用于CCD传感器的低功率，高速缓冲器

查询样品：VSP1000

特性

- 高速：
  - **210 MHz, 3-dB** 带宽
- 快速建立时间
- 可调有效负载电流
- 可调驱动强度
- 低功率：**20 mW**
- 超小型封装：
  - **1-mm × 1-mm** 超薄型 **0.35-mm QFN** 封装

说明

VSP1000 是一款高速，低噪声，快速建立，单位增益缓冲器。 此款器件特别适合安装在电荷耦合器件（CCD）和模拟前端（AFE）之间。 此器件具有一个可调节有效负载电流，此电流可为CCD传感器的输出提供合适的负载。 VSP1000 还特有一个可调节输出驱动强度，此驱动强度可根据带宽要求进行设置。 在 2 mA驱动电流情况下，此器件提供 210 MHz的带宽，这可实现超低功率运行情况下的良好性能。 超小型 1 mm × 1 mm的封装尺寸以及 0.35 mm的封装高度有助于节省印刷电路板（PCB）的空间并可实现很低的外形尺寸。

总的来说，VSP1000 非常适合驱动德州仪器生产的用于CCD传感器的AFE以及任何模数转换器（ADC）输入。 此可调节负载电流可轻松实现与不同制造商生产的多种CCD传感器间的接口连接。

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION(1)

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
VSP1000	QFN-6	DSF	0°C to +85°C	VSP1000DSF	VSP1000DSFT	Tape and Reel, 250
					VSP1000DSFR	Tape and Reel, 5000

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or visit the device product folder at www.ti.com.

ABSOLUTE MAXIMUM RATINGS(1)

Over free-air temperature range, unless otherwise noted.

		VSP1000	UNIT
Supply voltage	VCC	20.0	V
Input voltage		–0.3 to VCC + 0.3	V
Input current	Any pin except supplies	±10	mA
Ambient temperature under bias		–25 to +85	°C
Storage temperature		–55 to +125	°C
Junction temperature		+150	°C
Package temperature (IR reflow, peak)		+250	°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 under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

All specifications at T_A = +25°C, V_{CC} = 13 V, R_{IDRV} = 90 kΩ, and C_{LOAD} = 22 pF, unless otherwise noted.

PARAMETER		TEST CONDITIONS	VSP1000			UNIT
			MIN	TYP	MAX	
POWER SUPPLY						
V_{CC}	Supply voltage		10	13	16	V
I_{CC}	Supply current			2		mA
DYNAMIC PERFORMANCE						
	Gain	1-MHz, 200-mV_{PP} input		0.999		ns
	Rise time	V_{IN} = 7.5 V to 8.5 V		5		ns
	Fall time	V_{IN} = 8.5 V to 7.5 V		6		ns
	I/O delay time	V_{IN} = 7.5 V to 8.5 V		1.28		ns
	–3-dB bandwidth	100-mV_{PP} input		210		MHz
V_{IN}	Input voltage range	V_{CC} = 13 V	1.5		10.5	V
T_A	Operating free-air temperature		0		+85	°C

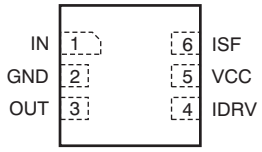
THERMAL INFORMATION

THERMAL METRIC(1)		VSP1000 DSF 6 PINS	UNITS
θ_{JA}	Junction-to-ambient thermal resistance	333.2	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	56.9	
θ_{JB}	Junction-to-board thermal resistance	239	
ψ_{JT}	Junction-to-top characterization parameter	13.9	
ψ_{JB}	Junction-to-board characterization parameter	236	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	202	

(1) 有关传统和新的热度量的更多信息，请参阅 *IC* 封装热度量 应用报告 SPRA953。

PIN CONFIGURATION

DSF PACKAGE
1-mm × 1-mm × 0.35-mm QFN-6
(TOP VIEW)



