Pch -30V -3.5A Small Signal MOSFET

V <sub>DSS</sub>	-30V
R <sub>DS(on)</sub> (Max.)	50mΩ
I <sub>D</sub>	±3.5A
P <sub>D</sub>	1.0W

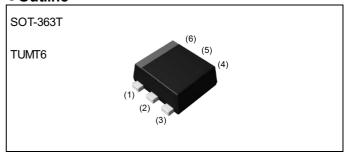
# ● Features

- 1) Low on resistance
- 2) Built-in G-S protection diode.
- 3) Small surface mount package(TUMT6)
- 4) Pb-free lead plating; RoHS compliant

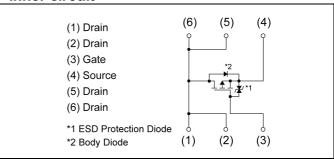
## Application

Switching

#### Outline



## ●Inner circuit



Packaging specifications

	Packing	Embossed Tape
	Reel size (mm)	180
Туре	Tape width (mm)	8
	Basic ordering unit (pcs)	3000
	Taping code	TR
	Marking	UF

## ullet Absolute maximum ratings (T<sub>a</sub> = 25°C ,unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain - Source voltage	V <sub>DSS</sub>	-30	V
Continuous drain current	I <sub>D</sub>	±3.5	А
Pulsed drain current	I <sub>DP</sub> *1	±14	А
Gate - Source voltage	$V_{GSS}$	±20	V
Dower discinction	P <sub>D</sub> *2	1.0	W
Power dissipation	P <sub>D</sub> *3	0.91	W
Junction temperature	T <sub>j</sub>	150	°C
Operating junction and storage temperature range	T <sub>stg</sub>	-55 to +150	°C

## ●Thermal resistance

Deremeter	Cumb of	Values			Lleit
Parameter	Symbol	Min.	Тур.	Max.	Unit
The word reciptores is unation, ambient	R <sub>thJA</sub> *2	-	-	125	°C/W
Thermal resistance, junction - ambient	R <sub>thJA</sub> *3	-	-	137	°C/W

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

Parameter	Symbol	Conditions	Values			Unit	
	Symbol	Conditions	Min.	Тур.	Max.	Offic	
Drain - Source breakdown voltage	V <sub>(BR)DSS</sub>	$V_{GS} = 0V$ , $I_D = -1mA$	-30	-	-	V	
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_{j}}$	I <sub>D</sub> = -1mA referenced to 25°C	-	-25	-	mV/°C	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V	-	1	-1	μA	
Gate - Source leakage current I <sub>GSS</sub>		$V_{GS} = \pm 20V, V_{DS} = 0V$	-	1	±10	μA	
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = -10V, I_{D} = -1mA$	-1.0	1	-2.5	V	
Gate threshold voltage temperature coefficient	$\frac{\DeltaV_{GS(th)}}{\DeltaT_j}$	I <sub>D</sub> = -1mA referenced to 25°C	-	3.9	-	mV/°C	
		V <sub>GS</sub> = -10V, I <sub>D</sub> = -3.5A	-	36	50		
Static drain - source on - state resistance	R <sub>DS(on)</sub> *4	$V_{GS} = -4.5V, I_D = -1.7A$	-	52	72	mΩ	
		$V_{GS} = -4.0V, I_D = -1.7A$	-	58	81		
Gate resistance	$R_{G}$	f = 1MHz, open drain	-	19	-	Ω	
Forward Transfer Admittance	Y <sub>fs</sub>  *4	V <sub>DS</sub> = -10V, I <sub>D</sub> = -3.5A	2.3	-	-	S	

<sup>\*1</sup> Pw≦10µs , Duty cycle≦1%

<sup>\*2</sup> Mounted on a ceramic board (30×30×0.8mm)

<sup>\*3</sup> Mounted on a FR4 (25×25×0.8mm,Cu pad:625mm<sup>2</sup>)

<sup>\*4</sup> Pulsed

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

Daramatar	Symbol	Conditions	Values			Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	800	-	_
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = -10V	-	120	-	pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	110	-	
Turn - on delay time	t <sub>d(on)</sub> *4	$V_{DD} \simeq -15V, V_{GS} = -10V$	-	7	-	
Rise time	t <sub>r</sub> *4	I <sub>D</sub> = -1.7A	-	9	-	no
Turn - off delay time	t <sub>d(off)</sub> *4	$R_L \simeq 8.8\Omega$	-	75	-	ns
Fall time	t <sub>f</sub> *4	$R_G = 10\Omega$	-	40	-	

