

## Description

The SiT9377 is a 220 MHz to 1 GHz differential ApexMEMS® oscillator that is engineered for low-jitter applications.

In addition to standard differential signal types, a unique FlexSwing™ output-driver performs like LVPECL and provides independent control of voltage swing and DC offset to simplify interfacing with chipsets having non-standard input voltage requirements and eliminate all external source-bias resistors. The device also integrates multiple on-chip regulators to filter power supply noise, eliminating the need for an external dedicated LDO.

The SiT9377 can be factory programmed for specific combinations of frequency, stability, output signaling, voltage, and output enable functionality. Programmability enables designers to optimize clock configurations while eliminating long lead times and customization costs associated with quartz devices where each combination is custom built.

The wide frequency range and programmability makes this device ideal for communications, enterprise, and industrial applications that require a variety of frequencies and operate in noisy environments.

Refer to [Manufacturing Notes](#) for proper reflow profile, tape and reel dimension, and other manufacturing related information.

## Features

- Wide frequency range between 220 MHz and 920 MHz accurate to 6 decimal places  
(For additional frequencies, refer to [SiT9376](#) and [SiT9375](#) datasheets)
- 150 fs RMS typical phase jitter, 12 kHz to 20 MHz
- 9 fs/mV typical PSNR
- LVPECL, LVDS, HCSL, Low-power HCSL, and FlexSwing signaling options
- ±20, ±25, ±30, and ±50 ppm frequency stabilities
- Wide temperature range (-40°C to 105°C)  
[Contact SiTime](#) for -55°C to 125°C
- Factory programmable options for low lead time
- 1.8 V, 2.5 V, 3.3 V, and wide continuous power supply voltage range options
- 2 x 1.6, 2.5 x 2, 3.2 x 2.5 mm x mm package

## Applications

- 100G/200G/400G network equipment
- Optical modules
- Coherent optics
- Network switches, routers
- Industrial networking equipment
- Server and storage systems
- Industrial networks
- Test and measurement
- Broadcast video



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## Block Diagram

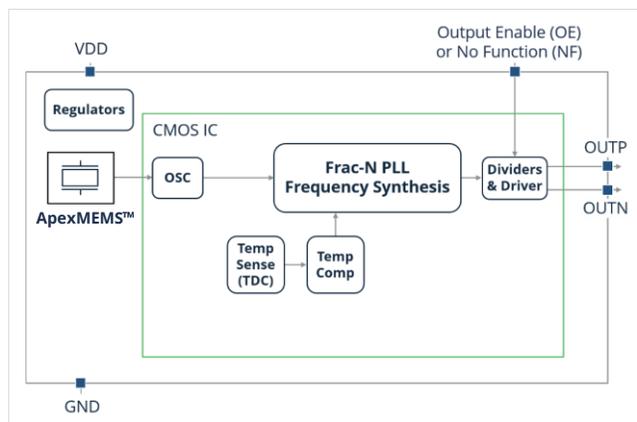


Figure 1. SiT9377 Block Diagram

## Package Pinout

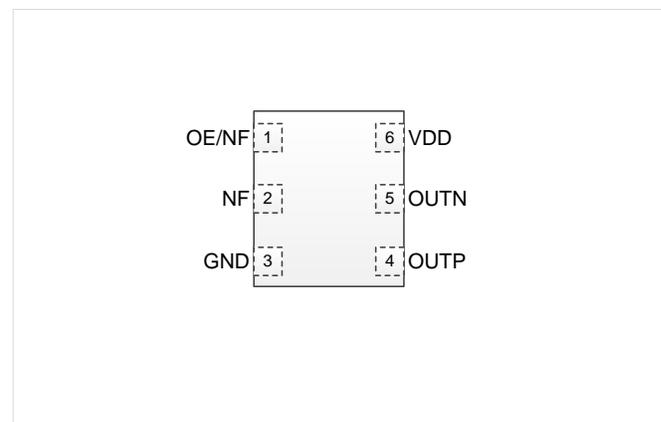
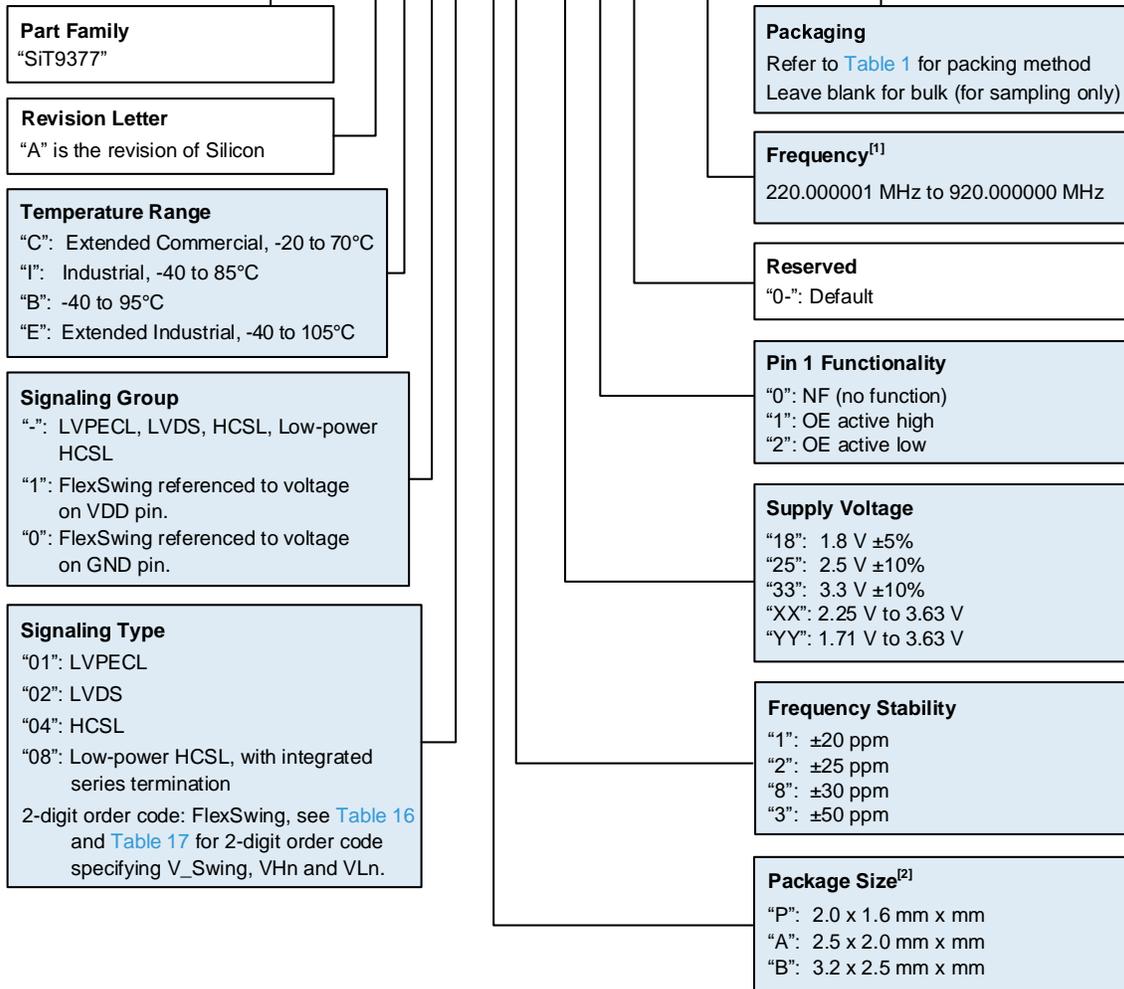


Figure 2. Pin Assignments (Top view)  
(Refer to [Table 16](#) for Pin Descriptions)

## Ordering Information

### SiT9377A-C-01B2-3310-220.000001D



**Notes:**

1. Frequencies between 690.000000 MHz and 740.000000 MHz are currently not supported. [Contact SiTime](#) for more options.
2. [Contact SiTime](#) for other package sizes.

**Table 1. Ordering Codes for Supported Tape & Reel Packing Method**

Device Size (mm x mm)	8 mm T&R (3ku)	8 mm T&R (1ku)	8 mm T&R (250u)
2.0 x 1.6	D	E	G
2.5 x 2.0	D	E	G
3.2 x 2.5	D	E	G

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## Electrical Characteristics

All Min and Max limits in the Electrical Characteristics tables are specified over operating temperature and rated operating voltage with standard output termination shown in the termination diagrams. Typical values are at 25°C and nominal supply voltage. See [Test Circuit Diagrams](#) for the test setups used with each signaling type.

**Table 2. Electrical Characteristics – Common to All Output Signaling Types**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Frequency Range</b>						
Output Frequency Range	f	220.000001	–	920.000000	MHz	Accurate to 6 decimal places. Frequencies between 690.000000 MHz and 740.000000 MHz are currently not supported. <a href="#">Contact SiTime</a> for more options.
<b>Frequency Stability</b>						
Frequency Stability	F_stab	–	–	±20	ppm	Inclusive of initial tolerance, operating temperature, rated power supply voltage, load variation of 2 pF ± 10%, and 10 years aging at 85°C.
		–	–	±25	ppm	
		–	–	±30	ppm	
		–	–	±50	ppm	
10 Year Aging	F_10y	–	±0.7	2.3	ppm	Ambient temperature of 85°C
<b>Temperature Range</b>						
Operating Temperature Range	T_use	-20	–	+70	°C	Extended commercial, ambient temperature
		-40	–	+85	°C	Industrial, ambient temperature
		-40	–	+95	°C	Ambient temperature
		-40	–	+105	°C	Extended industrial, ambient temperature
<b>Supply Voltage</b>						
Supply Voltage	Vdd	1.71	–	3.63	V	Voltage-supply order code “YY”
		2.25	–	3.63	V	Voltage-supply order code “XX”
		1.71	1.80	1.89	V	Voltage-supply order code “18”. <a href="#">Contact SiTime</a> for 1.5 V
		2.25	2.50	2.75	V	Voltage-supply order code “25”
		2.97	3.30	3.63	V	Voltage-supply order code “33”
<b>Input Characteristics</b>						
Input Voltage High	VIH	70%	–	–	Vdd	Logic High function for Pin 1
Input Voltage Low	VIL	–	–	30%	Vdd	Logic High function for Pin 1
Input Pull-up/Pull-down Impedance	Z_in	–	120	–	kΩ	Pin 1 for OE function
<b>Output Characteristics</b>						
Duty Cycle	DC	45	–	55	%	See <a href="#">Figure 15</a> for waveform.
<b>Startup, OE and SE Timing</b>						
Startup Time	T_start	–	1.2	2	ms	Measured from the time Vdd reaches its rated minimum value
Output Enable Time 1	T_oe	–	–	100+3 clock cycles	ns	For all signaling types except Low-Power HCSL. Measured from the time OE pin toggles to enable logic level to the time clock pins reach 90% of final swing. See <a href="#">Figure 21</a> for waveform.
Output Enable Time 2	T_oe	–	–	500+3 clock cycles	ns	For Low-Power HCSL signaling type. Measured from the time OE pin toggles to enable logic level to the time clock pins reach 90% of final swing. See <a href="#">Figure 21</a> for waveform.
Output Disable Time	T_od	–	–	100+3 clock cycles	ns	Measured from the time OE pin toggles to disable logic level to the last clock edge. See <a href="#">Figure 22</a> for waveform.
<b>Jitter and Phase Noise, measured at f = 622.08 MHz</b>						
RMS Phase Jitter (random)	T_phj	–	150	200	fs	12 kHz to 20 MHz offset frequency integration bandwidth. <a href="#">Contact SiTime</a> for <100 fs rms jitter
Spurious Phase Noise	PN_spur	–	-88	–	dBc	12 kHz to 20 MHz offset frequency range
RMS Period Jitter <sup>[3]</sup>	T_jitt_per	–	0.62	0.72	ps	Measured based on 10K cycle
Peak Cycle-to-cycle Jitter <sup>[3]</sup>	T_jitt_cc	–	3.5	4.4	ps	Measured based on 1K cycle

