

$V_{DSS}$	650V
$R_{DS(on)}$ (Typ.)	120mΩ
$I_D$	29A
$P_D$	165W

### ●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

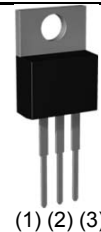
- Solar inverters
- DC/DC converters
- Switch mode power supplies
- Induction heating
- Motor drives

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

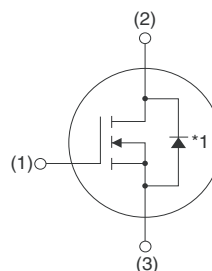
Parameter		Symbol	Value	Unit
Drain - Source voltage		$V_{DSS}$	650	V
Continuous drain current	$T_c = 25^\circ\text{C}$	$I_D^{*1}$	29	A
	$T_c = 100^\circ\text{C}$	$I_D^{*1}$	20	A
Pulsed drain current		$I_{D,pulse}^{*2}$	72	A
Gate - Source voltage		$V_{GSS}$	-6 to 22	V
Power dissipation ( $T_c = 25^\circ\text{C}$ )		$P_D$	165	W
Junction temperature		$T_j$	175	$^\circ\text{C}$
Range of storage temperature		$T_{stg}$	-55 to +175	$^\circ\text{C}$

### ●Outline

TO220AB



### ●Inner circuit



(1) Gate  
(2) Drain  
(3) Source

\*1 Body Diode

### ●Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	50
	Packing code	C
	Marking	SCT2120AF

## ●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	$R_{thJC}$	-	0.70	0.91	°C/W
Soldering temperature, wavesoldering for 10s	$T_{sold}$	-	-	265	°C

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	650	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$ $T_j = 25^\circ\text{C}$	-	1	10	$\mu\text{A}$
		$T_j = 150^\circ\text{C}$	-	2	-	
Gate - Source leakage current	$I_{GSS+}$	$V_{GS} = +22V, V_{DS} = 0V$	-	-	100	nA
Gate - Source leakage current	$I_{GSS-}$	$V_{GS} = -6V, V_{DS} = 0V$	-	-	-100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 3.3mA$	1.6	-	4.0	V
Static drain - source on - state resistance	$R_{DS(on)}^{*3}$	$V_{GS} = 18V, I_D = 10A$ $T_j = 25^\circ\text{C}$	-	120	156	$m\Omega$
		$T_j = 125^\circ\text{C}$	-	149	-	
Gate input resistance	$R_G$	$f = 1MHz, \text{open drain}$	-	13.8	-	$\Omega$

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	$g_{fs}^{*3}$	$V_{DS} = 10\text{V}, I_D = 10\text{A}$	-	2.7	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$ $V_{DS} = 500\text{V}$ $f = 1\text{MHz}$	-	1200	-	pF
Output capacitance	$C_{oss}$		-	90	-	
Reverse transfer capacitance	$C_{rss}$		-	13	-	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}$ $V_{DS} = 0\text{V to } 300\text{V}$	-	115	-	pF
Turn - on delay time	$t_{d(on)}^{*3}$	$V_{DD} = 300\text{V}, I_D = 10\text{A}$ $V_{GS} = 18\text{V}/0\text{V}$ $R_L = 30\Omega$ $R_G = 0\Omega$	-	22	-	ns
Rise time	$t_r^{*3}$		-	31	-	
Turn - off delay time	$t_{d(off)}^{*3}$		-	60	-	
Fall time	$t_f^{*3}$		-	19	-	
Turn - on switching loss	$E_{on}^{*3}$	$V_{DD} = 300\text{V}, I_D = 10\text{A}$ $V_{GS} = 18\text{V}/0\text{V}$ $R_G = 0\Omega, L = 500\mu\text{H}$ * $E_{on}$ includes diode reverse recovery	-	61	-	$\mu\text{J}$
Turn - off switching loss	$E_{off}^{*3}$		-	41	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	$Q_g^{*3}$	$V_{DD} = 300\text{V}$ $I_D = 10\text{A}$ $V_{GS} = 18\text{V}$	-	61	-	nC
Gate - Source charge	$Q_{gs}^{*3}$		-	14	-	
Gate - Drain charge	$Q_{gd}^{*3}$		-	21	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 300\text{V}, I_D = 10\text{A}$	-	10.4	-	V

\*1 Limited only by maximum temperature allowed.

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

\*3 Pulsed

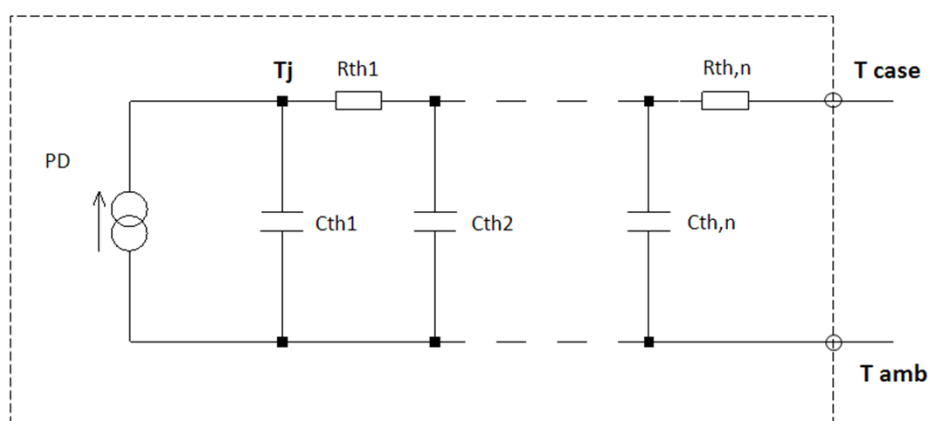
**●Body diode electrical characteristics (Source-Drain) ( $T_a = 25^\circ\text{C}$ )**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	$I_S^{*1}$	$T_c = 25^\circ\text{C}$	-	-	29	A
Inverse diode direct current, pulsed	$I_{SM}^{*2}$		-	-	72	A
Forward voltage	$V_{SD}^{*3}$	$V_{GS} = 0\text{V}, I_S = 10\text{A}$	-	4.3	-	V
Reverse recovery time	$t_{rr}^{*3}$	$I_F = 10\text{A}, V_R = 400\text{V}$ $di/dt = 160\text{A}/\mu\text{s}$	-	33	-	ns
Reverse recovery charge	$Q_{rr}^{*3}$		-	53	-	nC
Peak reverse recovery current	$I_{rrm}^{*3}$		-	3.0	-	A

