SCT3040KR

N-channel SiC power MOSFET

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**
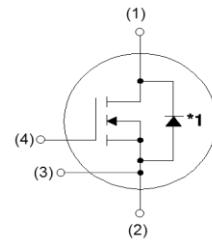
(1)
(1) Drain
(2) Power Source
(3) Driver Source
(4) Gate

*1 Body Diode

(4)
(3)
(2)

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

● **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	C14
	Marking	SCT3040KR

● **Absolute maximum ratings** (T_a = 25°C)

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		$I_{D,pulse}^{*2}$	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
Junction temperature		T_j	175	°C
Range of storage temperature		T_{stg}	-55 to +175	°C

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●**Electrical characteristics** (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 1mA				V
		T_j = 25°C	1200	-	-	
		T_j = -55°C	1200	-	-	
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =1200V				μA
		T_j = 25°C	-	1	10	
		T_j = 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 = 10mA	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{DS(on)}$ [*5]	V_{GS} = 18V, I_D = 20A				mΩ
		T_j = 25°C	-	40	52	
		T_j = 150°C	-	68	-	
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	°C/W

●**Typical Transient Thermal Characteristics**

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	2.56×10^{-2}		C_{th1}	1.39×10^{-3}	
R_{th2}	1.95×10^{-1}	K/W	C_{th2}	1.00×10^{-2}	Ws/K
R_{th3}	2.20×10^{-1}		C_{th3}	3.57×10^{-2}	

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● **Electrical characteristics** (T_a = 25°C)

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	-	1337	-	pF
Output capacitance	C_{oss}	V_{DS} = 800V	-	76	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	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	-	107	-	nC
Gate - Source charge	Q_{gs}[5]	I_D = 20A V_{GS} = 18V	-	17	-	
Gate - Drain charge	Q_{gd}[5]	See Fig. 1-1.	-	56	-	
Turn - on delay time	$t_{d(on)}$[5]	V_{DS} = 600V	-	6	-	ns
Rise time	t_r[5]	I_D = 20A V_{GS} = 0V/+18V	-	19	-	
Turn - off delay time	$t_{d(off)}$[5]	R_G = 0Ω, L = 750µH	-	29	-	
Fall time	t_f[5]	L_σ = 50nH, C_σ = 10pF See Fig. 2-1, 2-2, 2-3.	-	19	-	
Turn - on switching loss	E_{on}[5]	E_{on} includes diode reverse recovery.	-	286	-	µJ
Turn - off switching loss	E_{off}[5]		-	69	-	

●**Body diode electrical characteristics** (Source-Drain) (T_a = 25°C)

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_D = 20A	-	3.2	-	V
Reverse recovery time	t_{rr} [*5]	I_F = 20A	-	25	-	ns
Reverse recovery charge	Q_{rr} [*5]	V_R = 600V di/dt = 2500A/μs	-	535	-	nC
Peak reverse recovery current	I_{rrm} [*5]	L_σ = 50nH, C_σ = 10pF See Fig. 3-1, 3-2.	-	35	-	A

*1 Limited by maximum temperature allowed.

*2 $P_W \leq$ 10μs, Duty cycle $\leq$ 1%

*3 Example of acceptable V_{GS} waveform
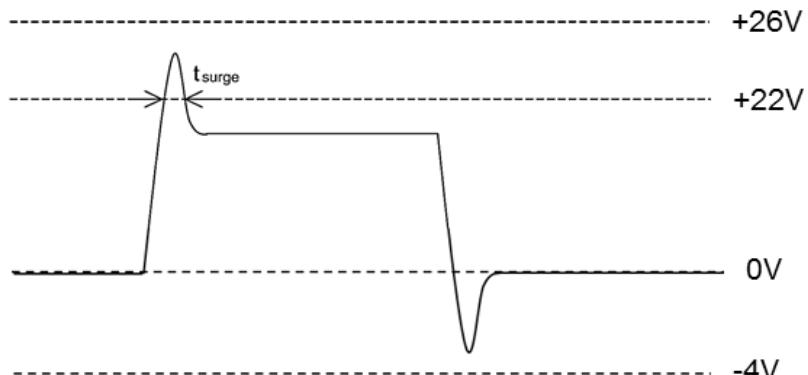
Please note especially when using driver source that V_{GSS_surge} must be in the range of absolute maximum rating.

*4 Please be advised not to use SiC-MOSFETs with V_{GS} below 13V as doing so may cause thermal runaway.

