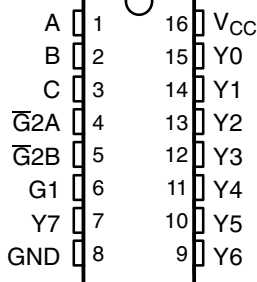


# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

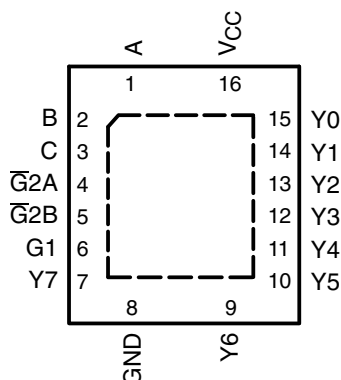
SCLS258L – DECEMBER 1995 – REVISED JULY 2003

- Operating Range 2-V to 5.5-V  $V_{CC}$
- Designed Specifically for High-Speed Memory Decoders and Data-Transmission Systems
- Incorporate Three Enable Inputs to Simplify Cascading and/or Data Reception
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

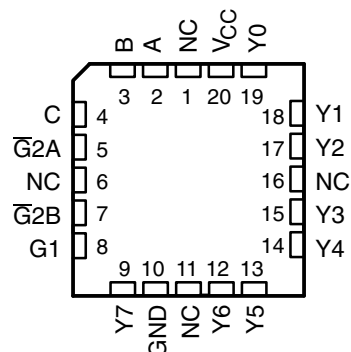
SN54AHC138 . . . J OR W PACKAGE  
SN74AHC138 . . . D, DB, DGV, N, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74AHC138 . . . RGY PACKAGE  
(TOP VIEW)



SN54AHC138 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'AHC138 decoders/demultiplexers are designed for high-performance memory-decoding and data-routing applications that require very short propagation-delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory usually are less than the typical access time of the memory. This means that the effective system delay introduced by the decoders is negligible.

## ORDERING INFORMATION

| $T_A$          | PACKAGE†    |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-------------|---------------|-----------------------|------------------|
| –40°C to 85°C  | QFN – RGY   | Tape and reel | SN74AHC138RGYR        | HA138            |
|                | PDIP – N    | Tube          | SN74AHC138N           | SN74AHC138N      |
|                | SOIC – D    | Tube          | SN74AHC138D           | AHC138           |
|                |             | Tape and reel | SN74AHC138DR          |                  |
|                | SOP – NS    | Tape and reel | SN74AHC138NSR         | AHC138           |
|                | SSOP – DB   | Tape and reel | SN74AHC138DBR         | HA138            |
|                | TSSOP – PW  | Tube          | SN74AHC138PW          | HA138            |
|                |             | Tape and reel | SN74AHC138PWR         |                  |
| –55°C to 125°C | TVSOP – DGV | Tape and reel | SN74AHC138DGVR        | HA138            |
|                | CDIP – J    | Tube          | SNJ54AHC138J          | SNJ54AHC138J     |
|                | CFP – W     | Tube          | SNJ54AHC138W          | SNJ54AHC138W     |
|                | LCCC – FK   | Tube          | SNJ54AHC138FK         | SNJ54AHC138FK    |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated  
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54AHC138, SN74AHC138

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

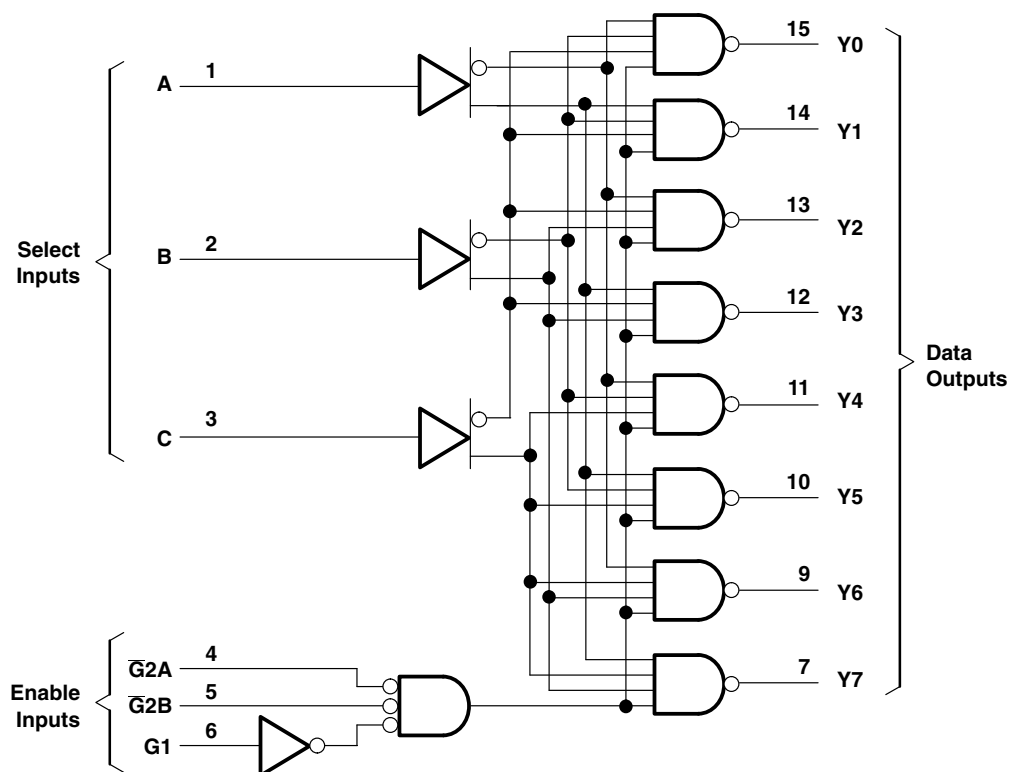
### description/ordering information (continued)

The conditions at the binary-select inputs and the three enable inputs select one of eight output lines. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters, and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

FUNCTION TABLE

| ENABLE INPUTS |     |     | SELECT INPUTS |   |   | OUTPUTS |    |    |    |    |    |    |    |
|---------------|-----|-----|---------------|---|---|---------|----|----|----|----|----|----|----|
| G1            | G2A | G2B | C             | B | A | Y0      | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| X             | H   | X   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |
| X             | X   | H   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |
| L             | X   | X   | X             | X | X | H       | H  | H  | H  | H  | H  | H  | H  |
| H             | L   | L   | L             | L | L | L       | H  | H  | H  | H  | H  | H  | H  |
| H             | L   | L   | L             | L | H | H       | L  | H  | H  | H  | H  | H  | H  |
| H             | L   | L   | L             | H | L | H       | H  | L  | H  | H  | H  | H  | H  |
| H             | L   | L   | L             | H | H | H       | H  | L  | H  | H  | H  | H  | H  |
| H             | L   | L   | H             | L | L | H       | H  | H  | H  | L  | H  | H  | H  |
| H             | L   | L   | H             | L | H | H       | H  | H  | H  | H  | L  | H  | H  |
| H             | L   | L   | H             | H | L | H       | H  | H  | H  | H  | H  | L  | H  |
| H             | L   | L   | H             | H | H | H       | H  | H  | H  | H  | H  | H  | L  |

### logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, NS, PW, RGY, and W packages.

# SN54AHC138, SN74AHC138

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                  |                            |
|------------------------------------------------------------------|----------------------------|
| Supply voltage range, $V_{CC}$                                   | –0.5 V to 7 V              |
| Input voltage range, $V_I$ (see Note 1)                          | –0.5 V to 7 V              |
| Output voltage range, $V_O$ (see Note 1)                         | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                      | –20 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )   | ±20 mA                     |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )       | ±25 mA                     |
| Continuous current through $V_{CC}$ or GND                       | ±75 mA                     |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): D package | 73°C/W                     |
| (see Note 2): DB package                                         | 82°C/W                     |
| (see Note 2): DGV package                                        | 120°C/W                    |
| (see Note 2): N package                                          | 67°C/W                     |
| (see Note 2): NS package                                         | 64°C/W                     |
| (see Note 2): PW package                                         | 108°C/W                    |
| (see Note 3): RGY package                                        | 39°C/W                     |
| Storage temperature range, $T_{stg}$                             | –65°C to 150°C             |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.  
3. The package thermal impedance is calculated in accordance with JESD 51-5.

### recommended operating conditions (see Note 4)

|                 |                                    |                                 | SN54AHC138 |                 | SN74AHC138 |                 | UNIT |
|-----------------|------------------------------------|---------------------------------|------------|-----------------|------------|-----------------|------|
|                 |                                    |                                 | MIN        | MAX             | MIN        | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                                 | 2          | 5.5             | 2          | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 2 V           | 1.5        |                 | 1.5        |                 | V    |
|                 |                                    | V <sub>CC</sub> = 3 V           | 2.1        |                 | 2.1        |                 |      |
|                 |                                    | V <sub>CC</sub> = 5.5 V         | 3.85       |                 | 3.85       |                 |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 2 V           | 0.5        |                 | 0.5        |                 | V    |
|                 |                                    | V <sub>CC</sub> = 3 V           | 0.9        |                 | 0.9        |                 |      |
|                 |                                    | V <sub>CC</sub> = 5.5 V         | 1.65       |                 | 1.65       |                 |      |
| V <sub>I</sub>  | Input voltage                      |                                 | 0          | 5.5             | 0          | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     |                                 | 0          | V <sub>CC</sub> | 0          | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 2 V           | –50        |                 | –50        |                 | μA   |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V | –4         |                 | –4         |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   | –8         |                 | –8         |                 |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 2 V           | 50         |                 | 50         |                 | μA   |
|                 |                                    | V <sub>CC</sub> = 3.3 V ± 0.3 V | 4          |                 | 4          |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   | 8          |                 | 8          |                 |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 3.3 V ± 0.3 V | 100        |                 | 100        |                 | ns/V |
|                 |                                    | V <sub>CC</sub> = 5 V ± 0.5 V   | 20         |                 | 20         |                 |      |
| T <sub>A</sub>  | Operating free-air temperature     |                                 | –55        | 125             | –40        | 85              | °C   |

NOTE 4: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



# SN54AHC138, SN74AHC138

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

| PARAMETER       | TEST CONDITIONS                                             | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |      | SN54AHC138 |     | SN74AHC138 |      | UNIT |
|-----------------|-------------------------------------------------------------|-----------------|-----------------------|-----|------|------------|-----|------------|------|------|
|                 |                                                             |                 | MIN                   | TYP | MAX  | MIN        | MAX | MIN        | MAX  |      |
| V <sub>OH</sub> | I <sub>OH</sub> = -50 µA                                    | 2 V             | 1.9                   | 2   |      | 1.9        |     | 1.9        |      | V    |
|                 |                                                             | 3 V             | 2.9                   | 3   |      | 2.9        |     | 2.9        |      |      |
|                 |                                                             | 4.5 V           | 4.4                   | 4.5 |      | 4.4        |     | 4.4        |      |      |
|                 | I <sub>OH</sub> = -4 mA                                     | 3 V             | 2.58                  |     |      | 2.48       |     | 2.48       |      |      |
|                 | I <sub>OH</sub> = -8 mA                                     | 4.5 V           | 3.94                  |     |      | 3.8        |     | 3.8        |      |      |
| V <sub>OL</sub> | I <sub>OL</sub> = 50 µA                                     | 2 V             |                       |     | 0.1  |            | 0.1 |            | 0.1  | V    |
|                 |                                                             | 3 V             |                       |     | 0.1  |            | 0.1 |            | 0.1  |      |
|                 |                                                             | 4.5 V           |                       |     | 0.1  |            | 0.1 |            | 0.1  |      |
|                 | I <sub>OL</sub> = 4 mA                                      | 3 V             |                       |     | 0.36 |            | 0.5 |            | 0.44 |      |
|                 | I <sub>OL</sub> = 8 mA                                      | 4.5 V           |                       |     | 0.36 |            | 0.5 |            | 0.44 |      |
| I <sub>I</sub>  | V <sub>I</sub> = 5.5 V or GND                               | 0 V to 5.5 V    |                       |     | ±0.1 |            | ±1* |            | ±1   | µA   |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 5.5 V           |                       |     | 4    |            | 40  |            | 40   | µA   |
| C <sub>i</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5 V             |                       | 2   | 10   |            |     |            | 10   | pF   |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested at V<sub>CC</sub> = 0 V.

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)**

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE       | T <sub>A</sub> = 25°C |       |        | SN54AHC138 |        | SN74AHC138 |      | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-------|--------|------------|--------|------------|------|------|
|                  |              |             |                        | MIN                   | TYP   | MAX    | MIN        | MAX    | MIN        | MAX  |      |
| t <sub>PLH</sub> | A, B, C      | Any Y       | C <sub>L</sub> = 15 pF |                       | 8.2** | 11.4** | 1**        | 13**   | 1          | 13   | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 8.2** | 11.4** | 1**        | 13**   | 1          | 13   |      |
| t <sub>PLH</sub> | G1           | Any Y       | C <sub>L</sub> = 15 pF |                       | 8.1** | 12.8** | 1**        | 15**   | 1          | 15   | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 8.1** | 12.8** | 1**        | 15**   | 1          | 15   |      |
| t <sub>PLH</sub> | G̅2A, G̅2B   | Any Y       | C <sub>L</sub> = 15 pF |                       | 8.2** | 11.4** | 1**        | 13.5** | 1          | 13.5 | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 8.2** | 11.4** | 1**        | 13.5** | 1          | 13.5 |      |
| t <sub>PLH</sub> | A, B, C      | Any Y       | C <sub>L</sub> = 50 pF |                       | 10    | 15.8   | 1          | 18     | 1          | 18   | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 10    | 15.8   | 1          | 18     | 1          | 18   |      |
| t <sub>PLH</sub> | G1           | Any Y       | C <sub>L</sub> = 50 pF |                       | 10.6  | 16.3   | 1          | 18.5   | 1          | 18.5 | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 10.6  | 16.3   | 1          | 18.5   | 1          | 18.5 |      |
| t <sub>PLH</sub> | G̅2A, G̅2B   | Any Y       | C <sub>L</sub> = 50 pF |                       | 10.7  | 14.9   | 1          | 17     | 1          | 17   | ns   |
| t <sub>PHL</sub> |              |             |                        |                       | 10.7  | 14.9   | 1          | 17     | 1          | 17   |      |

