
±18V Fault-Protected, 3V to 5.5V, RS-485 Transceivers with Flexible I/O Supply and IEC ESD

UM3481 SOP8/MSOP8/DFN8 3.0×3.0
UM3481V SOP8/MSOP8/DFN10 3.0×3.0
UM13082 SOP8/MSOP8/DFN8 3.0×3.0
UM13082V SOP8/MSOP8/DFN10 3.0×3.0

1 Description

UM3481 and UM13082 are ±18V fault-protected, half-duplex, RS-485 transceivers operating on a single 3V to 5.5V supply voltage. UM3481V and UM13082V are ±18V fault-protected, half-duplex, RS-485 transceivers using a 1.65V to 5.5V supply for logic signal interface, and a 3V to 5.5V bus side supply. Bus interface pins are protected against overvoltage conditions during all modes of operation ensuring robust communication in rugged industrial environments.

These devices available in two speed grades. UM3481 and UM3481V are available in 1Mbps. UM13082 and UM13082V are available in 20Mbps. All devices also feature integrated IEC ESD protection, eliminating the need for external system-level protection components. Extended ±15V input common-mode range ensures reliable data communication over longer cable run lengths and/or in the presence of large ground loop voltages. Enhanced 250mV receiver hysteresis provides high noise rejection. In addition, the receiver fail-safe feature provides a logic high when the bus inputs are open or shorted together.

UM3481 and UM13082 are available in SOP8, MSOP8, DFN8 3.0×3.0 packages. UM3481V and UM13082V are available in SOP8, MSOP8, DFN10 3.0×3.0 packages. All devices are designed for space-constrained applications.

2 Features

- Meets or exceeds the requirements of the TIA/EIA-485A standards
- 3V to 5.5V supply voltage
- 1.65V to 5.5V Supply for logic signal interface (UM3481V, UM13082V)
- Bus I/O protection
 - ±18V DC bus fault
 - ±18kV Human body model (HBM)
 - ±9kV IEC 61000-4-2 contact discharge
- Latch-up performance exceeds 800mA per JESD 78
- Extended operational common-mode range: ±15V
- Glitch-free power-up/down for hot plug-in capability
- Undervoltage lockout
- Differential output exceeds 2.1 V for PROFIBUS compatibility with 5V supply
- Available in two speed grades:
 - 1Mbps (UM3481, UM3481V)
 - 20Mbps (UM13082, UM13082V)
- Extended ambient temperature range: -40°C to 125°C
- Enhanced receiver hysteresis for noise immunity
- Open, short, and idle bus failsafe
- Thermal shutdown
- 1/8 unit load (up to 256 bus nodes)

3 Applications

- Automotive data links
- Industrial-Control Local Area Networks
- Integrated Services Digital Networks
- Building automation
- Electricity meters
- Transceivers for EMI-Sensitive applications

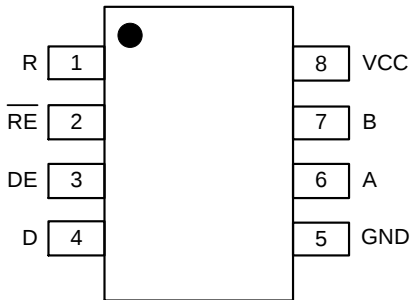
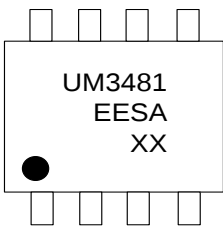
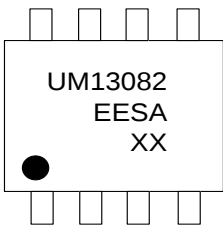
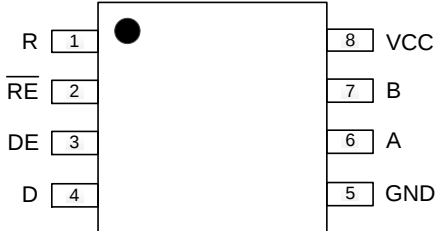
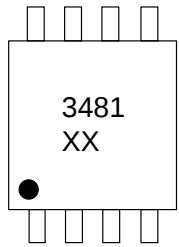
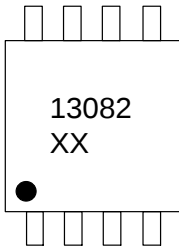
4 Selection Guide

Part Number	Data Rate (Mbps)	V _{CC} Range (V)	V _{IO} Range (V)
UM3481	1	3.0 to 5.5	-
UM3481V	1	3.0 to 5.5	1.65 to 5.5
UM13082	20	3.0 to 5.5	-
UM13082V	20	3.0 to 5.5	1.65 to 5.5

5 Ordering Information

Part Number	Mark Code	Package Type	Shipping Qty
UM3481EESA	UM3481EESA	SOP8	3000pcs/13Inch Tape & Reel
UM3481EEM8	3481	MSOP8	4000pcs/13Inch Tape & Reel
UM3481EEDA	3481	DFN8 3.0×3.0	3000pcs/13Inch Tape & Reel
UM3481VEESA	UM3481VEESA	SOP8	3000pcs/13Inch Tape & Reel
UM3481VEEM8	3481V	MSOP8	4000pcs/13Inch Tape & Reel
UM3481VEEDA	3481V	DFN10 3.0×3.0	3000pcs/13Inch Tape & Reel
UM13082EESA	UM13082EESA	SOP8	3000pcs/13Inch Tape & Reel
UM13082EEM8	13082	MSOP8	4000pcs/13Inch Tape & Reel
UM13082EEDA	13082	DFN8 3.0×3.0	3000pcs/13Inch Tape & Reel
UM13082VEESA	UM13082VEESA	SOP8	3000pcs/13Inch Tape & Reel
UM13082VEEM8	13082V	MSOP8	4000pcs/13Inch Tape & Reel
UM13082VEEDA	13082V	DFN10 3.0×3.0	3000pcs/13Inch Tape & Reel

6 Pin Configuration and Function

	 XX: Week Code UM3481EESA SOP8
	 XX: Week Code UM13082EESA SOP8
	 XX: Week Code UM3481EEM8 MSOP8  XX: Week Code UM13082EEM8 MSOP8

6 Pin Configuration and Function (continued)

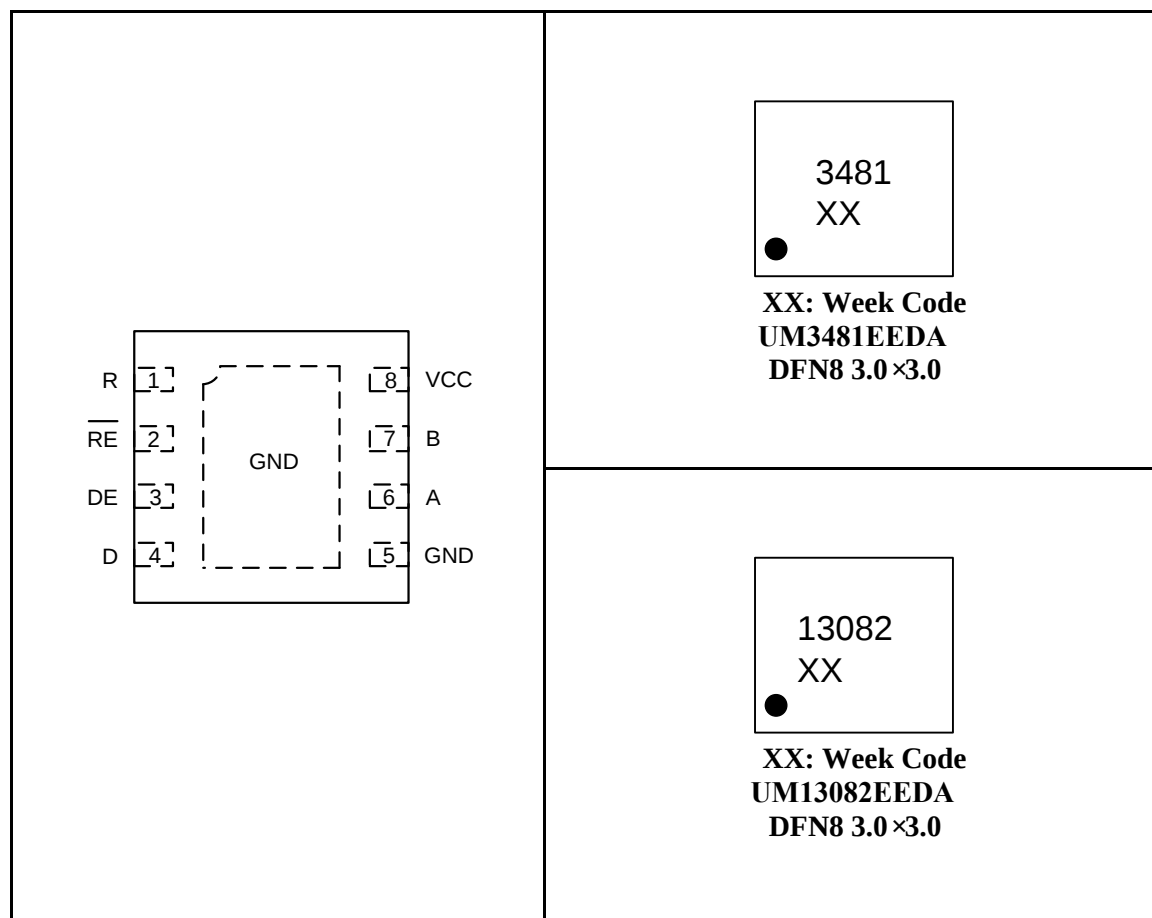
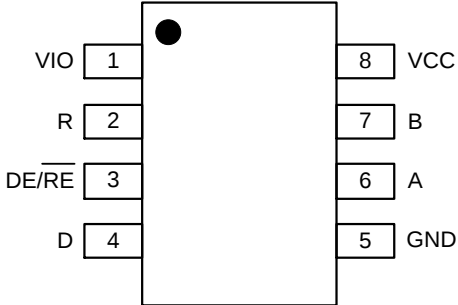
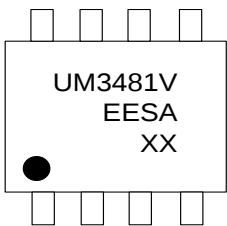
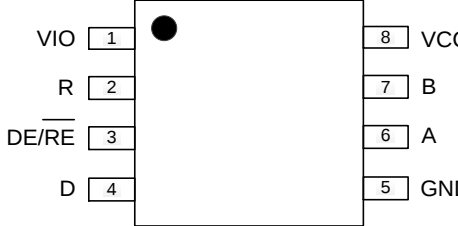
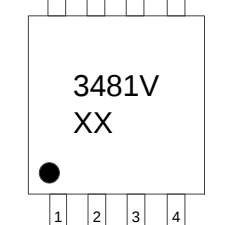
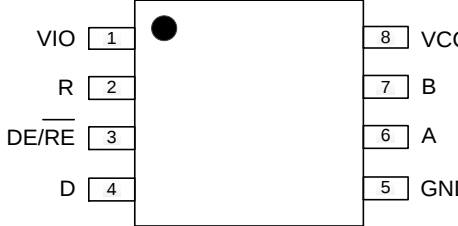
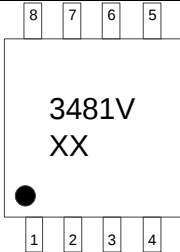
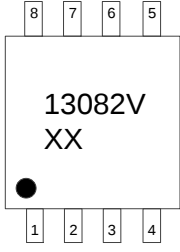


