#### 30V Nch+Pch Power MOSFET

Symbol	Tr1:Nch	Tr2:Pch
$V_{DSS}$	30V	-30V
R <sub>DS(on)</sub> (Max.)	30mΩ	28mΩ
I <sub>D</sub>	±6.0A	±7.0A
$P_D$	2.0	)W

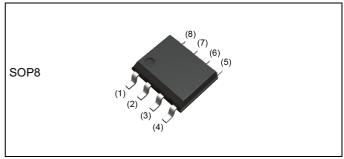
#### Features

- 1) Low on resistance
- 2) Small Surface Mount Package (SOP8)
- 3) Pb-free lead plating; RoHS compliant
- 4) AEC-Q101 Qualified

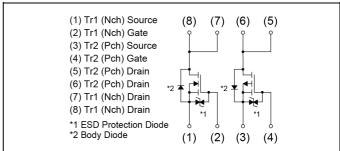
# Application

Switching

#### Outline



### Inner circuit



Packaging specifications

- 1 001101	Jing opcomodiono	
	Packing	Embossed Tape
	Reel size (mm)	330
Type	Tape width (mm)	12
	Basic ordering unit (pcs)	2500
	Taping code	ТВ
	Marking	SP8M5

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

Paramet	Parameter		Va	lue	Unit
Parameter		Symbol	Tr1:Nch	Tr2:Pch	Offic
Drain - Source voltage		$V_{DSS}$	30	-30	V
Continuous drain current		I <sub>D</sub>	±6.0	±7.0	А
Pulsed drain current		I <sub>DP</sub> *1	±24	±28	А
Gate - Source voltage		$V_{GSS}$	±20	±20	V
Down discipation	total	P <sub>D</sub> *2	2	.0	10/
Power dissipation	total	P <sub>D</sub> *3	1.4		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

Parameter		Cymahal		Values		Linit
		Symbol	Min.	Тур.	Max.	Unit
		R <sub>thJA</sub> *2	-	-	62.5	°C/W
Thermal resistance, junction - ambient	total	R <sub>thJA</sub> *3	ı	1	89.2	C/VV

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

Doromotor	Cumbal	T. //p.o	Conditions		Values		Unit
Parameter	Symbol	Type	Conditions	Min.	Тур.	Max.	Offic
Drain - Source breakdown	\/	Tr1	$V_{GS} = 0V$ , $I_D = 1mA$	30	-	-	V
voltage	V <sub>(BR)DSS</sub>	Tr2	$V_{GS} = 0V$ , $I_D = -1mA$	-30	-	-	V
Breakdown voltage	ΔV <sub>(BR)DSS</sub>	Tr1	I <sub>D</sub> = 1mA, referenced to 25°C	-	29	-	mV/°C
temperature coefficient	$\Delta T_{j}$	Tr2	I <sub>D</sub> = -1mA, referenced to 25°C	1	-20.7	1	IIIV/ C
Zero gate voltage	ı	Tr1	$V_{DS} = 30V, V_{GS} = 0V$	1	-	1	
drain current	I <sub>DSS</sub>	Tr2	$V_{DS} = -30V, V_{GS} = 0V$	1	-	-1	μA
Gate - Source	ı	Tr1	$V_{DS} = 0V, V_{GS} = \pm 20V$	1	-	±10	
leakage current	I <sub>GSS</sub>	Tr2	$V_{DS} = 0V, V_{GS} = \pm 20V$	1	-	±10	μA
Gate threshold	V <sub>GS(th)</sub>	Tr1	$V_{DS}$ = 10V, $I_D$ = 1mA	1.0	-	2.5	V
voltage		Tr2	$V_{DS} = -10V, I_{D} = -1mA$	-1.0	-	-2.5	V
Gate threshold voltage	$\Delta V_{GS(th)}$	Tr1	I <sub>D</sub> = 1mA, referenced to 25°C	1	-1.6	ı	mV/°C
temperature coefficient	$\Delta T_{j}$	Tr2	I <sub>D</sub> = -1mA, referenced to 25°C	-	3.1	-	IIIV/ C
			$V_{GS} = 10V, I_D = 6A$	•	21	30	
		Tr1	$V_{GS} = 4.5V, I_D = 6A$	-	30	42	
Static drain - source	R <sub>DS(on)</sub> *4		$V_{GS} = 4.0V, I_D = 6A$	-	33	47	mΩ
on - state resistance	DS(on)		$V_{GS} = 10V, I_D = -7A$	-	20	28	11122
		Tr2	$V_{GS} = -4.5V$ , $I_D = -3.5A$	-	25	35	
			$V_{GS} = -4.0V, I_D = -3.5A$	-	30	42	
Gate resistance	$R_{G}$	Tr1	f=1MHz, open drain	-	4.1	-	Ω
	٠ '(ن	Tr2	Tiviliz, open drain	-	3.7	-	72
Forward Transfer	  Y <sub>fs</sub>  *4	Tr1	$V_{DS} = 10V, I_{D} = 6A$	4.0	-	-	S
Admittance	I ' ISI	Tr2	$V_{DS} = -10V, I_{D} = -3.5A$	6.0	-	-	

