To all our customers

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

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HAT2099H

Silicon N Channel Power MOS FET
Power Switching

ADE-208-1432C (Z)

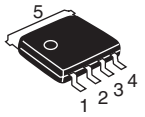
4th. Edition
Aug. 2002

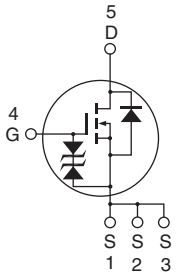
Features

- Capable of 4.5 V gate drive
- Low drive current
- High density mounting
- Low on-resistance
  $R_{DS(on)}$ = 2.9 mΩ typ. (at V_{GS} = 10 V)

Outline

LFPAK





1, 2, 3	Source
4	Gate
5	Drain

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	30	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	50	A
Drain peak current	$I_{D(pulse)}$ Note1	200	A
Body-drain diode reverse drain current	I_{DR}	50	A
Avalanche current	I_{AP} Note 3	5	A
Avalanche energy	E_{AR} Note 3	2.5	mJ
Channel dissipation	Pch Note2	30	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to + 150	°C

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%
2. Tc = 25°C
3. Value at Tch = 25°C, Rg ≥ 50 Ω

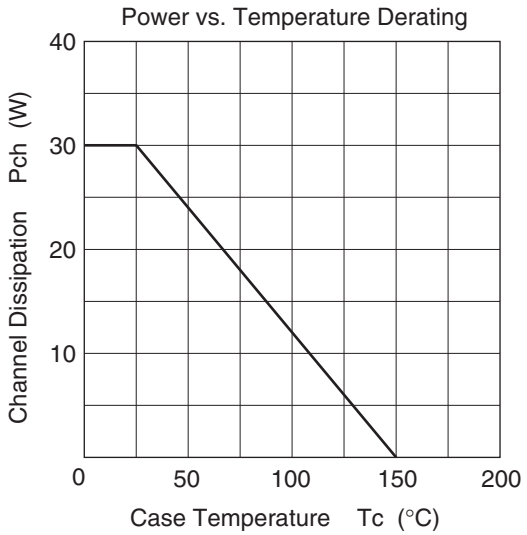
Electrical Characteristics

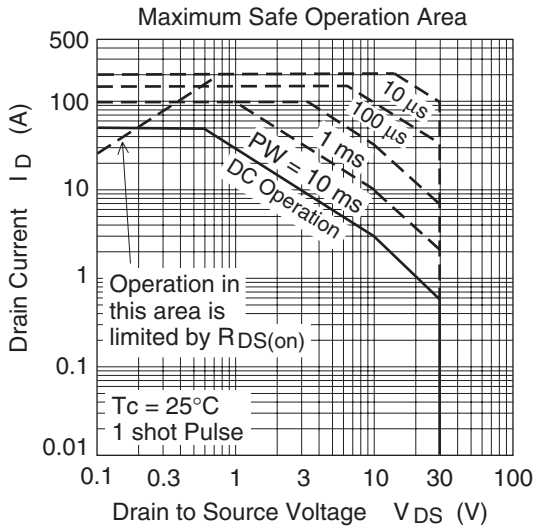
(Ta = 25°C)

