SCT3160KL

N-channel SiC power MOSFET

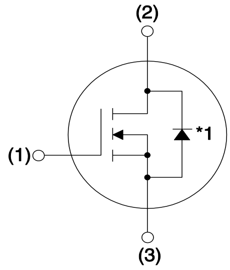
Datasheet

V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	160mΩ
I_D *1	17A
P_D	103W

●Outline

TO-247N

●Inner circuit



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

*Body Diode

●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	C11
	Marking	SCT3160KL

●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	17	A
	T_c = 100°C	I_D *1	12	A
Pulsed Drain current (T_c = 25°C)		$I_{D,pulse}$ *2	42	A
Gate - Source voltage (DC)		V_{GSS}	-4 to +22	V
Gate - Source surge voltage (t_{surge} < 300nsec)		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

●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 T_{vj} = 25°C	1200	-	-	V
		T_{vj} = -55°C	1200	-	-	
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =1200V T_{vj} = 25°C	-	1	10	μA
		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 = 2.5mA	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ *5	V_{GS} = 18V, I_D = 5A T_{vj} = 25°C	-	160	208	mΩ
		T_{vj} = 150°C	-	272	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	18	-	Ω

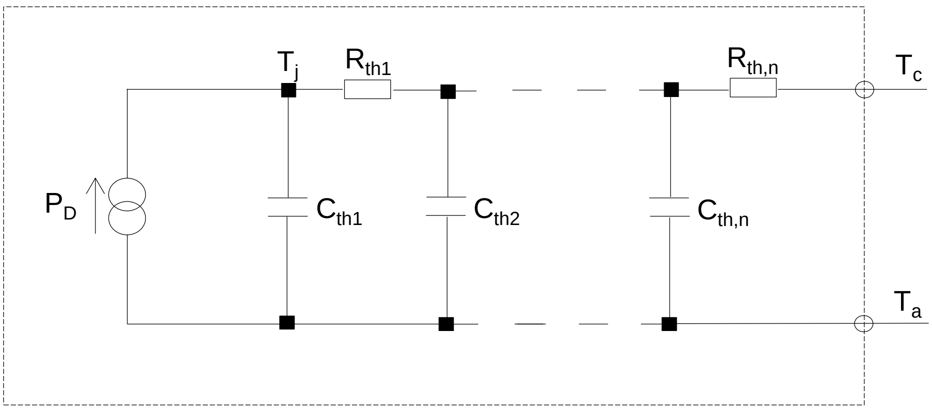
●Thermal resistance

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°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} *5	V_{DS} = 10V, I_D = 5A	-	2.5	-	S
Input capacitance	C_{iss}	V_{GS} = 0V V_{DS} = 800V f = 1MHz	-	398	-	pF
Output capacitance	C_{oss}		-	41	-	
Reverse transfer capacitance	C_{rss}		-	18	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 600V	-	45	-	pF
Total Gate charge	Q_g *5	V_{DS} = 600V I_D = 5A V_{GS} = 18V See Fig. 1-1.	-	42	-	nC
Gate - Source charge	Q_{gs} *5		-	10	-	
Gate - Drain charge	Q_{gd} *5		-	22	-	
Turn - on delay time	$t_{d(on)}$ *5	V_{DS} = 400V I_D = 5A V_{GS} = 0V/+18V R_G = 0Ω R_L = 80Ω See Fig. 1-1, 1-2.	-	14	-	ns
Rise time	t_r *5		-	18	-	
Turn - off delay time	$t_{d(off)}$ *5		-	24	-	
Fall time	t_f *5		-	25	-	
Turn - on switching loss	E_{on} *5	V_{DS} = 600V V_{GS}=0V/18V, I_D = 5A R_G = 0Ω, L = 750μH E_{on} includes diode reverse recovery L_σ = 50nH, C_σ = 200pF See Fig. 2-1, 2-2.	-	62	-	μJ
Turn - off switching loss	E_{off} *5		-	12	-	

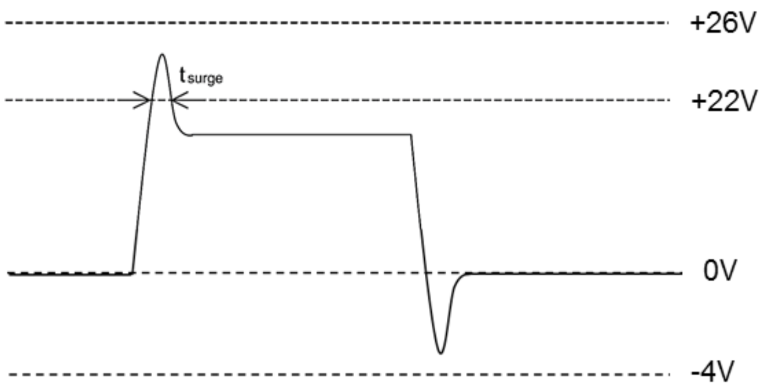
● **Body diode electrical characteristics** (Source-Drain) (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	I_S *1	T_c = 25°C	-	-	17	A
Body diode direct current, pulsed	I_{SM} *2		-	-	42	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_S = 5A	-	3.2	-	V
Reverse recovery time	t_{rr} *5	I_F = 5A V_R = 600V di/dt = 1100A/μs $L_σ$ = 50nH, $C_σ$ = 200pF See Fig. 3-1, 3-2.	-	13	-	ns
Reverse recovery charge	Q_{rr} *5		-	26	-	nC
Peak reverse recovery current	I_{rrm} *5		-	4	-	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



