# SCT3080AR

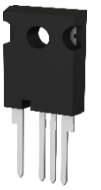
**N-channel SiC power MOSFET**

Datasheet

| | |
|---|---|
| $V_{DSS}$ | 650V |
| $R_{DS(on)}$ (Typ.) | 80mΩ |
| $I_D$ *1 | 30A |
| $P_D$ | 134W |

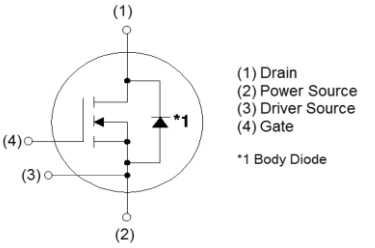
## ●Outline

TO-247-4L



(1) (2)(3)(4)

## ●Inner circuit




Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

## ●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
・Switch mode power supplies
・Induction heating
・Motor drives

## ●Packaging specifications

| | | |
|---|---|---|
| Type | Packing | Tube |
| | Reel size (mm) | - |
| | Tape width (mm) | - |
| | Basic ordering unit (pcs) | 30 |
| | Taping code | C15 |
| | Marking | SCT3080AR |

## ●Absolute maximum ratings ($T_{vj}$ = 25°C unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain - Source Voltage | | $V_{DSS}$ | 650 | V |
| Continuous Drain current | $T_c$ = 25°C | $I_D$ *1 | 30 | A |
| | $T_c$ = 100°C | $I_D$ *1 | 21 | A |
| Pulsed Drain current ($T_c$ = 25°C) | | $I_{D,pulse}$ *2 | 75 | A |
| Gate - Source voltage (DC) | | $V_{GSS}$ | -4 to +22 | V |
| Gate - Source surge voltage ($t_{surge}$ < 300ns) | | $V_{GSS\_surge}$ *3 | -4 to +26 | V |
| Recommended drive voltage | | $V_{GS\_op}$ *4 | 0 / +18 | V |
| Virtual Junction temperature | | $T_{vj}$ | 175 | °C |
| Range of storage temperature | | $T_{stg}$ | -55 to +175 | °C |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## ●Electrical characteristics ($T_{vj}$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Drain - Source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 1mA<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = -55°C | <br>650<br>650 | <br>-<br>- | <br>-<br>- | V |
| Zero Gate voltage Drain current | $I_{DSS}$ | $V_{GS}$ = 0V, $V_{DS}$ =650V<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 150°C | <br>-<br>- | <br>1<br>2 | <br>10<br>- | μA |
| Gate - Source leakage current | $I_{GSS+}$ | $V_{GS}$ = +22V, $V_{DS}$ = 0V | - | - | 100 | nA |
| Gate - Source leakage current | $I_{GSS-}$ | $V_{GS}$ = -4V, $V_{DS}$ = 0V | - | - | -100 | nA |
| Gate threshold voltage | $V_{GS\ (th)}$ | $V_{DS}$ = 10V, $I_D$ = 5mA | 2.7 | - | 5.6 | V |
| Static Drain - Source on - state resistance | $R_{DS(on)}$ *5 | $V_{GS}$ = 18V, $I_D$ = 10A<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 150°C | <br>-<br>- | <br>80<br>115 | <br>104<br>- | mΩ |
| Gate input resistance | $R_G$ | f = 1MHz, open drain | - | 13 | - | Ω |

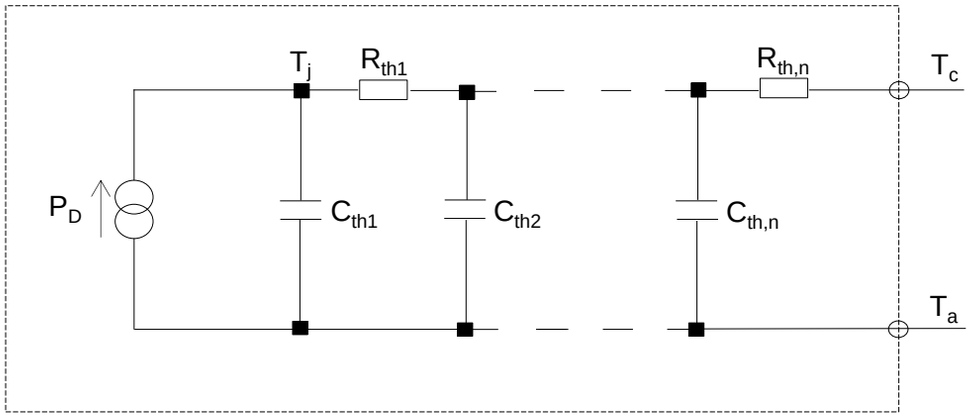
## ●Thermal resistance

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Thermal resistance, junction - case | $R_{thJC}$ | - | 0.86 | 1.12 | K/W |

## ●Typical Transient Thermal Characteristics

| Symbol | Value | Unit |
|---|---|---|
| $R_{th1}$ | $1.14\times10^{-1}$ | K/W |
| $R_{th2}$ | $5.07\times10^{-1}$ | |
| $R_{th3}$ | $2.51\times10^{-1}$ | |

| Symbol | Value | Unit |
|---|---|---|
| $C_{th1}$ | $5.02\times10^{-4}$ | Ws/K |
| $C_{th2}$ | $4.91\times10^{-3}$ | |
| $C_{th3}$ | $4.99\times10^{-2}$ | |





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●**Electrical characteristics** ($T_{vj}$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Transconductance | $g_{fs}$ *5 | $V_{DS}$ = 10V, $I_D$ = 10A | - | 3.8 | - | S |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0V | - | 571 | - | pF |
| Output capacitance | $C_{oss}$ | $V_{DS}$ = 500V | - | 39 | - | |
| Reverse transfer capacitance | $C_{rss}$ | f = 1MHz | - | 19 | - | |
| Effective output capacitance, energy related | $C_{o(er)}$ | $V_{GS}$ = 0V<br>$V_{DS}$ = 0V to 300V | - | 99 | - | pF |
| Total Gate charge | $Q_g$ *5 | $V_{DS}$ = 300V<br>$I_D$ = 10A<br>$V_{GS}$ = 18V<br>See Fig. 1-1. | - | 48 | - | nC |
| Gate - Source charge | $Q_{gs}$ *5 | | - | 10 | - | |
| Gate - Drain charge | $Q_{gd}$ *5 | | - | 25 | - | |
| Turn - on delay time | $t_{d(on)}$ *5 | $V_{DS}$ = 400V<br>$I_D$ = 15A<br>$V_{GS}$ = 0V/+18V<br>$R_G$ = 0Ω, L = 750μH<br>$L_\sigma$ = 50nH, $C_\sigma$ = 10pF<br>See Fig. 2-1, 2-2, 2-3.<br>$E_{on}$ includes diode reverse recovery. | - | 4 | - | ns |
| Rise time | $t_r$ *5 | | - | 14 | - | |
| Turn - off delay time | $t_{d(off)}$ *5 | | - | 15 | - | |
| Fall time | $t_f$ *5 | | - | 13 | - | |
| Turn - on switching loss | $E_{on}$ *5 | | - | 77 | - | μJ |
| Turn - off switching loss | $E_{off}$ *5 | | - | 15 | - | |


