

MOSFETs Silicon N-Channel MOS (DTMOS II)

TK50J60U

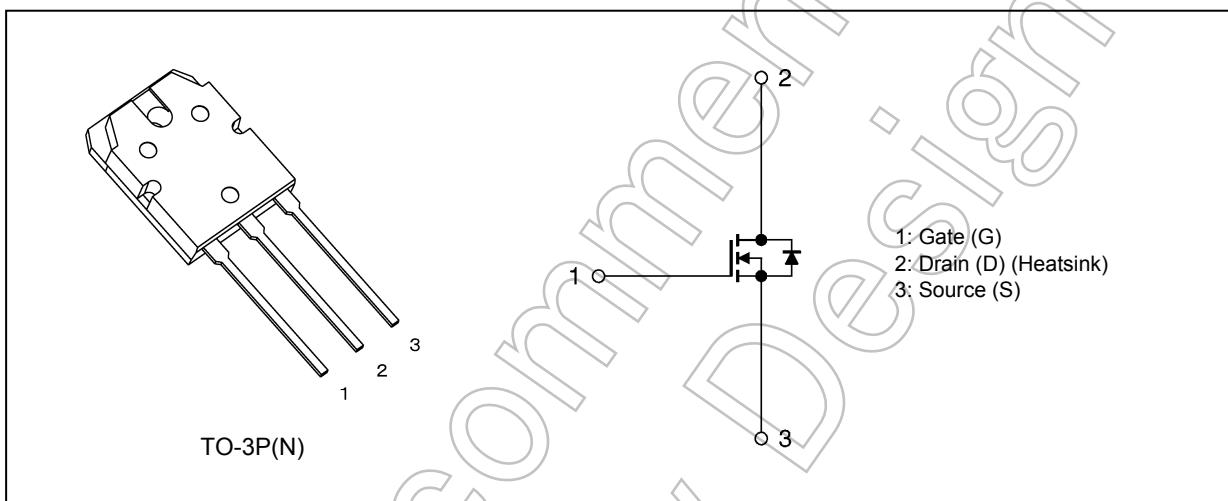
1. Applications

- Switching Voltage Regulators

2. Features

- (1) Low drain-source on-resistance: $R_{DS(ON)} = 0.056 \Omega$ (typ.)
- (2) High forward transfer admittance: $|Y_{fs}| = 30 \text{ S}$ (typ.)
- (3) Low leakage current: $I_{DSS} = 100 \mu\text{A}$ (max) ($V_{DS} = 600 \text{ V}$)
- (4) Enhancement mode: $V_{th} = 3.0$ to 5.0 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}	600	V
Gate-source voltage	V_{GSS}	± 30	
Drain current (DC)	(Note 1)	I_D	A
Drain current (pulsed)	(Note 1)	I_{DP}	
Power dissipation	($T_c = 25^\circ\text{C}$)	P_D	W
Single-pulse avalanche energy	(Note 2)	E_{AS}	mJ
Avalanche current	I_{AR}	25	A
Repetitive avalanche energy	(Note 3)	E_{AR}	mJ
Channel temperature	T_{ch}	150	
Storage temperature	T_{stg}	-55 to 150	$^\circ\text{C}$

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.

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.).

Start of commercial production
2010-01

5. Thermal Characteristics

Characteristics	Symbol	Max	Unit
Channel-to-case thermal resistance	$R_{th(ch-c)}$	0.313	°C/W
Channel-to-ambient thermal resistance	$R_{th(ch-a)}$	50	

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

Note 2: $V_{DD} = 90$ V, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 2.52$ mH, $R_G = 25$ Ω, $I_{AR} = 25$ 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.