*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

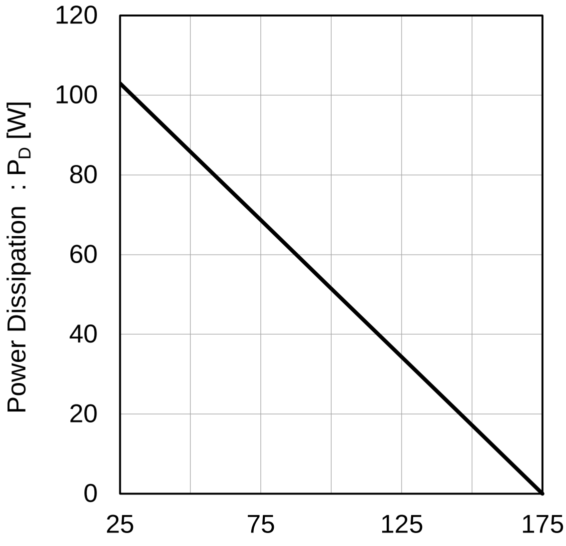


Fig.2 Maximum Safe Operating Area

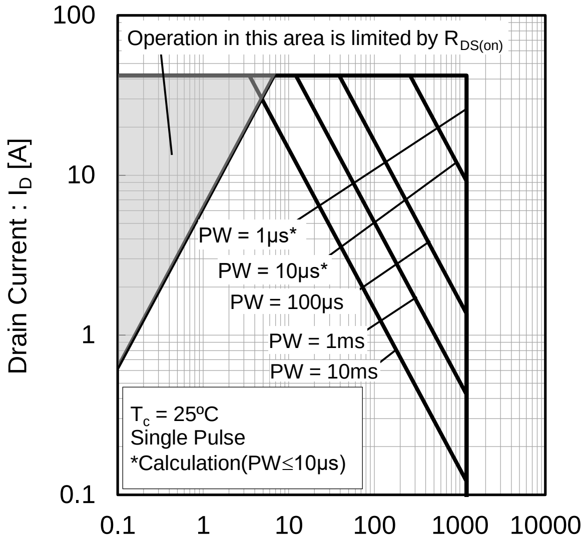
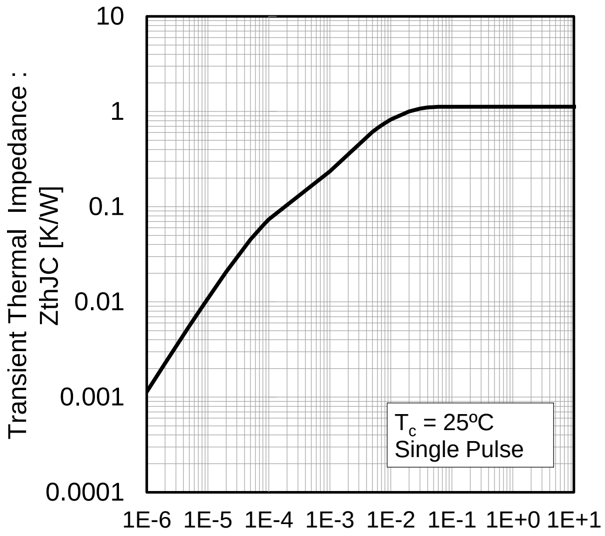


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

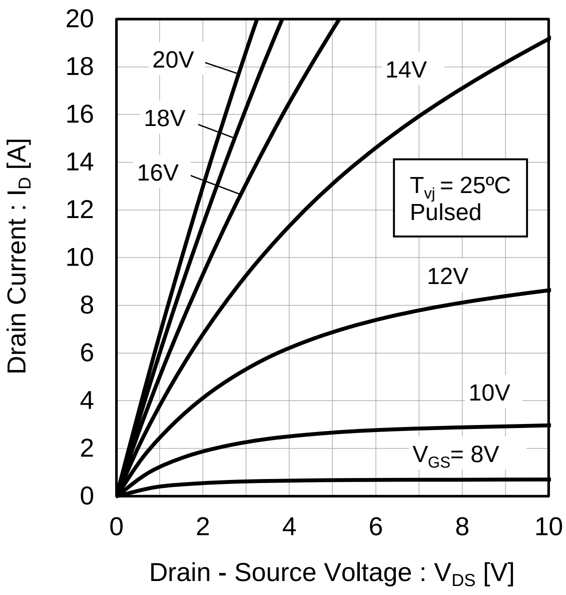


Fig.5 Typical Output Characteristics(II)

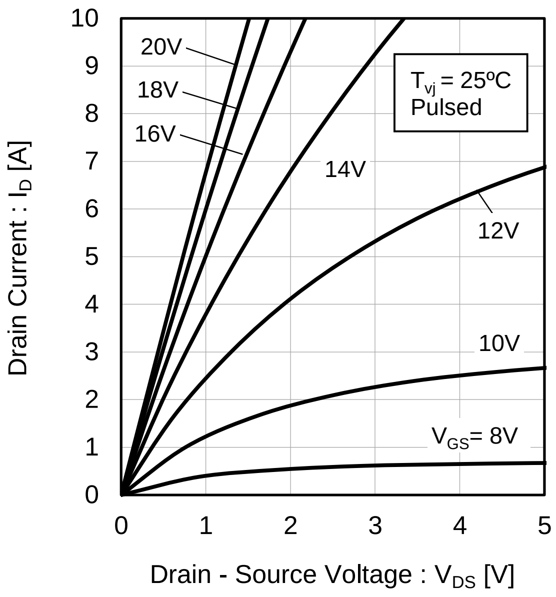
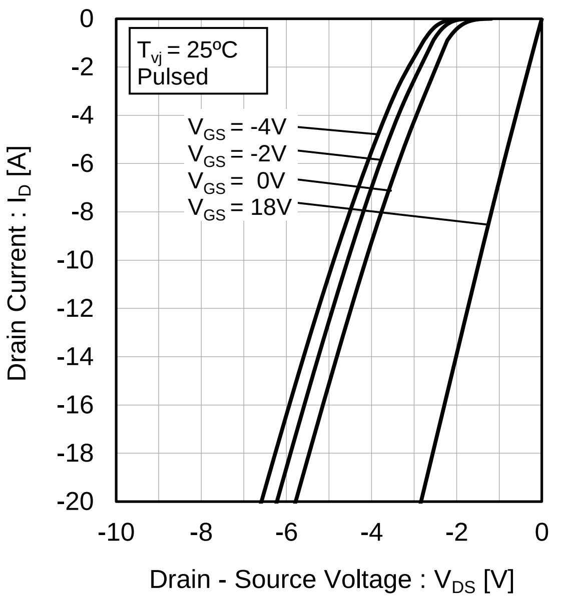


