

TK5A50D5

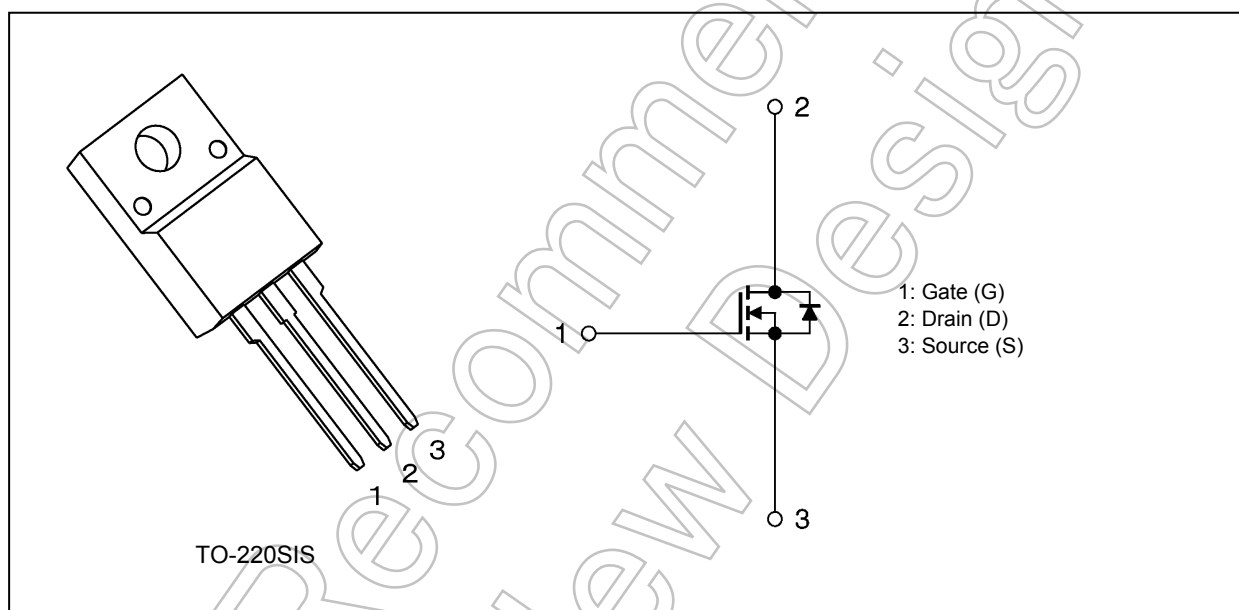
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Fast reverse recovery time: $t_{rrf} = 40 \text{ ns (typ.)}$, $t_{rr} = 90 \text{ ns (typ.)}$
- (2) Low drain-source on-resistance: $R_{DS(ON)} = 1.62 \Omega \text{ (typ.)}$
- (3) High forward transfer admittance: $|Y_{fs}| = 3.0 \text{ S (typ.)}$
- (4) Low leakage current: $I_{DSS} = 10 \mu\text{A (max)}$ ($V_{DS} = 500 \text{ V}$)
- (5) Enhancement mode: $V_{th} = 2.5 \text{ to } 4.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings (Note) ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	500	V
Gate-source voltage	V_{GSS}	± 30	
Drain current (DC) (Note 1)	I_{D}	5	A
Drain current (pulsed) ($t = 1 \text{ ms}$) (Note 1)	I_{DP}	20	
Power dissipation ($T_c = 25^\circ\text{C}$)	P_{D}	35	W
Single-pulse avalanche energy (Note 2)	E_{AS}	150	mJ
Avalanche current	I_{AR}	5	A
Repetitive avalanche energy (Note 3)	E_{AR}	3.5	mJ
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to 150	

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.

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).