**●Typical Transient Thermal Characteristics**

Symbol	Value	Unit
$R_{th1}$	96.1m	K/W
$R_{th2}$	404m	
$R_{th3}$	196m	

Symbol	Value	Unit
$C_{th1}$	1.55m	Ws/K
$C_{th2}$	5.23m	
$C_{th3}$	83.3m	



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

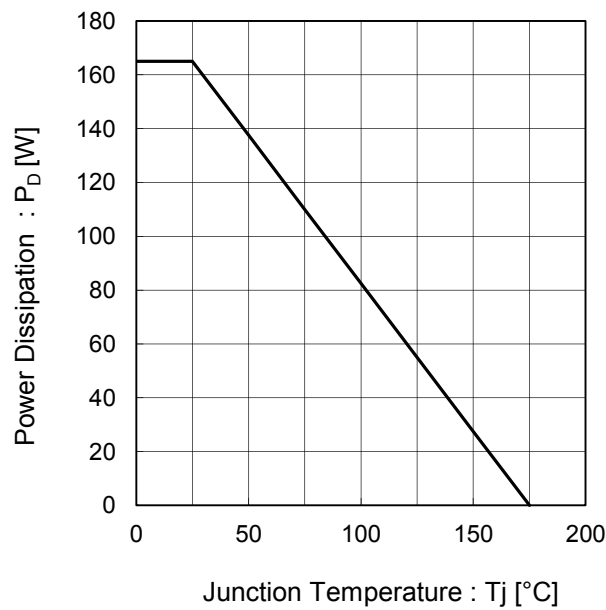


Fig.2 Maximum Safe Operating Area

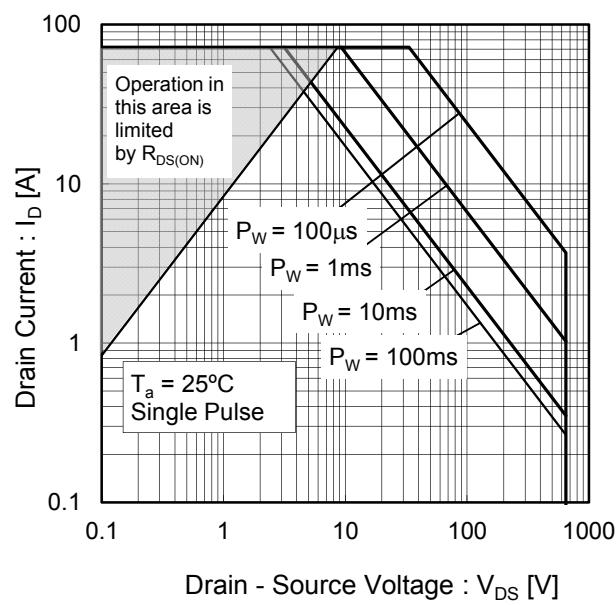
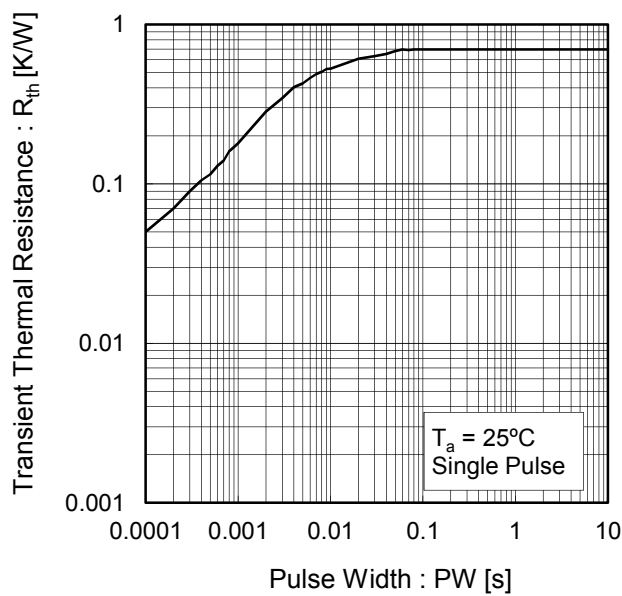


