

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

●Outline

TO-247N



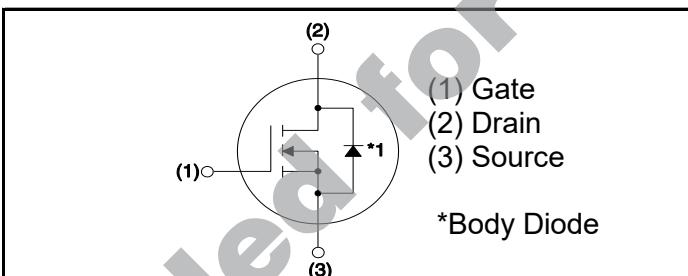
●Features

- 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

●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	I_D^{*1}	21	A
	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	°C
Range of storage temperature	T_{stg}	-55 to +175	°C

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

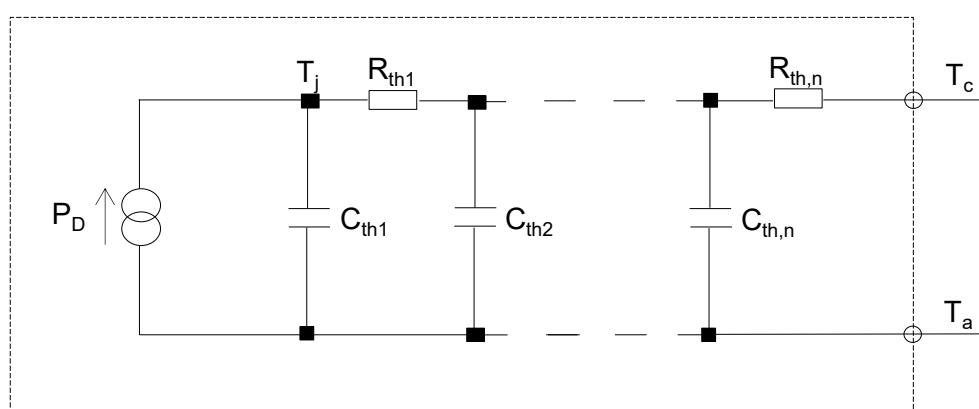
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0\text{V}$, $I_D = 1\text{mA}$ $T_j = 25^\circ\text{C}$ $T_j = -55^\circ\text{C}$	650	-	-	V
Zero Gate voltage Drain current	I_{DSS}	$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 650\text{V}$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	-	1	10	μA
Gate - Source leakage current	$I_{\text{GSS}+}$	$V_{\text{GS}} = +22\text{V}$, $V_{\text{DS}} = 0\text{V}$	-	-	100	nA
Gate - Source leakage current	$I_{\text{GSS}-}$	$V_{\text{GS}} = -4\text{V}$, $V_{\text{DS}} = 0\text{V}$	-	-	-100	nA
Gate threshold voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}} = 10\text{V}$, $I_D = 3.33\text{mA}$	2.7	-	5.6	V
Static Drain - Source on - state resistance	$R_{\text{DS}(\text{on})}^{*5}$	$V_{\text{GS}} = 18\text{V}$, $I_D = 6.7\text{A}$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	-	120	156	$\text{m}\Omega$
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	$^\circ\text{C}/\text{W}$

●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
$R_{\text{th}1}$	1.11E-01	K/W	$C_{\text{th}1}$	8.73E-04	Ws/K
$R_{\text{th}2}$	7.09E-01		$C_{\text{th}2}$	5.10E-03	
$R_{\text{th}3}$	3.01E-01		$C_{\text{th}3}$	2.94E-02	



●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}	$V_{GS} = 0\text{V}$ $V_{DS} = 500\text{V}$ $f = 1\text{MHz}$	-	460	-	pF
Output capacitance	C_{oss}		-	35	-	
Reverse transfer capacitance	C_{rss}		-	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
Total Gate charge	Q_g^{*5}	$V_{DS} = 300\text{V}$ $I_D = 6.7\text{A}$ $V_{GS} = 18\text{V}$	-	38	-	nC
Gate - Source charge	Q_{gs}^{*5}		-	10	-	
Gate - Drain charge	Q_{gd}^{*5}		-	18	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DS} = 300\text{V}$ $I_D = 6.7\text{A}$ $V_{GS} = 0\text{V/}+18\text{V}$	-	14	-	ns
Rise time	t_r^{*5}		-	21	-	
Turn - off delay time	$t_{d(off)}^{*5}$		-	23	-	
Fall time	t_f^{*5}	$R_G = 0\Omega$ $R_L = 45\Omega$ $\text{See Fig. 1-1, 1-2.}$	-	14	-	μJ
Turn - on switching loss	E_{on}^{*5}		-	29	-	
Turn - off switching loss	E_{off}^{*5}	E_{on} includes diode reverse recovery $L_\sigma = 50\text{nH}$, $C_\sigma = 200\text{pF}$ $\text{See Fig. 2-1, 2-2.}$	-	3	-	

