National Semiconductor

ADVANCE INFORMATION
June 1998

DS14C202
Low Power +5V Powered EIA/TIA-232 Dual Driver/Receiver

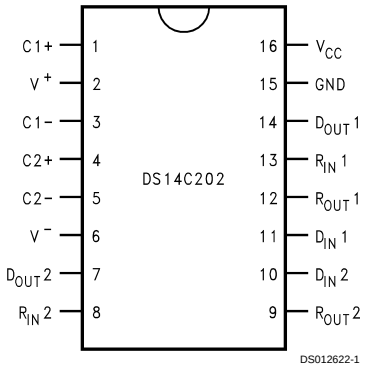
General Description

The DS14C202 is a low power dual driver/receiver featuring an onboard DC to DC converter. This eliminates the need for ±12V power supplies and requires only a +5V power supply. Only four 0.1 µF capacitors are needed for the DC to DC converter. The drivers maintain greater than ±5V output signal levels at data rates in excess of 128 kbits/sec when loaded in accordance with the EIA/TIA-232-E specification. I_{CC} is specified at 15 mA maximum, making the device ideal for battery and power conscious applications. The drivers' slew rate is set internally, eliminating the need for external slew rate capacitors. The device is designed to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). The driver inputs and receiver outputs are TTL and CMOS compatible. DS14C202 driver outputs and receiver inputs meet EIA/TIA-232-E and ITU-T V.28 standards. This device is an enhanced version of the DS14C232 that requires smaller external capacitors (0.1 µF) and supports higher data rates of up to 128 kbit/sec.

Features

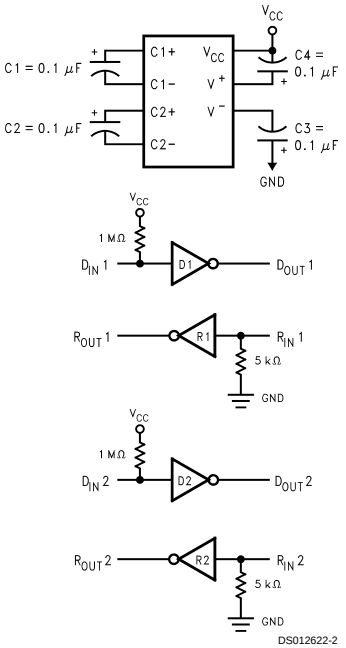
- Uses only four small 0.1 µF capacitors for DC to DC converter
- Operates over 128 kbit/sec
- Pin compatible with MAX202, MAX232A and others
- Single +5V power supply
- Low power
- DS14C202 meets EIA/TIA-232-E and ITU-T V.28 standards
- CMOS technology
- Package efficiency — 2 drivers and 2 receivers
- Available in Plastic DIP and Narrow SOIC packages
- Extended temperature range: −40˚C to +85˚C
- ESD ≥ 6.0 kV HBM

Connection Diagram



Order Number DS14C202TN
or DS14C202TM
See NS Package Number N16A or M16A

Functional Diagram



DS14C202 Low Power +5V Powered EIA/TIA-232 Dual Driver/Receiver

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.3V to 6V
Supply Voltage (V^+)	(V_{CC} − 0.3V) to +14V
Supply Voltage (V^-)	+0.3V to −14V
Short Circuit Duration, D_{OUT}	Continuous
Driver Input Voltage	−0.3V to (V_{CC} + 0.3V)
Driver Output Voltage	(V^+ + 0.3V) to (V^- − 0.3V)
Receiver Input Voltage	±25V
Receiver Output Voltage	−0.3V to (V_{CC} + 0.3V)
ESD Rating (HBM, 1.5 kΩ, 100 pF)	≥ 6.0 kV
Junction Temperature	+150˚C
Maximum Package Power Dissipation @ 25˚C (Note 6)	
N Package	TBD
M Package	TBD
Storage Temperature Range	−65˚C to +150˚C
Lead Temperature (Soldering, 4 sec.)	+260˚C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage, (V_{CC})	4.5	5.5	V
Operating Free Air Temp. (T_A)			
DS14C202T	−40	+85	˚C