Fig.3 Typical Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

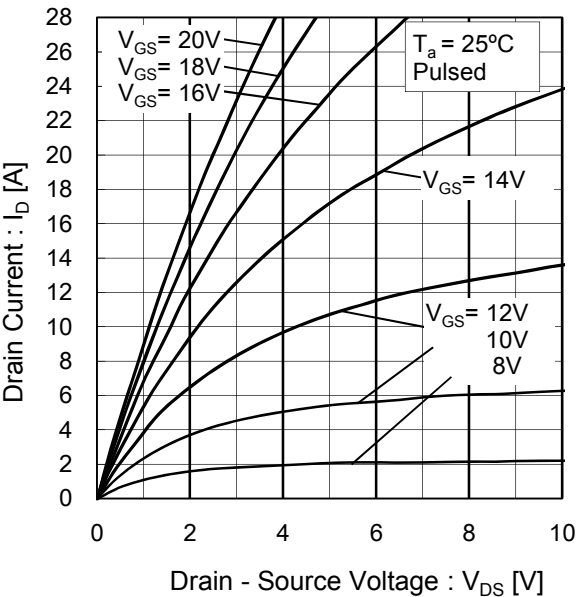


Fig.5 Typical Output Characteristics(II)

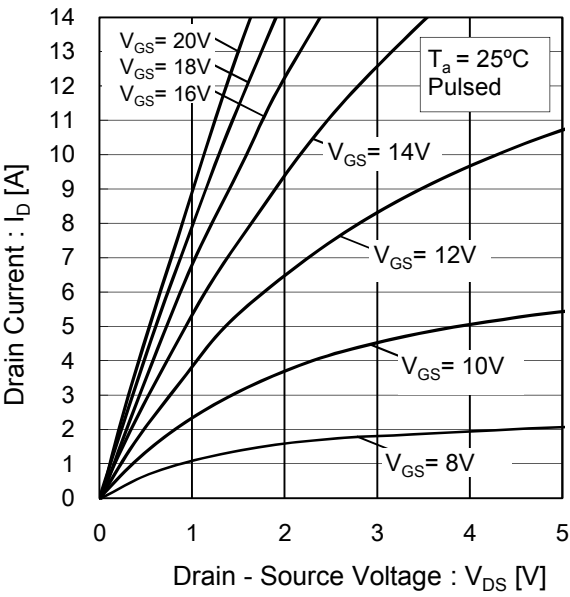


Fig.6  $T_j = 150^\circ\text{C}$  Typical Output Characteristics(I)

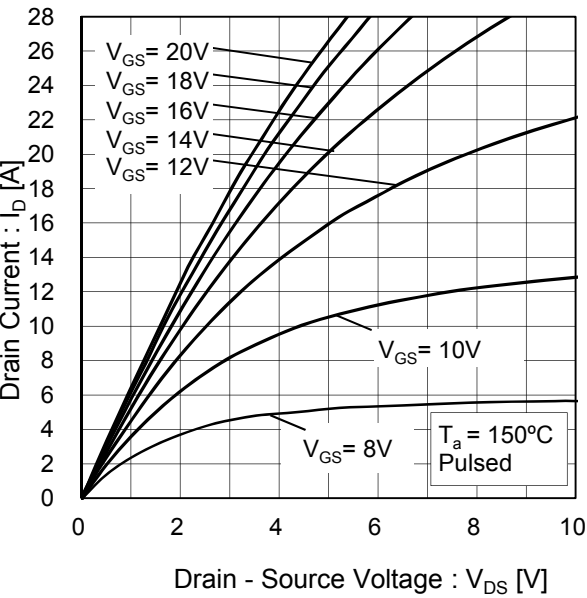
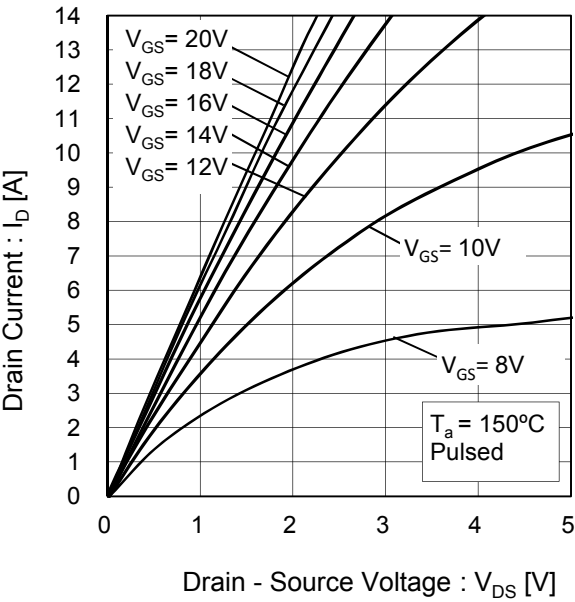


Fig.7  $T_j = 150^\circ\text{C}$  Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.8 Typical Transfer Characteristics (I)

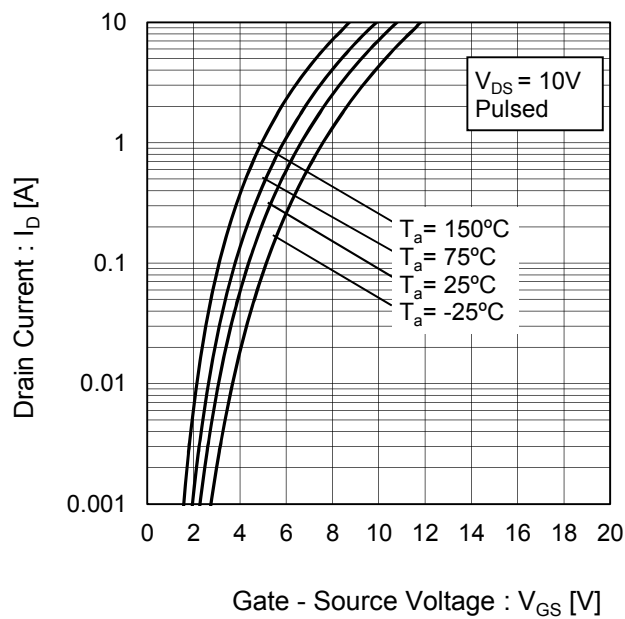


Fig.9 Typical Transfer Characteristics (II)