5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance	$R_{\text{th(ch-c)}}$	3.57	$^\circ\text{C/W}$
Channel-to-ambient thermal resistance	$R_{\text{th(ch-a)}}$	62.5	

Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{\text{DD}} = 90 \text{ V}$, $T_{\text{ch}} = 25^\circ\text{C}$ (initial), $L = 10.2 \text{ mH}$, $R_{\text{G}} = 25 \Omega$, $I_{\text{AR}} = 5 \text{ A}$

Note 3: Repetitive rating; pulse width limited by maximum channel temperature

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

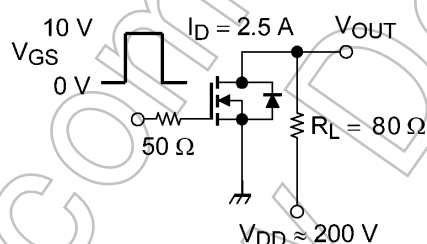
6. Electrical Characteristics

6.1. Static Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 30\text{ V}$, $V_{DS} = 0\text{ V}$	—	—	± 1	μA
Drain cut-off current	I_{DSS}	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$	—	—	10	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}$, $V_{GS} = 0\text{ V}$	500	—	—	V
Gate threshold voltage	V_{th}	$V_{DS} = 10\text{ V}$, $I_D = 1\text{ mA}$	2.5	—	4.5	
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$	—	1.62	2.1	Ω
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10\text{ V}$, $I_D = 2.5\text{ A}$	0.8	3.0	—	S

6.2. Dynamic Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	$V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$	—	490	—	pF
Reverse transfer capacitance	C_{rss}		—	3	—	
Output capacitance	C_{oss}		—	55	—	
Switching time (rise time)	t_r	See Figure 6.2.1.	—	18	—	ns
Switching time (turn-on time)	t_{on}		—	40	—	
Switching time (fall time)	t_f		—	8	—	
Switching time (turn-off time)	t_{off}		—	55	—	



Duty $\leq 1\%$, $t_w = 10\text{ }\mu\text{s}$

Fig. 6.2.1 Switching Time Test Circuit

6.3. Gate Charge Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Q_g	$V_{DD} \approx 400\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 5\text{ A}$	—	11	—	nC
Gate-source charge	Q_{gs}		—	6	—	
Gate-drain charge	Q_{gd}		—	5	—	

6.4. Source-Drain Characteristics ($T_a = 25^\circ\text{C}$ unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse drain current (DC) (Note 4)	I_{DR}	—	—	—	5	A
Reverse drain current (pulsed) (Note 4)	I_{DRP}	—	—	—	20	A
Diode forward voltage	V_{DSF}	$I_{DR} = 5\text{ A}$, $V_{GS} = 0\text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rrf}	$I_{DR} = 5\text{ A}$, $V_{GS} = 0\text{ V}$, $-dI_{DR}/dt = 100\text{ A}/\mu\text{s}$, See Figure 6.4.1	—	40	—	ns
	t_{rr}		—	90	—	
Reverse recovery charge	Q_{rr}	$I_{DR} = 5\text{ A}$, $V_{GS} = 0\text{ V}$, $-dI_{DR}/dt = 100\text{ A}/\mu\text{s}$	—	70	—	nC

Note 4: Ensure that the channel temperature does not exceed 150°C .

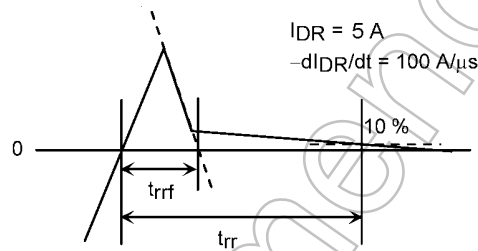


Fig. 6.4.1 Reverse Recovery Time

7. Marking (Note)

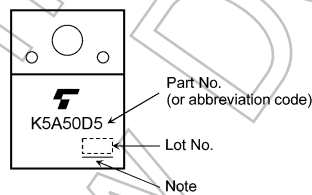


Fig. 7.1 Marking

Note: A line under a Lot No. identifies the indication of product Labels.

