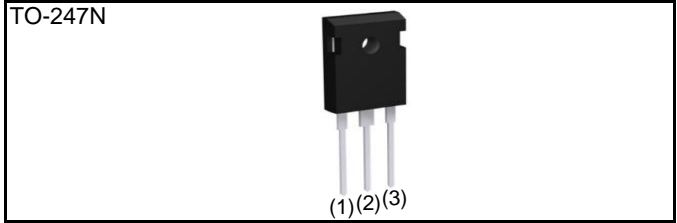
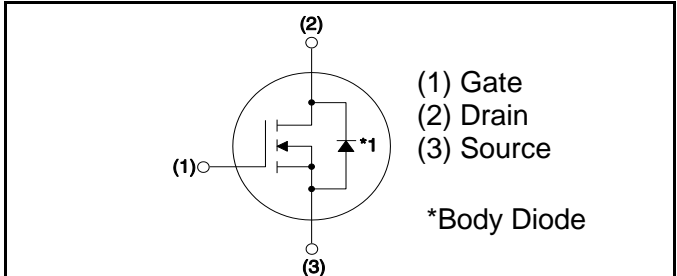


$V_{DSS}$	650V
$R_{DS(on)}$ (Typ.)	120mΩ
$I_D^{*1}$	21A
$P_D$	103W

### ●Outline



### ●Inner circuit



### ●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	C11
	Marking	SCT3120AL

### ●Absolute maximum ratings ( $T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit	
Drain - Source Voltage	$V_{DSS}$	650	V	
Continuous Drain current	$T_c = 25^{\circ}\text{C}$	$I_D^{*1}$	21	A
	$T_c = 100^{\circ}\text{C}$	$I_D^{*1}$	15	A
Pulsed Drain current ( $T_c = 25^{\circ}\text{C}$ )	$I_{D,pulse}^{*2}$	52	A	
Gate - Source voltage (DC)	$V_{GSS}$	-4 to +22	V	
Gate - Source surge voltage ( $t_{surge} < 300\text{nsec}$ )	$V_{GSS,surge}^{*3}$	-4 to +26	V	
Recommended drive voltage	$V_{GS,op}^{*4}$	0 / +18	V	
Virtual Junction temperature	$T_{vj}$	175	$^{\circ}\text{C}$	
Range of storage temperature	$T_{stg}$	-55 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{V}, I_D = 1\text{mA}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = -55^{\circ}\text{C}$	650 650	- -	- -	V
Zero Gate voltage Drain current	$I_{DSS}$	$V_{GS} = 0\text{V}, V_{DS} = 650\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	- -	1 2	10 -	$\mu\text{A}$
Gate - Source leakage current	$I_{GSS+}$	$V_{GS} = +22\text{V}, V_{DS} = 0\text{V}$	-	-	100	nA
Gate - Source leakage current	$I_{GSS-}$	$V_{GS} = -4\text{V}, V_{DS} = 0\text{V}$	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10\text{V}, I_D = 3.33\text{mA}$	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 18\text{V}, I_D = 6.7\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	- -	120 172	156 -	$\text{m}\Omega$
Gate input resistance	$R_G$	$f = 1\text{MHz}, \text{open drain}$	-	18	-	$\Omega$

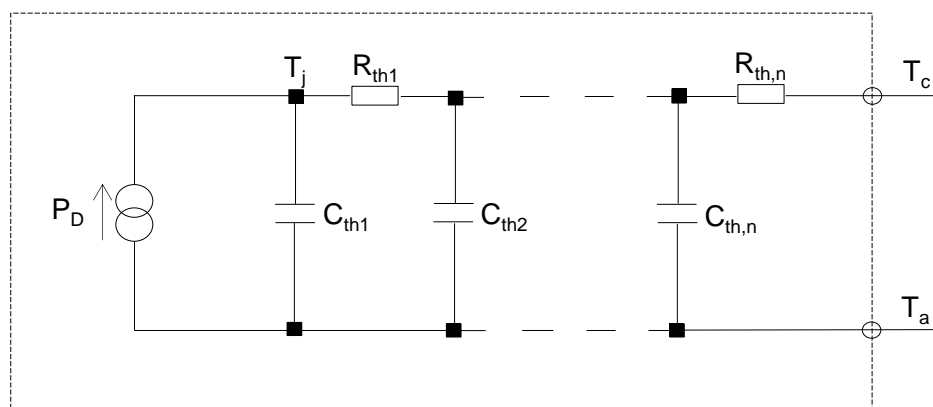
**●Thermal resistance**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	$R_{thJC}$	-	1.12	1.46	K/W

**●Typical Transient Thermal Characteristics**

Symbol	Value	Unit
$R_{th1}$	1.11E-01	K/W
$R_{th2}$	7.09E-01	
$R_{th3}$	3.01E-01	

Symbol	Value	Unit
$C_{th1}$	8.73E-04	Ws/K
$C_{th2}$	5.10E-03	
$C_{th3}$	2.94E-02	



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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	$g_{fs}^{*5}$	$V_{DS} = 10\text{V}, I_D = 6.7\text{A}$	-	2.7	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$	-	460	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 500\text{V}$	-	35	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1\text{MHz}$	-	16	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 300\text{V}$	-	70	-	pF
Total Gate charge	$Q_g^{*5}$	$V_{DS} = 300\text{V}$ $I_D = 6.7\text{A}$	-	38	-	nC
Gate - Source charge	$Q_{gs}^{*5}$	$V_{GS} = 18\text{V}$	-	10	-	
Gate - Drain charge	$Q_{gd}^{*5}$	See Fig. 1-1.	-	18	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DS} = 300\text{V}$ $I_D = 6.7\text{A}$	-	14	-	ns
Rise time	$t_r^{*5}$	$V_{GS} = 0\text{V}/+18\text{V}$	-	21	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_G = 0\Omega$ $R_L = 45\Omega$	-	23	-	
Fall time	$t_f^{*5}$	See Fig. 1-1, 1-2.	-	14	-	
Turn - on switching loss	$E_{on}^{*5}$	$V_{DS} = 300\text{V}$ $V_{GS} = 0\text{V}/18\text{V}, I_D = 6.7\text{A}$ $R_G = 0\Omega, L = 500\mu\text{H}$	-	29	-	$\mu\text{J}$
Turn - off switching loss	$E_{off}^{*5}$	$E_{on}$ includes diode reverse recovery $L_{\sigma} = 50\text{nH}, C_{\sigma} = 200\text{pF}$ See Fig. 2-1, 2-2.	-	3	-	

