

# Nineteen Output Differential Buffer for PCIe Gen3

9DB1933

## Recommended Application

19 output PCIe Gen3 zero-delay/fanout buffer

## General Description

The 9DB1933 zero-delay buffer supports PCIe Gen3 requirements, while being backwards compatible to PCIe Gen2 and Gen1. The 9DB1933 is driven by a differential SRC output pair from an IDT 932S421, 932SQ420, or equivalent, main clock generator. It attenuates jitter on the input clock and has a selectable PLL bandwidth to maximize performance in systems with or without Spread-Spectrum clocking.

## Output Features

- 19 - 0.7V current mode differential HCSL output pairs

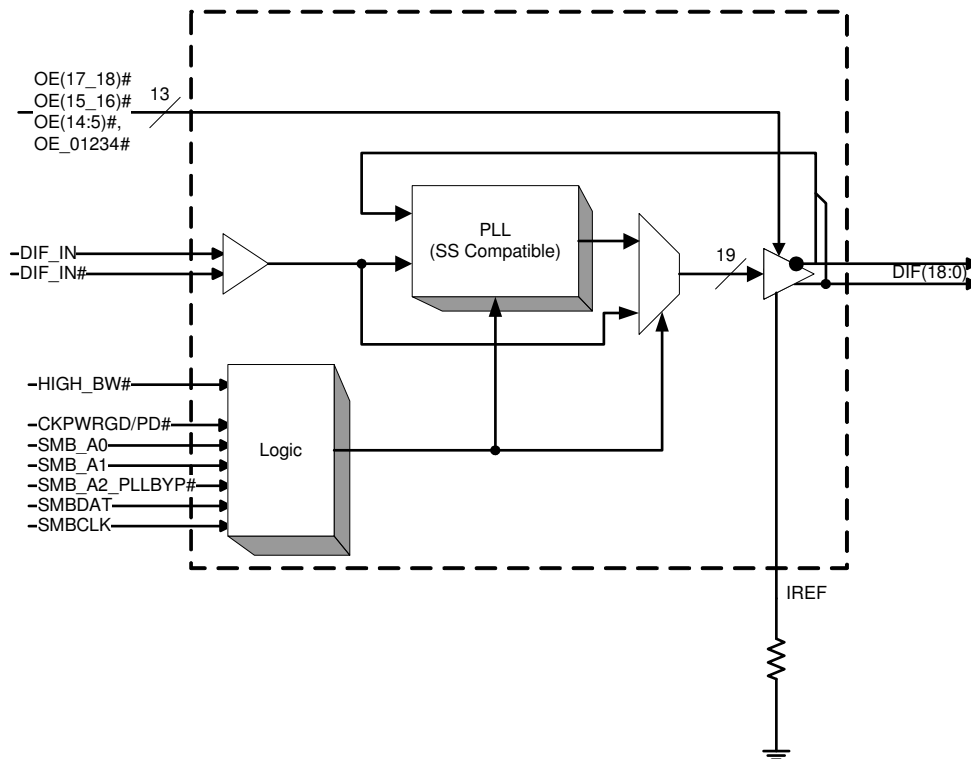
## Features/Benefits

- 8 Selectable SMBus Addresses/Multiple devices can share the same SMBus Segment
- 11 dedicated and 3 group OE# pins/Hardware control of the outputs
- PLL or bypass mode/PLL can de-jitter incoming clock
- Selectable PLL bandwidth/minimizes jitter peaking in downstream PLL's
- Spread Spectrum Compatible/tracks spreading input clock for low EMI
- SMBus Interface/unused outputs can be disabled
- Supports undriven differential outputs in Power Down mode for power management

