# R6030JNZ

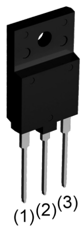
Nch 600V 30A Power MOSFET

Datasheet

| | |
|---|---|
| $V_{DSS}$ | 600V |
| $R_{DS(on)}$(Max.) | 0.143Ω |
| $I_D$ | ±30A |
| $P_D$ | 93W |

## ●Outline

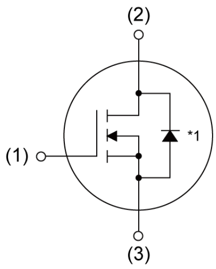
TO-3PF




## ●Features

1) Fast reverse recovery time (trr)
2) Low on-resistance
3) Fast switching speed
4) Drive circuits can be simple
5) Pb-free plating ; RoHS compliant

## ●Inner circuit




(1) Gate
(2) Drain
(3) Source

*1 Body Diode

## ●Application

Switching applications

## ●Packaging specifications

| | |
|---|---|
| Packing | Tube |
| Packing code | C17 |
| Marking | R6030JNZ |
| Quantity (pcs) | 300 |

## ●Absolute maximum ratings ($T_a$ = 25°C ,unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain - Source voltage | $V_{DSS}$ | 600 | V |
| Continuous drain current ($T_c$ = 25°C) | $I_D$ *1 | ±30 | A |
| Pulsed drain current | $I_{DP}$ *2 | ±90 | A |
| Gate - Source voltage | $V_{GSS}$ | ±30 | V |
| Avalanche current, single pulse | $I_{AS}$ *3 | 8.1 | A |
| Avalanche energy, single pulse | $E_{AS}$ *3 | 717 | mJ |
| Power dissipation ($T_c$ = 25°C) | $P_D$ | 93 | W |
| Junction temperature | $T_j$ | 150 | ℃ |
| Operating junction and storage temperature range | $T_{stg}$ | -55 to +150 | ℃ |

## ●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | - | 1.34 | °C/W |
| Thermal resistance, junction - ambient | $R_{thJA}$ | - | - | 40 | °C/W |
| Soldering temperature, wavesoldering for 10s | $T_{sold}$ | - | - | 265 | °C |

## ●Electrical characteristics ($T_a$ = 25°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°C | - | - | 100 | μA |
| Gate - Source leakage current | $I_{GSS}$ | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 5.5mA | 5.0 | 6.0 | 7.0 | V |
| Static drain - source on - state resistance | $R_{DS(on)}$ *5 | $V_{GS}$ = 15V, $I_D$ = 15A<br>$T_j$ = 25°C | - | 0.110 | 0.143 | Ω |
| Gate resistance | $R_G$ | f = 1MHz, open drain | - | 1.1 | - | Ω |

## ●Electrical characteristics ($T_a$ = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V | - | 2500 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{DS}$ = 100V | - | 140 | - | |
| Reverse transfer capacitance | $C_{rss}$ | f = 1MHz | - | 2.2 | - | |
| Effective output capacitance energy related | $C_{o(er)}$ *6 | $V_{GS}$ = 0V | - | 105 | - | |
| Effective output capacitance time related | $C_{o(tr)}$ *7 | $V_{DS}$ = 0V to 480V | - | 420 | - | |
| Turn - on delay time | $t_{d(on)}$ *5 | $V_{DD}$ ≃ 300V, $V_{GS}$ = 15V | - | 37 | - | ns |
| Rise time | $t_r$ *5 | $I_D$ = 15A | - | 26 | - | |
| Turn - off delay time | $t_{d(off)}$ *5 | $R_L$ ≃ 20.0Ω | - | 70 | - | |
| Fall time | $t_f$ *5 | $R_G$ = 10Ω | - | 25 | - | |

## ●Gate charge characteristics ($T_a$ = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Total gate charge | $Q_g$ *5 | $V_{DD}$ ≃ 300V | - | 74 | - | nC |
| Gate - Source charge | $Q_{gs}$ *5 | $I_D$ = 30A | - | 23.5 | - | |
| Gate - Drain charge | $Q_{gd}$ *5 | $V_{GS}$ = 15V | - | 26.5 | - | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD}$ ≃ 300V, $I_D$ = 30A | - | 9.3 | - | V |

*1 Limited only by maximum temperature allowed.

*2 Pw ≤ 10μs, Duty cycle ≤ 1%

*3 L ≃ 50mH, $V_{DD}$ = 50V, $R_G$ = 25Ω, starting $T_j$ = 25°C

*4 Tc=25°C

*5 Pulsed

*6 Co(er) is a fixed capacitance that gives the same stored energy as Coss while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

*7 Co(tr) is a fixed capacitance that gives the same charging time as Coss while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

● **Body diode electrical characteristics** (Source-Drain) ($T_a$ = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Source current | $I_S$ *1 | $T_C$ = 25°C | - | - | 30 | A |
| Pulsed source current | $I_{SP}$ *2 | | - | - | 90 | A |
| Source-Drain voltage | $V_{SD}$ *5 | $V_{GS}$ = 0V, $I_S$ = 30A | - | - | 1.7 | V |
| Reverse recovery time | $t_{rr}$ *5 | $I_S$ = 30A<br>di/dt = 100A/μs | - | 100 | - | ns |
| Reverse recovery charge | $Q_{rr}$ *5 | | - | 390 | - | nC |
| Peak reverse recovery current | $I_{rr}$ *5 | | - | 8.2 | - | A |

