Four Output Differential Buffer for PCIe Gen 2 with Spread

ICS9DS400

General Description

The 9DS400 is pin compatible to the 9DB403, but adds the ability to inject spread spectrum onto the incoming differential clock, while maintaining good phase noise.

Recommended Application

DB400 where spread spectrum needs to be added to the incoming clock.

Key Specifications

- Output cycle-cycle jitter < 50ps
- Output to Output skew <50ps
- Phase jitter: PCIe Gen1 < 86ps peak to peak
- Phase jitter: PCIe Gen2 < 3.0/3.1ps rms

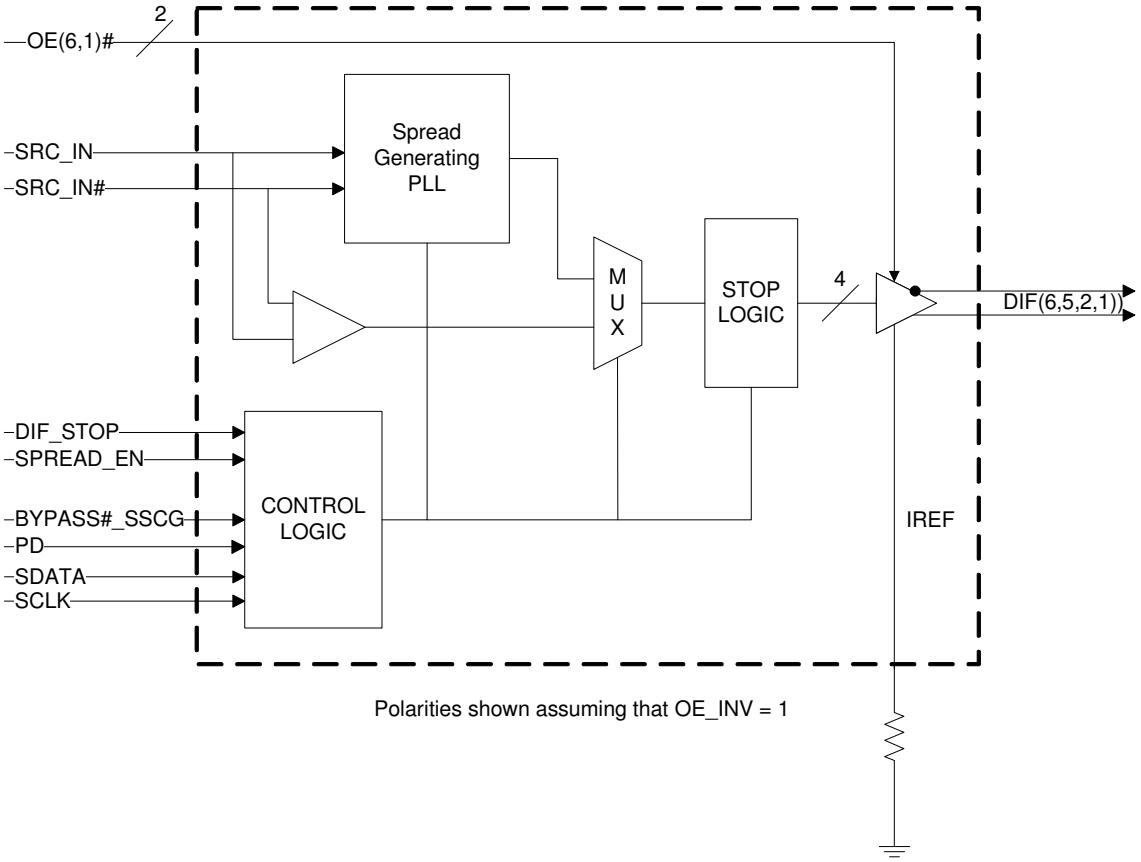
Features/Benefits

- Bypass mode
- Supports undriven differential outputs in PD# and SRC_STOP# modes for power management.

Output Features

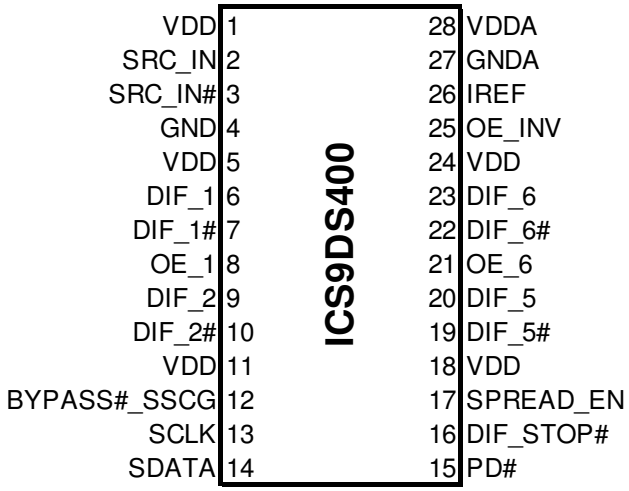
- 4 - 0.7V current-mode differential output pairs.
- Supports Spread Injection mode and fanout mode.
- Two pin selectable down spread amounts: 0.5% and 0.25%.
- 50-110 MHz operation in PLL mode
- 50-400 MHz operation in Bypass mode

Functional Block Diagram



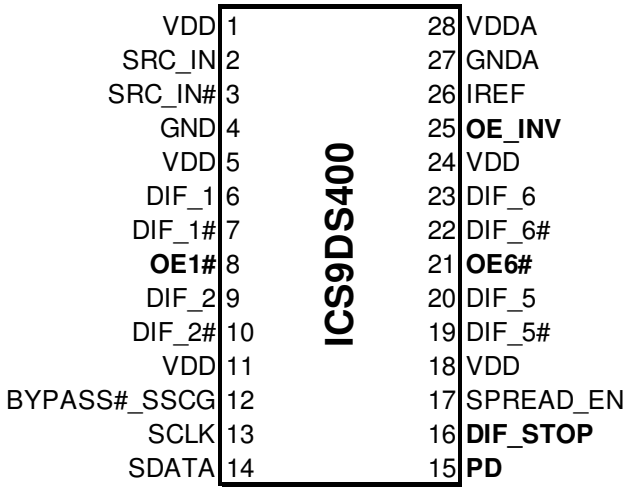
Polarities shown assuming that OE_INV = 1

