

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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

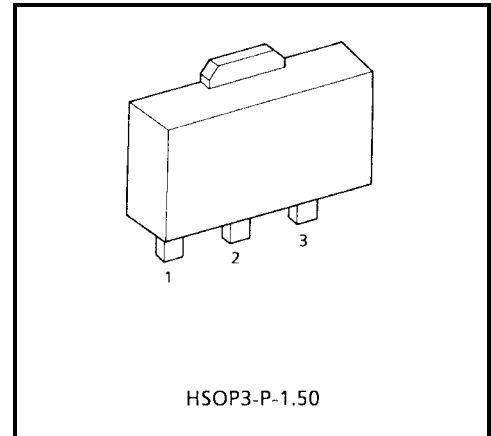
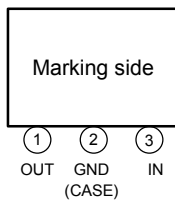
5 V, 6 V, 7 V, 8 V, 9 V, 10 V, 12 V, 15 V, 18 V, 20 V, 24 V

3-Terminal Positive Voltage Regulators

### Features

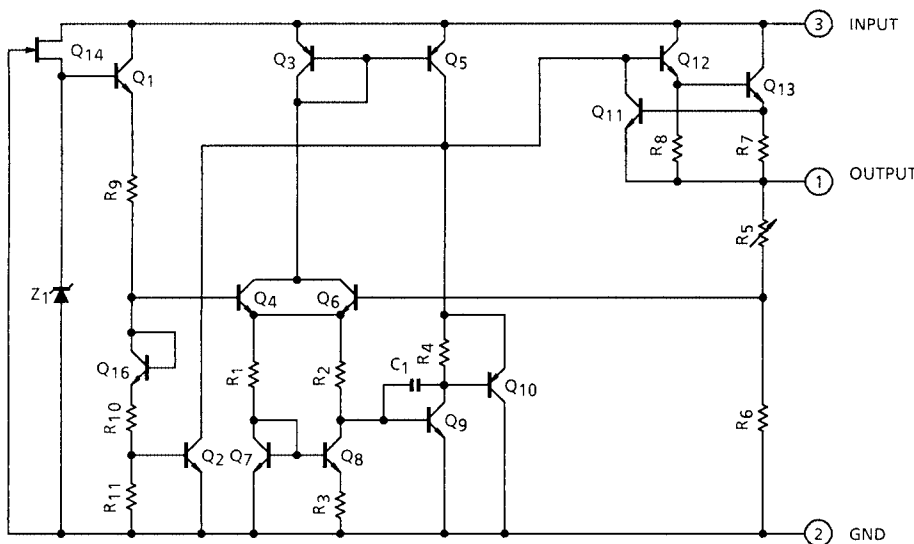
- Best suited to power supply for TTL/CMOS.
- No external part needed.
- Built-in thermal protective circuit.
- Built-in short-circuit current limiting.
- Max output current 150mA. ( $T_j = 25^\circ\text{C}$ ).
- Packaged in POWER MINI (SOT-89).

### Pin Assignment



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

## Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Input voltage	TA78L05F	35	V
	TA78L06F		
	TA78L07F		
	TA78L08F		
	TA78L09F		
	TA78L10F		
	TA78L12F		
	TA78L15F		
	TA78L18F		
	TA78L20F		
	TA78L24F	40	
Power dissipation (Ta = 25°C)	P <sub>D</sub>	500	mW
Power dissipation	P <sub>D</sub>	500	mW
Operating temperature	T <sub>opr</sub>	-30~85	°C
Storage temperature	T <sub>stg</sub>	-55~150	°C
Junction temperature	T <sub>j</sub>	150	°C
Thermal resistance	R <sub>th(j-a)</sub>	250	°C/W

