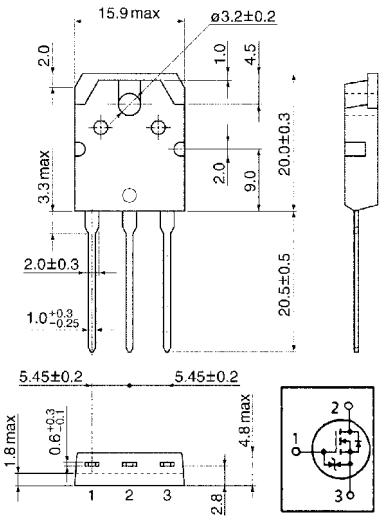
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (π−MOSV)

# 2SK2445

Chopper Regulator, DC−DC Converter and Motor Drive Applications

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 14 mΩ (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 40 S (typ.)
- Low leakage current : $I_{DSS}$ = 100 μA (max) ($V_{DS}$ = 60 V)
- Enhancement−mode : $V_{th}$ = 1.5~3.0 V ($V_{DS}$ = 10 V, $I_D$ = 1 mA)

Unit: mm




1. GATE
2. DRAIN (HEAT SINK)
3. SOURCE

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-16C1B |

Weight: 4.6 g (typ.)

## Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain−source voltage | | $V_{DSS}$ | 60 | V |
| Drain−gate voltage ($R_{GS}$ = 20 kΩ) | | $V_{DGR}$ | 60 | V |
| Gate−source voltage | | $V_{GSS}$ | ±20 | V |
| Drain current | DC (Note 1) | $I_D$ | 50 | A |
| | Pulse (Note 1) | $I_{DP}$ | 200 | A |
| Drain power dissipation (Tc = 25°C) | | $P_D$ | 125 | W |
| Single pulse avalanche energy (Note 2) | | $E_{AS}$ | 683 | mJ |
| Avalanche current | | $I_{AR}$ | 50 | A |
| Repetitive avalanche energy (Note 3) | | $E_{AR}$ | 12.5 | mJ |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55~150 | °C |

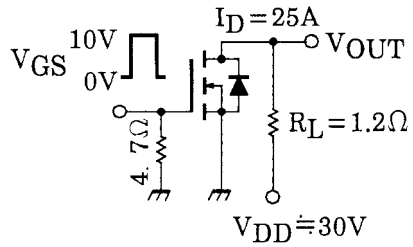
## Thermal Characteristics

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, channel to case | $R_{th\ (ch-c)}$ | 1.0 | °C / W |
| Thermal resistance, channel to ambient | $R_{th\ (ch-a)}$ | 50 | °C / W |

Note 1: Please use devices on condition that the channel temperature is below 150°C.
Note 2: $V_{DD}$ = 25 V, $T_{ch}$ = 25°C (initial), L = 371 μH, $R_G$ = 25 Ω, $I_{AR}$ = 50 A
Note 3: Repetitive rating: Pulse width limited by maximum channel temperature

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

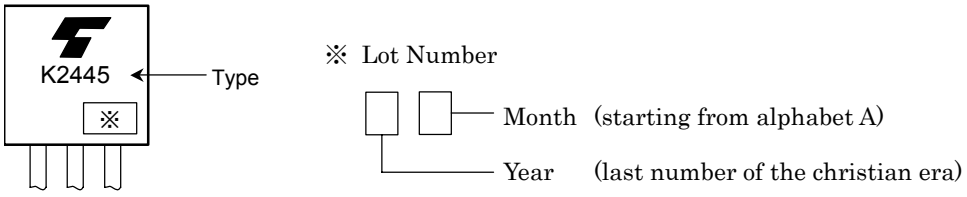
## Electrical Characteristics (Ta = 25°C)

