TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (High Speed U−MOSII)

# TPC8006−H

High Speed and High Efficiency DC−DC Converters
Portable Equipment Applications
Notebook PC Applications

- Small footprint due to small and thin package
- High speed switching
- Small gate charge : $Q_g$ = 16 nC (typ.)
- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 19 mΩ (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 8.8 S (typ.)
- Low leakage current : $I_{DSS}$ = 10 μA (max) ($V_{DS}$ = 30 V)
- Enhancement−mode : $V_{th}$ = 1.3~2.5 V ($V_{DS}$ = 10 V, $I_D$ = 1 mA)

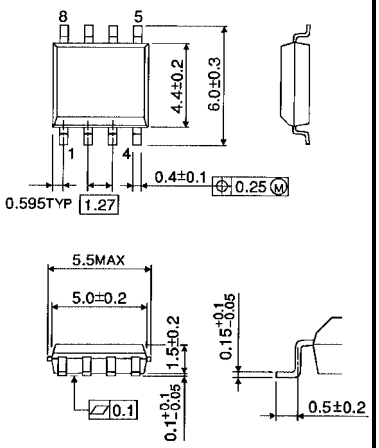
## Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-source voltage | | $V_{DSS}$ | 30 | V |
| Drain-gate voltage ($R_{GS}$ = 20 kΩ) | | $V_{DGR}$ | 30 | V |
| Gate-source voltage | | $V_{GSS}$ | ±20 | V |
| Drain current | DC (Note 1) | $I_D$ | 7 | A |
| | Pulse (Note 1) | $I_{DP}$ | 28 | |
| Drain power dissipation (t = 10 s) (Note 2a) | | $P_D$ | 2.4 | W |
| Drain power dissipation (t = 10 s) (Note 2b) | | $P_D$ | 1.0 | W |
| Single pulse avalanche energy (Note 3) | | $E_{AS}$ | 63.7 | mJ |
| Avalanche current | | $I_{AR}$ | 7 | A |
| Repetitive avalanche energy (Note 2a) (Note 4) | | $E_{AR}$ | 0.24 | mJ |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

Note: For (Note 1), (Note 2), (Note 3) and (Note 4), please refer to the next page.

This transistor is an electrostatic sensitive device. Please handle with caution.

Unit: mm

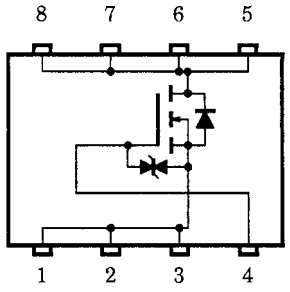



1, 2, 3 SOURCE
4 GATE
5, 6, 7, 8 DRAIN

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-6J1B |

Weight: 0.080 g (typ.)

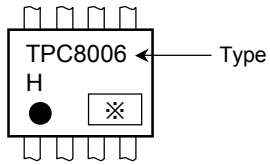
## Circuit Configuration



## Thermal Characteristics

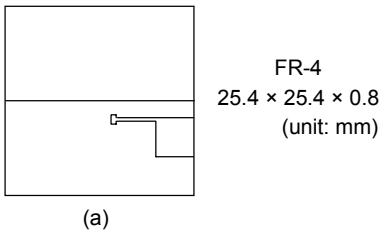
| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, channel to ambient (t = 10 s) (Note 2a) | $R_{th\ (ch\text{-}a)}$ | 52.1 | °C/W |
| Thermal resistance, channel to ambient (t = 10 s) (Note 2b) | $R_{th\ (ch\text{-}a)}$ | 125 | °C/W |

## Marking (Note 5)

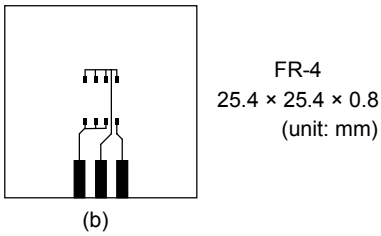



Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)




(a)




(b)

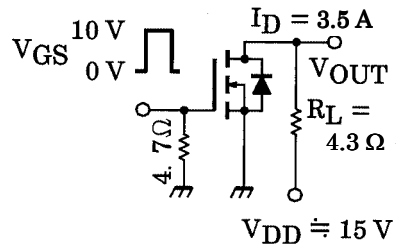
Note 3: $V_{DD}$ = 24 V, $T_{ch}$ = 25°C (initial), L = 1.0 mH, $R_G$ = 25 Ω, $I_{AR}$ = 7 A

Note 4: Reptitve rating; pulse width limited by maximum channel temperature

Note 5: ● on lower left of the marking indicates Pin 1.

