



钛迪半导体
Tudi Semiconductor

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Product Specification

TUDI-MAX3232E

Multi-channel RS-232 line driver and receiver with \pm 15kV IEC ESD protection function from 3V to 5.0V

网址 www.sztbdbdt.com

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**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



Features

- ESD protection for RS-232 bus pins
 - $\pm 15\text{kV}$ (HBM)
 - $\pm 8\text{kV}$ (I61000-4-2, 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 5.5V VCC power supply
- Data rates up to 250kbit/s
- Two drivers and two receivers
- Low power current: $30\mu\text{A}$ (typical)
- External capacitors: $4 \times 0.1\mu\text{F}$
- Accepts 5V logic input and 3.3V

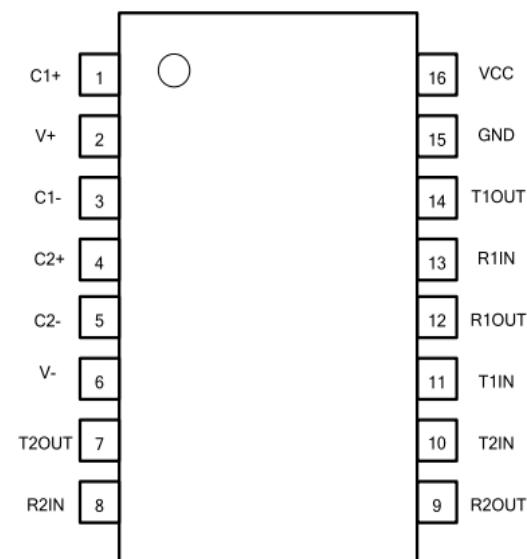


Figure 1. Pin Diagram

Description

The MAX3232E device consists of two line drivers, two line receivers, and a dual-path charge pump circuit with pin-topin (serial port connection pins, including GND) $\pm 15\text{kV}$ IEC ESD protection. The 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 single-supply operation from 3V-5.5V. The device operates at data signal transmission rates up to 250kbit/s and the driver output slew rate is maximized at $30/\mu\text{s}$.

Applications

- Industrial PC
- Wired network
- Data center and enterprise-level networking
- Battery-powered system
- PDA
- Notebook computer? Portable computer
- Handheld computer
- 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	T10UT	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	±25	V
Transmitter Output Voltage Range	T1OUT,T2OUT	±13.2	V
Receiver Output Voltage Range	R10UT,R2OUT	-0.3~VCC+0.3	V
Operating Temperature		-40~125	°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	I _{OUT} =1.6mA, V _{CC} =5V or 3.3V			0.4	V
Receiver Output Logic-High Voltage	VROH	I _{OUT} =-0.5mA, V _{CC} =5V or 3.3V	V _{CC} -0.6	V _{CC} -0.1		V

(If there is no additional explanation,typical value is tested when V_{CC}=+3.3V,Temp=25°C,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	V _{CC} =3.3V	0.6	1.1		V
		V _{CC} =5V	0.8	1.5		V
Receiver Input High Threshold	VRIH	V _{CC} =3.3V		1.5	2.4	V
		V _{CC} =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 V_{CC}=+3.3V,Temp=25°C,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	V _{CC} =0V, Transmitter Input=±2V	300			Ω
Transmitter Short-Circuit Current	Itsc				60	mA

(If there is no additional explanation,typical value is tested when V_{CC}=+3.3V,Temp=25°C,C1-C4=1μF)



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 $VCC=+3.3V$, $Temp=25^{\circ}C$, $C1-C4=1\mu F$)

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	$RL=3k\Omega$, $CL=1000pF$		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	$RL=3k\Omega \sim 7k\Omega$, $CL=150pF \sim 1000pF$ from -3.0V ~ 3.0V or from 3.0V ~ -3.0V See figures 2 and 3	4		30	V/ μ s