*5 Pulsed

●**Electrical characteristic curves**

Fig.1 Power Dissipation Derating Curve
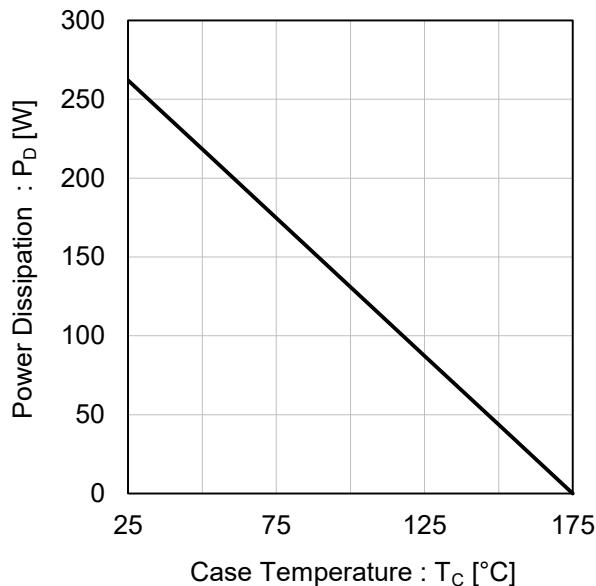
Fig.2 Maximum Safe Operating Area
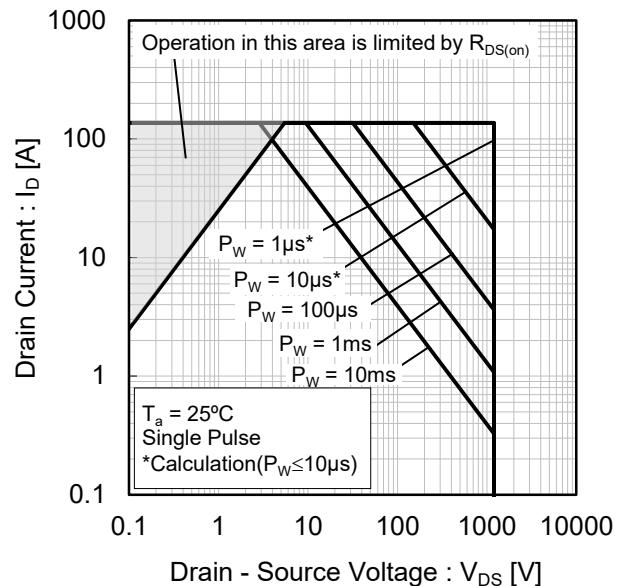
Fig.3 Typical Transient Thermal
Resistance vs. Pulse Width
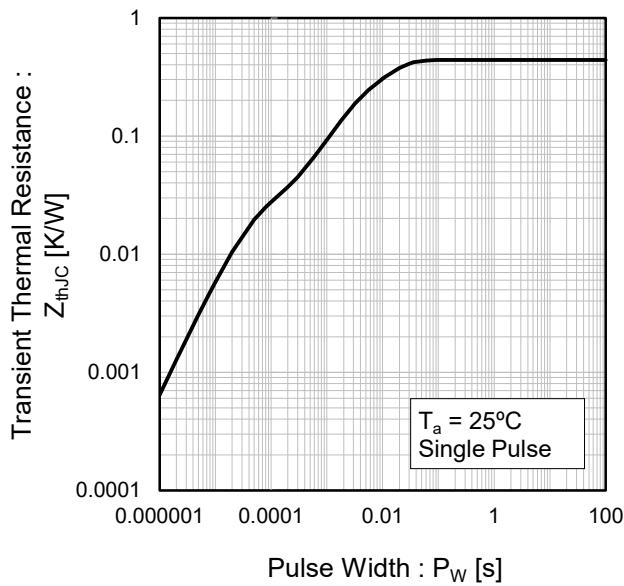
●**Electrical characteristic curves**

Fig.4 Typical Output Characteristics(I)
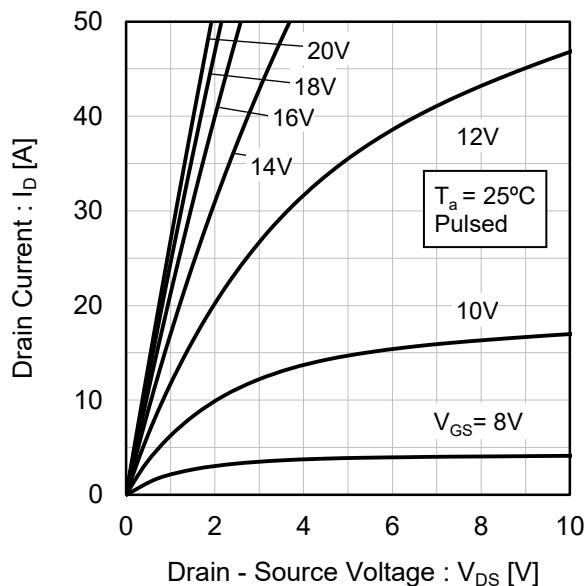
Fig.5 Typical Output Characteristics(II)

