

V_{DSS}	650V
$R_{DS(on)}$ (Typ.)	120mΩ
I_D^{*1}	21A
P_D	103W

●Features

- 1) Qualified to AEC-Q101
- 2) Low on-resistance
- 3) Fast switching speed
- 4) Fast reverse recovery
- 5) Easy to parallel
- 6) Simple to drive
- 7) Pb-free lead plating ; RoHS compliant

●Application

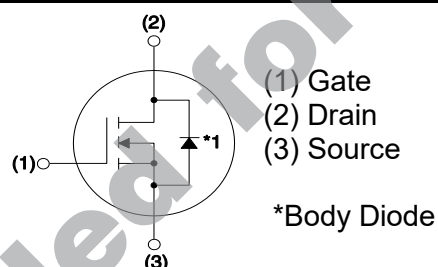
- Automobile
- Switch mode power supplies

●Outline

TO-247N



●Inner circuit



●Packaging specifications

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

●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	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$ $T_j = 25^\circ\text{C}$ $T_j = -55^\circ\text{C}$	650 650	- -	- -	V
Zero Gate voltage Drain current	I_{DSS}	$V_{GS} = 0V, V_{DS} = 650V$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- -	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	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 3.33mA$	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 18V, I_D = 6.7A$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- -	120 172	156 -	m Ω
Gate input resistance	R_G	$f = 1\text{MHz}$, open drain	-	18	-	Ω

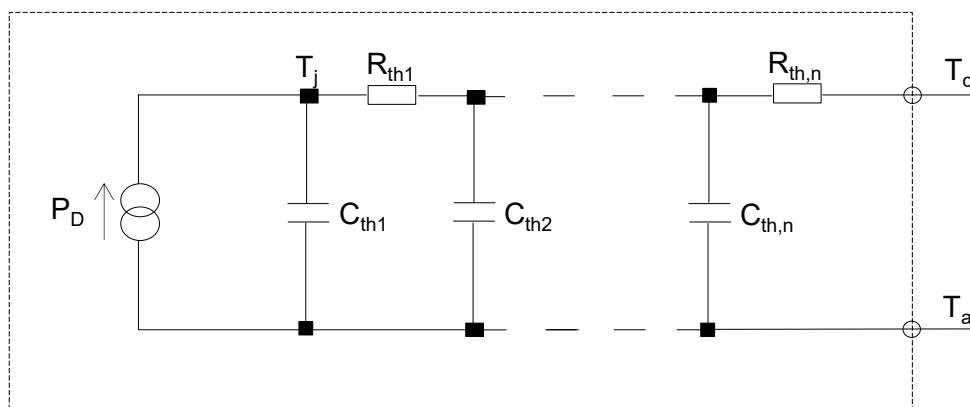
●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	1.12	1.46	$^\circ\text{C/W}$

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	1.11E-01	K/W
R_{th2}	7.09E-01	
R_{th3}	3.01E-01	

Symbol	Value	Unit
C_{th1}	8.73E-04	Ws/K
C_{th2}	5.10E-03	
C_{th3}	2.94E-02	



●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs}^{*5}	$V_{DS} = 10V, I_D = 6.7A$	-	2.7	-	S
Input capacitance	C_{iss}	$V_{GS} = 0V$	-	460	-	pF
Output capacitance	C_{oss}	$V_{DS} = 500V$	-	35	-	
Reverse transfer capacitance	C_{rss}	$f = 1MHz$	-	16	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0V$ $V_{DS} = 0V \text{ to } 300V$	-	70	-	pF
Total Gate charge	Q_g^{*5}	$V_{DS} = 300V$ $I_D = 6.7A$	-	38	-	nC
Gate - Source charge	Q_{gs}^{*5}	$V_{GS} = 18V$	-	10	-	
Gate - Drain charge	Q_{gd}^{*5}	See Fig. 1-1.	-	18	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DS} = 300V$ $I_D = 6.7A$	-	14	-	ns
Rise time	t_r^{*5}	$V_{GS} = 0V/+18V$	-	21	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_G = 0\Omega$ $R_L = 45\Omega$	-	23	-	
Fall time	t_f^{*5}	See Fig. 1-1, 1-2.	-	14	-	
Turn - on switching loss	E_{on}^{*5}	$V_{DS} = 300V$ $V_{GS} = 0V/18V, I_D = 6.7A$ $R_G = 0\Omega, L = 500\mu H$	-	29	-	μJ
Turn - off switching loss	E_{off}^{*5}	E_{on} includes diode reverse recovery $L_\sigma = 50nH, C_\sigma = 200pF$ See Fig. 2-1, 2-2.	-	3	-	

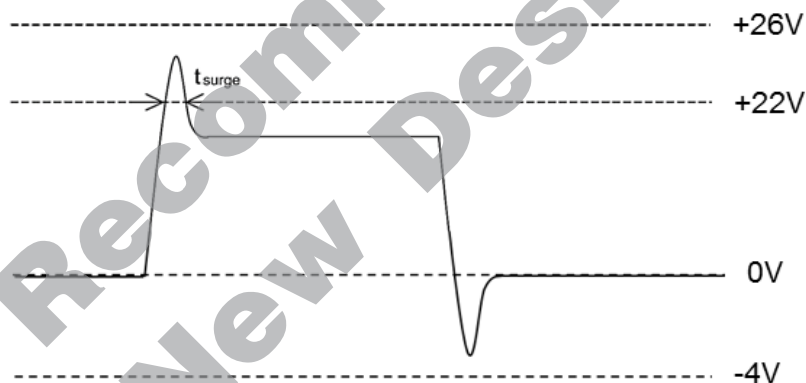
●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	I_S^{*1}	$T_c = 25^\circ\text{C}$	-	-	21	A
Body diode direct current, pulsed	I_{SM}^{*2}		-	-	52	A
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0\text{V}, I_D = 6.7\text{A}$	-	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_{rm}^{*5}		-	6	-	A

*1 Limited by maximum temperature allowed.

