SN74AHCT245-EP 具有三态输出的增强型产品 5V 八路总线收发器

1 特性

- 输入兼容 TTL 电压
- 闩锁性能超过 250mA，符合 JESD 17 规范
- 支持国防、航空航天和医疗应用：
  - 受控基线
  - 一个组装和测试基地
  - 一个制造基地
  - 延长了产品生命周期
  - 产品可追溯性

2 应用

- 启用或禁用数字信号
- 在控制器复位期间保持信号
- 对开关进行去抖

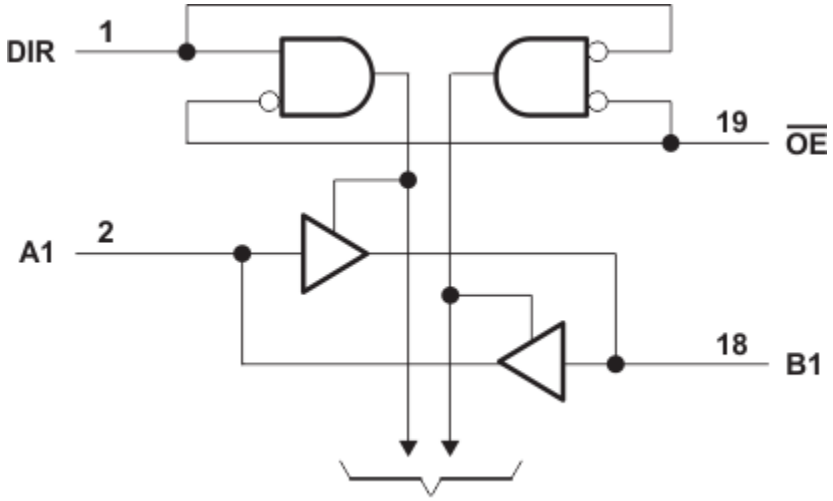
3 说明

SN74AHCT245-EP 八路总线收发器专为数据总线之间的异步双向通信而设计。这些器件的工作电压范围为 4.5V 至 5.5V。

封装信息

器件型号	封装(1)	封装尺寸(2)	封装尺寸（标称值）(3)
SN74AHCT245-EP	PW（TSSOP，20）	6.5 mm x 6.4 mm	6.5mm x 4.4mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。
(2) 封装尺寸（长 x 宽）为标称值，并包括引脚（如适用）。
(3) 封装尺寸（长 x 宽）为标称值，不包括引脚。



简化原理图

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4 Revision History

DATE	REVISION	NOTES
July 2023	*	Initial Release

5 Pin Configuration and Functions

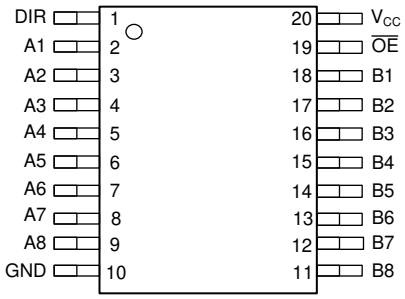


图 5-1. SN74AHCT245-EP: PW Package, 20-Pin TSSOP (Top View)

表 5-1. Pin Functions

PIN		TYPE(1)	DESCRIPTION
NAME	NO.		
DIR	1	I	Direction Pin
A1	2	I/O	A1 Input/Output
A2	3	I/O	A2 Input/Output
A3	4	I/O	A3 Input/Output
A4	5	I/O	A4 Input/Output
A5	6	I/O	A5 Input/Output
A6	7	I/O	A6 Input/Output
A7	8	I/O	A7 Input/Output
A8	9	I/O	A8 Input/Output
GND	10	G	Ground Pin
B8	11	I/O	B8 Input/Output
B7	12	I/O	B7 Input/Output
B6	13	I/O	B6 Input/Output
B5	14	I/O	B5 Input/Output
B4	15	I/O	B4 Input/Output
B3	16	I/O	B3 Input/Output
B2	17	I/O	B2 Input/Output
B1	18	I/O	B1 Input/Output
$\overline{OE}$	19	I	Output Enable
VCC	20	P	Power Pin

