Nch 600V 20A Power MOSFET

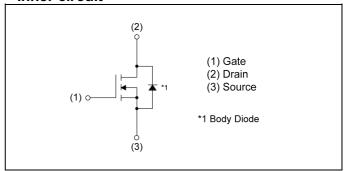
V _{DSS}	600V
R _{DS(on)} (Max.)	0.196Ω
I _D	±20A
P _D	231W

Outline TO-247

Features

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

•Inner circuit



Application

Switching

Packaging specifications

Packing	Tube
Packing code	C13
Marking	R6020KNZ4
Quantity (pcs)	600

ullet Absolute maximum ratings (T_a = 25°C ,unless otherwise specified)

Parameter	Symbol	Value	Unit	
Drain - Source voltage		V _{DSS}	600	V
Continuous drain current (T _c = 25°C)		I _D *1	±20	Α
Pulsed drain current		I _{DP} *2	±60	Α
Coto Course vallesse	static	V	±20	V
Gate - Source voltage	AC(f>1Hz)	V_{GSS}	±30	V
Avalanche current, single pulse		I _{AS}	3.4	А
Avalanche energy, single pulse		E _{AS} *3	418	mJ
Power dissipation (T _c = 25°C)	P _D	231	W	
Junction temperature	T _j	150	°C	
Operating junction and storage tempera	ature range	T _{stg}	-55 to +150	°C

●Thermal resistance

Downwortow	Cymah al	Values			1.124
Parameter	Symbol	Min.	Тур.	Max.	Unit
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 $(T_a = 25^{\circ}C)$

Parameter	Cumb al	Conditions	Values			Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Drain - Source breakdown voltage	$V_{(BR)DSS}$ $V_{GS} = 0V, I_D = 1mA$		600	-	-	V
		V _{DS} = 600V, V _{GS} = 0V				
Zero gate voltage drain current	I _{DSS}	$T_j = 25^{\circ}C$	-	-	100	μΑ
		$T_j = 125^{\circ}C$	-	-	1000	
Gate - Source leakage current	I _{GSS}	V_{GS} = ±20V, V_{DS} = 0V	1	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = 10V, I_D = 1mA	3	-	5	V
		V _{GS} = 10V, I _D = 9.5A				
Static drain - source on - state resistance	R _{DS(on)} *5	$T_j = 25^{\circ}C$	-	0.170	0.196	Ω
		$T_j = 125^{\circ}C$	-	-	-	
Gate resistance	R_{G}	f = 1MHz, open drain	-	2.3	-	Ω

● Electrical characteristics (T_a = 25°C)

Daramatar	Cumb al	Conditions	Values			Unit	
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Urill	
Input capacitance	C _{iss}	V _{GS} = 0V	-	1550	-		
Output capacitance	C _{oss}	V _{DS} = 25V	-	1350	-	pF	
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	55	-		
Turn - on delay time	t _{d(on)} *5	$V_{DD} \simeq 300V$, $V_{GS} = 10V$	-	30	-		
Rise time	t _r *5	I _D = 10A	-	30	-		
Turn - off delay time	t _{d(off)} *5	$R_L \simeq 30\Omega$	-	55	-	ns	
Fall time	t _f *5	$R_G = 10\Omega$	-	10	-		

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

Darameter	Complete al	Conditions	Values			l limit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Total gate charge	Q_g^{*5}	V _{DD} ≈ 300V	-	40	-	
Gate - Source charge	Q _{gs} *5	I _D = 20A	-	12	-	nC
Gate - Drain charge	Q _{gd} *5	V _{GS} = 10V	-	15	-	
Gate plateau voltage	V _(plateau)	V _{DD} ≈ 300V, I _D = 20A	-	6.4	-	V

^{*1} Limited only by maximum channel temperature allowed

^{*2} Pw ≤ 10µs, Duty cycle ≤ 1%

^{*3} L \doteqdot 70mH, V_{DD}=50V, R_G=25 Ω , Starting T_j=25°C

^{*4} T_C=25°C

^{*5} Pulsed

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

Parameter	Cymbol	Conditions	Values			Unit	
- Faranielei	Symbol	Conditions	Min.	Тур.	Max.	Offic	
Source current	I _S *1			-	20	Α	
Pulsed source current	I _{SP} *2	T _C = 25°C	1	-	60	Α	
Source-Drain voltage	V _{SD} *5	$V_{GS} = 0V, I_{S} = 20A$	-	-	1.5	٧	
Reverse recovery time	t _{rr} *5		-	500	-	ns	
Reverse recovery charge	Q _{rr} *5	I _S = 20Α di/dt = 100Α/μs	-	7.5	-	μC	
Peak reverse recovery current	_{rr} *5		-	30	-	А	

