

## 2-CHANNEL ESD-PROTECTION ARRAY FOR AC-COUPLED/NEGATIVE-RAIL DATA INTERFACES

Check for Samples: [TPD2E007](#)

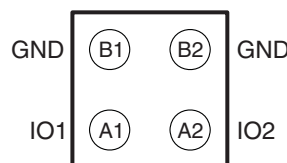
### FEATURES

- ESD Protection Exceeds IEC61000-4-2 (Level 4)
  - $\pm 15$ -kV Human-Body Model (HBM)
  - $\pm 8$ -kV IEC 61000-4-2 Contact Discharge
  - $\pm 15$ -kV IEC 61000-4-2 Air-Gap Discharge
- 4.5-A Peak Pulse Current (8/20 ms Pulse)
- 15-pF Line to GND Capacitance
- Low 50-nA Leakage Current
- 2-Channel Device
- Space-Saving PicoStar™ and DCK Package

### APPLICATIONS

- Cell Phones, PDAs
- Audio Interface Connections
- Consumer Electronics (DVR, Set-Top Box, TV)
- Industrial Interface (RS-232, RS-485, RS-422, LVDS)

**YFMG4 PACKAGE  
(BOTTOM VIEW)**

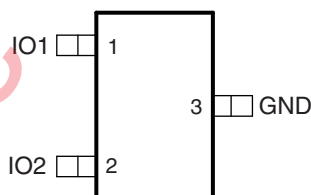


0.8 mm × 0.8 mm (0.4 mm pitch)

**YFMG4 PIN DESCRIPTIONS**

| TERMINAL |        | DESCRIPTION            |
|----------|--------|------------------------|
| NAME     | NO.    |                        |
| IO       | A1, A2 | ESD-protection channel |
| GND      | B1, B2 | Ground                 |

**DCK PACKAGE  
(TOP VIEW)**



### DESCRIPTION/ORDERING INFORMATION

This device is an application-specific integrated parts (ASIP) designed to offer system level ESD solutions for wide range of portable and industrial applications. The back-to-back diode array allows AC-coupled or negative-going data transmission (audio interface, LVDS, RS-485, RS-232, etc.) without compromising signal integrity. The PicoStar™ package is intended to be embedded inside the printed circuit board which saves board space in portable applications. This device exceeds the IEC61000-4-2 (Level 4) ESD protection and suitable to provide system level ESD protection for the valuable internal ICs while placed near the connector.

The TPD2E007 is offered in a 4-bump PicoStar™ and 3-pin DCK packages. The PicoStar™ package (YFMG4), with only 0.15 mm (Max) package height, is recommended for ultra space saving application where the package height is a key concern. The PicoStar™ package can be used in either embedded PCB board applications or in surface mount applications. The industry standard DCK package offers straightforward board layout option in legacy designs.



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

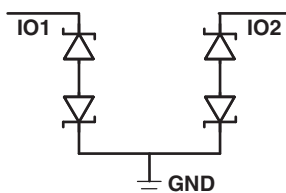
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**ORDERING INFORMATION**

| T <sub>A</sub> | PACKAGE <sup>(1)</sup> (2) |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------------|---------------|-----------------------|------------------|
| –40°C to 85°C  | DSLGA – YFM                | Tape and reel | TPD2E007YFMRG4        | 45<br>T          |
| –40°C to 85°C  | 3-DCK                      | Tape and reel | TPD2E007DCKR          | 45U              |

(1) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

**EQUIVALENT SCHEMATIC REPRESENTATION****ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

over operating free-air temperature range (unless otherwise noted)

|                                                         |                           | MIN   | MAX  | UNIT |
|---------------------------------------------------------|---------------------------|-------|------|------|
| V <sub>IO</sub>                                         |                           | –13.5 | 13.5 | V    |
| Continuous power dissipation<br>(T <sub>A</sub> = 70°C) | YFM package               |       | 270  | mW   |
|                                                         | DCK package               |       | 218  |      |
| Operating temperature range                             |                           | –40   | 85   | °C   |
| T <sub>stg</sub>                                        | Storage temperature range | –65   | 150  | °C   |
| T <sub>J</sub>                                          | Junction temperature      |       | 150  | °C   |
| Bump temperature (soldering)                            | Infrared (15 s)           |       | 220  | °C   |
|                                                         | Vapor phase (60 s)        |       | 215  |      |
| Lead temperature (soldering, 10 s)                      |                           |       | 300  | °C   |

