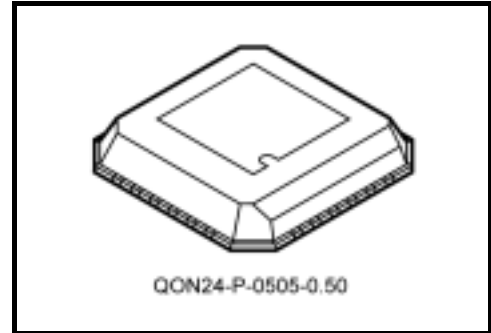


# TB6594FLG

## Dual DC motor driver with built-in DC-DC Converter

TB6594FLG is DC motor driver that uses low ON-resistance LDMOS transistors for the output block. two inputs (IN1, IN2) are used to drive a DC motors in forward and reverse and short-break and stop directions.



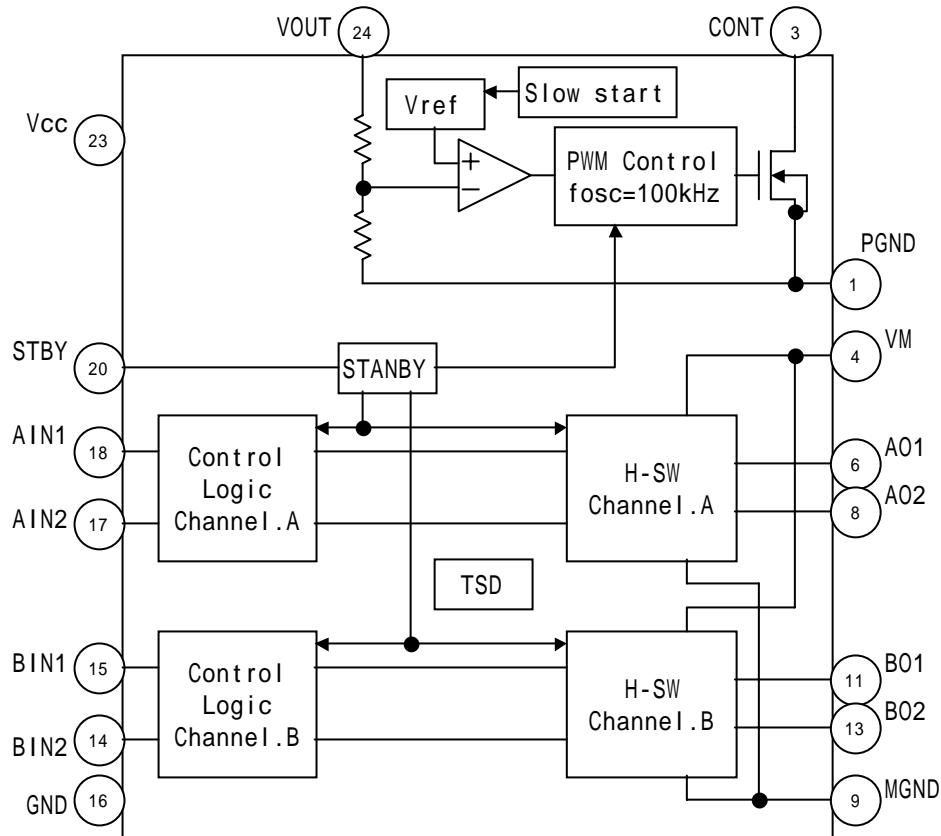
Weight: 0.05 g (typ.)

### Features

- Motor supply voltage:  $V_M \leq 5.5$  V (max)
- Control supply voltage:  $V_{CC} = 2.7$  V to 5.5 V
- Output current:  $I_{out} \leq 0.8$  A (max)
- Low ON-resistance: 1.5 ohm (upper side + lower side typ. @  $V_M = 5$  V)
- Forward/Reverse/short brake/stop mode control
- Built-in PWM DC-DC converter circuit (+5V output)
- Standby (power-saving) mode
- On-chip thermal shutdown circuit (TSD)
- Package: QON24

Note: This product has a MOS structure and is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer. Ensure also that the ambient temperature and relative humidity are maintained at reasonable levels.

