

## Description

DPQB04HB50MFN is a 4A,500V half-bridge Intelligent Power Module(IPM) designed for high-efficiency appliance motor drives. This module integrates 1 high voltage gate driver and 2 fast recovery MOSFETs in ESOP-9 package.

## Features

- High voltage gate driver
- Built-in 4A,500V fast recovery MOSFET
- Signal high level valid,compatible with 3.3V and 5V MCU
- Built-in bootstrap diode with current limiting resistor
- UVLO for both high side and low side
- Built-in dead time to avoid cross-conduction

## Key Parameters

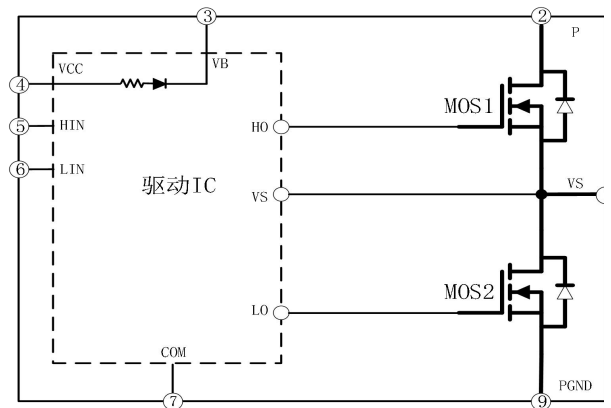
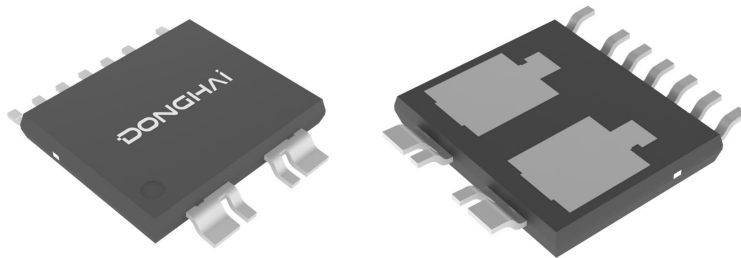
|                |                |
|----------------|----------------|
| Topology       | Half-bridge    |
| Driver         | HV Gate Driver |
| MOSFET         | 500V/4A/1.8Ω   |
| P <sub>D</sub> | 32.9W          |

