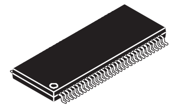


8-CHANNEL HALF-DUPLEX M-LVDS LINE TRANSCEIVERS

FEATURES

- **Low-Voltage Differential 30-Ω to 55-Ω Line Drivers and Receivers for Signaling Rates(1) Up to 250 Mbps; Clock Frequencies Up to 125 MHz**
- **Meets or Exceeds the M-LVDS Standard TIA/EIA-899 for Multipoint Data Interchange**
- **Power Up/Down Glitch Free**
- **Controlled Driver Output Voltage Transition Times for Improved Signal Quality**
- **−1 V to 3.4 V Common-Mode Voltage Range Allows Data Transfer With 2 V of Ground Noise**
- **Bus Pins High Impedance When Driver Disabled or $V_{CC} \leq 1.5$ V**
- **Independent Enables for each Driver**
- **Bus Pin ESD Protection Exceeds 8 kV**
- **Packaged in 64-Pin TSSOP (DGG)**

APPLICATIONS

- **Parallel Multipoint Data and Clock Transmission Via Backplanes and Cables**
- **Low-Power High-Speed Short-Reach Alternative to TIA/EIA-485**
- **Cellular Base Stations**
- **Central-Office Switches**
- **Network Switches and Routers**

DESCRIPTION

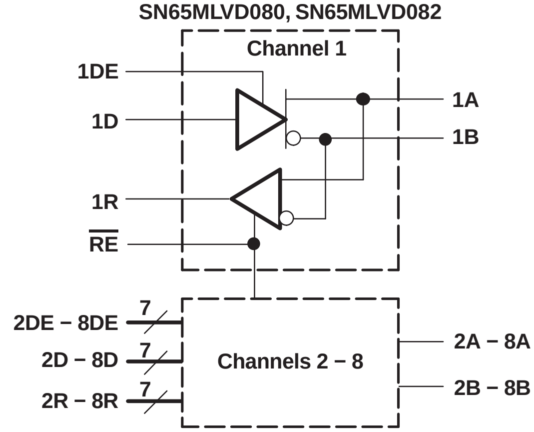
The SN65MLVD080 and SN65MLVD082 provide eight half-duplex transceivers for transmitting and receiving Multipoint-Low-Voltage Differential Signals in full compliance with the TIA/EIA-899 (M-LVDS) standard, which are optimized to operate at signaling rates up to 250 Mbps. The driver outputs have been designed to support multipoint buses presenting loads as low as 30-Ω and incorporates controlled transition times to allow for stubs off of the backbone transmission line.

The M-LVDS standard defines two types of receivers, designated as Type-1 and Type-2. Type-1 receivers (SN65MLVD080) have thresholds centered about zero with 25 mV of hysteresis to prevent output oscillations with loss of input; Type-2 receivers (SN65MLVD082) implement a failsafe by using an offset threshold. In addition, the driver rise and fall times are between 1 and 2.0 ns, complying with the M-LVDS standard to provide operation at 250 Mbps while also accommodating stubs on the bus. Receiver outputs are slew rate controlled to reduce EMI and crosstalk effects associated with large current surges. The M-LVDS standard allows for 32 nodes on the bus providing a high-speed replacement for RS-485 where lower common-mode can be tolerated or when higher signaling rates are needed.

The driver logic inputs and the receiver logic outputs are on separate pins rather than tied together as in some transceiver designs. The drivers have separate enables (DE) and the receivers are enabled globally through ($\overline{RE}$). This arrangement of separate logic inputs, logic outputs, and enable pins allows for a listen-while-talking operation. The devices are characterized for operation from −40°C to 85°C.

LOGIC DIAGRAM (POSITIVE LOGIC)

SN65MLVD080, SN65MLVD082



(1)The signaling rate of a line, is the number of voltage transitions that are made per second expressed in the units bps (bits per second).

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

ORDERING INFORMATION

PART NUMBER	RECEIVER TYPE	PACKAGE MARKING	PACKAGE/CARRIER
SN65MLVD080DGG	Type 1	MLVD080	64-Pin TSSOP/Tube
SM65MLVD080DGGR	Type 1	MLVD080	64-Pin TSSOP/Tape and Reeled
SN65MLVD082DGG	Type 2	MLVD082	64-Pin TSSOP/Tube
SM65MLVD082DGGR	Type 2	MLVD082	64-Pin TSSOP/Tape and Reeled

PACKAGE DISSIPATION RATINGS

PACKAGE	PCB JEDEC STANDARD	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR(1) ABOVE $T_A = 25°C$	$T_A = 85°C$ POWER RATING
DGG	Low-K(2)	1204.7 mW	10.5 mW/°C	576 mW
DGG	High-K(3)	1839.4 mW	16.0 mW/°C	880 mw

(1) This is the inverse of the junction-to-ambient thermal resistance when board mounted and with no air flow.
(2) In accordance with the Low-K thermal metric definitions of EIA/JESD51-3.
(3) In accordance with the High-K thermal metric definitions of EIA/JESD51-7.

THERMAL CHARACTERISTICS

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Junction-to-board thermal resistance, ΘJB			41.08		°C/W
Junction-to-case thermal resistance, Θ_{JC}			6.78		°C/W
Device power dissipation	V_{CC} = 3.3 V, DE = V_{CC}, $\overline{RE}$ = GND, C_L = 15 pF, R_L = 50 Ω, 250 Mbps random data on each input		477		mW
	V_{CC} = 3.6 V, DE = V_{CC}, $\overline{RE}$ = GND, C_L = 15 pF, R_L = 50 Ω, 250 Mbps data on one input and 125 MHz clock on the others			854(1)	

(1) When all channels are running at a 125-MHz clock frequency, a 250 lfm is required for a low-K board, and 150 lfm is required for a high-K board. In such applications, a TI 1:8 or dual 1:4 M-LVDS buffer is highly recommended, SN65MLVD128 or SN65MLVD129, to fan out clock signals in multiple paths.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range unless otherwise noted(1)

			SN65MLVD080, 082
Supply voltage range(2), V_{CC}			−0.5 V to 4 V
Input voltage range	D, DE, $\overline{RE}$		−0.5 V to 4 V
	A, B		−1.8 V to 4 V
Output voltage range	R		−0.3 V to 4 V
	A, or B		−1.8 V to 4 V
Electrostatic discharge	Human Body Model(3)	A, B	±8 kV
		All pins	±2 kV
	Charged-Device Model(4)	All pins	±1500 V
Continuous power dissipation			See Dissipation Rating Table
Storage temperature range			−65°C to 150°C

(1) 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.
(2) All voltage values, except differential I/O bus voltages, are with respect to network ground terminal.
(3) Tested in accordance with JEDEC Standard 22, Test Method A114−A.
(4) Tested in accordance with JEDEC Standard 22, Test Method C101.

RECOMMENDED OPERATING CONDITIONS

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	3	3.3	3.6	V
High-level input voltage, V_{IH}	2		V_{CC}	V
Low-level input voltage, V_{IL}	GND		0.8	V
Voltage at any bus terminal V_A or V_B	−1.4		3.8	V
Magnitude of differential input voltage, $\|V_{ID}\|$	0.05		V_{CC}	V
Operating free-air temperature, T_A	−40		85	°C
Maximum junction temperature			140	°C

DEVICE ELECTRICAL CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER			TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
I_{CC}	Supply current	Driver only	$\overline{RE}$ and DE at V_{CC}, R_L = 50 Ω, All others open		110	140	mA
		Both disabled	$\overline{RE}$ at V_{CC}, DE at 0 V, R_L = No Load, All others open		5	8	
		Both enabled	$\overline{RE}$ at 0 V, DE at V_{CC}, R_L = 50 Ω, C_L = 15 pF, All others open		140	180	
		Receiver only	$\overline{RE}$ at 0 V, DE at 0 V, C_L = 15 pF, All others open		38	50	

(1) All typical values are at 25°C and with a 3.3-V supply voltage.

DRIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN(1)	TYP(2)	MAX	UNIT
$\|V_{AB}\|$	Differential output voltage magnitude (A, B)	See Figure 2	480		650	mV
$\Delta\|V_{AB}\|$	Change in differential output voltage magnitude between logic states (A, B)		−50		50	mV
$V_{OS(SS)}$	Steady-state common-mode output voltage (A, B)	See Figure 3	0.8		1.2	V
$\Delta V_{OS(SS)}$	Change in steady-state common-mode output voltage between logic states (A, B)		−50		50	mV
$V_{OS(PP)}$	Peak-to-peak common-mode output voltage (A, B)				150	mV
$V_{A(OC)}$	Maximum steady-state open-circuit output voltage (A, B)	See Figure 7	0		2.4	V
$V_{B(OC)}$	Maximum steady-state open-circuit output voltage (A, B)		0		2.4	V
$V_{P(H)}$	Voltage overshoot, low-to-high level output (A, B)	See Figure 5			1.2 V_{SS}	V
$V_{P(L)}$	Voltage overshoot, high-to-low level output (A, B)		−0.2 V_{SS}			V
I_{IH}	High-level input current (D, DE)	V_{IH} = 2 V to V_{CC}			10	µA
I_{IL}	Low-level input current (D, DE)	V_{IL} = GND to 0.8 V			10	µA
$\|I_{OS}\|$	Differential short-circuit output current magnitude (A, B)	See Figure 4			24	mA
C_i	Input capacitance (D, DE)	$V_I = 0.4 \sin(30E6\pi t) + 0.5$ V, (3)		5		pF

(1) The algebraic convention, in which the least positive (most negative) limit is designated as minimum is used in this data sheet.
(2) All typical values are at 25°C and with a 3.3-V supply voltage.
(3) HP4194A impedance analyzer (or equivalent)

RECEIVER ELECTRICAL CHARACTERISTICS

over recommended operating conditions unless otherwise noted(1)

PARAMETER			TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
V_{IT+}	Positive-going differential input voltage threshold (A, B)	Type 1	See Figure 9 and Table 1 and Table 2			50	mV
		Type 2				150	
V_{IT-}	Negative-going differential input voltage threshold (A, B)	Type 1		−50			mV
		Type 2		50			
V_{HYS}	Differential input voltage hysteresis, ($V_{IT+} - V_{IT}$) (A, B)	Type 1			25		mV
		Type 2			0		
V_{OH}	High-level output voltage (R)		I_{OH} = −8 mA	2.4			V
V_{OL}	Low-level output voltage (R)		I_{OL} = 8 mA			0.4	V
I_{IH}	High-level input current ($\overline{RE}$)		V_{IH} = 2 V to V_{CC}	−10			µA
I_{IL}	Low-level input current ($\overline{RE}$)		V_{IL} = GND to 0.8 V	−10			µA
I_{OZ}	High-impedance output current (R)		V_O = 0 V or V_{CC}	−10		15	µA

(1) All typical values are at 25°C and with a 3.3-V supply voltage.

