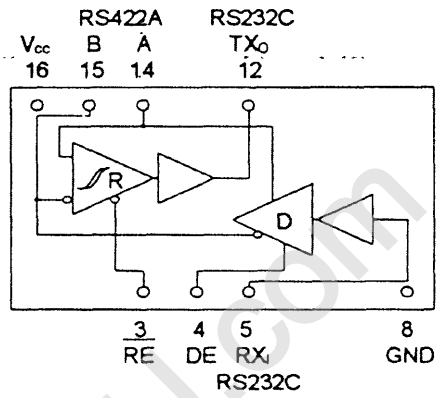
- ❒ **Bidirectional transceiver**
- ❒ **5 Volt only operation**
- ❒ **Meets EIA – RS232C and RS422A & RS485 standards**
- ❒ **3-State driver output**
- ❒ **Individual driver and receiver enables**

Dual-In-line Package (top view)



description

The NM422A Transceiver is designed for balanced transmission lines and meets EIA standard RS422A & RS485 for the bus port connection. At the RX IN and TX OUT connection it conforms with the specifications of EIA Standard RS232C. The device operates from a single 5 volt power supply yet provides full RS232C transmitter voltage levels.

The bus port driver and receiver have active enable lines that can be connected externally to function as a direction control. The driver differential output and the receiver differential input are internally connected forming a differential input/output bus port. The loading on the bus is minimised whenever the bus driver is disabled (three-state) or VCC = zero. The bus receiver has a minimum input impedance of 12kΩ and input sensitivity of ±200mV. The bus driver can handle loads up to 60mA of sink or source current and the total power demand is typically 200mW. The RX IN and TX OUT lines provide a data receive channel and data transmit channel both RS232C compatible connected as input and output to the RS422A compatible driver and receiver.

absolute maximum ratings over operating free-air temperature range

Supply voltage V_{CC}	7V
Voltage at any bus terminal	-10V to 15V
Enable input voltage	5.5V
Input voltage RS232C receiver	±30V
Output voltage RS232C transmitter	±15V
Continuous total dissipation at or below 25C free-air temperature	750mW
Operating free-air temperature range	0C to 70C
Storage temperature range	-55C to 125C
Lead temperature 1.5mm from case for 10 seconds	300C

RS232C Receiver

electrical specifications over operating free-air temperature range V_{CC} = 5V

Parameter	Test Conditions		Min	Typ	Max	Unit
V_{TH} Differential input H threshold					0.2	V
V_{TL} Differential input L threshold			- 0.2			V
V_{T+} to V_{T-} Hysteresis				50		mV
V_{IH} High-level enable input voltage			2			V
V_{IL} Low-level enable input voltage					0.8	V
V_{OH} High-level output voltage	V_{IH} = 0.2V R_L = 3kΩ	V_{CC} = 5V	8.0	9.0		V
V_{OL} Low-level output voltage	V_{IH} = - 0.2V R_L = 3kΩ	V_{CC} = 5V	- 7.0	- 8.0		V
I_I Line input current	other	V_I = 12V			1	mA
	input = 0	V_I = - 7V			- 0.8	
I_{IH} High-level enable input current	V_{IH} = 2.7V				20	μA
I_{IL} Low-level enable input current	V_{IL} = 0.4V				- 100	μA
r_i Input resistance			12			kΩ
$I_{OS(H)}$ Short-circuit output current	V_{IH} = 0.2V		15	20		mA
$I_{OS(L)}$ Short-circuit output current	V_{IL} = - 0.2V		- 10	- 15		mA
R_O	V_{CC} = 0V		300			Ω