**Block Diagram**



**Pin Functions**

| PinNO. | Pin name | Functional Description        | Remarks                   |
|--------|----------|-------------------------------|---------------------------|
| 1      | PGND     | GND pin for DC-DC             |                           |
| 2      | (NC)     | Non connect                   |                           |
| 3      | CONT     | DCDC switching pin            | External inductor connect |
| 4      | VM       | Motor power supply            | VM=2.2 ~ 5V               |
| 5      | (NC)     | Non connect                   |                           |
| 6      | A01      | OutputA1 (for motor A)        |                           |
| 7      | (NC)     | Non connect                   |                           |
| 8      | A02      | OutputA2 (for motor A)        |                           |
| 9      | MGND     | GND pin for motor             |                           |
| 10     | (NC)     | Non connect                   |                           |
| 11     | B01      | OutputB1 (for motor B)        |                           |
| 12     | (NC)     | Non connect                   |                           |
| 13     | B02      | OutputB2 (for motor B)        |                           |
| 14     | BIN2     | Control InputB2 (for motor B) |                           |
| 15     | BIN1     | Control InputB1 (for motor B) |                           |
| 16     | GND      | GND pin for small signal      |                           |
| 17     | AIN2     | Control InputA2 (for motor A) |                           |
| 18     | AIN1     | Control InputA1 (for motor A) |                           |
| 19     | (NC)     | Non connect                   |                           |
| 20     | STBY     | Standby control               | "L"=standby (all-off)     |
| 21     | (NC)     | Non connect                   |                           |
| 22     | (NC)     | Non connect                   |                           |
| 23     | Vcc      | Power supply for small signal | Vcc=2.7V ~ 5V             |
| 24     | VOUT     | DC-DC output                  | +5V (typ.)                |

## Truth Table

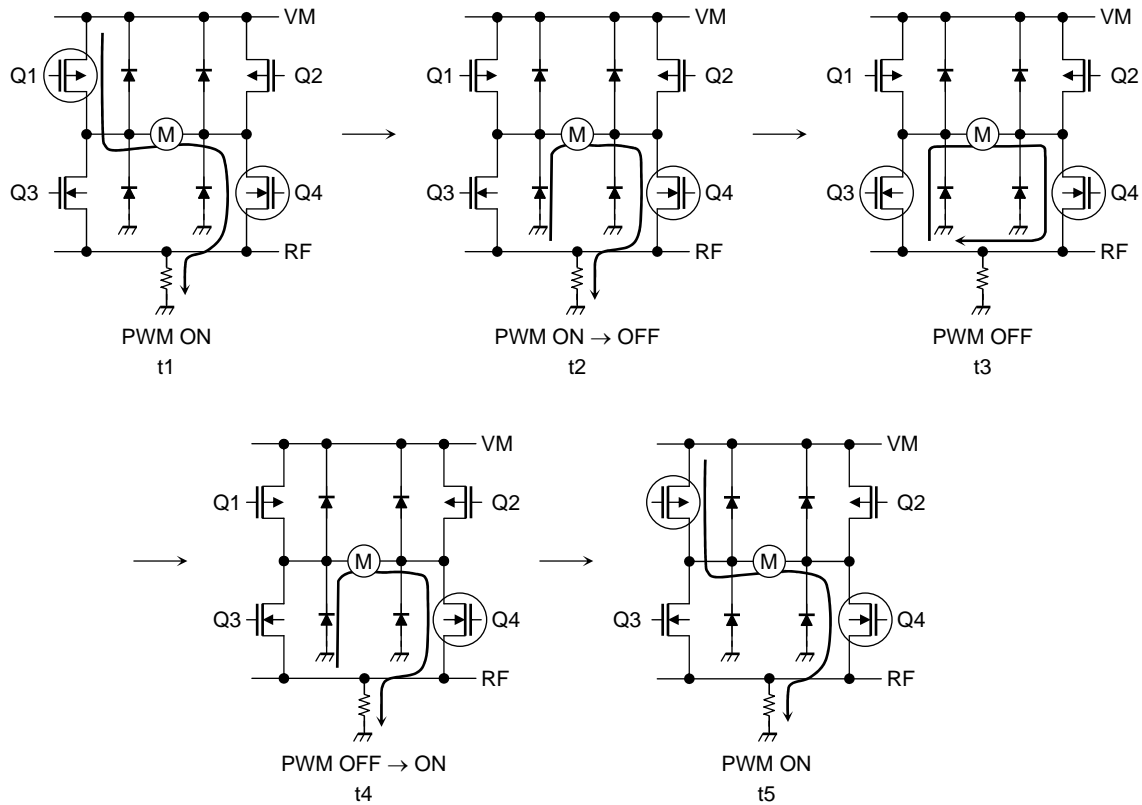
| Input |      |      | Output |      |             |
|-------|------|------|--------|------|-------------|
| IN1   | IN2  | STBY | OUT1   | OUT2 | Mode        |
| H     | H    | H    | L      | L    | Short brake |
| L     | H    | H    | L      | H    | Reverse     |
| H     | L    | H    | H      | L    | Forward     |
| L     | L    | H    | OFF    |      | Stop        |
| HorL  | HorL | L    | OFF    |      | Standby     |

