

|                    |       |
|--------------------|-------|
| $V_{DSS}$          | -20V  |
| $R_{DS(on)}(Max.)$ | 340mΩ |
| $I_D$              | ±1.5A |
| $P_D$              | 1.25W |

### ●Features

- 1) The QS5U27 combines Pch MOSFET with a Schottky barrier diode in a single TSMT5 package.
- 2) Low on-state resistance with fast switching
- 3) Low voltage drive (2.5V drive).
- 4) Built-in Low  $V_F$  schottky barrier diode.
- 5) Pb-free lead plating ; RoHS compliant.

### ●Application

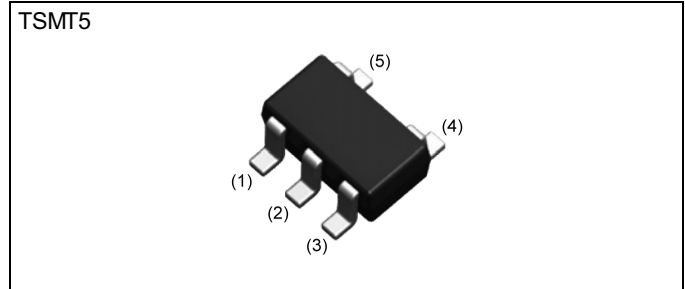
Load switch, DC/ DC conversion

### ●Absolute maximum ratings ( $T_a = 25^\circ C$ )

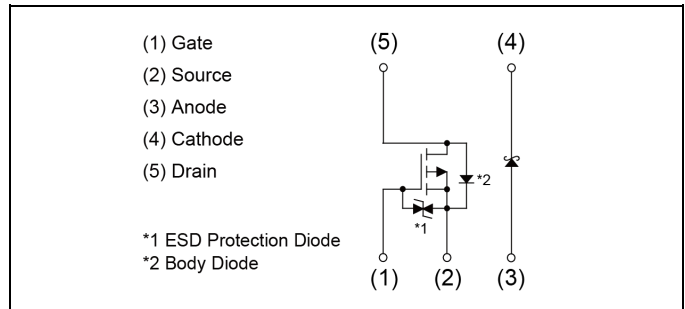
#### <MOSFET>

| Parameter                              | Symbol             | Value | Unit      |
|--|--------------------|-------|-----------|
| Drain - Source voltage                 | $V_{DSS}$          | -20   | V         |
| Gate - Source voltage                  | $V_{GSS}$          | ±12   | V         |
| Continuous drain current               | $I_D$              | ±1.5  | A         |
| Pulsed drain current                   | $I_{D,pulse}^{*1}$ | ±6.0  | A         |
| Continuous source current (body diode) | $I_S$              | -0.75 | A         |
| Pulsed source current (body diode)     | $I_{S,pulse}^{*1}$ | -3.0  | A         |
| Power dissipation                      | $P_D^{*3}$         | 0.9   | W/element |
| Junction temperature                   | $T_j$              | 150   | °C        |

### ●Outline



### ●Inner circuit



### ●Packaging specifications

| Type | Packing                   | Embossed Tape |
|------|---------------------------|---------------|
|      | Reel size (mm)            | 180           |
|      | Tape width (mm)           | 8             |
|      | Basic ordering unit (pcs) | 3000          |
|      | Taping code               | TR            |
|      | Marking                   | U27           |

● **Absolute maximum ratings** ( $T_a = 25^\circ\text{C}$ )

<SBD>

| Parameter                       | Symbol         | Value | Unit             |
|---------------------------------|----------------|-------|------------------|
| Repetitive peak reverse voltage | $V_{RM}$       | 25    | V                |
| Reverse voltage                 | $V_R$          | 20    | V                |
| Forward current                 | $I_F$          | 1.0   | A                |
| Forward current surge peak      | $I_{FSM}^{*2}$ | 3.0   | A                |
| Power dissipation               | $P_D^{*3}$     | 0.7   | W/element        |
| Junction temperature            | $T_j$          | 150   | $^\circ\text{C}$ |

