HAT2033R/HAT2033RJ

Silicon N Channel Power MOS FET
High Speed Power Switching

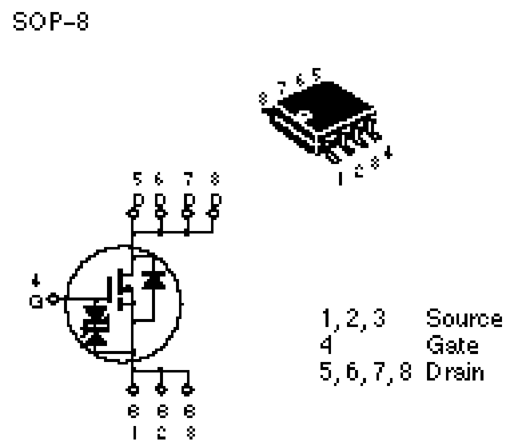
HITACHI

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



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

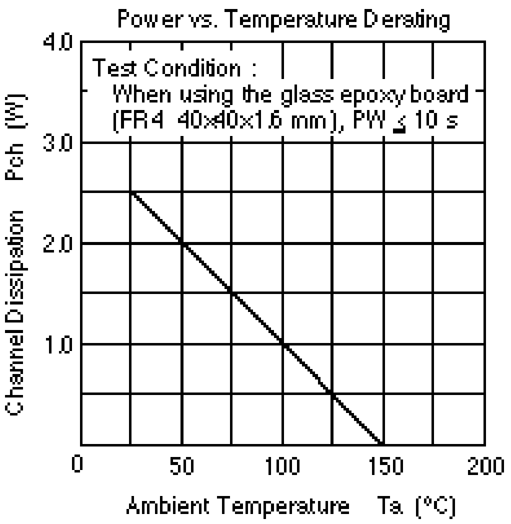
Note: 1. PW ≤ 10μs, duty cycle ≤ 1 %
2. When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW ≤ 10s
3. Value at Tch=25°C, Rg ≥ 50Ω

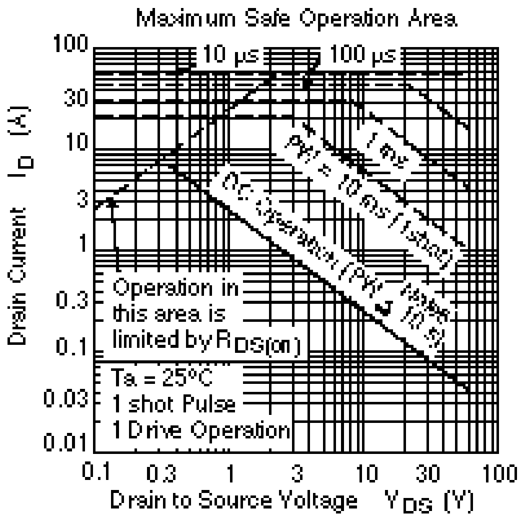
Electrical Characteristics (Ta = 25°C)

Item		Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage		$V_{(BR)DSS}$	60	—	—	V	I_D = 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	HAT2033R	I_{DSS}	—	—	1	μA	V_{DS} = 60V, V_{GS} = 0
	HAT2033RJ	I_{DSS}	—	—	0.1	μA	
Zero gate voltage drain current	HAT2033R	I_{DSS}	—	—	—	μA	V_{DS} =48V, V_{GS} = 0 Ta=125°C
	HAT2033RJ	I_{DSS}	—	—	10	μA	
Gate to source cutoff voltage		$V_{GS(off)}$	1.2	—	2.2	V	V_{DS} = 10V, I_D = 1mA
Static drain to source on state resistance		$R_{DS(on)}$	—	0.03	0.038	Ω	I_D = 4A, V_{GS} = 10V Note4
		$R_{DS(on)}$	—	0.04	0.053	Ω	I_D = 4A, V_{GS} = 4V Note4
Forward transfer admittance		$\|y_{fs}\|$	6.5	10	—	S	I_D = 4A, V_{DS} = 10V Note4
Input capacitance		Ciss	—	740	—	pF	V_{DS} = 10V V_{GS} = 0 f = 1MHz
Output capacitance		Coss	—	370	—	pF	
Reverse transfer capacitance		Crss	—	130	—	pF	
Turn-on delay time		$t_{d(on)}$	—	13	—	ns	V_{GS} =10V, I_D = 4A V_{DD} ≈ 30V
Rise time		t_r	—	55	—	ns	
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 = 7A, V_{GS} = 0 Note4
Body–drain diode reverse recovery time		t_{rr}	—	45	—	ns	IF =7A, V_{GS} = 0 diF/ dt =50A/μs