Not Recommended
for New Design

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}	$V_{DS} = 600 \text{ V}$, $V_{GS} = 0 \text{ V}$	—	—	100	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10 \text{ mA}$, $V_{GS} = 0 \text{ V}$	600	—	—	V
Gate threshold voltage	V_{th}	$V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$	3.0	—	5.0	
Drain-source on-resistance	$R_{DSS(\text{ON})}$	$V_{GS} = 10 \text{ V}$, $I_D = 25 \text{ A}$	—	0.056	0.065	Ω
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10 \text{ V}$, $I_D = 25 \text{ A}$	7.5	30	—	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}	$V_{DS} = 100 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$	—	4050	—	pF
Reverse transfer capacitance	C_{rss}		—	2	—	
Output capacitance	C_{oss}		—	210	—	
Switching time (rise time)	t_r	See Figure 6.2.1.	—	90	—	ns
Switching time (turn-on time)	t_{on}		—	200	—	
Switching time (fall time)	t_f		—	17	—	
Switching time (turn-off time)	t_{off}		—	200	—	

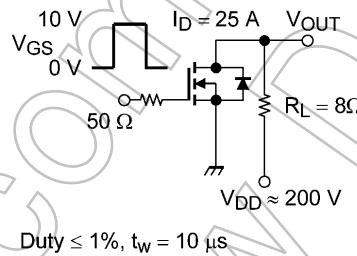


Fig. 6.2.1 Switching Time Test Circuit

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	$V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 50 \text{ A}$	—	67	—	nC
Gate-source charge	Q_{gs}		—	45	—	
Gate-drain charge	Q_{gd}		—	22	—	

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 1)	I_{DR}	—	—	—	50	A
Reverse drain current (pulsed) (Note 1)	I_{DRP}	—	—	—	100	
Diode forward voltage	V_{DSF}	$I_{DR} = 50 \text{ A}, V_{GS} = 0 \text{ V}$	—	—	-1.7	V
Reverse recovery time	t_{rr}	$I_{DR} = 50 \text{ A}, V_{GS} = 0 \text{ V}$ $-dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$	—	600	—	ns
Reverse recovery charge	Q_{rr}		—	17	—	μC

