RJG0601JSP

±60V, ±1.5A, N Channel, P Channel Thermal FET Power Switching

R07DS1213EJ0200
Rev.2.00
Nov 01, 2016

Description

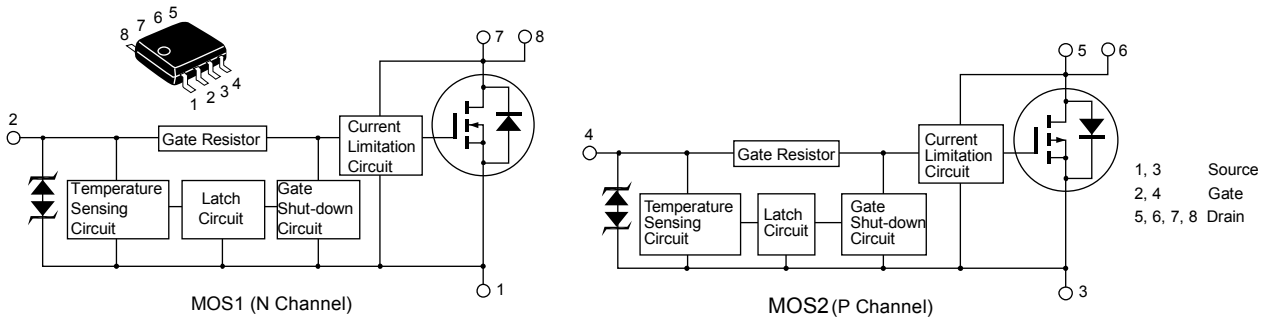
This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, over current etc..

Features

- Built-in the over temperature shut-down circuit.
- High endurance capability against to the short circuit.
- Latch type shut down operation (need 0 voltage recovery).
- Built-in the current limitation circuit.
- High density mounting
- Power supply voltage applies 12 V.
- AEC-Q101 Compliant
- 2 Operations on N Channel, P Channel Thermal FET.

Outline

RENESAS Package code: PRSP0008DD-D
(Package name: SOP-8 (FP-8DAV))



Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings Nch.	Ratings Pch.	Unit
Drain to source voltage	V_{DSS}	60	–60	V
Gate to source voltage	V_{GSS}	16	–16	V
	V_{GSS}	–2.5	2.5	V
Drain current	I_D Note4	1.5	–1.5	A
Body-drain diode reverse drain current	I_{DR}	1.5	–1.5	A
Avalanche current	I_{AP} Note 3	1.5	–1.5	A
Avalanche energy	E_{AR} Note 3	9.6	9.6	mJ
Channel dissipation	Pch Note 1	2	2	W
Channel dissipation	Pch Note 2	1.5	1.5	W
Channel temperature	Tch	150	150	°C
Storage temperature	Tstg	–55 to +150	–55 to +150	°C

Notes: 1. 1 Drive operation : When using the glass epoxy board (FR4 40 × 40 × 1.6 mm), PW ≤ 10 s
2. 2 Drive operation : When using the glass epoxy board (FR4 40 × 40 × 1.6 mm), PW ≤ 10 s
3. Tch = 25°C, Rg ≥ 50 Ω
4. It provides by the current limitation lower bound value.

Typical Operation Characteristics N Channel

(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	3.5	—	—	V	
	V_{IL}	—	—	1.2	V	
Input current (Gate non shut down)	I_{IH1}	—	0.8	—	mA	Vi = 8 V, V_{DS} = 0
	I_{IH2}	—	0.35	—	mA	Vi = 3.5 V, V_{DS} = 0
	I_{IL}	—	—	1	μA	Vi = 1.2 V, V_{DS} = 0
Input current (Gate shut down)	$I_{IH(sd)1}$	—	0.8	—	mA	Vi = 8 V, V_{DS} = 0
	$I_{IH(sd)2}$	—	0.35	—	mA	Vi = 3.5 V, V_{DS} = 0
Shut down temperature	Tsd	—	175	—	°C	Channel temperature
Gate operation voltage	Vop	3.5	—	12	V	
Drain current (Current limitation value)	$I_{D\ limt}$	1.5	—	5.6	A	V_{GS} = 5 V, V_{DS} = 10 V Note 5

Notes: 5. Pulse test

Electrical Characteristics N Channel

(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	—	—	5.4	A	V_{GS} = 3.5 V, V_{DS} = 10 V Note 6
	I_{D2}	—	—	10	mA	V_{GS} = 1.2 V, V_{DS} = 10 V
	I_{D3}	1.5	—	5.6	A	V_{GS} = 5V, V_{DS} = 10 V Note 6
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	V	I_G = 800 μA, V_{DS} = 0
	$V_{(BR)GSS}$	–2.5	—	—	V	I_G = –100 μA, V_{DS} = 0
Gate to source leak current	I_{GSS1}	—	—	100	μA	V_{GS} = 8 V, V_{DS} = 0
	I_{GSS2}	—	—	50	μA	V_{GS} = 3.5 V, V_{DS} = 0
	I_{GSS3}	—	—	1	μA	V_{GS} = 1.2 V, V_{DS} = 0
	I_{GSS4}	—	—	–100	μA	V_{GS} =– 2.4 V, V_{DS} = 0
Input current (shut down)	$I_{GS(OP)1}$	—	0.8	—	mA	V_{GS} = 8 V, V_{DS} = 0
	$I_{GS(OP)2}$	—	0.35	—	mA	V_{GS} = 3.5 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	10	μA	V_{DS} = 32 V, V_{GS} = 0 Ta = 125°C
Gate to source cutoff voltage	$V_{GS(off)}$	1.1	—	2.1	V	I_D = 1 mA, V_{DS} = 10 V
Static drain to source on state resistance	$R_{DS(on)}$	—	208	350	mΩ	I_D = 0.75 A, V_{GS} = 4 V Note 6
	$R_{DS(on)}$	—	142	263	mΩ	I_D = 0.75 A, V_{GS} = 10 V Note 6
Output capacitance	Coss	—	265	—	pF	V_{DS} = 10 V, V_{GS} = 0, f = 1MHz
Turn-on delay time	$t_{d(on)}$	—	0.55	—	μs	I_D= 0.75 A, V_{GS} = 10 V R_L = 40 Ω
Rise time	t_r	—	1.88	—	μs	
Turn-off delay time	$t_{d(off)}$	—	3.9	—	μs	
Fall time	t_f	—	3.7	—	μs	
Body-drain diode forward voltage	V_{DF}	—	0.82	—	V	I_F = 1.5 A, V_{GS} = 0
Body-drain diode reverse recovery time	t_{rr}	—	71	—	ns	I_F = 1.5 A, V_{GS} = 0 di_F/dt = 50 A/μs
Over load shut down operation time Note 7	t_{os}	—	1. 17	—	ms	V_{GS} = 5 V, V_{DD} = 16 V