\*\* On products compliant to MIL-PRF-38535, this parameter is not production tested.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE    | T <sub>A</sub> = 25°C |      |     | SN54AHC138 |     | SN74AHC138 |     | UNIT |
|------------------|-----------------|----------------|------------------------|-----------------------|------|-----|------------|-----|------------|-----|------|
|                  |                 |                |                        | MIN                   | TYP  | MAX | MIN        | MAX | MIN        | MAX |      |
| t <sub>PLH</sub> | A, B, C         | Any Y          | C <sub>L</sub> = 15 pF | 5.7*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 5.7*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        |     |      |
| t <sub>PLH</sub> | G1              | Any Y          | C <sub>L</sub> = 15 pF | 5.6*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 5.6*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        |     |      |
| t <sub>PLH</sub> | G̅2A, G̅2B      | Any Y          | C <sub>L</sub> = 15 pF | 5.8*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 5.8*                  | 8.1* | 1*  | 9.5*       | 1   | 9.5        |     |      |
| t <sub>PLH</sub> | A, B, C         | Any Y          | C <sub>L</sub> = 50 pF | 7.2                   | 10.1 | 1   | 11.5       | 1   | 11.5       | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 7.2                   | 10.1 | 1   | 11.5       | 1   | 11.5       |     |      |
| t <sub>PLH</sub> | G1              | Any Y          | C <sub>L</sub> = 50 pF | 7.1                   | 10.1 | 1   | 11.5       | 1   | 11.5       | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 7.1                   | 10.1 | 1   | 11.5       | 1   | 11.5       |     |      |
| t <sub>PLH</sub> | G̅2A, G̅2B      | Any Y          | C <sub>L</sub> = 50 pF | 7.3                   | 10.1 | 1   | 11.5       | 1   | 11.5       | ns  |      |
| t <sub>PHL</sub> |                 |                |                        | 7.3                   | 10.1 | 1   | 11.5       | 1   | 11.5       |     |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

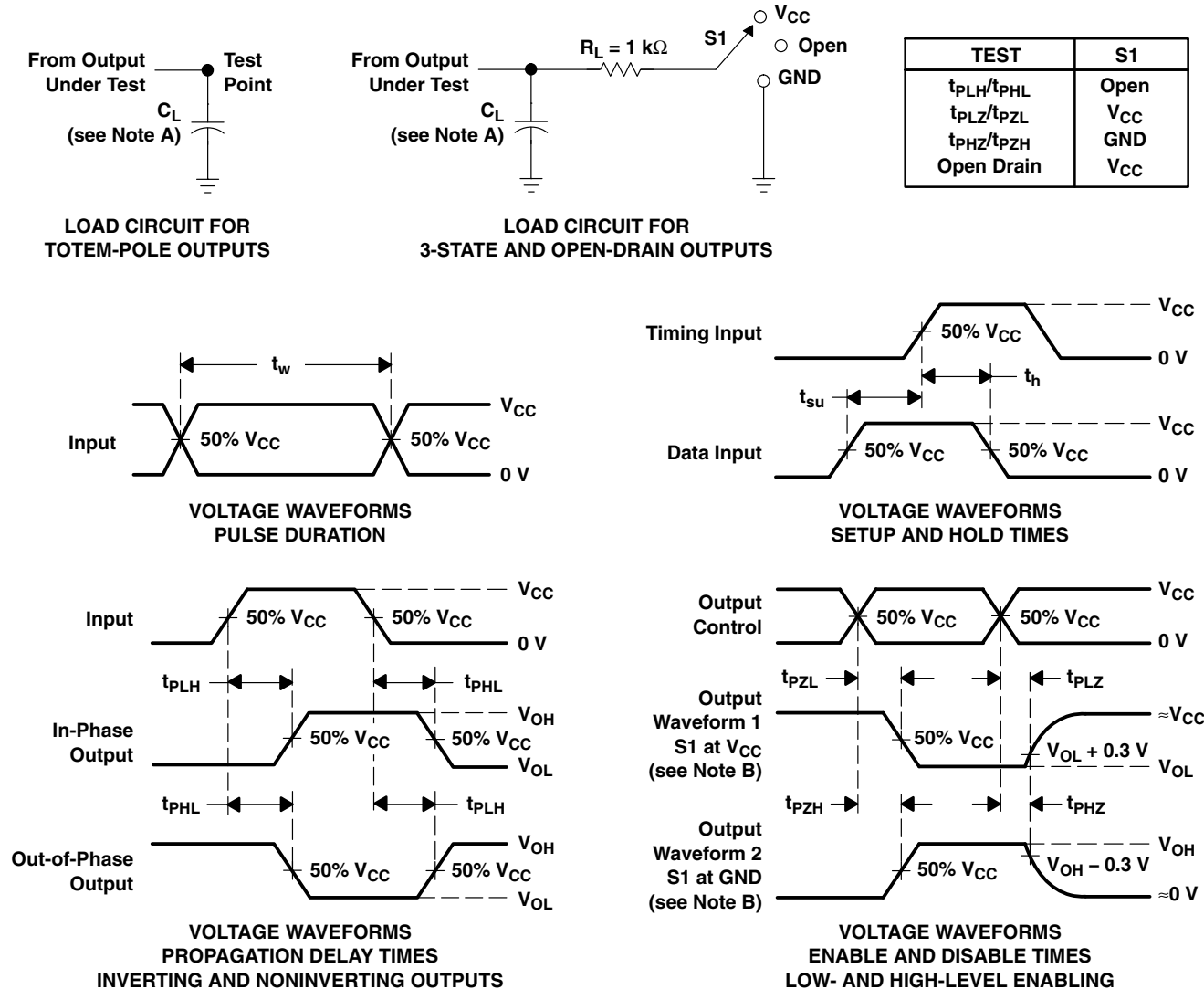
| PARAMETER                              | TEST CONDITIONS             | TYP | UNIT |
|----------------------------------------|-----------------------------|-----|------|
| $C_{pd}$ Power dissipation capacitance | No load, $f = 1\text{ MHz}$ | 13  | pF   |



# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

## PARAMETER MEASUREMENT INFORMATION



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$ .  
 D. The outputs are measured one at a time with one input transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

**Figure 1. Load Circuit and Voltage Waveforms**

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

## APPLICATION INFORMATION

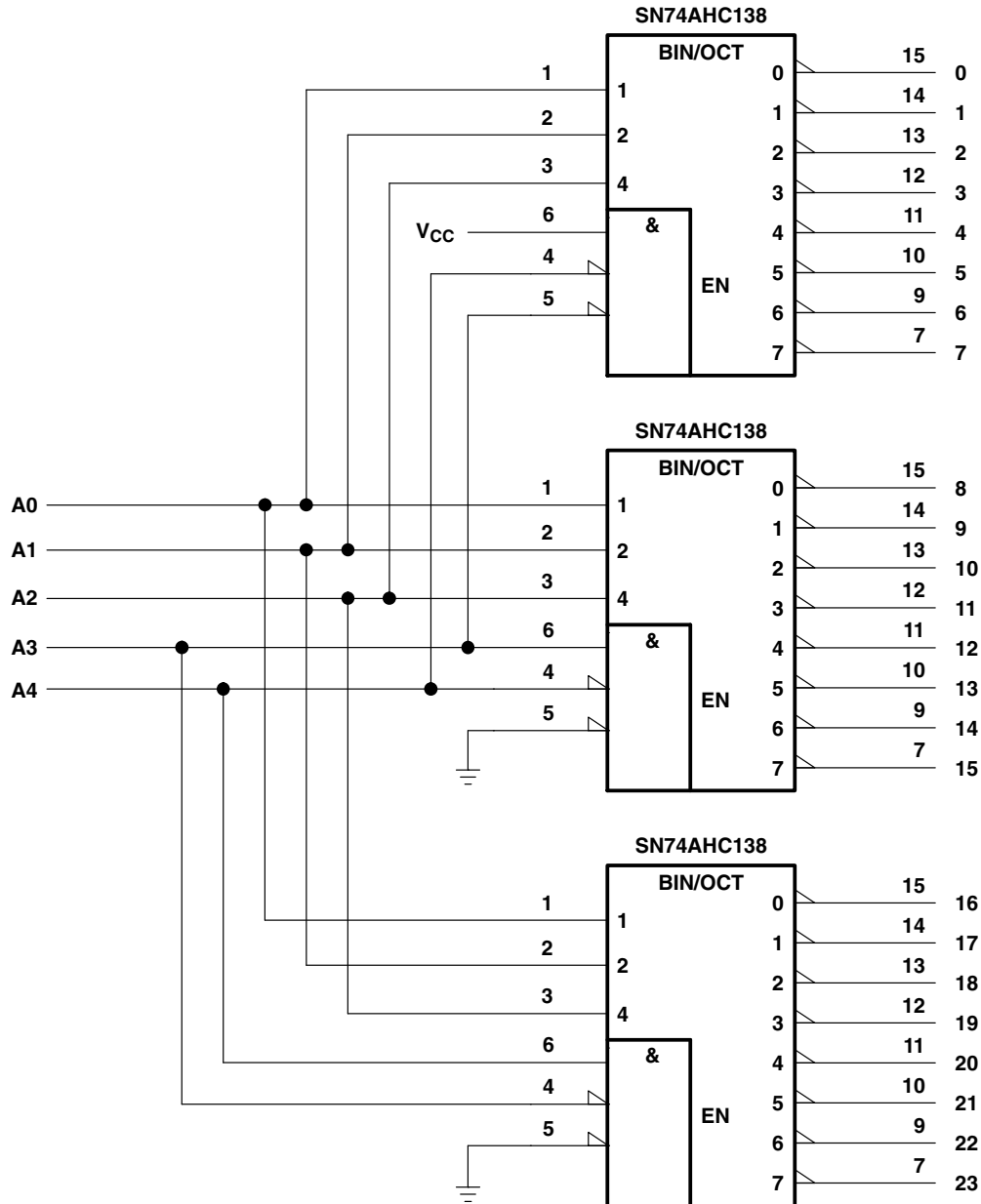


Figure 2. 24-Bit Decoding Scheme

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

SCLS258L – DECEMBER 1995 – REVISED JULY 2003

## APPLICATION INFORMATION

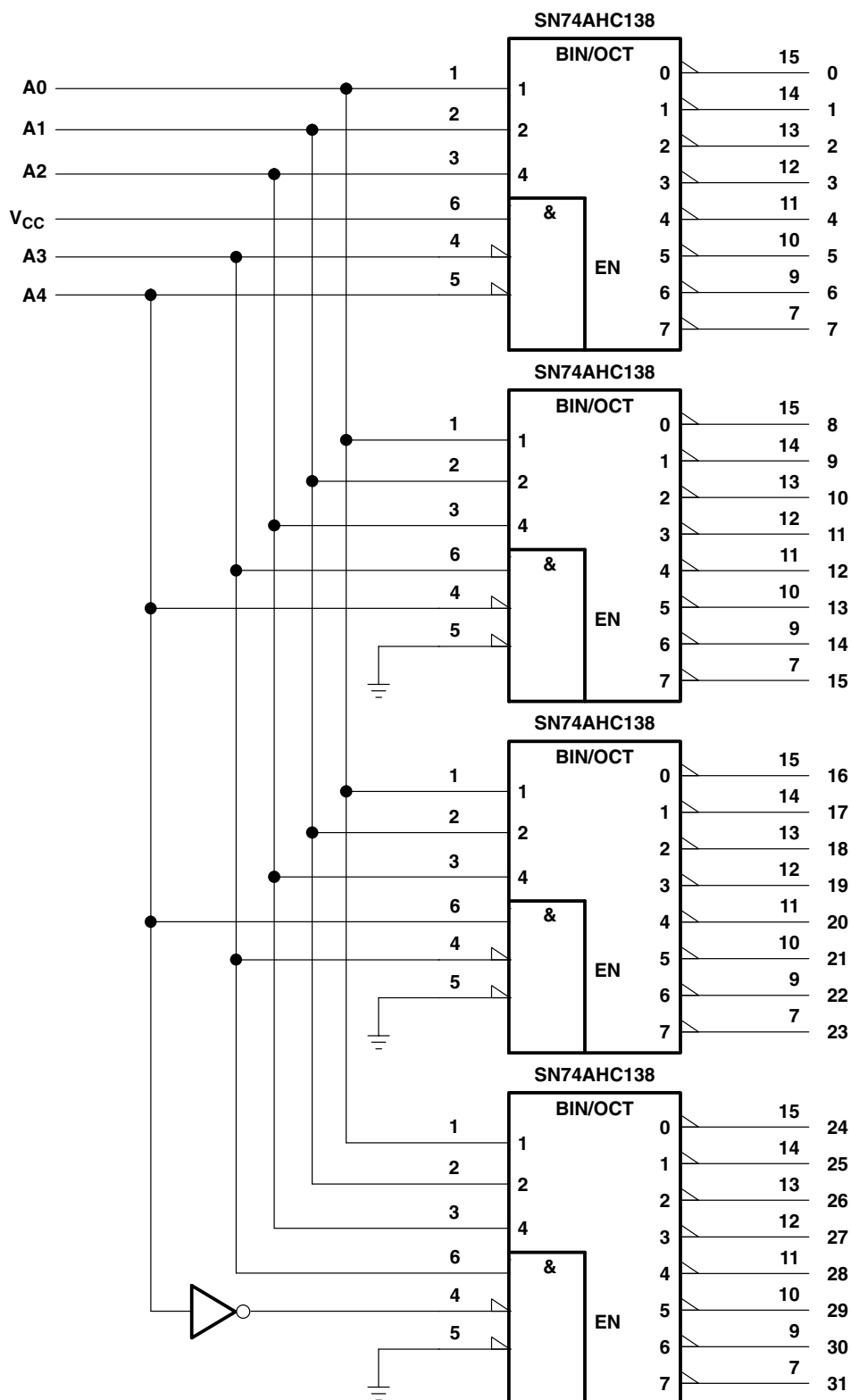


Figure 3. 32-Bit Decoding Scheme

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)                  | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|------------------------------------------|-------------------------|
| 5962-9851601Q2A  | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-<br>9851601Q2A<br>SNJ54AHC<br>138FK | <a href="#">Samples</a> |
| 5962-9851601QEA  | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9851601QE<br>A<br>SNJ54AHC138J      | <a href="#">Samples</a> |
| 5962-9851601QFA  | ACTIVE        | CFP          | W               | 16   | 1           | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9851601QF<br>A<br>SNJ54AHC138W      | <a href="#">Samples</a> |
| SN74AHC138D      | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | AHC138                                   | <a href="#">Samples</a> |
| SN74AHC138DBR    | ACTIVE        | SSOP         | DB              | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138DGVR   | ACTIVE        | TVSOP        | DGV             | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138DR     | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | AHC138                                   | <a href="#">Samples</a> |
| SN74AHC138DRE4   | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | AHC138                                   | <a href="#">Samples</a> |
| SN74AHC138DRG4   | ACTIVE        | SOIC         | D               | 16   | 2500        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | AHC138                                   | <a href="#">Samples</a> |
| SN74AHC138N      | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green        | NIPDAU                               | N / A for Pkg Type   | -40 to 85    | SN74AHC138N                              | <a href="#">Samples</a> |
| SN74AHC138NSR    | ACTIVE        | SO           | NS              | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | AHC138                                   | <a href="#">Samples</a> |
| SN74AHC138PW     | ACTIVE        | TSSOP        | PW              | 16   | 90          | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138PWR    | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138PWRE4  | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138PWRG4  | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green        | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SN74AHC138RGYR   | ACTIVE        | VQFN         | RGY             | 16   | 3000        | RoHS & Green        | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | HA138                                    | <a href="#">Samples</a> |