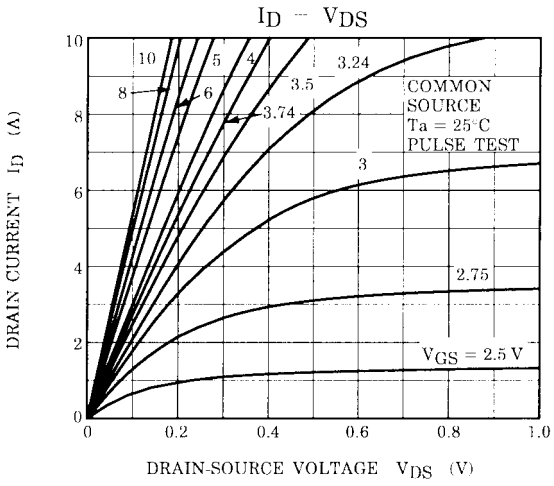
※ shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)

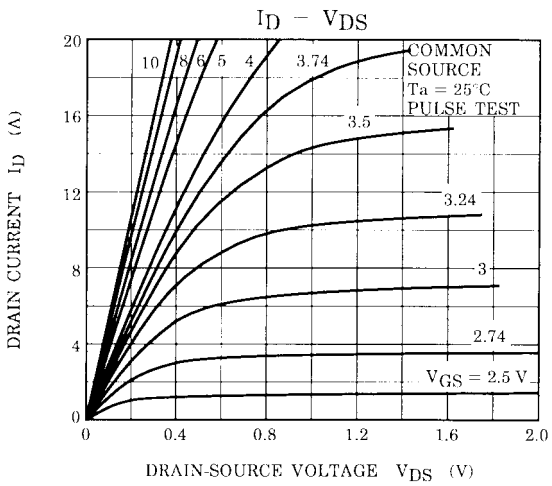
## Electrical Characteristics (Ta = 25°C)

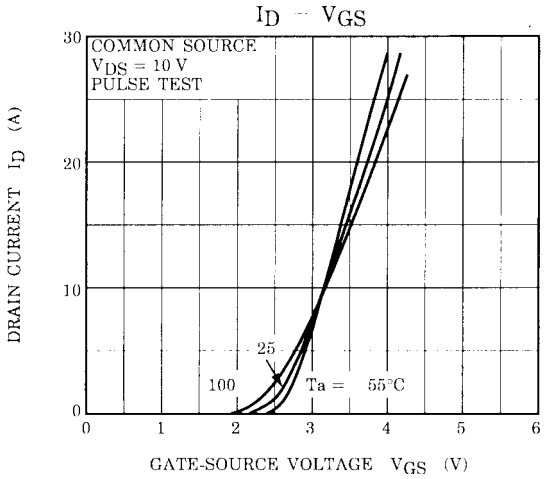
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 V | — | — | ±10 | μA |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V | — | — | 10 | μA |
| Drain−source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = 10 mA, $V_{GS}$ = 0 V | 30 | — | — | V |
| | | $V_{(BR)\ DSX}$ | $I_D$ = 10 mA, $V_{GS}$ = −20 V | 15 | — | — | V |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 1.3 | — | 2.5 | V |
| Drain−source ON resistance | | $R_{DS\ (ON)}$ | $V_{GS}$ = 4.5 V, $I_D$ = 3.5 A | — | 29 | 40 | mΩ |
| | | $R_{DS\ (ON)}$ | $V_{GS}$ = 10 V, $I_D$ = 3.5 A | — | 19 | 27 | mΩ |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = 10 V, $I_D$ = 3.5 A | 4.4 | 8.8 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 790 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 110 | — | |
| Output capacitance | | $C_{oss}$ | | — | 290 | — | |
| Switching time | Rise time | $t_r$ |   | — | 5 | — | ns |
| | Turn−on time | $t_{on}$ | | — | 13 | — | |
| | Fall time | $t_f$ | | — | 8 | — | |
| | Turn−off time | $t_{off}$ | | — | 36 | — | |
| Total gate charge (Gate−source plus gate−drain) | | $Q_g$ | $V_{DD}$ ≈ 24 V, $V_{GS}$ = 10 V, $I_D$ = 7 A | — | 16 | — | nC |
| Gate−source charge | | $Q_{gs}$ | | — | 12 | — | |
| Gate−drain (“miller”) charge | | $Q_{gd}$ | | — | 4 | — | |