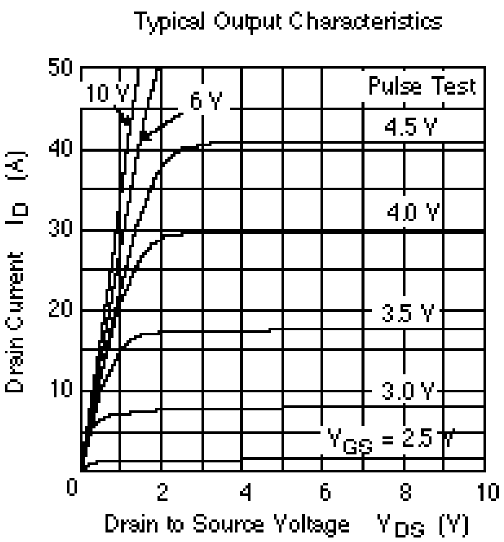
Note: 4. Pulse test

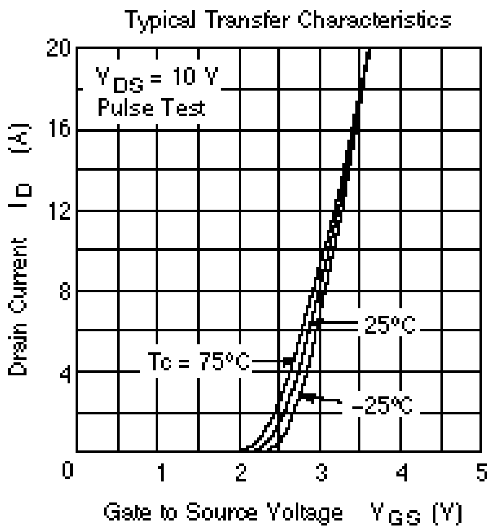
Main Characteristics



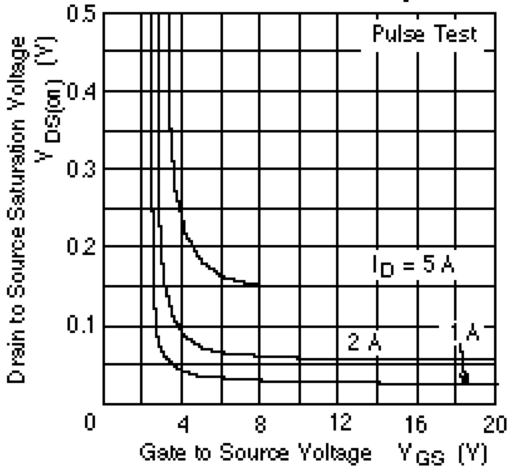


Note 6 :
When using the glass epoxy board (FR4 40×40×1.6 mm)

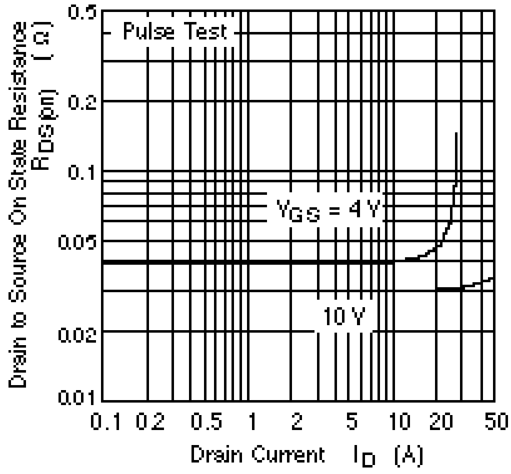




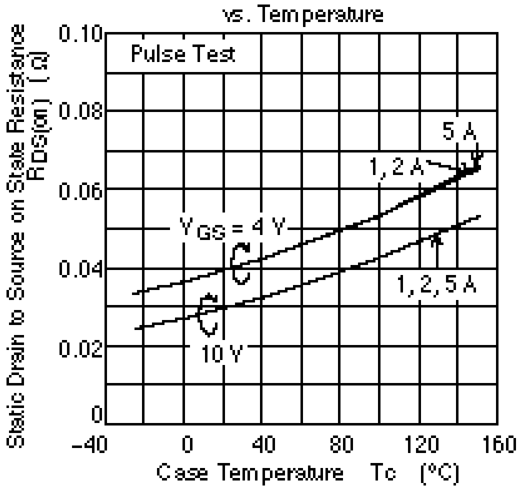
Drain to Source Saturation Voltage vs. Gate to Source Voltage



