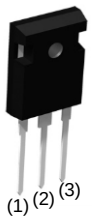
SCT2160KE

N-channel SiC power MOSFET Datasheet

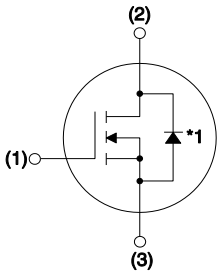
V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	160mΩ
I_D	22A
P_D	165W

●Outline

TO-247
TO-247N



●Inner circuit



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

*1 Body Diode

●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
- Induction heating
- Motor drives

●Packaging specifications[*1]

Package		TO-247	TO-247N
Type	Packing	Tube	
	Reel size (mm)	-	
	Tape width (mm)	-	
	Basic ordering unit (pcs)	30	
	Packing code	C	C11
	Marking	SCT2160KE	

●Absolute maximum ratings (Ta = 25°C)

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	1200	V
Continuous drain current	T_c = 25°C	I_D [*2]	22	A
	T_c = 100°C	I_D [*2]	16	A
Pulsed drain current		$I_{D,pulse}$ [*3]	55	A
Gate - Source voltage (DC)		V_{GSS}	-6 to 22	V
Gate - Source surge voltage (T_{surge} < 300nsec)		$V_{GSS-surge}$ [*4]	-10 to 26	V
Power dissipation (T_c = 25°C)		P_D	165	W
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 T_j = 150°C	- -	1 2	10 -	μA
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

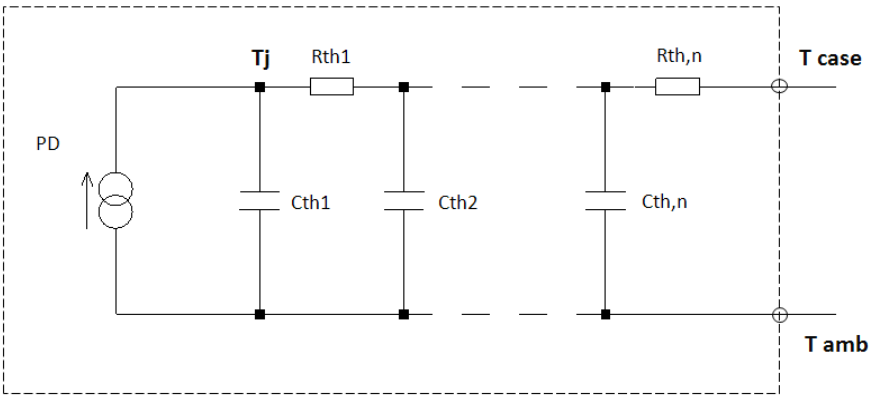
●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	0.70	0.91	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	50	°C/W
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	°C

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	9.61E-02	K/W
R_{th2}	4.04E-01	
R_{th3}	1.96E-01	

Symbol	Value	Unit
C_{th1}	1.55E-03	Ws/K
C_{th2}	5.23E-03	
C_{th3}	8.33E-02	



●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Static drain - source on - state resistance	$R_{DS(on)}$ *5	V_{GS} = 18V, I_D = 7A T_j = 25°C T_j = 125°C	- -	160 226	208 -	mΩ
Gate input resistance	R_G	f = 1MHz, open drain	-	13.7	-	Ω
Transconductance	g_{fs} *5	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	$t_{d(on)}$ *5	V_{DD} = 400V, I_D = 7A	-	23	-	ns
Rise time	t_r *5	V_{GS} = 18V/0V	-	25	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 57Ω	-	67	-	
Fall time	t_f *5	R_G = 0Ω	-	27	-	
Turn - on switching loss	E_{on} *5	V_{DD} = 600V, I_D=7A V_{GS} = 18V/0V R_G = 0Ω, L=500μH *E_{on} includes diode reverse recovery	-	126	-	μJ
Turn - off switching loss	E_{off} *5		-	55	-	

●Gate Charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *5	V_{DD} = 400V	-	62	-	nC
Gate - Source charge	Q_{gs} *5	I_D = 7A	-	14	-	
Gate - Drain charge	Q_{gd} *5	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)

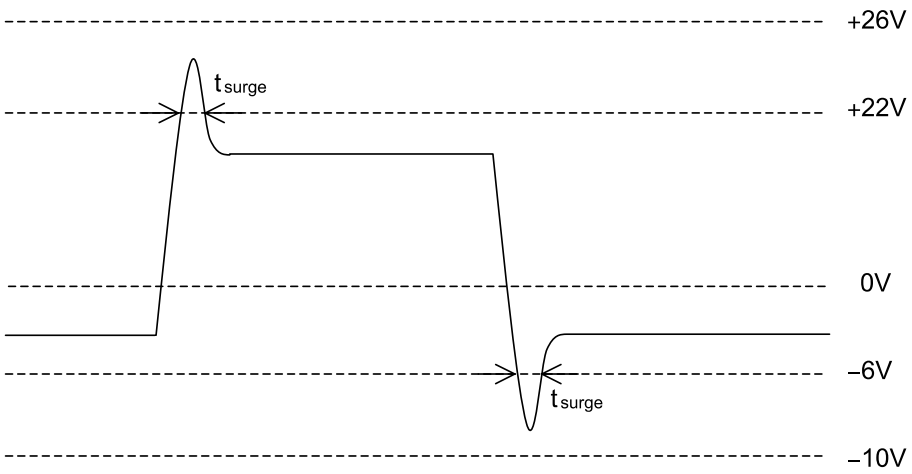
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *2	T_c = 25°C	-	-	22	A
Inverse diode direct current, pulsed	I_{SM} *3		-	-	55	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_S = 7A	-	4.1	-	V
Reverse recovery time	t_{rr} *5	I_F = 7A, V_R = 400V di/dt = 160A/μs	-	26	-	ns
Reverse recovery charge	Q_{rr} *5		-	39	-	nC
Peak reverse recovery current	I_{rrm} *5		-	3.0	-	A