Fig.1 Power Dissipation Derating Curve

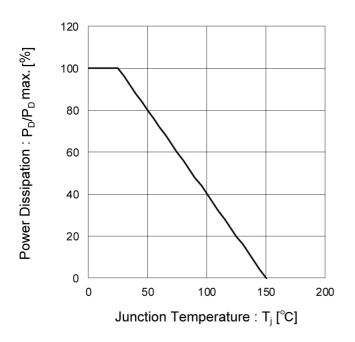


Fig.2 Drain Current Derating Curve

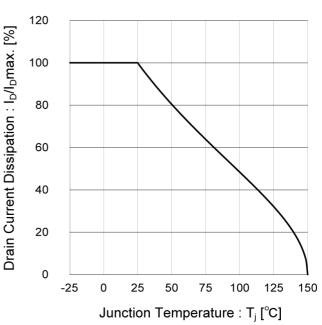


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

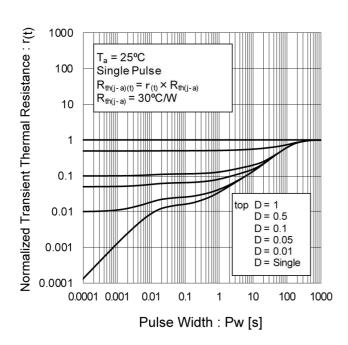
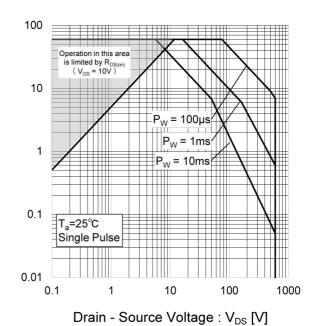


Fig.4 Maximum Safe Operating Area



Drain Current : I_D [A]

Fig.5 Avalanche Energy Derating
Curve vs. Junction Temperature

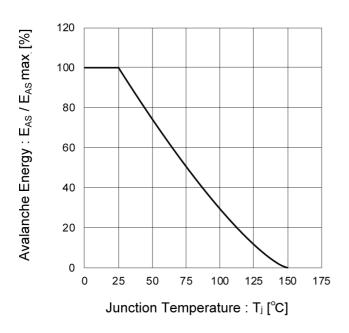


Fig.6 Normalized Breakdown Voltage vs. Junction Temperature

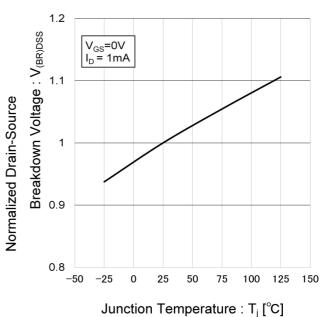
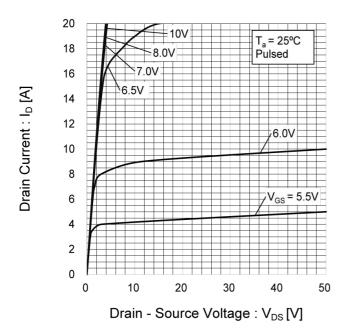
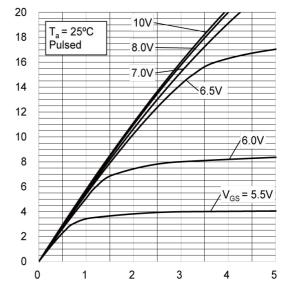


Fig.7 Typical Output Characteristics(I)



Drain Current : I_D [A]

Fig.8 Typical Output Characteristics(II)



Drain - Source Voltage: V_{DS}[V]

