SCT3120ALHR

Automotive Grade N-channel SiC power MOSFET

Datasheet

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

●**Outline**

TO-247N

●**Inner circuit**
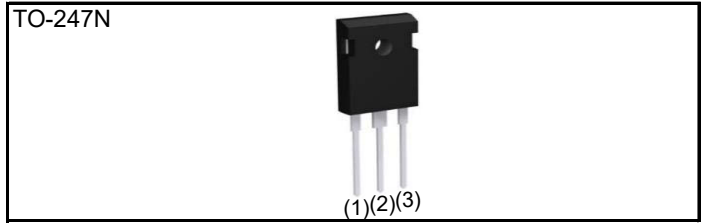
(2)
(1) Gate
(2) Drain
(3) Source
(1)
*1
(3)
*Body Diode

●**Features**

1) Qualified to AEC-Q101

2) Low on-resistance

3) Fast switching speed

4) Fast reverse recovery

5) Easy to parallel

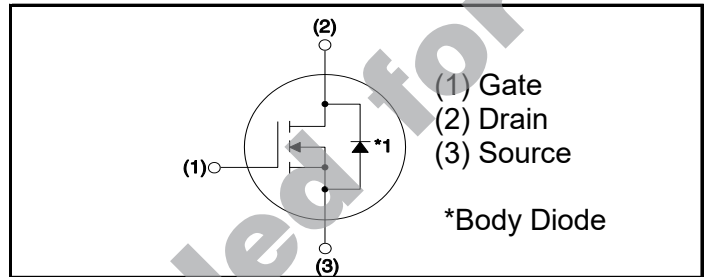6) Simple to drive

7) Pb-free lead plating ; RoHS compliant

●**Application**

・Automobile

・Switch mode power supplies

●**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°C)

Parameter		Symbol	Value	Unit
Drain - Source Voltage		V_{DSS}	650	V
Continuous Drain current	T_c = 25°C	I_D [*1]	21	A
	T_c = 100°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} < 300nsec)		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

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● **Electrical characteristics** (T_a = 25°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 1mA				V
		T_j = 25°C	650	-	-	
		T_j = -55°C	650	-	-	
Zero Gate voltage Drain current	I_{DSS}	V_{GS} = 0V, V_{DS} =650V				µA
		T_j = 25°C	-	1	10	
		T_j = 150°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				mΩ
		T_j = 25°C	-	120	156	
		T_j = 150°C	-	172	-	
Gate input resistance	R_G	f = 1MHz, open drain	-	18	-	Ω

● **Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	1.12	1.46	°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	
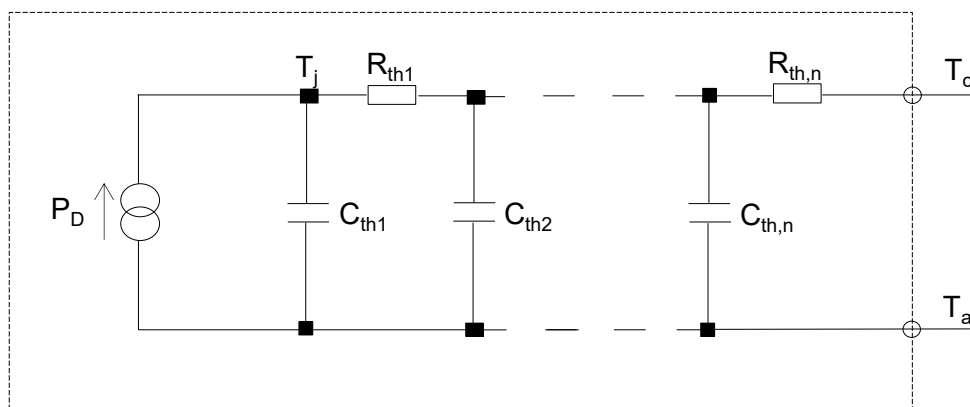
●**Electrical characteristics** (T_a = 25°C)

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 to 300V	-	70	-	pF
Total Gate charge	Q_g [*5]	V_{DS} = 300V	-	38	-	nC
Gate - Source charge	Q_{gs} [*5]	I_D = 6.7A 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	-	14	-	ns
Rise time	t_r [*5]	I_D = 6.7A	-	21	-	
Turn - off delay time	$t_{d(off)}$ [*5]	V_{GS} = 0V/+18V R_G = 0Ω	-	23	-	
Fall time	t_f [*5]	R_L = 45Ω 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 = 0Ω, L = 500µH	-	29	-	µJ
Turn - off switching loss	E_{off} [*5]	E_{on} includes diode reverse recovery L_σ = 50nH, C_σ = 200pF See Fig. 2-1, 2-2.	-	3	-	

● **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	-	-	21	A
Body diode direct current, pulsed	I_{SM} [*2]		-	-	52	A
Forward voltage	V_{SD} [*5]	V_{GS} = 0V, I_D = 6.7A	-	3.2	-	V
Reverse recovery time	t_{rr} [*5]	I_F = 6.7A V_R = 300V di/dt = 1100A/µs L_σ = 50nH, C_σ = 200pF See Fig. 3-1, 3-2.	-	13	-	ns
Reverse recovery charge	Q_{rr} [*5]		-	35	-	nC
Peak reverse recovery current	I_{rrm} [*5]		-	6	-	A

*1 Limited by maximum temperature allowed.