Fig.6 T$_j$ = 25ºC 3rd Quadrant Characteristics

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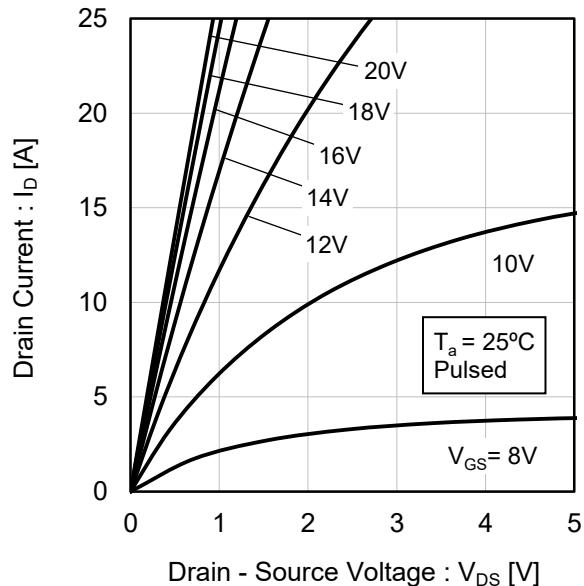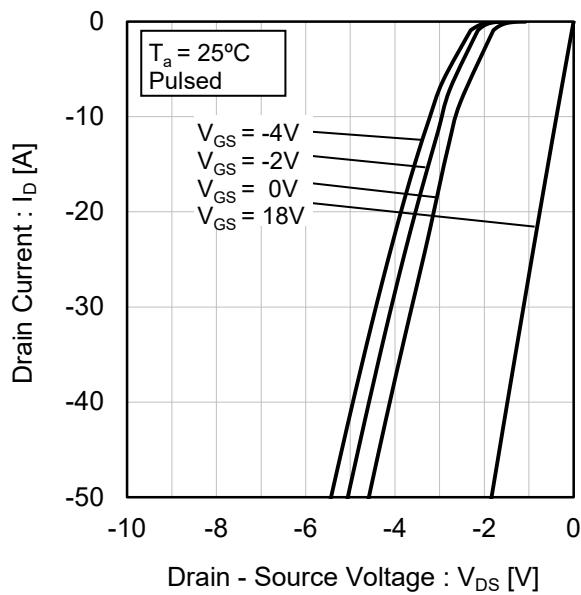
●**Electrical characteristic curves**

Fig.7 T$_j$ = 150ºC Typical Output Characteristics(I)
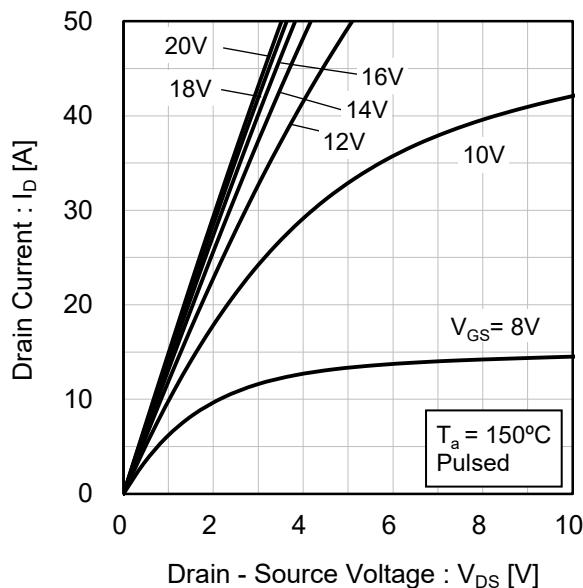
Fig.8 T$_j$ = 150ºC Typical Output Characteristics(II)
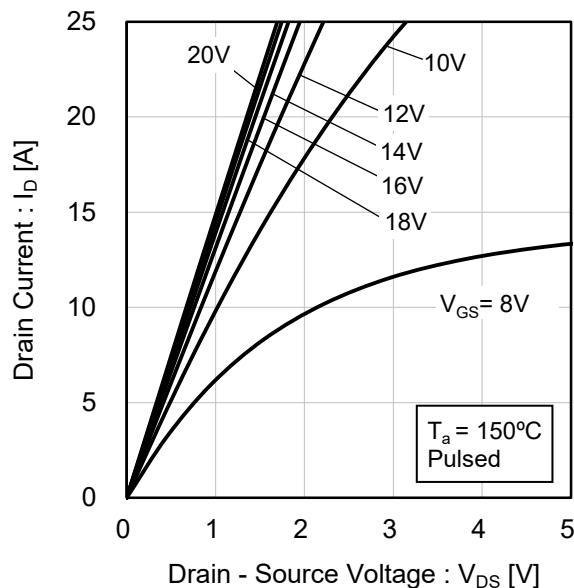
Fig.9 T$_j$ = 150ºC 3rd Quadrant Characteristics
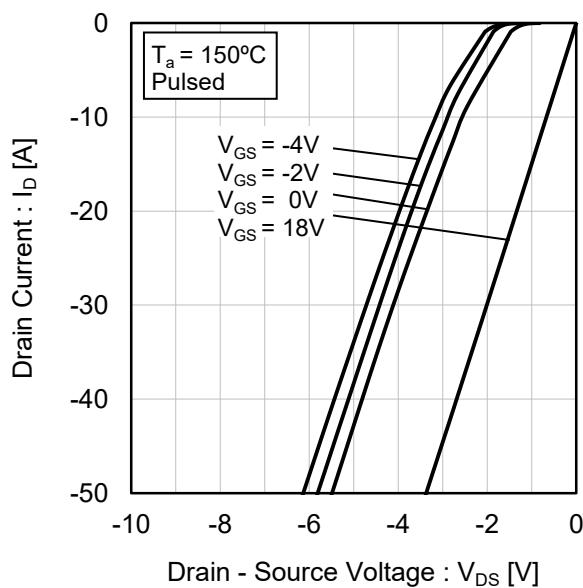
Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage
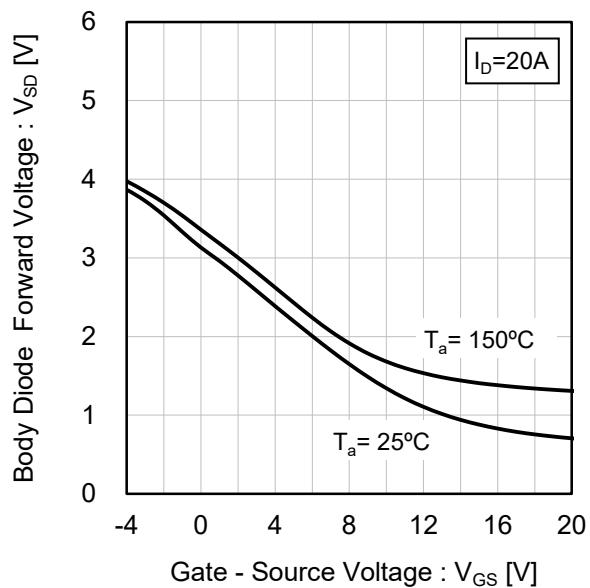
●**Electrical characteristic curves**

