30V I_{OUT} = 200mA	—	8	100	mV
					20V ≦ V_{IN} ≦ 30V I_{OUT} = 200mA	—	4	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	27	300	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	150	
Output Voltage		V_{OUT}	1	T_j = 25°C	17.5V ≦ V_{IN} ≦ 30V 5mA ≦ I_{OUT} ≦ 350mA	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	18V ≦ V_{IN} ≦ 30.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	80	450	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA 18.5V ≦ V_{IN} ≦ 28.5V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	−2.0	—	mV / °C

TA78M18S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 27V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	21V ≦ V_{IN} ≦ 33V, I_{OUT} = 200mA	—	9	100	mV
					24V ≦ V_{IN} ≦ 33V, I_{OUT} = 200mA	—	5	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	28	360	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	180	
Output Voltage		V_{OUT}	1	T_j = 25°C	21V ≦ V_{IN} ≦ 33V, 5mA ≦ I_{OUT} ≦ 350mA	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	21.5V ≦ V_{IN} ≦ 33.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	90	490	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 22V ≦ V_{IN} ≦ 32V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	−2.5	—	mV / °C

TA78M20S

ELECTRICAL CHARACTERISTICS

(V_{IN} = 29V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	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	23V ≦ V_{IN} ≦ 35V, I_{OUT} = 200mA	—	10	100	mV
					24V ≦ V_{IN} ≦ 35V, I_{OUT} = 200mA	—	6	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	28	400	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	200	
Output Voltage		V_{OUT}	1	T_j = 25°C	23V ≦ V_{IN} ≦ 35V, 5mA ≦ I_{OUT} ≦ 350mA	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	23.5V ≦ V_{IN} ≦ 35.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	95	540	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 24V ≦ V_{IN} ≦ 34V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	−3.0	—	mV / °C

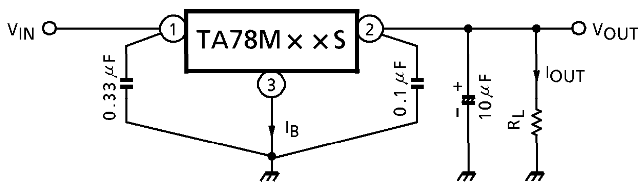
TA78M24S

ELECTRICAL CHARACTERISTICS

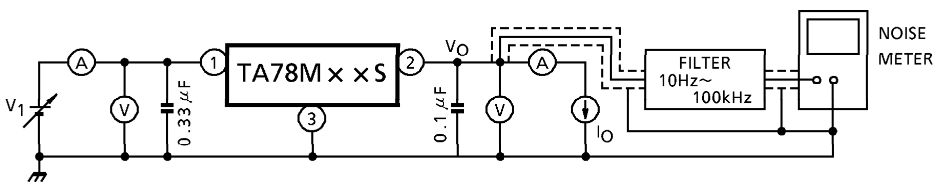
(V_{IN} = 33V, I_{OUT} = 350mA, 0°C ≦ T_j ≦ 125°C, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise noted)

CHARACTERISTIC		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	27V ≦ V_{IN} ≦ 38V, I_{OUT} = 200mA	—	12	100	mV
					28V ≦ V_{IN} ≦ 38V, I_{OUT} = 200mA	—	7	50	
Load Regulation		Reg.load	1	T_j = 25°C	5mA ≦ I_{OUT} ≦ 500mA	—	30	480	mV
					5mA ≦ I_{OUT} ≦ 200mA	—	10	240	
Output Voltage		V_{OUT}	1	T_j = 25°C	27V ≦ V_{IN} ≦ 38V, 5mA ≦ I_{OUT} ≦ 350mA	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	27.5V ≦ V_{IN} ≦ 38.5V, I_{OUT} = 200mA		—	—	0.8	mA
	Load	ΔI_{BO}	1	5mA ≦ I_{OUT} ≦ 350mA		—	—	0.5	
Output Noise Voltage		V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	115	650	μV_{rms}
Ripple Rejection		R.R.	3	f = 120Hz, I_{OUT} = 100mA, 28V ≦ V_{IN} ≦ 38V, 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	Ta = 25°C		—	1.7	—	V
Average Temperature Coefficient Of Output Voltage		T_{CVO}	1	I_{OUT} = 5mA		—	– 3.5	—	mV / °C