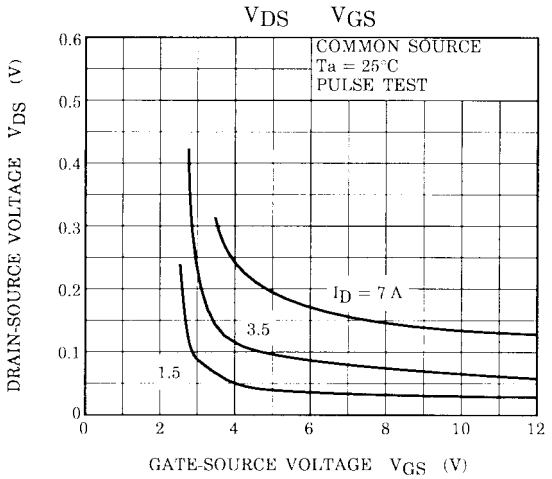
## Source−Drain Ratings and Characteristics (Ta = 25°C)

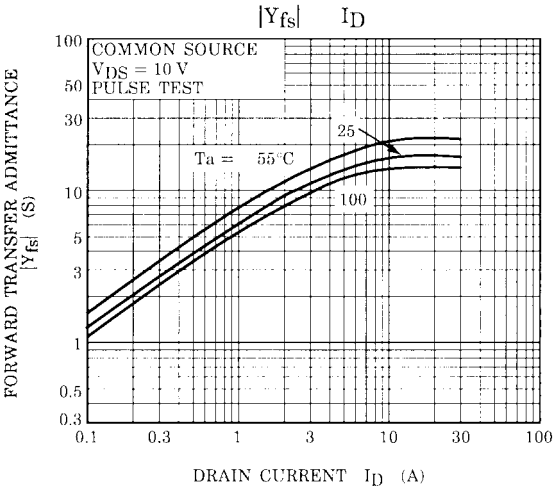
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Drain reverse current | Pulse (Note 1) | $I_{DRP}$ | — | — | — | 28 | A |
| Forward voltage (diode) | | $V_{DSF}$ | $I_{DR}$ = 7 A, $V_{GS}$ = 0 V | — | — | −1.2 | V |

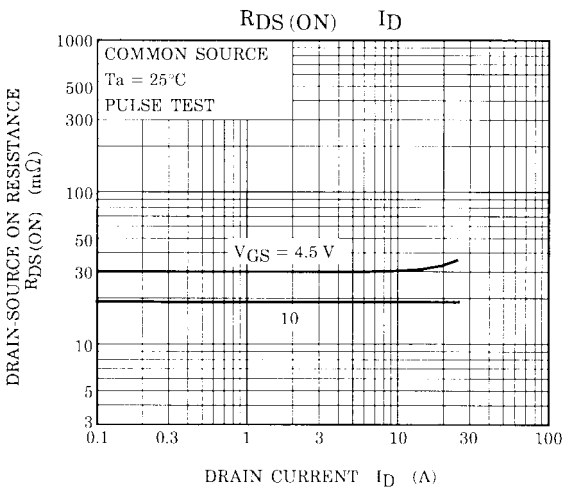

$I_D$ – $V_{DS}$
DRAIN CURRENT $I_D$ (A)
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
10
8
6
5
4
3.74
3.5
3.24
3
2.75
$V_{GS}$ = 2.5 V


