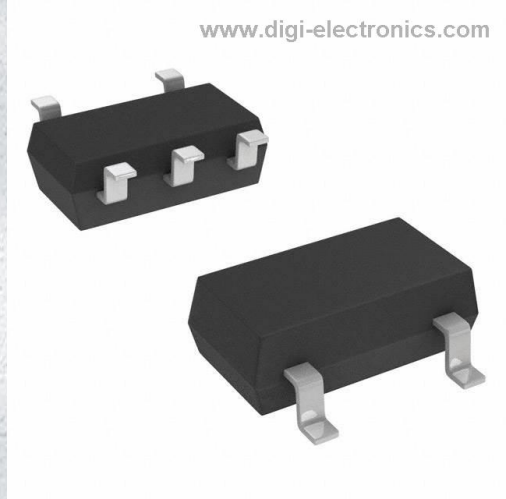
# NC7SP05P5X Datasheet




| | |
|---|---|
| DiGi Electronics Part Number | NC7SP05P5X-DG |
| Manufacturer | onsemi |
| Manufacturer Product Number | NC7SP05P5X |
| Description | IC INVERTER 1CH 1-INP SC70-5 |
| Detailed Description | Inverter IC 1 Channel Open Drain SC-70-5 |

https://www.DiGi-Electronics.com

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

## Purchase and inquiry

| Manufacturer Product Number: | Manufacturer: |
| --- | --- |
| NC7SP05P5X | onsemi |
| Series: | Product Status: |
| 7SP | Obsolete |
| Logic Type: | Number of Circuits: |
| Inverter | 1 |
| Number of Inputs: | Features: |
| 1 | Open Drain |
| Voltage - Supply: | Current - Quiescent (Max): |
| 0.9V ~ 3.6V | 900 nA |
| Current - Output High, Low: | Input Logic Level - Low: |
| -, 2.6mA | 0.7V ~ 0.9V |
| Input Logic Level - High: | Max Propagation Delay @ V, Max CL: |
| 1.6V ~ 2.1V | 10ns @ 3.3V, 30pF |
| Operating Temperature: | Mounting Type: |
| -40°C ~ 85°C | Surface Mount |
| Supplier Device Package: | Package / Case: |
| SC-70-5 | 5-TSSOP, SC-70-5, SOT-353 |
| Base Product Number: | |
| 7SP05 | |

## Environmental & Export classification

| RoHS Status: | Moisture Sensitivity Level (MSL): |
| --- | --- |
| ROHS3 Compliant | 1 (Unlimited) |
| REACH Status: | ECCN: |
| REACH Unaffected | EAR99 |
| HTSUS: | |
| 8542.39.0001 | |

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**www.onsemi.com**

# TinyLogic ULP-A Inverter (Open-Drain Output)

# NC7SP05

The NC7SP05 is a single inverter with open−drain output in tiny footprint packages. The device is designed to operate for $V_{CC}$ = 0.9 V to 3.6 V.

### Features

- Designed for 0.9 V to 3.6 V $V_{CC}$ Operation
- 3.2 ns $t_{PD}$ at 3.3 V (Typ)
- Inputs/Outputs Over−Voltage Tolerant up to 3.6 V
- $I_{OFF}$ Supports Partial Power Down Protection
- Source/Sink 2.6 mA at 3.3 V
- Available in SC−88A and MicroPak™ Packages
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

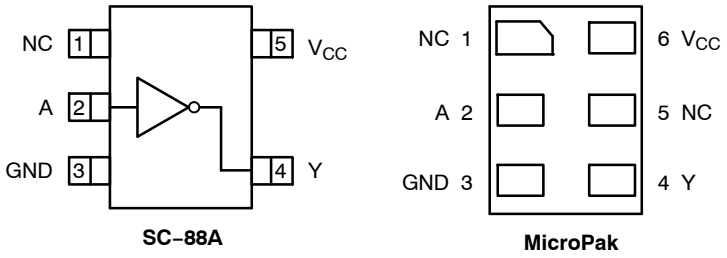


**Figure 1. Pinout Diagrams** (Top Views)

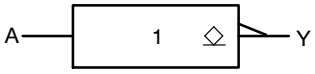


**Figure 2. Logic Symbol**

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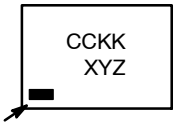
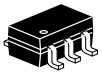
### MARKING DIAGRAMS

