

V_{DSS}	600V
$R_{DS(on)}(Max.)$	0.196Ω
I_D	±20A
P_D	231W

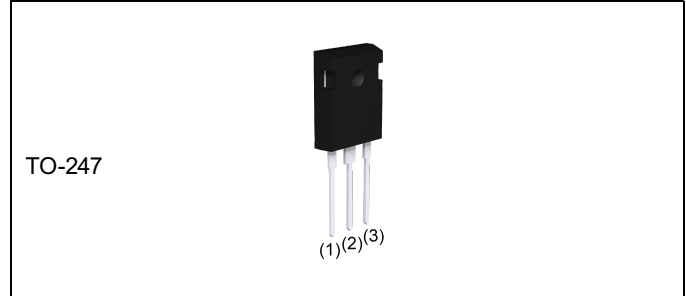
●Features

- 1) Low on-resistance.
- 2) Ultra fast switching speed.
- 3) Parallel use is easy.
- 4) Pb-free lead plating ; RoHS compliant

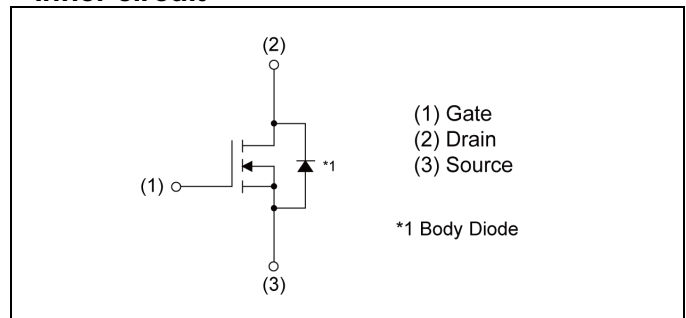
●Application

Switching

●Outline



●Inner circuit



●Packaging specifications

Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	450
	Taping code	C9
	Marking	R6020KNZ1

●Absolute maximum ratings ($T_a = 25^\circ\text{C}$, unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain - Source voltage		V_{DSS}	600	V
Continuous drain current ($T_c = 25^\circ\text{C}$)		I_D^{*1}	±20	A
Pulsed drain current		I_{DP}^{*2}	±60	A
Gate - Source voltage	static	V_{GSS}	±20	V
	AC($f > 1\text{Hz}$)		±30	V
Avalanche current, single pulse		I_{AS}	3.4	A
Avalanche energy, single pulse		E_{AS}^{*3}	418	mJ
Power dissipation ($T_c = 25^\circ\text{C}$)		P_D	231	W
Junction temperature		T_j	150	°C
Operating junction and storage temperature range		T_{stg}	-55 to +150	°C

● Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC}^{*4}	-	-	0.54	°C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	30	°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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	600	-	-	V
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V$ $T_j = 25^{\circ}\text{C}$	-	-	100	μA
		$T_j = 125^{\circ}\text{C}$	-	-	1000	
Gate - Source leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	3	-	5	V
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 10V, I_D = 9.5A$ $T_j = 25^{\circ}\text{C}$	-	0.170	0.196	Ω
		$T_j = 125^{\circ}\text{C}$	-	0.360	-	
Gate resistance	R_G	$f = 1\text{MHz, open drain}$	-	2.3	-	Ω

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward Transfer Admittance	$ Y_{fs} ^{*5}$	$V_{DS} = 10\text{V}, I_D = 10\text{A}$	5	10	-	S
Input capacitance	C_{iss}	$V_{GS} = 0\text{V}$	-	1550	-	pF
Output capacitance	C_{oss}	$V_{DS} = 25\text{V}$	-	1350	-	
Reverse transfer capacitance	C_{rss}	$f = 1\text{MHz}$	-	55	-	
Turn - on delay time	$t_{d(on)}^{*5}$	$V_{DD} \approx 300\text{V}, V_{GS} = 10\text{V}$	-	30	-	ns
Rise time	t_r^{*5}	$I_D = 10\text{A}$	-	30	-	
Turn - off delay time	$t_{d(off)}^{*5}$	$R_L \approx 30\Omega$	-	55	-	
Fall time	t_f^{*5}	$R_G = 10\Omega$	-	10	-	

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g^{*5}	$V_{DD} \approx 300\text{V}$	-	40	-	nC
Gate - Source charge	Q_{gs}^{*5}	$I_D = 20\text{A}$	-	12	-	
Gate - Drain charge	Q_{gd}^{*5}	$V_{GS} = 10\text{V}$	-	15	-	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} \approx 300\text{V}, I_D = 20\text{A}$	-	6.4	-	V

*1 Limited only by maximum channel temperature allowed.

