

# HAT3008R, HAT3008RJ

Silicon N / P Channel Power MOS FET  
High Speed Power Switching

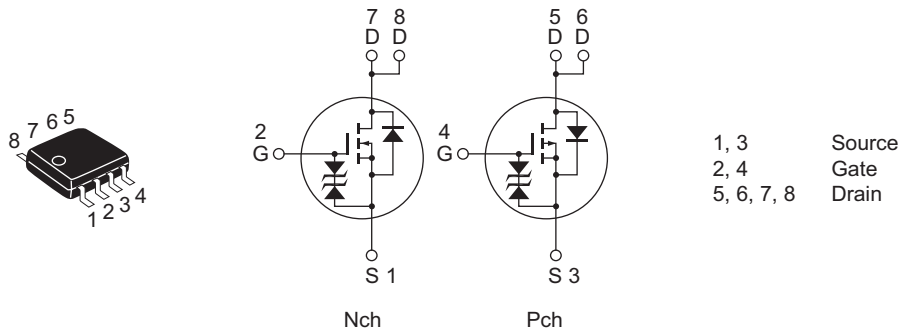
REJ03G1198-0400  
(Previous: ADE-208-536B)  
Rev.4.00  
Sep 07, 2005

## Features

- For Automotive Application (at Type Code "J")
- Low on-resistance
- Capable of 4 V gate drive
- High density mounting

## Outline

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



## Absolute Maximum Ratings

(Ta = 25°C)

| Item                                   | Symbol                           | Value                      |             | Unit |
|----------------------------------------|----------------------------------|----------------------------|-------------|------|
|                                        |                                  | Nch                        | Pch         |      |
| Drain to source voltage                | $V_{DSS}$                        | 60                         | -60         | V    |
| Gate to source voltage                 | $V_{GSS}$                        | $\pm 20$                   | $\pm 20$    | V    |
| Drain current                          | $I_D$                            | 5                          | -3.5        | A    |
| Drain peak current                     | $I_{D(pulse)}$ <sup>Note 1</sup> | 40                         | -28         | A    |
| Body-drain diode reverse drain current | $I_{DR}$                         | 5                          | -3.5        | A    |
| Avalanche current                      | HAT3008R                         | $I_{AP}$ <sup>Note 4</sup> | —           | —    |
|                                        | HAT3008RJ                        |                            | 5           | -3.5 |
| Avalanche energy                       | HAT3008R                         | $E_{AR}$ <sup>Note 4</sup> | —           | —    |
|                                        | HAT3008RJ                        |                            | 2.14        | 1.05 |
| Channel dissipation                    | $P_{ch}$ <sup>Note 2</sup>       | 2                          | 2           | W    |
| Channel dissipation                    | $P_{ch}$ <sup>Note 3</sup>       | 3                          | 3           | W    |
| Channel temperature                    | $T_{ch}$                         | 150                        | 150         | °C   |
| Storage temperature                    | $T_{stg}$                        | -55 to +150                | -55 to +150 | °C   |

Notes: 1.  $PW \leq 10 \mu s$ , duty cycle  $\leq 1\%$ 2. 1 Drive operation: When using the glass epoxy board (FR4 40 × 40 × 1.6 mm),  $PW \leq 10 s$ 3. 2 Drive operation: When using the glass epoxy board (FR4 40 × 40 × 1.6 mm),  $PW \leq 10 s$ 4. Value at  $T_{ch} = 25^\circ C$ ,  $R_g \geq 50 \Omega$ 

## Electrical Characteristics

## N Channel

(Ta = 25°C)

| Item                                       | Symbol        | Min       | Typ   | Max      | Unit     | Test Conditions                                                              |
|--------------------------------------------|---------------|-----------|-------|----------|----------|------------------------------------------------------------------------------|
| Drain to source breakdown voltage          | $V_{(BR)DSS}$ | 60        | —     | —        | V        | $I_D = 10 \text{ mA}$ , $V_{GS} = 0$                                         |
| Gate to source breakdown voltage           | $V_{(BR)GSS}$ | $\pm 20$  | —     | —        | V        | $I_G = \pm 100 \mu A$ , $V_{DS} = 0$                                         |
| Gate to source leak current                | $I_{GSS}$     | —         | —     | $\pm 10$ | $\mu A$  | $V_{GS} = \pm 16 \text{ V}$ , $V_{DS} = 0$                                   |
| Zero gate voltage drain current            | HAT3008R      | $I_{DSS}$ | —     | 1        | $\mu A$  | $V_{DS} = 60 \text{ V}$ , $V_{GS} = 0$                                       |
|                                            | HAT3008RJ     | $I_{DSS}$ | —     | 0.1      | $\mu A$  |                                                                              |
| Zero gate voltage drain current            | HAT3008R      | $I_{DSS}$ | —     | —        | $\mu A$  | $V_{DS} = 48 \text{ V}$ , $V_{GS} = 0$<br>$T_a = 125^\circ C$                |
|                                            | HAT3008RJ     | $I_{DSS}$ | —     | 10       | $\mu A$  |                                                                              |
| Gate to source cutoff voltage              | $V_{GS(off)}$ | 1.2       | —     | 2.2      | V        | $V_{DS} = 10 \text{ V}$ , $I_D = 1 \text{ mA}$                               |
| Static drain to source on state resistance | $R_{DS(on)}$  | —         | 0.043 | 0.058    | $\Omega$ | $I_D = 3 \text{ A}$ , $V_{GS} = 10 \text{ V}$ <sup>Note 5</sup>              |
|                                            | $R_{DS(on)}$  | —         | 0.056 | 0.084    | $\Omega$ | $I_D = 3 \text{ A}$ , $V_{GS} = 4 \text{ V}$ <sup>Note 5</sup>               |
| Forward transfer admittance                | $ y_{fs} $    | 6         | 9     | —        | S        | $I_D = 3 \text{ A}$ , $V_{DS} = 10 \text{ V}$ <sup>Note 5</sup>              |
| Input capacitance                          | $C_{iss}$     | —         | 520   | —        | pF       | $V_{DS} = 10 \text{ V}$<br>$V_{GS} = 0$<br>$f = 1 \text{ MHz}$               |
| Output capacitance                         | $C_{oss}$     | —         | 270   | —        | pF       |                                                                              |
| Reverse transfer capacitance               | $C_{rss}$     | —         | 100   | —        | pF       |                                                                              |
| Turn-on delay time                         | $t_{d(on)}$   | —         | 11    | —        | ns       | $V_{GS} = 10 \text{ V}$ , $I_D = 3 \text{ A}$<br>$V_{DD} \cong 30 \text{ V}$ |
| Rise time                                  | $t_r$         | —         | 40    | —        | ns       |                                                                              |
| Turn-off delay time                        | $t_{d(off)}$  | —         | 110   | —        | ns       |                                                                              |
| Fall time                                  | $t_f$         | —         | 80    | —        | ns       |                                                                              |
| Body-drain diode forward voltage           | $V_{DF}$      | —         | 0.84  | 1.1      | V        | $I_F = 5 \text{ A}$ , $V_{GS} = 0$ <sup>Note 5</sup>                         |
| Body-drain diode reverse recovery time     | $t_{rr}$      | —         | 40    | —        | ns       | $I_F = 5 \text{ A}$ , $V_{GS} = 0$<br>$di_F/dt = 50 \text{ A}/\mu s$         |

