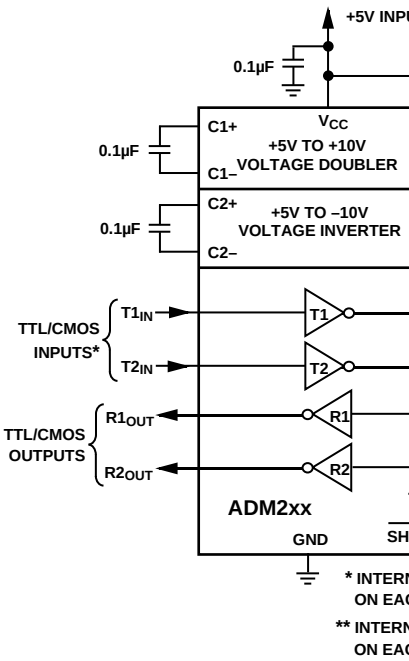
200 kB/s Transmission Rate
Small (0.1 μF) Charge Pump Capacitors
Single 5 V Power Supply
Meets All EIA-232-E and V.28 Specifications
Two Drivers and Two Receivers
On-Board DC-DC Converters
±9 V Output Swing with +5 V Supply
±30 V Receiver Input Levels
Pin Compatible with MAX222/MAX232A/MAX242

APPLICATIONS
Computers
Peripherals
Modems
Printers
Instruments



GENERAL DESCRIPTION

The ADM222, ADM232A, ADM242 are a family of high speed RS-232 line drivers/receivers offering transmission rates up to 200 kB/s. Operating from a single +5 V power supply, a highly efficient on-chip charge pump using small (0.1 μF) external capacitors allows RS-232 bipolar levels to be developed. Two RS-232 drivers and two RS-232 receivers are provided on each device.

The devices are fabricated on BiCMOS, an advanced mixed technology process which combines low power CMOS with high speed bipolar circuitry. This allows for transmission rates up to 200 kB/s yet minimizes the quiescent power supply current to under 5 mA.

The ADM232A is a pin-compatible, high speed upgrade for the AD232 and for the ADM232L. It is available in 16-pin DIP and in both narrow and wide surface mount (SOIC) packages.

The ADM222 contains an additional shutdown ($\overline{SHDN}$) function which may be used to disable the device thereby reducing the supply current to 0.1 μA. During shutdown, all transmit/receive functions are disabled. The ADM222 is available in 18-pin DIP and in a wide surface mount (SOIC) package.

The ADM242 combines both shutdown ($\overline{SHDN}$) and enable ($\overline{EN}$) functions. The shutdown function reduces the supply curent to 0.1 mA. During shutdown, the transmitters are disabled but the receivers continue to operate normally. The enable function allows the receiver outputs to be disabled thereby facilitating sharing a common bus. The ADM242 is available in 18-pin DIP and in a wide surface mount (SOIC) package.

***Protected by U.S. Patent No. 5,237,209.**

ORDERING GUI

Model	Temperature Ran
ADM222AN	–40°C to +85°C
ADM222AR	–40°C to +85°C
ADM232AAN	–40°C to +85°C
ADM232AARN	–40°C to +85°C
ADM232AARW	–40°C to +85°C
ADM242AN	–40°C to +85°C
ADM242AR	–40°C to +85°C

