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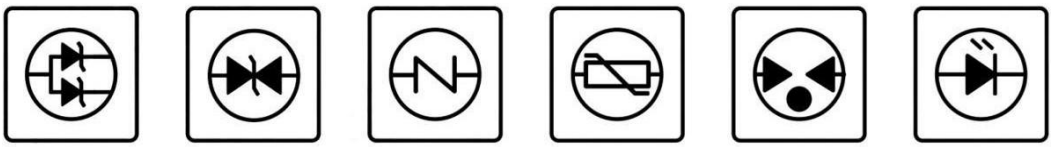
SEMICONDUCTOR



MAX3232E

Product specification

DESCRIPTION

MAX3232E is a 3.3V-power-supply, dual-channel,high ESD-protected, low-power RS-232 transceiver that fully meets the requirements of the TIA/EIA-232 standard.

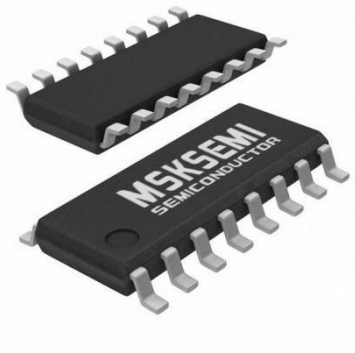
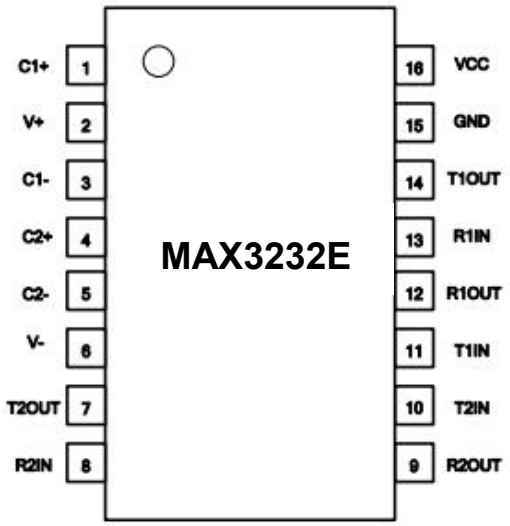
MAX3232E includes two drives and two receivers,with enhanced ESD protection function, reaching the protection capacity of HBM ESD above 15kV and 8kV IEC-4100-4-2 contact discharge.

Powered by 3.3V power supply, The charge pump requires only four 1μF external capacitance to work at a rate of at least 120Kbps error-free data transmission, both of which can be independently enabled and closed. Each driver and receiver can be used independently.

FEATURES

- Supply voltages from 3 V to 5.5V
- Dual-channel
- 120kbps Data Rates
- 15kV HBM ESD-Protected
- 8kV IEC-4100-4-2 Contact Dischar

Reference News

PACKAGE OUTLINE	PIN CONFIGURATION	Marking
		MSKSEMI MAX3232***MS * * * *
SOP-16		

PINNING

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

LIMITING VALUES

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	R1OUT,R2OUT	-0.3~VCC+0.3	V
Operating Temerature		-40~85	℃
Storage Temperature		-60~150	℃
Soldering Temperature		300	℃
Continuous Power		760	mW

The maximum limit parameters mean 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.

Supply Current

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
SupplyCurrentwith no Load	I_{sup}			2		mA

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

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	VTTIN_H	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=25C,C1-C4=lμF)

Receiver Output Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Output Logic-Low Voltage	V_{ROL}	IOUT=1.6mA, VCC=5V or 3.3V			0.4	V
Receiver Output Logic-High Voltage	V_{ROL}	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=lμF）

Receiver Input Electrical Characteristics

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Input Range	VRIN		-25		+25	V
Receiver Input Low Threshold	VRIL	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=lμF)

Transmitter Output Electrical Characteristics

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

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

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~1000F 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=1μF)

