

# SSM3J356R

## 1. Applications

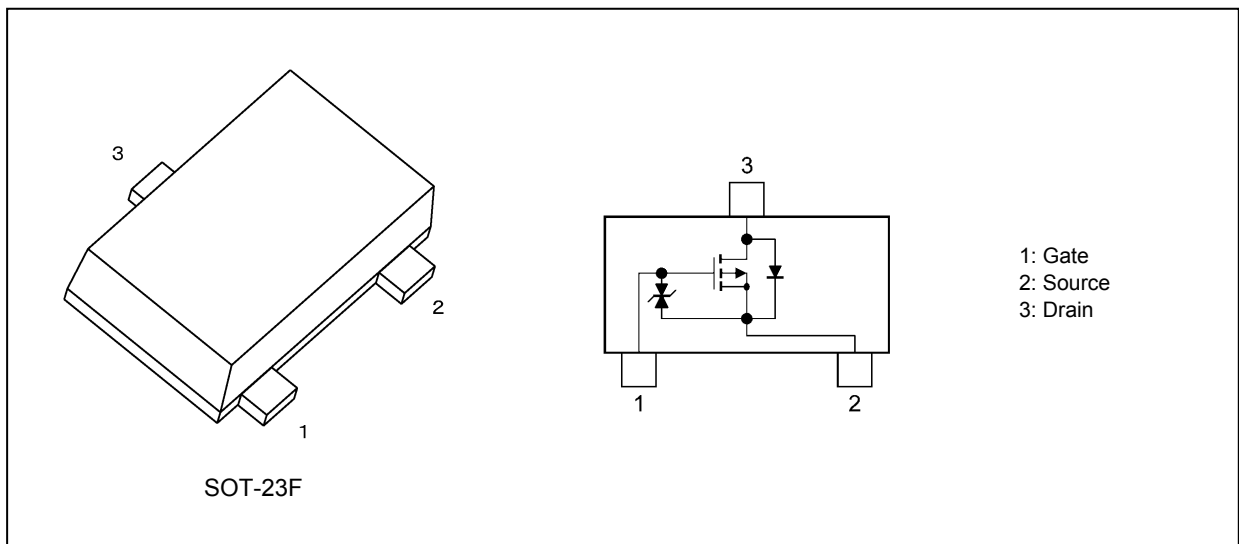
- Power Management Switches

## 2. Features

- (1) 4 V gate drive voltage.
- (2) Low drain-source on-resistance  
 :  $R_{DS(ON)} = 400 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.0 \text{ V}$ )  
 $R_{DS(ON)} = 300 \text{ m}\Omega$  (max) (@ $V_{GS} = -10 \text{ V}$ )
- (3) AEC-Q101 qualified (Note 1)

Note 1: For detail information, please contact to our sales.

## 3. Packaging and Pin Assignment



Start of commercial production  
2015-09

**4. Absolute Maximum Ratings (Note) (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

| Characteristics                           | Symbol    | Rating     | Unit             |
|---|-----------|------------|------------------|
| Drain-source voltage                      | $V_{DSS}$ | -60        | V                |
| Gate-source voltage                       | $V_{GSS}$ | -20/+10    |                  |
| Drain current (DC) (Note 1)               | $I_D$     | -2         | A                |
| Drain current (pulsed) (Note 1), (Note 2) | $I_{DP}$  | -6         |                  |
| Power dissipation (Note 3)                | $P_D$     | 1          | W                |
| Power dissipation (t ≤ 10 s) (Note 3)     |           | 2          |                  |
| Channel temperature                       | $T_{ch}$  | 150        | $^\circ\text{C}$ |
| Storage temperature                       | $T_{stg}$ | -55 to 150 |                  |

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: Ensure that the channel temperature does not exceed 150  $^\circ\text{C}$ .

Note 2: Repetitive rating; pulse width limited by maximum channel temperature.

