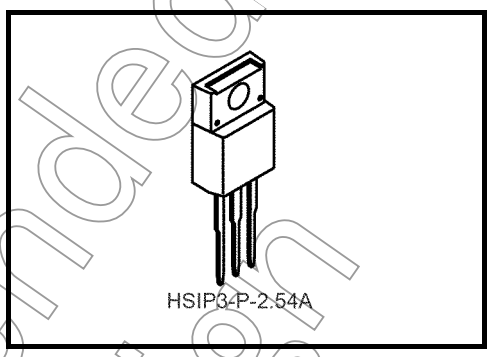
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA78DL05S,TA78DL06S,TA78DL08S,TA78DL09S, TA78DL10S,TA78DL12S,TA78DL15S

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

Three-Terminal Low Dropout Voltage Regulator

The TA78DL××S 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.

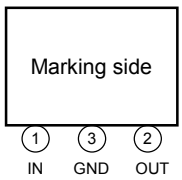


Weight: 1.7 g (typ.)

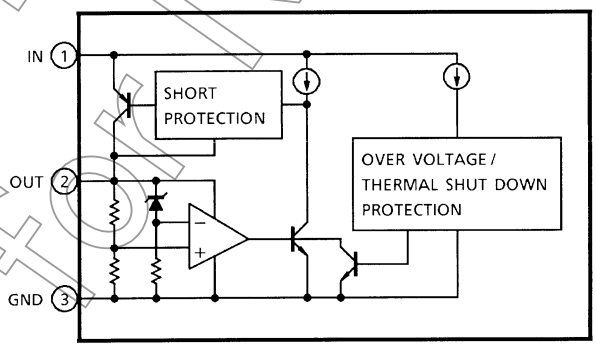
Features

- 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.
- Metal fin (tab) is fully covered with mold resin. (TO-220 NIS package)

Pin Assignment



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	2	W
	(Tc = 25°C)		20	
Operating temperature		T_{opr}	−40~85	°C
Storage temperature		T_{stg}	−55~150	°C
Junction temperature		T_j	150	°C
Thermal resistance		$R_{th\ (j\text{-}c)}$	6.25	°C/W
		$R_{th\ (j\text{-}a)}$	62.5	
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).

TA78DL05S
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	4.5	5.0	5.5	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

TA78DL06S
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	5.4	6.0	6.6	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

TA78DL08S
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	7.2	8	8.8	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

TA78DL09S
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	8.1	9	9.9	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

TA78DL10S
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	10	11	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

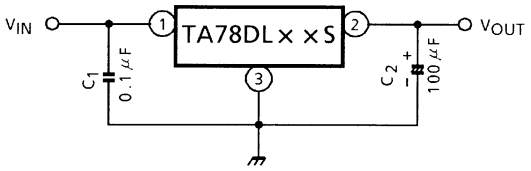
TA78DL12S
Electrical Characteristics (Unless otherwise specified, V_{IN} = 18 V, I_{OUT} = 10 mA, T_j = 25°C)

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	10.8	12	13.2	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

TA78DL15S
Electrical Characteristics (Unless otherwise specified, V_{IN} = 20 V, I_{OUT} = 10 mA, T_j = 25°C)

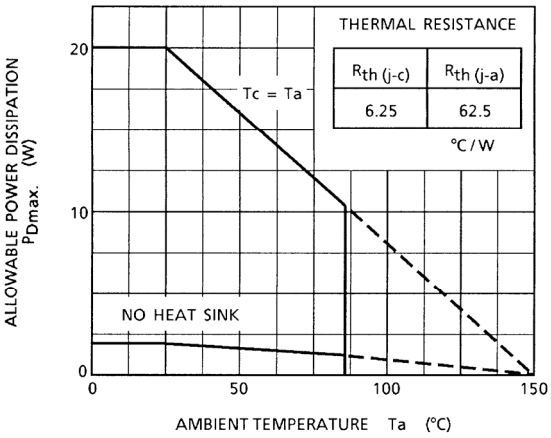
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	—	15.35 V ≤ V_{IN} ≤ 26 V, −40°C ≤ Ta ≤ 85°C	13.5	15	16.5	V
Line regulation	Reg·line	—	19 V ≤ V_{IN} ≤ 26 V	—	6	30	mV
			16 V ≤ V_{IN} ≤ 26 V	—	12	80	
Load regulation	Reg·load	—	10 mA ≤ I_{OUT} ≤ 200 mA	—	40	150	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

