GENERAL DESCRIPTION

The **SP26LV431** is a quad differential line driver that meets the specifications of the EIA standard RS-422 serial protocol. The **SP26LV431** features Exar's BiCMOS process allowing low power operational characteristics of CMOS technology while meeting all of the demands of the RS-422 serial protocol over 60Mbps under load. The RS-422 protocol allows up to 10 receivers to be connected to a multipoint bus transmission line. The **SP26LV431** features a driver enable control common to all four drivers that places the output pins in a high impedance state. Since the cabling can be as long as 4,000 feet, the RS-422 drivers of the **SP26LV431** are equipped with a wide common-mode output voltage range to accommodate ground potential differences.

FEATURES

- Quad Differential Line Drivers
- Compatible with the EIA standard for RS-422 serial protocol
- High-Z Output Control
- At Least 60Mbps Transmission Rates
- 11ns Typical Driver Propagation Delays
- Less than 1ns Typical Output Skew
- Single +3.3V Supply Operation
- Common Driver Enable Control
- Compatibility with the industry standard 26LV31
- Ideal For Use with SP26LV432, Quad Receivers

FIGURE 1. TYPICAL APPLICATION CIRCUIT

ENABLE	$\overline{\text{ENABLE}}$	INPUT	Non-Inverting A Output	Inverting B Output
LOW	HIGH	don't care	High - Z	High - Z
HIGH	don't care	LOW	LOW	HIGH
don't care	LOW	HIGH	HIGH	LOW

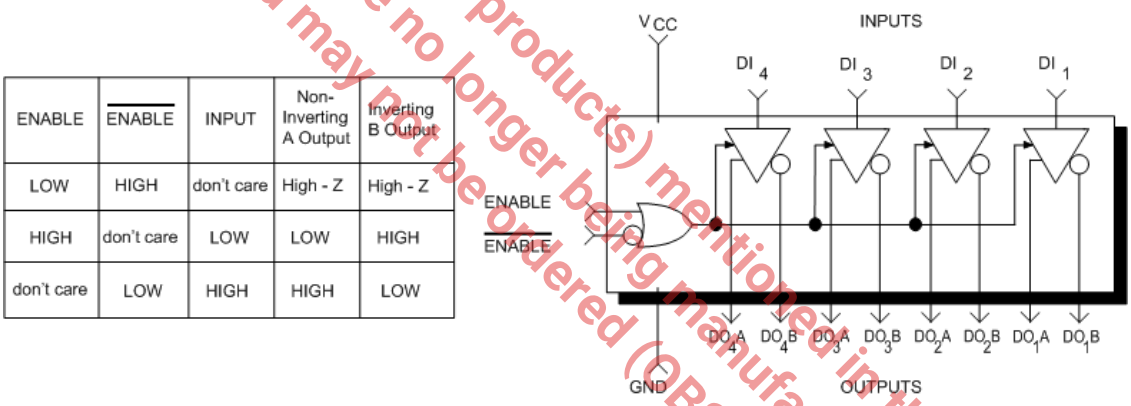
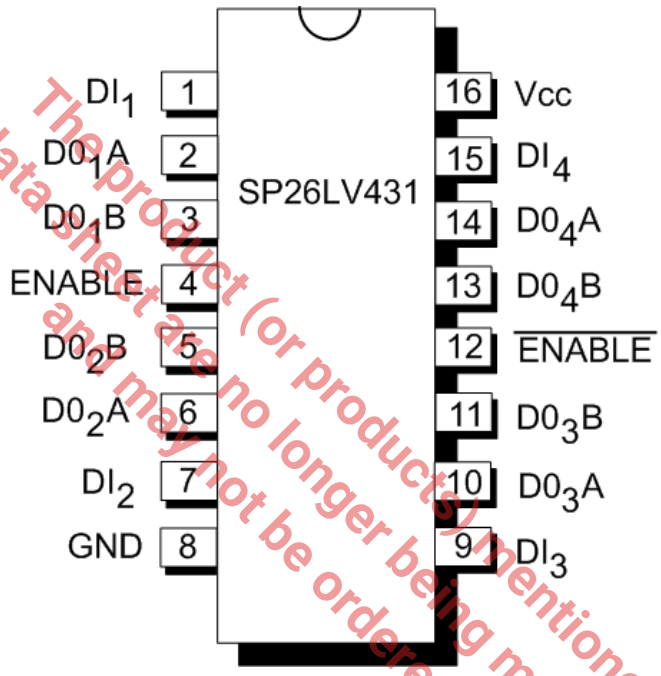


FIGURE 2. PIN OUT ASSIGNMENT



ORDERING INFORMATION

PART NUMBER	PACKAGE	OPERATING TEMPERATURE RANGE	DEVICE STATUS
SP26LV431CN-L	16-pin Narrow SOIC	0°C to +70°C	Active
SP26LV431CN-L/TR	16-pin Narrow SOIC	0°C to +70°C	Active
SP26LV431EN-L	16-pin Narrow SOIC	-40°C to +85°C	Active
SP26LV431EN-L/TR	16-pin Narrow SOIC	-40°C to +85°C	Active

PIN DESCRIPTIONS

Pin Assignments

PIN NUMBER	PIN NAME	TYPE	DESCRIPTION
1	DI_1	I	Driver 1 TTL input.
2	DO_1A	O	Non-inverted driver 1 output.
3	DO_1B	O	Inverted driver 1 output.
4	ENABLE	I	Driver output enable, active HIGH.
5	DO_2B	O	Inverted driver 2 output.
6	DO_2A	O	Non-inverted driver 2 output.
7	DI_2	I	Driver 2 TTL input.
8	GND	Pwr	Ground.
9	DI_3	I	Driver 3 TTL input.
10	DO_3A	O	Non-inverted driver 3 output.
11	DO_3B	O	Inverted driver 3 output.
12	$\overline{\text{ENABLE}}$	I	Driver output enable, active LOW.
13	DO_4B	O	Inverted driver 4 output.
14	DO_4A	O	Non-inverted driver 4 output.
15	DI_4	I	Driver 4 TTL input.
16	V_{CC}	Pwr	+3.0V to +3.6V power supply.

Pin type: I=Input, O=Output.

ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections to the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the device.

V_{CC}	0.5V to 7.0V
V_{IN} (DC Input Voltage)	-1.5V to (V_{CC} + 1.5V)
V_{OUT} (DC Output Voltage)	-0.5V to 7V
I_{IK}, I_{OK} (Clamp Diode Current)	±20mA
I_{OUT} (DC Output Current, per pin)	±150mA
I_{CC} (DC V_{CC} or GND Current, per pin)	±150mA
Storage Temperature Range	-65°C to + 150°C
Power Dissipation 16-pin PDIP (derate 14.3mW/°C above +70°C)	1150mW
Power Dissipation 16-pin NSOIC (derate 13.6mW/°C above +70°C)	1100mW

CAUTION:

ESD (Electrostatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

ELECTRICAL CHARACTERISTICS

UNLESS OTHERWISE NOTED: THE FOLLOWING SPECIFICATIONS APPLY FOR VCC = +3.0V TO +3.6V WITH TA = +25°C AND ALL MIN AND MAX LIMITS APPLY ACROSS THE RECOMMENDED OPERATING TEMPERATURE RANGE.

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
V_{CC}	Supply Voltage	3.0		3.6	V	
V_{IN} or V_{OUT}	DC Input or Output Voltage			VCC	V	
Input Electrical Characteristics						
t_r or t_f	Input Rise or Fall Times		3		ns	
V_{IH}	HIGH Level Input Voltage	2.0			V	
V_{IL}	LOW Level Input Voltage			0.8	V	
Output Electrical Characteristics						
V_{OH}	HIGH Level Output Voltage	2.5	2.9		V	V_{IN} = V_{IH} or V_{IL}, I_{OUT} = -20mA
V_{OL}	LOW Level Output Voltage		0.2	0.5	V	V_{IN} = V_{IH} or V_{IL}, I_{OUT} = 20mA
V_T	Differential Output Voltage	2.0	2.7		V	R_L = 100Ω, Note 1
$\lvert V_T \rvert - \lvert \overline{V_T} \rvert$	Differential Output Voltage			0.4	V	R_L = 100Ω, Note 1
V_{OS}	Common Mode Output Voltage			3.0	V	R_L = 100Ω, Note 1
$\lvert V_{OS} - \overline{V_{OS}} \rvert$	Difference in Common Mode Output			0.4	V	R_L = 100Ω, Note 1
I_{CC}	Quiescent Supply Current			100	uA	V_{IN} = V_{CC} or GND, Note 2

UNLESS OTHERWISE NOTED: THE FOLLOWING SPECIFICATIONS APPLY FOR VCC = +3.0V TO +3.6V WITH TA = +25°C AND ALL MIN AND MAX LIMITS APPLY ACROSS THE RECOMMENDED OPERATING TEMPERATURE RANGE.

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
I_{OZ}	Tri-state Output Leakage Current		±2.0		uA	V_{OUT} = V_{CC} or GND, ENABLE = V_{IL}, $\overline{ENABLE}$ = V_{IH}
I_{SC}	Output Short Circuit Current	-30		-150	mA	V_{IN} = V_{CC} or GND, Notes 1 & 3
I_{OFF}	Output Leakage Current Power Off			100	uA	V_{CC} = 0V, V_{OUT} = 6V, Note 1
I_{OFF}	Output Leakage Current Power Off			-100	uA	V_{CC} = 0V, V_{OUT} = -0.25V, Note 1
Switching Characteristics						
t_{PLHD}, t_{PHLD}	Propagation Delays		11	18	ns	**Figure 5**
t_{SKEW}	Skew, SP26LV431C_		0.8	2	ns	**Figure 5**, Note 4,
t_{SKEW}	Skew, SP26LV431E_			3	ns	**Figure 5**, Note 4
t_{TLH}, t_{THL}	Differential Output Rise/Fall Times		4	10	ns	**Figure 5**
t_{PZH}	Output Enable Time			40	ns	**Figure 7**
t_{PZL}	Output Enable Time			40	ns	**Figure 7**
t_{PHZ}	Output Disable Time			35	ns	**Figure 7**, Note 5
t_{PLZ}	Output Disable Time			35	ns	**Figure 7**, Note 5
C_{PD}	Power Dissipation Capacitance		50		pF	Note 6
C_{IN}	Input Capacitance		6		pF	

NOTE:

1. *Refer to EIA specifications for RS-422 serial protocol for exact test conditions.*
2. *Measured per input. All other inputs at V_{CC} or GND.*
3. *This is the current sourced when a high output is shorted to GND. Only one output at a time should be shorted.*
4. *Skew is defined as the difference in propagation delays between complementary outputs at the 50% input.*
5. *Output disable time is the delay from ENABLE or $\overline{ENABLE}$ being switched to the output transistors turning off. The actual disable times are less than indicated due to the delay added by the RC time constant of the load.*
6. *C_{PD} determines the no load dynamic power consumption, $P_D = (C_{PD}V_{CC}^2f) + (I_{CC}V_{CC})$, and the no load dynamic power consumption, $I_S = (C_{PD}V_{CC}f) + I_{CC}$.*