Table 6-1. Pin Functions of non-VIO versions

Pin No.	Pin Name	Function
1	R	Receive data output
2	$\overline{\text{RE}}$	Receiver enable, active low; integrated pull-up
3	DE	Driver enable, active high; integrated pull-down
4	D	Driver data input; integrated pull-up
5	GND	Local device ground
6	A	Driver output or receiver input (complementary to B)
7	B	Driver output or receiver input (complementary to A)
8	VCC	Supply voltage

6 Pin Configuration and Function (continued)

	 XX: Week Code UM3481VEESA SOP8
	 XX: Week Code UM13082VEESA SOP8
	 XX: Week Code UM3481VEEM8 MSOP8  XX: Week Code UM13082VEEM8 MSOP8

6 Pin Configuration and Function (continued)

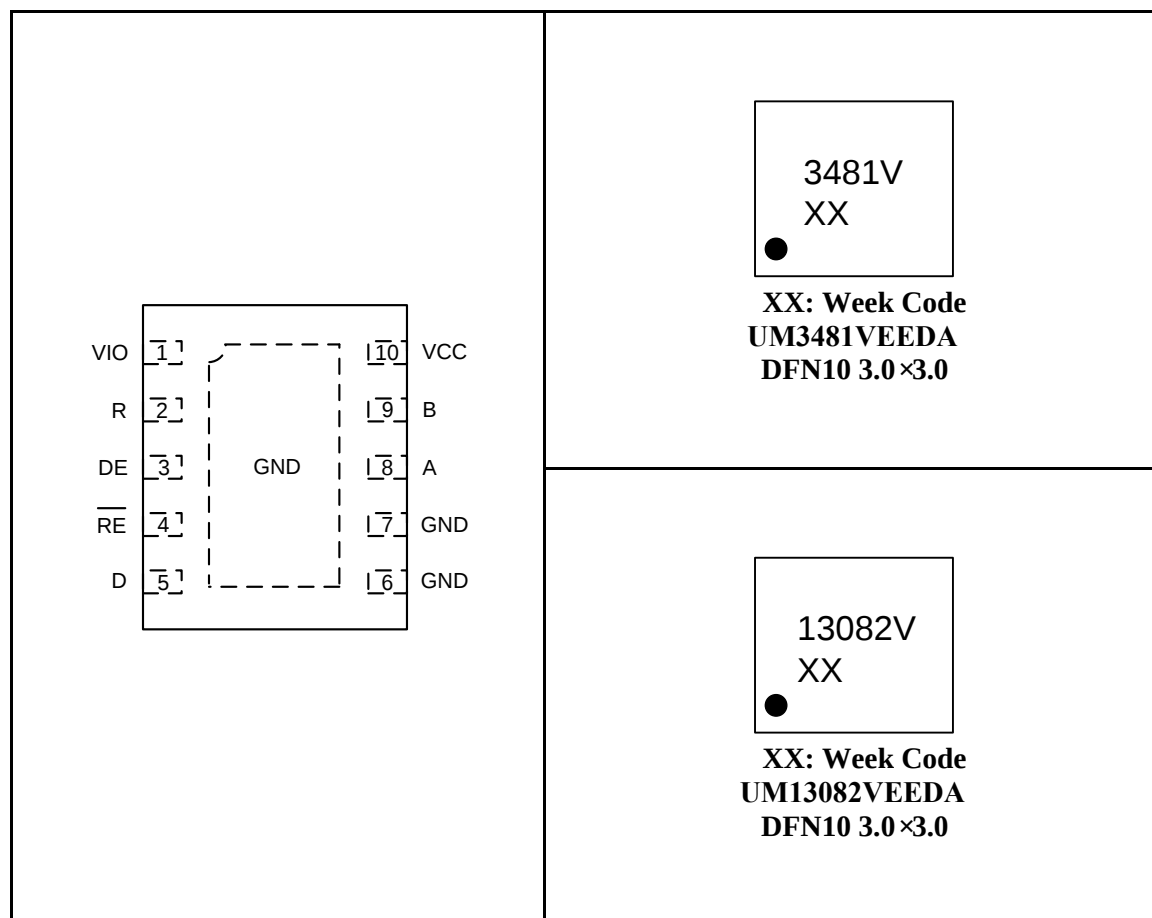


Table 6-2. Pin Functions of VIO versions

Pin Name	Function
VIO	1.65 V to 5.5 V supply for logic I/O signals (R, D, DE, $\overline{\text{RE}}$, DE/ $\overline{\text{RE}}$).
R	Receive data output.
DE/ $\overline{\text{RE}}$	Driver or Receiver select. High = Driver enable and Receiver disable, Low = Receiver enable and Driver disable. Connect this pin to ground with a 100k Ω resistor to avoid floating.
$\overline{\text{RE}}$	Receiver enable, active low.
DE	Driver enable, active high.
D	Driver data input.
GND	Local device ground.
A	Driver output or receiver input (complementary to B).
B	Driver output or receiver input (complementary to A).
VCC	3 V to 5.5 V bus supply.

7 Specifications

7.1 Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	Supply Voltage		3		5.5	V
V _{IO}	I/O Supply Voltage		1.65		V _{CC}	V
V _I	Input voltage at any bus terminal (separately or common mode)	Note1	-15		15	V
V _{ID}	Differential input voltage		-15		15	V
V _{ESD}	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	Bus terminals and GND		±18		kV
		All pins except bus terminals and GND		±8		kV
	Contact discharge, per IEC 61000-4-2	Bus terminals and GND		±9		kV
I _O	Output current, driver		-60		60	mA
I _{OR}	Output current, receiver	Non-VIO product variants	-8		8	mA
		V _{IO} = 1.8 V or 2.5 V	-4		4	mA
		V _{IO} = 3.3 V or 5 V	-8		8	mA
R _L	Differential load resistance		54	60		Ω
1/ t _{UI}	Signaling rate	UM3481,UM3481V			1	Mbps
		UM13082,UM13082V			20	Mbps
T _A	Operating free-air temperature (see application section for thermal information)		-40		125	℃
T _J	Junction temperature		-40		150	℃

Note 1: The algebraic convention, in which the least positive (most negative) limit is designated as minimum is used in this data sheet.

7.2 Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	Supply voltage		-0.5		6.5	V
V _{IO}	Logic supply voltage		-0.5		6.5	V
V _I	Voltage on A, B		-18		18	V
	Voltage on any logic pin (D, DE, $\overline{RE}$)	Note 2	-0.3		6.5	V
I _O	RXD output current		-24		24	mA
T _{STG}	Storage temperature		-65		150	°C
T _L	Lead Temperature for Soldering 10 Seconds				260	°C

Note 1: Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute maximum ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If briefly operating outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.

Note 2: V_{IO} = V_{CC} in non-VIO product variants.

