SCH2080KE

N-channel SiC power MOSFET co-packaged with SiC-SBD

Datasheet

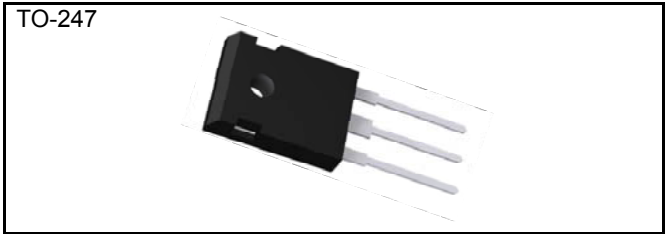|	
V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	80mΩ
I_D	40A
P_D	262W

●Features

1) Low on-resistance

2) Fast switching speed

3) Fast reverse recovery

4) Low V_{SD}

5) Easy to parallel

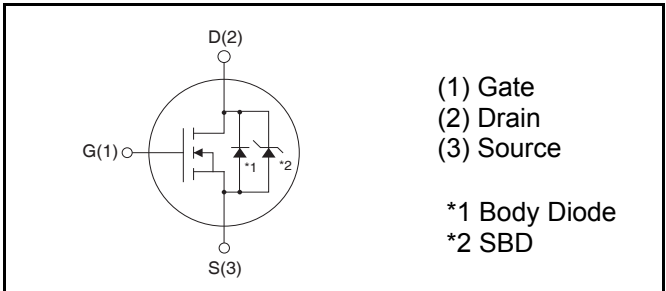6) Simple to drive

7) Pb-free lead plating ; RoHS compliant

●Application

・Solar inverters

・DC/DC converters

・Induction heating

・Motor drives

●Outline

TO-247

●Inner circuit

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

*1 Body Diode
*2 SBD

●Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Packing code	C
	Marking	SCH2080KE

●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]	40	A
	T_c = 100°C	I_D [*1]	28	A
Pulsed drain current		$I_{D,pulse}$ [*2]	80	A
Gate - Source voltage (DC)		V_{GSS}	−6 to 22	V
Gate - Source surge voltage (T_{surge} < 300nsec)		$V_{GSS\text{-}surge}$ [*3]	−10 to 26	V
Power dissipation (T_c = 25°C)		P_D	262	W
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}	-	0.44	0.57	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	50	°C/W
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	°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	-	20	400	μA
		T_j = 150°C	-	170	-	
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 = 4.4mA	1.6	2.8	4.0	V

*1 Limited only by maximum temperature allowed.

*2 PW ≤ 10μs, Duty cycle ≤ 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.	
Static drain - source on - state resistance	$R_{DS(on)}$ [4]	V_{GS} = 18V, I_D = 10A, T_j = 25°C	-	80	117	mΩ
		T_j = 125°C	-	125	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	6.3	-	Ω
Transconductance	g_{fs} [4]	V_{DS} = 10V, I_D = 10A	-	3.7	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	1850	-	pF
Output capacitance	C_{oss}	V_{DS} = 800V	-	175	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	20	-	
Turn - on delay time	$t_{d(on)}$ [4]	V_{DD} = 400V, V_{GS} = 18V	-	37	-	ns
Rise time	t_r [4]	I_D = 10A	-	33	-	
Turn - off delay time	$t_{d(off)}$ [4]	R_L = 40Ω	-	70	-	
Fall time	t_f [4]	R_G = 0Ω	-	28	-	
Turn - on switching loss	E_{on} [4]	V_{DD} = 600V, I_D=10A, V_{GS} = 18V/0V, R_G = 0Ω, L=500μH *E_{on} includes diode reverse recovery	-	218	-	μJ
Turn - off switching loss	E_{off} [4]		-	64	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g [4]	V_{DD} = 400V	-	106	-	nC
Gate - Source charge	Q_{gs} [4]	I_D = 10A	-	27	-	
Gate - Drain charge	Q_{gd} [4]	V_{GS} = 18V	-	31	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD} = 400V, I_D = 10A	-	9.7	-	V

●**Internal 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	-	-	40	A
Inverse diode direct current, pulsed	I_{SM} [*2]		-	-	80	A
Forward voltage	V_{SD} [*4]	V_{GS} = 0V, I_S = 10A	-	1.3	-	V
Reverse recovery time	t_{rr} [*4]	I_F = 10A, V_R = 400V di/dt = 150A/μs	-	37	-	ns
Reverse recovery charge	Q_{rr} [*4]		-	60	-	nC
Peak reverse recovery current	I_{rrm} [*4]		-	2.4	-	A

