



钲地半导体  
Tudi Semiconductor

## Product Specification

TUDI-TRS3232E

3V to 5.5V multi-channel RS-232 line drivers and  
receivers with  $\pm 15\text{kV}$  IEC ESD

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## Features

- ESD protection for RS-232 bus pins
  - $\pm 15\text{kV}$  HBM
  - $\pm 8\text{kV}$  (IEC6000-4-2, contact discharge)
  - $\pm 15\text{kV}$  (IEC61000-4-2, air gap discharge)
- Meets or exceeds requirements of TIA/EIA-232-F and ITU V.28 standards
- Powered by 3V to 5.5 VCC power supply
  - Operates with RS-232 as low as 2.7V VCC
- Operating speed up to 250kbps? Two drivers and two receivers
- Low power current
- External capacitors:  $4 \times 0.1\mu\text{F}$
- Supports 5V logic inputs ( powered by 3.3V)

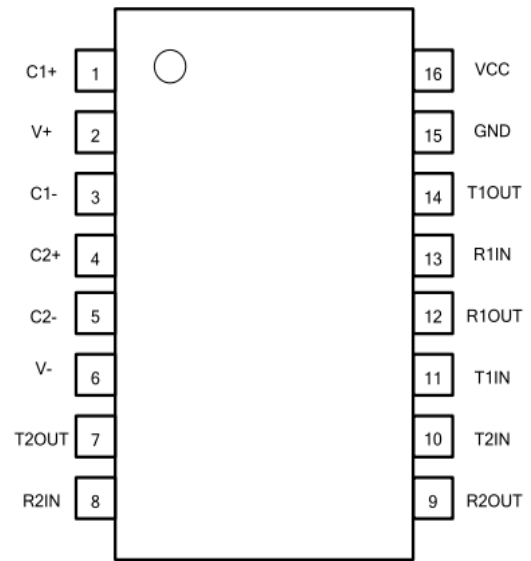


Figure 1. Pin Diagram

## Description

The TRS3232E device is composed of two line drivers, two line receivers, and a dual charge pump circuit with pin-topin (serial port connection pins, including GND)  $\pm 15\text{kV}$  IEC ESD protection. This device meets the requirements of TIA/EIA-232F and provides an electrical interface between asynchronous communication controllers and serial port connectors. The charge pump and four small external capacitors support operation from a single 3V to .5V power supply. These devices operate with data signal transmission rates up to 250kbps and driver output slew rates up to  $30\text{V}/\mu\text{s}$ .

## Applications

- Industrial PC
- Wired network
- Data center and enterprise-level computing
- Battery-powered system
- Notebook
- Portable computer
- PDA
- Handheld device



## 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- $		+13	V
Transmitter Input Voltage Range	T1IN,T2IN	-0.3~+6	V
Receiver Input Voltage Range	R1IN,R2IN	$\pm 25$	V
Transmitter Output Voltage Range	T1OUT,T2OUT	$\pm 13.2$	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			$\pm 1$	$\mu A$

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





## Receiver Output Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Output Logic-Low Voltage	VROL	IO <sub>UT</sub> =1.6mA, VCC=5V or 3.3V			0.4	V
Receiver Output Logic-High Voltage	VROH	IO <sub>UT</sub> =-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=1μF )

## 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	kΩ

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

## Transmitter Output Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Transmitter Output Swing	VTOUT	All output ports of transmitter connect 3kΩload to ground	±4		±5	V
Transmitter Output Impedance	RTOUT	VCC=0V, Transmitter Input=±2V	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=1μF )



## Supply Current

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current with no Load	I <sub>sup</sub>			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

