

|                    |        |
|--------------------|--------|
| $V_{DSS}$          | 600V   |
| $R_{DS(on)}(Max.)$ | 0.130Ω |
| $I_D$              | ±30A   |
| $P_D$              | 305W   |

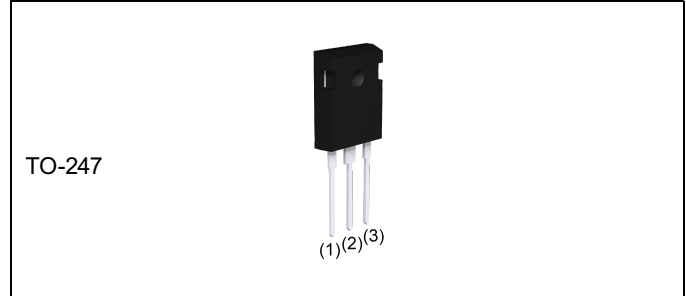
### ●Features

- 1) Low on-resistance.
- 2) Ultra fast switching speed.
- 3) Parallel use is easy.
- 4) Pb-free lead plating ; RoHS compliant

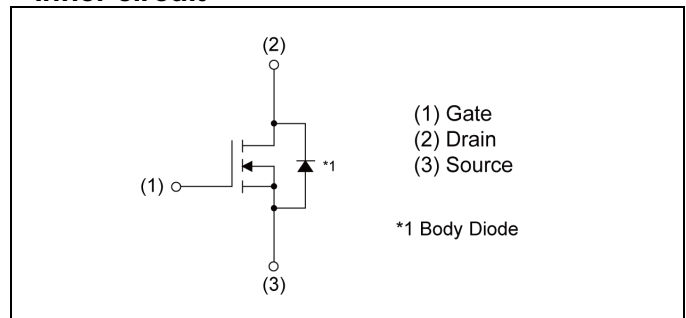
### ●Application

Switching

### ●Outline



### ●Inner circuit



### ●Packaging specifications

|      |                           |           |
|------|---------------------------|-----------|
| Type | Packing                   | Tube      |
|      | Reel size (mm)            | -         |
|      | Tape width (mm)           | -         |
|      | Basic ordering unit (pcs) | 450       |
|      | Taping code               | C9        |
|      | Marking                   | R6030KNZ1 |

### ●Absolute maximum ratings ( $T_a = 25^\circ\text{C}$ , unless otherwise specified)

| Parameter                                             |                        | Symbol        | Value       | Unit |
|-------------------------------------------------------|------------------------|---------------|-------------|------|
| Drain - Source voltage                                |                        | $V_{DSS}$     | 600         | V    |
| Continuous drain current ( $T_c = 25^\circ\text{C}$ ) |                        | $I_D^{*1}$    | ±30         | A    |
| Pulsed drain current                                  |                        | $I_{DP}^{*2}$ | ±90         | A    |
| Gate - Source voltage                                 | static                 | $V_{GSS}$     | ±20         | V    |
|                                                       | AC( $f > 1\text{Hz}$ ) |               | ±30         | V    |
| Avalanche current, single pulse                       |                        | $I_{AS}$      | 5.2         | A    |
| Avalanche energy, single pulse                        |                        | $E_{AS}^{*3}$ | 636         | mJ   |
| Power dissipation ( $T_c = 25^\circ\text{C}$ )        |                        | $P_D$         | 305         | W    |
| Junction temperature                                  |                        | $T_j$         | 150         | °C   |
| Operating junction and storage temperature range      |                        | $T_{stg}$     | -55 to +150 | °C   |

### ● Thermal resistance

| Parameter                                    | Symbol          | Values |      |      | Unit |
|----------------------------------------------|-----------------|--------|------|------|------|
|                                              |                 | Min.   | Typ. | Max. |      |
| Thermal resistance, junction - case          | $R_{thJC}^{*4}$ | -      | -    | 0.41 | °C/W |
| Thermal resistance, junction - ambient       | $R_{thJA}$      | -      | -    | 30   | °C/W |
| Soldering temperature, wavesoldering for 10s | $T_{sold}$      | -      | -    | 265  | °C   |

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

| Parameter                                   | Symbol            | Conditions                                               | Values |       |           | Unit          |
|---------------------------------------------|-------------------|----------------------------------------------------------|--------|-------|-----------|---------------|
|                                             |                   |                                                          | Min.   | Typ.  | Max.      |               |
| Drain - Source breakdown voltage            | $V_{(BR)DSS}$     | $V_{GS} = 0V, I_D = 1mA$                                 | 600    | -     | -         | V             |
| Zero gate voltage drain current             | $I_{DSS}$         | $V_{DS} = 600V, V_{GS} = 0V$<br>$T_j = 25^\circ\text{C}$ | -      | -     | 100       | $\mu\text{A}$ |
|                                             |                   | $T_j = 125^\circ\text{C}$                                | -      | -     | 1000      |               |
| Gate - Source leakage current               | $I_{GSS}$         | $V_{GS} = \pm 20V, V_{DS} = 0V$                          | -      | -     | $\pm 100$ | nA            |
| Gate threshold voltage                      | $V_{GS(th)}$      | $V_{DS} = 10V, I_D = 1mA$                                | 3      | -     | 5         | V             |
| Static drain - source on - state resistance | $R_{DS(on)}^{*5}$ | $V_{GS} = 10V, I_D = 14.5A$<br>$T_j = 25^\circ\text{C}$  | -      | 0.115 | 0.130     | $\Omega$      |
|                                             |                   | $T_j = 125^\circ\text{C}$                                | -      | 0.24  | -         |               |
| Gate resistance                             | $R_G$             | $f = 1MHz, \text{open drain}$                            | -      | 2.1   | -         | $\Omega$      |