*1 Tolerances of dimensions and packing specifications slightly differ between TO-247 and TO-247N, which is unlikely to influence compatibility for mounting. Please refer to corresponding specifications of dimensions for more details.

*2 Limited only by maximum temperature allowed.

*3 PW ≤ 10μs, Duty cycle ≤ 1%

*4 Example of acceptable Vgs waveform



*5 Pulsed

●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

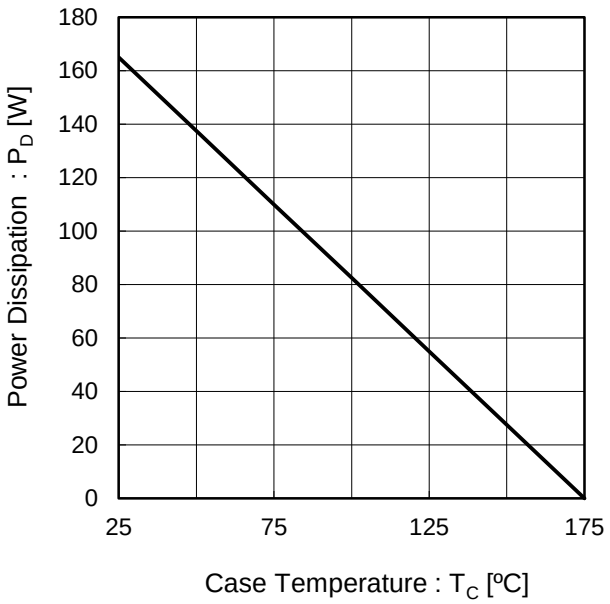


Fig.2 Maximum Safe Operating Area

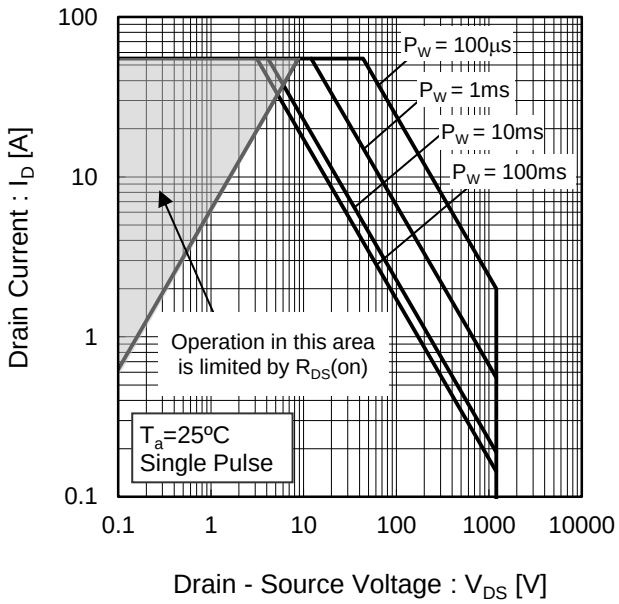
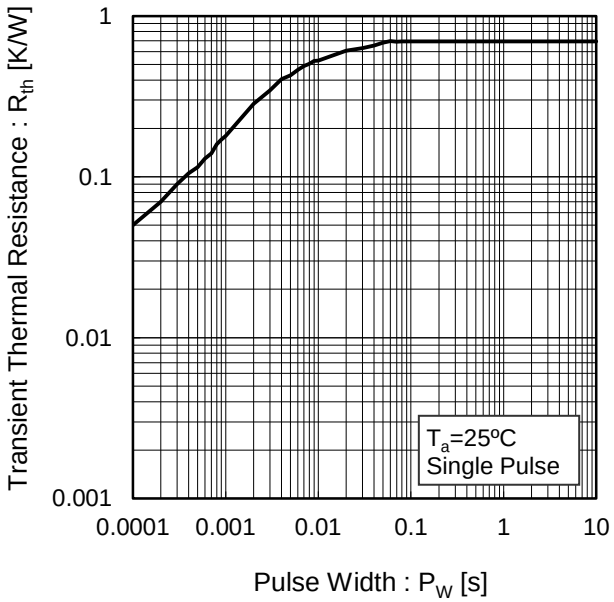


