

$V_{DSS}$	650V
$R_{DS(on)}$ (Typ.)	22mΩ
$I_D^{*1}$	93A
$P_D$	339W

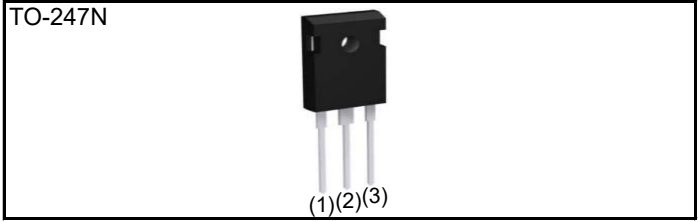
### ●Features

- 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

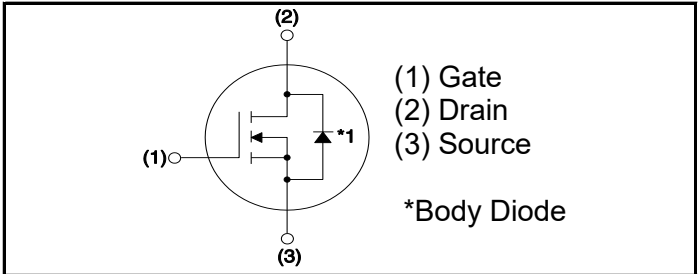
### ●Application

- Automobile
- Switch mode power supplies

### ●Outline



### ●Inner circuit



### ●Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Taping code	C11
	Marking	SCT3022AL

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

Parameter	Symbol	Value	Unit
Drain - Source Voltage	$V_{DSS}$	650	V
Continuous Drain current	$T_c = 25^\circ\text{C}$	$I_D^{*1}$	93 A
	$T_c = 100^\circ\text{C}$	$I_D^{*1}$	65 A
Pulsed Drain current	$I_{D,pulse}^{*2}$	232	A
Gate - Source voltage (DC)	$V_{GSS}$	-4 to +22	V
Gate - Source surge voltage ( $t_{surge} < 300\text{ns}$ )	$V_{GSS,surge}^{*3}$	-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<sub>a</sub> = 25°C)

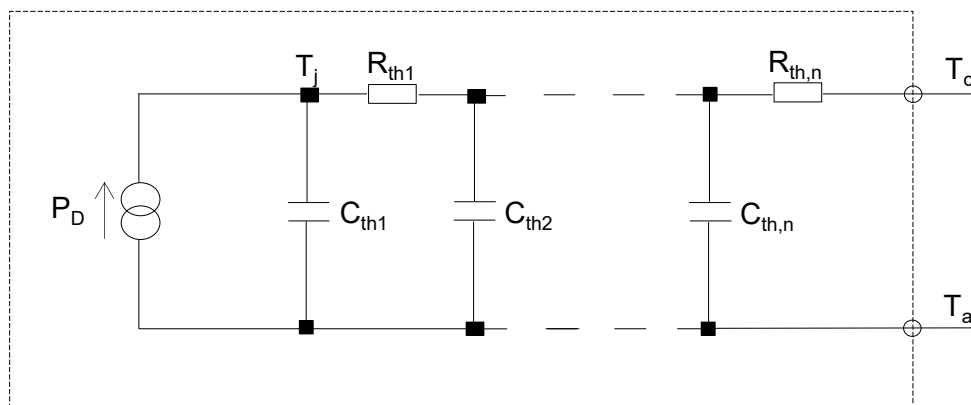
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA T <sub>j</sub> = 25°C T <sub>j</sub> = -55°C	650 650	- -	- -	V
Zero Gate voltage Drain current	I <sub>DSS</sub>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 650V T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C	- -	1 2	10 -	μA
Gate - Source leakage current	I <sub>GSS+</sub>	V <sub>GS</sub> = +22V, V <sub>DS</sub> = 0V	-	-	100	nA
Gate - Source leakage current	I <sub>GSS-</sub>	V <sub>GS</sub> = -4V, V <sub>DS</sub> = 0V	-	-	-100	nA
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = 10V, I <sub>D</sub> = 18.2mA	2.7	-	5.6	V
Static Drain - Source on - state resistance	R <sub>DS(on)</sub> <sup>*5</sup>	V <sub>GS</sub> = 18V, I <sub>D</sub> = 36A T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C	- -	22 32	28.6 -	mΩ
Gate input resistance	R <sub>G</sub>	f = 1MHz, open drain	-	5	-	Ω

### ●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R <sub>thJC</sub>	-	0.34	0.44	°C/W

### ●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R <sub>th1</sub>	4.83E-03	K/W	C <sub>th1</sub>	1.40E-03	Ws/K
R <sub>th2</sub>	1.73E-01		C <sub>th2</sub>	1.13E-02	
R <sub>th3</sub>	1.63E-01		C <sub>th3</sub>	6.02E-02	



