

RJG0601JSP

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

R07DS1213EJ0200
Rev.2.00
Nov 01, 2016

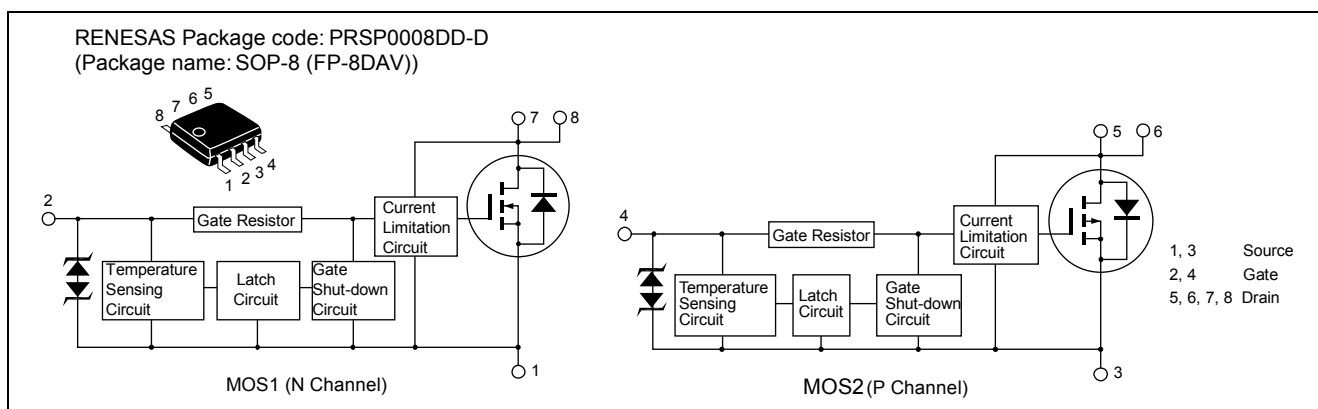
Description

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



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 ^{Note 4}	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	P _{ch} ^{Note 1}	2	2	W
Channel dissipation	P _{ch} ^{Note 2}	1.5	1.5	W
Channel temperature	T _{ch}	150	150	°C
Storage temperature	T _{stg}	-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. T_{ch} = 25°C, R_g ≥ 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	V _i = 8 V, V _{DS} = 0
	I _{IH2}	—	0.35	—	mA	V _i = 3.5 V, V _{DS} = 0
	I _{IL}	—	—	1	μA	V _i = 1.2 V, V _{DS} = 0
Input current (Gate shut down)	I _{IH(sD)1}	—	0.8	—	mA	V _i = 8 V, V _{DS} = 0
	I _{IH(sD)2}	—	0.35	—	mA	V _i = 3.5 V, V _{DS} = 0
Shut down temperature	T _{SD}	—	175	—	°C	Channel temperature
Gate operation voltage	V _{OP}	3.5	—	12	V	
Drain current (Current limitation value)	I _D limit	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	C _{oss}	—	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	V _i = -8 V, V _{DS} = 0
	I _{IH2}	—	—	-50	μA	V _i = -3.5 V, V _{DS} = 0
	I _{IL}	—	—	-10	μA	V _i = -1.2 V, V _{DS} = 0
Input current (Gate shut down)	I _{IH(sD)1}	—	-0.8	—	mA	V _i = -8 V, V _{DS} = 0
	I _{IH(sD)2}	—	-0.35	—	mA	V _i = -3.5 V, V _{DS} = 0
Shut down temperature	T _{SD}	—	175	—	°C	Channel temperature (dv/dt V _{GS} ≥ 500 V/ms)
Gate operation voltage	V _{OP}	-3.5	—	-12	V	
Drain current (Current limitation value)	I _{D limit}	-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)

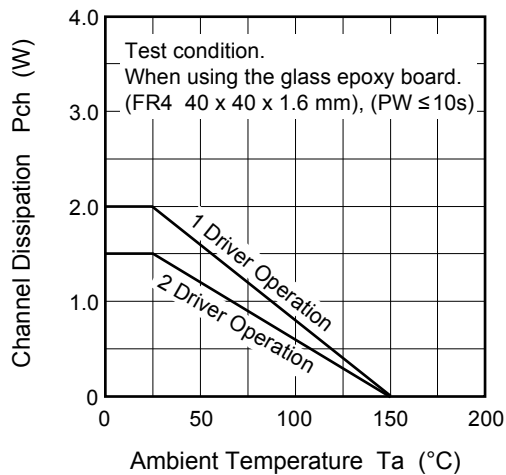
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I _{D1}	—	—	-2	A	V _{GS} = -3.5 V, V _{DS} = -10 V ^{Note9}
	I _{D2}	—	—	-10	mA	V _{GS} = -1.2 V, V _{DS} = -10 V
	I _{D3}	-1.5	—	-4	A	V _{GS} = -12 V, V _{DS} = -10 V ^{Note9}
Drain to source breakdown voltage	V _{(BR)DSS}	-60	—	—	V	I _D = -10 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	C _{oss}	—	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