7.3 Electrical Characteristics (Static) (Note 1)

over operating free-air temperature range (unless otherwise noted). All typical values are at 25°C and supply voltage of V_{CC} = 5 V, V_{IO} = 3.3 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply						
V _{UVD(VCC)RISING}	Rising under-voltage threshold on VCC			2.6	2.8	V
V _{UVD(VCC)FALLING}	Falling under-voltage threshold on VCC		1.95	2.4		V
V _{UVD(VCC)HYS}	Hysteresis on under-voltage of VCC			170		mV
V _{UVD(VIO)RISING}	Rising under-voltage threshold on VIO			1.2	1.6	V
V _{UVD(VIO)FALLING}	Falling under-voltage threshold on VIO		0.75	1.1		V
V _{UVD(VIO)HYS}	Hysteresis on under-voltage of VIO			120		mV

7.3 Electrical Characteristics (Static) (Note 1) (continued)

over operating free-air temperature range (unless otherwise noted). All typical values are at 25°C and supply voltage of $V_{CC} = 5\text{ V}$, $V_{IO} = 3.3\text{ V}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply						
I_{CC}	Supply current, $V_{CC} = 4.5\text{ V to }5.5\text{ V}$	$\overline{RE} = 0\text{ V}$, $DE = V_{IO}$, No load (Driver and receiver enabled)		1.6	3	mA
		$\overline{RE} = V_{IO}$, $DE = V_{IO}$, No load (Driver enabled, receiver disabled)		1.6	3	mA
		$\overline{RE} = 0\text{ V}$, $DE = 0\text{ V}$, No load (Driver disabled, receiver enabled)		0.8	2.4	mA
		$\overline{RE} = V_{IO}$, $DE = 0\text{ V}$, D = open, No load (Driver and receiver disabled)		0.6	3	μA
I_{CC}	Supply current, $V_{CC} = 3\text{ V to }3.6\text{ V}$	$\overline{RE} = 0\text{ V}$, $DE = V_{IO}$, No load (Driver and receiver enabled)		1.45	3	mA
		$\overline{RE} = V_{IO}$, $DE = V_{IO}$, No load (Driver enabled, receiver disabled)		1.45	3	mA
		$\overline{RE} = 0\text{ V}$, $DE = 0\text{ V}$, No load (Driver disabled, receiver enabled)		0.7	2.4	mA
		$\overline{RE} = V_{IO}$, $DE = 0\text{ V}$, D = open, No load (Driver and receiver disabled)		0.3	3	μA
I_{IO}	Logic supply current, $V_{IO} = 1.65\text{ V to }5.5\text{ V}$	$\overline{RE} = 0\text{ V}$, $DE = 0\text{ V}$, No load (Driver disabled, receiver enabled)		3.3	10	μA
		$\overline{RE} = V_{IO}$, $DE = 0\text{ V}$, No load (Driver and receiver disabled)		0.1	3	μA

7.3 Electrical Characteristics (Static) (Note 1) (continued)

over operating free-air temperature range (unless otherwise noted). All typical values are at 25°C and supply voltage of $V_{CC} = 5\text{ V}$, $V_{IO} = 3.3\text{ V}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Driver						
$ V_{OD} $	Driver differential output voltage magnitude	$R_L = 60\ \Omega$, $-15\text{ V} \leq V_{TEST} \leq 15\text{ V}$, See Figure 8-1	1.5	3.4		V
		$R_L = 60\ \Omega$, $-15\text{ V} \leq V_{TEST} \leq 15\text{ V}$, $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$, See Figure 8-1	2.1	3.4		V
		$R_L = 100\ \Omega$, See Figure 8-2	2	4		V
		$R_L = 54\ \Omega$, See Figure 8-2	1.5	3.4		V
$\Delta V_{OD} $	Change in magnitude of driver differential output voltage	$R_L = 54\ \Omega$ or $100\ \Omega$ See Figure 8-2	-50		50	mV
V_{OC}	Common-mode output voltage	$R_L = 54\ \Omega$ or $100\ \Omega$ See Figure 8-2	1	$V_{CC}/2$	3	V
$V_{OC(SS)}$	Steady-state common-mode output voltage	$R_L = 54\ \Omega$ or $100\ \Omega$ See Figure 8-2	-50		50	mV
I_{OS}	Short-circuit output current	$DE = V_{IO}$, $-15\text{ V} \leq (V_A \text{ or } V_B) \leq 15\text{ V}$	-250		250	mA
Receiver						
I_I	Bus input current	$DE = 0\text{ V}$, $V_{CC} = 0\text{ V}$ or 5.5 V , $V_I = 12\text{ V}$		70	125	μA
		$DE = 0\text{ V}$, $V_{CC} = 0\text{ V}$ or 5.5 V , $V_I = -7\text{ V}$	-100	-60		
V_{TH+}	Positive-going input threshold voltage	Over common-mode range of $\pm 15\text{ V}$	40	125	200	mV
V_{TH-}	Negative-going input threshold voltage		-200	-125	-40	
V_{HYS}	Input hysteresis			250		
$V_{TH(FSH)}$	Input fail-safe threshold		-40		40	
$C_{A,B}$	Input differential capacitance	Measured between A and B, $f = 1\text{ MHz}$		50		pF

7.3 Electrical Characteristics (Static) (Note 1) (continued)

over operating free-air temperature range (unless otherwise noted). All typical values are at 25°C and supply voltage of $V_{CC} = 5\text{ V}$, $V_{IO} = 3.3\text{ V}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OH}	Output high voltage	$I_{OH} = -4\text{ mA}$ $V_{IO} = 1.65\text{ V to } 2.75\text{ V}$	$V_{IO} - 0.4$	$V_{IO} - 0.1$		V
V_{OH}	Output high voltage	$I_{OH} = -8\text{ mA}$	$V_{IO} - 0.4$	$V_{IO} - 0.1$		V
V_{OL}	Output low voltage	$I_{OL} = 4\text{ mA}$ $V_{IO} = 1.65\text{ V to } 2.75\text{ V}$		0.1	0.4	V
V_{OL}	Output low voltage	$I_{OL} = 8\text{ mA}$		0.1	0.4	V
I_{OZ}	Output high-impedance current	$V_O = 0\text{ V or } V_{IO}$, $\overline{RE} = V_{IO}$	-1		1	μA
Logic						
V_{IH}	Input High Voltage	DE, D, $\overline{RE}$	$0.7V_{IO}$			V
V_{IL}	Input low Voltage	DE, D, $\overline{RE}$			$0.3V_{IO}$	V
I_I	Input current on DE pin	$1.65\text{ V} \leq V_{IO} \leq 5.5\text{ V}$, $0\text{ V} \leq V_{IN} \leq V_{IO}\text{ V}$			5	μA
	Input current on D, $\overline{RE}$ pin	$1.65\text{ V} \leq V_{IO} \leq 5.5\text{ V}$, $0\text{ V} \leq V_{IN} \leq V_{IO}\text{ V}$	-5			μA
Thermal Protection						
T_{SD}	Thermal shutdown threshold	Temperature rising	150	170		°C
T_{HYS}	Thermal shutdown hysteresis			10		°C

Note 1: $V_{IO} = V_{CC}$ in non-VIO product variants.

7.4 Electrical Characteristics (Dynamic)—1Mbps (Note 1)

over recommended operating conditions. All typical values are at 25°C and supply voltage of $V_{CC}=5V$, $V_{IO} = 3.3V$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Driver							
t _R , t _F	Driver differential output rise/fall time	R _L = 54 Ω, C _L = 50 pF, see Figure 8-3	V _{CC} = 3 to 3.6 V, Typical at 3.3 V	125	300	650	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V	130	475	650	ns
t _{PHL} , t _{PLH}	Driver propagation delay time		V _{CC} = 3 to 3.6 V, Typical at 3.3 V		245	300	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V		300	350	ns
t _{SK(P)}	Driver differential output pulse skew, t _{PHL} - t _{PLH}		V _{CC} = 3 to 3.6 V, Typical at 3.3 V		2.5	20	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V		1.5	15	ns
t _{PHZ} , t _{PLZ}	Disable time	See Figure 8-4 and Figure 8-5		180	250	ns	
t _{PZH} , t _{PZL}	Enable time	$\overline{RE}$ = 0 V, See Figure 8-4 and Figure 8-5		200	330	ns	
t _{PSH} , t _{PSL}		$\overline{RE}$ = V _{IO} , See Figure 8-4 and Figure 8-5		2.5	4.6	μs	
t _{PHS} , t _{PLS}	Time to shutdown	$\overline{RE}$ = V _{IO} , See Figure 8-4 and Figure 8-5	50		500	ns	
Receiver							
t _R , t _F	Receiver output rise/fall time	C _L = 15 pF, see Figure 8-6		9	20	ns	
t _{PHL} , t _{PLH}	Receiver propagation delay time			53	80	ns	
t _{SK(P)}	Receiver output pulse skew, t _{PHL} - t _{PLH}			1	12.5	ns	

7.4 Electrical Characteristics (Dynamic)—1Mbps (continued) (Note 1)

over recommended operating conditions. All typical values are at 25°C and supply voltage of $V_{CC}=5V$, $V_{IO} = 3.3 V$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Receiver						
t_{PHZ}, t_{PLZ}	Receiver disable time			30	50	ns
t_{PZL}, t_{PZH}	Receiver enable time	DE = V_{IO} , see Figure 8-7		30	120	ns
t_{PSH}, t_{PSL}		DE = 0 V, see Figure 8-8		2.5	4.5	μs
$t_{D(OFS)}$	Delay to enter fail-safe operation	$C_L = 15 pF$, see Figure 8-9	7	11	18	μs
$t_{D(FSO)}$	Delay to exit fail-safe operation		27	57	70	ns
t_{PHS}, t_{PLS}	Time to shutdown	DE = 0 V, see Figure 8-8	50		500	ns

Note 1: $V_{IO} = V_{CC}$ in non-VIO product variants.