*2 $P_W \leq$ 10µs, Duty cycle $\leq$ 1%

*3 Example of acceptable V_{GS} waveform
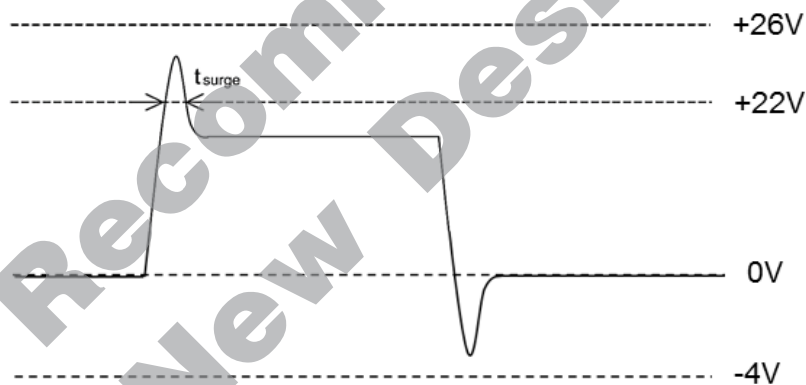
*4 Please be advised not to use SiC-MOSFETs with V_{GS} below 13V as doing so may cause thermal runaway.

*5 Pulsed

● **Electrical characteristic curves**

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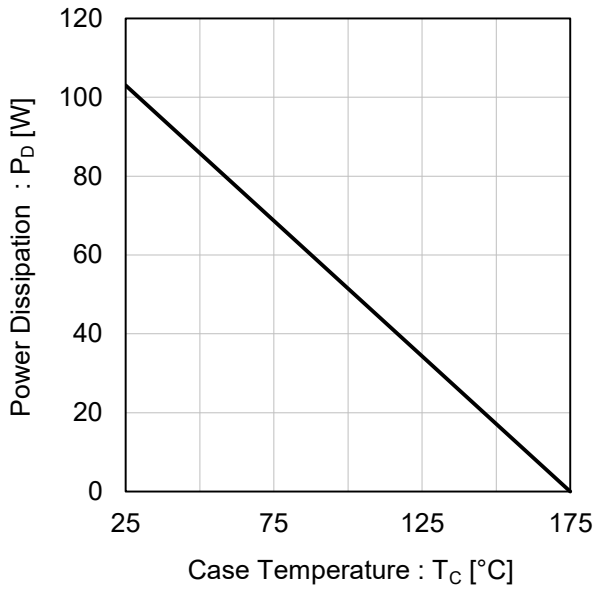
Fig.2 Maximum Safe Operating Area
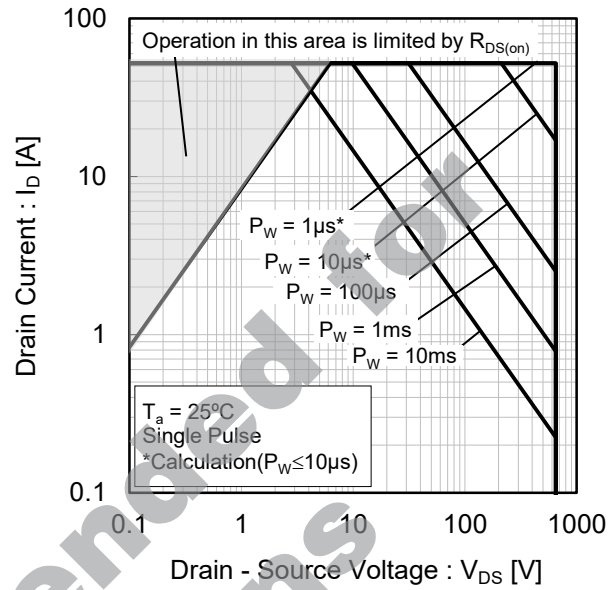
Fig.3 Typical Transient Thermal Resistance vs. Pulse Width