BUS INPUT AND OUTPUT ELECTRICAL CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER		TEST CONDITIONS			MIN	TYP(1)	MAX	UNIT
I_A	Receiver or transceiver with driver disabled input current	V_A = 3.8 V,	V_B = 1.2 V,		0		32	µA
		V_A = 0 V or 2.4 V,	V_B = 1.2 V		−20		20	
		V_A = −1.4 V,	V_B = 1.2 V		−32		0	
I_B	Receiver or transceiver with driver disabled input current	V_B = 3.8 V,	V_A = 1.2 V		0		32	µA
		V_B = 0 V or 2.4 V,	V_A = 1.2 V		−20		20	
		V_B = −1.4 V,	V_A = 1.2 V		−32		0	
I_{AB}	Receiver or transceiver with driver disabled differential input current ($I_A - I_B$)	$V_A = V_B$,	$-1.4 \le V_A \le 3.8$ V		−4		4	µA
$I_{A(OFF)}$	Receiver or transceiver power-off input current	V_A = 3.8 V,	V_B = 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	0		32	µA
		V_A = 0 V or 2.4 V,	V_B = 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	−20		20	
		V_A = −1.4 V,	V_B= 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	−32		0	
$I_{B(OFF)}$	Receiver or transceiver power-off input current	V_B = 3.8 V,	V_A = 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	0		32	µA
		V_B = 0 V or 2.4 V,	V_A = 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	−20		20	
		V_B = −1.4 V,	V_A = 1.2 V,	$0 V \le V_{CC} \le 1.5$ V	−32		0	
$I_{AB(OFF)}$	Receiver input or transceiver power-off differential input current ($I_{A(off)} - I_{B(off)}$)	$V_A = V_B$, $0 V \le V_{CC} \le 1.5$ V, $-1.4 \le V_A \le 3.8$ V			−4		4	µA
C_A	Transceiver with driver disabled input capacitance	V_A = 0.4 sin (30E6πt) + 0.5V(2),	V_B =1.2 V			5		pF
C_B	Transceiver with driver disabled input capacitance	V_B = 0.4 sin (30E6πt) + 0.5V(2),	V_A =1.2 V			5		pF
C_{AB}	Transceiver with driver disabled differential input capacitance	V_{AB} = 0.4 sin (30E6πt)V (2)					3	pF
$C_{A/B}$	Transceiver with driver disabled input capacitance balance, (C_A/C_B)				0.99		1.01	

(1) All typical values are at 25°C and with a 3.3-V supply voltage.
(2) HP4194A impedance analyzer (or equivalent)

DRIVER SWITCHING CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP[(1)]	MAX	UNIT
t_{pLH}	Propagation delay time, low-to-high-level output	See Figure 5	1	1.5	2.4	ns
t_{pHL}	Propagation delay time, high-to-low-level output		1	1.5	2.4	ns
t_r	Differential output signal rise time		1		2	ns
t_f	Differential output signal fall time		1		2	ns
$t_{sk(o)}$	Output skew				350	ps
$t_{sk(p)}$	Pulse skew ($\lvert t_{pHL} - t_{pLH} \rvert$)			0	150	ps
$t_{sk(pp)}$	Part-to-part skew				600	ps
$t_{jit(per)}$	Period jitter, rms (1 standard deviation) (2)	100 MHz clock input(3)			4	ps
$t_{jit(c-c)}$	Cycle-to-cycle jitter, rms				45	ps
$t_{jit(det)}$	Deterministic jitter	200 Mbps 2^{15}−1 PRBS input(4)			150	ps
$t_{jit(pp)}$	Peak-to-peak jitter(2)(5)				190	ps
t_{pZH}	Enable time, high-impedance-to-high-level output	See Figure 6			7	ns
t_{pZL}	Enable time, high-impedance-to-low-level output				7	ns
t_{pHZ}	Disable time, high-level-to-high-impedance output				7	ns
t_{pLZ}	Disable time, low-level-to-high−impedance output				7	ns

(1) All typical values are at 25°C and with a 3.3-V supply voltage.
(2) Jitter is ensured by design and characterization. Stimulus jitter has been subtracted from the numbers.
(3) $t_r = t_f$ = 0.5 ns (10% to 90%), measured over 30 k samples.
(4) $t_r = t_f$ = 0.5 ns (10% to 90%), measured over 100 k samples.
(5) Peak-to-peak jitter includes jitter due to pulse skew ($t_{sk(p)}$).

RECEIVER SWITCHING CHARACTERISTICS

over recommended operating conditions unless otherwise noted

PARAMETER			TEST CONDITIONS	MIN	TYP[(1)]	MAX	UNIT
t_{pLH}	Propagation delay time, low-to-high-level output		C_L = 15 pF, See Figure 10	2	4	6	ns
t_{pHL}	Propagation delay time, high-to-low-level output			2	4	6	ns
t_r	Output signal rise time			1		2.3	ns
t_f	Output signal fall time			1		2.3	ns
$t_{sk(o)}$	Output skew					350	ps
$t_{sk(p)}$	Pulse skew ($\|t_{pHL} - t_{pLH}\|$)				50	350	ps
$t_{sk(pp)}$	Part-to-part skew[(2)]					1	ns
$t_{jit(per)}$	Period jitter, rms (1 standard deviation) [(3)]		100 MHz clock input[(4)]			7	ps
$t_{jit(c-c)}$	Cycle-to-cycle jitter, rms					110	ps
$t_{jit(det)}$	Deterministic jitter	Type 1	200 Mbps 2^{15}−1 PRBS input[(5)]			550	ps
		Type 2				480	ps
$t_{jit(pp)}$	Peak-to-peak jitter[(3)(6)]	Type 1				720	ps
		Type 2				660	ps
t_{pZH}	Enable time, high-impedance-to-high-level output		C_L = 15 pF, See Figure 11			30	ns
t_{pZL}	Enable time, high-impedance-to-low-level output					30	ns
t_{pHZ}	Disable time, high-level-to-high-impedance output					18	ns
t_{pLZ}	Disable time, low-level-to-high-impedance output					28	ns

(1) All typical values are at 25°C and with a 3.3-V supply voltage.
(2) HP4194A impedance analyzer (or equivalent)
(3) Jitter is ensured by design and characterization. Stimulus jitter has been subtracted from the numbers.
(4) V_{ID} = 200 mV_{pp} (’080), V_{ID} = 400 mV_{pp} (’082), V_{cm} = 1 V, t_r = t_f = 0.5 ns (10% to 90%), measured over 30 k samples.
(5) V_{ID} = 200 mV_{pp} (’080), V_{ID} = 400 mV_{pp} (’082), V_{cm} = 1 V, t_r = t_f = 0.5 ns (10% to 90%), measured over 100 k samples.
(6) Peak-to-peak jitter includes jitter due to pulse skew ($t_{sk(p)}$).

PARAMETER MEASUREMENT INFORMATION

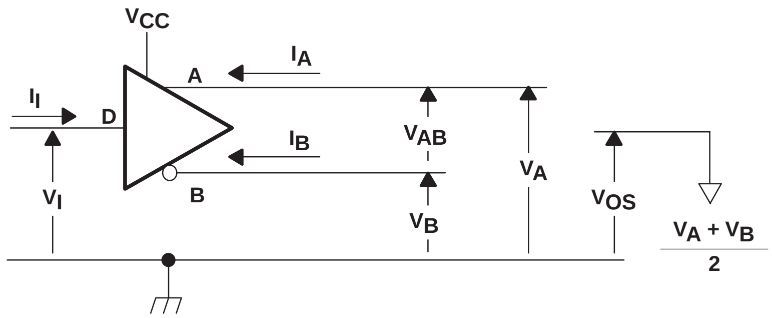
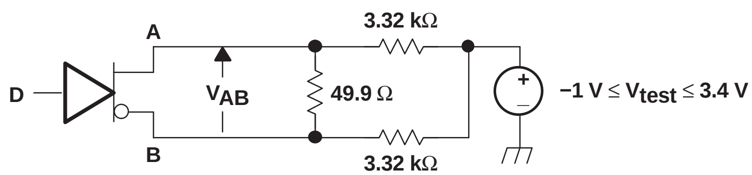
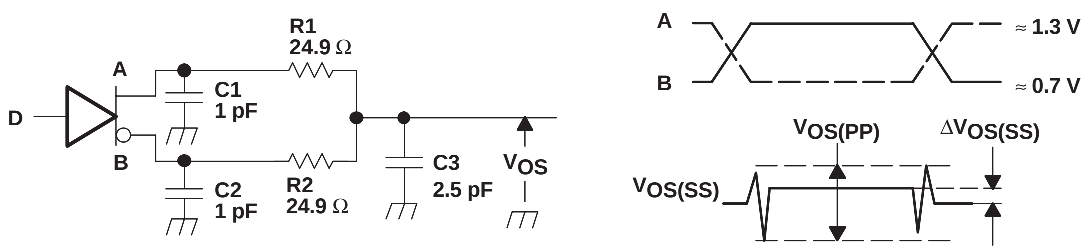


Figure 1. Driver Voltage and Current Definitions



NOTE: All resistors are 1% tolerance.

Figure 2. Differential Output Voltage Test Circuit



NOTES: A. All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, pulse frequency = 1 MHz, duty cycle = 50 ± 5%.
B. C1, C2 and C3 include instrumentation and fixture capacitance within 2 cm of the D.U.T. and are ±20%.
C. R1 and R2 are metal film, surface mount, ±1%, and located within 2 cm of the D.U.T.
D. The measurement of $V_{OS(PP)}$ is made on test equipment with a −3 dB bandwidth of at least 1 GHz.

