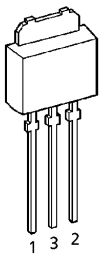
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

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.

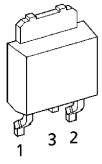
The TA78DLXXAF series consists of positive fixed output voltage regulator IC capable of sourcing current up to 250 mA.
Due to the features of low dropout voltage and low standby current, these devices are useful for battery powered equipment.
This series includes current limiting, thermal shutdown, overvoltage protection, input fault protection and excessive transient protection circuits internally.

TA78DLXXAF



HSIP3-P-2.30B

TA78DLXXAF
(LBSTA1)
(TE16L)



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

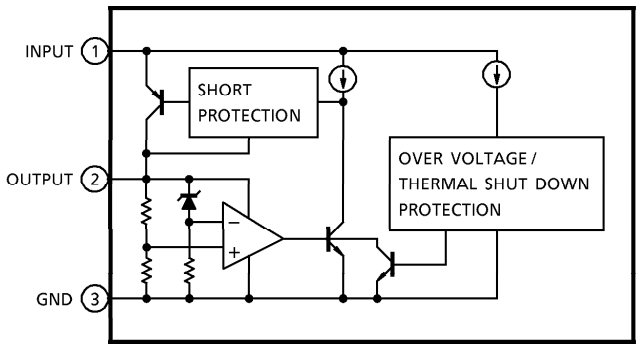
HSOP3-P-2.30A

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

FEATURES

- Low Standby Current of 500 μA 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.

BLOCK DIAGRAM



980910EBA1

MAXIMUM RATINGS (Ta = 25°C)

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

TA78DL05AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 10 mA, T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	5.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	4.75	5	5.25	V
Line Regulation	$\Delta V_{OUT(1)}$	—	9 V ≦ V_{IN} ≦ 16 V	—	2	10	mV
			6 V ≦ V_{IN} ≦ 26 V	—	4	30	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	14	50	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 6 V ≦ V_{IN} ≦ 26 V	—	0.5	1	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL06AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 10 mA, T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	6.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	5.7	6	6.3	V
Line Regulation	$\Delta V_{OUT(1)}$	—	10 V ≦ V_{IN} ≦ 17 V	—	2	12	mV
			7 V ≦ V_{IN} ≦ 26 V	—	5	36	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	17	60	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 7 V ≦ V_{IN} ≦ 26 V	—	0.55	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL08AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 10 mA, T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	8.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	7.6	8	8.4	V
Line Regulation	$\Delta V_{OUT(1)}$	—	12 V ≦ V_{IN} ≦ 19 V	—	3	16	mV
			9 V ≦ V_{IN} ≦ 26 V	—	6	45	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	22	80	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 9 V ≦ V_{IN} ≦ 26 V	—	0.6	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL09AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 10 mA, T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	9.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	8.55	9	9.45	V
Line Regulation	$\Delta V_{OUT(1)}$	—	13 V ≦ V_{IN} ≦ 20 V	—	3	18	mV
			10 V ≦ V_{IN} ≦ 26 V	—	7	50	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	25	90	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 10 V ≦ V_{IN} ≦ 26 V	—	0.65	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL10AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 16 V, I_{OUT} = 10 mA, T_j = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	10.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	9.5	10	10.5	V
Line Regulation	$\Delta V_{OUT(1)}$	—	14 V ≦ V_{IN} ≦ 21 V	—	4	20	mV
			11 V ≦ V_{IN} ≦ 26 V	—	8	60	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	28	100	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 11 V ≦ V_{IN} ≦ 26 V	—	0.7	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL12AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 18 V, I_{OUT} = 10 mA, T_j = 25°C)

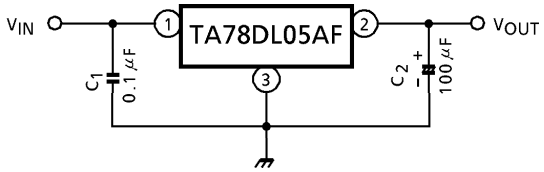
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	12.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	11.4	12	12.6	V
Line Regulation	$\Delta V_{OUT(1)}$	—	16 V ≦ V_{IN} ≦ 23 V	—	5	24	mV
			13 V ≦ V_{IN} ≦ 26 V	—	10	70	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	33	120	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 13 V ≦ V_{IN} ≦ 26 V	—	0.8	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

TA78DL15AF

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN} = 20 V, I_{OUT} = 10 mA, T_j = 25°C)