●**Typical Transient Thermal Characteristics**

Symbol	Value	Unit
R_{th1}	0.078	
R_{th2}	0.197	K/W
R_{th3}	0.162	

Symbol	Value	Unit
C_{th1}	0.005	
C_{th2}	0.018	Ws/K
C_{th3}	0.249	
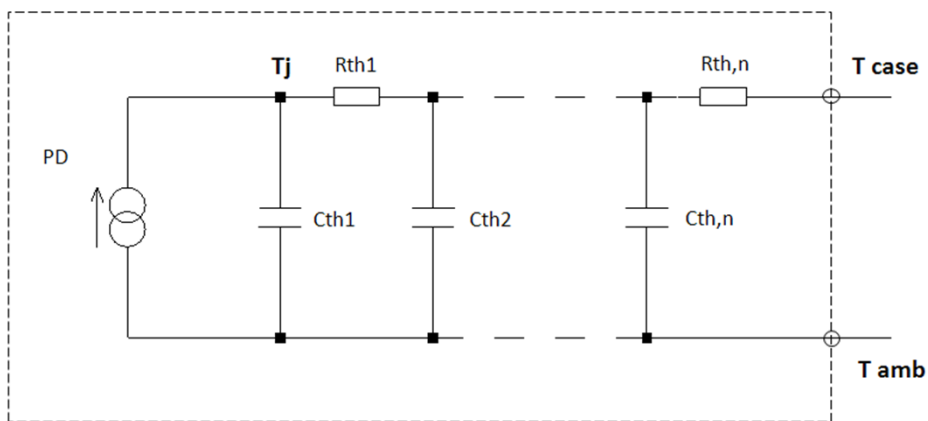
● **Electrical characteristic curves**

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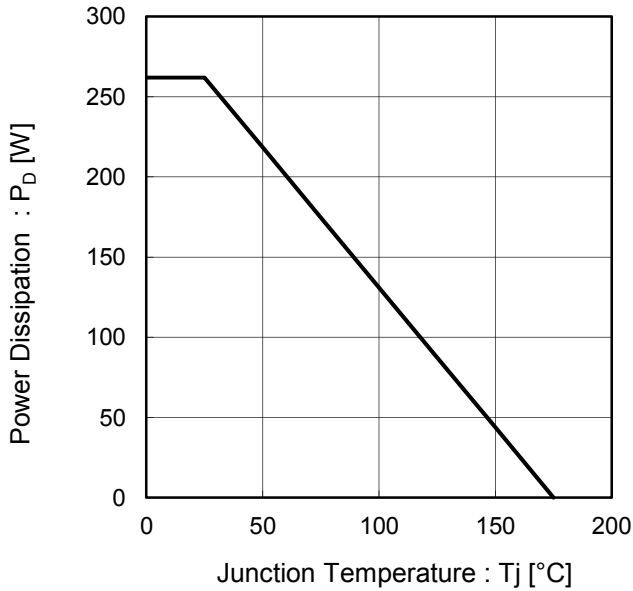
Fig.2 Maximum Safe Operating Area
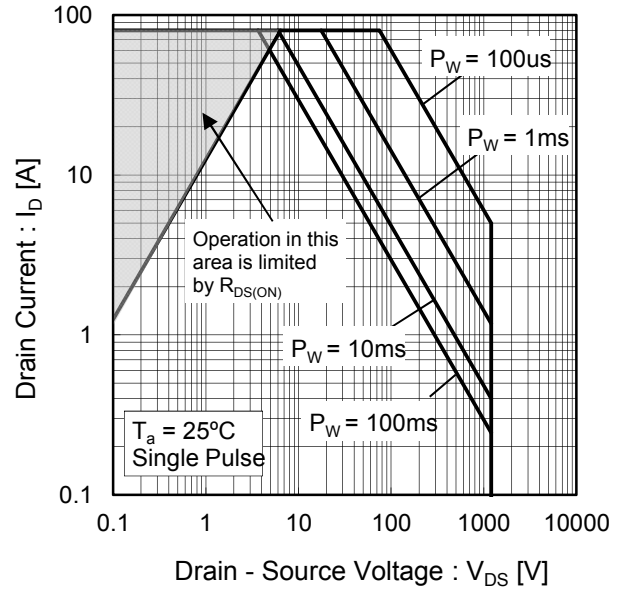
Fig.3 Typical Transient Thermal
Resistance vs. Pulse Width

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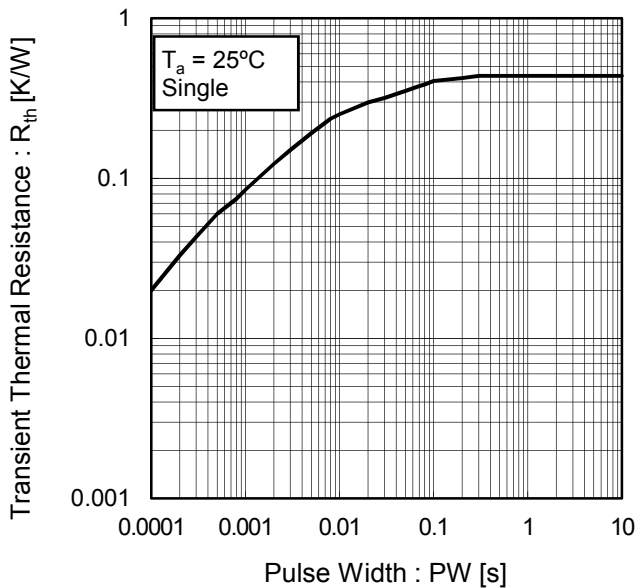
● **Electrical characteristic curves**

