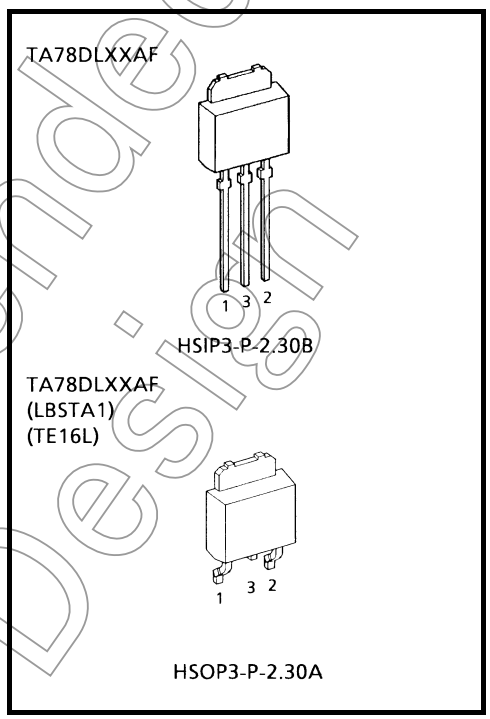
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA78DL05AF, TA78DL06AF, TA78DL08AF,TA78DL09AF, TA78DL10AF, TA78DL12AF, TA78DL15AF

5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V

Three-Terminal Low Dropout Voltage Regulator

The TA78DL××AF series consists of fixed-positive-output voltage regulator ICs capable of sourcing current of 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 built-in current limiting, thermal shutdown, overvoltage protection, input fault protection and excessive transient protection circuits.

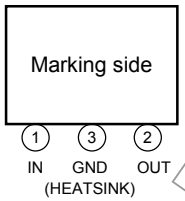


Weight
HSIP3-P-2.30B: 0.36 g (Typ.)
HSOP3-P-2.30A: 0.36 g (Typ.)

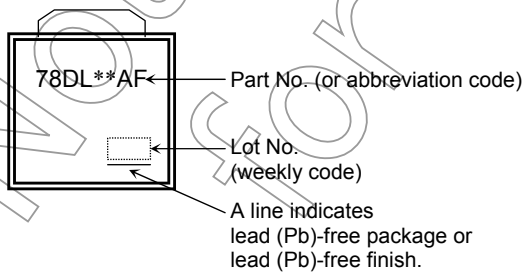
Features

- Low standby current of 500 μA typical.
- Maximum output current of 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.

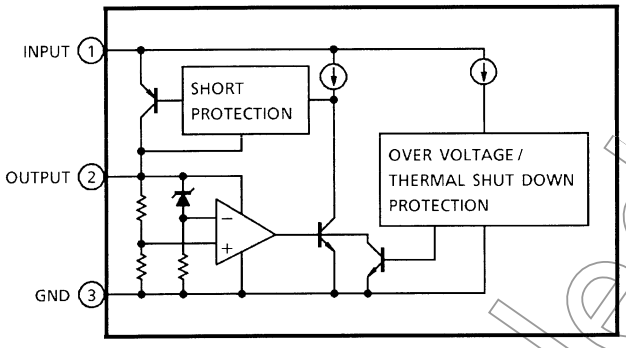
Pin Assignment



Marking



Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Characteristics		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		$R_{th\ (j\text{-}c)}$	12.5	°C/W
		$R_{th\ (j\text{-}a)}$	125	
Storage temperature time		T_{sol}	260 (10s)	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