## ●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

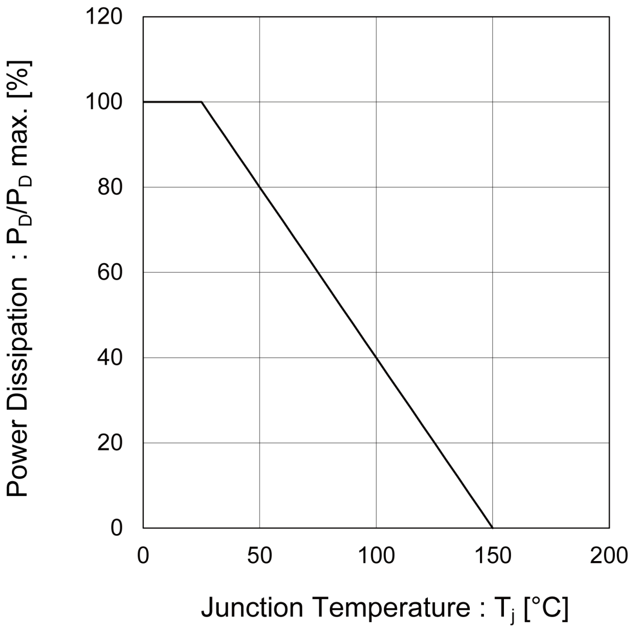



Fig.2 Drain Current Derating Curve vs. Junction Temperature

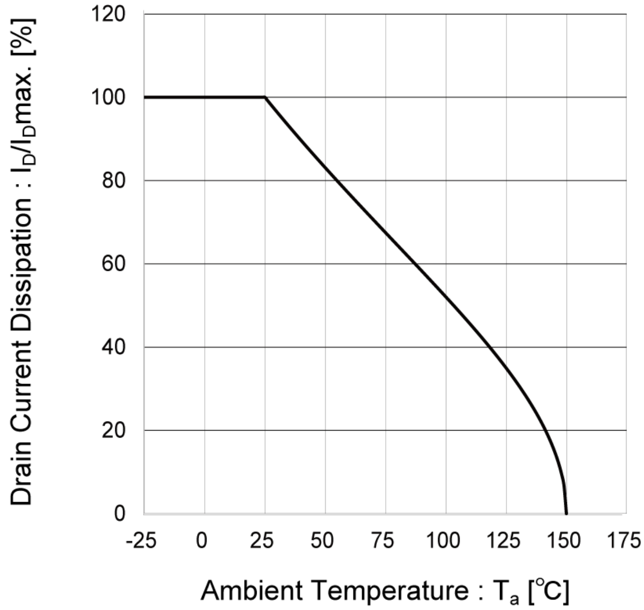



Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

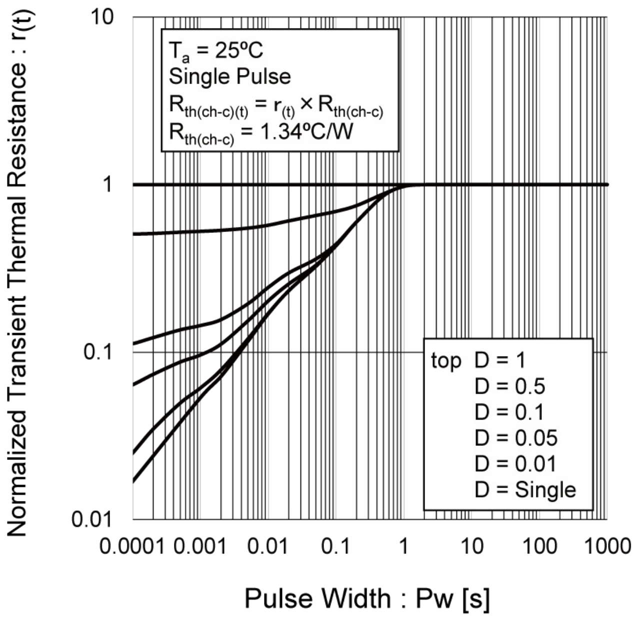
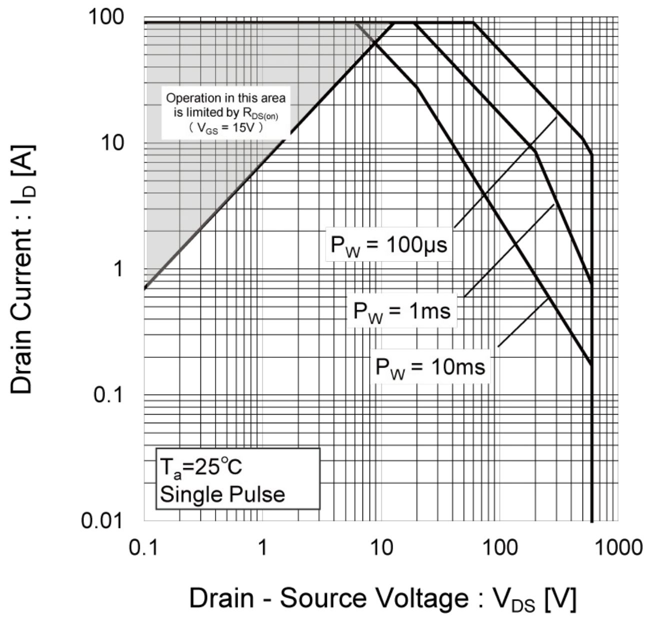



