

| | |
|---------------------|-------|
| V_{DSS} | 1200V |
| $R_{DS(on)}$ (Typ.) | 280mΩ |
| I_D | 14A |
| P_D | 108W |

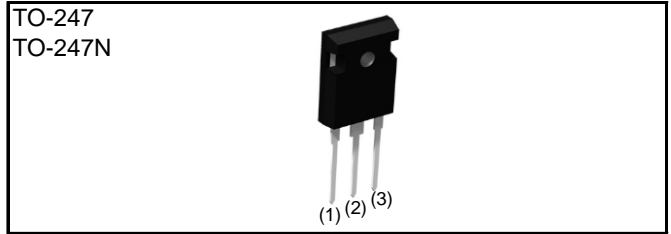
●Features

- 1) Low on-resistance
- 2) Fast switching speed
- 3) Fast reverse recovery
- 4) Easy to parallel
- 5) Simple to drive
- 6) Pb-free lead plating ; RoHS compliant

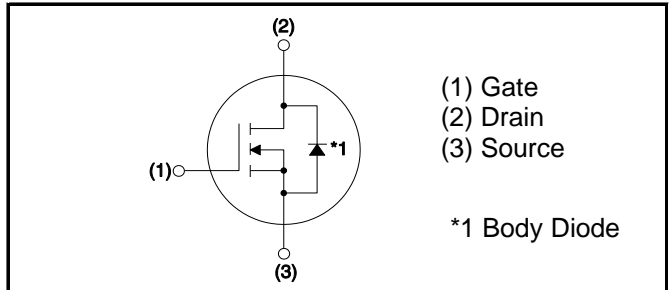
●Application

- Solar inverters
- DC/DC converters
- Induction heating
- Motor drives

●Outline



●Inner circuit



●Packaging specifications^{*1}

| Package | | TO-247 | TO-247N |
|---------|---------------------------|-----------|---------|
| Type | Packing | Tube | |
| | Reel size (mm) | - | |
| | Tape width (mm) | - | |
| | Basic ordering unit (pcs) | 30 | |
| | Packing code | C | C11 |
| | Marking | SCT2280KE | |

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

| Parameter | Symbol | Value | Unit |
|--|---------------------------|---------------|------------------|
| Drain - Source voltage | V_{DSS} | 1200 | V |
| Continuous drain current | $T_c = 25^\circ\text{C}$ | I_D^{*2} 14 | A |
| | $T_c = 100^\circ\text{C}$ | I_D^{*2} 10 | A |
| Pulsed drain current | $I_{D,pulse}^{*3}$ | 35 | A |
| Gate - Source voltage (DC) | V_{GSS} | -6 to 22 | V |
| Gate - Source surge voltage ($T_{surge} < 300\text{nsec}$) | $V_{GSS-surge}^{*4}$ | -10 to 26 | V |
| Power dissipation ($T_c = 25^\circ\text{C}$) | P_D | 108 | W |
| Junction temperature | T_j | 175 | $^\circ\text{C}$ |
| Range of storage temperature | T_{stg} | -55 to +175 | $^\circ\text{C}$ |

●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 | 1200 | - | - | V |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = 1200V, V _{GS} = 0V T _j = 25°C | - | 1 | 10 | μA |
| | | | - | 2 | - | |
| Gate - Source leakage current | I _{GSS+} | V _{GS} = +22V, V _{DS} = 0V | - | - | 100 | nA |
| Gate - Source leakage current | I _{GSS-} | V _{GS} = -6V, V _{DS} = 0V | - | - | -100 | nA |
| Gate threshold voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 1.4mA | 1.6 | 2.8 | 4.0 | V |

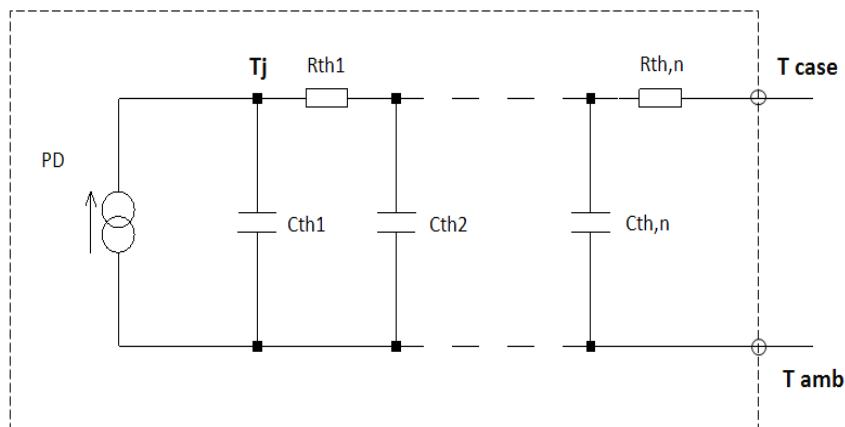
●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|--|-------------------|--------|------|------|------|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | R _{thJC} | - | 1.07 | 1.39 | °C/W |
| Thermal resistance, junction - ambient | R _{thJA} | - | - | 50 | °C/W |
| Soldering temperature, wavesoldering for 10s | T _{sold} | - | - | 265 | °C |

●Typical Transient Thermal Characteristics

| Symbol | Value | Unit |
|------------------|----------|------|
| R _{th1} | 1.00E-01 | K/W |
| R _{th2} | 6.62E-01 | |
| R _{th3} | 3.04E-01 | |

| Symbol | Value | Unit |
|------------------|----------|------|
| C _{th1} | 8.61E-04 | Ws/K |
| C _{th2} | 2.84E-03 | |
| C _{th3} | 5.59E-02 | |



