TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

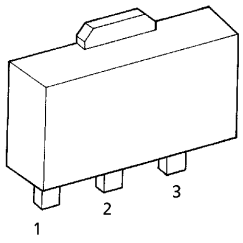
TA78L05F, TA78L06F, TA78L07F, TA78L08F, TA78L09F, TA78L10F TA78L12F, TA78L15F, TA78L18F, TA78L20F, TA78L24F

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°C)
- Packaged in POWER MINI. (SOT-89)

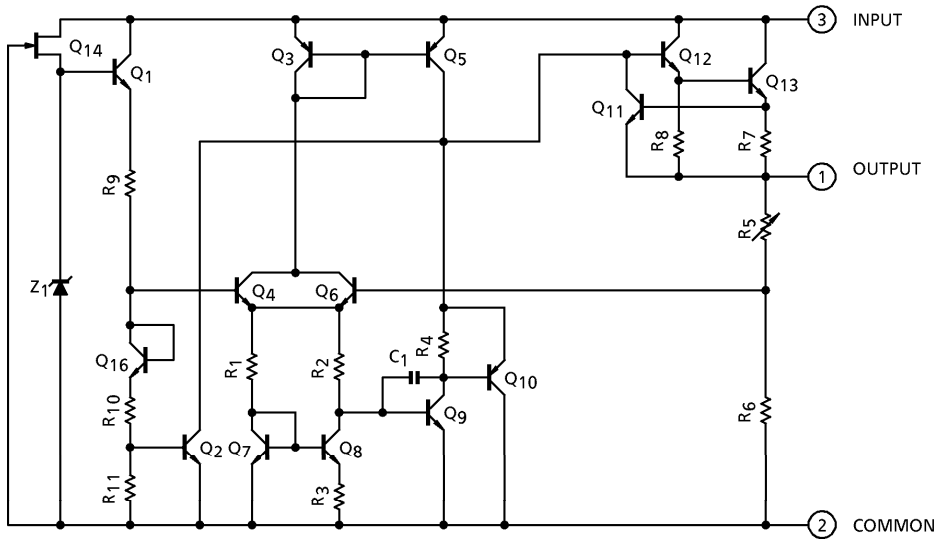


1. OUTPUT
2. COMMON (CASE)
3. INPUT

P-HSOP3-1.50

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)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Input Voltage	TA78L05F	V_{IN}	35	V
	TA78L06F			
	TA78L07F			
	TA78L08F			
	TA78L09F			
	TA78L10F			
	TA78L12F			
	TA78L15F			
	TA78L18F		40	
	TA78L20F			
	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 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		4.75	5.0	5.25	V
Line Regulation	Reg·line	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 20 V	—	55	150	mV
				8.0 V ≦ V_{IN} ≦ 20 V	—	45	100	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	11	60	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	5.0	30	
Output Voltage	V_{OUT}	1	T_j = 25°C	7.0 V ≦ V_{IN} ≦ 20 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	4.65	—	5.35	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	4.65	—	5.35	
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	T_j = 25°C	8.0 V ≦ V_{IN} ≦ 20 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	40	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	12	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 8.0 V ≦ V_{IN} ≦ 18 V, T_j = 25°C		41	49	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.6	—	mV / °C

TA78L06F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 11 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		5.7	6.0	6.3	V
Line Regulation	Reg·line	1	T_j = 25°C	8.1 V ≦ V_{IN} ≦ 21 V	—	50	150	mV
				9.0 V ≦ V_{IN} ≦ 21 V	—	45	110	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	12	70	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	5.5	35	
Output Voltage	V_{OUT}	1	T_j = 25°C	8.1 V ≦ V_{IN} ≦ 21 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	5.58	—	6.42	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	5.58	—	6.42	
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	T_j = 25°C	9.0 V ≦ V_{IN} ≦ 20 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	40	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	14	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 9.0 V ≦ V_{IN} ≦ 19 V, T_j = 25°C		39	47	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.7	—	mV / °C