Fig.6 T_{vj} = 25ºC 3rd Quadrant Characteristics



●Electrical characteristic curves

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

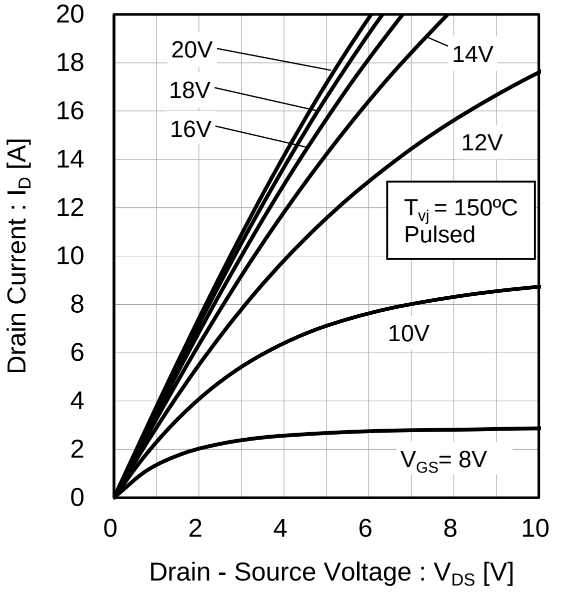


Fig.8 T_{vj} = 150ºC Typical Output Characteristics(II)

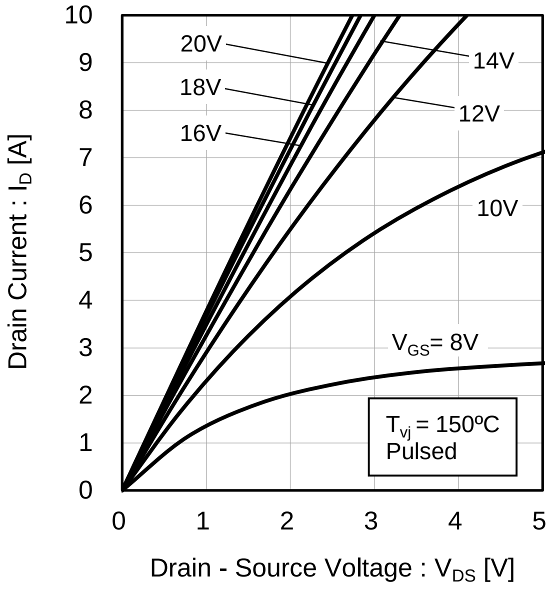


Fig.9 T_{vj} = 150ºC 3rd Quadrant Characteristics

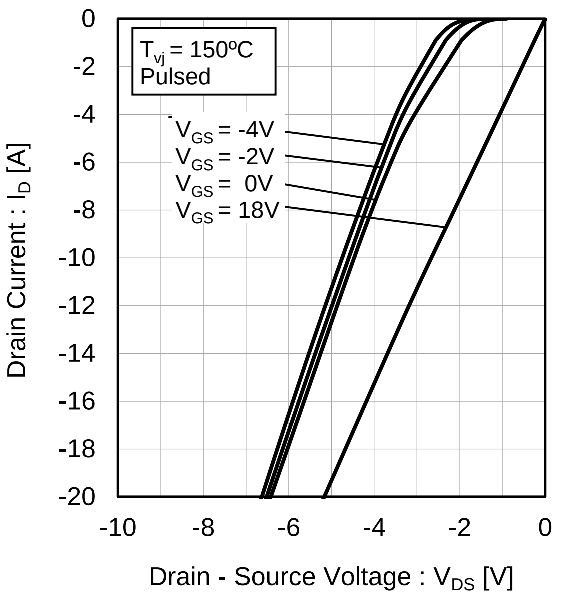
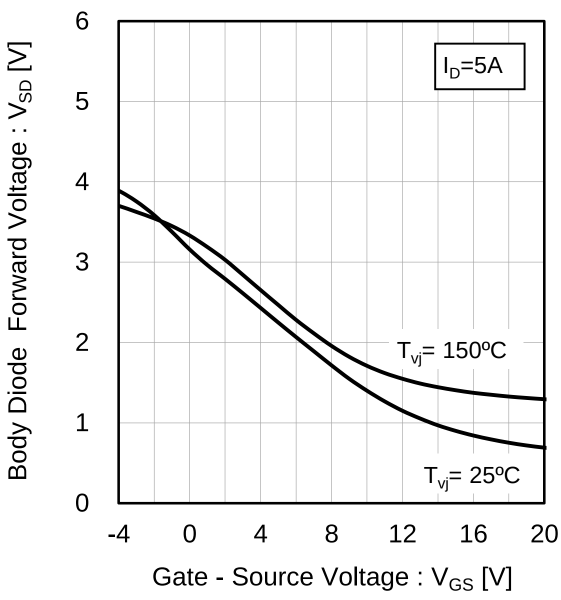


