

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

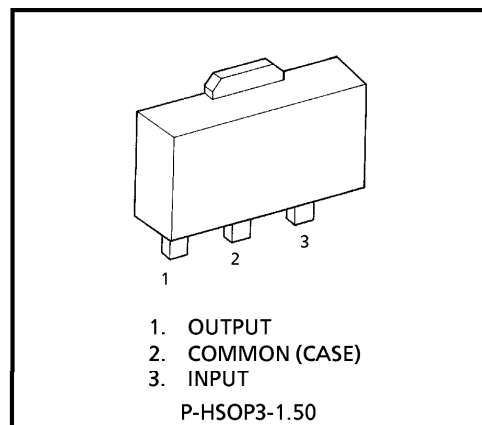
**TA78L05F, TA78L06F, TA78L07F, TA78L08F, TA78L09F, TA78L10F
TA78L12F, TA78L15F, TA78L18F, TA78L20F, TA78L24F**

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

3-TERMINAL POSITIVE VOLTAGE REGULATORS

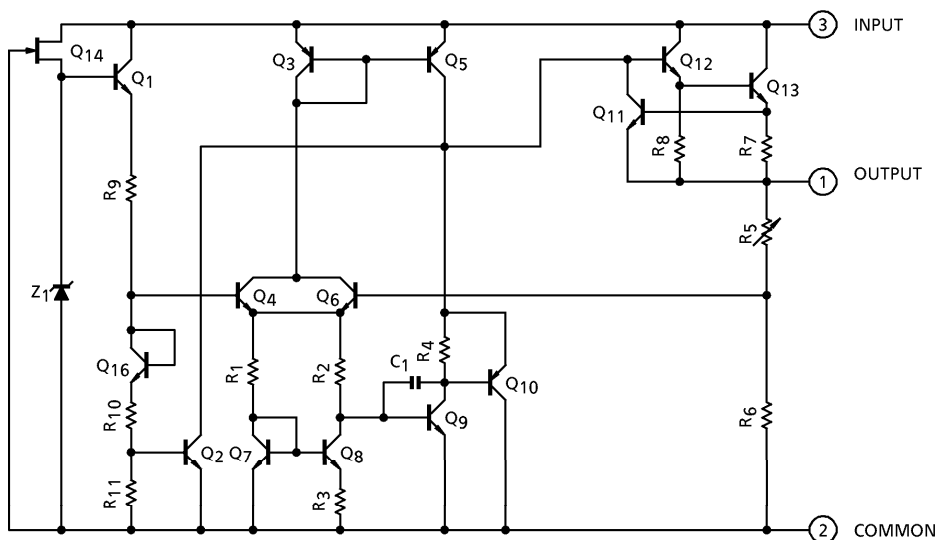
FEATURES

- Best suited to power supply for TTL/CMOS
- No external part needed
- Built-in thermal protective circuit
- Built-in short-circuit current limiting
- Max. output current 150mA. ($T_j = 25^\circ\text{C}$)
- Packaged in POWER MINI. (SOT-89)



Weight : 0.05 g (Typ.)

EQUIVALENT CIRCUIT



TYPE	MARKING
TA78L05F	AE
TA78L06F	BE
TA78L07F	KE
TA78L08F	CE
TA78L09F	DE
TA78L10F	EE
TA78L12F	FE
TA78L15F	GE
TA78L18F	HE
TA78L20F	IE
TA78L24F	JE

980910EBA1

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	TA78L05F	V _{IN}	35	V
	TA78L06F			
	TA78L07F			
	TA78L08F			
	TA78L09F			
	TA78L10F			
	TA78L12F			
	TA78L15F			
	TA78L18F			
	TA78L20F		40	
	TA78L24F			
Power Dissipation	(Ta = 25°C)	P _D	500	mW
Power Dissipation		P _D	500	mW
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-a)}	250	°C / W

TA78L05F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{IN} = 10\text{ V}$, $I_{OUT} = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	4.75	5.0	5.25	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$7.0\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	55	150	mV
				$8.0\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	45	100	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	11	60	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	5.0	30	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$7.0\text{ V} \leq V_{IN} \leq 20\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	4.65	—	5.35	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	4.65	—	5.35	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.1	6.0	mA	
			$T_j = 125^\circ\text{C}$	—	—	5.5		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$8.0\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	40	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	12	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $8.0\text{ V} \leq V_{IN} \leq 18\text{ V}$, $T_j = 25^\circ\text{C}$	41	49	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.6	—	mV/ $^\circ\text{C}$	

