

# SCT4036KRHR



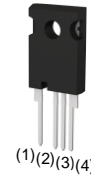
## Automotive Grade N-channel SiC power MOSFET

Datasheet

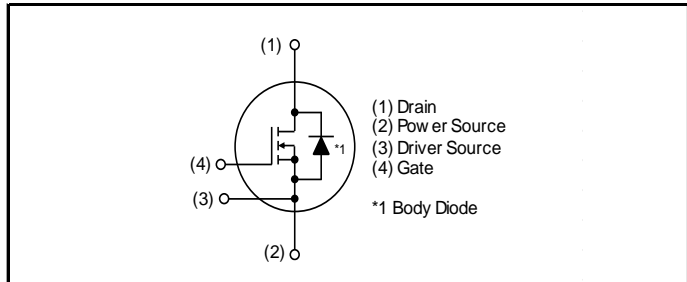
$V_{DSS}$	1200V
$R_{DS(on)}$ (Typ.)	36m $\Omega$
$I_D^{*1}$	43A
$P_D$	176W

### ● Outline

TO-247-4L



### ● Inner circuit



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

### ● Features

- 1) Qualified to AEC-Q101
- 2) Low on-resistance
- 3) Fast switching speed
- 4) Fast reverse recovery
- 5) Easy to parallel
- 6) Simple to drive
- 7) Pb-free lead plating ; RoHS compliant

### ● Application

- Automobile
- Switch mode power supplies

### ● Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Taping code	C15
	Marking	SCT4036KR

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

Parameter	Symbol	Value	Unit	
Drain - source voltage	$V_{DSS}$	1200	V	
Continuous drain and source current $T_c = 100^\circ\text{C}$	$V_{GS} = V_{GS\_on}$	$I_D, I_S^{*1}$	43	A
			30	A
Pulsed drain current	$V_{GS} = V_{GS\_on}$	$I_{D,pulse}^{*2}$	84	A
Body diode pulsed forward current	$V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*3}$	43	A
Body diode surge forward current	$V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*4}$	84	A
Gate - source voltage (DC)	$V_{GSS\_DC}$	-4 to +21	V	
Gate - source surge voltage ( $t_{surge} < 300\text{ns}$ )	$V_{GSS\_surge}^{*5}$	-4 to +23	V	
Recommended turn-on gate - source drive voltage	$V_{GS\_on}^{*6}$	+15 to +18	V	
Recommended turn-off gate - source drive voltage	$V_{GS\_off}$	0	V	
Virtual junction temperature	$T_{vj}$	175	$^\circ\text{C}$	
Range of storage temperature	$T_{stg}$	-40 to +175	$^\circ\text{C}$	

**●Electrical characteristics** ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)

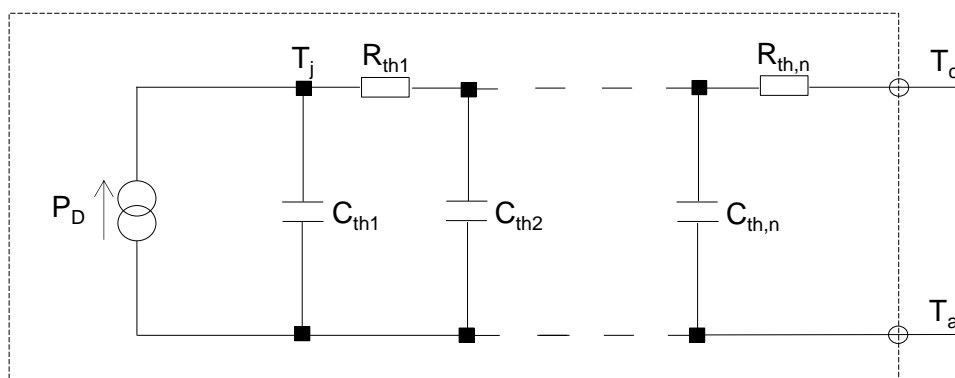
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 9.2\text{mA}$ $T_{vj} = 25^{\circ}\text{C}$	1200	-	-	V
Zero Gate voltage Drain current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	1 10	80 -	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS+}$	$V_{GS} = +21\text{ V}, V_{DS} = 0\text{V}$	-	-	100	nA
Gate - Source leakage current	$I_{GSS-}$	$V_{GS} = -4\text{ V}, V_{DS} = 0\text{V}$	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}^{*7}$	$V_{DS} = 10\text{V}, I_D = 11.1\text{mA}$	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}^{*8}$	$V_{GS} = 18\text{V}, I_D = 21\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	36 72	47 -	m $\Omega$
Gate input resistance	$R_G$	$f = 1\text{MHz}, \text{open drain}$	-	1	-	$\Omega$

**●Thermal resistance**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	$R_{thJC}^{*9}$	-	0.65	0.85	K/W

**●Typical Transient Thermal Characteristics**

Symbol	Value	Unit	Symbol	Value	Unit
$R_{th1}$	$1.1 \times 10^{-1}$	K/W	$C_{th1}$	$5.8 \times 10^{-4}$	Ws/K
$R_{th2}$	$2.5 \times 10^{-1}$		$C_{th2}$	$2.3 \times 10^{-3}$	
$R_{th3}$	$2.9 \times 10^{-1}$		$C_{th3}$	$1.1 \times 10^{-2}$	



●Electrical characteristics ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	$g_{fs}^{*8}$	$V_{DS} = 10\text{V}, I_D = 21\text{A}$	-	11	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$	-	2335	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 800\text{V}$	-	70	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	5	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 800\text{V}$	-	84	-	pF
Total Gate charge	$Q_g^{*8}$	$V_{DS} = 800\text{V}$ $I_D = 21\text{A}$	-	91	-	nC
Gate - Source charge	$Q_{gs}^{*8}$	$V_{GS} = 18\text{V}$	-	20	-	
Gate - Drain charge	$Q_{gd}^{*8}$	See Fig. 1-1, 1-2.	-	24	-	
Turn - on delay time	$t_{d(on)}^{*8}$	$V_{DS} = 800\text{V}$ $I_D = 21\text{A}$	-	8.1	-	ns
Rise time	$t_r^{*8}$	$V_{GS} = +18\text{V} / 0\text{V}$	-	15	-	
Turn - off delay time	$t_{d(off)}^{*8}$	$R_G = 3.3\Omega, L = 250\mu\text{H}$ $E_{on}$ includes diode	-	29	-	
Fall time	$t_f^{*8}$	reverse recovery $L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$	-	9.6	-	
Turn - on switching loss	$E_{on}^{*8}$	See Fig. 2-1, 2-2, 2-3.	-	239	-	$\mu\text{J}$
Turn - off switching loss	$E_{off}^{*8}$		-	26	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_{SD}^{*8}$	$V_{GS} = 0\text{V}, I_D = 21\text{A}$	-	3.3	-	V
Reverse recovery time	$t_{rr}^{*8}$	$I_F = 21\text{A}$ $V_R = 800\text{V}$	-	9.2	-	ns
Reverse recovery charge	$Q_{rr}^{*8}$	$di/dt = 3700\text{A}/\mu\text{s}$	-	140	-	nC
Peak reverse recovery current	$I_{rrm}^{*8}$	$L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ See Fig. 3-1, 3-2.	-	31	-	A

