



深圳市展恒电子有限公司  
**Broadic Electronics Co., Ltd**

# **HD32xxE**

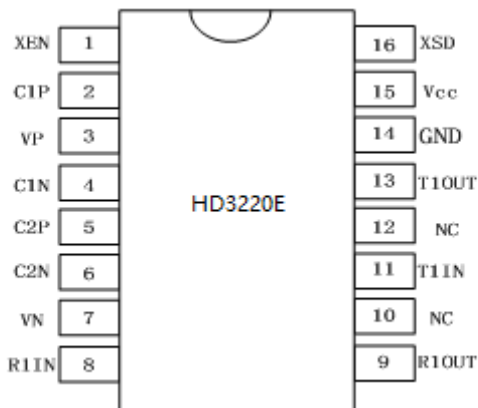
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**15kV ESD Protection, Low Power,  
Guaranteed Data Rate 250kbps  
RS232 Transceivers**

Broadic  
2016.01.28

## 产品特性

- HD32xxE 在 3.3V 或 5V 供电时，满足 EIA/TIA-232F 和 CCITT V. 28/V. 24 协议的通信要求
- 低静态工作电流：典型值 0.5mA，最大值 1mA
- 低关断电流：典型值 1uA，最大值 10uA。
- 保证 250kbps 数据传输速率
- 专用开关电容电压转换器
- 专用 XPWRSAVE 自动待机节能
- RS-232 I/O 的 ESD 防护
  - ±15kV Human Body Model (HBM)
  - ±15kV EN61000-4-2 Air Gap Discharge
  - ±8kV EN61000-4-2 Contact Discharge
- HD32xxE 系列保证传输速率为 250kbps



## 产品选择指南

型号	供电	RS232 驱动器	RS232 接收器	传输速率 (kbps)	15KV ESD IEC1000-4-2	接收器使能	关断使能	XPWRSAVE 功能	引脚数量	封装类型
HD3220E	+3V to +5.5V	1	1	250	RS232 I/O	YES	YES	NO	16	SSOP, TSSOP, HDOIC
HD3221E	+3V to +5.5V	1	1	250	RS232 I/O	YES	YES	YES	16	SSOP, TSSOP
HD3222E	+3V to +5.5V	2	2	250	RS232 I/O	YES	YES	NO	18, 20	18-WSOIC, 20-SSOP, 20-TSSOP,
HD3232E	+3V to +5.5V	2	2	250	RS232 I/O	NO	NO	NO	16	NSOIC, WSOIC, SOP, TSSOP
HD3223E	+3V to +5.5V	2	2	250	RS232 I/O	YES	YES	YES	20	SSOP, TSSOP
HD1385E	+3V to +5.5V	2	2	250	RS232 I/O	NO	YES	NO	18, 20	18-WSOIC, 20-SSOP

## 简要概述

HD32xxE系列是采用3V供电的满足EIA/TIA-232和CCITT V. 28/ V. 24通信要求的接口芯片，符合低功耗要求。内部包括两个驱动器、两个接收器和专用的开关电容稳压转换器。HD3220具有一个驱动器和一个接收器。这些器件能够在3V至5.5V电源条件下工作，保证数据传输速率为250kbit/s，所有RS232 I/O引脚的静电放电(ESD)保护均超过EN61000-4-2标准下的±15kV空气放电和±8kV接触放电。

HD3221E和HD3223E具有XPWRSAVE (专利技术)专有功能，当RS-232电缆从主机接口断开或连接的外围设备关闭时，XPWRSAVE可自动关闭芯片内部的稳压转换器和驱动器电路。

## 应用

- 电池供电设备和手持设备
- 笔记本和掌上电脑
- 蜂窝电话数据线缆
- 终端适配器和 POS 终端
- 调制解调器

## 绝对最大额定值

这些仅是产品测试最大额定值,但并不代表设备可以在这些额定值下或在操作中的任何其它额定值以上进行通讯操作。长时间应用在绝对最大额定值条件下可能会影响芯片可靠性。

Power Supply, ( $V_{CC}$ ) .....  $-0.3V$  to  $+6.0V$   
VP.....  $-0.3V$  to  $+7.0V$   
VN .....  $+0.3V$  to  $-7.0V$   
 $|VP| + |VN|$  .....  $+13.0V$   
Icc (DC  $V_{CC}$  or GND current) .....  $\pm 100mA$

### Input Voltages

TxIN,XPWRSAVE .XSD, XEN.....  $-0.3V$  to  $+6.0V$   
RxIN .....  $\pm 20V$

### Output Voltages

TxOUT.....  $\pm 15V$   
RxOUT, XIDLE.....  $-0.3V$  to  $(V_{CC} + 0.3V)$

### Short-Circuit Duration

TxOUT.....Continuous  
Operating Temperature .....  $-40^{\circ}C$  to  $+85^{\circ}C$   
Storage Temperature .....  $-65^{\circ}C$  to  $+150^{\circ}C$

### Power Dissipation Per Package

16-pin SSOP (derate  $7.20mW/^{\circ}C$  above  $+70^{\circ}C$ ).. 584mW  
16-pin nSOIC (derate  $10.00mW/^{\circ}C$  above  $+70^{\circ}C$ ) 720mW  
16-pin WSOIC (derate  $10.10mW/^{\circ}C$  above  $+70^{\circ}C$ ) 787mW  
16-pin TSSOP (derate  $6.80mW/^{\circ}C$  above  $+70^{\circ}C$ ).. 556mW  
16-pin PDIP (derate  $11.20mW/^{\circ}C$  above  $+70^{\circ}C$ ).... 896mW  
18-pin PDIP (derate  $12.60mW/^{\circ}C$  above  $+70^{\circ}C$ ).... 962mW  
18-pin WSOIC (derate  $11.10mW/^{\circ}C$  above  $+70^{\circ}C$ ) 850mW  
20-pin PDIP (derate  $12.80mW/^{\circ}C$  above  $+70^{\circ}C$ ).... 976mW  
20-pin SSOP (derate  $8.10mW/^{\circ}C$  above  $+70^{\circ}C$ ).... 647mW  
20-pin TSSOP (derate  $7.20mW/^{\circ}C$  above  $+70^{\circ}C$ ).. 584mW

## 产品存储须知

首选储存在低湿度环境中。产品封装塑封体对水分敏感,应存放在干燥的防潮袋中。使用前,器件应保持袋装状态,并储存在  $40^{\circ}C$  和 60%RH 以下。如果将器件从袋中取出,则应在 48 小时内使用或存放在相对湿度低于 20%的环境中。如果不能满足上述条件,则应在  $125^{\circ}C$  下烘烤器件 4 小时,以便在焊接前除去水分。我司在运输中会将产品装入带有湿度指示卡和密封的干燥防潮袋中。湿度指示卡应低于 30 %RH。

我司提供的信息经过仔细审查,以确保准确性和可靠性,但是,在其应用和使用过程中完全由用户负责。对于使用此信息不负有任何责任会成为部分条款以及后续与我司签订销售协议的任何条件。规范可能会发生变化从而导致相关的应用更新,公司有权不会另外再进行第三方通知。我司的任何专利或专利权均不得以私下或其他方式授予许可。

**电气特性**

除非特殊说明,  $V_{CC} = +3.0V$  to  $+5.0V$ ,  $T_A = T_{min}$  to  $T_{max}$ ,  $C1$  to  $C4 = 0.1\mu F$ , 典型值应用条件为  $V_{CC} = +3.3V$  or  $+5.0V$  and  $T_A = 25^\circ C$ .