(1) I = Input, O = Output, P= Positive Supply, G = Ground

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

				MIN	MAX	UNIT
V_{CC}	Supply voltage range			–0.5	7	V
V_I	Input voltage range(2)		Control inputs	–0.5	7	V
V_O	Output voltage range(2)			–0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0	Control inputs		–20	mA
I_{OK}	Output clamp current	V_O < 0 or V_O > V_{CC}			±20	mA
I_O	Continuous output current	V_O = 0 to V_{CC}			±25	mA
	Continuous current through V_{CC} or GND				±75	mA
T_{stg}	Storage temperature			-65	150	ºC

(1) Operation outside the *Absolute Maximum Rating* may cause permanent device damage. *Absolute Maximum Rating* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Condition*. If used outside the *Recommended Operating Condition* but within the *Absolute Maximum Rating*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

6.2 ESD Ratings

			MIN	MAX	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)		±2000	V
		Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002(2)		±1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)(1)

		SN74AHCT245-EP		UNIT
		MIN	MAX	
V_{CC}	Supply voltage	4.5	5.5	V
V_{IH}	High-level input voltage	2		V
V_{IL}	Low-level Input voltage		0.8	V
V_I	Input voltage	0	5.5	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current		–8	mA
I_{OL}	Low-level output current		8	mA
Δt/Δv	Input Transition rise and fall rate		20	ns/V
T_A	Operating free-air temperature	–55	125	°C

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

6.4 Thermal Information

THERMAL METRIC[1]		SN74AHCT245-EP PW 20 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	102.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	36.8	
$R_{\theta JB}$	Junction-to-board thermal resistance	53.8	
ψ_{JT}	Junction-to-top characterization parameter	2.5	
ψ_{JB}	Junction-to-board characterization parameter	53.3	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

6.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			–55°C to 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
V_{OH}		I_{OH} = –50 µA	4.5 V	4.4	4.5		4.4		V
		I_{OH} = –8 mA		3.94			3.7		
V_{OL}		I_{OL} = 50 µA	4.5 V			0.1		0.1	V
		I_{OH} = 8 mA				0.36		0.44	
I_I	$\overline{OE}$ or DIR	V_I = 5.5 V or GND	0 to 5.5 V			±0.1		±1	µA
I_{OZ}	A or B inputs[1]	$V_O = V_{CC}$ or GND	5.5 V			±.25		±2.5	µA
I_{CC}		$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			4		40	µA
ΔI_{CC} [2]		One input at 3.4 V, Other inputs at V_{CC} or GND	5.5 V			1.35		1.5	mA
C_i	$\overline{OE}$ or DIR	$V_I = V_{CC}$ or GND	5 V		2.5	10			pF
C_{io}	A or B inputs	$V_I = V_{CC}$ or GND	5 V		4				pF

(1) For I/O ports, the parameter I_{OZ} includes the input leakage current.
(2) This is the increase in supply current for each input at one of the specified TTL voltage levels, rather than 0 V or V_{CC}.

6.6 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C		–55°C to 125°C		UNIT
				TYP	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	C_L = 15 pF	4.5	7.7	1	10	ns
t_{PHL}				4.5	7.7	1	10	
t_{PZH}	$\overline{OE}$	A or B	C_L = 15 pF	8.9	13.8	1	16	ns
t_{PZL}				8.9	13.8	1	16	
t_{PHZ}	$\overline{OE}$	A or B	C_L = 15 pF	9.2	14.4	1	16.5	ns
t_{PLZ}				9.2	14.4	1	16.5	
t_{PLH}	A or B	B or A	C_L = 50 pF	5.3	8.7	1	11	ns
t_{PHL}				5.3	8.7	1	11	
t_{PZH}	$\overline{OE}$	A or B	C_L = 50 pF	9.7	14.8	1	17	ns
t_{PZL}				9.7	14.8	1	17	
t_{PHZ}	$\overline{OE}$	A or B	C_L = 50 pF	10	15.4	1	17.5	ns
t_{PLZ}				10	15.4	1	17.5	
$t_{sk(o)}$			C_L = 50 pF		1			ns

6.7 Noise Characteristics

V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C(1)

PARAMETER		SN74AHCT245-EP			UNIT
		MIN	TYP	MAX	
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		4		V
$V_{IH(D)}$	High-level dynamic input voltage	2			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.8	V

(1) Characteristics are for surface-mount packages only.