$I_D$ – $V_{DS}$
DRAIN CURRENT $I_D$ (A)
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
10
8
6
5
4
3.74
3.5
3.24
3
2.74
$V_{GS}$ = 2.5 V

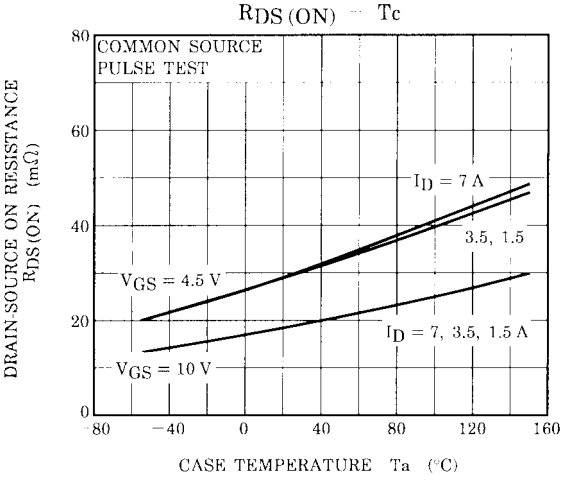

$I_D$ – $V_{GS}$
DRAIN CURRENT $I_D$ (A)
GATE-SOURCE VOLTAGE $V_{GS}$ (V)
COMMON SOURCE
$V_{DS}$ = 10 V
PULSE TEST
25
100
Ta = 55°C


$V_{DS}$ $V_{GS}$
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)
GATE-SOURCE VOLTAGE $V_{GS}$ (V)
COMMON SOURCE
Ta = 25°C
PULSE TEST
$I_D$ = 7 A
3.5
1.5

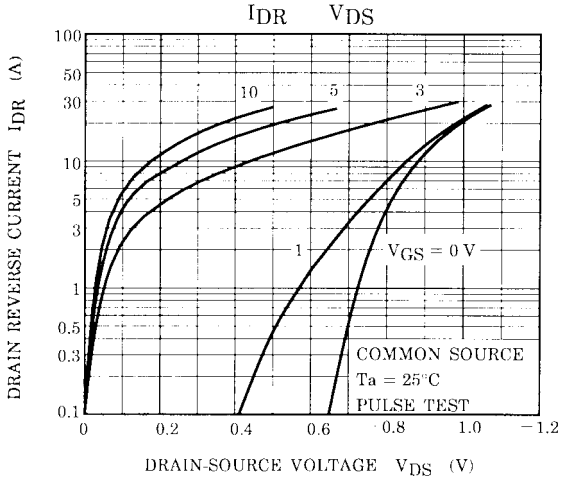

$|Y_{fs}|$ $I_D$
FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)
DRAIN CURRENT $I_D$ (A)
COMMON SOURCE
$V_{DS}$ = 10 V
PULSE TEST
25
Ta = 55°C
100


$R_{DS\,(ON)}$ $I_D$
DRAIN-SOURCE ON RESISTANCE $R_{DS\,(ON)}$ (mΩ)
DRAIN CURRENT $I_D$ (A)
COMMON SOURCE
Ta = 25°C
PULSE TEST
$V_{GS}$ = 4.5 V
10