[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

8. Characteristics Curves (Note)

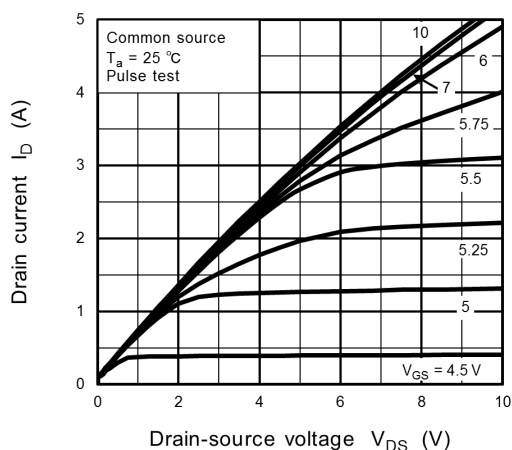


Fig. 8.1 $I_D - V_{DS}$

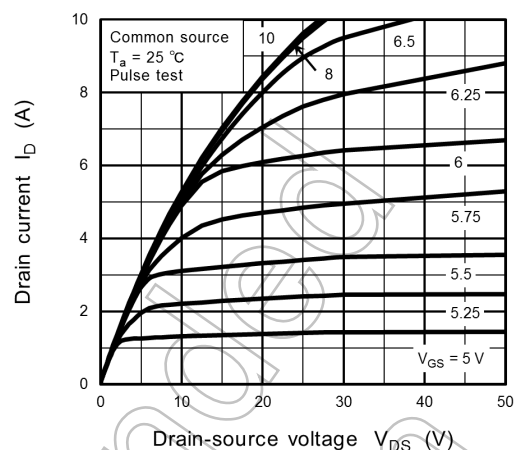


Fig. 8.2 $I_D - V_{DS}$

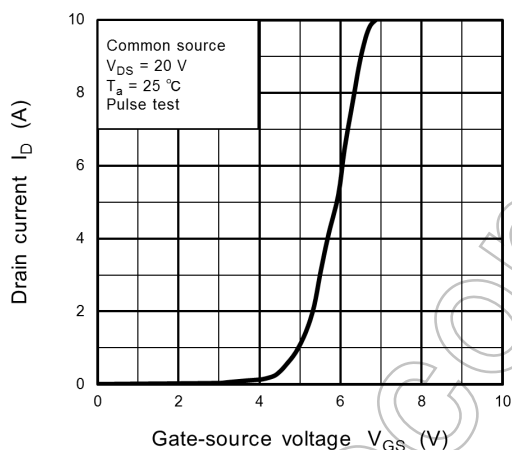


Fig. 8.3 $I_D - V_{GS}$

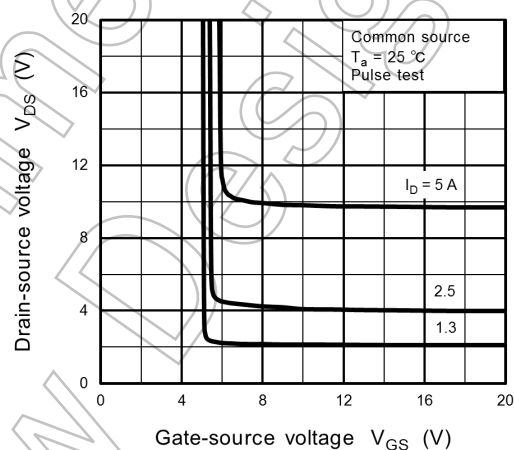


Fig. 8.4 $V_{DS} - V_{GS}$

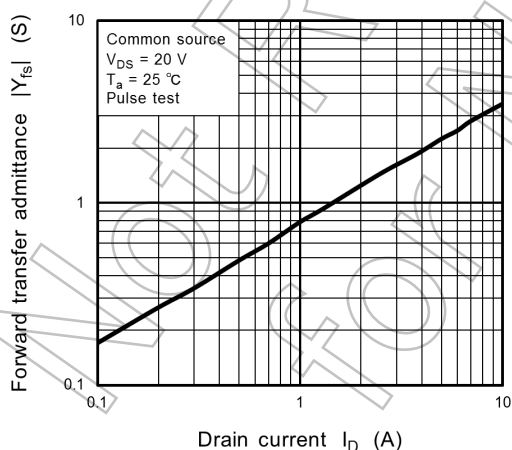


Fig. 8.5 $|Y_{fs}| - I_D$