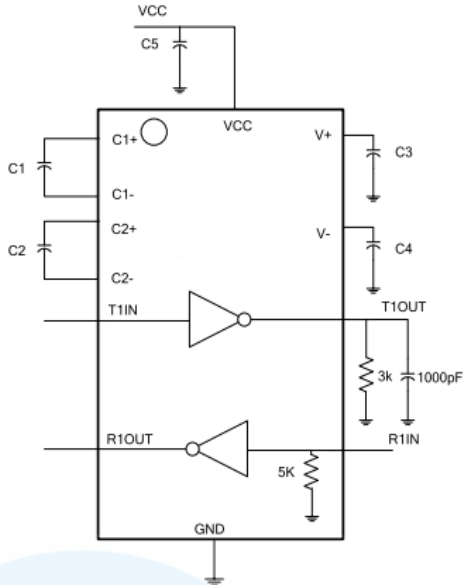


Figure 2 minimum swing rate test circuit

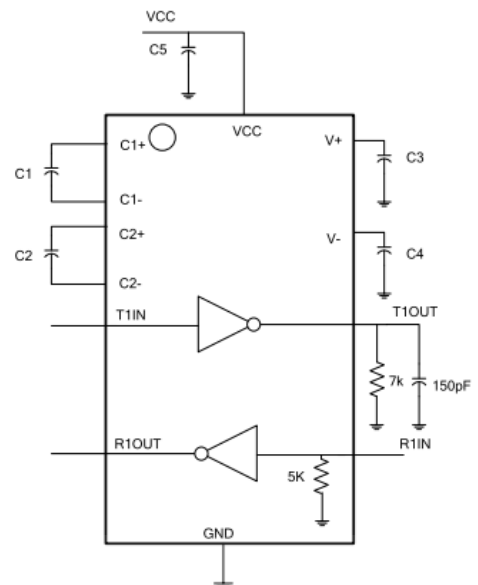


Figure 3 maximum swing rate test circuit

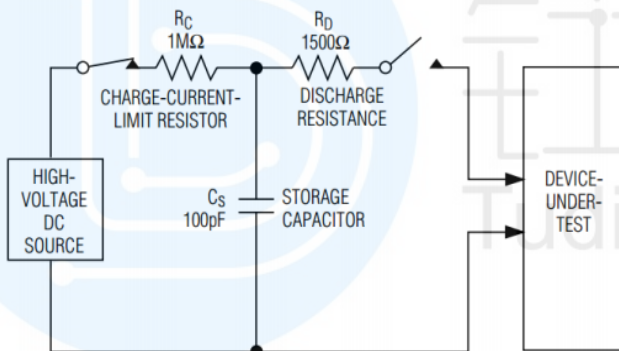


Figure 4 ESD test model of human body mode

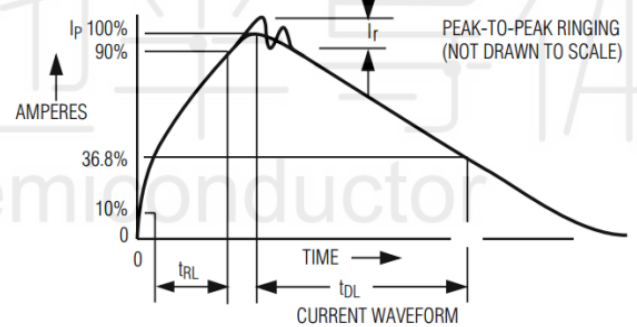


Figure 5 human body mode current waveform

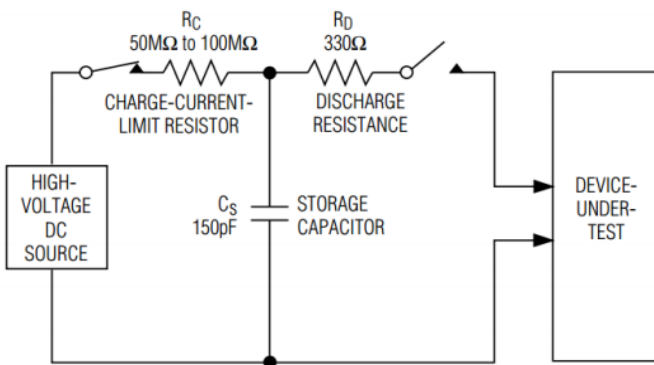


Figure 6 ESD test model of IEC 1000-4-2

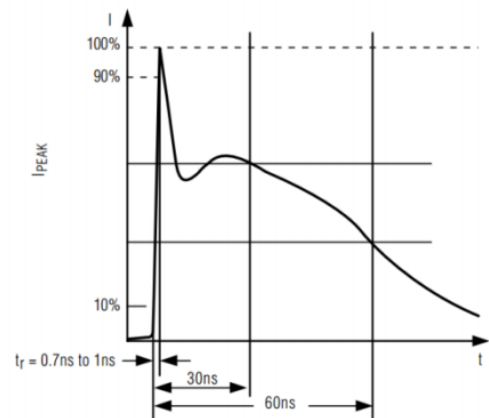


Figure 7 current waveform of IEC 1000-4-2 ESD



## 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 $-5.5\text{V}$ 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 $1000\text{pF}$ 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.