REV. 0

One Technology Way, P.O. Box 9106, Norwo
Tel: 617/329-4700

Logic Pullup Current		5	40	µA	T_{IN} = 0 V
Data Rate	200			kB/s	
Output Resistance	300			Ω	V_{CC} = V+ = V– = 0 V, V_{OUT}
Output Short Circuit Current (Instantaneous)	±7	±22		mA	
RS-232 RECEIVERS					
RS-232 Input Voltage Range	–30		+30	V	
RS-232 Input Threshold Low	0.8	1.3		V	
RS-232 Input Threshold High		1.8	2.4	V	
RS-232 Input Hysteresis	0.2	0.5	1.0	V	V_{CC} = 5 V
RS-232 Input Resistance	3	5	7	kΩ	
TTL/CMOS Output Voltage Low, V_{OL}		0.2	0.4	V	I_{OUT} = 3.2 mA
TTL/CMOS Output Voltage High, V_{OH}	3.5			V	I_{OUT} = –1.0 mA
TTL/CMOS Output Short-Circuit Current	–2	–10		mA	Source Current (V_{OUT} = G
TTL/CMOS Output Short-Circuit Current	10	30		mA	Sink Current (V_{OUT} = V_{CC})
TTL/CMOS Output Leakage Current		±0.05	±10	µA	$\overline{SHDN}$ = GND/$\overline{EN}$ = V_{CC} 0 V ≤ V_{OUT} ≤ V_{CC}
$\overline{EN}$ Input Threshold Low, V_{INL}		1.4	0.8	V	
$\overline{EN}$ Input Threshold High, V_{INH}	2.0	1.4		V	
POWER SUPPLY					
Power Supply Current		4	8	mA	No Load
		15		mA	3 kΩ Load on Both Output
Shutdown Power Supply Current		0.1	10	µA	
$\overline{SHDN}$ Input Leakage Current			±1	µA	
$\overline{SHDN}$ Input Threshold Low, V_{INL}		1.4	0.8	V	
$\overline{SHDN}$ Input Threshold High, V_{INH}	2.0	1.4		V	
AC CHARACTERISTICS					
Transition Region Slew Rate	6	12	30	V/µs	C_L = 50 pF to 2500 pF, R_L Measured from +3 V to –3
Transmitter Propagation Delay TTL to RS-232		0.7	3.5	µs	t_{PHLT}
		0.7	3.5	µs	t_{PLHT}
Receiver Propagation Delay RS-232 to TTL		0.2	0.5	µs	t_{PHLR}
		0.3	0.5	µs	t_{PLHR}
Receiver Output Enable Time		125	500	ns	t_{ER}
Receiver Output Disable Time		160	500	ns	t_{DR}
Transmitter Output Enable Time		250		µs	$\overline{SHDN}$ Goes high
Transmitter Output Disable Time		3.5		µs	$\overline{SHDN}$ Goes low
Transmitter + to – Propagation Delay Difference		300		ns	
Receiver + to – Propagation Delay Difference		100		ns	

Specifications subject to change without notice.

R_{IN} . . . . . ±30 V
Output Voltages
T_{OUT} . . . . . (V+, +0.3 V) to (V–, –0.3 V)
R_{OUT} . . . . . –0.3 V to (V_{CC} + 0.3 V)
Short Circuit Duration
T_{OUT} . . . . . Continuous
Power Dissipation N-16 . . . . . 400 mW
(Derate 7.5 mW/°C above +70°C)
θ_{JA}, Thermal Impedance . . . . . 80°C/W
Power Dissipation R-16N . . . . . 400 mW
(Derate 7 mW/°C above +70°C)
θ_{JA}, Thermal Impedance . . . . . 80°C/W

(Derate 7 mW/°C above +70°C)
θ_{JA}, Thermal Impedance . . . . .
Operating Temperature Range
Industrial (A Version) . . . . .
Storage Temperature Range . . . . .
Lead Temperature (Soldering, 10 sec) .
Vapor Phase (60 sec) . . . . .
Infrared (15 sec) . . . . . .

*This is a stress rating only and functional operatio
other conditions above those indicated in the oper
tion is not implied. Exposure to absolute maximum
periods of time may affect reliability.