Figure 3. Test Circuit and Definitions for the Driver Common-Mode Output Voltage

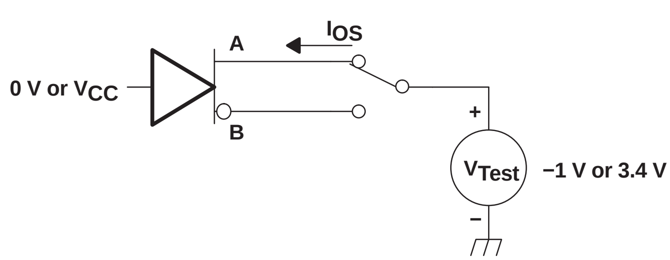
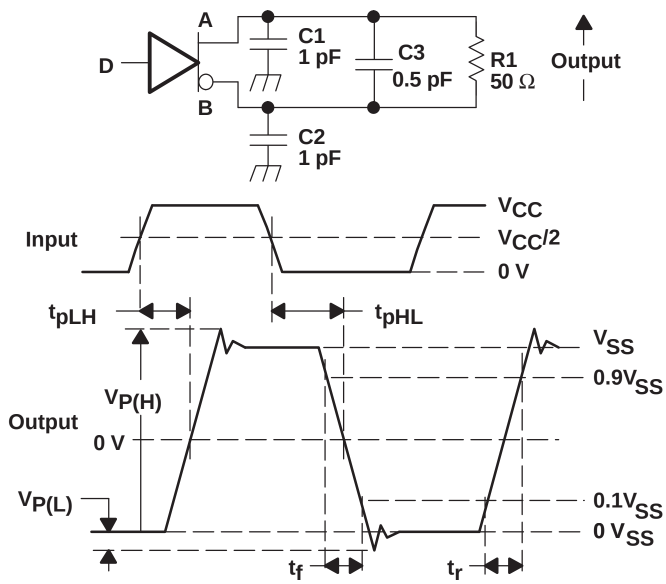


Figure 4. Driver Short-Circuit Test Circuit



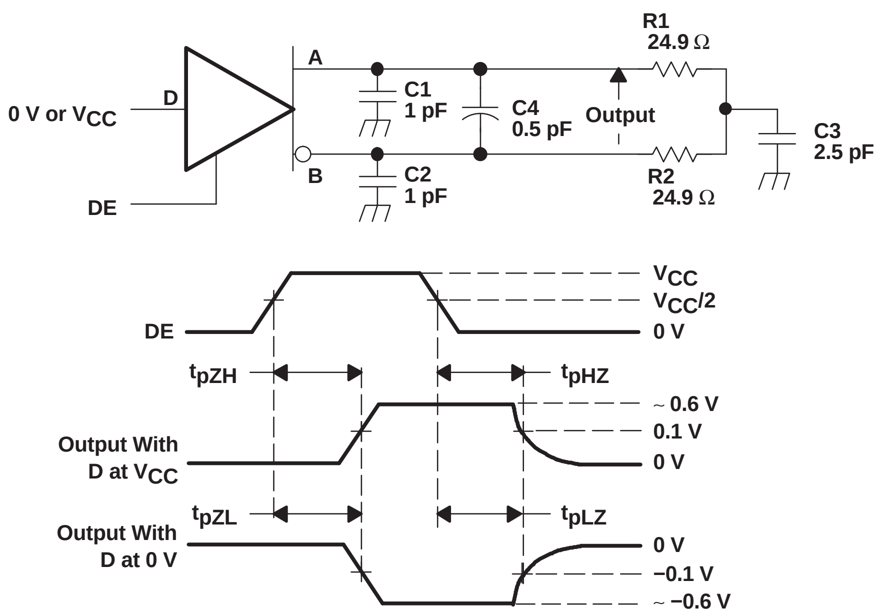
NOTES: A. All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, frequency = 1 MHz, duty cycle = 50 ± 5%.

B. C1, C2, and C3 include instrumentation and fixture capacitance within 2 cm of the D.U.T. and are ±20%.

C. R1 is a metal film, surface mount, and 1% tolerance and located within 2 cm of the D.U.T.

D. The measurement is made on test equipment with a −3 dB bandwidth of at least 1 GHz.

Figure 5. Driver Test Circuit, Timing, and Voltage Definitions for the Differential Output Signal



NOTES: A. All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, frequency = 1 MHz, duty cycle = 50 ± 5%.

B. C1, C2, C3, and C4 includes instrumentation and fixture capacitance within 2 cm of the D.U.T. and are ±20%.

C. R1 and R2 are metal film, surface mount, and 1% tolerance and located within 2 cm of the D.U.T.

D. The measurement is made on test equipment with a −3 dB bandwidth of at least 1 GHz.

Figure 6. Driver Enable and Disable Time Circuit and Definitions

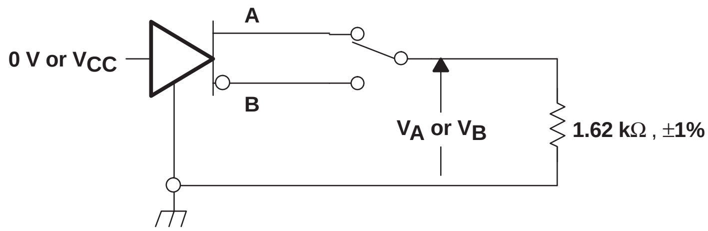
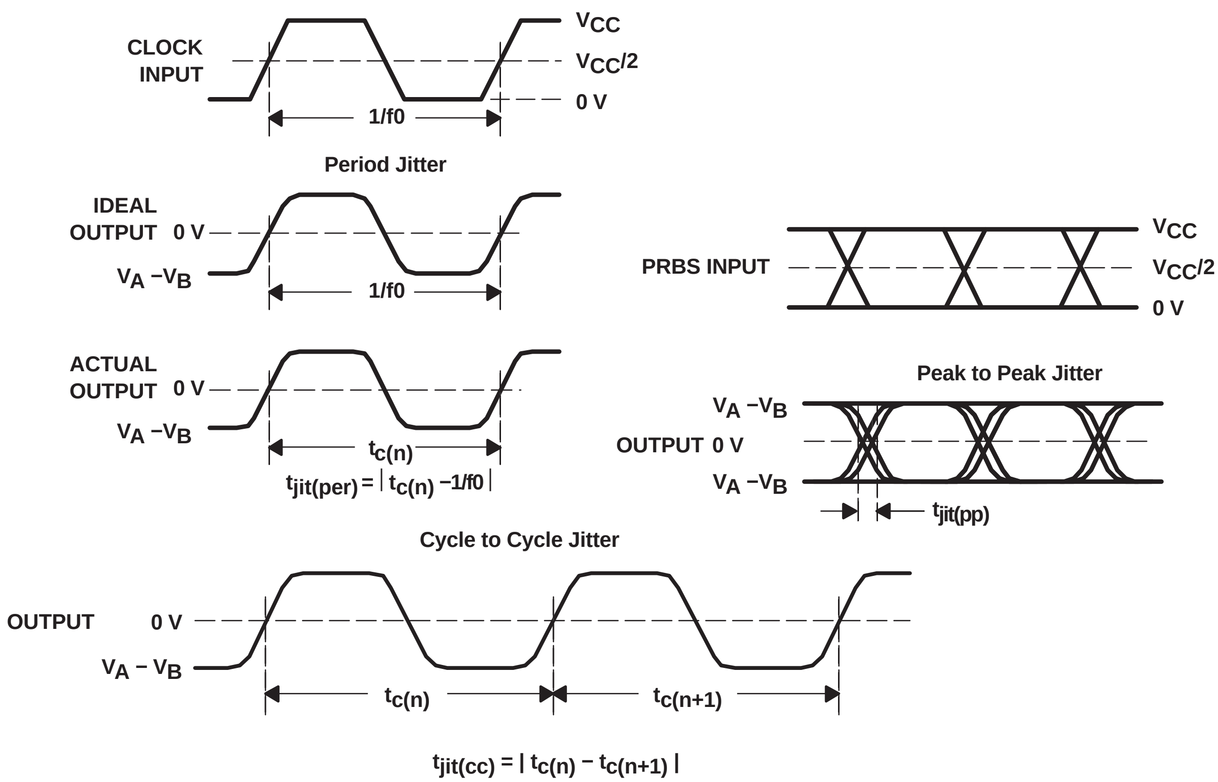


Figure 7. Maximum Steady State Output Voltage



NOTES: A. All input pulses are supplied by an Agilent 8304A Stimulus System with plug-in TBD.
B. The measurement is made on a TEK TDS6604 running TDSJIT3 application software
C. Period jitter and cycle-to-cycle jitter are measured using a 100 MHz 50 ±1% duty cycle clock input.
D. Peak-to-peak jitter and deterministic jitter are measured using a 200 Mbps 2^{15}−1 PRBS input.

Figure 8. Driver Jitter Measurement Waveforms

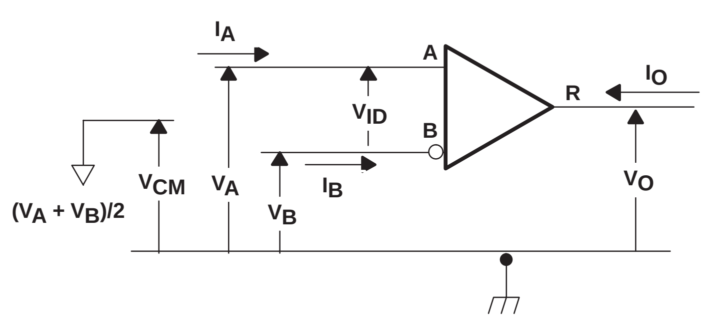


Figure 9. Receiver Voltage and Current Definitions

Table 1. Type-1 Receiver Input Threshold Test Voltages

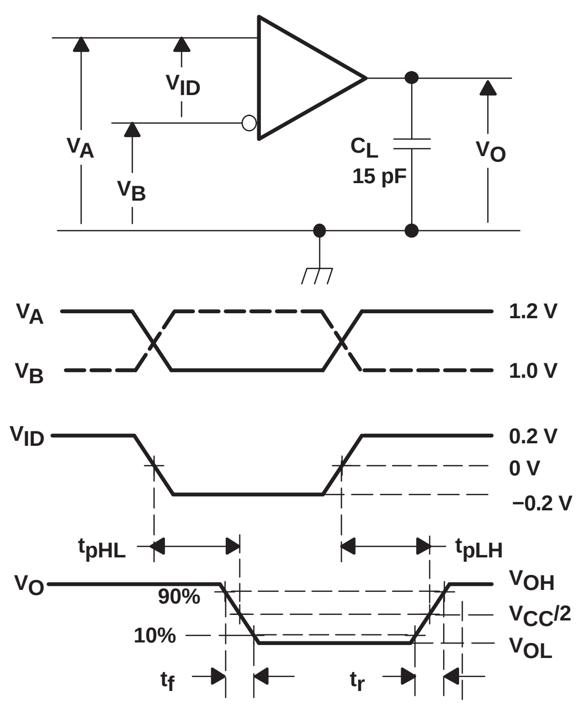
APPLIED VOLTAGES		RESULTING DIFFERENTIAL INPUT VOLTAGE	RESULTING COMMON−MODE INPUT VOLTAGE	RECEIVER OUTPUT
V_{IA}	V_{IB}	V_{ID}	V_{IC}	
2.400	0.000	2.400	1.200	H
0.000	2.400	−2.400	1.200	L
3.400	3.350	0.050	3.375	H
3.350	3.400	−0.050	3.375	L
−1.350	−1.400	0.050	−1.375	H
−1.400	−1.350	−0.050	−1.375	L

NOTE: H= high level, L = low level, output state assumes receiver is enabled ($\overline{RE}$ = L)