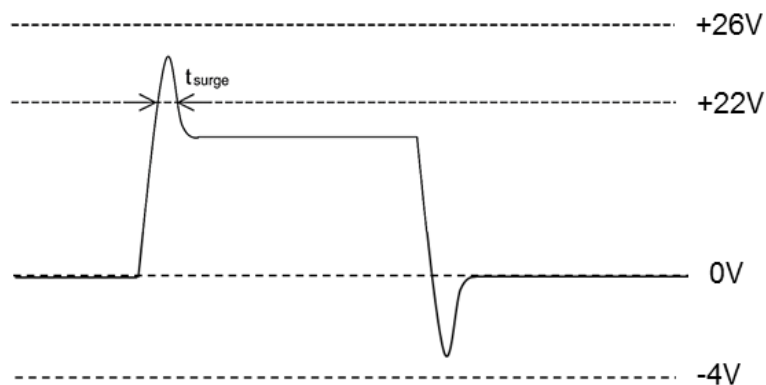
● **Body diode electrical characteristics** (Source-Drain) ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	$I_S^{*1}$	$T_c = 25^{\circ}\text{C}$	-	-	21	A
Body diode direct current, pulsed	$I_{SM}^{*2}$		-	-	52	A
Forward voltage	$V_{SD}^{*5}$	$V_{GS} = 0\text{V}, I_S = 6.7\text{A}$	-	3.2	-	V
Reverse recovery time	$t_{rr}^{*5}$	$I_F = 6.7\text{A}$ $V_R = 300\text{V}$ $di/dt = 1100\text{A}/\mu\text{s}$ $L_{\sigma} = 50\text{nH}, C_{\sigma} = 200\text{pF}$ See Fig. 3-1, 3-2.	-	13	-	ns
Reverse recovery charge	$Q_{rr}^{*5}$		-	35	-	nC
Peak reverse recovery current	$I_{rrm}^{*5}$		-	6	-	A

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

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

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



\*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

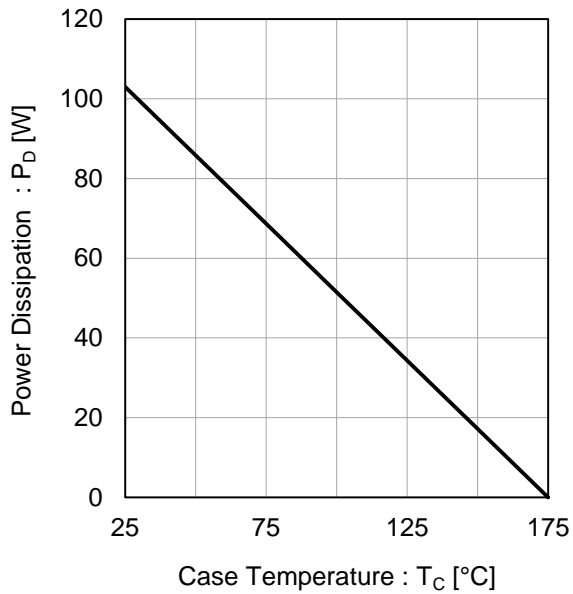


Fig.2 Maximum Safe Operating Area

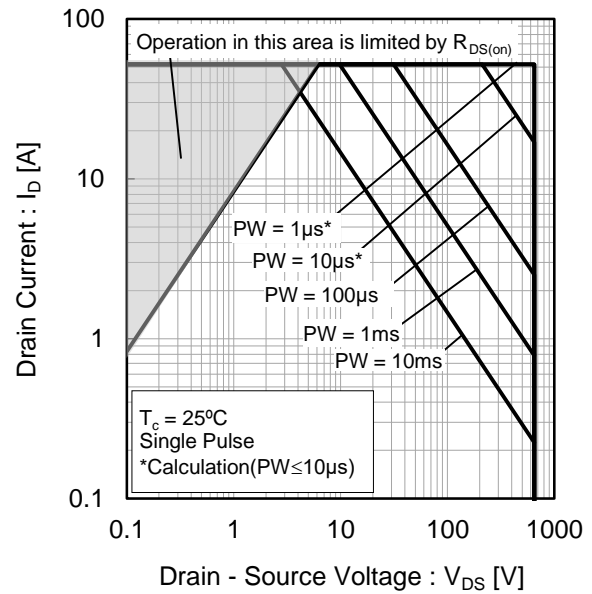
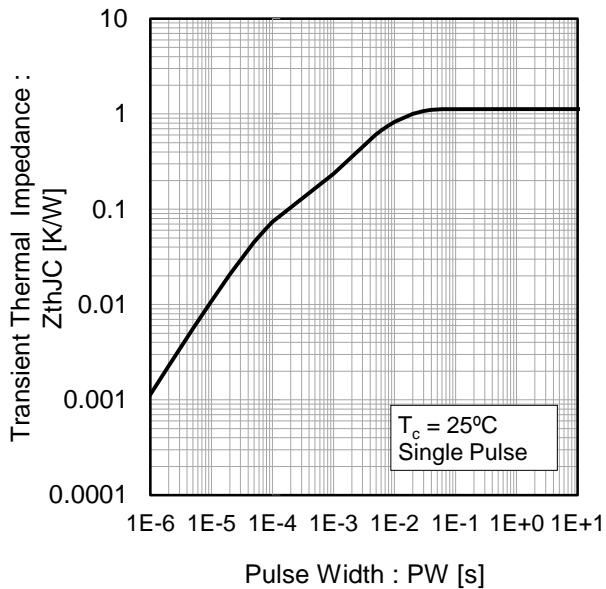


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

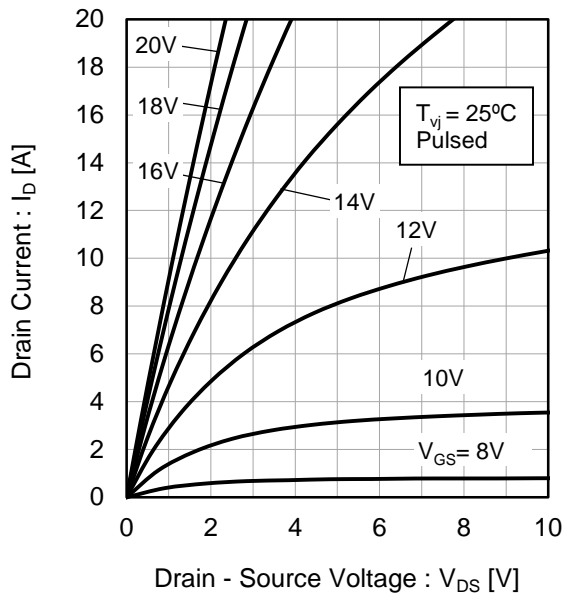


Fig.5 Typical Output Characteristics(II)