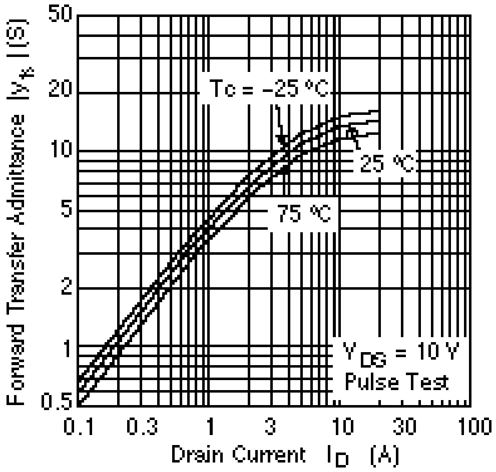
Static Drain to Source on State Resistance vs. Drain Current



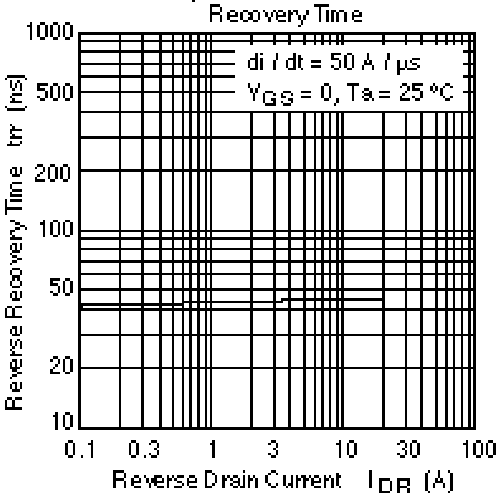
Static Drain to Source on State Resistance vs. Temperature



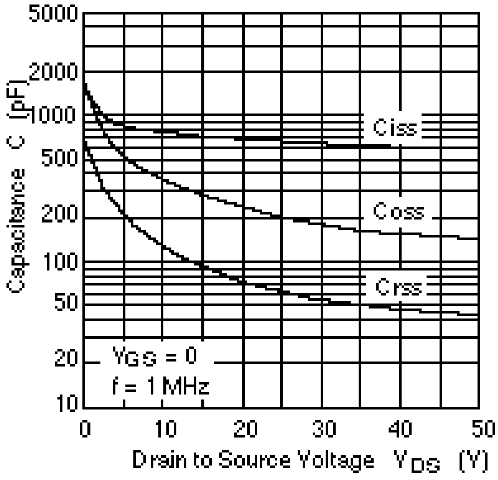
Forward Transfer Admittance vs. Drain Current



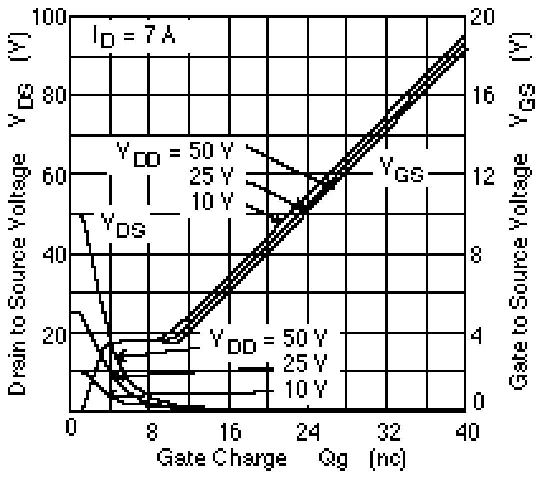
Body-Drain Diode Reverse Recovery Time



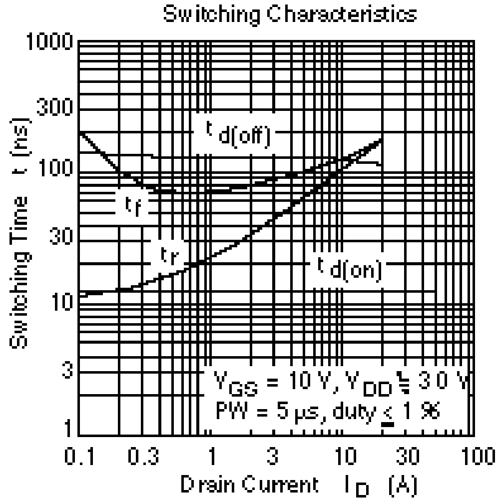
Typical Capacitance vs. Drain to Source Voltage

