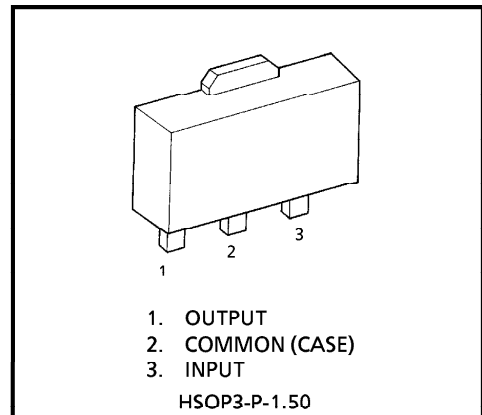


TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC  
**TA78L05F, TA78L06F, TA78L08F, TA78L09F, TA78L10F**  
**TA78L12F, TA78L15F, TA78L18F, TA78L20F, TA78L24F**

**5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V**  
**3-TERMINAL POSITIVE VOLTAGE REGULATORS**

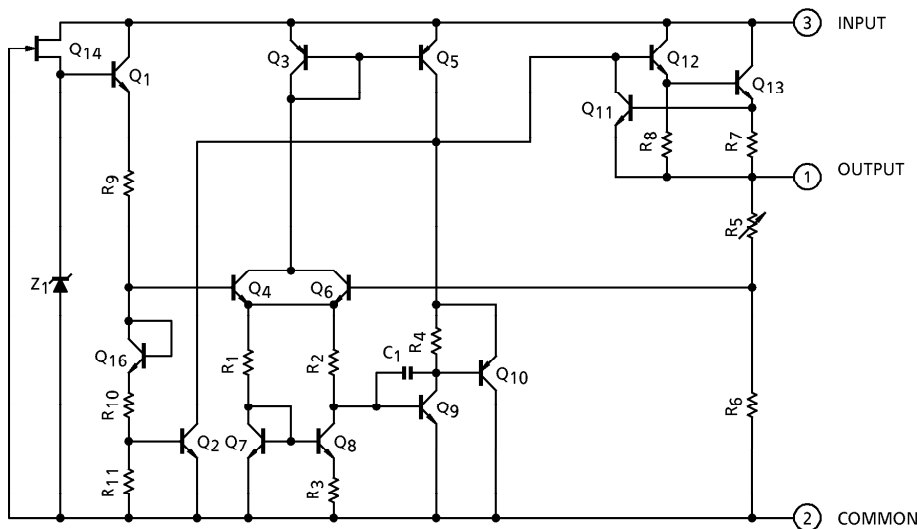
**FEATURES**

- 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 : 0.05g (Typ.)

**EQUIVALENT CIRCUIT**



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

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- The information contained herein is subject to change without notice.

## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	TA78L05F	V <sub>IN</sub>	35	V
	TA78L06F			
	TA78L08F			
	TA78L09F			
	TA78L10F			
	TA78L12F			
	TA78L15F			
	TA78L18F		40	
	TA78L20F			
	TA78L24F			
Power Dissipation	(Ta = 25°C)	P <sub>D</sub>	500	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>	250	°C/W

TA78L05F

**ELECTRICAL CHARACTERISTICS**

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

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

TA78L06F

**ELECTRICAL CHARACTERISTICS**

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

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

TA78L08F

**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 CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	7.6	8.0	8.4	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	$T_j = 25^{\circ}C$	$10.5V \leq V_{IN} \leq 23V$	7.44	—	8.56	V
				$1.0mA \leq I_{OUT} \leq 40mA$	7.44	—	8.56	
				$1.0mA \leq I_{OUT} \leq 70mA$	7.44	—	8.56	
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	$11V \leq V_{IN} \leq 23V$	—	—	1.5	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 Ratio	R.R.	3	$f = 120Hz$ $12V \leq V_{IN} \leq 23V$ , $T_j = 25^{\circ}C$	37	45	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-0.8	—	mV / $^{\circ}C$	

TA78L09F

**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 CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	8.55	9.0	9.45	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	$T_j = 25^{\circ}C$	$11.4V \leq V_{IN} \leq 24V$	8.37	—	9.63	V
				$1.0mA \leq I_{OUT} \leq 40mA$	8.37	—	9.63	
				$1.0mA \leq I_{OUT} \leq 70mA$	8.37	—	9.63	
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 Ratio	R.R.	3	$f = 120Hz$ $12V \leq V_{IN} \leq 24V$ , $T_j = 25^{\circ}C$	36	44	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-0.85	—	mV / $^{\circ}C$	

