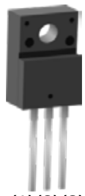
R6020ANX

Nch 600V 20A Power MOSFET Datasheet

V_{DSS}	600V
$R_{DS(on)}$ (Max.)	0.22Ω
I_D	20A
P_D	50W

●Outline

TO-220FM



(1)(2)(3)

●Features

1) Low on-resistance.

2) Fast switching speed.

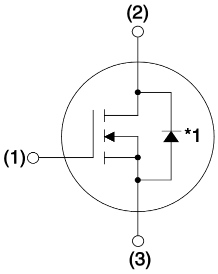
3) Gate-source voltage (V_{GSS}) guaranteed to be ±30V.

4) Drive circuits can be simple.

5) Parallel use is easy.

6) Pb-free lead plating ; RoHS compliant

●Inner circuit



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

*1 Body Diode

●Application

Switching Power Supply

●Packaging specifications

Type	Packing	Bulk
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	500
	Taping code	-
	Marking	R6020ANX

●Absolute maximum ratings (T_a = 25°C)

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	600	V
Continuous drain current	T_c = 25°C	I_D *1	±20	A
	T_c = 100°C	I_D *1	±9.7	A
Pulsed drain current		$I_{D,pulse}$ *2	±80	A
Gate - Source voltage		V_{GSS}	±30	V
Avalanche energy, single pulse		E_{AS} *3	26.7	mJ
Avalanche energy, repetitive		E_{AR} *4	3.5	mJ
Avalanche current		I_{AR} *3	10	A
Power dissipation (T_c = 25°C)		P_D	50	W
Junction temperature		T_j	150	°C
Range of storage temperature		T_{stg}	–55 to +150	°C
Reverse diode dv/dt		dv/dt *5	15	V/ns

●Absolute maximum ratings

Parameter	Symbol	Conditions	Values	Unit
Drain - Source voltage slope	dv/dt	V_{DS} = 480V, I_D = 20A T_j = 125°C	50	V/ns

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	-	2.5	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	70	°C/W
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	°C

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 1mA	600	-	-	V
Drain - Source avalanche breakdown voltage	$V_{(BR)DS}$	V_{GS} = 0V, I_D = 20A	-	700	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = 600V, V_{GS} = 0V T_j = 25°C T_j = 125°C	- -	0.1 -	100 1000	μA
Gate - Source leakage current	I_{GSS}	V_{GS} = ±30V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS\,(th)}$	V_{DS} = 10V, I_D = 1mA	2.5	-	4.5	V
Static drain - source on - state resistance	$R_{DS(on)}$ *6	V_{GS} = 10V, I_D = 10A T_j = 25°C T_j = 125°C	- -	0.17 0.36	0.22 -	Ω
Gate input resistance	R_G	f = 1MHz, open drain	-	13.8	-	Ω

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} *6	V_{DS} = 10V, I_D = 10A	7	14	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	2040	-	pF
Output capacitance	C_{oss}	V_{DS} = 25V	-	1660	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	70	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 480V	-	104	-	pF
Effective output capacitance, time related	$C_{o(tr)}$		-	104	-	
Turn - on delay time	$t_{d(on)}$ *6	V_{DD} ≃ 300V, V_{GS} = 10V	-	40	-	ns
Rise time	t_r *6	I_D = 10A	-	60	-	
Turn - off delay time	$t_{d(off)}$ *6	R_L = 30Ω	-	230	460	
Fall time	t_f *6	R_G = 10Ω	-	70	140	

●Gate Charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *6	V_{DD} ≃ 300V	-	65	-	nC
Gate - Source charge	Q_{gs} *6	I_D = 20A	-	10	-	
Gate - Drain charge	Q_{gd} *6	V_{GS} = 10V	-	25	-	
Gate plateau voltage	$V_{(plateau)}$	V_{DD} ≃ 300V, I_D = 20A	-	6.0	-	V

*1 Limited only by maximum temperature allowed.

*2 PW ≤ 10μs, Duty cycle ≤ 1%

*3 L ≃ 500μH, V_{DD} = 50V, R_G = 25Ω, starting T_j = 25°C

*4 L ≃ 500μH, V_{DD} = 50V, R_G = 25Ω, starting T_j = 25°C, f = 10kHz

*5 Reference measurement circuits Fig.5-1.

*6 Pulsed

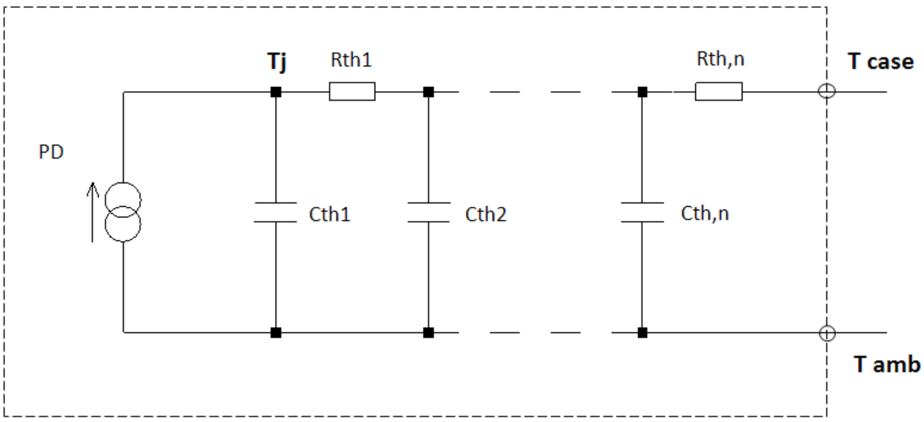
● **Body diode electrical characteristics** (Source-Drain) (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Inverse diode continuous, forward current	I_S *1	T_c = 25°C	-	-	20	A
Inverse diode direct current, pulsed	I_{SM} *2		-	-	80	A
Forward voltage	V_{SD} *6	V_{GS} = 0V, I_S = 10A	-	-	1.5	V
Reverse recovery time	t_{rr} *6	I_S = 20A di/dt = 100A/µs	-	486	-	ns
Reverse recovery charge	Q_{rr} *6		-	7.8	-	µC
Peak reverse recovery current	I_{rrm} *6		-	32	-	A
Peak rate of fall of reverse recovery current	di_{rr}/dt	T_j = 25°C	-	800	-	A/µs