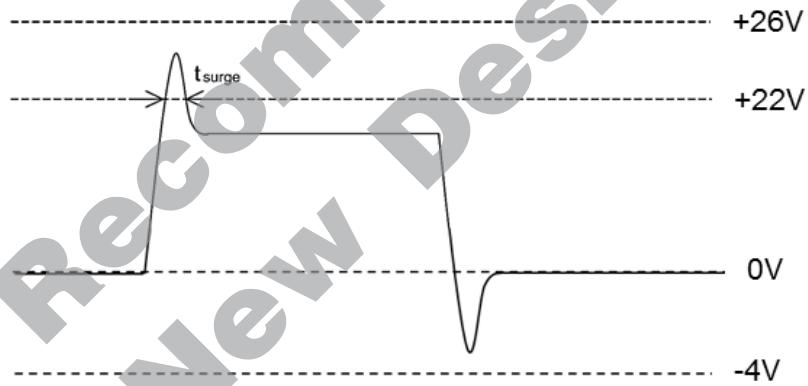
●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

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_{rrm} ^{*5}		-	6	-	A
See Fig. 3-1, 3-2.						

*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

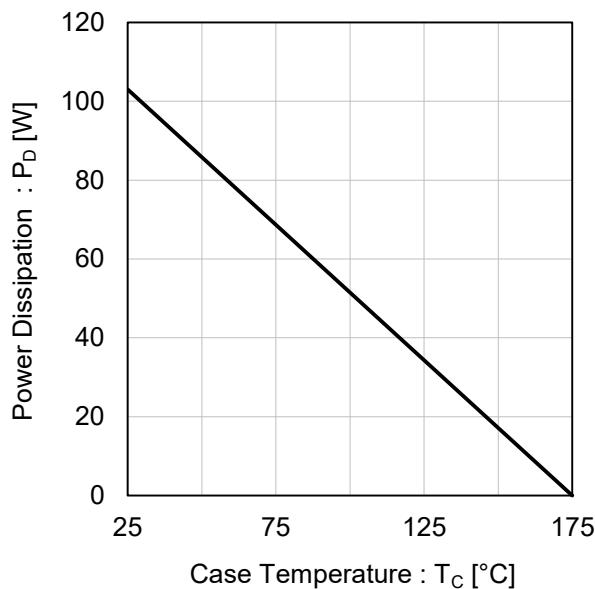


Fig.2 Maximum Safe Operating Area

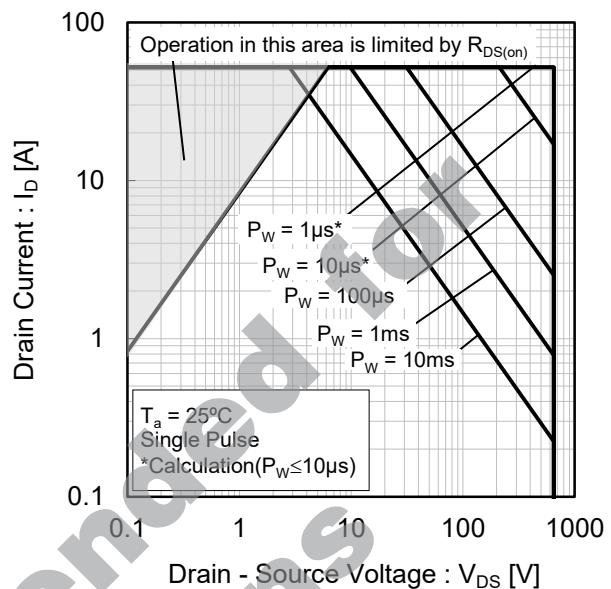
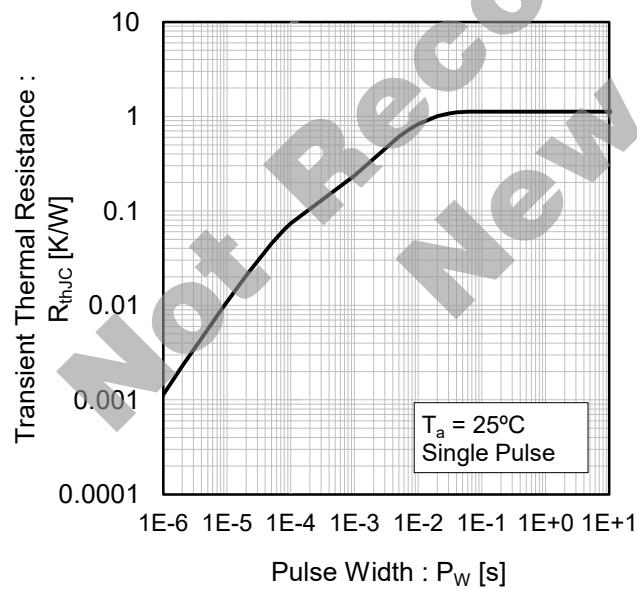