FIGURE 3. SP431 BLOCK DIAGRAM

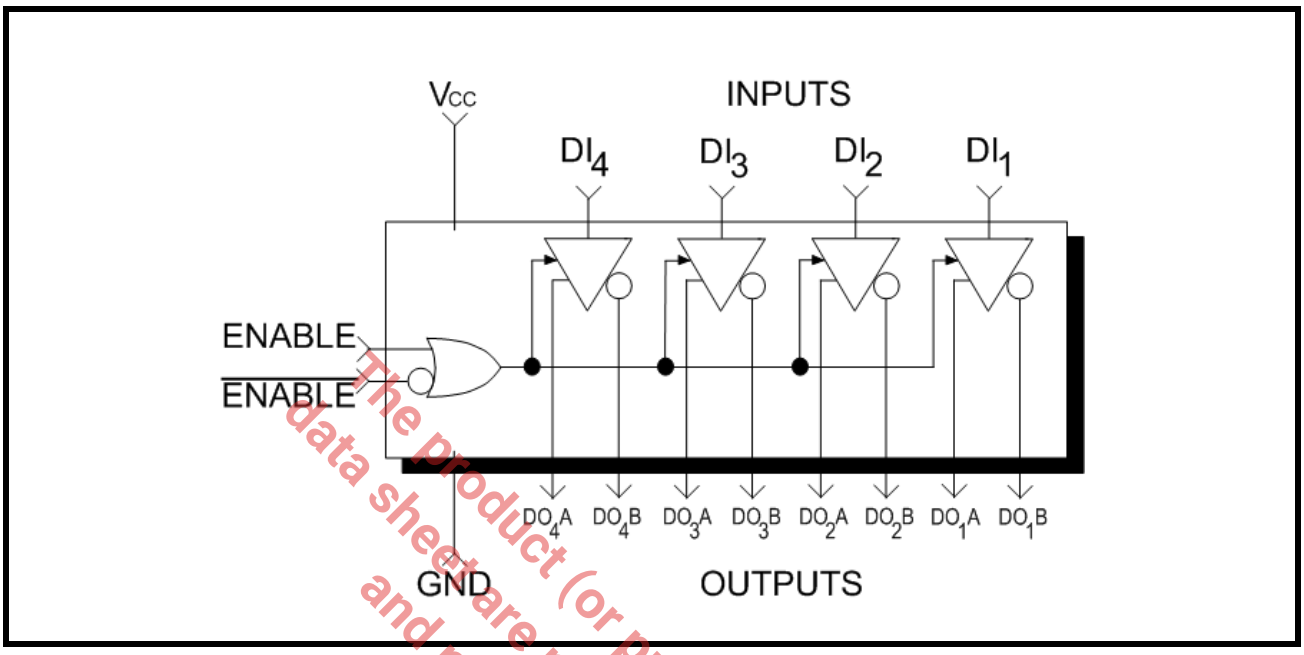


FIGURE 4. AC TEST CIRCUIT

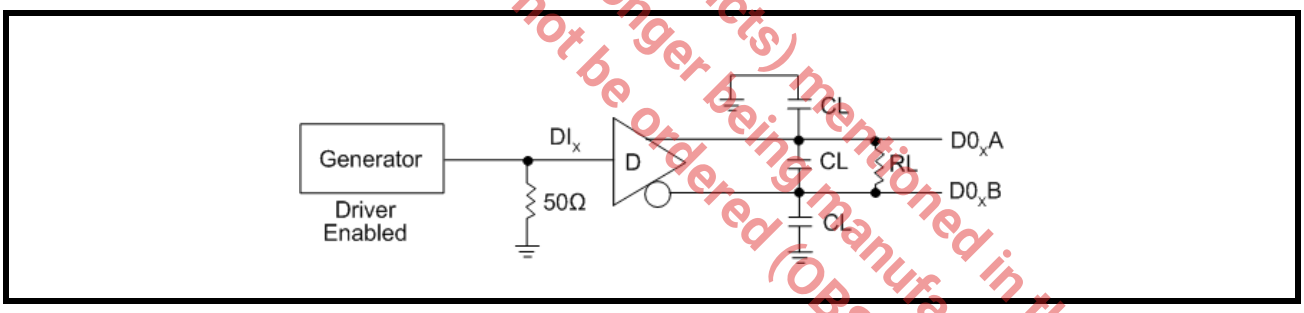


FIGURE 5. PROPAGATION DELAYS

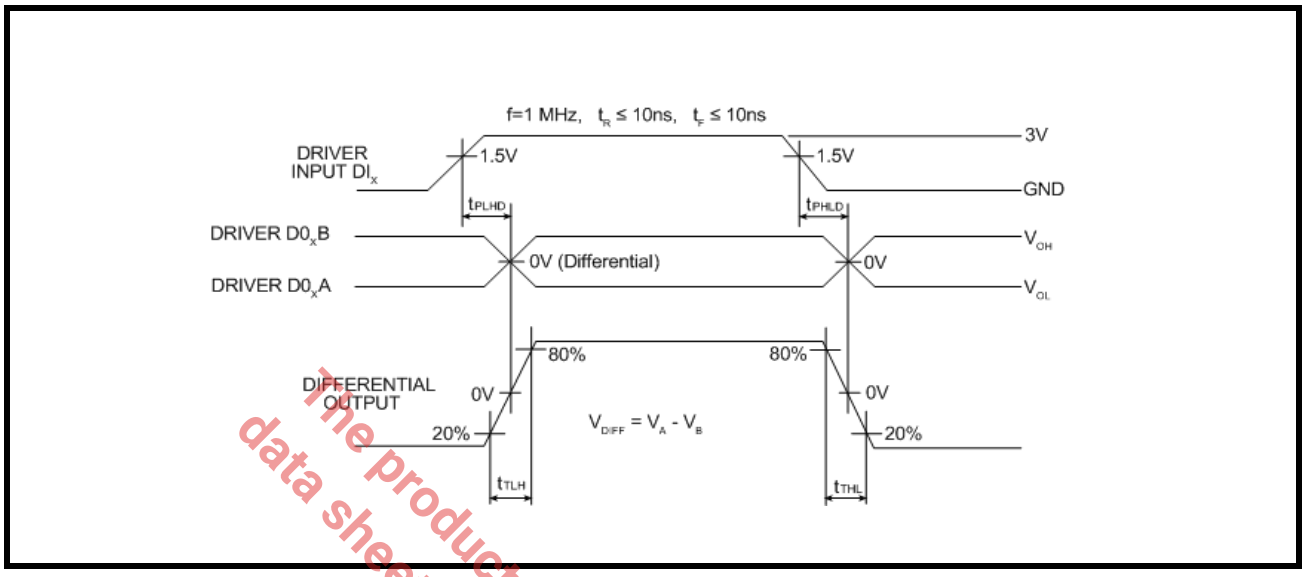


FIGURE 6. DRIVER SINGLE-ENDED TRI-STATE TEST CIRCUIT

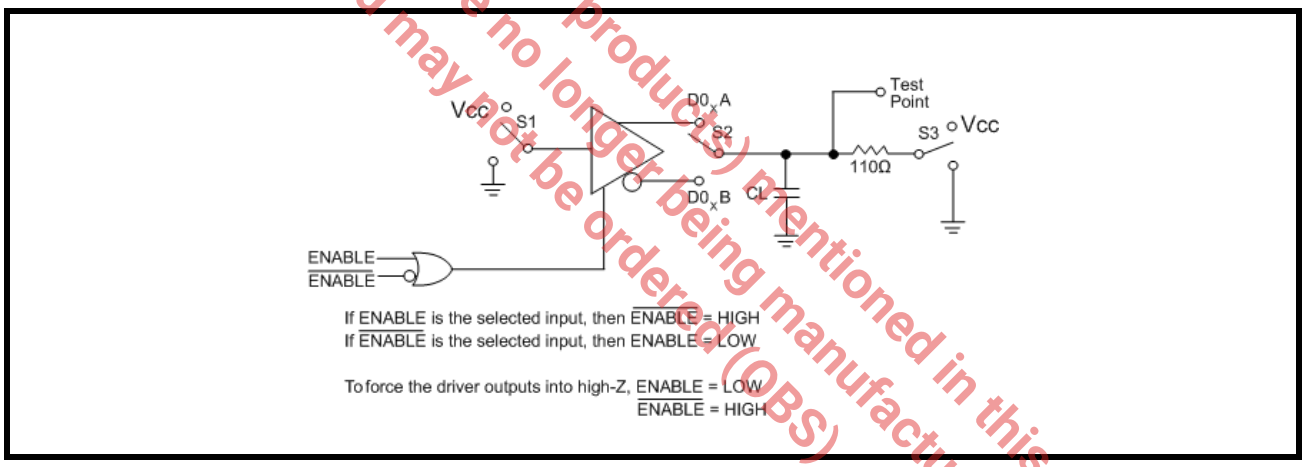


FIGURE 7. DRIVER SINGLE-ENDED TRI-STATE WAVEFORMS

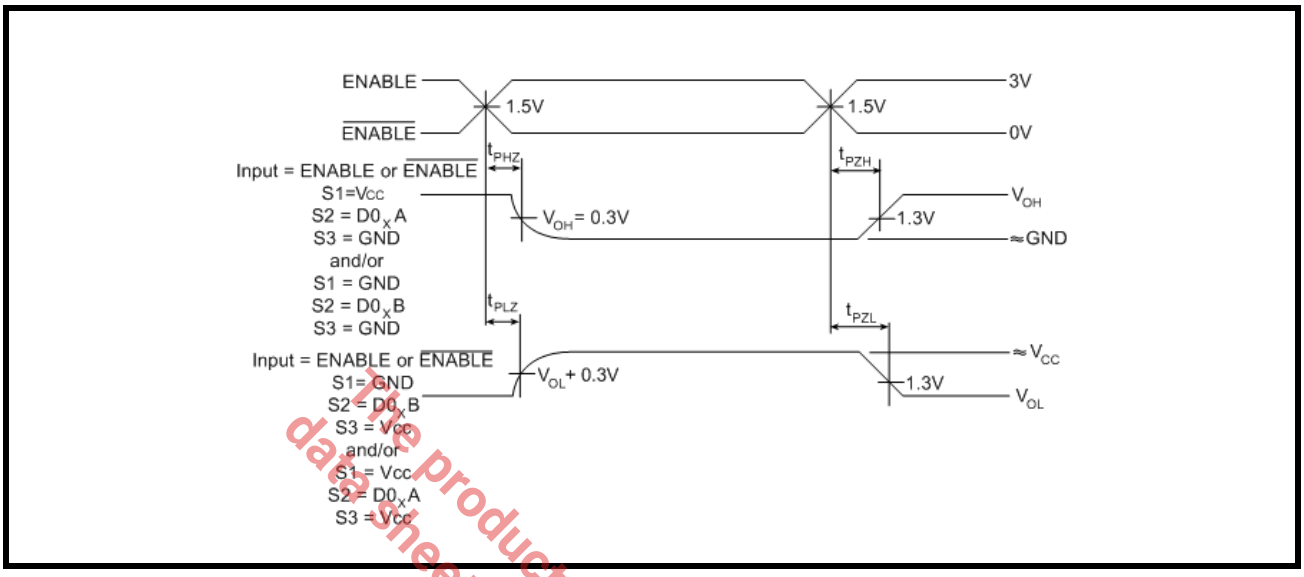
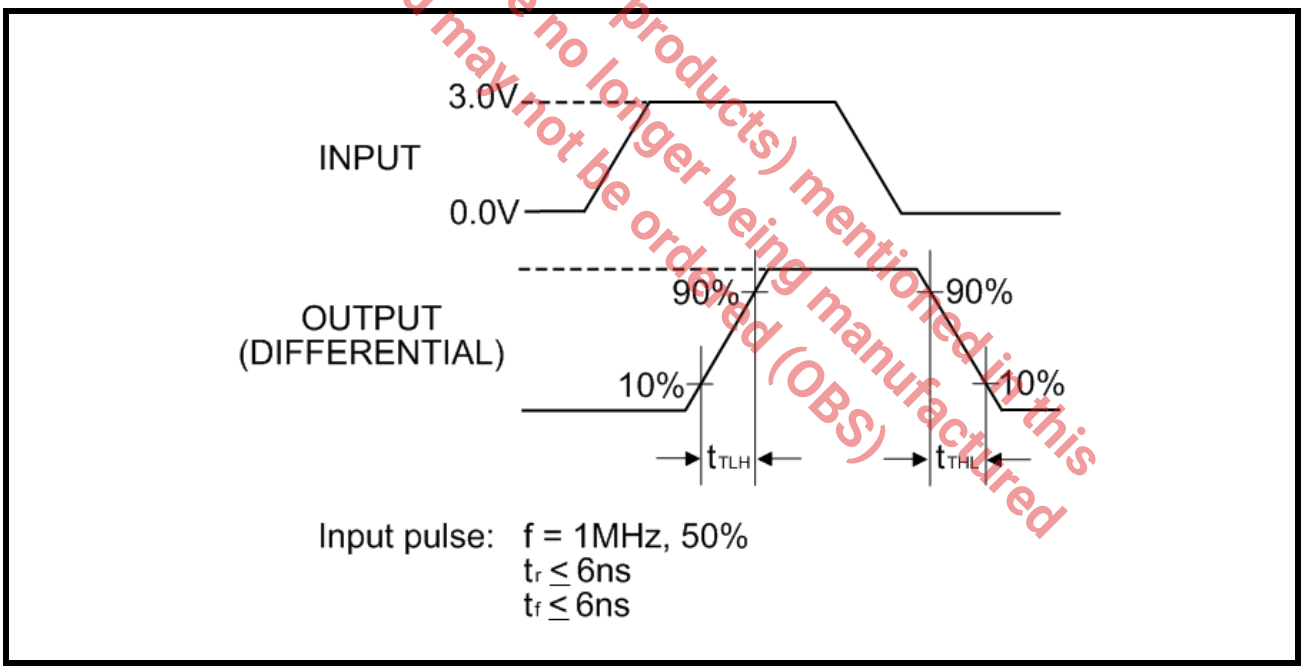


FIGURE 8. DIFFERENTIAL RISE AND FALL TIMES



1.0 PRODUCT DESCRIPTION

The **SP26LV431** is a low-power quad differential line driver designed for digital data transmission meeting the specifications of the EIA standard RS-422 serial protocol. The **SP26LV431** features Exar's BiCMOS process allowing low power operational characteristics of CMOS technology while meeting all of the demands of the RS-422 serial protocol up to 60Mbps under load in harsh environments.