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

| Parameter                    | Symbol            | Conditions                                        | Values |      |      | Unit |
|------------------------------|-------------------|---------------------------------------------------|--------|------|------|------|
|                              |                   |                                                   | Min.   | Typ. | Max. |      |
| Forward Transfer Admittance  | $ Y_{fs} ^{*5}$   | $V_{DS} = 10\text{V}, I_D = 15\text{A}$           | 10     | 20   | -    | S    |
| Input capacitance            | $C_{iss}$         | $V_{GS} = 0\text{V}$                              | -      | 2350 | -    | pF   |
| Output capacitance           | $C_{oss}$         | $V_{DS} = 25\text{V}$                             | -      | 2000 | -    |      |
| Reverse transfer capacitance | $C_{rss}$         | $f = 1\text{MHz}$                                 | -      | 140  | -    |      |
| Turn - on delay time         | $t_{d(on)}^{*5}$  | $V_{DD} \approx 300\text{V}, V_{GS} = 10\text{V}$ | -      | 36   | -    | ns   |
| Rise time                    | $t_r^{*5}$        | $I_D = 15\text{A}$                                | -      | 75   | -    |      |
| Turn - off delay time        | $t_{d(off)}^{*5}$ | $R_L \approx 20\Omega$                            | -      | 90   | -    |      |
| Fall time                    | $t_f^{*5}$        | $R_G = 10\Omega$                                  | -      | 45   | -    |      |

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

| Parameter            | Symbol          | Conditions                                     | Values |      |      | Unit |
|----------------------|-----------------|------------------------------------------------|--------|------|------|------|
|                      |                 |                                                | Min.   | Typ. | Max. |      |
| Total gate charge    | $Q_g^{*5}$      | $V_{DD} \approx 300\text{V}$                   | -      | 56   | -    | nC   |
| Gate - Source charge | $Q_{gs}^{*5}$   | $I_D = 30\text{A}$                             | -      | 18   | -    |      |
| Gate - Drain charge  | $Q_{gd}^{*5}$   | $V_{GS} = 10\text{V}$                          | -      | 23   | -    |      |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD} \approx 300\text{V}, I_D = 30\text{A}$ | -      | 6.3  | -    | V    |

\*1 Limited only by maximum channel temperature allowed.

\*2  $P_w \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*3  $L \approx 50\text{mH}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , STARTING  $T_j = 25^\circ\text{C}$

\*4  $T_C = 25^\circ\text{C}$

\*5 Pulsed

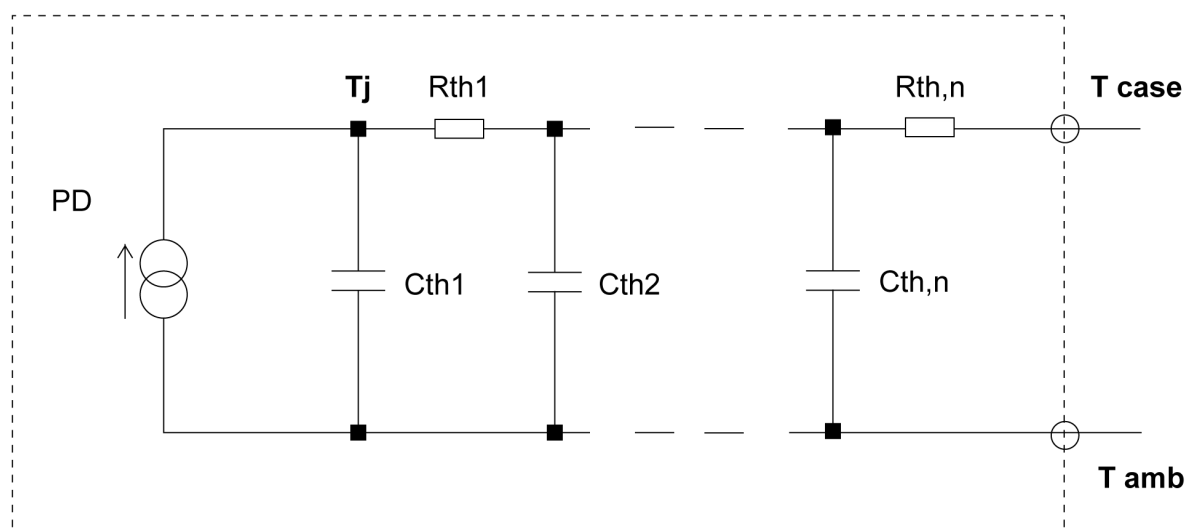
**●Body diode electrical characteristics (Source-Drain) ( $T_a = 25^\circ\text{C}$ )**

| Parameter                     | Symbol        | Conditions                                              | Values |      |      | Unit          |
|-------------------------------|---------------|---------------------------------------------------------|--------|------|------|---------------|
|                               |               |                                                         | Min.   | Typ. | Max. |               |
| Continuous forward current    | $I_S^{*1}$    | $T_C = 25^\circ\text{C}$                                | -      | -    | 30   | A             |
| Pulse forward current         | $I_{SP}^{*2}$ |                                                         | -      | -    | 90   | A             |
| Forward voltage               | $V_{SD}^{*5}$ | $V_{GS} = 0\text{V}, I_S = 30\text{A}$                  | -      | -    | 1.5  | V             |
| Reverse recovery time         | $t_{rr}$      | $I_S = 30\text{A}$<br>$di/dt = 100\text{A}/\mu\text{s}$ | -      | 517  | -    | ns            |
| Reverse recovery charge       | $Q_{rr}$      |                                                         | -      | 9.6  | -    | $\mu\text{C}$ |
| Peak reverse recovery current | $I_{rrm}$     |                                                         | -      | 37   | -    | A             |

**●Typical transient thermal characteristics**

| Symbol    | Value | Unit |
|-----------|-------|------|
| $R_{th1}$ | 0.190 | K/W  |
| $R_{th2}$ | 0.429 |      |
| $R_{th3}$ | 0.250 |      |

| Symbol    | Value  | Unit |
|-----------|--------|------|
| $C_{th1}$ | 0.0143 | Ws/K |
| $C_{th2}$ | 0.322  |      |
| $C_{th3}$ | 14.7   |      |



