

# HAT3008R/HAT3008RJ

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

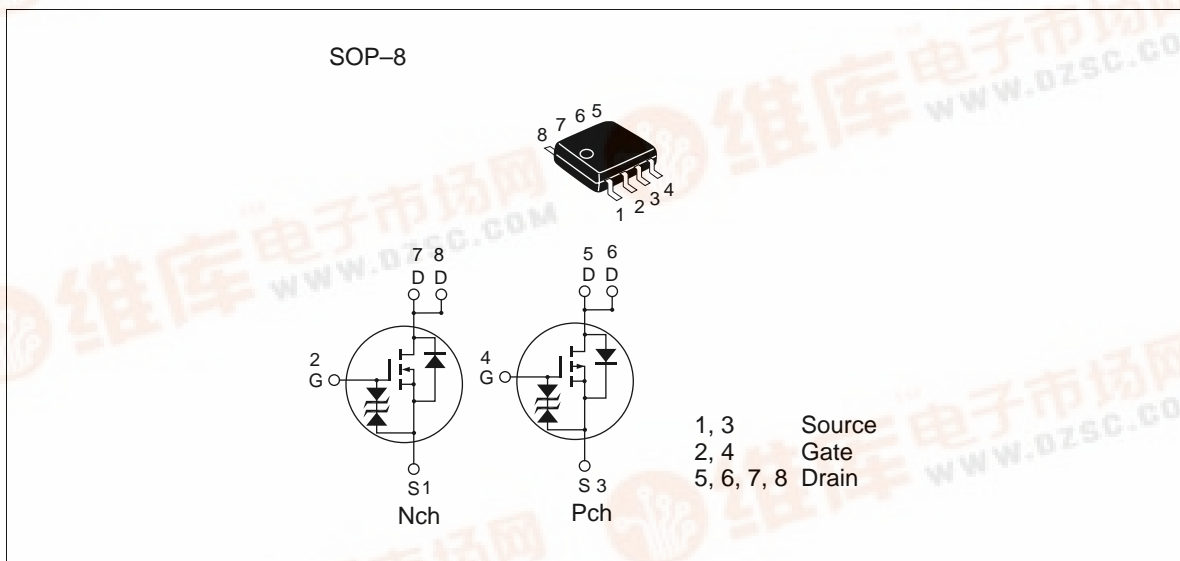
# HITACHI

ADE-208-536B (Z)  
3rd. Edition  
February 1999

## Features

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

## Outline



## HAT3008R/HAT3008RJ

### Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings		Unit
		Nch	Pch	
Drain to source voltage	$V_{DSS}$	60	- 60	V
Gate to source voltage	$V_{GSS}$	±20	± 20	V
Drain current	$I_D$	5	- 3.5	A
Drain peak current	$I_{D(pulse)}$ <sup>Note1</sup>	40	- 28	A
Body-drain diode reverse drain current	$I_{DR}$	5	- 3.5	A
Avalanche current	HAT3008R $I_{AP}$ <sup>Note4</sup>	—	—	—
	HAT3008RJ	5	- 3.5	A
Avalanche energy	HAT3008R $E_{AR}$ <sup>Note4</sup>	—	—	—
	HAT3008RJ	2.14	1.05	mJ
Channel dissipation	$Pch$ <sup>Note2</sup>	2	2	W
Channel dissipation	$Pch$ <sup>Note3</sup>	3	3	W
Channel temperature	Tch	150	150	°C
Storage temperature	Tstg	- 55 to + 150	-55 to + 150	°C

- Note: 1.  $PW \leq 10\mu s$ , duty cycle  $\leq 1\%$   
 2. 1 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$   
 3. 2 Drive operation : When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$   
 4. Value at Tch=25°C, Rg $\geq 50\Omega$

## HAT3008R/HAT3008RJ

### Electrical Characteristics (Ta = 25°C)

( N Channel )

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 HAT3008RJ	$I_{DSS}$	—	—	1 0.1	$\mu\text{A}$ $V_{DS} = 60 \text{ V}, V_{GS} = 0$
Zero gate voltage drain current	HAT3008R HAT3008RJ	$I_{DSS}$	—	—	— 10	$\mu\text{A}$ $V_{DS} = 48 \text{ V}, V_{GS} = 0$ $T_a = 125^\circ\text{C}$
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>Note4</sup>
	$R_{DS(on)}$	—	0.056	0.084	$\Omega$	$I_D = 3 \text{ A}, V_{GS} = 4 \text{ V}$ <sup>Note4</sup>
Forward transfer admittance	$ y_{fs} $	6	9	—	S	$I_D = 3 \text{ A}, V_{DS} = 10 \text{ V}$ <sup>Note4</sup>
Input capacitance	$C_{iss}$	—	520	—	pF	$V_{DS} = 10 \text{ V}$
Output capacitance	$C_{oss}$	—	270	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	$C_{rss}$	—	100	—	pF	$f = 1\text{MHz}$
Turn-on delay time	$t_{d(on)}$	—	11	—	ns	$V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}$
Rise time	$t_r$	—	40	—	ns	$V_{DD} \cong 30 \text{ V}$
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>Note4</sup>
Body–drain diode reverse recovery time	$t_{rr}$	—	40	—	ns	$I_F = 5 \text{ A}, V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$

