HT8MC5

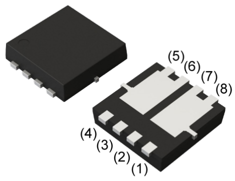
60V Nch+Pch Power MOSFET

Datasheet

Symbol	Tr1:Nch	Tr2:Pch
V_{DSS}	60V	-60V
$R_{DS(on)}$(Max.)	90mΩ	97mΩ
I_D	±10A	±11.5A
P_D	13W	

●Outline

HSMT8

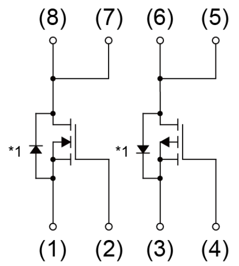


●Features

1) Low on - resistance
2) High Power small mold Package (HSMT8)
3) Pb-free plating ; RoHS compliant
4) Halogen Free
5) 100%Rg and UIS tested

●Inner circuit

(1) Tr1 (Nch) Source
(2) Tr1 (Nch) Gate
(3) Tr2 (Pch) Source
(4) Tr2 (Pch) Gate
(5) Tr2 (Pch) Drain
(6) Tr2 (Pch) Drain
(7) Tr1 (Nch) Drain
(8) Tr1 (Nch) Drain
*1 Body Diode



●Application

Switching

Motor drives

●Packaging specifications

Type	Packing	Embossed Tape
	Reel size (mm)	330
	Tape width (mm)	12
	Quantity (pcs)	3000
	Taping code	TB1
	Marking	HT8MC5

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

Parameter		Symbol	Value		Unit
			Tr1:Nch	Tr2:Pch	
Drain - Source voltage		V_{DSS}	60	-60	V
Continuous drain current	T_c = 25°C	I_D^{*1}	±10	±11.5	A
	T_a = 25°C	I_D	±3.5	±4.0	A
Pulsed drain current		I_{DP}^{*2}	±14	±16	A
Gate - Source voltage		V_{GSS}	±20	±20	V
Avalanche current, single pulse		I_{AS}^{*3}	3.5	-4.0	A
Avalanche energy, single pulse		E_{AS}^{*3}	1.0	1.2	mJ
Power dissipation (total)		P_D^{*1}	13		W
		P_D^{*4}	2.0		
Junction temperature		T_j	150		℃
Operating junction and storage temperature range		T_{stg}	-55 to +150		℃

●Thermal resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal resistance, junction - case	R_{thJC} *1	-	-	9.4	°C/W
Thermal resistance, junction - ambient	R_{thJA} *4	-	-	62.5	°C/W

●Electrical characteristics (T_a = 25°C)

Parameter	Symbol	Type	Conditions	Values			Unit
				Min.	Typ.	Max.	
Drain - Source breakdown voltage	$V_{(BR)DSS}$	Tr1	V_{GS} = 0V, I_D = 1mA	60	-	-	V
		Tr2	V_{GS} = 0V, I_D = -1mA	-60	-	-	
Breakdown voltage temperature coefficient	$\frac{\Delta V_{(BR)DSS}}{\Delta T_j}$	Tr1	I_D = 1mA, referenced to 25°C	-	38.9	-	mV/°C
		Tr2	I_D = -1mA, referenced to 25°C	-	-22	-	
Zero gate voltage drain current	I_{DSS}	Tr1	V_{DS} = 60V, V_{GS} = 0V	-	-	1	μA
		Tr2	V_{DS} = -60V, V_{GS} = 0V	-	-	-1	
Gate - Source leakage current	I_{GSS}	Tr1	V_{GS} = ±20V, V_{DS} = 0V	-	-	±100	nA
		Tr2	V_{GS} = ±20V, V_{DS} = 0V	-	-	±100	nA
Gate threshold voltage	$V_{GS(th)}$	Tr1	V_{DS} = V_{GS}, I_D = 1mA	1.0	-	2.5	V
		Tr2	V_{DS} = V_{GS}, I_D = -1mA	-1.0	-	-2.5	
Gate threshold voltage temperature coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_j}$	Tr1	I_D = 1mA, referenced to 25°C	-	-4.7	-	mV/°C
		Tr2	I_D = -1mA, referenced to 25°C	-	3.7	-	
Static drain - source on - state resistance	$R_{DS(on)}$ *5	Tr1	V_{GS} = 10V, I_D = 3.5A	-	69	90	mΩ
			V_{GS} = 4.5V, I_D = 3.5A	-	99	139	
		Tr2	V_{GS} = -10V, I_D = -4.0A	-	76	97	
			V_{GS} = -4.5V, I_D = -4.0A	-	85	109	
Gate resistance	R_G	Tr1	-	-	2.7	-	Ω
		Tr2		-	17	-	
Forward Transfer Admittance	$\|Y_{fs}\|$ *5	Tr1	V_{DS} = 5V, I_D = 3.5A	2.3	-	-	S
		Tr2	V_{DS} = -5V, I_D = -4.0A	5.0	-	-	

*1 T_C = 25°C, Limited only by maximum temperature allowed.

*2 Pw ≤ 10μs, Duty cycle ≤ 1%

*3 Tr1: L ≃ 0.1mH, V_{DD} = 30V, R_G = 25Ω, Starting T_j = 25°C Fig.3-1,3-2

Tr2: L ≃ 0.1mH, V_{DD} = -30V, R_G = 25Ω,Starting T_j = 25°C Fig.6-1,6-2

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

*5 Pulsed

●Electrical characteristics (T_a = 25°C)

<Tr1>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	135	-	pF
Output capacitance	C_{oss}	V_{DS} = 30V	-	38	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	6	-	
Turn - on delay time	$t_{d(on)}$ *5	V_{DD} ≃ 30V, V_{GS} = 10V	-	5.3	-	ns
Rise time	t_r *5	I_D = 1.75A	-	5.0	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 17.1Ω	-	13.0	-	
Fall time	t_f *5	R_G = 10Ω	-	3.1	-	

<Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	800	-	pF
Output capacitance	C_{oss}	V_{DS} = -30V	-	65	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	49	-	
Turn - on delay time	$t_{d(on)}$ *5	V_{DD} ≃ -30V, V_{GS} = -10V	-	9.7	-	ns
Rise time	t_r *5	I_D = -2A	-	17	-	
Turn - off delay time	$t_{d(off)}$ *5	R_L = 15Ω	-	91	-	
Fall time	t_f *5	R_G = 10Ω	-	32	-	

●Gate charge characteristics (T_a = 25°C)

<Tr1>

Parameter	Symbol	Conditions		Values			Unit
				Min.	Typ.	Max.	
Total gate charge	Q_g*5	V_{DD} ≃ 30V, I_D = 3.5A	V_{GS} = 10V	-	3.1	-	nC
			V_{GS} = 4.5V	-	1.7	-	
Gate - Source charge	Q_{gs}*5			-	0.9	-	
Gate - Drain charge	Q_{gd}*5			-	0.3	-	

<Tr2>

Parameter	Symbol	Conditions		Values			Unit
				Min.	Typ.	Max.	
Total gate charge	Q_g*5	V_{DD} ≃ -30V, I_D = -4.0A	V_{GS} = -10V	-	17.1	-	nC
			V_{GS} = -4.5V	-	8.6	-	
Gate - Source charge	Q_{gs}*5			-	2.9	-	
Gate - Drain charge	Q_{gd}*5			-	3.1	-	

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

<Tr1>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous forward current	I_S	T_a = 25℃	-	-	1.67	A
Pulse forward current	I_{SP}*2		-	-	14	
Forward voltage	V_{SD}*5	V_{GS} = 0V, I_S = 1.67A	-	-	1.2	V
Reverse recovery time	t_{rr}*5	I_S = 3.5A, V_{GS} = 0V, di/dt = 100A/μs	-	23	-	ns
Reverse recovery charge	Q_{rr}*5		-	20	-	nC

<Tr2>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Continuous forward current	I_S	T_a = 25℃	-	-	-1.67	A
Pulse forward current	I_{SP}		-	-	-16	
Forward voltage	V_{SD}*5	V_{GS} = 0V, I_S = -1.67A	-	-	-1.2	V
Reverse recovery time	t_{rr}*5	I_S = -4.0A, V_{GS} = 0V, di/dt = 100A/s	-	20	-	ns
Reverse recovery charge	Q_{rr}*5		-	17	-	nC