TA78L06F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{IN} = 11\text{ V}$, $I_{OUT} = 40\text{ mA}$, $C_{IN} = 0.33\ \mu\text{F}$, $C_{OUT} = 0.1\ \mu\text{F}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	5.7	6.0	6.3	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$8.1\text{ V} \leq V_{IN} \leq 21\text{ V}$	—	50	150	mV
				$9.0\text{ V} \leq V_{IN} \leq 21\text{ V}$	—	45	110	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	12	70	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	5.5	35	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$8.1\text{ V} \leq V_{IN} \leq 21\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	5.58	—	6.42	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	5.58	—	6.42	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.1	6.0	mA	
			$T_j = 125^\circ\text{C}$	—	—	5.5		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$9.0\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	40	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	14	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $9.0\text{ V} \leq V_{IN} \leq 19\text{ V}$, $T_j = 25^\circ\text{C}$	39	47	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.7	—	mV/°C	

TA78L07F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	6.65	7.0	7.35	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$9.2\text{ V} \leq V_{IN} \leq 22\text{ V}$	—	50	160	mV
				$10\text{ V} \leq V_{IN} \leq 22\text{ V}$	—	45	115	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	13	75	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	6.0	40	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$9.2\text{ V} \leq V_{IN} \leq 22\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	6.51	—	7.49	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	6.51	—	7.49	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.1	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$10\text{ V} \leq V_{IN} \leq 22\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	50	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	17	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $10\text{ V} \leq V_{IN} \leq 20\text{ V}$, $T_j = 25^\circ\text{C}$	37	46	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.75	—	mV/°C	

TA78L08F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	7.6	8.0	8.4	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	20	175	mV
				$11\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	12	125	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	15	80	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	7.0	40	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	7.44	—	8.56	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	7.44	—	8.56	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.1	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$11\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	60	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	20	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $12\text{ V} \leq V_{IN} \leq 23\text{ V}$, $T_j = 25^\circ\text{C}$	37	45	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.8	—	mV/°C	

TA78L09F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	8.55	9.0	9.45	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$11.4\text{ V} \leq V_{IN} \leq 24\text{ V}$	—	80	200	mV
				$12\text{ V} \leq V_{IN} \leq 24\text{ V}$	—	20	160	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	17	90	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	8.0	45	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$11.4\text{ V} \leq V_{IN} \leq 24\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	8.37	—	9.63	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	8.37	—	9.63	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.2	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$12\text{ V} \leq V_{IN} \leq 24\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	65	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	21	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $12\text{ V} \leq V_{IN} \leq 24\text{ V}$, $T_j = 25^\circ\text{C}$	36	44	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.85	—	mV/°C	

TA78L10F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	9.5	10	10.5	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$12.5\text{ V} \leq V_{IN} \leq 25\text{ V}$	—	80	230	mV
				$13\text{ V} \leq V_{IN} \leq 25\text{ V}$	—	30	170	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	18	90	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	8.5	45	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$12.5\text{ V} \leq V_{IN} \leq 25\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	9.3	—	10.7	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	9.3	—	10.7	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.2	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$13\text{ V} \leq V_{IN} \leq 25\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	70	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	22	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $13\text{ V} \leq V_{IN} \leq 24\text{ V}$, $T_j = 25^\circ\text{C}$	36	43	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-0.9	—	mV/°C	

TA78L12F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	11.4	12	12.6	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$	—	120	250	mV
				$16\text{ V} \leq V_{IN} \leq 27\text{ V}$	—	100	200	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	20	100	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	10	50	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	11.16	—	12.84	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	11.16	—	12.84	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.2	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$16\text{ V} \leq V_{IN} \leq 27\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	80	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	24	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $15\text{ V} \leq V_{IN} \leq 25\text{ V}$, $T_j = 25^\circ\text{C}$	36	41	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-1.0	—	mV/°C	