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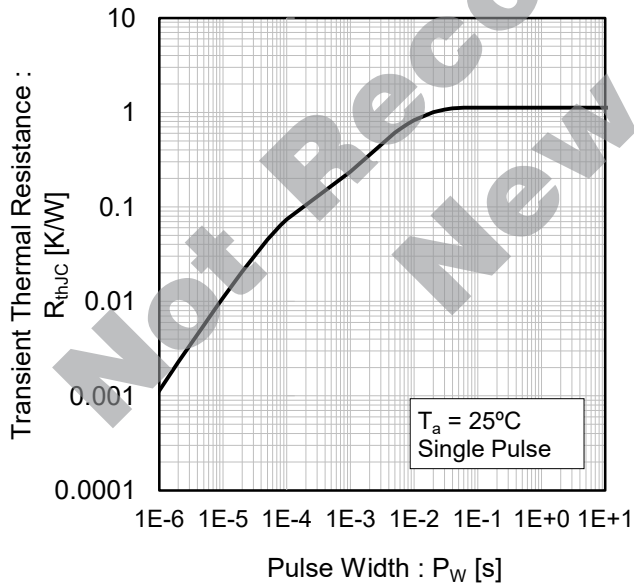
●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)
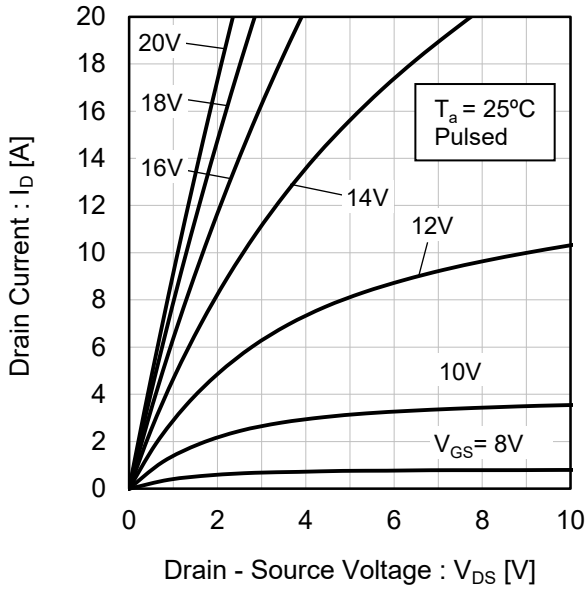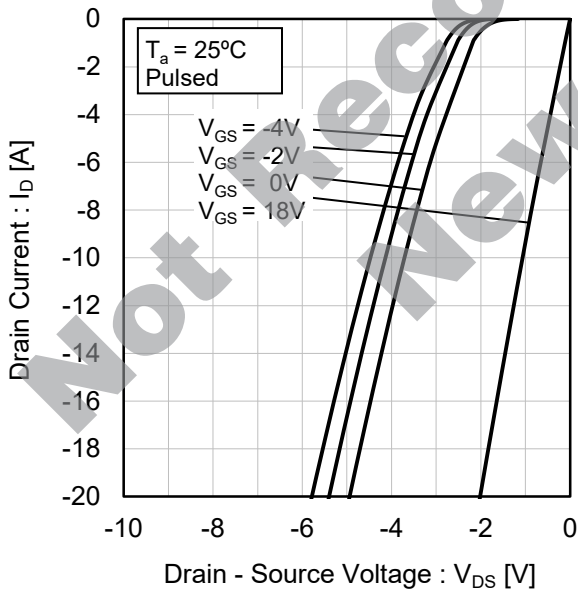

Fig.5 Typical Output Characteristics(II)
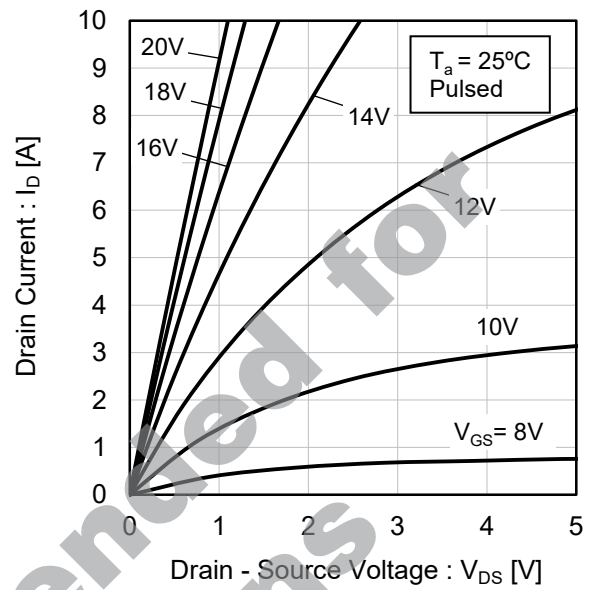
Fig.6 T$_j$ = 25ºC 3rd Quadrant Characteristics