TA78L07F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 12 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		6.65	7.0	7.35	V
Line Regulation	Reg·line	1	T_j = 25°C	9.2 V ≦ V_{IN} ≦ 22 V	—	50	160	mV
				10 V ≦ V_{IN} ≦ 22 V	—	45	115	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	13	75	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	6.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	9.2 V ≦ V_{IN} ≦ 22 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	6.51	—	7.49	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	6.51	—	7.49	
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	T_j = 25°C	10 V ≦ V_{IN} ≦ 22 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	50	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	17	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 10 V ≦ V_{IN} ≦ 20 V, T_j = 25°C		37	46	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 0.75	—	mV / °C

TA78L08F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		7.6	8.0	8.4	V
Line Regulation	Reg·line	1	T_j = 25°C	10.5V ≦ V_{IN} ≦ 23V	—	20	175	mV
				11 V ≦ V_{IN} ≦ 23 V	—	12	125	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	15	80	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	7.0	40	
Output Voltage	V_{OUT}	1	T_j = 25°C	10.5 V ≦ V_{IN} ≦ 23 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	7.44	—	8.56	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	7.44	—	8.56	
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	T_j = 25°C	11 V ≦ V_{IN} ≦ 23 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	60	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	20	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 12 V ≦ V_{IN} ≦ 23 V, T_j = 25°C		37	45	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.8	—	mV / °C

TA78L09F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 15 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		8.55	9.0	9.45	V
Line Regulation	Reg·line	1	T_j = 25°C	11.4 V ≦ V_{IN} ≦ 24 V	—	80	200	mV
				12 V ≦ V_{IN} ≦ 24 V	—	20	160	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	17	90	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	8.0	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	11.4 V ≦ V_{IN} ≦ 24 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	8.37	—	9.63	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	8.37	—	9.63	
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	T_j = 25°C	12 V ≦ V_{IN} ≦ 24 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	65	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	21	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 12 V ≦ V_{IN} ≦ 24 V, T_j = 25°C		36	44	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 0.85	—	mV / °C

TA78L10F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		9.5	10	10.5	V
Line Regulation	Reg·line	1	T_j = 25°C	12.5 V ≦ V_{IN} ≦ 25 V	—	80	230	mV
				13 V ≦ V_{IN} ≦ 25 V	—	30	170	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	18	90	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	8.5	45	
Output Voltage	V_{OUT}	1	T_j = 25°C	12.5 V ≦ V_{IN} ≦ 25 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	9.3	—	10.7	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	9.3	—	10.7	
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	T_j = 25°C	13 V ≦ V_{IN} ≦ 25 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	70	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	22	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 13 V ≦ V_{IN} ≦ 24 V, T_j = 25°C		36	43	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	−0.9	—	mV / °C

TA78L12F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 19 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		11.4	12	12.6	V
Line Regulation	Reg·line	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 27 V	—	120	250	mV
				16 V ≦ V_{IN} ≦ 27 V	—	100	200	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	20	100	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	10	50	
Output Voltage	V_{OUT}	1	T_j = 25°C	14.5 V ≦ V_{IN} ≦ 27 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	11.16	—	12.84	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	11.16	—	12.84	
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	T_j = 25°C	16 V ≦ V_{IN} ≦ 27 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	80	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	24	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 15 V ≦ V_{IN} ≦ 25 V, T_j = 25°C		36	41	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.0	—	mV / °C

TA78L15F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 23 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		14.25	15	15.75	V
Line Regulation	Reg·line	1	T_j = 25°C	17.5 V ≦ V_{IN} ≦ 30 V	—	130	300	mV
				20 V ≦ V_{IN} ≦ 30 V	—	110	250	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	25	150	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	12	75	
Output Voltage	V_{OUT}	1	T_j = 25°C	17.5 V ≦ V_{IN} ≦ 30 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	13.95	—	16.05	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	13.95	—	16.05	
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	T_j = 25°C	20 V ≦ V_{IN} ≦ 30 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	90	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	30	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 18.5 V ≦ V_{IN} ≦ 28.5 V, T_j = 25°C		34	40	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.3	—	mV / °C