Fig.11 Typical Transfer Characteristics (I)
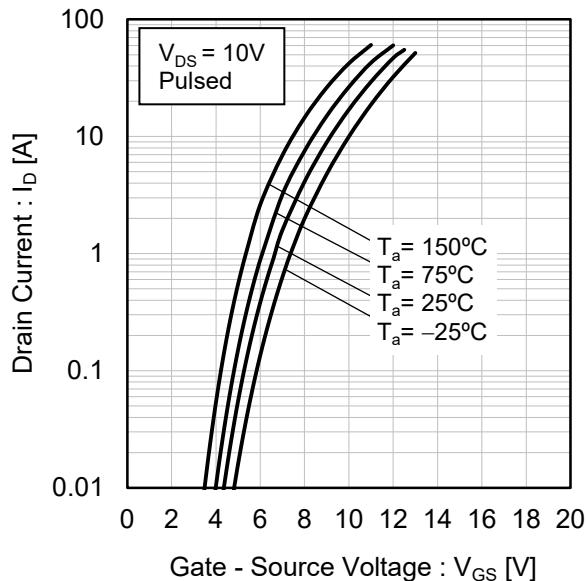
Fig.12 Typical Transfer Characteristics (II)
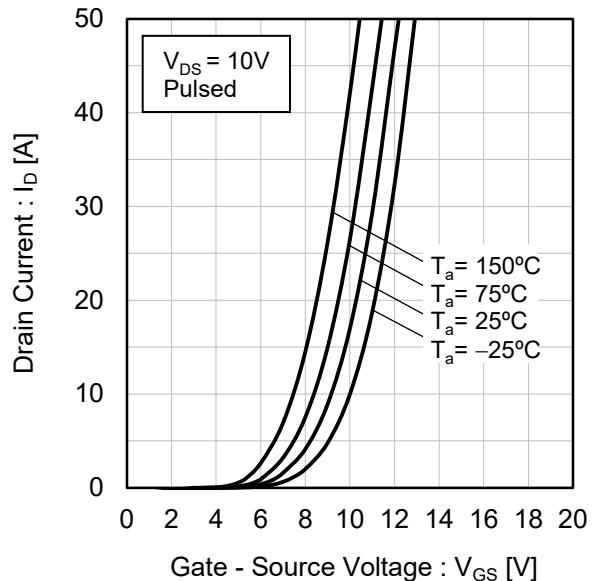
Fig.13 Gate Threshold Voltage
        vs. Junction Temperature
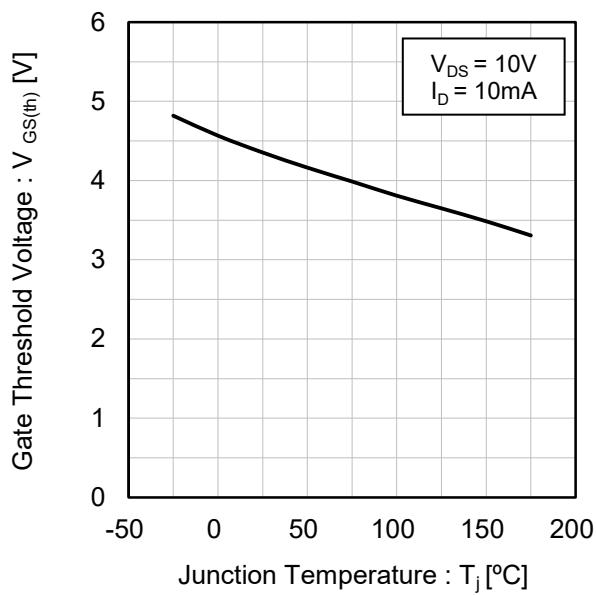
Fig.14 Transconductance vs. Drain Current