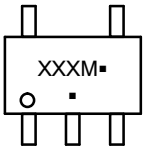
**SIP6 1.45X1.0 MicroPak CASE 127EB**




CC = Specific Device Code
KK = 2−Digit Lot Run Traceability Code
XY = 2−Digit Date Code
Z = Assembly Plant Code



**SC−88A CASE 419A−02**




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

### PIN ASSIGNMENT

| Pin | SC88A | MicroPak |
|---|---|---|
| 1 | N.C. | N.C. |
| 2 | A | A |
| 3 | GND | GND |
| 4 | Y | Y |
| 5 | $V_{CC}$ | N.C. |
| 6 | − | $V_{CC}$ |

N.C. = No Connect

### FUNCTION TABLE

| Input | Output |
|---|---|
| A | Y |
| L | Z |
| H | L |

H = HIGH Logic Level
L = LOW Logic Level
Z = High−Impedance State

## MAXIMUM RATINGS

| Symbol | Characteristics | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | −0.5 to +4.3 | V |
| $V_{IN}$ | DC Input Voltage | | −0.5 to +4.3 | V |
| $V_{OUT}$ | DC Output Voltage | Active−Mode (High or Low State)<br>Tri−State Mode (Note 1)<br>Power−Down Mode ($V_{CC}$ = 0 V) | −0.5 to $V_{CC}$ + 0.5<br>−0.5 to +4.3<br>−0.5 to +4.3 | V |
| $I_{IK}$ | DC Input Diode Current | $V_{IN}$ < GND | −50 | mA |
| $I_{OK}$ | DC Output Diode Current | $V_{OUT}$ < GND | −50 | mA |
| $I_{OUT}$ | DC Output Source/Sink Current | | ±50 | mA |
| $I_{CC}$ or $I_{GND}$ | DC Supply Current per Supply Pin or Ground Pin | | ±50 | mA |
| $T_{STG}$ | Storage Temperature Range | | −65 to +150 | °C |
| $T_L$ | Lead Temperature, 1 mm from Case for 10 Seconds | | 260 | °C |
| $T_J$ | Junction Temperature Under Bias | | +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Note 2) | SC−88A<br>MicroPak | 377<br>154 | °C/W |
| $P_D$ | Power Dissipation in Still Air | SC−88A<br>MicroPak | 332<br>812 | mW |
| MSL | Moisture Sensitivity | | Level 1 | − |
| $F_R$ | Flammability Rating | Oxygen Index: 28 to 34 | UL 94 V−0 @ 0.125 in | − |
| $V_{ESD}$ | ESD Withstand Voltage (Note 3) | Human Body Model<br>Charged Device Model | 2000<br>1000 | V |
| $I_{Latchup}$ | Latchup Performance (Note 4) | | ±100 | mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Applicable to devices with outputs that may be tri−stated.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm−by−1 inch, 2 ounce copper trace no air flow per JESD51−7.
3. HBM tested to EIA / JESD22−A114−A. CDM tested to JESD22−C101−A. JEDEC recommends that ESD qualification to EIA/JESD22−A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Positive DC Supply Voltage | | 0.9 | 3.6 | V |
| $V_{IN}$ | DC Input Voltage | | 0 | 3.6 | V |
