SCT3040KRHR

Automotive Grade N-channel SiC power MOSFET

Datasheet

V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	40mΩ
I_D *1	55A
P_D	262W

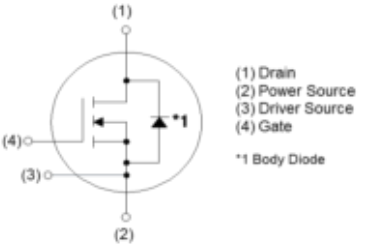
●Outline

TO-247-4L



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

●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	SCT3040KR

●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	55	A
	T_c = 100°C	I_D *1	39	A
Pulsed Drain current (T_c = 25°C)		$I_{D,pulse}$ *2	137	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 T_{vj} = 25°C T_{vj} = -55°C	 1200 1200	 - -	 - -	V
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =1200V T_{vj} = 25°C T_{vj} = 150°C	 - -	 1 2	 10 -	μA
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 = 10mA	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ *5	V_{GS} = 18V, I_D = 20A T_{vj} = 25°C T_{vj} = 150°C	 - -	 40 68	 52 -	mΩ
Gate input resistance	R_G	f = 1MHz, open drain	-	7	-	Ω

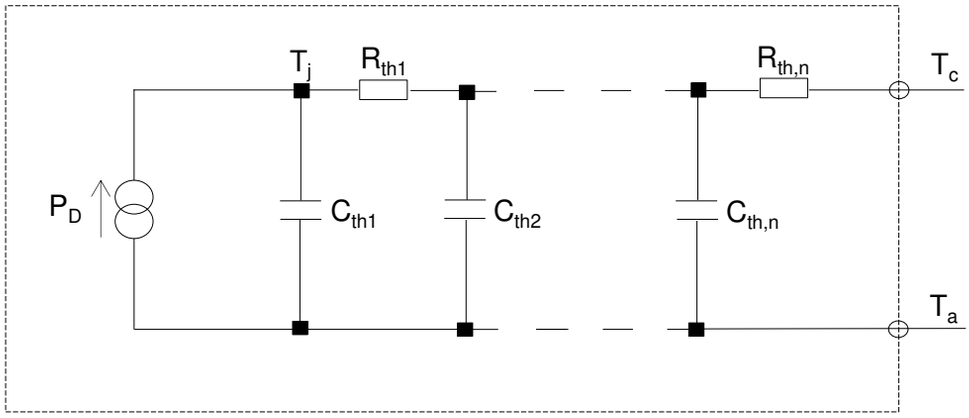
●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	0.44	0.57	K/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	2.56×10^{-2}	K/W
R_{th2}	1.95×10^{-1}	
R_{th3}	2.20×10^{-1}	

Symbol	Value	Unit
C_{th1}	1.39×10^{-3}	Ws/K
C_{th2}	1.00×10^{-2}	
C_{th3}	3.57×10^{-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 = 20A	-	8.3	-	S
Input capacitance	C_{iss}	V_{GS} = 0V V_{DS} = 800V f = 1MHz	-	1337	-	pF
Output capacitance	C_{oss}		-	76	-	
Reverse transfer capacitance	C_{rss}		-	27	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 600V	-	122	-	pF
Total Gate charge	Q_g *5	V_{DS} = 600V I_D = 20A V_{GS} = 18V See Fig. 1-1.	-	107	-	nC
Gate - Source charge	Q_{gs} *5		-	17	-	
Gate - Drain charge	Q_{gd} *5		-	56	-	
Turn - on delay time	$t_{d(on)}$ *5	V_{DS} = 600V I_D = 30A V_{GS} = 0V/+18V R_G = 0Ω, L = 750μH L_σ = 50nH, C_σ = 10pF See Fig. 2-1, 2-2, 2-3. E_{on} includes diode reverse recovery.	-	6	-	ns
Rise time	t_r *5		-	21	-	
Turn - off delay time	$t_{d(off)}$ *5		-	27	-	
Fall time	t_f *5		-	20	-	
Turn - on switching loss	E_{on} *5		-	341	-	μJ
Turn - off switching loss	E_{off} *5		-	130	-	

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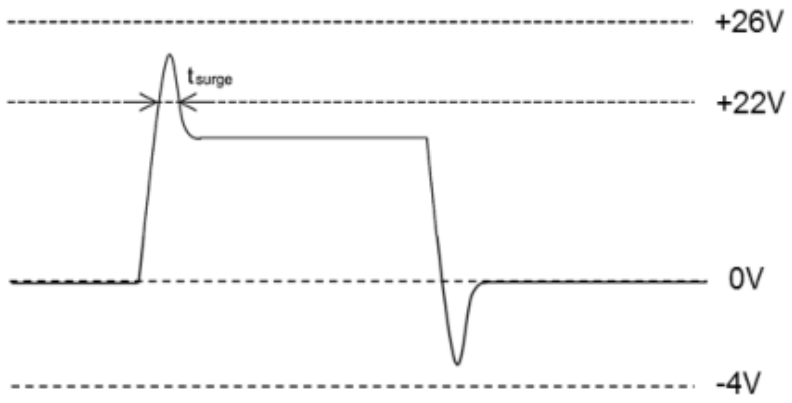
●**Body diode electrical characteristics** (Source-Drain) (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	I_S *1	T_c = 25°C	-	-	55	A
Body diode direct current, pulsed	I_{SM} *2		-	-	137	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_S = 20A	-	3.2	-	V
Reverse recovery time	t_{rr} *5	I_F = 20A V_R = 600V di/dt = 2500A/μs L_σ = 50nH, C_σ = 10pF See Fig. 3-1, 3-2.	-	25	-	ns
Reverse recovery charge	Q_{rr} *5		-	535	-	nC
Peak reverse recovery current	I_{rrm} *5		-	35	-	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

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●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