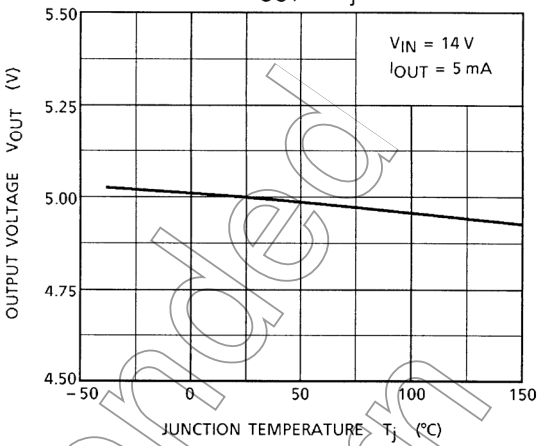


Capacitor C_{IN}/C_{OUT} must be guaranteed to operate of the temperature range that the regulator should be operated correctly.
The equivalent series resistance (ESR) of C_{OUT} must be less than 1 Ω in operating temperature range.

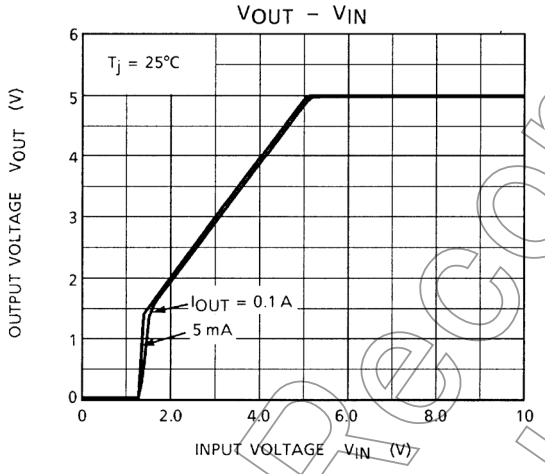
$P_{Dmax.}$ – Ta



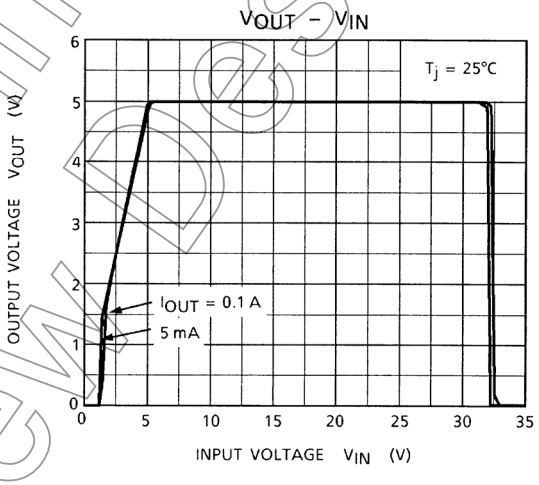