# SCT3040KR Datasheet
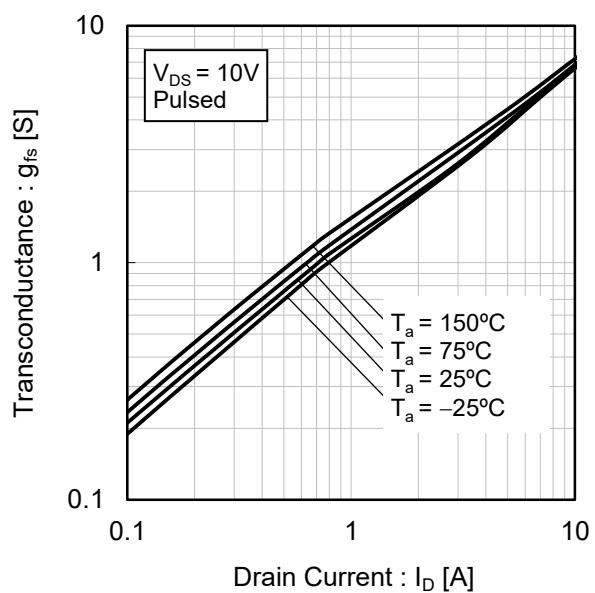
● **Electrical characteristic curves**

Fig.15 Static Drain - Source On - State
Resistance vs. Gate - Source Voltage
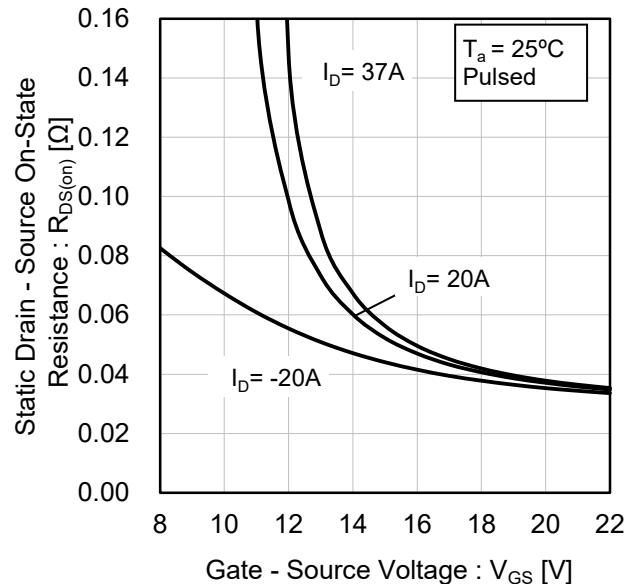
Fig.16 Static Drain - Source On - State
Resistance vs. Junction Temperature
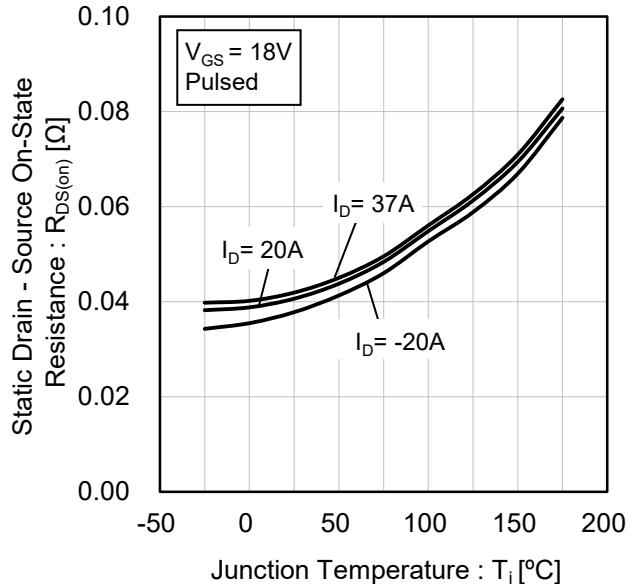
Fig.17 Static Drain - Source On - State
Resistance vs. Drain Current
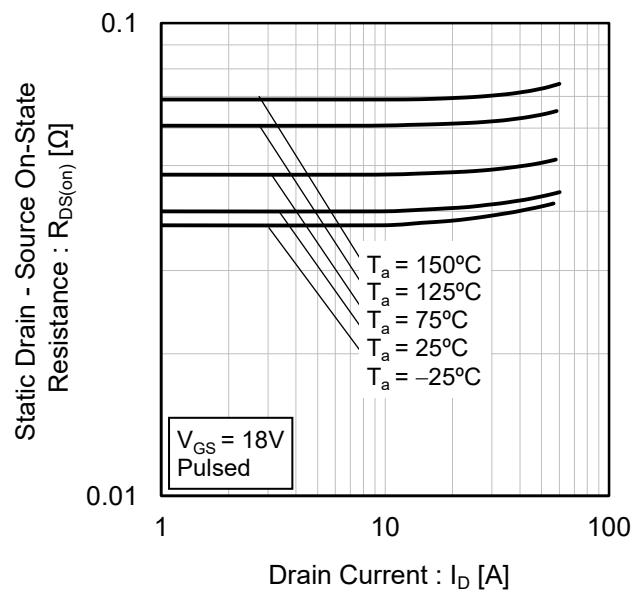
Fig.18 Normalized Drain - Source Breakdown
Voltage vs. Junction Temperature
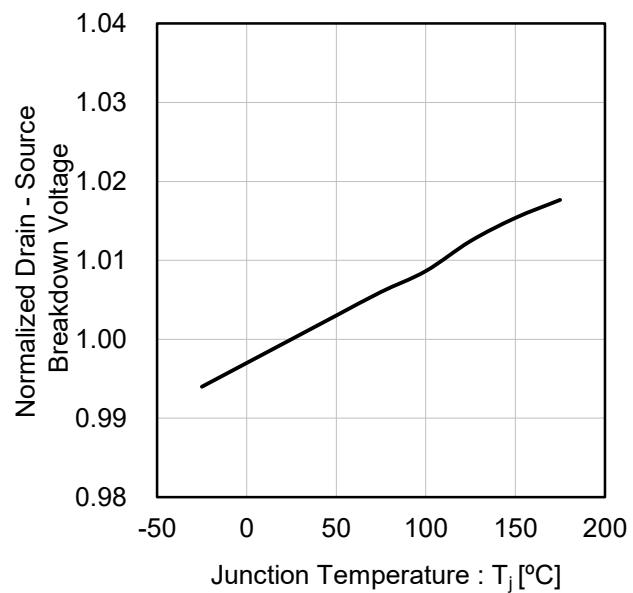
●**Electrical characteristic curves**

