

SCT4045DRHR



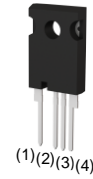
Automotive Grade N-channel SiC power MOSFET

Datasheet

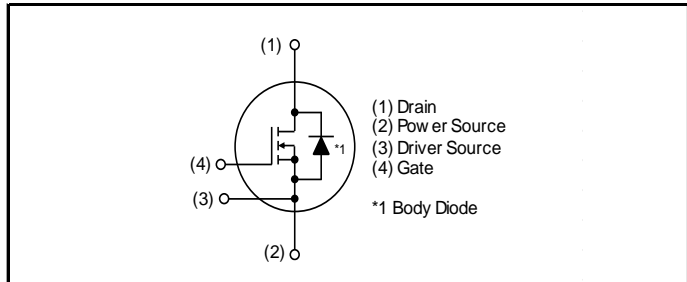
V_{DSS}	750V
$R_{DS(on)}$ (Typ.)	45mΩ
I_D^{*1}	34A
P_D	115W

● 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	SCT4045DR

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

Parameter	Symbol	Value	Unit	
Drain - source voltage	V_{DSS}	750	V	
Continuous drain and source current $T_c = 100^\circ\text{C}$	$V_{GS} = V_{GS_on}$	I_D, I_S^{*1}	34	A
			24	A
Pulsed drain current	$V_{GS} = V_{GS_on}$	$I_{D,pulse}^{*2}$	61	A
Body diode pulsed forward current	$V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*3}$	34	A
Body diode surge forward current	$V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*4}$	61	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)

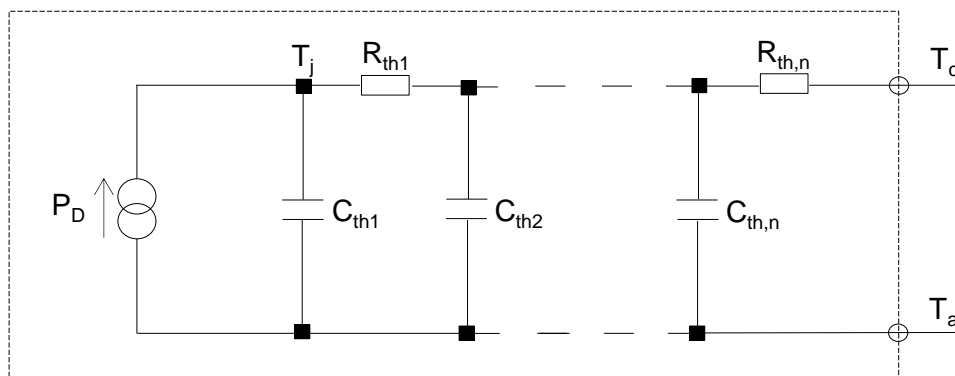
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 5.3\text{mA}$ $T_{vj} = 25^{\circ}\text{C}$	750	-	-	V
Zero Gate voltage Drain current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 750\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	1 10	80 -	μA
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}	$V_{DS} = 10\text{V}, I_D = 8.89\text{mA}$	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ ^{*8}	$V_{GS} = 18\text{V}, I_D = 17\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	45 77	59 -	m Ω
Gate input resistance	R_G	$f = 1\text{MHz}, \text{open drain}$	-	4	-	Ω

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC} ^{*9}	-	0.98	1.3	K/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	1.7×10^{-1}	K/W	C_{th1}	3.6×10^{-4}	Ws/K
R_{th2}	4.1×10^{-1}		C_{th2}	1.5×10^{-3}	
R_{th3}	4.0×10^{-1}		C_{th3}	6.5×10^{-3}	



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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*8}	$V_{DS} = 10\text{V}, I_D = 17\text{A}$	-	9.3	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	1460	-	pF
Output capacitance	C_{oss}	$V_{DS} = 500\text{V}$	-	69	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	5	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 500\text{V}$	-	90	-	pF
Total Gate charge	Q_g^{*8}	$V_{DS} = 500\text{V}$ $I_D = 17\text{A}$	-	63	-	nC
Gate - Source charge	Q_{gs}^{*8}	$V_{GS} = 18\text{V}$	-	14	-	
Gate - Drain charge	Q_{gd}^{*8}	See Fig. 1-1, 1-2.	-	19	-	
Turn - on delay time	$t_{d(on)}^{*8}$	$V_{DS} = 500\text{V}$ $I_D = 17\text{A}$	-	5.1	-	ns
Rise time	t_r^{*8}	$V_{GS} = +18\text{V} / 0\text{V}$	-	16	-	
Turn - off delay time	$t_{d(off)}^{*8}$	$R_G = 3.3\Omega, L = 250\mu\text{H}$ E_{on} includes diode	-	27	-	
Fall time	t_f^{*8}	reverse recovery $L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$	-	10	-	
Turn - on switching loss	E_{on}^{*8}	See Fig. 2-1, 2-2, 2-3.	-	112	-	μJ
Turn - off switching loss	E_{off}^{*8}		-	17	-	

●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}	$V_{GS} = 0\text{V}, I_D = 17\text{A}$	-	3.3	-	V
Reverse recovery time	t_{rr}^{*8}	$I_F = 17\text{A}$ $V_R = 500\text{V}$	-	9.3	-	ns
Reverse recovery charge	Q_{rr}^{*8}	$di/dt = 2900\text{A}/\mu\text{s}$	-	89	-	nC
Peak reverse recovery current	I_{rrm}^{*8}	$L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ See Fig. 3-1, 3-2.	-	19	-	A

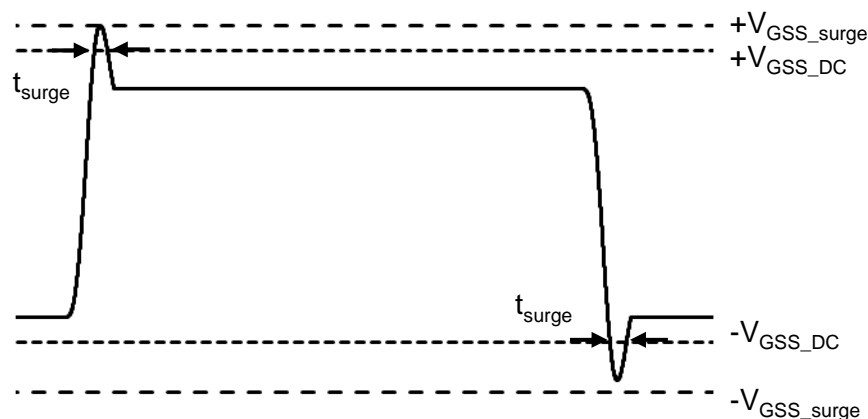
*1 Limited by maximum T_{vj} and for Max. R_{thJC} .