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

	\ a	,				
Parameter	Symbol	Conditions		Values		Unit
raiametei	Symbol	Conditions	Min.	Тур.	Max.	Offic
Total gate charge	Qg*4	V <sub>DD</sub> ≃ -15V.	-	8.0	-	
Gate - Source charge	Q <sub>gs</sub> *4	V <sub>DD</sub> ≃ -15V, I <sub>D</sub> = -3.5A, V <sub>GS</sub> = -5V	-	2.5	-	nC
Gate - Drain charge	Q <sub>gd</sub> *4	$V_{GS} = -5V$	-	3.0	-	

## ●Body diode electrical characteristics (Source-Drain) (T<sub>a</sub> = 25°C)

Darameter	Symbol	Conditions	Values			Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Continuous forward current	I <sub>S</sub>	T - 25°C	-	-	-0.8	Α
Pulse forward current	I <sub>SP</sub> *1	T <sub>a</sub> = 25°C	-	-	-14	Α
Forward voltage	V <sub>SD</sub> *4	$V_{GS} = 0V, I_S = -3.5A$	-	-	-1.2	V

#### • Electrical characteristic curves

Fig.1 Power Dissipation Derating Curve

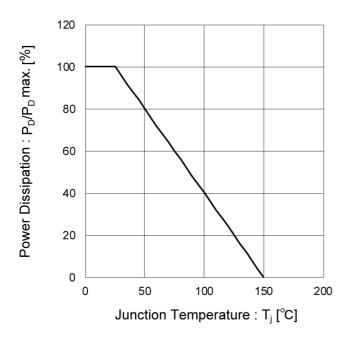
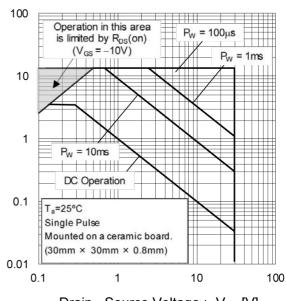


Fig.2 Maximum Safe Operating Area



Drain Current: -l<sub>D</sub> [A]

Drain - Source Voltage: -V<sub>DS</sub> [V]

Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

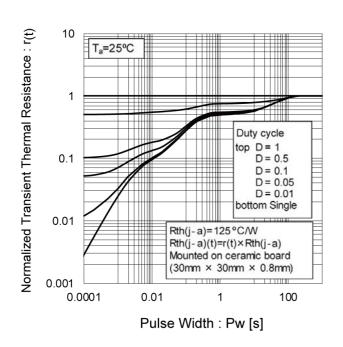
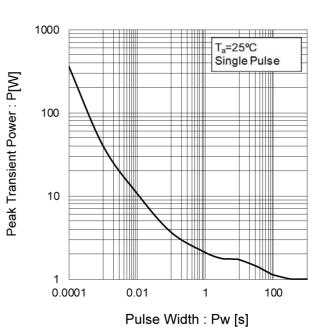


Fig.4 Single Pulse Maximum Power dissipation



#### Electrical characteristic curves

Fig.5 Typical Output Characteristics(I)

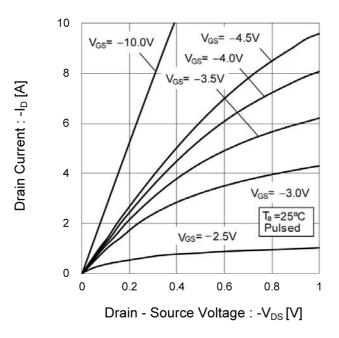
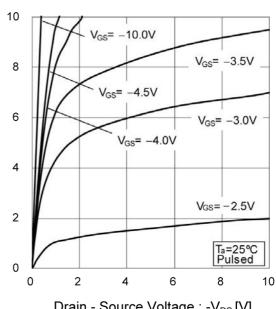


Fig.6 Typical Output Characteristics(II)



Drain Current : -I<sub>D</sub> [A]

Drain - Source Voltage : -V<sub>DS</sub> [V]

Fig.7 Breakdown Voltage vs. **Junction Temperature** 

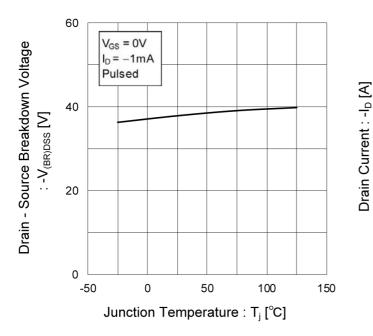
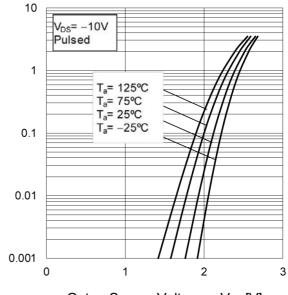


