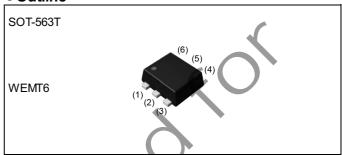


Nch 20V 1.5A Small Signal MOSFET + Schottky Barrier Diode

V _{DSS}	20V
R _{DS(on)} (Max.)	180mΩ
I _D	±1.5A
P _D	0.8W

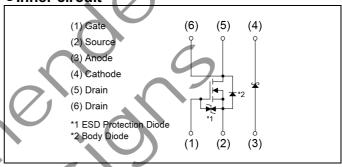
Outline



Features

- 1) Nch MOSFET and shottky barrier diode are put in WEMT6 package.
- 2) High-speed switching and Low onresistance.
- 3) Low voltage drive(1.5V drive)
- 4) Built in Low V_F schottky barrier diode.

Inner circuit



Packaging specifications

(O	Packing	Embossed Tape
	Reel size (mm)	180
Туре	Tape width (mm)	8
	Basic ordering unit (pcs)	8000
	Taping code	T2R
	Marking	U02

Application

Switching

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

< MOSFET >

· ·			
Parameter	Symbol	Value	Unit
Drain - Source voltage	V _{DSS}	20	V
Gate - Source voltage	V _{GSS}	±10	V
Continuous drain current	I _D	±1.5	А
Pulsed drain current	I _{DP} *1	±3	Α
Continuous source current (body diode)	I _S	0.5	А
Pulsed source current (body diode)	I _{SP} *1	3	А
Power dissipation	P _D *2	0.7	W/element
Junction temperature	T _j	150	°C

● Absolute maximum ratings (T_a = 25°C)

< Diode >

Parameter	Symbol	Value	Unit
Repetitive peak reverse voltage	V_{RM}	25	V
Reverse voltage	V _R	20	V
Forward current	I _F	0.5	À
Forward current surge peak	I _{FSM} *3	2.0	А
Power dissipation	P _D *2	0.5	W/element
Junction temperature	T _j	150	°C

< MOSFET + Diode >

Parameter	Symbol	Value	Unit
Power dissipation	P _D *2	0.8	W/total
Operating junction and storage temperature range	T _{stg}	-55 to +150	°C

●Electrical characteristics (T_a = 25°C)

< MOSFET >

Parameter	Symbol Conditions		Values			Unit
Falameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Gate - Source leakage current	I _{GSS}	$V_{GS} = \pm 10V, V_{DS} = 0V$	-	-	±10	μΑ
Drain - Source breakdown voltage	V _{(BR)DSS}	$V_{GS} = 0V$, $I_D = 1mA$	20	-	-	V
Zero gate voltage drain current	I _{DSS}	V _{DS} = 20V, V _{GS} = 0V	-	-	1	μΑ
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = 10V, I_{D} = 1mA$	0.3	-	1.0	V
		$V_{GS} = 4.5V, I_D = 1.5A$	1	130	180	
Static drain - source	D *4	$V_{GS} = 2.5V, I_D = 1.5A$	-	170	240	m-0
on - state resistance	R _{DS(on)} *4	$V_{GS} = 1.8V, I_D = 0.8A$	-	220	310	mΩ
		V _{GS} = 1.5V, I _D = 0.3A	-	300	600	
Forward Transfer Admittance	Y _{fs} *4	V _{DS} = 10V, I _D = 1.5A	1.6	-	-	S

● Electrical characteristics (T_a = 25°C)

< MOSFET >

Daramatar	Cumahal	Conditions	Values			1 1:4
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Input capacitance	C _{iss}	V _{GS} = 0V	-	110		
Output capacitance	C _{oss}	V _{DS} = 10V	-	18		pF
Reverse transfer capacitance	C _{rss}	f = 1MHz	-	15	-	
Turn - on delay time	t _{d(on)} *4	$V_{DD} \simeq 10V$, $V_{GS} = 4.5V$		5	-	
Rise time	t _r *4	I _D = 1A	\C	5	-	
Turn - off delay time	t _{d(off)} *4	R _L = 10Ω		20	-	ns
Fall time	t _f *4	$R_G = 10\Omega$	-	3	-	

●Gate charge characteristics (T_a = 25°C)

< MOSFET >

Parameter	Symbol	Conditions		Values		Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Total gate charge	Qg*4	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	-	1.8	-	
Gate - Source charge	Q _{gs} *4	$V_{DD} \approx 10V, I_{D} = 1.5A$ $V_{GS} = 4.5V$	-	0.3	-	nC
Gate - Drain charge	Q _{gd} *4	33 110 1	-	0.3	-	