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



TEST CIRCUIT

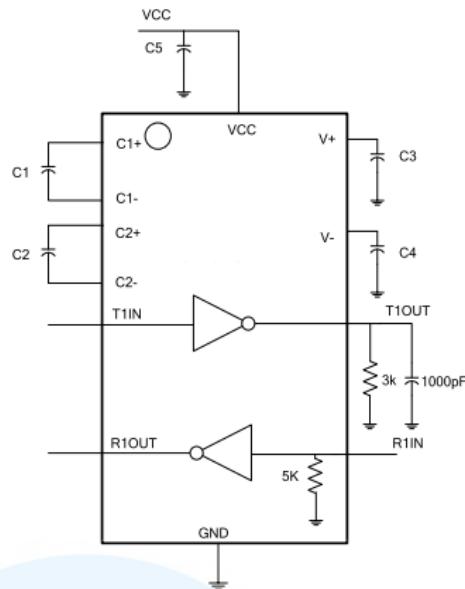


Figure 2 minimum swing rate test circuit

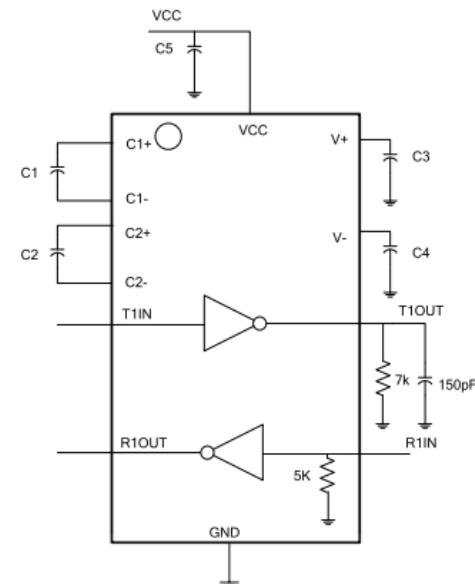


Figure 3 maximum swing rate test circuit

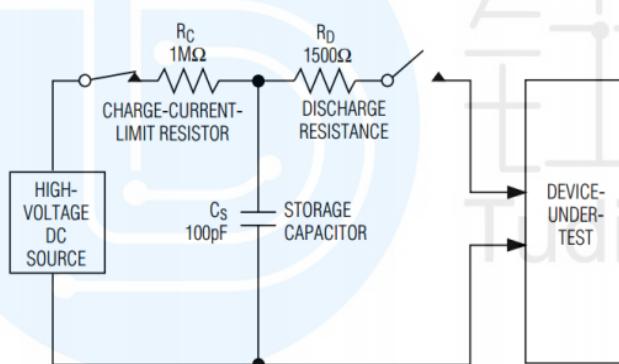


Figure 4 ESD test model of human body mode

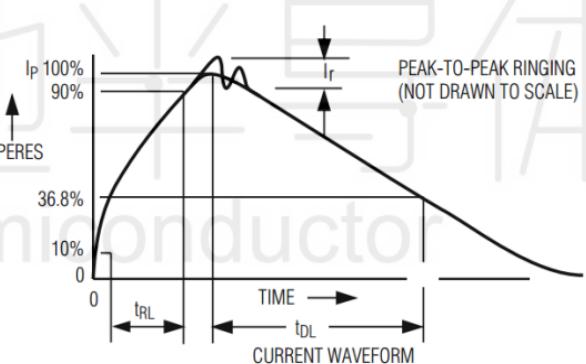


Figure 5 human body mode current waveform

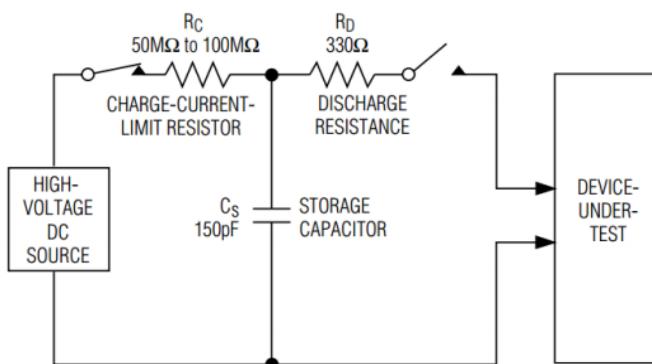


Figure 6 ESD test model of IEC 1000-4-2

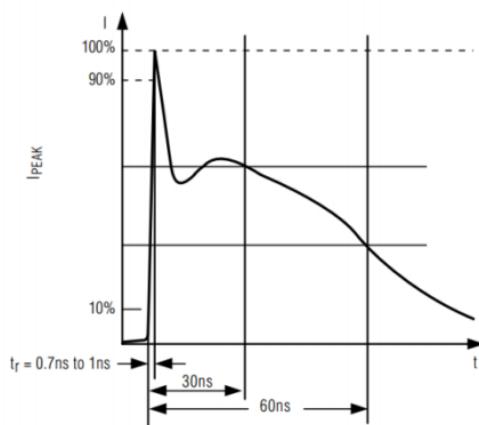


Figure 7 current waveform of IEC 1000-4-2 ESD



Description

RS232 Receiver

The 3232 has two separate receivers that convert the RS-232 signal to the CMOS logic output level.

ESD Protection

All pins of 3232 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

3232 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. 3232 Transmitter can guarantee 250kbps data rate under the worst operating conditions (Parallel load of 3kQresistor and 1000pf capacitor). Transmitter can drive multiple receivers in parallel. There is no pull-up resistance inside the input terminals T1IN and T2IN of 3232 transmitter. If the transmitter is not used, the unused input terminals T1IN and T2IN can be connected to GND or VCC.

