支持双通道 VGA 源极至汲极的 5 V、5 位视频交换开关 低导通电阻的 -2 V 下冲保护

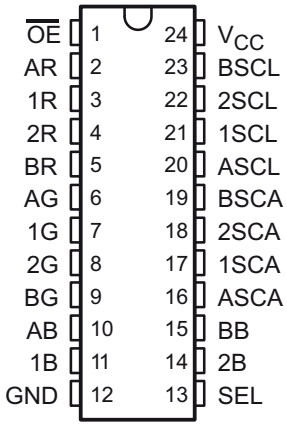
查询样品：TS5V522C

特性

- 双向数据流，支持近零传播延迟
- 高带宽、**380MHZ**（典型值）**RGB** 开关
- 低导通阻抗 **(ron)** 特性（**ron = 3 Ω** 典型值）
- 低输入 / 输出电容可最大限度地减少加载与信号失真（**CIO(OFF) = 8pF** 典型值）
- 数据与控制输出上的下冲钳位二极管
- 低功耗（**Icc = 3uA** 最大值）
- **Vcc** 工作范围 **4 V** 至 **5.5 V**
- 数据 **I/O** 支持 **0** 至 **5 V** 信号级（**0.8 V**、**1.2 V**、**1.5 V**、**1.8 V**、**2.5 V**、**3.3 V**、**4 V**）
- 可在 **I/O** 上实施高达 **5 V** 的上拉电阻器
- I_{off} 支持带电插入、局部关断模式以及后驱动保护
- 闭锁性能超过 **100 mA**，符合 **JESD 78 Class II** 标准
- **ESD** 性能等级超过 **JESD 22** 规范
  - **2000 V** 人体模型（**A114-B**、**Class II**）
  - **200 V** 机器模型（**A115-A**）
  - **1000 V** 充电器件模型（**C101**）

应用

- 数字及模拟信号接口
- 音频与视频信号接口
- 高速信号总线交换
- 总线隔离与交错
- 笔记本电脑图形控制



说明

TS5V522C 是高带宽模拟开关，可为 VGA 信号开关提供 2:2 双图形交叉解决方案。 该器件支持 2 个 VGA 信号源的开关，可在膝上型电脑中将信号指向两个目的位置中的一个。 TS5V522C 集成 5 个针对 RGB 信号的极高性能 380 Mhz（典型值）SPDT 开关、2 对适用于 HSYNC 与 VSYNC 线路的电平转换缓冲器以及集成型 ESD 保护。 5 个交叉开关均可通过 5 V 或 3.3 V TTL 控制信号控制。

TS5V522C 能够以更少的失真将 VGA 模拟信号带到目标位置。 DC 通道（SCA、SCL）可能需要 VGA 连接器上 +5 Vopen 的漏级，而且可能还需要在目标端上提供上拉电容器。 TS5V522C 数据端上的有源下冲保护电路可感测下冲事件并确保在适当关闭状态下进行开关，从而可对低至 -2 V 的下冲事件提供保护。

要在上电或关断过程中确保高阻抗状态，$\overline{OE}$ 必须通过上拉电阻器的 V_{CC} 进行控制；驱动器电流吸收性能可检测电阻器最小值。

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.

ORDERING INFORMATION(1)

T_A	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SSOP (QSOP) – DBQ	Tape and Reel	TS5V522CDBQR	TS5V522C
	TSSOP – PW	Tape and Reel	TS5V522CPWR	TE522C

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

Table 1. FUNCTION TABLE

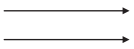
CONTROL		INPUT/OUTPUTS		FUNCTIONS	
$\overline{OE}$	SEL	1 X	2 X		
L	L	A X	B X	1X port = AX port 2x port = BX port	
L	H	B X	A X	1X port = BX port 2x port = AX port	
H	X	Z	Z	Disconnect	

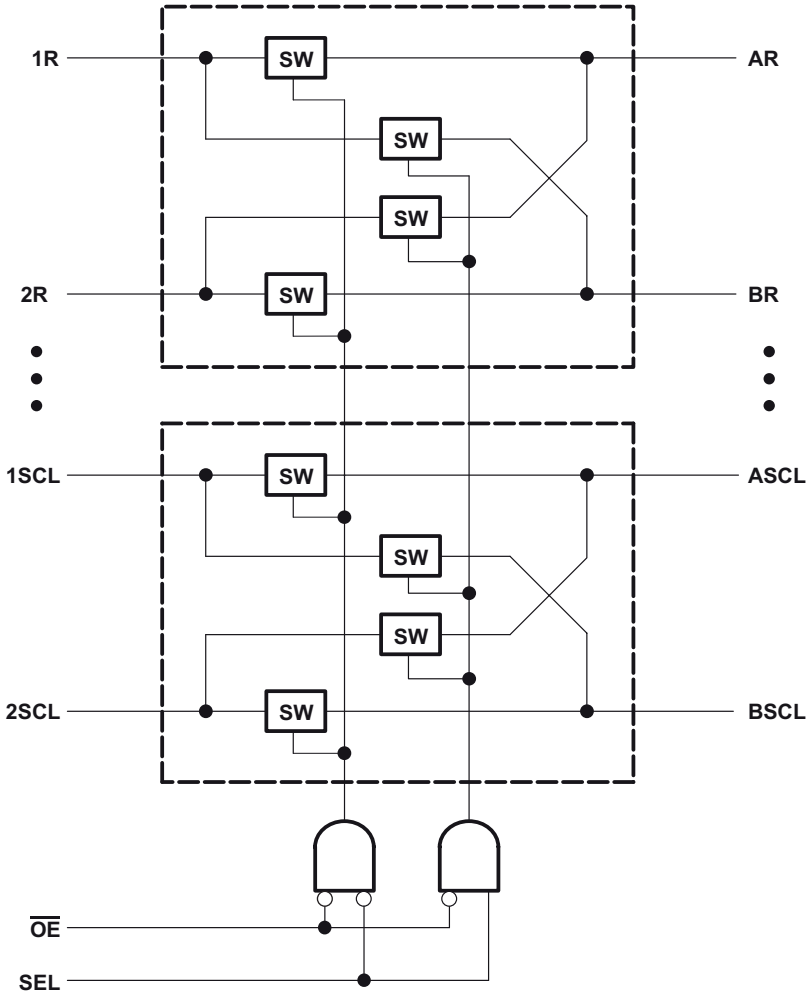
Table 2. PIN DESCRIPTION

PIN NAME	DESCRIPTION
xR, xG, xB	Analog Video I/Os
xSCL, xSCA	Analog sync I/Os
$\overline{OE}$	Enable pin
$\overline{EN}$	Input select