6.8 Operating Characteristics

V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	13	pF

6.9 Typical Characteristics

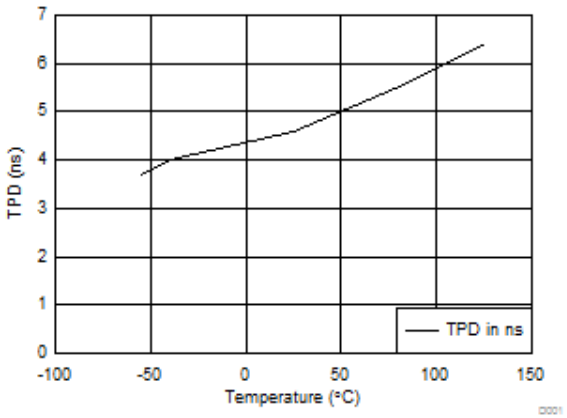
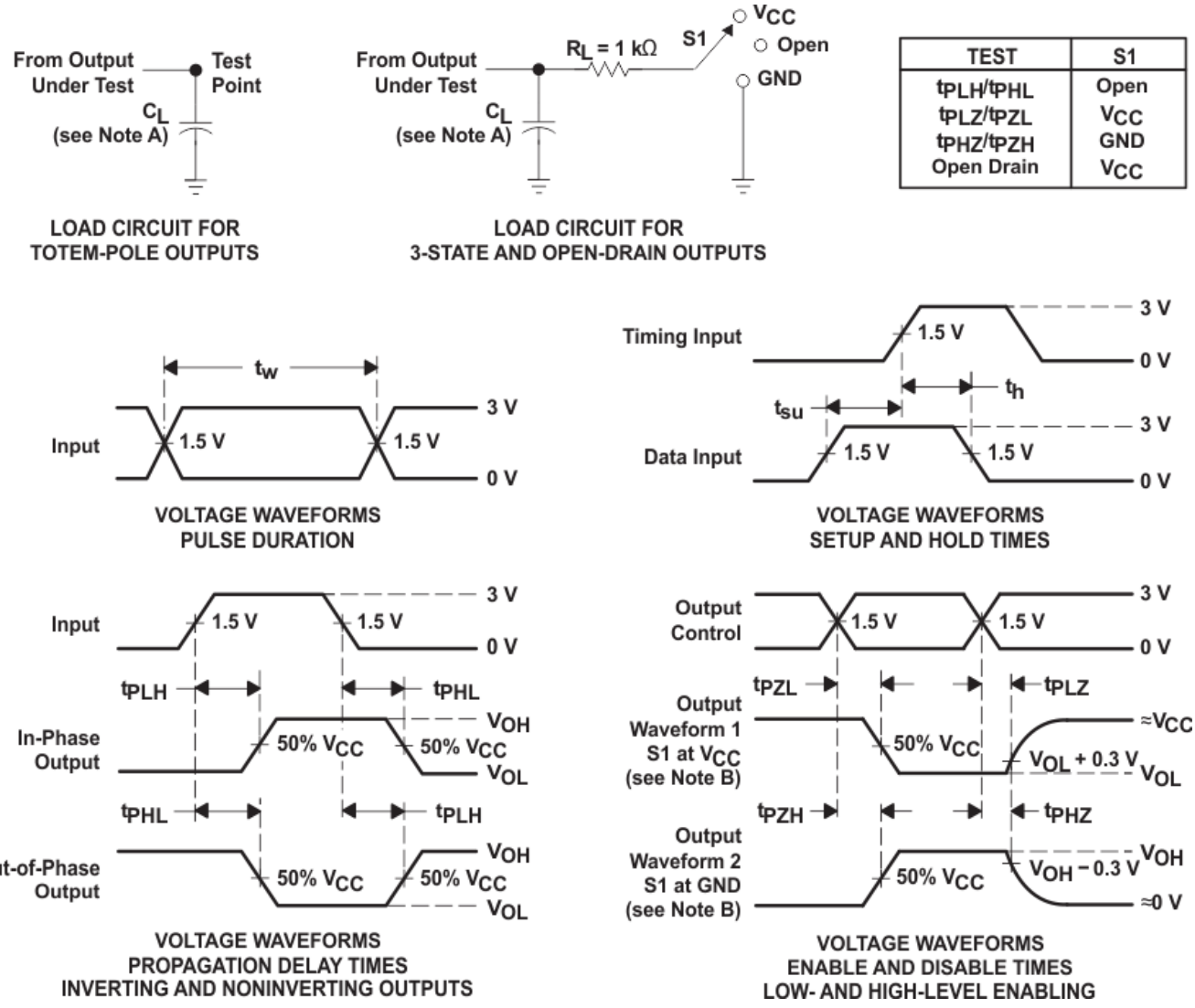


图 6-1. SN74AHCT245-EP TPD vs Temperature, 15 pF Load

7 Parameter Measurement Information



A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.
E. All parameters and waveforms are not applicable to all devices.