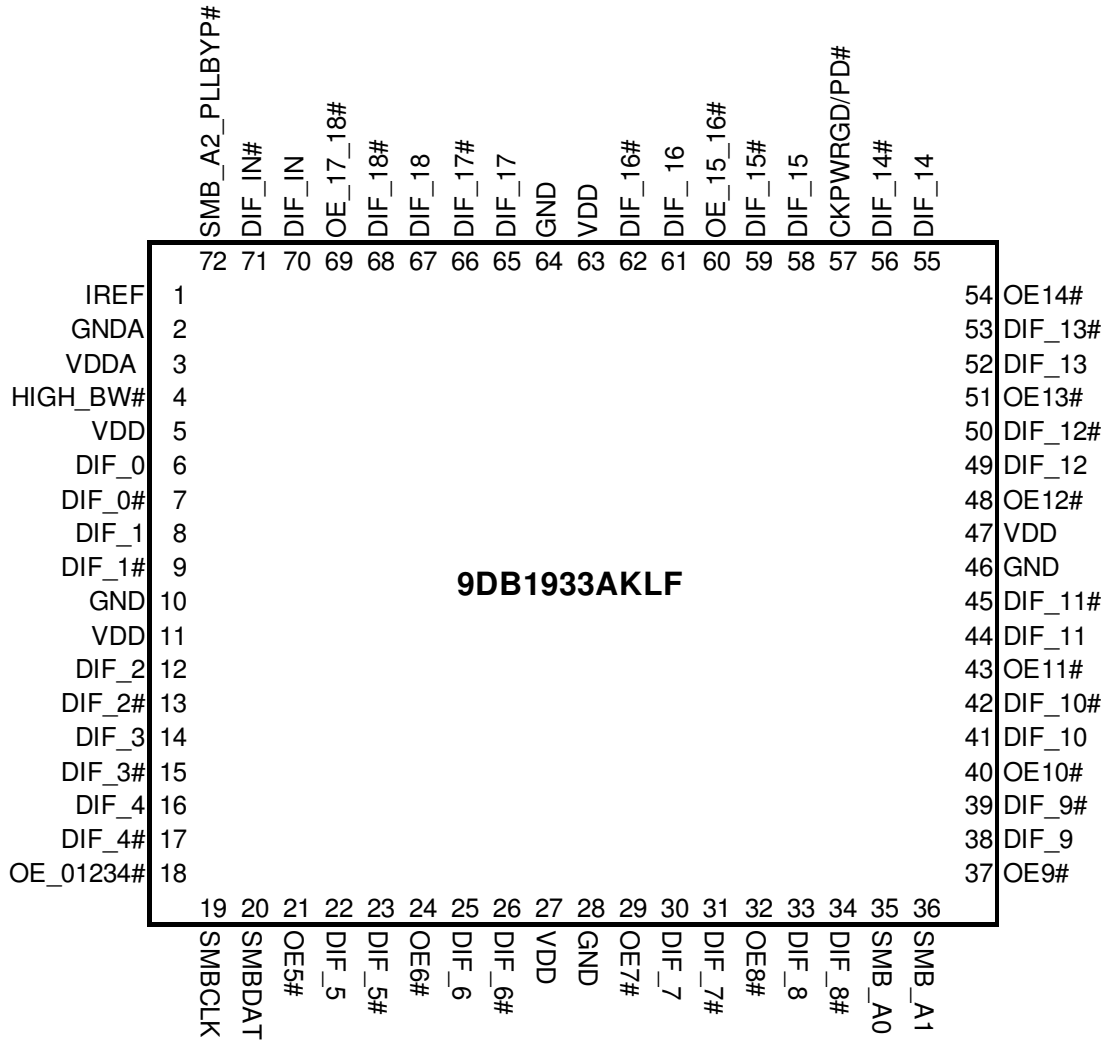
## Key Specifications

- Cycle-to-cycle jitter < 50ps
- Output-to-output skew < 150 ps
- PCIe Gen3 phase jitter < 1.0ps RMS

## Functional Block Diagram



## Pin Configuration



## Power Down Functionality

INPUTS		OUTPUTS	PLL State
CKPWRGD/ PD#	DIF_IN/ DIF_IN#	DIF/DIF#	
1	Running	Running	ON
0	X	Hi-Z	OFF

## Power Groups

Pin Number		Description
VDD	GND	
3	2	PLL, Analog
5,11,27,47,63	10,28,46,64	DIF clocks

## Pin Description

PIN #	PIN NAME	PIN TYPE	DESCRIPTION
1	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.
2	GNDA	PWR	Ground pin for the PLL core.
3	VDDA	PWR	3.3V power for the PLL core.
4	HIGH_BW#	IN	3.3V input for selecting PLL Band Width 0 = High, 1= Low
5	VDD	PWR	Power supply, nominal 3.3V
6	DIF_0	OUT	0.7V differential true clock output
7	DIF_0#	OUT	0.7V differential Complementary clock output
8	DIF_1	OUT	0.7V differential true clock output
9	DIF_1#	OUT	0.7V differential Complementary clock output
10	GND	PWR	Ground pin.
11	VDD	PWR	Power supply, nominal 3.3V
12	DIF_2	OUT	0.7V differential true clock output
13	DIF_2#	OUT	0.7V differential Complementary clock output
14	DIF_3	OUT	0.7V differential true clock output
15	DIF_3#	OUT	0.7V differential Complementary clock output
16	DIF_4	OUT	0.7V differential true clock output
17	DIF_4#	OUT	0.7V differential Complementary clock output
18	OE_01234#	IN	Active low input for enabling DIF pairs 0, 1, 2, 3 and 4. 1 =disable outputs, 0 = enable outputs
19	SMBCLK	IN	Clock pin of SMBUS circuitry, 5V tolerant
20	SMBDAT	I/O	Data pin of SMBUS circuitry, 5V tolerant
21	OE5#	IN	Active low input for enabling DIF pair 5. 1 =disable outputs, 0 = enable outputs
22	DIF_5	OUT	0.7V differential true clock output
23	DIF_5#	OUT	0.7V differential Complementary clock output
24	OE6#	IN	Active low input for enabling DIF pair 6. 1 =disable outputs, 0 = enable outputs
25	DIF_6	OUT	0.7V differential true clock output
26	DIF_6#	OUT	0.7V differential Complementary clock output
27	VDD	PWR	Power supply, nominal 3.3V
28	GND	PWR	Ground pin.
29	OE7#	IN	Active low input for enabling DIF pair 7. 1 =disable outputs, 0 = enable outputs
30	DIF_7	OUT	0.7V differential true clock output
31	DIF_7#	OUT	0.7V differential Complementary clock output
32	OE8#	IN	Active low input for enabling DIF pair 8. 1 =disable outputs, 0 = enable outputs
33	DIF_8	OUT	0.7V differential true clock output
34	DIF_8#	OUT	0.7V differential Complementary clock output
35	SMB_A0	IN	SMBus address bit 0 (LSB)
36	SMB_A1	IN	SMBus address bit 1