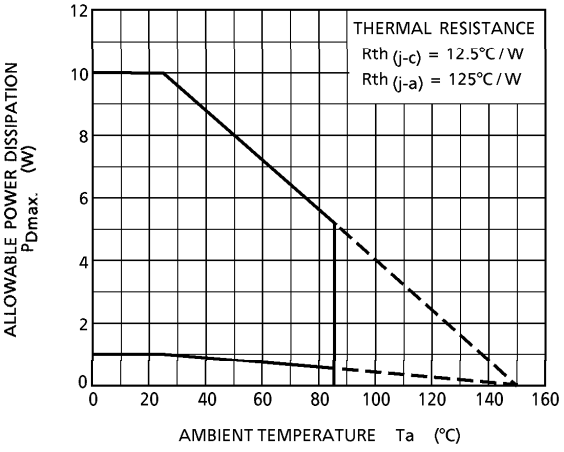
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{OUT}	—	15.35 V ≦ V_{IN} ≦ 26 V −40°C ≦ Ta ≦ 85°C	14.25	15	15.75	V
Line Regulation	$\Delta V_{OUT(1)}$	—	19 V ≦ V_{IN} ≦ 26 V	—	6	30	mV
			16 V ≦ V_{IN} ≦ 26 V	—	12	80	
Load Regulation	$\Delta V_{OUT(2)}$	—	10 mA ≦ I_{OUT} ≦ 200 mA	—	40	150	mV
Quiescent Current	I_{CC}	—	I_{OUT} ≦ 10 mA, 16 V ≦ V_{IN} ≦ 26 V	—	0.9	—	mA
Dropout Voltage	V_{DROP}	—	I_{OUT} = 50 mA	—	0.15	0.3	V
			I_{OUT} = 200 mA	—	0.4	0.6	
Max. Operating Voltage	V_{IN}	—	—	29	33	—	V

APPLICATION CIRCUITS

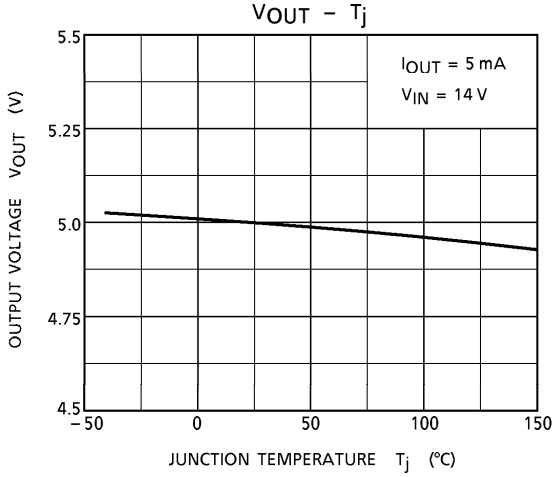


Capacitor C_2 must be guaranteed to operate of the temperature range that the regulator should be operated correctly.
100 μF is a suitable value to suppress the oscillation phenomenon at the output terminal.