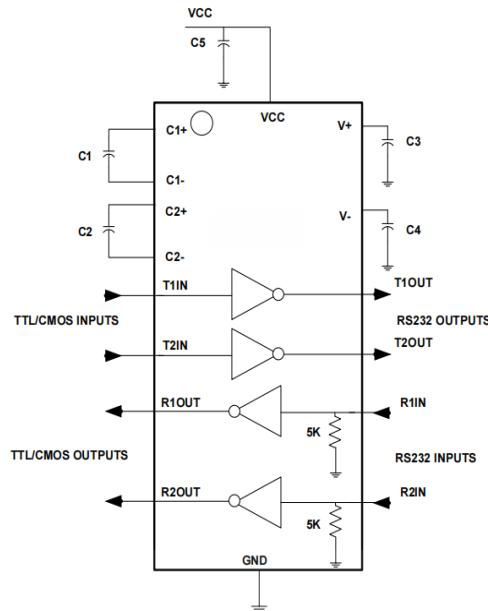


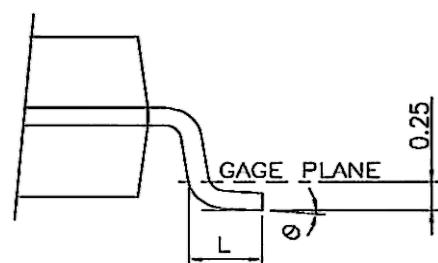
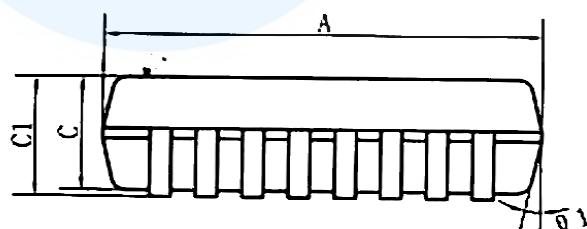
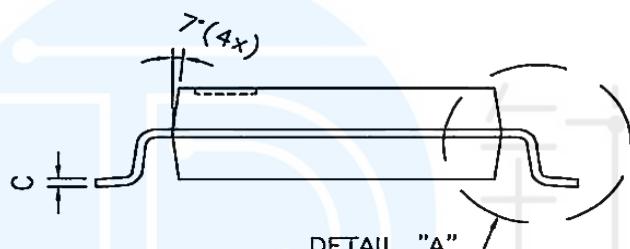
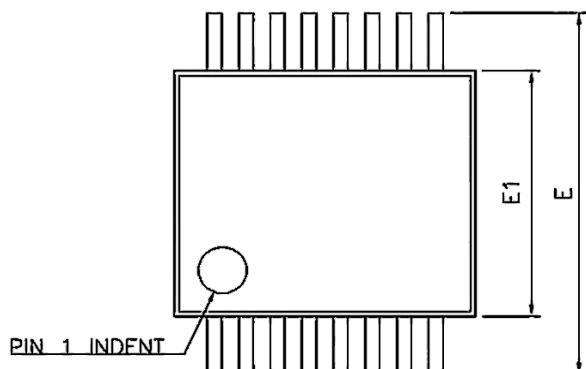
Figure 8 Typical dual-Path application scenarios

Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
MAX3232ECDBR-TUDI	SSOP16	Tape,Reel,2000	MP232EC	0°C to 70°C
MAX3232ECDR-TUDI	SOP16	Tape,Reel,2500	MAX3232EC	
MAX3232ECDWR-TUDI	SMD16	Tape,Reel,1000	MAX3232EC	
MAX3232ECPWR-TUDI	TSSOP16	Tape,Reel,2000	MP232EC	
MAX3232EIDBR-TUDI	SSOP16	Tape,Reel,2000	MP232EI	- 40°C to 85°C
MAX3232EIDR-TUDI	SOP16	Tape,Reel,2500	MAX3232EI	