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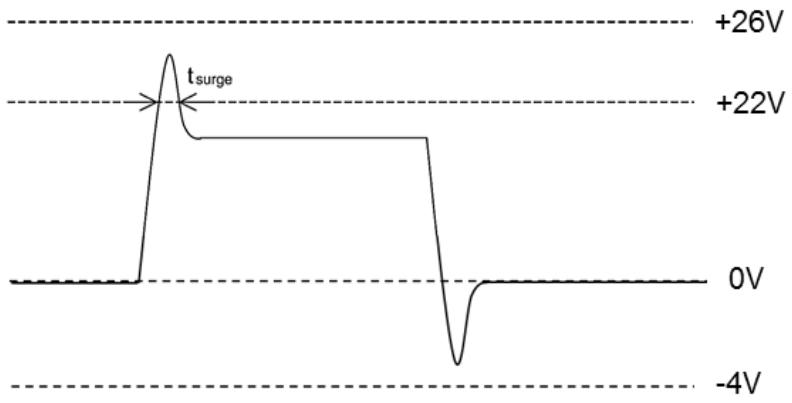
●**Body diode electrical characteristics** (Source-Drain) ($T_{vj}$ = 25°C unless otherwise specified)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Body diode continuous, forward current | $I_S$ *1 | $T_c$ = 25°C | - | - | 30 | A |
| Body diode direct current, pulsed | $I_{SM}$ *2 | | - | - | 75 | A |
| Forward voltage | $V_{SD}$ *5 | $V_{GS}$ = 0V, $I_S$ = 10A | - | 3.2 | - | V |
| Reverse recovery time | $t_{rr}$ *5 | $I_F$ = 10A<br>$V_R$ = 400V<br>di/dt = 2500A/μs<br>$L_\sigma$ = 50nH, $C_\sigma$ = 10pF<br>See Fig. 3-1, 3-2. | - | 18 | - | ns |
| Reverse recovery charge | $Q_{rr}$ *5 | | - | 254 | - | nC |
| Peak reverse recovery current | $I_{rrm}$ *5 | | - | 23 | - | A |

*1 Limited by maximum $T_{vj}$ and for Max. $R_{thJC}$.

*2 PW ≤ 10μs, Duty cycle ≤ 1%

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




Please note especially when using driver source that $V_{GSS\_surge}$ must be in the range of absolute maximum rating.

*4 Please be advised not to use SiC-MOSFETs with $V_{GS}$ below 13V as doing so may cause thermal runaway.

*5 Pulsed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## ●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

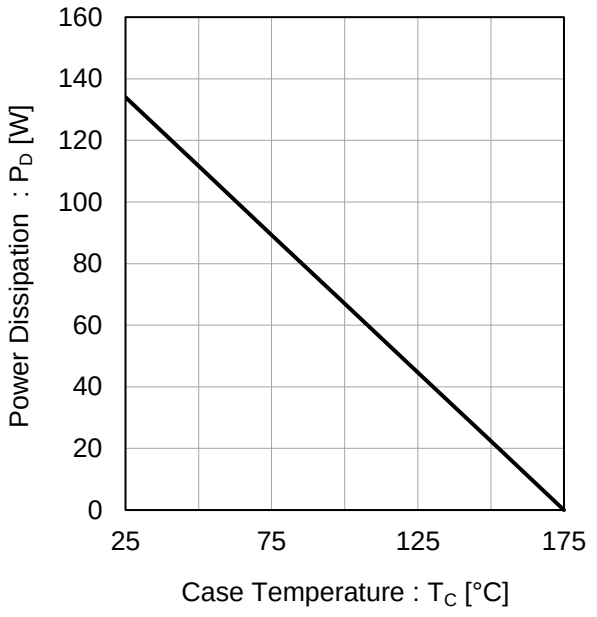



Fig.2 Maximum Safe Operating Area

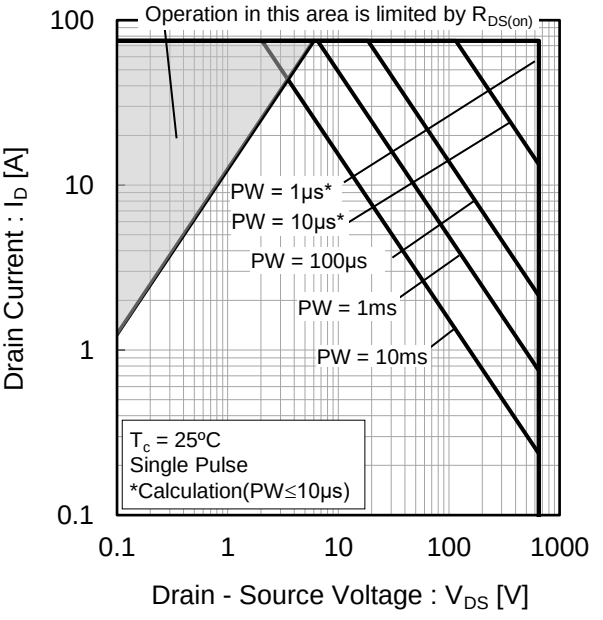
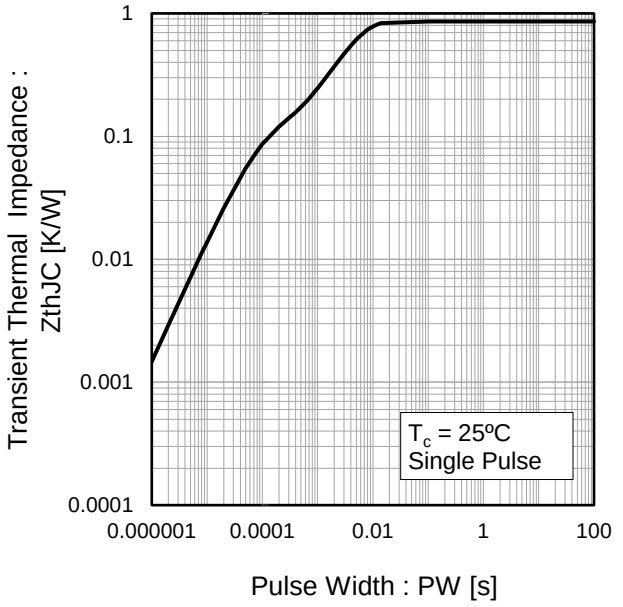