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

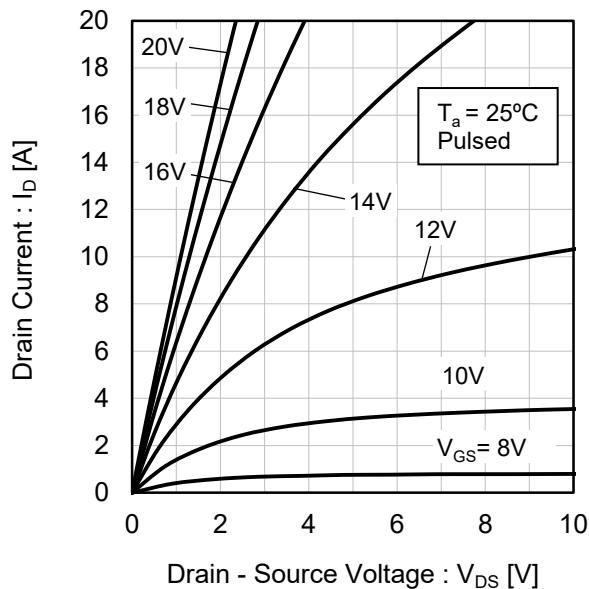
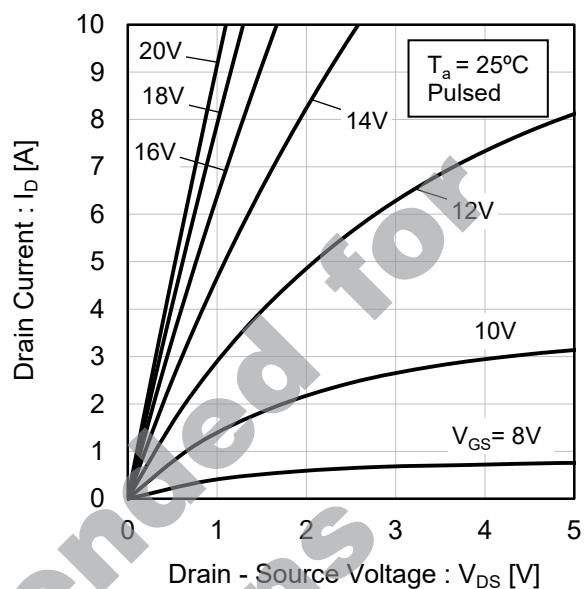
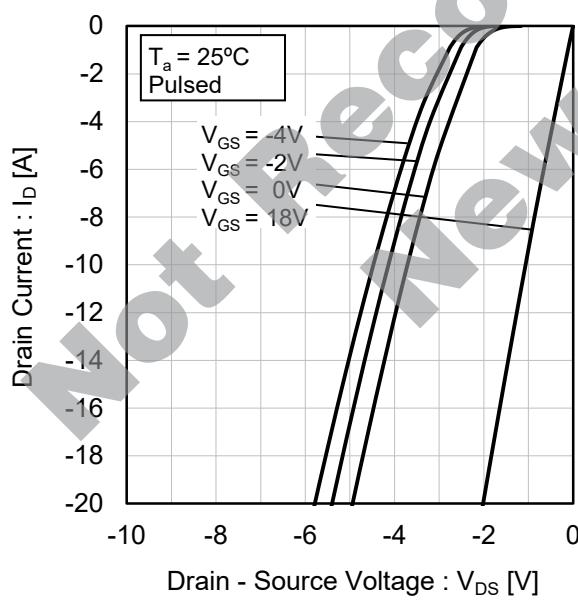


Fig.5 Typical Output Characteristics(II)

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)

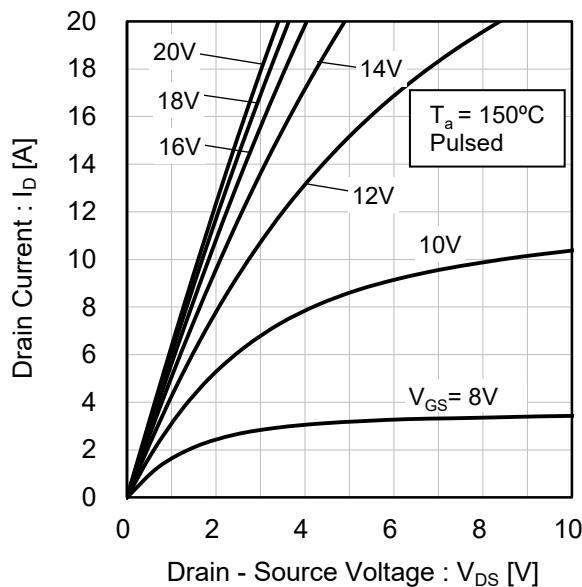


Fig.8 $T_j = 150^\circ\text{C}$ Typical Output Characteristics(II)