参数	条件	最小	典型	最大	单位
驱动输入 驱动输出 RS-232 输入 RS-232 输出 电荷泵 电源脚	T1IN, T2IN, XPWRSAVE, XSD, XEN R1OUT, R2OUT, XIDLE R1IN, R2IN T1OUT, T2OUT C1P, C1N, C2P, C2N $V_{CC}$ , $V_{GND}$ , $V_{DD}$ , $V_{SS}$				
电荷泵电容 温度 $0^\circ C$ to $+70^\circ C$ 温度 $-40^\circ C$ to $+85^\circ C$ 电源电压	C1P, C1N, C2P, C2N Commercial Grade Industrial Grade $V_{CC} = +5.0V$ Supply $V_{CC} = +3.3V$ Supply	0.1 0 -40 4.5 3	0.1 +25 +25 5 3.3	1 +70 +85 5.5 3.6	$\mu F$ $^\circ C$ $^\circ C$ V V
工作电流	TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float, $V_{CC} = 3.3V$ (For HD3220E, HD3222E, HD3232E and HD1385E)		0.5	1	mA
XPWRSAVE 不使能时工作电流	XPWRSAVE = $V_{CC}$ , (For HD3221E and HD3223E); XSD = $V_{CC}$ , (For HD3221E, HD3222E, HD1385E and HD3223E), TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float, $V_{CC} = 3.3V$		0.5	1	mA
XPWRSAVE 使能时工作电流	XPWRSAVE = GND, (For HD3221E and HD3223E); XSD = $V_{CC}$ , (For HD3221E, HD3222E, HD1385E and HD3223E), TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float, $V_{CC} = 3.3V$		1	10	$\mu A$
SHUTDOWN 使能时电流	XPWRSAVE = $V_{CC}/GND$ , (For HD3221E and HD3223E); XSD = GND, (For HD3221E, HD3222E, HD1385E and HD3223E), TTL Inputs = $V_{CC}/GND$ , RS-232 Inputs = float, $V_{CC} = 3.3V$		1	10	$\mu A$
驱动器输入 输入阈值电压 Low 输入阈值电压 High 输入阈值电压迟滞 输入漏电流	$V_{CC} = +5.0V$ Supply $V_{CC} = +3.3V$ Supply $V_{IN} = V_{CC}$ and GND, TIN, XEN, XPWRSAVE, XSD $V_{IN} = V_{CC}$ and GND, TIN (For HD1385E)	2.4 2	0.5 $\pm 0.01$ 50	0.8 $\pm 1$ 200	V V V $\mu A$ $\mu A$
接收器输出 输出电压 Low 输出电压 High 输出漏电流	$I_{OUT} = 1.6mA$ $I_{OUT} = -1.0mA$ Receiver Outputs Disabled, $V_{OUT} = V_{CC}$ or GND, XSD = GND, XEN = $V_{CC}$	$V_{CC}-0.6$	$V_{CC}-0.1$ $\pm 0.05$	0.4 $\pm 10$	V V $\mu A$
接收器输入 输入电压摆幅 输入阈值电压 Low 输入阈值电压 High 输入阈值电压迟滞 输入电阻	$T_A = T_{min} - T_{max}$ $T_A = 25^\circ C$ , $V_{CC} = 5.0V$ $T_A = 25^\circ C$ , $V_{CC} = 3.3V$ $T_A = 25^\circ C$ $T_A = 25^\circ C$ $V_{IN} = \pm 20V$ , $T_A = 25^\circ C$	-20 0.8 0.6 3	1.5 1.2 0.5	20 2.4 7	V V V V k $\Omega$
驱动器输出 输出电压幅值 输出电阻 输出短路电流 输出漏电流	$R_L = 3k\Omega$ , All Outputs are loaded $V_{CC} = V_{DD} = V_{SS} = GND$ , $V_{OUT} = \pm 2V$ $V_{OUT} = GND$ Transmitter Disabled, $V_{OUT} = \pm 12V$	$\pm 5$ 300	$\pm 5$	$\pm 60$	V $\Omega$ mA $\mu A$



参数	条件	最小	典型	最大	单位
最大数据传输速率	$R_L = 3k\Omega$ , $C_L = 1000pF$ , One Transmitter Switching, $T_A = 25^\circ C$ , Refers to Figure 1 and 2.	250			kbps
传输限摆率	$R_L = 3\sim 7k\Omega$ , $C_L = 150pF$ to $1000pF$ , One Transmitter Switching, $T_A = 25^\circ C$ , Measured from 3V to $-3V$ or $-3V$ to 3V	6		30	V/ $\mu s$
接收器输入输出延时	$C_L = 150pF$		0.15		$\mu s$
接收器输入输出延时之差	$C_L = 150pF$		0.15		$\mu s$
接收器使能到输出时间	$t_{PHL} - t_{PLH}$		50		ns
接收器输出高到关断时间	For HD3220E, HD3221E, HD3222E, HD3223E only		0.2		$\mu s$
<b>XPWRSAVE Timing</b> 接收器输入到 XIDLE 输出高 接收器输入到 XIDLE 输出低 Power Save 模式到驱动器使能	For HD3221E and HD3223E only		1		$\mu s$
	For HD3221E and HD3223E only		30		$\mu s$
	For HD3221E and HD3223E only		100		$\mu s$
<b>ESD 防护能力</b> ESD HBM EN61000-4-2ContactDischarge EN61000-4-2AirGapDischarge	RS-232 Inputs and Outputs RS-232 Inputs and Outputs RS-232 Inputs and Outputs		$\pm 15$ $\pm 8$ $\pm 15$		kV kV kV

产品型号对应

Part Number	Pin-to-Pin Cross MAXIM	Pin-to-Pin Cross Intersil	Pin-to-Pin Cross TI	Pin-to-Pin Cross ST-M	Pin-to-Pin Cross Sipex
HD3220E	MAX3220E MAX3220	n/a	MAX3220E	n/a	SP3220E
HD3221E	MAX3221E MAX3221	ICL3221E ICL3221	MAX3221E MAX3221	n/a	n/a
HD3222E	MAX3222E MAX3222	ICL3222E ICL3222	MAX3222E MAX3222	ST3222E ST3222	SP3222E SP3222EB
HD3232E	MAX3232E MAX3232	ICL3232E ICL3232	MAX3232E MAX3232	ST3232E ST3232	SP3232E SP3232EB
HD3223E	MAX3223E MAX3223	ICL3223E ICL3223	MAX3223E MAX3223	n/a	SP3223E SP3223EB
HD1385E	n/a	n/a	LT1385	n/a	SP385E

**引脚定义**

Pin Numbers								Name	Description
HD3220E	HD3221E	HD3222E		HD3232E	HD1385E		HD3223E		
16 Pins	16 Pins	18 Pins	20 Pins	16 Pins	18Pins	20 Pins	20 Pins		
1	1	1	1	-	-	-	1	XEN	接收器使能。低电平有效, 高电平强制使接收器输出为高阻态。
2	2	2	2	1	2	2	2	C1+	升压电荷泵电容的正端
3	3	3	3	2	3	3	3	V+	电荷泵产生的+5.4V 电压
4	4	4	4	3	4	4	4	C1-	升压电荷泵电容的负端
5	5	5	5	4	5	5	5	C2+	反向电荷泵电容的正端
7	7	7	7	6	7	7	7	V-	电荷泵产生的-5.4V 电压
6	6	6	6	5	6	6	6	C2-	反向电荷泵电容的负端
8	8	14	16	13	14	16	16	R1 IN	第一个 RS232 接收器输入
-	-	9	9	8	9	9	9	R2 IN	第二个 RS232 接收器输入
9	9	13	15	12	13	15	15	R1 OUT	第一个 TTL/CMOS 接收器输出
-	-	10	10	9	10	12	10	R2 OUT	第二个 TTL/CMOS 接收器输出
11	11	12	13	11	12	14	13	T1 IN	第一个 TTL/CMOS 驱动器输入
-	-	11	12	10	11	13	12	T2 IN	第二个 TTL/CMOS 驱动器输入
13	13	15	17	14	15	17	17	T1 OUT	第一个 RS232 驱动器输出
-	-	8	8	7	8	8	8	T2 OUT	第二个 RS232 驱动器输出
-	10	-	-	-	-	-	11	XIDLE	TTL/CMOS 输出, 指示 XPWRSAVE 或者关断状态
16	16	18	20	-	18	20	20	XSD	关断控制。低有效, 关断驱动器和电压转换器
-	12	-	-	-	-	-	14	XPWRSAVE	高电平强制使驱动器工作 (SHUTDOWN 必须为高)

14	14	16	18	15	16	18	18	GND	地
15	15	17	19	16	17	19	19	VCC	+3V 到 +5.5V 供电电压
10, 12	-	-	11, 14	-	1	1, 10, 11	-	NC	不连接

## 电路描述

### 专用开关电容电压转换器

与其他厂商不同, 我司使用专利保护的两路开关电容电压控制器设计, 提供强大的双极电压, 可以保证在供电电源波动的情况下仍输出符合 EIA /RS232 标准电压。该设计由内部稳压振荡器、两相时钟周期、稳压 MOS 开关、快速开关二极管和开关电容组成。开关电容双向电流发生器采用我司专有的互补 MOS 开关和快速开关二极管智能调节, 采用我司专有的高压工艺技术。这些双向电流发生器的效率远远超过 70%。开关频率由内部振荡器产生并由电流负载调节。开关电容泵设计提供比正升压电压更高的负降压电压, 由电流发生器调节负载来实现平衡电压控制, 从而为芯片提供平衡的双极电压供应。