TA78L15F

ELECTRICAL CHARACTERISTICS

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	14.25	15	15.75	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$	—	130	300	mV
				$20\text{ V} \leq V_{IN} \leq 30\text{ V}$	—	110	250	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	25	150	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	12	75	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$,	13.95	—	16.05	V
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$				
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	13.95	—	16.05	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.3	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$20\text{ V} \leq V_{IN} \leq 30\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	90	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	30	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $18.5\text{ V} \leq V_{IN} \leq 28.5\text{ V}$, $T_j = 25^\circ\text{C}$	34	40	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-1.3	—	mV/°C	

TA78L18F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{IN} = 27\text{ V}$, $I_{OUT} = 40\text{ mA}$, $C_{IN} = 0.33\ \mu\text{F}$, $C_{OUT} = 0.1\ \mu\text{F}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	17.1	18	18.9	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$21.4\text{ V} \leq V_{IN} \leq 33\text{ V}$	—	32	325	mV
				$22\text{ V} \leq V_{IN} \leq 33\text{ V}$	—	27	275	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	30	170	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	15	75	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$21.4\text{ V} \leq V_{IN} \leq 33\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	16.74	—	19.26	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	16.74	—	19.26	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.3	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$22\text{ V} \leq V_{IN} \leq 33\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	150	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	45	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $23\text{ V} \leq V_{IN} \leq 33\text{ V}$, $T_j = 25^\circ\text{C}$	32	38	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-1.5	—	mV/°C	

TA78L20F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{IN} = 29\text{ V}$, $I_{OUT} = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	19.0	20	21.0	V	
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$23.5\text{ V} \leq V_{IN} \leq 35\text{ V}$	—	33	330	mV
				$24\text{ V} \leq V_{IN} \leq 35\text{ V}$	—	28	285	
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	33	180	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	17	90	
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$23.5\text{ V} \leq V_{IN} \leq 35\text{ V}$.	18.6	—	21.4	V
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$				
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	18.6	—	21.4	
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.3	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$24\text{ V} \leq V_{IN} \leq 35\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	170	—	μV_{rms}	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	49	—	mV/kh	
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $25\text{ V} \leq V_{IN} \leq 35\text{ V}$, $T_j = 25^\circ\text{C}$	31	37	—	dB	
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-1.7	—	mV/°C	

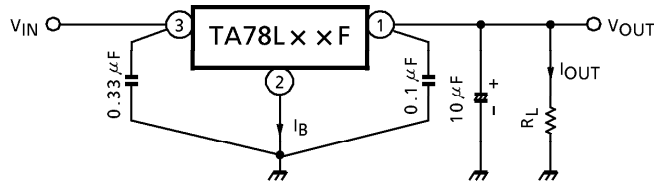
TA78L24F

ELECTRICAL CHARACTERISTICS

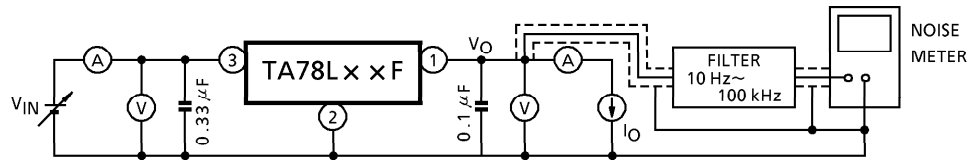
(Unless otherwise specified, $V_{IN} = 33\text{ V}$, $I_{OUT} = 40\text{ mA}$, $C_{IN} = 0.33\ \mu\text{F}$, $C_{OUT} = 0.1\ \mu\text{F}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	22.8	24	25.2	V
Line Regulation	Reg·line	1	$T_j = 25^\circ\text{C}$	$27.5\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	35	350
				$28\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	30	300
Load Regulation	Reg·load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	40	200
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	20	100
Output Voltage	V_{OUT}	1	$T_j = 25^\circ\text{C}$	$27.5\text{ V} \leq V_{IN} \leq 38\text{ V}$, $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	22.32	—	25.68
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	22.32	—	25.68
Quiescent Current	I_B	1	$T_j = 25^\circ\text{C}$	—	3.5	6.5	
			$T_j = 125^\circ\text{C}$	—	—	6.0	
Quiescent Current Change	ΔI_B	1	$T_j = 25^\circ\text{C}$	$28\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	—	1.5
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1
Output Noise Voltage	V_{NO}	2	$T_a = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	200	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	56	—	mV/kh
Ripple Rejection Ratio	R.R.	3	$f = 120\text{ Hz}$, $29\text{ V} \leq V_{IN} \leq 39\text{ V}$, $T_j = 25^\circ\text{C}$	31	35	—	dB
Dropout Voltage	V_D	1	$T_j = 25^\circ\text{C}$, $I_{OUT} = 150\text{ mA}$	—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	$I_{OUT} = 5\text{ mA}$	—	-2.0	—	mV/°C