## ●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

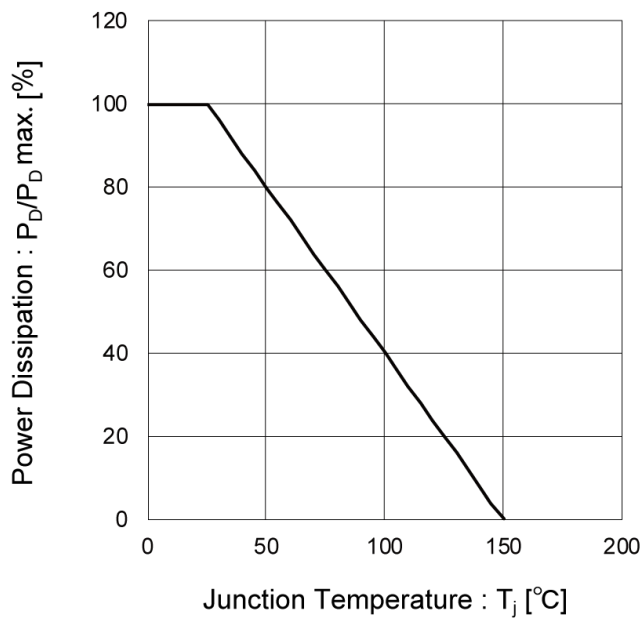


Fig.2 Maximum Safe Operating Area

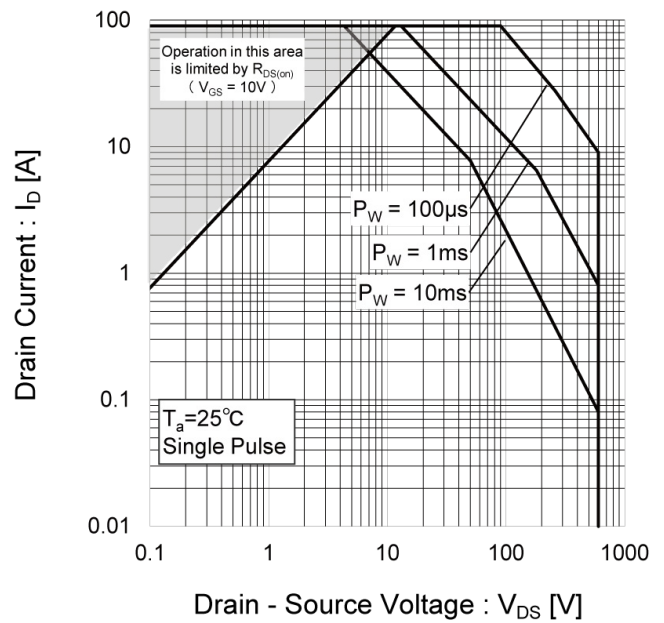
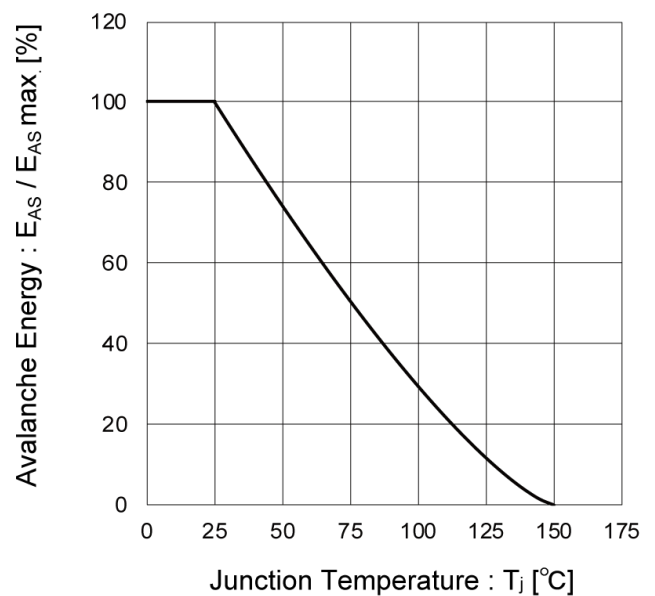


Fig.3 Avalanche Energy Derating Curve vs. Junction Temperature



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

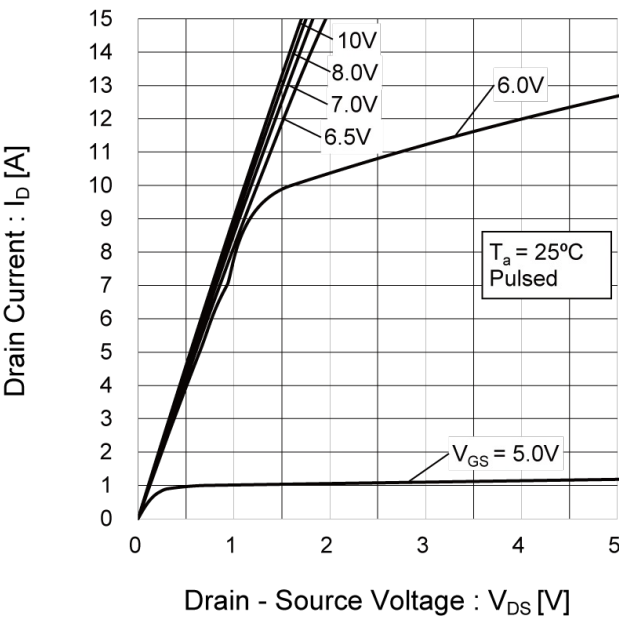
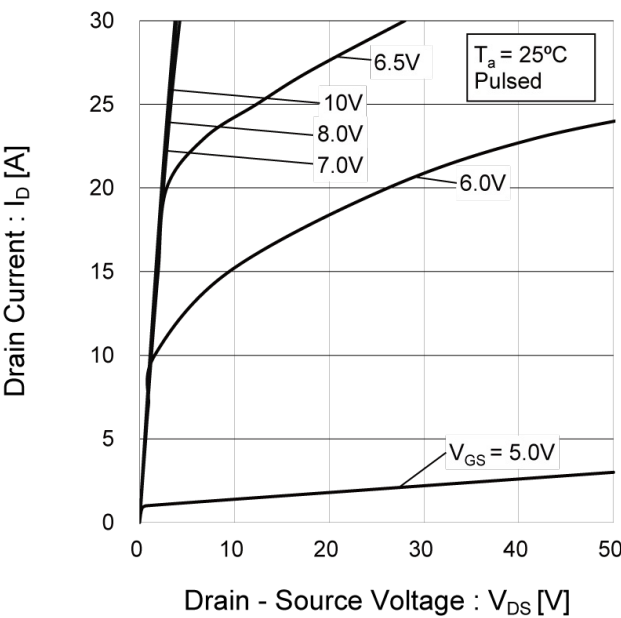