7. Marking (Note)

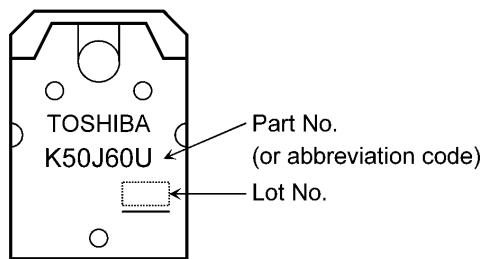


Fig. 7.1 Marking

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

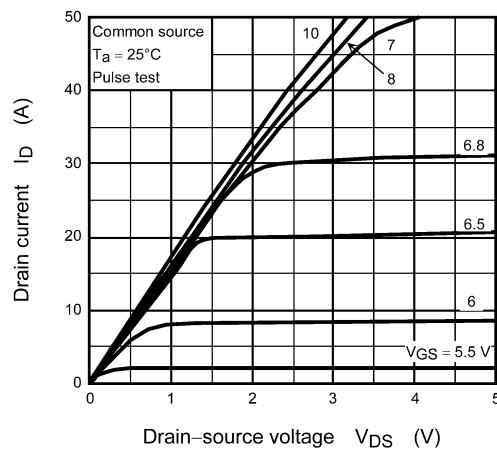
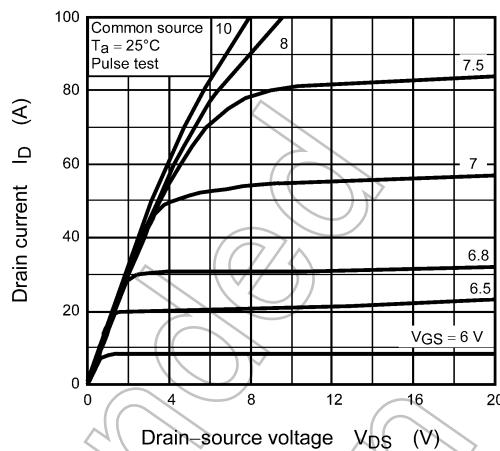
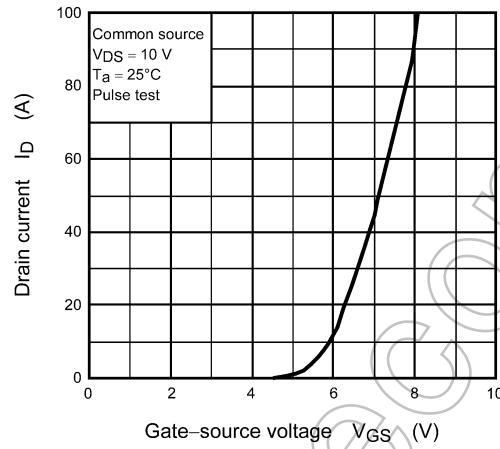
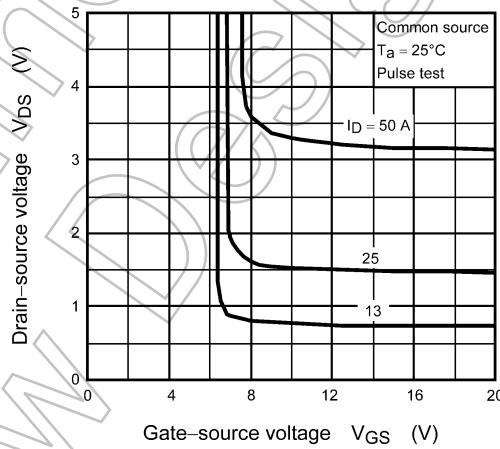
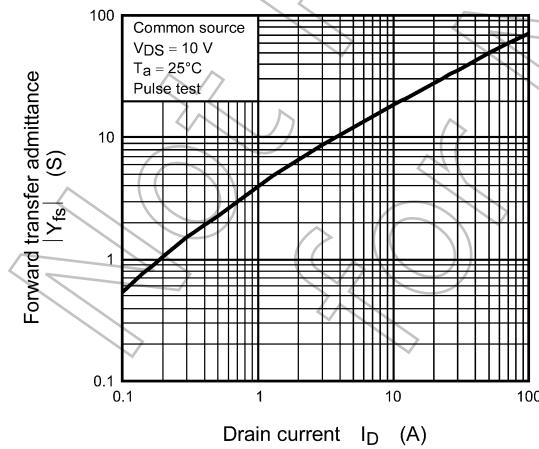
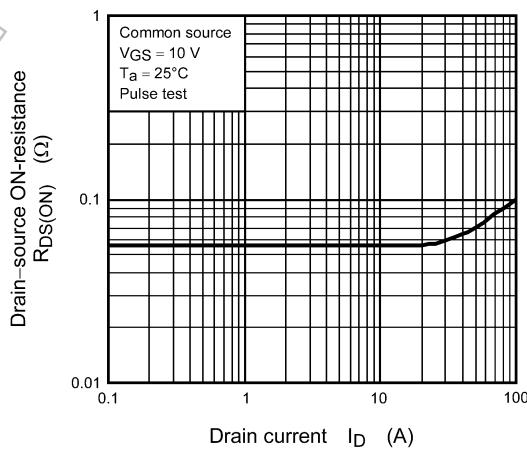
Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[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