Fig.8 Typical Transfer Characteristics



Gate - Source Voltage : -V<sub>GS</sub> [V]

Gate Threshold Voltage: -V<sub>GS(th)</sub> [V]

Fig.9 Gate Threshold Voltage vs.
Junction Temperature

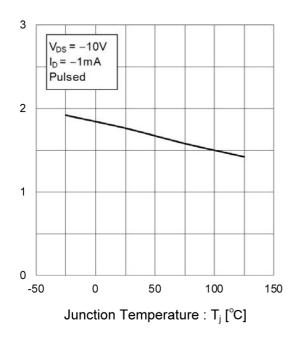


Fig.10 Forward Transfer Admittance vs.
Drain Current

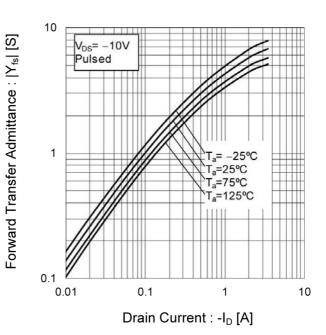


Fig.11 Drain Current Derating Curve

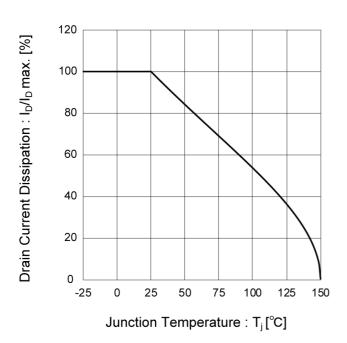
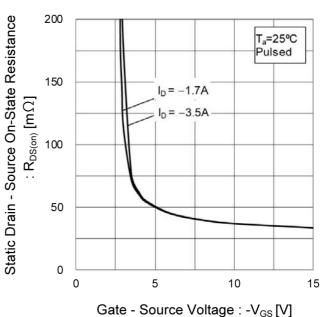


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage



RRL035P03

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

Static Drain - Source On-State Resistance On-Static Drain - Source On-State Resistance On-State Resis On-State Resistance On-State Resistance On-State Resistance On-

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

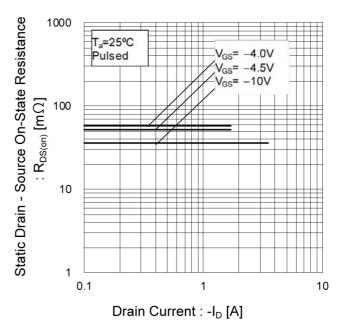




Fig.15 Static Drain - Source On - State Resistance vs. Drain Current (II)

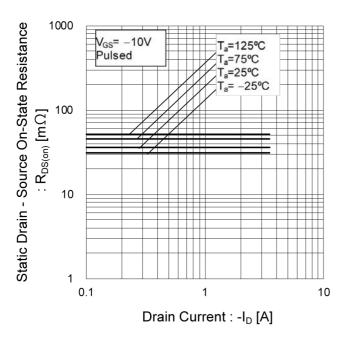


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

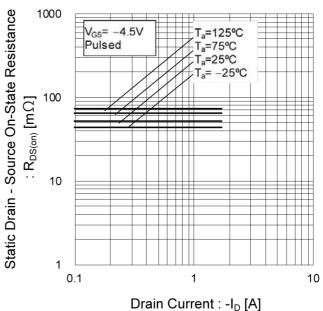


Fig.17 Static Drain - Source On - State
Resistance vs. Drain Current (IV)

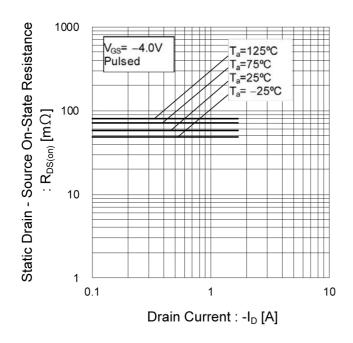


Fig.18 Typical Capacitance vs.