Notes: 6. Pulse test

7. Including the junction temperature rise of the over loaded condition.

Typical Operation Characteristics P Channel

(Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	–3.5	—	—	V	
	V_{IL}	—	—	–1.2	V	
Input current (Gate non shut down)	I_{IH1}	—	—	–100	μA	Vi = –8 V, V_{DS} = 0
	I_{IH2}	—	—	–50	μA	Vi = –3.5 V, V_{DS} = 0
	I_{IL}	—	—	–10	μA	Vi = –1.2 V, V_{DS} = 0
Input current (Gate shut down)	$I_{IH(sd)1}$	—	–0.8	—	mA	Vi = –8 V, V_{DS} = 0
	$I_{IH(sd)2}$	—	–0.35	—	mA	Vi = –3.5 V, V_{DS} = 0
Shut down temperature	Tsd	—	175	—	°C	Channel temperature (dv/dt V_{GS} ≥ 500 V/ms)
Gate operation voltage	Vop	–3.5	—	–12	V	
Drain current (Current limitation value)	$I_{D\ limt}$	–1.5	—	–4	A	V_{GS} = –12 V, V_{DS} = –10 V Note 8

Notes: 8. Pulse test

Electrical Characteristics P Channel

(Ta = 25°C)

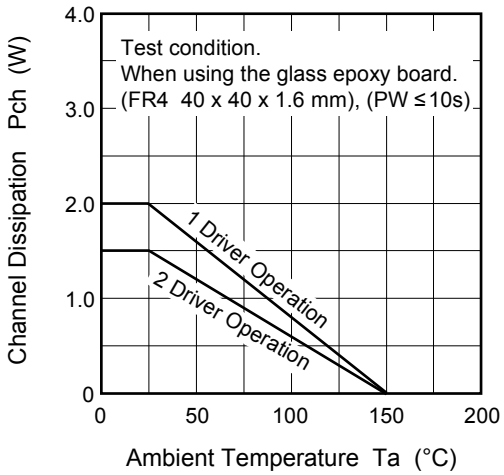
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	—	—	–2	A	V_{GS} = –3.5 V, V_{DS} = –10 V Note9
	I_{D2}	—	—	–10	mA	V_{GS} = –1.2 V, V_{DS} = –10 V
	I_{D3}	–1.5	—	–4	A	V_{GS} = –12 V, V_{DS} = –10 V Note9
Drain to source breakdown voltage	$V_{(BR)DSS}$	–60	—	—	V	I_D = –10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	–16	—	—	V	I_G = –800 μA, V_{DS} = 0
	$V_{(BR)GSS}$	2.5	—	—	V	I_G = 100 μA, V_{DS} = 0
Gate to source leak current	I_{GSS1}	—	—	–100	μA	V_{GS} = –8 V, V_{DS} = 0
	I_{GSS2}	—	—	–50	μA	V_{GS} = –3.5 V, V_{DS} = 0
	I_{GSS3}	—	—	–10	μA	V_{GS} = –1.2 V, V_{DS} = 0
	I_{GSS4}	—	—	100	μA	V_{GS} = 2.4 V, V_{DS} = 0
Input current (shut down)	$I_{GS(OP)1}$	—	–0.8	—	mA	V_{GS} = –8 V, V_{DS} = 0
	$I_{GS(OP)2}$	—	–0.35	—	mA	V_{GS} = –3.5 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	–10	μA	V_{DS} = –32 V, V_{GS} = 0 Ta = 125°C
Gate to source cutoff voltage	$V_{GS(off)}$	–2.2	—	–3.4	V	V_{DS} = –10 V, I_D = –1 mA
Static drain to source on state resistance	$R_{DS(on)}$	—	242	380	mΩ	I_D = –0.75 A, V_{GS} = –6 V Note9
	$R_{DS(on)}$	—	173	260	mΩ	I_D = –0.75 A, V_{GS} = –10 V Note9
Output capacitance	Coss	—	194	—	pF	V_{DS} = –10 V, V_{GS} = 0, f = 1MHz
Turn-on delay time	$t_{d(on)}$	—	1.82	—	μs	V_{GS} = –10 V, I_D= –0.75 A, R_L = 40 Ω
Rise time	t_r	—	1.95	—	μs	
Turn-off delay time	$t_{d(off)}$	—	0.99	—	μs	
Fall time	t_f	—	0.84	—	μs	
Body-drain diode forward voltage	V_{DF}	—	–0.83	—	V	I_F = –1.5 A, V_{GS} = 0
Body-drain diode reverse recovery time	t_{rr}	—	85	—	ns	I_F = –1.5 A, V_{GS} = 0 di_F/dt = 50 A/μs
Over load shut down operation time Note 10	t_{os}	—	23.6	—	ms	V_{GS} = –5 V, V_{DD} = –16 V

Notes: 9. Pulse test

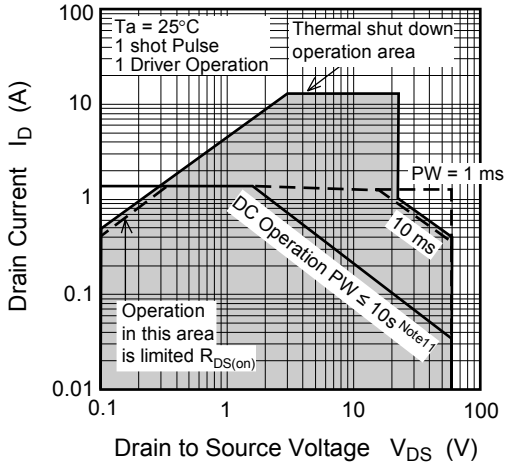
10. Including the junction temperature rise of the over loaded condition.

