



钲地半导体
Tudi Semiconductor

Product Specification

TUDI-ICL3232E

±15kV ESD Protected, +3V to +5.5V, 1μA, 250kbps,
RS-232 Transmitters/Receivers

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**semiconductor device
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- Design
- research and development
- production
- and sales



Features

- ESD protection for RS-232 I/O pins to $\pm 15\text{kV}$ (IEC61000)
- The ICL3232E is a low-power upgrade for the pin-compatible competitor devices
- RS-232 compatible with $V_{CC} = 2.7\text{V}$
- Meets EIA/TIA-232 and V.28/V.24 specifications at 3V
- Latch-up free
- On-chip voltage converters require only four external $0.1\mu\text{F}$ capacitors at $V_{CC} = 3.3\text{V}$
- Manual and automatic power-down features
- Receiver hysteresis for improved noise immunity
- Ensured minimum data rate: 250kbps
- Wide power supply range: single +3V to +5.5V
- Low supply current in power-down state: $1\mu\text{A}$
- Pb-free (RoHS compliant)

Description

The ICL3232E is 3.0V to 5.5V powered RS-232 transmitters/receivers that meet EIA/TIA-232 and V.28/V.24 specifications, even at $V_{CC} = 3.0\text{V}$.

Additionally, they provide $\pm 15\text{kV}$ ESD protection (IEC61000-4-2 Air Gap and Human Body Model) on transmitter outputs and receiver inputs (RS-232 pins). Targeted applications are notebook and laptop computers in which the low operational power consumption and even lower standby power consumption is critical.

Small footprint packaging and the use of small, low value capacitors ensure board space savings. Data rates is 250kbps. This family is fully compatible with 3.3V-only systems, mixed 3.3V and 5.0V systems, and 5.0V-only systems.

Applications

- Any system requiring RS-232 communication ports
- Battery powered, hand-held, and portable equipment
- Laptop computers, Notebooks
- Modems, printers, and other peripherals
- Digital cameras
- Cellular/mobile phones

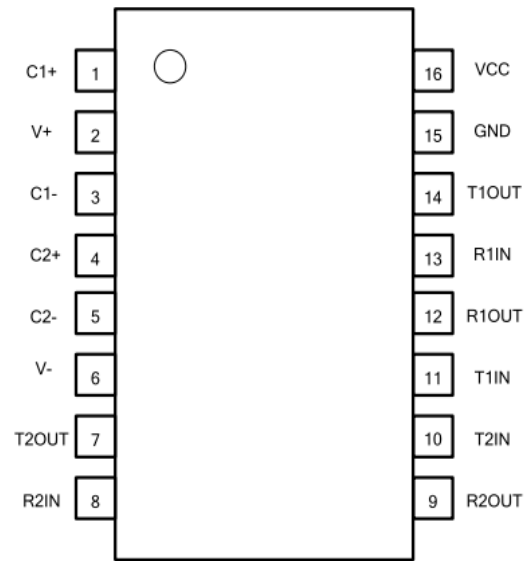


Figure 1. Pin Diagram



Pin description

PIN	SYMBOL	DESCRIPTION
1	C1+	Positive Terminal for the first Charge Pump Capacitor
2	V+	Doubled Voltage Terminal
3	C1-	Negative Terminal for the first Charge Pump Capacitor
4	C2+	Positive Terminal for the second Charge Pump Capacitor
5	C2-	Negative Terminal for the second Charge Pump Capacitor
6	V-	Inverted Voltage Terminal
7	T2OUT	Second Transmitter Output Voltage
8	R2IN	Second Receiver Input Voltage
9	R2OUT	Second Receiver Output Voltage
10	T2IN	Second Transmitter Input Voltage
11	T1IN	First Transmitter Input Voltage
12	R1OUT	First Receiver Output Voltage
13	R1IN	First Receiver Input Voltage
14	T1OUT	First Transmitter Output Voltage
15	GND	Ground
16	VCC	Supply Voltage



