S2306

N-channel SiC power MOSFET bare die

Data Sheet

V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	160mΩ
I_D	22A[*1]

● **Features**

1) Low on-resistance

2) Fast switching speed

3) Fast reverse recovery

4) Easy to parallel

5) Simple to drive

● **Inner circuit**

(G) Gate
(D) Drain
(S) Source

*1 Body Diode
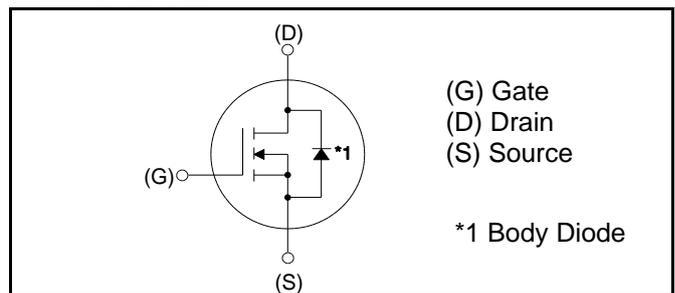
● **Application**

• Solar inverters

• DC/DC converters

• Switch mode power supplies

• Induction heating

• Motor drives

● **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]	22	A
Pulsed drain current		$I_{D,pulse}$ [*2]	55	A
Gate - Source voltage (DC)		V_{GSS}	−6 to 22	V
Gate - Source surge voltage (T_{surge} < 300nsec)		$V_{GSS-surge}$ [*3]	−10 to 26	V
Junction temperature		T_j	175	°C
Range of storage temperature		T_{stg}	−55 to +175	°C

● **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} = −6V, V_{DS} = 0V	-	-	−100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 2.5mA	1.6	2.8	4.0	V
Static drain - source on - state resistance	$R_{DS(on)}$ [4]	V_{GS} = 18V, I_D = 7A T_j = 25°C	-	160	198	mΩ
		T_j = 125°C	-	226	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	13.7	-	Ω

*1 Limited only by maximum temperature allowed.

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

*3 Example of acceptable Vgs waveform
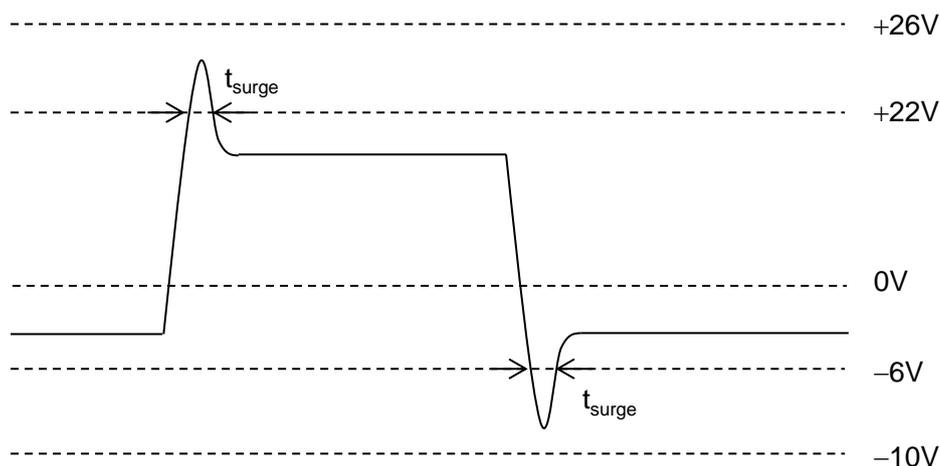
*4 Pulsed

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} [4]	$V_{DS} = 10V$, $I_D = 7A$	-	2.4	-	S
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	1200	-	pF
Output capacitance	C_{oss}	$V_{DS} = 800V$	-	45	-	
Reverse transfer capacitance	C_{rss}	$f = 1MHz$	-	7	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0V$ $V_{DS} = 0V$ to $500V$	-	71	-	pF
Turn - on delay time	$t_{d(on)}$ [4]	$V_{DD} = 400V$, $I_D = 7A$	-	23	-	ns
Rise time	t_r [4]	$V_{GS} = 18V/0V$	-	25	-	
Turn - off delay time	$t_{d(off)}$ [4]	$R_L = 57\Omega$	-	67	-	
Fall time	t_f [4]	$R_G = 0\Omega$	-	27	-	
Turn - on switching loss	E_{on} [4]	$V_{DD} = 600V$, $I_D=7A$ $V_{GS} = 18V/0V$ $R_G = 0\Omega$, $L=500\mu H$ *E_{on} includes diode reverse recovery	-	126	-	μJ
Turn - off switching loss	E_{off} [4]		-	55	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g [4]	$V_{DD} = 400V$	-	62	-	nC
Gate - Source charge	Q_{gs} [4]	$I_D = 7A$	-	14	-	
Gate - Drain charge	Q_{gd} [4]	$V_{GS} = 18V$	-	20	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 400V$, $I_D = 7A$	-	9.6	-	V