Fig.4 Maximum Safe Operating Area



## ●Electrical characteristic curves

Fig.5 Avalanche Energy Derating Curve vs. Junction Temperature

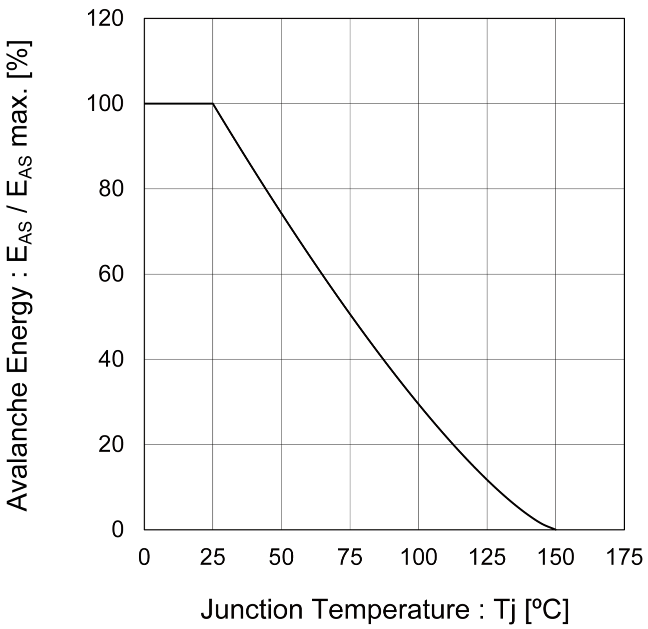



Fig.6 Normalized Breakdown Voltage vs. Junction Temperature

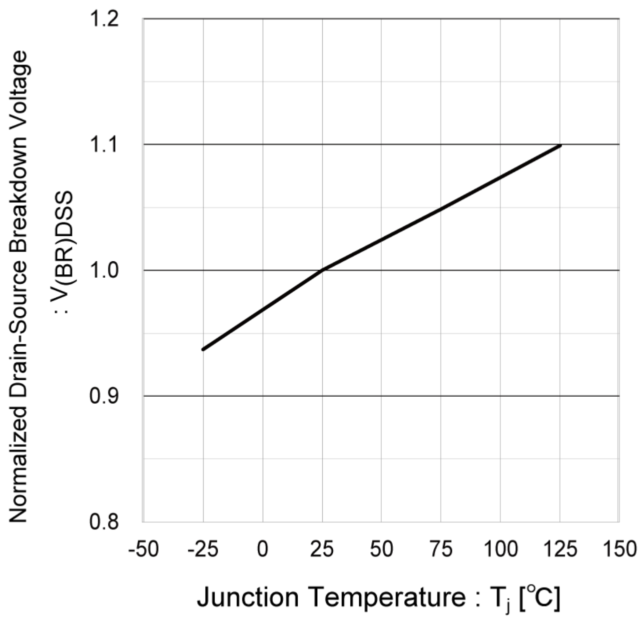



Fig.7 Typical Output Characteristics(I)

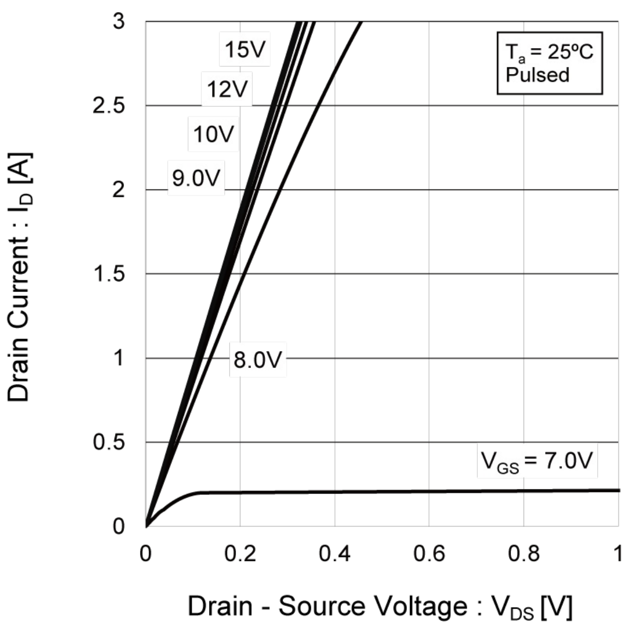
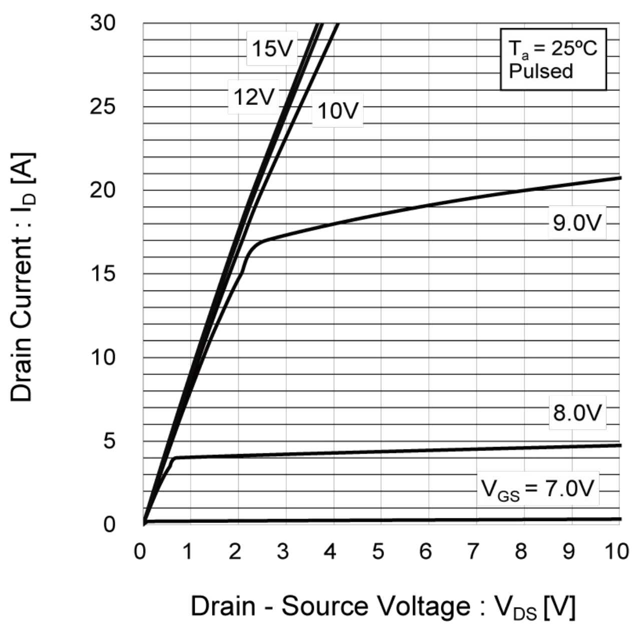



