TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

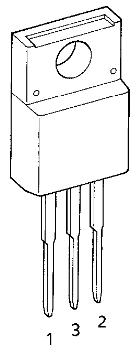
TA7805S, TA78057S, TA7806S, TA7807S, TA7808S, TA7809S TA7810S, TA7812S, TA7815S, TA7818S, TA7820S, TA7824S

THREE TERMINAL POSITIVE VOLTAGE REGULATORS

5 V, 5.7 V, 6 V, 7 V, 8 V, 9 V, 10 V, 12 V, 15 V, 18 V, 20 V, 24 V

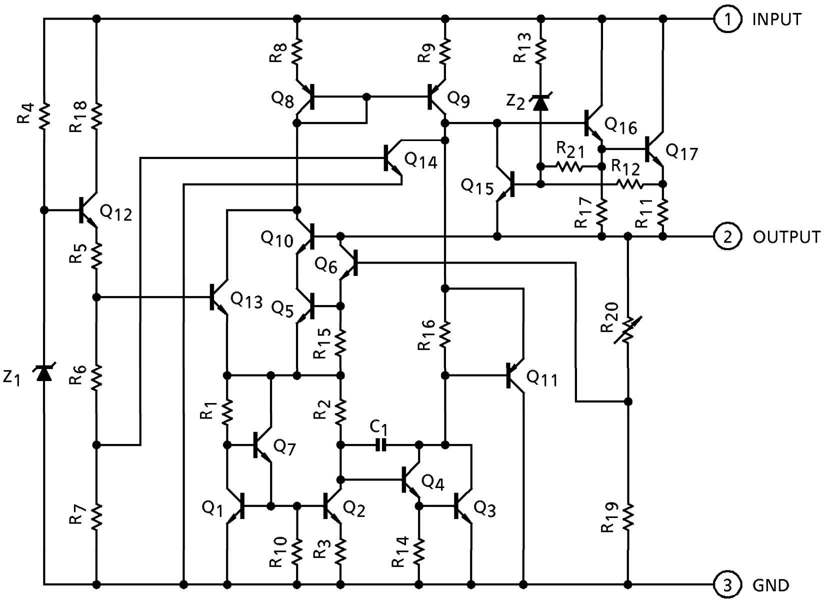
FEATURES

- Suitable for CMOS, TTL, the other digital IC's power supply
- Internal thermal overload protection
- Internal short circuit current limiting
- Output current in excess of 1 A
- Metal Fin (Tab) is fully covered with Mold Resin. (T0-220 NIS package)



Weight : 1.7 g (Typ.)

EQUIVALENT CIRCUIT



980910EBA1

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	TA7805S	V_{IN}	35	V
	TA78057S			
	TA7806S			
	TA7807S			
	TA7808S			
	TA7809S			
	TA7810S			
	TA7812S			
	TA7815S			
	TA7818S		40	
	TA7820S			
	TA7824S			
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	

TA7805S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 10 V, I_{OUT} = 500 mA, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C, I_{OUT} = 100mA		4.8	5.0	5.2	V
Line Regulation	Reg·line	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 25 V	—	3	100	mV
				8.0 V ≦ V_{IN} ≦ 12 V	—	1	50	
Load Regulation	Reg·load	1	T_j = 25°C	5 mA ≦ I_{OUT} ≦ 1.4 A	—	15	100	mV
				250 mA ≦ I_{OUT} ≦ 750 mA	—	5	50	
Output Voltage	V_{OUT}	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 20 V 5.0 mA ≦ I_{OUT} ≦ 1.0 A	4.75	—	5.25	V
Quiescent Current	I_B	1	T_j = 25°C, I_{OUT} = 5 mA		—	4.2	8.0	mA
Quiescent Current Change	ΔI_B	1	7.0 V ≦ V_{IN} ≦ 25 V, I_{OUT} = 5 mA, T_j = 25°C		—	—	1.3	mA
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz I_{OUT} = 50 mA		—	50	—	μV_{rms}
Ripple Rejection	R.R.	3	f = 120 Hz, 8.0 V ≦ V_{IN} ≦ 18 V I_{OUT} = 50 mA, T_j = 25°C		62	78	—	dB
Dropout Voltage	V_D	1	I_{OUT} = 1.0 A, T_j = 25°C		—	2.0	—	V
Short Circuit Current Limit	I_{SC}	1	T_j = 25°C		—	1.6	—	A
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.6	—	mV / °C

