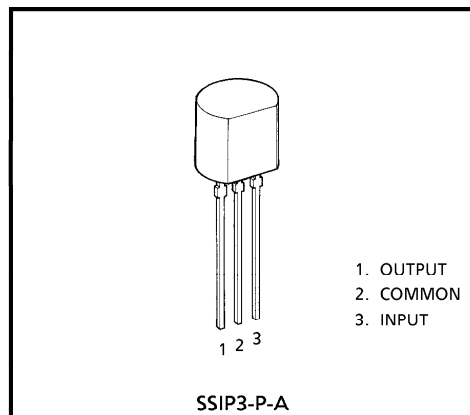


## THREE TERMINAL POSITIVE VOLTAGE REGULATORS 5V, 7V, 8V, 9V, 10V, 12V, 15V

The TA78Lx xS series of fixed voltage monolithic integrated circuit voltage regulators is designed for a wide range of applications.

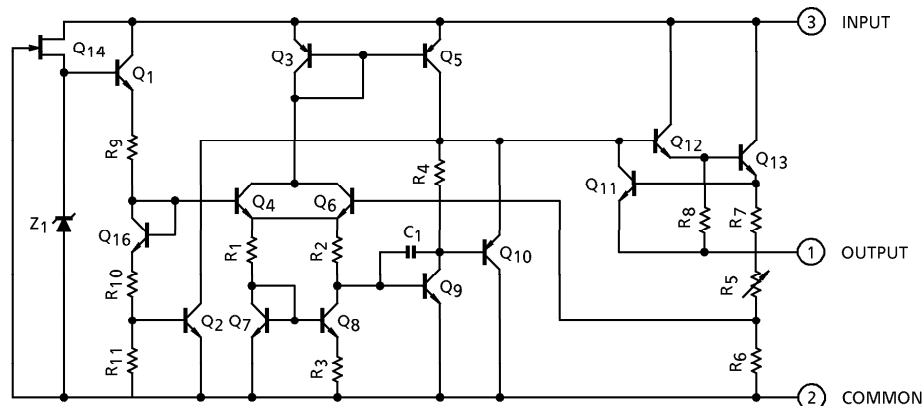
### FEATURES

- Suitable for TTL, C<sup>2</sup>MOS Power Supply
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- Maximum Output Current of 100mA ( $T_j = 25^\circ\text{C}$ )
- TO-92 Package



Weight : 0.21g (Typ.)

### EQUIVALENT CIRCUIT



**MAXIMUM RATINGS** (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V <sub>IN</sub>	35	V
Power Dissipation	(Ta = 25°C) P <sub>D</sub>	600	mW
Operating Temperature	T <sub>opr</sub>	-30~75	°C
Storage Temperature	T <sub>stg</sub>	-55~150	°C
Operating Junction Temperature	T <sub>j</sub>	-30~150	°C
Thermal Resistance	R <sub>th(j-a)</sub>	208	°C/W