## Pin Description (cont.)

PIN #	PIN NAME	PIN TYPE	DESCRIPTION
37	OE9#	IN	Active low input for enabling DIF pair 9. 1 =disable outputs, 0 = enable outputs
38	DIF_9	OUT	0.7V differential true clock output
39	DIF_9#	OUT	0.7V differential Complementary clock output
40	OE10#	IN	Active low input for enabling DIF pair 10. 1 =disable outputs, 0 = enable outputs
41	DIF_10	OUT	0.7V differential true clock output
42	DIF_10#	OUT	0.7V differential Complementary clock output
43	OE11#	IN	Active low input for enabling DIF pair 11. 1 =disable outputs, 0 = enable outputs
44	DIF_11	OUT	0.7V differential true clock output
45	DIF_11#	OUT	0.7V differential Complementary clock output
46	GND	PWR	Ground pin.
47	VDD	PWR	Power supply, nominal 3.3V
48	OE12#	IN	Active low input for enabling DIF pair 12. 1 =disable outputs, 0 = enable outputs
49	DIF_12	OUT	0.7V differential true clock output
50	DIF_12#	OUT	0.7V differential Complementary clock output
51	OE13#	IN	Active low input for enabling DIF pair 13. 1 =disable outputs, 0 = enable outputs
52	DIF_13	OUT	0.7V differential true clock output
53	DIF_13#	OUT	0.7V differential Complementary clock output
54	OE14#	IN	Active low input for enabling DIF pair 14. 1 =disable outputs, 0 = enable outputs
55	DIF_14	OUT	0.7V differential true clock output
56	DIF_14#	OUT	0.7V differential Complementary clock output
57	CKPWRGD/PD#	IN	A rising edge samples latched inputs and release Power Down Mode, a low puts the part into power down mode and tristates all outputs.
58	DIF_15	OUT	0.7V differential true clock output
59	DIF_15#	OUT	0.7V differential Complementary clock output
60	OE_15_16#	IN	Active low input for enabling DIF pair 15 and 16. 1 = tri-state outputs, 0 = enable outputs
61	DIF_16	OUT	0.7V differential true clock output
62	DIF_16#	OUT	0.7V differential Complementary clock output
63	VDD	PWR	Power supply, nominal 3.3V
64	GND	PWR	Ground pin.
65	DIF_17	OUT	0.7V differential true clock output
66	DIF_17#	OUT	0.7V differential Complementary clock output
67	DIF_18	OUT	0.7V differential true clock output
68	DIF_18#	OUT	0.7V differential Complementary clock output
69	OE_17_18#	IN	Active low input for enabling DIF pair 17, 18. 1 = tri-state outputs, 0 = enable outputs
70	DIF_IN	IN	0.7 V Differential TRUE input
71	DIF_IN#	IN	0.7 V Differential Complementary Input
72	SMB_A2_PLLBYP#	IN	SMBus address bit 2. When Low, the part operates as a fanout buffer with the PLL bypassed. When High, the part operates as a zero-delay buffer (ZDB) with the PLL operating. 0 = fanout mode (PLL bypassed), 1 = ZDB mode (PLL used)

**Electrical Characteristics - Absolute Maximum Ratings**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
3.3V Core Supply Voltage	VDDA				4.6	V	1,2
3.3V Logic Supply Voltage	VDD				4.6	V	1,2
Input Low Voltage	V <sub>IL</sub>		GND-0.5			V	1
Input High Voltage	V <sub>IH</sub>	Except for SMBus interface			V <sub>DD</sub> +0.5V	V	1
Input High Voltage	V <sub>IHSMB</sub>	SMBus clock and data pins			5.5V	V	1
Storage Temperature	T <sub>s</sub>		-65		150	°C	1
Junction Temperature	T <sub>j</sub>				125	°C	1
Input ESD protection	ESD prot	Human Body Model	2000			V	1

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>Operation under these conditions is neither implied nor guaranteed.

**Electrical Characteristics - Input/Supply/Common Parameters**

T<sub>A</sub> = T<sub>COM</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Ambient Operating Temperature	T <sub>COM</sub>	Commercial range	0		70	°C	1
Input High Voltage	V <sub>IH</sub>	Single-ended inputs, except SMBus, low threshold and tri-level inputs	2		V <sub>DD</sub> + 0.3	V	1
Input Low Voltage	V <sub>IL</sub>	Single-ended inputs, except SMBus, low threshold and tri-level inputs	GND - 0.3		0.8	V	1
Input Current	I <sub>IN</sub>	Single-ended inputs, V <sub>IN</sub> = GND, V <sub>IN</sub> = VDD	-5		5	uA	1
	I <sub>INP</sub>	Single-ended inputs V <sub>IN</sub> = 0 V; Inputs with internal pull-up resistors V <sub>IN</sub> = VDD; Inputs with internal pull-down resistors	-200		200	uA	1
Input Frequency	F <sub>ibyp</sub>	V <sub>DD</sub> = 3.3 V, Bypass mode	10		166	MHz	2
	F <sub>ipll</sub>	V <sub>DD</sub> = 3.3 V, 100MHz PLL mode	90	100	110	MHz	2
Pin Inductance	L <sub>pin</sub>				7	nH	1
Capacitance	C <sub>IN</sub>	Logic Inputs, except DIF_IN	1.5		5	pF	1
	C <sub>INDIF_IN</sub>	DIF_IN differential clock inputs	1.5		2.7	pF	1,4
	C <sub>OUT</sub>	Output pin capacitance		2.5	6	pF	1
Clk Stabilization	T <sub>STAB</sub>	From V <sub>DD</sub> Power-Up and after input clock stabilization or de-assertion of PD# to 1st clock		1.000	1.8	ms	1,2
Input SS Modulation Frequency	f <sub>MODIN</sub>	Allowable Frequency (Triangular Modulation)	30		33	kHz	1
OE# Latency	t <sub>LATOE#</sub>	DIF start after OE# assertion DIF stop after OE# deassertion	4		12	cycles	1,3
Tdrive_PD#	t <sub>DRVPD</sub>	DIF output enable after PD# de-assertion			300	us	1,3
Tfall	t <sub>F</sub>	Fall time of control inputs			5	ns	1,2
Trise	t <sub>R</sub>	Rise time of control inputs			5	ns	1,2
SMBus Input Low Voltage	V <sub>ILSMB</sub>				0.8	V	1
SMBus Input High Voltage	V <sub>IHSMB</sub>		2.1		V <sub>DD</sub> SMB	V	1
SMBus Output Low Voltage	V <sub>OLSMB</sub>	@ I <sub>PULLUP</sub>			0.4	V	1
SMBus Sink Current	I <sub>PULLUP</sub>	@ V <sub>OL</sub>	4			mA	1
Nominal Bus Voltage	V <sub>DD</sub> SMB	3V to 5V +/- 10%	2.7		5.5	V	1
SCLK/SDATA Rise Time	t <sub>RSMB</sub>	(Max VIL - 0.15) to (Min VIH + 0.15)			1000	ns	1
SCLK/SDATA Fall Time	t <sub>FSMB</sub>	(Min VIH + 0.15) to (Max VIL - 0.15)			300	ns	1
SMBus Operating Frequency	f <sub>MAXSMB</sub>	Maximum SMBus operating frequency			100	kHz	1,5

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>Control input must be monotonic from 20% to 80% of input swing.

