# THE DATASHEET OF

# DS90CP22MTX/NOPB

www.win-source.net 0086-755-83957316

# DS90CP22 800 Mbps 2x2 LVDS Crosspoint Switch

**Check for Samples: DS90CP22**

## FEATURES

- **DC - 800 Mbps Low Jitter, Low Skew Operation**
- **65 ps (typ) of Pk-Pk Jitter with PRBS = $2^{23}-1$ Data Pattern at 800 Mbps**
- **Single +3.3 V Supply**
- **Less than 330 mW (typ) Total Power Dissipation**
- **Non-Blocking "'Switch Architecture"'**
- **Balanced Output Impedance**
- **Output Channel-to-Channel Skew is 35 ps (typ)**
- **Configurable as 2:1 mux, 1:2 demux, Repeater or 1:2 Signal Splitter**
- **LVDS Receiver Inputs Accept LVPECL Signals**
- **Fast Switch Time of 1.2ns (typ)**
- **Fast Propagation Delay of 1.3ns (typ)**
- **Receiver Input Threshold < ±100 mV**
- **Available in 16 Lead TSSOP and SOIC Packages**
- **Conforms to ANSI/TIA/EIA-644-1995 LVDS Standard**
- **Operating Temperature: −40°C to +85°C**

## DESCRIPTION

DS90CP22 is a 2x2 crosspoint switch utilizing LVDS (Low Voltage Differential Signaling) technology for low power, high speed operation. Data paths are fully differential from input to output for low noise generation and low pulse width distortion. The non-blocking design allows connection of any input to any output or outputs. LVDS I/O enable high speed data transmission for point-to-point interconnects. This device can be used as a high speed differential crosspoint, 2:1 mux, 1:2 demux, repeater or 1:2 signal splitter. The mux and demux functions are useful for switching between primary and backup circuits in fault tolerant systems. The 1:2 signal splitter and 2:1 mux functions are useful for distribution of serial bus across several rack-mounted backplanes.

The DS90CP22 accepts LVDS signal levels, LVPECL levels directly or PECL with attenuation networks.

The individual LVDS outputs can be put into TRI-STATE by use of the enable pins.

For more details, please refer to the Application Information section of this datasheet.

## Connection Diagram

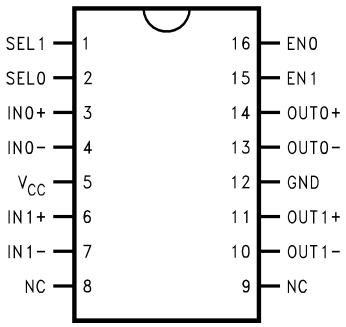


**Figure 1. SOIC-16 Package or TSSOP-16 Package**

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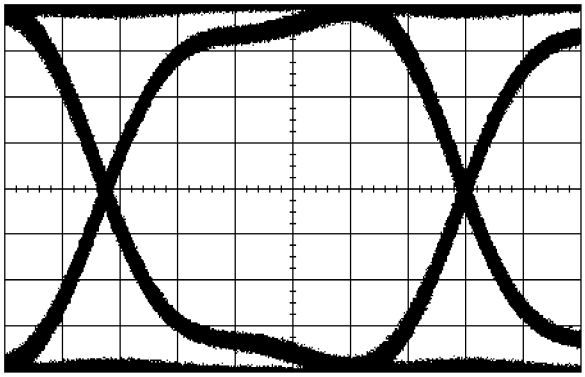

**Figure 2. Diff. Output Eye-Pattern in 1:2 split mode @ 800 Mbps**
**Conditions: 3.3 V, PRBS = $2^{23}$−1 data pattern,**
**$V_{ID}$ = 300mV, $V_{CM}$ = +1.2 V, 200 ps/div, 100 mV/div**

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## Absolute Maximum Ratings(1)(2)

| | | |
|---|---|---|
| Supply Voltage ($V_{CC}$) | | −0.3V to +4V |
| CMOS/TTL Input Voltage (EN0, EN1, SEL0, SEL1) | | −0.3V to ($V_{CC}$ + 0.3V) |
| LVDS Receiver Input Voltage (IN+, IN−) | | −0.3V to +4V |
| LVDS Driver Output Voltage (OUT+, OUT−) | | −0.3V to +4V |
| LVDS Output Short Circuit Current | | Continuous |
| Junction Temperature | | +150°C |
| Storage Temperature Range | | −65°C to +150°C |
| Lead Temperature (Soldering, 4 sec.) | | +260°C |
| Maximum Package Power Dissipation at 25°C | 16L SOIC | 1.435 W |
| | 16L SOIC Package Derating | 11.48 mW/°C above +25°C |
| | 16L TSSOP | 0.866 W |
| | 16L TSSOP Package Derating | 9.6 mW/°C above +25°C |
| ESD Rating | (HBM, 1.5kΩ, 100pF) | > 5 kV |
| | (EIAJ, 0Ω, 200pF) | > 250 V |

(1) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(2) "Absolute Maximum Ratings" are these beyond which the safety of the device cannot be verified. They are not meant to imply that the device should be operated at these limits. "Electrical Characteristics" provides conditions for actual device operation.