图 7-1. Load Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

The SNx7ACHT245 octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements. The SN74AHCT245-EP devices allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction–control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so that the buses effectively are isolated. For the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

8.2 Functional Block Diagram

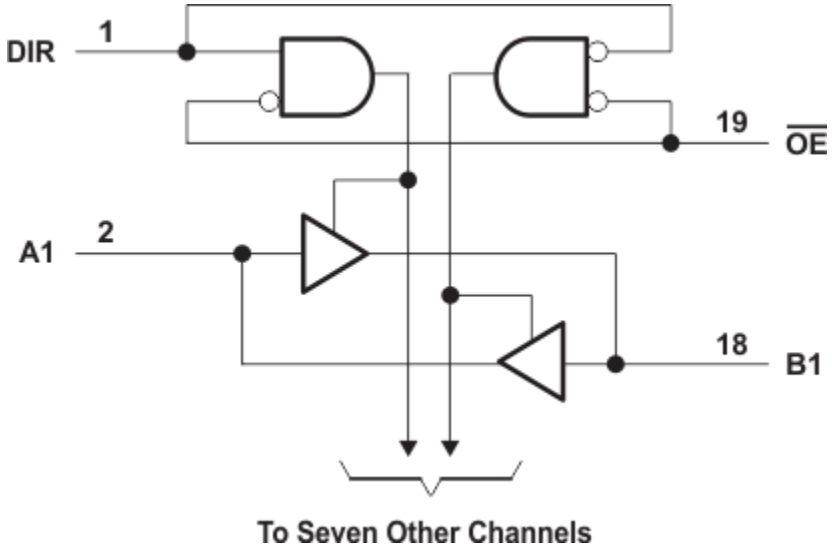


图 8-1. Logic Diagram (Positive Logic)

8.3 Feature Description

- V_{CC} is optimized at 5 V
- Allows up voltage translation from 3.3 V to 5 V
  - Inputs accept V_{IH} levels of 2 V
- Slow edge rates minimize output ringing

8.4 Device Functional Modes

表 8-1. Function Table (Each Transceiver)

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

9 Application and Implementation

备注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

9.1 Application Information

The SN74AHCT245-EP can be used to drive signals over relatively long traces or transmission lines. To reduce ringing caused by impedance mismatches between the driver, transmission line, and receiver, a series damping resistor placed in series with the transmitter's output can be used. The figure in the *Application Curve* section shows the received signal with three separate resistor values. Just a small amount of resistance can make a significant impact on signal integrity in this type of application.

9.2 Typical Application

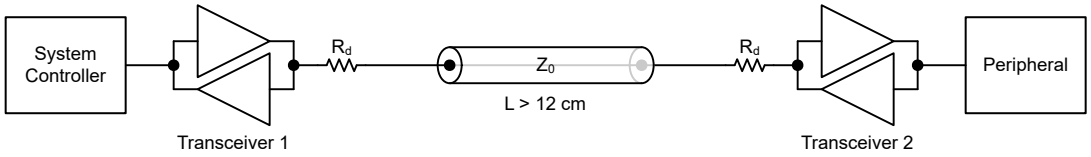


图 9-1. Application Block Diagram

9.3 Design Requirements

9.3.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the *Recommended Operating Conditions*. The supply voltage sets the device's electrical characteristics as described in the *Electrical Characteristics*.

The positive voltage supply must be capable of sourcing current equal to the maximum static supply current, I_{CC}, listed in the *Electrical Characteristics* and any transient current required for switching.

The ground must be capable of sinking current equal to the total current to be sunk by all outputs of the SN74AHCT245-EP plus the maximum supply current, I_{CC}, listed in the *Electrical Characteristics*, and any transient current required for switching. The logic device can only sink as much current as can be sunk into its ground connection. Be sure not to exceed the maximum total current through GND listed in the *Absolute Maximum Ratings*.

The SN74AHCT245-EP can drive a load with a total capacitance less than or equal to 50 pF while still meeting all of the data sheet specifications. Larger capacitive loads can be applied; however, it is not recommended to exceed 50 pF.

