SCT3160KL

N-channel SiC power MOSFET

Datasheet

V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	160mΩ
I_D	17A
P_D	103W

● **Outline**

TO-247N

(1)(2)(3)

● **Inner circuit**

(2)

(1) Gate
(2) Drain
(3) Source

*1 Body Diode

(1)

(3)

● **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**

	Packing	Tube
Type	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Taping code	C11
	Marking	SCT3160KL

● **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]	17	A
	T_c = 100°C	I_D [*1]	12	A
Pulsed drain current		$I_{D,pulse}$ [*2]	42	A
Gate - Source voltage		V_{GSS}	−4 to +22	V
Gate-Source Surge Voltage		V_{GSS_surge}	−4 to +26	V
Recommended Drive Voltage		V_{GS_op}	0 / +18	V
Junction temperature		T_j	175	°C
Range of storage temperature		T_{stg}	−55 to +175	°C

● **Thermal resistance**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	1.12	1.46	°C/W

● **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	1200	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200V, V_{GS} = 0V T_j = 25°C	-	1	10	μA
		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 = 2.5mA	2.7	-	5.6	V
Static drain - source on - state resistance	$R_{DS(on)}$ *3	V_{GS} = 18V, I_D = 5A T_j = 25°C	-	160	208	mΩ
		T_j = 125°C	-	240	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	18	-	Ω

● **Example of acceptable Vgs waveform**

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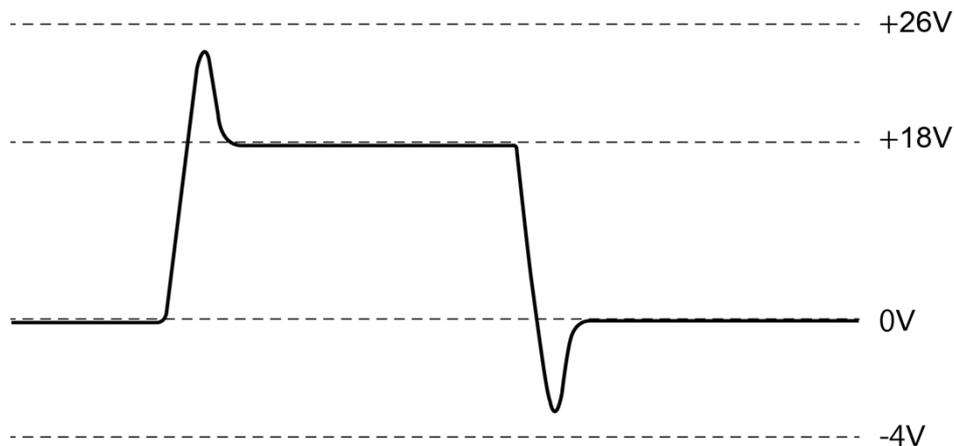
●**Electrical characteristics** (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} [3]	V_{DS} = 10V, I_D = 5A	-	2.5	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	398	-	pF
Output capacitance	C_{oss}	V_{DS} = 800V	-	41	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	18	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 600V	-	45	-	pF
Turn - on delay time	$t_{d(on)}$ [3]	V_{DD} = 400V, I_D = 5A	-	14	-	ns
Rise time	t_r [3]	V_{GS} = 18V/0V	-	18	-	
Turn - off delay time	$t_{d(off)}$ [3]	R_L = 80Ω	-	24	-	
Fall time	t_f [3]	R_G = 0Ω	-	25	-	
Turn - on switching loss	E_{on} [3]	V_{DD} = 600V, I_D = 5A V_{GS} = 18V/0V	-	62	-	μJ
Turn - off switching loss	E_{off} [3]	R_G = 0Ω L=750μH *E_{on} includes diode reverse recovery	-	12	-	

●**Gate Charge characteristics** (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g [3]	V_{DD} = 600V	-	42	-	nC
Gate - Source charge	Q_{gs} [3]	I_D = 5A	-	11	-	
Gate - Drain charge	Q_{gd} [3]	V_{GS} = 18V	-	18	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD} = 600V, I_D = 5A	-	9.6	-	V

*1 Limited only by maximum temperature allowed.