*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

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

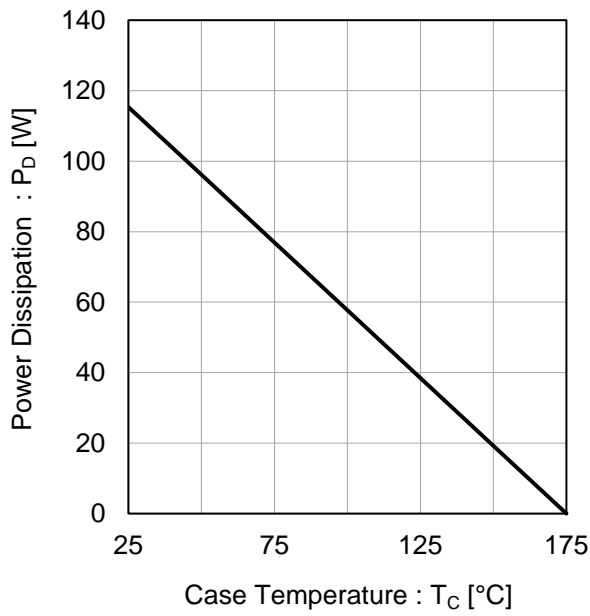


Fig.2 Maximum Safe Operating Area

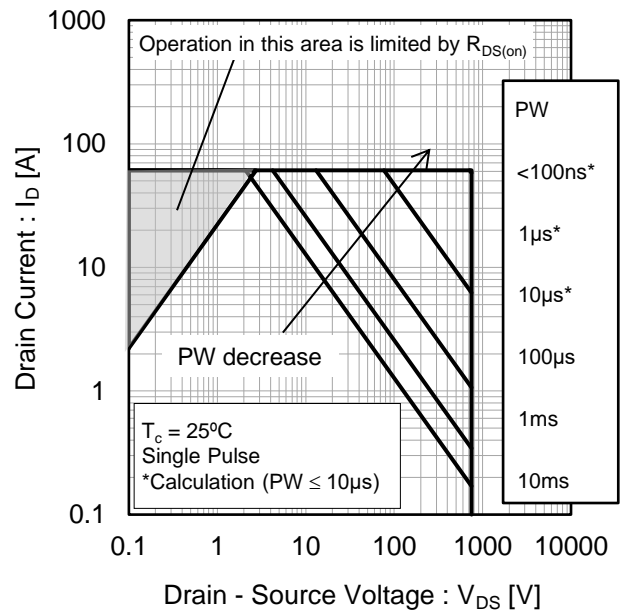
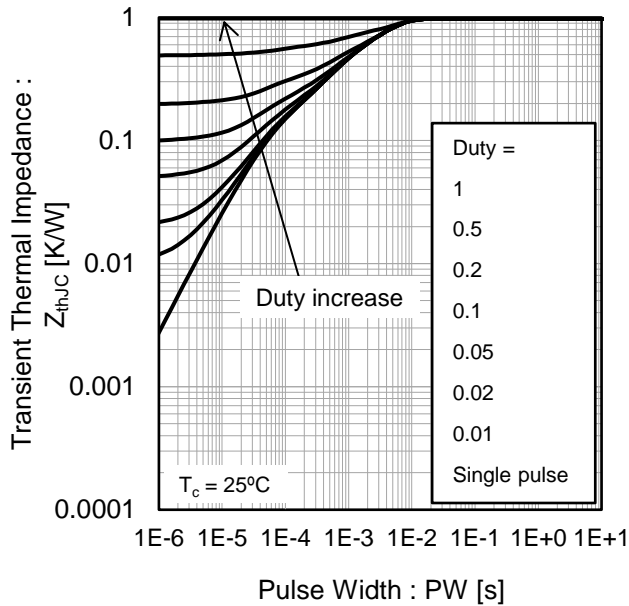


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

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

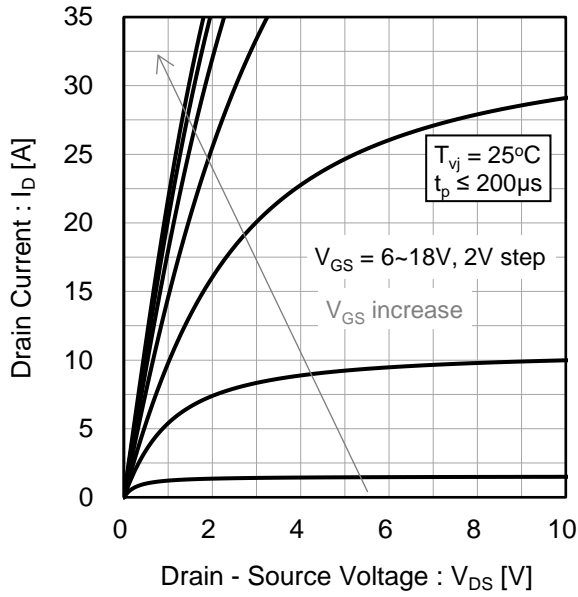


Fig.5 $T_{vj} = 25^{\circ}\text{C}$ Typical Output Characteristics(II)