TA7806S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 11 V, I_{OUT} = 500 mA, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C, I_{OUT} = 100 mA		5.75	6.0	6.25	V
Line Regulation	Reg·line	1	T_j = 25°C	8.0 V ≦ V_{IN} ≦ 25 V	—	4	120	mV
				9 V ≦ V_{IN} ≦ 13 V	—	2	60	
Load Regulation	Reg·load	1	T_j = 25°C	5 mA ≦ I_{OUT} ≦ 1.4 A	—	15	120	mV
				250 mA ≦ I_{OUT} ≦ 750 mA	—	5	60	
Output Voltage	V_{OUT}	1	T_j = 25°C	8 V ≦ V_{IN} ≦ 21 V 5.0 mA ≦ I_{OUT} ≦ 1.0 A	5.7	—	6.3	V
Quiescent Current	I_B	1	T_j = 25°C, I_{OUT} = 5 mA		—	4.3	8.0	mA
Quiescent Current Change	ΔI_B	1	8.0 V ≦ V_{IN} ≦ 25 V, I_{OUT} = 5 mA, T_j = 25°C		—	—	1.3	mA
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz I_{OUT} = 50 mA		—	55	—	μV_{rms}
Ripple Rejection	R.R.	3	f = 120 Hz, 9 V ≦ V_{IN} ≦ 19 V I_{OUT} = 50 mA, T_j = 25°C		61	77	—	dB
Dropout Voltage	V_D	1	I_{OUT} = 1.0 A, T_j = 25°C		—	2.0	—	V
Short Circuit Current Limit	I_{SC}	1	T_j = 25°C		—	1.5	—	A
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.7	—	mV / °C

TA7809S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 15 V, I_{OUT} = 500 mA, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C, I_{OUT} = 100 mA		8.64	9.0	9.36	V
Line Regulation	Reg·line	1	T_j = 25°C	11.5 V ≦ V_{IN} ≦ 26 V	—	7	180	mV
				13 V ≦ V_{IN} ≦ 19 V	—	2.5	90	
Load Regulation	Reg·load	1	T_j = 25°C	5 mA ≦ I_{OUT} ≦ 1.4 A	—	12	180	mV
				250 mA ≦ I_{OUT} ≦ 750 mA	—	4	90	
Output Voltage	V_{OUT}	1	T_j = 25°C	11.5 V ≦ V_{IN} ≦ 24 V 5.0 mA ≦ I_{OUT} ≦ 1.0 A	8.55	—	9.45	V
Quiescent Current	I_B	1	T_j = 25°C, I_{OUT} = 5 mA		—	4.3	8.0	mA
Quiescent Current Change	ΔI_B	1	11.5 V ≦ V_{IN} ≦ 26 V, I_{OUT} = 5 mA, T_j = 25°C		—	—	1.0	mA
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz I_{OUT} = 50 mA		—	75	—	μV_{rms}
Ripple Rejection	R.R.	3	f = 120 Hz, 12.5 V ≦ V_{IN} ≦ 22.5 V I_{OUT} = 50 mA, T_j = 25°C		56	72	—	dB
Dropout Voltage	V_D	1	I_{OUT} = 1.0 A, T_j = 25°C		—	2.0	—	V
Short Circuit Current Limit	I_{SC}	1	T_j = 25°C		—	1.0	—	A
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.1	—	mV / °C