The RS-422 standard is ideal for multi-drop applications and for long-distance communication. The RS-422 protocol allows up to 10 receivers to be connected to a data bus, making it an ideal choice for multi-drop applications. Since the cabling can be as long as 4,000 feet, RS-422 drivers are equipped with a wide common mode output range to accommodate ground potential differences. Because the RS-422 is a differential interface, data is virtually immune to noise in the transmission line.

The **SP26LV431** accepts TTL or CMOS input levels and translates these to RS-422 output levels. The **SP26LV431** features active HIGH and active LOW driver enable controls common to all four driver channels see Table 1. A logic HIGH on the ENABLE pin (pin 4) or a logic LOW on the $\overline{\text{ENABLE}}$ pin (pin 12) will enable the differential driver outputs. A logic LOW on the ENABLE pin (pin 4) and a logic HIGH on the $\overline{\text{ENABLE}}$ pin (pin 12) will force the driver outputs into high impedance (high-Z). Refer to the truth table in Table 1.

All drivers are internally protected against short circuits on their outputs. The driver outputs are short-circuit limited to 150mA. The driver output skew times are typically 0.8ns. To minimize reflections, the multipoint bus transmission line should be terminated at both ends in its characteristic impedance, and stub lengths off the main line should be kept as short as possible.

FIGURE 9. TWO-WIRE BALANCED SYSTEM, RS-422

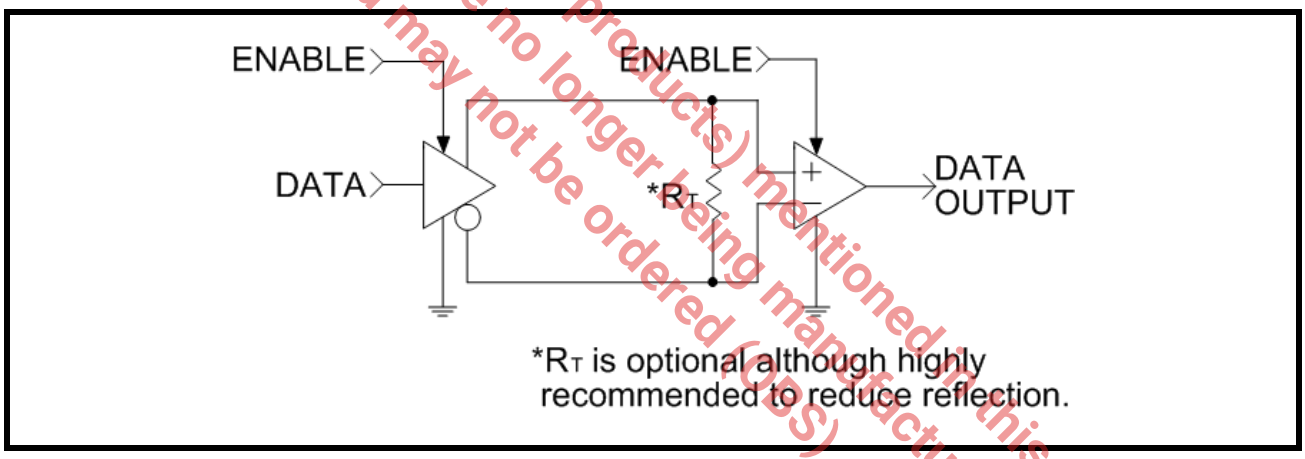


TABLE 1: TRUTH TABLE, ENABLE/DISABLE FUNCTION COMMON TO ALL FOUR RS-422 DRIVERS

ENABLE	$\overline{\text{ENABLE}}$	INPUT	NON-INVERTING A OUTPUT	INVERTING B OUTPUT
LOW	HIGH	don't care	high-Z	high-Z
HIGH	don't care	LOW	LOW	HIGH
don't care	LOW	HIGH	HIGH	LOW