**Note:**

3. Measured according to JESD65B using Keysight DSAX91604A Oscilloscope.

**Table 3. Electrical Characteristics – LVPECL** | Supply voltage (“order code”): 2.5 V  $\pm$ 10% (“25”), 3.3 V  $\pm$ 10% (“33”), 2.25 V to 3.63 V (“XX”). All typical specifications are measured at nominal supply voltage of 2.5 V and nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 4](#) and [Figure 5](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	46	56	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination 1	Idd_oe_wt1	–	58	71	mA	Including load termination current as shown in <a href="#">Figure 26</a> for Vdd=3.3 V $\pm$ 10%, Vdd=2.25 V to 3.63 V and R3=50 Ohms.
		–	58	65.5	mA	Including load termination current as shown in <a href="#">Figure 26</a> for Vdd=2.5 V $\pm$ 10% and R3=50 Ohms.
Current Consumption, Output Enabled with Termination 2	Idd_oe_wt2	–	71	76	mA	Including load termination current. See <a href="#">Figure 27</a> for termination.
Current Consumption Output Disabled with Termination 1	Idd_od_wt1	–	59	74	mA	Including load termination current as shown in <a href="#">Figure 26</a> for Vdd=3.3 V $\pm$ 10%, Vdd=2.25 V to 3.63 V and R3=50 Ohms. Driver output is at logic-high voltage levels.
		–	59	66.5	mA	Including load termination current as shown in <a href="#">Figure 26</a> for Vdd=2.5 V $\pm$ 10% and R3=50 Ohms. Driver output is at logic-high voltage levels.
Current Consumption, Output Disabled with Termination 2	Idd_od_wt2	–	74	79.5	mA	Including load termination current. See <a href="#">Figure 27</a> for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	Vdd-1.15	Vdd-0.95	Vdd-0.77	V	See <a href="#">Figure 14</a> for waveform.
Output Low Voltage	VOL	Vdd-1.92	Vdd-1.7	Vdd-1.58	V	See <a href="#">Figure 14</a> for waveform.
Output Differential Voltage Swing	V_Swing	1.35	1.5	1.7	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	115	165	ps	20% to 80%. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V_da	–	65	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	$\pm$ 30	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V_ov	–	8	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	13	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	4.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 6</a>
Power Supply-Induced Phase Noise	PSPN	–	-64	–	dBc	50 mV peak-peak ripple on VDD.
		–	-73.5	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 6</a>

**Table 4. Electrical Characteristics – FlexSwing** | Supply voltage (“order code”) referred to VDD, only: 2.5 V ±10% (“25”), 3.3 V ±10% (“33”), 2.25 V to 3.63 V (“XX”). All typical specifications are measured at nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 6](#) and [Figure 7](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	49.5	61	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	Idd_oe_wt	–	58.5	73	mA	Including load termination current, for FlexSwing order code “ER”. See <a href="#">Figure 26</a> for Vdd=3.3 V ±10%, Vdd=2.25 V to 3.63 V, and R3=100 Ohms.
		–	58.5	65.5	mA	Including load termination current, for FlexSwing order code “ER”. See <a href="#">Figure 26</a> for Vdd=2.5 V ±10%, and R3=100 Ohms.
Current Consumption Output Disabled with Termination	Idd_od_wt	–	57	72	mA	Including load termination current, for FlexSwing order code “ER”. See <a href="#">Figure 26</a> for Vdd=3.3 V ±10%, Vdd=2.25 V to 3.63 V, and R3=100 Ohms. Driver output is at logic-high voltage levels.
		–	57	65	mA	Including load termination current, for FlexSwing order code “ER”. See <a href="#">Figure 26</a> for Vdd=2.5 V ±10%, and R3=100 Ohms. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	VHn -0.24	VHn	VHn +0.17	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOH (i.e. VHn) values
Output Low Voltage	VOL	VLn -0.24	VLn	VLn +0.18	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOL (i.e. VLn) values
Output Differential Voltage Swing	V_Swing	-22%	2*( VHn-VLn)	+22%	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	115	165	ps	20% to 80%. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V_da	–	55	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	±40	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V_ov	–	8	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	17	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “ER”.
		–	4.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “ER”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .
Power Supply-Induced Phase Noise	PSPN	–	-61.5	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “ER”.
		–	-69	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “ER”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .

**Table 5. Electrical Characteristics – FlexSwing** | Supply voltage (“order code”) referred to GND, only: 1.8 V ±5% (“18”), 1.71 V to 3.63 V (“YY”). All typical specifications are measured at nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 6](#) and [Figure 7](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	46.5	53	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	Idd_oe_wt	–	56	60.5	mA	Including load termination current, for FlexSwing order code “3E”. See <a href="#">Figure 26</a> for Vdd=1.8 V ±5% and R3=100 Ohms.
		–	56	62.5	mA	Including load termination current, for FlexSwing order code “3E”. See <a href="#">Figure 26</a> for Vdd=1.71 V to 3.63 V and R3=100 Ohms.
Current Consumption Output Disabled with Termination	Idd_od_wt	–	56	60.5	mA	Including load termination current, for FlexSwing order code “3E”. See <a href="#">Figure 26</a> for Vdd=1.8 V ±5% and R3=100 Ohms. Driver output is at logic-high voltage levels.
		–	56	62.5	mA	Including load termination current, for FlexSwing order code “3E”. See <a href="#">Figure 26</a> for Vdd=1.71 V to 3.63 V and R3=100 Ohms. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	VHn – 0.12	VHn	VHn + 0.12	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOH (i.e. VHn) values
Output Low Voltage	VOL	VLn – 0.13	VLn	VLn + 0.12	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOL (i.e. VLn) values
Output Differential Voltage Swing	V_Swing	-21%	$2 \times (V_{Hn} - V_{Ln})$	+21%	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	120	175	ps	20% to 80%. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V_da	–	60	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	±40	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V_ov	–	8	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	15	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “3E”.
		–	3	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “3E”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .
Power Supply-Induced Phase Noise	PSPN	–	-62.5	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “3E”.
		–	-76.5	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “3E”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .

**Table 6. Electrical Characteristics – FlexSwing** | Supply voltage (“order code”) referred to GND, only: 2.5 V ±10% (“25”), 3.3 V ±10% (“33”), 2.25 V to 3.63 V (“XX”). All typical specifications are measured at nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 6](#) and [Figure 7](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
<b>Current Consumption, Output Enabled without Termination</b>	Idd_oe_nt	–	47.5	53	mA	Excluding load termination current.
<b>Current Consumption, Output Enabled with Termination</b>	Idd_oe_wt	–	57	62.5	mA	Including load termination current, for FlexSwing order code “VP”. See <a href="#">Figure 26</a> for Vdd=3.3 V ±10%, Vdd=2.25 V to 3.63 V, and R3=100 Ohms.
<b>Current Consumption Output Disabled with Termination</b>	Idd_od_wt	–	57.5	65	mA	Including load termination current, for FlexSwing order code “VP”. See <a href="#">Figure 26</a> for Vdd=3.3 V ±10%, Vdd=2.25 V to 3.63 V, and R3=100 Ohms. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
<b>Output High Voltage</b>	VOH	VHn – 0.13	VHn	VHn + 0.1	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOH (i.e. VHn) values
<b>Output Low Voltage</b>	VOL	VLn – 0.16	VLn	VLn + 0.1	V	See <a href="#">Figure 14</a> for waveform; Refer to <a href="#">Table 17</a> or <a href="#">Table 18</a> order codes for nominal VOL (i.e. VLn) values
<b>Output Differential Voltage Swing</b>	V_Swing	-21%	2*( VHn-VLn)	+21%	V	See <a href="#">Figure 15</a> for waveform.
<b>Rise/Fall Time</b>	Tr, Tf	–	115	165	ps	20% to 80%. See <a href="#">Figure 15</a> for waveform.
<b>Differential Asymmetry, peak-peak</b>	V_da	–	60	–	mV	See <a href="#">Figure 17</a> for waveform.
<b>Differential Skew, peak</b>	V_ds	–	±40	–	ps	See <a href="#">Figure 18</a> for waveform.
<b>Overshoot Voltage, peak</b>	V_ov	–	8	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
<b>Power Supply-Induced Jitter Sensitivity</b>	PSJS	–	17	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “VP”
		–	3.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. For FlexSwing order code “VP”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .
<b>Power Supply-Induced Phase Noise</b>	PSPN	–	-61.5	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “VP”.
		–	-73	–	dBc	50 mV peak-peak ripple on VDD. For FlexSwing order code “VP”. Using RC power supply filter as shown in <a href="#">Figure 6</a> .

**Table 7. Electrical Characteristics – LVDS** | Supply voltage (“order code”): 2.5 V  $\pm$ 10% (“25”), 3.3 V  $\pm$ 10% (“33”), 2.25 V to 3.63 V (“XX”). All typical specifications are measured at nominal supply of 2.5 V and nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 8](#) and [Figure 9](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	I <sub>dd_oe_nt</sub>	–	40.5	47.5	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	I <sub>dd_oe_wt</sub>	–	44.5	51	mA	Including load termination current. See <a href="#">Figure 30</a> for termination.
Current Consumption Output Disabled with Termination	I <sub>dd_od_wt</sub>	–	46	51	mA	Including load termination current. See <a href="#">Figure 30</a> for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Differential Output Voltage	V <sub>OD</sub>	250	345	450	mV	See <a href="#">Figure 16</a> for waveform.
Delta VOD	$\Delta$ V <sub>OD</sub>	–	–	50	mV	See <a href="#">Figure 16</a> for waveform.
Offset Voltage	V <sub>OS</sub>	1.125	1.25	1.375	V	See <a href="#">Figure 16</a> for waveform.
Delta VOS	$\Delta$ V <sub>OS</sub>	–	–	50	mV	See <a href="#">Figure 16</a> for waveform.
Rise/Fall Time	T <sub>r</sub> , T <sub>f</sub>	–	75	95	ps	Measured 20% to 80% using <a href="#">Figure 30</a> for termination. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V <sub>da</sub>	–	45	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V <sub>ds</sub>	–	$\pm$ 40	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V <sub>ov</sub>	–	16	–	%	Measured as percent of V <sub>OD</sub> . See <a href="#">Figure 20</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	14	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	3.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 8</a> .
Power Supply-Induced Phase Noise	PSPN	–	-63	–	dBc	50 mV peak-peak ripple on VDD.
		–	-76	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 8</a> .

