To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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Keep safety first in your circuit designs!

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# HAT2126RP

## Silicon N Channel Power MOS FET with Schottky Barrier Diode
## High Speed Power Switching

ADE-208-1576D (Z)

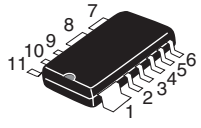
5th. Edition
Dec. 2002

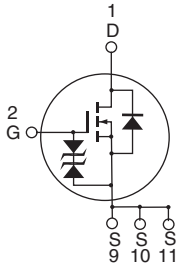
### Features

- Low on-resistance
- Capable of 4.5 V gate drive
- High density mounting
- Built-in Schottky Barrier Diode

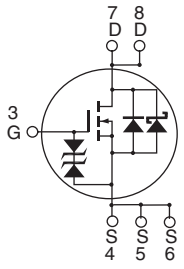
### Outline

HSOP-11




MOS1




MOS2 and
Schottky Barrier Diode

| | |
|---|---|
| 4, 5, 6, 9, 10 , 11 | Source |
| 2, 3 | Gate |
| 1, 7, 8 | Drain |

## Absolute Maximum Ratings

(Ta = 25°C)

| Item | Symbol | Ratings | | Unit |
|---|---|---|---|---|
| | | MOS1 | MOS2 & SBD | |
| Drain to source voltage | $V_{DSS}$ | 30 | 30 | V |
| Gate to source voltage | $V_{GSS}$ | ±20 | ±12 | V |
| Drain current | $I_D$ | 12 | 16 | A |
| Drain peak current | $I_{D(pulse)}$ Note1 | 96 | 128 | A |
| Reverse drain current | $I_{DR}$ | 12 | 16 | A |
| Channel dissipation | Pch Note2 | 2.0 | 3.5 | 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. 1 Drive operation; When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW ≤ 10s

## Electrical Characteristics

(Ta = 25°C)

**• MOS1**

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 30 | — | — | V | $I_D$ = 10mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | ±20 | — | — | V | $I_G$ = ±100µA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS}$ | — | — | ±10 | µA | $V_{GS}$ = ±16V, $V_{DS}$ = 0 |
| Zero gate voltage drain current | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 30V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | 1.0 | — | 2.5 | V | $V_{DS}$ = 10V, $I_D$ = 1mA |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 10 | 13 | mΩ | $I_D$ = 6A, $V_{GS}$ = 10V Note3 |
| | $R_{DS(on)}$ | — | 18 | 27 | mΩ | $I_D$ = 6A, $V_{GS}$ = 4.5V Note3 |
| Forward transfer admittance | $\|y_{fs}\|$ | 12 | 20 | — | S | $I_D$ = 6A, $V_{DS}$ = 10V Note3 |
| Input capacitance | Ciss | — | 1000 | — | pF | $V_{DS}$ = 10V |
| Output capacitance | Coss | — | 280 | — | pF | $V_{GS}$ = 0 |
| Reverse transfer capacitance | Crss | — | 160 | — | pF | f = 1MHz |
| Total gate charge | Qg | — | 9 | — | nc | $V_{DD}$ = 10 V |
| Gate to source charge | Qgs | — | 3.6 | — | nc | $V_{GS}$ = 5 V |
| Gate to drain charge | Qgd | — | 3.2 | — | nc | $I_D$ = 16 A |
| Turn-on delay time | $t_{d(on)}$ | — | 12 | — | ns | $V_{GS}$ =10V, $I_D$ = 6A |
| Rise time | $t_r$ | — | 22 | — | ns | $V_{DD}$ ≈ 10V |
| Turn-off delay time | $t_{d(off)}$ | — | 55 | — | ns | $R_L$ = 1.67Ω |
| Fall time | $t_f$ | — | 9 | — | ns | $R_g$ = 4.7Ω |
| Body–drain diode forward voltage | $V_{DF}$ | — | 0.82 | 1.07 | V | IF = 12A, $V_{GS}$ = 0 Note3 |
| Body–drain diode reverse recovery time | $t_{rr}$ | — | 25 | — | ns | IF =12A, $V_{GS}$ = 0<br>diF/ dt =50A/µs |