Transmitter and Receiver

electrical characteristics over operating free-air temperature range V_{CC} = 5V

Parameter	Test Conditions		Min	Typ	Max	Unit
I_{CC} Supply current	No loads	Inputs high		30		mA
		Inputs low		40		
PD Total power dissipation	RS232C R_L = 3kΩ RS422A R_L = 60Ω			385		mW

all typical values are at T_a = 25C

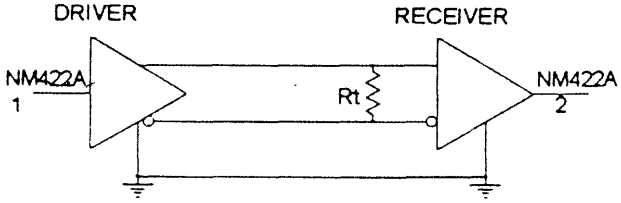
RS232C Receiver to RS422A Driver

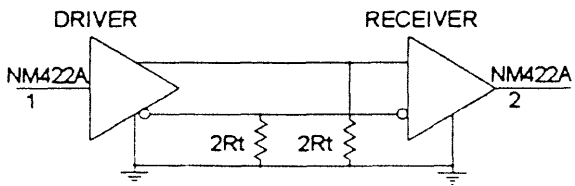
electrical characteristics over operating free-air temperature range V_{CC}=5V

Parameter	Test Conditions		Min	Typ	Max	Unit
V_{T+} Positive going threshold				2.4	2.0	V
V_{T-} Negative going threshold			1.0		1.6	V
V_{OH} High-level output voltage	V_{IH} = 3V, I_{OH} = - 33mA				4.0	V
V_{OL} Low-level output voltage	V_{IL} = –3V, I_{OL} = 33mA				0.9	V
[V_{OD1}] Differential output voltage	I_O = 0			$2V_{OD2}$		V
[V_{OD2}] Differential output voltage	R_L = 100Ω		2		3.0	V
	R_L = 54Ω		1.5		2.4	V
Δ [V_{OD}] Change in magnitude of differential output voltage	R_L = 54Ω or 100Ω			±0.2		V
V_{OC} Common-mode output voltage				3		
Δ [V_{OC}] Change in magnitude of common-mode output voltage				±0.2		
I_O Output current	Output disabled	V_O = 12V		1		mA
		V_O = - 7V		- 0.8		
I_{IH} High-level input current	V_{IN} = 25V		5.5	6.3		mA
	V_{IN} = 3V			0.65	0.6	
I_{IL} Low-level input current	V_{IN} = - 25V		- 6.0	- 6.8		mA
	V_{IN} = - 3V			- 0.65	- 0.6	
I_{OS} Short-circuit output current	V_O = - 7V			- 180		mA
	V_O = V_{CC}			180		
	V_O = 12V			500		

all typical values are at T_a = 25C

RS422A connection techniques





NM422A
RS232C to RS422A Transceiver

RS232C switching characteristics V_{cc} = 5V, T_a = 25C

Parameter	Test Conditions	Min	Typ	Max	Unit
t_{PLH} Propagation delay time L to H	R_L = 3kΩ C_L = 30pF		1.3		µs
t_{PHL} Propagation delay time H to L			1.2		ms
t_{TLH} Transition time L to H level			1.0	1.6	µs
t_{THL} Transition time H to L level			1.0	1.6	µs
t_{TLH} Transition time L to H level	R_L = 3kΩ to 7kΩ C_L = 2500pF		2.0	2.5	µs
t_{THL} Transition time H to L level			2.0	2.5	µs

all typical values are at T_a = 25C

RS422A switching characteristics V_{cc} = 5V, T_a = 25C

Parameter	Test Conditions	Min	Typ	Max	Unit
t_{DD} Differential output delay time	R_L = 60Ω		35	50	ns
t_{TD} Differential output transition time			50	75	
t_{PLH} Propagation delay time L to H	R_L = 27Ω		16	25	ns
t_{PHL} Propagation delay time H to L			44	65	
t_{PZH} Output enable time to H level	R_L = 110Ω		60	80	ns
t_{PZL} Output enable time to L level	R_L = 110Ω		30	45	ns
t_{PHZ} Output disable time from H level	R_L = 110Ω		51	75	ns
t_{PLZ} Output disable time from L level	RL = 110Ω		18	30	ns