*2 PW ≤ 10μs, Duty cycle ≤ 1%

*3 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	T_c = 25°C	-	-	17	A
Inverse diode direct current, pulsed	I_{SM} *2		-	-	42	A
Forward voltage	V_{SD} *3	V_{GS} = 0V, I_S = 5A	-	3.2	-	V
Reverse recovery time	t_{rr} *3	I_F =5A, V_R = 600V di/dt = 1100A/μs	-	13	-	ns
Reverse recovery charge	Q_{rr} *3		-	26	-	nC
Peak reverse recovery current	I_{rrm} *3		-	4	-	A

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● **Electrical characteristic curves**

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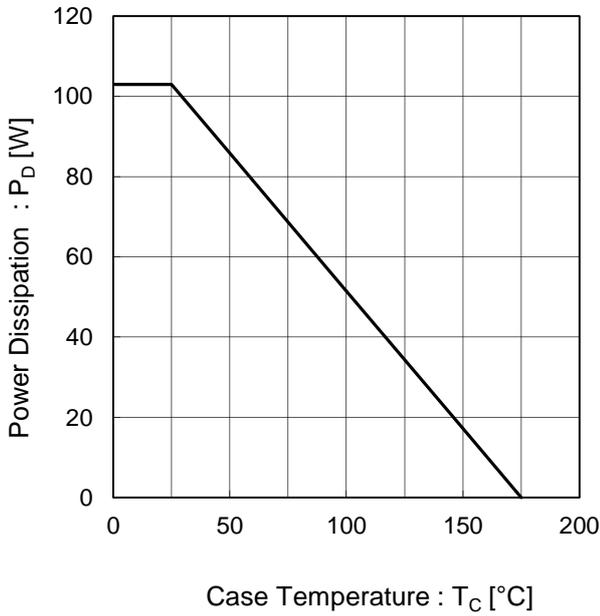
Fig.2 Maximum Safe Operating Area
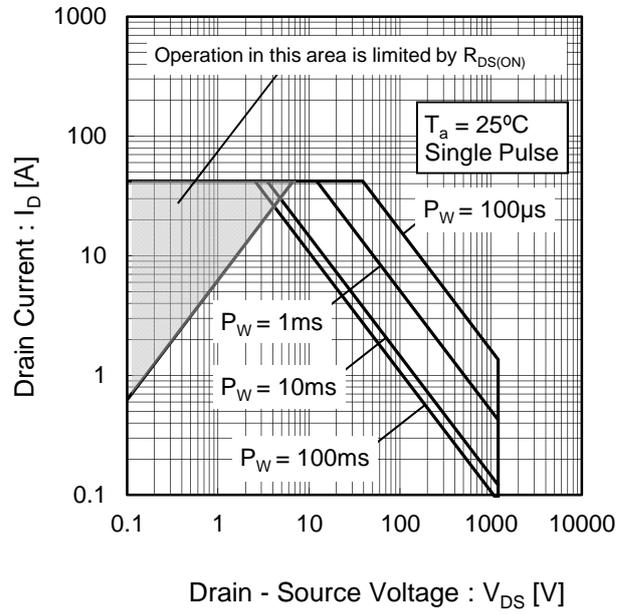
Fig.3 Typical Transient Thermal Resistance vs. Pulse Width

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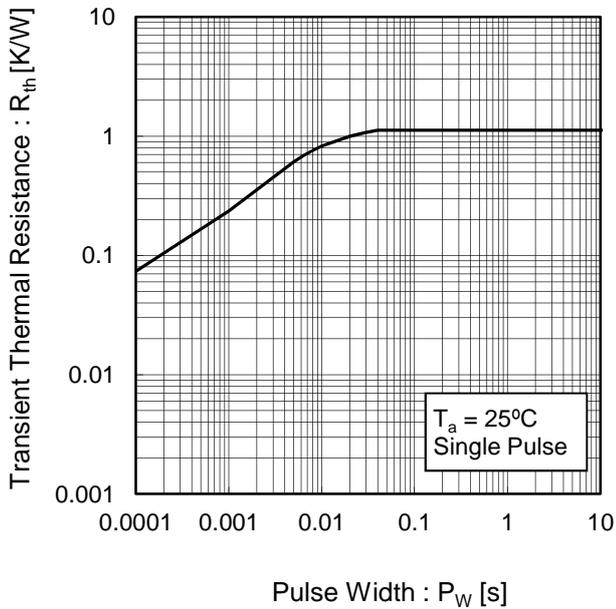
● **Electrical characteristic curves**

Fig.4 Typical Output Characteristics(I)

Drain Current : I_D [A]

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

20V, 18V, 16V, 14V, 12V, 10V, V_{GS}= 8V

T_a = 25ºC
Pulsed

Fig.5 Typical Output Characteristics(II)

Drain Current : I_D [A]

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

20V, 18V, 16V, 14V, 12V, 10V, V_{GS}= 8V

T_a = 25ºC
Pulsed

Fig.6 T_j = 150ºC Typical Output
Characteristics(I)

Drain Current : I_D [A]

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

20V, 18V, 16V, 14V, 12V, 10V, V_{GS}= 8V

T_a = 150ºC
Pulsed

Fig.7 T_j = 150ºC Typical Output
Characteristics(II)

Drain Current : I_D [A]

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

20V, 18V, 16V, 14V, 12V, 10V, V_{GS}= 8V

T_a = 150ºC
Pulsed

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● **Electrical characteristic curves**