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

< MOSFET >

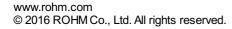
Parameter	Symbol	Conditions	Values			Unit
Parameter			Min.	Тур.	Max.	Offic
Forward voltage	V _{SD} *4	$V_{GS} = 0V, I_{S} = 1.5A$	-	-	1.2	V

● Electrical characteristics (T_a = 25°C)

< Diode >

Doromotor	Symbol	Conditions	Values			1.1-4
Parameter			Min.	Тур.	Max.	Unit
		I _F = 0.1A	-	-	0.36	V
Forward voltage	V_{F}	I _F = 0.5A	-	-	0.52	V
Reverse current	I _R	V _R = 20V	-	- 🗙	100	μA

^{*1} Pw≦ 0µs, Duty cycle≦1%



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^{*2} Mounted on a ceramic board (30×30×0.8mm)

^{*3 60}Hz-1cycle

^{*4} Mounted on a FR4 (12×20×0.8mm,Cu pad:240mm²)

^{*5} Pulsed

Fig.1 Typical Output Characteristics(I)

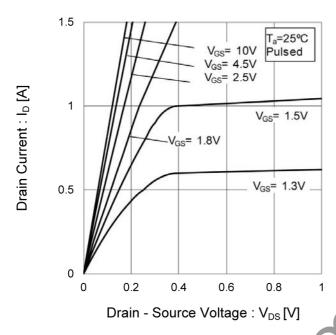


Fig.2 Typical Output Characteristics(II)

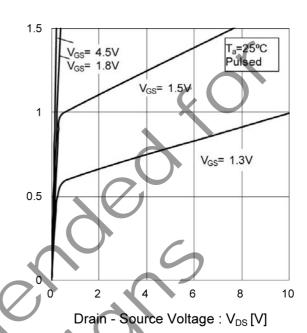


Fig.3 Breakdown Voltage vs.

Junction Temperature

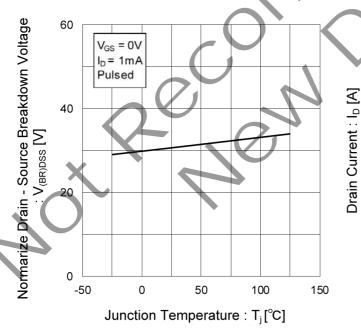
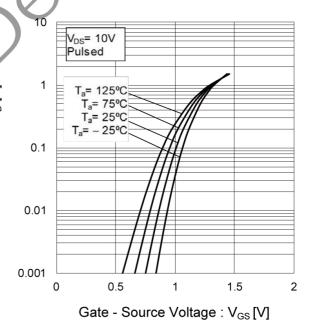


Fig.4 Typical Transfer Characteristics



Drain Current : I_D [A]

Fig.5 Gate Threshold Voltage vs.
Junction Temperature

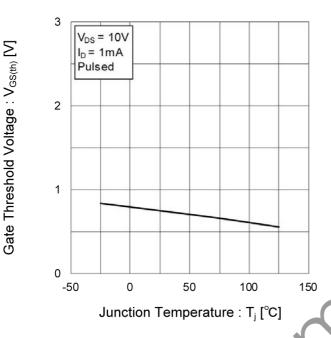
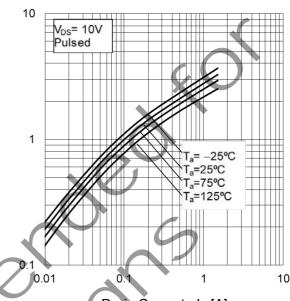


Fig.6 Forward Transfer Admittance vs. Drain Current



Forward Transfer Admittance : |Y_{fs}| [S]

Drain Čurrent : I_D [A]

Fig.7 Drain Current Derating Curve

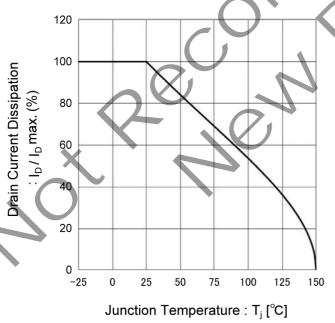
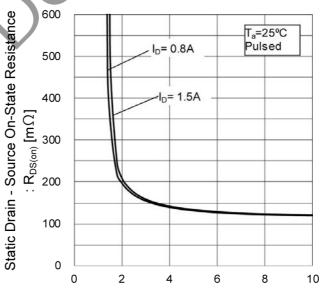