Note: 5. Pulse test

## P Channel

(Ta = 25°C)

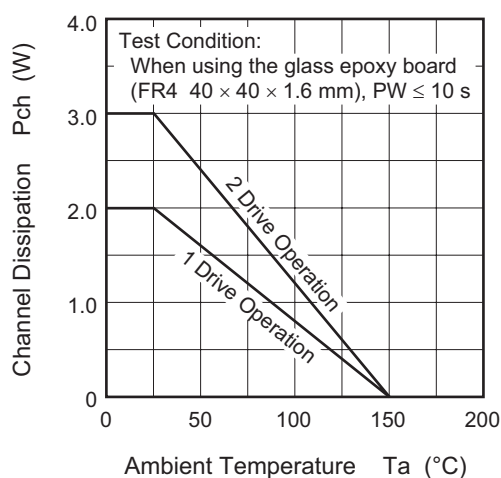
| Item                                       |           | Symbol        | Min      | Typ   | Max      | Unit          | Test Conditions                                                              |
|--------------------------------------------|-----------|---------------|----------|-------|----------|---------------|------------------------------------------------------------------------------|
| Drain to source breakdown voltage          |           | $V_{(BR)DSS}$ | -60      | —     | —        | V             | $I_D = -10\text{ mA}$ , $V_{GS} = 0$                                         |
| Gate to source breakdown voltage           |           | $V_{(BR)GSS}$ | $\pm 20$ | —     | —        | V             | $I_G = \pm 100\text{ }\mu\text{A}$ , $V_{DS} = 0$                            |
| Gate to source leak current                |           | $I_{GSS}$     | —        | —     | $\pm 10$ | $\mu\text{A}$ | $V_{GS} = \pm 16\text{ V}$ , $V_{DS} = 0$                                    |
| Zero gate voltage drain current            | HAT3008R  | $I_{DSS}$     | —        | —     | -1       | $\mu\text{A}$ | $V_{DS} = -60\text{ V}$ , $V_{GS} = 0$                                       |
|                                            | HAT3008RJ | $I_{DSS}$     | —        | —     | -0.1     | $\mu\text{A}$ |                                                                              |
| Zero gate voltage drain current            | HAT3008R  | $I_{DSS}$     | —        | —     | —        | $\mu\text{A}$ | $V_{DS} = -48\text{ V}$ , $V_{GS} = 0$<br>$T_a = 125^\circ\text{C}$          |
|                                            | HAT3008RJ | $I_{DSS}$     | —        | —     | -10      | $\mu\text{A}$ |                                                                              |
| Gate to source cutoff voltage              |           | $V_{GS(off)}$ | -1.2     | —     | -2.2     | V             | $V_{DS} = -10\text{ V}$ , $I_D = -1\text{ mA}$                               |
| Static drain to source on state resistance |           | $R_{DS(on)}$  | —        | 0.12  | 0.15     | $\Omega$      | $I_D = -2\text{ A}$ , $V_{GS} = -10\text{ V}$ <sup>Note 6</sup>              |
|                                            |           | $R_{DS(on)}$  | —        | 0.16  | 0.23     | $\Omega$      | $I_D = -2\text{ A}$ , $V_{GS} = -4\text{ V}$ <sup>Note 6</sup>               |
| Forward transfer admittance                |           | $ y_{fs} $    | 3        | 4.5   | —        | S             | $I_D = -2\text{ A}$ , $V_{DS} = -10\text{ V}$ <sup>Note 6</sup>              |
| Input capacitance                          |           | $C_{iss}$     | —        | 600   | —        | pF            | $V_{DS} = -10\text{ V}$<br>$V_{GS} = 0$<br>$f = 1\text{ MHz}$                |
| Output capacitance                         |           | $C_{oss}$     | —        | 290   | —        | pF            |                                                                              |
| Reverse transfer capacitance               |           | $C_{rss}$     | —        | 75    | —        | pF            |                                                                              |
| Turn-on delay time                         |           | $t_{d(on)}$   | —        | 11    | —        | ns            | $V_{GS} = -10\text{ V}$ , $I_D = -2\text{ A}$<br>$V_{DD} \cong -30\text{ V}$ |
| Rise time                                  |           | $t_r$         | —        | 30    | —        | ns            |                                                                              |
| Turn-off delay time                        |           | $t_{d(off)}$  | —        | 100   | —        | ns            |                                                                              |
| Fall time                                  |           | $t_f$         | —        | 55    | —        | ns            |                                                                              |
| Body-drain diode forward voltage           |           | $V_{DF}$      | —        | -0.98 | -1.28    | V             | $I_F = -3.5\text{ A}$ , $V_{GS} = 0$ <sup>Note 6</sup>                       |
| Body-drain diode reverse recovery time     |           | $t_{rr}$      | —        | 70    | —        | ns            | $I_F = -3.5\text{ A}$ , $V_{GS} = 0$<br>$di_F/dt = 50\text{ A}/\mu\text{s}$  |

