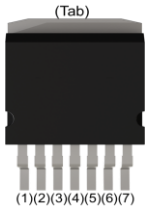
SCT3040KW7

N-channel SiC power MOSFET Datasheet

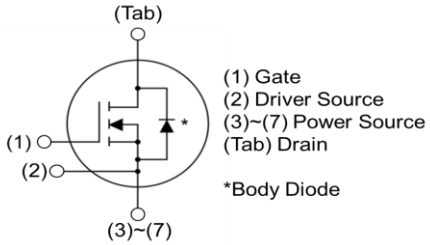
V_{DSS}	1200V
$R_{DS(on)}$ (Typ.)	40mΩ
I_D *1	56A
P_D	267W

●Outline

TO-263-7L



●Inner circuit



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	Embossed tape
	Reel size (mm)	330
	Tape width (mm)	24
	Basic ordering unit (pcs)	1000
	Taping code	TL
	Marking	SCT3040KW7

●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	56	A
	T_c = 100°C	I_D *1	39	A
Pulsed Drain current		$I_{D,pulse}$ *2	140	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

●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 T_j = 25°C T_j = -55°C	 1200 1200	 - -	 - -	V
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =1200V 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} = -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 T_j = 25°C T_j = 150°C	 - -	 40 68	 52 -	mΩ
Gate input resistance	R_G	f = 1MHz, open drain	-	7	-	Ω

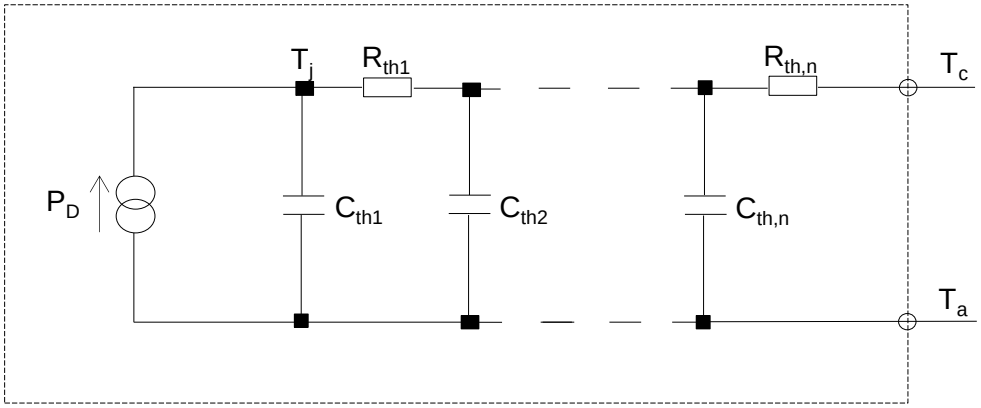
●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	0.44	0.56	°C/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	5.89×10^{-2}	K/W
R_{th2}	1.79×10^{-1}	
R_{th3}	1.61×10^{-1}	

Symbol	Value	Unit
C_{th1}	2.17×10^{-3}	Ws/K
C_{th2}	1.31×10^{-2}	
C_{th3}	1.12×10^{-2}	



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

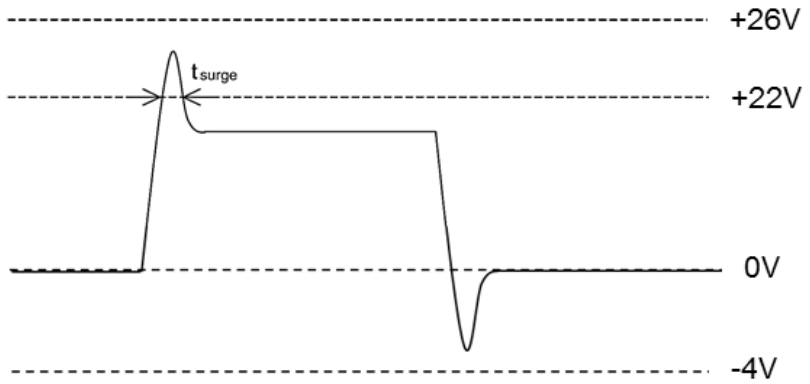
●**Body diode electrical characteristics** (Source-Drain) (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	I_S *1	T_c = 25°C	-	-	56	A
Body diode direct current, pulsed	I_{SM} *2		-	-	140	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_D = 20A	-	3.2	-	V
Reverse recovery time	t_{rr} *5	I_F = 20A V_R = 600V di/dt = 2500A/μs L_σ = 50nH, C_σ = 10pF See Fig. 3-1, 3-2.	-	25	-	ns
Reverse recovery charge	Q_{rr} *5		-	535	-	nC
Peak reverse recovery current	I_{rrm} *5		-	35	-	A

*1 Limited by maximum temperature allowed.