## Applications

- Fans
- Pumps



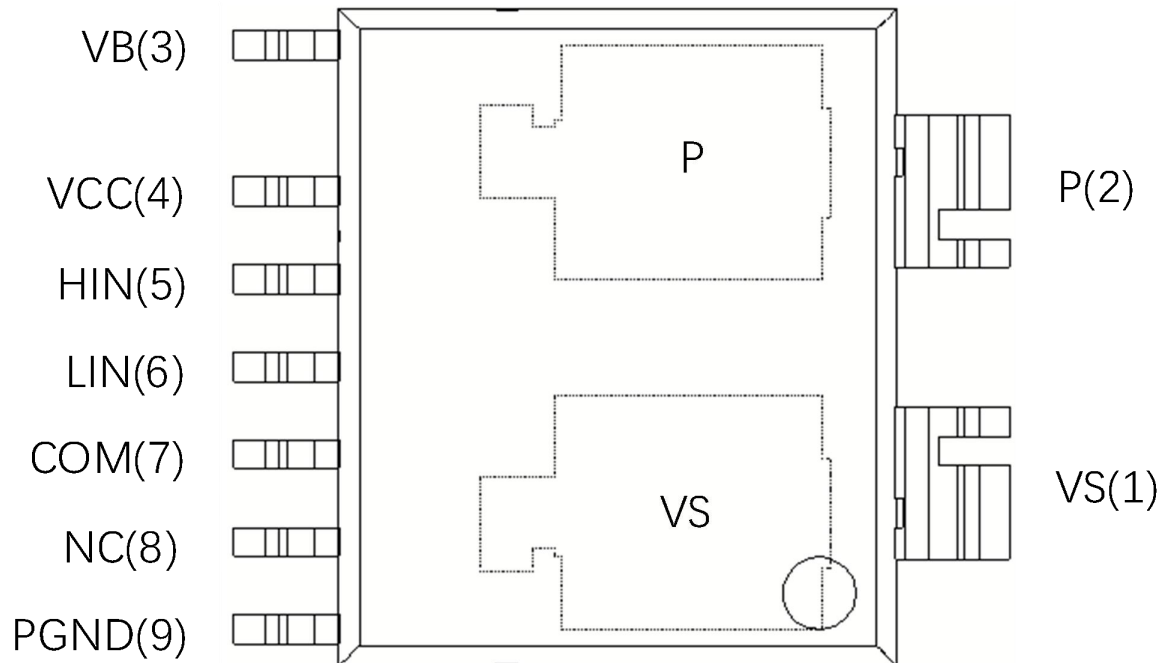
## ESOP-9



## Marking & Packing Information

| Part #        | Package | Marking       | Tube/Reel | Qty(pcs) |
|---------------|---------|---------------|-----------|----------|
| DPQB04HB50MFN | ESOP-9  | DPQB04HB50MFN | Reel      | 2500/box |

## Module Pin-Out Description



| Pin Number | Pin Name | Description                                       |
|------------|----------|---------------------------------------------------|
| 1          | VS       | High Side Floating Offset Voltage                 |
| 2          | P        | DC Bus Voltage Positive                           |
| 3          | VB       | High Side Floating Supply Voltage                 |
| 4          | VCC      | Low Side Driving And High Side Logic Power Supply |
| 5          | HIN      | Logic Input For High Side Gate Driver             |
| 6          | LIN      | Logic Input For Low Side Gate Driver              |
| 7          | COM      | Logic Common Ground                               |
| 8          | NC       | Not Connected                                     |
| 9          | PGND     | Source For Low Side MOSFET                        |

### Absolute Maximum Ratings

| Parameter                                                                                                                                                          | Symbol        | Value                    | Unit                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------|-----------------------------|
| Drain-Source Voltage                                                                                                                                               | $V_{DS}$      | 500                      | V                           |
| Continuous Drain Current<br>$T_C = 25^{\circ}\text{C}$ (Silicon limit)<br>$T_C = 25^{\circ}\text{C}$ (Package limit)<br>$T_C = 80^{\circ}\text{C}$ (Package limit) | $I_D$         | 4<br>3<br>1.8            | A                           |
| Pulsed Drain Current ( $T_C = 25^{\circ}\text{C}, t_p < 100\mu\text{s}$ )                                                                                          | $I_{DP}$      | 12                       | A                           |
| Power Dissipation ( $T_C = 25^{\circ}\text{C}$ , Each MOSFET)                                                                                                      | $P_D$         | 32.9                     | W                           |
| Low Side Driving And High Side Logic Power Supply                                                                                                                  | $V_{CC}$      | 20                       | V                           |
| High-Side Bias Voltage                                                                                                                                             | $V_{BS}$      | 20                       | V                           |
| Input Signal Voltage                                                                                                                                               | $V_{IN}$      | $-0.3 \sim V_{CC} + 0.3$ | V                           |
| Operating Junction Temperature                                                                                                                                     | $T_J$         | $-40 \sim 150$           | $^{\circ}\text{C}$          |
| Operating Case Temperature                                                                                                                                         | $T_C$         | $-40 \sim 125$           | $^{\circ}\text{C}$          |
| Storage Temperature                                                                                                                                                | $T_{stg}$     | $-40 \sim 125$           | $^{\circ}\text{C}$          |
| Junction to Case Thermal Resistance                                                                                                                                | $\theta_{JC}$ | 3.8                      | $^{\circ}\text{C}/\text{W}$ |
| Bootstrap Diode Reverse Voltage                                                                                                                                    | $V_{RRMB}$    | 500                      | V                           |

### Recommended Operating Conditions

| Parameter                                         | Symbol        | Value |      |          | Unit          |
|---------------------------------------------------|---------------|-------|------|----------|---------------|
|                                                   |               | min.  | typ. | max.     |               |
| Supply Voltage                                    | $V_{PN}$      | -     | 300  | 400      | V             |
| Low Side Driving And High Side Logic Power Supply | $V_{CC}$      | 12    | 15   | 18       | V             |
| High-Side Bias Voltage                            | $V_{BS}$      | 12    | 15   | 18       | V             |
| Input ON Threshold Voltage                        | $V_{IN(ON)}$  | 3     | -    | $V_{CC}$ | V             |
| Input OFF Threshold Voltage                       | $V_{IN(OFF)}$ | 0     | -    | 0.8      | V             |
| Blanking Time for Preventing Arm-Short            | $t_{DEAD}$    | 1     | -    | -        | $\mu\text{s}$ |
| PWM Switching Frequency                           | $f_{PWM}$     | -     | 25   | 35       | kHz           |