● **Typical Transient Thermal Characteristics**

Symbol	Value	Unit
R_{th1}	0.0789	K/W
R_{th2}	0.579	
R_{th3}	2.17	

Symbol	Value	Unit
C_{th1}	0.00458	Ws/K
C_{th2}	0.0603	
C_{th3}	0.549	



● **Electrical characteristic curves**

Fig.1 Power Dissipation Derating Curve

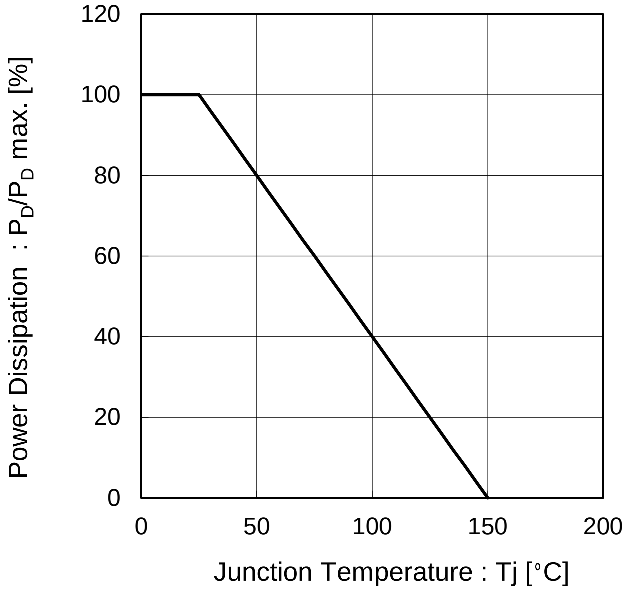


Fig.2 Maximum Safe Operating Area

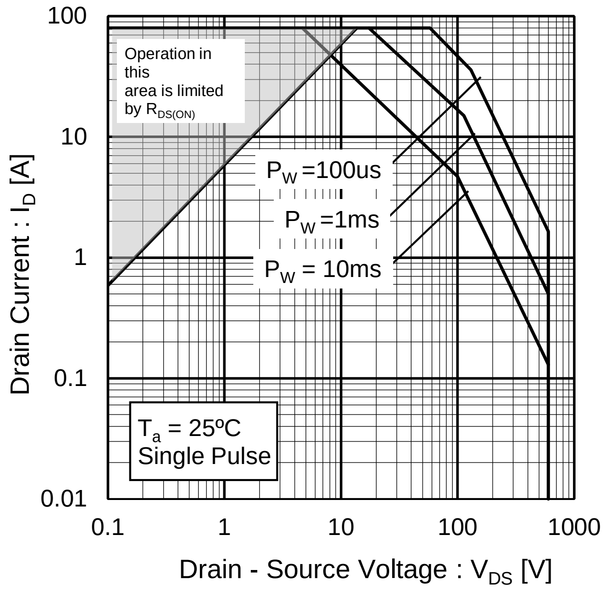
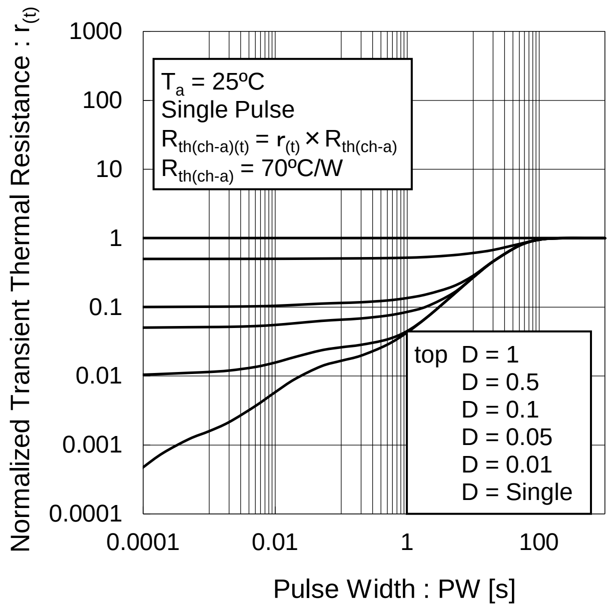