| $V_{OUT}$ | DC Output Voltage | Active−Mode (High or Low State)<br>Tri−State Mode (Note 1)<br>Power−Down Mode ($V_{CC}$ = 0 V) | 0<br>0<br>0 | $V_{CC}$<br>3.6<br>3.6 | |
| $T_A$ | Operating Temperature Range | | −40 | +85 | °C |
| $t_r$ , $t_f$ | Input Transition Rise and Fall Time | $V_{CC}$ = 3.3 V ± 0.3 V | 0 | 10 | ns/V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | $T_A$ = −40°C to +85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $V_{IH}$ | High−Level Input Voltage | | 0.9 | _ | 0.5 | – | _ | – | V |
| | | | 1.1 to 1.3 | 0.65 x $V_{CC}$ | – | – | 0.65 x $V_{CC}$ | – | |
| | | | 1.4 to 1.6 | 0.65 x $V_{CC}$ | – | – | 0.65 x $V_{CC}$ | – | |
| | | | 1.65 to 1.95 | 0.65 x $V_{CC}$ | – | – | 0.65 x $V_{CC}$ | – | |
| | | | 2.3 to 2.7 | 1.6 | – | – | 1.6 | – | |
| | | | 3.0 to 3.6 | 2.1 | – | – | 2.1 | – | |
| $V_{IL}$ | Low−Level Input Voltage | | 0.9 | – | 0.5 | – | – | – | V |
| | | | 1.1 to 1.3 | – | – | 0.35 x $V_{CC}$ | – | 0.35 x $V_{CC}$ | |
| | | | 1.4 to 1.6 | – | – | 0.35 x $V_{CC}$ | – | 0.35 x $V_{CC}$ | |
| | | | 1.65 to 1.95 | – | – | 0.35 x $V_{CC}$ | – | 0.35 x $V_{CC}$ | |
| | | | 2.3 to 2.7 | – | – | 0.7 | – | 0.7 | |
| | | | 3.0 to 3.6 | – | – | 0.9 | – | 0.9 | |
| $V_{OL}$ | Low−Level Output Voltage | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | | | | | | | V |
| | | $I_{OL}$ = 20 μA | 0.9 | – | 0.1 | – | – | – | |
| | | | 1.1 to 1.3 | – | – | 0.1 | – | 0.1 | |
| | | | 1.4 to 1.6 | – | – | 0.1 | – | 0.1 | |
| | | | 1.65 to 1.95 | – | – | 0.1 | – | 0.1 | |
| | | | 2.3 to 2.7 | – | – | 0.1 | – | 0.1 | |
| | | | 3.0 to 3.6 | – | – | 0.1 | – | 0.1 | |
| | | $I_{OL}$ = 0.5 mA | 1.1 to 1.3 | – | – | 0.3 x $V_{CC}$ | – | 0.3 x $V_{CC}$ | |
| | | $I_{OL}$ = 1 mA | 1.4 to 1.6 | – | – | 0.31 | – | 0.37 | |
| | | $I_{OL}$ = 1.5 mA | 1.65 to 1.95 | – | – | 0.31 | – | 0.35 | |
| | | $I_{OL}$ = 2.1 mA | 2.3 to 2.7 | – | – | 0.31 | – | 0.33 | |
| | | $I_{OL}$ = 2.6 mA | 3.0 to 3.6 | – | – | 0.31 | – | 0.33 | |
| $I_{IN}$ | Input Leakage Current | $V_{IN}$ = 0 V to 3.6 V | 0.9 to 3.6 | – | – | ±0.1 | – | ±0.5 | μA |
| $I_{OZ}$ | 3−State Output Leakage Current | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = 0 V to 3.6 V | 0.9 to 3.6 | – | – | ±0.5 | – | ±0.5 | μA |
| $I_{OFF}$ | Power Off Leakage Current | $V_{IN}$ = 0 V to 3.6 V or<br>$V_{OUT}$ = 0 V to 3.6 V | 0 | – | – | 0.5 | – | 0.5 | μA |
| $I_{CC}$ | Quiescent Supply Current | $V_{IN}$ = $V_{CC}$ or GND | 0.9 to 3.6 | – | – | 0.9 | – | 0.9 | μA |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

