

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

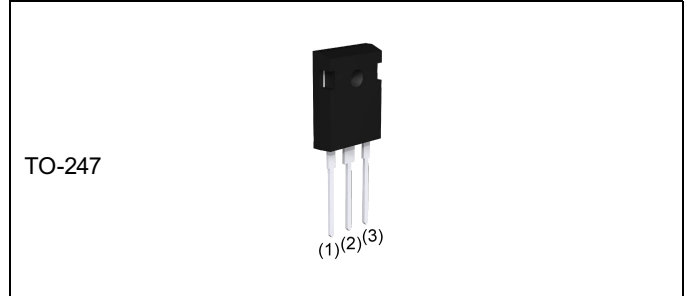
### ●Features

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

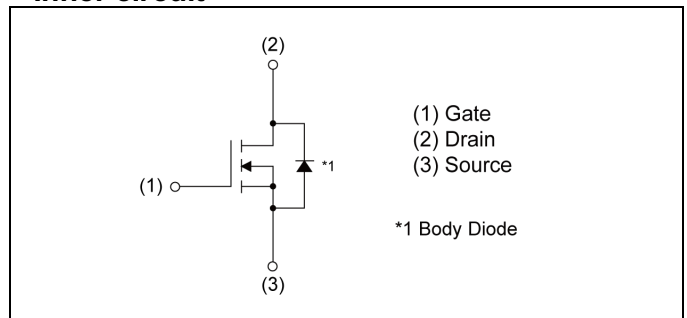
### ●Application

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 ( $T_a = 25^\circ C$ , unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain - Source voltage	$V_{DSS}$	600	V
Continuous drain current ( $T_c = 25^\circ C$ )	$I_D^{*1}$	±20	A
Pulsed drain current	$I_{DP}^{*2}$	±60	A
Gate - Source voltage	static	±20	V
	AC( $f > 1Hz$ )	±30	V
Avalanche current, single pulse	$I_{AS}$	3.4	A
Avalanche energy, single pulse	$E_{AS}^{*3}$	418	mJ
Power dissipation ( $T_c = 25^\circ C$ )	$P_D$	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	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$	-	-	100	$\mu\text{A}$
		$T_j = 125^\circ\text{C}$	-	-	1000	
Gate - Source leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_D = 1mA$	3	-	5	V
Static drain - source on - state resistance	$R_{DS(on)}^{*5}$	$V_{GS} = 10V, I_D = 9.5A$	-	0.170	0.196	$\Omega$
		$T_j = 125^\circ\text{C}$	-	0.360	-	
Gate resistance	$R_G$	$f = 1MHz, \text{open drain}$	-	2.3	-	$\Omega$

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

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward Transfer Admittance	Y <sub>fs</sub>   <sup>*5</sup>	V <sub>DS</sub> = 10V, I <sub>D</sub> = 10A	5	10	-	S
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	1550	-	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 25V	-	1350	-	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	55	-	
Turn - on delay time	t <sub>d(on)</sub> <sup>*5</sup>	V <sub>DD</sub> ≈ 300V, V <sub>GS</sub> = 10V	-	30	-	ns
Rise time	t <sub>r</sub> <sup>*5</sup>	I <sub>D</sub> = 10A	-	30	-	
Turn - off delay time	t <sub>d(off)</sub> <sup>*5</sup>	R <sub>L</sub> ≈ 30Ω	-	55	-	
Fall time	t <sub>f</sub> <sup>*5</sup>	R <sub>G</sub> = 10Ω	-	10	-	

**●Gate charge characteristics (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q <sub>g</sub> <sup>*5</sup>	V <sub>DD</sub> ≈ 300V	-	40	-	nC
Gate - Source charge	Q <sub>gs</sub> <sup>*5</sup>	I <sub>D</sub> = 20A	-	12	-	
Gate - Drain charge	Q <sub>gd</sub> <sup>*5</sup>	V <sub>GS</sub> = 10V	-	15	-	
Gate plateau voltage	V <sub>(plateau)</sub>	V <sub>DD</sub> ≈ 300V, I <sub>D</sub> = 20A	-	6.4	-	V

\*1 Limited only by maximum channel temperature allowed.