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

*3 $L \approx 70\text{mH}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, STARTING $T_j=25^\circ\text{C}$

*4 $T_C=25^\circ\text{C}$

*5 Pulsed

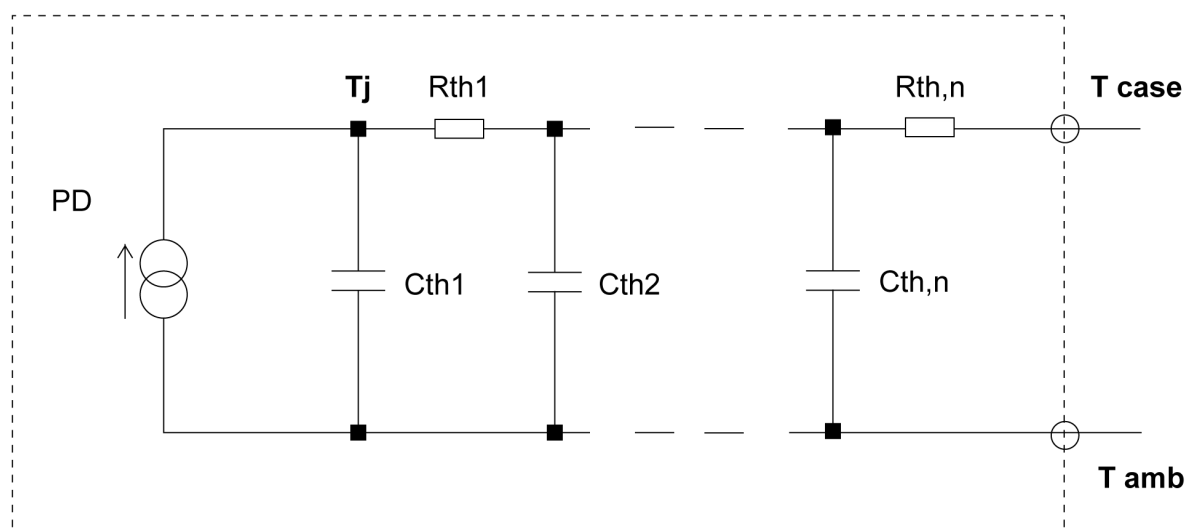
●Body diode electrical characteristics (Source-Drain) ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous forward current	I_S^{*1}	$T_C = 25^\circ\text{C}$	-	-	20	A
Pulse forward current	I_{SP}^{*2}		-	-	60	A
Forward voltage	V_{SD}^{*5}	$V_{GS} = 0\text{V}, I_S = 20\text{A}$	-	-	1.5	V
Reverse recovery time	t_{rr}^{*5}	$I_S = 20\text{A}$ $di/dt = 100\text{A}/\mu\text{s}$	-	500	-	ns
Reverse recovery charge	Q_{rr}^{*5}		-	7.5	-	μC
Peak reverse recovery current	I_{rm}^{*5}		-	30	-	A