## Recommended Operating Conditions

| | Min | Typ | Max | Units |
|---|---|---|---|---|
| Supply Voltage ($V_{CC}$) | 3.0 | 3.3 | 3.6 | V |
| Receiver Input Voltage | 0 | | $V_{CC}$ | V |
| Operating Free Air Temperature | -40 | +25 | +85 | °C |


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## Electrical Characteristics[1]

Over recommended operating supply and temperature ranges unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **CMOS/TTL DC SPECIFICATIONS (EN0,EN1,SEL0,SEL1)** | | | | | | |
| $V_{IH}$ | High Level Input Voltage | | 2.0 | | $V_{CC}$ | V |
| $V_{IL}$ | Low Level Input Voltage | | GND | | 0.8 | V |
| $I_{IH}$ | High Level Input Current | $V_{IN}$ = 3.6V or 2.0V; $V_{CC}$ = 3.6V | | +7 | +20 | µA |
| $I_{IL}$ | Low Level Input Current | $V_{IN}$ = 0V or 0.8V; $V_{CC}$ = 3.6V | | ±1 | ±10 | µA |
| $V_{CL}$ | Input Clamp Voltage | $I_{CL}$ = −18 mA | | −0.8 | −1.5 | V |
| **LVDS OUTPUT DC SPECIFICATIONS (OUT0,OUT1)** | | | | | | |
| $V_{OD}$ | Differential Output Voltage | $R_L$ = 75Ω | 270 | 365 | 475 | mV |
| | | $R_L$ = 75Ω, $V_{CC}$ = 3.3V, $T_A$ = 25°C | 285 | 365 | 440 | mV |
| $\Delta V_{OD}$ | Change in $V_{OD}$ between Complimentary Output States | | | | 35 | mV |
| $V_{OS}$ | Offset Voltage[2] | | 1.0 | 1.2 | 1.45 | V |
| $\Delta V_{OS}$ | Change in $V_{OS}$ between Complimentary Output States | | | | 35 | mV |
| $I_{OZ}$ | Output TRI-STATE Current | TRI-STATE Output, | | ±1 | ±10 | µA |
| | | $V_{OUT}$ = $V_{CC}$ or GND | | | | |
| $I_{OFF}$ | Power-Off Leakage Current | $V_{CC}$ = 0V; $V_{OUT}$ = 3.6V or GND | | ±1 | ±10 | µA |
| $I_{OS}$ | Output Short Circuit Current | $V_{OUT+}$ OR $V_{OUT-}$ = 0V | | −15 | −25 | mA |
| $I_{OSB}$ | Both Outputs Short Circuit Current | $V_{OUT+}$ AND $V_{OUT-}$ = 0V | | −30 | −50 | mA |
| **LVDS RECEIVER DC SPECIFICATIONS (IN0,IN1)** | | | | | | |
| $V_{TH}$ | Differential Input High Threshold | $V_{CM}$ = +0.05V or +1.2V or +3.25V, | | 0 | +100 | mV |
| $V_{TL}$ | Differential Input Low Threshold | Vcc = 3.3V | −100 | 0 | | mV |
| $V_{CMR}$ | Common Mode Voltage Range | $V_{ID}$ = 100mV, Vcc = 3.3V | 0.05 | | 3.25 | V |
| $I_{IN}$ | Input Current | $V_{IN}$ = +3.0V, $V_{CC}$ = 3.6V or 0V | | ±1 | ±10 | µA |
| | | $V_{IN}$ = 0V, $V_{CC}$ = 3.6V or 0V | | ±1 | ±10 | µA |
| **SUPPLY CURRENT** | | | | | | |
| $I_{CCD}$ | Total Supply Current | $R_L$ = 75Ω, $C_L$ = 5 pF, EN0 = EN1 = High | | 98 | 125 | mA |
| $I_{CCZ}$ | TRI-STATE Supply Current | EN0 = EN1 = Low | | 43 | 55 | mA |

(1) All typical are given for $V_{CC}$ = +3.3V and $T_A$ = +25°C, unless otherwise stated.
(2) $V_{OS}$ is defined and measured on the ATE as ($V_{OH}$ + $V_{OL}$) / 2.

## AC Electrical Characteristics

Over recommended operating supply and temperature ranges unless otherwise specified[1]

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $T_{SET}$ | Input to SEL Setup Time[2], (Figure 3 and Figure 4) | | 0.7 | 0.5 | | ns |
| $T_{HOLD}$ | Input to SEL Setup Time[2], (Figure 3 and Figure 4) | | 1.0 | 0.5 | | ns |
| $T_{SWITCH}$ | SEL to Switched Output, (Figure 3 and Figure 4) | | 0.9 | 1.2 | 1.7 | ns |
| $T_{PHZ}$ | Disable Time (Active to TRI-STATE) High to Z, Figure 5 | | | 2.1 | 4.0 | ns |
| $T_{PLZ}$ | Disable Time (Active to TRI-STATE) Low to Z, Figure 5 | | | 3.0 | 4.5 | ns |
| $T_{PZH}$ | Enable Time (TRI-STATE to Active) Z to High, Figure 5 | | | 25.5 | 55.0 | ns |
| $T_{PZL}$ | Enable Time (TRI-STATE to Active) Z to Low, Figure 5 | | | 25.5 | 55.0 | ns |
| $T_{LHT}$ | Output Low-to-High Transition Time, 20% to 80%, Figure 7 | | 290 | 400 | 580 | ps |
| $T_{HLT}$ | Output High-to-Low Transition Time, 80% to 20%, Figure 7 | | 290 | 400 | 580 | ps |

(1) The parameters are specified by design. The limits are based on statistical analysis of the device performance over PVT (process, voltage and temperature) range.
(2) $T_{SET}$ and $T_{HOLD}$ time specify that data must be in a stable state before and after the SEL transition.