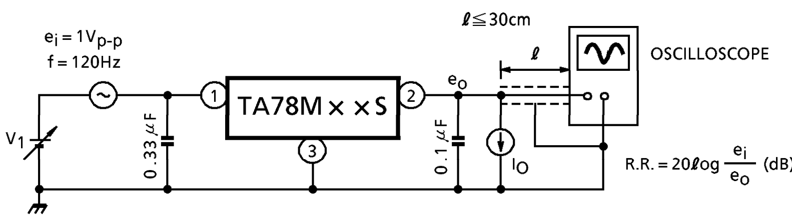
TEST CIRCUIT 1 / STANDARD APPLICATION



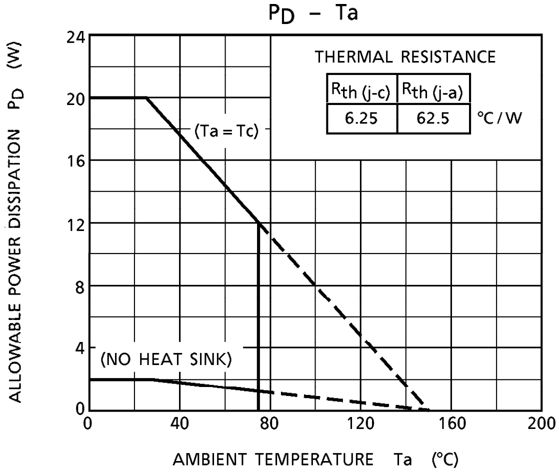
TEST CIRCUIT 2 V_{NO}



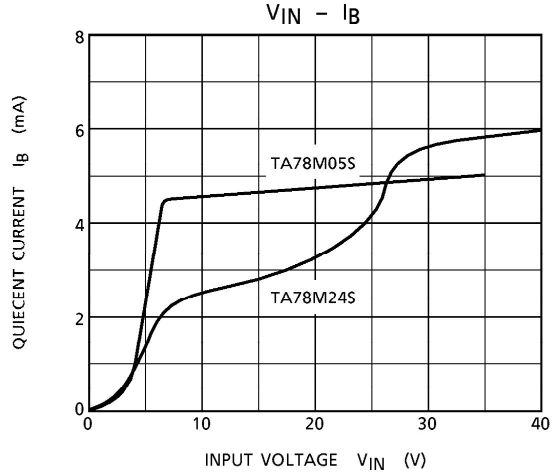
TEST CIRCUIT 3 R.R.