Note: 6. Pulse test

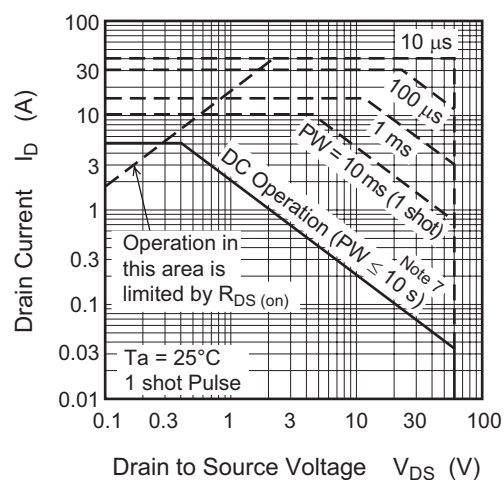
## Main Characteristics

## N Channel

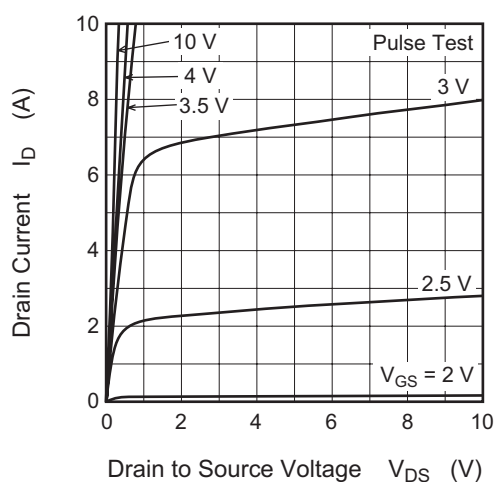
Power vs. Temperature Derating



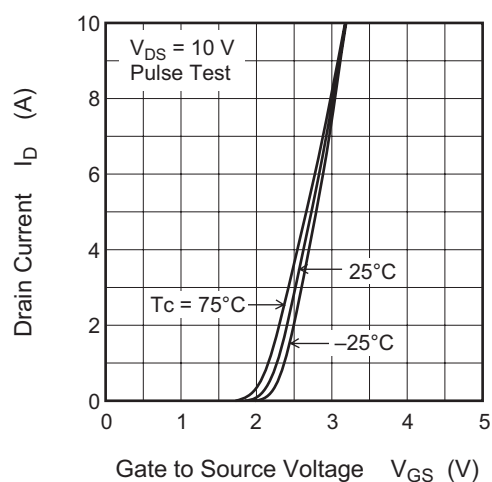
Maximum Safe Operation Area



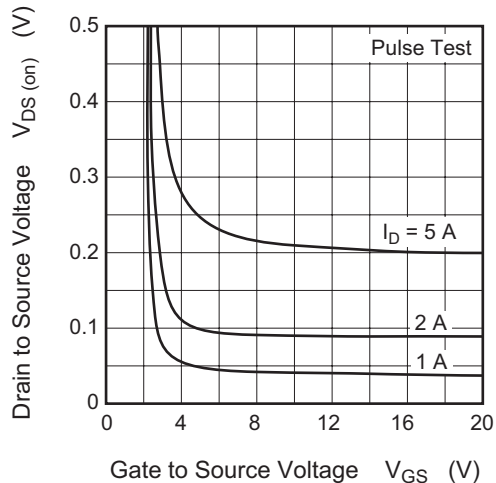
Typical Output Characteristics



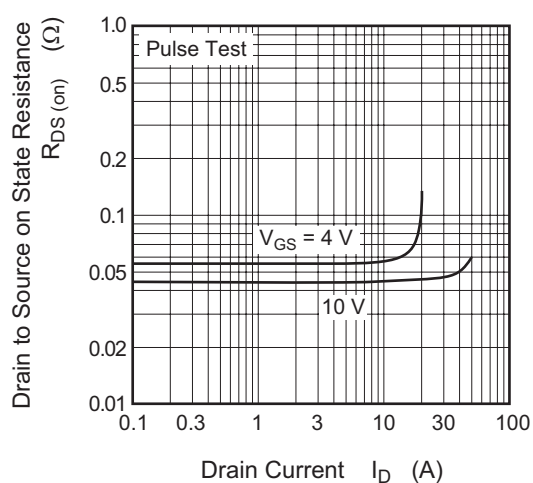
Typical Transfer Characteristics

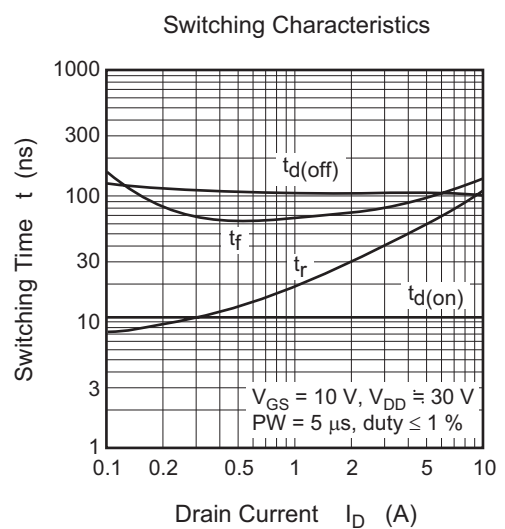
