

$V_{DSS}$	750V
$R_{DS(on)}$ (Typ.)	13mΩ
$I_D^{*1}$	120A
$P_D$	405W

### ● 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
- 7) MSL1(Moisture stress level)

### ● Application

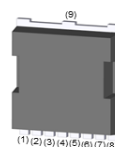
- Solar inverters
- DC/DC converters
- SMPS(Switch mode power supplies)
- UPS (uninterruptable power supplies)
- Energy storage and battery formation

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

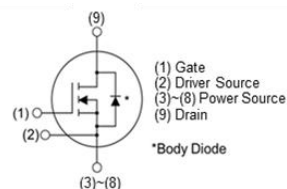
Parameter			Symbol	Value	Unit
Drain - source voltage			$V_{DSS}$	750	V
Continuous drain and source current	$V_{GS} = V_{GS\_on}$	$T_c = 25^{\circ}C$	$I_D, I_S^{*1}$	120	A
		$T_c = 100^{\circ}C$		85	A
Pulsed drain current	$V_{GS} = V_{GS\_on}$	$T_c = 25^{\circ}C$	$I_{D,pulse}^{*2}$	233	A
Body diode pulsed forward current		$T_c = 25^{\circ}C$ $V_{GS} = 0\text{ V}$	$I_{S,pulse}^{*1,*3}$	120	A
Body diode surge forward current			$I_{S,pulse}^{*1,*4}$	233	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	$^{\circ}C$
Range of storage temperature			$T_{stg}$	-40 to +175	$^{\circ}C$

### ● Outline

TOLL



### ● Inner circuit



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

### ● Packaging specifications

Type	Packing	Embossed tape
	Reel size (mm)	330
	Tape width (mm)	24
	Basic ordering unit (pcs)	2000
	Taping code	TRDC
	Marking	SCT4013DLL

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

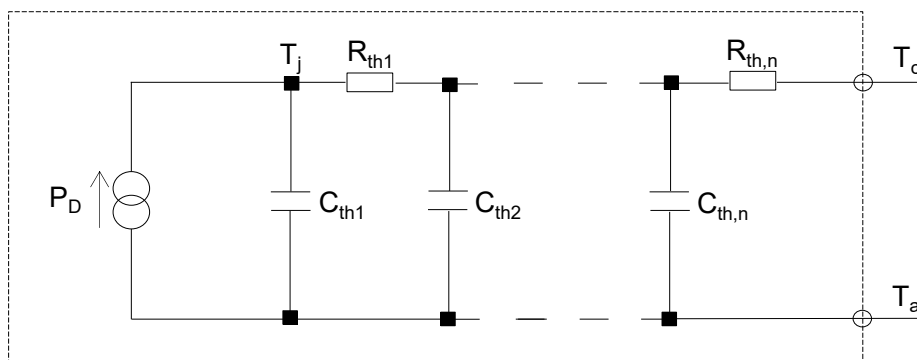
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = 18.6\text{mA}$ $T_{vj} = 25^{\circ}\text{C}$	750	-	-	V
Zero Gate voltage Drain current	$I_{DSS}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 750\text{V}$ $T_{vj} = 25^{\circ}\text{C}$	-	1	80	$\mu\text{A}$
		$T_{vj} = 150^{\circ}\text{C}$	-	10	-	
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	$V_{GS(th)}^{*7}$	$V_{DS} = 10\text{V}$ , $I_D = 30.8\text{mA}$	2.8	-	4.8	V
Static Drain - Source on - state resistance	$R_{DS(on)}^{*8}$	$V_{GS} = 18\text{V}$ , $I_D = 58\text{A}$ $T_{vj} = 25^{\circ}\text{C}$	-	13.0	16.9	$\text{m}\Omega$
		$T_{vj} = 150^{\circ}\text{C}$	-	22.2	-	
Gate input resistance	$R_G$	$f = 1\text{MHz}$ , open drain	-	1	-	$\Omega$

**●Thermal resistance**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	$R_{thJC}^{*9}$	-	0.26	0.37	K/W

**●Typical Transient Thermal Characteristics**

Symbol	Value	Unit	Symbol	Value	Unit
$R_{th1}$	$5.1 \times 10^{-2}$	K/W	$C_{th1}$	$1.7 \times 10^{-3}$	Ws/K
$R_{th2}$	$2.0 \times 10^{-1}$		$C_{th2}$	$4.7 \times 10^{-3}$	
$R_{th3}$	$1.4 \times 10^{-2}$		$C_{th3}$	$4.7 \times 10^{-3}$	



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

Parameter		Symbol	Conditions	Values			Unit
				Min.	Typ.	Max.	
Transconductance		$g_{fs}^{*8}$	$V_{DS} = 10\text{V}, I_D = 58\text{A}$	-	32	-	S
Input capacitance		$C_{iss}$	$V_{GS} = 0\text{V}$	-	4580	-	pF
Output capacitance		$C_{oss}$	$V_{DS} = 500\text{V}$	-	203	-	
Reverse transfer capacitance		$C_{rss}$	$f = 1\text{MHz}$	-	10	-	
Effective output capacitance, energy related		$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 500\text{V}$	-	263	-	pF
Total Gate charge		$Q_g^{*8}$	$V_{DS} = 500\text{V}$ $I_D = 58\text{A}$	-	170	-	nC
Gate - Source charge		$Q_{gs}^{*8}$	$V_{GS} = 18\text{V}$	-	39	-	
Gate - Drain charge		$Q_{gd}^{*8}$	See Fig. 1-1, 1-2.	-	42	-	
Turn - on delay time		$t_{d(on)}^{*8}$	$V_{DS} = 500\text{V}$ $I_D = 58\text{A}$	-	17	-	ns
Rise time		$t_r^{*8}$	$V_{GS} = +18\text{V} / 0\text{V}$	-	32	-	
Turn - off delay time		$t_{d(off)}^{*8}$	$R_G = 6.8\Omega, L = 250\mu\text{H}$ $E_{on}$ includes diode reverse recovery	-	82	-	
Fall time		$t_f^{*8}$	$L_\sigma = 50\text{nH}, C_\sigma = 10\text{pF}$	-	17	-	
Turn - on switching loss		$E_{on}^{*8}$	See Fig. 2-1, 2-2, 2-3.	-	500	-	$\mu\text{J}$
Turn - off switching loss		$E_{off}^{*8}$		-	310	-	
Short-circuit withstand time	$V_{GS(on)} = +15\text{V}$	$t_{sc}^{*10}$	$V_{DS} \leq 400\text{V}$ $V_{DS,peak} \leq 750\text{V}$ $T_{vj(start)} = 25^{\circ}\text{C}$ $R_G = 2.2\Omega$	-	12.0	-	$\mu\text{s}$
	$V_{GS(on)} = +18\text{V}$			-	11.5	-	$\mu\text{s}$

