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# SCT2080KE

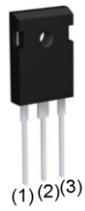
**N-channel SiC power MOSFET**

Datasheet

| | |
|---|---|
| $V_{DSS}$ | 1200V |
| $R_{DS(on)}$ (Typ.) | 80mΩ |
| $I_D$ | 40A |

## ●Outline

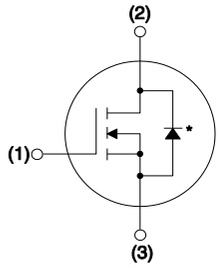
TO-247N




## ●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

## ●Inner circuit




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

* Body Diode

## ●Application

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

## ●Packaging specifications

| Package | | TO-247N |
|---|---|---|
| Type | Packing | Tube |
| | Reel size (mm) | - |
| | Tape width (mm) | - |
| | Basic ordering unit (pcs) | 30 |
| | Packing code | C11 |
| | Marking | SCT2080KE |

## ●Absolute maximum ratings ($T_a$ = 25°C)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain - Source voltage | | $V_{DSS}$ | 1200 | V |
| Continuous drain current | $T_c$ = 25°C | $I_D$ *1 | 40 | A |
| | $T_c$ = 100°C | $I_D$ *1 | 28 | A |
| Pulsed drain current | | $I_{D,pulse}$ *2 | 80 | A |
| Gate - Source voltage (DC) | | $V_{GSS}$ | −6 to +22 | V |
| Gate - Source surge voltage ($t_{surge}$ < 300nsec) | | $V_{GSS_surge}$ *3 | −10 to +26 | V |
| Total power dissipation | $T_C$=25°C, See Fig.1 | $P_D$ | 262 | W |
| | $T_C$=100°C, See Fig.1 | | 130 | W |
| Junction temperature | | $T_j$ | 175 | °C |
| Range of storage temperature | | $T_{stg}$ | −55 to +175 | °C |


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## ●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<br>$T_j$ = 25°C<br>$T_j$ = 150°C | -<br>- | 1<br>2 | 10<br>- | μA |
| 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 | $V_{GS\ (th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 4.4mA | 1.6 | 2.8 | 4.0 | V |

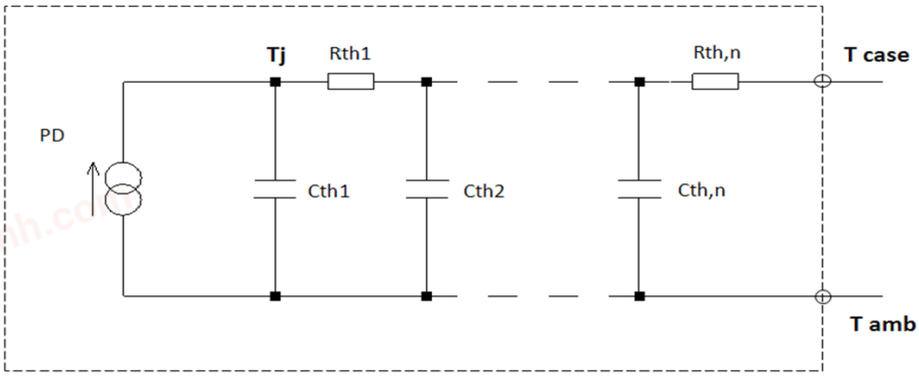
## ●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | 0.44 | 0.57 | °C/W |

## ●Typical Transient Thermal Characteristics

| Symbol | Value | Unit |
|---|---|---|
| $R_{th1}$ | 7.80E-02 | K/W |
| $R_{th2}$ | 1.97E-01 | |
| $R_{th3}$ | 1.62E-01 | |

| Symbol | Value | Unit |
|---|---|---|
| $C_{th1}$ | 5.00E-03 | Ws/K |
| $C_{th2}$ | 1.80E-02 | |
| $C_{th3}$ | 2.49E-01 | |





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

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Static drain - source on - state resistance | $R_{DS(on)}$ *4 | $V_{GS}$ = 18V, $I_D$ = 10A<br>$T_j$ = 25°C<br>$T_j$ = 125°C | -<br>- | 80<br>125 | 117<br>- | mΩ |
| Gate input resistance | $R_G$ | f = 1MHz, open drain | - | 6.3 | - | Ω |
| Transconductance | $g_{fs}$ *4 | $V_{DS}$ = 10V, $I_D$ = 10A | - | 3.7 | - | S |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V<br>$V_{DS}$ = 800V<br>f = 1MHz | - | 2080 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 77 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 16 | - | |
| Effective output capacitance, energy related | $C_{o(er)}$ | $V_{GS}$ = 0V<br>$V_{DS}$ = 0V to 500V | - | 116 | - | pF |
| Turn - on delay time | $t_{d(on)}$ *4 | $V_{DD}$ = 400V, $V_{GS}$ = 18V<br>$I_D$ = 10A<br>$R_L$ = 40Ω<br>$R_G$ = 0Ω | - | 35 | - | ns |
| Rise time | $t_r$ *4 | | - | 36 | - | |
| Turn - off delay time | $t_{d(off)}$ *4 | | - | 76 | - | |
| Fall time | $t_f$ *4 | | - | 22 | - | |
| Turn - on switching loss | $E_{on}$ *4 | $V_{DD}$ = 600V, $I_D$=10A<br>$V_{GS}$ = 18V/0V<br>$R_G$ = 0Ω, L=500μH<br>*$E_{on}$ includes diode reverse recovery | - | 174 | - | μJ |
| Turn - off switching loss | $E_{off}$ *4 | | - | 51 | - | |

