UN3088ES

ROHS

3.3~5.5V Supply,16Mbps,Half-duplex, RS485/RS422 Transceiver

www.unsemi.com.tw

Features

- 3.3~5.5V wide power Supply, Half-duplex
- 1/8-unit-load, allows up to 256 transceivers on the bus
- Hot-Swap Input Structures on DE and /RE
- Thermal shutdown protection
- Low-Current Shutdown Mode
- True Fail-Safe Receiver
- Integrated transient voltage suppression
- ESD Protection for Bus Terminals：IEC 61000-4-2 model ±16KV
- 16Mbps in Electrically Noisy Environments

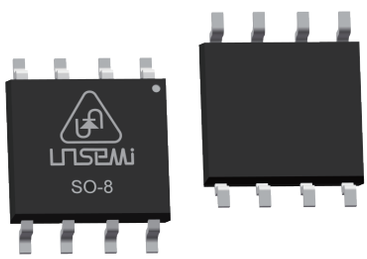
Applications

- RS-422/RS-485 communication
- Industrial control automation
- Security system
- Intelligent instrument
- Road traffic control automation
- Building automation system
- Landscape lighting control system
- Level converter

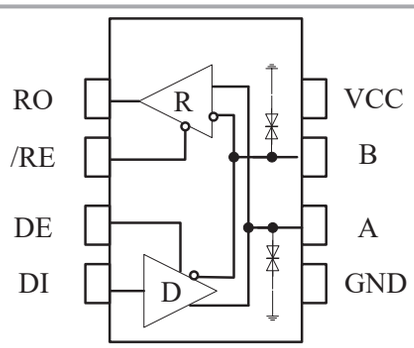
General Description

The UN3088ES is an RS-485 transceiver with 3.3V~5.5V wide power supply, ESD protection capability of bus port up to ±16KV, half duplex, low power consumption, fully meeting TIA/EIA-485 standards.
The UN3088ES has a fail-safe circuit that outputs logical high levels when receiver inputs are open or short, or when all transmitters attached to the terminal matching bus are disabled. The UN3088ES has 1/8 load and allows 256 UN3088ES transceivers connected to the same communication bus.
The UN3088ES can achieve transmission rates up to 16Mbps and is hot-swappable to eliminate fault transients on the bus during power-on or hot-insertion.

Configuration



Functional Block



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	+6	V
Control Input Voltage	/RE,DE,DI	-0.3~6	V
Receiver Intput Voltag	A,B	-7~12	V
Receiver Output Voltage	RO	-0.3~VCC~+0.3	V
Operating Temperature	--	-40~85	°C
Storage Temperature Range	--	-60~150	°C
Lead Temperature	--	300	°C
Continuous Power Dissipation	--	500	mW

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Pin Description

Pin Number	Pin Name	Function
1	RO	Receiver Output. When enabled, if A-B ≥ -50mV, then RO = high. If A-B ≤ -200 mV, then RO = low.
2	/RE	Receiver Output Enable. A low level enables the RO; A high level places it in a high impedance state.
3	DE	Driver Output Enable. A high level enables the driver differential outputs, Pin A and Pin B; A low level places the driver in a high impedance state
4	DI	Driver Input. When the driver is enabled, a logic low on DI forces Pin A low and Pin B high; A logic high on DI forces Pin A high and Pin B low.
5	GND	Ground Connection (0V).
6	A	No inverting Receiver Input A/Driver Output A.
7	B	Inverting Receiver Input B/Driver Output B.
8	VCC	Power Supply

DC Electrical Characteristics Of Driver

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Differential Driver Output(no load)	V_{OD1}	--	3	--	5.5	V
Differential Driver Output	V_{OD2}	Fig 1，RL = 54Ω VCC=5V	2.1	--	VCC	V
Change in Magnitude of Differential Output Voltage (NOTE1)	ΔV_{OD}	Fig 1，RL = 54 Ω	--	--	0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig 1，RL = 54 Ω	--	VCC/2	3	V
Change In Magnitude of Common-Mode Voltage (NOTE1)	ΔV_{OC}	Fig 1，RL = 54 Ω	--	--	0.2	V
Input High Voltage	V_{IH}	DE，DI，/RE	2.0	--	--	V
Input Low Voltage	V_{IL}	DE，DI，/RE	--	--	0.8	V
Logic Input Current	I_{IN}	DE，DI，/RE	-1	--	1	μA
Driver Short-Circuit Output Current (short to high)	I_{OSD1}	Short to 0V~12V	--	--	250	mA
Driver Short-Circuit Output Current (short to low)	I_{OSD2}	Short to -7V~VCC	-250	--	--	mA
Thermal-Shutdown Threshold	T_{TS}	--	--	165	--	°C
Thermal-Shutdown Hysteresis	T_{TSH}	--	--	15	--	°C