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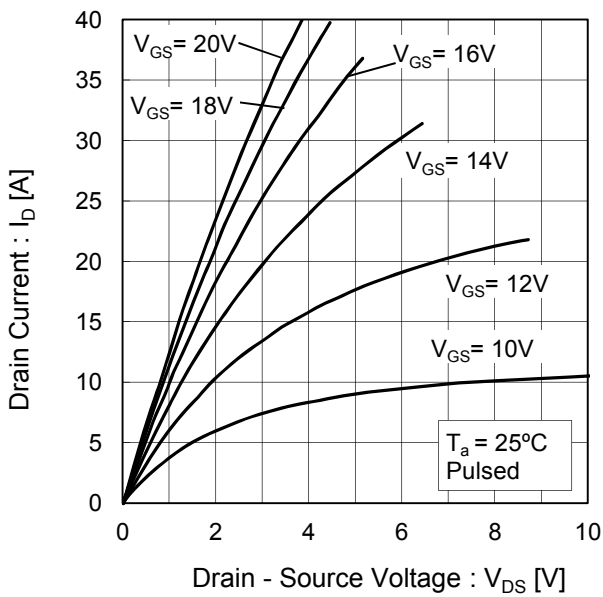
Fig.5 Typical Output Characteristics(II)
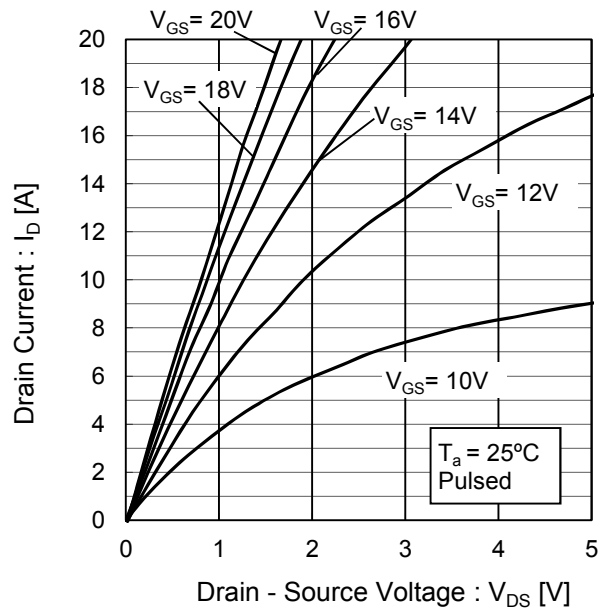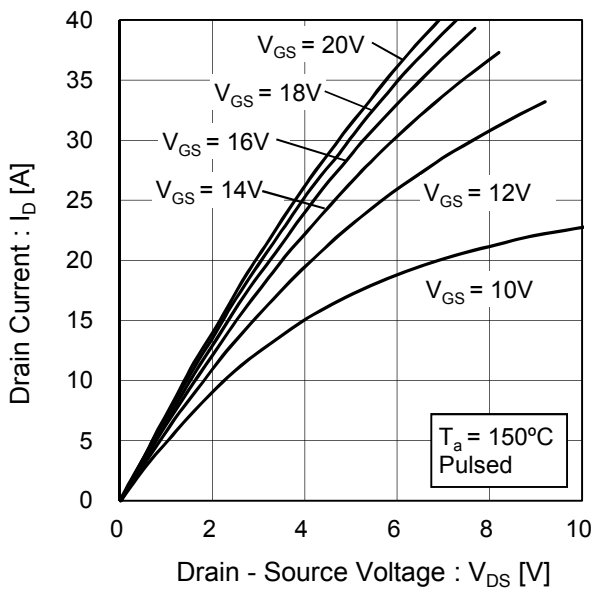

Fig.6 Typical Output Characteristics(I)

Fig.7 Typical Output Characteristics(II)

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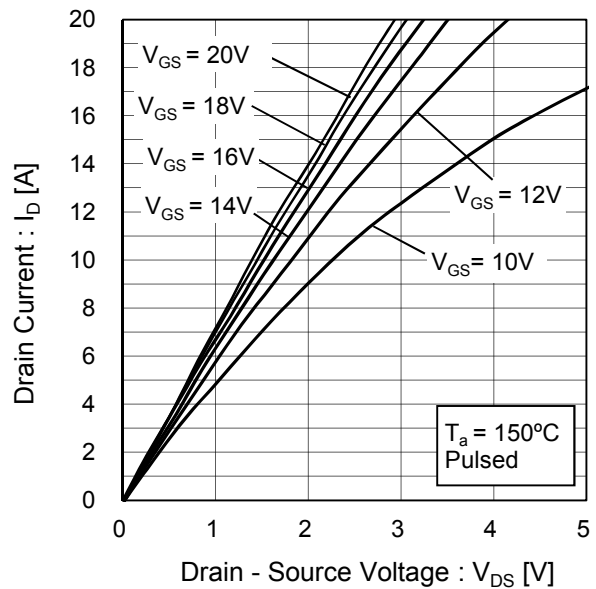
● **Electrical characteristic curves**