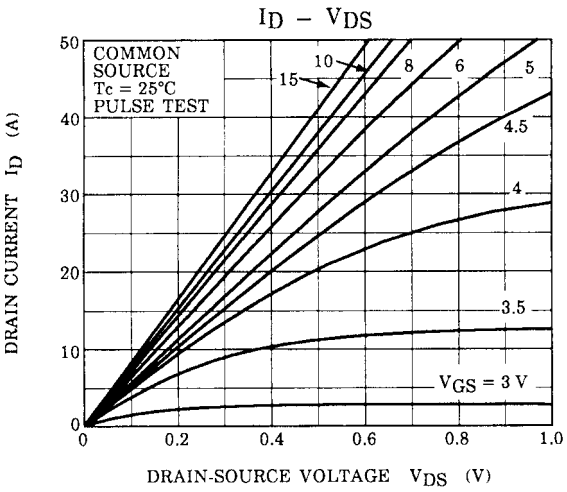
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 V | — | — | ±10 | μA |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | — | — | 100 | μA |
| Drain−source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = 10 mA, $V_{GS}$ = 0 V | 60 | — | — | V |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 1.5 | — | 3.0 | V |
| Drain−source ON resistance | | $R_{DS\ (ON)}$ | $V_{GS}$ = 10 V, $I_D$ = 25 A | — | 14 | 18 | mΩ |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = 15 V, $I_D$ = 25 A | 28 | 40 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 3350 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 550 | — | |
| Output capacitance | | $C_{oss}$ | | — | 1600 | — | |
| Switching time | Rise time | $t_r$ |   | — | 25 | — | ns |
| | Turn−on time | $t_{on}$ | | — | 55 | — | |
| | Fall time | $t_f$ | | — | 60 | — | |
| | Turn−off time | $t_{off}$ | | — | 180 | — | |
| Total gate charge (Gate−source plus gate−drain) | | $Q_g$ | $V_{DD}$ ≈ 48 V, $V_{GS}$ = 10 V, $I_D$ = 50 A | — | 110 | — | nC |
| Gate−source charge | | $Q_{gs}$ | | — | 70 | — | |
| Gate−drain (“miller”) charge | | $Q_{gd}$ | | — | 40 | — | |

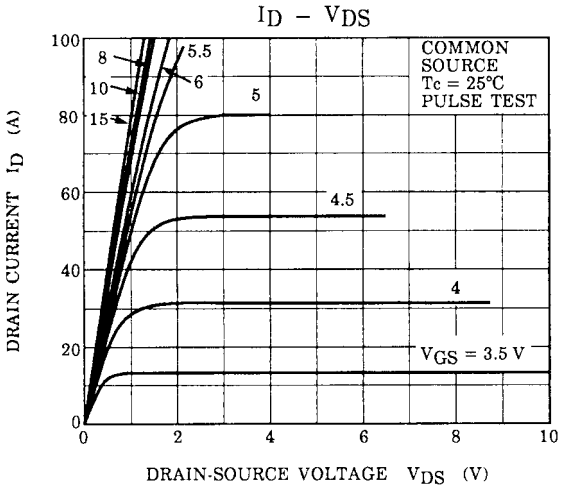
## Source−Drain Ratings and Characteristics (Ta = 25°C)

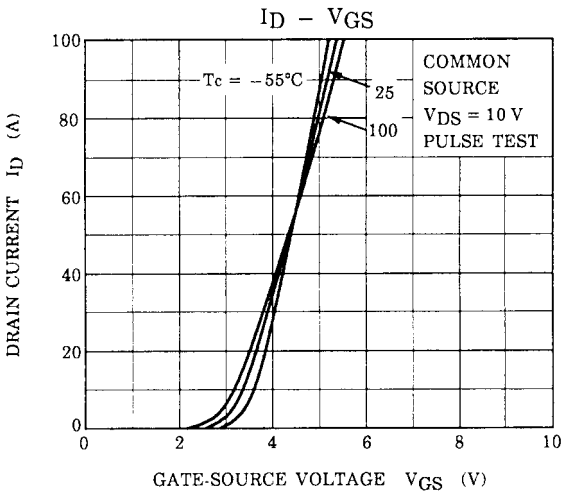
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Continuous drain reverse current (Note 1) | $I_{DR}$ | — | — | — | 50 | A |
| Pulse drain reverse current (Note 1) | $I_{DRP}$ | — | — | — | 200 | A |
| Forward voltage (diode) | $V_{DSF}$ | $I_{DR}$ = 50 A, $V_{GS}$ = 0 V | — | — | −1.7 | V |
| Reverse recovery time | $t_{rr}$ | $I_{DR}$ = 50 A, $V_{GS}$ = 0 V, $dI_{DR}$ / dt = 50 A / μs | — | 120 | — | ns |
| Reverse recovery charge | $Q_{rr}$ | | — | 0.2 | — | μC |