TA78L05S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified, V<sub>IN</sub> = 10V, I<sub>OUT</sub> = 40mA, C<sub>IN</sub> = 0.33μF, C<sub>OUT</sub> = 0.1μF, 0°C ≤ T<sub>j</sub> ≤ 125°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V <sub>OUT</sub>	1	T <sub>j</sub> = 25°C	4.8	5.0	5.2	V	
Line Regulation	Reg.line	1	T <sub>j</sub> = 25°C	7.0V ≤ V <sub>IN</sub> ≤ 20V	—	55	150	mV
			8.0V ≤ V <sub>IN</sub> ≤ 20V	—	45	100		
Load Regulation	Reg.load	1	T <sub>j</sub> = 25°C	1.0mA ≤ I <sub>OUT</sub> ≤ 100mA	—	11	60	mV
				1.0mA ≤ I <sub>OUT</sub> ≤ 40mA	—	5.0	30	
Output Voltage	V <sub>OUT</sub>	1	T <sub>j</sub> = 25°C	7.0V ≤ V <sub>IN</sub> ≤ 20V	4.75	—	5.25	V
				1.0mA ≤ I <sub>OUT</sub> ≤ 40mA	4.75	—	5.25	
				1.0mA ≤ I <sub>OUT</sub> ≤ 70mA	4.75	—	5.25	
Quiescent Current	I <sub>B</sub>	1	T <sub>j</sub> = 25°C	—	3.1	6.0	mA	
			T <sub>j</sub> = 125°C	—	—	5.5		
Quiescent Current Change	ΔI <sub>B</sub>	1	8.0V ≤ V <sub>IN</sub> ≤ 20V	1.0mA ≤ I <sub>OUT</sub> ≤ 40mA	—	—	1.5	mA
					—	—	0.1	
Output Noise Voltage	V <sub>NO</sub>	2	Ta = 25°C, 10Hz ≤ f ≤ 100kHz	—	40	—	μV <sub>rms</sub>	
Long Term Stability	ΔV <sub>OUT</sub> / Δt	1	—	—	12	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	f = 120Hz, T <sub>j</sub> = 25°C 8.0V ≤ V <sub>IN</sub> ≤ 18V	41	49	—	dB	
Dropout Voltage	V <sub>IN</sub> - V <sub>OUT</sub>	1	T <sub>j</sub> = 25°C	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T <sub>CVO</sub>	1	I <sub>OUT</sub> = 5mA	—	-0.6	—	mV / °C	

TA78L07S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 12V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	6.72	7.0	7.28	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$9.2V \leq V_{IN} \leq 22V$	—	50	160	mV
				$10V \leq V_{IN} \leq 22V$	—	45	115	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	13	75	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	6.0	40	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$9.2V \leq V_{IN} \leq 22V$	6.65	—	7.35	V
				$1.0mA \leq I_{OUT} \leq 40mA$	6.65	—	7.35	
				$1.0mA \leq I_{OUT} \leq 70mA$	6.65	—	7.35	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.1	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$10V \leq V_{IN} \leq 22V$	—	—	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	—	—	0.1		
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	50	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	17	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $10V \leq V_{IN} \leq 20V$	37	46	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-0.84	—	mV / $^{\circ}C$	

TA78L08S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 14V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	7.7	8.0	8.3	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$10.5V \leq V_{IN} \leq 23V$	—	20	175	mV
				$11V \leq V_{IN} \leq 23V$	—	12	125	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	15	80	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	7.0	40	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$10.5V \leq V_{IN} \leq 23V$	7.6	—	8.4	V
				$1.0mA \leq I_{OUT} \leq 40mA$	7.6	—	8.4	
				$1.0mA \leq I_{OUT} \leq 70mA$	7.6	—	8.4	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.1	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$11V \leq V_{IN} \leq 23V$	$1.0mA \leq I_{OUT} \leq 40mA$	—	—	1.5	mA
				$1.0mA \leq I_{OUT} \leq 40mA$	—	—	0.1	
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	60	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	20	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $12V \leq V_{IN} \leq 23V$	37	45	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-0.97	—	mV / $^{\circ}C$	

TA78L09S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 15V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	8.64	9.0	9.36	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$11.4V \leq V_{IN} \leq 24V$	—	80	200	mV
				$12V \leq V_{IN} \leq 24V$	—	20	160	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	17	90	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	8.0	45	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$11.4V \leq V_{IN} \leq 24V$	8.55	—	9.45	V
				$1.0mA \leq I_{OUT} \leq 40mA$	8.55	—	9.45	
				$1.0mA \leq I_{OUT} \leq 70mA$	8.55	—	9.45	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.2	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$12V \leq V_{IN} \leq 24V$	—	—	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	—	—	0.1		
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	65	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	21	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $12V \leq V_{IN} \leq 24V$	36	44	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.09	—	mV / $^{\circ}C$	

