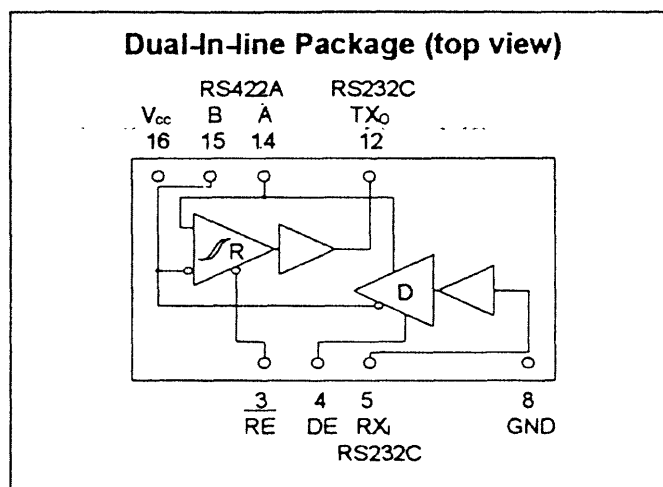


- ☐ Bidirectional transceiver
- ☐ 5 Volt only operation
- ☐ Meets EIA – RS232C and RS422A & RS485 standards
- ☐ 3-State driver output
- ☐ Individual driver and receiver enables



### 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 12k $\Omega$  and input sensitivity of  $\pm 200\text{mV}$ . 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 Vcc	7V
Voltage at any bus terminal	- 10V to 15V
Enable input voltage	5.5V
Input voltage RS232C receiver	$\pm 30\text{V}$
Output voltage RS232C transmitter	$\pm 15\text{V}$
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

# NM422A

## RS232C to RS422A Transceiver

### 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	$V_{IH} = 0.2V$ $R_L = 3k\Omega$	$V_{CC} = 5V$	8.0	9.0		V
$V_{OL}$ Low-level output voltage	$V_{IH} = - 0.2V$ $R_L = 3k\Omega$	$V_{CC} = 5V$	- 7.0	- 8.0		V
$I_I$ Line input current	other input = 0	$V_I = 12V$			1	mA
		$V_I = - 7V$			- 0.8	
$I_{IH}$ High-level enable input current	$V_{IH} = 2.7V$				20	$\mu A$
$I_{IL}$ Low-level enable input current	$V_{IL} = 0.4V$				- 100	$\mu A$
$r_i$ Input resistance			12			$k\Omega$
$I_{OS(H)}$ 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			$\Omega$

### 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 $R_L = 3k\Omega$ RS422A $R_L = 60\Omega$			385		mW

all typical values are at  $T_a = 25C$

# NM422A

## RS232C to RS422A Transceiver

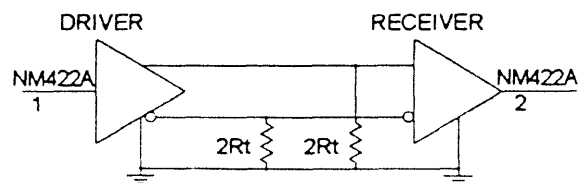
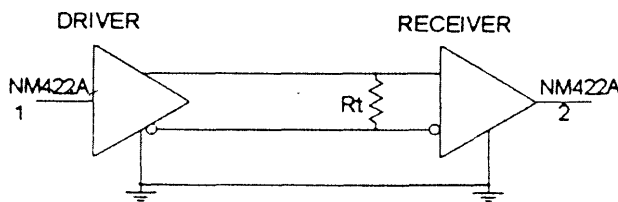
### RS232C Receiver to RS422A Driver