TA78DL05AF
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 14 V, I_{OUT} = 10 mA, T_j = 25°C)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	9 V ≤ V_{IN} ≤ 16 V	—	2	10	mV
			6 V ≤ V_{IN} ≤ 26 V	—	4	30	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	14	50	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 6 V ≤ V_{IN} ≤ 26 V	—	0.5	1	mA
Dropout voltage	V_D	—	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)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	10 V ≤ V_{IN} ≤ 17 V	—	2	12	mV
			7 V ≤ V_{IN} ≤ 26 V	—	5	36	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	17	60	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 7 V ≤ V_{IN} ≤ 26 V	—	0.55	—	mA
Dropout voltage	V_D	—	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)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	12 V ≤ V_{IN} ≤ 19 V	—	3	16	mV
			9 V ≤ V_{IN} ≤ 26 V	—	6	45	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	22	80	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 9 V ≤ V_{IN} ≤ 26 V	—	0.6	—	mA
Dropout voltage	V_D	—	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)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	13 V ≤ V_{IN} ≤ 20 V	—	3	18	mV
			10 V ≤ V_{IN} ≤ 26 V	—	7	50	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	25	90	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 10 V ≤ V_{IN} ≤ 26 V	—	0.65	—	mA
Dropout voltage	V_D	—	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)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	14 V ≤ V_{IN} ≤ 21 V	—	4	20	mV
			11 V ≤ V_{IN} ≤ 26 V	—	8	60	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	28	100	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 11 V ≤ V_{IN} ≤ 26 V	—	0.7	—	mA
Dropout voltage	V_D	—	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

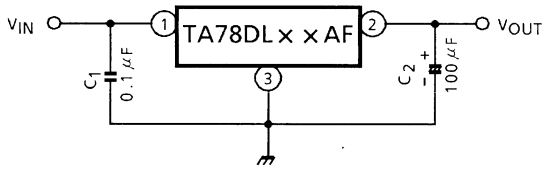
TA78DL12AF
Electrical Characteristics
(Unless otherwise specified, V_{IN} = 18 V, I_{OUT} = 10 mA, T_j = 25°C)

Characteristics	Symbol	Test Circuit	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	Reg·line	—	16 V ≤ V_{IN} ≤ 23 V	—	5	24	mV
			13 V ≤ V_{IN} ≤ 26 V	—	10	70	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	33	120	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 13 V ≤ V_{IN} ≤ 26 V	—	0.8	—	mA
Dropout voltage	V_D	—	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)

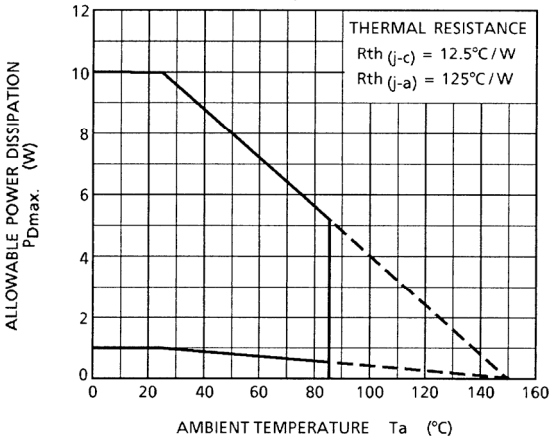
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	15.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	14.25	15	15.75	V
Line regulation	Reg·line	—	19 V ≤ V_{IN} ≤ 26 V	—	6	30	mV
			16 V ≤ V_{IN} ≤ 26 V	—	12	80	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	40	150	mV
Quiescent current	I_B	—	I_{OUT} ≤ 10 mA, 16 V ≤ V_{IN} ≤ 26 V	—	0.9	—	mA
Dropout voltage	V_D	—	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 Circuit

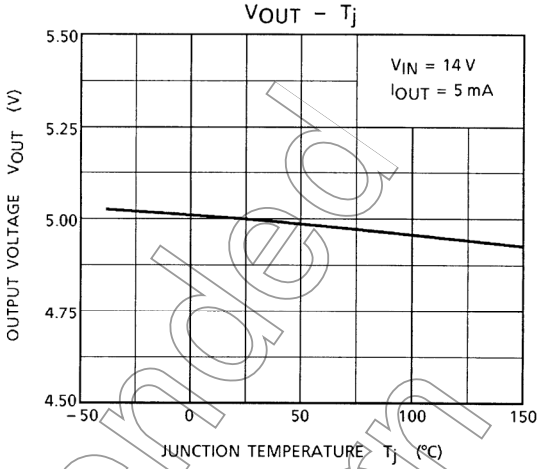


The capacitors C_{IN}/C_{OUT} must be guaranteed to operate within the temperature range in which the regulator operates correctly.
The equivalent series resistance (ESR) of C_{OUT} must be less than 1 Ω inside the operating temperature range.