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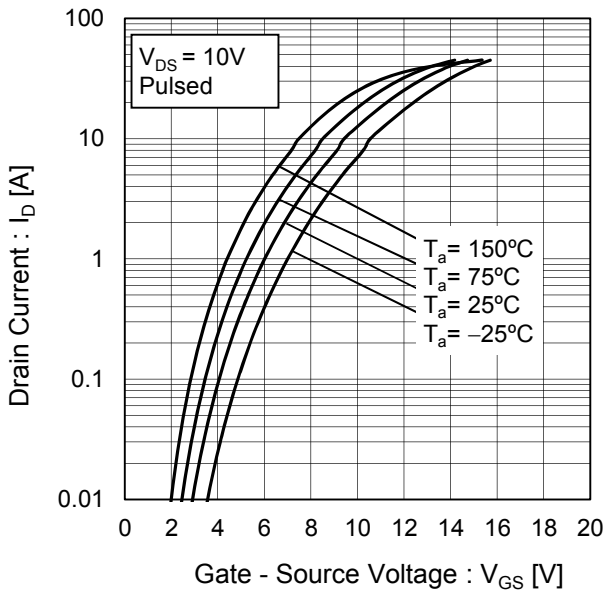
Fig.9 Typical Transfer Characteristics (II)
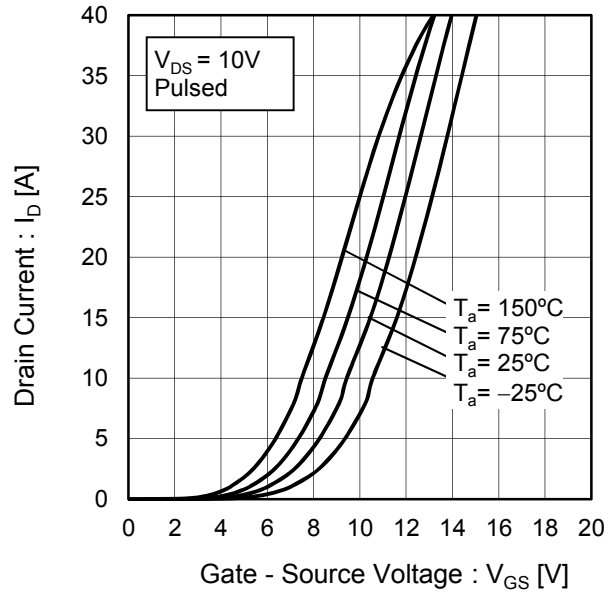
Fig.10 Gate Threshold Voltage vs. Junction Temperature
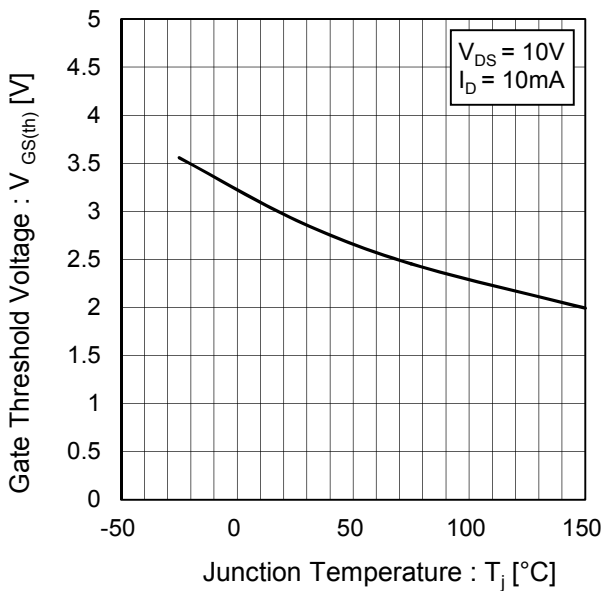
Fig.11 Transconductance vs. Drain Current

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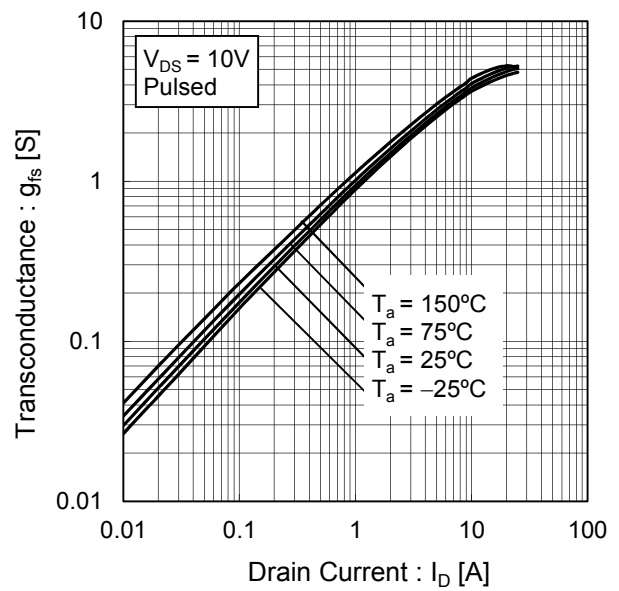
● **Electrical characteristic curves**

