

# RBA50N04DANS-4UB05

N-Channel Power [MOSFET](#)

40V - 50A - 5.0mΩ

## Description

Renesas SO8-FL technology in 5x6mm<sup>2</sup> flat-lead package designed for supporting high current with copper clip-applied, compact & efficient designs and including optimal thermal performance. AEC-Q101 qualified MOSFET and PPAP capable suitable for automotive applications.

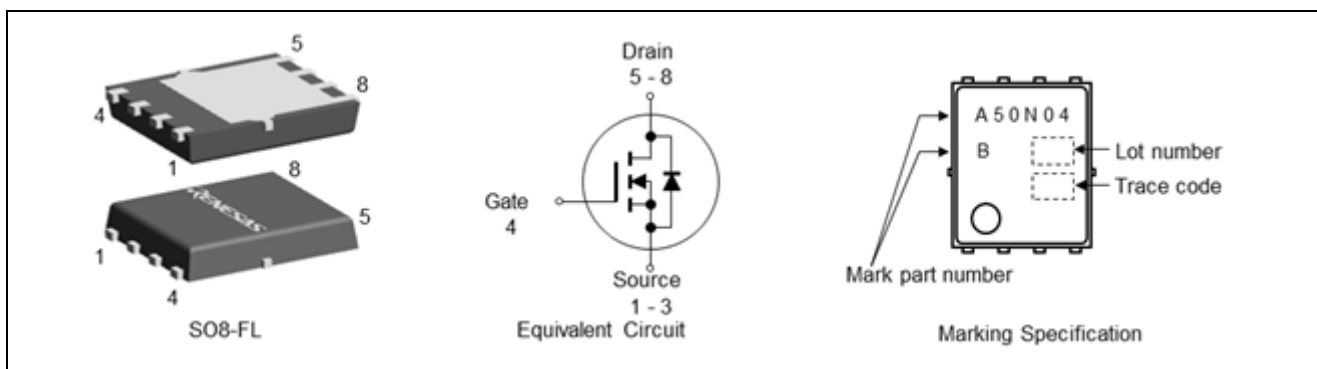
## Features

- Standard level gate drive voltage:  $V_{GS(th)} = 2.0\sim 4.0V$
- Low on-state resistance to minimize conduction losses:  $R_{DS(on)} = 5.0m\Omega$  Max.
- Low input capacitance to minimize driver losses
- Small footprint (5x6mm<sup>2</sup>) with compact design
- AEC-Q101 qualified
- PPAP capable
- Pb-free lead plating: RoHS compliant
- MSL1 classified according to IPC/JEDEC J-STD-020

## Application

- Automotive: 12V/24V load EPS, ABS, BMS, e-fuse, etc.

## Outline



## Absolute Maximum Ratings

( $T_j=25^\circ C$  unless otherwise notice.)

Item	Symbol	Ratings	Unit
Drain to Source Voltage	$V_{DSS}$	40	V
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$ Notes1,2,5	$\pm 50$	A
Drain Current (pulse)	$I_{D(pulse)}$ Notes1,3,5	$\pm 150$	A
Power Dissipation	$P_D$ Notes1,5	50	W
Junction Temperature	$T_j$	175	$^\circ C$
Storage Temperature	$T_{stg}$	-55 to 175	$^\circ C$
Single Avalanche Current	$I_{AS}$ Notes4	21	A
Single Avalanche Energy	$E_{AS}$ Notes4	44	mJ

## Thermal Resistance

Item	Symbol	Max.	Unit
Junction to Case Thermal Resistance	$R_{th(j-c)}$ <sup>Notes5</sup>	3.0	°C/W