PARAMETER DEFINITIONS

PARAMETER	DESCRIPTION
r_{ON}	Resistance between the input and output ports with the switch in the ON-state
I_{OZ}	Output leakage current measured at the D and S ports with the switch in the OFF-state
I_{OS}	Short circuit current measured at the I/O pins.
V_{IN}	Voltage at the IN pin
V_{EN}	Voltage at the $\overline{EN}$ pin
C_{IN}	Capacitance at the control inputs ($\overline{EN}$, IN)
C_{OFF}	Capacitance at the analog I/O port when the switch is OFF
C_{ON}	Capacitance at the analog I/O port when the switch is ON
V_{IH}	Minimum input voltage for logic high for the control inputs ($\overline{EN}$, IN)
V_{IL}	Minimum input voltage for logic low for the control inputs ($\overline{EN}$, IN)
V_H	Hysteresis voltage at the control inputs ($\overline{EN}$, IN)
V_{IK}	I/O and control inputs diode clamp voltage ($\overline{EN}$, IN)
V_I	Voltage applied to the I/O pins when I/O is the switch input.
V_O	Voltage applied to the I/O pins when I/O is the switch output.
I_{IH}	Input high leakage current of the control inputs ($\overline{EN}$, IN)
I_{IL}	Input low leakage current of the control inputs ($\overline{EN}$, IN)
I_I	Current into the I/O pins when I/O is the switch input.
I_O	Current into the I/O pins when I/O is the switch output.
I_{off}	Output leakage current measured at the I/O ports with V_{CC} = 0
t_{ON}	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned ON.
t_{OFF}	Propagation delay measured between 50% of the digital input to 90% of the analog output when switch is turned OFF.
BW	Frequency response of the switch in the ON-state measured at –3 dB
X_{TALK}	Unwanted signal coupled from channel to channel. Measured in –dB. X_{TALK} = 20 LOG V_{OUT}/V_{IN}. This is a non-adjacent crosstalk.
O_{IRR}	Off-isolation is the resistance (measured in –dB) between the input and output with the switch OFF.
D_G	Magnitude variation between analog input and output pins when the switch is ON and the DC offset of composite video signal varies at the analog input pin. In NTSC standard the frequency of the video signal is 3.58 MHz and DC offset is from 0 to 0.714 V.
D_P	Phase variation between analog input and output pins when the switch is ON and the DC offset of composite video signal varies at the analog input pin. In NTSC standard the frequency of the video signal is 3.58 MHz and DC offset is from 0 to 0.714 V.
I_{CC}	Static power supply current
I_{CCD}	Variation of I_{CC} for a change in frequency in the control inputs ($\overline{EN}$, IN)
ΔI_{CC}	This is the increase in supply current for each control input that is at the specified voltage level, rather than V_{CC} or GND.

LOGIC DIAGRAM (XX GATE)



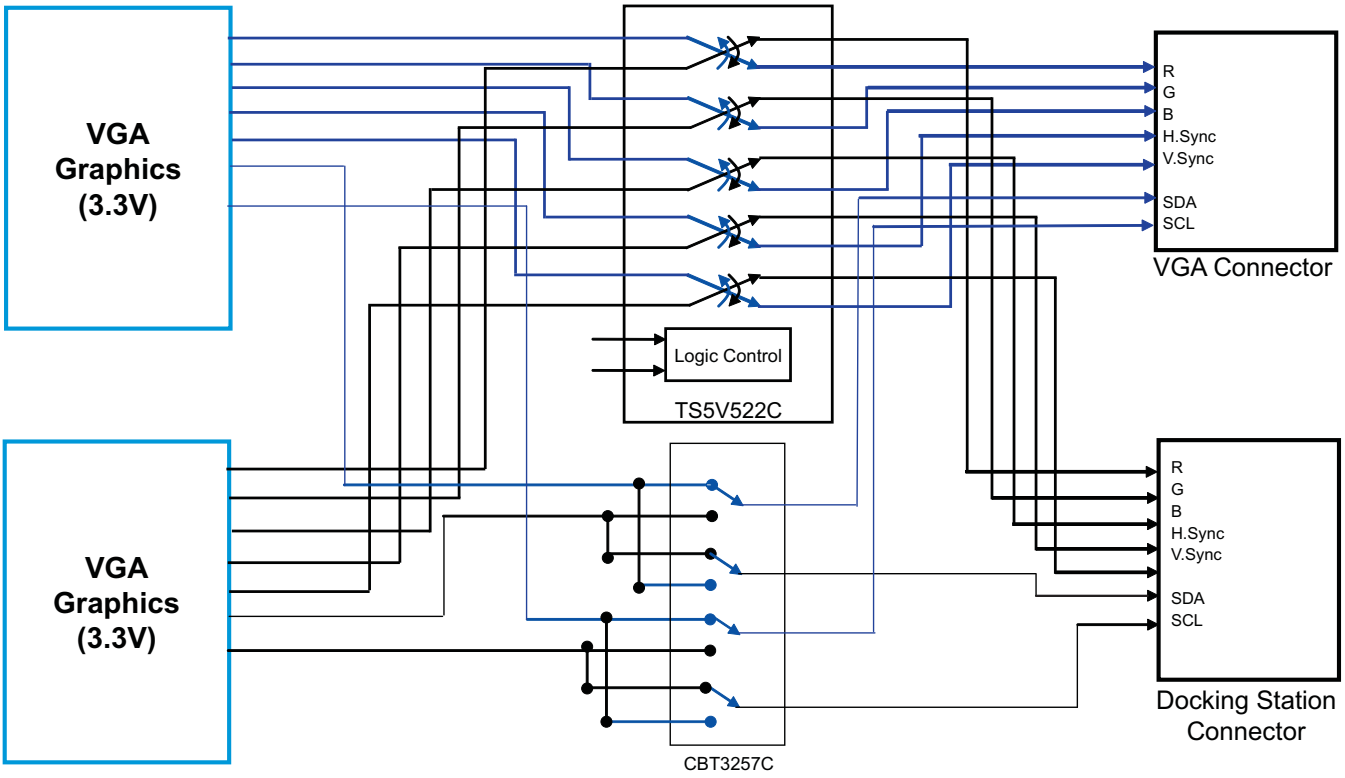
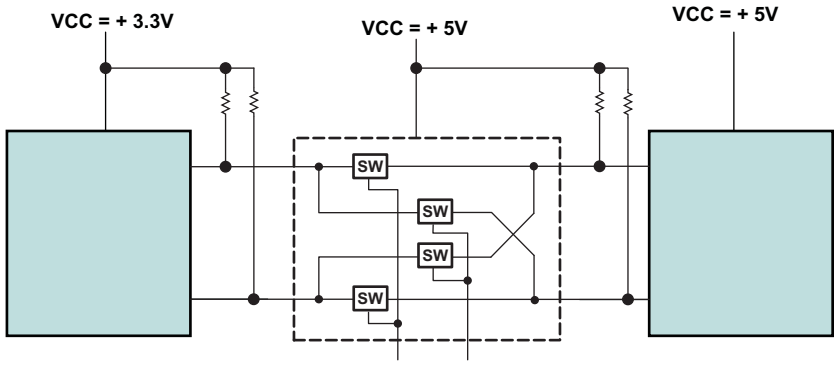