The SN74AHCT245-EP can drive a load with total resistance described by $R_L \geq V_O / I_O$, with the output voltage and current defined in the *Electrical Characteristics* table with V_{OL}. When outputting in the high state, the output voltage in the equation is defined as the difference between the measured output voltage and the supply voltage at the V_{CC} pin.

Total power consumption can be calculated using the information provided in CMOS Power Consumption and Cpd Calculation.

Thermal increase can be calculated using the information provided in Thermal Characteristics of Standard Linear and Logic (SLL) Packages and Devices.

CAUTION

The maximum junction temperature, $T_{J(max)}$ listed in the *Absolute Maximum Ratings*, is an additional limitation to prevent damage to the device. Do not violate any values listed in the *Absolute Maximum Ratings*. These limits are provided to prevent damage to the device.

9.3.2 Input Considerations

Input signals must cross to be considered a logic LOW, and to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the *Absolute Maximum Ratings*.

Unused inputs must be terminated to either V_{CC} or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the SN74AHCT245-EP, as specified in the *Electrical Characteristics*, and the desired input transition rate. A 10-kΩ resistor value is often used due to these factors.

Refer to the *Feature Description* section for additional information regarding the inputs for this device.

9.3.3 Output Considerations

The ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the V_{OL} specification in the *Electrical Characteristics*.

Unused outputs can be left floating. Do not connect outputs directly to V_{CC} or ground.

Refer to *Feature Description* section for additional information regarding the outputs for this device.

9.3.4 Detailed Design Procedure

1. Add a decoupling capacitor from V_{CC} to GND. The capacitor needs to be placed physically close to the device and electrically close to both the V_{CC} and GND pins. An example layout is shown in the *Layout* section.
2. Ensure the capacitive load at the output is ≤ 50 pF. This is not a hard limit; it will, however, ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the SN74AHCT245-EP to one or more of the receiving devices.
3. Ensure the resistive load at the output is larger than (V_{CC} / $I_{O(max)}$) Ω. This will ensure that the maximum output current from the *Absolute Maximum Ratings* is not violated. Most CMOS inputs have a resistive load measured in MΩ; much larger than the minimum calculated previously.
4. Thermal issues are rarely a concern for logic gates; the power consumption and thermal increase, however, can be calculated using the steps provided in the application report, *CMOS Power Consumption and Cpd Calculation*.

9.4 Application Curves

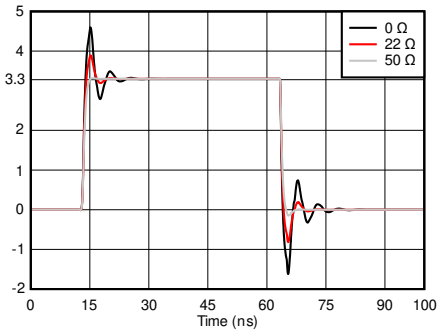


图 9-2. Simulated Signal Integrity at the Receiver With Different Damping Resistor (R_d) Values

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. A 0.1-µF capacitor is recommended for this device. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. The 0.1-µF and 1-µF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in the following layout example.

11 Layout

11.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or V_{CC}, whichever makes more sense for the logic function or is more convenient.

11.2 Layout Example

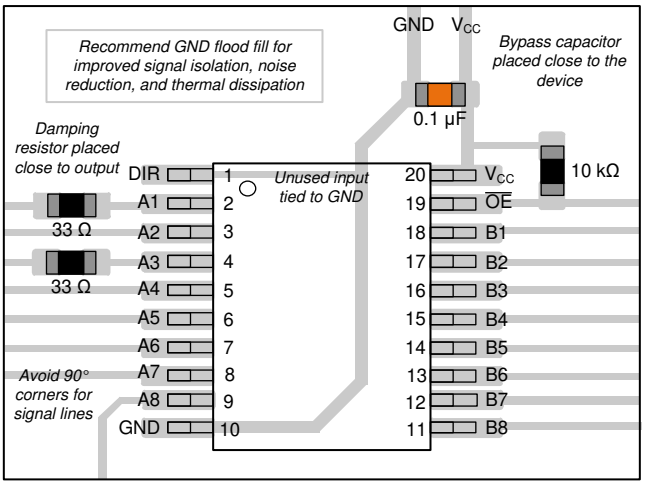


图 11-1. Example Layout for the SN74AHCT245-EP in PW

12 Device and Documentation Support

12.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 *订阅更新* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.2 支持资源

TI E2E™ 支持论坛是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的《使用条款》。

12.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
所有商标均为其各自所有者的财产。

12.4 静电放电警告

静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.5 术语表

TI 术语表　　本术语表列出并解释了术语、首字母缩略词和定义。

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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)
SN74AHCT245MPWREP	Active	Production	TSSOP (PW) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HB245EP
SN74AHCT245MPWREP.A	Active	Production	TSSOP (PW) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HB245EP
V62/23618-01XE	Active	Production	TSSOP (PW) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HB245EP

(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.

