

V_{DSS}	650V
$R_{DS(on)}$ (Typ.)	120mΩ
I_D	21A
P_D	103W

●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

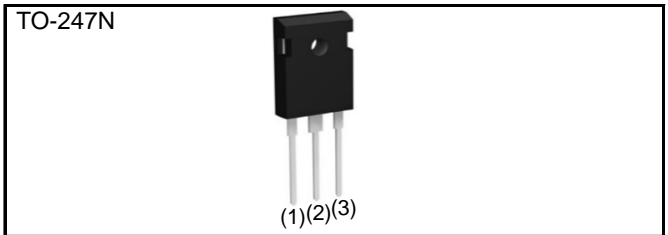
●Application

- Solar inverters
- DC/DC converters
- Switch mode power supplies
- Induction heating
- Motor drives

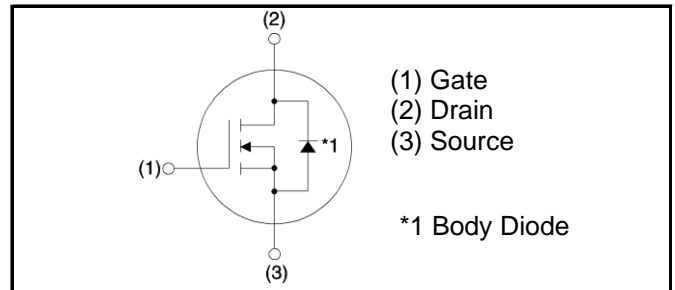
●Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	650	V
Continuous drain current	$T_c = 25^\circ\text{C}$	I_D^{*1} 21	A
	$T_c = 100^\circ\text{C}$	I_D^{*1} 15	A
Pulsed drain current	$I_{D,pulse}^{*2}$	52	A
Gate - Source voltage (DC)	V_{GSS}	-4 to +22	V
Gate-Source Surge Voltage ($t_{surge} < 300\text{nsec}$)	$V_{GSS,surge}^{*3}$	-4 to +26	V
Recommended Drive Voltage	$V_{GS,op}^{*4}$	0 / +18	V
Junction temperature	T_j	175	$^\circ\text{C}$
Range of storage temperature	T_{stg}	-55 to +175	$^\circ\text{C}$

●Outline



●Inner circuit



●Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Taping code	C11
	Marking	SCT3120AL

● Thermal resistance

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

● Electrical characteristics ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	650	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	1	10	μA
		$T_j = 150^\circ\text{C}$	-	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	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 3.33mA$	2.7	-	5.6	V
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 18V, I_D = 6.7A$ $T_j = 25^\circ\text{C}$	-	120	156	$m\Omega$
		$T_j = 125^\circ\text{C}$	-	158.4	-	
Gate input resistance	R_G	$f = 1MHz, \text{open drain}$	-	18	-	Ω

●Electrical characteristics ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*5}	$V_{DS} = 10\text{V}, I_D = 6.7\text{A}$	-	2.7	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	460	-	pF
Output capacitance	C_{oss}	$V_{DS} = 500\text{V}$	-	35	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	16	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 300\text{V}$	-	70	-	pF
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} = 300\text{V}, I_D = 6.7\text{A}$	-	14	-	ns
Rise time	t_r^{*5}	$V_{GS} = 18\text{V}/0\text{V}$	-	21	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L = 45\Omega$	-	23	-	
Fall time	t_f^{*5}	$R_G = 0\Omega$	-	14	-	
Turn - on switching loss	E_{on}^{*5}	$V_{DD} = 300\text{V}, I_D = 6.7\text{A}$ $V_{GS} = 18\text{V}/0\text{V}$	-	29	-	μJ
Turn - off switching loss	E_{off}^{*5}	$R_G = 0\Omega, L = 500\mu\text{H}$ * E_{on} includes diode reverse recovery	-	3	-	

●Gate Charge characteristics ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} = 300\text{V}$	-	38	-	nC
Gate - Source charge	Q_{gs}^{*5}	$I_D = 6.7\text{A}$	-	11	-	
Gate - Drain charge	Q_{gd}^{*5}	$V_{GS} = 18\text{V}$	-	13	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 300\text{V}, I_D = 6.7\text{A}$	-	9.6	-	V