## Operating Description

### PWM control function

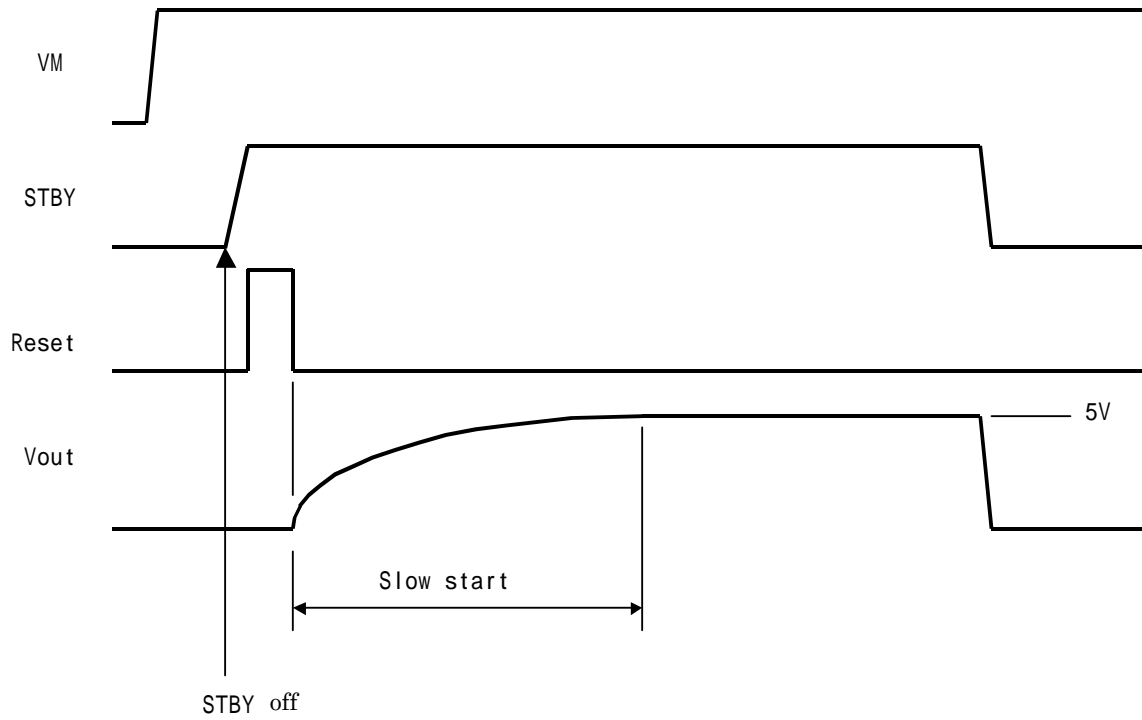
When PWM control is activated, normal operation and short brake operation are repeated.

