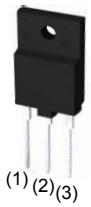
R6020ENZ

Nch 600V 20A Power MOSFET Data Sheet

V_{DSS}	600V
$R_{DS(on)}$ (Max.)	0.196Ω
I_D	20A
P_D	120W

●Outline

TO-3PF



●Features

1) Low on-resistance.

2) Fast switching speed.

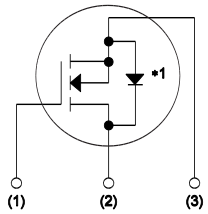
3) Gate-source voltage (V_{GSS}) guaranteed to be ±20V.

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	Packaging	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	360
	Taping code	C8
	Marking	R6020ENZ

●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	±9.4	A
Pulsed drain current		$I_{D,pulse}$ *2	±60	A
Gate - Source voltage		V_{GSS}	±20	V
Avalanche energy, single pulse		E_{AS} *3	418	mJ
Avalanche energy, repetitive		E_{AR} *3	0.63	mJ
Avalanche current, repetitive		I_{AR}	3.4	A
Power dissipation (T_c = 25°C)		P_D	120	W
Junction temperature		T_j	150	°C
Range of storage temperature		T_{stg}	−55 to +150	°C
Reverse diode dv/dt		dv/dt *4	15	V/ns

●Absolute maximum ratings

Parameter	Symbol	Conditions	Values	Unit
Drain - Source voltage slope	dv/dt	V_{DS} = 480V T_j = 25°C	50	V/ns

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}	-	-	1.04	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	40	°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
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} = ±20V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS\ (th)}$	V_{DS} = 10V, I_D = 1mA	2	-	4	V
Static drain - source on - state resistance	$R_{DS(on)}$ *5	V_{GS} = 10V, I_D = 9.5A T_j = 25°C T_j = 125°C	- -	0.170 0.360	0.196 -	Ω
Gate input resistance	R_G	f = 1MHz, open drain	-	5.8	-	Ω

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Transconductance	g_{fs} *5	V_{DS} = 10V, I_D = 10A	5	10	-	S
Input capacitance	C_{iss}	V_{GS} = 0V	-	1400	-	pF
Output capacitance	C_{oss}	V_{DS} = 25V	-	1200	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	130	-	
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS} = 0V V_{DS} = 0V to 480V	-	56	-	pF
Effective output capacitance, time related	$C_{o(tr)}$		-	266	-	
Turn - on delay time	$t_{d(on)}$ *5	$V_{DD} \simeq$ 480V, V_{GS} = 10V	-	35	-	ns
Rise time	t_r *5	I_D = 10A	-	53	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 47.5Ω	-	150	-	
Fall time	t_f *5	R_G = 10Ω	-	67	-	

●Gate Charge characteristics (T_a = 25°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *5	$V_{DD} \simeq$ 480V	-	60	-	nC
Gate - Source charge	Q_{gs} *5	I_D = 20A	-	8	-	
Gate - Drain charge	Q_{gd} *5	V_{GS} = 10V	-	33	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \simeq$ 480V, I_D = 20A	-	6.9	-	V

*1 Limited only by maximum temperature allowed.

*2 $P_W \leq 10\mu s$, Duty cycle ≤ 1%

*3 I_D = 3.4A, V_{DD} = 50V

*4 Reference measurement circuits Fig.5-1.

*5 Pulsed

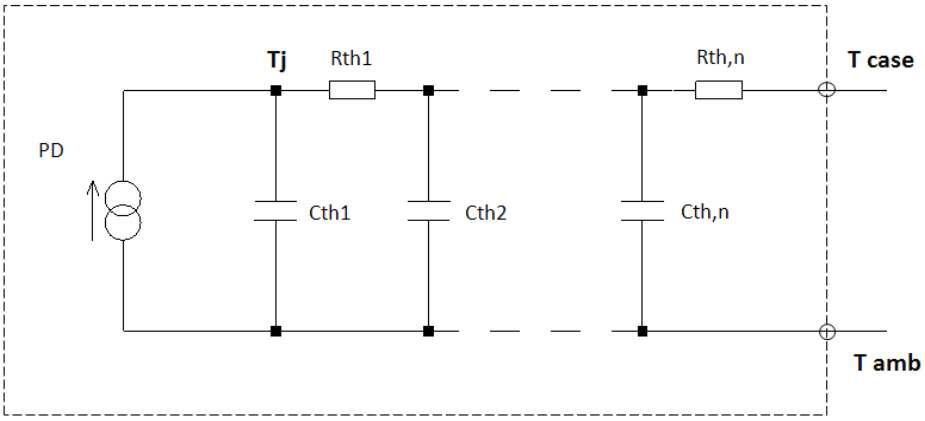
●Body diode electrical characteristics (Source-Drain) (T_a = 25°C)

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		-	-	60	A
Forward voltage	V_{SD} *5	V_{GS} = 0V, I_S = 10A	-	-	1.5	V
Reverse recovery time	t_{rr} *5	I_S = 20A di/dt = 100A/μs	-	550	-	ns
Reverse recovery charge	Q_{rr} *5		-	10.4	-	μC
Peak reverse recovery current	I_{rrm} *5		-	38	-	A

