

1 FEATURES

- It can be powered by a 3V to 5.5V V_{CC} supply
- Operates up to 500kbps
- Two Drivers and Two Receivers
- Meets the Requirements of TIA/EIA-232-F and ITU V.28 standard
- External Capacitors: 0.1 μ F
- Serial pins provide enhanced ESD protection

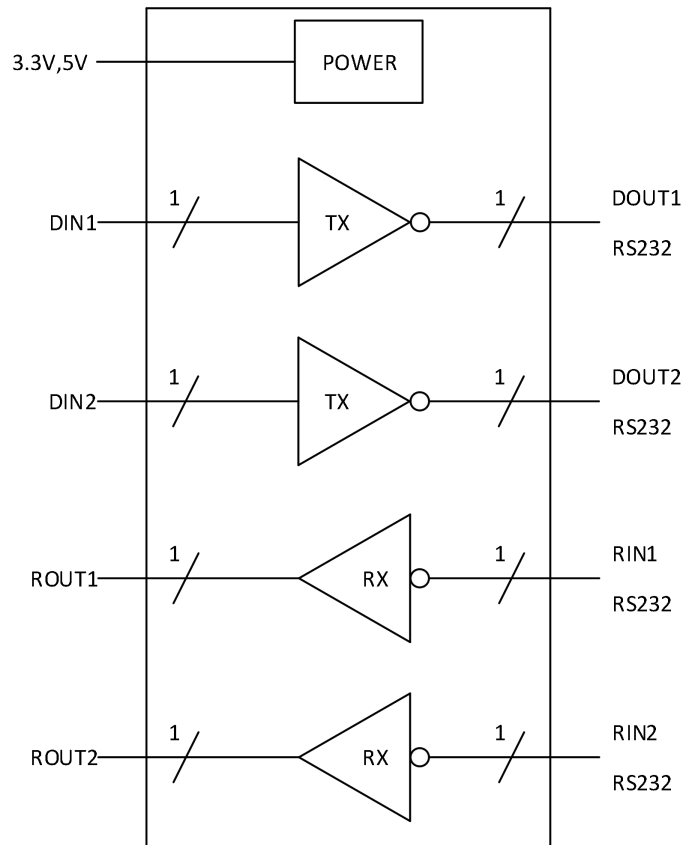
2 APPLICATIONS

- Industrial PC
- Wired network
- Data center and enterprise computing
- Notebook, Computers
- Handheld device

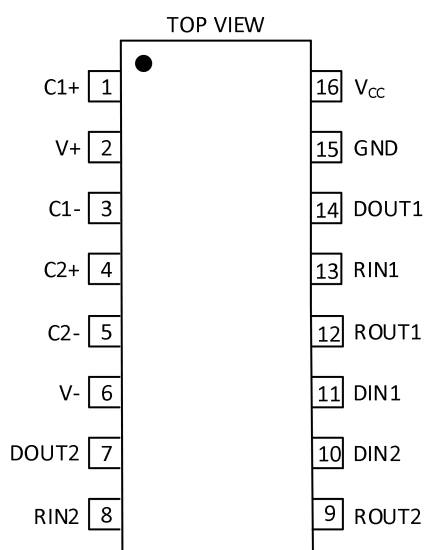
3 DESCRIPTION

The GM3232E interface chip consists of two-channel drivers, two-channel receivers, and a dual charge-pump circuit. The serial port has $\pm 15\text{kV}$ IEC ESD protection. The GM3232E meets the requirements of TIA/EIA-232-F and provides the electrical interface function between an asynchronous communication controller and the serial-port connector. The internal charge pump of the chip and four small external capacitors support a single power supply of 3V to 5.5V. The GM3232E supports a data signaling rate of up to 500kbit/s.

FUNCTION BLOCK



4 Pin Configuration and Functions



Name	Pin No.	Description
C1+	1	The positive end of the voltage doubler charge pump capacitor
V-	2	Positive voltage produced by charge pump
C1-	3	The negative end of the voltage doubler charge pump capacitor
C2+	4	The positive end of the inverting charge pump capacitor
C2-	5	The negative end of the inverting charge pump capacitance
V-	6	Negative voltage generated by charge pump
DOUT2	7	RS-232 driver output
RIN2	8	RS-232 receiver input
ROUT2	9	TTL/CMOS receiver output
DIN2	10	TTL/CMOS driver input
DIN1	11	TTL/CMOS driver input
ROUT1	12	TTL/CMOS receiver output
RIN1	13	RS-232 receiver input
DOUT1	14	RS-232 driver output
GND	15	Ground
V _{CC}	16	+3.0V to +5.5V power supply
Cooling Pad		Cooling Pad, can improve the chip cooling capacity, can be grounded or suspended

5 ABSOLUTE MAXIMUM RATINGS

Parameter	Parameter	Rating	UNIT
V _{CC}	Supply Voltage	+6	V
V+	Positive Output Supply Voltage ⁽¹⁾	-0.3 to +7	V
V-	Negative Output Supply Voltage ⁽¹⁾	-0.3 to -7	V
V+~V-	Supply Voltage Difference ⁽¹⁾	+13	V
Driver input	Input Voltage	-0.3 to +6	V
Receiver input		-25 to 25	V
Driver output	Output Voltage	-13.2 to 13.2	V
Receiver output		-0.3 to V _{CC} +0.3	V

1: V+ and V- can reach the maximum voltage value of 7V, but the difference between them cannot exceed 13V.