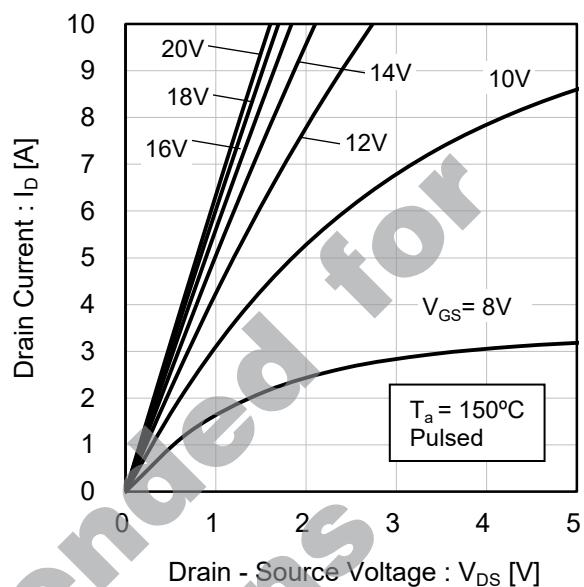


Fig.9 $T_j = 150^\circ\text{C}$ 3rd Quadrant Characteristics

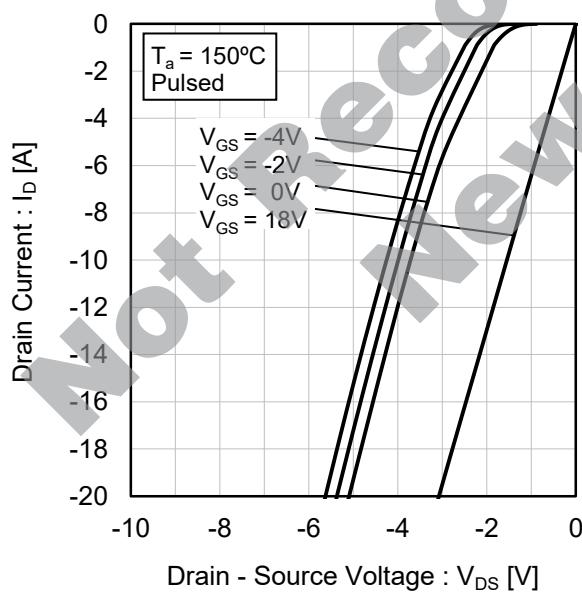
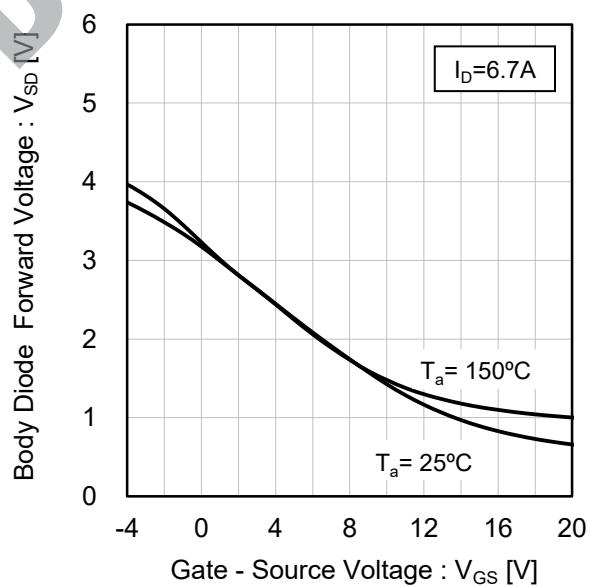


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

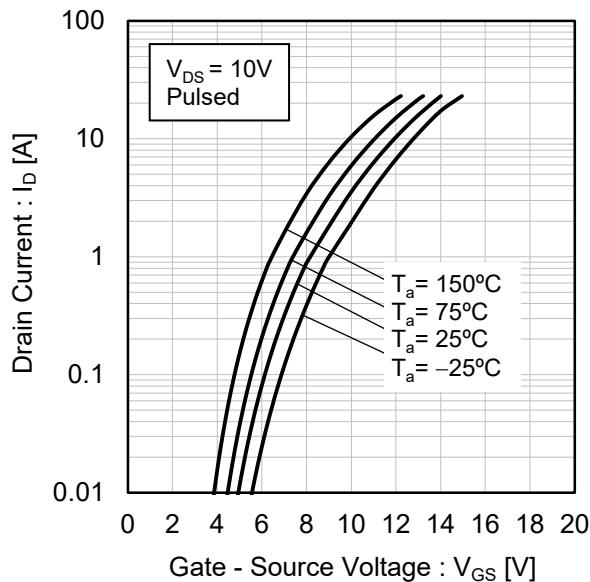


Fig.12 Typical Transfer Characteristics (II)