**Table 8. Electrical Characteristics – LVDS** | Supply voltage (“order code”): 1.8 V  $\pm$ 5% (“18”), 1.71 V to 3.63 V (“YY”). All typical specifications are measured at nominal supply of 2.5 V and nominal frequency of 622.08 MHz unless otherwise stated. See [Figure 8](#) and [Figure 9](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
<b>Current Consumption, Output Enabled without Termination</b>	I <sub>dd_oe_nt</sub>	–	40.5	47.5	mA	Excluding load termination current.
<b>Current Consumption, Output Enabled with Termination</b>	I <sub>dd_oe_wt</sub>	–	44.5	51	mA	Including load termination current. See <a href="#">Figure 30</a> for termination.
<b>Current Consumption Output Disabled with Termination</b>	I <sub>dd_od_wt</sub>	–	46	51	mA	Including load termination current. See <a href="#">Figure 30</a> for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
<b>Differential Output Voltage</b>	V <sub>OD</sub>	250	345	450	mV	See <a href="#">Figure 16</a> for waveform.
<b>Delta VOD</b>	$\Delta$ V <sub>OD</sub>	–	–	50	mV	See <a href="#">Figure 16</a> for waveform.
<b>Offset Voltage</b>	V <sub>OS</sub>	1.125	1.25	1.375	V	See <a href="#">Figure 16</a> for waveform.
<b>Delta VOS</b>	$\Delta$ V <sub>OS</sub>	–	–	50	mV	See <a href="#">Figure 16</a> for waveform.
<b>Rise/Fall Time</b>	T <sub>r</sub> , T <sub>f</sub>	–	75	95	ps	Measured 20% to 80% using <a href="#">Figure 30</a> for termination. See <a href="#">Figure 15</a> for waveform.
<b>Differential Asymmetry, peak-peak</b>	V <sub>da</sub>	–	45	–	mV	See <a href="#">Figure 17</a> for waveform.
<b>Differential Skew, peak</b>	V <sub>ds</sub>	–	$\pm$ 40	–	ps	See <a href="#">Figure 18</a> for waveform.
<b>Overshoot Voltage, peak</b>	V <sub>ov</sub>	–	16	–	%	Measured as percent of V <sub>OD</sub> . See <a href="#">Figure 20</a> for waveform.
<b>Power Supply Noise Immunity</b>						
<b>Power Supply-Induced Jitter Sensitivity</b>	PSJS	–	16	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	3.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 8</a> .
<b>Power Supply-Induced Phase Noise</b>	PSPN	–	-62	–	dBc	50 mV peak-peak ripple on VDD.
		–	-76	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 8</a> .

**Table 9. Electrical Characteristics – HCSL** | Supply voltage (“order code”): 2.5 V  $\pm$ 10% (“25”), 3.3 V  $\pm$ 10% (“33”), 2.25 V to 3.63 V (“XX”), 1.8 V  $\pm$ 5% (“18”), 1.71 V to 3.63 V (“YY”). All typical specifications are measured at nominal supply of 2.5V and nominal frequency of 322.265625 MHz unless otherwise stated. See [Figure 10](#) and [Figure 11](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	38	42.5	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	Idd_oe_wt	–	52	56.5	mA	Including load termination current. See <a href="#">Figure 31</a> (a) and <a href="#">Figure 31</a> (b) for termination.
Current Consumption, Output Disabled with Termination	Idd_od_wt	–	56.5	61.5	mA	Including load termination current. See <a href="#">Figure 31</a> (a) and <a href="#">Figure 31</a> (b) for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	0.53	0.7	0.9	V	See <a href="#">Figure 14</a> for waveform.
Output Low Voltage	VOL	-0.1	0	0.1	V	See <a href="#">Figure 14</a> for waveform.
Output Differential Voltage Swing	V_Swing	1.0	1.25	1.5	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	65	95	ps	Measured from -150mV to +150V. See <a href="#">Figure 15</a> for waveform.
Ring-back Voltage	Rb	210	-	-	mV	
Differential Asymmetry, peak-peak	V_da	–	65	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	$\pm$ 70	–	ps	See <a href="#">Figure 18</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	12	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	2.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 10</a> .
Power Supply-Induced Phase Noise	PSPN	–	-70	–	dBc	50 mV peak-peak ripple on VDD
		–	-83.5	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 10</a> .

**Table 10. Electrical Characteristics – Low-Power HCSL** | Supply voltage (“order code”): 2.5 V  $\pm$ 10% (“25”), 3.3 V  $\pm$ 10% (“33”), 2.25 V to 3.63 V (“XX”), 1.8 V  $\pm$ 5% (“18”), 1.71 V to 3.63 V (“YY”). All typical specifications are measured at nominal supply of 2.5V and nominal frequency of 350 MHz unless otherwise stated. See [Figure 12](#) and [Figure 13](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	40	45	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	Idd_oe_wt	–	41	46.5	mA	Including load termination current. See <a href="#">Figure 32</a> for termination.
Current Consumption, Output Disabled with Termination	Idd_od_wt	–	36	41.5	mA	Including load termination current. See <a href="#">Figure 32</a> for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	0.8	1.0	1.15	V	See <a href="#">Figure 14</a> for waveform.
Output Low Voltage	VOL	-0.15	0	0.1	V	See <a href="#">Figure 14</a> for waveform.
Output Differential Voltage Swing	V_Swing	1.6	2.0	2.25	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	250	330	ps	Measured 20% to 80%. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V_da	–	55	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	$\pm$ 30	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V_ov	–	1	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	16.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 12</a> .
Power Supply-Induced Phase Noise	PSPN	–	-67	–	dBc	50 mV peak-peak ripple on VDD.
		–	-77.5	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 12</a> .

**Table 11. Electrical Characteristics – Low-Power HCSL** | Supply voltage (“order code”): 2.5 V ±10% (“25”), 3.3 V ±10% (“33”), 2.25 V to 3.63 V (“XX”), 1.8 V ±5% (“18”), 1.71 V to 3.63 V (“YY”). All typical specifications are measured at nominal supply of 2.5V and nominal frequency of 675 MHz unless otherwise stated. See [Figure 12](#) and [Figure 13](#) for test setups.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
<b>Current Consumption</b>						
Current Consumption, Output Enabled without Termination	Idd_oe_nt	–	48.5	55.5	mA	Excluding load termination current.
Current Consumption, Output Enabled with Termination	Idd_oe_wt	–	51	58	mA	Including load termination current. See <a href="#">Figure 32</a> for termination.
Current Consumption, Output Disabled with Termination	Idd_od_wt	–	37.5	43.5	mA	Including load termination current. See <a href="#">Figure 32</a> for termination. Driver output is at logic-high voltage levels.
<b>Output Characteristics</b>						
Output High Voltage	VOH	0.77	0.9	1.15	V	See <a href="#">Figure 14</a> for waveform.
Output Low Voltage	VOL	-0.15	0	0.2	V	See <a href="#">Figure 14</a> for waveform.
Output Differential Voltage Swing	V_Swing	1.6	2.0	2.2	V	See <a href="#">Figure 15</a> for waveform.
Rise/Fall Time	Tr, Tf	–	255	315	ps	Measured 20% to 80%. See <a href="#">Figure 15</a> for waveform.
Differential Asymmetry, peak-peak	V_da	–	60	–	mV	See <a href="#">Figure 17</a> for waveform.
Differential Skew, peak	V_ds	–	±30	–	ps	See <a href="#">Figure 18</a> for waveform.
Overshoot Voltage, peak	V_ov	–	1	–	%	Measured as percent of V_Swing. See <a href="#">Figure 19</a> for waveform.
<b>Power Supply Noise Immunity</b>						
Power Supply-Induced Jitter Sensitivity	PSJS	–	18.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz
		–	5.5	–	fs/mV	Power supply ripple from 10 kHz to 20 MHz. Using RC power supply filter as shown in <a href="#">Figure 12</a> .
Power Supply-Induced Phase Noise	PSPN	–	-60	–	dBc	50 mV peak-peak ripple on VDD.
		–	-70.5	–	dBc	50 mV peak-peak ripple on VDD. Using RC power supply filter as shown in <a href="#">Figure 12</a> .

**Table 12. Absolute Maximum Ratings**

Operation outside the absolute maximum ratings may cause permanent damage to the part. Performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameter	Test Conditions	Min.	Max.	Unit
Continuous Power Supply Voltage Range (Vdd)		-0.5	4.0	V
Input Voltage, Maximum	Any input pin	–	Vdd + 0.3	V
Input Voltage, Minimum	Any input pin	-0.3	–	V
Storage Temperature		-65	150	°C
Maximum Junction Temperature		–	135	°C

**Table 13. Thermal Considerations<sup>[4]</sup>**

Package	$\theta_{JA}$ (°C/W)	$\Psi_{JT}$ (°C/W)	$\theta_{JB}$ (°C/W)	$\theta_{JC,Top}$ (°C/W)
3225, 6-pin	101	4.7	23	86
2520, 6-pin	111	3.7	24	116
2016, 6-pin	134	3.4	24	147

**Notes:**

- $\theta_{JA}$ ,  $\Psi_{JT}$ ,  $\theta_{JB}$  and  $\theta_{JC}$  are provided according to JEDEC standards 51-2A, 51-7, 51-8, and 51-12.01 with a 25°C ambient and 250 mW power consumption (typical of 1 GHz  $f_{out}$ ). The conduction thermal resistances  $\theta_{JB}$  and  $\theta_{JC}$  are obtained with the assumption that all heat flows from the junction to a heat sink through either the solder pads ( $\theta_{JB}$ ) or the top of the package ( $\theta_{JC,Top}$ ). These may be used in a two-resistor compact model. The values of  $\theta_{JA}$  and  $\Psi_{JT}$  are strongly application dependent, and we report values based on the JEDEC thermal environment.  $\theta_{JA}$  is the thermal resistance to ambient on a JEDEC PCB – it is a highly conservative estimate, since the JEDEC board does not have vias to PCB planes in the vicinity of the package.  $\Psi_{JT}$  can be used to estimate the junction temperature from measurements of the temperature at the top of the package if the thermal environment is similar to the JEDEC environment.

**Table 14. Maximum Operating Junction Temperature<sup>[5]</sup>**

Max Operating Temperature (ambient)	Maximum Operating Junction Temperature
70°C	85°C
85°C	100°C
95°C	110°C
105°C	120°C

**Notes:**

- Datasheet specifications are not guaranteed if junction temperature exceeds the maximum operating junction temperature.