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

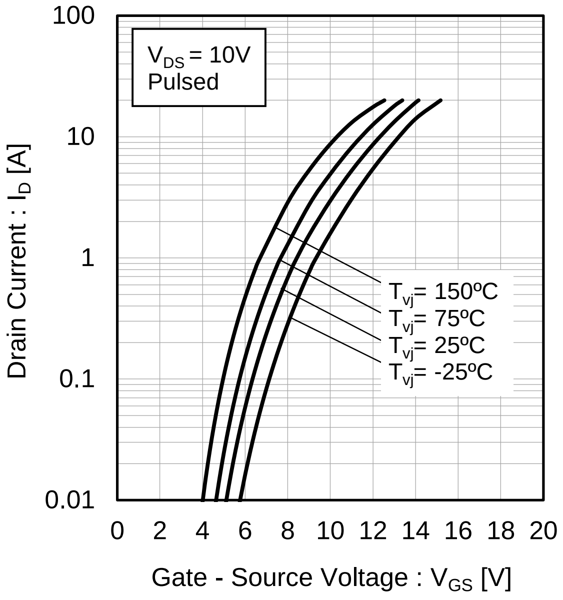


Fig.12 Typical Transfer Characteristics (II)

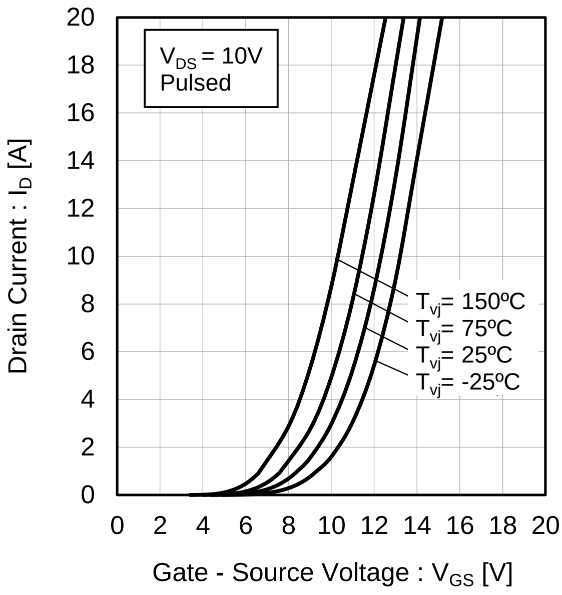


Fig.13 Gate Threshold Voltage vs. Junction Temperature

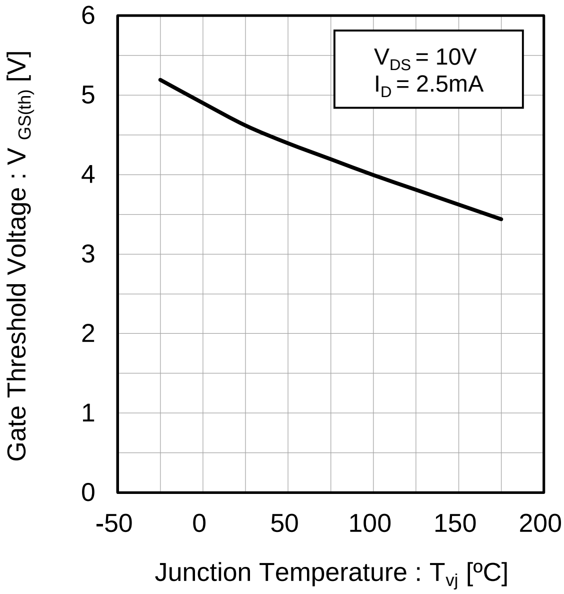
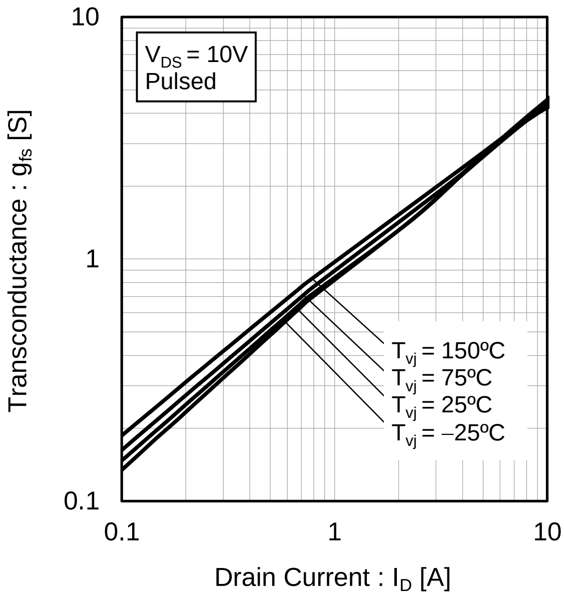


