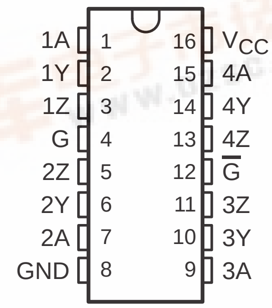
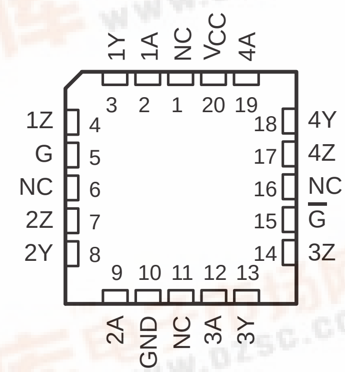
- **Meet or Exceed the Requirements of TIA/EIA-422-B and ITU Recommendation V.11**
- **Low Power, I_{CC} = 100 μA Typ**
- **Operate From a Single 5-V Supply**
- **High Speed, t_{PLH} = t_{PHL} = 7 ns Typ**
- **Low Pulse Distortion, $t_{sk(p)}$ = 0.5 ns Typ**
- **High Output Impedance in Power-Off Conditions**
- **Improved Replacement for AM26LS31**

AM26C31C, AM26C31I . . . D, DB†, OR N PACKAGE
AM26C31M . . . J OR W PACKAGE
(TOP VIEW)



† The DB package is only available left-ended taped (order AM26C31IDBLE or AM26C31CDBLE).

AM26C31M . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

The AM26C31C, AM26C31I, and AM26C31M are four complementary-output line drivers designed to meet the requirements of TIA/EIA-422-B and ITU (formerly CCITT). The 3-state outputs have high-current capability for driving balanced lines, such as twisted-pair or parallel-wire transmission lines, and they provide the high-impedance state in the power-off condition. The enable function is common to all four drivers and offers the choice of an active-high or active-low enable input. BiCMOS circuitry reduces power consumption without sacrificing speed.

The AM26C31C is characterized for operation from 0°C to 70°C, the AM26C31I is characterized for operation from –40°C to 85°C, and the AM26C31M is characterized for operation from –55°C to 125°C.

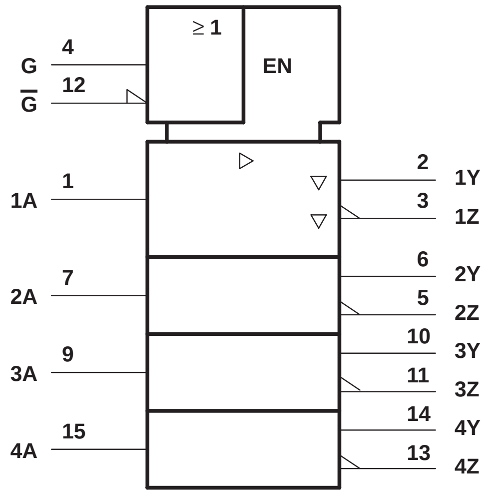
FUNCTION TABLE
(each driver)

INPUT	ENABLES		OUTPUTS	
A	G	$\overline{G}$	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

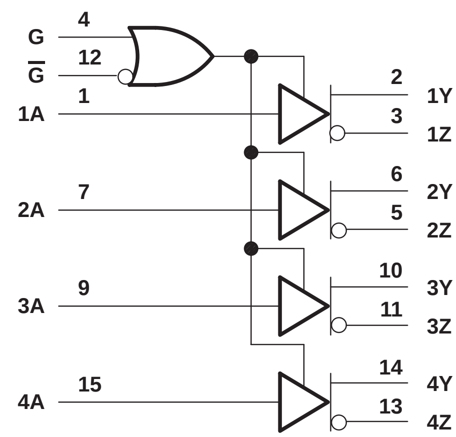
H = high level, L = low level, X = irrelevant, Z = high impedance (off)