Note: 5. Pulse test

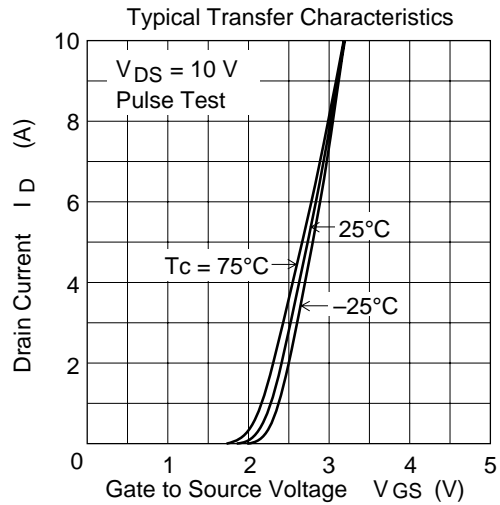
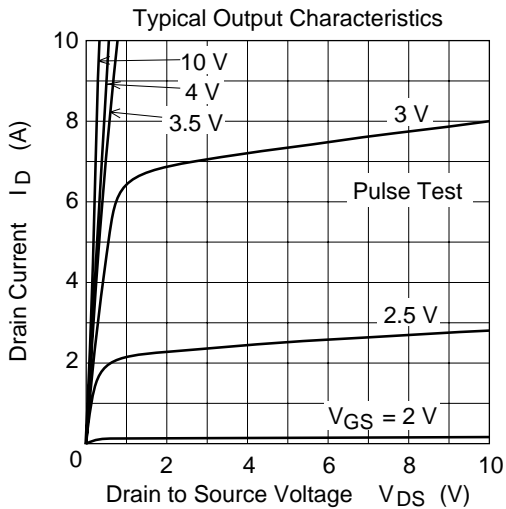
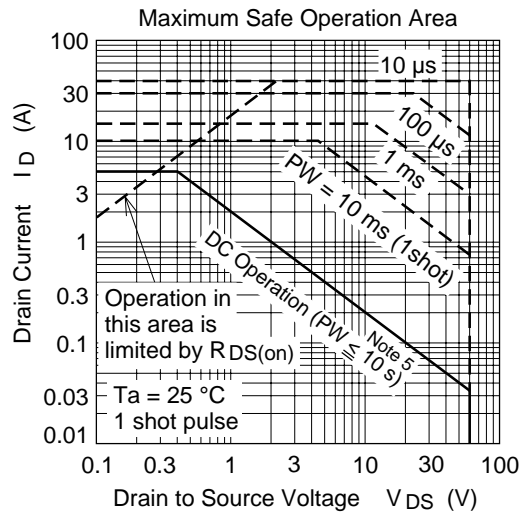
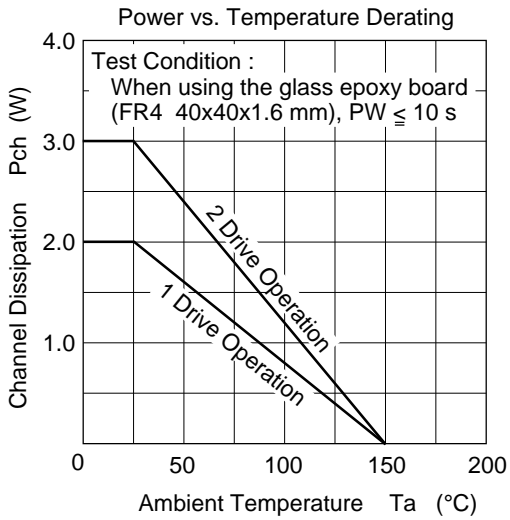
## HAT3008R/HAT3008RJ

( P Channel )