●Typical Transient Thermal Characteristics

Symbol	Value	Unit
R_{th1}	0.129	K/W
R_{th2}	0.627	
R_{th3}	1.22	

Symbol	Value	Unit
C_{th1}	0.00475	Ws/K
C_{th2}	0.0387	
C_{th3}	1.06	



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

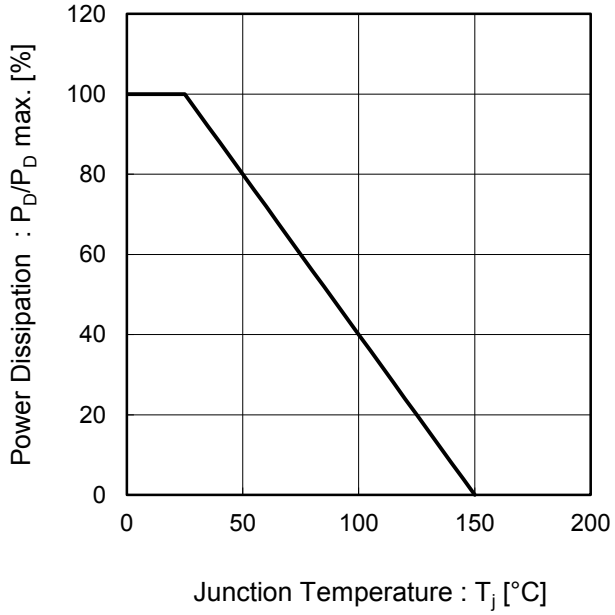


Fig.2 Maximum Safe Operating Area

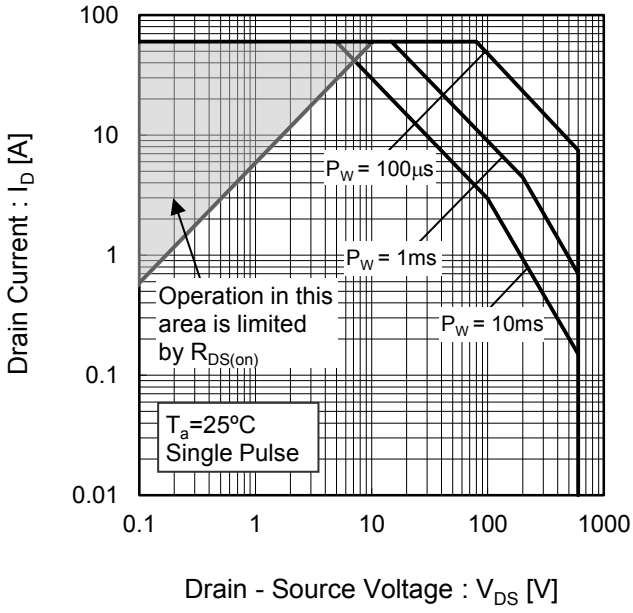


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

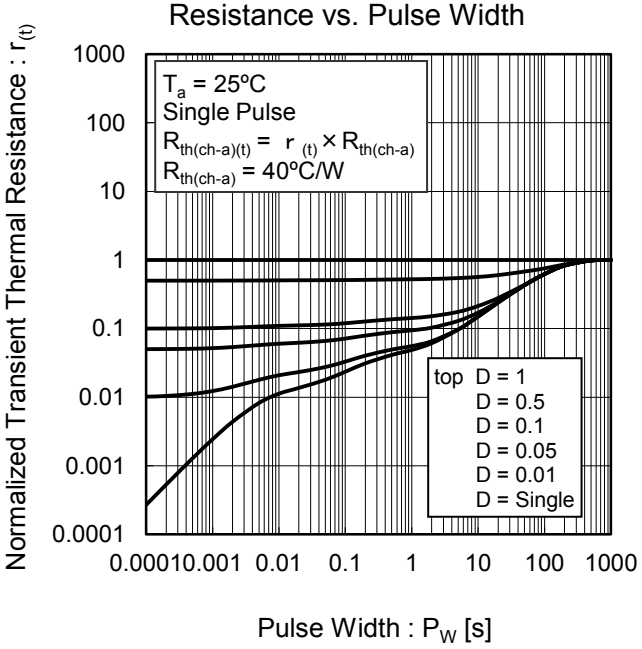
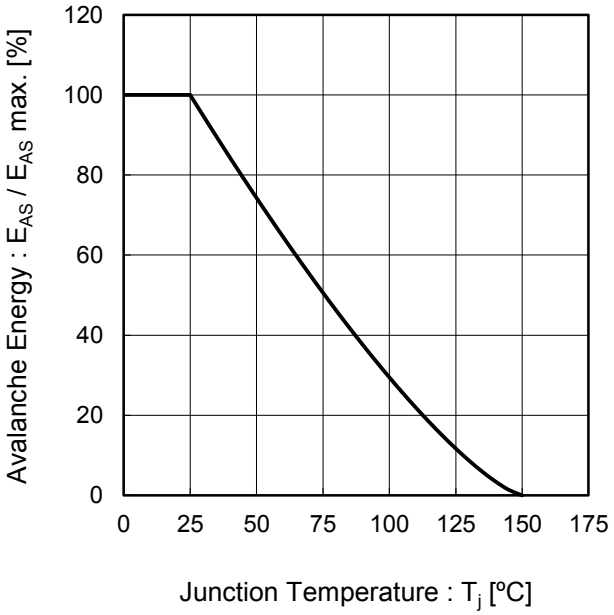


