SCT3080KR

N-channel SiC power MOSFET

V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	80mΩ
I_D [*1]	31A
P_D	165W

● **Outline**

TO-247-4L

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

● **Inner circuit**

(1) Drain
(2) Power Source
(3) Driver Source
(4) Gate

*1 Body Diode

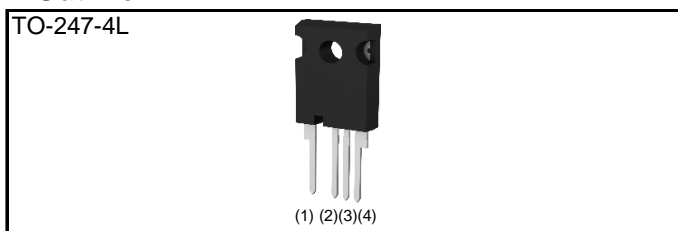Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

● **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

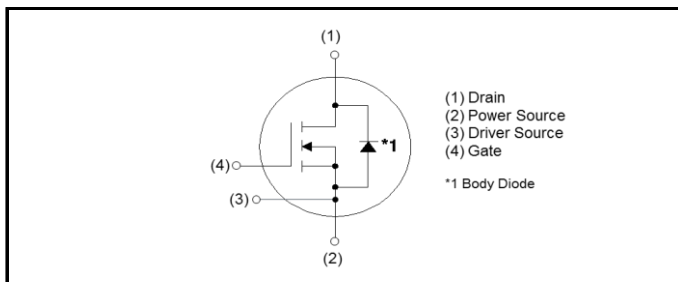● **Application**

・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	SCT3080KR

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

Parameter		Symbol	Value	Unit
Drain - Source Voltage		V_{DSS}	1200	V
Continuous Drain current	T_c = 25°C	I_D [*1]	31	A
	T_c = 100°C	I_D [*1]	22	A
Pulsed Drain current (T_c = 25°C)		$I_{D,pulse}$ [*2]	77	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				V
		T_{vj} = 25°C	1200	-	-	
		T_{vj} = -55°C	1200	-	-	
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =1200V				µA
		T_{vj} = 25°C	-	1	10	
		T_{vj} = 150°C	-	2	-	
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				mΩ
		T_{vj} = 25°C	-	80	104	
		T_{vj} = 150°C	-	136	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	12	-	Ω

●**Thermal resistance**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	0.70	0.91	K/W

●**Typical Transient Thermal Characteristics**

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	8.52×10^{-2}		C_{th1}	1.22×10^{-3}	
R_{th2}	4.15×10^{-1}	K/W	C_{th2}	6.20×10^{-3}	Ws/K
R_{th3}	2.06×10^{-1}		C_{th3}	3.49×10^{-2}	
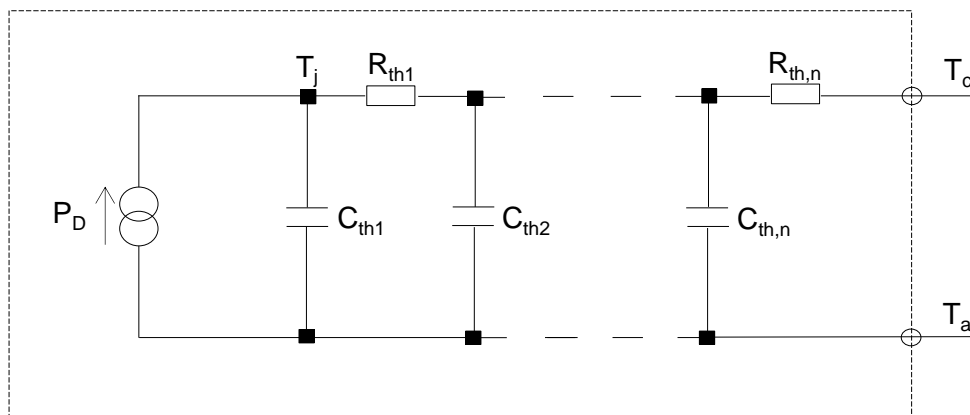
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●**Electrical characteristics** ($T_{vj} = 25°C$ unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} [*5]	$V_{DS} = 10V$, $I_D = 10A$	-	4.4	-	S
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	785	-	pF
Output capacitance	C_{oss}	$V_{DS} = 800V$	-	75	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	35	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0V$ $V_{DS} = 0V$ to 600V	-	74	-	pF
Total Gate charge	Q_g [*5]	$V_{DS} = 600V$	-	60	-	nC
Gate - Source charge	Q_{gs} [*5]	$I_D = 10A$ $V_{GS} = 18V$	-	11	-	
Gate - Drain charge	Q_{gd} [*5]	See Fig. 1-1.	-	31	-	
Turn - on delay time	$t_{d(on)}$ [*5]	$V_{DS} = 600V$	-	5	-	ns
Rise time	t_r [*5]	$I_D = 15A$ $V_{GS} = 0V/+18V$	-	14	-	
Turn - off delay time	$t_{d(off)}$ [*5]	$R_G = 0Ω$, $L = 750μH$	-	19	-	
Fall time	t_f [*5]	$L_σ = 50nH$, $C_σ = 10pF$ See Fig. 2-1, 2-2, 2-3.	-	13	-	
Turn - on switching loss	E_{on} [*5]	E_{on} includes diode reverse recovery.	-	168	-	μJ
Turn - off switching loss	E_{off} [*5]		-	21	-	