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width



●Electrical characteristic curves

Fig.4 Avalanche Current vs Inductive Load

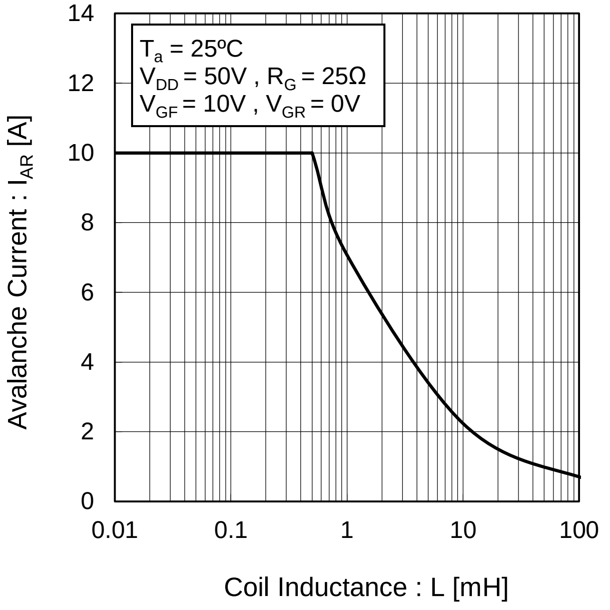


Fig.5 Avalanche Power Losses

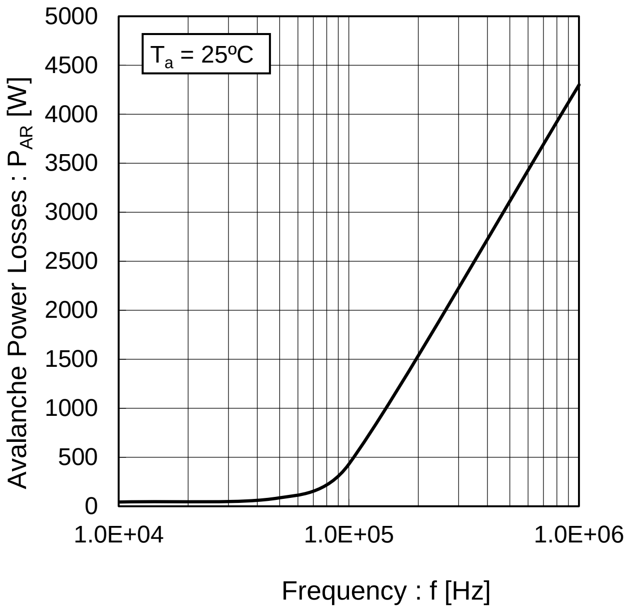
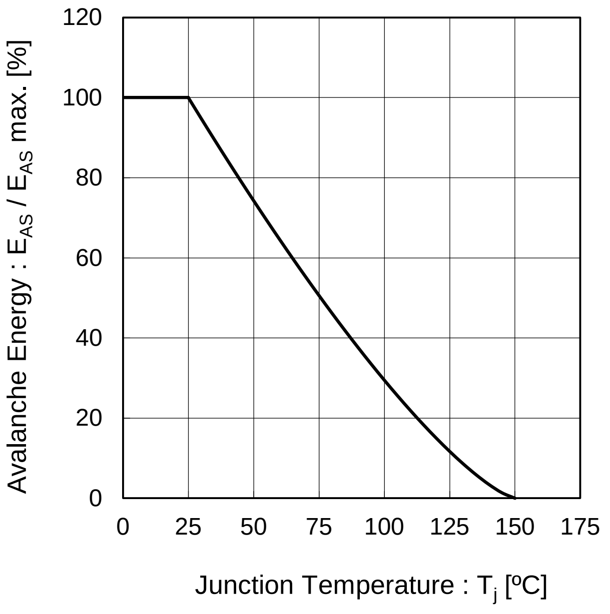


Fig.6 Avalanche Energy Derating Curve vs Junction Temperature



●Electrical characteristic curves

Fig.7 Typical Output Characteristics(I)

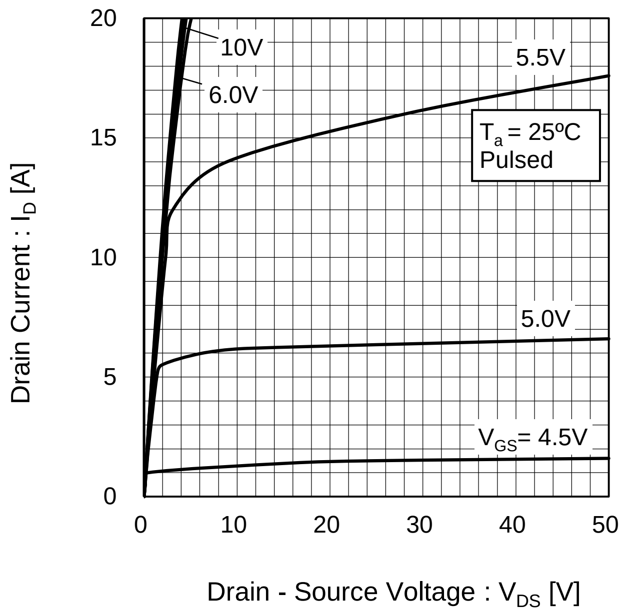


Fig.8 Typical Output Characteristics(II)

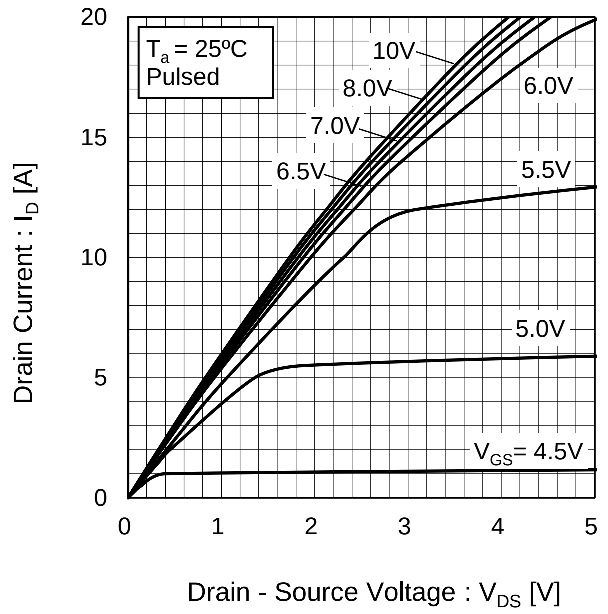


Fig.9 T_j = 150°C Typical Output Characteristics(I)