TA78L10S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 16V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	9.6	10	10.4	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$12.5V \leq V_{IN} \leq 25V$	—	80	230	mV
				$13V \leq V_{IN} \leq 25V$	—	30	170	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	18	90	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	8.5	45	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$12.5V \leq V_{IN} \leq 25V$	9.5	—	10.5	V
				$1.0mA \leq I_{OUT} \leq 40mA$				
				$1.0mA \leq I_{OUT} \leq 70mA$	9.5	—	10.5	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.2	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$13V \leq V_{IN} \leq 25V$	$1.0mA \leq I_{OUT} \leq 40mA$	—	—	1.5	mA
					—	—	0.1	
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	70	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	22	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $13V \leq V_{IN} \leq 24V$	36	43	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.21	—	mV / $^{\circ}C$	

TA78L12S

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 19V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	11.5	12	12.5	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$14.5V \leq V_{IN} \leq 27V$	—	120	250	mV
				$16V \leq V_{IN} \leq 27V$	—	100	200	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	20	100	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	10	50	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$14.5V \leq V_{IN} \leq 27V$	11.4	—	12.6	V
				$1.0mA \leq I_{OUT} \leq 40mA$	11.4	—	12.6	
				$1.0mA \leq I_{OUT} \leq 70mA$	11.4	—	12.6	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.2	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$16V \leq V_{IN} \leq 27V$	—	—	1.5	mA	
				$1.0mA \leq I_{OUT} \leq 40mA$	—	—		0.1
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	80	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	24	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $15V \leq V_{IN} \leq 25V$	36	41	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.45	—	mV / $^{\circ}C$	

TA78L15S

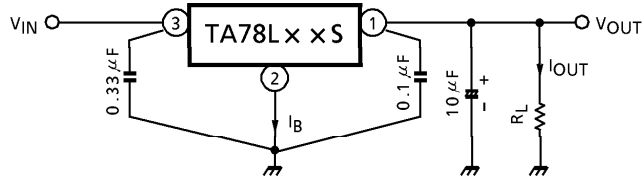
**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 23V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

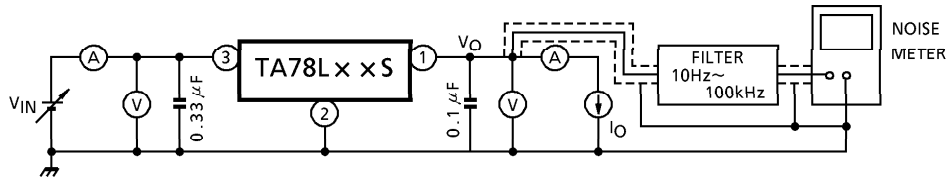
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	14.4	15	15.6	V	
Line Regulation	Reg.line	1	$T_j = 25^{\circ}C$	$17.5V \leq V_{IN} \leq 30V$	—	130	300	mV
				$20V \leq V_{IN} \leq 30V$	—	110	250	
Load Regulation	Reg.load	1	$T_j = 25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	—	25	150	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	—	12	75	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	$17.5V \leq V_{IN} \leq 30V$	14.25	—	15.75	V
				$1.0mA \leq I_{OUT} \leq 40mA$	14.25	—	15.75	
				$1.0mA \leq I_{OUT} \leq 70mA$	14.25	—	15.75	
Quiescent Current	$I_B$	1	$T_j = 25^{\circ}C$	—	3.3	6.5	mA	
			$T_j = 125^{\circ}C$	—	—	6.0		
Quiescent Current Change	$\Delta I_B$	1	$20V \leq V_{IN} \leq 30V$	—	—	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	—	—	0.1		
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	—	90	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	30	—	mV / 1.0kh	
Ripple Rejection	R.R.	3	$f = 120Hz$ , $T_j = 25^{\circ}C$ $18.5V \leq V_{IN} \leq 28.5V$	34	40	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.82	—	mV / $^{\circ}C$	



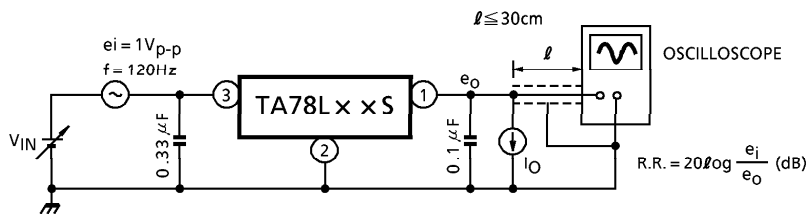
TEST CIRCUIT 1 / STANDARD APPLICATION



TEST CIRCUIT 2  $V_{NO}$



TEST CIRCUIT 3 R.R.