<sup>\*1</sup> Pw  $\leq$  10 $\mu$ s, Duty cycle  $\leq$  1%

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

<sup>\*3</sup> Mounted on a FR4 (25×25×0.8mm)

<sup>\*4</sup> Pulsed

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

# <Tr1>

Parameter	Cumbal	Conditions	,	Values		l loit	
r arameter	Symbol	Conditions	Min.	Тур.	Max.	Unit	
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	520	-		
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 10V	-	150	-	pF	
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	95	-		
Turn - on delay time	t <sub>d(on)</sub> *4	$V_{DD} \simeq 15V$ , $V_{GS} = 10V$	-	9	-		
Rise time	t <sub>r</sub> *4	I <sub>D</sub> = 3A	-	21	-	no	
Turn - off delay time	t <sub>d(off)</sub> *4	$R_L = 5.0\Omega$	-	36	-	ns	
Fall time	t <sub>f</sub> *4	$R_G = 10\Omega$	-	13	ı		

### <Tr2>

Doromotor	arameter Symbol Conditions		,	Unit		
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V	-	2600	-	
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = -10V	-	450	-	pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1MHz	-	350	-	
Turn - on delay time	t <sub>d(on)</sub> *4	$V_{DD} \simeq -15V$ , $V_{GS} = -10V$	-	20	-	
Rise time	t <sub>r</sub> *4	I <sub>D</sub> = -3.5A	-	50	-	
Turn - off delay time	t <sub>d(off)</sub> *4	$R_L = 4.29\Omega$	-	110	-	ns
Fall time	t <sub>f</sub> *4	$R_G = 10\Omega$	-	70	-	

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

### <Tr1>

Doromotor	Cumbal	Conditions	,	Values		Unit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Offic
Total gate charge	Q <sub>g</sub> *4		-	7.2	-	
Gate - Source charge	Q <sub>gs</sub> *4	V <sub>DD</sub> ≃ 15V, I <sub>D</sub> = 6A V <sub>GS</sub> = 5V	-	1.8	-	nC
Gate - Drain charge	Q <sub>gd</sub> *4	VGS 0V	-	2.8	1	

#### <Tr2>

Doromotor	Cumbal	Conditions	,	Values		Lloit
Parameter	Symbol Conditions —	Min.	Тур.	Max.	Unit	
Total gate charge	Q <sub>g</sub> *4		-	25	-	
Gate - Source charge	Q <sub>gs</sub> *4	V <sub>DD</sub> ≃ -15V, I <sub>D</sub> = -7A V <sub>GS</sub> = -5V	-	5.5	-	nC
Gate - Drain charge	Q <sub>gd</sub> *4	, GS	-	10	-	

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

### <Tr1>

Daramatar	Cumphal	Conditions	,	Values		Lloit
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Continuous forward current	I <sub>S</sub>	T - 25°C	-	-	1.6	^
Pulse forward current	I <sub>SP</sub> *1	T <sub>a</sub> = 25°C	-	-	24	А
Forward voltage	V <sub>SD</sub> *4	V <sub>GS</sub> = 0V, I <sub>S</sub> = 6.4A	-	-	1.2	V

### <Tr2>

Doromotor	Parameter Symbol Conditions		,	Values		
Parameter	Symbol Conditions	Min.	Тур.	Max.	Unit	
Continuous forward current	I <sub>S</sub>	T = 25°C	-	-	-1.6	^
Pulse forward current	I <sub>SP</sub> *1	T <sub>a</sub> = 25°C	-	-	-28	A
Forward voltage	V <sub>SD</sub> *4	V <sub>GS</sub> = 0V, I <sub>S</sub> = -1.6A	-	-	-1.2	V