Fig.19 Typical Capacitance
   vs. Drain - Source Voltage

C_{iss}

C_{oss}

C_{rss}

Capacitance : C [pF]

$T_a = 25ºC$
$f = 1MHz$
$V_{GS} = 0V$

Drain - Source Voltage : V_{DS} [V]

Fig.20 C_{oss} Stored Energy

C_{oss} Stored Energy : E_{OSS} [μJ]

$T_a = 25ºC$
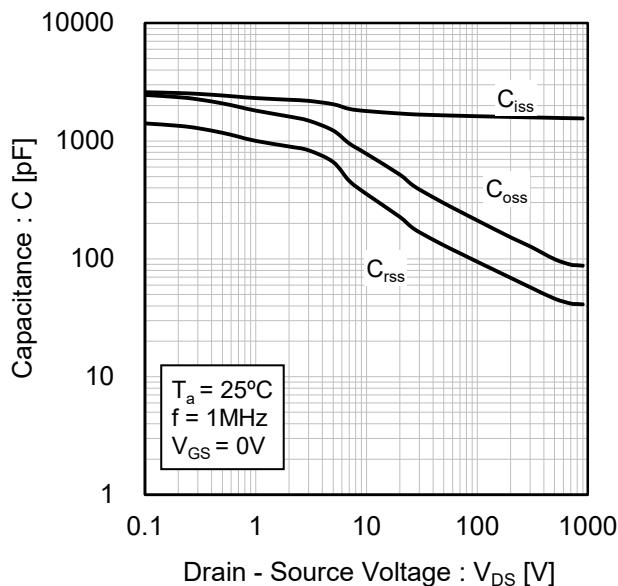
Drain - Source Voltage : V_{DS} [V]
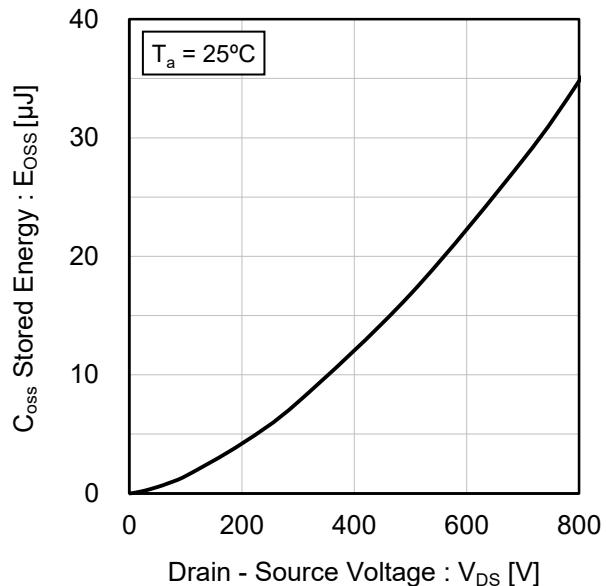
Fig.21 Dynamic Input Characteristics

Gate - Source Voltage : V_{GS} [V]

$T_a = 25ºC$
$V_{DD} = 600V$
$I_D = 20A$
Pulsed

Total Gate Charge : Q_g [nC]
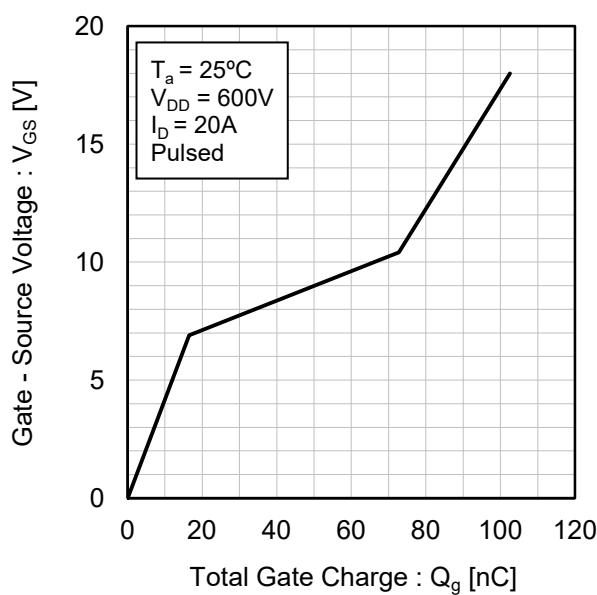
*Gate Charge Waveform