Figure 1. Typical Design Examples for Dual VGA Source Signal Exchange



Design Notes:

1. DDC (SCL,SDA) is open drain I^2C Bus type and need pull up resistors. N-Channel FET Switch allow to pull up desired Vcc Level not exceeding the Vcc of FET Switch

2. VGA (H.Sync, V.Sync) are TTL/CMOS Type from the source of V ideo and it may required pull up to achieve as high as 5V Signal level to meet VGA Specifications too.

Figure 2. Typical Design Example for Level Shifting with N-Channel FET Switch

ABSOLUTE MAXIMUM RATINGS(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		–0.5	7	V
V_{IN}	Control input voltage range(2)(3)		–0.5	7	V
$V_{I/O}$	Output voltage range(2)(3)(4)		–0.5	7	V
I_{IK}	Control input clamp current	V_{IN} < 0		–50	mA
$I_{I/OK}$	I/O port clamp current	$V_{I/O}$ < 0		–50	mA
$I_{I/O}$	ON-state switch current(5)			±128	mA
	Continuous current through V_{CC} or GND			±100	mA
T_{stg}	Storage temperature range		–65	150	°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.
(2) All input and output negative voltages are with respect to ground unless otherwise specified.
(3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(4) V_I and V_O are used to denote specific conditions for $V_{I/O}$.
(5) I_I and I_O are used to denote specific conditions of $I_{I/O}$.

THERMAL IMPEDANCE RATINGS

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

				UNIT
θ_{JA}	Package thermal impedance	DBQ package(1)	90	°C/W
		PW package(1)	108	

(1) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS(1)

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

		MIN	MAX	UNIT
V_{CC}	Supply voltage	4	5.5	V
V_{IH}	High-level control input voltage ($\overline{EN}$, IN)	2	5.5	V
V_{IL}	Low-level control input voltage ($\overline{EN}$, IN)	0	0.8	V
V_{ANALOG}	Analog input/output voltage	0	V_{CC}	V
T_A	Operating free-air temperature	–40	85	V

(1) All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implication of slow or Floating CMOS Inputs*, literature number SCBA004.

ELECTRICAL CHARACTERISTICS(1)

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

PARAMETER		TEST CONDITIONS			MIN	TYP(2)	MAX	UNIT
V_{IK}	$\overline{EN}$, IN	V_{CC} = 4.5 V,	I_{IN} = –18 mA				–1.8	V
V_H	$\overline{EN}$, IN						400	mV
I_{IH}	$\overline{EN}$, IN	V_{CC} = 5.5 V,	V_{IN} and V_{EN} = V_{CC}				±1	µA
I_{IL}	$\overline{EN}$, IN	V_{CC} = 5.5 V,	V_{IN} and V_{EN} = GND				±1	µA
I_{OZ}(3)		V_{CC} = 5.5 V,	V_O = 0 to 5.5 V, V_I = 0,	Switch OFF			±10	µA
I_{OS}		V_{CC} = 5.5 V,	V_O = 0 to 5.5 V, V_I = 0,	Switch ON			±110	mA
I_{off}		V_{CC} = 0 V,	V_O = 0 to 5.5 V,	V_I = 0			±1	µA
I_{CC}		V_{CC} = 5.5 V,	$I_{I/O}$ = 0,	Switch ON or OFF			3	µA
ΔI_{CC}	$\overline{EN}$, IN	V_{CC} = 5.5 V,	One input at 3.4 V,	Other Inputs at V_{CC} or GND			2.5	mA
I_{CCD}		V_{CC} = 5.5 V, V_{EN} = GND,	I/O ports are open,	V_{IN} switching 50% duty cycle			0.25	mA/MHz
C_{in}	$\overline{EN}$, IN	V_{IN} or V_{EN} = 0 V,	f = 1 MHz			3..5		pF
C_{OFF}	D port	$V_{I/O}$ = 3 V or 0 V,	Switch OFF,	V_{IN} = V_{CC} or GND		8.5		pF
	S port		Switch ON,			5.5		
C_{ON}		V_I = 0 V,	f = 1MHz, output open,	Switch ON		16.5		pF
r_{ON}(4)		V_{CC} = 4.5 V,	V_I = 1 V,	I_O = 13 mA, R_L = 75Ω		3	7	Ω
			V_I = 2 V,	I_O = 26 mA, R_L = 75Ω		3	10	

(1) V_I, V_O, I_I, and I_O refer to the I.O pins.
(2) All typical values are at V_{CC} = 5 V (unless otherwise noted). T_A = 25°C
(3) For I/O ports, the parameter I_{OZ} includes the input leakage current.
(4) Measured by the voltage drop between the D and S terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (S or D) terminals.

SWITCHING CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted), see Figure 10

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP	MAX	UNIT
t_{ON}	S	D	1		6.6	ns
t_{OFF}	S	D	1		6.0	ns

DYNAMIC CHARACTERISTICS

over recommended operating free-air temperature range, VCC = 5 V ±10%(unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
D_G	R_L = 150 Ω, f = 3.58 MHz, see Figure 11		0.37		%
D_P	R_L = 150 Ω, f = 3.58 MHz, see Figure 11		0.0330		Deg
B_W	R_L = 150 Ω, see Figure 12		380		MHz
X_{TALK}	R_{IN} = 10 Ω, R_L = 150 Ω, f = 10 MHz, see Figure 12		–83		dB
O_{IRR}	R_L = 150 Ω, f = 10 MHz, see Figure 12		–44		dB

(1) All typical values are at V_{CC} = 5V (unless otherwise noted). TA = 25°C.

over recommended operating free-air temperature range, VCC = 5 V ±10%(unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
D_G	R_L = 75 Ω, f = 3.58 MHz, see Figure 11		0.37		%
D_P	R_L = 75 Ω, f = 3.58 MHz, see Figure 11		0.0330		Deg
B_W	R_L = 75 Ω, see Figure 12		330		MHz
X_{TALK}	R_{IN} = 10 Ω, R_L = 150Ω, f = 10 MHz, see Figure 12		–83		dB
O_{IRR}	R_L = 75 Ω, f = 10 MHz, see Figure 12		–44		dB

(1) All typical values are at V_{CC} = 5V (unless otherwise noted). TA = 25°C.