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

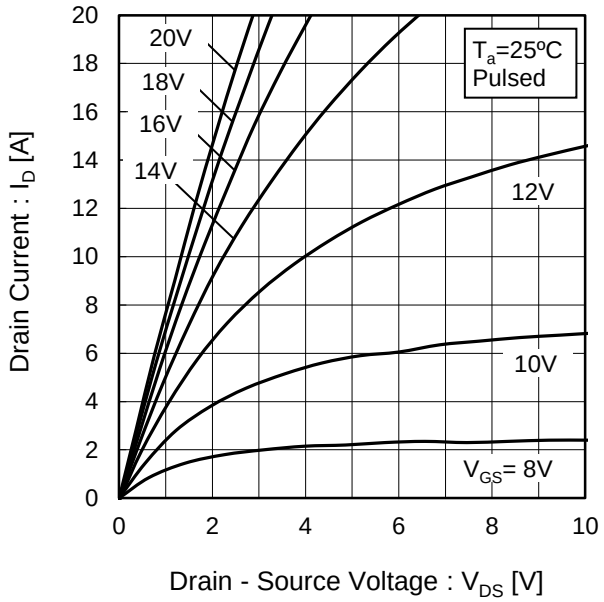


Fig.5 Typical Output Characteristics(II)

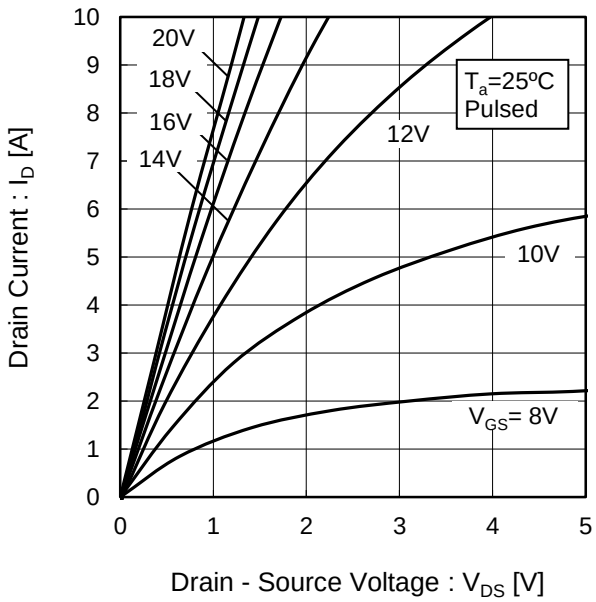


Fig.6 T_j = 150ºC Typical Output Characteristics(I)

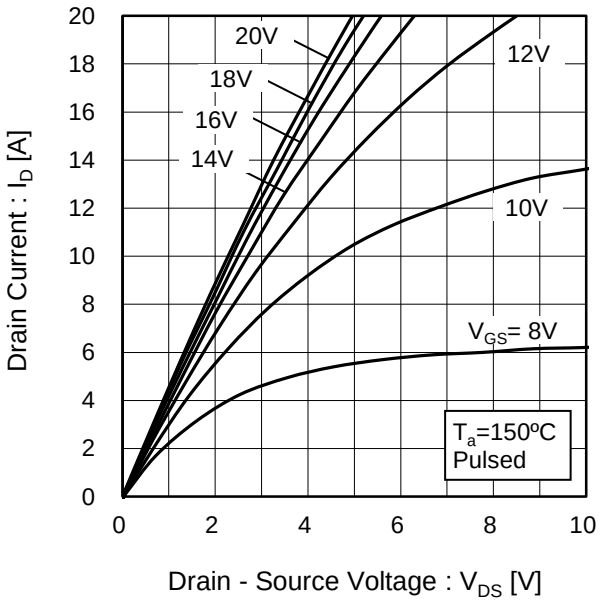
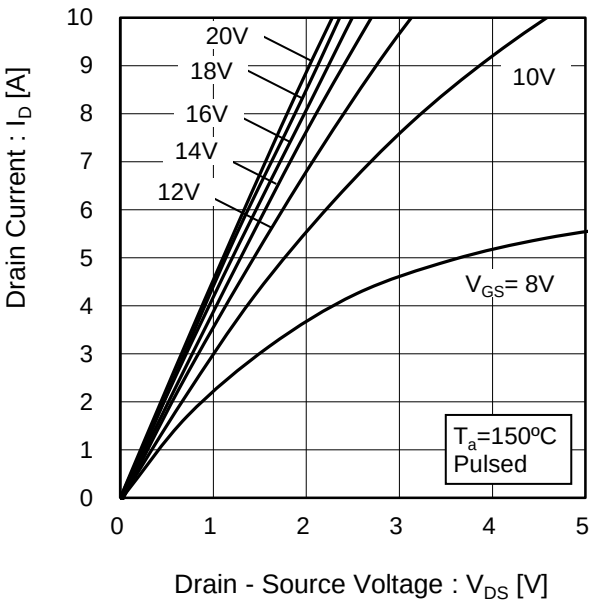


Fig.7 T_j = 150ºC Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics (I)