●Electrical characteristic curves <Tr1>

Fig.1 Power Dissipation Derating Curve

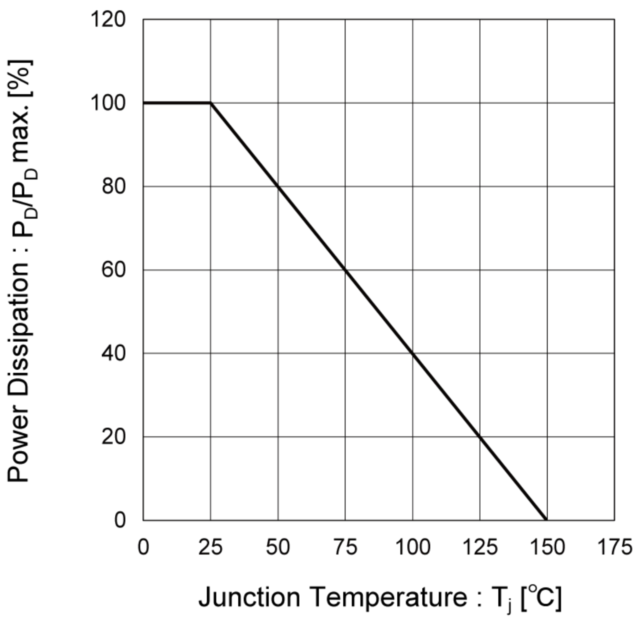


Fig.2 Maximum Safe Operating Area

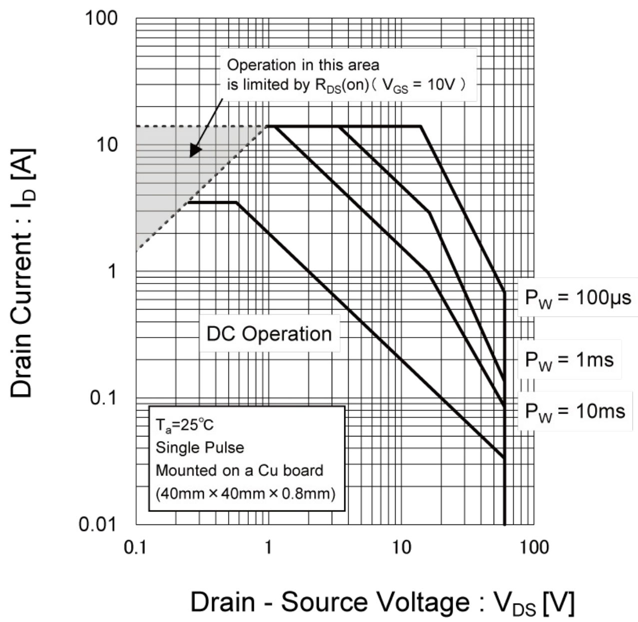


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

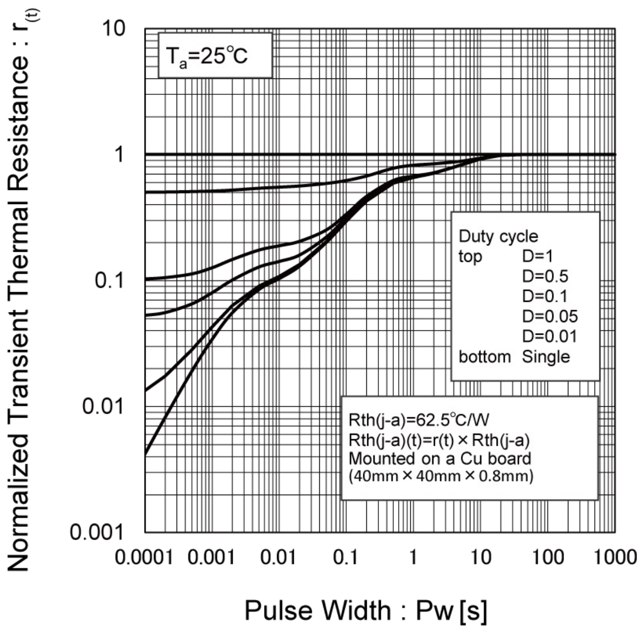
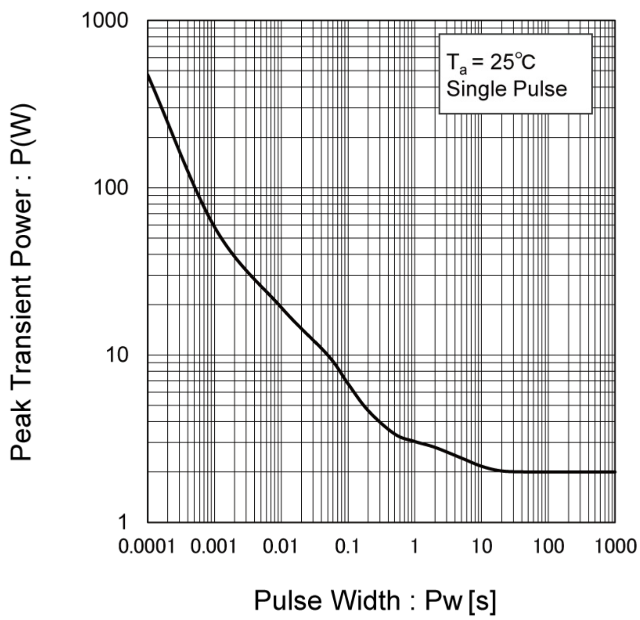


Fig.4 Single Pulse Maximum Power Dissipation



●Electrical characteristic curves <Tr1>

Fig.5 Typical Output Characteristics(I)

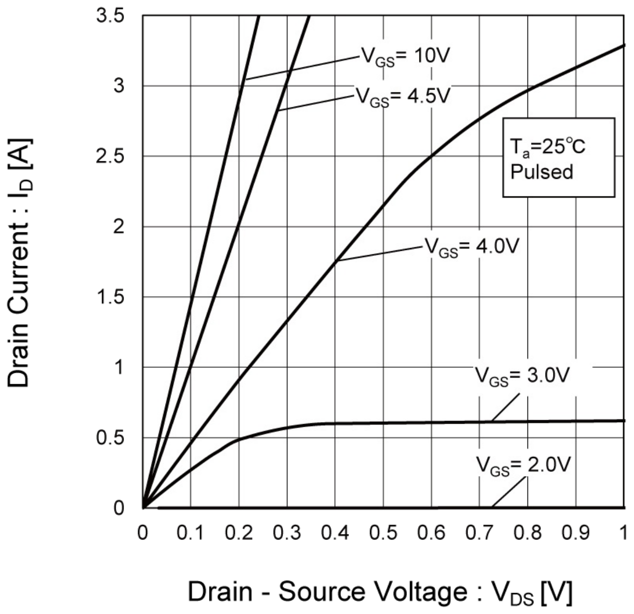


Fig.6 Typical Output Characteristics(II)

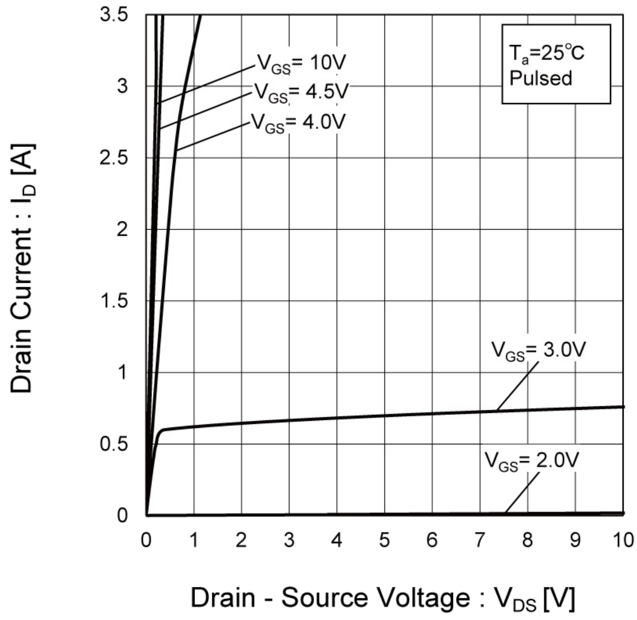
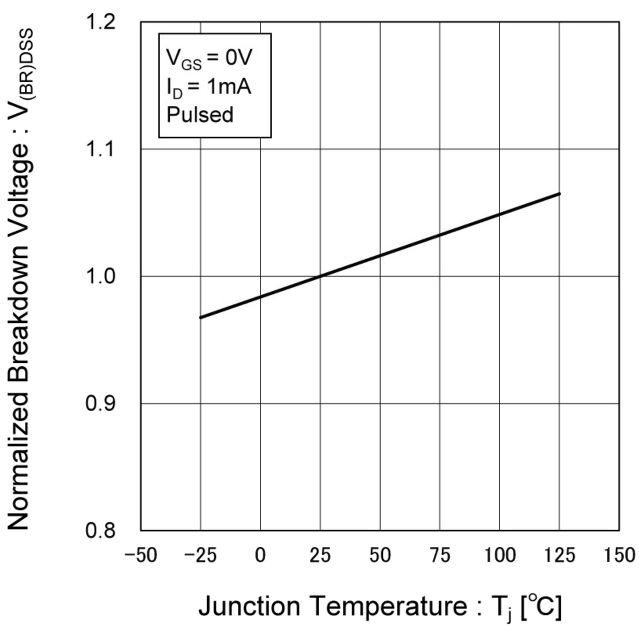


