HAT1097R, HAT1097RJ

Silicon P Channel Power MOS FET
High Speed Power Switching

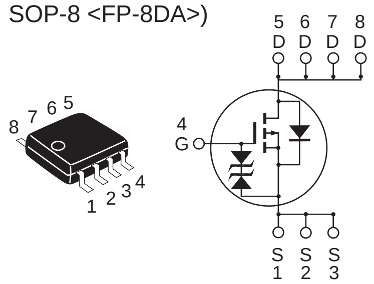
REJ03G0529-0100
Rev.1.00
Feb.15.2005

Features

- Low on-resistance
- Capable of 4.5 V gate drive
- High density mounting
- "J" is for Automotive application
  High temperature D-S leakage guarantee
  Avalanche rating

Outline

RENESAS Package code: PRSP0008DD-A
(Previous code: SOP-8 <FP-8DA>)



1, 2, 3 Source
4 Gate
5, 6, 7, 8 Drain

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings		Unit
		HAT1097R	HAT1097RJ	
Drain to source voltage	V_{DSS}	–60	–60	V
Gate to source voltage	V_{GSS}	±20	±20	V
Drain current	I_D	–5	–5	A
Drain peak current	I_D (pulse)[Note1]	–40	–40	A
Avalanche current	I_{AP}[Note3]	—	–5	A
Avalanche energy	E_{AR}[Note3]	—	2.14	mJ
Channel dissipation	Pch[Note2]	2	2	W
Channel temperature	Tch	150	150	°C
Storage temperature	Tstg	–55 to +150	–55 to +150	°C

Notes: 1. PW ≤ 10μs, duty cycle ≤ 1%
2. When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW ≤ 10 s
3. Value at Tch = 25°C, Rg ≥ 50 Ω

Electrical Characteristics

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	–60	—	—	V	I_D = –10 mA, V_{GS} = 0
Gate to Source breakdown voltage		$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 µA, V_{DS} = 0
Zero gate voltage drain current		I_{DSS}	—	—	–1	µA	V_{DS} = –60 V, V_{GS} = 0
Zero gate voltage drain current	HAT1097R	I_{DSS}	—	—	—	µA	V_{DS} = –48 V, V_{GS} = 0 Ta = 125°C
	HAT1055RJ	I_{DSS}	—	—	–10	µA	
Gate to source leak current		I_{GSS}	—	—	±10	µA	V_{GS} = ±16 V, V_{DS} = 0
Gate to source cutoff voltage		$V_{GS(off)}$	–1.0	—	–2.5	V	V_{DS} = –10 V, I_D = –1 mA
Forward transfer admittance		$\|y_{fs}\|$	3	5	—	S	I_D = –2.5 A [Note4], V_{DS} = –10 V
Static drain to source on state resistance		$R_{DS(on)}$	—	60	76	mΩ	I_D = –2.5 A [Note4], V_{GS} = –10 V
		$R_{DS(on)}$	—	90	130	mΩ	I_D = –2.5 A [Note4], V_{GS} = –4.5 V
Input capacitance		Ciss	—	1350	—	pF	V_{DS} = –10 V, V_{GS} = 0 f = 1 MHz
Output capacitance		Coss	—	135	—	pF	
Reverse transfer capacitance		Crss	—	85	—	pF	
Total gate charge		Qg	—	21	—	nC	V_{DD} = –25 V V_{GS} = –10 V I_D = –5 A
Gate to source charge		Qgs	—	3	—	nC	
Gate to drain charge		Qgd	—	4	—	nC	
Turn-on delay time		td(on)	—	20	—	ns	V_{GS} = –10 V, I_D= –2.5 A V_{DD} ≅ –30 V R_L = 12 Ω R_G = 4.7 Ω
Rise time		tr	—	15	—	ns	
Turn-off delay time		td(off)	—	55	—	ns	
Fall time		tf	—	10	—	ns	
Body-drain diode forward voltage		V_{DF}	—	–0.85	–1.10	V	I_F = –5 A, V_{GS} = 0 [Note4]
Body-drain diode reverse recovery time		trr	—	25	—	ns	I_F = –5 A, V_{GS} = 0 diF/dt = 100 A/µs