V_{OUT} – T_j



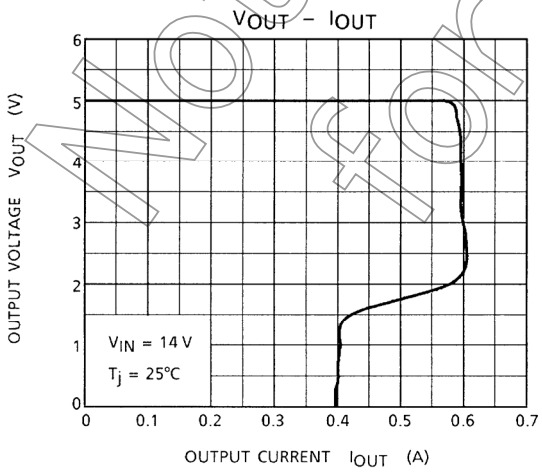
V_{OUT} – V_{IN}



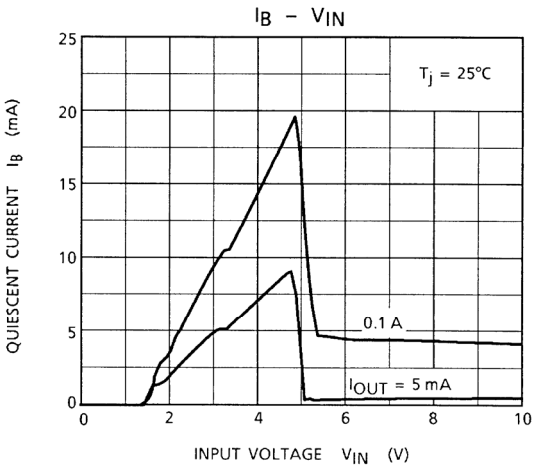
V_{OUT} – V_{IN}



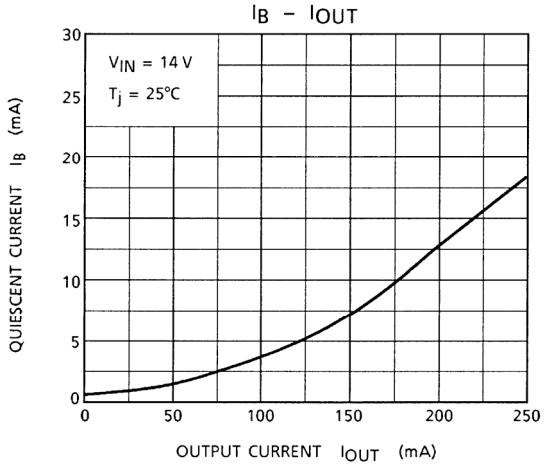
V_{OUT} – I_{OUT}



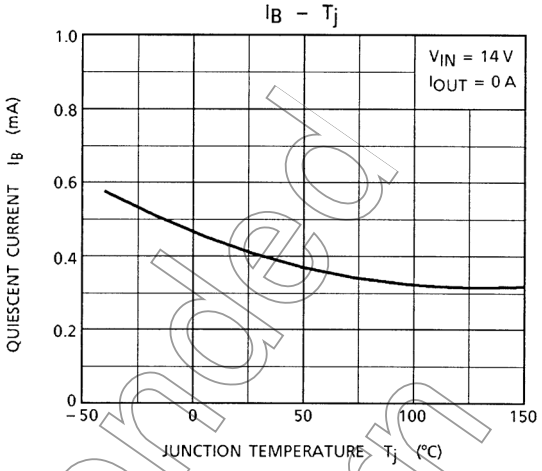
I_B – V_{IN}



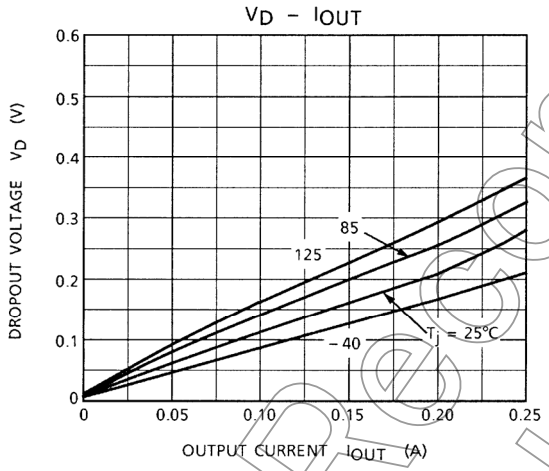
I_B – I_{OUT}



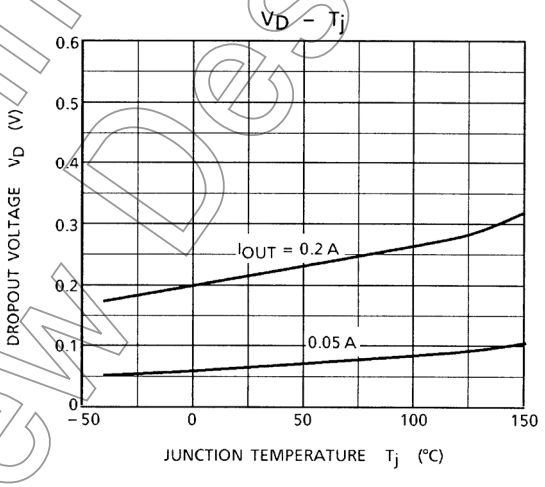
I_B – T_j