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	$R_L = 100\Omega$	2		3.0	V
	$R_L = 54\Omega$	1.5		2.4	V
$\Delta[V_{OD}]$ Change in magnitude of differential output voltage	$R_L = 54\Omega$ or $100\Omega$		$\pm 0.2$		V
$V_{OC}$ Common-mode output voltage			3		
$\Delta[V_{OC}]$ Change in magnitude of common-mode output voltage			$\pm 0.2$		
$I_O$ 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	$R_L = 3k\Omega$ $C_L = 30pF$		1.3		$\mu s$
$t_{PHL}$ Propagation delay time H to L			1.2		ms
$t_{TLH}$ Transition time L to H level			1.0	1.6	$\mu s$
$t_{THL}$ Transition time H to L level			1.0	1.6	$\mu s$
$t_{TLH}$ Transition time L to H level	$R_L = 3k\Omega$ to $7k\Omega$ $C_L = 2500pF$		2.0	2.5	$\mu s$
$t_{THL}$ Transition time H to L level			2.0	2.5	$\mu s$

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	$R_L = 60\Omega$		35	50	ns
$t_{TD}$ Differential output transition time			50	75	
$t_{PLH}$ Propagation delay time L to H	$R_L = 27\Omega$		16	25	ns
$t_{PHL}$ Propagation delay time H to L			44	65	
$t_{PZH}$ Output enable time to H level	$R_L = 110\Omega$		60	80	ns
$t_{PZL}$ Output enable time to L level	$R_L = 110\Omega$		30	45	ns
$t_{PHZ}$ Output disable time from H level	$R_L = 110\Omega$		51	75	ns
$t_{PLZ}$ Output disable time from L level	$R_L = 110\Omega$		18	30	ns

all typical values are at  $T_a = 25C$

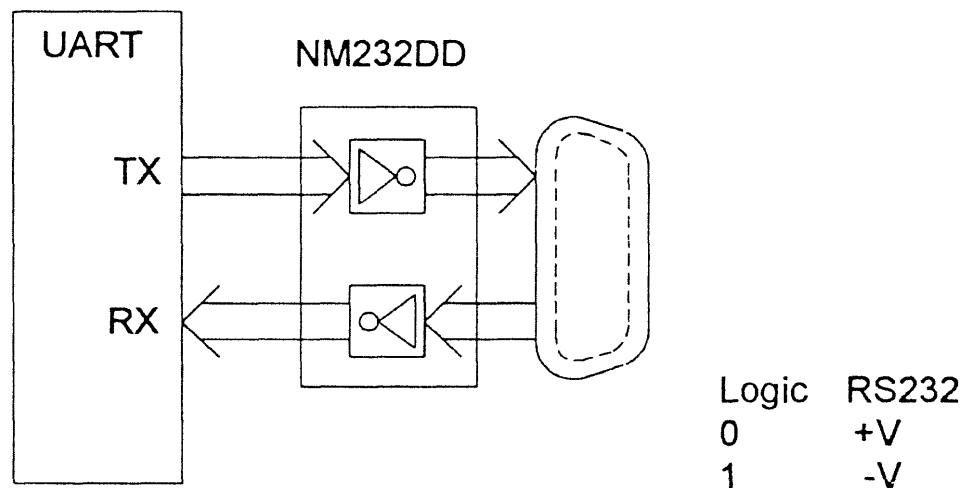
#### logic state table

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.



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.

## NM422A

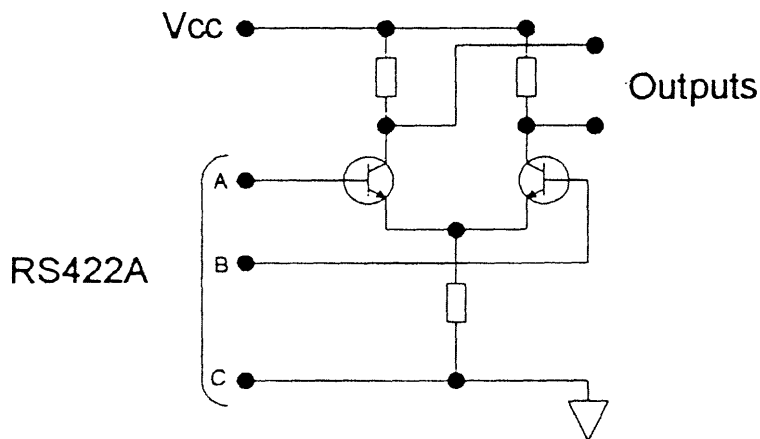
### RS232C to RS422A Transceiver

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#### 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.