●Typical transient thermal characteristics

Symbol	Value	Unit
R_{th1}	0.283	K/W
R_{th2}	0.430	
R_{th3}	0.250	

Symbol	Value	Unit
C_{th1}	0.00969	Ws/K
C_{th2}	0.226	
C_{th3}	13.8	



●Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

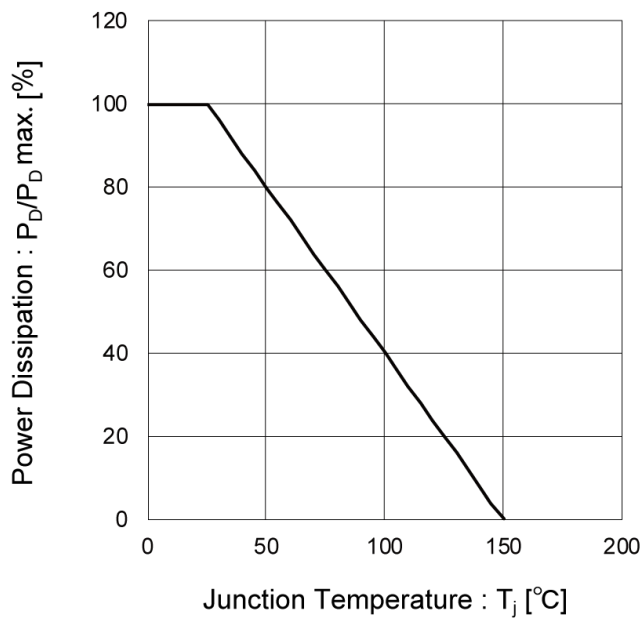


Fig.2 Maximum Safe Operating Area

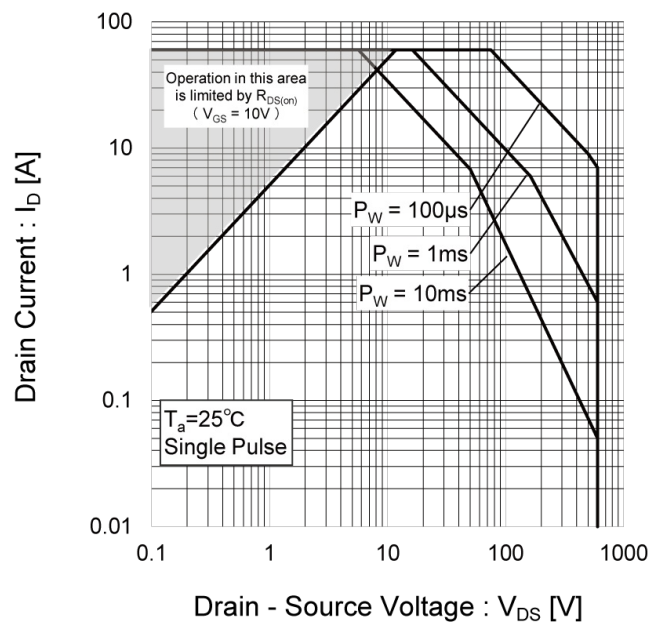
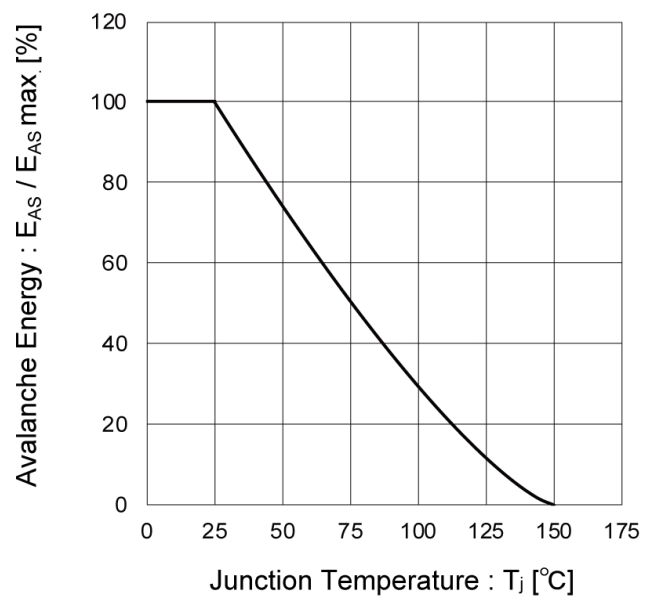


Fig.3 Avalanche Energy Derating Curve vs. Junction Temperature



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

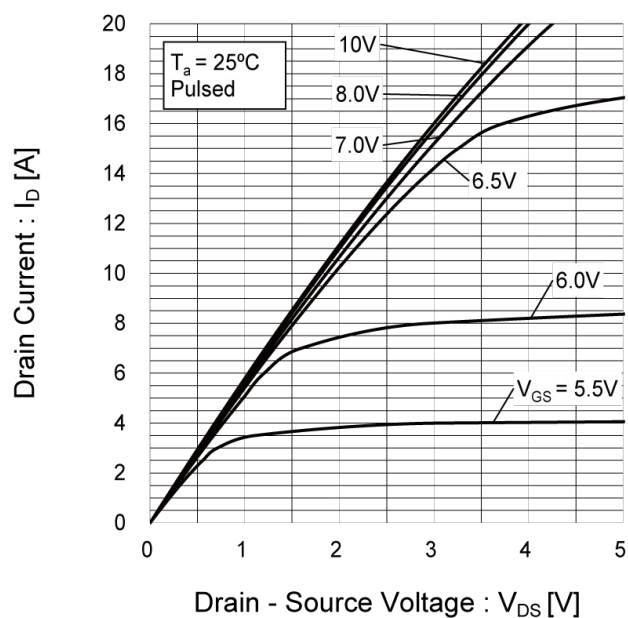
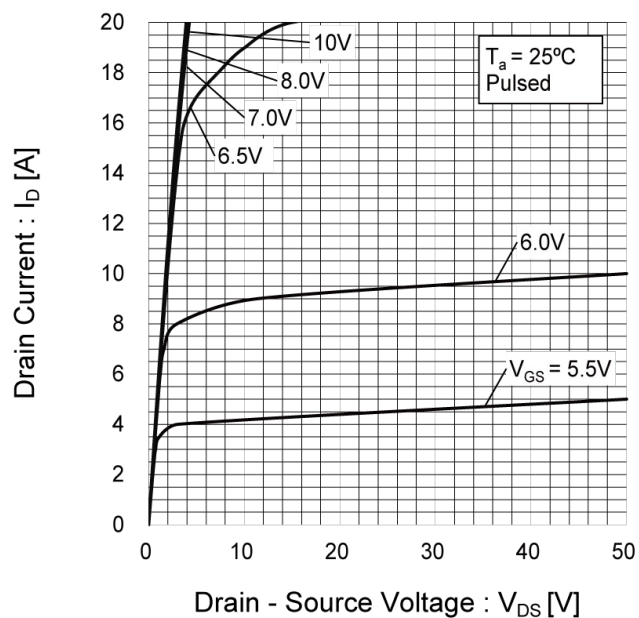


Fig.5 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.6 Breakdown Voltage vs.
Junction Temperature