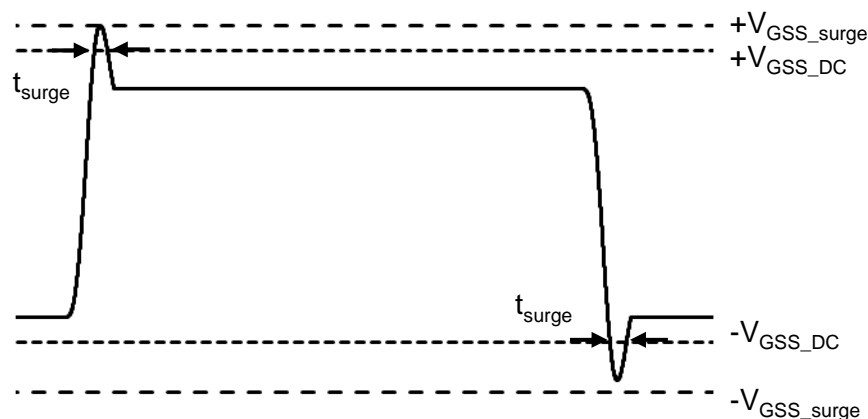
\*1 Limited by maximum  $T_{vj}$  and for Max.  $R_{thJC}$ .

\*2  $PW \leq 10\mu\text{s}$ , Duty cycle  $\leq 1\%$

\*3 Only for body-diode, Repetitive pulse,  $PW \leq 500\text{ns}$ , Duty cycle  $\leq 5\%$

\*4 When used as a protective function,  $PW \leq 10\mu\text{s}$

\*5 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.

\*6 Please be advised not to use SiC-MOSFETs with  $V_{GS}$  below 10V as doing so may cause thermal runaway.

\*7 Tested after applying  $V_{GS} = 21\text{V}$  for 100ms.

\*8 Pulsed

\*9 Measured conformable to JESD51-14.

See the application note "rthjc\_measurement\_and\_usage\_an-e.pdf". [Link](#)

URL: [https://fscdn.rohm.com/en/products/databook/applinote/discrete/common/rthjc\\_measurement\\_and\\_usage\\_an-e.pdf](https://fscdn.rohm.com/en/products/databook/applinote/discrete/common/rthjc_measurement_and_usage_an-e.pdf)

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

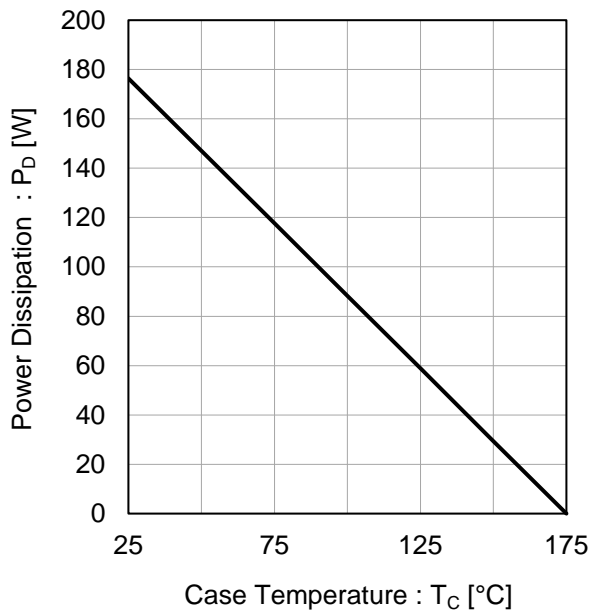


Fig.2 Maximum Safe Operating Area

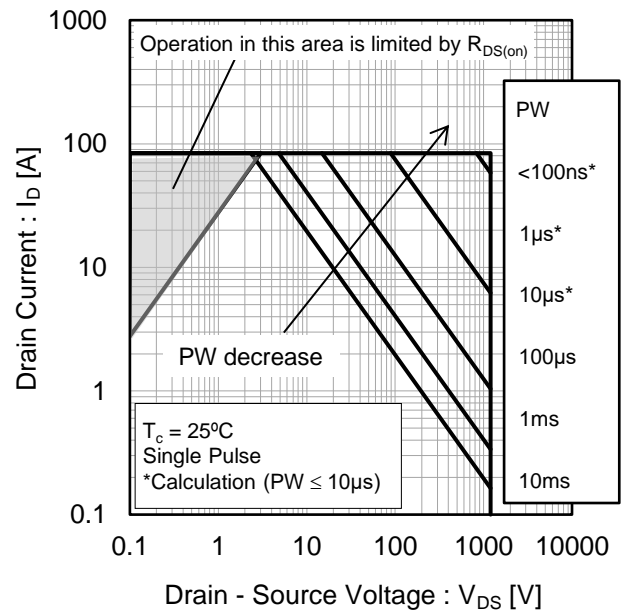
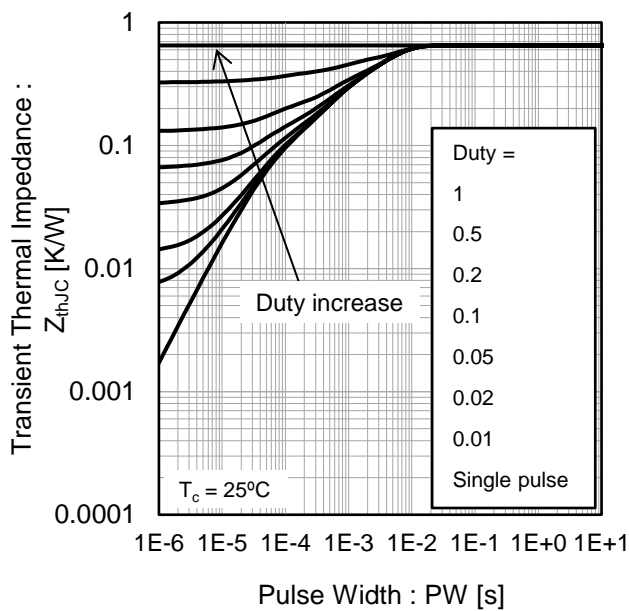