*2 $P_W \leq$ 10μs, Duty cycle ≤ 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

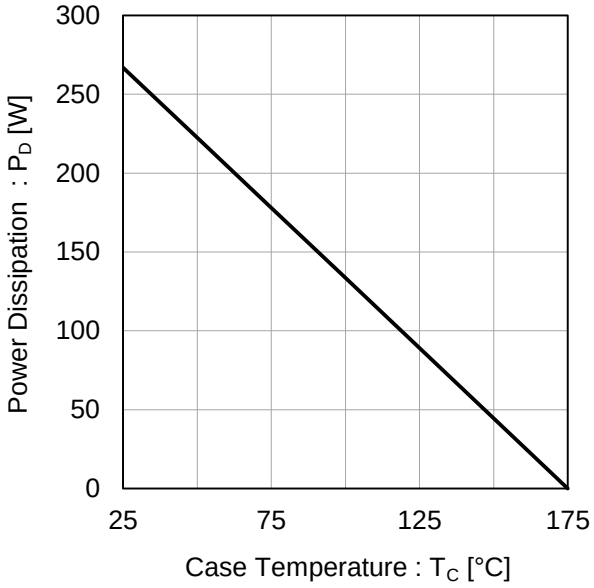


Fig.2 Maximum Safe Operating Area

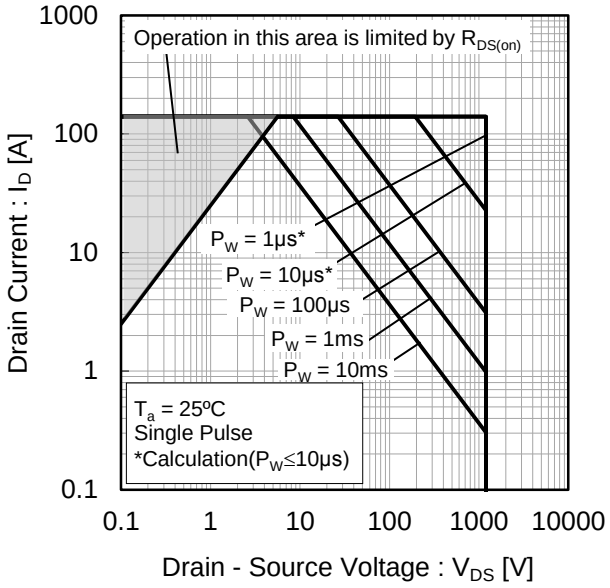
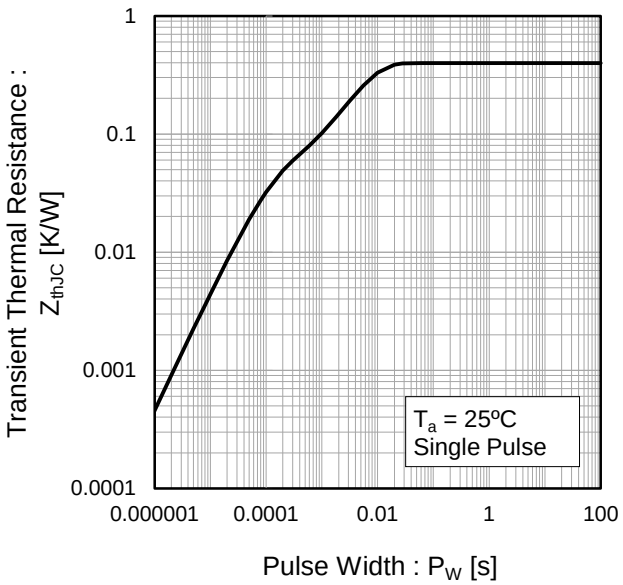


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

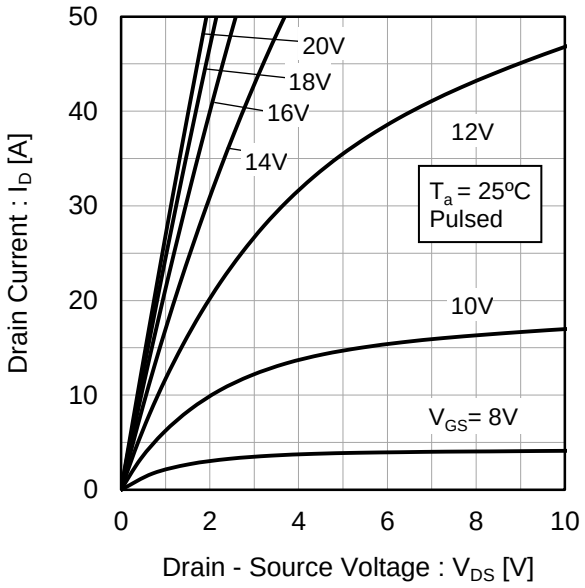


Fig.5 Typical Output Characteristics(II)