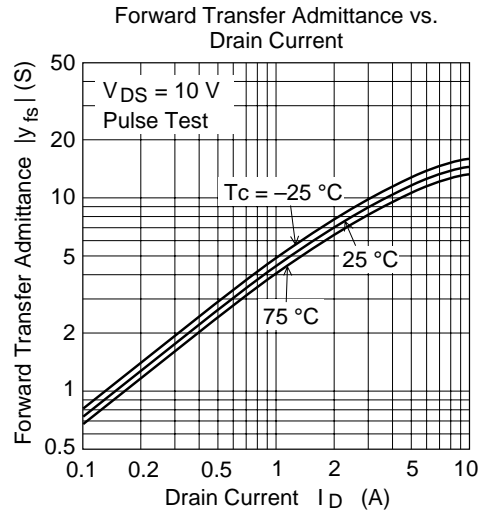
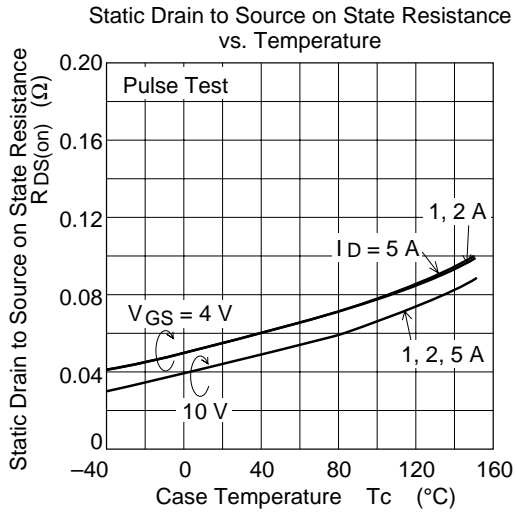
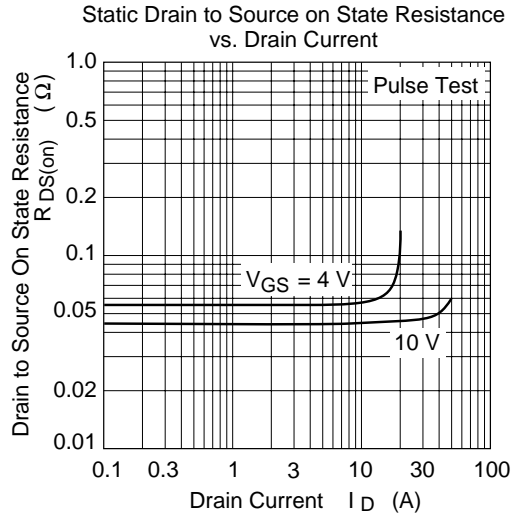
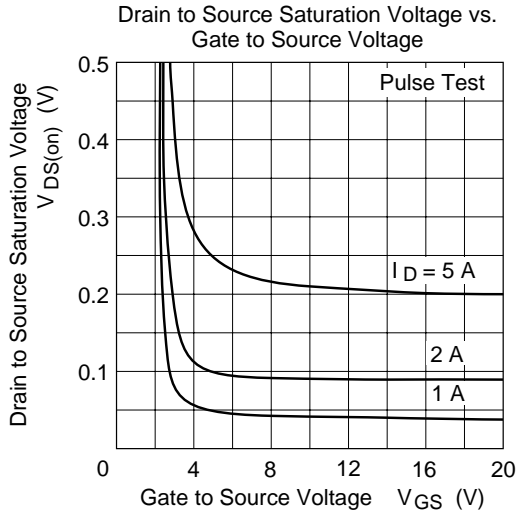
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	-60	—	—	V	$I_D = -10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	$\pm 20$	—	—	V	$I_G = \pm 100 \text{ }\mu\text{A}, V_{DS} = 0$
Gate to source leak current	$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0$
Zero gate voltage drain current	HAT3008R HAT3008RJ	$I_{DSS}$	—	—	-1 -0.1	$\mu\text{A}$ $V_{DS} = -60 \text{ V}, V_{GS} = 0$
Zero gate voltage drain current	HAT3008R HAT3008RJ	$I_{DSS}$	—	—	— -10	$\mu\text{A}$ $V_{DS} = -48 \text{ V}, V_{GS} = 0$ $T_a = 125^\circ\text{C}$
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>Note4</sup>
	$R_{DS(on)}$	—	0.16	0.23	$\Omega$	$I_D = -2 \text{ A}, V_{GS} = -4 \text{ V}$ <sup>Note4</sup>
Forward transfer admittance	$ y_{fs} $	3	4.5	—	S	$I_D = -2 \text{ A}, V_{DS} = -10 \text{ V}$ <sup>Note4</sup>
Input capacitance	$C_{iss}$	—	600	—	pF	$V_{DS} = -10 \text{ V}$
Output capacitance	$C_{oss}$	—	290	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	$C_{rss}$	—	75	—	pF	$f = 1 \text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	11	—	ns	$V_{GS} = -10 \text{ V}, I_D = -2 \text{ A}$
Rise time	$t_r$	—	30	—	ns	$V_{DD} \cong -30 \text{ V}$
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>Note4</sup>
Body-drain diode reverse recovery time	$t_{rr}$	—	70	—	ns	$I_F = -3.5 \text{ A}, V_{GS} = 0$ $di_F/dt = 50 \text{ A}/\mu\text{s}$

Note: 5. Pulse test

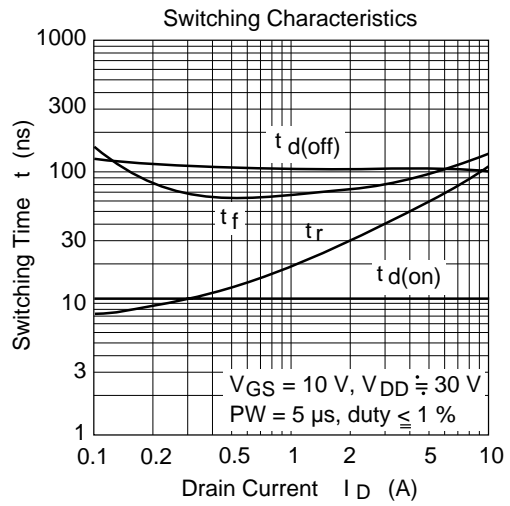
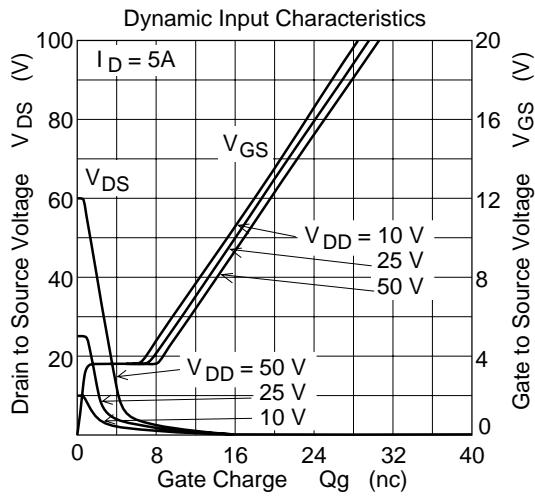
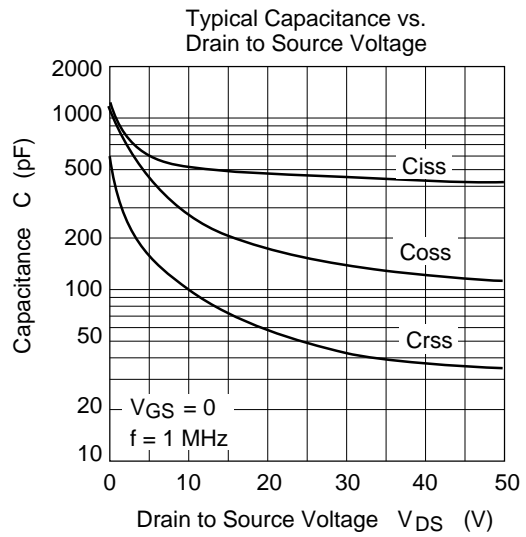
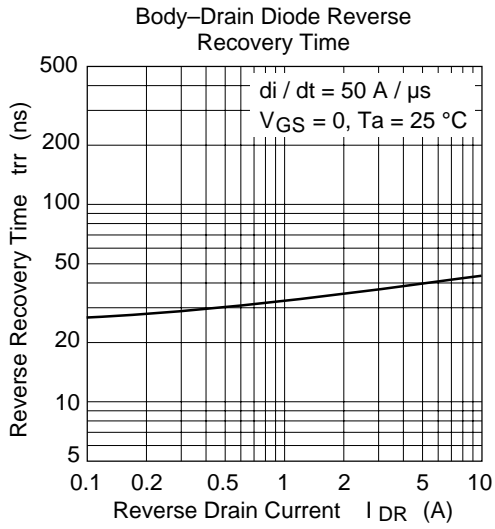
Main Characteristics ( N Channel )