V_G

Q_g

V_{GS}

Q_{gs} Q_{gd}

Charge
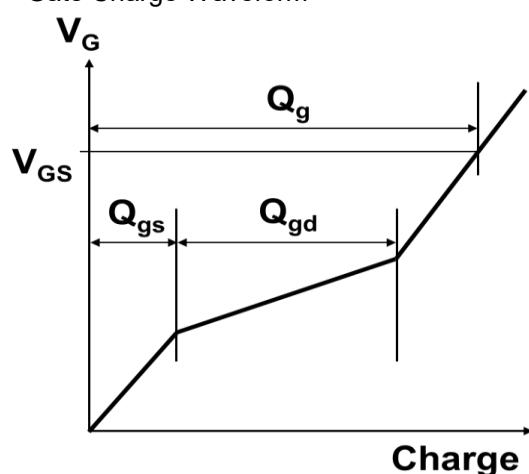
●**Electrical characteristic curves**

Fig.22 Typical Switching Time
vs. External Gate Resistance
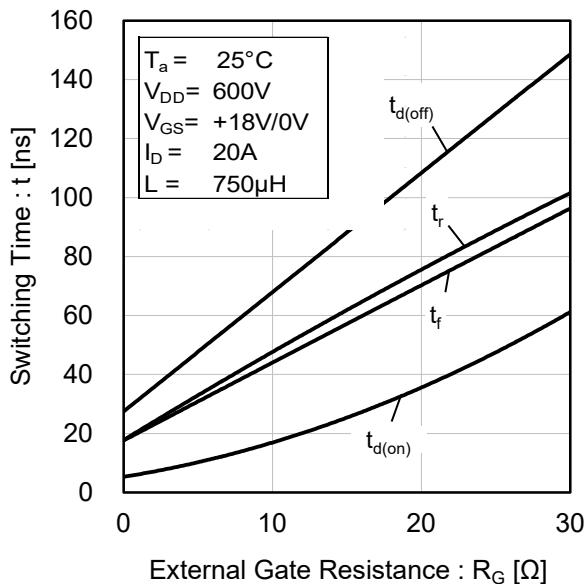
Fig.23 Typical Switching Loss
vs. Drain - Source Voltage
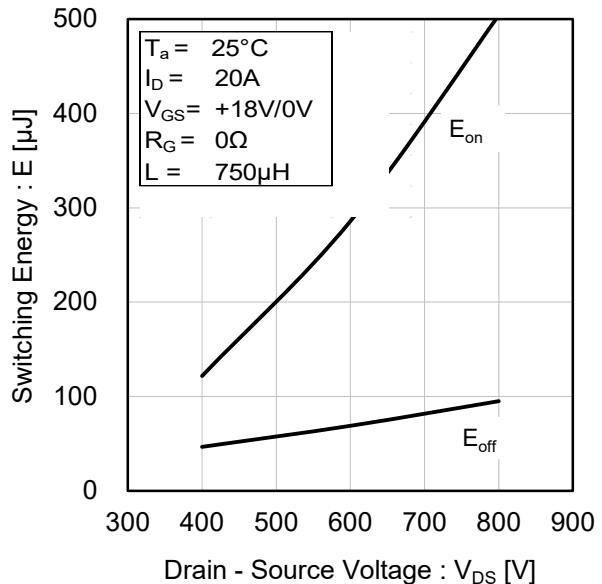
Fig.24 Typical Switching Loss
vs. Drain Current
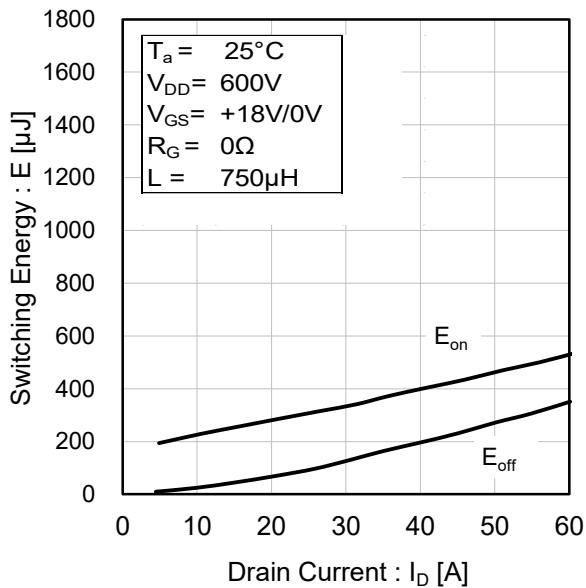
Fig.25 Typical Switching Loss
vs. External Gate Resistance