（If no special situation occurs，VCC=5V±10% ,Temp=T_{MIN}~T_{MAX}，typically VCC=+5V，Temp=25℃）
NOTE1：ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

DC Electrical Characteristics Of Receiver

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Current（A，B）	I_{IN2}	DE = GND，V_{IN} = 12V VCC = GND or 3.3/5V	--	--	125	μA
		DE = GND，V_{IN} = -7V VCC = GND or 3.3/5V	-100	--	--	μA
Positive-going input threshold voltage	V_{IT+}	-7V ≤ V_{CM} ≤ 12V	--	--	-50	mV
Negative-going input threshold voltage	V_{IT-}	-7V ≤ V_{CM} ≤ 12V	-200	--	--	mV
Receiver Input Hysteresis	Vhys	V_A+V_B = 0	--	15	--	mV
RO Output-High Voltage	V_{OH}	I_{OUT} = −4mA，V_{ID} = +200mV	VCC-0.6	--	--	V
RO Output-Low Voltage	V_{OL}	I_{OUT} = +4mA，V_{ID} = -200mV	--	--	0.4	V
Three-State Output Current at Receiver	I_{OZR}	0 < Vo < VCC	--	--	±1	μA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ 12V	96	--	--	kΩ
Receiver Output Short-Circuit	I_{OSR}	0V ≤ Vo ≤ VCC	±7	--	±95	mA

(If no special situation occurs，VCC=5V±10% ,Temp=T_{MIN}~T_{MAX}，Typically VCC=+5V，Temp=25℃)

Supply Current

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Supply Current	I_{CC1}	non-loaded， /RE = VCC DI = GND or VCC	DE = VCC	--	530	900	μA
			DE = GND	--	475	600	μA
	I_{CC2}	non-loaded， /RE = GND DI = GND or VCC	DE = VCC	--	530	1000	μA
			DE = GND	--	475	800	μA
Supply Current in Shutdown Mode	I_{SHDN}	DE = GND，/RE = VCC	--	--	--	10	μA

ESD Protection

Parameter	Conditions	Min.	Typ.	Max.	Units
A、B	Human Body Model(HBM)	--	±16	--	KV
	Contact, air discharge	--	±16	--	KV
Other Pins	Human Body Model(HBM)	--	±4	--	KV

Switching Characteristics Of Driver

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Driver Propagation Delay(Low to High)	t_{DPLH}	R_L = 54Ω , C_L = 50pF (Fig 2,5)	--	--	50	ns
Driver Propagation Delay(High to Low)	t_{DPHL}		--	--	50	ns
Driver Output Rise and Fall Time Asymmetry $\lvert t_{DPLH} - t_{DPHL} \rvert$	t_{DSKEW}	R_L = 54Ω , C_L = 50pF (Fig 2,5)	--	--	10	ns
Drive Rise or Fall Time	t_{DR}, t_{DF}	R_L = 54Ω , C_L = 50pF (Fig 2,5)	--	--	20	ns
Maximum Data Rate	f_{MAX}	--	16	--	--	Mbps
Driver Enable to Output High	t_{DZH}	(Fig 3,6) C_L = 100pF , S3 closed	--	--	150	ns
Driver Enable to Output Low	t_{DZL}	(Fig 3,6) C_L = 100pF , S2 closed	--	--	150	ns
Driver From High to Ineffective Time	t_{DHZ}	(Fig 3,6) C_L = 15pF , S3 closed	--	--	100	ns
Driver From Low to Ineffective Time	t_{DLZ}	(Fig 3,6) C_L = 15pF , S2 closed	--	--	100	ns
Enable Drive From Standby To High Output	$t_{DZH(SHDN)}$	(Fig 3,6) C_L = 15pF , S3 closed	--	--	2200	ns
Enable Drive From Standby to Low Output	$t_{DZL(SHDN)}$	(Fig 3,6) C_L = 15pF , S2 closed	--	--	2200	ns
Stand-by Time	t_{SHDN}	--	50	350	700	ns