<MOSFET + SBD>

| Parameter                    | Symbol     | Value       | Unit             |
|------------------------------|------------|-------------|------------------|
| Power dissipation            | $P_D^{*3}$ | 1.25        | W/total          |
| Range of storage temperature | $T_{stg}$  | -55 to +150 | $^\circ\text{C}$ |

● **Electrical characteristics** ( $T_a = 25^\circ\text{C}$ )

<MOSFET>

| Parameter                                   | Symbol            | Conditions                                    | Values |      |          | Unit          |
|---|-------------------|---|--------|------|----------|---------------|
|   |                   |   | Min.   | Typ. | Max.     |               |
| Gate - Source leakage current               | $I_{GSS}$         | $V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$ | -      | -    | $\pm 10$ | $\mu\text{A}$ |
| Drain - Source breakdown voltage            | $V_{(BR)DSS}$     | $V_{GS} = 0\text{V}, I_D = -1\text{mA}$       | -20    | -    | -        | V             |
| Zero gate voltage drain current             | $I_{DSS}$         | $V_{DS} = -20\text{V}, V_{GS} = 0\text{V}$    | -      | -    | -1       | $\mu\text{A}$ |
| Gate threshold voltage                      | $V_{GS(th)}$      | $V_{DS} = -10\text{V}, I_D = -1\text{mA}$     | -0.7   | -    | -2.0     | V             |
| Static drain - source on - state resistance | $R_{DS(on)}^{*4}$ | $V_{GS} = -4.5\text{V}, I_D = -1.5\text{A}$   | -      | 160  | 200      | m $\Omega$    |
|   |                   | $V_{GS} = -4\text{V}, I_D = -1.5\text{A}$     | -      | 180  | 240      |               |
|   |                   | $V_{GS} = -2.5\text{V}, I_D = -0.75\text{A}$  | -      | 260  | 340      |               |
| Transconductance                            | $g_{fs}^{*4}$     | $V_{DS} = -10\text{V}, I_D = -0.75\text{A}$   | 1.0    | -    | -        | S             |

● **Electrical characteristics** ( $T_a = 25^\circ\text{C}$ )

<MOSFET>

| Parameter                    | Symbol            | Conditions                            | Values |      |      | Unit |
|------------------------------|-------------------|---------------------------------------|--------|------|------|------|
|                              |                   |                                       | Min.   | Typ. | Max. |      |
| Input capacitance            | $C_{iss}$         | $V_{GS} = 0V$                         | -      | 325  | -    | pF   |
| Output capacitance           | $C_{oss}$         | $V_{DS} = -10V$                       | -      | 60   | -    |      |
| Reverse transfer capacitance | $C_{rss}$         | $f = 1\text{MHz}$                     | -      | 40   | -    |      |
| Turn - on delay time         | $t_{d(on)}^{*4}$  | $V_{DD} \approx -15V, V_{GS} = -4.5V$ | -      | 10   | -    | ns   |
| Rise time                    | $t_r^{*4}$        | $I_D = -0.75A$                        | -      | 10   | -    |      |
| Turn - off delay time        | $t_{d(off)}^{*4}$ | $R_L = 20\Omega$                      | -      | 35   | -    |      |
| Fall time                    | $t_f^{*4}$        | $R_G = 10\Omega$                      | -      | 10   | -    |      |

● **Gate charge characteristics** ( $T_a = 25^\circ\text{C}$ )

<MOSFET>

| Parameter            | Symbol        | Conditions   | Values |      |      | Unit |
|----------------------|---------------|--|--------|------|------|------|
|                      |               |  | Min.   | Typ. | Max. |      |
| Total gate charge    | $Q_g^{*4}$    | $V_{DD} \approx -15V, I_D = -1.5A$<br>$V_{GS} = -4.5V$ | -      | 4.2  | -    | nC   |
| Gate - Source charge | $Q_{gs}^{*4}$ |  | -      | 1.0  | -    |      |
| Gate - Drain charge  | $Q_{gd}^{*4}$ |  | -      | 1.1  | -    |      |