7.4 Electrical Characteristics (Dynamic)—20Mbps (Note 1)

over recommended operating conditions. All typical values are at 25°C and supply voltage of $V_{CC}=5V$, $V_{IO} = 3.3V$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Driver							
t _R , t _F	Driver differential output rise/fall time	R _L = 54 Ω, C _L = 50 pF, see Figure 8-3	V _{CC} = 3 to 3.6 V, Typical at 3.3 V	4	12	20	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V	4	13	20	ns
t _{PHL} , t _{PLH}	Driver propagation delay time		V _{CC} = 3 to 3.6 V, Typical at 3.3 V	6	18	30	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V	4	15	25	ns
t _{SK(P)}	Driver differential output pulse skew, t _{PHL} - t _{PLH}		V _{CC} = 3 to 3.6 V, Typical at 3.3 V		1	3	ns
			V _{CC} = 4.5 to 5.5 V, Typical at 5 V		0.5	3	ns
t _{PHZ} , t _{PLZ}	Disable time	See Figure 8-4 and Figure 8-5		25	70	ns	
t _{PZH} , t _{PZL}	Enable time	$\overline{RE}$ = 0 V, See Figure 8-4 and Figure 8-5		23	70	ns	
t _{PSH} , t _{PSL}		$\overline{RE}$ = V _{IO} , See Figure 8-4 and Figure 8-5		2.4	4.5	μs	
t _{PHS} , t _{PLS}	Time to shutdown	$\overline{RE}$ = V _{IO} , See Figure 8-4 and Figure 8-5	50		500	ns	
Receiver							
t _R , t _F	Receiver output rise/fall time	C _L = 15 pF, see Figure 8-6		4	8	ns	
t _{PHL} , t _{PLH}	Receiver propagation delay time		10	18	58	ns	
t _{SK(P)}	Receiver output pulse skew, t _{PHL} - t _{PLH}			0.5	5	ns	

7.4 Electrical Characteristics (Dynamic)—20Mbps (continued) (Note 1)

over recommended operating conditions. All typical values are at 25°C and supply voltage of $V_{CC}=5V$, $V_{IO} = 3.3 V$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Receiver						
t_{PHZ}, t_{PLZ}	Receiver disable time			15	35	ns
t_{PZL}, t_{PZH}	Receiver enable time	DE = V_{IO} , see Figure 8-7		15	82	ns
t_{PSH}, t_{PSL}		DE = 0 V, see Figure 8-8		2.5	5	μs
$t_{D(OFS)}$	Delay to enter fail-safe operation	$C_L = 15 pF$, see Figure 8-9	7	11	18	μs
$t_{D(FSO)}$	Delay to exit fail-safe operation		13	23	60	ns
t_{PHS}, t_{PLS}	Time to shutdown	DE = 0 V, see Figure 8-8	50		500	ns

Note 1: $V_{IO} = V_{CC}$ in non-VIO product variants.

8 Parameter Measurement Information

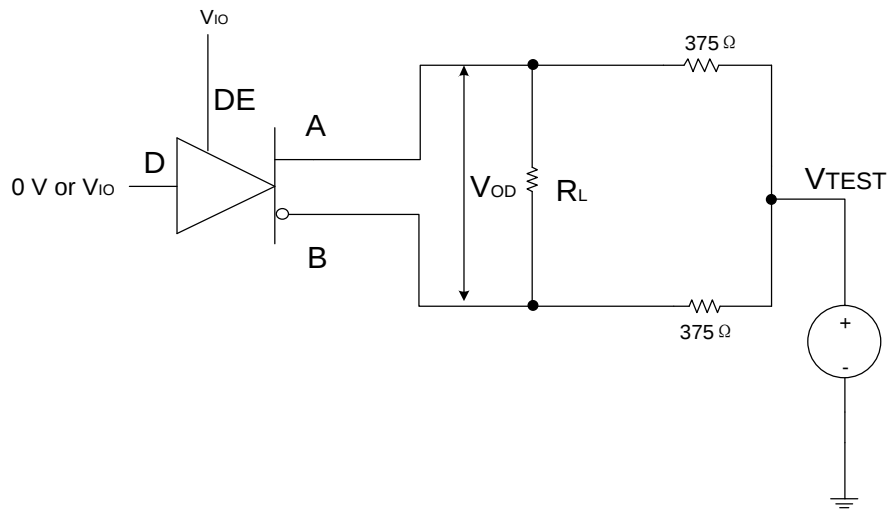


Figure 8-1. Measurement of Driver Differential Output Voltage With Common-Mode Load

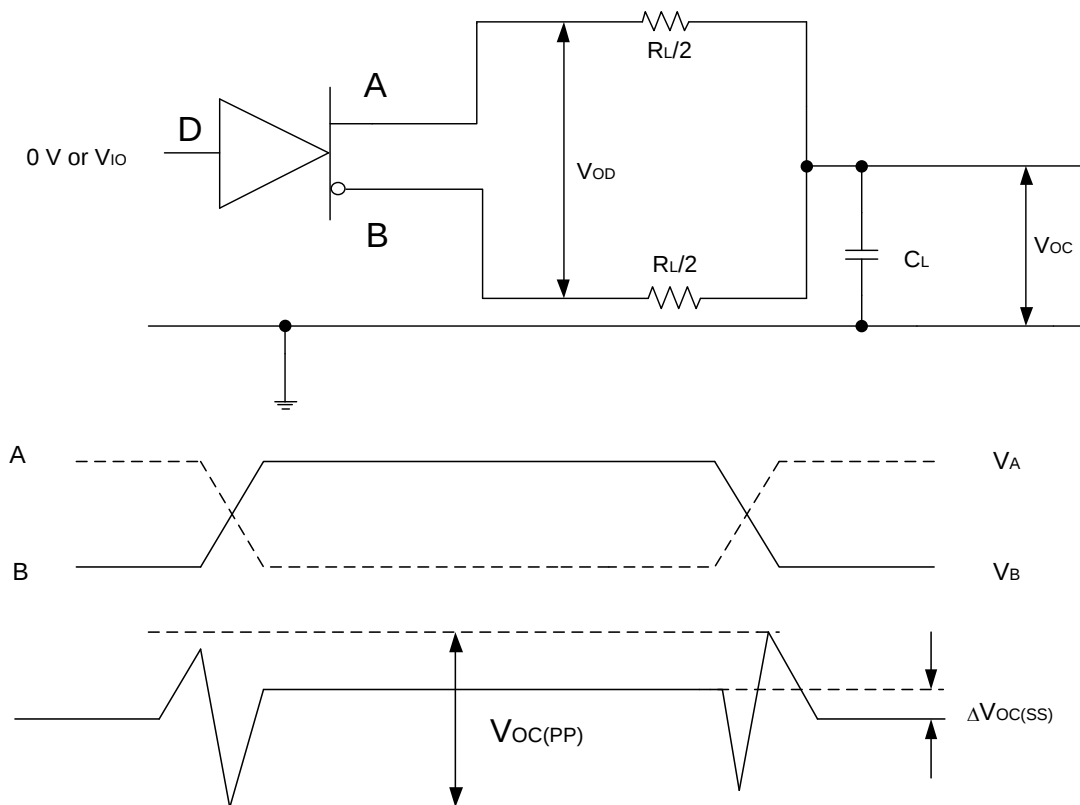


Figure 8-2. Measurement of Driver Differential and Common-Mode Output With RS-485 Load

8 Parameter Measurement Information (continued)

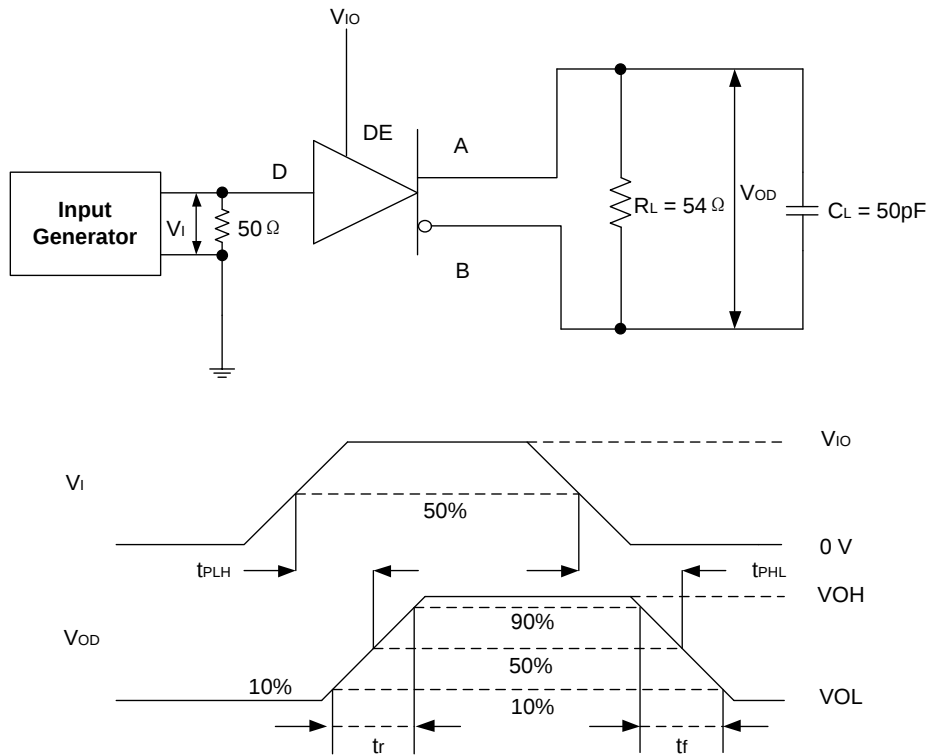


Figure 8-3. Measurement of Driver Differential Output Rise and Fall Times and Propagation Delays

