GS2975A HD-LINX® III Multi-Rate SDI Automatic Reclocker with Dual Differential Outputs

Features

- SMPTE 424M, 292M, and 259M-C compliant
- Supports data rates of 270, 1483.5, 1485, 2967, 2970Mb/s
- Supports DVB-ASI at 270Mb/s
- Pb-free and RoHS Compliant
- Auto and Manual Modes for rate selection
- Standards indication in Auto Mode
- 4:1 input multiplexer patented technology
- Choice of dual reclocked data outputs or one data output and one recovered clock output
- Footprint and drop-in compatible with existing GS2975 designs
- Loss of Signal (LOS) Output
- Lock Detect Output
- On-chip Input and Output Termination
- Differential 50Ω inputs and outputs
- Mute, Bypass and Autobypass functions
- SD/HD indication output to control GS2978 Dual Slew-Rate Cable Driver
- Single 3.3V power supply
- Operating temperature range: 0°C to 70°C

Applications

- SMPTE 424M, SMPTE 292M and SMPTE 259M-C Serial Digital Interfaces

Description

The GS2975A is a Multi-Rate Serial Digital Reclocker designed to automatically recover the embedded clock from a digital video signal and re-time the incoming video data.

The GS2975A Serial Digital Reclocker will recover the embedded clock signal and re-time the data from a SMPTE 424M, SMPTE 292M, or SMPTE 259M-C compliant digital video signal.

The GS2975A removes the high frequency jitter components from the bit-serial stream. Input termination is on-chip for seamless matching to 50Ω transmission lines.

The GS2975A can operate in either auto or manual rate selection mode. In Auto mode the device will automatically detect and lock onto incoming SMPTE SDI data signals at any supported rate. For single rate data systems, the GS2975A can be configured to operate in Manual mode. In both modes, the device requires only one external crystal to set the VCO frequency when not locked and provides adjustment free operation.

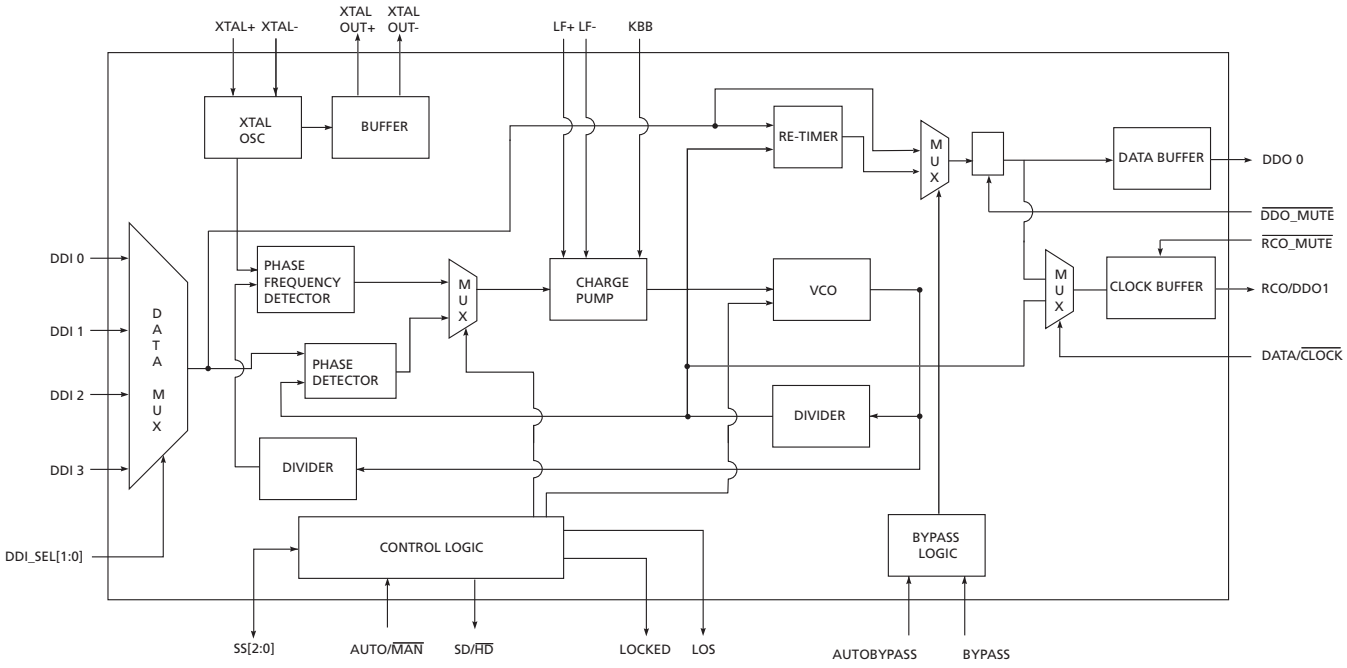
In systems which require passing of non-SMPTE data rates, the GS2975A can be configured to either automatically or manually enter a bypass mode in order to pass the signal without reclocking.