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

Fig.4  $T_{vj} = 25^{\circ}\text{C}$  Typical Output Characteristics(I)

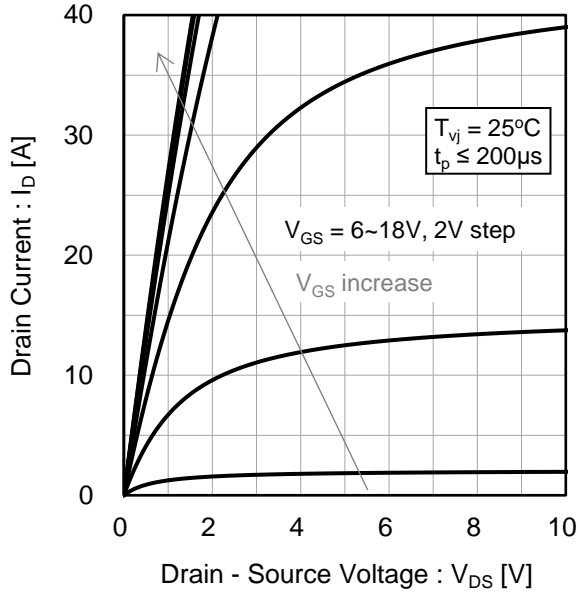


Fig.5  $T_{vj} = 25^{\circ}\text{C}$  Typical Output Characteristics(II)

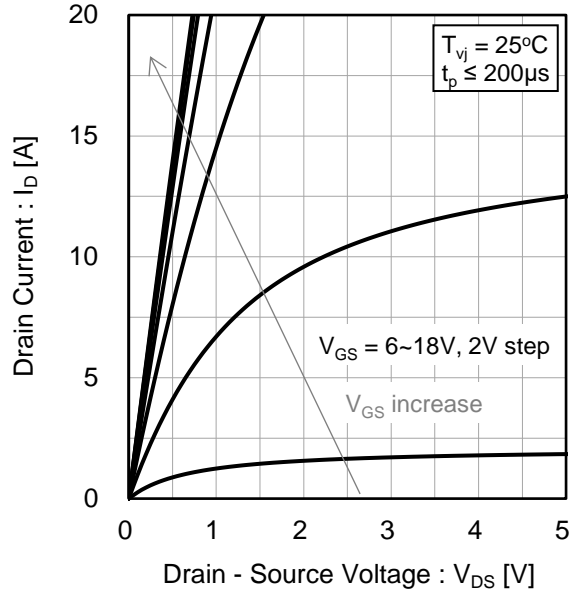
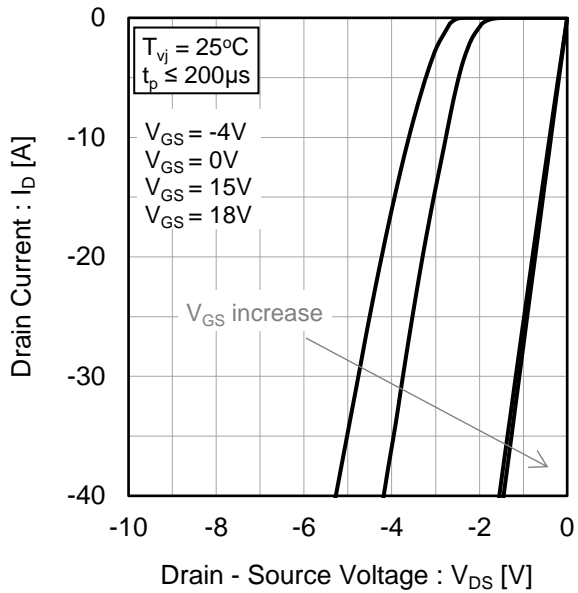


Fig.6  $T_{vj} = 25^{\circ}\text{C}$  3rd Quadrant Characteristics



●Electrical characteristic curves

Fig.7  $T_{vj} = 150^{\circ}\text{C}$  Typical Output Characteristics(I)

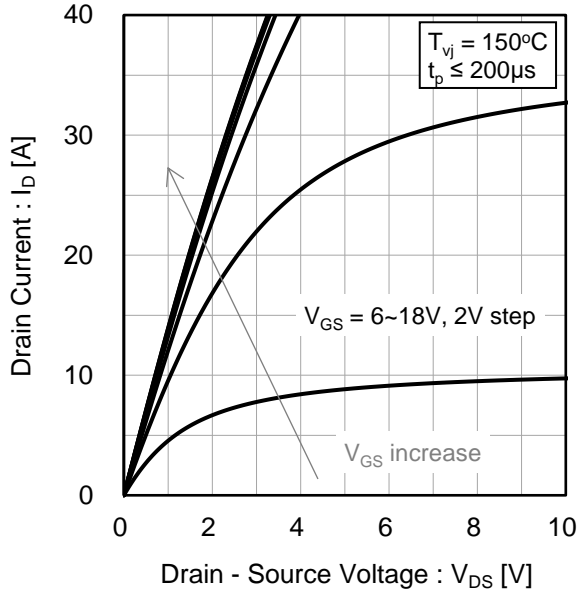


Fig.8  $T_{vj} = 150^{\circ}\text{C}$  Typical Output Characteristics(II)

