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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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HD74HC4022

Octal Counters/Dividers

REJ03D0646-0200
 (Previous ADE-205-532)
 Rev.2.00
 Mar 30, 2006

Description

The HD74HC4022 is a four-stage Johnson octal counter with built-in code converter. High speed operation and spike-free outputs are obtained by use of a Johnson octal counter design. The eight decoded outputs are normally low, and go high only at their appropriate octal time period. The output changes occur on the positive-going edge of the clock pulse. This part can be used in frequency division application as well as octal counter or octal decode display applications.





Features

- High Speed Operation
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC} = 2$ to 6 V
- Low Input Current: $1 \mu\text{A}$ max
- Low Quiescent Supply Current: I_{CC} (static) = $4 \mu\text{A}$ max ($T_a = 25^\circ\text{C}$)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|------------------------------|----------------------|--------------------------------|
| HD74HC4022P | DILP-16 pin | PRDP0016AE-B (DP-16FV) | P | — |
| HD74HC4022FPEL | SOP-16 pin (JEITA) | PRSP0016DH-B (FP-16DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC4022RPEL | SOP-16 pin (JEDEC) | PRSP0016DG-A (FP-16DNV) | RP | EL (2,500 pcs/reel) |

Note: Please consult the sales office for the above package availability.

Function Table

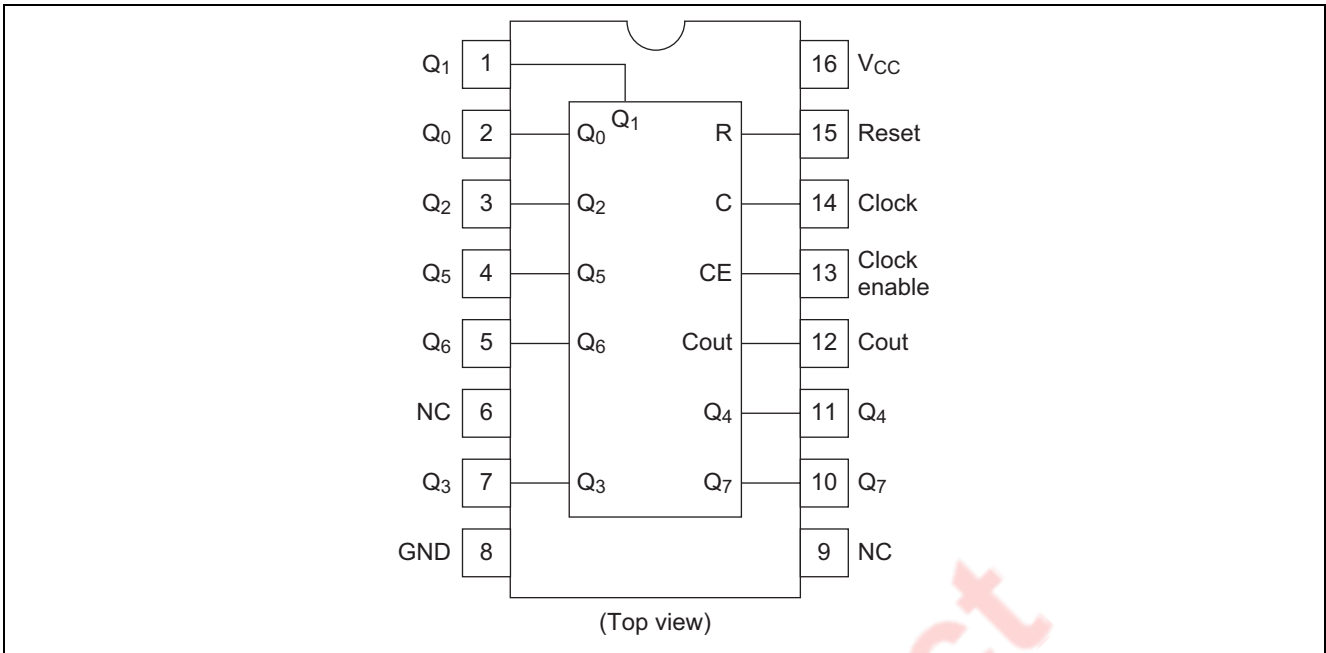
| Clock | Clock Enable | Reset | Output n |
|---|---|-------|----------|
| L | X | L | n |
| X | H | L | n |
|  | L | L | n + 1 |
|  | X | L | n |
| H |  | L | n + 1 |
| X |  | L | n |
| X | X | H | Q_0 |

