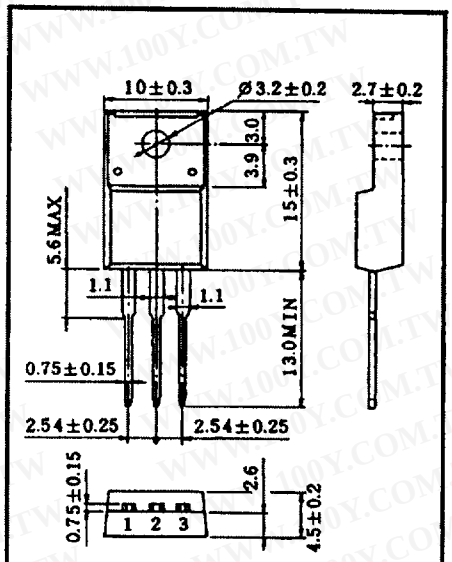
## Field Effect Transistor

## Silicon N Channel MOS Type (π-MOS II)

## High Speed, High Current DC-DC Converter, Relay Drive and Motor Drive Applications

**Industrial Applications** Unit in mm




1. GATE
2. DRAIN
3. SOURCE

| | |
|---|---|
| JEDEC | — |
| EIAJ | SC-67 |
| TOSHIBA | 2-10R1B |

Weight : 1.9g

### Features

- 4-Volt Gate Drive
- Low Drain-Source ON Resistance
  - $R_{DS(ON)}$ = 0.95Ω (Typ.)
- High Forward Transfer Admittance
  - $|Y_{fs}|$ = 4.0S (Typ.)
- Low Leakage Current
  - $I_{DSS}$ = 300μA (Max.) @ $V_{DS}$ = 600V
- Enhancement-Mode
  - $V_{th}$ = 1.5 ~ 3.5V @ $V_{DS}$ = 10V, $I_D$ = 1mA

### Absolute Maximum Ratings (Ta = 25°C)

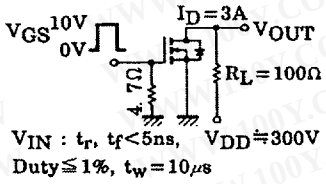
| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 600 | V |
| Drain-Gate Voltage ($R_{GS}$ = 20kΩ) | | $V_{DGR}$ | 600 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Drain Current | DC | $I_D$ | 6 | A |
| | Pulse | $I_{DP}$ | 24 | |
| Drain Power Dissipation (Tc = 25°C) | | $P_D$ | 45 | W |
| Channel Temperature | | $T_{ch}$ | 150 | °C |
| Storage Temperature Range | | $T_{stg}$ | -55 ~ 150 | °C |

### Thermal Characteristics

| CHARACTERISTIC | SYMBOL | MAX. | UNIT |
|---|---|---|---|
| Thermal Resistance, Channel to Case | $R_{th(ch-c)}$ | 2.77 | °C/W |
| Thermal Resistance, Channel to Ambient | $R_{th(ch-a)}$ | 62.5 | °C/W |