Notes: 4. Pulse test

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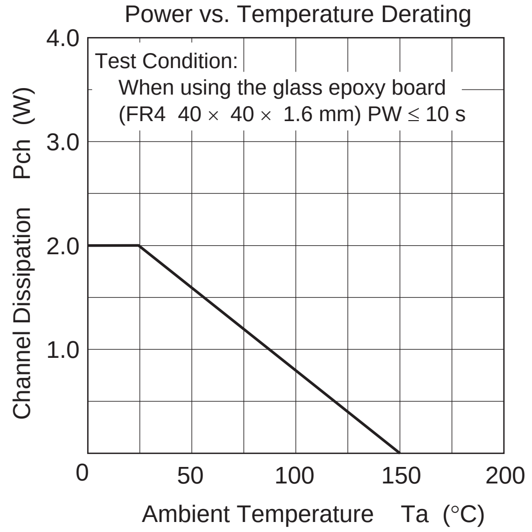
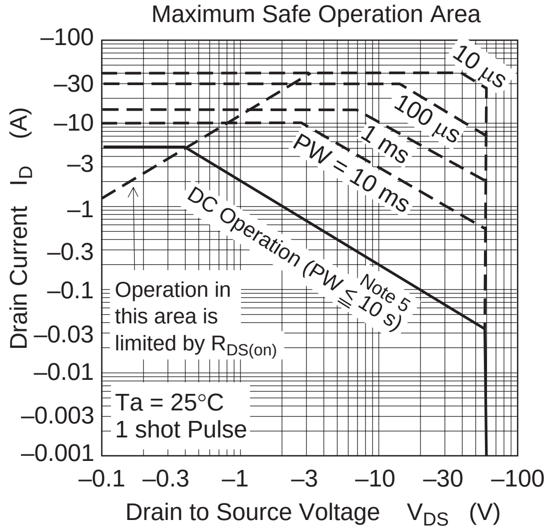
Main Characteristics

Power vs. Temperature Derating

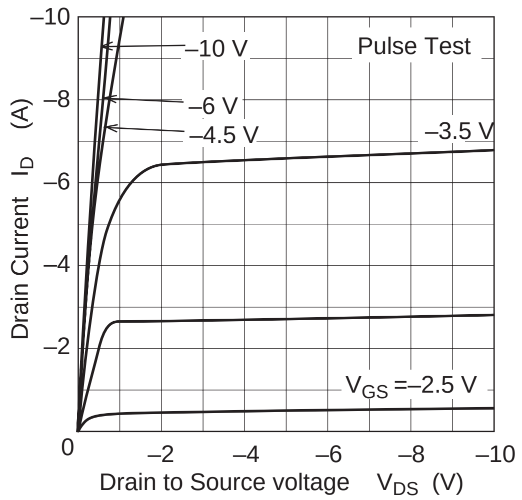


Maximum Safe Operation Area

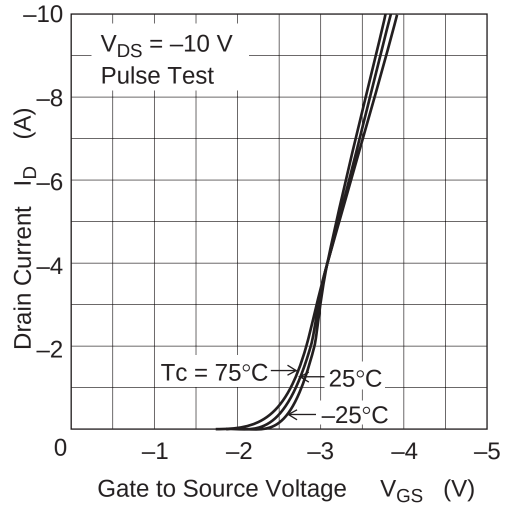


Note 5: When using the glass epoxy board
(FR4 40 × 40 × 1.6 mm)