Fig.3 Typical Transient Thermal Impedance vs. Pulse Width





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## ●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

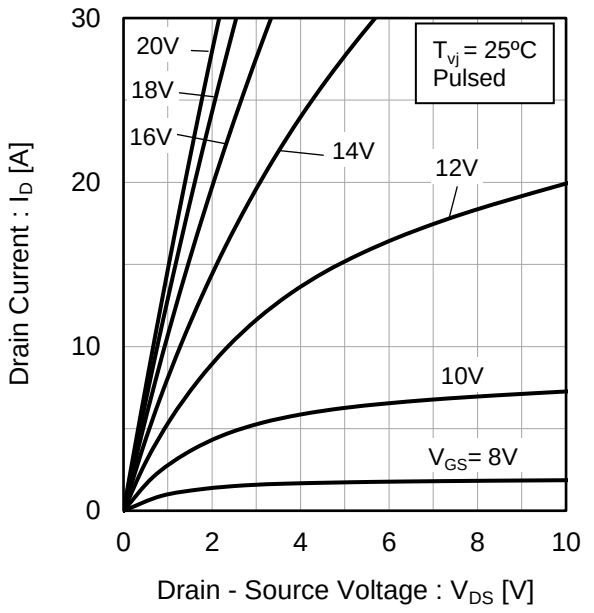



Fig.5 Typical Output Characteristics(II)

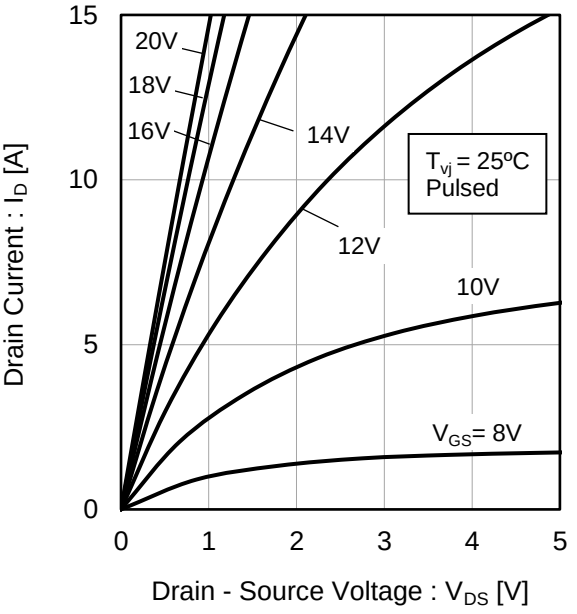
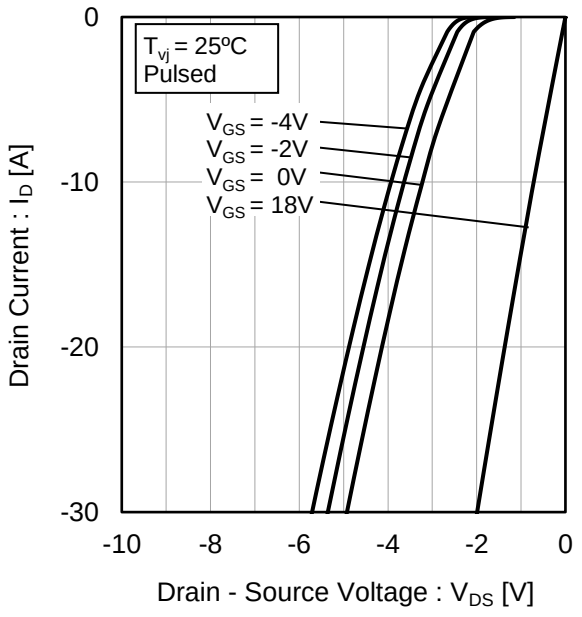



Fig.6 $T_{vj}$ = 25ºC 3rd Quadrant Characteristics





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## ●Electrical characteristic curves

Fig.7 $T_{vj}$ = 150ºC Typical Output Characteristics(I)

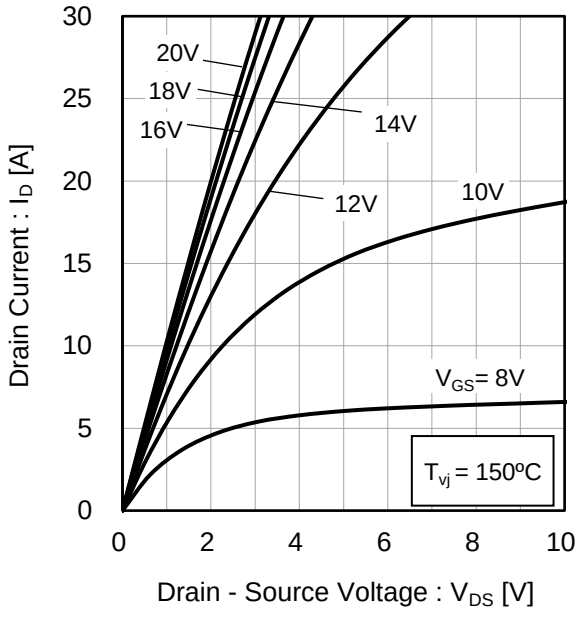



Fig.8 $T_{vj}$ = 150ºC Typical Output Characteristics(II)