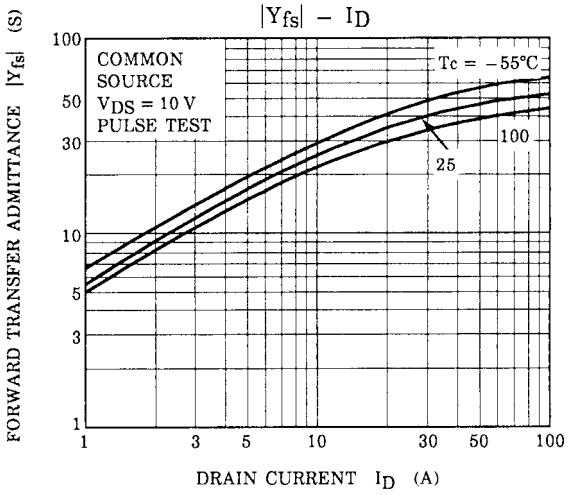
## Marking

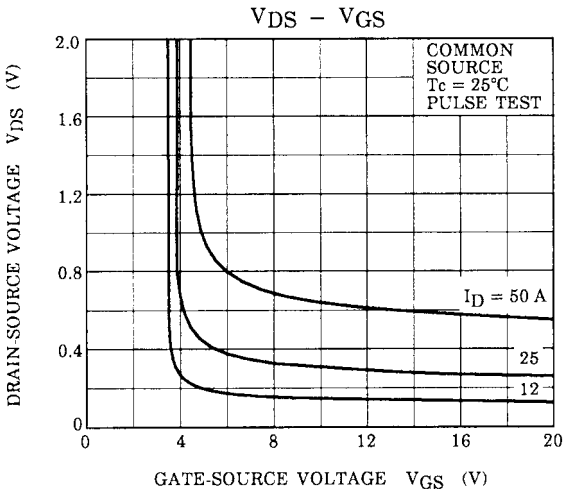


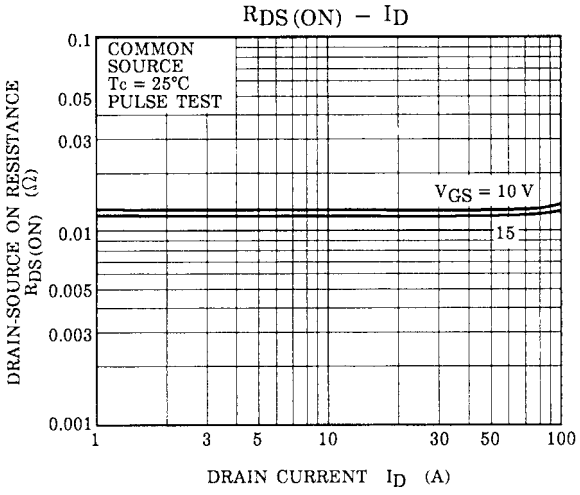

$I_D$ – $V_{DS}$
COMMON SOURCE
Tc = 25°C
PULSE TEST
15
10
8
6
5
4.5
4
3.5
$V_{GS}$ = 3 V
DRAIN CURRENT $I_D$ (A)
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)


$I_D$ – $V_{DS}$
COMMON SOURCE
Tc = 25°C
PULSE TEST
8
10
15
5.5
6
5
4.5
4
$V_{GS}$ = 3.5 V
DRAIN CURRENT $I_D$ (A)
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)

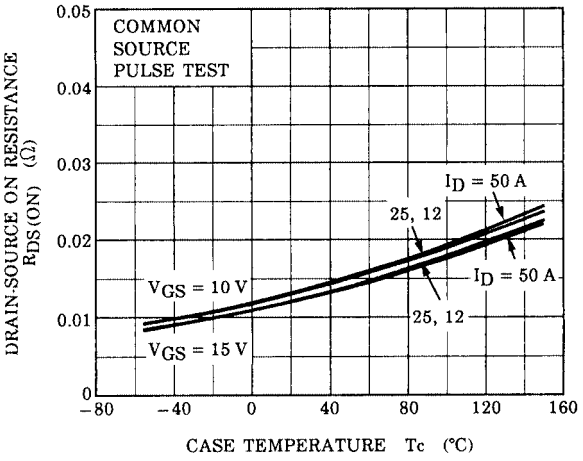

$I_D$ – $V_{GS}$
COMMON SOURCE
$V_{DS}$ = 10 V
PULSE TEST
Tc = –55°C
25
100
DRAIN CURRENT $I_D$ (A)
GATE-SOURCE VOLTAGE $V_{GS}$ (V)