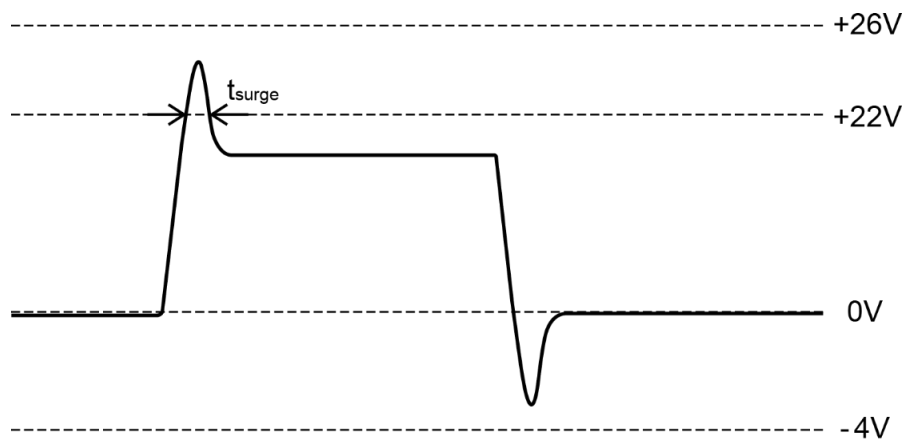
●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S^{*1}	$T_c = 25^\circ\text{C}$	-	-	21	A
Inverse diode direct current, pulsed	I_{SM}^{*2}		-	-	52	A
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0\text{V}, I_S = 6.7\text{A}$	-	3.2	-	V
Reverse recovery time	t_{rr}^{*5}	$I_F = 6.7\text{A}, V_R = 300\text{V}$ $di/dt = 1100\text{A}/\mu\text{s}$	-	13	-	ns
Reverse recovery charge	Q_{rr}^{*5}		-	35	-	nC
Peak reverse recovery current	I_{rrm}^{*5}		-	6	-	A

*1 Limited only by maximum temperature allowed.

*2 $PW \leq 10\mu\text{s}$, Duty cycle $\leq 1\%$

*3 Example of acceptable V_{gs} waveform



*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

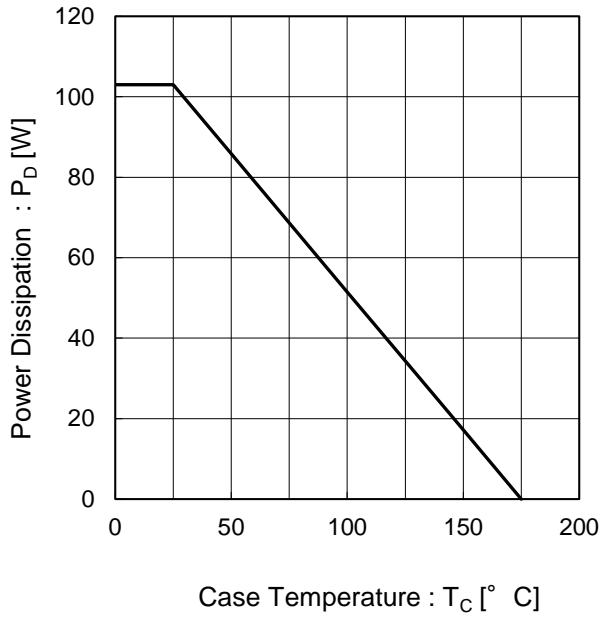


Fig.2 Maximum Safe Operating Area

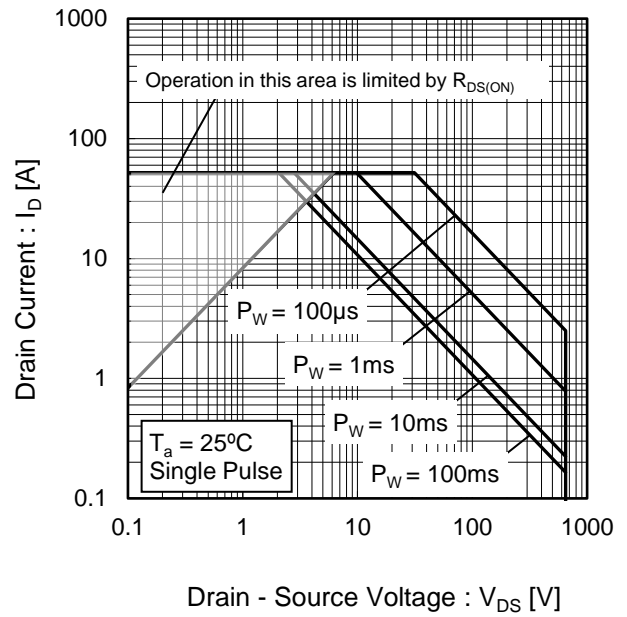
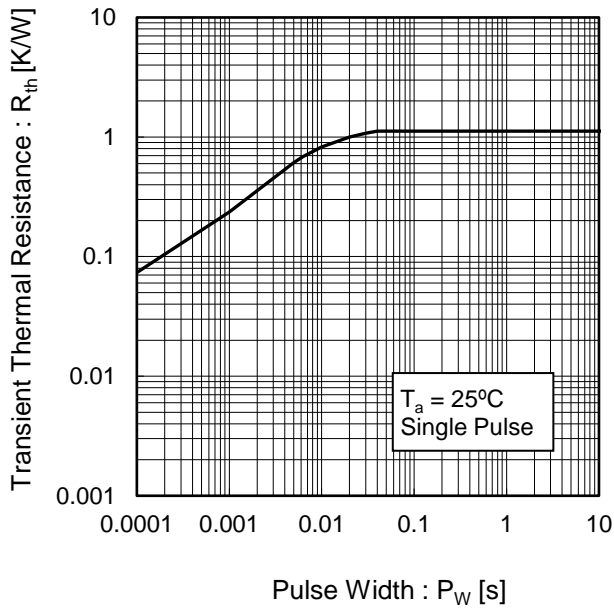