TEST CIRCUIT

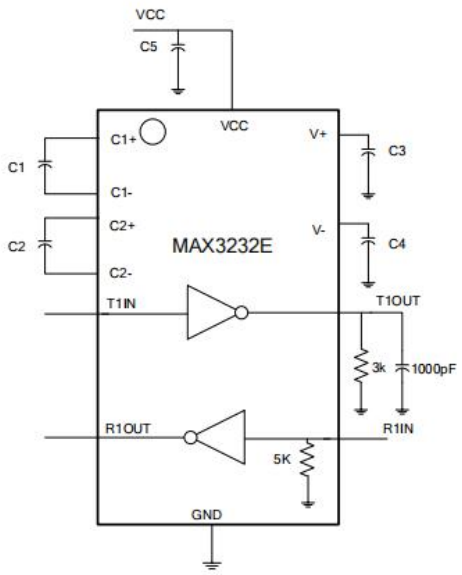


Figure 2 minimum swing rate test circuit

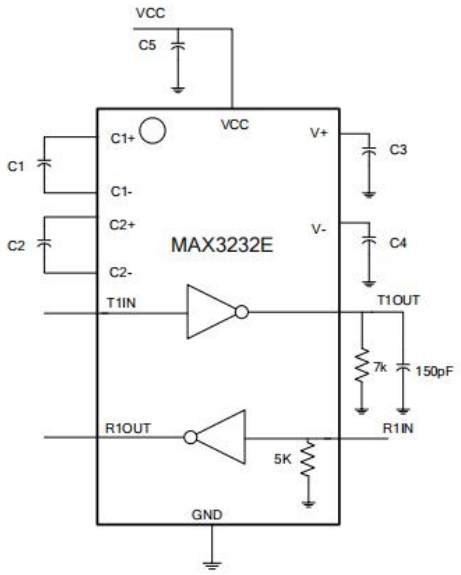


Figure 3 maximum swing rate test circuit

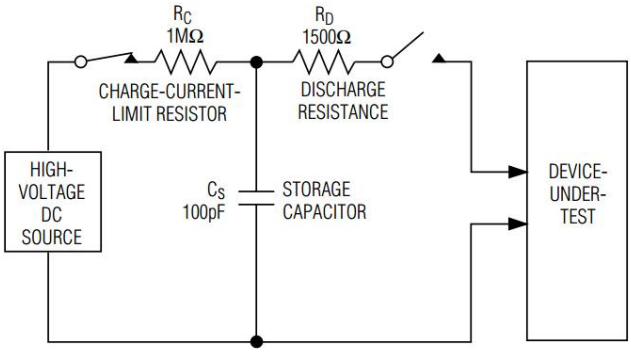


Figure 4 ESD test model of human body mode

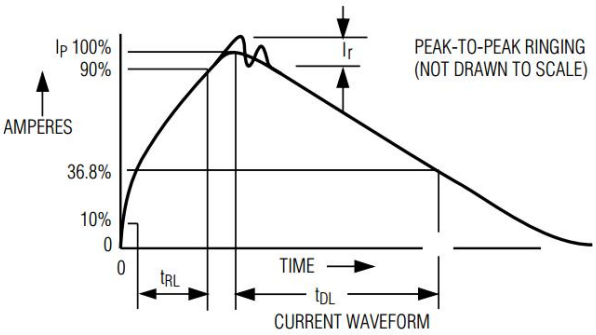


Figure 5 human body mode current waveform

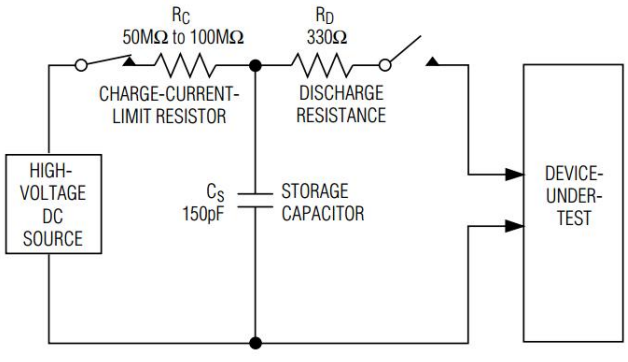


Figure 6 ESD test model of IEC 1000-4-2

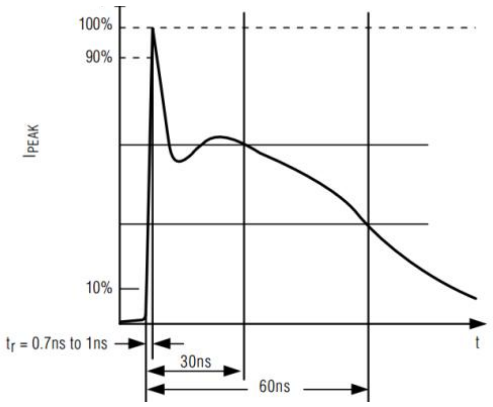


Figure 7 current waveform of IEC 1000-4-2 ESD

ADDITIONAL DESCRIPTION

1 Dual Charge-Pump Operation

MAX3232E has a two-way charge pump inside to support the chip's voltage conversion work. Dual-electric pump provides +5.5V and -5.5V output voltage in the range of 3.0 ~ 5.5V, 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.