Table 2. Type-2 Receiver Input Threshold Test Voltages

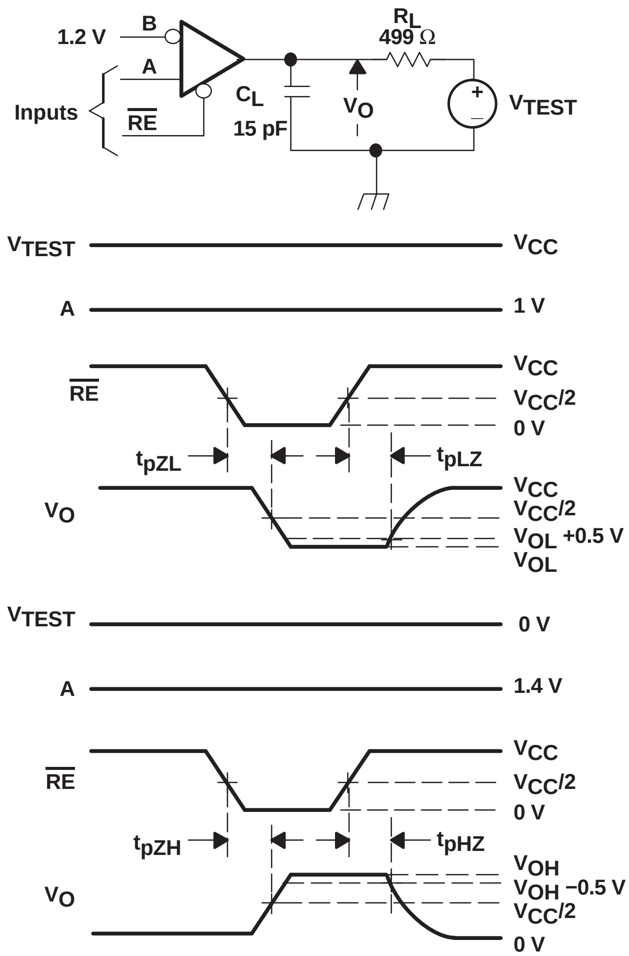
APPLIED VOLTAGES		RESULTING DIFFERENTIAL INPUT VOLTAGE	RESULTING COMMON−MODE INPUT VOLTAGE	RECEIVER OUTPUT
V_{IA}	V_{IB}	V_{ID}	V_{IC}	
2.400	0.000	2.400	1.200	H
0.000	2.400	−2.400	1.200	L
3.400	3.250	0.150	3.325	H
3.400	3.350	0.050	3.375	L
−1.250	−1.400	0.150	−1.325	H
−1.350	−1.400	0.050	−1.375	L

NOTE: H= high level, L = low level, output state assumes receiver is enabled ($\overline{RE}$ = L)



NOTES:A. All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, frequency = 1 MHz, duty cycle = 50 ± 5%. C_L is a combination of a 20%-tolerance, low-loss ceramic, surface-mount capacitor and fixture capacitance within 2 cm of the D.U.T.
B. The measurement is made on test equipment with a −3 dB bandwidth of at least 1 GHz.

Figure 10. Receiver Timing Test Circuit and Waveforms

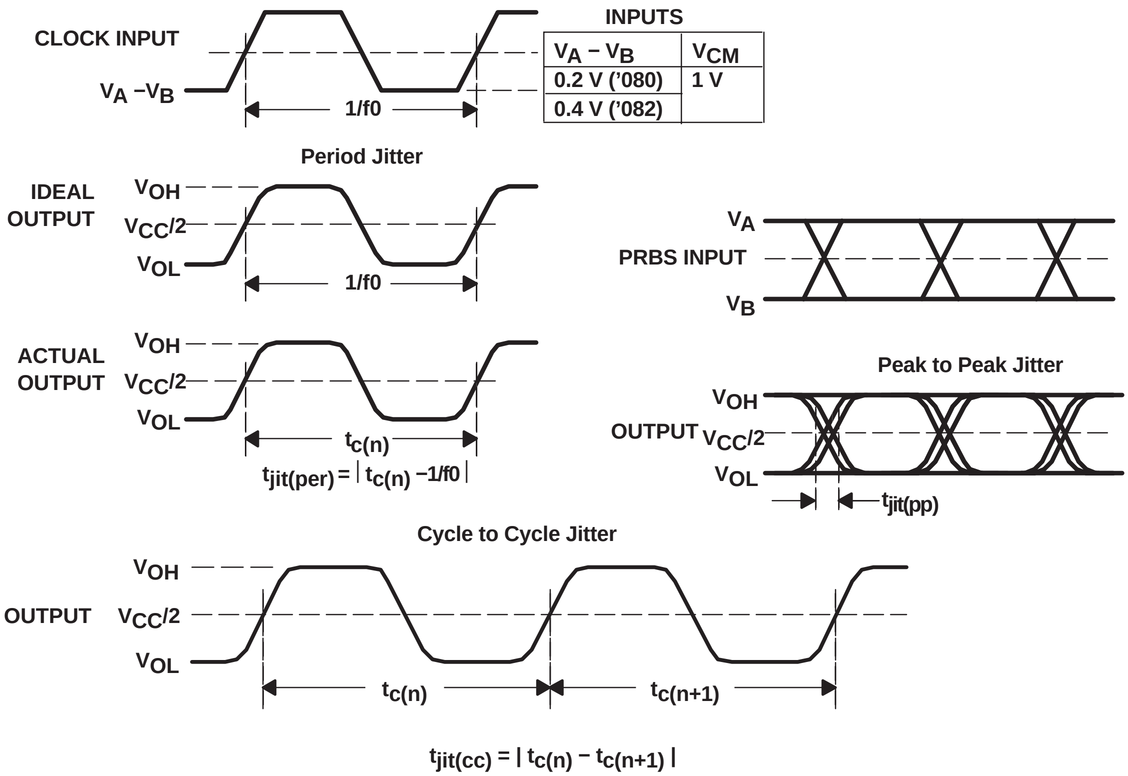


NOTES:A. All input pulses are supplied by a generator having the following characteristics: t_r or t_f ≤ 1 ns, frequency = 1 MHz, duty cycle = 50 ± 5%.

B. R_L is 1% tolerance, metal film, surface mount, and located within 2 cm of the D.U.T.

C. C_L is the instrumentation and fixture capacitance within 2 cm of the DUT and ±20%. The measurement is made on test equipment with a −3 dB bandwidth of at least 1 GHz.

Figure 11. Receiver Enable/Disable Time Test Circuit and Waveforms



NOTES: A. All input pulses are supplied by an Agilent 8304A Stimulus System with plug-in TBD.
B. The measurement is made on a TEK TDS6604 running TDSJIT3 application software
C. Period jitter and cycle-to-cycle jitter are measured using a 100 MHz 50 ±1% duty cycle clock input.
D. Peak-to-peak jitter and deterministic jitter are measured using a 200 Mbps 2^{15}−1 PRBS input.

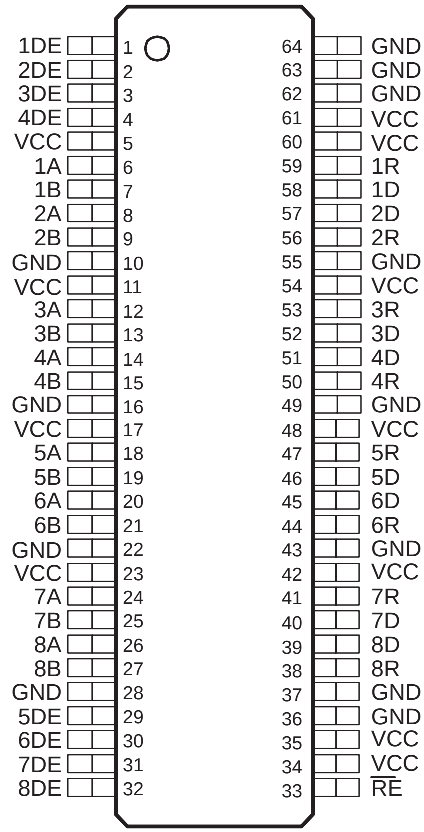
Figure 12. Receiver Jitter Measurement Waveforms

Terminal Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
1D − 8D	58, 57, 52, 51, 46, 45, 40, 39	Input	Data inputs for drivers
1R − 8R	59, 56, 53, 50, 47, 44, 41, 38	Output	Data output for receivers
1A − 8A	6, 8, 12, 14, 18, 20, 24, 26	Bus I/O	M-LVDS bus noninverting input/output
1B − 8B	7, 9, 13, 15, 19, 21, 25, 27	Bus I/O	M-LVDS bus inverting input/output
GND	10, 16, 22, 28, 36, 37, 43, 49, 55, 62, 63, 64	Power	Circuit ground
V_{CC}	5, 11, 17, 23, 34, 35, 42, 48, 54, 60, 61	Power	Supply voltage
$\overline{RE}$	33	Input	Receiver enable, active low, enables all receivers
1DE − 8DE	1, 2, 3, 4, 29, 30, 31, 32	Input	Driver enable, active high, individual enables

PIN ASSIGNMENTS

DGG PACKAGE
(TOP VIEW)



DEVICE FUNCTION TABLE

RECEIVER (080)

INPUTS		OUTPUT
$V_{ID} = V_A - V_B$	$\overline{RE}$	R
$V_{ID} \geq 50$ mV	L	H
-50 mV $< V_{ID} < 50$ mV	L	?
$V_{ID} \leq -50$ mV	L	L
X	H	Z
X	Open	Z
Open Circuit	L	?

RECEIVER (082)

INPUTS		OUTPUT
$V_{ID} = V_A - V_B$	$\overline{RE}$	R
$V_{ID} \geq 150$ mV	L	H
50 mV $< V_{ID} < 150$ mV	L	?
$V_{ID} \leq$ 50 mV	L	L
X	H	Z
X	Open	Z
Open Circuit	L	L

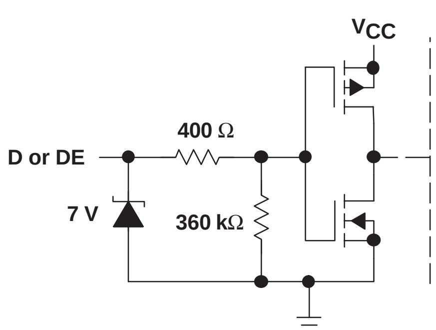
DRIVERS

INPUT	ENABLE	OUTPUTS	
D	DE	A OR Y	B OR Z
L	H	L	H
H	H	H	L
OPEN	H	L	H
X	OPEN	Z	Z
X	L	Z	Z

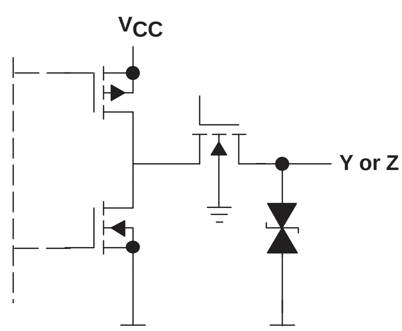
H = high level, L = low level, Z = high impedance, X = Don’t care, ? = indeterminate