Fig.8 Typical Transfer Characteristics (I)
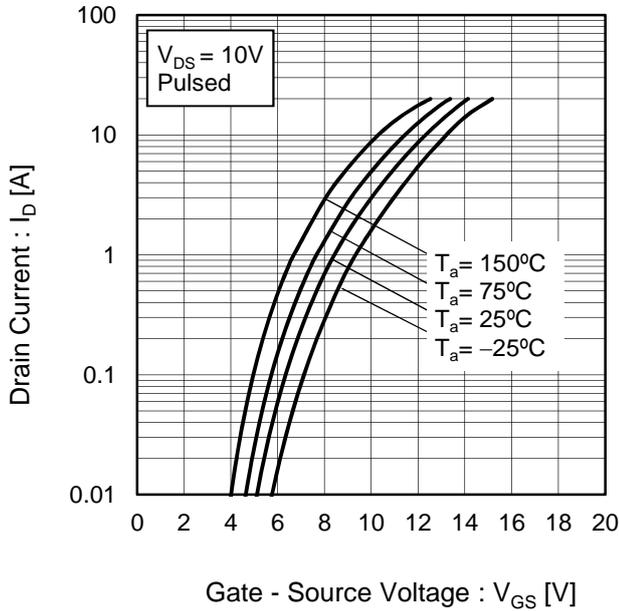
Fig.9 Typical Transfer Characteristics (II)
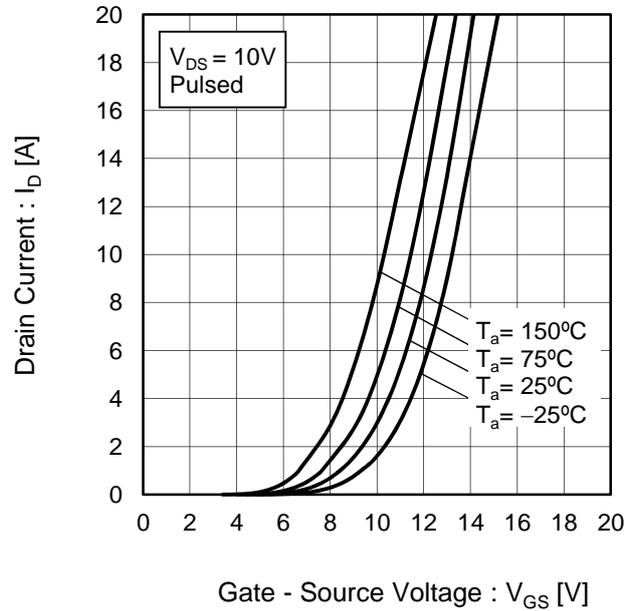
Fig.10 Gate Threshold Voltage
vs. Junction Temperature
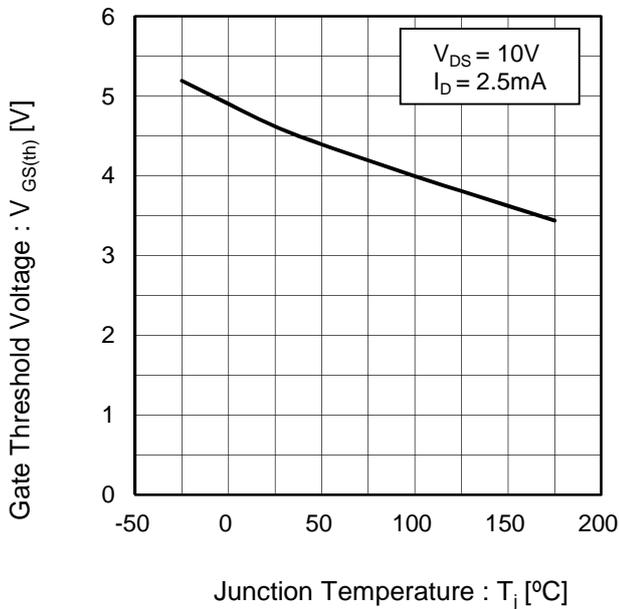
Fig.11 Transconductance vs. Drain Current