\*2 P<sub>w</sub> ≤ 10μs, Duty cycle ≤ 1%

\*3 L ≐ 70mH, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, STARTING T<sub>j</sub>=25°C

\*4 T<sub>C</sub>=25°C

\*5 Pulsed

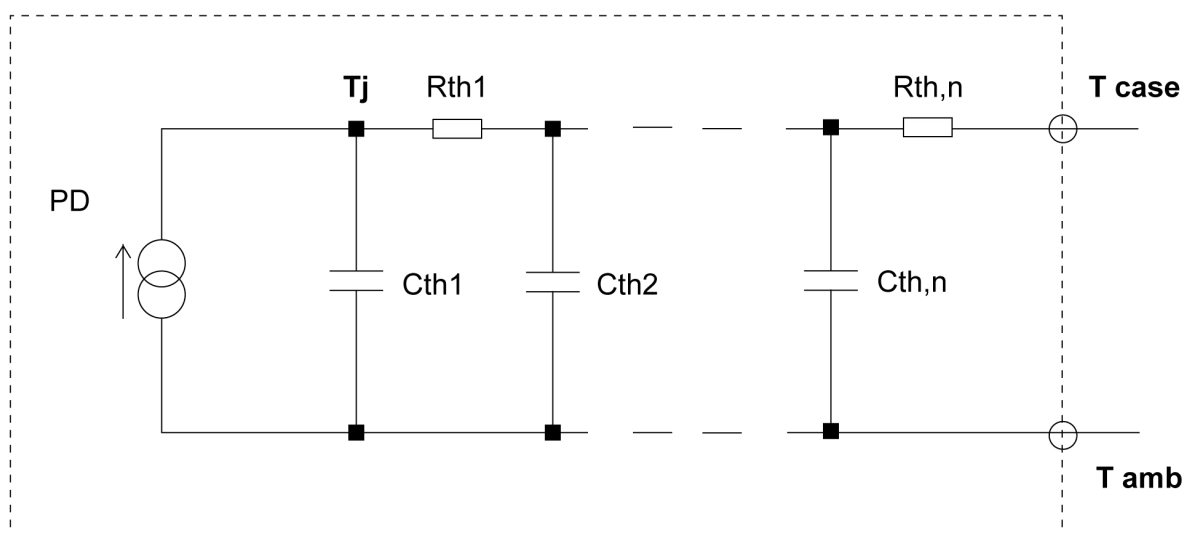
●Body diode electrical characteristics (Source-Drain) ( $T_a = 25^\circ\text{C}$ )

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	-	$\mu\text{C}$
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