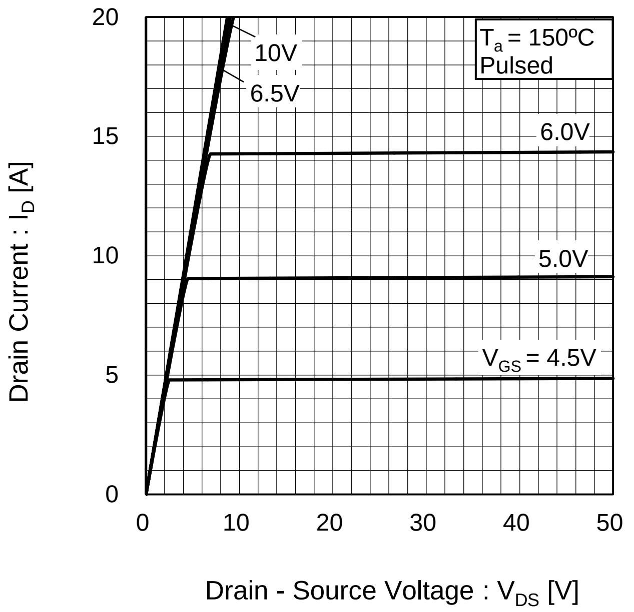
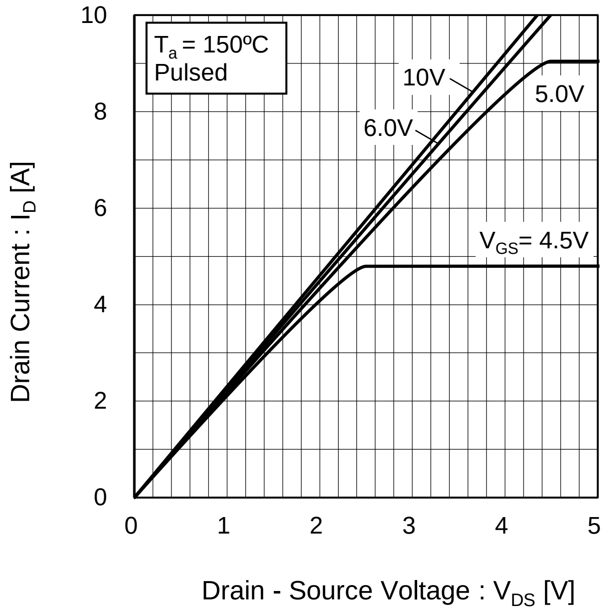


Fig.10 T_j = 150°C Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.11 Breakdown Voltage vs. Junction Temperature

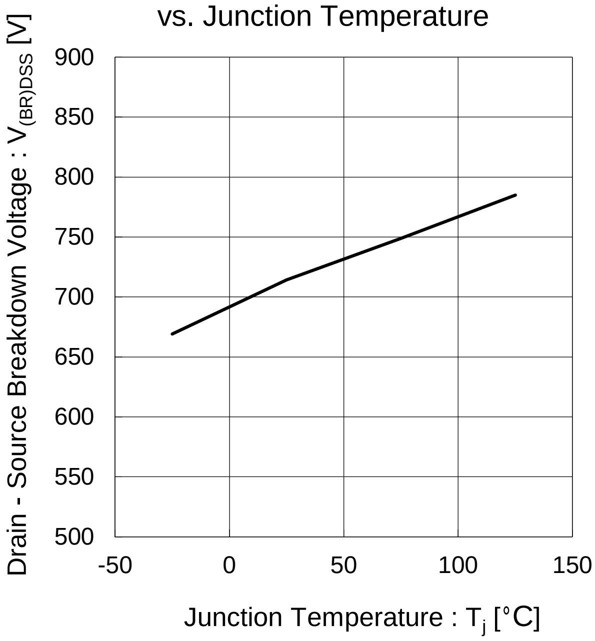


Fig.12 Typical Transfer Characteristics

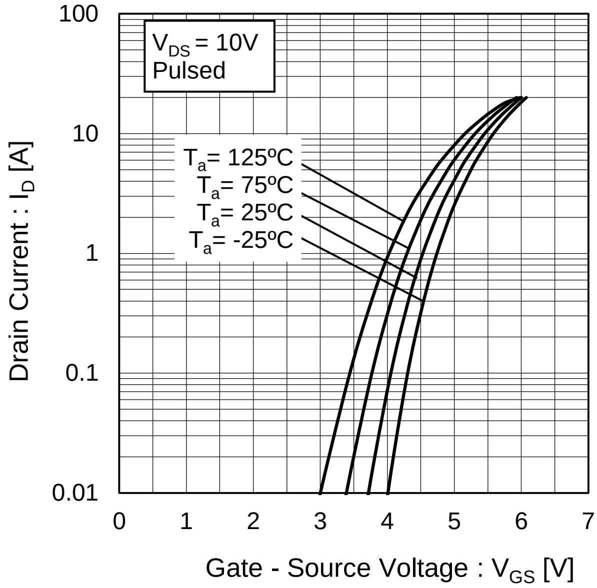


Fig.13 Gate Threshold Voltage vs. Junction Temperature

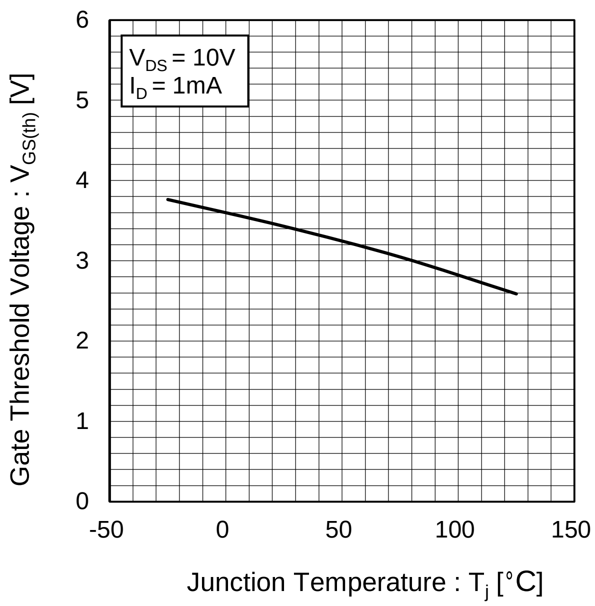
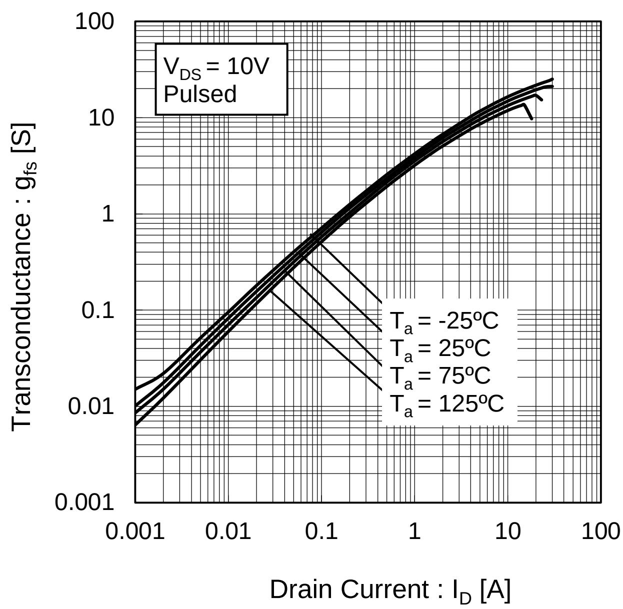