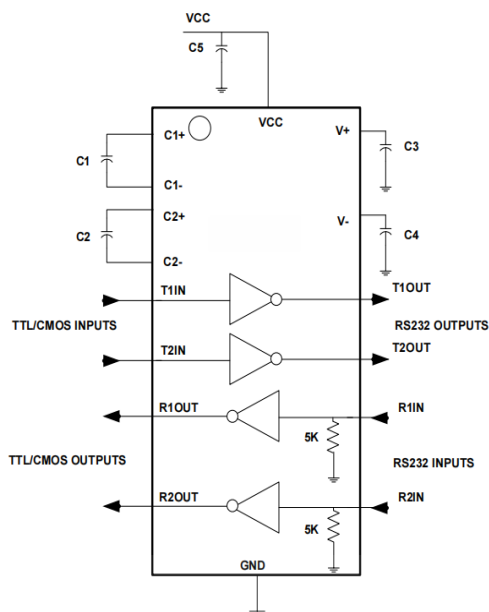


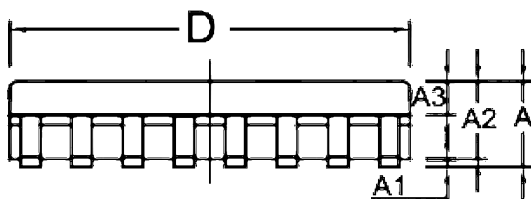
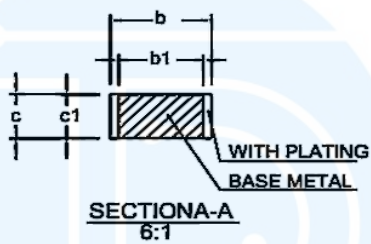
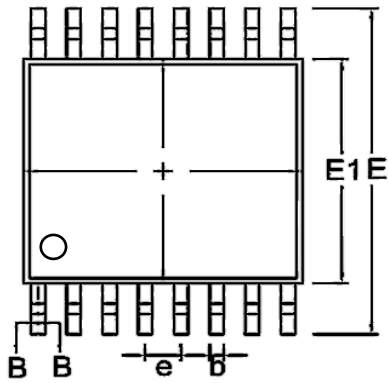
Figure 8 Typical dual-Path application scenarios

## Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
TRS3232ECDBR-TUDI	SSOP16	Tape,Reel,2000	RS32EC	0°C to 70°C
TRS3232ECDR-TUDI	SOP16	Tape,Reel,2500	TRS3232EC	
TRS3232ECDWR-TUDI	SMD16	Tape,Reel,1000	TRS3232EC	
TRS3232ECPWR-TUDI	TSSOP16	Tape,Reel,2500	RS32EC	
TRS3232EIDBR-TUDI	SSOP16	Tape,Reel,2000	RS32EI	- 40°C to 85°C
TRS3232EIDR-TUDI	SOP16	Tape,Reel,2500	TRS3232EI	
TRS3232EIDWR-TUDI	SMD16	Tape,Reel,1000	TRS3232EI	
TRS3232EIPWR-TUDI	TSSOP16	Tape,Reel,2500	RS32EI	