Notes: 3. Pulse test

**• MOS2 & Schottky Barrier Diode**

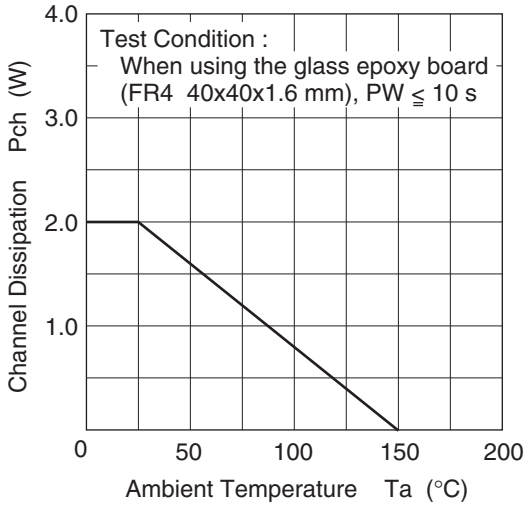
| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 30 | — | — | V | $I_D$ = 10mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | ±12 | — | — | V | $I_G$ = ±100µA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS}$ | — | — | ±10 | µA | $V_{GS}$ = ±10V, $V_{DS}$ = 0 |
| Zero gate voltage drain current | $I_{DSS}$ | — | — | 1 | m A | $V_{DS}$ = 30V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | 1.4 | — | 2.5 | V | $V_{DS}$ = 10V, $I_D$ =1mA |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 5.6 | 7.3 | mΩ | $I_D$ = 8A, $V_{GS}$ = 10V Note3 |
| | $R_{DS(on)}$ | — | 7.3 | 9.5 | mΩ | $I_D$ = 8A, $V_{GS}$ = 4.5V Note3 |
| Forward transfer admittance | $\|y_{fs}\|$ | 25 | 41 | — | S | $I_D$ = 8A, $V_{DS}$ = 10V Note3 |
| Input capacitance | Ciss | — | 3800 | — | pF | $V_{DS}$ = 10V |
| Output capacitance | Coss | — | 745 | — | pF | $V_{GS}$ = 0 |
| Reverse transfer capacitance | Crss | — | 300 | — | pF | f = 1MHz |
| Total gate charge | Qg | — | 34 | — | nc | $V_{DD}$ = 10 V |
| Gate to source charge | Qgs | — | 10 | — | nc | $V_{GS}$ = 5 V |
| Gate to drain charge | Qgd | — | 8 | — | nc | $I_D$ = 16 A |
| Turn-on delay time | $t_{d(on)}$ | — | 18 | — | ns | $V_{GS}$ = 10V, $I_D$ = 8A |
| Rise time | $t_r$ | — | 22 | — | ns | $V_{DD}$ ≈ 10V |
| Turn-off delay time | $t_{d(off)}$ | — | 88 | — | ns | $R_L$ = 1.25Ω |
| Fall time | $t_f$ | — | 9.0 | — | ns | $R_g$ = 4.7Ω |
| Schottky Barrier diode forward voltage | $V_F$ | — | 0.5 | — | V | IF = 3.5A, $V_{GS}$ = 0 Note3 |
| Body–drain diode reverse recovery time | $t_{rr}$ | — | 35 | — | ns | IF = 16A, $V_{GS}$ = 0<br>diF/ dt =50A/µs |

Notes: 3. Pulse test

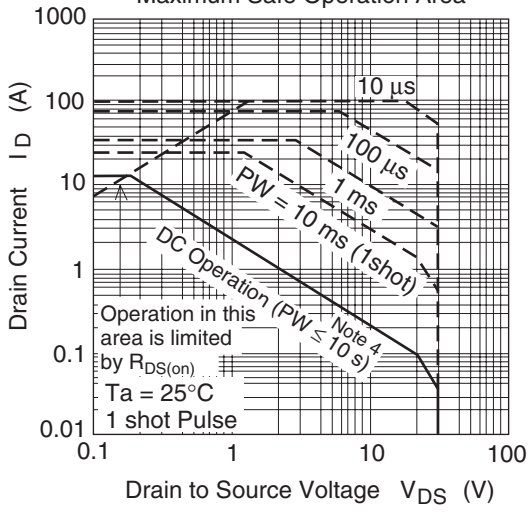
## Main Characteristics

• **MOS1**

Power vs. Temperature Derating

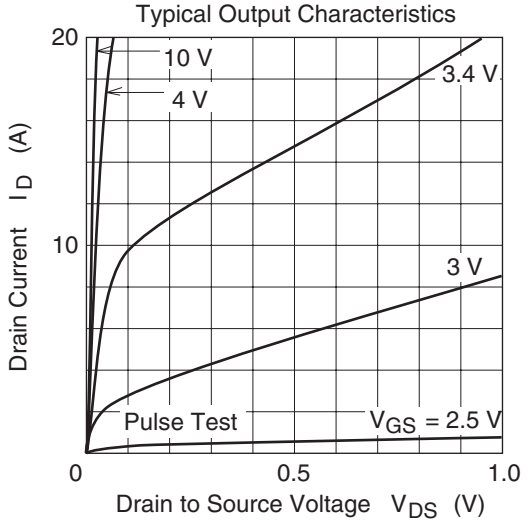



Maximum Safe Operation Area

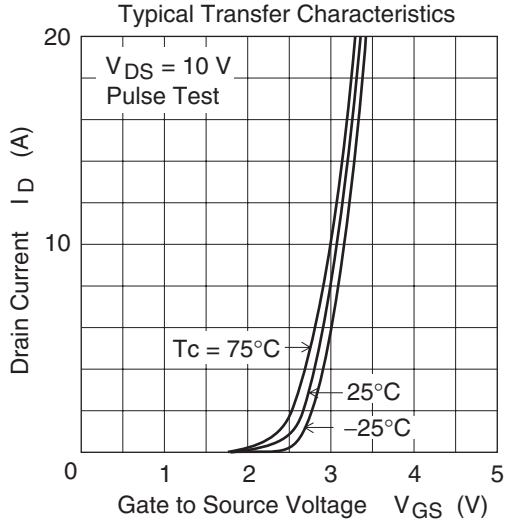



Note 4 :
When using the glass epoxy board
(FR4 40x40x1.6 mm)