EQUIVALENT INPUT AND OUTPUT SCHEMATIC DIAGRAMS

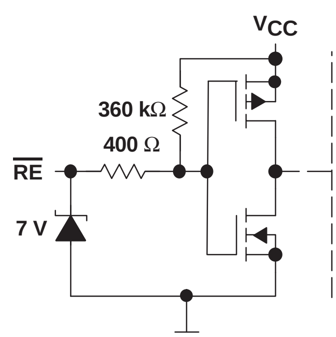
DRIVER INPUT AND DRIVER ENABLE



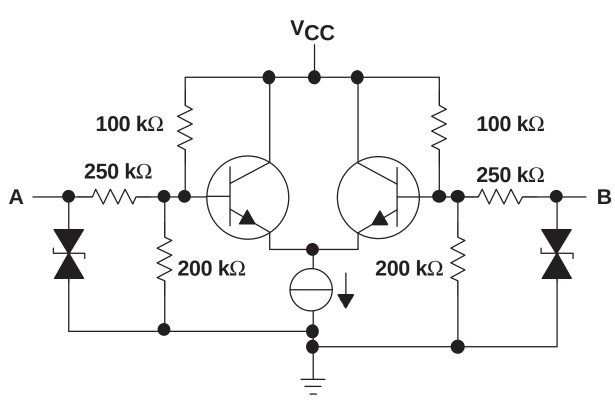
DRIVER OUTPUT



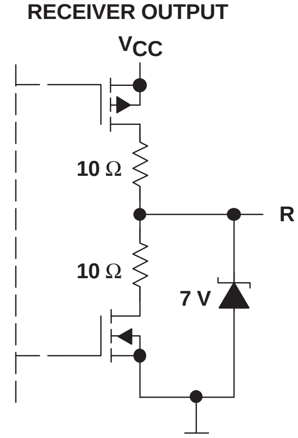
RECEIVER ENABLE



RECEIVER INPUT



RECEIVER OUTPUT



TYPICAL CHARACTERISTICS

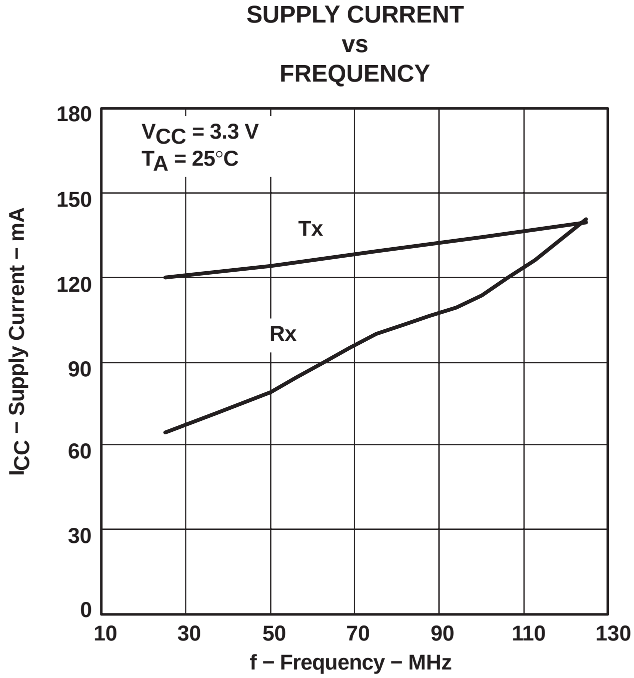


Figure 13

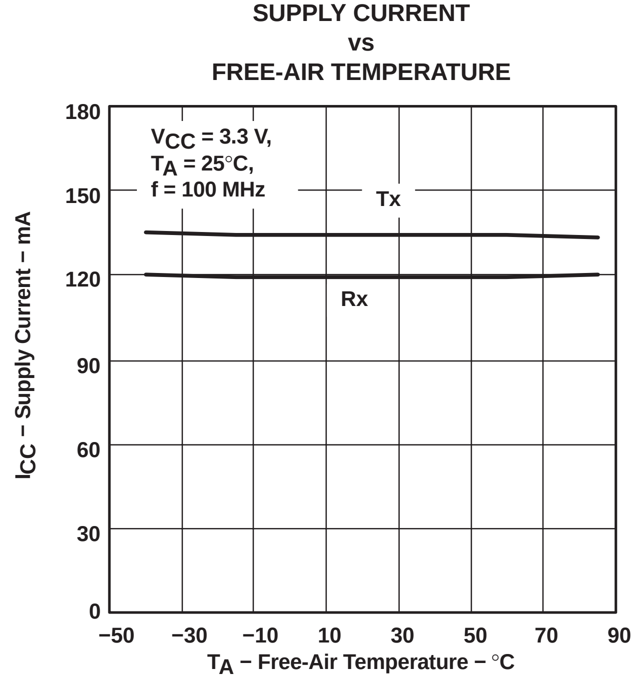


Figure 14

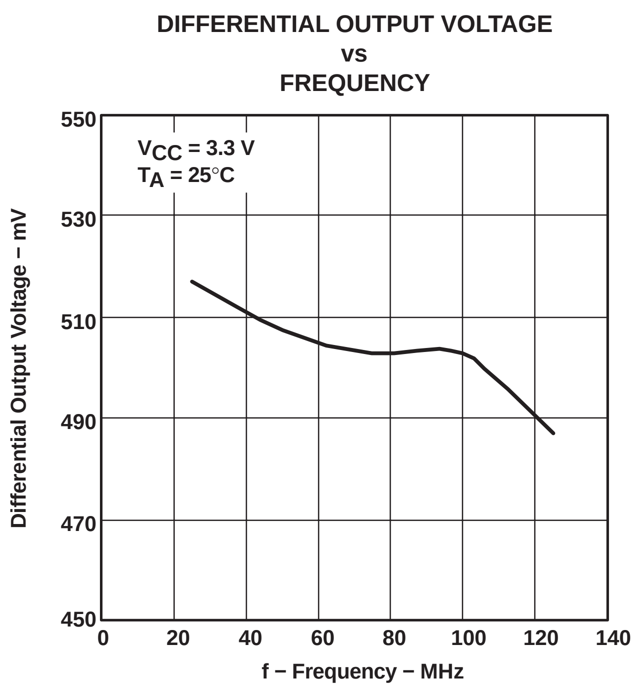


Figure 15

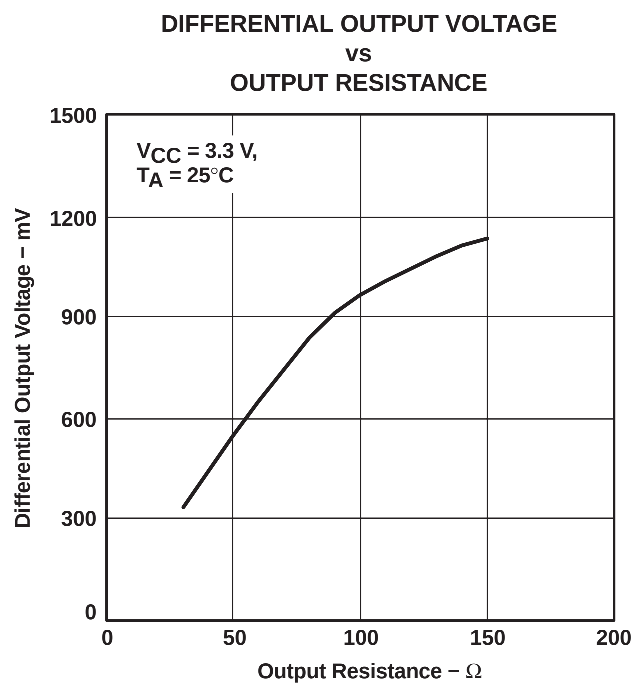


Figure 16

DIFFERENTIAL OUTPUT VOLTAGE
vs
TRACE LENGTH

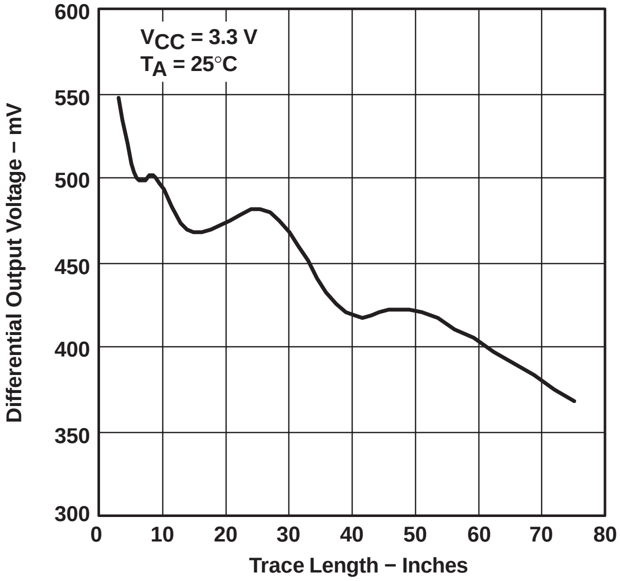


Figure 17

DRIVER PROPAGATION DELAY
vs
FREE-AIR TEMPERATURE

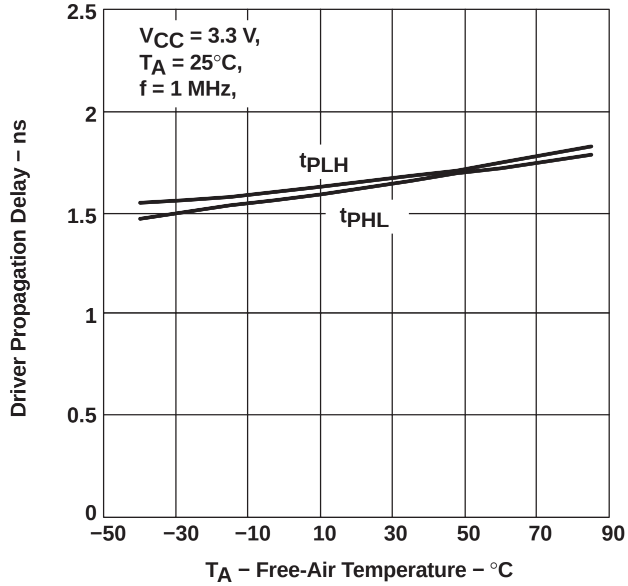


Figure 18

RECEIVER TYPE-1 PROPAGATION DELAY
vs
FREE-AIR TEMPERATURE

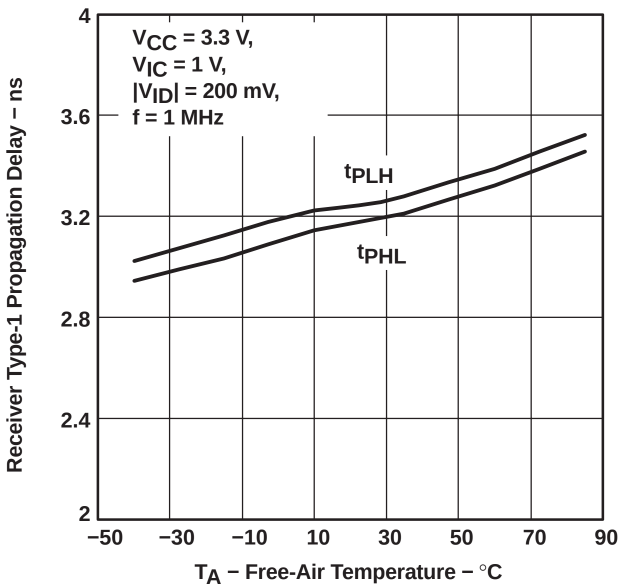


Figure 19

RECEIVER TYPE-2 PROPAGATION DELAY
vs
FREE-AIR TEMPERATURE

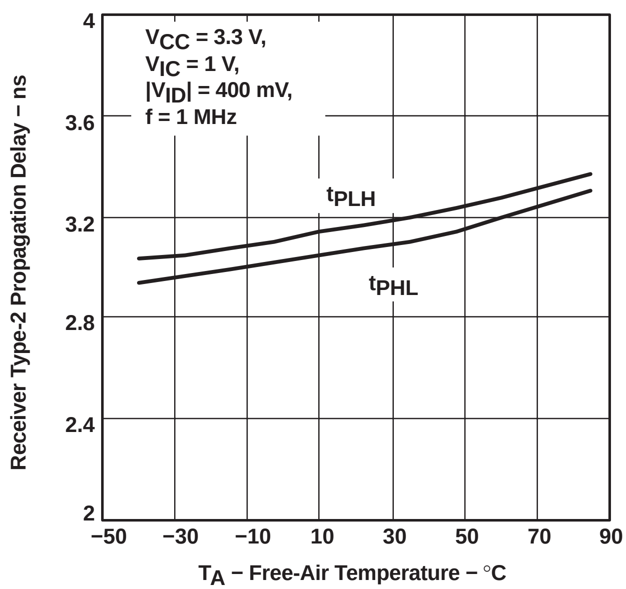


Figure 20

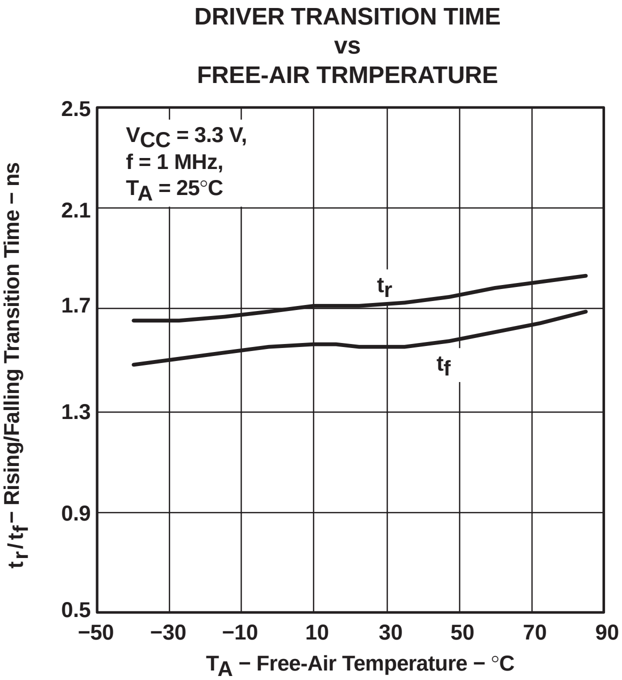


Figure 21

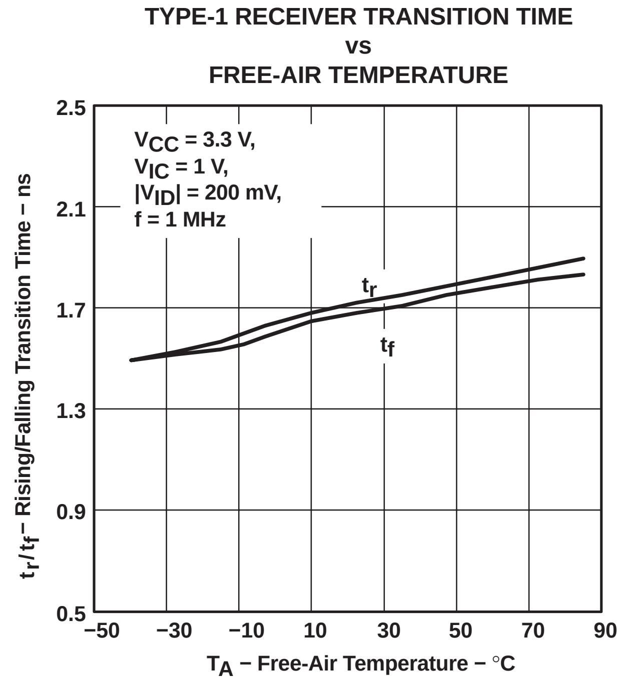


Figure 22

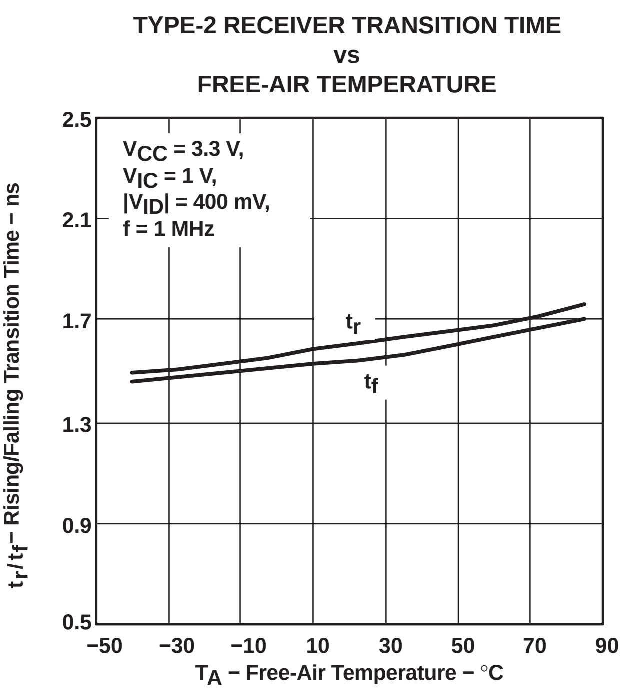


Figure 23

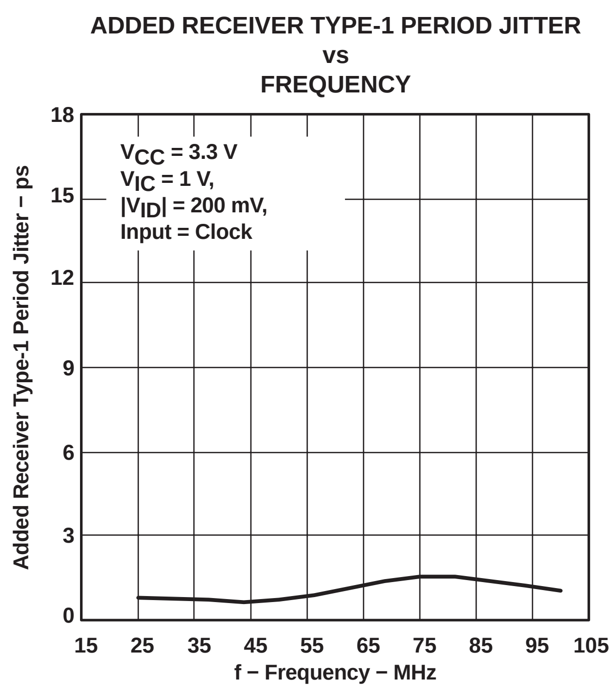


Figure 24