| SNJ54AHC138FK    | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-<br>9851601Q2A<br>SNJ54AHC          | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)     | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)             | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------------------|-------------------------|
|                  |               |              |                    |      |                |                     |                                      |                      |              | 138FK                               |                         |
| SNJ54AHC138J     | ACTIVE        | CDIP         | J                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9851601QE<br>A<br>SNJ54AHC138J | <a href="#">Samples</a> |
| SNJ54AHC138W     | ACTIVE        | CFP          | W                  | 16   | 1              | Non-RoHS<br>& Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9851601QF<br>A<br>SNJ54AHC138W | <a href="#">Samples</a> |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

<sup>(3)</sup> MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54AHC138, SN74AHC138 :**

- Catalog : [SN74AHC138](#)
- Military : [SN54AHC138](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AHC138DBR  | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| SN74AHC138DGVR | TVSOP        | DGV             | 16   | 2000 | 330.0              | 12.4               | 6.8     | 4.0     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74AHC138DR   | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74AHC138NSR  | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| SN74AHC138PWR  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74AHC138RGYR | VQFN         | RGY             | 16   | 3000 | 330.0              | 12.4               | 3.8     | 4.3     | 1.5     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AHC138DBR  | SSOP         | DB              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74AHC138DGVR | TVSOP        | DGV             | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74AHC138DR   | SOIC         | D               | 16   | 2500 | 340.5       | 336.1      | 32.0        |
| SN74AHC138NSR  | SO           | NS              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74AHC138PWR  | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74AHC138RGYR | VQFN         | RGY             | 16   | 3000 | 356.0       | 356.0      | 35.0        |

## TUBE



\*All dimensions are nominal

| Device          | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-9851601Q2A | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| SN74AHC138D     | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74AHC138N     | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74AHC138N     | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74AHC138PW    | PW           | TSSOP        | 16   | 90  | 530    | 10.2   | 3600   | 3.5    |
| SNJ54AHC138FK   | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |

