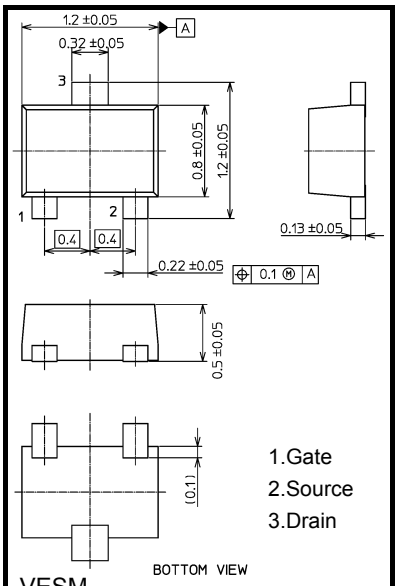
TOSHIBA Field-Effect Transistor Silicon P-Channel MOS Type (U-MOSⅥ)

# SSM3J56MFV

## ○ Load Switching Applications

- 1.2 V drive
- Low ON-resistance: $R_{DS(ON)}$ = 390 mΩ (max) (@$V_{GS}$ = -4.5 V)
  $R_{DS(ON)}$ = 480 mΩ (max) (@$V_{GS}$ = -2.5 V)
  $R_{DS(ON)}$ = 660 mΩ (max) (@$V_{GS}$ = -1.8 V)
  $R_{DS(ON)}$ = 900 mΩ (max) (@$V_{GS}$ = -1.5 V)
  $R_{DS(ON)}$ = 4000 mΩ (max) (@$V_{GS}$ = -1.2 V)

Unit: mm




| | |
|---|---|
| VESM | |
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-1L1B |

Weight: 1.5mg (typ.)

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

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-Source voltage | | $V_{DSS}$ | -20 | V |
| Gate-Source voltage | | $V_{GSS}$ | ± 8 | V |
| Drain current | DC | $I_D$ (Note 1) | -800 | mA |
| | Pulse | $I_{DP}$ (Note 1) | -1600 | |
| Power dissipation | | $P_D$ (Note 2) | 150 | mW |
| | | $P_D$ (Note 3) | 500 | |
| | | t < 5s | 800 | |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

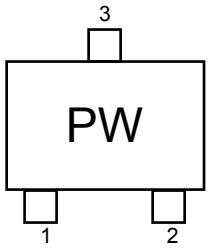
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

Note 1: The channel temperature should not exceed 150°C during use.

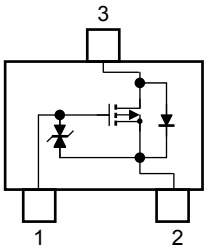
Note 2: Mounted on a FR4 board.
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.585 $mm^2$)

Note 3: Mounted on a FR4 board.
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 $mm^2$)

## Marking




## Equivalent Circuit (top view)




## Handling Precaution

When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

Thermal resistance $R_{th\ (ch\text{-}a)}$ and Power dissipation $P_D$ vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration.