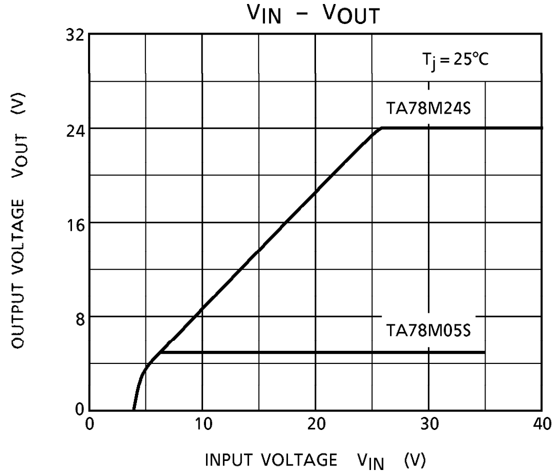
P_D – Ta



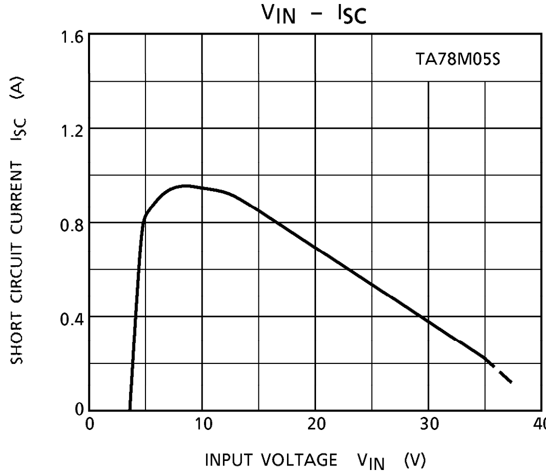
V_{IN} – I_B



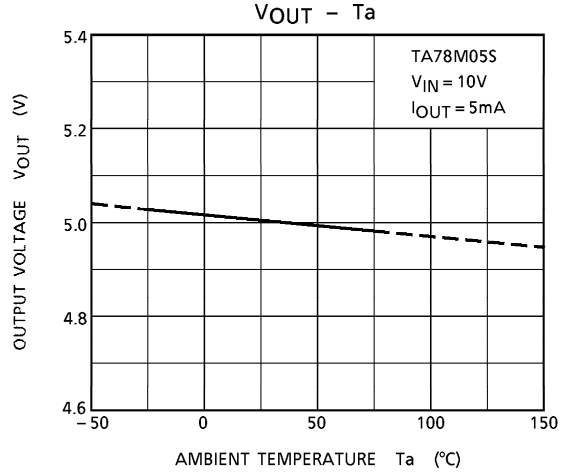
V_{IN} – V_{OUT}



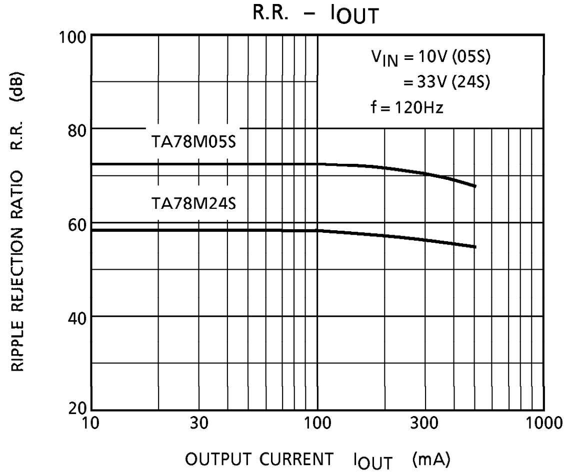
V_{IN} – I_{SC}

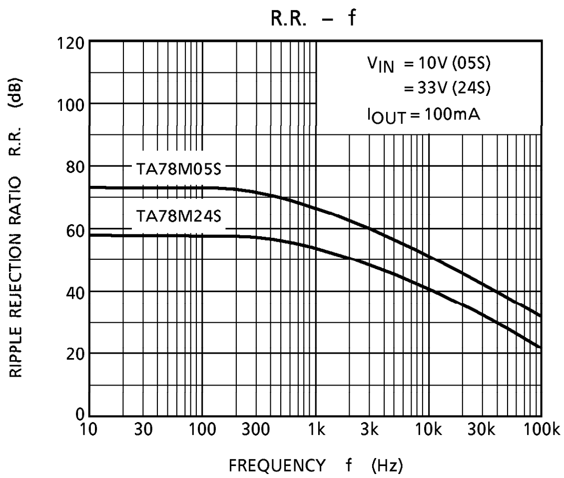


V_{OUT} – Ta



R.R. – I_{OUT}

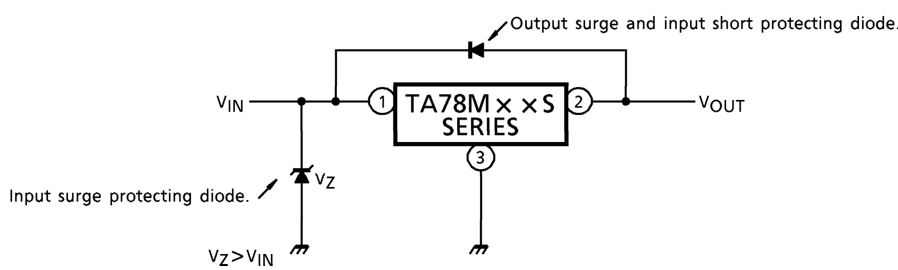



R.R. – f
120
100
80
60
40
20
0
10
30
100
300
1k
3k
10k
30k
100k
RIPPLE REJECTION RATIO R.R. (dB)
FREQUENCY f (Hz)
VIN = 10V (05S)
= 33V (24S)
IOUT = 100mA
TA78M05S
TA78M24S