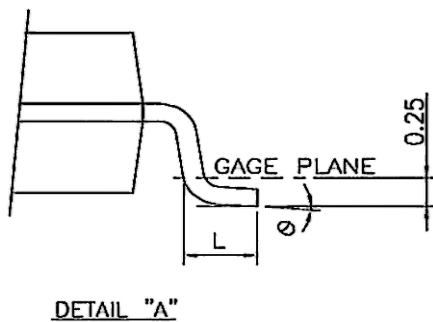
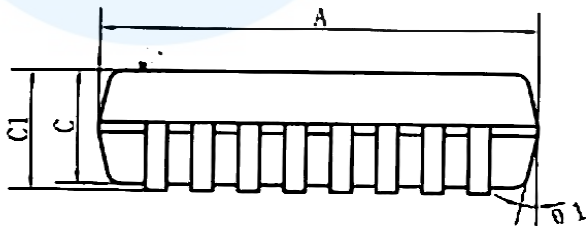
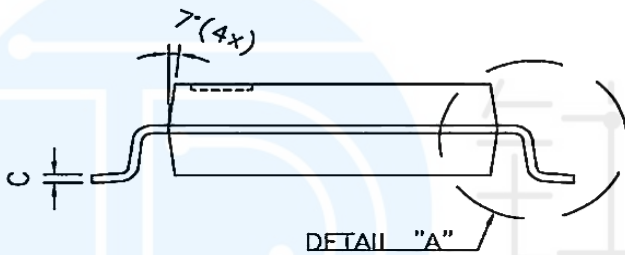
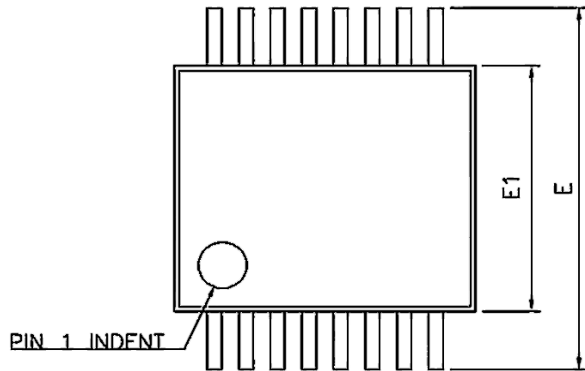
## Package TSSOP16