(1) 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 in the operational sections of the specifications is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

**ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = –40°C to 85°C (unless otherwise noted)

| PARAMETER       | TEST CONDITIONS           | MIN                     | TYP <sup>(1)</sup> | MAX | UNIT |
|-----------------|---------------------------|-------------------------|--------------------|-----|------|
| V <sub>BR</sub> | Break-down voltage        | I <sub>IO</sub> = 10 mA | ±14                |     | V    |
| I <sub>IO</sub> | Channel leakage current   |                         | 20                 | 50  | nA   |
| R <sub>d</sub>  | Dynamic resistance        |                         | 3.5                |     | Ω    |
| C <sub>IN</sub> | Channel input capacitance | V <sub>IO</sub> = 2.5 V | 10                 | 15  | pF   |

(1) Typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.

**ESD Protection**

| PARAMETER                       | TYP | UNIT |
|---------------------------------|-----|------|
| HBM                             | ±15 | kV   |
| IEC 61000-4-2 Contact Discharge | ±8  | kV   |
| IEC 61000-4-2 Air-Gap Discharge | ±15 | kV   |

## TYPICAL OPERATING CHARACTERISTICS

### IEC Clamping Waveforms (20 ns/div)

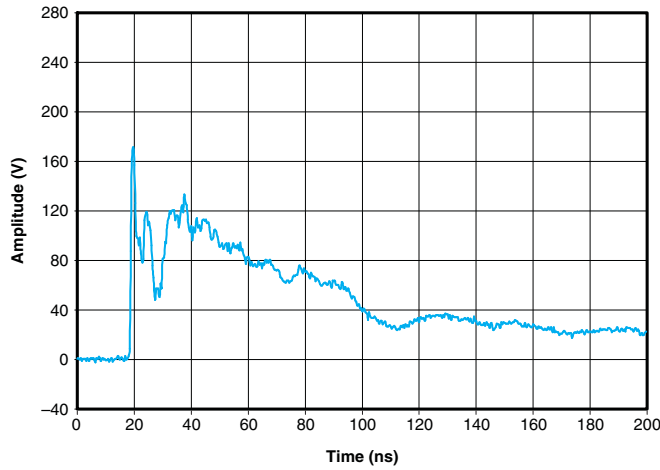


Figure 1. 8-kV Contact

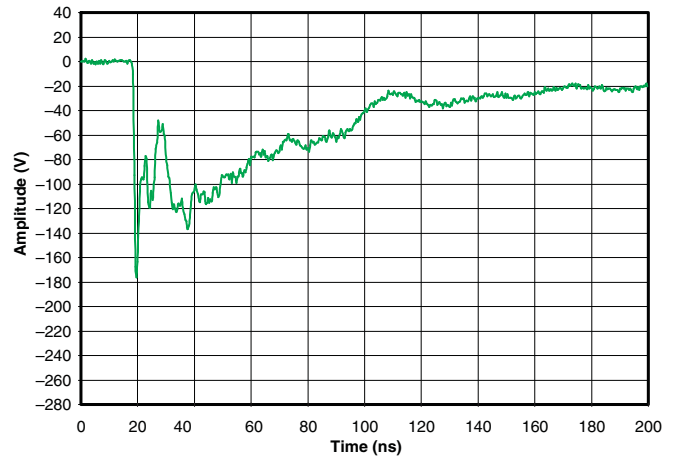


Figure 2. -8-kV Contact

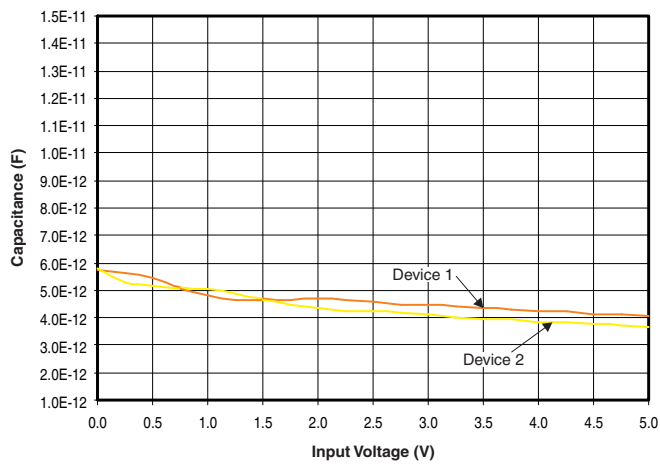


Figure 3. Capacitance vs Input Voltage at  $T_A = 27^\circ\text{C}$

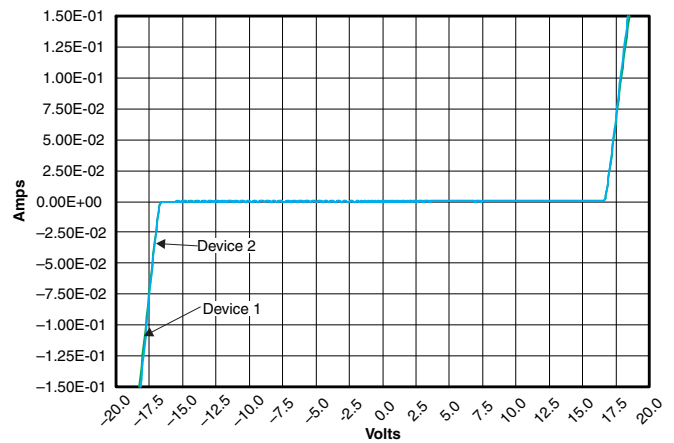