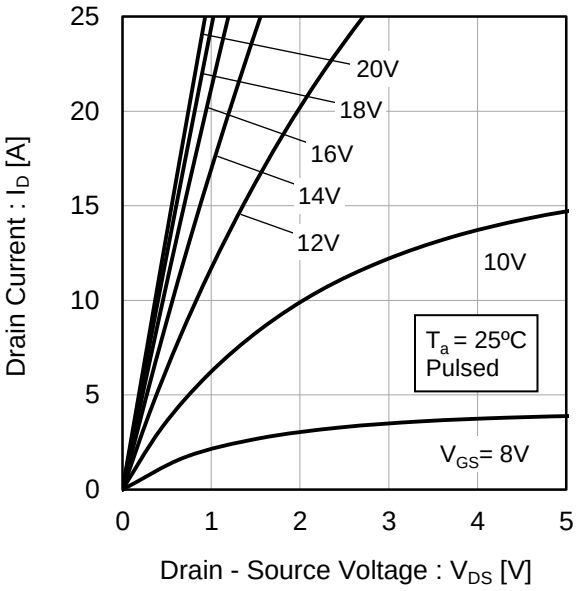
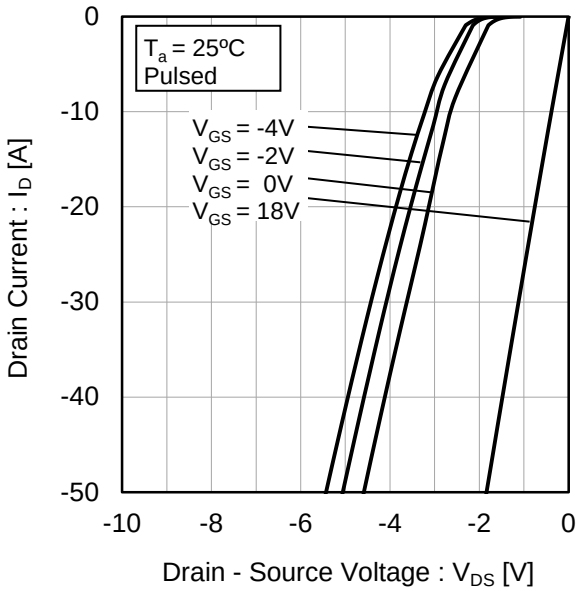


Fig.6 T_j = 25ºC 3rd Quadrant Characteristics



●Electrical characteristic curves

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

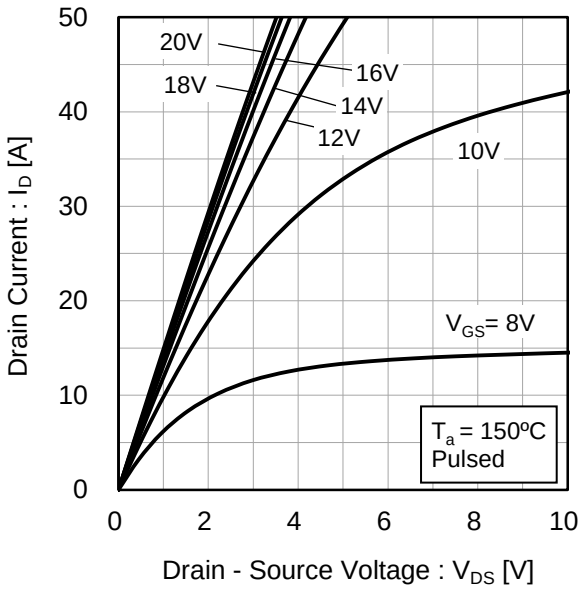


Fig.8 T_j = 150ºC Typical Output Characteristics(II)