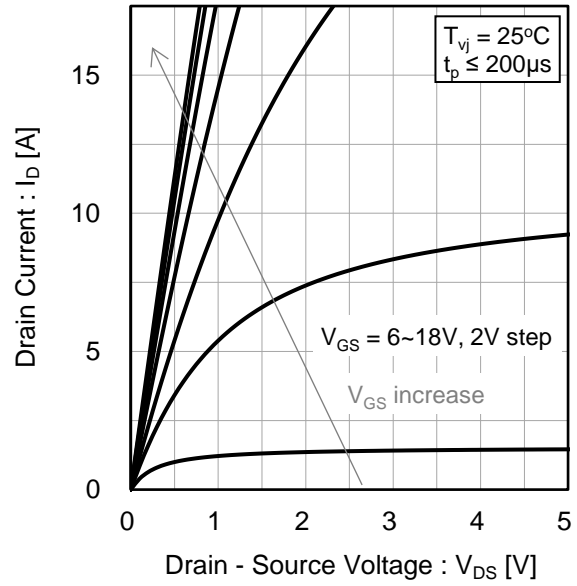
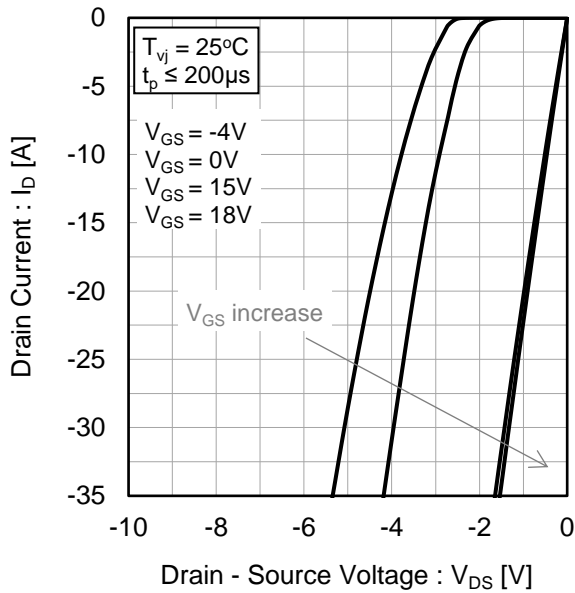


Fig.6 $T_{vj} = 25^{\circ}\text{C}$ 3rd Quadrant Characteristics



●Electrical characteristic curves

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

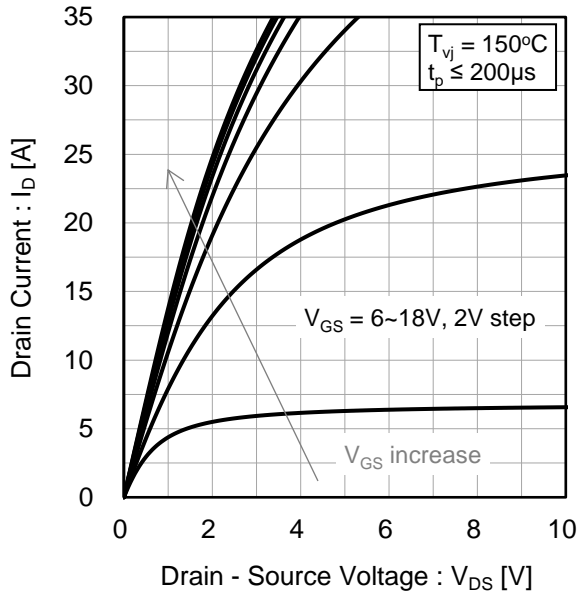


Fig.8 $T_{vj} = 150^{\circ}\text{C}$ Typical Output Characteristics(II)

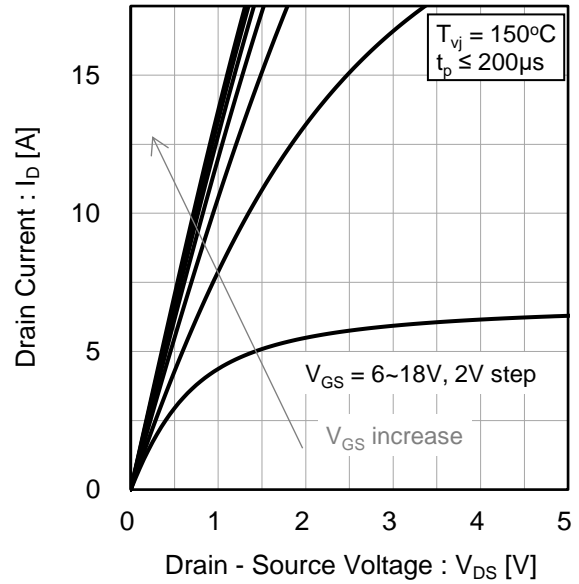


Fig.9 $T_{vj} = 150^{\circ}\text{C}$ 3rd Quadrant Characteristics

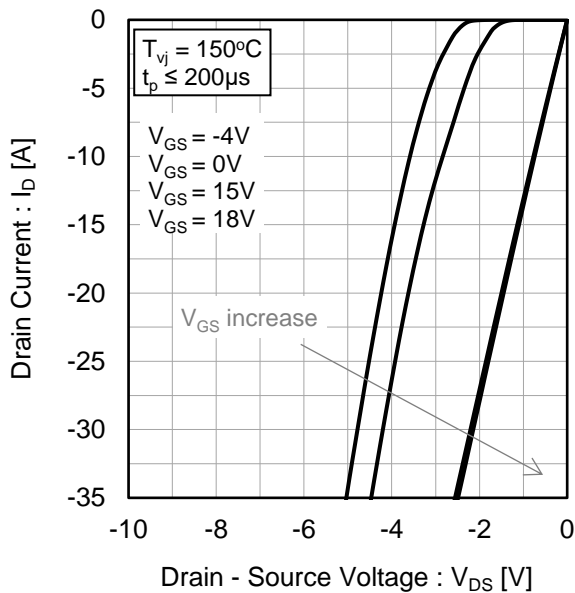
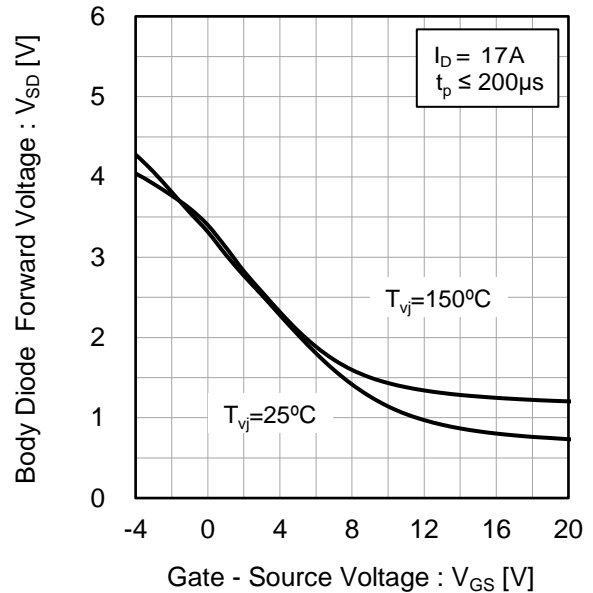