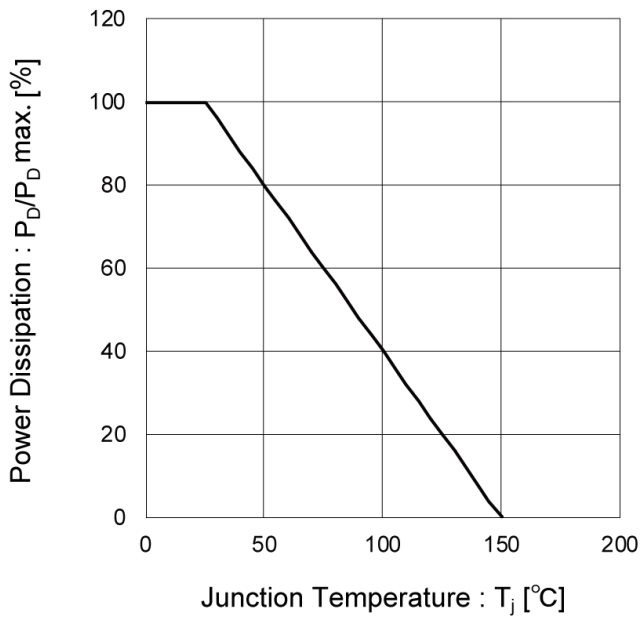


Fig.2 Maximum Safe Operating Area

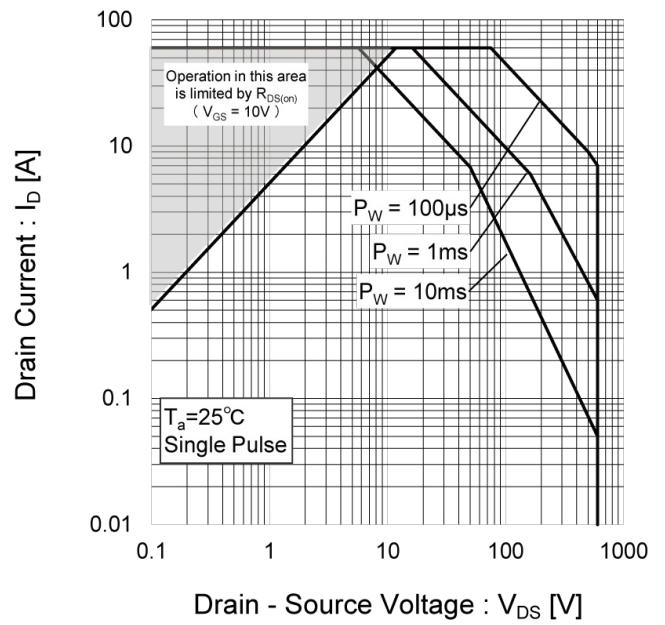
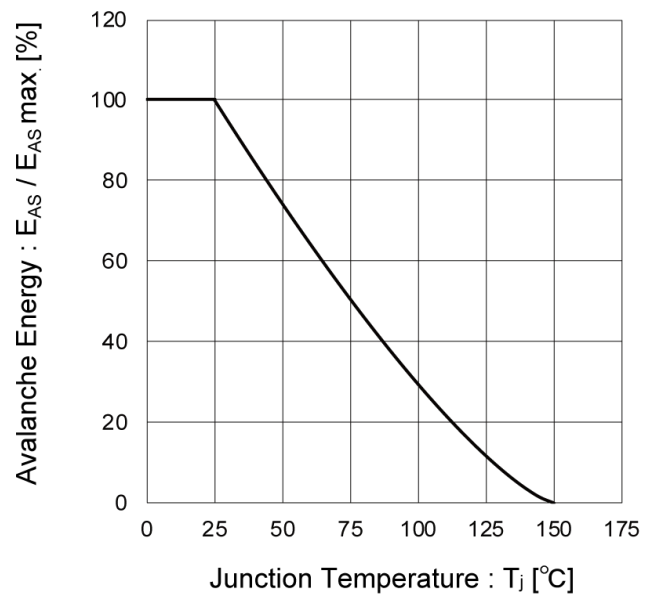


Fig.3 Avalanche Energy Derating Curve vs. Junction Temperature



●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

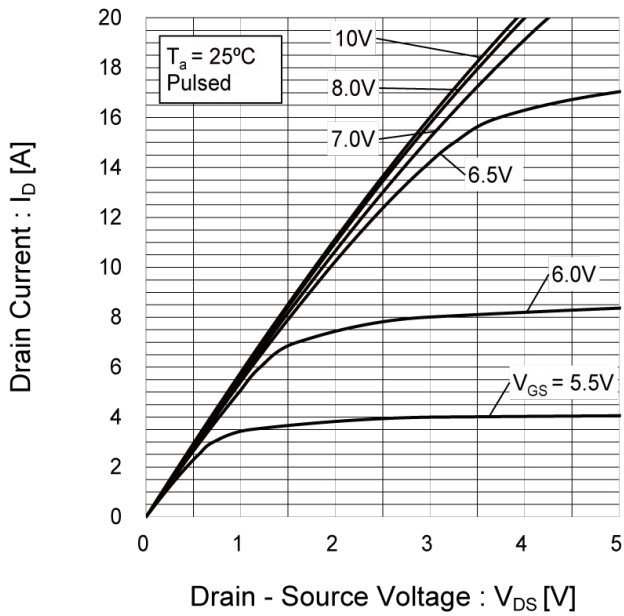
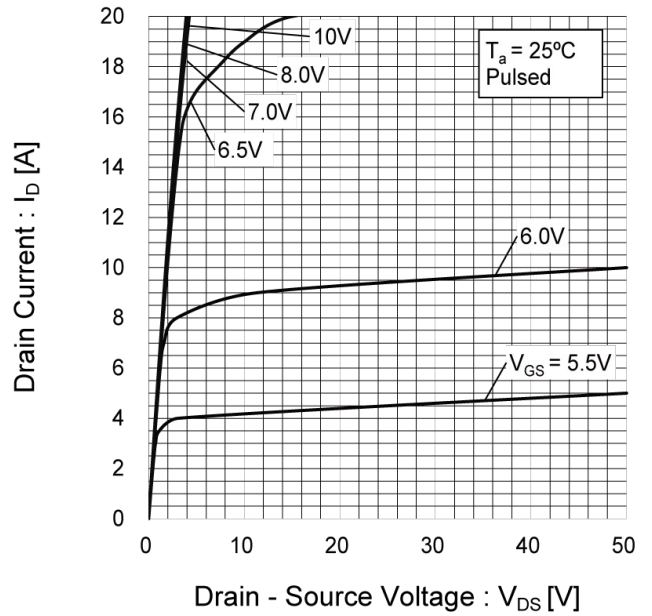