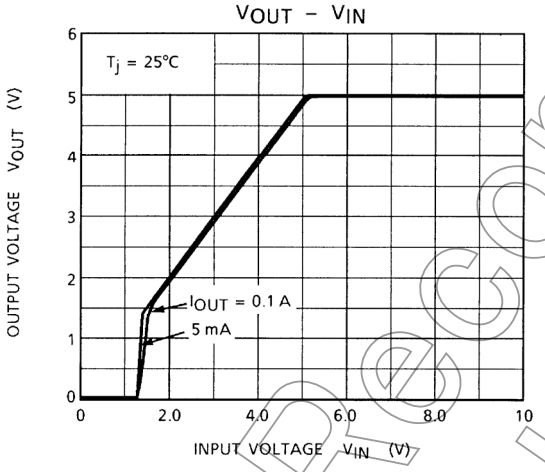
$P_{Dmax.}$ – Ta



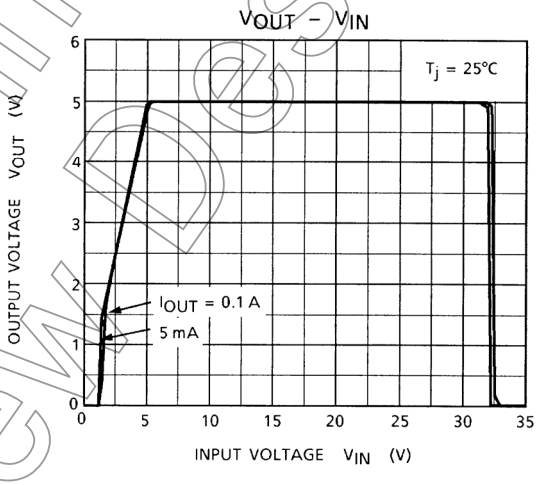
V_{OUT} – T_j



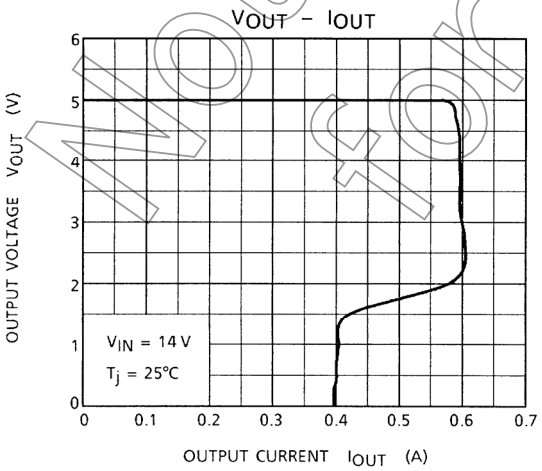
V_{OUT} – V_{IN}



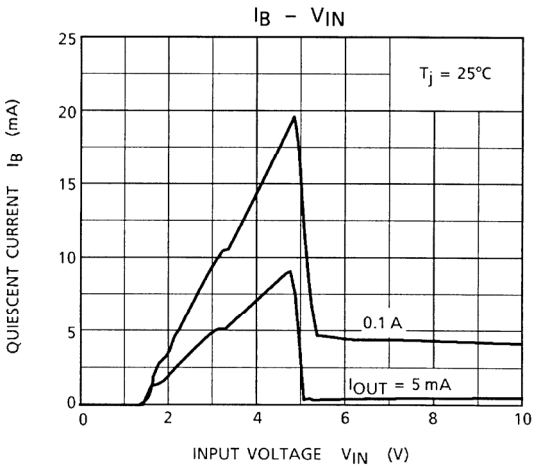
V_{OUT} – V_{IN}