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

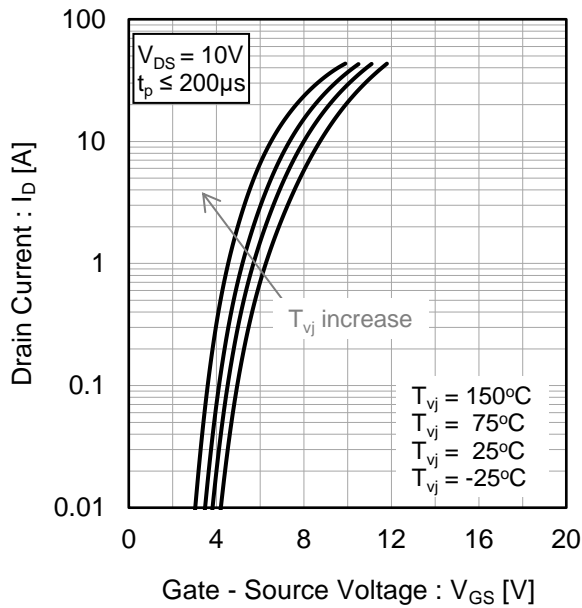


Fig.12 Typical Transfer Characteristics (II)

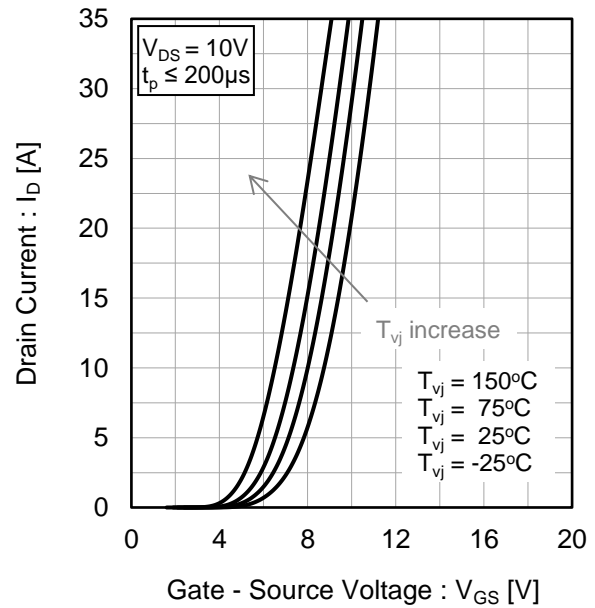


Fig.13 Gate Threshold Voltage vs. Virtual Junction Temperature

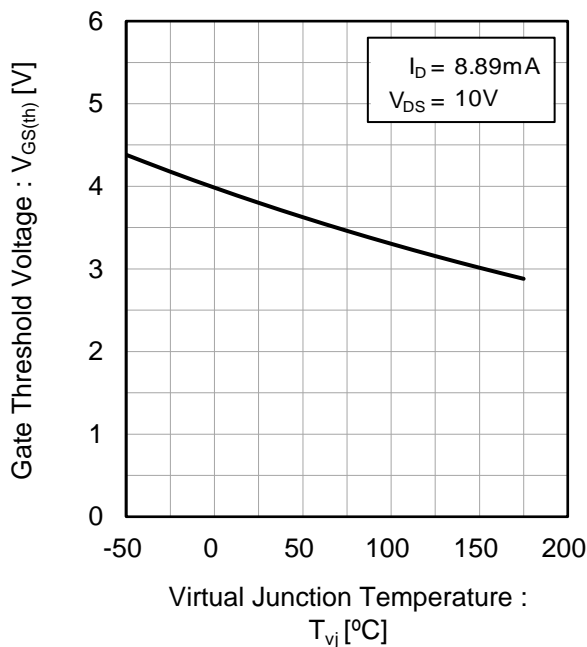
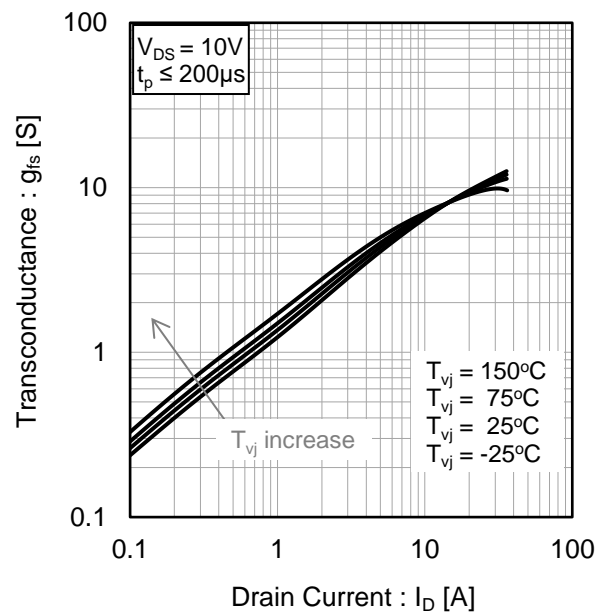