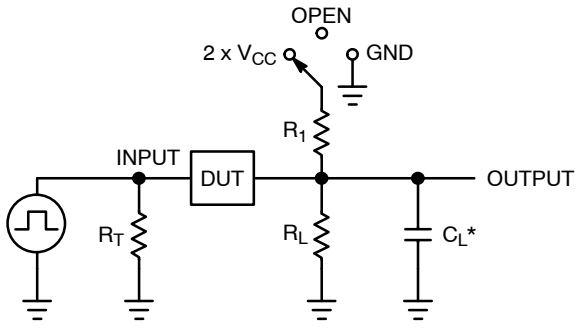
## AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | $T_A$ = −40°C to +85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $t_{PZL}$, $t_{PLZ}$ | Propagation Delay, A to Y (Figures 3 and 4) | R1 = $R_L$ = 5 kΩ, $C_L$ = 10 pF | 0.9 | – | 32.1 | – | – | – | ns |
| | | | 1.10 to 1.30 | – | 9.6 | 25.9 | – | 30.9 | |
| | | | 1.40 to 1.60 | – | 5.4 | 12.4 | – | 13.9 | |
| | | | 1.65 to 1.95 | – | 4.4 | 9.6 | – | 12.1 | |
| | | | 2.3 to 2.7 | – | 3.4 | 9.0 | – | 10.0 | |
| | | | 3.0 to 3.6 | – | 3.2 | 8.7 | – | 9.0 | |
| | | R1 = $R_L$ = 5 kΩ, $C_L$ = 15 pF | 0.9 | – | 33.6 | – | – | – | ns |
| | | | 1.10 to 1.30 | – | 10.4 | 27.2 | – | 33.9 | |
| | | | 1.40 to 1.60 | – | 6.0 | 13.3 | – | 16.0 | |
| | | | 1.65 to 1.95 | – | 5.0 | 10.3 | – | 12.6 | |
| | | | 2.3 to 2.7 | – | 4.0 | 9.4 | – | 10.2 | |
| | | | 3.0 to 3.6 | – | 3.8 | 9.1 | – | 9.7 | |
| | | R1 = $R_L$ = 5 kΩ, $C_L$ = 30 pF | 0.9 | – | 39.1 | – | – | – | ns |
| | | | 1.10 to 1.30 | – | 12.7 | 31.0 | – | 43.0 | |
| | | | 1.40 to 1.60 | – | 7.9 | 16.0 | – | 18.0 | |
| | | | 1.65 to 1.95 | – | 7.0 | 12.0 | – | 14.0 | |
| | | | 2.3 to 2.7 | – | 5.9 | 11.0 | – | 12.0 | |
| | | | 3.0 to 3.6 | – | 5.5 | 10.6 | – | 11.0 | |

## CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Test Condition | Typical ($T_A$ = 25°C) | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 0 V | 2.0 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC}$ = 0 V | 4.0 | pF |
| $C_{PD}$ | Power Dissipation Capacitance (Note 5) | f = 10 MHz, $V_{CC}$ = 0.9 to 3.6 V, $V_{IN}$ = 0 V or $V_{CC}$ | 6.0 | pF |