## TA78L05F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit	
Output voltage	V <sub>OUT</sub>	1	T <sub>j</sub> = 25°C	4.75	5.0	5.25	V	
Line regulation	Reg·line	1	T <sub>j</sub> = 25°C	7.0 V ≤ V <sub>IN</sub> ≤ 20 V	—	55	150	mV
				8.0 V ≤ V <sub>IN</sub> ≤ 20 V	—	45	100	
Load regulation	Reg·load	1	T <sub>j</sub> = 25°C	1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA	—	11	60	mV
				1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA	—	5.0	30	
Output voltage	V <sub>OUT</sub>	1	T <sub>j</sub> = 25°C	7.0 V ≤ V <sub>IN</sub> ≤ 20 V, 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA	4.65	—	5.35	V
				1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA	4.65	—	5.35	
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	T <sub>j</sub> = 25°C	8.0 V ≤ V <sub>IN</sub> ≤ 20 V	—	—	1.5	mA
				1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA	—	—	0.1	
Output noise voltage	V <sub>NO</sub>	2	Ta = 25°C, 10 Hz ≤ f ≤ 100 kHz	—	40	—	μV <sub>rms</sub>	
Long term stability	ΔV <sub>OUT</sub> /Δt	1	—	—	12	—	mV/kh	
Ripple rejection ratio	R.R.	3	f = 120 Hz, 8.0 V ≤ V <sub>IN</sub> ≤ 18 V, T <sub>j</sub> = 25°C	41	49	—	dB	
Dropout voltage	V <sub>D</sub>	1	T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA	—	1.7	—	V	
Average temperature coefficient of output voltage	T <sub>CV0</sub>	1	I <sub>OUT</sub> = 5 mA	—	-0.6	—	mV/°C	

## TA78L06F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L07F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L08F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L09F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L10F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{\text{rms}}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L12F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	



## TA78L15F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$T_j = 25^\circ\text{C}$	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$ , $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	13.95	—	16.05	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L18F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

## TA78L20F

### Electrical Characteristics

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

Characteristics	Symbol	Test Circuit	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	$T_j = 25^\circ\text{C}$	$23.5\text{ V} \leq V_{IN} \leq 35\text{ V}$ , $1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	18.6	—	21.4	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	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	$\Delta I_B$	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	—	$\mu\text{V}_{rms}$	
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	—	$\text{mV}/^\circ\text{C}$	

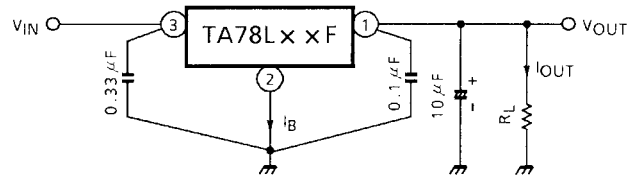
## TA78L24F

### Electrical Characteristics

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

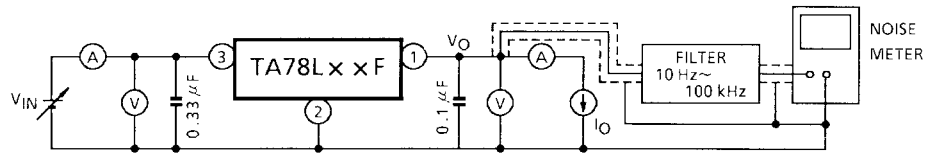
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit	
Output voltage	$V_{OUT}$	1	$T_j = 25^\circ\text{C}$	22.8	24	25.2	V	
Line regulation	Reg-line	1	$T_j = 25^\circ\text{C}$	$27.5\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	35	350	mV
				$28\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	30	300	
Load regulation	Reg-load	1	$T_j = 25^\circ\text{C}$	$1.0\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$	—	40	200	mV
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	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	V
				$1.0\text{ mA} \leq I_{OUT} \leq 70\text{ mA}$	22.32	—	25.68	
Quiescent current	$I_B$	1	$T_j = 25^\circ\text{C}$	—	3.5	6.5	mA	
			$T_j = 125^\circ\text{C}$	—	—	6.0		
Quiescent current change	$\Delta I_B$	1	$T_j = 25^\circ\text{C}$	$28\text{ V} \leq V_{IN} \leq 38\text{ V}$	—	—	1.5	mA
				$1.0\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$	—	—	0.1	
Output noise voltage	$V_{NO}$	2	$T_a = 25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$	—	200	—	$\mu\text{V}_{\text{rms}}$	
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	—	$\text{mV}/^\circ\text{C}$	