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

## Electrical Characteristics (Ta = 25°C)

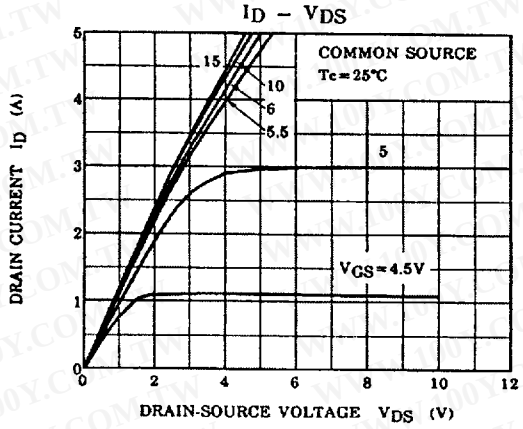
| CHARACTERISTIC | | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| Gate Leakage Current | | $I_{GSS}$ | $V_{GS}$ = ±25V, $V_{DS}$ = 0V | – | – | ±100 | nA |
| Drain Cut-off Current | | $I_{DSS}$ | $V_{DS}$ = 600V, $V_{GS}$ = 0V | – | – | 300 | μA |
| Drain-Source Breakdown Voltage | | $V_{(BR)\ DSS}$ | $I_D$ = 10mA, $V_{GS}$ = 0V | 600 | – | – | V |
| Gate Threshold Voltage | | $V_{th}$ | $V_{DS}$ = 10V, $I_D$ = 1mA | 1.5 | – | 3.5 | V |
| Drain-Source ON Resistance | | $R_{DS\ (ON)}$ | $I_D$ = 3A, $V_{GS}$ = 10V | – | 0.95 | 1.25 | Ω |
| Forward Transfer Admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = 10V, $I_D$ = 3A | 3.0 | 4.0 | – | S |
| Input Capacitance | | $C_{iss}$ | $V_{DS}$ = 10V, $V_{GS}$ = 0V, f = 1MHz | – | 1400 | 2000 | pF |
| Reverse Transfer Capacitance | | $C_{rss}$ | | – | 75 | 120 | |
| Output Capacitance | | $C_{oss}$ | | – | 250 | 380 | |
| Switching Time | Rise Time | $t_r$ |  | – | 25 | 50 | ns |
| | Turn-on Time | $t_{on}$ | | – | 40 | 80 | |
| | Fall Time | $t_f$ | | – | 20 | 40 | |
| | Turn-off Time | $t_{off}$ | | – | 85 | 170 | |
| Total Gate Charge (Gate-Source Plus Gate-Drain) | | $Q_g$ | $V_{DD}$ = 400V, $V_{GS}$ = 10V, $I_D$ = 6A | – | 56 | 110 | nC |
| Gate-Source Charge | | $Q_{gs}$ | | – | 32 | – | |
| Gate-Drain ("Miller") Charge | | $Q_{gd}$ | | – | 24 | – | |



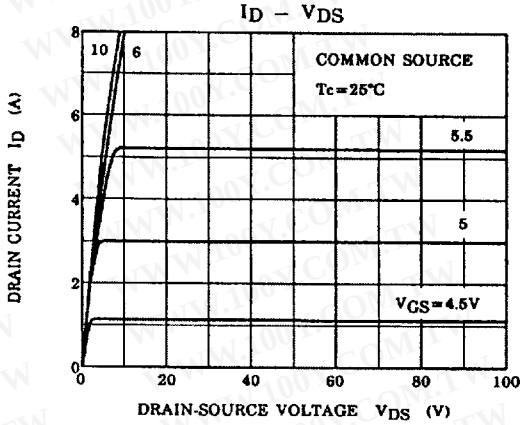
## Source-Drain Diode Ratings and Characteristics (Ta = 25°C)

| CHARACTERISTICS | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Continuous Drain Reverse Current | $I_{DR}$ | – | – | – | 6 | A |
| Pulse Drain Reverse Current | $I_{DRP}$ | – | – | – | 24 | A |
| Diode Forward Voltage | $V_{DSF}$ | $I_{DR}$ = 6A, $V_{GS}$ = 0V | – | – | -2.0 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_{DR}$ = 6A, $V_{GS}$ = 0V, $dI_{DR}/dt$ = 100A/μs | – | 460 | – | ns |
| Reverse Recovered Charge | $Q_{rr}$ | | – | 3.5 | – | μC |