PIN ASSIGNMENTS

PIN NAME	PIN NUMBER	TYPE	DESCRIPTION
IN	1	Analog input	Input terminal; connect this pin to the sensor output
VEE	2	Ground	Negative supply terminal; must be connected to ground
OUT	3	Analog output	Output terminal; connect this pin to the AFE input
IDRV	4	Analog input	Drive current adjustment; refer to the application diagram for further details
VCC	5	Power	Positive supply terminal; must be decoupled to the VEE terminal with a 0.1-μF capacitor
ISF	6	Analog input	Sink current adjustment; refer to the application diagram for further details

FUNCTIONAL BLOCK DIAGRAM

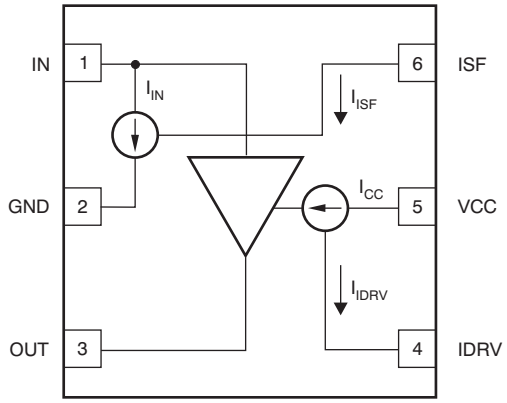


Figure 1. Block Diagram

TYPICAL CHARACTERISTICS

At T_A = +25°C, V_{CC} = 13 V, R_{IDRV} = 90 kΩ, R_{ISF} = 300 kΩ, and C_{LOAD} = 22 pF, unless otherwise noted.

BANDWIDTH vs IDRV

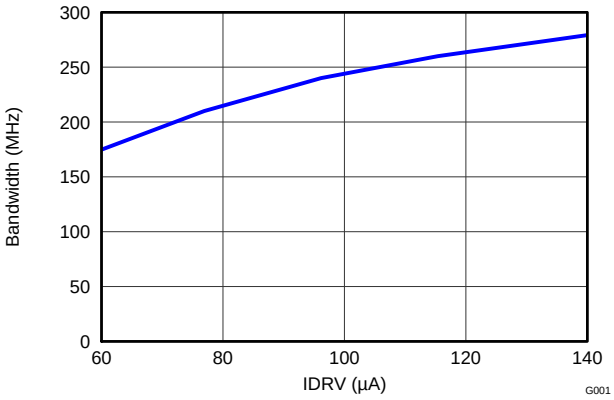


Figure 2.

INPUT MARGIN FROM V_{CC} vs IDRV

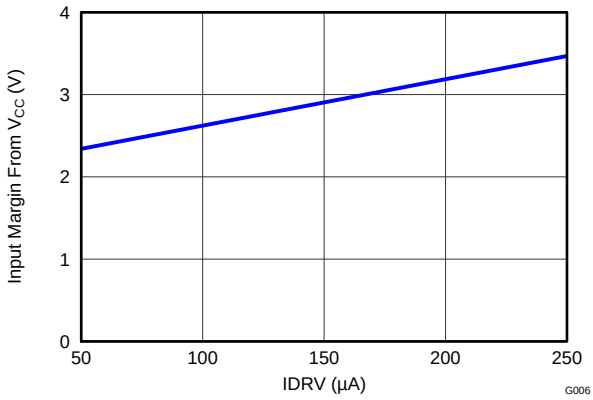


Figure 3.

IDRV vs R_{IDRV}

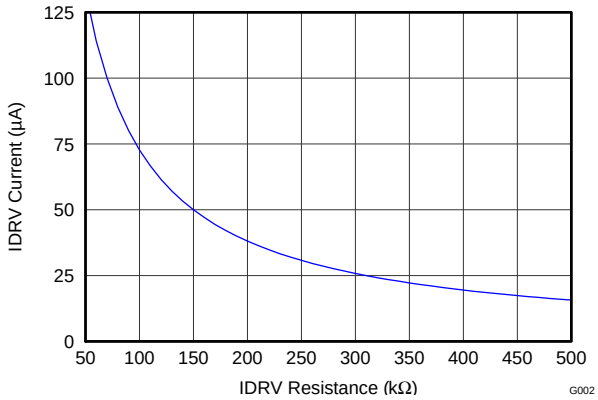


Figure 4.