Fig.4 Avalanche Energy Derating Curve vs Junction Temperature



●Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

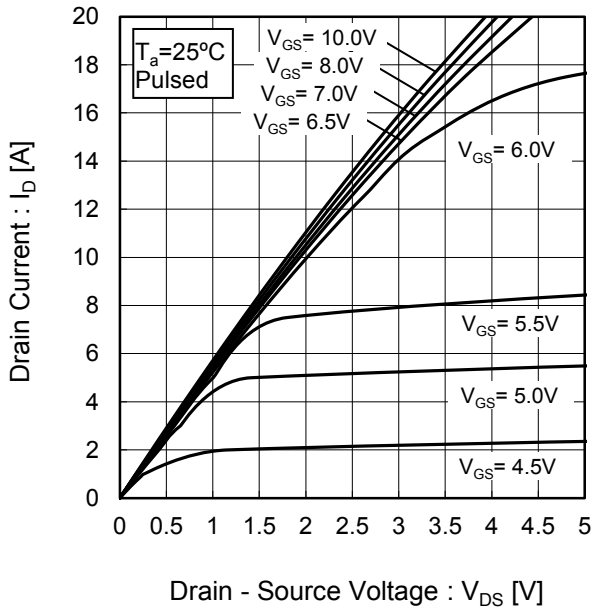


Fig.6 Typical Output Characteristics(II)

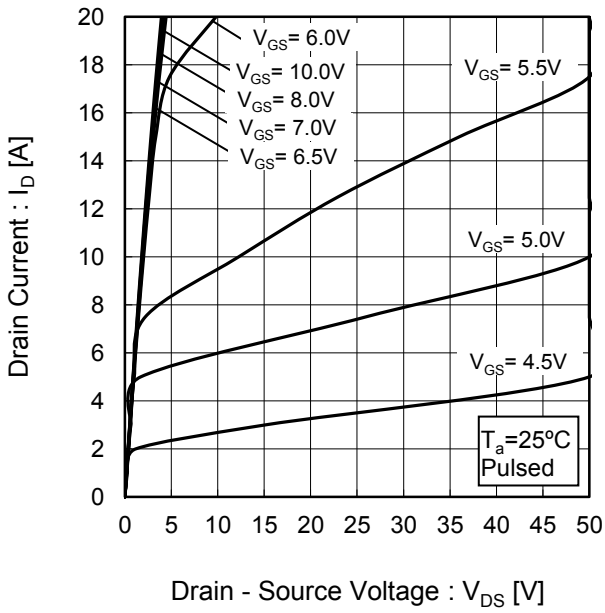


Fig.7 T_j = 150°C Typical Output Characteristics(I)

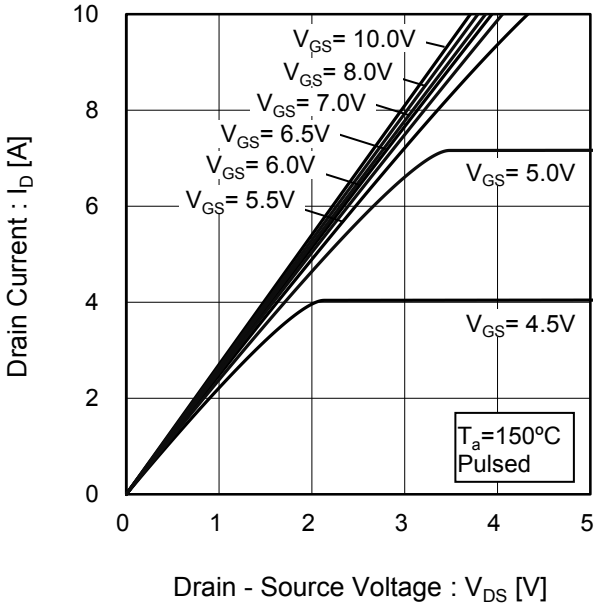
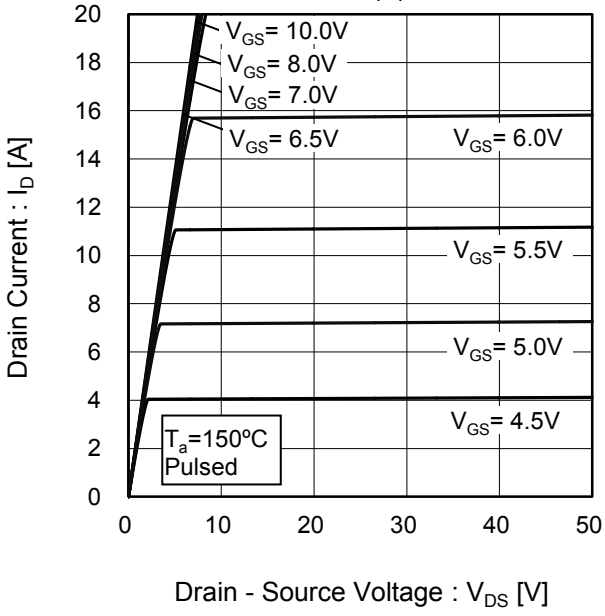


Fig.8 T_j = 150°C Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.9 Breakdown Voltage vs. Junction Temperature