Fig.1 Power Dissipation Derating Curve

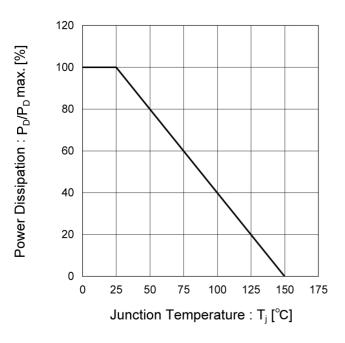
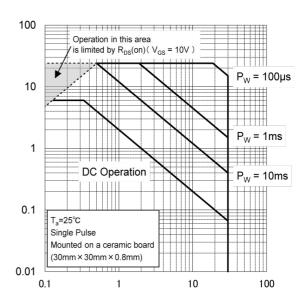


Fig.2 Maximum Safe Operating Area



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

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

Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

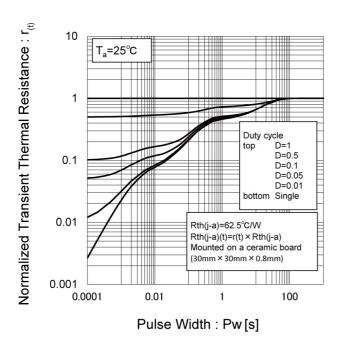
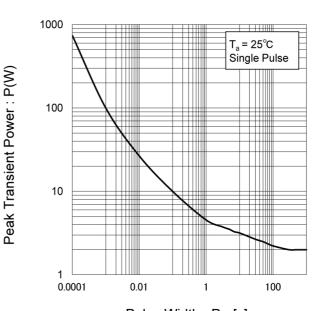


Fig.4 Single Pulse Maximum Power dissipation

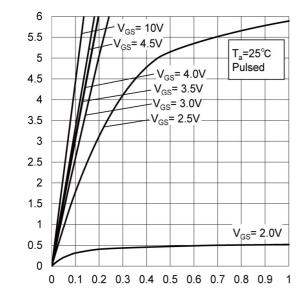


Pulse Width : Pw [s]

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

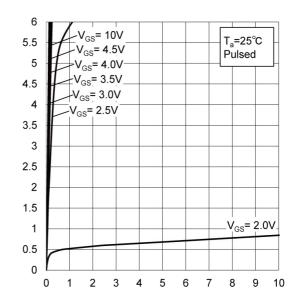
#### ● Electrical characteristic curves < Tr1>

Fig.5 Typical Output Characteristics(I)



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

Fig.6 Typical Output Characteristics(II)

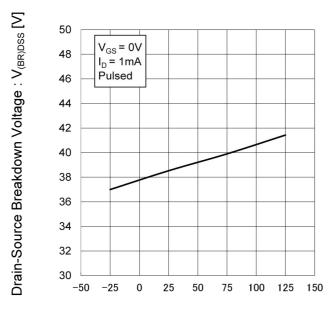


Drain Current : I<sub>D</sub> [A]

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

Fig.7 Breakdown Voltage vs.

Junction Temperature



Junction Temperature : T<sub>i</sub> [°C]

Fig.8 Typical Transfer Characteristics

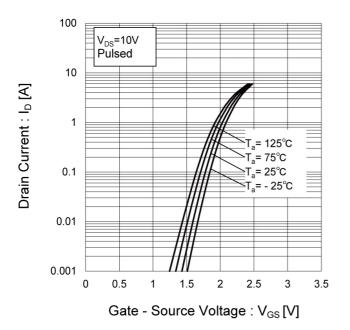


Fig.9 Gate Threshold Voltage vs.
Junction Temperature

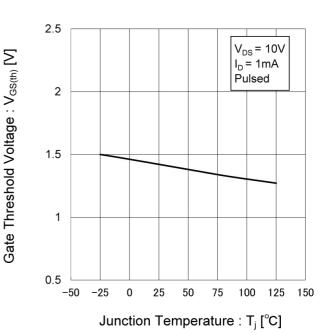


Fig.10 Forward Transfer Admittance vs.
Drain Current

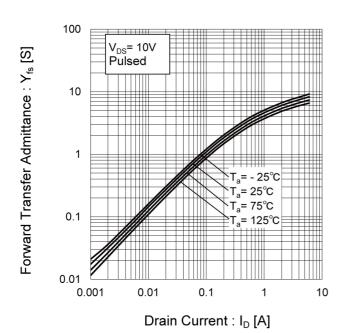


Fig.11 Drain Current Derating Curve

120 100 Drain Current Dissipation 80 : I<sub>D</sub>/I<sub>D</sub>max. [%] 60 40 20 0 -25 0 25 50 75 100 125 150 Junction Temperature : T<sub>j</sub> [°C]