Main Characteristics (N channel)

Power vs. Temperature Derating

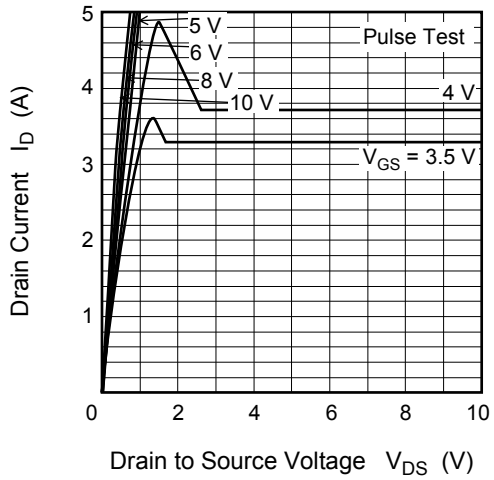


Maximum Safe Operation Area

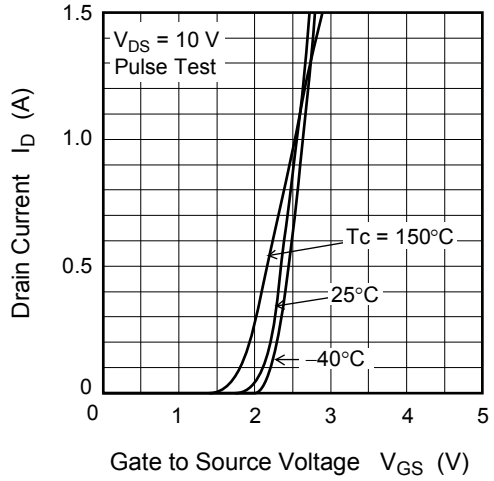


Note 11:
When using the glass epoxy board.
(FR4 40 x 40 x 1.6 mm)

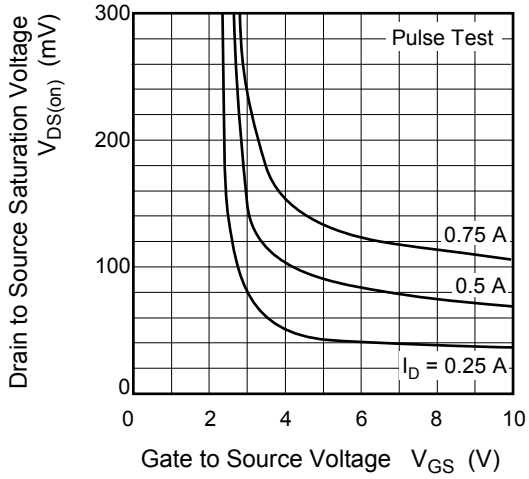
Typical Output Characteristics



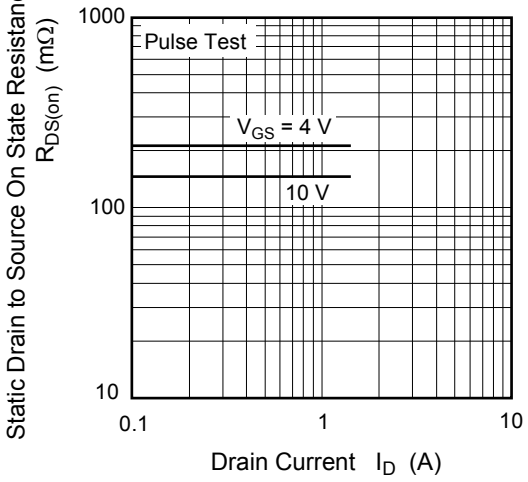
Typical Transfer Characteristics



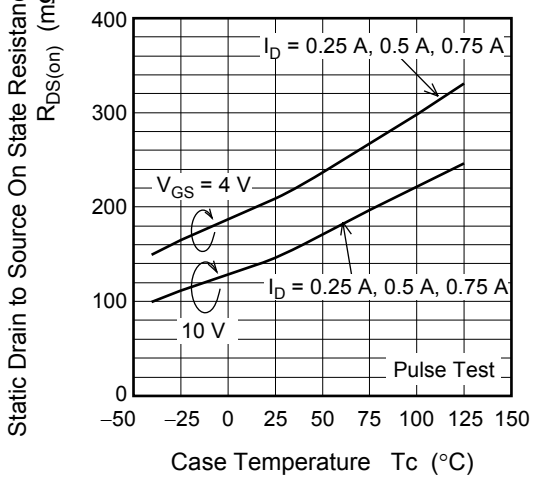
Drain Source Saturation Voltage vs. Gate to Source Voltage



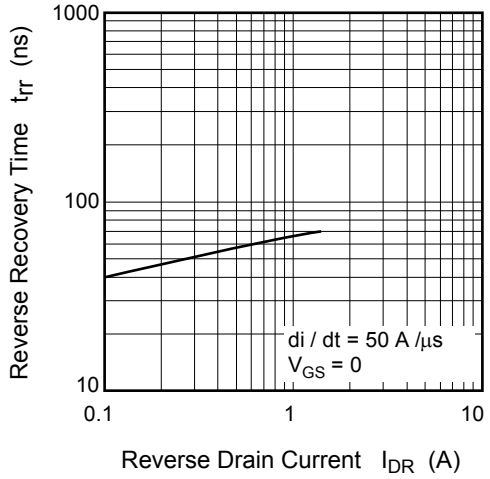
Static Drain to Source On State Resistance vs. Drain Current