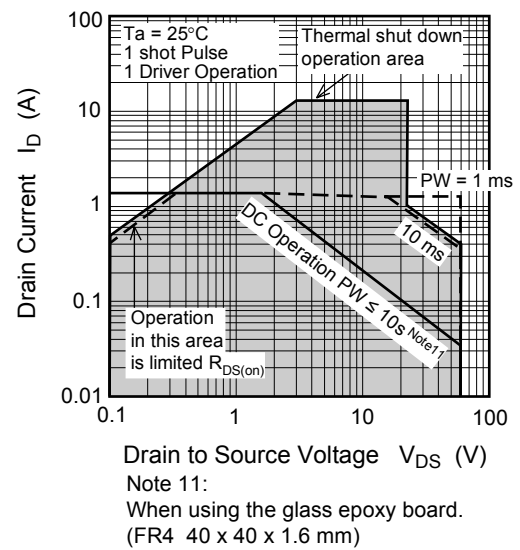
10. Including the junction temperature rise of the over loaded condition.

Main Characteristics (N channel)

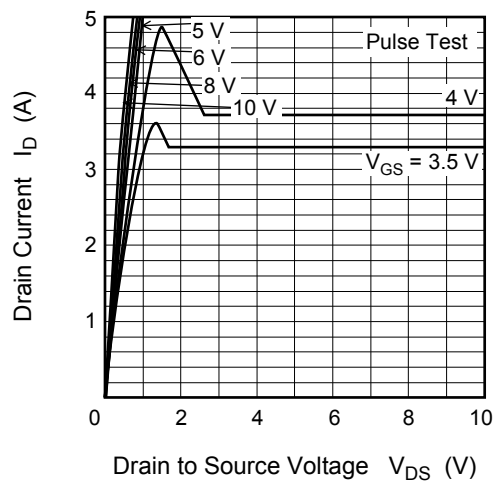
Power vs. Temperature Derating



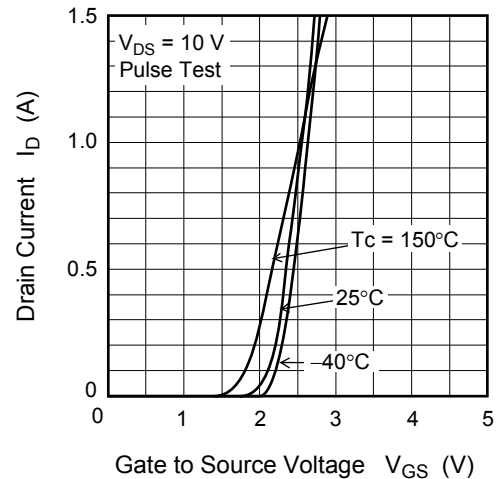
Maximum Safe Operation Area



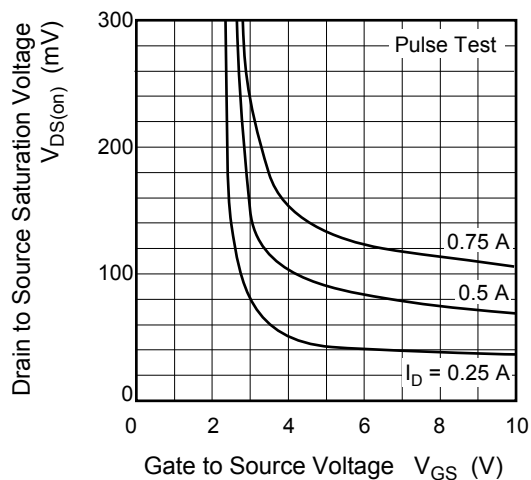