## Electrical Characteristics

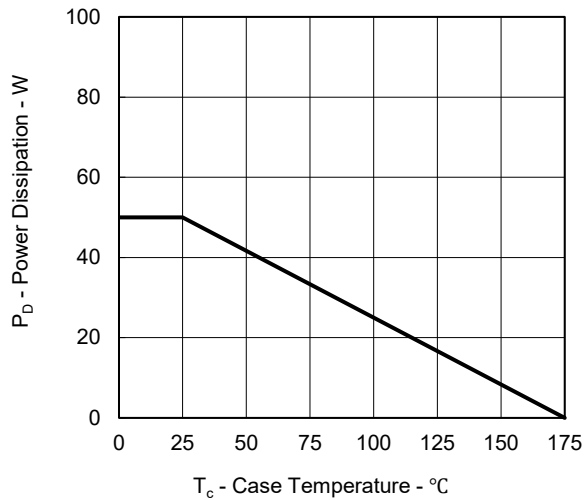
(T<sub>j</sub>=25°C unless otherwise notice.)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	μA	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	$I_{GSS}$	—	—	±100	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Threshold Voltage	$V_{GS(th)}$	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\text{ μA}$
Drain to Source On-state Resistance	$R_{DS(on)}$	—	4.17	5.0	mΩ	$V_{GS} = 10\text{ V}, I_D = 25\text{ A}$
Input Capacitance	$C_{iss}$	—	1560	—	pF	$V_{DS} = 25\text{ V}$ $V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$
Output Capacitance	$C_{oss}$	—	173	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	128	—	pF	
Gate resistance	$R_g$	—	1.8	—	Ω	
Turn-on Delay Time	$t_{d(on)}$	—	16	—	ns	$V_{DD} = 20\text{ V}, I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$ $R_G = 5\text{ Ω}$
Rise Time	$t_r$	—	16	—	ns	
Turn-off Delay Time	$t_{d(off)}$	—	39	—	ns	
Fall Time	$t_f$	—	12	—	ns	
Total Gate Charge	$Q_g$	—	34	—	nC	$V_{DD} = 20\text{ V}$ $V_{GS} = 10\text{ V}$ $I_D = 25\text{ A}$
Gate to Source Charge	$Q_{gs}$	—	9.5	—	nC	
Gate to Drain Charge	$Q_{gd}$	—	9.1	—	nC	
Body Diode Forward Voltage	$V_{F(S-D)}$	—	0.83	1.5	V	$I_F = 25\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Time	$t_{rr}$	—	33	—	ns	$I_F = 25\text{ A}, V_{GS} = 0\text{ V}$ $di/dt = 100\text{ A/μs}$
Reverse Recovery Charge	$Q_{rr}$	—	29	—	nC	

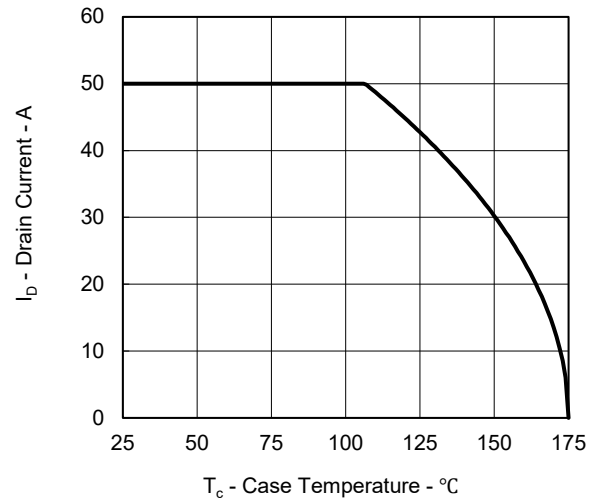
- Notes
1. T<sub>c</sub> = 25°C
  2. Value is limited by overall system design including PCB.
  3. PW ≤ 10 μs , Duty Cycle ≤ 1%
  4. L = 100μH , V<sub>DD</sub> = 20V , V<sub>GS</sub> = 20 → 0V , R<sub>G</sub> = 25 Ω
  5. Defined by design. Not subject to production test.

