

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC
TA78DL05AF, TA78DL06AF, TA78DL08AF, TA78DL09AF
TA78DL10AF, TA78DL12AF, TA78DL15AF

5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V
LOW DROPOUT VOLTAGE REGULATOR.

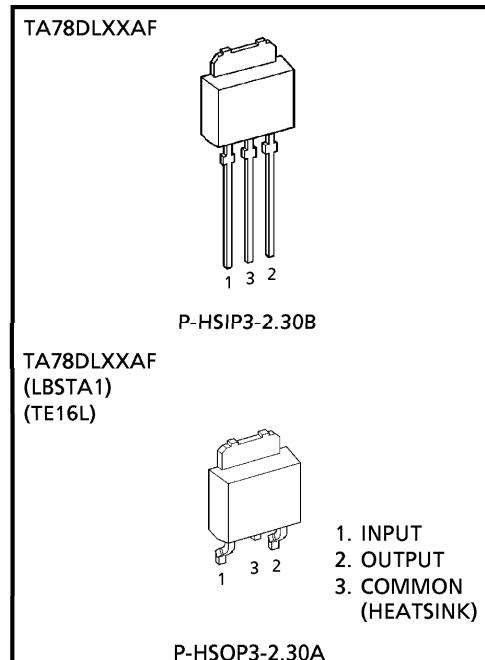
The TA78DLXXAF series consists of positive fixed output voltage regulator IC capable of sourcing current up to 250 mA.

Due to the features of low dropout voltage and low standby current, these devices are useful for battery powered equipment.

This series includes current limiting, thermal shutdown, overvoltage protection, input fault protection and excessive transient protection circuits internally.

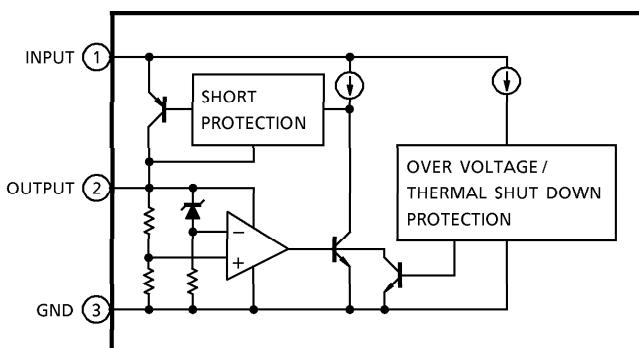
FEATURES

- Low Standby Current of 500 μ A Typical.
- Maximum Output Current Up to 250 mA.
- Low Dropout Voltage of Less than 0.6 V (@ $I_{OUT} = 0.2$ A).
- Multi-protection
 - : Reverse Connection of Power Supply, 60 V Load Dump, Thermal Shut Down and Current Limiting.
- Packaged in POWER MOLD.



Weight
 P-HSIP3-2.30B : 0.36 g (Typ.)
 P-HSOP3-2.30A : 0.36 g (Typ.)

BLOCK DIAGRAM



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.
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MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Operating Input Voltage		V_{IN}	29	V
Input Voltage of Surge		V_{IN}	60	V
Power Dissipation	($T_a = 25^\circ\text{C}$)	P_D	1	W
	($T_c = 25^\circ\text{C}$)		10	
Operating Temperature		T_{opr}	-40~85	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55~150	$^\circ\text{C}$
Junction Temperature		T_j	150	$^\circ\text{C}$
Thermal Resistance		$R_{th(j-c)}$	12.5	$^\circ\text{C} / \text{W}$
		$R_{th(j-a)}$	125	
Storage Temperature-Time		T_{sol}	260 (10 s)	$^\circ\text{C}$