To prevent shoot-through current, dead time  $t_2$  and  $t_4$  is provided in the IC.



## DC-DC Converter

| STBY | Vout ( DCDC output ) | remarks             |
|------|----------------------|---------------------|
| L    | Standby ( off )      | Sw Tr.:off          |
| H    | Output ON ( +5V )    | Slow start sequence |



VM on  
 STBY off ( "L" → "H" )  
 internal Logic Reset  
 Slow start  
 Vout = +5V constant voltage control

## Maximum Ratings (Ta = 25°C)

| Characteristics       | Symbol            | Rating     | Unit | Remarks                       |
|-----------------------|-------------------|------------|------|-------------------------------|
| Power supply voltage  | V <sub>M</sub>    | 5.5        | V    | Power supply for motor        |
|                       | V <sub>CC</sub>   | 5.5        |      | Power supply for small signal |
| Input voltage         | V <sub>IN</sub>   | -0.2 ~ 5.5 | V    | A1N1,A1N2,B1N1,B1N2,STBY      |
| Output voltage        | V <sub>out</sub>  | 5.5        | V    | AO1,AO2,BO1,BO2               |
|                       | V <sub>cont</sub> | 5.5        |      | CONT pin                      |
| Output current        | I <sub>out</sub>  | 0.8        | A    | AO1,AO2,BO1,BO2               |
|                       | I <sub>cont</sub> | 0.5        |      | CONT                          |
| Power dissipation     | PD                | 0.78       | W    | Note                          |
| Operating temperature | T <sub>opr</sub>  | -20 to 85  |      |                               |
| Storage temperature   | T <sub>stg</sub>  | -55 to 150 |      |                               |

Note : When mounted on a glass-epoxy PCB (50 mm × 30 mm × 1.6 mm, Cu area: 40%)

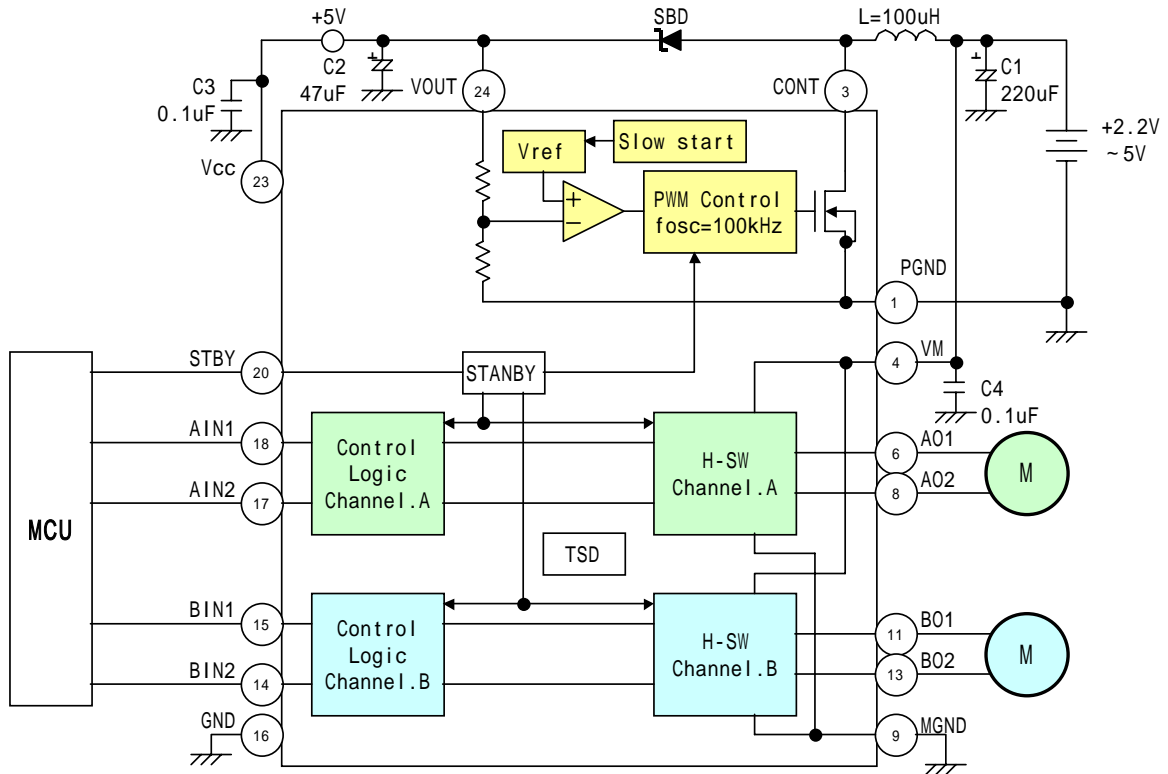
## Operating Range (Ta = -20 to 85°C)