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

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Total gate charge | $Q_g$ *4 | $V_{DD}$ = 400V<br>$I_D$ = 10A<br>$V_{GS}$ = 18V | - | 106 | - | nC |
| Gate - Source charge | $Q_{gs}$ *4 | | - | 27 | - | |
| Gate - Drain charge | $Q_{gd}$ *4 | | - | 31 | - | |
| Gate plateau voltage | $V_{(plateau)}$ | $V_{DD}$ = 400V, $I_D$ = 10A | - | 9.7 | - | V |


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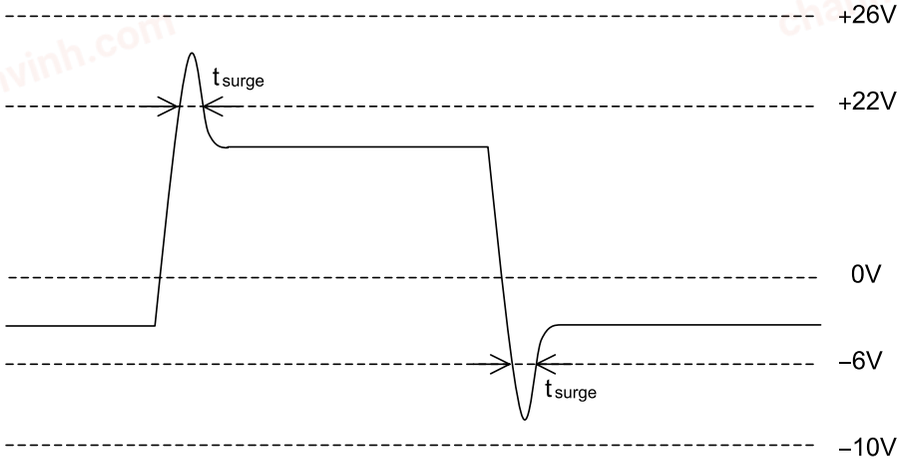
## ●Body diode electrical characteristics (Source-Drain) ($T_a$ = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Body diode continuous, forward current | $I_S$ *1 | $T_c$ = 25°C | - | - | 40 | A |
| Body diode direct current, pulsed | $I_{SM}$ *2 | | - | - | 80 | A |
| Forward voltage | $V_{SD}$ *4 | $V_{GS}$ = 0V, $I_S$ = 10A | - | 4.6 | - | V |
| Reverse recovery time | $t_{rr}$ *4 | $I_F$ = 10A, $V_R$ = 400V di/dt = 150A/μs | - | 31 | - | ns |
| Reverse recovery charge | $Q_{rr}$ *4 | | - | 44 | - | nC |
| Peak reverse recovery current | $I_{rrm}$ *4 | | - | 2.3 | - | A |

*1 Limited only by maximum temperature allowed.

*2 PW ≤ 10μs, Duty cycle ≤ 1%

*3 Example of acceptable $V_{GS}$ waveform




*4 Pulsed


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## ●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