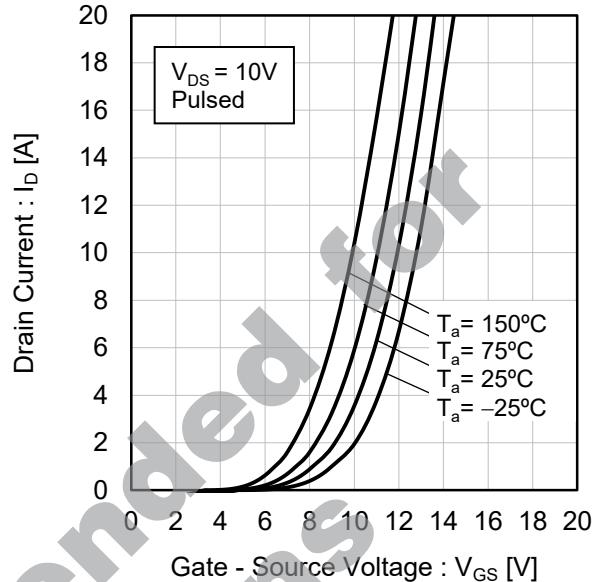


Fig.13 Gate Threshold Voltage vs. Junction Temperature

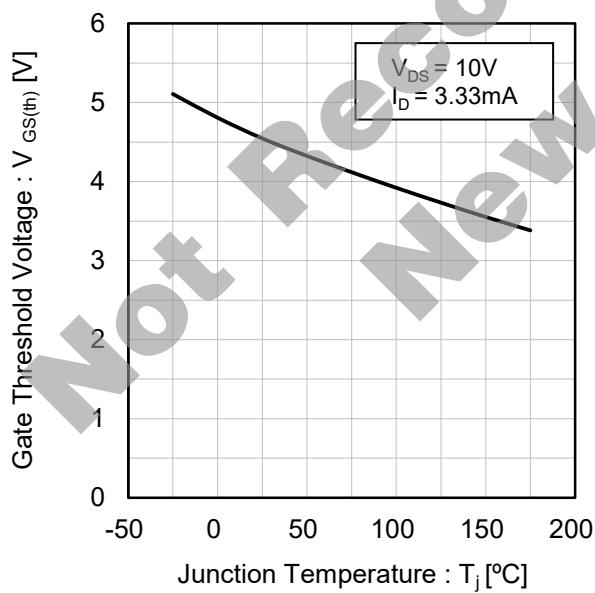
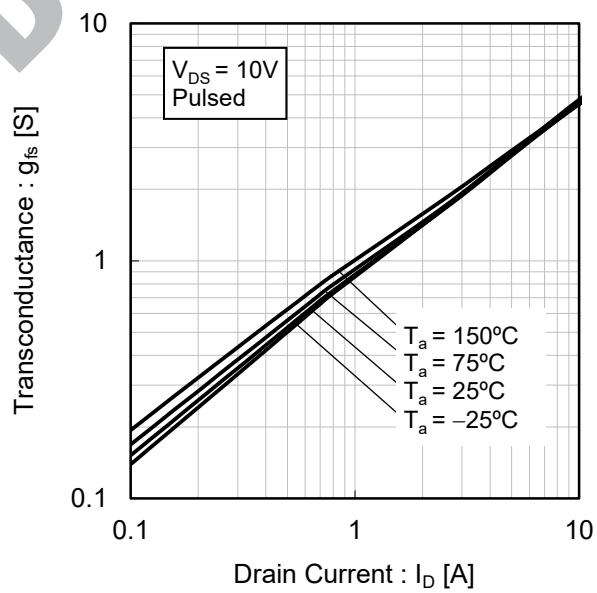