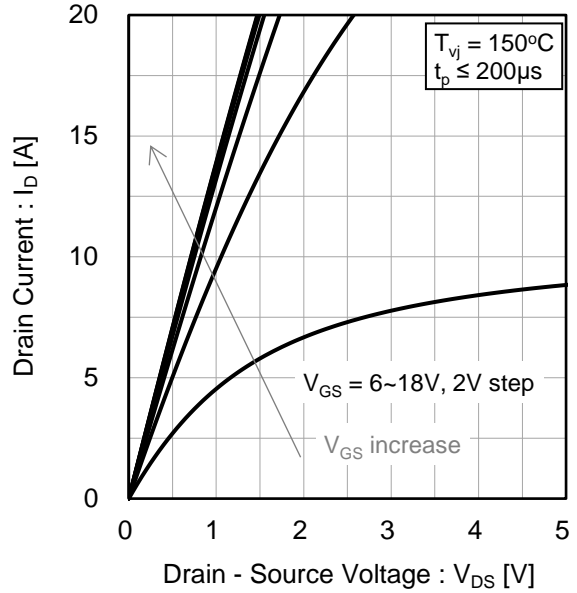


Fig.9  $T_{vj} = 150^{\circ}\text{C}$  3rd Quadrant Characteristics

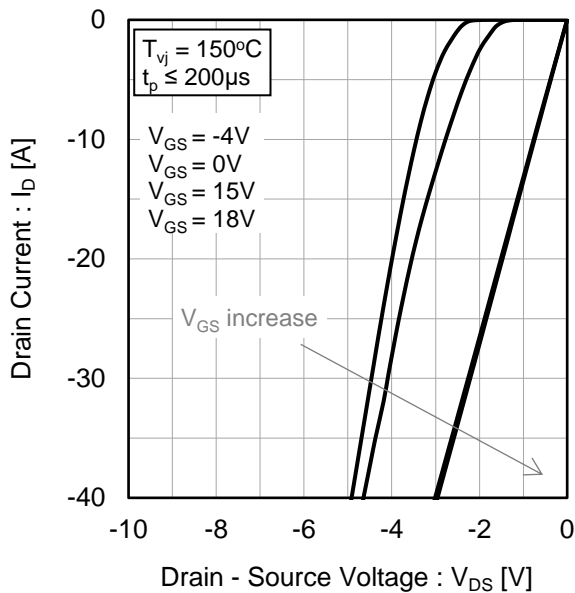
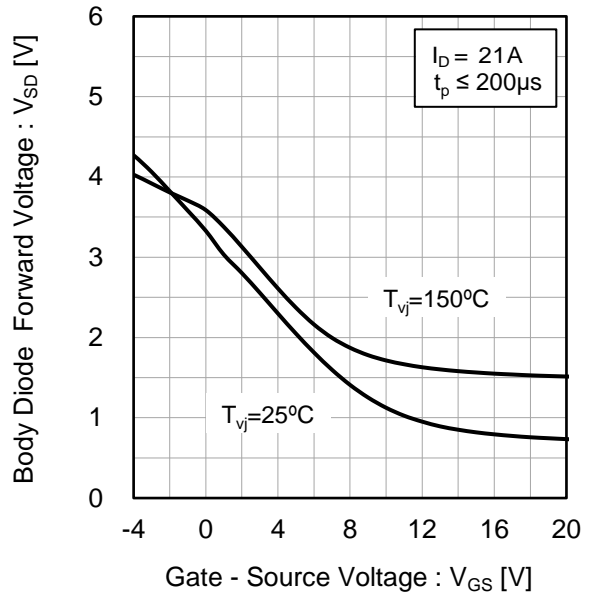


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

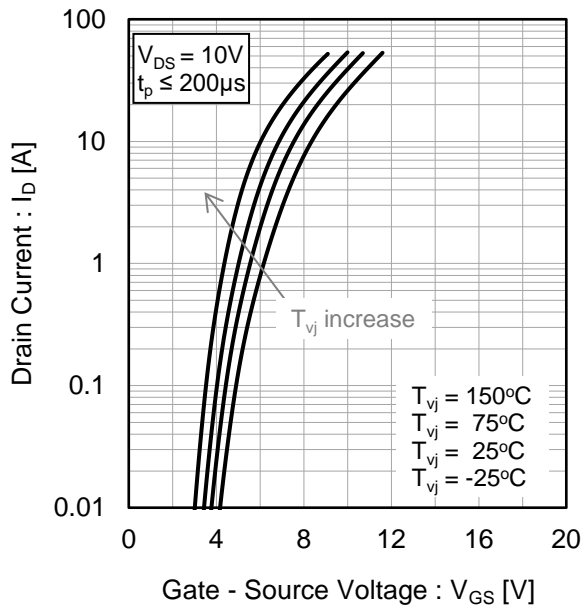


Fig.12 Typical Transfer Characteristics (II)

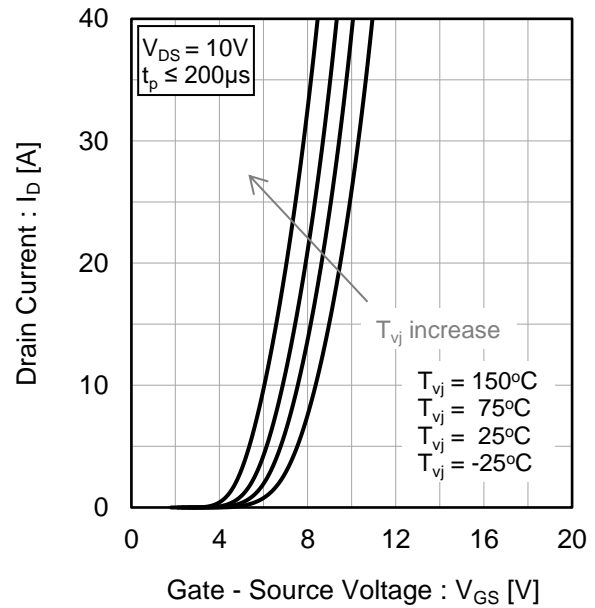


Fig.13 Gate Threshold Voltage vs. Virtual Junction Temperature

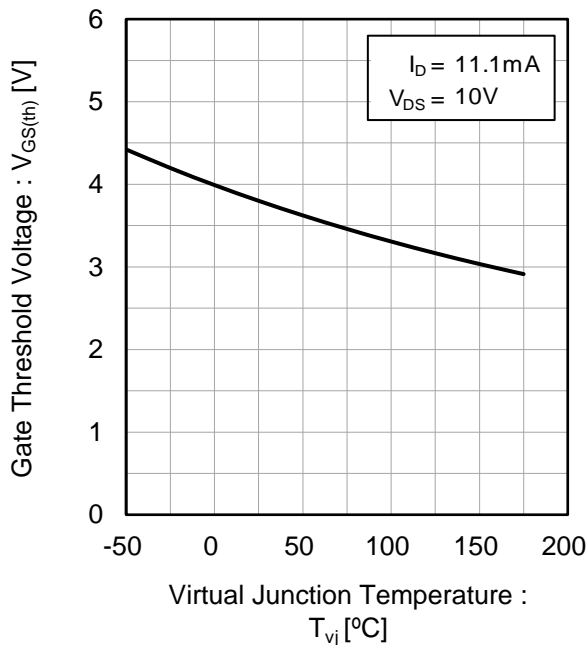
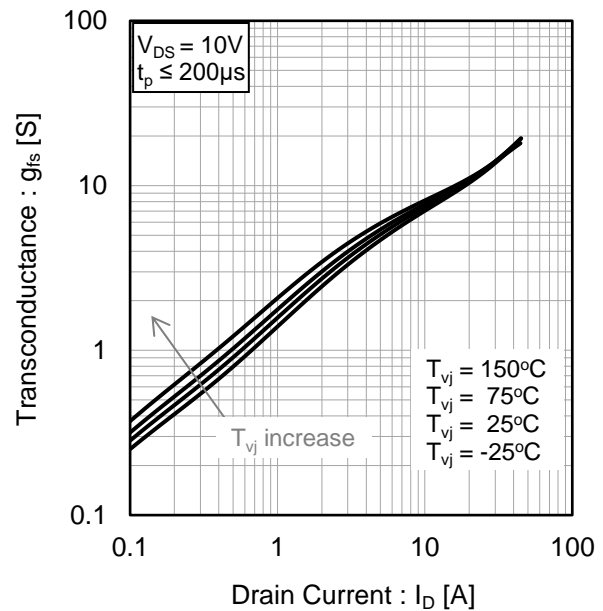