FIGURE 10. DIFFERENTIAL PROPAGATION DELAY VS TEMPERATURE

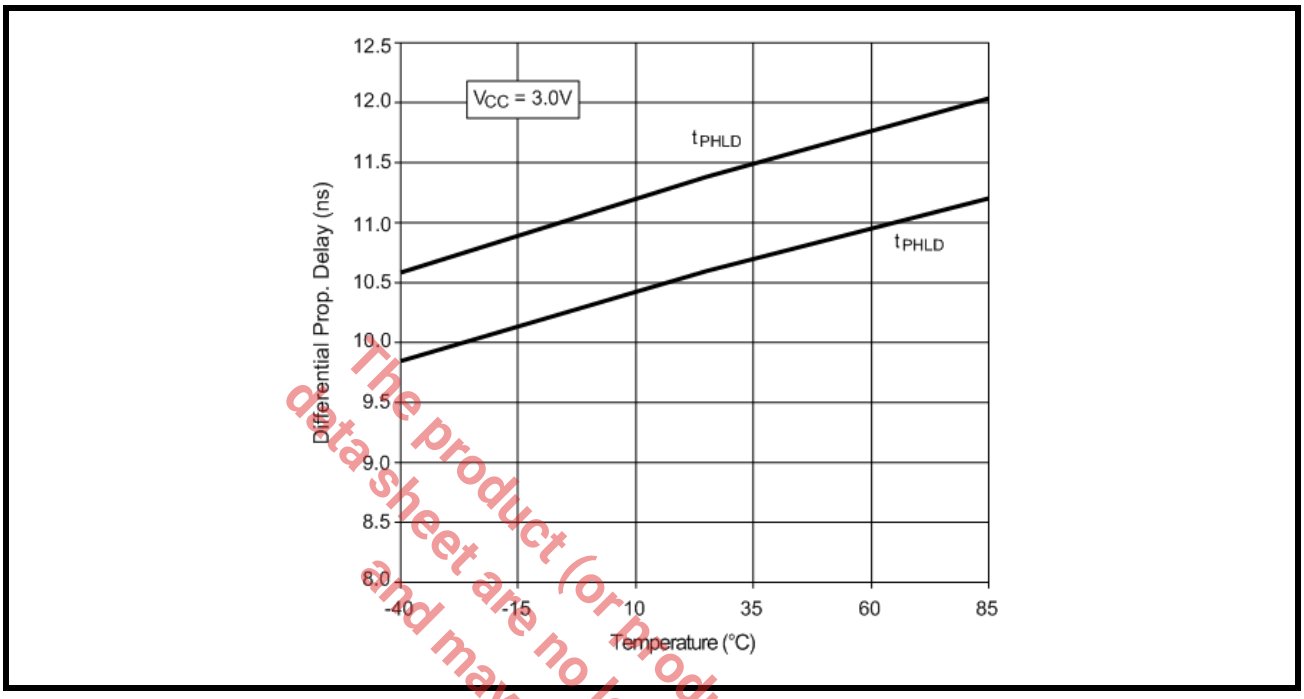


FIGURE 11. DIFFERENTIAL PROPAGATION DELAY VS VOLTAGE

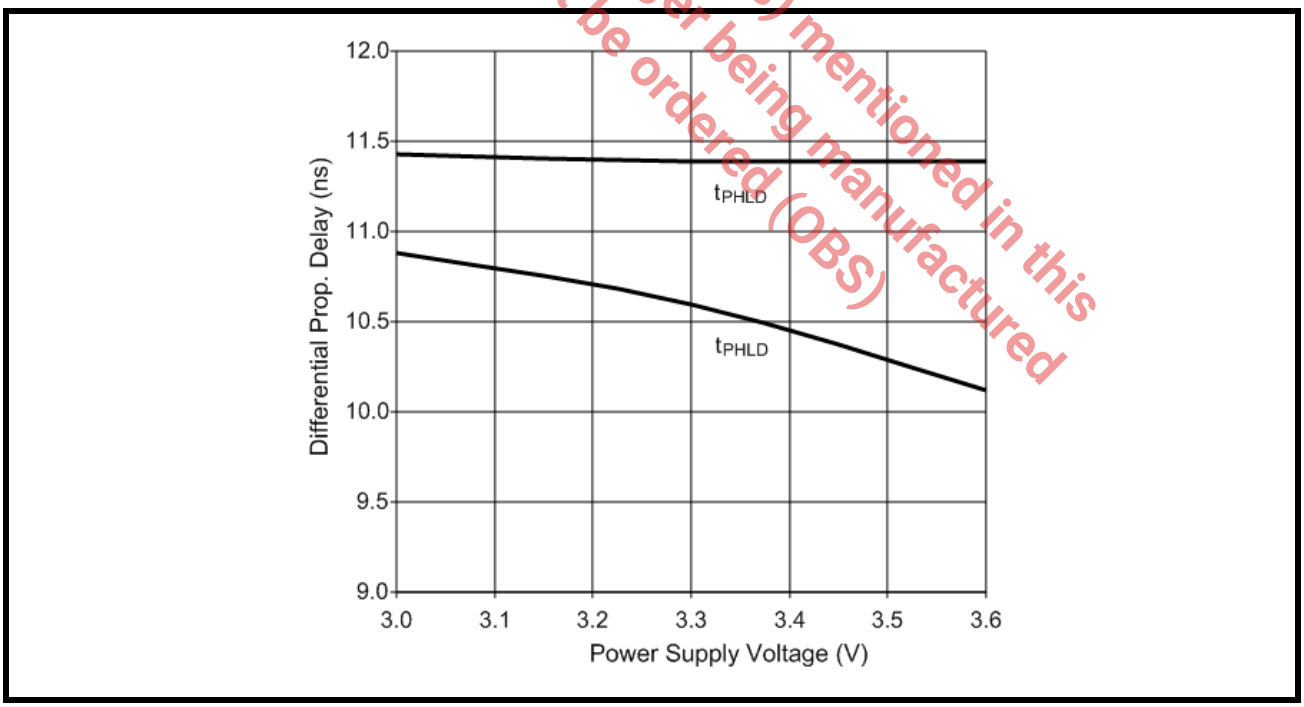


FIGURE 12. DIFFERENTIAL SKEW VS TEMPERATURE

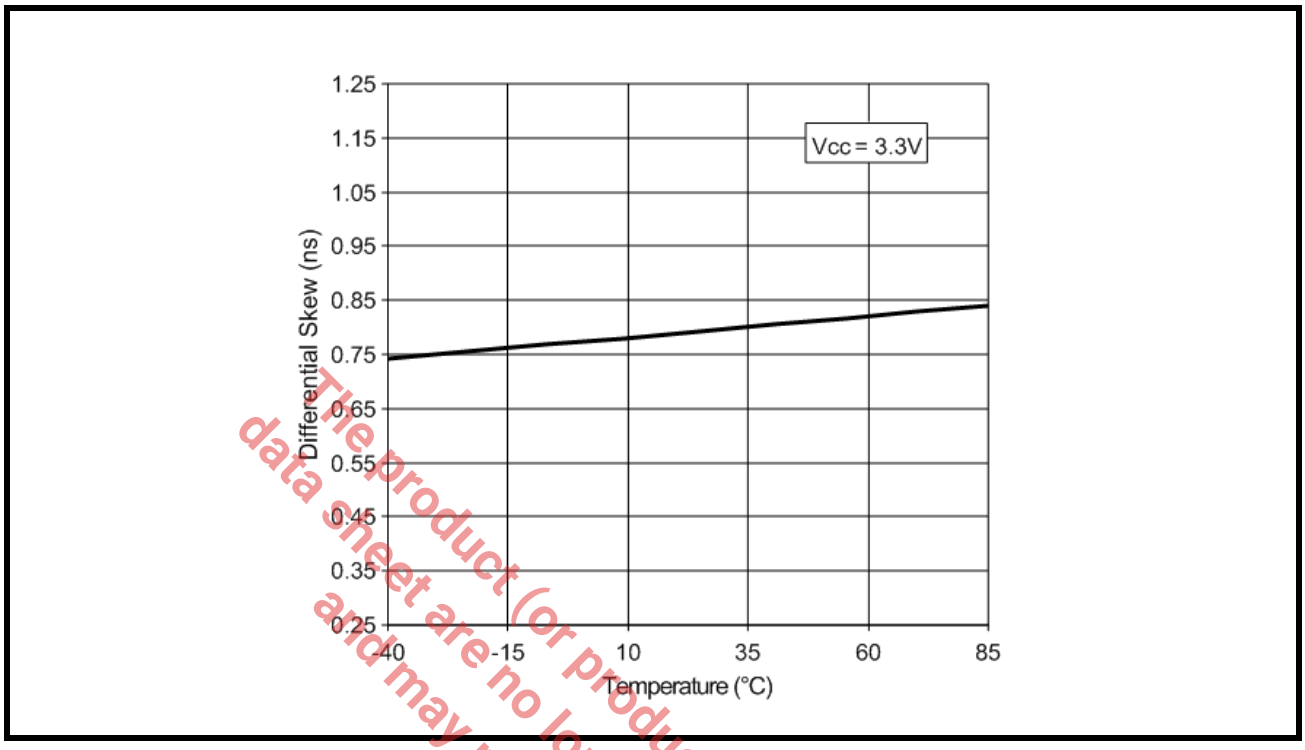


FIGURE 13. DIFFERENTIAL SKEW VS VOLTAGE

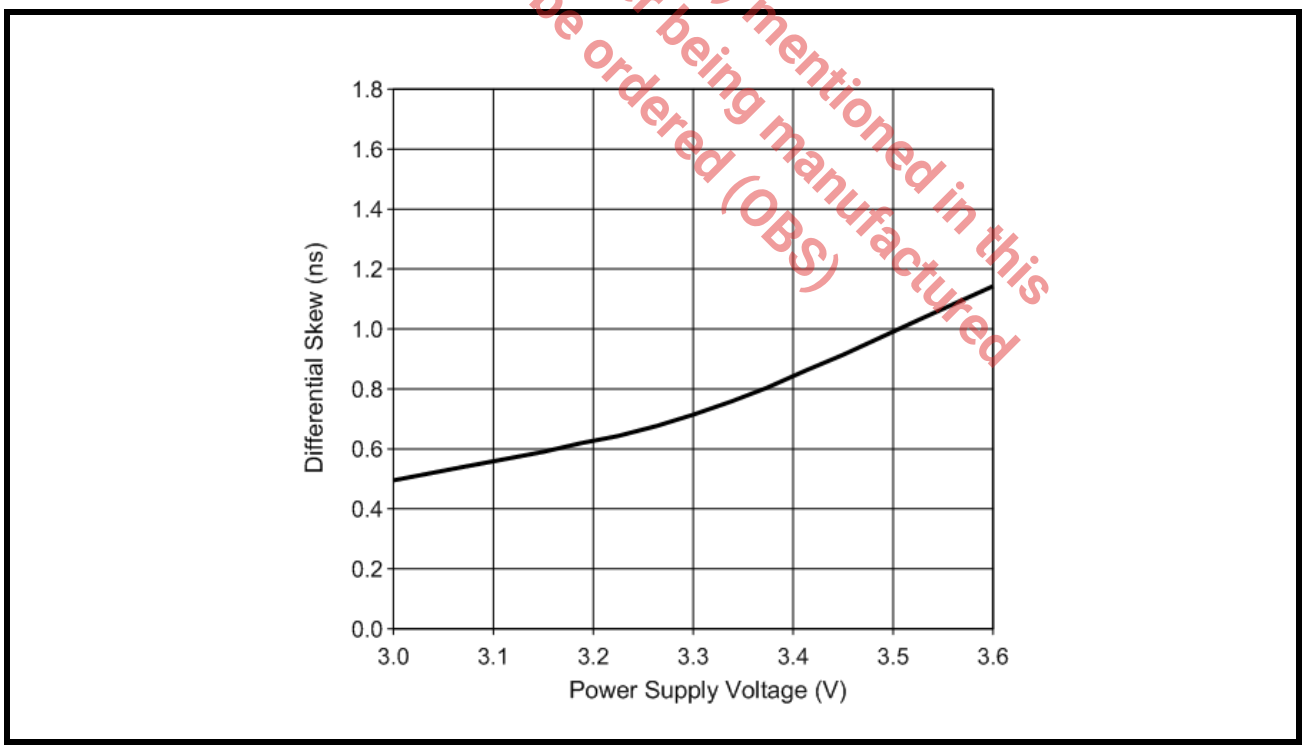


FIGURE 14. DIFFERENTIAL TRANSITION TIME VS TEMPERATURE

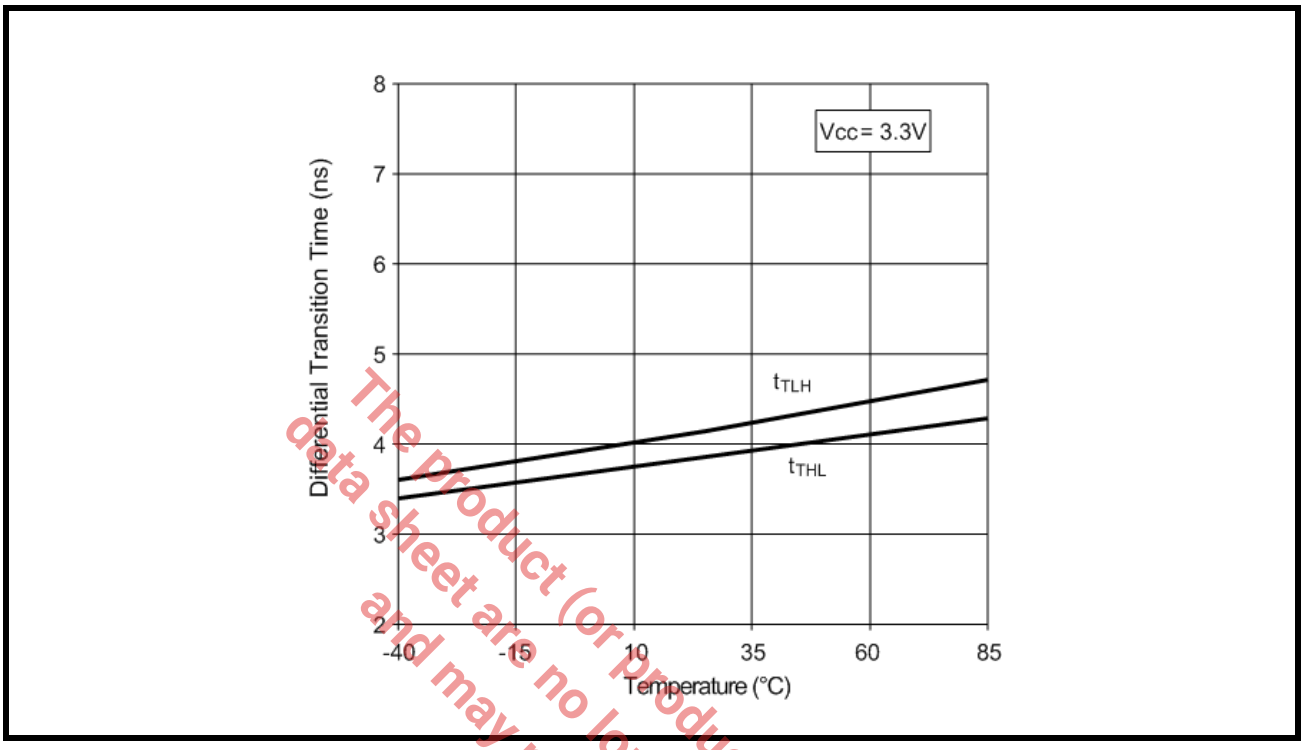


FIGURE 15. DIFFERENTIAL TRANSITION TIME VS VOLTAGE

