SCT4036KRHR

Automotive Grade N-channel SiC power MOSFET

Datasheet

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

●Outline

TO-247-4L

● Features

1) Qualified to AEC-Q101

2) Low on-resistance

3) Fast switching speed

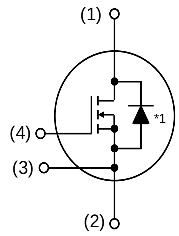
4) Fast reverse recovery

5) Easy to parallel

6) Simple to drive

7) Pb-free lead plating ; RoHS compliant

●Inner circuit



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

● 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°C)

Parameter		Symbol	Value	Unit
Drain - source voltage		V_{DSS}	1200	V
Continuous drain and source current	$V_{GS} = V_{GS\_on}$	I_D, I_S *1	43	A
T_c = 100°C			30	A
Pulsed drain current	$V_{GS} = V_{GS\_on}$	$I_{D,pulse}$ *2	84	A
Body diode pulsed forward current	V_{GS} = 0 V	$I_{S,pulse}$ *3	43	A
Body diode surge forward current	V_{GS} = 0 V	$I_{S,pulse}$ *4	84	A
Gate - source voltage (DC)		V_{GSS_DC}	-4 to +21	V
Gate - source surge voltage (t_{surge} < 300ns)		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	°C
Range of storage temperature		T_{stg}	-40 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} = 0 V, I_D = 9.2mA T_{vj} = 25°C	1200	-	-	V
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0 V, V_{DS} =1200V T_{vj} = 25°C	-	1	80	μA
		T_{vj} = 150°C	-	10	-	
Gate - Source leakage current	I_{GSS+}	V_{GS} = +21V , V_{DS} = 0V	-	-	100	nA
Gate - Source leakage current	I_{GSS-}	V_{GS} = -4V , V_{DS} = 0V	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}$ *7	V_{DS} = 10V, I_D = 11.1mA	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ *8	V_{GS} = 18V, I_D = 21A T_{vj} = 25°C	-	36	47	mΩ
		T_{vj} = 150°C	-	72	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	1	-	Ω

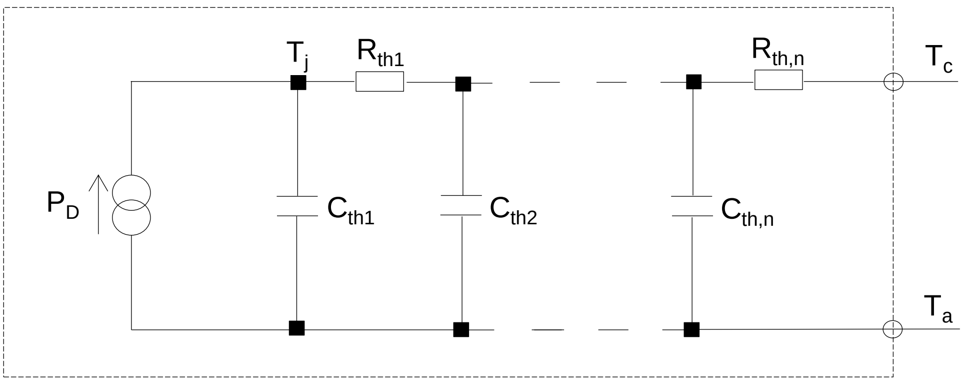
●Thermal resistance

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
R_{th1}	1.1×10^{-1}	K/W
R_{th2}	2.5×10^{-1}	
R_{th3}	2.9×10^{-1}	

Symbol	Value	Unit
C_{th1}	5.8×10^{-4}	Ws/K
C_{th2}	2.3×10^{-3}	
C_{th3}	1.1×10^{-2}	



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

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

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

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

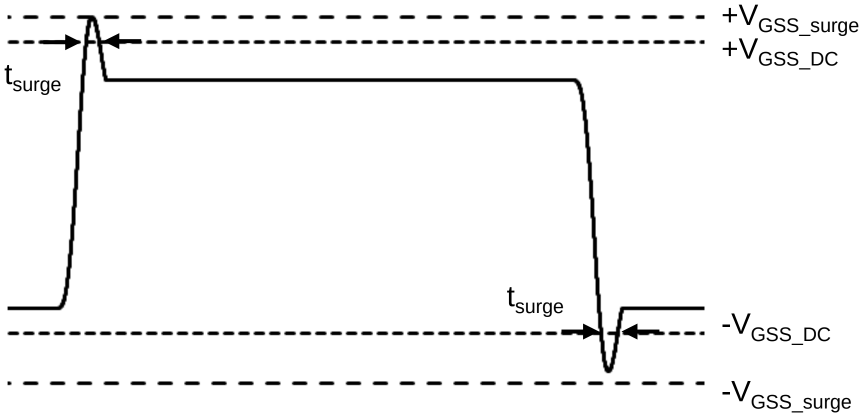
*1 Limited by maximum T_{vj} and for Max. R_{thJC}.

*2 PW ≤ 10μs, Duty cycle ≤ 1%

*3 Only for body-diode, Repititive pulse, PW ≤ 500ns, Duty cycle ≤ 5%

*4 When used as a protective function, PW ≤ 10μs

*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} = 21V 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