Fig.7 Normalized Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr1>

Fig.8 Typical Transfer Characteristics

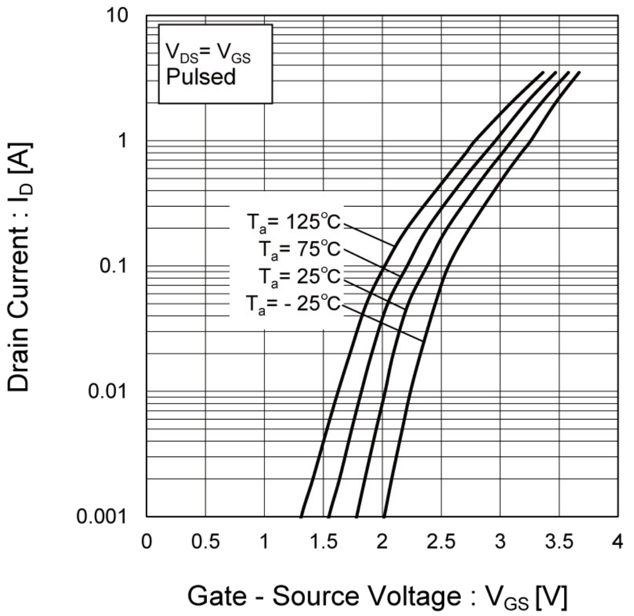


Fig.9 Gate Threshold Voltage vs. Junction Temperature

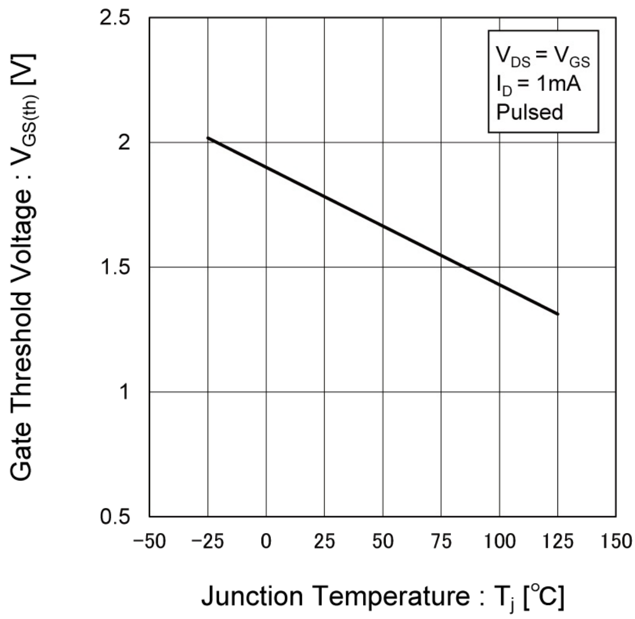
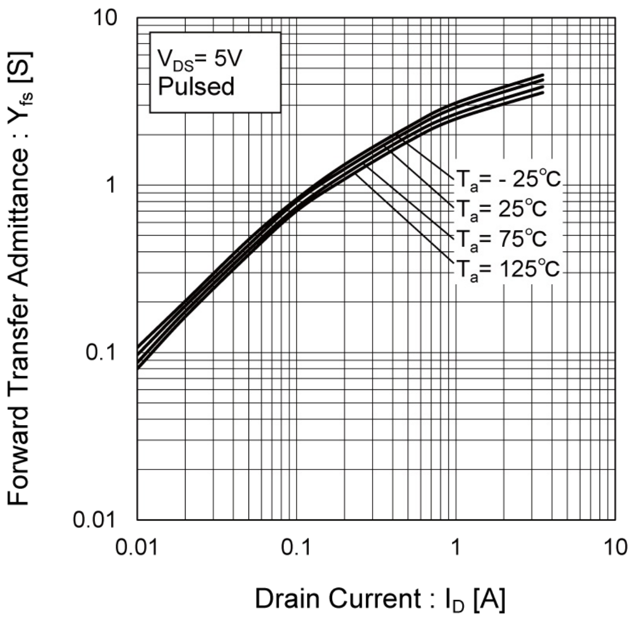


Fig.10 Forward Transfer Admittance vs. Drain Current



●Electrical characteristic curves <Tr1>

Fig.11 Drain Current Derating Curve

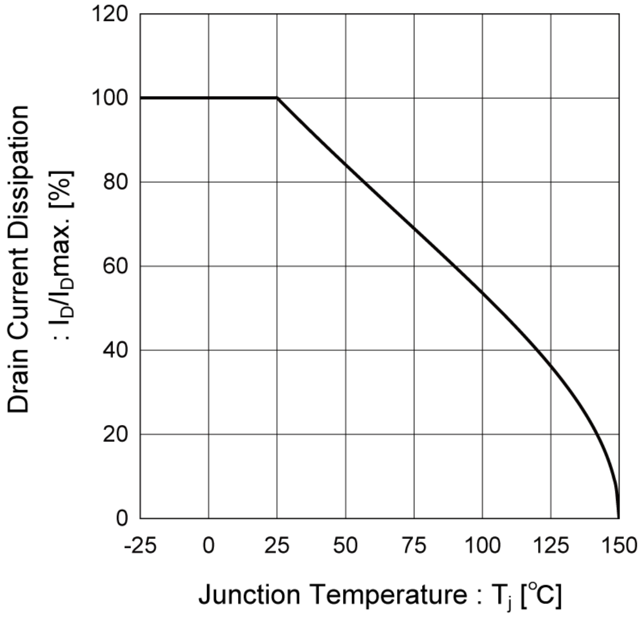


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

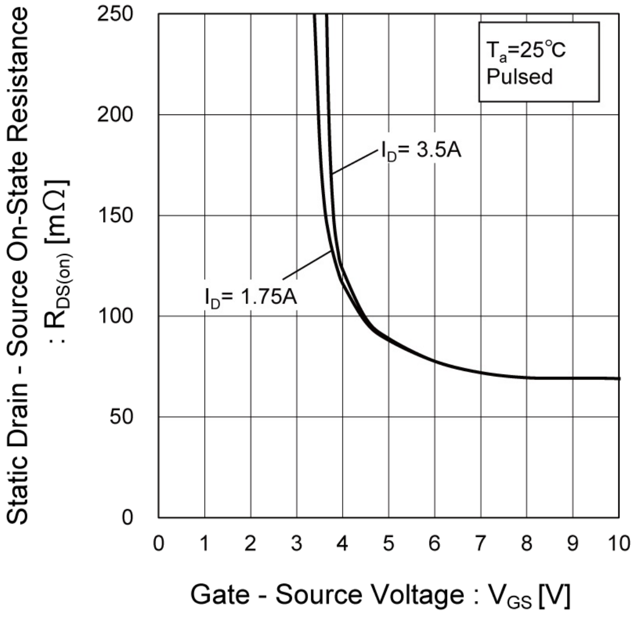
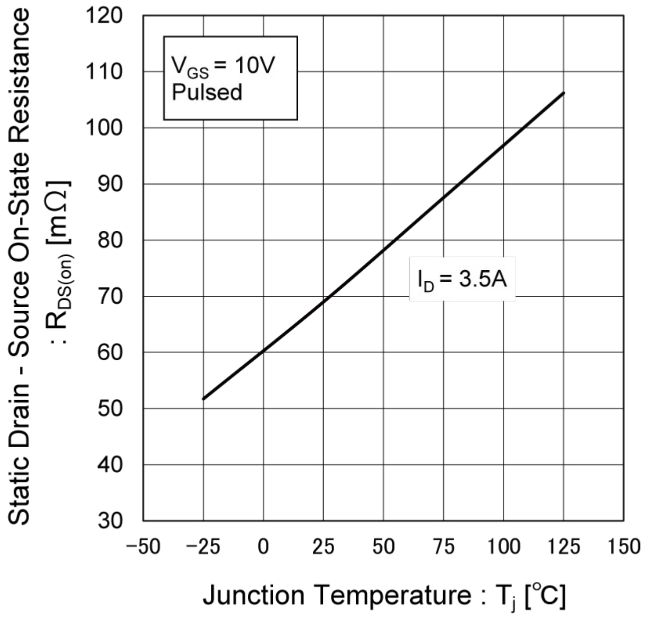