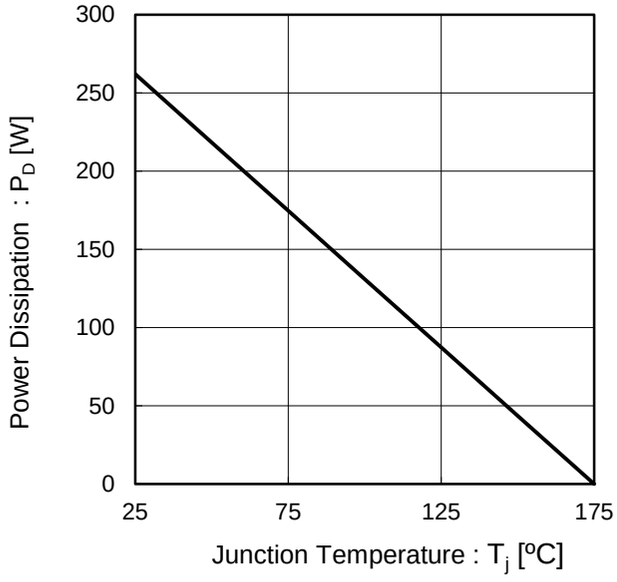



Fig.2 Maximum Safe Operating Area

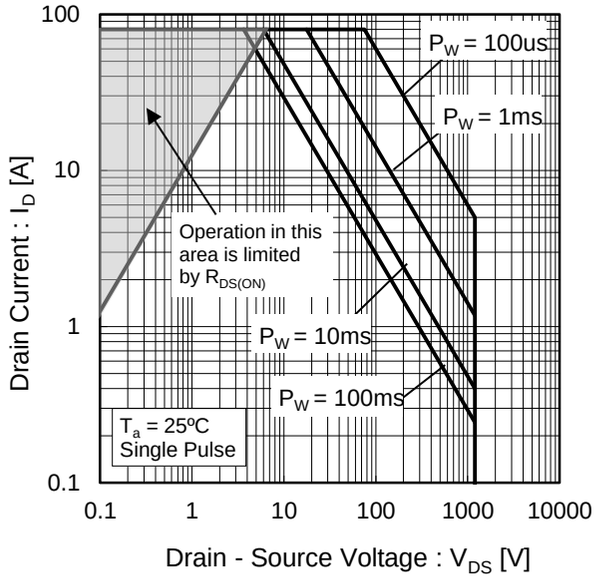
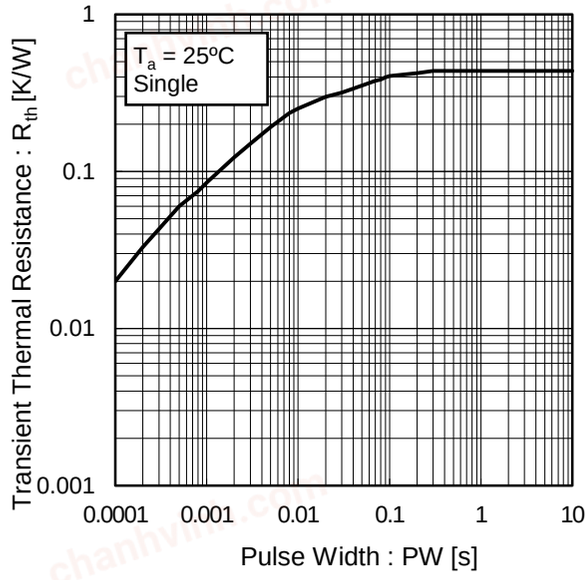



Fig.3 Typical Transient Thermal Resistance vs. Pulse Width





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## ●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

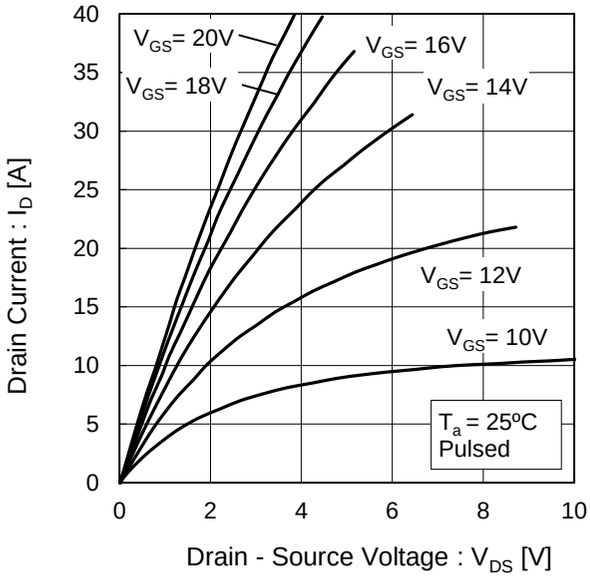



Fig.5 Typical Output Characteristics(II)

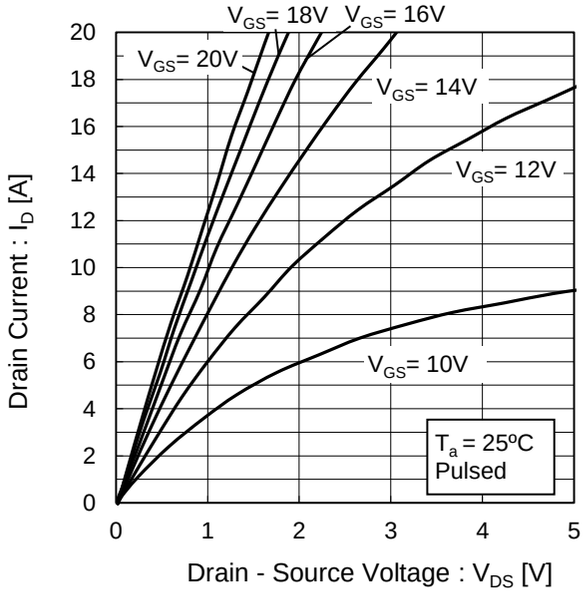



Fig.6 Typical Output Characteristics(I)