| Characteristics                         | Symbol           | Min | Typ. | Max | Unit |
|---|------------------|-----|------|-----|------|
| Power supply voltage (V <sub>CC</sub> ) | V <sub>CC</sub>  | 2.7 | 3    | 5   | V    |
| Power supply voltage (V <sub>M</sub> )  | V <sub>M</sub>   | 2.2 | 3    | 5   | V    |
| Output current (for motor)              | I <sub>OUT</sub> | —   | —    | 0.6 | A    |

## Electrical Characteristics (Unless otherwise specified, V<sub>CC</sub> = 3 V, V<sub>M</sub> = 5 V, Ta = 25°C)

| Characteristics       |   | Symbol                 | Test Condition      | Min  | Typ. | Max         | Unit |
|-----------------------|---|------------------------|---------------------|------|------|-------------|------|
| DC-DC<br>Circuit      | Output voltage                                    | Vout                   |                     | 4.75 | 5    | 5.25        | V    |
|                       | Input voltage                                     | VIN                    |                     | ---  | ---  | 5           |      |
|                       | DCDCStart level                                   | VST1                   | Iout=1mA            | ---  | ---  | 2.2         |      |
|                       | OSC start level                                   | VST2                   | No load, Vout sweep | ---  | ---  | 2           |      |
|                       | DCDC hold level                                   | VLD                    | Iout=1mA, VIN sweep | ---  | ---  | 1.9         | μ A  |
|                       | Supply current                                    | Iout1                  | No load, Vout=4.75V | ---  | 420  | 600         |      |
|                       |   | Iout(STB)              | STBY=0V             | ---  | 0    | 0.5         |      |
|                       | Ron SWTr  | Rsw(on)                | VCONT=0.4V          | ---  | 1    | 2           | μ A  |
|                       | Leakage of SWTr                                   | ILCONT                 | VOUT=VCONT=5.5V     | ---  | 0    | 1           |      |
|                       | Regural line                                      | Δ Vout                 | VM=2.2V to 3V       | ---  | 10   | 60          | m V  |
|                       | Regular load                                      | Vo load                | Iout=10μ A to 50m A | ---  | 150  | 250         |      |
|                       | Osc frequency                                     | fosc                   |                     | 70   | 100  | 130         | k Hz |
|                       | Max duty ratio                                    | Maxduty                |                     | 78   | 87   | 92          |      |
|                       | Effiency  | EFFI                   |                     | ---  | 80   | ---         | %    |
| Slow start time       | Tss   | RL=5kohm               | 2.5                 | 5    | 7.5  | m s         |      |
| H-SW<br>circuit       | Supply current                                    | Icc                    | STBY=Vcc            | ---  | 0.23 | 0.5         | m A  |
|                       |   | Icc(STB)               | STBY=0V             | ---  | 0    | 1           | μ A  |
|                       |   | IM(STB)                |                     | ---  | 0    | 1           |      |
|                       | Input voltage                                     | VIH                    |                     | 2    | ---  | Vcc<br>+0.2 | V    |
|                       |   | VIL                    |                     | -0.2 | ---  | 0.8         |      |
|                       |   | VIN(hys)               | (Design guarantee)  | ---  | 0.2  | ---         |      |
|                       | Input current                                     | IIH                    | VIN=3V              | 5    | 15   | 25          | μ A  |
|                       |   | IIL                    | VIN=0V              | ---  | 0    | 1           |      |
|                       | Input voltage<br>(standby pin)                    | VIH(STB)               |                     | 2    | ---  | Vcc<br>+0.2 | V    |
|                       |   | VIL(STB)               |                     | -0.2 | ---  | 0.8         |      |
|                       | Input current<br>(standby pin)                    | IIH(STB)               | VIN=3V              | 15   | 40   | 80          | μ A  |
|                       |   | IIL(STB)               | VIN=0V              | ---  | 0    | 1           |      |
|                       | Output saturating voltage                         | Vsat<br>(U+L)          | Io=0.2A             | ---  | 0.2  | 0.4         | V    |
|                       |   |                        | Io=0.6A             | ---  | 0.6  | 1.2         |      |
|                       | Output leakage                                    | IL(U)                  | VM=AO1,2,BO1,2=5.5V | ---  | 0    | 1           | μ A  |
| IL(L)                 |   | VM=5.5V,AO1,2,BO1,2=0V | -1                  | 0    | ---  |             |      |
| Diode forward voltage | VF(U)   | IF=0.6A                | ---                 | 0.9  | 1.2  | V           |      |
|                       | VF(L)   |                        | ---                 | 0.9  | 1.2  |             |      |
| TSD                   | Thermal shutdown circuit<br>operating temperature | TSD                    | (Design guarantee)  | ---  | 170  | ---         |      |
|                       | Thermal shutdown hysteresis                       | Δ TSD                  |                     | ---  | 20   | ---         |      |

