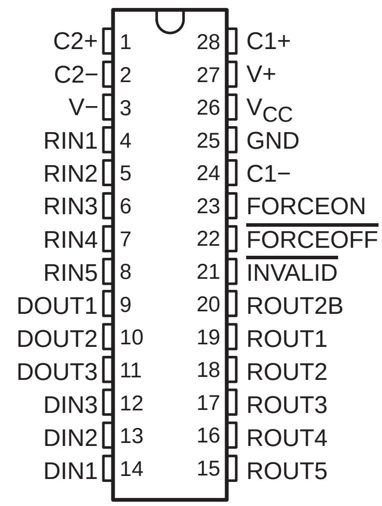
- **Single-Chip and Single-Supply Interface for IBM™ PC/AT™ Serial Port**
- **Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards**
- **Operates With 3-V to 5.5-V V_{CC} Supply**
- **Three Drivers and Five Receivers**
- **Operates Up To 250 kbit/s**
- **Designed to Transmit at a Data Rate of 250 kbit/s**
- **Low Standby Current . . . 1 μA Typical**
- **External Capacitors . . . 4 × 0.1 μF**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **Always-Active Noninverting Receiver Output (ROUT2B)**
- **Designed to Be Interchangeable With Maxim MAX3243**
- **Alternative High-Speed Pin-Compatible Device (1 Mbit/s)**
  - **SNx5C3243**
- **Serial-Mouse Driveability**
- **RS-232 Bus-Pin ESD Protection Exceeds ±15 kV Using Human-Body Model (HBM)**
- **Auto-Powerdown Feature to Disable Driver Outputs When No Valid RS-232 Signal Is Sensed**
- **Applications**
  - **Battery-Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment**

DB, DW, OR PW PACKAGE
(TOP VIEW)



description/ordering information

The MAX3243 consists of three line drivers, five line receivers, and a dual charge-pump circuit with ±15-kV ESD (HBM) protection pin to pin (serial-port connection pins, including GND). The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. This combination of drivers and receivers matches that needed for the typical serial port used in an IBM PC/AT, or compatible. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, the device includes an always-active noninverting output (ROUT2B), which allows applications using the ring indicator to transmit data while the device is powered down. The device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/μs driver output slew rate.

description/ordering information (continued)

Flexible control options for power management are available when the serial port is inactive. The auto-powerdown feature functions when FORCEON is low and $\overline{\text{FORCEOFF}}$ is high. During this mode of operation, if the device does not sense a valid RS-232 signal, the driver outputs are disabled. If $\overline{\text{FORCEOFF}}$ is set low, both drivers and receivers (except ROUT2B) are shut off, and the supply current is reduced to 1 µA. Disconnecting the serial port or turning off the peripheral drivers causes the auto-powerdown condition to occur.

Auto-powerdown can be disabled when FORCEON and $\overline{\text{FORCEOFF}}$ are high and should be done when driving a serial mouse. With auto-powerdown enabled, the device is activated automatically when a valid signal is applied to any receiver input. The $\overline{\text{INVALID}}$ output is used to notify the user if an RS-232 signal is present at any receiver input. $\overline{\text{INVALID}}$ is high (valid data) if any receiver input voltage is greater than 2.7 V or less than −2.7 V or has been between −0.3 V and 0.3 V for less than 30 µs. $\overline{\text{INVALID}}$ is low (invalid data) if all receiver input voltages are between −0.3 V and 0.3 V for more than 30 µs. Refer to Figure 5 for receiver input levels.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SOIC (DW)	Tube of 20	MAX3243CDW	MAX3243C
		Reel of 1000	MAX3243CDWR	
	SSOP (DB)	Reel of 2000	MAX3243CDBR	MAX3243C
	TSSOP (PW)	Tube of 50	MAX3243CPW	MA3243C
		Reel of 2000	MAX3243CPWR	
−40°C to 85°C	SOIC (DW)	Tube of 20	MAX3243IDW	MAX3243I
		Reel of 1000	MAX3243IDWR	
	SSOP (DB)	Reel of 2000	MAX3243IDBR	MAX3243I
	TSSOP (PW)	Tube of 50	MAX3243IPW	MB3243I
		Reel of 2000	MAX3243IPWR	

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

Function Tables

EACH DRIVER

INPUTS				OUTPUT DOUT	DRIVER STATUS
DIN	FORCEON	$\overline{\text{FORCEOFF}}$	VALID RIN RS-232 LEVEL		
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto-powerdown disabled
H	H	H	X	L	
L	L	H	Yes	H	Normal operation with auto-powerdown enabled
H	L	H	Yes	L	
L	L	H	No	Z	Powered off by auto-powerdown feature
H	L	H	No	Z	