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

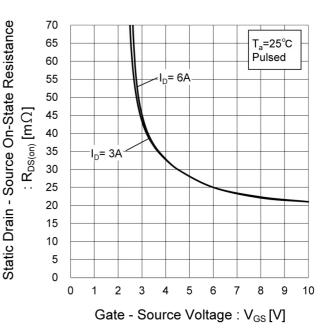
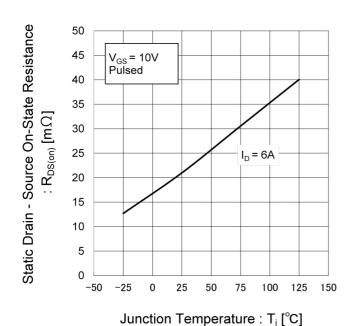


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



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

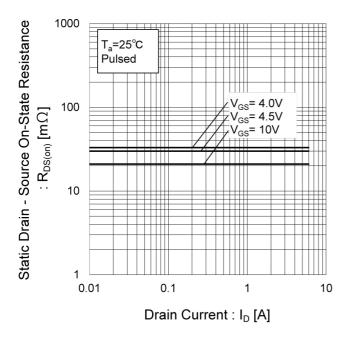


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current (II)

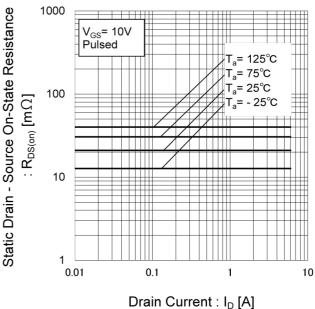


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

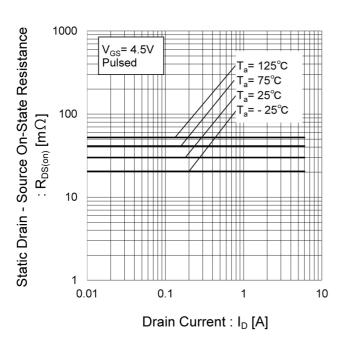


Fig.17 Static Drain - Source On - State Resistance vs. Drain Current (IV)

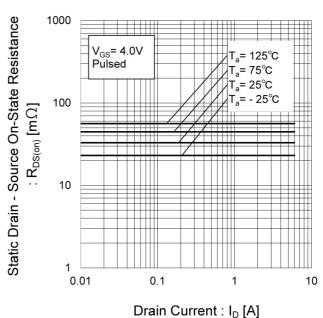


Fig.18 Typical Capacitance vs.

Drain - Source Voltage

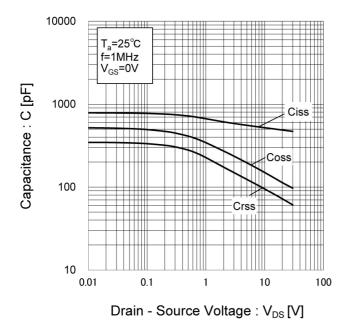


Fig.19 Switching Characteristics

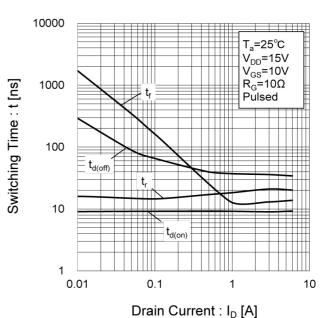


Fig.20 Dynamic Input Characteristics

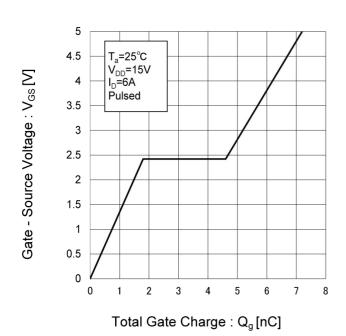
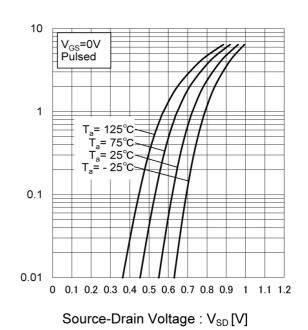