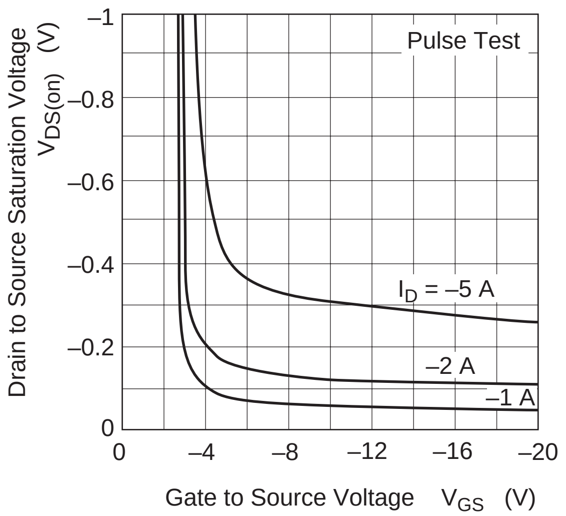
Typical Output Characteristics



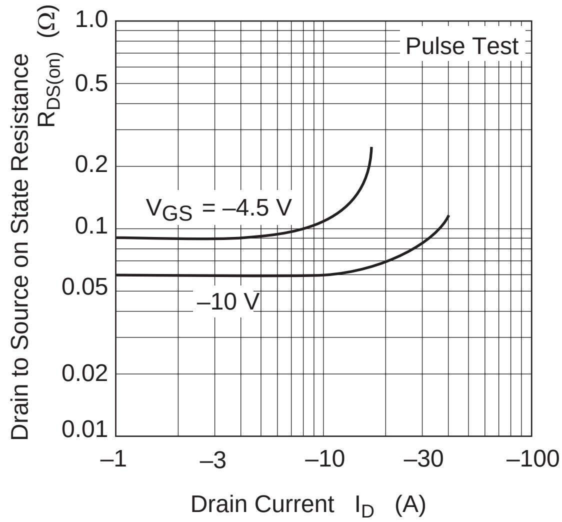
Typical Transfer Characteristics

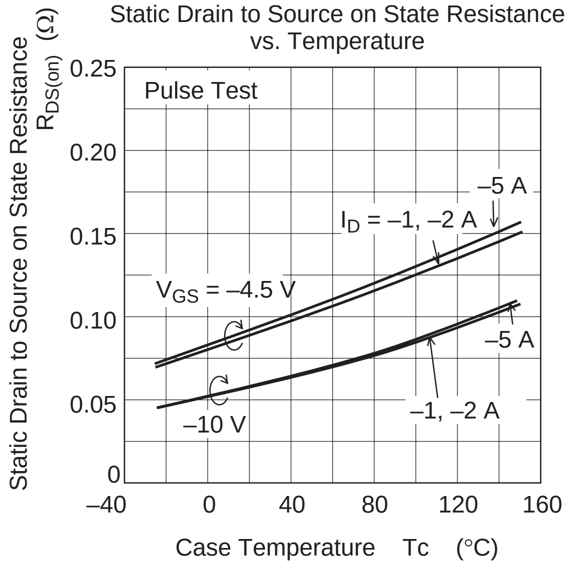


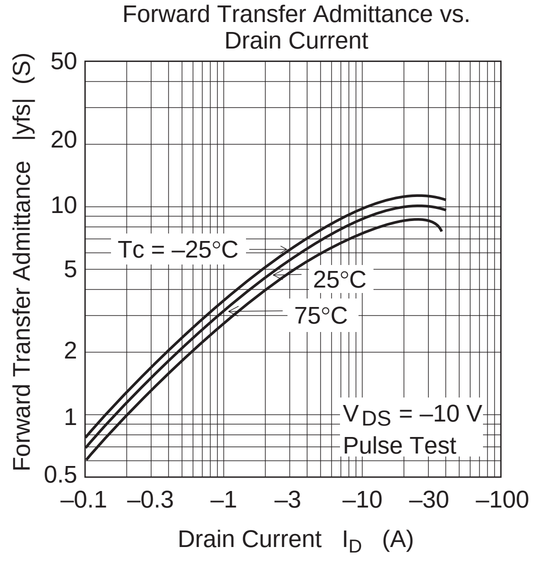
Drain to Source Saturation Voltage vs.
Gate to Source Voltage