## Typical Characteristics

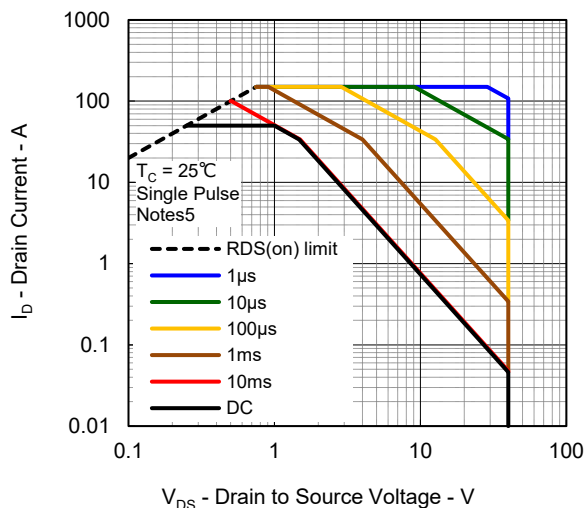
POWER DISSIPATION vs. CASE TEMPERATURE



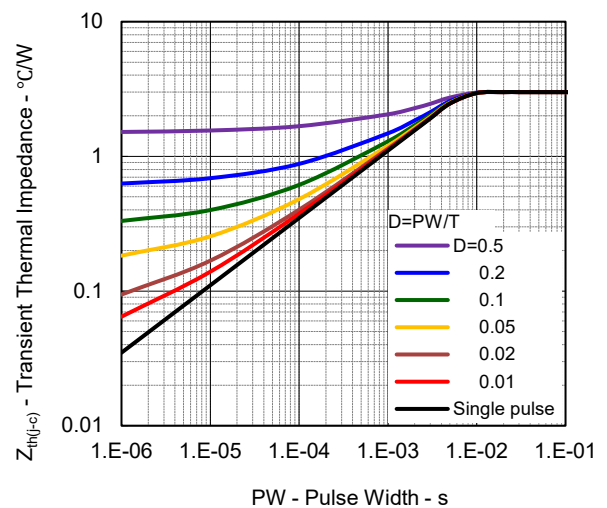
DRAIN CURRENT vs. CASE TEMPERATURE



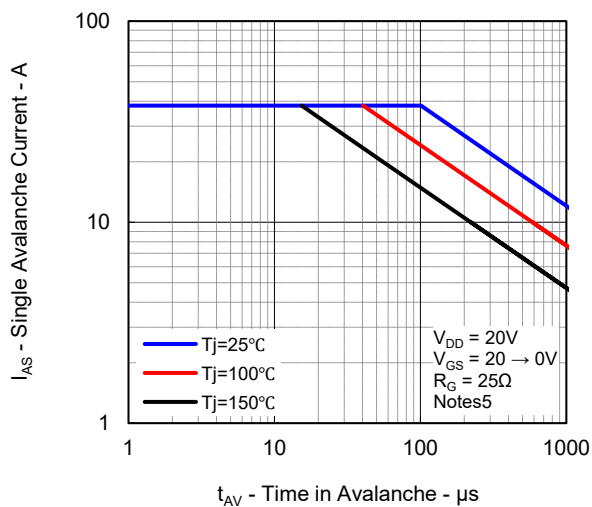
FORWARD BIAS SAFE OPERATING AREA



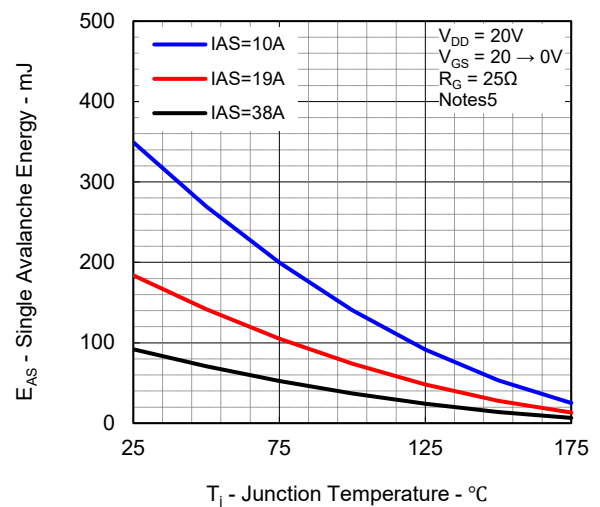
TRANSIENT THERMAL IMPEDANCE vs. PULSE WIDTH