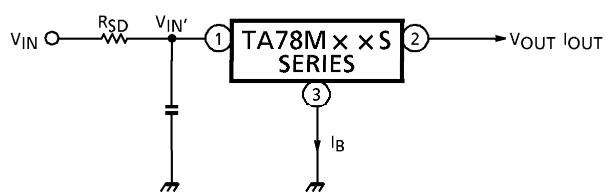
PRECAUTIONS ON APPLICATION

(1) In regard to GND, be careful not to apply a negative voltage to the input / output terminal. Further, special care is necessary in 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 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) 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 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	0.6N·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.

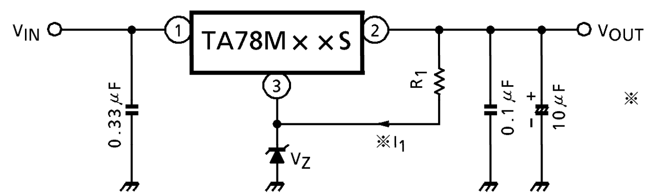
(c) Torque

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

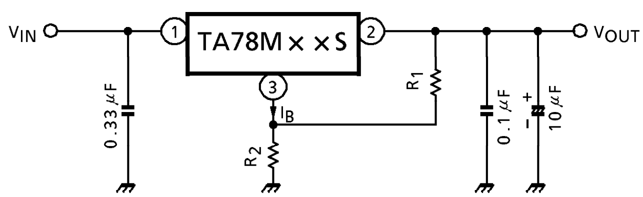


※ $I_1 = \frac{V_{OUT\,(IC)}}{R_1}$

$I_1 \geqq 5\,\text{mA}$

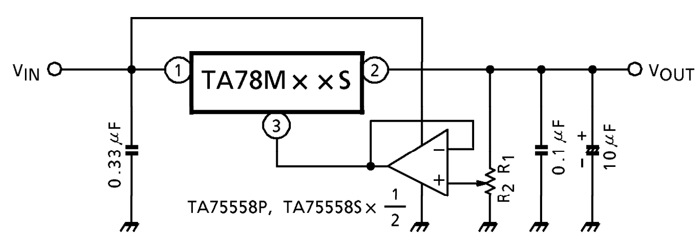
$$V_{OUT} = V_{OUT\,(IC)} + V_Z$$

(b) Voltage boost by use of resistor



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