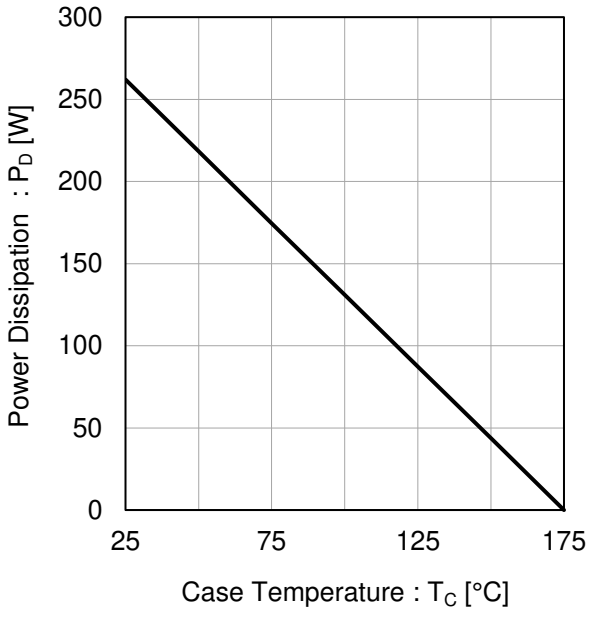


Fig.2 Maximum Safe Operating Area

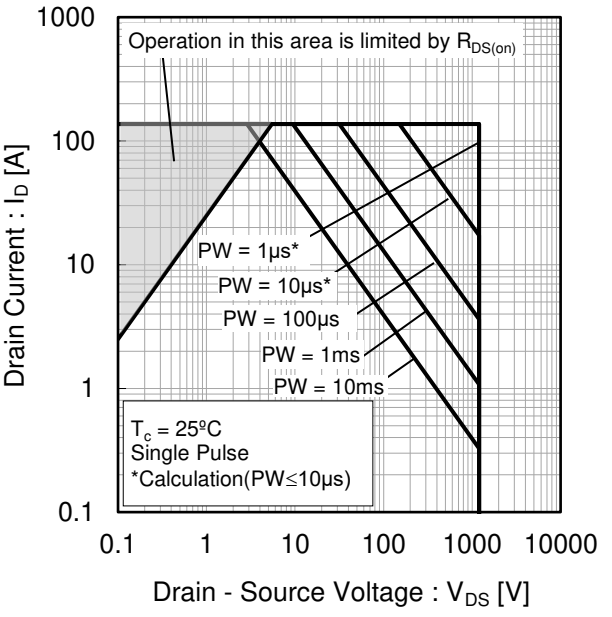
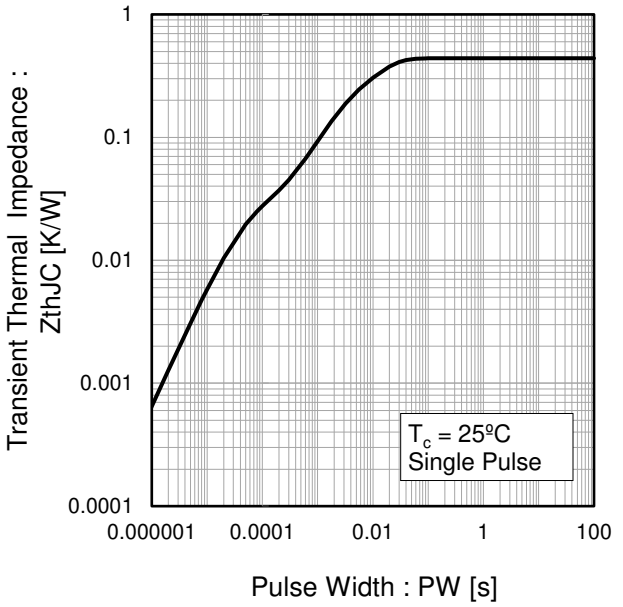


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



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●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

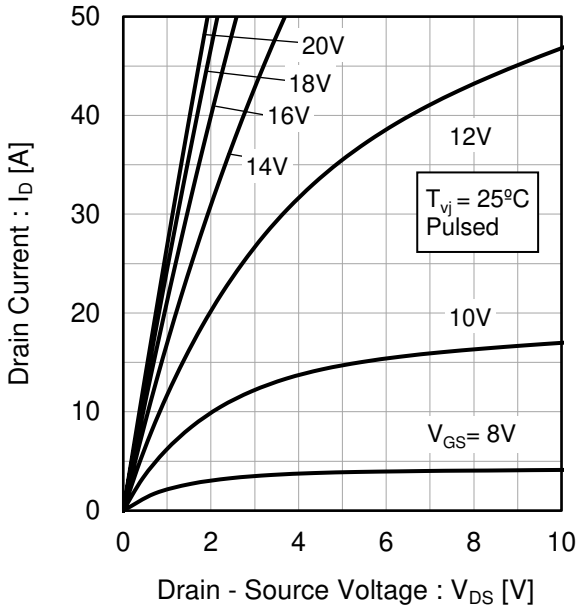


Fig.5 Typical Output Characteristics(II)

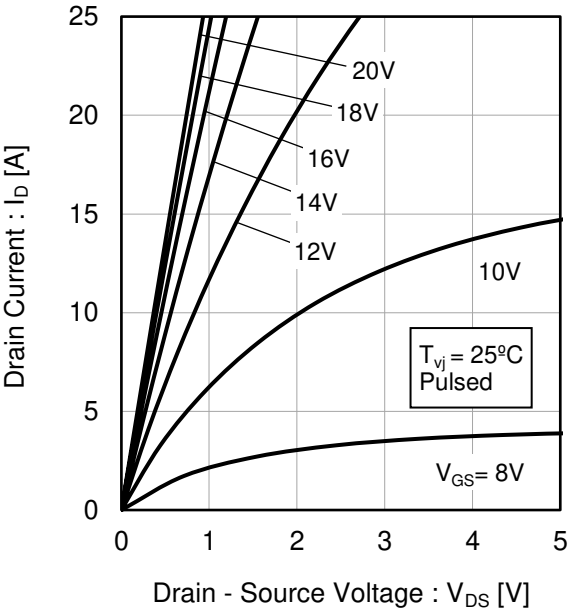
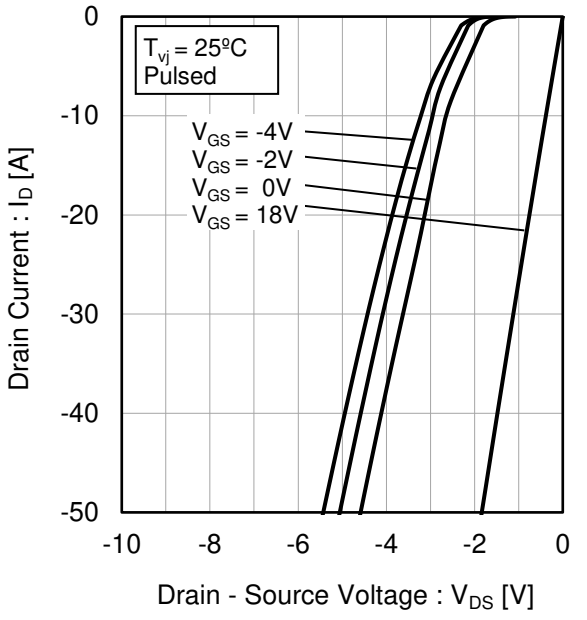