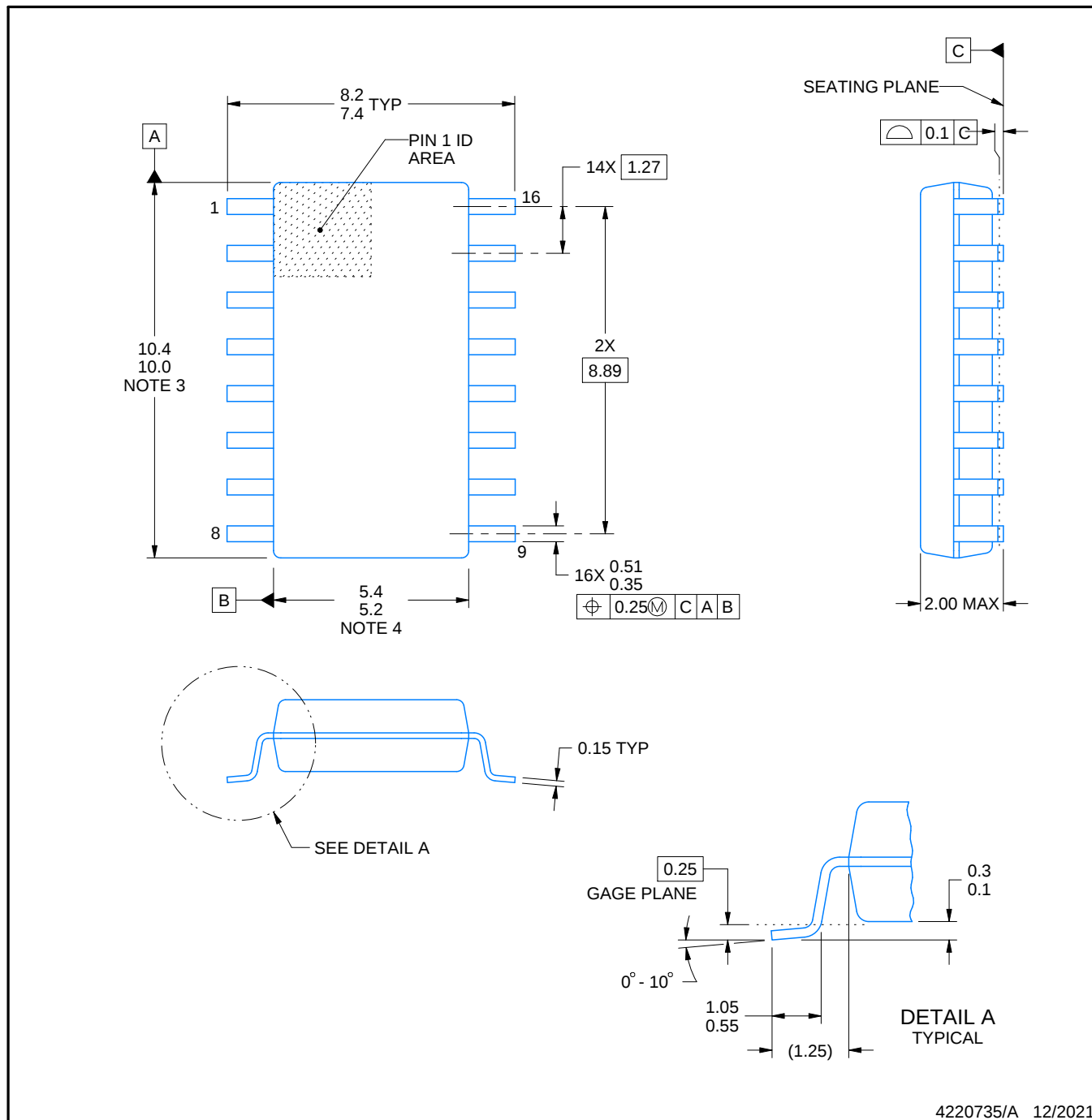


# PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

## NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.





SOLDER PASTE EXAMPLE  
 BASED ON 0.125 mm THICK STENCIL  
 SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF<br>TERMINALS<br>** | A                |                  | B                |                  |
|---------------------------|------------------|------------------|------------------|------------------|
|                           | MIN              | MAX              | MIN              | MAX              |
| 20                        | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                        | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                        | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                        | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                        | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                        | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



4220204/A 02/2017

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

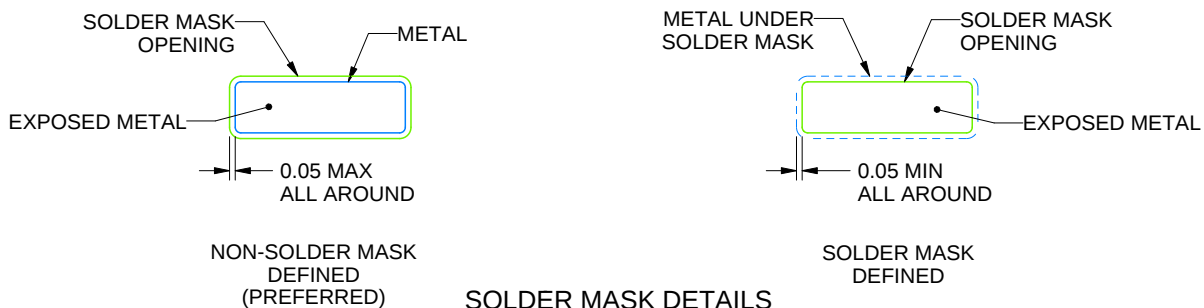
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