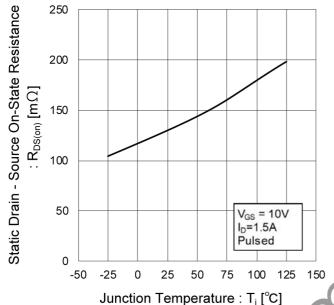
Fig.8 Static Drain - Source On - State Resistance vs. Gate Source Voltage

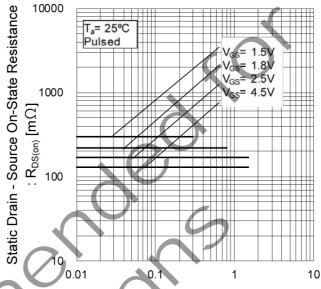


Gate - Source Voltage : V_{GS} [V]

Fig.9 Static Drain - Source On - State Resistance vs. Junction Temperature

Fig.10 Static Drain - Source On - State Resistance vs. Drain Current (I)





Drain Current : ID [A]

Static Drain - Source On-State Resistance

 $: \mathbf{R}_{\mathsf{DS}(\mathsf{on})} \left[\mathsf{m} \Omega \right]$

10

0.01

• Electrical characteristic curves < MOSFET>

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

10000

V_{GS}= 4.5V

Pulsed

T_a=125°C

T_a=75°C

T_a=25°C

T_a= -25°C

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

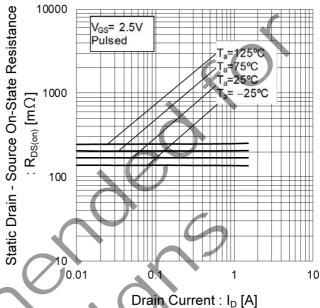


Fig.13 Static Drain - Source On - State Resistance vs. Drain Current (IV)

Drain Current : ID [A]

10

0.1

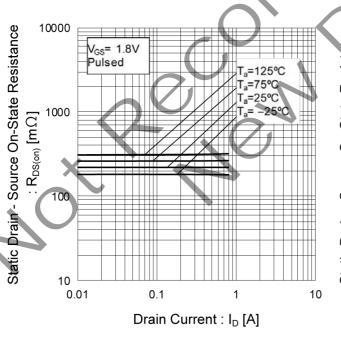
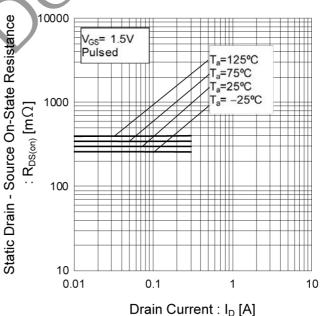


Fig.14 Static Drain - Source On - State Resistance vs. Drain Current (V)



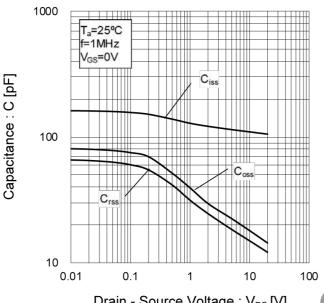
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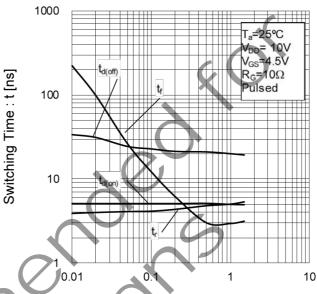
Fig.15 Typical Capacitance vs.

Drain - Source Voltage

Fig.16 Switching Characteristics

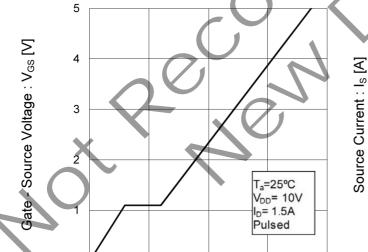


Drain - Source Voltage : $V_{DS}[V]$



Drain Current : I_D [A]

Fig.17 Dynamic Input Characteristics

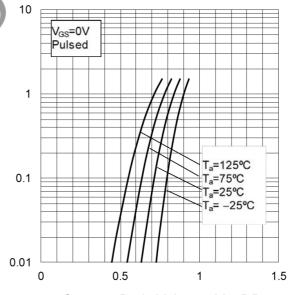


Total Gate Charge: Qq [nC]

1

1.5

Fig.18 Source Current vs. Source Drain Voltage



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

0.5

0

0

2

● Electrical characteristic curves < Di>

Fig.19 Reverse Current vs.