The GS2975A offers a choice of dual reclocked data outputs or one data output and one recovered clock output. The device is footprint and drop-in compatible with existing GS2975 designs, with no additional application changes required.

The GS2975A is Pb-free, and the encapsulation compound does not contain halogenated flame retardant.

This component and all homogeneous sub-components are RoHS compliant.

Functional Block Diagram



GS2975A Functional Block Diagram

Revision History

Version	ECR	PCN	Date	Changes and/or Modifications
4	151358	–	April 2009	Added 2.5k reel option to section 6.6 Ordering Information. Changed the maximum input swing value from 800mV to 1100mV in Table 2-2: AC Electrical Characteristics.
3	150068	–	June 2008	Removed references to GND_DRV in Section 1.1 GS2975A Pin Assignment and Table 1-1: Pin Descriptions.
2	147068	–	August 2007	Typo: Functional Block Diagram on page 2.
1	146316	–	July 2007	Typo: Pin 64 in Table 1-1& TAC Figure 5-1 on page 22, Pins 38/40 & 44/46 in Table 1-1.
0	143947	43428	February 2007	Converting to Data Sheet. Removed 'Proprietary and Confidential' footer. Updated AC Electrical Characteristics table. Added junction - board thermal resistance parameter to 6.3 Packaging Data. Added section 6.4 Marking Diagram.