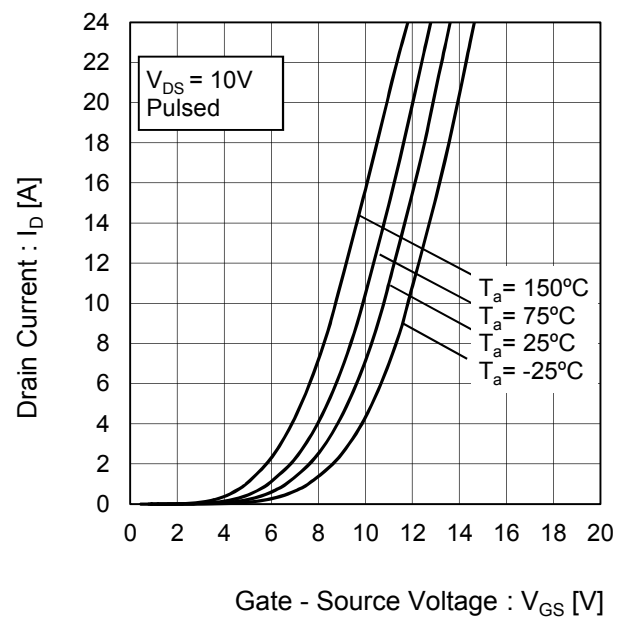


Fig.10 Gate Threshold Voltage vs. Junction Temperature

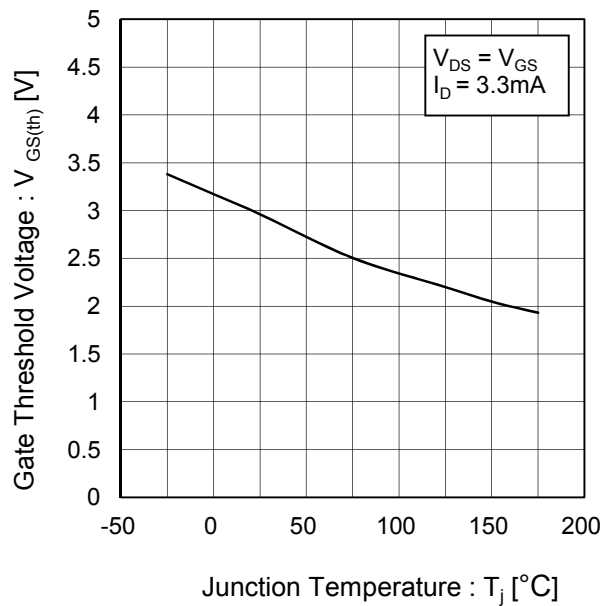
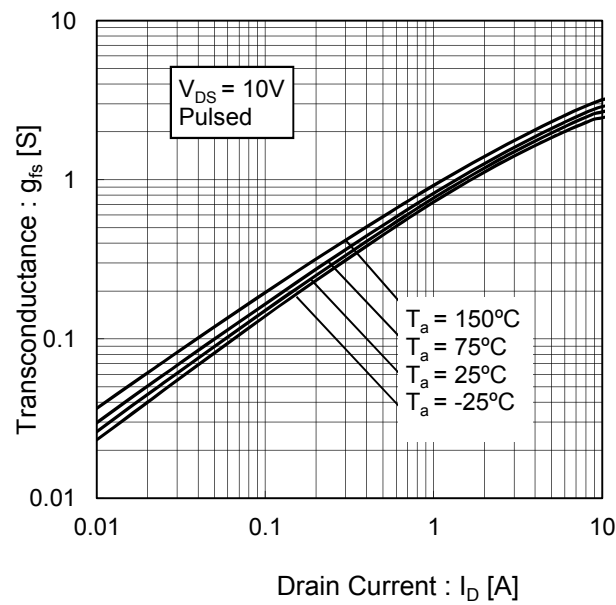