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves <Tr1>

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

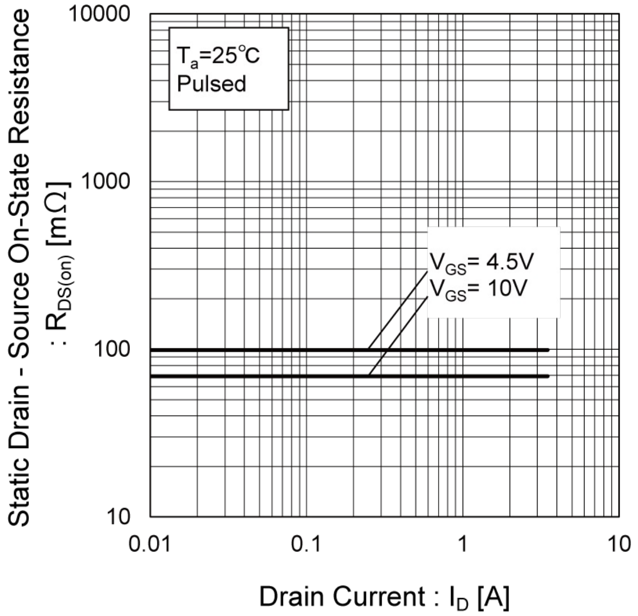


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

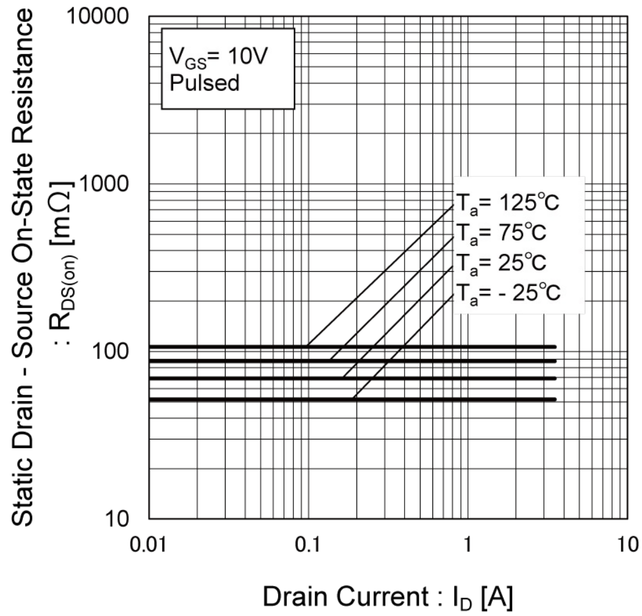
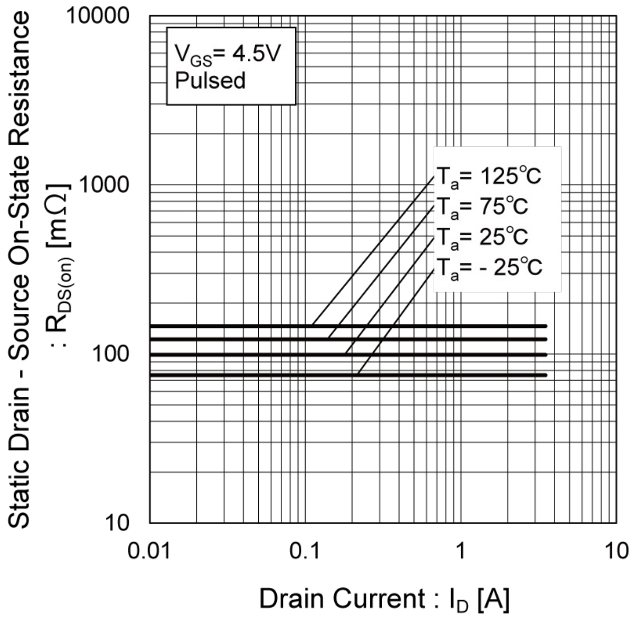


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr1>

Fig.17 Typical Capacitances vs. Drain - Source Voltage

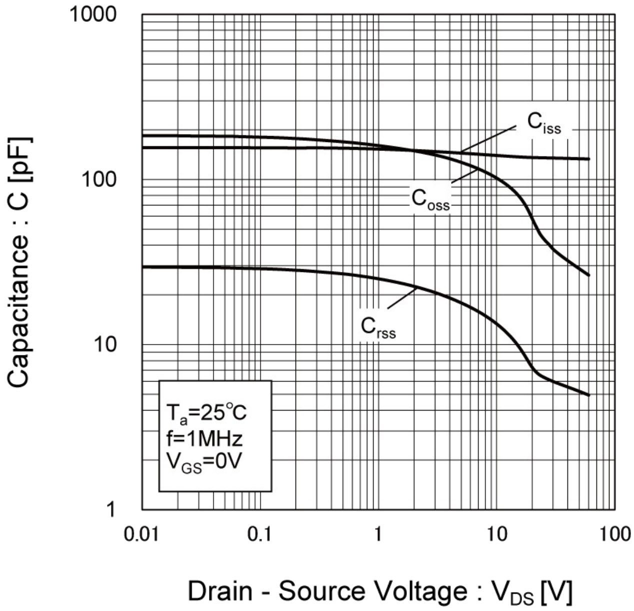


Fig.18 Switching Characteristics

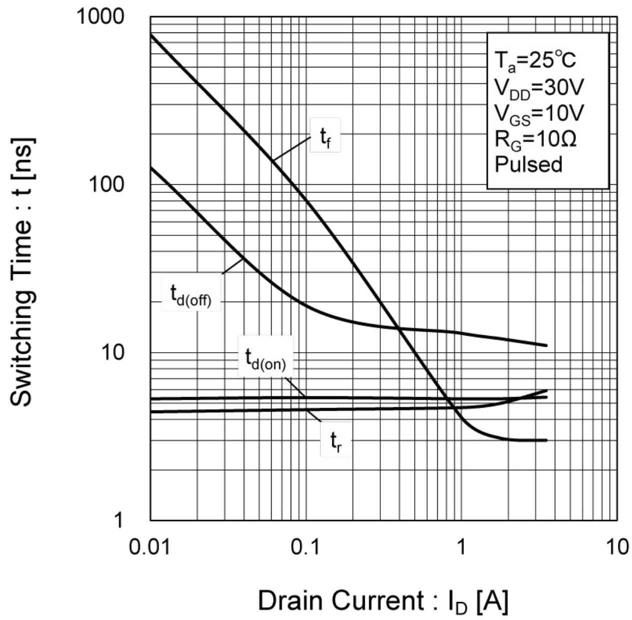


Fig.19 Typical Gate Charge

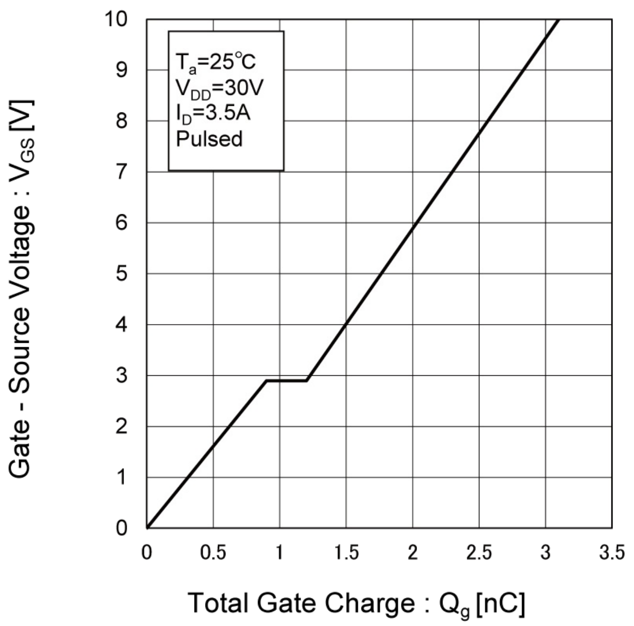
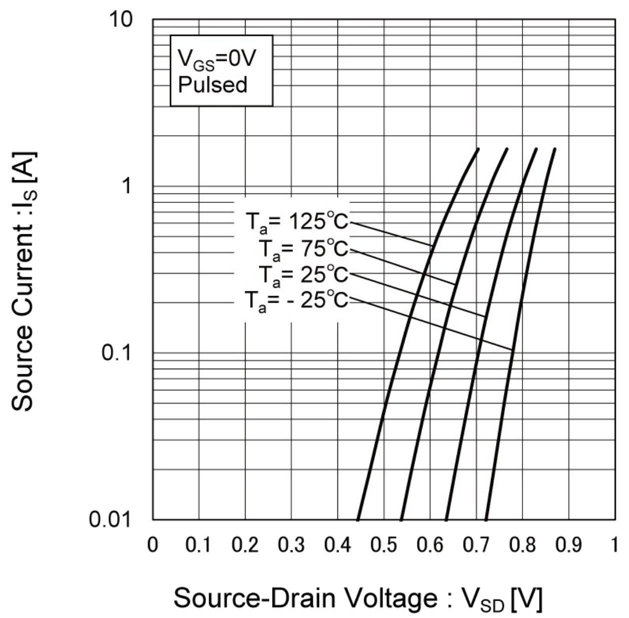