**Electrical Characteristic** (at  $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

**Power Characteristic**

| Parameter                                     | Symbol       | Value |      |      | Unit     | Test Condition                                                    |
|-----------------------------------------------|--------------|-------|------|------|----------|-------------------------------------------------------------------|
|                                               |              | min.  | typ. | max. |          |                                                                   |
| Drain-Source Breakdown Voltage <sup>(1)</sup> | $BV_{DSS}$   | 500   | -    | -    | V        | $V_{IN}=0V, I_D=250\mu A$                                         |
| Zero Gate Voltage Drain Current               | $I_{DSS}$    | -     | -    | 250  | $\mu A$  | $V_{IN}=0V, V_{DS}=500V$                                          |
| Drain-Source on-state Resistance              | $R_{DS(on)}$ | -     | 1.8  | 2.2  | $\Omega$ | $V_{CC}=V_{BS}=15V$<br>$V_{IN}=5V, I_D=2A$                        |
| Diode Forward Voltage                         | $V_{SD}$     | -     | -    | 1.5  | V        | $V_{CC}=V_{BS}=15V$<br>$V_{IN}=0V, I_{SD}=4A$                     |
| Switching Times <sup>(2)</sup>                | $t_{ON}$     | -     | 770  | -    | ns       | $V_{PN}=300V$<br>$V_{CC}=V_{BS}=15V$<br>$V_{IN}=0\sim 5V, I_D=2A$ |
|                                               | $t_{OFF}$    | -     | 549  | -    | ns       |                                                                   |
|                                               | $t_{rr}$     | -     | 95   | -    | ns       |                                                                   |
|                                               | $E_{ON}$     | -     | 136  | -    | $\mu J$  |                                                                   |
|                                               | $E_{OFF}$    | -     | 17   | -    | $\mu J$  |                                                                   |

**Control Characteristic**

| Parameter                                         | Symbol     | Value |      |      | Unit    | Test Condition                      |
|---------------------------------------------------|------------|-------|------|------|---------|-------------------------------------|
|                                                   |            | min.  | typ. | max. |         |                                     |
| Quiescent VCC Supply Current                      | $I_{QCC}$  | -     | -    | 200  | $\mu A$ | $V_{CC}=V_{BS}=15V$<br>$V_{LIN}=5V$ |
| Quiescent VBS Supply Current                      | $I_{QBS}$  | -     | -    | 150  | $\mu A$ | $V_{CC}=V_{BS}=15V$<br>$V_{HIN}=5V$ |
| High-side Control Supply under-voltage Protection | $UV_{BSD}$ | 6     | 6.5  | 7    | V       | Trip Level                          |
|                                                   | $UV_{BSR}$ | 6.5   | 7    | 7.5  | V       | Reset Level                         |
| Low-side Control Supply under-voltage Protection  | $UV_{CCD}$ | 7.5   | 8.2  | 8.9  | V       | Trip Level                          |
|                                                   | $UV_{CCR}$ | 8     | 9.1  | 9.8  | V       | Reset Level                         |
| ON Threshold Voltage                              | $V_{IH}$   | -     | -    | 2.5  | V       | Logic High Level                    |
| OFF Threshold Voltage                             | $V_{IL}$   | 0.8   | -    | -    | V       | Logic Low Level                     |
| ON Input Bias Current                             | $I_{IH}$   | -     | -    | 15   | $\mu A$ | $V_{CC}=15V, V_{IH}=5V$             |
| Off Input Bias Current                            | $I_{IL}$   | -     | -    | 1    | $\mu A$ | $V_{CC}=15V, V_{IH}=0V$             |