Fig.8 Typical Output Characteristics(II)



●**Electrical characteristic curves**

Fig.9 Typical Transfer Characteristics

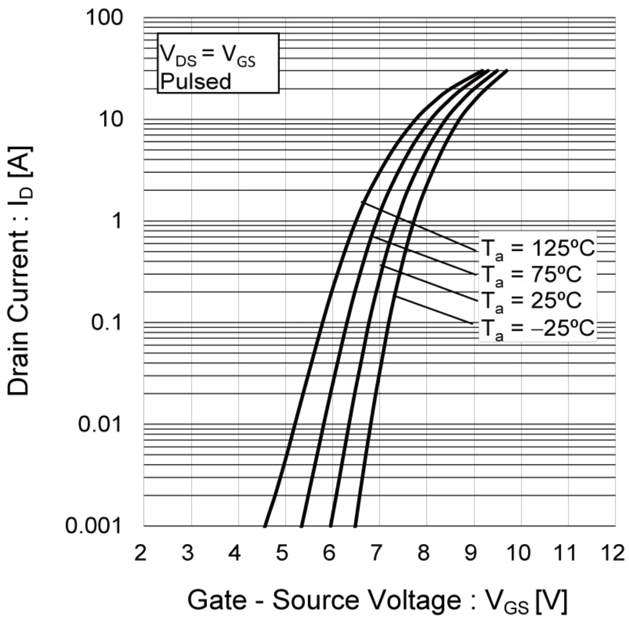



Fig.10 Normalized Gate Threshold . Voltage vs Junction Temperature

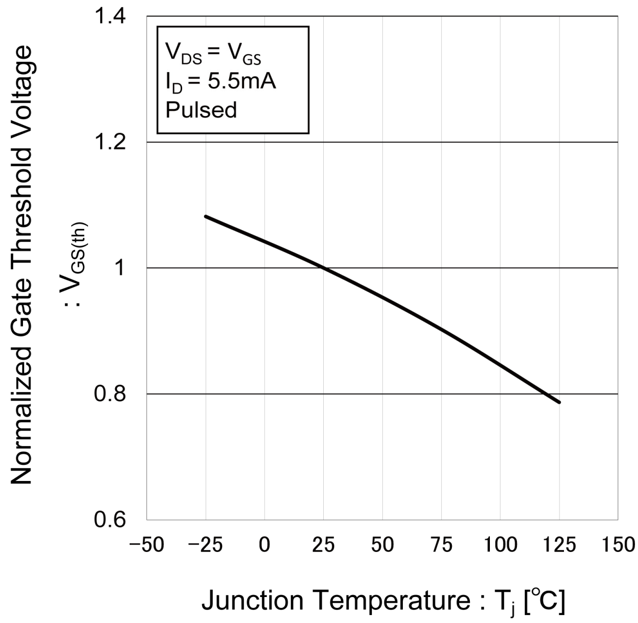



Fig.11 Static Drain - Source On - State Resistance vs. Gate Source Voltage

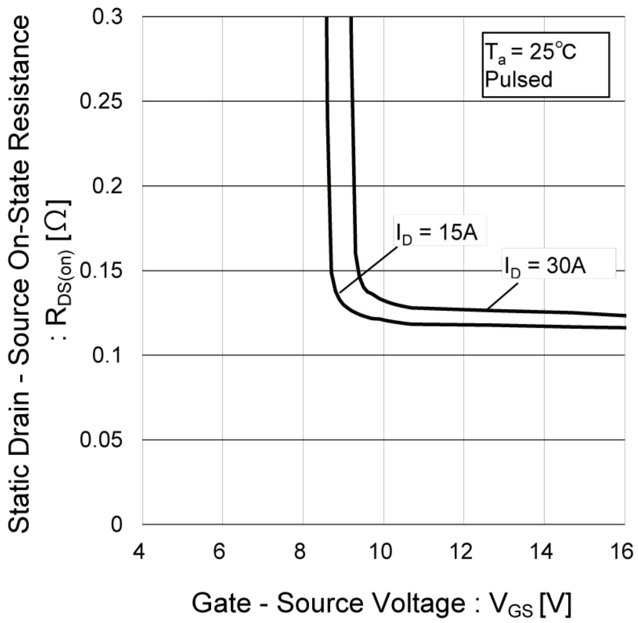
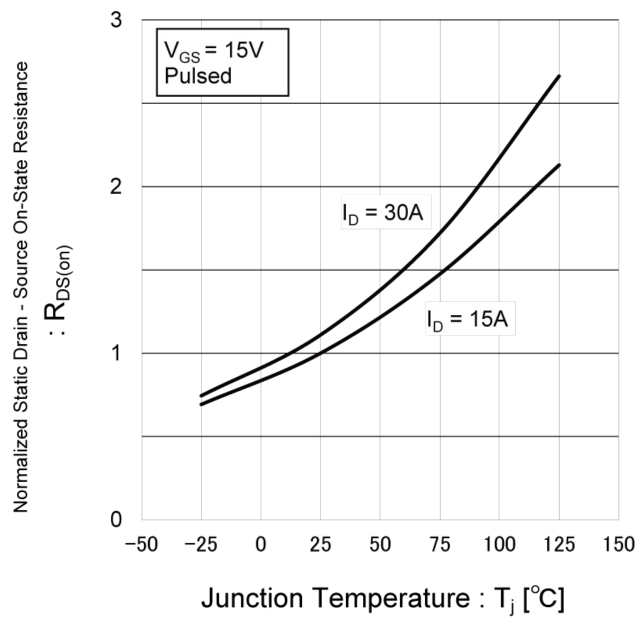