我司的接口系列产品采用独特的专有设计技术, 可提供更高的能效、更稳定且符合 EIA /RS232 标准的低功耗产品。

### 自动待机控制电路

HD3220E、HD3221E、HD3222E 和 HD3223E 具有由 XPWRSAVE 引脚控制的低功耗关断模式。关断期间, 驱动器输出和开关电容稳压转换器禁用, 电源电流降至  $1\mu\text{A}$  以下。

HD3221E 和 HD3223E 使用我司的 XPWRSAVE 电路来设置/重置锁存器, 当 RS232 电缆断开或外围设备

关闭时, 这些锁存器可启用电路关闭功能, 并将电源漏极降至  $1\mu\text{A}$  电源电流。连接 RS232 电缆或启用外设时, 设备将自动重新激活。

### ESD 防护电路

静电放电 (ESD) 在系统的串行端口应用中是一个重要参数。在某些应用中, 系统的 ESD 保护能力必须留有一定的余量, 这是至关重要的。由于 RS232 收发器设备暴露在外, 因此有许多环境因素会影响串行端口, 使其承受可能损坏收发器本身的一些瞬变。

RS232 收发器通常通过印刷电路板上的金属引线从串口连接器按路径传送到收发器 IC。该引线有一些小的电阻, 这将限制到达 IC 的瞬态电流从而为 IC 增加一些保护。然而, 对于附加的电压保护器件, 瞬态电压抑制器 (TVS) 或 transzorb (它们是背靠背二极管阵列箝位) 通常是保护串行端口电路所必需的。

为了进一步降低系统内的成本, 需要更多的内部集成保护电路而不需要外围增加昂贵的 TVS 电路。

我司的 RS232 收发器内置瞬态电压抑制电路, 无需外部 ESD 电路即可满足 MIL-STD-883 标准, 人体模型 HBM 和 EN61000-4-2 空气/接触放电测试。人体模型已成为公认的半导体 ESD 测试方法, 该测试旨在模拟人体存储静电能量并在接近或接触时将其放电到集成电路的过程。该方法将测试 IC 在正常



接触期间(例如在 IC 频繁接触的制造领域)承受 ESD 瞬变的能力。

EN61000-4-2 用于测试设备和系统上的 ESD。对于系统制造商来说,由于系统本身暴露于外部环境和人为因素,他们必须保证一定量的 ESD 保护。

EN61000-4-2 规定,当 ESD 施加到暴露的金属点或者在设备正常使用期间人员接触到设备表面时,系统需要承受一定量的静电。当 ESD 施加到连接器引脚时,收发器 IC 将会承受大部分的 ESD 电流。

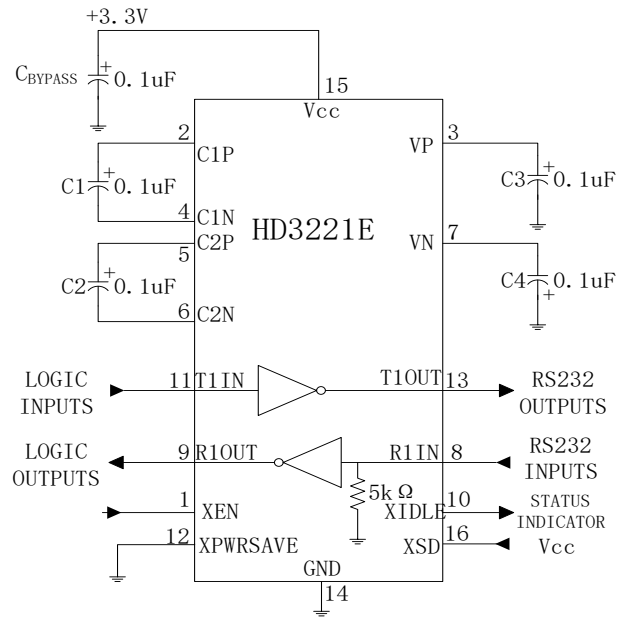
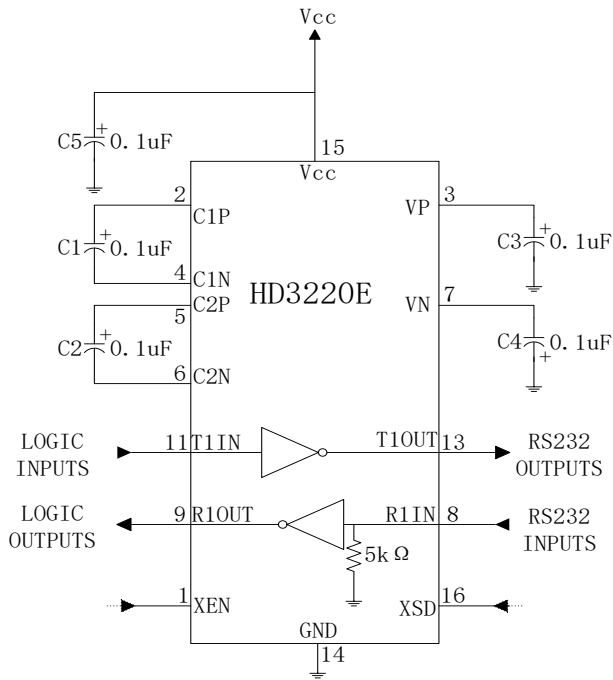
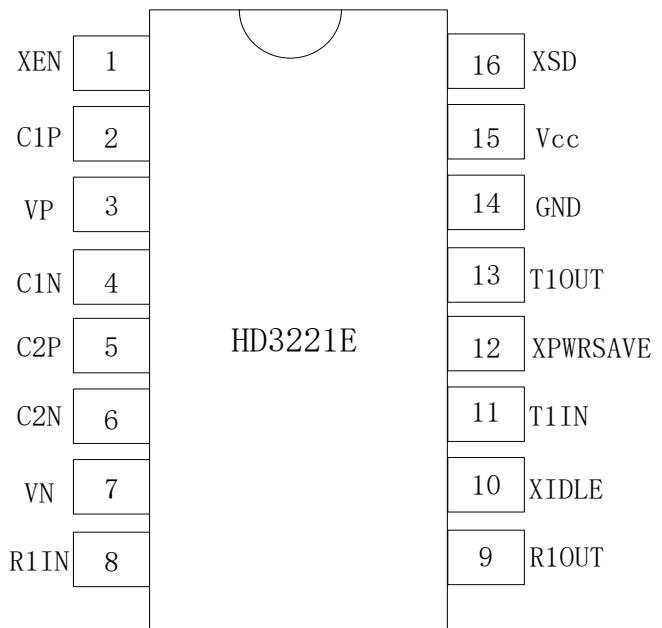
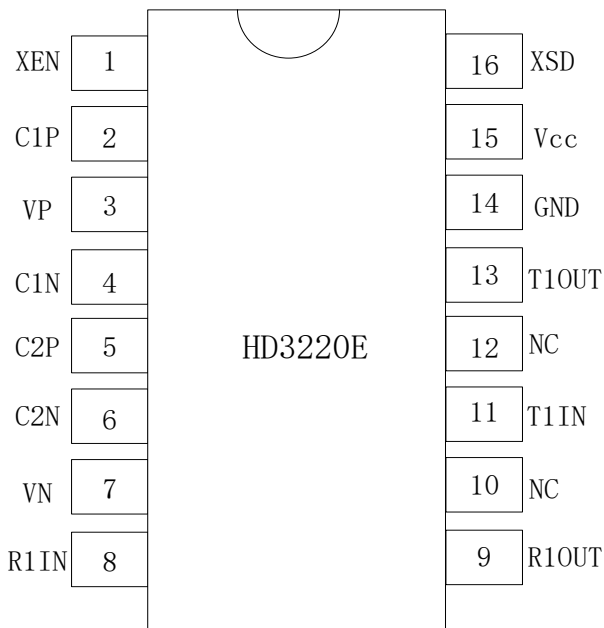
EN61000-4-2 中有两种方法:空气放电和接触放电。空气放电是通过空气将 ESD 电压施加到被测设备,其模拟带电人员在准备将电缆连接到系统后部时,在该人员接触到系统之前,由于身上带有的潜在高能量电势通过电弧放电到系统后面板的过程。接触放电是将 ESD 电流直接施加到 EUT。该方法旨在降低 ESD 电弧的不可预测性。与气隙电弧相比,能量直接传递的放电电流上升时间是恒定的。