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

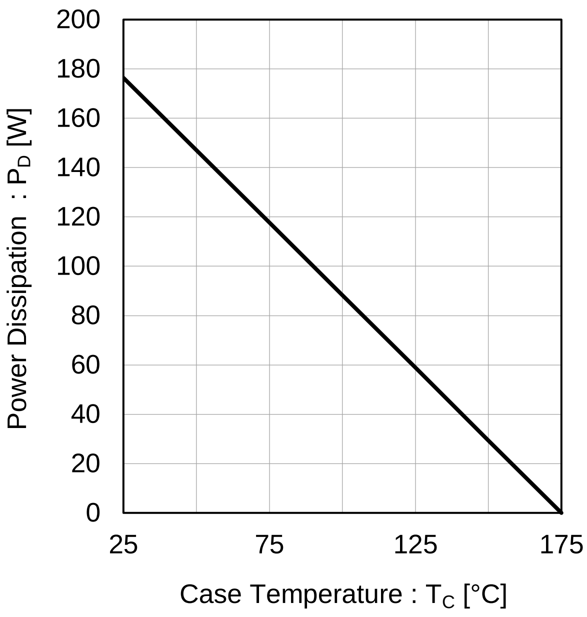


Fig.2 Maximum Safe Operating Area

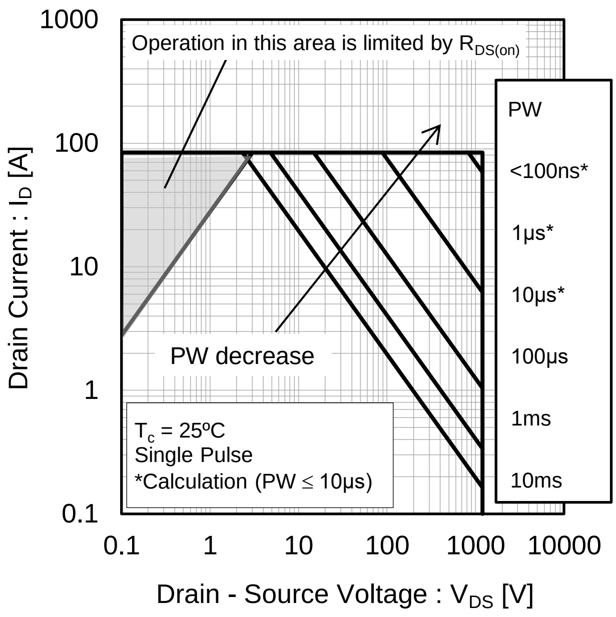
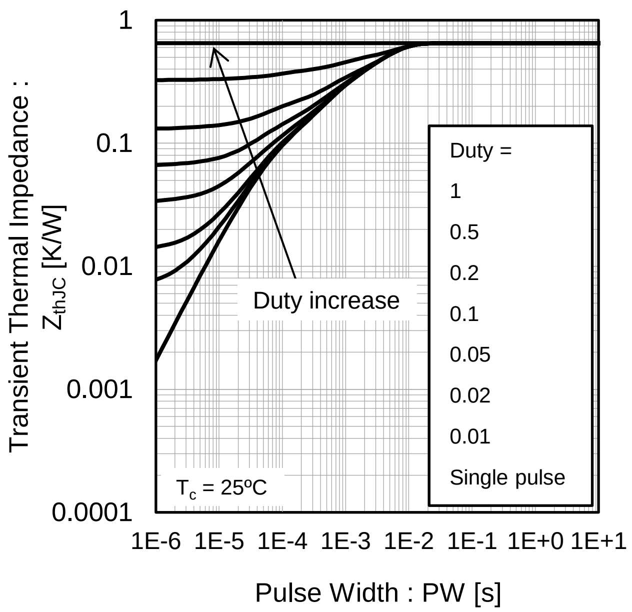


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

Fig.4 T_{vj} = 25ºC Typical Output Characteristics(I)

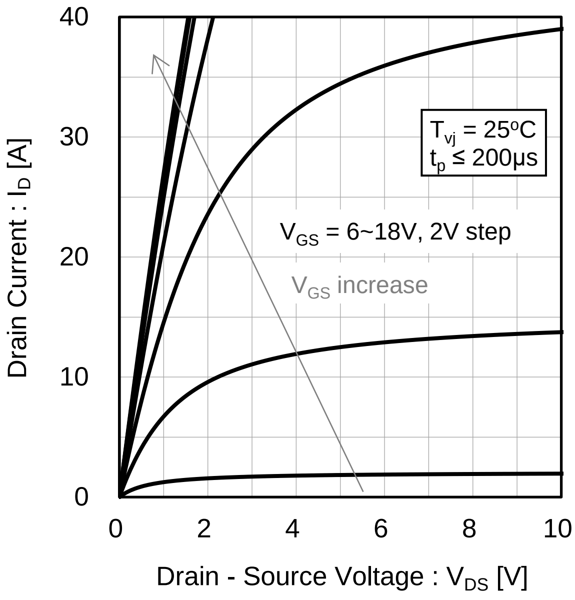


Fig.5 T_{vj} = 25ºC Typical Output Characteristics(II)

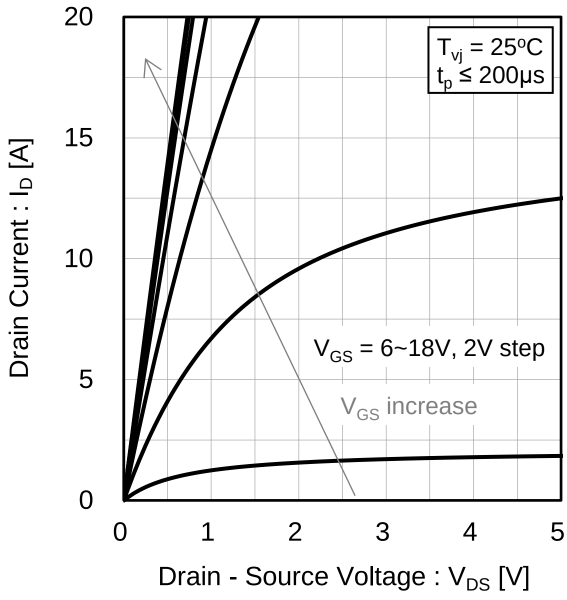
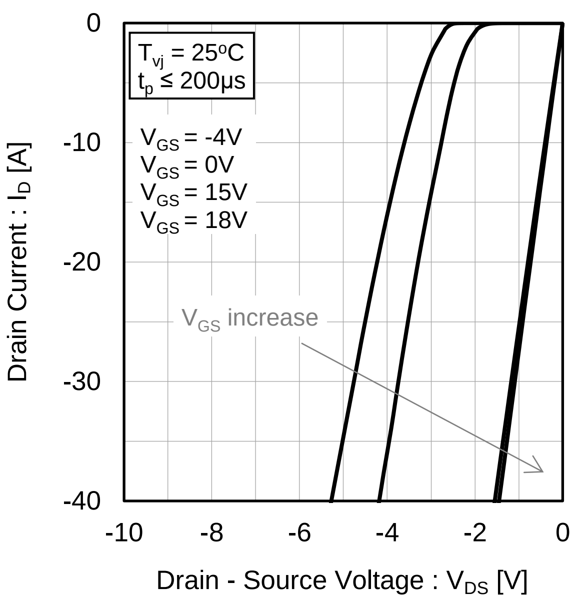