Fig.9 Typical Transfer Characteristics

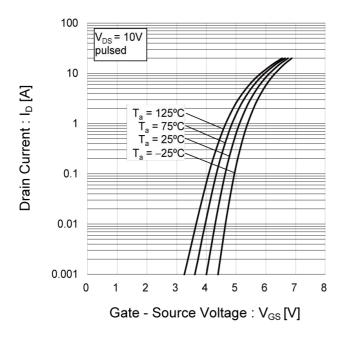


Fig.10 Gate Threshold Voltage vs. Junction Temperature

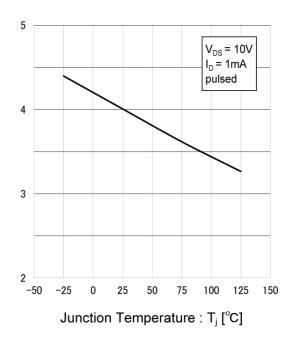


Fig.11 Static Drain - Source On - State Resistance vs. Drain Current

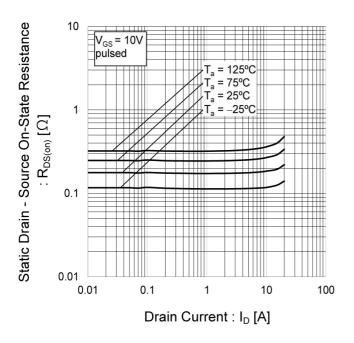
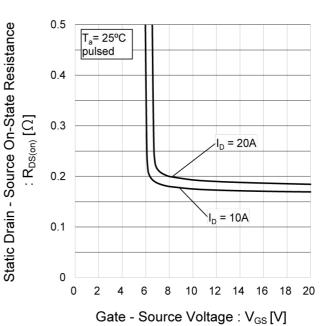


Fig.12 Static Drain - Source On - State Resistance vs. Gate - Source Voltage



Gate Threshold Voltage: V_{GS(th)} [V]

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

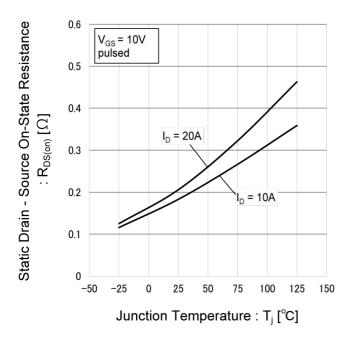


Fig.14 Typical Capacitance vs.
Drain - Source Voltage

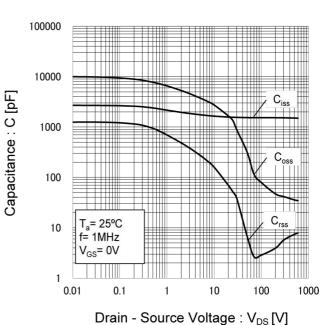


Fig.15 Switching Characteristics

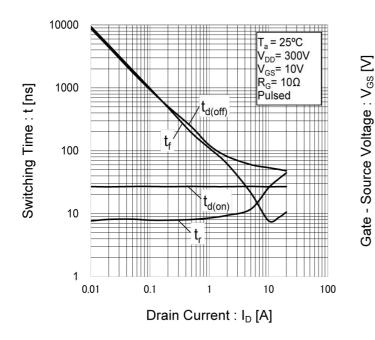


Fig.16 Typical Gate Charge

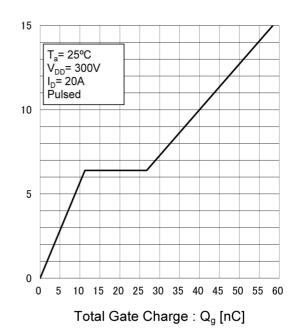
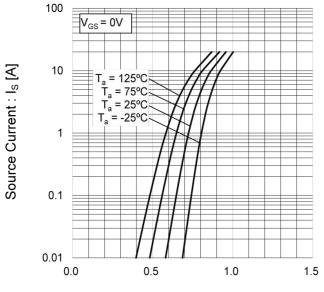
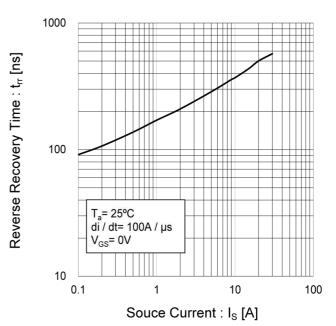


Fig.17 Source Current vs. Source - Drain Voltage



Source - Drain Voltage : V_{SD} [V]