●**Electrical characteristic curves**

Fig.7 T_j = 150ºC Typical Output
Characteristics(I)
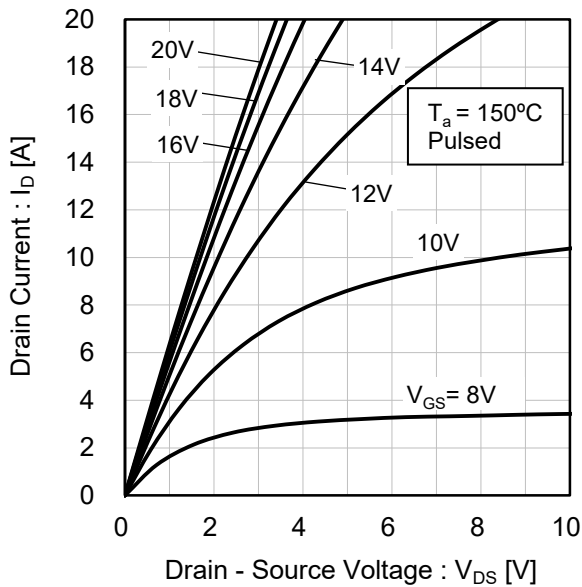
Fig.8 T_j = 150ºC Typical Output
Characteristics(II)
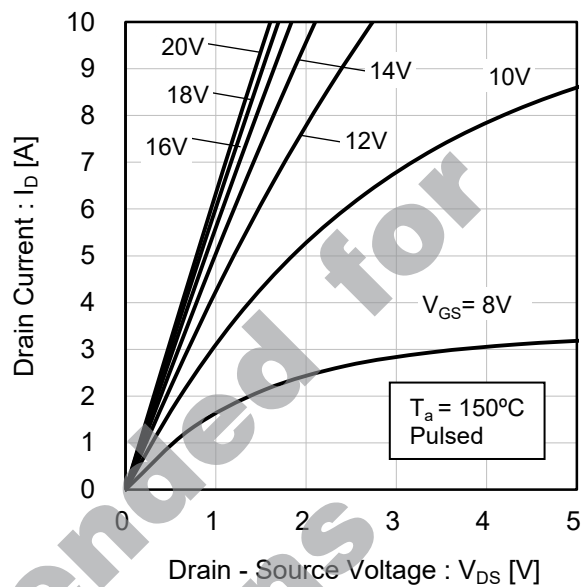
Fig.9 T_j = 150ºC 3rd Quadrant Characteristics
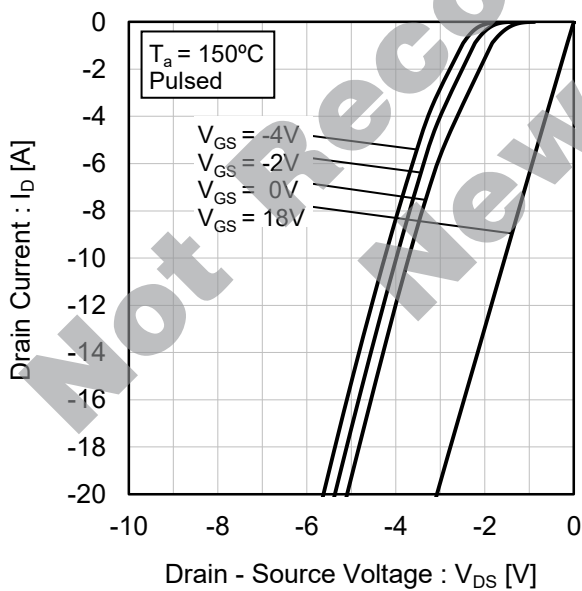
Fig.10 Body Diode Forward Voltage
vs. Gate - Source Voltage
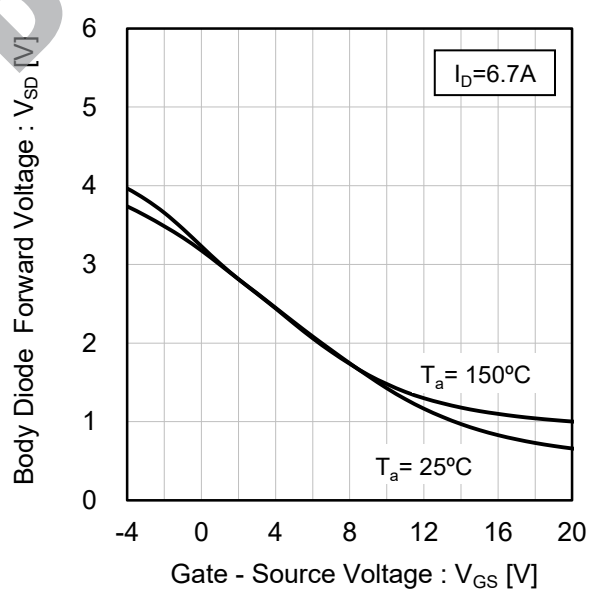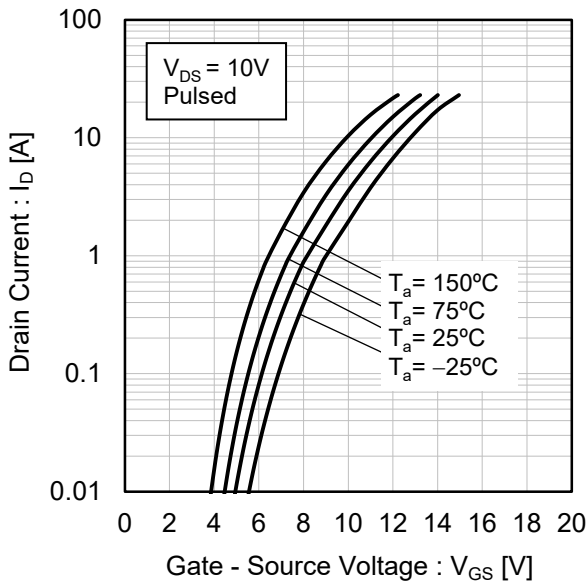
● **Electrical characteristic curves**

Fig.11 Typical Transfer Characteristics (I)