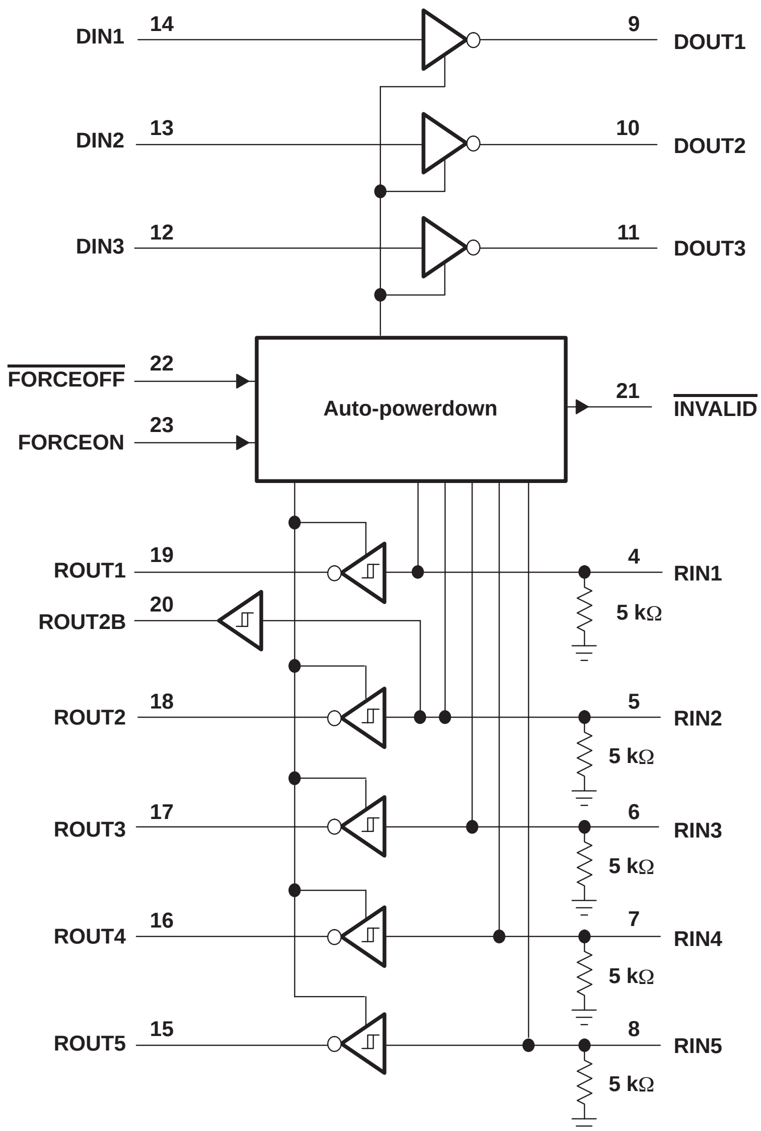
H = high level, L = low level, X = irrelevant, Z = high impedance

EACH RECEIVER

INPUTS				OUTPUTS		RECEIVER STATUS
RIN2	RIN1, RIN3−RIN5	$\overline{\text{FORCEOFF}}$	VALID RIN RS-232 LEVEL	ROUT2B	ROUT	
L	X	L	X	L	Z	Powered off while ROUT2B is active
H	X	L	X	H	Z	
L	L	H	Yes	L	H	Normal operation with auto-powerdown disabled/enabled
L	H	H	Yes	L	L	
H	L	H	Yes	H	H	
H	H	H	Yes	H	L	
Open	Open	H	No	L	H	

H = high level, L = low level, X = irrelevant, Z = high impedance (off), Open = input disconnected or connected driver off

logic diagram (positive logic)



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:	Driver ($\overline{\text{FORCEOFF}}$, FORCEON)	−0.3 V to 6 V
	Receiver	−25 V to 25 V
Output voltage range, V_O:	Driver	−13.2 V to 13.2 V
	Receiver ($\overline{\text{INVALID}}$)	−0.3 V to V_{CC} + 0.3 V
Package thermal impedance, θ_{JA} (see Notes 2 and 3):	DB package	62°C/W
	DW package	46°C/W
	PW package	62°C/W
Operating virtual junction temperature, T_J		150°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. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4 and Figure 6)

				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 and control high-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON	V_{CC} = 3.3 V	2			V
			V_{CC} = 5 V	2.4			
V_{IL}	Driver and control low-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON				0.8	V
V_I	Driver and control input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON		0		5.5	V
V_I	Receiver input voltage			−25		25	V
T_A	Operating free-air temperature		MAX3243C	0		70	°C
			MAX3243I	−40		85	