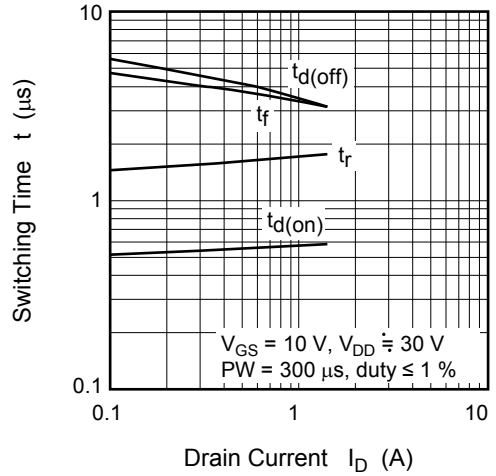
Static Drain to Source On State Resistance vs. Temperature



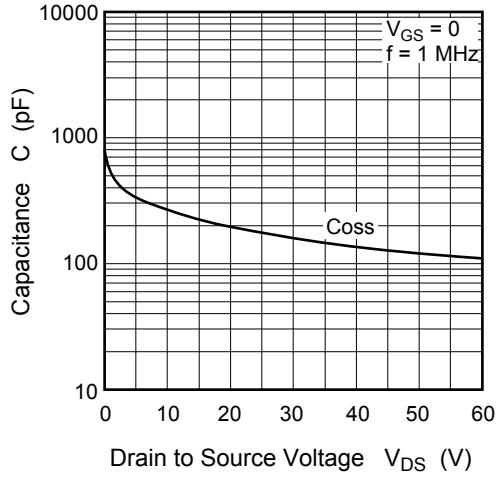
Body-Drain Diode Reverse Recovery Time



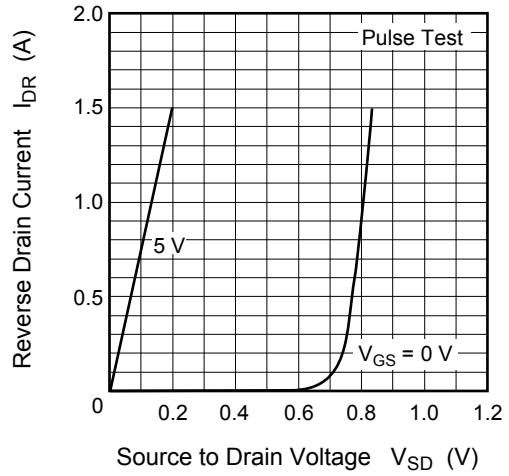
Switching Characteristics



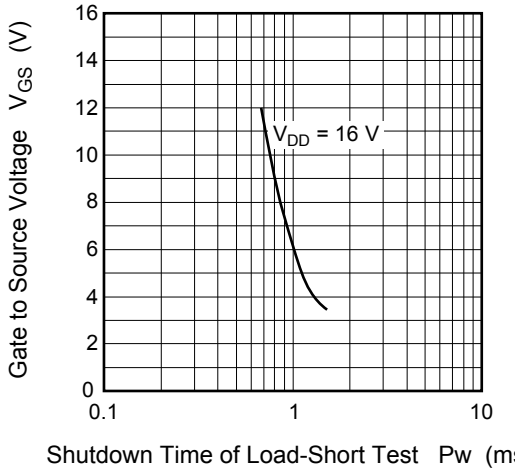
Typical Capacitance vs. Drain to Source Voltage



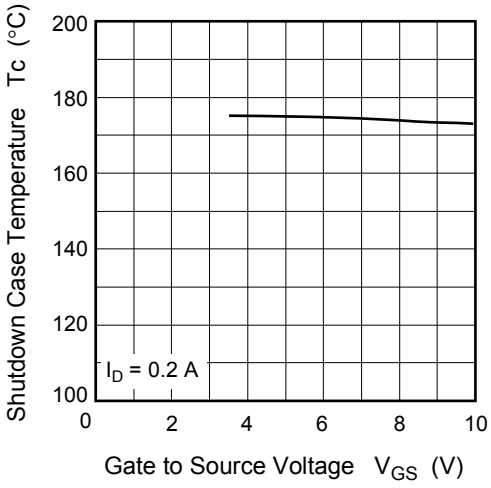
Reverse Drain Current vs. Source to Drain Voltage



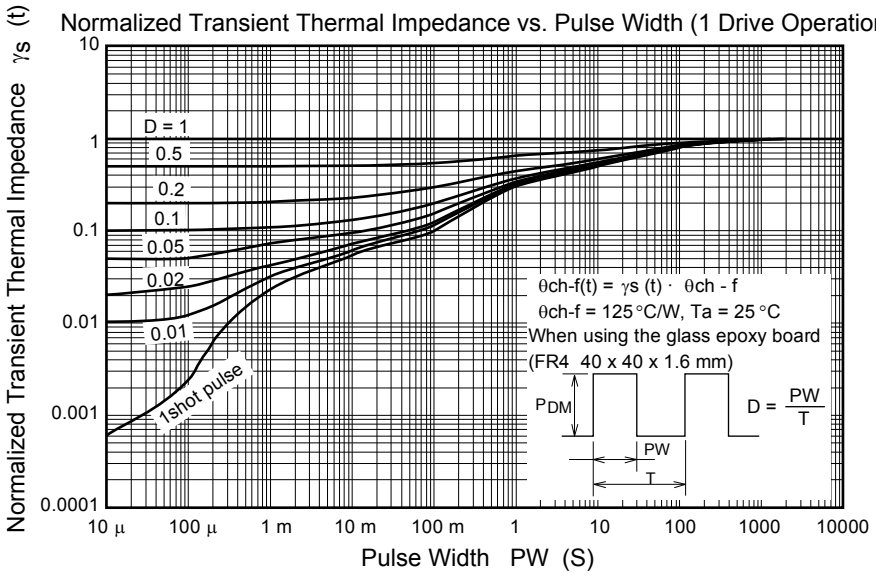
Gate to Source Voltage vs. Shutdown Time of Load-Short Test