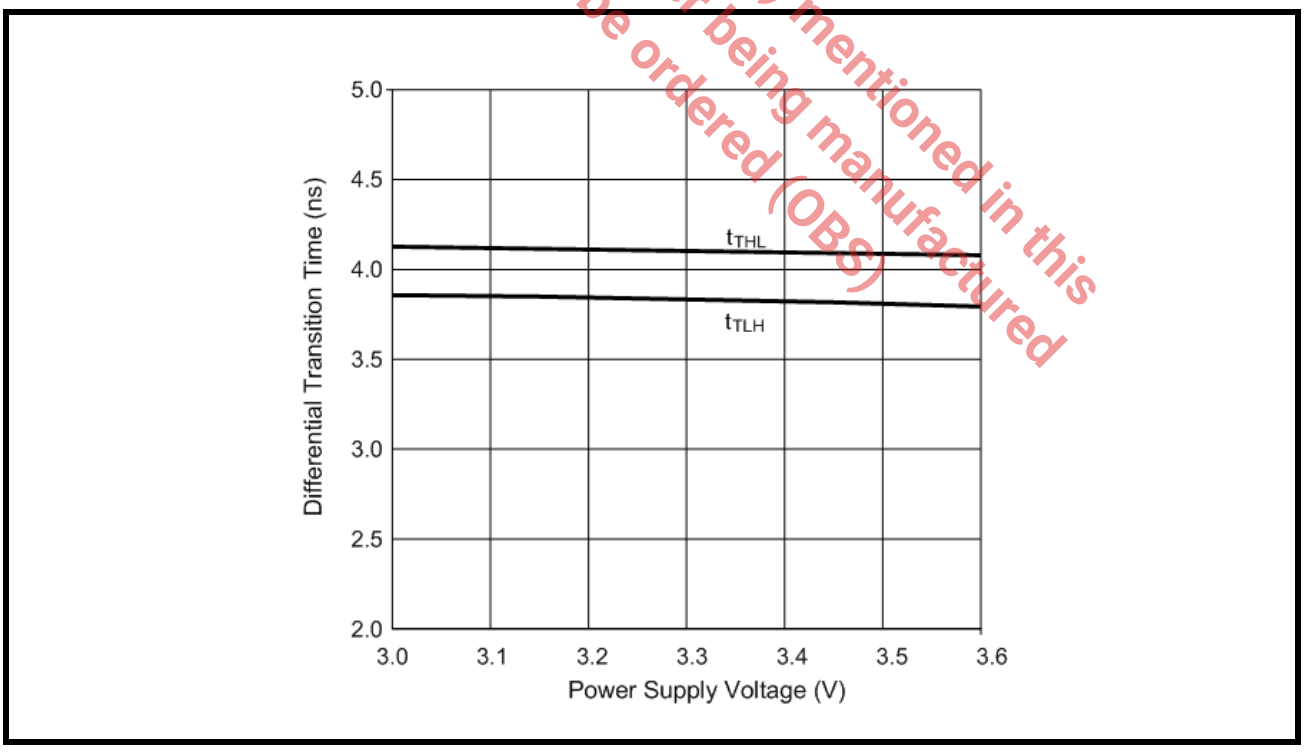


FIGURE 16. COMPLEMENTARY SKEW VS TEMPERATURE

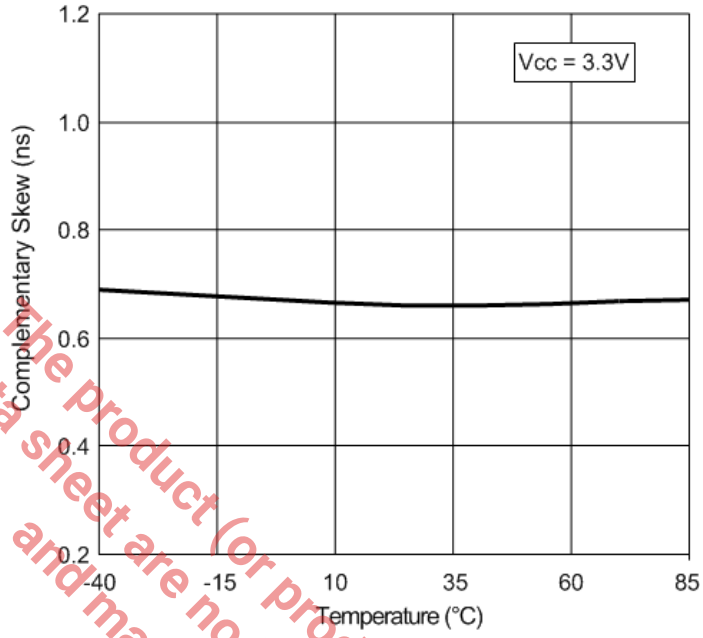


FIGURE 17. COMPLEMENTARY SKEW VS VOLTAGE

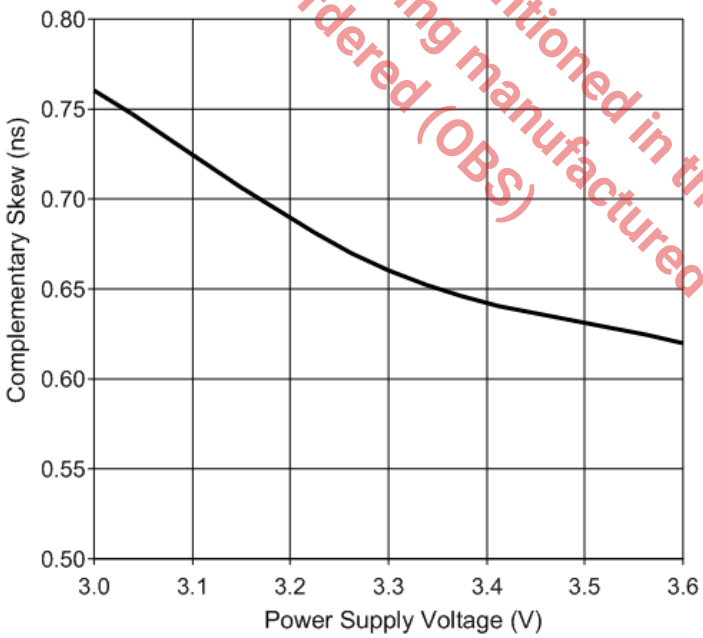


FIGURE 18. DIFFERENTIAL VOUT VS IOUT (TEMPERATURE)

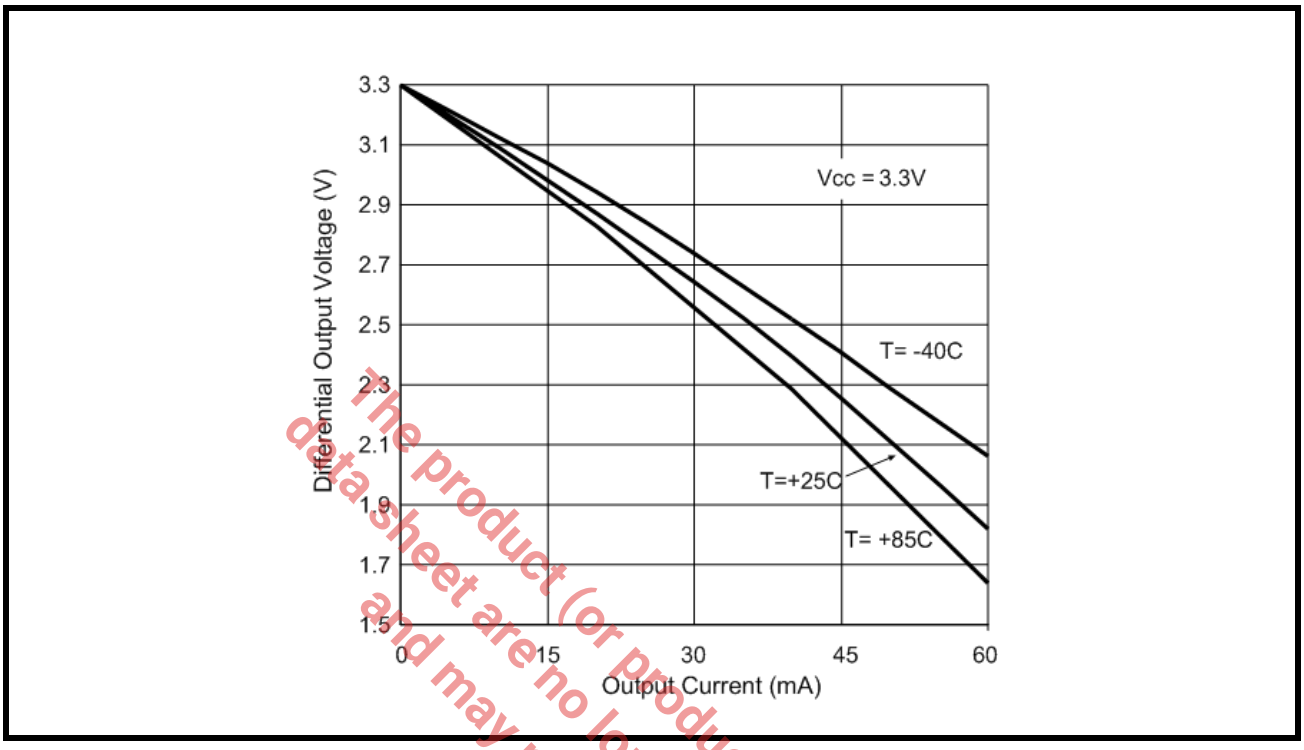


FIGURE 19. DIFFERENTIAL VOUT VS IOUT (VCC)

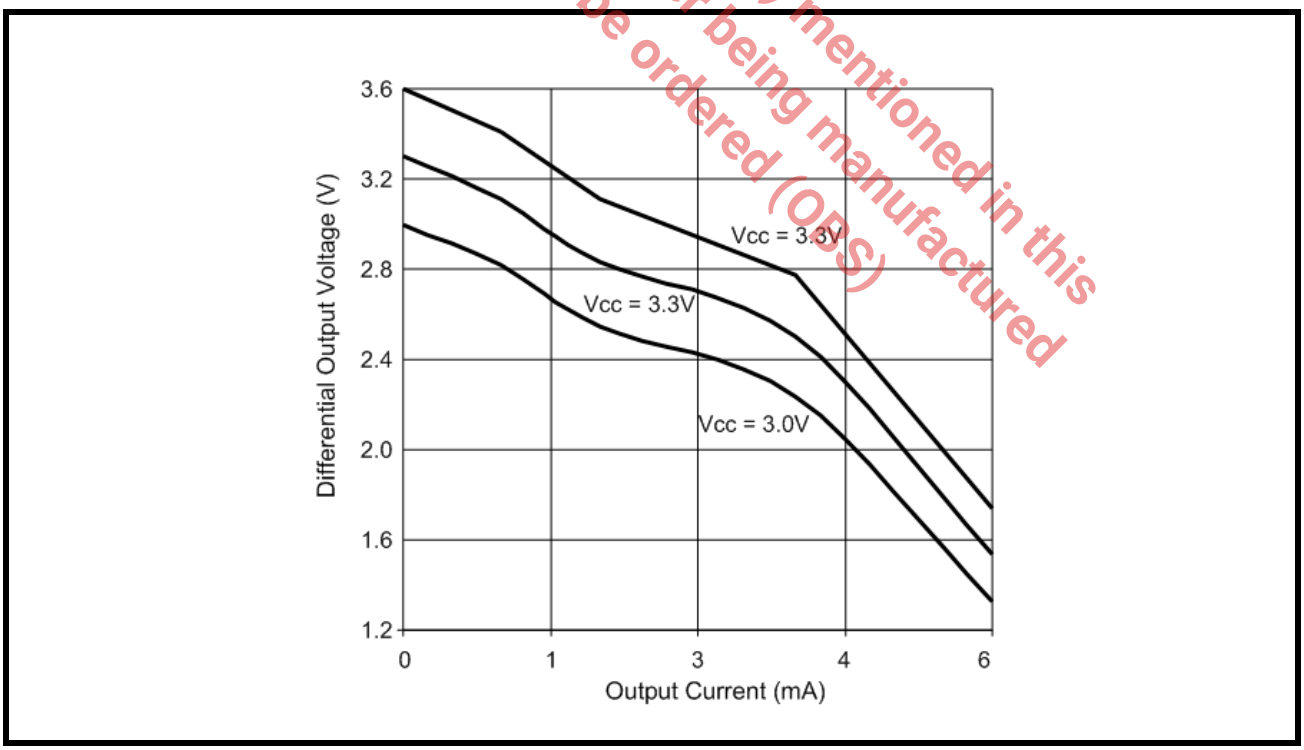


FIGURE 20. VOUT HIGH VS IOUT (TEMPERATURE)

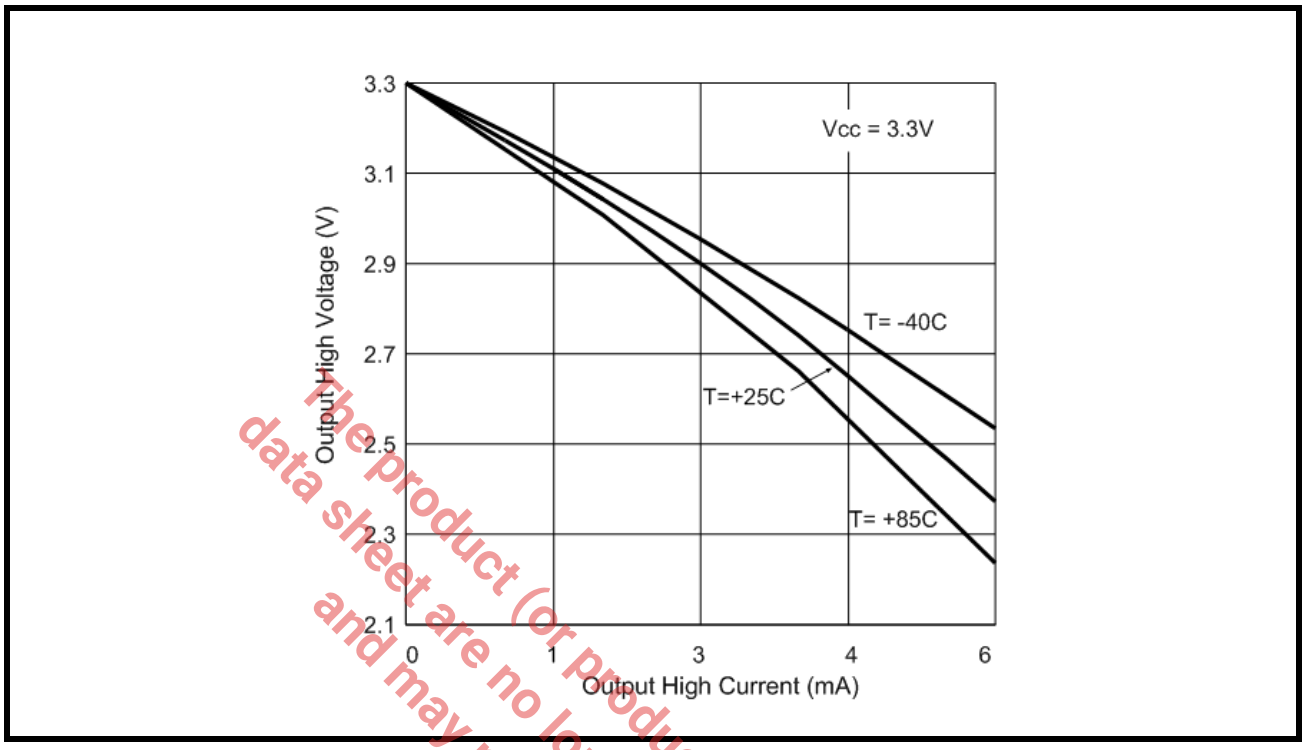


FIGURE 21. VOUT HIGH VS IOUT (VCC)