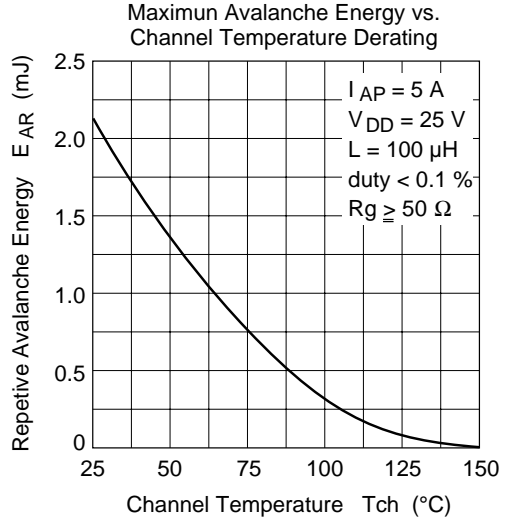
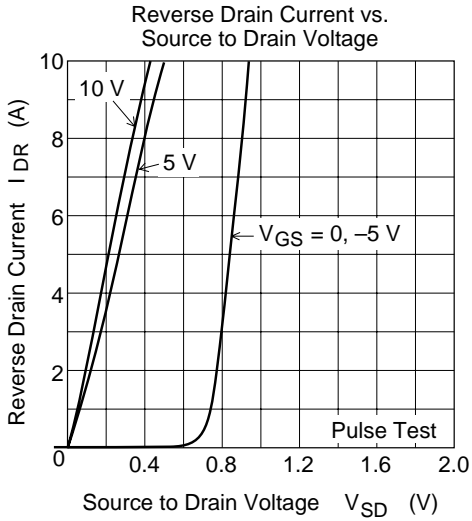
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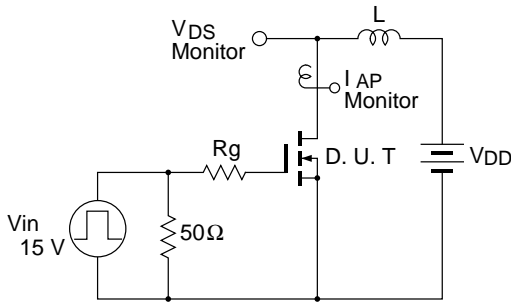
# HAT3008R/HAT3008RJ



# HAT3008R/HAT3008RJ

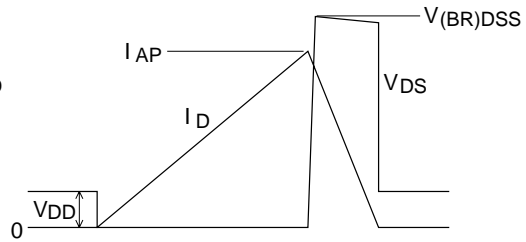


Avalanche Test Circuit

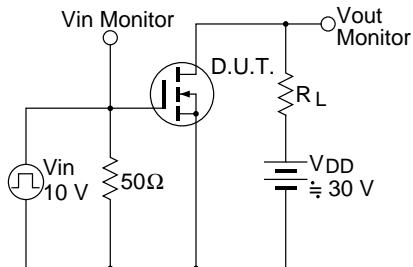


Avalanche Waveform

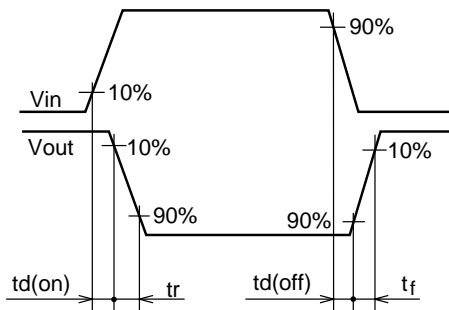
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