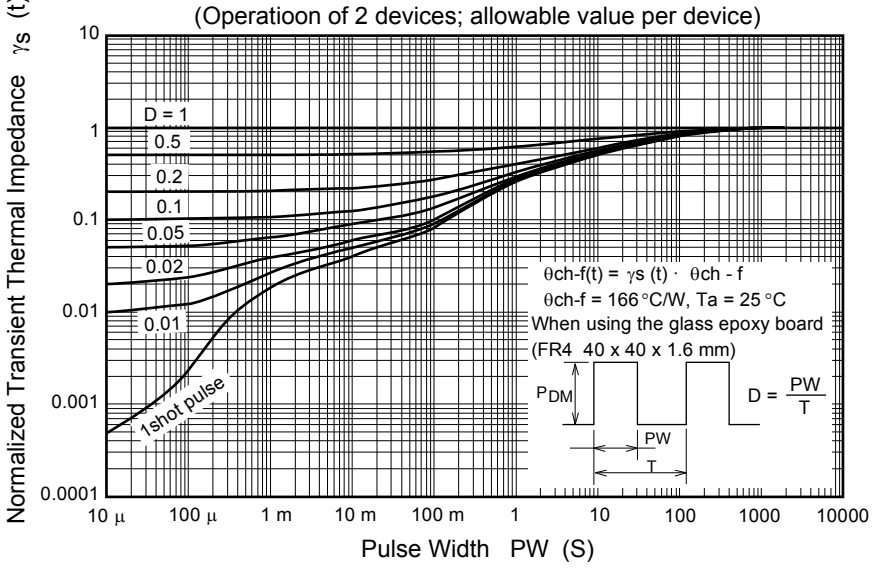
Shutdown Case Temperature vs.
Gate to Source Voltage



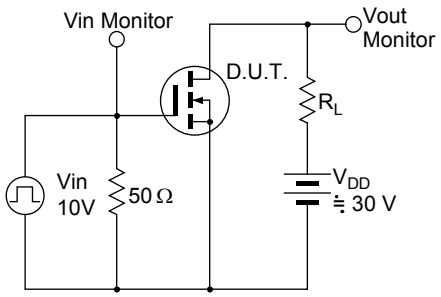
Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



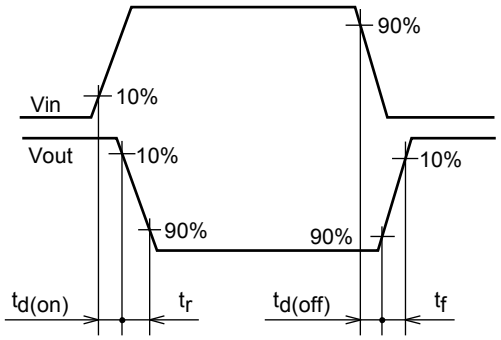
Normalized Transient Thermal Impedance vs. Pulse Width
(Operatioon of 2 devices; allowable value per device)



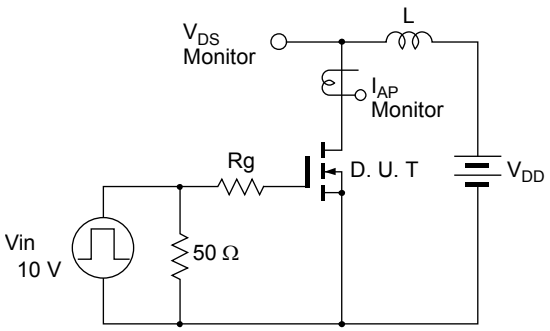
Switching Time Test Circuit



Waveform

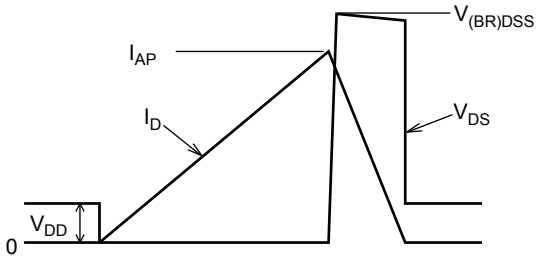


Avalanche Test Circuit



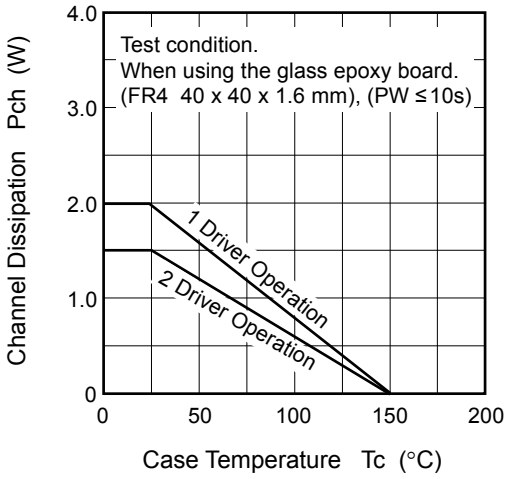
Avalanche Waveform

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

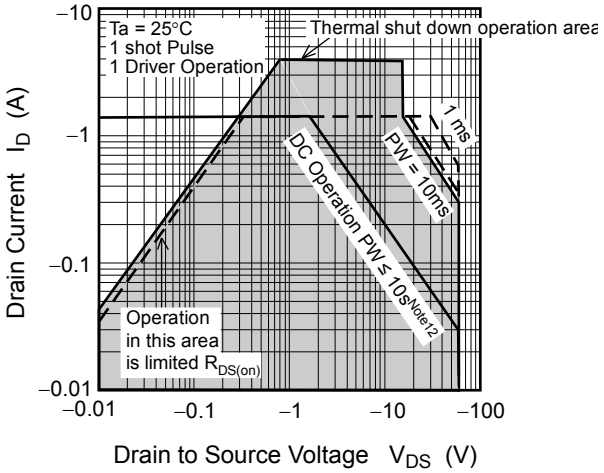


Main Characteristics (P channel)

