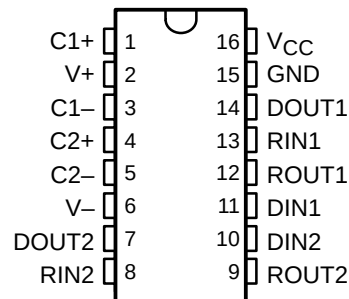


SN65C3232, SN75C3232 3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

SLLS540 – JULY 2002

- Operate With 3-V to 5.5-V V_{CC} Supply
- Operate up to 1 Mbit/s
- Low Supply Current . . . 300 μ A Typical
- External Capacitors . . . $4 \times 0.1 \mu$ F
- Accept 5-V Logic Input With 3.3-V Supply
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- RS-232 Bus-Pin ESD Protection Exceeds ± 15 kV Using Human-Body Model (HBM)
- Applications
 - Battery-Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment

D, DB, DW, OR PW PACKAGE
(TOP VIEW)



description/ordering information

The SN65C3232 and SN75C3232 consist of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV ESD protection pin to pin (serial-port connection pins, including GND). These devices provide the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The devices operate at data signaling rates up to 1 Mbit/s and a driver output slew rate of 24 V/ μ s to 150 V/ μ s.

ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – D	Tube	SN65C3232D	65C3232
		Tape and reel	SN65C3232DR	
	SOIC – DW	Tube	SN65C3232DW	65C3232
		Tape and reel	SN65C3232DWR	
	SSOP – DB	Tape and reel	SN65C3232DBR	65C3232
0°C to 70°C	SOIC – D	Tube	SN75C3232D	75C3232
		Tape and reel	SN75C3232DR	
	SOIC – DW	Tube	SN75C3232DW	75C3232
		Tape and reel	SN75C3232DWR	
	SSOP – DB	Tape and reel	SN75C3232DBR	CA3232
	TSSOP – PW	Tape and reel	SN75C3232PW	CA3232

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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SN65C3232, SN75C3232
3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

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Function Tables

EACH DRIVER

INPUT DIN	OUTPUT DOUT
L	H
H	L

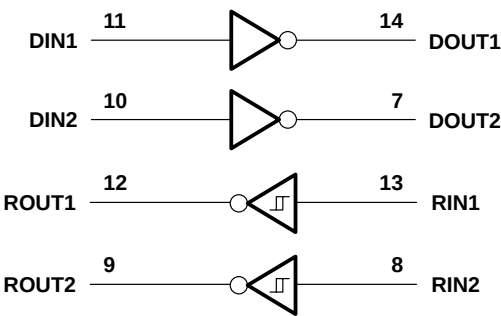
H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

H = high level, L = low level, Open = input disconnected or connected driver off

logic diagram (positive logic)



SN65C3232, SN75C3232

3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC} (see Note 1)	–0.3 V to 6 V
Positive output supply voltage range, $V+$ (see Note 1)	–0.3 V to 7 V
Negative output supply voltage range, $V-$ (see Note 1)	0.3 V to –7 V
Supply voltage difference, $V+ - V-$ (see Note 1)	13 V
Input voltage range, V_I : Drivers	–0.3 V to 6 V
Receivers	–25 V to 25 V
Output voltage range, V_O : Drivers	–13.2 V to 13.2 V
Receivers	–0.3 V to $V_{CC} + 0.3$ V
Package thermal impedance, θ_{JA} (see Note 2): D package	73°C/W
DB package	82°C/W
DW package	57°C/W
PW package	108°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	–65°C to 150°C

[†] 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 under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3 and Figure 4)

				MIN	NOM	MAX	UNIT
Supply voltage		$V_{CC} = 3.3$ V		3	3.3	3.6	V
		$V_{CC} = 5$ V		4.5	5	5.5	
V_{IH}	Driver high-level input voltage	DIN	$V_{CC} = 3.3$ V	2			V
			$V_{CC} = 5$ V	2.4			
V_{IL}	Driver low-level input voltage	DIN				0.8	V
V_I	Driver input voltage	DIN		0		5.5	V
	Receiver input voltage			–25		25	
T_A	Operating free-air temperature	SN65C3232		–40		85	°C
		SN75C3232		0		70	

NOTE 3: Test conditions are C1–C4 = 0.1 μ F at $V_{CC} = 3.3$ V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at $V_{CC} = 5$ V $\pm$ 0.5 V.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 4)

PARAMETER		TEST CONDITIONS	MIN	TYP [‡]	MAX	UNIT
I_{CC}	Supply current	No load, $V_{CC} = 3.3$ V or 5 V		0.3	1	mA

[‡] All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25^\circ$ C.