NOTE 4: 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.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

PARAMETER			TEST CONDITIONS		MIN	TYP‡	MAX	UNIT
I_I	Input leakage current	$\overline{\text{FORCEOFF}}$, FORCEON				±0.01	±1	µA
I_{CC}	Supply current	Auto-powerdown disabled	V_{CC} = 3.3 V or 5 V, T_A = 25°C	No load, $\overline{\text{FORCEOFF}}$ and FORCEON at V_{CC}		0.3	1	mA
		Powered off		No load, $\overline{\text{FORCEOFF}}$ at GND		1	10	µA
		Auto-powerdown enabled		No load, $\overline{\text{FORCEOFF}}$ at V_{CC}, FORCEON at GND, All RIN are open or grounded, All DIN are grounded		1	10	

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

NOTE 4: 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.

DRIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{OH}	High-level output voltage	All DOUT at R_L = 3 kΩ to GND			5	5.4		V
V_{OL}	Low-level output voltage	All DOUT at R_L = 3 kΩ to GND			−5	−5.4		V
V_O	Output voltage (mouse driveability)	DIN1 = DIN2 = GND, DIN3 = V_{CC}, 3-kΩ to GND at DOUT3, DOUT1 = DOUT2 = 2.5 mA			±5			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					
r_o	Output resistance	V_{CC}, V+, and V− = 0 V,	V_O = ±2 V		300	10M		Ω
I_{off}	Output leakage current	$\overline{\text{FORCEOFF}}$ = GND,	V_O = ±12 V,	V_{CC} = 0 to 5.5 V			±25	μA

† 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 4: 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 4 and Figure 6)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
	Maximum data rate	C_L = 1000 pF, One DOUT switching,	R_L = 3 kΩ, See Figure 1	150	250		kbit/s
$t_{sk(p)}$	Pulse skew§	C_L = 150 pF to 2500 pF	R_L = 3 kΩ to 7 kΩ, See Figure 2		100		ns
SR(tr)	Slew rate, transition region (see Figure 1)	V_{CC} = 3.3 V, R_L = 3 kΩ to 7 kΩ	C_L = 150 pF to 1000 pF	6		30	V/μs
			C_L = 150 pF to 2500 pF	4		30	

† 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 4: 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 4 and Figure 6)

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		1.6	2.4	V
		V_{CC} = 5 V		1.9	2.4	
V_{IT-}	Negative-going input threshold voltage	V_{CC} = 3.3 V	0.6	1.1		V
		V_{CC} = 5 V	0.8	1.4		
V_{hys}	Input hysteresis (V_{IT+} − V_{IT-})			0.5		V
I_{off}	Output leakage current (except ROUT2B)	$\overline{FORCEOFF}$ = 0 V		±0.05	±10	μA
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 4: 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 4)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	C_L = 150 pF, See Figure 3		150		ns
t_{PHL}	Propagation delay time, high- to low-level output			150		ns
t_{en}	Output enable time	C_L = 150 pF, R_L = 3 kΩ, See Figure 4		200		ns
t_{dis}	Output disable time			200		ns
$t_{sk(p)}$	Pulse skew‡	See Figure 3		50		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 4: 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.

AUTO-POWERDOWN SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 5)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{T+(valid)}$	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_{CC}			2.7	V
$V_{T-(valid)}$	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_{CC}	−2.7			V
$V_{T(invalid)}$	Receiver input threshold for $\overline{\text{INVALID}}$ low-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_{CC}	−0.3		0.3	V
V_{OH}	$\overline{\text{INVALID}}$ high-level output voltage	I_{OH} = −1 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_{CC}	V_{CC}−0.6			V
V_{OL}	$\overline{\text{INVALID}}$ low-level output voltage	I_{OL} = 1.6 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_{CC}			0.4	V

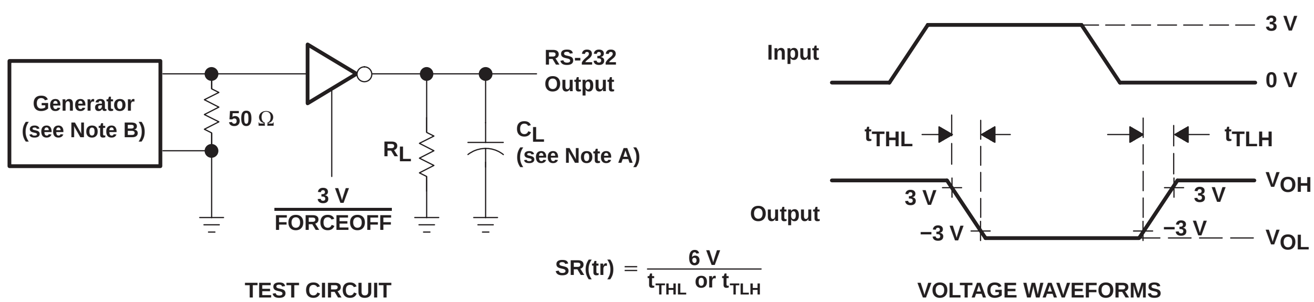
† All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 5)