**●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	$V_{SD}^{*8}$	$V_{GS} = 0\text{V}, I_S = 58\text{A}$	-	3.3	-	V
Reverse recovery time	$t_{rr}^{*8}$	$I_F = 58\text{A}$ $V_R = 500\text{V}$	-	16	-	ns
Reverse recovery charge	$Q_{rr}^{*8}$	$di/dt = 3300\text{A}/\mu\text{s}$	-	290	-	nC
Peak reverse recovery current	$I_{rrm}^{*8}$	$L_{\sigma} = 50\text{nH}, C_{\sigma} = 10\text{pF}$ See Fig. 3-1, 3-2.	-	36	-	A

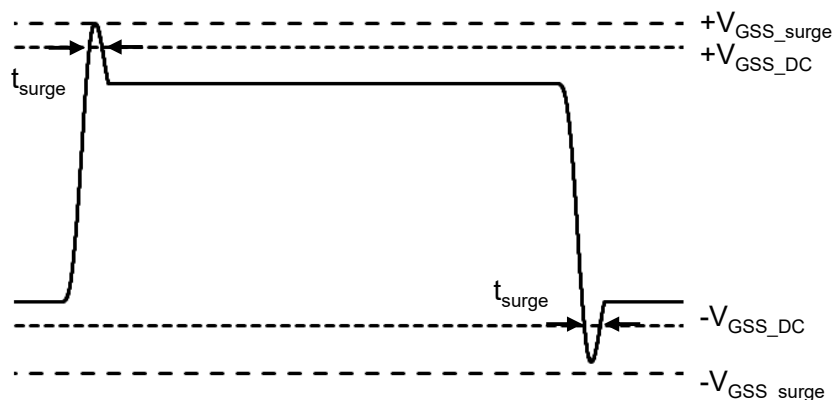
\*1 Limited by maximum  $T_{vj}$  and for Max.  $R_{thJC}$ .

\*2 Pulse width and duty cycle are limited by  $T_{vj,max}$ .

\*3 Only for body-diode, Repetitive pulse,  $PW \leq 1.5\mu\text{s}$ , 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](https://fscdn.rohm.com/en/products/databook/applinote/discrete/common/rthjc_measurement_and_usage_an-e.pdf)

\*10 The value is based on TO-247 package. Single Pulsed.

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

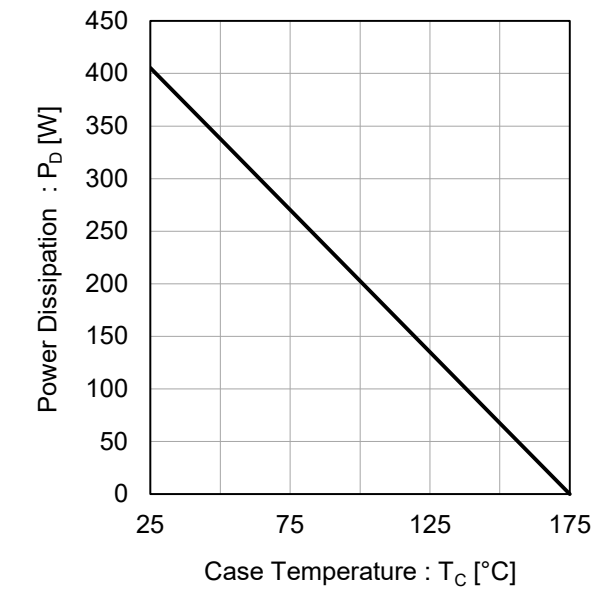


Fig.2 Maximum Safe Operating Area

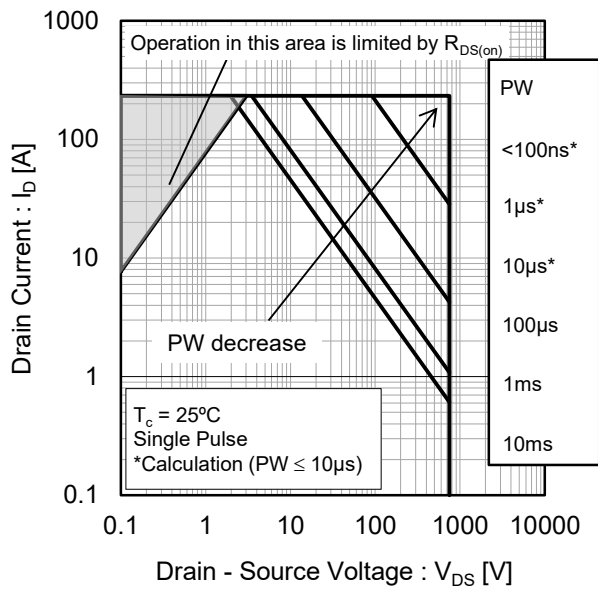
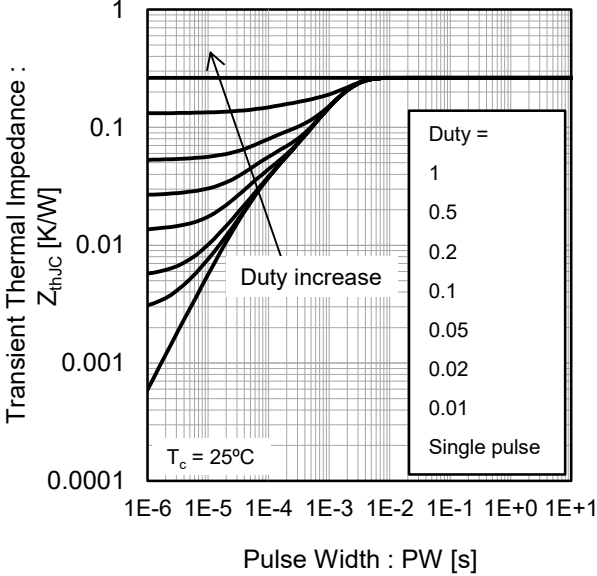