Fig.12 Normalized Static Drain - Source On - State Resistance vs. Junction Temperature



## ●Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Drain Current(I)

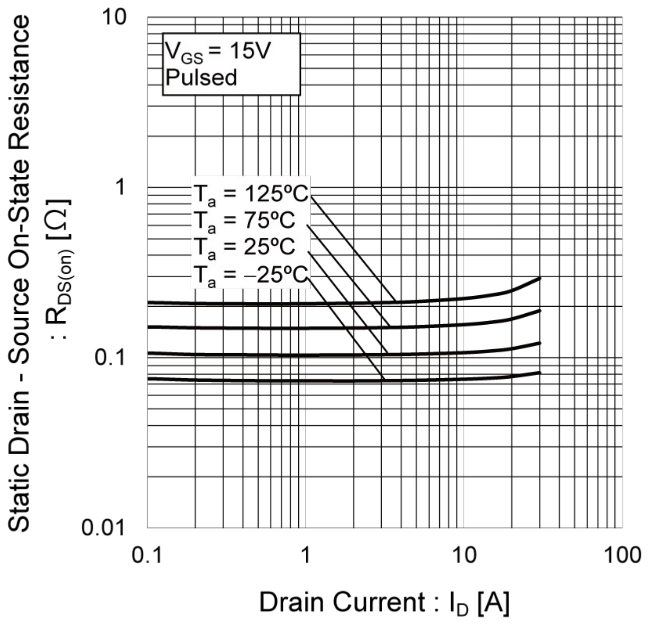



Fig.14 Typical Capacitance vs. Drain - Source Voltage

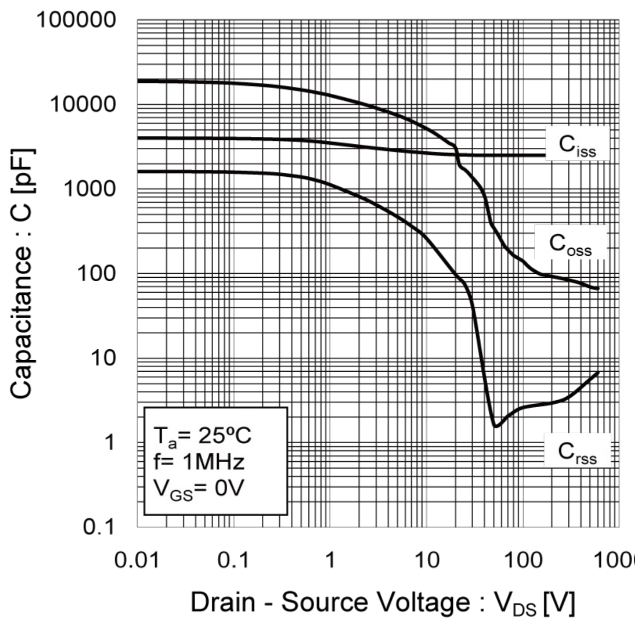



Fig.15 Typical Coss Stored Energy

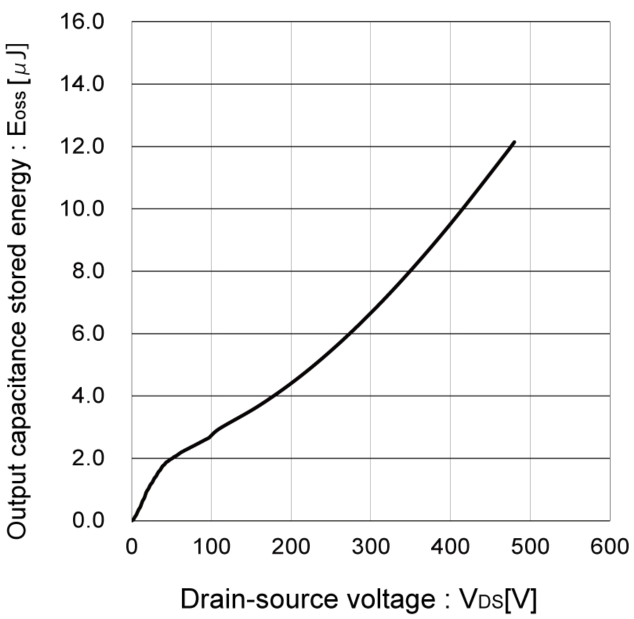
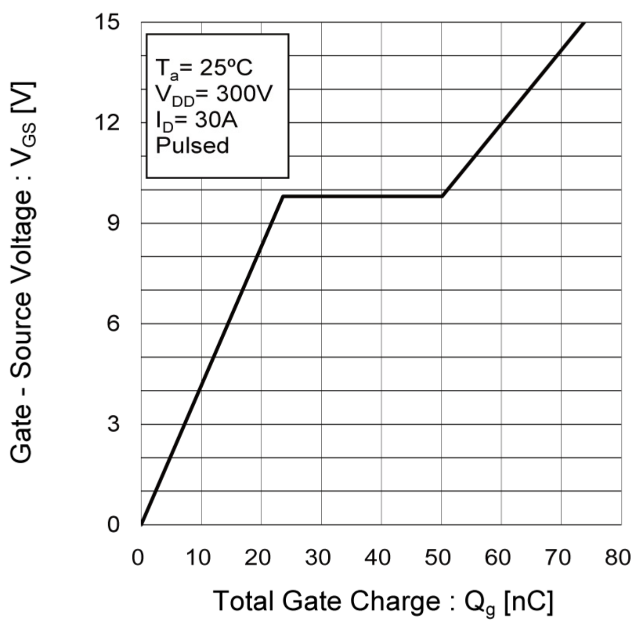