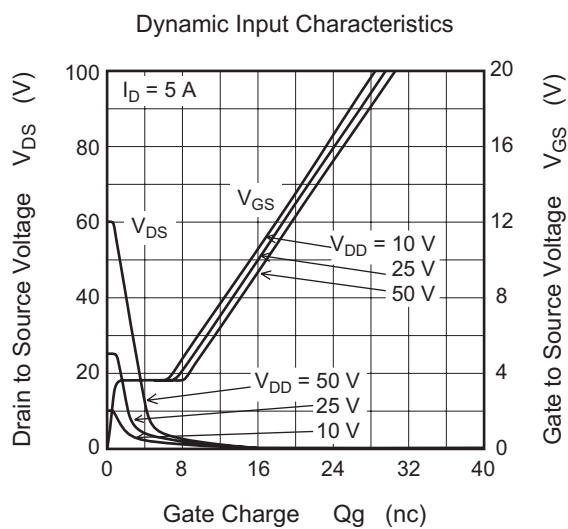
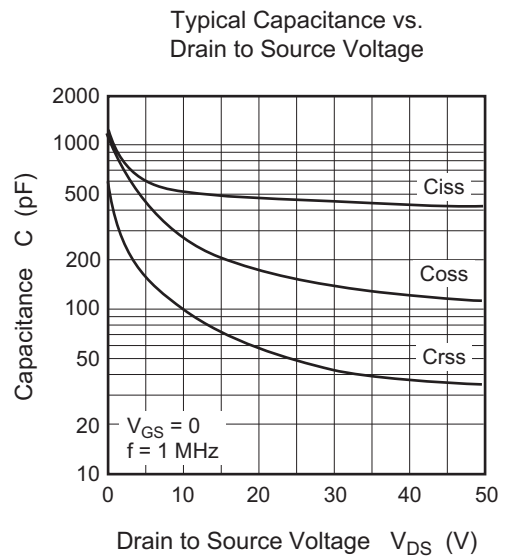
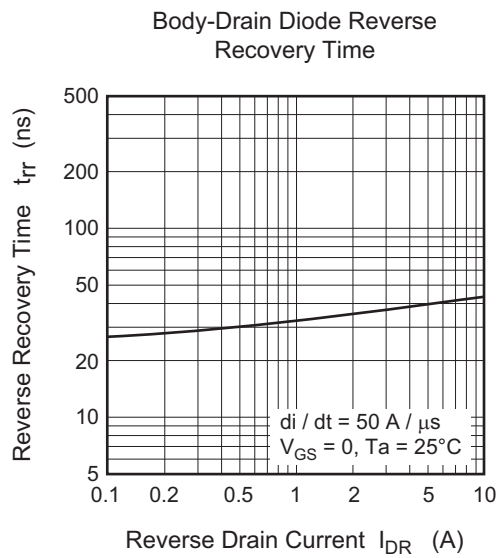
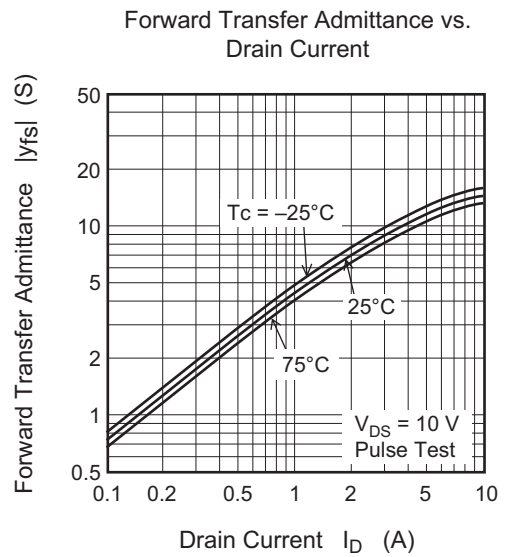
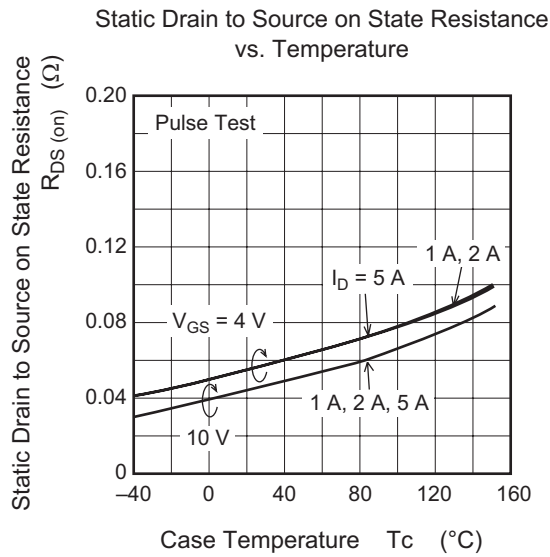


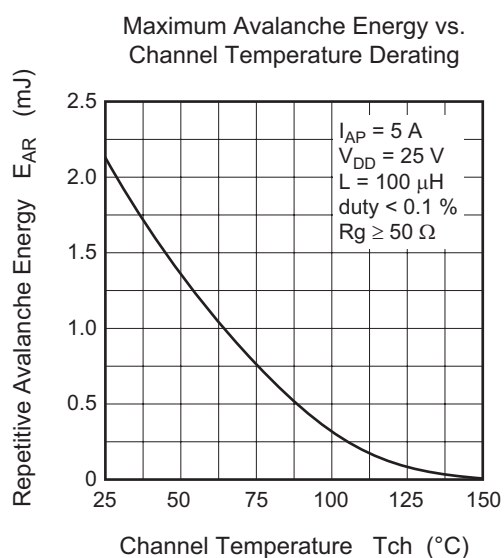
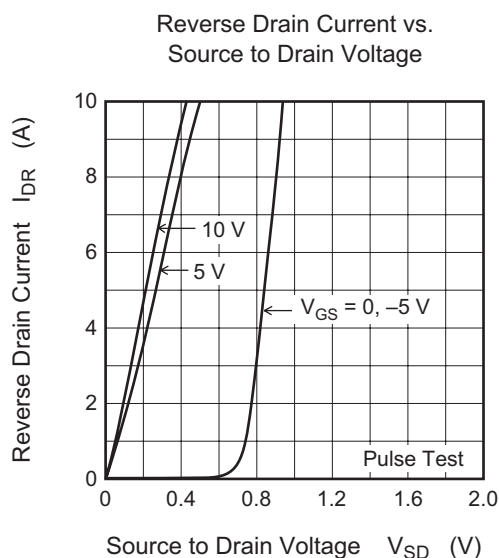
Drain to Source Saturation Voltage vs. Gate to Source Voltage



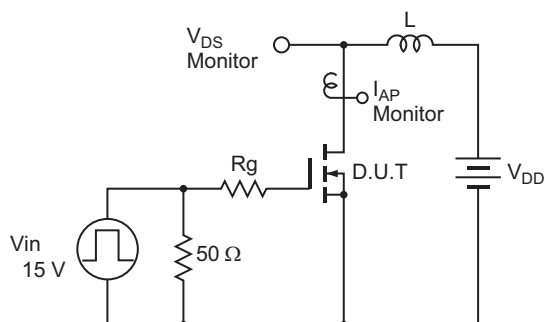
Static Drain to Source on State Resistance vs. Drain Current