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

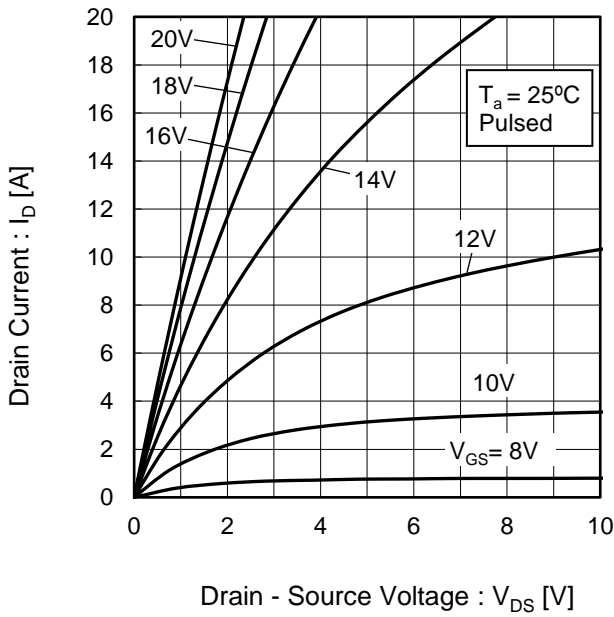


Fig.5 Typical Output Characteristics(II)

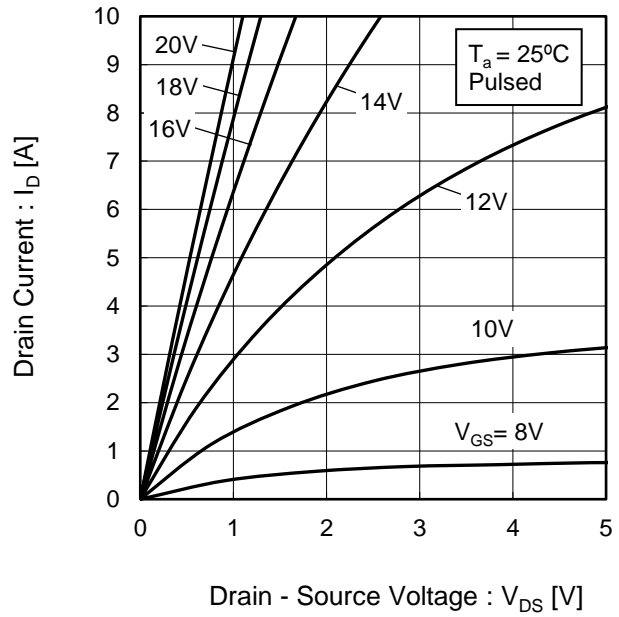


Fig.6 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(I)

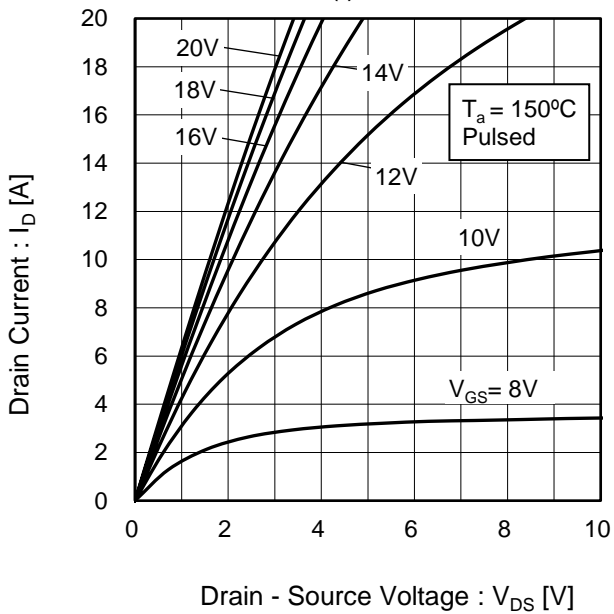
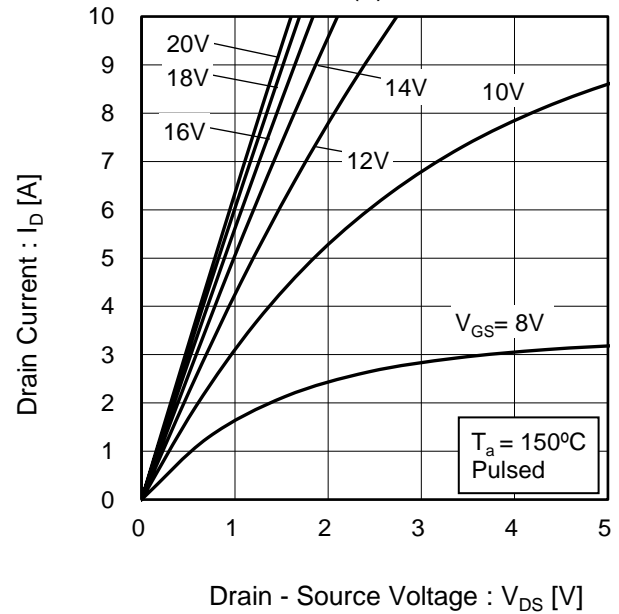


Fig.7 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics (I)

