Fail-Safe,Slew-Rate-Limited RS-485/RS-422 Transceivers

■ Description

The TK3081 is interface transceiver of serial data under RS-485 standard with low power consumption.The TK3081 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 115Kbps.It intended for full-duplex communications.

The TK3081 is purposed for application in telecom systems under RS485/RS422 standards with low power dissipation, translators of the level, transceiving devices sensitive to electromagnetic radiation, industrial control systems.

■ Features

- Allows up to 256 transceivers on the bus
- Supply voltage range: 5.0V ± 5%
- Data rate: 115Kbps
- Full-duplex communications
- Latch current, min – 300mA at normal climatic condition
- Enhanced ESD Specifications(TK3081E_ only):
  ±15kV IEC61000-4-2 Air Discharge
  ±8kV IEC61000-4-2 Contact Discharge

■ Ordering Information

Part Number	Package	Packing	Temperature(TA)	Package Qty	ESD
TK3081CSA	SOIC-8	Reel	0°C ~ 70°C	2500	
TK3081ESA	SOIC-8	Reel	-40°C ~ 85°C	2500	
TK3081ECSA	SOIC-8	Reel	0°C ~ 70°C	2500	±15KV
TK3081EESA	SOIC-8	Reel	-40°C ~ 85°C	2500	±15KV

Note: Please contact us to customize DIP packaging device.
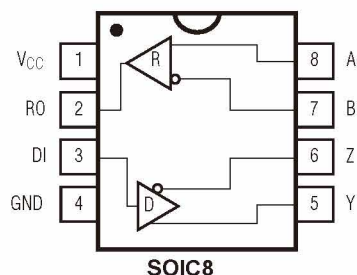
■ Pin Description

SOIC8

Table 1. **Pin Description**

Pin Num	Symbol	Pin Description
01	V$_{CC}$	Positive Supply 4.75V ≤ V$_{CC}$ ≤ 5.25V
02	RO	Receiver Output. When $\overline{RE}$ is low and if A - B ≥ -50mV, RO will be high; if A - B ≤ -200mV, RO will be low.
03	DI	Driver Input. With DE high, a low on DI forces noninverting output low and inverting output high. Similarly, a high on DI forces non-inverting output high and inverting output low.
04	GND	Ground
05	Y	Noninverting Driver Output
06	Z	Inverting Driver Output
07	B	Inverting Receiver Input
08	A	Noninverting Receiver Input

Typical Full-Duplex Operating Circuit
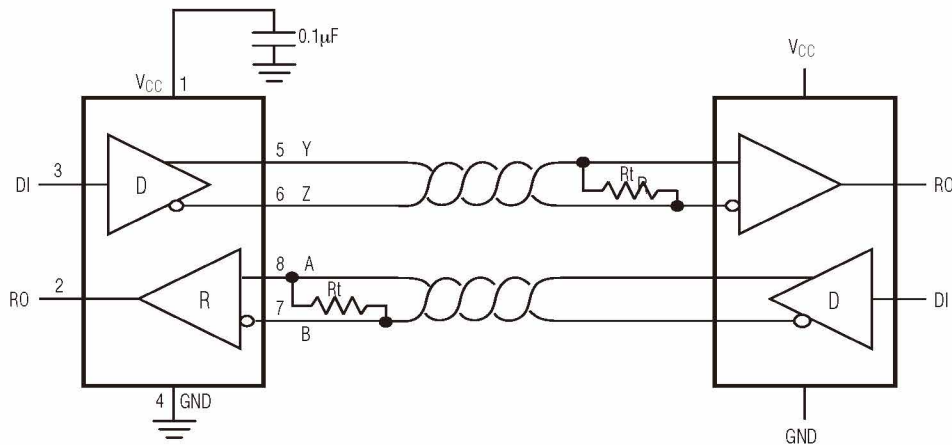
Table 2. **Transmitter Truth Table**

TRANSMITTING		
INPUT	OUTPUTS	
DI	Z	Y
H	L	H
L	H	L

Note : H – high level, L – low level , X –don't care

Table 3. **Receiver Truth Table**

RECEIVING	
INPUTS	OUTPUT
A - B	RO
≥ -0.05V	H
≤ -0.2V	L
Open/shorted	H

Note : H – high level, L – low level , BH – inputs not used, X –don't care

Table 4. **Maximum Ratings**

Parameter	Limit		Unit
	min	max	
Supply Voltage (V_{CC})		7.0	V
Driver Input Voltage (DI)	0.3	V_{CC} + 0.3	V
Driver Output Voltage (A, B, Y, Z)	-13	13	V
Receiver Input Voltage, Full Duplex (A, B)	-25	25	V
Receiver Output Voltage (RO)	0.3	V_{CC} + 0.3	V
Continuous Power Dissipation (T_A = +70°C)		471	mW