● **Body diode electrical characteristics** (Source-Drain) ( $T_a = 25^\circ\text{C}$ )

<MOSFET>

| Parameter       | Symbol        | Conditions                  | Values |      |      | Unit |
|-----------------|---------------|-----------------------------|--------|------|------|------|
|                 |               |                             | Min.   | Typ. | Max. |      |
| Forward voltage | $V_{SD}^{*4}$ | $V_{GS} = 0V, I_S = -0.75A$ | -      | -    | -1.2 | V    |

● **Electrical characteristics** ( $T_a = 25^\circ\text{C}$ )

<SBD>

| Parameter       | Symbol | Conditions          | Values |      |      | Unit          |
|-----------------|--------|---------------------|--------|------|------|---------------|
|                 |        |                     | Min.   | Typ. | Max. |               |
| Forward voltage | $V_F$  | $I_F = 1.0\text{A}$ | -      | -    | 0.45 | V             |
| Reverse current | $I_R$  | $V_R = 20\text{V}$  | -      | -    | 200  | $\mu\text{A}$ |

\*1  $P_w \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*2 60Hz · 1 cycle

\*3 Mounted on a ceramic board

\*4 Pulsed

● Electrical characteristic curves <MOSFET>

Fig.1 Typical Capacitance vs. Drain - Source Voltage

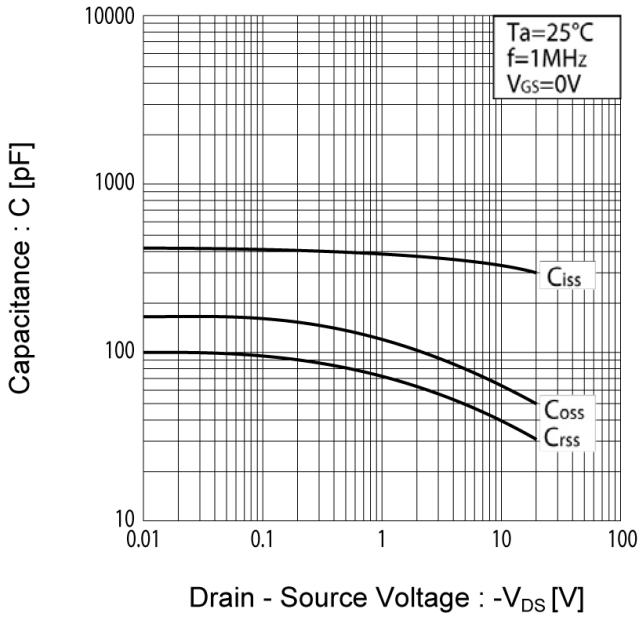


Fig.2 Switching Characteristics

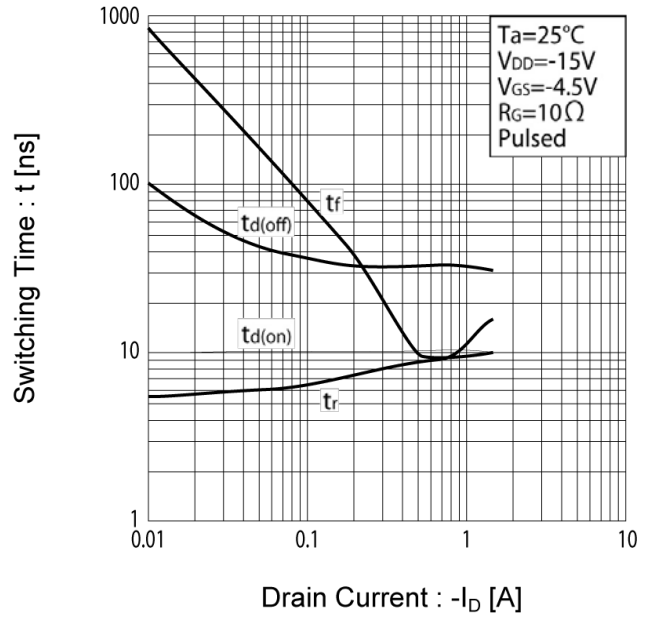


Fig.3 Typical Transfer Characteristics

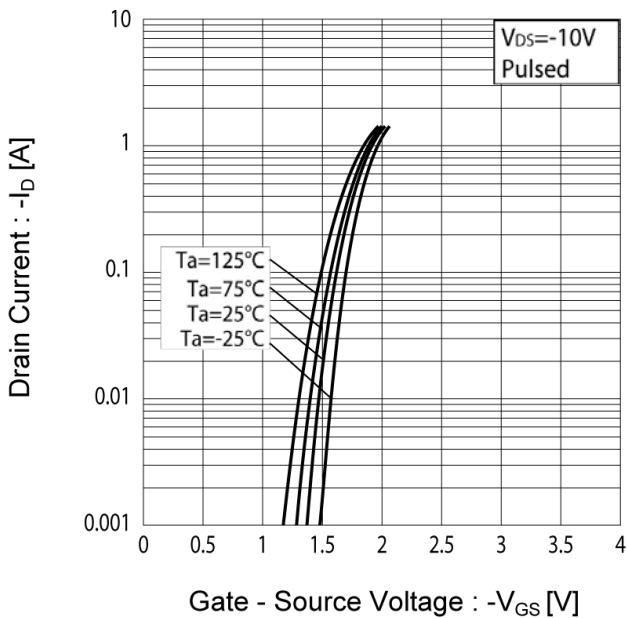
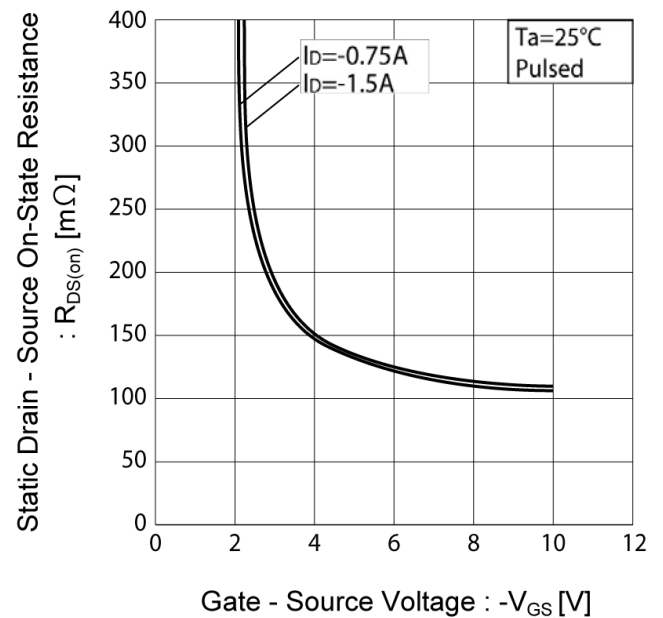


Fig.4 Static Drain - Source On - State Resistance vs. Gate Source Voltage



● Electrical characteristic curves <MOSFET>

Fig.5 Source Current vs. Source Drain Voltage

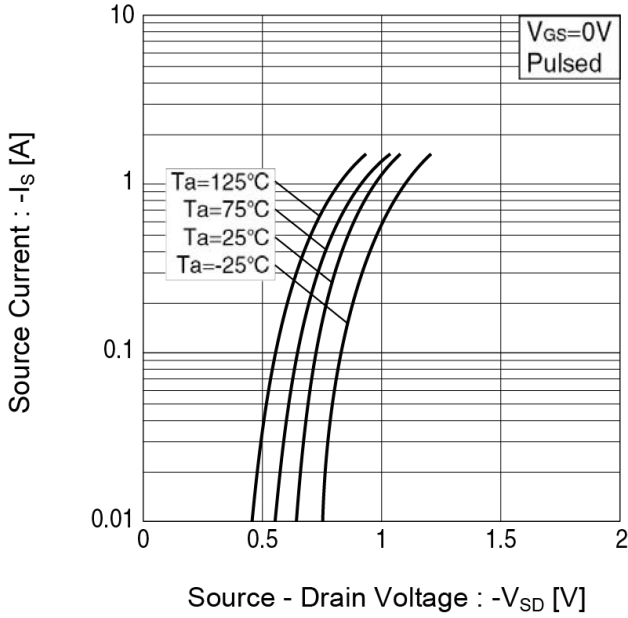


Fig.6 Static Drain - Source On - State Resistance vs. Drain Current (I)