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Body diode continuous, forward current	I_S [*1]	T_c = 25°C	-	-	31	A
Body diode direct current, pulsed	I_{SM} [*2]		-	-	77	A
Forward voltage	V_{SD} [*5]	V_{GS} = 0V, I_S = 10A	-	3.2	-	V
Reverse recovery time	t_{rr} [*5]	I_F = 10A	-	17	-	ns
Reverse recovery charge	Q_{rr} [*5]	V_R = 600V di/dt = 2500A/µs	-	261	-	nC
Peak reverse recovery current	I_{rrm} [*5]	L_σ = 50nH, C_σ = 10pF See Fig. 3-1, 3-2.	-	26	-	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
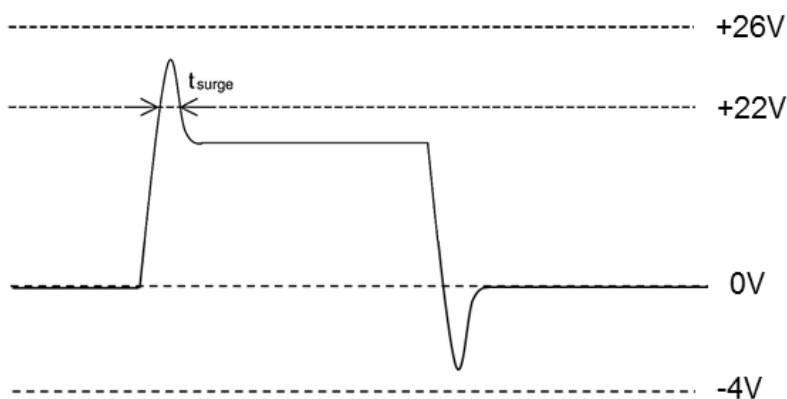
Please note especially when using driver source that V_{GSS_surge} must be in the range of absolute maximum rating.

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

*5 Pulsed

●**Electrical characteristic curves**

Fig.1 Power Dissipation Derating Curve
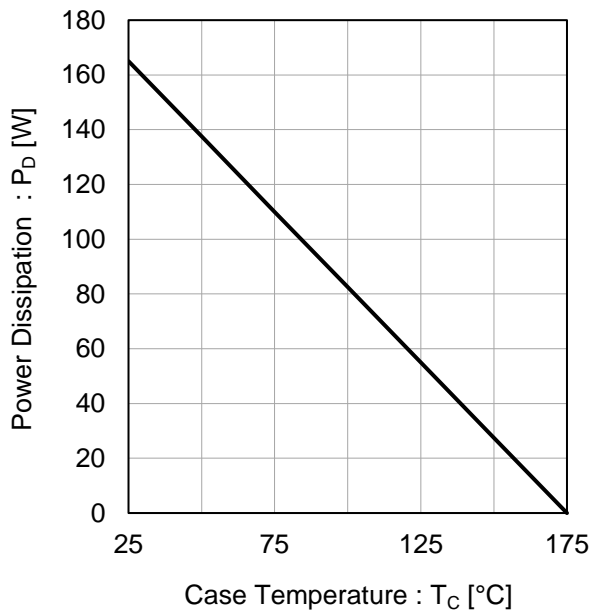
Fig.2 Maximum Safe Operating Area
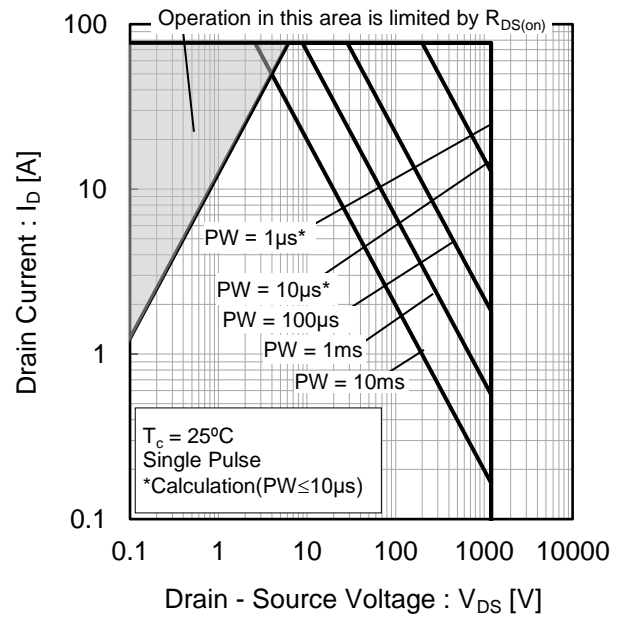
Fig.3 Typical Transient Thermal
     Impedance vs. Pulse Width
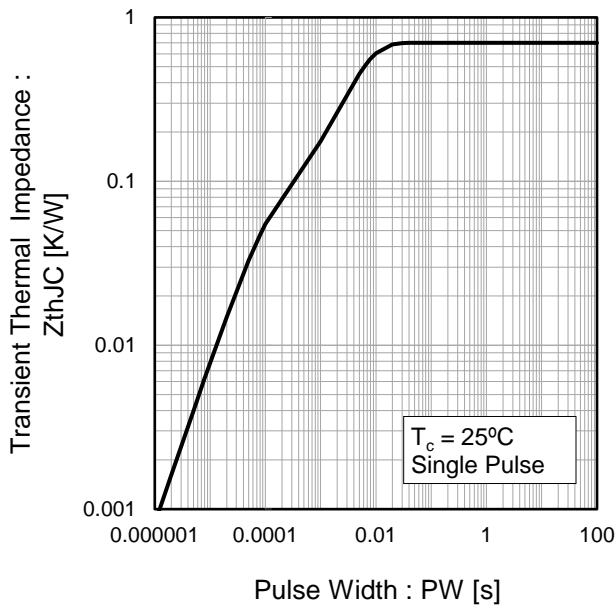
●**Electrical characteristic curves**