我司的 RS232 收发器满足并超过 EN61000-4-2 的最低标准,空气放电为±15kV,接触放电为±8kV。

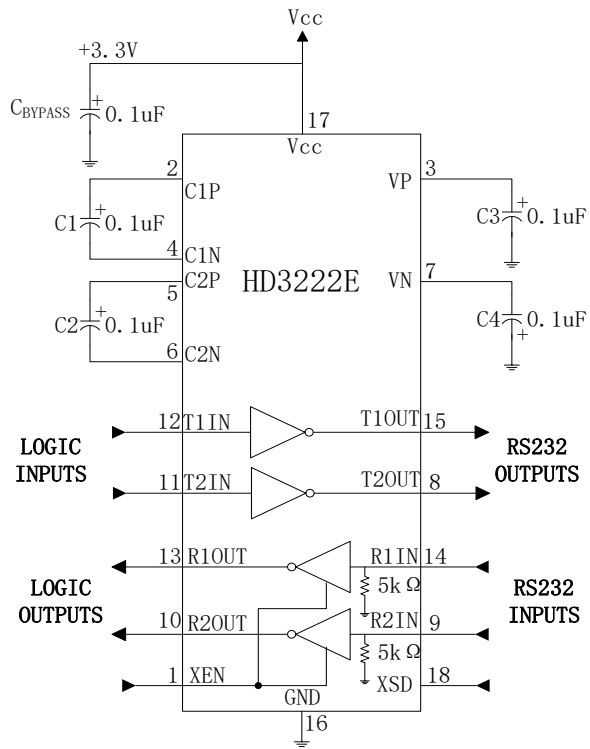
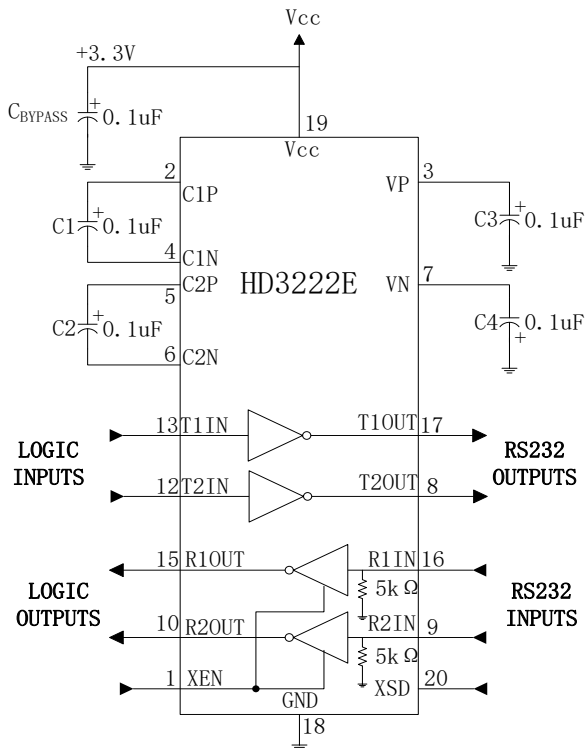
工作状态	XPWRSAVE	XSD	XEN	Signal at RXIN	XIDE	TXOUT	RXOUT
Shutdown	don't care	0	0	present	1	tri-state	active
	don't care	0	0	not present	0	tri-state	active
	don't care	0	1	present	1	tri-state	tri-state
	don't care	0	1	not present	0	tri-state	tri-state
Normal without XPWRSAVE	1	1	0	present	1	active	active
	1	1	0	not present	0	active	active
	1	1	1	present	1	active	tri-state
	1	1	1	not present	0	active	tri-state
Normal with XPWRSAVE	0	1	0	present	1	active	active
	0	1	0	not present	0	tri-state	tri-state
	0	1	1	present	1	active	tri-state
	0	1	1	not present	0	tri-state	tri-state

**Table 1. HD32xxE 真值表**



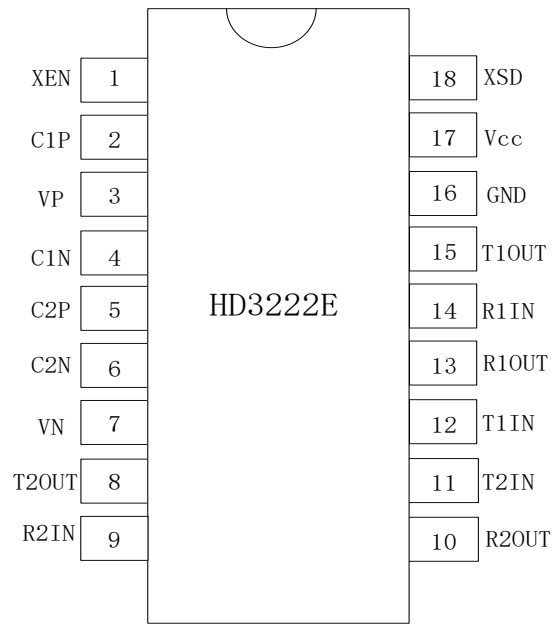
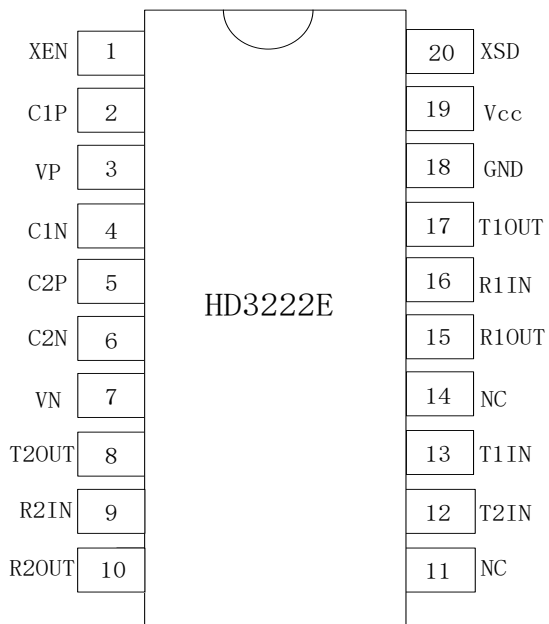
**典型外围电路和引脚图**

**16-pin SSOP/TSSOP/WSOIC**
**16-pin SSOP/TSSOP**


## 典型外围电路和引脚图

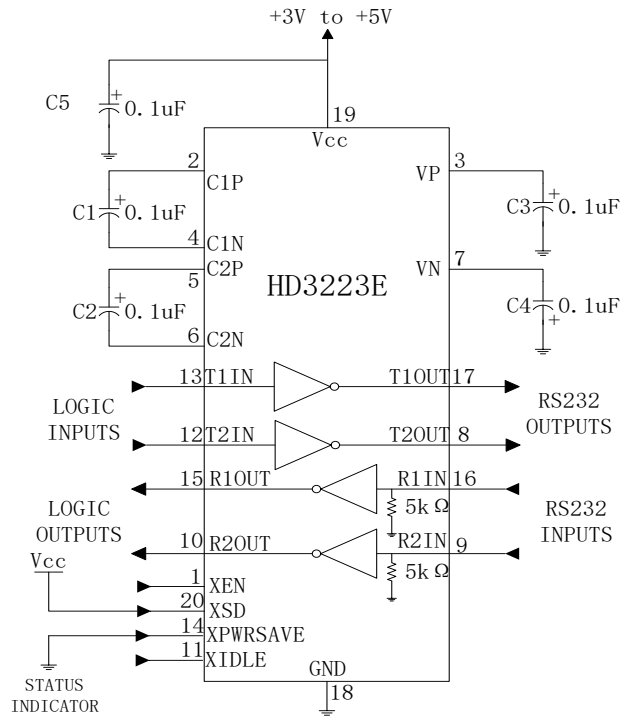
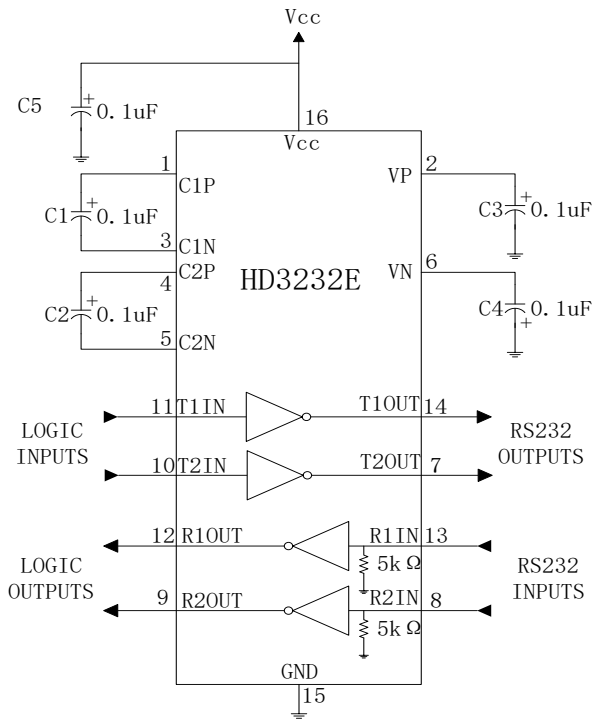