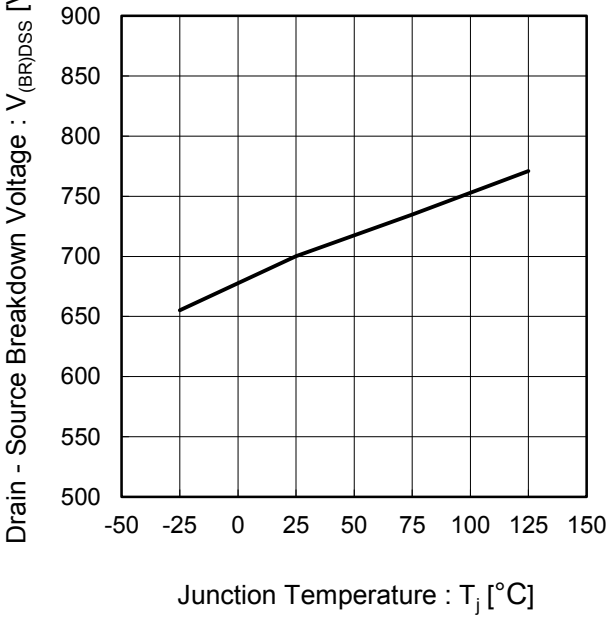


Fig.10 Typical Transfer Characteristics

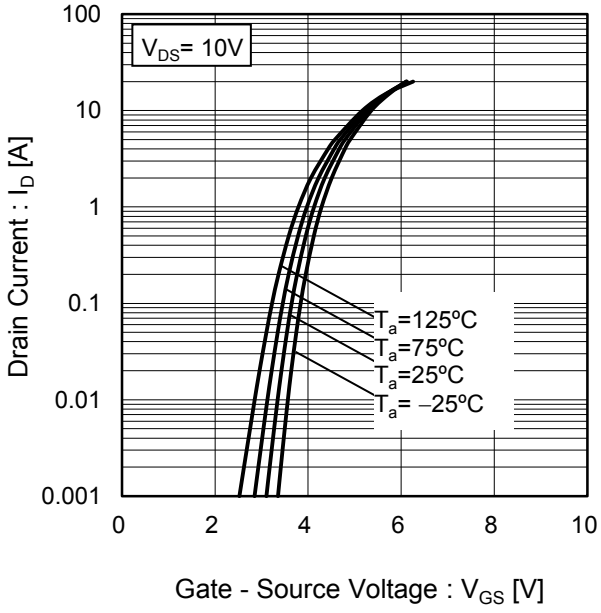


Fig.11 Gate Threshold Voltage vs. Junction Temperature

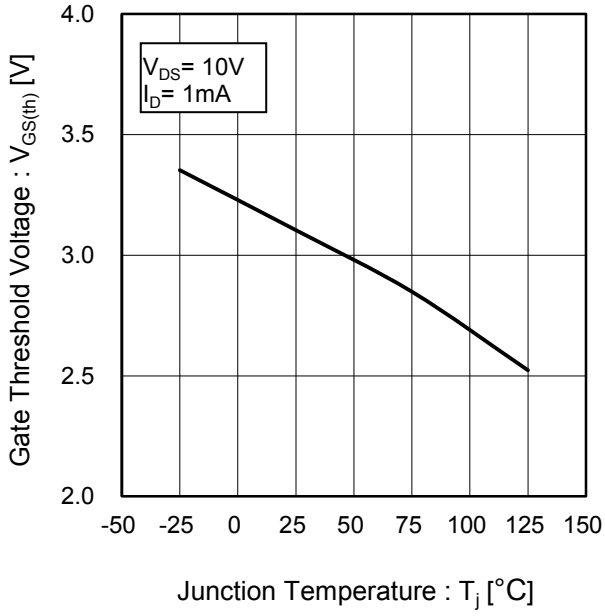
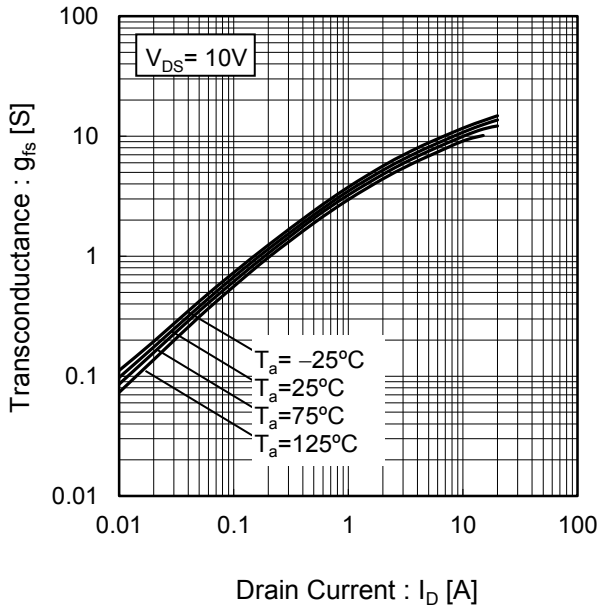