*2 $P_W \leq 10\mu\text{s}$, 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

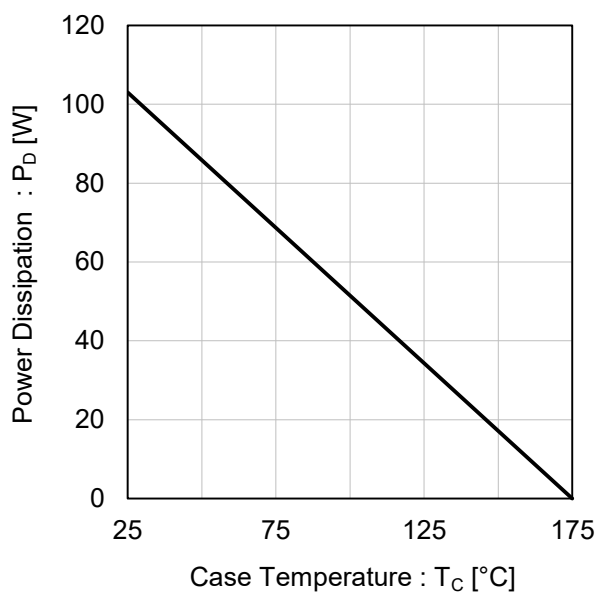


Fig.2 Maximum Safe Operating Area

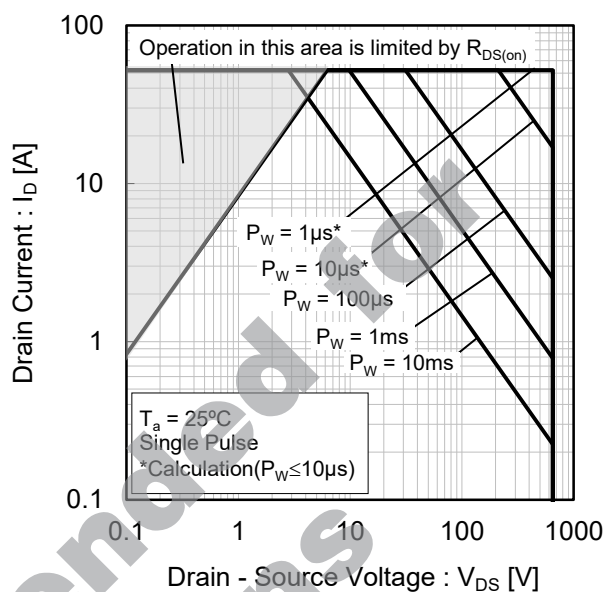
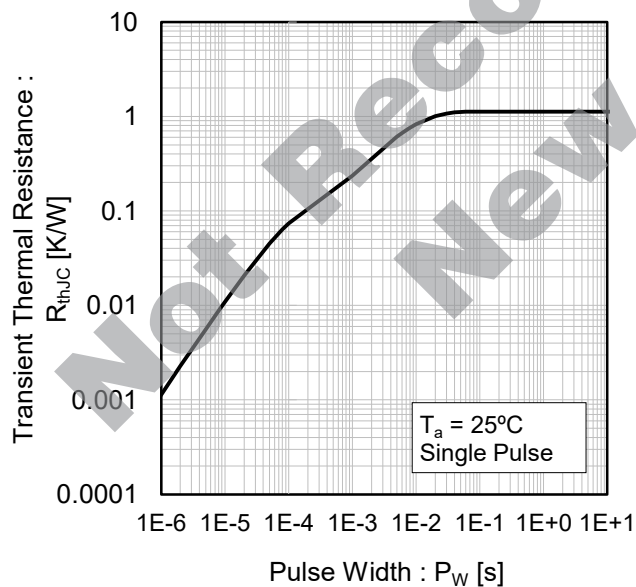