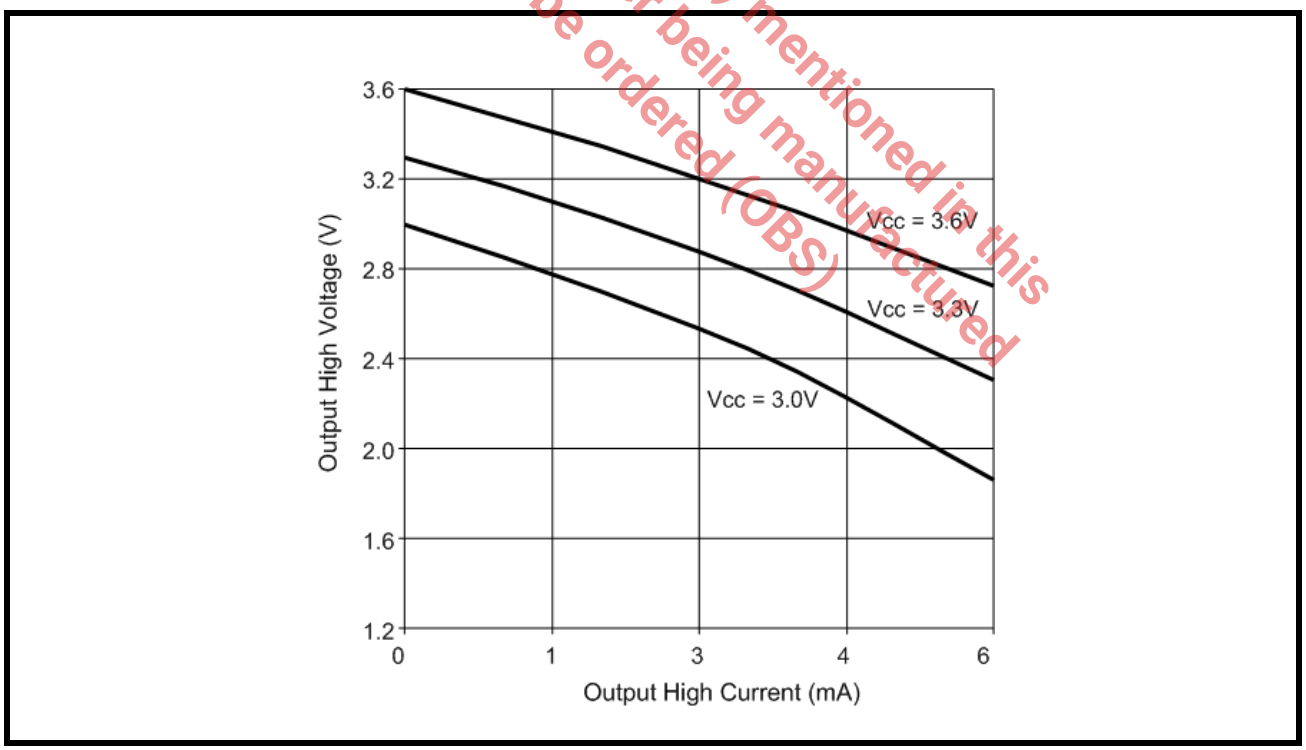


FIGURE 22. VOUT LOW VS CURRENT (TEMPERATURE)

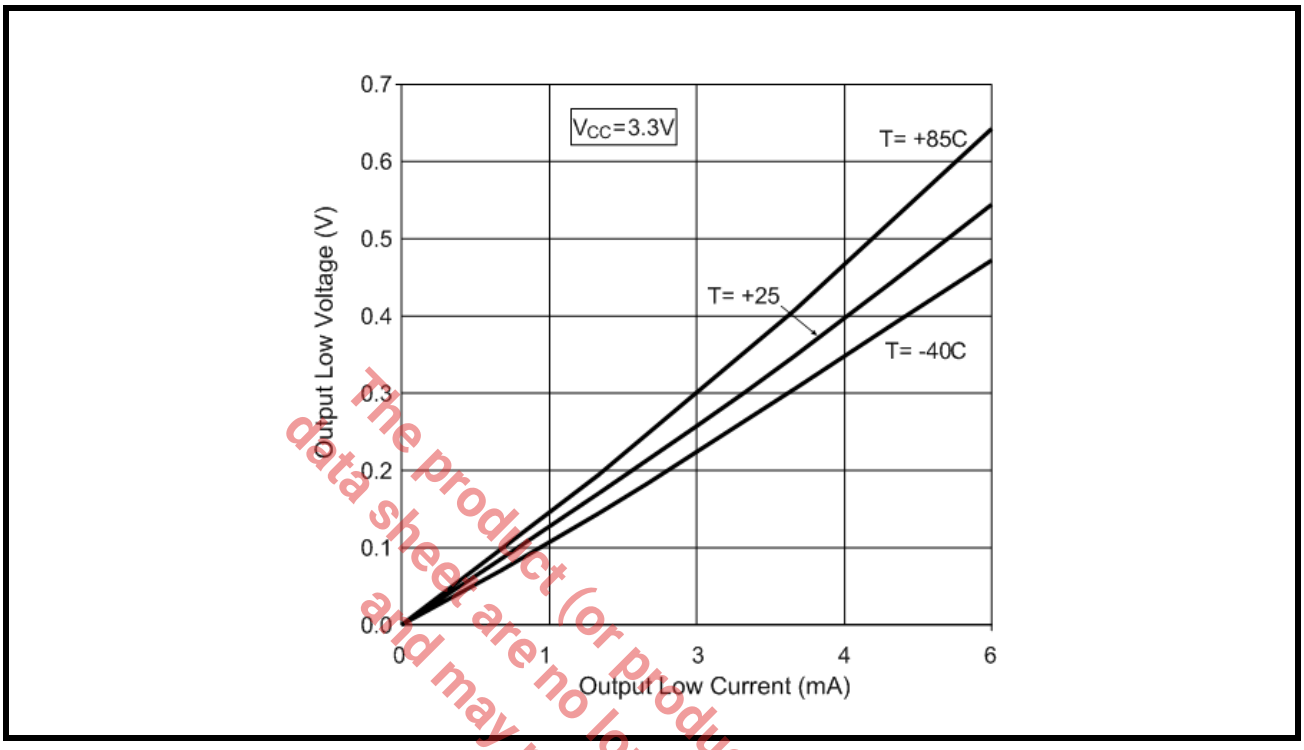


FIGURE 23. VOUT LOW VS CURRENT (VCC)