Fig.11 Transconductance vs. Drain Current



●Electrical characteristic curves

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

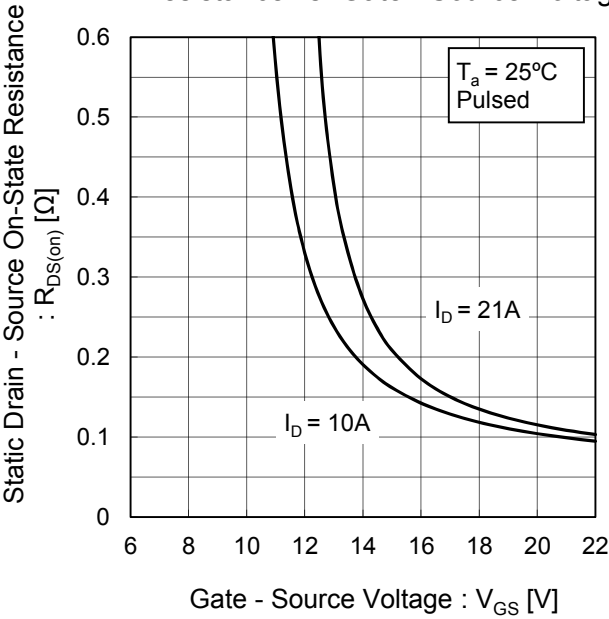


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

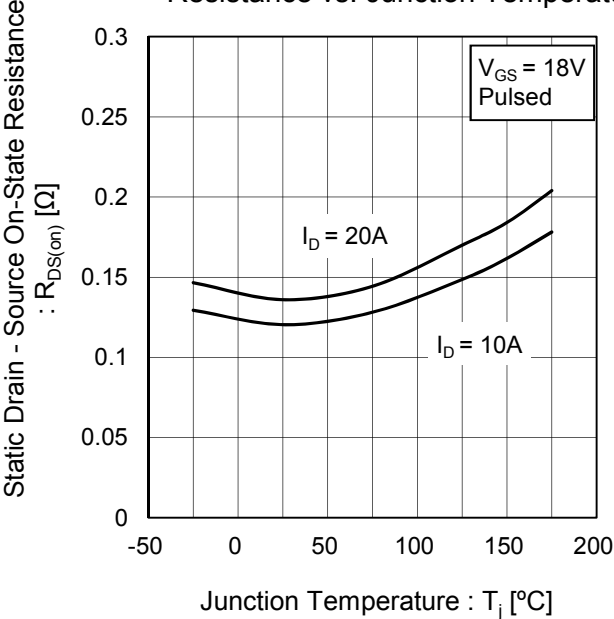
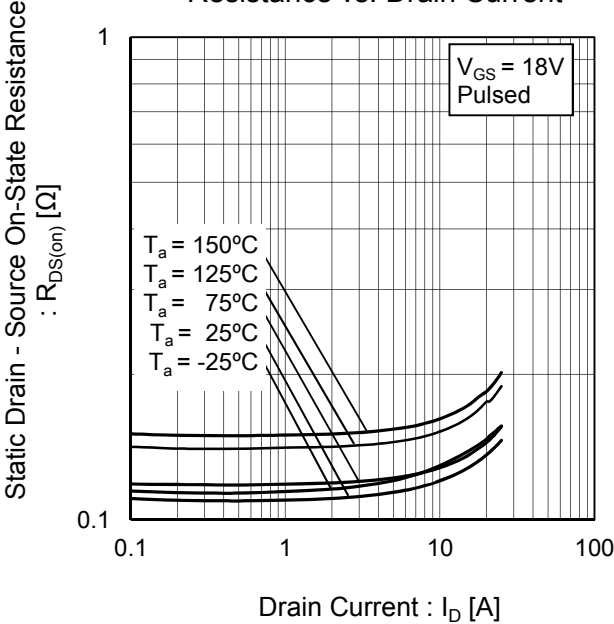