Fig.5 Typical Output Characteristics(II)



●Electrical characteristic curves

Fig.6 Breakdown Voltage vs. Junction Temperature

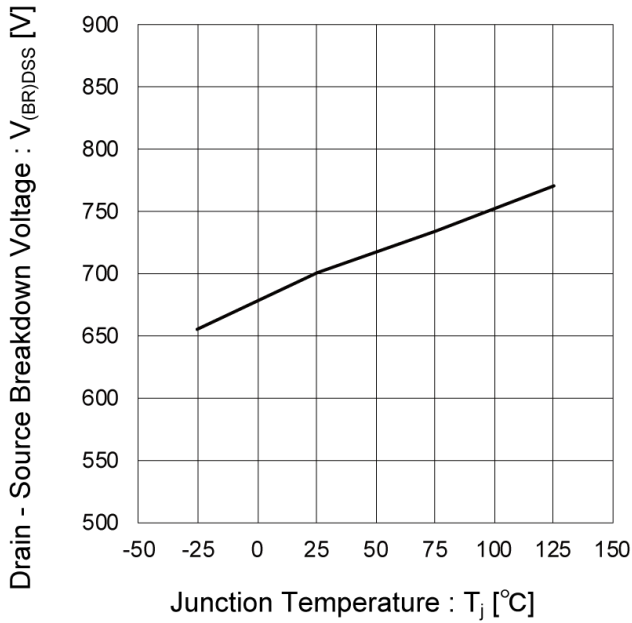


Fig.7 Typical Transfer Characteristics

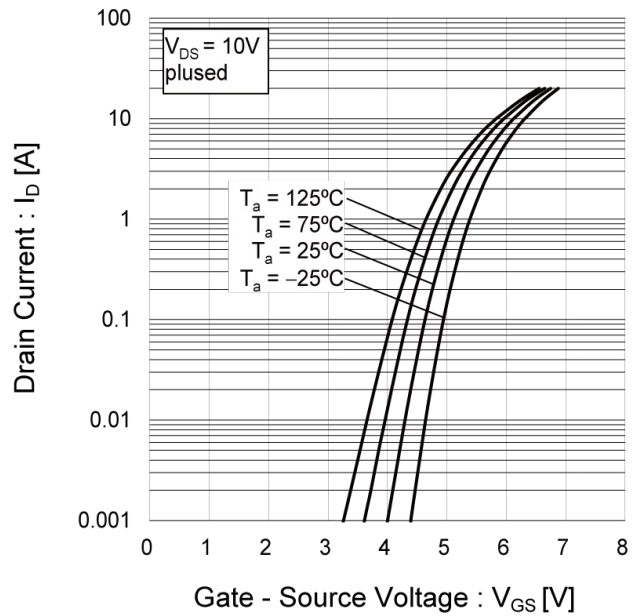


Fig.8 Gate Threshold Voltage vs. Junction Temperature

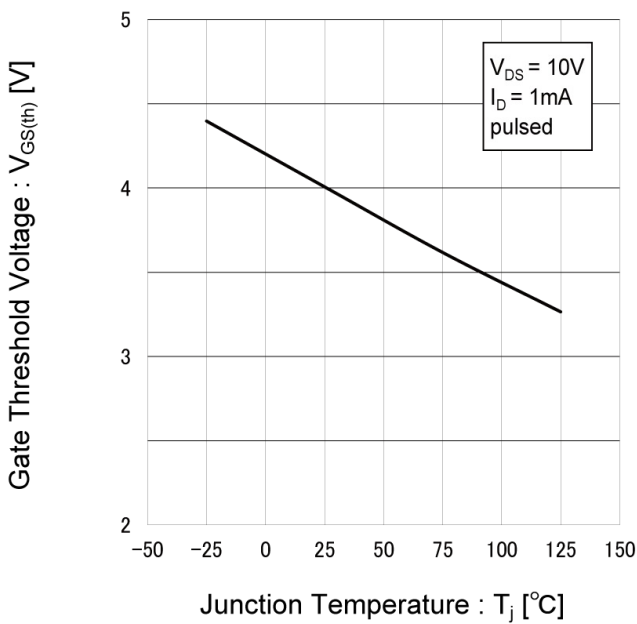
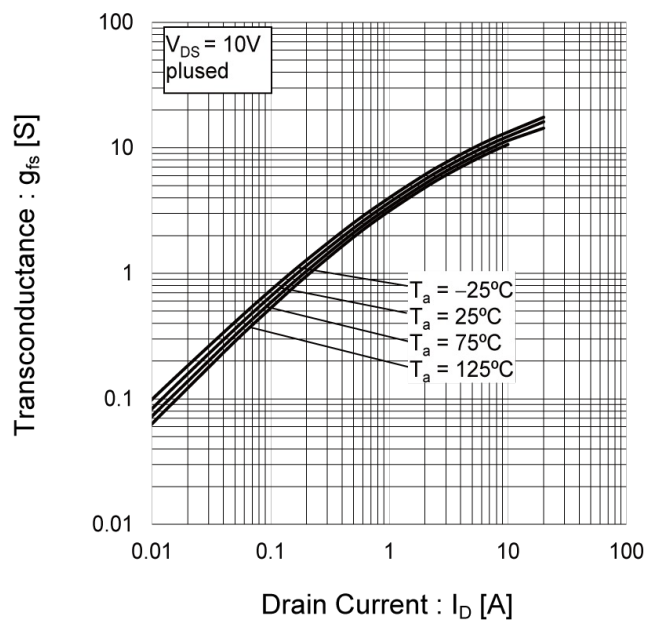