2 RS232 Transmitter

Convert the TTL/CMOS logic voltage to a voltage compatible with the EIA/TIA-232 standard. MAX3232E Transmiter can guarantee 120kbps data rate under the worst operating conditions (Parallel load of 3kΩ 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 MAX3232E transmitter. If the transmitter is not used, the unused input terminals T1IN and T2IN can be connected to GND or VCC.

3 RS232 Receiver

The MAX3232E has two separate receivers that convert the RS-232 signal to the CMOS logic output level.

4 ESD Protection

All pins of MAX3232E adopt ESD protection structure, and all driver outputs and receiver inputs have additional electrostatic protection capability. It can withstand ±15kV ESD (HBM) discharge, contact discharge above ±8KV and air gap discharge above ± 15kV. The ESD protection structure can withstand the impact of high voltage ESD under all conditions, including standard working mode and power-off mode.

5 Typical Application

Typical dual-Path application scenarios are shown in Figure 8, where the C1-C5 typical capacitance value is 0.1μF.

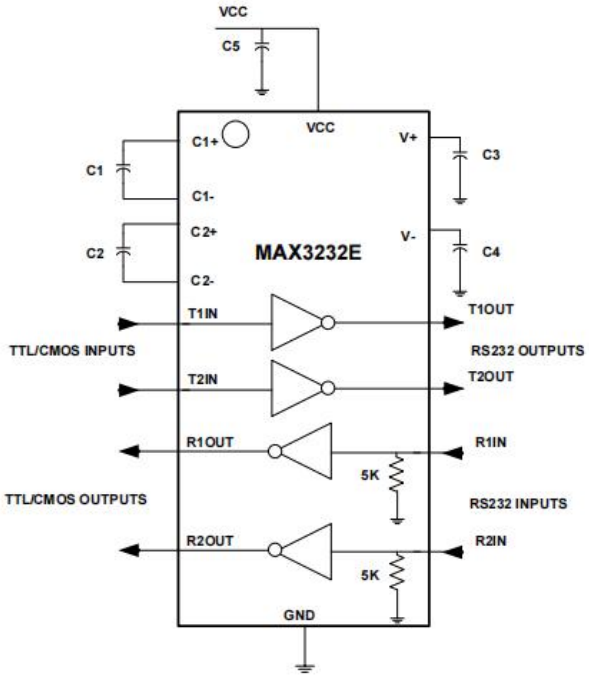
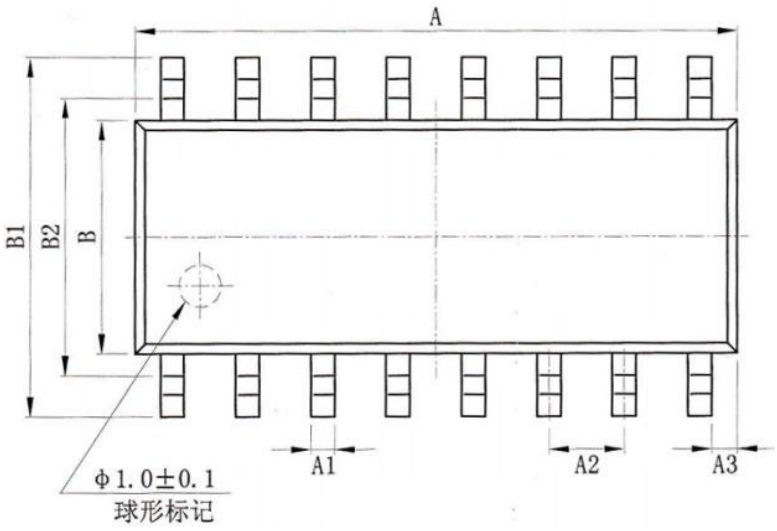