Fig.21 Source Current vs.
Source Drain Voltage



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Source Current : Is [A]

Fig.1 Power Dissipation Derating Curve

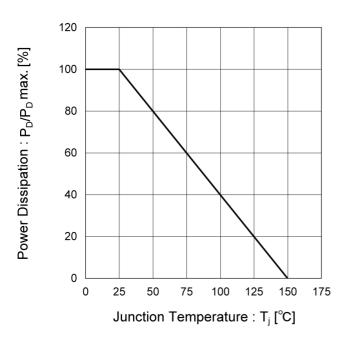


Fig.2 Maximum Safe Operating Area

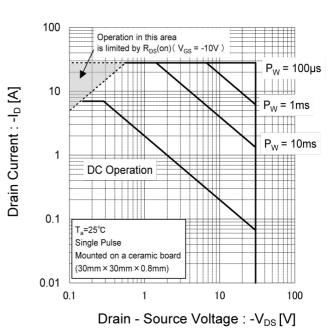


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

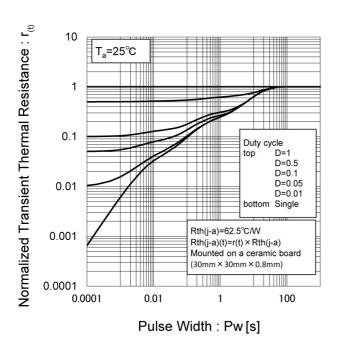
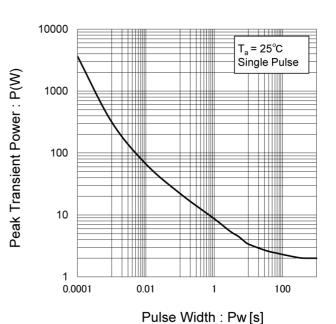


Fig.4 Single Pulse Maximum Power dissipation



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

#### ● Electrical characteristic curves < Tr2>

Fig.5 Typical Output Characteristics(I)

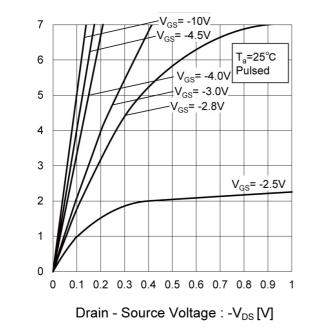
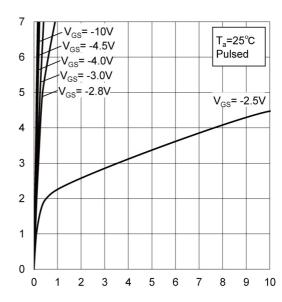


Fig.6 Typical Output Characteristics(II)



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

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

Fig.7 Breakdown Voltage vs.