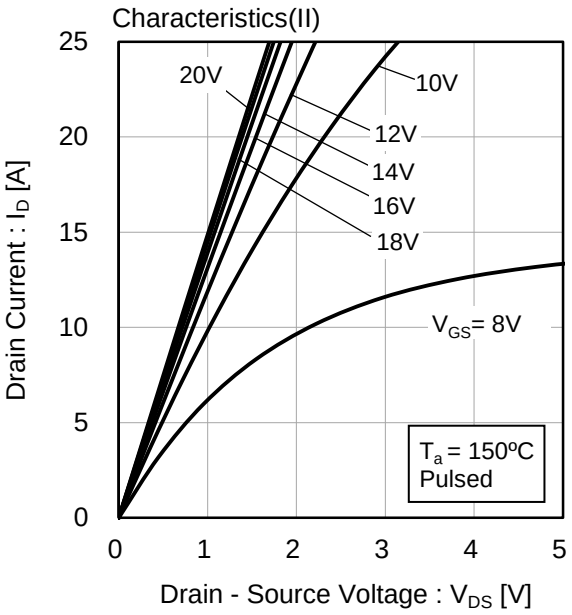


Fig.9 T_j = 150ºC 3rd Quadrant Characteristics

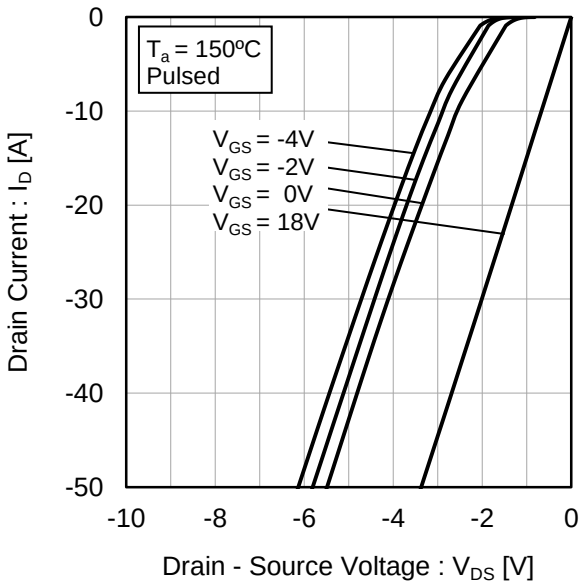
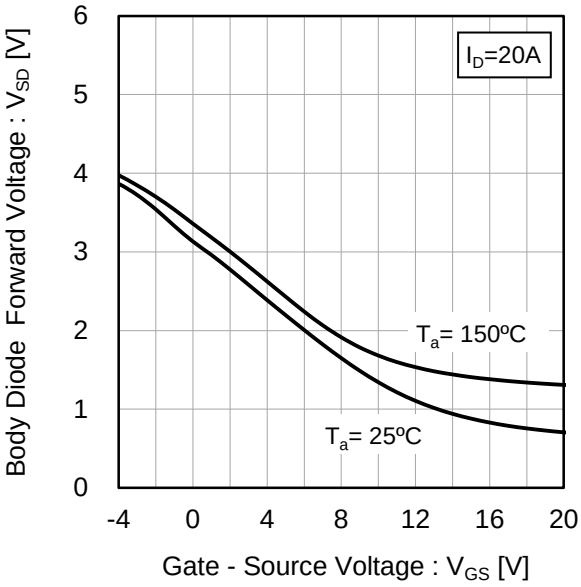


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

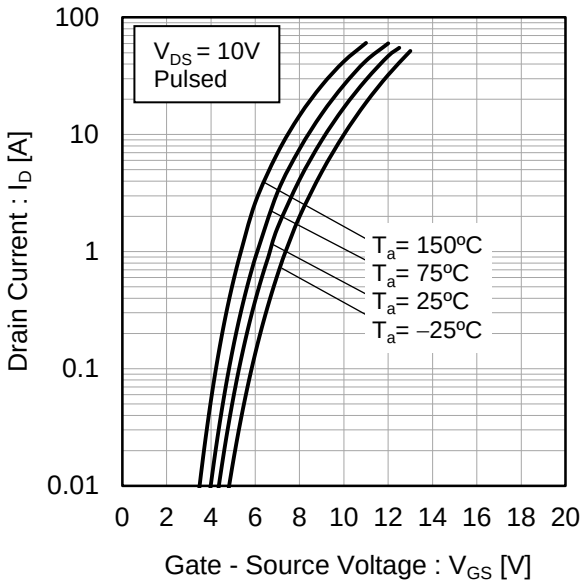


Fig.12 Typical Transfer Characteristics (II)