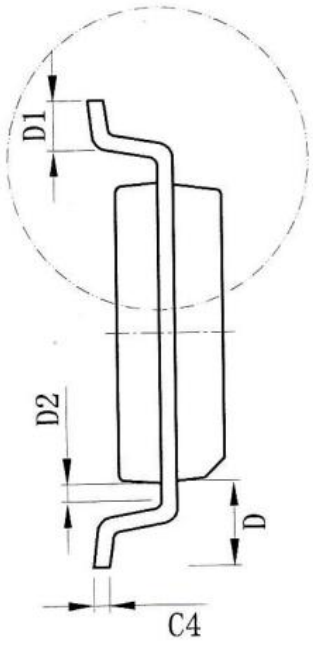
Figure 8 Typical dual-Path application scenarios

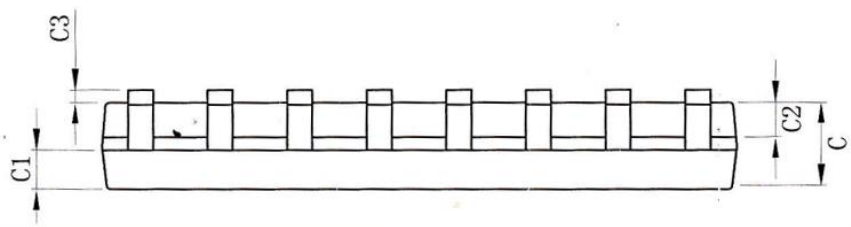
SOP16 DIMENSIONS

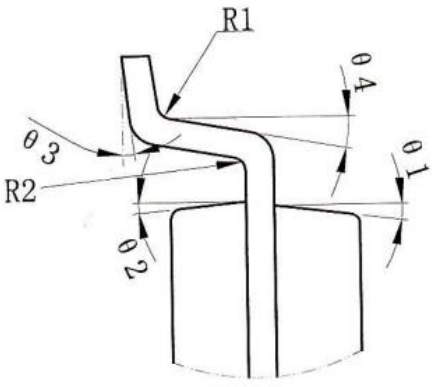
PACKAGE SIZE

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	
θ1	8°~12°TYP4	
θ2	8°~12°TYP4	
θ3	0°~8°	
θ4	4°~12°	





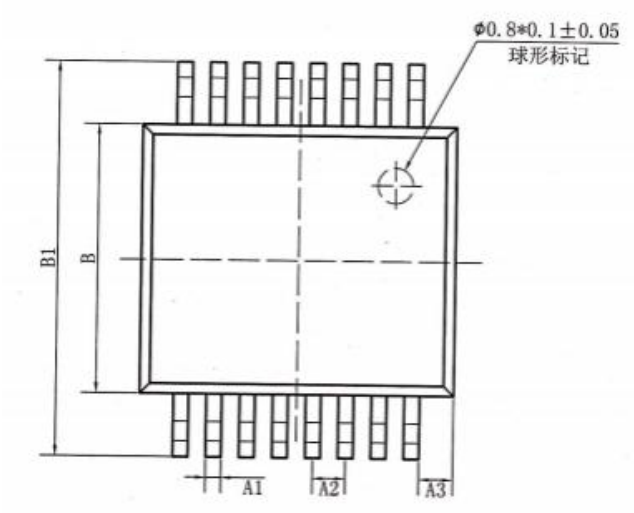


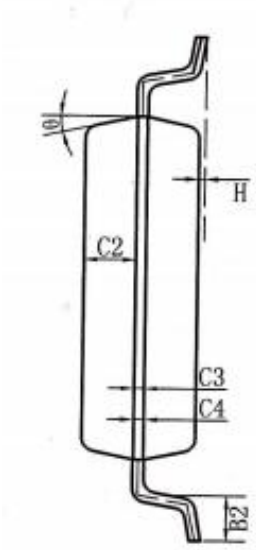


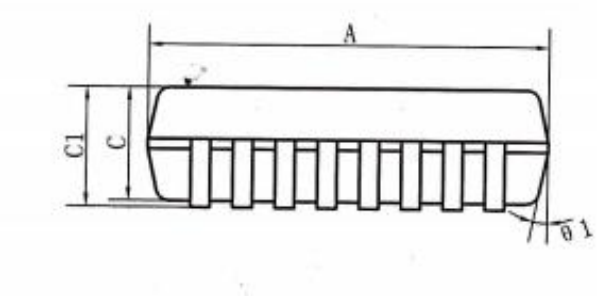
SSOP16(0.65) DIMENSIONS

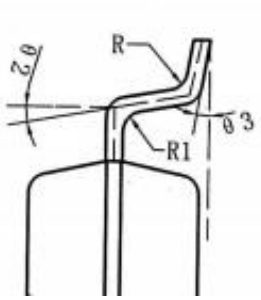
PACKAGE SIZE

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	
θ 1	12° TYP4	
θ 2	10° TYP	
θ 3	0° ~8°	
R	0.20° TYP	
R	0. 15° TYP	