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1. Pin Out

1.1 GS2975A Pin Assignment

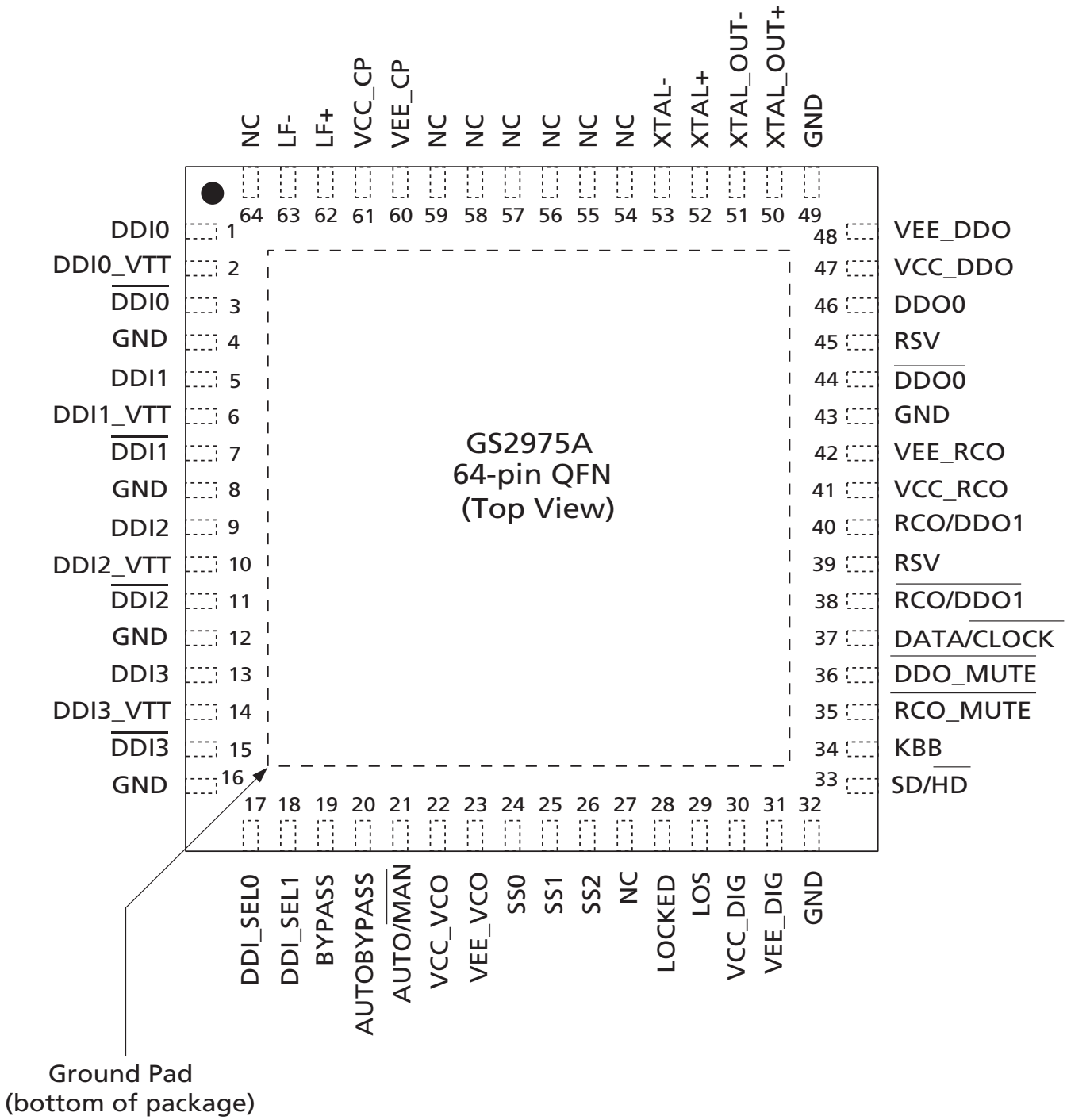


Figure 1-1: 64-Pin QFN

1.2 GS2975A Pin Descriptions

Table 1-1: Pin Descriptions

Pin Number	Name	Type	Description
1, 3	DDI0, $\overline{\text{DDI0}}$	Input	Serial digital differential input 0.
2	DDI0_VTT	Passive	Center tap of two 50Ω on-chip termination resistors between DDI0 and $\overline{\text{DDI0}}$.
4, 8, 12,16, 32, 43, 49	GND	Passive	Recommended connect to GND.
5, 7	DDI1,$\overline{\text{DDI1}}$	Input	Serial digital differential input 1.
6	DDI1_VTT	Passive	Center tap of two 50Ω on-chip termination resistors between DDI1 and $\overline{\text{DDI1}}$.
9, 11	DDI2, $\overline{\text{DDI2}}$	Input	Serial digital differential input 2.
10	DDI2_VTT	Passive	Center tap of two 50Ω on-chip termination resistors between DDI2 and $\overline{\text{DDI2}}$.
13, 15	DDI3, $\overline{\text{DDI3}}$	Input	Serial digital differential input 3.
14	DDI3_VTT	Passive	Center tap of two 50Ω on-chip termination resistors between DDI3 and $\overline{\text{DDI3}}$.
17, 18	DDI_SEL[1:0]	Logic Input	Serial digital input select.)DI_SEL1 / DDI_SEL0 / INPUT SELECTED 0 / 0 / DDI0 0 / 1 / DDI1 1 / 0 / DDI2 1 / 1 / DDI3
19	BYPASS	Logic Input	Bypass the reclocker stage. When BYPASS is HIGH, it overwrites the AUTOBYPASS setting.
20	AUTOBYPASS	Logic Input	Automatically bypasses the reclocker stage when the PLL is not locked This pin is ignored when BYPASS is HIGH.
21	AUTO/$\overline{\text{MAN}}$	Logic Input	Auto/Manual select. When set HIGH, the standard is automatically detected from the input data rate. When set LOW, the user must program the input standard using the SS[2:0] pins.
22	VCC_VCO	Power	Most positive power supply connection for the internal VCO section. Connect to 3.3V.
23	VEE_VCO	Power	Most negative power supply connection for the internal VCO section. Connect to GND.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Type	Description
24, 25, 26	SS[0:2]	Bi-directional	When AUTO/$\overline{\text{MAN}}$ is HIGH, SS[0:2] are outputs, displaying the data rate to which the PLL has locked. When AUTO/$\overline{\text{MAN}}$ is LOW, SS[0:2] are inputs, forcing the PLL to lock only to a selected data rate
27	NC	No Connect	Not connected internally.
28	LOCKED	Output	Lock Detect. This pin is set HIGH by the device when the PLL is locked.
29	LOS	Output	Loss of Signal. Set HIGH when there are no transitions on the active DDI[3:0] input.
30	VCC_DIG	Power	Most positive power supply connection for the internal glue logic. Connect to 3.3V.
31	VEE_DIG	Power	Most negative power supply connection for the internal glue logic. Connect to GND.
33	SD/$\overline{\text{HD}}$	Output	This signal will be set LOW by the device when the reclocker has locked to 2.97Gb/s (2.967Gb/s) or 1.485Gb/s (1.4835Gb/s), or when a non-SMPTE standard is applied (i.e. the device is not locked). It will be set HIGH when the reclocker has locked to 270Mbps.
34	KBB	Analog Input	Controls the loop bandwidth of the PLL.
35	$\overline{\text{RCO\_MUTE}}$	Power	Serial clock or secondary data output mute. Assert LOW for reduced power consumption, see 2.2 DC Electrical Characteristics. When $\overline{\text{RCO\_MUTE}}$ = LOW, the RCO/DDO1 output is powered down. When $\overline{\text{RCO\_MUTE}}$ = HIGH, the RCO/DDO1 output is active. NOTE: This is not a logic input pin.