## Test Circuit 1/Standard Application



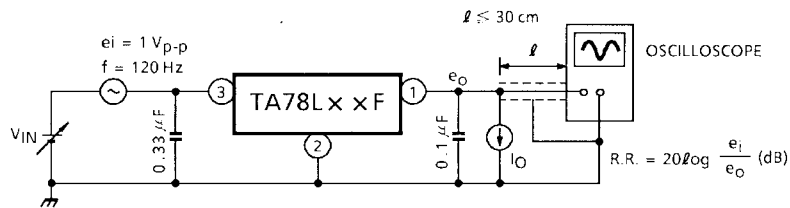
## Test Circuit 2

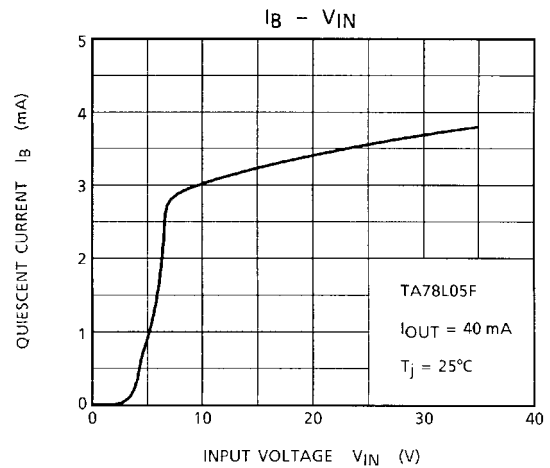
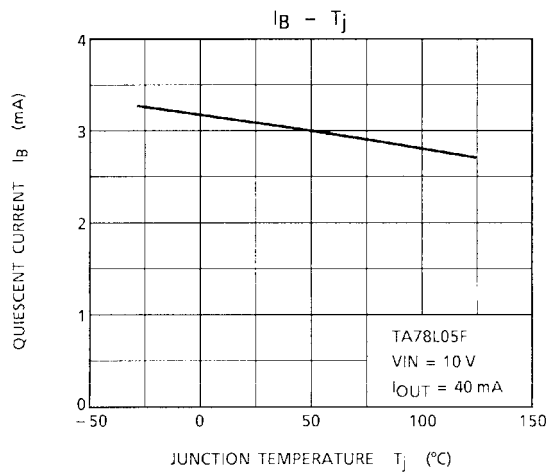
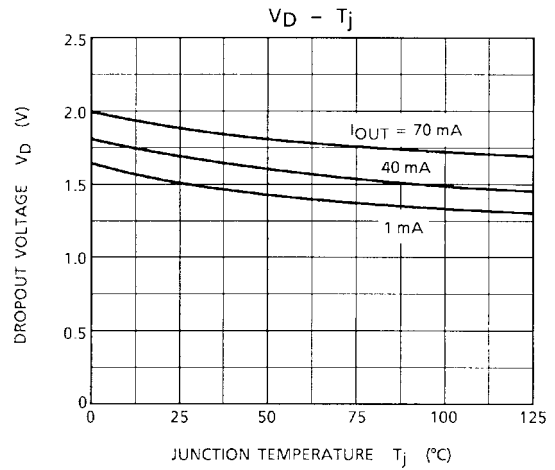
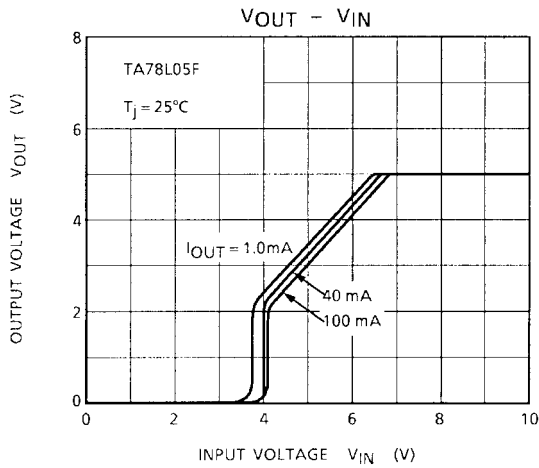
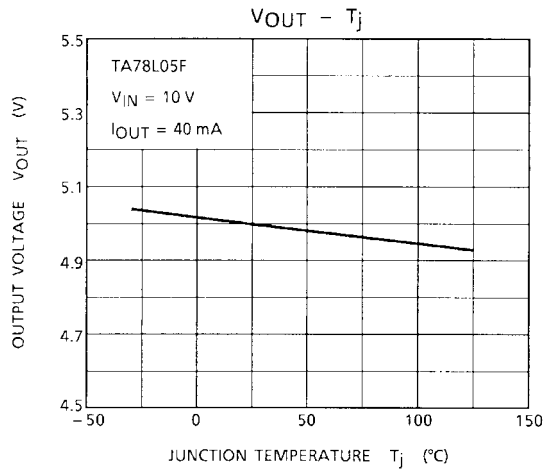
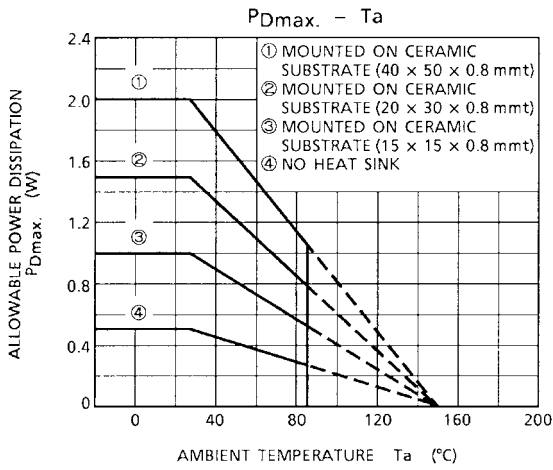
$V_{NO}$