Start of commercial production
2011-05

## Electrical Characteristics (Ta = 25°C)

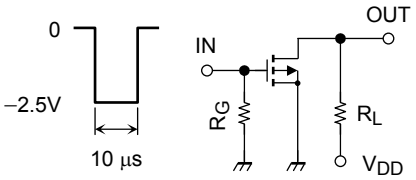
| Characteristic | | Symbol | Test Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Drain-source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = -1 mA, $V_{GS}$ = 0 V | -20 | — | — | V |
| | | $V_{(BR)\ DSX}$ | $I_D$ = -1 mA, $V_{GS}$ = 5 V (Note 5) | -15 | — | — | V |
| Drain cut-off current | | $I_{DSS}$ | $V_{DS}$ = -20 V, $V_{GS}$ = 0 V | — | — | -1 | μA |
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±8 V, $V_{DS}$ = 0 V | — | — | ±1 | μA |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = -3 V, $I_D$ = -1 mA | -0.3 | — | -1.0 | V |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = -3 V, $I_D$ = -100 mA (Note 4) | 0.5 | 1.0 | — | S |
| Drain–source ON-resistance | | $R_{DS\ (ON)}$ | $I_D$ = -800 mA, $V_{GS}$ = -4.5 V (Note 4) | — | 310 | 390 | mΩ |
| | | | $I_D$ = -500 mA, $V_{GS}$ = -2.5 V (Note 4) | — | 380 | 480 | |
| | | | $I_D$ = -200 mA, $V_{GS}$ = -1.8 V (Note 4) | — | 470 | 660 | |
| | | | $I_D$ = -100 mA, $V_{GS}$ = -1.5 V (Note 4) | — | 560 | 900 | |
| | | | $I_D$ = -10 mA, $V_{GS}$ = -1.2 V (Note 4) | — | 770 | 4000 | |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = -10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 100 | — | pF |
| Output capacitance | | $C_{oss}$ | | — | 16 | — | |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 10 | — | |
| Switching time | Turn-on time | $t_{on}$ | $V_{DD}$ = -10 V, $I_D$ = -200 mA | — | 8 | — | ns |
| | Turn-off time | $t_{off}$ | $V_{GS}$ = 0 to -2.5 V, $R_G$ = 50 Ω | — | 26 | — | |
| Total gate charge | | $Q_g$ | $V_{DD}$ = -10 V, $I_D$ = -800 mA, $V_{GS}$ = -4.5 V | — | 1.6 | — | nC |
| Gate-source charge | | $Q_{gs1}$ | | — | 0.2 | — | |
| Gate-drain charge | | $Q_{gd}$ | | — | 0.4 | — | |
| Drain-source forward voltage | | $V_{DSF}$ | $I_D$ = 800 mA, $V_{GS}$ = 0 V (Note 4) | — | 0.9 | 1.2 | V |

Note 4: Pulse test

Note 5: If a forward bias is applied between gate and source, this device enters V(BR)DSX mode. Note that the drain-source breakdown voltage is lowered in this mode.

## Switching Time Test Circuit

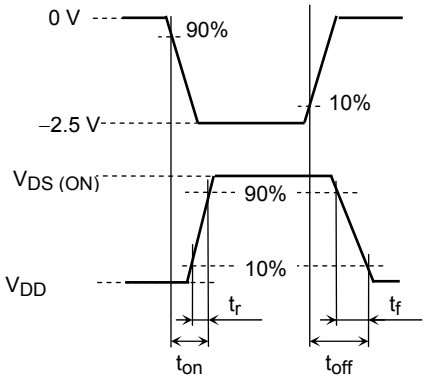
### (a) Test Circuit




$V_{DD}$ = -10 V
$R_G$ = 50 Ω
Duty ≤ 1%
$V_{IN}$: $t_r$, $t_f$ < 5 ns
Common Source
Ta = 25°C

### (b) $V_{IN}$

### (c) $V_{OUT}$

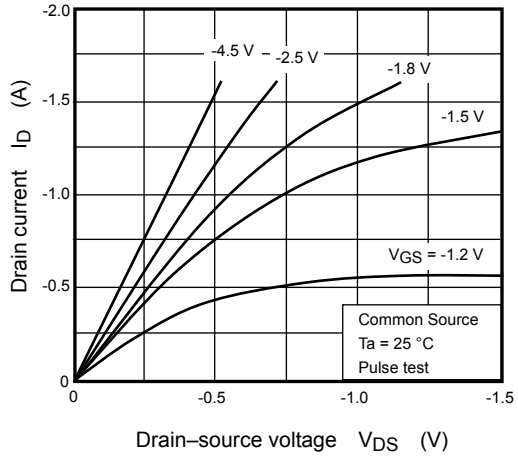



## Notice on Usage

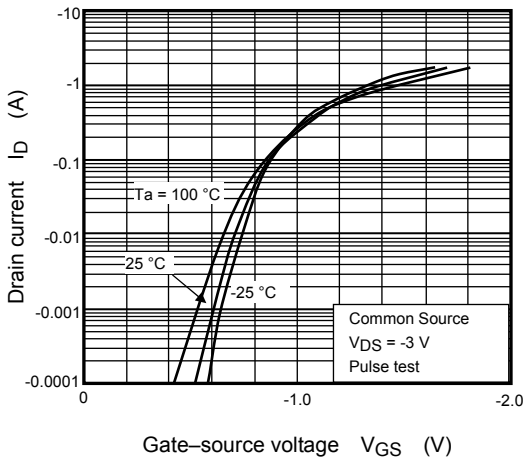
$V_{th}$ can be expressed as the voltage between gate and source when the low operating current value is $I_D$ = -1 mA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than $V_{th}$ and $V_{GS\ (off)}$ requires a lower voltage than $V_{th}$. (The relationship can be established as follows: $V_{GS\ (off)} < V_{th} < V_{GS\ (on)}$.)