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°

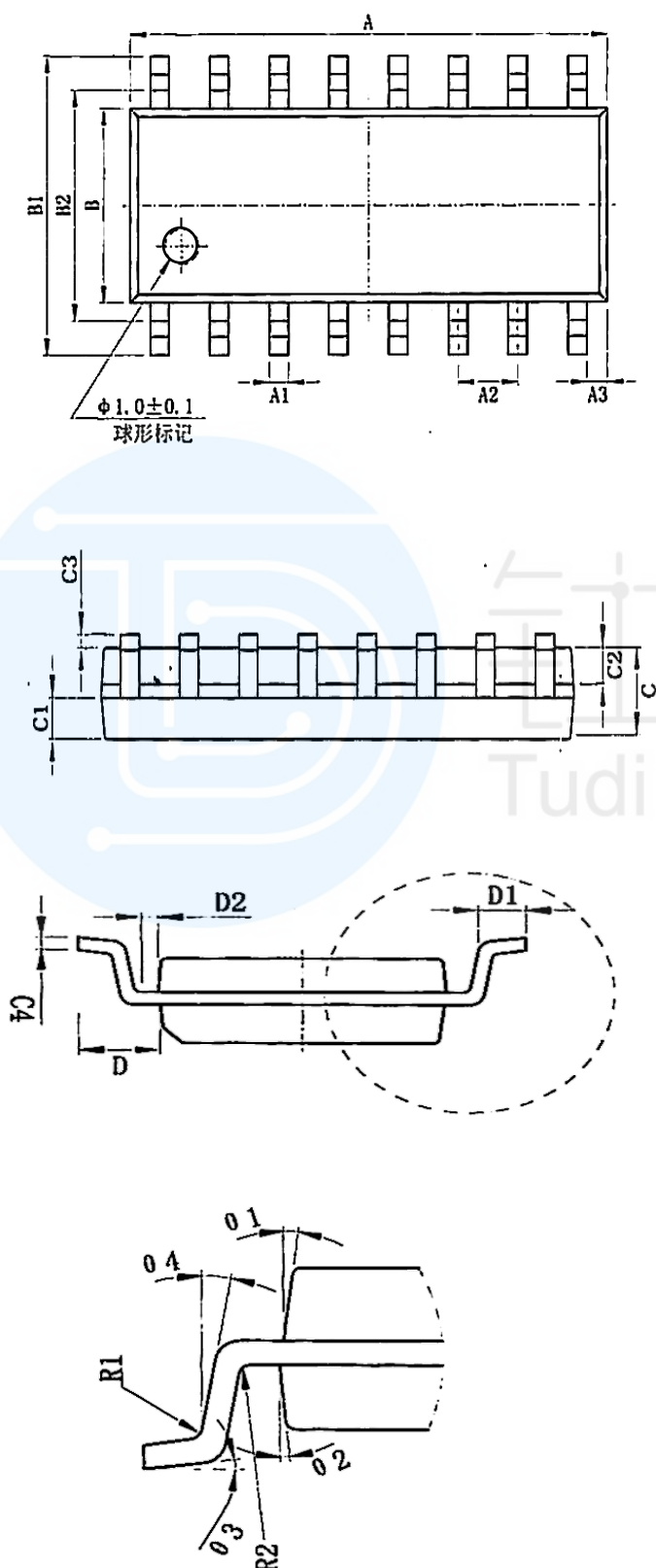


## Package SSOP16



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 SOP16

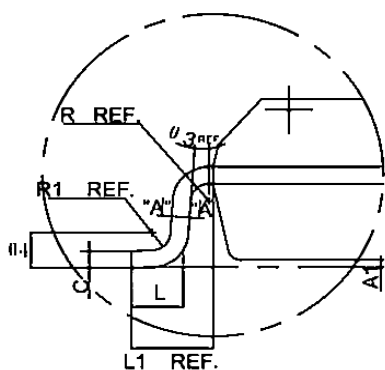
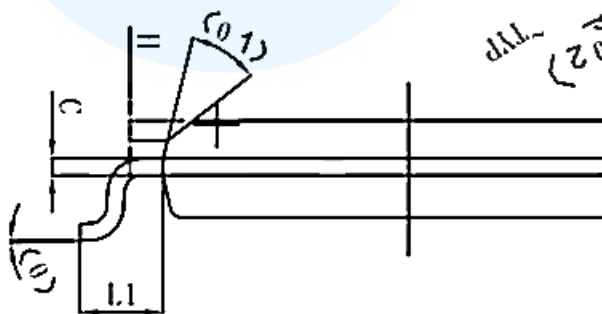
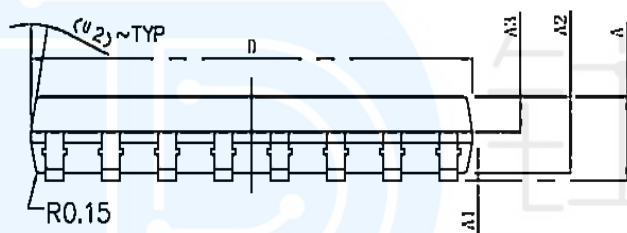
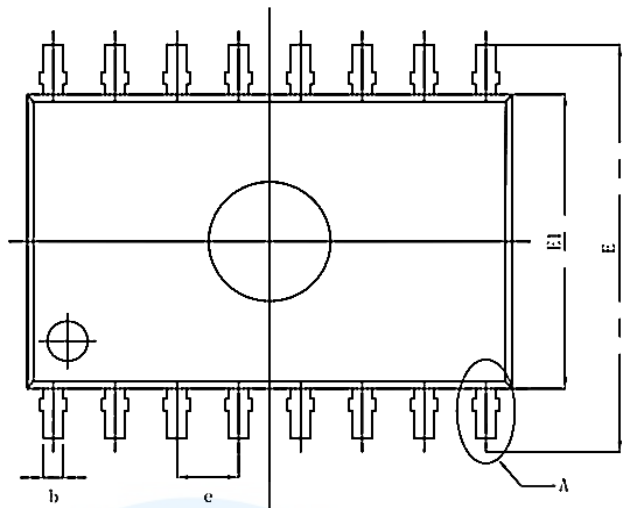


SIZE SYMBOL	MIN./mm	MAX./mm
A	9.80	10.00
A1	0.356	0.456
A2	1.27TYP	
A3	0.302TYP	
B	3.85	3.95
B1	5.84	6.24
B2	5.00 TYP	
C	1.40	1.60
C1	0.61	0.71
C2	0.54	0.64
C3	0.05	0.25
C4	0.203	0.233
D	1.05 TYP	
D1	0.40	0.70
D2	0.15	0.25
R1	0.20TYP	
R2	0.20TYP	
01	8°~12°TYP4	
02	8°~12°TYP4	
03	0°~8°	
04	4°~12°	





## 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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