Fig.12 Static Drain - Source On - State
Resistance vs. Gate - Source Voltage
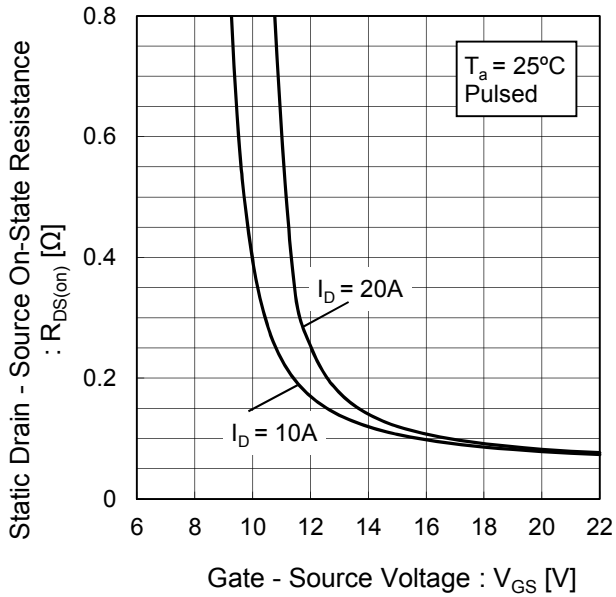
Fig.13 Static Drain - Source On - State
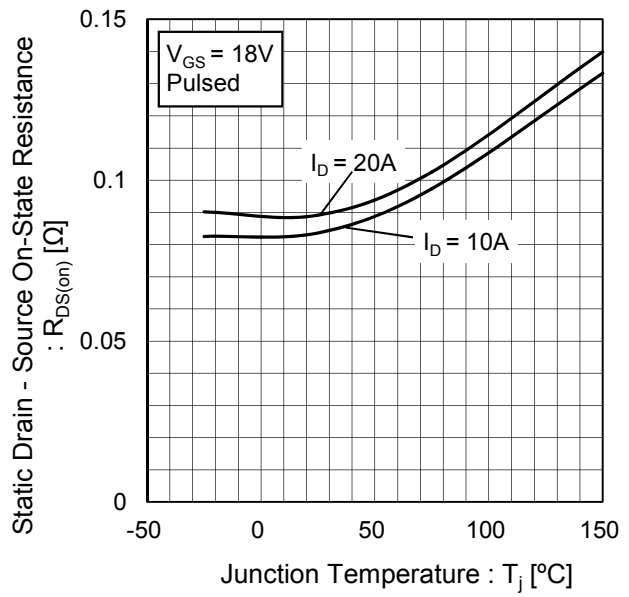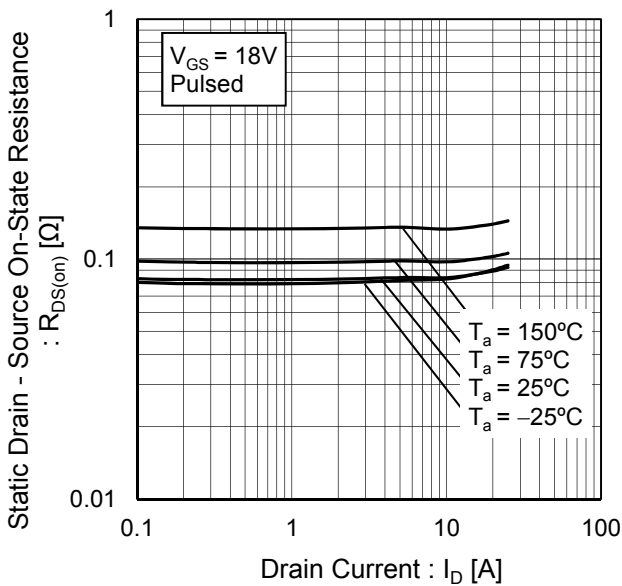Resistance vs. Junction Temperature

Fig.14 Static Drain - Source On - State
Resistance vs. Drain Current

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● **Electrical characteristic curves**
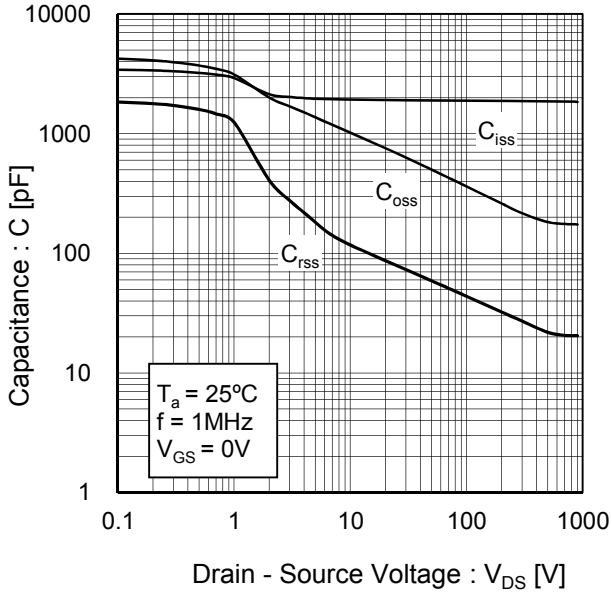
Fig.15 Typical Capacitance vs. Drain - Source Voltage
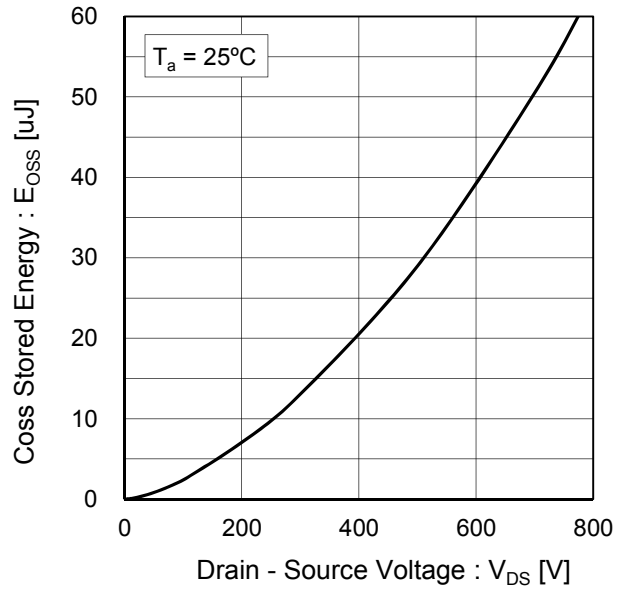