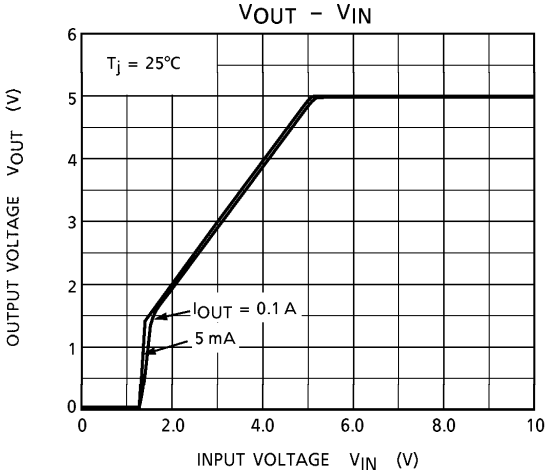
$P_{Dmax.}$ – Ta



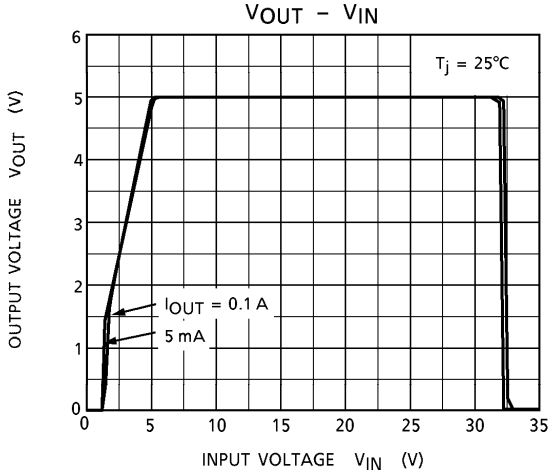
V_{OUT} – T_j



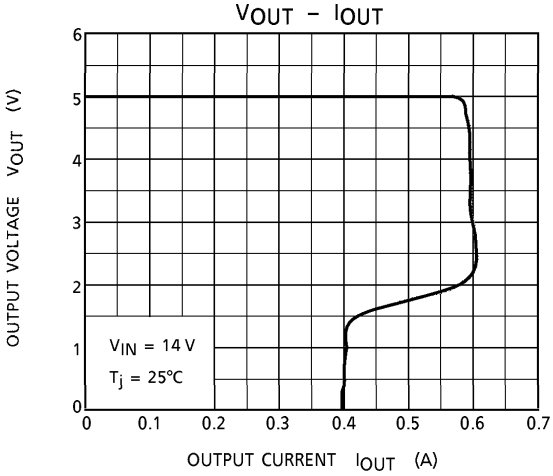
V_{OUT} – V_{IN}



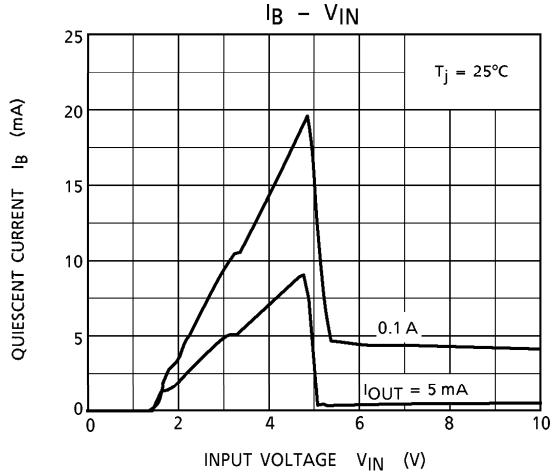
V_{OUT} – V_{IN}



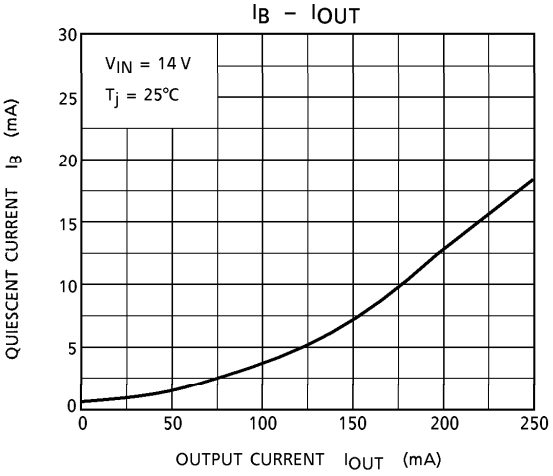
V_{OUT} – I_{OUT}



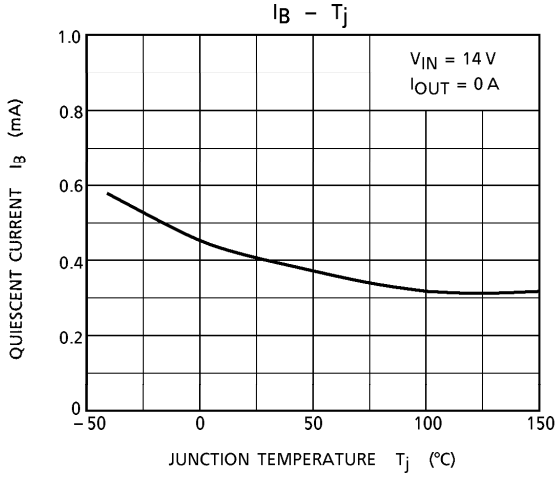
I_B – V_{IN}