Fig.6 T_{vj} = 25ºC 3rd Quadrant Characteristics



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●Electrical characteristic curves

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

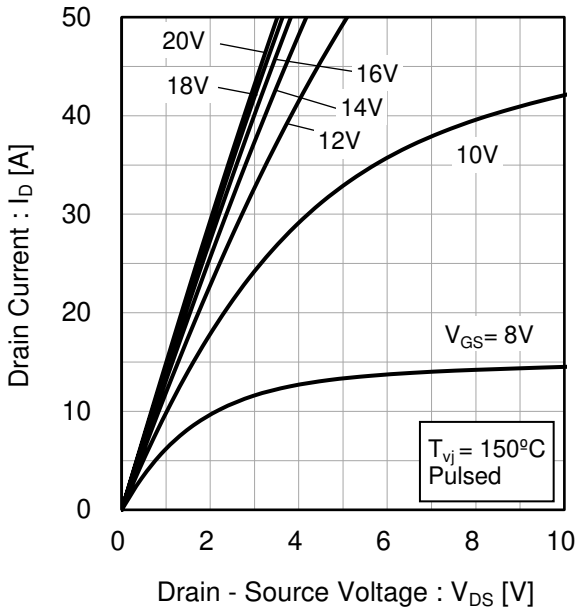


Fig.8 T_{vj} = 150ºC Typical Output Characteristics(II)

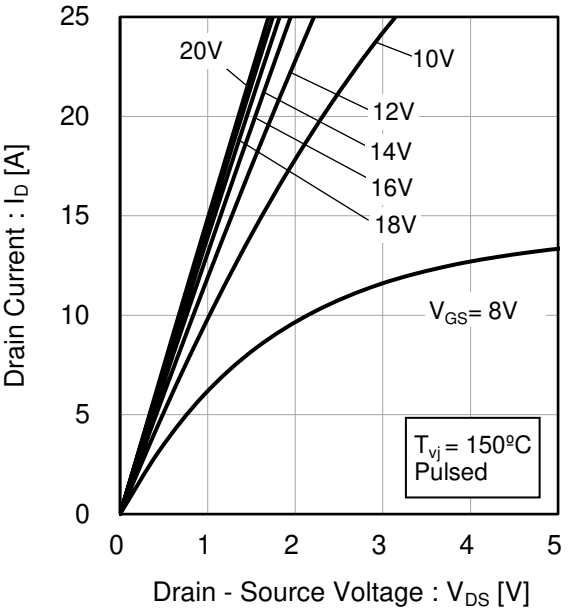


Fig.9 T_{vj} = 150ºC 3rd Quadrant Characteristics

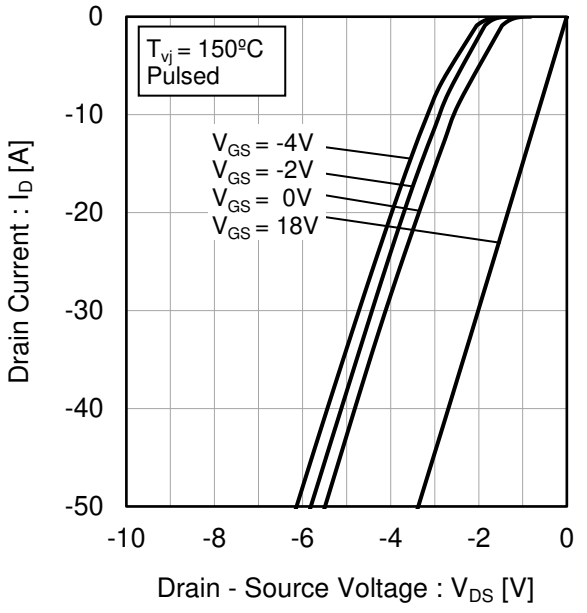
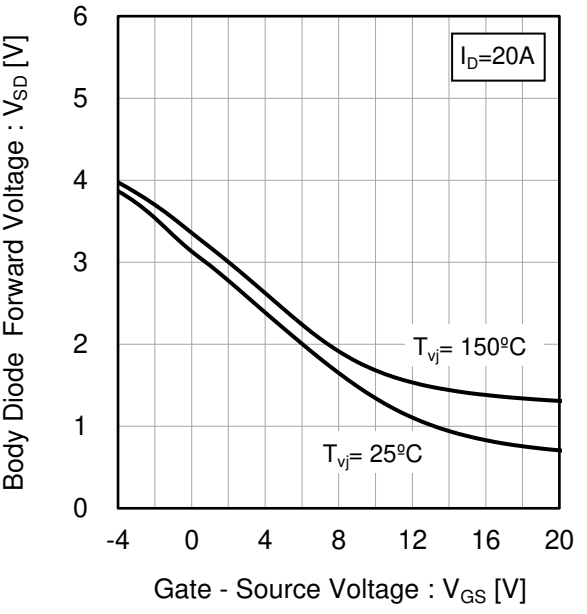


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



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●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

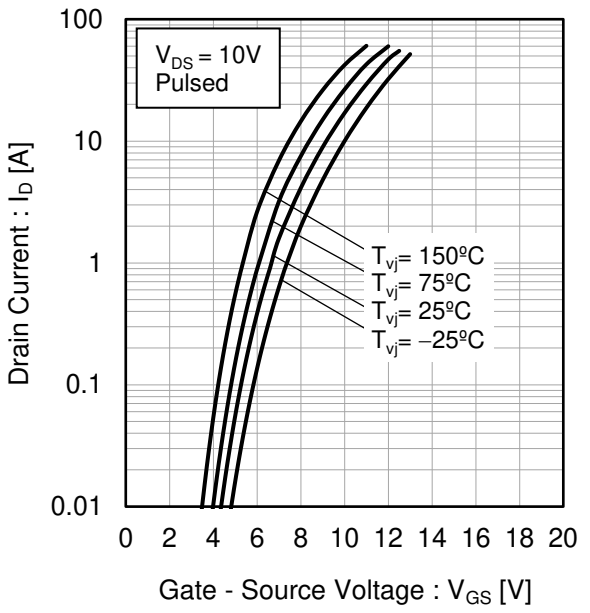


Fig.12 Typical Transfer Characteristics (II)