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

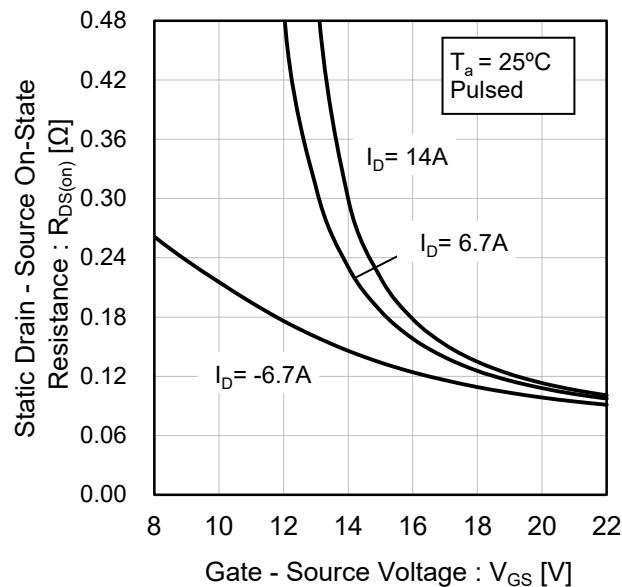


Fig.16 Static Drain - Source On - State
Resistance vs. Junction Temperature

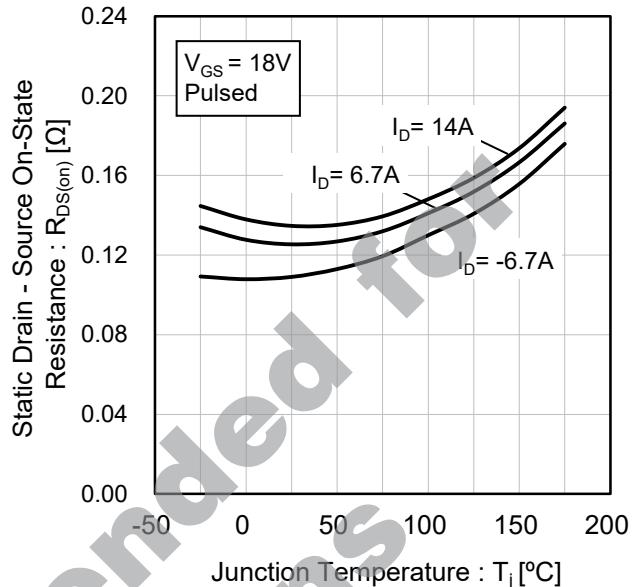


Fig.17 Static Drain - Source On - State
Resistance vs. Drain Current

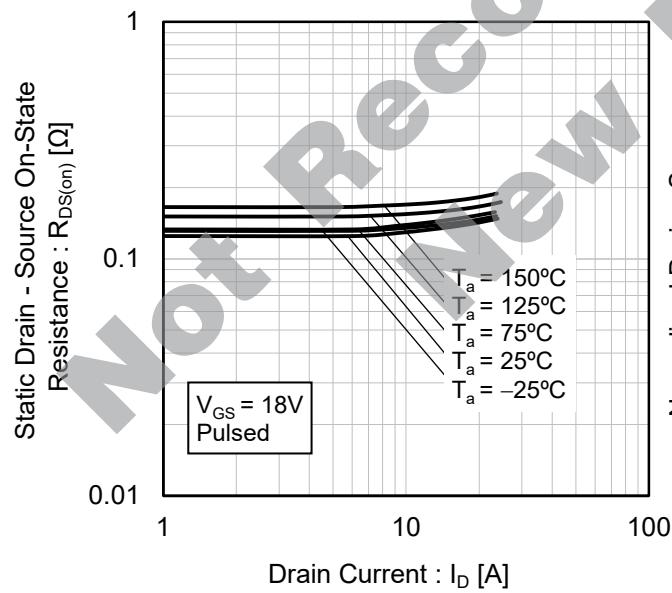