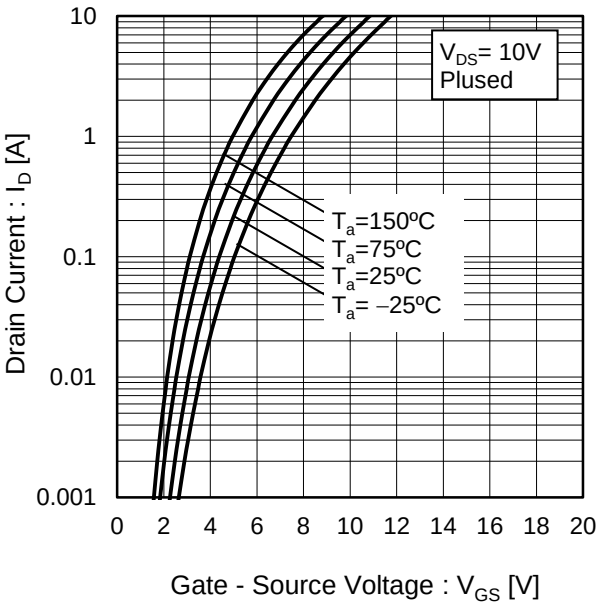


Fig.9 Typical Transfer Characteristics (II)

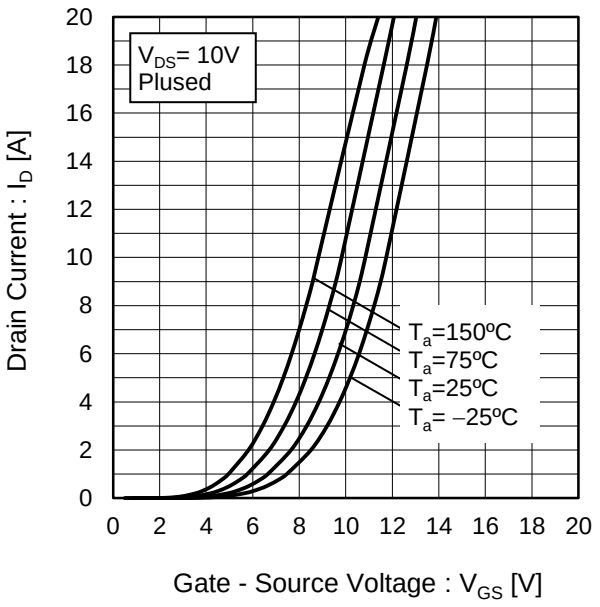


Fig.10 Gate Threshold Voltage vs. Junction Temperature

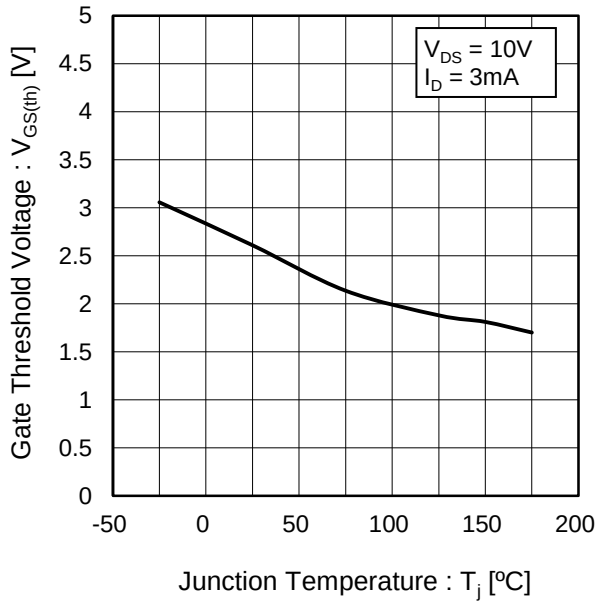
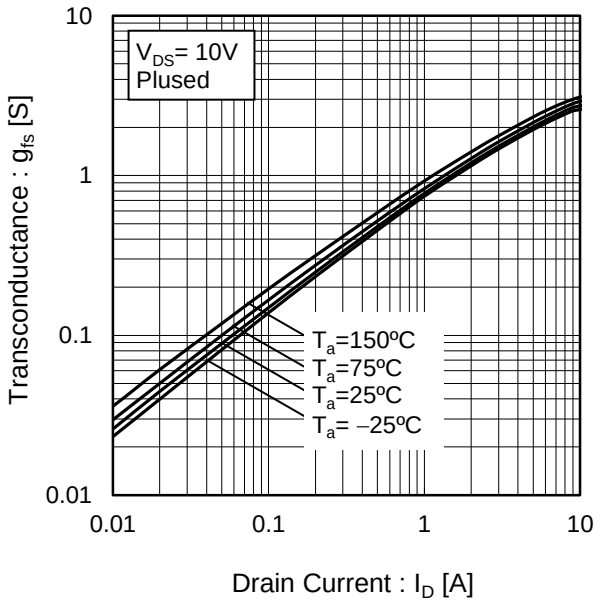