Fig.9 Forward Transfer Admittance vs. Drain Current



● Electrical characteristic curves

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

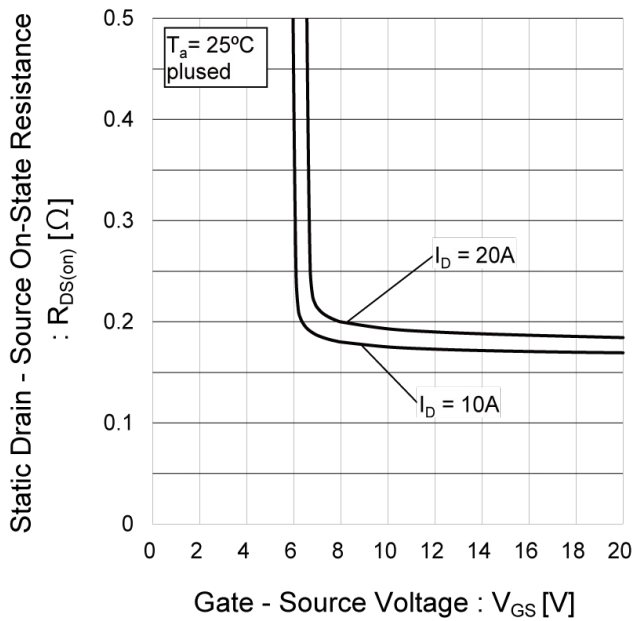


Fig.11 Static Drain - Source On - State Resistance vs. Junction Temperature

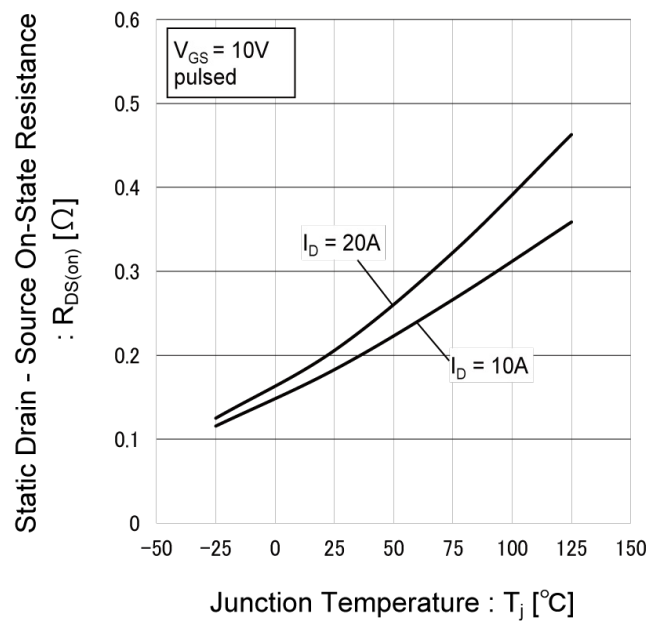
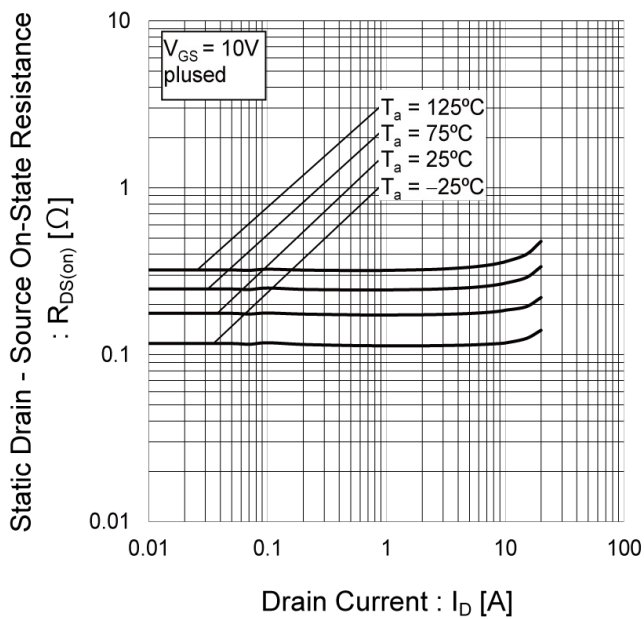