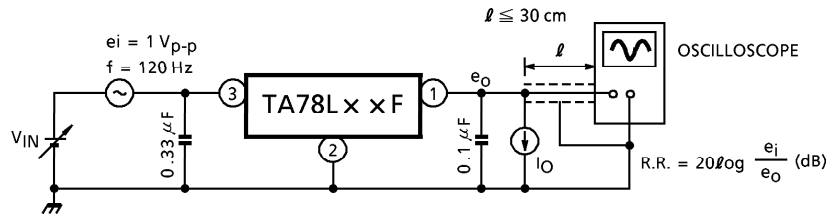
TEST CIRCUIT 1 / STANDARD APPLICATION

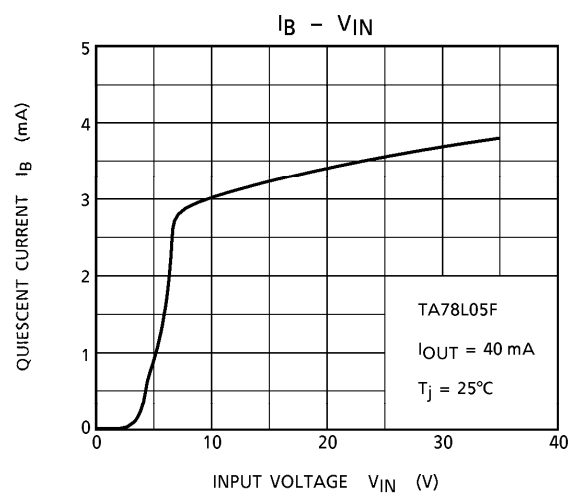
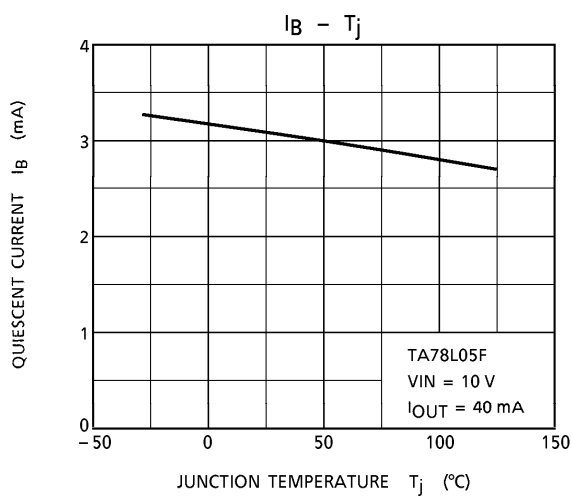
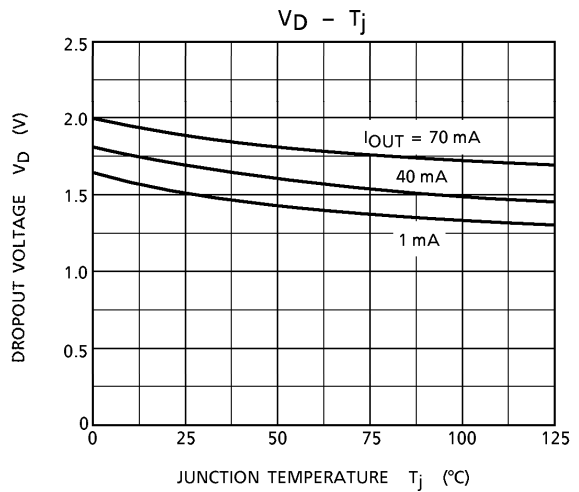
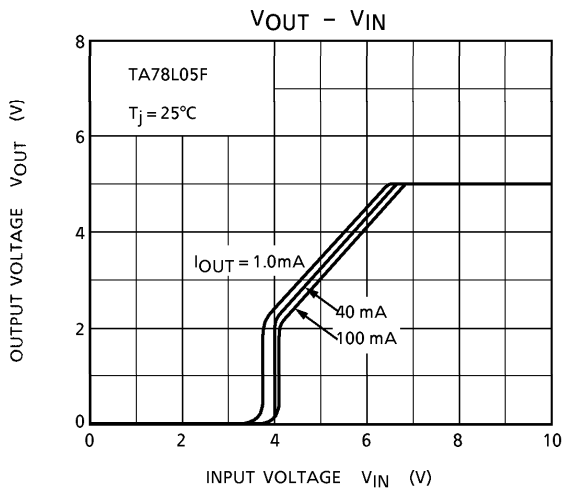
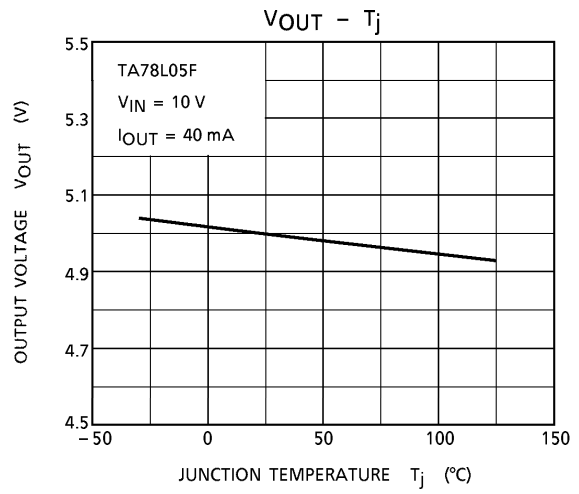
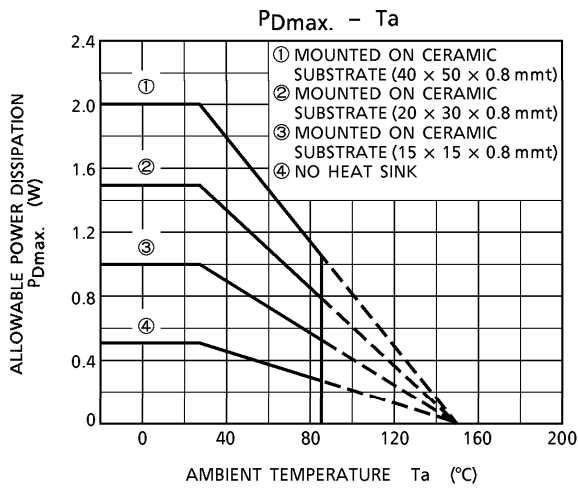