PARAMETER		MIN	TYP†	MAX	UNIT
t_{valid}	Propagation delay time, low- to high-level output		1		µs
$t_{invalid}$	Propagation delay time, high- to low-level output		30		µs
t_{en}	Supply enable time		100		µs

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

PARAMETER MEASUREMENT INFORMATION

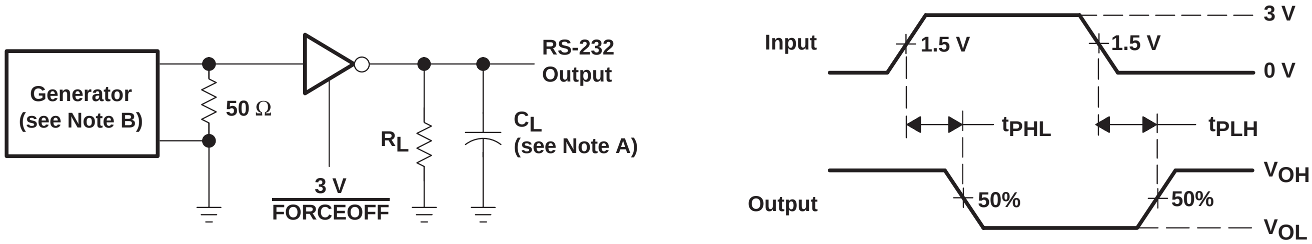


NOTES: A. C_L includes probe and jig capacitance.

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

Figure 1. Driver Slew Rate

PARAMETER MEASUREMENT INFORMATION

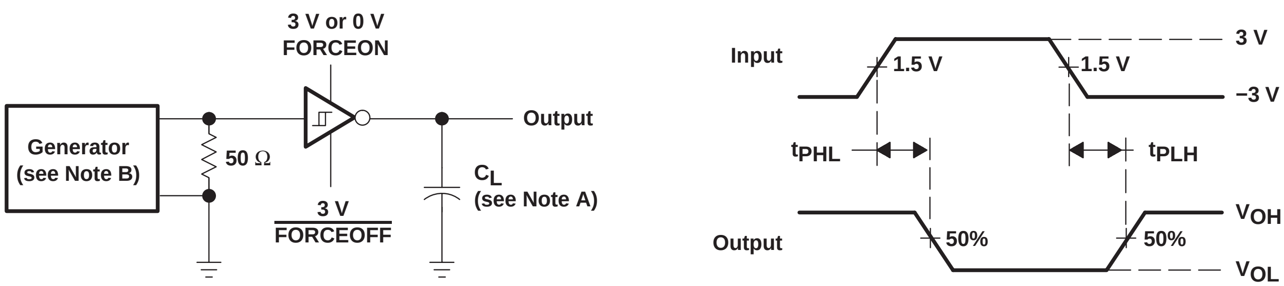


TEST CIRCUIT

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 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.