Take this into consideration when using the device.

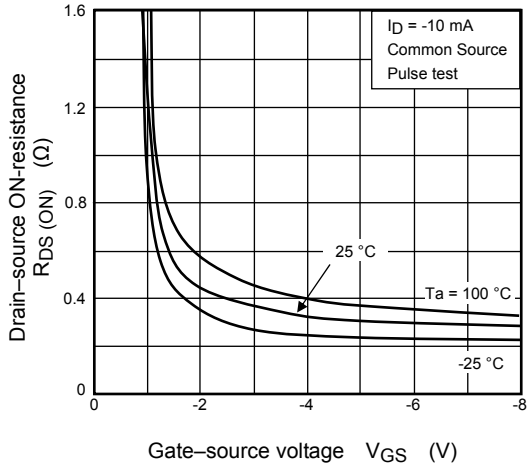
$I_D - V_{DS}$



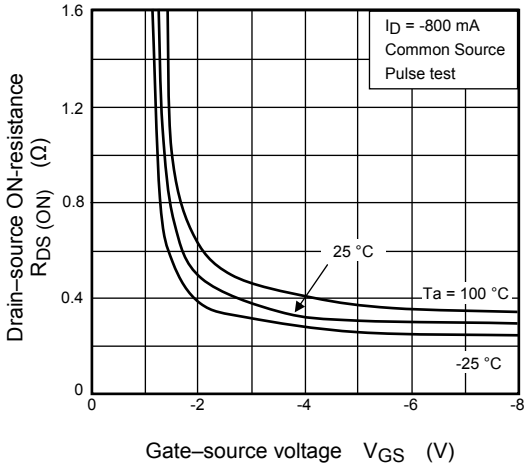

$I_D - V_{GS}$



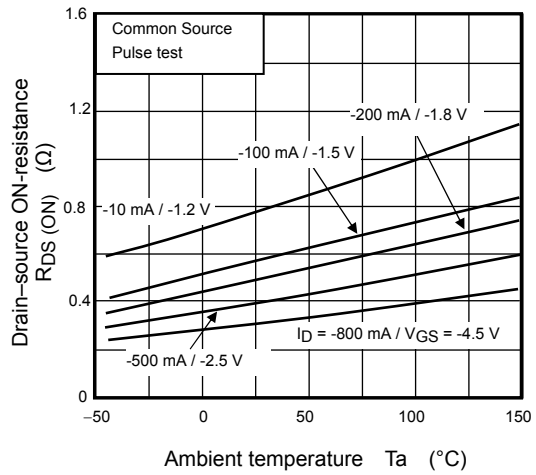

$R_{DS\ (ON)} - V_{GS}$



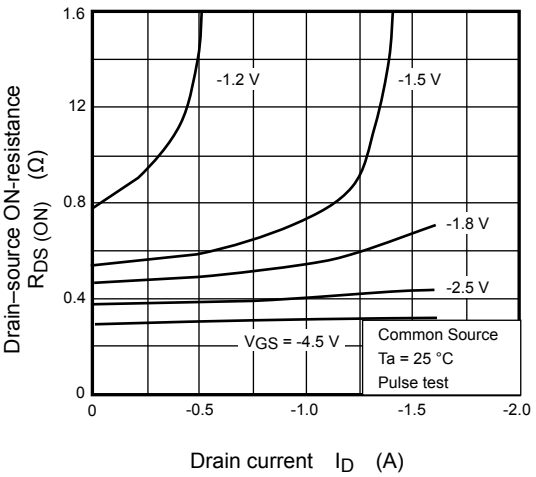

$R_{DS\ (ON)} - V_{GS}$



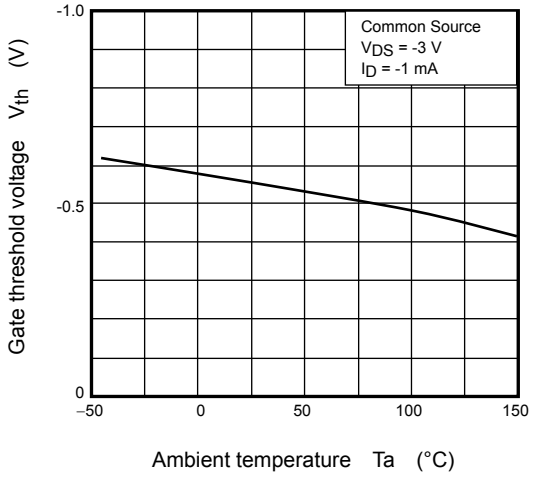

$R_{DS\ (ON)} - Ta$



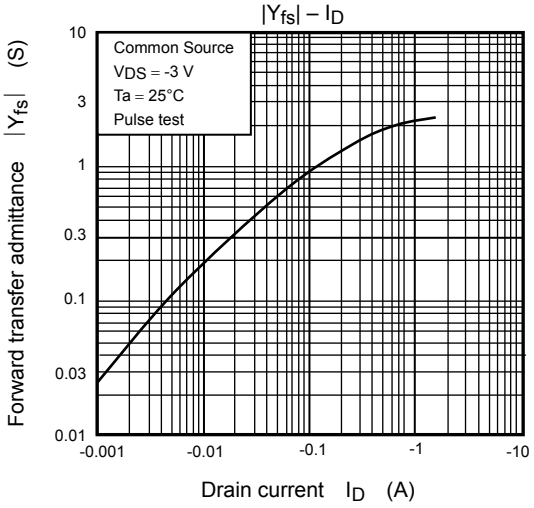

$R_{DS\ (ON)} - I_D$



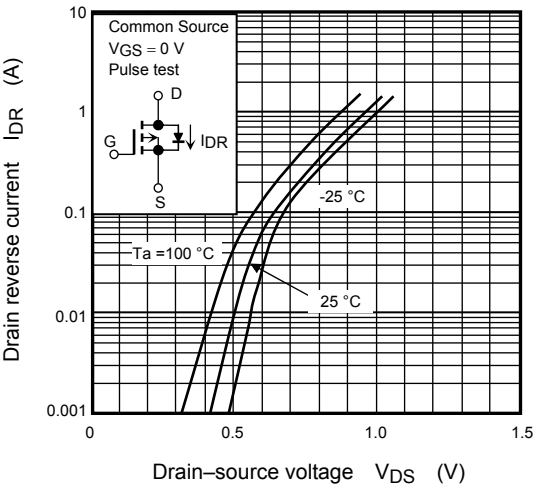