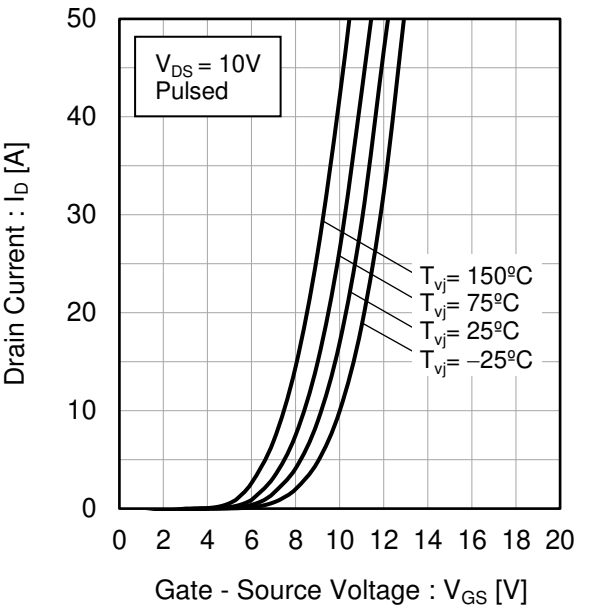


Fig.13 Gate Threshold Voltage
vs. Virtual Junction Temperature

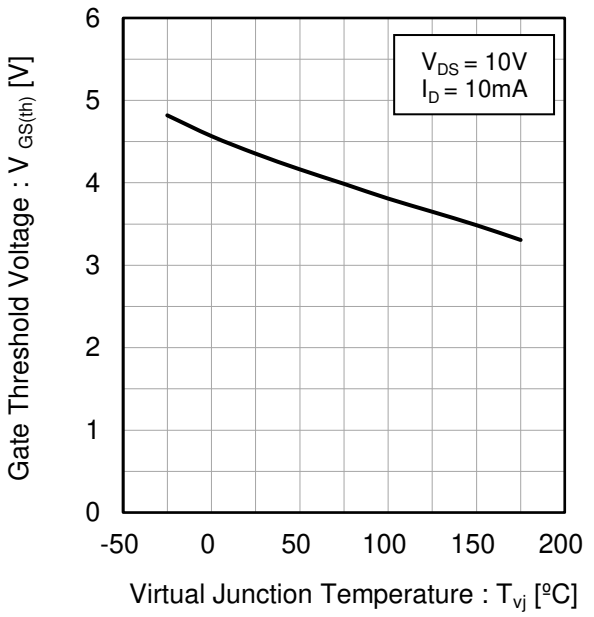
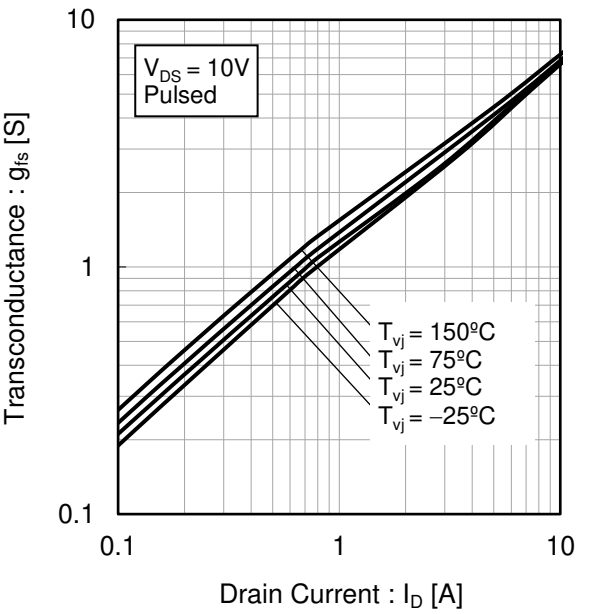


Fig.14 Transconductance vs. Drain Current



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●Electrical characteristic curves