Fig.14 Transconductance vs. Drain Current



●Electrical characteristic curves

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

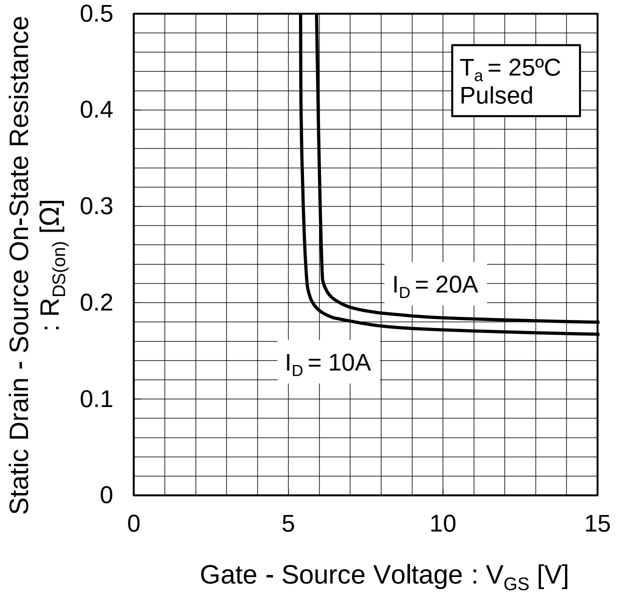


Fig.16 Static Drain - Source On - State Resistance vs. Junction Temperature

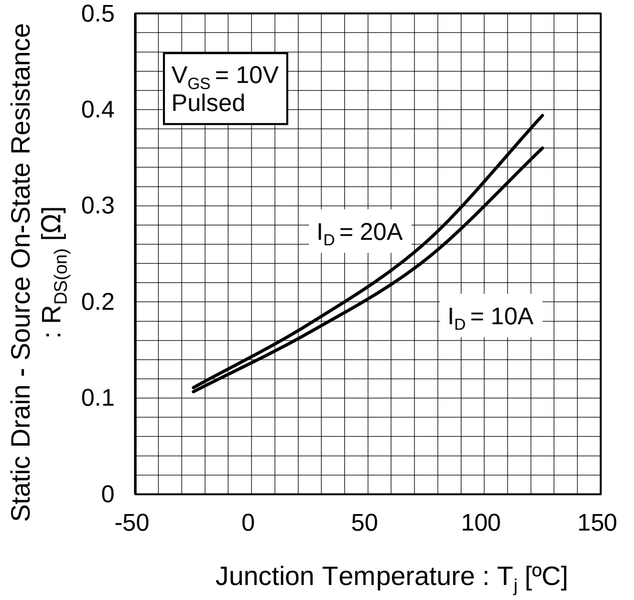
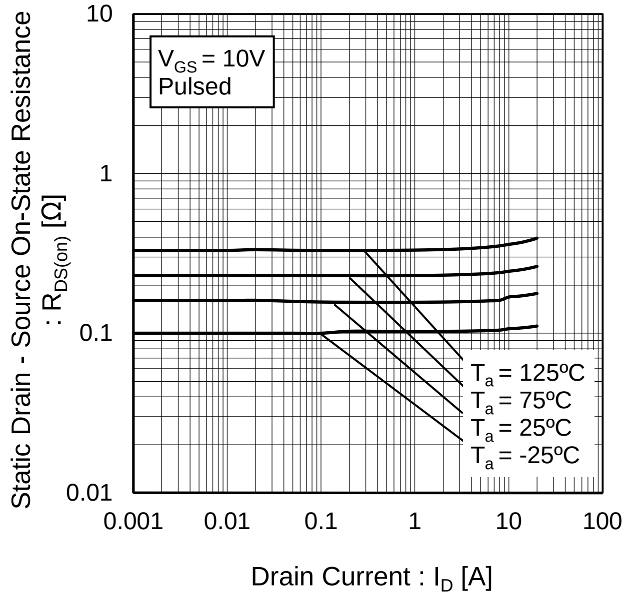


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.18 Typical Capacitance vs. Drain - Source Voltage