SS2	SS1	SS0	DATA RATE SELECTED/FORCED (Mb/s)
0	1	0	270
1	0	1	1483.5/1485
1	1	0	2967/2970

Table 1-1: Pin Descriptions (Continued)

<table>
<tr><th>Pin Number</th><th>Name</th><th>Type</th><th>Description</th></tr>
<tr><td>36</td><td>$\overline{\text{DDO\_MUTE}}$</td><td>Logic Input</td><td>Mutes the DDO0 and/or RCO/DDO1 outputs.
<table>
<tr><th>$\overline{\text{DDO\_MUTE}}$</th><th>$\overline{\text{RCO\_MUTE}}$</th><th>DATA/$\overline{\text{CLOCK}}$</th><th>DDO0</th><th>RCO/DDO1</th></tr>
<tr><td>1</td><td>1</td><td>0</td><td>DATA</td><td>CLOCK</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>DATA</td><td>DATA</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>MUTE</td><td>CLOCK</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>MUTE</td><td>MUTE</td></tr>
<tr><td>1</td><td>0</td><td>X</td><td>DATA</td><td>Power down</td></tr>
<tr><td>0</td><td>0</td><td>X</td><td>MUTE</td><td>Power down</td></tr>
</table>
NOTE:
MUTE = Outputs latched at previous data bit.
Power down = Outputs pulled to V_{cc} through 50Ω resistor.</td></tr>
<tr><td>37</td><td>DATA/$\overline{\text{CLOCK}}$</td><td>Logic Input</td><td>Data/$\overline{\text{Clock}}$ select.
When set HIGH, the RCO/DDO1 pin will output a copy of the serial digital output (DDO0).
When set LOW, the RCO/DDO1 pin will output a re-timed clock (RCO).</td></tr>
<tr><td>38, 40</td><td>$\overline{\text{RCO/DDO1}}$,
RCO/DDO1</td><td>Output</td><td>Serial clock or secondary data output.
When $\overline{\text{RCO\_MUTE}}$ is connected to VCC, the serial digital differential clock or secondary data output will be presented.</td></tr>
<tr><td>39, 45</td><td>RSV</td><td>Reserved</td><td>Do not connect.</td></tr>
<tr><td>41</td><td>VCC_RCO</td><td>Power</td><td>Most positive power supply connection for the RCO/DDO1 and $\overline{\text{RCO/DDO1}}$ output driver.
Connect to 3.3V.</td></tr>
<tr><td>42</td><td>VEE_RCO</td><td>Power</td><td>Most negative power supply connection for the RCO/DDO1 and $\overline{\text{RCO/DDO1}}$ output driver.
Connect to GND.</td></tr>
<tr><td>44, 46</td><td>$\overline{\text{DDO0}}$, DDO0</td><td>Output</td><td>Differential Serial Digital Outputs.</td></tr>
<tr><td>47</td><td>VCC_DDO</td><td>Power</td><td>Most positive power supply connection for the DDO0/$\overline{\text{DDO0}}$ output driver.
Connect to 3.3V.</td></tr>
<tr><td>48</td><td>VEE_DDO</td><td>Power</td><td>Most negative power supply connection for the DDO0/$\overline{\text{DDO0}}$ output driver.
Connect to GND.</td></tr>
<tr><td>50, 51</td><td>XTAL_OUT+,
XTAL_OUT-</td><td>Output</td><td>Differential outputs of the reference oscillator used for monitoring or test purposes.</td></tr>
<tr><td>52, 53</td><td>XTAL+, XTAL-</td><td>Input</td><td>Reference crystal input. Connect to the GO1535 as shown in the Typical Application Circuit on page 22.</td></tr>
<tr><td>54 - 59</td><td>NC</td><td>No Connect</td><td>Not connected internally.</td></tr>
<tr><td>60</td><td>VEE_CP</td><td>Power</td><td>Most negative power supply connection for the internal charge pump.
Connect to GND.</td></tr>
</table>

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Type	Description
61	VCC_CP	Power	Most positive power supply connection for the internal charge pump. Connect to 3.3V.
62, 63	LF+, LF-	Passive	Loop filter capacitor connection. Connect as shown in the Typical Application Circuit on page 22.
64	NC	No Connect	Not connected internally. Recommended connect to GND.
–	Center Pad	–	Ground pad on bottom of package. Solder to main ground plane following recommendations under Recommended PCB Footprint on page 24

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Parameter	Value
Supply Voltage Range	-0.5V to +3.6 V_{DC}
Input Voltage Range	V_{ee} - 0.5V to V_{cc} + 0.5V
Operating Temperature Range	-20°C to 85°C
Storage Temperature Range	-50°C < T_s < 125°C
Input ESD Voltage	4kV HBM, 100V MM
Solder Reflow Temperature	260°C

NOTE: Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions or at any other condition beyond those indicated in the AC/DC Electrical Characteristic sections is not implied.