6 RECOMMENDED APPLICATION CONDITIONS⁽²⁾

Parameter			Condition	MIN	TYP	MAX	UNIT
V _{CC}	Supply Voltage		V _{CC} =3.3V	3	3.3	3.6	V
			V _{CC} =5V	4.5	5	5.5	
V _{IH}	Driver Input High Voltage	DIN	V _{CC} =3.3V	2.0		5.5	V
			V _{CC} =5V	2.4		5.5	
V _{IH}	Driver Input High Voltage	DIN		0		0.8	V
V _I	Receiver Input Voltage	RIN		-25		25	V
T _O	Operating Temperature			-40		+85	°C

2: C1-C4=0.1μF when V_{CC}=3.3V±0.3V; When V_{CC}=5V±0.5V, C1=0.047μF, C2-C4=0.33μF.

7 ELECTRICAL CHARACTERISTICS⁽³⁾

(unless otherwise noted, C1–C4 = 0.1μF at V_{CC} = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V_{CC} = 5V±0.5V; T_A = +25°C.)

Symbol	Parameter	Condition	MIN	TYP	MAX	UNIT
DC ELECTRICAL CHARACTERISTIC						
I _{CC}	Supply Current	No load, V _{CC} = 3.3 V or 5 V		0.3	1.0	mA
	Driver					
V _{OH}	High-Level Output Voltage	DOUT at R _L = 3 kΩ to GND, DIN = GND	5	5.4		V
V _{OL}	Low-Level Output Voltage	DOUT at R _L = 3 kΩ to GND, DIN = V _{CC}	-5	-5.4		
I _{IH}	High-Level Input Current	V _I = V _{CC}		±0.01	±1	μA
I _{IL}	Low-Level Input Current	V _I at GND		±0.01	±1	μA
I _{OS}	Short-Circuit Output Current	V _{CC} = 3.6 V, V _O = 0 V			±60	mA
		V _{CC} = 5.5 V, V _O = 0 V				
r _o	Output Resistance	V _{CC} , V _I , and V _O = 0 V, V _O = ±2 V	300	50k		Ω
RECEIVER						
V _{OH}	High-Level Output Voltage	I _{OH} = -1mA	V _{CC} -0.6	V _{CC} -0.1		V
V _{OL}	Low-Level Output Voltage	I _{OL} = 1.6mA			0.4	mV
V _{IT+}	Positive-Going Input Threshold Voltage	V _{CC} = 3.3V		1.5	2.4	V
		V _{CC} = 5V		2.0	2.4	
V _{IT-}	Negative-Going Input Threshold Voltage	V _{CC} = 3.3V	0.6	1.1		V
		V _{CC} = 5V	0.8	1.5		
V _{hys}	Input Hysteresis (V _{IT+} - V _{IT-})			0.5		V
r _i	Input Resistance	V _I = ±3 V to ±25 V	3	5	7	kΩ
ESD ELECTROSTATIC PROTECTION						
V _(ESD)	Electrostatic Protection (232 pin)	Human Body Model		±15		kV
		Machine Mode		±800		V
		Contact Discharge IEC 61000-4-2		±10		kV
		Air Discharge IEC 61000-4-2		±15		kV
V _(ESD)	Electrostatic Protection (other pins)	Human Body Model		±4		kV
		Machine Mode		±400		V

3: Typical Test conditions are at V_{CC} = 3.3V or V_{CC} = 5V, T_A = 25°C.

8 SWITCHING CHARACTERISTICS

(unless otherwise noted, C1–C4 = 0.1μF at V_{CC} = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V_{CC} = 5V±0.5V; T_A = +25°C.)

Symbol	Parameter	Condition	MIN	TYP	MAX	UNIT
F _{MAX}	Maximum Data Rate	R _L = 3kΩ, C _L = 1000pF, see Figure 1		500		kbps
T _{sk(p)}	Driver pulse skew	R _L = 5 kΩ, C _L = 1000 pF, see Figure 2		200		ns
SR _(TR)	Driver slew rate, transition region	R _L = 3 kΩ to 7 kΩ, C _L = 150 pF to 1000 pF V _{CC} = 3.3 V	6		25	V/μs
T _{PLH}	Receiver propagation delay time, low- to high-level output	C _L = 150 pF, see Figure 3		10		ns
T _{PHL}	Receiver propagation delay time, high- to low-level output			35		ns
T _{sk(p)}	Receiver pulse skew			60		ns