Switching Time Test Circuit

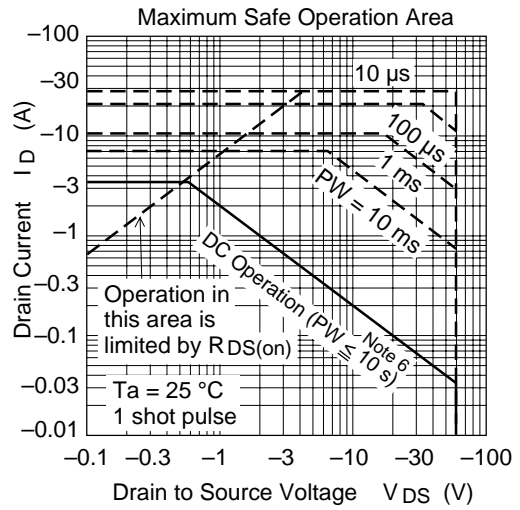
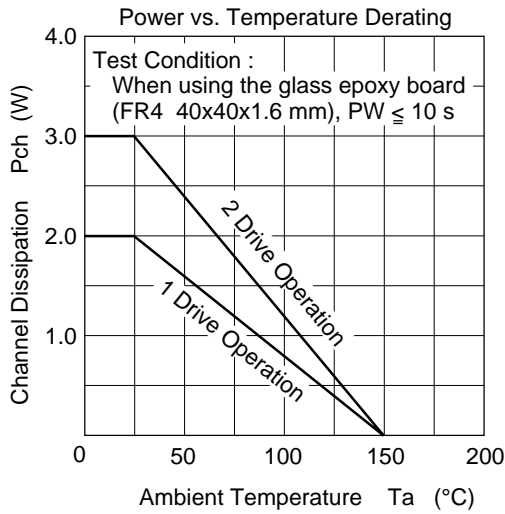


Switching Time Waveform

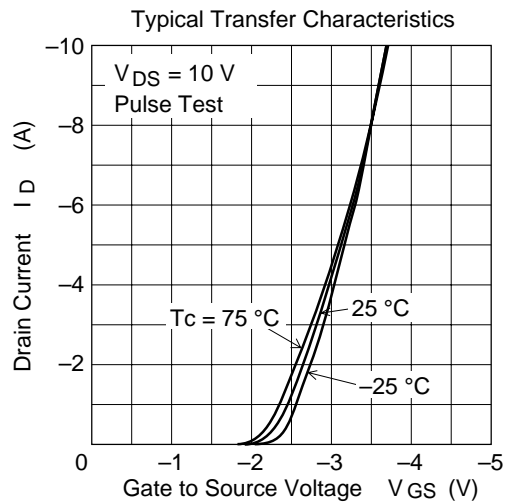
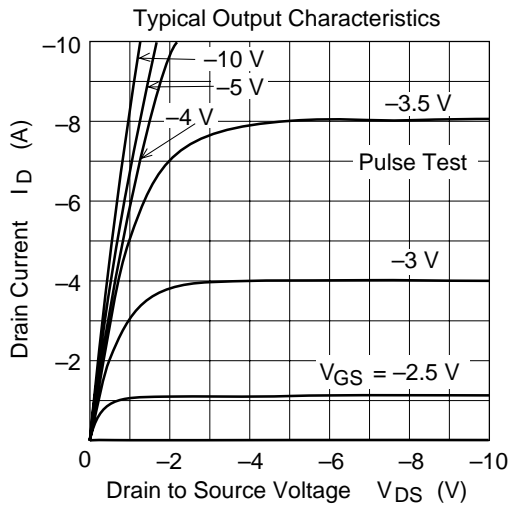




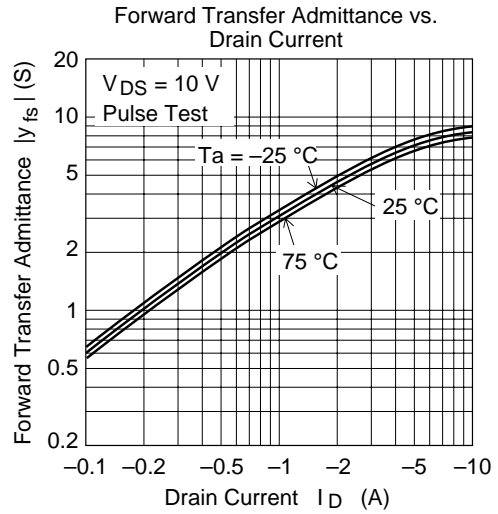
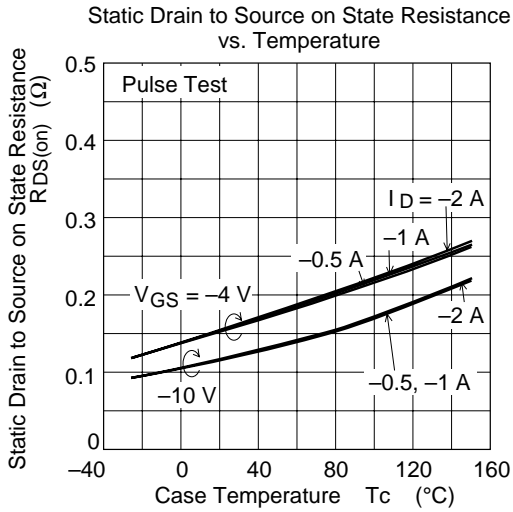
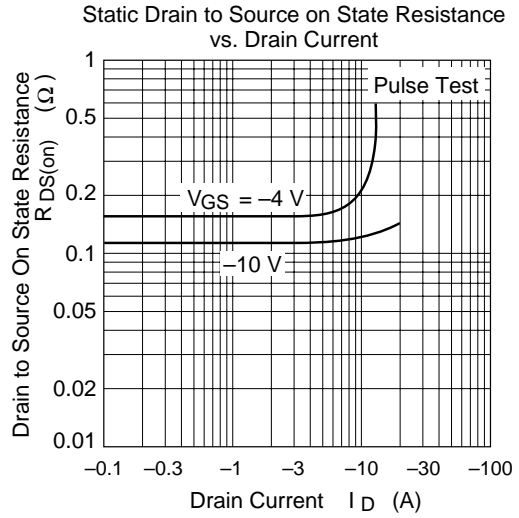
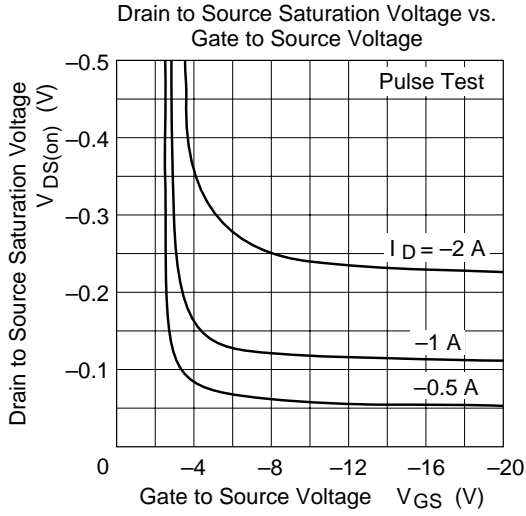
( P Channel )