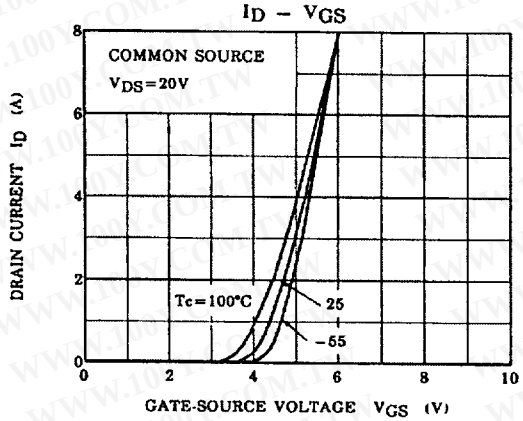
$I_D - V_{DS}$



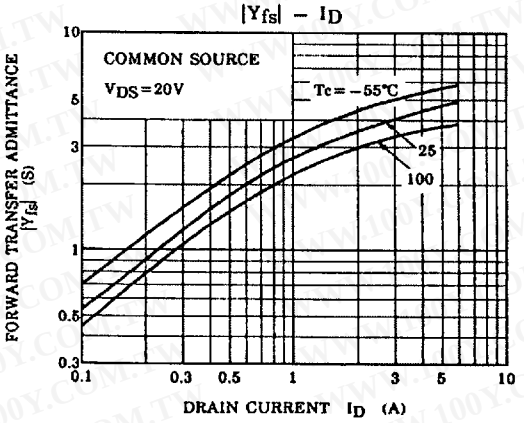

$I_D - V_{DS}$



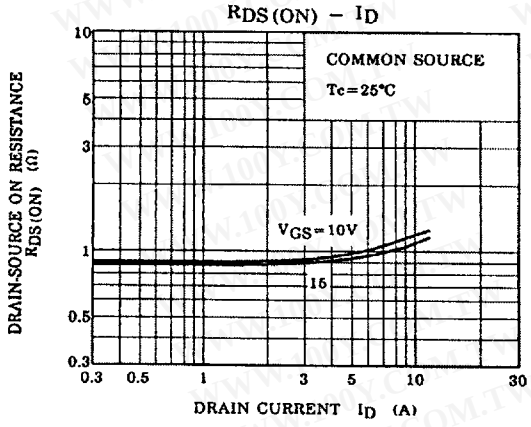

$I_D - V_{GS}$



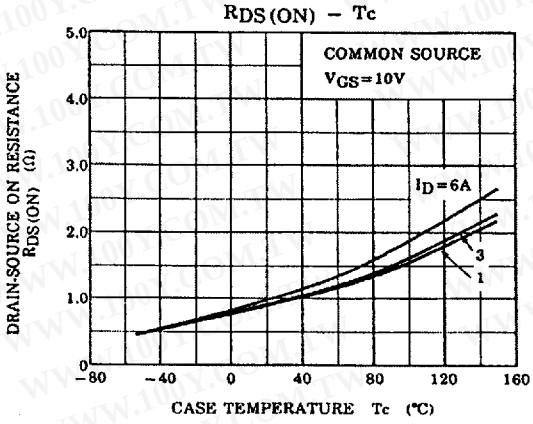

$|Y_{fs}| - I_D$



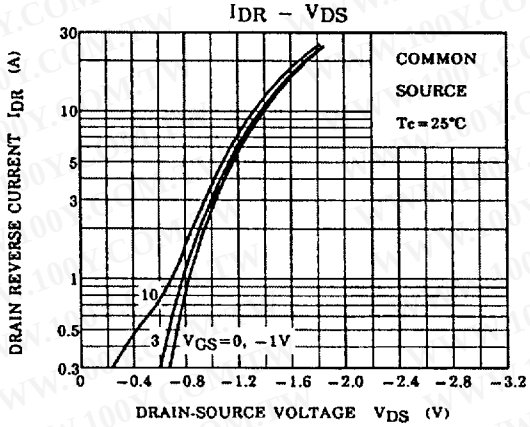

$R_{DS(ON)} - I_D$



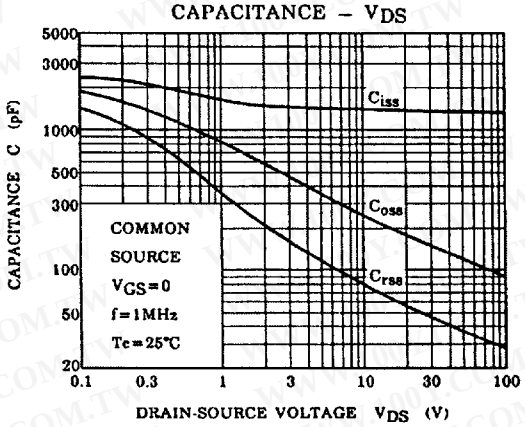

$R_{DS(ON)} - T_c$