Table 5. **Electrical Parameters**

(Vcc = 5V ± 5%)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DRIVER							
Differential Driver Output (no load)	V_{OD1}	Fig 1				5	V
Differential Driver Output	V_{OD2}	Fig 1, R = 50Ω (RS-422)		2.0			V
		Fig 1, R = 27Ω (RS-485)		1.5			
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Fig 1, R = 50Ω or R = 27Ω				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig 1, R = 50Ω or R = 27Ω				3	V
Change In Magnitude of Common-Mode Voltage)	ΔV_{OC}	Fig 1, R = 50Ω or R = 27Ω				0.2	V
Input High Voltage	V_{IH1}	DE, DI, $\overline{RE}$, H/$\overline{F}$, TXP, RXP		2.0			V
Input Low Voltage	V_{IL1}	DE, DI, $\overline{RE}$, H/$\overline{F}$, TXP, RXP				0.8	V
DI Input Hysteresis	V_{HYS}	TK3080–TK3085, and TK3089 with SRL = V_{CC} or unconnected			100		mV
SRL Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	μA
	I_{IN2}	H/$\overline{F}$, TXP, RXP, internal pulldown		10		40	
Input High Voltage	V_{IH2}	SRL		V_{CC} - 0.8			V
Input Middle Voltage	V_{IM2}	SRL		$0.4V_{CC}$		$0.6V_{CC}$	V
Input Low Voltage	V_{IL2}	SRL				0.8	V
SRL Input Current	I_{IN3}	SRL = V_{CC}				75	μA
		SRL = GND		-75			
Input Current (A and B) Full Duplex	I_{IN4}	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = 12V			125	μA
			V_{IN} = -7V			-75	
Output Leakage (Y and Z) Full Duplex	I_O	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = 12V			125	μA
			V_{IN} = -7V	-100			
Driver Short-Circuit Output Current	V_{OD1}	-7V ≤ V_{OUT} ≤ V_{CC}		-250			mA
		0V ≤ V_{OUT} ≤ 12V				250	
		0V ≤ V_{OUT} ≤ V_{CC}			±25		
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ +12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV_{TH}				25		mV
Receiver Output High Voltage	V_{OH}	I_O = -4mA, V_{ID} = -50mV		V_{CC} -1.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA, V_{ID} = -200mV				0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4V ≤ V_O ≤ 2.4V				±1	μA
	R_{IN}				96		kΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V ≤ V_{RO} ≤ V_{CC}		±7		±95	mA
SUPPLY CURRENT							
Supply Current	I_{CC}	No load, $\overline{RE}$ = DI = GND or V_{CC}, SRL = V_{CC}	DE = V_{CC}		430	900	μA
			DE = GND		375	600	
		No load, $\overline{RE}$ = DI = GND or V_{CC}, SRL = GND	DE = V_{CC}		475	1000	μA
			DE = GND		420	800	
Supply Current in Shutdown Mode	I_{SHDN}	DE = GND, V$\overline{RE}$ = V_{CC}			0.001	10	μA
ESD Protection for Y, Z, A, B		Human Body Model (TK3086E_)			±15		kV

Table 6. **SWITCHING CHARACTERISTICS**

(V_{CC} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, Typical values are at V_{CC} = +5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t_{DPLH}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	500	2030	2600	ns
	t_{DPHL}		500	2030	2600	
Driver Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF		-3	±200	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Fig 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	667	1320	2500	ns
Maximum Data Rate	f_{MAX}		115			kbps
Driver Enable to Output High	t_{DZH}	Fig 4 and 6, C_L = 100pF, S2 closed			3500	ns
Driver Enable to Output Low	t_{DZL}	Fig 4 and 6, C_L = 100pF, S1 closed			3500	ns
Driver Disable Time from Low	t_{DLZ}	Fig 4 and 6, C_L = 15pF, S1 closed			100	ns
Driver Disable Time from High	t_{DHZ}	Fig 4 and 6, C_L = 15pF, S2 closed			100	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig 7; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		127	200	ns
| t_{RPLH} - t_{RPHL} | Differential Receiver Skew	t_{RSKD}	Fig 7; | V_{ID} | ≥ 2.0V; rise and fall time of V_{ID} ≤ 15ns		3	±30	ns
Receiver Enable to Output Low	t_{RZL}	Fig 2 and 8 , C_L = 100pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{RZH}	Fig 2 and 8, C_L = 100pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{RLZ}	Fig 2 and 8, C_L = 100pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{RHZ}	C_L = 100pF, S2 closed		20	50	ns
Time to Shutdown	t_{SHDN}	(Note 1）	50	200	600	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig 4 and 6, C_L = 15pF, S2 closed			6000	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig 4 and 6, C_L = 15pF, S1 closed			6000	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig 2 and 8, C_L = 100pF, S2 closed			3500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig 2 and 8, C_L = 100pF, S1 closed			3500	ns