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

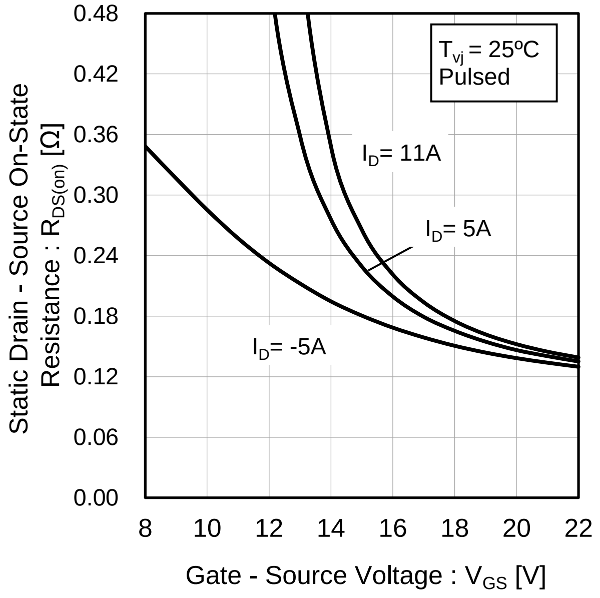


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

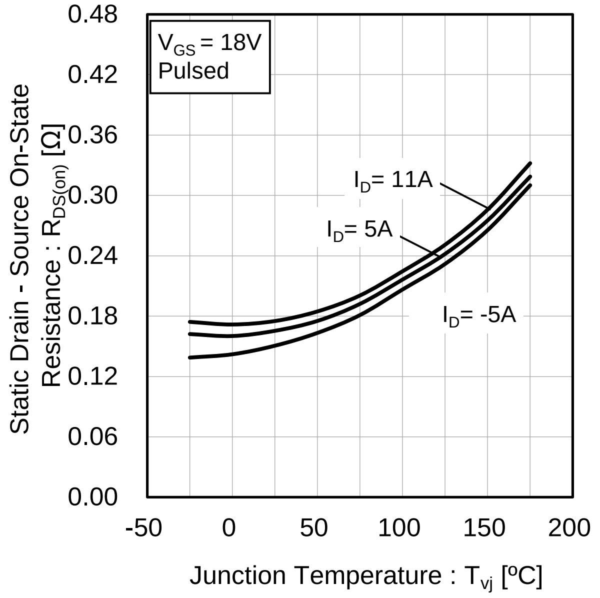


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

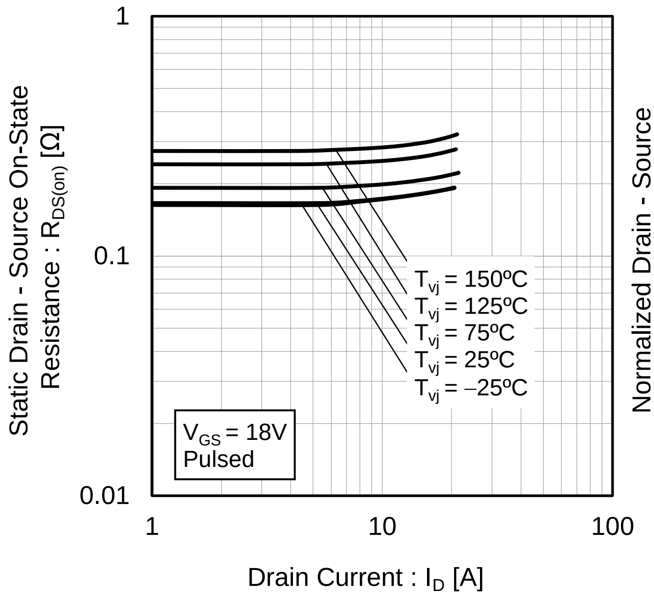
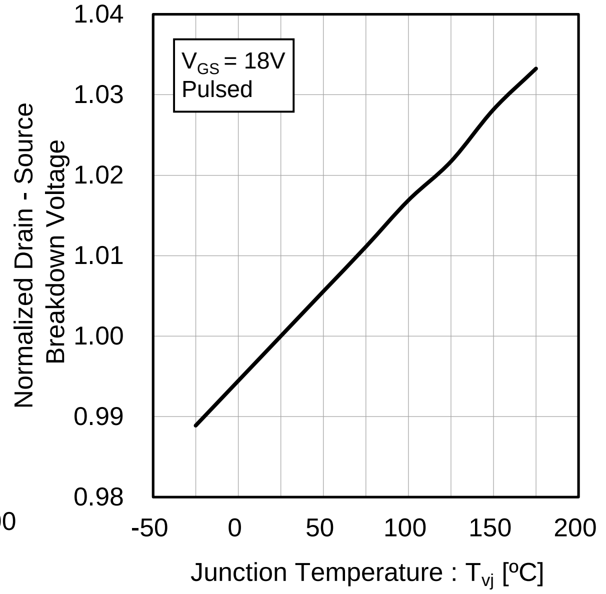