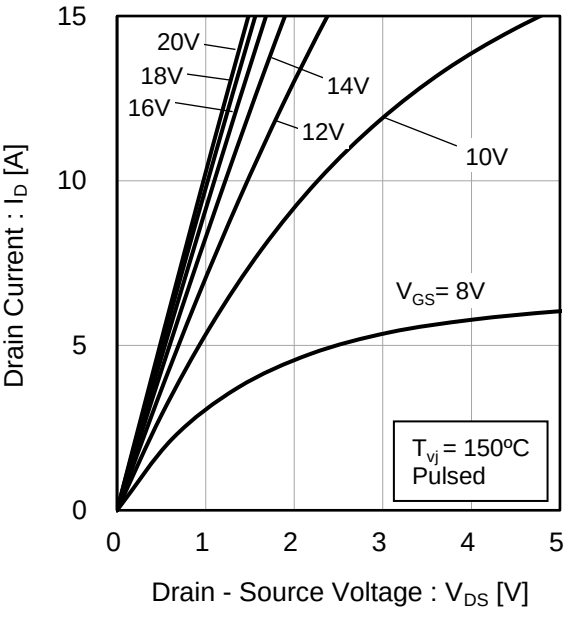



Fig.9 $T_{vj}$ = 150ºC 3rd Quadrant Characteristics

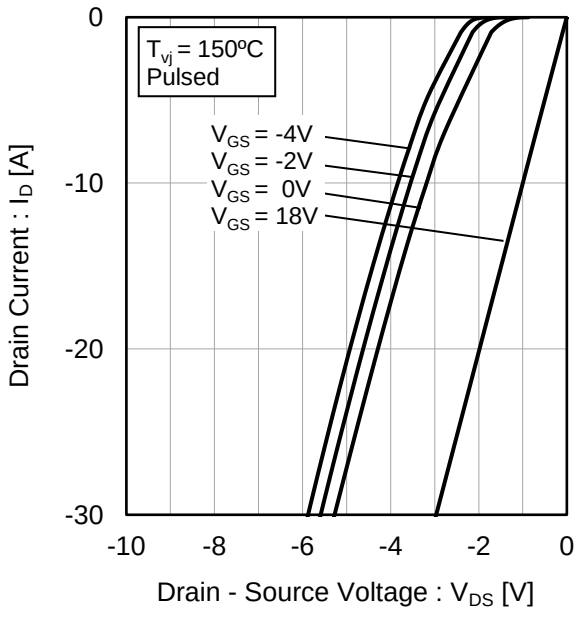
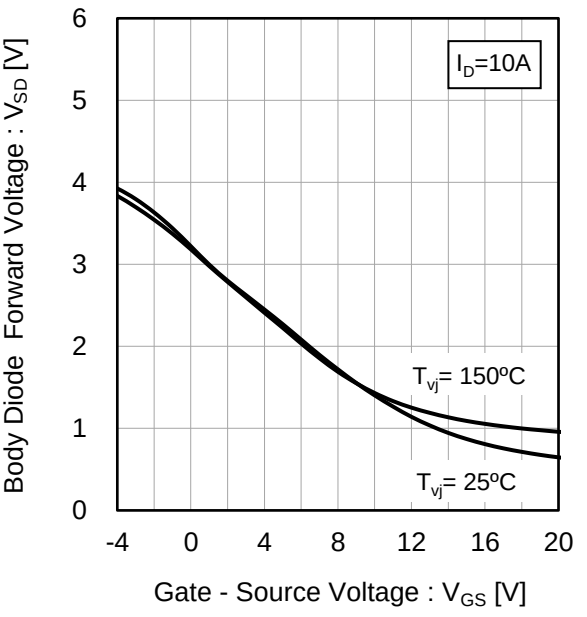



Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage





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## ●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

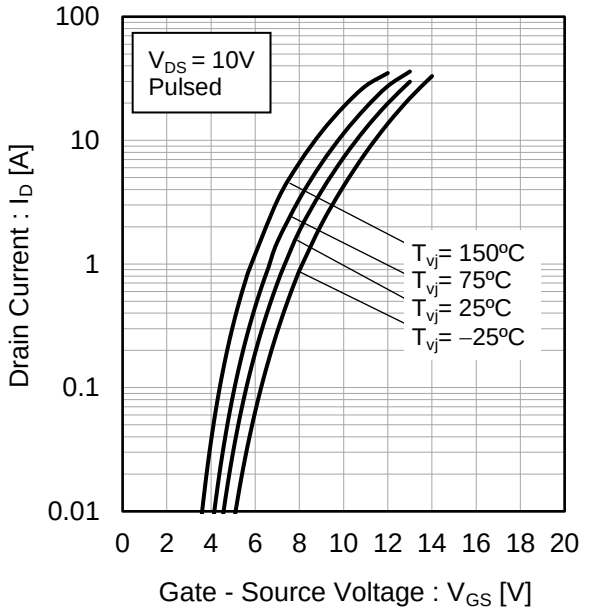



Fig.12 Typical Transfer Characteristics (II)

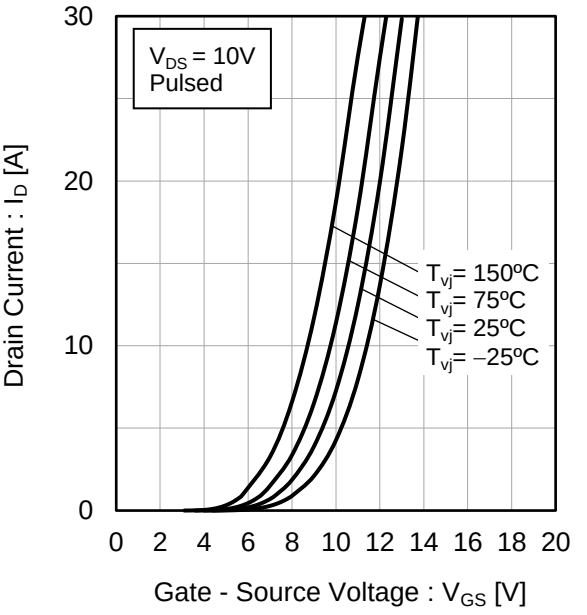



Fig.13 Gate Threshold Voltage
vs. Virtual Junction Temperature

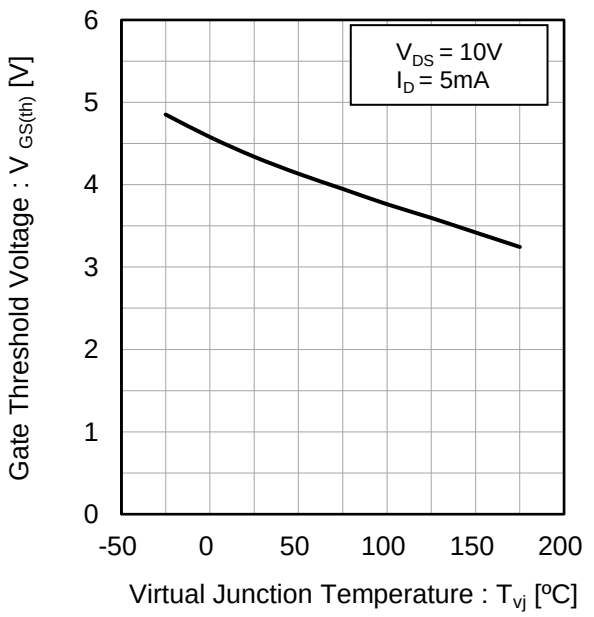
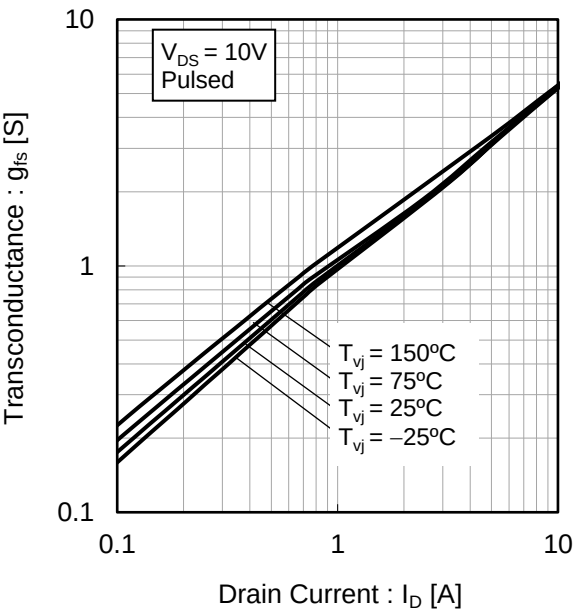



