To our customers,

# Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation



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

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# HD74HC4543

## BCD-to-Seven Segment Latch/Decoder/Driver

REJ03D0655-0200
(Previous ADE-205-544)
Rev.2.00
Mar 30, 2006

## Description

This circuit contains a 4-bit latch, BCD-to-7 segment decoder, and 7 output drivers. Data on the input pins flow through to the output when the Latch Disable (LE) is high and is latched on the high to low transition of the LE input. The Phase input (Ph) controls the polarity of the 7 segment outputs. When Ph is low the outputs are true 7 segment, and when Ph is high the outputs are inverted 7 segment. When the Phase input is driven by a liquid crystal display (LCD) backplane waveform the segment pins output the correct segment waveform for proper LCD AC drive voltages.

In addition a Blanking input (BI) is provided, which will blank the display.

## Features

- High Speed Operation: $t_{pd}$ (A, B, C, D to a – g) = 33 ns typ ($C_L$ = 50 pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC}$ = 2 to 6 V
- Low Input Current: 1 µA max
- Low Quiescent Supply Current: $I_{CC}$ (static) = 4 µA max (Ta = 25°C)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| HD74HC4543P | DILP-16 pin | PRDP0016AE-B (DP-16FV) | P | — |
| HD74HC4543FPEL | SOP-16 pin (JEITA) | PRSP0016DH-B (FP-16DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC4543RPEL | SOP-16 pin (JEDEC) | PRSP0016DG-A (FP-16DNV) | RP | EL (2,500 pcs/reel) |

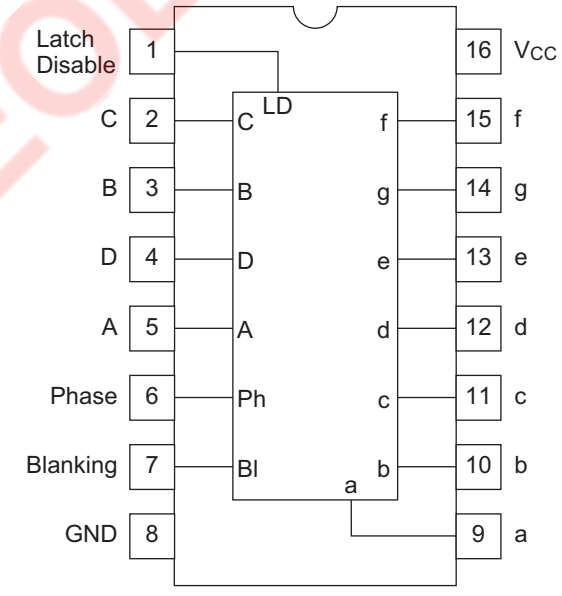
Note: Please consult the sales office for the above package availability.

## Function Table

| Inputs | | | | | | | Outputs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD | BI | Ph*[1] | D | C | B | A | a | b | c | d | e | f | g | Display |
| X | H | L | X | X | X | X | L | L | L | L | L | L | L | Blank |
| H | L | L | L | L | L | L | H | H | H | H | H | H | L | 0 |
| H | L | L | L | L | L | H | L | H | H | L | L | L | L | 1 |
| H | L | L | L | L | H | L | H | H | L | H | H | L | H | 2 |
| H | L | L | L | L | H | H | H | H | H | H | L | L | H | 3 |
| H | L | L | L | H | L | L | L | H | H | L | L | H | H | 4 |
| H | L | L | L | H | L | H | H | L | H | H | L | H | H | 5 |
| H | L | L | L | H | H | L | H | L | H | H | H | H | H | 6 |
| H | L | L | L | H | H | H | H | H | H | L | L | L | L | 7 |
| H | L | L | H | L | L | L | H | H | H | H | H | H | H | 8 |
| H | L | L | H | L | L | H | H | H | H | H | L | H | H | 9 |
| H | L | L | H | L | H | L | L | L | L | L | L | L | L | Blank |
| H | L | L | H | L | H | H | L | L | L | L | L | L | L | Blank |
| H | L | L | H | H | L | L | L | L | L | L | L | L | L | Blank |
| H | L | L | H | H | L | H | L | L | L | L | L | L | L | Blank |
| H | L | L | H | H | H | L | L | L | L | L | L | L | L | Blank |
| H | L | L | H | H | H | H | L | L | L | L | L | L | L | Blank |
| L | L | L | X | X | X | X | *[2] | | | | | | | *[1] |