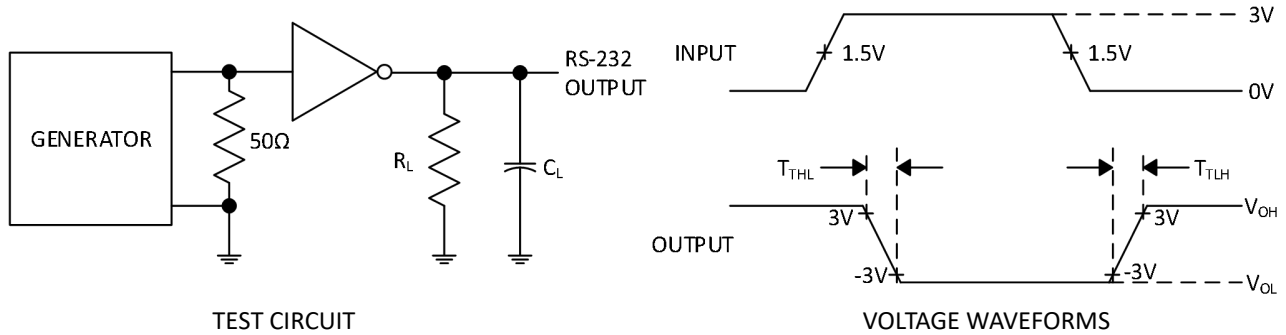


Figure 1. Driver Skew Rate

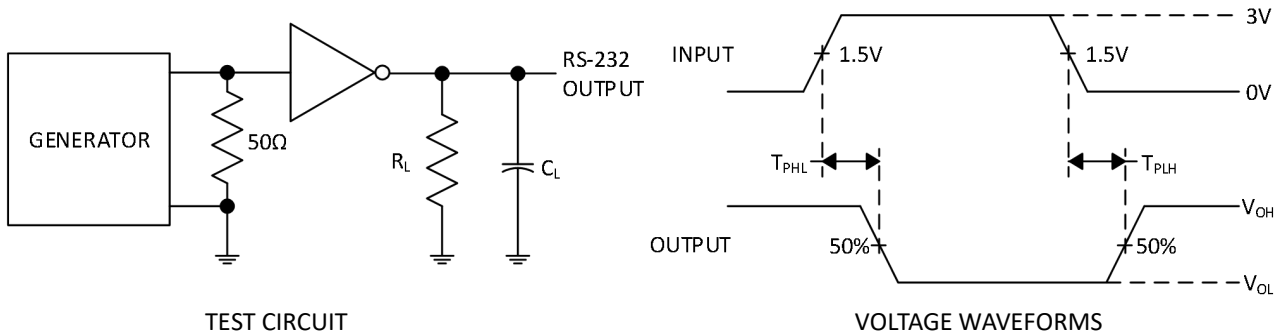


Figure 2. Driver Pulse Skew

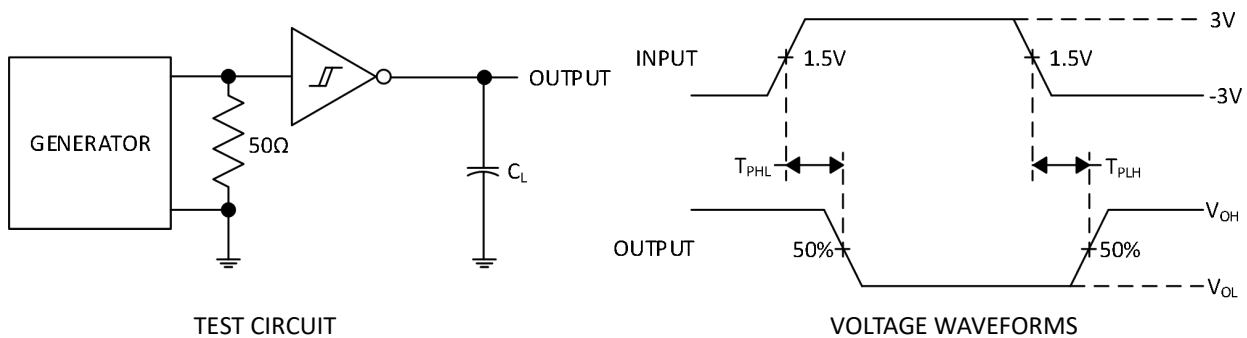


Figure 3. Receiver Propagation Delay Times

9 TYPICAL OPERATING CHARACTERISTICS

9.1 DESCRIPTION

The GM3232E interface chip comprises two drivers, two receivers, and a dual charge-pump circuit. The serial port has an ESD protection level of ±15kV according to IEC61000-4-2. The GM3232E meets the requirements of TIA/EIA-232-F and provides an electrical interface function between an asynchronous communication controller and a serial port connector. The internal charge pump of the chip and four small external capacitors support a single power supply ranging from 3V to 5.5V. The GM3232E supports a data signaling rate of up to 500kbit/s, and the maximum slew rate of the driver output is 30V/μs. The output ports of the chip are equipped with short-circuit protection to ground.