Power vs. Temperature Derating

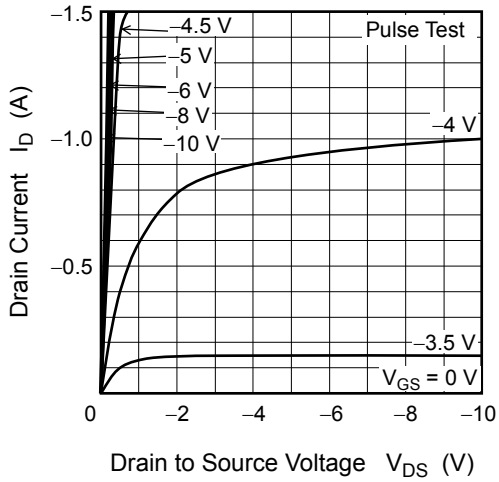


Maximum Safe Operation Area

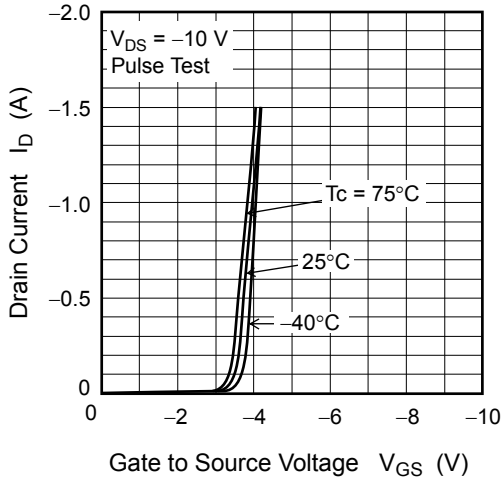


Note 12:
When using the glass epoxy board.
(FR4 40 x 40 x 1.6 mm)

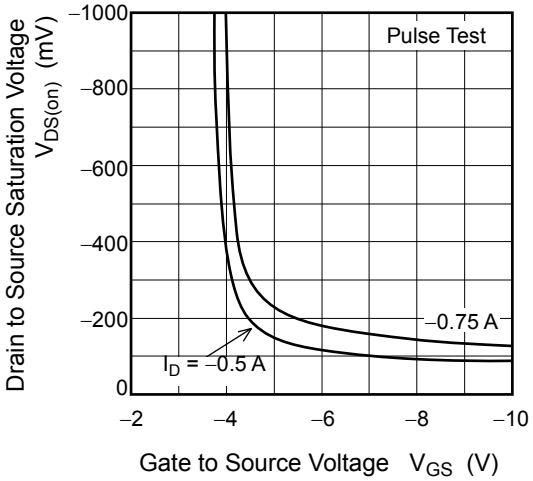
Typical Output Characteristics



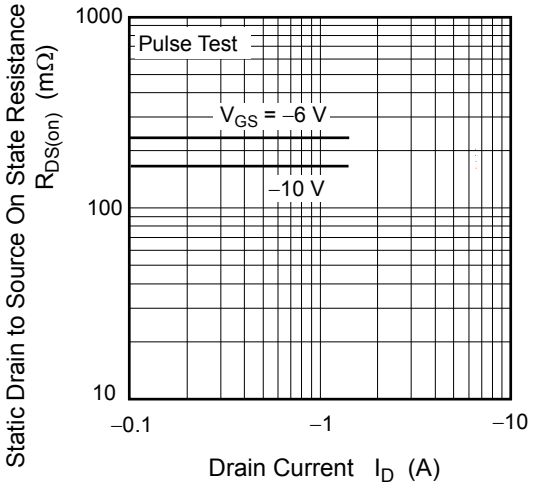
Typical Transfer Characteristics



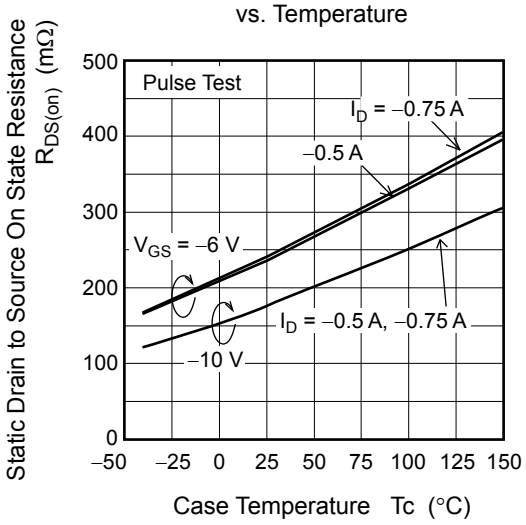
Drain Source Saturation Voltage vs. Gate to Source Voltage



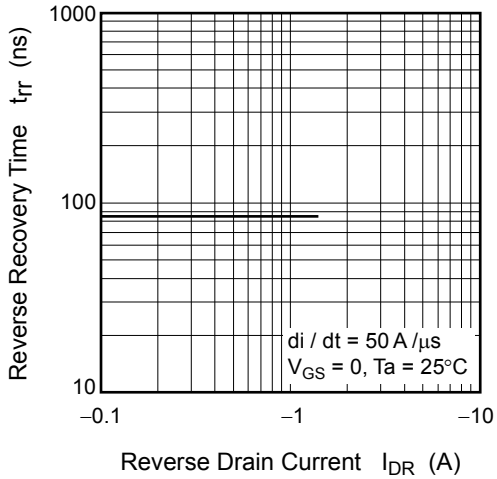
Static Drain to Source On State Resistance vs. Drain Current



