

40V Nch+Nch Power MOSFET

V _{DSS}	40V
R _{DS(on)} (Max.)	8.4mΩ
I _D	±13.5A
P _D	2.0W

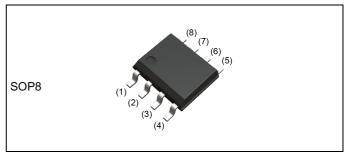
Features

- 1) Low on resistance
- 2) Small Surface Mount Package (SOP8)
- 3) Pb-free plating; RoHS compliant
- 4) Halogen Free

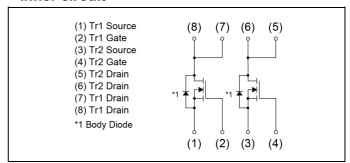
Application

Switching

Outline



•Inner circuit



Packaging specifications

•		
	Packing	Embossed Tape
	Reel size (mm)	330
Туре	Tape width (mm)	12
	Quantity (pcs)	2500
	Taping code	TB1
	Marking	SH8KB7

● **Absolute maximum ratings** (T_a = 25°C ,unless otherwise specified) < Tr1 and Tr2>

Parameter	Symbol	Value	Unit
Drain - Source voltage	V _{DSS}	40	V
Continuous drain current	I _D	±13.5	Α
Pulsed drain current	I _{DP} *1	±54	Α
Gate - Source voltage	V _{GSS}	±20	V
Avalanche current, single pulse	I _{AS} *2	13.5	Α
Avalanche energy, single pulse	E _{AS} *2	17.0	mJ
Device discinction (total)	P _D *3	2.0	10/
Power dissipation (total)	P _D *4	1.4	W
Junction temperature	T _j	150	°C
Operating junction and storage temperature range	T _{stg}	-55 to +150	°C

●Thermal resistance

Doromotor	Cymbol	Values			l leit
Parameter	Symbol	Min.	Тур.	Max.	Unit
Thermal registeres innetion, embient (total)	R_{thJA}^{*3}	-	-	62.5	°C/W
Thermal resistance, junction - ambient (total)	R _{thJA} *4	-	-	89.2	C/VV

● Electrical characteristics (T_a = 25°C) < Tr1 and Tr2>

Damanatan	Currente e l	0 - 1111 - 11	Values			1.1	
Parameter	Symbol	Conditions	Min. Typ.		Max.	Unit	
Drain - Source breakdown voltage	V _{(BR)DSS}	$V_{GS} = 0V$, $I_D = 1mA$	40	-	-	V	
Breakdown voltage	ΔV _{(BR)DSS}	I _D = 1mA	-	28.9	_	mV/°C	
temperature coefficient	ΔT_{j}	referenced to 25°C	1	20.9	•	IIIV/ C	
Zero gate voltage drain current	I _{DSS}	V _{DS} = 40V, V _{GS} = 0V	-	-	1	μA	
Gate - Source leakage current	I _{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	1	-	±100	nA	
Gate threshold voltage	V _{GS(th)}	$V_{DS} = V_{GS}$, $I_D = 1mA$	1.0	-	2.5	V	
Gate threshold voltage	$\Delta V_{GS(th)}$	I _D = 1mA		-4.6		mV/°C	
temperature coefficient	ΔT_{j}	referenced to 25°C	1	-4.0	-		
Static drain - source	D *5	V _{GS} = 10V, I _D = 13.5A	-	6.5	8.4	C	
on - state resistance	R _{DS(on)} *5	V _{GS} = 4.5V, I _D = 13.5A	-	7.5	10.5	mΩ	
Gate resistance	R_G	-	-	1.0	-	Ω	
Forward Transfer Admittance	Y _{fs} *5	V _{DS} = 5V, I _D = 13.5A	13	-	-	S	

^{*1} Pw ≤ 10µs, Duty cycle ≤ 1%

^{*2} L \simeq 0.1mH, V_{DD} = 20V, R_G = 25 Ω , Starting T_j = 25 $^{\circ}$ C Fig.3-1,3-2

^{*3} Mounted on a ceramic board (30×30×0.8mm)

^{*4} Mounted on a Cu board (40×40×0.8mm)

^{*5} Pulsed

● Electrical characteristics (T_a = 25°C) < Tr1 and Tr2>

Darameter	Cumbal	Conditions		Unit		
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Input capacitance	C _{iss}	V _{GS} = 0V	-	1570	-	
Output capacitance	C _{oss}	V _{DS} = 20V	-	800	-	pF
Reverse transfer capacitance	C _{rss}	f = 1MHz	1	75	-	
Turn - on delay time	t _{d(on)} *5	V _{DD} ≈ 20V,V _{GS} = 10V	-	18	-	
Rise time	t _r *5	I _D = 6.75A	-	16	-	
Turn - off delay time	t _{d(off)} *5	$R_L = 2.96\Omega$	-	47	-	ns
Fall time	t _f *5	$R_G = 10\Omega$	-	18	-	