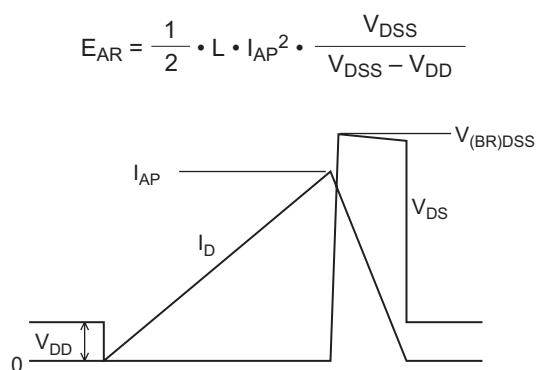




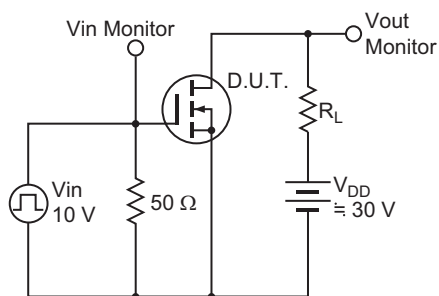
Avalanche Test Circuit



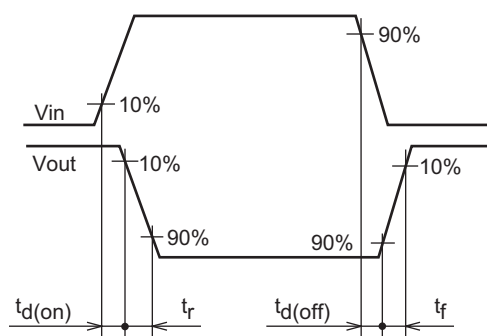
Avalanche Waveform



Switching Time Test Circuit

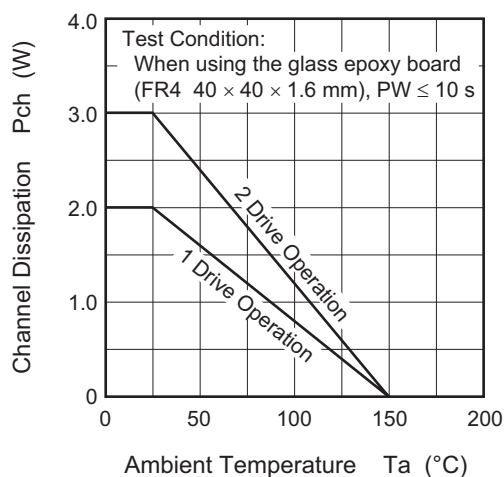


Switching Time Waveform

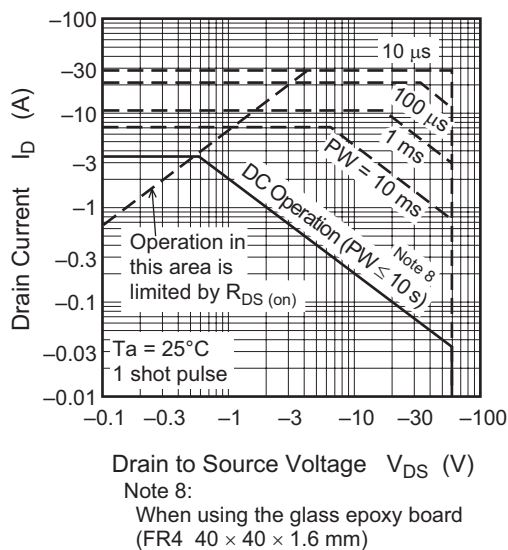


## P Channel

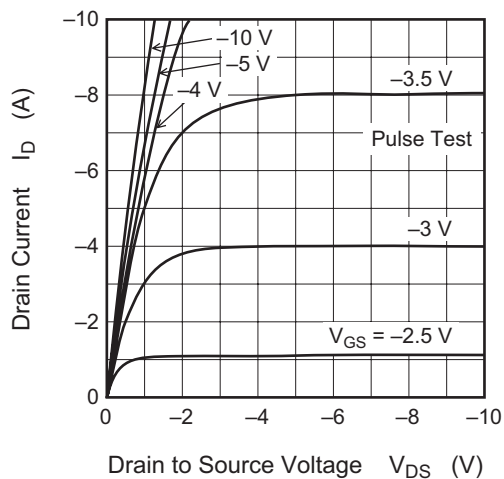
Power vs. Temperature Derating



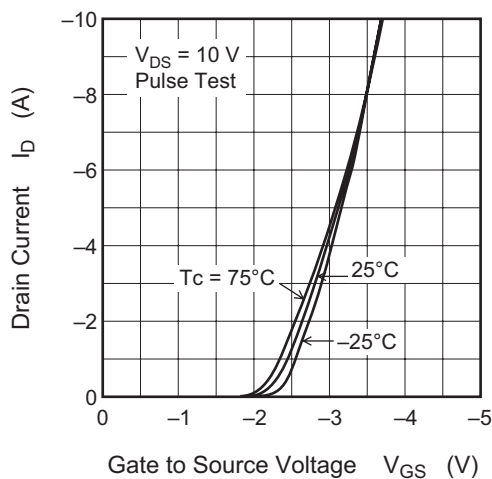