**Table 15. Environmental Compliance**

Parameter	Test Conditions	Value	Unit
Mechanical Shock Resistance	MIL-STD-883F, Method 2002	10,000	g
Mechanical Vibration Resistance	MIL-STD-883F, Method 2007	70	g
Soldering Temperature (follow standard Pb free soldering guidelines) <sup>[6]</sup>	MIL-STD-883F, Method 2003	260	°C
Moisture Sensitivity Level	MSL1 @ 260°C		
Electrostatic Discharge (HBM)	HBM, JESD22-A114	2,000	V
Charge-Device Model ESD Protection	JESD220C101	750	V
Latch-up Tolerance	JESD78 Compliant		

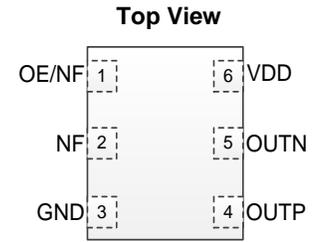
**Notes:**

- Please refer to [SiTime Manufacturing Notes](#).

## Pin Description

**Table 16. Pin Description**

Pin	Map	Functionality	
1	OE/NF	Output Enable (OE)	H <sup>[7]</sup> : Specified frequency output L <sup>[8]</sup> : OUT: Logic HIGH,
		No Function (NF)	Open, 120 kΩ internal pull-down resistor to GND
2	NF	No Function	H or L or Open: No effect on output frequency or other device functions. <sup>[9]</sup>
3	GND	Power	Power Supply Ground
4	OUTP	Output	Oscillator output
5	OUTN	Output	Complementary oscillator output
6	VDD	Power	Power supply voltage <sup>[10]</sup>



**Figure 3. Pin Assignments**

**Notes:**

7. OE pin includes a 120 kΩ internal pull-up resistor to VDD when active high, and a 120 kΩ internal pull-down resistor to GND when active low. In noisy environments, the OE pin is recommended to include an external 10 kΩ resistor (Use 10kΩ pull-up if active high OE; use 10kΩ pull-down if active low OE) when the pin is not externally driven.
8. Differential Logic high means OUTP=VOH, OUTN=VOL.
9. Can be left open. SiTime recommends grounding it for better thermal performance.
10. A capacitor of value 0.1 μF or higher between VDD and GND pins is required.

## FlexSwing Configurations

A FlexSwing output-driver performs like LVPECL and additionally provides independent control of voltage swing and DC offset voltage levels. This simplifies interfacing with chipsets having non-standard input voltage requirements

and can eliminate all external source-bias resistors. FlexSwing supports power supply voltages from 1.71 V to 3.63 V, and the programmable VOH and VOL levels may be referenced to the voltage on either VDD or GND pins.

**Table 17. FlexSwing 2-digit Order Codes specifying VHn and VLn referenced to voltage on VDD pin**

Order Code V_Swing (V)		VLn																							
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X		
VHn	A									AJ	AK	AL	AM	AN	AP	AQ	AR	AS	AT	AU	AV	AW	AX		
	B								1.94	BJ	BK	BL	BM	BN	BP	BQ	BR	BS	BT	BU	BV	BW	BX		
	C							1.94	1.86	CJ	CK	CL	CM	CN	CP	CQ	CR	CS	CT	CU	CV	CW	CX		
	D						1.94	1.86	1.77	DJ	DK	DL	DM	DN	DP	DQ	DR	DS	DT	DU	DV	DW	DX		
	E				1.94		1.86	1.77	1.69	EJ	EK	EL	EM	EN	EP	EQ	ER	ES	ET	EU	EV	EW	EX		
	F				1.94	1.86	1.77	1.69	1.61	FJ	FK	FL	FM	FN	FP	FQ	FR	FS	FT	FU	FV	FW			
	G			1.94	1.86	1.77	1.69	1.61	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.676	0.59	0.51	0.42			
	H		1.94	1.86	1.77	1.69	1.61	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25		
	J	1.94	1.86	1.77	1.69	1.61	JF	JG	JH	JJ	JK	JL	JM	JN	JP	JQ	JR	JS	JT						
	K	1.86	1.77	1.69	1.61	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25				
	L	1.77	1.69	1.61	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25					
	M	1.69	1.61	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25						
	N	1.61	NB	NC	ND	NE	NF	NG	NH	NJ	NK	NL	NM	NN	NP										
	P	1.52	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25								
	Q	1.44	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25									
	R	1.35	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25										
	S	1.27	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25											
	T	1.18	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25												
	U	1.10	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25													
	V	1.01	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25														
	W	0.93	0.85	0.76	0.68	0.59	0.51	0.42	0.34	0.25															

Supply Voltage	Available Colors
1.8V±5%	Not Supported
1.71V to 3.63V	Not Supported
2.5V±10%	Blue
3.3V±10%	Blue Red
2.25V to 3.63V	Blue
Note 11	Gray

**Note:**  
11. Please [contact SiTime](#).

The above table identifies supported combinations of nominal VOH (i.e. VHn) and nominal VOL (i.e. VLn) in colored boxes. The two-character code in each box corresponds to the VHn and VLn codes specified in the 2<sup>nd</sup> column and 2<sup>nd</sup> row in the table, respectively. The number in each box indicates the nominal differential swing (i.e. VHn – VLn).

For example, order code “FS” selects VHn code “F” (i.e. Vdd-1.144 V) and VLn code “S” (i.e. Vdd-1.530 V) corresponding to a V\_Swing of 0.845 V peak-peak, which may be used for supply voltages of 2.5 V ±10%, 3.3 V ±10% or (2.25 V to 3.63 V). Alternatively, an order code of “GS” corresponds to a VHn code “G” (i.e. Vdd-1.193 V) and a VLn order code “S” (e.g. Vdd-1.530 V) corresponding to a V\_Swing of 0.760 V peak-peak, which may be used for a supply voltage of 3.3 V ±10%.

Table 18. FlexSwing 2-digit Order Codes specifying VHn and VLn referenced to voltage on GND pin

Order Code V_Swing (V)		C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y											
		0.45V	0.49V	0.54V	0.59V	0.64V	0.69V	0.74V	0.79V	0.84V	0.89V	0.94V	0.99V	1.03V	1.08V	1.16V	1.23V	1.3V	1.38V	1.45V	1.53V	1.6V											
VHn	A																		AV	AW	AX	AY											
	B																			1.94	1.86	1.69	1.61										
	C	Supply Voltage		Available Colors																													
		1.8V±5%		Orange			Green																										
	D	1.71V to 3.63V		Green																													
		2.5V±10%		Orange			Green			Blue		Purple																					
	E	3.3V±10%		Green				Blue		Red																							
		2.25V to 3.63V		Green				Blue																									
	F	Note 12		Gray																													
	G															1.94				FS	FT	FU	FV	FX	FY								
	H															1.94	1.86			GS	GT	GU	GV	GW	GX	GY							
	J															1.94	1.86	1.77		HS	HT	HU	HV	HW	HX	HY							
	K															1.94	1.86	1.77	1.69	JS	JT	JU	JV	JW	JX	JY							
	L															1.94	1.86	1.77	1.69	KS	KT	KU	KV	KW	KX	KY							
	M															1.94	1.86	1.77	1.69	LS	LT	LU	LV	LW	LX	LY							
	N															1.94	1.86	1.77	1.69	MS	MT	MU	MV	MW	MX	MY							
	P															1.94	1.86	1.77	1.69	NR	NS	NT	NU	NV	NW	NX	NY						
	Q															1.94	1.86	1.77	1.69	NQ	NR	NS	NT	NU	NV	NW	NX	NY					
	R															1.94	1.86	1.77	1.69	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY				
	S															1.94	1.86	1.77	1.69	QN	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY			
	T															1.94	1.86	1.77	1.69	RM	RN	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY		
	U															1.94	1.86	1.77	1.69	SL	SM	SN	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	
	V															1.94	1.86	1.77	1.69	TK	TL	TM	TN	TP	TQ	TR	TS	TT	TU	TV	TV	TY	
	W															1.94	1.86	1.77	1.69	TK	TL	TM	TN	TP	TQ	TR	TS	TT	TU	TV	TV	TY	
	X															1.94	1.86	1.77	1.69	UJ	UK	UL	UM	UN	UP	UQ	UR	US	UT	UU	UV	UV	UY
	Y															1.94	1.86	1.77	1.69	UJ	UK	UL	UM	UN	UP	UQ	UR	US	UT	UU	UV	UV	UY
Z															1.94	1.86	1.77	1.69	VH	VJ	VK	VL	VM	VN	VP	VQ	VR	VS	VT	VU	VU	YZ	
1															1.94	1.86	1.77	1.69	UJ	UK	UL	UM	UN	UP	UQ	UR	US	UT	UU	UV	UV	YZ	
2															1.94	1.86	1.77	1.69	UJ	UK	UL	UM	UN	UP	UQ	UR	US	UT	UU	UV	UV	YZ	
3															1.94	1.86	1.77	1.69	UJ	UK	UL	UM	UN	UP	UQ	UR	US	UT	UU	UV	UV	YZ	

Note:  
12. Please contact SiTime.

## Test Circuit Diagrams

A 1.5 pF capacitive load is used at each differential output. Because of the additive input capacitance of the active probe used with the oscilloscope, the output characteristics for all signal types are measured with a total of 2 pF capacitive load.

### Test Setups for LVPECL Measurements

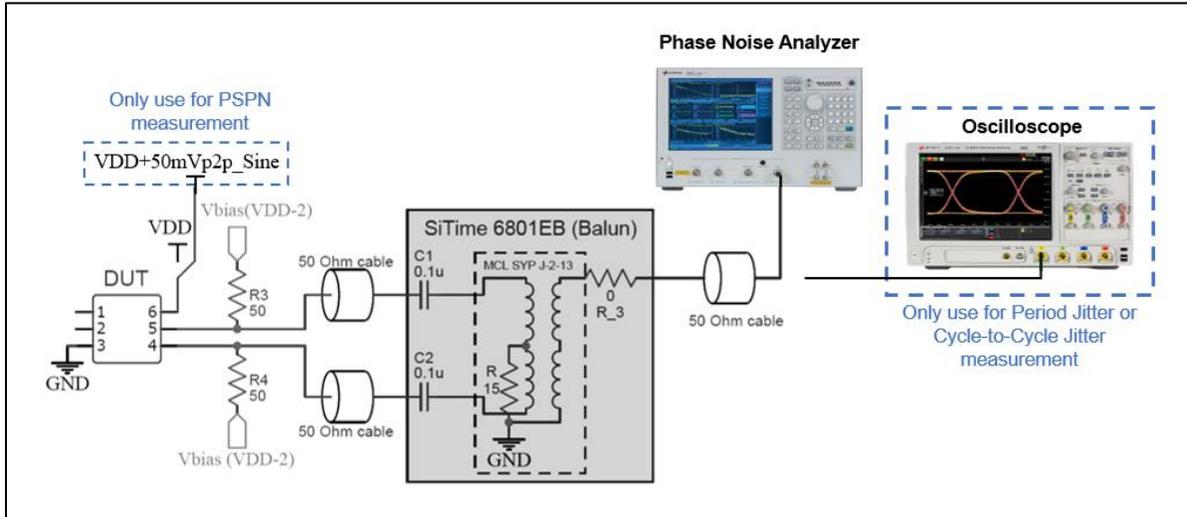


Figure 4. Test setup to measure LVPECL Phase Noise, Period Jitter, Cycle-to-Cycle Jitter, and Power Supply-Induced Phase Noise (PSPN) without filter added<sup>[13]</sup>