Reverse Voltage

10000 pulsed

1000

Ta = 75°C

Ta = 25°C

Ta = 25°C

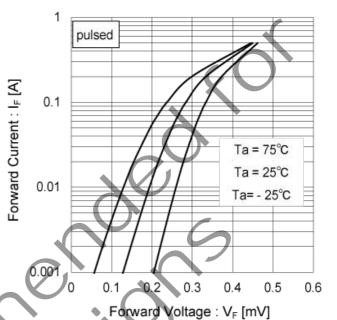
Ta = -25°C

O.01

0 5 10 15 20 25

Reverse Voltage : V_R [V]

Fig.20 Forward Current vs. Forward Voltage



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Measurement circuits

Fig. 1-1 SWITCHING TIME MEASUREMENT CIRCUIT

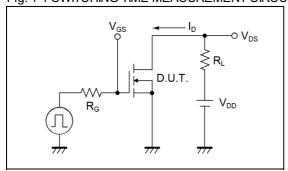


Fig. 2-1 GATE CHARGE MEASUREMENT CIRCUIT

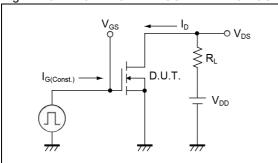


Fig. 1-2 SWITCHING WAVEFORMS

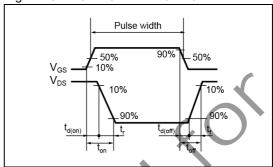
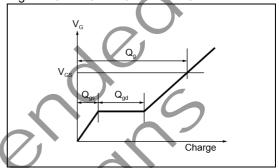


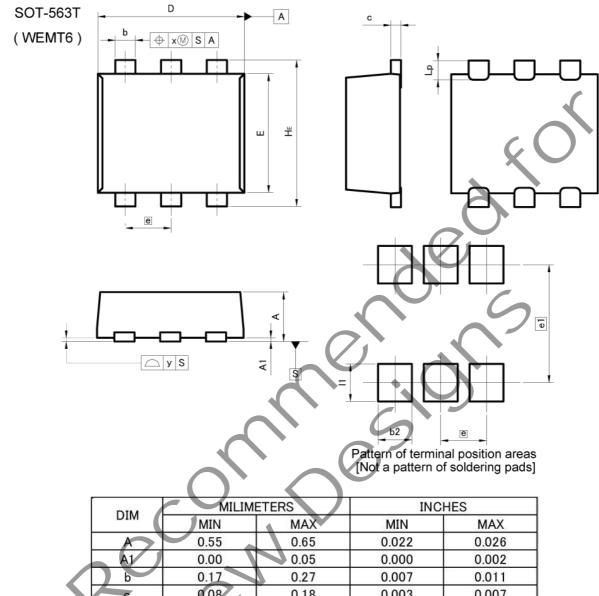
Fig. 2-2 GATE CHARGE WAVEFORM



Notice

- SBD has a large reverse leak current compared to other type of diode. Therefore, it would raise a junction temperature, and increase a reverse power loss. Further rise of inside temperature would cause a thermal runaway. This built-in SBD has low V_F characteristics and therefore, higher leak current. Please consider enough the surrounding temperature, generating heat of MOSFET and the reverse current.
- 2. This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

Dimensions



DIM	MILIME	ETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
A	0.55	0.65	0.022	0.026
A1	0.00	0.05	0.000	0.002
Ь	0.17	0.27	0.007	0.011
C	0.08	0.18	0.003	0.007
D	1.50	1.70	0.059	0.067
E	1.20	1.40	0.047	0.055
е	0.5	50	0.0	20
HE	1.50	1.70	0.059	0.067
Lp	0.11	0.31	0.004	0.012
Х	-	0.10	=	0.004
У		0.10		0.004

DIM	MILIM	ETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
b2	*	0.37	-	0.015
e1	1.	29	0.0)51
11	=	0.41	=	0.016

Dimension in mm/inches

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (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	CLASSII	CLASS II b	CLASSII
CLASSIV		CLASSⅢ	

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 - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
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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 (even if you use no-clean type fluxes, cleaning residue of flux is recommended); 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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- 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
- 2. 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.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

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