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

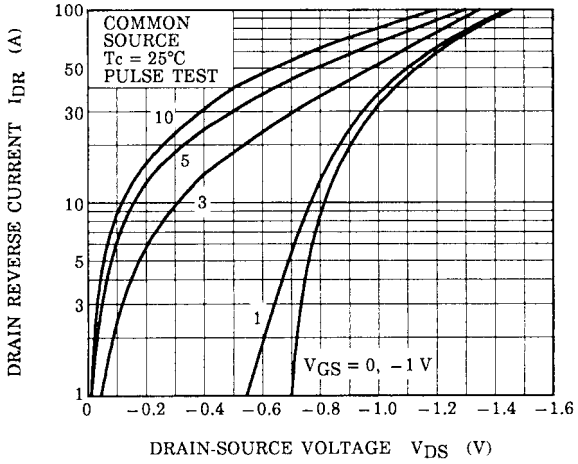

$V_{DS}$ – $V_{GS}$
COMMON SOURCE
Tc = 25°C
PULSE TEST
$I_D$ = 50 A
25
12
DRAIN-SOURCE VOLTAGE $V_{DS}$ (V)
GATE-SOURCE VOLTAGE $V_{GS}$ (V)


$R_{DS\,(ON)}$ – $I_D$
COMMON SOURCE
Tc = 25°C
PULSE TEST
$V_{GS}$ = 10 V
15
DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (Ω)
DRAIN CURRENT $I_D$ (A)