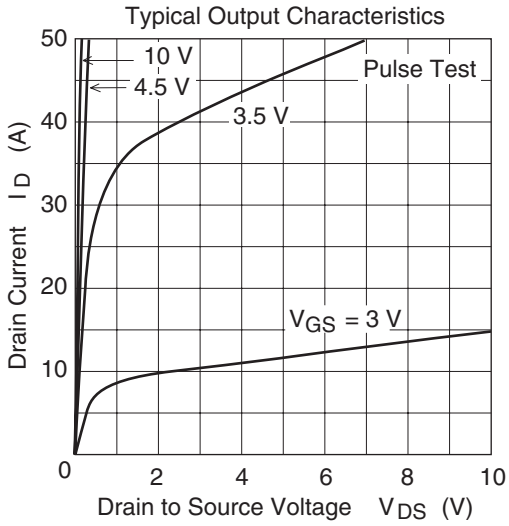
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	30	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	± 20	—	—	V	I_G = ±100 µA, V_{DS} = 0
Gate to source leak current	I_{GSS}	—	—	± 10	µA	V_{GS} = ±16 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	1	µA	V_{DS} = 30 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.5	V	V_{DS} = 10 V, I_D = 1 mA
Static drain to source on state resistance	$R_{DS(on)}$	—	2.9	3.7	mΩ	I_D = 25 A, V_{GS} = 10 V Note3
	$R_{DS(on)}$	—	5.0	7.3	mΩ	I_D = 25 A, V_{GS} = 4.5 V Note3
Forward transfer admittance	$\|y_{fs}\|$	39	65	—	S	I_D = 25 A, V_{DS} = 10 V Note3
Input capacitance	Ciss	—	4750	—	pF	V_{DS} = 10 V
Output capacitance	Coss	—	1180	—	pF	V_{GS} = 0
Reverse transfer capacitance	Crss	—	650	—	pF	f = 1 MHz
Total gate charge	Qg	—	75	—	nc	V_{DD} = 10 V
Gate to source charge	Qgs	—	16	—	nc	V_{GS} = 10 V
Gate to drain charge	Qgd	—	14	—	nc	I_D = 50 A
Turn-on delay time	$t_{d(on)}$	—	26	—	ns	V_{GS} = 10 V, I_D = 25 A
Rise time	t_r	—	60	—	ns	V_{DD} ≅ 10 V
Turn-off delay time	$t_{d(off)}$	—	85	—	ns	R_L = 0.4 Ω
Fall time	t_f	—	26	—	ns	Rg = 4.7 Ω
Body–drain diode forward voltage	V_{DF}	—	0.85	0.98	V	IF = 50 A, V_{GS} = 0 Note3
Body–drain diode reverse recovery time	t_{rr}	—	60	—	ns	IF = 50 A, V_{GS} = 0 diF/ dt = 50 A/ µs