TA78DL05AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 14\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$5.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	4.75	5	5.25	V
Line Regulation	Reg·line	—	$9\text{ V} \leq V_{IN} \leq 16\text{ V}$	—	2	10	mV
			$6\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	4	30	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	14	50	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $6\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.5	1	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL06AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 14\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$6.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	5.7	6	6.3	V
Line Regulation	Reg·line	—	$10\text{ V} \leq V_{IN} \leq 17\text{ V}$	—	2	12	mV
			$7\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	5	36	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	17	60	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $7\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.55	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL08AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 16\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$8.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq Ta \leq 85^\circ\text{C}$	7.6	8	8.4	V
Line Regulation	Reg·line	—	$12\text{ V} \leq V_{IN} \leq 19\text{ V}$	—	3	16	mV
			$9\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	6	45	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	22	80	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $9\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.6	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL09AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 16\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$9.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq Ta \leq 85^\circ\text{C}$	8.55	9	9.45	V
Line Regulation	Reg·line	—	$13\text{ V} \leq V_{IN} \leq 20\text{ V}$	—	3	18	mV
			$10\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	7	50	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	25	90	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $10\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.65	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL10AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 16\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$10.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq Ta \leq 85^\circ\text{C}$	9.5	10	10.5	V
Line Regulation	Reg·line	—	$14\text{ V} \leq V_{IN} \leq 21\text{ V}$	—	4	20	mV
			$11\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	8	60	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	28	100	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $11\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.7	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL12AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 18\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

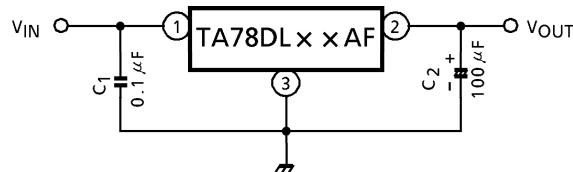
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq Ta \leq 85^\circ\text{C}$	11.4	12	12.6	V
Line Regulation	Reg·line	—	$16\text{ V} \leq V_{IN} \leq 23\text{ V}$	—	5	24	mV
			$13\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	10	70	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	33	120	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $13\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.8	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL15AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{IN} = 20\text{ V}$, $I_{OUT} = 10\text{ mA}$, $T_j = 25^\circ\text{C}$)