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

logic symbol†



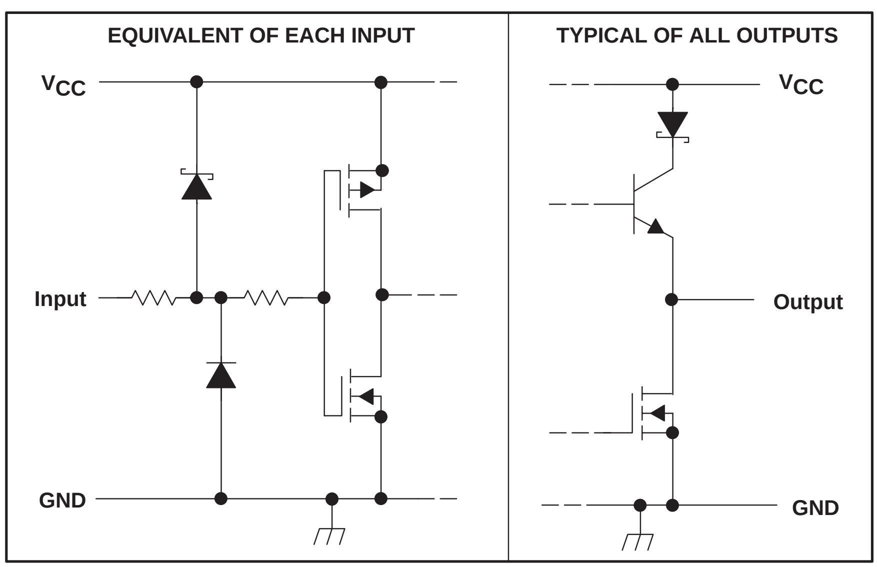
logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

The terminal numbers shown are for the D, DB, J, N, and W packages.

schematics of inputs and outputs



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

Supply voltage range, V_{CC} (see Note 1) . . . . –0.5 V to 7 V
Input voltage range, V_I . . . . –0.5 V to V_{CC} + 0.5 V
Differential input voltage range, V_{ID} . . . . –14 V to 14 V
Output voltage range, V_O . . . . –0.5 V to 7 V
Input or output clamp current, I_{IK} or I_{OK} . . . . ±20 mA
Output current, I_O . . . . ±150 mA
V_{CC} current . . . . 200 mA
GND current . . . . –200 mA
Continuous total power dissipation . . . . See Dissipation Rating Table
Storage temperature range, T_{stg} . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°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.

NOTE 1: All voltage values, except differential output voltage (V_{OD}), are with respect to the network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW	—
DB	781 mW	6.2 mW/°C	502 mW	409 mW	—
N	1150 mW	9.2 mW/°C	736 mW	598 mW	—
FK	1375 mW	11 mW/°C	—	—	275 mW
J	1375 mW	11 mW/°C	—	—	275 mW
W	1000 mW	8.0 mW/°C	—	—	200 mW

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.5	5	5.5	V
Differential input voltage, V_{ID}			±7		V
High-level input voltage, V_{IH}		2			V
Low-level input voltage, V_{IL}				0.8	V
High-level output current, I_{OH}				–20	mA
Low-level output current, I_{OL}				20	mA
Operating free-air temperature, T_A	AM26C31C	0		70	°C
	AM26C31I	–40		85	
	AM26C31M	–55		125	

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

PARAMETER		TEST CONDITIONS		AM26C31C AM26C31I			UNIT
				MIN	TYP†	MAX	
V_{OH}	High-level output voltage	$I_O = -20$ mA		2.4	3.4		V
V_{OL}	Low-level output voltage	$I_O = 20$ mA			0.2	0.4	V
$\|V_{OD}\|$	Differential output voltage magnitude	$R_L = 100\ \Omega$,	See Figure 1	2	3.1		V
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage‡					±0.4	V
V_{OC}	Common-mode output voltage					3	V
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage‡					±0.4	V
I_I	Input current	$V_I = V_{CC}$ or GND				±1	µA
$I_{O(off)}$	Driver output current with power off	$V_{CC} = 0$,	$V_O = 6$ V			100	µA
		$V_{CC} = 0$,	$V_O = -0.25$ V			–100	
I_{OS}	Driver output short-circuit current	$V_O = 0$		–30		–150	mA
I_{OZ}	High-impedance off-state output current	$V_O = 2.5$ V				20	µA
		$V_O = 0.5$ V				–20	µA
I_{CC}	Quiescent supply current	$I_O = 0$,	$V_I = 0$ V or 5 V			100	µA
		$I_O = 0$, See Note 2	$V_I = 2.4$ V or 0.5 V,		1.5	3	mA
C_i	Input capacitance				6		pF

† All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.
‡ $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.
NOTE 2: This parameter is measured per input. All other inputs are at 0 or 5 V.