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## AC Electrical Characteristics (continued)

Over recommended operating supply and temperature ranges unless otherwise specified(1)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $T_{JIT}$ | LVDS Data Path Peak to Peak Jitter(3) | $V_{ID}$ = 300mV; 50% Duty Cycle; $V_{CM}$ = 1.2V at 800Mbps | | 40 | 90 | ps |
| | | $V_{ID}$ = 300mV; PRBS=$2^{23}$-1 data pattern; $V_{CM}$ = 1.2V at 800Mbps | | 65 | 120 | ps |
| $T_{PLHD}$ | Propagation Low to High Delay, Figure 8 | | 0.9 | 1.3 | 1.6 | ns |
| | Propagation Low to High Delay, Figure 8 | $V_{CC}$ = 3.3V, $T_A$ = 25°C | 1.0 | 1.3 | 1.5 | ns |
| $T_{PHLD}$ | Propagation High to Low Delay, Figure 8 | | 0.9 | 1.3 | 1.6 | ns |
| | Propagation High to Low Delay, Figure 8 | $V_{CC}$ = 3.3V, $T_A$ = 25°C | 1.0 | 1.3 | 1.5 | ns |
| $T_{SKEW}$ | Pulse Skew $\|T_{PLHD} - T_{PHLD}\|$ | | | 0 | 225 | ps |
| $T_{CCS}$ | Output Channel-to-Channel Skew, Figure 9 | | | 35 | 80 | ps |

(3) The parameters are specified by design. The limits are based on statistical analysis of the device performance over PVT range with the following equipment test setup: HP70004A (display mainframe) with HP70841B (pattern generator), 5 feet of RG-142 cable with DUT test board and HP83480A (digital scope mainframe) with HP83483A (20GHz scope module).

## AC Timing Diagrams

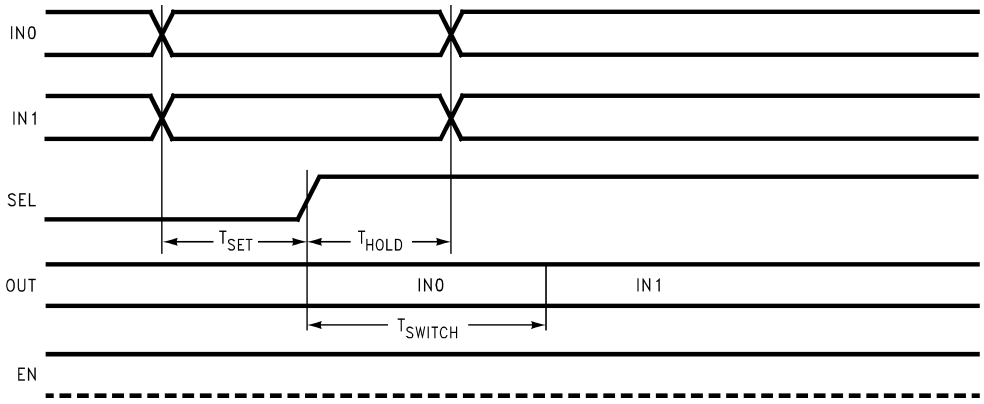


**Figure 3. Input-to-Select rising edge setup and hold times and mux switch time**

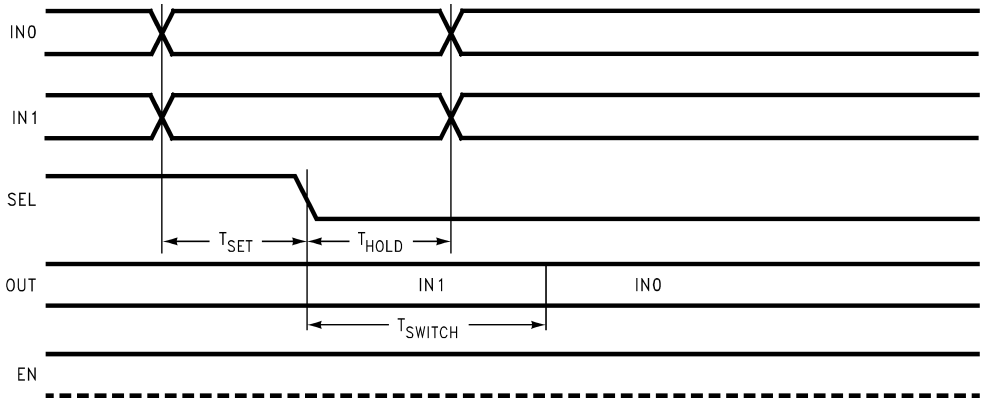


**Figure 4. Input-to-Select falling edge setup and hold times and mux switch time**


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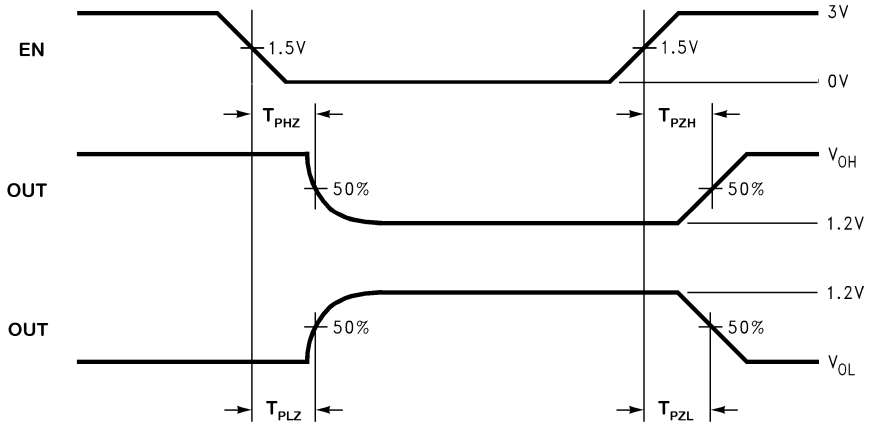