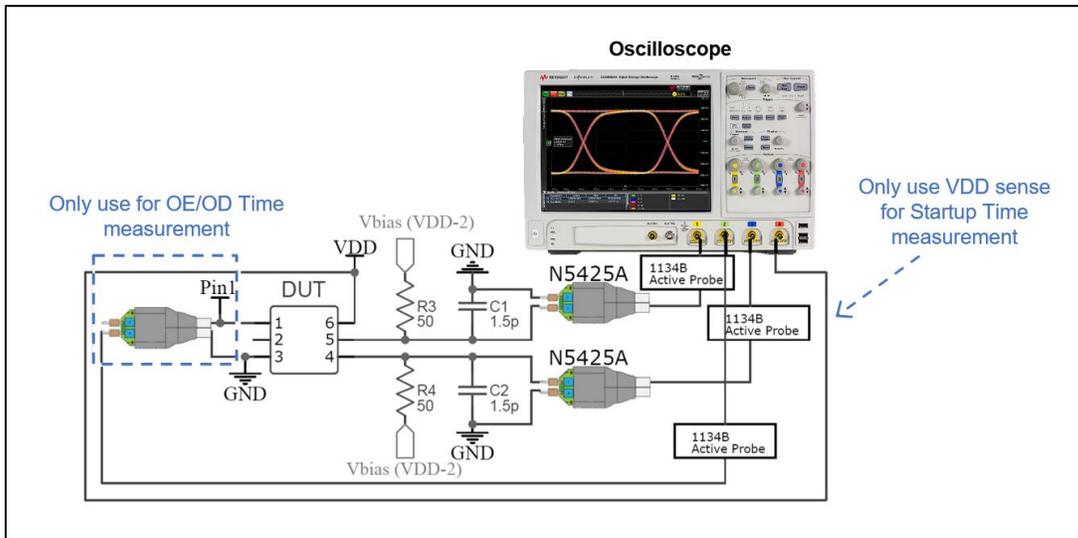


Figure 5. Test setup to measure LVPECL Output Waveform Characteristics, Current Consumption (with Termination 2)<sup>[14]</sup>, Output Enable/Disable Time, and Startup Time

**Notes:**

- 13. See Figure 6 for the test setup to measure LVPECL Power Supply-Induced Phase Noise (PSPN) with filter added.
- 14. See Figure 7 for the test setup to measure LVPECL Current Consumption with Termination 1 or without Termination.

## Test Circuit Diagrams (continued)

### Test Setups for FlexSwing Measurements<sup>[15]</sup>

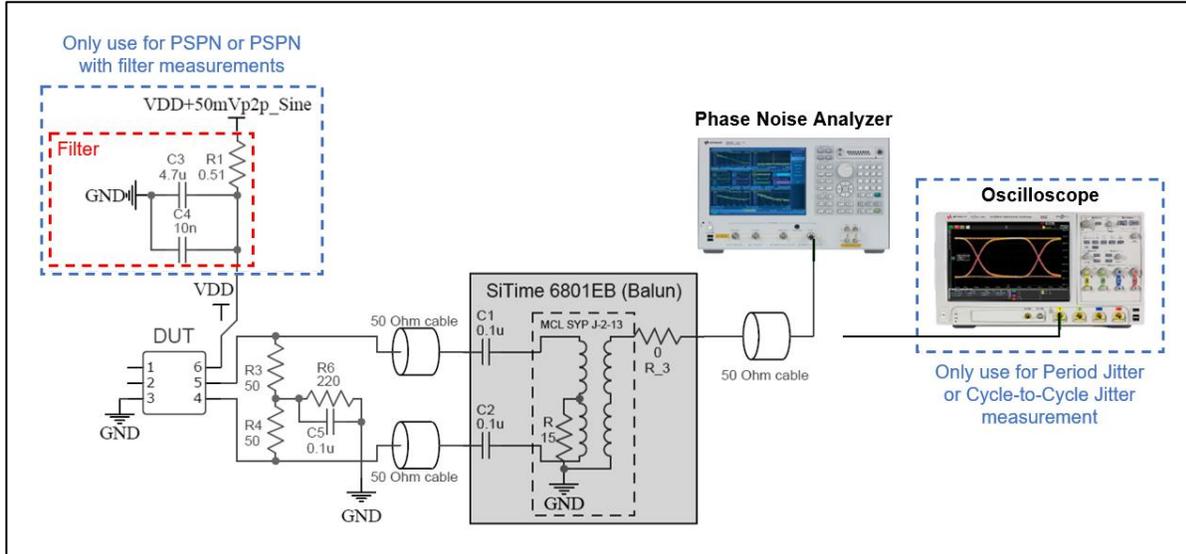


Figure 6. Test setup to measure FlexSwing Phase Noise, Period Jitter, Cycle-to-Cycle Jitter, and Power Supply-Induced Phase Noise (PSPN) with and without filter added<sup>[16]</sup>

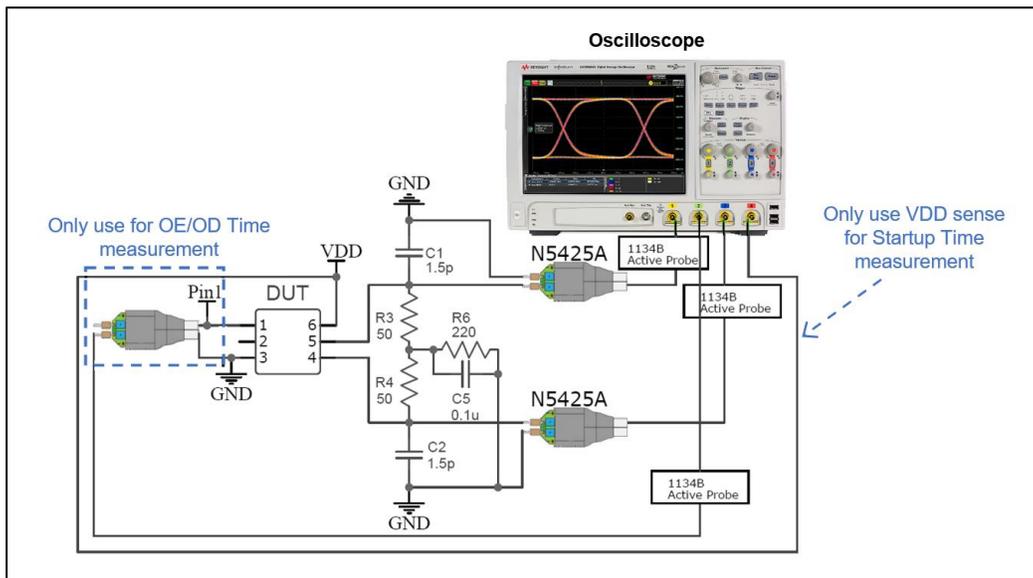


Figure 7. Test setup to measure FlexSwing Output Waveform Characteristics, Current Consumption<sup>[17]</sup>, Output Enable/Disable Time, and Startup Time

**Notes:**

- 15. The same test circuits are used for FlexSwing referenced to VDD and FlexSwing referenced to GND.
- 16. Test setup is also used to measure LVPECL Power Supply-Induced Phase Noise (PSPN) with filter added.
- 17. Test setup is also used to measure LVPECL Current Consumption with Termination 1 or without Termination.

## Test Circuit Diagrams (continued)

### Test Setups for LVDS Measurements

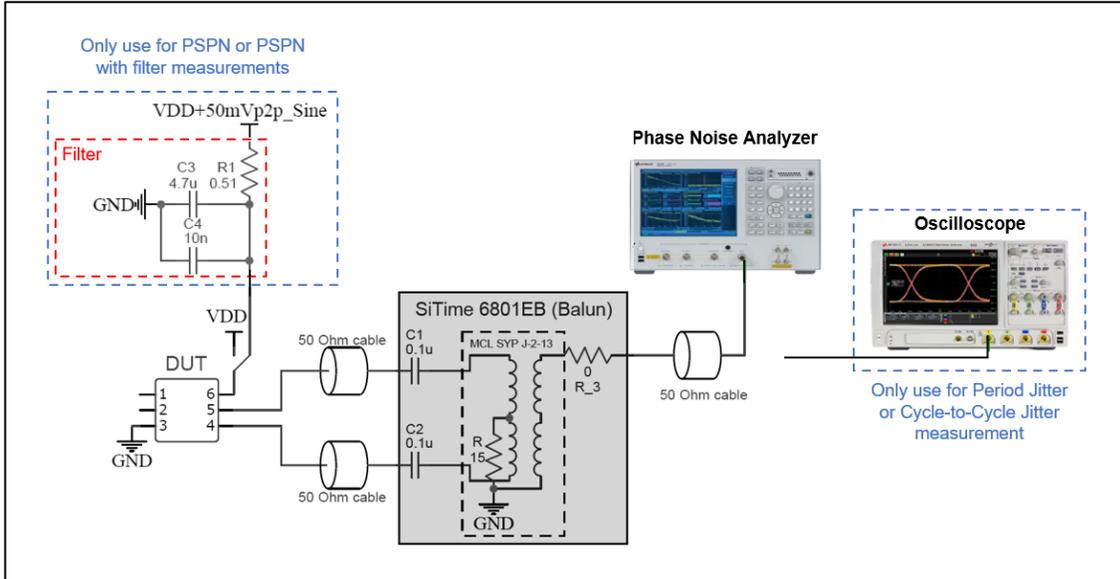


Figure 8. Test setup to measure LVDS Phase Noise, Period Jitter, Cycle-to-Cycle Jitter, and Power Supply-Induced Phase Noise (PSPN) with and without filter added

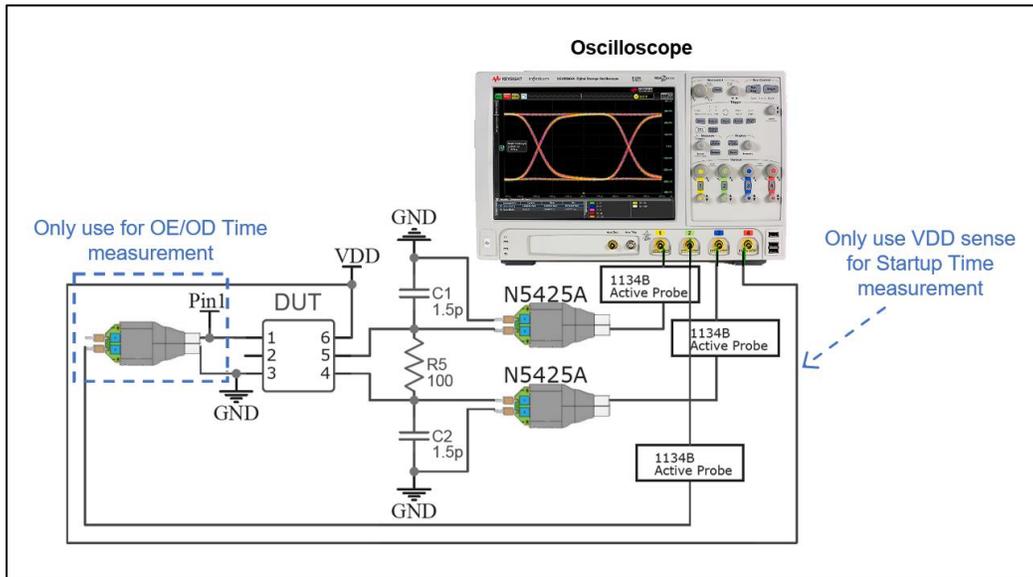


Figure 9. Test setup to measure LVDS Output Waveform Characteristics, Current Consumption, Output Enable/Disable Time, and Startup Time