9.2 POWER SUPPLY

The GM3232E internally integrates a dual charge-pump circuit to provide positive and negative voltages. The positive and negative voltages generated by the charge pump are available at the V+ and V- pins of the chip respectively. This charge pump requires four off-chip capacitors to operate properly.

9.3 RS232 DRIVER

When the input level of the driver, DIN, is a valid high or low level, the driver will convert the TTL/CMOS standard logic level into the RS232 level that meets the requirements of TIA/EIA-232-F.

9.4 RS232 RECEIVER

The two receivers of GM3232E can convert the RS232 level into the standard logic output level. If the receiver input is open-circuit, the receiver output ROUT is at a high level. The input terminal RIN of each receiver has a standard built-in RS232 load.

9.5 RS232 LOGICAL FUNCTION TABLE

The logic function tables of the driver and receiver of GM3232E are shown in [Table 1](#) and [Table 2](#) below (H=High level, L=Low level, Open=Input open circuit).

Table 1: Drive logic function table

Driver	
Input DIN	Output DOUT
L	H
H	L

Table 2: Receiver logic function table

Receiver	
Input DIN	Output DOUT
L	H
H	L
Open	H

10 TYPICAL APPLICATION⁽⁴⁾

Figure 4 below shows a typical application of GM3232E. The ROUT and DIN pins are connected to the UART port or the common logic line, and the RIN and DOUT pins are connected to the RS232 connector port or the RS232 bus. In order to work properly, please refer to Table 3 to select the appropriate capacitor.

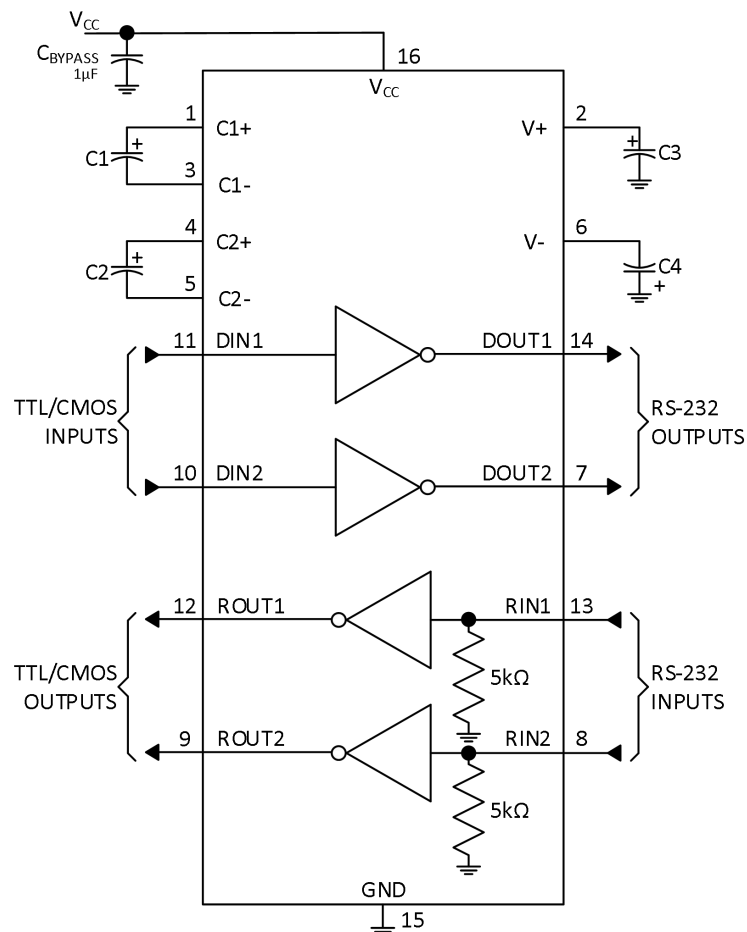


Figure 4. Typical Operating Circuit and Capacitor Values

4: Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

Table 3. V_{CC} vs Capacitor Values

V _{CC}	C1	C2, C3, C4
3.3V±0.3V	0.1μF	0.1μF
5V±0.5V	0.047μF	0.33μF
3V to 5.5V	0.1μF	0.47μF

11 LAYOUT

Keep the external capacitor traces short. This is more important on C1 and C2 nodes that have the fastest rise and fall times.