Fig.6 T_{vj} = 25ºC 3rd Quadrant Characteristics



●Electrical characteristic curves

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

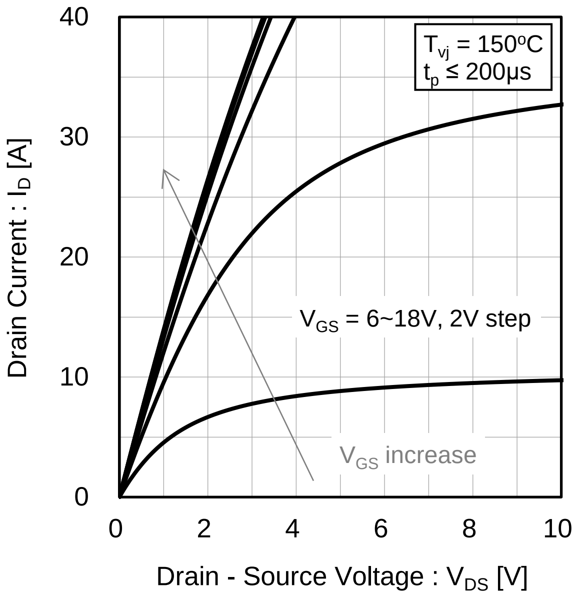


Fig.8 T_{vj} = 150ºC Typical Output Characteristics(II)

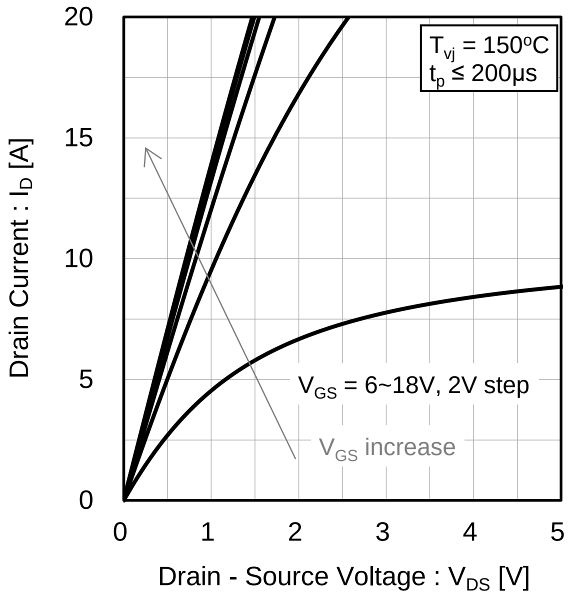


Fig.9 T_{vj} = 150ºC 3rd Quadrant Characteristics

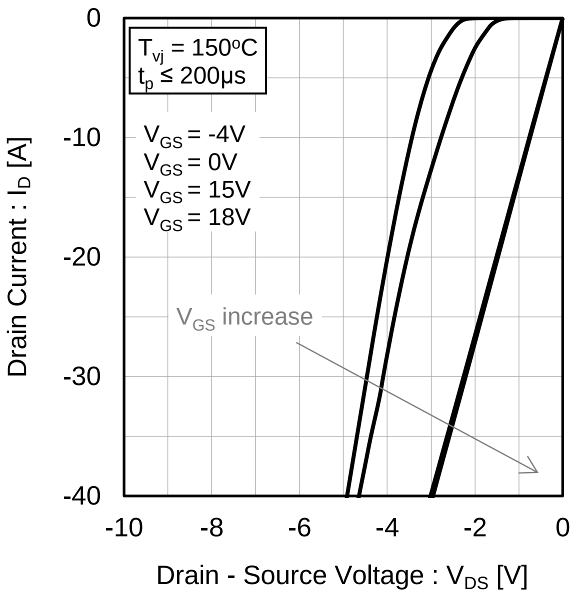
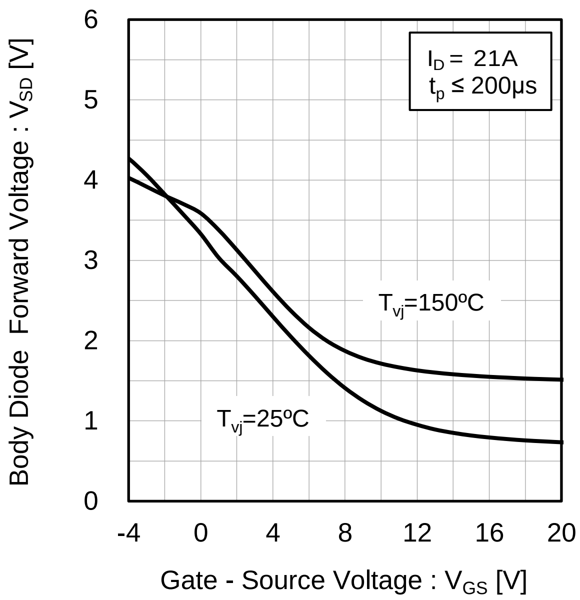


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●**Electrical characteristic curves**

Fig.11 Typical Transfer Characteristics (I)

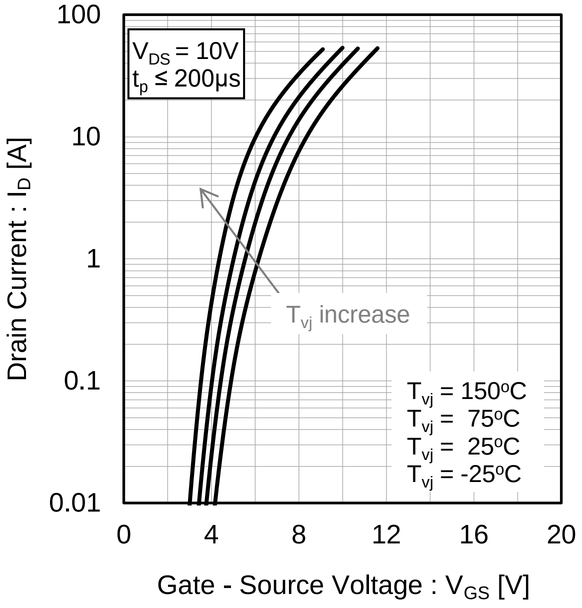


Fig.12 Typical Transfer Characteristics (II)