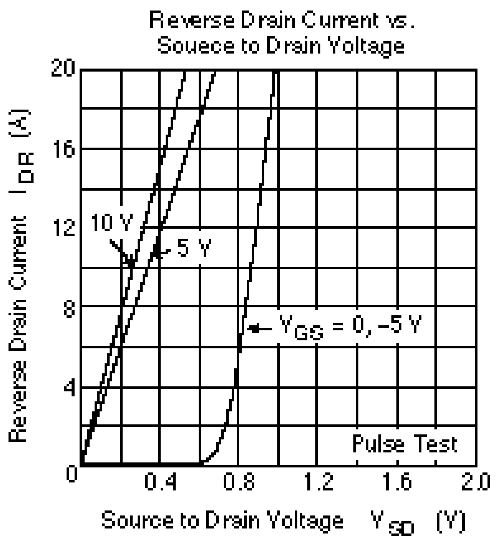


Dynamic Input Characteristics

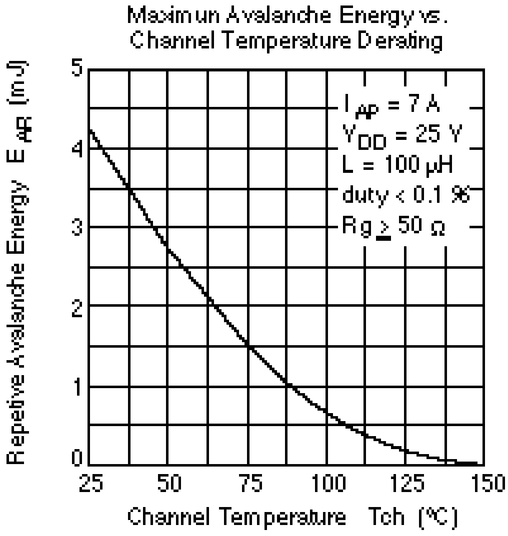


Switching Characteristics

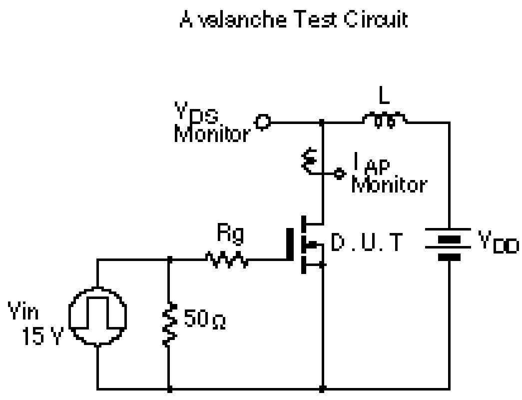




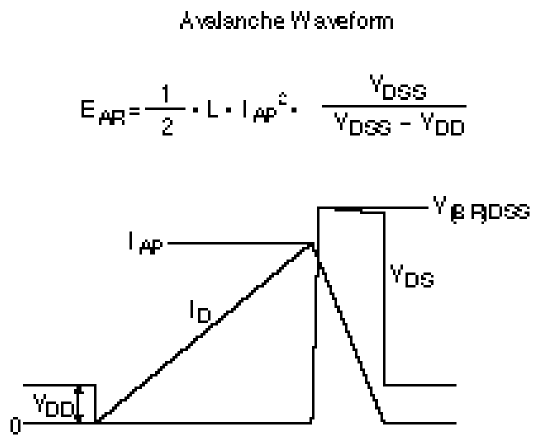
Reverse Drain Current vs.
Souece to Drain Voltage
Reverse Drain Current I DR (A)
Source to Drain Voltage V SD (V)
10 V
5 V
V GS = 0, –5 V
Pulse Test
0
4
8
12
16
20
0.4
0.8
1.2
1.6
2.0



Maximun Avalanche Energy vs.
Channel Temperature Derating
Repetive Avalanche Energy E AR (mJ)
Channel Temperature Tch (°C)
I AP = 7 A
V DD = 25 V
L = 100 μH
duty < 0.1 %
Rg ≥ 50 Ω
0
1
2
3
4
5
25
50
75
100
125
150