Parameter limit

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	VCC	-0.3~+6	V
Doubled Voltage Terminal	V+	VCC-0.3~+7	V
Inverted Voltage Terminal	V-	+0.3~-7	V
$V_{++} V_{-I}$		+13	V
Transmitter Input Voltage Range	T1IN,T2IN	-0.3~+6	V
Receiver Input Voltage Range	R1IN,R2IN	± 25	V
Transmitter Output Voltage Range	T1OUT,T2OUT	± 13.2	V
Receiver Output Voltage Range	R1OUT,R2OUT	-0.3~VCC+0.3	V
Operating Temperature		-40~85	°C
Storage Temperature		-60~150	°C
Soldering Temperature		300	°C
Continuous Power	SOP16	760	mW
	DIP16	840	mW

The maximum limit parameters means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

Logic Input Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Logic Control Low Level	VTTIN_L	T1IN,T2IN			0.8	V
Logic Control High Level	VTTINH	T1IN,T2IN	2			V
Logic Control Hysteresis		T1IN,T2IN		0.3		V
Input Logic Current	ITIN	T1IN,T2IN			± 1	μA

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μF)



Receiver Output Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Output Logic-Low Voltage	VROL	IOUT=1.6mA, VCC=5V or 3.3V			0.4	V
Receiver Output Logic-High Voltage	VROH	IOUT=-0.5mA, VCC=5V or 3.3V	VCC-0.6	VCC-0.1		V

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μ F)

Receiver Input Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Input Range	VRIN		-25		+25	V
Receiver Input Low Threshold	VRL	VCC=3.3V	0.6	1.1		V
		VCC=5V	0.8	1.5		V
Receiver Input High Threshold	VRIH	VCC=3.3V		1.5	2.4	V
		VCC=5V		1.9	2.4	V
Receiver Input Hysteresis				0.4		V
Receiver Input Impedance	RRIN		3	5	7	k Ω

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μ F)

Transmitter Output Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Transmitter Output Swing	VTOUT	All output ports of transmitter connect 3k Ω load to ground	± 4		± 5	V
Transmitter Output Impedance	RTOUT	VCC=0V, Transmitter Input= ± 2 V	300			Ω
Transmitter Short-Circuit Current	Itsc				60	mA

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μ F)



Supply Current

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current with no Load	I _{sup}			2		mA

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μ F)

ESD Protection

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
R1IN、R2IN T1OUT、T2OUT		HBM		±15		KV
		Air Discharge		±15		KV
		Contact Discharge		±8		KV

Switching Characteristics Parameter

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Rate	Speed	RL=3kΩ, CL=1000pF		120		kbps
Receiver Propagation delay	tRPHL	CL=150pF		300		ns
	tRPLH			300		ns
tRPHL-tRPLH				150		ns
tTPHL-tTPLH				150		ns
Transmitter Slew Rate	SR	RL=3kΩ~7kΩ, CL=150pF~1000pF from-3.0V~3.0V or from3.0V~-3.0V See figures 2 and 3	4		30	V/μs

(If there is no additional explanation,typical value is tested when VCC=+3.3V,Temp=25 ,C1-C4=1 μ F)