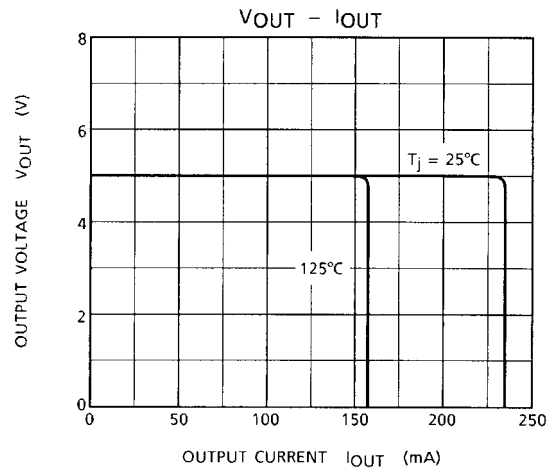
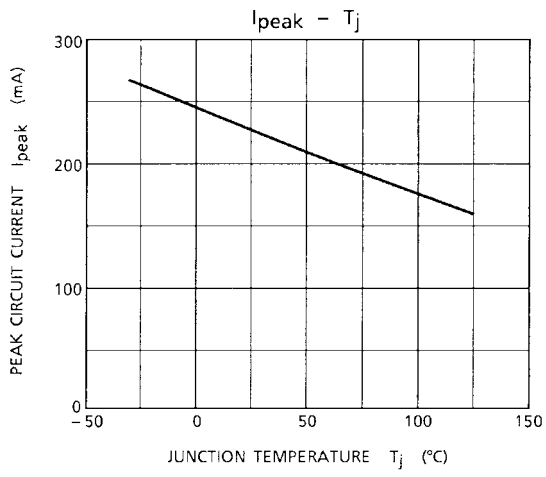


## Test Circuit 3

R.R.