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

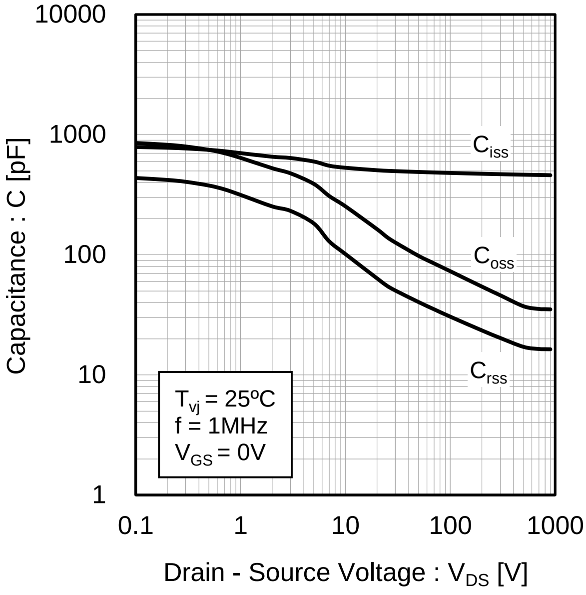


Fig.20 C_{oss} Stored Energy

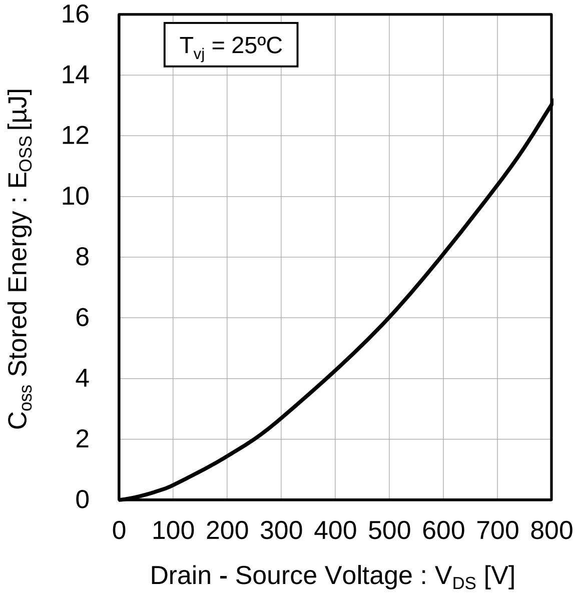
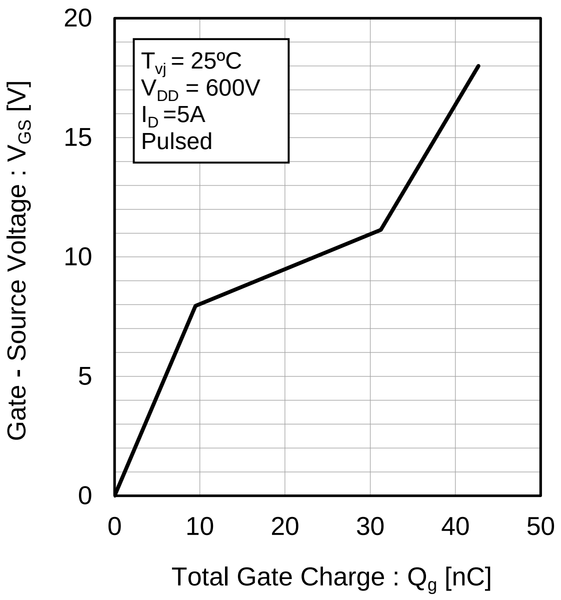
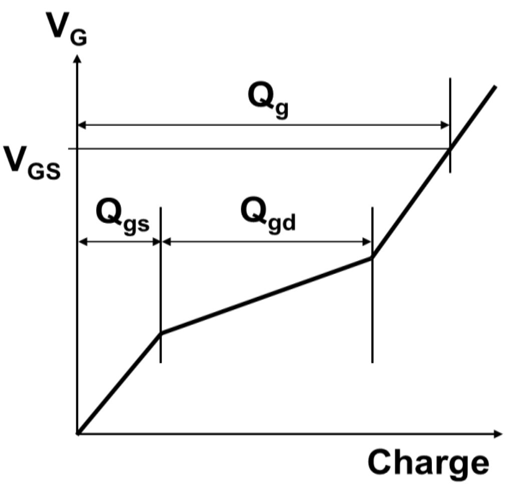