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

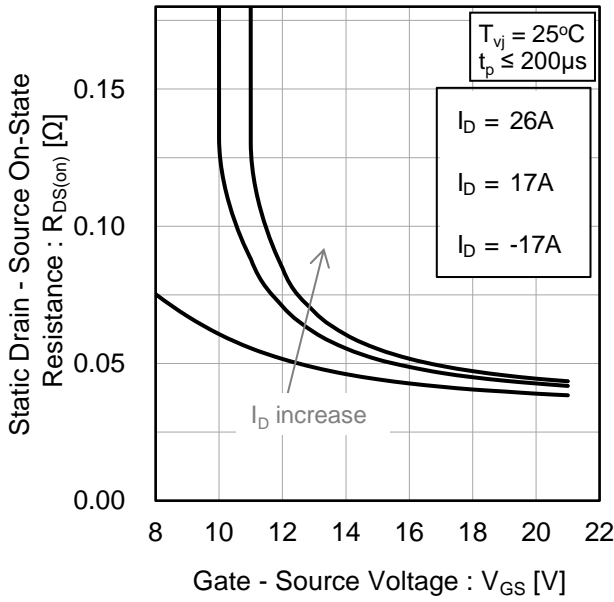


Fig.16 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

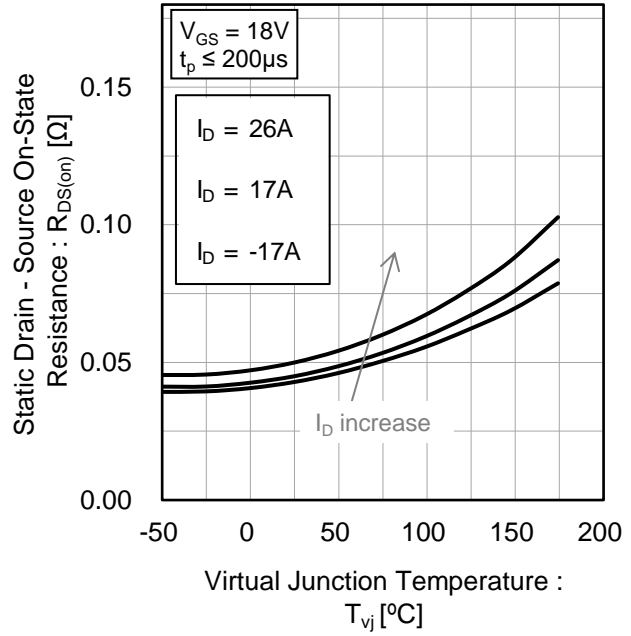


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

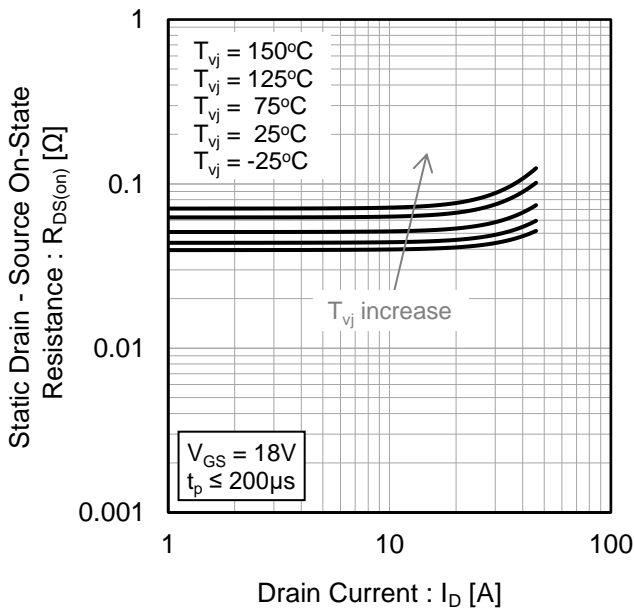
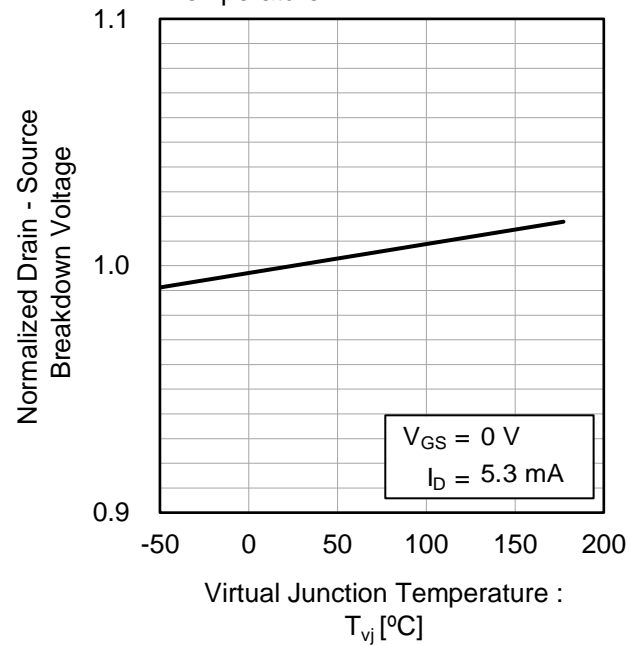