●Electrical characteristics (T<sub>a</sub> = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	$g_{fs}^{*5}$	$V_{DS} = 10V, I_D = 36A$	-	12.2	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$	-	2208	-	pF
Output capacitance	$C_{oss}$	$V_{DS} = 500V$	-	118	-	
Reverse transfer capacitance	$C_{rss}$	$f = 1MHz$	-	52	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0V$ $V_{DS} = 0V \text{ to } 300V$	-	303	-	pF
Total Gate charge	$Q_g^{*5}$	$V_{DS} = 300V$ $I_D = 36A$	-	133	-	nC
Gate - Source charge	$Q_{gs}^{*5}$	$V_{GS} = 18V$	-	22	-	
Gate - Drain charge	$Q_{gd}^{*5}$	See Fig. 1-1.	-	69	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DS} = 300V$ $I_D = 18A$	-	25	-	ns
Rise time	$t_r^{*5}$	$V_{GS} = 0V/+18V$	-	53	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_G = 0\Omega$ $R_L = 17\Omega$	-	61	-	
Fall time	$t_f^{*5}$	See Fig. 1-1, 1-2.	-	35	-	
Turn - on switching loss	$E_{on}^{*5}$	$V_{DS} = 300V$ $V_{GS}=0V/18V, I_D = 36A$ $R_G = 0\Omega, L = 100\mu H$	-	252	-	$\mu J$
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.	-	201	-	

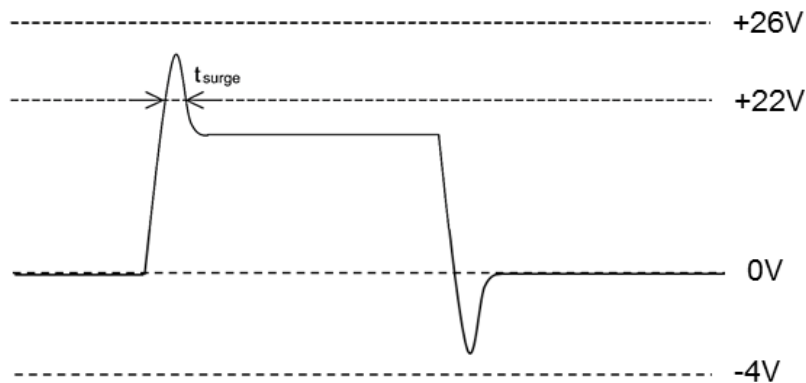
**●Body diode electrical characteristics (Source-Drain) ( $T_a = 25^\circ\text{C}$ )**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Body diode continuous, forward current	$I_S$ *1	$T_c = 25^\circ\text{C}$	-	-	93	A
Body diode direct current, pulsed	$I_{SM}$ *2		-	-	232	A
Forward voltage	$V_{SD}$ *5	$V_{GS} = 0\text{V}, I_D = 36\text{A}$	-	3.2	-	V
Reverse recovery time	$t_{rr}$ *5	$I_F = 36\text{A}$ $V_R = 300\text{V}$ $di/dt = 1100\text{A}/\mu\text{s}$	-	27	-	ns
Reverse recovery charge	$Q_{rr}$ *5		-	146	-	nC
Peak reverse recovery current	$I_{rrm}$ *5		$L_\sigma = 50\text{nH}, C_\sigma = 200\text{pF}$ See Fig. 3-1, 3-2.	-	10	-

\*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

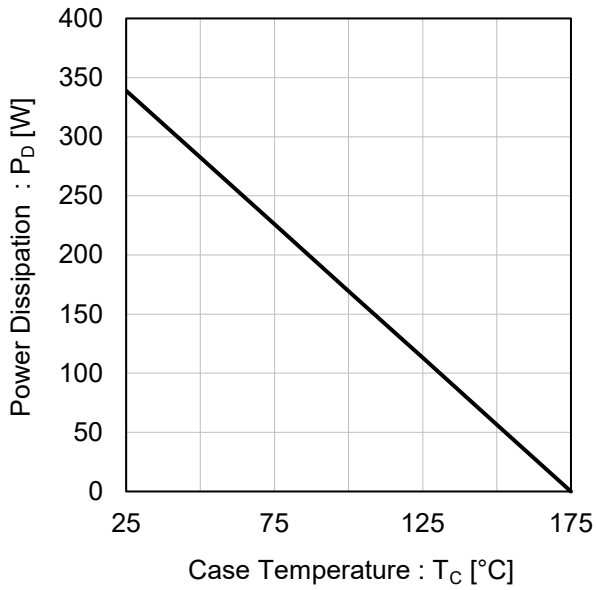


Fig.2 Maximum Safe Operating Area

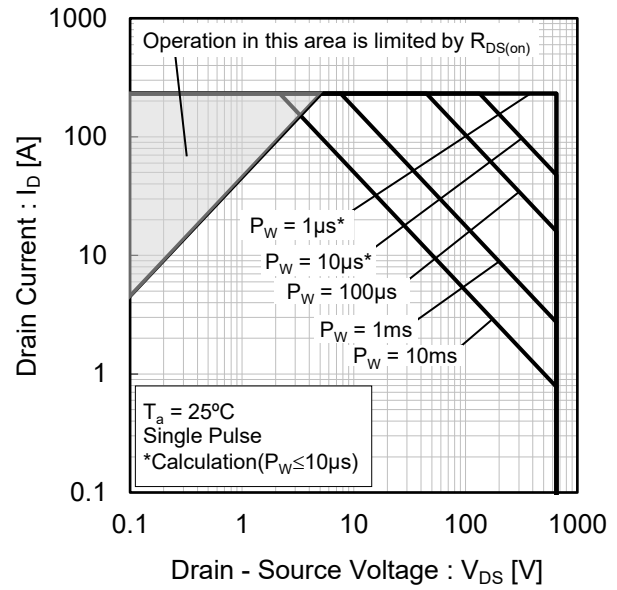
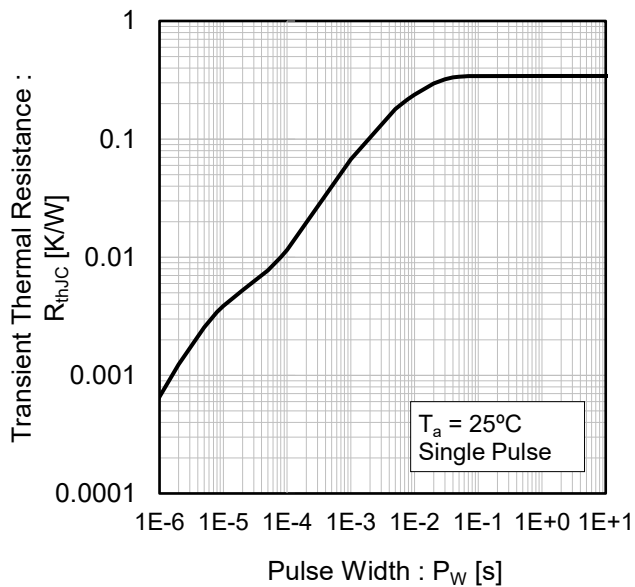