Fig.4 Typical Output Characteristics(I)
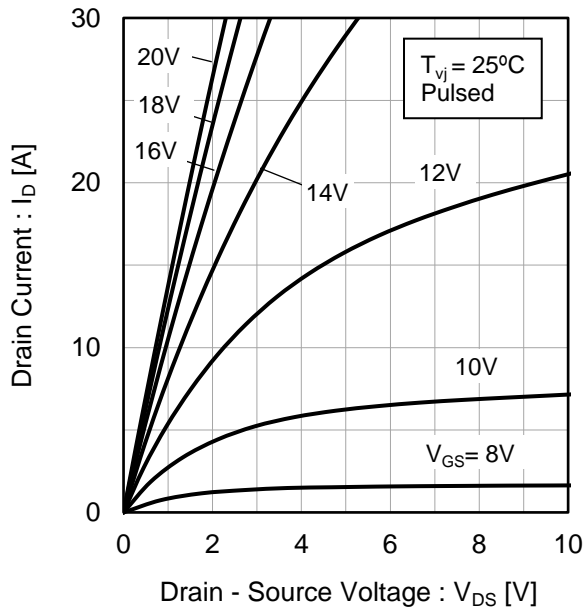
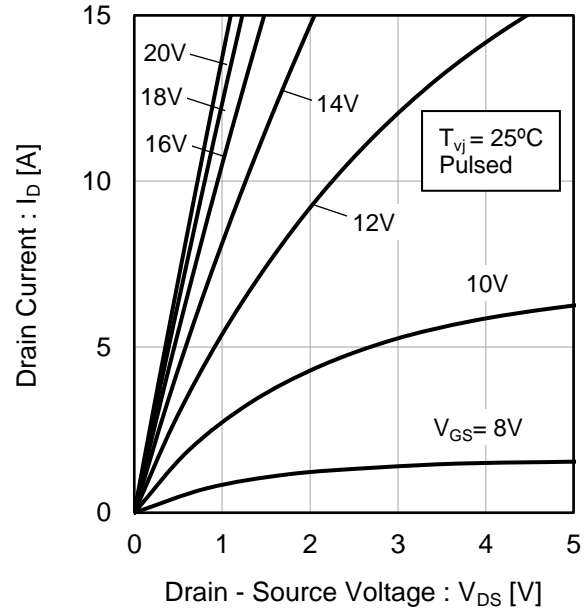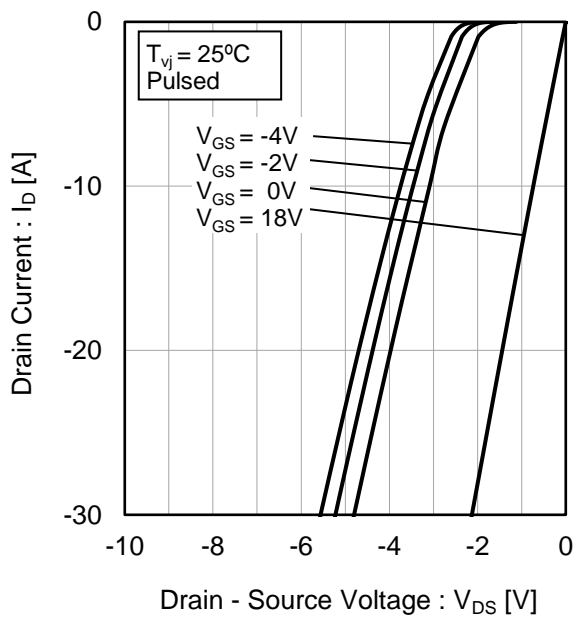Fig.5 Typical Output Characteristics(II)

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

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●**Electrical characteristic curves**

Fig.7 T_{vj} = 150ºC Typical Output
Characteristics(I)
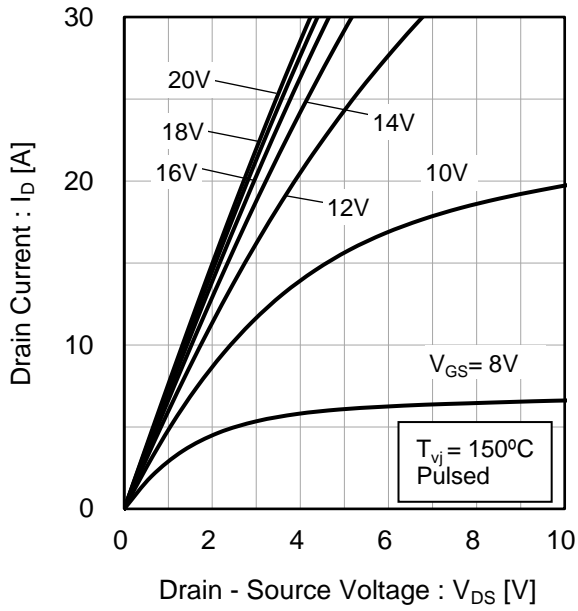
Fig.8 T_{vj} = 150ºC Typical Output
Characteristics(II)
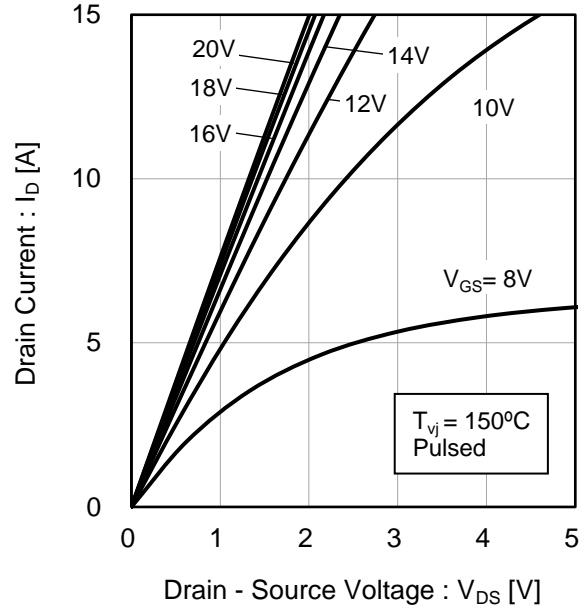
Fig.9 T_{vj} = 150ºC 3rd Quadrant Characteristics
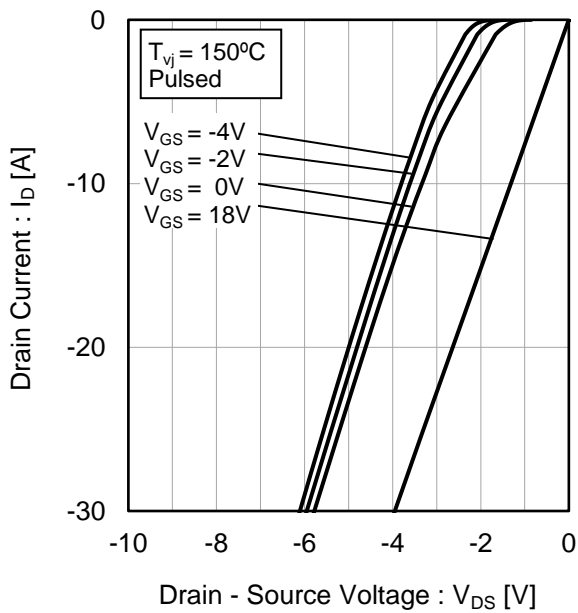
Fig.10 Body Diode Forward Voltage
vs. Gate - Source Voltage
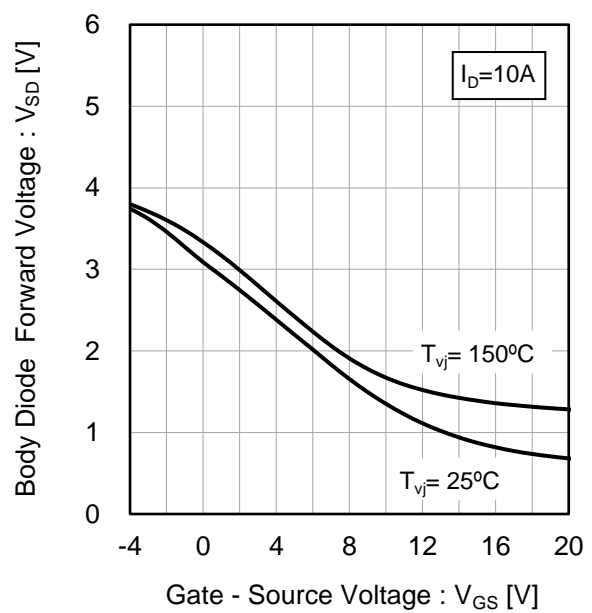
● **Electrical characteristic curves**