Figure 4. Diode Breakdown Voltage Data at  $T_A = 27^\circ\text{C}$

## REVISION HISTORY

| Changes from Revision D (October 2009) to Revision E                                                                 | Page              |
|----------------------------------------------------------------------------------------------------------------------|-------------------|
| <ul style="list-style-type: none"> <li>Added max continuous power dissipation value for DCK package .....</li> </ul> | <a href="#">2</a> |

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|-------------------------|
| TPD2E007DCKR     | ACTIVE        | SC70         | DCK                | 3    | 3000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR  | -40 to 85    | 45U                     | <a href="#">Samples</a> |
| TPD2E007YFMR     | PREVIEW       | DSLGA        | YFM                | 4    |                | TBD                        | Call TI          | Call TI              | -40 to 85    |                         |                         |
| TPD2E007YFMRG4   | ACTIVE        | DSLGA        | YFM                | 4    | 3000           | Green (RoHS<br>& no Sb/Br) | Call TI          | Level-1-260C-UNLIM   | -40 to 85    | 45<br>T                 | <a href="#">Samples</a> |
| TPD2E007YFMTG4   | ACTIVE        | DSLGA        | YFM                | 4    | 250            | Green (RoHS<br>& no Sb/Br) | Call TI          | Level-1-260C-UNLIM   | -40 to 85    | 45<br>T                 | <a href="#">Samples</a> |

(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)