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

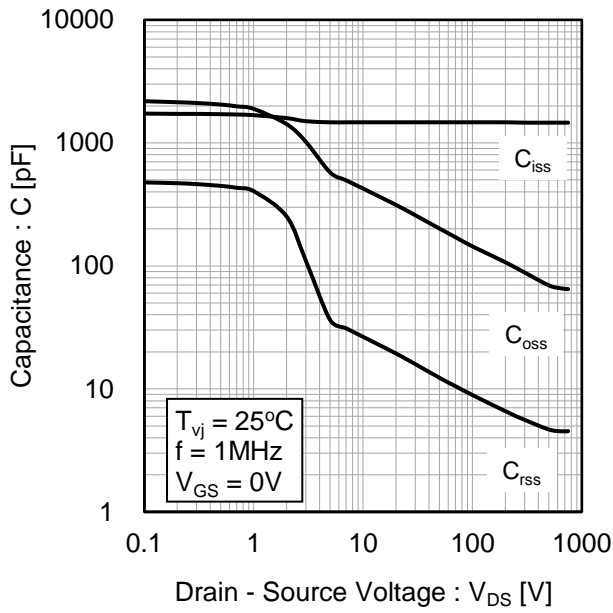


Fig.20 C_{oss} Stored Energy

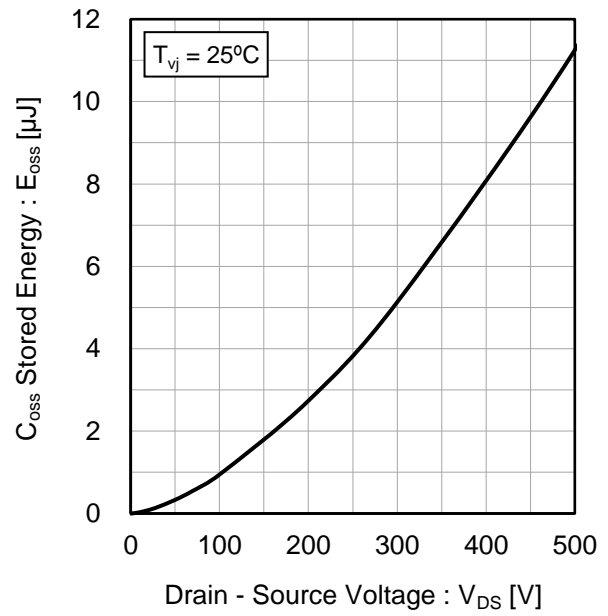
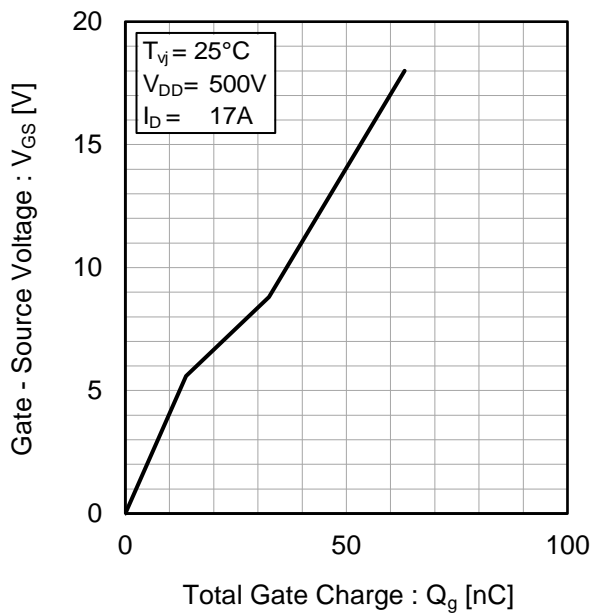


Fig.21 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

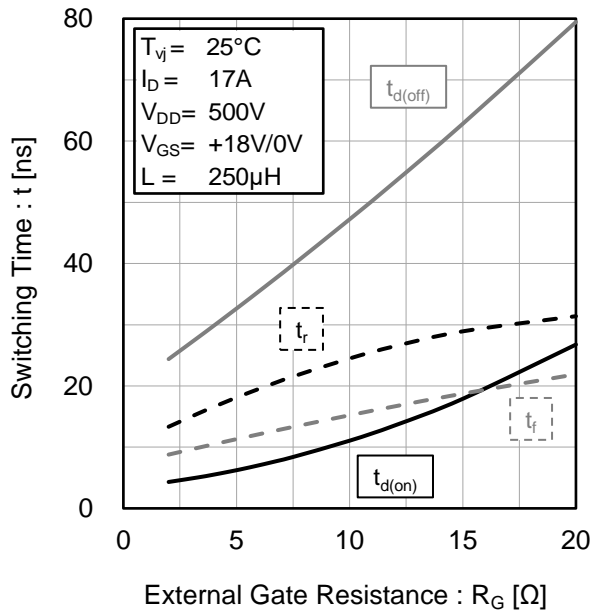


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

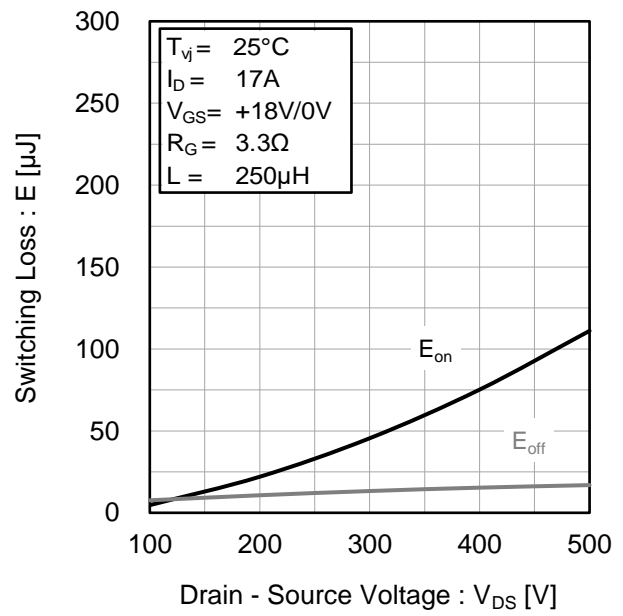


Fig.24 Typical Switching Loss vs. Drain Current

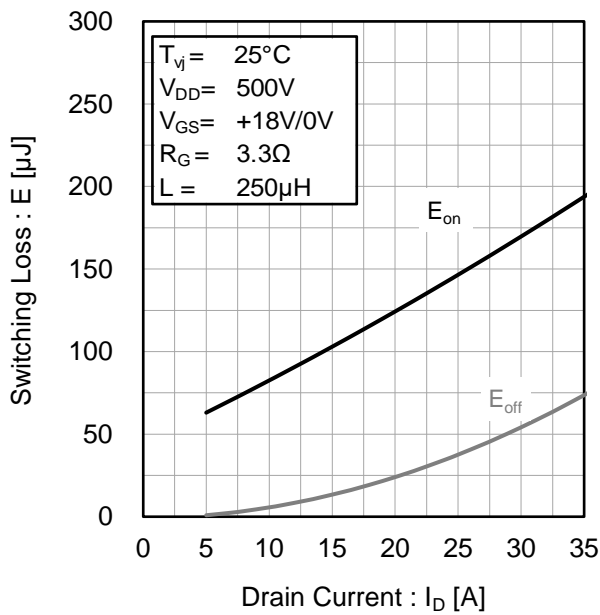
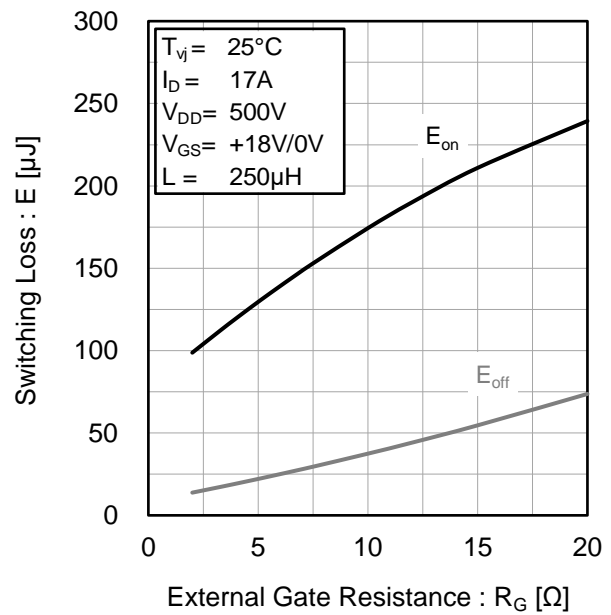