**Figure 5. Output active to TRI-STATE and TRI-STATE to active output time**

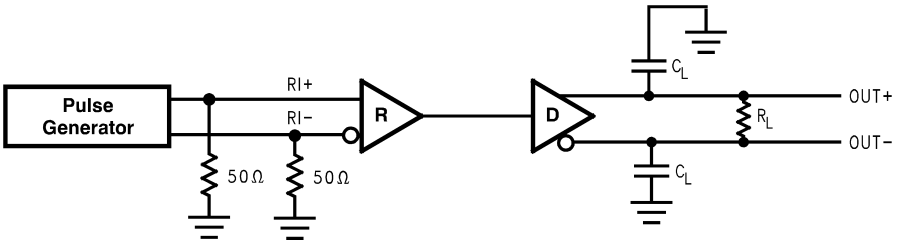


**Figure 6. LVDS Output Load**

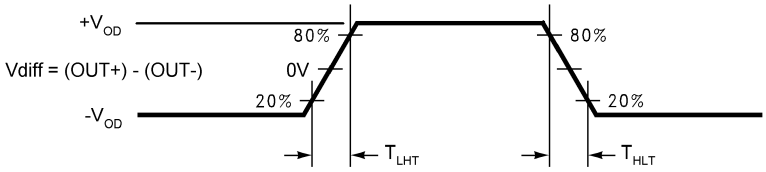


**Figure 7. LVDS Output Transition Time**

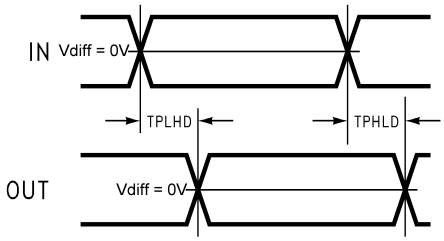


**Figure 8. Propagation Delay Low-to-High and High-to-Low**

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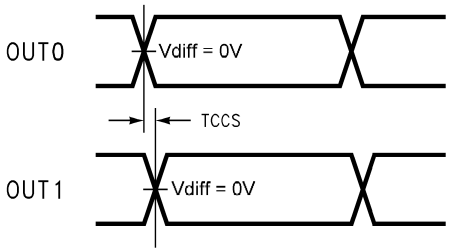


**Figure 9. Output Channel-to-Channel Skew in 1:2 splitter mode**

## PIN DESCRIPTIONS

| Pin Name | # of Pin | Input/Output | Description |
|---|---|---|---|
| IN+ | 2 | I | Non-inverting LVDS input |
| IN - | 2 | I | Inverting LVDS input |
| OUT+ | 2 | O | Non-inverting LVDS Output |
| OUT - | 2 | O | Inverting LVDS Output |
| EN | 2 | I | A logic low on the Enable puts the LVDS output into TRI-STATE and reduces the supply current |
| SEL | 2 | I | 2:1 mux input select |
| GND | 1 | P | Ground |
| $V_{CC}$ | 1 | P | Power Supply |
| NC | 2 | | No Connect |


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# APPLICATION INFORMATION

## MODES OF OPERATION

The DS90CP22 provides three modes of operation. In the 1:2 splitter mode, the two outputs are copies of the same single input. This is useful for distribution / fan-out applications. In the repeater mode, the device operates as a 2 channel LVDS buffer. Repeating the signal restores the LVDS amplitude, allowing it to drive another media segment. This allows for isolation of segments or long distance applications. The switch mode provides a crosspoint function. This can be used in a system when primary and redundant paths are supported in fault tolerant applications.

## INPUT FAIL-SAFE

The receiver inputs of the DS90CP22 do not have internal fail-safe biasing. For point-to-point and multidrop applications with a single source, fail-safe biasing may not be required. When the driver is off, the link is in-active. If fail-safe biasing is required, this can be accomplished with external high value resistors. The IN+ should be pull to Vcc with 10kΩ and the IN− should be pull to Gnd with 10kΩ. This provides a slight positive differential bias, and sets a known HIGH state on the link with a minimum amount of distortion.

## UNUSED LVDS INPUTS

Unused LVDS Receiver inputs should be tied off to prevent the high-speed sensitive input stage from picking up noise signals. The open input to IN+ should be pull to Vcc with 10kΩ and the open input to IN− should be pull to Gnd with 10kΩ.

## UNUSED CONTROL INPUTS

The SEL and EN control input pins have internal pull down devices. Unused pins may be tied off or left as no-connect (if a LOW state is desired).

## EXPANDING THE NUMBER OF OUTPUT PORTS

To expand the number of output ports, more than one DS90CP22 can be used. Total propagation delay through the devices should be considered to determine the maximum expansion. For example, if 2 X 4 is desired, than three of the DS90CP22 are required. A minimum of two device propagation delays (2 x 1.3ns = 2.6ns (typ)) can be achieved. For a 2 X 8, a total of 7 devices must be used with propagation delay of 3 x 1.3ns = 3.9ns (typ). The power consumption will increase proportional to the number of devices used.

## PCB LAYOUT AND POWER SYSTEM BYPASS

Circuit board layout and stack-up for the DS90CP22 should be designed to provide noise-free power to the device. Good layout practice also will separate high frequency or high level inputs and outputs to minimize unwanted stray noise pickup, feedback and interference. Power system performance may be greatly improved by using thin dielectrics (4 to 10 mils) for power/ground sandwiches. This increases the intrinsic capacitance of the PCB power system which improves power supply filtering, especially at high frequencies, and makes the value and placement of external bypass capacitors less critical. External bypass capacitors should include both RF ceramic and tantalum electrolytic types. RF capacitors may use values in the range 0.01 µF to 0.1 µF. It is recommended practice to use two vias at each power pin of the DS90CP22 as well as all RF bypass capacitor terminals. Dual vias reduce the interconnect inductance by up to half, thereby reducing interconnect inductance and extending the effective frequency range of the bypass components.

The outer layers of the PCB may be flooded with additional ground plane. These planes will improve shielding and isolation as well as increase the intrinsic capacitance of the power supply plane system. Naturally, to be effective, these planes must be tied to the ground supply plane at frequent intervals with vias. Frequent via placement also improves signal integrity on signal transmission lines by providing short paths for image currents which reduces signal distortion.

There are more common practices which should be followed when designing PCBs for LVDS signaling.