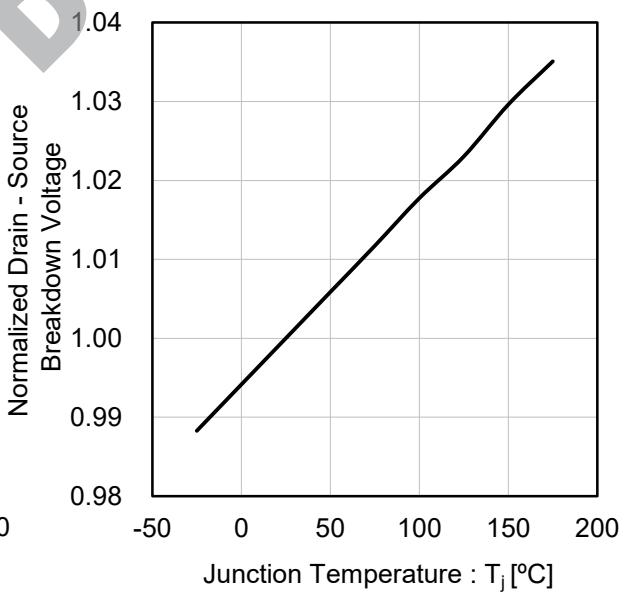


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

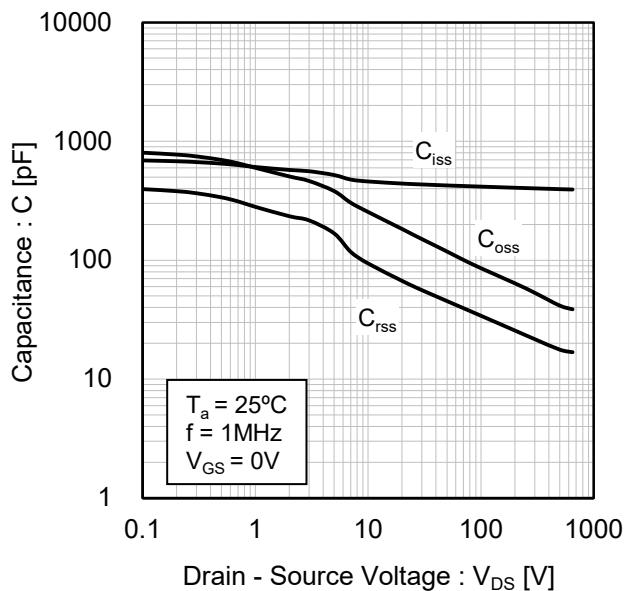


Fig.20 C_{oss} Stored Energy

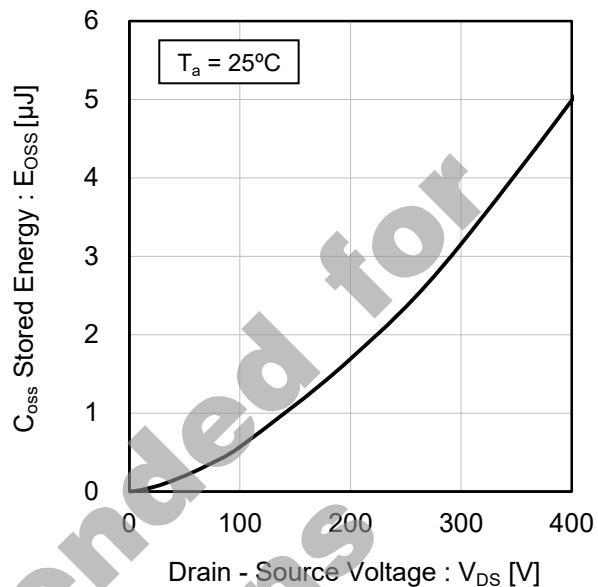
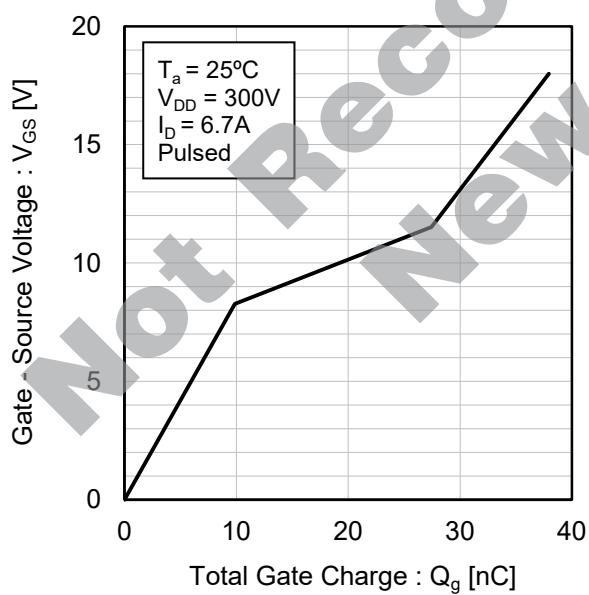
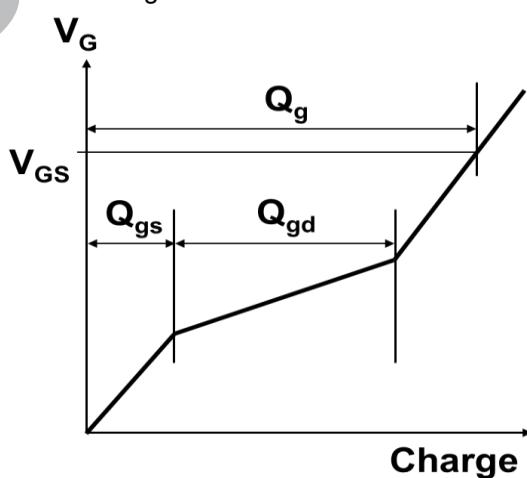