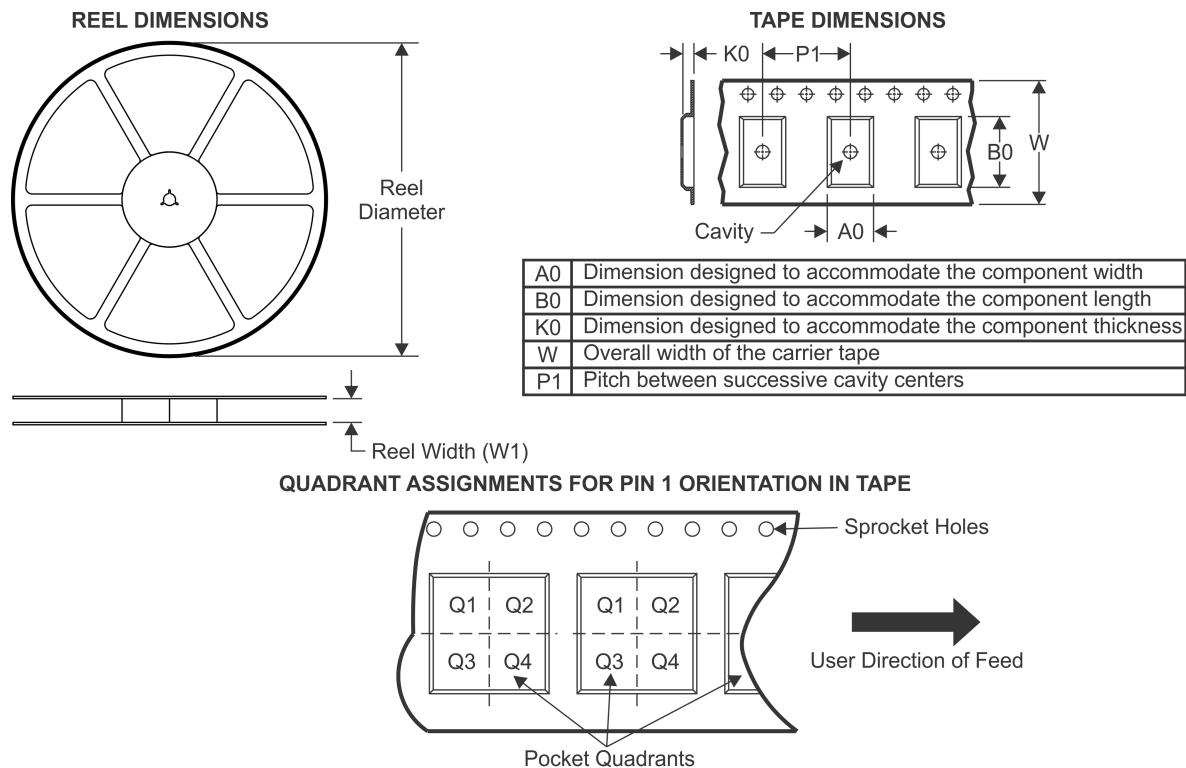
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

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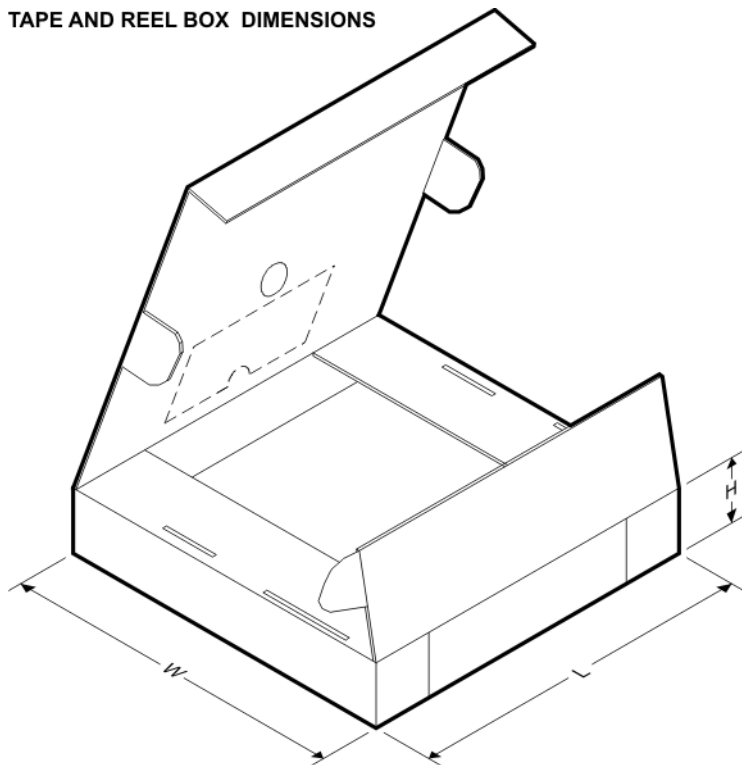
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**TAPE AND REEL INFORMATION**