Pin Configuration



OE_INV = 0

See Pin Description Table for pins w/internal pull up or pull down



OE_INV = 1

See Pin Description Table for pins w/internal pull up or pull down

Power Groups

Pin Number		Description
VDD	GND	
1	4	SRC_IN/SRC_IN#
5,11,18, 24	4	DIF(1,2,5,6)
N/A	27	IREF
28	27	Analog VDD & GND for PLL core

Pin Description for OE_INV = 0

PIN #	PIN NAME	PIN TYPE	DESCRIPTION	INTERNAL PULL UP OR PULL DOWN?
1	VDD	PWR	Power supply, nominal 3.3V	N/A
2	SRC_IN	IN	0.7 V Differential SRC TRUE input	N/A
3	SRC_IN#	IN	0.7 V Differential SRC COMPLEMENTARY input	N/A
4	GND	PWR	Ground pin.	N/A
5	VDD	PWR	Power supply, nominal 3.3V	N/A
6	DIF_1	OUT	0.7V differential true clock output	N/A
7	DIF_1#	OUT	0.7V differential Complementary clock output	N/A
8	OE_1	IN	Active high input for enabling output 1. 0 = tri-state outputs, 1= enable outputs	PULL UP
9	DIF_2	OUT	0.7V differential true clock output	N/A
10	DIF_2#	OUT	0.7V differential Complementary clock output	N/A
11	VDD	PWR	Power supply, nominal 3.3V	N/A
12	BYPASS#_SSCG	IN	Input to select Bypass(fan-out) or SSCG (PLL) mode 0 = Bypass mode, 1= SSCG mode	PULL UP
13	SCLK	IN	Clock pin of SMBus circuitry, 5V tolerant.	N/A
14	SDATA	I/O	Data pin for SMBus circuitry, 3.3V tolerant.	N/A
15	PD#	IN	Asynchronous active low input pin used to power down the device. The internal clocks are disabled and the VCO and the crystal osc. (if any) are stopped.	PULL UP
16	DIF_STOP#	IN	Active low input to stop differential output clocks.	PULL UP
17	SPREAD_EN	IN	Asynchronous, active high input to enable spread spectrum functionality.	PULL UP
18	VDD	PWR	Power supply, nominal 3.3V	N/A
19	DIF_5#	OUT	0.7V differential Complementary clock output	N/A
20	DIF_5	OUT	0.7V differential true clock output	N/A
21	OE_6	IN	Active high input for enabling output 6. 0 = tri-state outputs, 1= enable outputs	PULL UP
22	DIF_6#	OUT	0.7V differential Complementary clock output	N/A
23	DIF_6	OUT	0.7V differential true clock output	N/A
24	VDD	PWR	Power supply, nominal 3.3V	N/A
25	OE_INV	IN	This latched input selects the polarity of the OE pins. 0 = OE pins active high, 1 = OE pins active low (OE#)	N/A
26	IREF	OUT	This pin establishes the reference current for the differential current-mode output pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current. 475 ohms is the standard value.	N/A
27	GNDA	PWR	Ground pin for the PLL core.	N/A
28	VDDA	PWR	3.3V power for the PLL core.	N/A

Pin Description for OE_INV = 1

PIN #	PIN NAME	PIN TYPE	DESCRIPTION	INTERNAL PULL UP OR PULL DOWN?
1	VDD	PWR	Power supply, nominal 3.3V	N/A
2	SRC_IN	IN	0.7 V Differential SRC TRUE input	N/A
3	SRC_IN#	IN	0.7 V Differential SRC COMPLEMENTARY input	N/A
4	GND	PWR	Ground pin.	N/A
5	VDD	PWR	Power supply, nominal 3.3V	N/A
6	DIF_1	OUT	0.7V differential true clock output	N/A
7	DIF_1#	OUT	0.7V differential Complementary clock output	N/A
8	OE1#	IN	Active low input for enabling DIF pair 1. 1 = tri-state outputs, 0 = enable outputs	PULL UP
9	DIF_2	OUT	0.7V differential true clock output	N/A
10	DIF_2#	OUT	0.7V differential Complementary clock output	N/A
11	VDD	PWR	Power supply, nominal 3.3V	N/A
12	BYPASS#_SSCG	IN	Input to select Bypass(fan-out) or SSCG (PLL) mode 0 = Bypass mode, 1= SSCG mode	PULL UP
13	SCLK	IN	Clock pin of SMBus circuitry, 5V tolerant.	N/A
14	SDATA	I/O	Data pin for SMBus circuitry, 3.3V tolerant.	N/A
15	PD	IN	Asynchronous active high input pin used to power down the device. The internal clocks are disabled and the VCO is stopped.	PULL UP
16	DIF_STOP	IN	Active High input to stop differential output clocks.	PULL UP
17	SPREAD_EN	IN	Asynchronous, active high input to enable spread spectrum functionality.	PULL UP
18	VDD	PWR	Power supply, nominal 3.3V	N/A
19	DIF_5#	OUT	0.7V differential Complementary clock output	N/A
20	DIF_5	OUT	0.7V differential true clock output	N/A
21	OE6#	IN	Active low input for enabling DIF pair 6. 1 = tri-state outputs, 0 = enable outputs	PULL UP
22	DIF_6#	OUT	0.7V differential Complementary clock output	N/A
23	DIF_6	OUT	0.7V differential true clock output	N/A
24	VDD	PWR	Power supply, nominal 3.3V	N/A
25	OE_INV	IN	This latched input selects the polarity of the OE pins. 0 = OE pins active high, 1 = OE pins active low (OE#)	N/A
26	IREF	OUT	This pin establishes the reference current for the differential current-mode output pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current. 475 ohms is the standard value.	N/A
27	GNDA	PWR	Ground pin for the PLL core.	N/A
28	VDDA	PWR	3.3V power for the PLL core.	N/A

Absolute Max

Symbol	Parameter	Min	Max	Units
VDD	3.3V Supply Voltage		4.6	V
V_{IL}	Input Low Voltage	GND-0.5		V
V_{IH}	Input High Voltage		V_{DD}+0.5V	V
Ts	Storage Temperature	-65	150	°C
Tcase	Case Temperature		115	°C
ESD prot	Input ESD protection human body model	2000		V