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

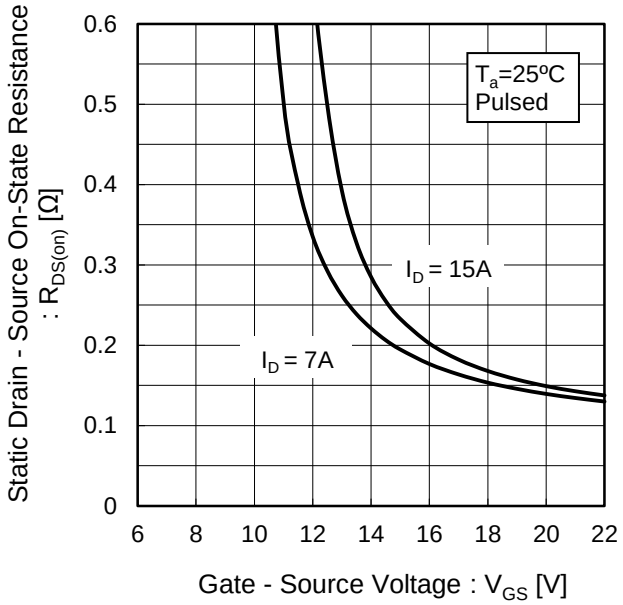


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

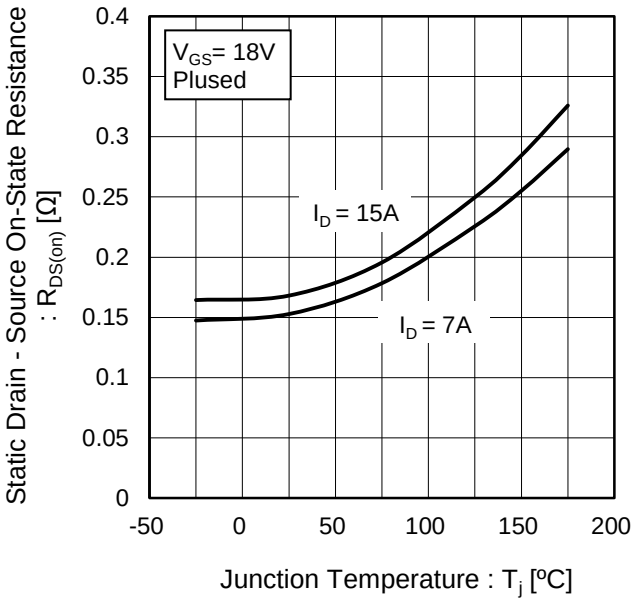
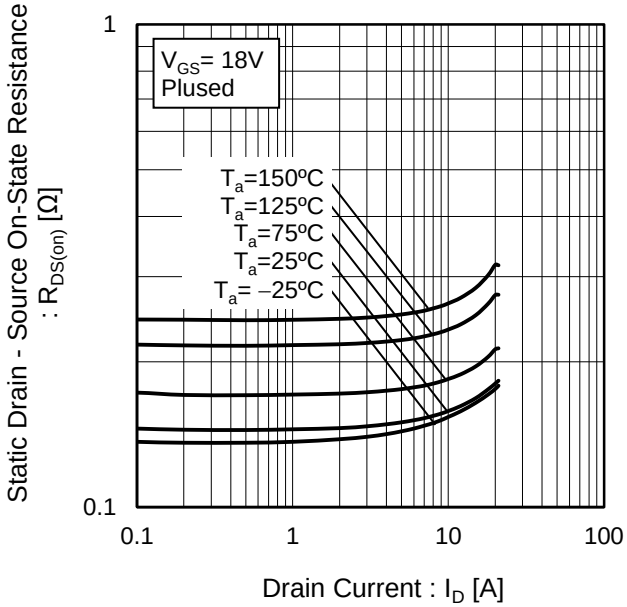


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.15 Typical Capacitance vs. Drain - Source Voltage