TA78L10F

**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 CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	9.5	10	10.5	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	$T_j = 25^{\circ}C$	$12.5V \leq V_{IN} \leq 25V$	9.3	—	10.7	V
				$1.0mA \leq I_{OUT} \leq 40mA$	9.3	—	10.7	
				$1.0mA \leq I_{OUT} \leq 70mA$	9.3	—	10.7	
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	$13V \leq V_{IN} \leq 25V$	—	—	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	—	—	0.1		
Output Noise Voltage	$V_{NO}$	2	$T_a = 25^{\circ}C$ $10Hz \leq f \leq 100kHz$	—	70	—	$\mu V_{rms}$	
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—	—	22	—	mV / 1.0kh	
Ripple Rejection Ratio	R.R.	3	$f = 120Hz$ $13V \leq V_{IN} \leq 24V$ , $T_j = 25^{\circ}C$	36	43	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-0.9	—	mV / $^{\circ}C$	

TA78L12F

**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 CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	11.4	12	12.6	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	$T_j = 25^{\circ}C$	$14.5V \leq V_{IN} \leq 27V$	11.16	—	12.84	V
				$1.0mA \leq I_{OUT} \leq 40mA$	11.16	—	12.84	
				$1.0mA \leq I_{OUT} \leq 70mA$	11.16	—	12.84	
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 Ratio	R.R.	3	$f = 120Hz$ $15V \leq V_{IN} \leq 25V$ , $T_j = 25^{\circ}C$	36	41	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.0	—	mV / $^{\circ}C$	



TA78L15F

**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 CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j = 25^{\circ}C$	14.25	15	15.75	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	$T_j = 25^{\circ}C$	$17.5V \leq V_{IN} \leq 30V$	13.95	—	16.05	V
				$1.0mA \leq I_{OUT} \leq 40mA$	13.95	—	16.05	
				$1.0mA \leq I_{OUT} \leq 70mA$	13.95	—	16.05	
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 Ratio	R.R.	3	$f = 120Hz$ $18.5V \leq V_{IN} \leq 28.5V$ , $T_j = 25^{\circ}C$	34	40	—	dB	
Dropout Voltage	$ V_{IN} - V_{OUT} $	1	$T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$	—	1.7	—	V	
Average Temperature Coefficient of Output Voltage	$T_{CVO}$	1	$I_{OUT} = 5mA$	—	-1.3	—	mV / $^{\circ}C$	

TA78L18F

**ELECTRICAL CHARACTERISTICS**

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

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

TA78L20F

**ELECTRICAL CHARACTERISTICS**

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

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

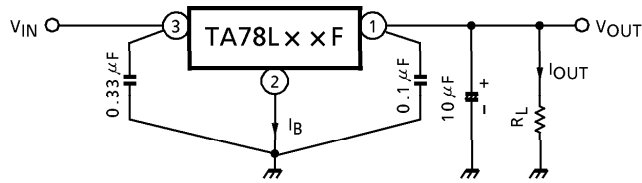
TA78L24F

**ELECTRICAL CHARACTERISTICS**

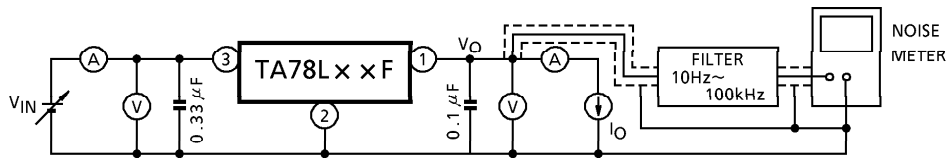
(Unless otherwise specified,  $V_{IN} = 33V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