Fig.14 Transconductance vs. Drain Current





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## ●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

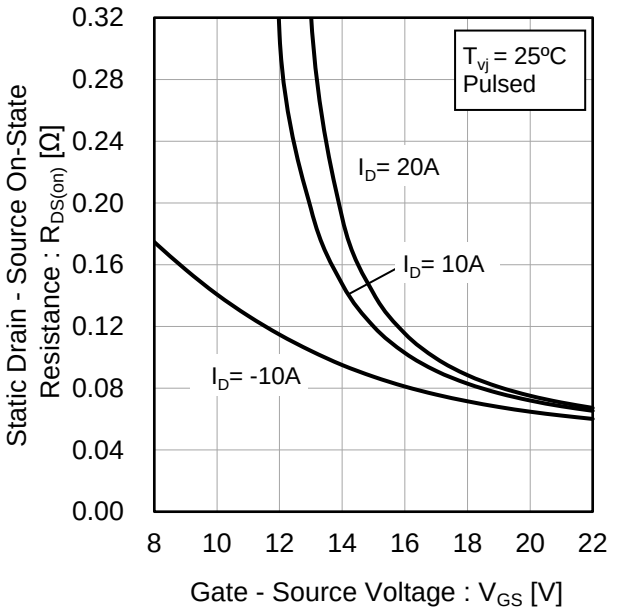



Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

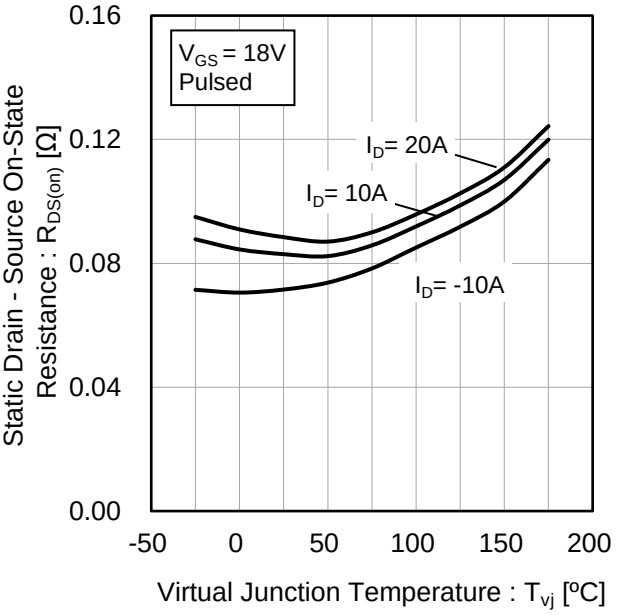



Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

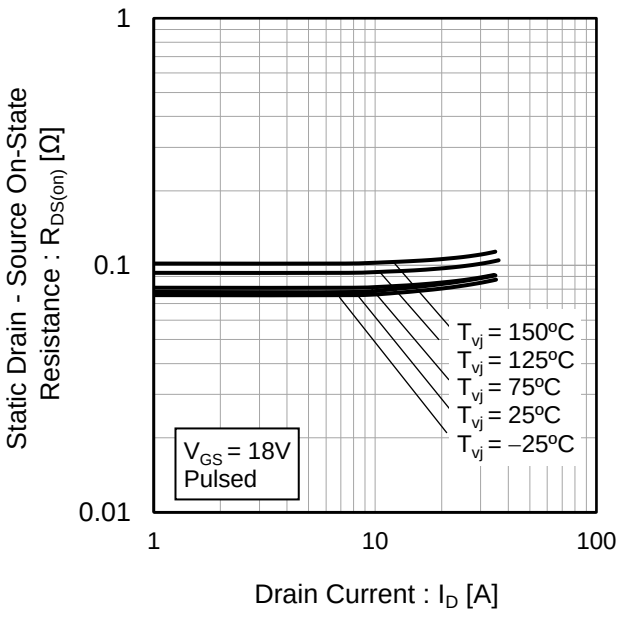
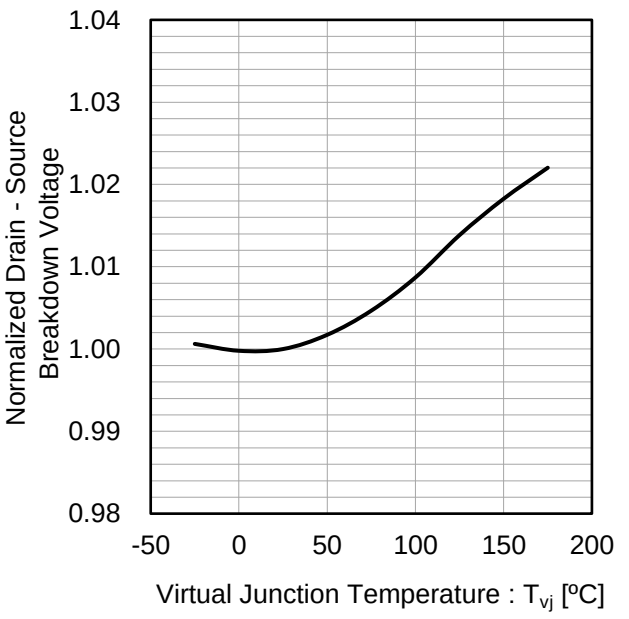



Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature





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## ●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