2.2 DC Electrical Characteristics

Table 2-1: DC Electrical Characteristics

V_{CC} = 3.3V ±5%, T_A = 0°C to 70°C, unless otherwise shown. Typical values: V_{CC} = 3.3V and T_A =25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage	V_{CC}	Operating Range	3.135	3.3	3.465	V
Supply Current	I_{CC}	RCO/DD01 enabled	–	142	170	mA
	I_{CC}	RCO/DDO1 disabled	–	123	152	mA

Table 2-1: DC Electrical Characteristics (Continued)

V_{CC} = 3.3V ±5%, T_A = 0°C to 70°C, unless otherwise shown. Typical values: V_{CC} = 3.3V and T_A =25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Power Consumption	–	RCO/DD01 enabled	–	468	590	mW
	–	RCO/DD01 disabled	–	404	528	mW
Logic Inputs DDI_SEL[1:0], BYPASS, AUTOBYPASS, AUTO/$\overline{\text{MAN}}$, ASI/$\overline{\text{177}}$, $\overline{\text{DDO\_MUTE}}$	V_{IH}	High	2.0	–	–	V
	V_{IL}	Low	–	–	0.8	V
Logic Outputs SD/HD, LOCKED, LOS	V_{OH}	I_{OH} = -2mA	2.4	–	–	V
	V_{OL}	I_{OL} = 2mA	–	–	0.4	V
Bi-Directional Pins (Manual Mode) SS[2:0], AUTO/$\overline{\text{MAN}}$ = 0	V_{IH}	High	2.0	–	–	V
	V_{IL}	Low	–	–	0.8	V
Bi-Directional Pins (Auto Mode) SS[2:0], AUTO/MAN = 1	V_{OH}	I_{OH} = -2mA	2.4	–	–	V
	V_{OL}	I_{OL} = 2mA	–	–	0.4	V
XTAL_OUT+, XTAL_OUT-	V_{OH}	High	–	V_{CC} - 0.075	–	V
	V_{OL}	Low	–	V_{CC} - 0.300	–	V
RCO_MUTE	–	I = -1.5mA	V_{CC} - 0.165	V_{CC}	V_{CC} + 0.165	V
Serial Input Voltage	–	Common Mode	1.65 + (V_{SID}/2)	–	V_{CC} - (V_{SID}/2)	V
Serial Output Voltage DDO0/$\overline{\text{DDO0}}$, RCO/DDO1 / $\overline{\text{RCO/DDO1}}$	–	Common Mode	–	V_{CC} - (V_{OD}/2)	–	V

2.3 AC Electrical Characteristics

Table 2-2: AC Electrical Characteristics

V_{CC} = 3.3V ±5%, T_A = 0°C to 70°C, unless otherwise shown. Typical values: V_{CC} = 3.3V and T_A =25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Notes
Serial Input Data Rate	–	–	270	–	2970	Mb/s	–
Serial Input Jitter Tolerance	–	Worst case modulation (e.g. square wave modulation) 270, 1485, 2970 Mb/s	0.8	–	–	UI	–
PLL Lock Time - Asynchronous	t_{ALOCK}	–	–	1.5	10	ms	–
PLL Lock Time - Synchronous	t_{SLOCK}	KBB = Float, CLF=47nF SD/$\overline{HD}$ = 0	–	0.5	4	µs	–
		KBB = Float, CLF=47nF SD/$\overline{HD}$ = 1	–	5	20	µs	–
Serial Output Rise/Fall Time SDO0 and RCO/DDO1 (20% - 80%)	t_{rSDO},t_{rRCO}	50Ω load (on chip)	–	110	–	ps	–
	t_{fSDO},t_{fRCO}	50Ω load (on chip)	–	110	–	ps	–
Serial Digital Input Signal Swing	V_{SID}	Differential with internal 100Ω input termination See Figure 2-1	100	–	1100	mV_{p-p}	–
Serial Digital Output Signal Swing DDO0 and RCO/DDO1	VOD	100Ω load differential See Figure	300	450	600	mV_{p-p}	–
DDO0 to DDO1 skew	DD_{skew}	–	–	156	–	ps	1
DDO0 to RCO skew	DR_{skew}	2970 Mb/s, 1485 Mb/s	–	28	–	ps	2
		270 Mb/s	–	37	–	ps	2
Serial Output Jitter on DDO0 (RCO/DDO1 disabled)	t_{OJ}	270 Mb/s	–	0.02	0.07	UI	3
		1485 Mb/s	–	0.06	0.10	UI	4
		2970 Mb/s	–	0.10	0.15	UI	4
Serial Output Jitter on DDO0 and DDO1 (Both DDO0 and DDO1enabled)	t_{OJ}	270 Mb/s	–	0.02	0.07	UI	3
		1485 Mb/s	–	0.06	0.10	UI	4
		2970 Mb/s	–	0.11	0.16	UI	4
Additive Jitter	t_{AJ}	Bypass mode, 2970 Mb/s DDO0 enabled	–	15	–	ps	–
		Bypass mode, 2970 Mb/s DDO0 and DDO1 enabled	–	20	–	ps	–