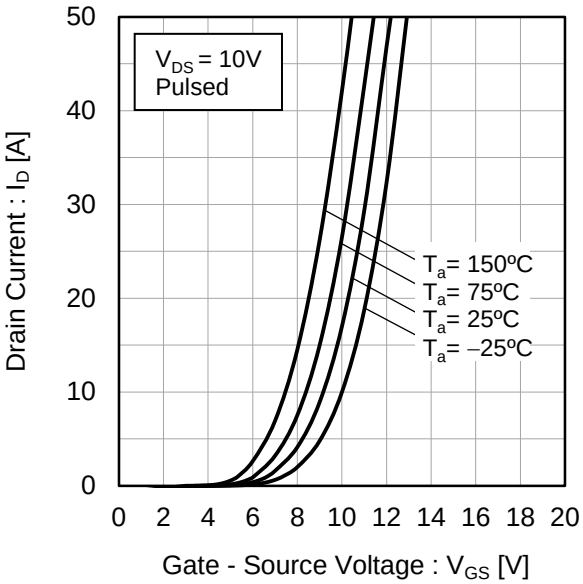


Fig.13 Gate Threshold Voltage vs. Junction Temperature

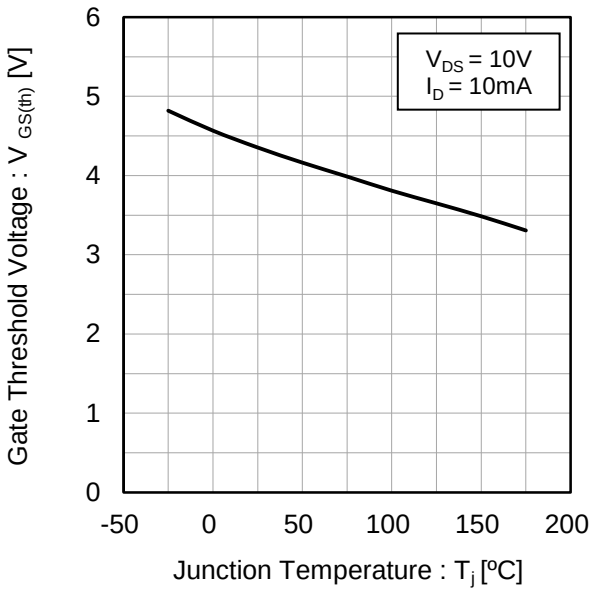
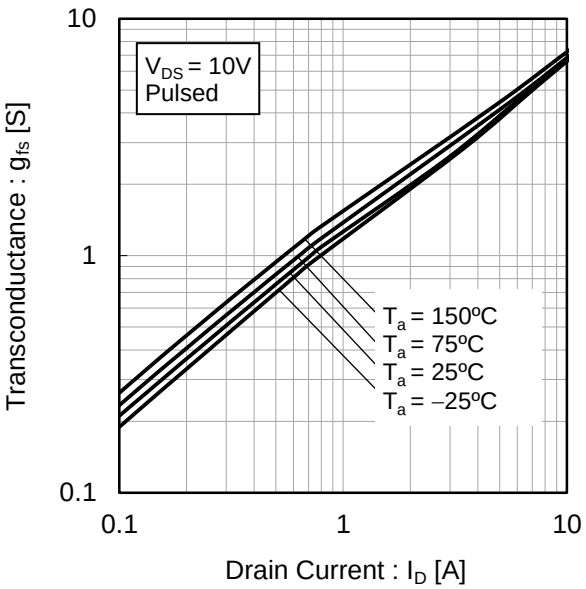


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.15 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