Maximum Safe Operation Area



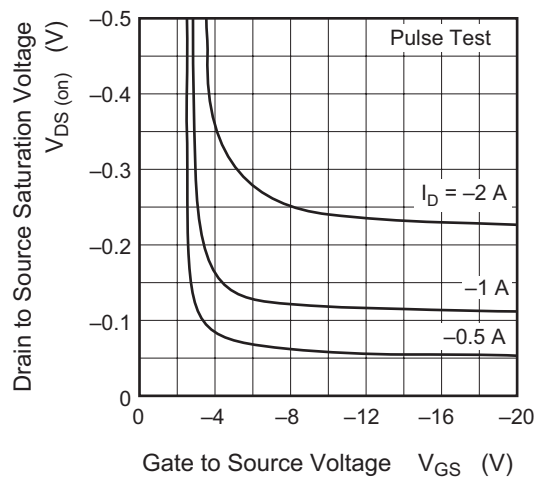
Typical Output Characteristics



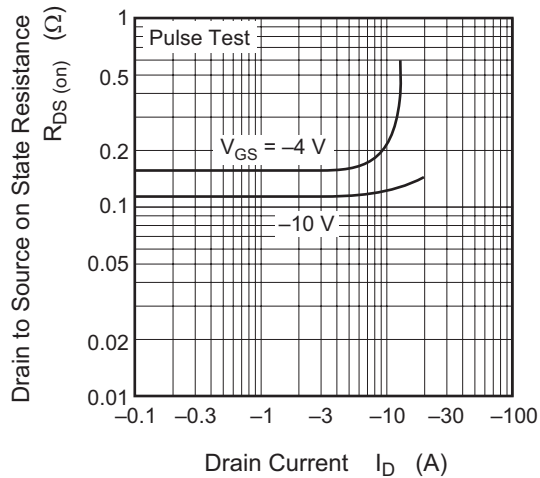
Typical Transfer Characteristics

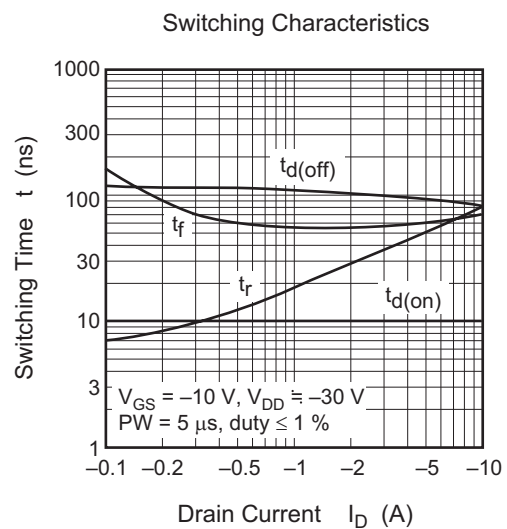
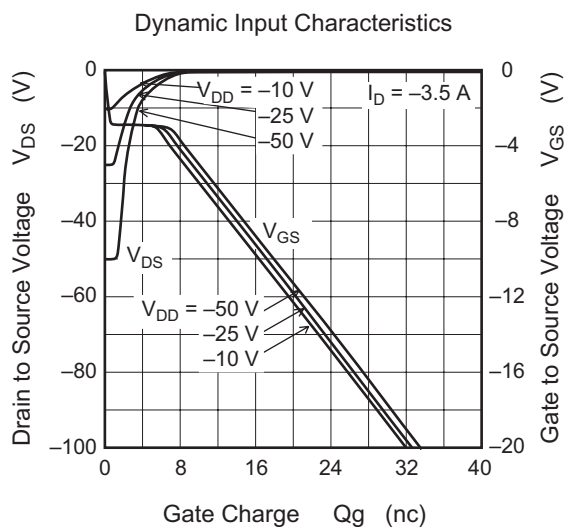
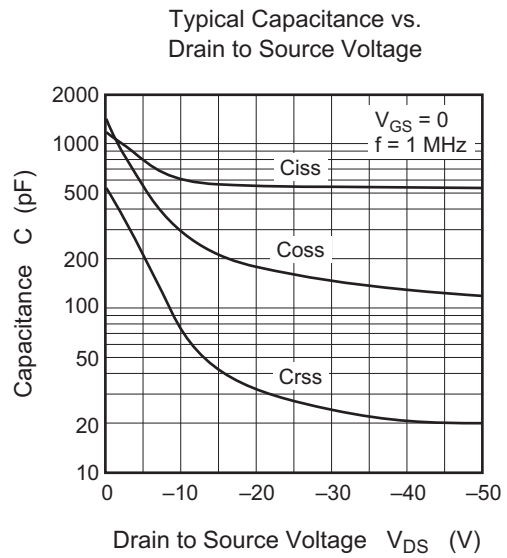
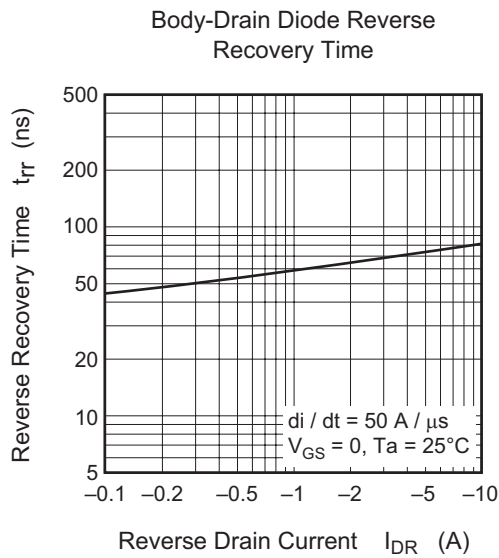
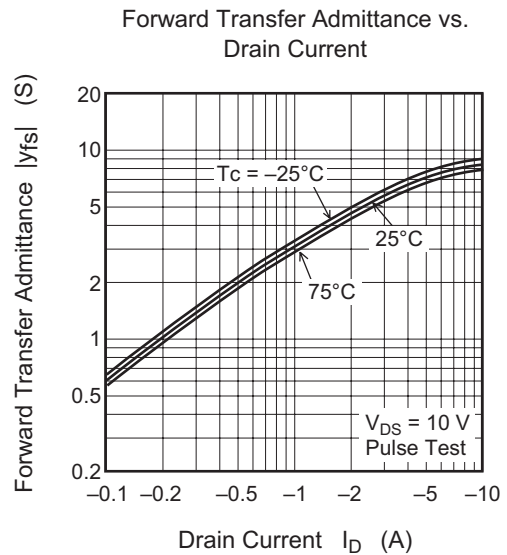
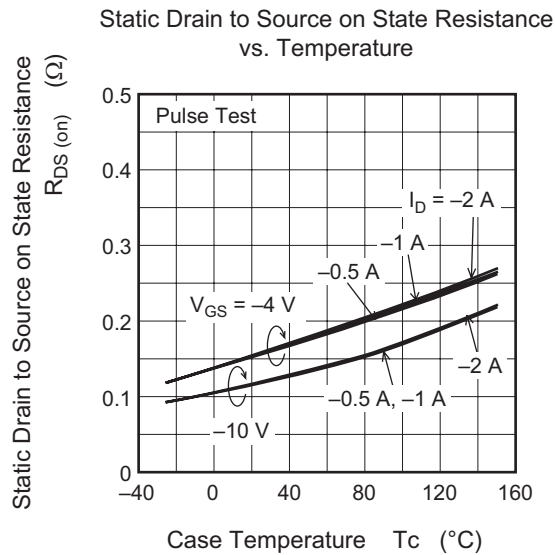