Fig.14 Transconductance vs. Drain Current





●Electrical characteristic curves

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

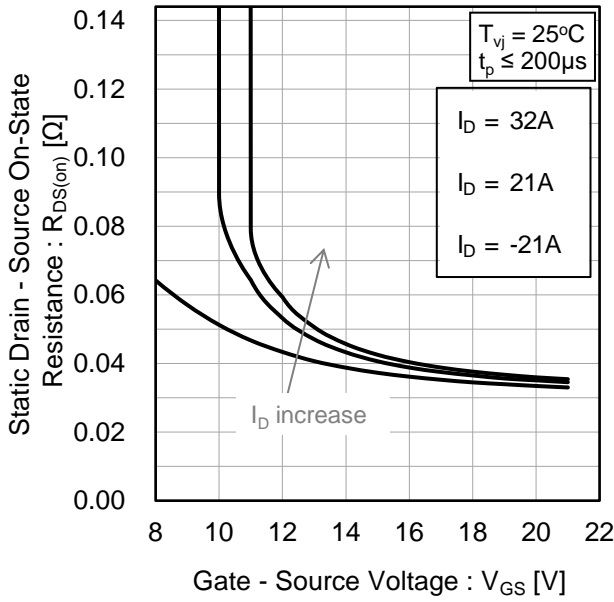


Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

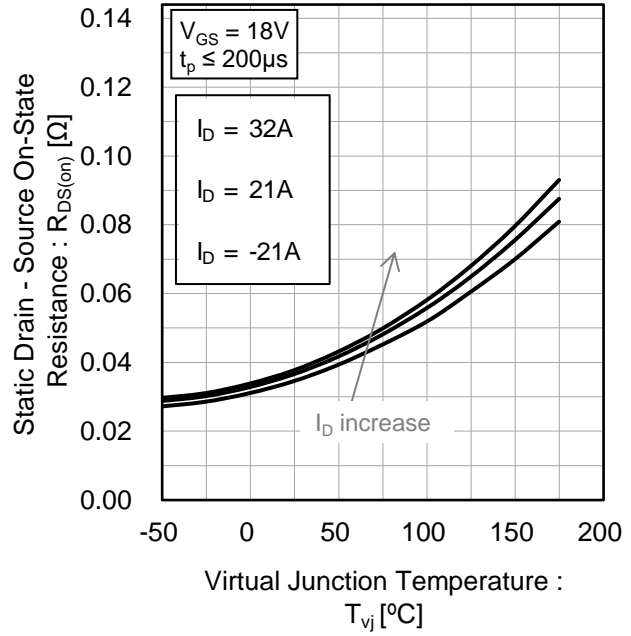


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

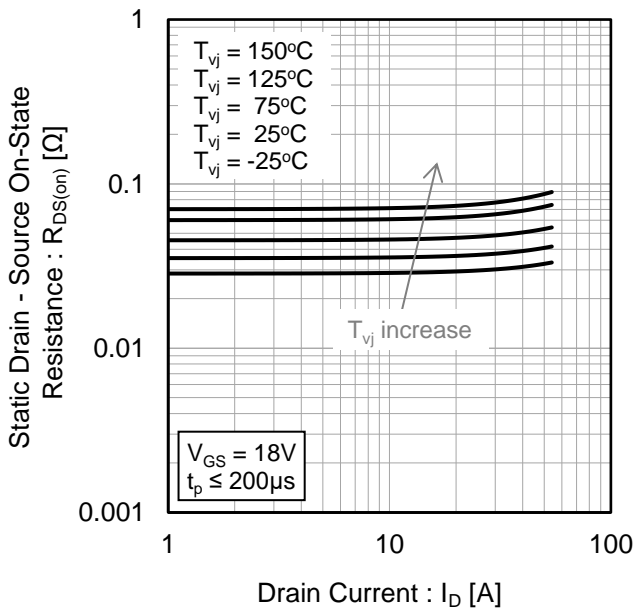
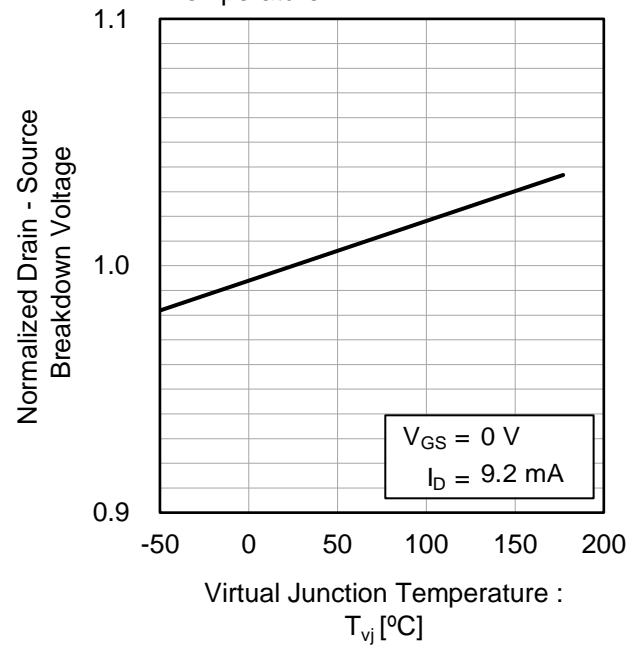