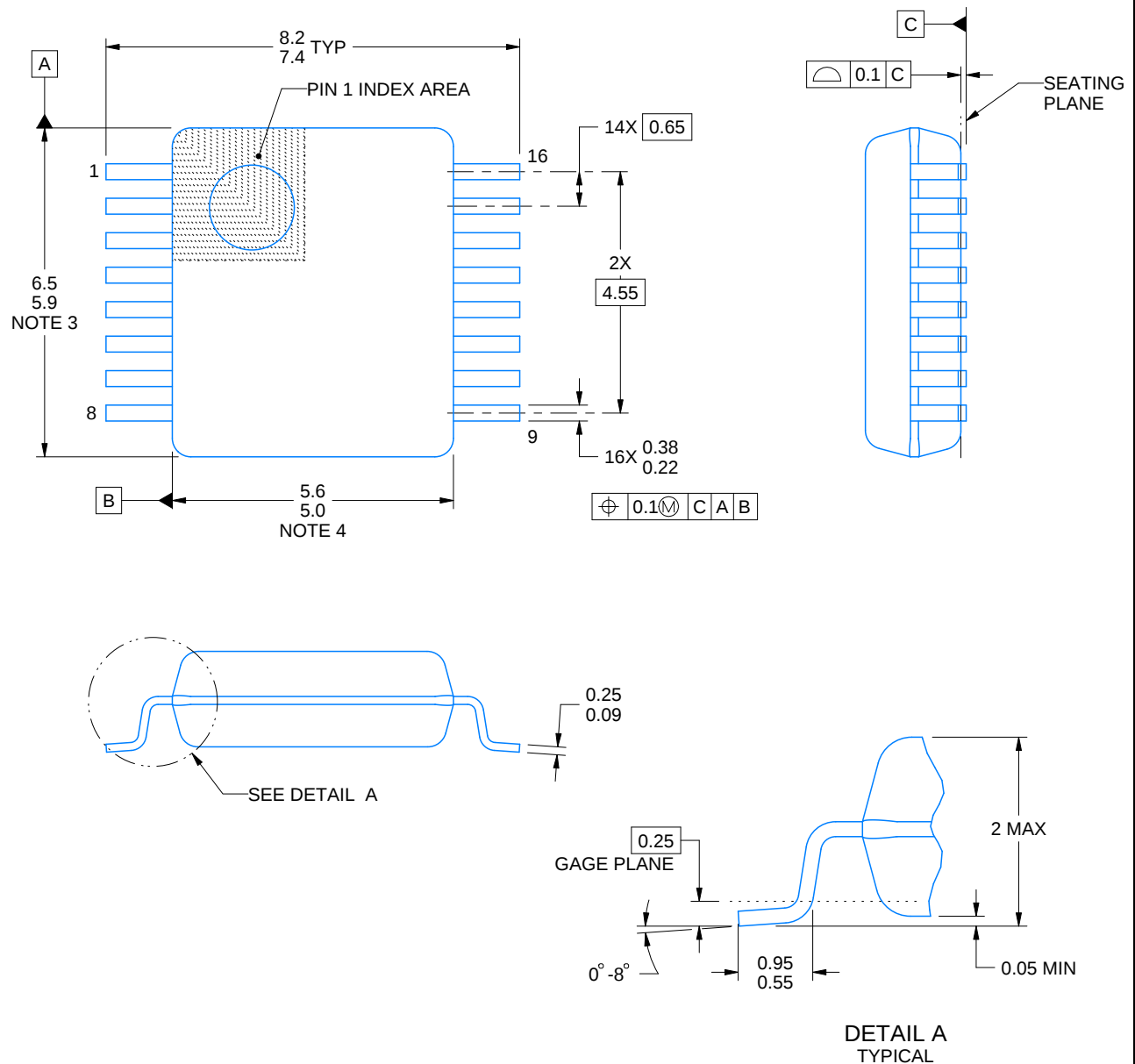


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



4220763/A 05/2022

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220763/A 05/2022

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220763/A 05/2022

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

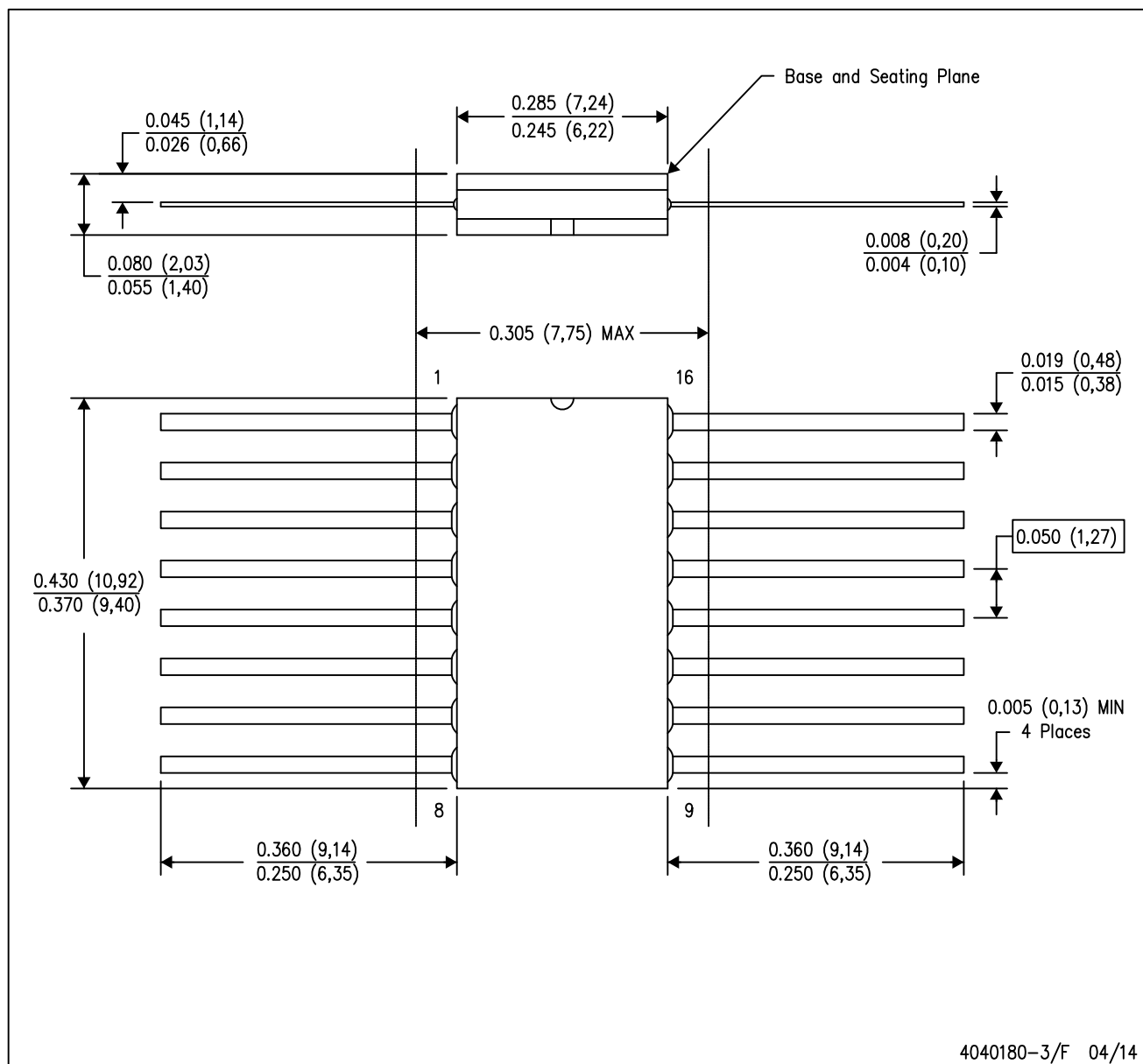
24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK

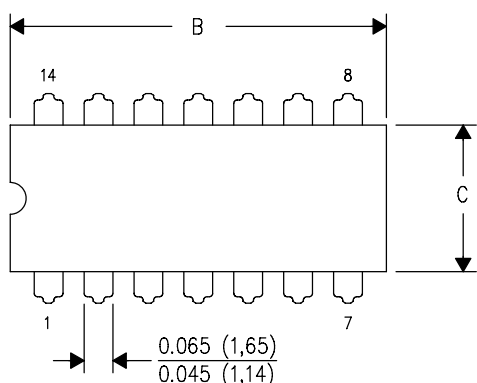


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP2-F16

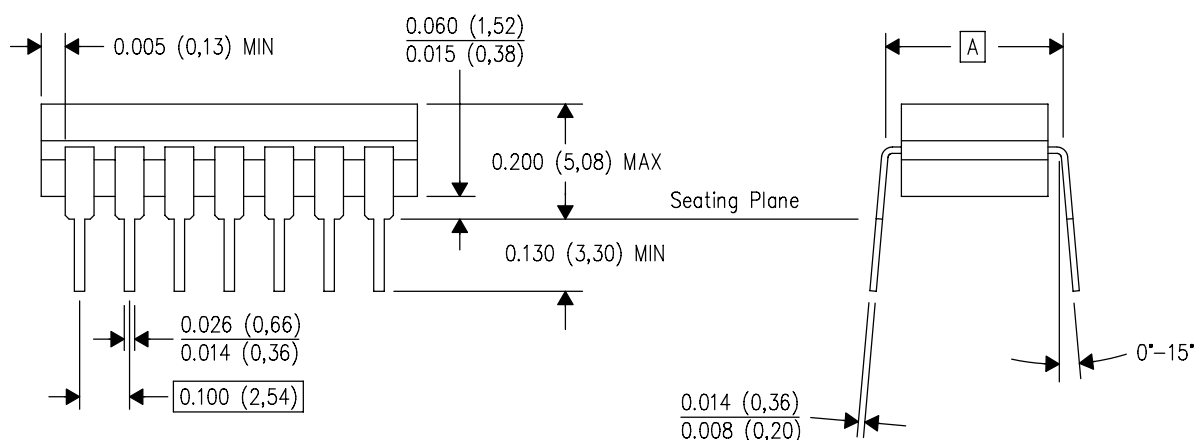
J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