7/12

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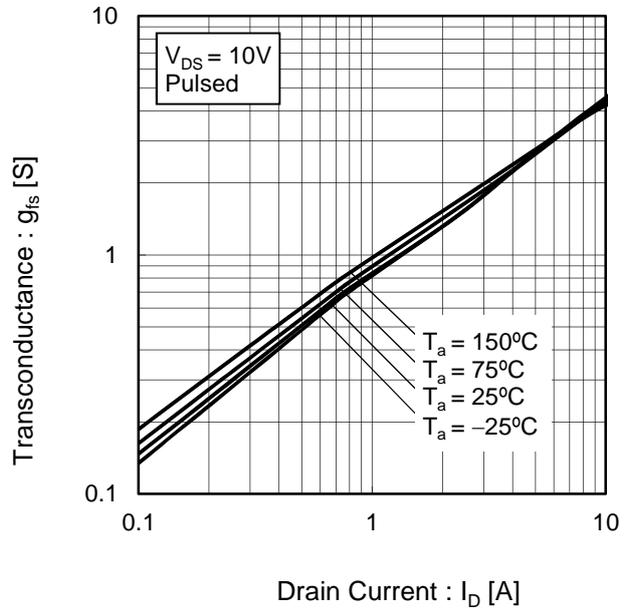
●**Electrical characteristic curves**

Fig.12 Static Drain - Source On - State
Resistance vs. Gate - Source Voltage

Static Drain - Source On-State Resistance
: $R_{DS(on)}$ [Ω]

$T_a = 25°C$
Pulsed

$I_D = 11A$

$I_D = 5A$

Gate - Source Voltage : V_{GS} [V]
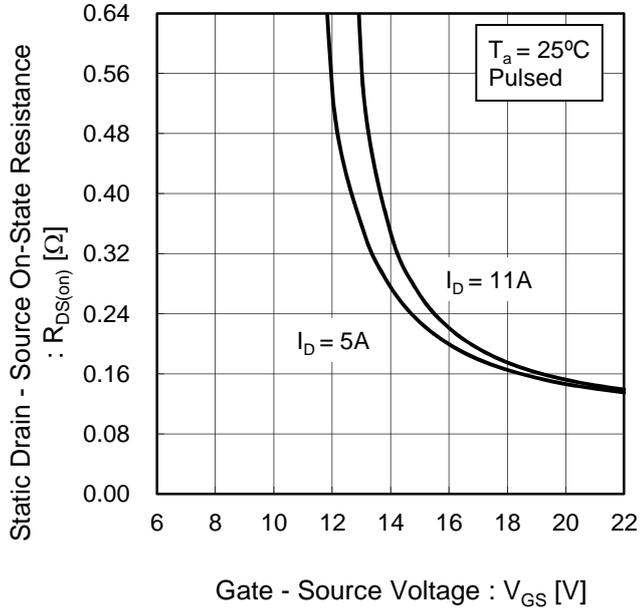
Fig.13 Static Drain - Source On - State
Resistance vs. Junction Temperature

Static Drain - Source On-State Resistance
: $R_{DS(on)}$ [Ω]

$V_{GS} = 18V$
Pulsed

$I_D = 11A$

$I_D = 5A$

Junction Temperature : T_j [°C]
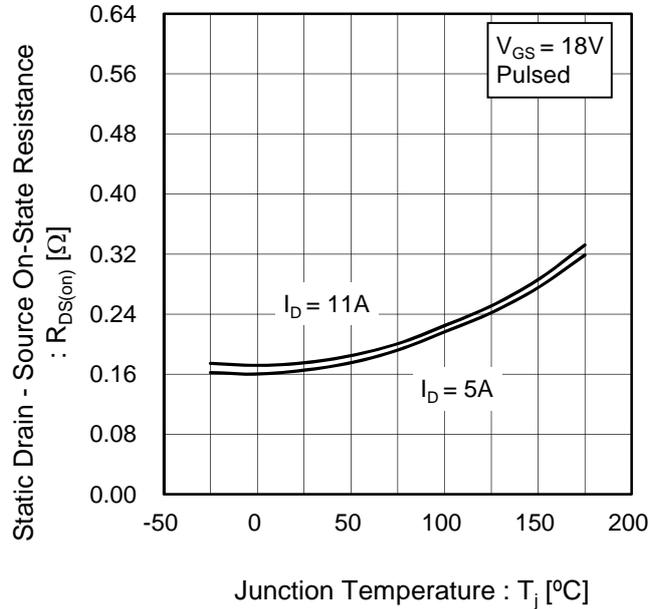
Fig.14 Static Drain - Source On - State
Resistance vs. Drain Current

Static Drain - Source On-State Resistance
: $R_{DS(on)}$ [Ω]

$T_a = 150°C$
$T_a = 125°C$
$T_a = 75°C$
$T_a = 25°C$
$T_a = -25°C$

$V_{GS} = 18V$
Pulsed

Drain Current : I_D [A]