●**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	-	-	22	A
Inverse diode direct current, pulsed	I_{SM} [*2]		-	-	55	A
Forward voltage	V_{SD} [*4]	V_{GS} = 0V, I_S = 7A	-	4.1	-	V
Reverse recovery time	t_{rr} [*4]	I_F = 7A, V_R = 400V di/dt = 160A/μs	-	26	-	ns
Reverse recovery charge	Q_{rr} [*4]		-	39	-	nC
Peak reverse recovery current	I_{rrm} [*4]		-	3.0	-	A

● **Electrical characteristic curves**

Fig.1 Typical Output Characteristics(I)
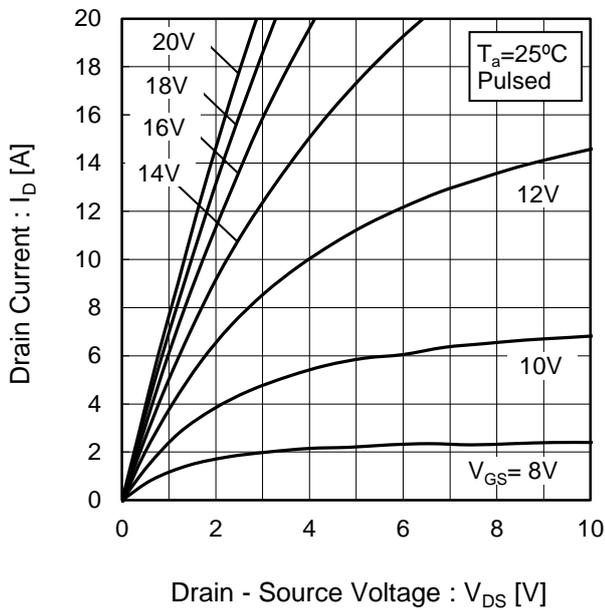
Fig.2 Typical Output Characteristics(II)
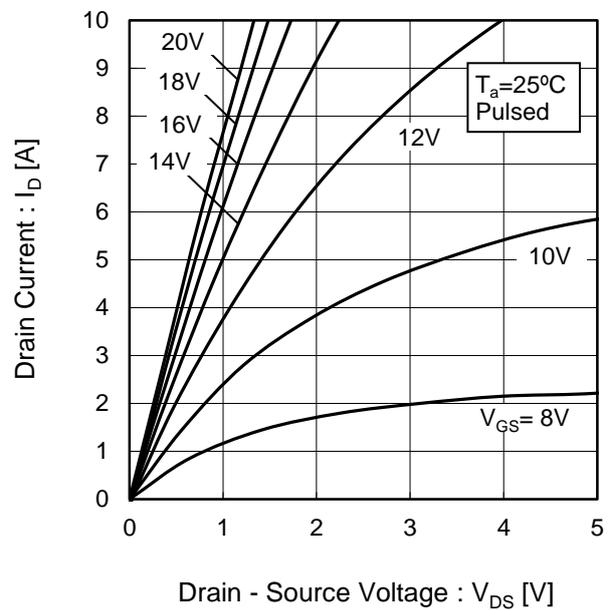
Fig.3 T_j = 150°C Typical Output Characteristics(I)
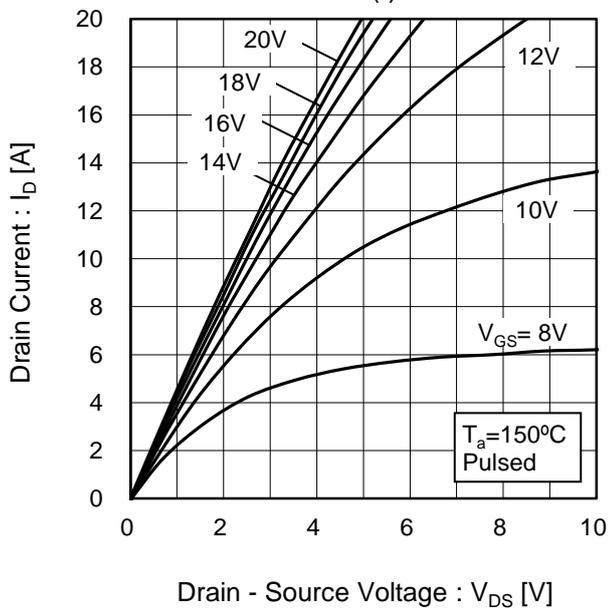
Fig.4 T_j = 150°C Typical Output Characteristics(II)
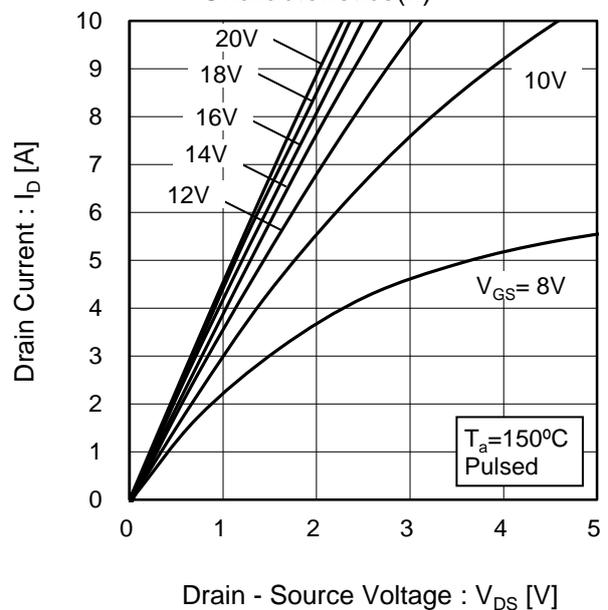
● **Electrical characteristic curves**