Typical Output Characteristics



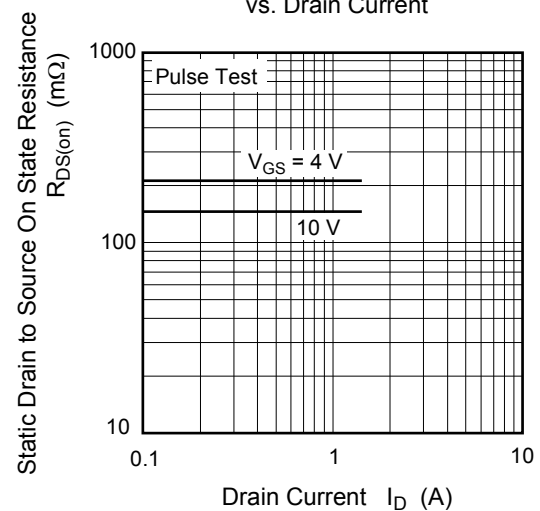
Typical Transfer Characteristics

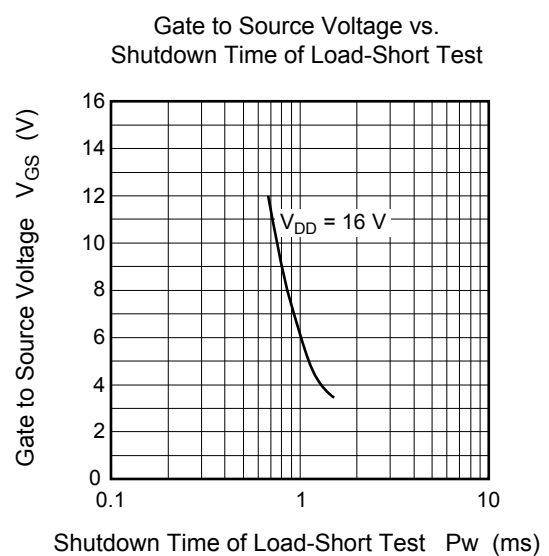
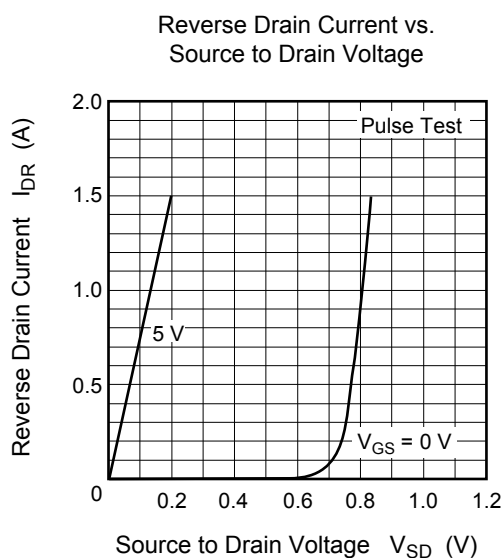
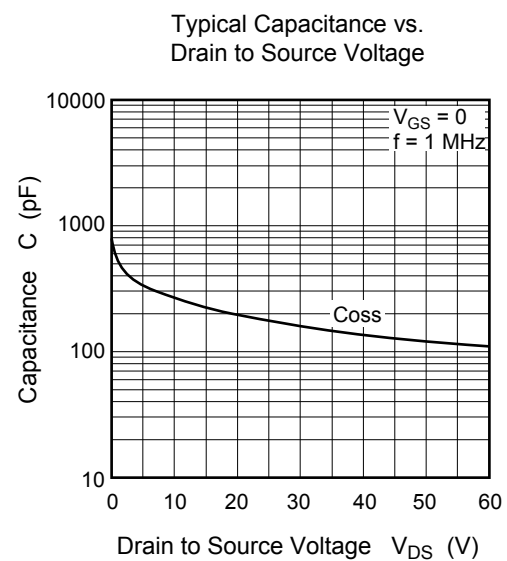
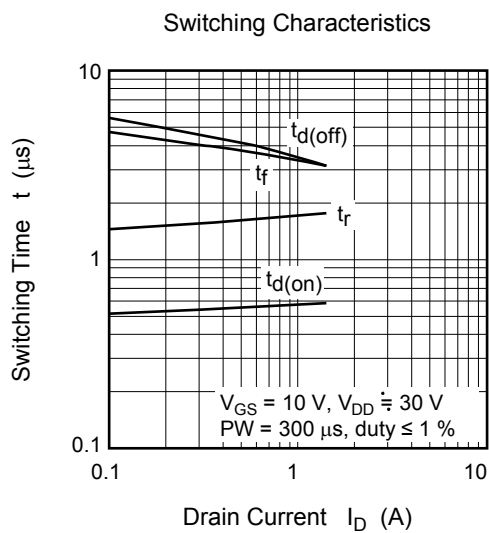
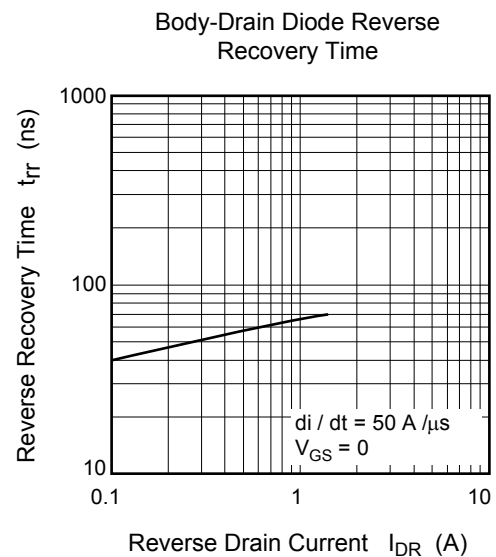
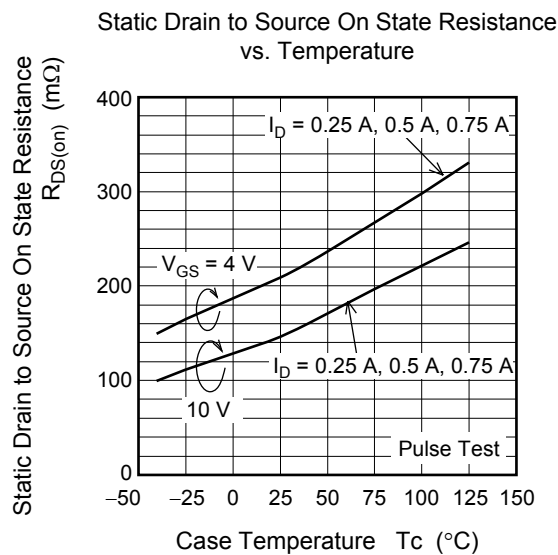