Electrical Characteristics (Notes 2, 5)

Over recommended operating conditions, unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DEVICE CHARACTERISTICS							
V^+	Positive Power Supply	R_L = 3 kΩ, C1–C4 = 0.1 µF, D_{IN} = 0.8V			9.0		V
V^-	Negative Power Supply	R_L = 3 kΩ, C1–C4 = 0.1 µF, D_{IN} = 2.0V			−8.5		V
I_{CC}	V_{CC} Supply Current	No Load				15	mA
DRIVER CHARACTERISTICS							
V_{IH}	High Level Input Voltage			2.0		V_{CC}	V
V_{IL}	Low Level Input Voltage			GND		0.8	V
I_{IH}	High Level Input Current	$V_{IN} \geq 2.0V$		−30		+30	µA
I_{IL}	Low Level Input Current	$V_{IN} \leq 0.8V$		−30		+30	µA
V_{OH}	High Level Output Voltage	R_L = 3 kΩ		5.0	8.0		V
V_{OL}	Low Level Output Voltage	R_L = 3 kΩ			−7.0	−5.0	V
I_{OS}^+	Output High Short Circuit Current	V_{OUT} = 0V, V_{IN} = 0.8V	(Note 3)	−5.0	−15	−30	mA
I_{OS}^-	Output Low Short Circuit Current	V_{OUT} = 0V, V_{IN} = 2.0V		5.0	11	30	mA
R_O	Output Resistance	−2V ≤ V_{OUT} ≤ +2V, V_{CC} = 0V = GND or Open		300			Ω
RECEIVER CHARACTERISTICS							
V_{TH}	Input High Threshold Voltage				1.7	2.4	V
V_{TL}	Input Low Threshold Voltage			0.8	1.5		V
V_{HY}	Hysteresis			0.2	0.4	1.0	V
R_{IN}	Input Resistance	−15V ≤ V_{IN} ≤ +15V		3.0	4.7	7.0	kΩ
I_{IN}	Input Current	V_{IN} = +15V		+2.14	+3.5	+5.0	mA
		V_{IN} = +3V		+0.43	+0.6	+1.0	mA
		V_{IN} = −3V		−0.43	−0.6	−1.0	mA
		V_{IN} = −15V		−2.14	−3.5	−5.0	mA
V_{OH}	High Level Output Voltage	V_{IN} = −3V, I_{OH} = −3.2 mA		3.5	4.5		V
		V_{IN} = −3V, I_{OH} = −20 µA		4.0	4.9		V
V_{OL}	Low Level Output Voltage	V_{IN} = +3V, I_{OL} = +3.2 mA			0.15	0.4	V

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Switching Characteristics (Note 5)

Over recommended operating conditions, unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Units
DRIVER CHARACTERISTICS							
t_{PLH}	Propagation Delay Low to High	R_L = 3 kΩ C_L = 50 pF (*Figure 1*)			1.0	4.0	µs
t_{PHL}	Propagation Delay High to Low				1.0	4.0	µs
t_{SK}	Skew $\lvert t_{PLH} - t_{PHL} \rvert$				0.1	1.0	µs
SR1	Output Slew Rate	R_L = 3 kΩ to 7 kΩ, C_L = 50 pF	(Note 7)	4.0	10	30	V/µs
SR2	Output Slew Rate	R_L = 3 kΩ to 7 kΩ, C_L = 2500 pF		4.0	10	30	V/µs
RECEIVER CHARACTERISTICS							
t_{PLH}	Propagation Delay Low to High	Input Pulse Width > 10 µs C_L = 50 pF (*Figure 2*)				2.0	µs
t_{PHL}	Propagation Delay High to Low					2.0	µs
t_{SK}	Skew $\lvert t_{PLH} - t_{PHL} \rvert$					300	ns
t_r	Output Rise Time					15	ns
t_f	Output Fall Time					15	ns
DATA RATES							
f_{MAX}	Maximum Data Rate	R_L = 3 kΩ to 7 kΩ, C_L = 50 pF to 1000 pF (Note 8)		128	TBD		kbps

Note 1: Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of Electrical Characteristics specify conditions for device operation.