Fig.12 Typical Transfer Characteristics (II)
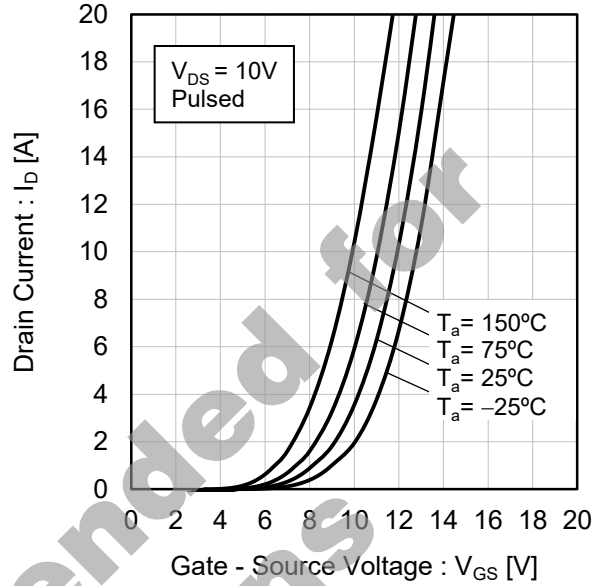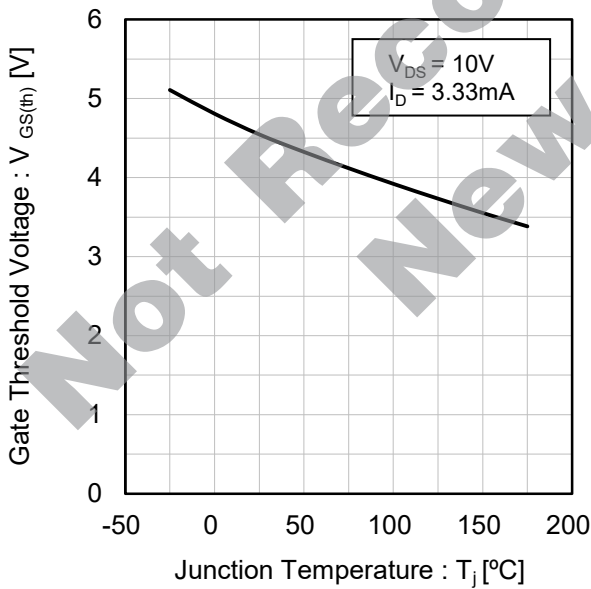

Fig.13 Gate Threshold Voltage vs. Junction Temperature

Fig.14 Transconductance vs. Drain Current

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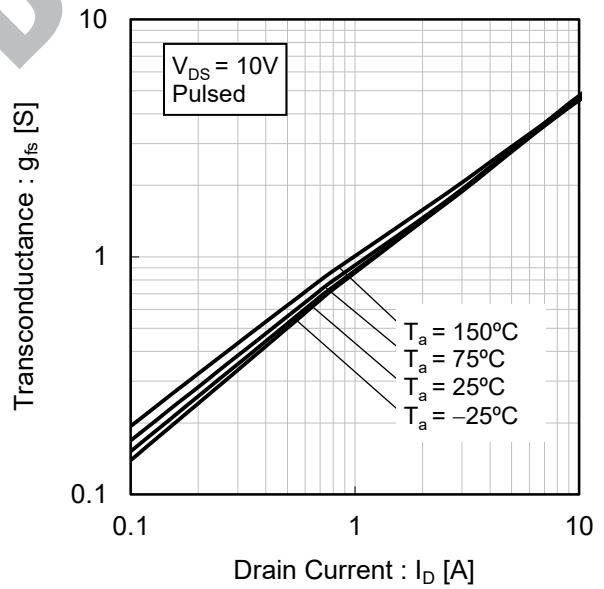
●**Electrical characteristic curves**

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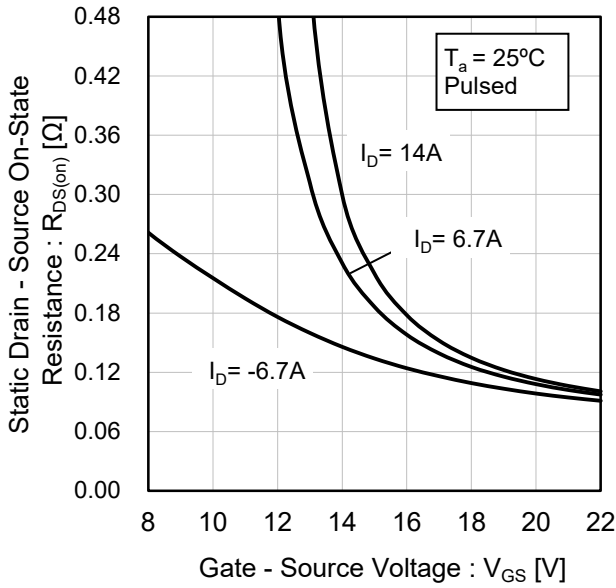Resistance vs. Gate - Source Voltage

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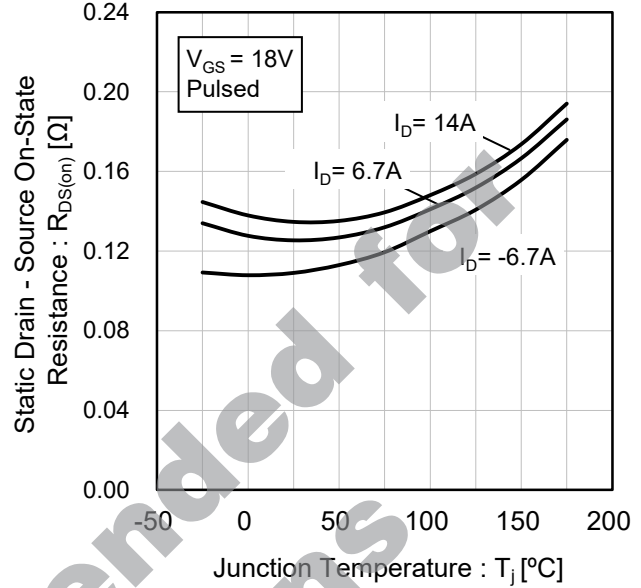Resistance vs. Junction Temperature