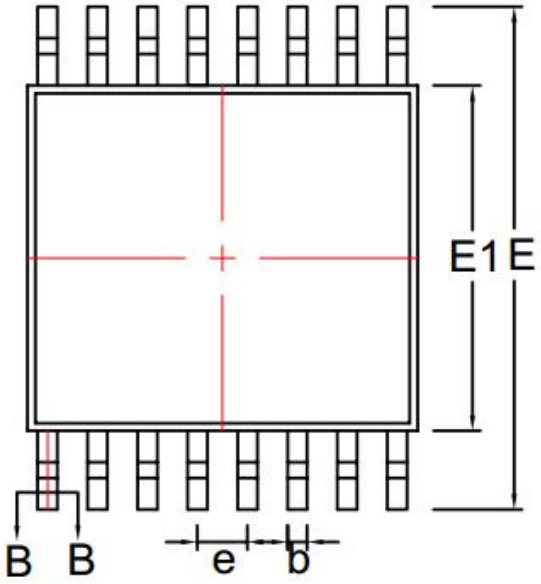


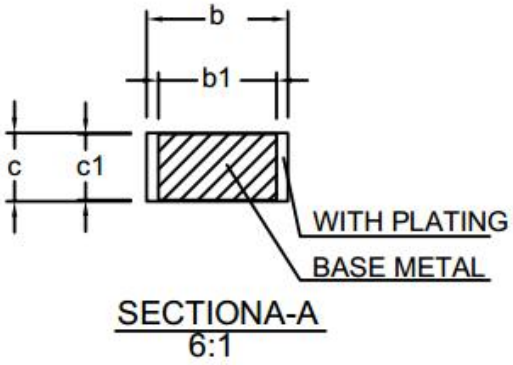


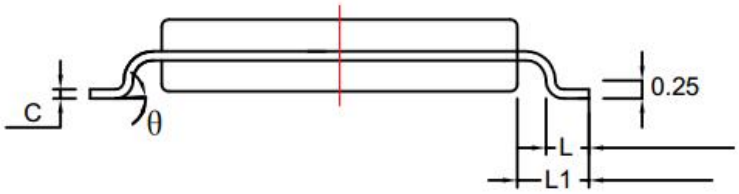
TSSOP16 DIMENSIONS

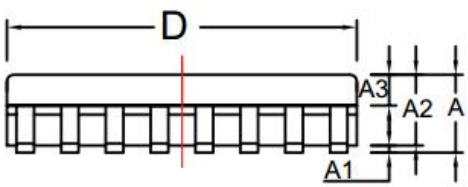
PACKAGE SIZE

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°





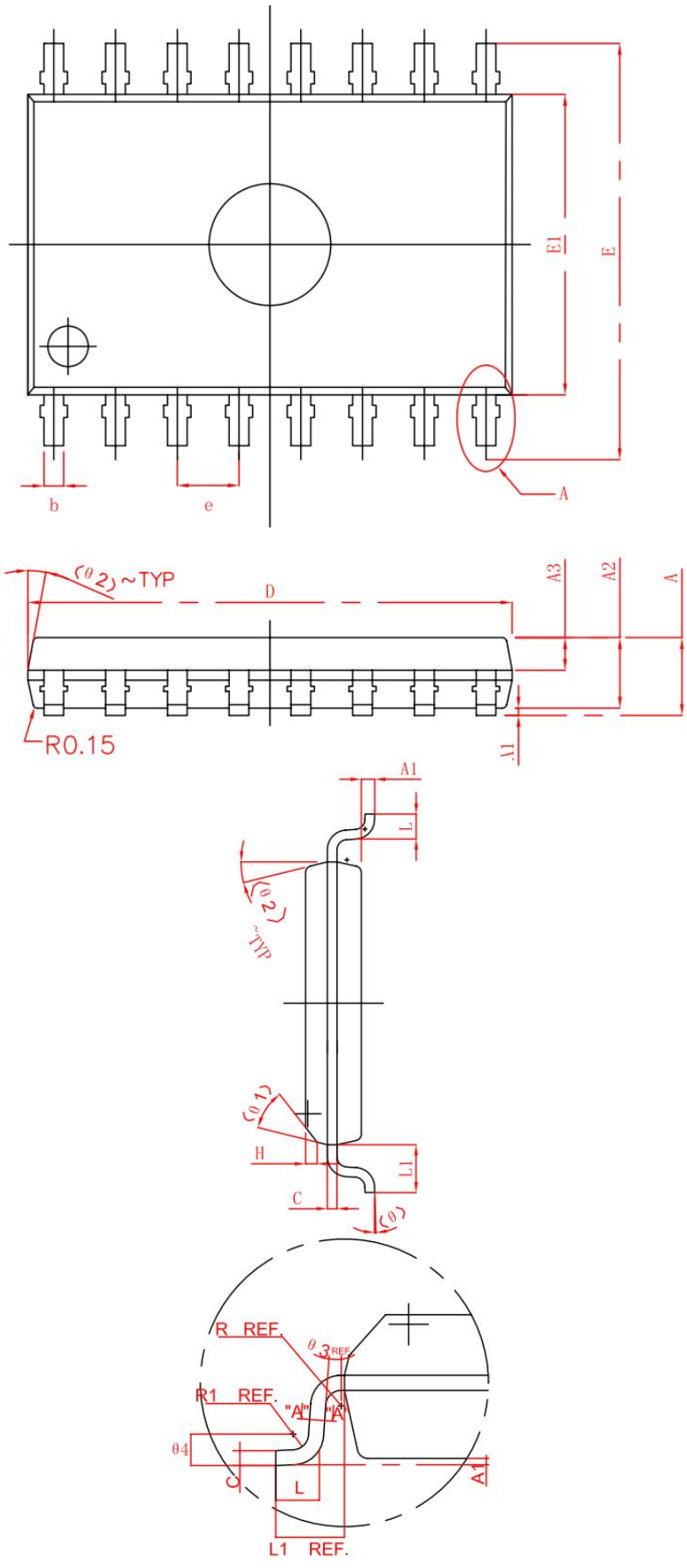




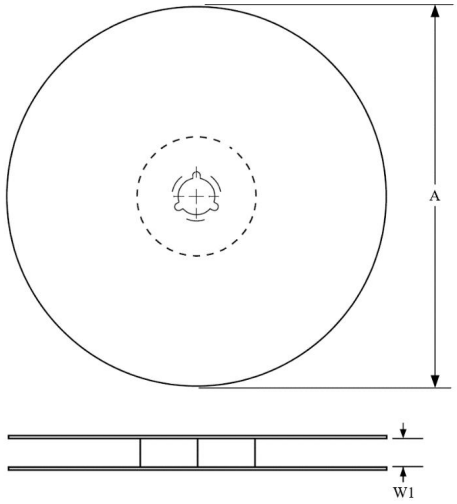