Fig.20 Source Current vs. Source Drain Voltage



●Electrical characteristic curves <Tr2>

Fig.1 Power Dissipation Derating Curve

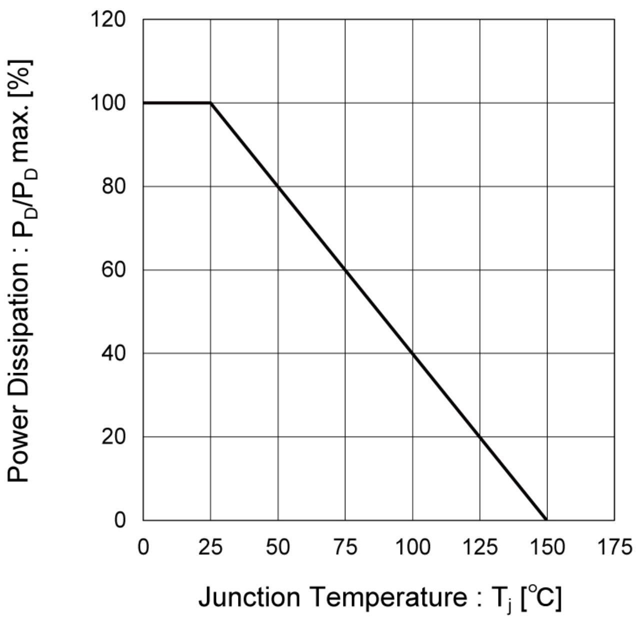


Fig.2 Maximum Safe Operating Area

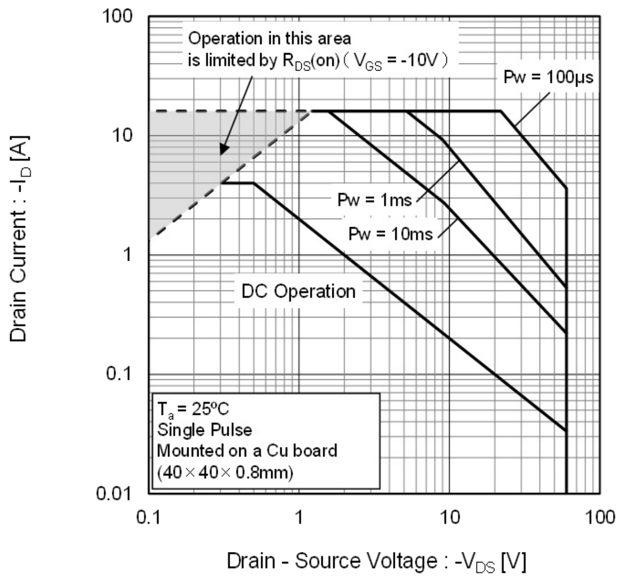


Fig.3 Normalized Transient Thermal Resistance vs. Pulse Width

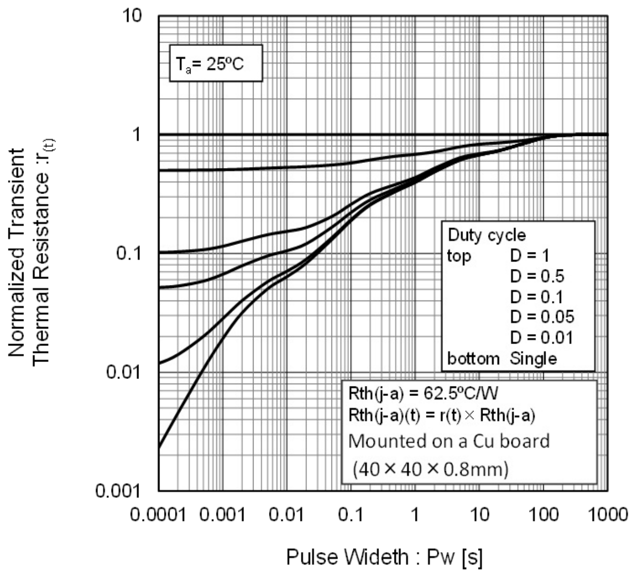
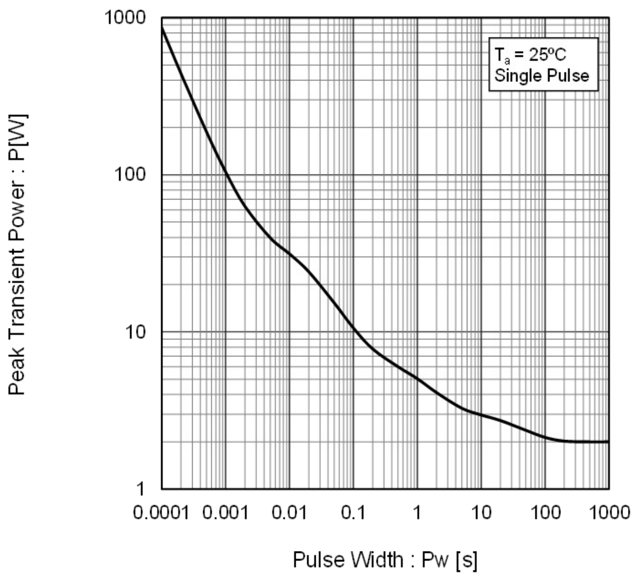


Fig.4 Single Pulse Maximum Power Dissipation



●Electrical characteristic curves <Tr2>

Fig.5 Typical Output Characteristics(I)

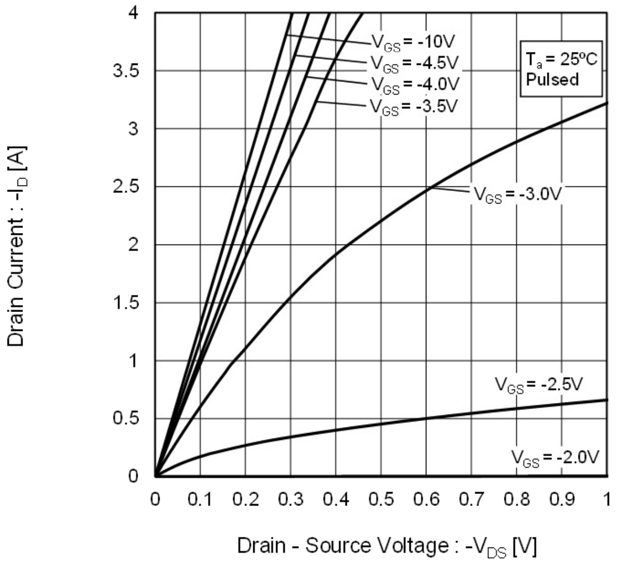


Fig.6 Typical Output Characteristics(II)

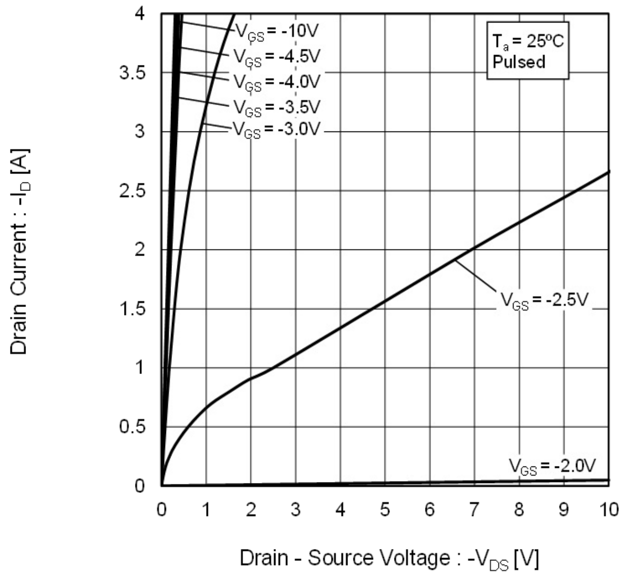
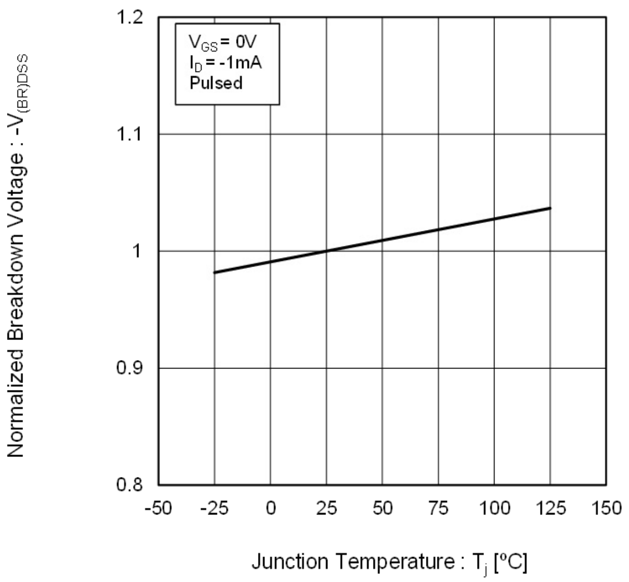