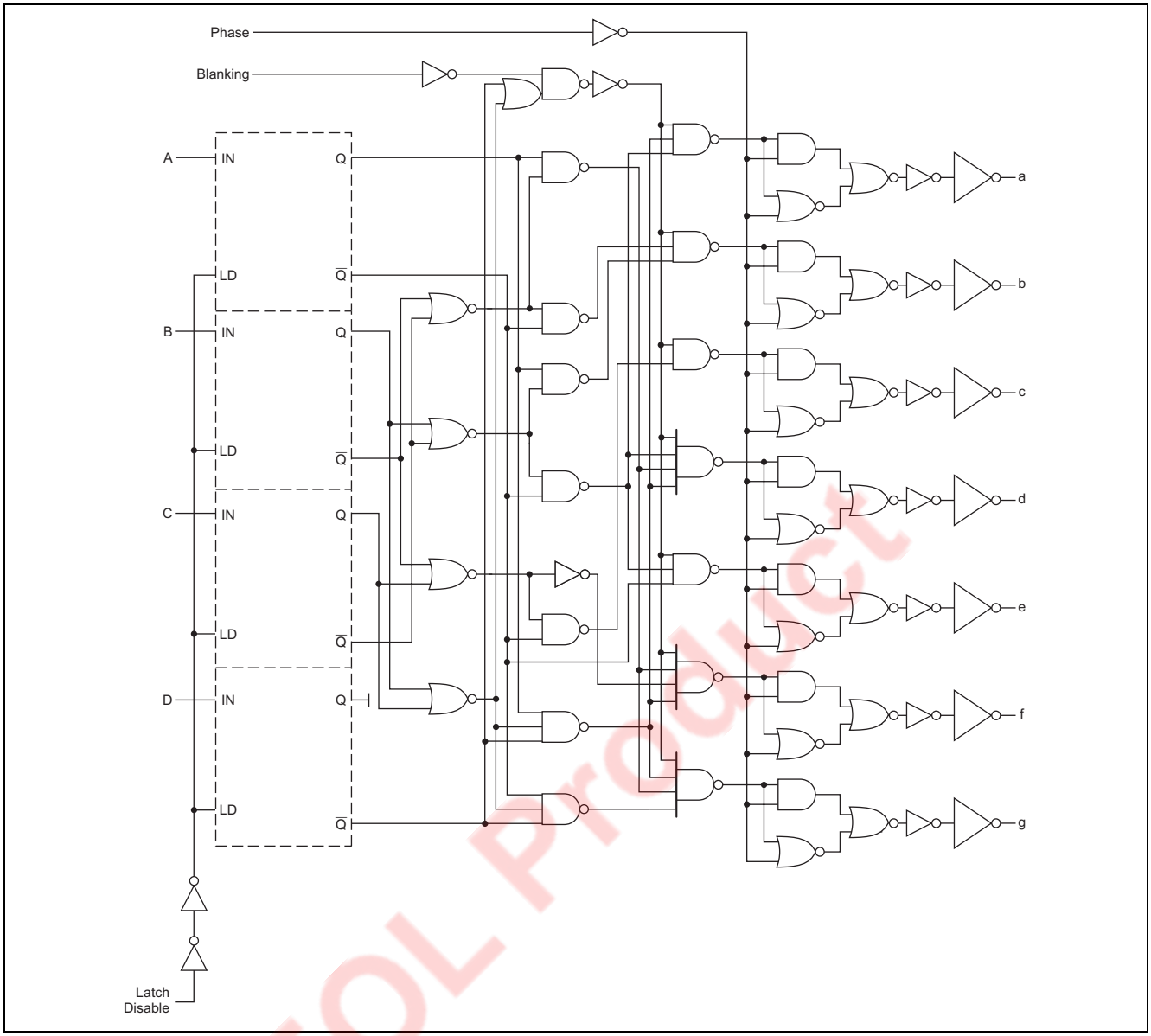
Notes: 1. For liquid crystal readouts, apply a square wave to Ph.
For common cathode LED readouts, select Ph = L. For common anode LED readouts, select Ph = H
2. Depends upon the BCD coder previously applied when LD = H