NOTE 3: Test conditions are C1–C4 = 0.1 μ F at $V_{CC} = 3.3$ V $\pm$ 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at $V_{CC} = 5$ V $\pm$ 0.5 V.



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DRIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 4)

PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
V _{OH} High-level output voltage	DOUT at R _L = 3 kΩ to GND, DIN = GND	5	5.4		V
V _{OL} Low-level output voltage	DOUT at R _L = 3 kΩ to GND, DIN = V _{CC}	–5	–5.4		V
I _{IH} High-level input current	V _I = V _{CC}		±0.01	±1	μA
I _{IL} Low-level input current	V _I at GND		±0.01	±1	μA
I _{OS} [‡] Short-circuit output current	V _{CC} = 3.6 V, V _O = 0 V		±35	±60	mA
	V _{CC} = 5.5 V, V _O = 0 V		±35	±90	
r _O Output resistance	V _{CC} , V+, and V– = 0 V, V _O = ±2 V	300	10M		Ω

[†] All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

[‡] Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 4)

PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
Maximum data rate (see Figure 1)	R _L = 3 kΩ, One DOUT switching	C _L = 1000 pF	250		kbit/s
		C _L = 250 pF, V _{CC} = 3 V to 4.5 V	1000		
		C _L = 1000 pF, V _{CC} = 4.5 V to 5.5 V	1000		
t _{sk(p)} Pulse skew [§]	C _L = 150 pF to 2500 pF	R _L = 3 kΩ to 7 kΩ, See Figure 2	300		ns
SR(tr) Slew rate, transition region (see Figure 1)	R _L = 3 kΩ to 7 kΩ, V _{CC} = 3.3 V	C _L = 150 pF to 1000 pF	24	150	V/μs

[†] All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

[§] Pulse skew is defined as |t_{pLH} – t_{pHL}| of each channel of the same device.

NOTE 3: Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.



RECEIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 4)

PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
V _{OH} High-level output voltage	I _{OH} = -1 mA	V _{CC} -0.6 V	V _{CC} -0.1 V		V
V _{OL} Low-level output voltage	I _{OL} = 1.6 mA			0.4	V
V _{IT+} Positive-going input threshold voltage	V _{CC} = 3.3 V		1.5	2.4	V
	V _{CC} = 5 V		1.8	2.4	
V _{IT-} Negative-going input threshold voltage	V _{CC} = 3.3 V	0.6	1.2		V
	V _{CC} = 5 V	0.8	1.5		
V _{hys} Input hysteresis (V _{IT+} - V _{IT-})			0.3		V
r _i Input resistance	V _I = ±3 V to ±25 V	3	5	7	kΩ

[†] All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

NOTE 3: Test conditions are C₁-C₄ = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C₁ = 0.047 μF, C₂-C₄ = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Figure 3)

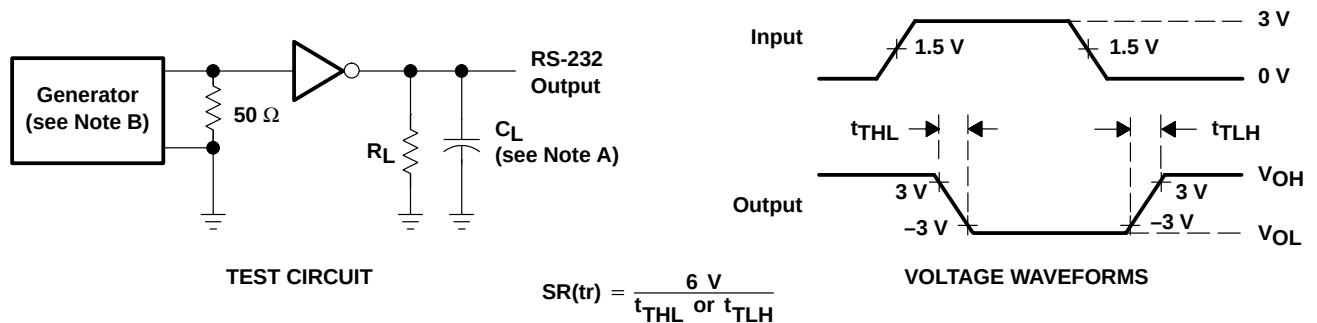
PARAMETER	TEST CONDITIONS	MIN	TYP [†]	MAX	UNIT
t _{pLH} Propagation delay time, low- to high-level output	C _L = 150 pF		300		ns
t _{pHL} Propagation delay time, high- to low-level output			300		ns
t _{sk(p)} Pulse skew [‡]			300		ns

[†] All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

[‡] Pulse skew is defined as |t_{pLH} - t_{pHL}| of each channel of the same device.