## Test Circuit Diagrams (continued)

### Test Setups for HCSL Measurements

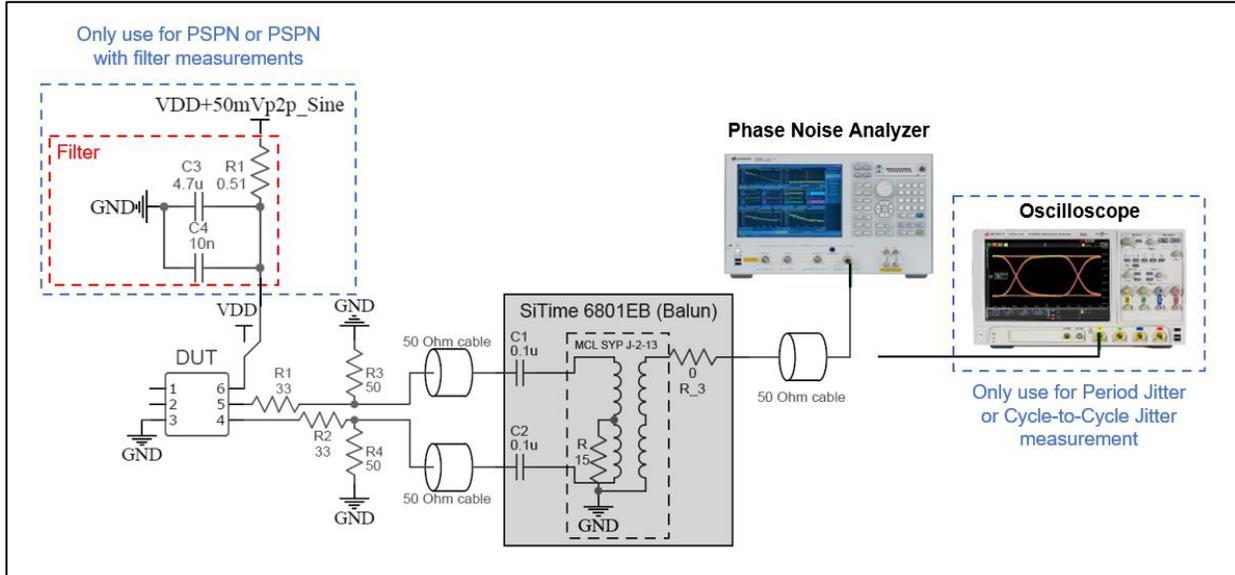


Figure 10. Test setup to measure HCSL Phase Noise, Period Jitter, Cycle-to-Cycle Jitter, and Power Supply-Induced Phase Noise (PSPN) with and without filter added

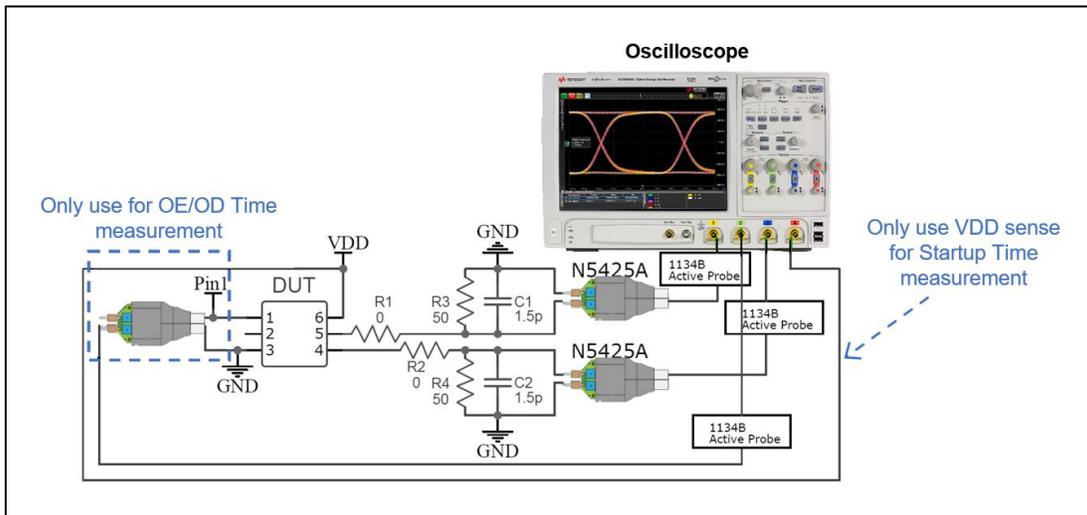


Figure 11. Test setup to measure HCSL Output Waveform Characteristics, Current Consumption, Output Enable/Disable Time, and Startup Time

## Test Circuit Diagrams (continued)

### Test Setups for Low-Power HCSL Measurements

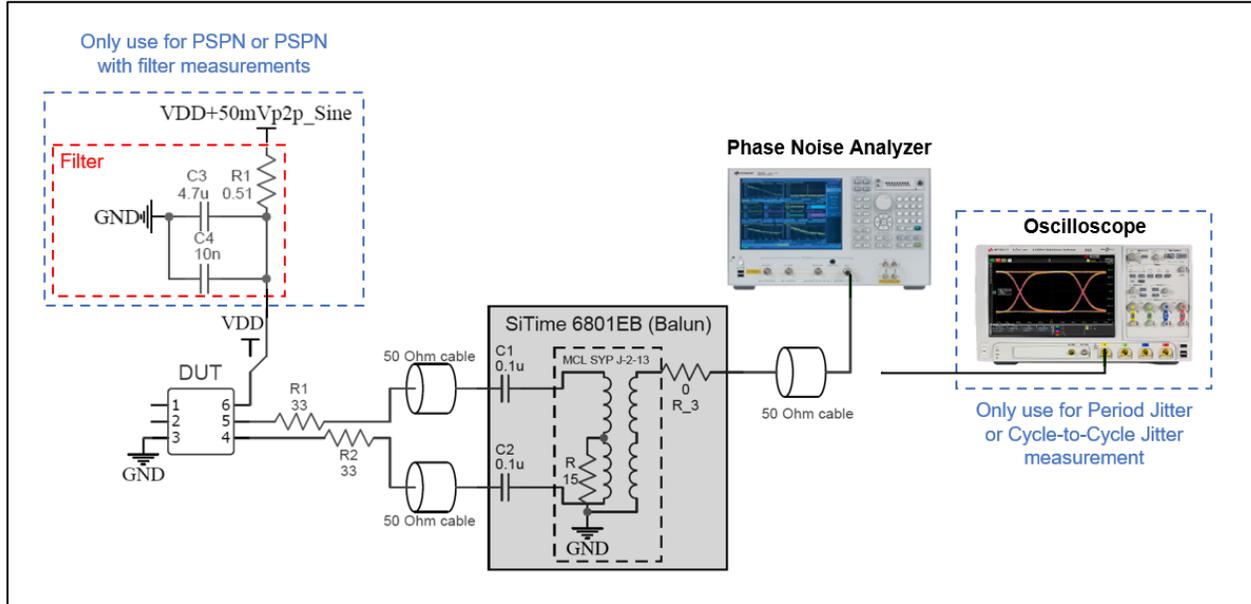


Figure 12. Test setup to measure Low-Power HCSL Phase Noise, Period Jitter, Cycle-to-Cycle Jitter, and PowerSupply-Induced Phase Noise (PSPN) with and without filter added

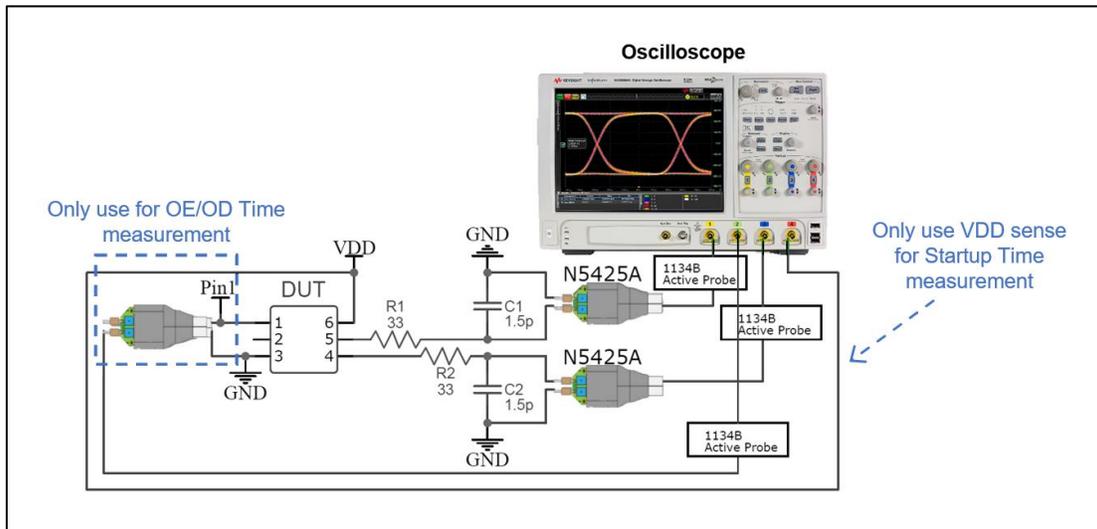
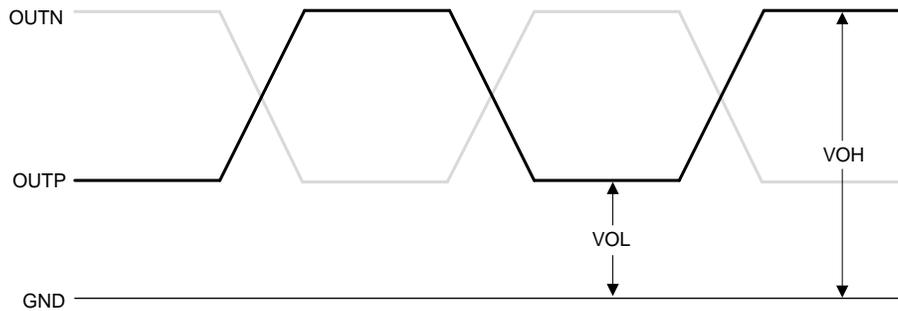
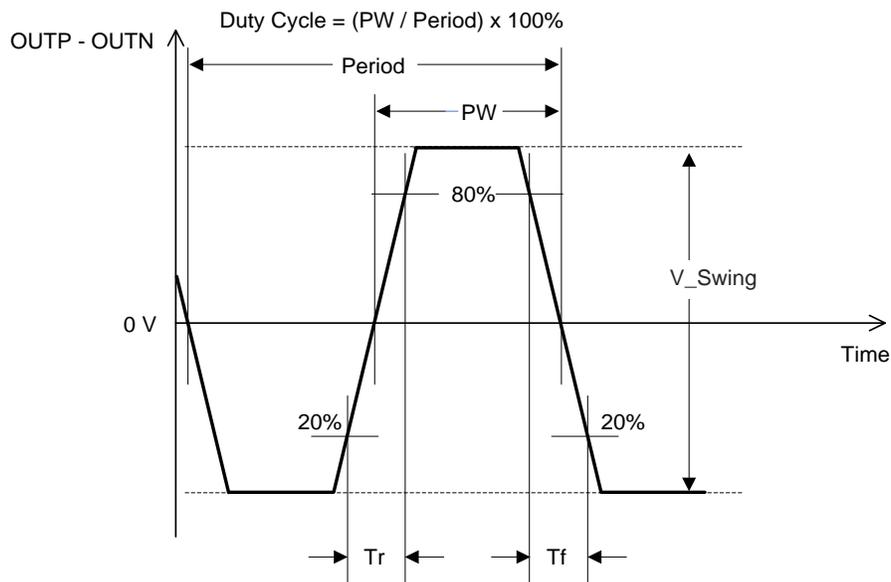