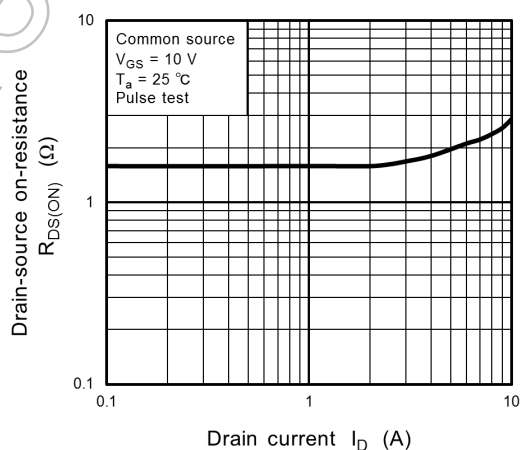


Fig. 8.6 $R_{DS(ON)} - I_D$

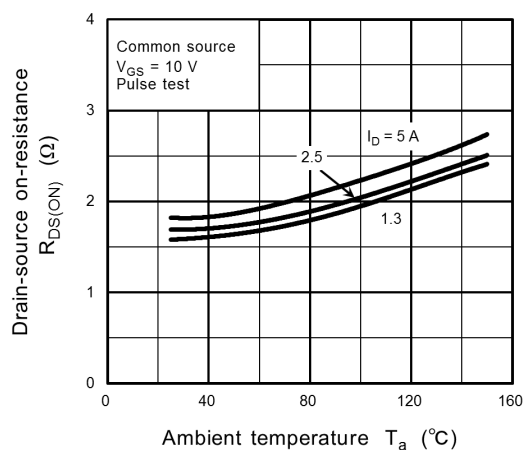


Fig. 8.7 $R_{DS(ON)} - T_a$

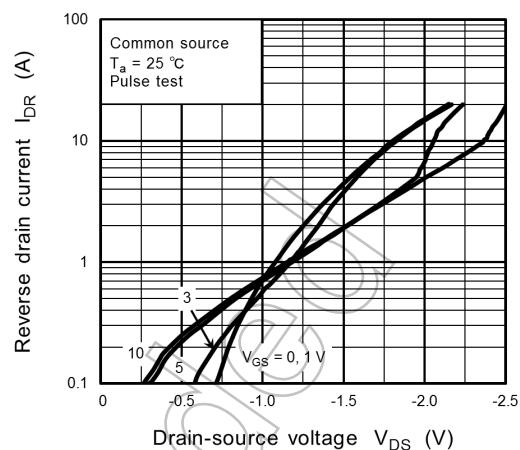


Fig. 8.8 $I_{DR} - V_{DS}$

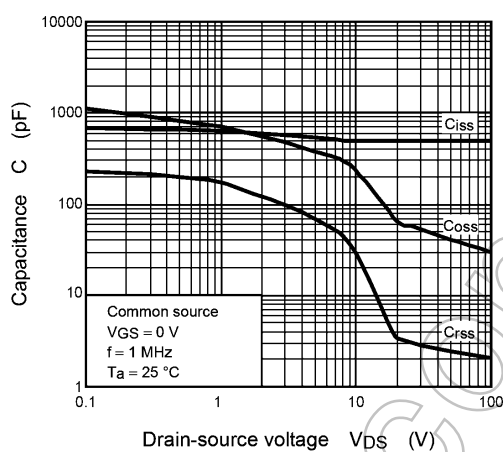


Fig. 8.9 $C - V_{DS}$

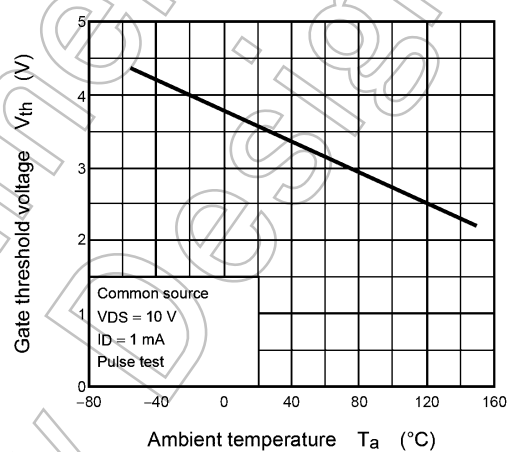


Fig. 8.10 $V_{th} - T_a$

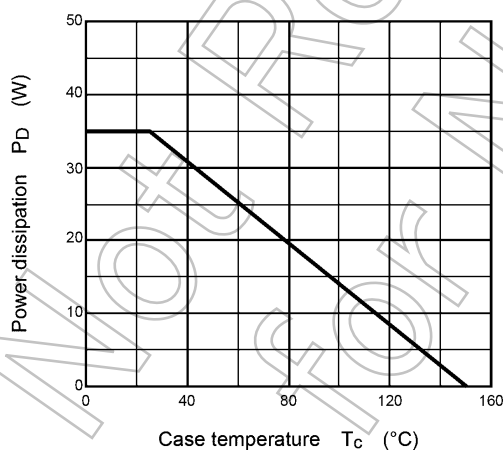


Fig. 8.11 $P_D - T_c$
(Guaranteed Maximum)