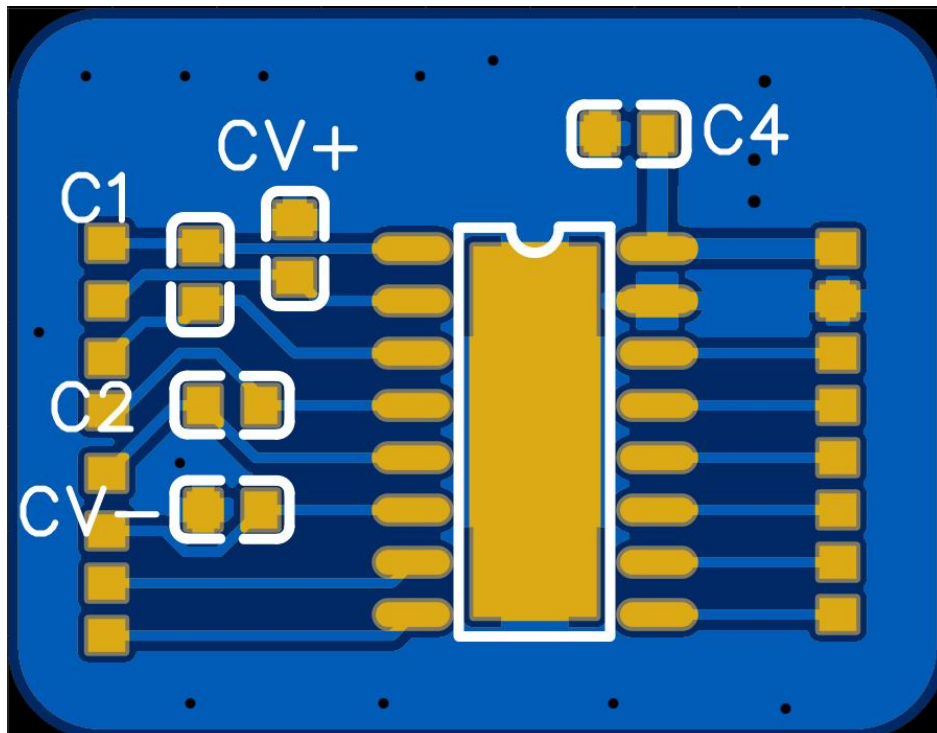
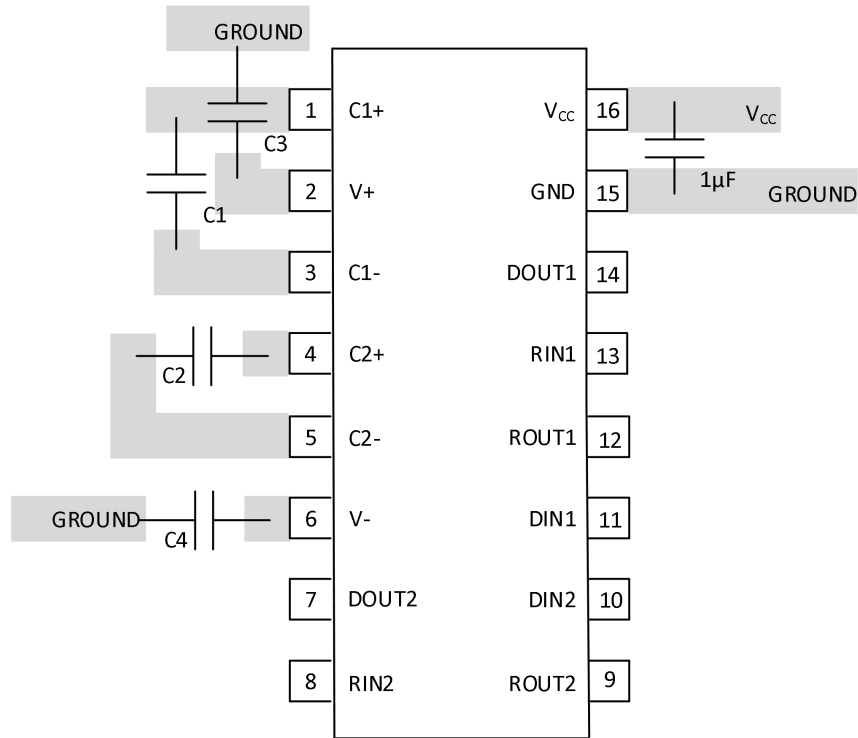