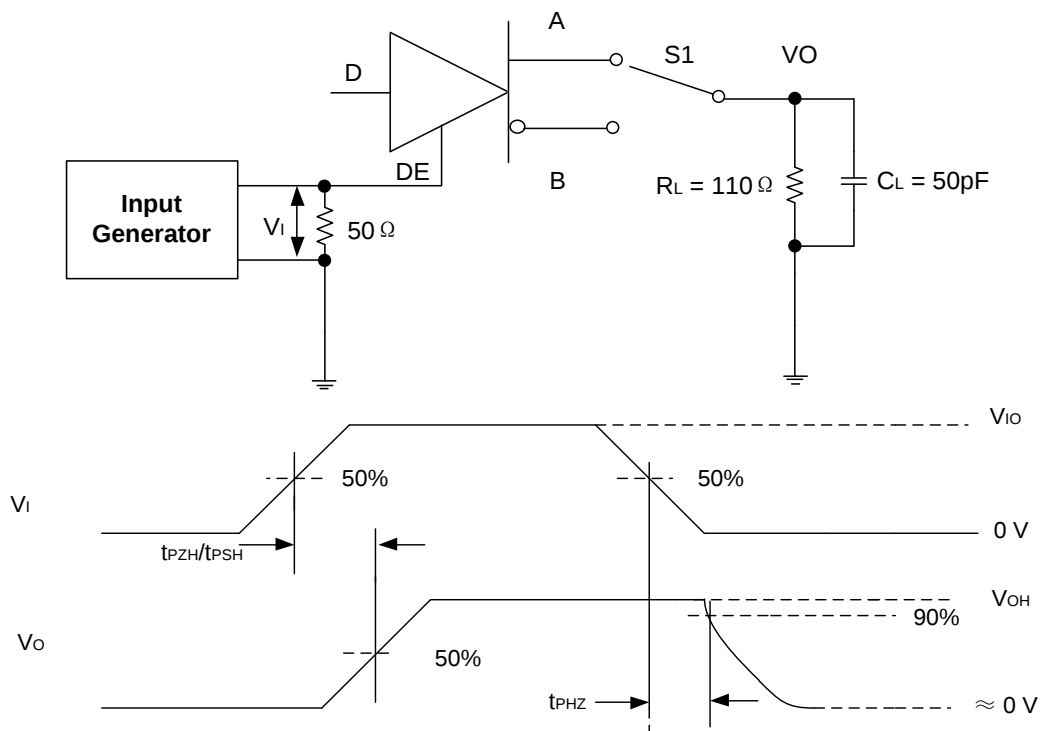


Figure 8-4. Measurement of Driver Enable and Disable Times With Active High Output and Pull-Down Load

8 Parameter Measurement Information (continued)

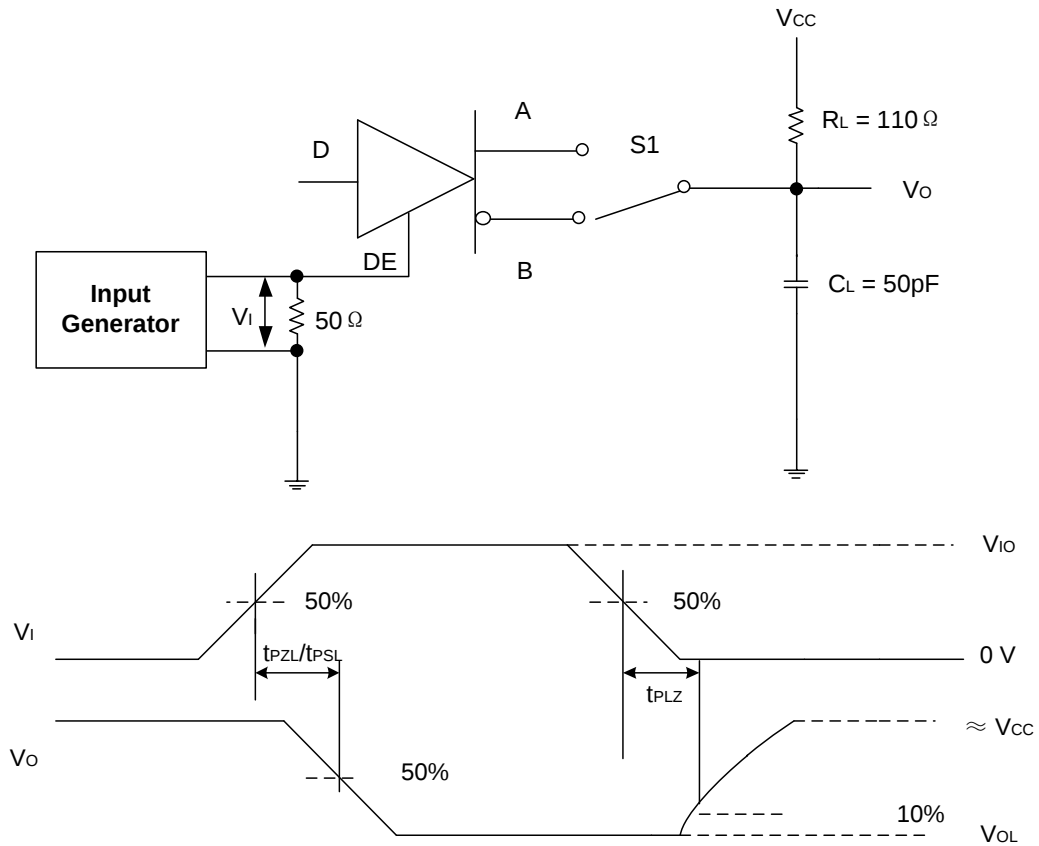


Figure 8-5. Measurement of Driver Enable and Disable Times With Active Low Output and Pull-up Load

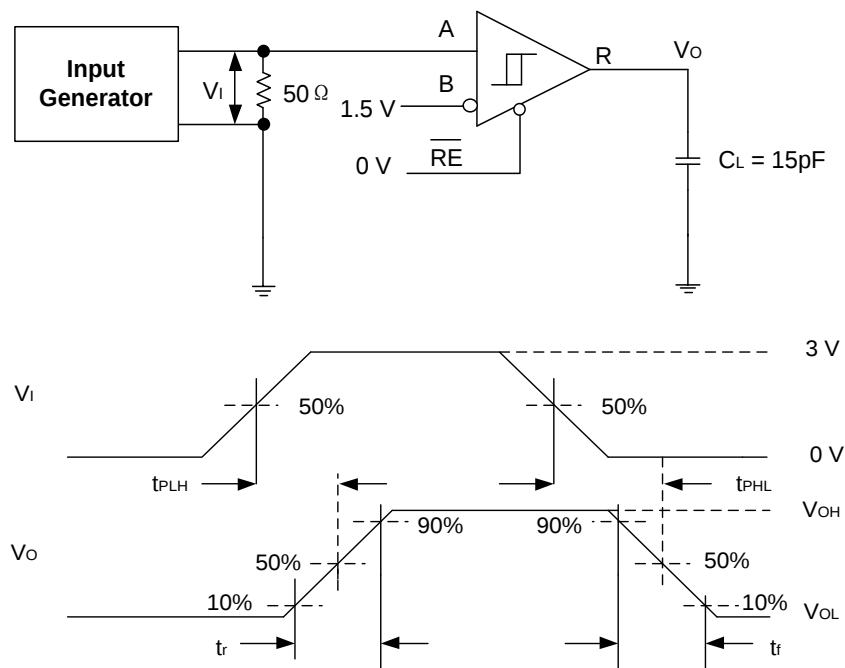


Figure 8-6. Measurement of Receiver Output Rise and Fall Times and Propagation Delays