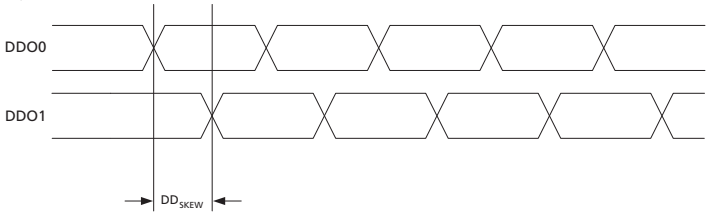
Table 2-2: AC Electrical Characteristics (Continued)

V_{CC} = 3.3V ±5%, T_A = 0°C to 70°C, unless otherwise shown. Typical values: V_{CC} = 3.3V and T_A =25°C

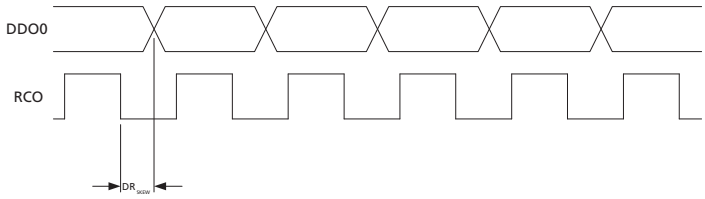
Parameter	Symbol	Conditions	Min	Typ	Max	Units	Notes
Loop Bandwidth	BW_{LOOP}	2.97 Gb/s, KBB = V_{CC}	–	1.75	–	MHz	–
		2.97 Gb/s, KBB = FLOAT	–	3.5	–	MHz	–
		2.97 Gb/s, KBB = GND, <0.1dB Peaking	–	7.0	–	MHz	–
		1.485 Gb/s, KBB = V_{CC}	–	0.875	–	MHz	–
		1.485 Gb/s, KBB = FLOAT	–	1.75	–	MHz	–
		1.485 Gb/s, KBB = GND, <0.1dB Peaking	–	3.5	–	MHz	–
		270 Mb/s, KBB = VCC	–	0.16	–	MHz	–
		270 Mb/s, KBB = FLOAT	–	0.32	–	MHz	–
		270 Mb/s, KBB = GND, <0.1dB Peaking	–	0.64	–	MHz	–

NOTES:

1. DDO0 to DDO1 skew alignment as defined here:



2. DDO0 to RCO skew alignment as defined here:



3. KBB = Float, PRN = 2^{23}-1, input jitter = $40ps_{p-p}$.
4. KBB = Float, PRN = 2^{23}-1, input jitter = $20ps_{p-p}$.