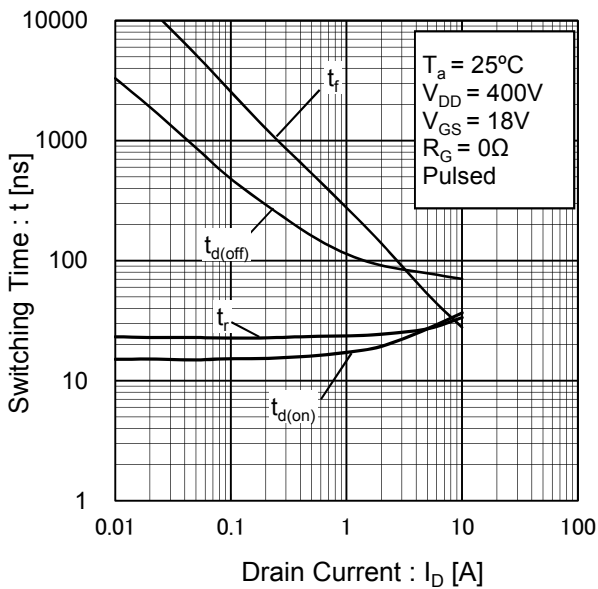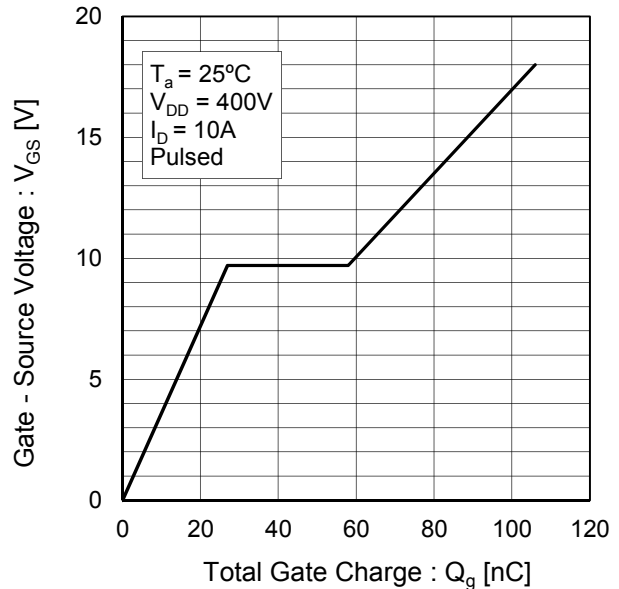Fig.16 Coss Stored Energy

Fig.17 Switching Characteristics

Fig.18 Dynamic Input Characteristics

●**Electrical characteristic curves**

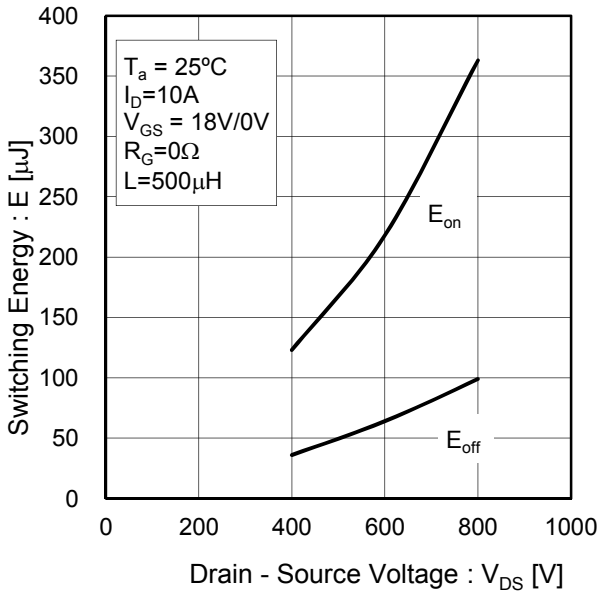Fig.19 Typical Switching Loss
vs. Drain - Source Voltage

T_a = 25ºC
I_D=10A
V_{GS} = 18V/0V
R_G=0Ω
L=500μH

E_{on}

E_{off}

Switching Energy : E [μJ]