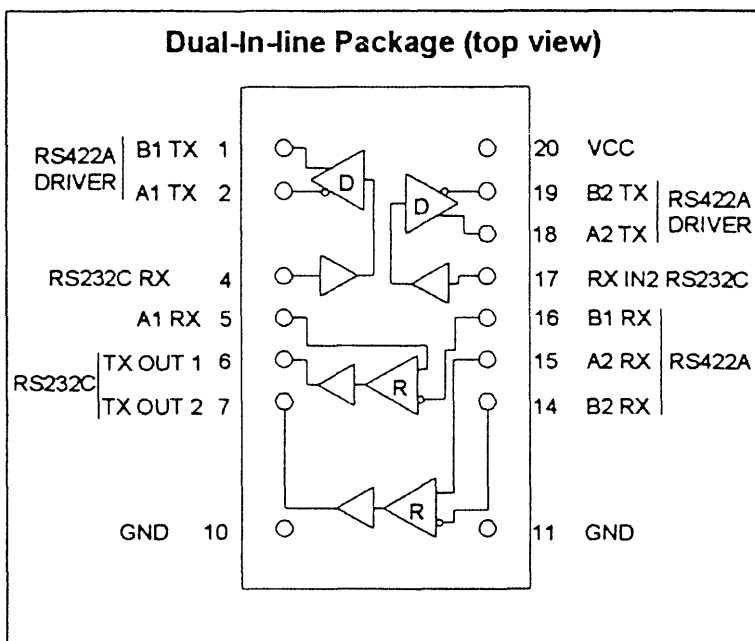
The differential signal is connected to the base of two transistors which are referred to ground via the emitters.

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

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



### 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 Vcc	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

# NM422AD

## Dual RS232C to RS422A Transceiver

### 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	$V_{IH} = 0.2V$ $R_L = 3k\Omega$	$V_{CC} = 5V$	8.0	9.0		V
$V_{OL}$ Low-level output voltage	$V_{IH} = - 0.2V$ $R_L = 3k\Omega$	$V_{CC} = 5V$	- 7.5	- 8.0		V
$I_I$ Line input current	other input = 0	$V_I = 10V$			3.25	mA
		$V_I = - 10V$			- 3.25	
$r_i$ Input resistance				8		$k\Omega$
$I_{OS(H)}$ 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			$\Omega$

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	$R_L = 3k\Omega$ $C_L = 30pF$		1.3		$\mu s$
$t_{PHL}$ Propagation delay time H to L			1.2		ms
$t_{TLH}$ Transition time L to H level			1.0	1.6	$\mu s$
$t_{THL}$ Transition time H to L level			1.0	1.6	$\mu s$
$t_{TLH}$ Transition time L to H level	$R_L = 3k\Omega$ to $7k\Omega$ $C_L = 2500pF$		2.0	2.5	$\mu s$
$t_{THL}$ Transition time H to L level			2.0	2.5	$\mu s$

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 $R_L = 3k\Omega$ RS422A $R_L = 100\Omega$			800		mW

all typical values are at  $T_a = 25^\circ C$

## RS422A connection techniques



## ordering information

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

## Dual RS232C to RS422A Transceiver

## 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	$R_L = 100\Omega$	2		3.0	V
$\Delta[V_{OD}]$ Change in magnitude of differential output voltage	$V_{CC} = \text{Min.}$ $R_L = 100\Omega$		$\pm 0.4$	$\pm 0.02$	V
$V_{OC}$ Common-mode output voltage			3		
$\Delta[V_{OC}]$ Change in magnitude of common-mode output voltage	$V_{CC} = \text{Min.}$ $R_L = 100\Omega$		$\pm 0.4$		
$I_O$ 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	$V_{CC} = \text{Max.}$		-150		mA

all typical values are at  $T_a = 25^\circ C$ switching characteristics  $V_{CC} = 5V$ 

Parameter	Test Conditions	Min	Typ	Max	Unit
$t_{PLH}$ Propagation delay time L to H	$R_L = 100\Omega$		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  $T_a = 25^\circ C$