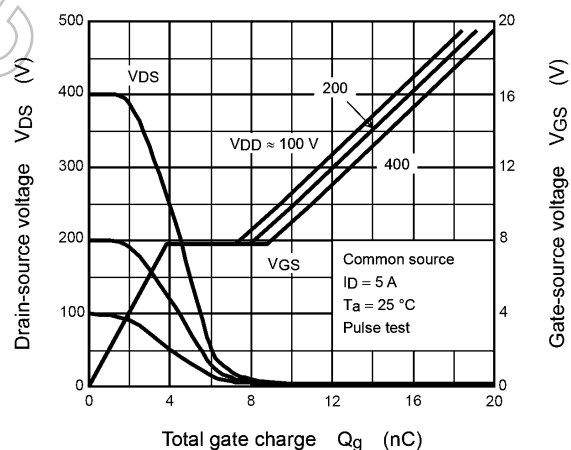


Fig. 8.12 Dynamic Input/Output Characteristics

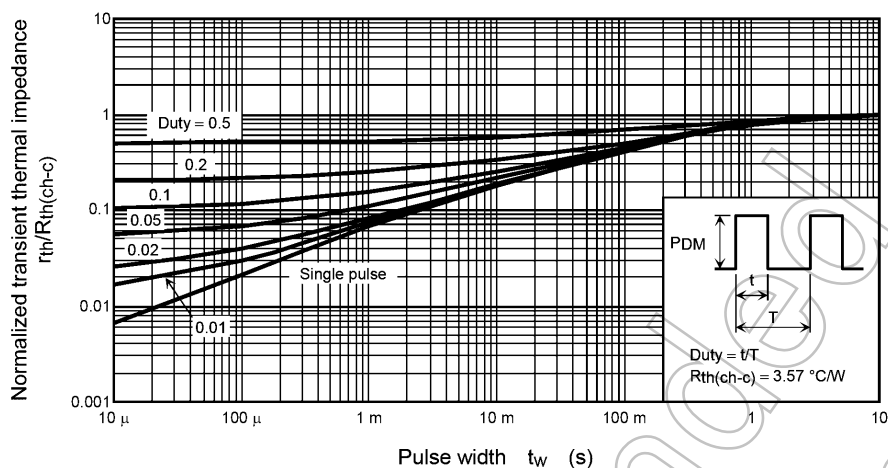


Fig. 8.13 $r_{th}/R_{th(ch-c)} - t_w$
(Guaranteed Maximum)

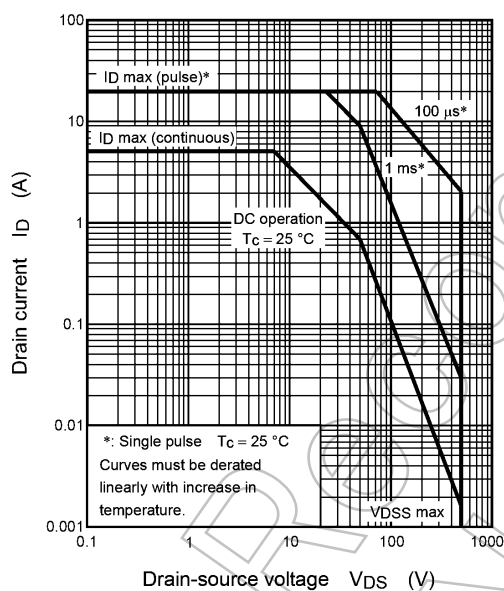


Fig. 8.14 Safe Operating Area
(Guaranteed Maximum)