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current





●Electrical characteristic curves

Fig.15 Typical Capacitance vs. Drain - Source Voltage

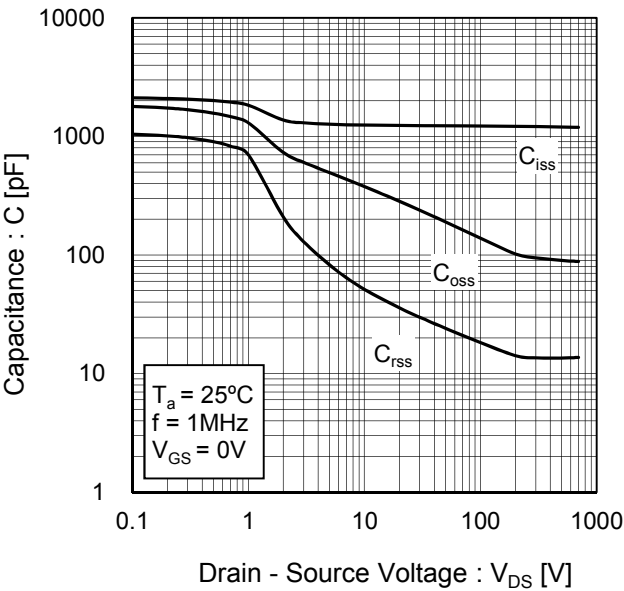


Fig.16 Coss Stored Energy

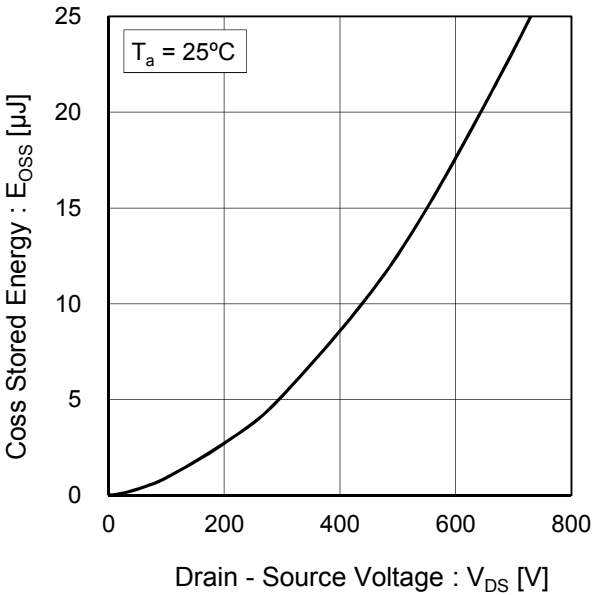


Fig.17 Switching Characteristics

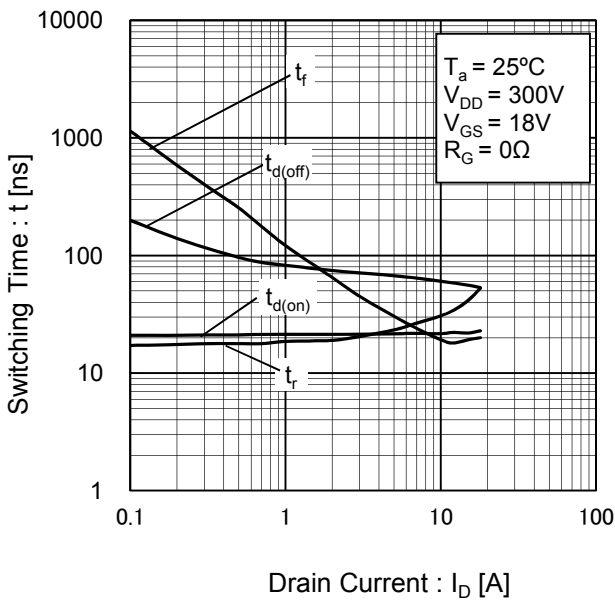
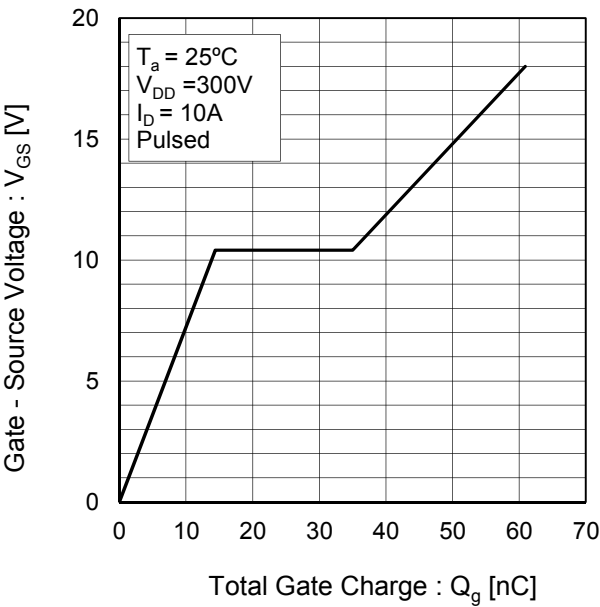


Fig.18 Dynamic Input Characteristics



●Electrical characteristic curves

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

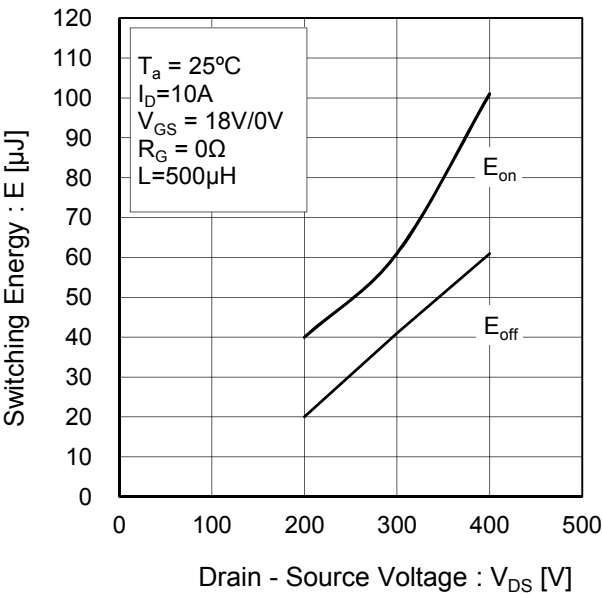


Fig.20 Typical Switching Loss  
vs. Drain Current

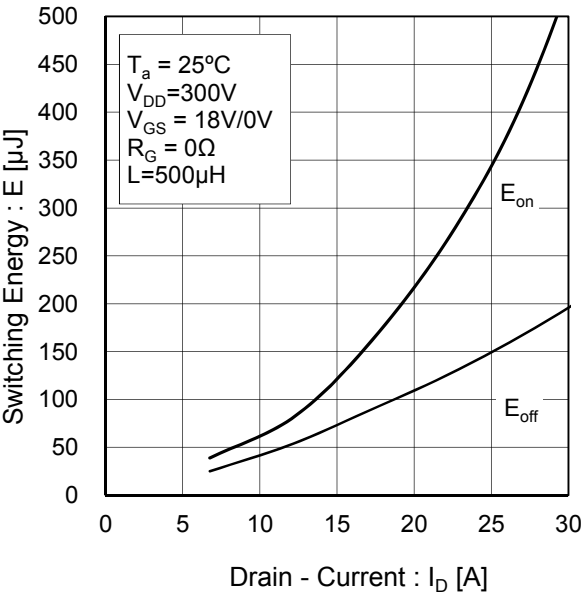
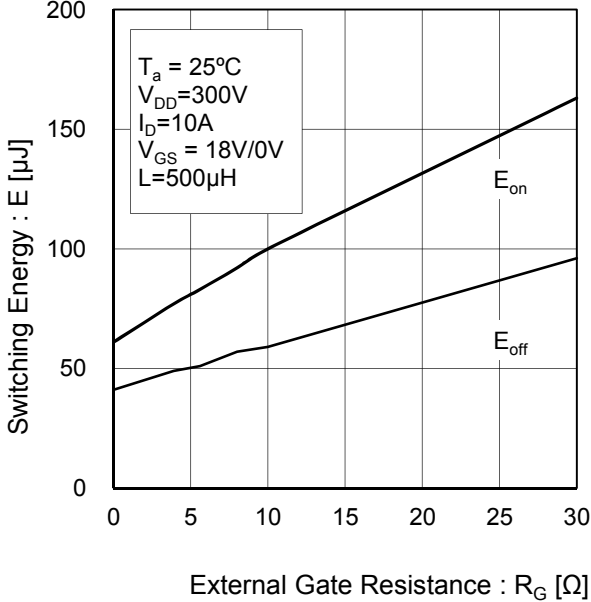