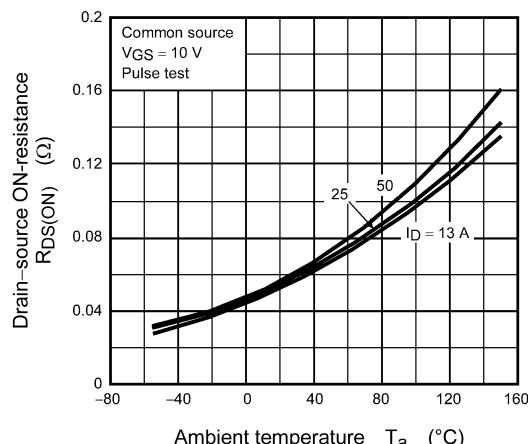
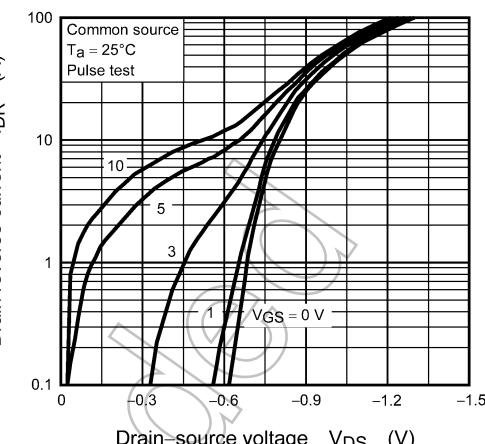
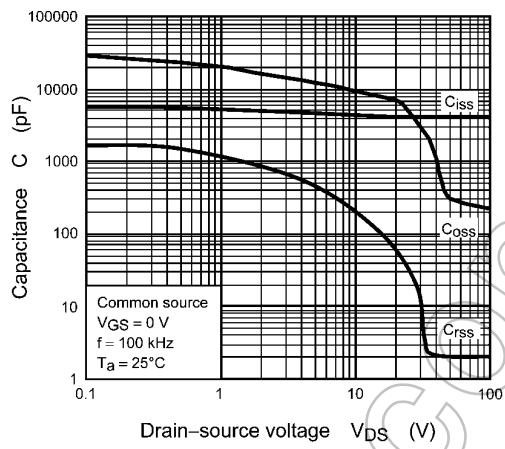
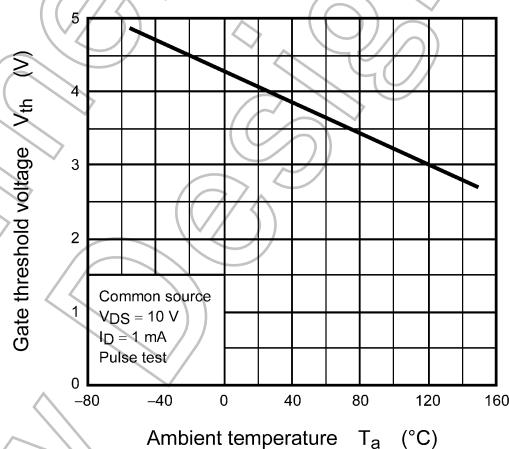
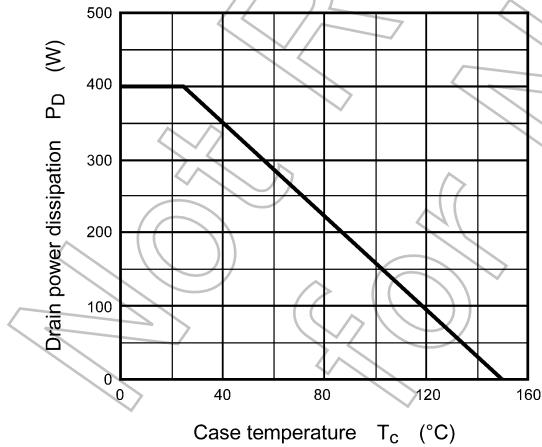
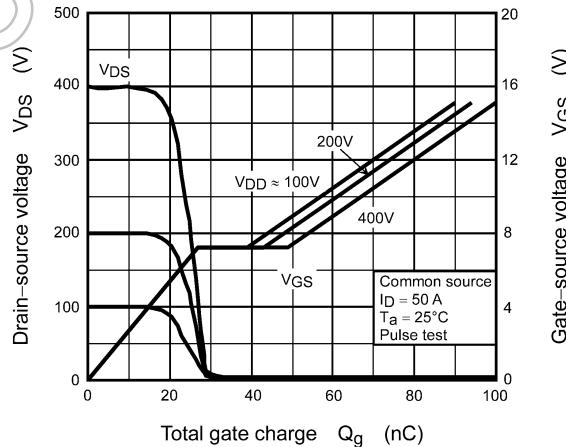
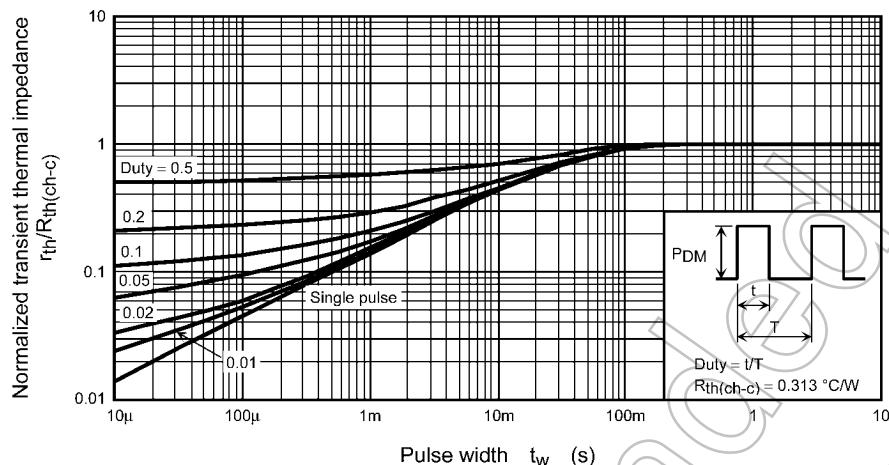
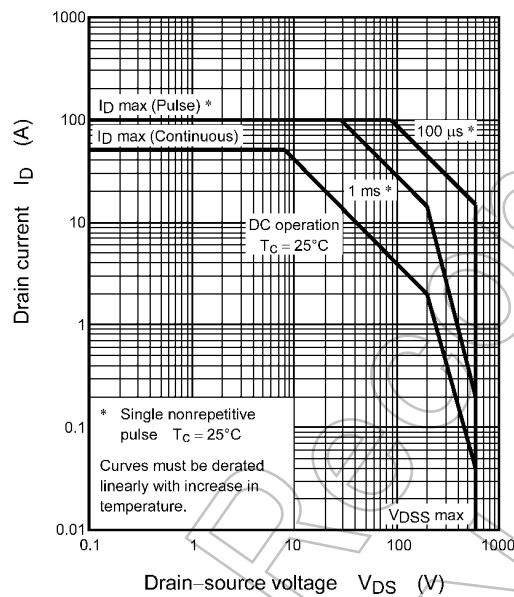
Fig. 8.7 $R_{DS(ON)}$ - T_a Fig. 8.8 I_{DR} - V_{DS} Fig. 8.9 C - V_{DS} Fig. 8.10 V_{th} - T_a Fig. 8.11 P_D - T_c
(Guaranteed Maximum)