INPUT LOAD CURRENT vs R_{ISF}

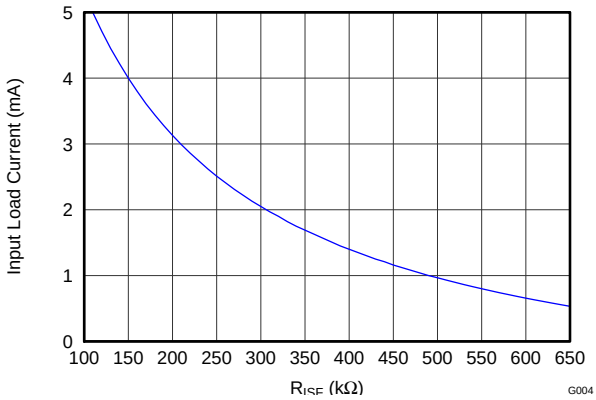


Figure 5.

IDRV vs TEMPERATURE

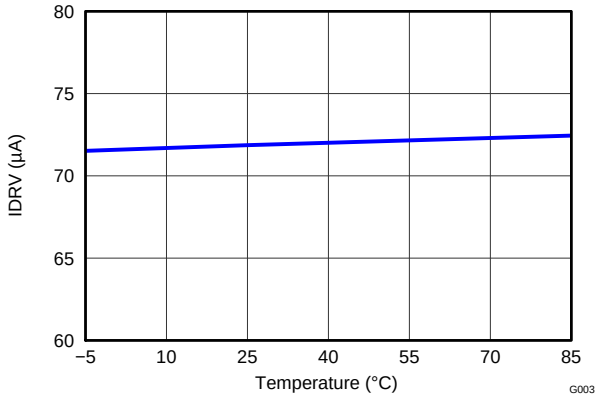


Figure 6.

INPUT LOAD CURRENT vs TEMPERATURE

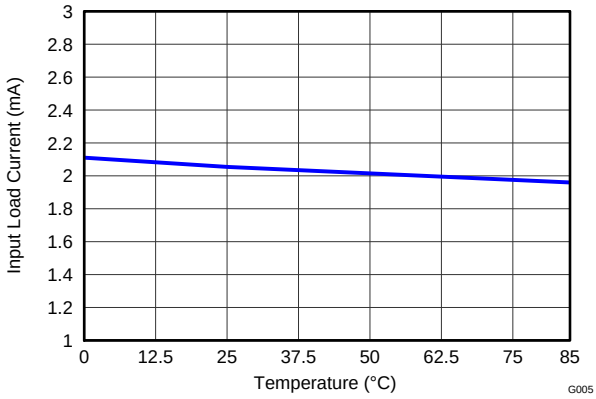


Figure 7.

TYPICAL CHARACTERISTICS (continued)

At T_A = +25°C, V_{CC} = 13 V, R_{IDRV} = 90 kΩ, R_{ISF} = 300 kΩ, and C_{LOAD} = 22 pF, unless otherwise noted.

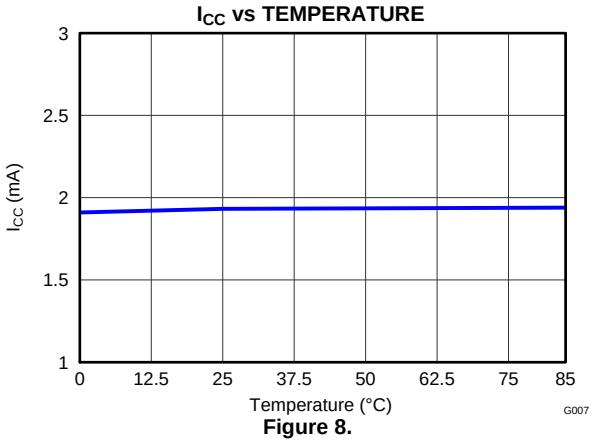


Figure 8.