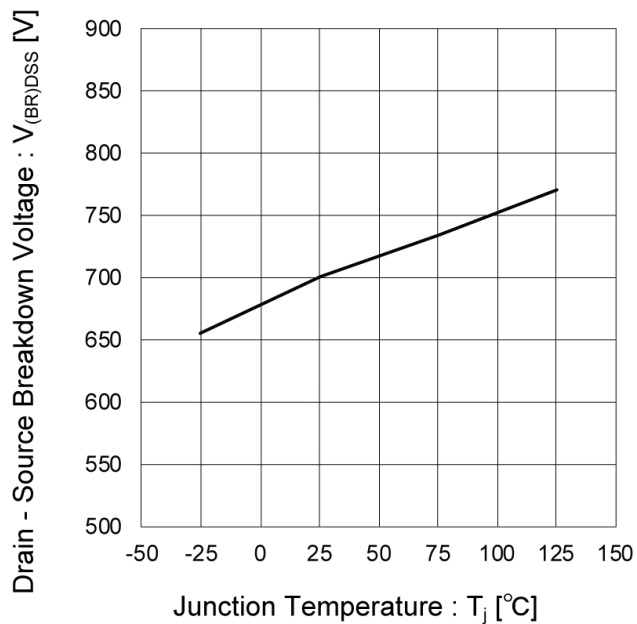


Fig.7 Typical Transfer Characteristics

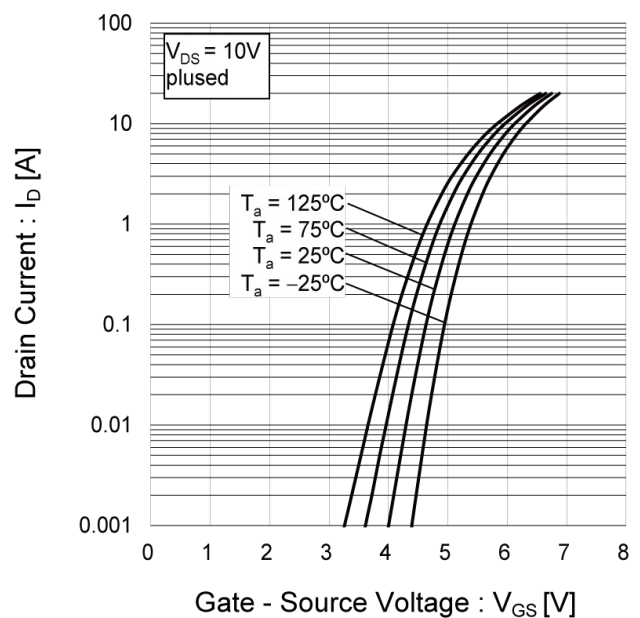


Fig.8 Gate Threshold Voltage vs.
Junction Temperature

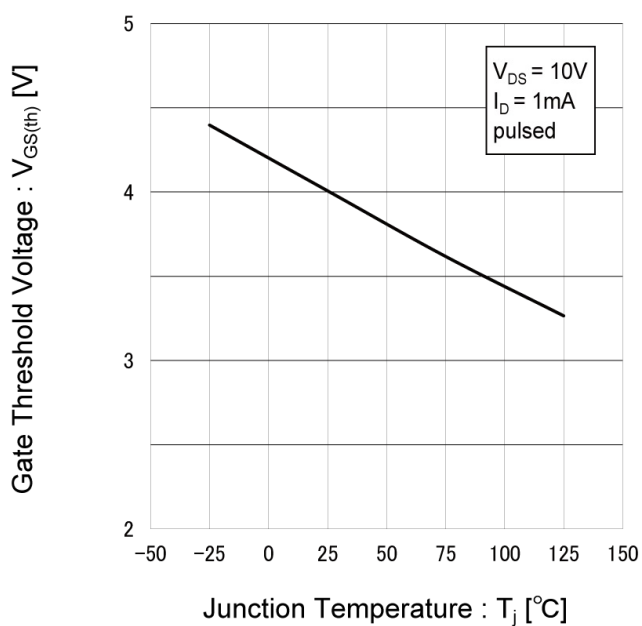
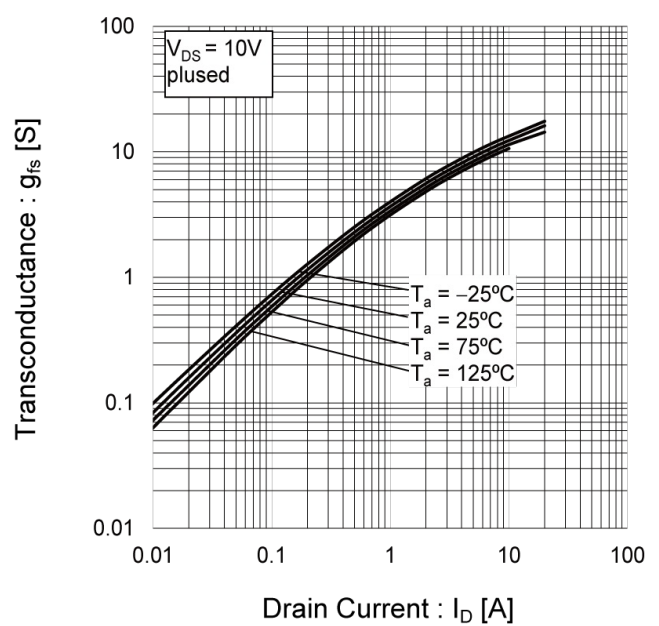