Figure 2. Driver Pulse Skew

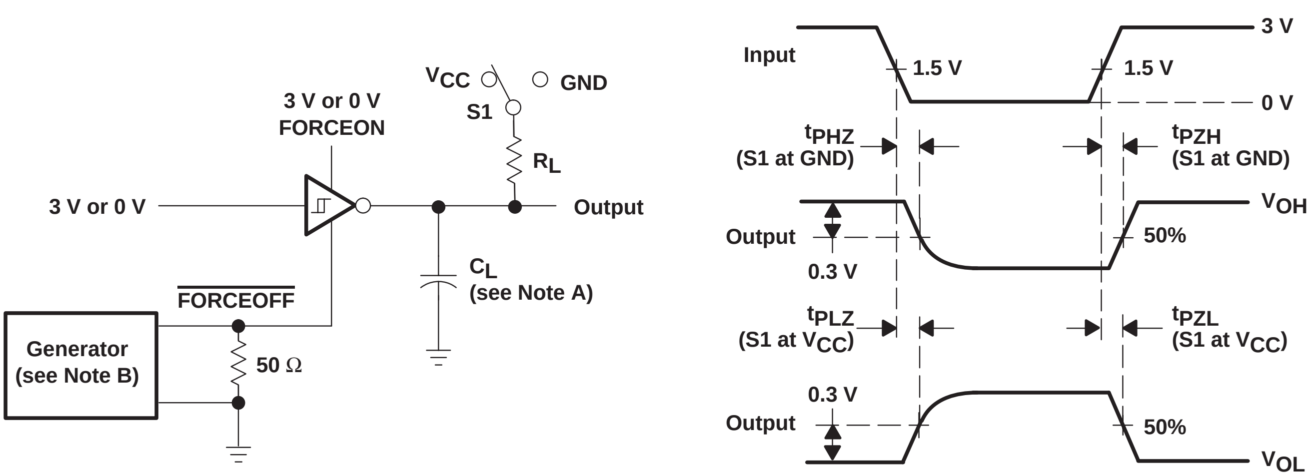


TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z_O = 50 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.

Figure 3. Receiver Propagation Delay Times



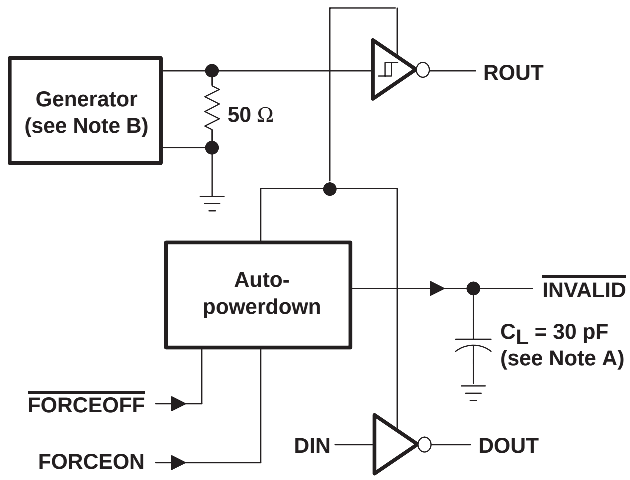
TEST CIRCUIT

VOLTAGE WAVEFORMS

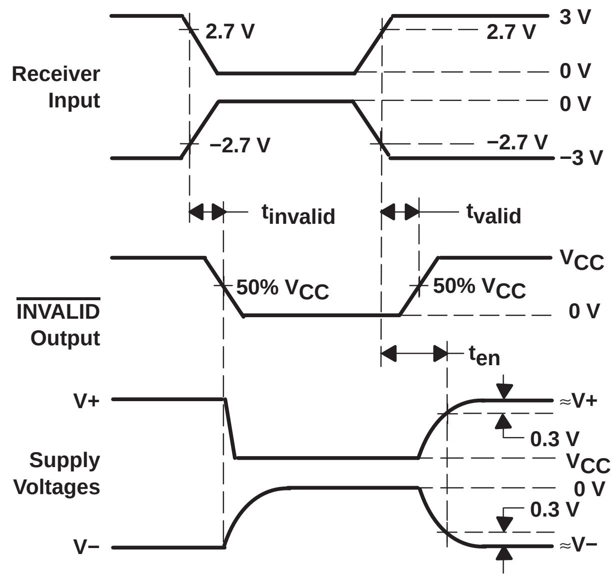
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z_O = 50 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.
C. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
D. t_{PZL} and t_{PZH} are the same as t_{en}.

Figure 4. Receiver Enable and Disable Times

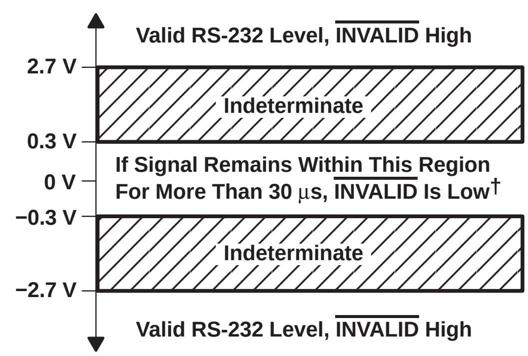
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