Note 3: Device mounted on a 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm<sup>2</sup>)

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: The channel-to-ambient thermal resistance,  $R_{th(ch-a)}$ , and the drain power dissipation,  $P_D$ , vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

**5. Electrical Characteristics**

**5.1. Static Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

| Characteristics                         | Symbol        | Test Condition  | Min  | Typ. | Max      | Unit             |
|---|---------------|---|------|------|----------|------------------|
| Gate leakage current                    | $I_{GSS}$     | $V_{GS} = -16\text{ V}/+10\text{ V}, V_{DS} = 0\text{ V}$ | —    | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain cut-off current                   | $I_{DSS}$     | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$              | —    | —    | -10      | $\mu\text{A}$    |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$ | $I_D = -1\text{ mA}, V_{GS} = 0\text{ V}$                 | -60  | —    | —        | V                |
| Drain-source breakdown voltage (Note 1) | $V_{(BR)DSX}$ | $I_D = -1\text{ mA}, V_{GS} = 10\text{ V}$                | -50  | —    | —        | V                |
| Gate threshold voltage                  | $V_{th}$      | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$               | -0.8 | —    | -2.0     | V                |
| Drain-source on-resistance (Note 2)     | $R_{DS(ON)}$  | $I_D = -1.0\text{ A}, V_{GS} = -4.0\text{ V}$             | —    | 280  | 400      | $\text{m}\Omega$ |
|   |               | $I_D = -1.0\text{ A}, V_{GS} = -4.5\text{ V}$             | —    | 270  | 360      |                  |
|   |               | $I_D = -1.0\text{ A}, V_{GS} = -10\text{ V}$              | —    | 240  | 300      |                  |
| Forward transfer admittance (Note 2)    | $ Y_{fs} $    | $V_{DS} = -10\text{ V}, I_D = -1\text{ A}$                | —    | 4.7  | —        | S                |

Note 1: If a reverse 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.

Note 2: Pulse measurement.

**5.2. Dynamic Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

| Characteristics                | Symbol     | Test Condition   | Min | Typ. | Max | Unit        |
|--------------------------------|------------|--|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$  | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1\text{ MHz}$  | —   | 330  | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{riss}$ |  | —   | 25   | —   |             |
| Output capacitance             | $C_{oss}$  |  | —   | 40   | —   |             |
| Switching time (turn-on time)  | $t_{on}$   | $V_{DD} = -30\text{ V}, I_D = -1.0\text{ A}$<br>$V_{GS} = 0\text{ to }-4.5\text{ V}, R_G = 10\text{ }\Omega$<br>Duty $\leq 1\%$ , $V_{IN}$ : $t_r, t_f < 5\text{ ns}$ ,<br>Common source, See Chapter 5.3. | —   | 29   | —   | ns          |
| Switching time (turn-off time) | $t_{off}$  |  | —   | 48   | —   |             |