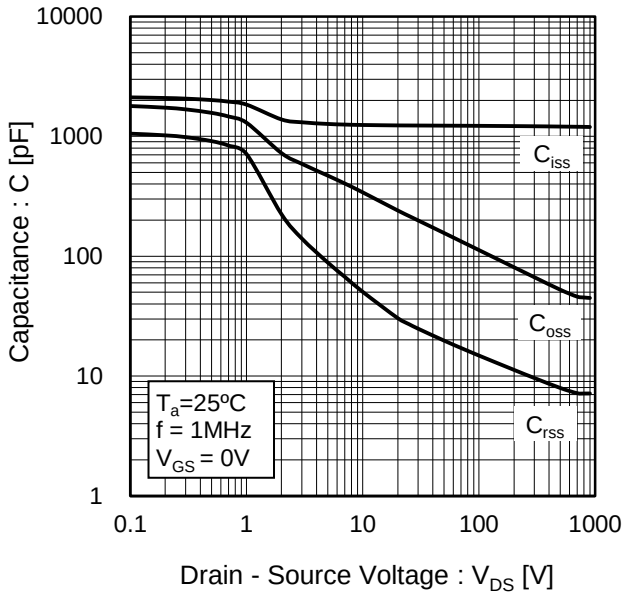


Fig.16 C_{OSS} Stored Energy

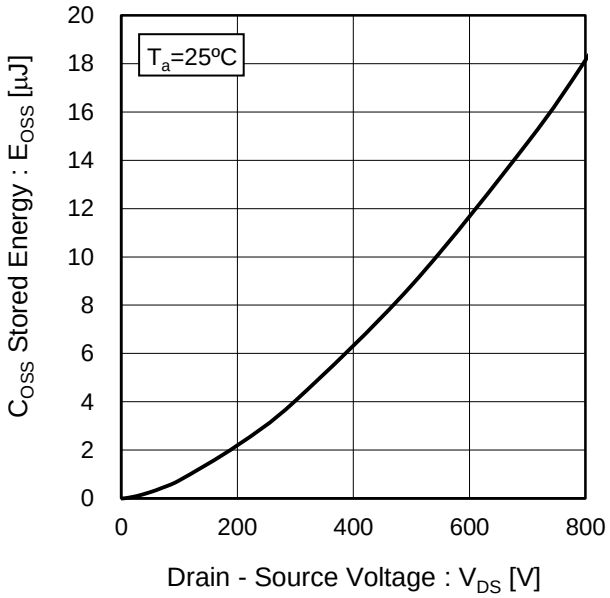


Fig.17 Switching Characteristics

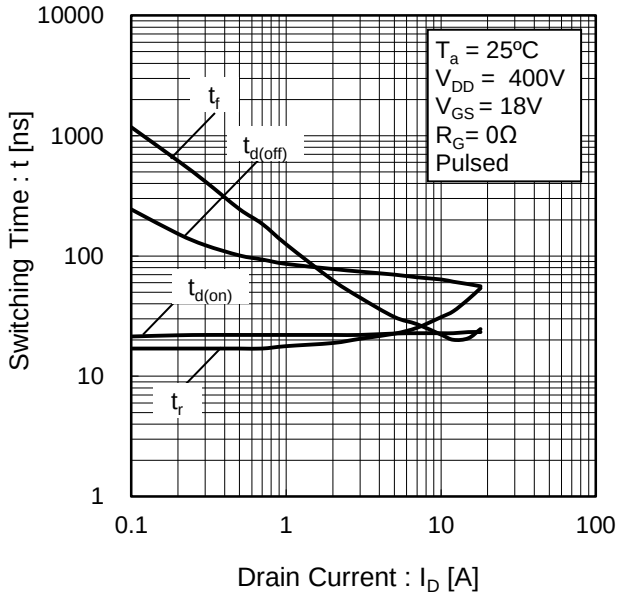
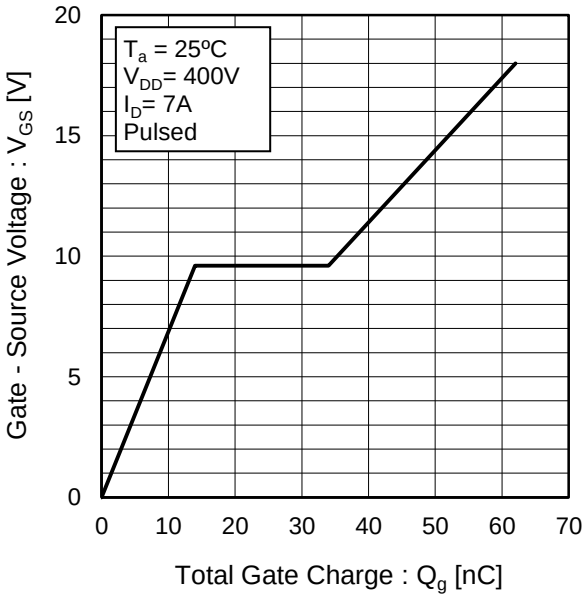