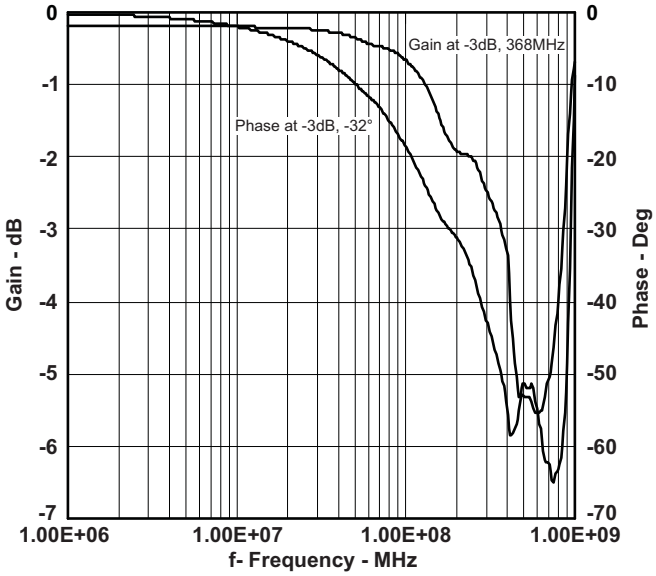


Figure 3. Frequency Response

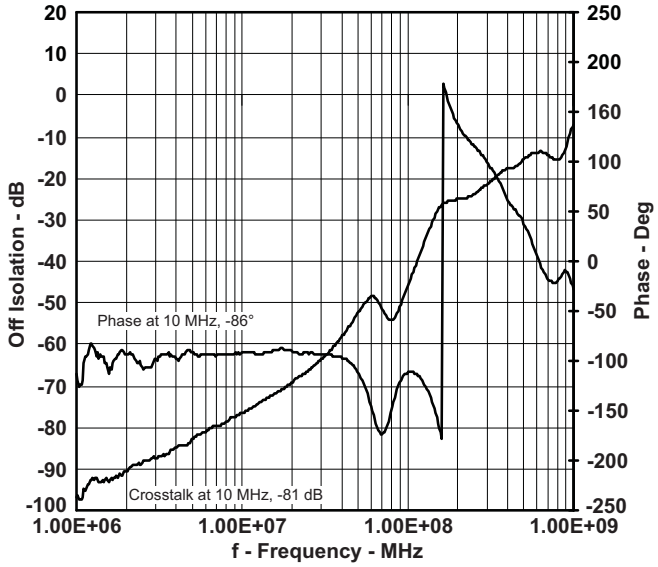


Figure 4. Non-adjacent Crosstalk vs Frequency

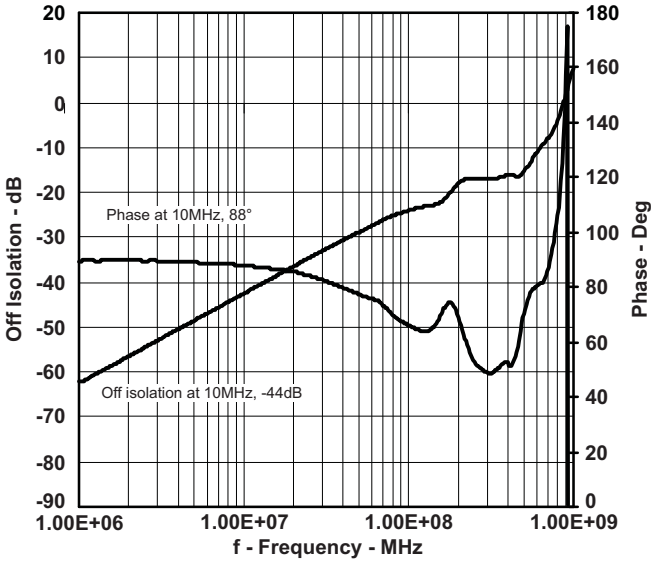


Figure 5. Off Isolation vs Frequency

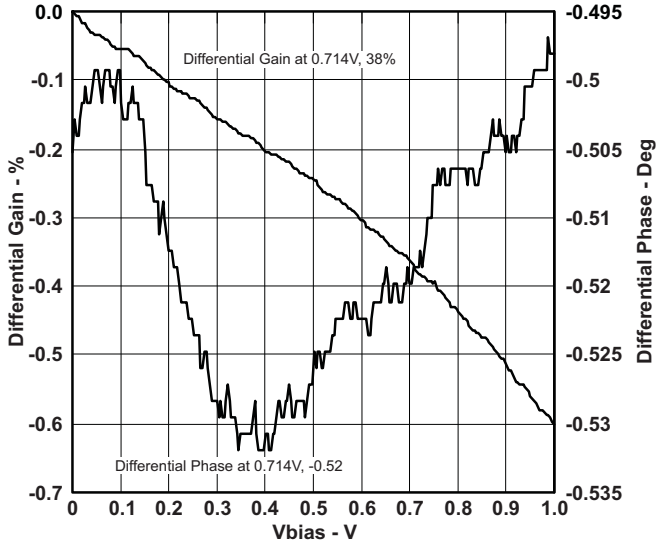


Figure 6. Differential Phase/Gain vs Vbias

Table 3. UNDERSHOOT CHARACTERISTICS (see Figure 7 and Figure 8)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
VOUTU	V_{CC} = 5.5 V,	Switch OFF,	V_{IN} = V_{CC} or GND	2	V_{OH} – 0.3		V