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

Fig.20 Typical Switching Loss
vs. Drain Current

T_a = 25ºC
V_{DD}=600V
V_{GS} = 18V/0V
R_G=0Ω
L=500μH

E_{on}

E_{off}

Switching Energy : E [μJ]

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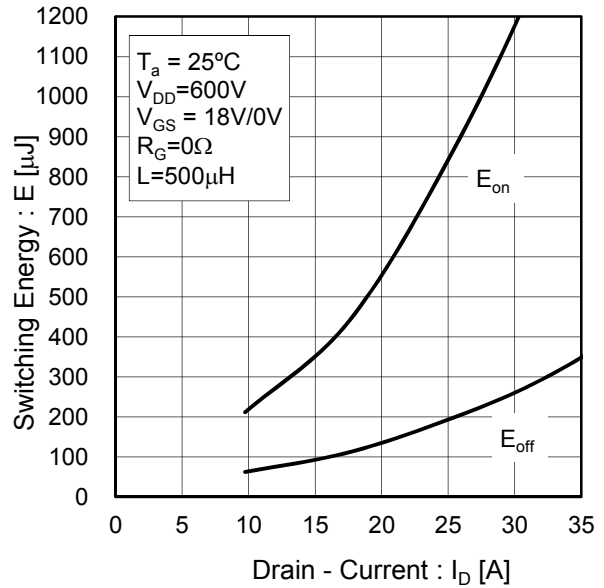
Fig.21 Typical Switching Loss
vs. External Gate Resistance

T_a = 25ºC
V_{DD}=600V
I_D=10A
V_{GS} = 18V/0V
L=500μH

E_{on}

E_{off}

Switching Energy : E [μJ]

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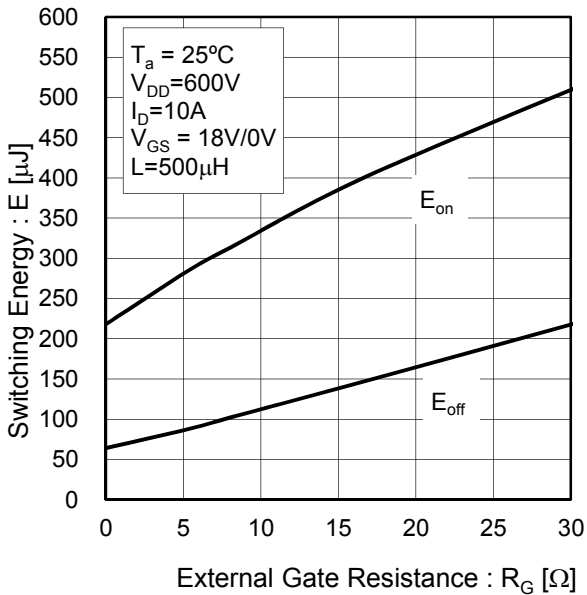
●**Electrical characteristic curves**

Fig.22 Inverse Diode Forward Current
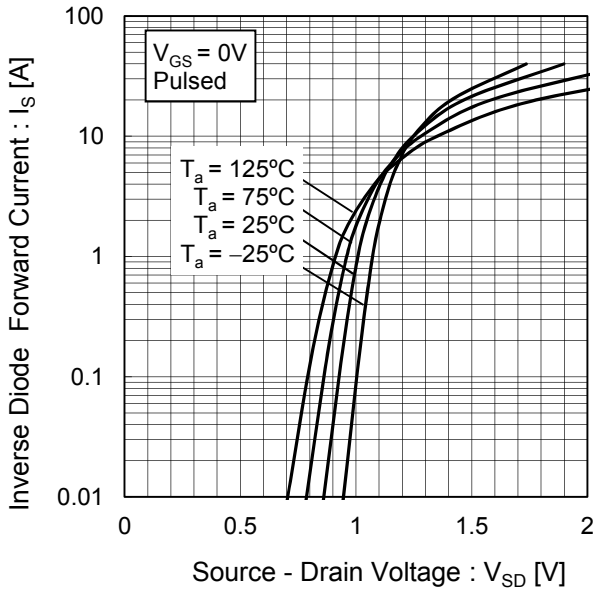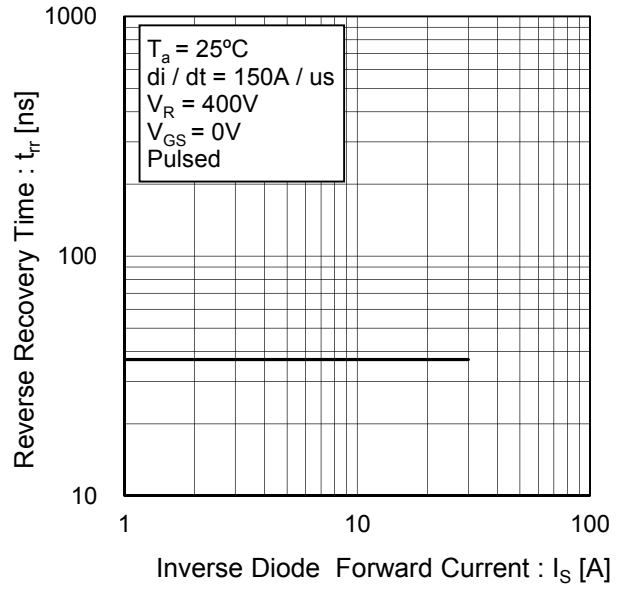vs. Source - Drain Voltage