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## COMPATIBILITY WITH LVDS STANDARD

The DS90CP22 is compatible with LVDS and Bus LVDS Interface devices. It is enhanced over standard LVDS drivers in that it is able to driver lower impedance loads with standard LVDS levels. Standard LVDS drivers provide 330mV differential output with a 100Ω load. The DS90CP22 provides 365mV with a 75Ω load or 400mV with 100Ω loads. This extra drive capability is useful in certain multidrop applications.

In backplane multidrop configurations, with closely spaced loads, the effective differential impedance of the line is reduced. If the mainline has been designed for 100Ω differential impedance, the loading effects may reduce this to the 70Ω range depending upon spacing and capacitance load. Terminating the line with a 75Ω load is a better match than with 100Ω and reflections are reduced.

## BLOCK DIAGRAM

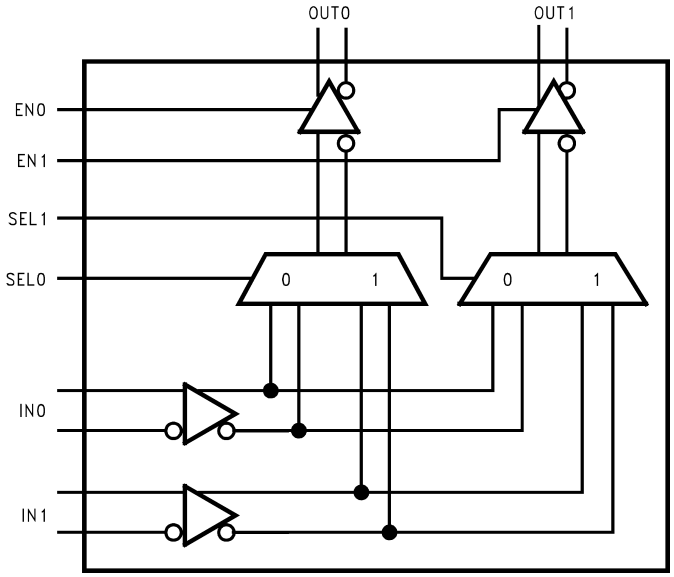


**Table 1. Function Table**

| SEL0 | SEL1 | OUT0 | OUT1 | Mode |
|---|---|---|---|---|
| 0 | 0 | IN0 | IN0 | 1:2 splitter |
| 0 | 1 | IN0 | IN1 | repeater |
| 1 | 0 | IN1 | IN0 | switch |
| 1 | 1 | IN1 | IN1 | 1:2 splitter |


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## Typical Performance Characteristics

**Diff. Output Voltage ($V_{OD}$) vs. Resistive Load ($R_T$)**

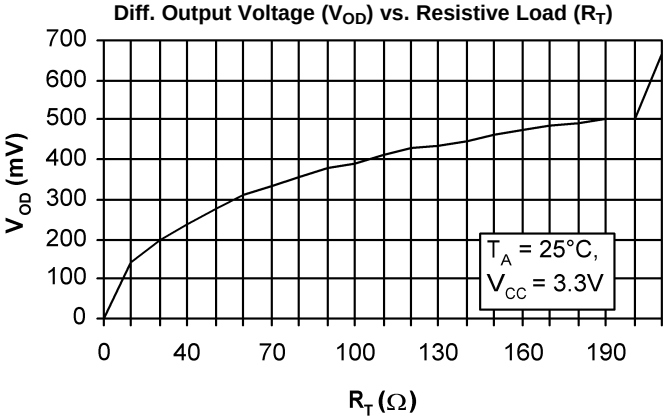


**Figure 10.**

**Peak-to-Peak Output Jitter at $V_{CM}$ = +0.4V vs. VID**

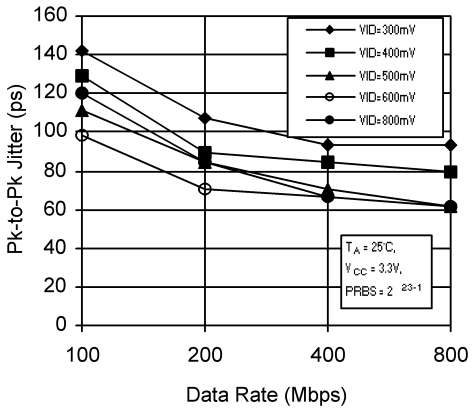


**Figure 11.**

**Peak-to-Peak Output Jitter at $V_{CM}$ = +1.2V vs. VID**

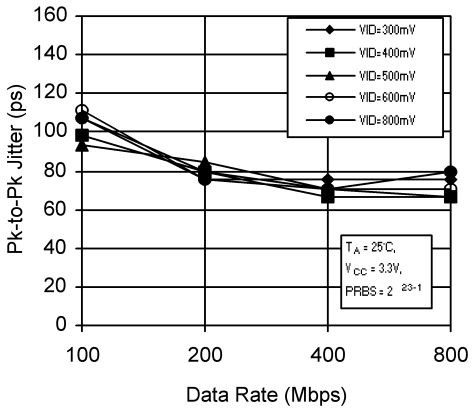


**Figure 12.**

**Peak-to-Peak Output Jitter at $V_{CM}$ = +1.6V vs. VID**

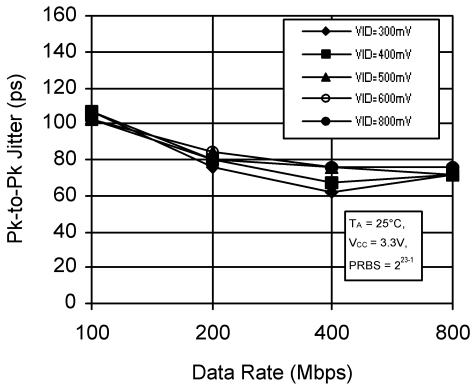


**Figure 13.**

## REVISION HISTORY

| Changes from Revision D (April 2013) to Revision E | Page |
|---|---|
| • Changed layout of National Data Sheet to TI format | 9 |