Fig.9 Forward Transfer Admittance vs.
Drain Current



●Electrical characteristic curves

Fig.10 Static Drain - Source On - State Resistance vs. Gate Source Voltage

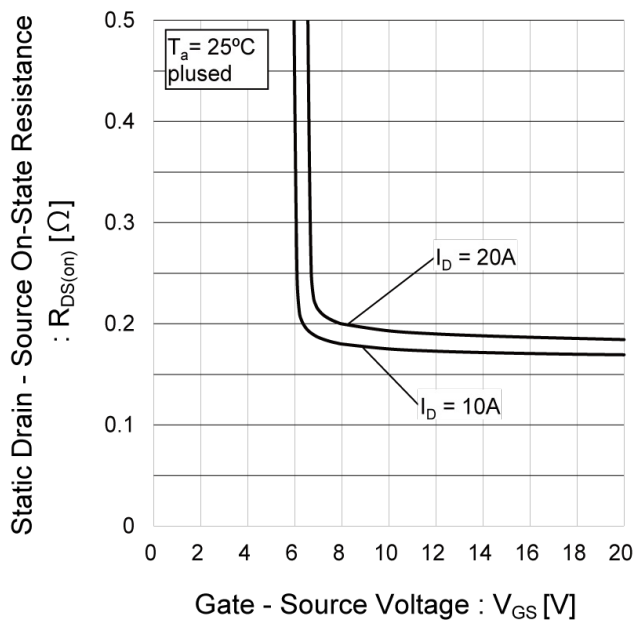


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature

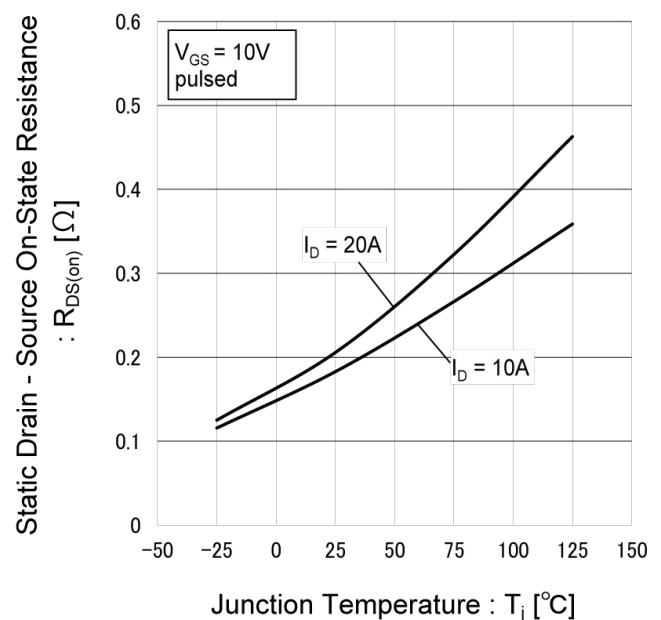
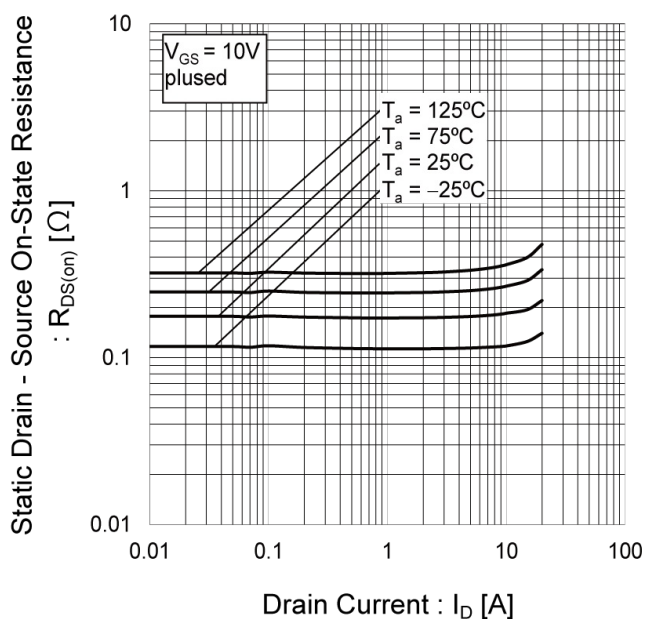


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current(I)