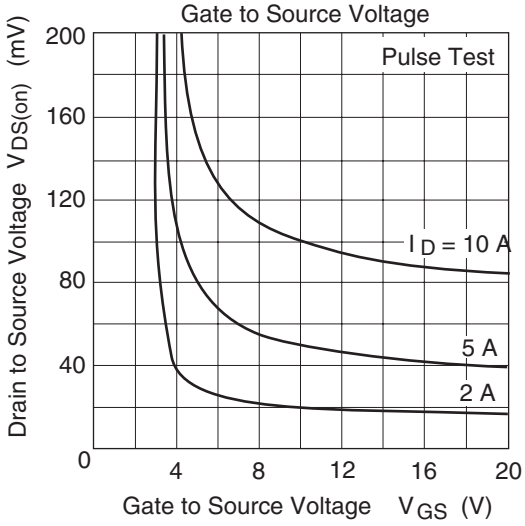
Typical Output Characteristics



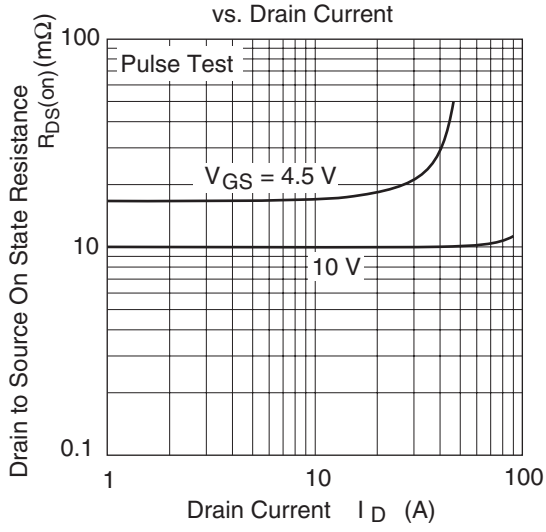

Typical Transfer Characteristics



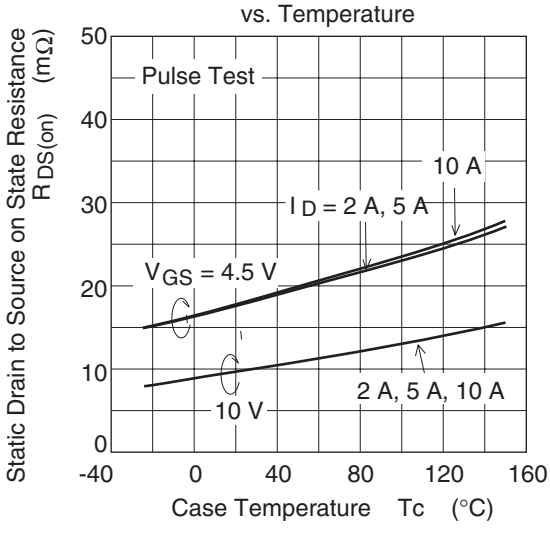
Drain to Source Saturation Voltage vs Gate to Source Voltage