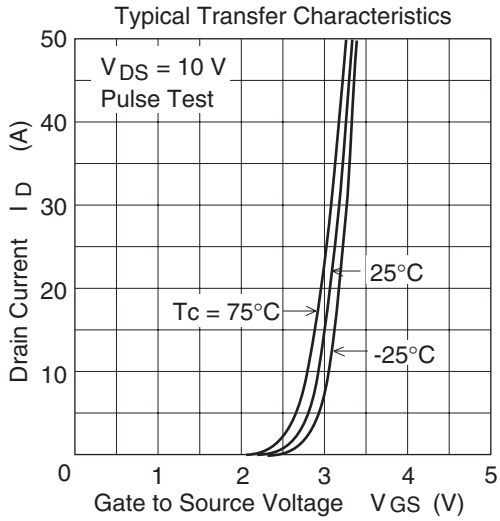
Notes: 3. Pulse test

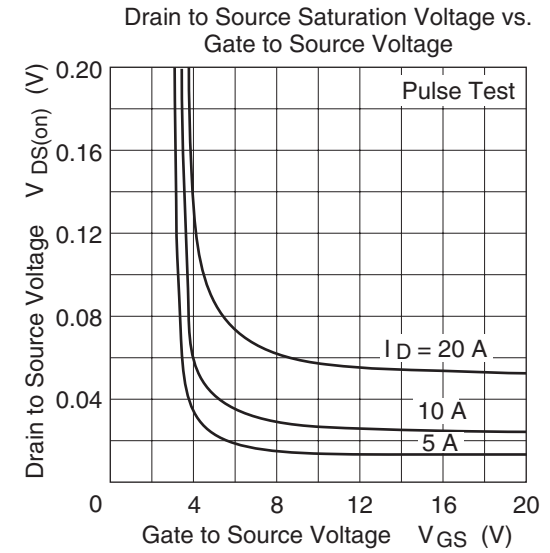
Main Characteristics

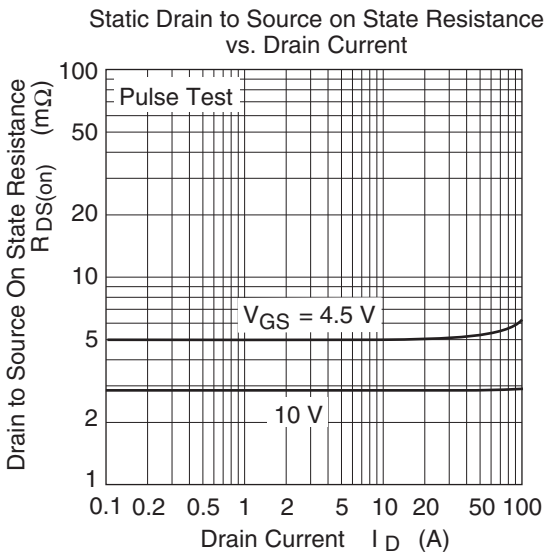


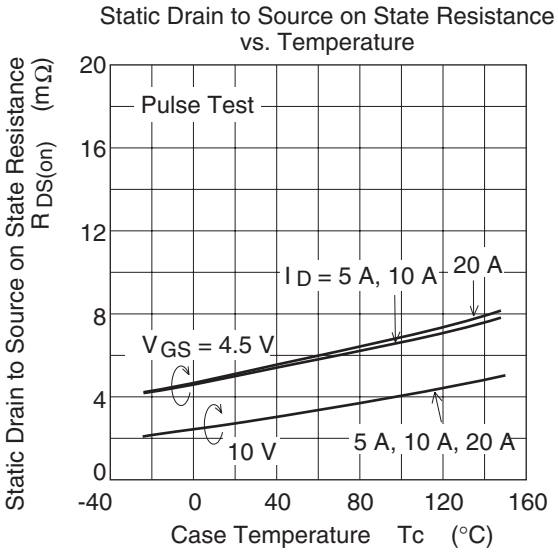


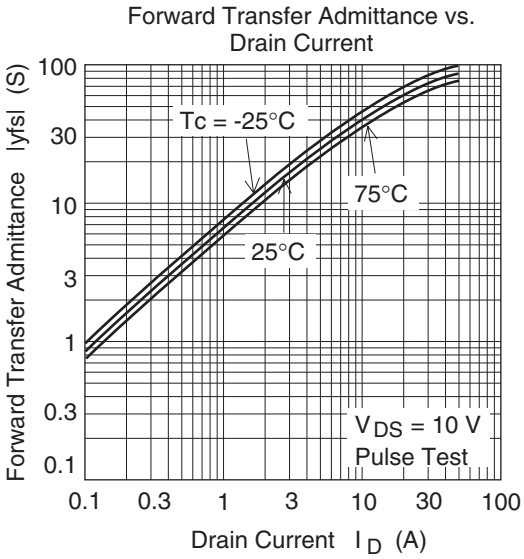


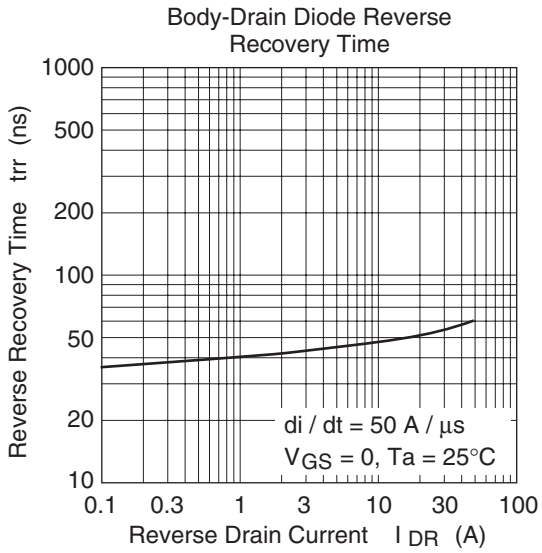


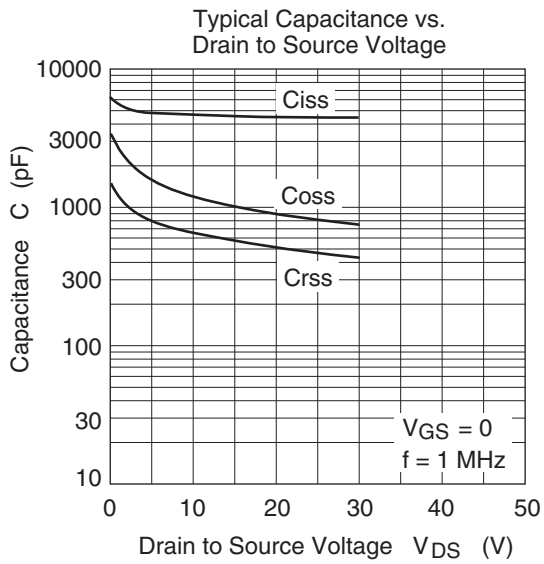

Drain to Source Saturation Voltage vs.
Gate to Source Voltage
Pulse Test
Drain to Source Voltage V DS(on) (V)
0.20
0.16
0.12
0.08
0.04
0
4
8
12
16
20
Gate to Source Voltage V GS (V)
I D = 20 A
10 A
5 A