Note 1: The device is put into shutdown by bringing $\overline{RE}$ high and DE low. If the enable inputs are in this state for less than 50ns, **The** device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 600ns, the device is guaranteed to have entered shutdown.
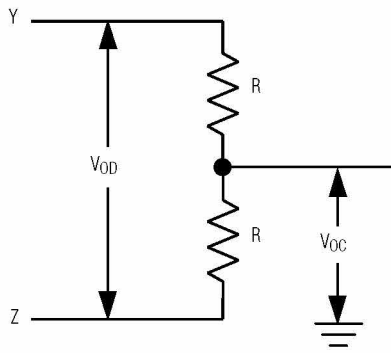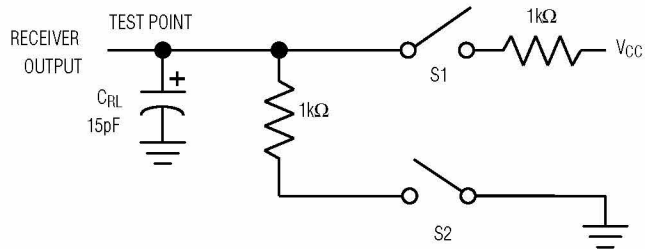
Fig 1. Driver DC Test Load

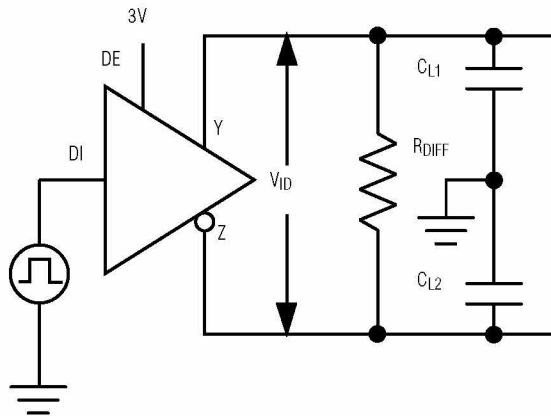
Fig 2. Receiver Enable/Disable Timing Test Load

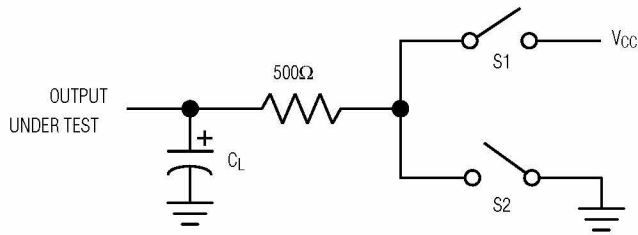*Fig 3. Driver Timing Test Circuit*
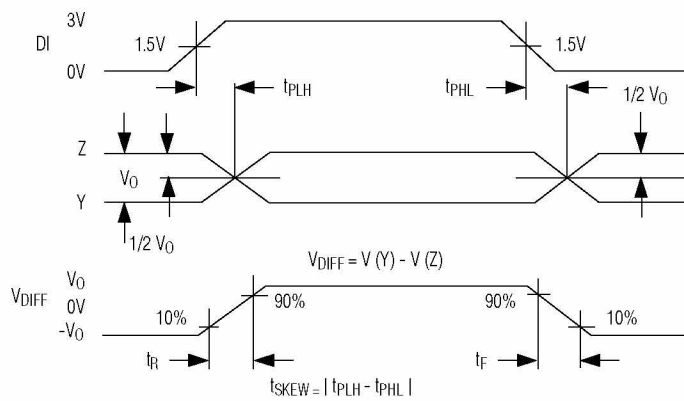
Fig 4 Driver Enable/Disable Timing Test Load