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

PARAMETER		TEST CONDITIONS		AM26C31C AM26C31I			UNIT
				MIN	TYP†	MAX	
t_{PLH}	Propagation delay time, low- to high-level output	S1 is open,	See Figure 2	3	7	12	ns
t_{PHL}	Propagation delay time, high- to low-level output			3	7	12	ns
$t_{sk(p)}$	Pulse skew time ($\|t_{PLH} - t_{PHL}\|$)				0.5	4	ns
$t_{r(OD)}$, $t_{f(OD)}$	Differential output rise and fall times	S1 is open,	See Figure 3		5	10	ns
t_{PZH}	Output enable time to high level	S1 is closed,	See Figure 4		10	19	ns
t_{PZL}	Output enable time to low level				10	19	ns
t_{PHZ}	Output disable time from high level				7	16	ns
t_{PLZ}	Output disable time from low level				7	16	ns
C_{pd}	Power dissipation capacitance (each driver) (see Note 3)	S1 is open,	See Figure 2		170		pF

† All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.
NOTE 3: C_{pd} is used to estimate the switching losses according to $P_D = C_{pd} \times V_{CC}^2 \times f$, where f is the switching frequency.

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

PARAMETER		TEST CONDITIONS			AM26C31M			UNIT
					MIN	TYP†	MAX	
V_{OH}	High-level output voltage	$I_O = -20$ mA			2.2	3.4		V
V_{OL}	Low-level output voltage	$I_O = 20$ mA				0.2	0.4	V
$\|V_{OD}\|$	Differential output voltage magnitude	$R_L = 100\ \Omega$,	See Figure 1		2	3.1		V
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage‡						±0.4	V
V_{OC}	Common-mode output voltage						3	V
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage‡						±0.4	V
I_I	Input current	$V_I = V_{CC}$ or GND					±1	μA
$I_{O(off)}$	Driver output current with power off	$V_{CC} = 0$,	$V_O = 6$ V				100	μA
		$V_{CC} = 0$,	$V_O = -0.25$ V				–100	
I_{OS}	Driver output short-circuit current	$V_O = 0$					–170	mA
I_{OZ}	High-impedance off-state output current	$V_O = 2.5$ V					20	μA
		$V_O = 0.5$ V					–20	μA
I_{CC}	Quiescent supply current	$I_O = 0$,	$V_I = 0$ V or 5 V				100	μA
		$I_O = 0$,	$V_I = 2.4$ V or 0.5 V,	See Note 2			3.2	mA
C_i	Input capacitance					6		pF

† All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.
‡ $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.
NOTE 2: This parameter is measured per input. All other inputs are at 0 V or 5 V.

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

PARAMETER		TEST CONDITIONS		AM26C31M			UNIT
				MIN	TYP†	MAX	
t_{PLH}	Propagation delay time, low- to high-level output	S1 is open,	See Figure 2		7	12	ns
t_{PHL}	Propagation delay time, high- to low-level output				6.5	12	ns
$t_{sk(p)}$	Pulse skew time ($\|t_{PLH} - t_{PHL}\|$)				0.5	4	ns
$t_{r(OD)}$, $t_{f(OD)}$	Differential output rise and fall times	S1 is open,	See Figure 3		5	12	ns
t_{PZH}	Output enable time to high level	S1 is closed,	See Figure 4		10	19	ns
t_{PZL}	Output enable time to low level				10	19	ns
t_{PHZ}	Output disable time from high level				7	16	ns
t_{PLZ}	Output disable time from low level				7	16	ns
C_{pd}	Power dissipation capacitance (each driver) (see Note 3)	S1 is open,	See Figure 2		100		pF

† All typical values are at $V_{CC} = 5$ V and $T_A = 25°C$.
NOTE 3: C_{pd} is used to estimate the switching losses according to $P_D = C_{pd} \times V_{CC}^2 \times f$, where f is the switching frequency.