Fig.18 Reverse Recovery Time vs. Source Current



Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

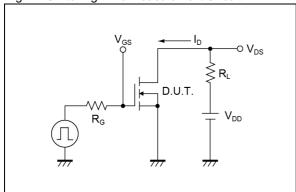


Fig.2-1 Gate Charge Measurement Circuit

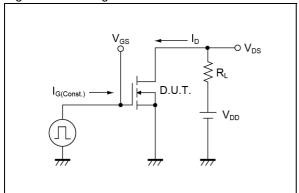


Fig.3-1 Avalanche Measurement Circuit

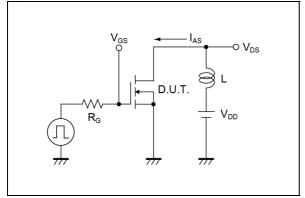


Fig.4-1 trr Measurement Circuit

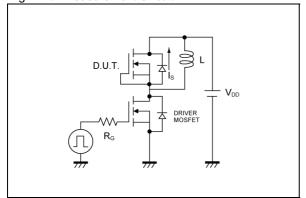


Fig.1-2 Switching Waveforms

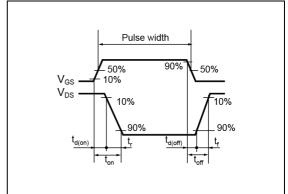


Fig.2-2 Gate Charge Waveform

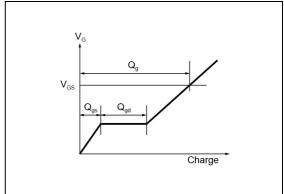


Fig.3-2 Avalanche Waveform

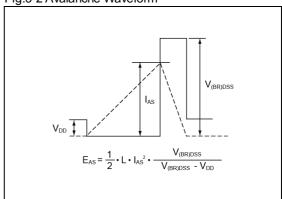
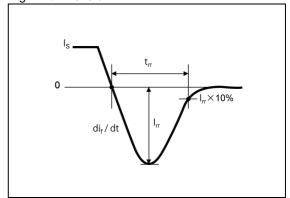
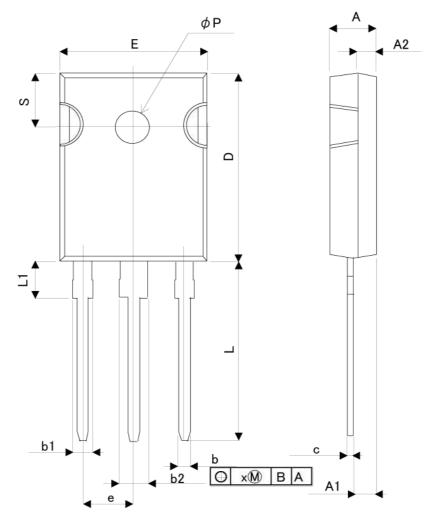


Fig.4-2 trr Waveform



Dimensions

TO-247



DIM	MILIME	ETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	4.82	5.22	0.190	0.206
A1	2.11	2.71	0.083	0.107
A2	1.80	2.20	0.071	0.087
b	1.00	1.40	0.039	0.055
b1	1.80	2.20	0.071	0.087
b2	2.80	3.20	0.110	0.126
С	0.45	0.75	0.018	0.030
D	20.65	21.25	0.813	0.837
E	15.64	16.24	0.616	0.639
е	5.4	14	0.2	14
L	19.77	20.37	0.778	0.802
L1	4.09	4.29	0.161	0.169
Р	3.51	3.71	0.138	0.146
S	5.97	6.37	0.235	0.251

Dimension in mm/inches



Notice

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JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASS II b	CLASSIII
CLASSIV	CLASSIII	CLASSⅢ	CLASSIII

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 - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
 - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
 - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Sealing or coating our Products with resin or other coating materials
 - [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
 - [h] Use of the Products in places subject to dew condensation
- 4. The Products are not subject to radiation-proof design.
- 5. Please verify and confirm characteristics of the final or mounted products in using the Products.
- 6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.
- 8. Confirm that operation temperature is within the specified range described in the product specification.
- 9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

- 1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- 2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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- 1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
- 2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of lonizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

- 1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
 - [a] the Products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [b] the temperature or humidity exceeds those recommended by ROHM
 - [c] the Products are exposed to direct sunshine or condensation
 - [d] the Products are exposed to high Electrostatic
- Even under ROHM recommended storage condition, solderability of products out of recommended storage time period
 may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is
 exceeding the recommended storage time period.
- 3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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