Fig.11 Typical Transfer Characteristics (I)
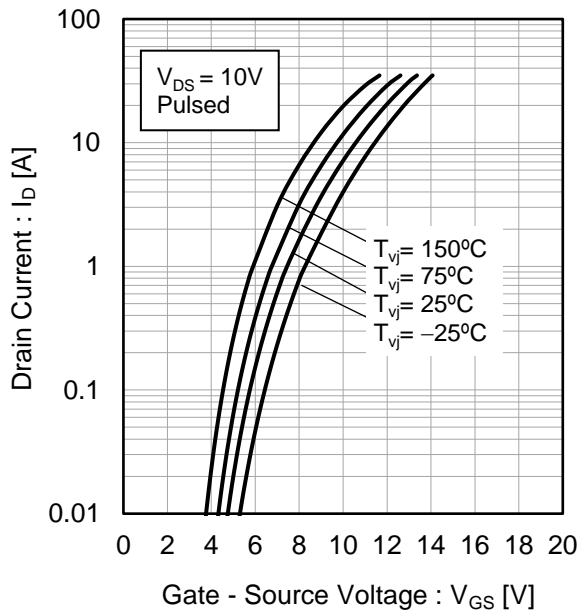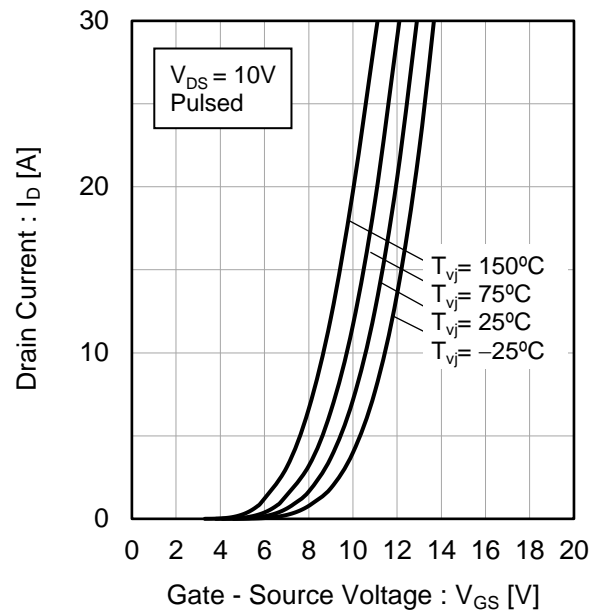

Fig.12 Typical Transfer Characteristics (II)
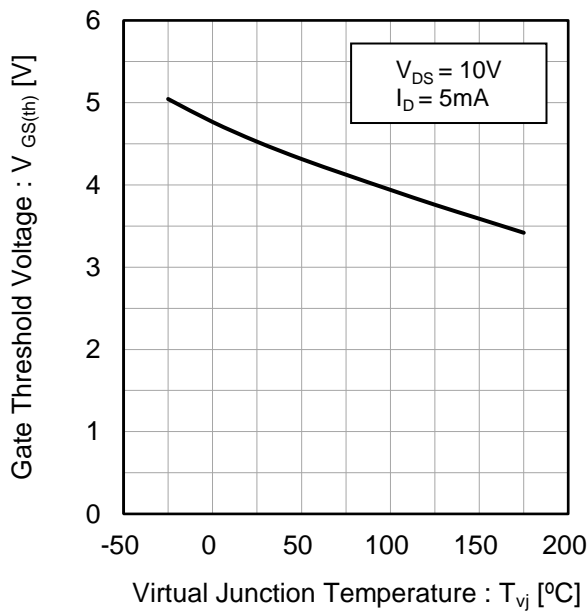

Fig.13 Gate Threshold Voltage
vs. Virtual Junction Temperature

Fig.14 Transconductance vs. Drain Current

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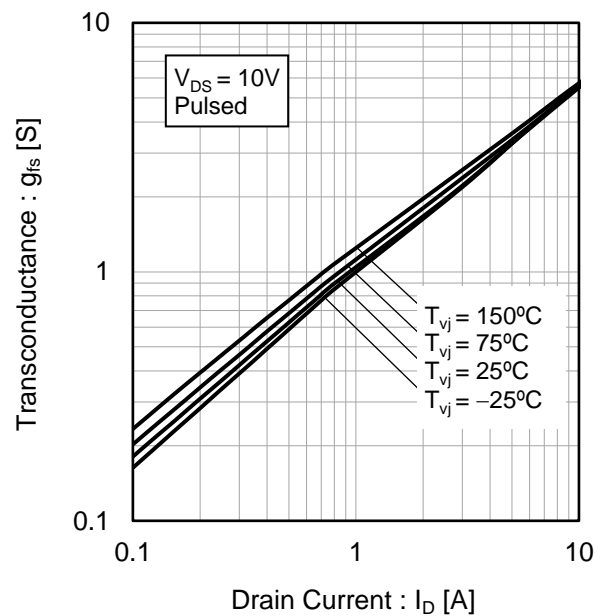
● **Electrical characteristic curves**