MAX3232EIDWR-TUDI	SMD16	Tape,Reel,1000	MAX3232EI	
MAX3232EIPWR-TUDI	TSSOP16	Tape,Reel,2000	MP232EI	
MAX3232EIPWRQ1-TUDI	TSSOP16	Tape,Reel,2000	MB3232I	- 40°C to 125°C



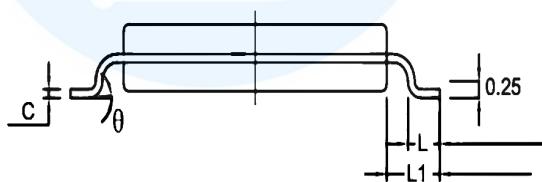
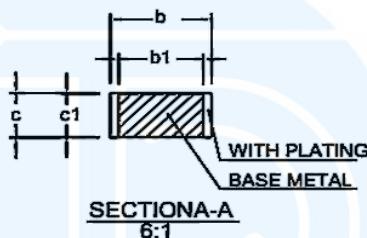
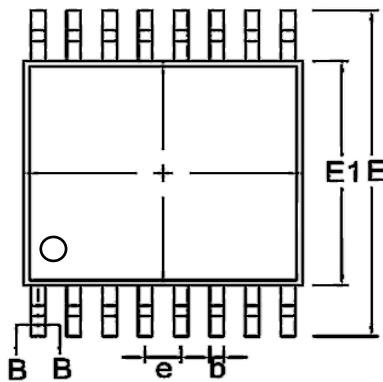
Package SSOP16



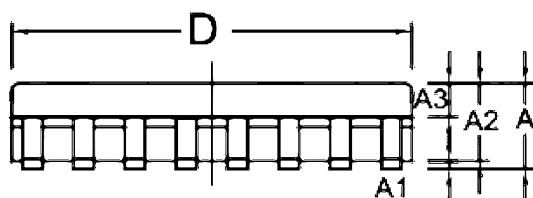
SIZE SYMBOL	MIN/mm	MAX/mm
A	6.15	6.25
A1	0.30TYP	
A2	0.65TYP	
A3	0.675TYP	
B	5.25	5.35
B1	7.65	7.95
B2	0.60	0.80
C	1.70	1.80
C1	1.75	1.95
C2	0.799	
C3	0.152	
C4	0.172	
H	0.05	0.15
θ	12°TYP4	
01	12°TYP4	
02	10°TYP	
03	0°~8°	
R	0.20°TYP	
R	0.15°TYP	