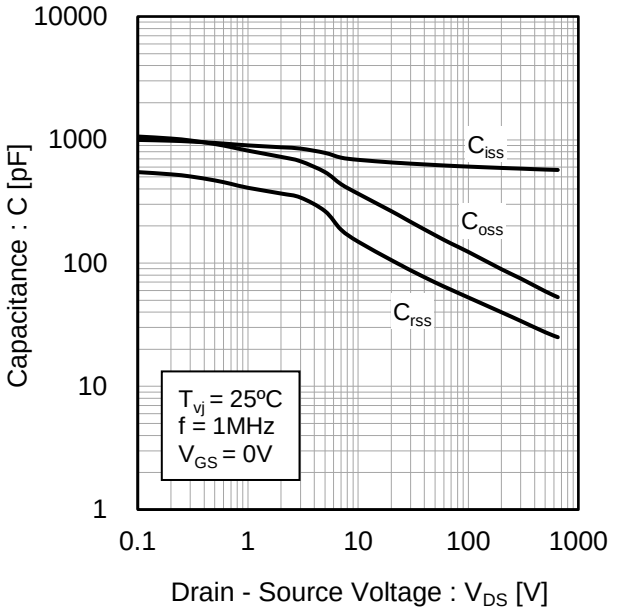



Fig.20 $C_{oss}$ Stored Energy

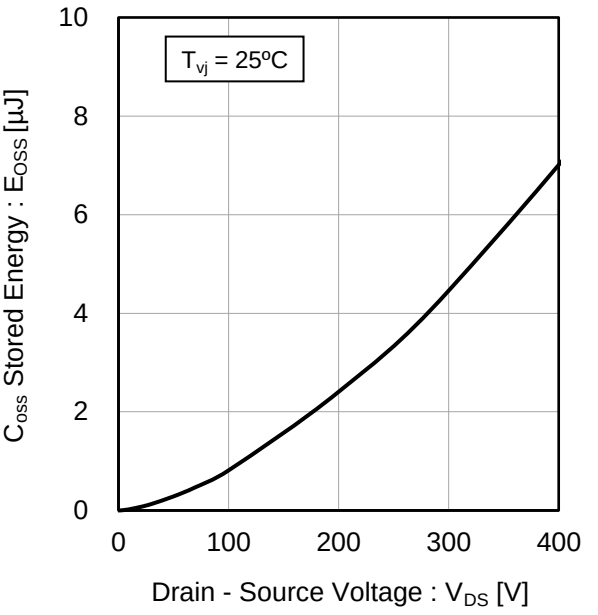
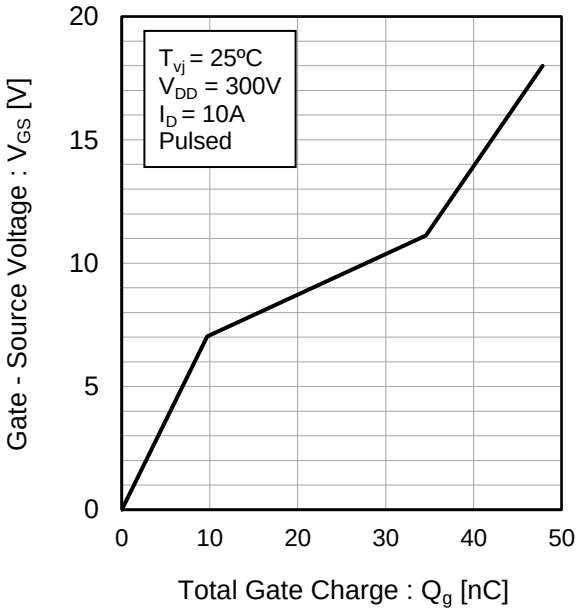
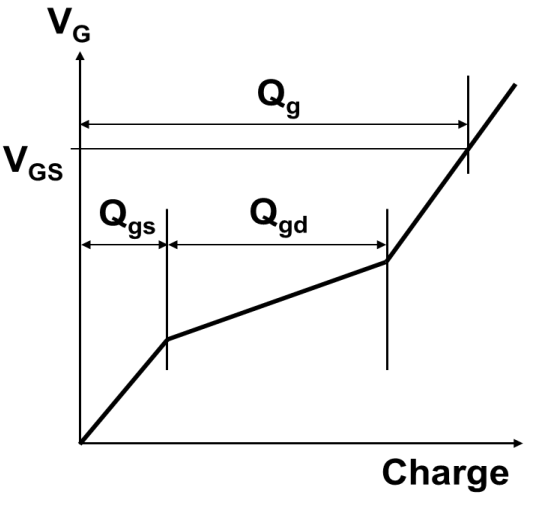



Fig.21 Dynamic Input Characteristics




*Gate Charge Waveform





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## ●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