\*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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPD2E007DCKR   | SC70         | DCK             | 3    | 3000 | 179.0              | 8.4                | 2.4     | 2.4     | 1.19    | 4.0     | 8.0    | Q3            |
| TPD2E007YFMRG4 | DSLGA        | YFM             | 4    | 3000 | 178.0              | 9.2                | 0.83    | 0.83    | 0.19    | 4.0     | 8.0    | Q1            |
| TPD2E007YFMTG4 | DSLGA        | YFM             | 4    | 250  | 178.0              | 9.2                | 0.83    | 0.83    | 0.19    | 4.0     | 8.0    | Q1            |

## TAPE AND REEL BOX DIMENSIONS

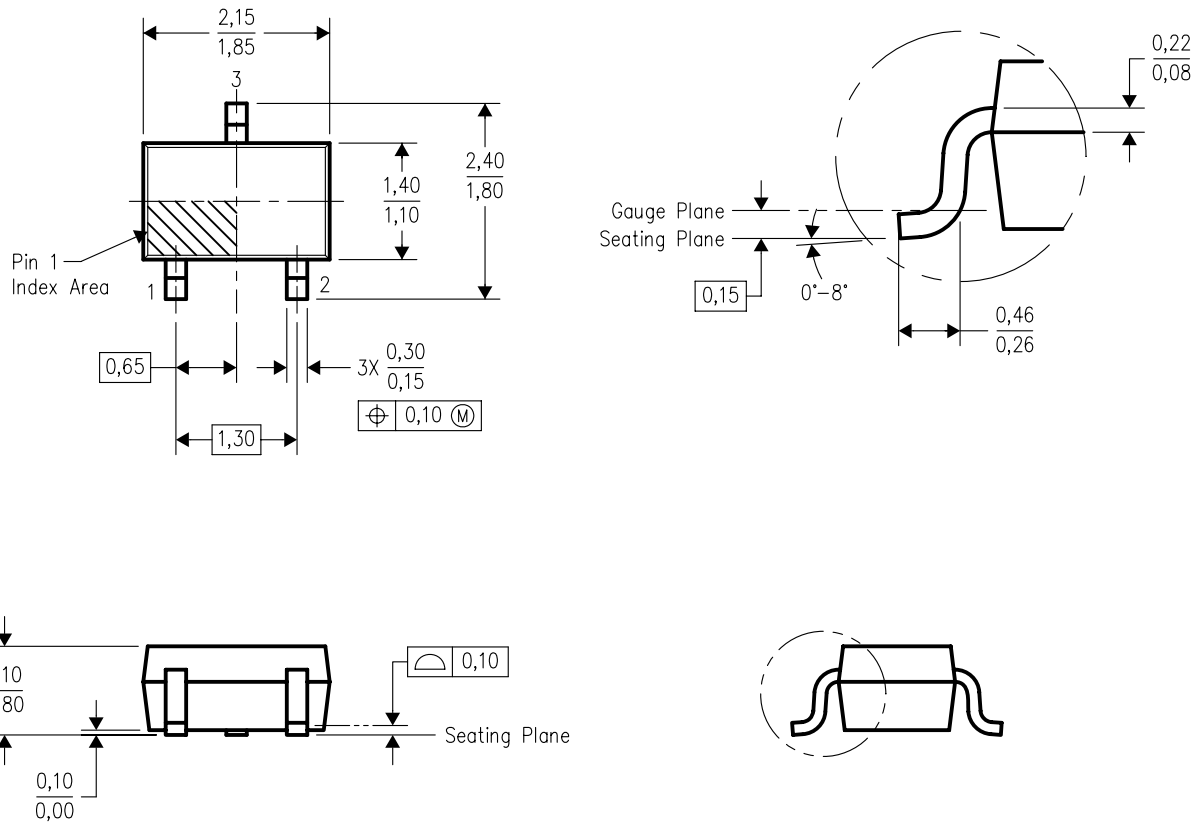


\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPD2E007DCKR   | SC70         | DCK             | 3    | 3000 | 195.0       | 200.0      | 45.0        |