WSOP16 DIMENSIONS

PACKAGE SIZE

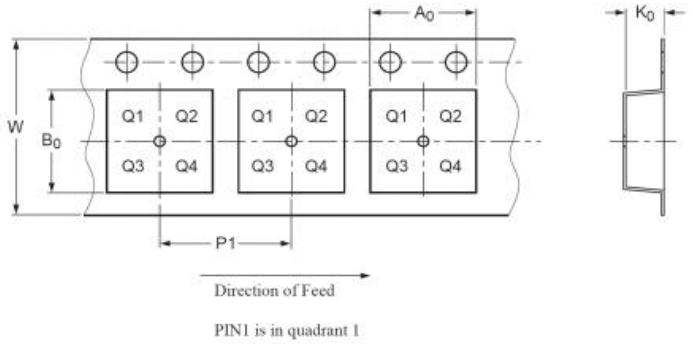
SIZE / SYMBOL	MIN./mm	TYP./mm
A	-	2.65
A1	0.10	0.30
A2	2.25	2.35
A3	0.97	1.07
D	10.10	10.50
E	10.26	10.60
E1	7.30	7.70
e	1.27BSC	
L	0.55	0.85
L1	1.4BSC	
H	0.345	0.365
R	0.20TYP	
R1	0.30TYP	
θ	0°	8°
1	45°TYP	
θ2	12°TYP	
θ3	0°	8°
θ4	0°	10°