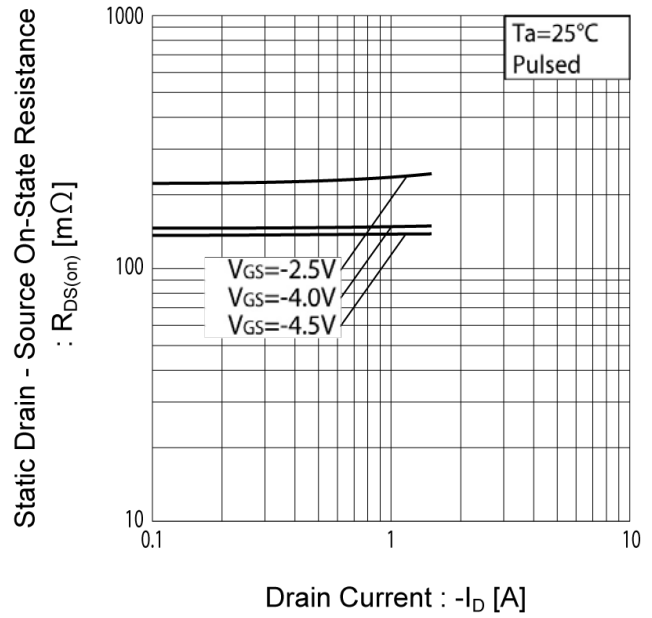


Fig.7 Static Drain - Source On - State Resistance vs. Drain Current (II)