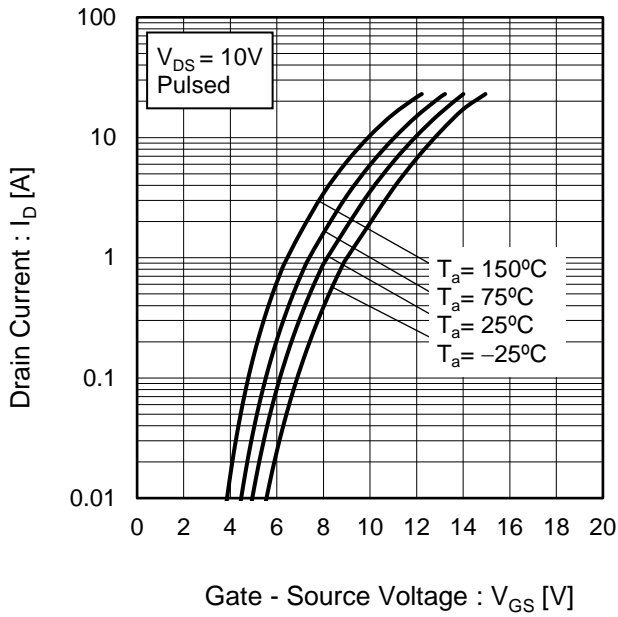


Fig.9 Typical Transfer Characteristics (II)

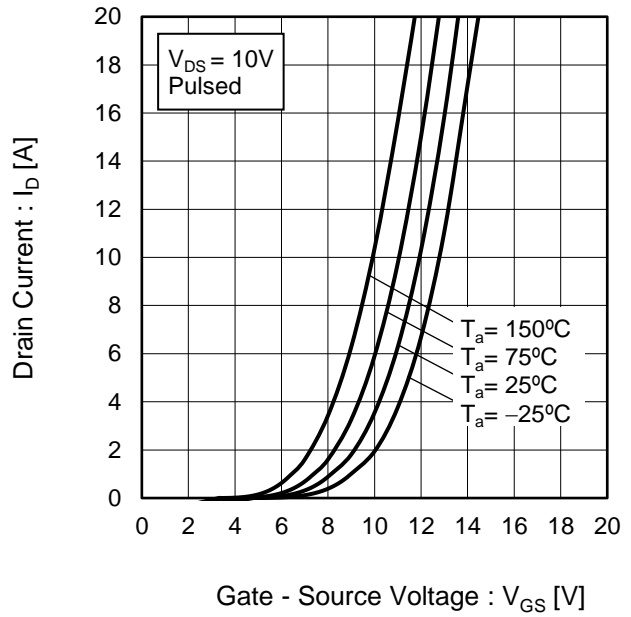


Fig.10 Gate Threshold Voltage vs. Junction Temperature

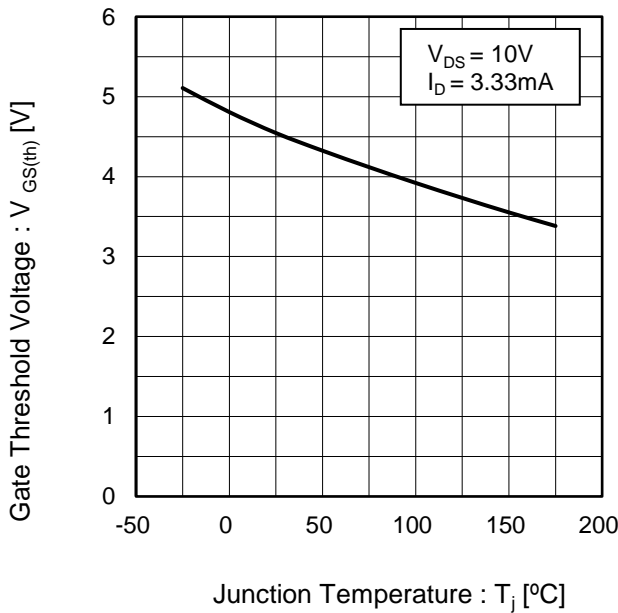
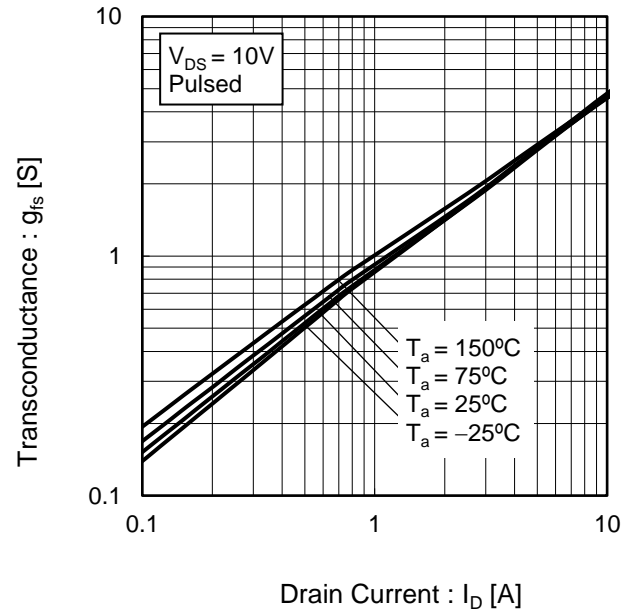