Fig.3 Typical Transient Thermal Impedance vs. Pulse Width



●Electrical characteristic curves

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

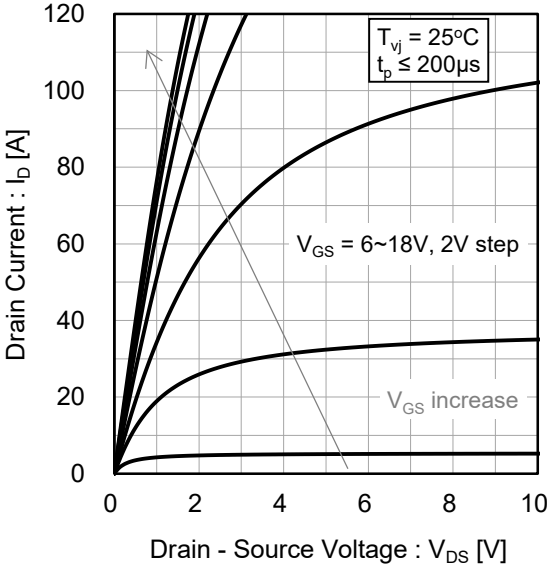
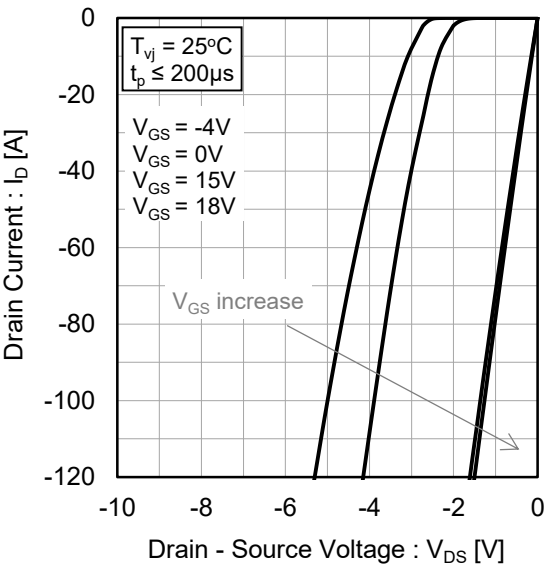


Fig.5  $T_{vj} = 25^{\circ}\text{C}$  3rd Quadrant Characteristics



●Electrical characteristic curves

Fig.6  $T_{vj} = 150^{\circ}\text{C}$  Typical Output Characteristics

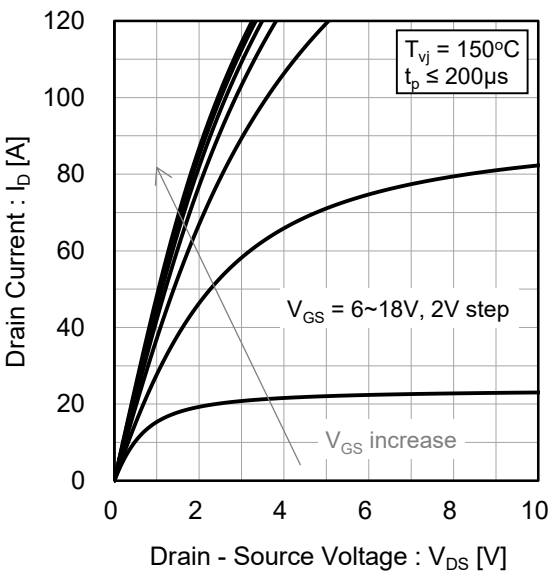


Fig.7  $T_{vj} = 150^{\circ}\text{C}$  3rd Quadrant Characteristics

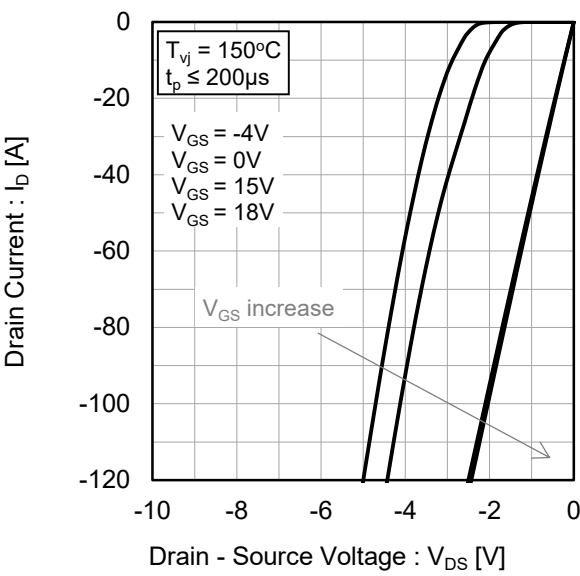
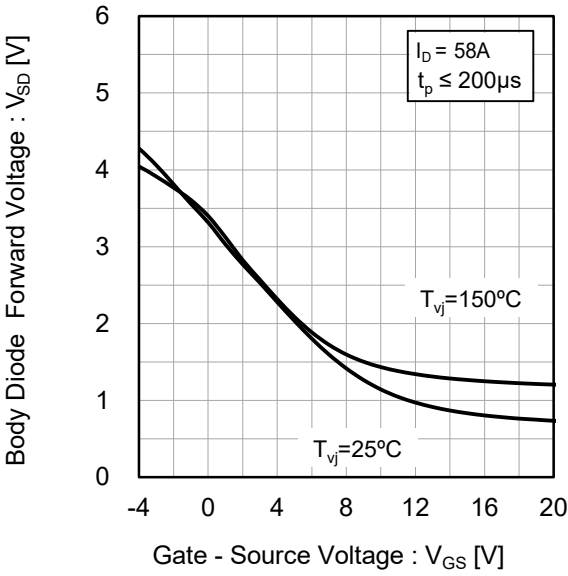