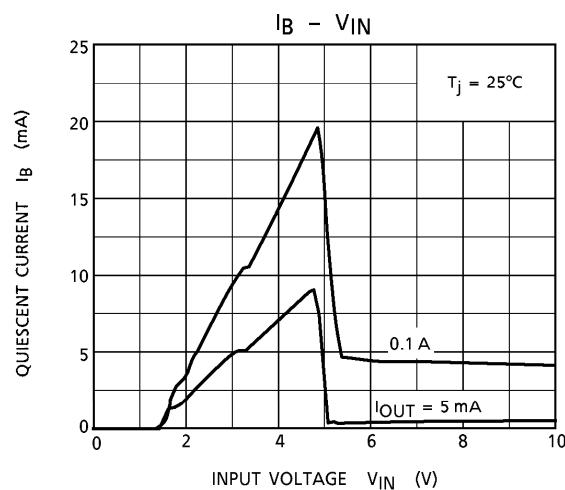
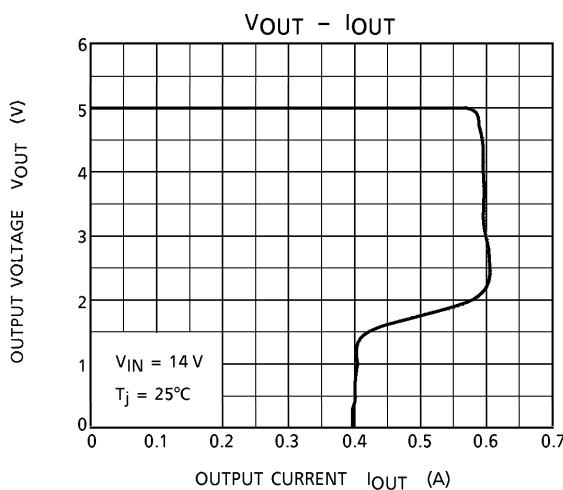
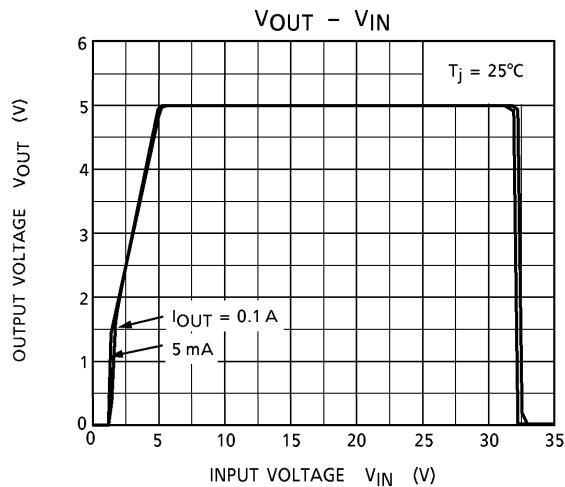
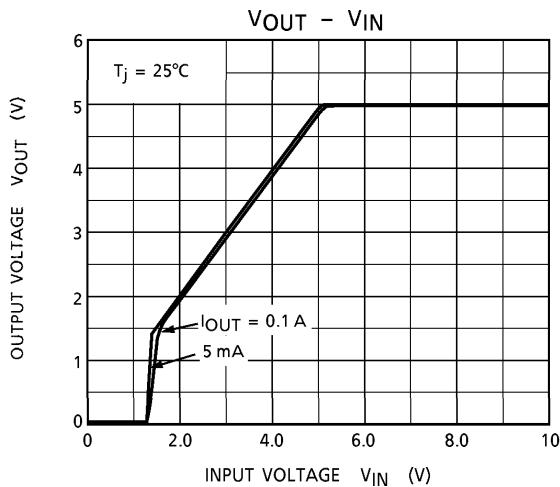
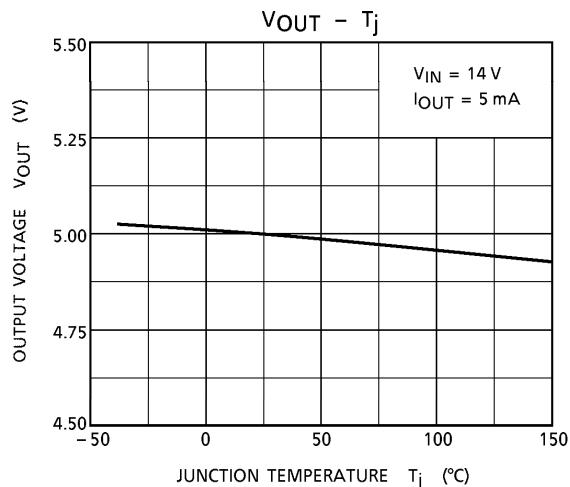
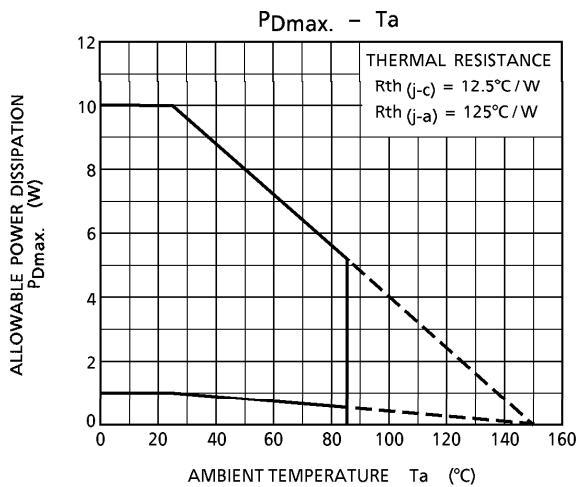
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	$15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$ $-40^\circ\text{C} \leq Ta \leq 85^\circ\text{C}$	14.25	15	15.75	V
Line Regulation	Reg·line	—	$19\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	6	30	mV
			$16\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	12	80	
Load Regulation	Reg·load	—	$10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$	—	40	150	mV
Quiescent Current	I_B	—	$I_{OUT} \leq 10\text{ mA}$, $16\text{ V} \leq V_{IN} \leq 26\text{ V}$	—	0.9	—	mA
Dropout Voltage	V_D	—	$I_{OUT} = 50\text{ mA}$	—	0.15	0.3	V
			$I_{OUT} = 200\text{ mA}$	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