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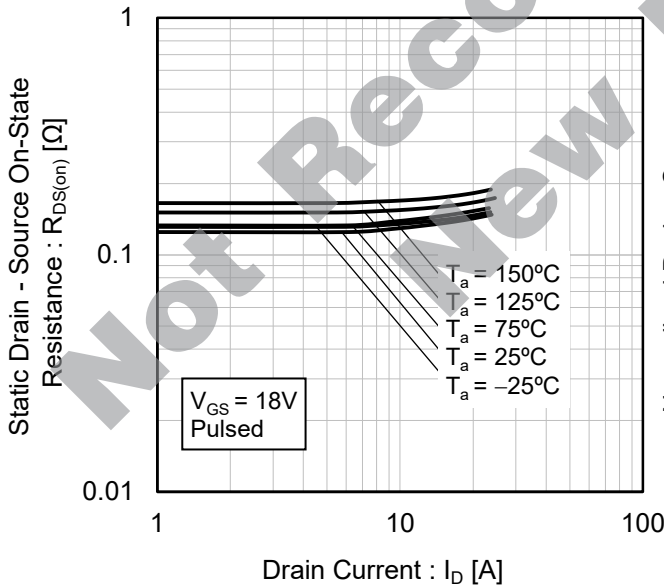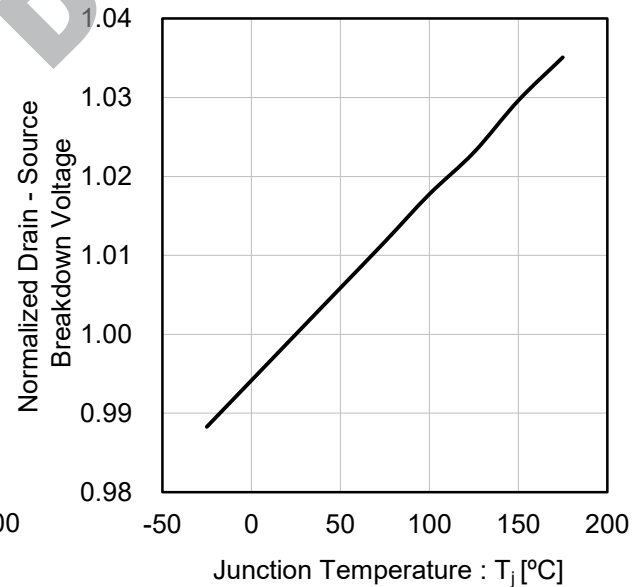Resistance vs. Drain Current

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

● **Electrical characteristic curves**

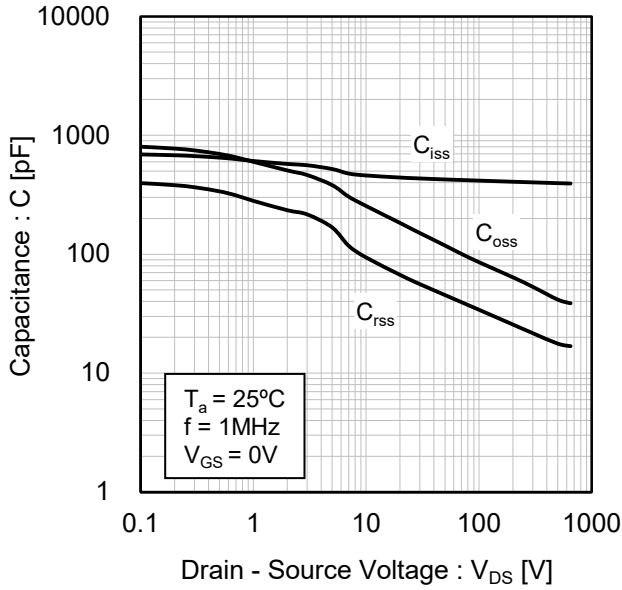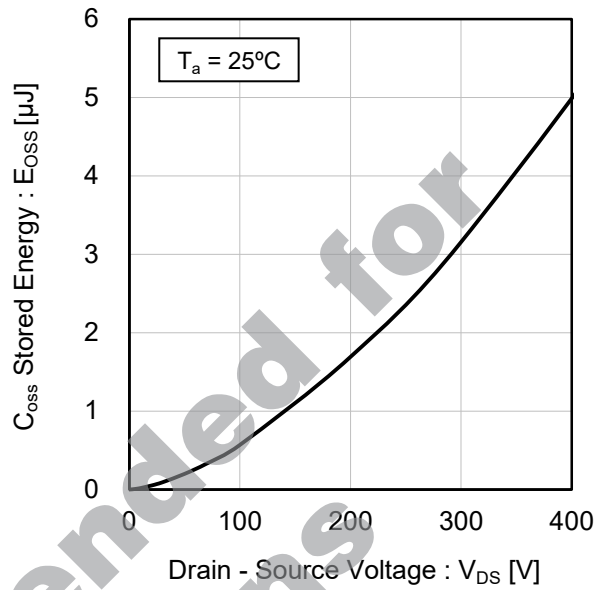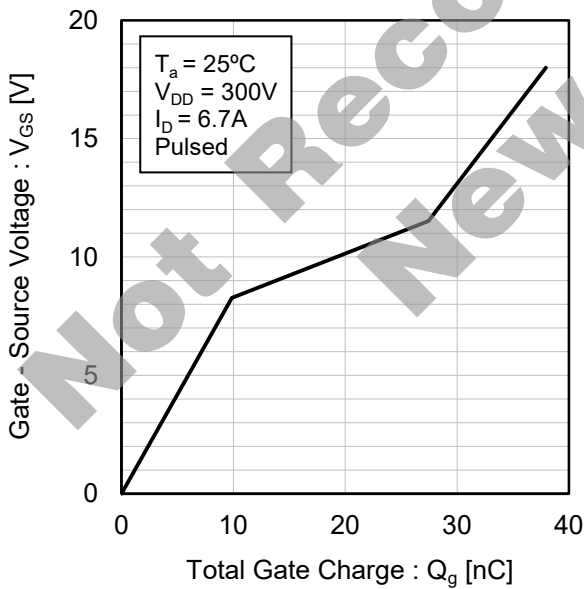Fig.19 Typical Capacitance
vs. Drain - Source Voltage