TA7812S

ELECTRICAL CHARACTERISTICS

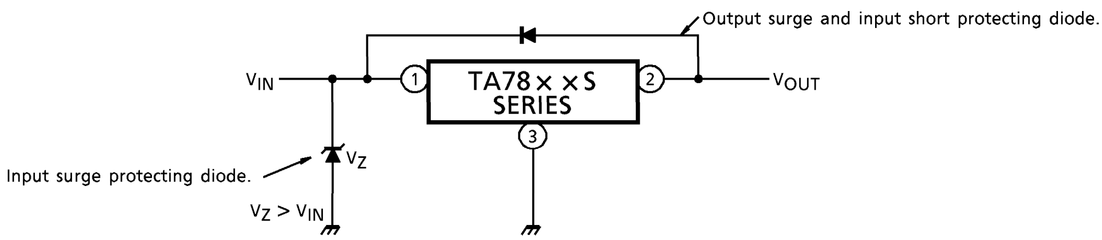
(Unless otherwise specified, V_{IN} = 19 V, I_{OUT} = 500 mA, 0°C ≦ T_j ≦ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	T_j = 25°C, I_{OUT} = 100 mA		11.5	12.0	12.5	V
Line Regulation	Reg·line	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 30 V	—	10	240	mV
				16 V ≦ V_{IN} = 22 V	—	3	120	
Load Regulation	Reg·load	1	T_j = 25°C	5 mA ≦ I_{OUT} ≦ 1.4 A	—	12	240	mV
				250 mA ≦ I_{OUT} ≦ 750 mA	—	4	120	
Output Voltage	V_{OUT}	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 27 V 5.0 mA ≦ I_{OUT} ≦ 1.0 A	11.4	—	12.6	V
Quiescent Current	I_B	1	T_j = 25°C, I_{OUT} = 5 mA		—	4.3	8.0	mA
Quiescent Current Change	ΔI_B	1	14.5 V ≦ V_{IN} ≦ 30 V, I_{OUT} = 5 mA, T_j = 25°C		—	—	1.0	mA
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz I_{OUT} = 50 mA		—	90	—	μV_{rms}
Ripple Rejection	R.R.	3	f = 120 Hz, 15 V ≦ V_{IN} ≦ 25 V I_{OUT} = 50 mA, T_j = 25°C		55	71	—	dB
Dropout Voltage	V_D	1	I_{OUT} = 1.0 A, T_j = 25°C		—	2.0	—	V
Short Circuit Current Limit	I_{SC}	1	T_j = 25°C		—	0.7	—	A
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	– 1.6	—	mV / °C

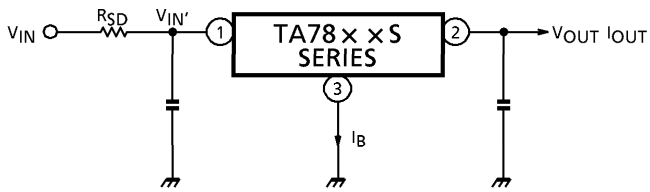
PRECAUTIONS ON APPLICATION

(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 shorts 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 insulating sheet (mica) and heat sink grease.

TABLE 1 Unit : °C/W

PACKAGE	MODEL No.	TORQUE	MICA	$\theta_C + \theta_S$
TO-220NIS	TA78××S	0.6N·m	Not Provided	0.4~0.6 (1.0~1.5)

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

The package of regulator IC serves as GND, therefore, usually use the value at time of "no mica."

(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.

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

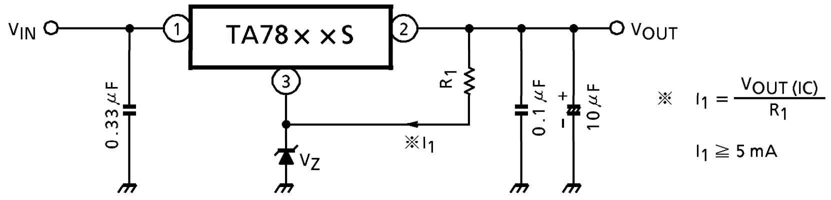
(c) Torque

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.
Further, if polycarbonate screws are used, the torque causes a change with the passage of time, which may lessen the effect of radiation.