Electrical Characteristics - Input/Supply/Common Output Parameters

T_A =Over the Specified Operating Range; V_{DD} = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Input High Voltage	V_{IH}	3.3 V +/-5%	2		V_{DD} + 0.3	V	1
Input Low Voltage	V_{IL}	3.3 V +/-5%	GND - 0.3		0.8	V	1
Input High Current	I_{IH}	V_{IN} = V_{DD}	-5		5	uA	1
Input Low Current	I_{IL1}	V_{IN} = 0 V; Inputs with no pull-up resistors	-5			uA	1
	I_{IL2}	V_{IN} = 0 V; Inputs with pull-up resistors	-200			uA	1
Operating Supply Current	$I_{DD3.3OP}$	Full Active, C_L = Full load;			125	mA	1
Powerdown Current	$I_{DD3.3PD}$	all diff pairs driven			30	mA	1
		all differential pairs tri-stated			6	mA	1
Input Frequency	F_{iPLL}	PCIe Mode (Bypass#/PLL= 1)	90	100.00	110	MHz	1
	$F_{iBYPASS}$	Bypass Mode ((Bypass#/PLL= 0)	33		400	MHz	1
Pin Inductance	L_{pin}				7	nH	1
Capacitance	C_{IN}	Logic Inputs, except SRC_IN	1.5		5	pF	1
	C_{INSRC_IN}	SRC_IN differential clock inputs	1.5		2.7	pF	1,4
	C_{OUT}	Output pin capacitance			6	pF	1
Clk Stabilization	T_{STAB}	From V_{DD} Power-Up and after input clock stabilization or de-assertion of PD# to 1st clock			1	ms	1,2
SS Modulation Frequency	f_{MOD}	Assuming 100 MHz input (Triangular Modulation)	30	32.000	33	kHz	1
OE# Latency	$t_{LATOE\#}$	DIF start after OE# assertion DIF stop after OE# deassertion	1		3	cycles	1,3
Tdrive_PD#	t_{DRVPD}	DIF output enable after PD# de-assertion			300	us	1,3
Tfall	t_F	Fall time of PD# and SRC_STOP#			5	ns	1
Trise	t_R	Rise time of PD# and SRC_STOP#			5	ns	2
SMBus Voltage	V_{MAX}	Maximum input voltage			5.5	V	1
Low-level Output Voltage	V_{OL}	@ I_{PULLUP}			0.4	V	1
Current sinking at V_{OL}	I_{PULLUP}		4			mA	1
SCLK/SDATA Clock/Data Rise Time	t_{RSMB}	(Max VIL - 0.15) to (Min VIH + 0.15)			1000	ns	1
SCLK/SDATA Clock/Data Fall Time	t_{FSMB}	(Min VIH + 0.15) to (Max VIL - 0.15)			300	ns	1
SMBus Operating Frequency	f_{MAXSMB}	Maximum SMBus operating frequency			100	kHz	1,5

[1]Guaranteed by design and characterization, not 100% tested in production.

[2]See timing diagrams for timing requirements.

[3]Time from deassertion until outputs are >200 mV

[4]SRC_IN input

[5]The differential input clock must be running for the SMBus to be active

Electrical Characteristics - Differential Clock Input Parameters

TA =Over the Specified Operating Range; VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Input High Voltage - DIF_IN	V_{IHDIF}	Differential inputs (single-ended measurement)	600	800	1150	mV	1
Input Low Voltage - DIF_IN	V_{ILDIF}	Differential inputs (single-ended measurement)	V_{SS} - 300	0	300	mV	1
Input Common Mode Voltage - DIF_IN	V_{COM}	Common Mode Input Voltage	300		1000	mV	1
Input Amplitude - DIF_IN	V_{SWING}	Peak to Peak value	300		1450	mV	1
Input Slew Rate - DIF_IN	dv/dt	Measured differentially	0.4		8	V/ns	1,2
Input Leakage Current	I_{IN}	$V_{IN} = V_{DD}$, V_{IN} = GND	-5		5	uA	1
Input Duty Cycle	d_{tin}	Measurement from differential wavefrom	45		55	%	1
Input Jitter - Cycle to Cycle	J_{DIFIn}	Differential Measurement	0		125	ps	1

[1] Guaranteed by design and characterization, not 100% tested in production.

[2]Slew rate measured through Vswing min centered around differential zero

Electrical Characteristics - DIF 0.7V Current Mode Differential Pair

TA =Over the Specified Operating Range; VDD = 3.3 V +/-5%; C_L =2pF, R_S=33Ω, R_P=49.9Ω, R_{REF}=475Ω

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Current Source Output Impedance	Zo[1]		3000			Ω	1
Voltage High	VHigh	Statistical measurement on single ended signal using oscilloscope math function.	660		850	mV	1,2
Voltage Low	VLow		-150		150		1,2
Max Voltage	Vovs	Measurement on single ended signal using absolute value.			1150	mV	1
Min Voltage	Vuds		-300				1
Crossing Voltage (abs)	Vcross(abs)		250		550	mV	1
Crossing Voltage (var)	d-Vcross	Variation of crossing over all edges			140	mV	1
Rise Time	t_r	V_{OL} = 0.175V, V_{OH} = 0.525V	175		700	ps	1
Fall Time	t_f	V_{OH} = 0.525V V_{OL} = 0.175V	175		700	ps	1
Rise Time Variation	d-t_r				125	ps	1
Fall Time Variation	d-t_f				125	ps	1
Duty Cycle	d_{t3}	Measurement from differential wavefrom	45		55	%	1
Skew, Input to Output	t_{pdBYP}	Bypass Mode, V_T = 50%	2500		4500	ps	1
	t_{pdPLL}	PLL Mode V_T = 50%, Spread Off	-250		250	ps	1
Skew, Output to Output	t_{sk3}	V_T = 50%			50	ps	1
Jitter, Cycle to cycle	$t_{jcyc-cyc}$	PLL mode			50	ps	1,3
		Additive Jitter in Bypass Mode			50	ps	1,3
Jitter, Phase	$t_{jphaseBYP}$	PCIe Gen1 phase jitter (Additive in Bypass Mode)			10	ps (pk2pk)	1,4,5
		PCIe Gen 2 Low Band phase jitter (Additive in Bypass Mode)			0.1	ps (rms)	1,4,5
		PCIe Gen 2 High Band phase jitter (Additive in Bypass Mode)			0.5	ps (rms)	1,4,5
	$t_{jphasePLL}$	PCIe Gen 1 phase jitter			86	ps (pk2pk)	1,4,5
		PCIe Gen 2 Low Band phase jitter			3	ps (rms)	1,4,5
		PCIe Gen 2 High Band phase jitter			3.1	ps (rms)	1,4,5

[1]Guaranteed by design and characterization, not 100% tested in production.