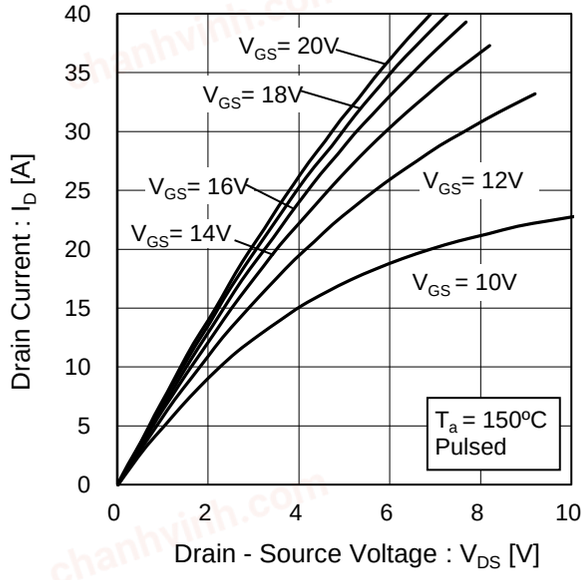
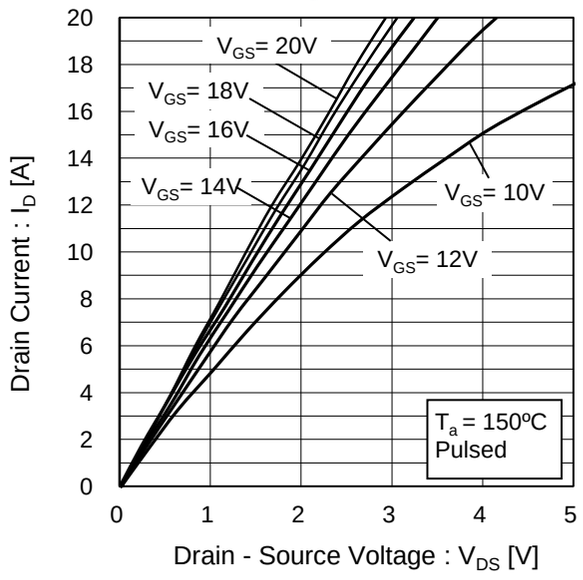



Fig.7 Typical Output Characteristics(II)





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## ●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics

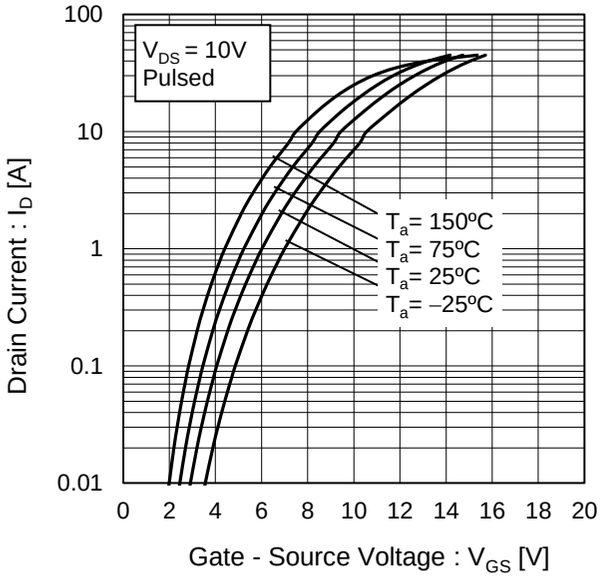



Fig.9 Typical Transfer Characteristics (II)

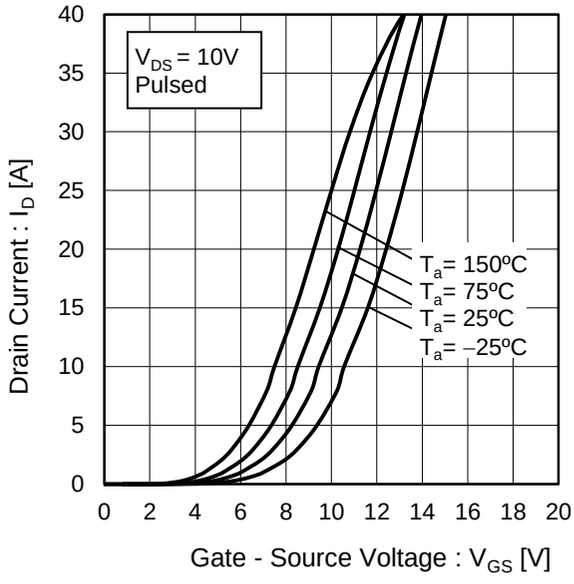



Fig.10 Gate Threshold Voltage vs. Junction Temperature

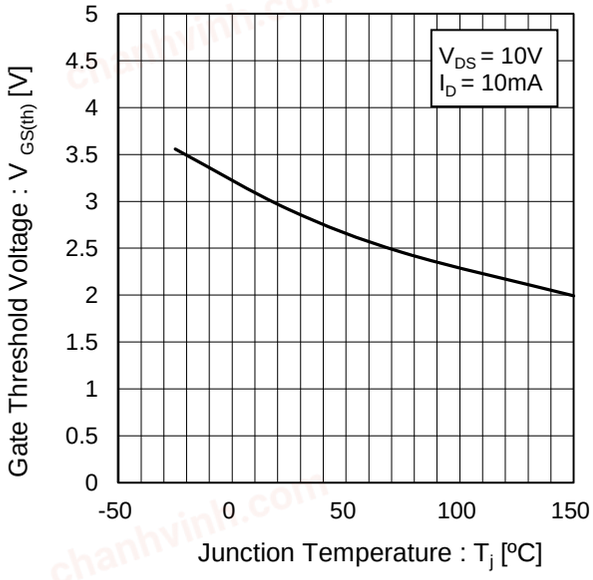
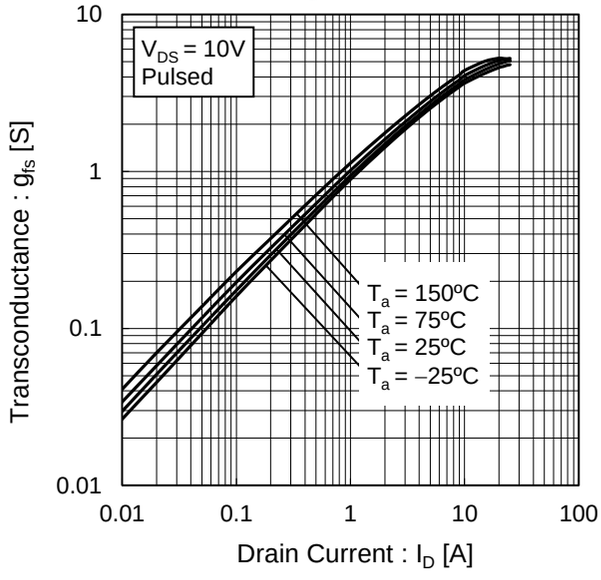