Test Circuits

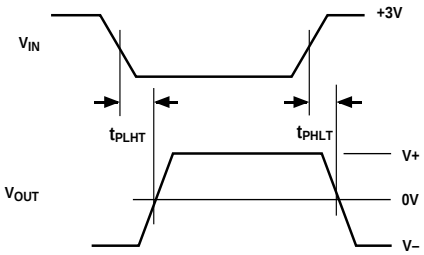


Figure 1. Transmitter Propagation Delay Timing

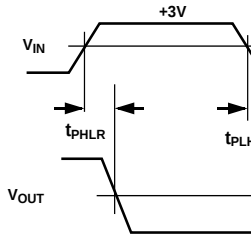


Figure 3. Receiver Propagatio

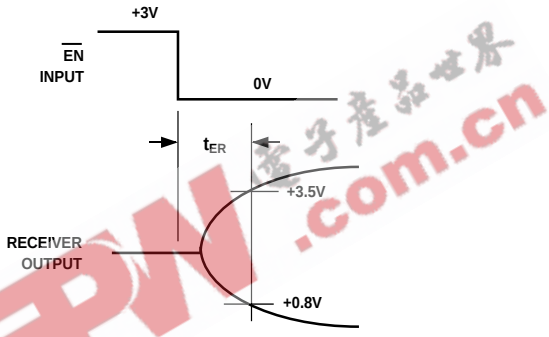


Figure 2. Receiver Enable Timing

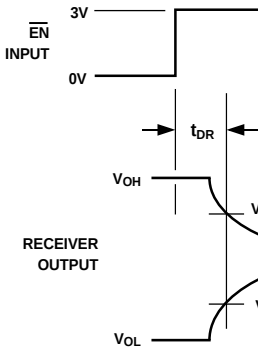


Figure 4. Receiver Disa

Figure 5. Shutdown Test Circuit

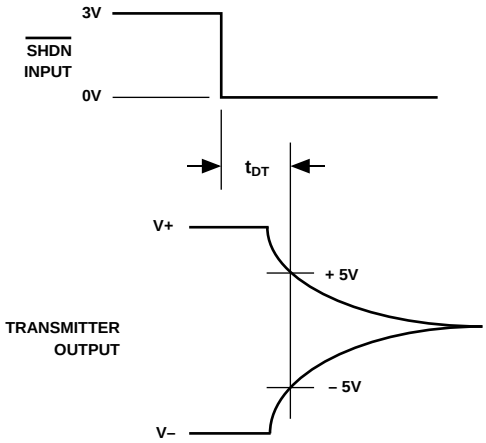


Figure 6. Transmitter Shutdown Disable Timing

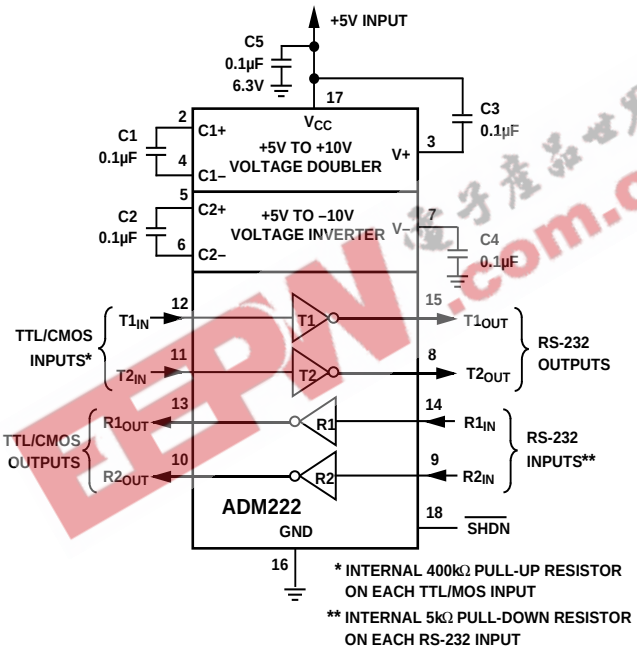


Figure 7. ADM222 Typical Operating Circuit

V–	Internally generated negative nominal).
GND	Ground Pin. Must be connect
C1+	External capacitor 1, (+ termi to this pin.
C1–	External capacitor 1, (– termi to this pin.
C2+	External capacitor 2, (+ termi to this pin.
C2–	External capacitor 2, (– termi to this pin.
T_{IN}	Transmitter (Driver) Inputs. TTL/CMOS levels. An intern resistor to V_{CC} is connected or
T_{OUT}	Transmitter (Driver) Outputs. levels (typically ±9 V).
R_{IN}	Receiver Inputs. These inputs signal levels. An internal 5 kΩ resistor to GND is connected inputs.
R_{OUT}	Receiver Outputs. These are T
NC	No Connect. No connections pin.
$\overline{EN}$	(ADM242 Only) Active Low I be used to enable or disable (receiver outputs.
$\overline{SHDN}$	(ADM222 & ADM242) Activ Input. May be used to disable the power consumption is min ADM222 all drivers and recei On the ADM242 the drivers a receivers remain enabled.