Fig.21 Dynamic Input Characteristics



*Gate Charge Waveform



●Electrical characteristic curves

Fig.19 Typical Switching Time vs. Drain Current

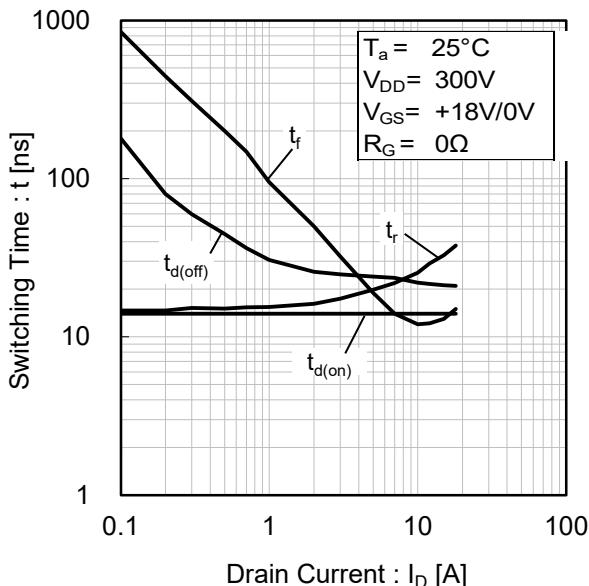


Fig.20 Typical Switching Loss vs. Drain - Source Voltage

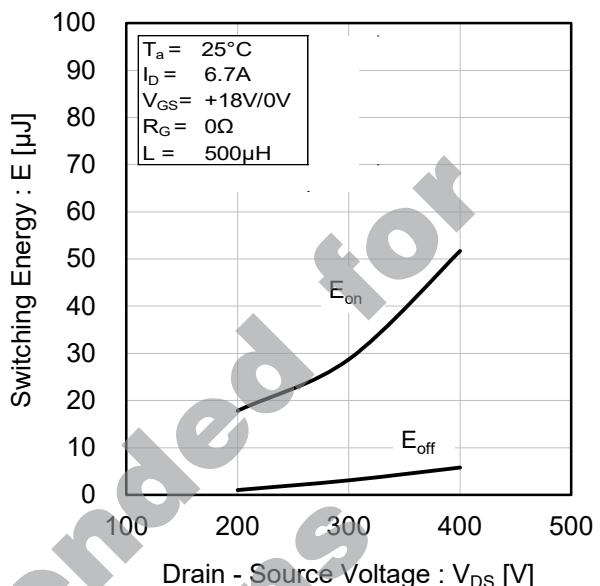


Fig.21 Typical Switching Loss vs. Drain Current

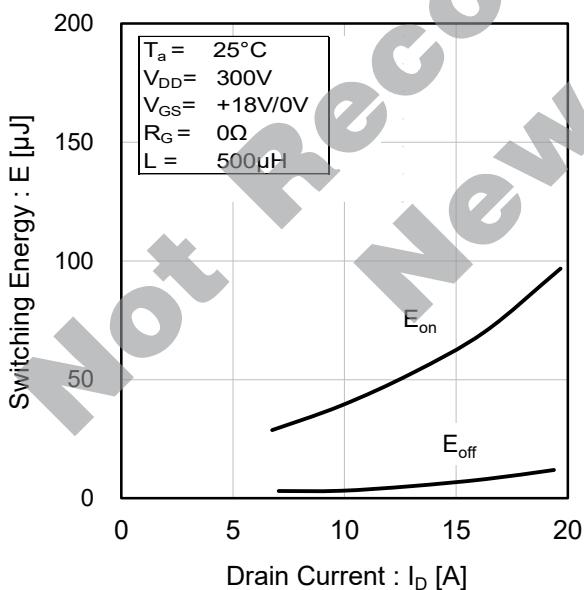
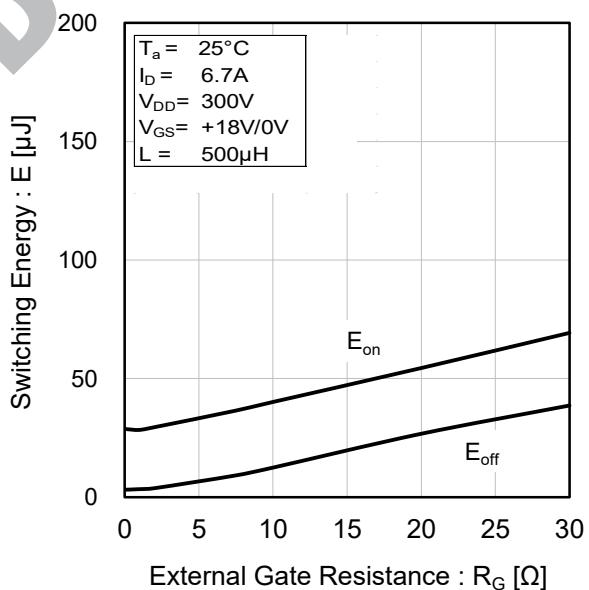


Fig.22 Typical Switching Loss vs. External Gate Resistance



●Measurement circuits and waveforms

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

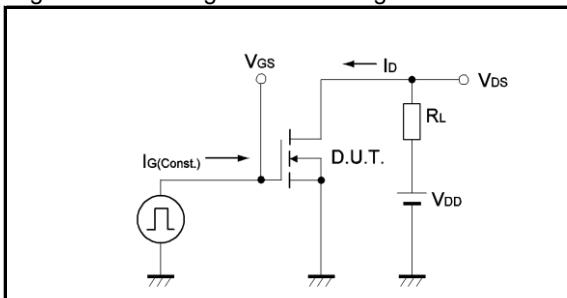


Fig.1-2 Waveforms for Switching Time

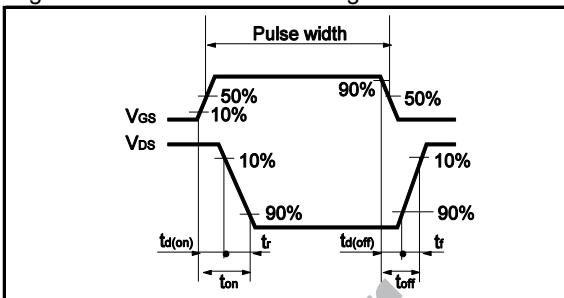


Fig.2-1 Switching Energy Measurement Circuit

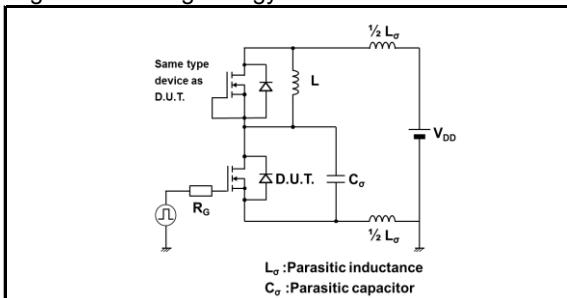


Fig.2-2 Waveforms for Switching Energy Loss

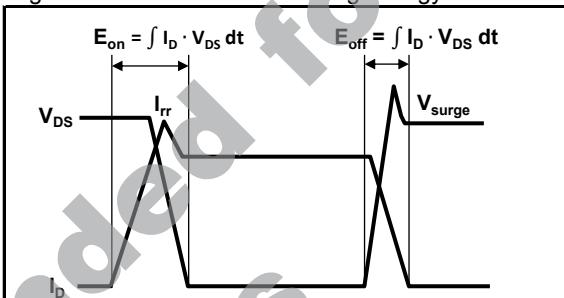


Fig.3-1 Reverse Recovery Time Measurement Circuit

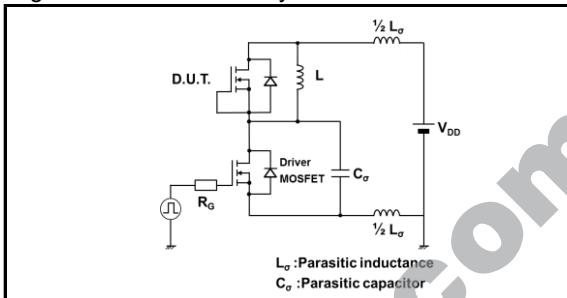
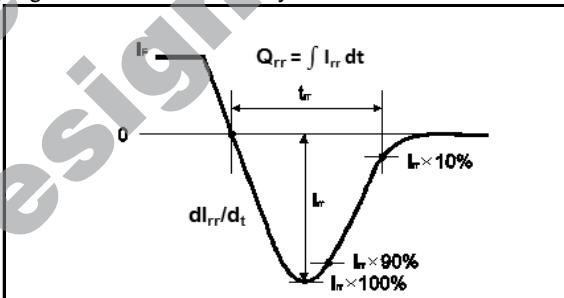


Fig.3-2 Reverse Recovery Waveform



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