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

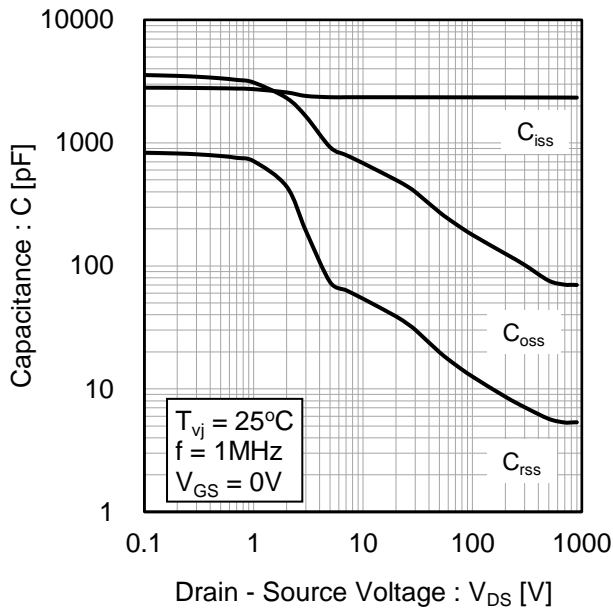


Fig.20  $C_{oss}$  Stored Energy

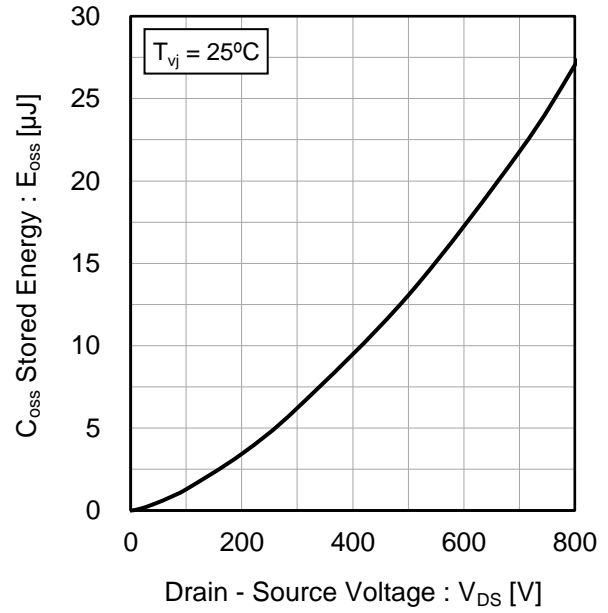
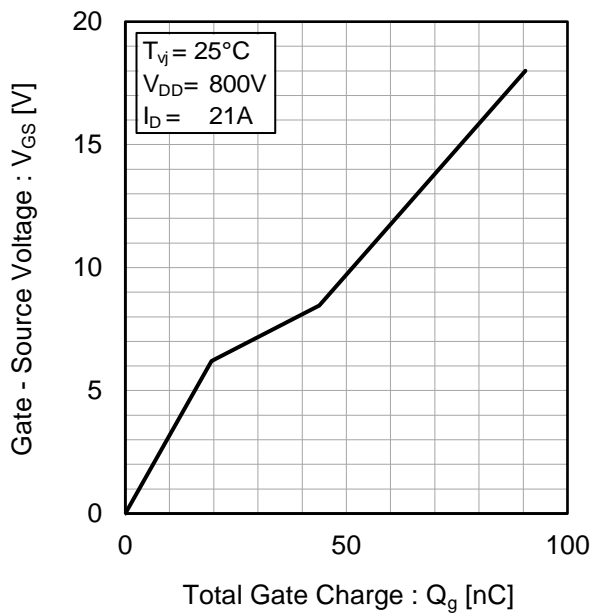