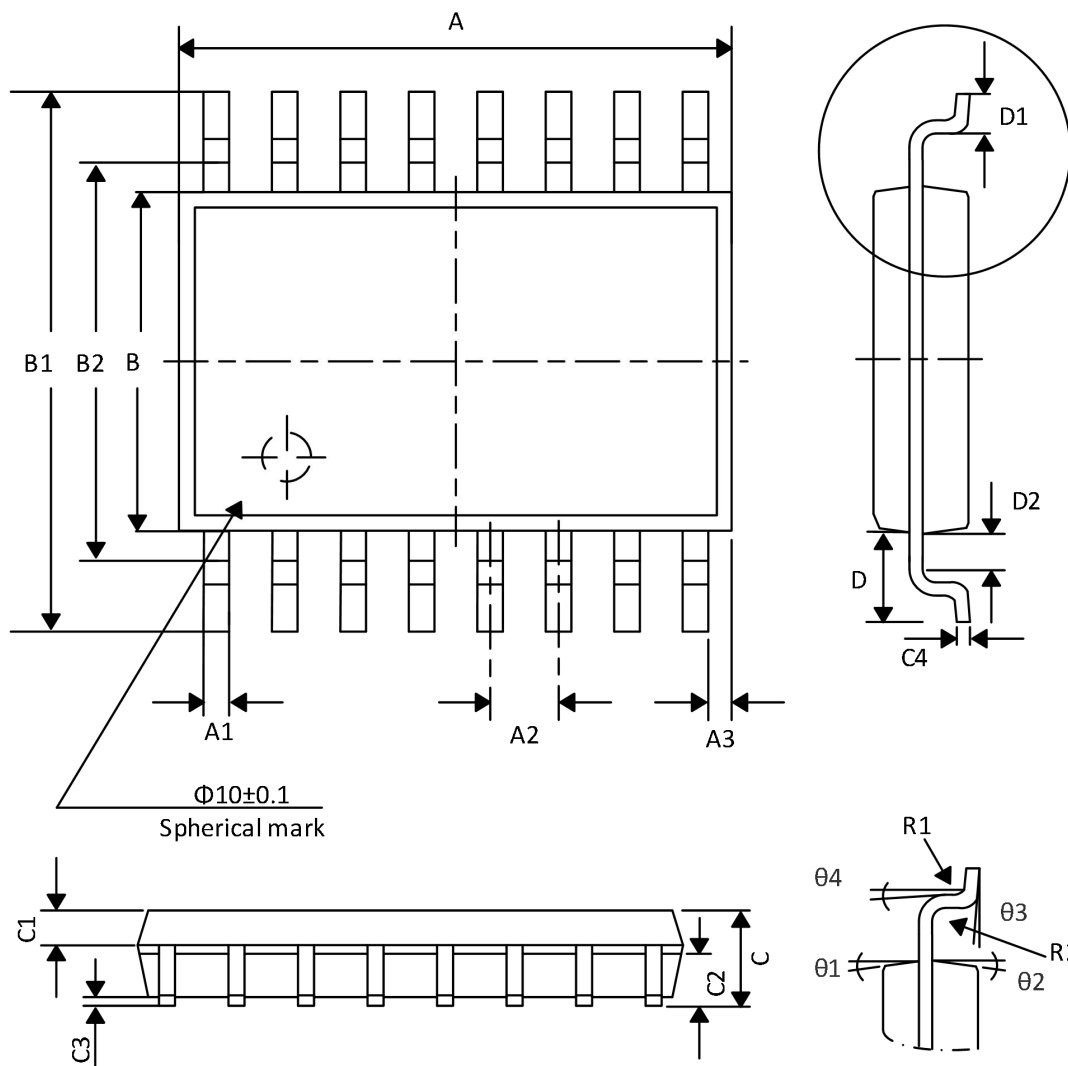