●Electrical characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|--|-----------------------------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Static drain - source on - state resistance | R _{DS(on)} ^{*5} | V _{GS} = 18V, I _D = 4A | - | 280 | 364 | mΩ |
| | | T _j = 25°C | - | 388 | - | |
| | | T _j = 125°C | - | | | |
| Gate input resistance | R _G | f = 1MHz, open drain | - | 17 | - | Ω |
| Transconductance | g _{fs} ^{*5} | V _{DS} = 10V, I _D = 4A | - | 1.4 | - | S |
| Input capacitance | C _{iss} | V _{GS} = 0V | - | 667 | - | pF |
| Output capacitance | C _{oss} | V _{DS} = 800V | - | 27 | - | |
| Reverse transfer capacitance | C _{rss} | f = 1MHz | - | 5 | - | |
| Effective output capacitance, energy related | C _{o(er)} | V _{GS} = 0V V _{DS} = 0V to 500V | - | 41 | - | pF |
| Turn - on delay time | t _{d(on)} ^{*5} | V _{DD} = 400V, V _{GS} = 18V | - | 19 | - | ns |
| Rise time | t _r ^{*5} | I _D = 4A | - | 19 | - | |
| Turn - off delay time | t _{d(off)} ^{*5} | R _L = 100Ω | - | 47 | - | |
| Fall time | t _f ^{*5} | R _G = 0Ω | - | 29 | - | |
| Turn - on switching loss | E _{on} ^{*5} | V _{DD} = 600V, I _D = 4A V _{GS} = 18V/0V | - | 57 | - | μJ |
| Turn - off switching loss | E _{off} ^{*5} | R _G = 0Ω, L = 500μH *E _{on} includes diode reverse recovery | - | 20 | - | |

●Gate Charge characteristics (T_a = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|----------------------|-------------------------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Total gate charge | Q _g ^{*5} | V _{DD} = 400V | - | 36 | - | nC |
| Gate - Source charge | Q _{gs} ^{*5} | I _D = 4A | - | 9 | - | |
| Gate - Drain charge | Q _{gd} ^{*5} | V _{GS} = 18V | - | 12 | - | |
| Gate plateau voltage | V _(plateau) | V _{DD} = 400V, I _D = 4A | - | 9.8 | - | V |

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

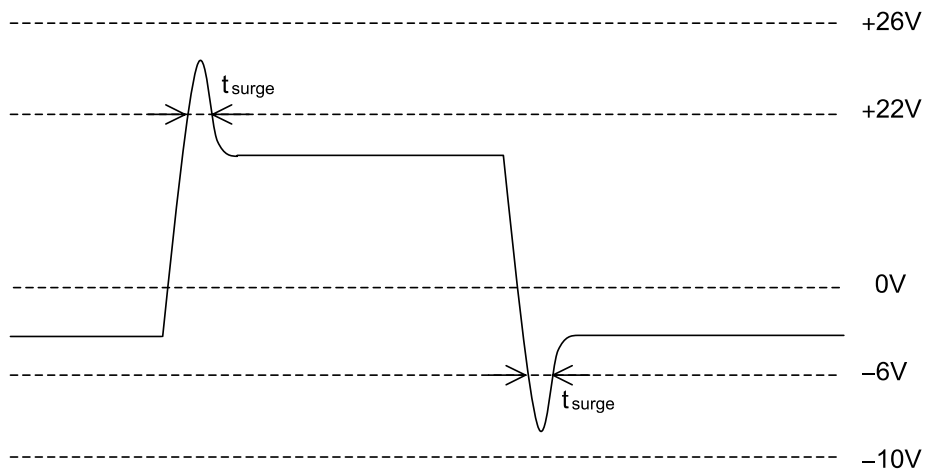
| Parameter | Symbol | Conditions | Values | | | Unit |
|---|----------------|---|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Inverse diode continuous, forward current | I_S^{*2} | $T_c = 25^\circ\text{C}$ | - | - | 14 | A |
| Inverse diode direct current, pulsed | I_{SM}^{*3} | | - | - | 35 | A |
| Forward voltage | V_{SD}^{*5} | $V_{GS} = 0\text{V}, I_S = 4\text{A}$ | - | 4.0 | - | V |
| Reverse recovery time | t_{rr}^{*5} | $I_F = 4\text{A}, V_R = 400\text{V}$ $di/dt = 160\text{A}/\mu\text{s}$ | - | 22 | - | ns |
| Reverse recovery charge | Q_{rr}^{*5} | | - | 21 | - | nC |
| Peak reverse recovery current | I_{rrm}^{*5} | | - | 2.0 | - | A |

*1 Tolerances of dimensions and packing specifications slightly differ between TO-247 and TO-247N, which is unlikely to influence compatibility for mounting. Please refer to corresponding specifications of dimensions for more details.

*2 Limited only by maximum temperature allowed.