8 Parameter Measurement Information (continued)

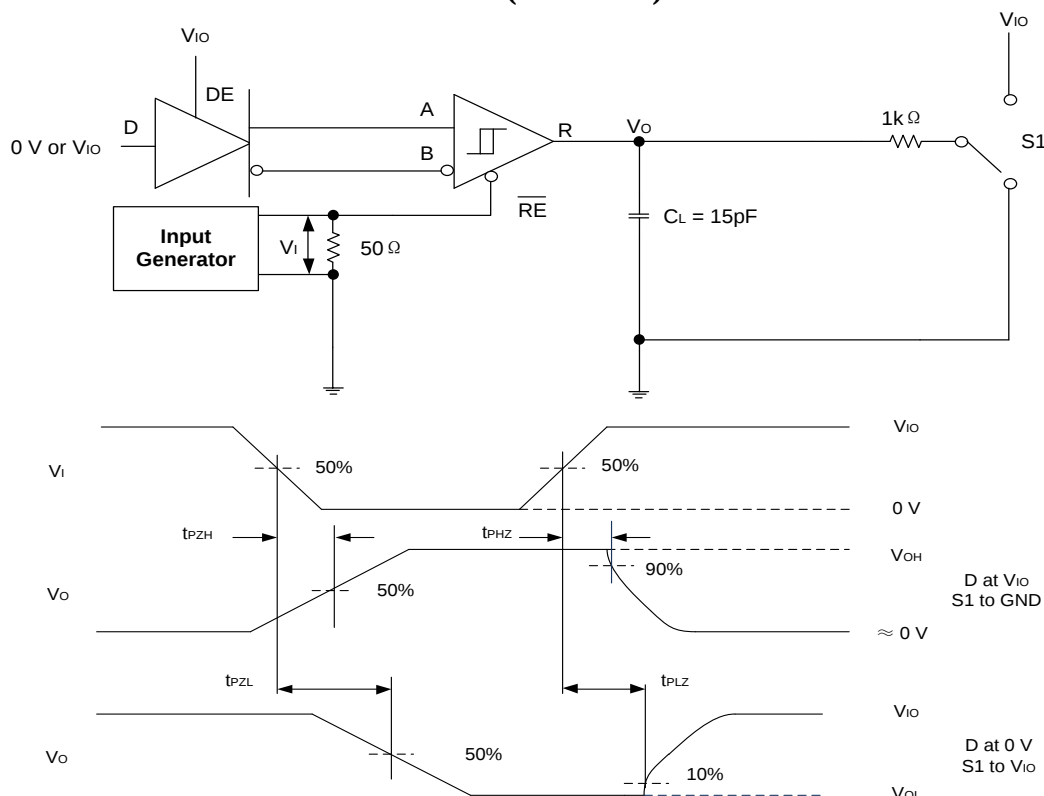


Figure 8-7. Measurement of Receiver Enable/Disable Times With Driver Enabled

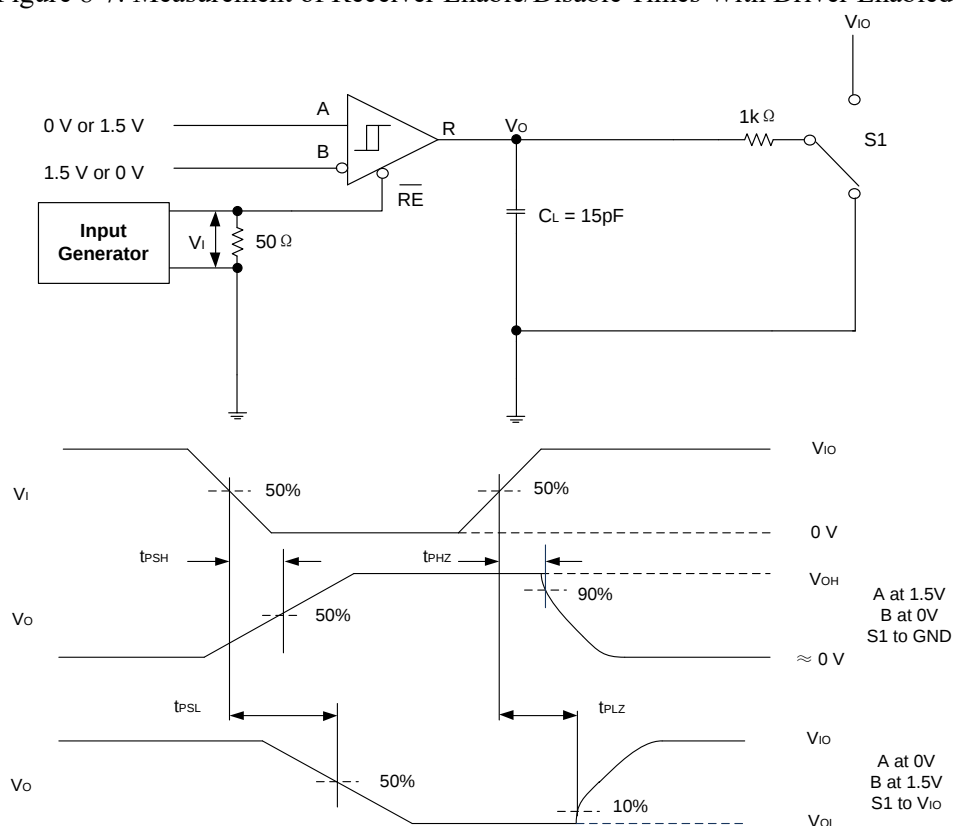


Figure 8-8. Measurement of Receiver Enable Times With Driver Disabled

8 Parameter Measurement Information(continued)

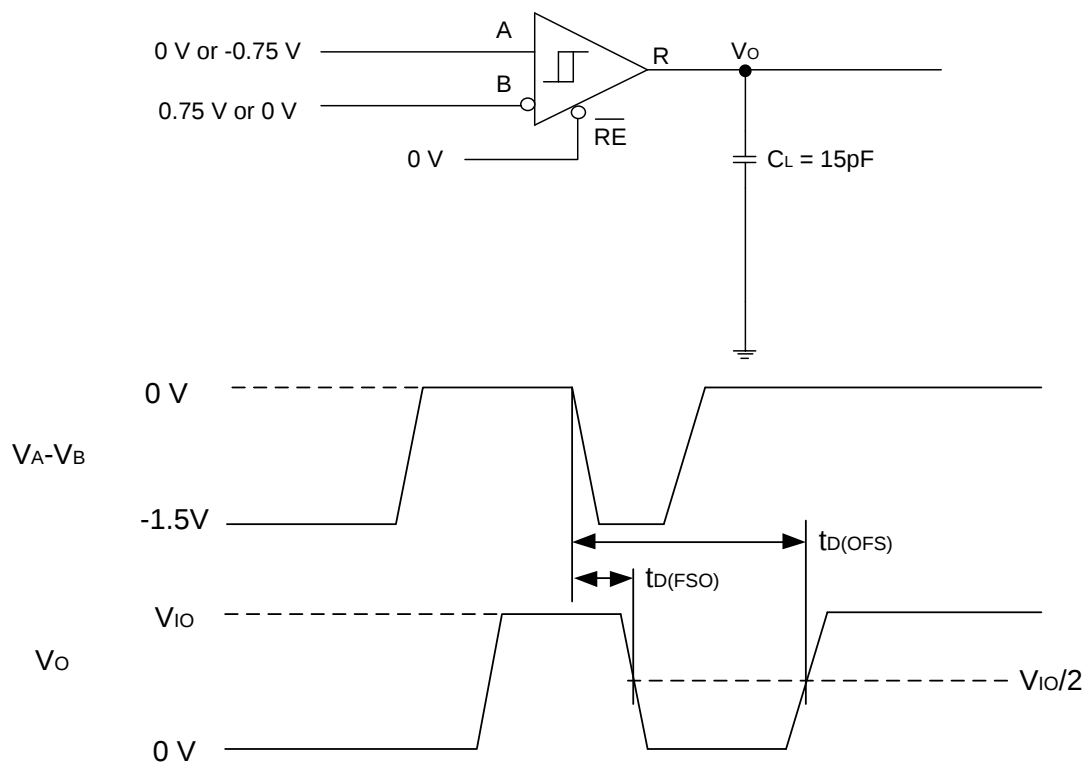


Figure 8-9. Measurement of Fail-Safe Delay

9 Detailed Description

9.1 Overview

UM3481 and UM3481V are fault-protected, half duplex RS-485 transceivers available in speed grade suitable for data transmission up to 1Mbps. UM13082 and UM13082V are fault-protected, half duplex RS-485 transceivers available in speed grade suitable for data transmission up to 20 Mbps. This is beneficial as customers can qualify one device and use it in two different end-applications. Additionally, UM3481V and UM13082V have flexible I/O supply pin VIO which enables digital interface voltage range, from 1.65V to 5.5V, different from bus voltage supply 3V to 5.5V.

9.2 Functional Block Diagram

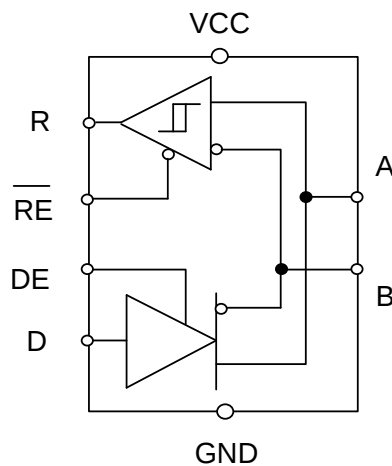
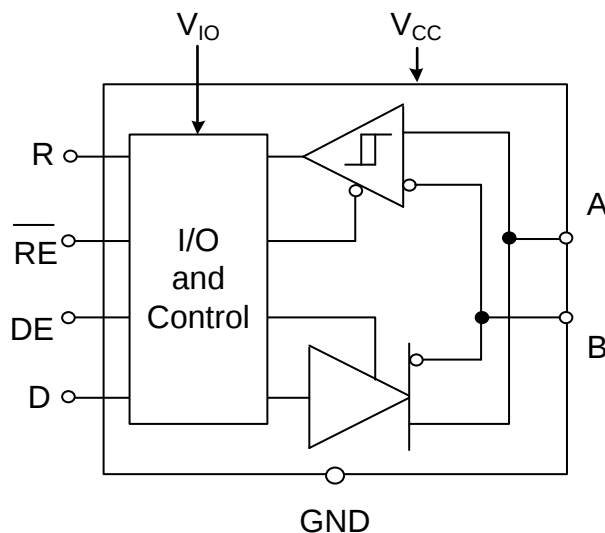


Figure 9-1. UM3481 and UM13082 Block Diagram



Note 1: DE and $\overline{RE}$ pins are tied together in some packages with VIO pin

Figure 9-2. UM3481V and UM13082V Block Diagram

10 Feature Description

10.1 Receiver Fail-Safe Operation

The receivers are fail-safe to invalid bus states caused by the following:

- Open bus conditions, such as a disconnected connector
- Shorted bus conditions, such as cable damage shorting the twisted-pair together
- Idle bus conditions that occur when no driver on the bus is actively driving

In any of these cases, the receiver outputs a fail-safe logic high state if the input amplitude stays for longer than $t_{D(OFS)}$ at less than $|V_{TH(FSH)}|$.

10.2 Low-Power Shutdown Mode

Driving DE low and $\overline{RE}$ high for longer than 500 ns puts the devices into the shutdown mode. If either DE goes high or $\overline{RE}$ goes low, the counters reset. All devices do not enter the shutdown mode if the enable pins are in disable state for less than 50 ns. This feature prevents the devices from accidentally going into shutdown mode due to skew between DE and $\overline{RE}$.