Drain Source Saturation Voltage vs. Gate to Source Voltage

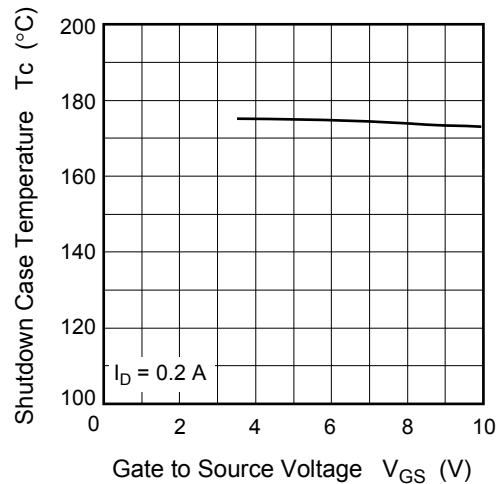


Static Drain to Source On State Resistance vs. Drain Current

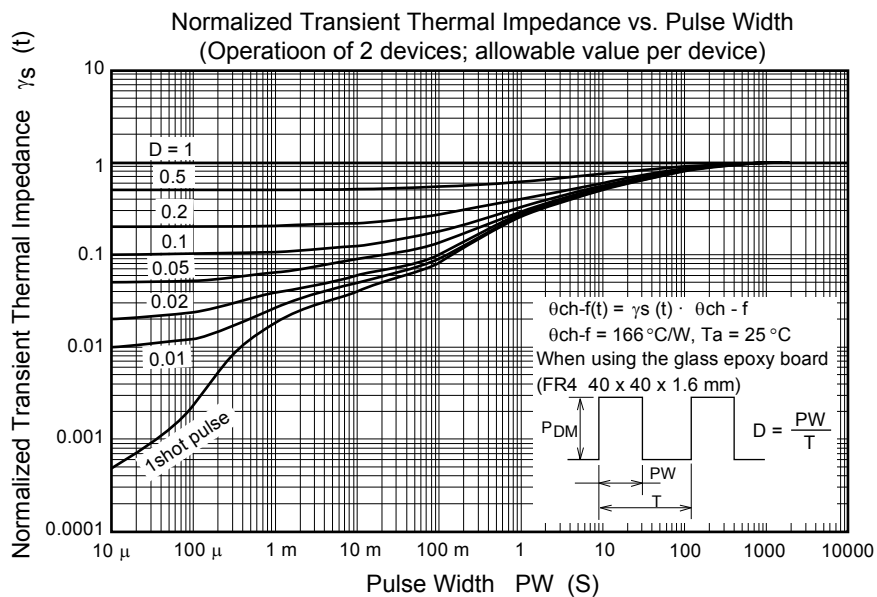
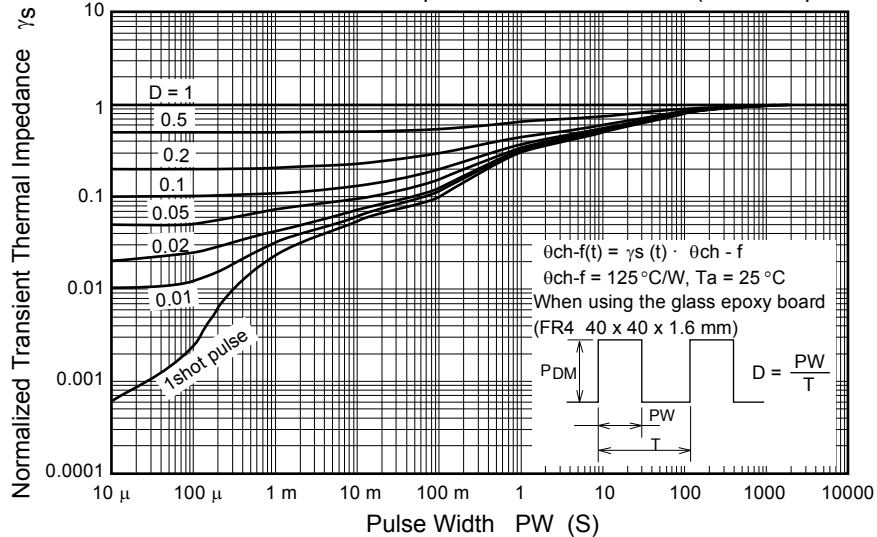




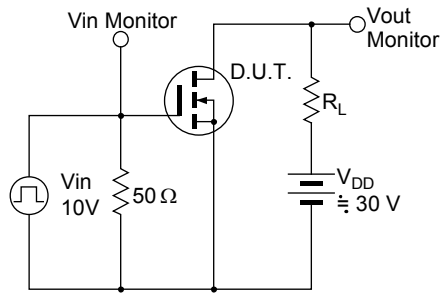
Shutdown Case Temperature vs.
Gate to Source Voltage



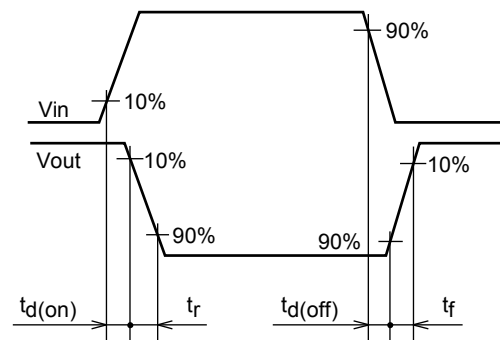
Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