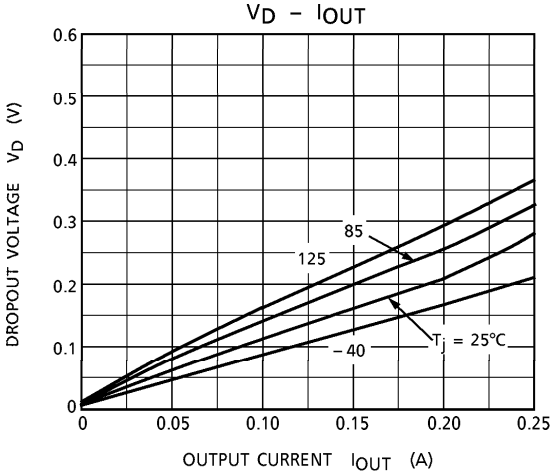
I_B – I_{OUT}



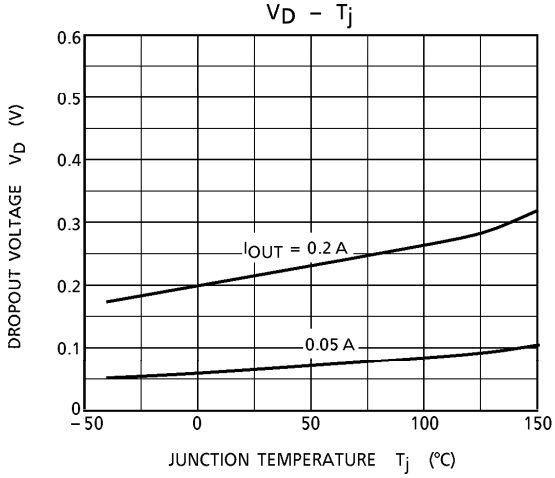
I_B – T_j



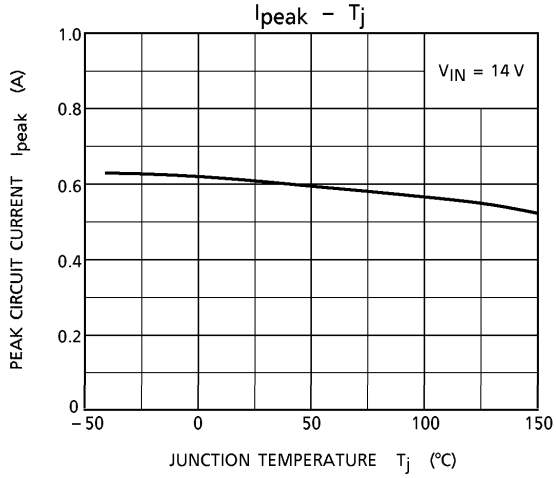
V_D – I_{OUT}



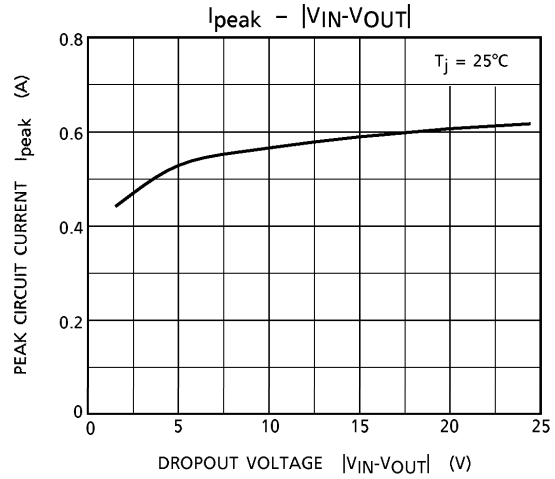
V_D – T_j

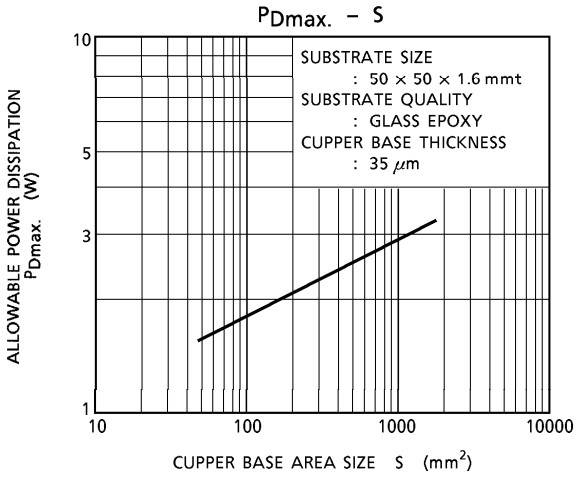


I_{peak} – T_j



I_{peak} – $|V_{IN}-V_{OUT}|$

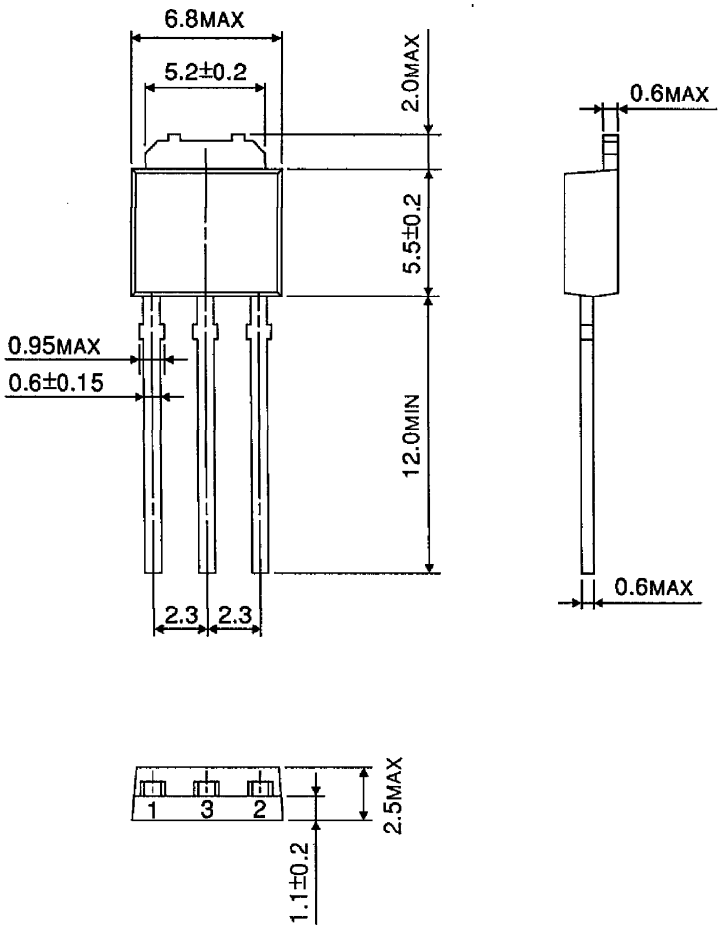



PDmax. – S