$T_a = 25°C$
$f = 1MHz$
$V_{GS} = 0V$

Fig.20 C_{oss} Stored Energy

$T_a = 25°C$

Fig.21 Dynamic Input Characteristics

$T_a = 25°C$
$V_{DD} = 300V$
$I_D = 6.7A$
Pulsed

*Gate Charge Waveform

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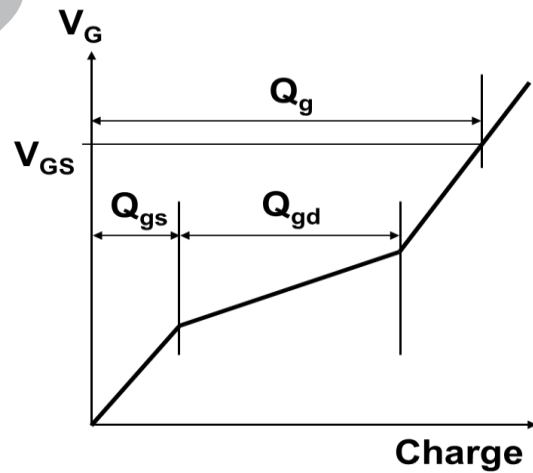
●**Electrical characteristic curves**
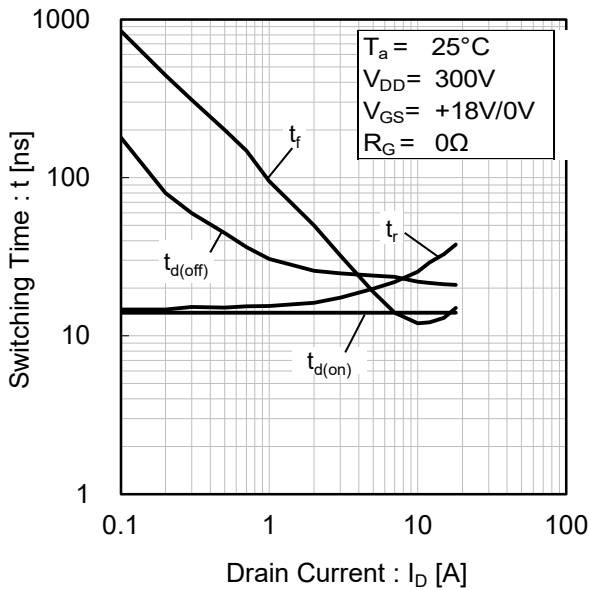
Fig.19 Typical Switching Time
vs. Drain Current

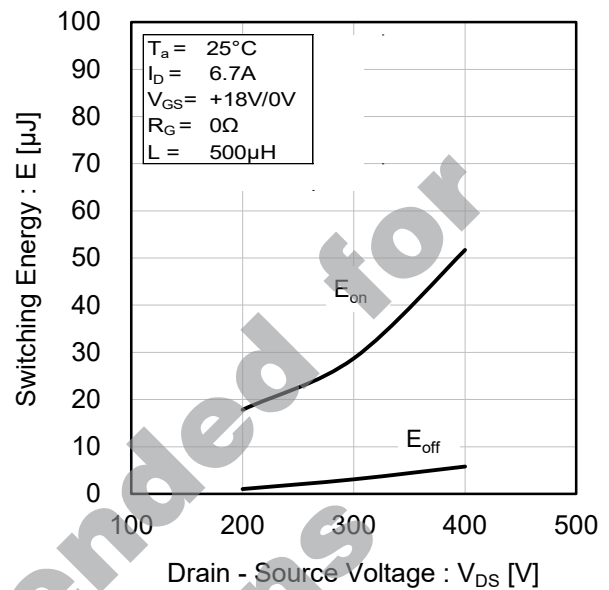Fig.20 Typical Switching Loss
vs. Drain - Source Voltage

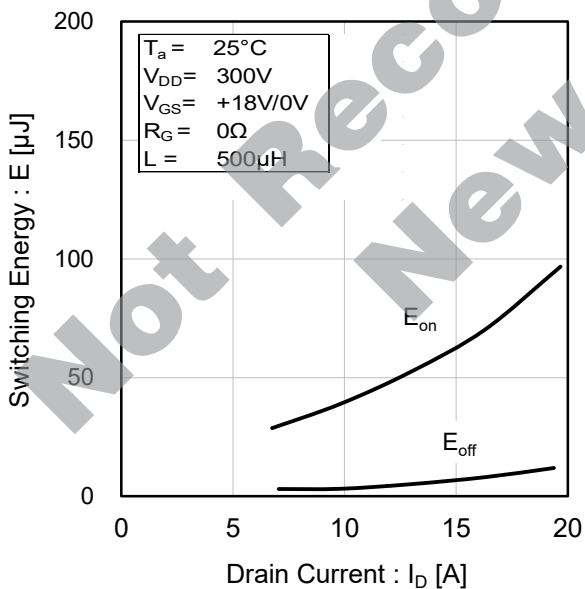Fig.21 Typical Switching Loss
vs. Drain Current