Fig.21 Typical Switching Loss  
vs. External Gate Resistance



●Electrical characteristic curves

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

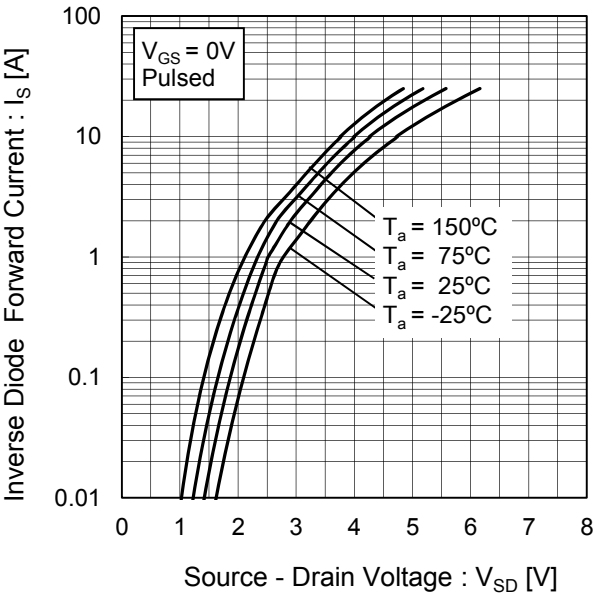
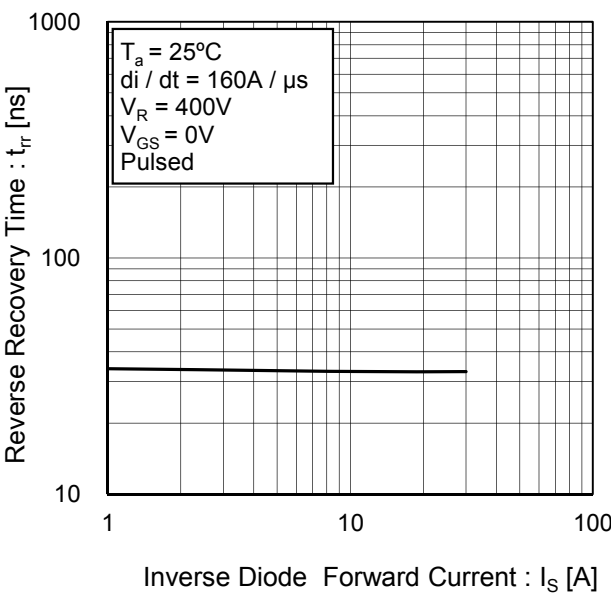


Fig.23 Reverse Recovery Time vs. Inverse Diode Forward Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