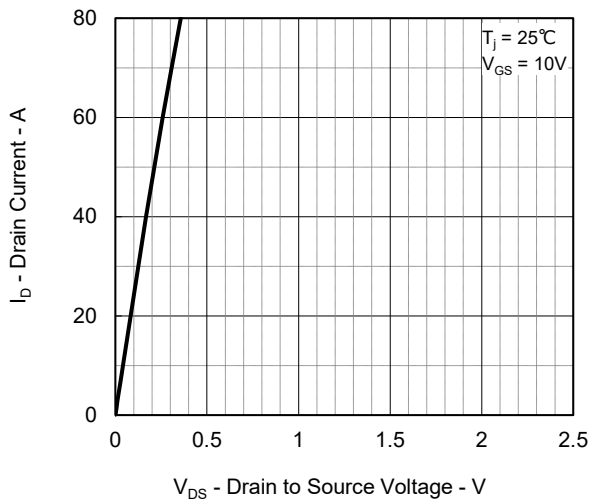
TYPICAL AVALANCHE CHARACTERISTICS



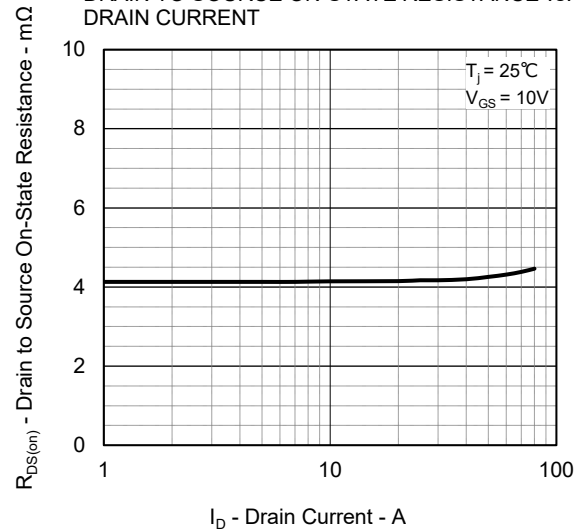
TYPICAL AVALANCHE ENERGY



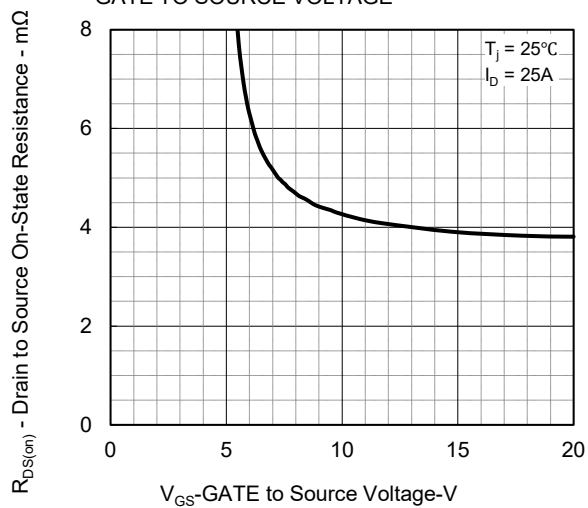
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



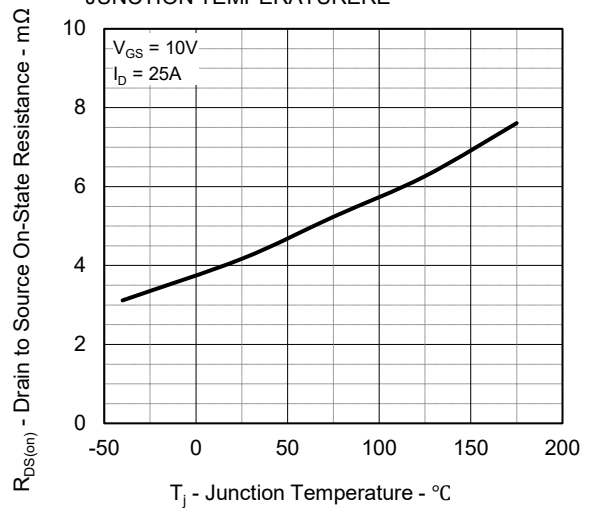
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



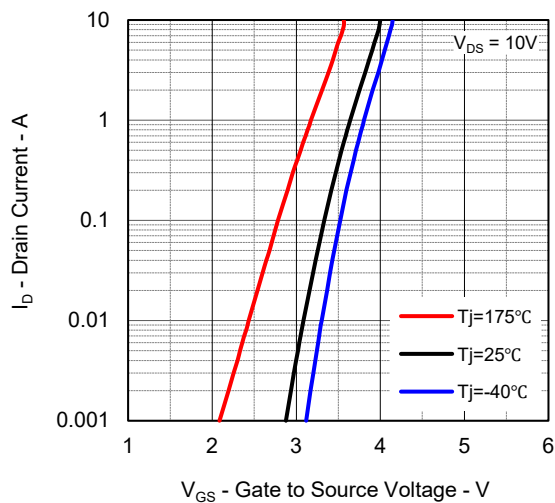
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