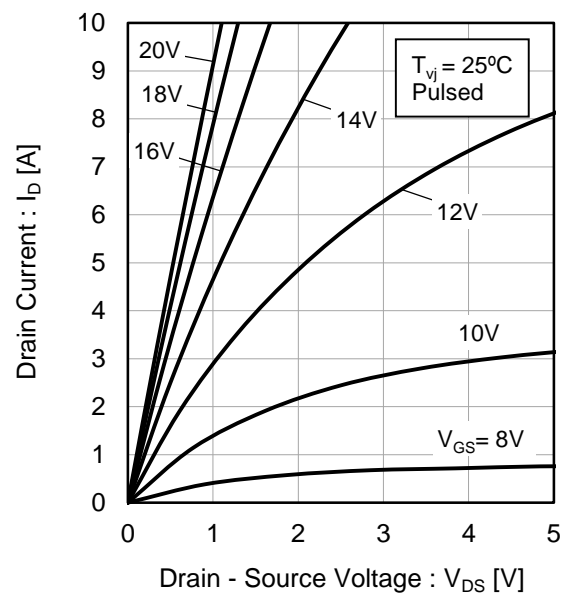
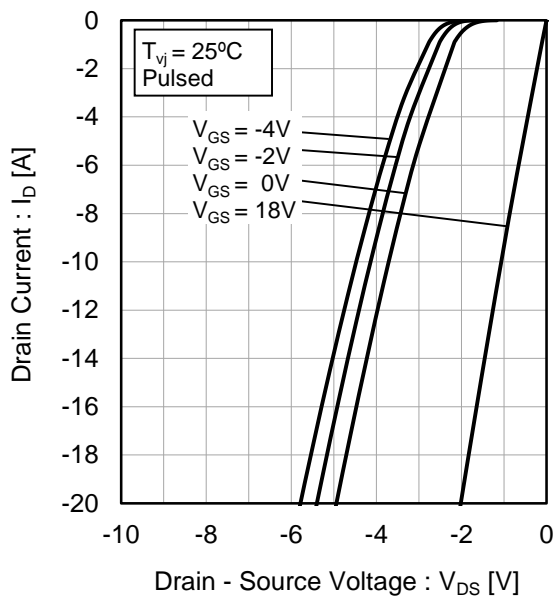


Fig.6  $T_{vj} = 25^\circ\text{C}$  3rd Quadrant Characteristics



●Electrical characteristic curves

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

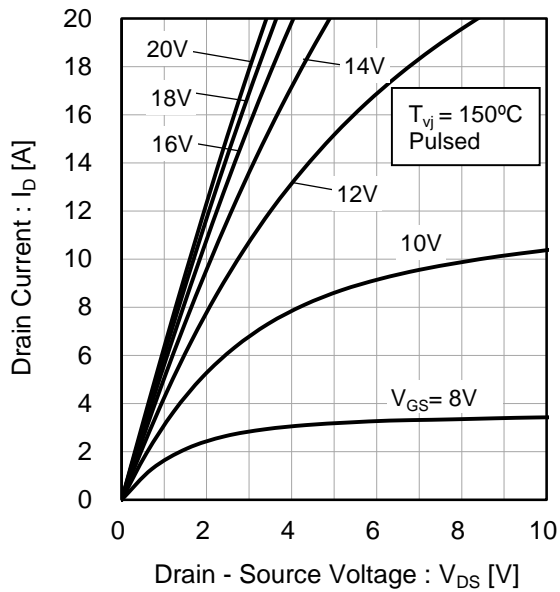


Fig.8  $T_{vj} = 150^{\circ}\text{C}$  Typical Output Characteristics(II)