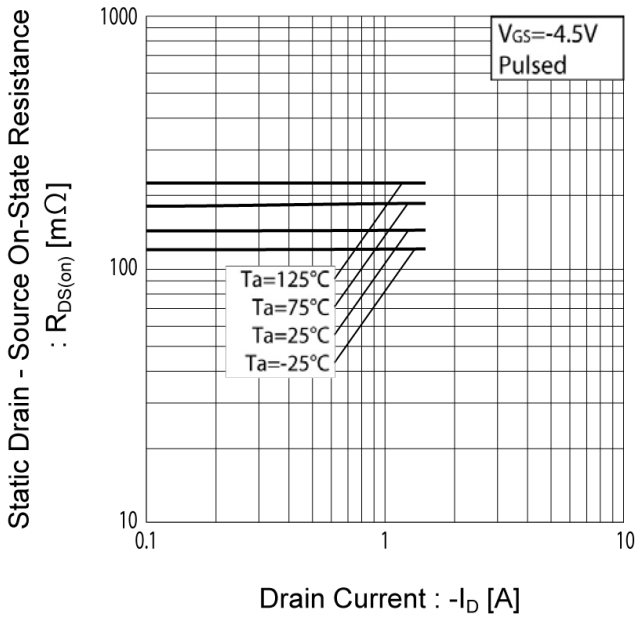
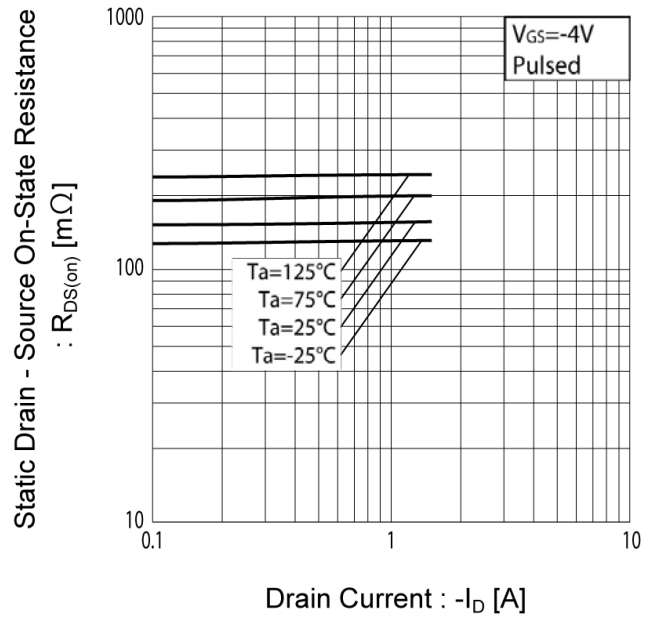
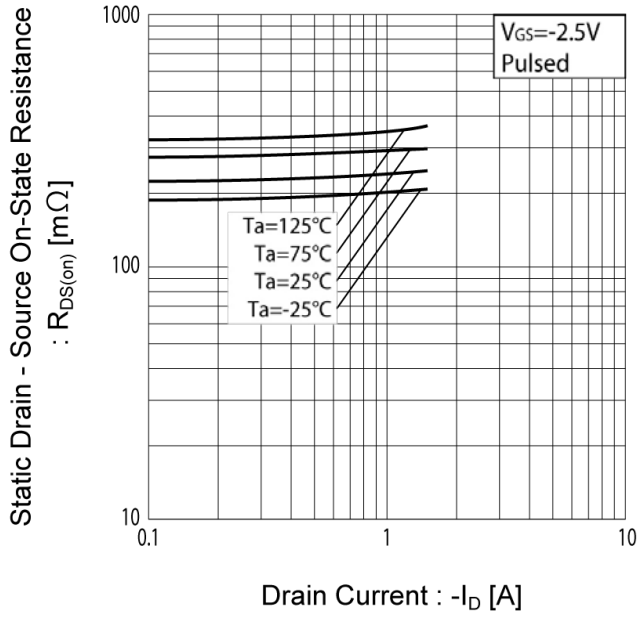


Fig.8 Static Drain - Source On - State Resistance vs. Drain Current (III)



● Electrical characteristic curves <MOSFET>

Fig.9 Static Drain - Source On - State Resistance vs. Drain Current (IV)



● Electrical characteristic curves <SBD>

Fig.11 Forward Current vs. Forward Voltage

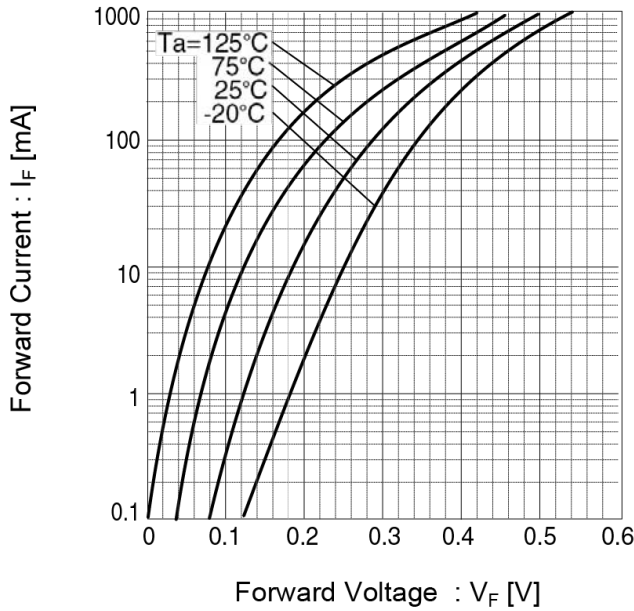
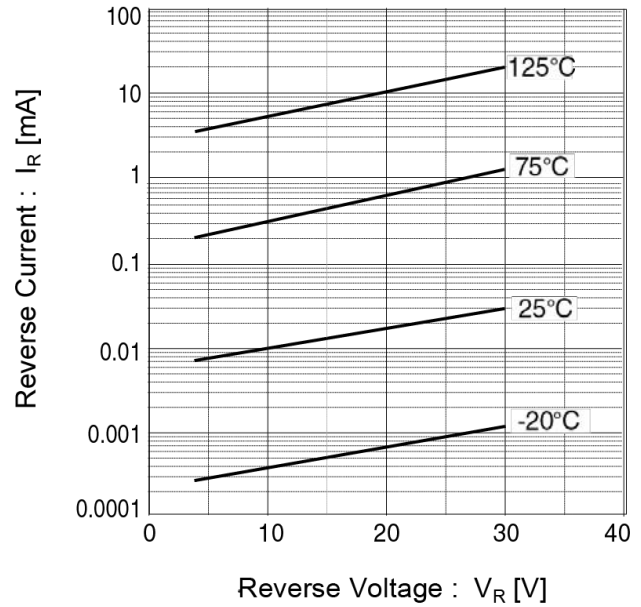