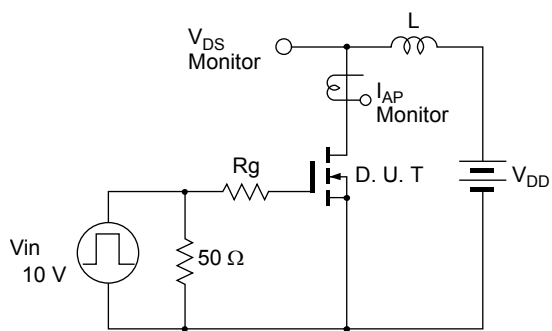
Switching Time Test Circuit



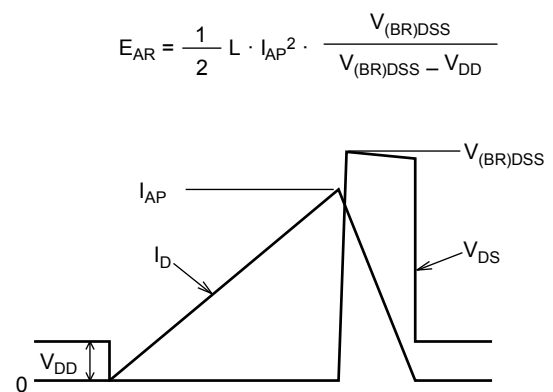
Waveform



Avalanche Test Circuit

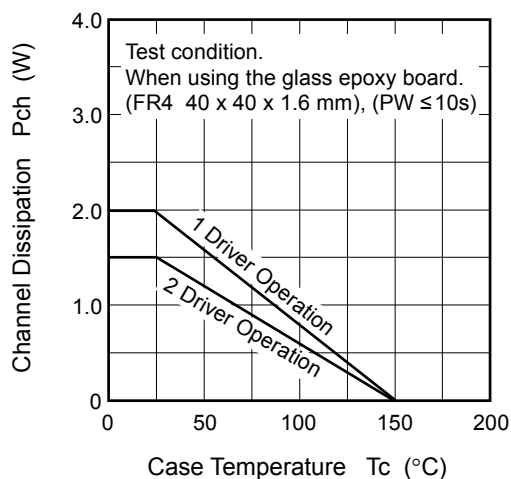


Avalanche Waveform

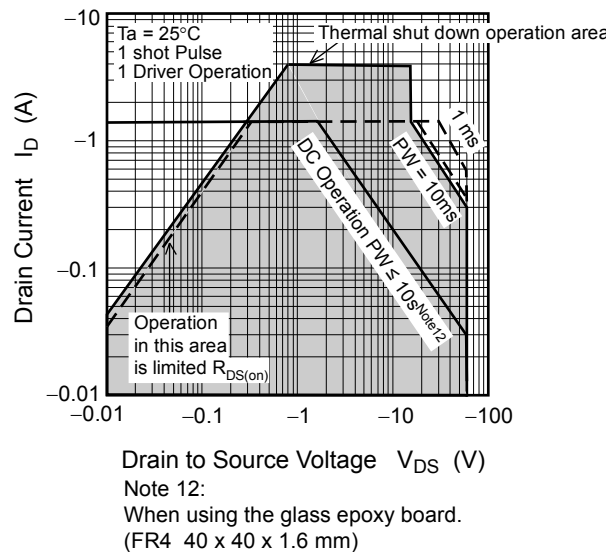


Main Characteristics (P channel)