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

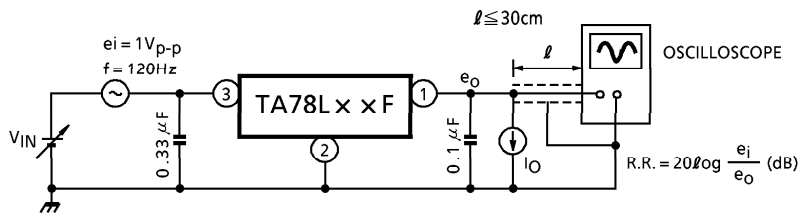
**TEST CIRCUIT 1 / STANDARD APPLICATION**

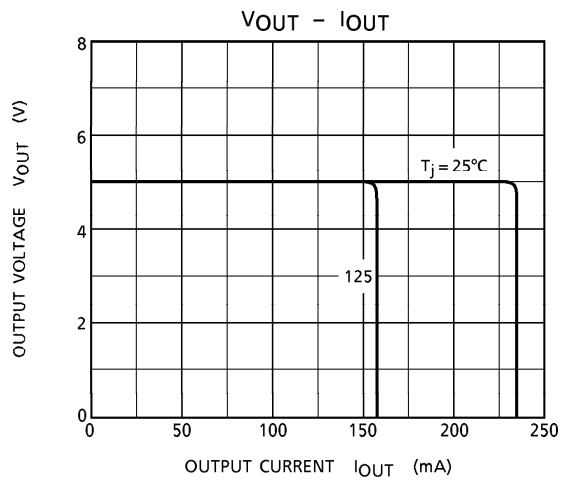
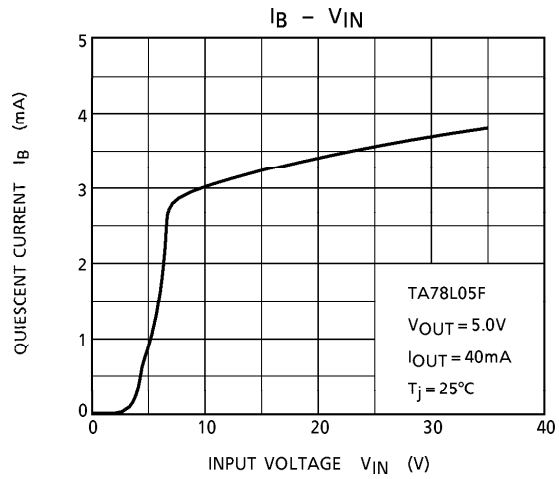
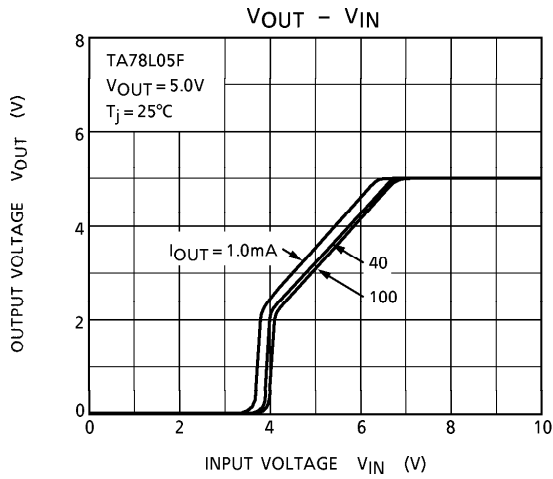
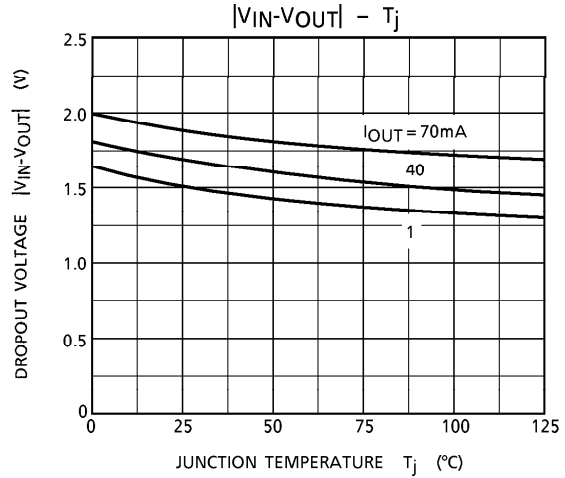
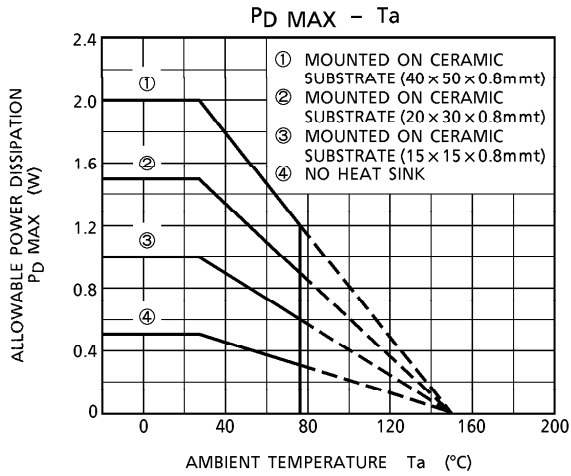