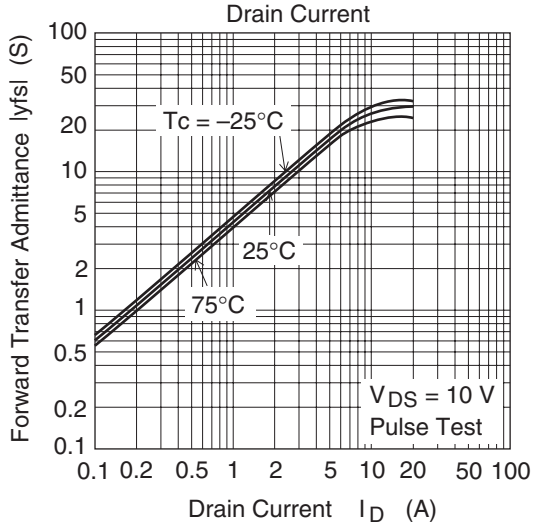

Static Drain to Source on State Resistance vs. Drain Current



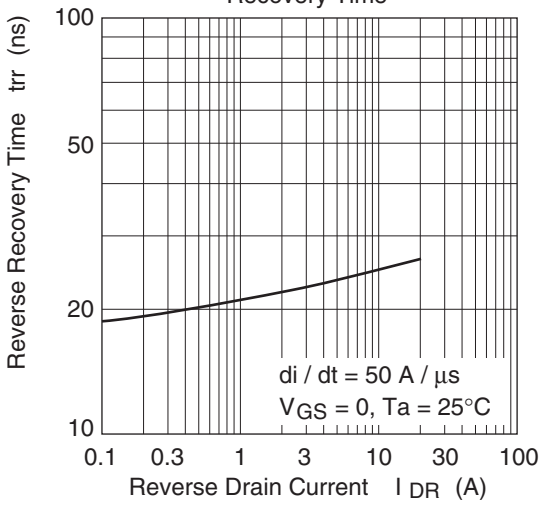

Static Drain to Source on State Resistance vs. Temperature



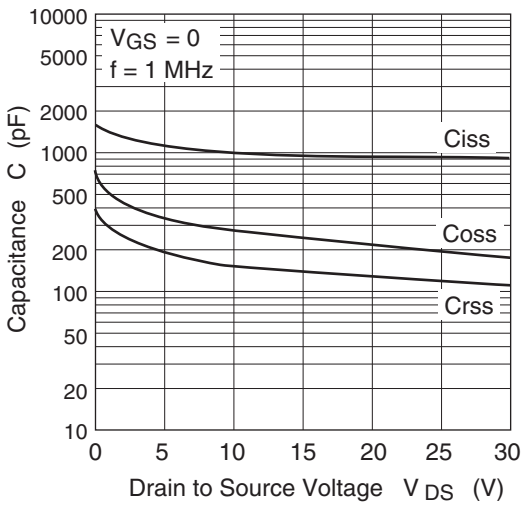

Forward Transfer Admittance vs. Drain Current



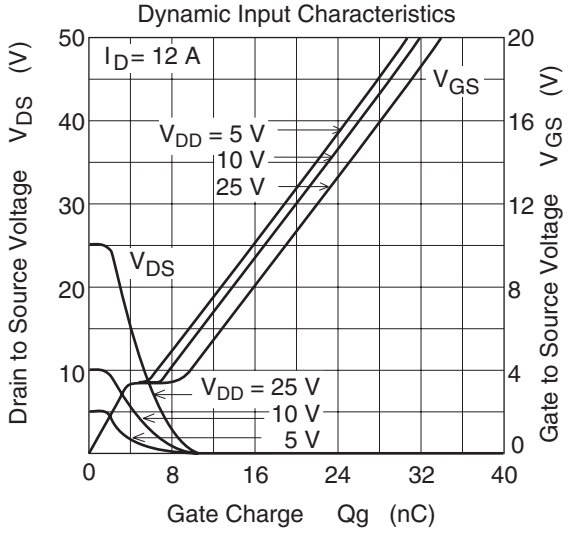
Body-Drain Diode Reverse Recovery Time



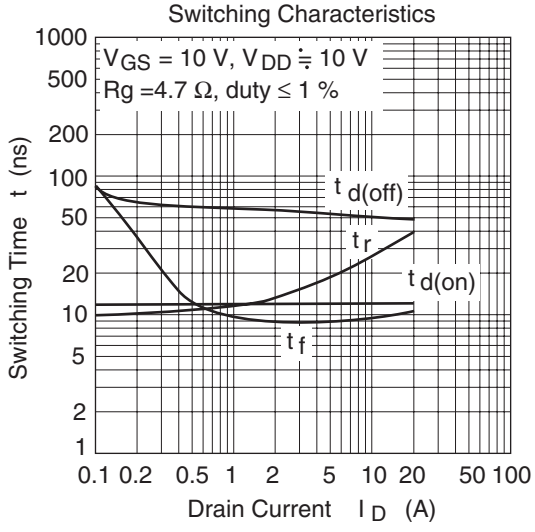

Typical Capacitance vs. Drain to Source Voltage

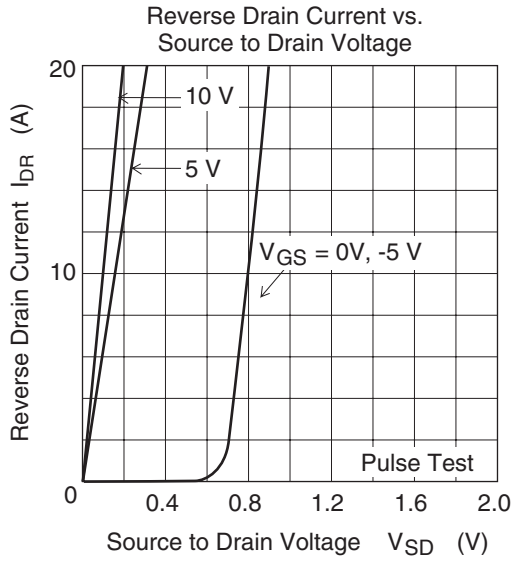


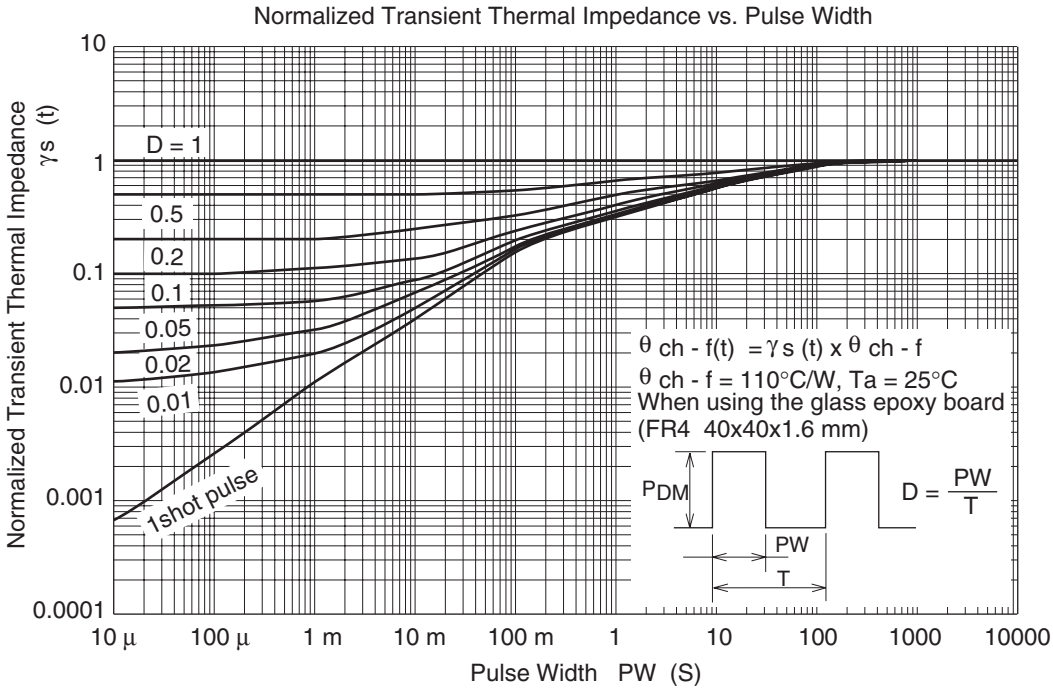

Dynamic Input Characteristics




Switching Characteristics

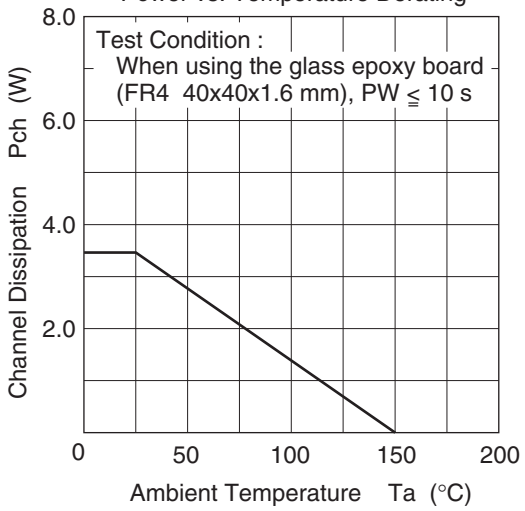



Reverse Drain Current vs.
Source to Drain Voltage