[2] $I_{REF} = V_{DD}/(3xR_R)$. For R_R = 475Ω (1%), I_{REF} = 2.32mA. I_{OH} = 6 x I_{REF} and V_{OH} = 0.7V @ Z_O=50Ω.

3 Measured from differential waveform

[4] See http://www.pcisig.com for complete specs

[5] Device driven by 932S421C or equivalent.

Clock Periods Differential Outputs with Spread Spectrum Enabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock		
Symbol		Lg-	-SSC	-ppm error	0ppm	+ ppm error	+SSC	Lg+		
Definition		Absolute Period	Short-term Average	Long-Term Average	Period	Long-Term Average	Short-term Average	Period		
		Minimum Absolute Period	Minimum Absolute Period	Minimum Absolute Period	Nominal	Maximum	Maximum	Maximum	Units	Notes
Signal Name	DIF 100	9.87400	9.99900	9.99900	10.00000	10.00100	10.05130	10.17630	ns	1,2,3
	DIF 133	7.41425	7.49925	7.49925	7.50000	7.50075	7.53845	7.62345	ns	1,2,4
	DIF 166	5.91440	5.99940	5.99940	6.00000	6.00060	6.03076	6.11576	ns	1,2,4
	DIF 200	4.91450	4.99950	4.99950	5.00000	5.00050	5.02563	5.11063	ns	1,2,4
	DIF 266	3.66463	3.74963	3.74963	3.75000	3.75038	3.76922	3.85422	ns	1,2,4
	DIF 333	2.91470	2.99970	2.99970	3.00000	3.00030	3.01538	3.10038	ns	1,2,4
	DIF 400	2.41475	2.49975	2.49975	2.50000	2.50025	2.51282	2.59782	ns	1,2,4

Clock Periods Differential Outputs with Spread Spectrum Disabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock		
Symbol		Lg-	-SSC	-ppm error	0ppm	+ ppm error	+SSC	Lg+		
Definition		Absolute Period	Short-term Average	Long-Term Average	Period	Long-Term Average	Short-term Average	Period		
		Minimum Absolute Period	Minimum Absolute Period	Minimum Absolute Period	Nominal	Maximum	Maximum	Maximum	Units	Notes
Signal Name	DIF 100	9.87400		9.99900	10.00000	10.00100		10.17630	ns	1,2,3
	DIF 133	7.41425		7.49925	7.50000	7.50075		7.62345	ns	1,2,4
	DIF 166	5.91440		5.99940	6.00000	6.00060		6.11576	ns	1,2,4
	DIF 200	4.91450		4.99950	5.00000	5.00050		5.11063	ns	1,2,4
	DIF 266	3.66463		3.74963	3.75000	3.75038		3.85422	ns	1,2,4
	DIF 333	2.91470		2.99970	3.00000	3.00030		3.10038	ns	1,2,4
	DIF 400	2.41475		2.49975	2.50000	2.50025		2.59782	ns	1,2,4

[1]Guaranteed by design and characterization, not 100% tested in production.

[2] All Long Term Accuracy specifications are guaranteed with the assumption that the input clock complies with CK409/CK410B/CK505 accuracy requirements. The 9DS400/800 itself does not contribute to ppm error.

[3] Driven by SRC output of main clock, PLL or Bypass mode

[4] Driven by CPU output of CK410B/CK505 main clock, **Bypass mode only**

SRC Reference Clock			
Common Recommendations for Differential Routing	Dimension or Value	Unit	Figure
L1 length, route as non-coupled 50ohm trace	0.5 max	inch	1
L2 length, route as non-coupled 50ohm trace	0.2 max	inch	1
L3 length, route as non-coupled 50ohm trace	0.2 max	inch	1
Rs	33	ohm	1
Rt	49.9	ohm	1

Down Device Differential Routing			
L4 length, route as coupled microstrip 100ohm differential trace	2 min to 16 max	inch	1
L4 length, route as coupled stripline 100ohm differential trace	1.8 min to 14.4 max	inch	1

Differential Routing to PCI Express Connector			
L4 length, route as coupled microstrip 100ohm differential trace	0.25 to 14 max	inch	2
L4 length, route as coupled stripline 100ohm differential trace	0.225 min to 12.6 max	inch	2

Figure 1: Down Device Routing

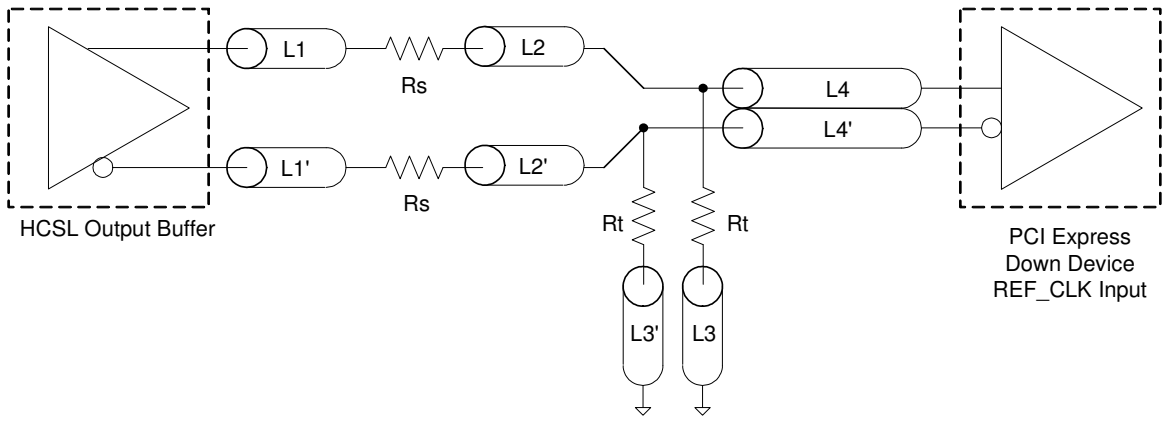
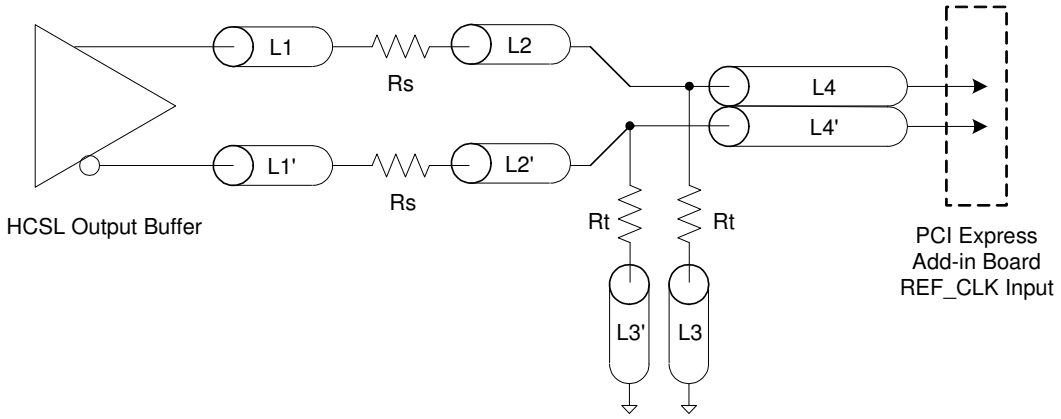