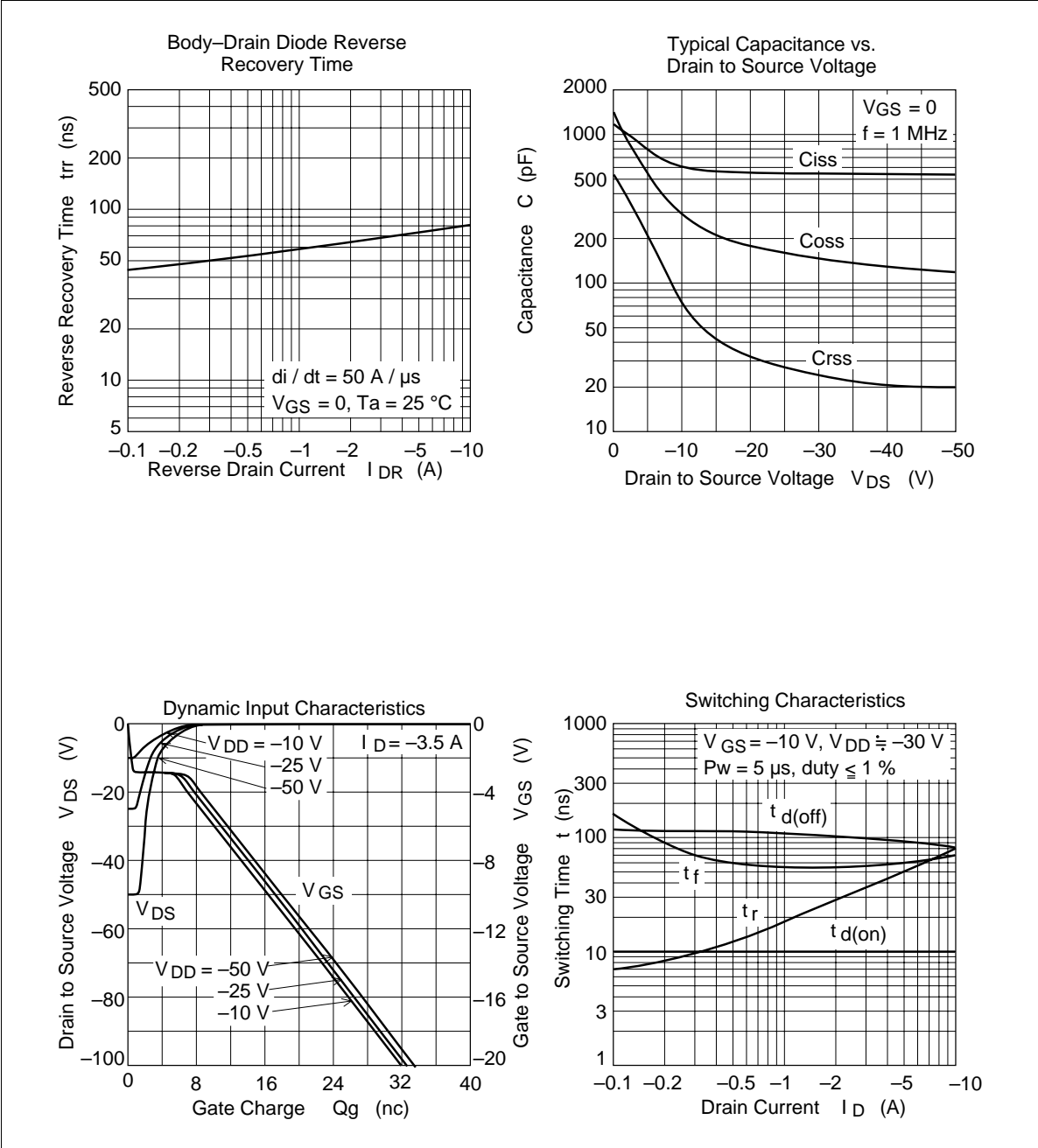
Note 6 :  
When using the glass epoxy board  
(FR4 40x40x1.6 mm)