Fig.25 Typical Switching Loss vs. External Gate Resistance



● Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

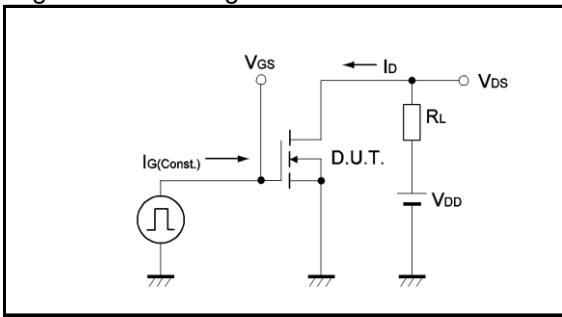


Fig.1-2 Gate Charge Waveform

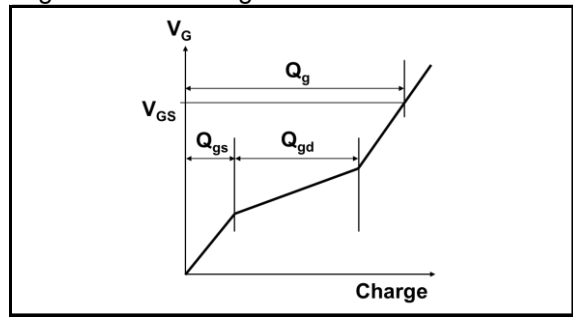


Fig.2-1 Switching Characteristics Measurement Circuit

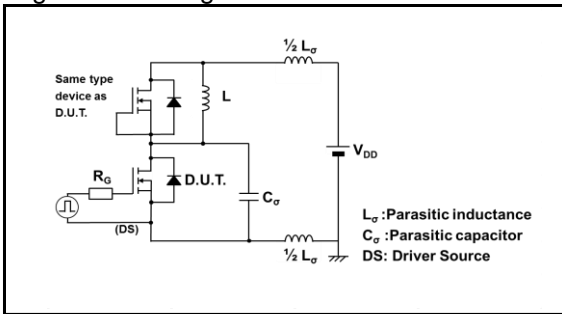


Fig.2-2 Waveforms for Switching Time

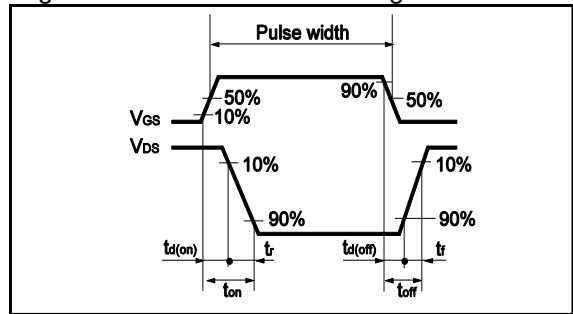


Fig.2-3 Waveforms for Switching Energy Loss

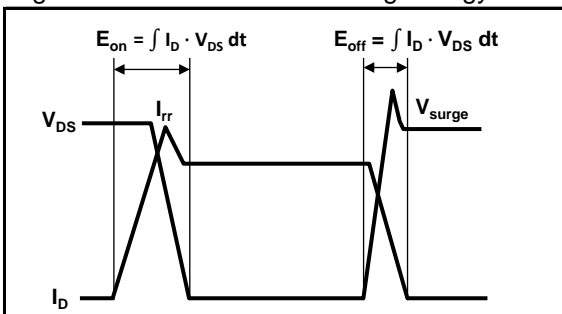