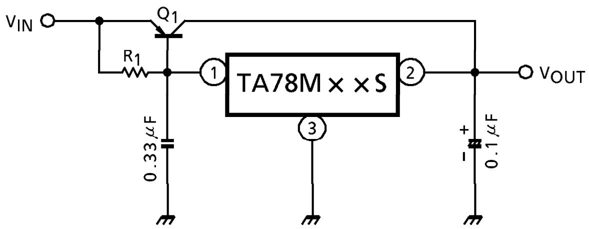
(c) Adjustable output regulator



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

(2) CURRENT BOOST REGULATOR

(a) CURRENT BOOST VOLTAGE REGULATOR



Heat sink is needed for Q_1

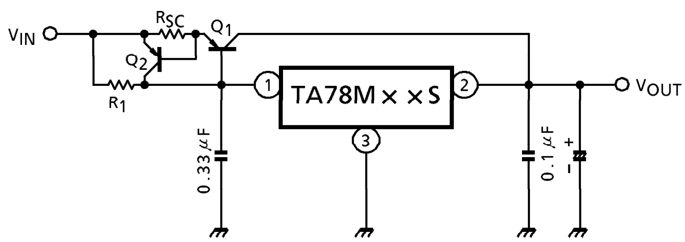
$R_1 \leqq \frac{V_{BE1}}{I_{B\ MAX}}$

where,

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

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

(b) SHORT-CIRCUIT PROTECTION

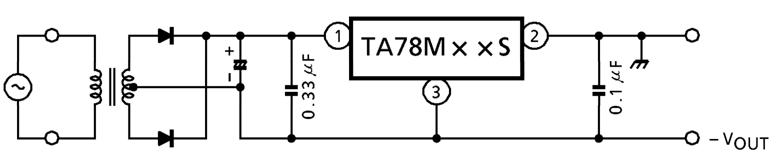


$R_{SC} = \frac{V_{BE2}}{I_{SC}}$

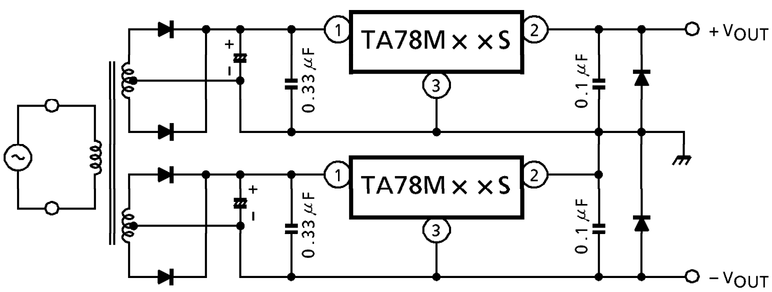
where,

I_{SC} : Short-circuit current

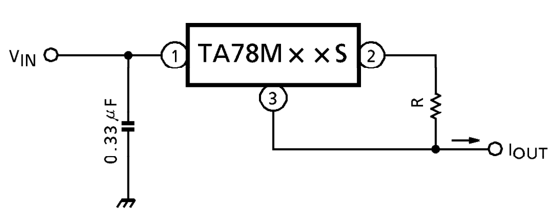
(3) NEGATIVE REGULATOR



(4) POSITIVE AND NEGATIVE REGULATOR



(5) CURRENT REGULATOR

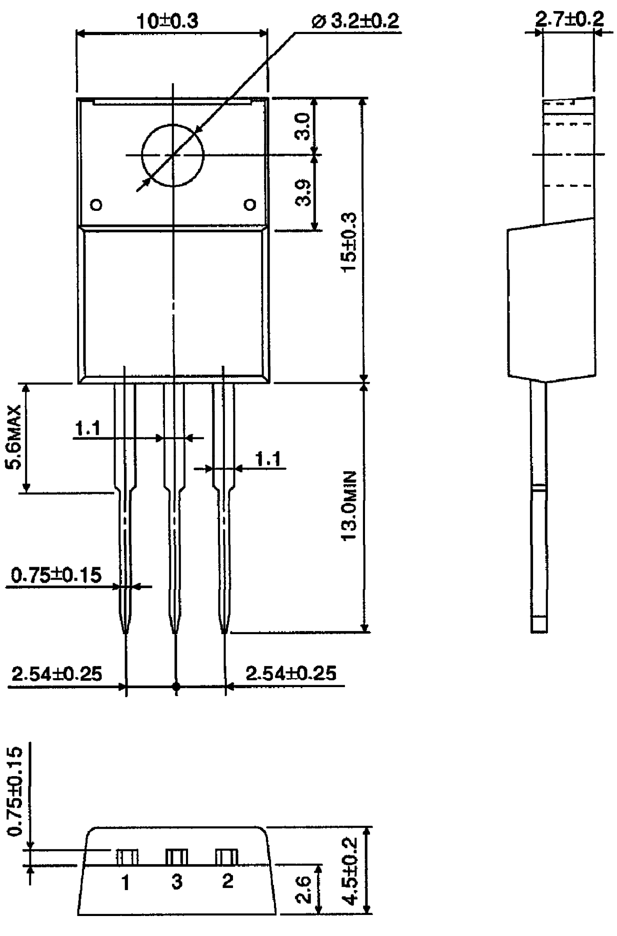


$I_{OUT} = \frac{V_{OUT}}{R} + I_B$

OUTLINE DRAWING

HSIP3-P-2.54A

Unit : mm



Weight : 1.7g (Typ.)