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

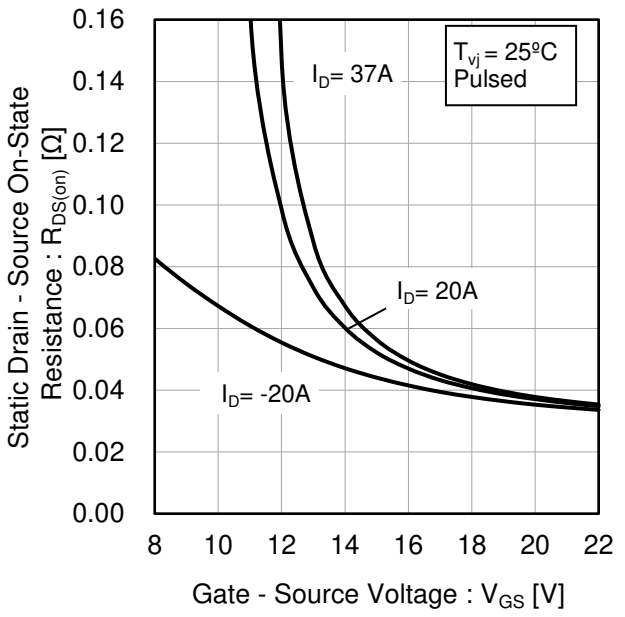


Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

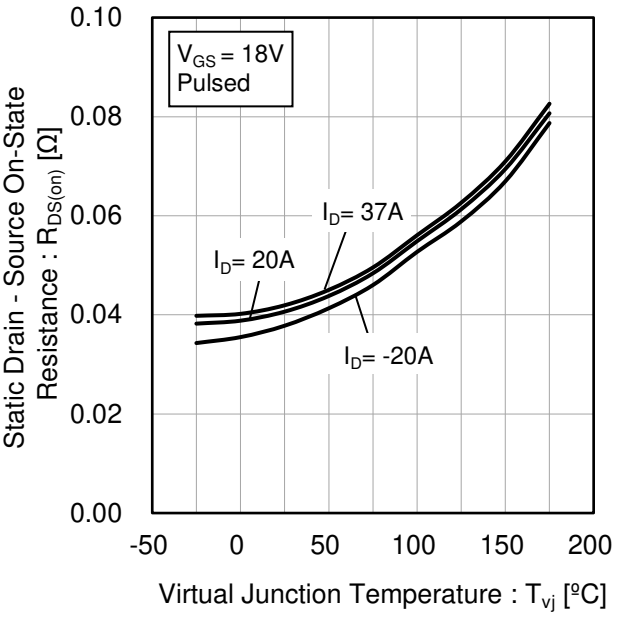


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

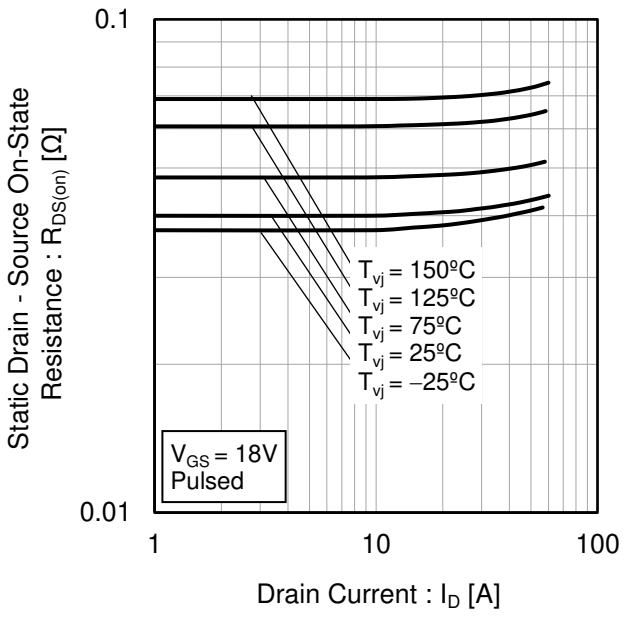
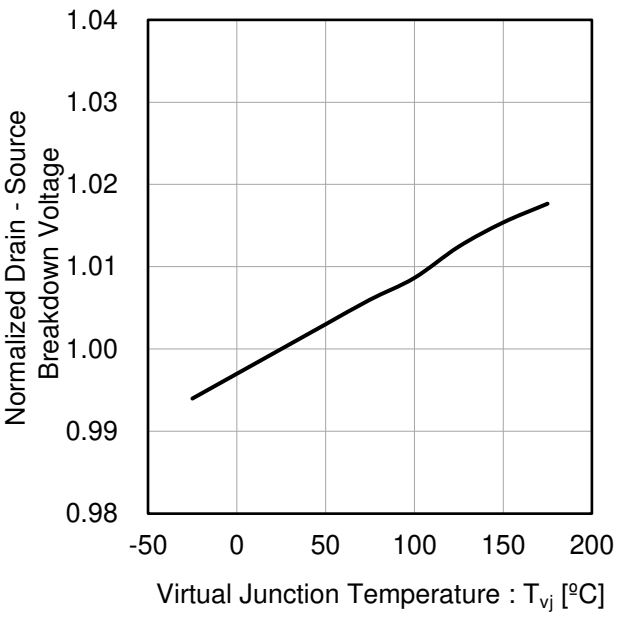


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



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●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

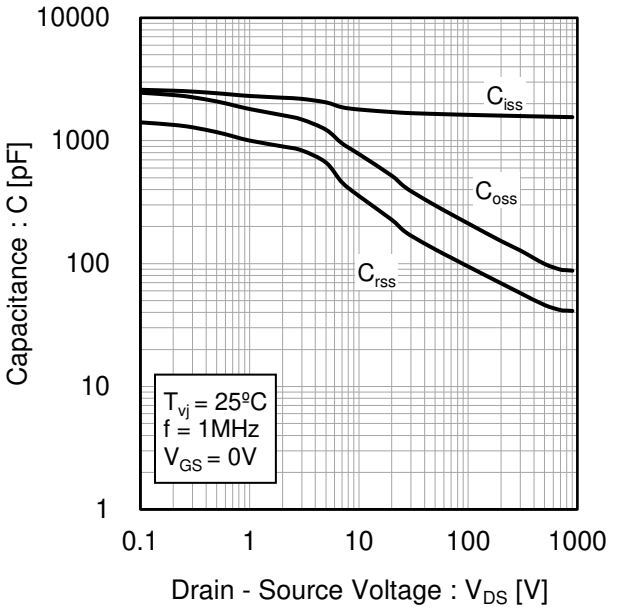


Fig.20 C_{oss} Stored Energy

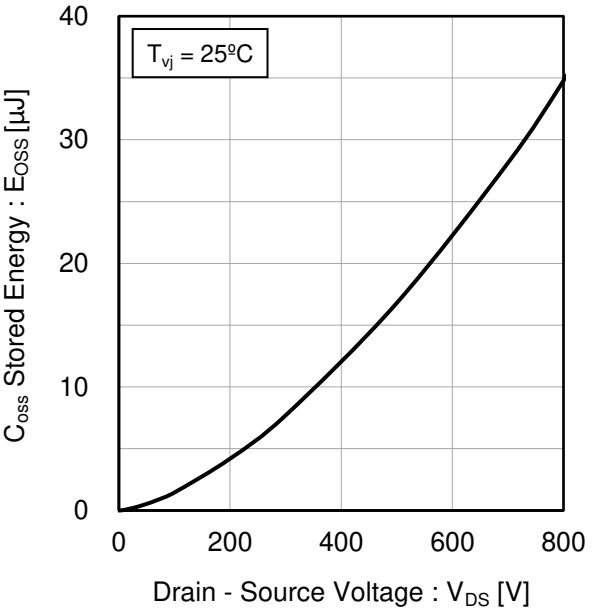
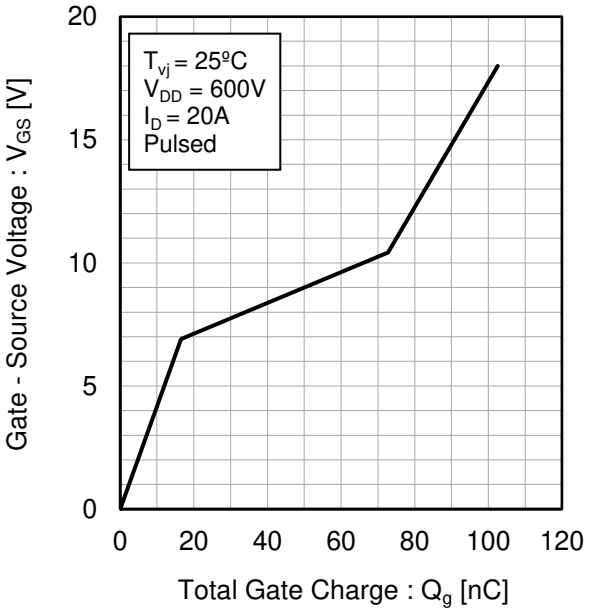
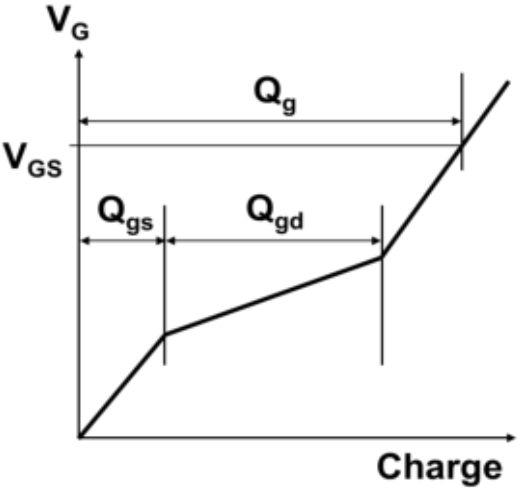