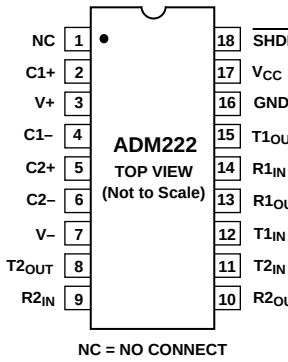


Figure 8. ADM222 DIP & SOIC Pin C

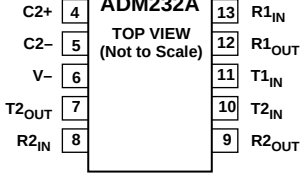


Figure 9. ADM232A DIP/SOIC Pin Configuration

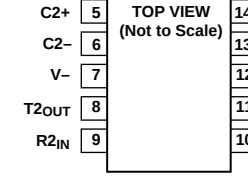


Figure 11. ADM242 DIP/SOIC P

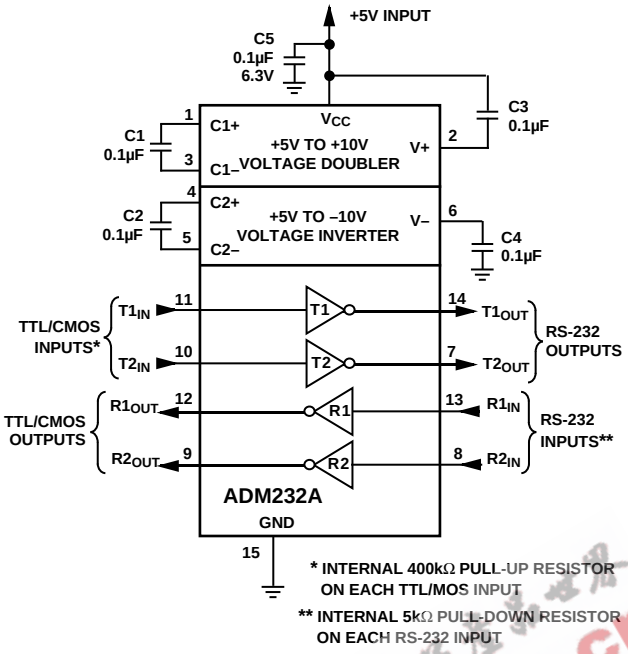


Figure 10. ADM232A Typical Operating Circuit

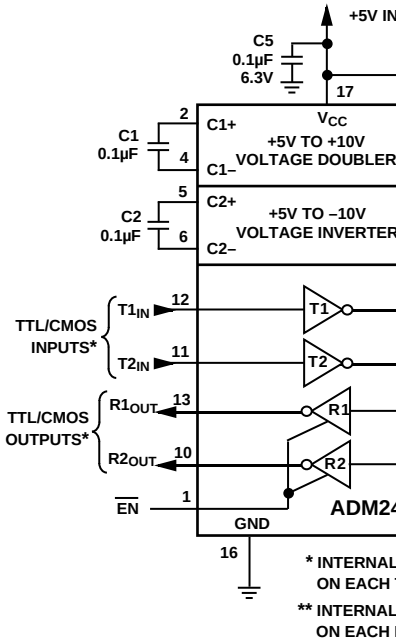


Figure 12. ADM242 Typical C

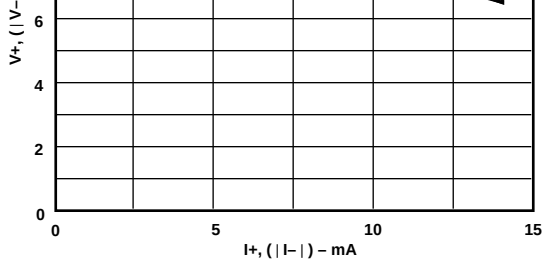


Figure 13. Charge Pump V+, V– vs. Current

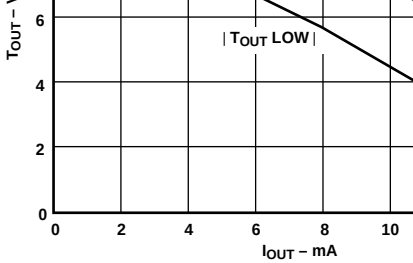


Figure 16. Transmitter Output Volta

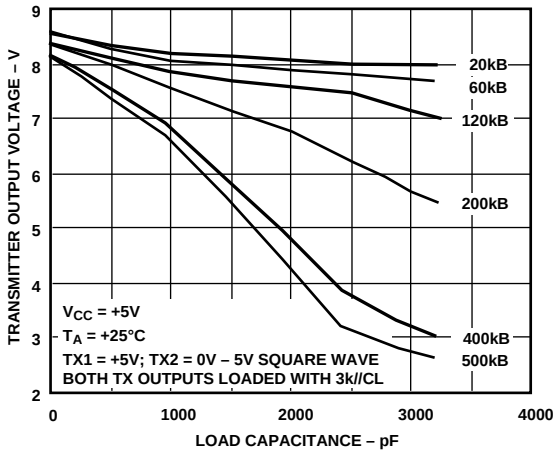


Figure 14. Transmitter Baud Rate vs. Load Capacitance

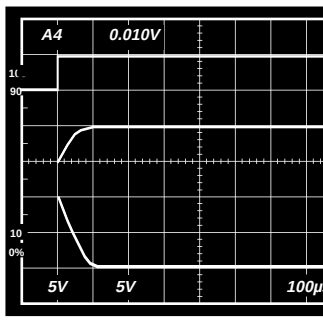


Figure 17. Charge Pump V+, V– Exit

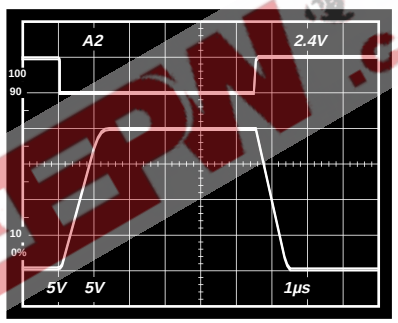


Figure 15. Transmitter Unloaded Slew Rate

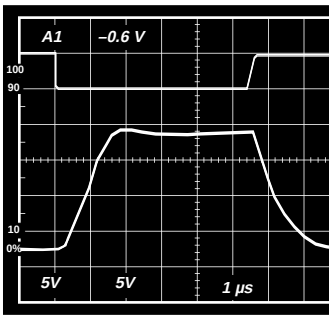


Figure 18. Transmitter Fully Loade

mitters and receivers onto the same chip. CMOS technology is used to keep the power dissipation to an absolute minimum. All devices contains an internal charge pump voltage doubler and a voltage inverter that generates ±10 V from the +5 V input. Four external 0.1 µF capacitors are required for the internal charge pump voltage converter.

The ADM222/ADM232A/ADM242 is a modification, enhancement and improvement to the AD230-AD241 family and derivatives thereof. It is essentially plug-in compatible and does not have materially different applications.

CIRCUIT DESCRIPTION

The internal circuitry consists of four main sections. These are:

A Charge Pump Voltage Converter
TTL/CMOS to RS-232 Transmitters
RS-232 to TTL/CMOS Receivers
Enable and Shutdown Functions.

Charge Pump DC-DC Voltage Converter

The Charge Pump Voltage converter consists of an oscillator and a switching matrix. The converter generates a ±10 V supply from the input 5 V level. This is done in two stages using a switched capacitor technique. The 5 V input supply is doubled to 10 V using capacitor C1 as the charge storage element. The –10 V level is also generated from the input 5 V supply using C1 and C2 as the storage elements.