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

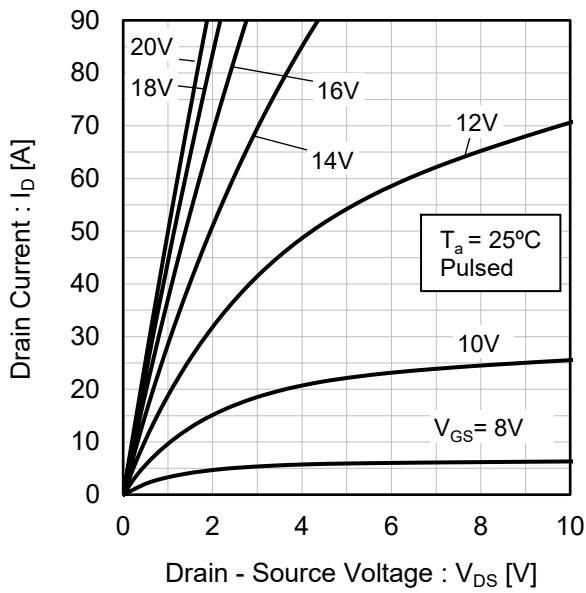


Fig.5 Typical Output Characteristics(II)

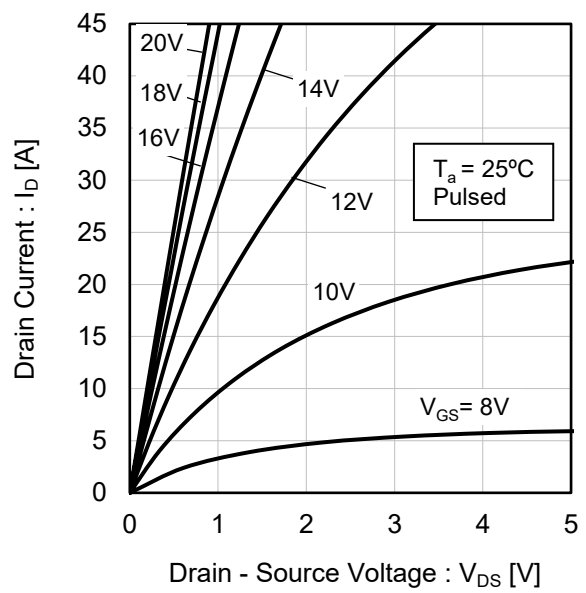
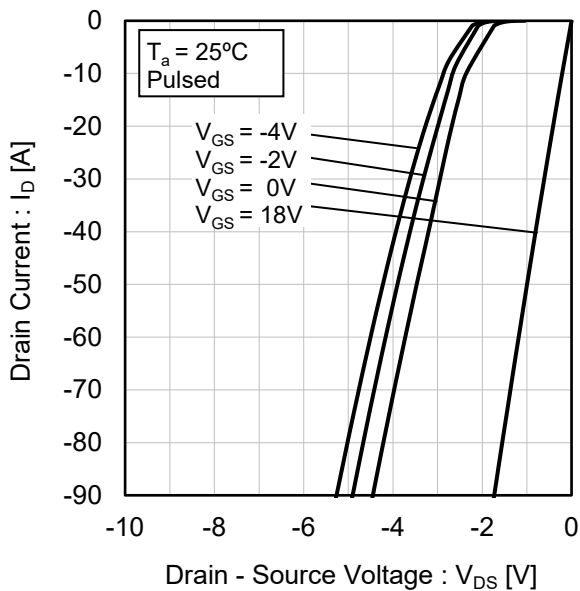


Fig.6  $T_j = 25^\circ\text{C}$  3rd Quadrant Characteristics



●Electrical characteristic curves

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

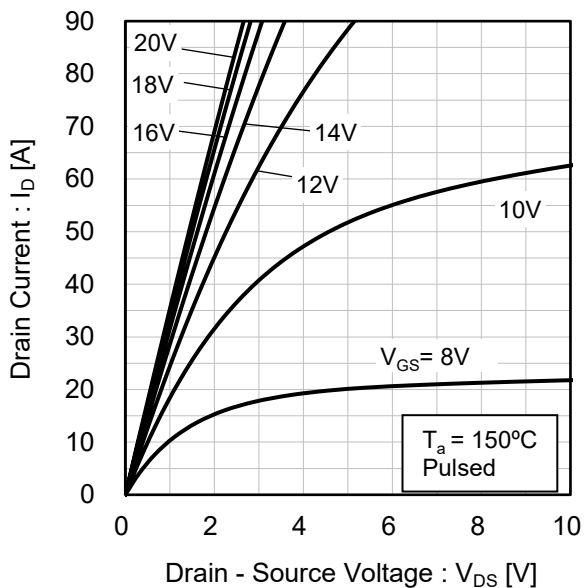


Fig.8  $T_j = 150^\circ\text{C}$  Typical Output Characteristics(II)