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## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DS90CP22M-8 | NRND | SOIC | D | 16 | 48 | TBD | Call TI | Call TI | -40 to 85 | DS90CP22M -8 | |
| DS90CP22M-8/NOPB | ACTIVE | SOIC | D | 16 | 48 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | DS90CP22M -8 | Samples |
| DS90CP22MT | NRND | TSSOP | PW | 16 | 92 | TBD | Call TI | Call TI | -40 to 85 | DS90CP 22MT | |
| DS90CP22MT/NOPB | ACTIVE | TSSOP | PW | 16 | 92 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | DS90CP 22MT | Samples |
| DS90CP22MTX/NOPB | ACTIVE | TSSOP | PW | 16 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | DS90CP 22MT | Samples |
| DS90CP22MX-8/NOPB | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | DS90CP22M -8 | Samples |

(1) 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.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
**TBD:** The Pb-Free/Green conversion plan has not been defined.
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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

(5) 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.

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

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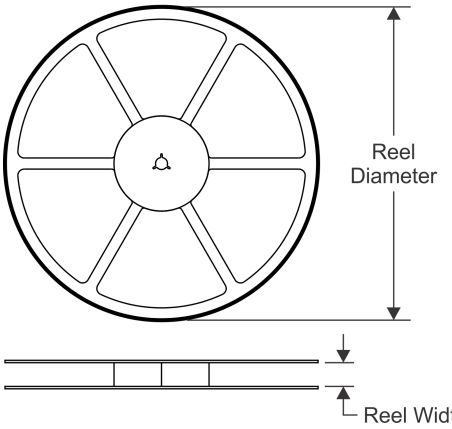
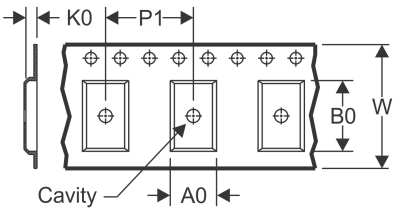
## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

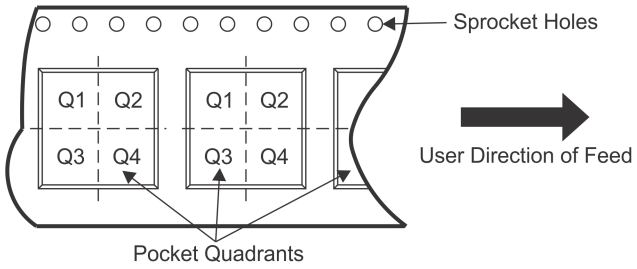



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

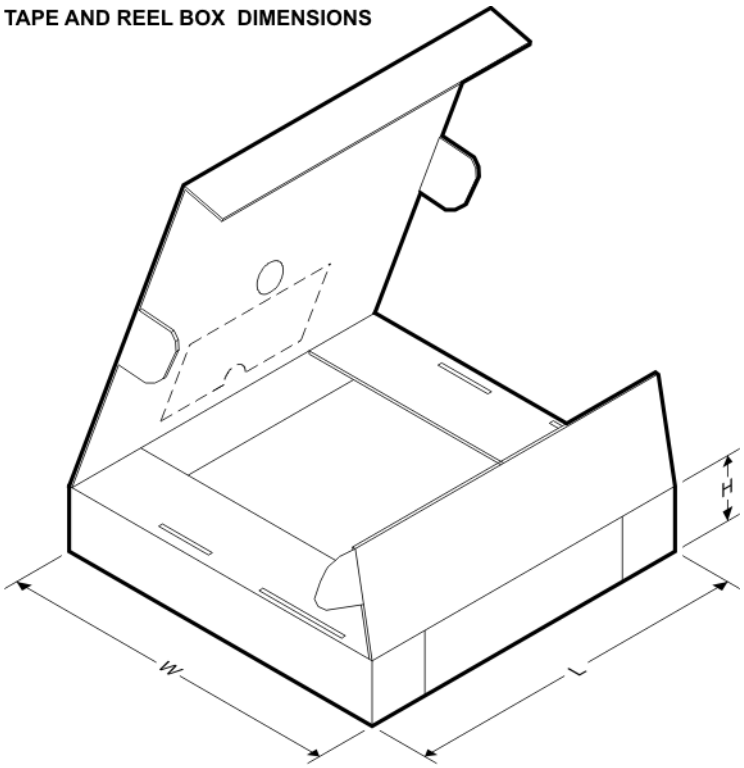
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS90CP22MTX/NOPB | TSSOP | PW | 16 | 2500 | 330.0 | 12.4 | 6.95 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| DS90CP22MX-8/NOPB | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.3 | 8.0 | 16.0 | Q1 |