Figure 13. Test setup to measure Low-Power HCSL Output Waveform Characteristics, Current Consumption, Output Enable/Disable Time, and Startup Time

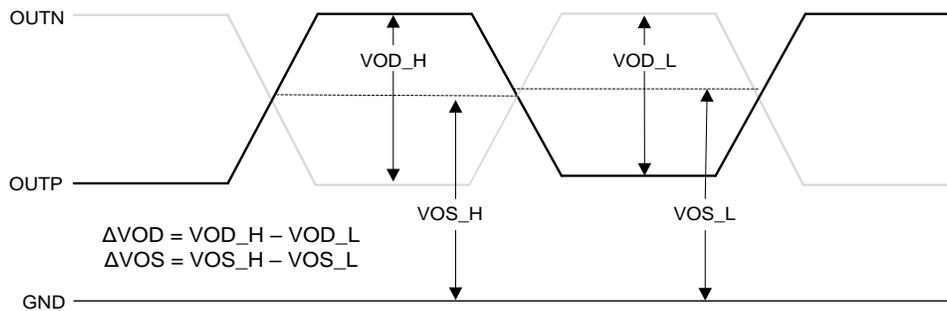
## Waveform Diagrams



**Figure 14. LVPECL, HCSL, Low-Power HCSL, and FlexSwing Voltage Levels per Differential Pin**



**Figure 15. LVPECL, HCSL, Low-Power HCSL, and FlexSwing Voltage Levels Across Differential Pair**



**Figure 16. LVDS Voltage Levels per Differential Pin**

Waveform Diagrams (continued)

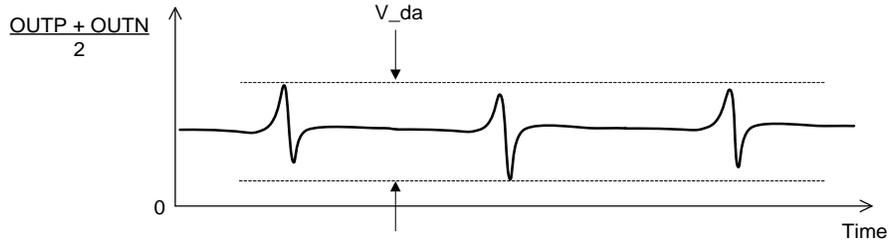


Figure 17. Differential Asymmetry ( $V_{da}$ )

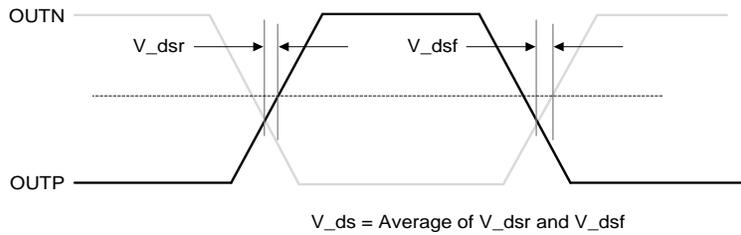


Figure 18. Differential Skew ( $V_{ds}$ ) is measured as the Time between the Average Voltage Level and Crossing Voltage

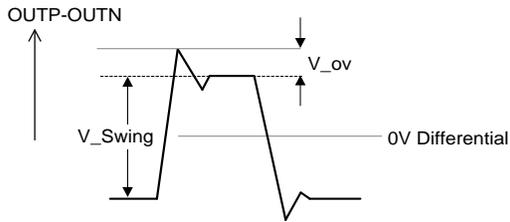


Figure 19. Overshoot Voltage ( $V_{ov}$ ) for LVPECL, FlexSwing, HCSL, Low-power HCSL

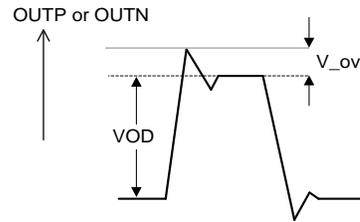


Figure 20. Overshoot Voltage ( $V_{ov}$ ) for LVDS Output

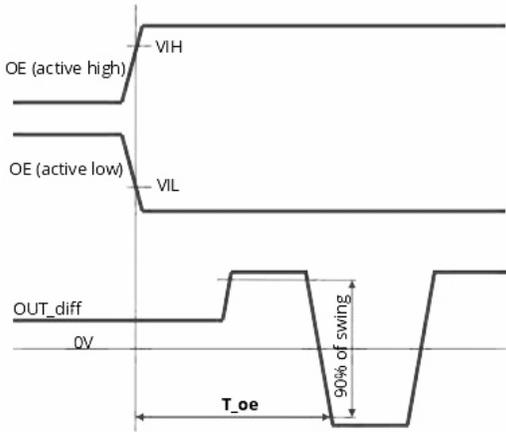


Figure 21. OE Pin Enable Timing ( $T_{oe}$ )

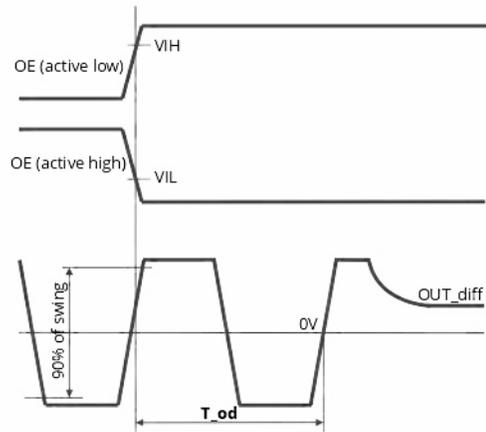


Figure 22. OE Pin Disable Timing ( $T_{od}$ )

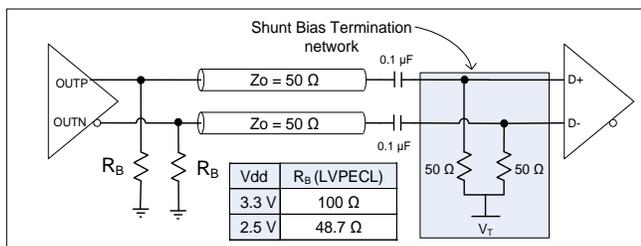
## Termination Diagrams

### LVPECL and FlexSwing Termination

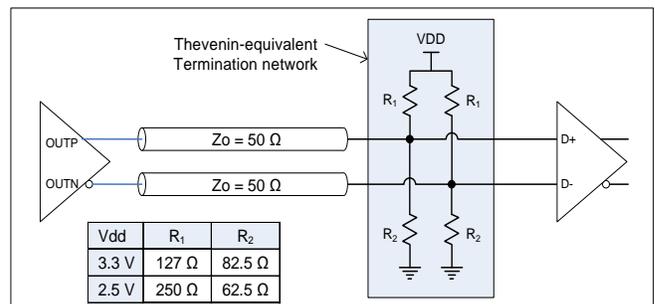
The SiT9377 FlexSwing output drivers support low power without sacrificing signal integrity via simple terminations as shown in Figure 24 and Figure 26, compared to traditional LVPECL drivers. The FlexSwing and LVPECL outputs are voltage-mode drivers. Use the table and figures below to select a termination circuit for the desired supply voltage. The table also provides LVPECL current consumption ( $I_{load}$ ) into the load termination.

**Table 199. Termination Options for LVPECL and FlexSwing Signaling**

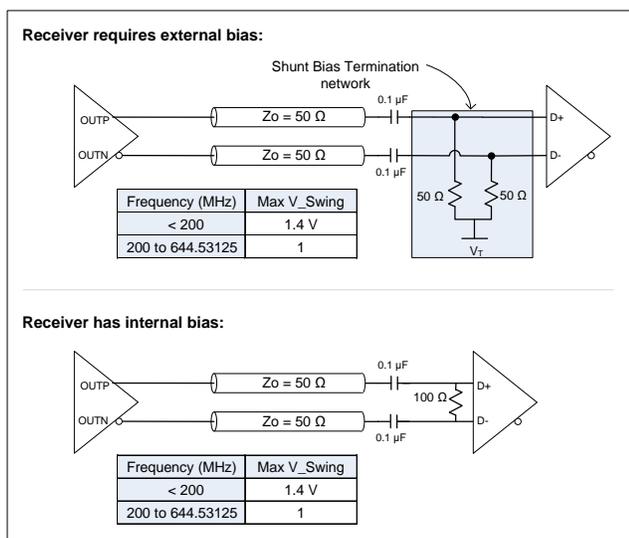
Signaling	Supply Voltage Order Codes	Termination Options					
		Figure 23	Figure 24	Figure 25	Figure 26	Figure 27	Figure 28
LVPECL referenced to Vdd	"25", "33", "XX"	OK to use $I_{load} = 40$ mA with 100 $\Omega$ near-end bias resistor	<b>Do Not Use</b>	OK to use $I_{load} = 28$ mA	OK to use	OK to use $I_{load} = 28$ mA	<b>Do Not Use</b>
FlexSwing referenced to Vdd		OK to use <sup>[18]</sup>	OK to use (See Figure 24 for frequency ranges and voltage swings)	OK to use <sup>[19]</sup>	OK to use	OK to use	<b>Do Not Use</b>
FlexSwing referenced to Gnd	"25", "33", "XX", "YY"	OK to use <sup>[18]</sup>	OK to use (See Figure 24 for frequency ranges and voltage swings)	<b>Do Not Use</b>	OK to use	<b>Do Not Use</b>	<b>Do Not Use</b>
	"18"			<b>Do Not Use</b>	OK to use	<b>Do Not Use</b>	OK to use



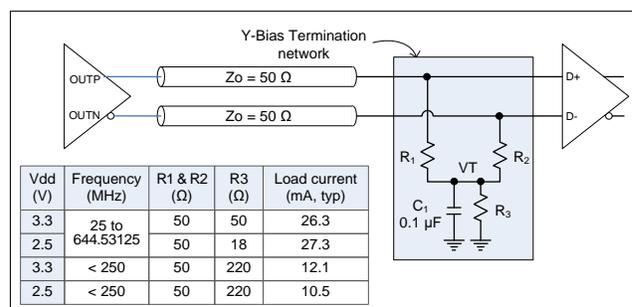
**Figure 23. Recommended LVPECL and FlexSwing<sup>[18]</sup> Termination when AC-coupled**