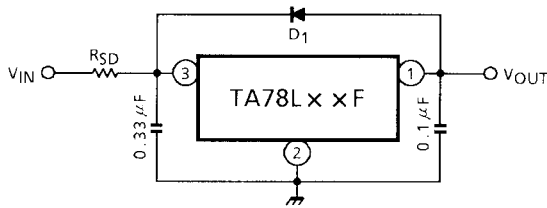


**Precautions for Use**

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<sub>1</sub> (a resistor for bypassing IC bias current) or gradually rise input voltage in addition to use of a Zener diode as mentioned above.

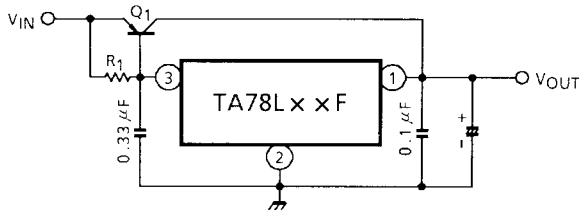
**Application Circuits**

**(1) Standard Application**



D<sub>1</sub> : IC protective diode  
 When surge voltage is applied to IC output terminal or V<sub>IN</sub> < V<sub>OUT</sub> at the time of power ON/OFF, always connect the high speed swithing diode D<sub>1</sub>.  
 R<sub>SD</sub> : Power limiting resistor  
 If V<sub>IN</sub> is too high, always connect R<sub>SD</sub> in order to reduce power consumption of IC.

**(2) A. Current Boost Voltage Regulator**

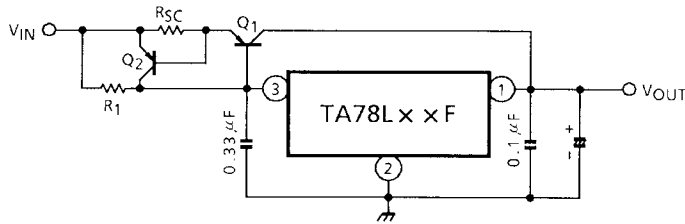


Use a required rediation plate for Q<sub>1</sub>.

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

where, V<sub>BE1</sub> : V<sub>BE</sub> of external transistor Q<sub>1</sub>.  
 I<sub>B</sub> MAX : Max. bias current of IC.

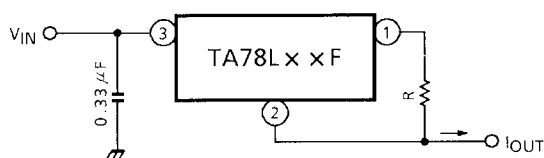
**B. Short-Circuit Protection**



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

where, I<sub>SC</sub> : Short-Circuit current

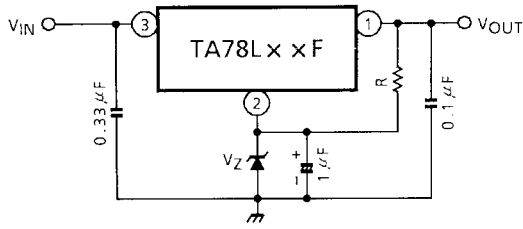
**(3) Current Regulator**



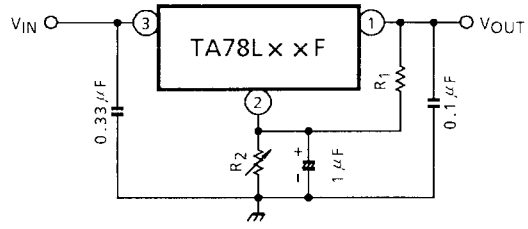
$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$



**(4) Voltage Boost Regulator**

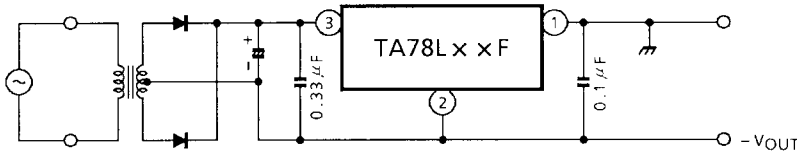


$V_{OUT} = V_Z + V_{OUT} \text{ (of IC)}$   
Apply current of several mA to R.