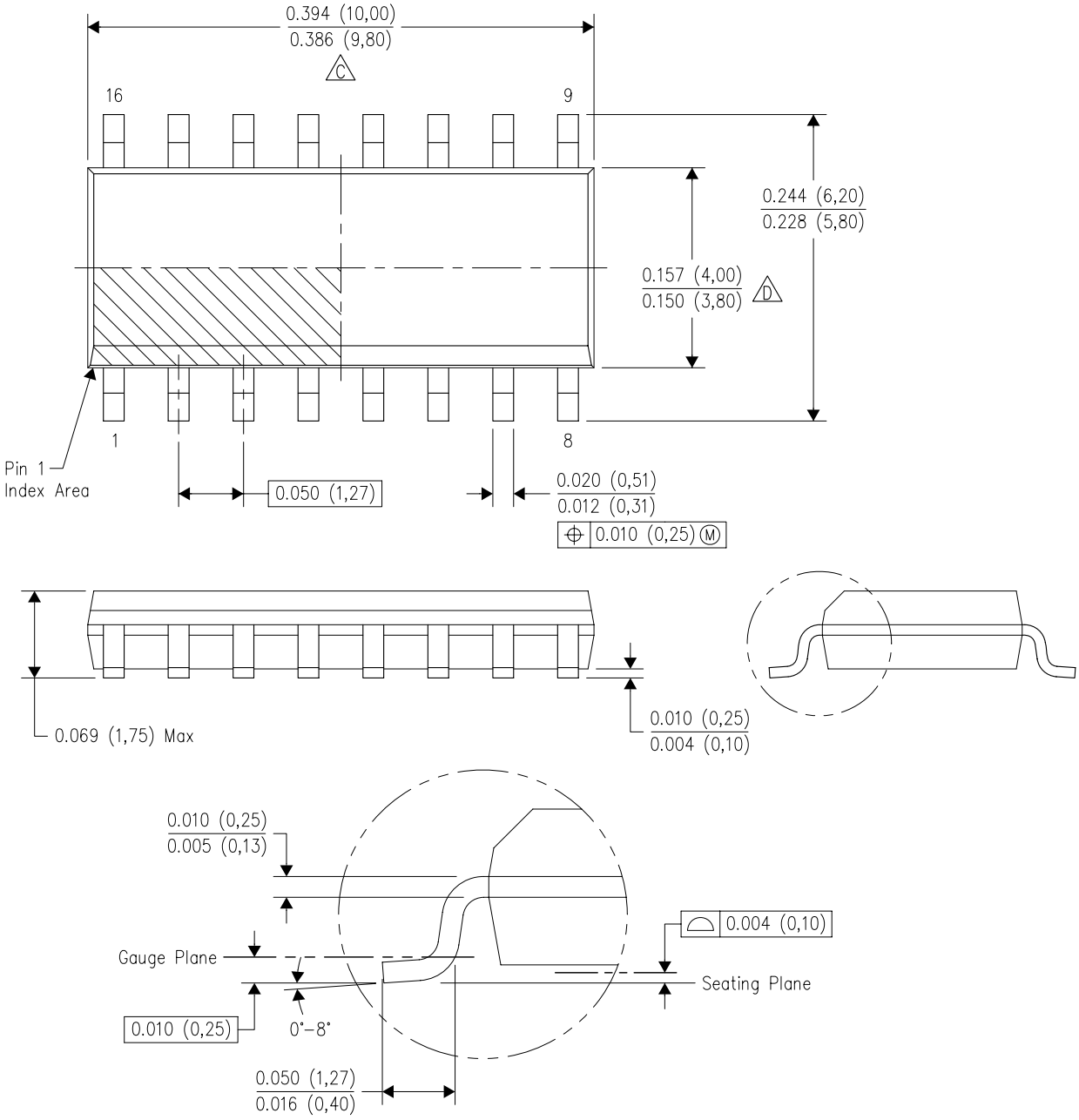
**TAPE AND REEL BOX DIMENSIONS**




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| DS90CP22MTX/NOPB | TSSOP | PW | 16 | 2500 | 367.0 | 367.0 | 35.0 |
| DS90CP22MX-8/NOPB | SOIC | D | 16 | 2500 | 367.0 | 367.0 | 35.0 |