ADDED RECEIVER TYPE-2 PERIOD JITTER
vs
FREQUENCY

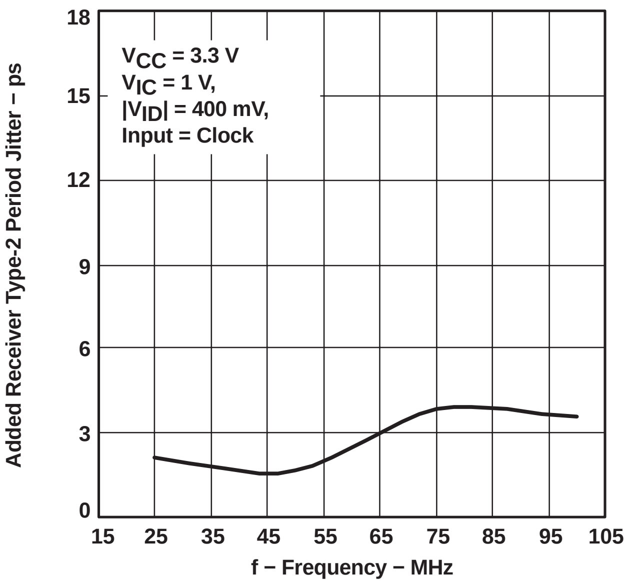


Figure 25

ADDED DRIVER PERIOD JITTER
vs
FREQUENCY

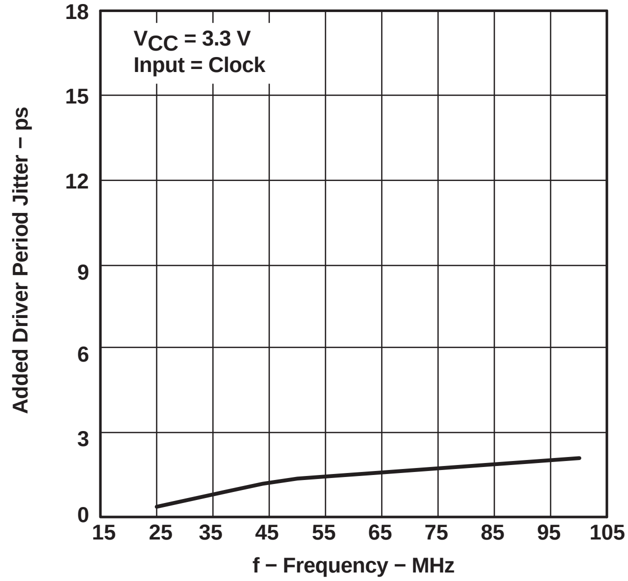


Figure 26

ADDED RECEIVER TYPE-1 CYCLE-TO-CYCLE JITTER
vs
FREQUENCY

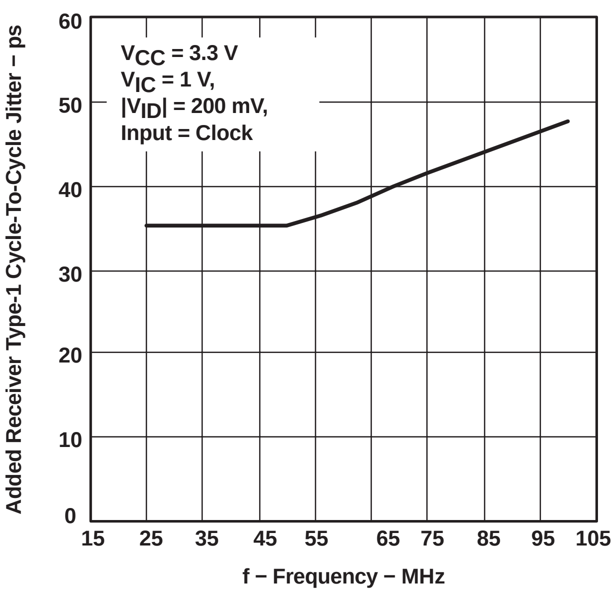


Figure 27

ADDED RECEIVER TYPE-2 CYCLE-TO-CYCLE JITTER
vs
FREQUENCY

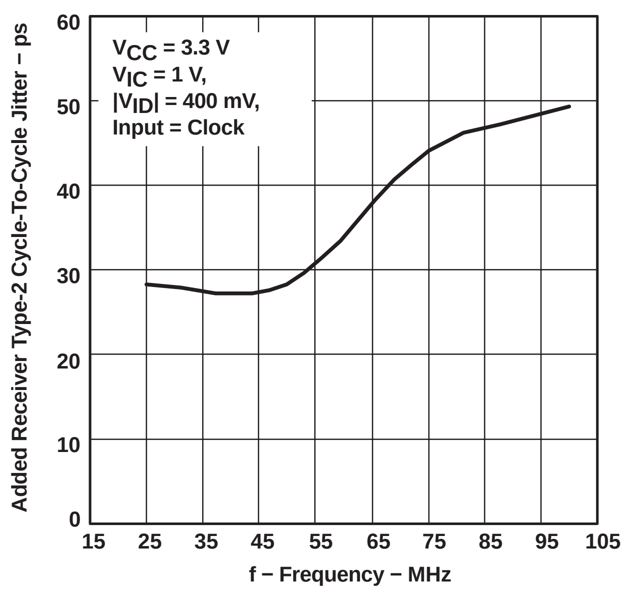


Figure 28

ADDED DRIVER CYCLE-TO-CYCLE JITTER vs FREQUENCY

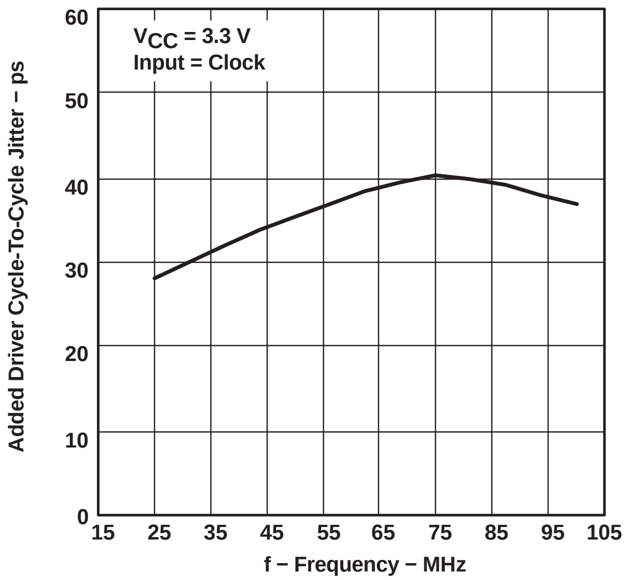


Figure 29

ADDED RECEIVER TYPE-1 DETERMINISTIC JITTER vs DATA RATE

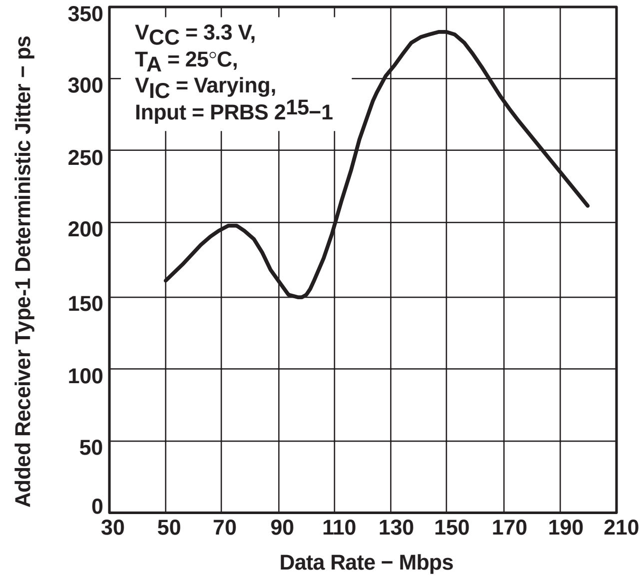


Figure 30

ADDED RECEIVER TYPE-2 DETERMINISTIC JITTER vs DATA RATE

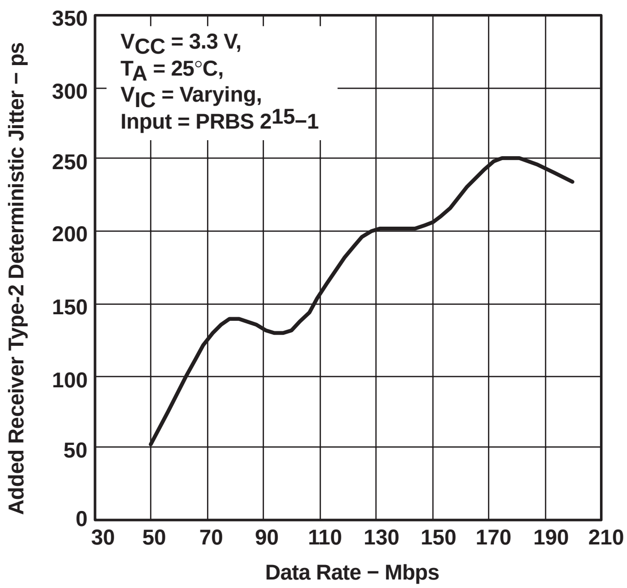


Figure 31

ADDED RECEIVER TYPE-1 PEAK-TO-PEAK JITTER vs DATA RATE

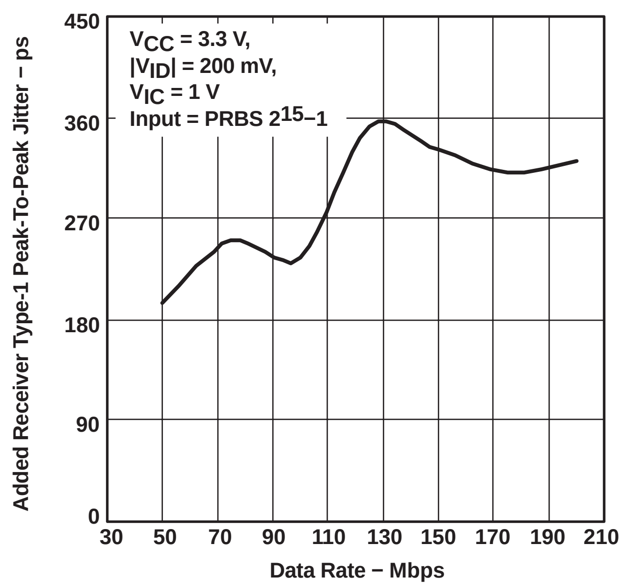


Figure 32

ADDED RECEIVER TYPE-2 PEAK-TO-PEAK JITTER
vs
DATA RATE

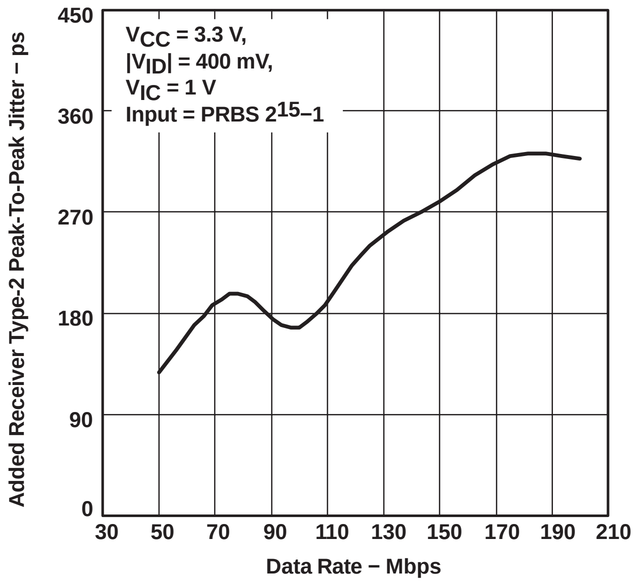


Figure 33

ADDED DRIVER PEAK-TO-PEAK JITTER
vs
DATA RATE

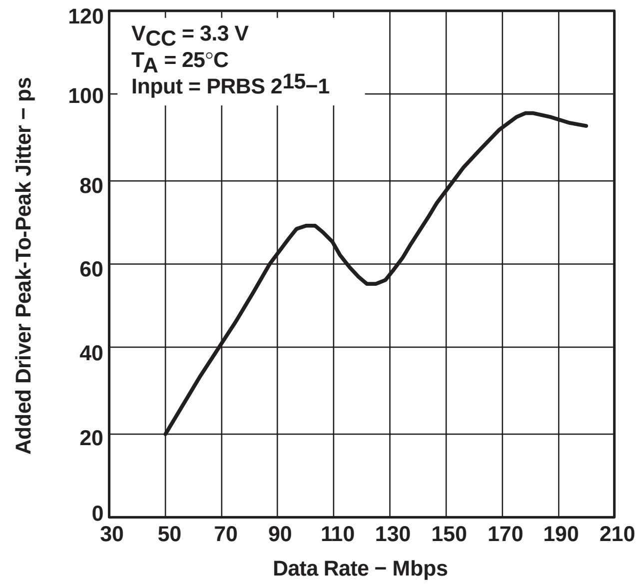


Figure 34

DRIVER OUTPUT EYE PATTERN
200 Mbps, 2^{15}–1 PRBS, V_{CC} = 3.3 V

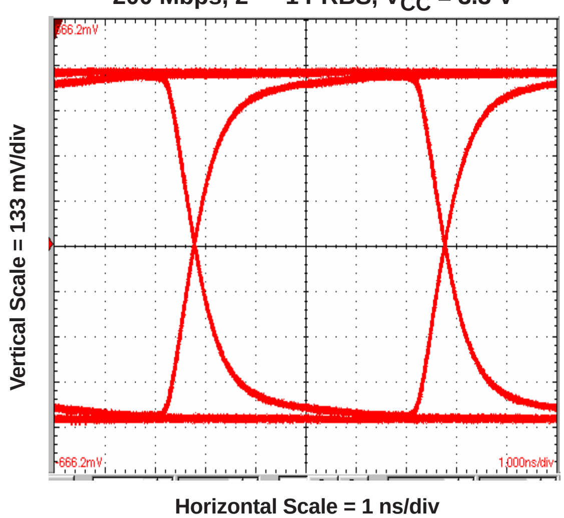


Figure 35