Capacitors C3 and C4 are used to reduce the output ripple. Their values are not critical and can be reduced if higher levels of ripple are acceptable. The charge pump capacitors C1 and C2 may also be reduced at the expense of higher output impedance on the V+ and V– supplies.

The V+ and V– supplies may also be used to power external circuitry if the current requirements are small. Please refer to the typical performance characteristics which shows the V+, V– output voltage vs. current.

In the shutdown mode the charge pump is disabled and V+ decays to V_{CC} while V– decays to 0 V.

Transmitter (Driver) Section

The Drivers convert TTL/CMOS input levels into RS-232 output levels. With V_{CC} = +5 V and driving a typical RS-232 load, the output voltage swing is ±9 V. Even under worst case conditions the drivers are guaranteed to meet the ±5 V RS-232 minimum requirement.

The input threshold levels are both TTL and CMOS compatible with the switching threshold set at $V_{CC}/4$. With a nominal V_{CC} = 5 V the switching threshold is 1.25 V typical. Unused inputs may be left unconnected, as an internal 400 kΩ pull- up resistor pulls them high forcing the outputs into a low state.

CMOS levels. The inputs have internal
to ground and are also protected against
±30 V. The guaranteed switching thresh
mum and 2.4 V maximum which are we
232 requirement. The low level threshol
as it ensures that an unconnected input
low level.

The receivers have Schmitt trigger input
of 0.5 V. This ensures error free-recepti
and for inputs with slow transition times

Enable and Shutdown Functions

On the ADM222, both receivers are full
shutdown.

On the ADM242, both receivers continu
This function is useful for monitoring ac
occurs, the device can be taken out of th

The ADM242 also contains a receiver e
which can be used to fully disable the re
$\overline{\text{SHDN}}$.