Reverse Drain Current $I_{DR}$ (A)
20
10
0
10 V
5 V
$V_{GS}$ = 0V, -5 V
Pulse Test
0.4
0.8
1.2
1.6
2.0
Source to Drain Voltage $V_{SD}$ (V)

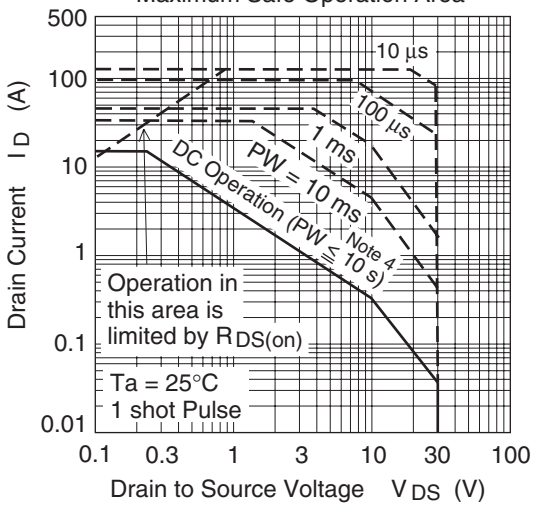

Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
0.001
0.0001
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θ ch - f(t) = γs (t) x θ ch - f
θ ch - f = 110°C/W, Ta = 25°C
When using the glass epoxy board
(FR4 40x40x1.6 mm)
PDM
D = PW/T
PW
T
10 μ
100 μ
1 m
10 m
100 m
1
10
100
1000
10000
Pulse Width PW (S)

• **MOS2 & Schottky Barrier Diode**

Power vs. Temperature Derating

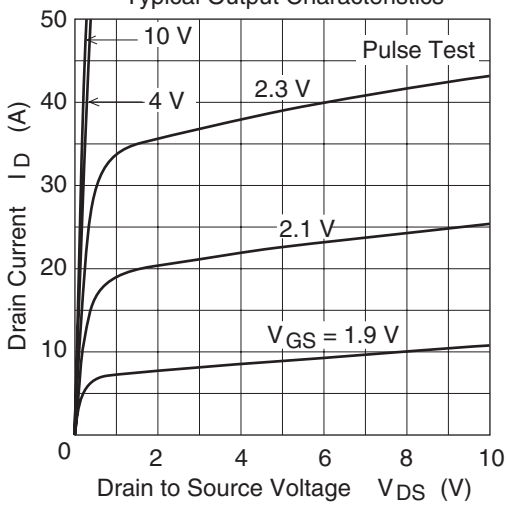



Maximum Safe Operation Area

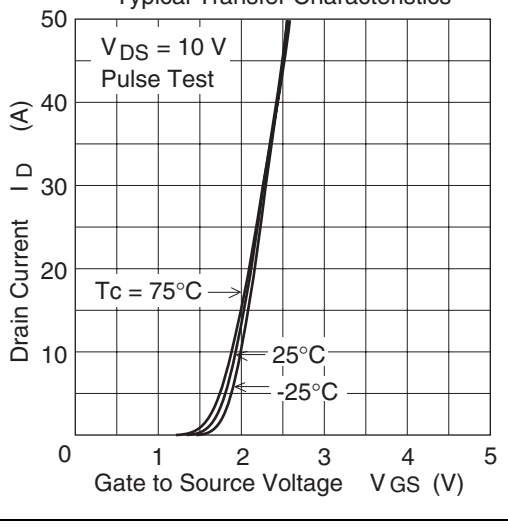



Note 4 :
When using the glass epoxy board
(FR4 40x40x1.6 mm)