RECEIVER OUTPUT EYE PATTERN
200 Mbps, 2^{15}–1 PRBS, V_{CC} = 3.3 V,
$|V_{ID}|$ = 200 mV, V_{IC} = 1 V

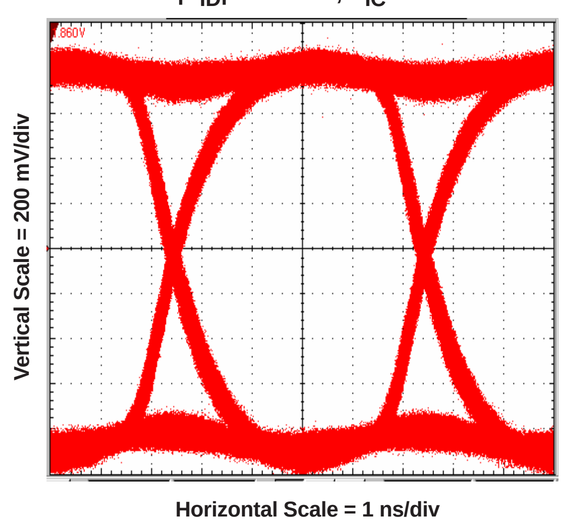


Figure 36

APPLICATION INFORMATION

SOURCE SYNCHRONOUS SYSTEM CLOCK (SSSC)

There are two approaches to transmit data in a synchronous system: centralized synchronous system clock (CSSC) and source synchronous system clock (SSSC). CSSC systems synchronize data transmission between different modules using a clock signal from a centralized source. The key requirement for a CSSC system is for data transmission and reception to complete during a single clock cycle. The maximum operating frequency is the inverse of the shortest clock cycle for which valid data transmission and reception can be ensured. SSSC systems achieve higher operating frequencies by sending clock and data signals together to eliminate the flight time on the transmission media, backplane, or cables. In SSSC systems, the maximum operating frequency is limited by the cumulated skews that can exist between clock and data. The absolute flight time of data on the backplane does not provide a limitation on the operating frequency as it does with CSSC.