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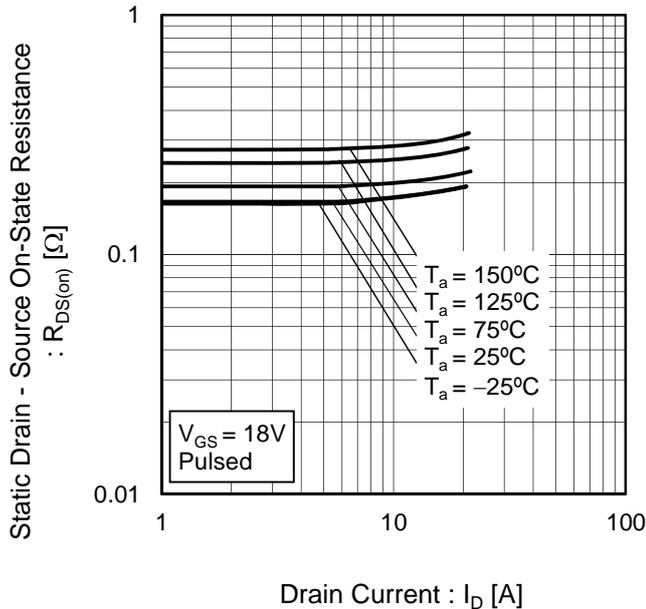
● **Electrical characteristic curves**

Fig.15 Typical Capacitance
vs. Drain - Source Voltage
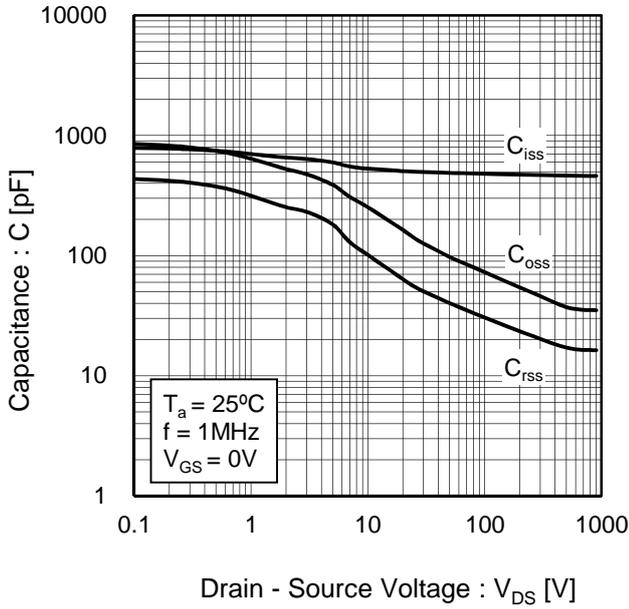
Fig.16 Coss Stored Energy
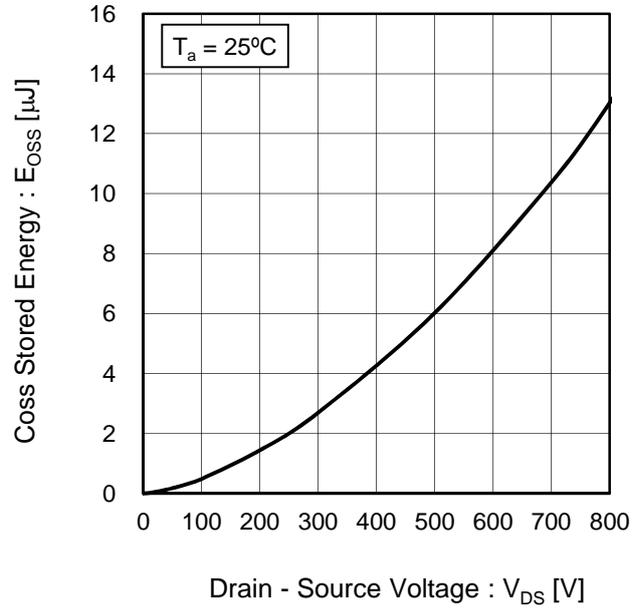
Fig.17 Switching Characteristics
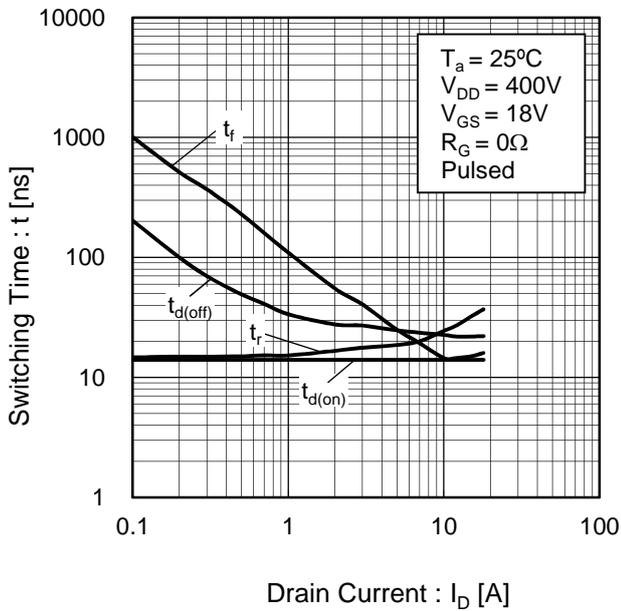
Fig.18 Dynamic Input Characteristics