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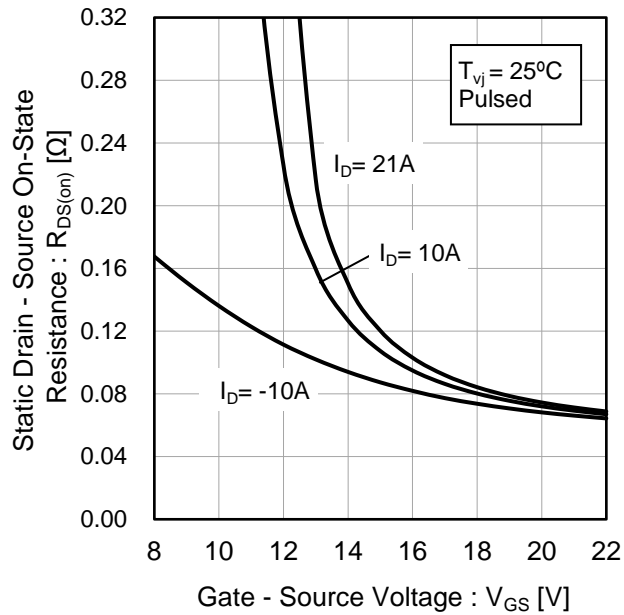

Fig.16 Static Drain - Source On - State
        Resistance vs. Virtual Junction Temperature
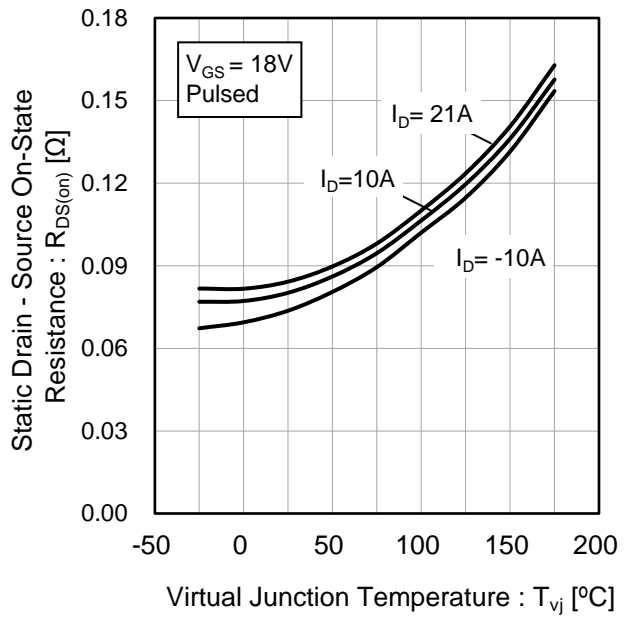

Fig.17 Static Drain - Source On - State
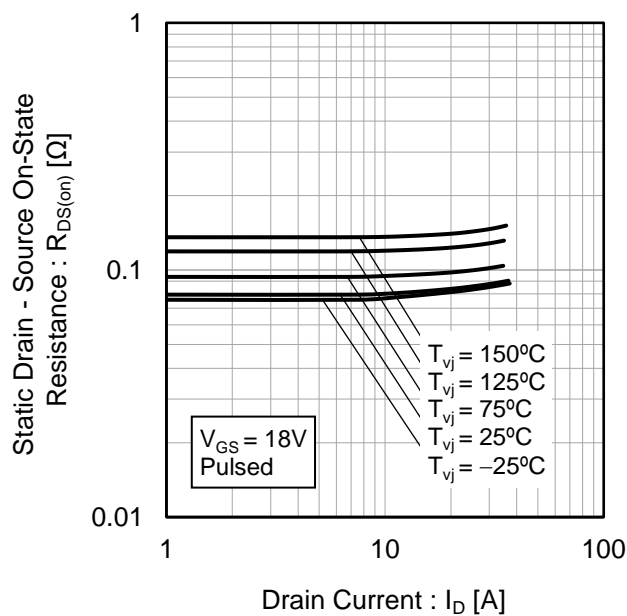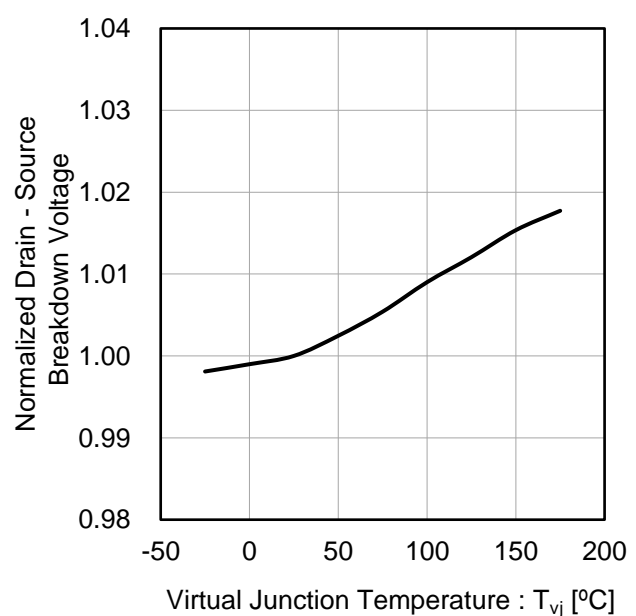   Resistance vs. Drain Current