TAPE AND REEL INFORMATION



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

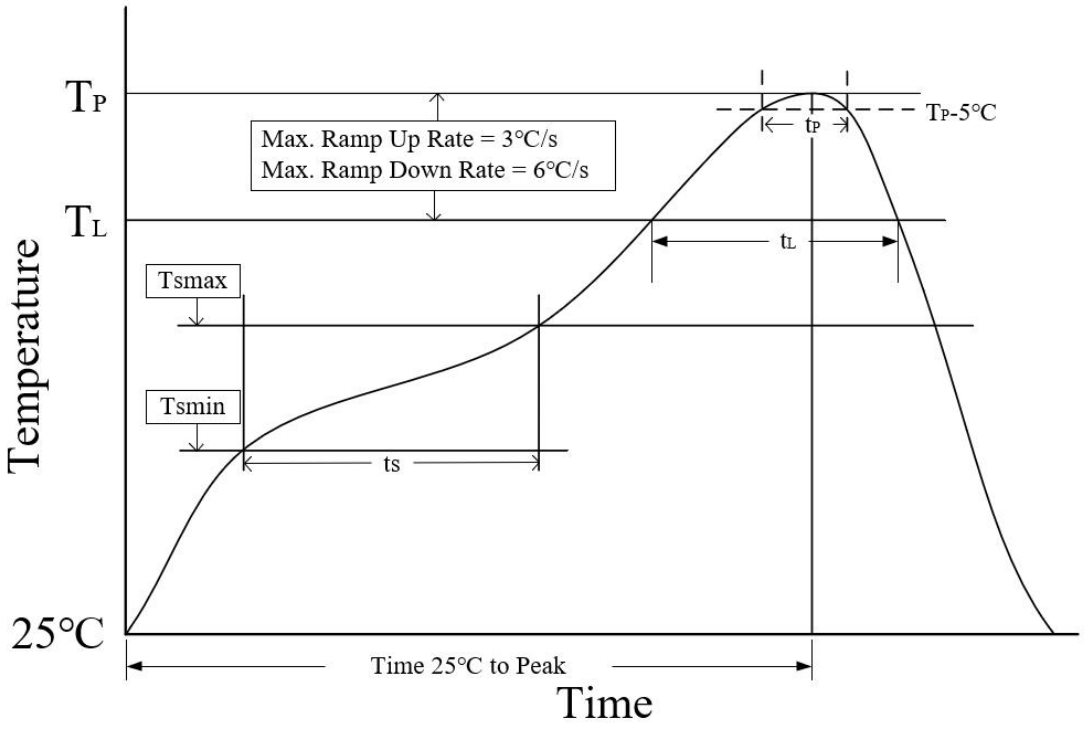


Package Type	Reel Diameter A (mm)	Tape width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP16	330	16	6.43±0.10	10.40±0.1	1.85±0.10	8.00±0.1	$16.00^{+0.30}_{-0.10}$
SSOP16	330	16	$8.30^{+0.10}_{-0.10}$	$6.60^{+0.10}_{-0.10}$	$2.40^{+0.10}_{-0.10}$	8.00±0.1	$16.00^{+0.30}_{-0.30}$
TSSOP16	330	12	6.80±0.1	5.50±0.1	1.30±0.1	8.00±0.1	12.00±0.30

TAPE AND REEL INFORMATION

TYPE NUMBER	PACKAGE	PACKING
MAX3232ESE-MS	SOP16	Tape and reel
MAX3232EAE-MS	SSOP16	Tape and reel
MAX3232EUE-MS	TSSOP16	Tape and reel
MAX3232EWE-MS	WSOP16 Wide body	Tube

SOP 16, SSOP16 and TSSOP16 is packed with 2500 pieces/disc in braided packing. WSOP16 is packed with 44 pieces/tube in tubed packaging.



Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3 °C/second max
Preheat time ts (T_{smin}=150 °C to T_{smax}=200 °C)	60- 120 seconds
Melting time t_L (T_L=217 °C)	60- 150 seconds
Peak temp T_P	260-265 °C
5°C below peak temperature t_P	30 seconds
Ave cooling rate (T_P to T_L)	6 °C/second max
Normal temperature 25°C to peak temperature T_P time	8 minutes max

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