<sup>3</sup>Time from deassertion until outputs are >200 mV

<sup>4</sup>DIF\_IN input

<sup>5</sup>The differential input clock must be running for the SMBus to be active

**Electrical Characteristics - Clock Input Parameters**T<sub>A</sub> = T<sub>COM</sub> or T<sub>IND</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Input High Voltage - DIF_IN	V <sub>IHDIF</sub>	Differential inputs (single-ended measurement)	600	800	1150	mV	1
Input Low Voltage - DIF_IN	V <sub>ILDIF</sub>	Differential inputs (single-ended measurement)	V <sub>SS</sub> - 300	0	300	mV	1
Input Common Mode Voltage - DIF_IN	V <sub>COM</sub>	Common Mode Input Voltage	300		1000	mV	1
Input Amplitude - DIF_IN	V <sub>SWING</sub>	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 <sub>IN</sub>	V <sub>IN</sub> = V <sub>DD</sub> , V <sub>IN</sub> = GND	-5		5	uA	1
Input Duty Cycle	d <sub>tin</sub>	Measurement from differential waveform	45		55	%	1
Input Jitter - Cycle to Cycle	J <sub>DIFIn</sub>	Differential Measurement	0		125	ps	1

<sup>1</sup> Guaranteed by design and characterization, not 100% tested in production.<sup>2</sup> Slew rate measured through +/-75mV window centered around differential zero**Electrical Characteristics - DIF 0.7V Current Mode Differential Outputs**T<sub>A</sub> = T<sub>COM</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Slew rate	Trf	Scope averaging on	1	2	4	V/ns	1, 2, 3
Slew rate matching	ΔTrf	Slew rate matching, Scope averaging on			20	%	1, 2, 4
Voltage High	V <sub>High</sub>	Statistical measurement on single-ended signal using oscilloscope math function. (Scope averaging on)	660	789	850	mV	1
Voltage Low	V <sub>Low</sub>		-150	45	150		1
Max Voltage	V <sub>max</sub>	Measurement on single ended signal using absolute value. (Scope averaging off)		834	1150	mV	1
Min Voltage	V <sub>min</sub>		-300	17			1
Vswing	V <sub>swing</sub>	Scope averaging off	300	744		mV	1, 2
Crossing Voltage (abs)	V <sub>cross abs</sub>	Scope averaging off	250	380	550	mV	1, 5
Crossing Voltage (var)	ΔV <sub>cross</sub>	Scope averaging off		24	140	mV	1, 6

<sup>1</sup> Guaranteed by design and characterization, not 100% tested in production. I<sub>REF</sub> = VDD/(3xR<sub>R</sub>). For R<sub>R</sub> = 475Ω (1%), I<sub>REF</sub> = 2.32mA. I<sub>OH</sub> = 6 x I<sub>REF</sub> and V<sub>OH</sub> = 0.7V @ Z<sub>O</sub>=50Ω (100Ω differential impedance).<sup>2</sup> Measured from differential waveform<sup>3</sup> Slew rate is measured through the V<sub>swing</sub> voltage range centered around differential 0V. This results in a +/-150mV window around differential 0V.<sup>4</sup> Matching applies to rising edge rate of Clock / falling edge rate of Clock#. It is measured in a +/-75mV window centered on the average cross point where Clock rising meets Clock# falling. The median cross point is used to calculate the voltage thresholds the oscilloscope uses for the edge rate calculations.<sup>5</sup> V<sub>cross</sub> is defined as voltage where Clock = Clock# measured on a component test board and only applies to the differential rising edge (i.e. Clock rising and Clock# falling).<sup>6</sup> The total variation of all V<sub>cross</sub> measurements in any particular system. Note that this is a subset of V<sub>cross\_min/max</sub> (V<sub>cross absolute</sub>) allowed. The intent is to limit V<sub>cross</sub> induced modulation by setting V<sub>cross\_delta</sub> to be smaller than V<sub>cross absolute</sub>.**Electrical Characteristics - Current Consumption**T<sub>A</sub> = T<sub>COM</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
Operating Supply Current	I <sub>DD3,30P</sub>	All outputs active @100MHz, C <sub>L</sub> = Full load;		427	500	mA	1
Powerdown Current	I <sub>DD3,3PDZ</sub>	All differential pairs tri-stated		32	40	mA	1

<sup>1</sup> Guaranteed by design and characterization, not 100% tested in production.