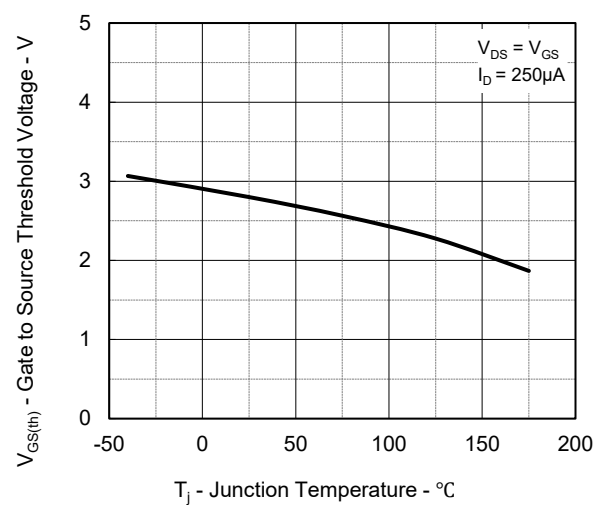
DRAIN TO SOURCE ON-STATE RESISTANCE vs. JUNCTION TEMPERATURE



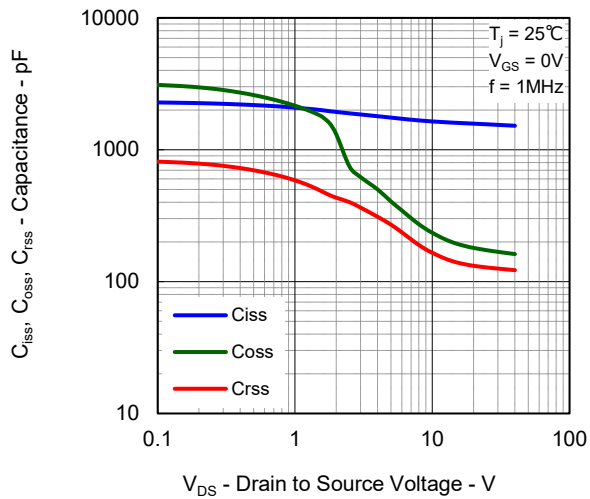
FORWARD TRANSFER CHARACTERISTICS



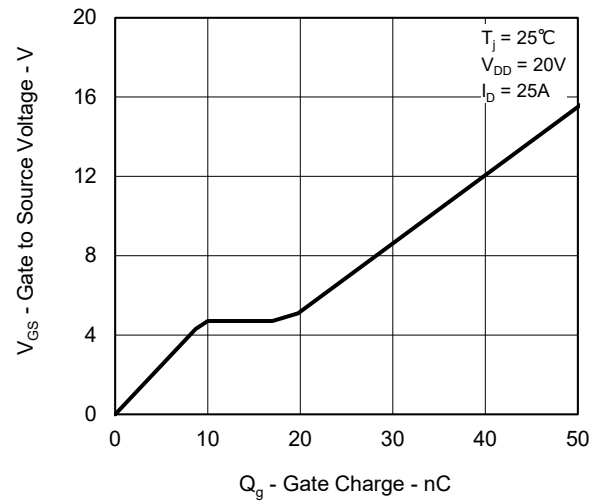
GATE TO SOURCE THRESHOLD VOLTAGE vs. JUNCTION TEMPERATURE



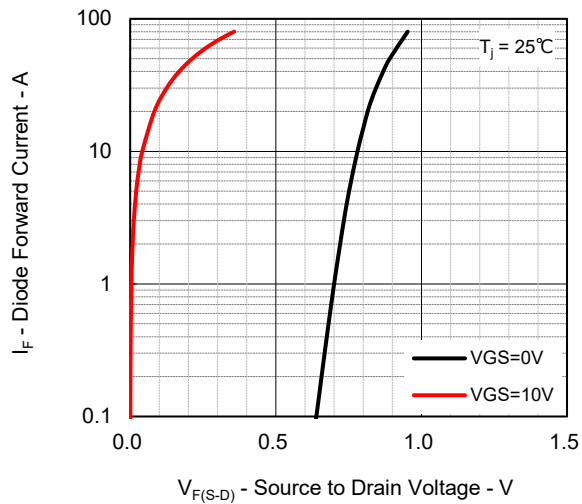
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



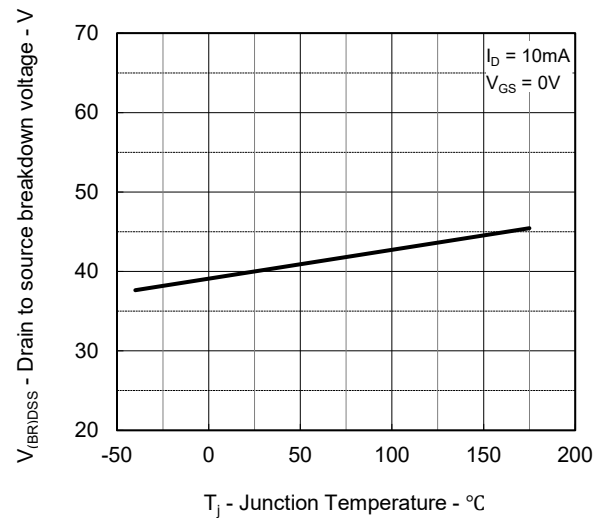
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