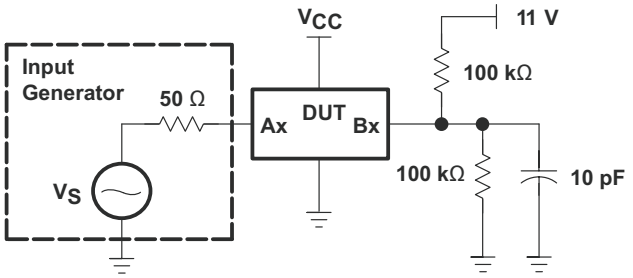


Figure 7. Device Test Setup

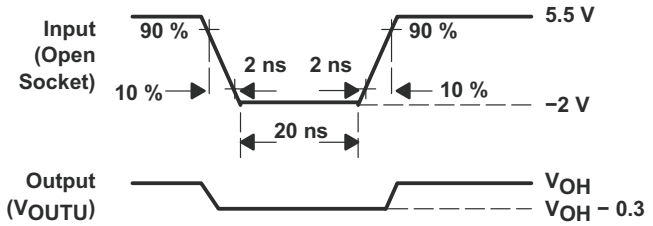
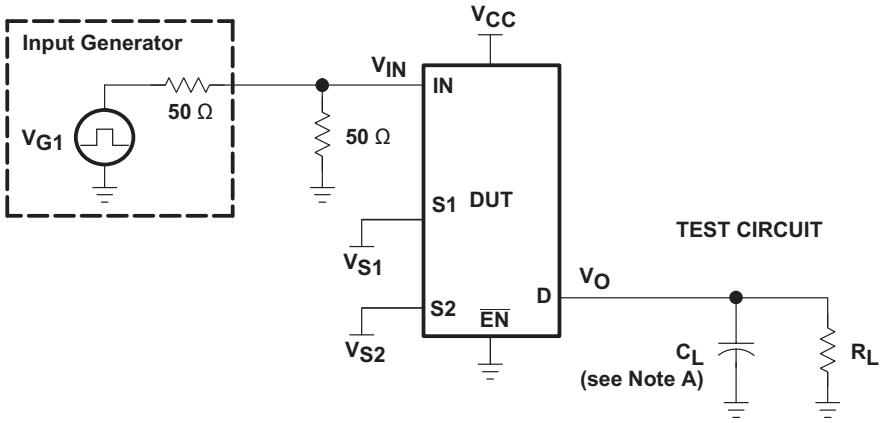


Figure 8. Transient Input Voltage (V^I) and Output Voltage (V_{OUTU}) Waveforms (Switch OFF)

Figure 9. PARAMETER MEASUREMENT INFORMATION



TEST	V_{CC}	R_L	C_L	V_{S1}	V_{S2}
t_{ON}	5 V ± 0.5 V 5 V ± 0.5 V	75 Ω 75 Ω	20 pF 20 pF	GND 3 V	3 V GND
t_{OFF}	5 V ± 0.5 V 5 V ± 0.5 V	75 Ω 75 Ω	20 pF 20 pF	GND 3 V	3 V GND

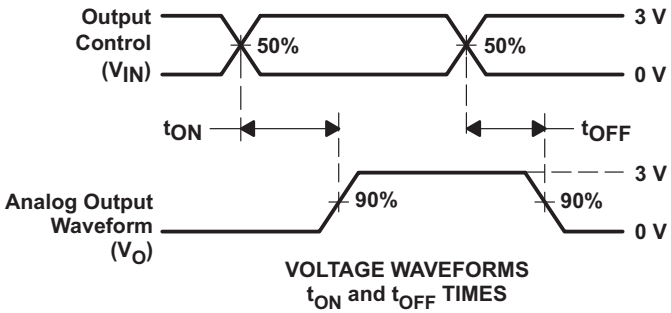
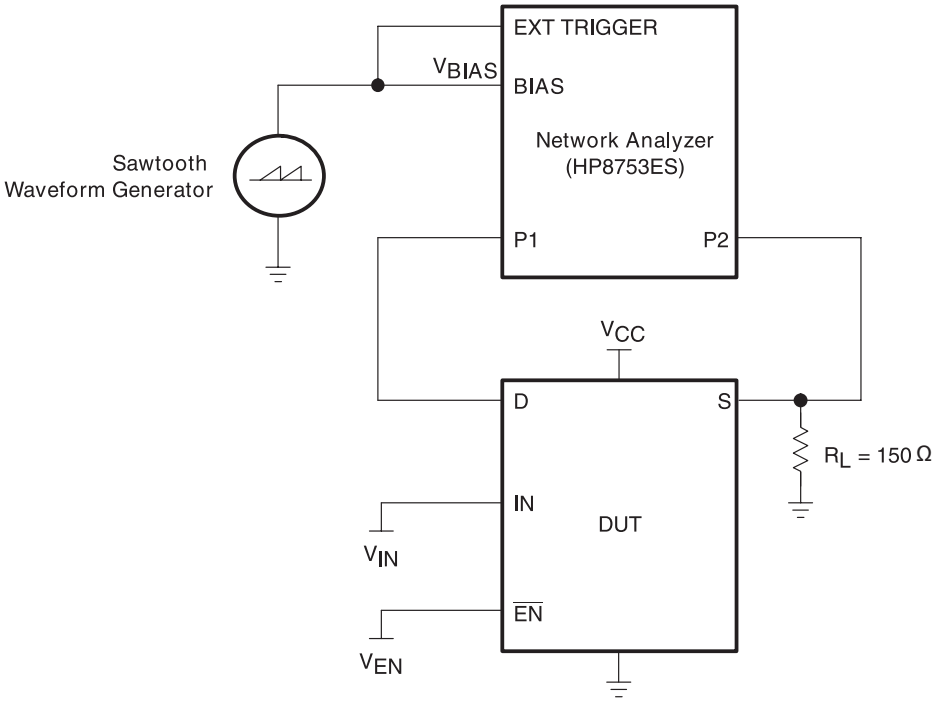


Figure 10. Test Circuit and Voltage Waveforms



For additional information, refer to the TI application report, *Measuring Differential Gain and Phase*, literature number SLOA040.

Figure 11. Test Circuit for Differential Gain/Phase Measurement

The differential gain and phase is measured at the output of the ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at S_{1A}.

HP8753ES Setup

Average = 20

RBW = 300 Hz

Smoothing = 2%

V_{BIAS} = 0 to 1 V

ST = 1.381 s.