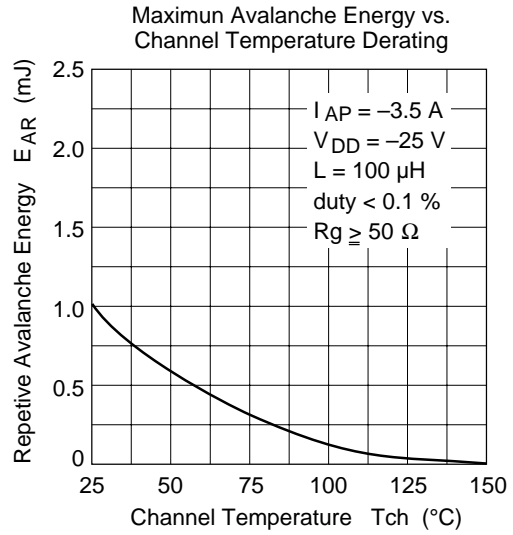
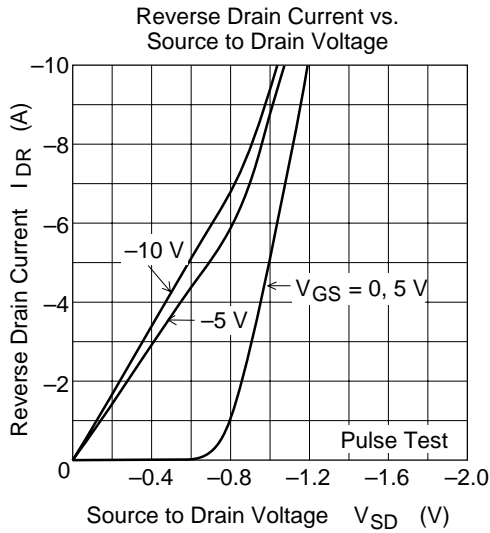
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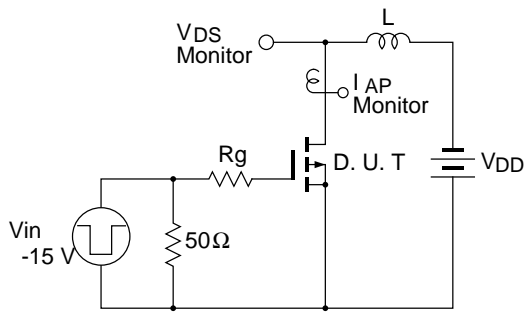
# HAT3008R/HAT3008RJ



# HAT3008R/HAT3008RJ

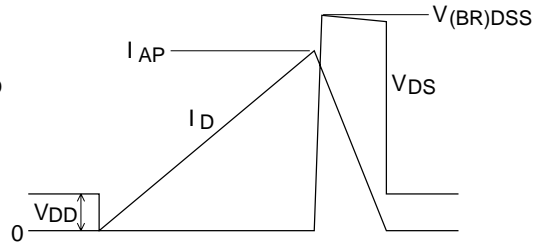


Avalanche Test Circuit

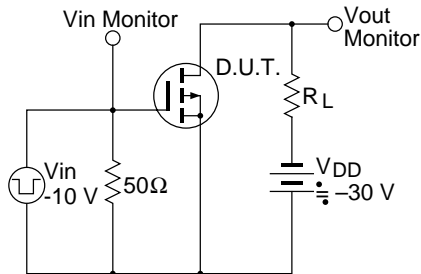


Avalanche Waveform

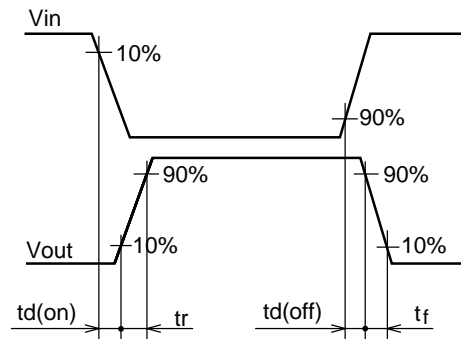
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$