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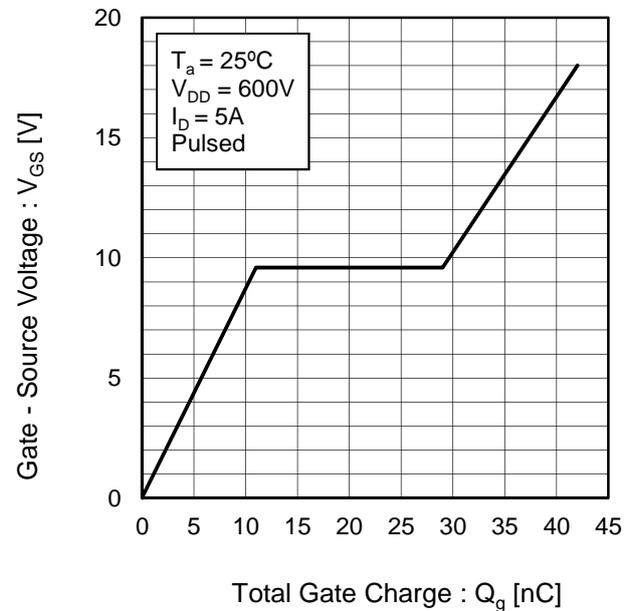
● **Electrical characteristic curves**

Fig.19 Typical Switching Loss
vs. Drain - Source Voltage

$T_a = 25°C$
$I_D = 5A$
$V_{GS} = 18V/0V$
$R_G = 0Ω$
$L = 750μH$

E_{on}

E_{off}

Switching Energy : E [μJ]

Drain - Source Voltage : V_{DS} [V]
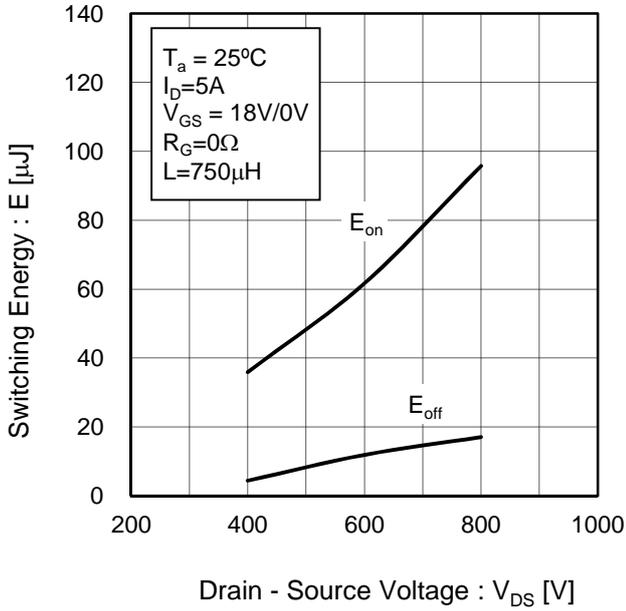
Fig.20 Typical Switching Loss
vs. Drain Current

$T_a = 25°C$
$V_{DD} = 600V$
$V_{GS} = 18V/0V$
$R_G = 0Ω$
$L = 750μH$

E_{on}

E_{off}

Switching Energy : E [μJ]

Drain Current : I_D [A]
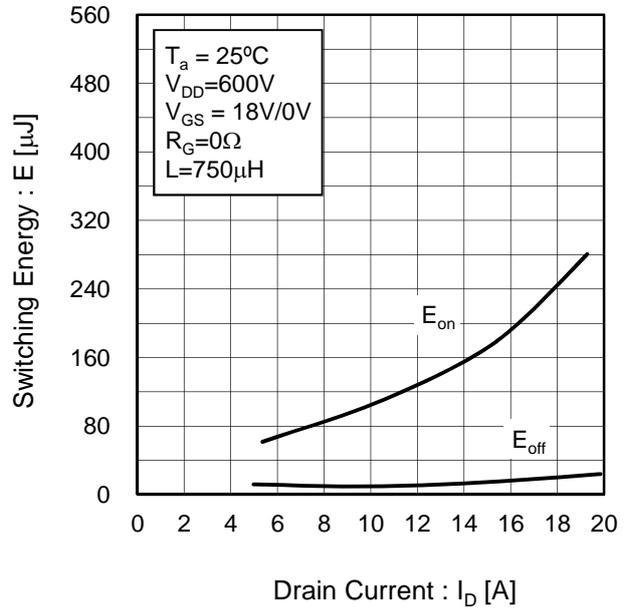
Fig.21 Typical Switching Loss
vs. External Gate Resistance