## Pin Arrangement




(Top view)

## 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 | Tstg | –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 | Ta | –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

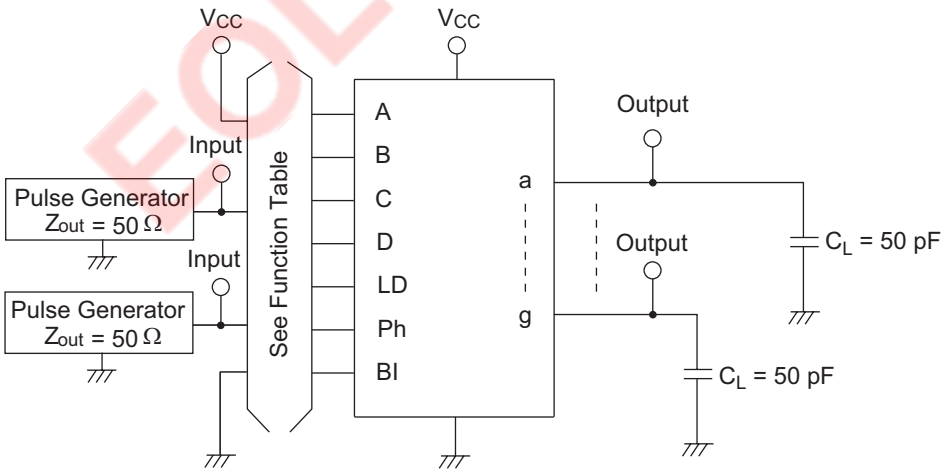
| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to+85°C | | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | | |
| Input voltage | $V_{IH}$ | 2.0 | 1.5 | — | — | 1.5 | — | V | | |
| | | 4.5 | 3.15 | — | — | 3.15 | — | | | |
| | | 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 | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –20 µA |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | | $I_{OH}$ = –4 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | | $I_{OH}$ = –5.2 mA |
| | $V_{OL}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 µA |
| | | 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 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | | $I_{OH}$ = 5.2 mA |
| Input current | Iin | 6.0 | — | — | ±0.1 | — | ±1.0 | µA | Vin = $V_{CC}$ or GND | |
| Quiescent supply current | $I_{CC}$ | 6.0 | — | — | 4.0 | — | 40 | µA | Vin = $V_{CC}$ or GND, Iout = 0 µA | |

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

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | |
| Propagation delay time | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 400 | — | 500 | ns | A, B, C or D to a – g |
| | | 4.5 | — | 33 | 80 | — | 100 | | |
| | | 6.0 | — | — | 68 | — | 86 | | |
| | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 300 | — | 380 | ns | Blanking to a – g |
| | | 4.5 | — | 22 | 60 | — | 76 | | |
| | | 6.0 | — | — | 52 | — | 66 | | |
| | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 300 | — | 380 | ns | Phase to a – g |
| | | 4.5 | — | 18 | 60 | — | 76 | | |
| | | 6.0 | — | — | 52 | — | 66 | | |
| | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 400 | — | 500 | ns | Latch Disable to a – g |
| | | 4.5 | — | 35 | 80 | — | 100 | | |
| | | 6.0 | — | — | 68 | — | 86 | | |
| Pulse width | $t_w$ | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | 5 | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |
| Setup time | $t_{su}$ | 2.0 | 100 | — | — | 125 | — | ns | |
| | | 4.5 | 20 | 2 | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Hold time | $t_h$ | 2.0 | 50 | — | — | 65 | — | ns | |
| | | 4.5 | 10 | 1 | — | 13 | — | | |
| | | 6.0 | 9 | — | — | 11 | — | | |
| Output rise/fall time | $t_{TLH}$ $t_{THL}$ | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | Cin | — | — | — | 5 | 10 | — | 10 | pF | |