Switching Characteristics Of Receiver

Parameter	Symbol	Conditions	Min.	Typ.	Max	Units
Receiver Propagation Delay (Low to High)	t_{RPLH}	(Fig 7,8), CL=15pF｜VID｜≥ 2.0V, VID ≤ 15ns	--	--	50	ns
Receiver Propagation Delay (High to Low)	t_{RPHL}		--	--	50	ns
Receiver Output Rise and Fall Time Asymmetry |t_{RPLH}- t_{RPHL}|	t_{RSKEW}	(Fig 7,8), CL=15pF｜VID｜≥ 2.0V, VID≤15ns	--	--	20	ns ns
Maximum Data Rate	f_{MAX}	--	16	--	--	Mbps
Receiver Enable to Output High	t_{RZH}	(Fig 4,9) , S1 = +1.5V,S2 to GND	--	--	50	ns
Receiver Enable to Output Low	t_{RZL}	(Fig 4,9) , S1 = -1.5V,S2 to VCC	--	--	50	ns
Receiver From High to Ineffective Time	t_{RHZ}	(Fig 4,9) , S1 = +1.5V,S2 to GND	--	--	100	ns
Receiver From Low to Ineffective Time	t_{RLZ}	(Fig 4,9) , S1 = -1.5V,S2 to VCC	--	--	100	ns
Enable Receiver From Standby to High Output	$t_{RZH(SHDN)}$	(Fig 4,9) , S1 = +1.5V,S2 to GND	--	--	2200	ns
Enable Receiver From Standby to Low Output	$t_{RZL(SHDN)}$	(Fig 4,9) , S1 = -1.5V,S2 to VCC	--	--	2200	ns
Stand-by Time	t_{SHDN}	--	50	350	700	ns

(If no special situation occurs，VCC=5V±10% ,Temp=T_{MIN}~T_{MAX}，typically VCC=+5V，Temp=25℃)

Functions Tables

TRANSMITTING				
Control		Inputs	Outputs	
/RE	DE	DI	A	B
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	shutudown	
X：Don’t care；Z：high impedance				

RECEIVING			
Control		Inputs	Outputs
/RE	DE	A-B	RO
0	X	≥ -50mV	H
0	X	≤ -200mV	L
0	X	Open/shorted	H
1	1	X	Z
1	0	X	shutudown
X：Don’t care；Z：high impedance			