●Electrical characteristic curves

Fig.13 Typical Capacitance vs.
Drain - Source Voltage

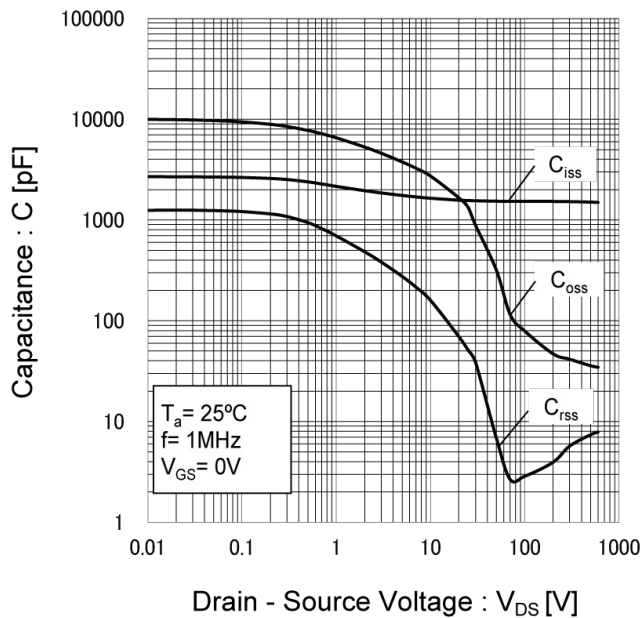


Fig.14 Switching Characteristics

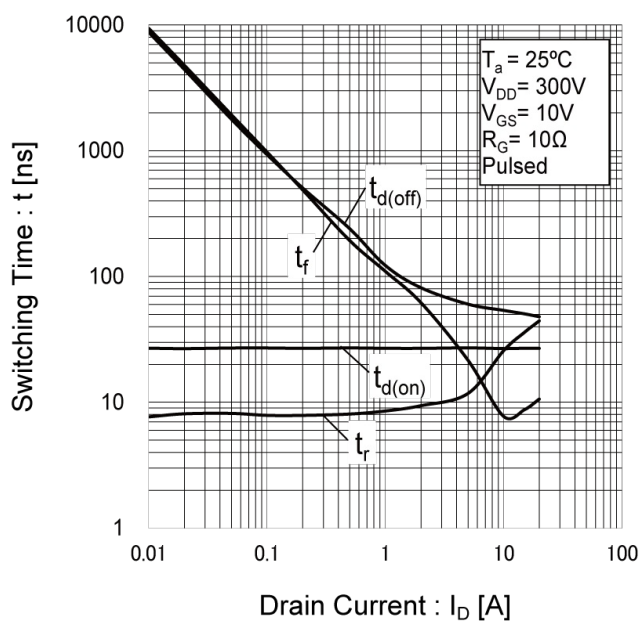
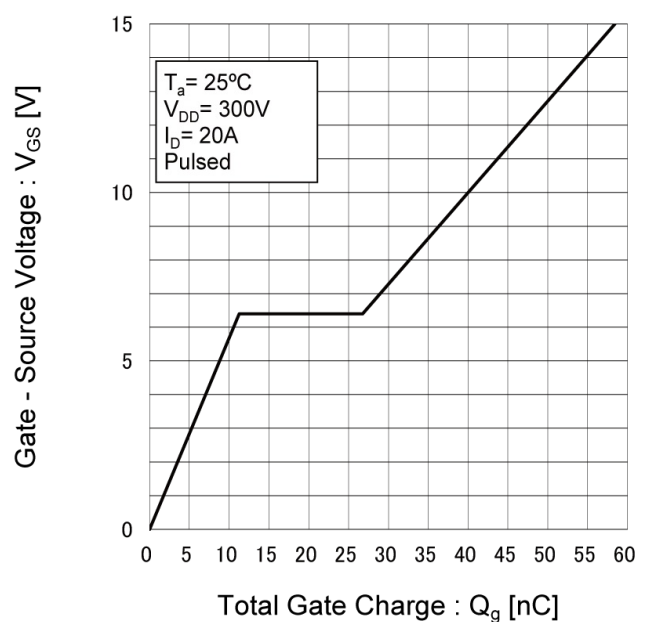


Fig.15 Dynamic Input Characteristics



●Electrical characteristic curves

Fig.16 Inverse Diode Forward Current
vs. Source - Drain Voltage

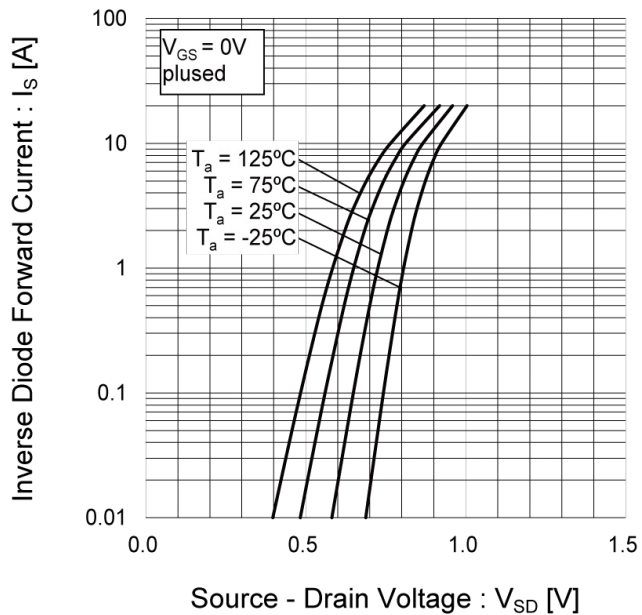
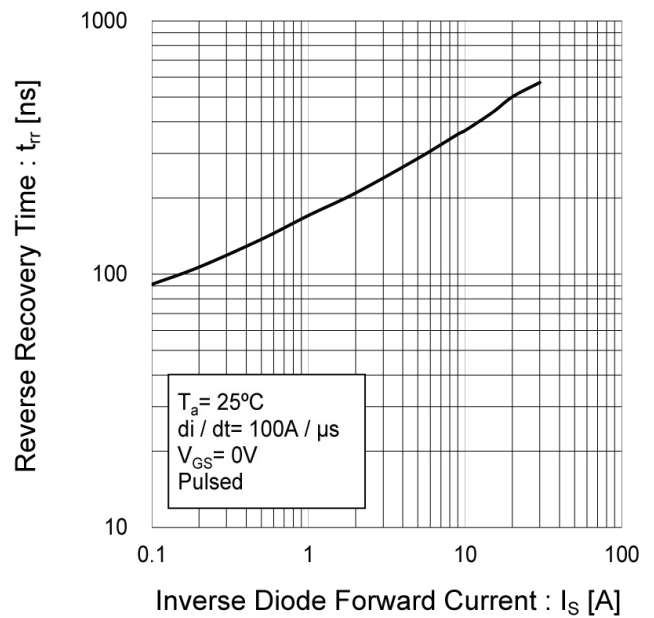