$T_a = 25°C$
$V_{DD} = 600V$
$I_D = 5A$
$V_{GS} = 18V/0V$
$L = 750μH$

E_{on}

E_{off}

Switching Energy : E [μJ]

External Gate Resistance : R_G [Ω]
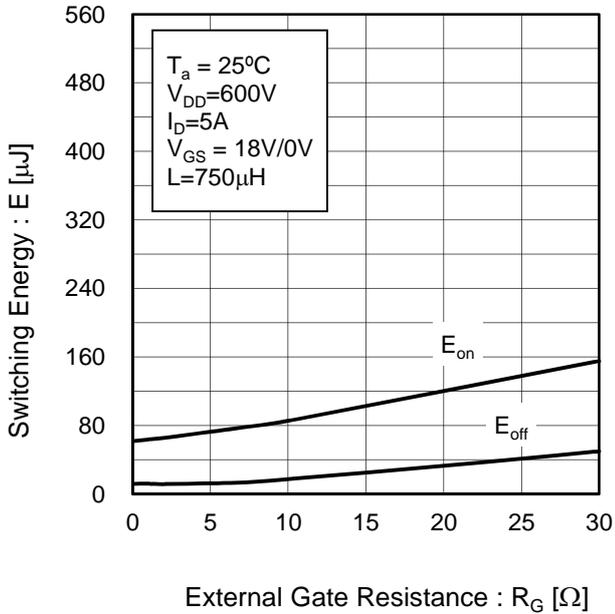
● **Electrical characteristic curves**

Fig.22 Inverse Diode Forward Current
vs. Source - Drain Voltage
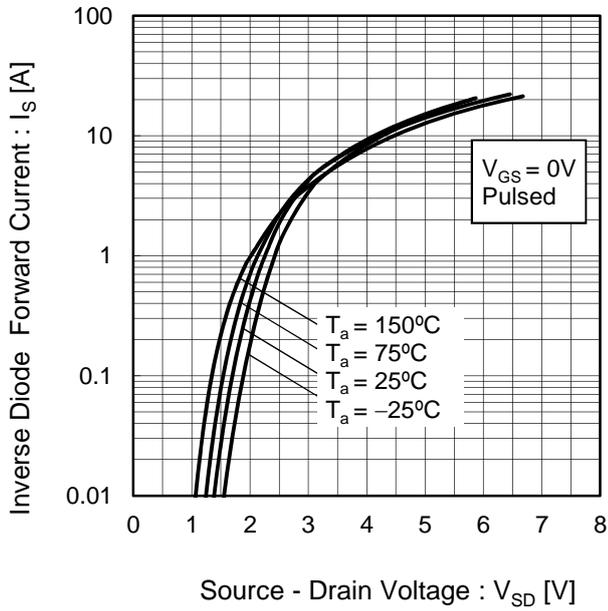
Fig.23 Reverse Recovery Time
vs.Inverse Diode Forward Current

Inverse Diode Forward Current : I_S [A]

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

V_{GS} = 0V
Pulsed

T_a = 150ºC
T_a = 75ºC
T_a = 25ºC
T_a = −25ºC

Reverse Recovery Time : t_{rr} [ns]

Inverse Diode Forward Current : I_S [A]

T_a = 25ºC
di / dt = 1100A / us
V_R = 600V
V_{GS} = 0V
Pulsed

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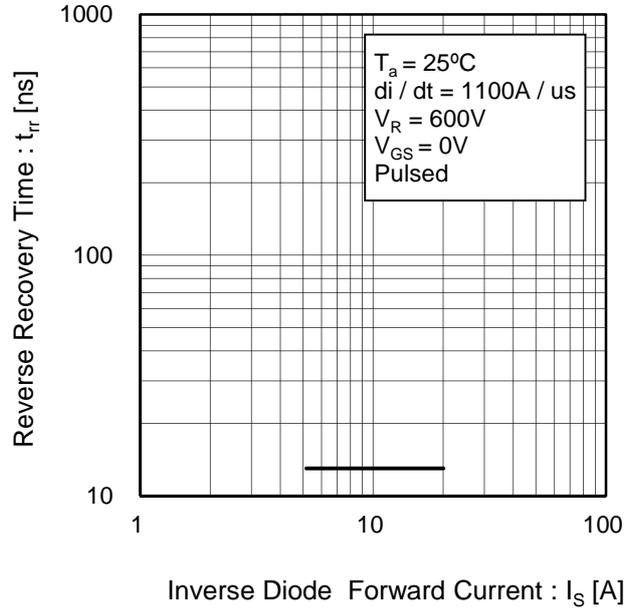
● **Measurement circuits**