Fig.8 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.9 Typical Transfer Characteristics (I)

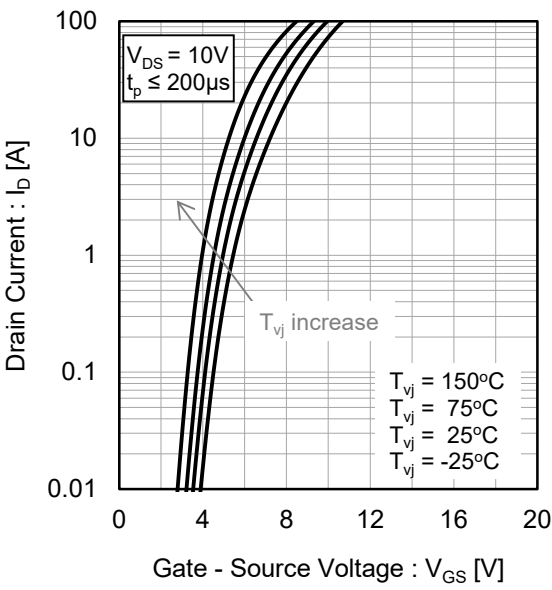


Fig.10 Typical Transfer Characteristics (II)

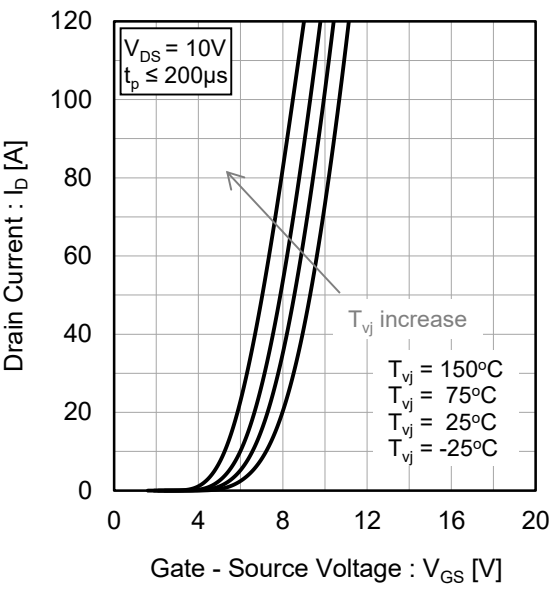


Fig.11 Gate Threshold Voltage vs. Virtual Junction Temperature

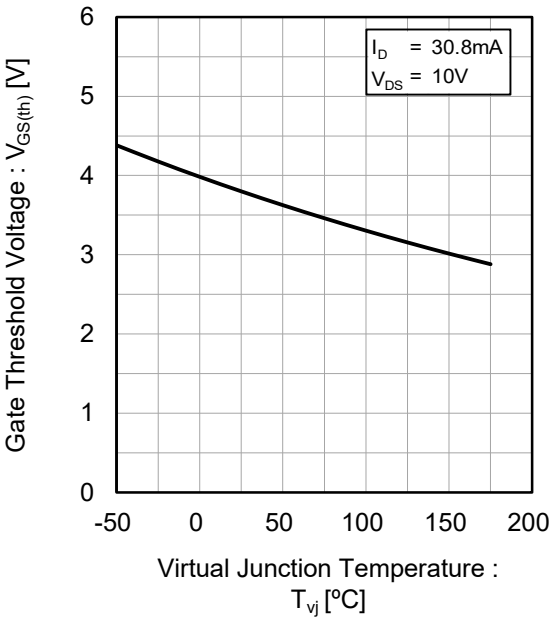
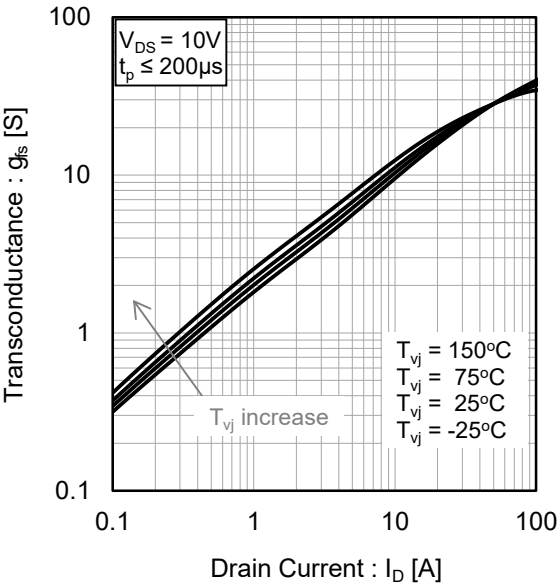