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



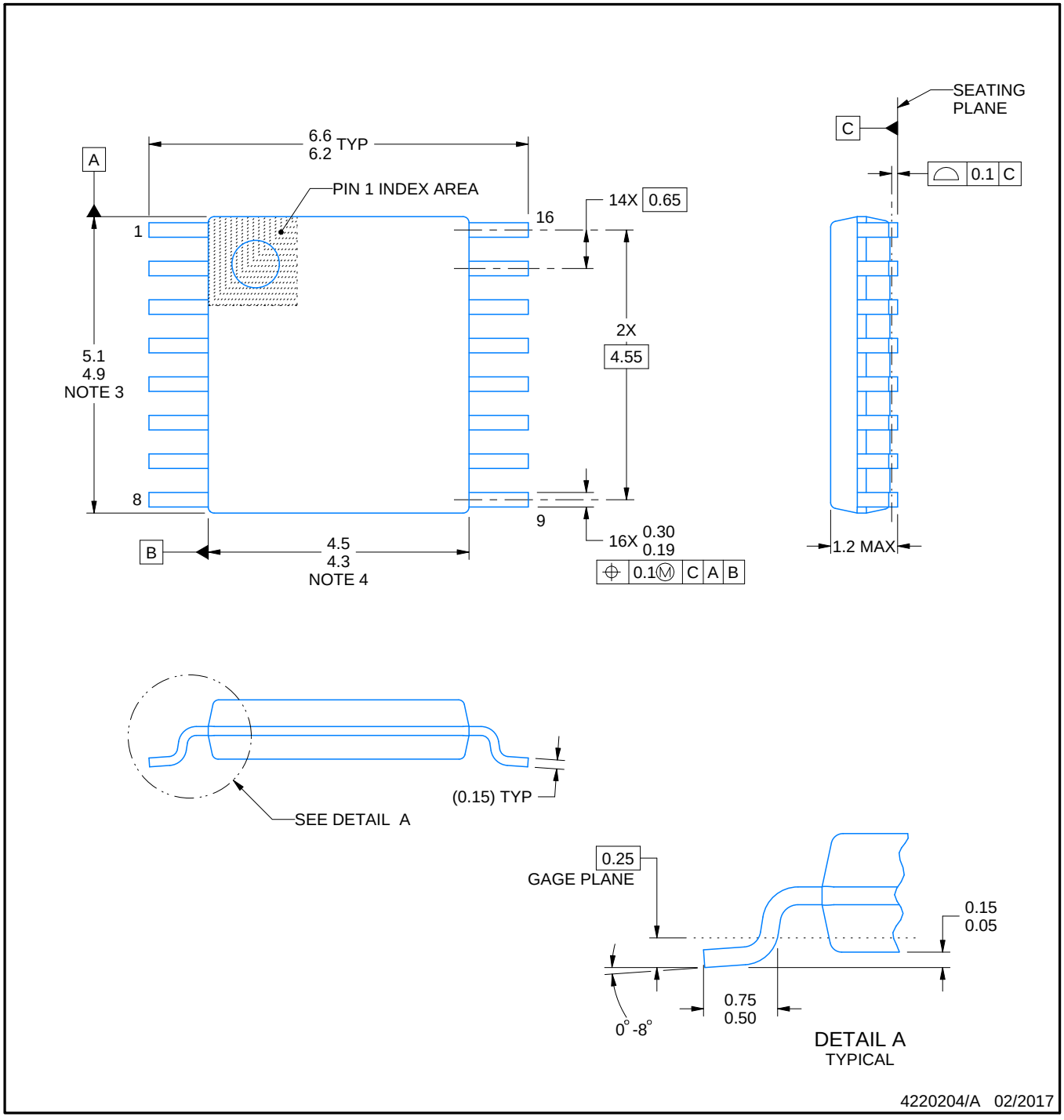

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead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

# PACKAGE OUTLINE

## PW0016A

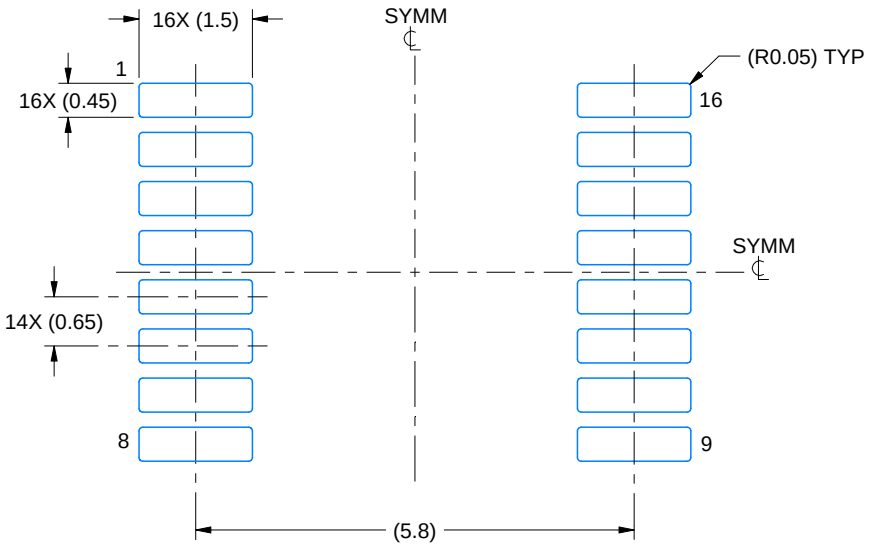
## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

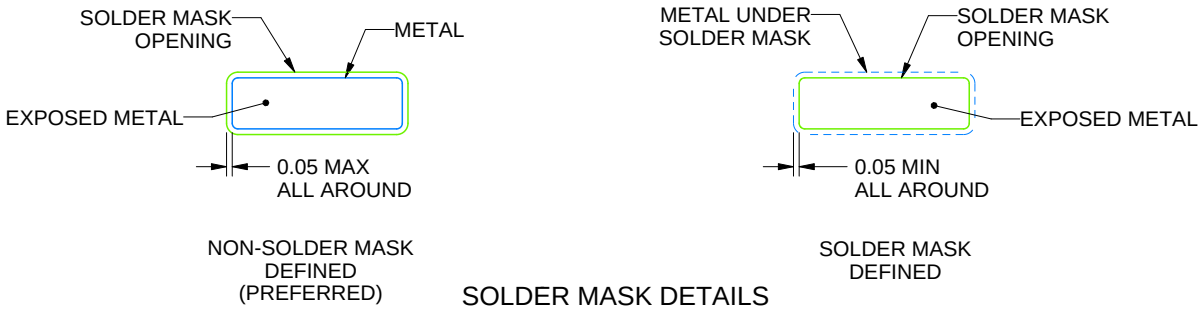



NOTES:

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.




LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X




SOLDER MASK DETAILS

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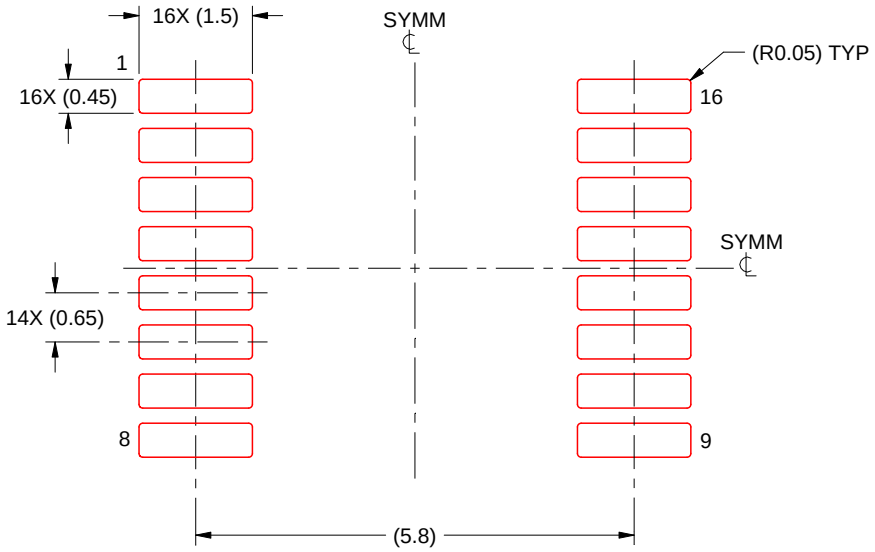
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




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

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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.

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