X: Irrelevant

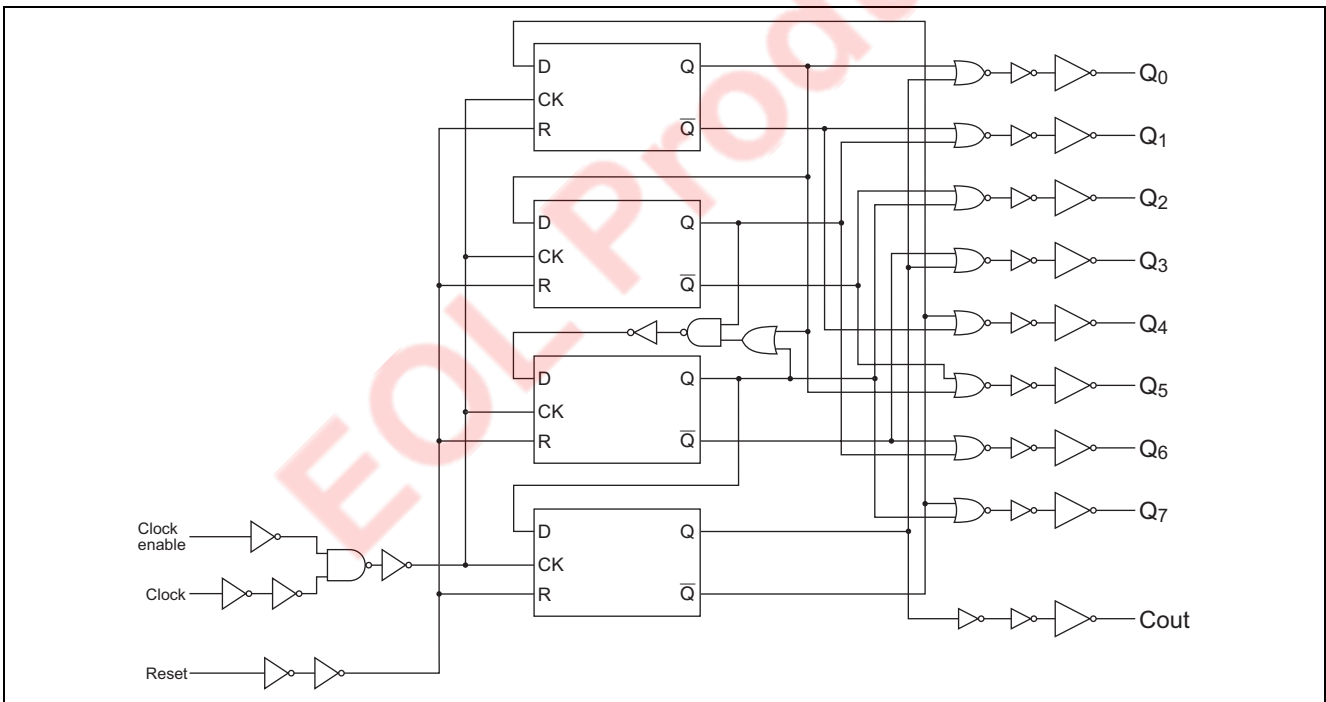
$n < 4$... Carry = H

$n \geq 4$... Carry = L

Pin Arrangement



Logic Diagram



Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit |
|------------------------------|-----------------------|------------------------|------|
| Supply voltage range | V_{CC} | -0.5 to 7.0 | V |
| Input / Output voltage | V_{IN}, V_{OUT} | -0.5 to $V_{CC} + 0.5$ | V |
| Input / Output diode current | I_{IK}, I_{OK} | ± 20 | mA |
| Output current | I_{OUT} | ± 25 | mA |
| V_{CC} , GND current | I_{CC} or I_{GND} | ± 50 | mA |
| Power dissipation | P_T | 500 | mW |
| Storage temperature | T_{stg} | -65 to +150 | °C |