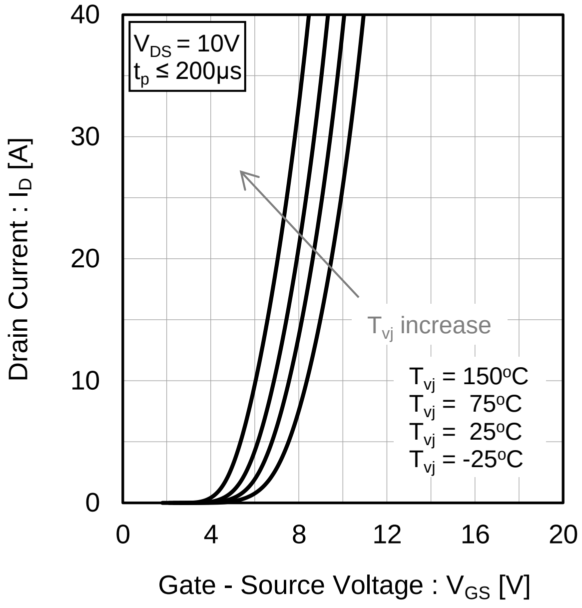


Fig.13 Gate Threshold Voltage vs. Virtual Junction Temperature

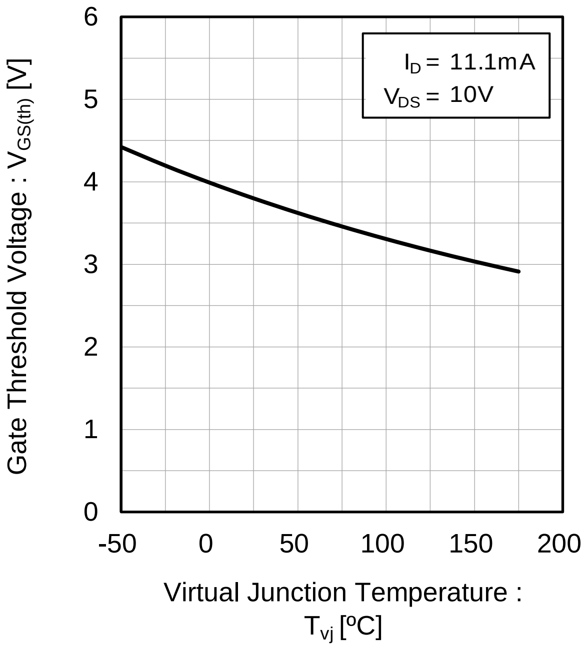
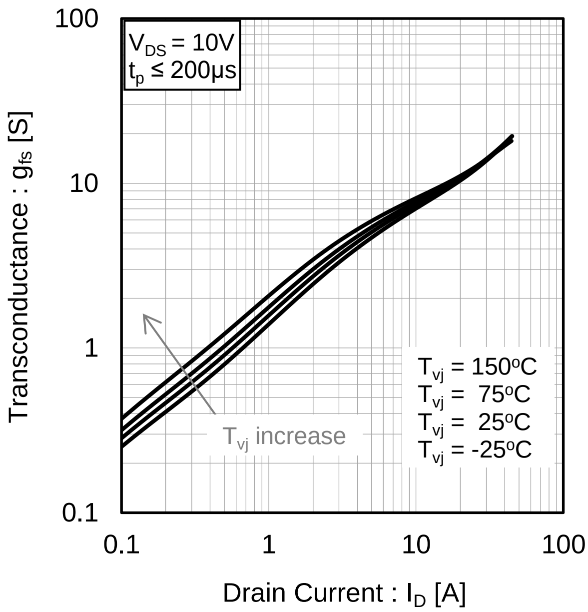


