HAT2033R/HAT2033RJ

Silicon N Channel Power MOS FET
High Speed Power Switching

HITACHI

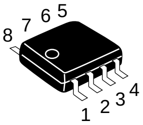
ADE-208-664B (Z)
3rd. Edition
February 1999

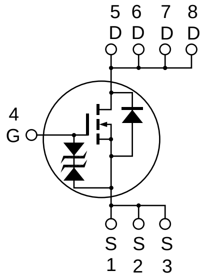
Features

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

Outline

SOP–8





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

Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Ratings	Unit
Drain to source voltage		V_{DSS}	60	V
Gate to source voltage		V_{GSS}	± 20	V
Drain current		I_D	7	A
Drain peak current		$I_{D(pulse)}$ Note1	56	A
Body-drain diode reverse drain current		I_{DR}	7	A
Avalanche current	HAT2033R	I_{AP} Note4	—	—
	HAT2033RJ		7	A
Avalanche energy	HAT2033R	E_{AR} Note4	—	—
	HAT2033RJ		4.2	mJ
Channel dissipation		Pch Note2	2.5	W
Channel temperature		Tch	150	°C
Storage temperature		Tstg	– 55 to + 150	°C

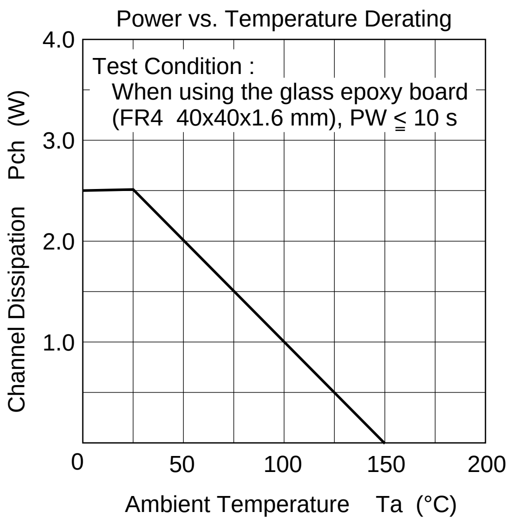
Note: 1. PW ≤ 10µs, duty cycle ≤ 1 %
2. When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW≤ 10s
3. Value at Tch=25°C, Rg≥50Ω

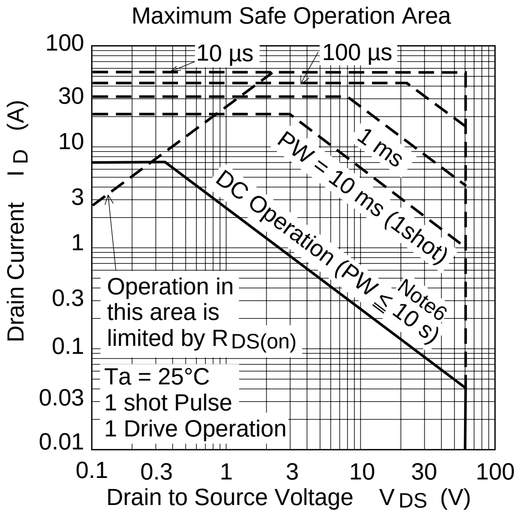
Electrical Characteristics (Ta = 25°C)