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

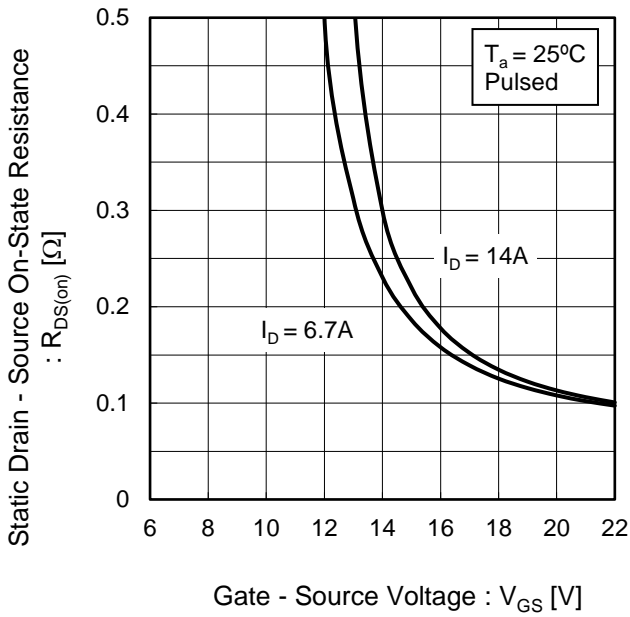


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

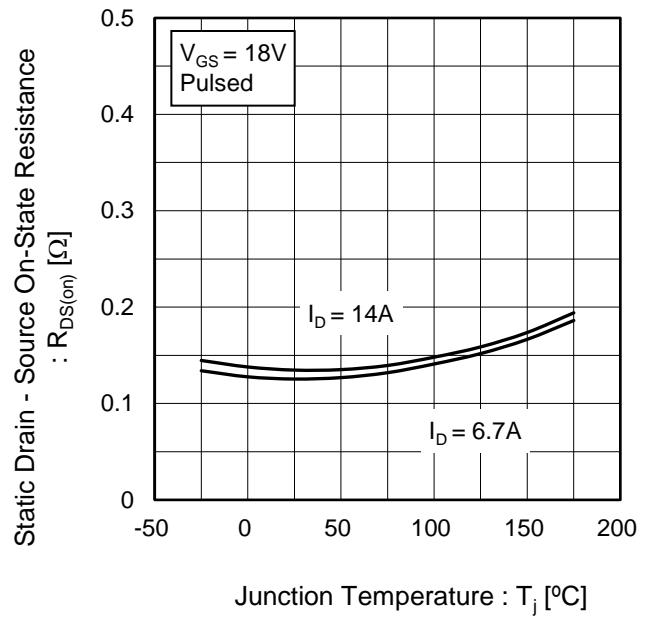
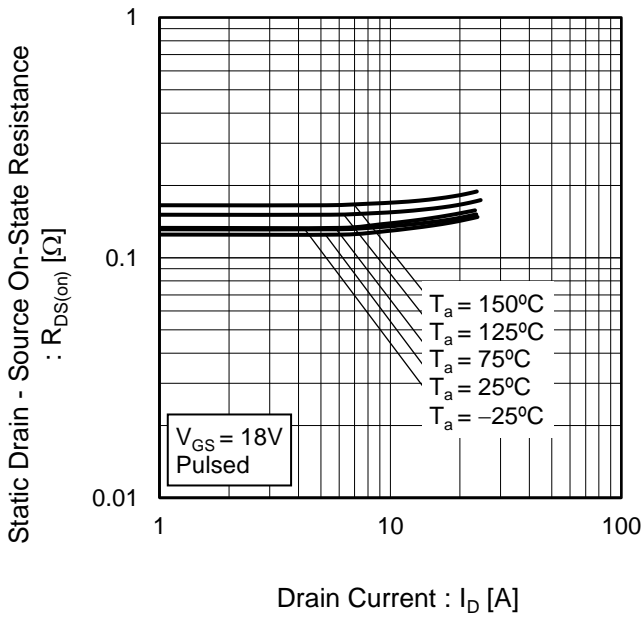


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.15 Typical Capacitance vs. Drain - Source Voltage