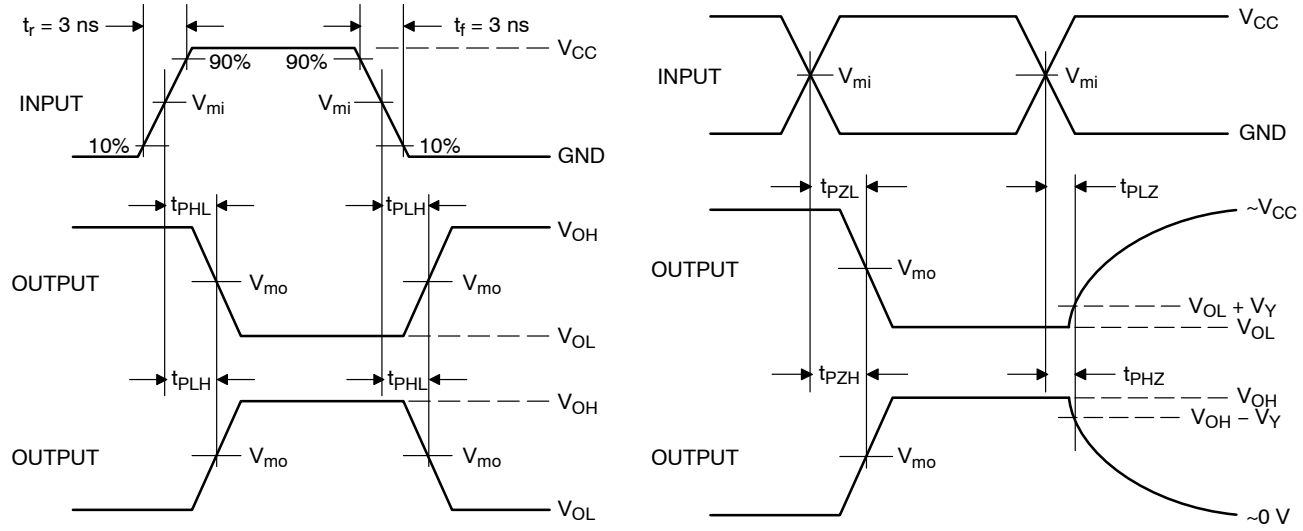
5. $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. $C_{PD}$ is used to determine the no−load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.




$C_L$ includes probe and jig capacitance
$R_T$ is $Z_{OUT}$ of pulse generator (typically 50 Ω)
f = 1 MHz

| Test | Switch Position |
|---|---|
| $t_{PLH}$ / $t_{PHL}$ | Open |
| $t_{PLZ}$ / $t_{PZL}$ | 2 x $V_{CC}$ |
| $t_{PHZ}$ / $t_{PZH}$ | GND |

**Figure 3. Test Circuit**




| $V_{CC}$, V | $V_{mi}$, V | $V_{mo}$, V | $V_Y$, V |
|---|---|---|---|
| 0.9 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | 0.1 |
| 1.1 to 1.3 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | 0.1 |
| 1.4 to 1.6 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | 0.1 |
| 1.65 to 1.95 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | 0.15 |
| 2.3 to 2.7 | $V_{CC}$ / 2 | $V_{CC}$ / 2 | 0.15 |
| 3.0 to 3.6 | 1.5 | 1.5 | 0.3 |

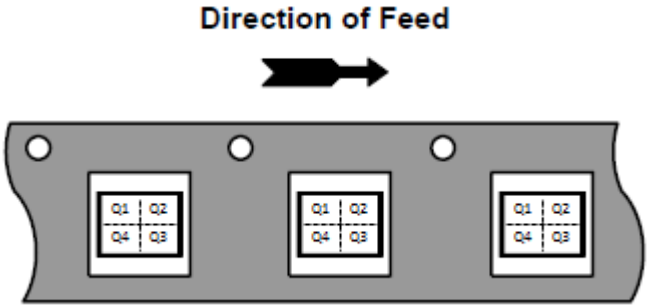
**Figure 4. Switching Waveforms**

## ORDERING INFORMATION

| Device | Package | Marking | Pin 1 Orientation (See below) | Shipping† |
|---|---|---|---|---|
| NC7SP05P5X | SC−88A | P05 | Q4 | 3000 / Tape & Reel |
| NC7SP05L6X | MicroPak | J7 | Q4 | 5000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