*3 $PW \leq 10\mu\text{s}$, Duty cycle $\leq 1\%$

*4 Example of acceptable V_{gs} waveform



*4 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

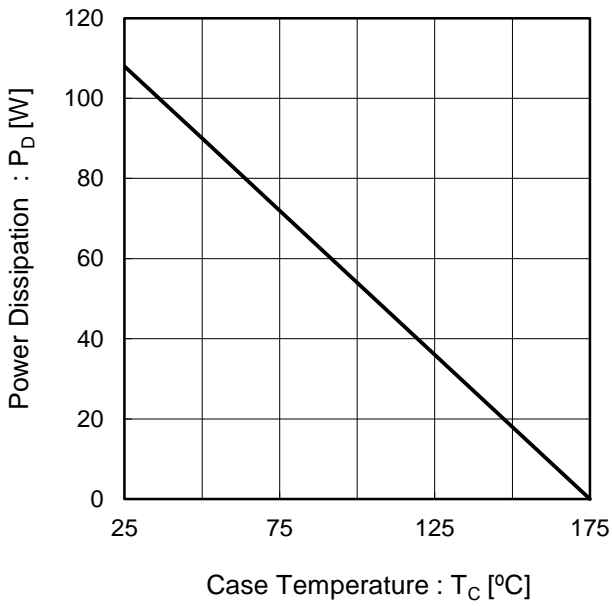


Fig.2 Maximum Safe Operating Area

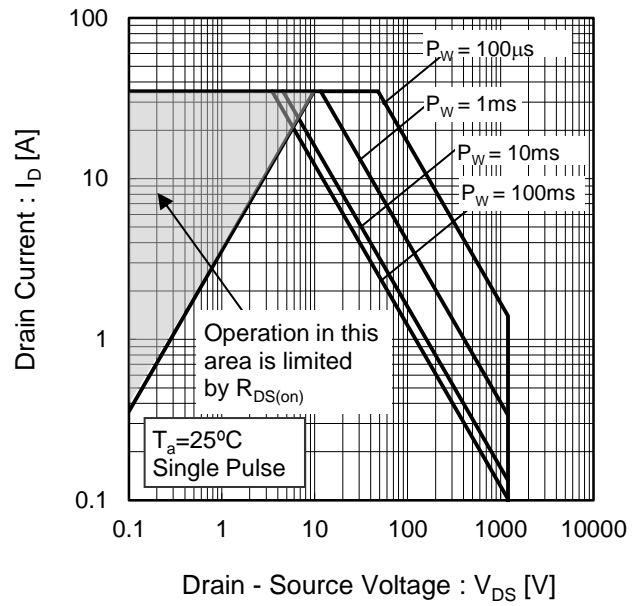
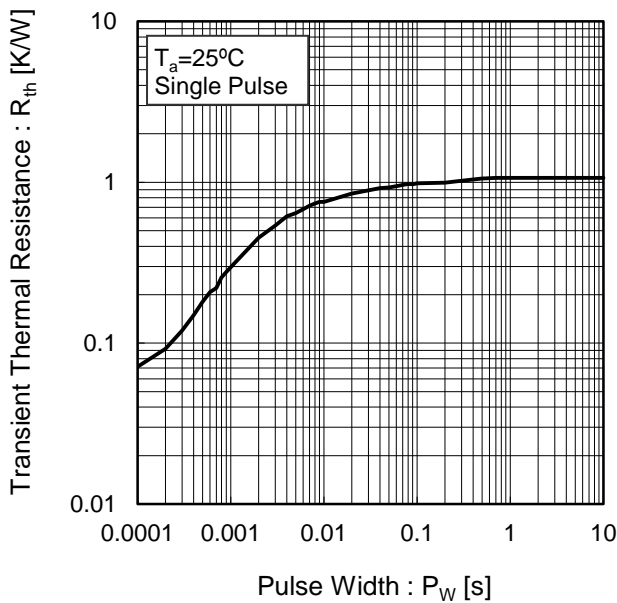


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

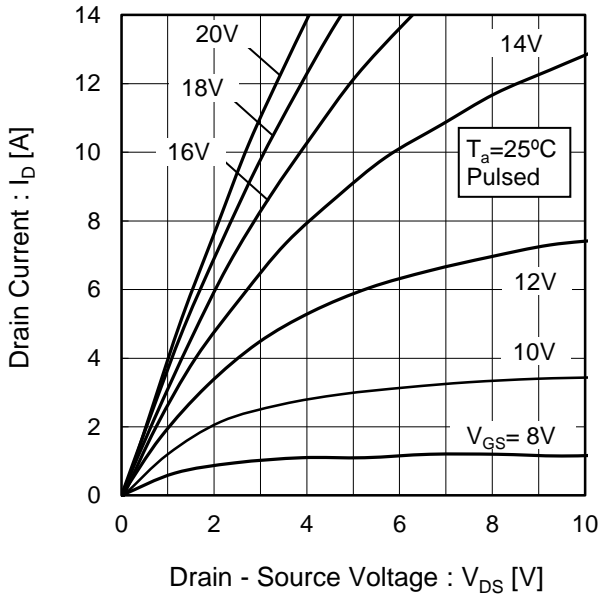


Fig.5 Typical Output Characteristics(II)

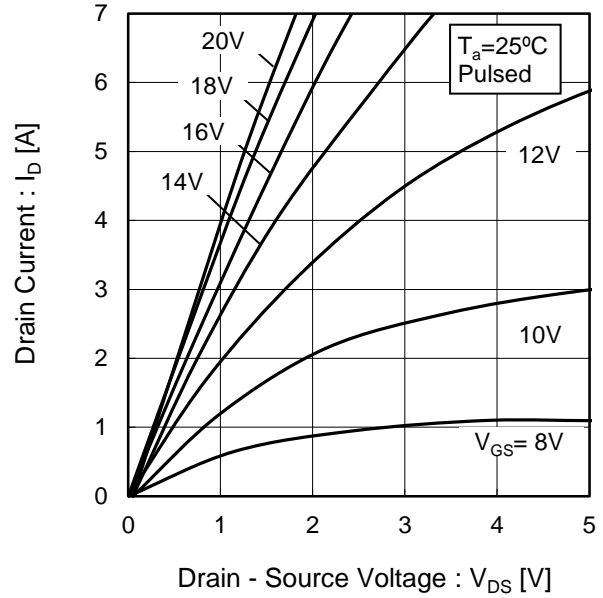


Fig.6 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(I)