Junction Temperature

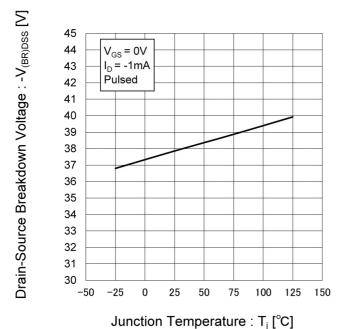


Fig.8 Typical Transfer Characteristics

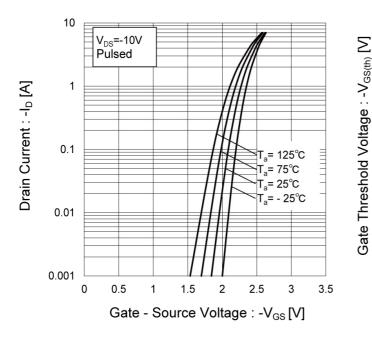


Fig.9 Gate Threshold Voltage vs.
Junction Temperature

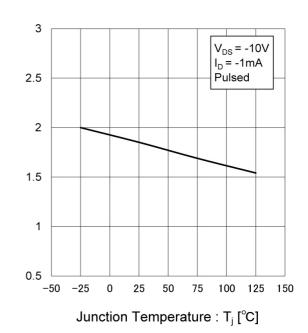


Fig.10 Forward Transfer Admittance vs.
Drain Current

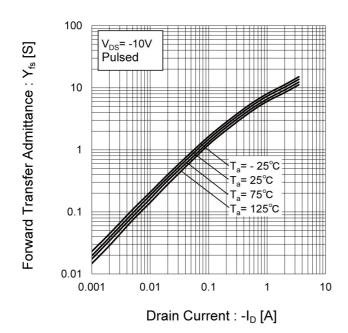


Fig.11 Drain Current Derating Curve

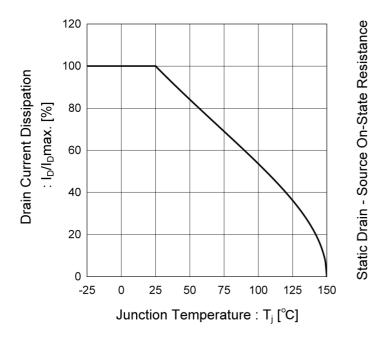


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

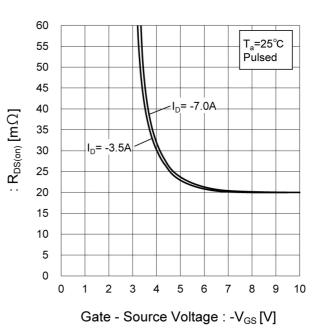


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature

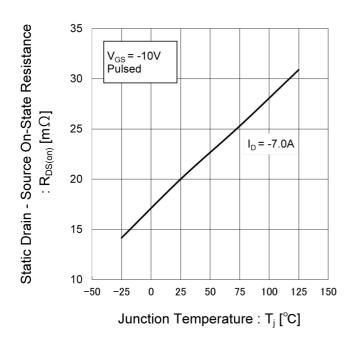


Fig.14 Static Drain - Source On - State
Resistance vs. Drain Current (I)

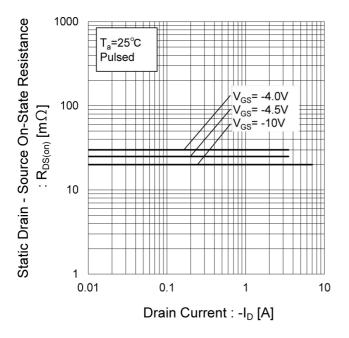


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current (II)

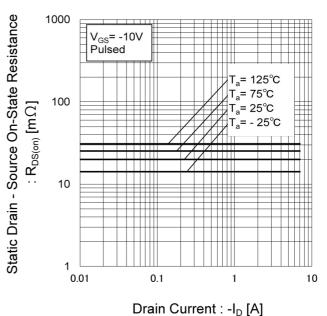
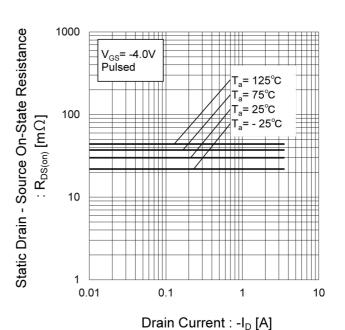


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current (III)

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

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



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Fig.18 Typical Capacitance vs.

Drain - Source Voltage

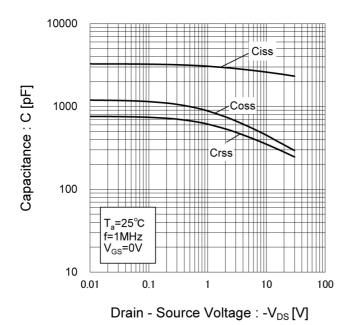


Fig.19 Switching Characteristics

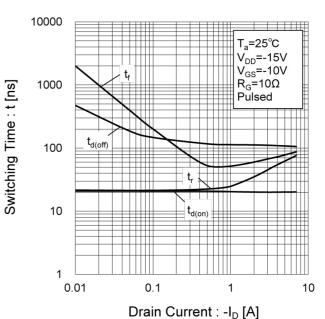


Fig.20 Dynamic Input Characteristics

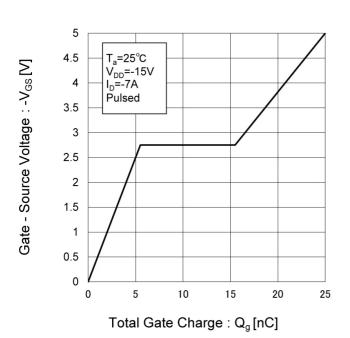
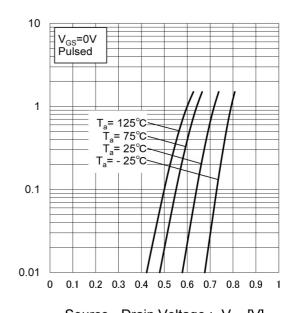


