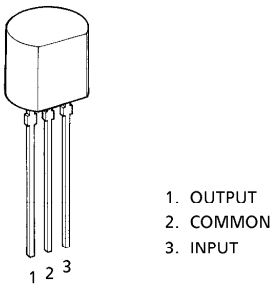
THREE TERMINAL POSITIVE VOLTAGE REGULATORS

5V, 7V, 8V, 9V, 10V, 12V, 15V

The TA78L××S series of fixed voltage monolithic integrated circuit voltage regulators is designed for a wide range of applications.



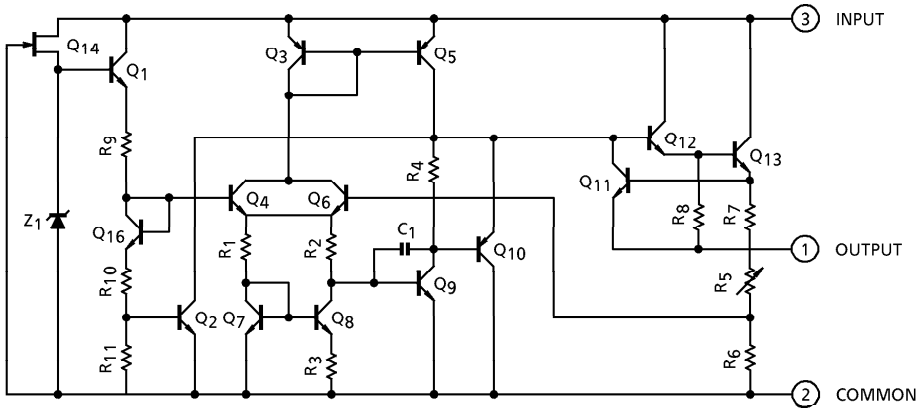
SSIP3-P-A

Weight : 0.21g (Typ.)

FEATURES

- Suitable for TTL, C^2MOS Power Supply
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- Maximum Output Current of 100mA ($T_j = 25°C$)
- TO-92 Package

EQUIVALENT CIRCUIT



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage		V_{IN}	35	V
Power Dissipation	(Ta = 25°C)	P_D	600	mW
Operating Temperature		T_{opr}	−30~75	°C
Storage Temperature		T_{stg}	−55~150	°C
Operating Junction Temperature		T_j	−30~150	°C
Thermal Resistance		$R_{th\ (j-a)}$	208	°C / W

TA78L05S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 10V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		4.8	5.0	5.2	V
Line Regulation	Reg.line	1	T_j = 25°C	7.0V ≦ V_{IN} ≦ 20V	—	55	150	mV
				8.0V ≦ V_{IN} ≦ 20V	—	45	100	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	11	60	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	5.0	30	
Output Voltage	V_{OUT}	1	T_j = 25°C	7.0V ≦ V_{IN} ≦ 20V 1.0mA ≦ I_{OUT} ≦ 40mA	4.75	—	5.25	V
				1.0mA ≦ I_{OUT} ≦ 70mA	4.75	—	5.25	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.0	mA
			T_j = 125°C		—	—	5.5	
Quiescent Current Change	ΔI_B	1	8.0V ≦ V_{IN} ≦ 20V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	40	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	12	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 8.0V ≦ V_{IN} ≦ 18V		41	49	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	−0.6	—	mV / °C

TA78L07S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 12V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		6.72	7.0	7.28	V
Line Regulation	Reg.line	1	T_j = 25°C	9.2V ≦ V_{IN} ≦ 22V	—	50	160	mV
				10V ≦ V_{IN} ≦ 22V	—	45	115	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	13	75	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	6.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	9.2V ≦ V_{IN} ≦ 22V 1.0mA ≦ I_{OUT} ≦ 40mA	6.65	—	7.35	V
				1.0mA ≦ I_{OUT} ≦ 70mA	6.65	—	7.35	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	10V ≦ V_{IN} ≦ 22V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	50	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	17	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 10V ≦ V_{IN} ≦ 20V		37	46	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	– 0.84	—	mV / °C