Fig.12 Transconductance vs. Drain Current





# ●Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

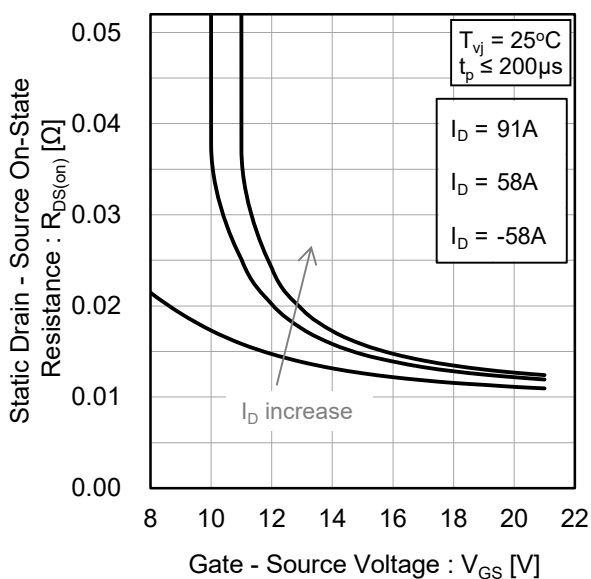


Fig.14 Static Drain - Source On - State Resistance vs. Virtual Junction Temperature

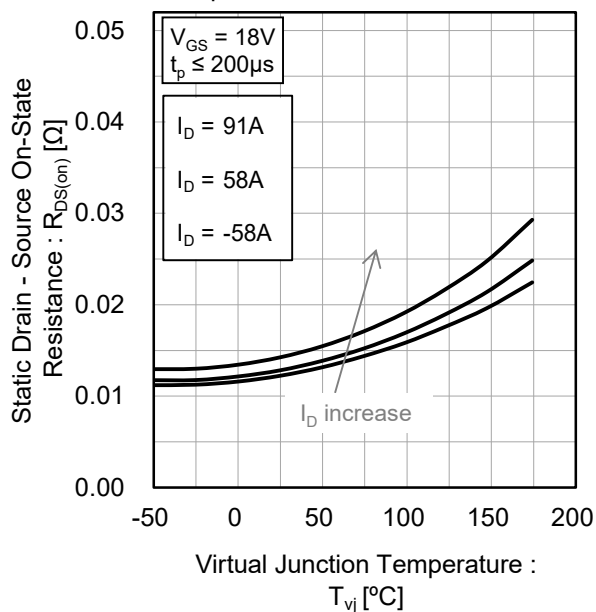


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current

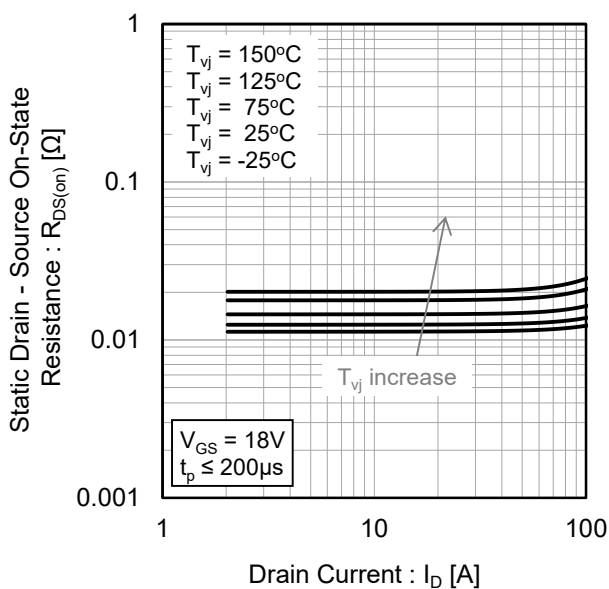
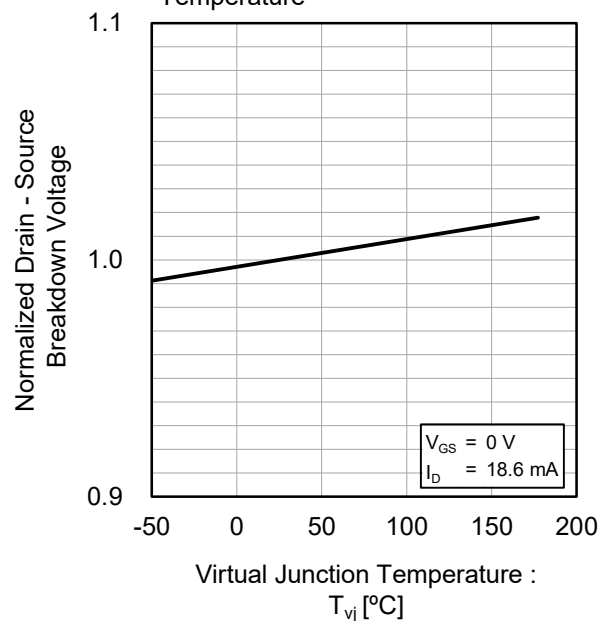


Fig.16 Normalized Drain - Source Breakdown Voltage vs. Virtual Junction Temperature