Fig.21 Dynamic Input Characteristics



*Gate Charge Waveform



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●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

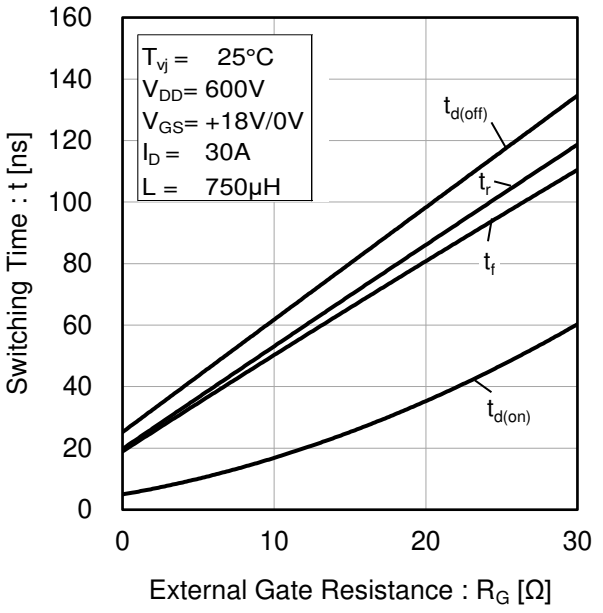


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

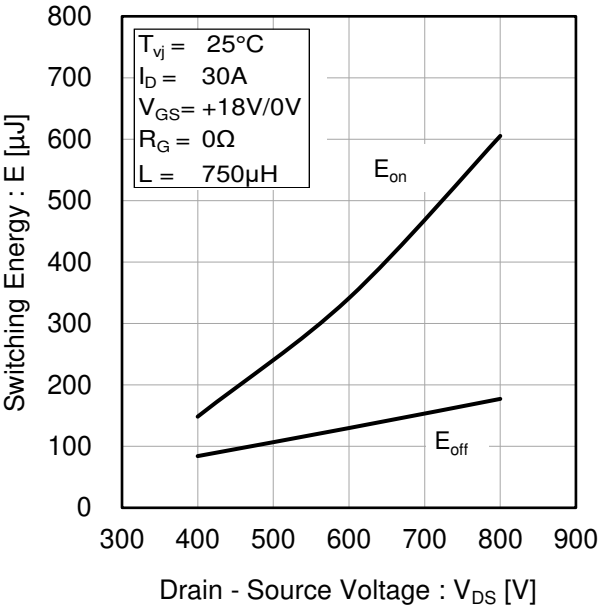


Fig.24 Typical Switching Loss vs. Drain Current

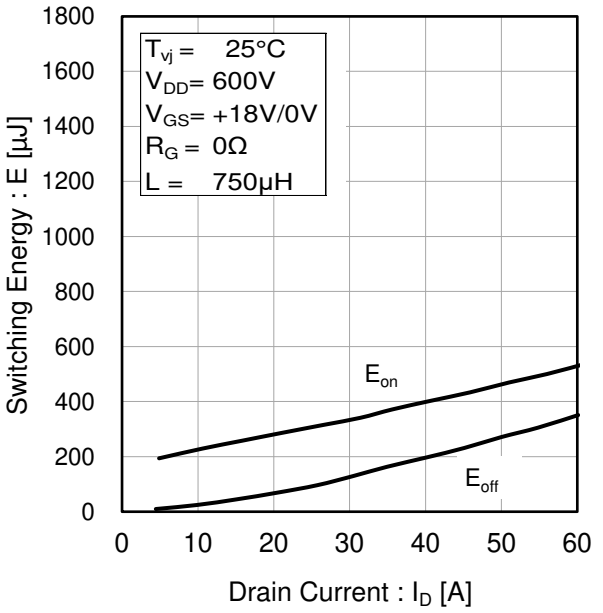
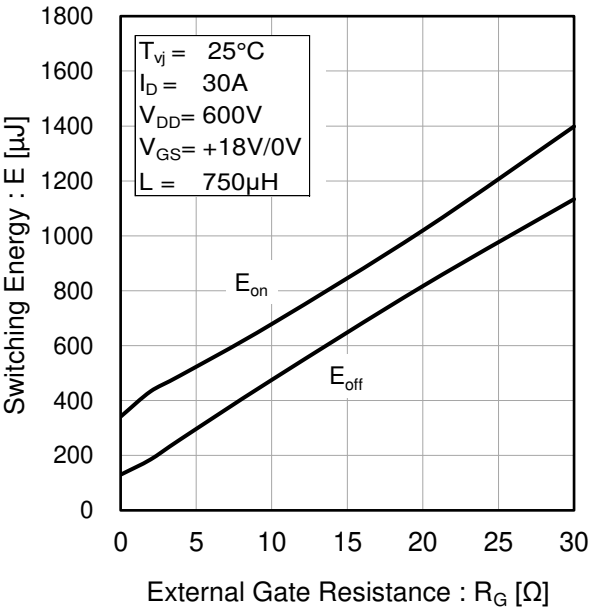


Fig.25 Typical Switching Loss vs. External Gate Resistance



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●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