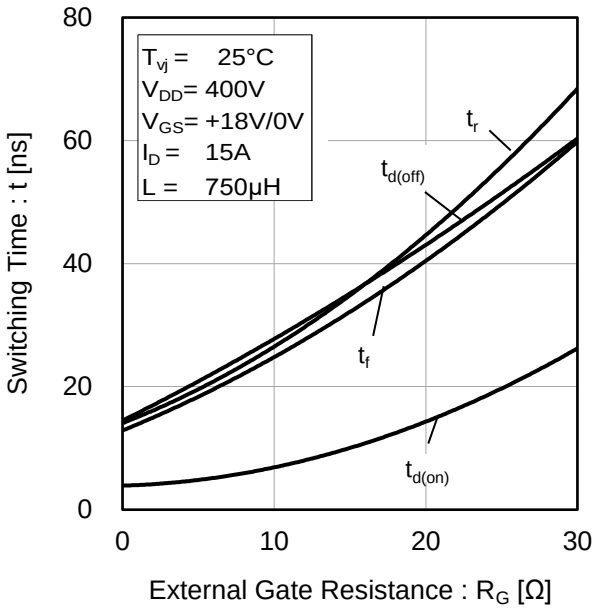



Fig.23 Typical Switching Loss vs. Drain - Source Voltage

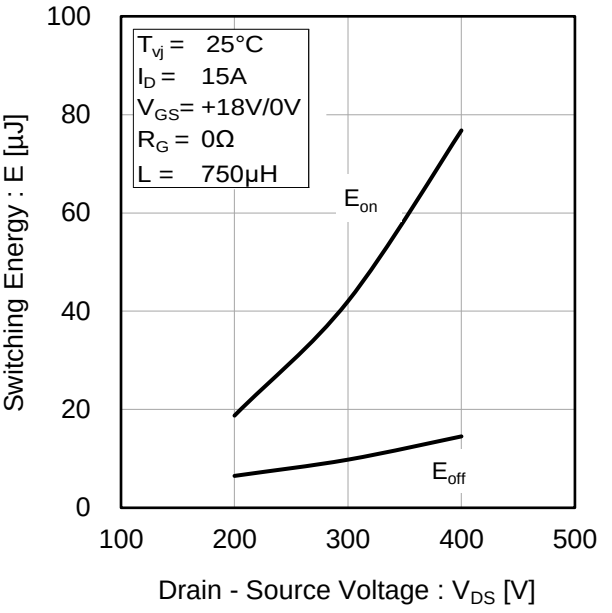



Fig.24 Typical Switching Loss vs. Drain Current

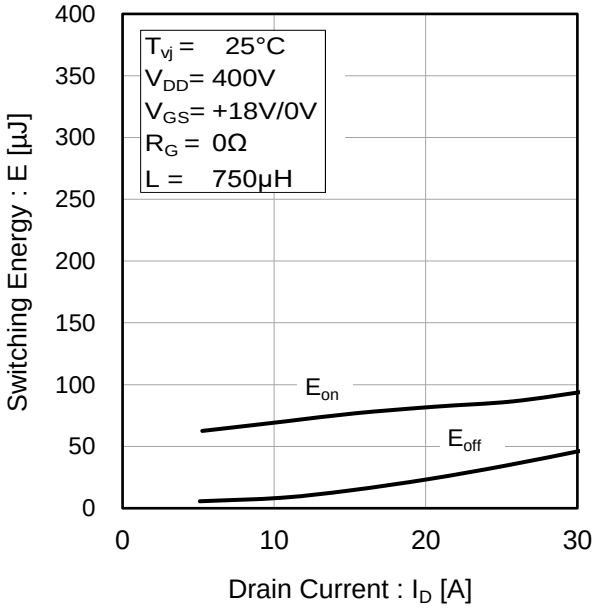
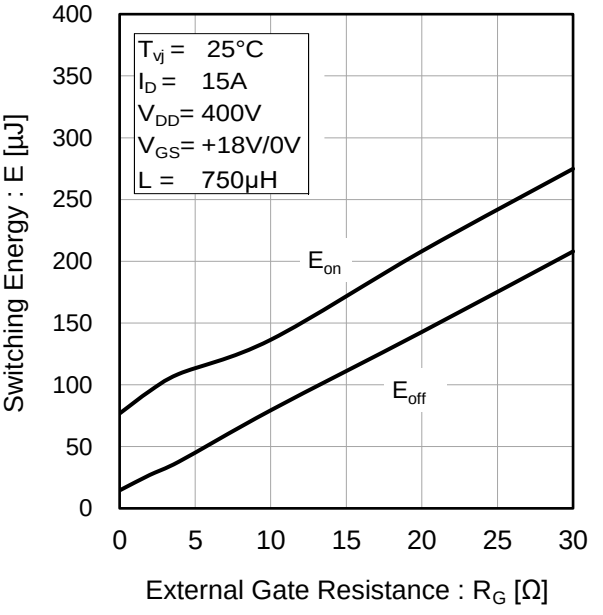



Fig.25 Typical Switching Loss vs. External Gate Resistance





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## ●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

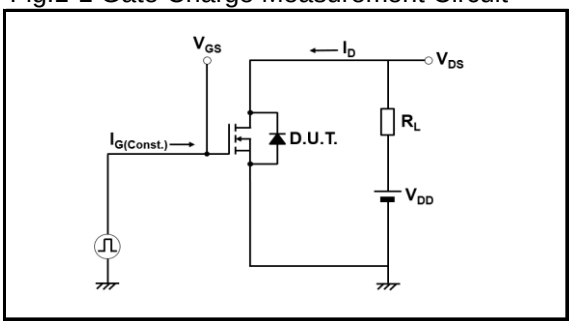



Fig.2-1 Switching Characteristics Measurement Circuit

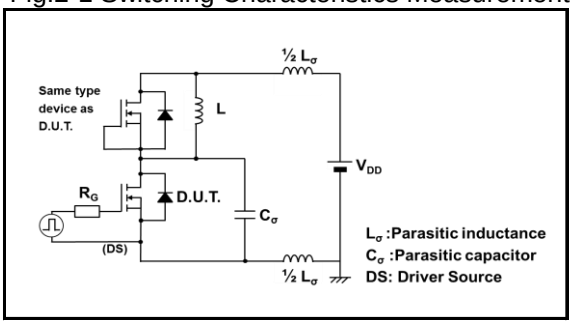



Fig.2-2 Waveforms for Switching Time

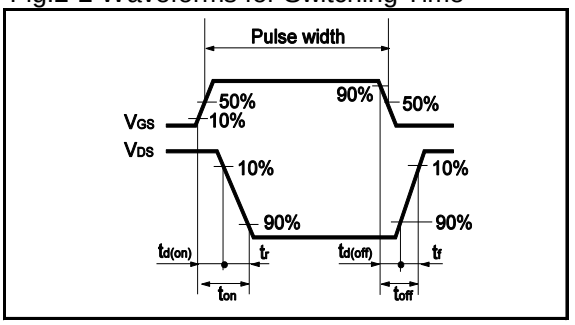



Fig.2-3 Waveforms for Switching Energy Loss

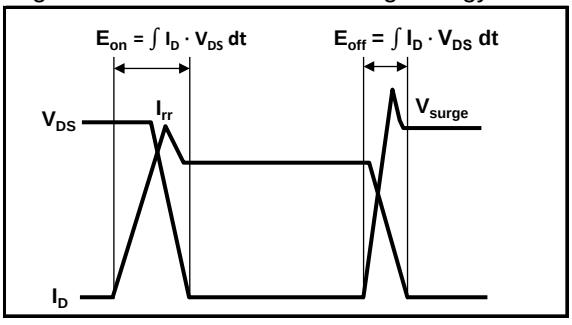



Fig.3-1 Reverse Recovery Time Measurement Circuit

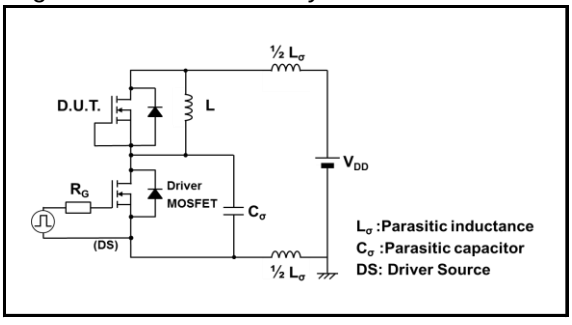
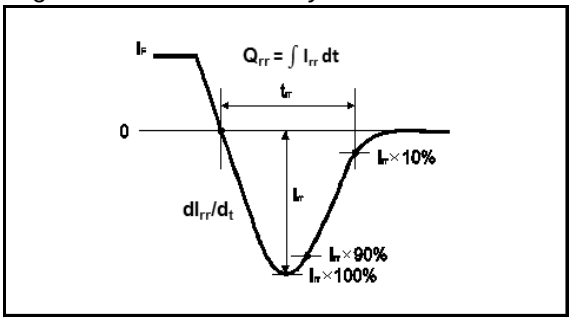