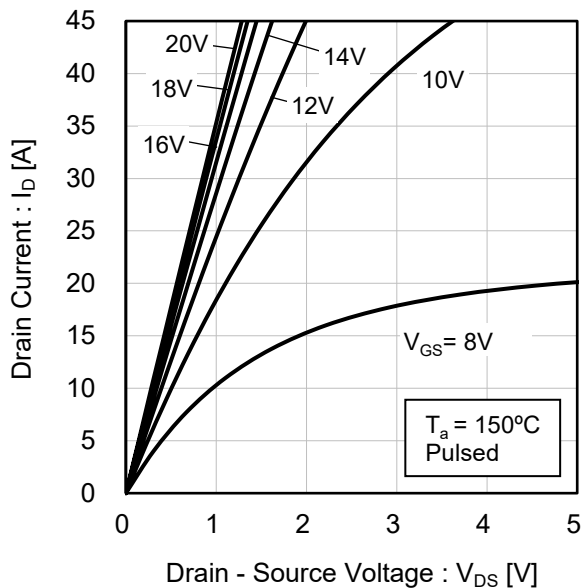


Fig.9  $T_j = 150^\circ\text{C}$  3rd Quadrant Characteristics

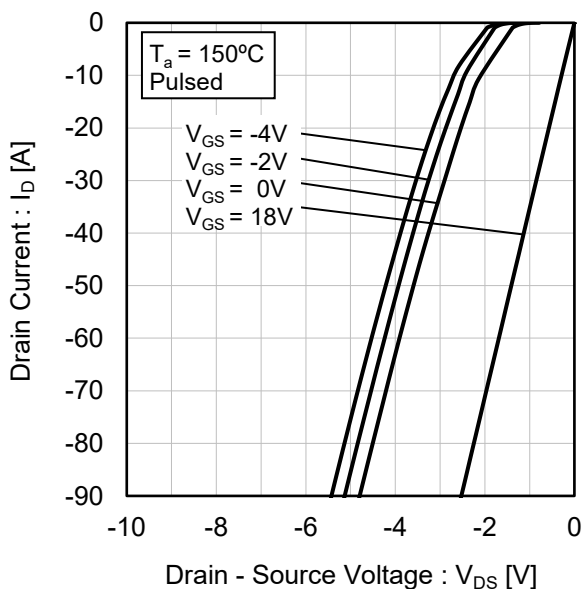
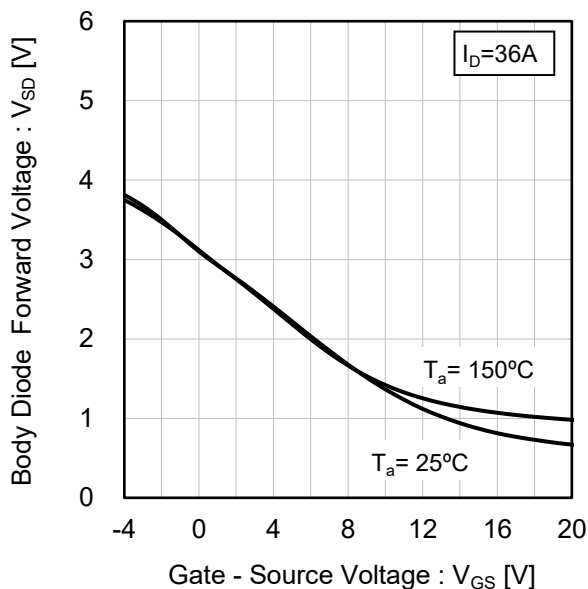


Fig.10 Body Diode Forward Voltage vs. Gate - Source Voltage



●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

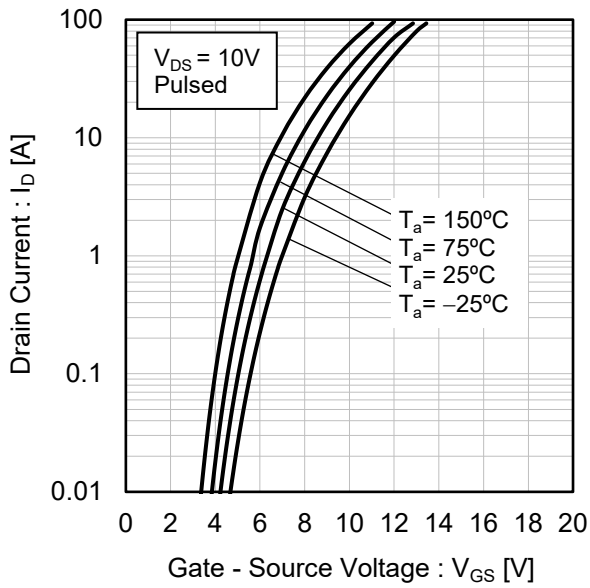


Fig.12 Typical Transfer Characteristics (II)