Fig.7 Normalized Breakdown Voltage vs. Junction Temperature



●Electrical characteristic curves <Tr2>

Fig.8 Typical Transfer Characteristics

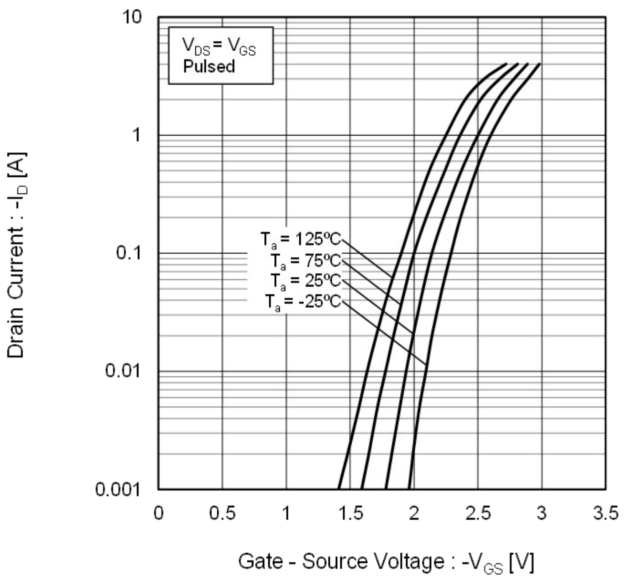


Fig.9 Gate Threshold Voltage vs. Junction Temperature

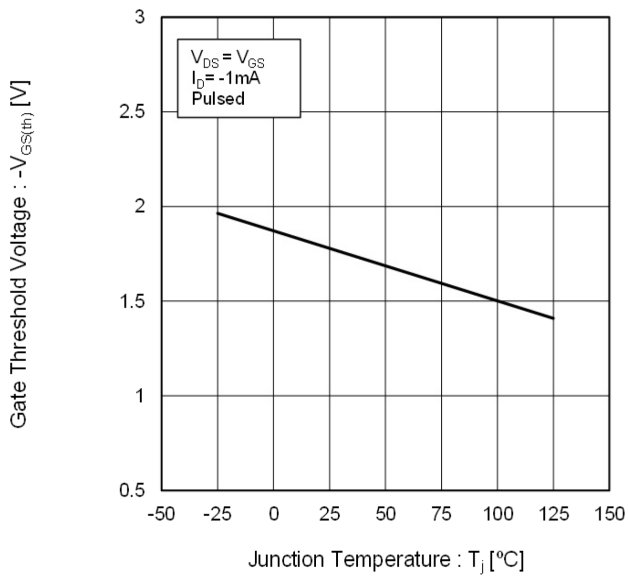
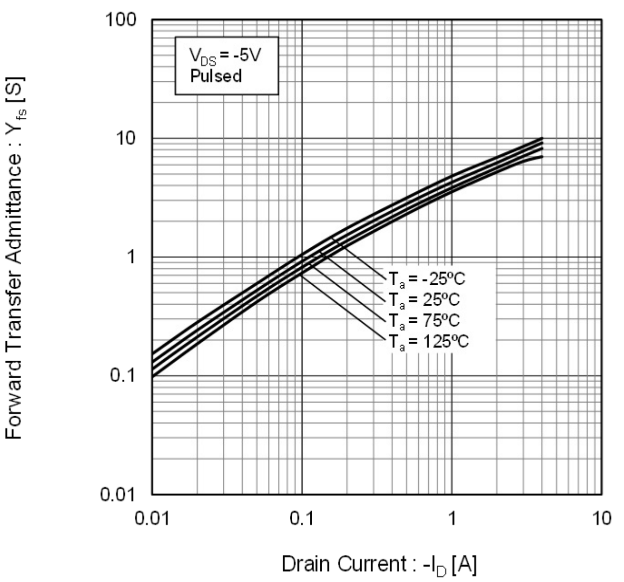


Fig.10 Forward Transfer Admittance vs. Drain Current



●Electrical characteristic curves <Tr2>

Fig.11 Drain Current Derating Curve

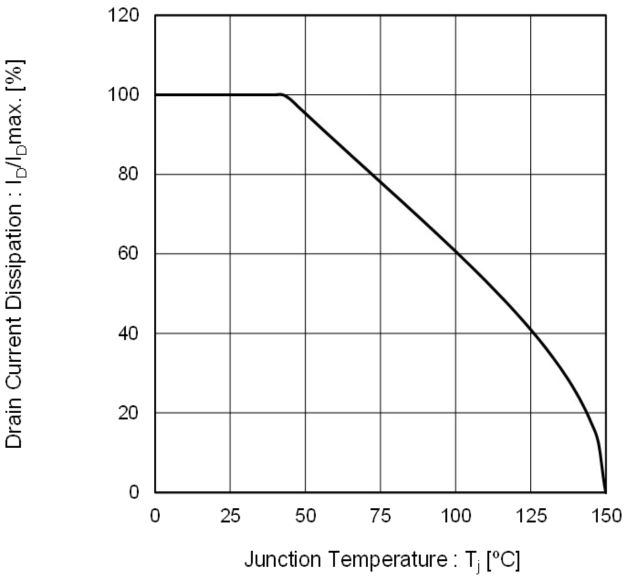


Fig.12 Static Drain - Source On - State Resistance vs. Gate Source Voltage

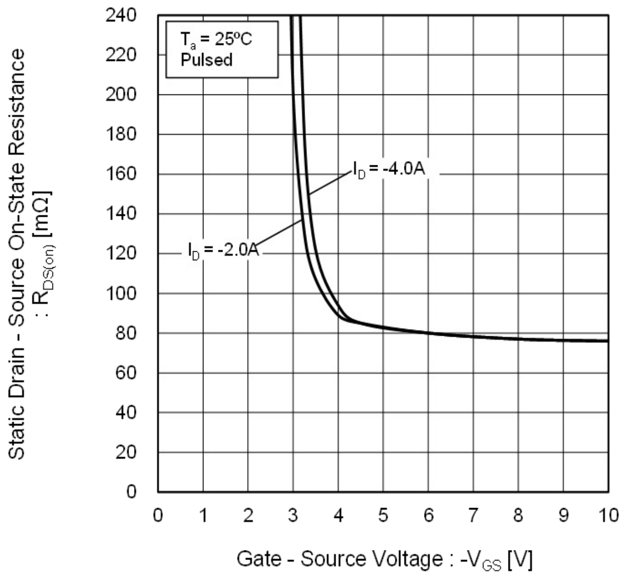
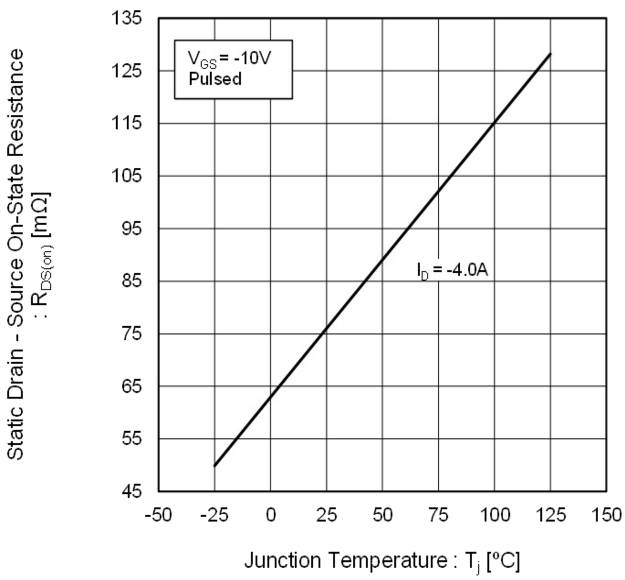


Fig.13 Static Drain - Source On - State Resistance vs. Junction Temperature



●Electrical characteristic curves <Tr2>

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

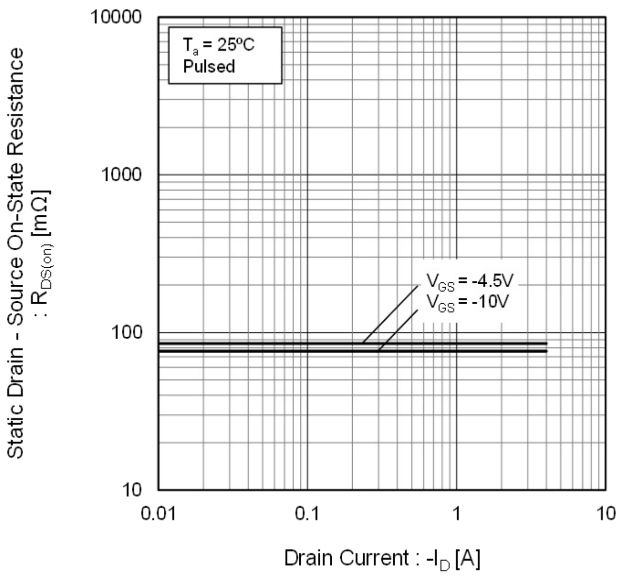


Fig.15 Static Drain - Source On - State Resistance vs. Drain Current(II)