Fig.5 Typical Transfer Characteristics (I)
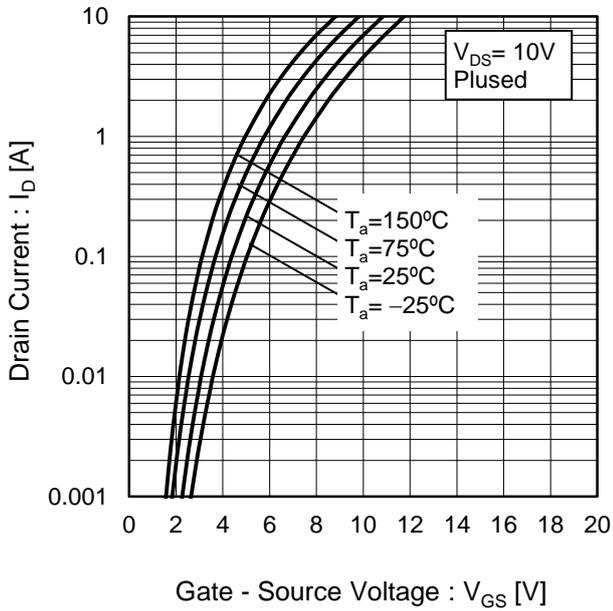
Fig.6 Typical Transfer Characteristics (II)
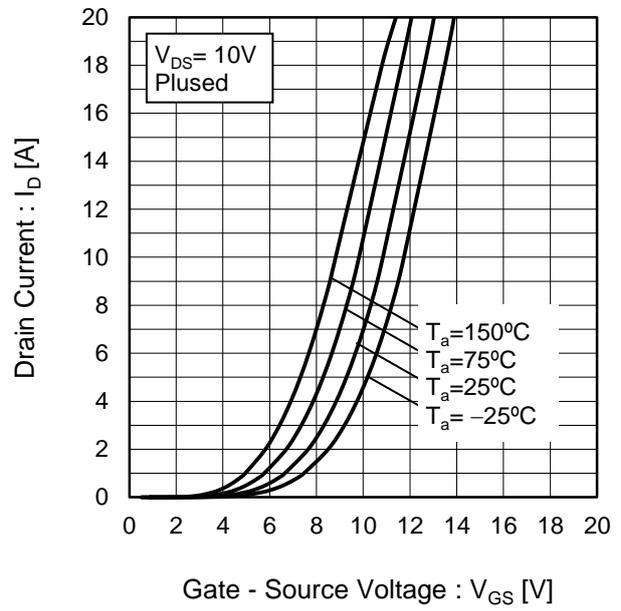
Fig.7 Gate Threshold Voltage
vs. Junction Temperature
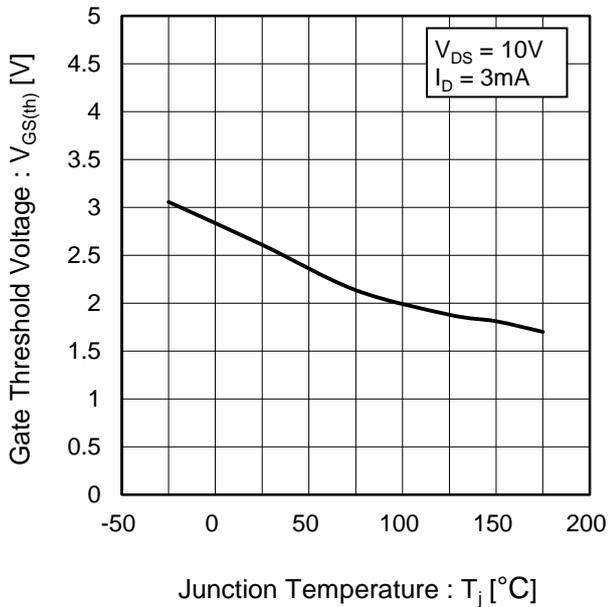
Fig.8 Transconductance vs. Drain Current
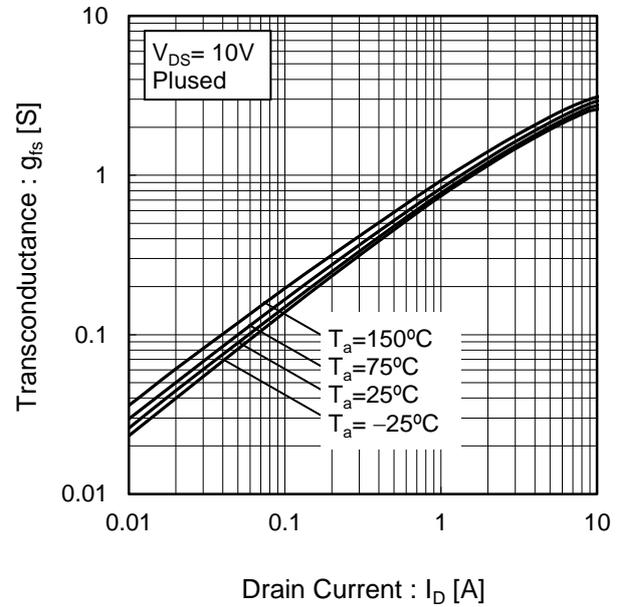
● **Electrical characteristic curves**