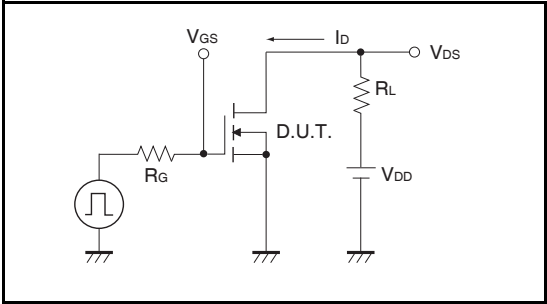


Fig.1-2 Switching Waveforms

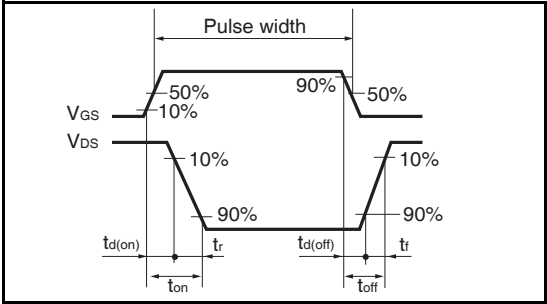


Fig.2-1 Gate Charge Measurement Circuit

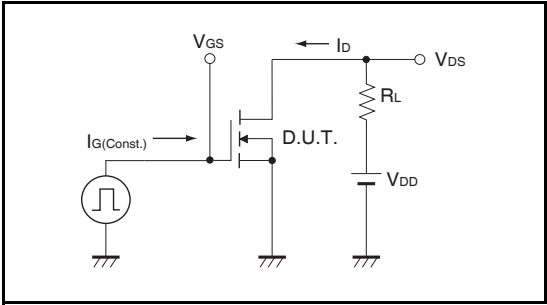


Fig.2-2 Gate Charge Waveform

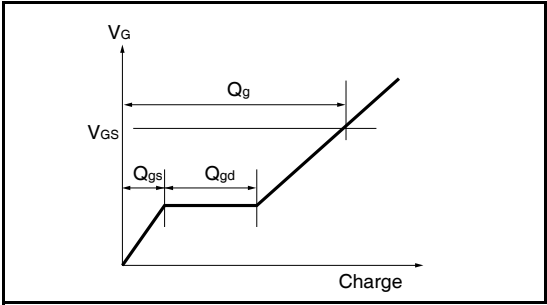


Fig.3-1 Switching Energy Measurement Circuit

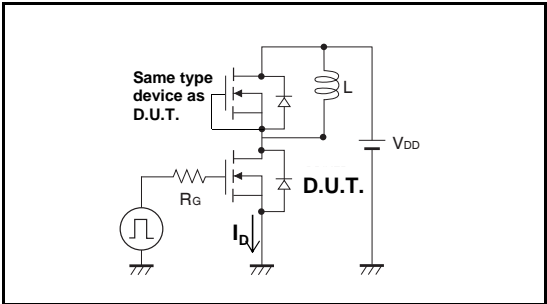


Fig.3-2 Switching Waveforms

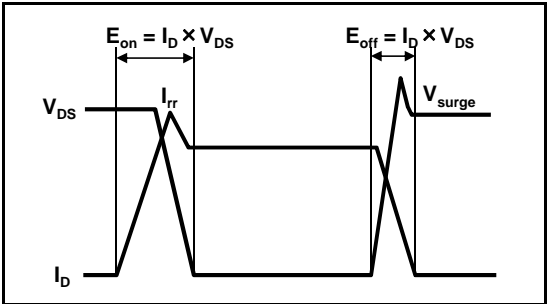


Fig.4-1 Reverse Recovery Time Measurement Circuit

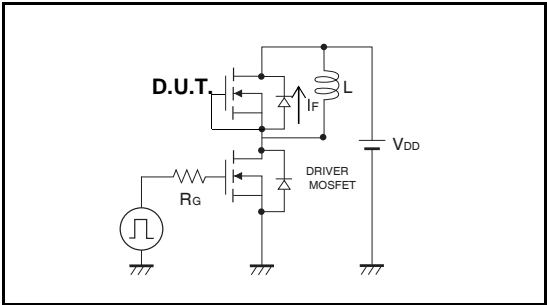
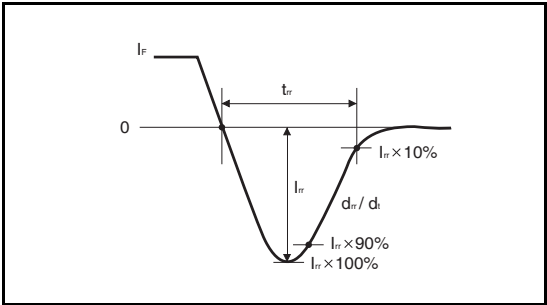
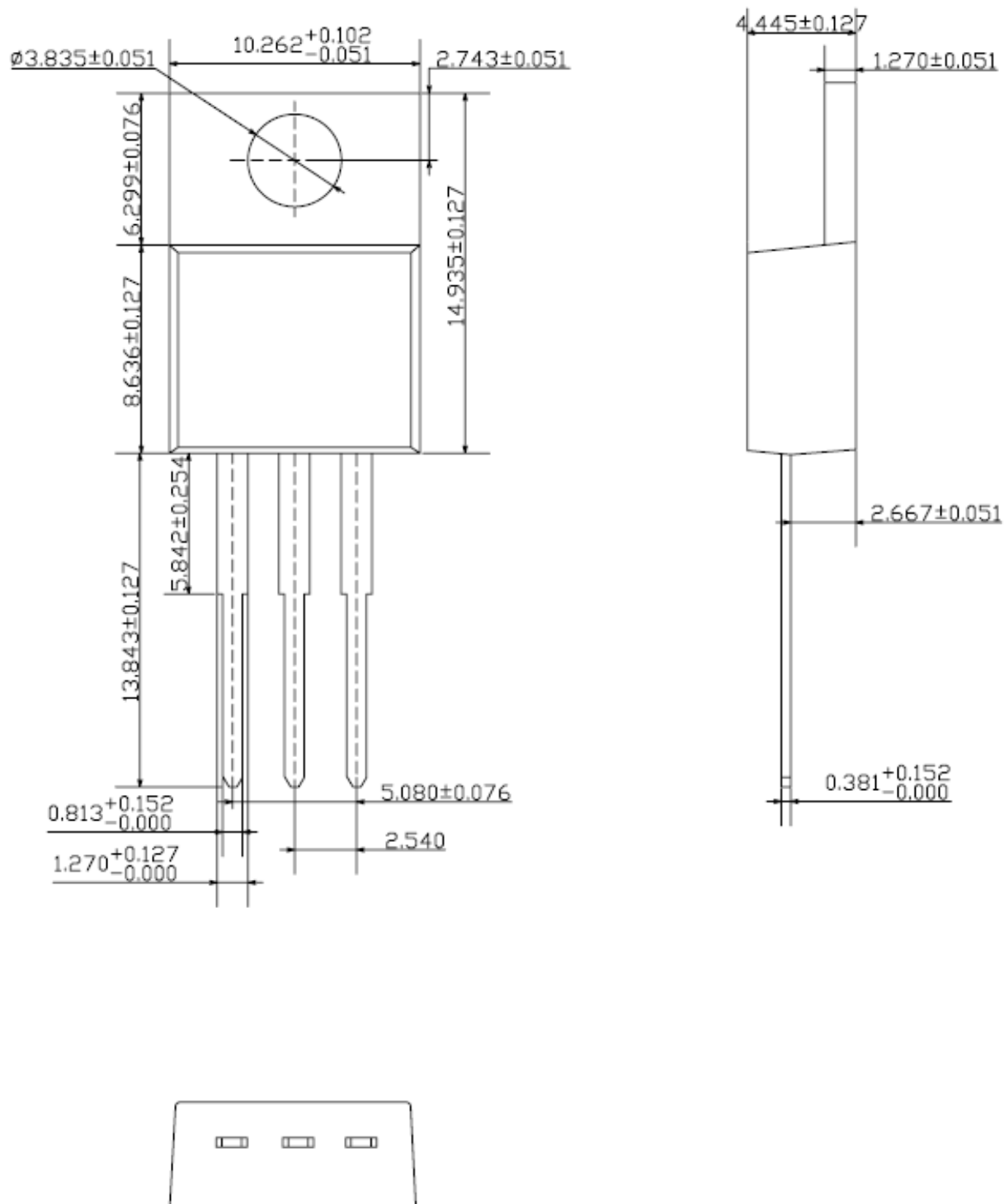


Fig.4-2 Reverse Recovery Waveform



●Dimensions (Unit : mm)

TO-220AB



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