**5.3. Switching Time Test Circuit**

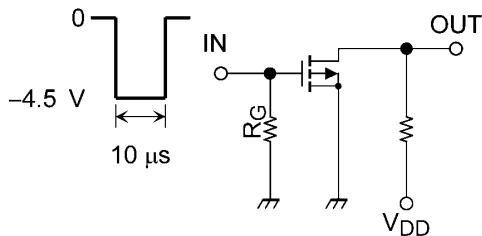


Fig. 5.3.1 Switching Time Test Circuit

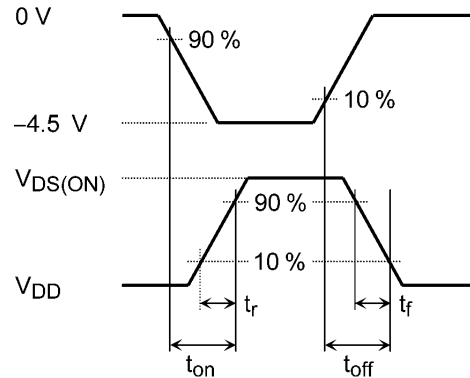


Fig. 5.3.2 Input Waveform/Output Waveform

**5.4. Gate Charge Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

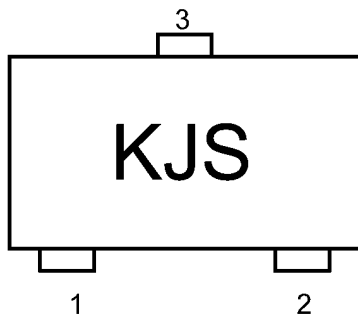
| Characteristics                                 | Symbol    | Test Condition   | Min | Typ. | Max | Unit |
|---|-----------|--|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | $Q_g$     | $V_{DD} = -48\text{ V}, V_{GS} = -10\text{ V},$<br>$I_D = -2.0\text{ A}$ | —   | 8.3  | —   | nC   |
| Gate-source charge 1                            | $Q_{gs1}$ |  | —   | 0.8  | —   |      |
| Gate-drain charge                               | $Q_{gd}$  |  | —   | 1.7  | —   |      |

**5.5. Source-Drain Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

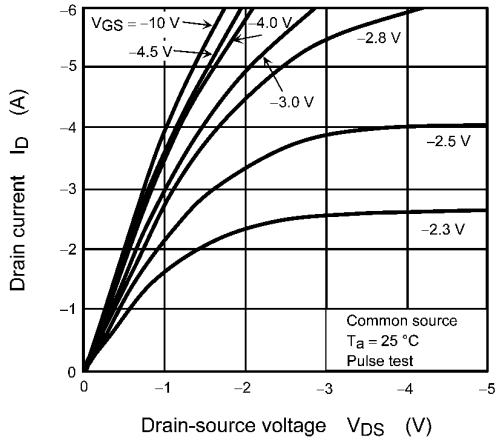
| Characteristics                | Symbol    | Test Condition                            | Min | Typ. | Max | Unit |
|--------------------------------|-----------|---|-----|------|-----|------|
| Diode forward voltage (Note 1) | $V_{DSF}$ | $I_D = 2.0\text{ A}, V_{GS} = 0\text{ V}$ | —   | 0.9  | 1.2 | V    |

Note 1: Pulse measurement.