Fig.3-2 Reverse Recovery Waveform





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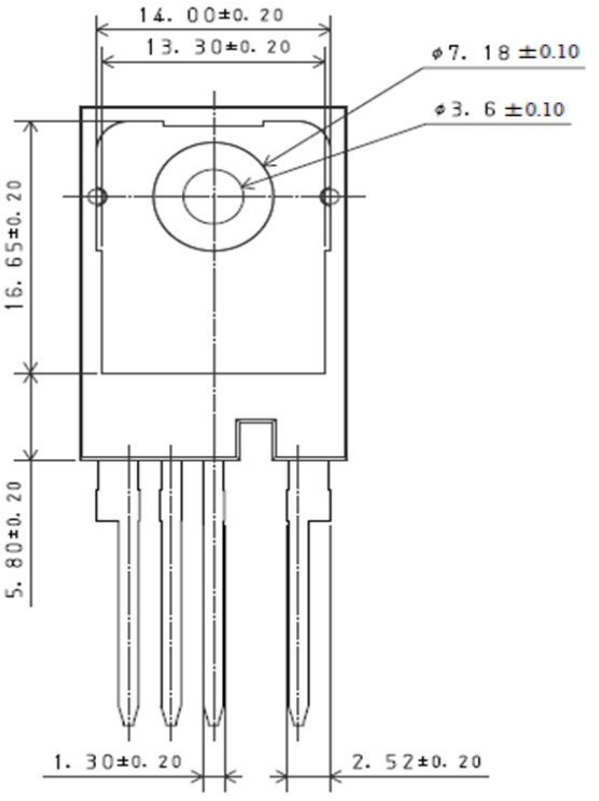


Unit: mm


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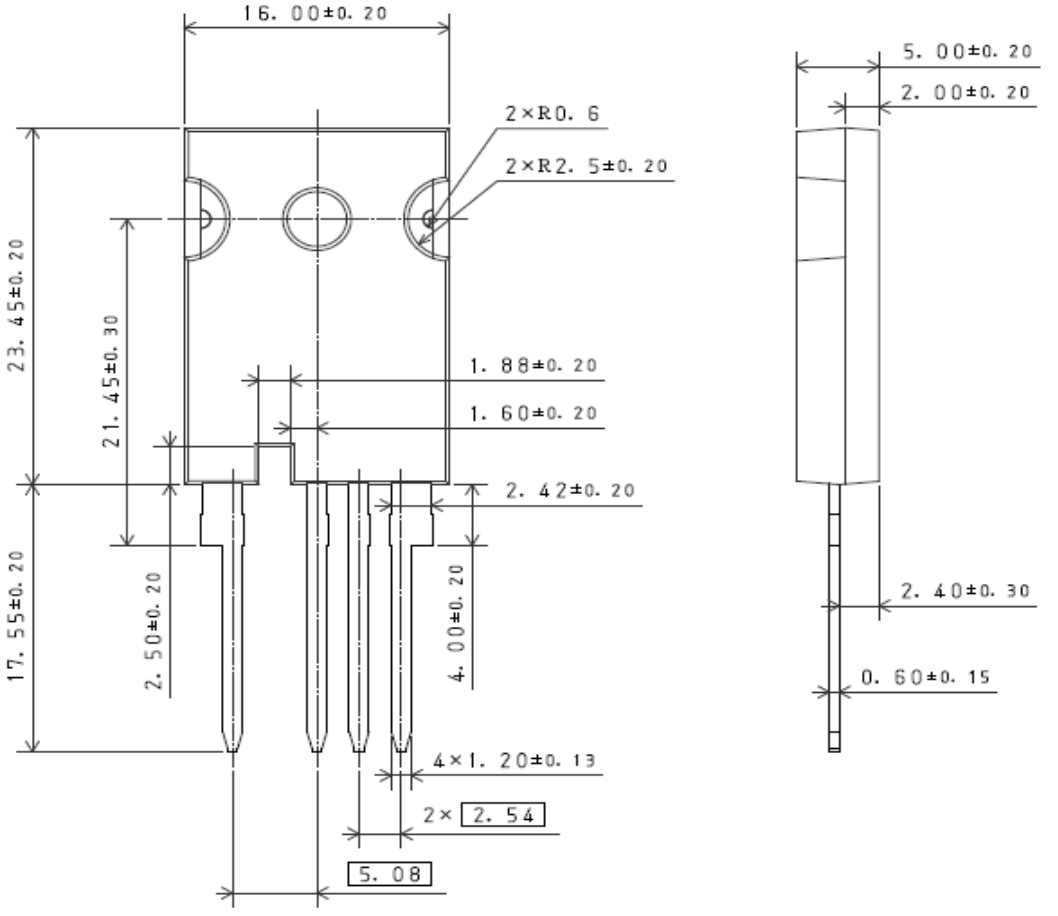
## ●Package Dimensions




Unit: mm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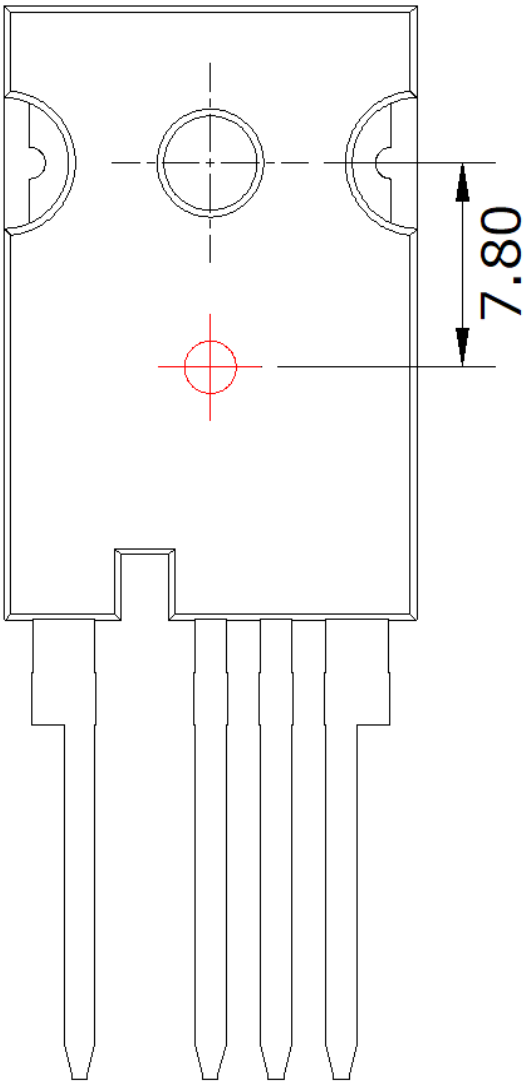
## ●Die Bonding Layout




: Die position

・Front view of the packaging.

・Dimensions are design values.

・If the heat sink is to be installed, it should be in contact with the die bonding point.

Unit: mm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ROHM SEMICONDUCTOR

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