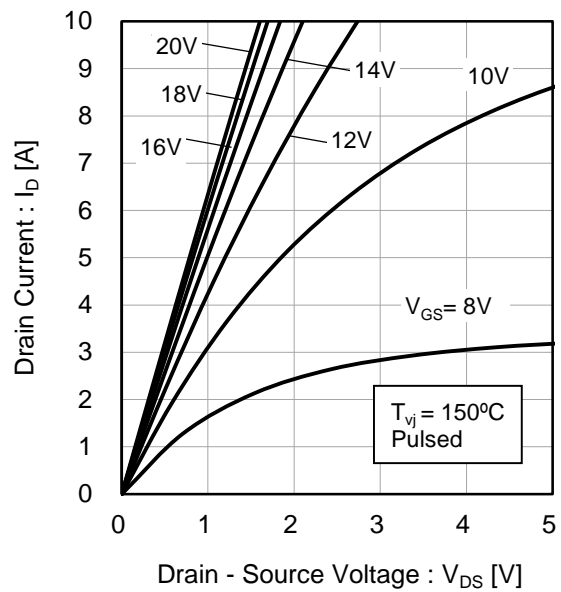


Fig.9  $T_{vj} = 150^{\circ}\text{C}$  3rd Quadrant Characteristics

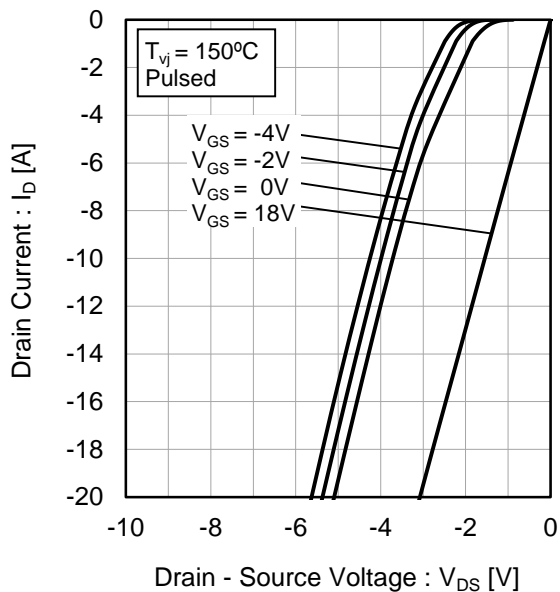
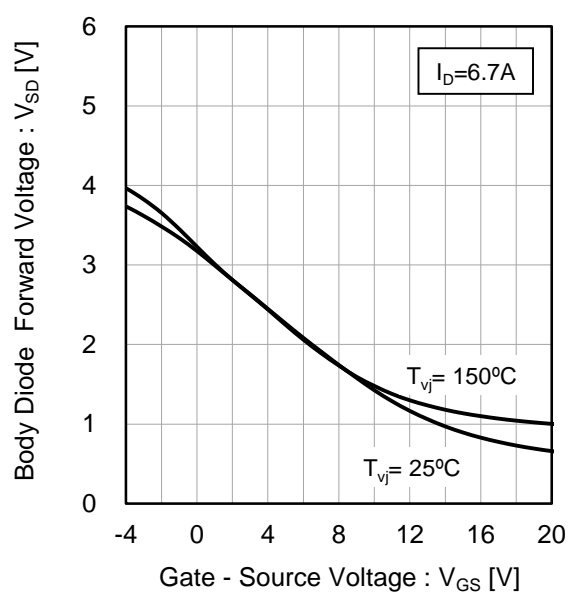


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

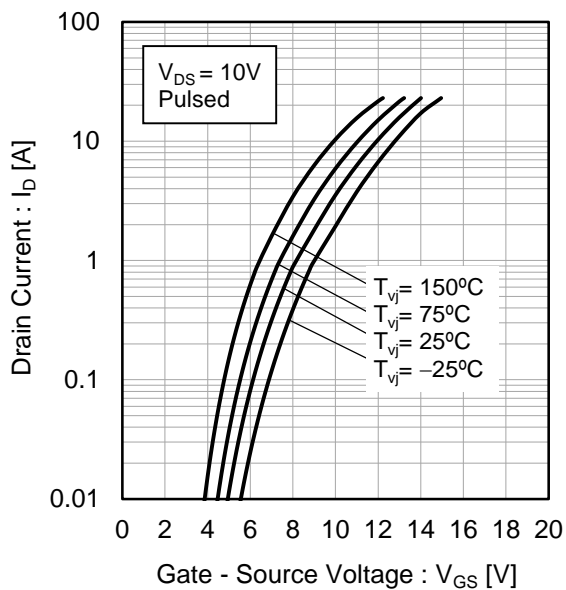


Fig.12 Typical Transfer Characteristics (II)

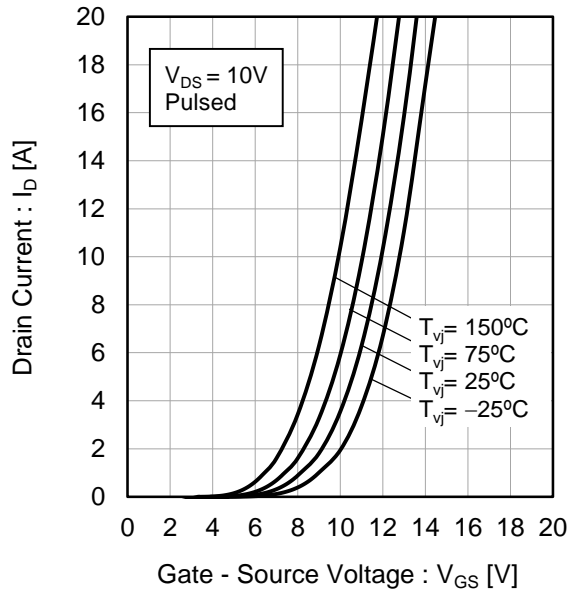


Fig.13 Gate Threshold Voltage vs. Junction Temperature

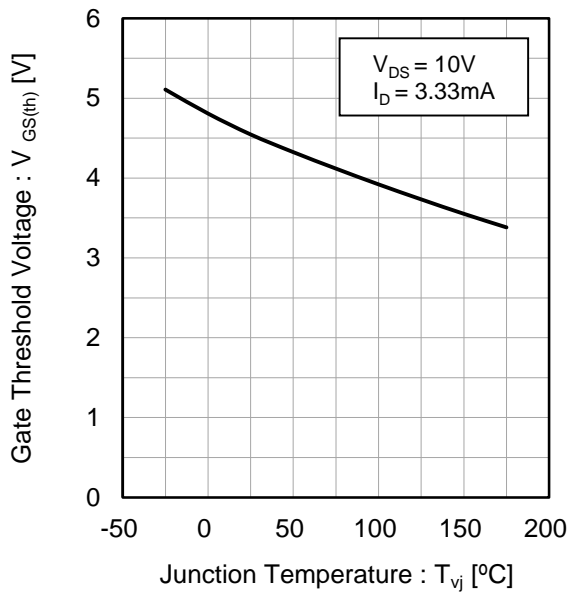
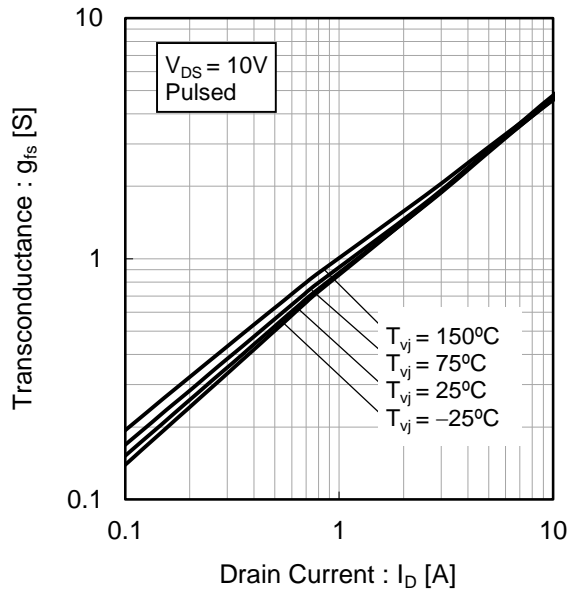