TA78L18F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 27 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		17.1	18	18.9	V
Line Regulation	Reg·line	1	T_j = 25°C	21.4 V ≦ V_{IN} ≦ 33 V	—	32	325	mV
				22 V ≦ V_{IN} ≦ 33 V	—	27	275	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	30	170	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	15	75	
Output Voltage	V_{OUT}	1	T_j = 25°C	21.4 V ≦ V_{IN} ≦ 33 V, 1.0 mA ≦ I_{OUT} ≦ 40 mA	16.74	—	19.26	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	16.74	—	19.26	
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	T_j = 25°C	22 V ≦ V_{IN} ≦ 33 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	150	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	45	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 23 V ≦ V_{IN} ≦ 33 V, T_j = 25°C		32	38	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.5	—	mV / °C

TA78L20F

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, V_{IN} = 29 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 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		19.0	20	21.0	V
Line Regulation	Reg·line	1	T_j = 25°C	23.5 V ≦ V_{IN} ≦ 35 V	—	33	330	mV
				24 V ≦ V_{IN} ≦ 35 V	—	28	285	
Load Regulation	Reg·load	1	T_j = 25°C	1.0 mA ≦ I_{OUT} ≦ 100 mA	—	33	180	mV
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	17	90	
Output Voltage	V_{OUT}	1	T_j = 25°C	23.5 V ≦ V_{IN} ≦ 35 V. 1.0 mA ≦ I_{OUT} ≦ 40 mA	18.6	—	21.4	V
				1.0 mA ≦ I_{OUT} ≦ 70 mA	18.6	—	21.4	
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	T_j = 25°C	24 V ≦ V_{IN} ≦ 35 V	—	—	1.5	mA
				1.0 mA ≦ I_{OUT} ≦ 40 mA	—	—	0.1	
Output Noise Voltage	V_{NO}	2	Ta = 25°C, 10 Hz ≦ f ≦ 100 kHz		—	170	—	μV_{rms}
Long Term Stability	$\Delta V_{OUT} / \Delta t$	1	—		—	49	—	mV /kh
Ripple Rejection Ratio	R.R.	3	f = 120 Hz, 25 V ≦ V_{IN} ≦ 35 V, T_j = 25°C		31	37	—	dB
Dropout Voltage	V_D	1	T_j = 25°C, I_{OUT} = 150 mA		—	1.7	—	V
Average Temperature Coefficient of Output Voltage	T_{CVO}	1	I_{OUT} = 5 mA		—	− 1.7	—	mV / °C

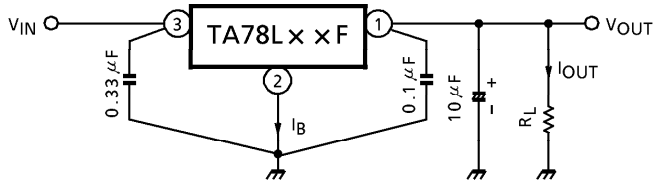
TA78L24F

ELECTRICAL CHARACTERISTICS

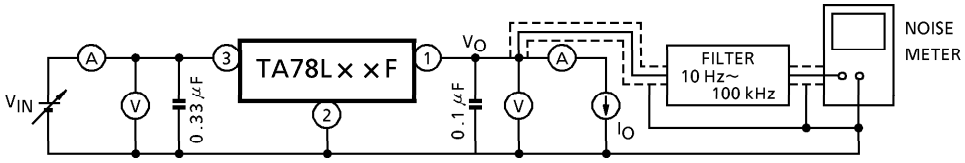
(Unless otherwise specified, V_{IN} = 33 V, I_{OUT} = 40 mA, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, 0°C ≦ T_j ≦ 125°C)