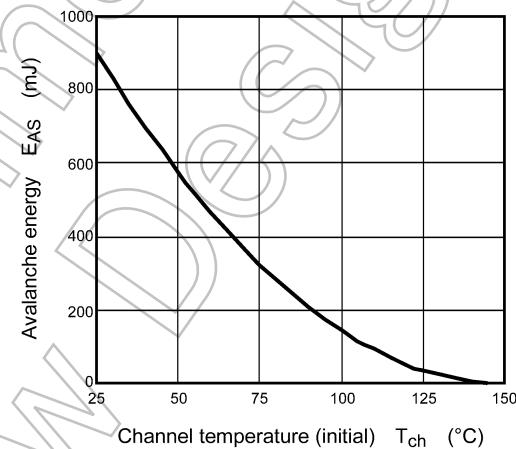
Fig. 8.12 Dynamic Input/Output Characteristics



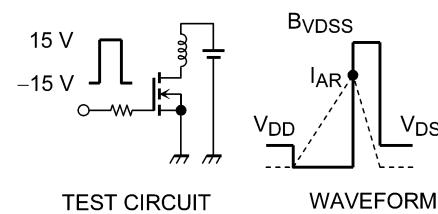
**Fig. 8.13 $r_{th}/R_{th(ch-c)}$ - t_w
(Guaranteed Maximum)**