**TEST CIRCUIT 2  $V_{NO}$**



**TEST CIRCUIT 3 R.R.**



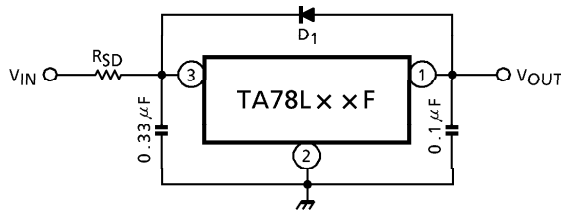


**Precautions for Use**

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.

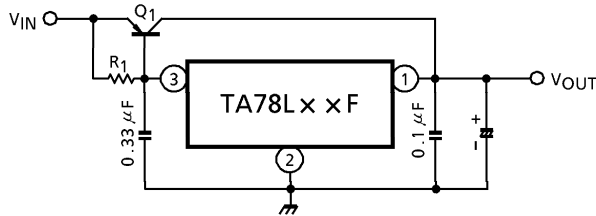
**APPLICATION CIRCUIT**

**(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 switching 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**

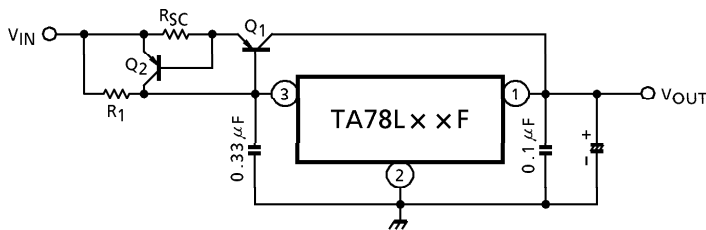


Use a required radiation plate for  $Q_1$ .

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

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

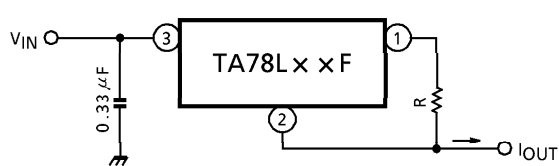
**B. SHORT-CIRCUIT PROTECTION**



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

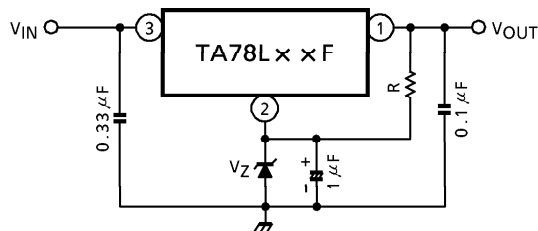
where,  $I_{SC}$  : Short-Circuit current

(3) CURRENT REGULATOR

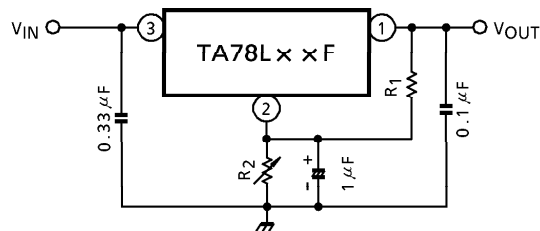


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

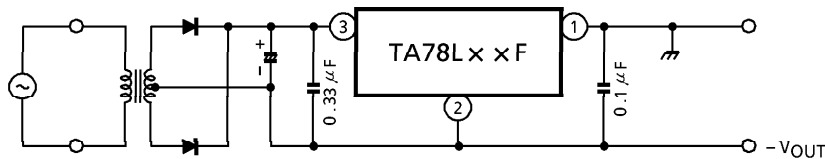


$V_{OUT} = V_Z + V_{OUT}(\text{of IC})$   
Apply current of several mA to R.