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

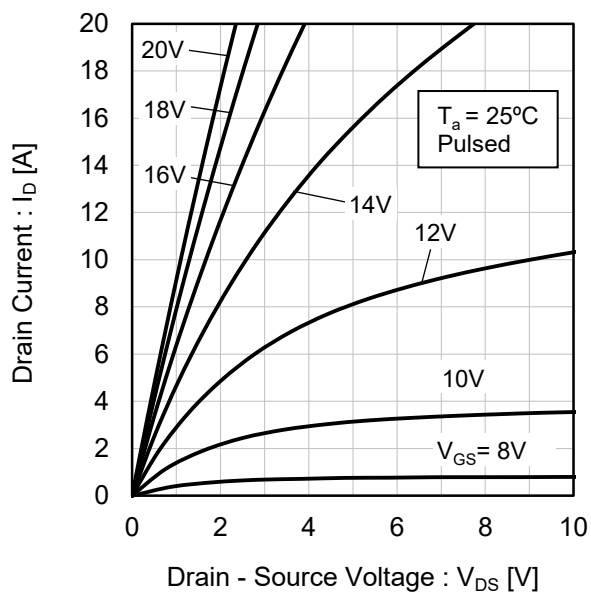
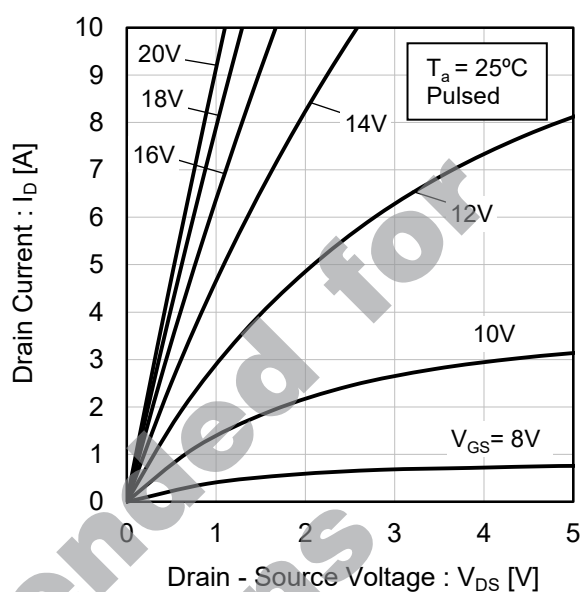
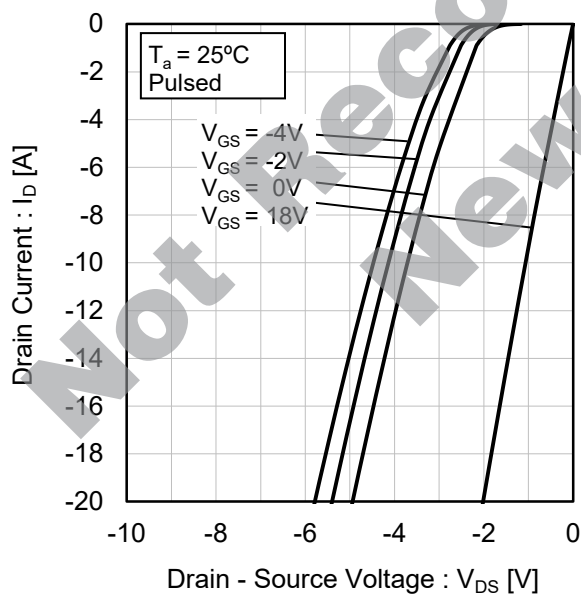


Fig.5 Typical Output Characteristics(II)

Fig.6 $T_j = 25^\circ\text{C}$ 3rd Quadrant Characteristics

●Electrical characteristic curves

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

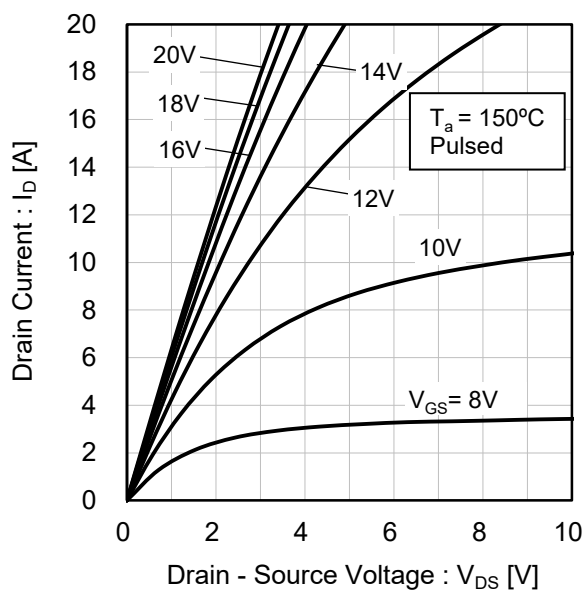


Fig.8 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)