### Electrical Characteristics - Output Duty Cycle, Jitter, Skew and PLL Characteristics

TA = T<sub>COM</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
PLL Bandwidth	BW	-3dB point in High BW Mode	2	3	4	MHz	1
		-3dB point in Low BW Mode	0.7	1	1.4	MHz	1
PLL Jitter Peaking	t <sub>JPEAK</sub>	Peak Pass band Gain		1.4	2	dB	1
Duty Cycle	t <sub>DC</sub>	Measured differentially, PLL Mode	45	49.5	55	%	1,2
Duty Cycle Distortion	t <sub>DCD</sub>	Measured differentially, Bypass Mode @100MHz	-2	1	2	%	1,2,5
Skew, Input to Output	t <sub>pdBYP</sub>	Bypass Mode, nominal value @ 25°C, 3.3V, V <sub>T</sub> = 50%	2500	3700	4500	ps	1,2,4
	t <sub>pdPLL</sub>	PLL Mode, nominal value @ 25°C, 3.3V, V <sub>T</sub> = 50%	100	300	500	ps	1,2,3
DIF_IN, DIF [x:0]	Δt <sub>pd_BYP</sub>	Input-to-Output Skew Variation in Bypass mode (over specified voltage / temperature operating ranges)		500	600	ps	1,2,4,6, 7,8,9, 13
DIF_IN, DIF [x:0]	Δt <sub>pd_PLL</sub>	Input-to-Output Skew Variation in PLL mode (over specified voltage / temperature operating ranges)		250	350	ps	1,2,3,6, 7,8,9, 13
DIF[X:0]	t <sub>JPH</sub>	Differential Phase Jitter (RMS Value)		2	10	ps	1,7,10
DIF[X:0]	t <sub>SSTERROR</sub>	Differential Spread Spectrum Tracking Error (peak to peak)		40	80	ps	1,7,12
Skew, Output to Output	t <sub>sk3</sub>	V <sub>T</sub> = 50%		100	150	ps	1
Jitter, Cycle to cycle	t <sub>jcyc-cyc</sub>	PLL mode		40	50	ps	1,2
		Additive Jitter in Bypass Mode		25	50	ps	1,2

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production. C<sub>LOAD</sub> = 2pF

<sup>2</sup>Measured from differential cross-point to differential cross-point

<sup>3</sup>PLL mode Input-to-Output skew is measured at the first output edge following the corresponding input.

<sup>4</sup>All Bypass Mode Input-to-Output specs refer to the timing between an input edge and the specific output edge created by it.

<sup>5</sup>Duty cycle distortion is the difference in duty cycle between the output and the input clock when the device is operated in bypass mode.

<sup>6</sup>V<sub>T</sub> = 50% of V<sub>out</sub>

<sup>7</sup>This parameter is deterministic for a given device

<sup>8</sup>Measured with scope averaging on to find mean value.

<sup>9</sup>Long-term variation from nominal of input-to-output skew over temperature and voltage for a single device.

<sup>10</sup>This parameter is measured at the outputs of two separate 9DB1933 devices driven by a single main clock. The 9DB1933's must be set to high bandwidth. Differential phase jitter is the accumulation of the phase jitter not shared by the outputs (eg. not including the

<sup>11</sup>t is the period of the input clock

<sup>12</sup>Differential spread spectrum tracking error is the difference in spread spectrum tracking between two 9DB1933 devices. This parameter is measured at the outputs of two separate 9DB1933 devices driven by a single main clock in Spread Spectrum mode. The 9DB1933's must be set to high bandwidth. The spread spectrum characteristics are: maximum of 0.5%, 30-33KHz modulation frequency, linear

<sup>13</sup>This parameter is an absolute value. It is not a double-sided figure.

**Electrical Characteristics - PCIe Phase Jitter Parameters**TA = T<sub>COM</sub>; Supply Voltage VDD = 3.3 V +/-5%

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	Notes
Phase Jitter, PLL Mode	t <sub>jphPCIeG1</sub>	PCIe Gen 1		44	86	ps (p-p)	1,2,3
	t <sub>jphPCIeG2</sub>	PCIe Gen 2 Lo Band 10kHz < f < 1.5MHz		1.4	3	ps (rms)	1,2
		PCIe Gen 2 High Band 1.5MHz < f < Nyquist (50MHz)		2.5	3.1	ps (rms)	1,2
	t <sub>jphPCIeG3</sub>	PCIe Gen 3 (PLL BW of 2-4MHz, CDR = 10MHz)		0.6	1	ps (rms)	1,2,4
Additive Phase Jitter, Bypass Mode	t <sub>jphPCIeG1</sub>	PCIe Gen 1		3	5	ps (p-p)	1,2,3
	t <sub>jphPCIeG2</sub>	PCIe Gen 2 Lo Band 10kHz < f < 1.5MHz		0.02	0.1	ps (rms)	1,2
		PCIe Gen 2 High Band 1.5MHz < f < Nyquist (50MHz)		0.2	0.3	ps (rms)	1,2
	t <sub>jphPCIeG3</sub>	PCIe Gen 3 (PLL BW of 2-4MHz, CDR = 10MHz)		0.04	0.1	ps (rms)	1,2,4

<sup>1</sup> Applies to all outputs.<sup>2</sup> See <http://www.pcisig.com> for complete specs<sup>3</sup> Sample size of at least 100K cycles. This figures extrapolates to 108ps pk-pk @ 1M cycles for a BER of 1-12.<sup>4</sup> Subject to final radification by PCI SIG.



### Clock Periods Differential Outputs with Spread Spectrum Enabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock	Units	Notes
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		
DIF	DIF 100	9.87400	9.99900	9.99900	10.00000	10.00100	10.05130	10.17630	ns	1,2,3

### Clock Periods Differential Outputs with Spread Spectrum Disabled

Measurement Window		1 Clock	1us	0.1s	0.1s	0.1s	1us	1 Clock	Units	Notes
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		
DIF	DIF 100	9.87400		9.99900	10.00000	10.00100		10.17630	ns	1,2,3

<sup>1</sup>Guaranteed by design and characterization, not 100% tested in production.

<sup>2</sup>All Long Term Accuracy specifications are guaranteed with the assumption that the input clock complies with CK410B+/CK420BQ accuracy requirements. The 9DB1933 itself does not contribute to ppm error.