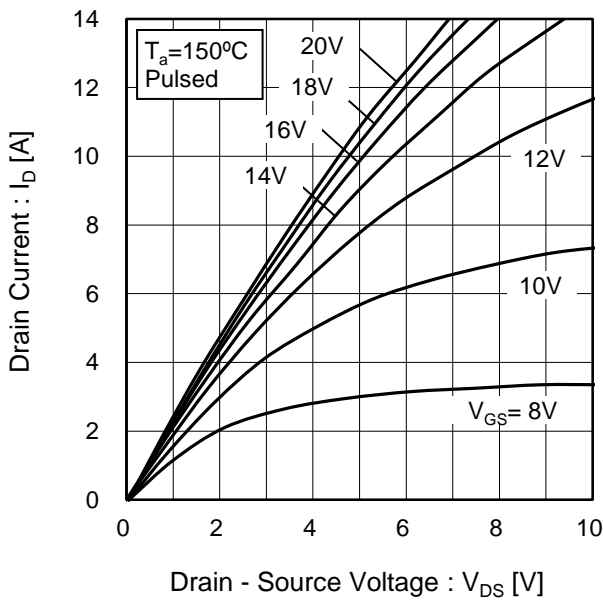
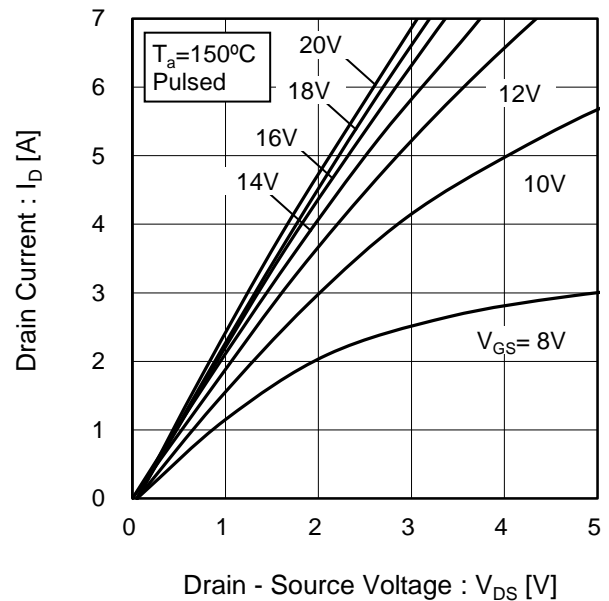


Fig.7 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics (I)

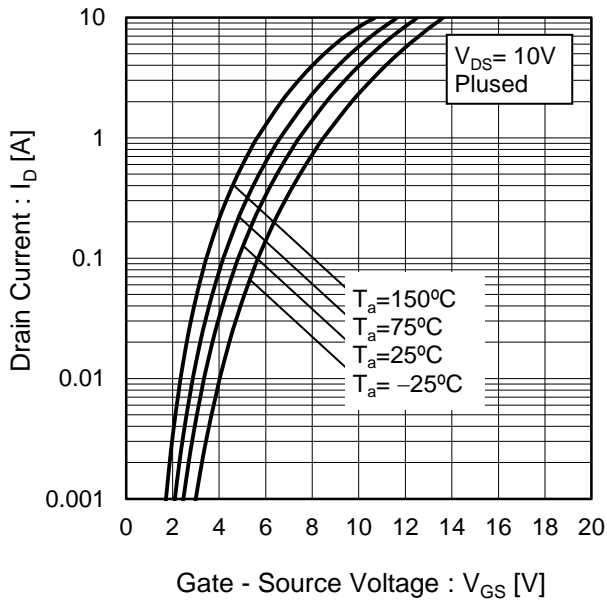


Fig.9 Typical Transfer Characteristics (II)