Fig.5 Typical Output Characteristics(II)



## ●Electrical characteristic curves

Fig.6 Breakdown Voltage vs.  
Junction Temperature

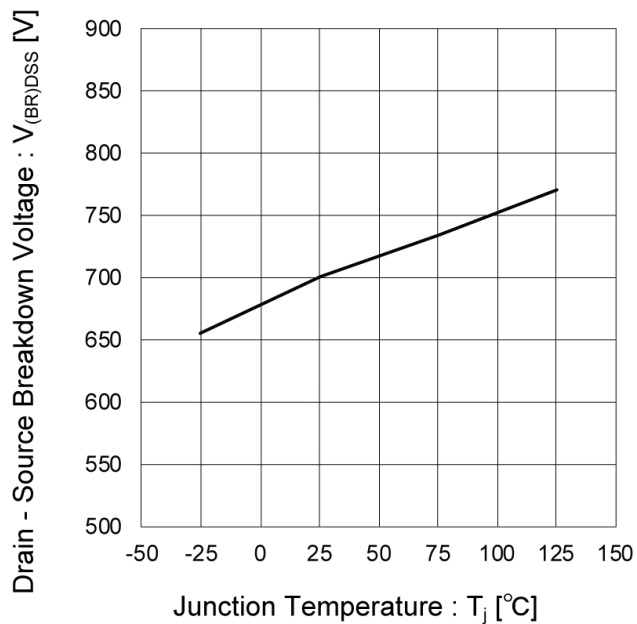


Fig.7 Typical Transfer Characteristics

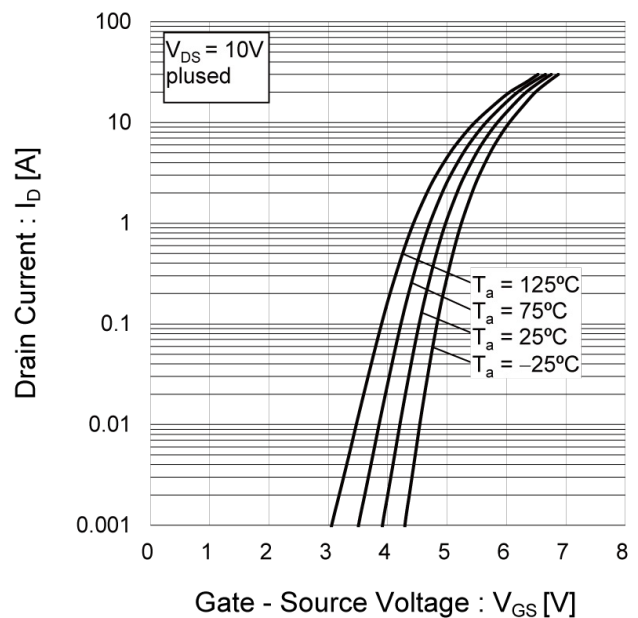


Fig.8 Gate Threshold Voltage vs.  
Junction Temperature

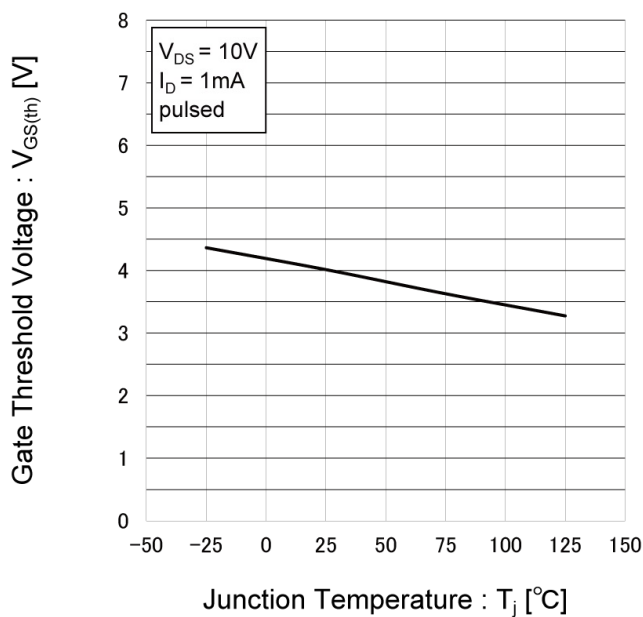
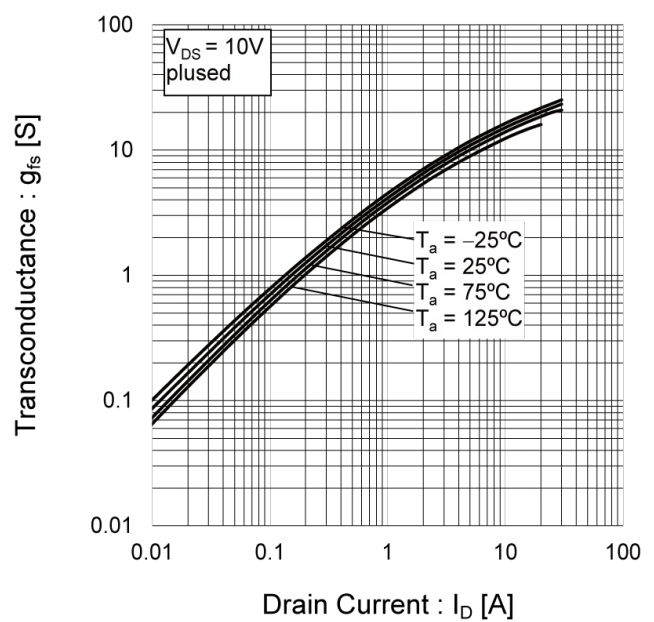