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

● **Electrical characteristic curves**

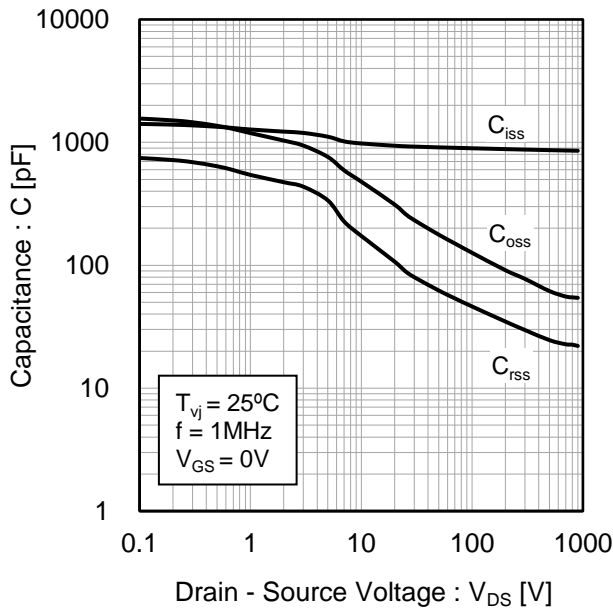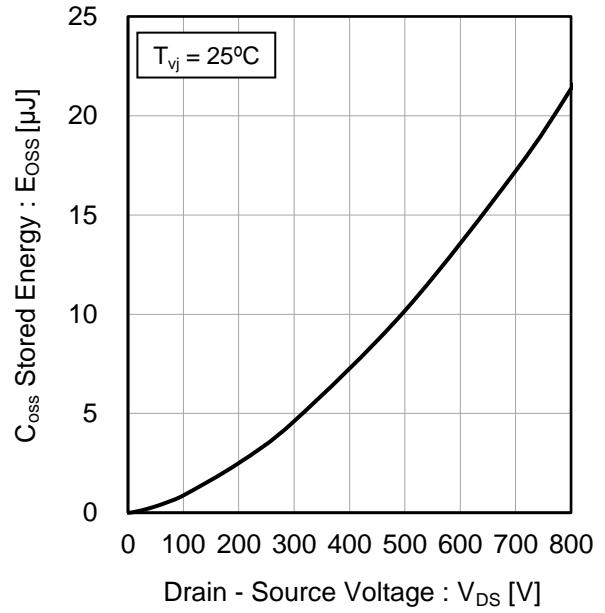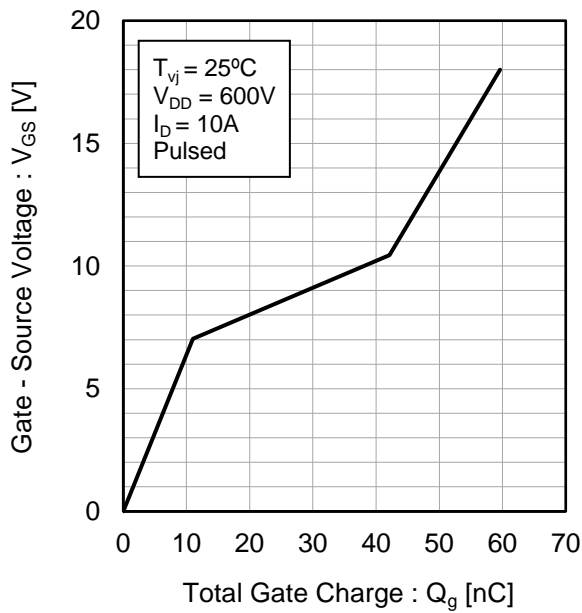Fig.19 Typical Capacitance
   vs. Drain - Source Voltage

$T_{vj} = 25ºC$
$f = 1MHz$
$V_{GS} = 0V$

Fig.20 C_{oss} Stored Energy

$T_{vj} = 25ºC$

Fig.21 Dynamic Input Characteristics

$T_{vj} = 25ºC$
$V_{DD} = 600V$
$I_D = 10A$
Pulsed

*Gate Charge Waveform

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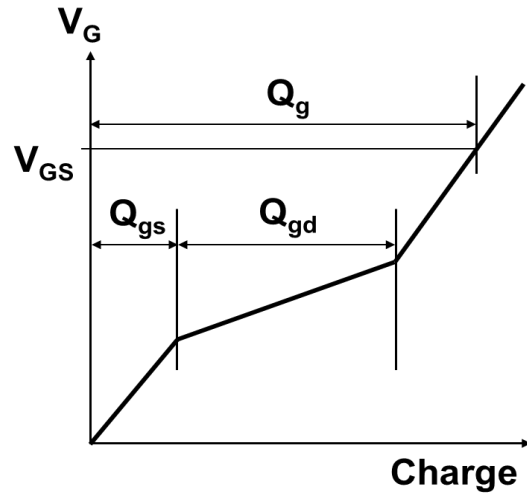
● **Electrical characteristic curves**

Fig.22 Typical Switching Time
vs. External Gate Resistance

Conditions:
$T_{vj} = 25°C$
$V_{DD} = 600V$
$V_{GS} = +18V/0V$
$I_D = 15A$
$L = 750\mu H$
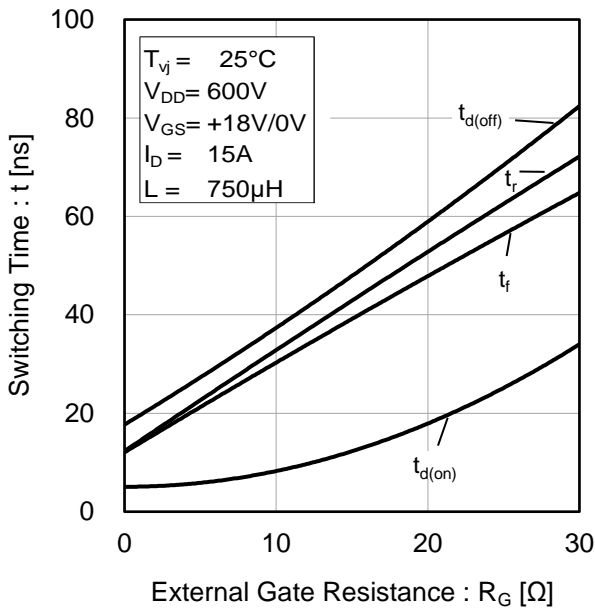
Fig.23 Typical Switching Loss
vs. Drain - Source Voltage

Conditions:
$T_{vj} = 25°C$
$I_D = 15A$
$V_{GS} = +18V/0V$
$R_G = 0\Omega$
$L = 750\mu H$
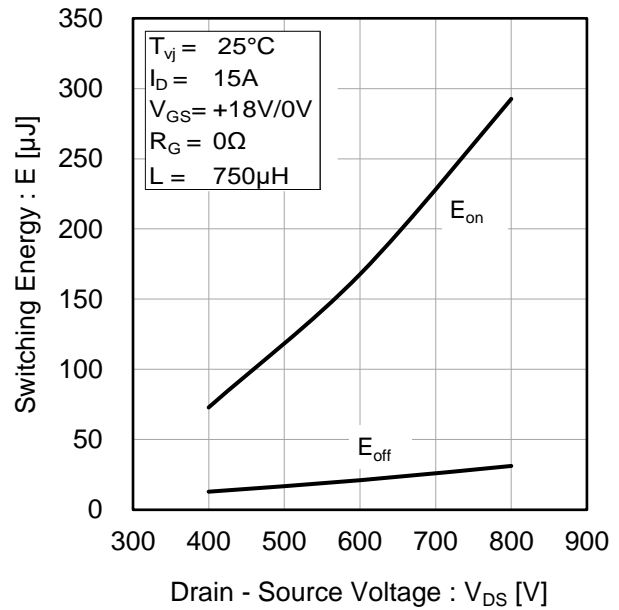
Fig.24 Typical Switching Loss
vs. Drain Current