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

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

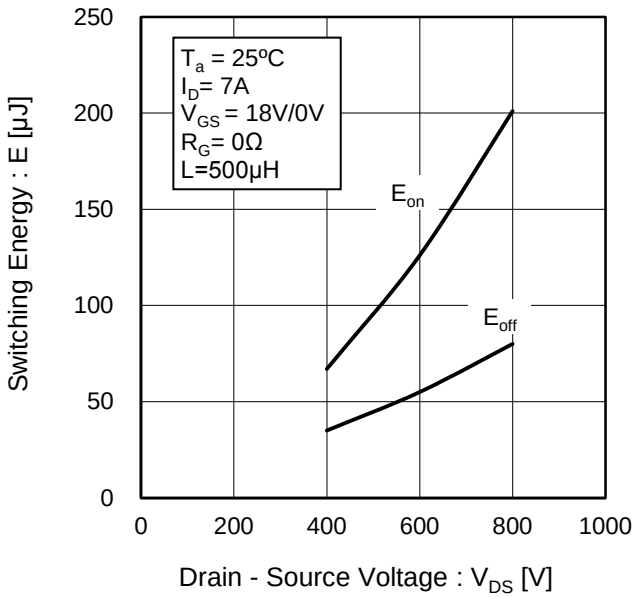


Fig.20 Typical Switching Loss vs. Drain Current

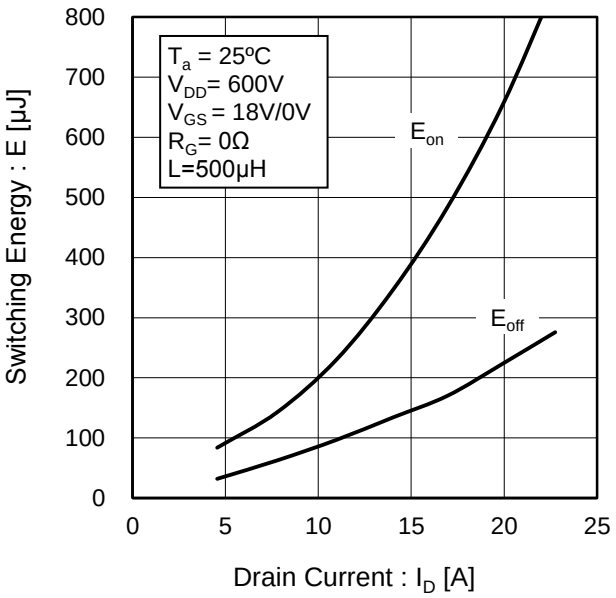
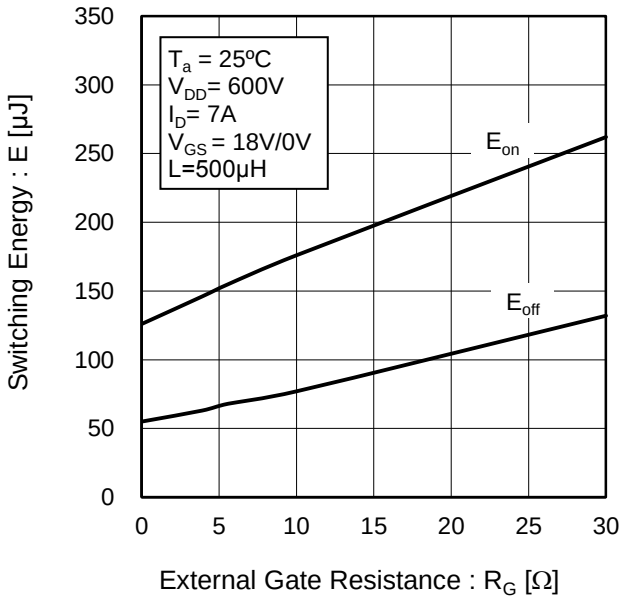


Fig.21 Typical Switching Loss vs. External Gate Resistance



●Electrical characteristic curves

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

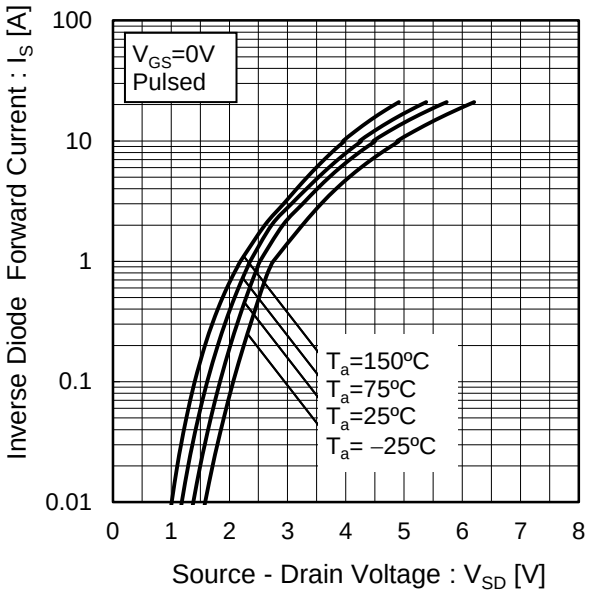
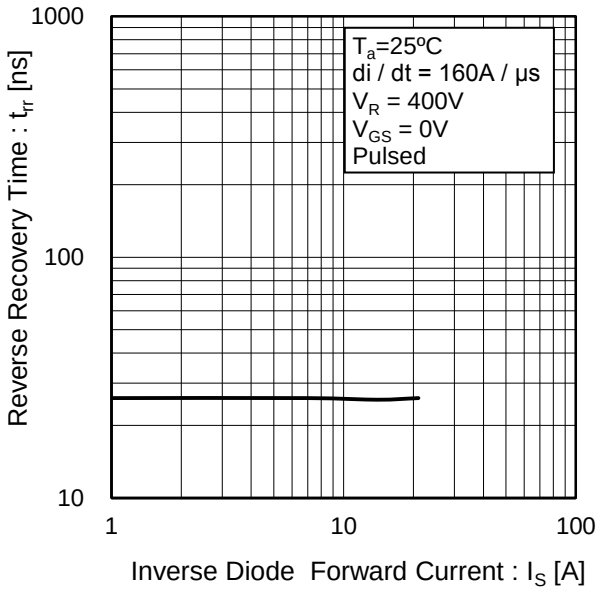


Fig.23 Reverse Recovery Time vs.Inverse Diode Forward Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