● Gate charge characteristics (T_a = 25°C) < Tr1 and Tr2>

Darameter	Cymahal	Conditions -		Values			1 1:4
Parameter	Symbol			Min.	Тур.	Max.	Unit
Total mate above	Q_g^{*5}	O *5	V _{GS} = 10V	-	27.0	-	
Total gate charge		\mathbf{Q}_{g}	V _{DD} ≈ 20V		-	13.0	-
Gate - Source charge	Q _{gs} *5	I _D = 13.5A	V _{GS} = 4.5V	-	4.3	-	nC
Gate - Drain charge	Q _{gd} *5			-	4.7	-	

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

<Tr1 and Tr2>

Parameter	Symbol	Conditions		Unit			
Farameter	Symbol	Conditions	Min.	Тур.	Max.	Offic	
Continuous forward current	I _S	T _a = 25°C	-	1	1.67	^	
Pulse forward current	I _{SP} *1	1 _a – 25 C	-	-	54	A	
Forward voltage	V _{SD} *5	V _{GS} = 0V, I _S = 1.67A	-	-	1.2	V	
Reverse recovery time	t _{rr} *5	I _S = 13.5A, V _{GS} = 0V	-	39	-	ns	
Reverse recovery charge	Q _{rr} *5	di/dt = 100A/μs	-	49	-	nC	

Fig.1 Power Dissipation Derating Curve

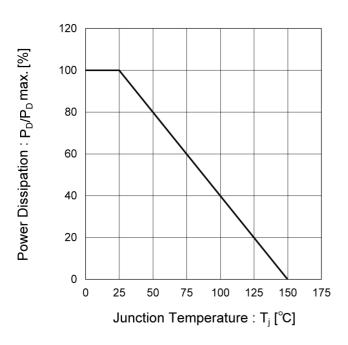
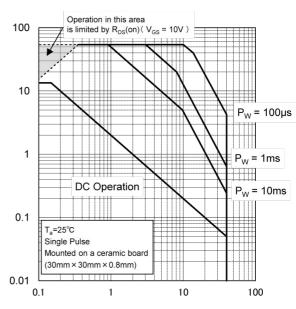


Fig.2 Maximum Safe Operating Area



Drain Current : I_D [A]

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

Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

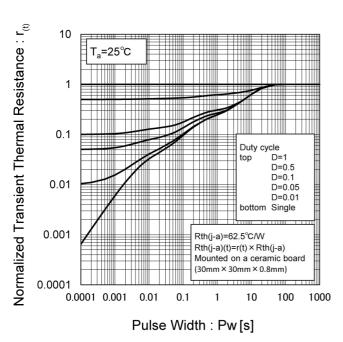
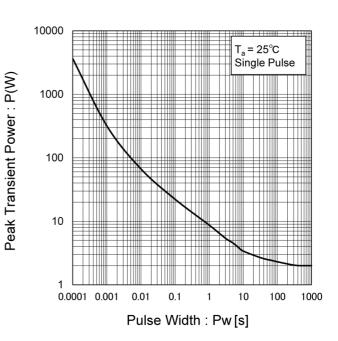


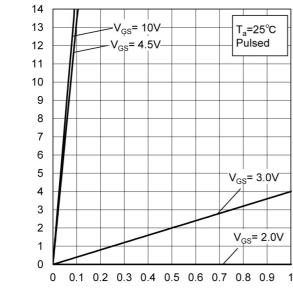
Fig.4 Single Pulse Maximum Power Dissipation



Drain Current : I_D [A]

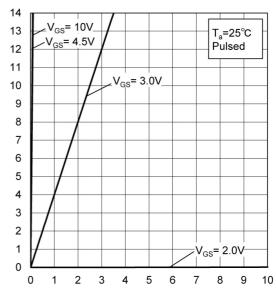
• Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)



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

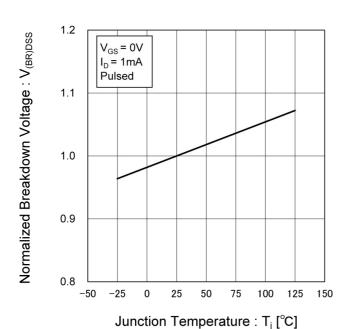
Fig.6 Typical Output Characteristics(II)



Drain Current : I_D [A]

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

Fig.7 Breakdown Voltage vs.
Junction Temperature



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Fig.8 Typical Transfer Characteristics