Fig.12 Reverse Current vs. Reverse Voltage



● Notice

1. SBD has a large reverse leak current compared to other type of diode. Therefore, it would raise a junction temperature, and increase a reverse power loss. Further rise of inside temperature would cause a thermal runaway. This built-in SBD has low  $V_F$  characteristics and therefore, higher leak current. Please consider enough the surrounding temperature, generating heat of MOSFET and the reverse current.
2. This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

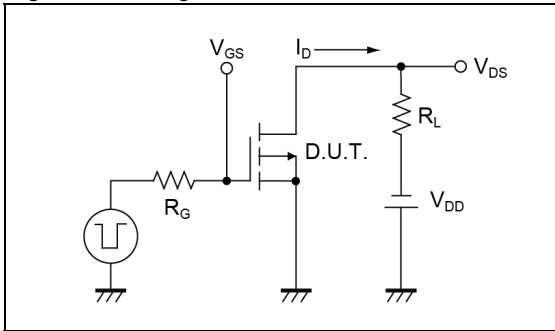


Fig.1-2 Switching Waveforms

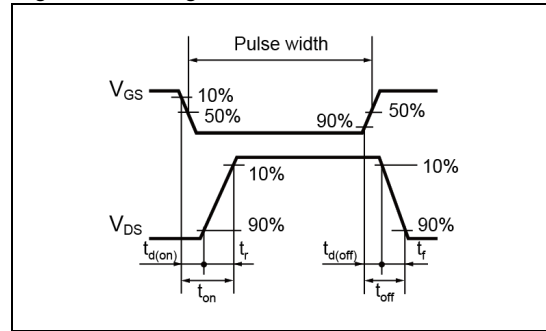


Fig.2-1 Gate Charge Measurement Circuit

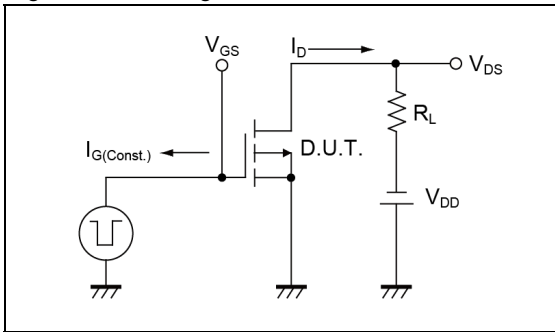
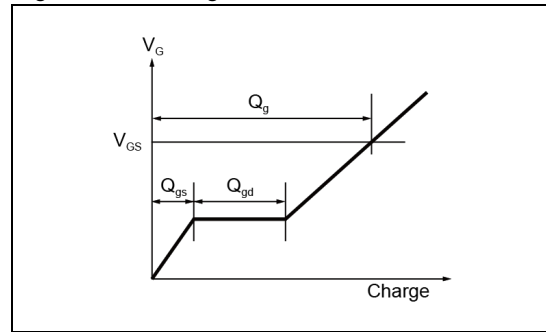
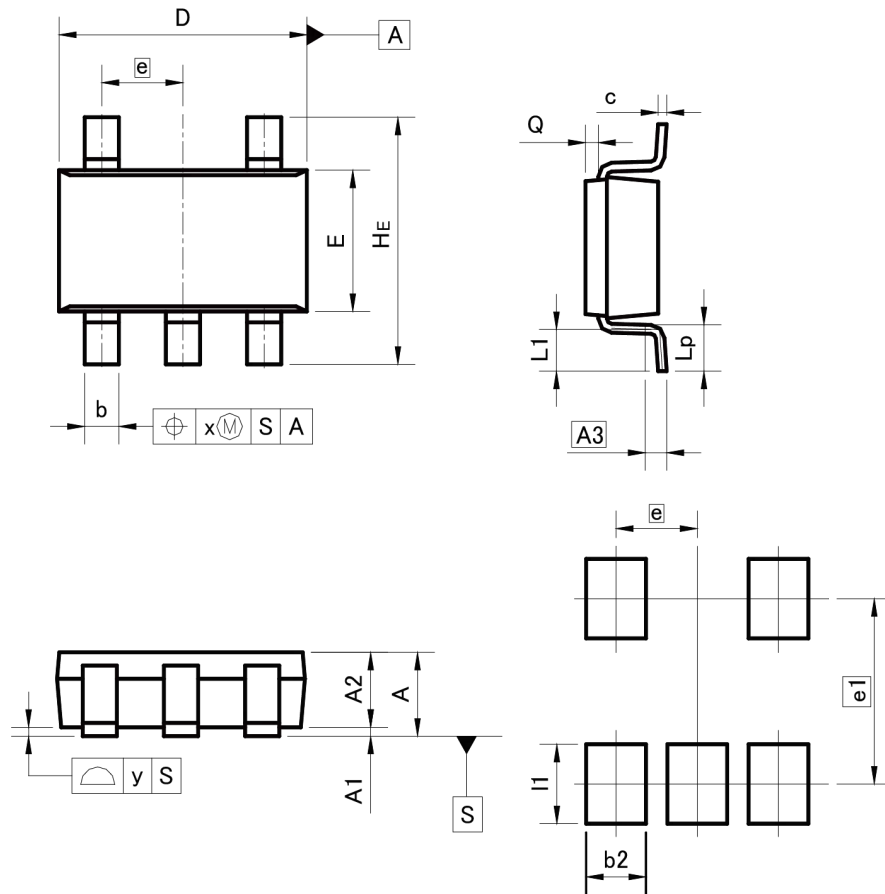


Fig.2-2 Gate Charge Waveform



●Dimensions

TSMT5



Pattern of terminal position areas  
[Not a recommended pattern of soldering pads]

| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| A   | -          | 1.00 | -      | 0.039 |