<sup>3</sup> Driven by SRC output of main clock, PLL or Bypass mode

DIF 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
$R_s$	33	ohm	1
$R_t$	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

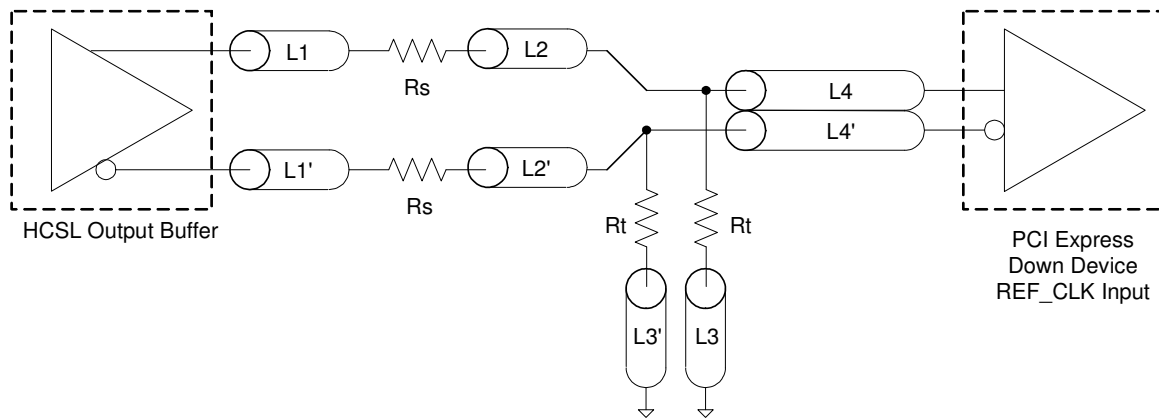
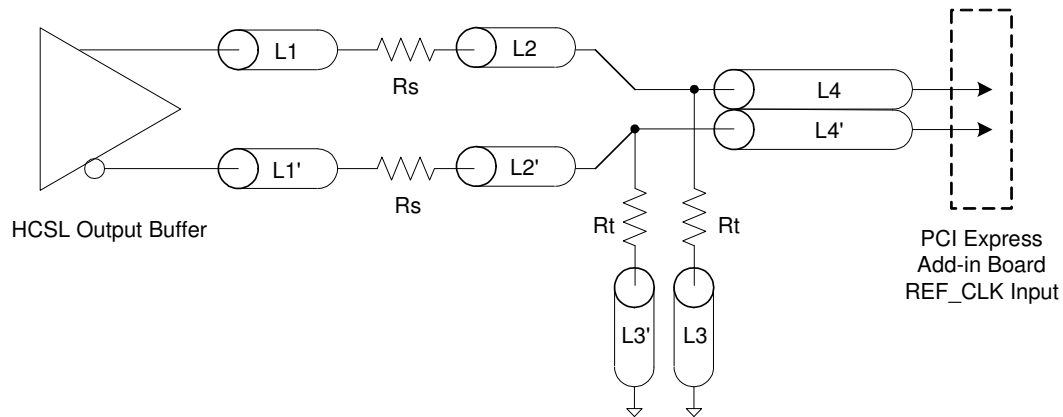
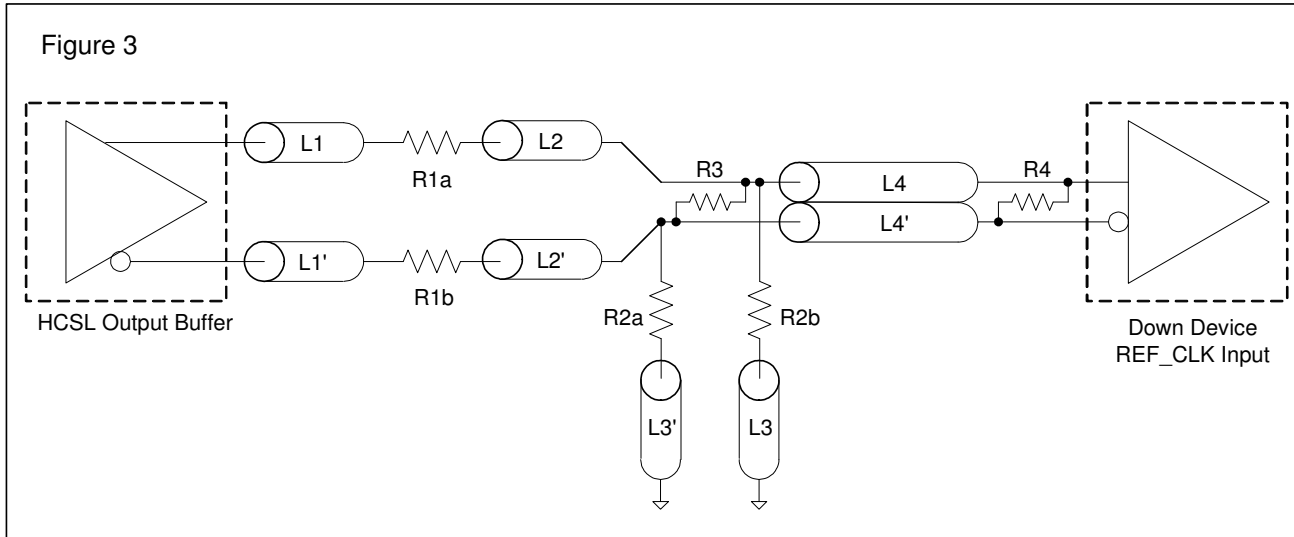