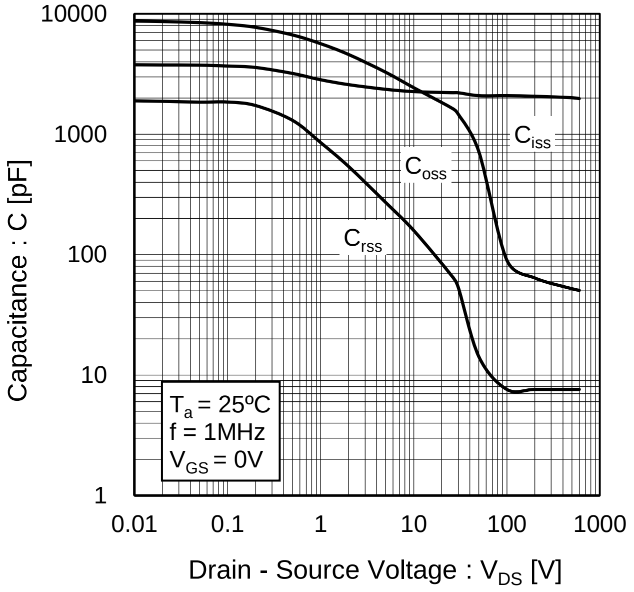


Fig.19 Coss Stored Energy

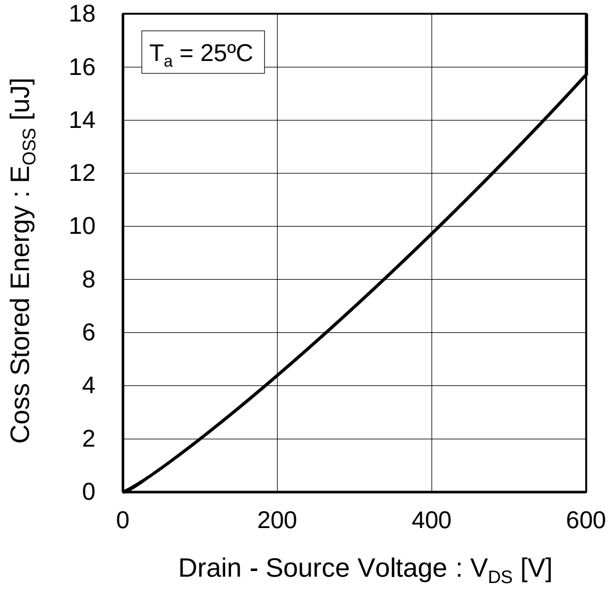


Fig.20 Switching Characteristics

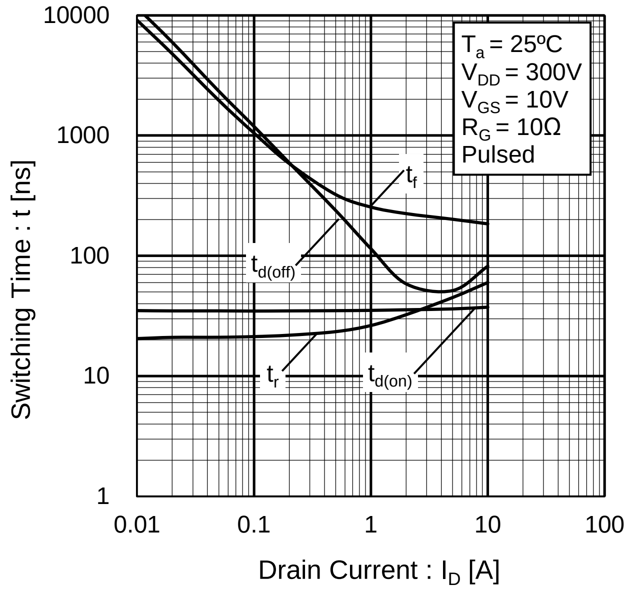
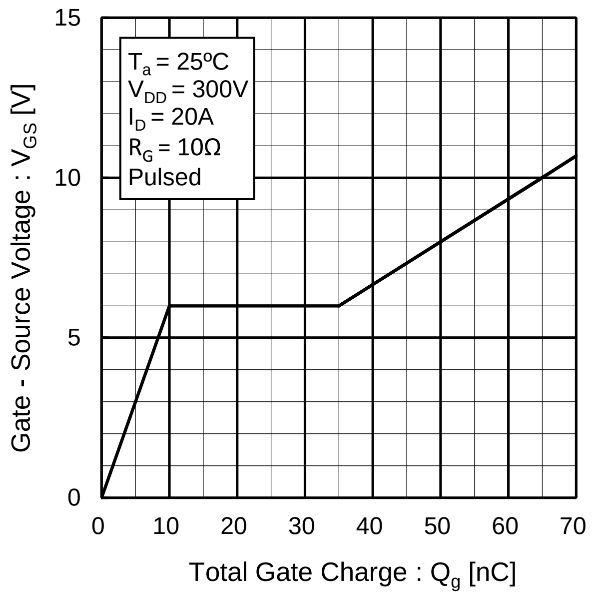
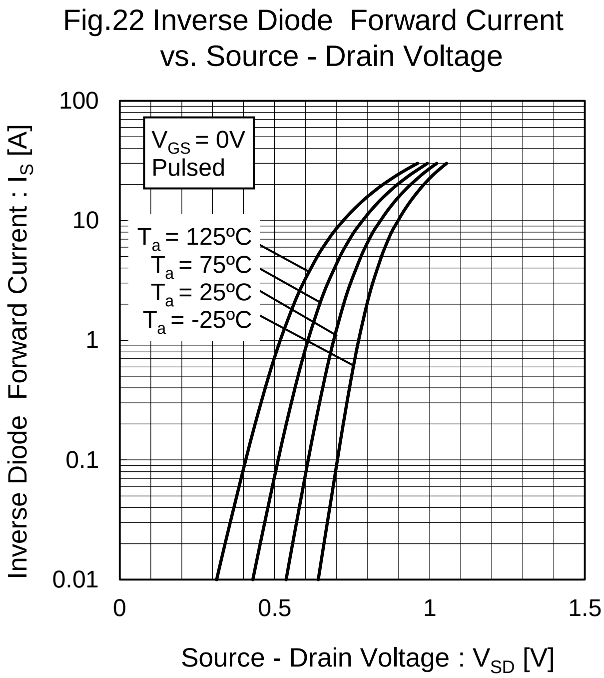
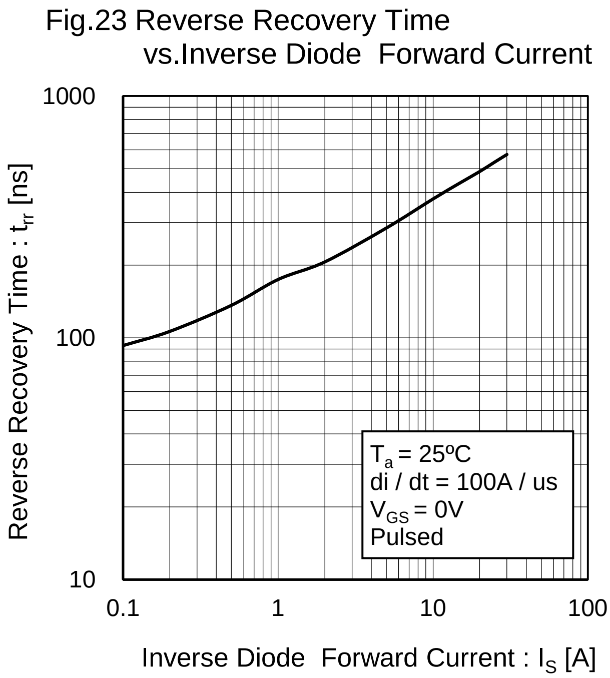