P1 = –7 dBM

CW frequency = 3.58 MHz

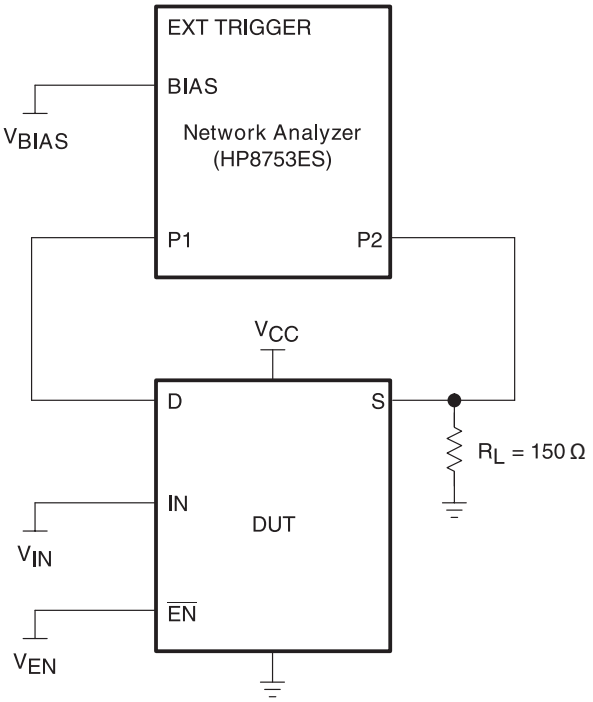


Figure 12. Test Circuit for Frequency Response, Crosstalk, and OFF-Isolation

The frequency response is measured at the output of the ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at S_{1A}. All unused analog I/O ports are held at V_{CC} or GND.

The crosstalk is measured at the output of the non-adjacent ON channel. For example, when V_{IN} = 0, V_{EN} = 0, and D_A is the input, the output is measured at S_{1B}. All unused analog I/O ports are held at V_{CC} or GND.

The off-isolation is measured at the output of the OFF channel. For example, when V_{IN} = 0, V_{EN} = V_{CC}, and D_A is the input, the output is measured at S_{1A}. All unused analog I/O ports are held at V_{CC} or GND.

HP8753ES Setup

Average = 4

RBW = 3 kHz

Smoothing = 0%

V_{BIAS} = 0.35 V

ST = 2 s

P1 = 0 dBM

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接口	http://www.ti.com.cn/interface
逻辑	http://www.ti.com.cn/logic
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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TS5V522CDBQR	ACTIVE	SSOP	DBQ	24	2500	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	TS5V522C	Samples
TS5V522CPWR	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TE522C	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) **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.

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

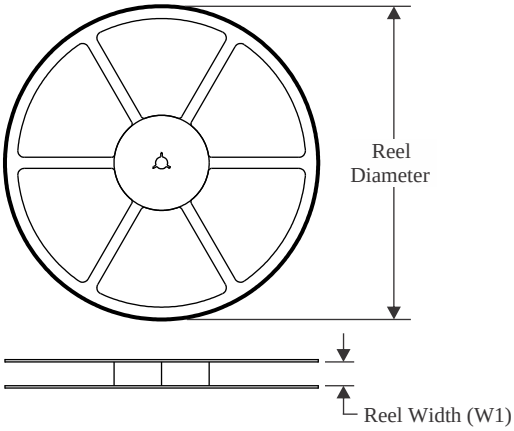
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

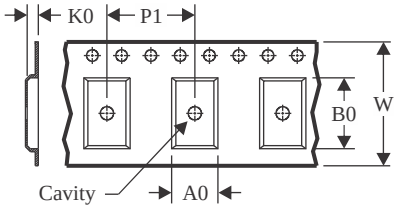
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

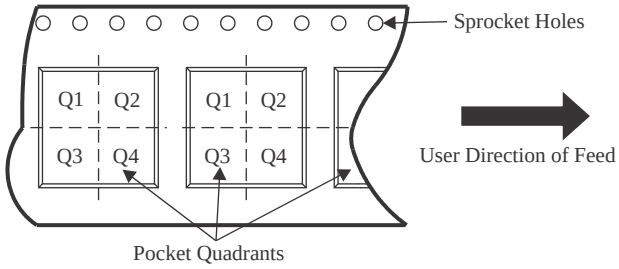


TAPE DIMENSIONS



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

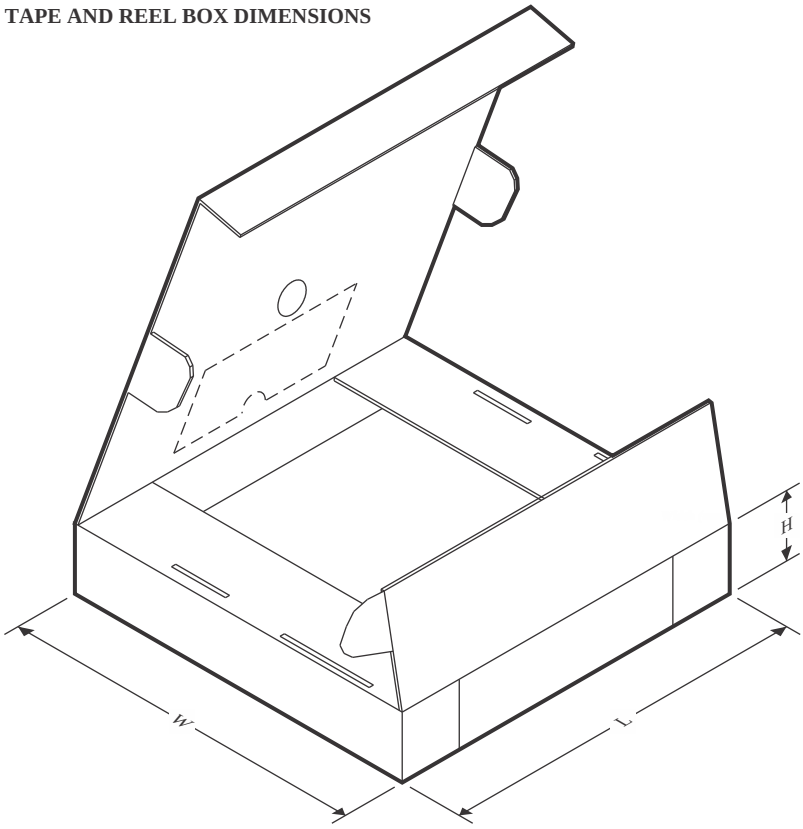
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TS5V522CDBQR	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TS5V522CPWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