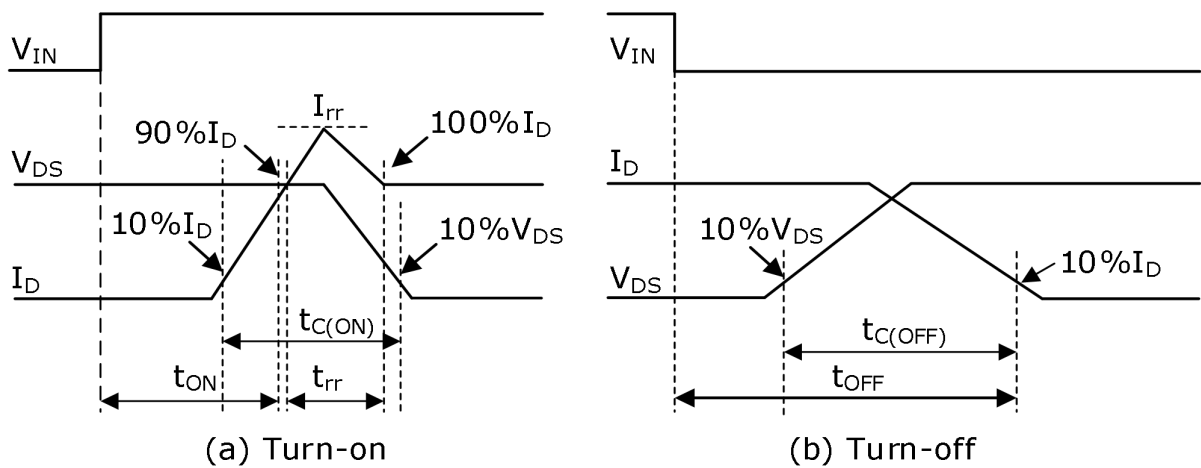
### Bootstrap Diode Characteristic

| Parameter                       | Symbol   | Value |      |      | Unit     | Test Condition                          |
|---------------------------------|----------|-------|------|------|----------|-----------------------------------------|
|                                 |          | min.  | typ. | max. |          |                                         |
| Bootstrap Diode Forward Voltage | $V_F$    | -     | 1.5  | -    | V        | $I_F=10\text{mA}, T_C=25^\circ\text{C}$ |
| Built-in Limiting Resistance    | $R_{BS}$ | -     | 50   | -    | $\Omega$ |                                         |

#### Note:

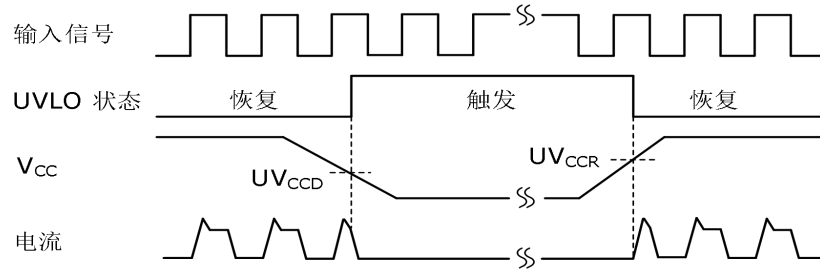
1. BVDSS is the absolute maximum rated voltage between drain and source of each MOSFET. Thinking of the effects of stray inductance,  $V_{PN}$  should be less than this value to ensure that  $V_{DS}$  doesn't exceed BVDSS in any case.

2.  $T_{on}, T_{off}$  include delay time of internal driver IC. The values were mresured under laboratory test conditions. Due to printed circuit board and wiring, they may vary depending on the field application. And the definition of switching times can refer to the following figure.