Fig.21 Dynamic Input Characteristics



*Gate Charge Waveform



●Electrical characteristic curves

Fig.19 Typical Switching Time vs. Drain Current

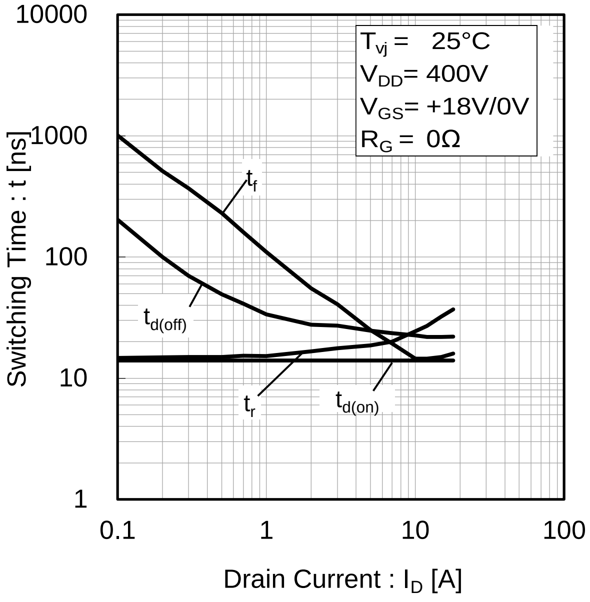


Fig.20 Typical Switching Loss vs. Drain - Source Voltage

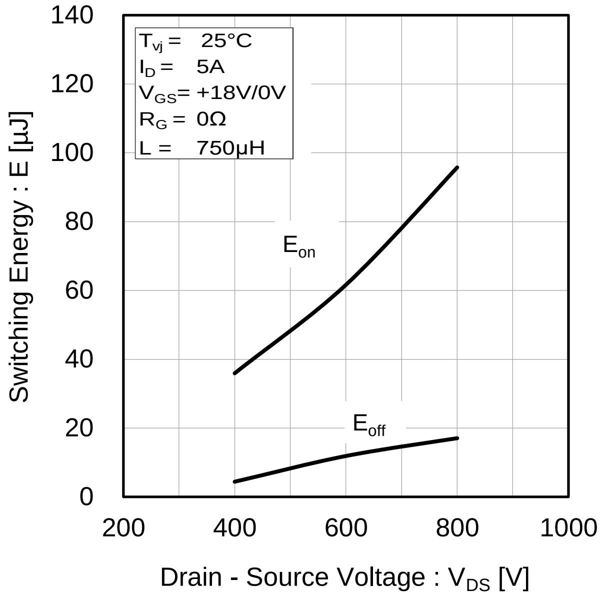


Fig.21 Typical Switching Loss vs. Drain Current

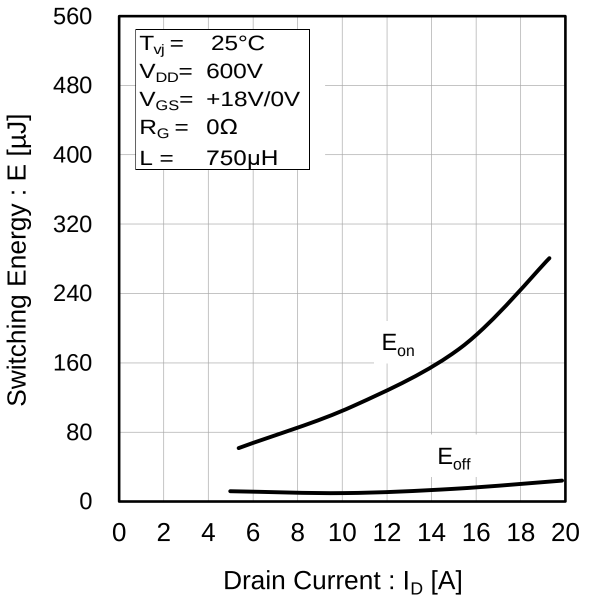
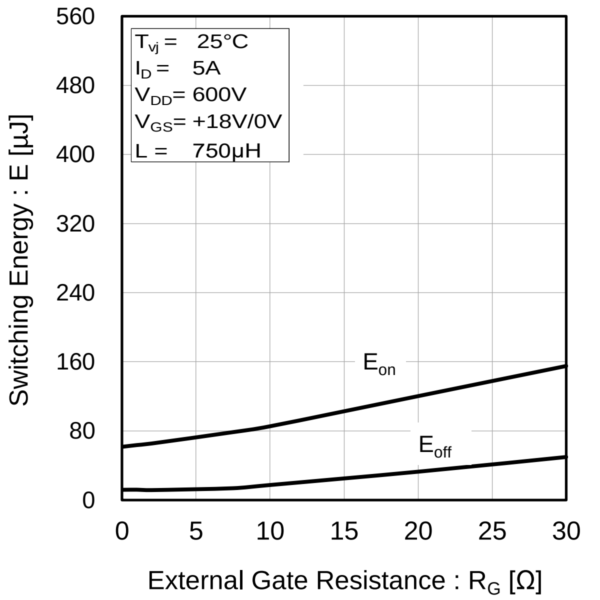