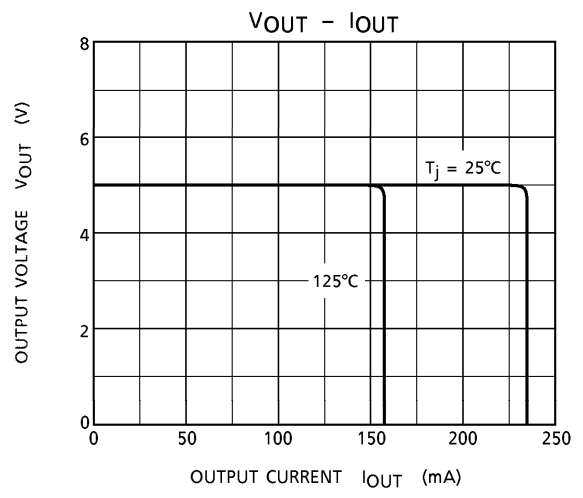
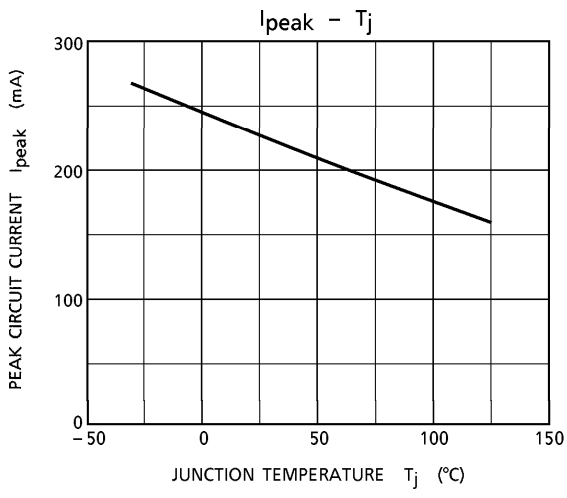
TEST CIRCUIT 2 V_{NO}



TEST CIRCUIT 3 R.R.