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

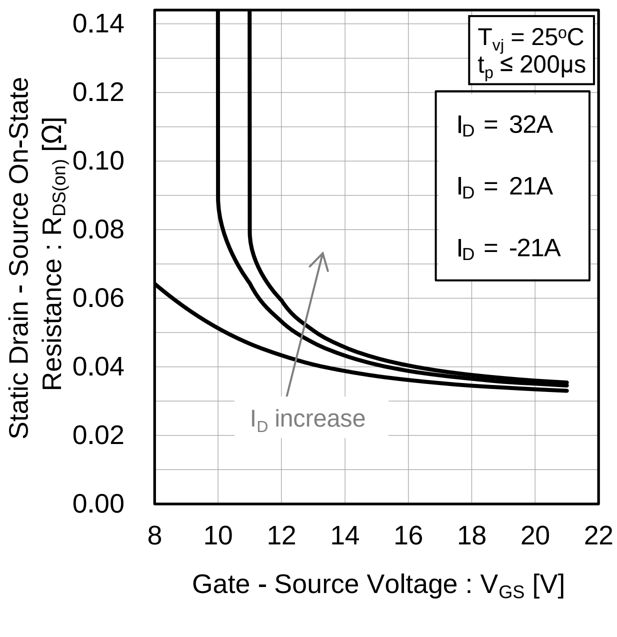


Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

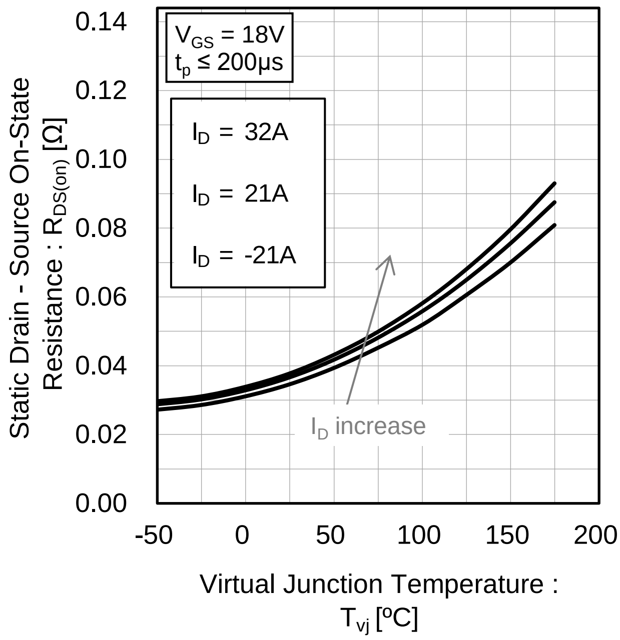


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

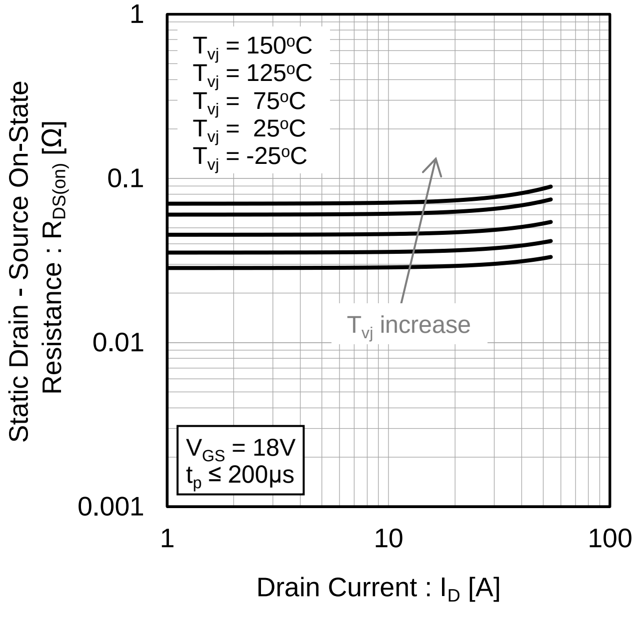
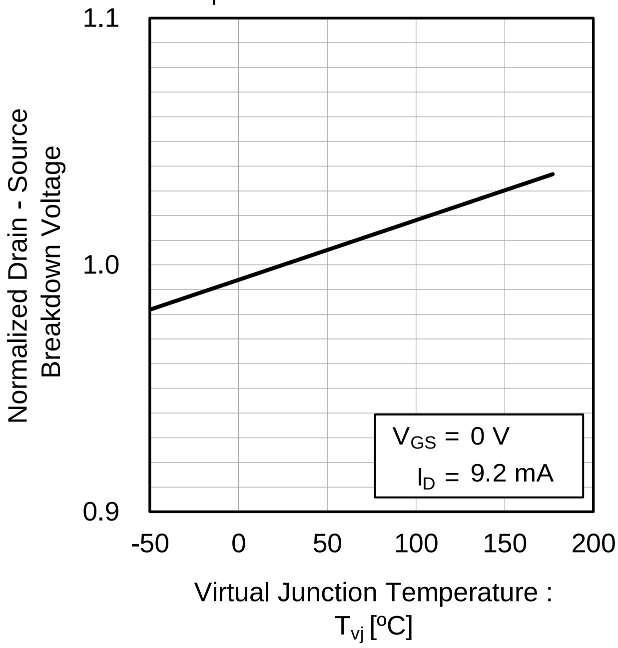


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

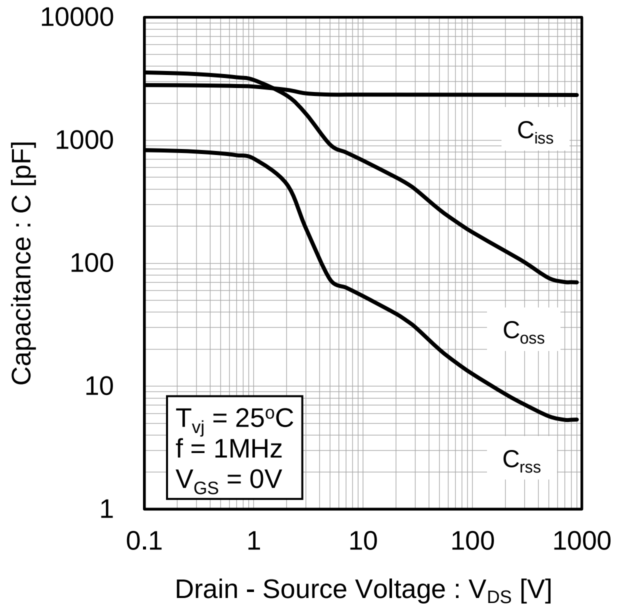


Fig.20 C_{oss} Stored Energy

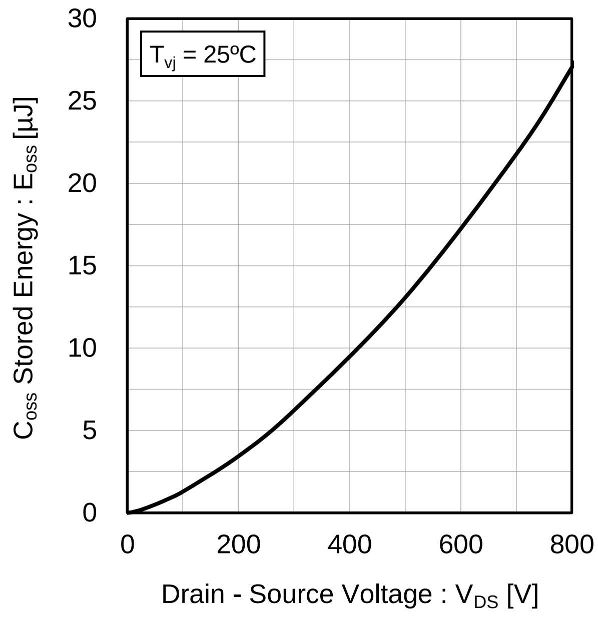
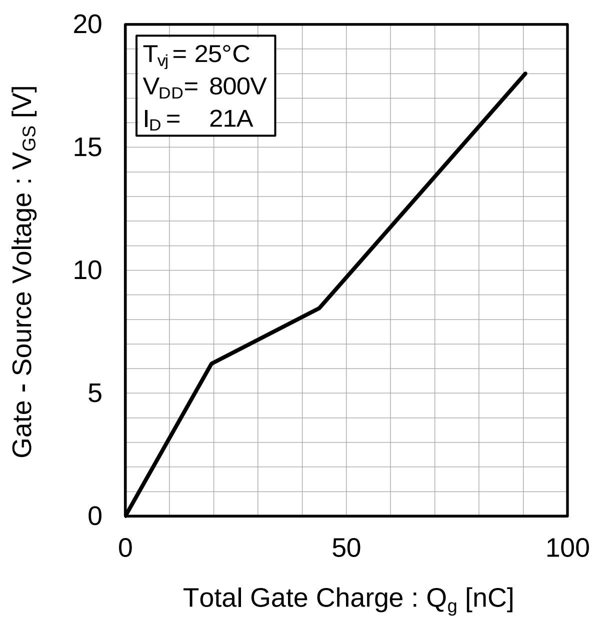