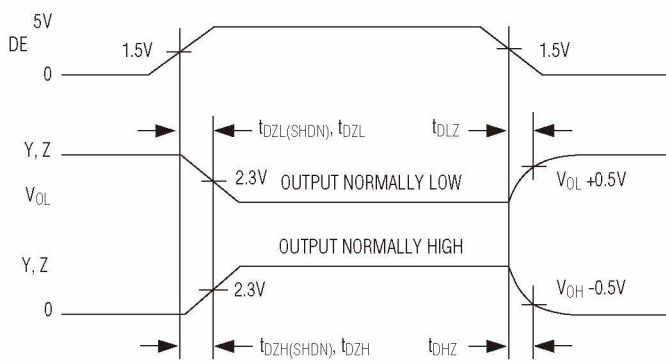*Fig 5. Driver Propagation Delays*

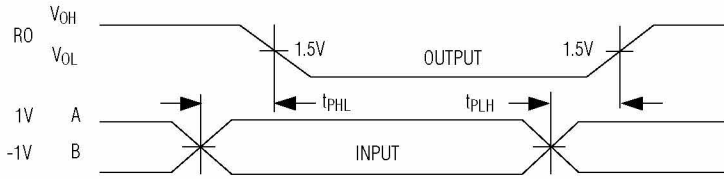
Fig 6. Driver Enable and Disable Times

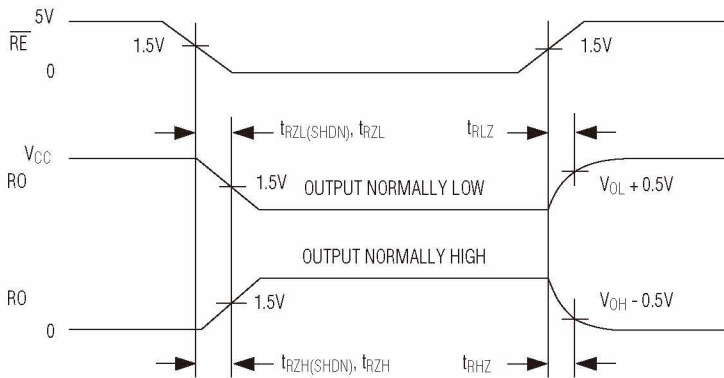Fig 7. Receiver Propagation Delays

Fig 8. Receiver Enable and Disable Times

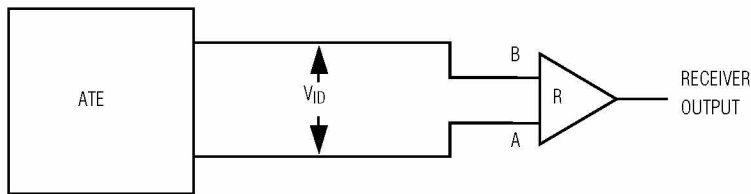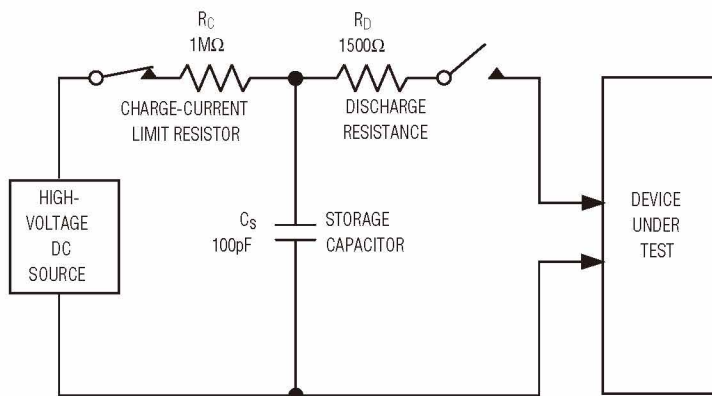
Fig 9. Receiver Propagation Delay Test Circuit

Fig 10. Human Body ESD Test Model

PACKAGE OUTLINE SOIC - 8,1.75 mm max height

.228-.244   TYP
[5.80-6.19]

PIN 1 mark hole

A

1

.189-.197
[4.81-5.00]

4

B

.150-.157
[3.81-3.98]

6X .050
[1.27]

8

2X

.150
[3.81]

5

8X .012-.020
[0.31-0.51]

C

SEATING PLANE

.004 [0.1] C

4X (0°-15°)

.069 MAX
[1.75]

.005-.010   TYP
[0.13-0.25]

4X (0°-15°)

SEE DETAIL A

.010
[0.25]