Note 2: Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground unless otherwise specified. For current, minimum and maximum values are specified as an absolute value and the sign is used to indicate direction. For voltage logic levels, the more positive value is designated as maximum. For example, if −6V is a maximum, the typical value of −6.8V is more negative.

Note 3: I_{OS}^+ and I_{OS}^- values are for one output at a time.

Note 4: Receiver AC input waveform for test purposes: $t_r = t_f$ = 160 ns (10% to 90%), V_{IH} = 3V, V_{IL} = −3V, f = 64 kHz, 50% duty cycle. Driver AC input waveform for test purposes: $t_r = t_f$ = 10 ns (10% to 90%), V_{IH} = 3V, V_{IL} = 0V, f = 64 kHz, 50% duty cycle.

Note 5: All typicals are given for V_{CC} = 5.0V, +25˚C.

Note 6: Ratings apply to ambient temperature at +25˚C. Above this temperature derate: N Package TBD and M Package TBD.

Note 7: Slew rate is defined as ΔV/Δt, measured between ±3V level.

Note 8: f_{MAX} criteria is either 60%–40% duty cycle or a waveform that is ⅓ rise, ⅓ fall, ⅓ logic level (driver ±5V and receiver 3.5V/0.4V).

Parameter Measurement Information

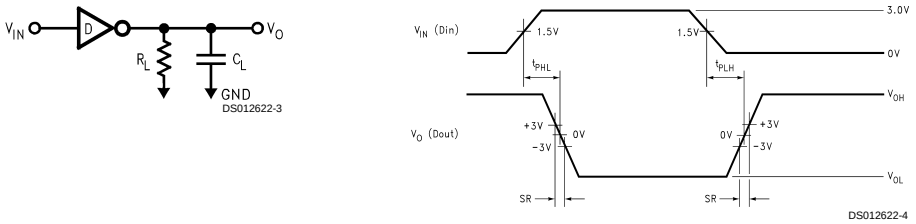
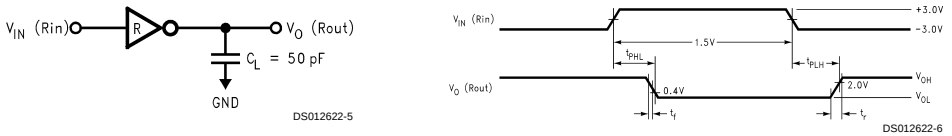


FIGURE 1. Driver Load Circuit and Switching Waveform (Note 4)



t_r and t_f measured between 20% and 80% of the waveform.

FIGURE 2. Receiver Load Circuit and Switching Waveform (Note 4)

Pin Descriptions

V_{CC} (Pin 16)

Power supply pin for the device, +5V (±10%).

V^+ (Pin 2)

Positive supply for EIA/TIA-232-E drivers. Recommended external capacitor: C4 = 0.1 µF (≥ 6.3V). Capacitor value should not be less than 0.1 µF. This supply is not intended to be loaded externally. (Note 9)

V^- (Pin 6)

Negative supply for EIA/TIA-232-E drivers. Recommended external capacitor: C3 = 0.1 µF (≥ 16V). Capacitor value should not be less than 0.1 µF. This supply is not intended to be loaded externally. (Note 9)

C1+, C1− (Pins 1, 3)

External capacitor connection pins. Recommended capacitor: C1 = 0.1 µF (≥ 6.3V). Capacitor value should not be less than 0.1 µF. (Note 9)

C2+, C2− (Pins 4, 5)

External capacitor connection pins. Recommended capacitor: C2 = 0.1 µF (≥ 16V). Capacitor value should not be less than 0.1 µF. (Note 9)

$D_{IN}1$, $D_{IN}2$ (Pins 11, 10)

Driver input pins are TTL/CMOS compatible. Inputs of unused drivers may be left open, an internal active pull-up resistor (500 kΩ minimum, typically 1 MΩ) pulls input HIGH. Output will be LOW for input pins.