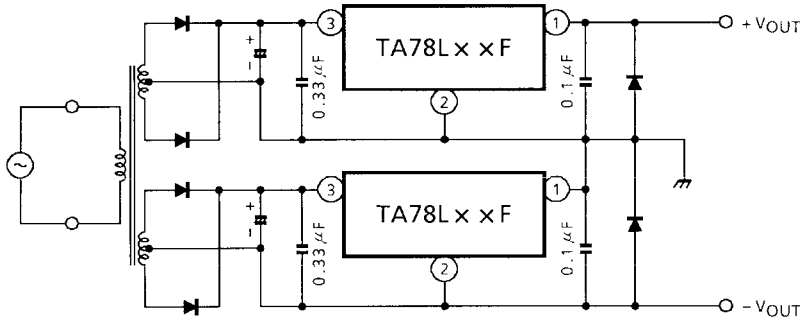


$$V_{OUT} = R_2 \left( I_B + \frac{V_{OUT} \text{ (of IC)}}{R_1} \right) + V_{OUT} \text{ (of IC)}$$

**(5) Negative Regulator**



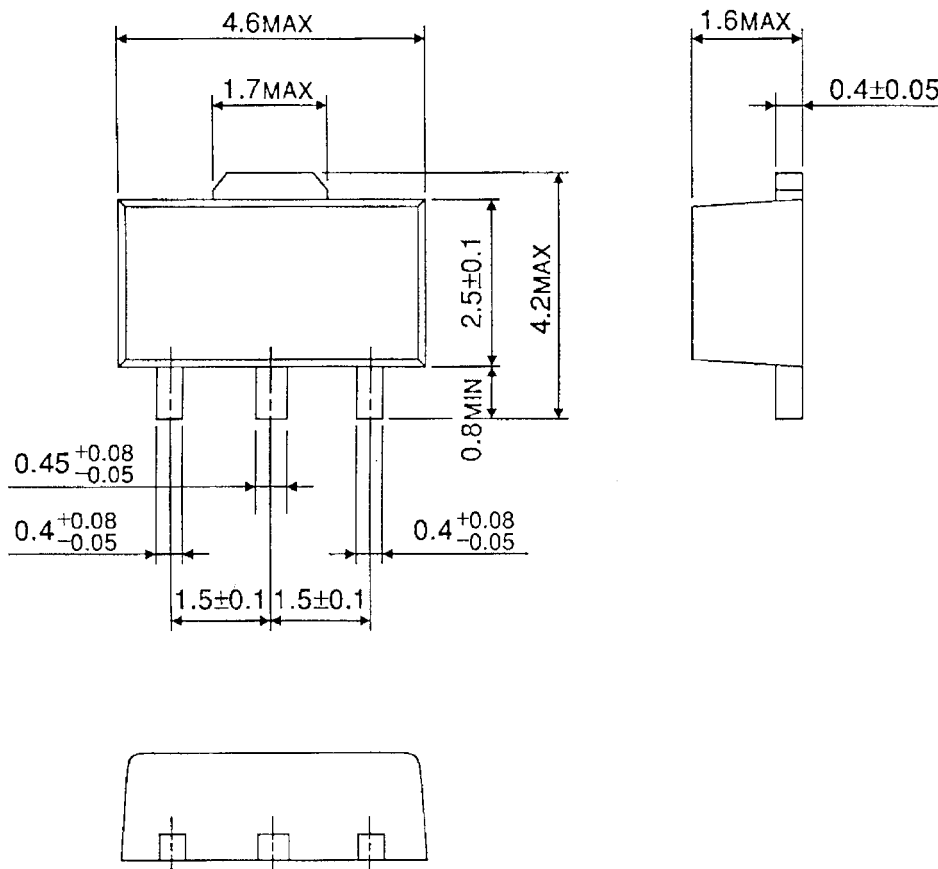
**(6) Positive and Negative Regulator**



## Package Dimensions

HSOP3-P-1.50

Unit : mm



Weight : 0.05 g (Typ.)

**RESTRICTIONS ON PRODUCT USE**

000707EBA

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