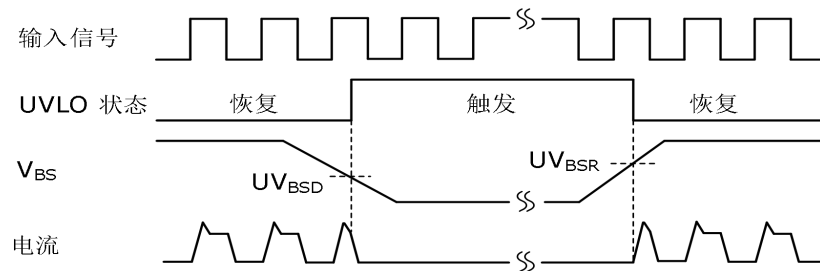


## Undervoltage Lockout Protection Circuit

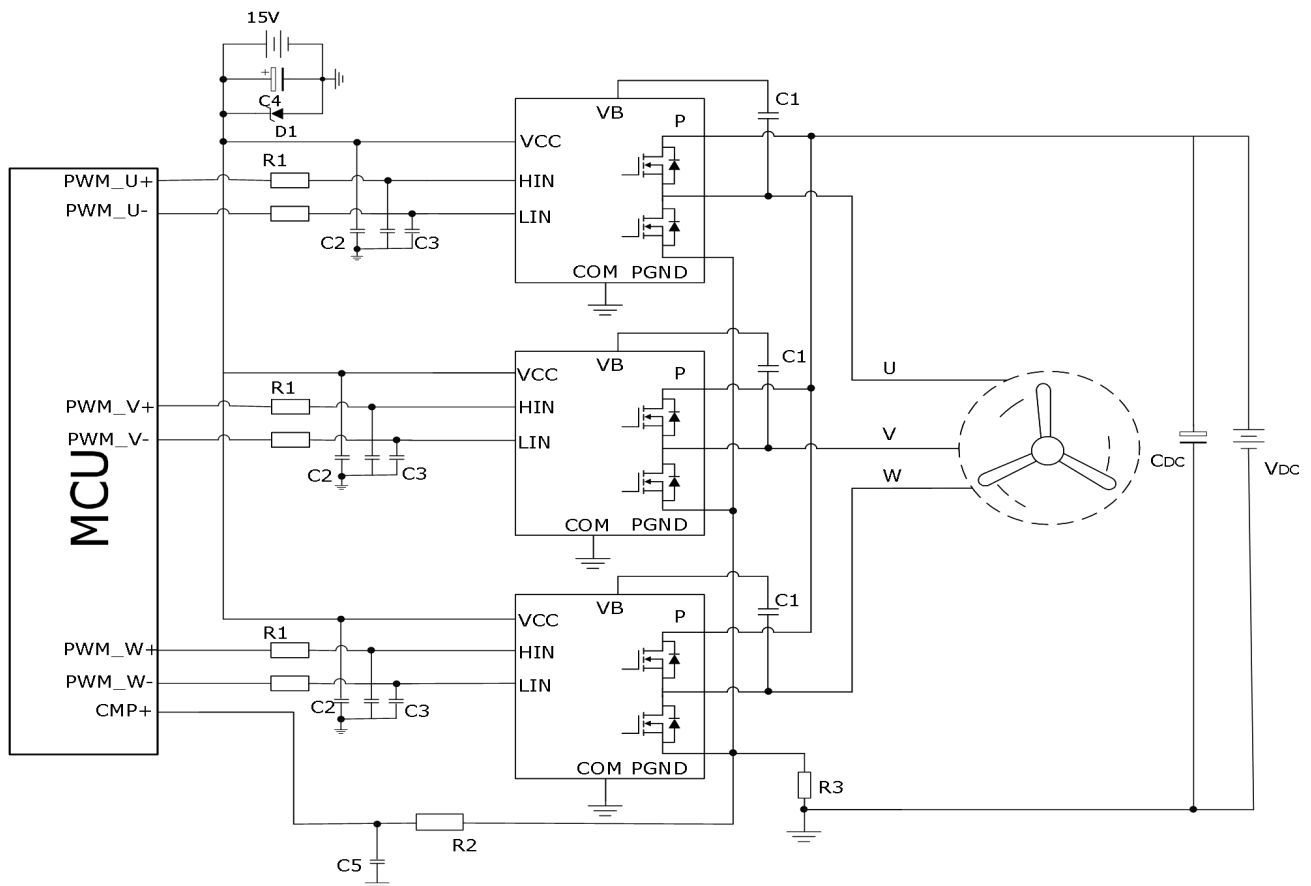
低侧



高侧

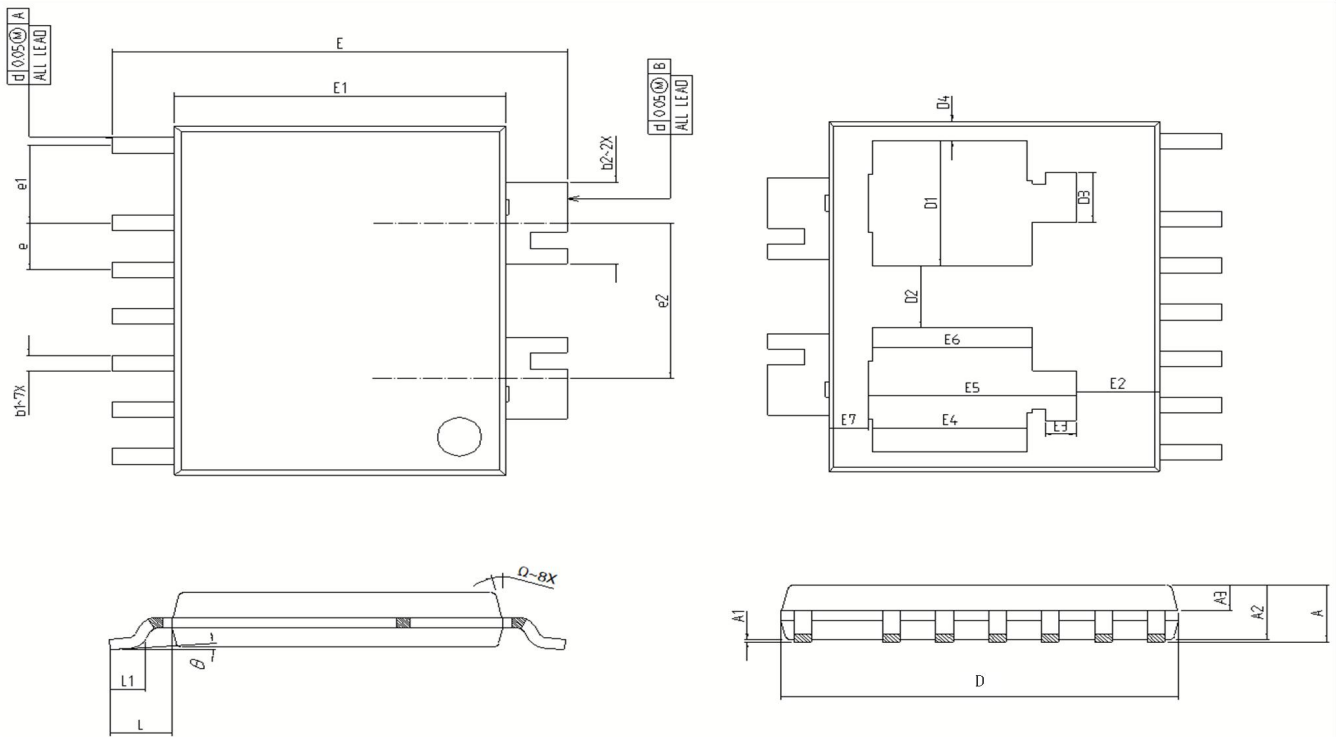


## Recommended Application Circuit



## Package Outline : ESOP-9

\*Dimensions in mm



| Symbol | Value |      |      | Symbol | Value    |      |      |
|--------|-------|------|------|--------|----------|------|------|
|        | min.  | typ. | max. |        | min.     | typ. | max. |
| A      | -     | -    | 1.52 | E2     | -        | 1.9  | -    |
| A1     | 0.02  | -    | 0.12 | E3     | -        | 0.7  | -    |
| A2     | 1.35  | 1.4  | 1.45 | E4     | -        | 3.5  | -    |
| A3     | 0.6   | 0.65 | 0.7  | E5     | -        | 4.7  | -    |
| b1     | 0.37  | -    | 0.43 | E6     | -        | 3.6  | -    |
| b2     | -     | -    | 2.13 | E7     | -        | 0.9  | -    |
| D      | 8.95  | 9    | 9.05 | e      | 1.2(BSC) |      |      |
| D1     | -     | 3.2  | -    | e1     | 2.0(BSC) |      |      |
| D2     | -     | 1.6  | -    | e2     | 4.0(BSC) |      |      |
| D3     | -     | 1.28 | -    | L      | -        | 1.4  | -    |
| D4     | -     | 0.5  | -    | L1     | -        | 0.8  | -    |
| E      | 10.1  | 10.3 | 10.5 | Ω      | -        | 13°  | -    |
| E1     | 7.45  | 7.5  | 7.55 | θ      | -        | 4°   | -    |

## Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as aviation, aerospace, life-support devices or systems.

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