Fig.16 Dynamic Input Characteristics



## ●Electrical characteristic curves

Fig.17 Inverse Diode Forward Current vs. Source - Drain Voltage

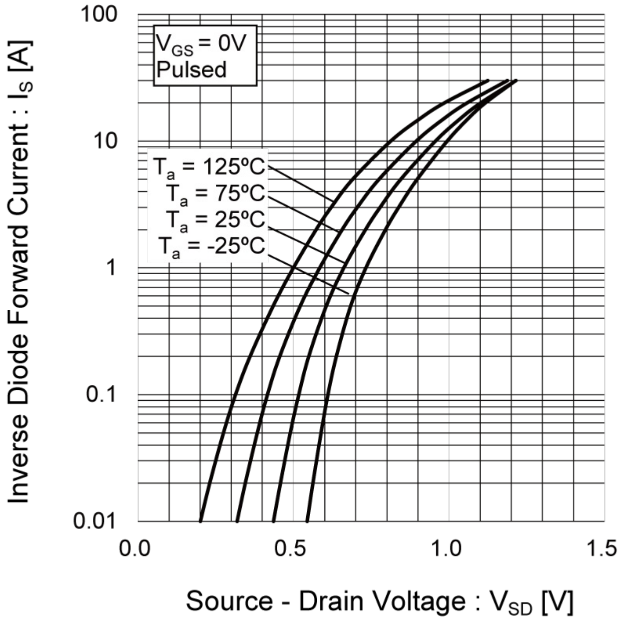
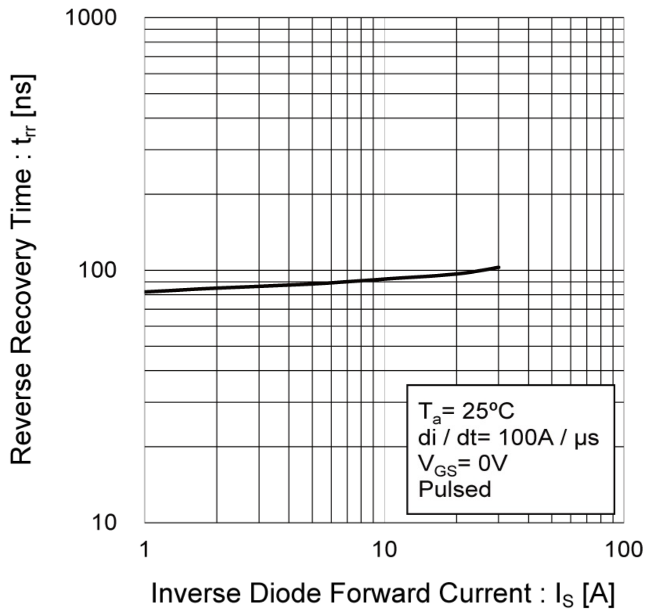