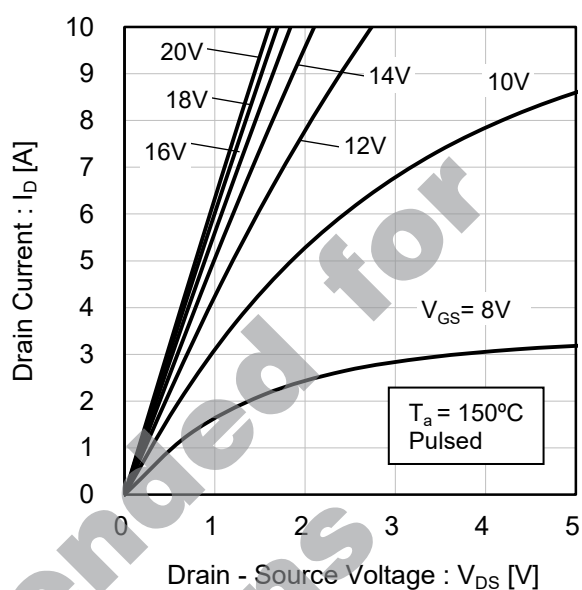


Fig.9 $T_j = 150^\circ\text{C}$ 3rd Quadrant Characteristics

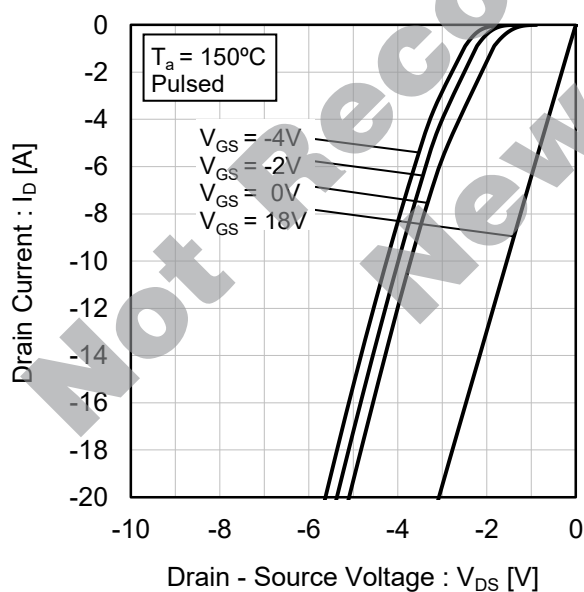
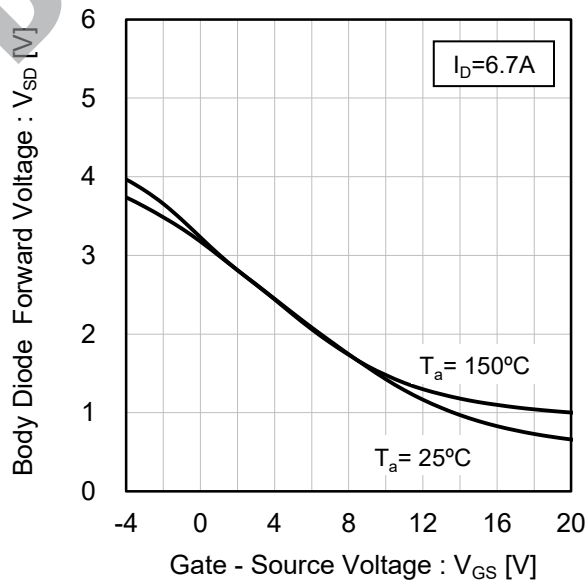


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

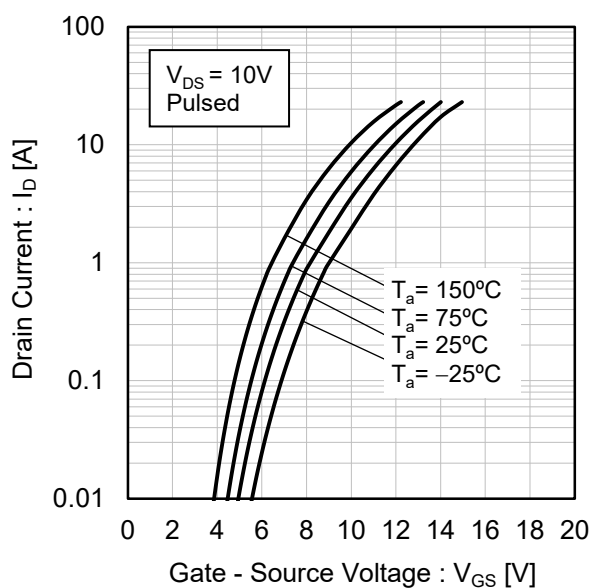


Fig.12 Typical Transfer Characteristics (II)