Figure 2: PCI Express Connector Routing

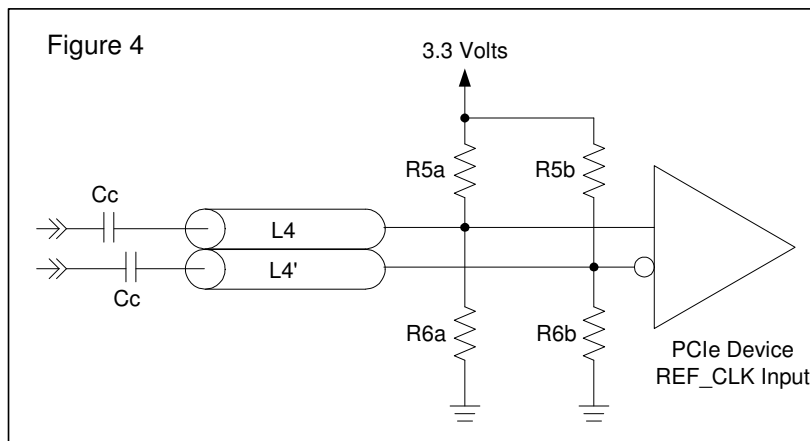


Alternative Termination for LVDS and other Common Differential Signals (figure 3)							
Vdiff	Vp-p	Vcm	R1	R2	R3	R4	Note
0.45v	0.22v	1.08	33	150	100	100	
0.58	0.28	0.6	33	78.7	137	100	
0.80	0.40	0.6	33	78.7	none	100	ICS874003i-02 input compatible
0.60	0.3	1.2	33	174	140	100	Standard LVDS

R1a = R1b = R1  
R2a = R2b = R2



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



## General SMBus serial interface information for the 9DB1933

### How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address  $DC_{(h)}$
- ICS clock will **acknowledge**
- Controller (host) sends the beginning 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  $DC_{(h)}$
- ICS clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- ICS clock will **acknowledge**
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address  $DD_{(h)}$
- 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
- Controller (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 $DC_{(h)}$			
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 $DC_{(h)}$			
WR	WRite		
		ACK	
Beginning Byte = N			
		ACK	
RT	Repeat starT		
Slave Address $DD_{(h)}$			
RD	ReaD		
		ACK	
		Data Byte Count = X	
ACK			
ACK		X Byte	
			Beginning Byte N
◊			◊
◊			◊
◊			◊
		Byte N + X - 1	
N	Not acknowledge		
P	stoP bit		

Note: Addresses show assumes pin 29 is low.

SMBusTable: Reserved Register

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

SMBusTable: Output Control Register

Byte 1	Pin #	Name	Control Function	Type	0	1	Default
Bit 7		DIF_7	Output Control	RW	Hi-Z	Enable	1
Bit 6		DIF_6	Output Control	RW	Hi-Z	Enable	1
Bit 5		DIF_5	Output Control	RW	Hi-Z	Enable	1
Bit 4		DIF_4	Output Control	RW	Hi-Z	Enable	1
Bit 3		DIF_3	Output Control	RW	Hi-Z	Enable	1
Bit 2		DIF_2	Output Control	RW	Hi-Z	Enable	1
Bit 1		DIF_1	Output Control	RW	Hi-Z	Enable	1
Bit 0		DIF_0	Output Control	RW	Hi-Z	Enable	1

SMBusTable: Output and PLL BW Control Register

Byte 2	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	see note		PLL_BW# adjust	RW	High BW	Low BW	1
Bit 6	see note		BYPASS# test mode / PLL	RW	Bypass	PLL	1
Bit 5		DIF_13	Output Control	RW	Hi-Z	Enable	1
Bit 4		DIF_12	Output Control	RW	Hi-Z	Enable	1
Bit 3		DIF_11	Output Control	RW	Hi-Z	Enable	1
Bit 2		DIF_10	Output Control	RW	Hi-Z	Enable	1
Bit 1		DIF_9	Output Control	RW	Hi-Z	Enable	1
Bit 0		DIF_8	Output Control	RW	Hi-Z	Enable	1

Note: Bit 7 is wired OR to the HIGH\_BW# input, any 0 selects High BW

Note: Bit 6 is wired OR to the SMB\_A2\_PLLBYP# input, any 0 selects Fanout Bypass mode

SMBusTable: Output Enable Readback Register

Byte 3	Pin #	Name	Control Function	Type	0	1	Default
Bit 7			Readback - OE9# Input	R	Readback		X
Bit 6			Readback - OE8# Input	R	Readback		X
Bit 5			Readback - OE7# Input	R	Readback		X
Bit 4			Readback - OE6# Input	R	Readback		X
Bit 3			Readback - OE5# Input	R	Readback		X
Bit 2			Readback - OE_01234# Input	R	Readback		X
Bit 1	8		Readback - HIGH_BW# In	R	Readback		X
Bit 0	72		Readback - SMB_A2_PLLBYP# In	R	Readback		X

**SMBusTable: Output Enable Readback Register**

Byte 4	Pin #	Name	Control Function	Type	0	1	Default	
Bit 7	69	Readback - OE17_18# Input		R	Readback		X	
Bit 6	60	Readback - OE15_16# Input		R	Readback		X	
Bit 5		Reserved						0
Bit 4	54	Readback - OE14# Input		R	Readback		X	
Bit 3	51	Readback - OE13# Input		R	Readback		X	
Bit 2	48	Readback - OE12# Input		R	Readback		X	
Bit 1	43	Readback - OE11# Input		R	Readback		X	
Bit 0	40	Readback - OE10# Input		R	Readback		X	

**SMBusTable: Vendor & Revision ID Register**

Byte 5	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	-	-	1
Bit 3	-	VID3	VENDOR ID	R	-	-	0
Bit 2	-	VID2		R	-	-	0
Bit 1	-	VID1		R	-	-	0
Bit 0	-	VID0		R	-	-	1

**SMBusTable: DEVICE ID (194 Decimal or C2 Hex)**

Byte 6	Pin #	Name	Control Function	Type	0	1	Default
Bit 7	-	Device ID 7 (MSB)		RW	Reserved		1
Bit 6	-	Device ID 6		RW	Reserved		1
Bit 5	-	Device ID 5		RW	Reserved		0
Bit 4	-	Device ID 4		RW	Reserved		0
Bit 3	-	Device ID 3		RW	Reserved		0
Bit 2	-	Device ID 2		RW	Reserved		0
Bit 1	-	Device ID 1		RW	Reserved		1
Bit 0	-	Device ID 0		RW	Reserved		0