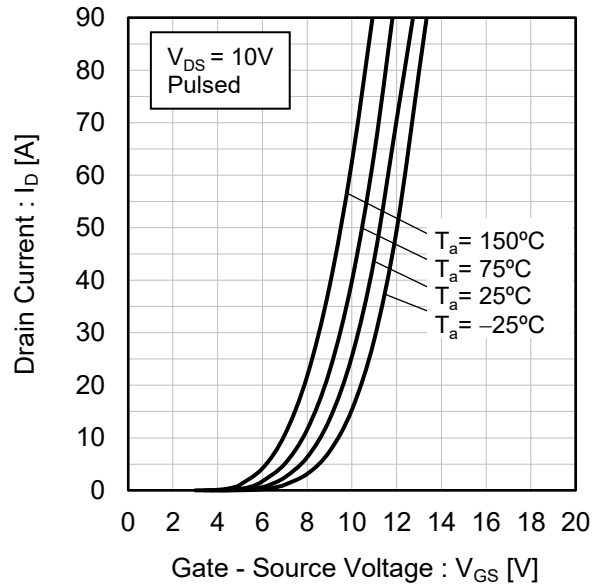


Fig.13 Gate Threshold Voltage vs. Junction Temperature

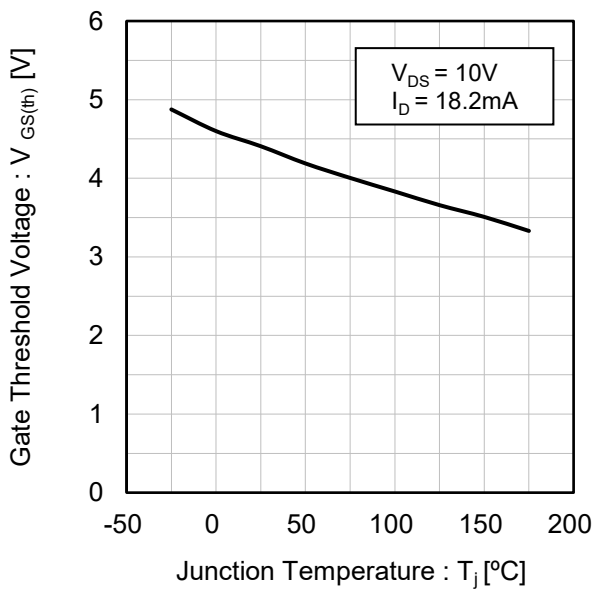
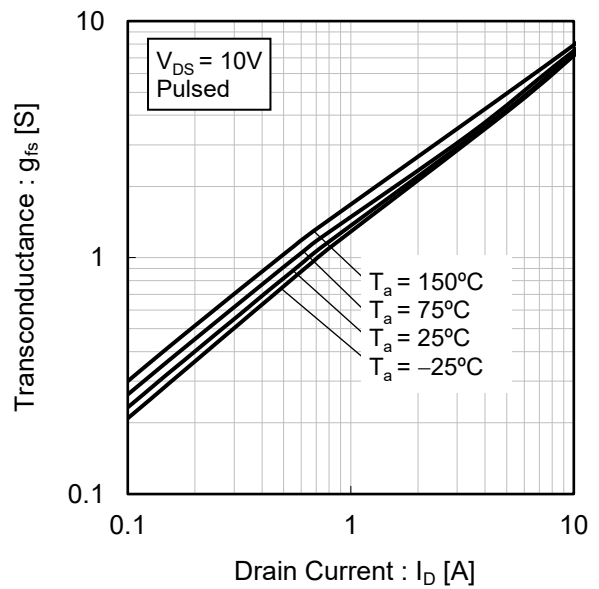