Package TSSOP16

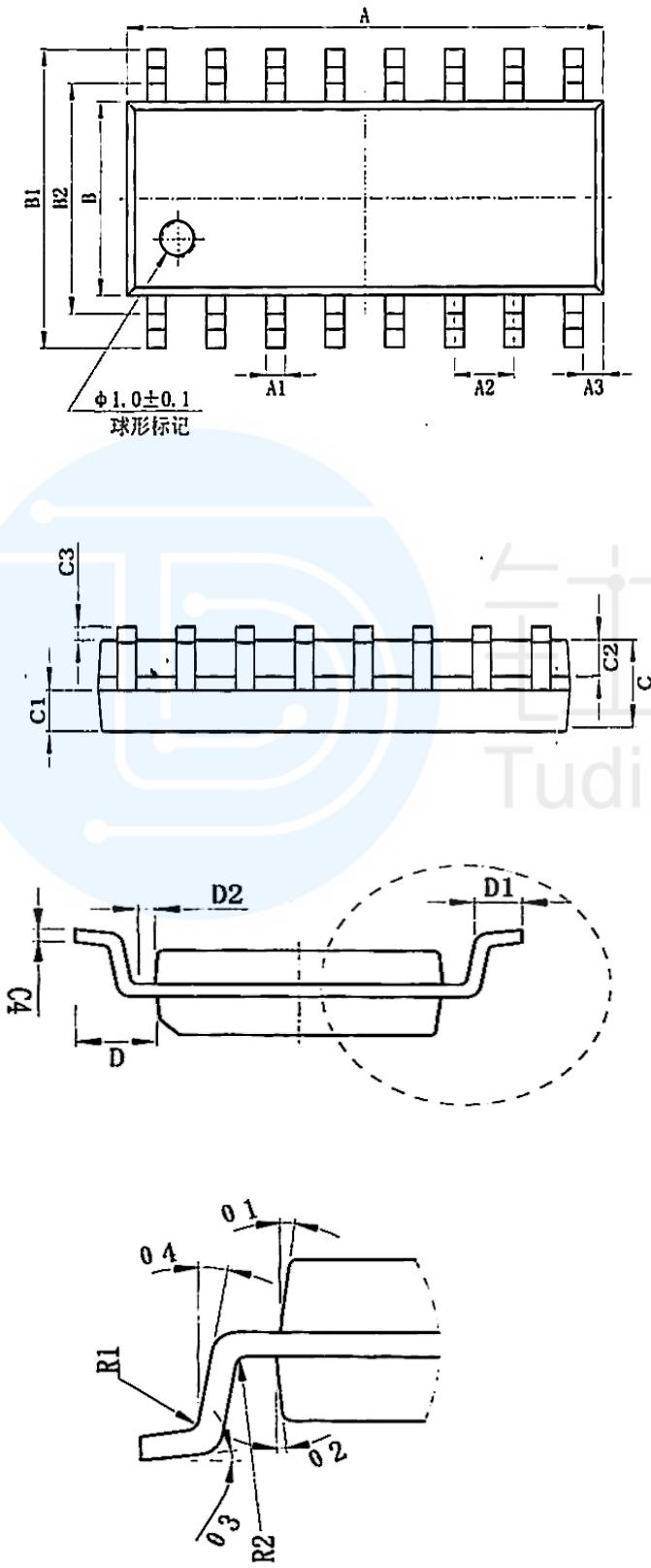


SIZE SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	--	--	1.20
A1	0.05		0.15
A2	0.90	1.00	1.05
b	0.20	--	0.30
b1	0.19	0.22	0.25
c	0.110	0.127	0.145
c1	0.12	0.13	0.14
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e		0.65BSC	
L	0.45	0.60	0.75
L1		1.00BSC	
	0°	--	8°