OTHER QUALIFIED VERSIONS OF SN74AHCT245-EP :

- Catalog : SN74AHCT245

- Automotive : SN74AHCT245-Q1
- Military : SN54AHCT245

NOTE: Qualified Version Definitions:

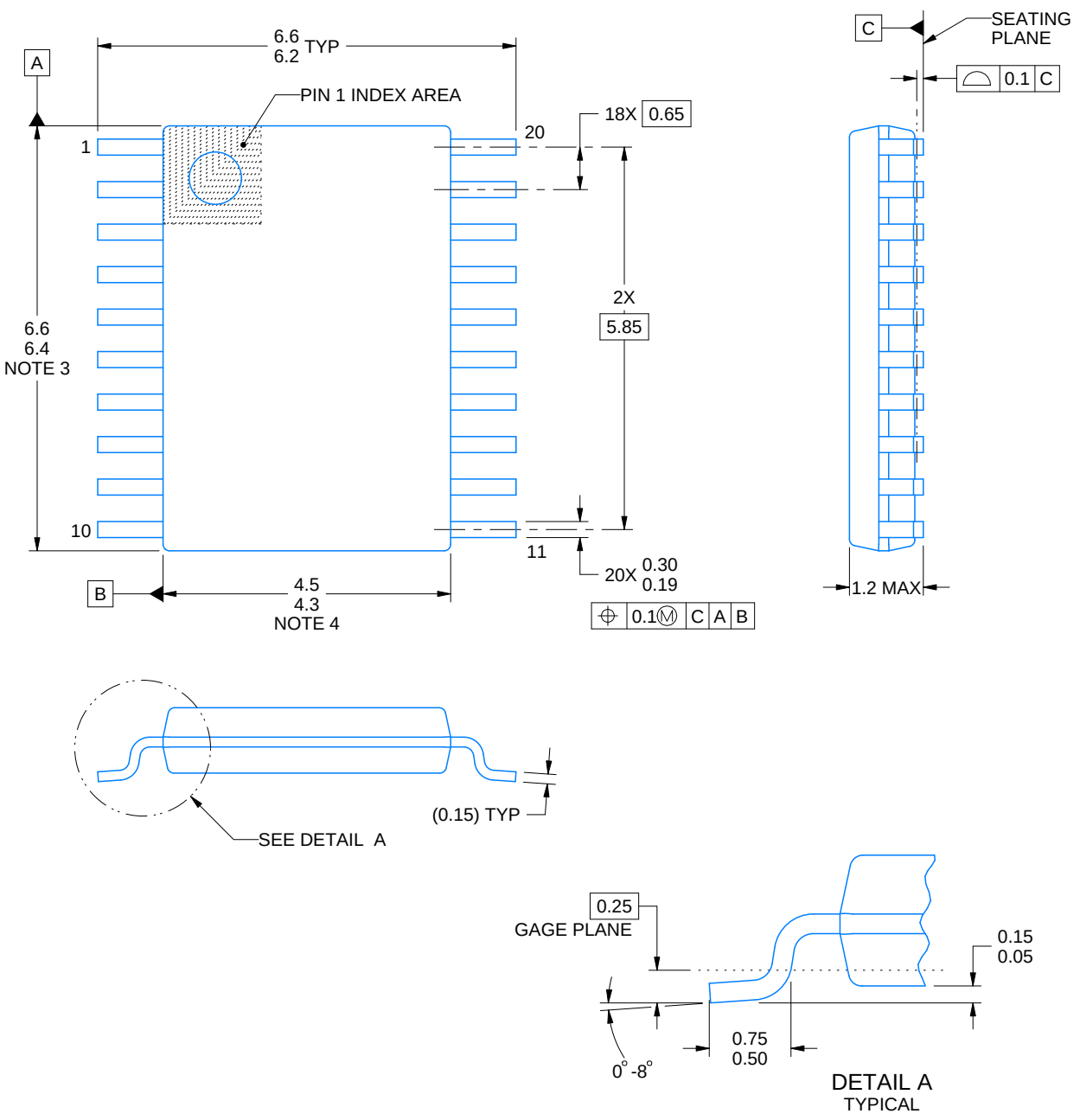
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