Fig.21 Source Current vs.
Source Drain Voltage



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

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## ● Measurement circuits < Tr1>

Fig.1-1 Switching Time Measurement Circuit

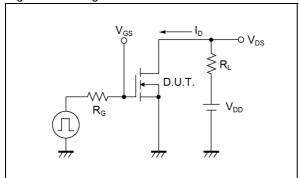


Fig.2-1 Gate Charge Measurement Circuit

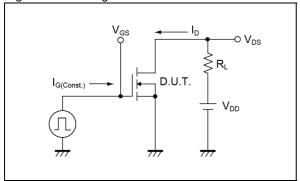


Fig.1-2 Switching Waveforms

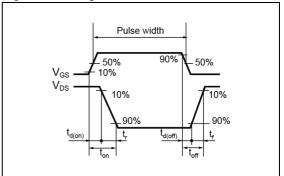
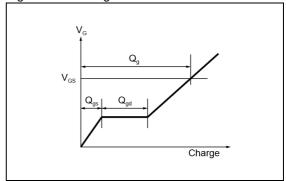


Fig.2-2 Gate Charge Waveform



# ● Measurement circuits < Tr2>

Fig.3-1 Switching Time Measurement Circuit

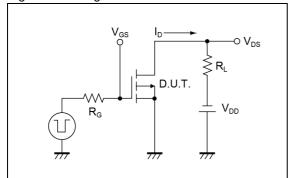


Fig.4-1 Gate Charge Measurement Circuit

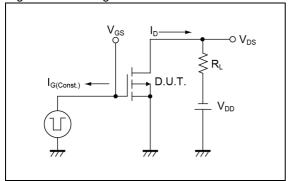


Fig.3-2 Switching Waveforms

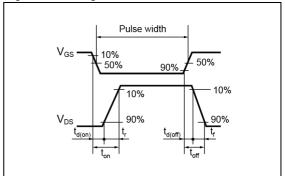
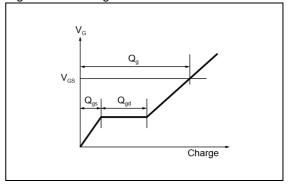
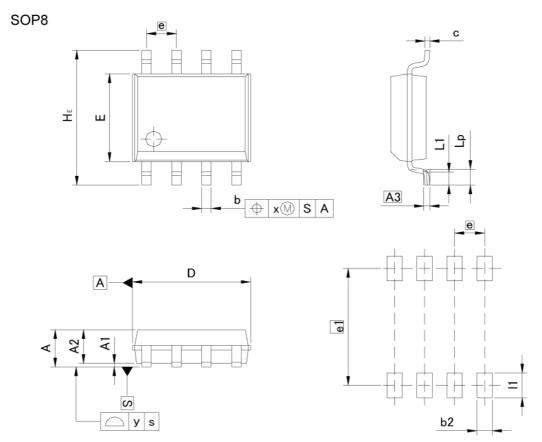


Fig.4-2 Gate Charge Waveform



### 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.	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
Е	3.75	4.05	0.148	0.159
е	1.	27	0.0	50
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	0.0	006
У	0.	10	0.0	004
	MILIM	ETERS	INC	HES
DIM	MINI	MAY	MINI	MAN

	DIM	MILIMETERS		INCHES	
		MIN	MAX	MIN	MAX
	b2	-	0.65	-	0.026
	e1	5.15		0.203	
	11	-,7	1.15	- 1	0.045

Dimension in mm/inches



# **Notice**

#### **Precaution on using ROHM Products**

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, 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

Ī	JAPAN	USA	EU	CHINA
ĺ	CLASSⅢ	CLACCIII	CLASS II b	СГУССШ
Ī	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:
  - [a] Installation of protection circuits or other protective devices to improve system safety
  - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
- 3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
  - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
  - [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.
- 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.

#### **Precaution for Foreign Exchange and Foreign Trade act**

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

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