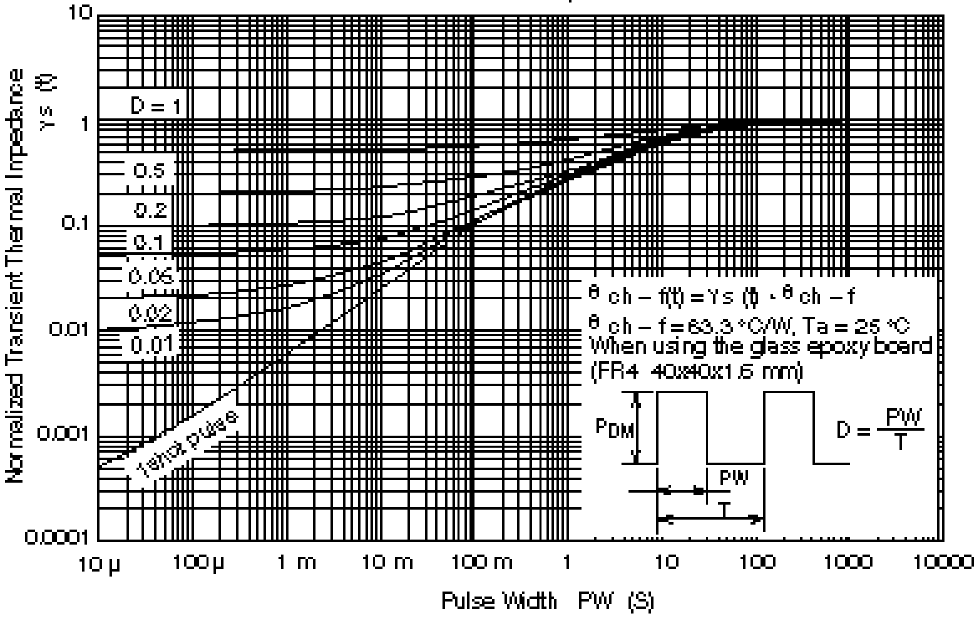


Avalanche Test Circuit
V DS Monitor
L
I AP Monitor
Rg
D. U. T
V DD
Vin 15 V
50 Ω

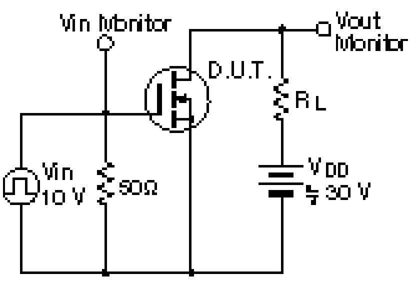


Avalanche Waveform
$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$
V (BR)DSS
I AP
V DS
I D
V DD
0

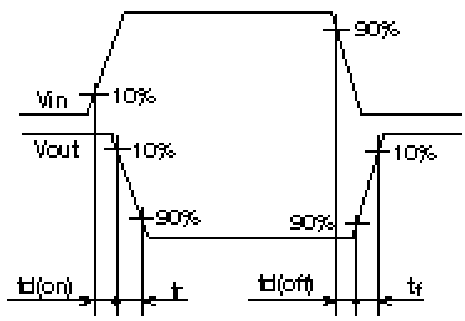
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

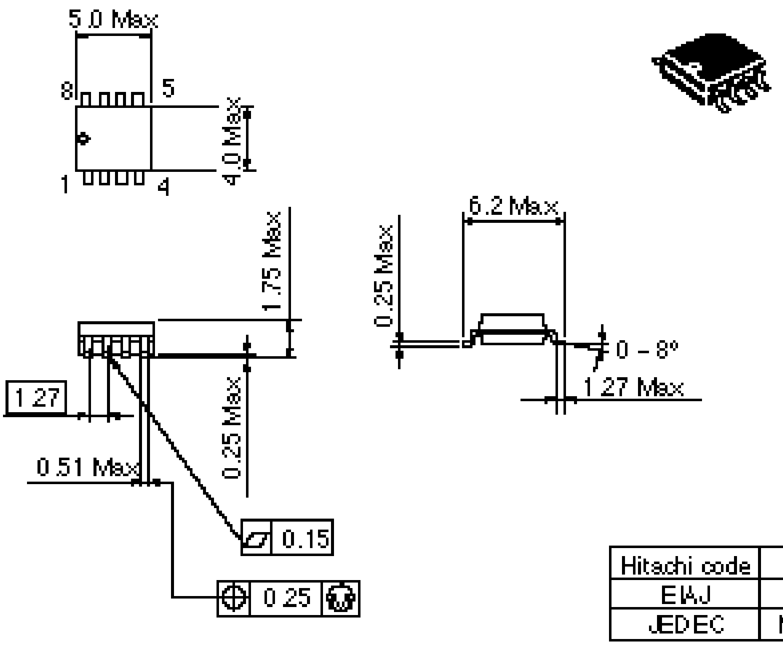


Switching Time Waveform



Package Dimensions

Unit: mm



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