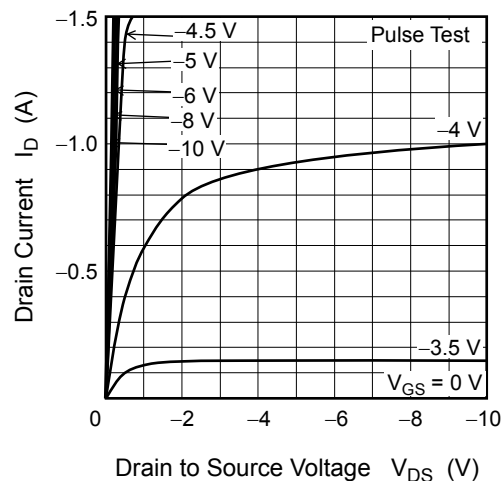
Power vs. Temperature Derating



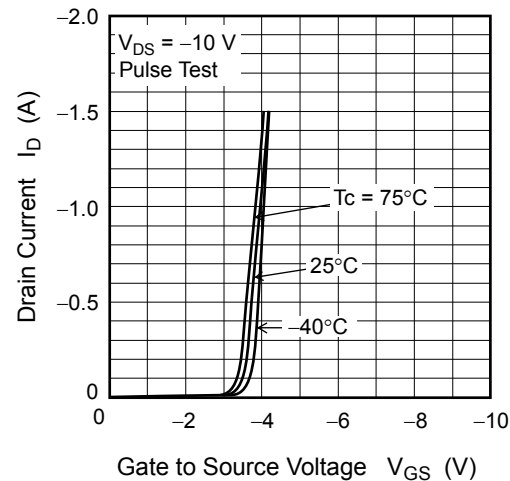
Maximum Safe Operation Area



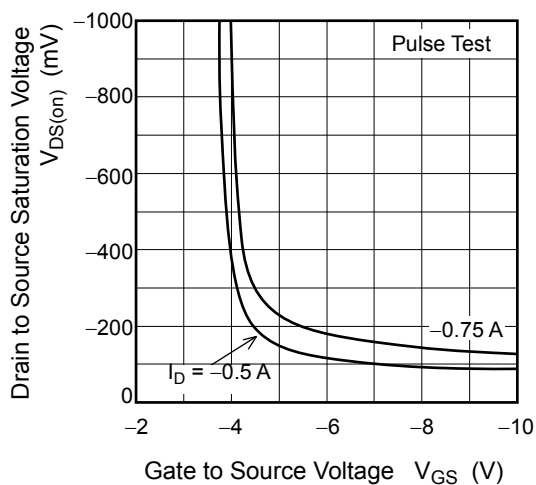
Typical Output Characteristics



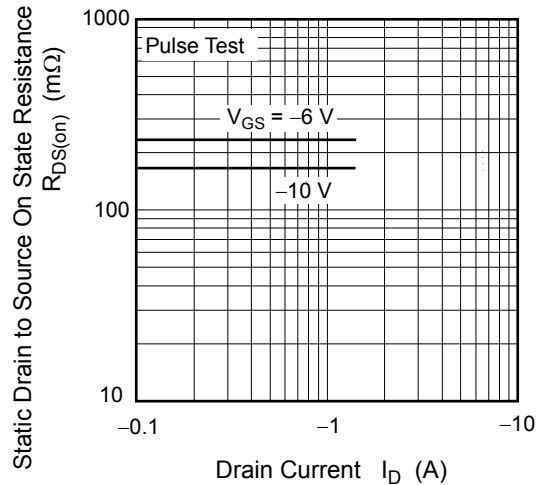
Typical Transfer Characteristics

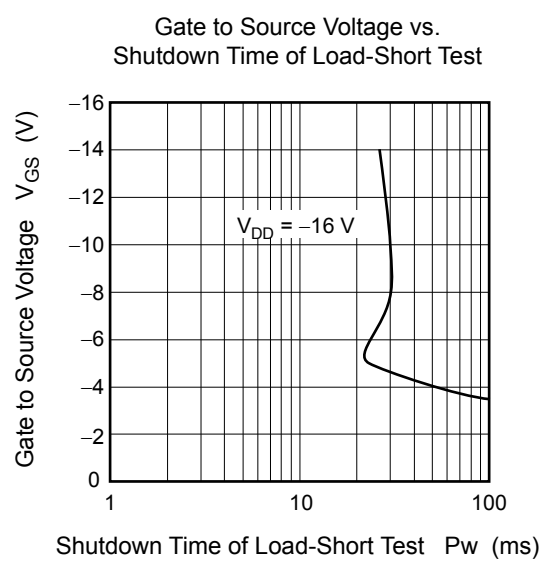
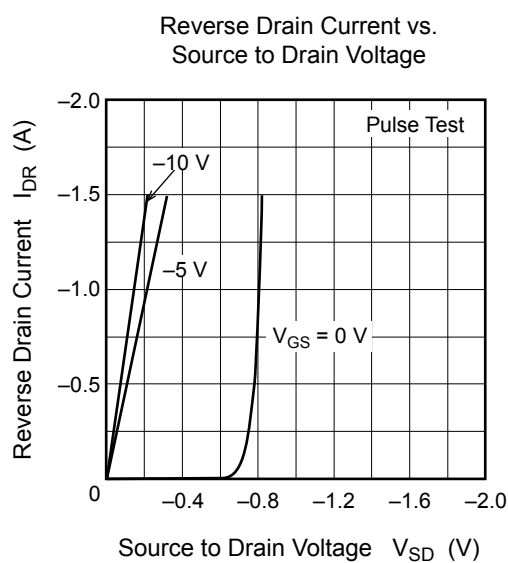
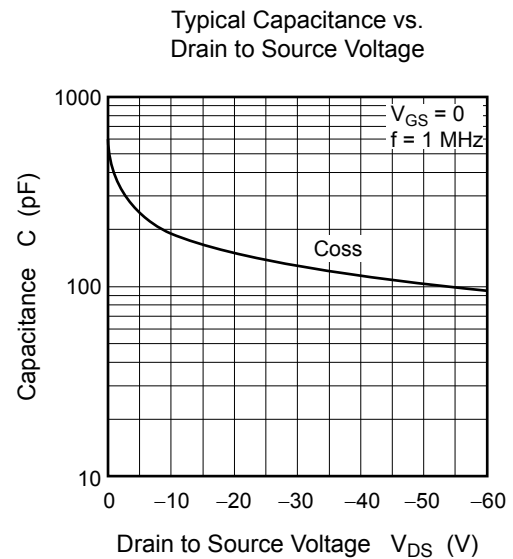
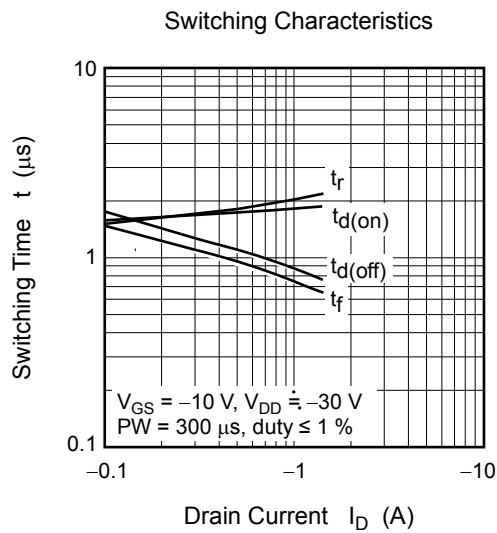
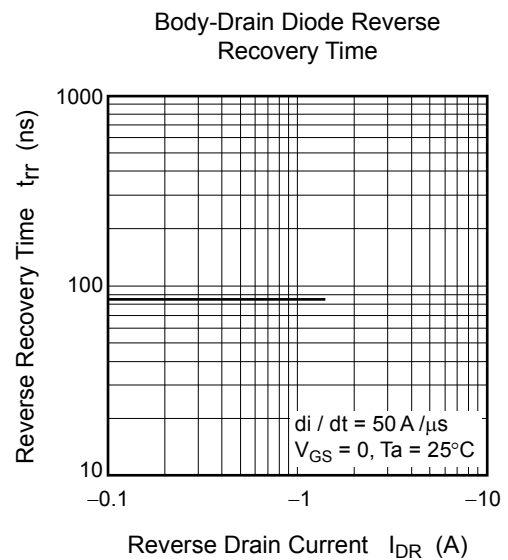
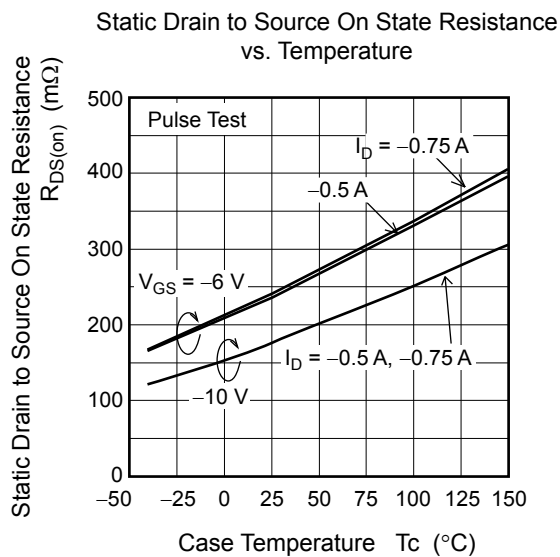