Note: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

Recommended Operating Conditions

| Item | Symbol | Ratings | Unit | Conditions |
|--------------------------------------|-------------------|---------------|------|------------------|
| Supply voltage | V_{CC} | 2 to 6 | V | |
| Input / Output voltage | V_{IN}, V_{OUT} | 0 to V_{CC} | V | |
| Operating temperature | T_a | -40 to 85 | °C | |
| Input rise / fall time ^{*1} | t_r, t_f | 0 to 1000 | ns | $V_{CC} = 2.0$ V |
| | | 0 to 500 | | $V_{CC} = 4.5$ V |
| | | 0 to 400 | | $V_{CC} = 6.0$ V |

Note: 1. This item guarantees maximum limit when one input switches.

Waveform: Refer to test circuit of switching characteristics.

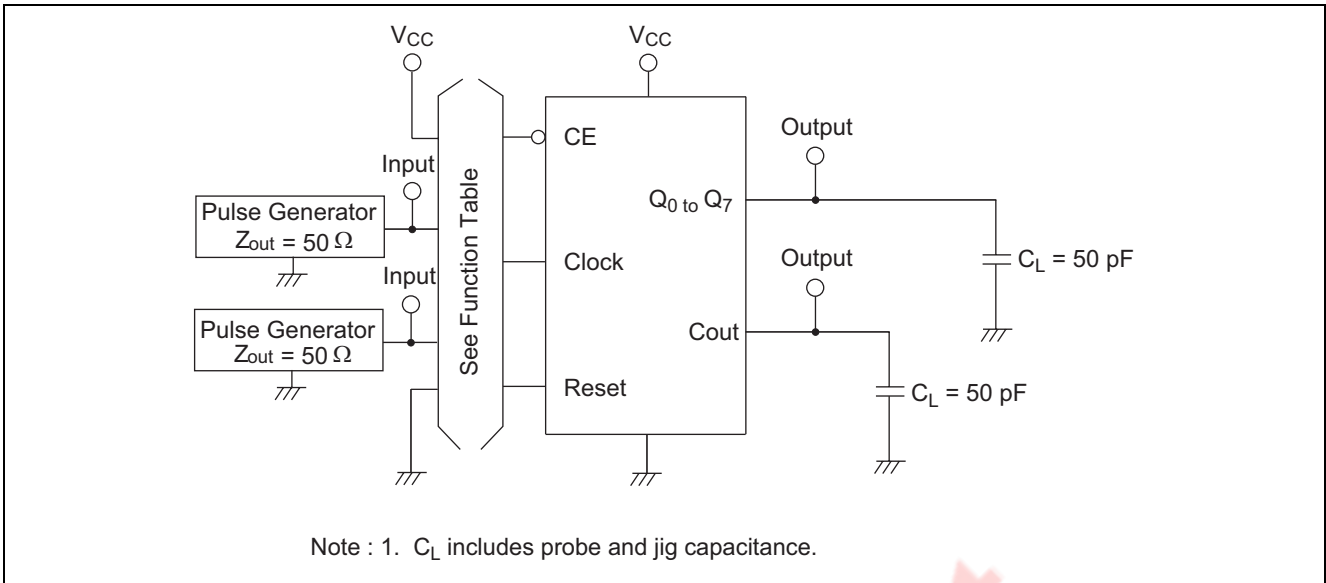
Electrical Characteristics

| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40 \text{ to } +85^\circ\text{C}$ | | Unit | Test Conditions | | |
|--------------------------|----------|--------------|--------------------------|-----|-----------|---|-----------|---------------|---|----------------------------|---------------------------|
| | | | Min | Typ | Max | Min | Max | | | | |
| Input voltage | V_{IH} | 2.0 | 1.5 | — | — | 1.5 | — | V | | | |
| | | 4.5 | 3.15 | — | — | 3.15 | — | | | | |
| | | 6.0 | 4.2 | — | — | 4.2 | — | | | | |
| | V_{IL} | 2.0 | — | — | 0.5 | — | 0.5 | V | | | |
| | | 4.5 | — | — | 1.35 | — | 1.35 | | | | |
| | | 6.0 | — | — | 1.8 | — | 1.8 | | | | |
| Output voltage | V_{OH} | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V | $V_{in} = V_{IH}$ or V_{IL} | $I_{OH} = -20 \mu\text{A}$ | |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | $I_{OH} = -4 \text{ mA}$ | |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | $I_{OH} = -5.2 \text{ mA}$ | |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | | | |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | | | |
| | V_{OL} | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | $V_{in} = V_{IH}$ or V_{IL} | $I_{OL} = 20 \mu\text{A}$ | |
| | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | | |
| | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | | |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | | | $I_{OH} = 4 \text{ mA}$ |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | | | $I_{OH} = 5.2 \text{ mA}$ |