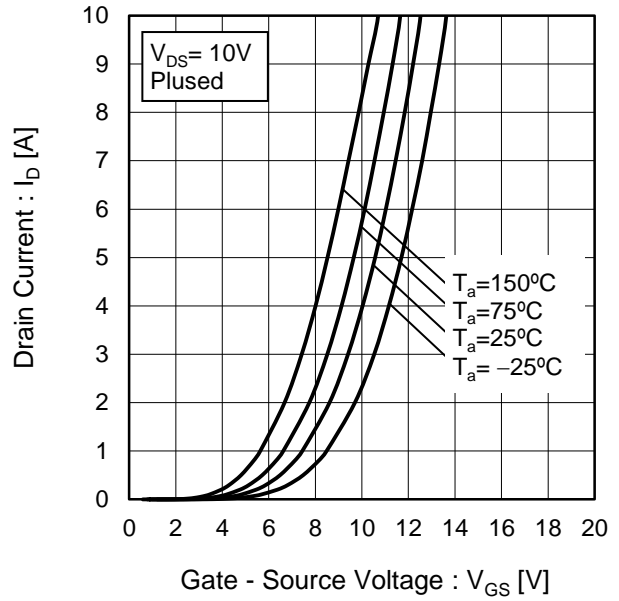


Fig.10 Gate Threshold Voltage vs. Junction Temperature

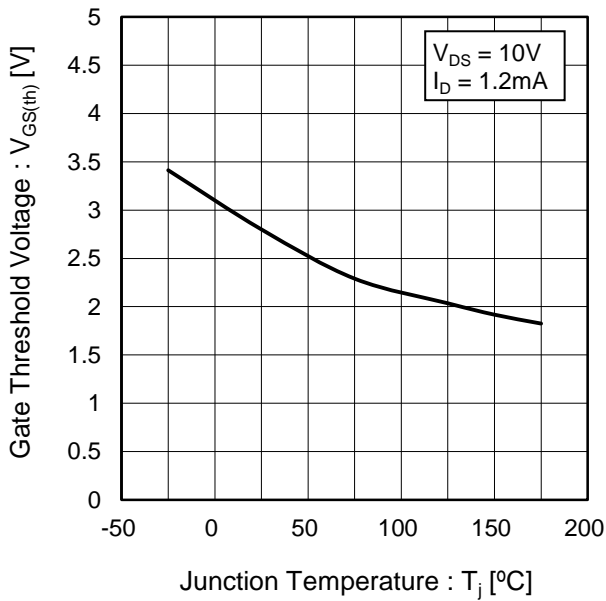
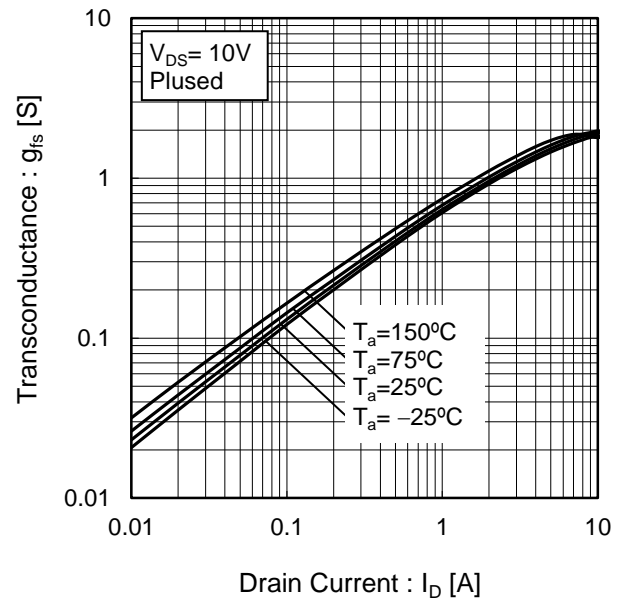


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

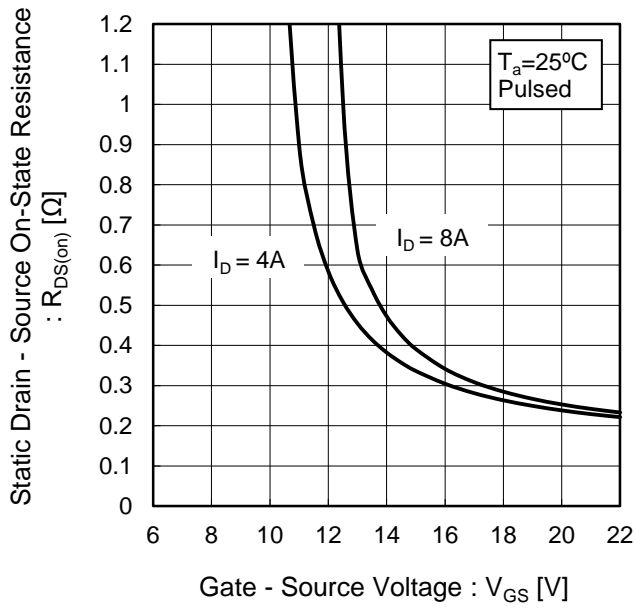


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

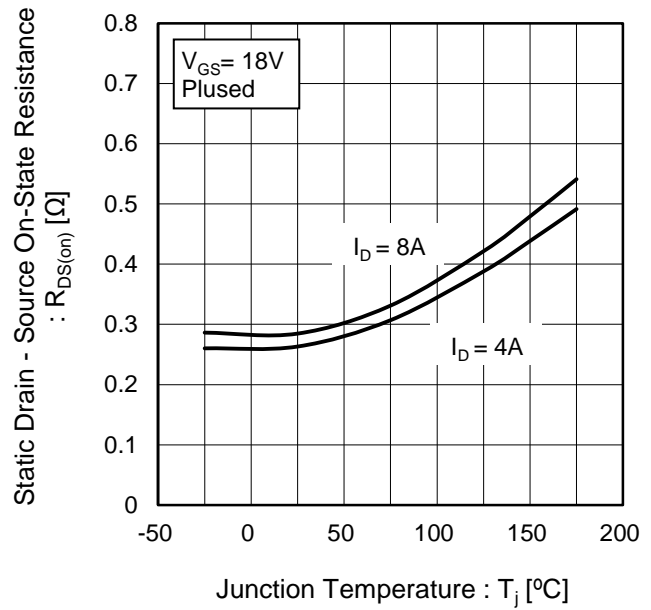
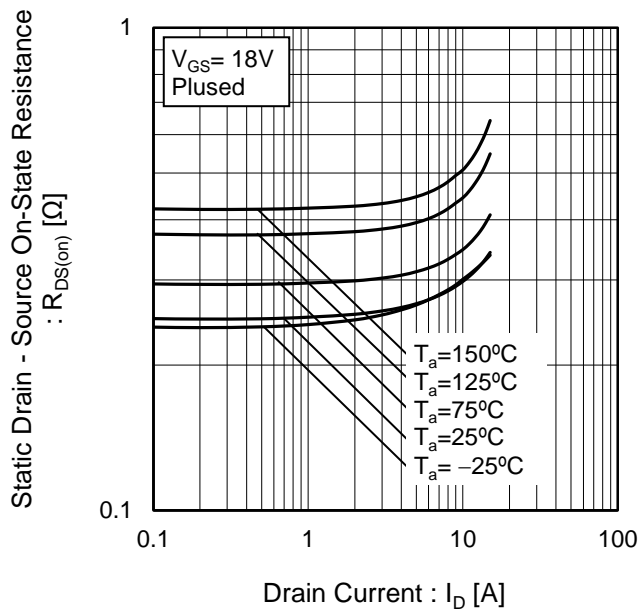