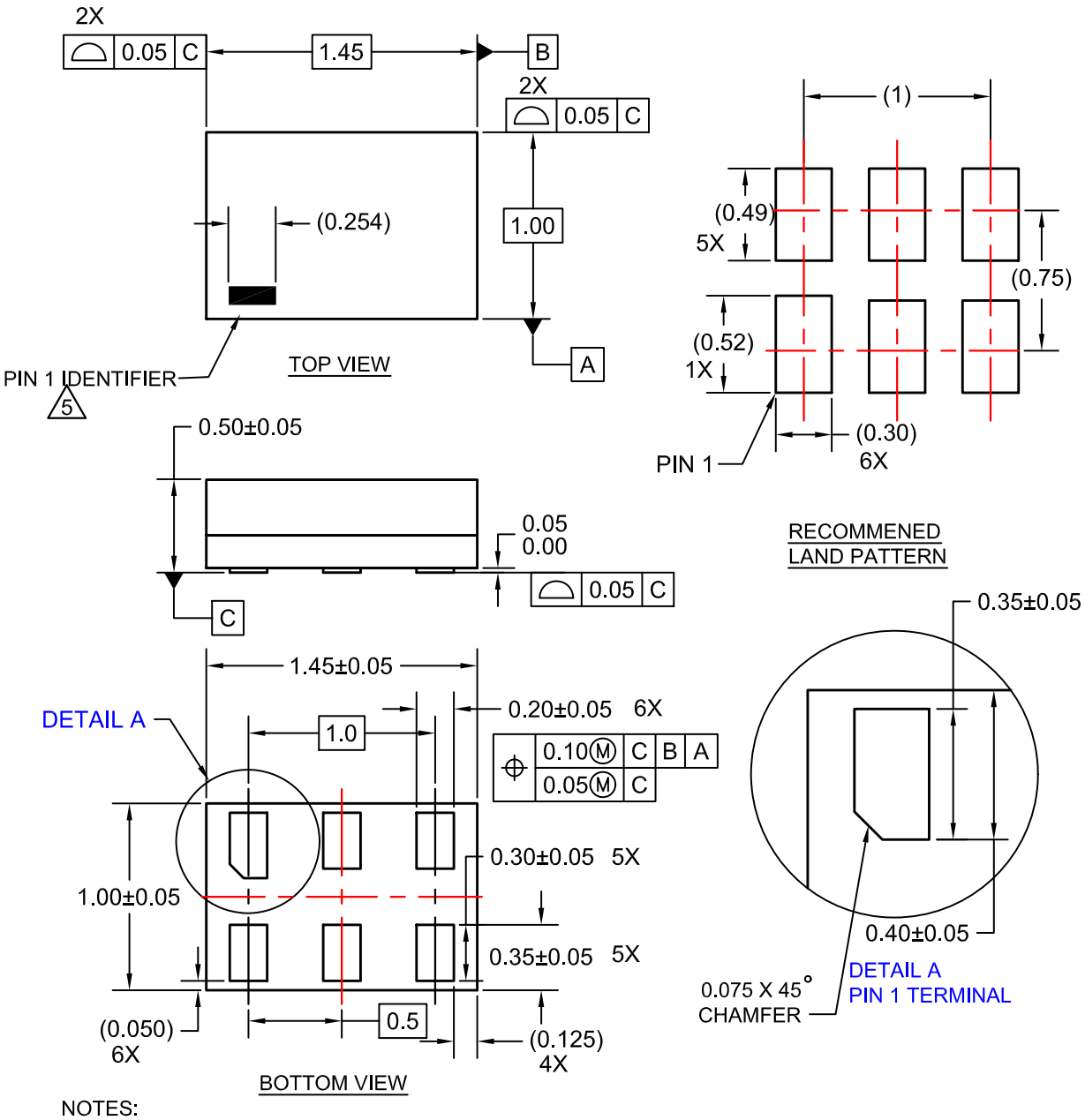
### Pin 1 Orientation in Tape and Reel



# NC7SP05

## PACKAGE DIMENSIONS

**SIP6 1.45X1.0**
CASE 127EB
ISSUE O



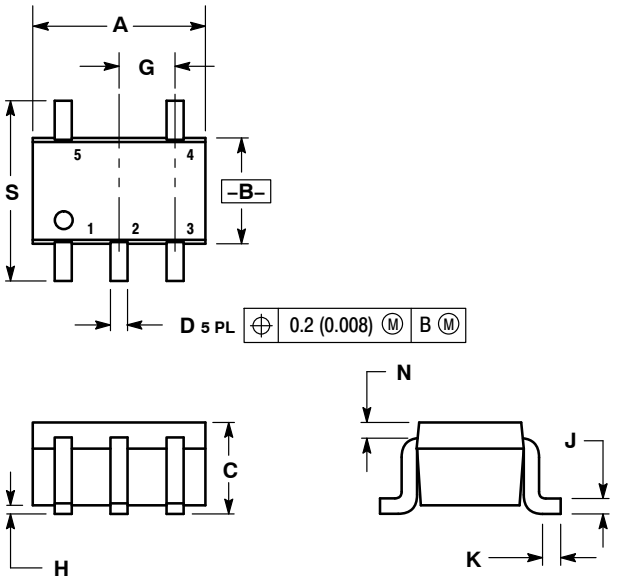

NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

# NC7SP05

## PACKAGE DIMENSIONS

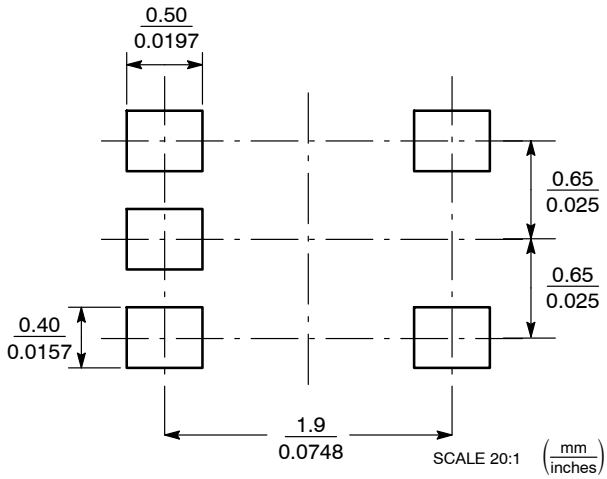