Fig.18 Reverse Recovery Time vs. Inverse Diode Forward Current



## ●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

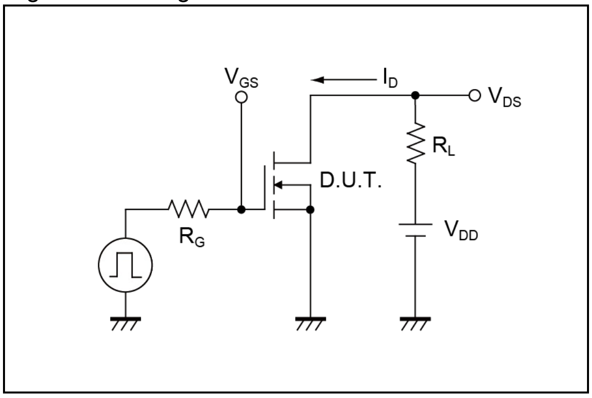



Fig.1-2 Switching Waveforms

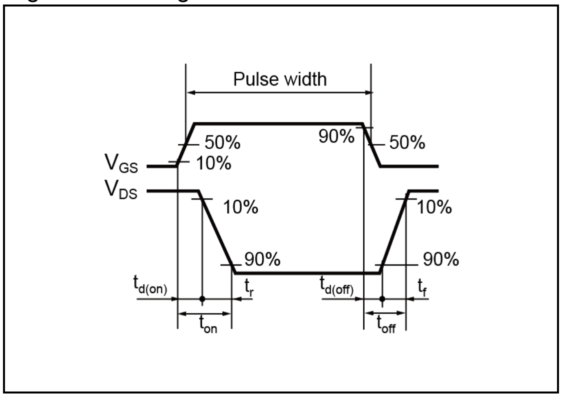



Fig.2-1 Gate Charge Measurement Circuit

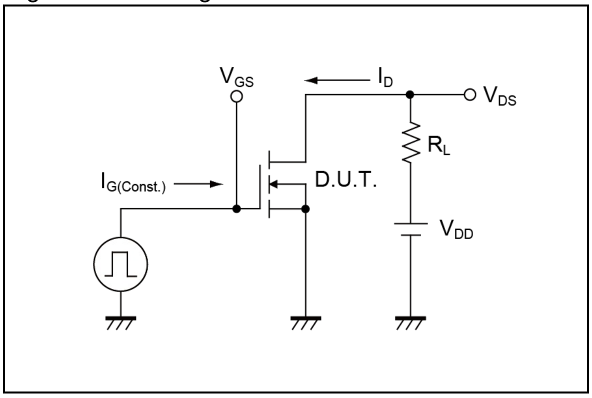



Fig.2-2 Gate Charge Waveform

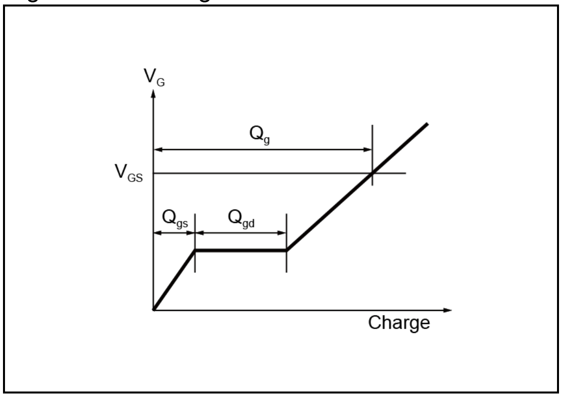



Fig.3-1 Avalanche Measurement Circuit

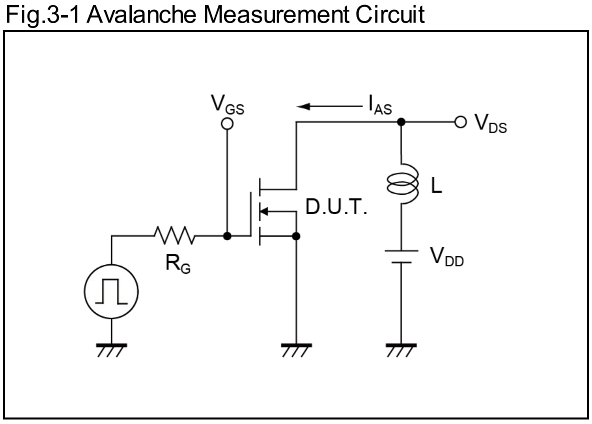
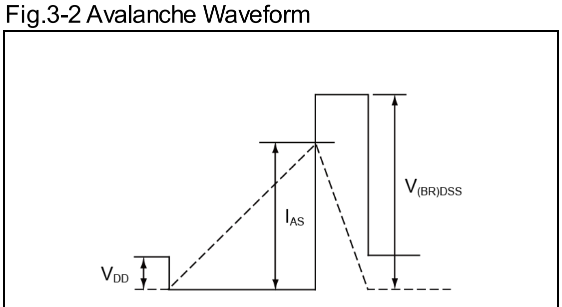



Fig.3-2 Avalanche Waveform




$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AS}^{2} \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