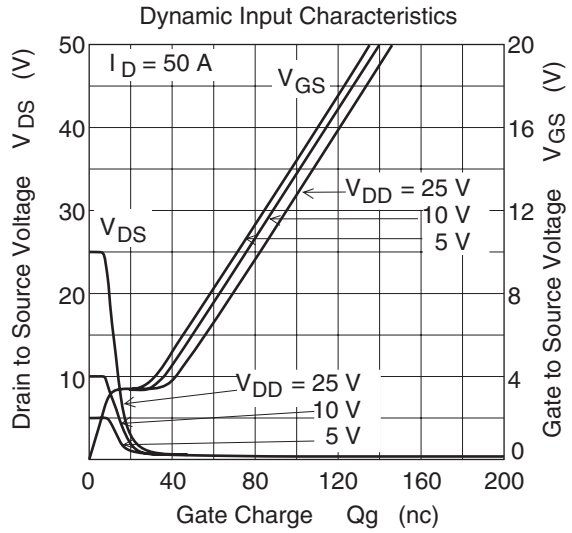

Static Drain to Source on State Resistance
vs. Drain Current
Pulse Test
Drain to Source On State Resistance
R DS(on) (mΩ)
100
50
20
10
5
2
1
V GS = 4.5 V
10 V
0.1 0.2 0.5 1 2 5 10 20 50 100
Drain Current I D (A)

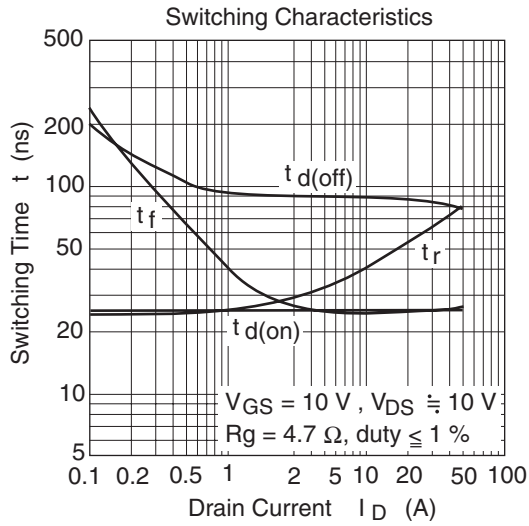

Static Drain to Source on State Resistance
vs. Temperature
Pulse Test
Static Drain to Source on State Resistance
R DS(on) (mΩ)
20
16
12
8
4
0
I D = 5 A, 10 A
20 A
V GS = 4.5 V
10 V
5 A, 10 A, 20 A
-40 0 40 80 120 160
Case Temperature Tc (°C)


Forward Transfer Admittance vs.
Drain Current
Forward Transfer Admittance |yfs| (S)
100
30
10
3
1
0.3
0.1
Tc = -25°C
75°C
25°C
V DS = 10 V
Pulse Test
0.1 0.3 1 3 10 30 100
Drain Current I D (A)

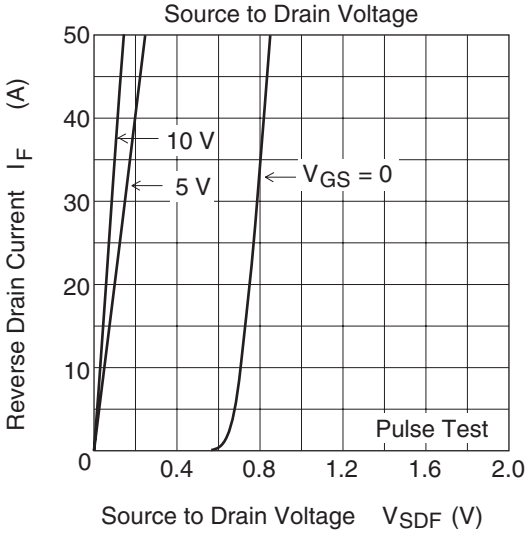

Body-Drain Diode Reverse Recovery Time
Reverse Recovery Time trr (ns)
1000
500
200
100
50
20
10
0.1
0.3
1
3
10
30
100
Reverse Drain Current I DR (A)
di / dt = 50 A / µs
VGS = 0, Ta = 25°C


Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
10000
3000
1000
300
100
30
10
0
10
20
30
40
50
Drain to Source Voltage VDS (V)
Ciss
Coss
Crss
VGS = 0
f = 1 MHz

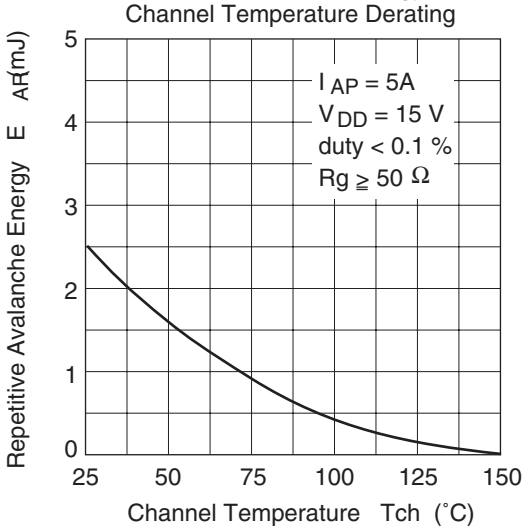

Dynamic Input Characteristics
Drain to Source Voltage VDS (V)
Gate to Source Voltage VGS (V)
50
40
30
20
10
20
16
12
8
4
0
0
40
80
120
160
200
Gate Charge Qg (nc)
I D = 50 A
VGS
VDS
VDD = 25 V
10 V
5 V
VDD = 25 V
10 V
5 V


Switching Characteristics
Switching Time t (ns)
500
200
100
50
20
10
5
0.1
0.2
0.5
1
2
5
10
20
50
100
Drain Current I D (A)
t d(off)
t f
t r
t d(on)
VGS = 10 V , VDS ≒ 10 V
Rg = 4.7 Ω, duty ≦ 1 %

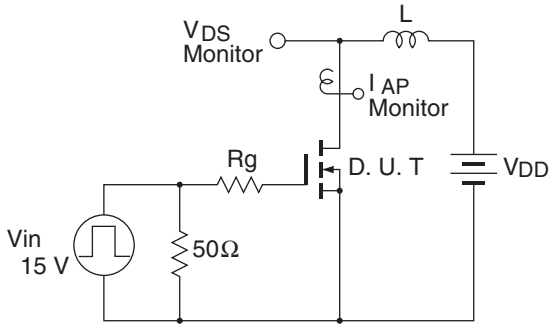
Reverse Drain Current vs.
Source to Drain Voltage