OVERVIEW

TYPICAL APPLICATION CIRCUIT

Figure 9 shows a typical application circuit for the VSP1000.

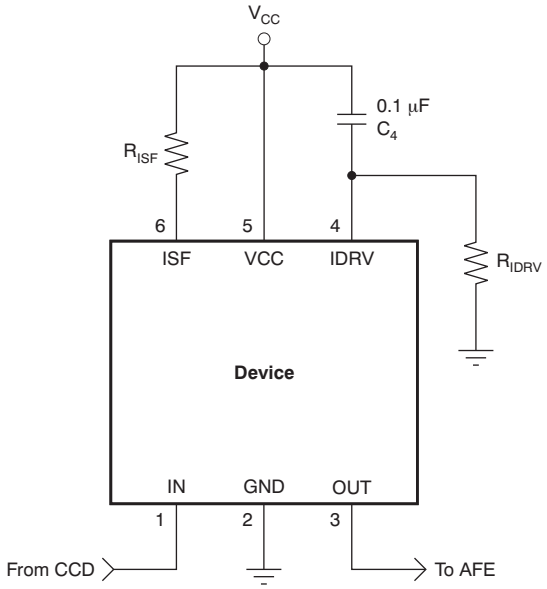


Figure 9. Typical Application Circuit

DESIGN EQUATIONS

The CCD outputs must be loaded with current for proper operation. The VSP1000 provides the ability to draw adjustable current through the IN pin. The value of the input load current can be set by choosing an appropriate value of R_{ISF} connected to the ISF pin, as per Equation 1.

$$I_{IN} = \frac{\left(\frac{(V_{CC} \times 100\ k\Omega)}{(R_{ISF} + 100\ k\Omega)}\right) - 1.2}{1\ k\Omega} \quad (1)$$

The bandwidth of the VSP1000 can be adjusted using the IDRV pin. The resistor connected at IDRV determines the drive strength of the output buffer as well as the total quiescent current of the VSP1000. Equation 2 and Equation 3 describe the relationship between R_{IDRV} and the drive strength. C_{IDRV} is used to increase the power-supply rejection ratio of the device. A value of 0.1 µF for C_{IDRV} is recommended.

$$I_{DRV} = \frac{(V_{CC} - 5)}{(R_{IDRV} + 10\ k\Omega)} \quad (2)$$

$$I_{CC} = 26 \times I_{DRV} \quad (3)$$

EXAMPLE CONFIGURATIONS

Table 1 details several example configurations for the VSP1000. All examples are with V_{CC} = 13 V.

Table 1. Example Configurations

CONFIGURATION	I_{CC} (mA)	R_{ISF} (kΩ)	R_{IDRV} (kΩ)
Bandwidth = 170 MHz , I_{IN} = 2 mA	1.5	300	133
Bandwidth = 170 MHz , I_{IN} = 4 mA	1.5	150	133
Bandwidth = 210 MHz , I_{IN} = 2 mA	2	300	91
Bandwidth = 210 MHz , I_{IN} = 4 mA	2	150	91
Bandwidth = 260 MHz , I_{IN} = 2 mA	3	300	62
Bandwidth = 260 MHz , I_{IN} = 4 mA	3	150	62

LAYOUT GUIDELINES

The decoupling capacitors C_{IDRV}, R_{IDRV}, and R_{ISF} should be placed as close as possible to the VSP1000.