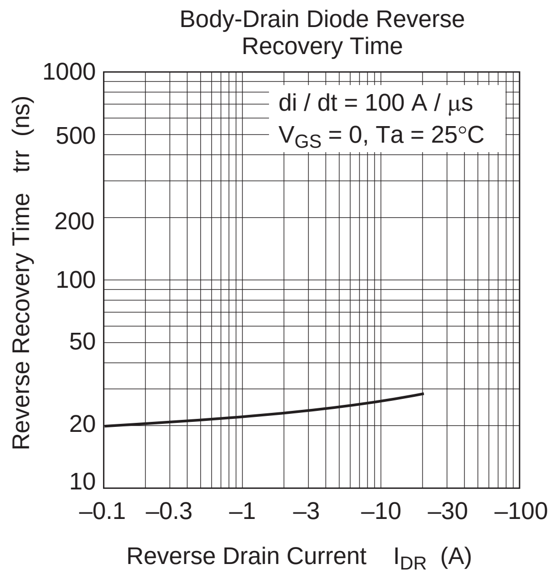


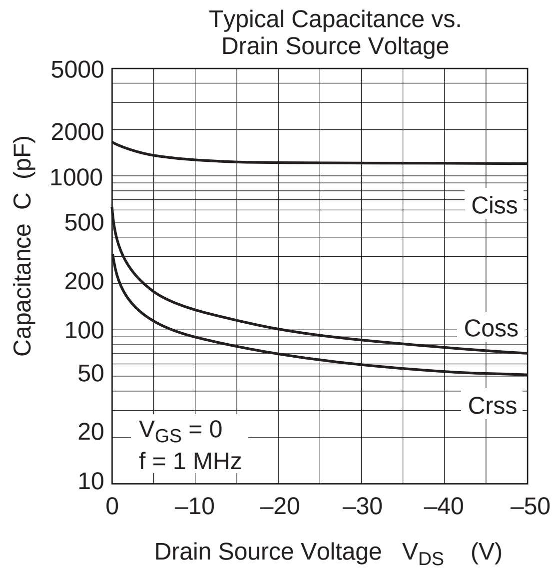
Static Drain to Source on State Resistance
vs. Drain Current

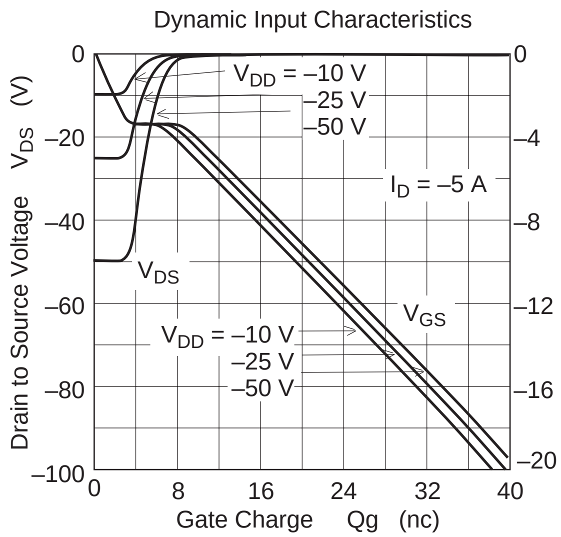


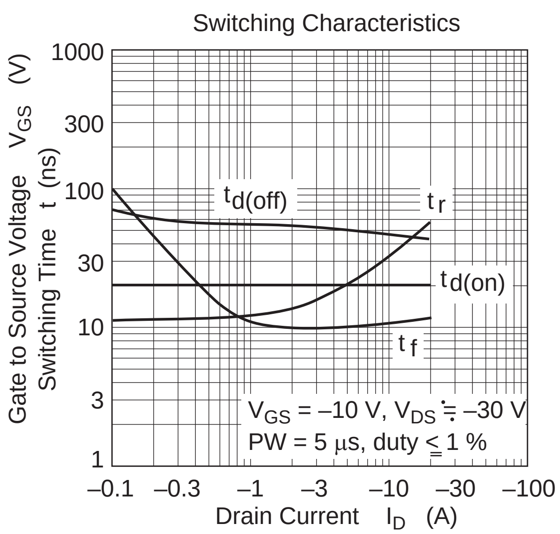

Static Drain to Source on State Resistance
vs. Temperature
Static Drain to Source on State Resistance $R_{DS(on)}$ (Ω)
Pulse Test
I_D = –1, –2 A
–5 A
V_{GS} = –4.5 V
–5 A
–1, –2 A
–10 V
0.25
0.20
0.15
0.10
0.05
0
–40
0
40
80
120
160
Case Temperature Tc (°C)