Fig.14 Transconductance vs. Drain Current





●Electrical characteristic curves

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

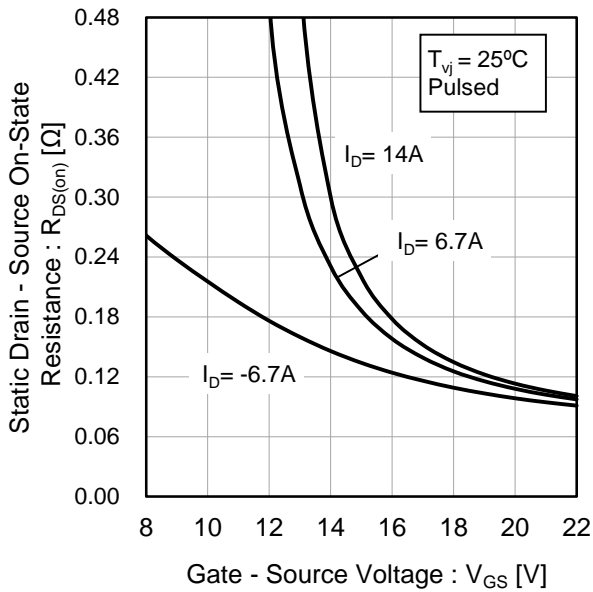


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

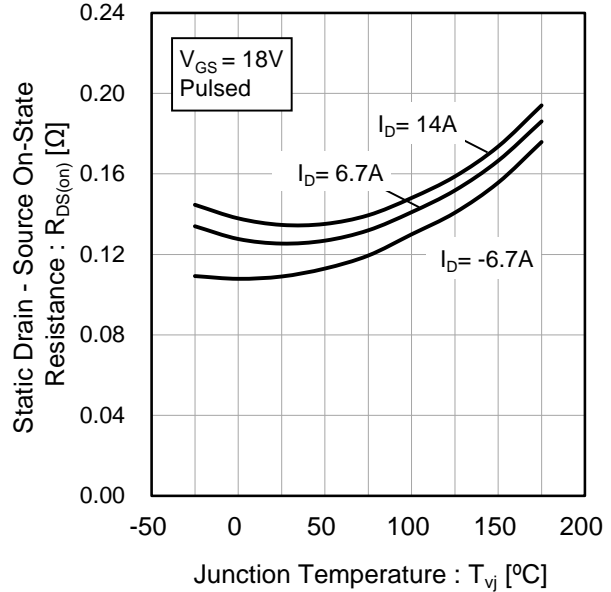


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

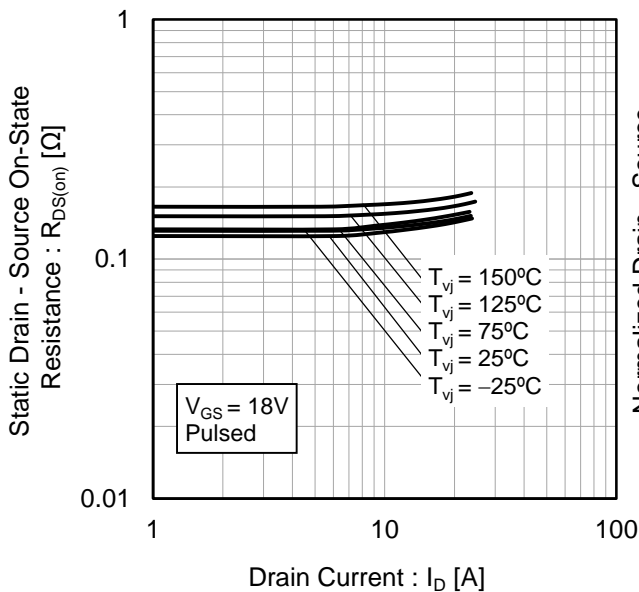
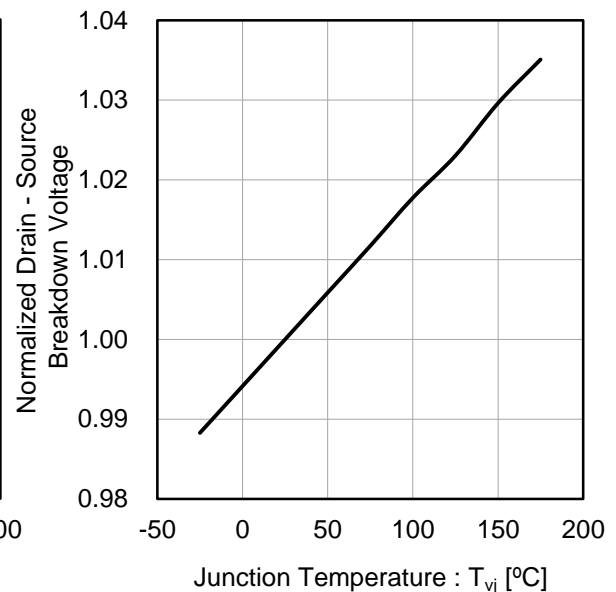