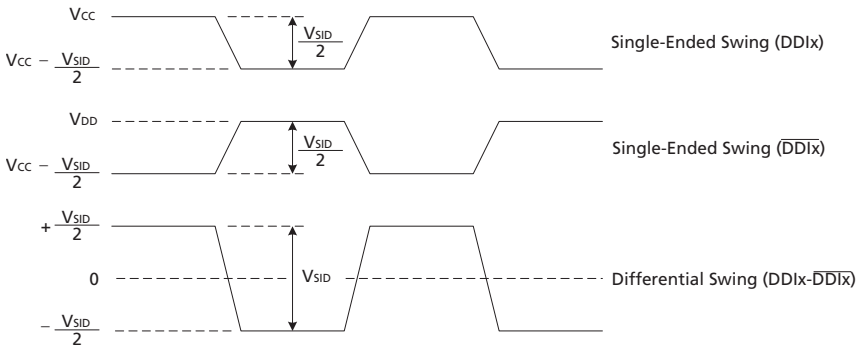


Figure 2-1: Serial Digital Input Signal Swing

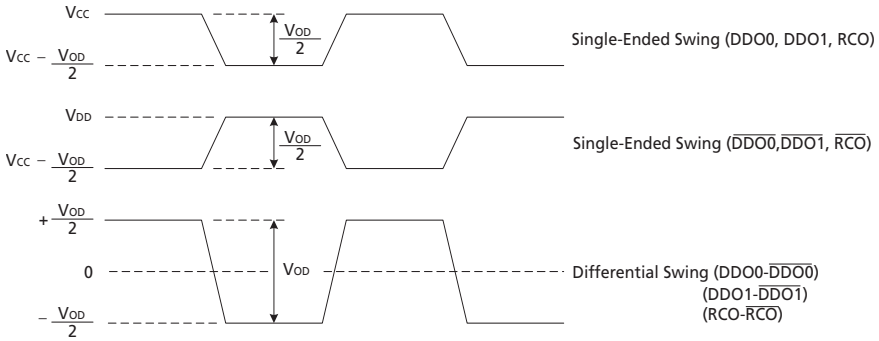


Figure 2-2: Serial Digital Output Signal Swing

3. Input/Output Circuits

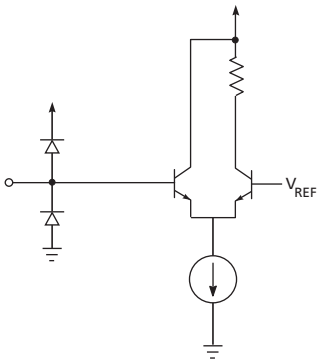


Figure 3-1: TTL Inputs

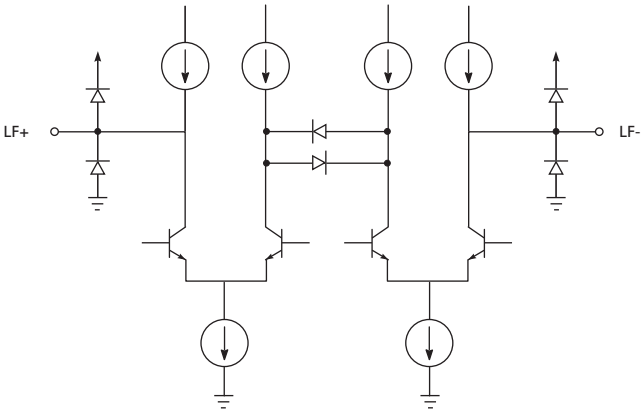


Figure 3-2: Loop Filter

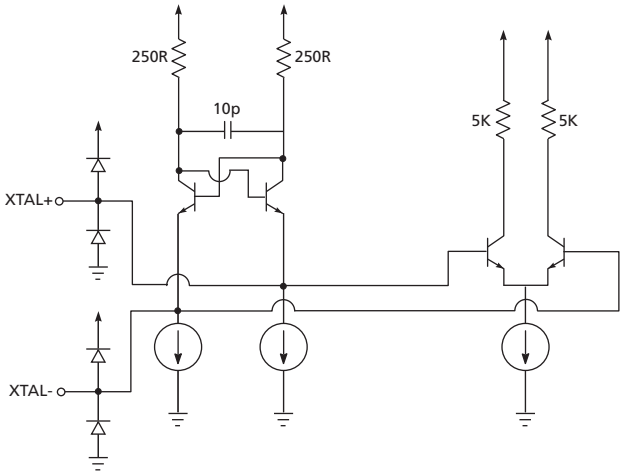


Figure 3-3: Crystal Input

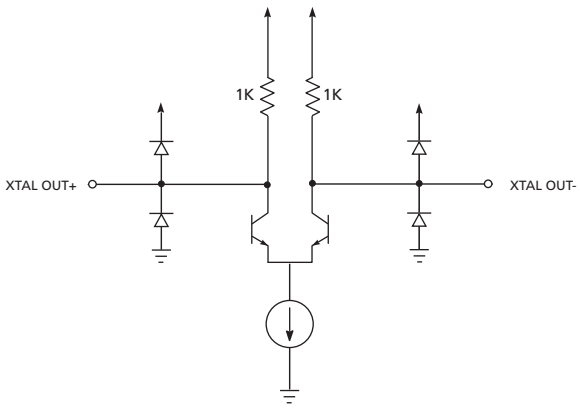


Figure 3-4: Crystal Output Buffer

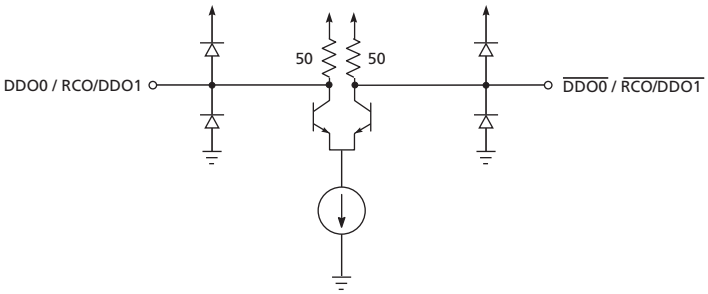


Figure 3-5: Serial Data Outputs, Serial Clock Outputs

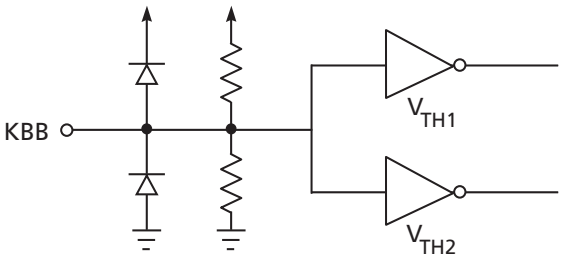


Figure 3-6: KBB

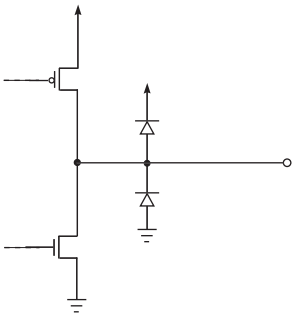


Figure 3-7: Indicator Outputs: SD/$\overline{\text{HD}}$, LOCKED, LOS

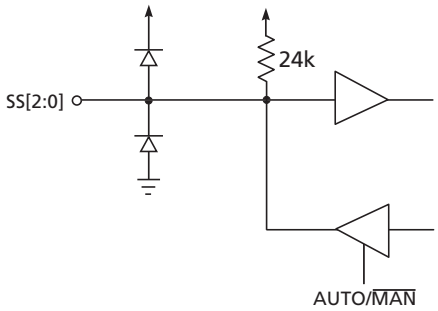


Figure 3-8: Standard Select/Indication Bi-directional Pins

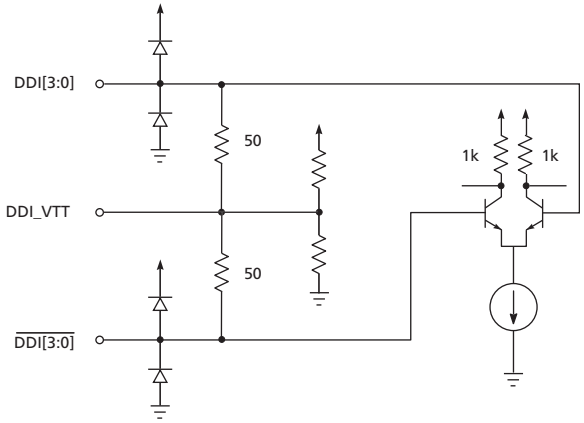


Figure 3-9: Serial Data Inputs

4. Detailed Description

The GS2975A is a Multi-Rate Serial Digital Reclocker designed to automatically recover the embedded clock from a digital video signal and re-time the incoming video data.

The GS2975A will recover the embedded clock signal and re-time the data from a SMPTE 424M, SMPTE 292M, or SMPTE 259M-C compliant digital video signal.

Using the functional block diagram (page 2) as a guide, Slew Rate Phase Lock Loop (S-PLL) on page 16 to on page 21 describes each aspect of the GS2975A in detail.

4.1 Slew Rate Phase Lock Loop (S-PLL)

The term "slew" refers to the output phase of the PLL in response to a step change at the input. Linear PLLs have an output phase response characterized by an exponential response whereas an S-PLL's output is a ramp response (see Figure 4-1). Because of this non-linear response characteristic, traditional small signal analysis is not possible with an S-PLL.