Fig.21 Dynamic Input Characteristics



●**Electrical characteristic curves**





●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

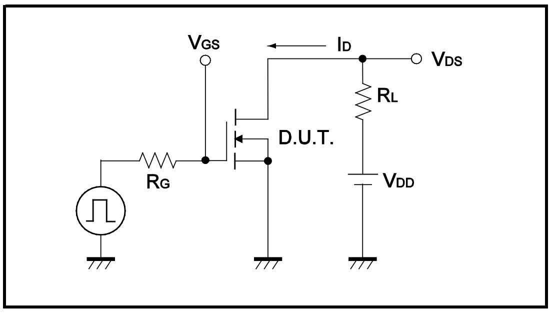


Fig.1-2 Switching Waveforms

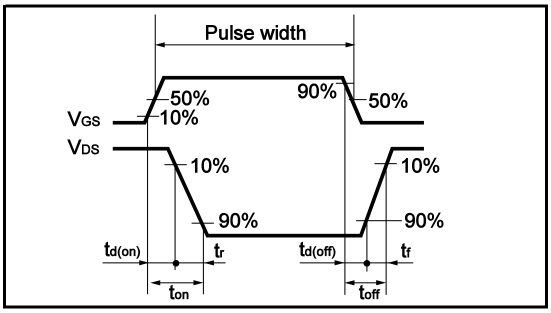


Fig.2-1 Gate Charge Measurement Circuit

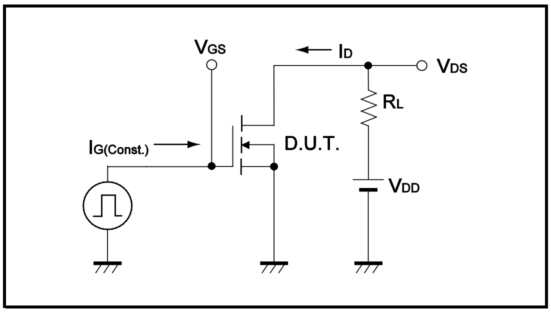


Fig.2-2 Gate Charge Waveform

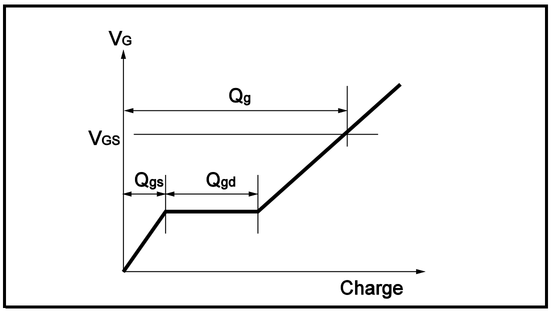


Fig.3-1 Avalanche Measurement Circuit

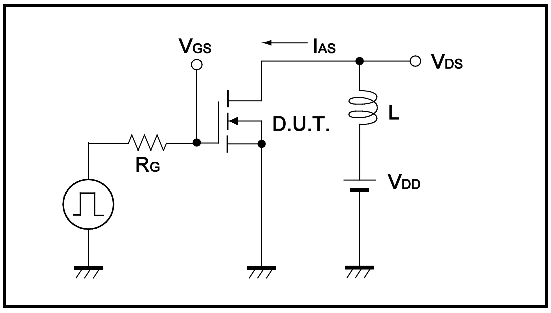


Fig.3-2 Avalanche Waveform

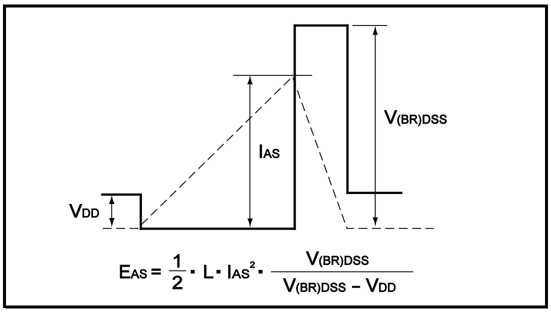


Fig.4-1 dv/dt Measurement Circuit

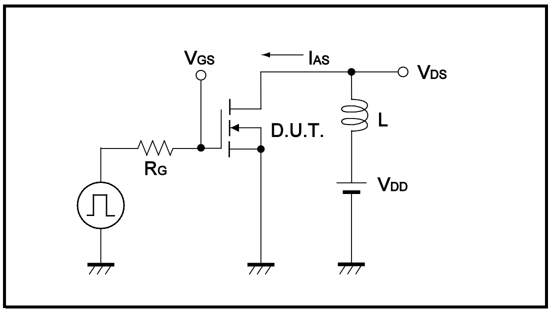


Fig.4-2 dv/dt Waveform

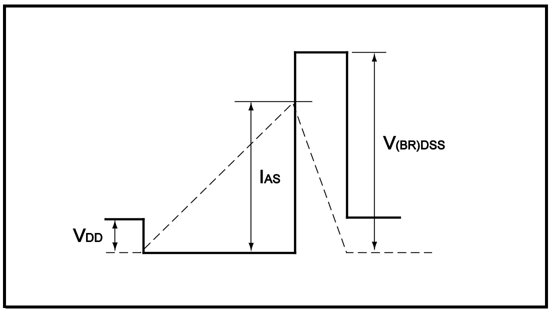


Fig.5-1 di/dt Measurement Circuit