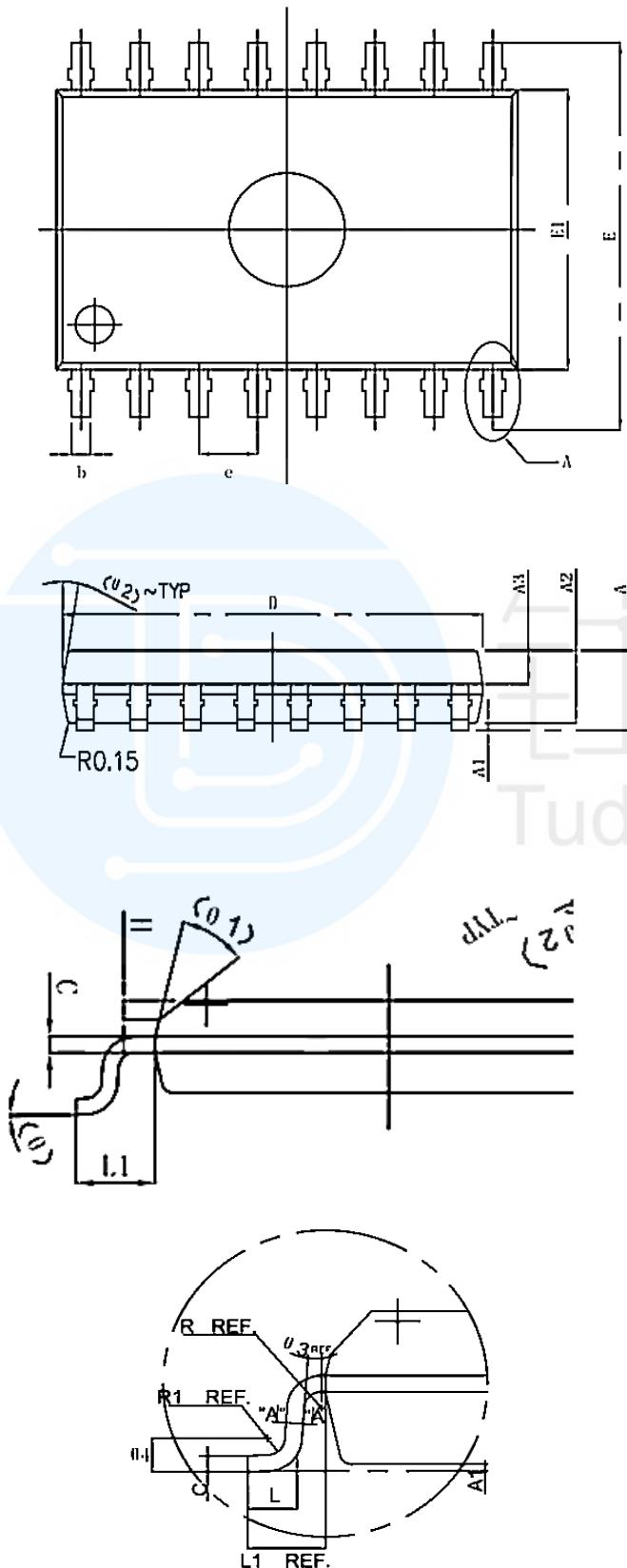
Package SOP16



SYMBOL	SIZE MIN./mm	SIZE 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



SYMBOL	SIZE MIN./mm	SIZE 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°
θ1	45° TYP	
θ2	12° TYP	
θ3	0°	8°
θ4	0°	10°



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