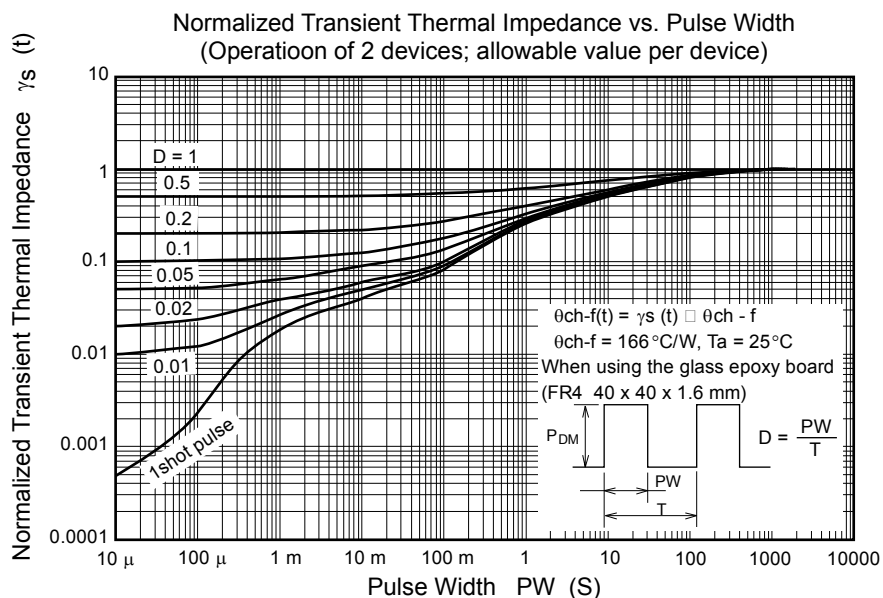
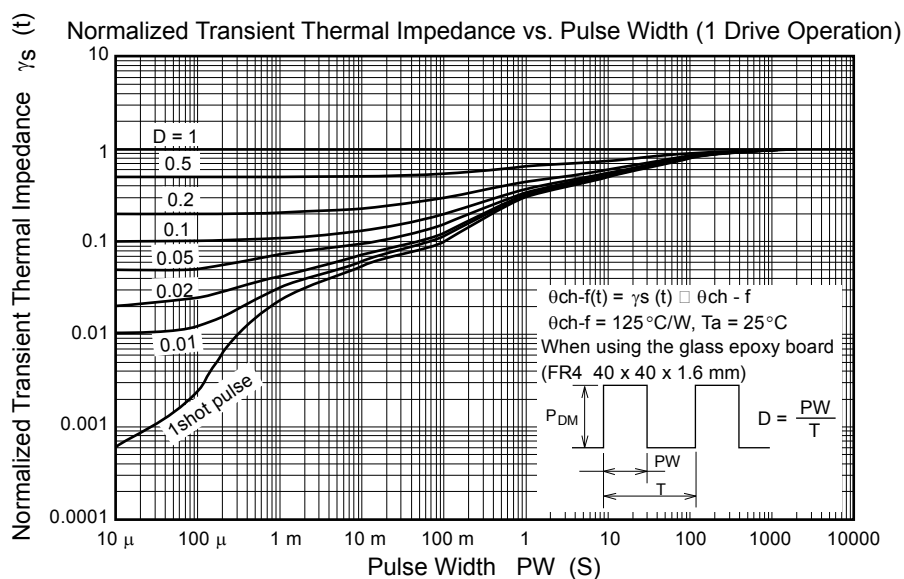
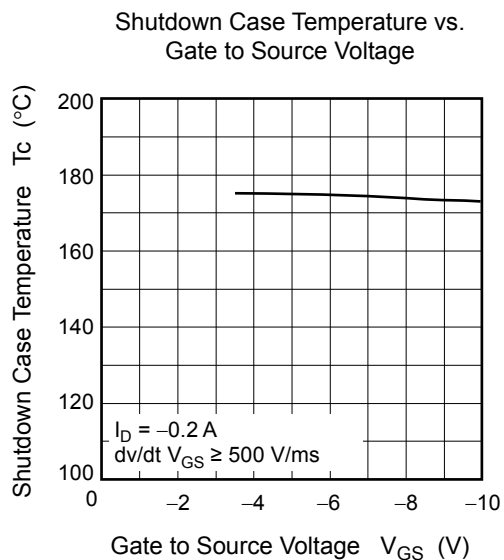
Drain Source Saturation Voltage vs. Gate to Source Voltage