0° - 8°

.016-.050
[0.41-1.27]

(.041)
[1.04]

.004-.010
[0.11-0.25]

DETAIL A
TYPICAL

8X (.061)
[1.55]

1

8X (.024)
[0.6]

4

6X (.050)
[1.27]

SYMM
¢

SEE
DETAILS

8

SYMM
¢

5

(R.002) TYP
[0.05]

(.213)
[5.4]

⊕ .010 [0.25] Ⓜ C A B
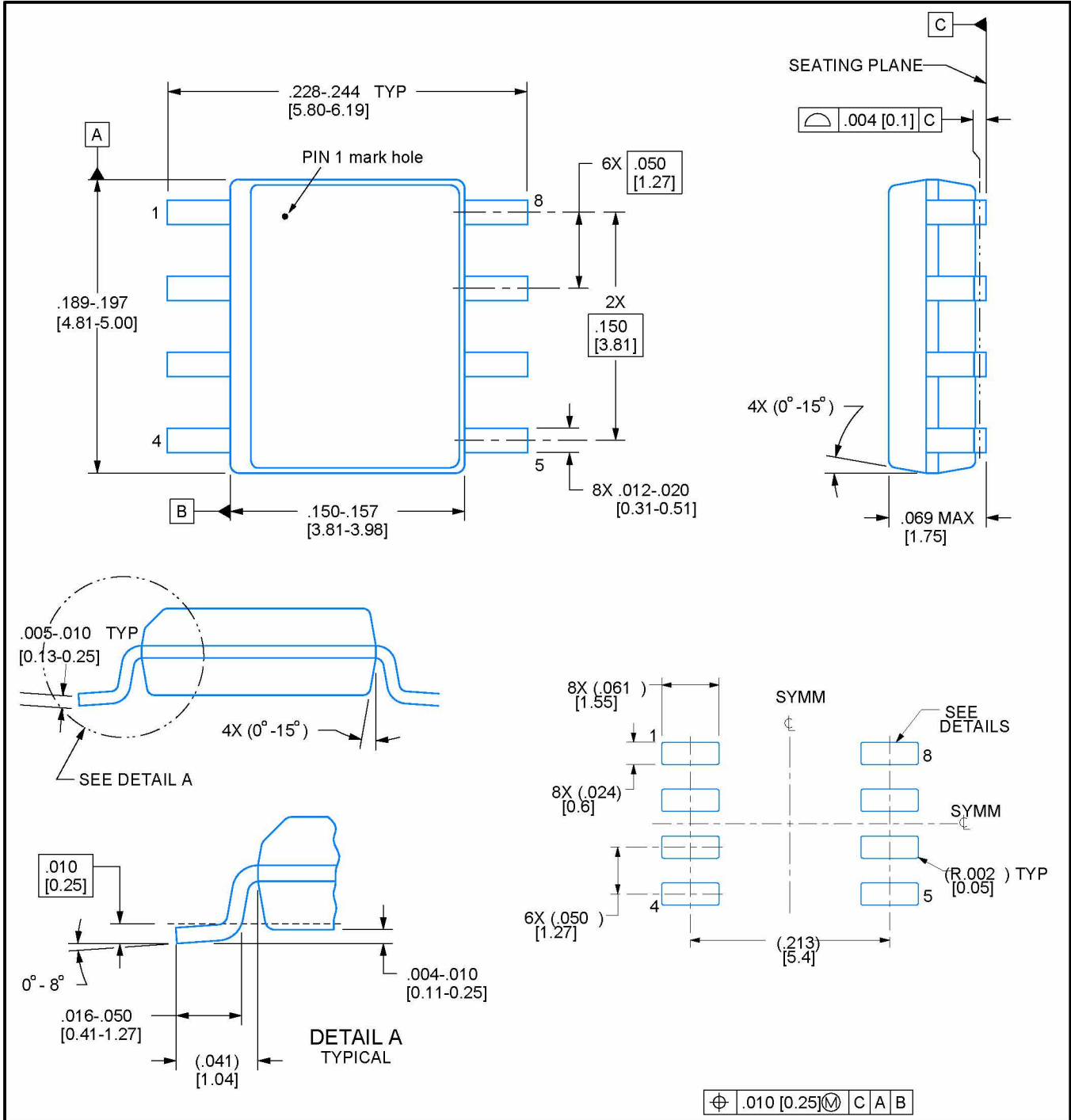
NOTES: Linear dimensions are in inches [millimeters]. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.