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
Gate to source leak current		I_{GSS}	—	—	± 10	µA	V_{GS} = ± 16 V, V_{DS} = 0
Zero gate voltage	HAT2033R	I_{DSS}	—	—	1	µA	V_{DS} = 60 V, V_{GS} = 0
drain current	HAT2033RJ	I_{DSS}	—	—	0.1	µA	
Zero gate voltage	HAT2033R	I_{DSS}	—	—	—	µA	V_{DS} =4 8V , V_{GS} = 0
drain current	HAT2033RJ	I_{DSS}	—	—	10	µA	Ta = 125°C
Gate to source cutoff voltage		$V_{GS(off)}$	1.2	—	2.2	V	V_{DS} = 10 V, I_D = 1 mA
Static drain to source on state		$R_{DS(on)}$	—	0.03	0.038	Ω	I_D = 4 A, V_{GS} = 10 V Note4
resistance		$R_{DS(on)}$	—	0.04	0.053	Ω	I_D = 4 A, V_{GS} = 4 V Note4
Forward transfer admittance		$\|y_{fs}\|$	6.5	10	—	S	I_D = 4 A, V_{DS} = 10 V Note4
Input capacitance		Ciss	—	740	—	pF	V_{DS} = 10 V
Output capacitance		Coss	—	370	—	pF	V_{GS} = 0
Reverse transfer capacitance		Crss	—	130	—	pF	f = 1MHz
Turn-on delay time		$t_{d(on)}$	—	13	—	ns	V_{GS} =10 V, I_D = 4 A
Rise time		t_r	—	55	—	ns	V_{DD} ≅ 30 V
Turn-off delay time		$t_{d(off)}$	—	140	—	ns	
Fall time		t_f	—	95	—	ns	
Body–drain diode forward voltage		V_{DF}	—	0.82	1.07	V	IF = 7 A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time		t_{rr}	—	45	—	ns	IF = 7 A , V_{GS} = 0 diF/ dt = 50 A/µs