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

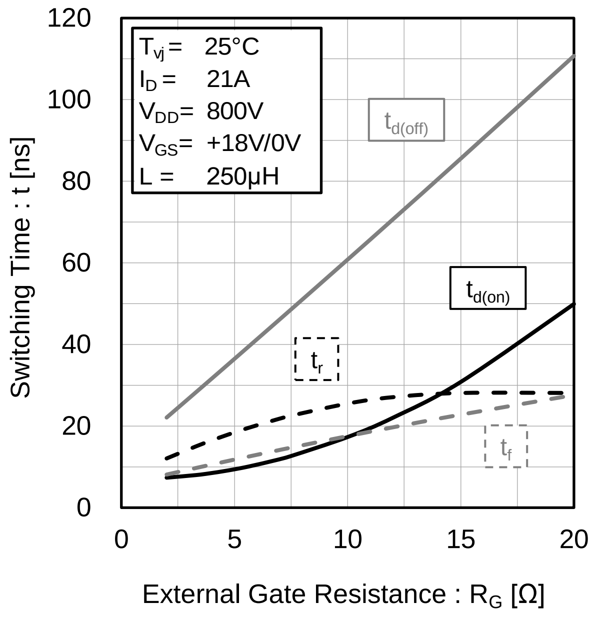


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

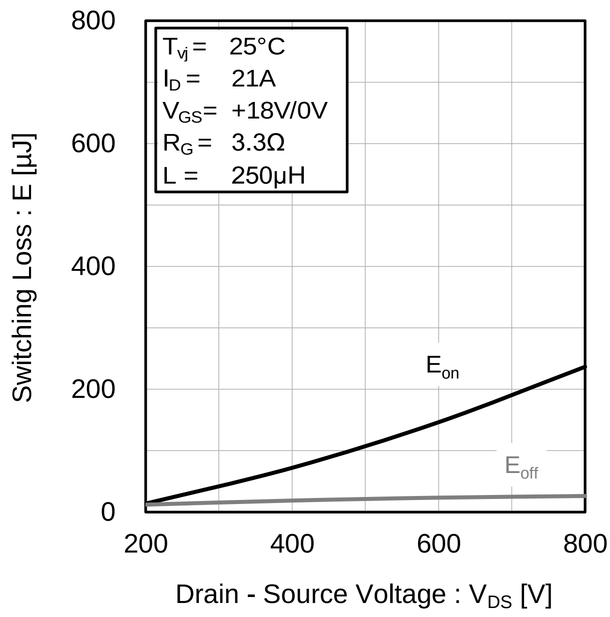


Fig.24 Typical Switching Loss vs. Drain Current

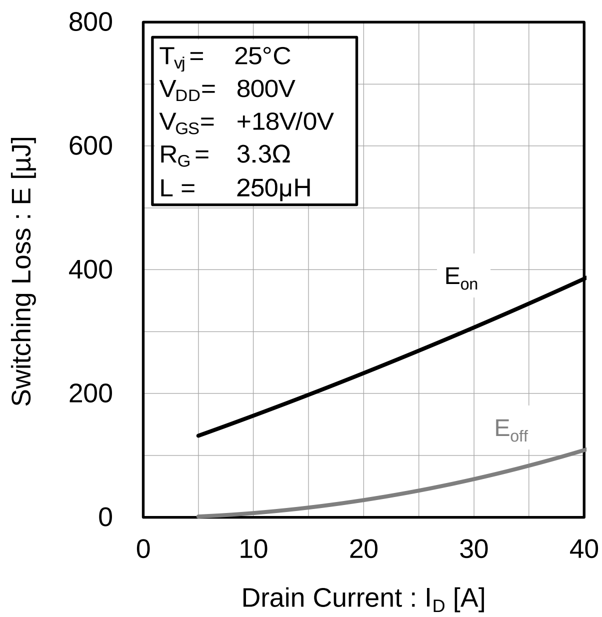
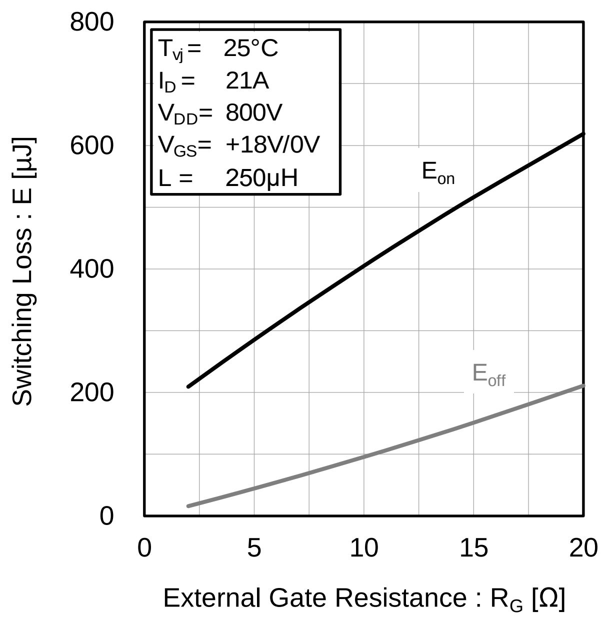