Fig.11 Transconductance vs. Drain Current





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## ●Electrical characteristic curves

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

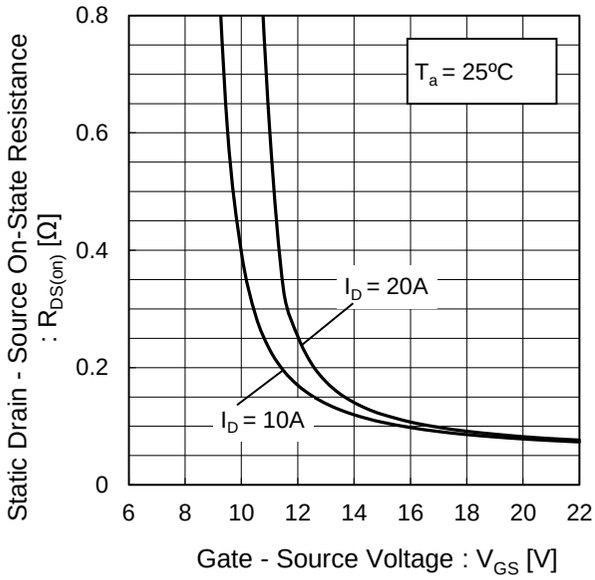



Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

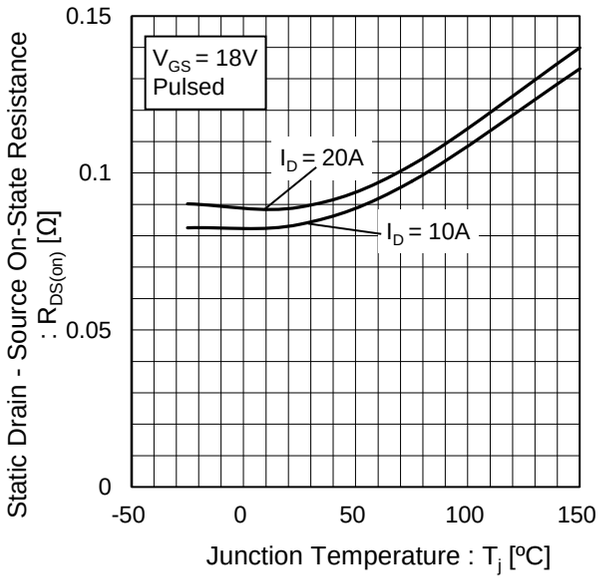
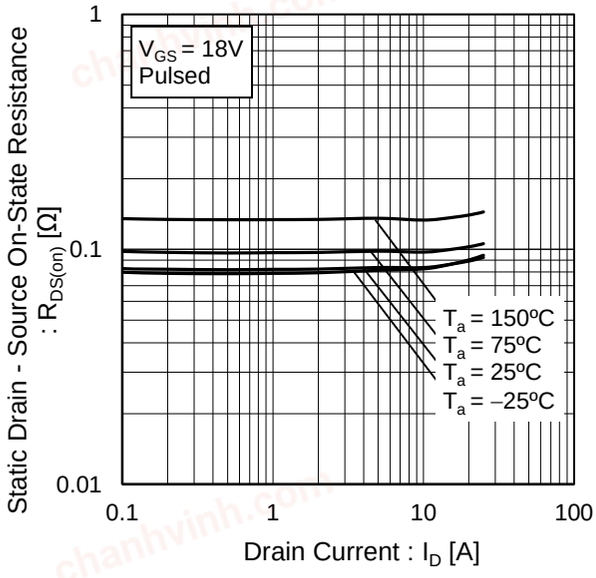



Fig.14 Static Drain - Source On - State Resistance vs. Drain Current





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## ●Electrical characteristic curves