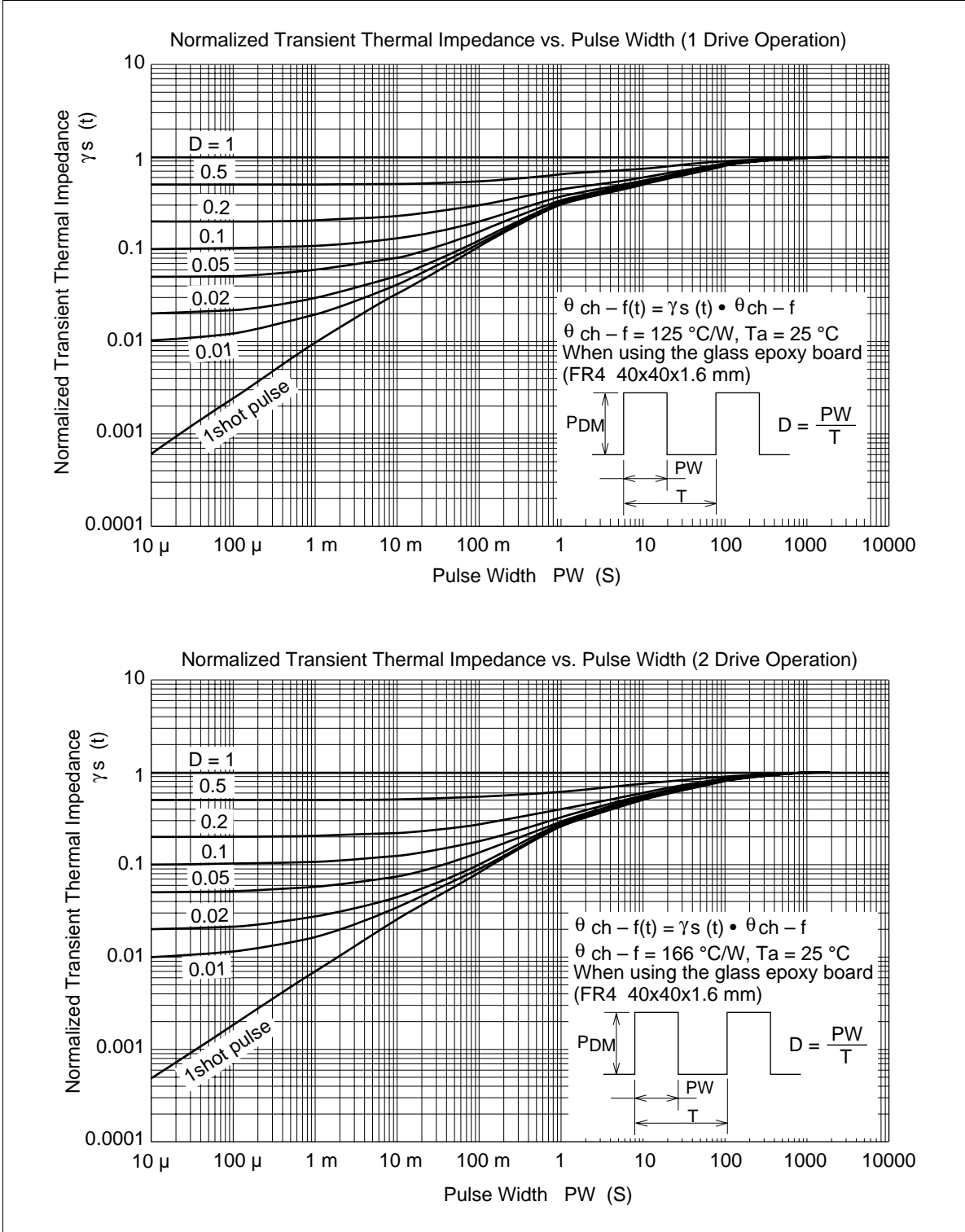


Switching Time Test Circuit



Switching Time Waveform

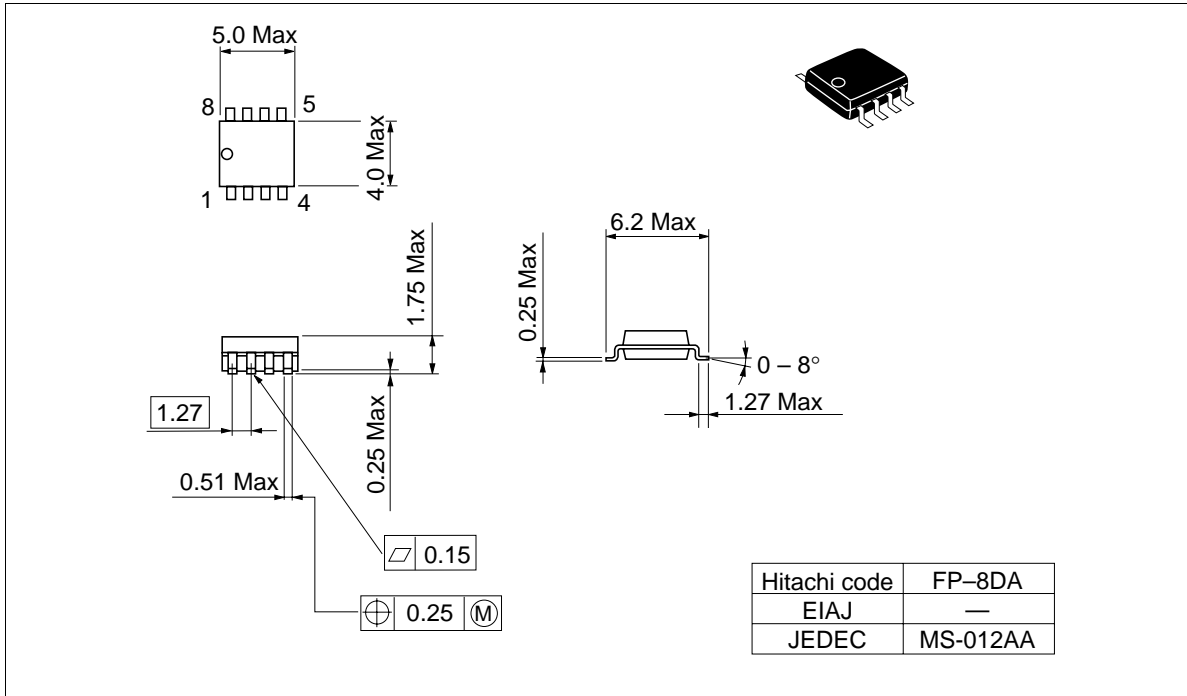




# HAT3008R/HAT3008RJ

## Package Dimensions

Unit: mm



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