Fig.22 Typical Switching Loss
vs. External Gate Resistance

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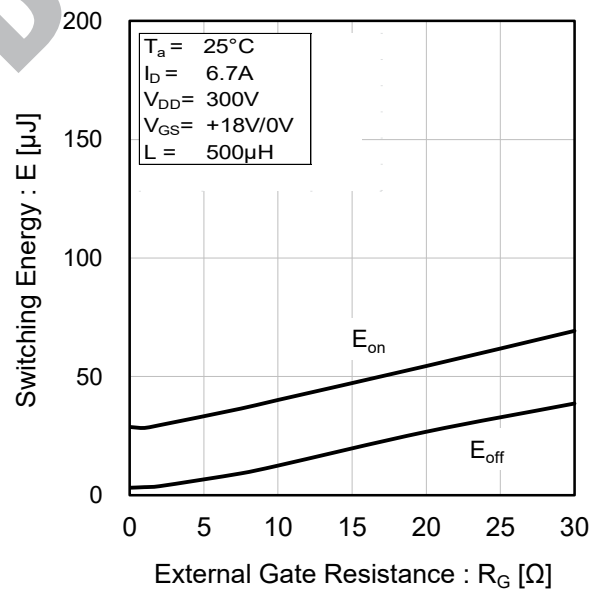
●Measurement circuits and waveforms

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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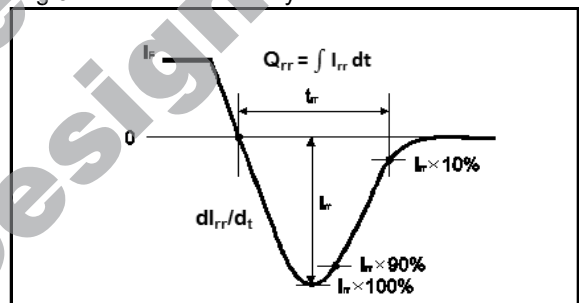
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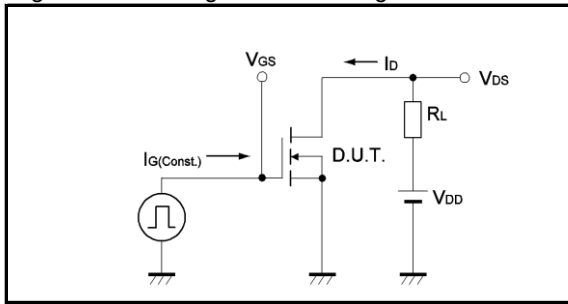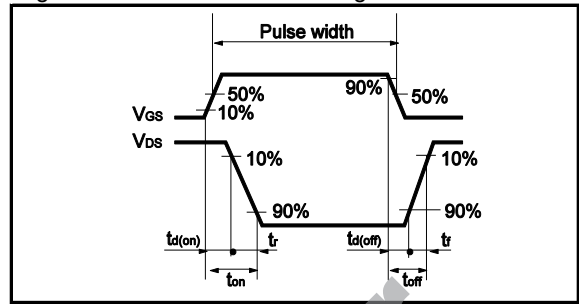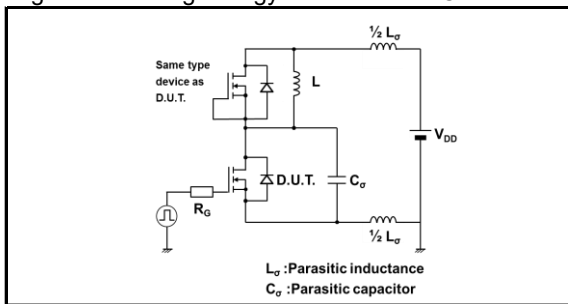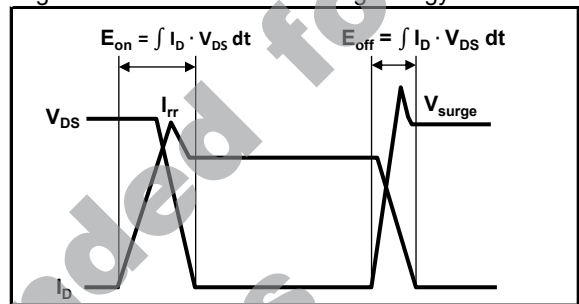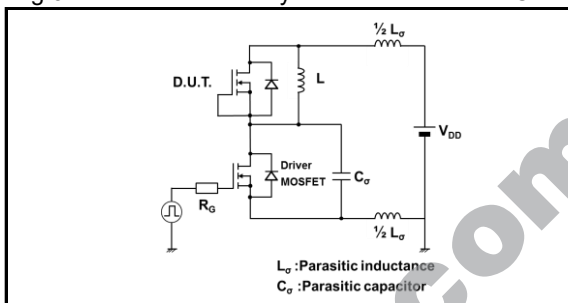1) The information contained herein is subject to change without notice.

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