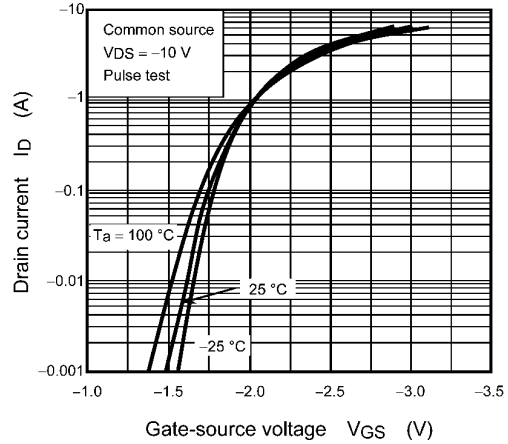
**6. Marking**



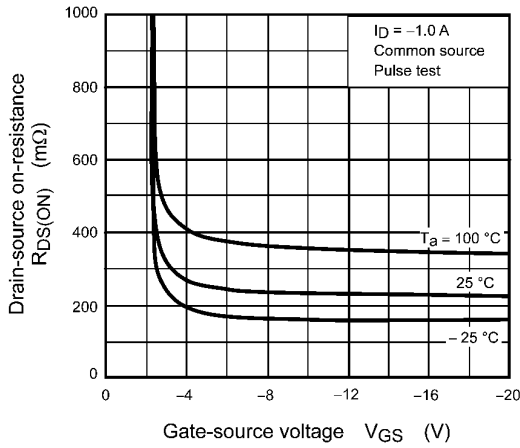
**7. Characteristics Curves (Note)**



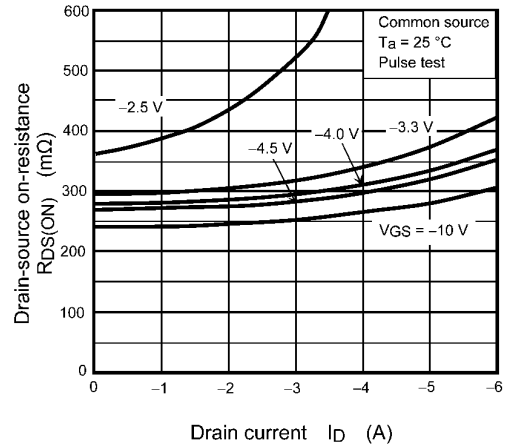
**Fig. 7.1  $I_D - V_{DS}$**



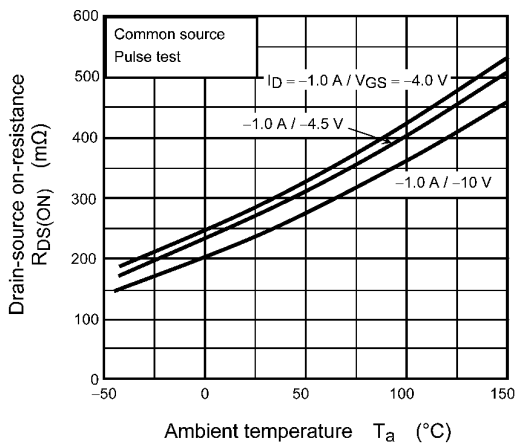
**Fig. 7.2  $I_D - V_{GS}$**



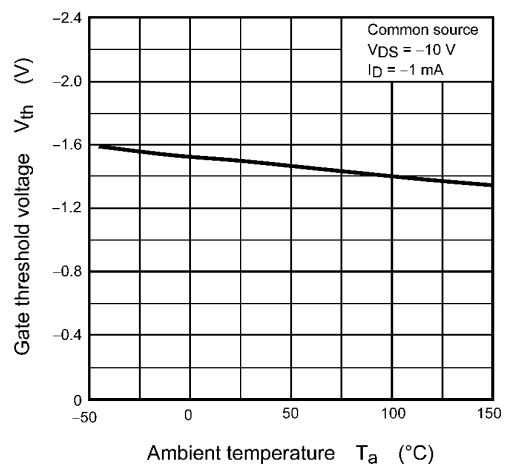
**Fig. 7.3  $R_{DS(ON)} - V_{GS}$**



**Fig. 7.4  $R_{DS(ON)} - I_D$**



**Fig. 7.5  $R_{DS(ON)} - T_a$**



**Fig. 7.6  $V_{th} - T_a$**

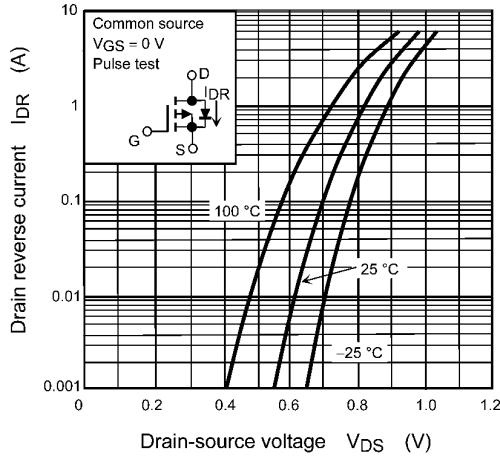


Fig. 7.7  $I_{DR} - V_{DS}$

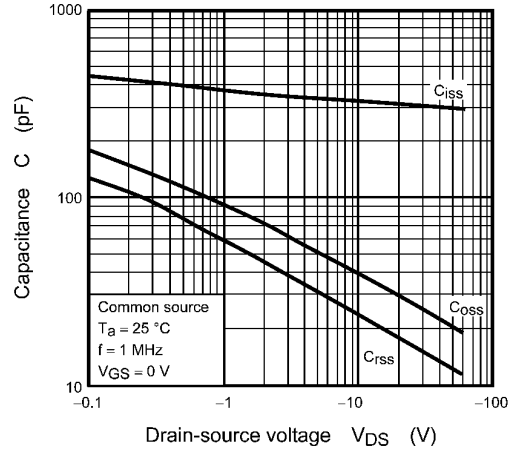


Fig. 7.8  $C - V_{DS}$