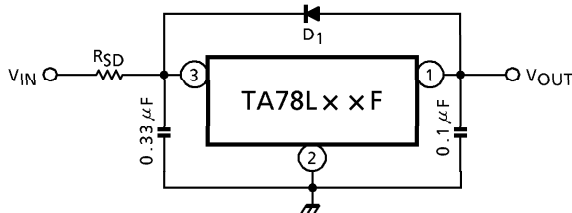


Precautions for Use

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 R₁ (a resistor for bypassing IC bias current) or gradually rise input voltage in addition to use of a Zener diode as mentioned above.

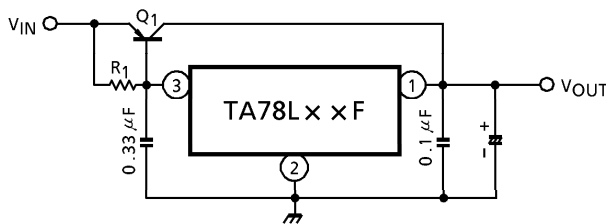
APPLICATION CIRCUIT

(1) STANDARD APPLICATION



D₁ : 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 D₁.
 R_{SD} : Power limiting resistor
 If V_{IN} is too high, always connect R_{SD} in order to reduce power consumption of IC.

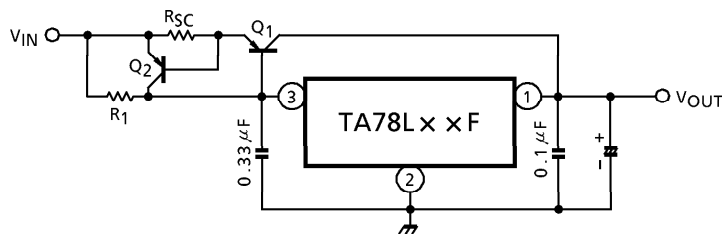
(2) A. CURRENT BOOST VOLTAGE REGULATOR



Use a required rediation plate for Q₁.

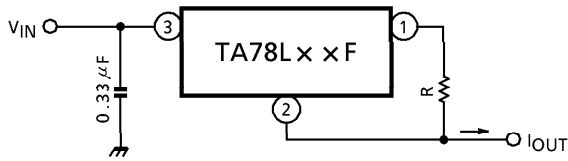
$$R_1 \leq \frac{V_{BE1}}{I_B \text{ MAX}}$$
 where, V_{BE1} : V_{BE} of external transistor Q₁.
 I_B MAX : Max. bias current of IC.

B. SHORT-CIRCUIT PROTECTION



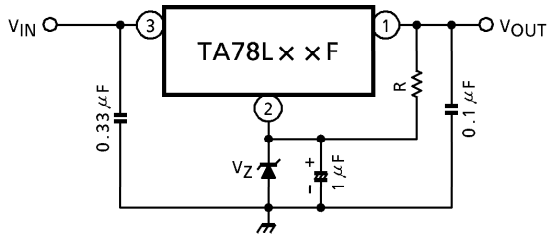
$$R_{SC} = \frac{V_{BE2}}{I_{SC}}$$
 where, I_{SC} : Short-Circuit current

(3) CURRENT REGULATOR

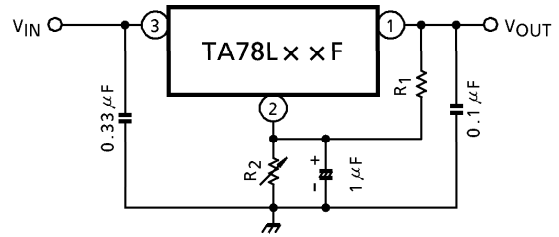


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

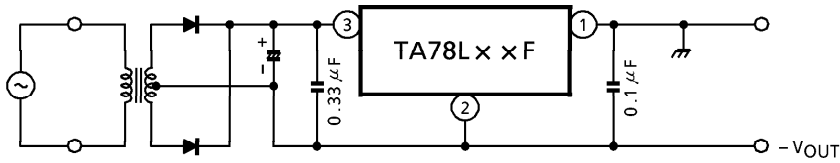


$V_{OUT} = V_Z + V_{OUT}(\text{of IC})$
Apply current of several mA to R.