Fig.14 Transconductance vs. Drain Current





●Electrical characteristic curves

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

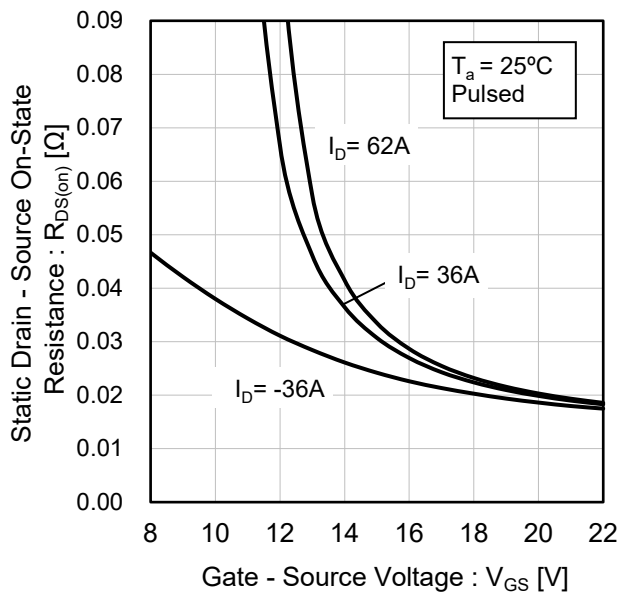


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

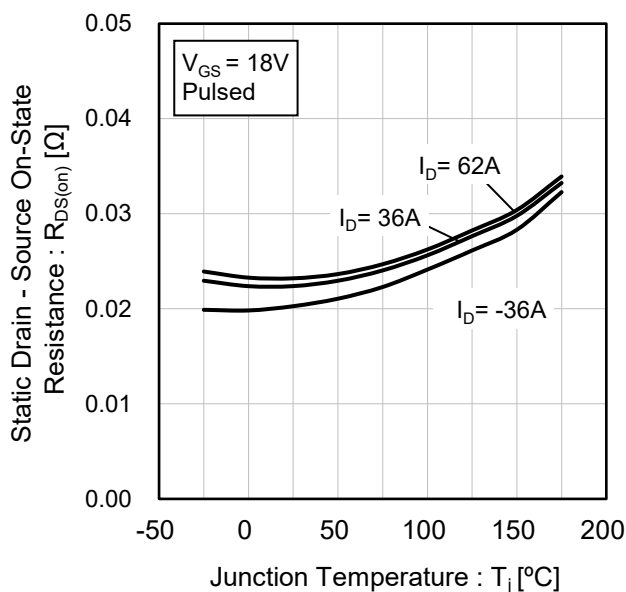


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current

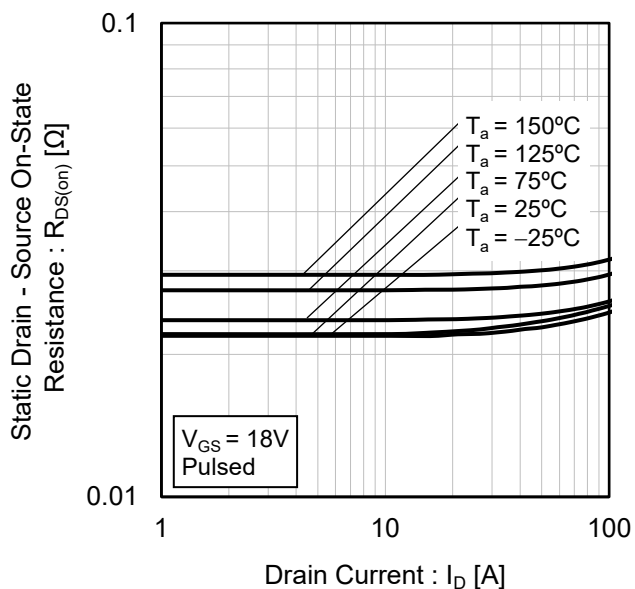
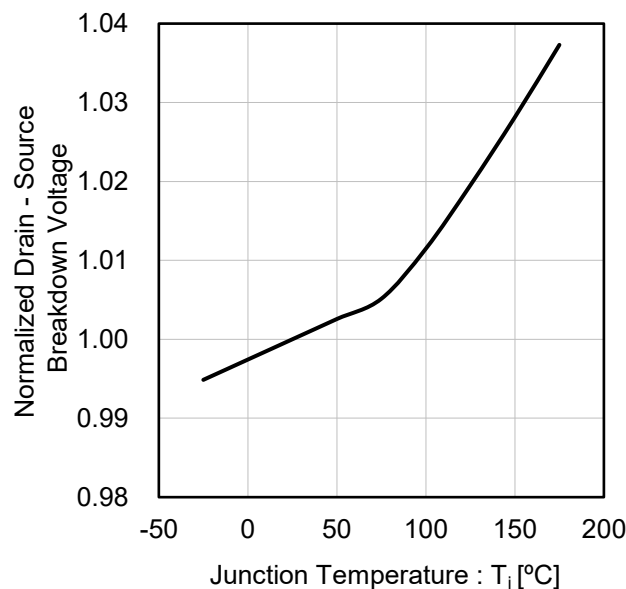


Fig.18 Normalized Drain - Source Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