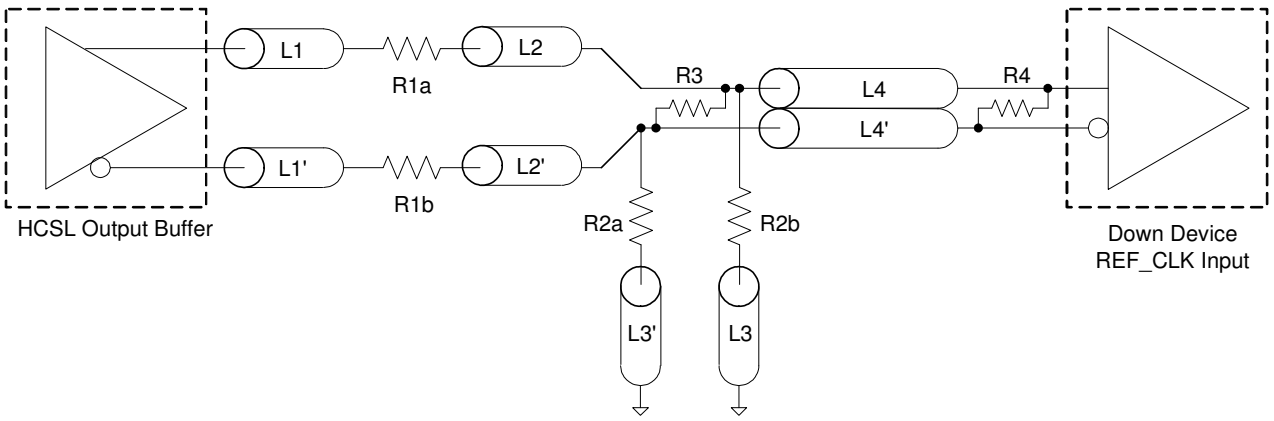
Figure 2: PCI Express Connector Routing



Alternative Termination for LVDS and other Common Differential Signals (figure 3)							
Vdiff	Vp-p	Vcm	R1	R2	R3	R4	Note
0.45v	0.22v	1.08	33	150	100	100	
0.58	0.28	0.6	33	78.7	137	100	
0.80	0.40	0.6	33	78.7	none	100	ICS874003i-02 input compatible
0.60	0.3	1.2	33	174	140	100	Standard LVDS

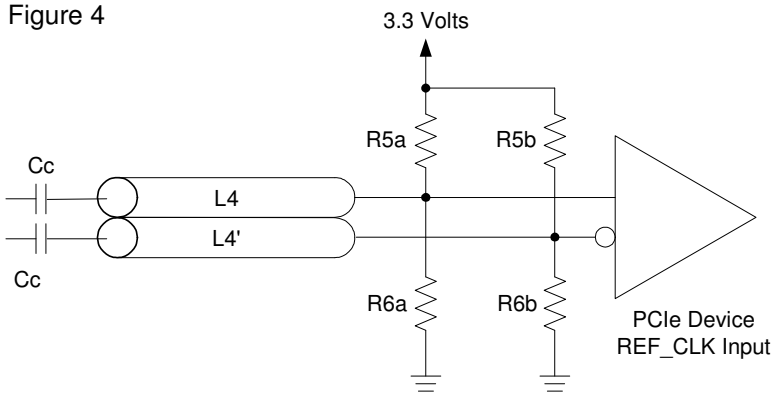
R1a = R1b = R1
R2a = R2b = R2

Figure 3



Cable Connected AC Coupled Application (figure 4)		
Component	Value	Note
R5a, R5b	8.2K 5%	
R6a, R6b	1K 5%	
Cc	0.1 µF	
Vcm	0.350 volts	

Figure 4



General SMBus serial interface information for the ICS9DS400

How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address D8 (h)
- ICS clock will ***acknowledge***
- Controller (host) sends the begining byte location = N
- ICS clock will ***acknowledge***
- Controller (host) sends the data byte count = X
- ICS clock will ***acknowledge***
- Controller (host) starts sending ***Byte N through Byte N + X -1***
- ICS clock will ***acknowledge*** each byte ***one at a time***
- Controller (host) sends a Stop bit

How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address D8 (h)
- ICS clock will ***acknowledge***
- Controller (host) sends the begining byte location = N
- ICS clock will ***acknowledge***
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address D9 (h)
- ICS clock will ***acknowledge***
- ICS clock will send the data byte count = X
- ICS clock sends ***Byte N + X -1***
- ICS clock sends ***Byte 0 through byte X (if X(h) was written to byte 8)***.
- Controller (host) will need to acknowledge each byte
- Controllor (host) will send a not acknowledge bit
- Controller (host) will send a stop bit

Index Block Write Operation

Controller (Host)		ICS (Slave/Receiver)
T	starT bit	
Slave Address D8(h)		
WR	WRite	
		ACK
Beginning Byte = N		
		ACK
Data Byte Count = X		
		ACK
Beginning Byte N	X Byte	
		ACK
◇		
◇		◇
◇		◇
		◇
Byte N + X - 1		
		ACK
P	stoP bit	