TA78L08S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 14V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		7.7	8.0	8.3	V
Line Regulation	Reg.line	1	T_j = 25°C	10.5V ≦ V_{IN} ≦ 23V	—	20	175	mV
				11V ≦ V_{IN} ≦ 23V	—	12	125	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	15	80	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	7.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	10.5V ≦ V_{IN} ≦ 23V 1.0mA ≦ I_{OUT} ≦ 40mA	7.6	—	8.4	V
				1.0mA ≦ I_{OUT} ≦ 70mA	7.6	—	8.4	
Quiescent Current	I_B	1	T_j = 25°C		—	3.1	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	11V ≦ V_{IN} ≦ 23V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	60	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	20	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 12V ≦ V_{IN} ≦ 23V		37	45	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	– 0.97	—	mV / °C

TA78L09S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 15V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		8.64	9.0	9.36	V
Line Regulation	Reg.line	1	T_j = 25°C	11.4V ≦ V_{IN} ≦ 24V	—	80	200	mV
				12V ≦ V_{IN} ≦ 24V	—	20	160	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	17	90	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	8.0	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	11.4V ≦ V_{IN} ≦ 24V 1.0mA ≦ I_{OUT} ≦ 40mA	8.55	—	9.45	V
				1.0mA ≦ I_{OUT} ≦ 70mA	8.55	—	9.45	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	12V ≦ V_{IN} ≦ 24V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	65	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	21	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 12V ≦ V_{IN} ≦ 24V		36	44	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	– 1.09	—	mV / °C

TA78L10S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 16V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		9.6	10	10.4	V
Line Regulation	Reg.line	1	T_j = 25°C	12.5V ≦ V_{IN} ≦ 25V	—	80	230	mV
				13V ≦ V_{IN} ≦ 25V	—	30	170	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	18	90	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	8.5	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	12.5V ≦ V_{IN} ≦ 25V 1.0mA ≦ I_{OUT} ≦ 40mA	9.5	—	10.5	V
				1.0mA ≦ I_{OUT} ≦ 70mA	9.5	—	10.5	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	13V ≦ V_{IN} ≦ 25V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	70	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	22	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 13V ≦ V_{IN} ≦ 24V		36	43	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	− 1.21	—	mV / °C

TA78L12S

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 19V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 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		11.5	12	12.5	V
Line Regulation	Reg.line	1	T_j = 25°C	14.5V ≦ V_{IN} ≦ 27V	—	120	250	mV
				16V ≦ V_{IN} ≦ 27V	—	100	200	
Load Regulation	Reg.load	1	T_j = 25°C	1.0mA ≦ I_{OUT} ≦ 100mA	—	20	100	mV
				1.0mA ≦ I_{OUT} ≦ 40mA	—	10	50	
Output Voltage	V_{OUT}	1	T_j = 25°C	14.5V ≦ V_{IN} ≦ 27V 1.0mA ≦ I_{OUT} ≦ 40mA	11.4	—	12.6	V
				1.0mA ≦ I_{OUT} ≦ 70mA	11.4	—	12.6	
Quiescent Current	I_B	1	T_j = 25°C		—	3.2	6.5	mA
			T_j = 125°C		—	—	6.0	
Quiescent Current Change	ΔI_B	1	16V ≦ V_{IN} ≦ 27V		—	—	1.5	mA
			1.0mA ≦ I_{OUT} ≦ 40mA		—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10Hz ≦ f ≦ 100kHz		—	80	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	24	—	mV / 1.0kh
Ripple Rejection	R.R.	3	f = 120Hz, T_j = 25°C 15V ≦ V_{IN} ≦ 25V		36	41	—	dB
Dropout Voltage	$\lvert V_{IN}-V_{OUT} \rvert$	1	T_j = 25°C		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5mA		—	− 1.45	—	mV / °C