APPLICATIONS INFORMATION

A selection of typical operating circuits i
to 19.

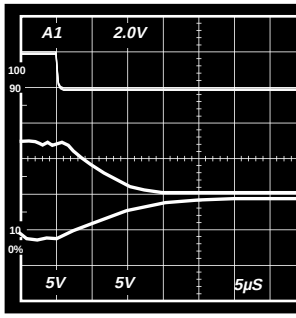
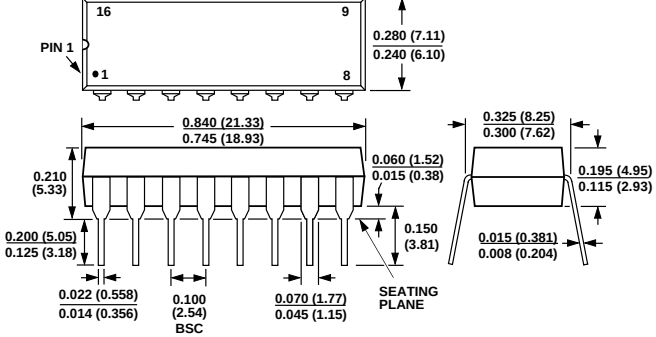
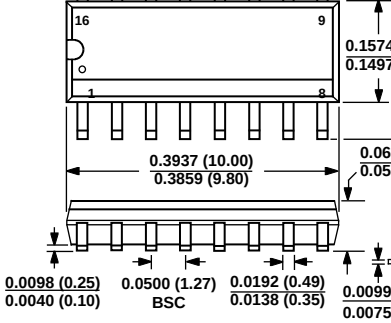
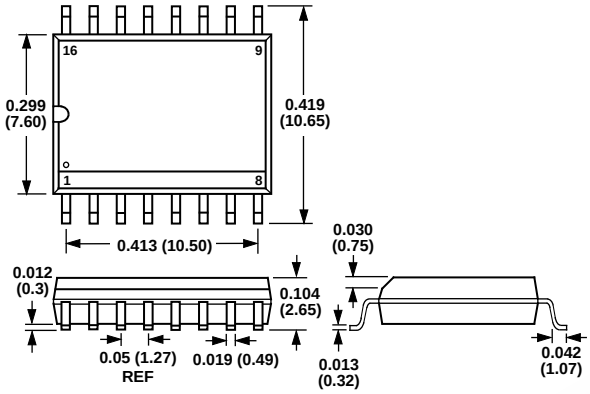


Figure 19. Transmitter Output L

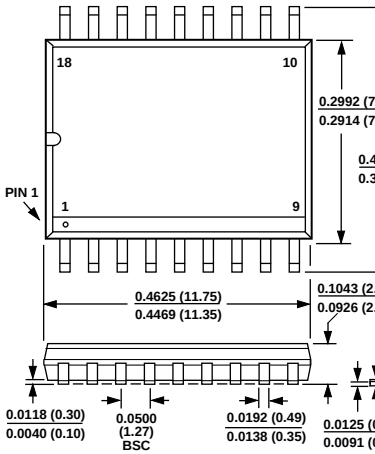




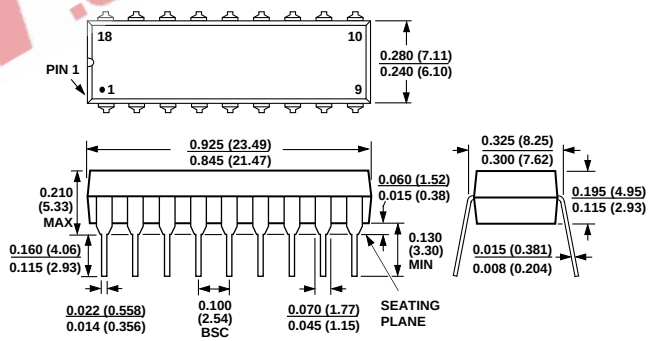
16-Lead Wide SOIC
(R-16W)



18-Lead Wide SOIC
(R-18W)



18-Pin Plastic DIP
(N-18)



ADM232AARN	–40°C to +85°C	R-16N
ADM232AARW	–40°C to +85°C	R-16W
ADM242AN	–40°C to +85°C	N-18
ADM242AR	–40°C to +85°C	R-18W

*For outline information see Package Information section.