Index Block Read Operation

Controller (Host)		ICS (Slave/Receiver)	
T	starT bit		
Slave Address D8(h)			
WR	WRite		
		ACK	
Beginning Byte = N			
		ACK	
RT	Repeat starT		
Slave Address D9(h)			
RD	ReaD		
		ACK	
		Data Byte Count = X	
ACK			
			Beginning Byte N
ACK			
			◇
◇		X Byte	◇
◇			◇
◇			
			Byte N + X - 1
N	Not acknowledge		
P	stoP bit		

SMBus Table: Frequency Select Register, READ/WRITE ADDRESS (D8/D9)

Byte 0	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	PD_Mode	PD# drive mode	RW	driven	Hi-Z	0
Bit 6	-	STOP_Mode	SRC_Stop# drive mode	RW	driven	Hi-Z	0
Bit 5	-	Reserved					0
Bit 4	1	SPREAD_AMT(1)	Spread % MSB	RW	00 = -0.125% 01 = -0.25% 10 = -0.375% 11 = -0.50%		Latch
Bit 3	-	SPREAD_AMT(0)	Spread % LSB	RW			1
Bit 2	28	SPREAD_EN	Turns on spread	RW	SS Off	SS On	Latch
Bit 1	22	BYPASS#	BYPASS#_SSCG	RW	fan-out	SSCG	Latch
Bit 0	-	Byte0 CONTROL	Selects control source of Byte 0	RW	Smbus	Input Pins	1

Notes: Pins 1, 22 and 28 are latched into Byte 0 on the first power up of the device. Bits [4:1] will NOT reflect changes in these pin states after power up, even though the pins are controlling the function of the part. Setting Byte 0 bit 0 to 0 allows the SMBus to write Bits [4:1] and transfers control of the functions from the pins to SMBus. Once Byte 0 bit 0 is set to 0, the pins no longer impact Byte 0, bits [4:1] or the device function.

SMBus Table: Output Control Register

Byte 1	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	Reserved	Reserved	RW	Reserved		1
Bit 6	22,23	DIF_6	Output Enable	RW	Disable	Enable	1
Bit 5	19,20	DIF_5	Output Enable	RW	Disable	Enable	1
Bit 4	-	Reserved	Reserved	RW	Reserved		1
Bit 3	-	Reserved	Reserved	RW	Reserved		1
Bit 2	9,10	DIF_2	Output Enable	RW	Disable	Enable	1
Bit 1	6,7	DIF_1	Output Enable	RW	Disable	Enable	1
Bit 0	-	Reserved	Reserved	RW	Reserved		1

NOTE: The SMBus Output Enable Bit must be '1' AND the respective OE pin must be active for the output to run!

SMBus Table: OE Pin Control Register

Byte 2	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	Reserved	Reserved	RW	Reserved		0
Bit 6	22,23	DIF_6	DIF_6 Stoppable with OE6	RW	Free-run	Stoppable	0
Bit 5	-	Reserved	Reserved	RW	Reserved		0
Bit 4	-	Reserved	Reserved	RW	Reserved		0
Bit 3	-	Reserved	Reserved	RW	Reserved		0
Bit 2	-	Reserved	Reserved	RW	Reserved		0
Bit 1	6,7	DIF_1	DIF_1 Stoppable with OE1	RW	Free-run	Stoppable	0
Bit 0	-	Reserved	Reserved	RW	Reserved		0

SMBus Table: Reserved Register

Byte 3	Pin #	Name	Control Function	Type	0	1	Default
Bit 7		Reserved					X
Bit 6		Reserved					X
Bit 5		Reserved					X
Bit 4		Reserved					X
Bit 3		Reserved					X
Bit 2		Reserved					X
Bit 1		Reserved					X
Bit 0		Reserved					X

SMBus Table: Vendor & Revision ID Register

Byte 4	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	RID3	REVISION ID	R	-	-	0
Bit 6	-	RID2		R	-	-	0
Bit 5	-	RID1		R	-	-	0
Bit 4	-	RID0		R	-	-	0
Bit 3	-	VID3	VENDOR ID	R	-	-	0
Bit 2	-	VID2		R	-	-	0
Bit 1	-	VID1		R	-	-	0
Bit 0	-	VID0		R	-	-	1

SMBus Table: DEVICE ID

Byte 5	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	Device ID 7 (MSB)		R	Device ID is 80 Hex for 9DS800 and 40 Hex for 9DS400		X
Bit 6	-	Device ID 6		R			X
Bit 5	-	Device ID 5		R			0
Bit 4	-	Device ID 4		R			0
Bit 3	-	Device ID 3		R			0
Bit 2	-	Device ID 2		R			0
Bit 1	-	Device ID 1		R			0
Bit 0	-	Device ID 0		R			0

SMBus Table: Byte Count Register

Byte 6	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	BC7	Writing to this register configures how many bytes will be read back.	RW	-	-	0
Bit 6	-	BC6		RW	-	-	0
Bit 5	-	BC5		RW	-	-	0
Bit 4	-	BC4		RW	-	-	0
Bit 3	-	BC3		RW	-	-	0
Bit 2	-	BC2		RW	-	-	1
Bit 1	-	BC1		RW	-	-	1
Bit 0	-	BC0		RW	-	-	1

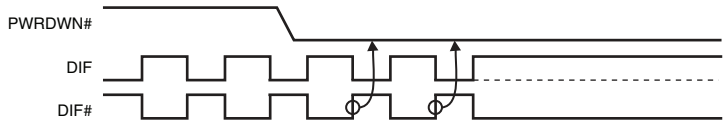
Note: Polarities in timing diagrams are shown OE_INV = 0. They are similar to OE_INV = 1.

PD#, Power Down

The PD# pin cleanly shuts off all clocks and places the device into a power saving mode. PD# must be asserted before shutting off the input clock or power to insure an orderly shutdown. PD is asynchronous active-low input for both powering down the device and powering up the device. When PD# is asserted, all clocks will be driven high, or tri-stated (depending on the PD# drive mode and Output control bits) before the PLL is shut down.