Fig.15 Typical Capacitance vs. Drain - Source Voltage

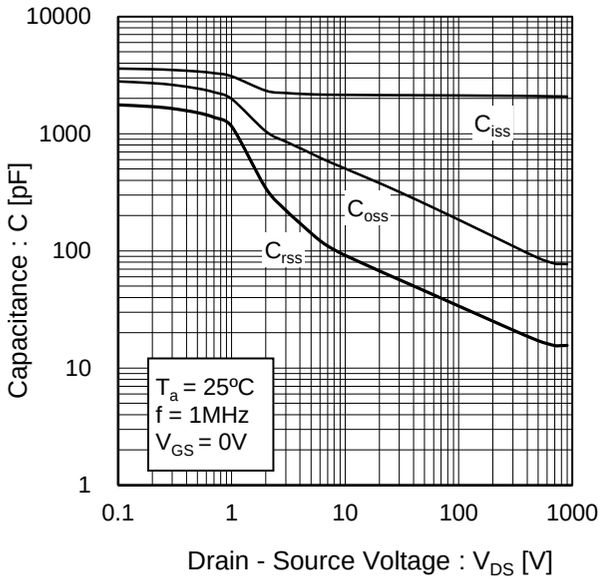



Fig.16 $C_{oss}$ Stored Energy

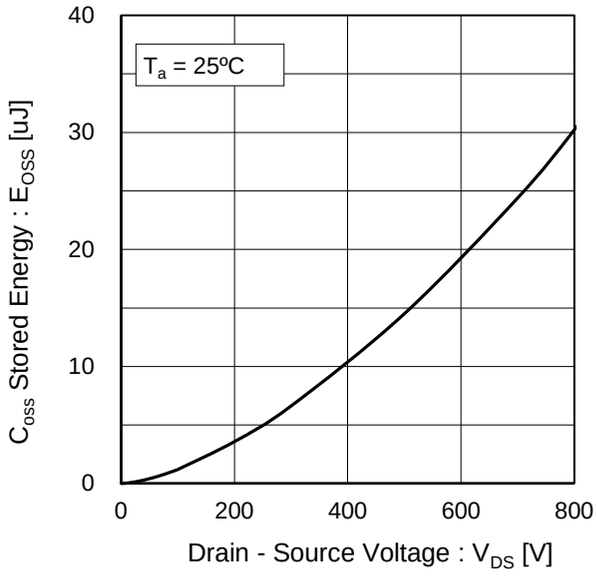



Fig.17 Switching Characteristics

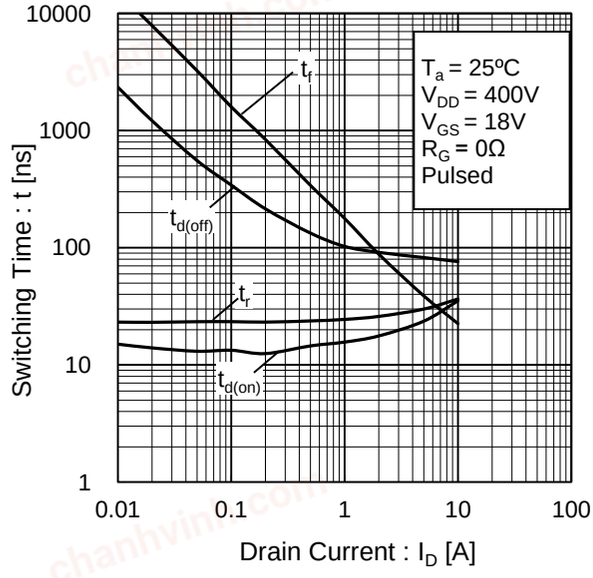
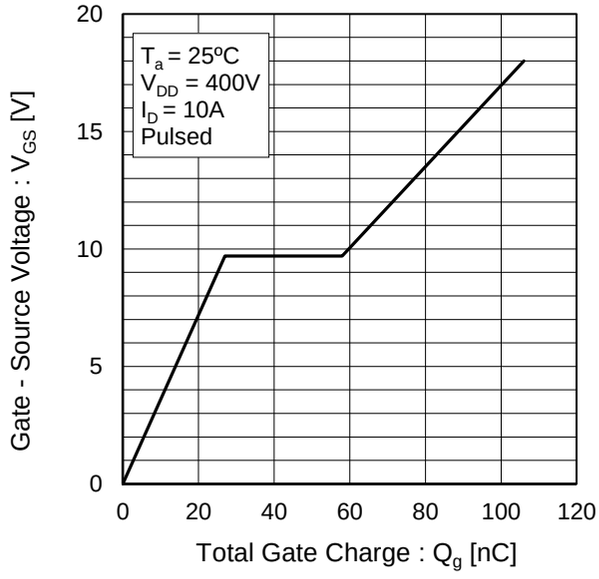



Fig.18 Dynamic Input Characteristics





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## ●Electrical characteristic curves