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (September 2011) to Revision A	Page
• Updated Figure 4	5
• Updated Figure 5	5

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
VSP1000DSFR	Active	Production	SON (DSF) | 6	5000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 85	VK
VSP1000DSFR.B	Active	Production	SON (DSF) | 6	5000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	0 to 85	VK
VSP1000DSFT	Active	Production	SON (DSF) | 6	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 85	VK
VSP1000DSFT.B	Active	Production	SON (DSF) | 6	250 | SMALL T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	0 to 85	VK

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

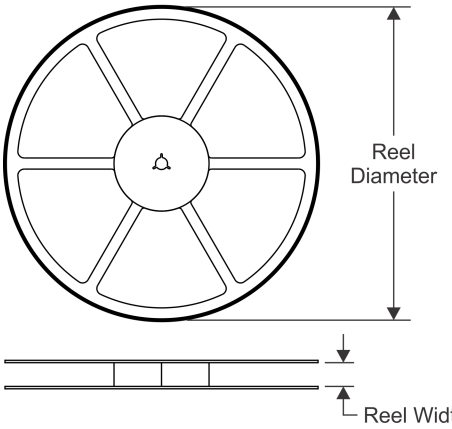
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

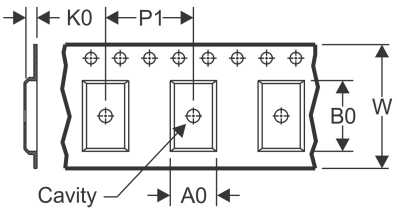
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

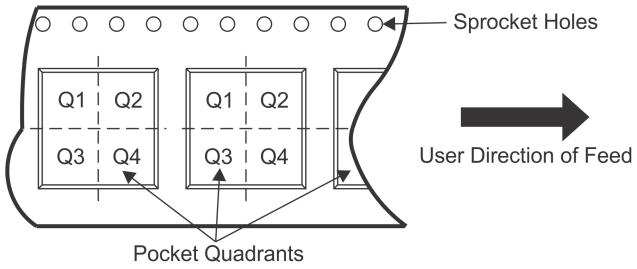


TAPE DIMENSIONS



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

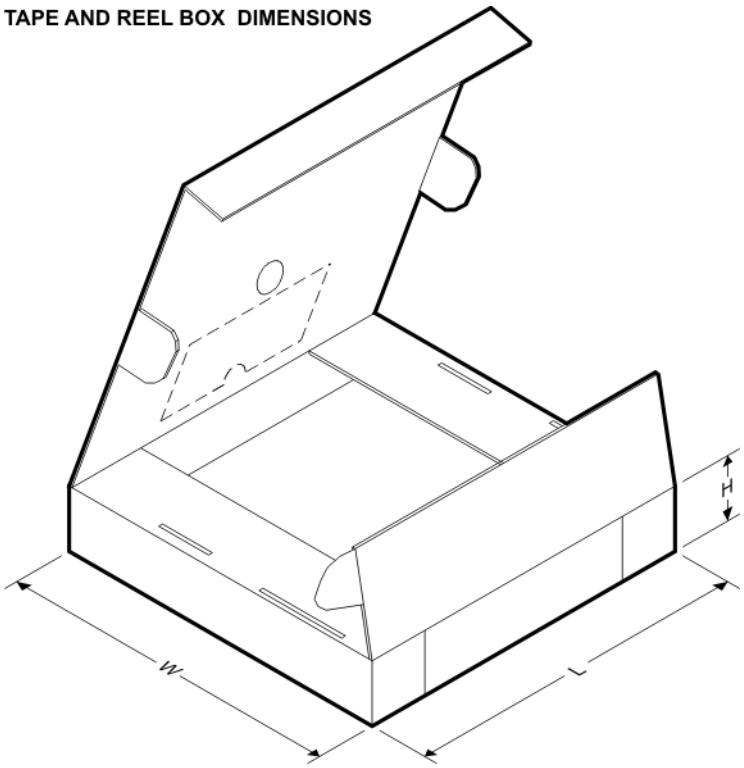
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
VSP1000DSFR	SON	DSF	6	5000	180.0	9.5	1.16	1.16	0.63	4.0	8.0	Q2
VSP1000DSFT	SON	DSF	6	250	180.0	9.5	1.16	1.16	0.63	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