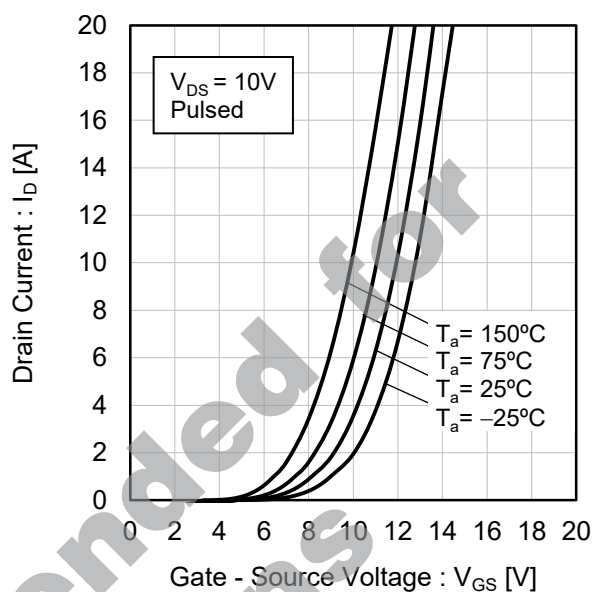


Fig.13 Gate Threshold Voltage vs. Junction Temperature

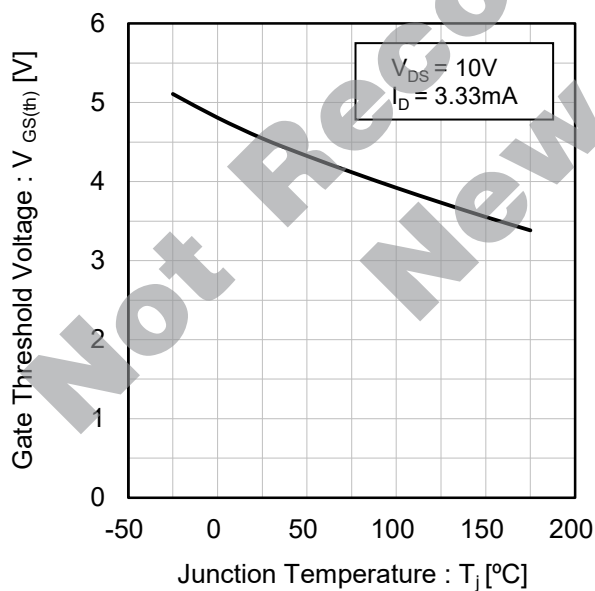
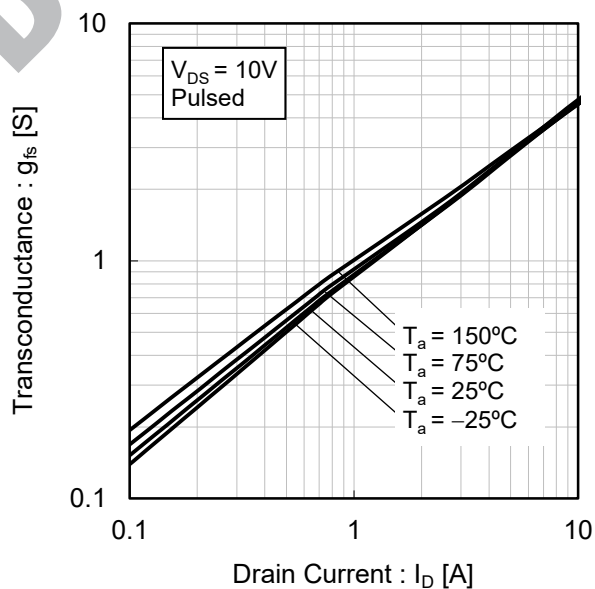