Figure 5. Layout Diagram

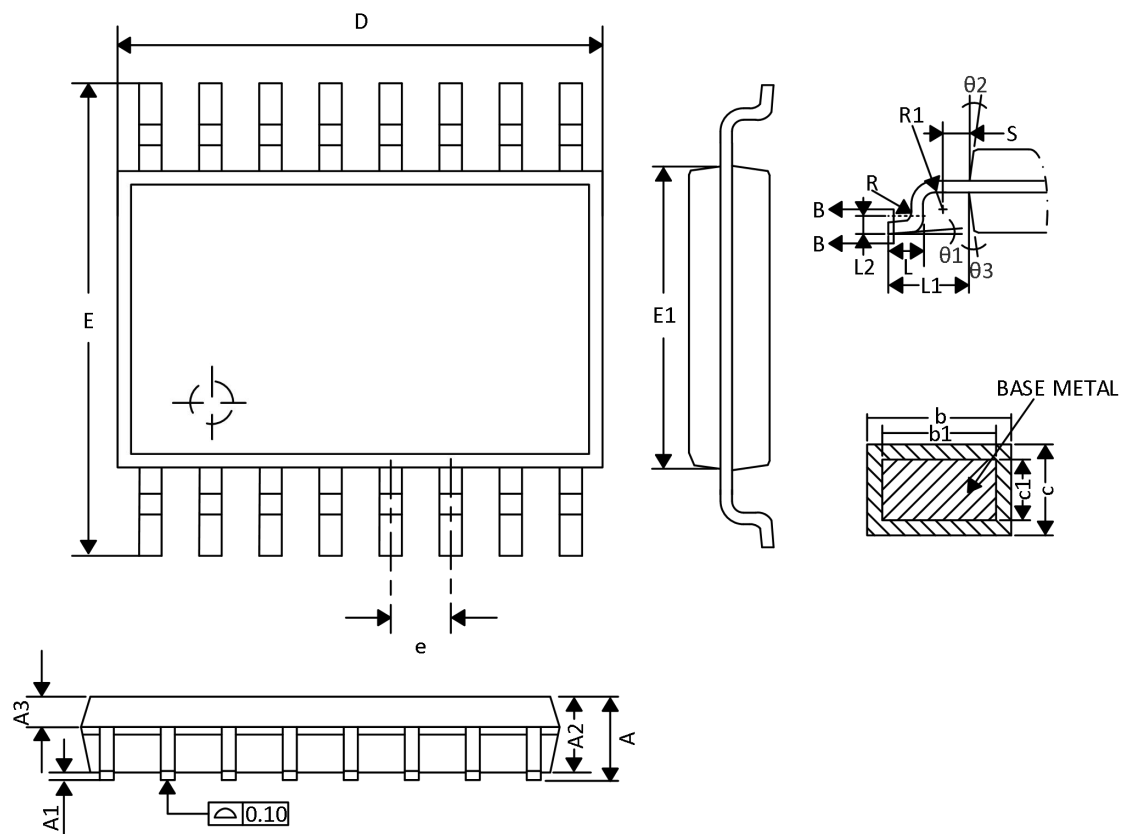
PACKAGE DIMENSION

SOP16



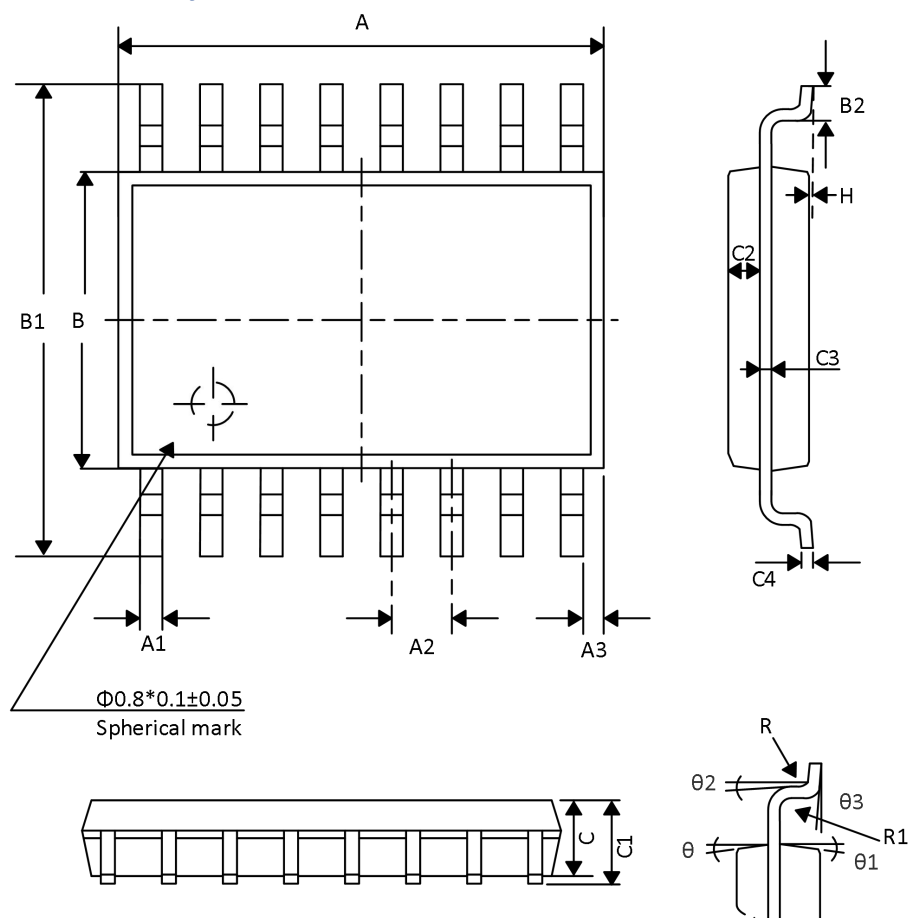
DIMENSION SYMBOL	MIN (mm)	MAX (mm)	DIMENSION SYMBOL	MIN (mm)	MAX (mm)
A	9.80	10.00	C4	0.203	0.233
A1	0.356	0.456	D	1.05TYP	
A2	1.27TYP		D1	0.40	0.70
A3	0.302TYP		D2	0.15	0.25
B	3.85	3.95	R1	0.20TYP	
B1	5.84	6.20	R2	0.20TYP	
B2	5.00TYP		$\theta 1$	$8^{\circ} \sim 12^{\circ}$ TYP4	
C	1.40	1.60	$\theta 2$	$8^{\circ} \sim 12^{\circ}$ TYP4	
C1	0.61	0.71	$\theta 3$	$0^{\circ} \sim 8^{\circ}$	
C2	0.54	0.64	$\theta 4$	$4^{\circ} \sim 12^{\circ}$	
C3	0.05	0.25			