SUBSTRATE SIZE
: 50 × 50 × 1.6 mmt
SUBSTRATE QUALITY
: GLASS EPOXY
CUPPER BASE THICKNESS
: 35 μm
ALLOWABLE POWER DISSIPATION PDmax. (W)
10
5
3
1
10
100
1000
10000
CUPPER BASE AREA SIZE S (mm²)

OUTLINE DRAWING

HSIP3-P-2.30B

Unit : mm

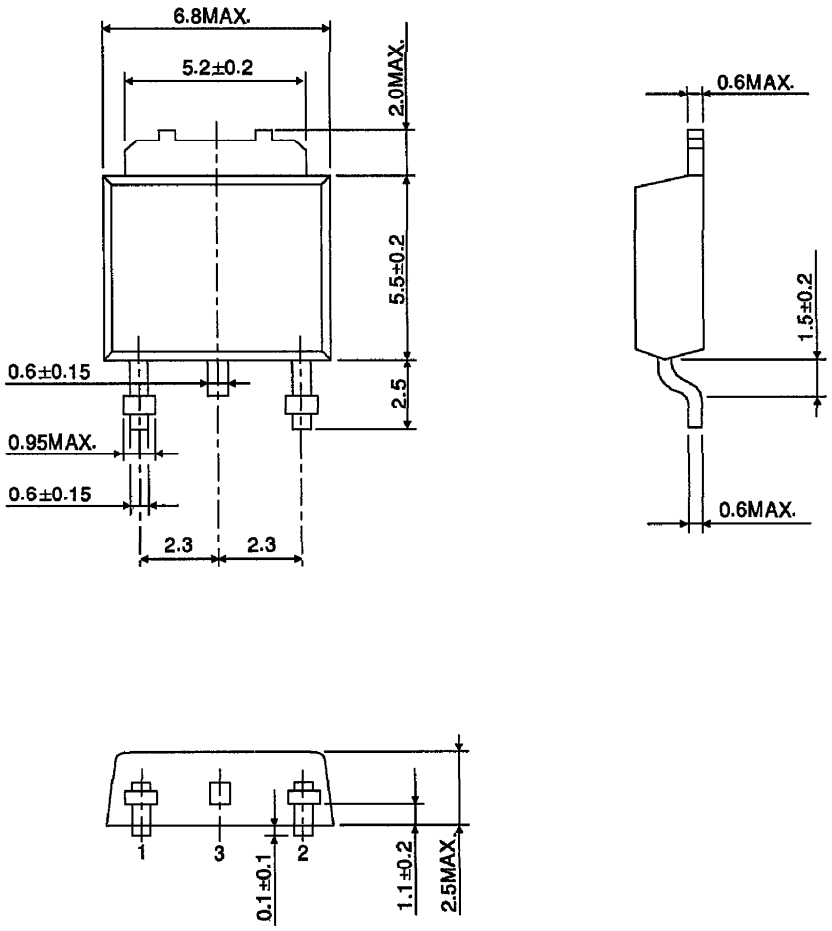


Weight : 0.36 g (Typ.)

OUTLINE DRAWING

HSOP3-P-2.30A

Unit : mm



Weight : 0.36 g (Typ.)