Fig.1-1 Switching Time Measurement Circuit
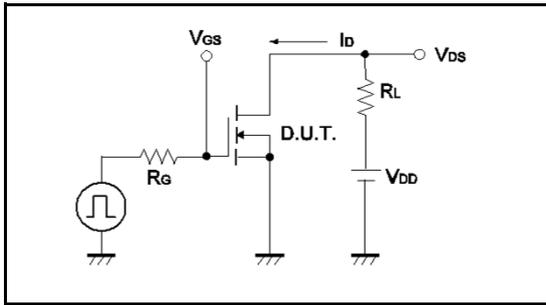
Fig.1-2 Switching Waveforms
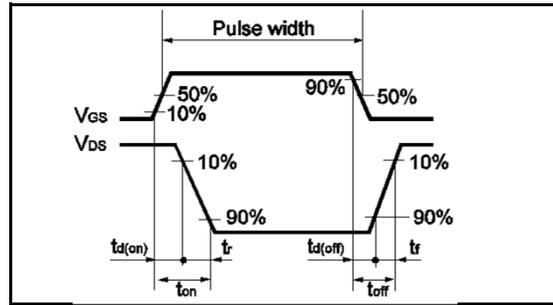
Fig.2-1 Gate Charge Measurement Circuit
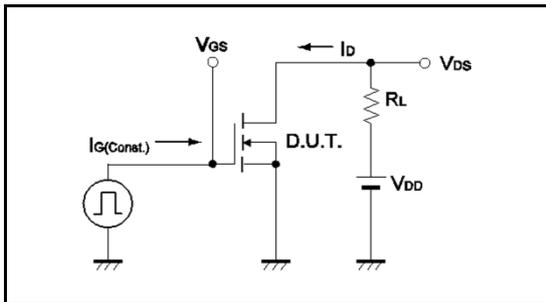
Fig.2-2 Gate Charge Waveform
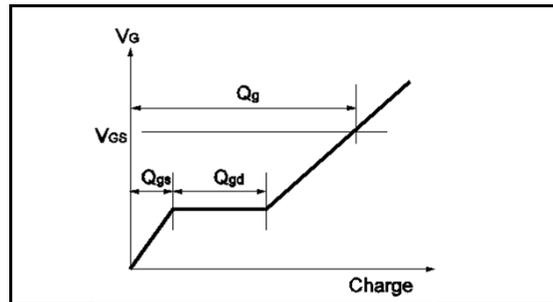
Fig.3-1 Switching Energy Measurement Circuit
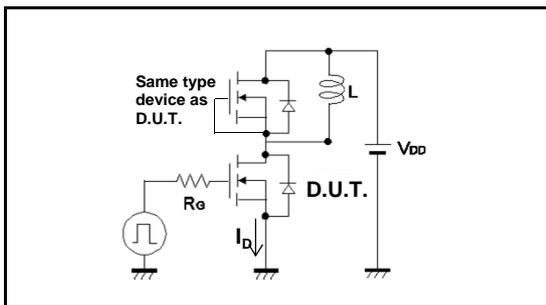
Fig.3-2 Switching Waveforms
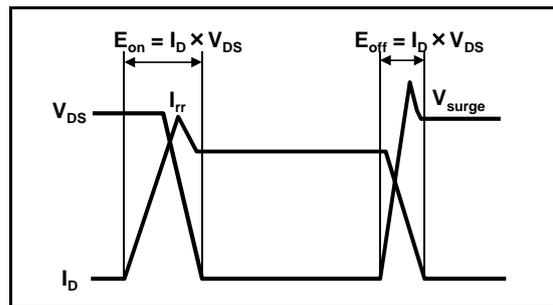
Fig.4-1 Reverse Recovery Time Measurement Circuit
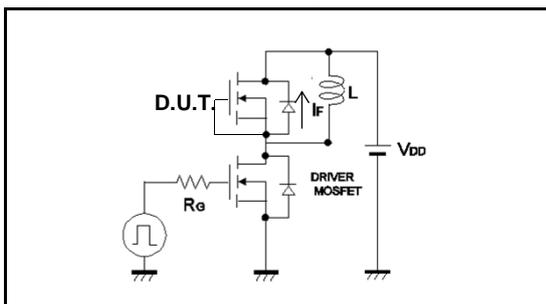

Fig.4-2 Reverse Recovery Waveform
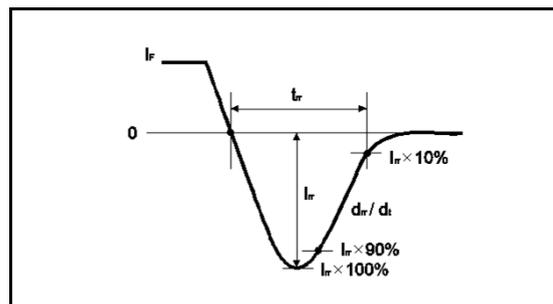
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