TSSOP16



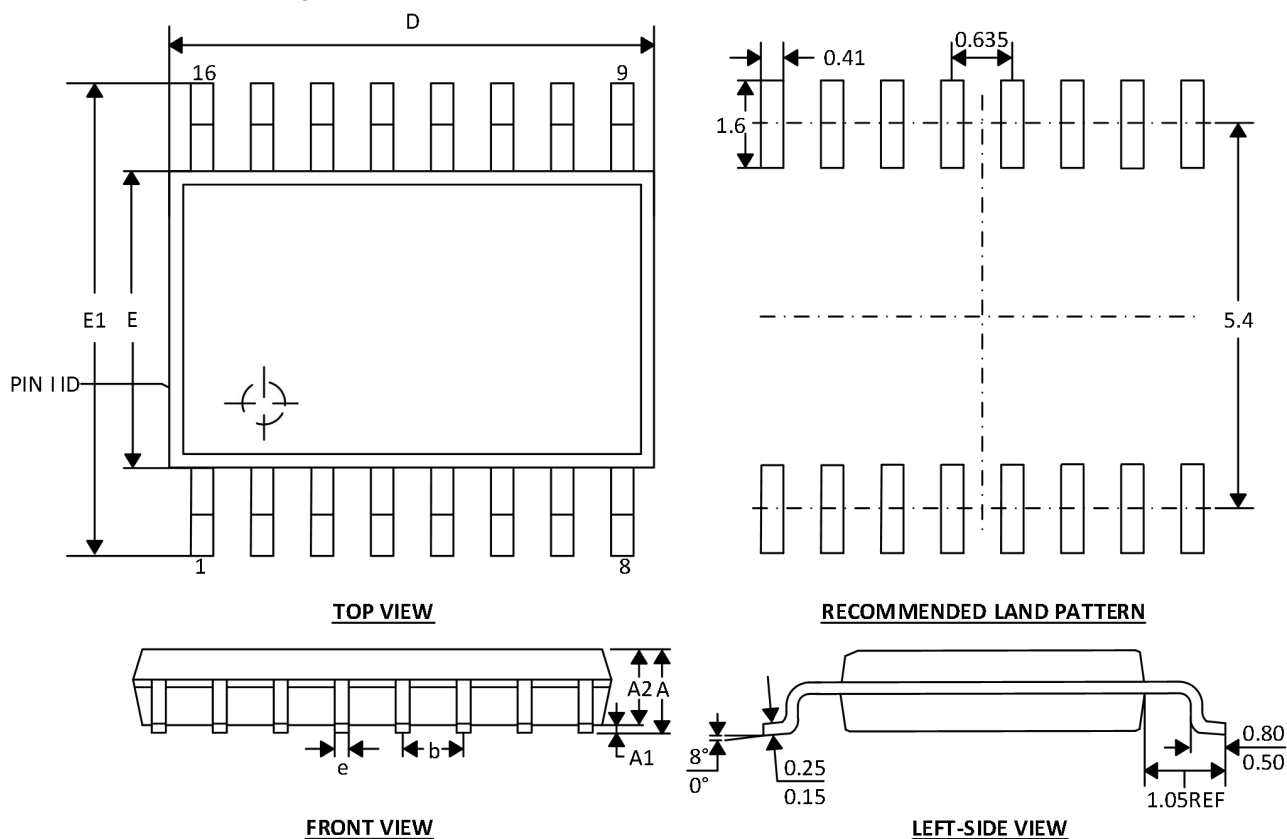
DIMENSION SYMBOL	MIN (mm)	TYP (mm)	MAX (mm)	DIMENSION SYMBOL	MIN (mm)	TYP (mm)	MAX (mm)
A	-	-	1.20	e	0.65BSC		
A1	0.05	-	0.15	L	0.45	0.60	0.75
A2	0.90	1.00	1.05	L1	1.00 REF		
A3	0.34	0.44	0.54	L2	0.25 BSC		
b	0.250	-	0.28	R	0.09	-	-
b1	0.20	0.22	0.24	R1	0.09	-	-
c	0.10	-	0.19	S	0.20	-	-
c1	0.10	0.13	0.15	θ1	0	-	8°
D	4.86	4.96	5.06	θ2	10°	12°	14°
E	6.20	6.40	6.06	θ3	10°	12°	14°
E1	4.30	4.40	4.50				

SSOP16-208mil(Wide body)



DIMENSION SYMBOL	MIN (mm)	MAX (mm)	DIMENSION SYMBOL	MIN (mm)	MAX (mm)
A	6.15	6.25	C3	0.152	
A1	0.30TYP		C4	0.172	
A2	0.65TYP		H	0.05	0.15
A3	0.675TYP		θ	12°TYP4	
B	5.25	5.35	θ1	12°TYP4	
B1	7.65	7.95	θ2	10°TYP	
B2	0.60	0.80	θ3	0°~8°	
C	1.70	1.80	R	0.20TYP	
C1	1.75	1.95	R1	0.15TYP	
C2	0.799				

SSOP16(Narrow body)



DIMENSION SYMBOL	MIN (mm)	TYP (mm)	MAX (mm)
A	-	-	1.75
A1	0.10	0.15	0.25
A2	1.35	1.45	1.55
e	0.23	-	0.31
b		0.63	
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20

Order Information

Order number	Package	Marking information	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
GM3232ESA	SOP16	GM3232ESA	-40 to 85°C	3	T&R,2500	RoHS
GM3232ETA	TSSOP16	GM3232ETA	-40 to 85°C	3	T&R,2500	RoHS
GM3232EBA	SSOP16(Wide body)	GM3232EBA	-40 to 85°C	3	T&R,2500	RoHS
GM3232ENA	SSOP16(Narrow body)	GM3232ENA	-40 to 85°C	3	T&R,2500	RoHS