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

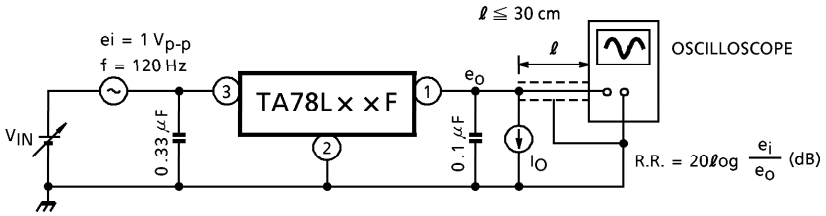
TEST CIRCUIT 1 / STANDARD APPLICATION



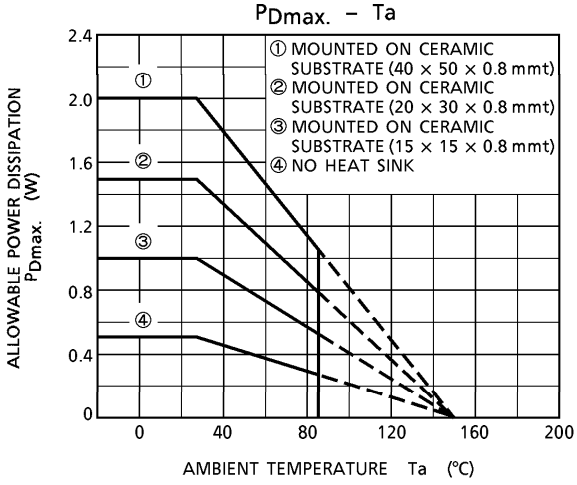
TEST CIRCUIT 2 V_{NO}



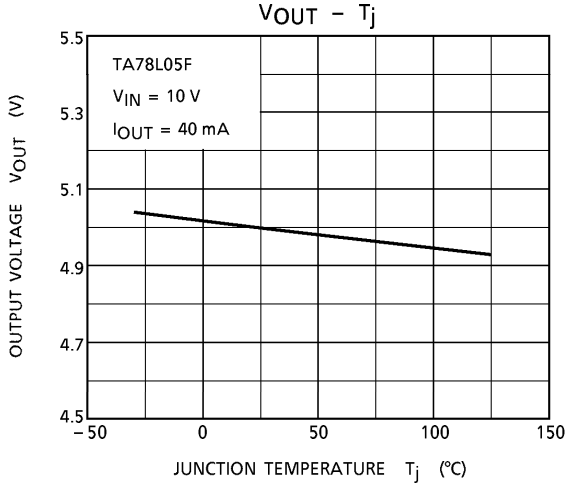
TEST CIRCUIT 3 R.R.