Fig.12 Transconductance vs. Drain Current



●Electrical characteristic curves

Fig.13 Static Drain - Source On - State Resistance vs. Gate Source Voltage

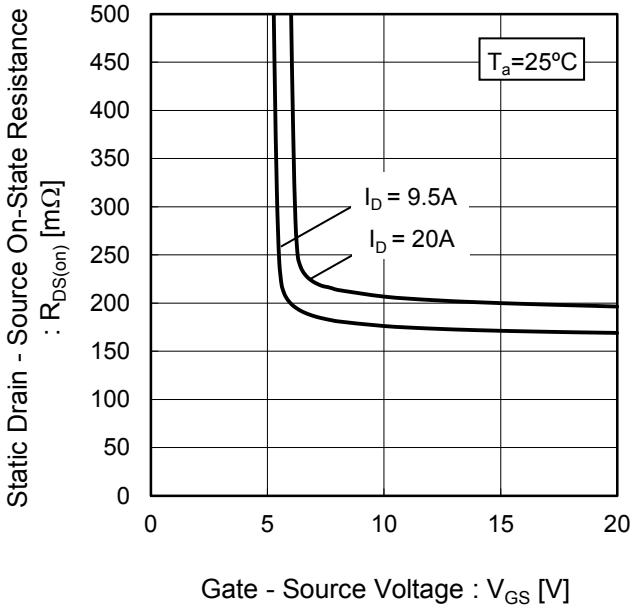


Fig.14 Static Drain - Source On - State Resistance vs. Junction Temperature

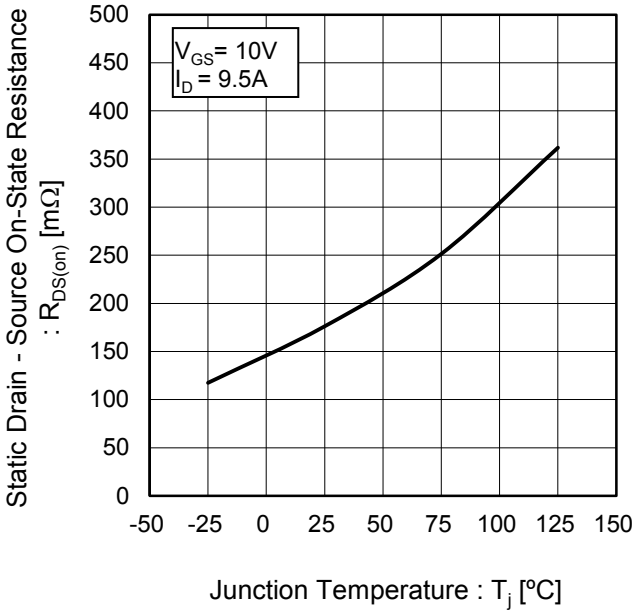


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current

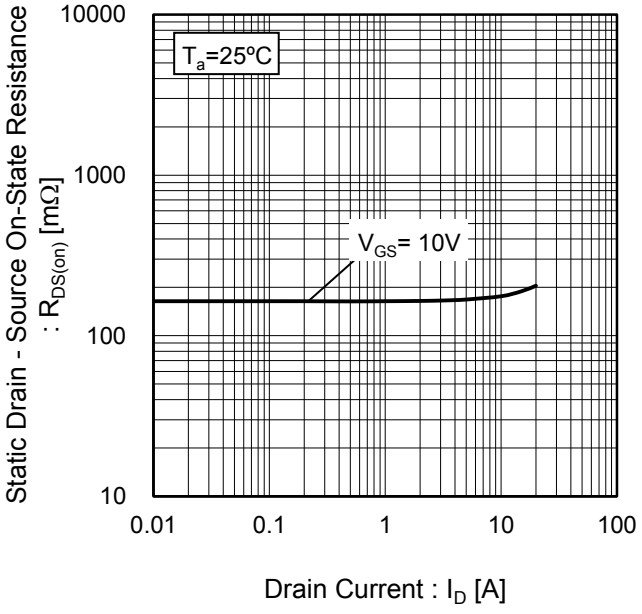
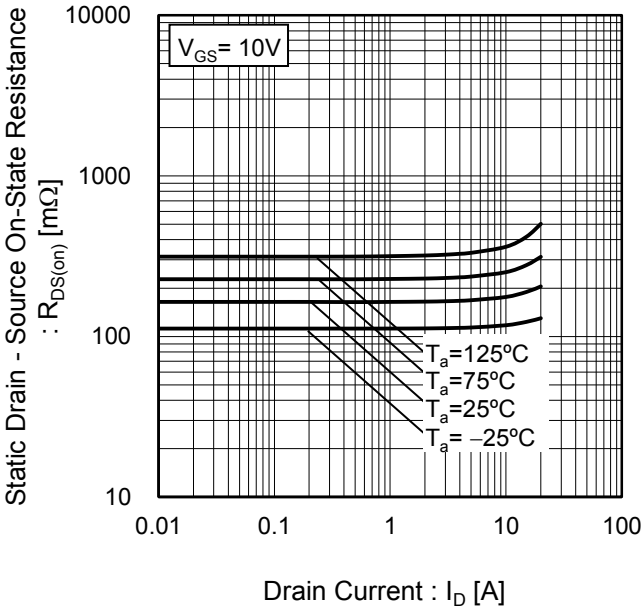