The SN65MLVD082 can be designed for interfacing the data and clock to support source synchronous system clock (SSSC) operation. It is specified for transmitting data up to 250 Mbps and clock frequencies up to 125 MHz. The figure below shows an example of a SSSC architecture supported by M-LVDS transceivers. The SN65MLVD206, a single channel transceiver, transmits the main system clock between modules. A retiming unit is then applied to the main system clock to generate a local clock for subsystem synchronization processing. System operating data (or control) and subsystem clock signals are generated from the data processing unit, such as a microprocessor, FPGA, or ASIC, on module 1, and sent to slave modules through the SN65MLVD082. Such design configurations are common while transmitting parallel control data over the backplane with a higher SSSC subsystem clock frequency. The subsystem clock frequency is aligned with the operating frequencies of the data processing unit to synchronize data transmission between different units.

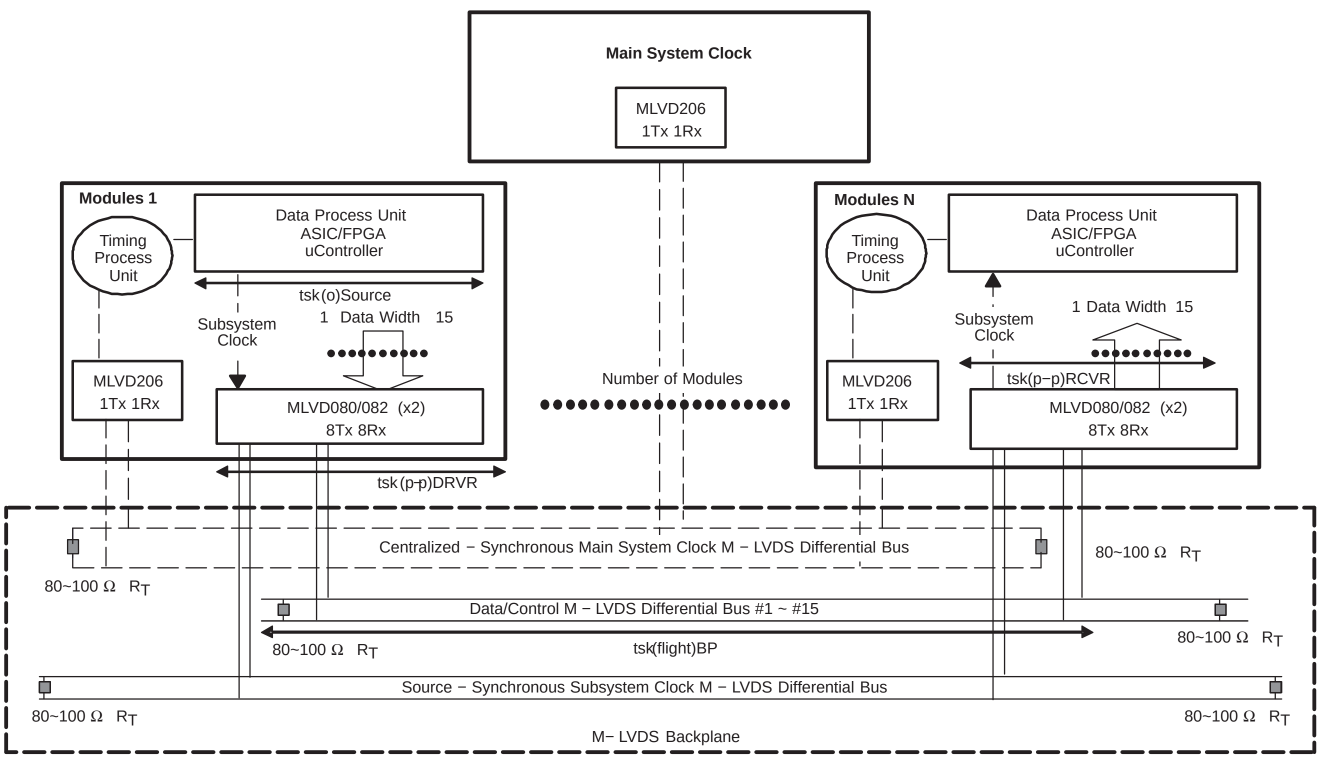


Figure 37. Using Differential M-LVDS to Perform Source Synchronous System Clock Distribution

The maximum SSSC frequencies in a transparent mode can be calculated with the following equation:

$$f_{max(clk)} \leq 1/[\ t_{sk(o)Source} + t_{sk(p-p)DRVR} + t_{sk(flight)BP} + t_{sk(p-p)RCVR}$$

Setup time and hold time on the receiver side are decided by the data processing unit, FPGA, or ASIC in this example. By considering data passes through the transceiver only, the general calculation result is 238 MHz when using the following data:

$t_{sk(o)Source}$ = 2.0 ns	Output skew of data processing unit; any skew between data bits, or clock and data bits
$t_{sk(p-p)DRVR}$ = 0.6 ns	Driver part-to-part skew of the SN65MLVD082
$t_{sk(flight)BP}$ = 0.4 ns	Skew of propagation delay on the backplane between data and clock
$t_{sk(p-p)RCVR}$ = 1.0 ns	Receiver part-to-part skew of the SN65MLVD082

The 238-MHz maximum operating speed calculated above was determined based on data and clock skews only. Another important consideration when calculating the maximum operating speed is output transition time. Transition-time-limited operating speed can be calculated from the following formula:

$$f = 45\% \times \frac{1}{2 \times t_{transition}}$$

Using the typical transition time of the SN65MLVD082 of 1.4 ns, a transition-time-limited operating frequency of 170 MHz can be supported.

In addition to the high operating frequencies of SSSC that can be ensured, the SN65MLVD082 presents other benefits as other M-LVDS bus transceivers can provide:

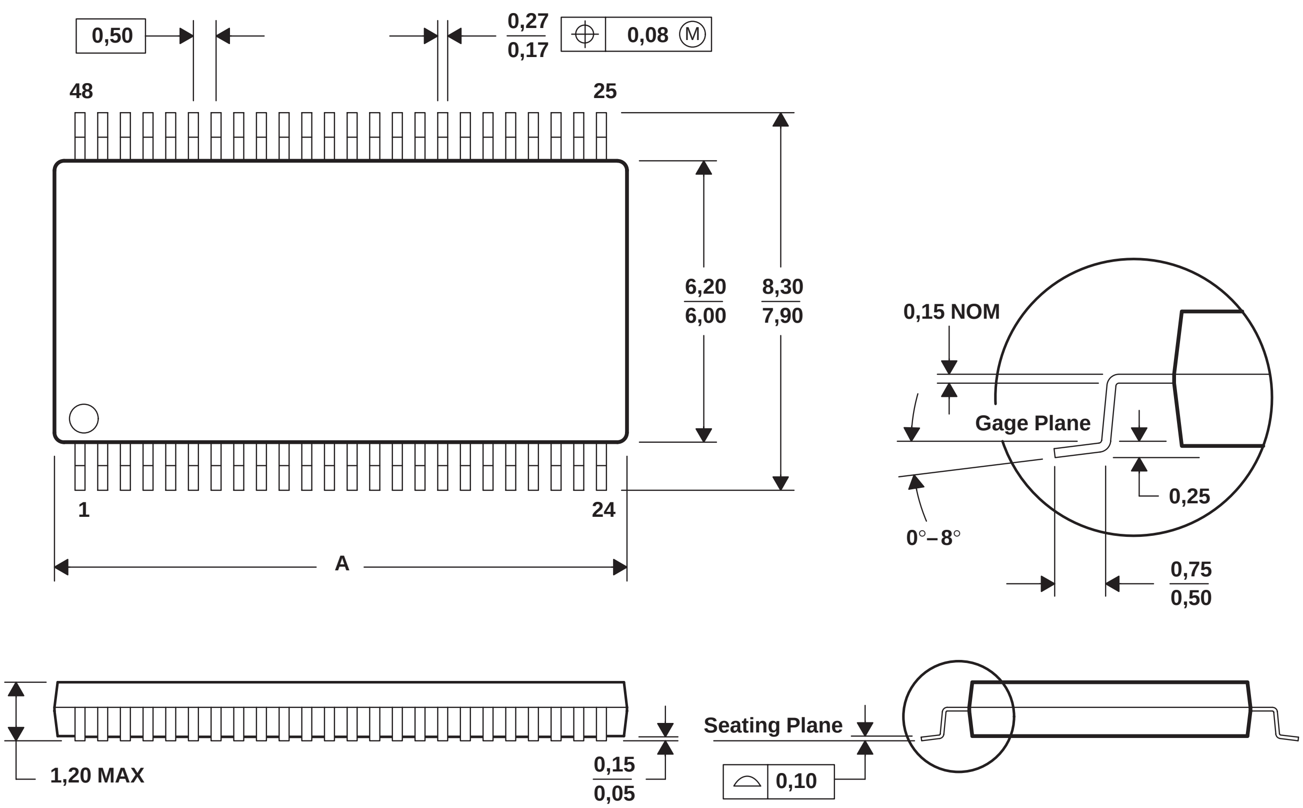
- Robust system operation due to common mode noise cancellation using a low voltage differential receiver
- Low EMI radiation noise due to differential signaling improves signal integrity through the backplane
- A singly terminated transmission line is easy to design and implement
- Low power consumption in both active and idle modes minimizes thermal concerns on each module

In dense backplane design, these benefits are important for improving the performance of the whole system.

A similar result can be achieved with the SN65MLVD080.

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

48 PINS SHOWN



PINS ** / DIM	48	56	64
A MAX	12,60	14,10	17,10
A MIN	12,40	13,90	16,90

4040078 / F 12/97

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

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Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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