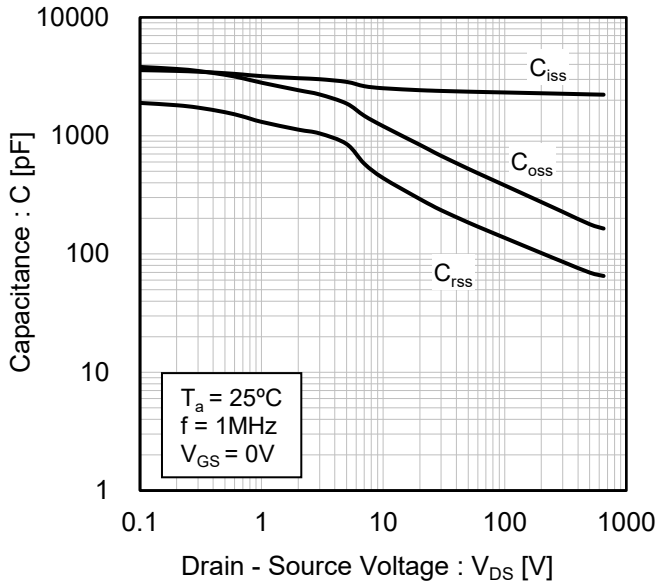


Fig.20 C<sub>oss</sub> Stored Energy

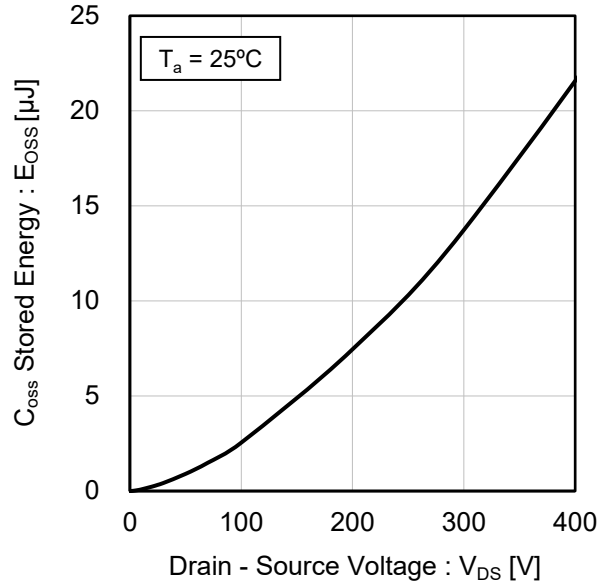
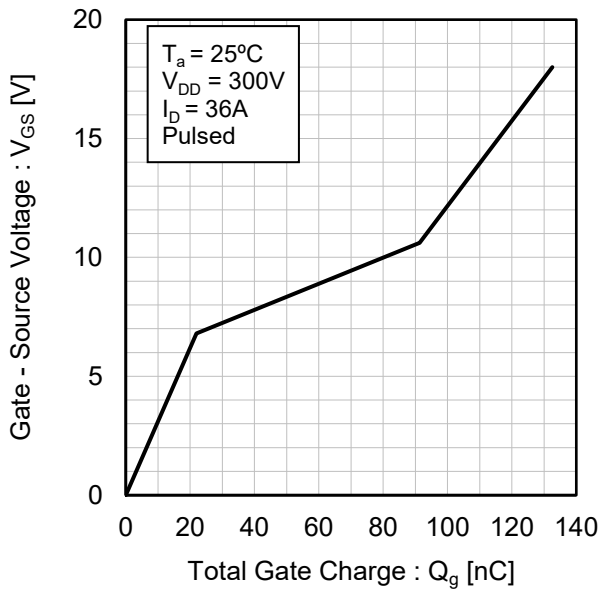
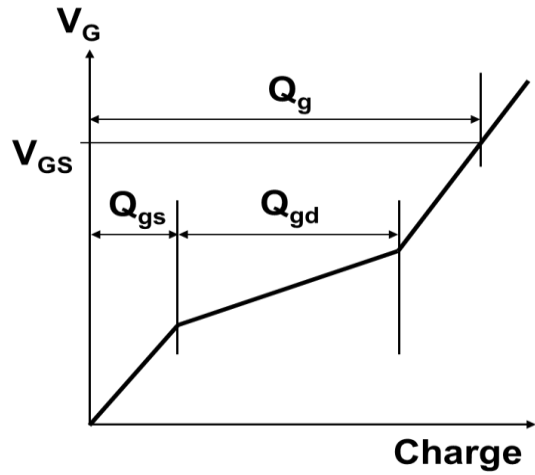