**Figure 25. LVPECL and FlexSwing DC-coupled Load Termination with Thevenin Equivalent Network<sup>[19]</sup>**



**Figure 24. Recommended FlexSwing Termination when AC-coupled**



**Figure 26. LVPECL and FlexSwing with DC-coupled Parallel Shunt Load Termination**

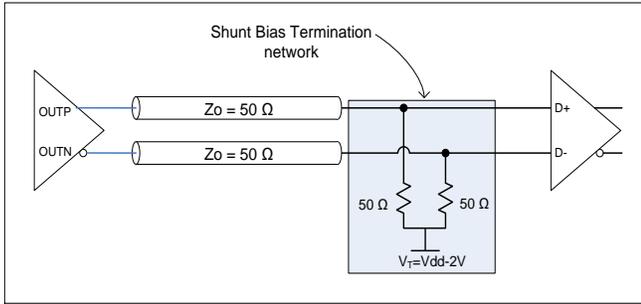


Figure 27. LVPECL and FlexSwing with Y-Bias Termination

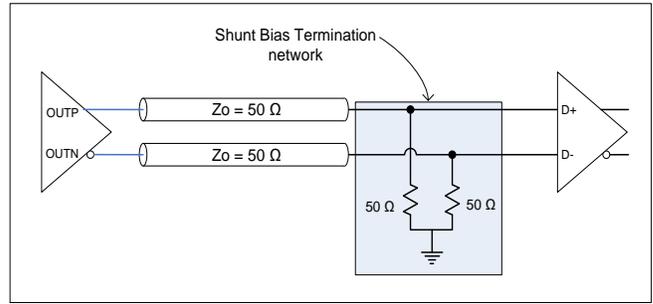


Figure 28. FlexSwing Termination – Only for use with Supply Voltage Order Code “18”

### Termination Diagrams (continued)

LVDS, Supply Voltage: 1.8 V ±5%, 2.5 V ±10%, 3.3 V ±10%, 2.25 V to 3.63 V, 1.71 V to 3.63 V

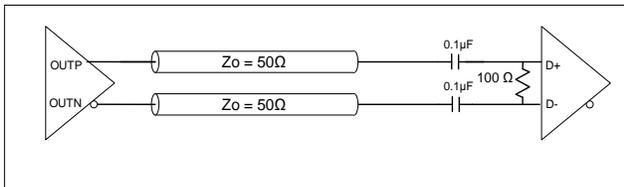


Figure 29. LVDS AC Termination

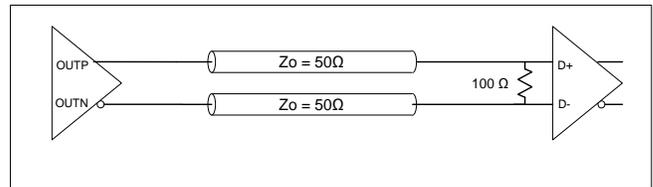


Figure 30. LVDS DC Termination at the Load

HCSL, Supply Voltage: 1.8 V ±5%, 2.5 V ±10%, 3.3 V ±10%, 2.25 V to 3.63 V, 1.71 V to 3.63 V

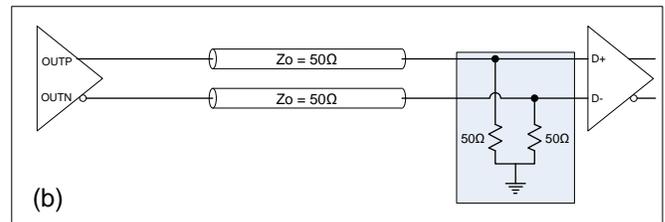
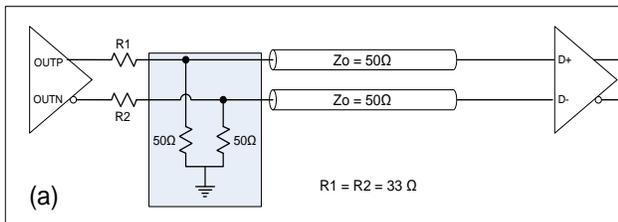


Figure 31. (a) HCSL Source Termination and (b) HCSL Load Termination

Low-power HCSL, Supply Voltage: 1.8 V ±5%, 2.5 V ±10%, 3.3 V ±10%, 2.25 V to 3.63 V, 1.71 V to 3.63 V

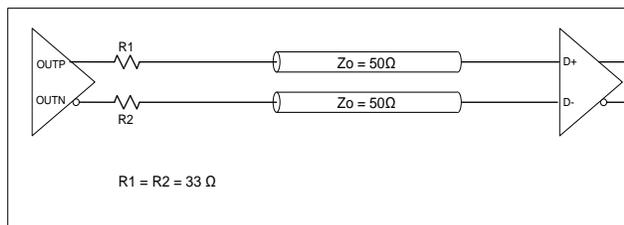


Figure 32. Low-power HCSL Termination

**Notes:**

- 18. Contact SiTime for optimum  $R_B$  values for FlexSwing options.
- 19. Contact SiTime for optimum  $R_1$  and  $R_2$  values for FlexSwing options.

**Dimensions and Patterns — 2.0 x 1.6 mm x mm**

Package Size – Dimensions (Unit: mm)<sup>[20]</sup>

	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.700	0.750	0.800
STAND OFF	A1	0.000	0.035	0.050
BODY SIZE	X	D		
	Y	E		
LEAD WIDTH	b	0.225	0.275	0.325
LEAD LENGTH	L	0.300	0.400	0.500
LEAD PITCH	e	0.730 BSC		
PACKAGE TOLERANCE	aaa	0.100		
MOLD FLATNESS	bbb	0.100		
COPLANARITY	ccc	0.080		
NOTE				
1. ALL DIMENSION IN MM				
PKG INFO		DRAWING NO.		
6L PQFN 2.000x1.600x0.750 mm		POD-077-PQFN-006-C02016		
DATE	11-AUG-2024	REV	SHEET	
		B03	01	

Recommended Land Pattern (Unit: mm)<sup>[21]</sup>

Note : All units in mm.

	PKG INFO	SPL DRAWING NO.	
DATE	6L PQFN 2.000x1.600 mm	SPL-077-PQFN-006-C02016	
2020/04/20		REV	SHEET
		A00	01

**Notes:**

20. Top Marking: Y denotes manufacturing origin and XXXX denotes manufacturing lot number. The value of “Y” will depend on the assembly location of the device.
21. A capacitor of value 0.1 μF or higher between VDD and GND is required. An additional 10 μF capacitor between VDD and GND is required for the best phase jitter performance.

Dimensions and Patterns — 2.5 x 2.0 mm x mm

Package Size – Dimensions (Unit: mm)<sup>[20]</sup>

	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.800	0.850	0.900
STAND OFF	A1	0.000	0.035	0.050
BODY SIZE	X	D		
	Y	E		
LEAD WIDTH	b	0.330	0.380	0.430
LEAD LENGTH	L	0.550	0.650	0.750
LEAD PITCH	e	0.900 BSC		
PACKAGE TOLERANCE	aaa	0.100		
MOLD FLATNESS	bbb	0.100		
COPLANARITY	ccc	0.080		

NOTE  
1. ALL DIMENSION IN MM

PKG INFO	DRAWING NO.	
6L PQFN 2.500x2.000x0.850 mm	POD-092-PQFN-006-C02520	
DATE	REV	SHEET
11-AUG-2024	A02	01

Recommended Land Pattern (Unit: mm)<sup>[21]</sup>

Note : All units in mm.

PKG INFO	SPL DRAWING NO.	
6L PQFW 2,500x2,000 mm	SPL-078-PQFW-006-C02520	
DATE	REV	SHEET
2020/04/20	A00	01

**Dimensions and Patterns — 3.2 x 2.5 mm x mm**

Package Size – Dimensions (Unit: mm)<sup>[20]</sup>

(TOP VIEW) (BOTTOM VIEW) (SIDE VIEW)

	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.800	0.850	0.900
STAND OFF	A1	0.000	0.035	0.050
BODY SIZE	X	D		
	Y	E		
LEAD WIDTH	b	0.550	0.600	0.650
	L	0.650	0.700	0.750
LEAD LENGTH	L1	0.800 REF		
	e	1.100 BSC		
LEAD PITCH	e	1.100 BSC		
PACKAGE TOLERANCE	aaa	0.100		
MOLD FLATNESS	bbb	0.100		
COPLANARITY	ccc	0.080		
DIMPLE WIDTH	T	0.150 REF		
DIMPLE LENGTH	P	0.150 REF		
DIMPLE DEPTH	A2	0.100 REF		

NOTE  
1. ALL DIMENSION IN MM

PKG INFO		DRAWING NO.	
6L PQFD 3.200x2.500x0.850 mm		POD-076-PQFD-006-C03225	
DATE	11-AUG-2024	REV	SHEET
		B02	01

Recommended Land Pattern (Unit: mm)<sup>[21]</sup>

Note : All units in mm.

	PKG INFO	SPL DRAWING NO.	
	6L PQFD 3.200x2.500 mm	SPL-076-PQFD-006-C03225	
DATE	REV	SHEET	
2020/04/20	A01	01	

## Additional Information

**Table 20. Additional Information**

Document	Description	Download Link
<b>ECCN #: EAR99</b>	Five character designation used on the commerce Control List (CCL) to identify dual use items for export control purposes.	—
<b>HTS Classification Code: 8542.39.0000</b>	A Harmonized Tariff Schedule (HTS) code developed by the World Customs Organization to classify/define internationally traded goods.	—
<b>Manufacturing Notes</b>	Tape & Reel dimension, reflow profile and other manufacturing related info	<a href="https://www.sitime.com/support/resource-library/manufacturing-notes-sitime-products">https://www.sitime.com/support/resource-library/manufacturing-notes-sitime-products</a>
<b>Termination Techniques</b>	Termination design recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>
<b>Layout Techniques</b>	Layout recommendations	<a href="http://www.sitime.com/support/application-notes">http://www.sitime.com/support/application-notes</a>
<b>Evaluation Boards</b>	SiT6760EB	<a href="https://www.sitime.com/support/resource-library/user-manuals/sit6760eb-evaluation-board-user-manual">https://www.sitime.com/support/resource-library/user-manuals/sit6760eb-evaluation-board-user-manual</a>

## Revision History

**Table 20. Revision History**

Revision	Release Date	Change Summary
0.1	20-Apr-2021	Preliminary datasheet
0.11	12-May-2022	Updated FlexSwing tables
0.2	5-Aug-2022	Updated Electrical Characteristics tables and descriptions
0.65	12-Aug-2022	Preliminary datasheet Added Test Diagrams section Updated Electrical Characteristics tables and descriptions Updated frequency range
0.66	22-Sep-2022	Formatting changes
0.67	13-Oct-2022	Updated Dimensions and Patterns diagrams
1.0	7-Oct-2024	Revision 1.0

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