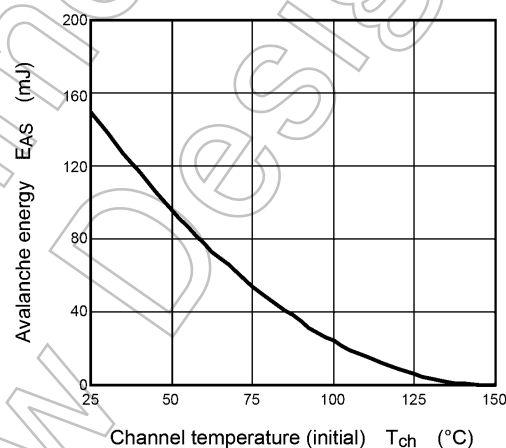
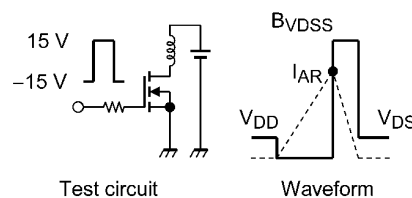


Fig. 8.15 $E_{AS} - T_{ch}$
(Guaranteed Maximum)



$$R_G = 25\ \Omega$$

$$V_{DD} = 90\ \text{V}, L = 10.2\ \text{mH}$$

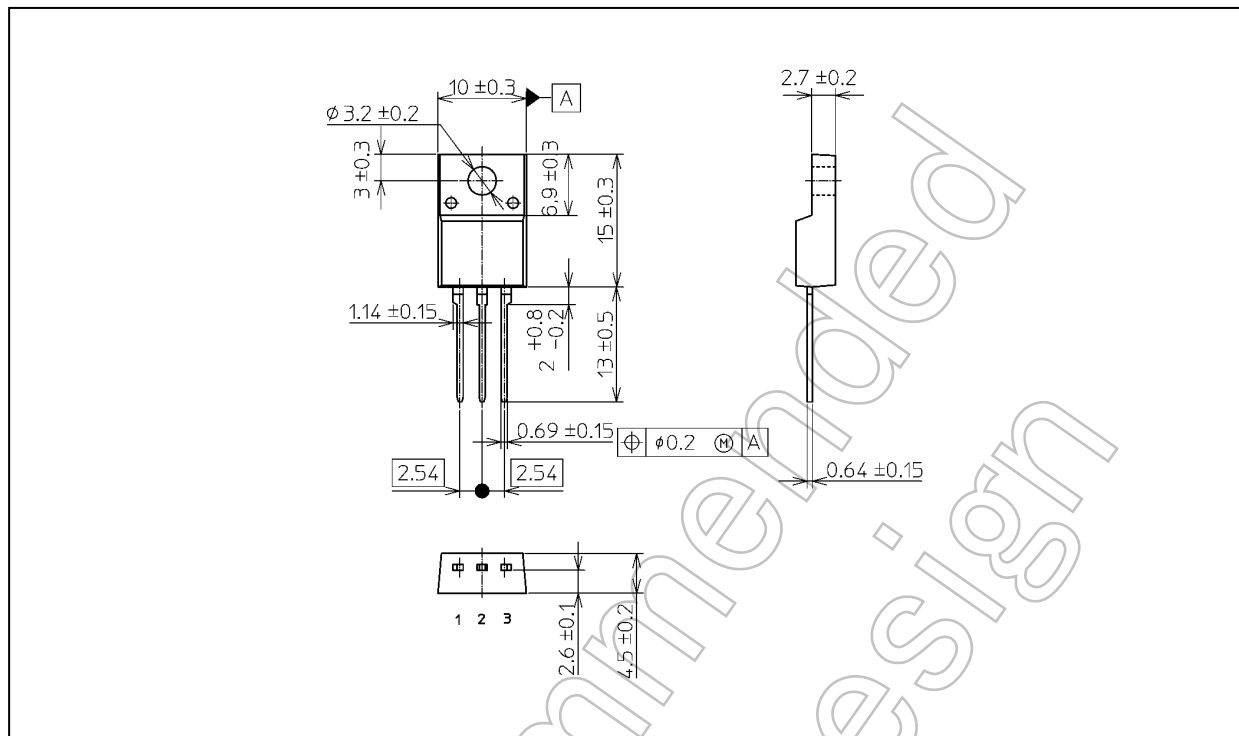
$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDS}}{B_{VDS} - V_{DD}} \right)$$

Fig. 8.16 Test Circuit/Waveform

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 1.7 g (typ.)

Package Name(s)
JEITA: SC-67
TOSHIBA: 2-10U1S
Nickname: TO-220SIS

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