PACKAGE OUTLINE

PW0020A

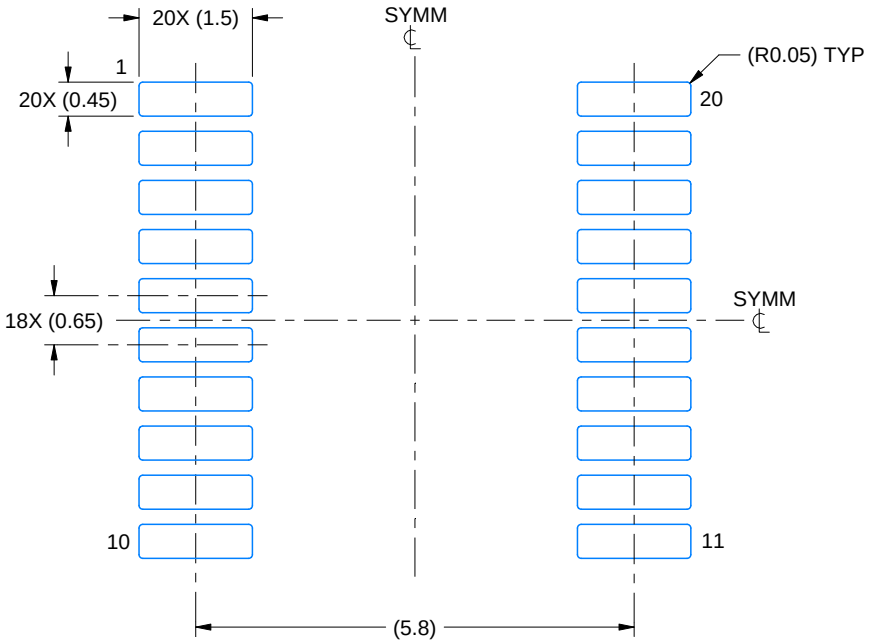
TSSOP - 1.2 mm max height

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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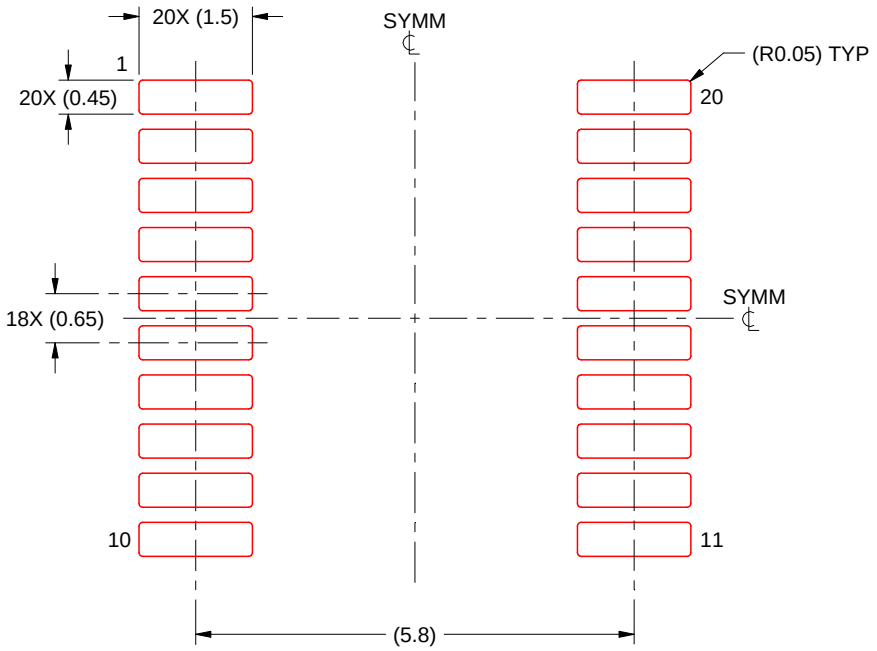
NOTES: (continued)

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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