**SC−88A (SC−70−5/SOT−353)**
CASE 419A−02
ISSUE L




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

## SOLDER FOOTPRINT



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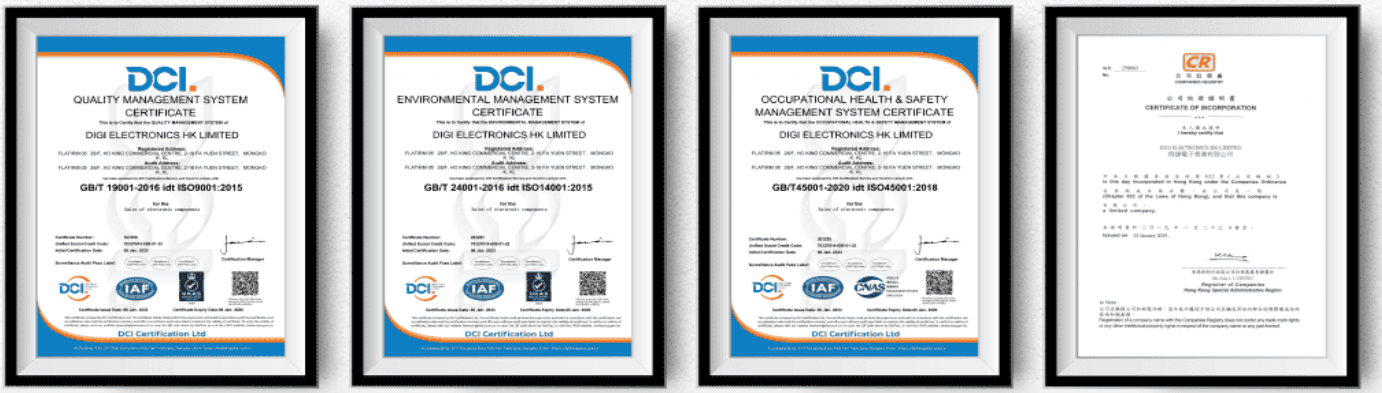



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