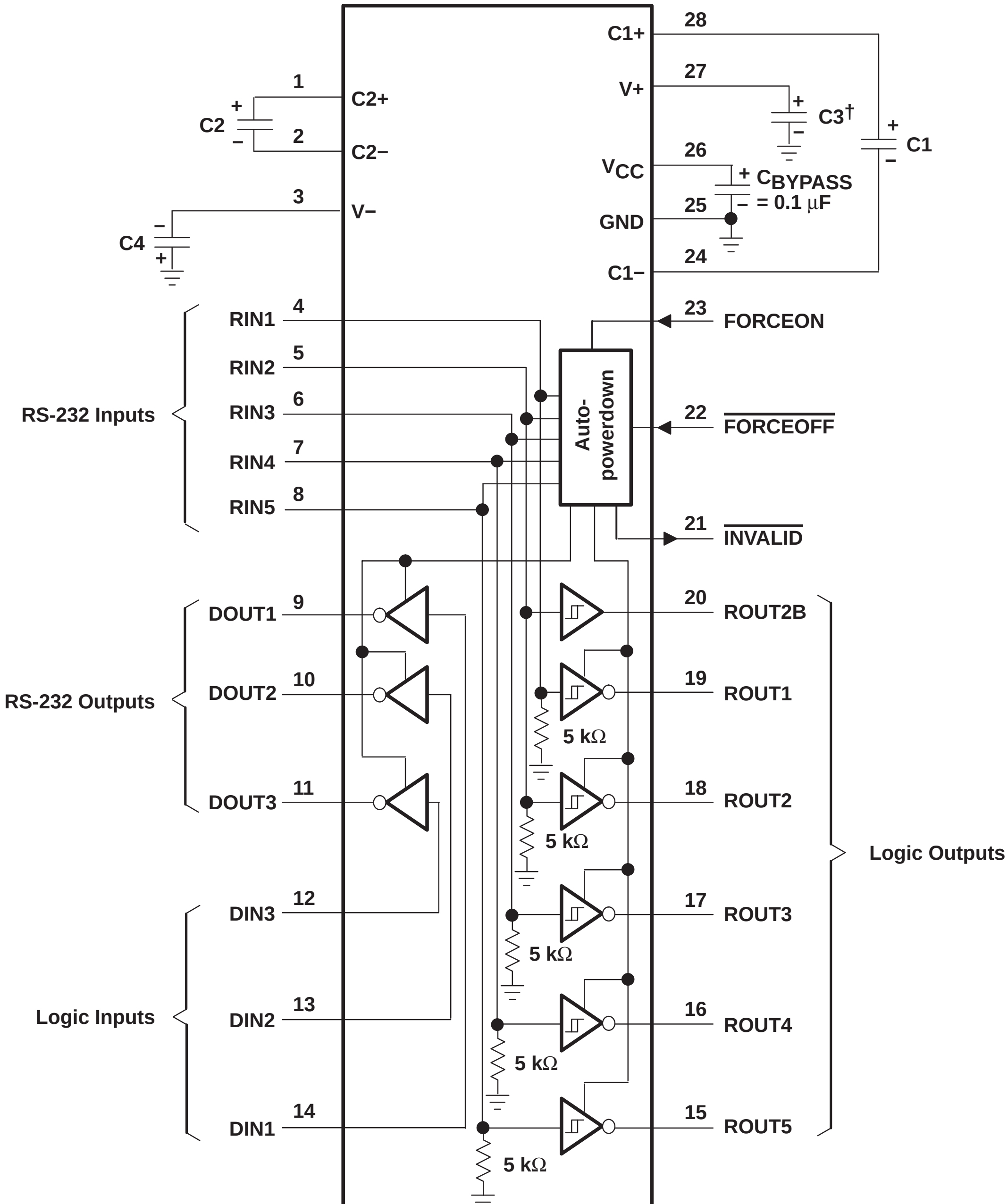


† Auto-powerdown disables drivers and reduces supply current to 1 µA.

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 5 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \leq$ 10 ns, $t_f \leq$ 10 ns.

Figure 5. INVALID Propagation Delay Times and Supply Enabling Time

APPLICATION INFORMATION



† C3 can be connected to V_{CC} or GND.
NOTE A: Resistor values shown are nominal.