Fig.23 Reverse Recovery Time
vs.Inverse Diode Forward Current

● **Measurement circuits**

Fig.1-1 Switching Time Measurement Circuit
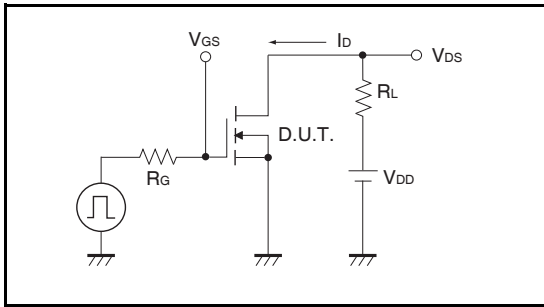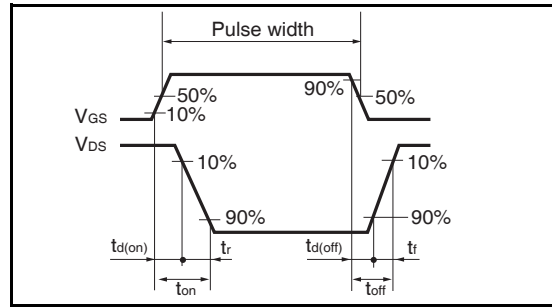

Fig.1-2 Switching Waveforms

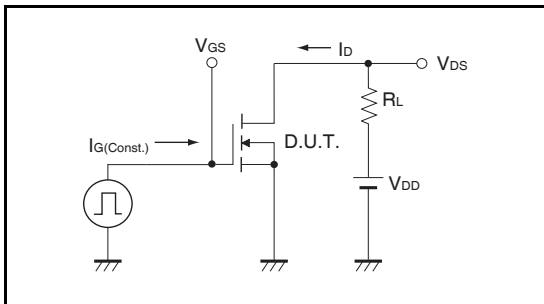Fig.2-1 Gate Charge Measurement Circuit

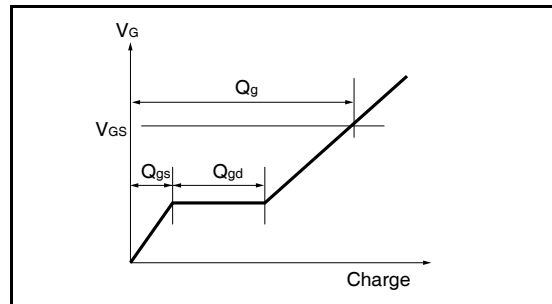Fig.2-2 Gate Charge Waveform
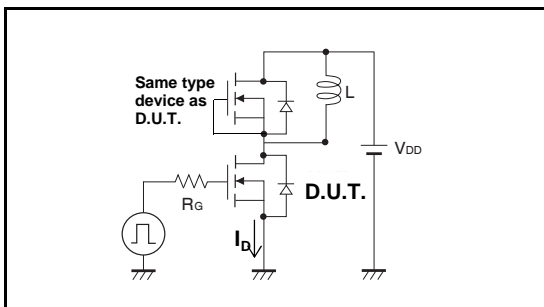

Fig.3-1 Switching Energy Measurement Circuit

Fig.3-2 Switching Waveforms
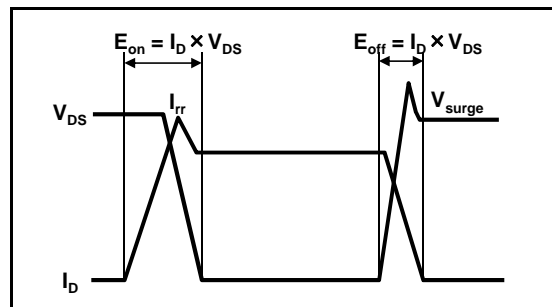
Fig.4-1 Reverse Recovery Time Measurement Circuit

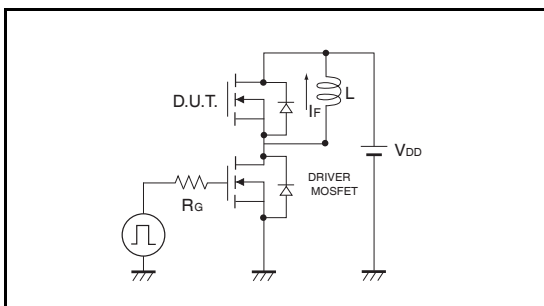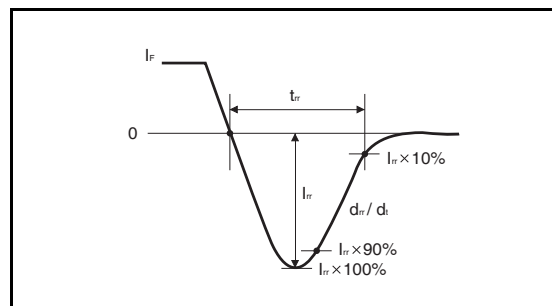Fig.4-2 Reverse Recovery Waveform

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