Fig.21 Dynamic Input Characteristics



\*Gate Charge Waveform



●Electrical characteristic curves

Fig.19 Typical Switching Time vs. Drain Current

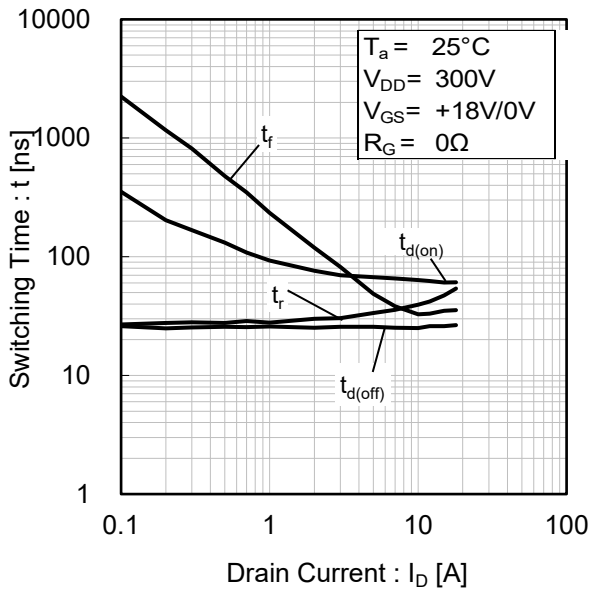


Fig.20 Typical Switching Loss vs. Drain - Source Voltage

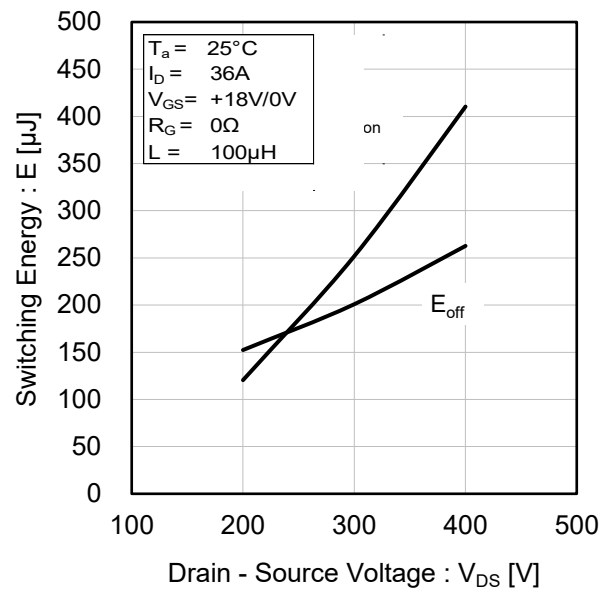


Fig.21 Typical Switching Loss vs. Drain Current

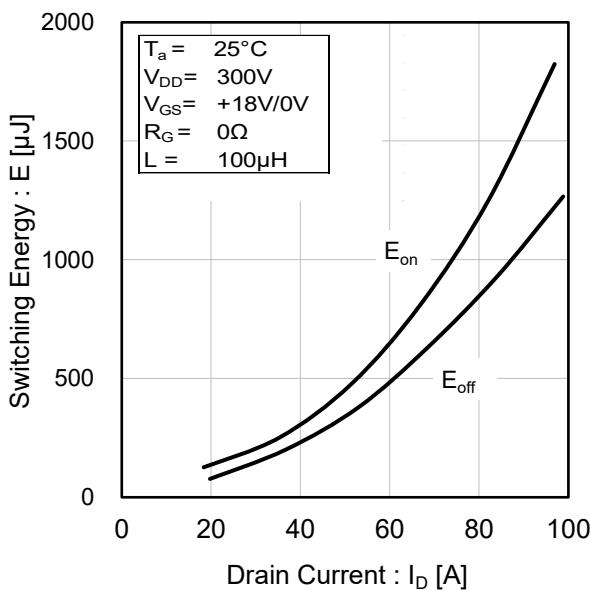
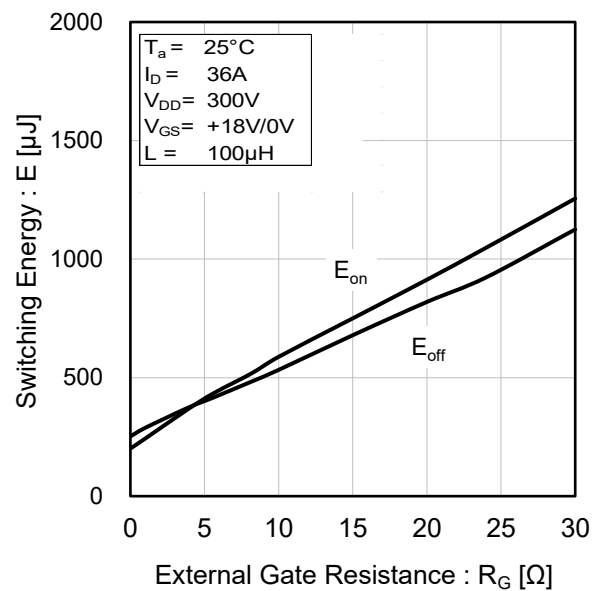


Fig.22 Typical Switching Loss vs. External Gate Resistance



● Measurement circuits and waveforms

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

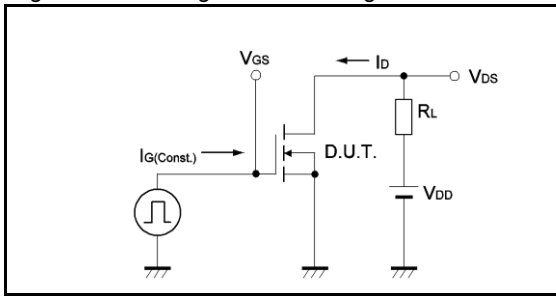


Fig.1-2 Waveforms for Switching Time

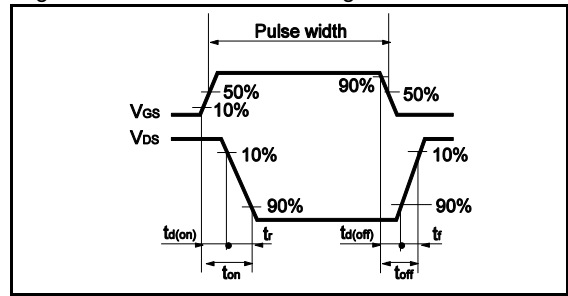


Fig.2-1 Switching Energy Measurement Circuit

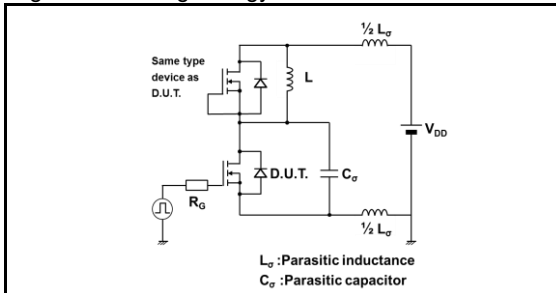


Fig.2-2 Waveforms for Switching Energy Loss

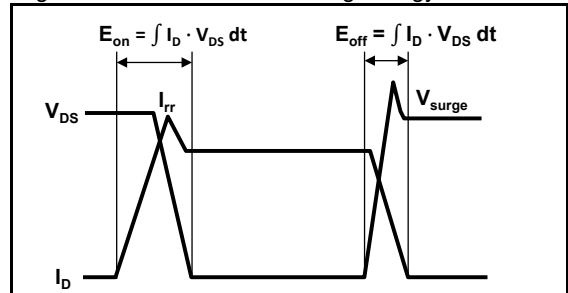


Fig.3-1 Reverse Recovery Time Measurement Circuit

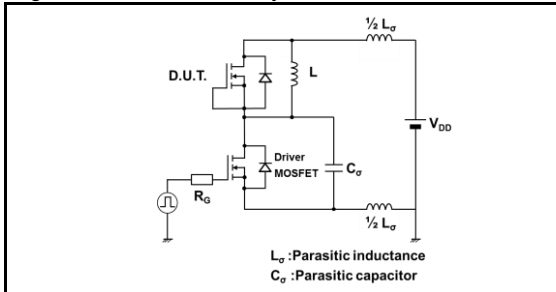
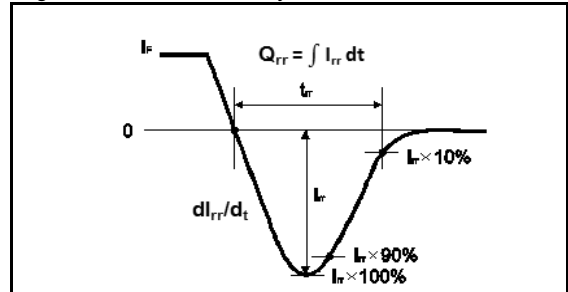


Fig.3-2 Reverse Recovery Waveform



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