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

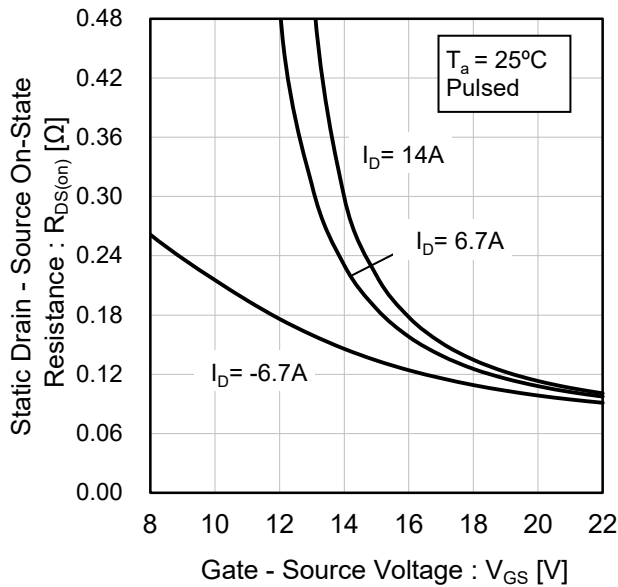


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

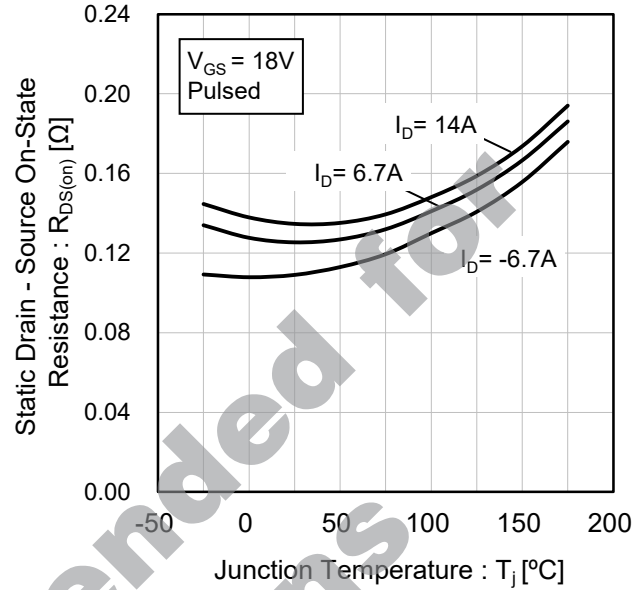


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

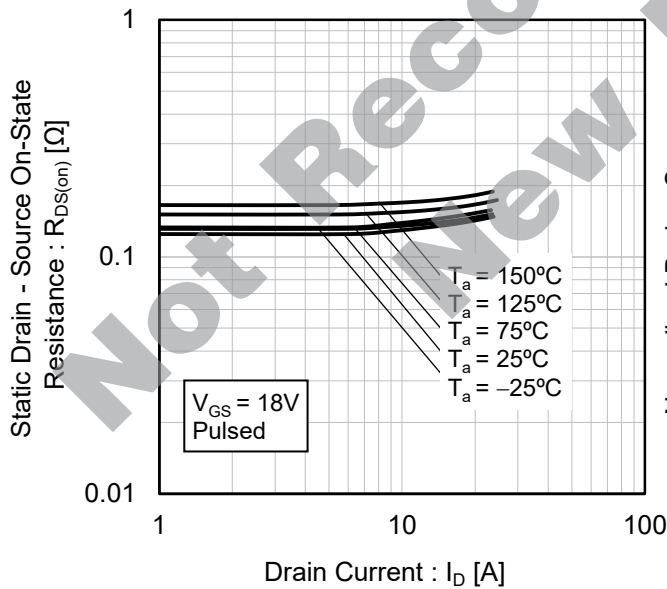