TEST CIRCUIT

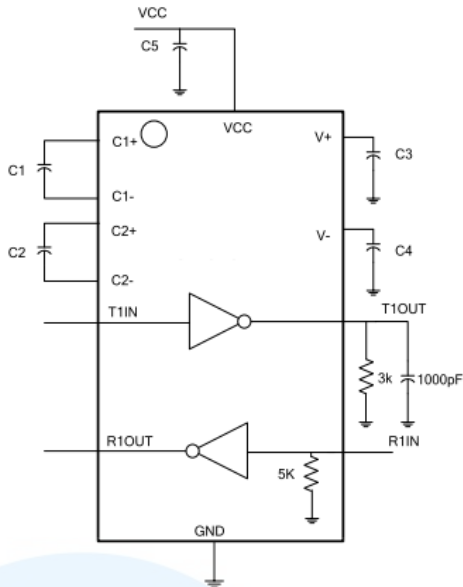


Figure 2 minimum swing rate test circuit

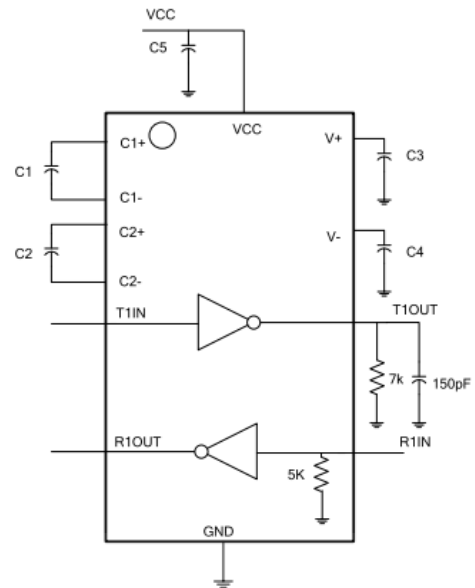


Figure 3 maximum swing rate test circuit

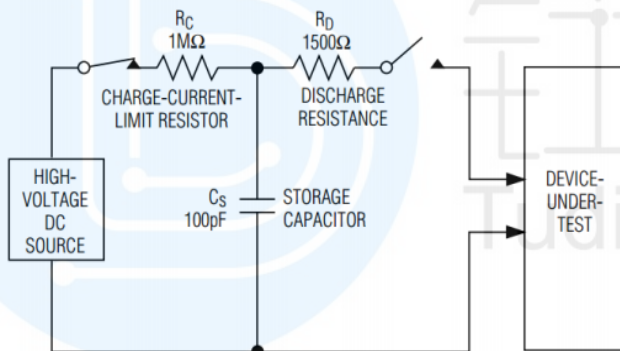


Figure 4 ESD test model of human body mode

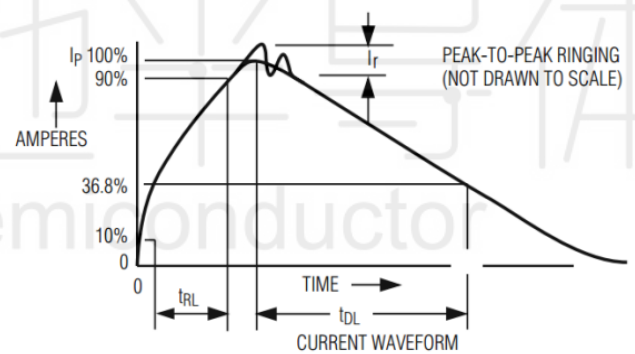


Figure 5 human body mode current waveform

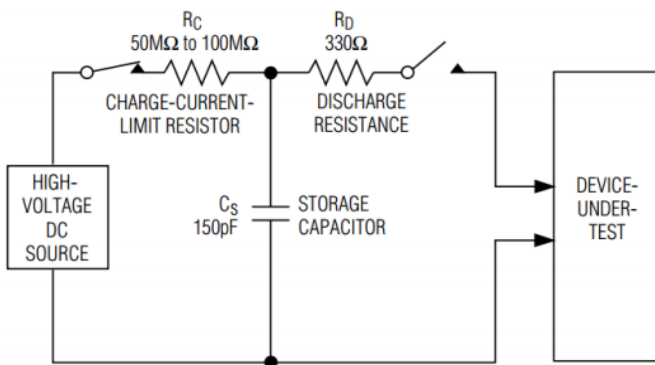


Figure 6 ESD test model of IEC 1000-4-2

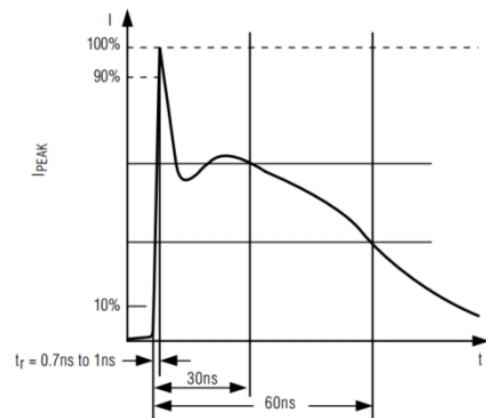


Figure 7 current waveform of IEC 1000-4-2 ESD



Description

RS232 Receiver
The 3232E has two separate receivers that convert the RS-232 signal to the CMOS logic output level.
ESD Protection
All pins of 3232E adopt ESD protection structure, and all driver outputs and receiver inputs have additional electrostatic protection capability. It can withstand $\pm 15\text{kV}$ ESD (HBM) discharge, contact discharge above $\pm 8\text{kV}$ and air gap discharge above $\pm 15\text{kV}$. The ESD protection structure can withstand the impact of high voltage ESD under all conditions, including standard working mode and power-off mode.
Typical Application
Typical dual-Path application scenarios are shown in Figure 8, where the C1-C5 typical capacitance value is $0.1\mu\text{F}$.
Dual Charge-Pump Operation
3232E has a two-way charge pump inside to support the chip's voltage conversion work. Dual-electric pump provides $+5.5\text{V}$ and -5.5V output voltage in the range of $3.0\text{--}5.5\text{V}$. Each charge pump requires a capacitor (C1, C2) and an energy storage capacitor (C3, C4) to generate $V+$ and $V-$ power supplies, as shown in Fig 8.
RS232 Transmitter
Convert the TTL/CMOS logic voltage to a voltage compatible with the EIA/TIA-232 standard. 3232E Transmitter can guarantee 250kbps data rate under the worst operating conditions (Parallel load of $3\text{k}\Omega$ resistor and 1000pF capacitor). Transmitter can drive multiple receivers in parallel. There is no pull-up resistance inside the input terminals T1IN and T2IN of 3232E transmitter. If the transmitter is not used, the unused input terminals T1IN and T2IN can be connected to GND or VCC.