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

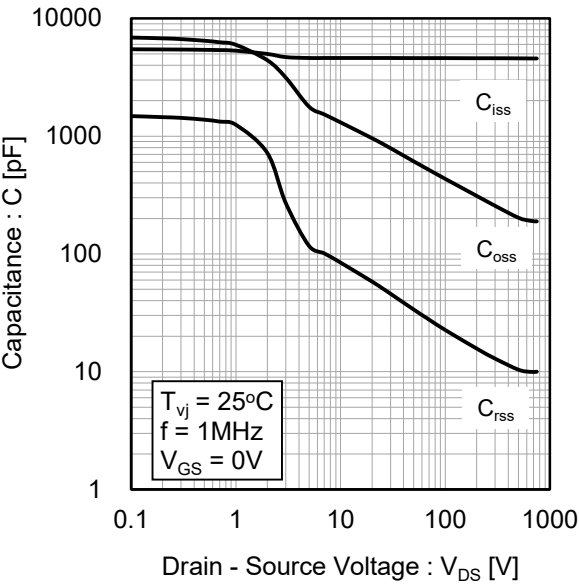


Fig.18  $C_{oss}$  Stored Energy vs. Drain - Source Voltage

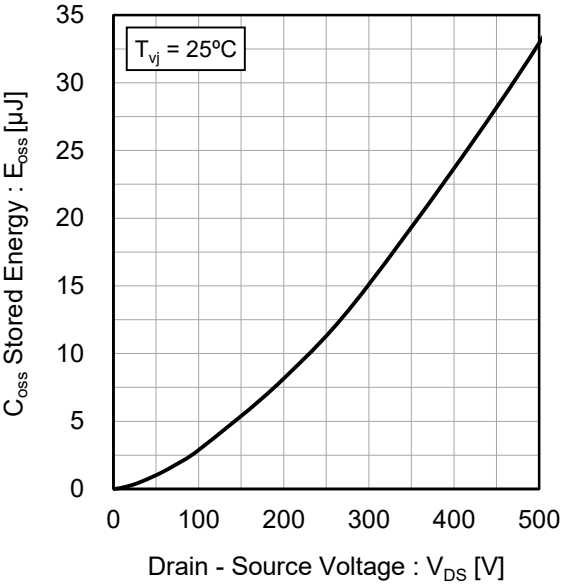
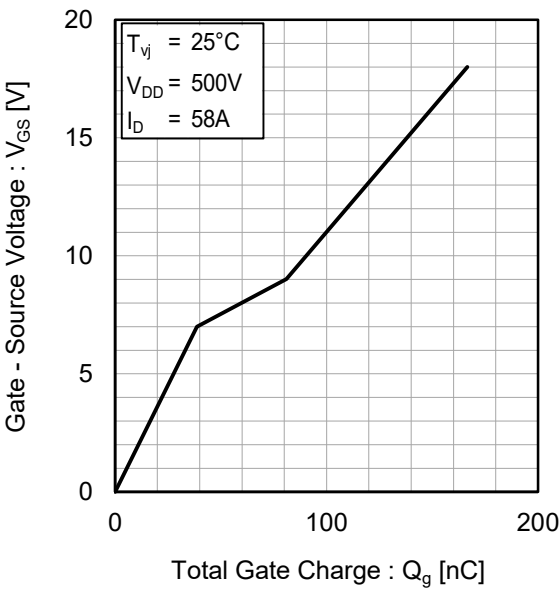