NOTE 3: Test conditions are C₁-C₄ = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C₁ = 0.047 μF, C₂-C₄ = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

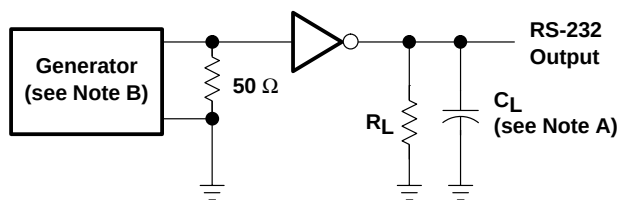
Figure 1. Driver Slew Rate

SN65C3232, SN75C3232

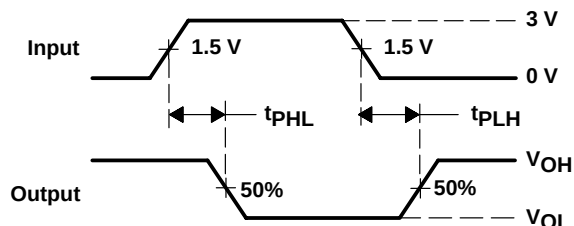
3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

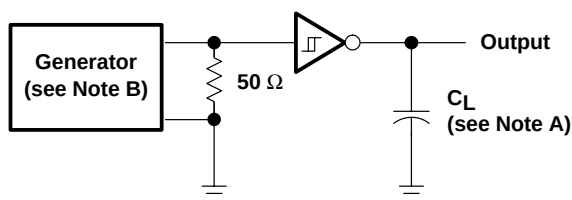


VOLTAGE WAVEFORMS

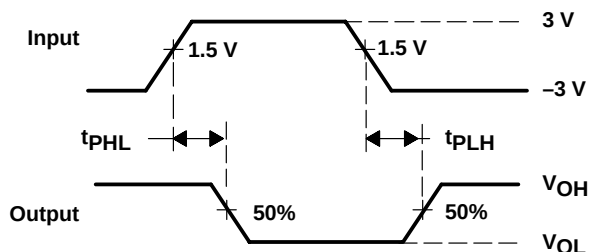
NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 2. Driver Pulse Skew



TEST CIRCUIT



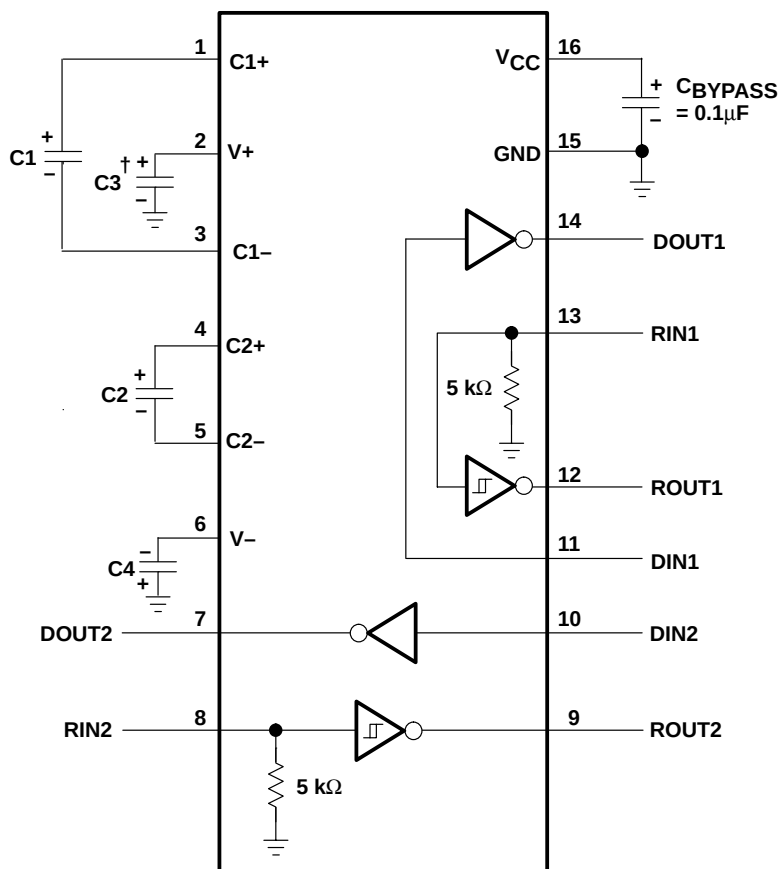
VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 3. Receiver Propagation Delay Times

APPLICATION INFORMATION



† C3 can be connected to V_{CC} or GND.

V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, C4
3.3 V ± 0.3 V	0.1 μF	0.1 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.1 μF	0.47 μF

Figure 4. Typical Operating Circuit and Capacitor Values

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