Fig.9 Forward Transfer Admittance vs.  
Drain Current



## ●Electrical characteristic curves

Fig.10 Static Drain - Source On - State Resistance vs. Gate Source Voltage

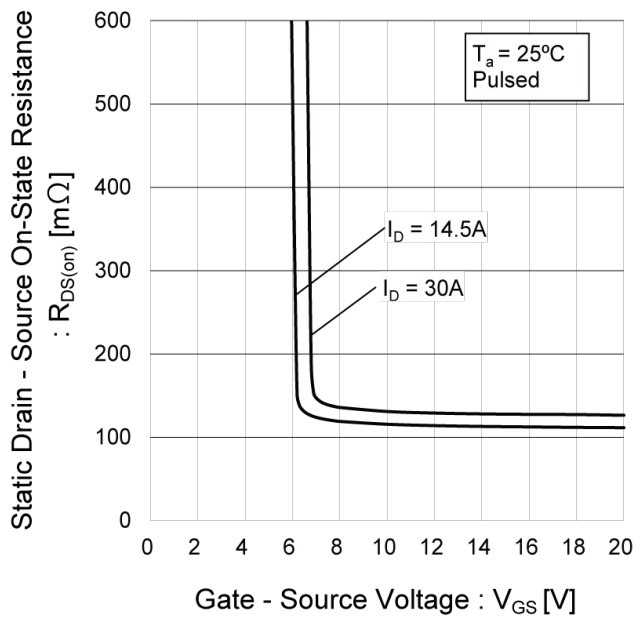


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature

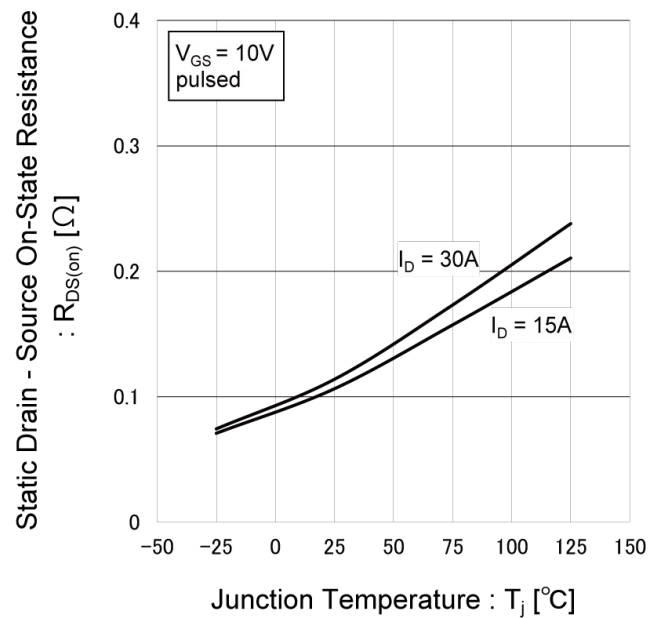
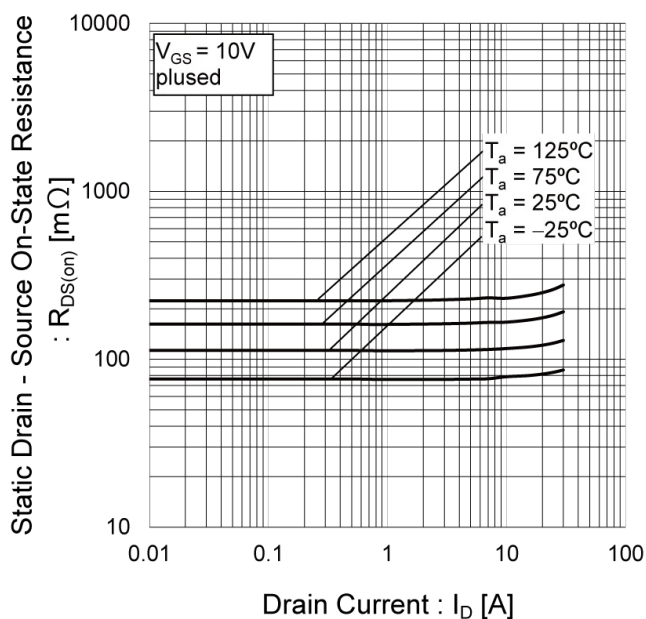


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current( $I$ )