**Fig. 8.14 Safe Operating Area
(Guaranteed Maximum)**



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



$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 2.52 \text{ mH}$$

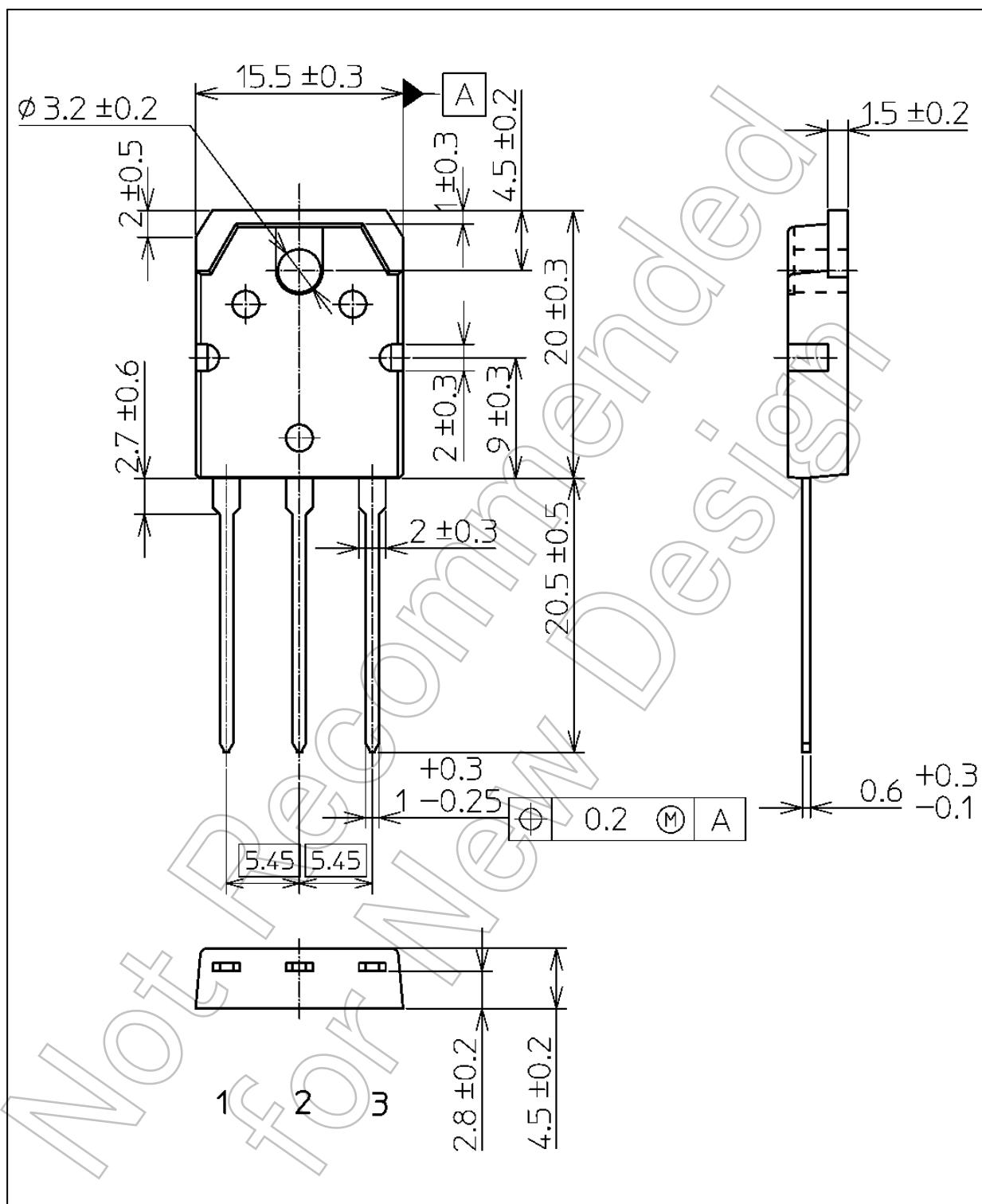
$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDS}}{B_{VDS} - V_{DD}} \right)$$

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: 4.6 g (typ.)

Package Name(s)
JEITA: SC-65
TOSHIBA: 2-16C1S
Nickname: TO-3P(N)

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