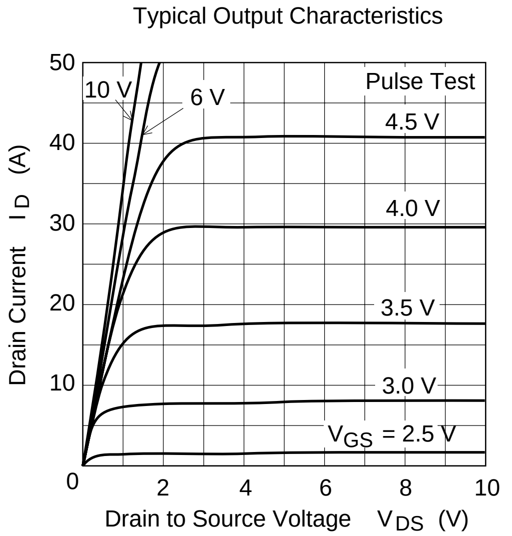
Note: 4. Pulse test

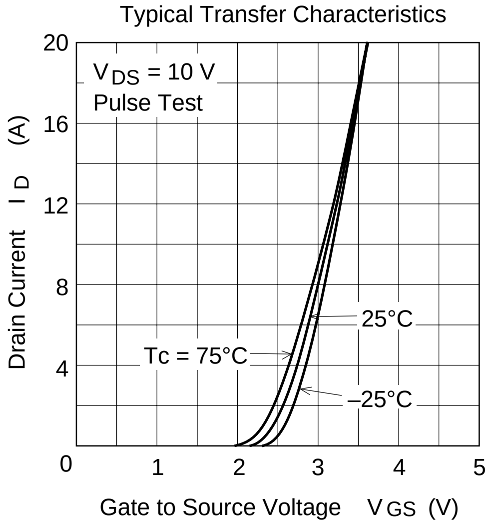
Main Characteristics

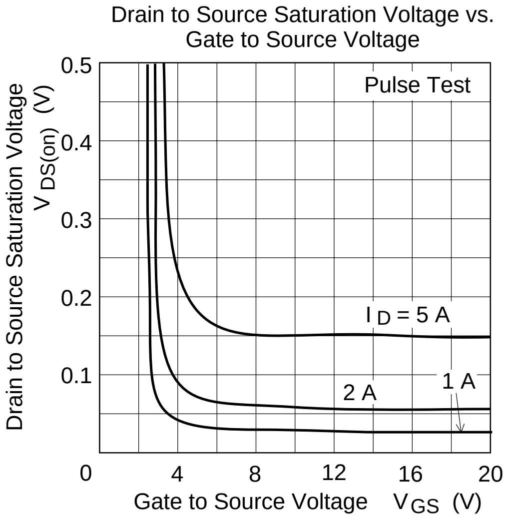


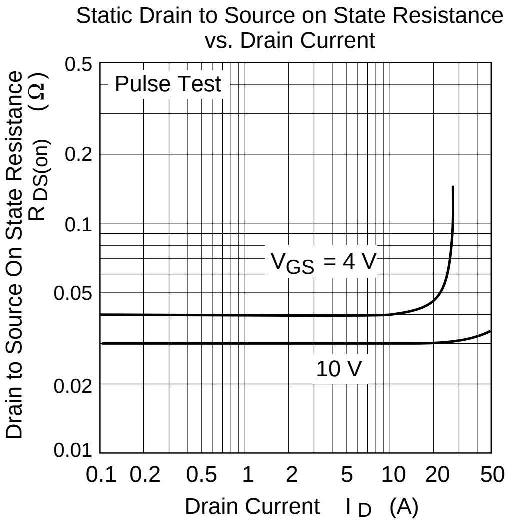


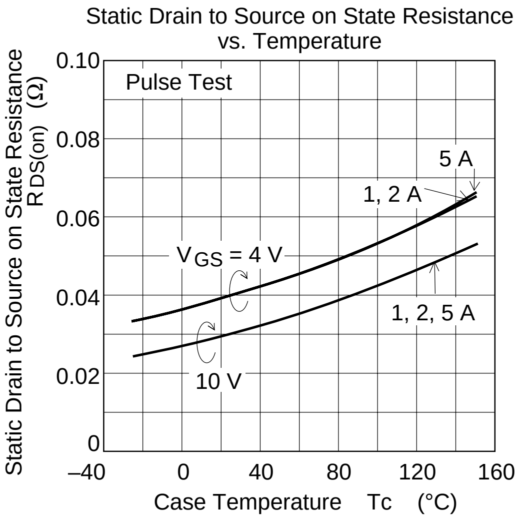
Note 6 :
When using the glass epoxy board
(FR4 40x40x1.6 mm)

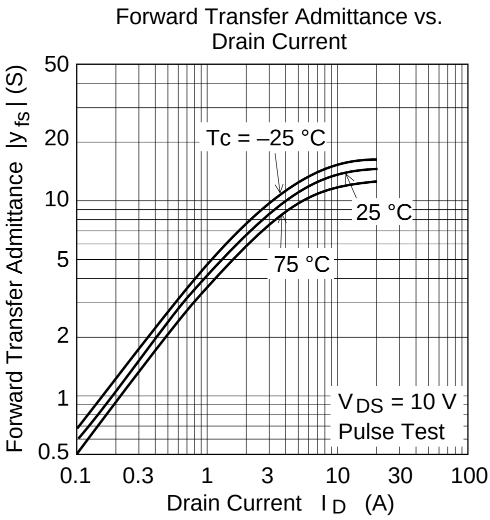




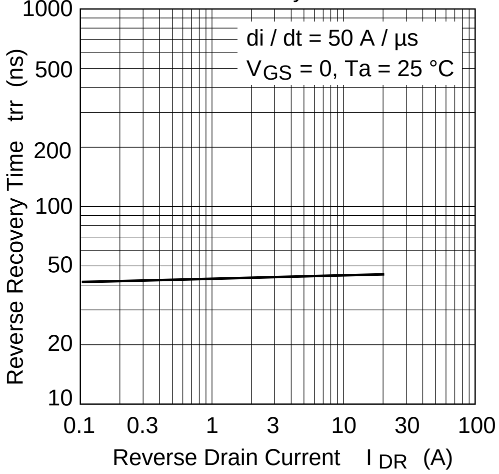

Drain to Source Saturation Voltage vs.
Gate to Source Voltage
Pulse Test
I D = 5 A
2 A
1 A
Drain to Source Saturation Voltage V DS(on) (V)
0.5
0.4
0.3
0.2
0.1
0
4
8
12
16
20
Gate to Source Voltage V GS (V)