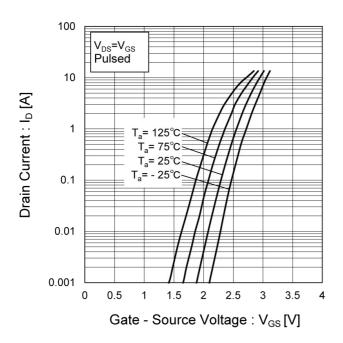


Fig.9 Gate Threshold Voltage vs.
Junction Temperature

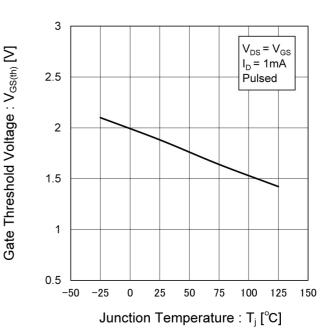


Fig.10 Forward Transfer Admittance vs.
Drain Current

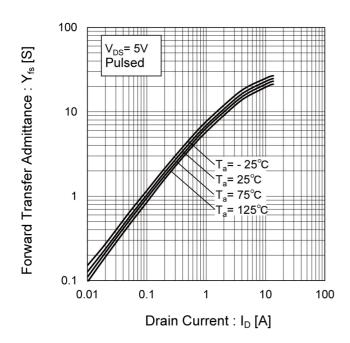
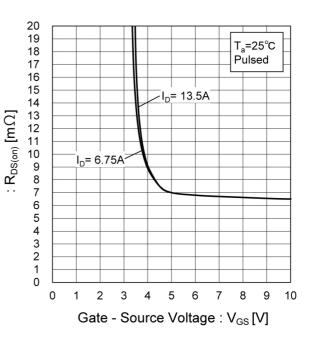


Fig.11 Drain Current Derating Curve

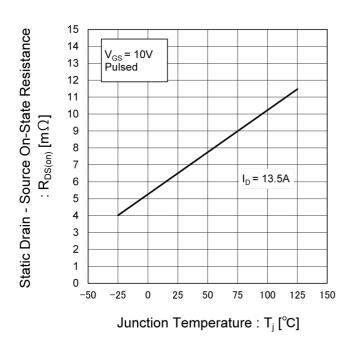
120 100 Drain Current Dissipation 80 : I_D/I_Dmax. [%] 60 40 20 0 -25 0 25 50 75 100 125 150 Junction Temperature : T_j [°C]

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



Static Drain - Source On-State Resistance

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



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Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (I)

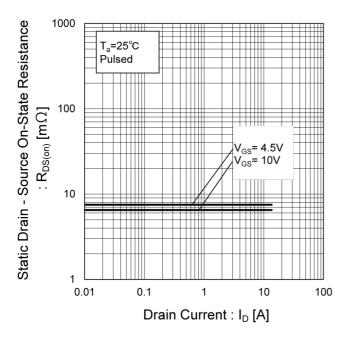


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current (II)

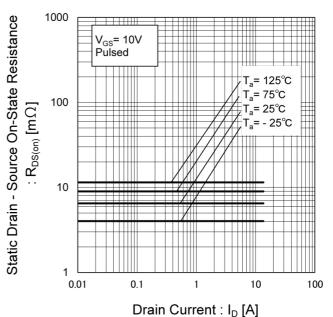
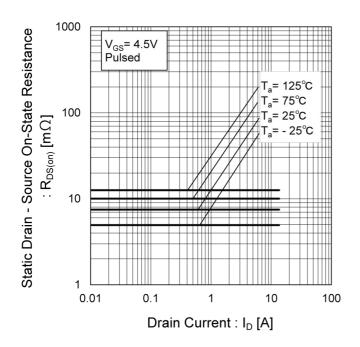


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)



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Fig.17 Typical Capacitances vs.