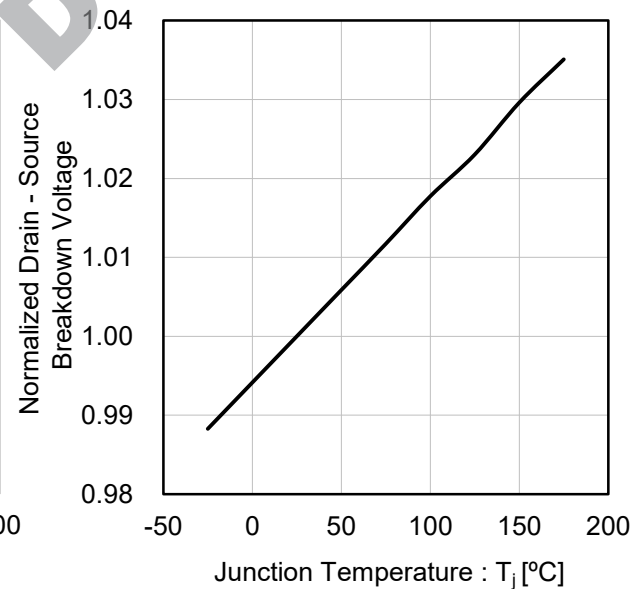


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance
vs. Drain - Source Voltage

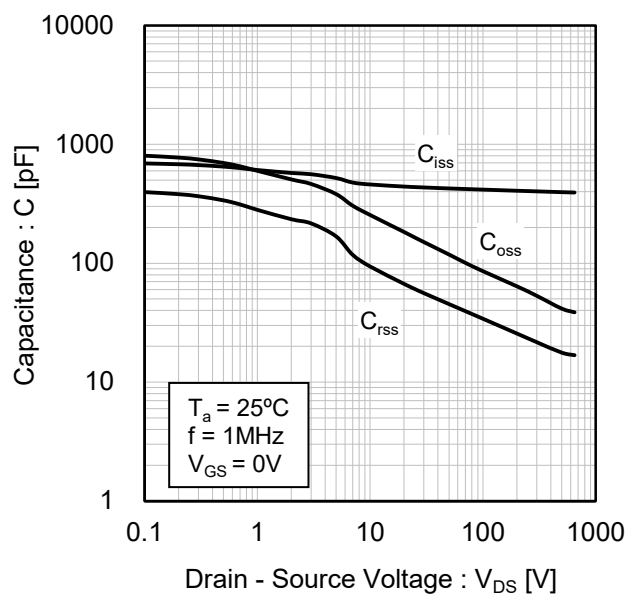


Fig.20 C_{oss} Stored Energy

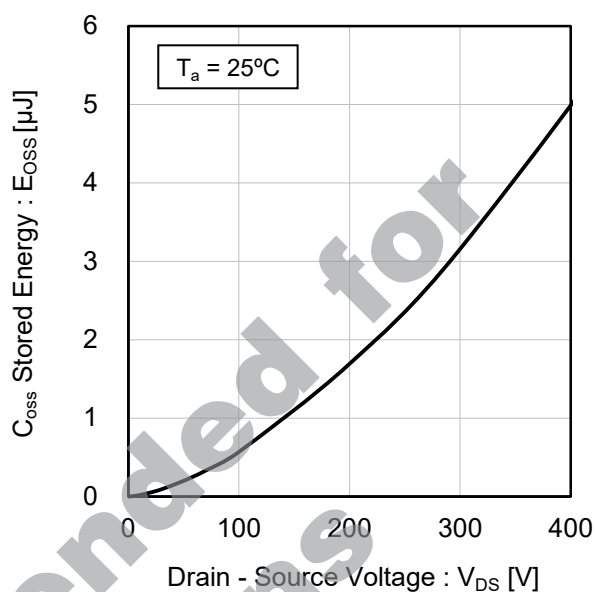
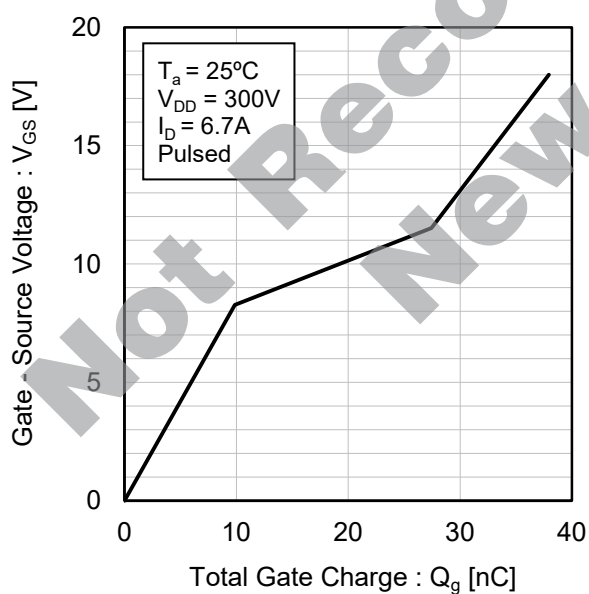
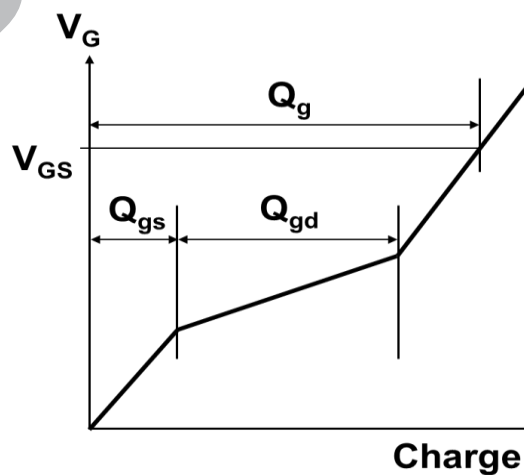