$D_{OUT}1$, $D_{OUT}2$ (Pins 14, 7)

Driver output pins conform to EIA/TIA-232-E levels.

$R_{IN}1$, $R_{IN}2$ (Pins 13, 8)

Receiver input pins accept EIA/TIA-232-E input voltages (±25V). Receivers feature guaranteed hysteresis of 200 mV. Unused receiver input pins may be left open. Internal input resistor (5 kΩ) pulls input LOW, providing a fail-safe HIGH output.

$R_{OUT}1$, $R_{OUT}2$ (Pins 12, 9)

Receiver output pins are TTL/CMOS compatible. Receiver output HIGH voltage is specified for both CMOS and TTL load conditions.

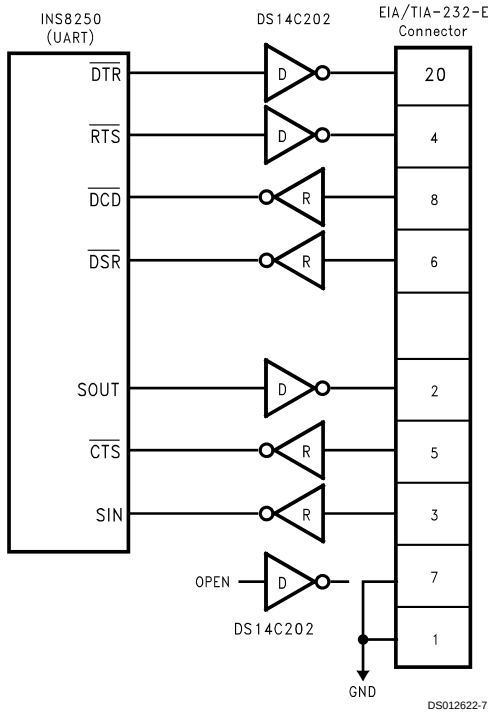
GND (Pin 15)

Ground Pin.

Note 9: All capacitor values have tolerances of less than ±20%.