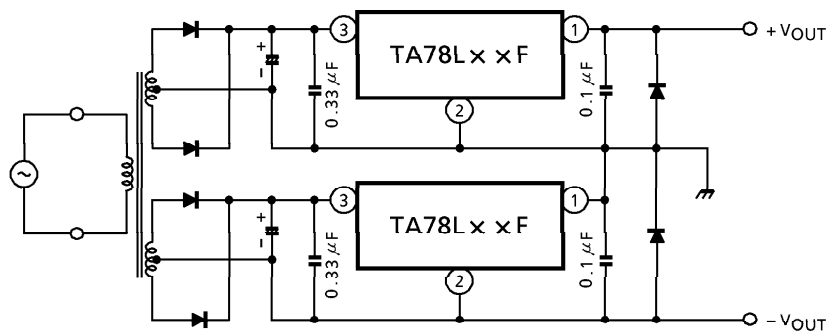


$$V_{OUT} = R_2 \left( I_B + \frac{V_{OUT}(\text{of IC})}{R_1} \right) + V_{OUT}(\text{of IC})$$

(5) NEGATIVE REGULATOR



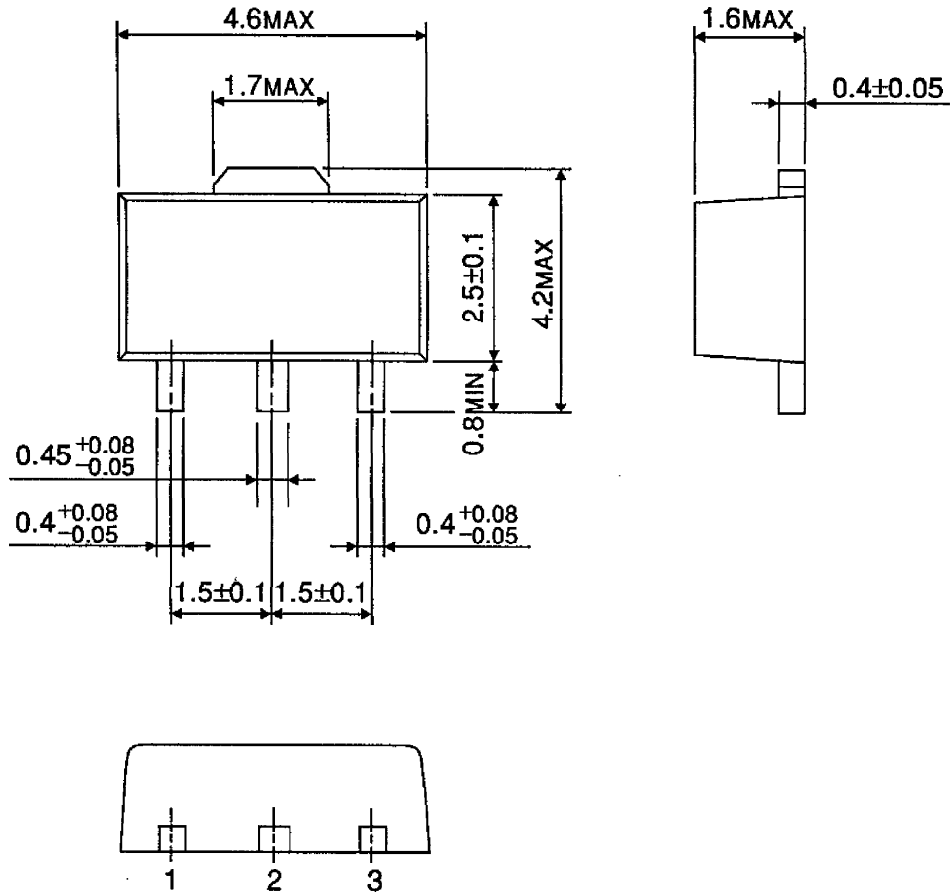
(6) POSITIVE AND NEGATIVE REGULATOR





OUTLINE DRAWING  
HSOP3-P-1.50

Unit : mm



Weight : 0.05g (Typ.)