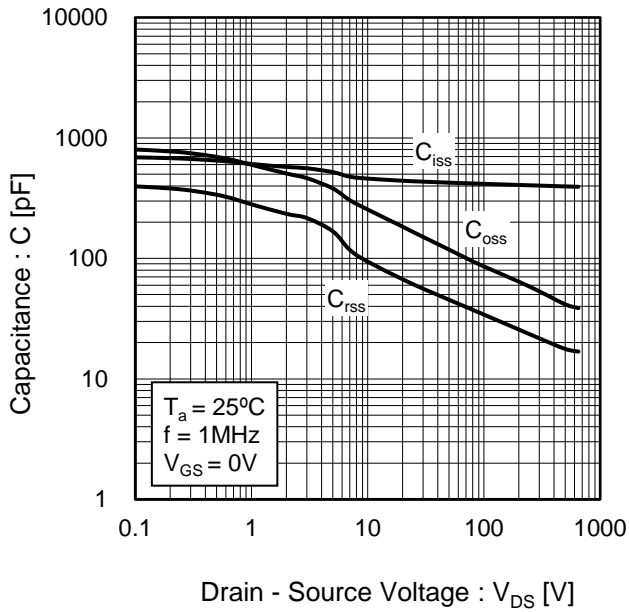


Fig.16 Coss Stored Energy

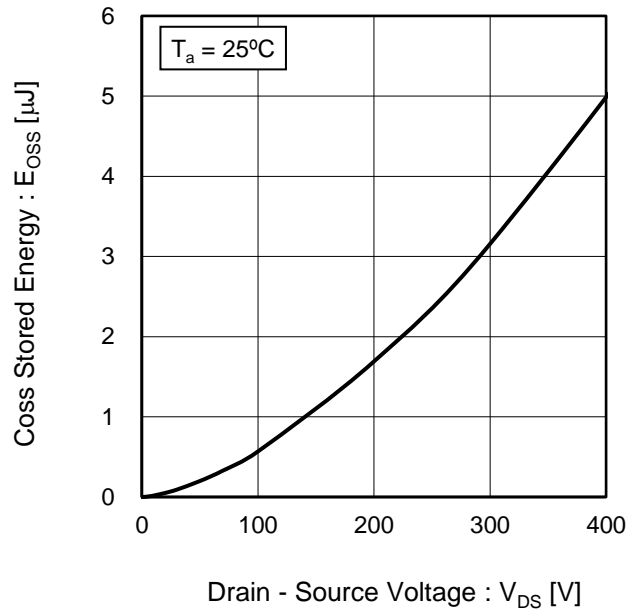


Fig.17 Switching Characteristics

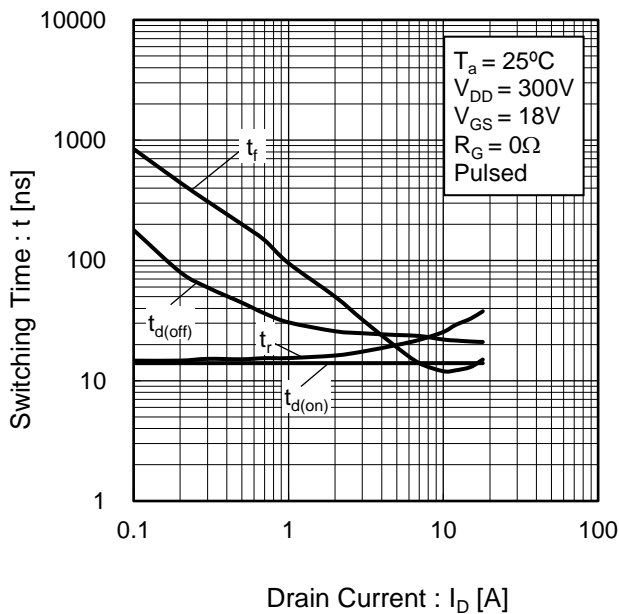
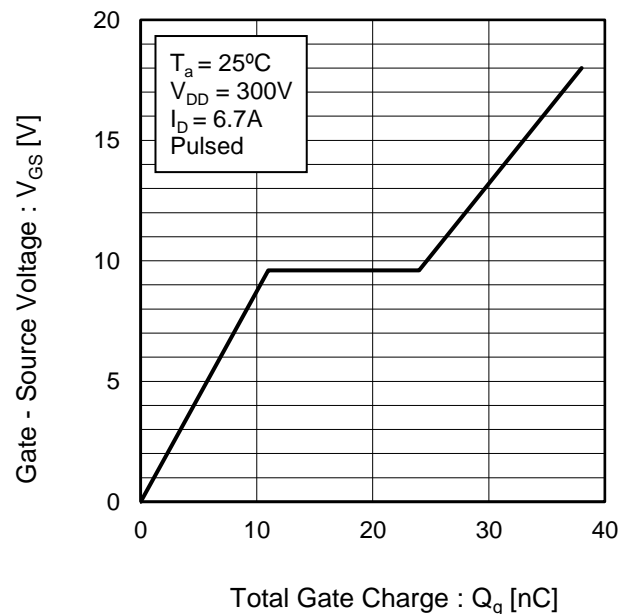