| Input current | I_{in} | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | $V_{in} = V_{CC}$ or GND | | |
| Quiescent supply current | I_{CC} | 6.0 | — | — | 4.0 | — | 40 | μA | $V_{in} = V_{CC}$ or GND, $I_{out} = 0 \mu\text{A}$ | | |

Switching Characteristics ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

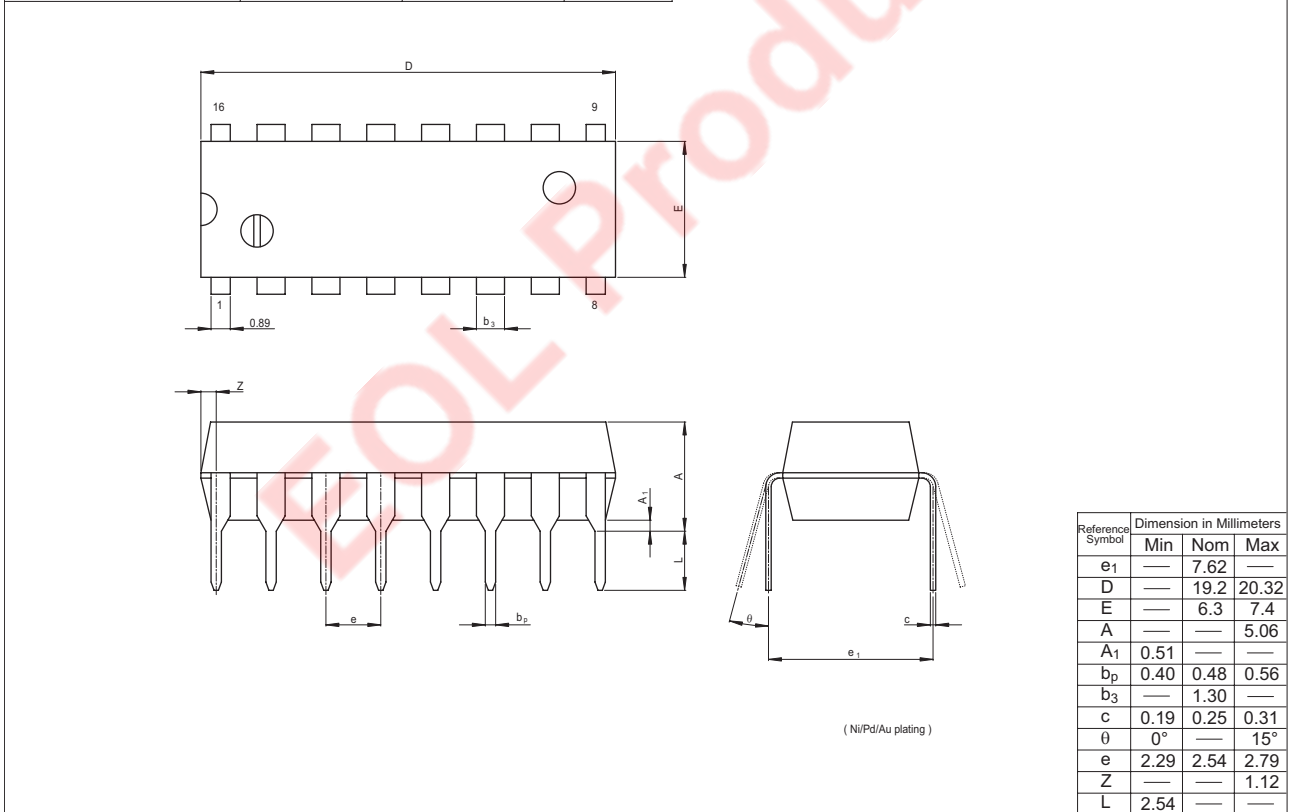
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40$ to $+85^\circ\text{C}$ | | Unit | Test Conditions |
|-------------------------|------------|--------------|--------------------------|-----|-----|------------------------------------|-----|------|-----------------|
| | | | Min | Typ | Max | Min | Max | | |
| Maximum clock frequency | f_{\max} | 2.0 | — | — | 6 | — | 5 | MHz | |
| | | 4.5 | — | — | 31 | — | 27 | | |
| | | 6.0 | — | — | 36 | — | 31 | | |
| Propagation delay time | t_{PLH} | 2.0 | — | — | 230 | — | 290 | ns | Clock to Q |
| | | 4.5 | — | 19 | 46 | — | 58 | | |
| | | 6.0 | — | — | 39 | — | 49 | | |
| | t_{PHL} | 2.0 | — | — | 230 | — | 290 | ns | Reset to Q |
| | | 4.5 | — | 16 | 46 | — | 58 | | |
| | | 6.0 | — | — | 39 | — | 49 | | |
| | t_{PLH} | 2.0 | — | — | 230 | — | 290 | ns | Clock to Cout |
| | | 4.5 | — | — | 46 | — | 58 | | |
| | | 6.0 | — | — | 39 | — | 49 | | |
| | t_{PHL} | 2.0 | — | — | 230 | — | 290 | ns | Reset to Cout |
| | | 4.5 | — | 13 | 46 | — | 58 | | |
| | | 6.0 | — | — | 39 | — | 49 | | |
| Pulse width | t_w | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | 7 | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |
| Setup time | t_{su} | 2.0 | 50 | — | — | 65 | — | ns | |
| | | 4.5 | 10 | — | — | 13 | — | | |
| | | 6.0 | 9 | — | — | 11 | — | | |
| Hold time | t_h | 2.0 | 75 | — | — | 95 | — | ns | |
| | | 4.5 | 15 | — | — | 19 | — | | |
| | | 6.0 | 13 | — | — | 16 | — | | |
| Removal time | t_{rem} | 2.0 | 75 | — | — | 95 | — | ns | |
| | | 4.5 | 15 | -3 | — | 19 | — | | |
| | | 6.0 | 13 | — | — | 16 | — | | |
| Output rise/fall time | t_{TLH} | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | — | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | C_{in} | — | — | 5 | 10 | — | 10 | pF | |