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

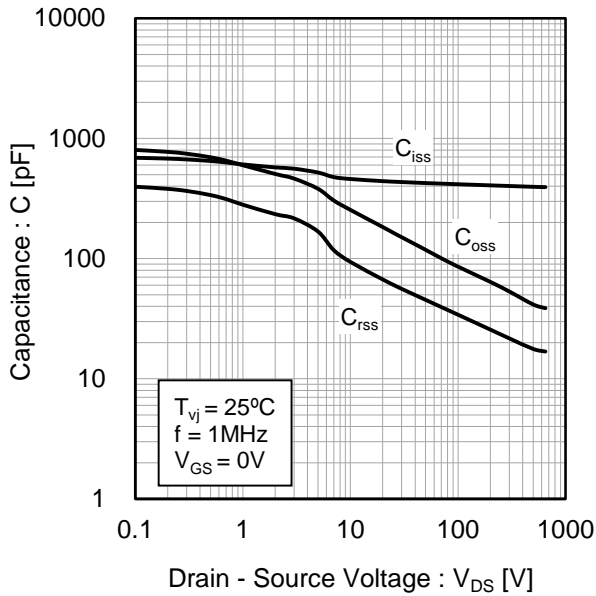


Fig.20 C<sub>oss</sub> Stored Energy

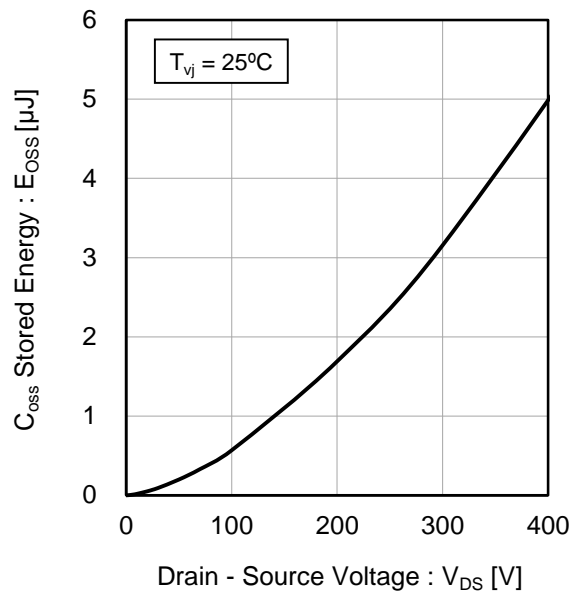
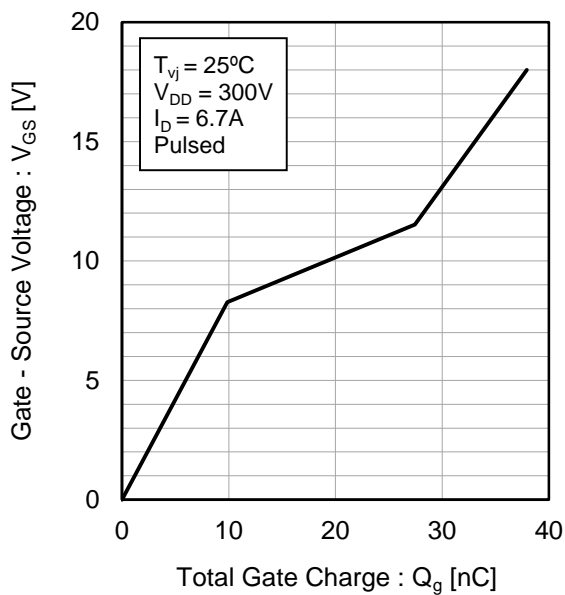
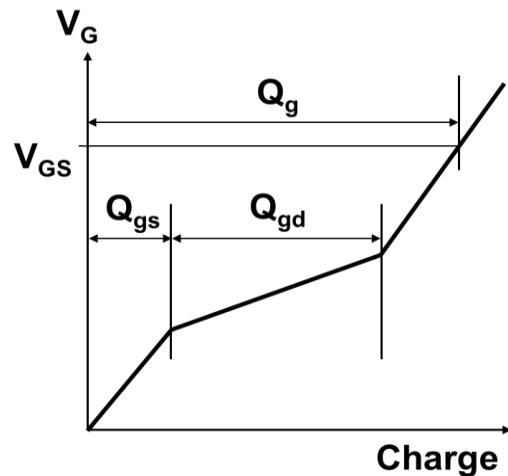