10.3 Device Functional Modes

When the driver enable pin, DE, is logic high, the differential outputs A and B follow the logic states at data input D. A logic high at D causes A to turn high and B to turn low. In this case, the differential output voltage defined as $V_{OD} = V_A - V_B$ is positive. When D is low, the output states reverse: B turns high, A becomes low, and V_{OD} is negative.

When DE is low, both outputs turn high-impedance. In this condition, the logic state at D is irrelevant. The DE pin has an internal pull-down resistor to ground, thus when left open the driver is disabled (high-impedance) by default. The D pin has an internal pull-up resistor to V_{CC} , thus, when left open while the driver is enabled, output A turns high and B turns low.

Table 10-1. Driver Function Table

Enable DE	Input D	Output		Function
		A	B	
H	H	H	L	Actively drive bus high
H	L	L	H	Actively drive bus low
H	Open	H	L	Actively drive bus high by default
L	X	Z	Z	Driver disabled
Open	X	Z	Z	Driver disabled by default

When the receiver enable pin, $\overline{RE}$, is logic low, the receiver is enabled. When the differential input voltage defined as $V_{ID} = V_A - V_B$ is higher than the positive input threshold, V_{TH+} , the receiver output, R, turns high. When V_{ID} is lower than the negative input threshold, V_{TH-} , the receiver output, R, turns low. If V_{ID} is between V_{TH+} and V_{TH-} , the output is indeterminate.

When $\overline{RE}$ is logic high or left open, the receiver output is high-impedance and the magnitude and polarity of V_{ID} are irrelevant. Internal biasing of the receiver inputs causes the output to go failsafe-high when the transceiver is disconnected from the bus (open-circuit), or the bus lines are shorted to one another (short-circuit), or the bus is not actively driven (idle bus).

10.3 Device Functional Modes (continued)

Table 10-2. Receiver Function Table

Enable	Differential Input	Output	Function
$\overline{RE}$	$V_{ID} = V_A - V_B$	R	
L	$V_{TH+} < V_{ID}$	H	Receive valid bus high
L	$V_{TH-} < V_{ID} < V_{TH+}$	N/A	Indeterminate bus state
L	$V_{ID} < V_{TH-}$	L	Receive valid bus low
L	Open-circuit bus	H	Fail-safe high output
L	Short-circuit bus	H	Fail-safe high output
L	Idle (terminated) bus	H	Fail-safe high output
H	X	Z	Receiver disabled
Open	X	Z	Receiver disabled by default

Table 10-3 shows the device behavior in undervoltage scenarios:

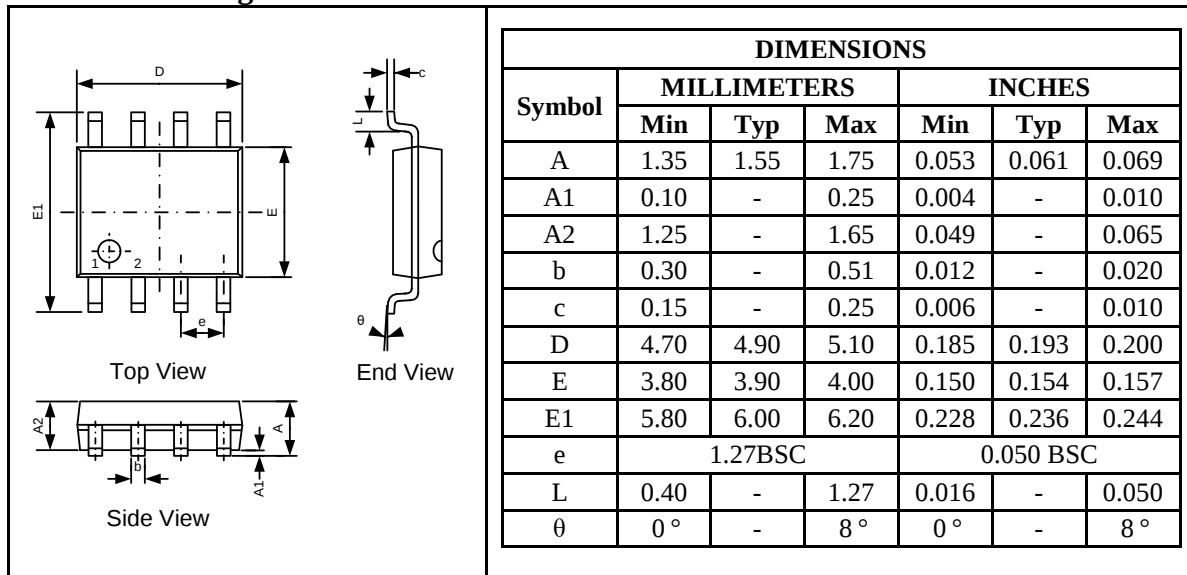
Table 10-3. Receiver Function Table

V_{CC}	V_{IO}	Driver Output	Receiver Output
$> V_{UVD(VCC)RISING}$	$> V_{UVD(VIO)RISING}$	Determined by DE and D inputs	Determined by $\overline{RE}$ and A-B
$< V_{UVD(VCC)FALLING}$	$> V_{UVD(VIO)RISING}$	High impedance	High impedance
$> V_{UVD(VCC)RISING}$	$< V_{UVD(VIO)RISING}$	High impedance	High impedance
$< V_{UVD(VCC)FALLING}$	$< V_{UVD(VIO)FALLING}$	High impedance	High impedance