## ●Electrical characteristic curves

Fig.13 Typical Capacitance vs.  
Drain - Source Voltage

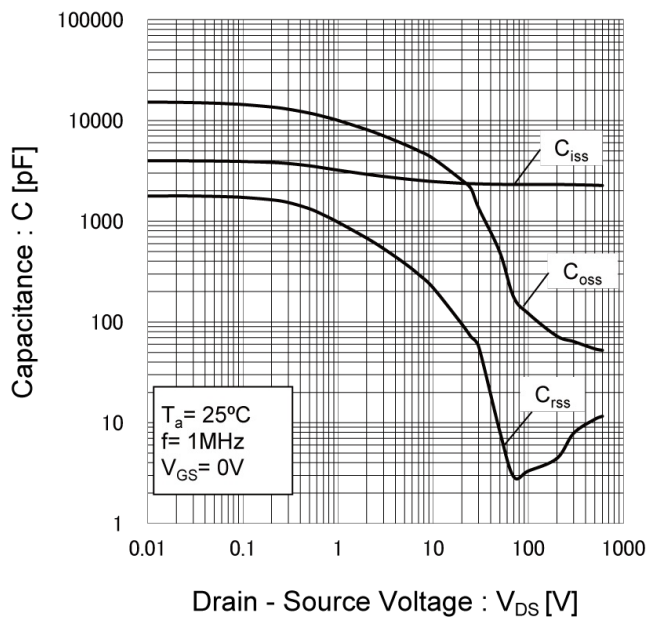


Fig.14 Switching Characteristics

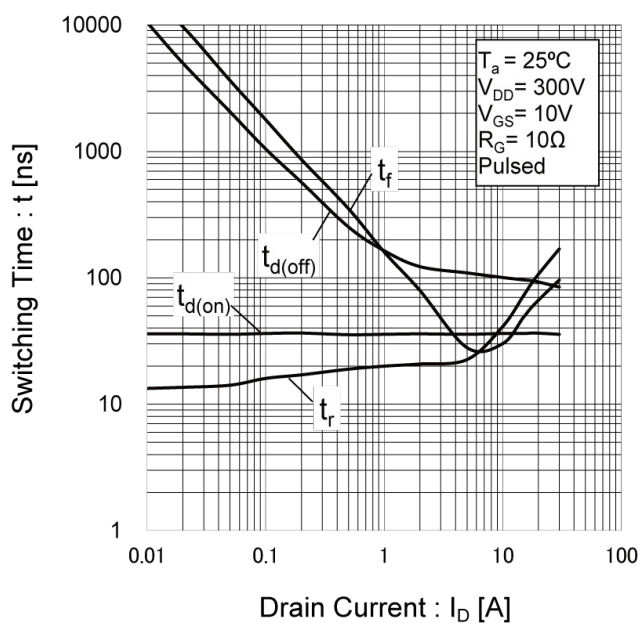
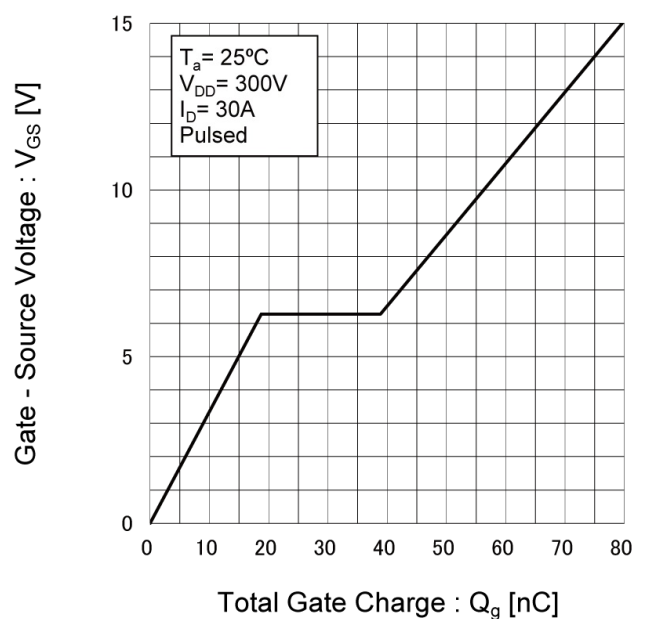


Fig.15 Dynamic Input Characteristics



# ●Electrical characteristic curves

Fig.16 Inverse Diode Forward Current  
vs. Source - Drain Voltage

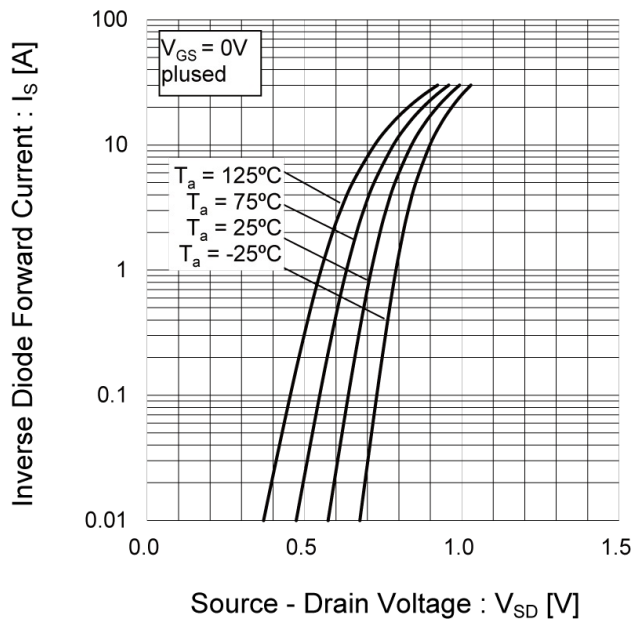
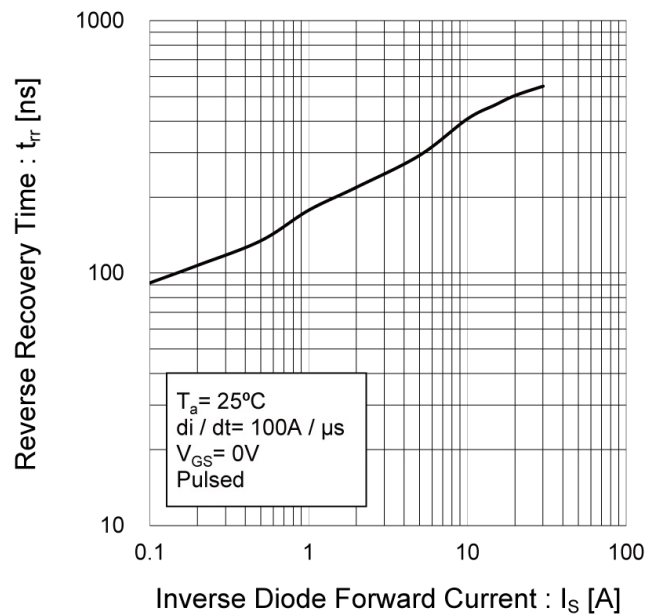