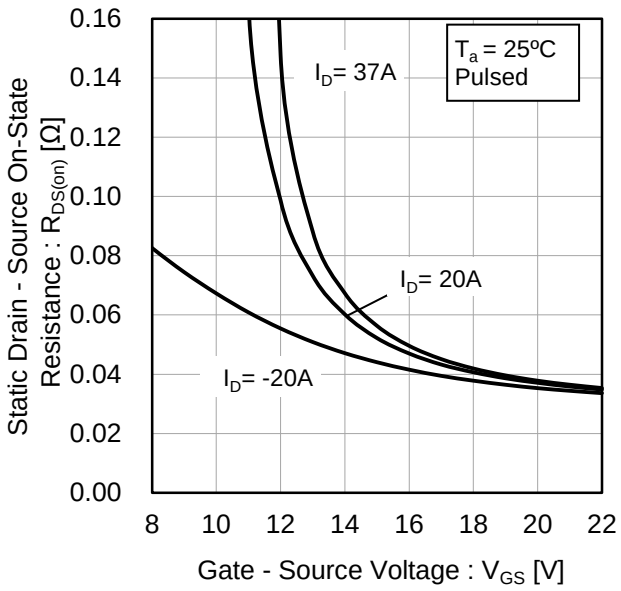


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

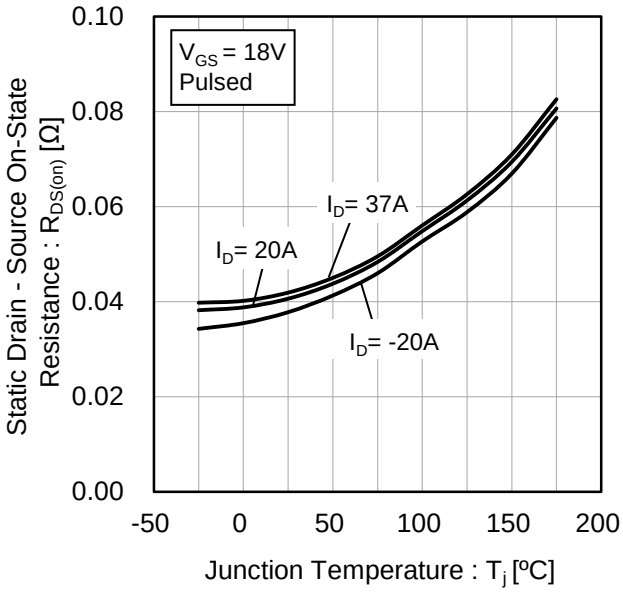


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

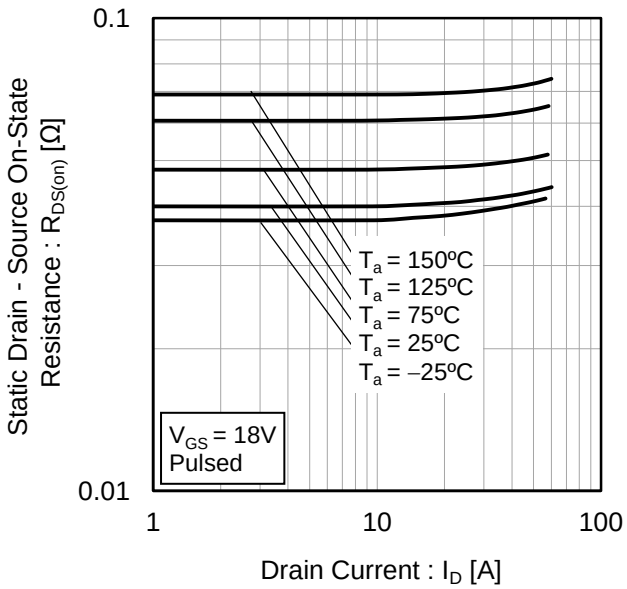
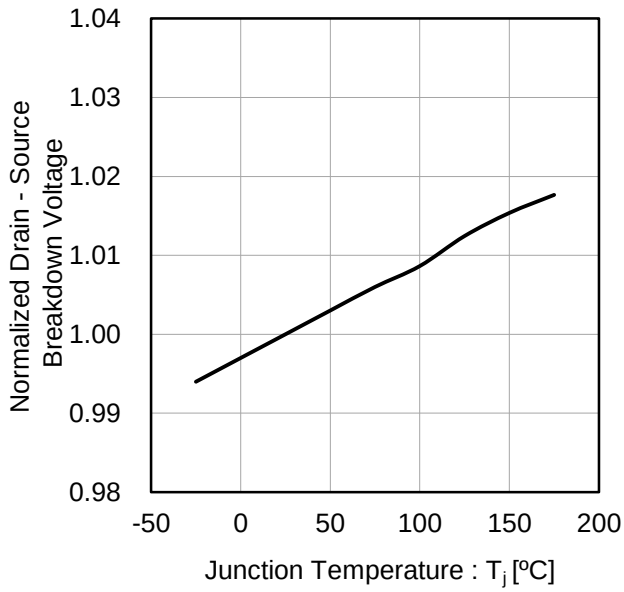


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

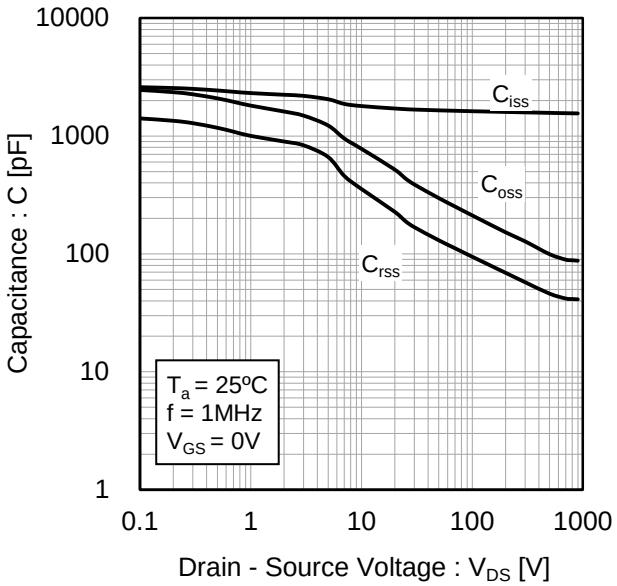


Fig.20 C_{oss} Stored Energy

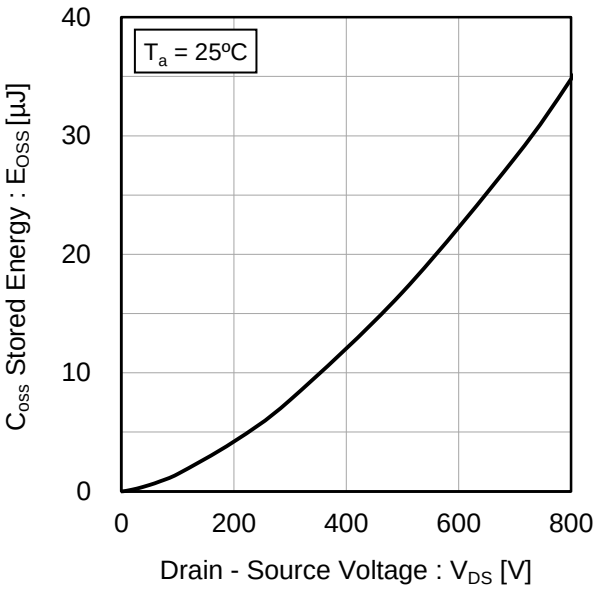
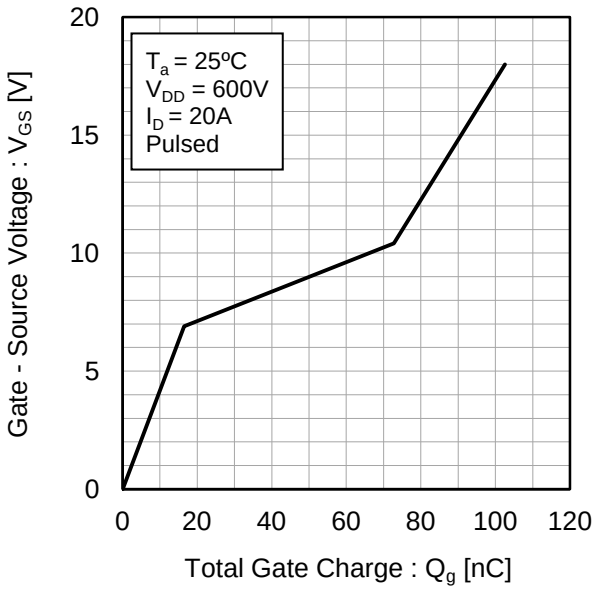
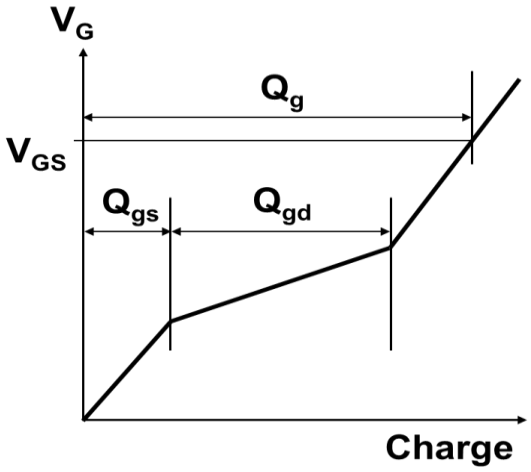