$V_{th}$ – Ta



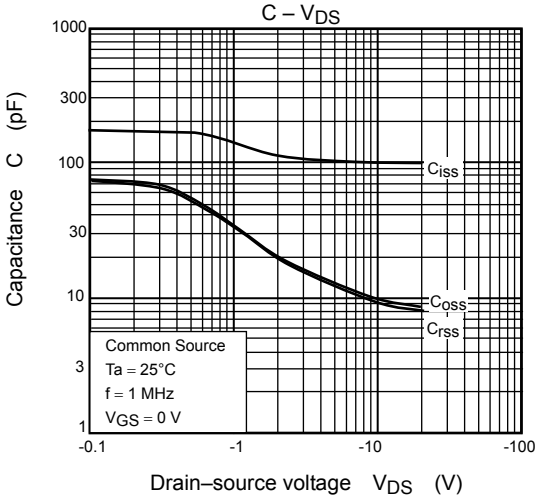

$|Y_{fs}|$ – $I_D$



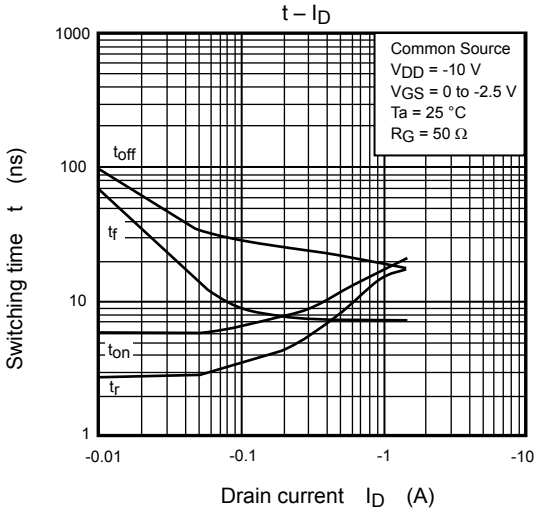

$I_{DR}$ – $V_{DS}$



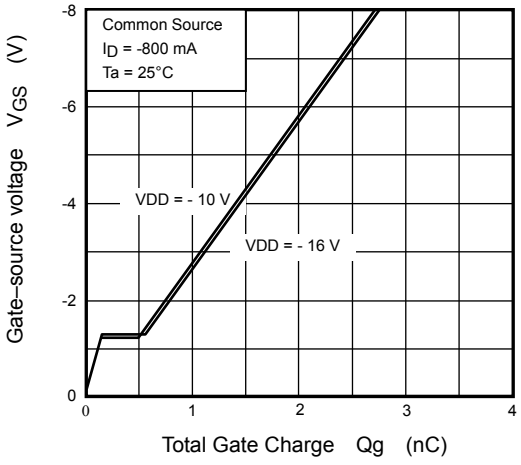

C – $V_{DS}$



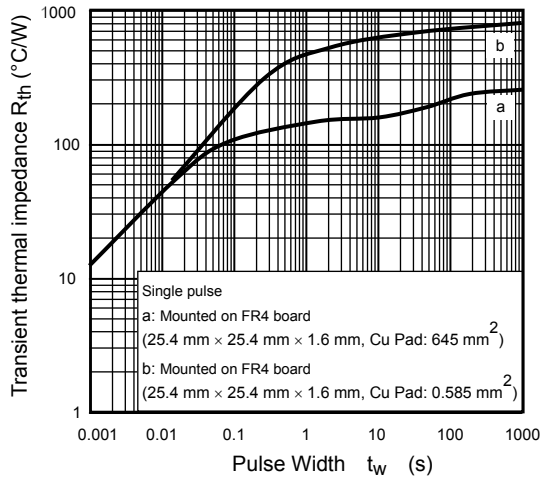

t – $I_D$



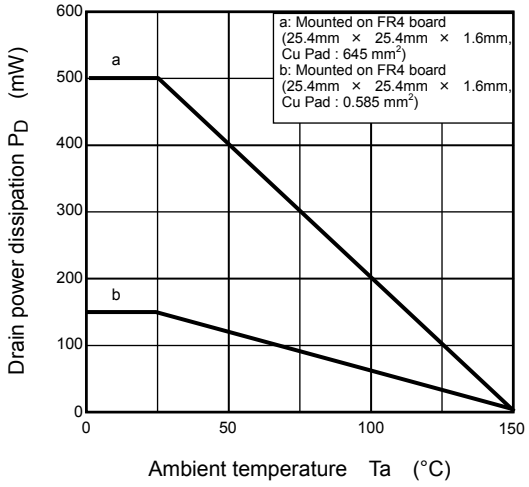

Dynamic Input Characteristic



$R_{th} – t_w$


Transient thermal impedance $R_{th}$ (°C/W)
1000
100
10
1
0.001
0.01
0.1
1
10
100
1000
Pulse Width $t_w$ (s)
b
a
Single pulse
a: Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm$^2$)
b: Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.585 mm$^2$)

$P_D – Ta$


Drain power dissipation $P_D$ (mW)
600
500
400
300
200
100
0
0
50
100
150
Ambient temperature Ta (°C)
a
b
a: Mounted on FR4 board
(25.4mm × 25.4mm × 1.6mm,
Cu Pad : 645 mm$^2$)
b: Mounted on FR4 board
(25.4mm × 25.4mm × 1.6mm,
Cu Pad : 0.585 mm$^2$)

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