Test Circuit

Fig 1. Driver DC Test Load

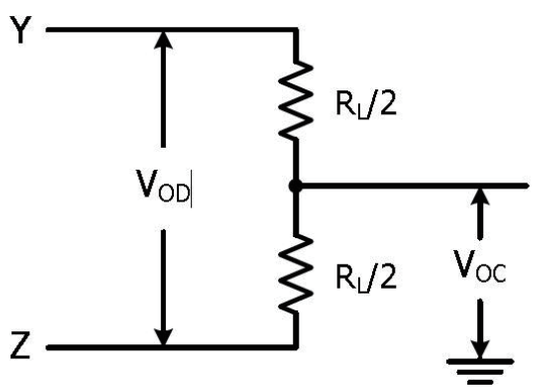


Fig 2. Driver Timing Test Circuit

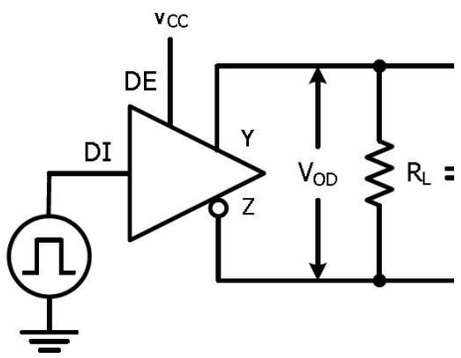


Fig 3. Drives enable and disable test circuits

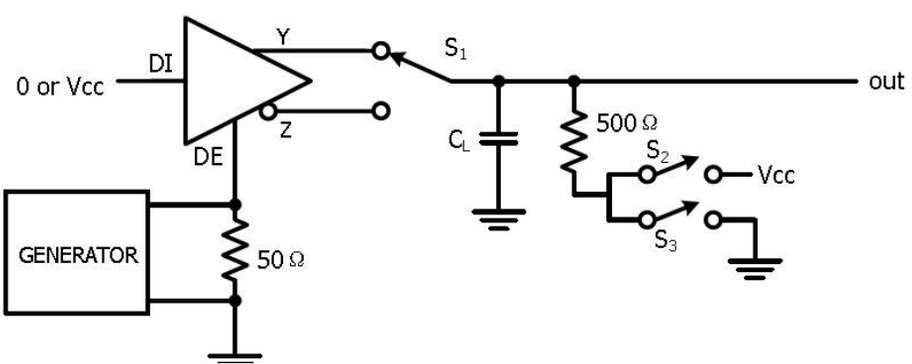