Drain to Source Saturation Voltage vs. Gate to Source Voltage

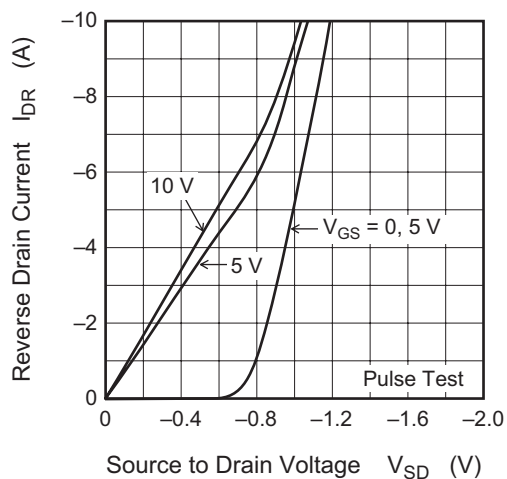
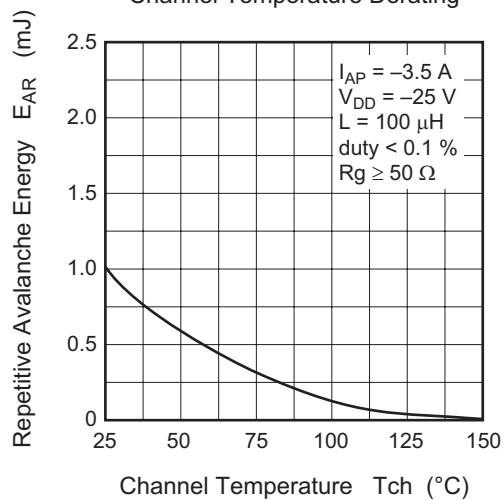