## Application Circuit Example



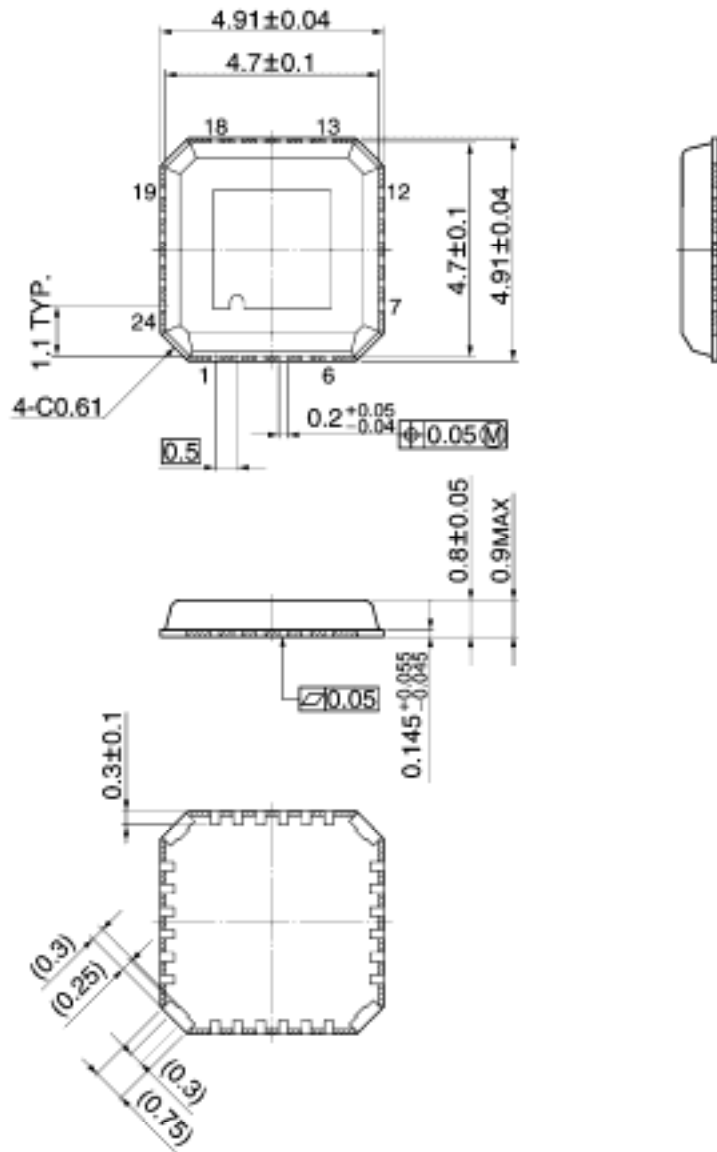
- L: 100 $\mu$  H CD54 :SUMIDA corp.
- SBD: MA720 :MATSUSHITA corp.
- C2: 47 $\mu$  F :NICHIKON corp.


Note: Noise suppression capacitors and oscillator capacitors should be connected as close as possible to the IC.

Package Dimensions

QON24-P-0505-0.50

Unit: mm



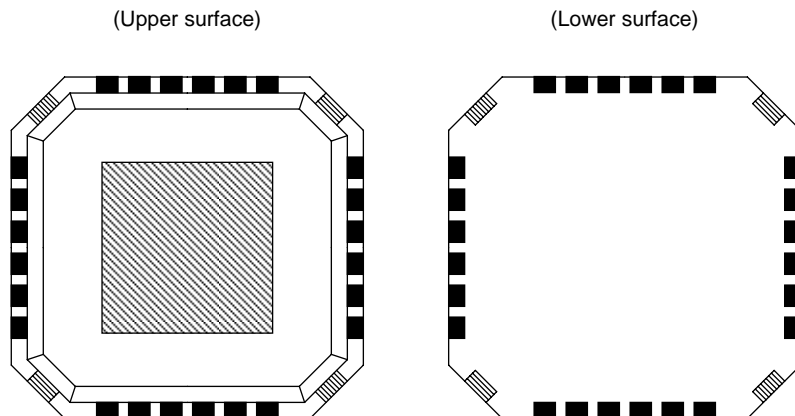
- Note 1) The solder plating portion in four corners of the package shall not be treated as an external terminal.
- Note 2) Don't carry out soldering to four corners of the package.
- Note 3)  area : Resin surface

Weight: 0.05 g (typ.)



## Requests Concerning Use of QON

### Outline Drawing of Package



When using QON, please take into account the following items.

#### Caution

Do not carry out soldering on the island section in the four corners of the package (the section shown on the lower surface drawing with diagonal lines) with the aim of increasing mechanical strength.

The island section exposed on the package surface (the section shown on the upper surface drawing with diagonal lines) must be used as (Note 6) below while electrically insulated from outside.

Note 6: Ensure that the island section (the section shown on the lower surface drawing with diagonal lines) does not come into contact with solder from through-holes on the board layout.

- When mounting or soldering, take care to ensure that neither static electricity nor electrical overstress is applied to the IC (measures to prevent anti-static, leaks, etc.).
- When incorporating into a set, adopt a set design that does not apply voltage directly to the island section.

**RESTRICTIONS ON PRODUCT USE**

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