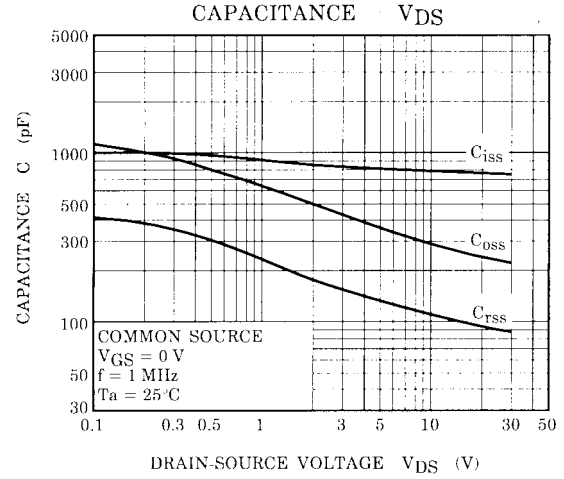
$R_{DS\,(ON)}$ – Tc



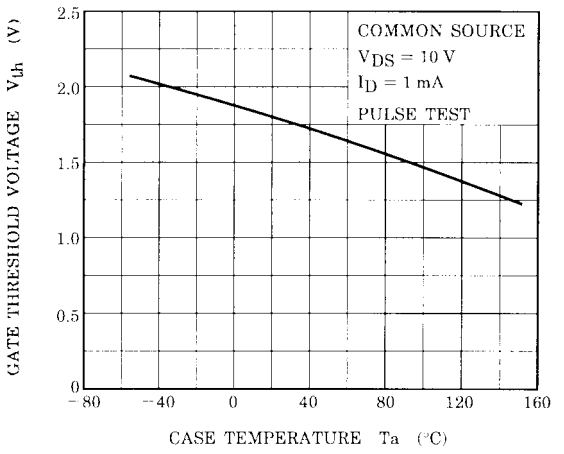

$I_{DR}$ $V_{DS}$



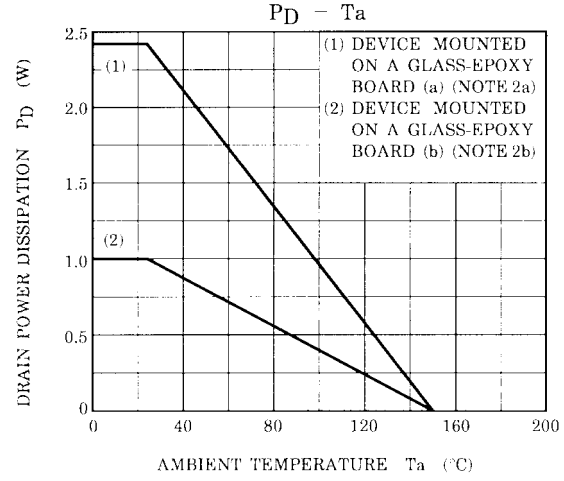

CAPACITANCE $V_{DS}$



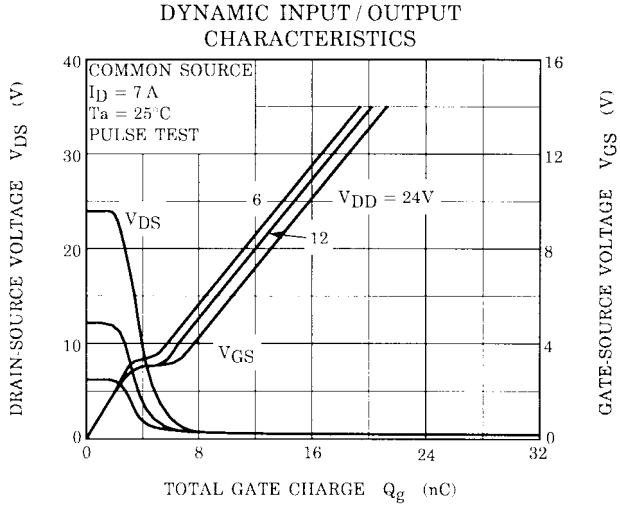

$V_{th}$ Tc



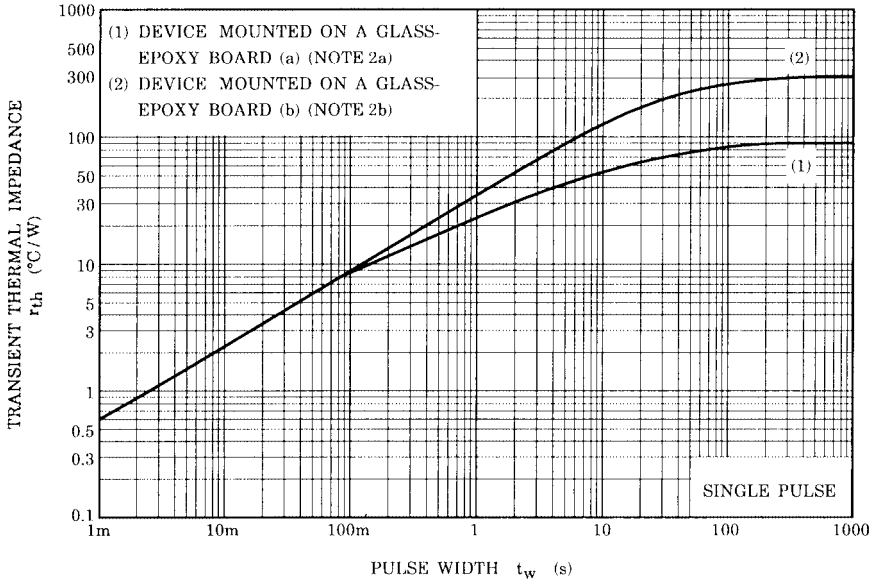

$P_D$ – Ta



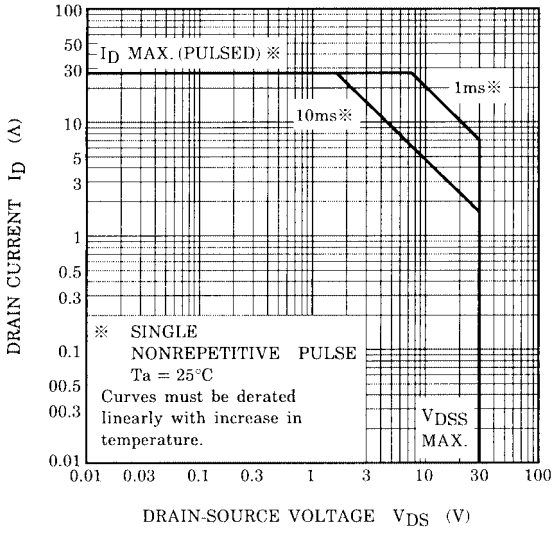