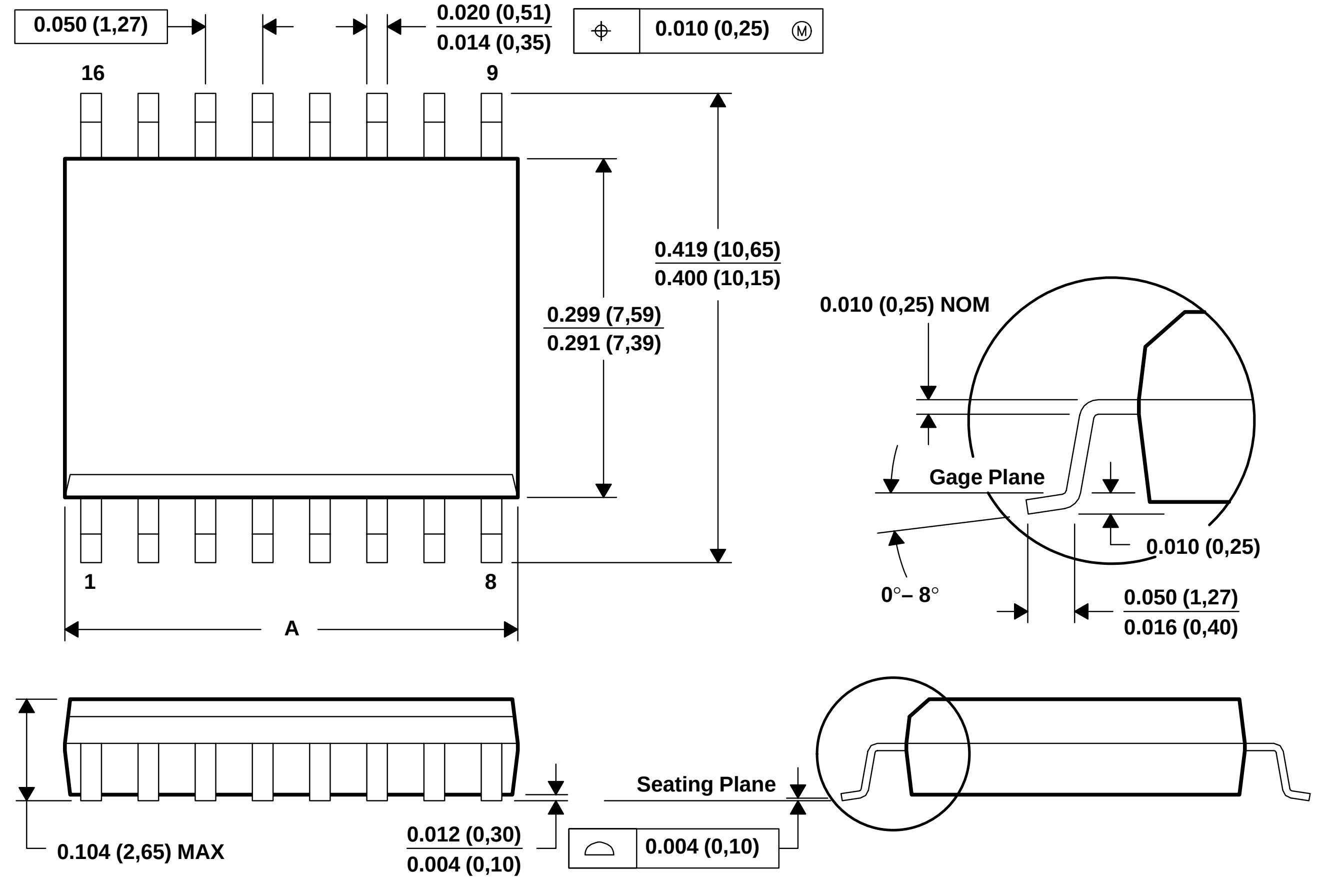
V_{CC} vs CAPACITOR VALUES

V_{CC}	C1	C2, C3, and 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 6. Typical Operating Circuit and Capacitor Values

DW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

16 PINS SHOWN



PINS ** / DIM	16	18	20	24	28
A MAX	0.410 (10,41)	0.462 (11,73)	0.510 (12,95)	0.610 (15,49)	0.710 (18,03)
A MIN	0.400 (10,16)	0.453 (11,51)	0.500 (12,70)	0.600 (15,24)	0.700 (17,78)