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.15 Typical Capacitance vs. Drain - Source Voltage

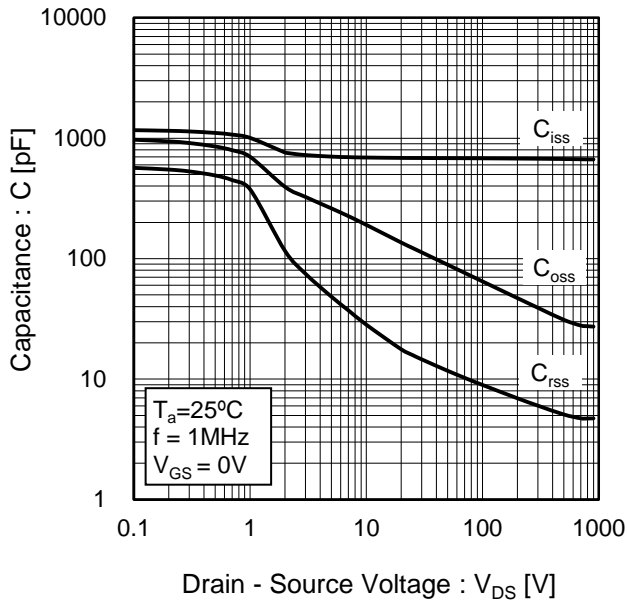


Fig.16 C_{OSS} Stored Energy

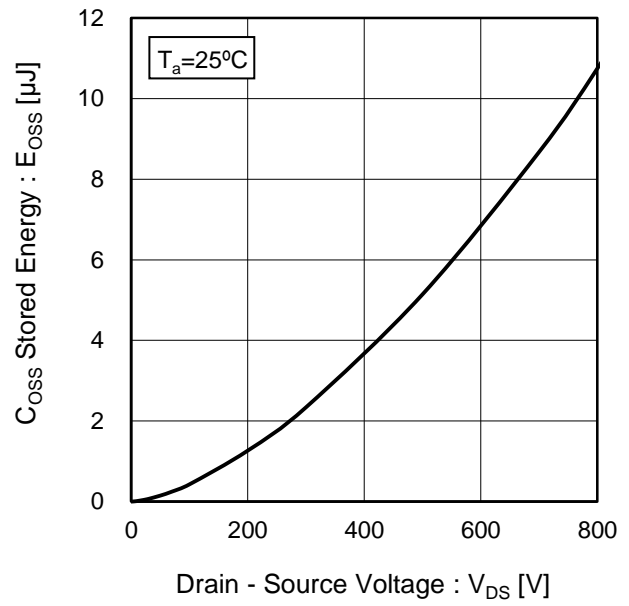


Fig.17 Switching Characteristics

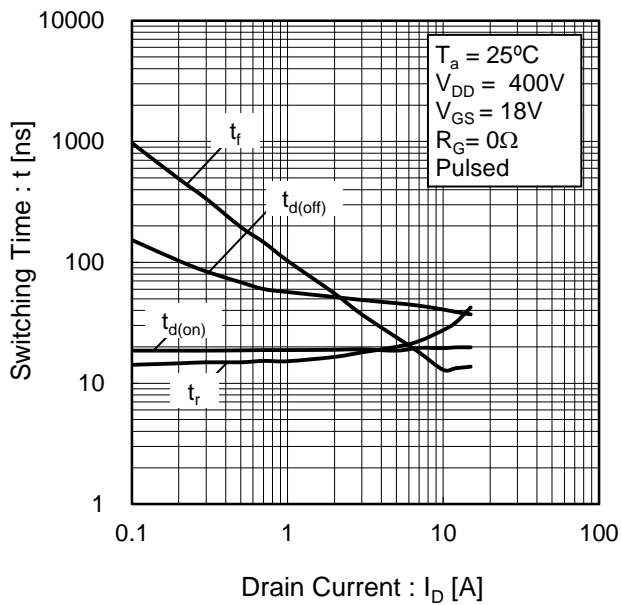
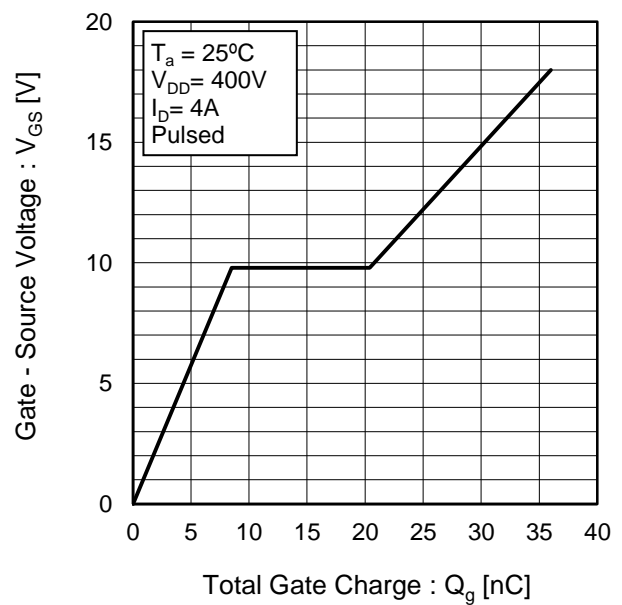


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.19 Typical Switching Loss vs. Drain - Source Voltage