Conditions:
$T_{vj} = 25°C$
$V_{DD} = 600V$
$V_{GS} = +18V/0V$
$R_G = 0\Omega$
$L = 750\mu H$
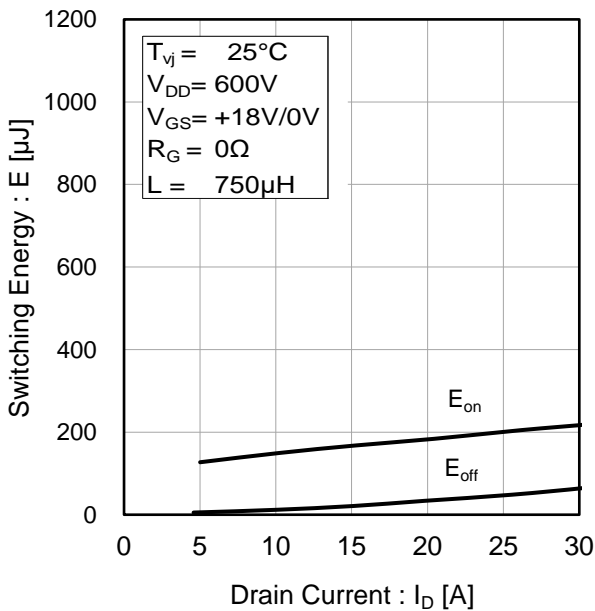
Fig.25 Typical Switching Loss
vs. External Gate Resistance

Conditions:
$T_{vj} = 25°C$
$I_D = 15A$
$V_{DD} = 600V$
$V_{GS} = +18V/0V$
$L = 750\mu H$

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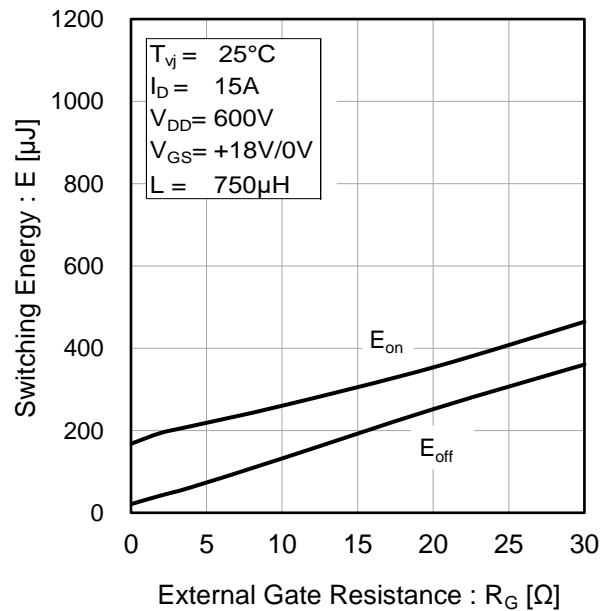
● **Measurement circuits and waveforms**
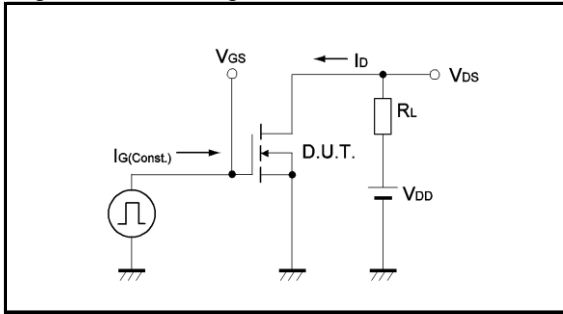
Fig.1-1 Gate Charge Measurement Circuit

Fig.2-1 Switching Characteristics Measurement Circuit
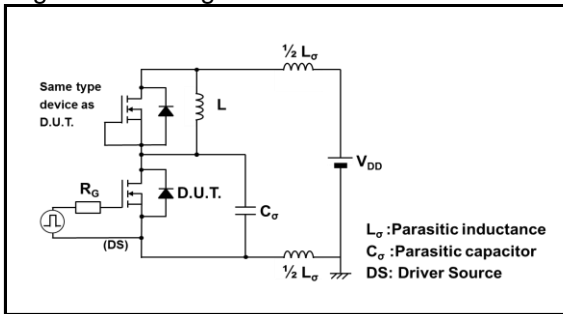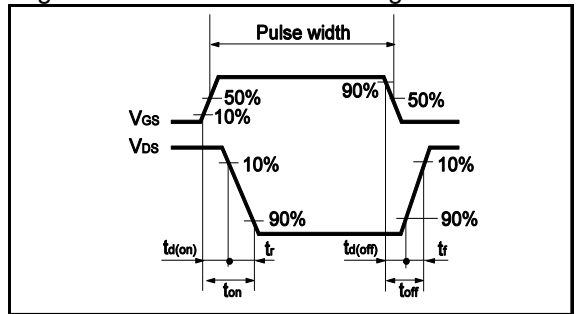