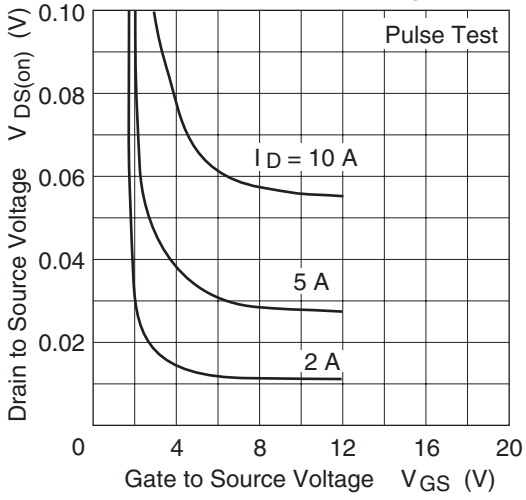
Typical Output Characteristics



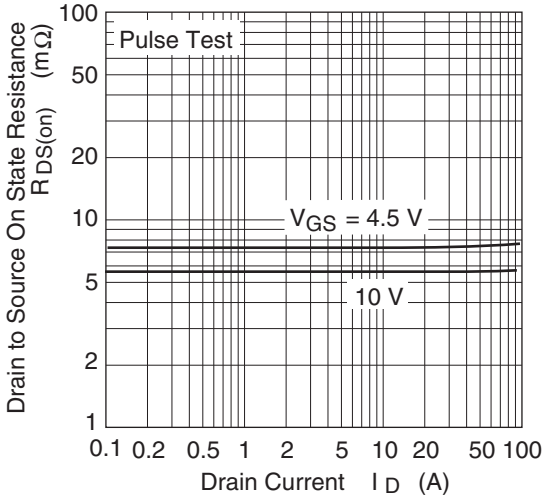

Typical Transfer Characteristics



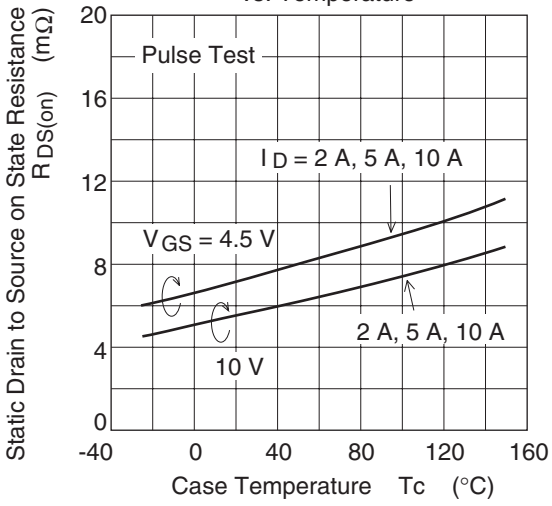
Drain to Source Saturation Voltage vs. Gate to Source Voltage