Fig.9 Static Drain - Source On - State
Resistance vs. Gate Source Voltage
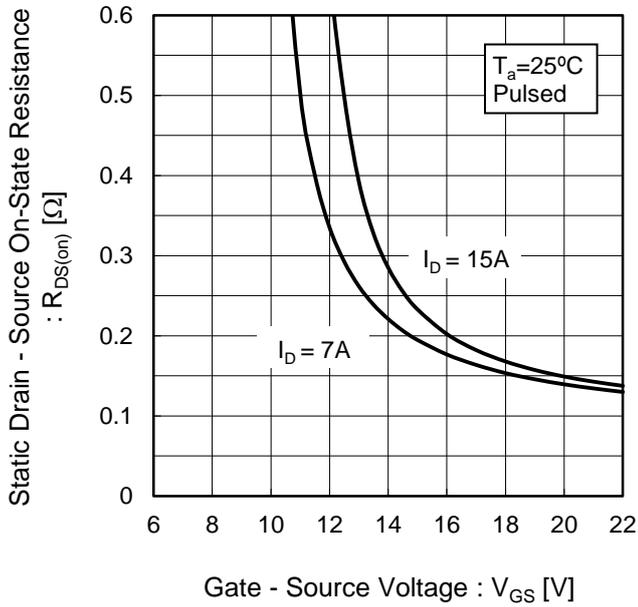
Fig.10 Static Drain - Source On - State
Resistance vs. Junction Temperature
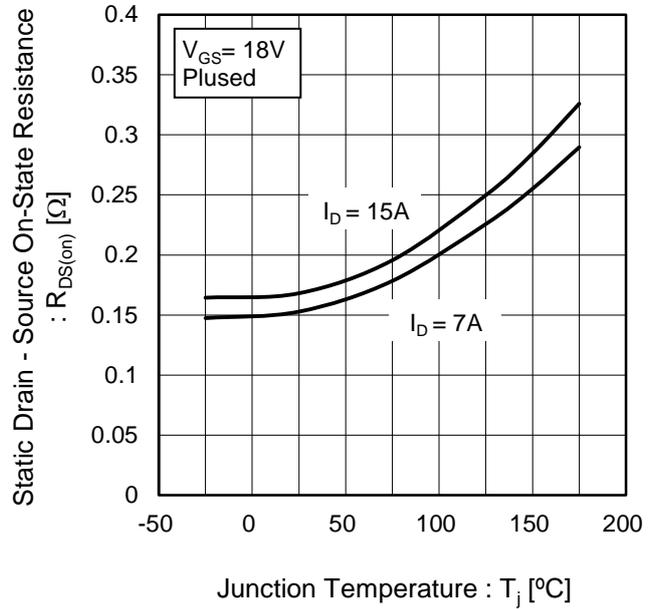
Fig.11 Static Drain - Source On - State
Resistance vs. Drain Current