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

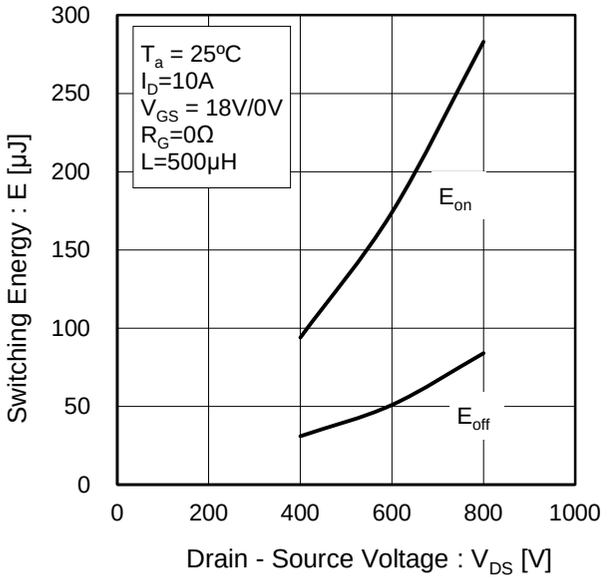



Fig.20 Typical Switching Loss vs. Drain Current

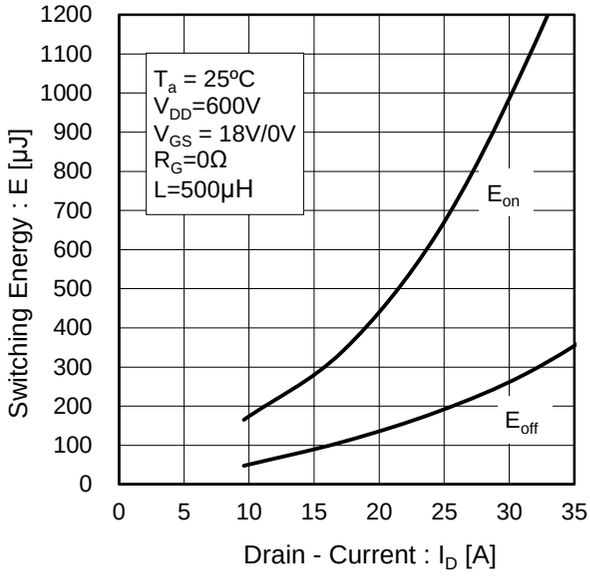
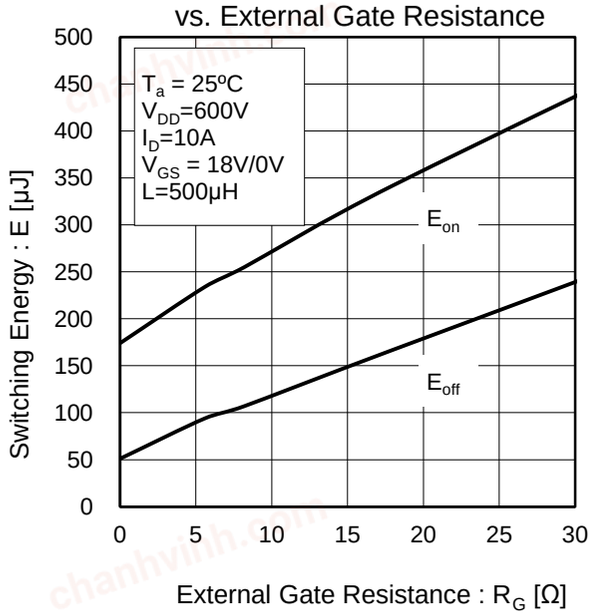



Fig.21 Typical Switching Loss vs. External Gate Resistance





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## ●Electrical characteristic curves

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

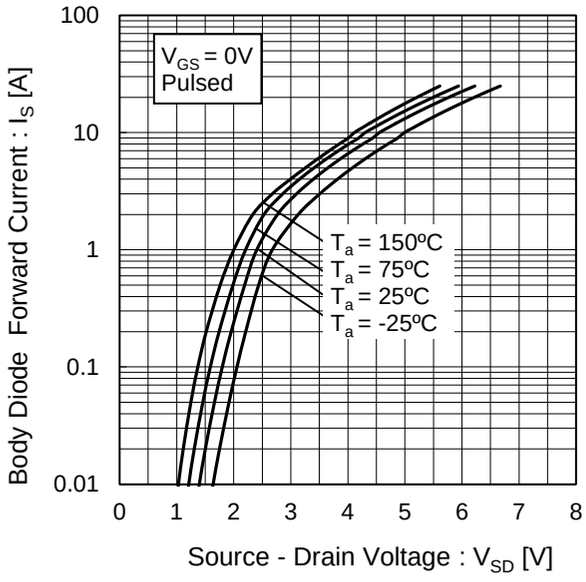
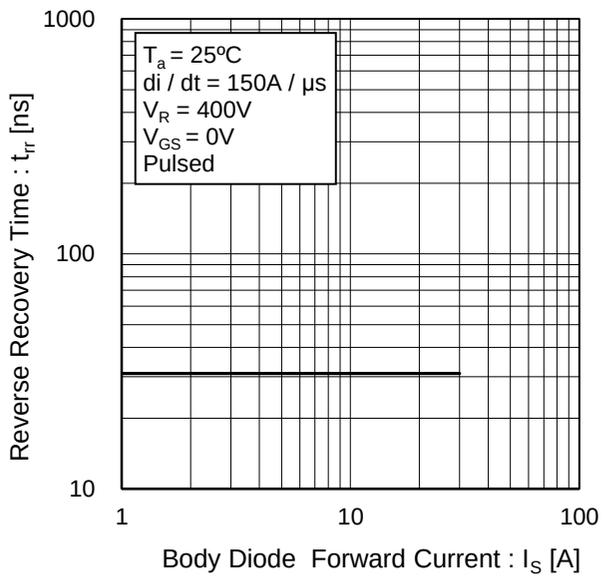



Fig.23 Reverse Recovery Time vs.Body Diode Forward Current





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## ●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