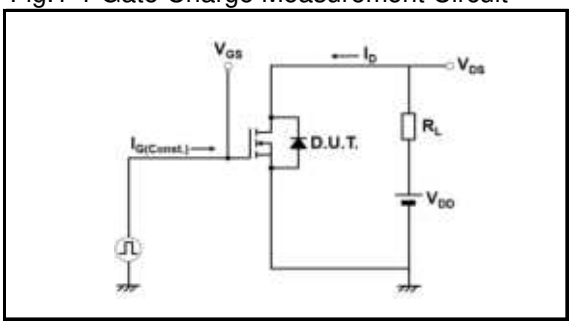


Fig.2-1 Switching Characteristics Measurement Circuit

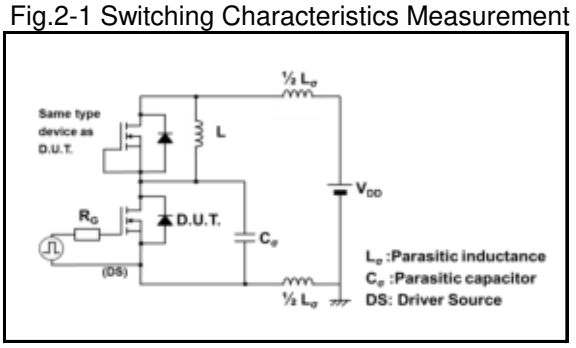


Fig.2-2 Waveforms for Switching Time

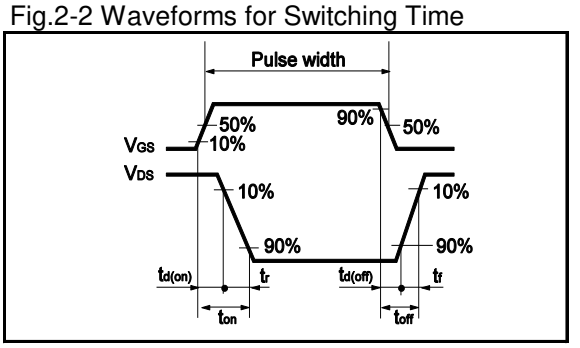


Fig.2-3 Waveforms for Switching Energy Loss

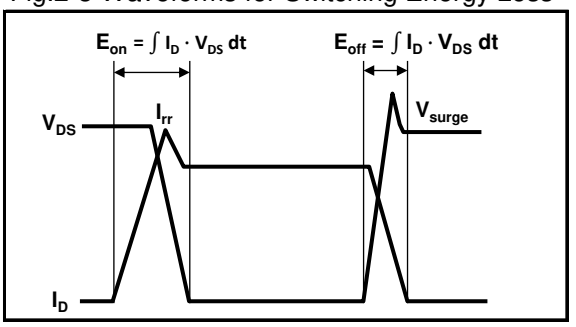


Fig.3-1 Reverse Recovery Time Measurement Circuit

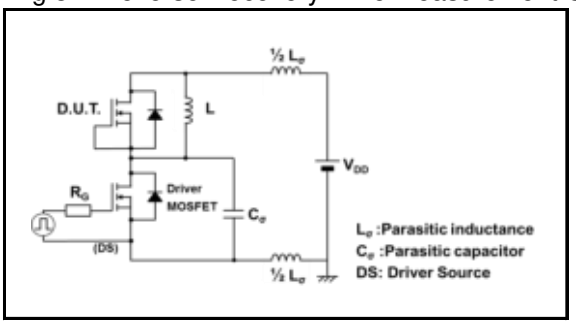
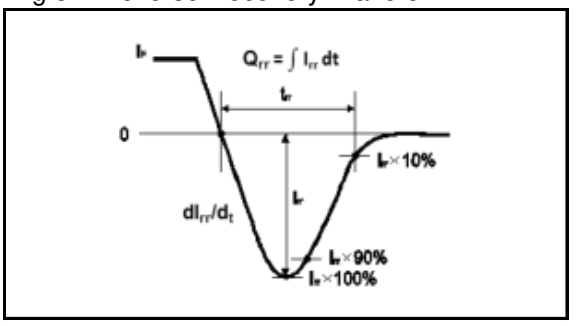
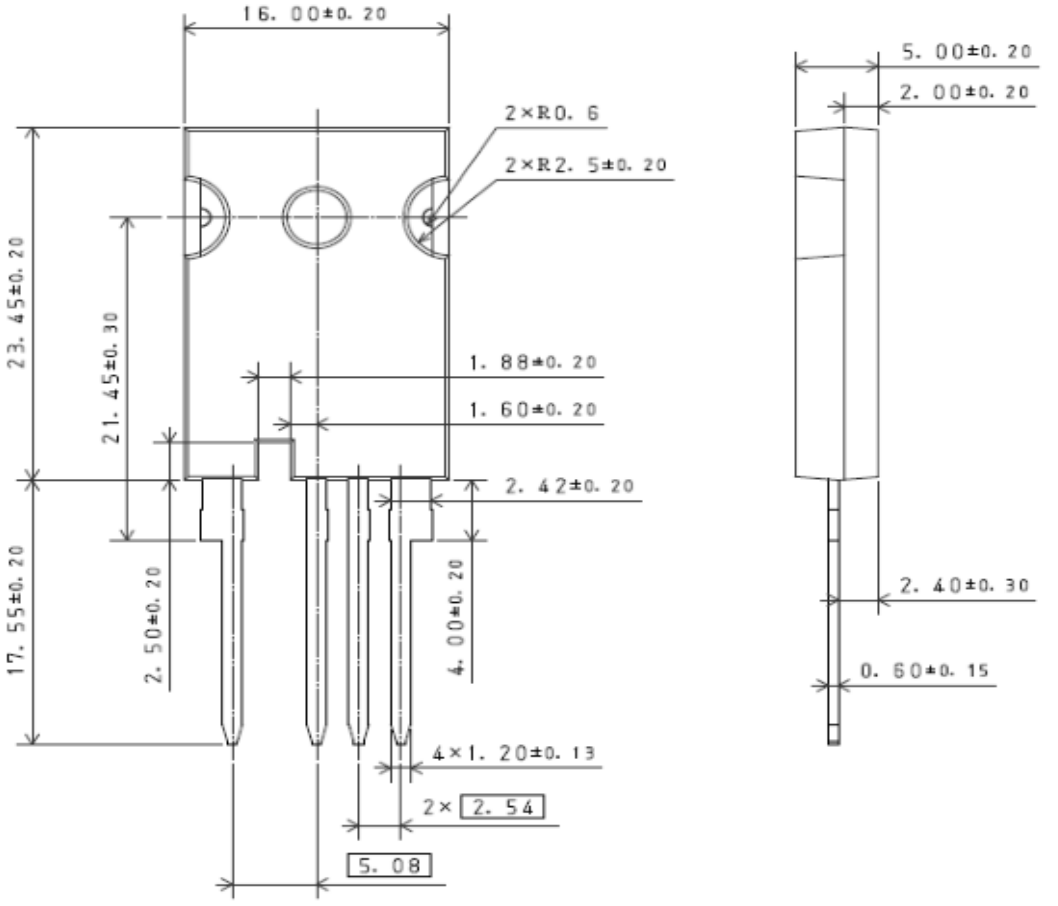