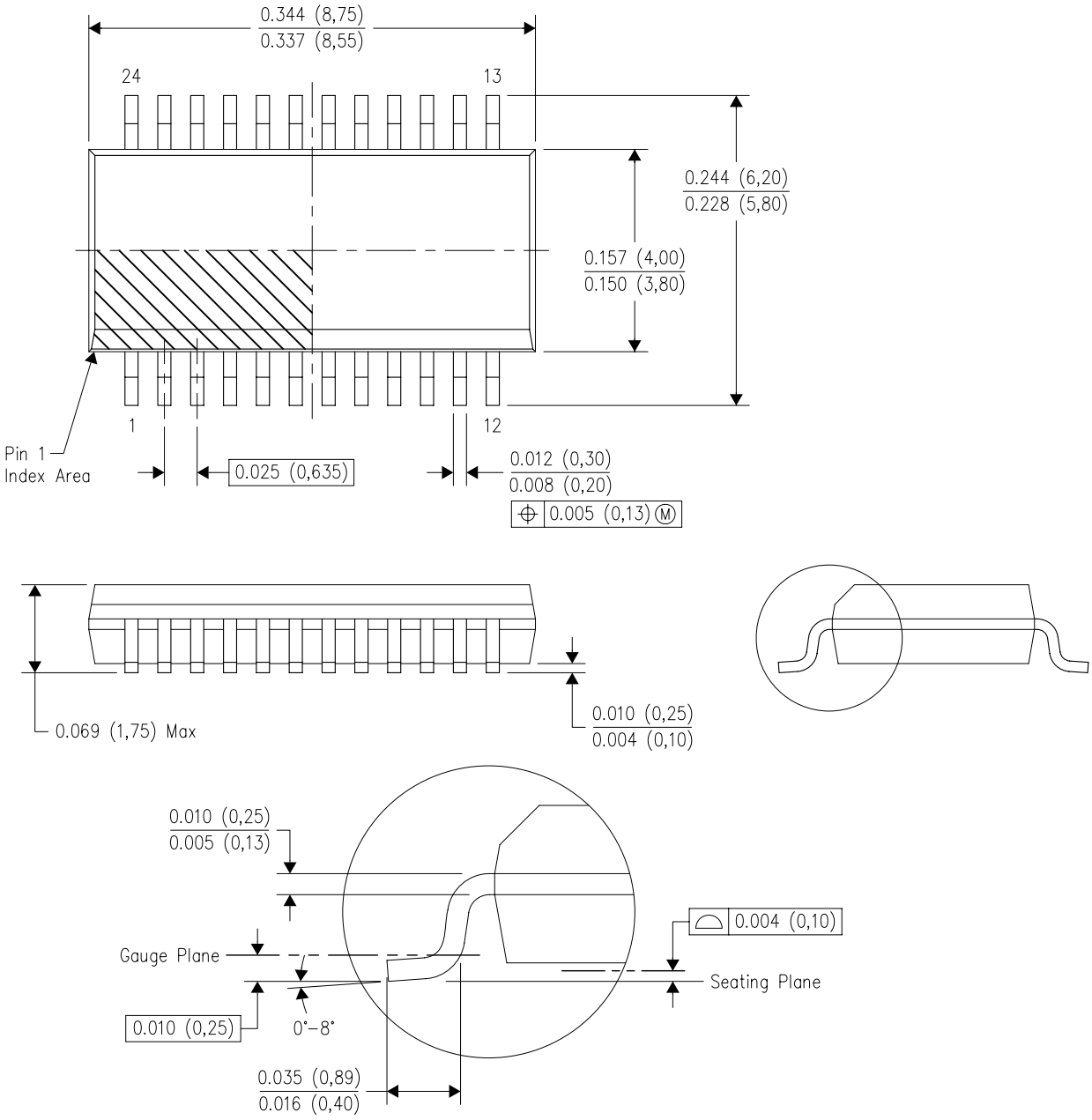
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TS5V522CDBQR	SSOP	DBQ	24	2500	356.0	356.0	35.0
TS5V522CPWR	TSSOP	PW	24	2000	356.0	356.0	35.0

DBQ (R–PDSO–G24) PLASTIC SMALL–OUTLINE PACKAGE



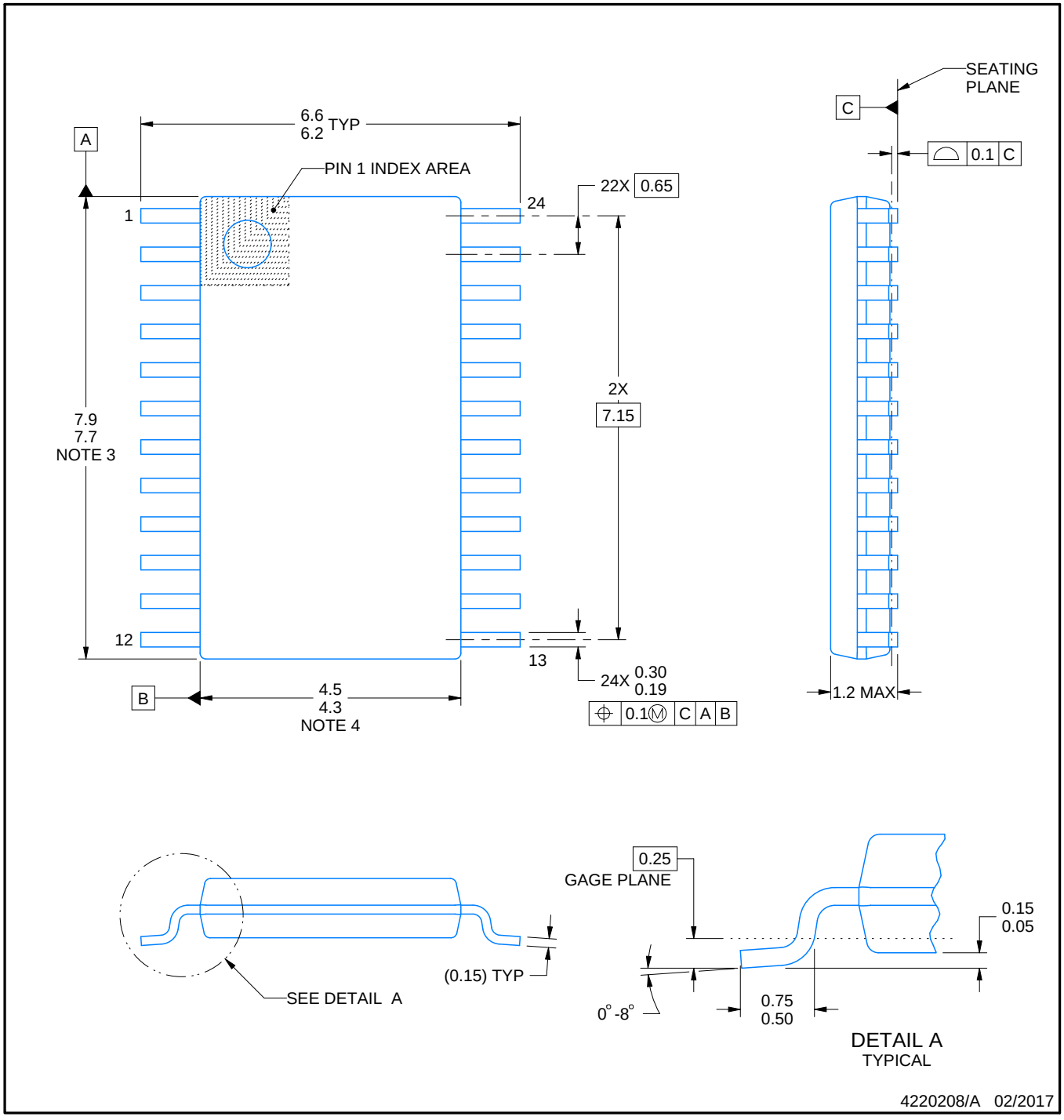
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
D. Falls within JEDEC MO–137 variation AE.