Fig.21 Dynamic Input Characteristics



*Gate Charge Waveform



●Electrical characteristic curves

Fig.22 Typical Switching Time vs. External Gate Resistance

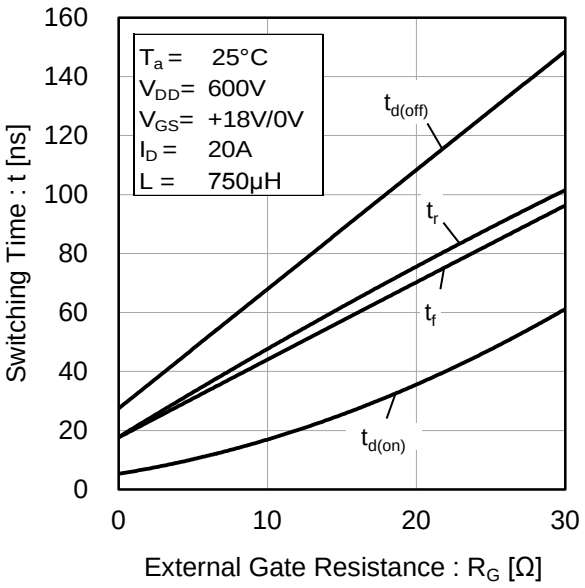


Fig.23 Typical Switching Loss vs. Drain - Source Voltage

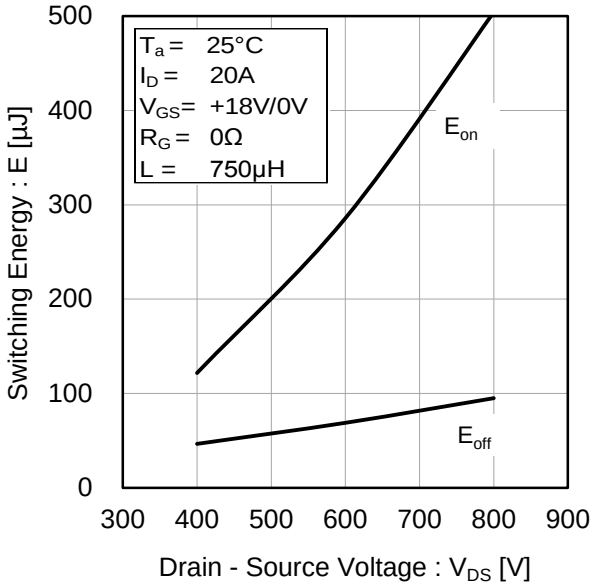


Fig.24 Typical Switching Loss vs. Drain Current

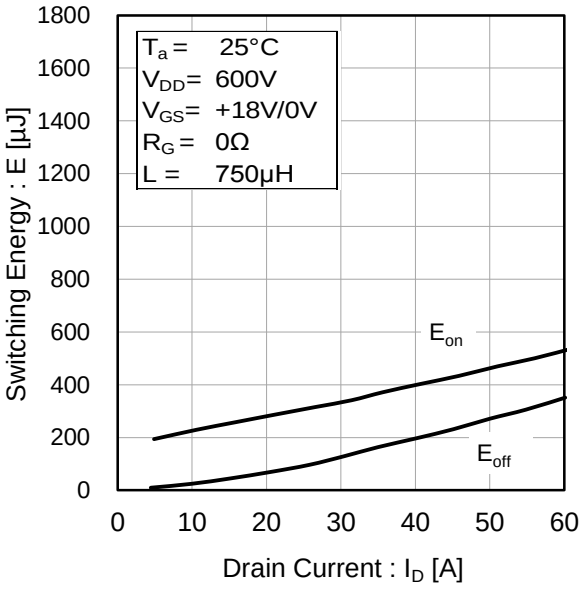
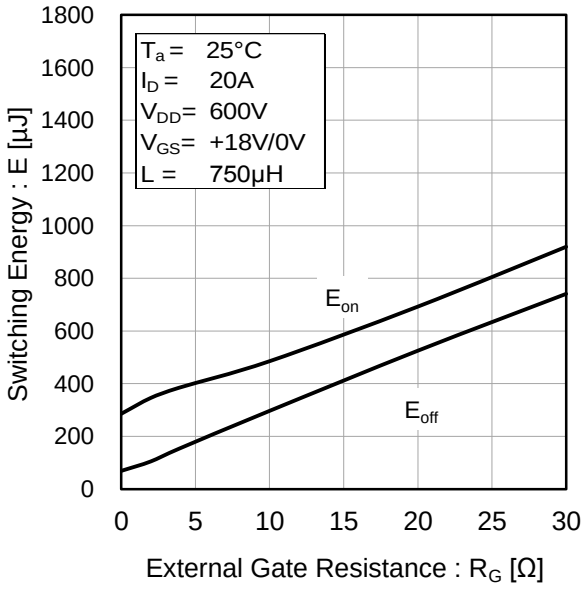