Fig.3-2 Reverse Recovery Waveform



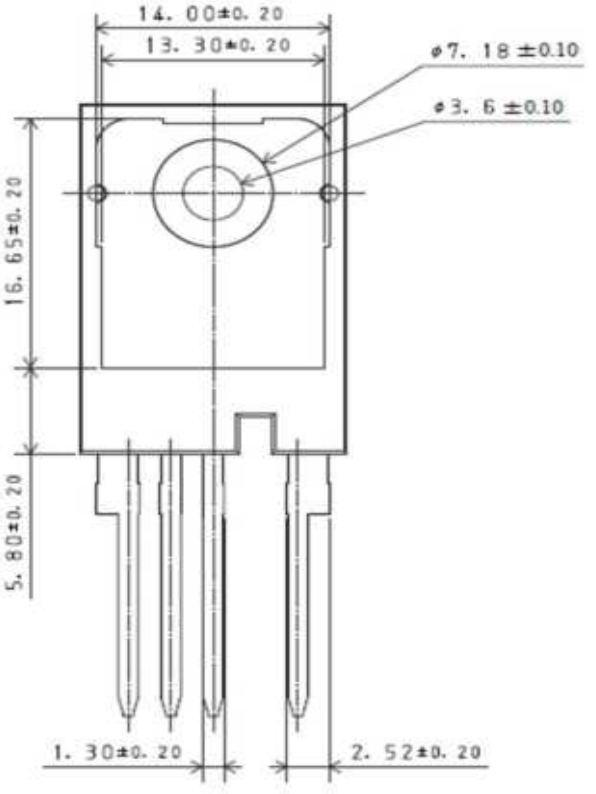
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●Package Dimensions



Unit: mm

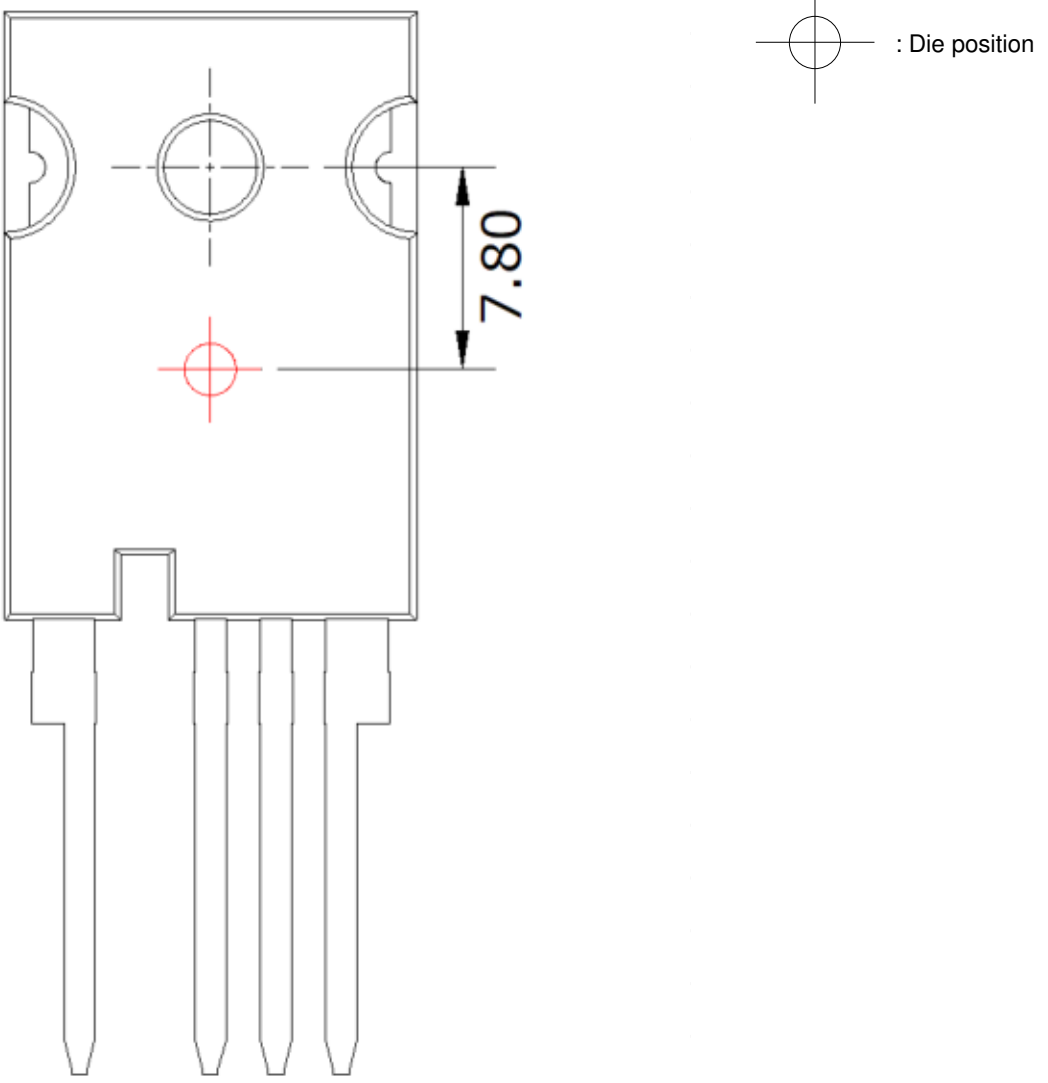
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Unit: mm

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●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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Notes

1) The information contained herein is subject to change without notice.

2) Before you use our Products, please contact our sales representative and verify the latest specifications.

3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Poducts beyond the rating specified by ROHM.

4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.

6) The Products specified in this document are not designed to be radiation tolerant.

7) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, and power transmission systems.

8) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.

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