Fig.12 Static Drain - Source On - State Resistance vs. Drain Current(I)





● Electrical characteristic curves

Fig.13 Typical Capacitance vs. Drain - Source Voltage

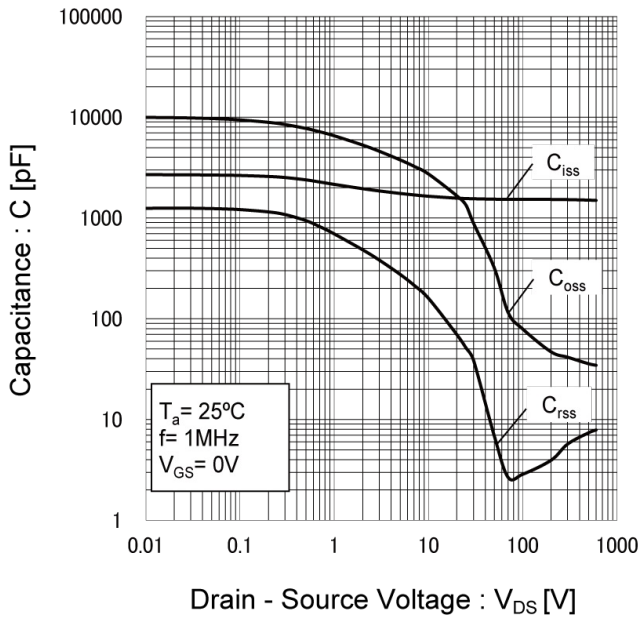


Fig.14 Switching Characteristics

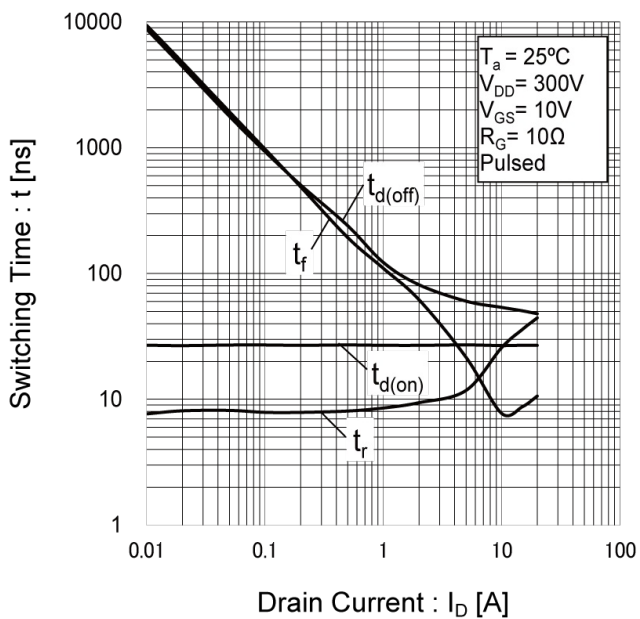
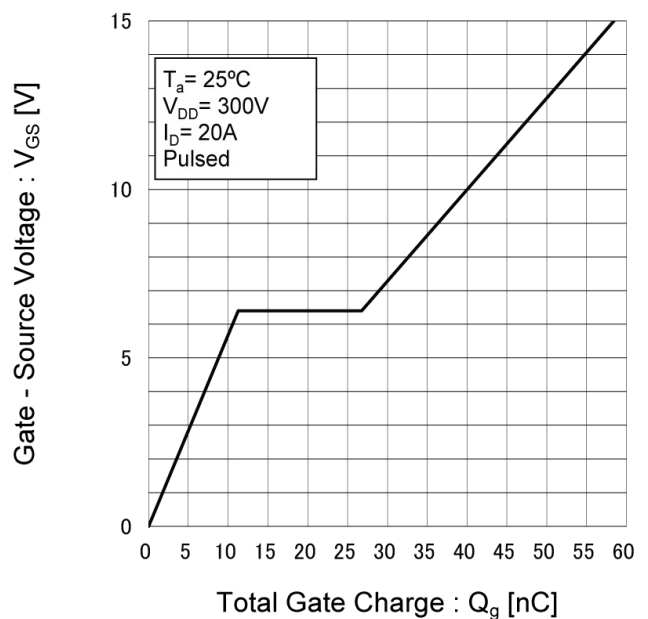