Fig.3-1 Reverse Recovery Time Measurement Circuit

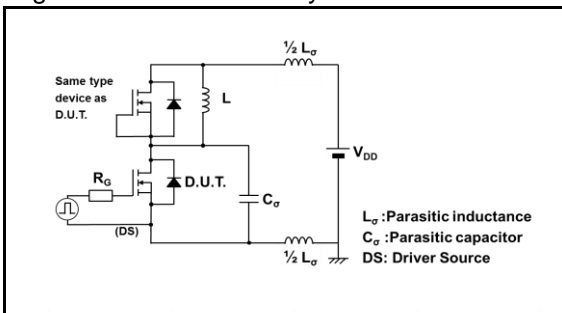
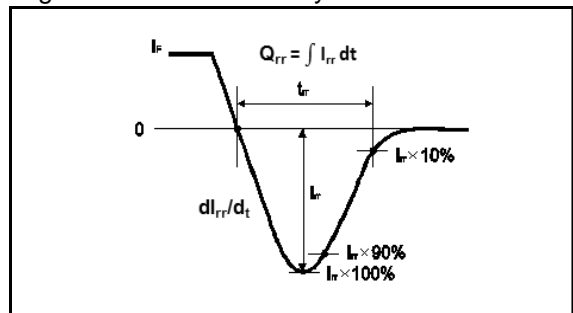
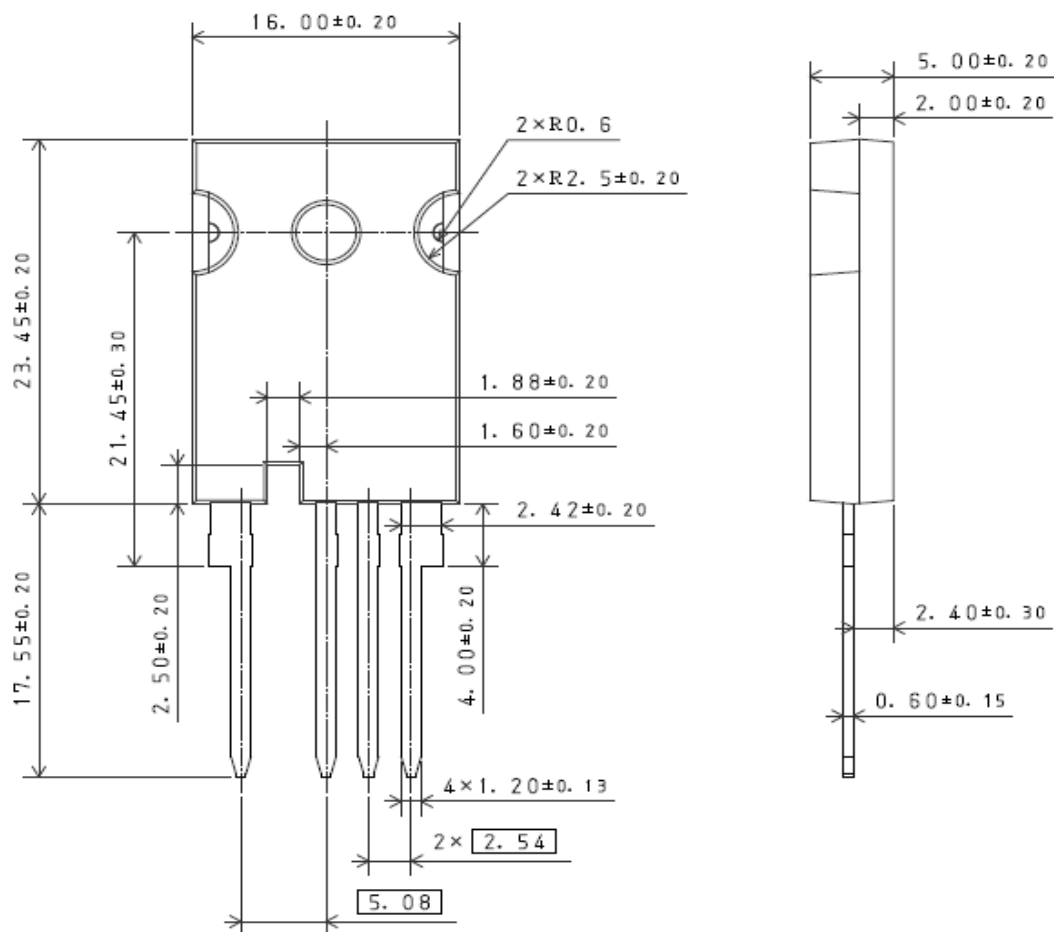


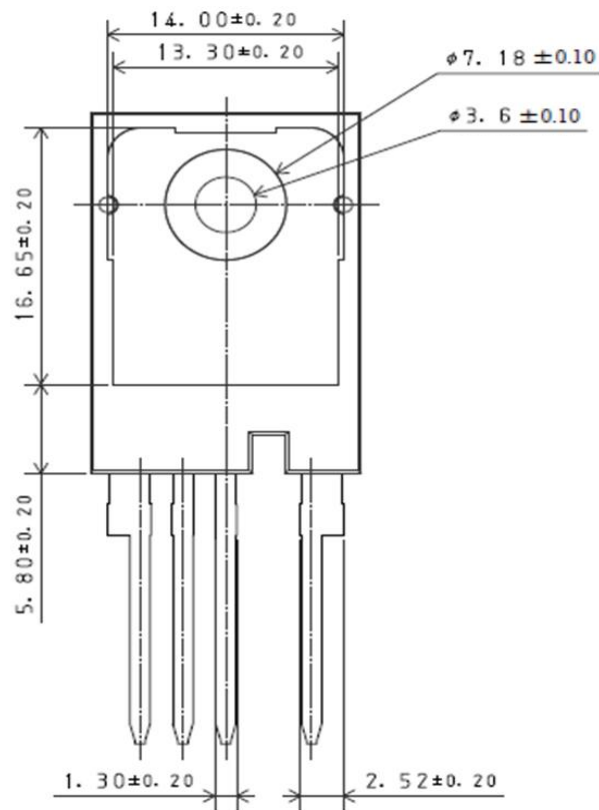
Fig.3-2 Reverse Recovery Waveform



●Package Dimensions

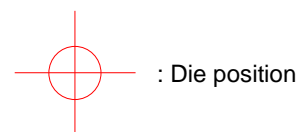
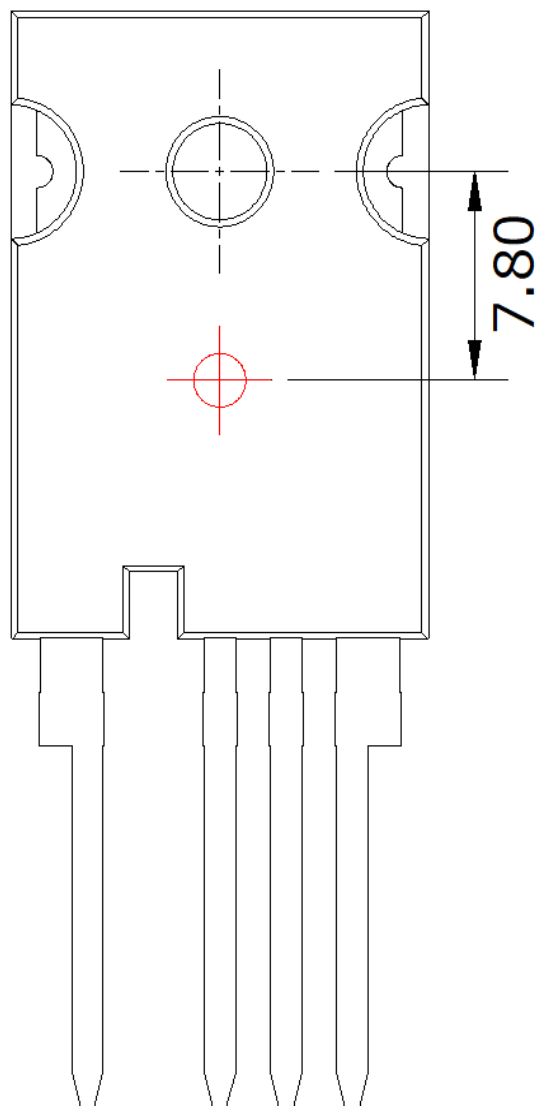


Unit: mm



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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