Fig.19 Dynamic Input Characteristics



# ●Electrical characteristic curves

Fig.20 Typical Switching Time  
vs. External Gate Resistance

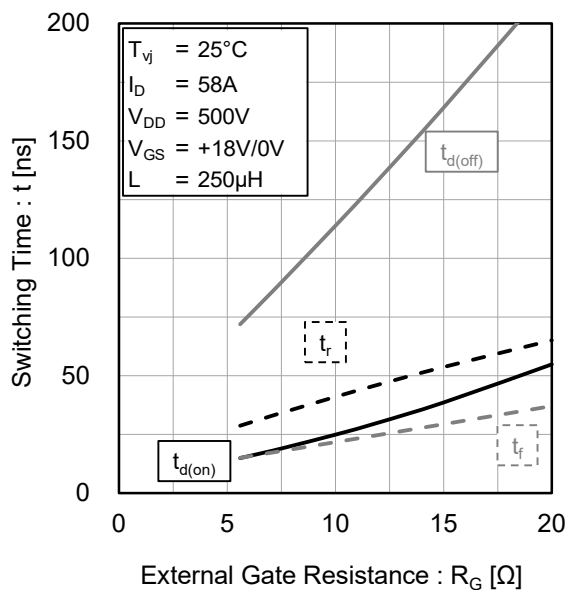


Fig.21 Typical Switching Loss  
vs. Drain - Source Voltage

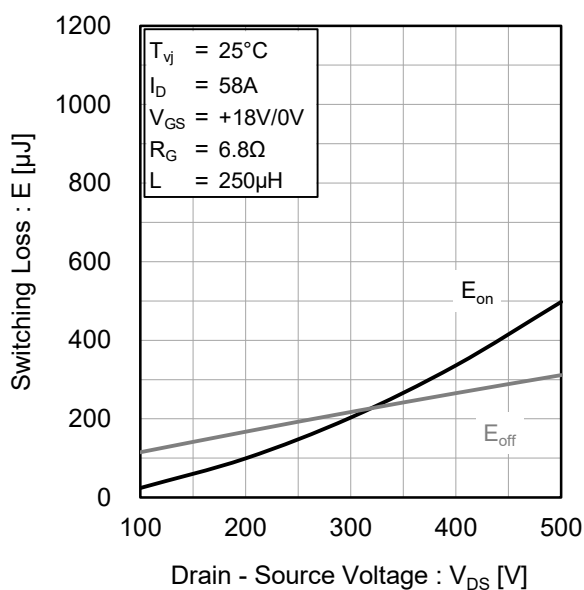


Fig.22 Typical Switching Loss  
vs. Drain Current

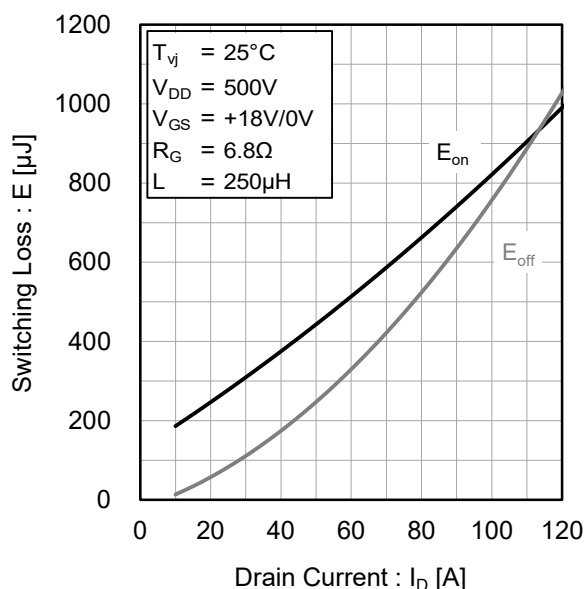
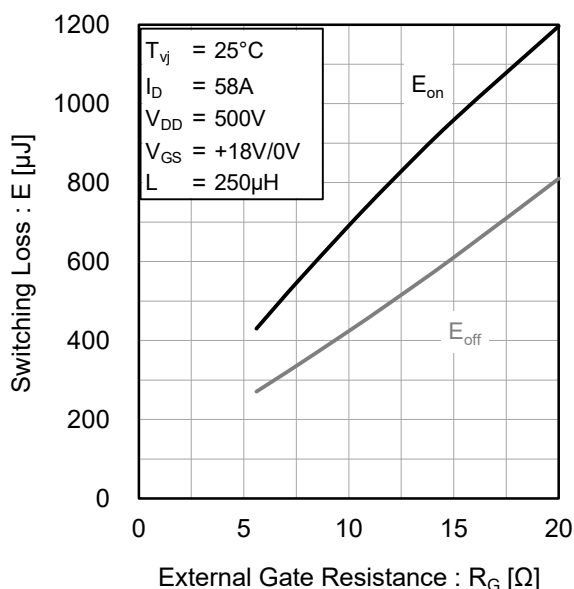