Fig.17 Reverse Recovery Time vs.
Inverse Diode Forward Current



● Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

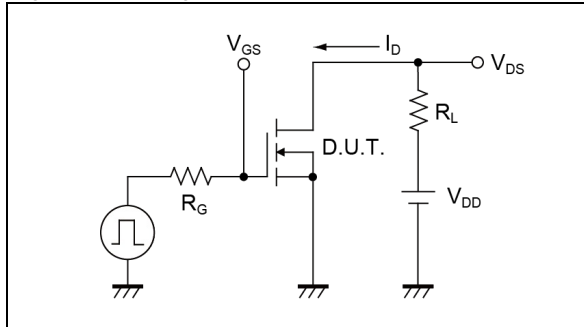


Fig.1-2 Switching Waveforms

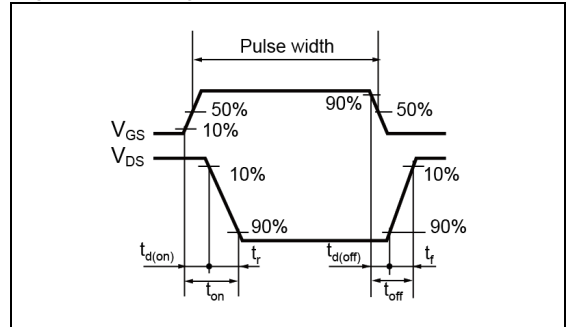


Fig.2-1 Gate Charge Measurement Circuit

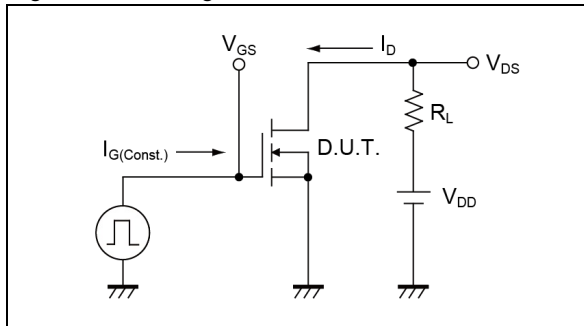


Fig.2-2 Gate Charge Waveform

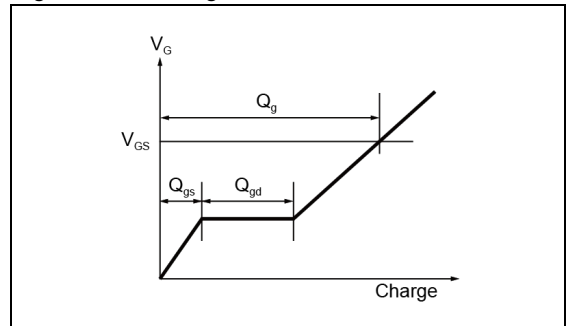


Fig.3-1 Avalanche Measurement Circuit

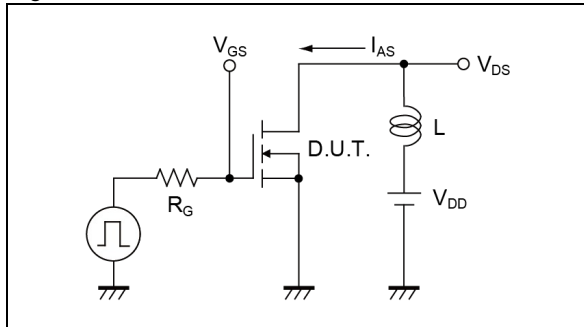


Fig.3-2 Avalanche Waveform

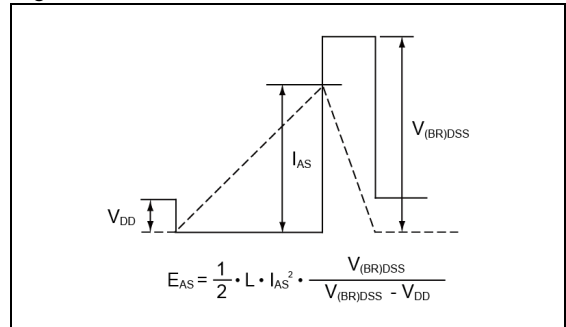


Fig.4-1 dv/dt Measurement Circuit

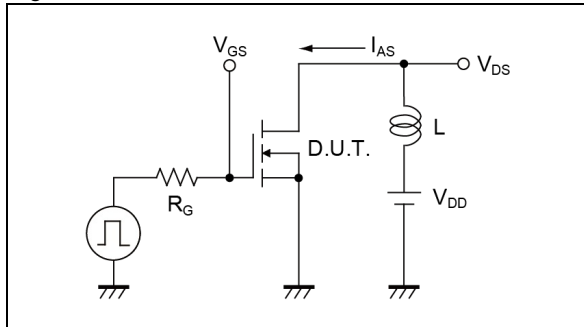


Fig.4-2 dv/dt Waveform

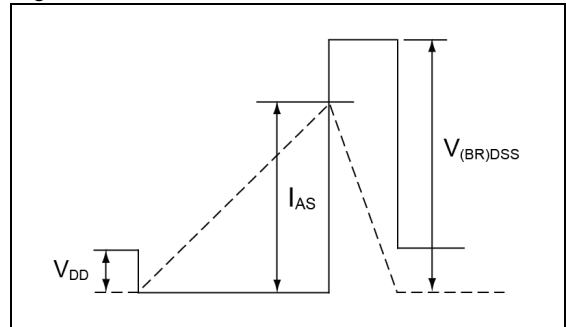


Fig.5-1 dv/dt Measurement Circuit

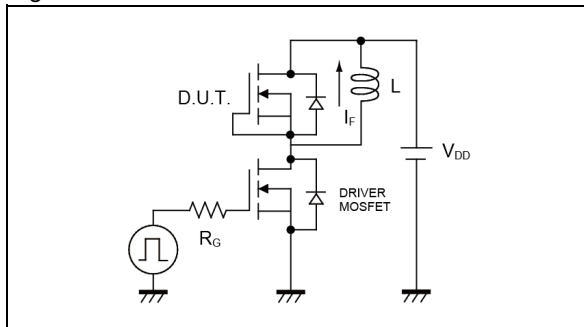