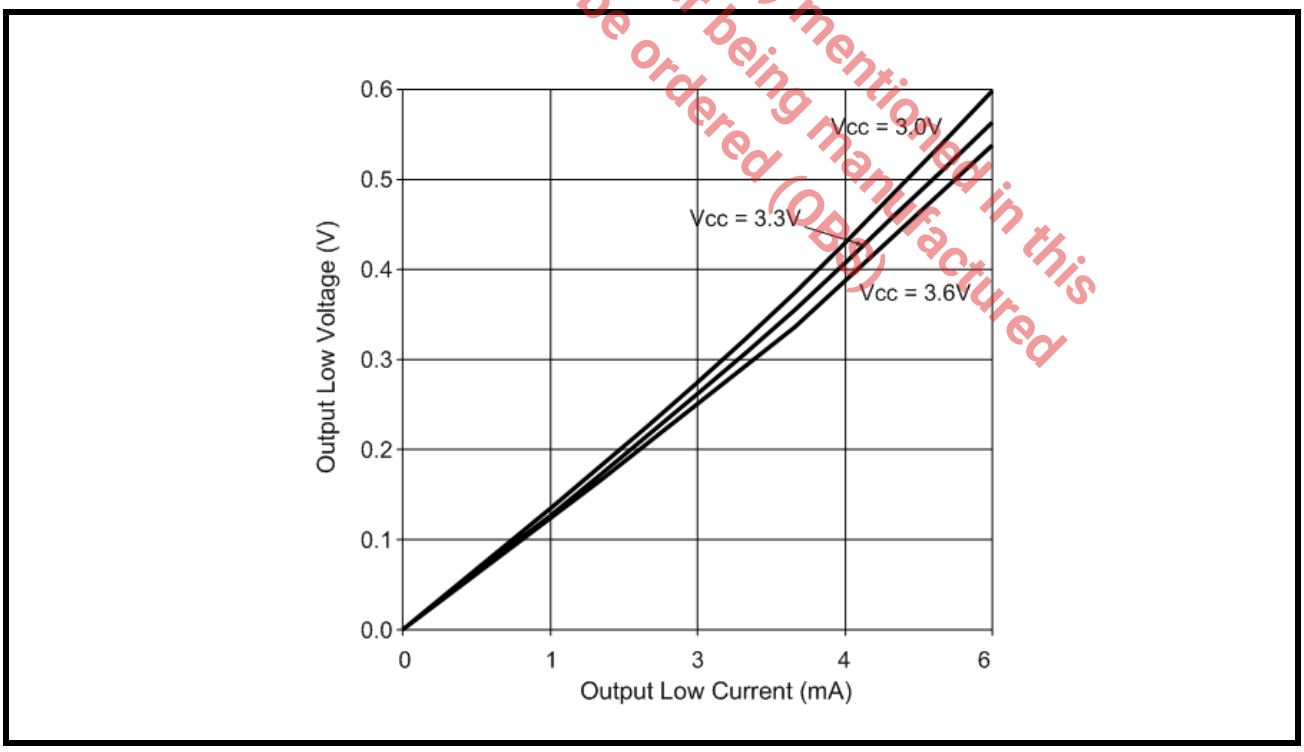


FIGURE 24. SUPPLY CURRENT VS TEMPERATURE

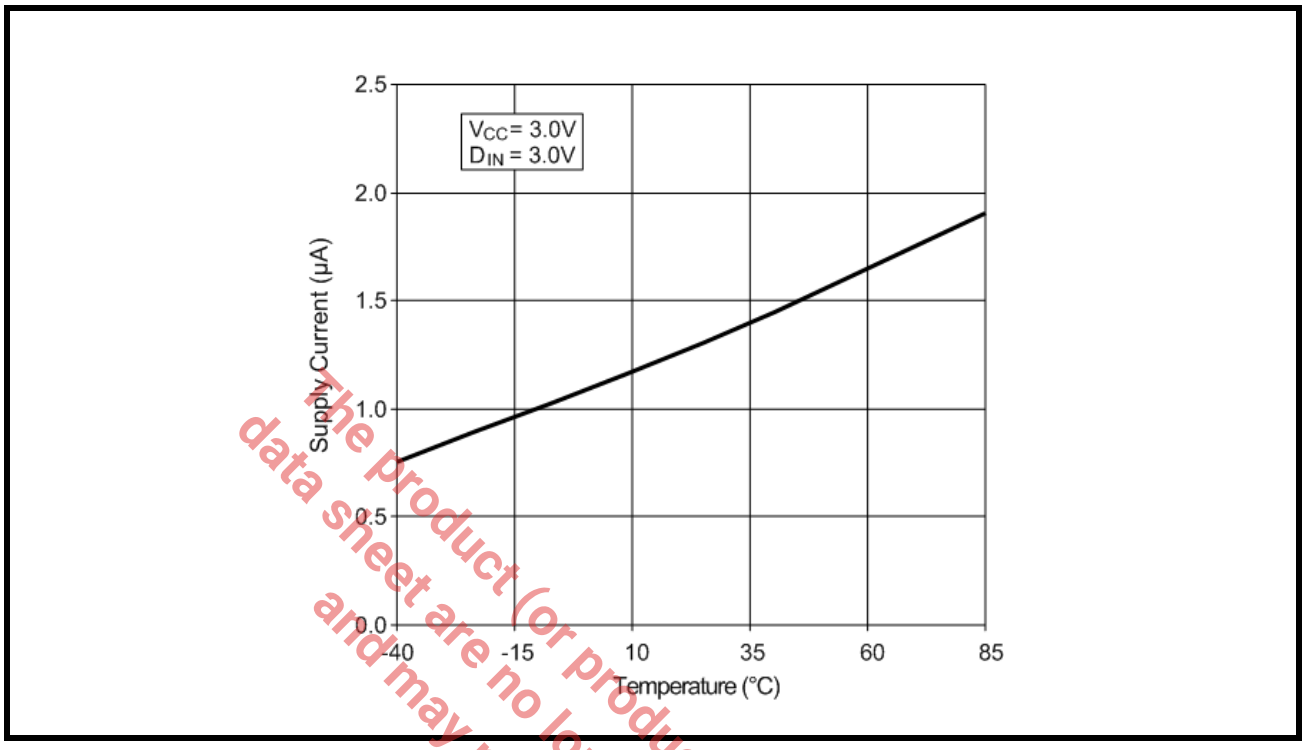


FIGURE 25. SUPPLY CURRENT VS VOLTAGE

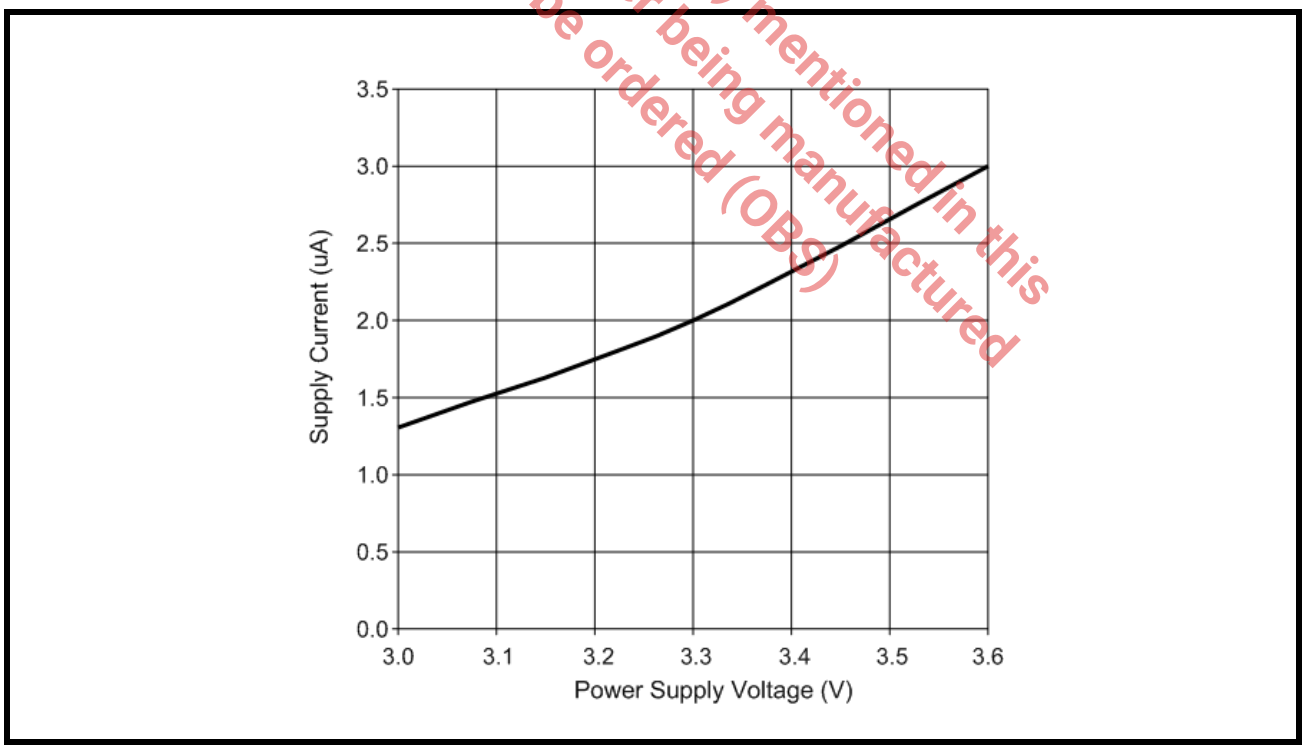


FIGURE 26. SUPPLY CURRENT VS DATA RATE

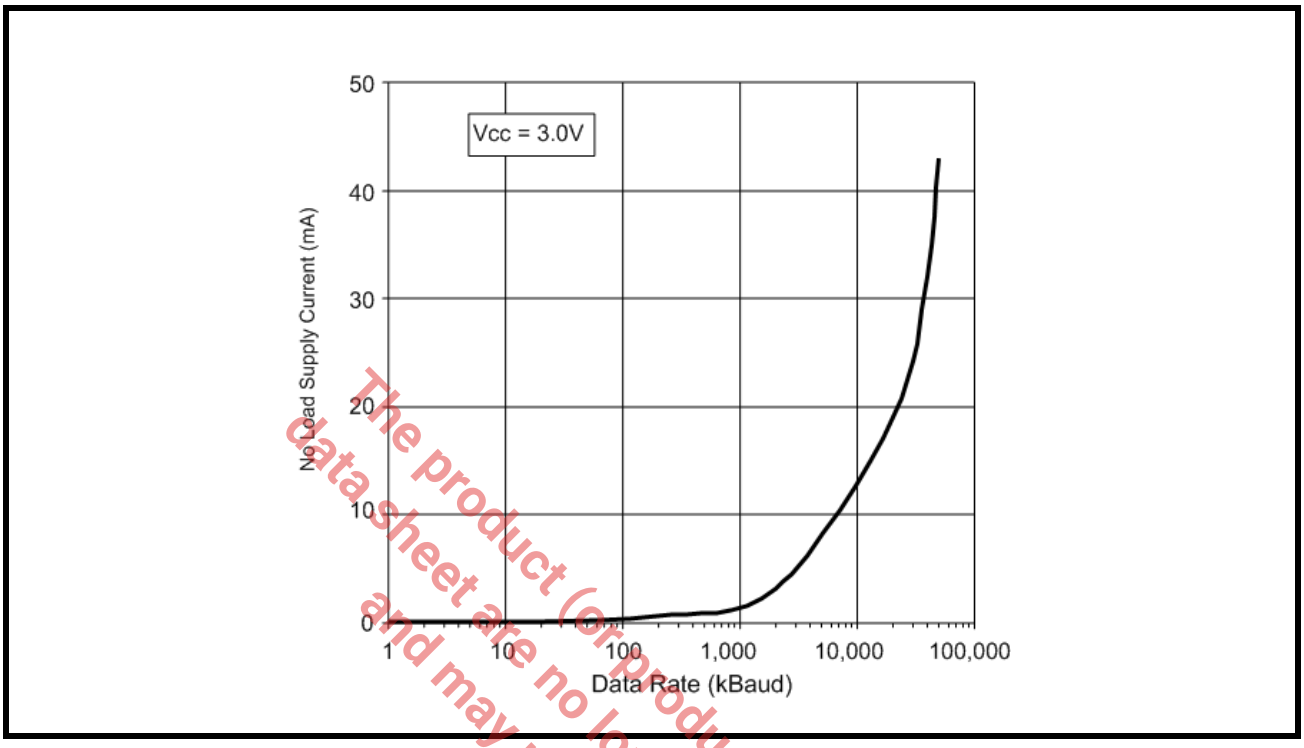


FIGURE 27. ICC (LOADED) VS DATA RATE

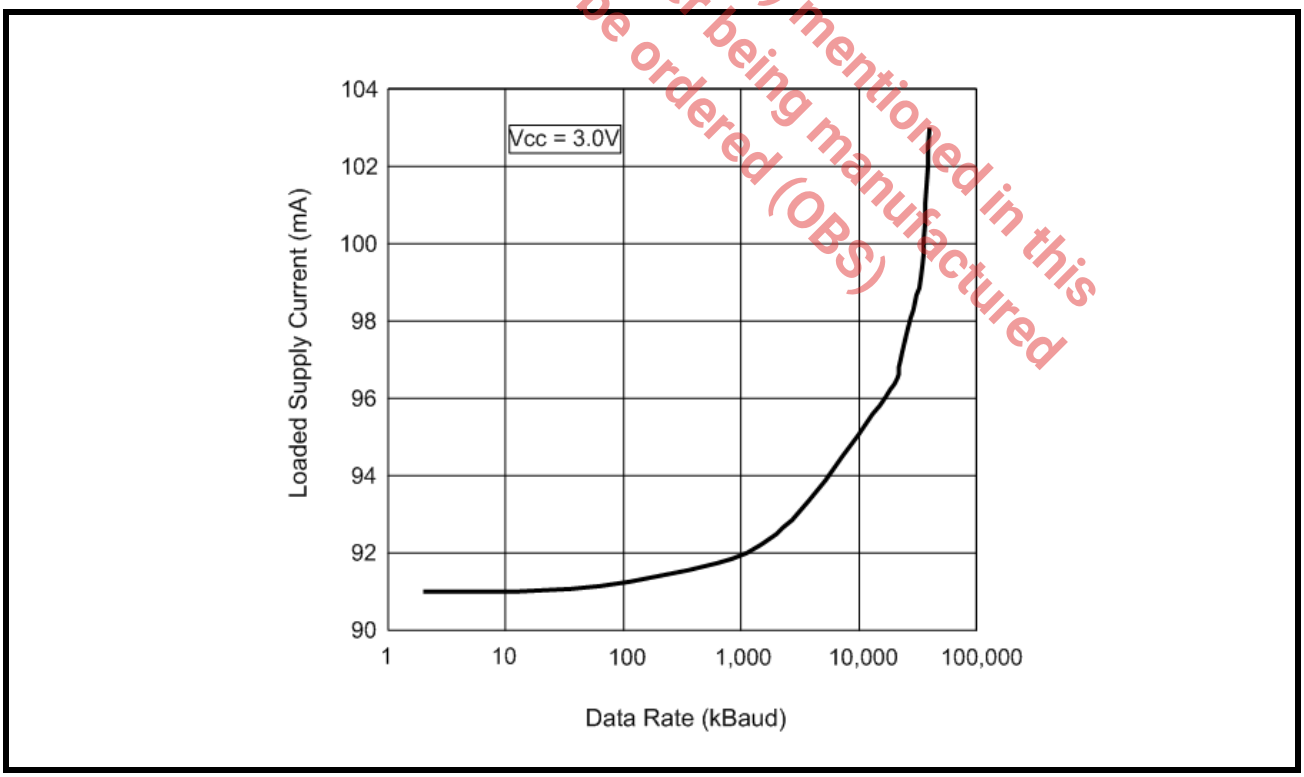


FIGURE 28. SHORT CIRCUIT CURRENT VS TEMPERATURE

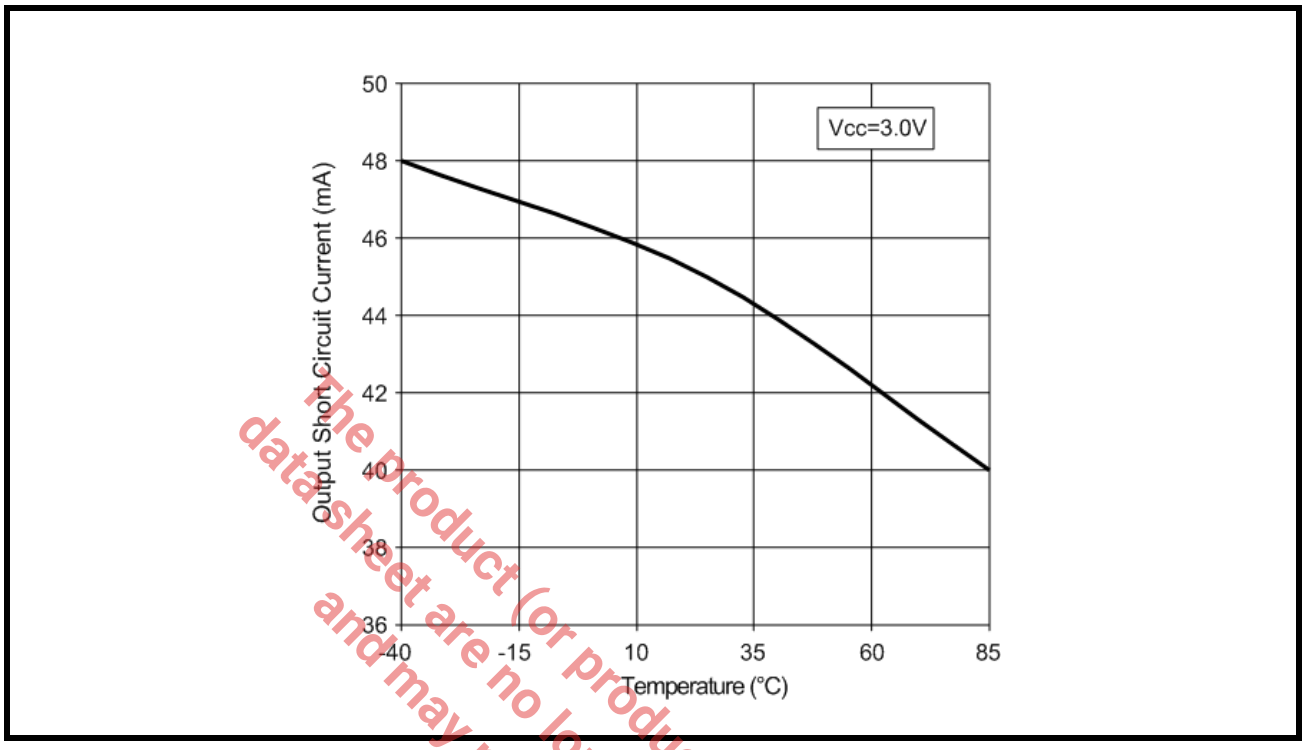
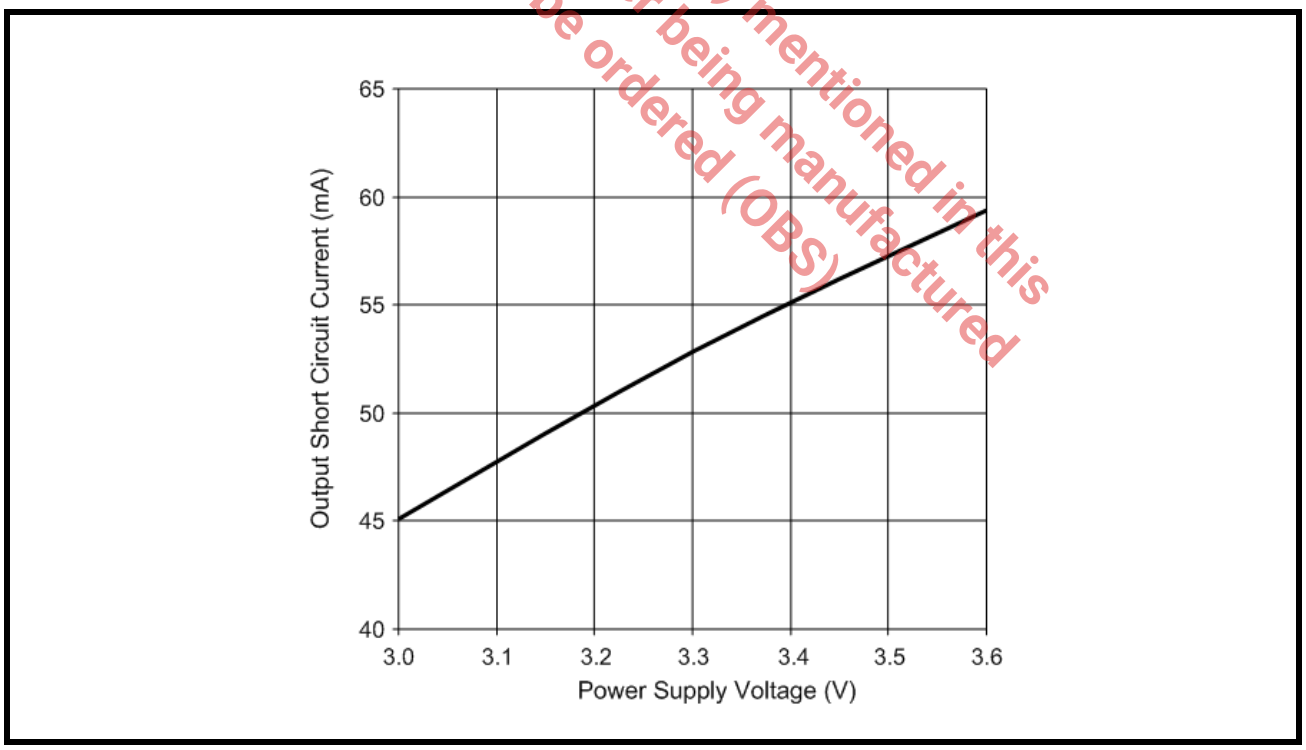
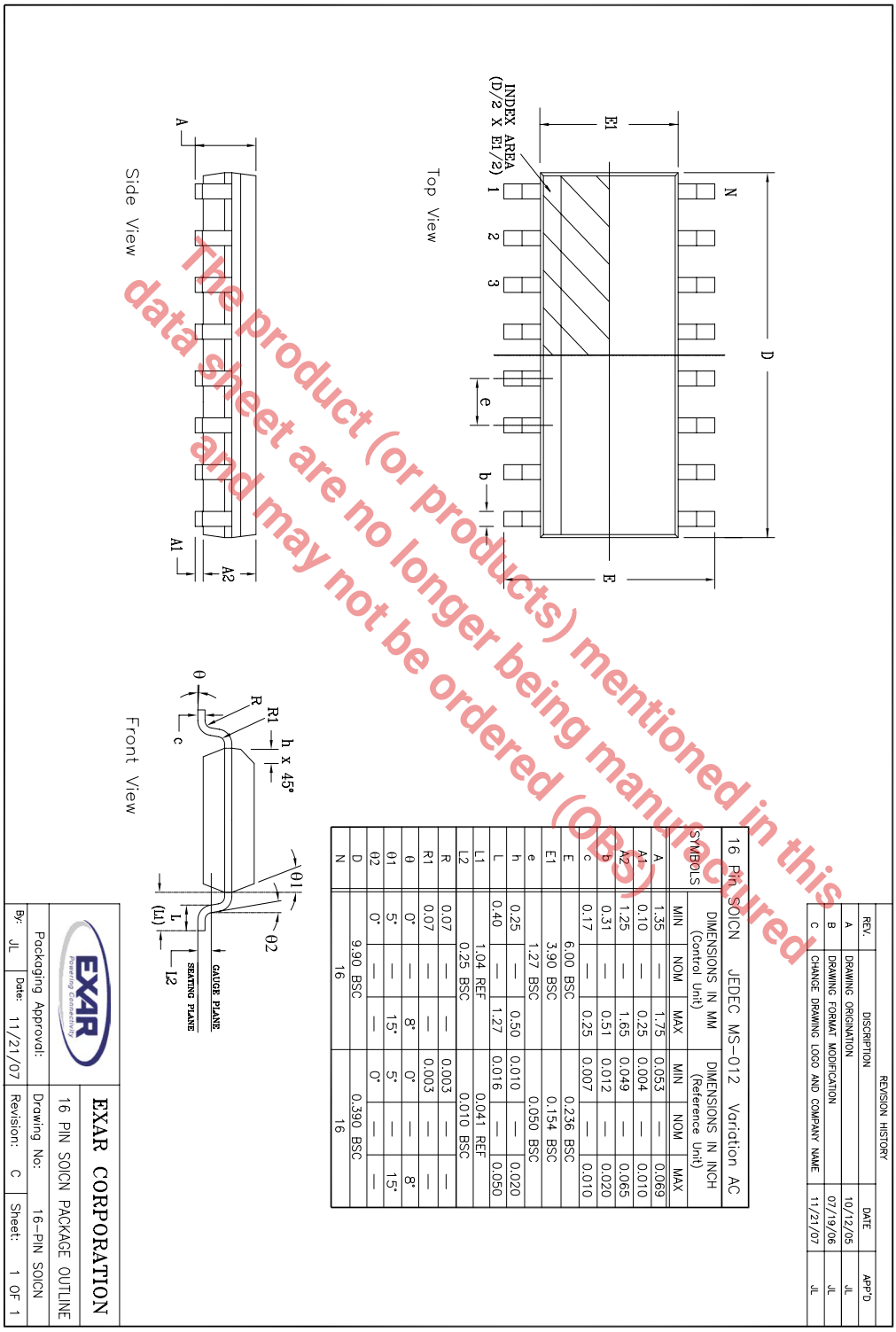


FIGURE 29. SHORT CIRCUIT CURRENT VS VOLTAGE



PACKAGE DIMENSIONS (16 PIN NSOIC)



REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	10/12/05	JL
B	DRAWING FORMAT MODIFICATION	07/19/06	JL
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/21/07	JL

16 Pin SOICN JEDEC MS-012 Variation AC

SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	—	1.75	0.053	—	0.069
A1	0.10	—	0.25	0.004	—	0.010
A2	1.25	—	1.65	0.049	—	0.065
b	0.31	—	0.51	0.012	—	0.020