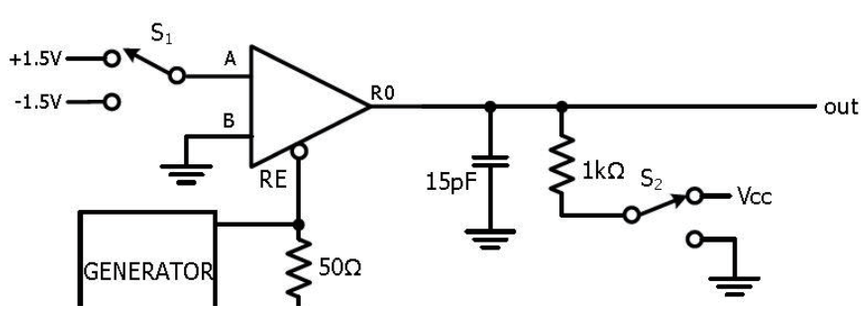


Fig 4. Receivers enable and disable the test circuit



Test Circuit

Fig 5. Driver transmission delay

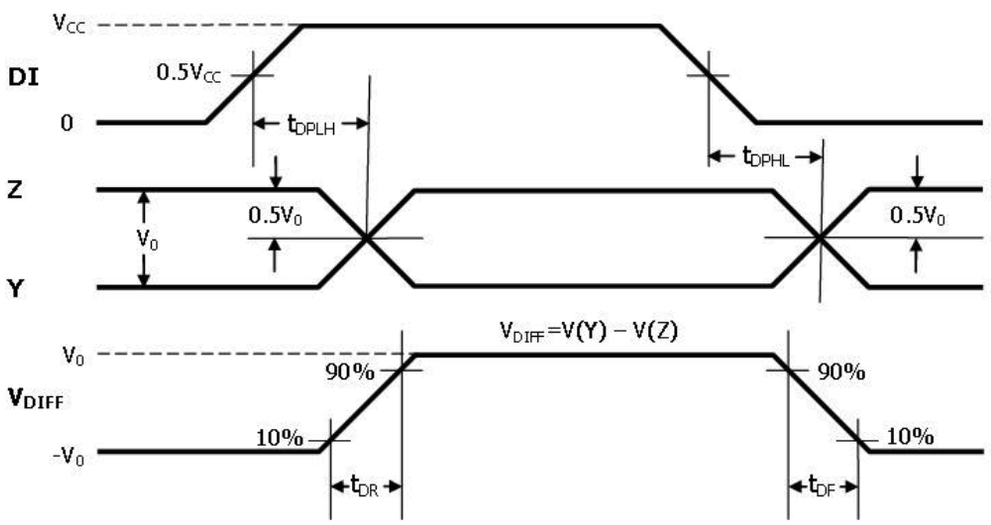
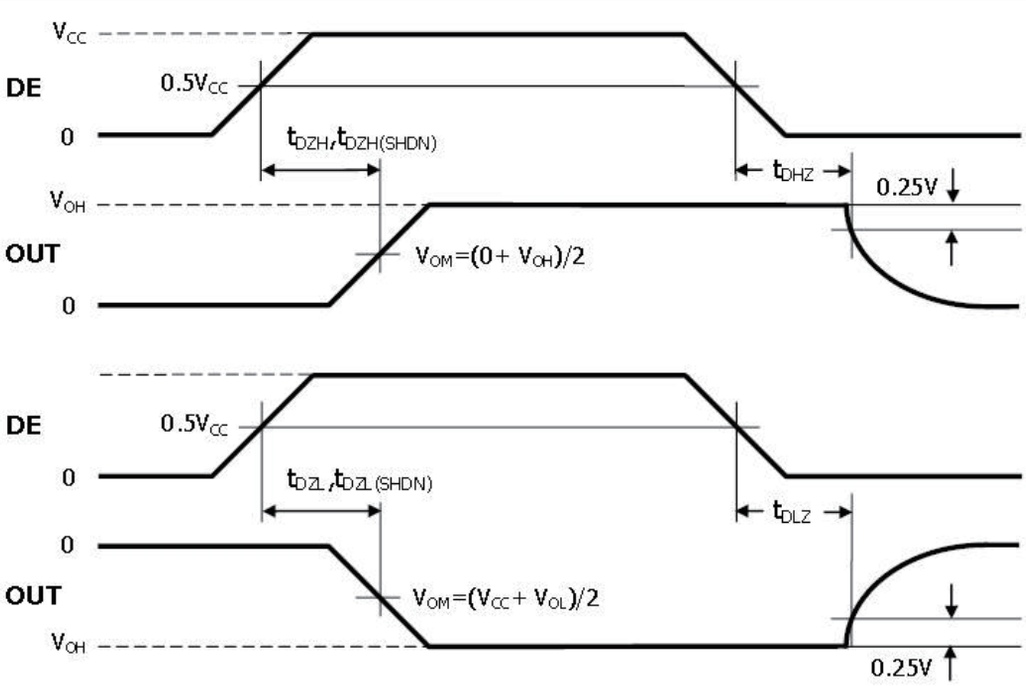