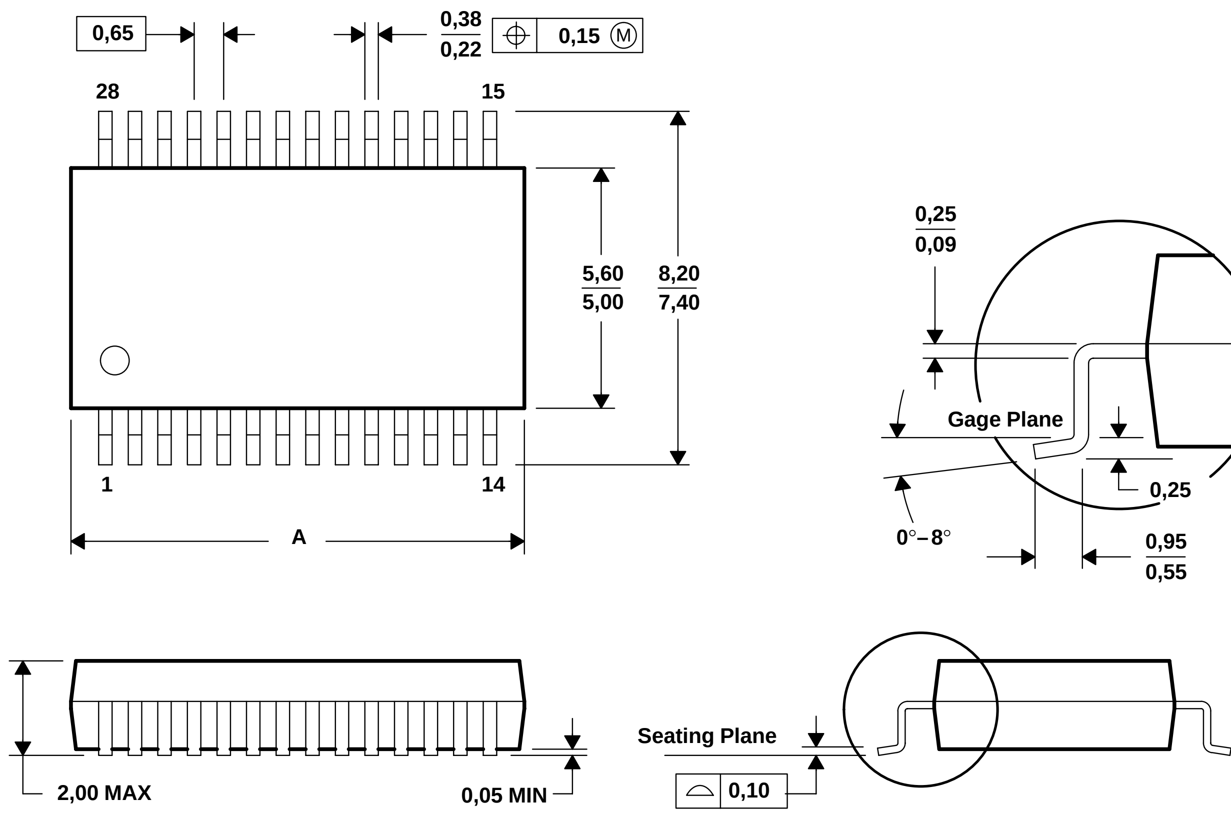
4040000/E 08/01

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN



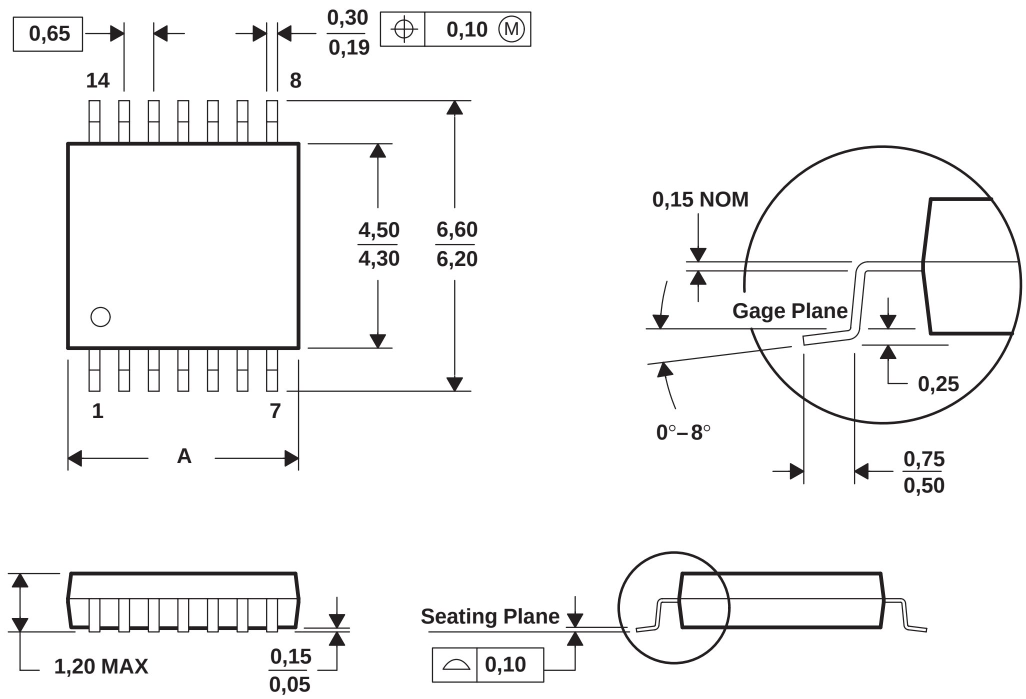
PINS ** / DIM	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-150

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



PINS ** / DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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