DYNAMIC INPUT / OUTPUT CHARACTERISTICS



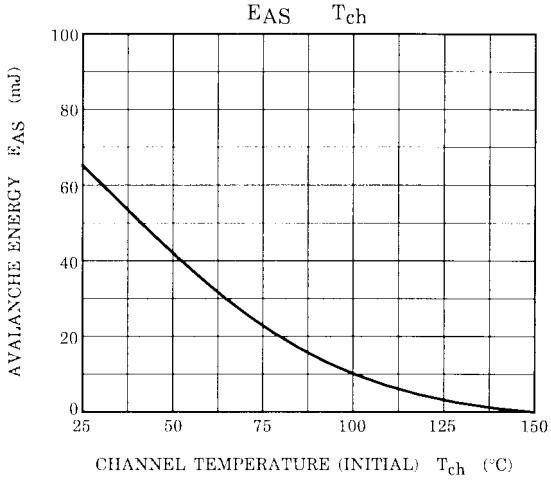
$r_{th}$ – $t_w$

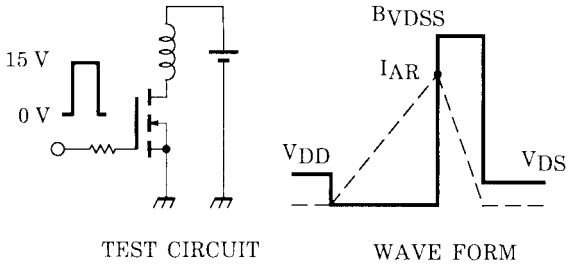



SAFE OPERATING AREA




$E_{AS}$ – $T_{ch}$




$T_{ch}$ = 25°C (Initial)
Peak $I_{AR}$ = 7 A, $R_G$ = 25 Ω
$V_{DD}$ = 24 V, L = 1.0 mH

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

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