Fig.15 Dynamic Input Characteristics



● Electrical characteristic curves

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

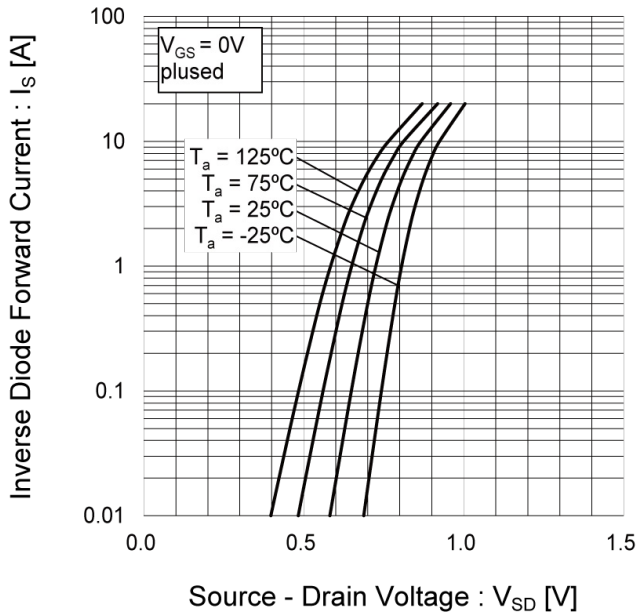
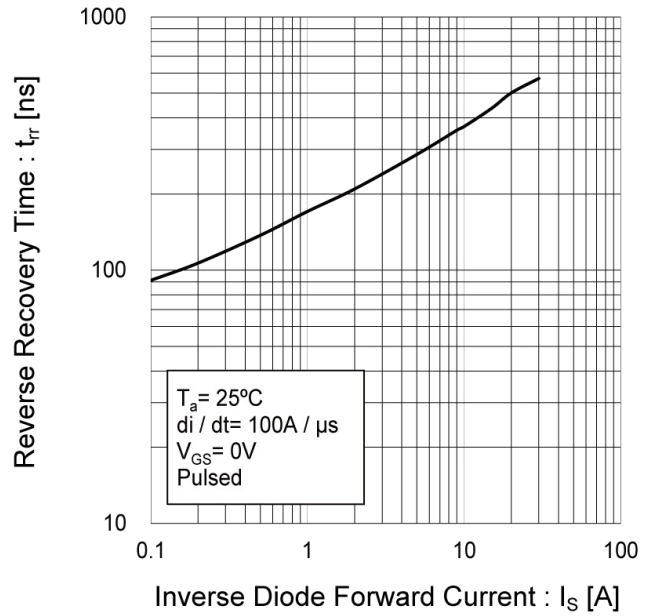