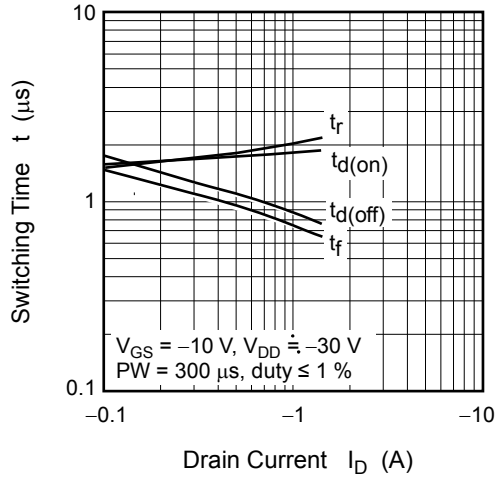
Static Drain to Source On State Resistance vs. Temperature



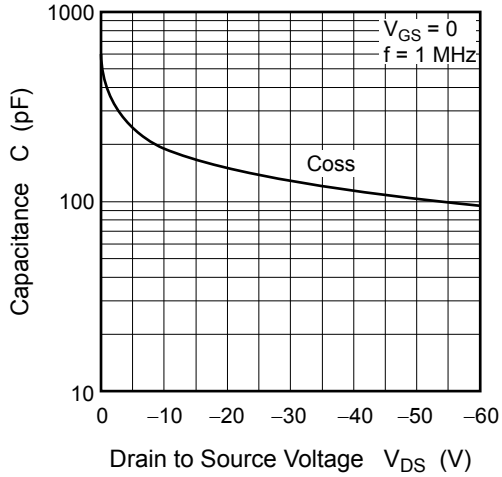
Body-Drain Diode Reverse Recovery Time



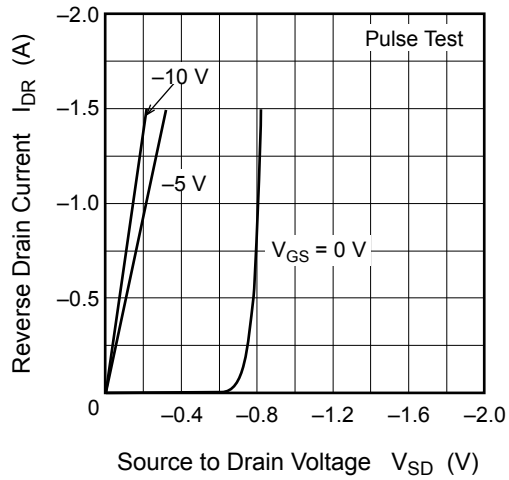
Switching Characteristics



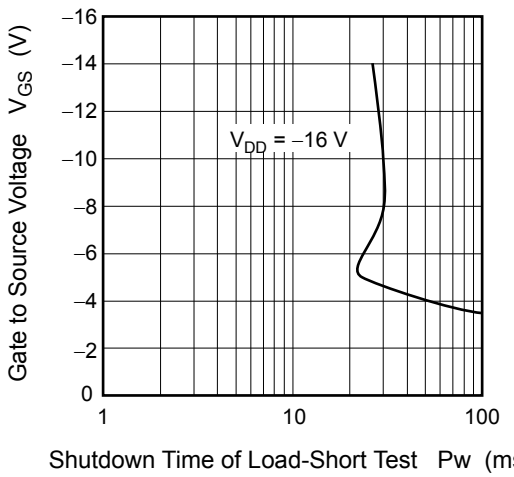
Typical Capacitance vs. Drain to Source Voltage



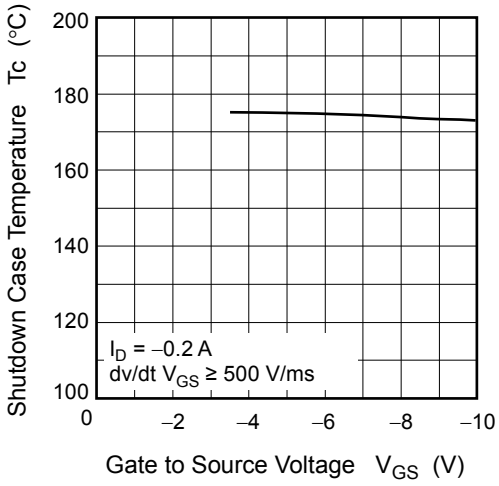
Reverse Drain Current vs. Source to Drain Voltage



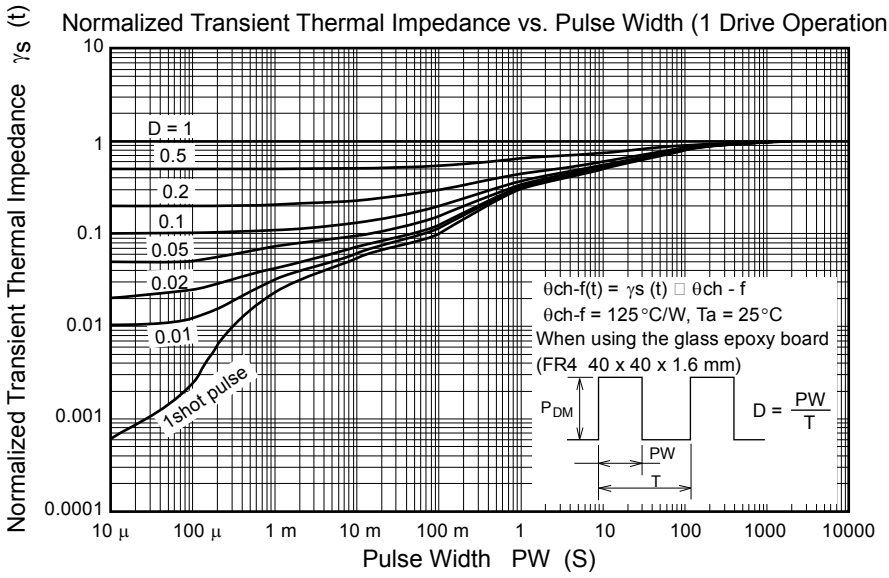
Gate to Source Voltage vs. Shutdown Time of Load-Short Test