Fig.4-1 Diode Recovery Measurement Circuit

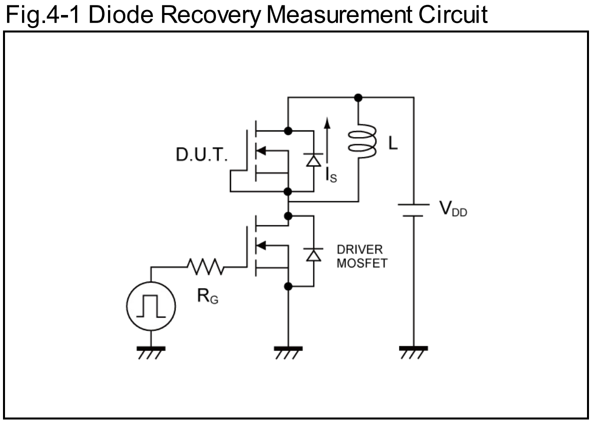
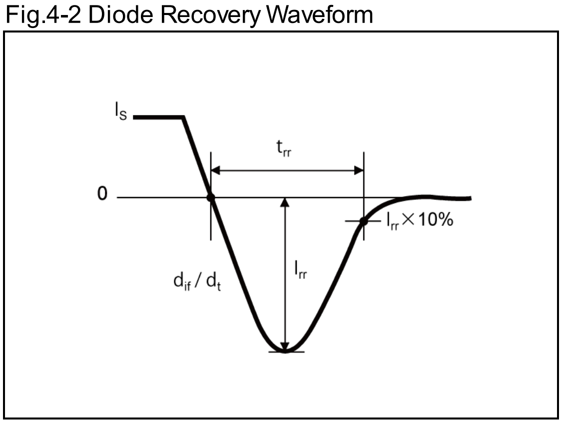
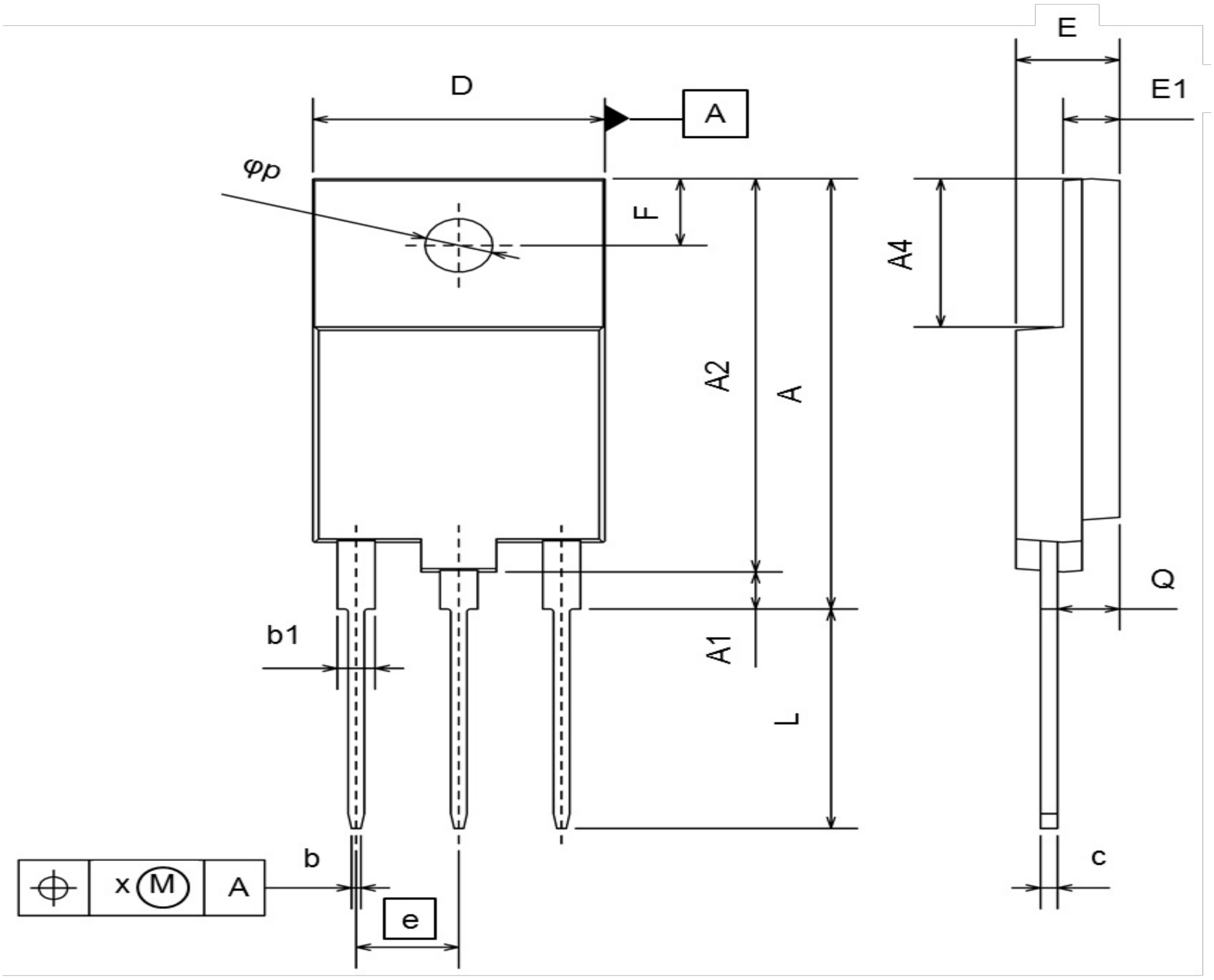



Fig.4-2 Diode Recovery Waveform



● Dimensions




| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 28.60 | 29.40 | 1.126 | 1.157 |
| A1 | 2.30 | 2.70 | 0.091 | 0.106 |
| A2 | 26.30 | 26.70 | 1.035 | 1.051 |
| A4 | 9.80 | 10.20 | 0.386 | 0.402 |
| b | 0.66 | 0.95 | 0.026 | 0.037 |
| b1 | 1.80 | 2.20 | 0.071 | 0.087 |
| c | 0.80 | 1.00 | 0.031 | 0.039 |
| D | 15.30 | 15.70 | 0.602 | 0.618 |
| E | 5.30 | 5.70 | 0.209 | 0.224 |
| E1 | 2.80 | 3.20 | 0.110 | 0.126 |
| e | 5.45 | | 0.215 | |
| F | 4.35 | 4.65 | 0.171 | 0.183 |
| L | 14.60 | 15.00 | 0.575 | 0.591 |
| φp | 3.40 | 3.80 | 0.134 | 0.150 |
| Q | 3.10 | 3.50 | 0.122 | 0.138 |
| x | - | 0.50 | - | 0.020 |

Dimension in mm / inches

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| JAPAN | USA | EU | CHINA |
|---|---|---|---|
| CLASSⅢ | CLASSⅢ | CLASSⅡb | CLASSⅢ |
| CLASSⅣ | | CLASSⅢ | |

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   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including $Cl_2$, $H_2S$, $NH_3$, $SO_2$, and $NO_2$
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.) ; or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

## Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

### Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

### Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including $Cl_2$, $H_2S$, $NH_3$, $SO_2$, and $NO_2$
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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