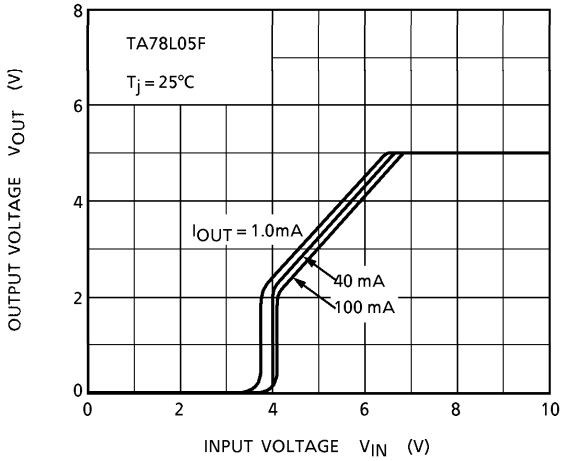
$P_{Dmax.}$ – Ta



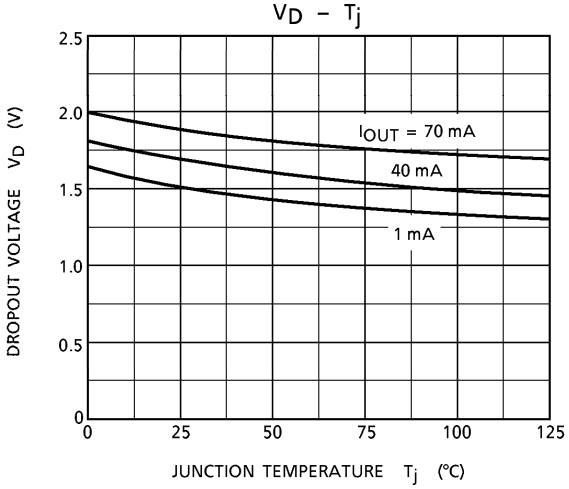
V_{OUT} – T_j



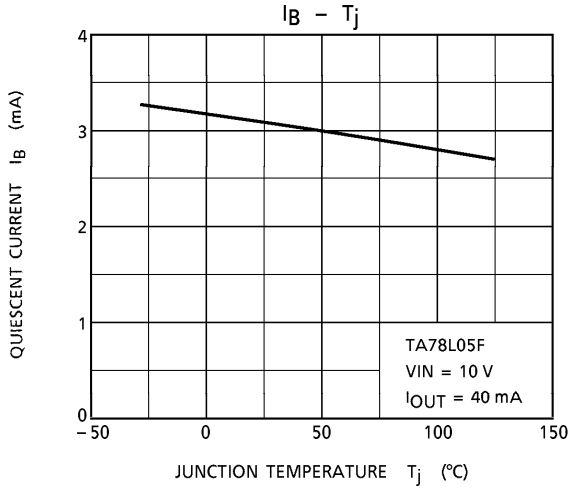
V_{OUT} – V_{IN}



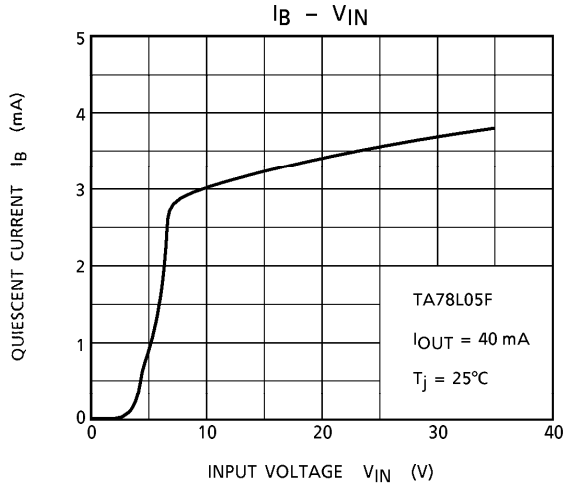
V_D – T_j

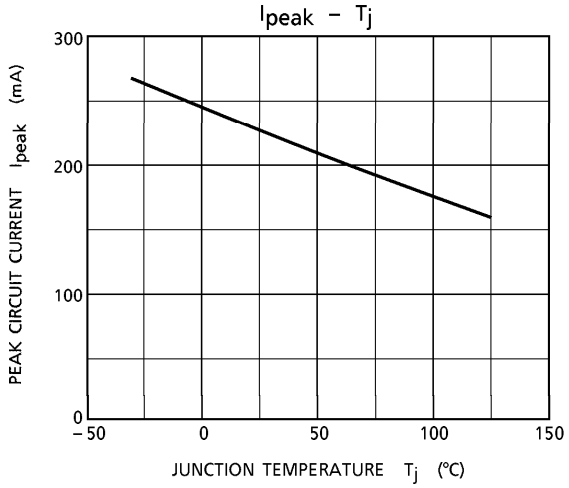


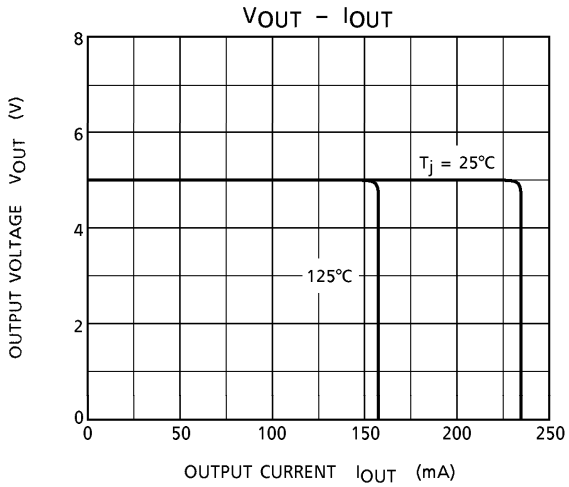
I_B – T_j



I_B – V_{IN}




I_{peak} – T_j
PEAK CIRCUIT CURRENT I_{peak} (mA)
300
200
100
0
– 50
0
50
100
150
JUNCTION TEMPERATURE T_j (°C)