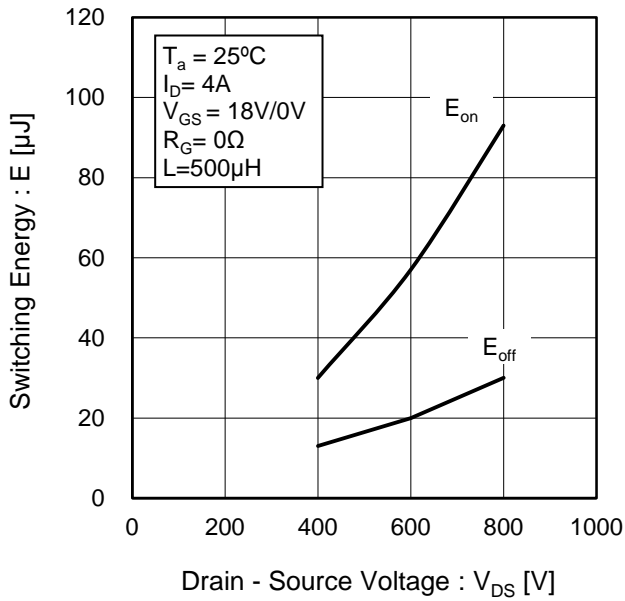


Fig.20 Typical Switching Loss vs. Drain Current

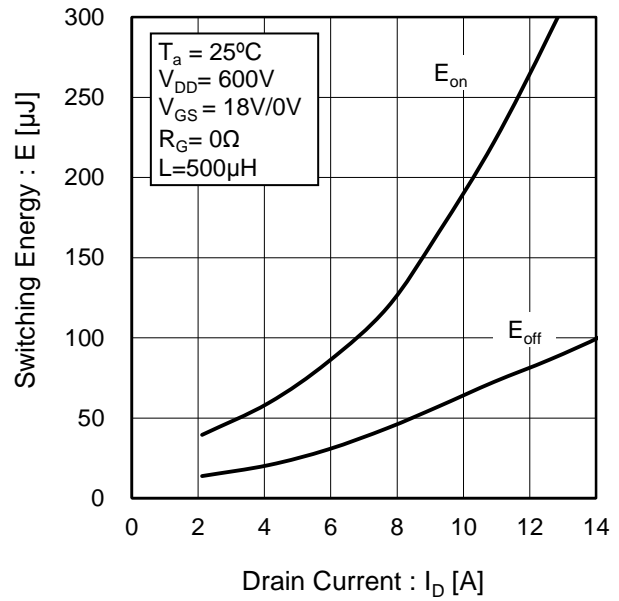
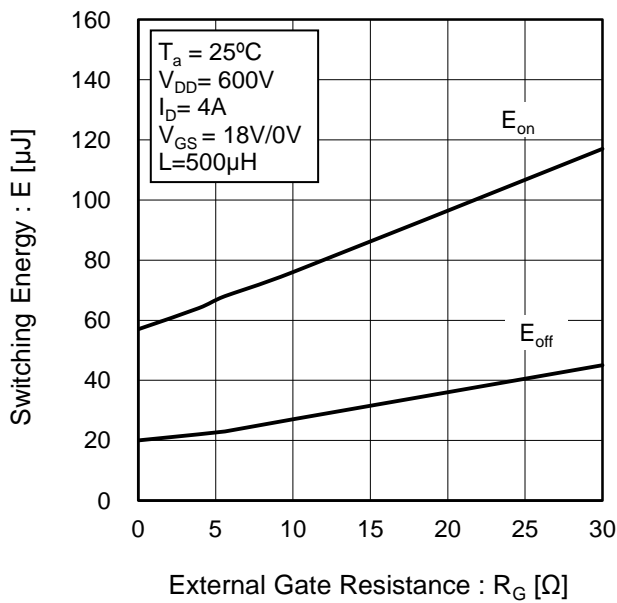


Fig.21 Typical Switching Loss vs. External Gate Resistance



●Electrical characteristic curves

Fig.22 Inverse Diode Forward Current vs. Source - Drain Voltage

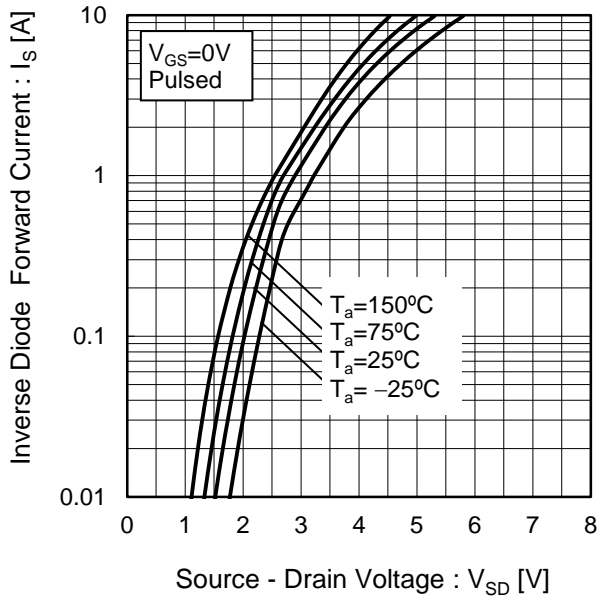
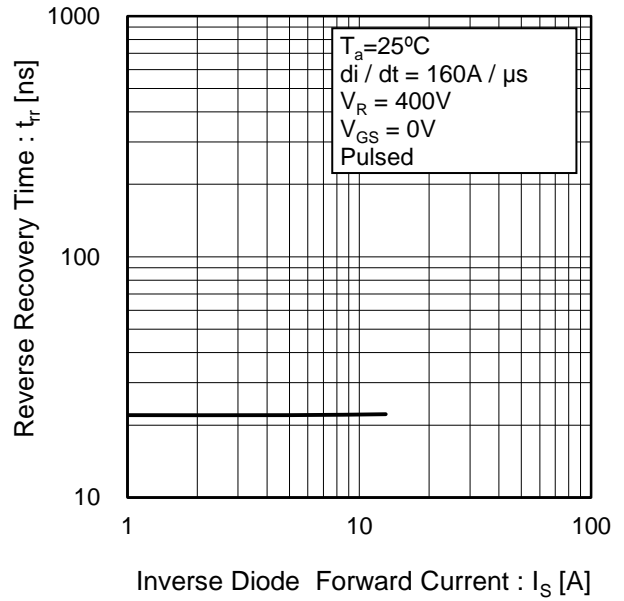