PARAMETER MEASUREMENT INFORMATION

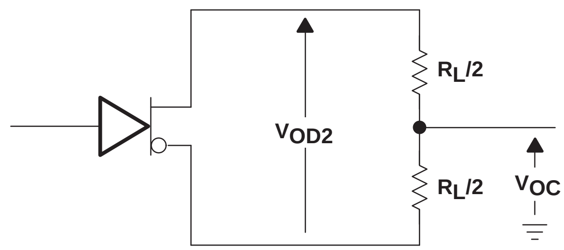
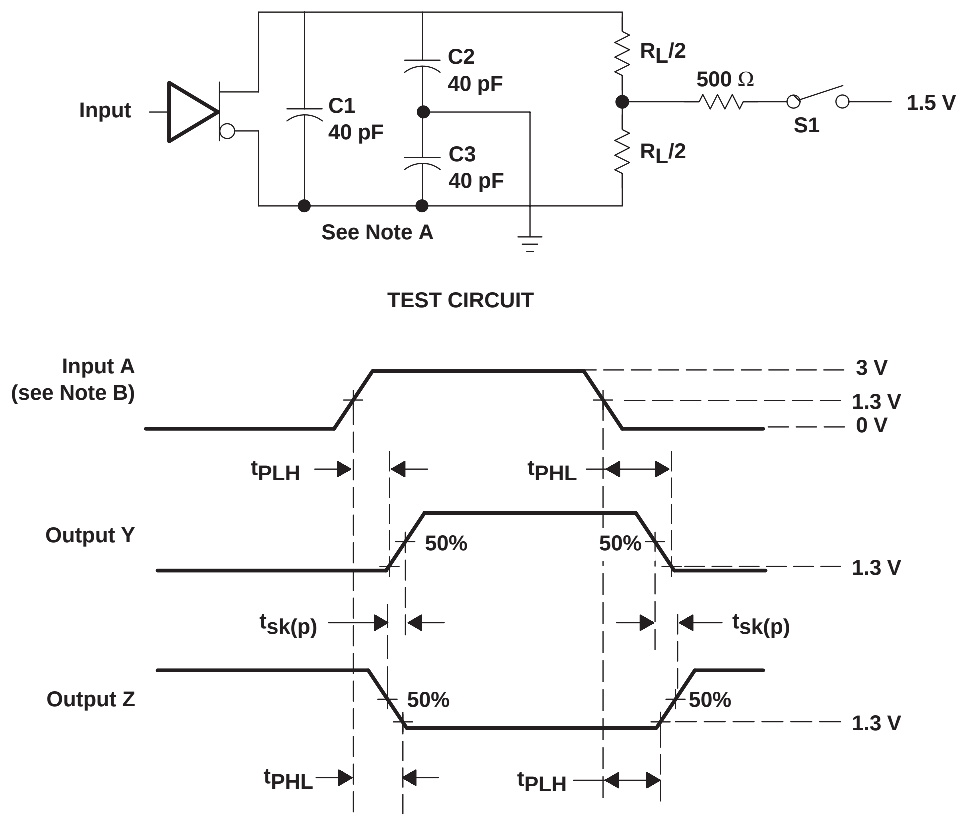


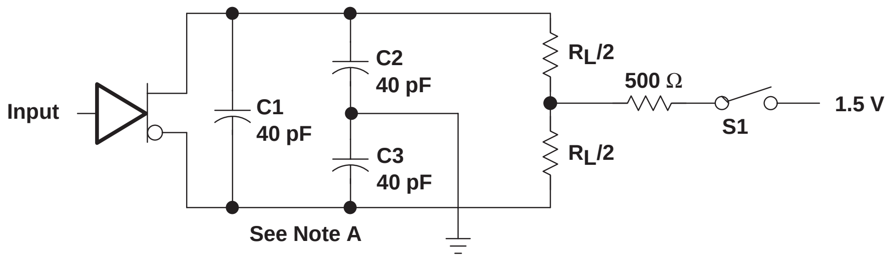
Figure 1. Differential and Common-Mode Output Voltages



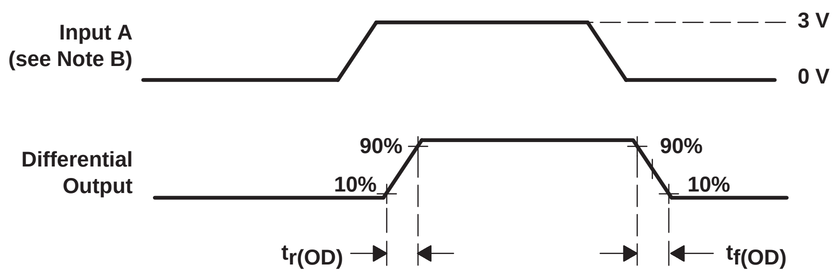
NOTES: A. C1, C2, and C3 include probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, and t_r t_f ≤ 6 ns.