Fig.23 Typical Switching Loss  
vs. External Gate Resistance



## ● Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

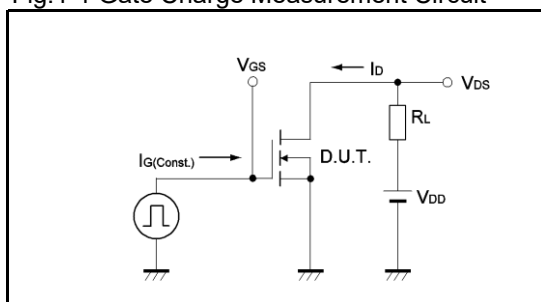


Fig.1-2 Gate Charge Waveform

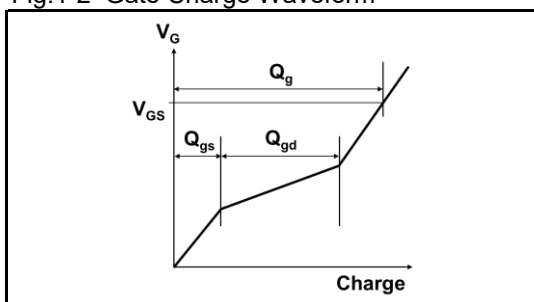


Fig.2-1 Switching Characteristics Measurement Circuit

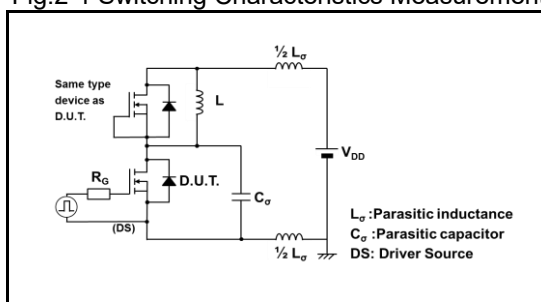


Fig.2-2 Waveforms for Switching Time

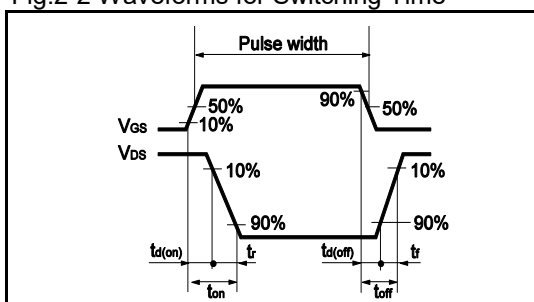


Fig.2-3 Waveforms for Switching Energy Loss

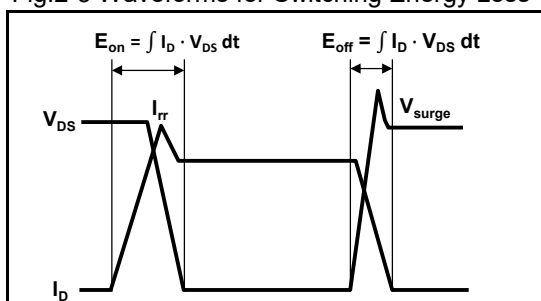


Fig.3-1 Reverse Recovery Time Measurement Circuit

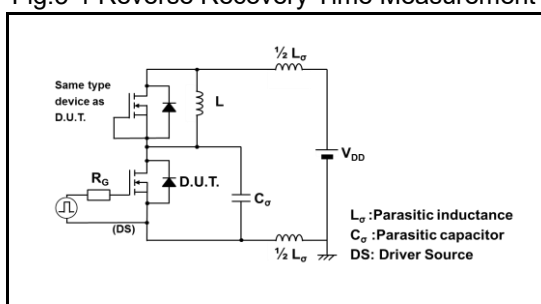
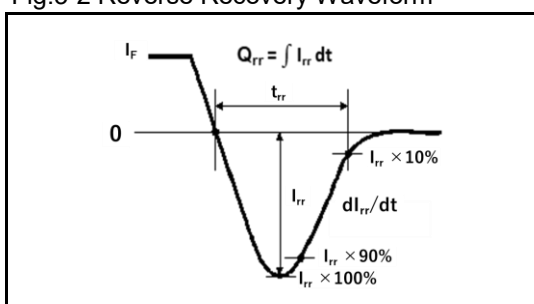
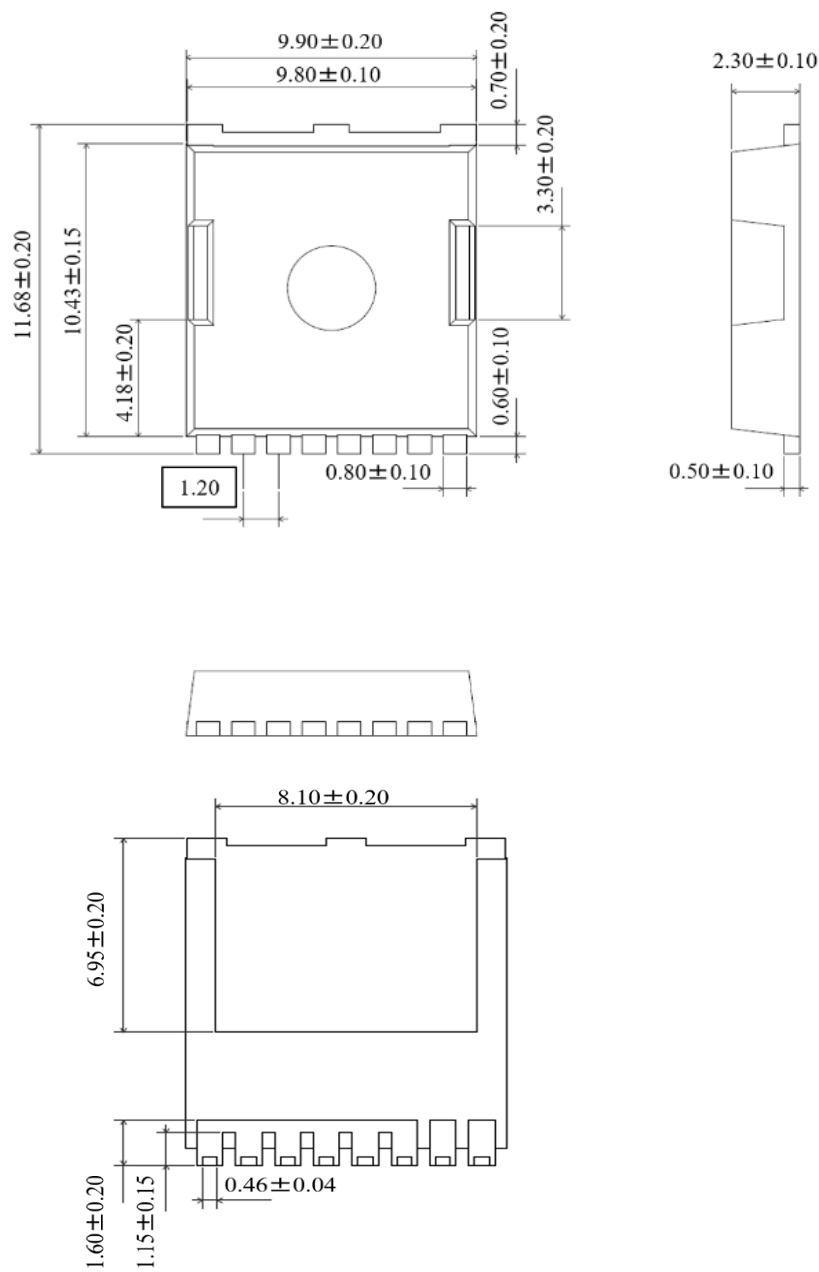


Fig.3-2 Reverse Recovery Waveform

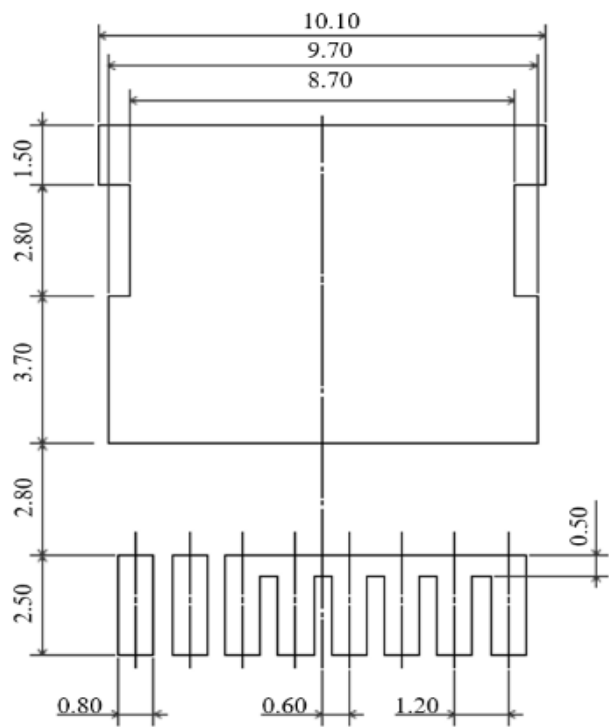


●Package Dimensions



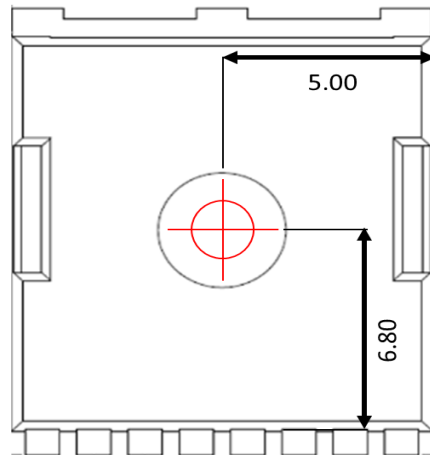
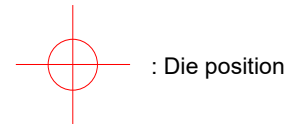
Unit: mm

2. REFERENCE COPPER PLATE AREA DIMENSION



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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