Fig.17 Reverse Recovery Time vs.  
Inverse Diode Forward Current



## ● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

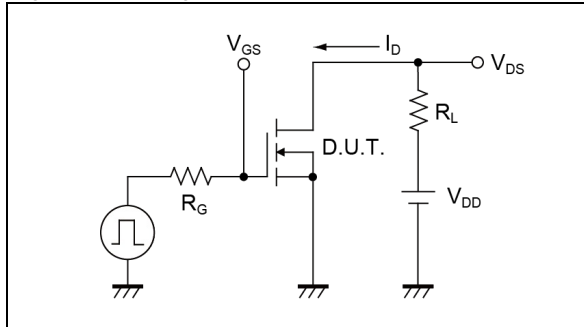


Fig.1-2 Switching Waveforms

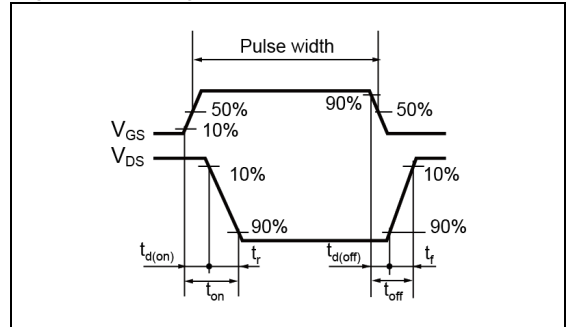


Fig.2-1 Gate Charge Measurement Circuit

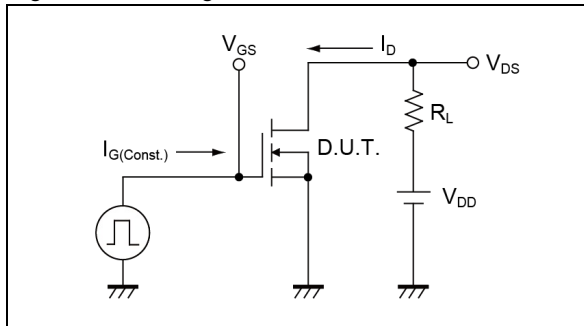


Fig.2-2 Gate Charge Waveform

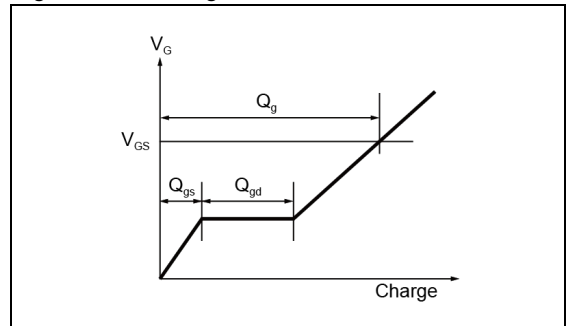


Fig.3-1 Avalanche Measurement Circuit

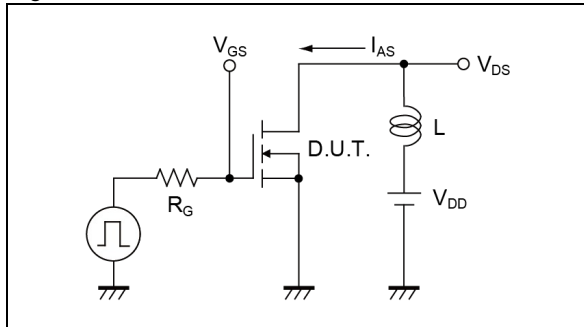


Fig.3-2 Avalanche Waveform

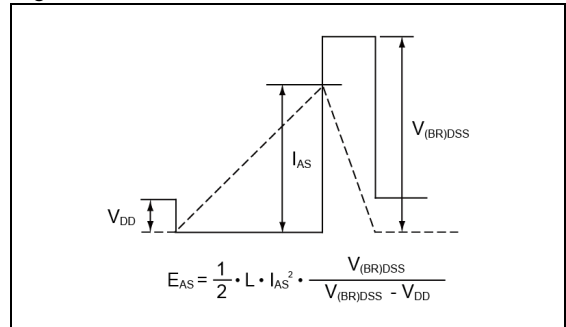


Fig.4-1 dv/dt Measurement Circuit

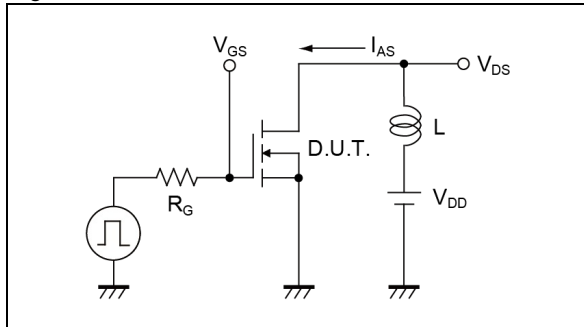


Fig.4-2 dv/dt Waveform

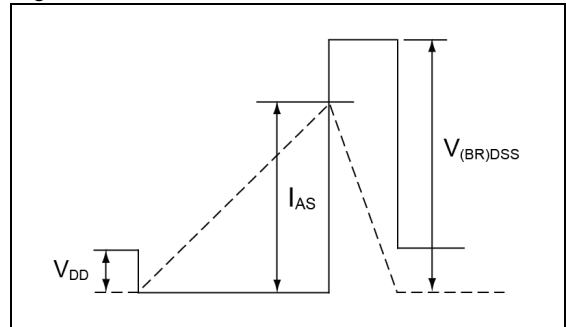


Fig.5-1 dv/dt Measurement Circuit

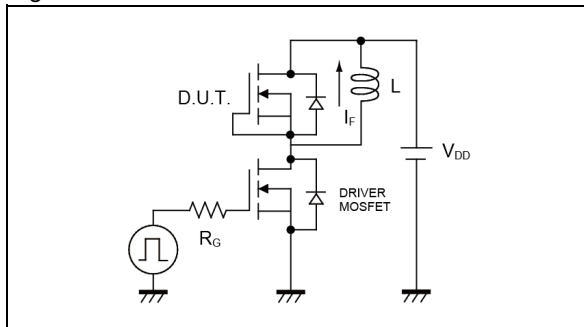
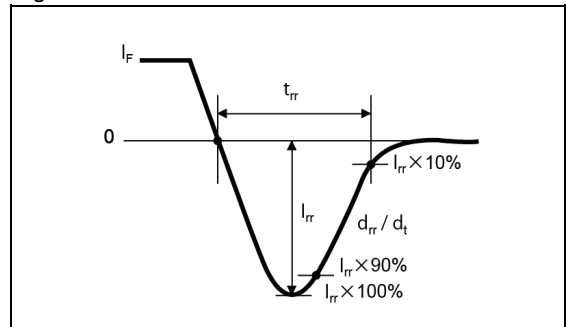
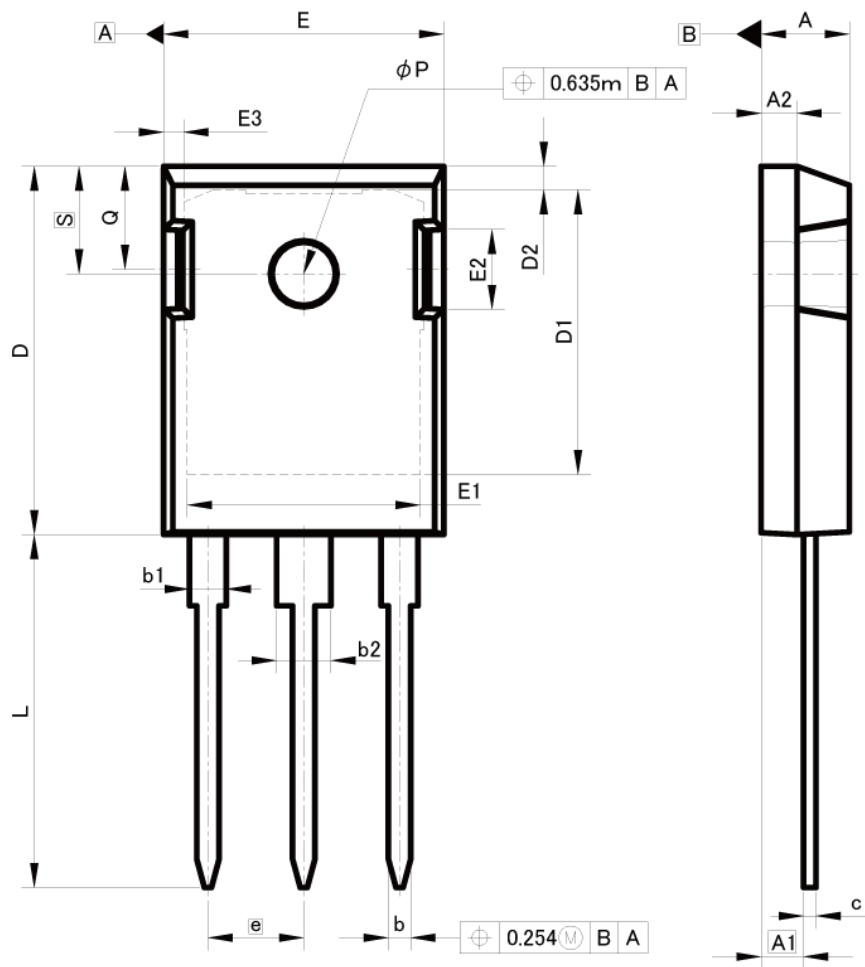


Fig.5-2 dv/dt Waveform



●Dimensions

TO-247



| DIM | MILIMETERS |       | INCHES |       |
|-----|------------|-------|--------|-------|
|     | MIN        | MAX   | MIN    | MAX   |
| A   | 4.83       | 5.21  | 0.19   | 0.205 |
| A1  | 2.29       | 2.54  | 0.09   | 0.1   |
| A2  | 1.91       | 2.16  | 0.075  | 0.085 |