APPLICATION CIRCUITS

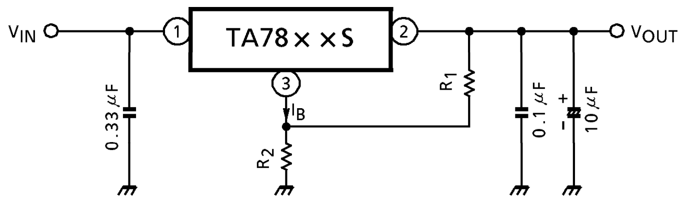
(1) VOLTAGE BOOST REGULATOR

(a) Voltage boost by use of zener diode



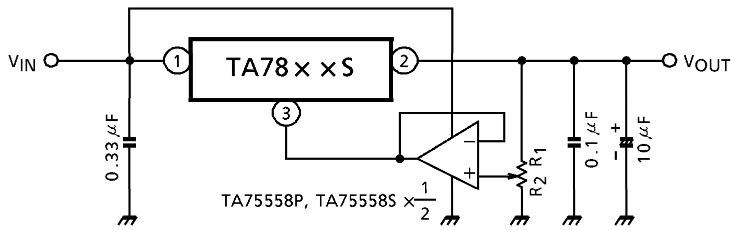
$$V_{OUT} = V_{OUT\,(IC)} + V_Z$$

(b) Voltage boost by use of resistor



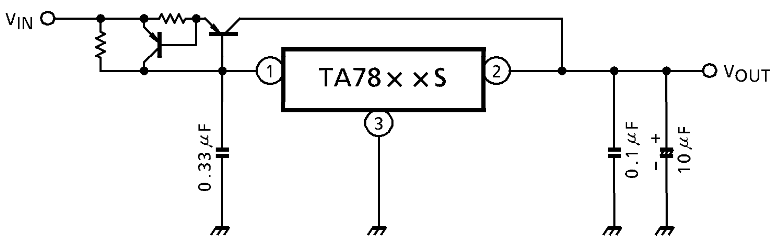
$$V_{OUT} = V_{OUT\,(IC)} \left(1 + \frac{R_2}{R_1}\right) + R_2 \cdot I_B$$

(c) Adjustable output regulator



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

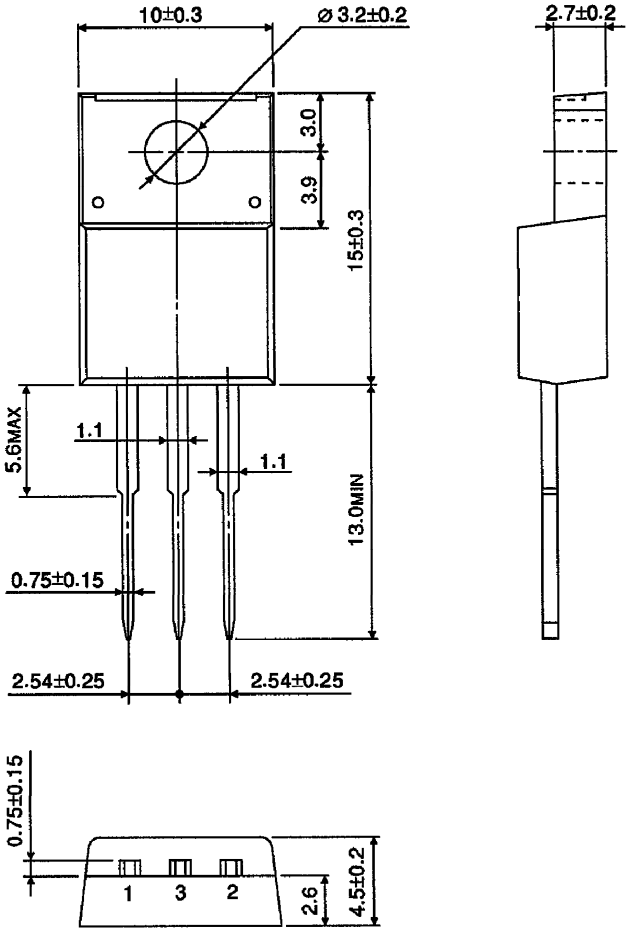
(2) CURRENT BOOST REGULATOR



PACKAGE DIMENSIONS

P-HSIP3-2.54A

Unit : mm



Weight : 1.7 g (Typ.)