Fig.17 Reverse Recovery Time vs. Inverse Diode Forward Current



● 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

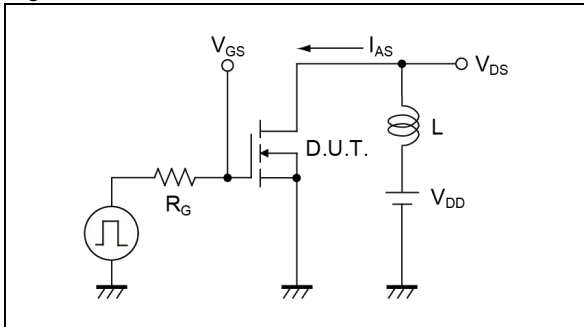


Fig.4-2 dv/dt Waveform

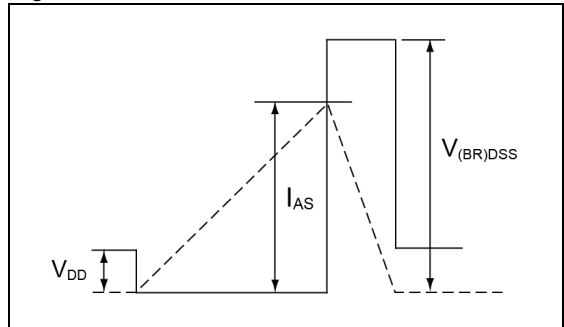


Fig.5-1 dv/dt Measurement Circuit

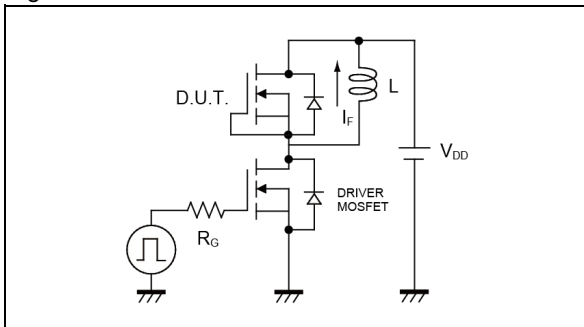
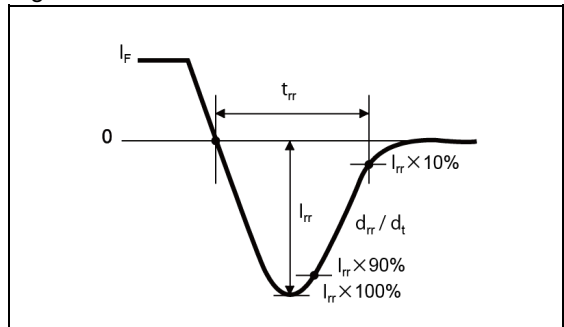
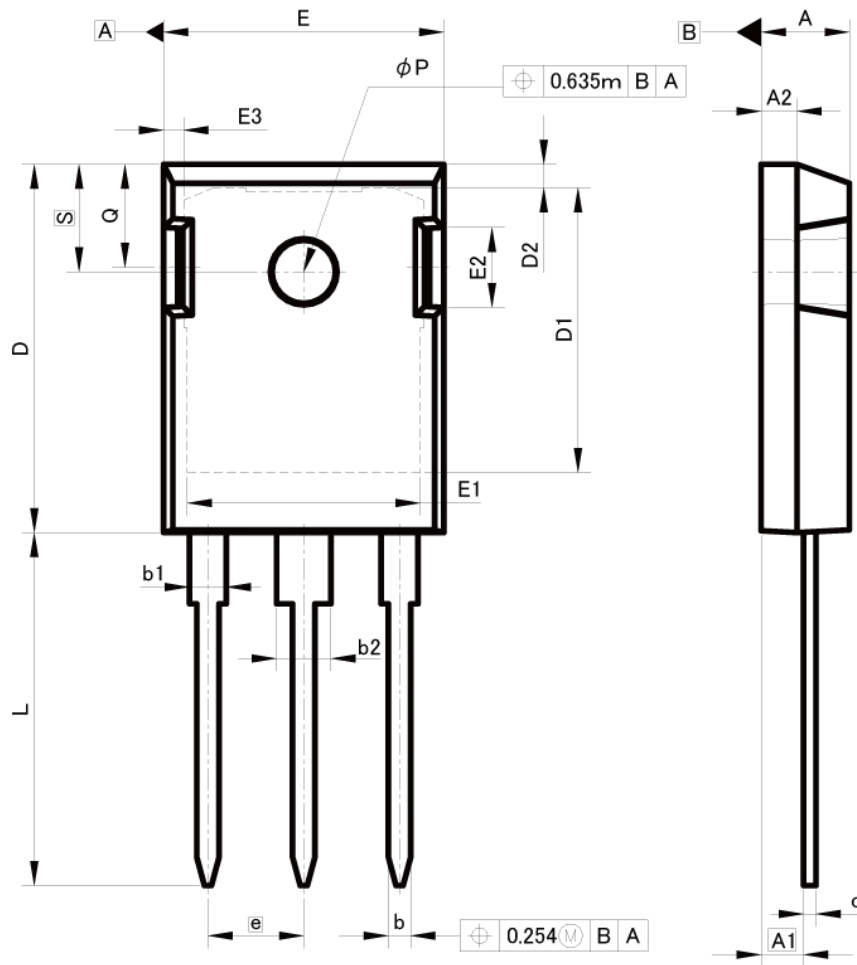


Fig.5-2 dv/dt Waveform



●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
$\phi P$	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

[Distribution Inventory](#)

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