Fig.25 Typical Switching Loss vs. External Gate Resistance



●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

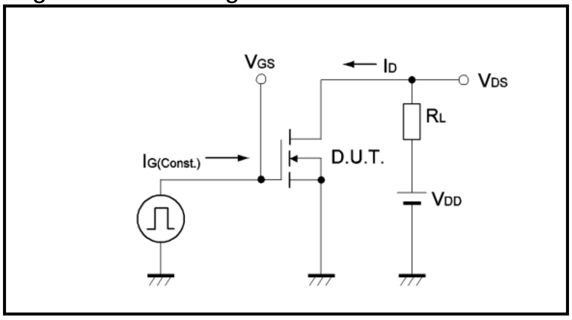


Fig.1-2 Gate Charge Waveform

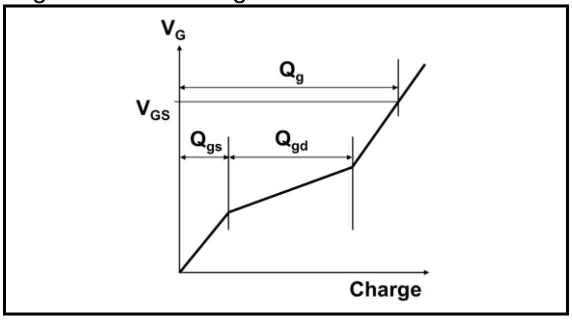


Fig.2-1 Switching Characteristics Measurement Circuit

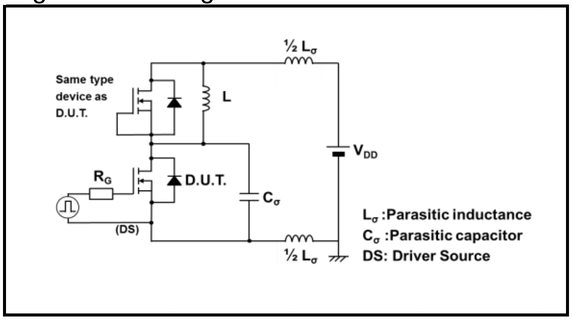


Fig.2-2 Waveforms for Switching Time

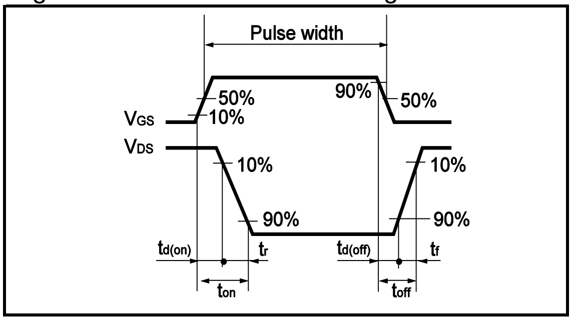


Fig.2-3 Waveforms for Switching Energy Loss

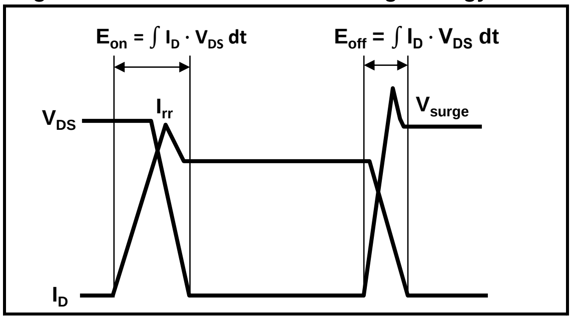


Fig.3-1 Reverse Recovery Time Measurement Circuit

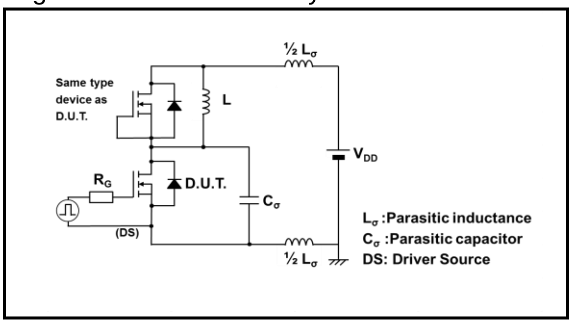
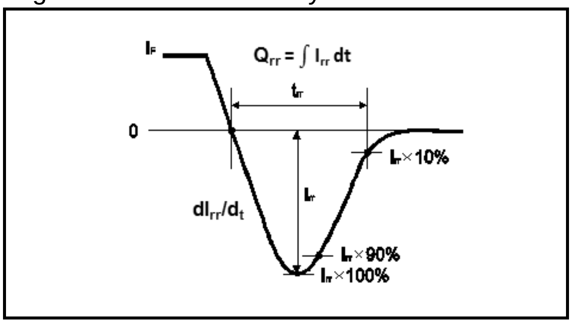
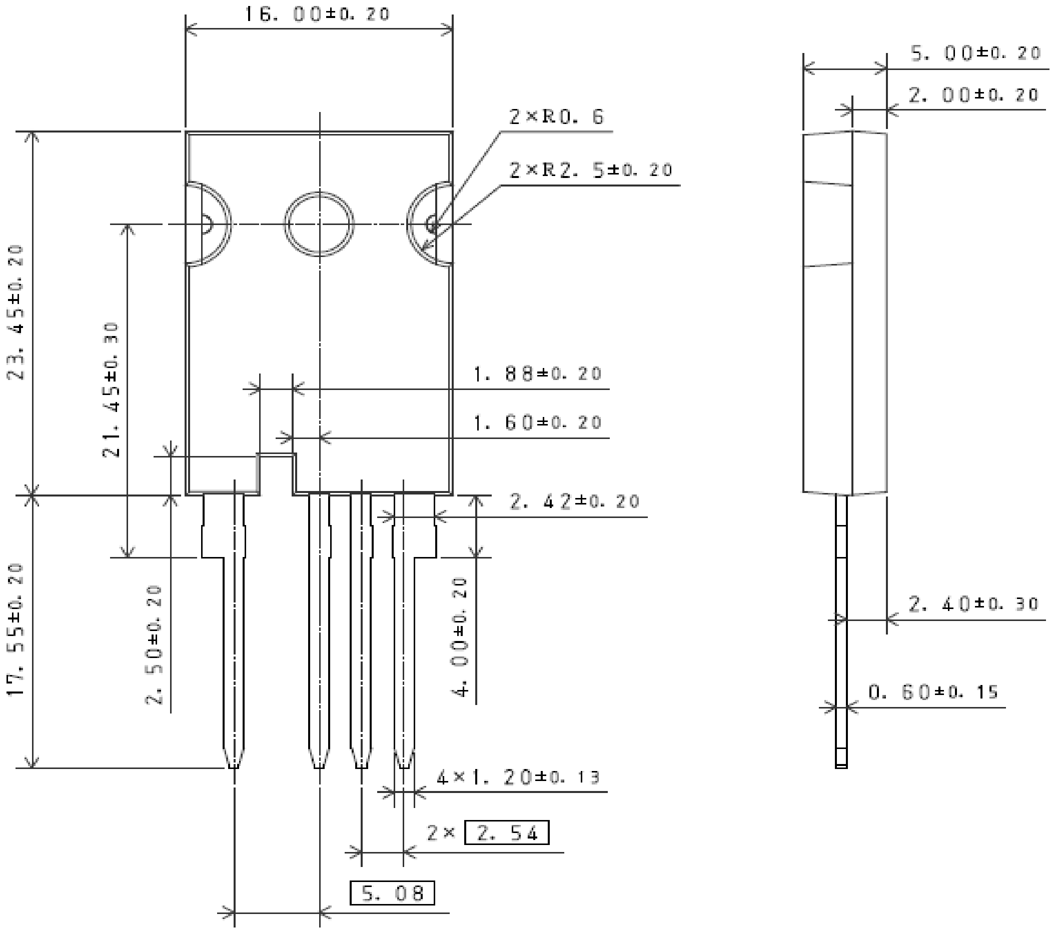