Fig 6. Drive enable and disable timing(T_{DHZ}、T_{DZH}、T_{DZH}、T_{DZL}、T_{DLZ}、T_{DLZ})



Test Circuit

Fig 7. Receiver transmission delay test circuit

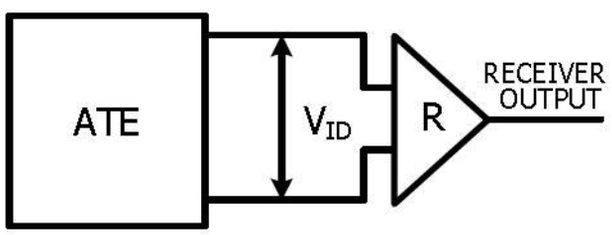


Fig 8. Receiver transmission delay

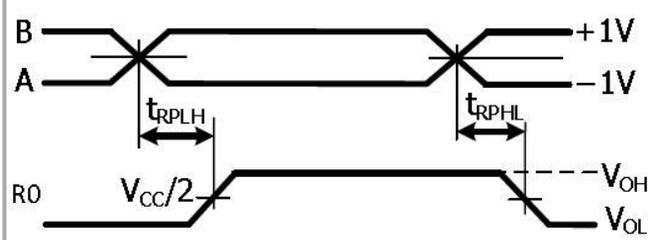
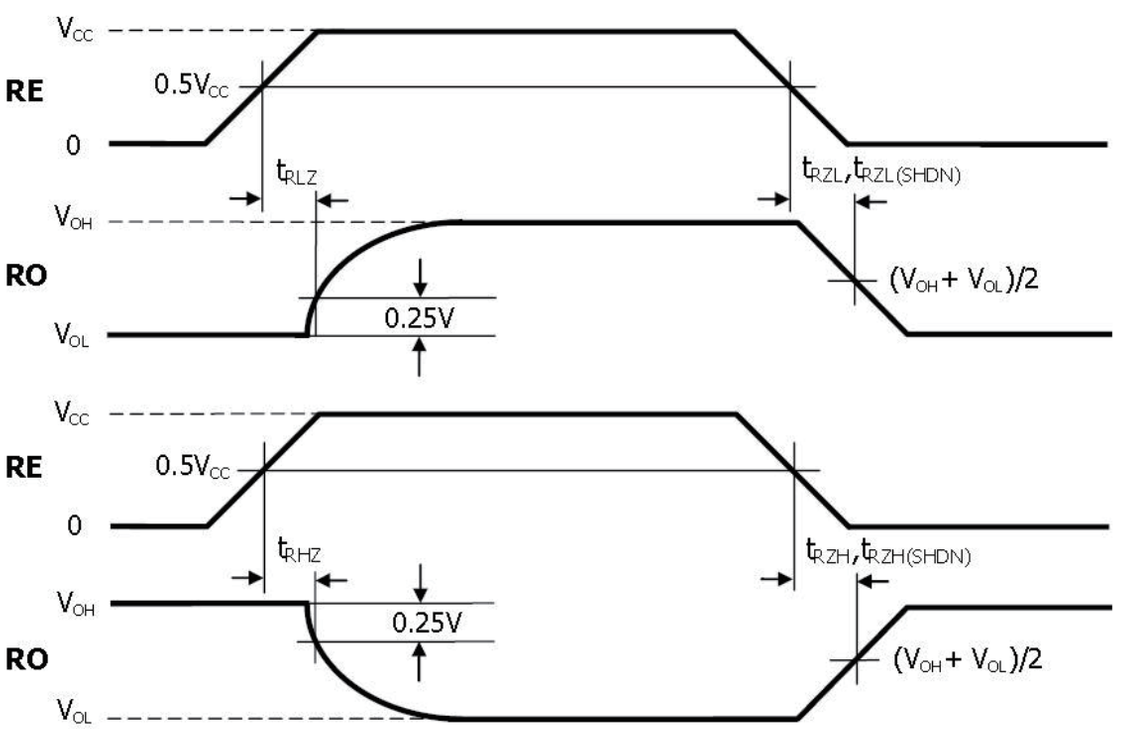


Fig 9. Receiver enable and disable timing



Summary

1 Description

The UN3088ES is a 3.3V to 5.5V wide power supply, bus port ESD protection up to 16KV, half-duplex high-speed transceiver for RS-485 / RS-422 communications. It contains a driver and receiver with output short-circuit current limiting function. The hot - off circuit protects the driver from excessive power consumption. After entering the thermal shutdown protection, the driver output is placed in the high resistance state. The UN3088ES can achieve transmission rates up to 16Mbps and is hot-swappable to eliminate fault transients on the bus during power-on or hot-insertion

2 Connecting 256 Transceivers on one Bus

The standard RS485 receiver has an input impedance of 12kΩ(1 unit load), and the standard driver can drive up to 32 unit loads. The receiver of the UN3088ES transceiver has a 1/8 unit load input impedance (96kΩ), allowing up to 256 transceivers to be attached in parallel to the same communication bus. These devices can be arbitrarily combined or combined with other RS-485 transceivers and can be attached to the same bus as long as the total load does not exceed 32 unit loads.

3 Fail Safe

The UN3088ES ensures that the receiver output logic level is high when the receiver input is short-circuited or open, or when all drivers attached to the terminal matching transmission line are disabled. This is achieved by setting the receiver input thresholds to -50mV and -200mV, respectively. If the differential receiver input voltage (A-B) is greater than or equal to -50mV, RO is logic high level; If the voltage (A-B) is less than or equal to -200mV, RO indicates the logic low level. When all transmitters attached to the terminal matching bus are disabled, the receiver differential input voltage is pulled to 0V through the terminal resistance. The receiver threshold of the UN3088ES enables logic high levels with a minimum noise tolerance of 50mV. -50 mV to -200mV threshold voltage meets the EIA/ tia-485 of ± 200mV

4 Typical Application

The UN3088ES transceiver is designed for multi-point bi-directional data communication bus transmission lines. Fig 10 shows a typical network application circuit. These devices can also be used as a cable longer than 4,000 feet of line repeater, to reduce the reflection, the transmission line should be in its ends terminated in its characteristic impedance, and stub lengths off the main line should be as short as possible.