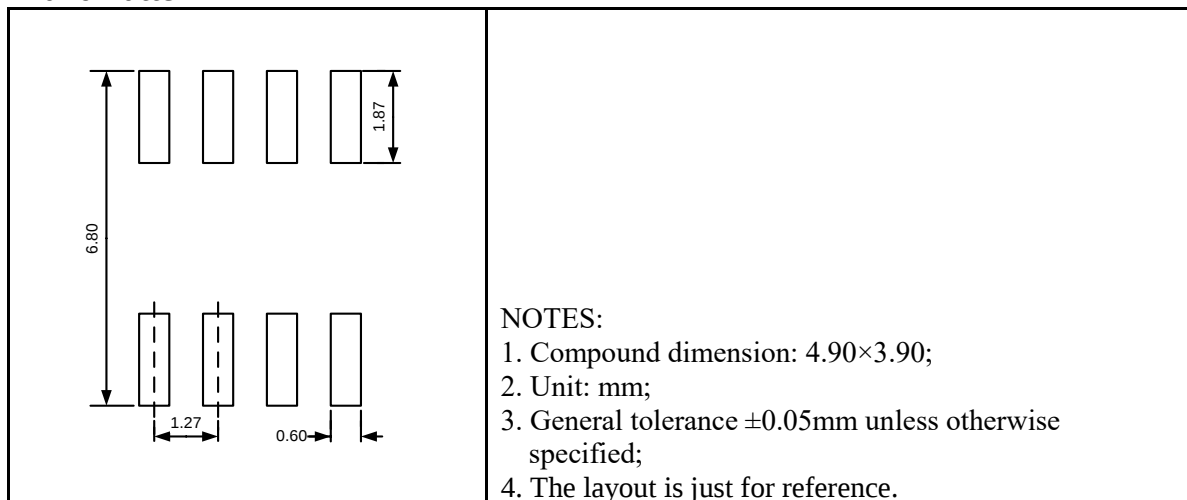
Package Information

SOP8

Outline Drawing

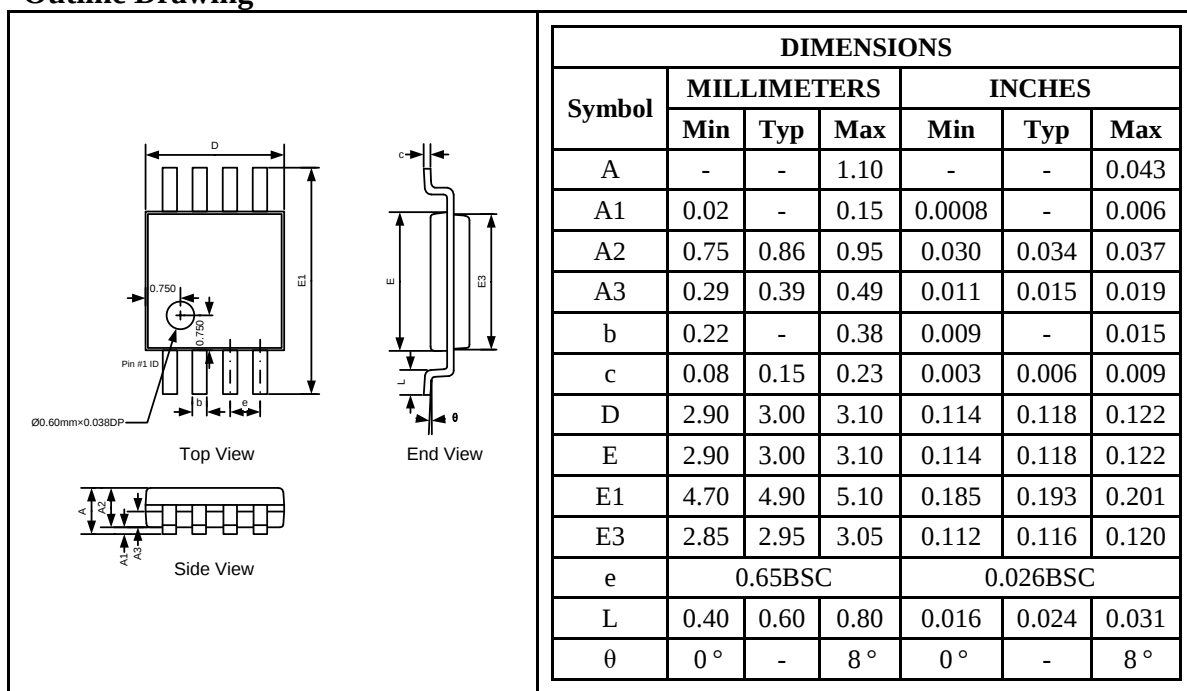


Land Pattern

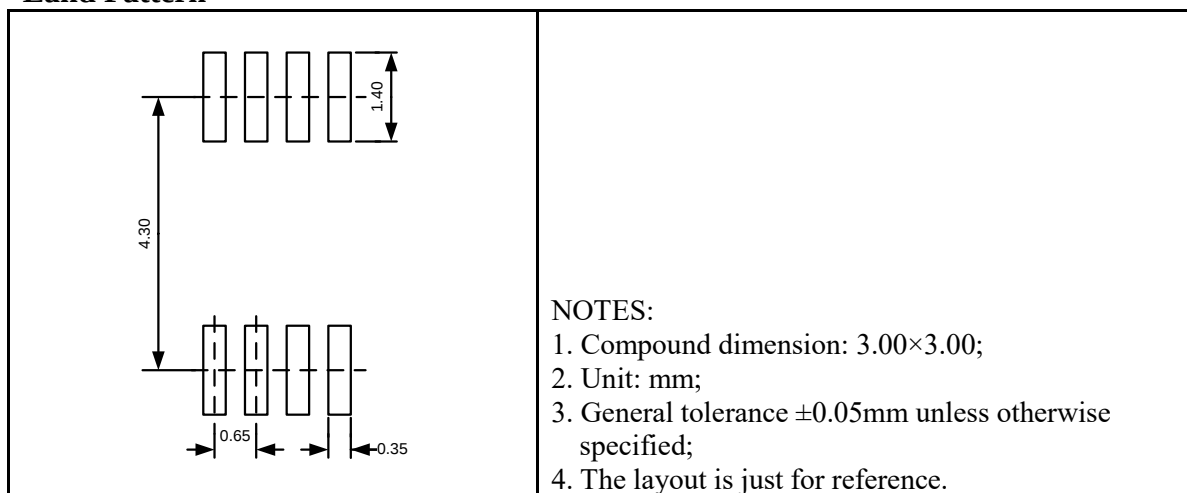


MSOP8

Outline Drawing



Land Pattern

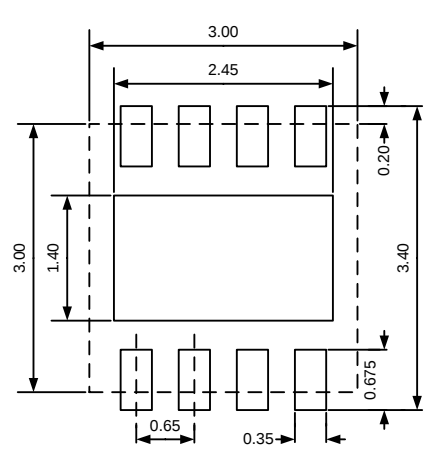


DFN8 3.0×3.0

Outline Drawing

DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.57	-	0.80	0.022	-	0.031
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20REF			0.008REF		
b	0.20	-	0.35	0.008	-	0.014
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.15	-	2.55	0.085	-	0.100
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.40	-	1.75	0.055	-	0.069
e	0.65BSC			0.026BSC		
L	0.30	-	0.60	0.012	-	0.024

Land Pattern

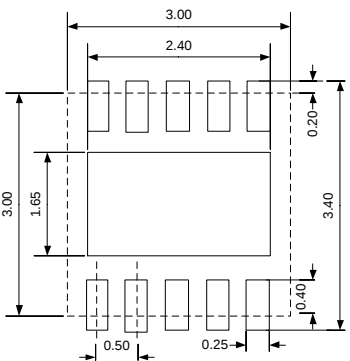
	NOTES: 1. Compound dimension: 3.00×3.00; 2. Unit: mm; 3. General tolerance $\pm 0.05\text{mm}$ unless otherwise specified; 4. The layout is just for reference.
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DFN10 3.0 × 3.0

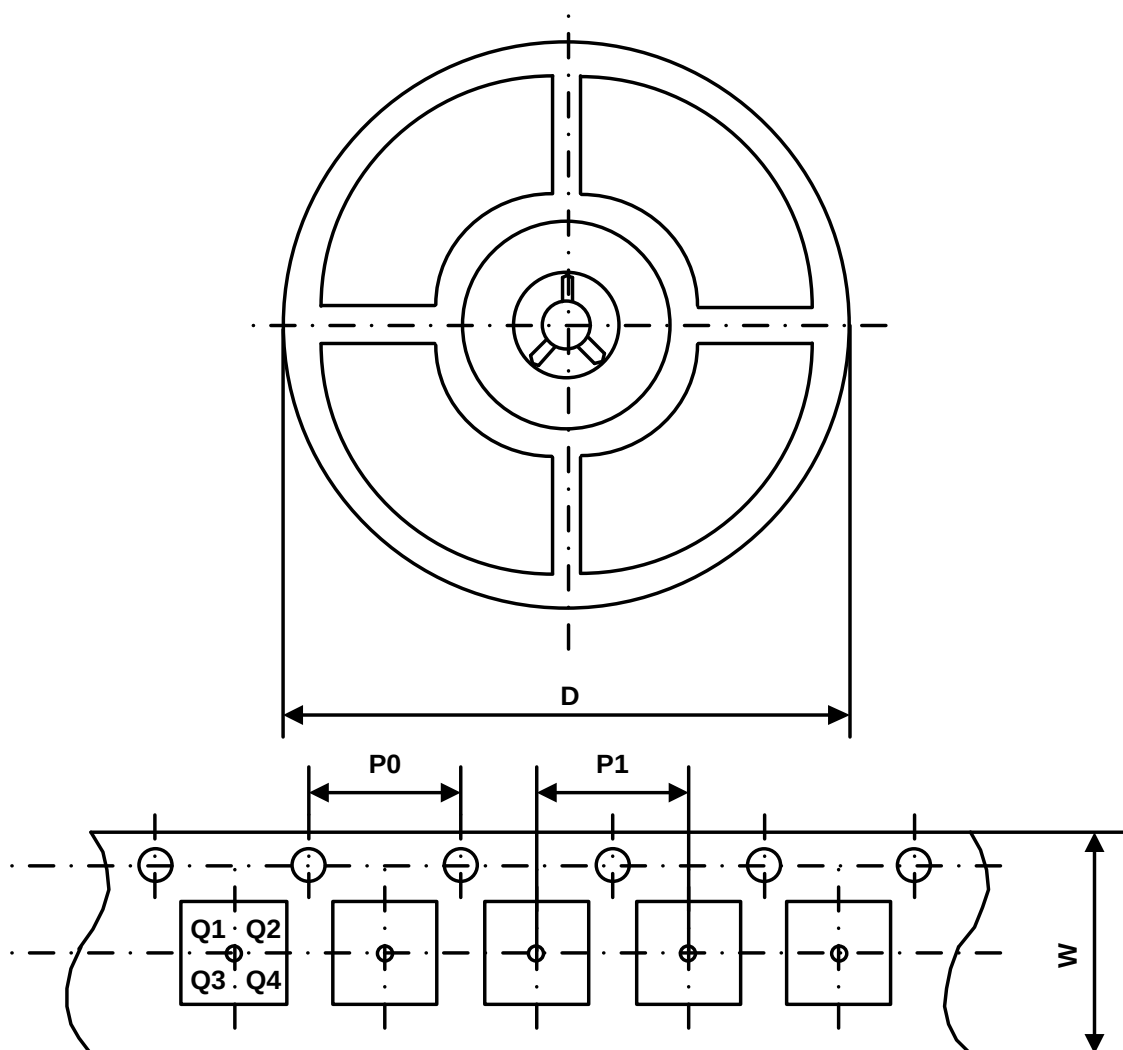
Outline Drawing

DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.70	0.75	0.80	0.028	0.030	0.032
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.20REF			0.008REF		
b	0.20	0.25	0.30	0.008	0.010	0.012
D	2.90	3.00	3.10	0.116	0.120	0.124
E	2.90	3.00	3.10	0.116	0.120	0.124
D2	1.55	1.65	1.75	0.062	0.066	0.070
E2	2.30	2.40	2.50	0.092	0.096	0.100
e	0.40	0.50	0.60	0.016	0.020	0.024
K	0.175	0.275	0.375	0.007	0.011	0.015
L	0.35	0.40	0.45	0.014	0.016	0.018
R	0.20REF			0.008REF		

Land Pattern

	NOTES: 1. Compound dimension: 3.00×3.00; 2. Unit: mm; 3. General tolerance $\pm 0.05\text{mm}$ unless otherwise specified; 4. The layout is just for reference.
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Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UM3481EESA	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM3481EEM8	MSOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM3481EEDA	DFN8 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1
UM3481VEESA	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM3481VEEM8	MSOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM3481VEEDA	DFN10 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1
UM13082EESA	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM13082EEM8	MSOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM13082EEDA	DFN8 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1
UM13082VEESA	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM13082VEEM8	MSOP8	12 mm	4 mm	8 mm	330 mm	Q1
UM13082VEEDA	DFN10 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1

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