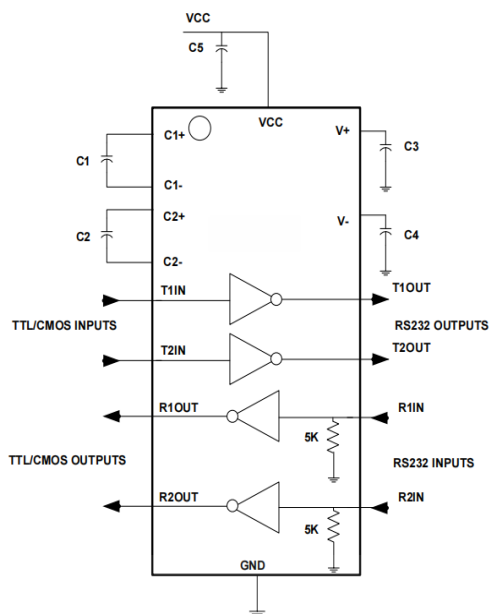


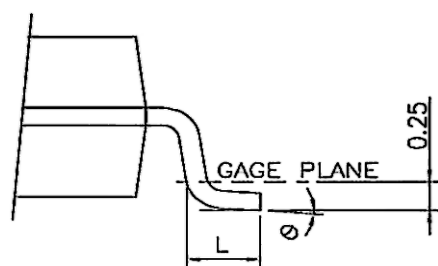
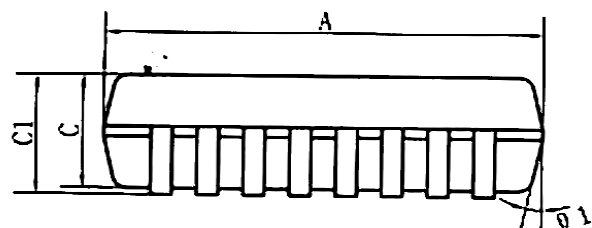
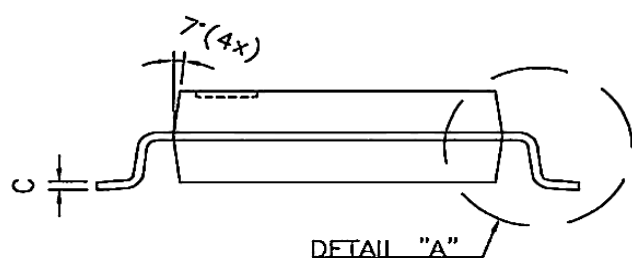
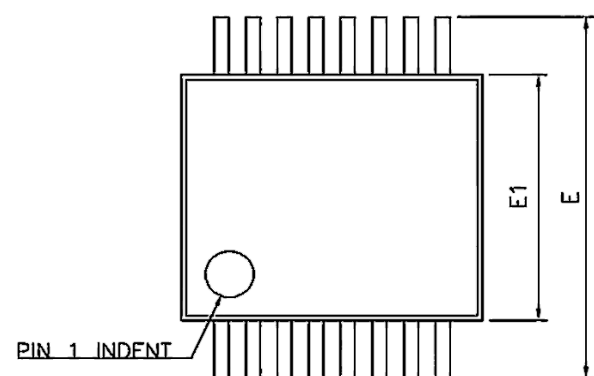
Figure 8 Typical dual-Path application scenarios

Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
ICL3232ECAZ-T-TUDI	SSOP16	Tape,Reel,2000	3232ECAZ	0°C to 70°C
ICL3232ECBZ-T-TUDI	SMD16	Tape,Reel,1000	3232ECBZ	
ICL3232ECBNZ-T-TUDI	SOP16	Tape,Reel,2500	3232ECBNZ	
ICL3232ECV-16Z-T-TUDI	TSSOP16	Tape,Reel,2500	3232ECV-16Z	
ICL3232EIAZ-T-TUDI	SSOP16	Tape,Reel,2000	3232EIAZ	- 40°C to 85°C
ICL3232EIBZ-T-TUDI	SMD16	Tape,Reel,1000	3232EIBZ	
ICL3232EIBNZ-T-TUDI	SOP16	Tape,Reel,2500	3232EIBNZ	
ICL3232EIV-16Z-T-TUDI	TSSOP16	Tape,Reel,2500	3232EIV-16Z	



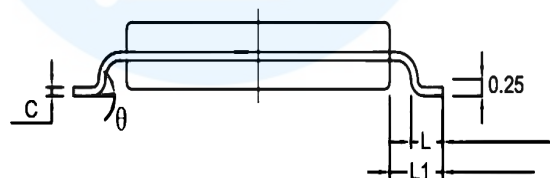
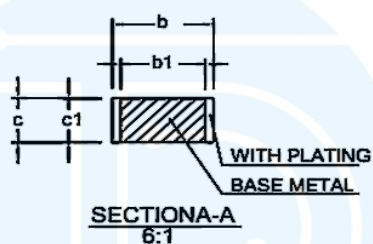
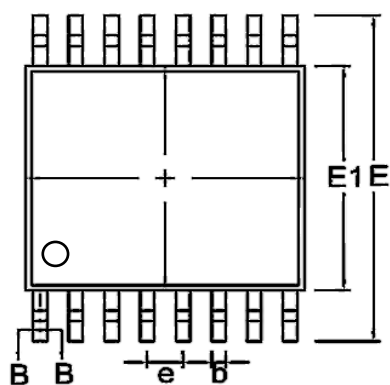
Package SSOP16



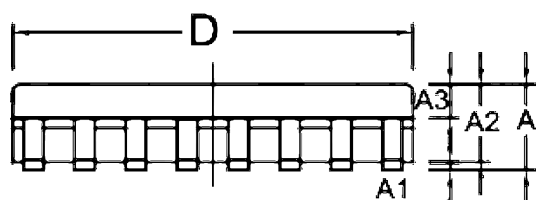
DETAIL "A"