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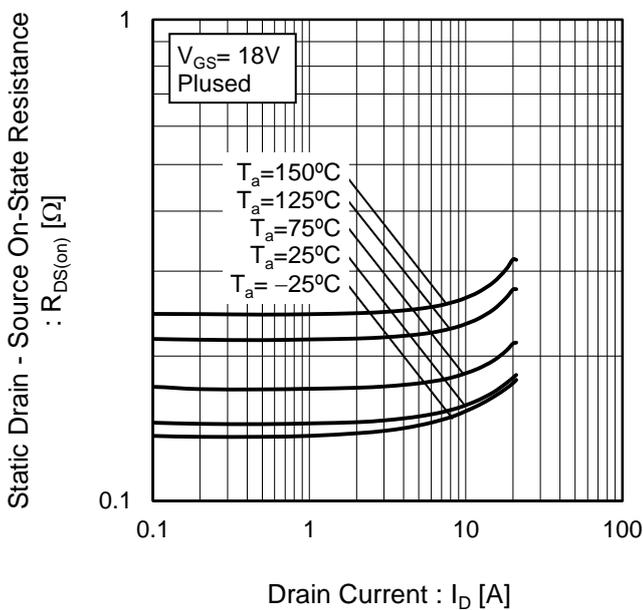
● **Electrical characteristic curves**

Fig.12 Typical Capacitance
        vs. Drain - Source Voltage
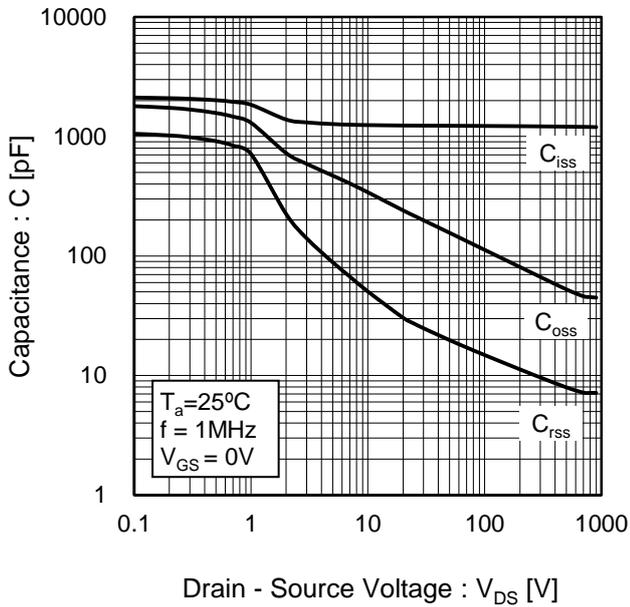
Fig.13 Coss Stored Energy
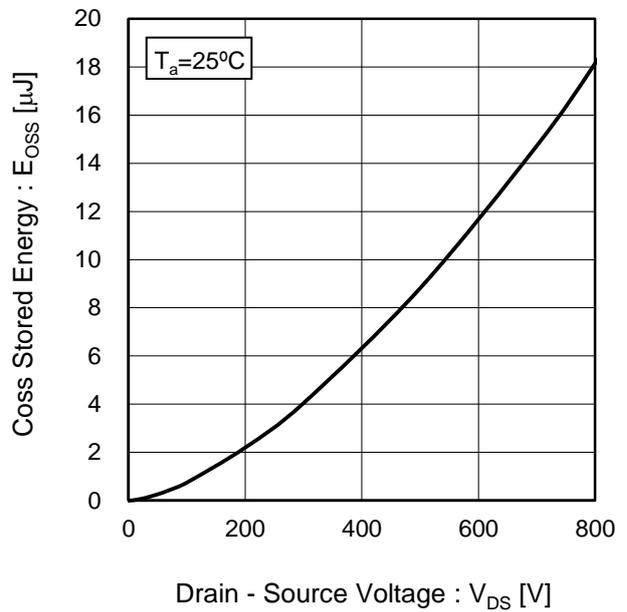
Fig.14 Switching Characteristics
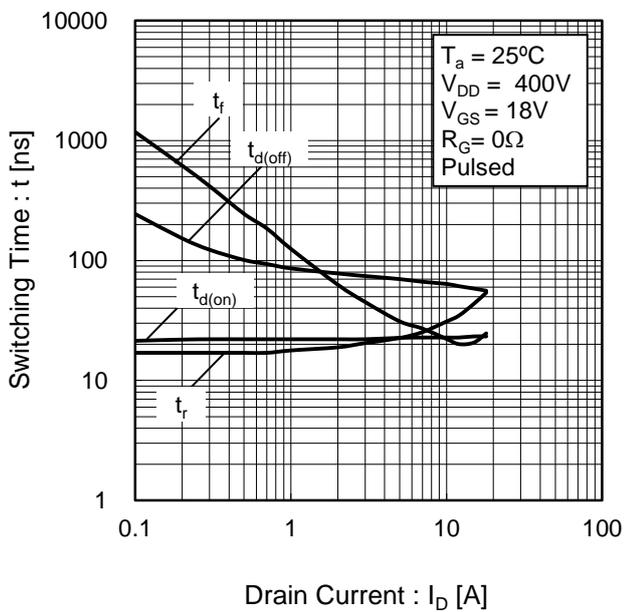
Fig.15 Dynamic Input Characteristics