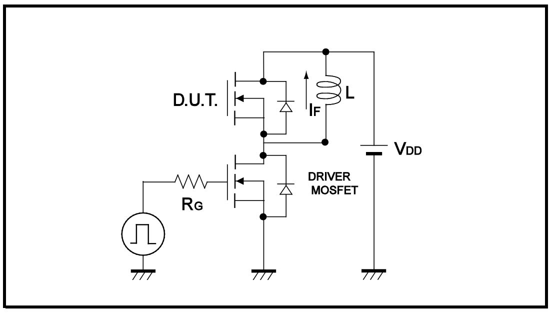
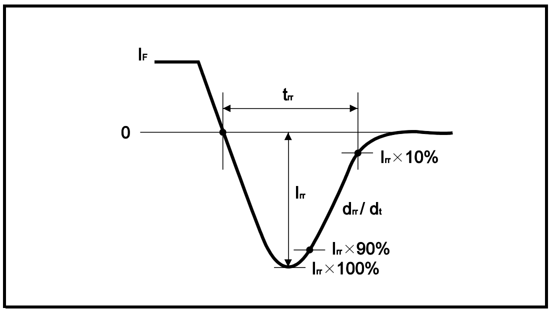
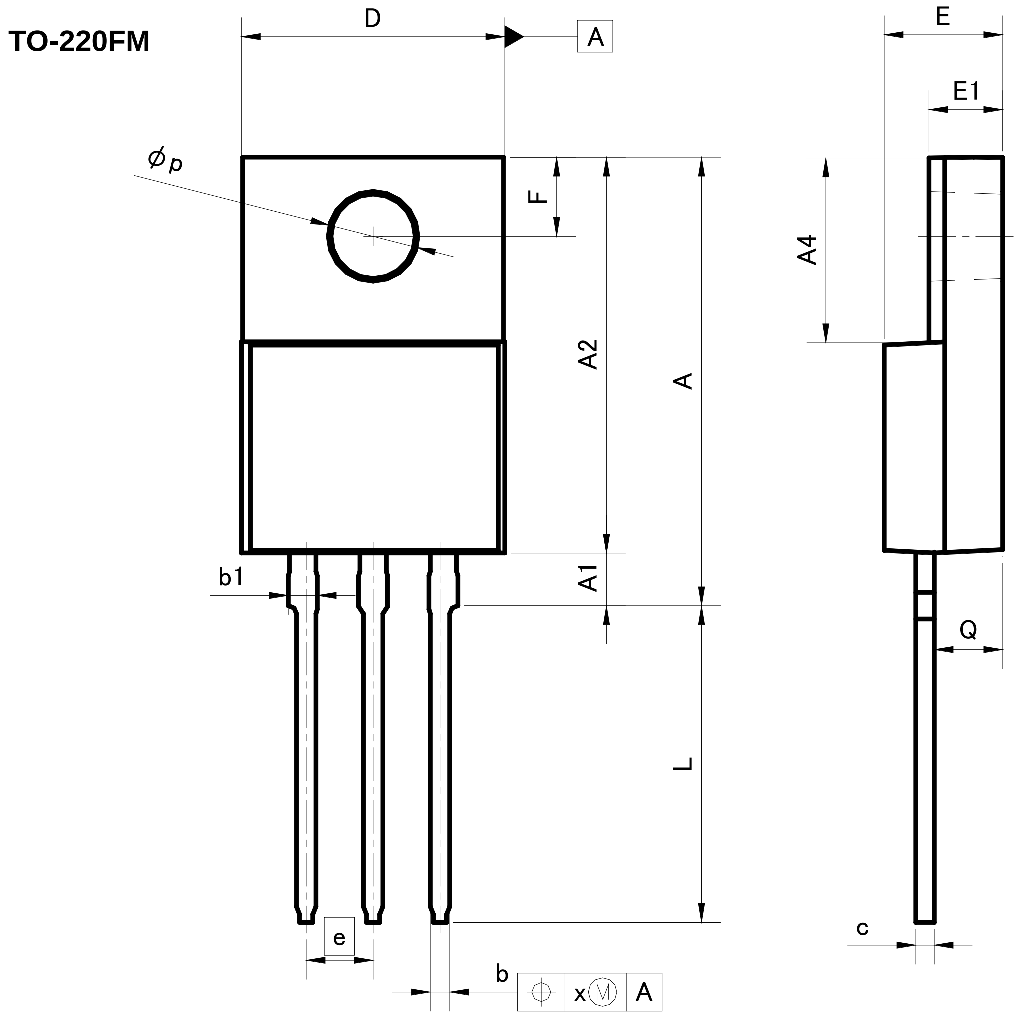


Fig.5-2 di/dt Waveform



●**Dimensions** (Unit : mm)



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	16.60	17.60	0.654	0.693
A1	1.80	2.20	0.071	0.087
A2	14.80	15.40	0.583	0.606
A4	6.80	7.20	0.268	0.283
b	0.70	0.85	0.028	0.033
b1	1.10	1.50	0.043	0.059
c	0.70	0.85	0.028	0.033
D	9.90	10.30	0.39	0.406
E	4.40	4.80	0.173	0.189
e	2.54		0.10	
E1	2.70	3.00	0.106	0.118
F	2.80	3.20	0.11	0.126
L	11.50	12.50	0.453	0.492
p	3.00	3.40	0.118	0.134
Q	2.10	3.10	0.083	0.122
x	−	0.381	−	0.015

Dimension in mm/inches

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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