Fig.2-2 Waveforms for Switching Time

Fig.2-3 Waveforms for Switching Energy Loss
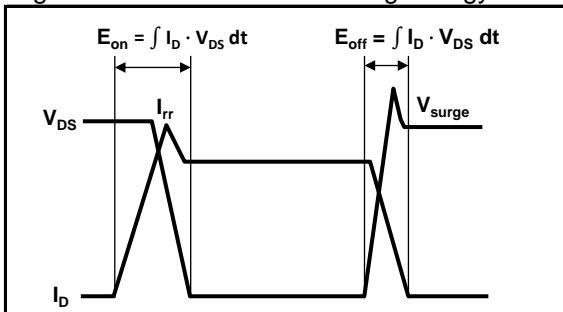
Fig.3-1 Reverse Recovery Time Measurement Circuit
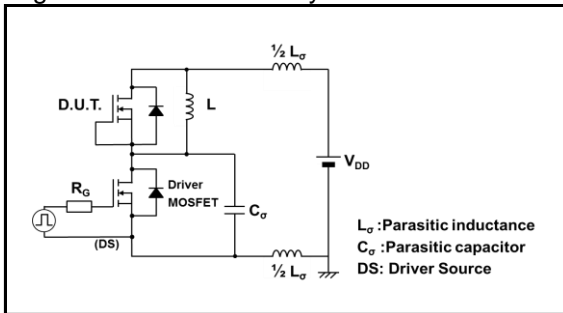
Fig.3-2 Reverse Recovery Waveform

● **Package Dimensions**

Unit: mm

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14. 00±0. 20
13. 30±0. 20
φ7. 18 ±0.10
φ3. 6 ±0.10
16. 65±0. 20
5. 80±0. 20
1. 30±0. 20
2. 52±0. 20
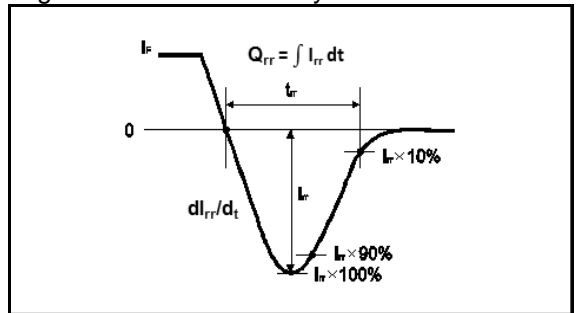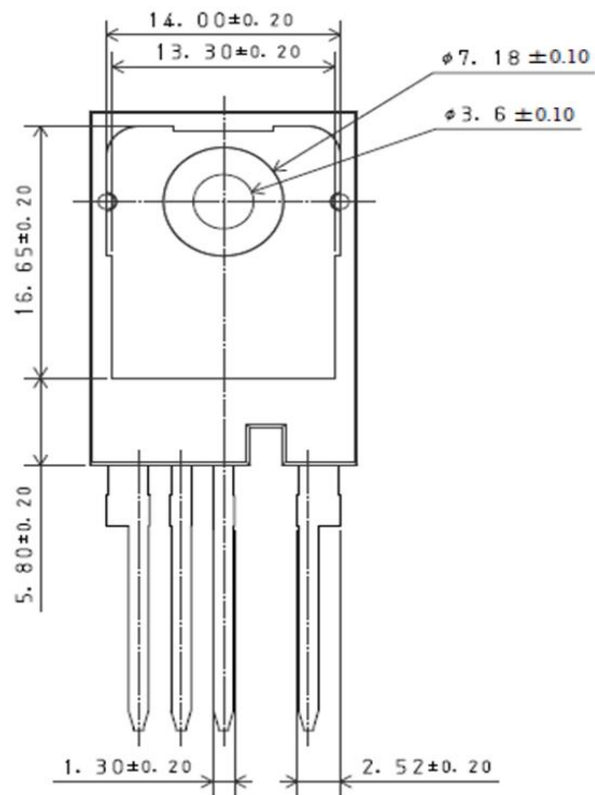
Unit: mm

●**Die Bonding Layout**

: Die position

7.80
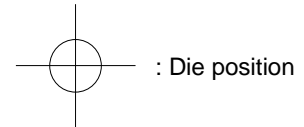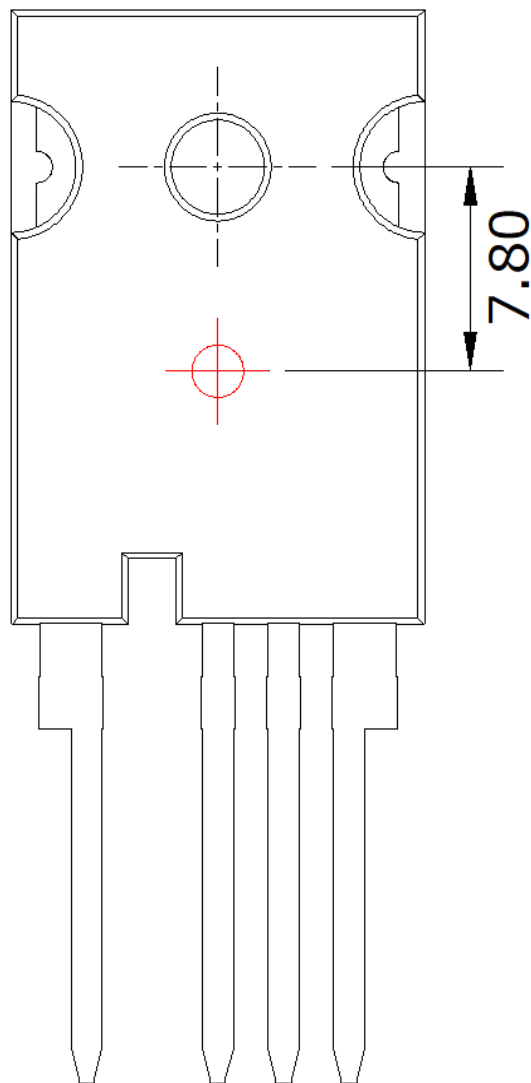
・Front view of the packaging.

・Dimensions are design values.

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

Unit: mm

Notes

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C3M0045065K E3M0120090J C3M0065090J-TR C3M0120100J C3M0075120J DMWS120H100SM4 DMWSH120H28SM4
DMWSH120H90SM4 DMWSH120H90SM4Q DMWSH120H28SM4Q DMWSH120H90SCT7Q DMWSH120H28SM3
DMWSH120H43SM3 DMWSH120H90SM3 DMWSH120H28SM3Q DMWSH120H90SM3Q DIF120SIC053-AQ DIW120SIC059-AQ
G2R1000MT17D G3R60MT07K G2R50MT33K G3R12MT12K G3R160MT12D G3R160MT12J-TR G3R160MT17D G3R160MT17J-TR
G3R20MT12K G3R20MT12N G3R20MT17K G3R20MT17N G3R30MT12J-TR G3R30MT12K G3R350MT12D G3R40MT12D
G3R40MT12J