Forward Transfer Admittance vs.
Drain Current
Forward Transfer Admittance |yfs| (S)
Tc = –25°C
25°C
75°C
V_{DS} = –10 V
Pulse Test
50
20
10
5
2
1
0.5
–0.1
–0.3
–1
–3
–10
–30
–100
Drain Current I_D (A)

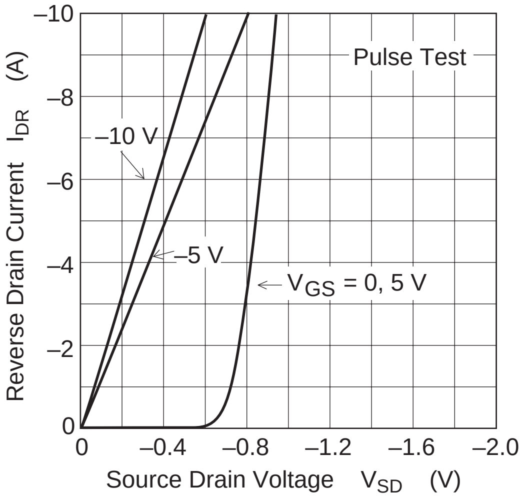

Body-Drain Diode Reverse
Recovery Time
Reverse Recovery Time trr (ns)
di / dt = 100 A / µs
V_{GS} = 0, Ta = 25°C
1000
500
200
100
50
20
10
–0.1
–0.3
–1
–3
–10
–30
–100
Reverse Drain Current I_{DR} (A)


Typical Capacitance vs.
Drain Source Voltage
Capacitance C (pF)
Ciss
Coss
Crss
V_{GS} = 0
f = 1 MHz
5000
2000
1000
500
200
100
50
20
10
0
–10
–20
–30
–40
–50
Drain Source Voltage V_{DS} (V)

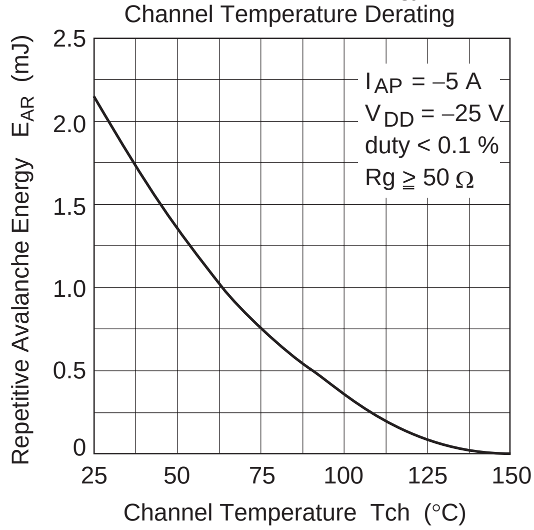

Dynamic Input Characteristics
Drain to Source Voltage V_{DS} (V)
V_{DD} = –10 V
–25 V
–50 V
I_D = –5 A
V_{DS}
V_{GS}
V_{DD} = –10 V
–25 V
–50 V
0
–20
–40
–60
–80
–100
0
–4
–8
–12
–16
–20
0
8
16
24
32
40
Gate Charge Qg (nc)


Switching Characteristics
Gate to Source Voltage V_{GS} (V)
Switching Time t (ns)
$t_{d(off)}$
t_r
$t_{d(on)}$
t_f
V_{GS} = –10 V, V_{DS} ≒ –30 V
PW = 5 µs, duty ≦ 1 %
1000
300
100
30
10
3
1
–0.1
–0.3
–1
–3
–10
–30
–100
Drain Current I_D (A)