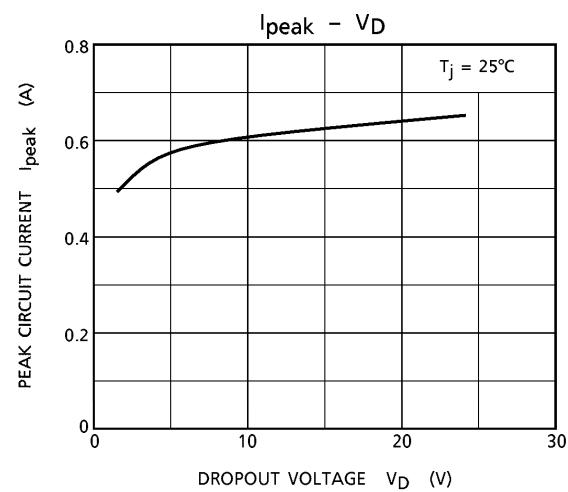
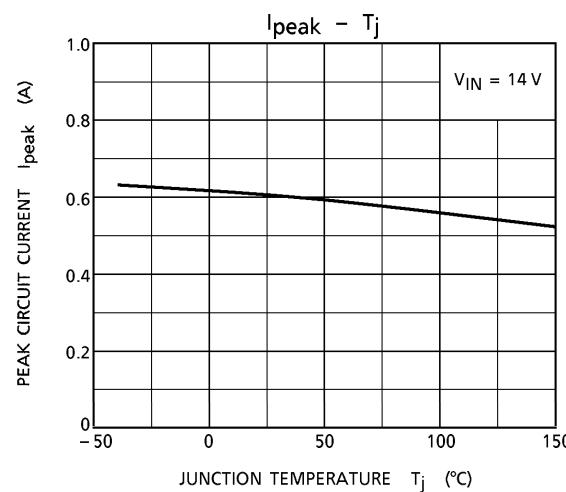
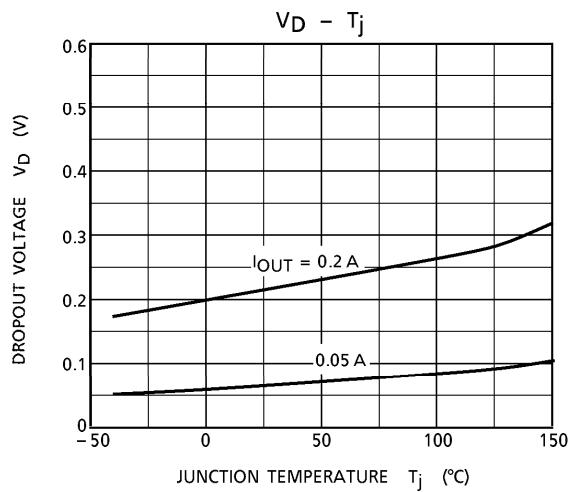
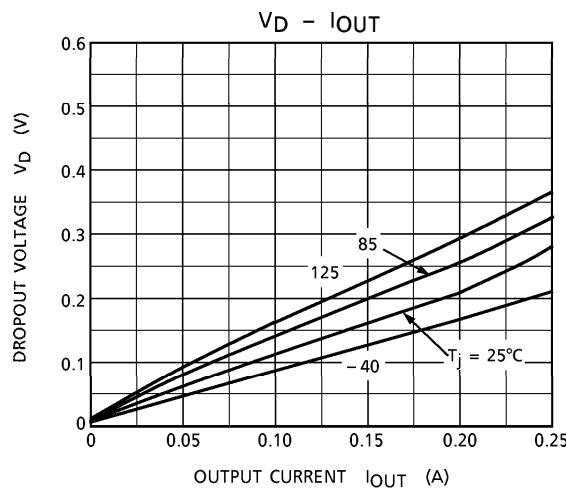
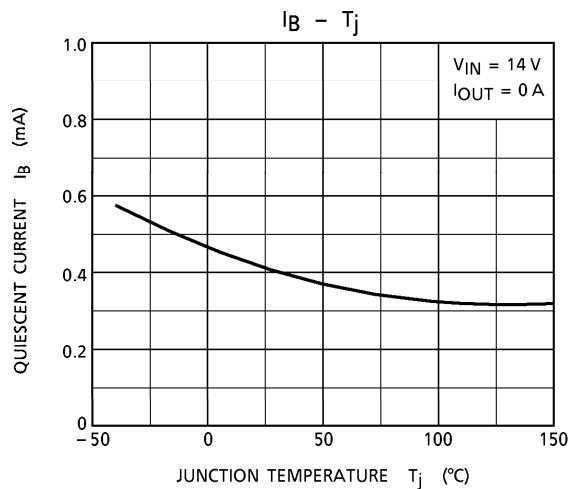
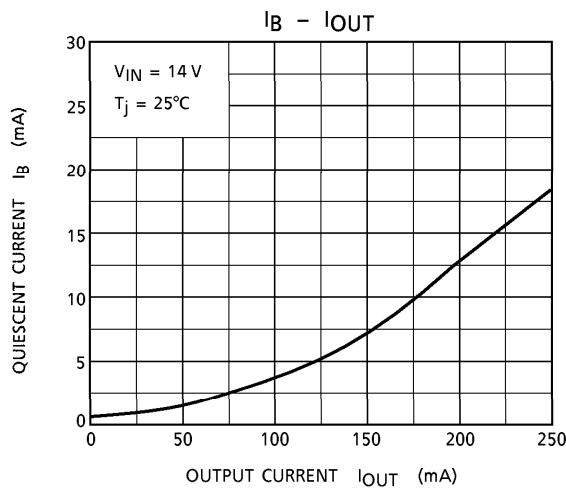
APPLICATION CIRCUITS