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

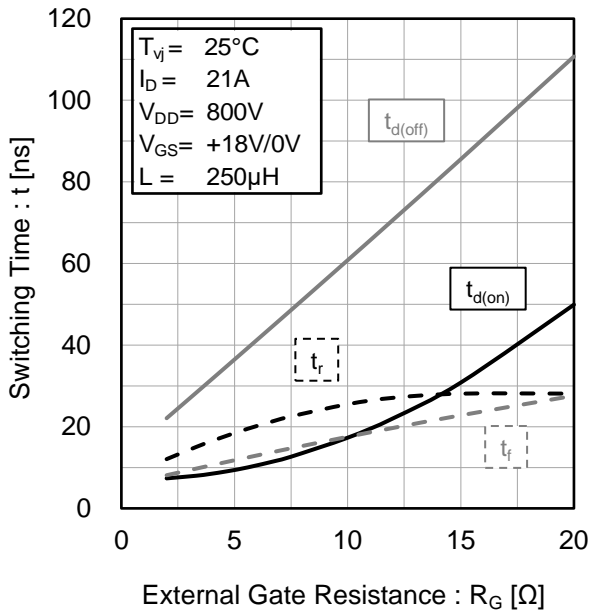


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

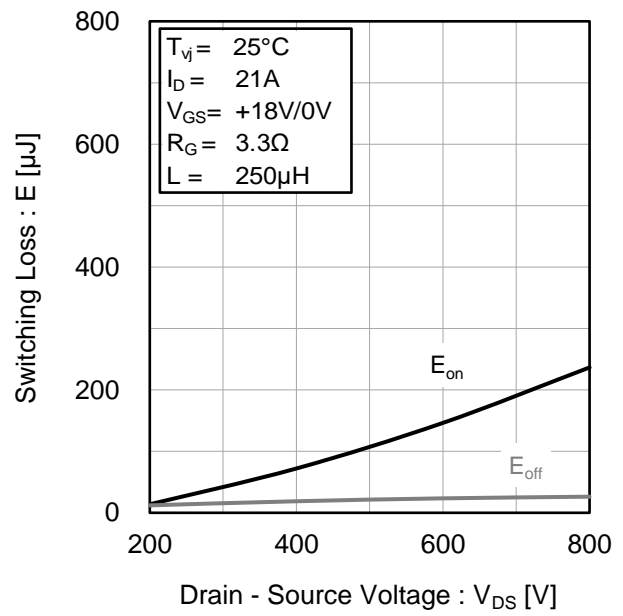


Fig.24 Typical Switching Loss vs. Drain Current

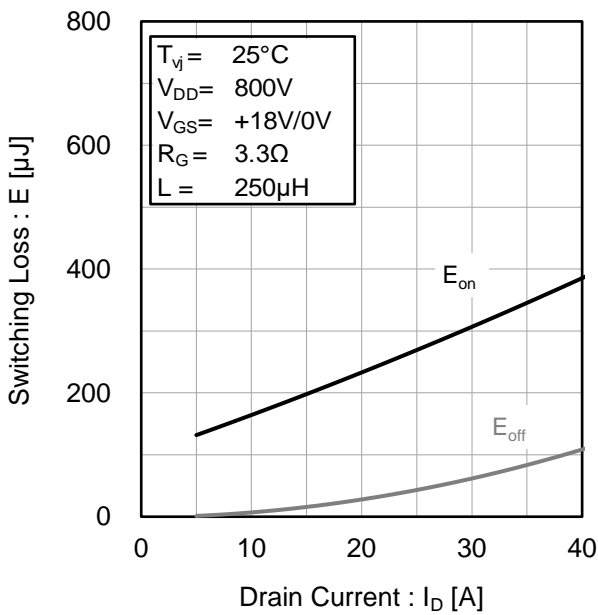
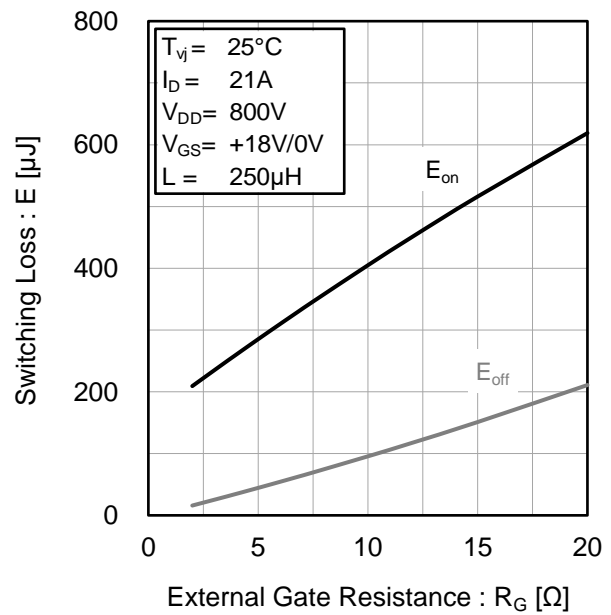