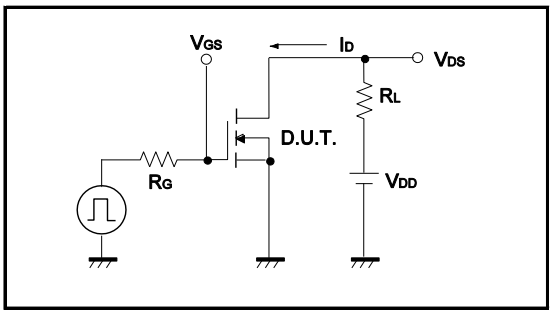


Fig.1-2 Switching Waveforms

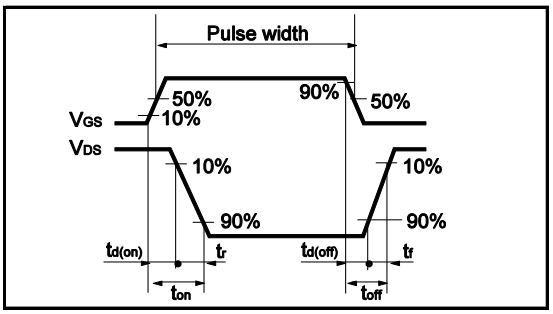


Fig.2-1 Gate Charge Measurement Circuit

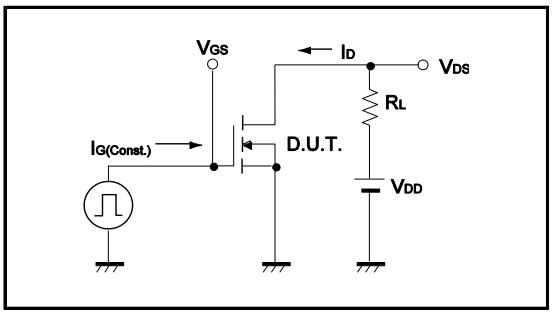


Fig.2-2 Gate Charge Waveform

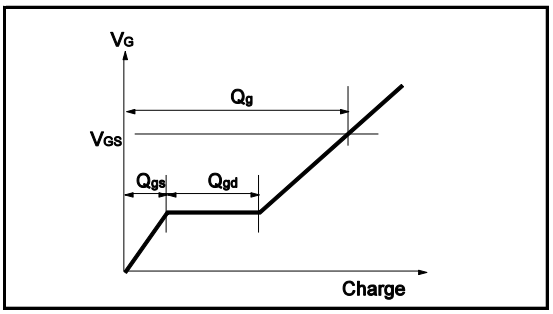


Fig.3-1 Switching Energy Measurement Circuit

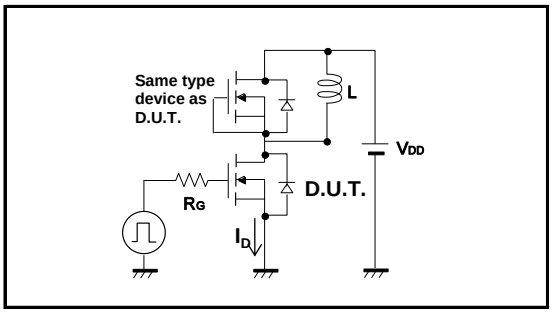


Fig.3-2 Switching Waveforms

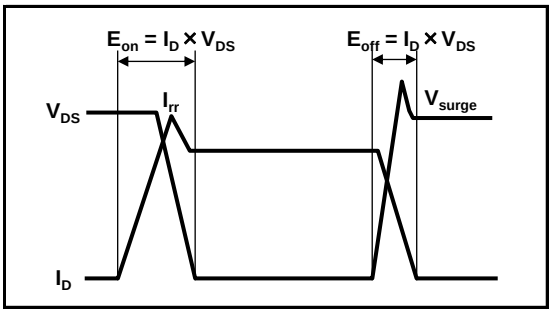


Fig.4-1 Reverse Recovery Time Measurement Circuit

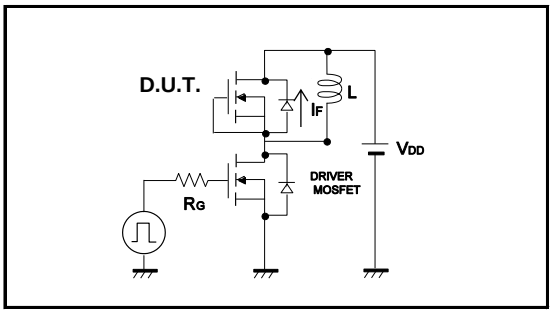
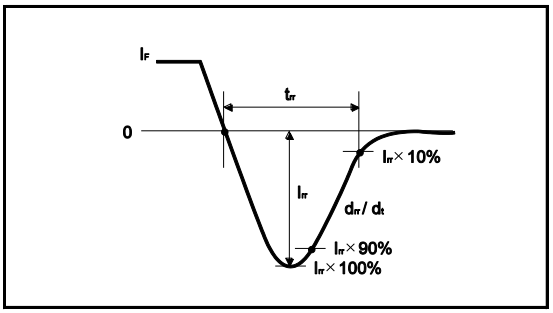


Fig.4-2 Reverse Recovery Waveform



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