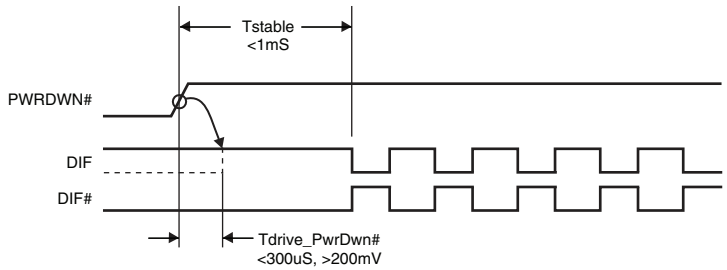
PD# Assertion

When PD# is sampled low by two consecutive rising edges of DIF#, all DIF outputs must be held High, or tri-stated (depending on the PD# drive mode and Output control bits) on the next High-Low transition of the DIF# outputs. When the PD# drive mode bit is set to '0', all clock outputs will be held with DIF driven High with 2 x I_{REF} and DIF# tri-stated. If the PD# drive mode bit is set to '1', both DIF and DIF# are tri-stated.



PD# De-assertion

Power-up latency is less than 1 ms. This is the time from de-assertion of the PD# pin, or VDD reaching 3.3V, or the time from valid SRC_IN clocks until the time that stable clocks are output from the device (PLL Locked). If the PD# drive mode bit is set to '1', all the DIF outputs must driven to a voltage of >200 mV within 300 us of PD# de-assertion.



DIF_STOP#

The DIF_STOP# signal is an active-low asynchronous input that cleanly stops and starts the DIF outputs. A valid clock must be present on DIF_IN for this input to work properly. The DIF_STOP# signal is de-bounced and must remain stable for two consecutive rising edges of DIF# to be recognized as a valid assertion or de-assertion.

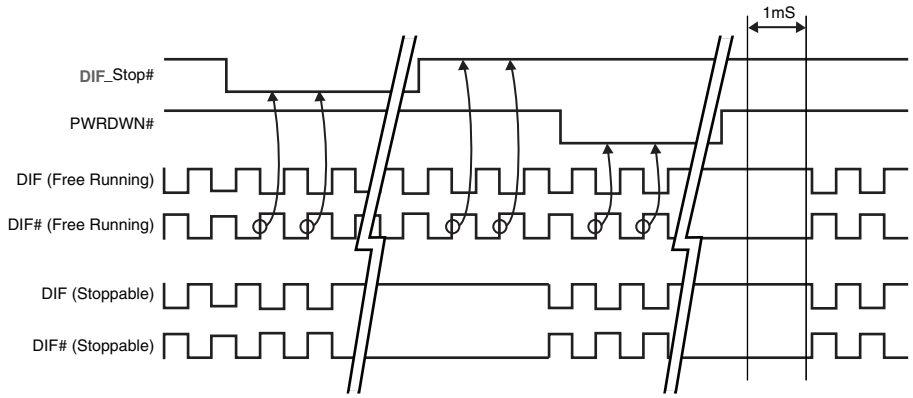
DIF_STOP# - Assertion

Asserting DIF_STOP# causes all DIF outputs to stop after their next transition (if the control register settings allow the output to stop). When the DIF_STOP# drive bit is '0', the final state of all stopped DIF outputs is DIF = High and DIF# = Low. There is no change in output drive current. DIF is driven with $6xI_{REF}$. DIF# is not driven, but pulled low by the termination. When the DIF_STOP# drive bit is '1', the final state of all DIF output pins is Low. Both DIF and DIF# are not driven.

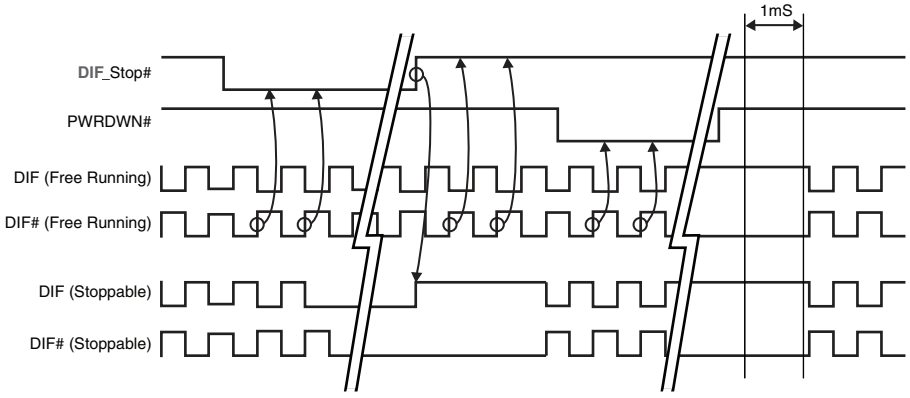
DIF_STOP# - De-assertion (transition from '0' to '1')

All stopped differential outputs resume normal operation in a glitch-free manner. The de-assertion latency to active outputs is 2-6 DIF clock periods, with all DIF outputs resuming simultaneously. If the DIF_STOP# drive control bit is '1' (tri-state), all stopped DIF outputs must be driven High (>200 mV) within 10 ns of de-assertion.

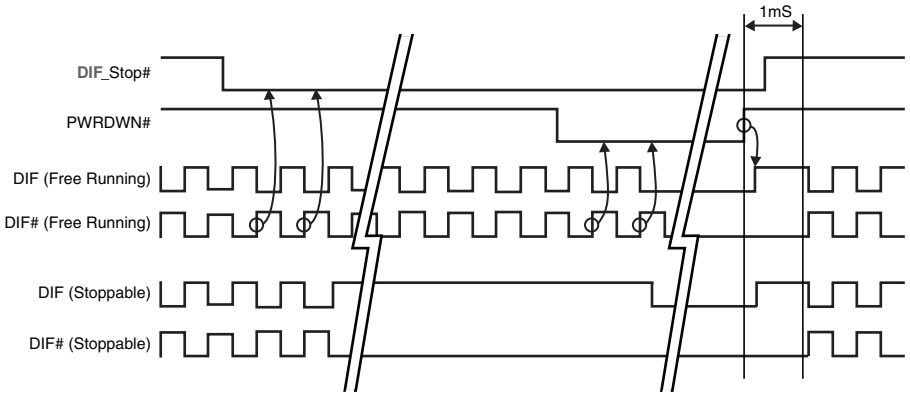
DIF_STOP_1 (DIF_Stop = Driven, PD = Driven)