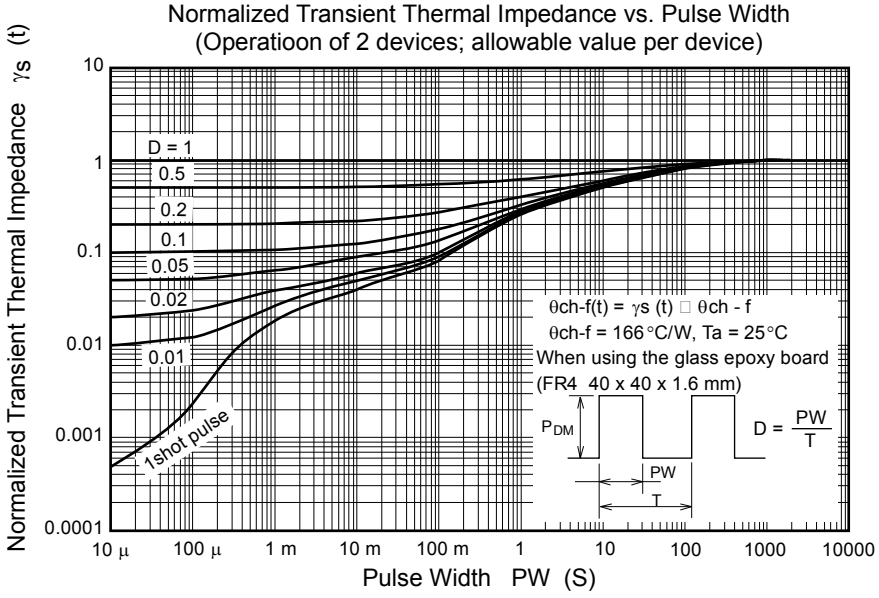
Shutdown Case Temperature vs.
Gate to Source Voltage



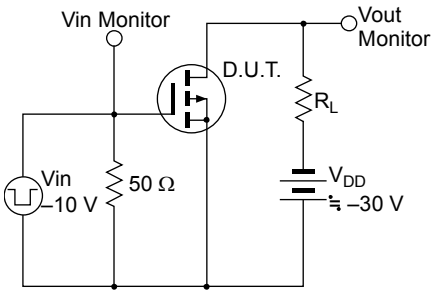
Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



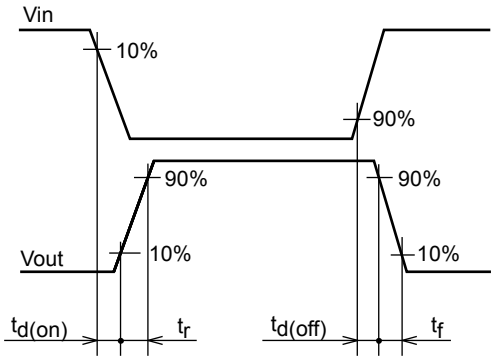
Normalized Transient Thermal Impedance vs. Pulse Width
(Operatioon of 2 devices; allowable value per device)



Switching Time Test Circuit

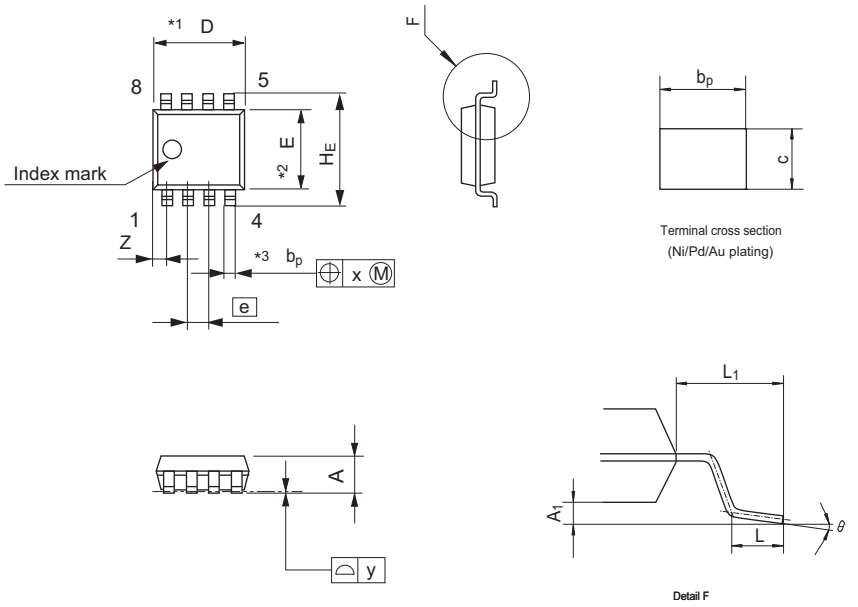


Waveform



Package Dimensions

Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
SOP-8	P-SOP8-3.95 x 4.9-1.27	PRSP0008DD-D	FP-8DAV	0.085g



NOTE)
1. DIMENSIONS "*1(Nom)" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	4.90	5.3
E	—	3.95	—
A_2	—	—	—
A_1	0.10	0.14	0.25
A	—	—	1.75
b_p	0.34	0.40	0.46
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	5.80	6.10	6.20
e	—	1.27	—
x	—	—	0.25
y	—	—	0.1
Z	—	—	0.75
L	0.40	0.60	1.27
L_1	—	1.08	—

Ordering Information

Orderable Part Number	Quantity	Shipping Container
RJG0601JSP-00-J0	2500 pcs/reel	Taping

Note: The symbol of 2nd "-" is occasionally presented as "#".

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