| b   | 1.14       | 1.40  | 0.045  | 0.055 |
| b1  | 1.91       | 2.20  | 0.075  | 0.087 |
| b2  | 2.92       | 3.20  | 0.115  | 0.126 |
| c   | 0.61       | 0.80  | 0.024  | 0.031 |
| D   | 20.80      | 21.34 | 0.819  | 0.84  |
| D1  | 17.43      | 17.83 | 0.686  | 0.702 |
| E   | 15.75      | 16.13 | 0.62   | 0.635 |
| e   | 5.45       |       | 0.22   |       |
| N   | 3          |       | 3      |       |
| L   | 19.81      | 20.57 | 0.78   | 0.81  |
| L1  | 3.81       | 4.07  | 0.15   | 0.16  |
| ΦP  | 3.55       | 3.65  | 0.14   | 0.144 |
| Q   | 5.59       | 6.20  | 0.22   | 0.244 |
| S   | 6.15       |       | 0.24   |       |

Dimension in mm/inches

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## R6030KNZ1 - Web Page

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|                             |           |
|-----------------------------|-----------|
| Part Number                 | R6030KNZ1 |
| Package                     | TO-247    |
| Unit Quantity               | 450       |
| Minimum Package Quantity    | 450       |
| Packing Type                | Tube      |
| Constitution Materials List | inquiry   |
| RoHS                        | Yes       |