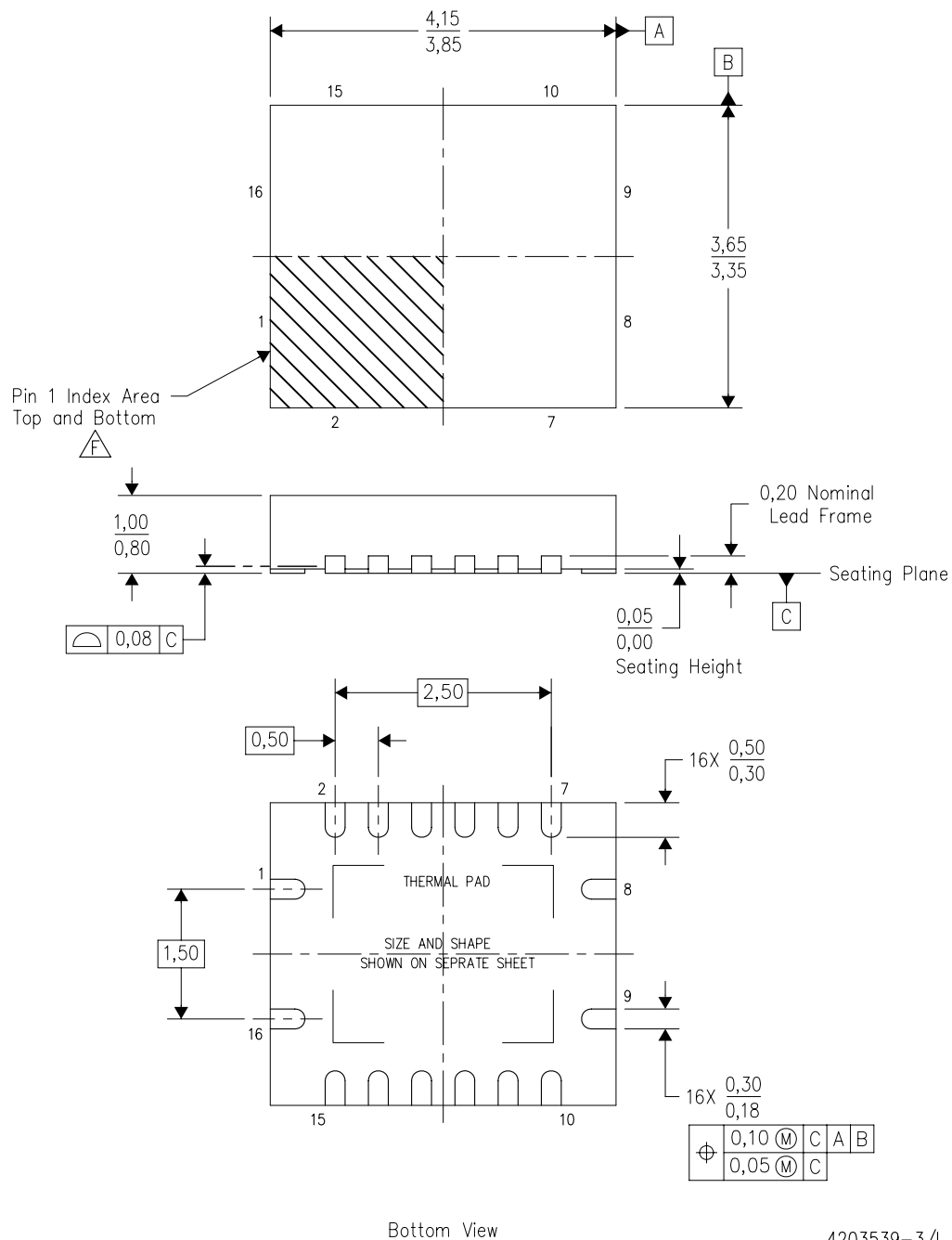
14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



4203539-3/I 06/2011

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
- F** Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
- Package complies to JEDEC MO-241 variation BA.

RGY (R-PVQFN-N16)

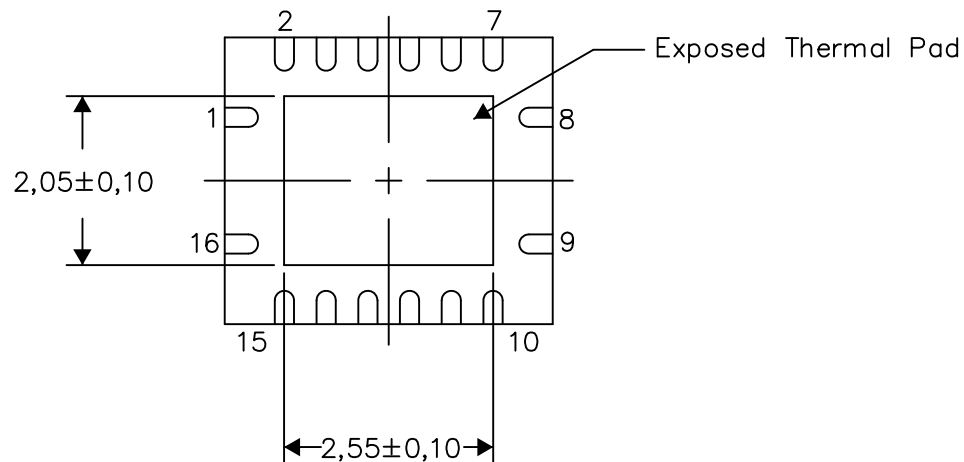
PLASTIC QUAD FLATPACK NO-LEAD

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.

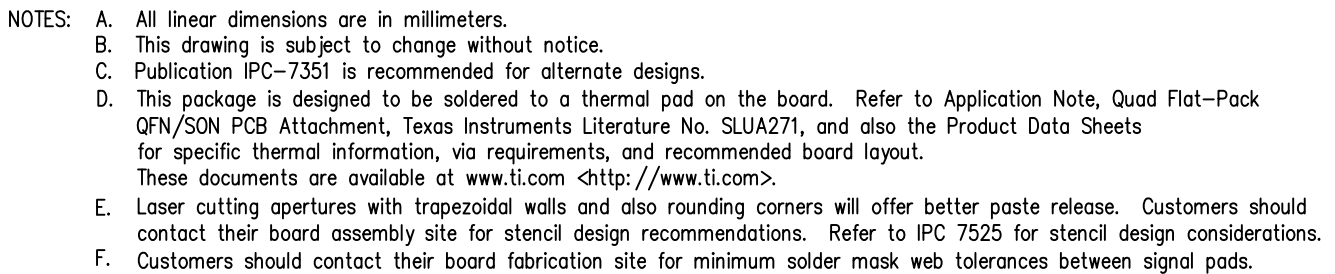


Bottom View

Exposed Thermal Pad Dimensions

4206353-3/P 03/14

NOTE: All linear dimensions are in millimeters



## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2022, Texas Instruments Incorporated