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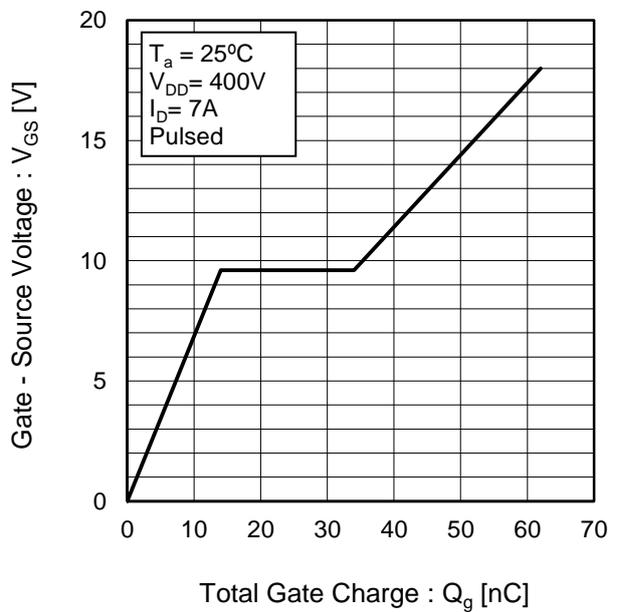
● **Electrical characteristic curves**

Fig.16 Typical Switching Loss
vs. Drain - Source Voltage
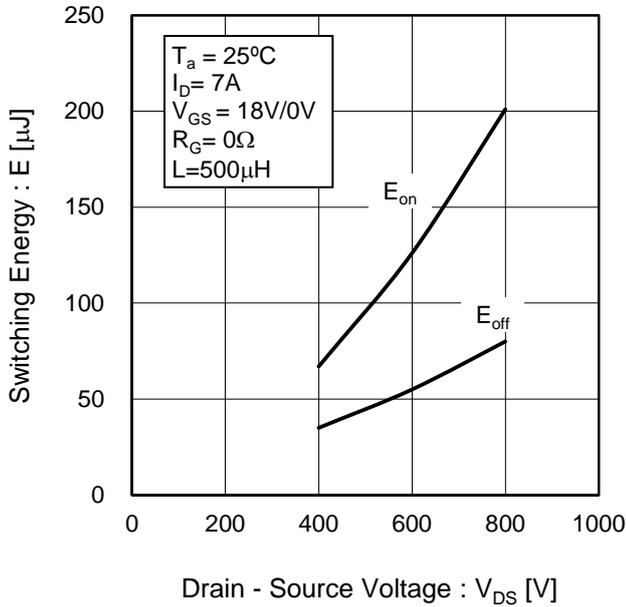
Fig.17 Typical Switching Loss
vs. Drain Current
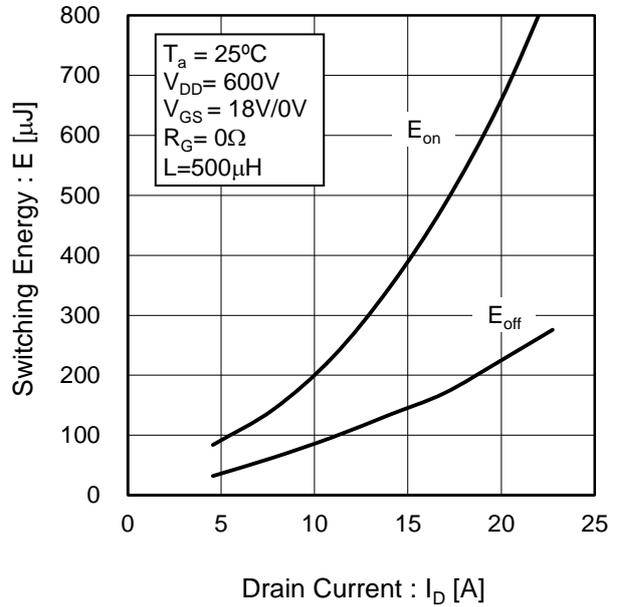
Fig.18 Typical Switching Loss
vs. External Gate Resistance
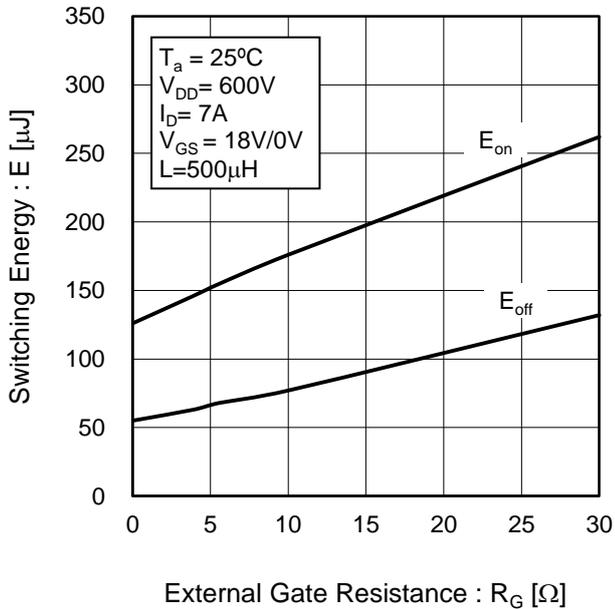
● **Electrical characteristic curves**