20-pin SSOP/TSSOP

18-pin WSOIC

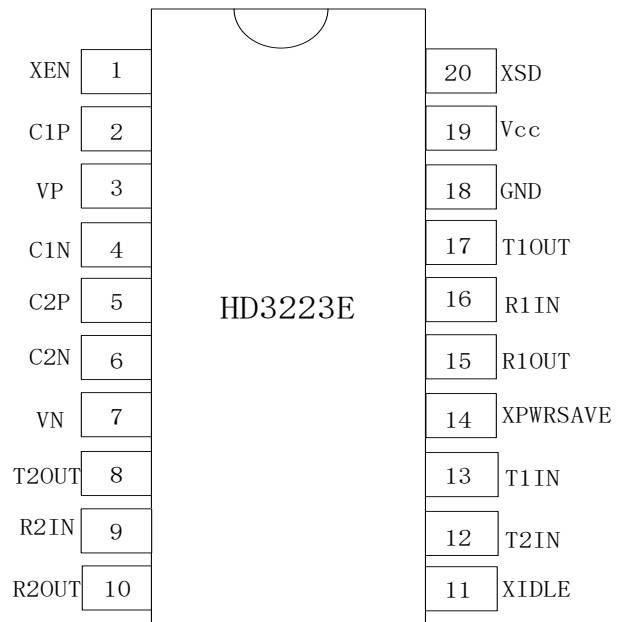
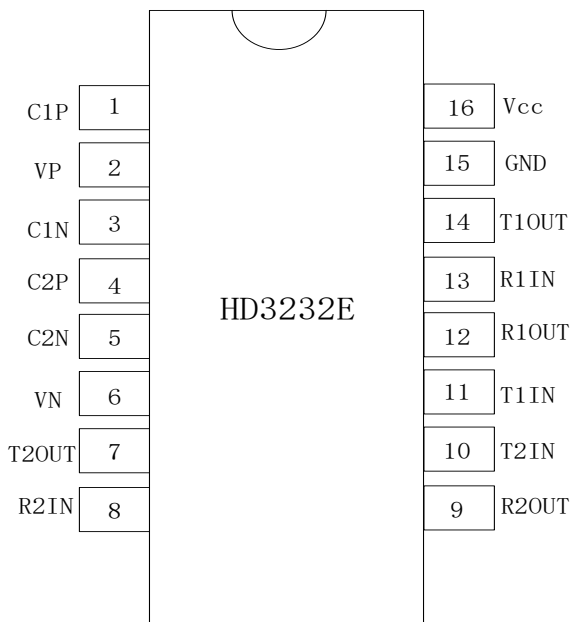


## 典型外围电路和引脚图

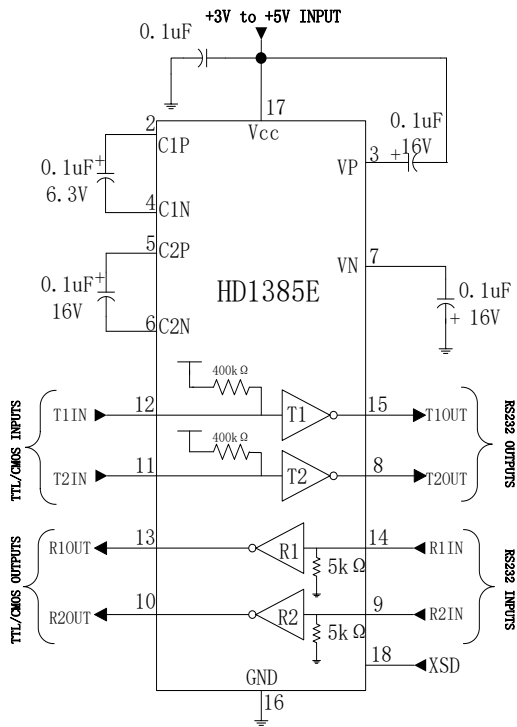


16-pin SSOP/TSSOP/NSOIC/WSOIC

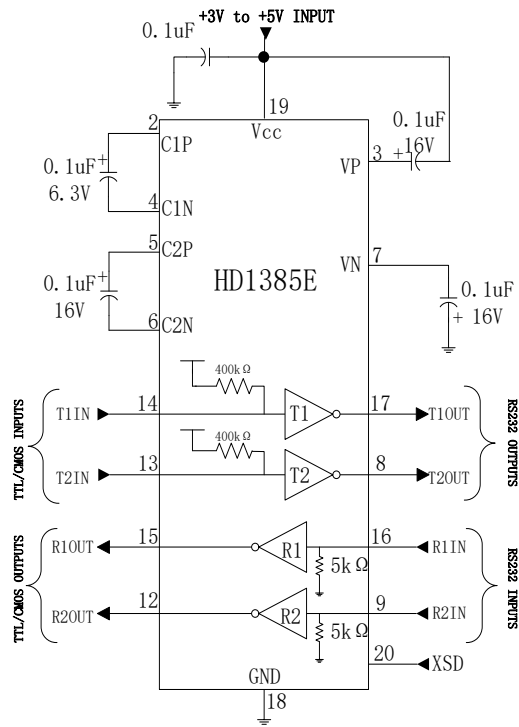
20-pin SSOP/TSSOP



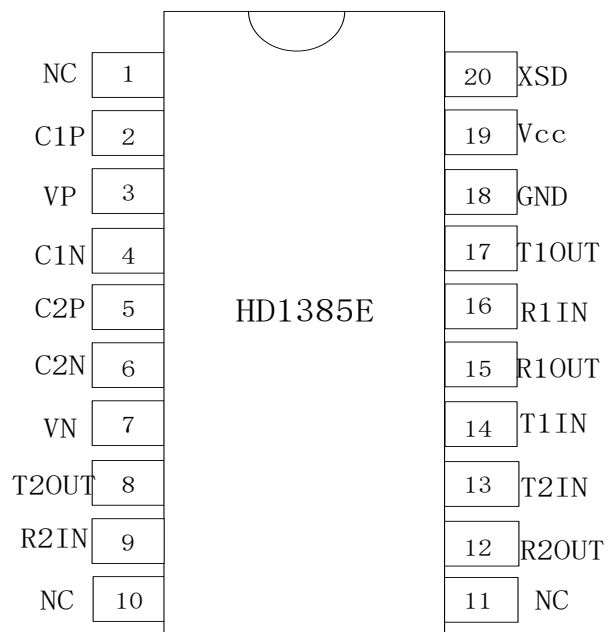
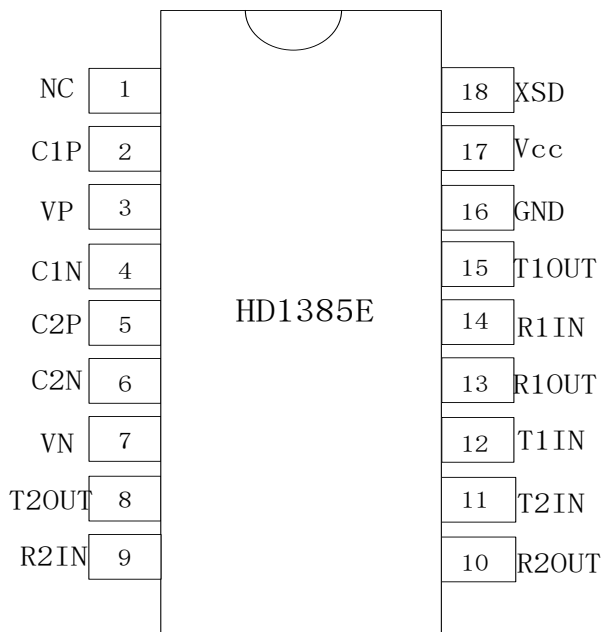
## 典型外围电路和引脚图



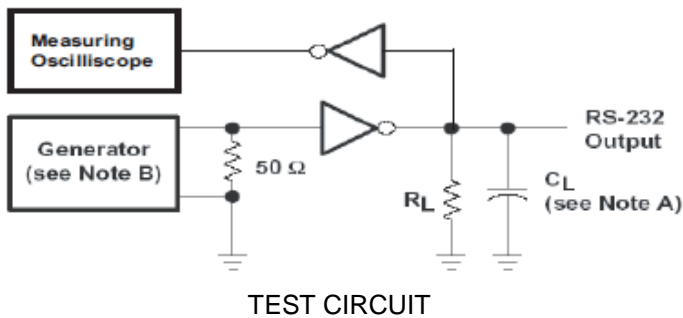
18-pin WS0IC



20-pin SSOP/TSSOP



## 典型测试电路



## 最大速率测试电路

注:

A.  $R_L = 3k\Omega$ ,  $C_L = 1000pF$ ,  $T_A = 25^\circ C$ ,  
一个驱动器工作

B. 波形发生器要求以下参数特性:  
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,  
 $T_r \& T_f \leq 10ns$ .

C.  $XSD = V_{CC}$

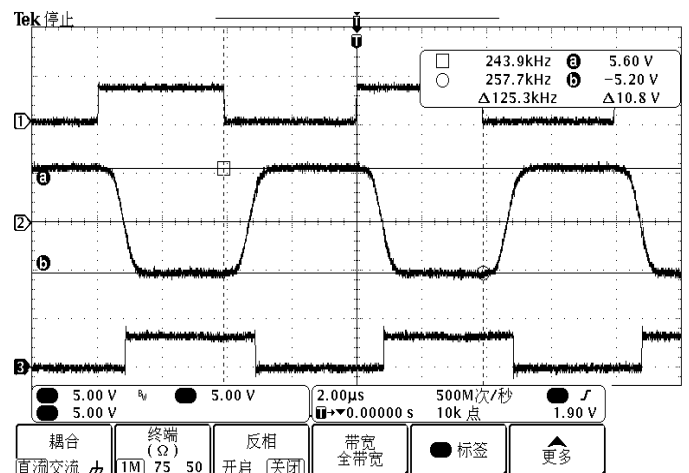
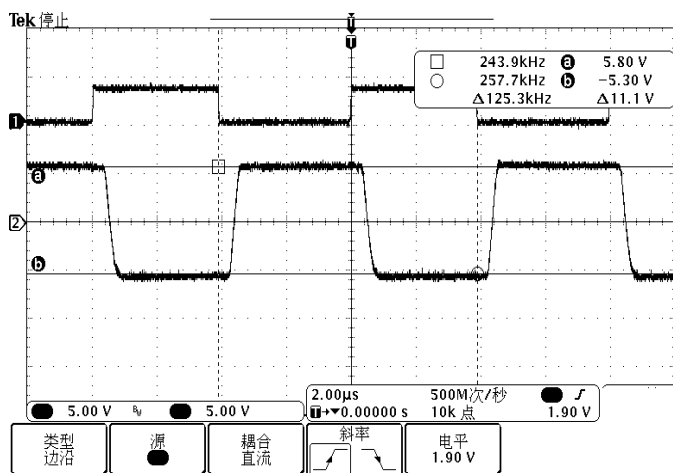


Figure 1. HD32xxE TxIN to TxOut (no load) at 250kbps waveform

Figure 2. HD32xxE TxIN to TxOut to RxOut (loopback to Rx with 1000pF load) at 250kbps waveform

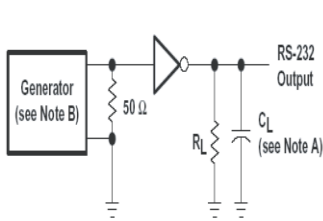
## RS232 信号特性

图1显示了RS232收发器功能，TTL/CMOS信号施加到驱动器输入端如通道1，RS232驱动器输出结果显示在通道2上。此图显示了典型的RS232不加负载驱动器输出，即这是一个RS232开路的输出电压。电荷泵电压转换器有效地转换出驱动器输出所需的电压，使得RS232输出接近理想的5.8V电压。

图2显示了RS232收发器功能，TTL/CMOS信号施加到驱动器输入端如通道1，RS232驱动器输出结果显示在通道2上。当输出负载为 $3k\Omega$ 和 $1000pF$ 时，RS232

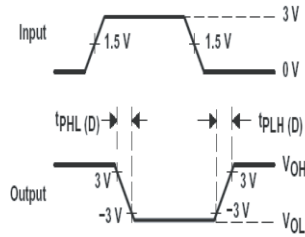
信号如图所示。电阻负载是当驱动器的输出接到接收器的输入时接收器的输入阻抗。通道3是接收器的TTL /CMOS输出。当负载为典型RS232负载时，在传输速率250kbps条件下驱动器的输出电压仅比其开路电压下降0.2V。通道2上的RS-232驱动器输出表现出高速下的信号完整性，这允许接收器在处理信号时最小化斜率和延迟。HD32xxE的低压降驱动电路配合高效稳压器，可提供卓越的线路驱动能力，并具有 $\pm 15kV$  ESD抗冲击能力。

### 典型测试电路



TEST CIRCUIT

$$SR(tr) = \frac{6V}{t_{PHL(D)} \text{ or } t_{PLH(D)}}$$



VOLTAGE WAVEFORMS

#### Driver Transition-Region Slew Rate Test Circuit

Notes:

A.  $R_L = 3k\sim 7k\Omega$ ,  $C_L = 150pF$  to  $1000pF$ ,

One Driver Switching,  $T_A = 25^\circ C$ ,

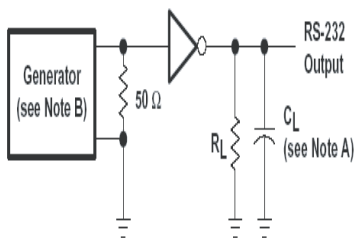
Measured from +3V to -3V or -3V to +3V.

B. The pulse generator had the following characteristics:

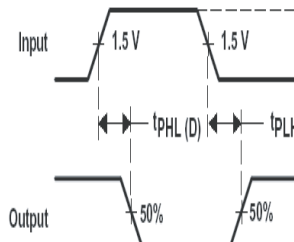
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f < 10ns$ .

C. XSD =  $V_{CC}$  when applicable



TEST CIRCUIT



VOLTAGE WAVEFORMS

#### Driver Propagation ( $t_{PHL}$ & $t_{PLH}$ ) Test Circuit

Notes:

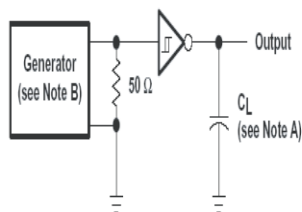
A. All drivers loaded with  $R_L = 3k\Omega$ ,  $C_L = 1000pF$ .

B. The pulse generator had the following characteristics:

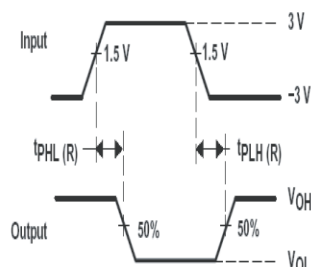
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f < 10ns$ .

C. XSD =  $V_{CC}$  when applicable



TEST CIRCUIT



VOLTAGE WAVEFORMS

#### Receiver Propagation Delay Times Test Circuit

Notes:

A.  $C_L = 150pF$ , including probe and jig capacitance.

B. The pulse generator had the following characteristics:

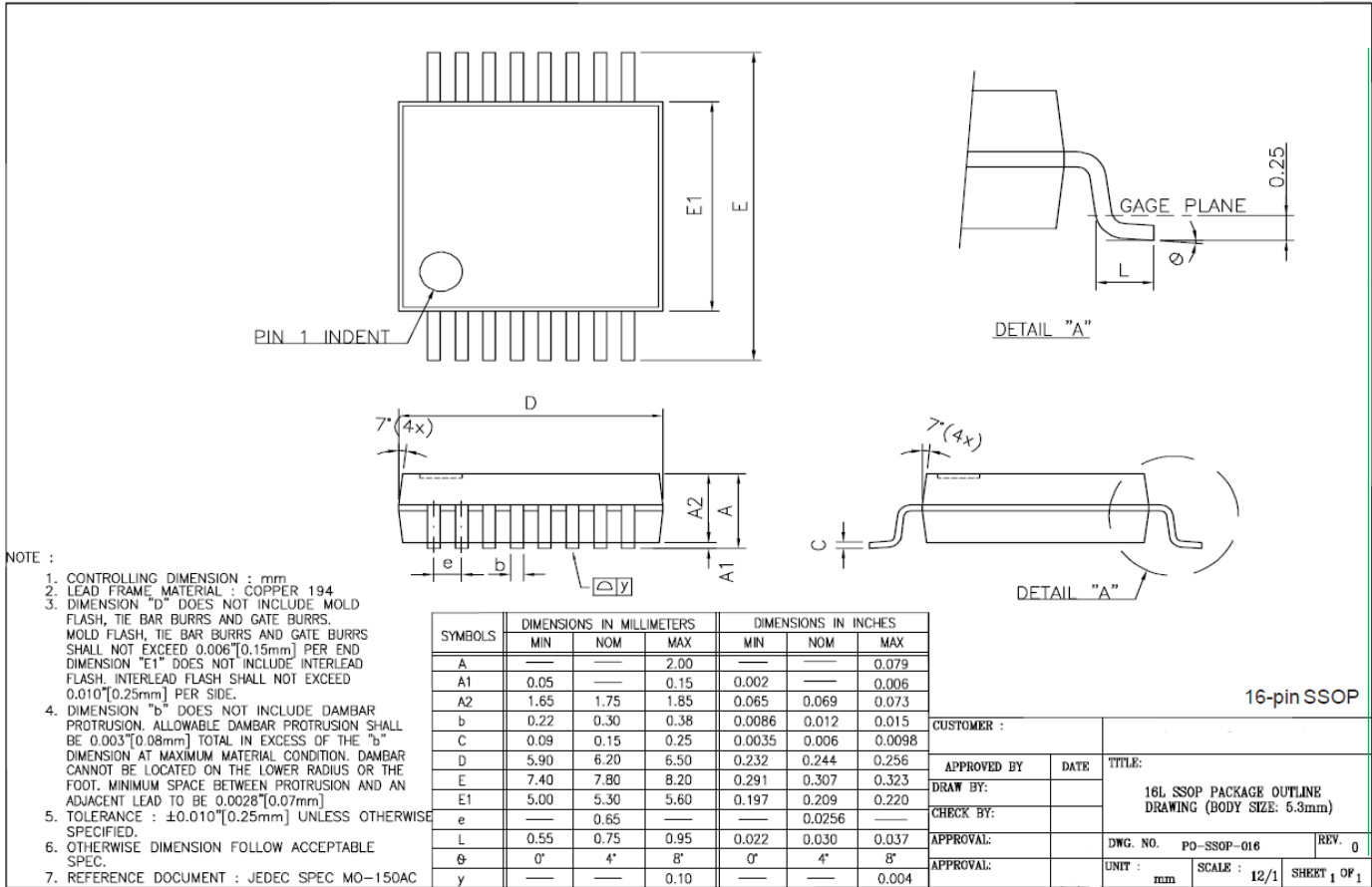
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f < 10ns$ .

C. XSD =  $V_{CC}$  when applicable



## 封装信息



**PIN 1 INDENT**

**DETAIL "A"**

**DETAIL "A"**

**NOTE :**

1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "d" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH, INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MO-150

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	2.00	—	—	0.079
A1	0.05	—	—	0.002	—	—
A2	—	1.75	—	—	0.069	—
b	0.22	0.30	0.38	0.0086	0.012	0.015
c	0.13	0.15	0.20	0.0051	0.006	0.0079
d	7.08	7.20	7.34	0.279	0.284	0.289
E	7.40	7.80	8.20	0.291	0.307	0.323
E1	5.00	5.30	5.60	0.197	0.209	0.220
e	—	0.65	—	—	0.0256	—
L	0.56	0.75	0.97	0.022	0.030	0.037
φ	—	4"	8"	—	4"	8"
y	—	—	0.076	—	—	0.003

**20-pin SSOP**

CUSTOMER :

APPROVED BY: DATE: TITLE: 20L MEDIUM FINE PITCH STANDARD SMALL OUTLINE PACKAGE DRAWING

DRAW BY: CHECK BY: APPROVAL: DWG. NO. PO-SSOP-010 REV. 0

APPROVAL: UNIT: INCH SCALE: 12/1 SHEET 1 OF 1

**PIN 1 INDICATOR Ø0.70 SURFACE POLISHED**

**DETAIL A**

**DETAIL A**

**NOTE :**

1. CONTROLLING DIMENSION : mm
2. LEAD FRAME MATERIAL : 60LN C7025/EFTEC 64T
3. DIMENSION "d" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH, INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MO-153

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.05	1.10	1.20	0.041	0.043	0.047
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	—	1.00	1.05	—	0.039	0.041
b	0.20	0.25	0.28	0.008	0.010	0.011
c	—	0.127	—	—	0.005	—
d	4.90	5.075	5.10	0.193	0.1998	0.200Δ
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.170	0.173	0.177
e	—	0.65	—	—	0.026	—
L	0.50	0.60	0.70	0.020	0.024	0.028
y	—	—	0.076	—	—	0.003
φ	0"	4"	8"	0"	4"	8"

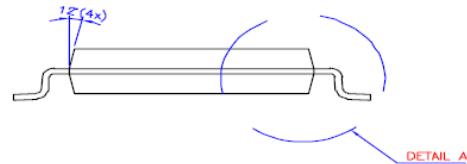
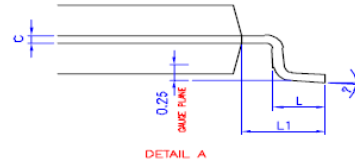
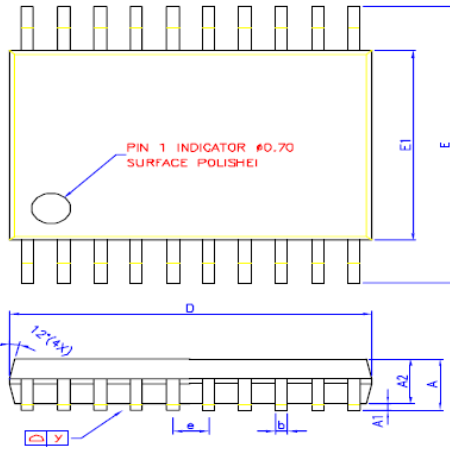
**16-pin TSSOP**

CUSTOMER :

APPROVED BY: DATE: TITLE: 16L TSSOP PACKAGE OUTLINE DRAWING

DRAW BY: CHECK BY: APPROVAL: DWG. NO. PO-TSSOP-002 REV. 1

APPROVAL: UNIT: mm SCALE: 15/1 SHEET 1 OF 1

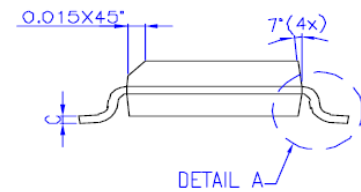
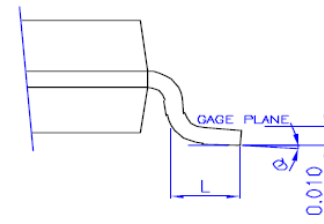
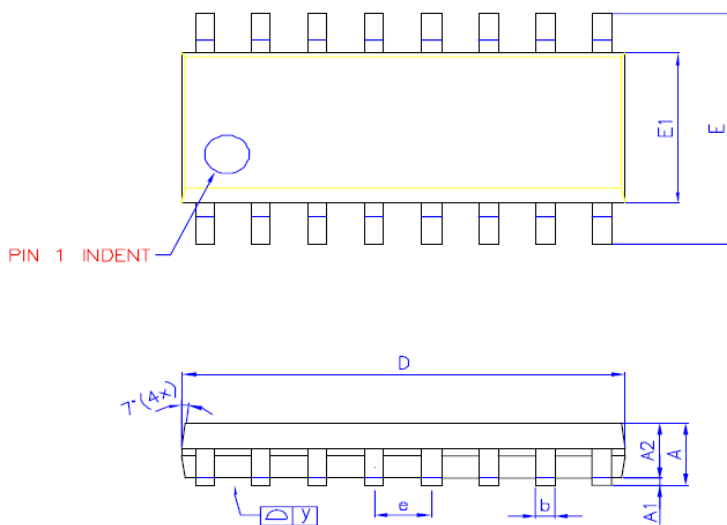


- NOTE :
1. CONTROLLING DIMENSION : mm
  2. LEAD FRAME MATERIAL : OLIN C7025/EFTEC 64T
  3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
  4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
  5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
  6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
  7. REFERENCE DOCUMENT : JEDEC SPEC MO-153

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.20	—	—	0.047
A1	0.05	—	0.15	0.002	—	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	—	0.30	0.007	—	0.012
C	0.09	—	0.20	0.0035	—	0.008
D	6.40	6.50	6.60	0.252	0.258	0.260
E	—	6.40	—	—	0.252	—
E1	4.30	4.40	4.50	0.170	0.173	0.177
e	—	0.65	—	—	0.026	—
L	0.45	0.60	0.75	0.0177	0.024	0.0295
L1	—	1.00	—	—	0.039	—
y	—	—	0.076	—	—	0.003
ø'	0'	—	ø'	0'	—	ø'

20-pin TSSOP

CUSTOMER :		TITLE:	
APPROVED BY:	DATE:	20L TSSOP PACKAGE OUTLINE DRAWING (4.4mm)	
DRAW BY:		DWG. NO.	PO-TSSOP-008
CHECK BY:		REV.	0
APPROVAL:		UNIT :	mm
APPROVAL:		SCALE :	1:1
		SHEET :	1 OF 1