all typical values are at T_a = 25C

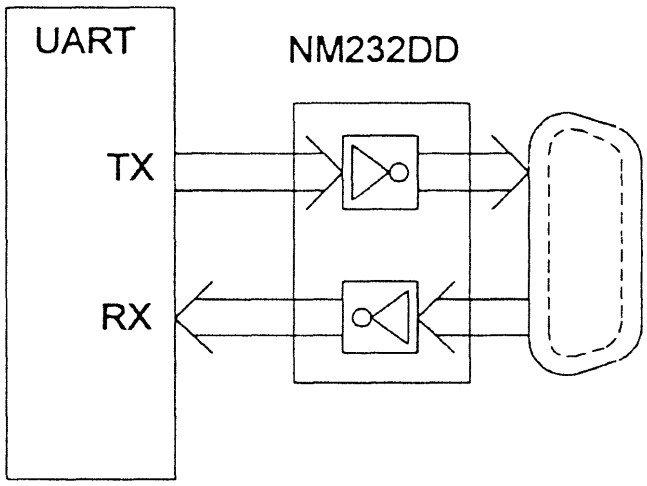
logic state table

RS232C	Voltage	RS422A	Voltage A	Voltage B
0	+V	0	+V	- V
1	- V	1	- V	+V

application notes

Inverted or non-inverted

There is sometimes confusion in the user's mind about whether Newport's interfaces provide signal inversion. Between a UART and the RS-232D lines an inversion is ALWAYS required. The NM232 series of interfaces all provide this inversion in the same way that the old-fashioned 1488/1489 combination did.



Logic	RS232
0	+V
1	-V

The NM422 series does NOT provide an inversion since it is designed to convert from RS-232D to RS-422A and the sense of the signal lines must be preserved during this conversion.

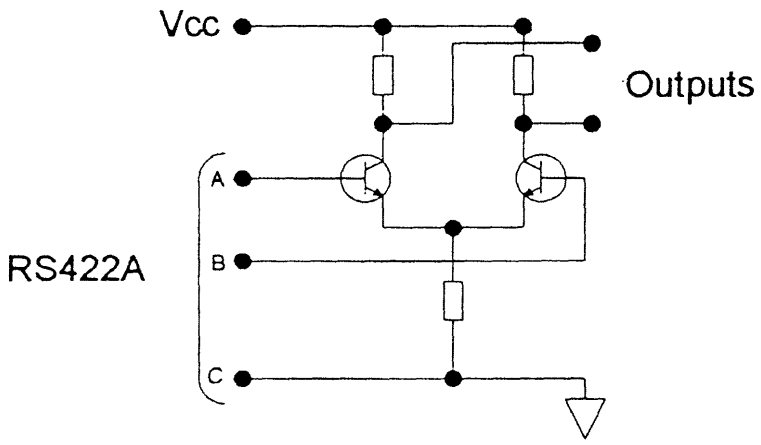
RS-485 compatibility

The question of compatibility of the NM422 types with the EIA standard RS-485 is often raised. The NM422A is fully compatible with the standard. In contrast the NM422AD is not compatible with the RS-485 standard and this is witnessed by the lack of a driver disable line on the device which is necessary for party line applications. It is mainly this feature which separates RS-485 from RS-422A. On RS-422A lines there can be only one driver and it is usually intended for point-to-point communications. RS-485 lines are party lines where up to 32 drivers and receivers can be interconnected and control of the drivers is mandatory.

application notes

Explanation of 2-wire operation differential mode

The RS-422A standard is a communication method using 2 signal wires differentially connected. In addition an earth or reference line is also used. Compare this with RS-232D which has just a signal and ground line. The receiver input on an RS-422 line is in concept like the following diagram.



The differential signal is connected to the base of two transistors which are referred to ground via the emitters.
Clearly for stable operation which avoids saturating either transistor it is necessary for a ground connection from the driving circuit. This allows the signal currents to return to the driving circuit. Many implementation problems stem from the mistaken belief that just two wires constitute an RS-422A channel BUT there must be three wires - two signal and a return or ground wire.