Figure 2. Propagation Delay Time and Skew Waveforms and Test Circuit

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

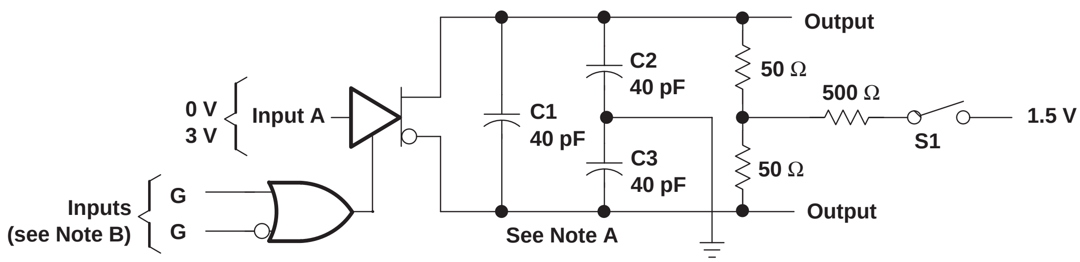


VOLTAGE WAVEFORMS

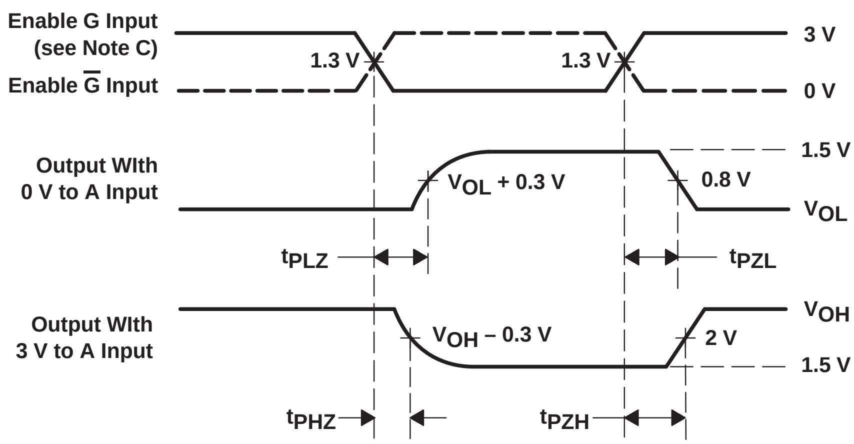
NOTES: A. C1, C2, and C3 include probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, and t_r, t_f ≤ 6 ns.

Figure 3. Differential Output Rise and Fall Time Waveforms and Test Circuit

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. C1, C2, and C3 includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, t_r < 6 ns, and t_f < 6 ns.
C. Each enable is tested separately.

Figure 4. Output Enable and Disable Time Waveforms and Test Circuit

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
vs
SWITCHING FREQUENCY

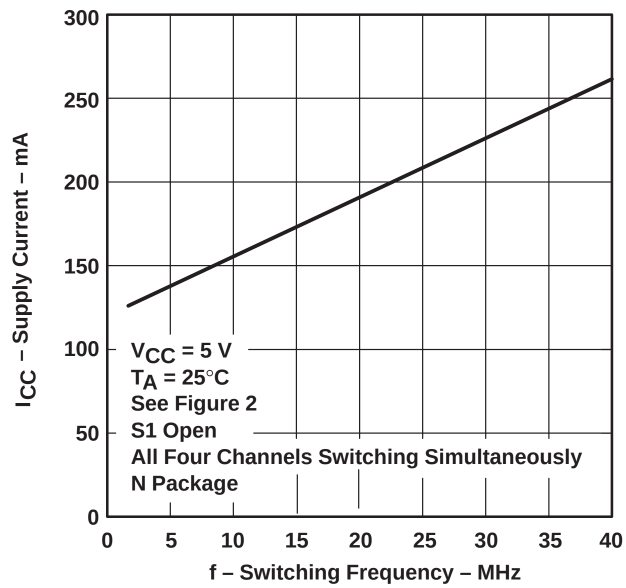


Figure 5

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