Drain - Source Voltage

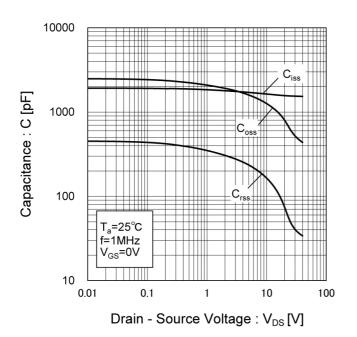


Fig.18 Switching Characteristics

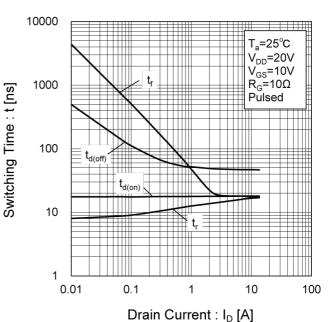


Fig.19 Typical Gate Charge

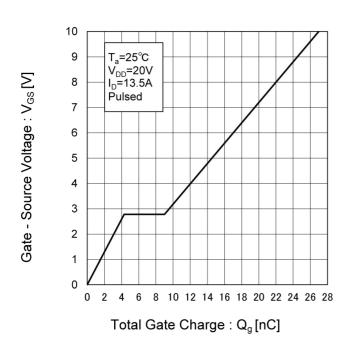
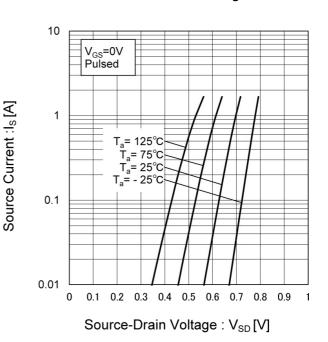


Fig.20 Source Current vs.

Source Drain Voltage



• Measurement circuits < It is the same for the Tr1 and Tr2>

Fig.1-1 Switching Time Measurement Circuit

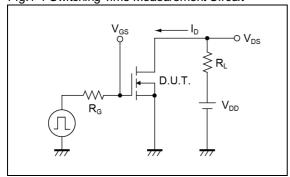


Fig.2-1 Gate Charge Measurement Circuit

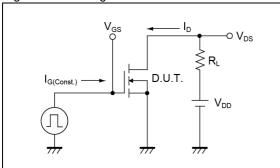


Fig.3-1 Avalanche Measurement Circuit

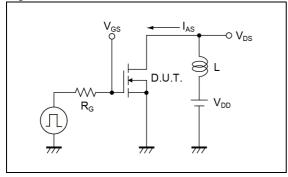


Fig.1-2 Switching Waveforms

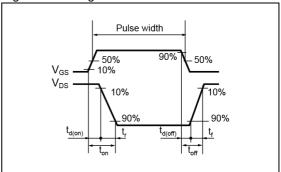


Fig.2-2 Gate Charge Waveform

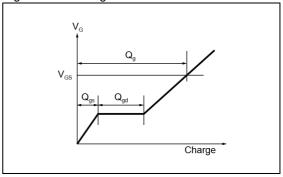
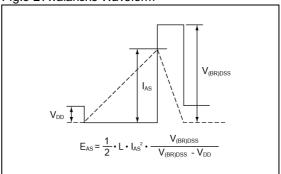


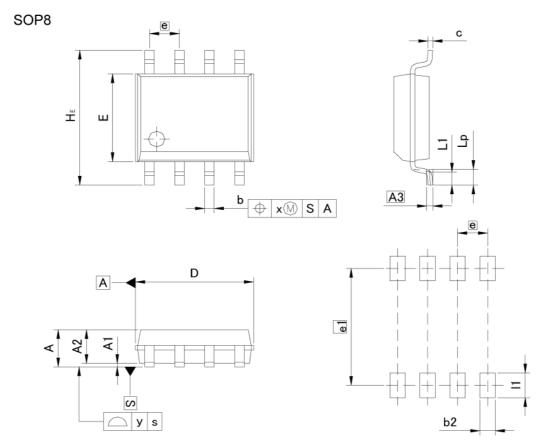
Fig.3-2 Avalanche Waveform



Notice

This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

Dimensions



Pattern of terminal position areas [Not a pattern of soldering pads]

DIM	MILIM	ETERS	INC	HES	
DIM	MIN	MAX	MIN	MAX	
Α	-	1.75	_	0.069	
A1	0.	15	0.0	006	
A2	1.40	1.60	0.055	0.063	
A3	0.5	25	0.0	10	
b	0.30	0.50	0.012	0.020	
С	0.10	0.30	0.004	0.012	
D	4.80	5.20	0.189	0.205	
E	3.75	4.05	0.148	0.159	
е	1.27		0.0	0.050	
HE	5.70	6.30	0.224	0.248	
L1	0.40	0.60	0.016	0.024	
Lp	0.65	0.85	0.026	0.033	
х	0.15		0.006		
У	0.10		0.004		
12127	MILIM	ETERS	INC	HES	
DIM	A 47A I	MAN	14751	MAN	

 DIM
 MILIMETERS
 INCHES

 MIN
 MAX
 MIN
 MAX

 b2
 0.65
 0.026

 e1
 5.15
 0.203

 I1
 1.15
 0.045

Dimension in mm/inches

Notice

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1. Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, 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 any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JÁPAN	USA	EU	CHINA
CLASSⅢ	OL A COTT	CLASS II b	CL ACCIII
CLASSIV	CLASSⅢ	CLASSⅢ	CLASSⅢ

- 2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
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 - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
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 - [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.
- 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

Precautions Regarding Application Examples and External Circuits

- 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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