Static Drain to Source on State Resistance vs. Drain Current

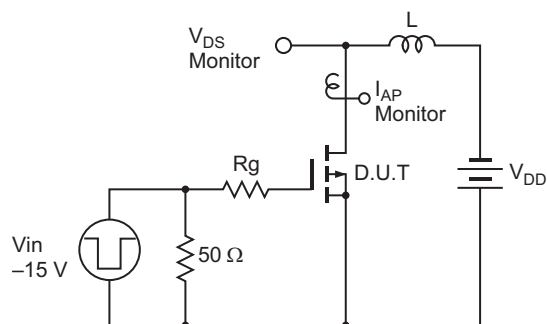




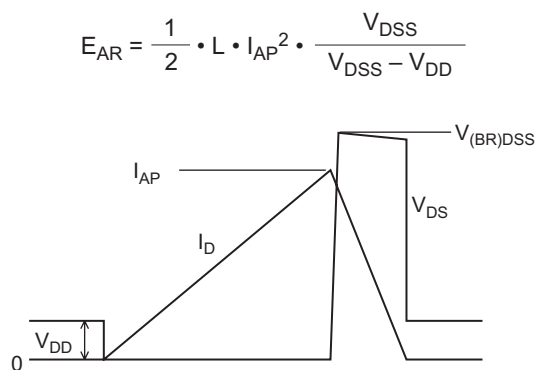


Reverse Drain Current vs.  
Source to Drain Voltage

Maximum Avalanche Energy vs.  
Channel Temperature Derating


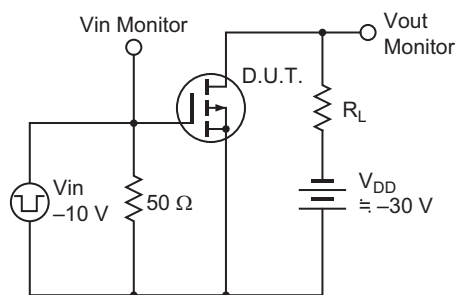
Avalanche Test Circuit



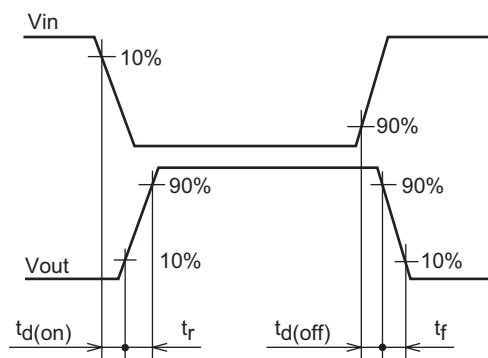
Avalanche Waveform



Switching Time Test Circuit

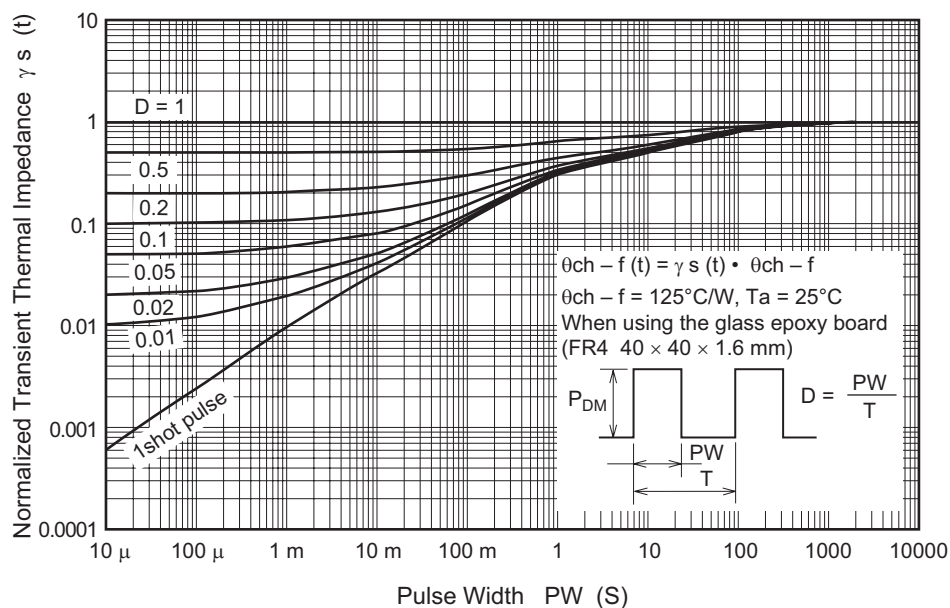


Switching Time Waveform

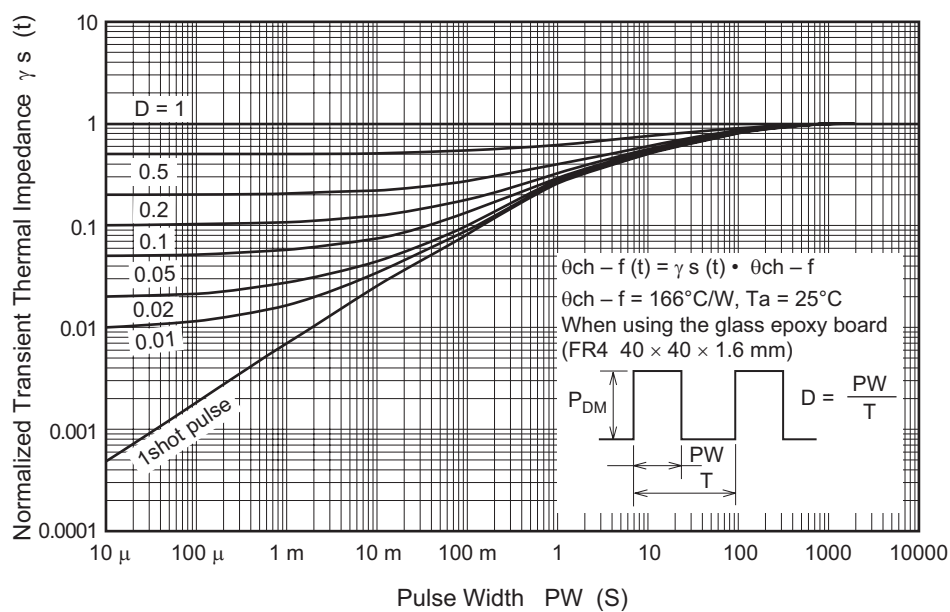


## Common

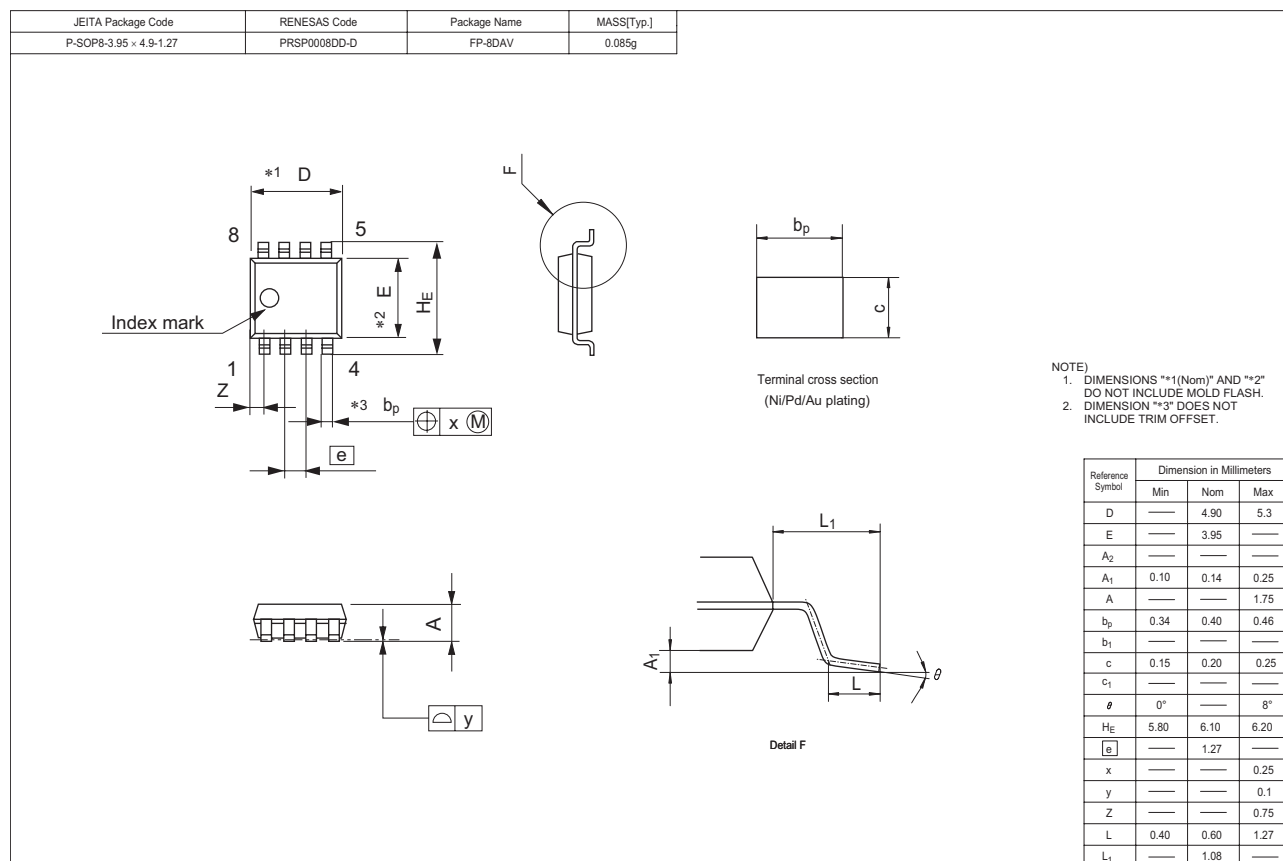
Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



Normalized Transient Thermal Impedance vs. Pulse Width (2 Drive Operation)



## Package Dimensions



## Ordering Information

| Part Name      | Quantity | Shipping Container |
|----------------|----------|--------------------|
| HAT3008R-EL-E  | 2500 pcs | Taping             |
| HAT3008RJ-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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