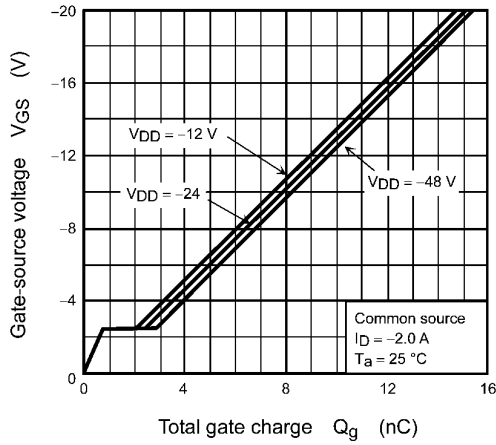


Fig. 7.9 Dynamic Input Characteristics

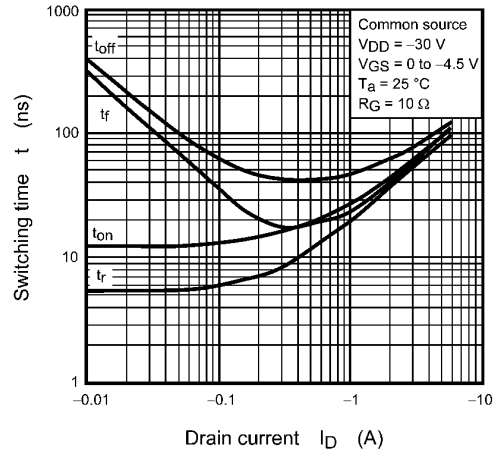


Fig. 7.10  $t - I_D$

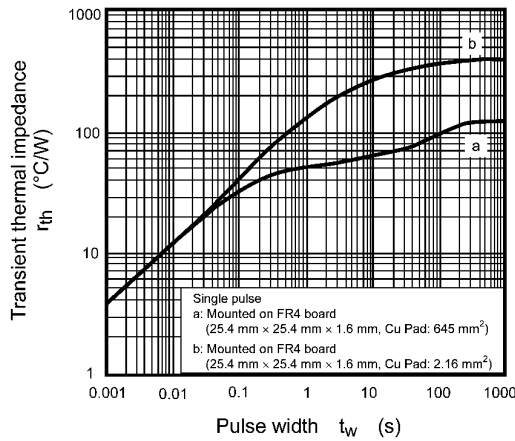


Fig. 7.11  $r_{th} - t_w$

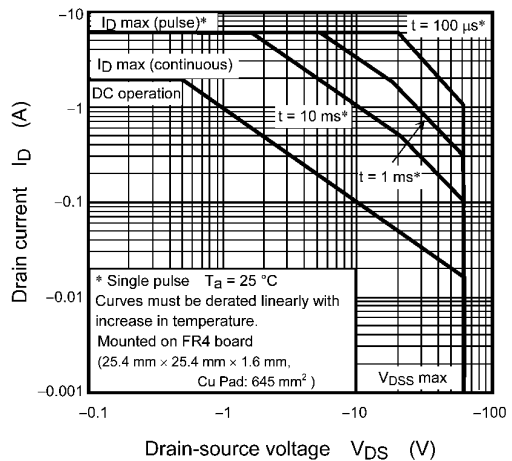
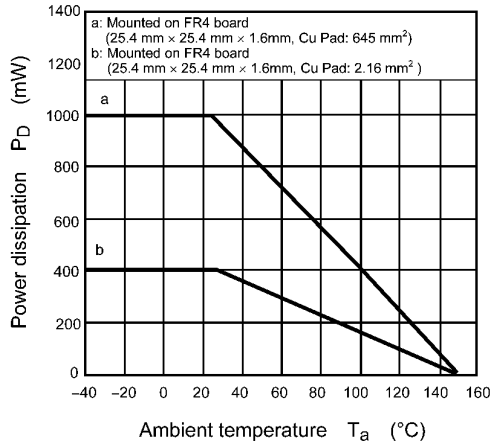


Fig. 7.12 Safe Operating Area



**Fig. 7.13 P<sub>D</sub> - T<sub>a</sub>**

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 0.011 g (typ.)

| Package Name(s)   |
|-------------------|
| TOSHIBA: 2-3Z1S   |
| Nickname: SOT-23F |



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