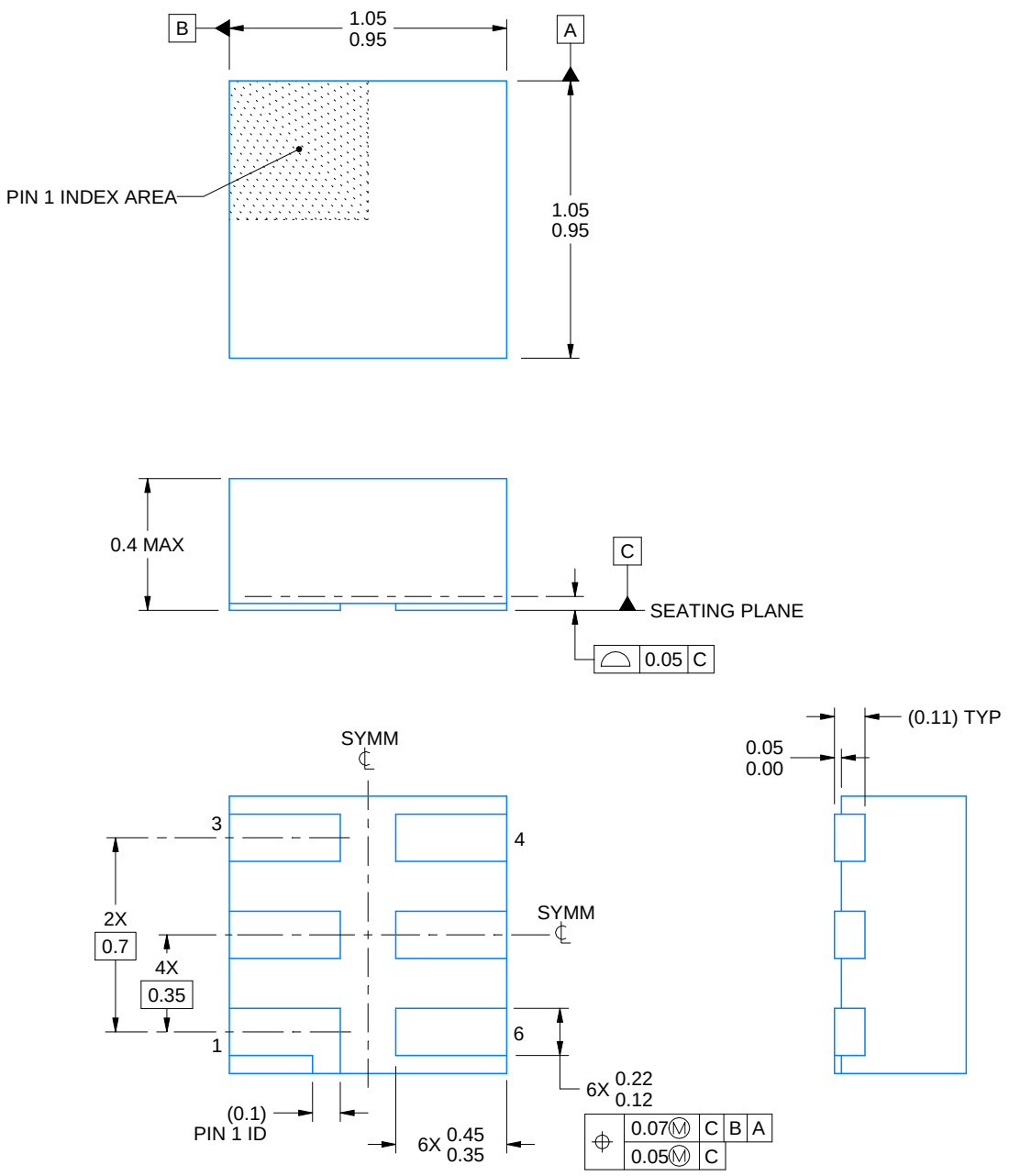
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
VSP1000DSFR	SON	DSF	6	5000	184.0	184.0	19.0
VSP1000DSFT	SON	DSF	6	250	184.0	184.0	19.0