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

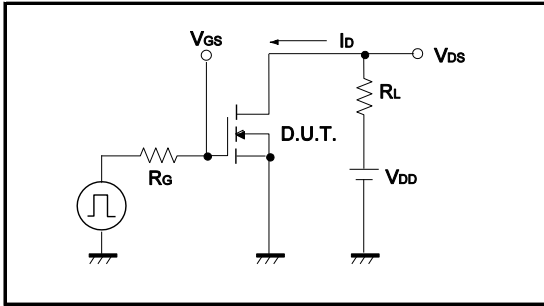


Fig.1-2 Switching Waveforms

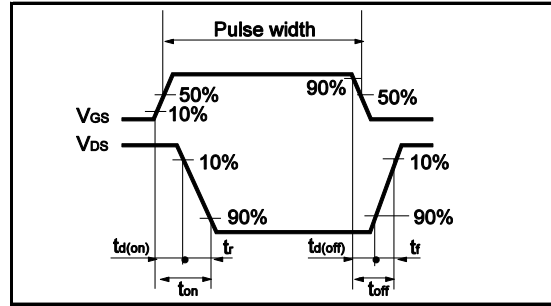


Fig.2-1 Gate Charge Measurement Circuit

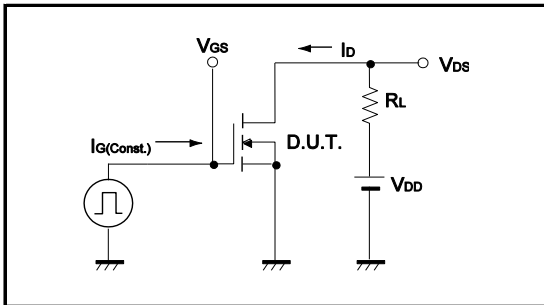


Fig.2-2 Gate Charge Waveform

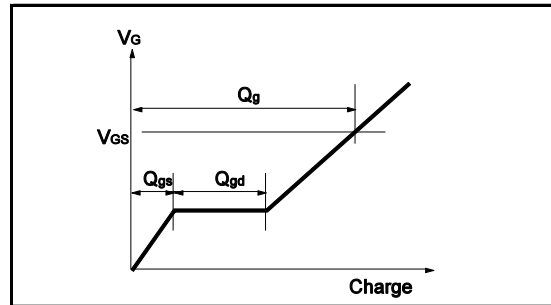


Fig.3-1 Switching Energy Measurement Circuit

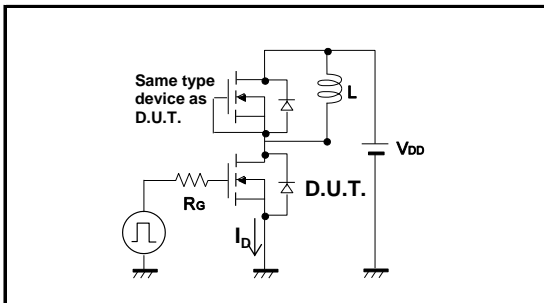


Fig.3-2 Switching Waveforms

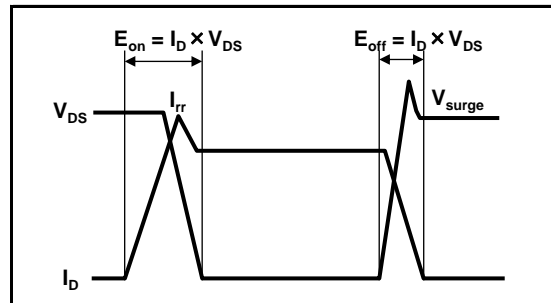


Fig.4-1 Reverse Recovery Time Measurement Circuit

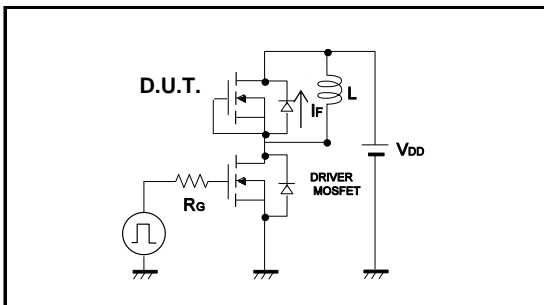
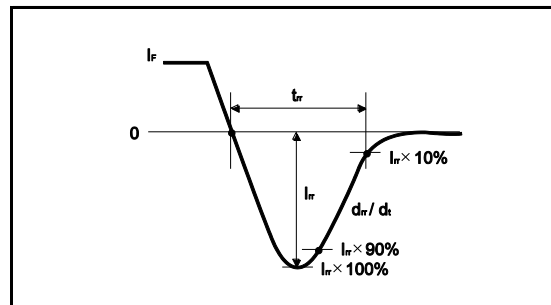


Fig.4-2 Reverse Recovery Waveform



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