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current



●Electrical characteristic curves

Fig.17 Typical Capacitance vs. Drain - Source Voltage

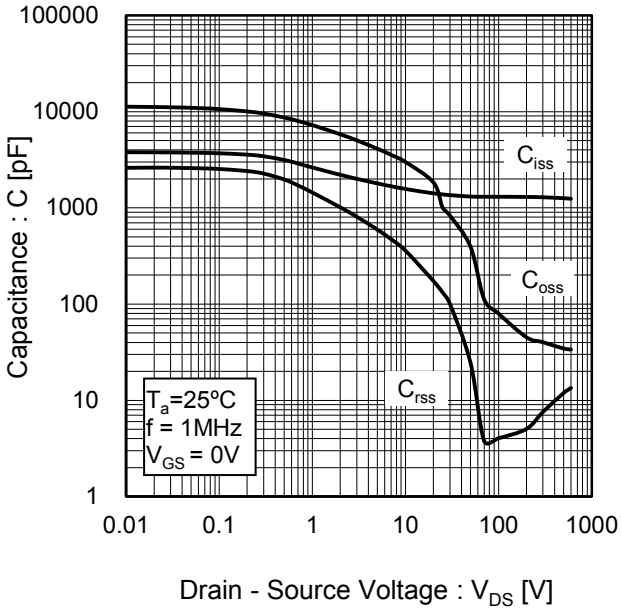


Fig.18 Coss Stored Energy

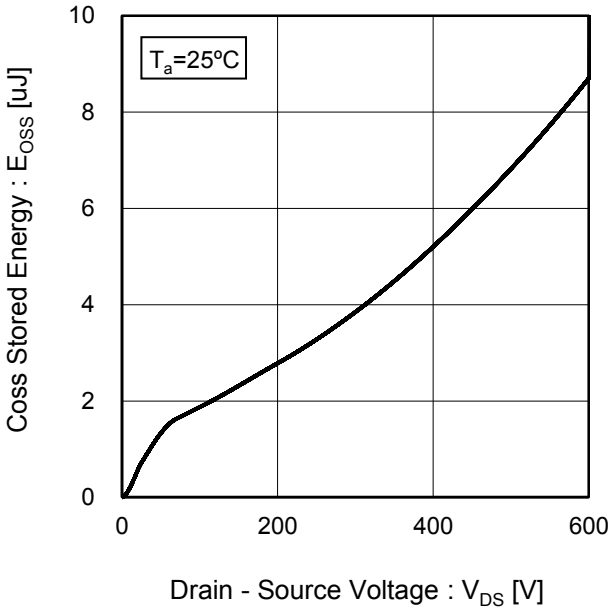


Fig.19 Switching Characteristics

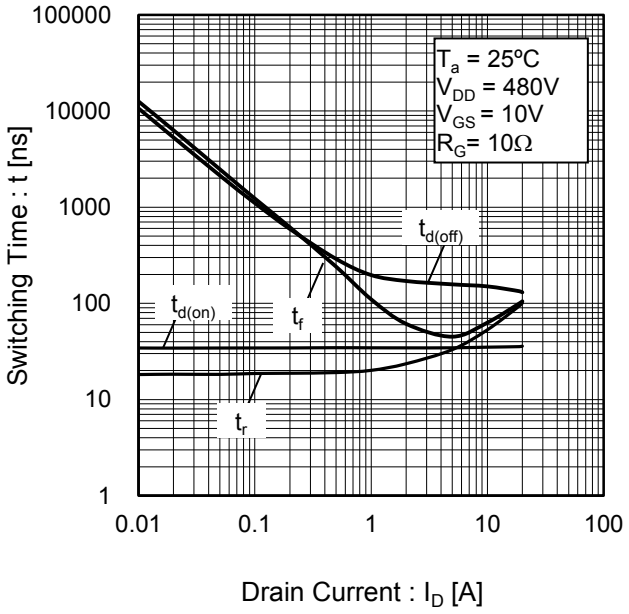
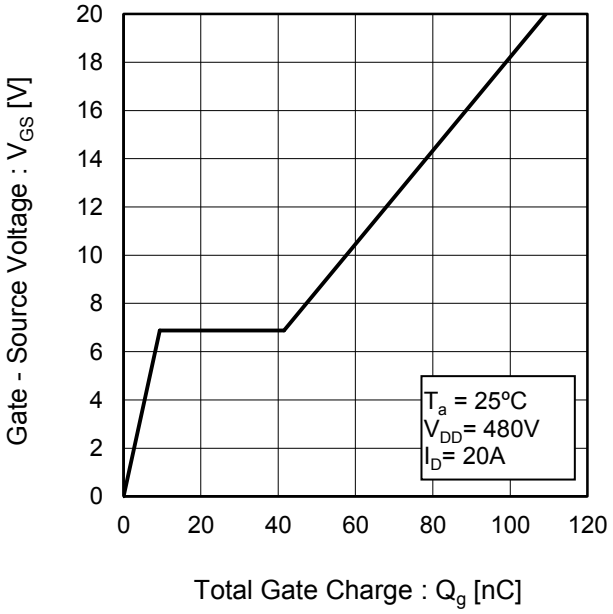


Fig.20 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.21 Inverse Diode Forward Current vs. Source - Drain Voltage

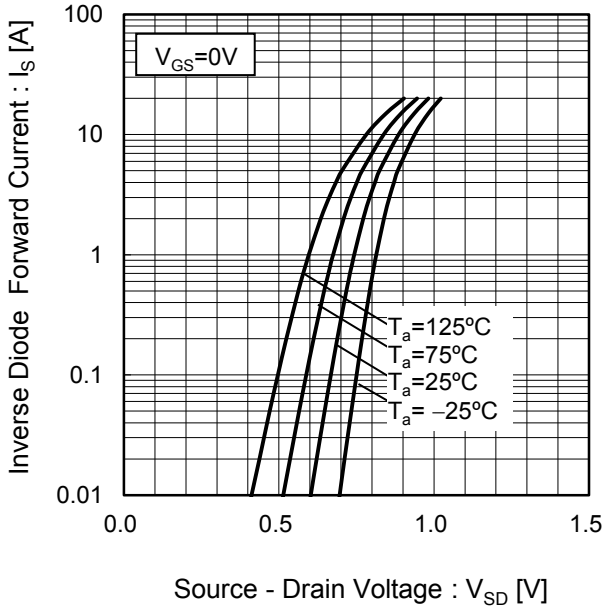
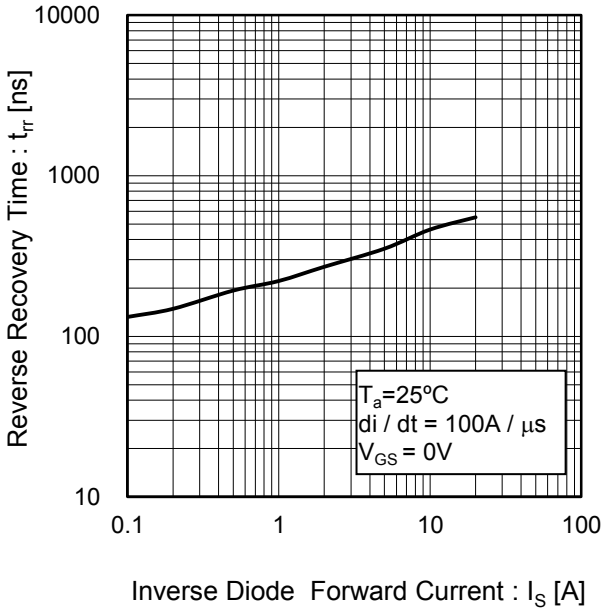