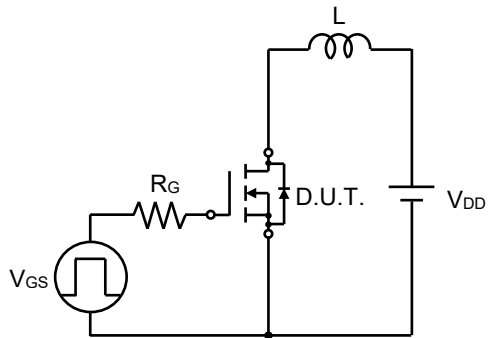
DRAIN TO SOURCE BREAKDOWN VOLTAGE vs. JUNCTION TEMPERATURE



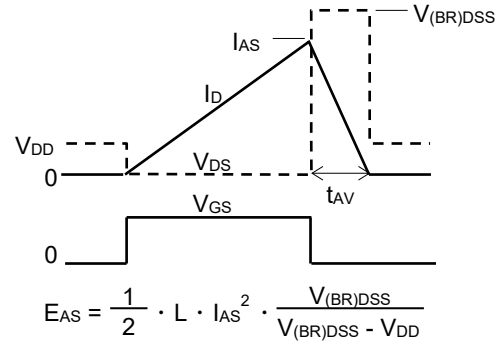
## Test Circuit

### Avalanche

Test Circuit

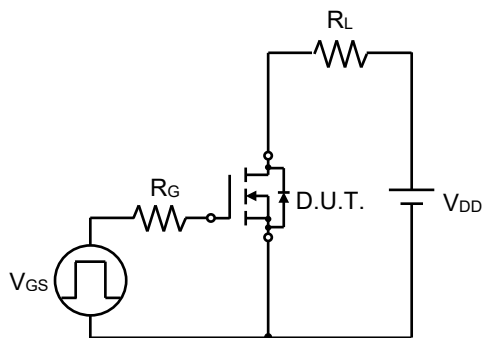


Waveform

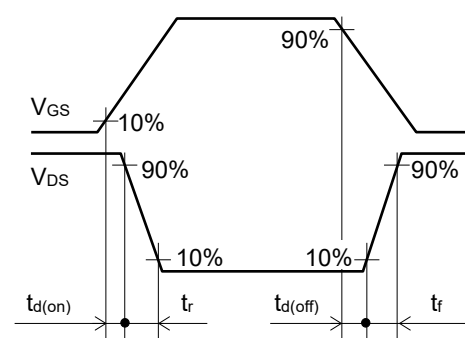


### Switching Time

Test Circuit

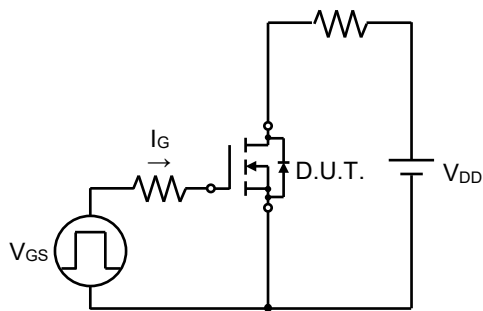


Waveform

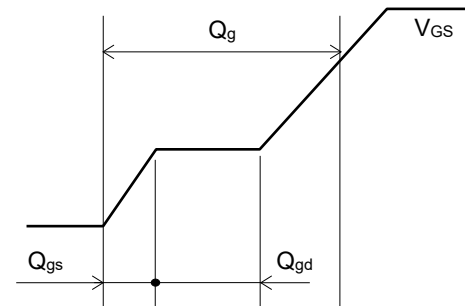


### Gate Charge

Test Circuit

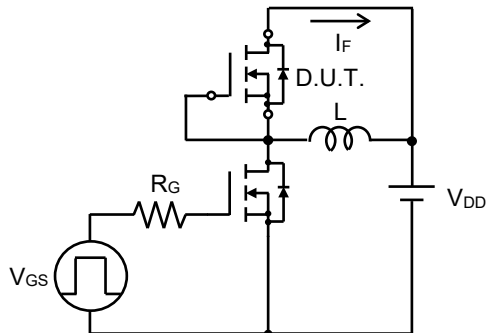


Waveform

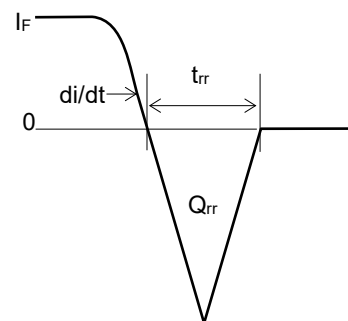