Static Drain to Source on State Resistance
vs. Drain Current
Pulse Test
V GS = 4 V
10 V
Drain to Source On State Resistance R DS(on) (Ω)
0.5
0.2
0.1
0.05
0.02
0.01
0.1 0.2 0.5 1 2 5 10 20 50
Drain Current I D (A)

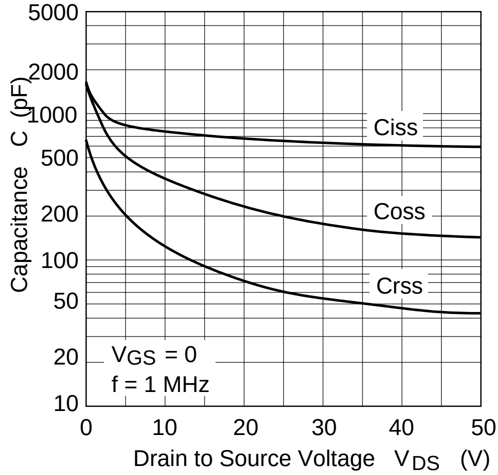

Static Drain to Source on State Resistance
vs. Temperature
Pulse Test
5 A
1, 2 A
V GS = 4 V
1, 2, 5 A
10 V
Static Drain to Source on State Resistance R DS(on) (Ω)
0.10
0.08
0.06
0.04
0.02
0
–40
0
40
80
120
160
Case Temperature Tc (°C)


Forward Transfer Admittance vs.
Drain Current
Tc = –25 °C
25 °C
75 °C
V DS = 10 V
Pulse Test
Forward Transfer Admittance |y fs| (S)
50
20
10
5
2
1
0.5
0.1 0.3 1 3 10 30 100
Drain Current I D (A)

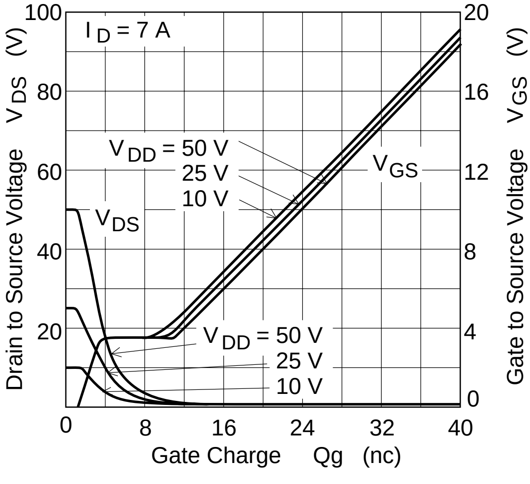
Body–Drain Diode Reverse Recovery Time



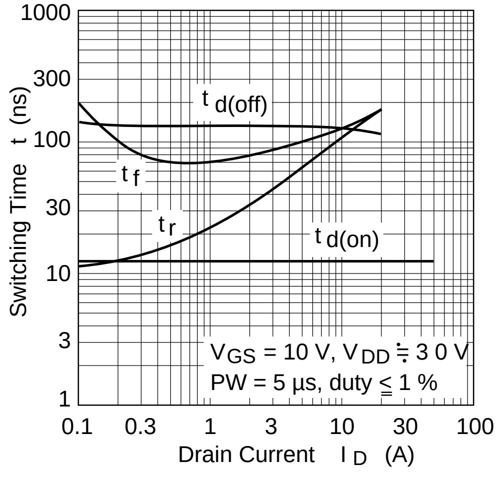
Typical Capacitance vs. Drain to Source Voltage