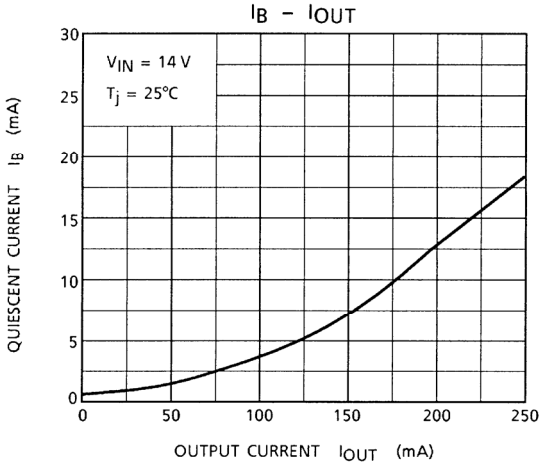
V_{OUT} – I_{OUT}



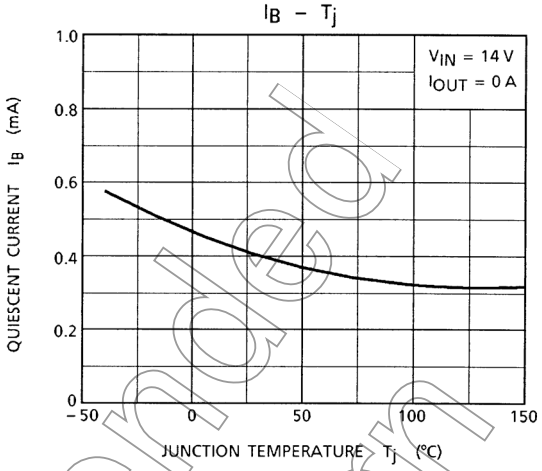
I_B – V_{IN}



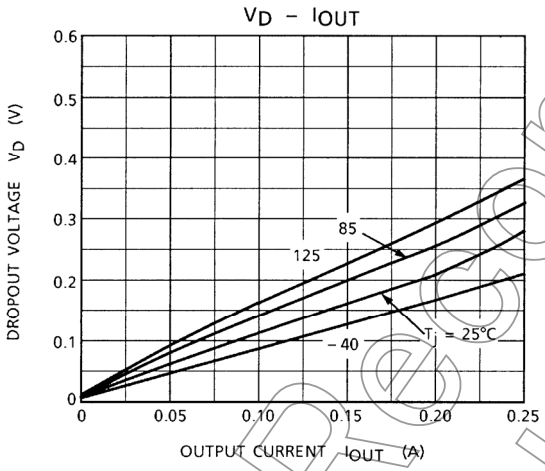
I_B – I_{OUT}



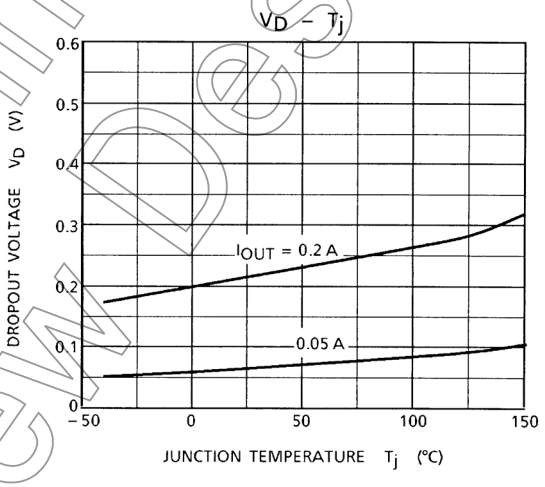
I_B – T_j



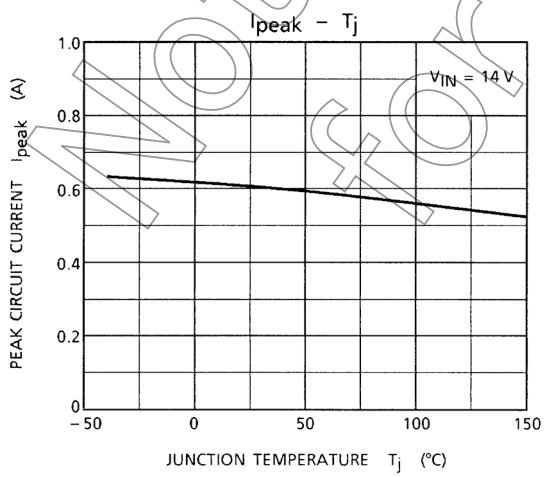