PACKAGE OUTLINE

DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



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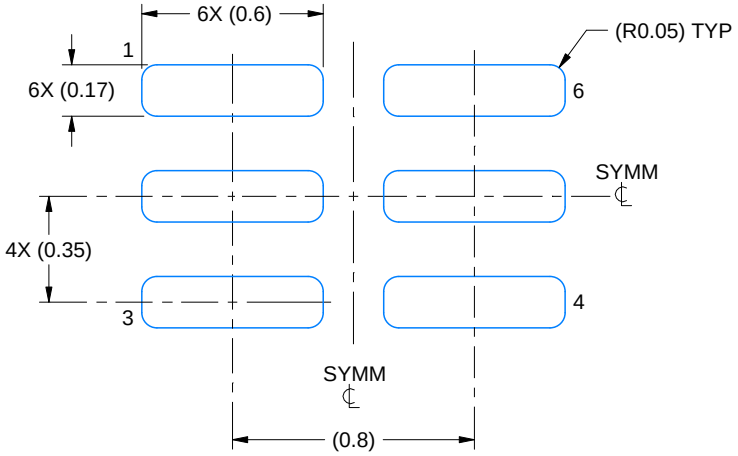
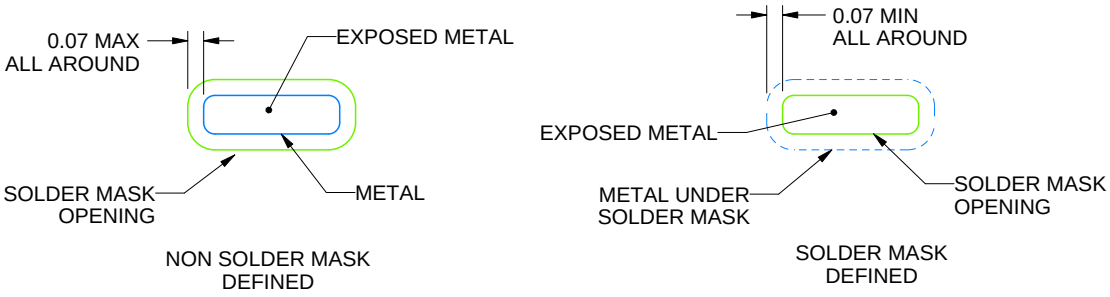
NOTES:

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. Reference JEDEC registration MO-287, variation X2AAF.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:40X



SOLDER MASK DETAILS

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NOTES: (continued)

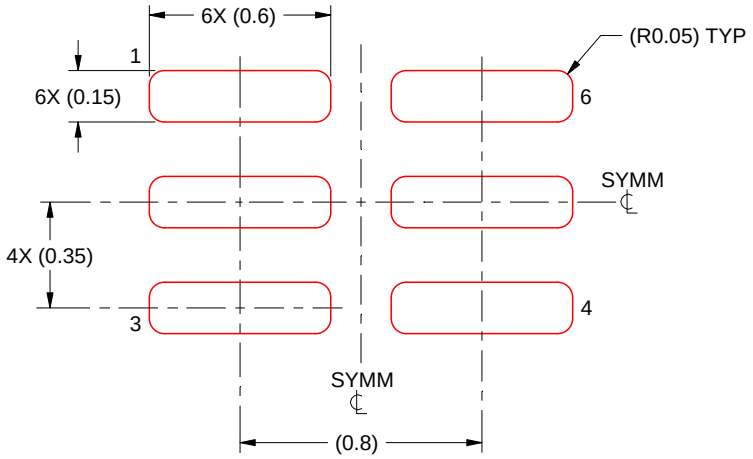
4. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

DSF0006A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.09 mm THICK STENCIL

PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:40X

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4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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最后更新日期：2025 年 10 月