### Reverse Recovery

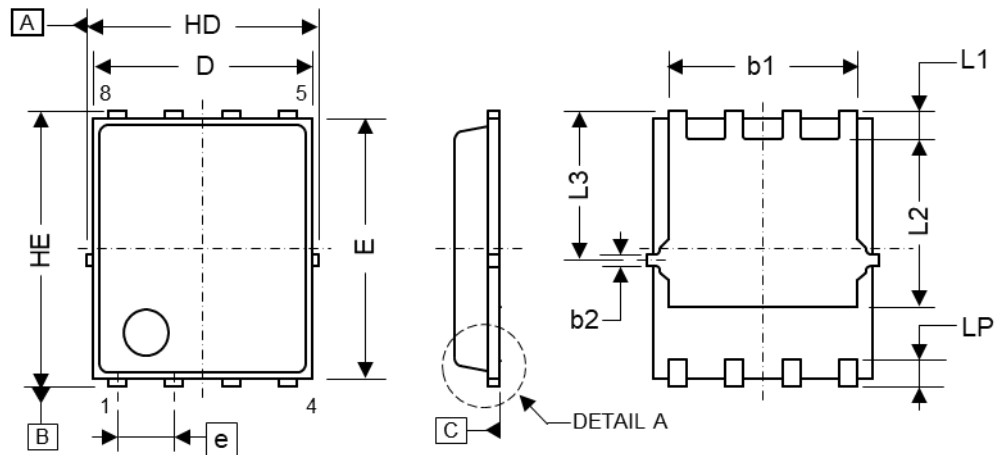
Test Circuit



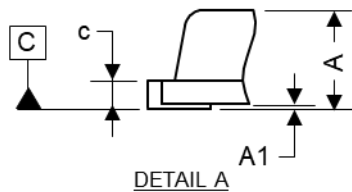
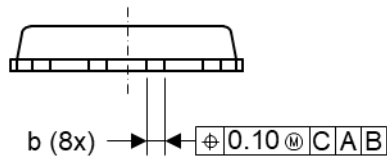
Waveform



# Package Dimensions

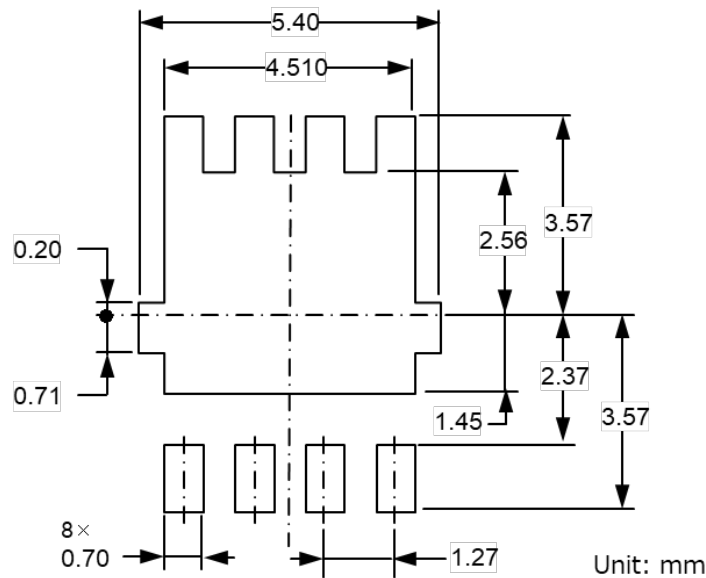


Mass : 0.1g



SYMBOL	DIMENSION (mm)		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	—	0.05
b	0.30	0.40	0.50
b1	4.11	4.21	4.31
b2	—	0.26	—
c	0.15	0.25	0.35
D	4.75	4.90	5.05
E	5.60	5.75	5.90
e	1.27BSC		
HD	4.95	5.15	5.35
HE	5.90	6.10	6.30
L1	0.45	0.65	0.85
L2	3.49	3.69	3.89
L3	3.10	3.30	3.50
LP	0.40	0.60	0.80