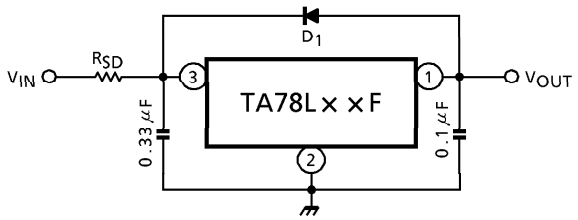

V_{OUT} – I_{OUT}
OUTPUT VOLTAGE V_{OUT} (V)
8
6
4
2
0
T_j = 25°C
125°C
0
50
100
150
200
250
OUTPUT CURRENT I_{OUT} (mA)

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

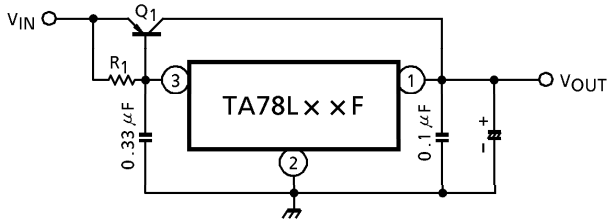
(1) STANDARD APPLICATION



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

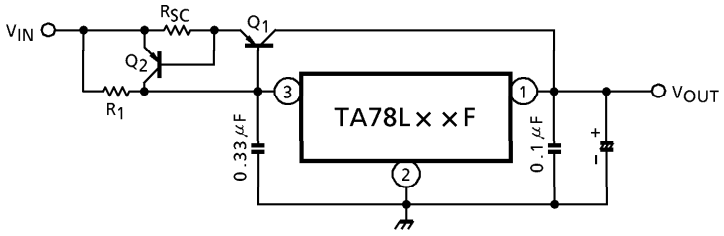


Use a required rediation plate for Q_1.

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

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

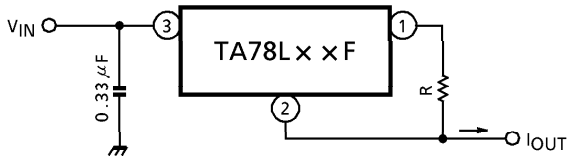
B. SHORT-CIRCUIT PROTECTION



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

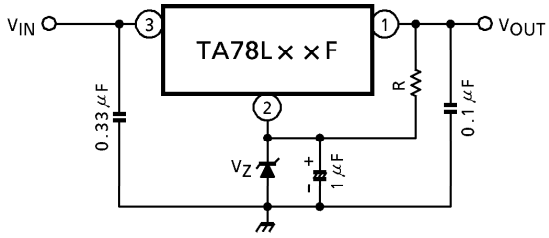
where, I_{SC} : Short-Circuit current

(3) CURRENT REGULATOR

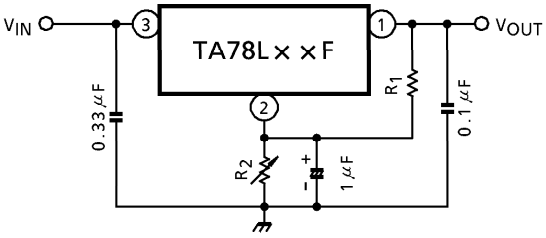


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

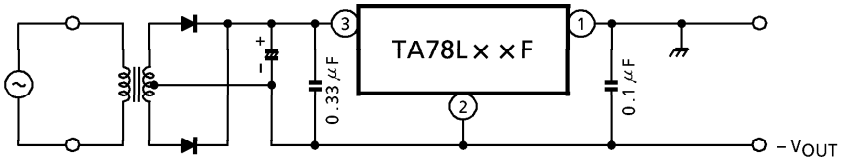


$V_{OUT} = V_Z + V_{OUT}$ (of IC)
Apply current of several mA to R.