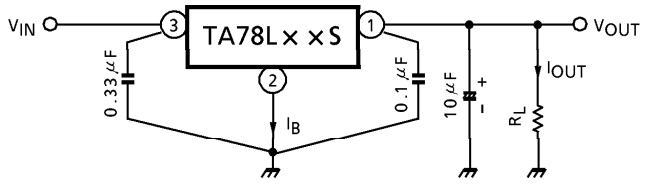
TA78L15S

ELECTRICAL CHARACTERISTICS

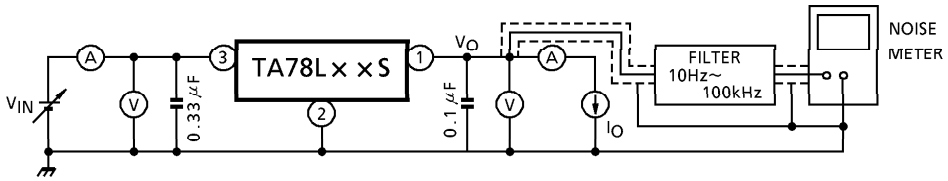
(Unless otherwise specified, V_{IN} = 23V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, 0°C ≦ T_j ≦ 125°C)

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

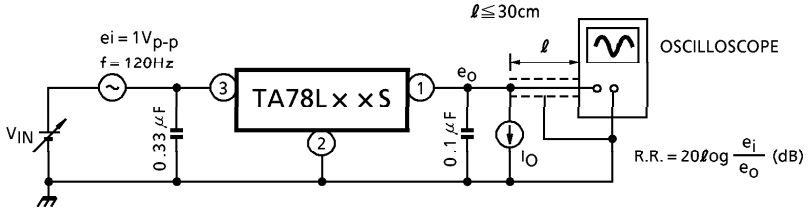
TEST CIRCUIT 1 / STANDARD APPLICATION



TEST CIRCUIT 2 V_{NO}



TEST CIRCUIT 3 R.R.

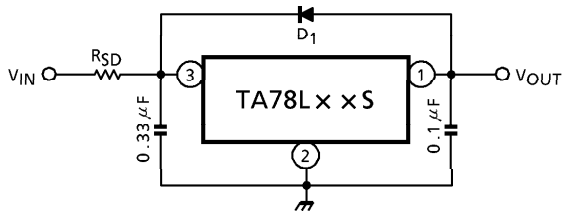


Precautions for Use

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

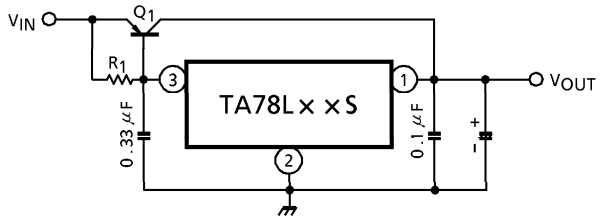
(1) STANDARD APPLICATION



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

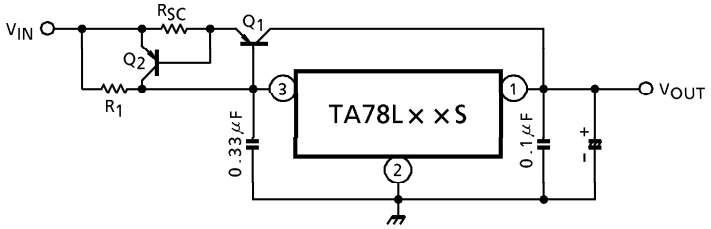


Use a required rediation plate for Q_1.