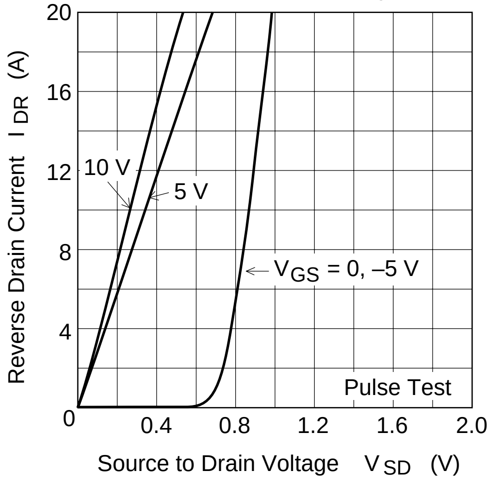
Dynamic Input Characteristics



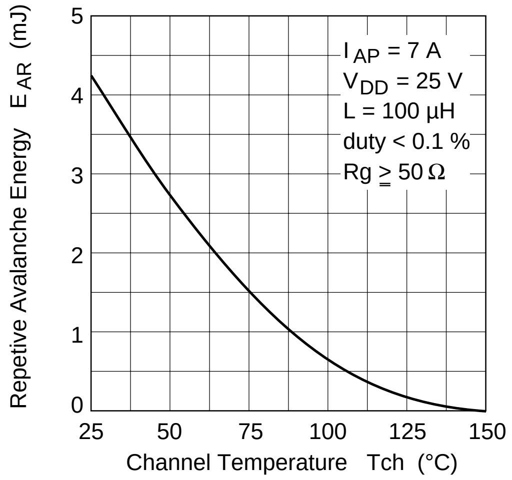
Switching Characteristics



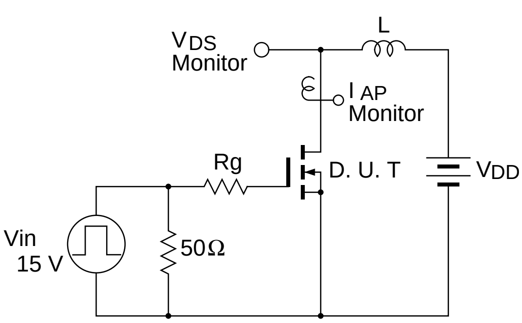
Reverse Drain Current vs.
Souece to Drain Voltage