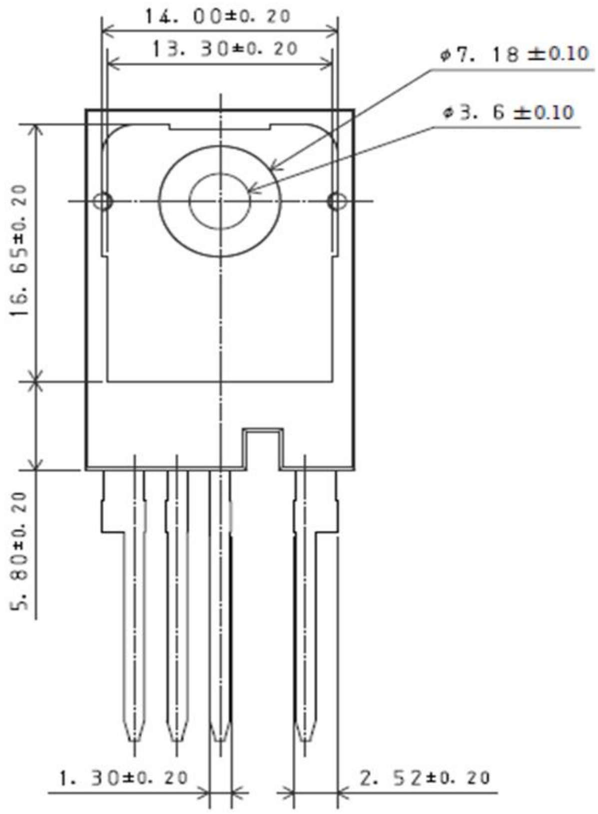
Fig.3-2 Reverse Recovery Waveform



●Package Dimensions

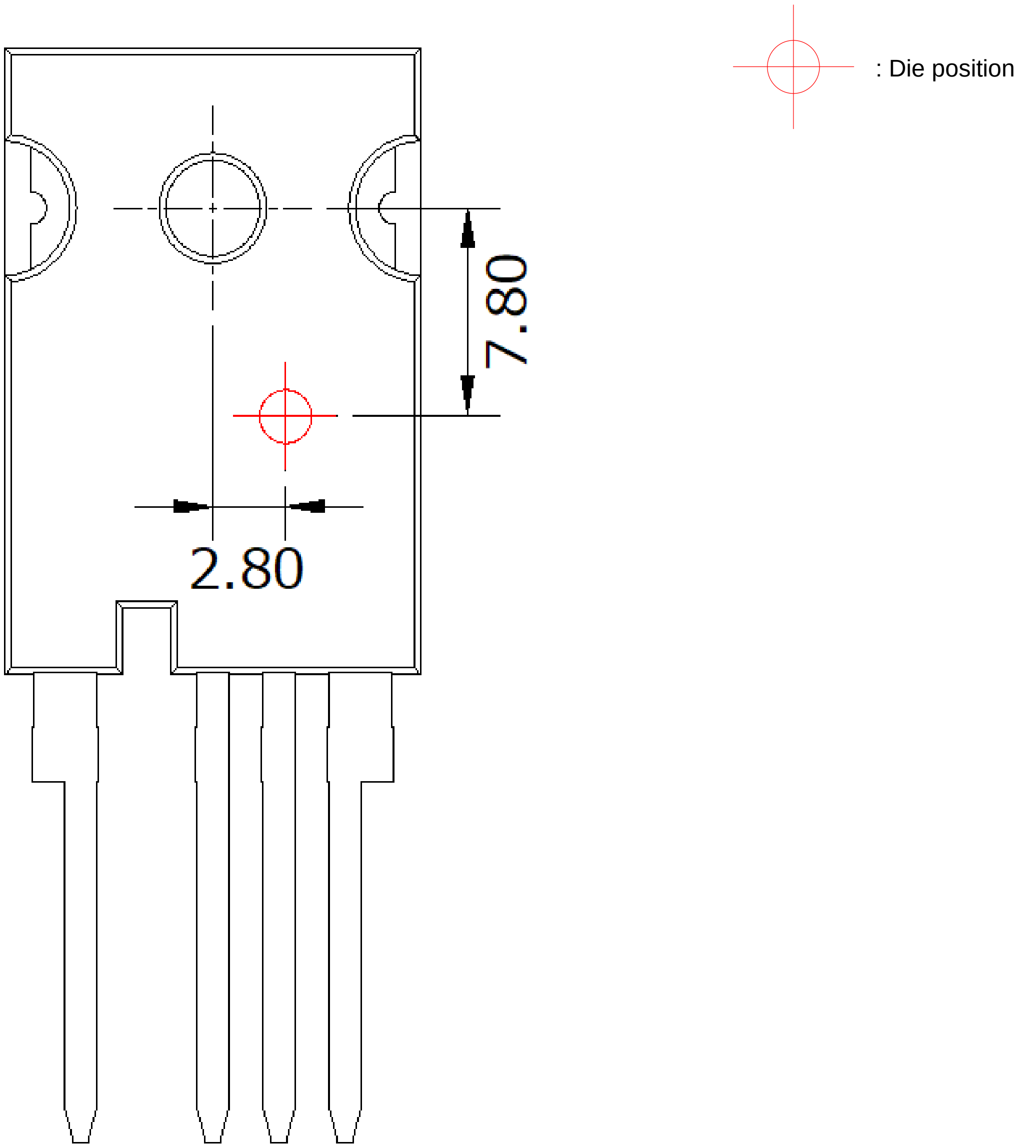


Unit: mm


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**



・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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3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
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