Fig.21 Dynamic Input Characteristics



*Gate Charge Waveform



●Electrical characteristic curves

Fig.19 Typical Switching Time
vs. Drain Current

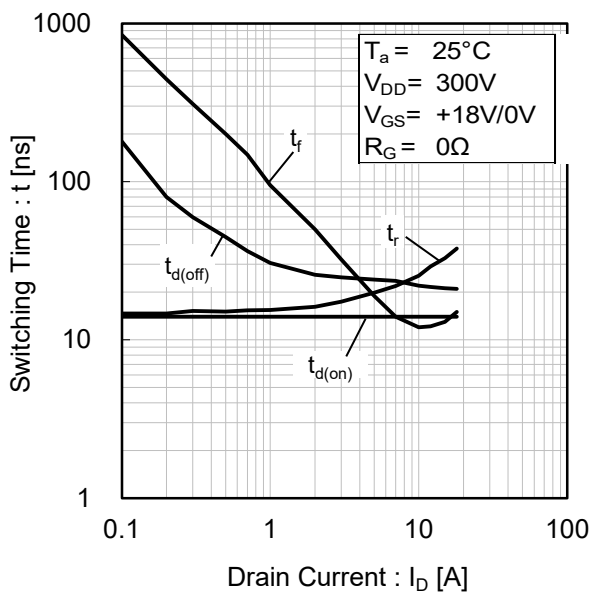


Fig.20 Typical Switching Loss
vs. Drain - Source Voltage

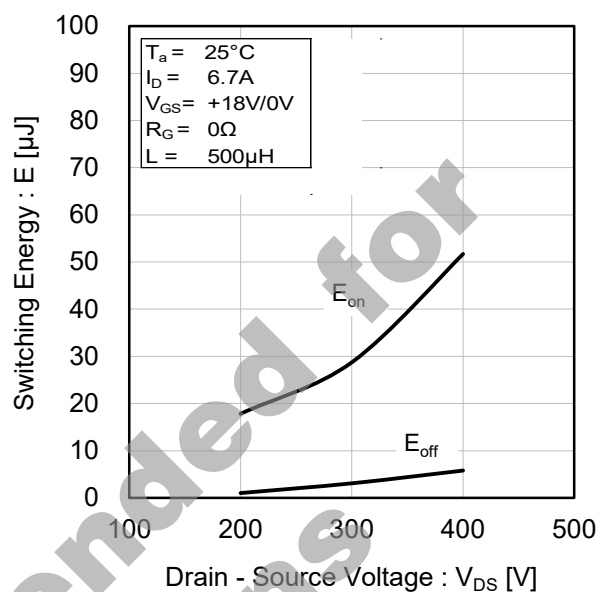


Fig.21 Typical Switching Loss
vs. Drain Current

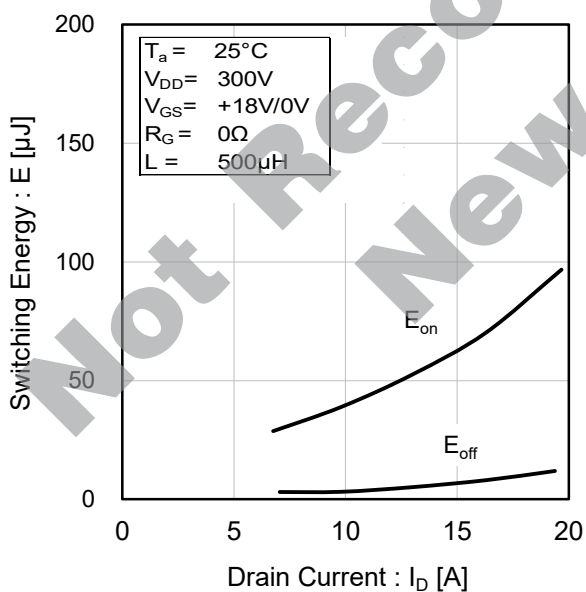
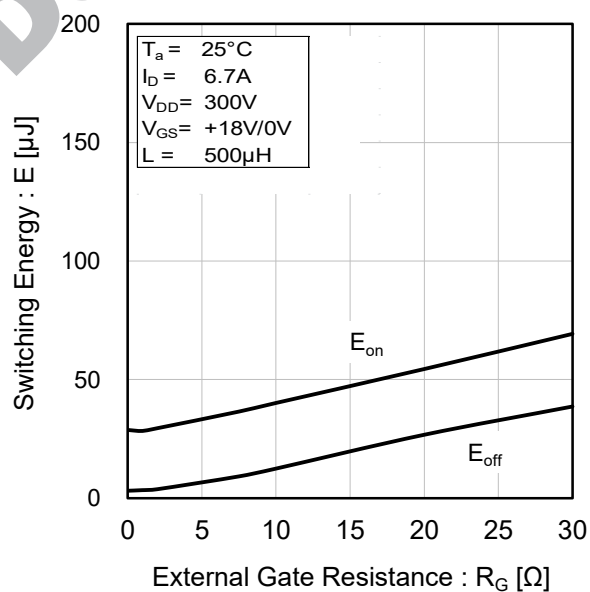


Fig.22 Typical Switching Loss
vs. External Gate Resistance



●Measurement circuits and waveforms

Fig.1-1 Gate Charge and Switching Time Measurement Circuit

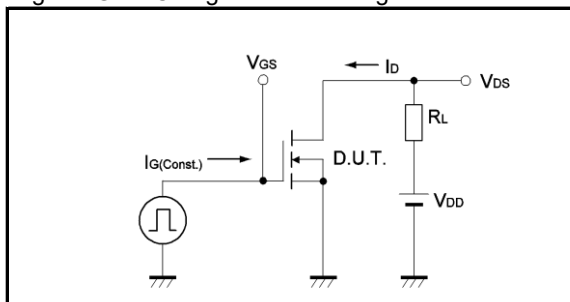


Fig.1-2 Waveforms for Switching Time

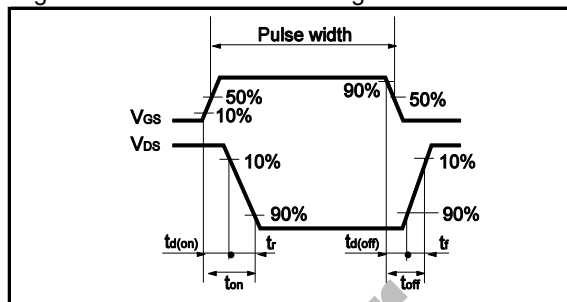


Fig.2-1 Switching Energy Measurement Circuit

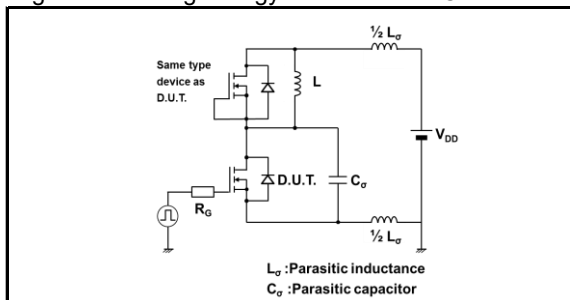


Fig.2-2 Waveforms for Switching Energy Loss

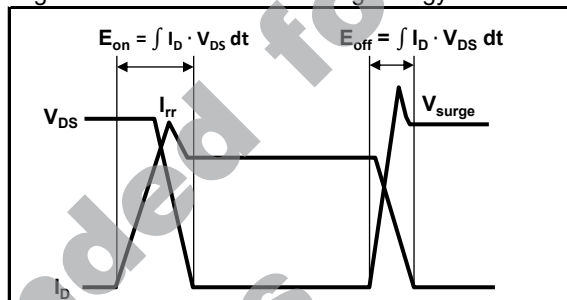


Fig.3-1 Reverse Recovery Time Measurement Circuit

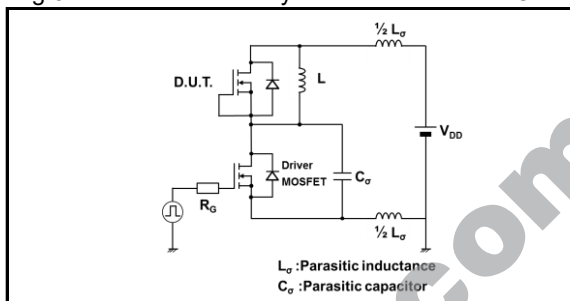
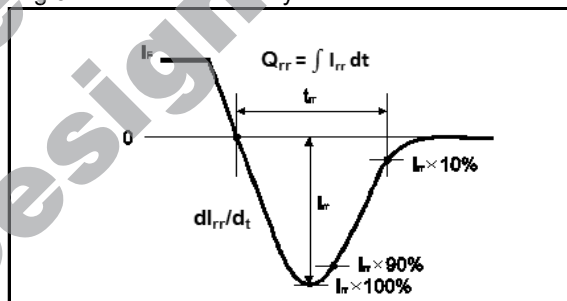


Fig.3-2 Reverse Recovery Waveform



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