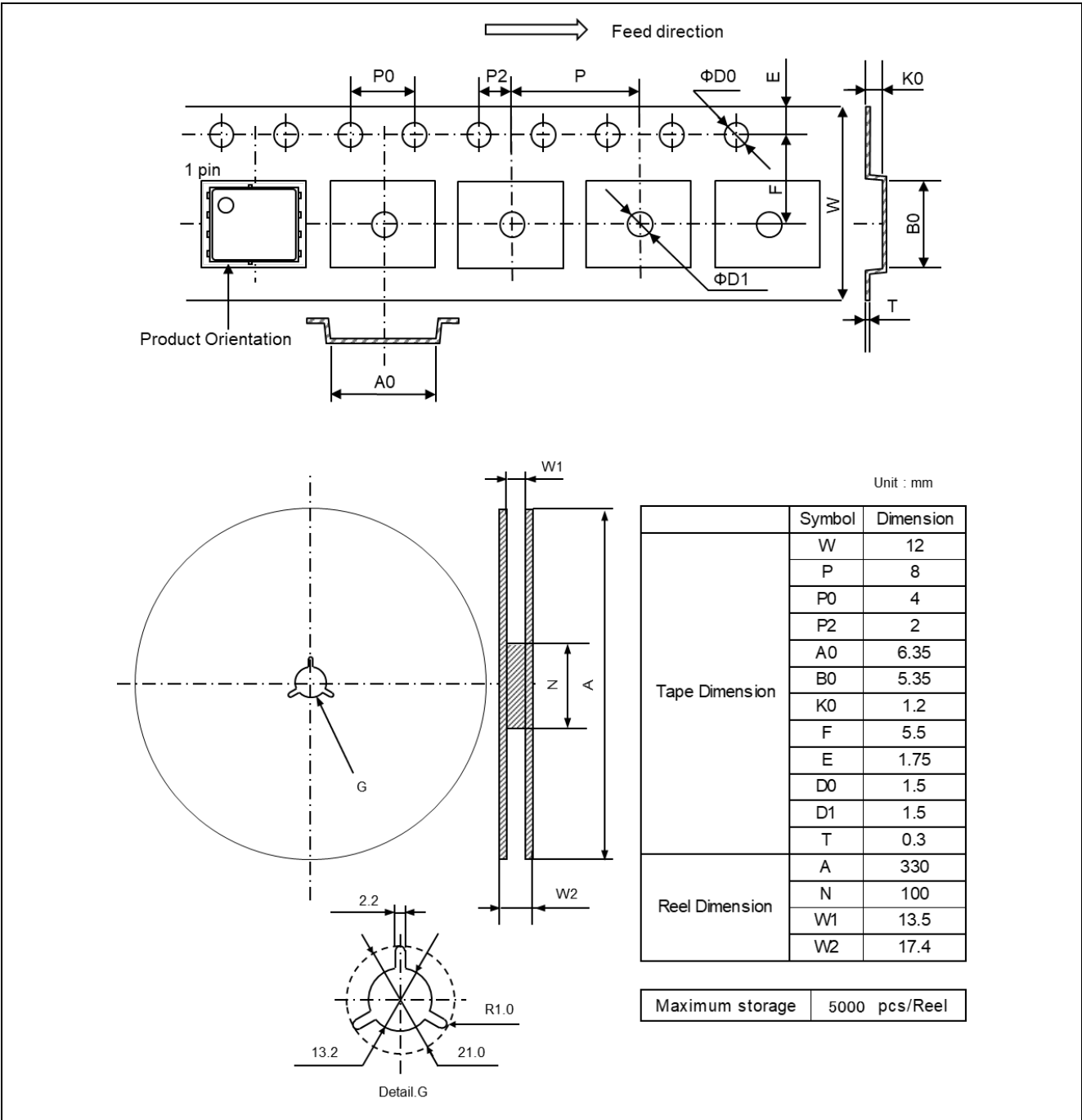
## Mount pad



Ordering Information

Part No.	Packing	Quantity
RBA50N04DANS-4UB05#HB0	Taping	5000pcs/reel

Packing Specification



Remark : Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

Continuous heavy condition (e.g. high temperature/voltage/current or high variation of temperature) may affect reliability even if it is within the absolute maximum ratings. Please consider derating condition for appropriate reliability in reference Renesas Semiconductor Reliability Handbook.



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