V_D – I_{OUT}



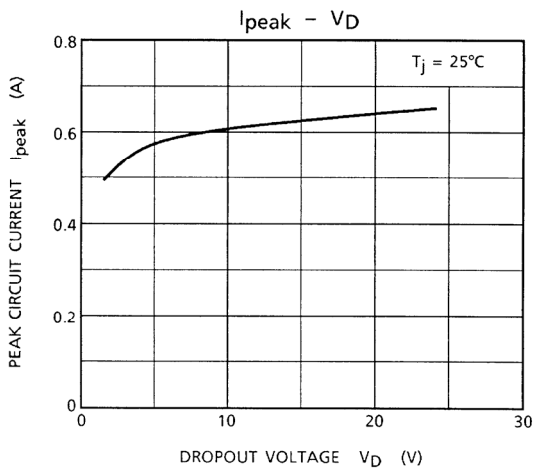
V_D – T_j

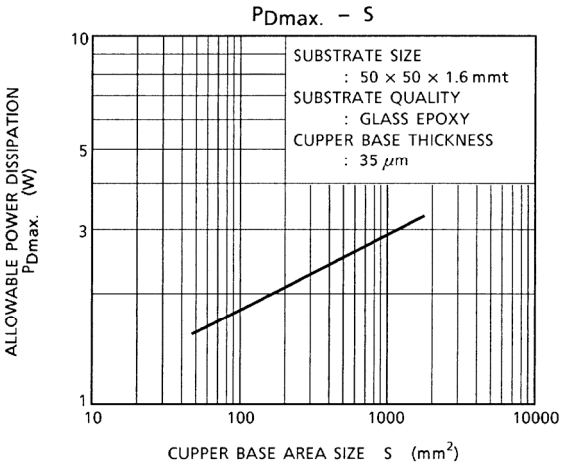


I_{peak} – T_j



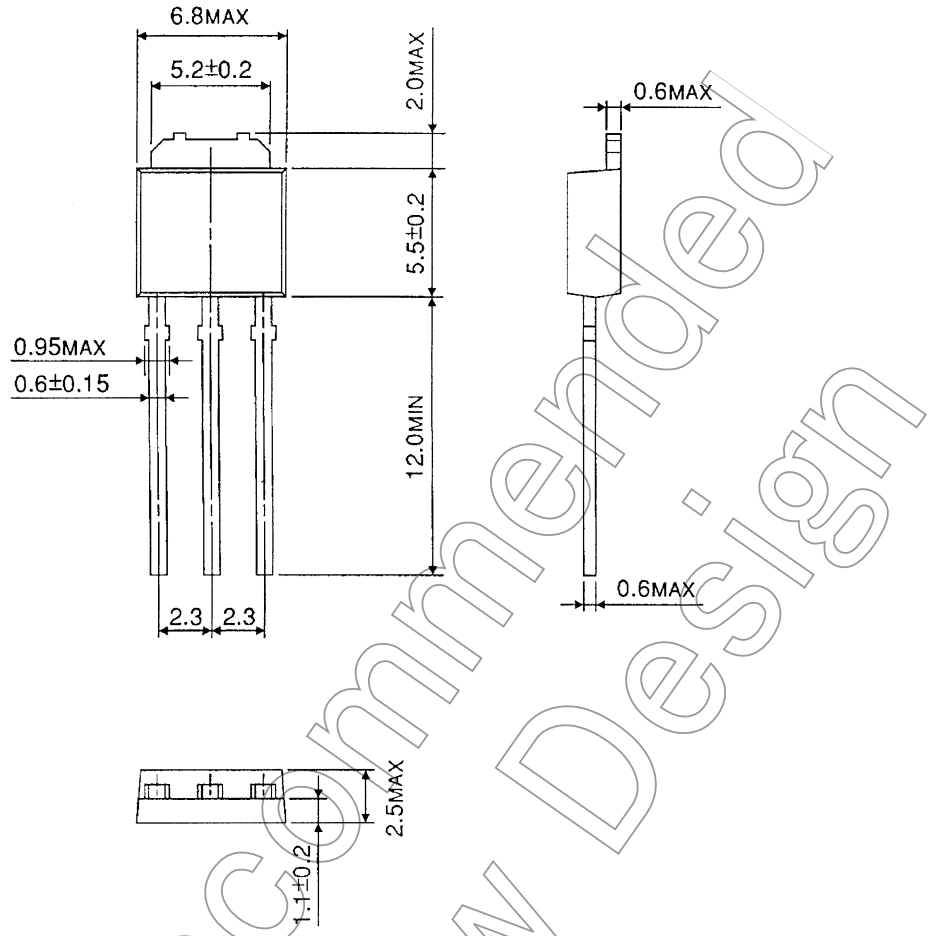
I_{peak} – V_D





Package Dimensions

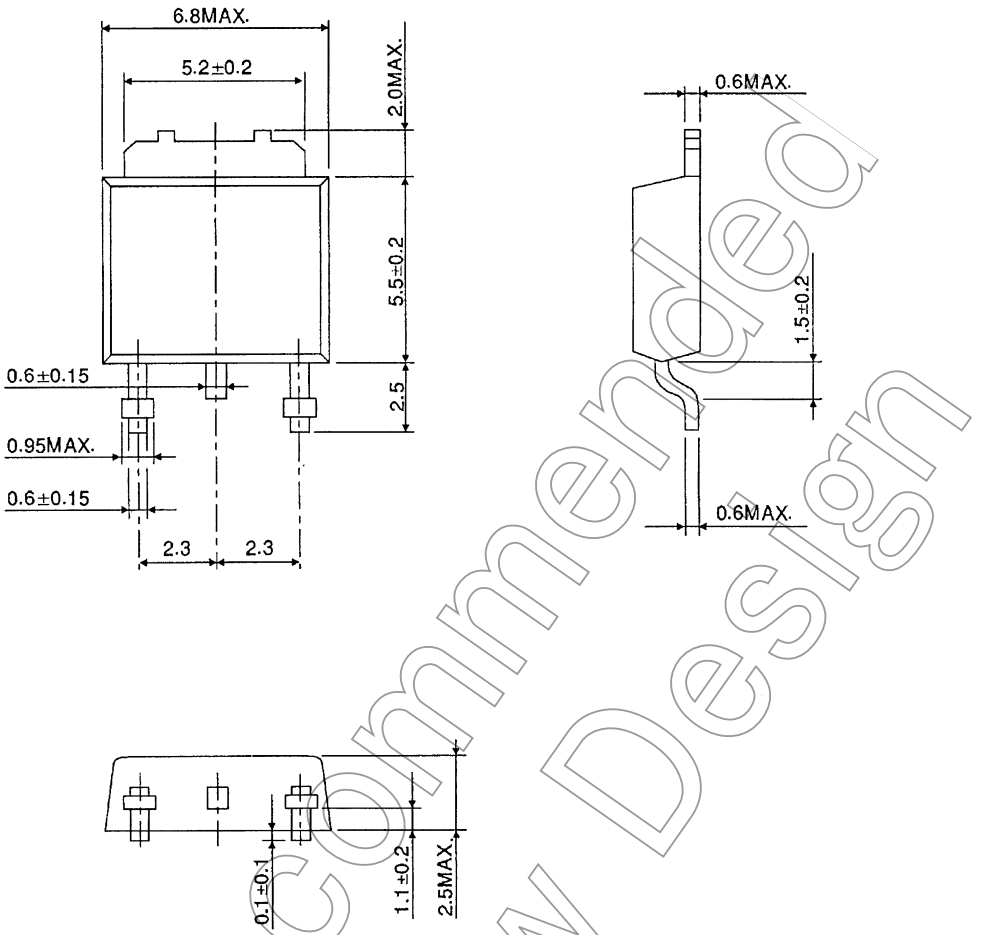
HSIP3-P-2.30B Unit : mm



Weight : 0.36 g (Typ.)

Package Dimensions

HSOP3-P-2.30A Unit : mm



Weight : 0.36 g (Typ.)

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20070701-EN

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