| TPD2E007YFMRG4 | DSLGA        | YFM             | 4    | 3000 | 220.0       | 220.0      | 35.0        |
| TPD2E007YFMTG4 | DSLGA        | YFM             | 4    | 250  | 220.0       | 220.0      | 35.0        |

## DCK (R-PDSO-G3)

## PLASTIC SMALL-OUTLINE PACKAGE

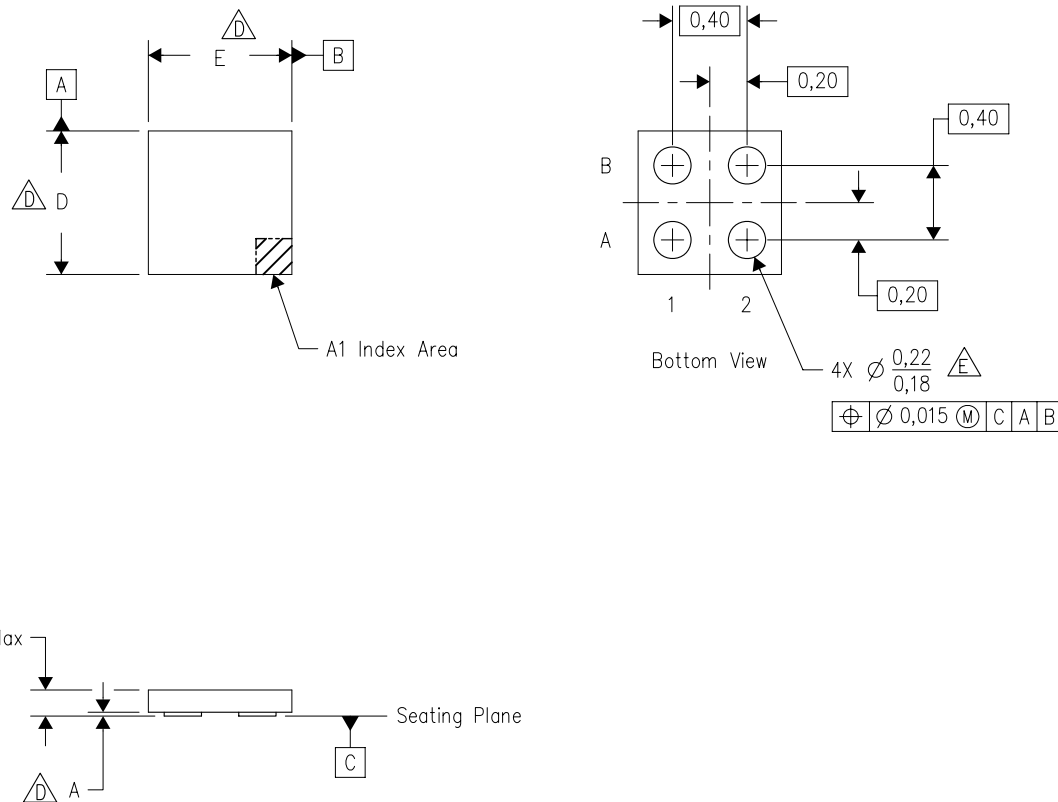


4093553-2/G 01/2007

- 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. Mold flash and protrusion shall not exceed 0.15 per side.

YFM (S-pSTAR-N4)

PicoStar™



4209106-2/K 11/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

C. PicoStar™ package configuration.

**D** The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.

 Reference Product Data Sheet for array population. 2 x 2 matrix pattern is shown for illustration only.

F. This package is a Pb-free solder land design.

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