Maximun Avalanche Energy vs.
Channel Temperature Derating

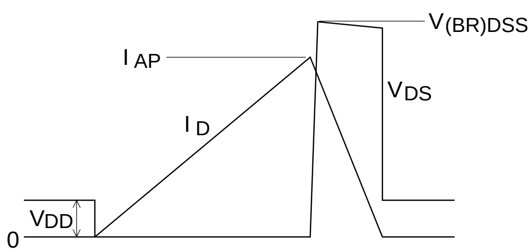


Avalanche Test Circuit

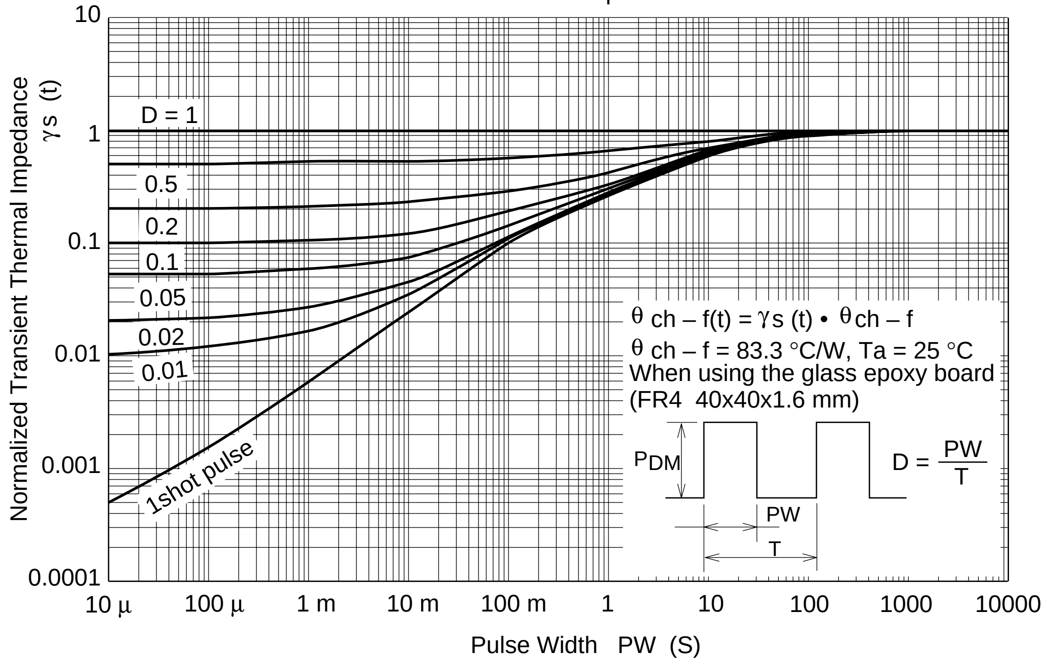


Avalanche Waveform

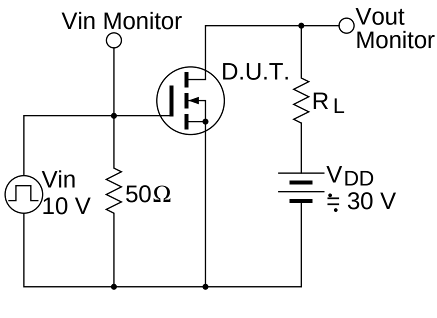
$$E_{AR} = \frac{1}{2} \bullet L \bullet I_{AP}{}^{2} \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



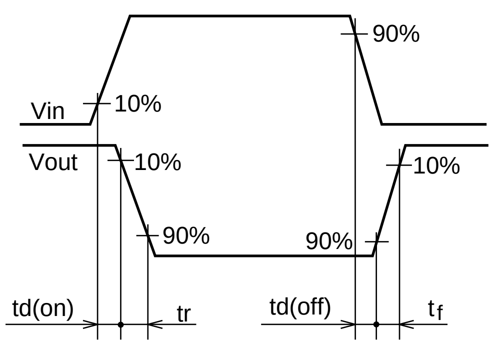
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

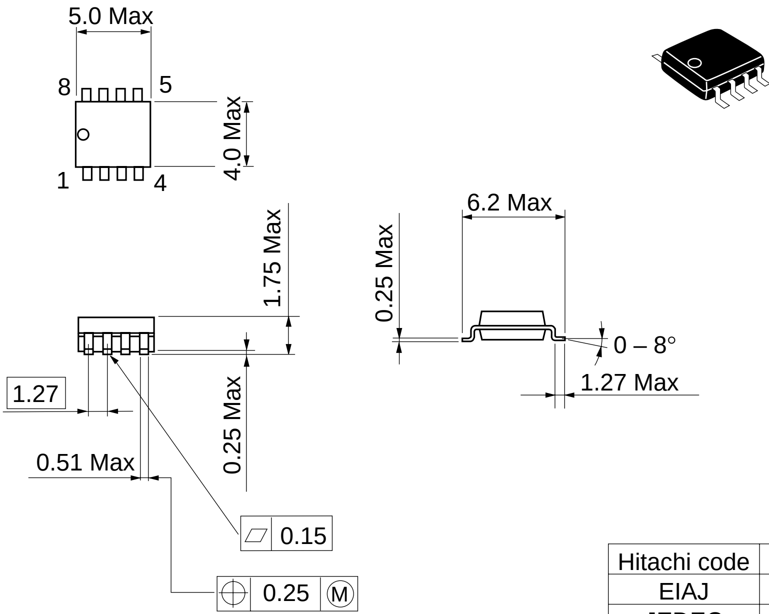


Switching Time Waveform



Package Dimensions

Unit: mm



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