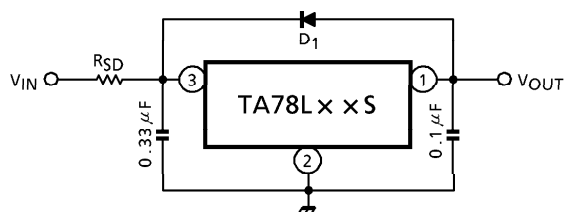


Precautions for Use

If high voltage in excess of output voltage (TYP. value) of IC is applied to its output terminal, IC may be destroyed. In this case, connect a Zener diode between the output terminal and GND to prevent application of excessive voltage. In particular, in such a current boosting circuit as shown in Application Circuit Example (2), if input voltage is suddenly applied by stages and furthermore, load is light, excessive voltage may be applied transiently to the output terminal of IC. In such a case as this, it may become necessary to increase capacity of output capacitor as appropriate, use a smaller  $R_1$  (a resistor for bypassing IC bias current) or gradually rise input voltage in addition to use of a Zener diode as mentioned above.

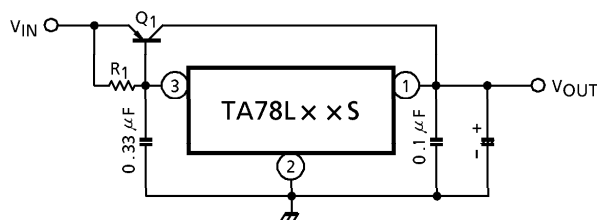
APPLICATION CIRCUIT

(1) STANDARD APPLICATION



$D_1$  : IC protective diode  
When surge voltage is applied to IC output terminal or  $V_{IN} < V_{OUT}$  at the time of power ON/OFF, always connect the high speed swithing diode  $D_1$ .  
 $R_{SD}$  : Power limiting resistor  
If  $V_{IN}$  is too high, always connect  $R_{SD}$  in order to reduce power consumption of IC.

(2) A. CURRENT BOOST VOLTAGE REGULATOR

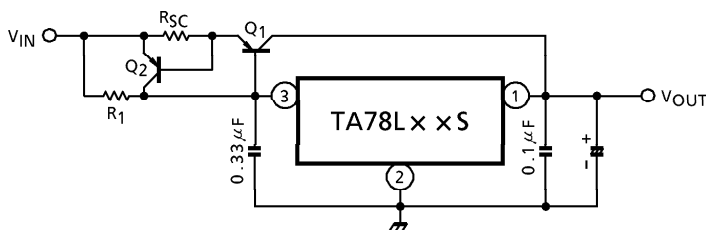


Use a required rediation plate for  $Q_1$ .

$$R_1 \leq \frac{V_{BE1}}{I_B \text{ MAX}}$$

where,  $V_{BE1}$  :  $V_{BE}$  of external transistor  $Q_1$ .  
 $I_B \text{ MAX}$  : Max. bias current of IC.

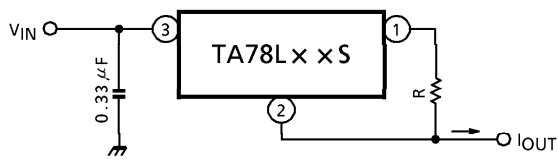
B. SHORT-CIRCUIT PROTECTION



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

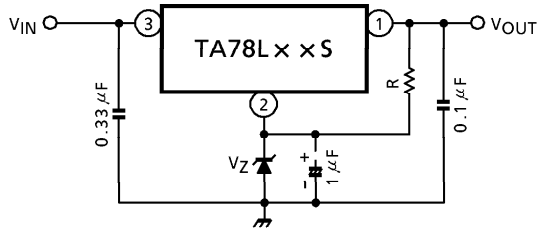
where,  $I_{SC}$  : Short-Circuit current