Fig.22 Typical Switching Loss vs. External Gate Resistance



●Measurement circuits and waveforms

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

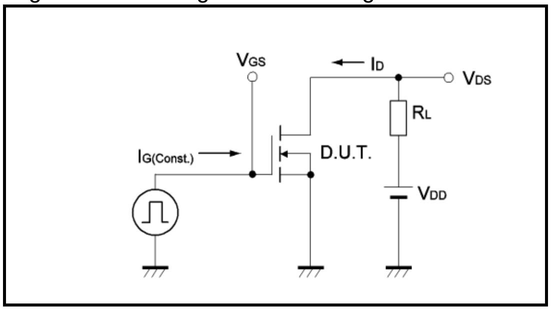


Fig.1-2 Waveforms for Switching Time

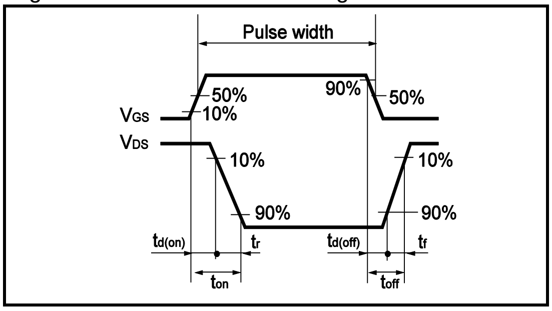


Fig.2-1 Switching Energy Measurement Circuit

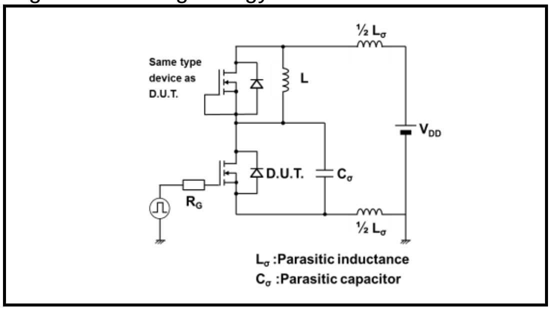


Fig.2-2 Waveforms for Switching Energy Loss

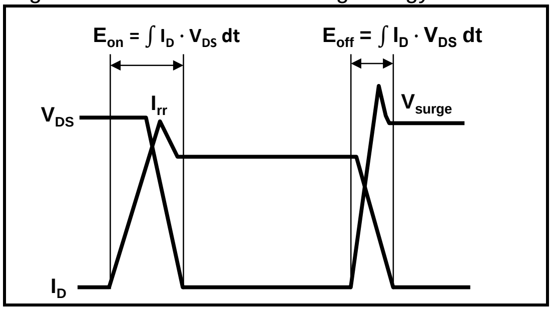


Fig.3-1 Reverse Recovery Time Measurement Circuit

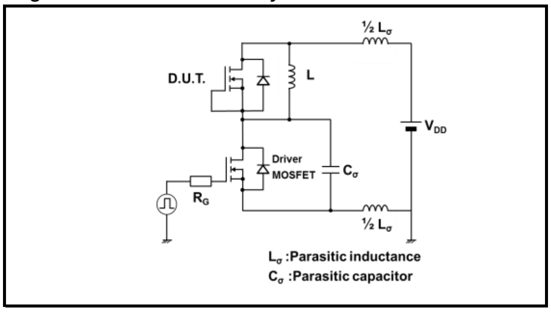
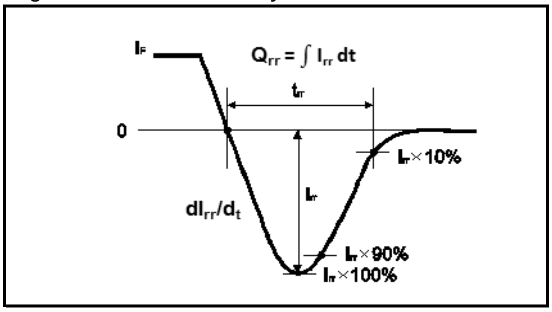
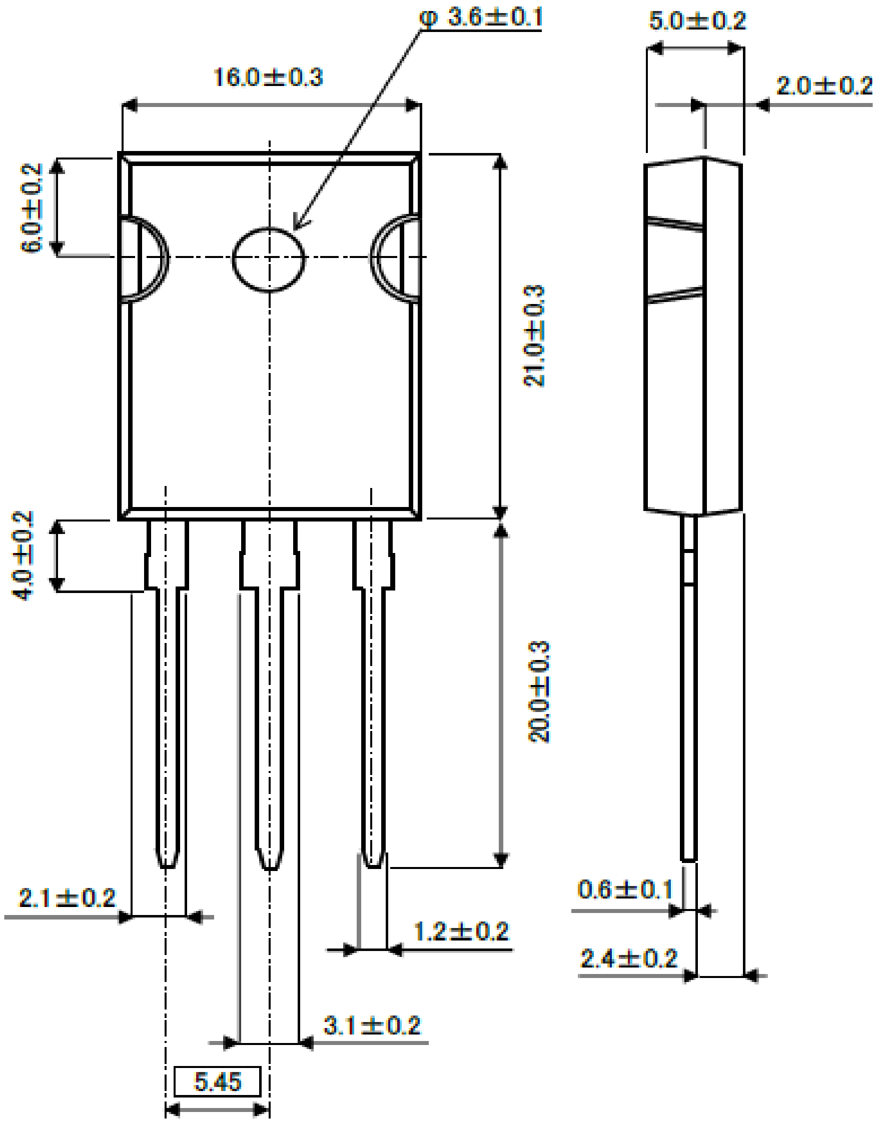
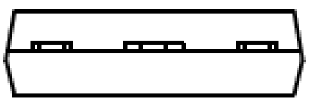


Fig.3-2 Reverse Recovery Waveform

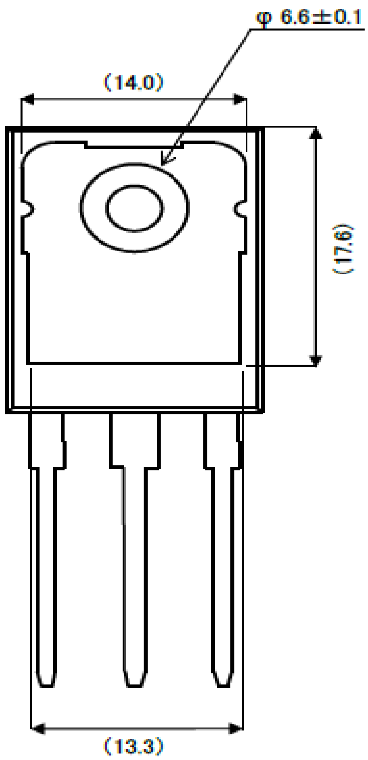


●**Package Dimensions**



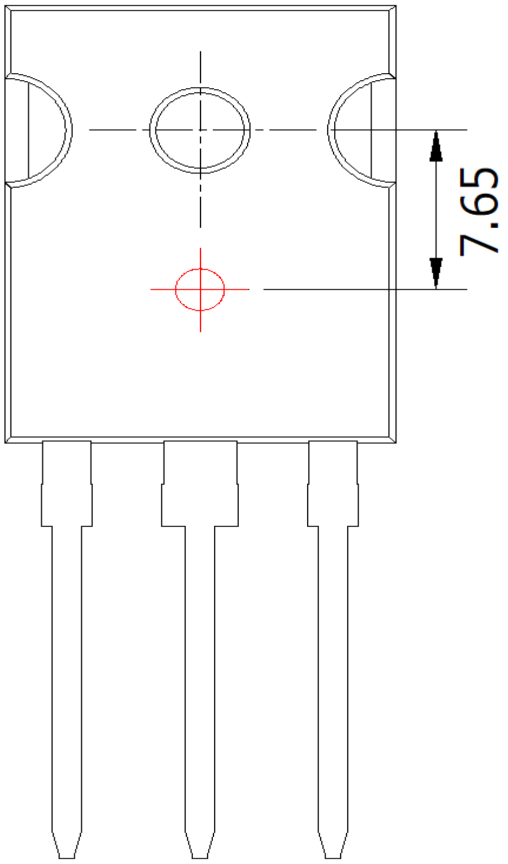


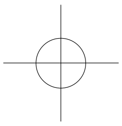
Unit: mm



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

Notes

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