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

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

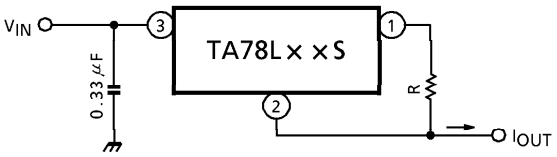
B. SHORT-CIRCUIT PROTECTION



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

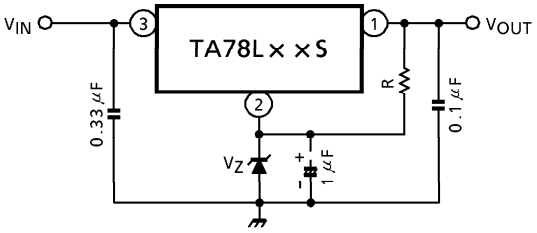
where, I_{SC} : Short-Circuit current

(3) CURRENT REGULATOR

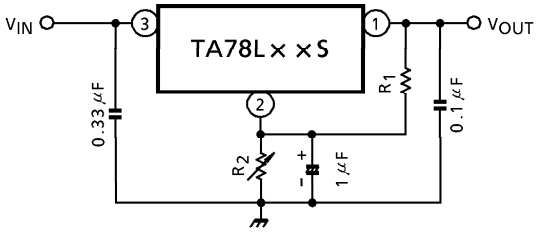


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

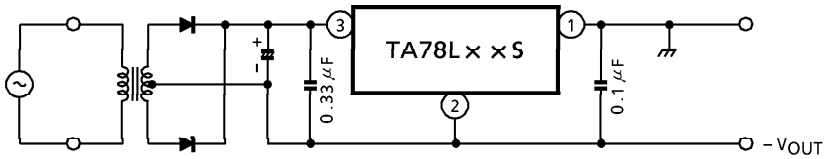


$V_{OUT} = V_Z + V_{OUT}$ (of IC)
Apply current of several mA to R.

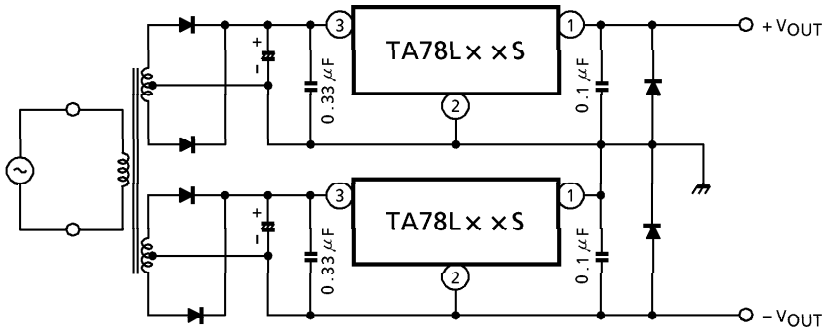


$$V_{OUT} = R_2 \left(I_B + \frac{V_{OUT}\ (\text{of IC})}{R_1}\right) + V_{OUT}\ (\text{of IC})$$

(5) NEGATIVE REGULATOR



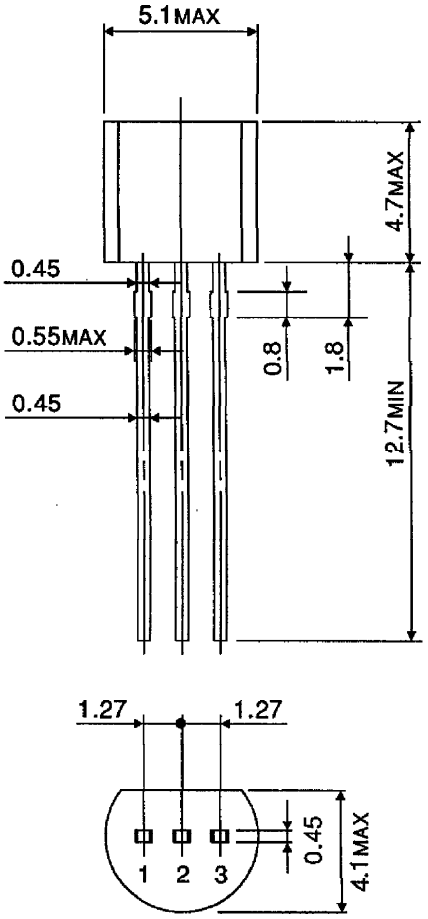
(6) POSITIVE AND NEGATIVE REGULATOR



OUTLINE DRAWING

SSIP3-P-A

Unit : mm



Weight : 0.21g (Typ.)