Drain - Source Voltage

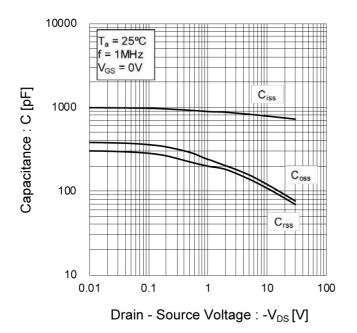


Fig.19 Switching Characteristics

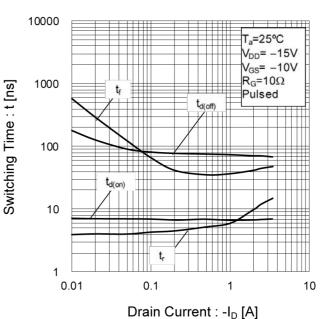
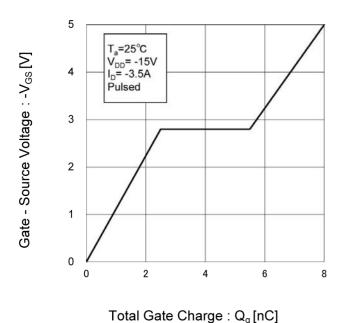


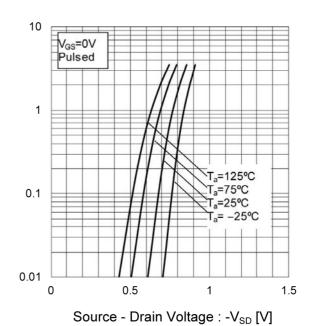
Fig.20 Dynamic Input Characteristics



Source Current : -I<sub>s</sub> [A]

Fig.21 Source Current vs.

Source Drain Voltage



### Measurement circuits

Fig. 1-1 SWITCHING TIME MEASUREMENT CIRCUIT

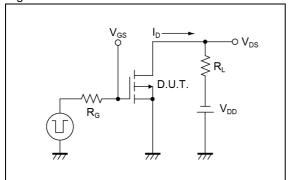


Fig. 2-1 GATE CHARGE MEASUREMENT CIRCUIT

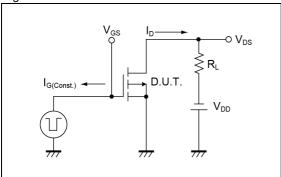


Fig. 1-2 SWITCHING WAVEFORMS

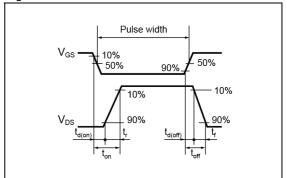
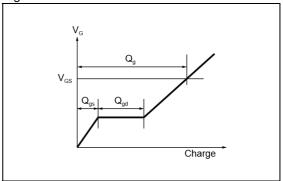


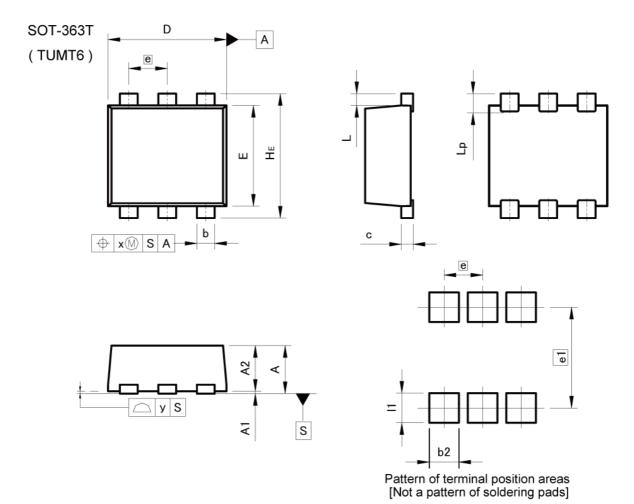
Fig. 2-2 GATE CHARGE WAVEFORM



### Notice

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

## Dimensions



DIM -	MILIM	ETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	<b>4</b> 3	0.85	-	0.033
A1	0.00	0.05	0.000	0.002
A2	0.72	0.82	0.028	0.032
b	0.25	0.40	0.010	0.016
С	0.12	0.22	0.005	0.009
D	1.90	2.10	0.075	0.083
E	1.60	1.80	0.063	0.071
е	0.0	65	0.0	26
HE	2.00	2.20	0.079	0.087
L	0.3	20	0.0	08
Lp	<u> 2000</u>	0.40	_	0.016
х	<u> 200</u> 9	0.10	(22)	0.004
у	#3	0.10	-	0.004

DIM -	MILIMETERS		INC	HES
DIM L	MIN	MAX	MIN	MAX
b2	<del>-</del>	0.50	: <del>-</del>	0.020
e1	1.	70	0.0	067
11	<u>48</u>	0.50	9 <del>2</del>	0.020

Dimension in mm/inches



# **Notice**

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JÁPAN	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 Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [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

#### **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.

#### **Precaution for Product Label**

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

#### **Precaution for Disposition**

When disposing Products please dispose them properly using an authorized industry waste company.

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