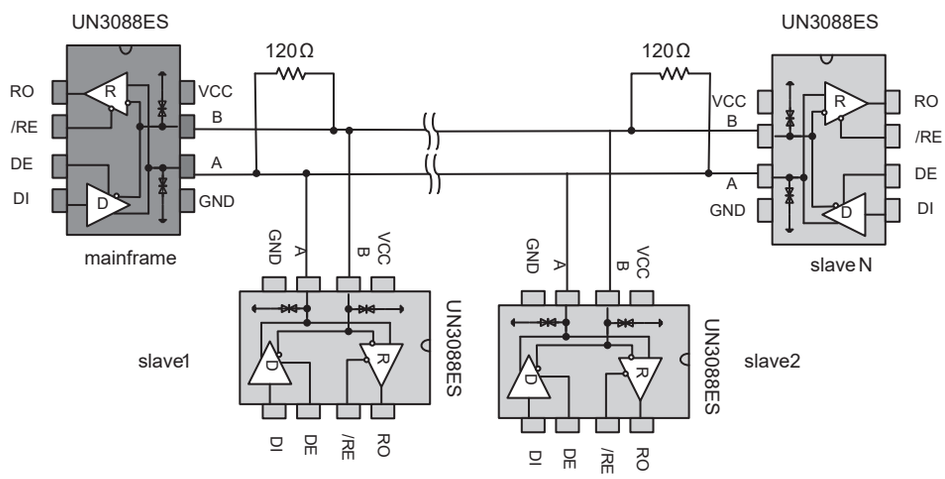
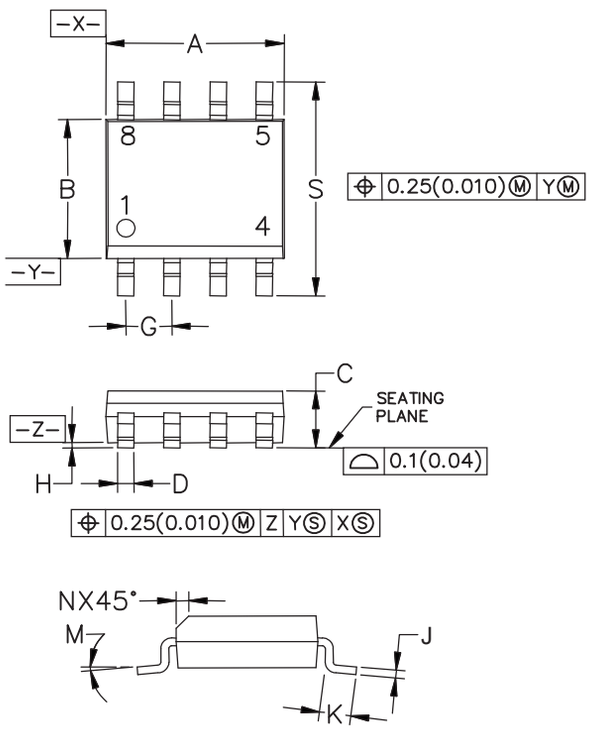


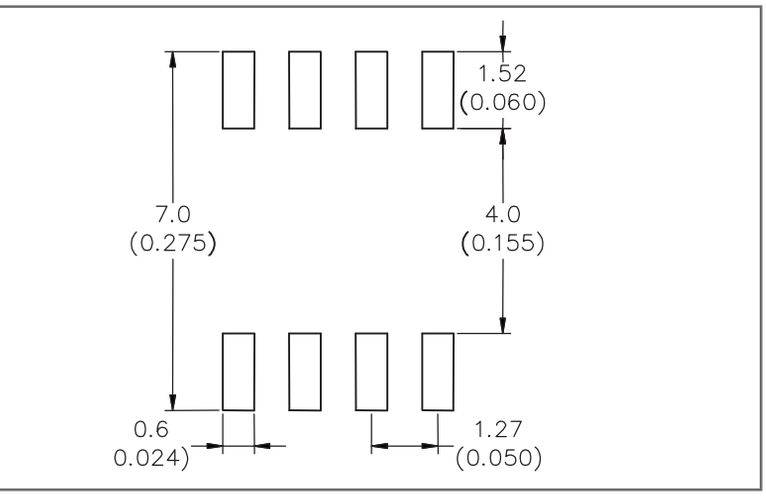
Fig10 . Backbone cable type RS485 communications networ

Package Outline



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.35	0.51	0.013	0.020
G	1.27BSC		0.050BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

Pad Size



Type	Temperature	Packaging	Quantity
UN3088ES	-40℃~85℃	SO-8	2500pcs

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ROHS

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