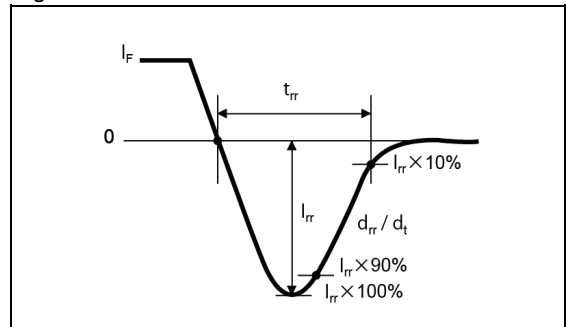
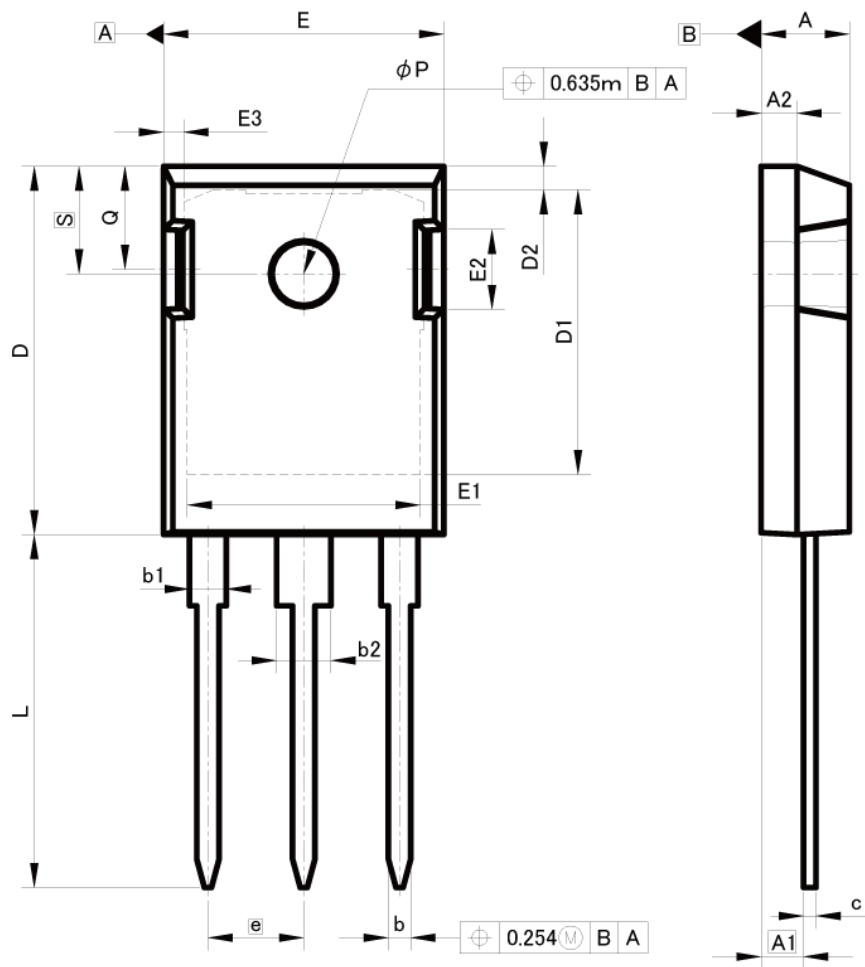


Fig.5-2 dv/dt Waveform



●Dimensions

TO-247



DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.19	0.205
A1	2.29	2.54	0.09	0.1
A2	1.91	2.16	0.075	0.085
b	1.14	1.40	0.045	0.055
b1	1.91	2.20	0.075	0.087
b2	2.92	3.20	0.115	0.126
c	0.61	0.80	0.024	0.031
D	20.80	21.34	0.819	0.84
D1	17.43	17.83	0.686	0.702
E	15.75	16.13	0.62	0.635
e	5.45		0.22	
N	3		3	
L	19.81	20.57	0.78	0.81
L1	3.81	4.07	0.15	0.16
ΦP	3.55	3.65	0.14	0.144
Q	5.59	6.20	0.22	0.244
S	6.15		0.24	

Dimension in mm/inches

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R6020KNZ1 - Web Page

Part Number	R6020KNZ1
Package	TO-247
Unit Quantity	450
Minimum Package Quantity	450
Packing Type	Tube
Constitution Materials List	inquiry
RoHS	Yes