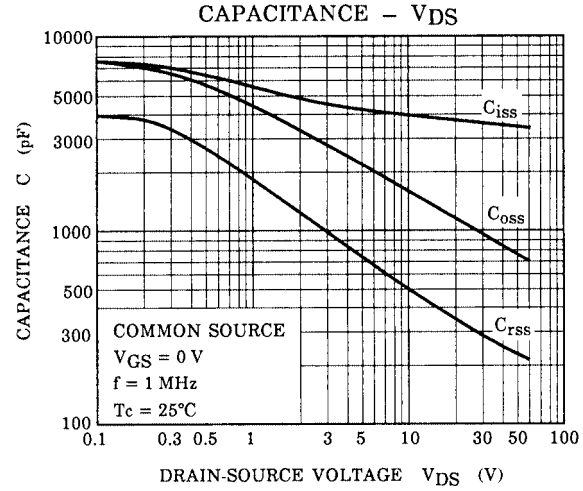
$R_{DS(ON)}$ – Tc



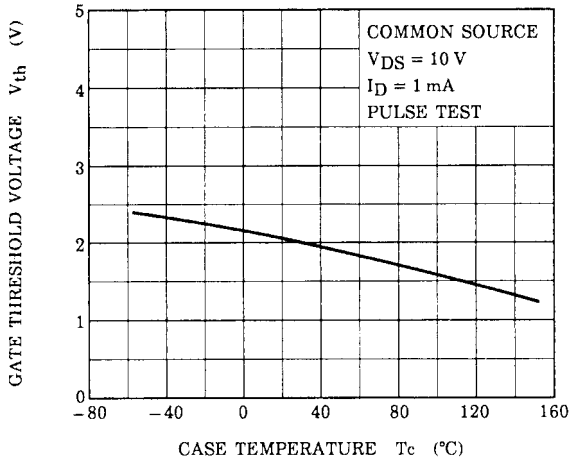

$I_{DR}$ – $V_{DS}$



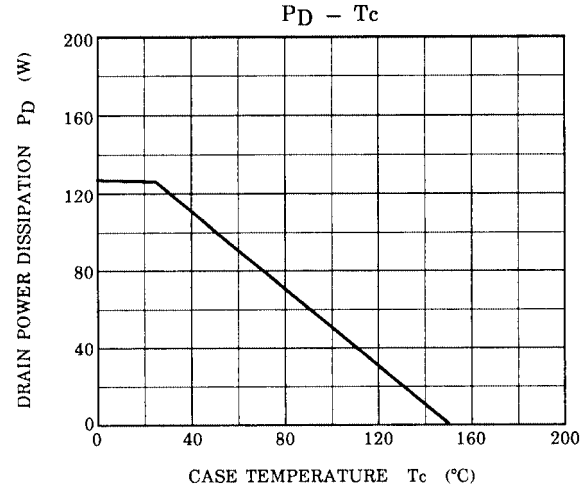

CAPACITANCE – $V_{DS}$



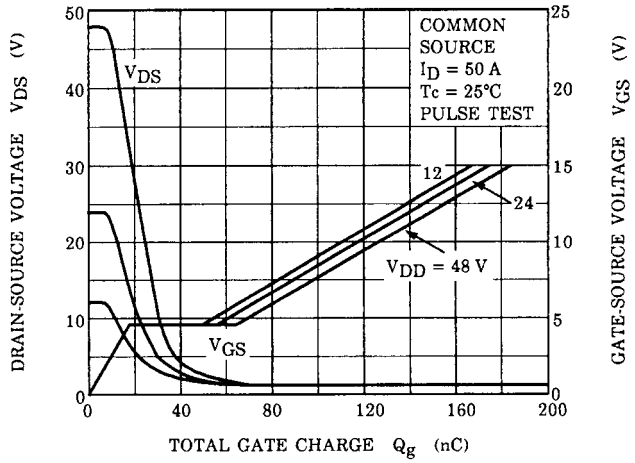

$V_{th}$ – Tc



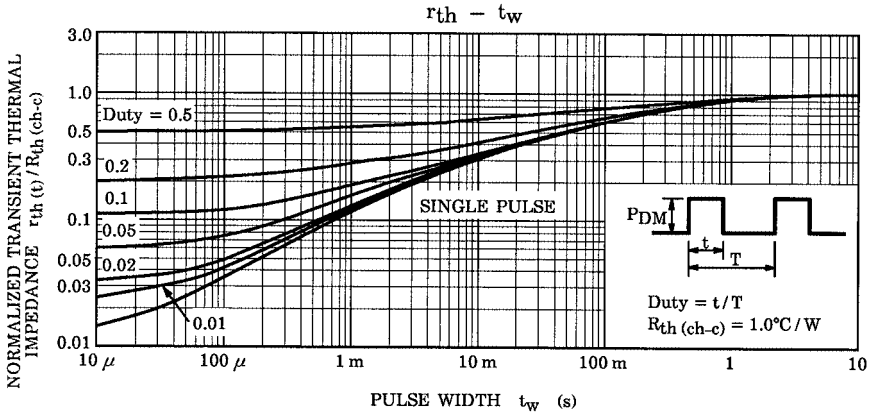

$P_D$ – Tc



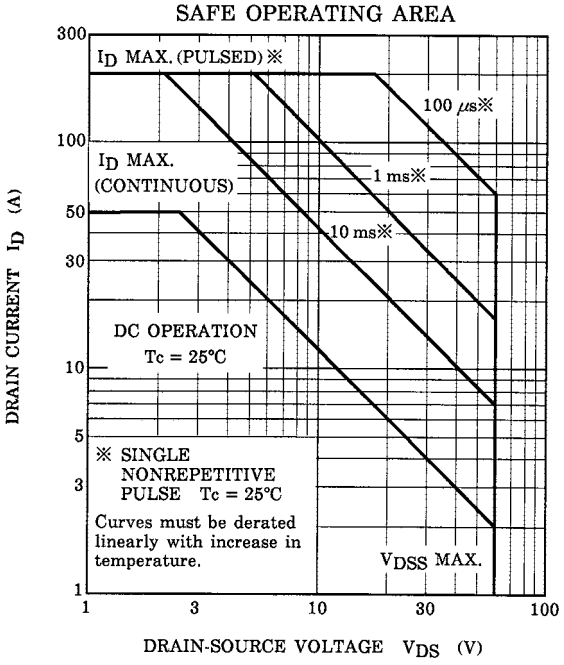

DYNAMIC INPUT / OUTPUT CHARACTERISTICS



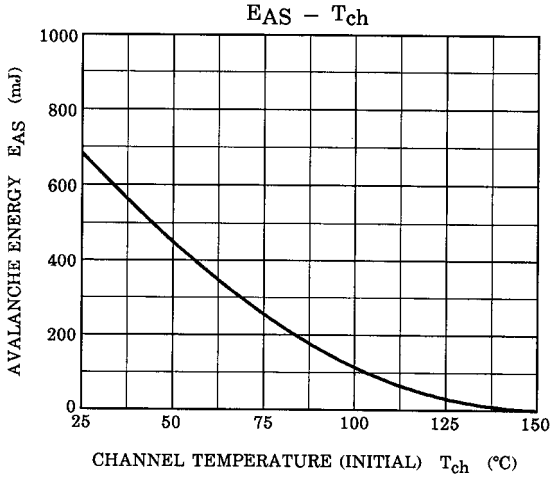
$r_{th}$ – $t_w$

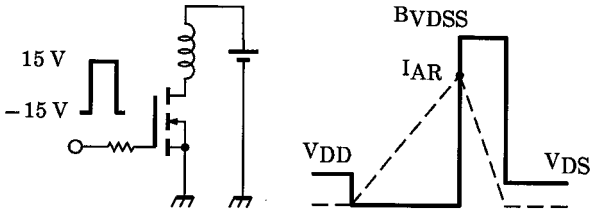



SAFE OPERATING AREA




$E_{AS}$ – $T_{ch}$




TEST CIRCUIT WAVE FORM

$R_G = 25\ \Omega$
$V_{DD} = 25$ V, L = 371 μH

$$EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left( \frac{BVDSS}{BVDSS - VDD} \right)$$

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