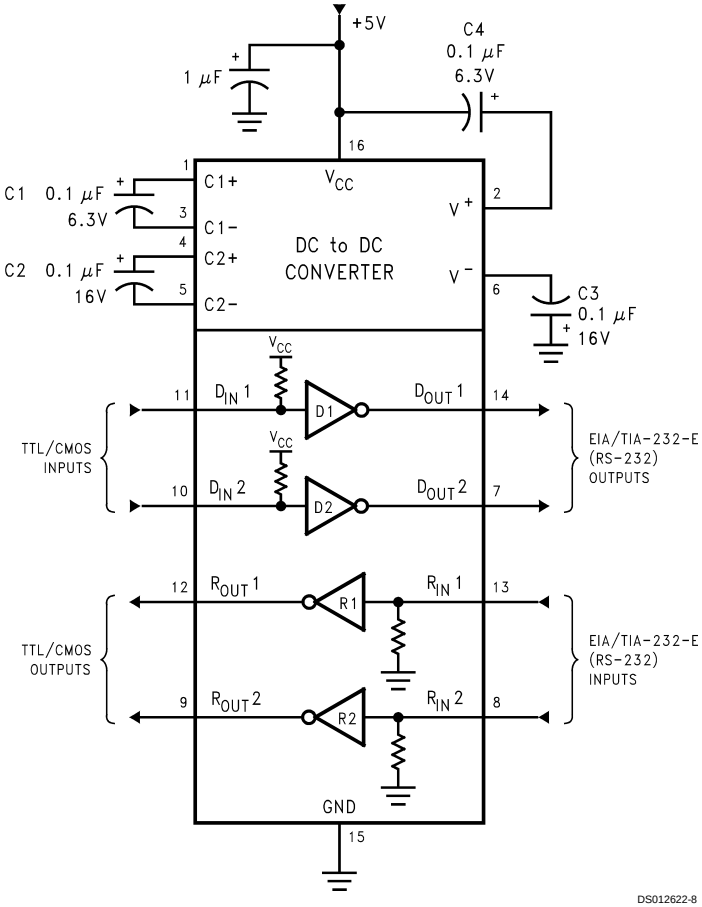
Typical Application Information

Application of DS14C202 and INS8250



Book
Extract
End

Typical Connection Diagram



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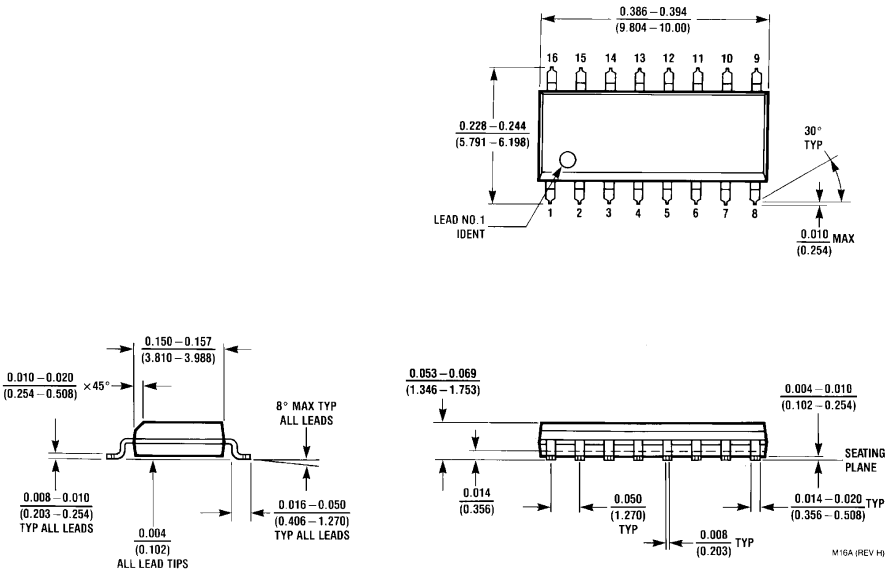
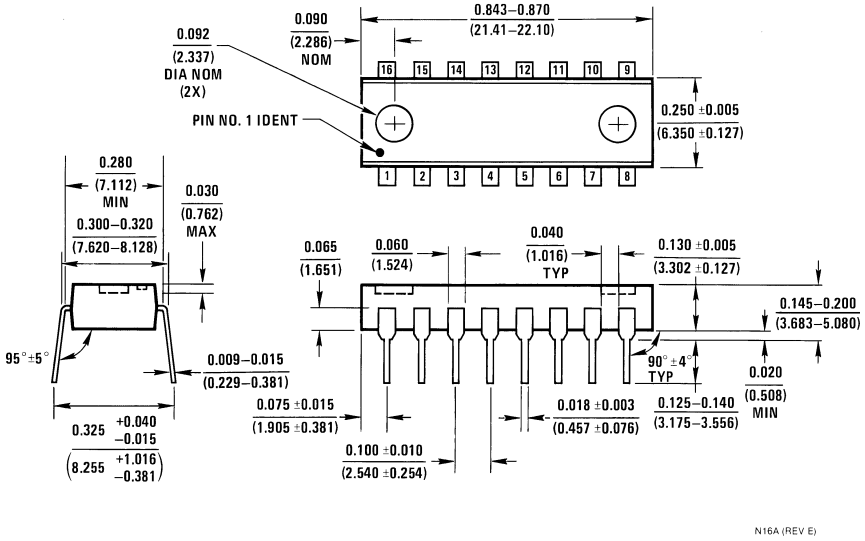
Physical Dimensions inches (millimeters) unless otherwise noted



Order Number DS14C202TM
NS Package Number M16A



Order Number DS14C202TN
NS Package Number N16A

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