Fig.21 Dynamic Input Characteristics



\*Gate Charge Waveform



●Electrical characteristic curves

Fig.19 Typical Switching Time vs. Drain Current

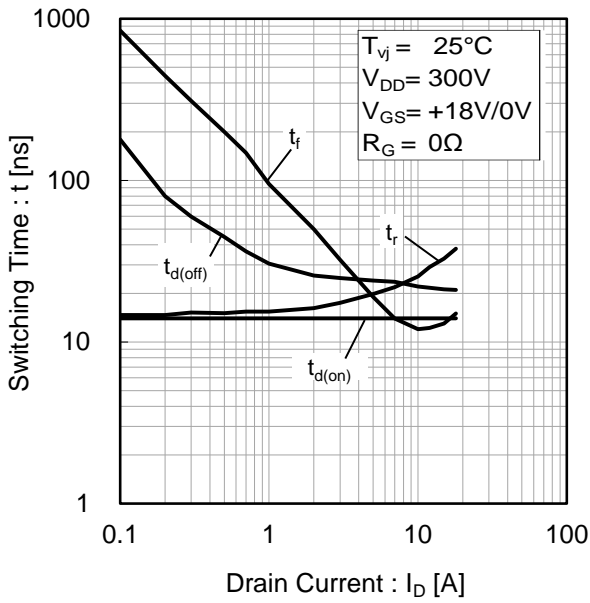


Fig.20 Typical Switching Loss vs. Drain - Source Voltage

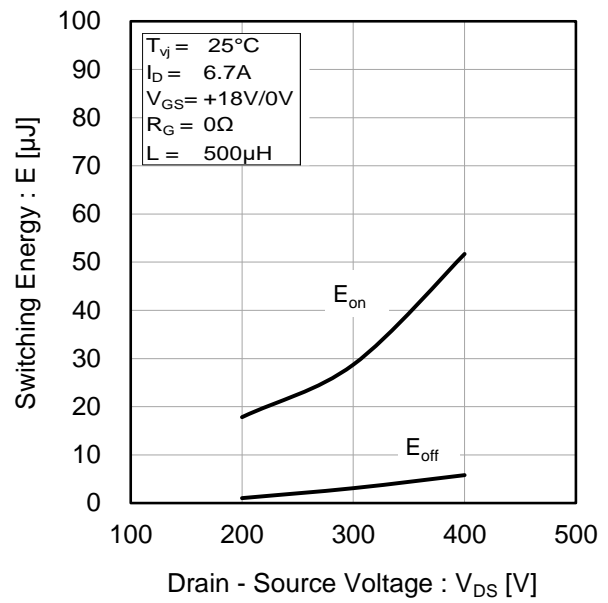


Fig.21 Typical Switching Loss vs. Drain Current

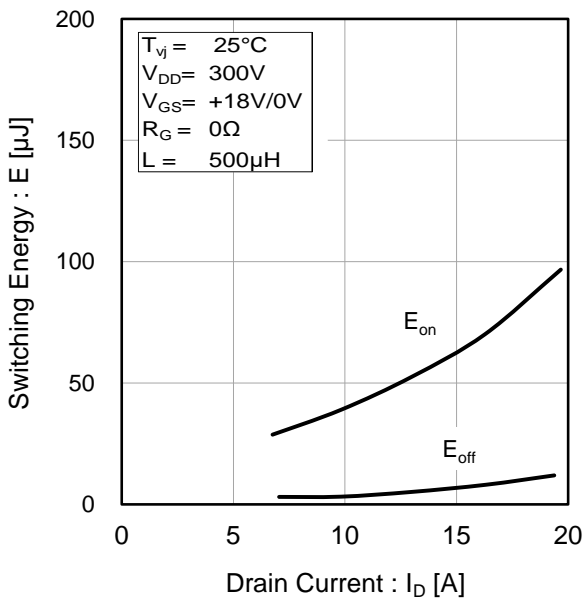
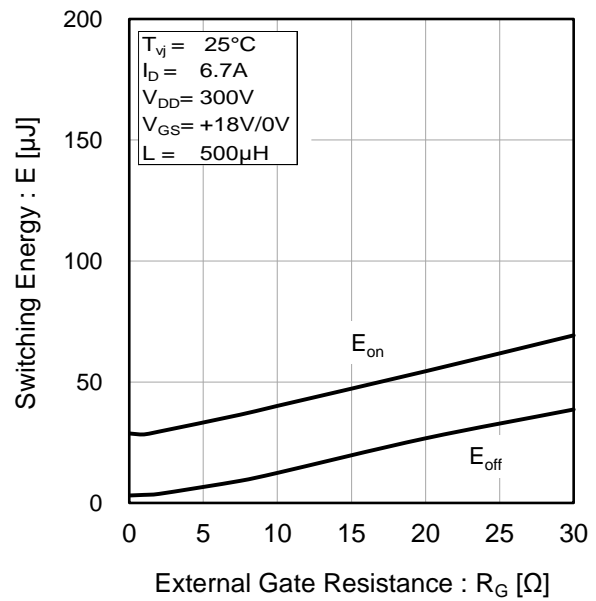