PACKAGE OUTLINE

PW0024A

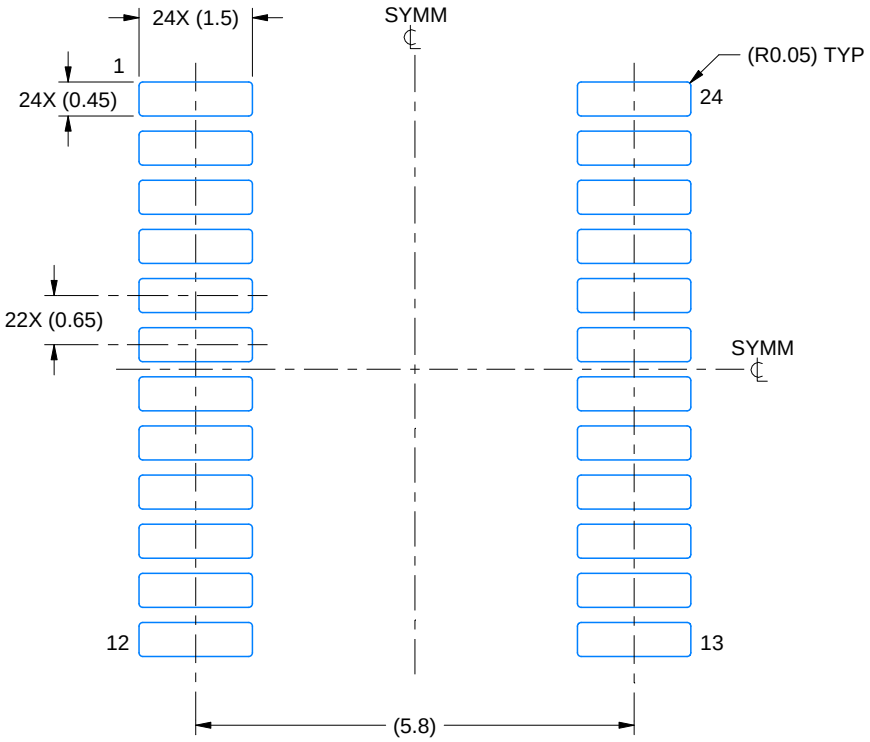
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

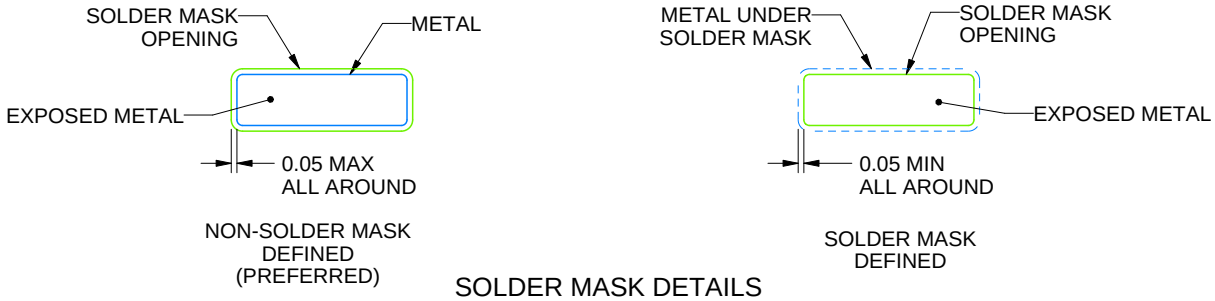


NOTES:

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

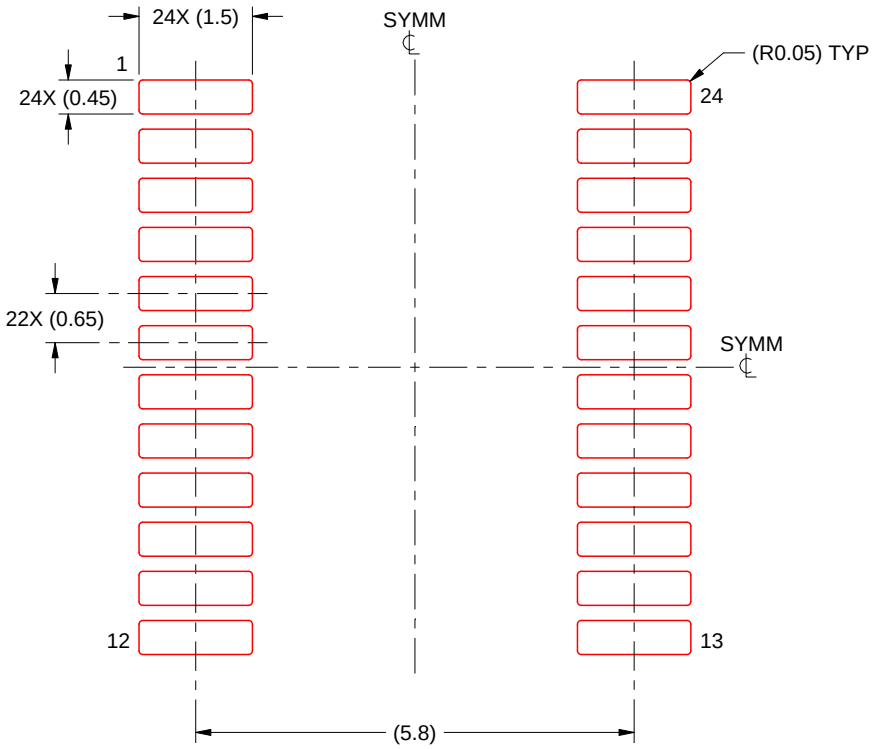


SOLDER MASK DETAILS

4220208/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.



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

4220208/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.

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