Fig.25 Typical Switching Loss vs. External Gate Resistance



● Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

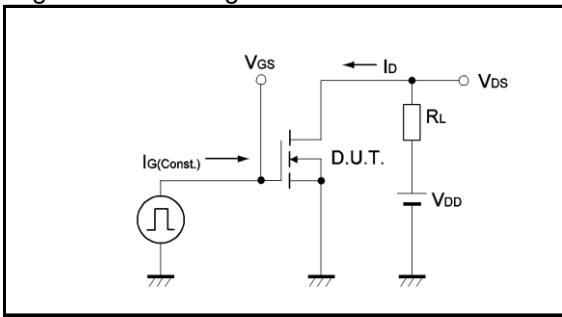


Fig.1-2 Gate Charge Waveform

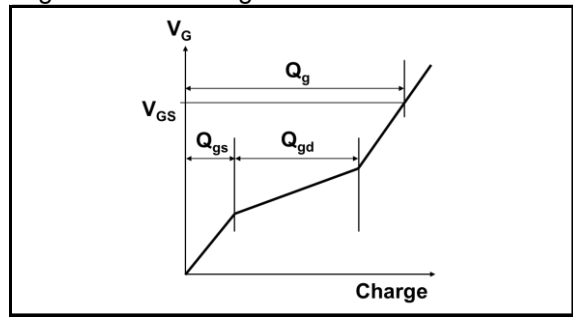


Fig.2-1 Switching Characteristics Measurement Circuit

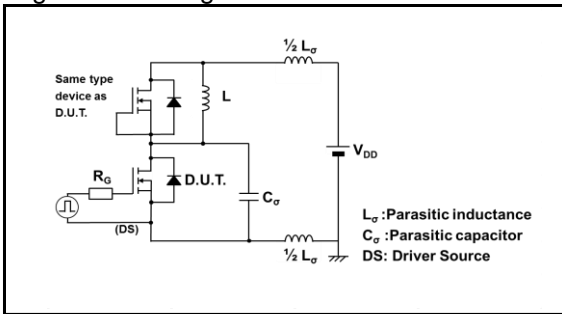


Fig.2-2 Waveforms for Switching Time

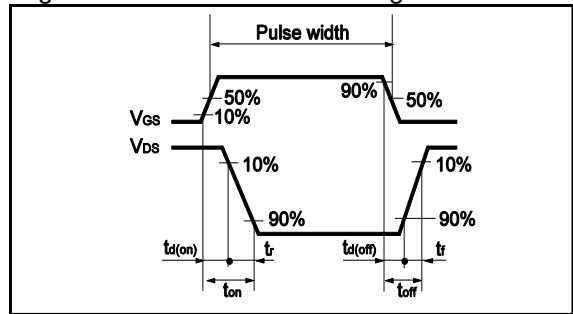


Fig.2-3 Waveforms for Switching Energy Loss

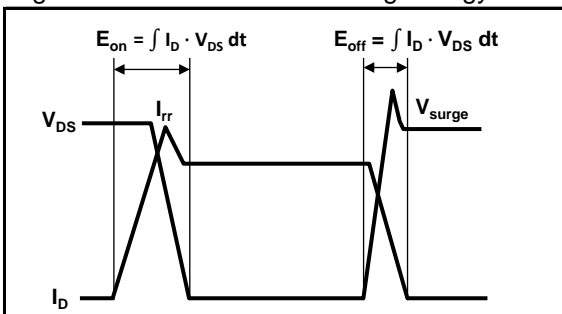


Fig.3-1 Reverse Recovery Time Measurement Circuit

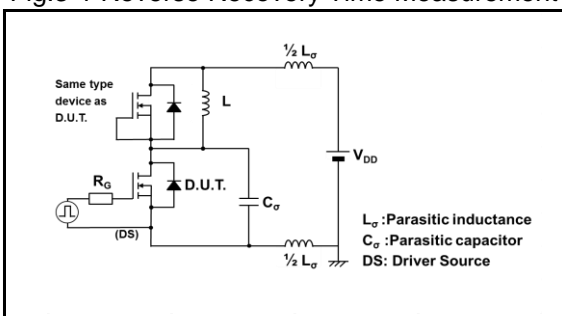
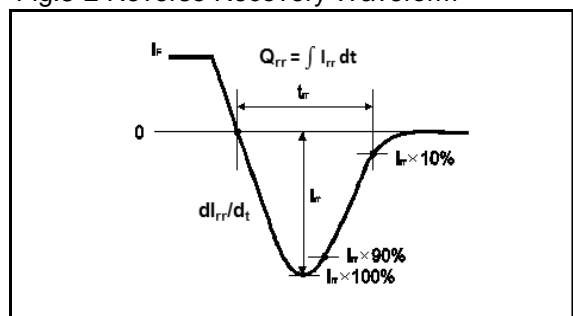
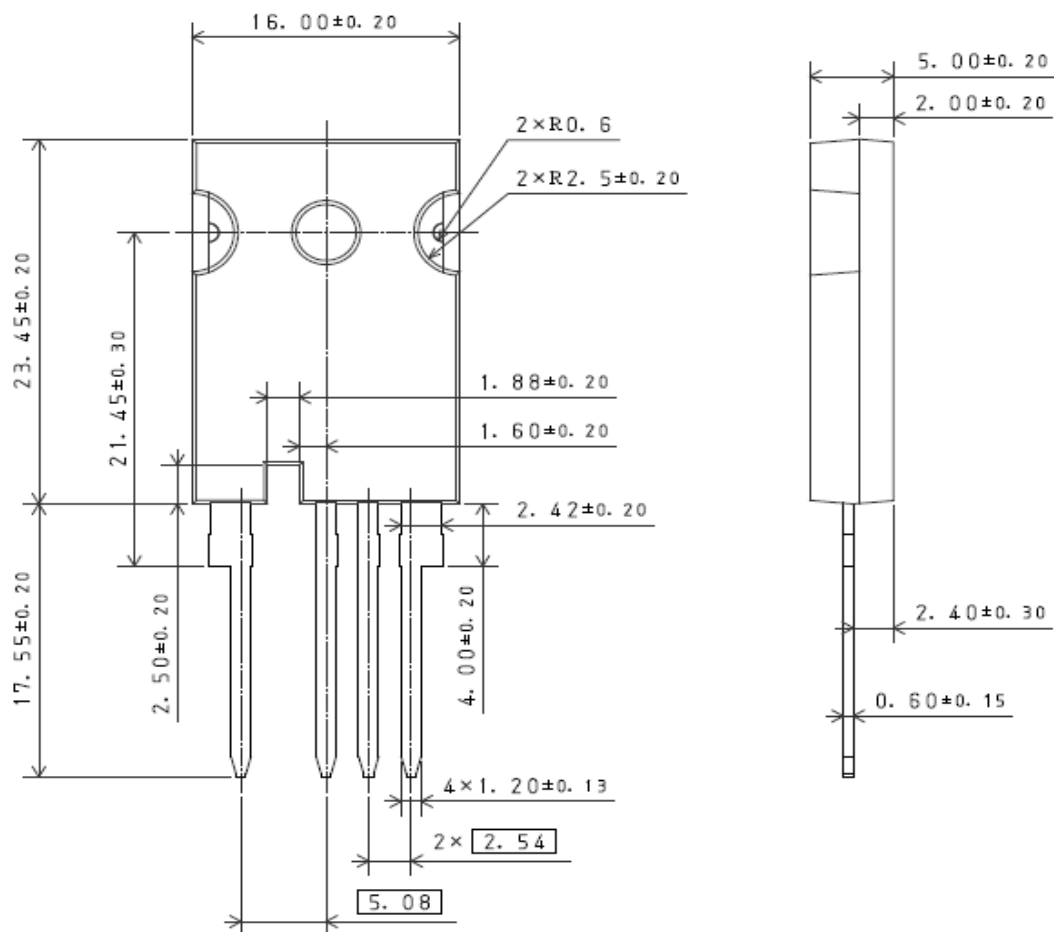


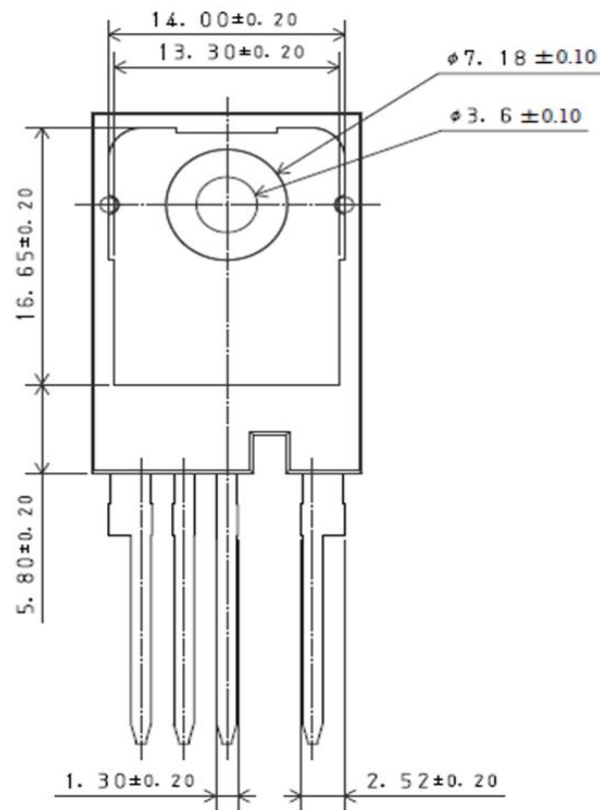
Fig.3-2 Reverse Recovery Waveform



●Package Dimensions

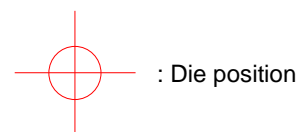
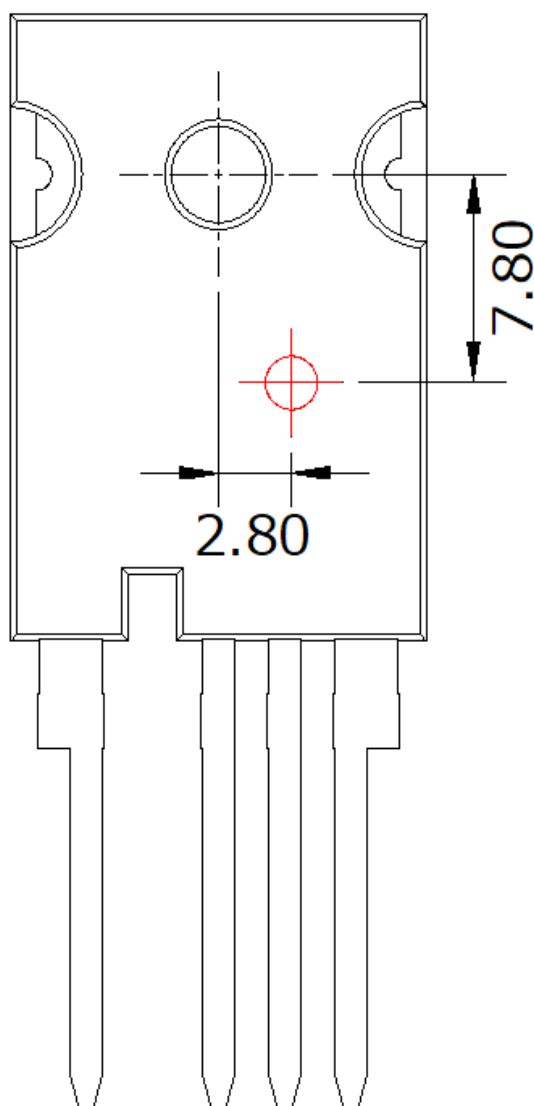


Unit: mm



Unit: mm

## ●Die Bonding Layout



- 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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