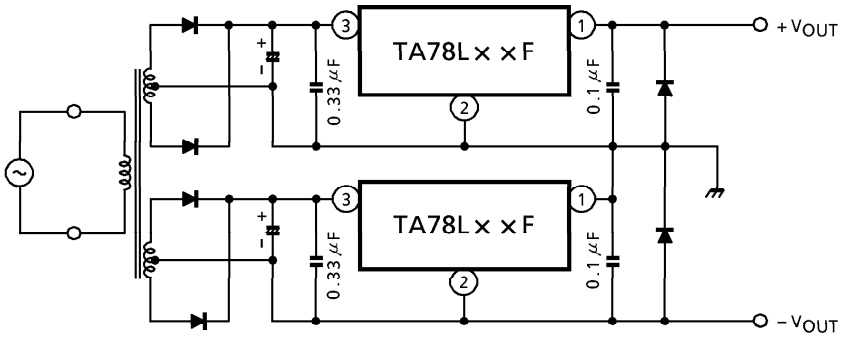


$$V_{OUT} = R_2 \left(I_B + \frac{V_{OUT}\,(\text{of IC})}{R_1}\right) + V_{OUT}\,(\text{of IC})$$

(5) NEGATIVE REGULATOR

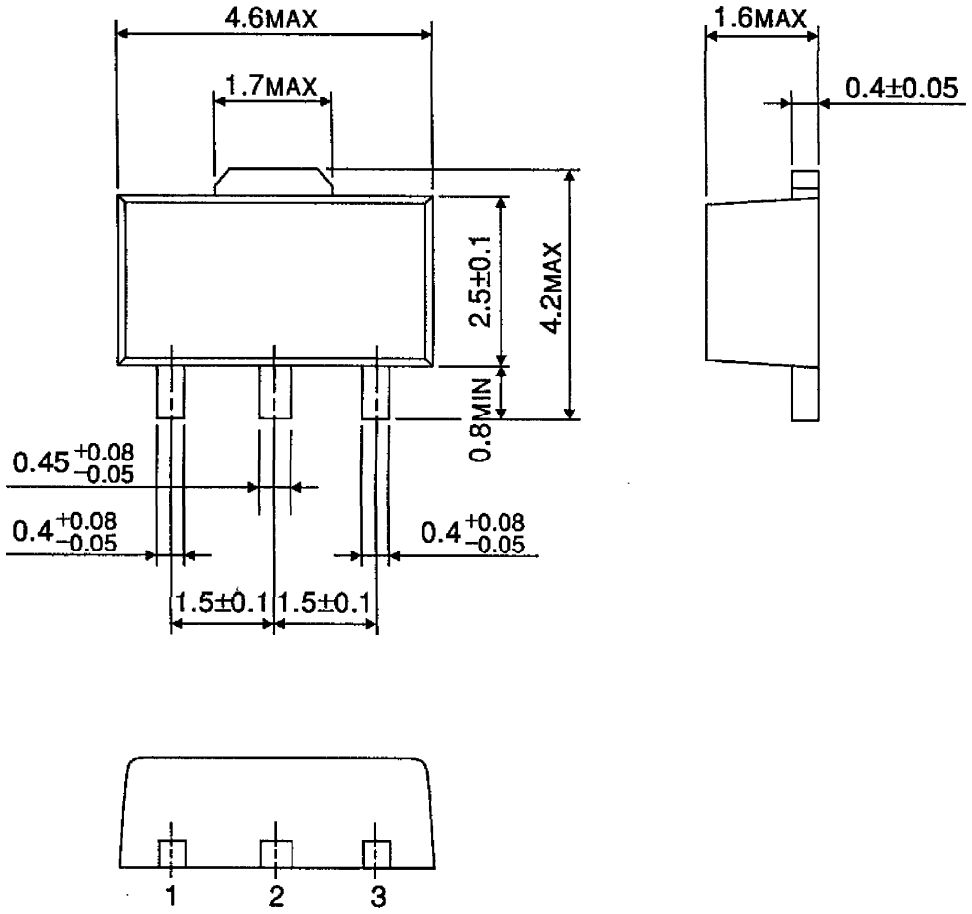


(6) POSITIVE AND NEGATIVE REGULATOR



PACKAGE DIMENSIONS

P-HSOP3-1.50 Unit : mm



Weight : 0.05 g (Typ.)