Test Circuit



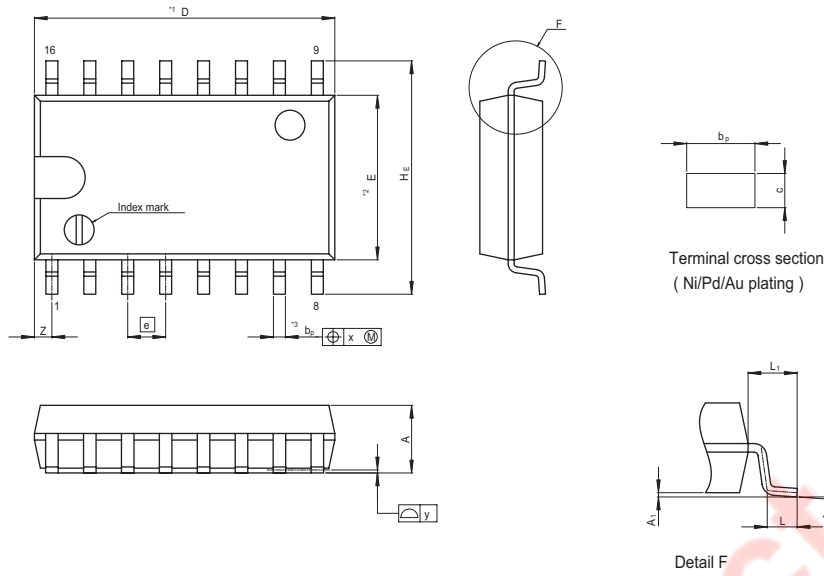
Package Dimensions

| | | | |
|-----------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-DIP16-6.3x19.2-2.54 | PRDP0016AE-B | DP-16FV | 1.05g |