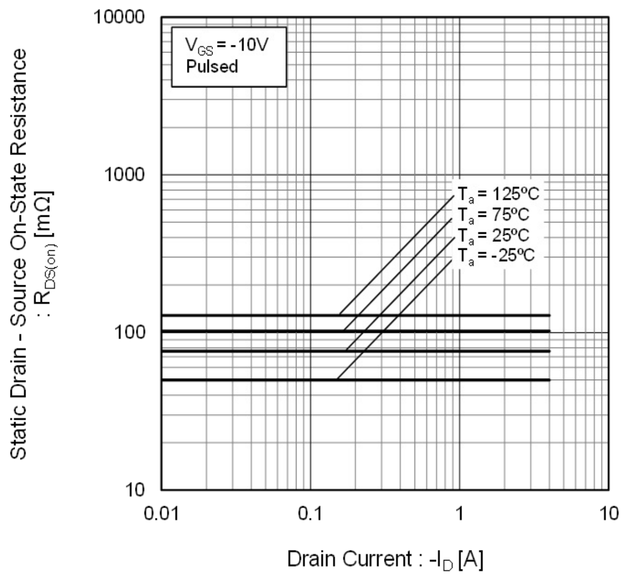
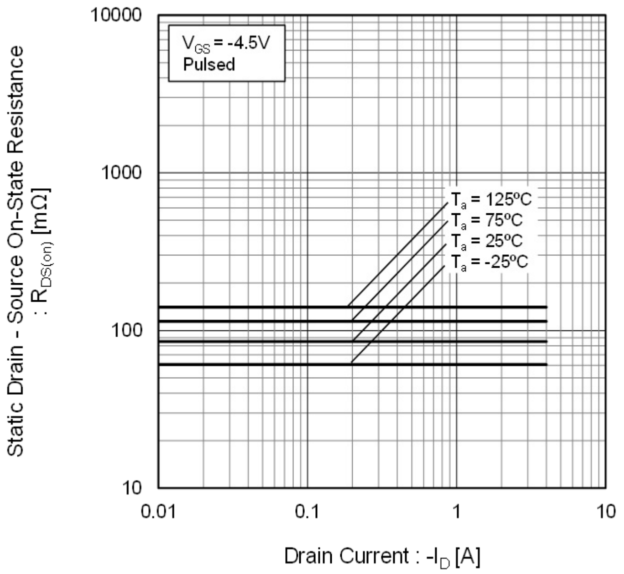


Fig.16 Static Drain - Source On - State Resistance vs. Drain Current(III)



●Electrical characteristic curves <Tr2>

Fig.17 Typical Capacitances vs. Drain - Source Voltage

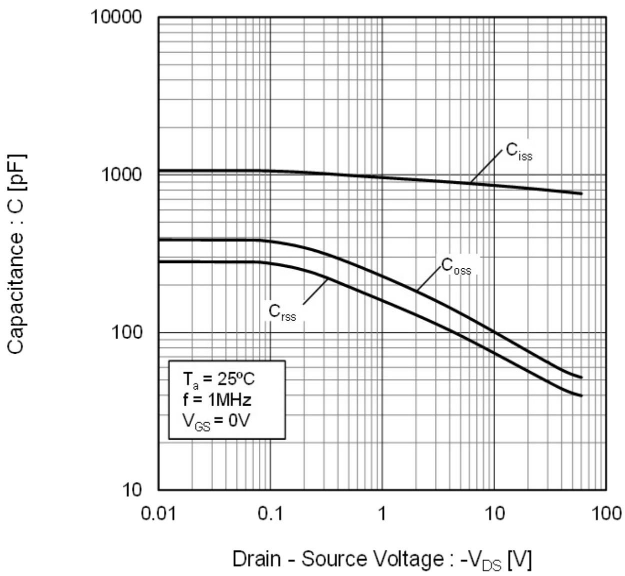


Fig.18 Switching Characteristics

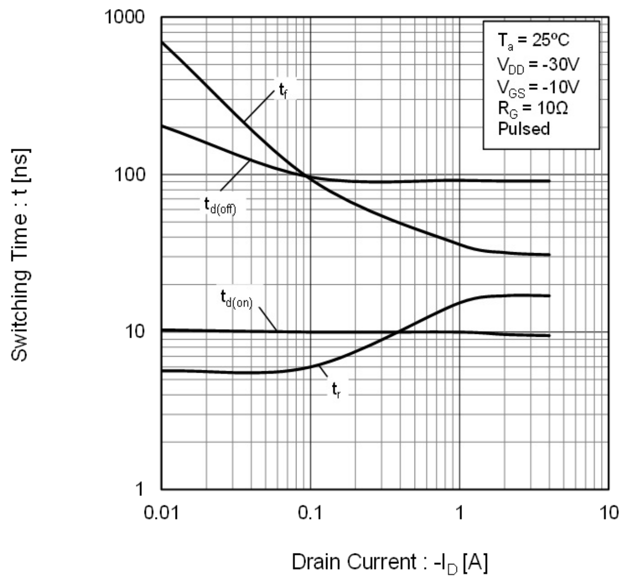


Fig.19 Typical Gate Charge

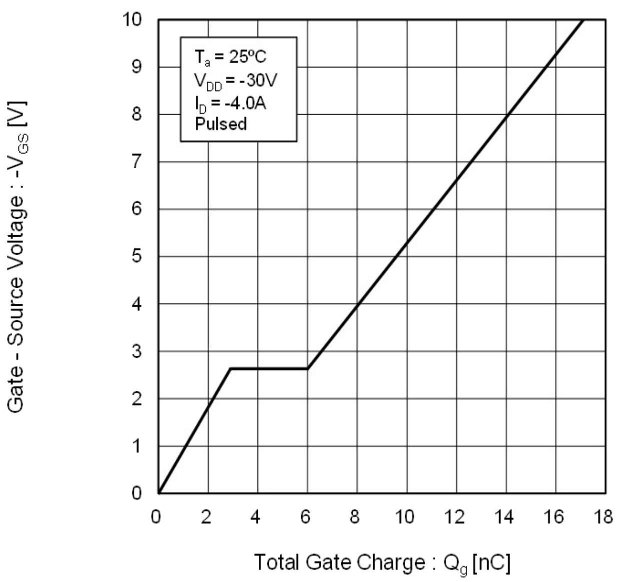
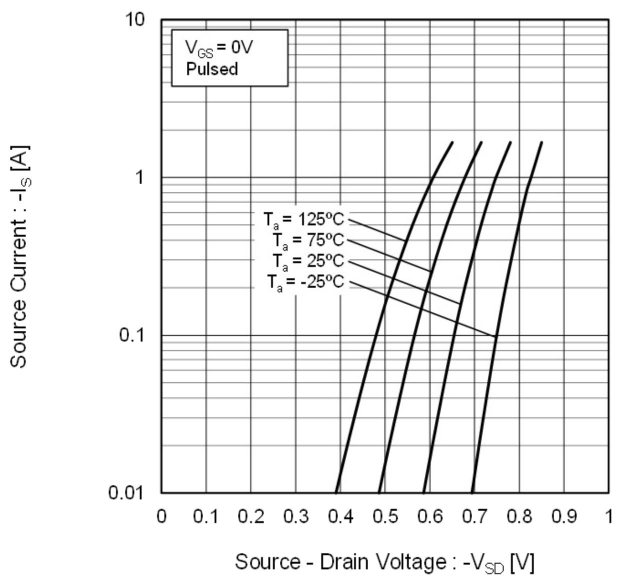