Fig.22 Typical Switching Loss vs. External Gate Resistance



● Measurement circuits and waveforms

Fig.1-1 Gate Charge and Switching Time Measurement Circuit

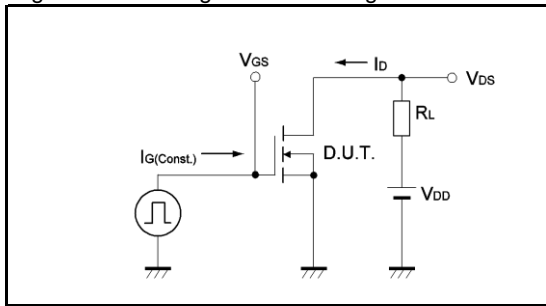


Fig.1-2 Waveforms for Switching Time

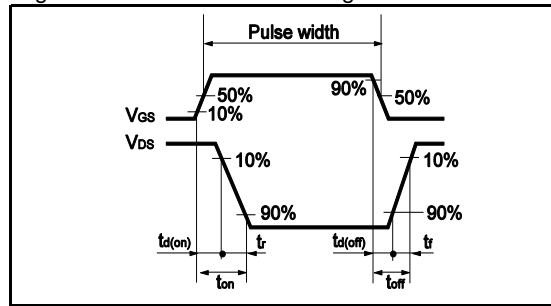


Fig.2-1 Switching Energy Measurement Circuit

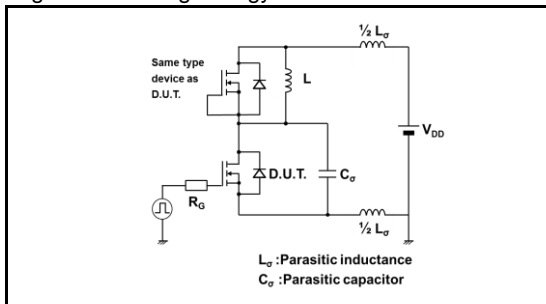


Fig.2-2 Waveforms for Switching Energy Loss

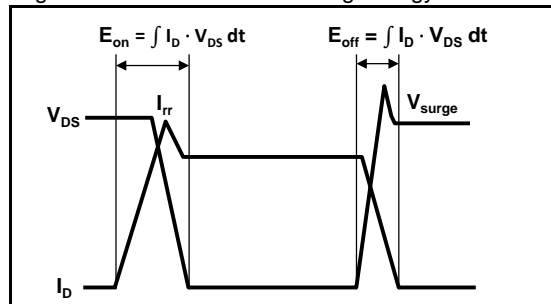


Fig.3-1 Reverse Recovery Time Measurement Circuit

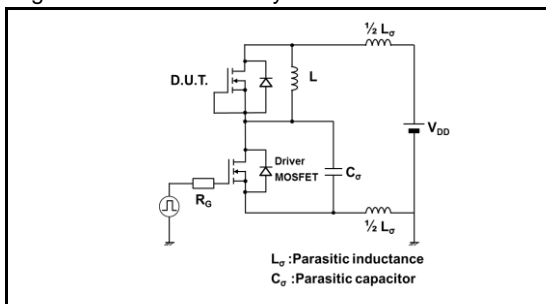
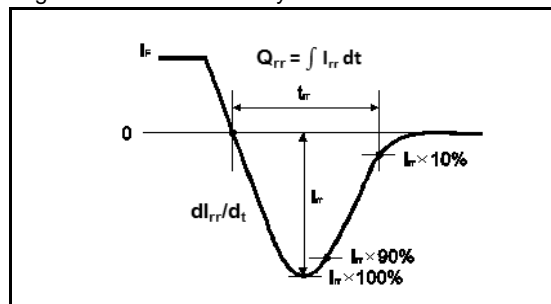
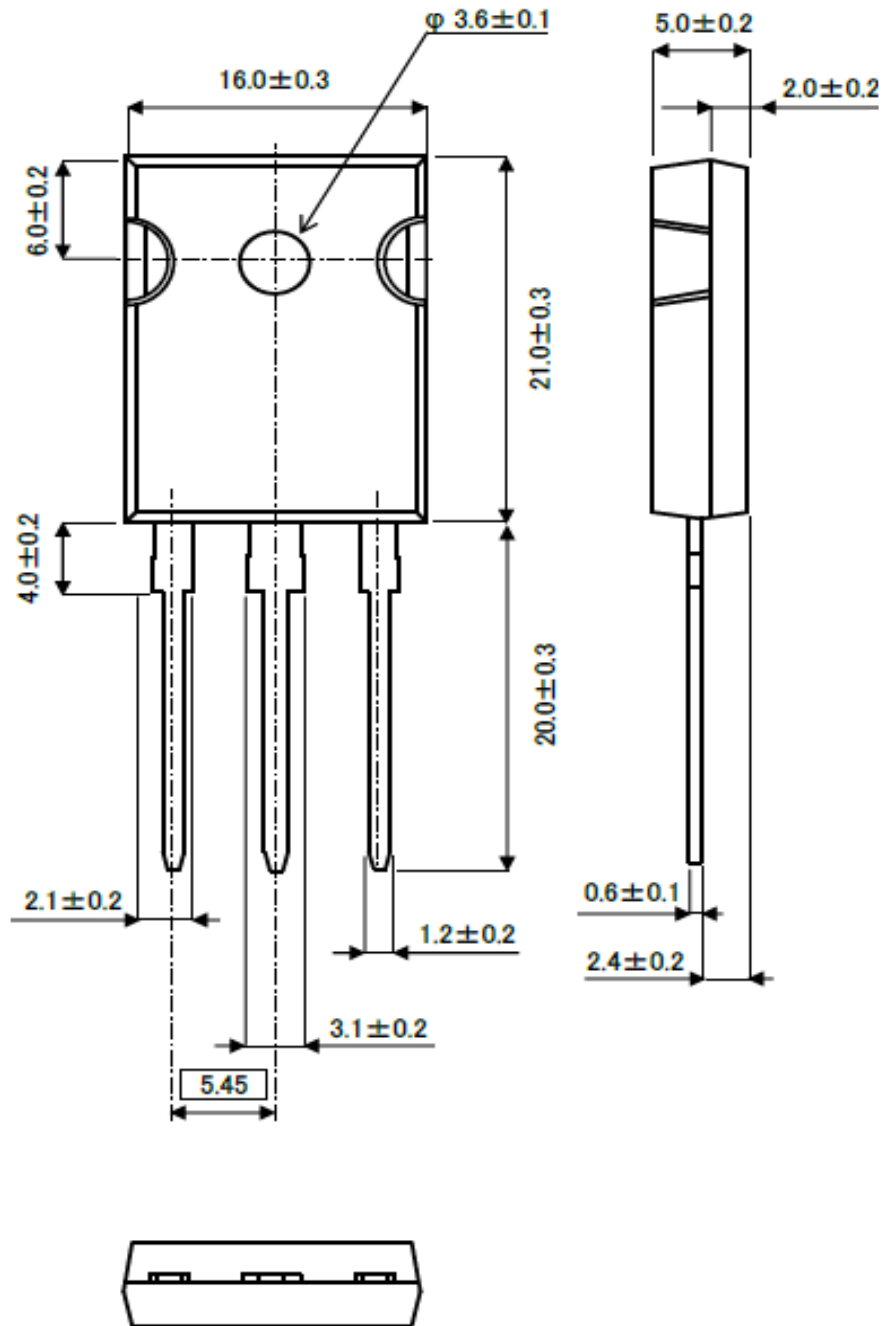


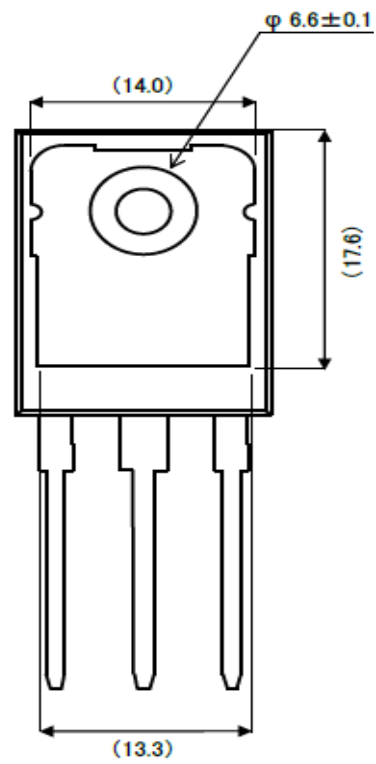
Fig.3-2 Reverse Recovery Waveform



●Package Dimensions

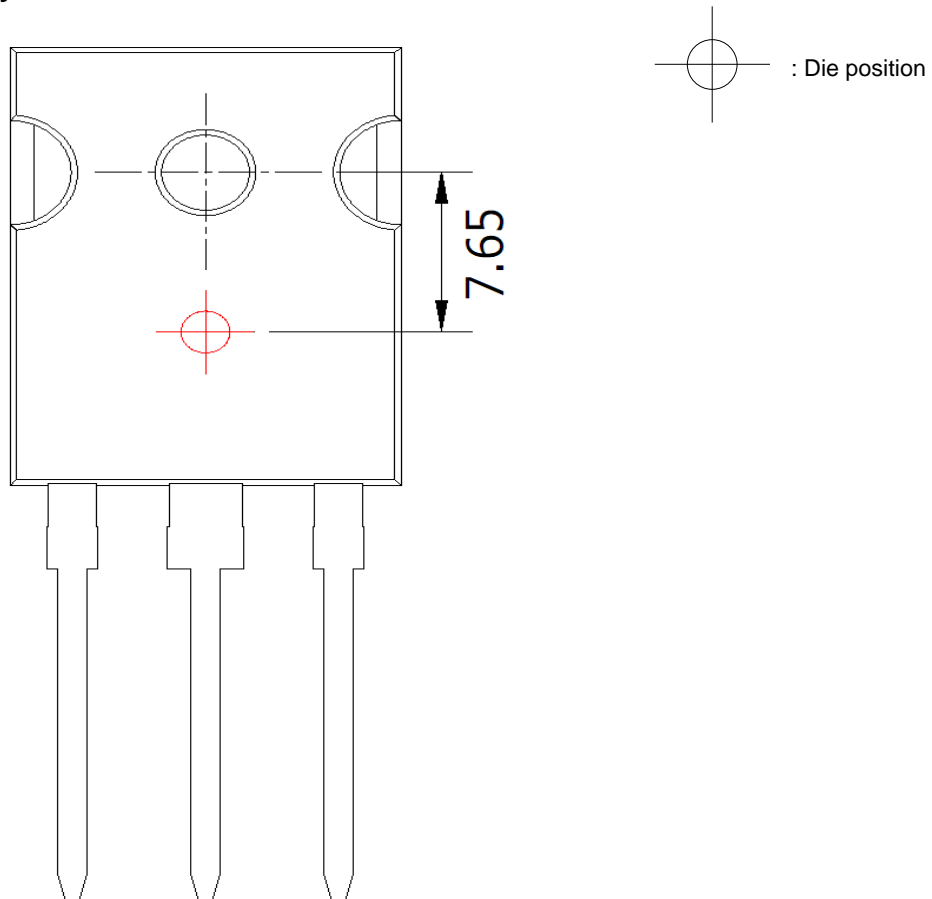


Unit: mm



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

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