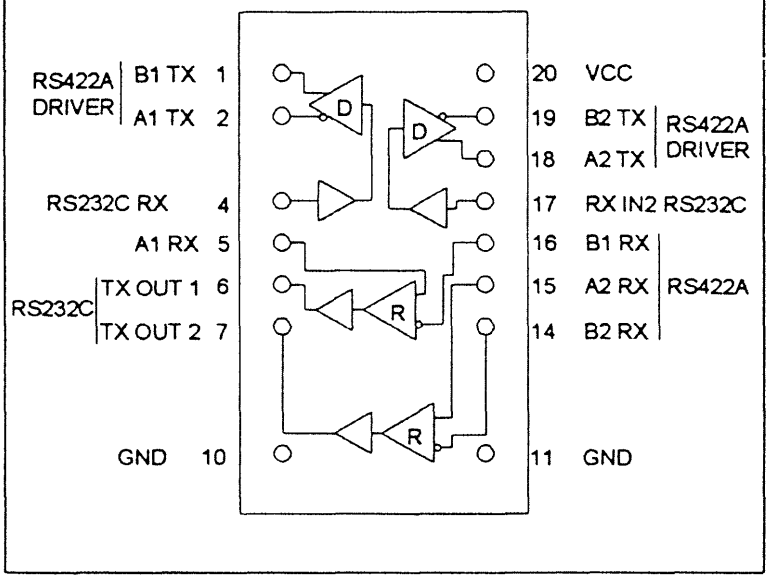
ordering information

Part No.	Function	Package Style
NM422A	5 volt only RS232C to RS422A transceiver	6

NM422AD
Dual RS232C to RS422A Transceiver

- ☐ 5 Volt only operation
- ☐ Meets EIA-RS232C and RS422A Standards
- ☐ Two full-duplex links
- ☐ DIL 0.5" package
- ☐ Low profile
- ☐ Low power consumption

Dual-In-line Package (top view)



description

The NM422AD is a device for connecting and converting data levels between the RS422A standard and the RS232C standard. RS422A uses balanced transmission lines and RS232C uses single signal lines. Two full-duplex links can be constructed between the two standards with a pair of modules. The transceiver operates from a single 5 Volt supply yet all inputs and outputs meet the EIA standards for RS422A and RS232C.
The RS422A receivers utilise Schottky circuitry and have differential line inputs which are compatible with either a single ended or a differential line system. The RS422A drivers provide complementary output signals with high-current capability for driving balanced lines. Driver output stages are TTL totem-pole type having a high-impedance state when in the power off condition. The total power demand is typically 450mW with no load.

absolute maximum ratings over operating free-air temperature range

Supply voltage V_{CC}	7V
Voltage at RS422A receiver	±15V
Input voltage RS232C receiver	±30V
Output voltage RS232C transmitter	±15V
Continuous total dissipation at or below 25C free-air temperature	1.0W
Operating free-air temperature range	0C to 70C
Storage temperature range	- 55C to 125C
Lead temperature 1.5mm from case for 10 seconds	300C

RS422A Receiver to RS232C Transmitter

electrical characteristics over operating free-air temperature range V_{CC} = 5V

Parameter	Test Conditions		Min	Typ	Max	Unit
V_{TH} Differential input H threshold					0.2	V
V_{TL} Differential input L threshold			- 0.2			V
V_{T+} to V_{T-} Hysteresis				70		mV
V_{OH} High-level output voltage	V_{IH} = 0.2V	V_{CC} = 5V	8.0	9.0		V
	R_L = 3kΩ					
V_{OL} Low-level output voltage	V_{IH} = - 0.2V	V_{CC} = 5V	- 7.5	- 8.0		V
	R_L = 3kΩ					
I_I Line input current	other	V_I = 10V			3.25	mA
	input = 0	V_I = - 10V			- 3.25	
ri Input resistance				8		kΩ
$I_{OS(H)}$ Short-circuit output current	V_{IH} = 0.2V		15	20		mA
$I_{OS(L)}$ Short-circuit output current	V_{IL} = - 0.2V		- 10	- 15		mA
R_O	V_{CC} = 0V		300			Ω