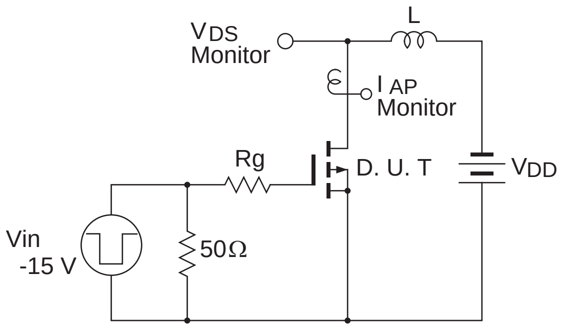
Reverse Drain Current vs.
Source to Drain Voltage



Maximum Avalanche Energy vs.
Channel Temperature Derating

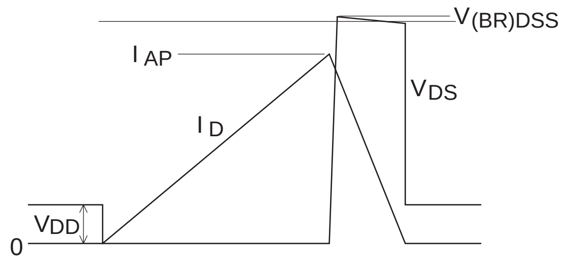


Avalanche Test Circuit

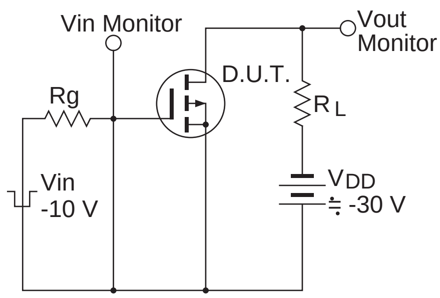


Avalanche Waveform

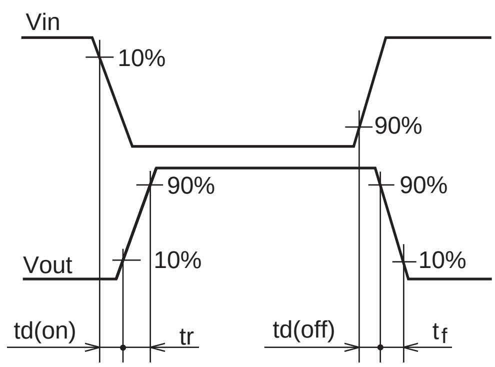
$$E_{AR} = \frac{1}{2} L \bullet I_{AP}^{2} \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