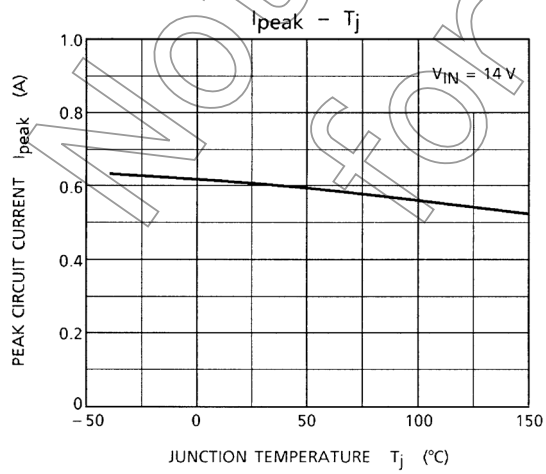
V_D – I_{OUT}



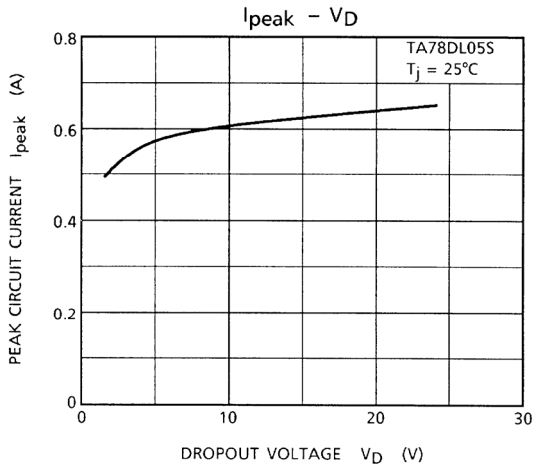
V_D – T_j



I_{peak} – T_j

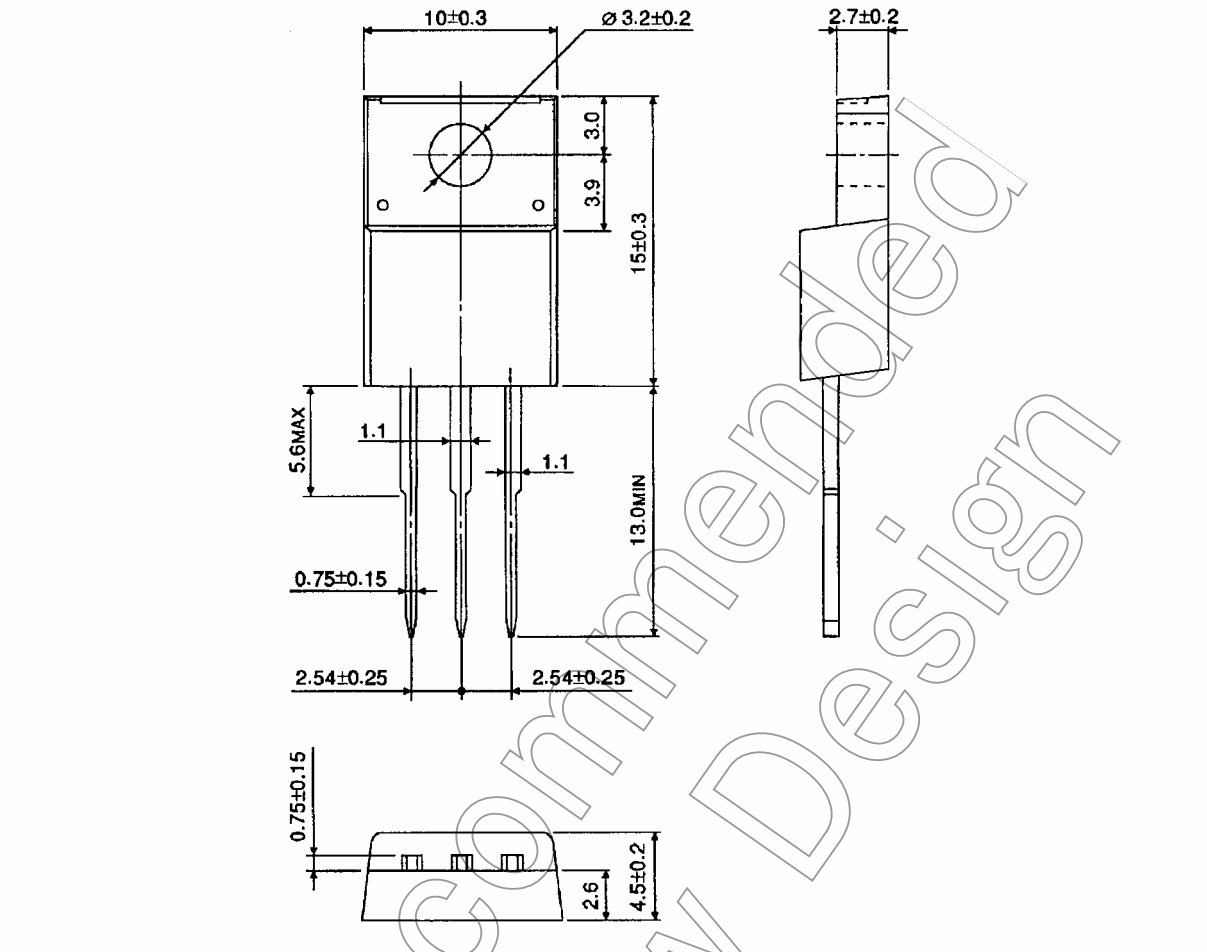


I_{peak} – V_D



Package Dimensions

HSIP3-P-2.54A Unit: mm



Weight: 1.7 g (typ.)

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20070701-EN

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