Fig.22 Reverse Recovery Time vs.Inverse Diode Forward Current



●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

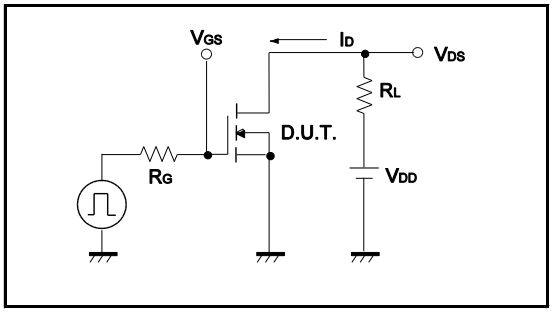


Fig.1-2 Switching Waveforms

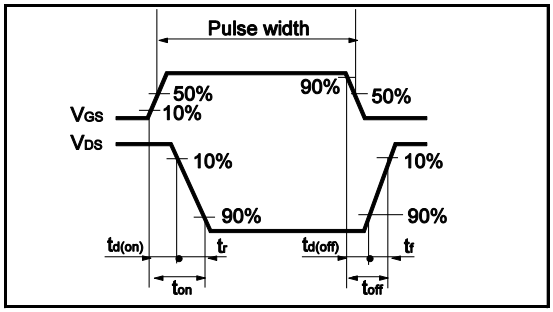


Fig.2-1 Gate Charge Measurement Circuit

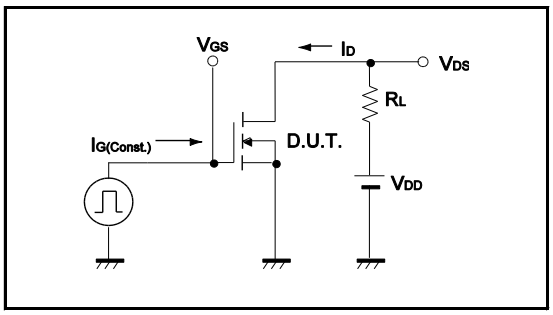


Fig.2-2 Gate Charge Waveform

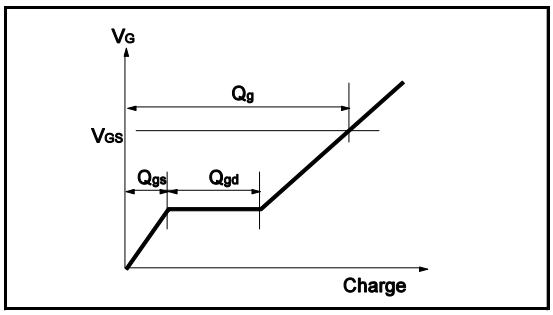


Fig.3-1 Avalanche Measurement Circuit

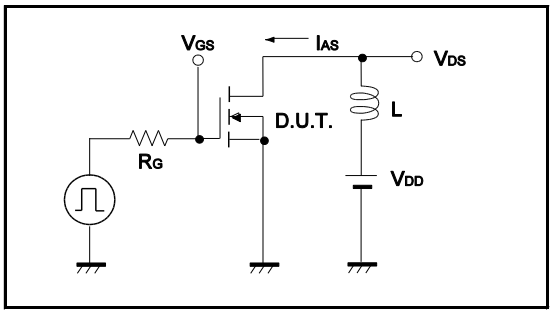


Fig.3-2 Avalanche Waveform

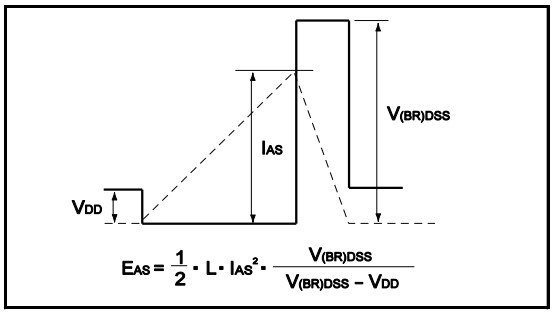


Fig.4-1 dv/dt Measurement Circuit

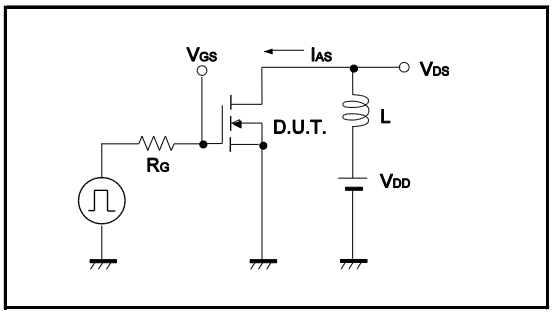


Fig.4-2 dv/dt Waveform

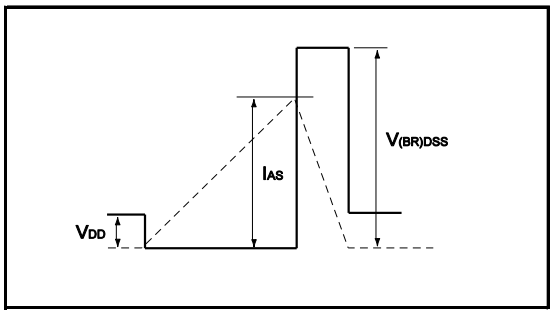


Fig.5-1 di/dt Measurement Circuit

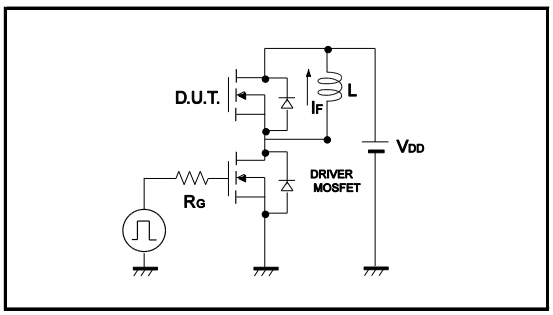
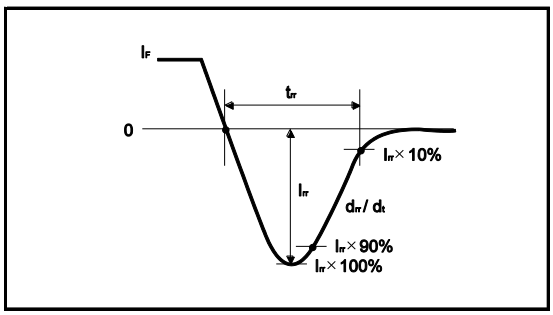
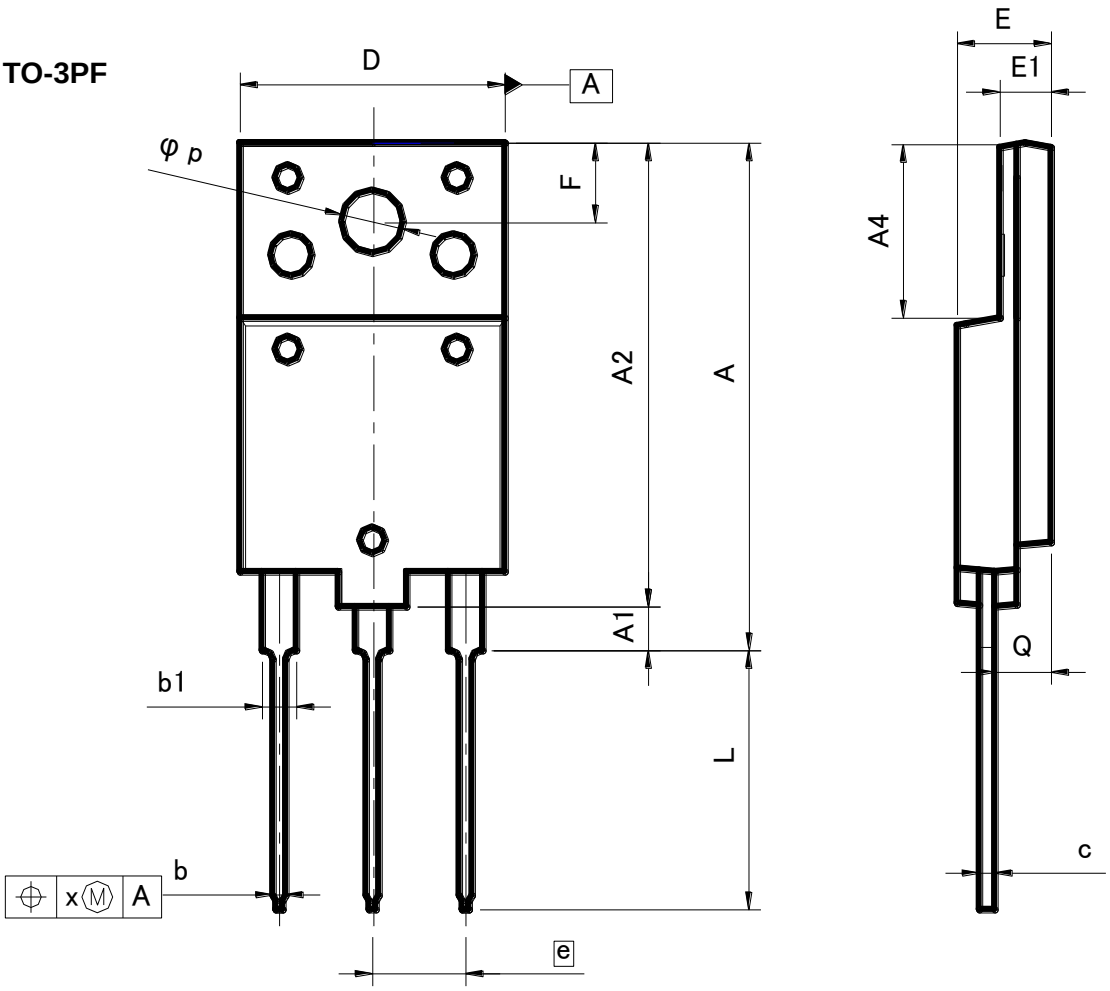


Fig.5-2 di/dt Waveform



●**Dimensions** (Unit : mm)

TO-3PF



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	26.30	26.70	1.035	1.051
A1	2.30	2.70	0.091	0.106
A2	26.30	26.70	1.035	1.051
A4	9.80	10.20	0.386	0.402
b	0.65	0.95	0.026	0.037
b1	1.80	2.20	0.071	0.087
c	0.80	1.10	0.031	0.043
D	15.30	15.70	0.602	0.618
E	5.30	5.70	0.209	0.224
e	5.45		0.215	-
E1	2.80	3.20	0.110	0.126
F	4.30	4.70	0.169	0.185
L	14.60	15.00	0.575	0.591
p	3.40	3.80	0.134	0.150
Q	3.10	3.50	0.122	0.138
x	-	0.50	-	0.020

Dimension in mm / inches

Notes

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2) Before you use our Products, please contact our sales representative and verify the latest specifications :

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7) The Products specified in this document are not designed to be radiation tolerant.

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