HD74HC4022

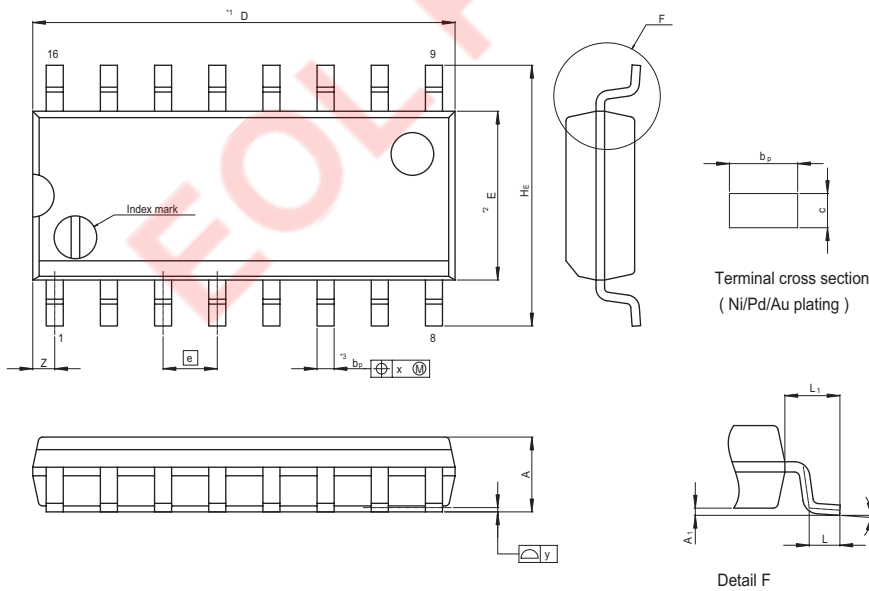
| | | | |
|------------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-SOP16-5.5x10.06-1.27 | PRSP0016DH-B | FP-16DAV | 0.24g |



NOTE)
 1. DIMENSIONS**1 (Nom)**AND**2*
 DO NOT INCLUDE MOLD FLASH.
 2. DIMENSION**3*DOES NOT
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|-------|------|
| | Min | Nom | Max |
| D | — | 10.06 | 10.5 |
| E | — | 5.50 | — |
| A ₂ | — | — | — |
| A ₁ | 0.00 | 0.10 | 0.20 |
| A | — | — | 2.20 |
| b _p | 0.34 | 0.40 | 0.46 |
| b ₁ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| c ₁ | — | — | — |
| θ | 0° | — | 8° |
| H _E | 7.50 | 7.80 | 8.00 |
| ⓪ | — | 1.27 | — |
| x | — | — | 0.12 |
| y | — | — | 0.15 |
| Z | — | — | 0.80 |
| L | 0.50 | 0.70 | 0.90 |
| L ₁ | — | 1.15 | — |

| | | | |
|-----------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-SOP16-3.95x9.9-1.27 | PRSP0016DG-A | FP-16DNV | 0.15g |



NOTE)
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 DO NOT INCLUDE MOLD FLASH.
 2. DIMENSION**3*DOES NOT
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|------|-------|
| | Min | Nom | Max |
| D | — | 9.90 | 10.30 |
| E | — | 3.95 | — |
| A ₂ | — | — | — |
| A ₁ | 0.10 | 0.14 | 0.25 |
| A | — | — | 1.75 |
| b _p | 0.34 | 0.40 | 0.46 |
| b ₁ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| c ₁ | — | — | — |
| θ | 0° | — | 8° |
| H _E | 5.80 | 6.10 | 6.20 |
| ⓪ | — | 1.27 | — |
| x | — | — | 0.25 |
| y | — | — | 0.15 |
| Z | — | — | 0.635 |
| L | 0.40 | 0.60 | 1.27 |
| L ₁ | — | 1.08 | — |

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Renesas Technology America, Inc.

450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.

7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.

10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.

Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510