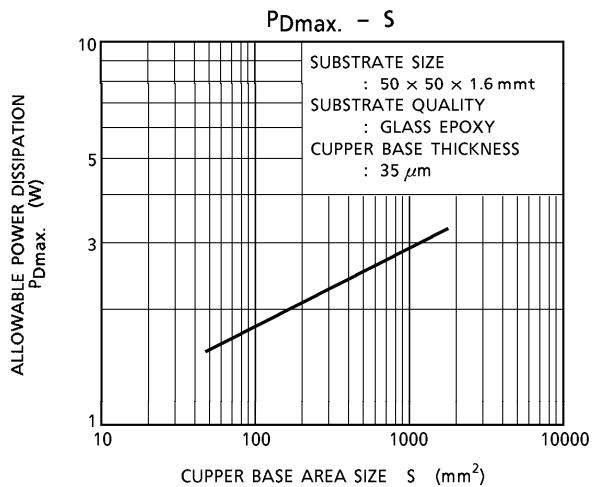


Capacitor C_2 must be guaranteed to operate in the temperature range that the regulator should be operated correctly.

100 μF is a suitable value to suppress the oscillation phenomenon at the output terminal.



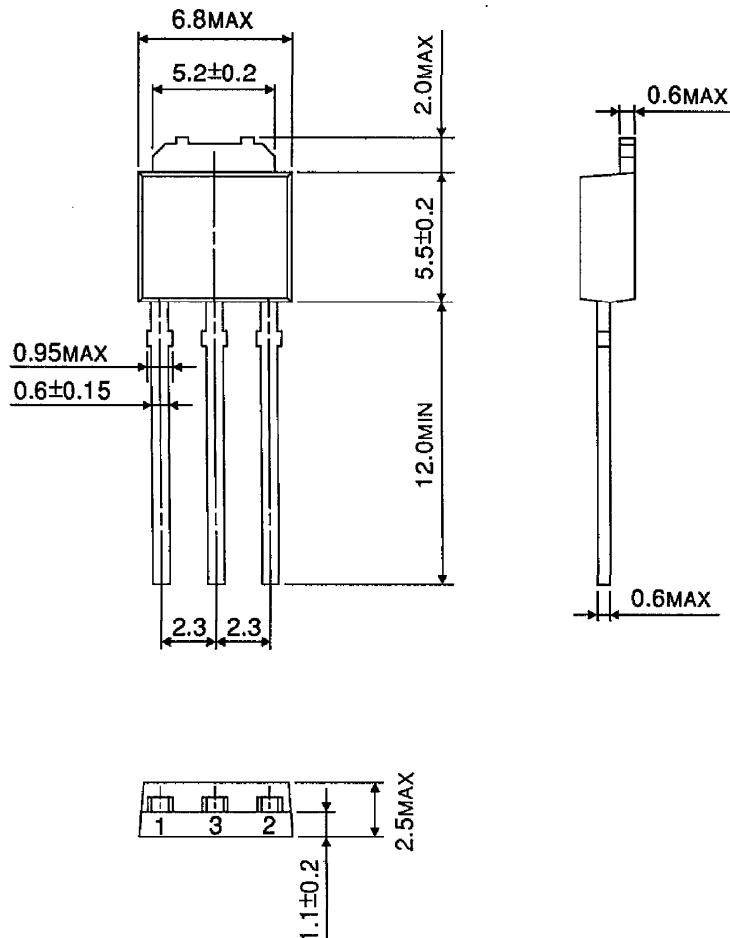




PACKAGE DIMENSIONS

P-HSIP3-2.30B

Unit : mm

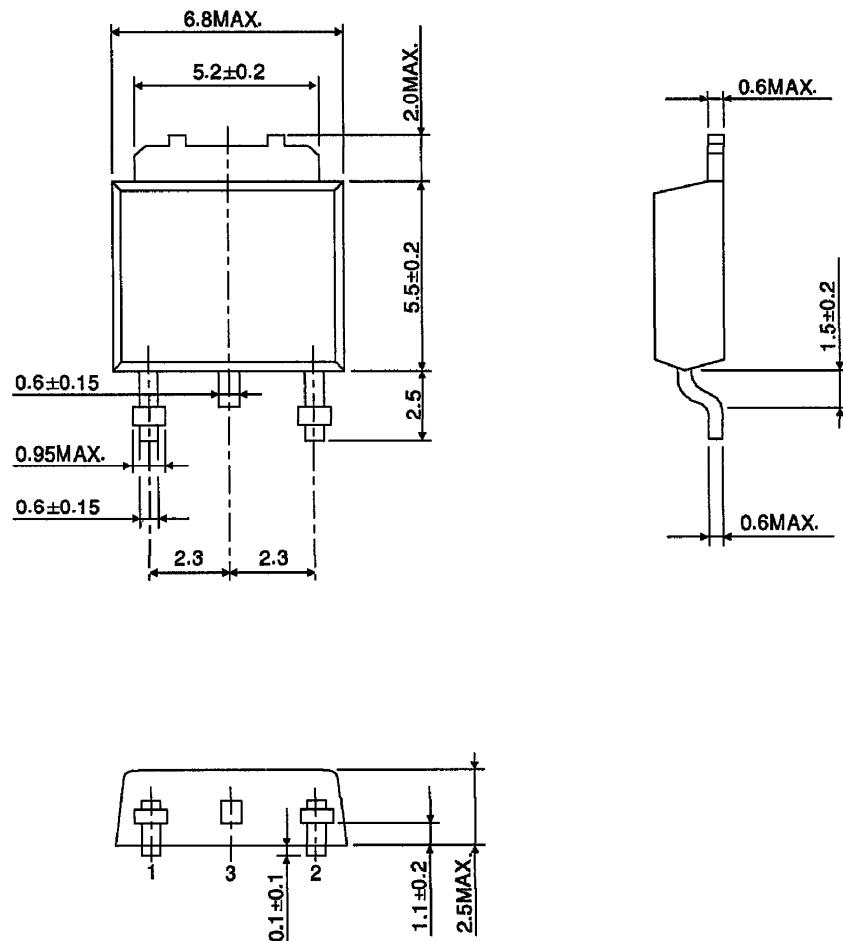


Weight : 0.36 g (Typ.)

PACKAGE DIMENSIONS

P-HSOP3-2.30A

Unit : mm



Weight : 0.36 g (Typ.)