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

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

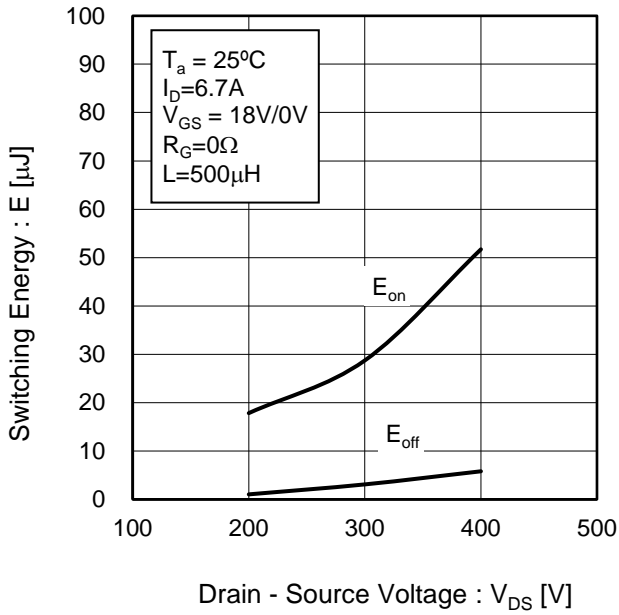


Fig.20 Typical Switching Loss vs. Drain Current

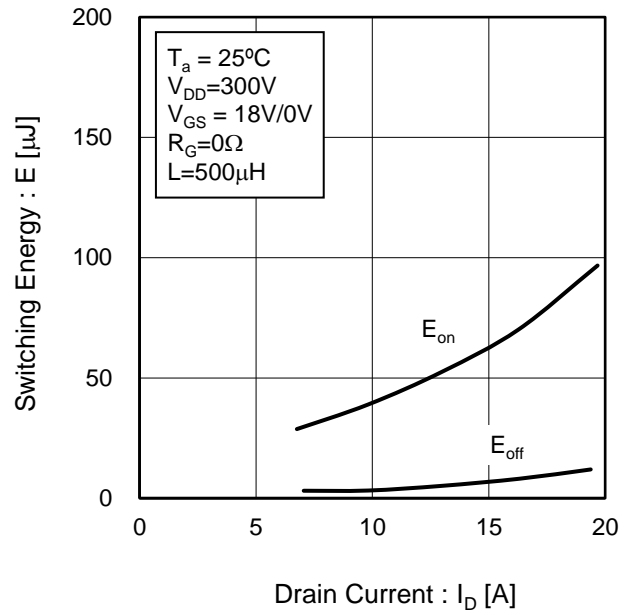
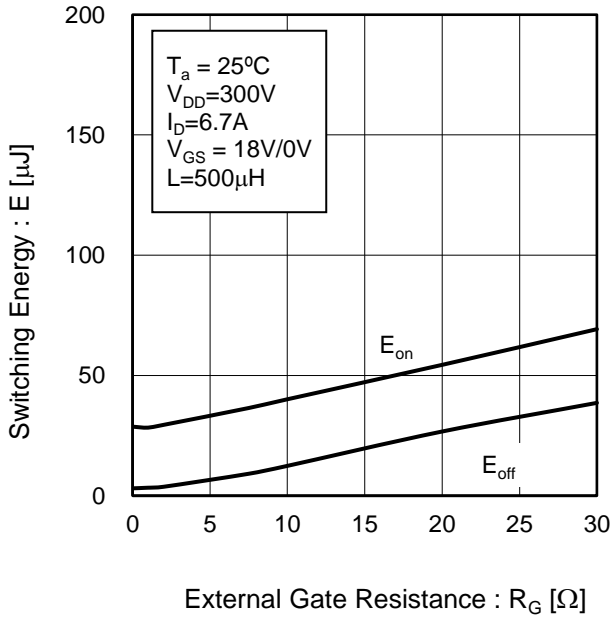


Fig.21 Typical Switching Loss vs. External Gate Resistance



●Electrical characteristic curves

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

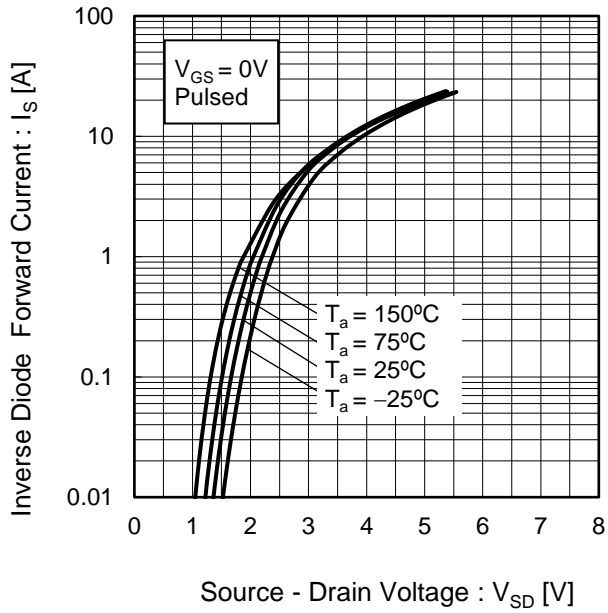
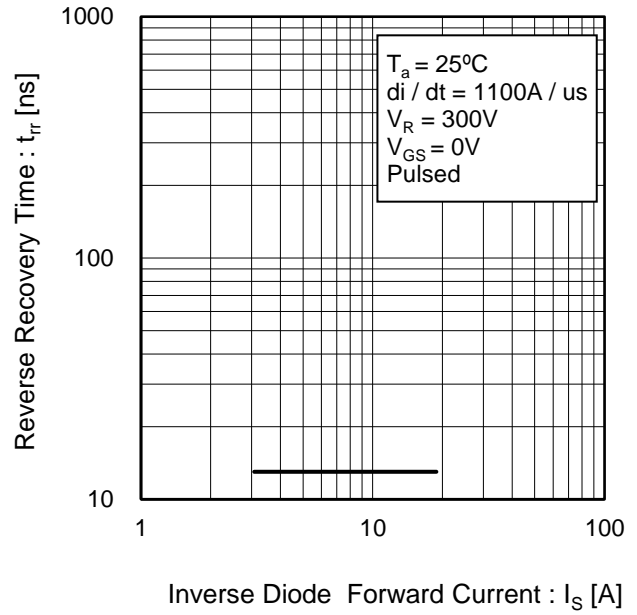