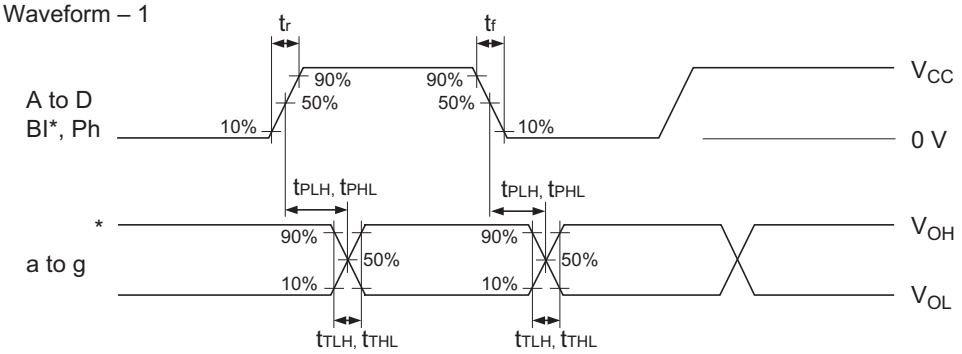
## Test Circuit




Note : 1. $C_L$ includes probe and jig capacitance.

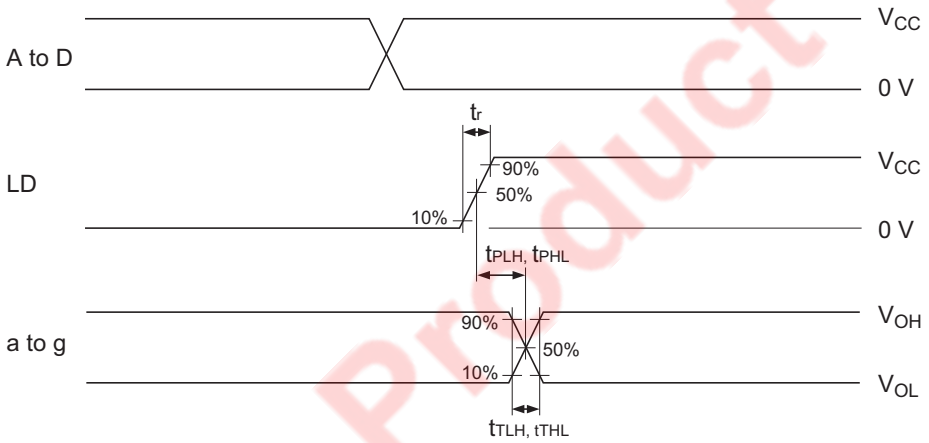
## Waveforms

• Waveform – 1



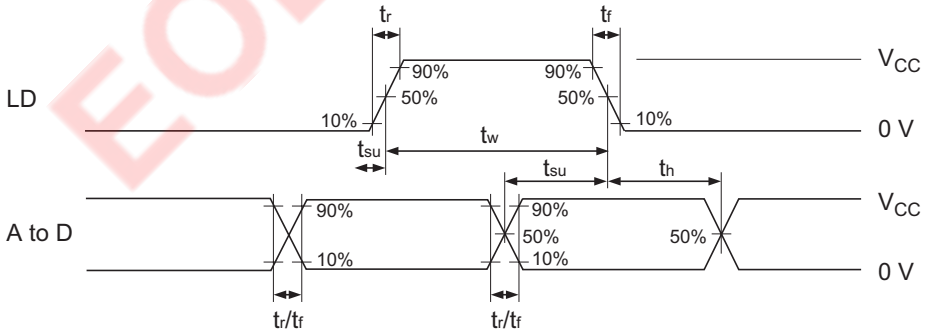

Note : 1. Input waveform: PRR ≤ 1 MHz, Zo = 50 Ω, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns

• Waveform – 2




Note : 1. Input waveform: PRR ≤ 1 MHz, Zo = 50 Ω, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns

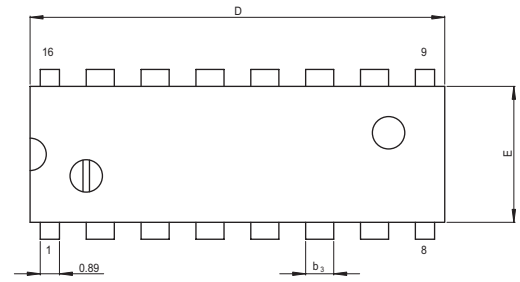
• Waveform – 3

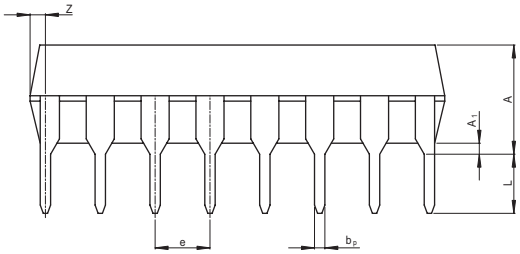


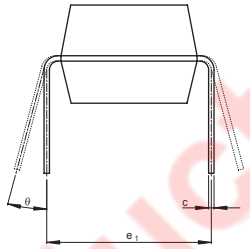

Note : 1. Input waveform: PRR ≤ 1 MHz, Zo = 50 Ω, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns

## Package Dimensions

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



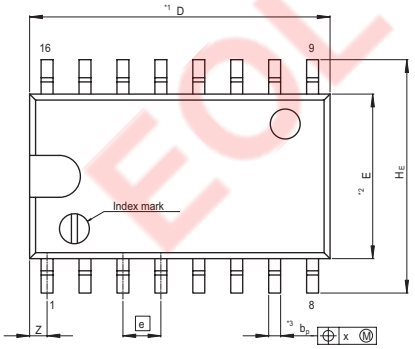



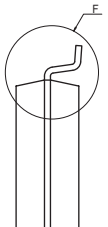




( Ni/Pd/Au plating )

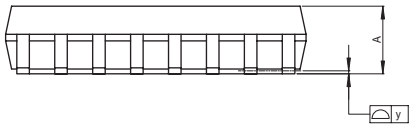
| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| $e_1$ | — | 7.62 | — |
| D | — | 19.2 | 20.32 |
| E | — | 6.3 | 7.4 |
| A | — | — | 5.06 |
| $A_1$ | 0.51 | — | — |
| $b_p$ | 0.40 | 0.48 | 0.56 |
| $b_3$ | — | 1.30 | — |
| c | 0.19 | 0.25 | 0.31 |
| θ | 0° | — | 15° |
| e | 2.29 | 2.54 | 2.79 |
| Z | — | — | 1.12 |
| L | 2.54 | — | — |

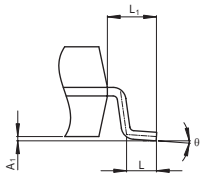
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP16-5.5x10.06-1.27 | PRSP0016DH-B | FP-16DAV | 0.24g |




Terminal cross section
( Ni/Pd/Au plating )



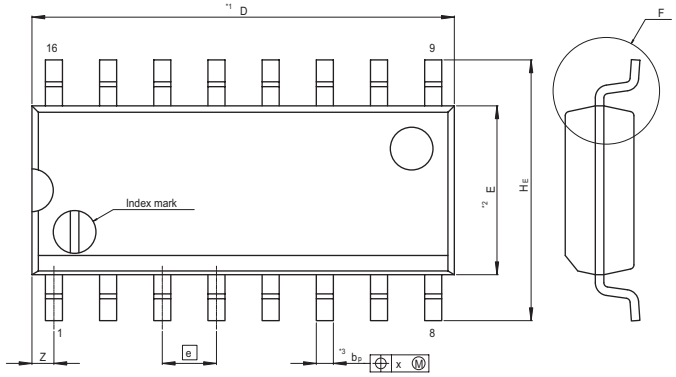



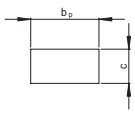

Detail F

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

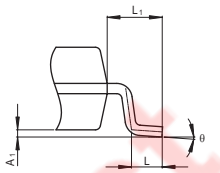
| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | — | 10.06 | 10.5 |
| E | — | 5.50 | — |
| $A_2$ | — | — | — |
| $A_1$ | 0.00 | 0.10 | 0.20 |
| A | — | — | 2.20 |
| $b_p$ | 0.34 | 0.40 | 0.46 |
| $b_1$ | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| $c_1$ | — | — | — |
| θ | 0° | — | 8° |
| $H_E$ | 7.50 | 7.80 | 8.00 |
| e | — | 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 |




Terminal cross section
( Ni/Pd/Au plating )




Detail F

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 | — | 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 |
| e | — | 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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