Fig.25 Typical Switching Loss vs. External Gate Resistance



●Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

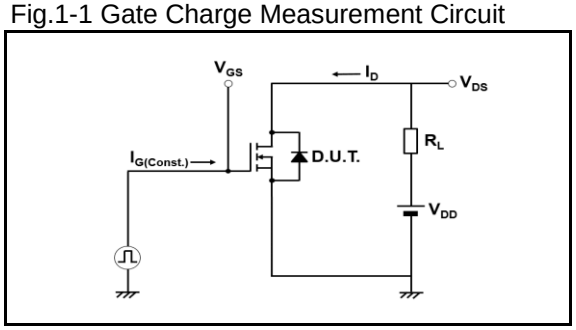


Fig.2-1 Switching Characteristics Measurement Circuit

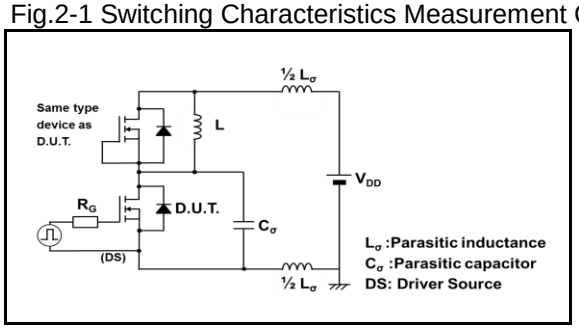


Fig.2-2 Waveforms for Switching Time

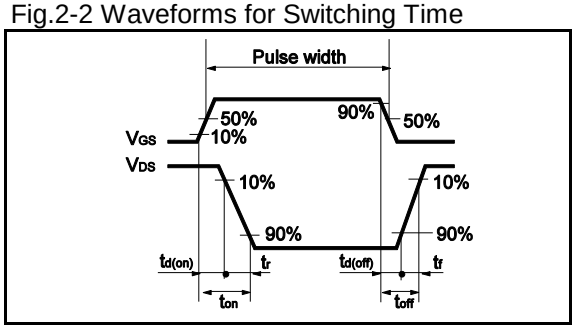


Fig.2-3 Waveforms for Switching Energy Loss

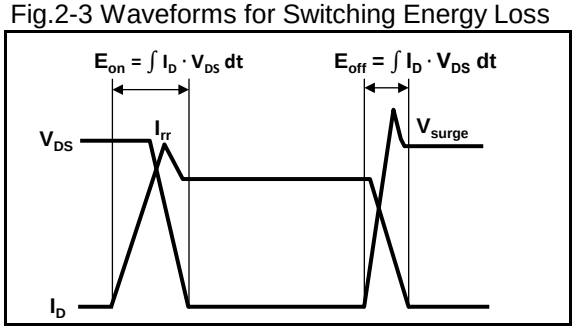


Fig.3-1 Reverse Recovery Time Measurement Circuit

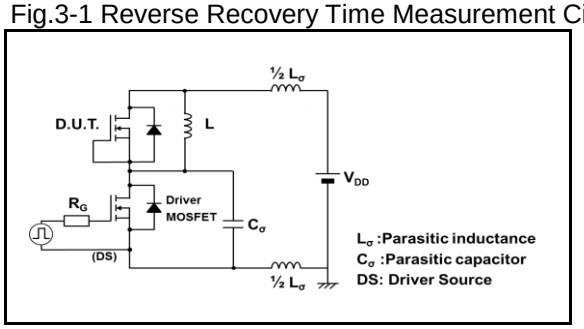
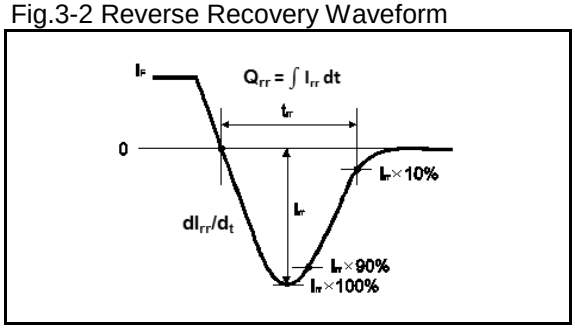


Fig.3-2 Reverse Recovery Waveform



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