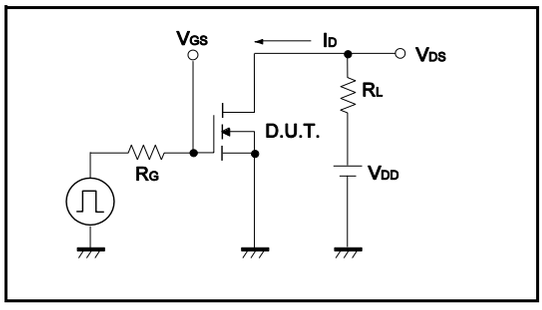



Fig.1-2 Switching Waveforms

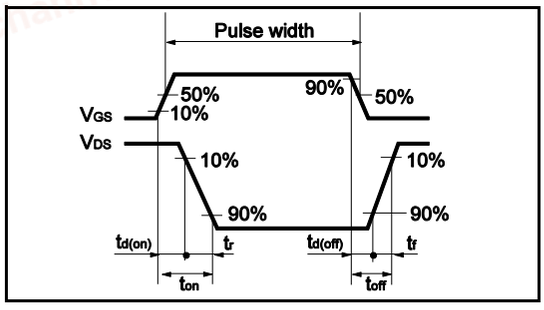



Fig.2-1 Gate Charge Measurement Circuit

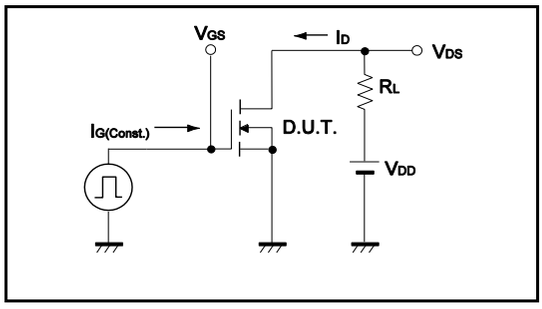



Fig.2-2 Gate Charge Waveform

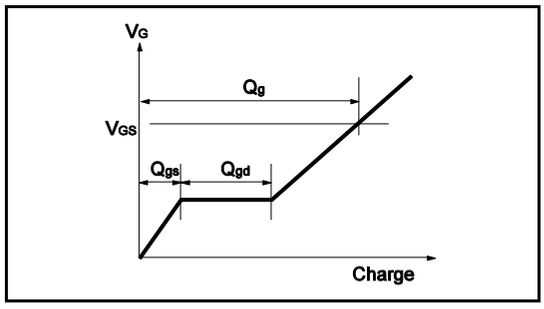



Fig.3-1 Switching Energy Measurement Circuit

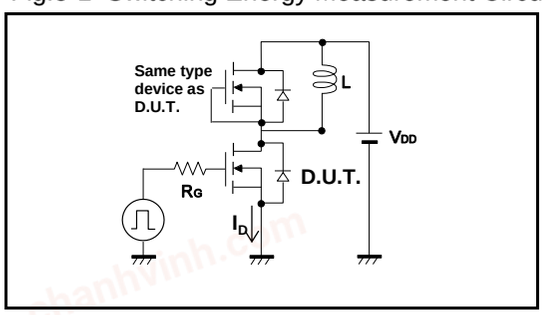



Fig.3-2 Switching Waveforms

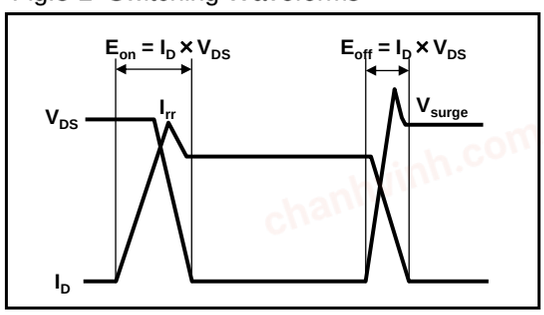



Fig.4-1 Reverse Recovery Time Measurement Circuit

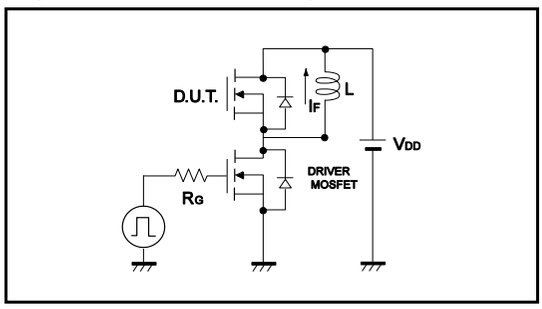
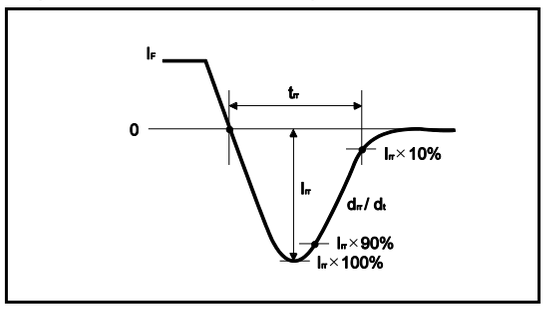



Fig.4-2 Reverse Recovery Waveform





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