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

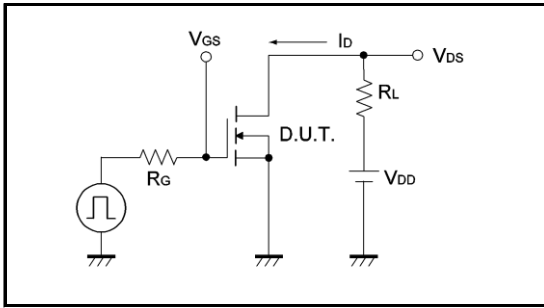


Fig.1-2 Switching Waveforms

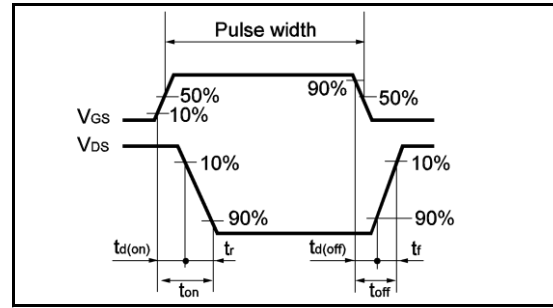


Fig.2-1 Gate Charge Measurement Circuit

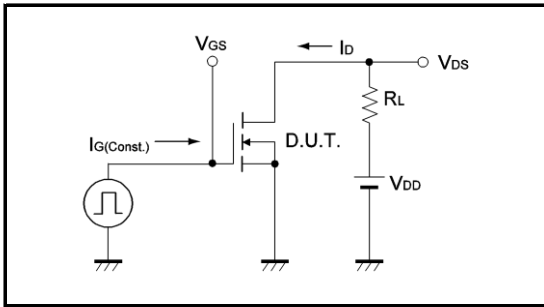


Fig.2-2 Gate Charge Waveform

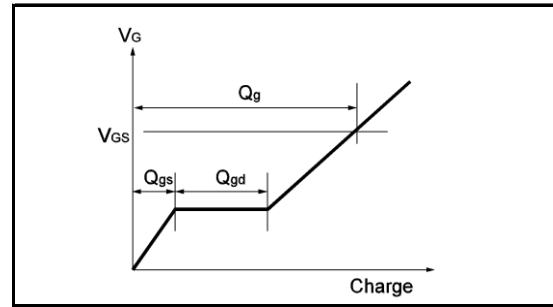


Fig.3-1 Switching Energy Measurement Circuit

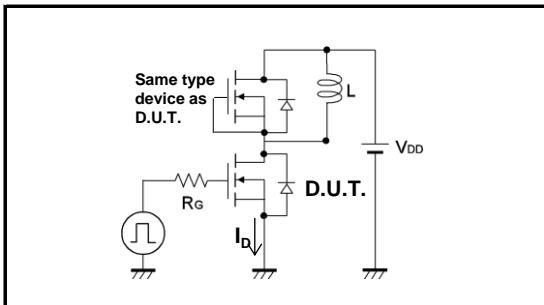


Fig.3-2 Switching Waveforms

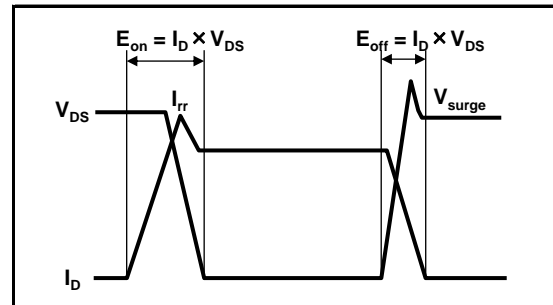


Fig.4-1 Reverse Recovery Time Measurement Circuit

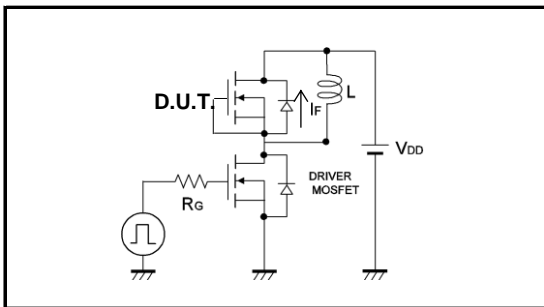
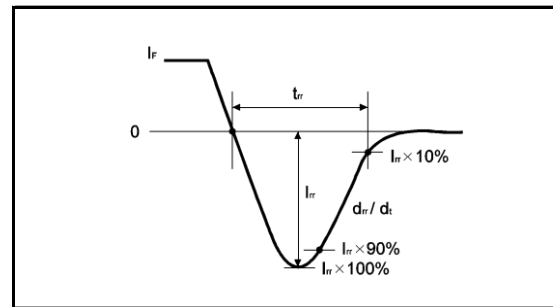


Fig.4-2 Reverse Recovery Waveform



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