(3) CURRENT REGULATOR

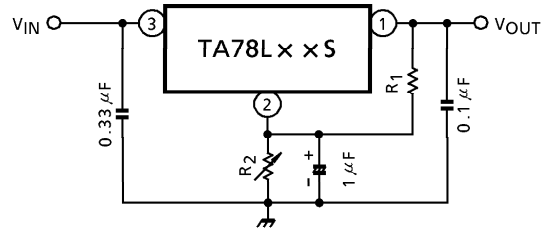


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

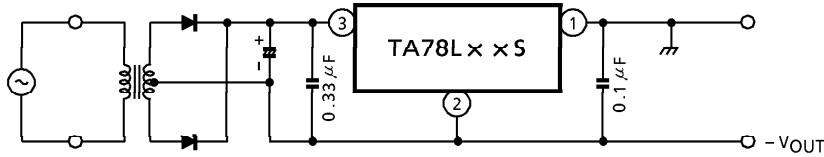


$V_{OUT} = V_Z + V_{OUT}(\text{of IC})$   
Apply current of several mA to R.

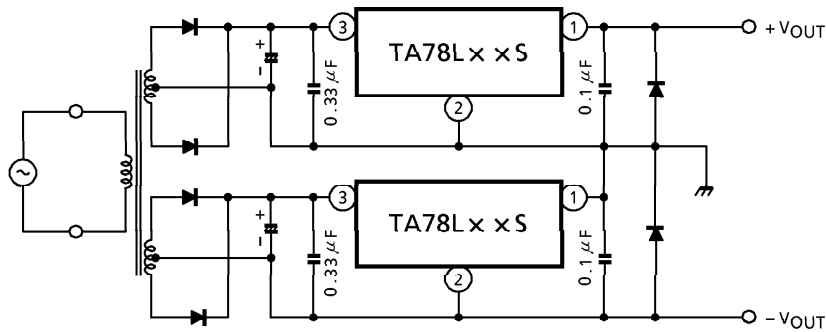


$$V_{OUT} = R_2 \left( I_B + \frac{V_{OUT}(\text{of IC})}{R_1} \right) + V_{OUT}(\text{of IC})$$

(5) NEGATIVE REGULATOR

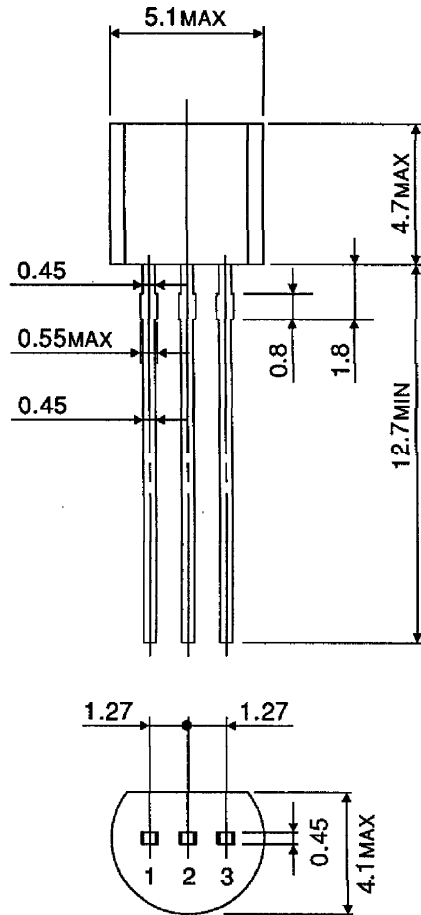


(6) POSITIVE AND NEGATIVE REGULATOR



OUTLINE DRAWING  
SSIP3-P-A

Unit : mm



Weight : 0.21g (Typ.)

TA78L05S - 12*
1994 - 3 - 7
<b>TOSHIBA CORPORATION</b>