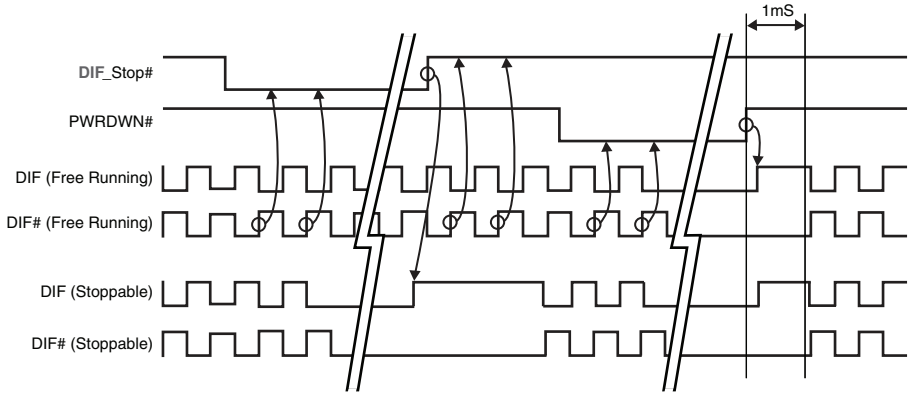
DIF_STOP_2 (DIF_Stop =Tristate, PD = Driven)



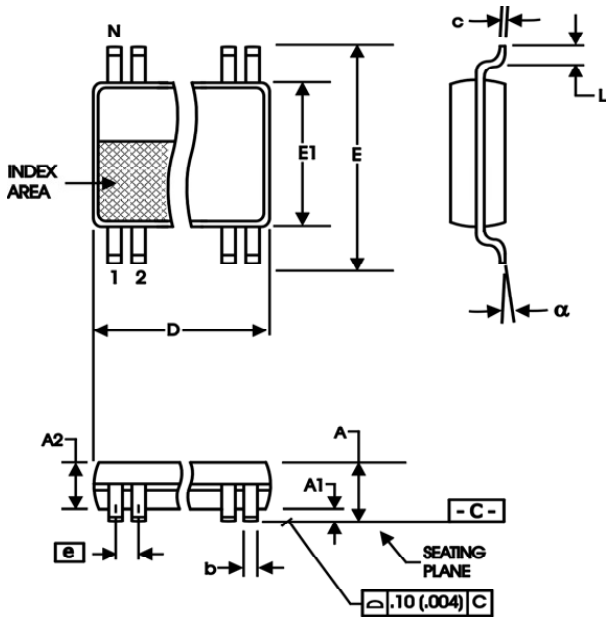
DIF_STOP_3 (DIF_Stop = Driven, PD = Tristate)



DIF_STOP_4 (DIF_Stop = Tristate, PD = Tristate)



28-pin SSOP Package Dimensions



209 mil SSOP

209 mil SSOP

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	--	2.00	--	.079
A1	0.05	--	.002	--
A2	1.65	1.85	.065	.073
b	0.22	0.38	.009	.015
c	0.09	0.25	.0035	.010
D	SEE VARIATIONS		SEE VARIATIONS	
E	7.40	8.20	.291	.323
E1	5.00	5.60	.197	.220
e	0.65 BASIC		0.0256 BASIC	
L	0.55	0.95	.022	.037
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°

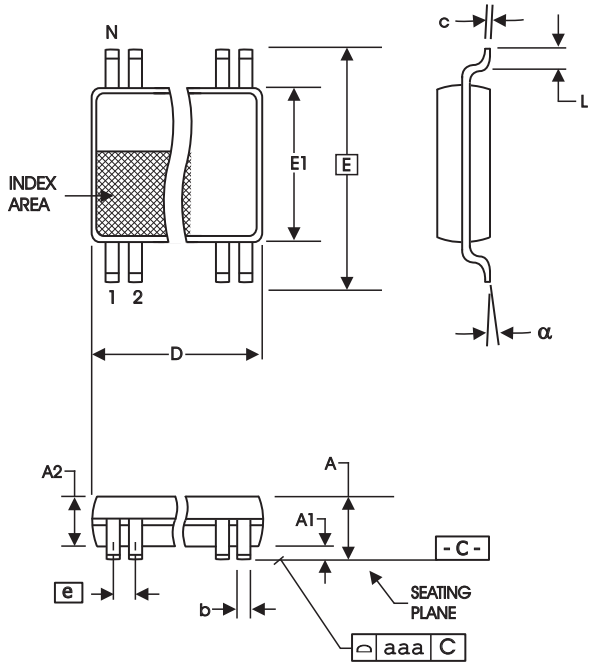
VARIATIONS

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
28	9.90	10.50	.390	.413

Reference Doc.: JEDEC Publication 95, MO-150

10-0033

28-pin TSSOP Package Dimensions



4.40 mm. Body, 0.65 mm. Pitch TSSOP

(173 mil) (25.6 mil)

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	--	1.20	--	.047
A1	0.05	0.15	.002	.006
A2	0.80	1.05	.032	.041
b	0.19	0.30	.007	.012
c	0.09	0.20	.0035	.008
D	SEE VARIATIONS		SEE VARIATIONS	
E	6.40 BASIC		0.252 BASIC	
E1	4.30	4.50	.169	.177
e	0.65 BASIC		0.0256 BASIC	
L	0.45	0.75	.018	.030
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°
aaa	--	0.10	--	.004

VARIATIONS

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
28	9.60	9.80	.378	.386

Reference Doc.: JEDEC Publication 95, MO-153

10-0035

9DS400 Ordering Information

Part / Order Number	Marking	Shipping Packaging	Package	Ambient Operating Temperature
9DS400AGLF	9DS400AGLF	Tubes	28-pin TSSOP	0 to +70° C
9DS400AGLFT	9DS400AGLF	Tape and Reel	28-pin TSSOP	0 to +70° C
9DS400AGILF	9DS400AGILF	Tubes	28-pin TSSOP	-40 to +85° C
9DS400AGILFT	9DS400AGILF	Tape and Reel	28-pin TSSOP	-40 to +85° C
9DS400AFLF	9DS400AFLF	Tubes	28-pin SSOP	0 to +70° C
9DS400AFLFT	9DS400AFLF	Tape and Reel	28-pin SSOP	0 to +70° C
9DS400AFILF	9DS400AFILF	Tubes	28-pin SSOP	-40 to +85° C
9DS400AFILFT	9DS400AFILF	Tape and Reel	28-pin SSOP	-40 to +85° C

Parts that are ordered with a "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

Revision History

Rev.	Issue Date	Description	Page #
0.1	9/16/2009	Initial release.	
0.2	9/17/2009	Updated IDD specs in Input/Supply/Common Output Parameters table	5

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