Maximum Avalanche Energy vs.
Channel Temperature Derating

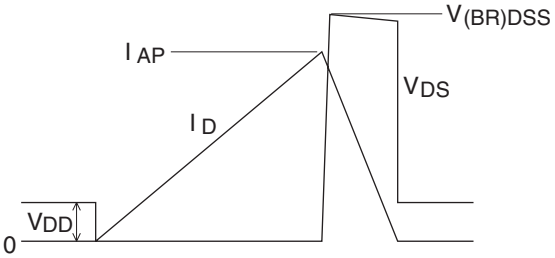


Avalanche Test Circuit

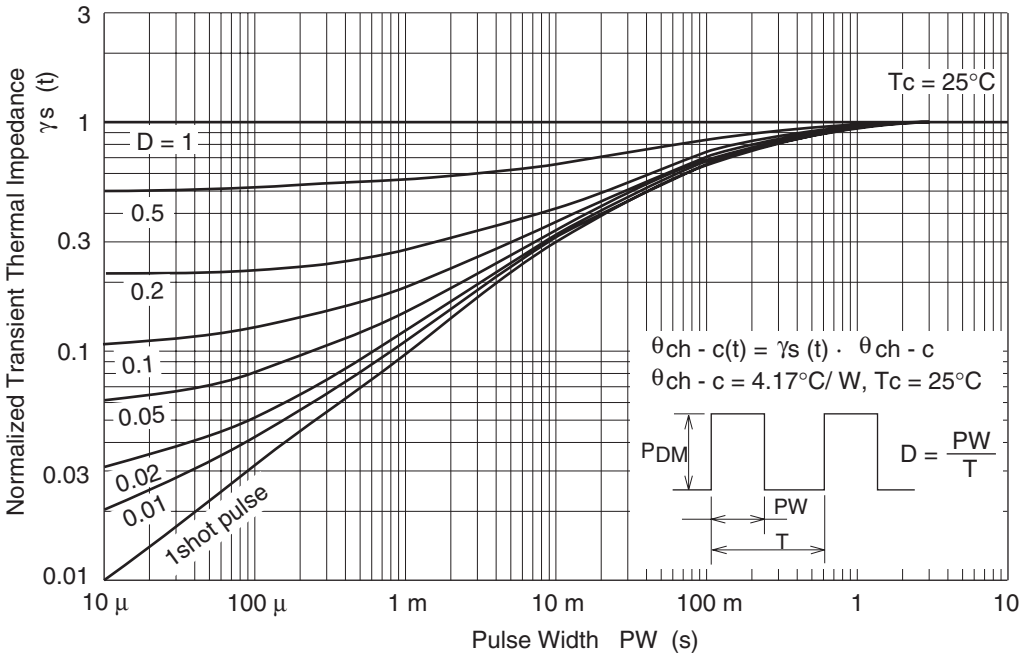


Avalanche Waveform

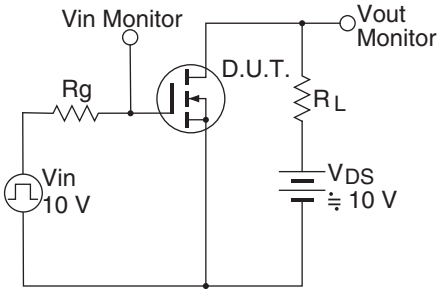
$$E_{AR} = \frac{1}{2} L \bullet I_{AP}^2 \bullet \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



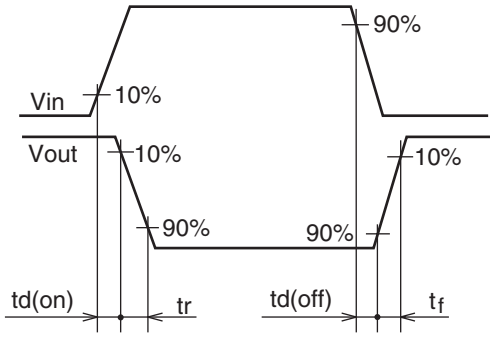
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit



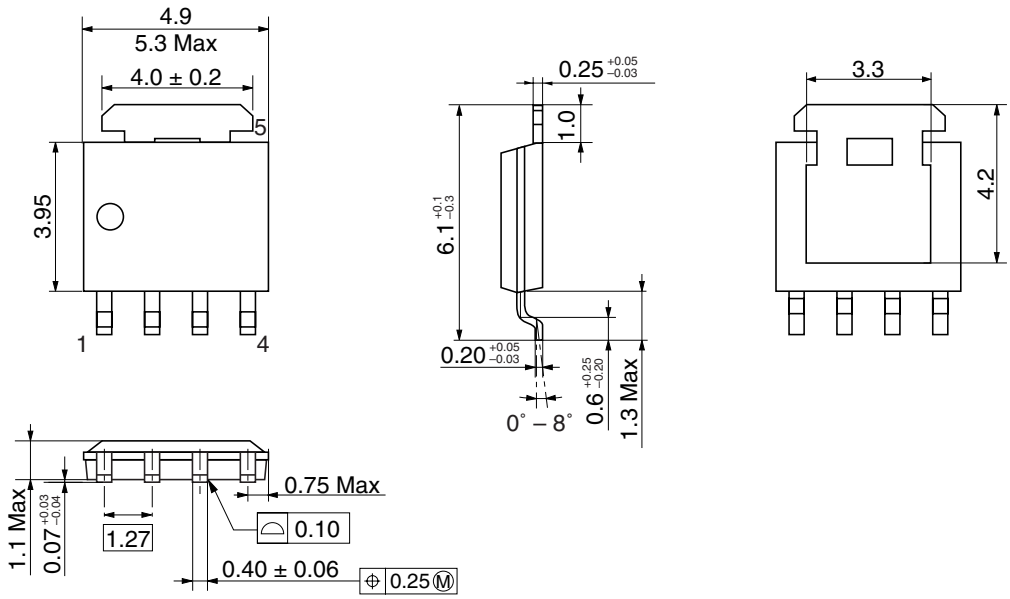
Switching Time Waveform



Package Dimensions

As of January, 2002

Unit: mm



Hitachi Code	LFPAK
JEDEC	—
JEITA	—
Mass (reference value)	0.080 g

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