Fig.19 Inverse Diode Forward Current
vs. Source - Drain Voltage
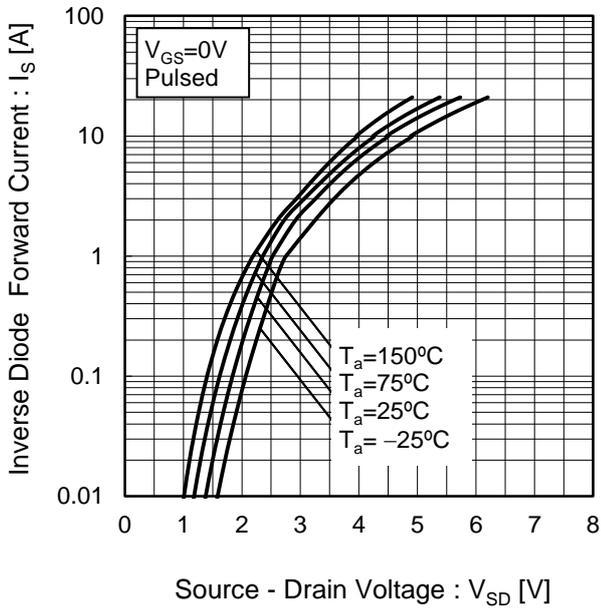
Fig.20 Reverse Recovery Time
vs.Inverse Diode Forward Current

$V_{GS}=0V$
Pulsed

$T_a=150ºC$
$T_a=75ºC$
$T_a=25ºC$
$T_a=-25ºC$

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

$T_a=25ºC$
$di / dt = 160A / \mu s$
$V_R = 400V$
$V_{GS} = 0V$
Pulsed

Inverse Diode Forward Current : I_S [A]
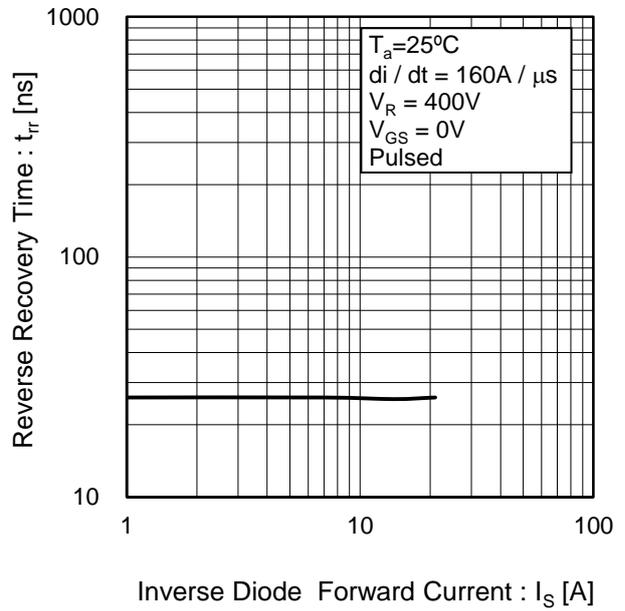
● **Measurement circuits**