- NOTE :
1. CONTROLLING DIMENSION : INCH
  2. LEAD FRAME MATERIAL : COPPER 194
  3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.005"[0.15mm] PER END. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
  4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
  5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED
  6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
  7. REFERENCE DOCUMENT : JEDEC SPEC MS-012

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	—	0.25	0.004	—	0.010
A2	—	1.45	—	—	0.057	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.0098
D	9.80	9.91	10.01	0.386	0.390	0.394
E	5.79	5.99	6.20	0.228	0.236	0.244
E1	3.81	3.91	3.99	0.150	0.154	0.157
e	—	1.27	—	—	0.050	—
L	0.38	0.71	1.27	0.015	0.028	0.050
y	—	—	0.076	—	—	0.003
ø	0'	—	ø'	0'	—	ø'

16-pin SOIC

CUSTOMER :		TITLE:	
APPROVED BY:	DATE:	16L SMALL OUTLINE PACKAGE DRAWING(0.150")	
DRAW BY:		DWG. NO.	PO-SOP-003
CHECK BY:		REV.	0
APPROVAL:		UNIT :	INCH
APPROVAL:		SCALE :	12/1
		SHEET :	1 OF 1

**NOTE :**

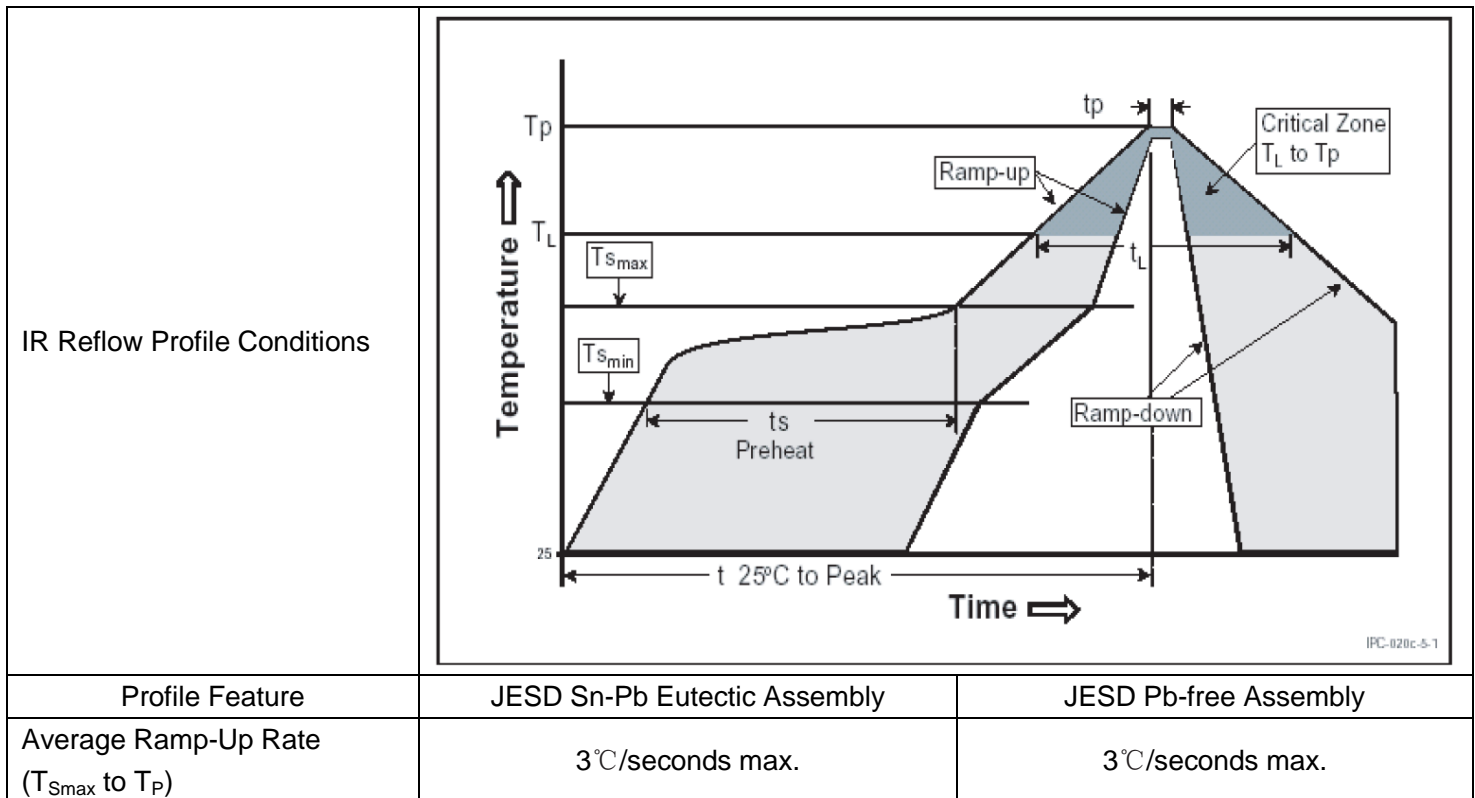
1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, THE BAR BURRS AND GATE BURRS. MOLD FLASH, THE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH, INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-013

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	2.36	2.49	2.64	0.093	0.098	0.104
A1	0.10	—	0.30	0.004	—	0.012
A2	—	2.31	—	—	0.091	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.18	0.23	0.28	0.007	0.009	0.011
D	10.08	10.31	10.49	0.397	0.406	0.413
E	10.01	10.31	10.64	0.394	0.406	0.419
E1	7.39	7.49	7.59	0.291	0.295	0.299
e	—	1.27	—	—	0.050	—
L	0.38	0.81	1.27	0.015	0.032	0.050
Y	—	—	0.076	—	—	0.003
Ø	0"	—	8"	0"	—	8"

**16-pin wSOIC**

CUSTOMER :		TITLE:	
APPROVED BY:	DATE:	16L WIDE BODY SMALL OUTLINE PACKAGE DRAWING	
DRAW BY:		DWG. NO.:	PO-SOP-004
CHECK BY:		SCALE:	8/1
APPROVAL:		REV:	0
APPROVAL:		UNIT:	INCH
		SHEET:	1 OF 1

## GREEN Package SMD IR Reflow Profile Information





Pre-heat - Temperature Min ( $T_{Smin}$ ) - Temperature Max ( $T_{Smax}$ ) - Time ( $T_{Smin}$ to $t_{Smax}$ )	100°C 150°C 60~120 seconds	150°C 200°C 60~180 seconds
Time maintained above: - Temperature ( $T_L$ ) - Time ( $t_L$ )	183°C 60~150 seconds	217°C 60~150 seconds
Peak/Classification Temperature ( $T_P$ )	235°C+5/-0°C	255°C+5/-0°C
Time within 5°C of actual Peak Temperature ( $t_P$ )	10~30 seconds	20~40 seconds
Ramp-Down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

HD32xxE GREEN Packages are Pb-free and RoHS compliance.

### 订购信息

Part Number	Temperature Range	Package Type	Green Package
HD3220ECA	-40°C to +85°C	16-pin SSOP	HD3220ECA
HD3220ECT	-40°C to +85°C	16-pin WSOIC	HD3220ECT
HD3220ECY	-40°C to +85°C	16-pin TSSOP	HD3220ECY
HD3221ECA	-40°C to +85°C	16-pin SSOP	HD3221ECA
HD3221ECY	-40°C to +85°C	16-pin TSSOP	HD3221ECY
HD3222ECA	-40°C to +85°C	20-pin SSOP	HD3222ECA
HD3222ECT	-40°C to +85°C	18-pin WSOIC	HD3222ECT
HD3222ECY	-40°C to +85°C	20-pin TSSOP	HD3222ECY
HD3223ECA	-40°C to +85°C	20-pin SSOP	HD3223ECA
HD3223ECY	-40°C to +85°C	20-pin TSSOP	HD3223ECY
HD3232ECA	-40°C to +85°C	16-pin SSOP	HD3232ECA
HD3232ECN	-40°C to +85°C	16-pin nSOIC	HD3232ECN
HD3232ECT	-40°C to +85°C	16-pin WSOIC	HD3232ECT
HD3232ECY	-40°C to +85°C	16-pin TSSOP	HD3232ECY
HD1385ECA	-40°C to +85°C	20-pin SSOP	HD1385ECA
HD1385ECT	-40°C to +85°C	18-pin WSOIC	HD1385ECT

Please contact the factory for pricing, availability on Tape-and-Reel, and Green Package options.