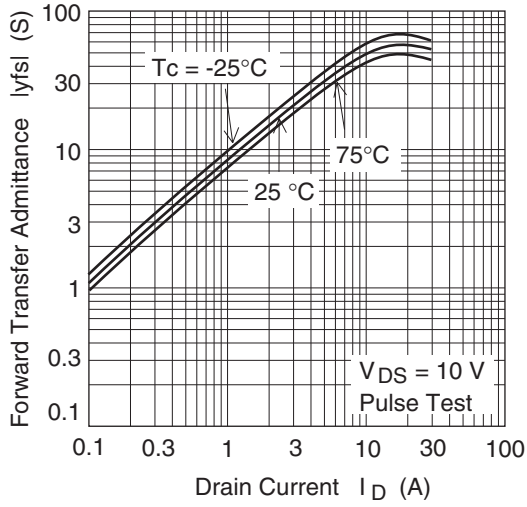

Static Drain to Source on State Resistance vs. Drain Current



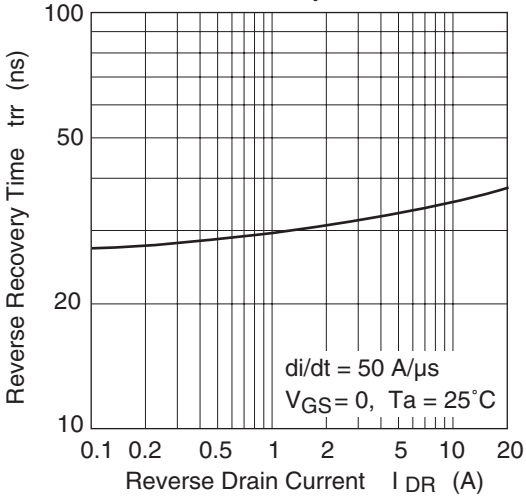

Static Drain to Source on State Resistance vs. Temperature



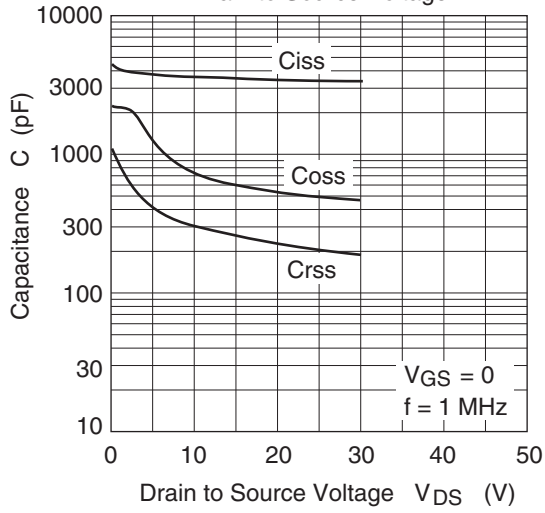

Forward Transfer Admittance vs. Drain Current



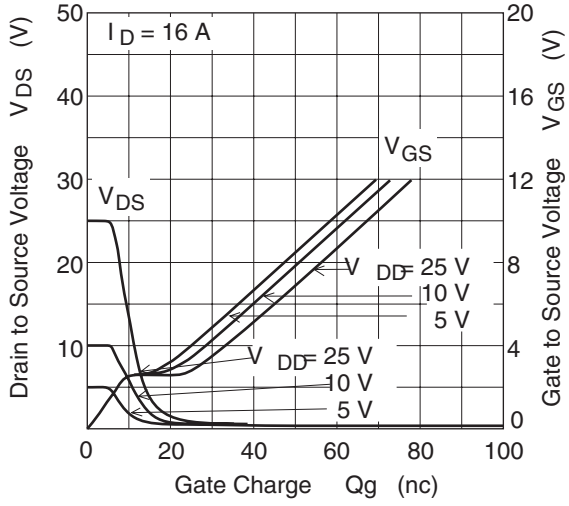
Body - Drain Diode Reverse Recovery Time