SIZE SYMBOL	MIN/mm	MAX/mm
A	6.15	6.25
A1	0.30TYP	
A2	0.65TYP	
A3	0.675TYP	
B	5.25	5.35
B1	7.65	7.95
B2	0.60	0.80
C	1.70	1.80
C1	1.75	1.95
C2	0.799	
C3	0.152	
C4	0.172	
H	0.05	0.15
θ	12°TYP4	
01	12°TYP4	
02	10°TYP	
03	0°~8°	
R	0.20°TYP	
R	0.15°TYP	

Package TSSOP16

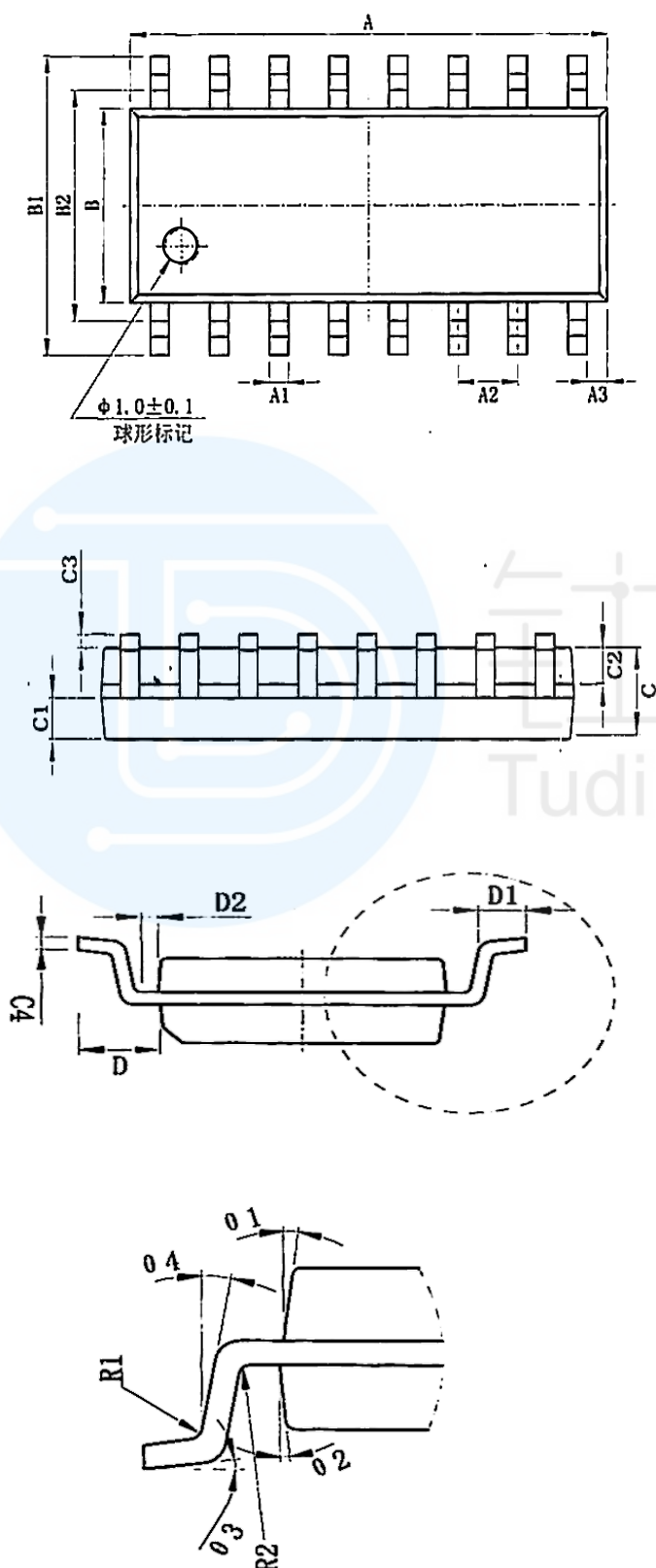


SIZE SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	--	--	1.20
A1	0.05		0.15
A2	0.90	1.00	1.05
b	0.20	--	0.30
b1	0.19	0.22	0.25
C	0.110	0.127	0.145
cl	0.12	0.13	0.14
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00BSC		
	0°	--	8°