| A1  | 0.00       | 0.10 | 0.000  | 0.004 |
| A2  | 0.75       | 0.95 | 0.030  | 0.037 |
| A3  | 0.25       |      | 0.010  |       |
| b   | 0.35       | 0.50 | 0.014  | 0.020 |
| c   | 0.10       | 0.26 | 0.004  | 0.010 |
| D   | 2.80       | 3.00 | 0.110  | 0.118 |
| E   | 1.50       | 1.80 | 0.059  | 0.071 |
| e   | 0.95       |      | 0.037  |       |
| HE  | 2.60       | 3.00 | 0.102  | 0.118 |
| L1  | 0.30       | 0.60 | 0.012  | 0.024 |
| Lp  | 0.40       | 0.70 | 0.016  | 0.028 |
| Q   | 0.05       | 0.25 | 0.002  | 0.010 |
| x   | -          | 0.20 | -      | 0.008 |
| y   | -          | 0.10 | -      | 0.004 |

| DIM | MILIMETERS |      | INCHES |       |
|-----|------------|------|--------|-------|
|     | MIN        | MAX  | MIN    | MAX   |
| b2  | -          | 0.70 | -      | 0.028 |
| e1  | 2.10       |      | 0.083  |       |
| I1  | -          | 0.90 | -      | 0.035 |

Dimension in mm/inches

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