Fig.20 Source Current vs. Source Drain Voltage



●Measurement circuits <Tr1>

Fig.1-1 Switching Time Measurement Circuit

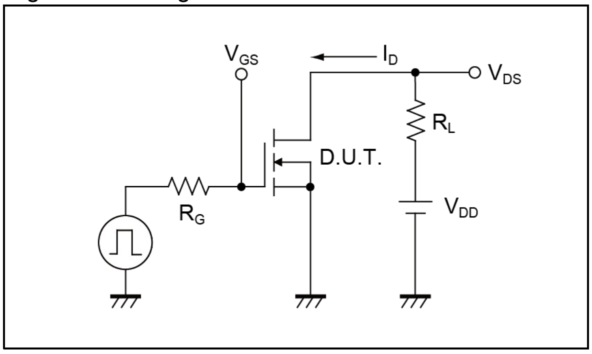


Fig.1-2 Switching Waveforms

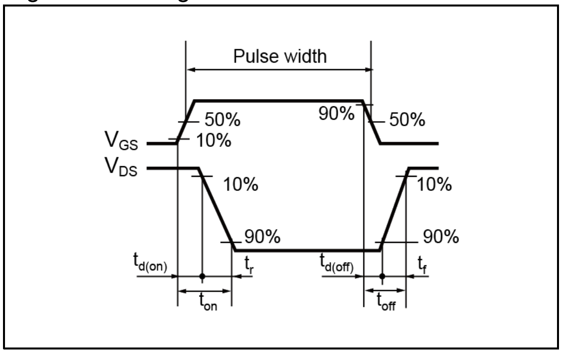


Fig.2-1 Gate Charge Measurement Circuit

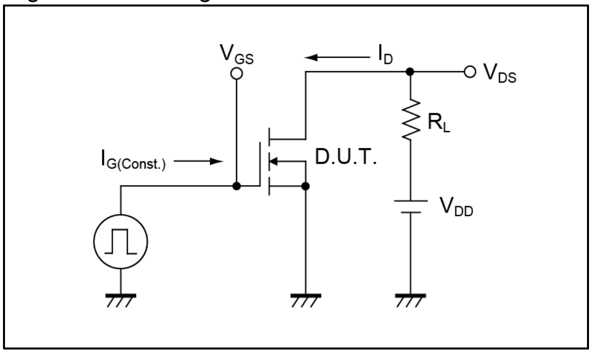


Fig.2-2 Gate Charge Waveform

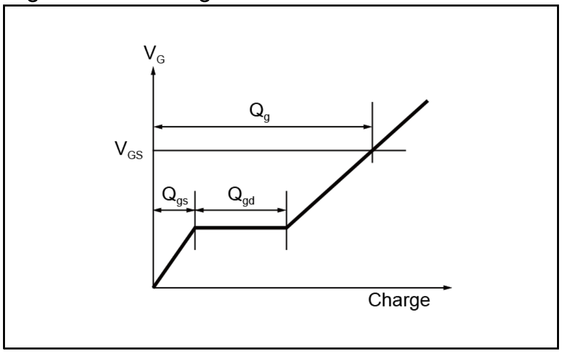


Fig.3-1 Avalanche Measurement Circuit

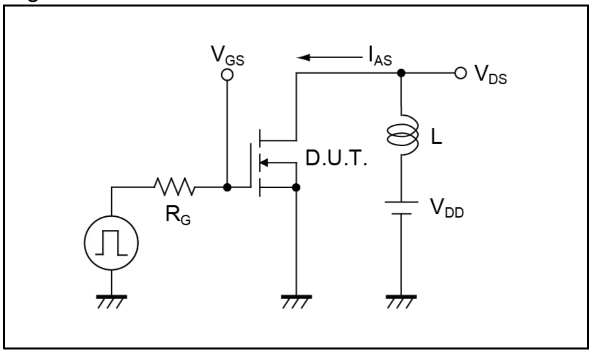
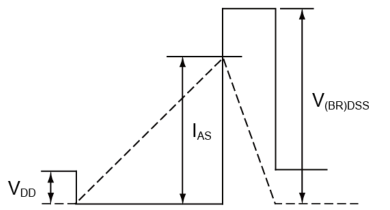


Fig.3-2 Avalanche Waveform



$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AS}^2 \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

●Measurement circuits <Tr2>

Fig.4-1 Switching Time Measurement Circuit

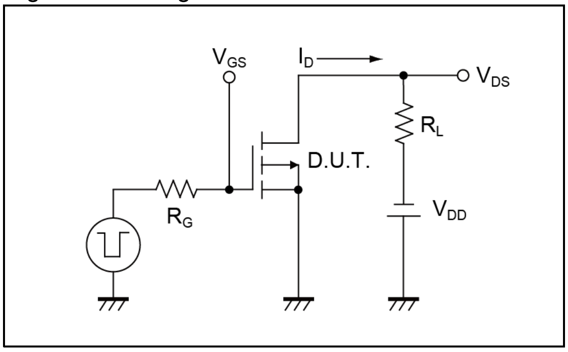


Fig.4-2 Switching Waveforms

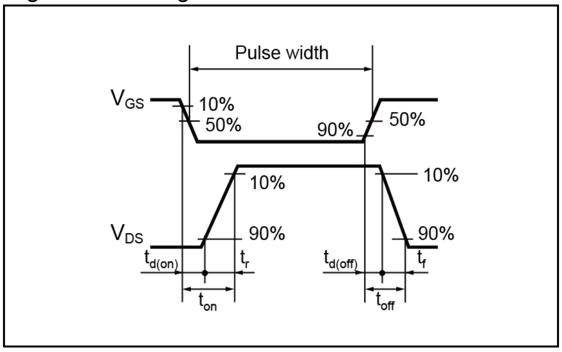


Fig.5-1 Gate Charge Measurement Circuit

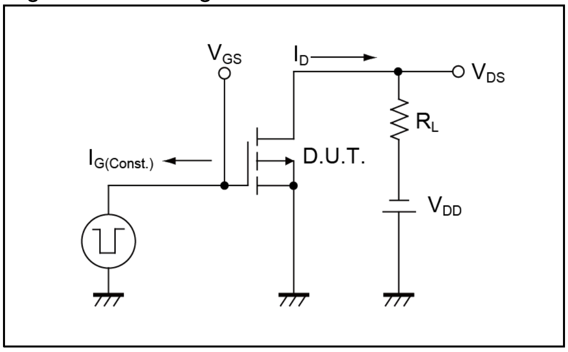


Fig.5-2 Gate Charge Waveform

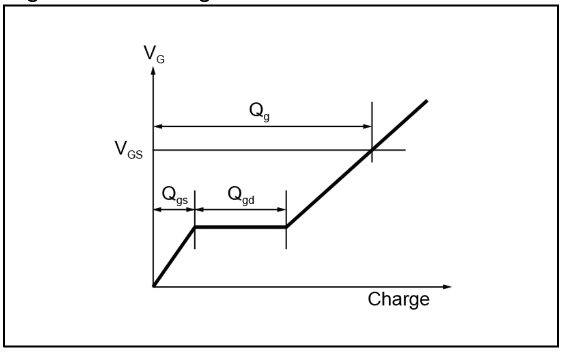


Fig.6-1 Avalanche Measurement Circuit

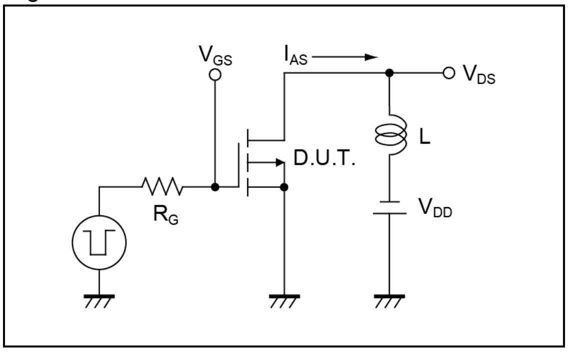
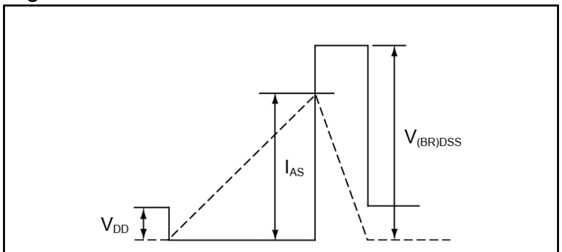


Fig.6-2 Avalanche Waveform



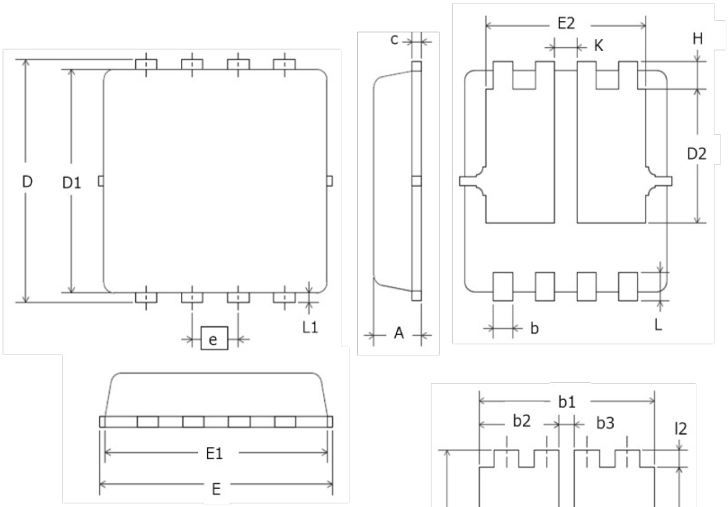
$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AS}^{2} \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

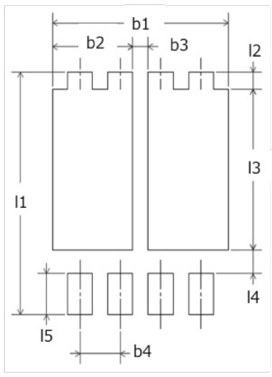
●Notice

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

●Dimensions

HSMT8 (Dual)





Soldering footprint

DIM	Milimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.70	0.80	0.028	0.031
b	0.25	0.35	0.010	0.014
c	0.10	0.25	0.004	0.010
D	3.25	3.45	0.128	0.136
D1	3.00	3.20	0.118	0.126
D2	1.78	1.98	0.070	0.078
E	3.20	3.40	0.126	0.134
E1	3.00	3.20	0.118	0.126
E2	2.39	2.59	0.094	0.102
e	0.65		0.026	
H	0.30	0.50	0.012	0.020
L	0.30	0.50	0.012	0.020
L1	0.13		0.005	
K	0.30	-	0.012	-

DIM	Milimeters	Inches
	Nom.	Nom.
l1	3.55	0.140
l2	0.25	0.010
l3	2.35	0.093
l4	0.35	0.014
l5	0.60	0.024
b1	2.83	0.111
b2	1.29	0.051
b3	0.25	0.010
b4	0.40	0.016

Dimension in mm / inches

Notice

Precaution on using ROHM Products

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

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		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 designed and manufactured for use under standard conditions and not 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_2, H_2S, NH_3, SO_2, and NO_2
   [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

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 Ionizer, 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 Cl_2, H_2S, NH_3, SO_2, and NO_2
   [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

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.

Precaution Regarding Intellectual Property Rights

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