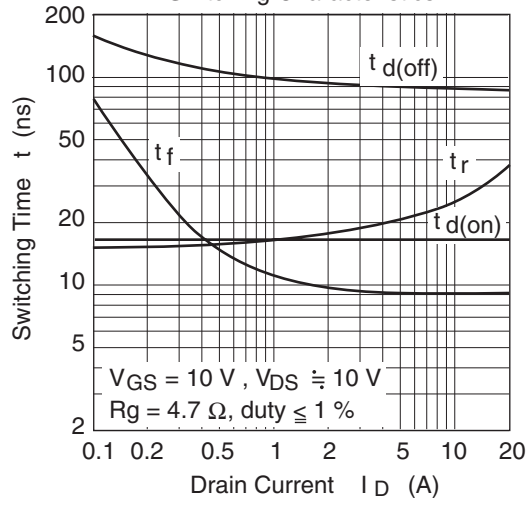

Typical Capacitance vs. Drain to Source Voltage



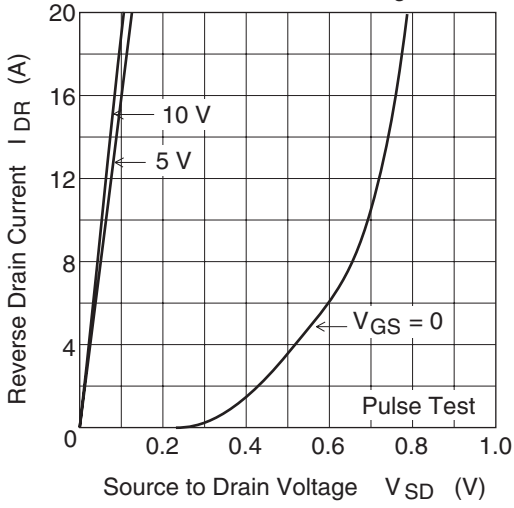

Dynamic Input Characteristics



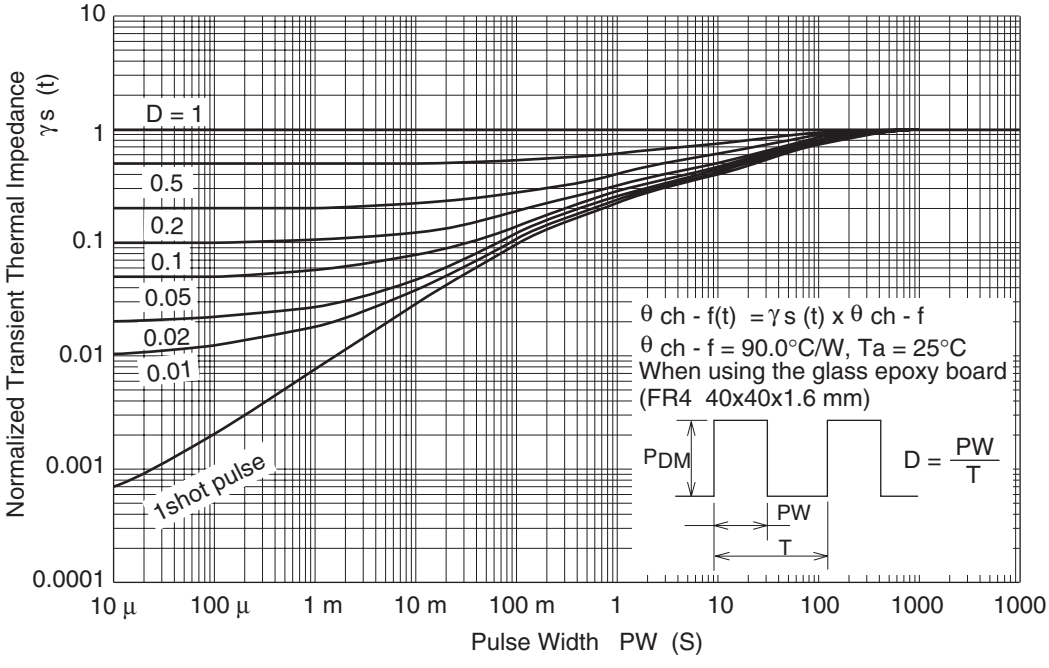

Switching Characteristics



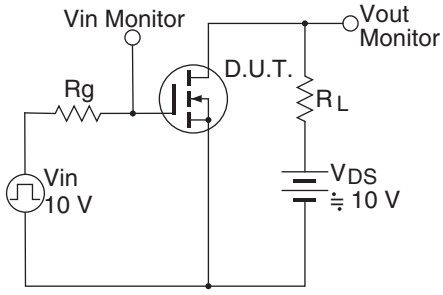
Reverse Drain Current vs.
Source to Drain Voltage



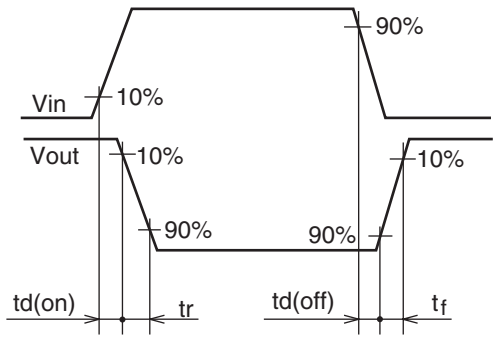

Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

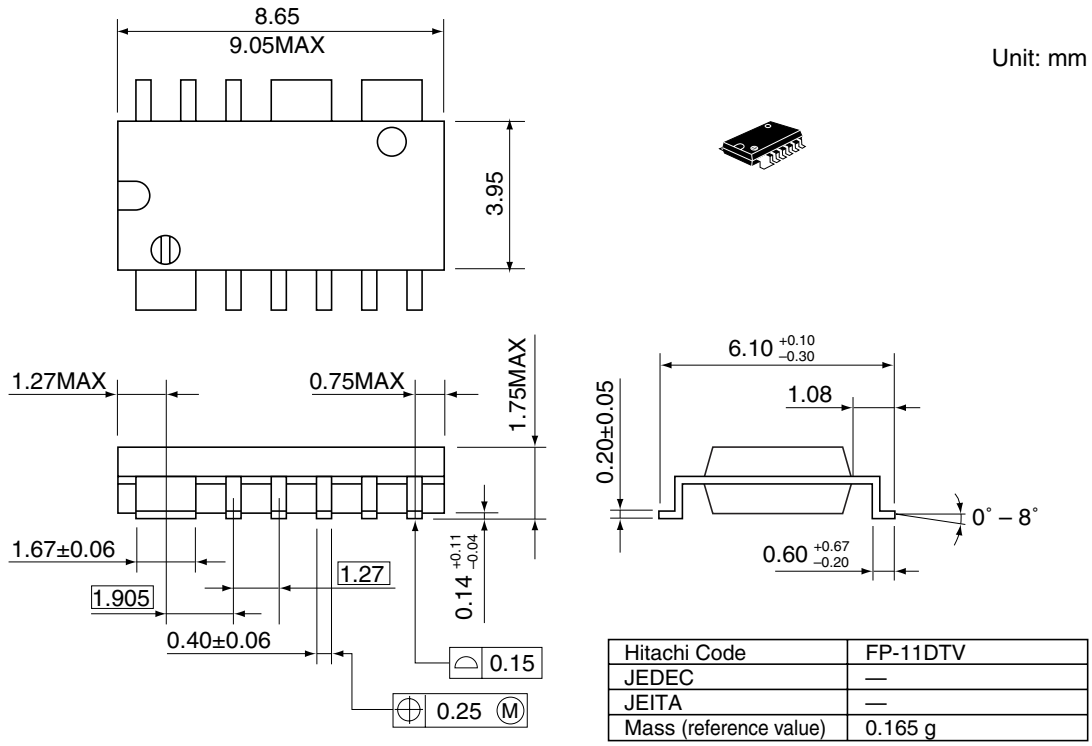



Switching Time Waveform



## Package Dimensions

Unit: mm




| | |
|---|---|
| Hitachi Code | FP-11DTV |
| JEDEC | — |
| JEITA | — |
| Mass (reference value) | 0.165 g |

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