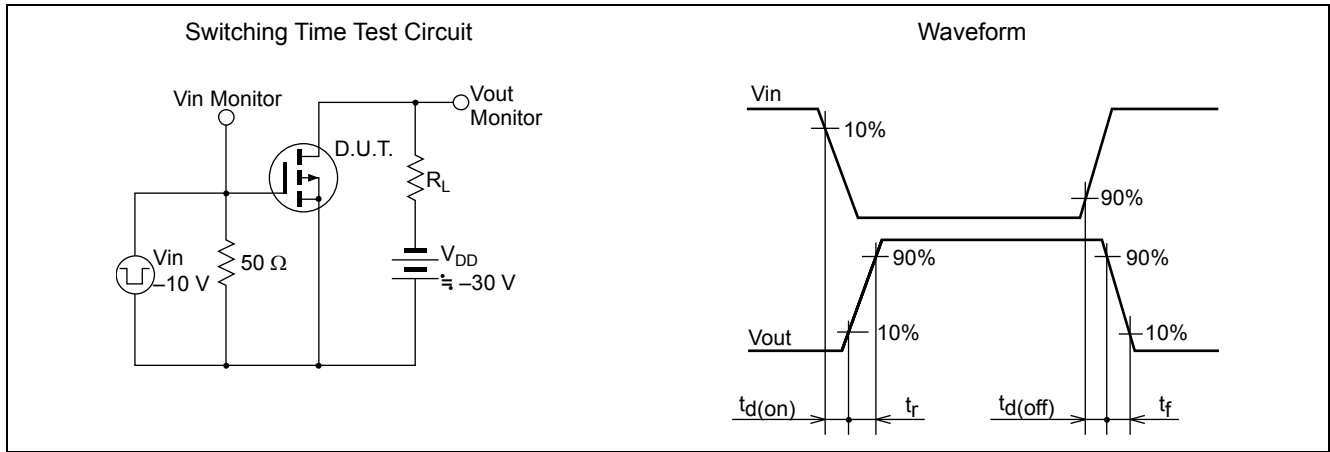


Static Drain to Source On State Resistance vs. Drain Current



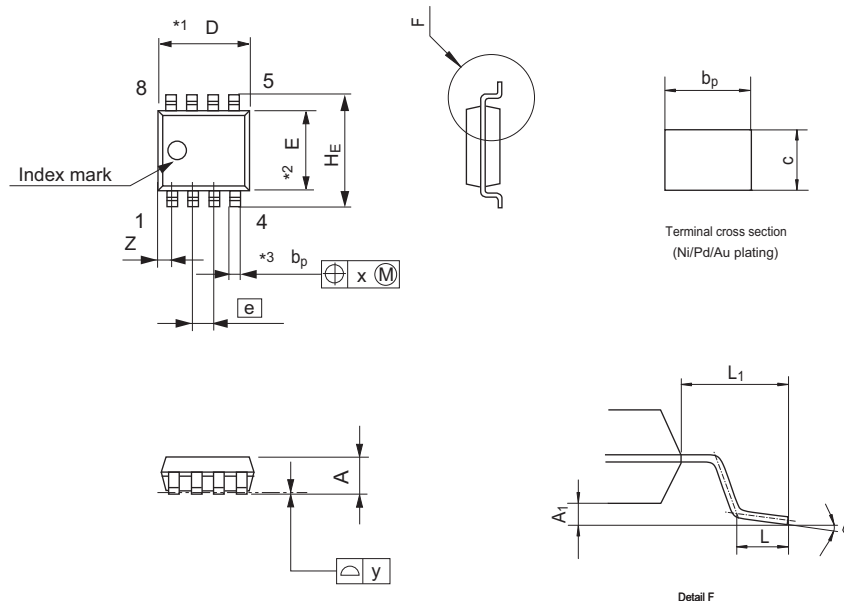






Package Dimensions

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
ϕ	—	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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