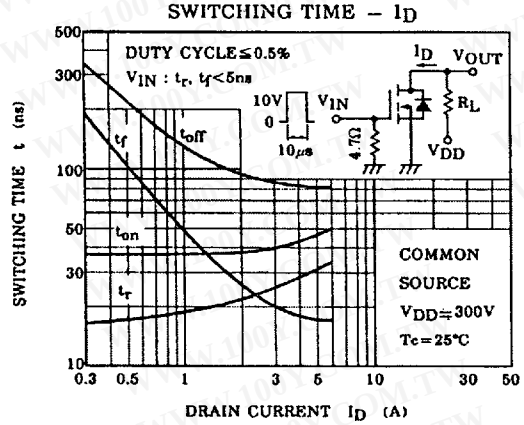
$I_{DR}$ – $V_{DS}$



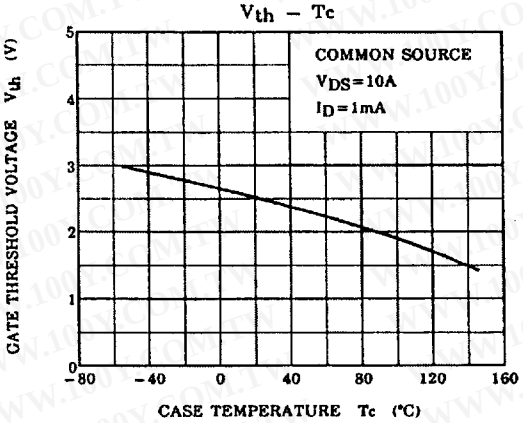

CAPACITANCE – $V_{DS}$



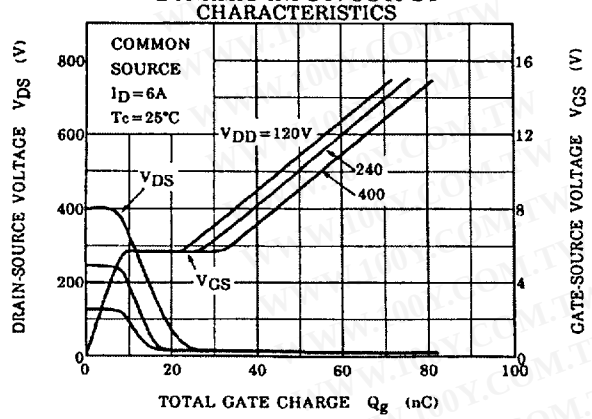

SWITCHING TIME – $I_D$



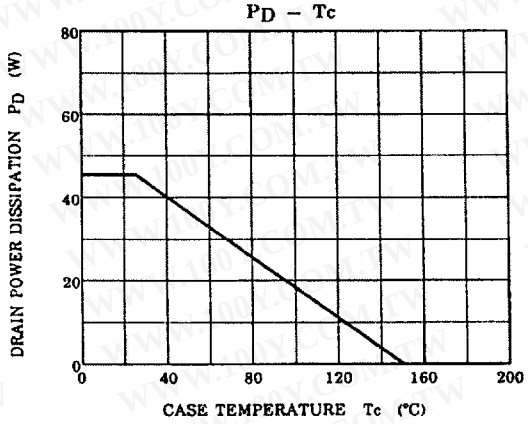

$V_{th}$ – Tc



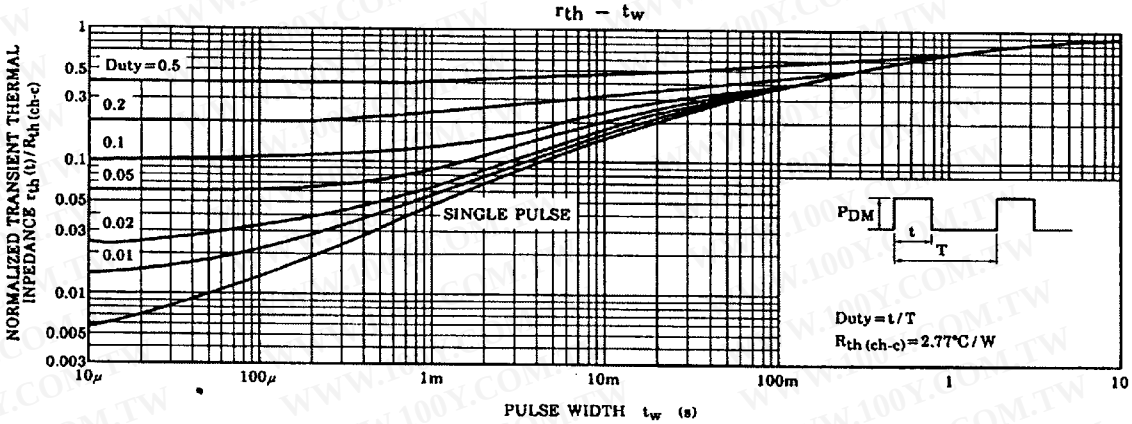

DYNAMIC INPUT / OUTPUT CHARACTERISTICS




$P_D$ – Tc



$r_{th} - t_w$




SAFE OPERATING AREA