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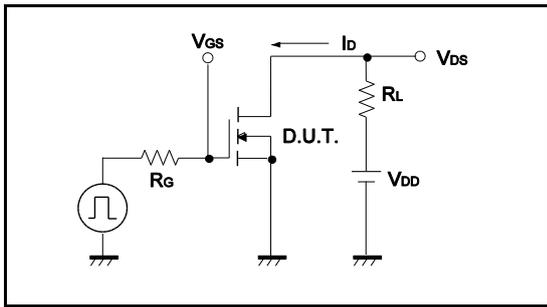
Fig.1-2 Switching Waveforms
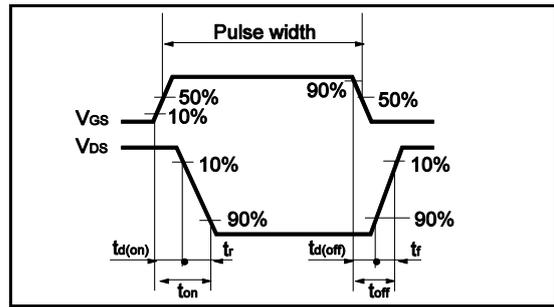
Fig.2-1 Gate Charge Measurement Circuit
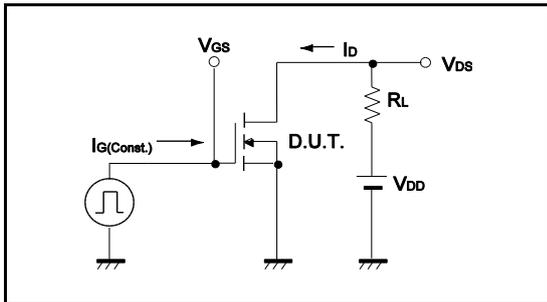
Fig.2-2 Gate Charge Waveform
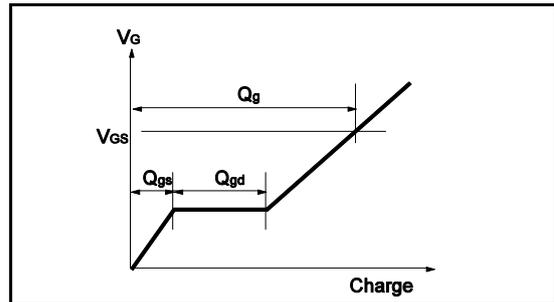
Fig.3-1 Switching Energy Measurement Circuit
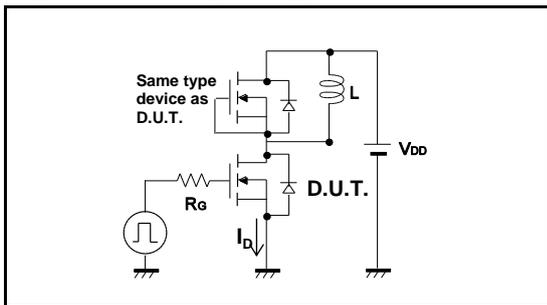
Fig.3-2 Switching Waveforms
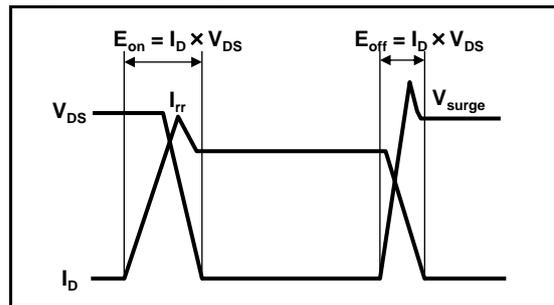

Fig.4-1 Reverse Recovery Time Measurement Circuit
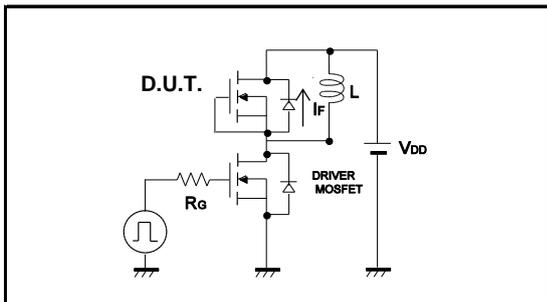
Fig.4-2 Reverse Recovery Waveform

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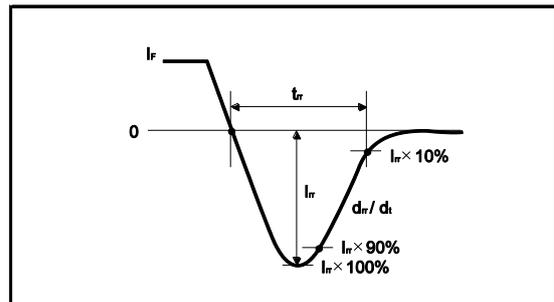
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