all typical values are at T_a = 25C

switching characteristics V_{CC} = 5V

Parameter	Test Conditions	Min	Typ	Max	Unit
t_{PLH} Propagation delay time L to H	R_L = 3kΩ C_L = 30pF		1.3		μs
t_{PHL} Propagation delay time H to L			1.2		ms
t_{TLH} Transition time L to H level			1.0	1.6	μs
t_{THL} Transition time H to L level			1.0	1.6	μs
t_{TLH} Transition time L to H level	R_L = 3kΩ to 7kΩ C_L = 2500pF		2.0	2.5	μs
t_{THL} Transition time H to L level			2.0	2.5	μs

all typical values are at T_a = 25C

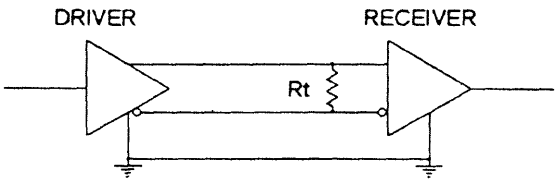
NM422AD
Dual RS232C to RS422A Transceiver

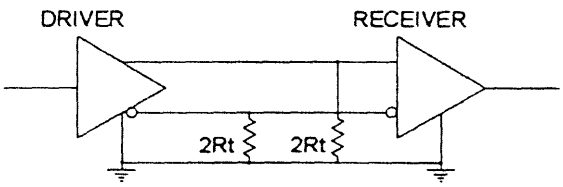
electrical characteristics over operating free-air temperature range V_{CC} = 5V

Parameter	Test Conditions		Min	Typ	Max	Unit
I_{CC} Supply current	No loads	Inputs high		180		mA
		Inputs low		90		
PD Total power dissipation	RS232C R_L = 3kΩ RS422A R_L = 100Ω			800		mW

all typical values are at T_a = 25C

RS422A connection techniques





ordering information

Part No.	Function	Package Style
NM422AD	5 volt only RS232C to RS422A transceiver	7

RS232C Receiver to RS422A Driver

electrical characteristics over operating free-air temperature range V_{CC}=5V

Parameter	Test Conditions		Min	Typ	Max	Unit
V_{T+} Positive going threshold				2.4	2.0	V
V_{T-} Negative going threshold			1.0		1.6	V
V_{OH} High-level output voltage	V_{IH} = 3V, I_{OH} = - 40mA		2.4		3.2	V
V_{OL} Low-level output voltage	V_{IL} = - 3V, I_{OL} = 40mA			0.4	0.2	V
[V_{OD1}] Differential output voltage	I_O = 0			2V_{OD2}	3.5	V
[V_{OD2}] Differential output voltage	R_L = 100Ω		2		3.0	V
Δ [V_{OD}] Change in magnitude of differential output voltage	V_{CC} = Min. R_L = 100Ω			±0.4	±0.02	V
V_{OC} Common-mode output voltage				3		
Δ [V_{OC}] Change in magnitude of common-mode output voltage	V_{CC} = Min. R_L = 100Ω			±0.4		
I_O Output current with power off	V_{CC} = 0V	V_O =6V		100		mA
		V_O =-0.25V		- 100		
I_{IH} High-level input current	V_{IN} = 25V		5.5	6.3		mA
	V_{IN} = 3V			0.65	0.6	
I_{IL} Low-level input current	V_{IN} = - 25V		- 6.0	- 6.8		mA
	V_{IN} = - 3V			- 0.65	- 0.6	
I_{OS} Short-circuit output current	V_{CC} = Max.			- 150		mA

all typical values are at T_a = 25C

switching characteristics V_{CC} = 5V

Parameter	Test Conditions	Min	Typ	Max	Unit
t_{PLH} Propagation delay time L to H	R_L = 100Ω		25	35	ns
t_{PHL} Propagation delay time H to L			44	65	ns
t_{TLH} Transition time L to H level			4	20	ns
t_{THL} Transition time H to L level			4	20	ns

all typical values are at T_a = 25C