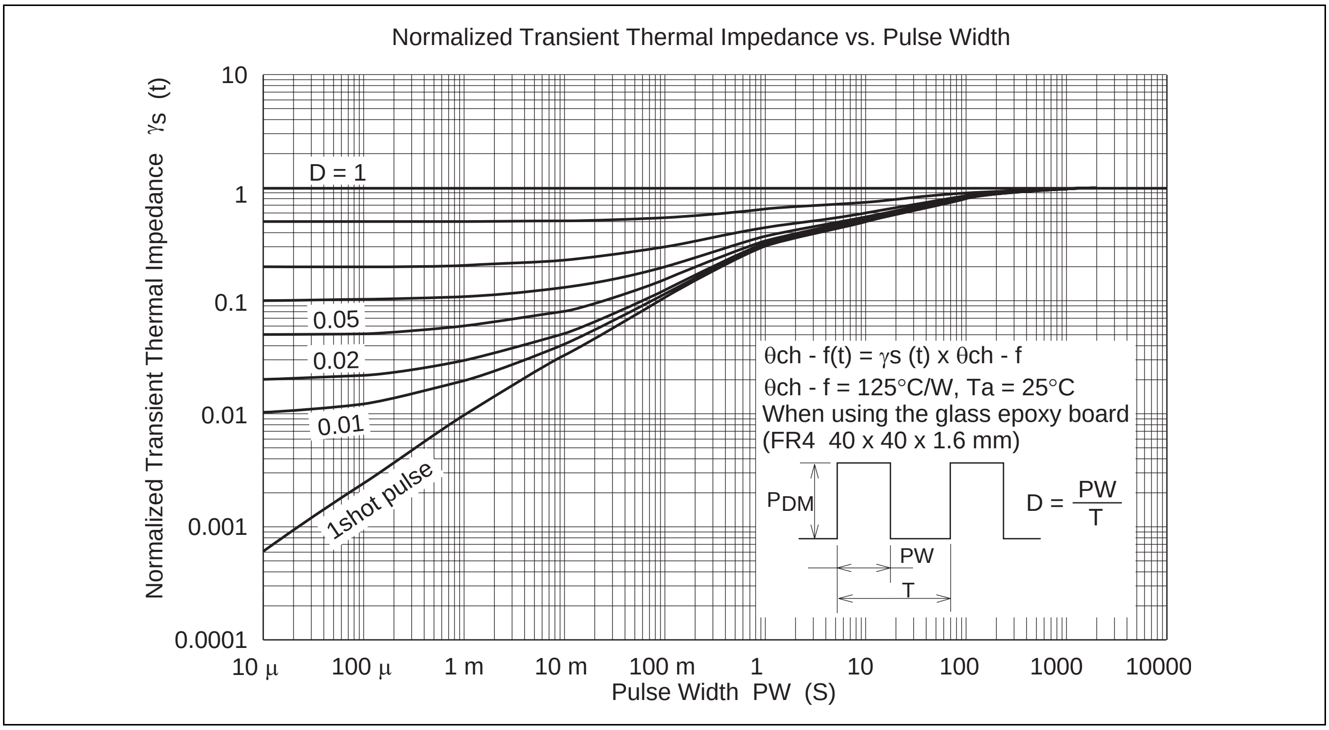


Switching Time Test Circuit



Switching Time Waveform

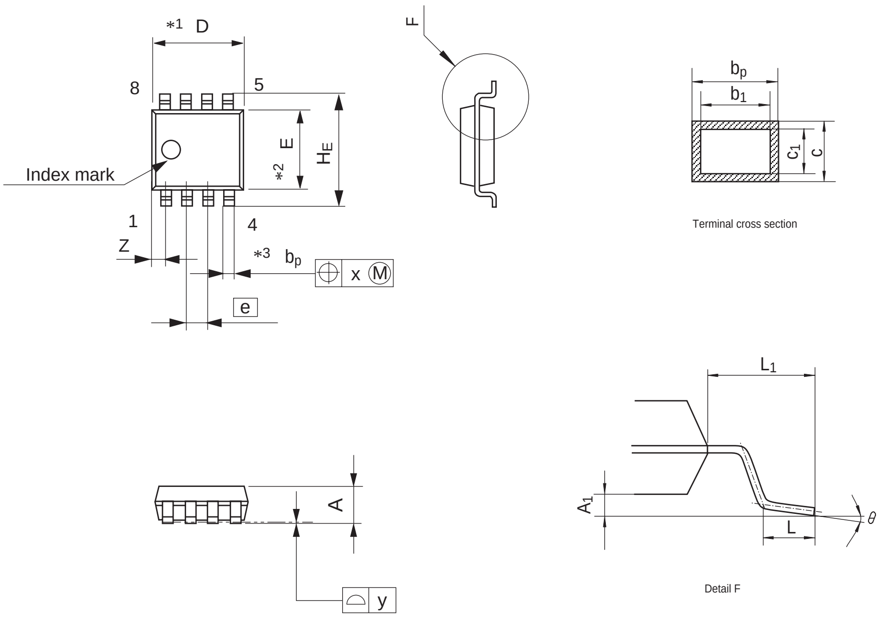



Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
0.001
0.0001
D = 1
0.05
0.02
0.01
1shot pulse
θch - f(t) = γs (t) x θch - f
θch - f = 125°C/W, Ta = 25°C
When using the glass epoxy board
(FR4 40 x 40 x 1.6 mm)
PDM
D = PW / T
PW
T
10 μ
100 μ
1 m
10 m
100 m
1
10
100
1000
10000
Pulse Width PW (S)

RENESAS

Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-3.95 × 4.9-1.27	PRSP0008DD-A	FP-8DA	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	0.42	0.50
b_1	—	0.40	—
c	0.19	0.22	0.25
c_1	—	0.20	—
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

Part Name	Quantity	Shipping Container
HAT1097R-EL-E	2500 pcs.	Taping
HAT1097RJ-EL-E	2500 pcs.	Taping

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

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RENESAS SALES OFFICES

http://www.renesas.com

Refer to "**http://www.renesas.com/en/network**" for the latest and detailed information.

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