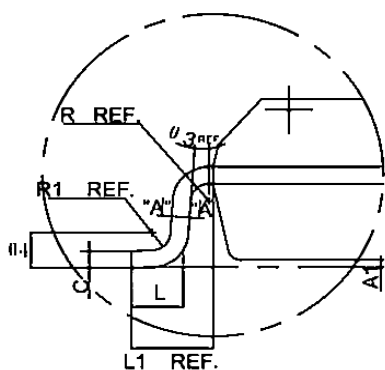
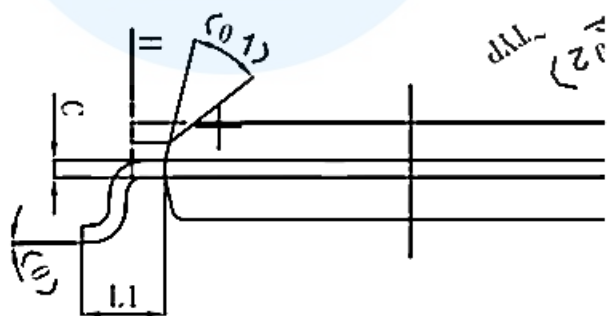
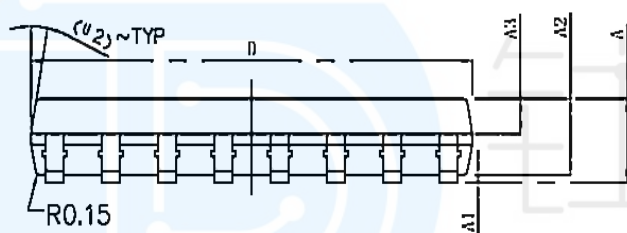
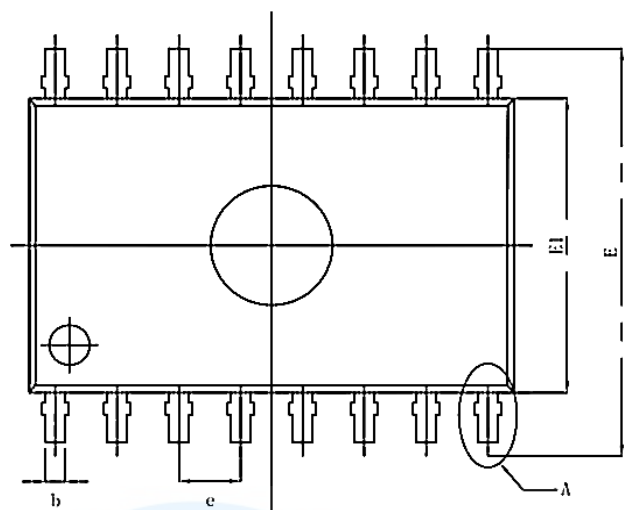
Package SOP16



SIZE SYMBOL	MIN./mm	MAX./mm
A	9.80	10.00
A1	0.356	0.456
A2	1.27TYP	
A3	0.302TYP	
B	3.85	3.95
B1	5.84	6.24
B2	5.00 TYP	
C	1.40	1.60
C1	0.61	0.71
C2	0.54	0.64
C3	0.05	0.25
C4	0.203	0.233
D	1.05 TYP	
D1	0.40	0.70
D2	0.15	0.25
R1	0.20TYP	
R2	0.20TYP	
01	8°~12°TYP4	
02	8°~12°TYP4	
03	0°~8°	
04	4°~12°	



Package SMD16



SIZE SYMBOL	MIN./mm	MAX./mm
A	—	2.65
A1	0.10	0.30
A2	2.25	2.35
A3	0.97	1.07
D	10.10	10.50
E	10.26	10.60
E1	7.30	7.70
e	1.27BSC	
L	0.55	0.85
L1	1.4BSC	
H	0.345	0.365
R	0.20TYP	
R1	0.30TYP	
θ	0°	8°
θ 1	45° TYP	
02	12° TYP	
03	0°	8°
04	0°	10°



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