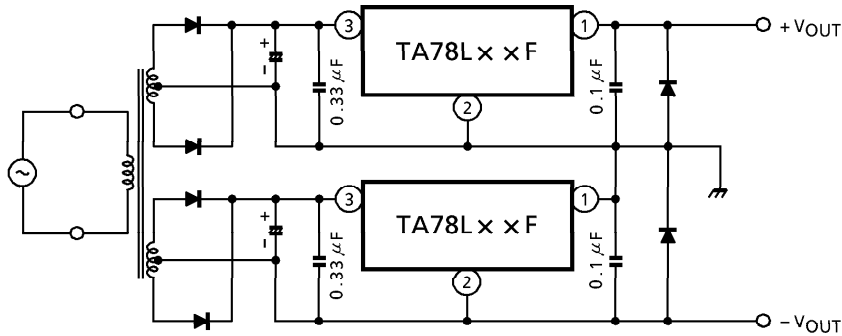


$$V_{OUT} = R_2 \left(I_B + \frac{V_{OUT}(\text{of IC})}{R_1} \right) + V_{OUT}(\text{of IC})$$

(5) NEGATIVE REGULATOR

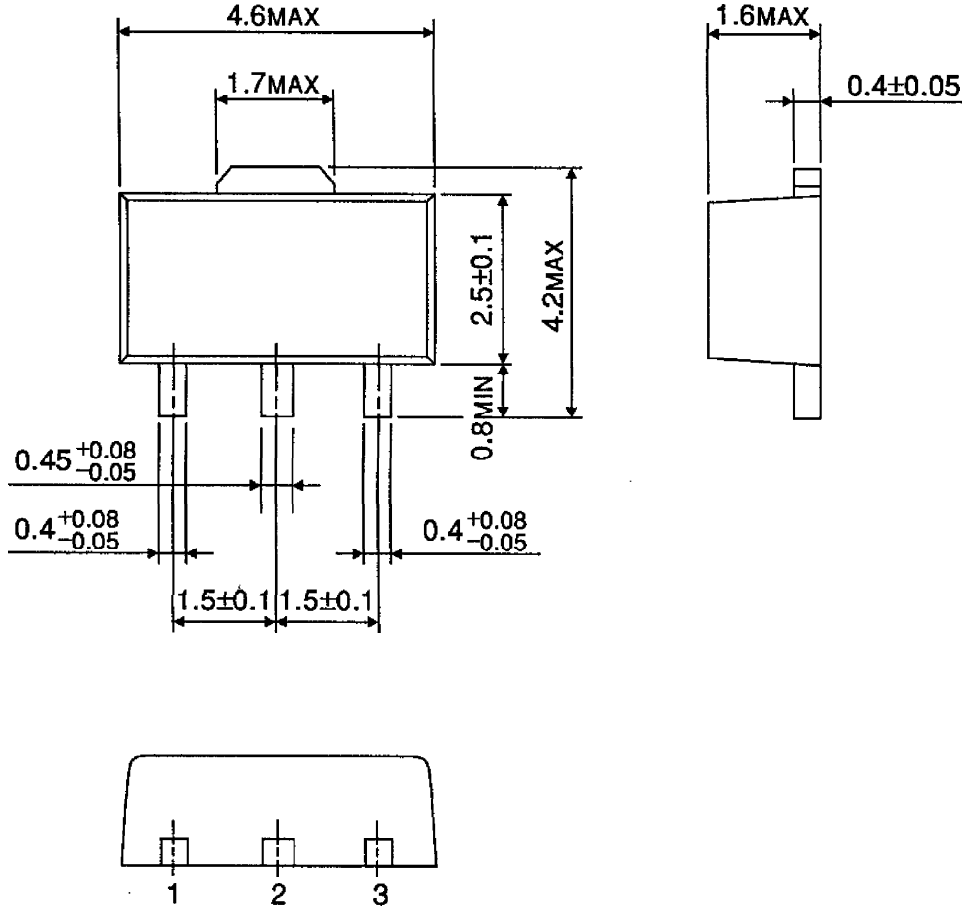


(6) POSITIVE AND NEGATIVE REGULATOR



PACKAGE DIMENSIONS
P-HSOP3-1.50

Unit : mm



Weight : 0.05 g (Typ.)