c	0.17	—	0.25	0.007	—	0.010
E		6.00 BSC			0.236 BSC	
E1		3.90 BSC			0.154 BSC	
e		1.27 BSC			0.050 BSC	
h	0.25	—	0.50	0.010	—	0.020
L	0.40	—	1.27	0.016	—	0.050
L1		1.04 REF			0.041 REF	
L2		0.25 BSC			0.010 BSC	
R	0.07	—	—	0.003	—	—
R1	0.07	—	—	0.003	—	—
θ	0°	—	8°	0°	—	8°
θ1	5°	—	15°	5°	—	15°
θ2	0°	—	—	0°	—	—
D	9.90 BSC			0.390 BSC		
N	16			16		

EXAR CORPORATION

16 PIN SOICN PACKAGE OUTLINE

Packaging Approval:	Drawing No:	16-PIN SOICN
By: JL	Date: 11/21/07	Revision: C	Sheet: 1 OF 1

REVISION HISTORY

DATE	REVISION	DESCRIPTION
3/08/04	A	Production Release.
2/24/05	B	Include tape and reel p/n's.
9/05/08	1.0.0	Converted to Exar standard datasheet format. Add -40C to +85C temperature range option. Changed revision to 1.0.0.
2/19/09	1.1.0	Add 3ns maximum driver skew for industrial temperature option.
6/03/11	1.1.1	Remove SP26LV431CP-L option per PDN 110510-01

NOTICE

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Send your Serial Transceiver technical inquiry with technical details to: serialtechsupport@exar.com.