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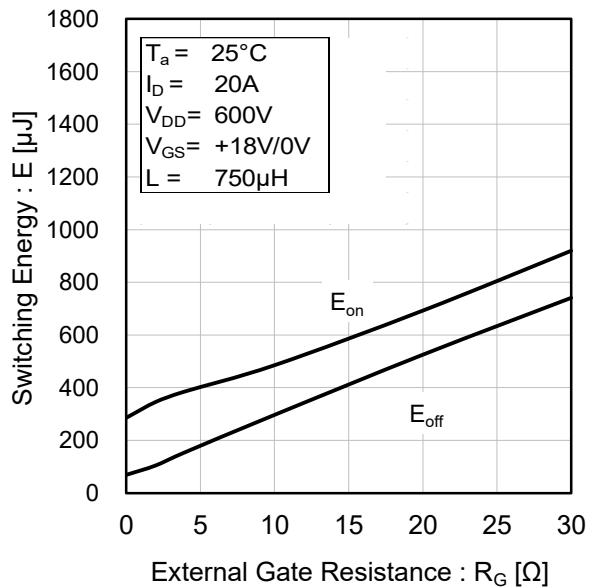
●**Measurement circuits and waveforms**

Fig.1-1 Gate Charge Measurement Circuit
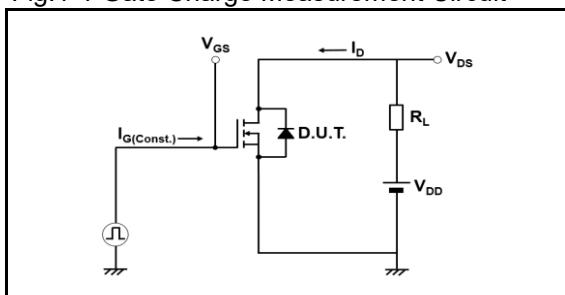
Fig.2-1 Switching Characteristics Measurement Circuit
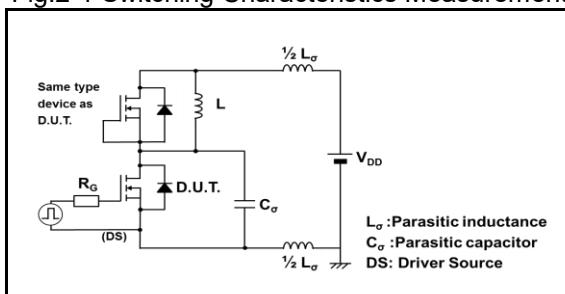
Fig.2-2 Waveforms for Switching Time
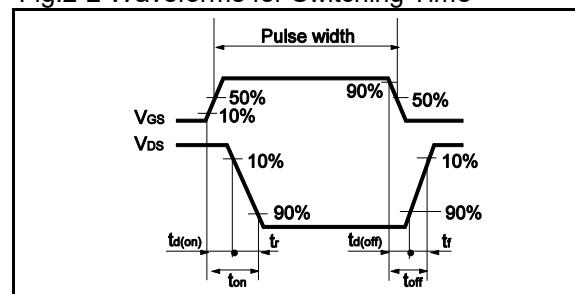
Fig.2-3 Waveforms for Switching Energy Loss
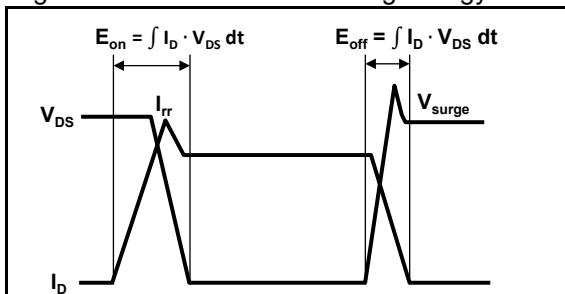
Fig.3-1 Reverse Recovery Time Measurement Circuit
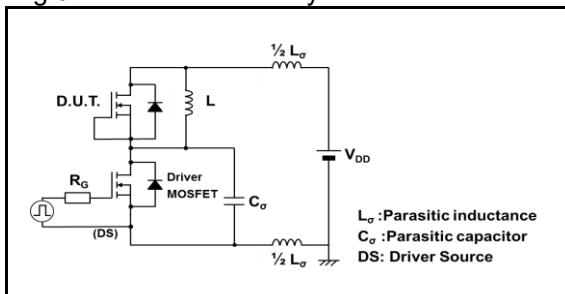
Fig.3-2 Reverse Recovery Waveform
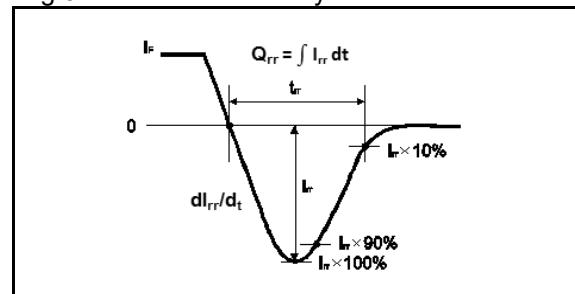
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