**SMBusTable: Byte Count Register**

Byte 7	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

**SMBusTable: Output Control Register**

Byte 8	Pin #	Name	Control Function	Type	0	1	Default
Bit 7			RESERVED				1
Bit 6			RESERVED				X
Bit 5			RESERVED				X
Bit 4		DIF_18	Output Control	RW	Hi-Z	Enable	1
Bit 3		DIF_17	Output Control	RW	Hi-Z	Enable	1
Bit 2		DIF_16	Output Control	RW	Hi-Z	Enable	1
Bit 1		DIF_15	Output Control	RW	Hi-Z	Enable	1
Bit 0		DIF_14	Output Control	RW	Hi-Z	Enable	1

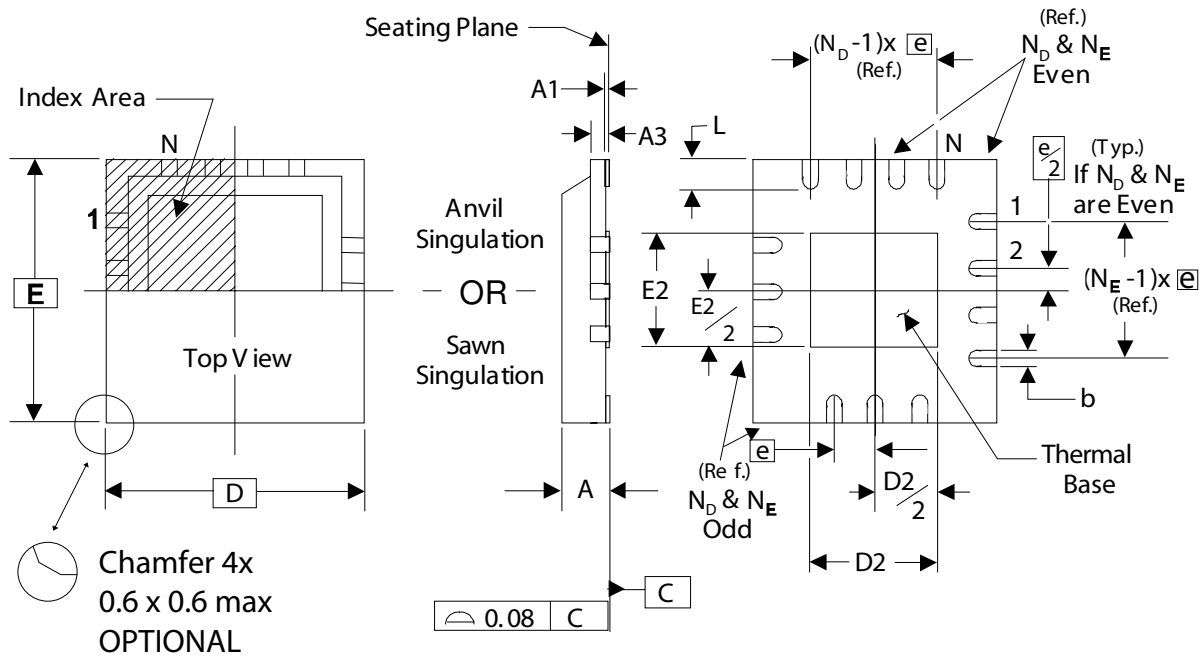
**SMBusTable: Reserved Register**

Byte 9	Pin #	Name	Control Function	Type	0	1	Default
Bit 7			RESERVED				0
Bit 6			RESERVED				0
Bit 5			RESERVED				0
Bit 4			RESERVED				0
Bit 3			RESERVED				0
Bit 2			RESERVED				1
Bit 1			RESERVED				0
Bit 0			RESERVED				1

### SMBus Address Mapping

SMBus Address (Hex)	Main Clock (CKxxx)	9DB233	9DB433	9DB633	9DB833	9DB1233	9DB1933
D0							✓
D2	✓						✓
D4		✓		✓		✓	✓
D6						✓	✓
D8			✓		✓		✓
DA			✓		✓		✓
DC			✓		✓	✓	✓
DE							✓

Note:  Indicates Bypass Mode. PLL is OFF.



THERMALLY ENHANCED, VERY THIN, FINE PITCH  
QUAD FLAT / NO LEAD PLASTIC PACKAGE

DIMENSIONS

SYMBOL	72L
N	72
$N_D$	18
$N_E$	18

DIMENSIONS (mm)

SYMBOL	MIN.	MAX.
A	0.8	1.0
A1	0	0.05
A3	0.25 Reference	
b	0.18	0.3
e	0.50 BASIC	
D x E BASIC	10.00 x 10.00	
D2 MIN. / MAX.	5.75	6.15
E2 MIN. / MAX.	5.75	6.15
L MIN. / MAX.	0.3	0.5

## Ordering Information

Part / Order Number	Shipping Packaging	Package	Temperature
9DB1933AKLF	Tubes	72-pin MLF	0 to +70°C
9DB1933AKLFT	Tape and Reel	72-pin MLF	0 to +70°C

“LF” after the package code denotes the Pb-Free configuration, RoHS compliant.

“A” is the device revision designator (will not correlate with the datasheet revision).



### Revision History

Rev.	Issue Date	Who	Description	Page #
0.1	7/7/2010	RDW	Initial release	-
A	7/12/2010	RDW	1. Updated 'PWD' to 'Default' in SMBus column headings 2. Updated electrical tables with char data 3. Added SMBusAddressing Table to page 15	5-8,13-15

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### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

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