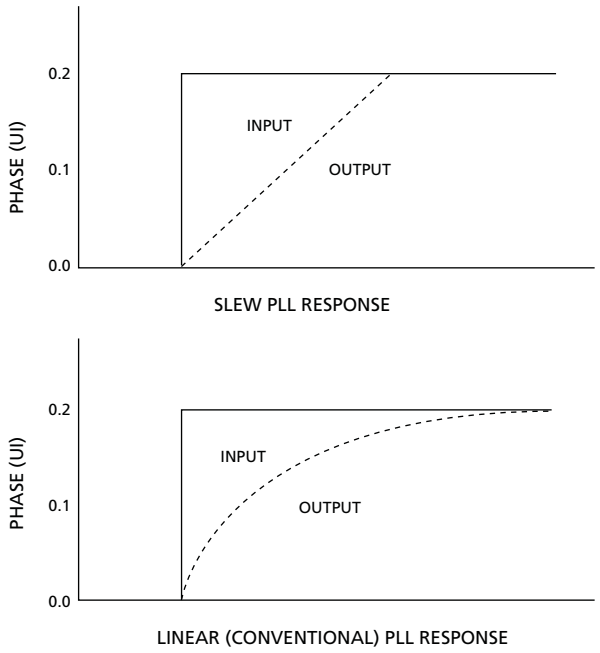


Figure 4-1: PLL Characteristics

The S-PLL offers several advantages over the linear PLL. The Loop Bandwidth of an S-PLL is independent of the transition density of the input data. Pseudo-random data has a transition density of 0.5 verses a pathological signal which has a transition density of 0.05. The loop bandwidth of a linear PLL will change proportionally with this change in transition density. With an S-PLL, the loop bandwidth is defined by the jitter at the data input. This translates to infinite loop bandwidth with a zero jitter input signal. This allows the loop to correct for small variations in the input jitter quickly, resulting in very low output jitter. The loop bandwidth of the GS2975A's PLL is defined at 0.2UI of input jitter.

The PLL consists of two acquisition loops. First is the Frequency Acquisition (FA) loop. This loop is active when the device is not locked and is used to achieve lock to the supported data rates. Second is the phase acquisition (PA) loop. Once locked, the PA loop tracks the incoming data and makes phased corrections to produce a re-clocked output.

4.2 VCO

The internal VCO of the GS2975A is an LC oscillator. It is trimmed at the time of manufacture to capture all data rates over temperature and operation voltage ranges.

Integrated into the VCO is a series of programmable dividers used to achieve all serial data rates, as well as additional dividers for the frequency acquisition loop.

4.3 Charge Pump

During frequency acquisition, the charge pump has two states, "pump-up" and "pump-down," which is produced by a leading or lagging phase difference between the input and the VCO frequency.

During phase acquisition, there are two levels of "pump-up" and two levels of "pump down" produced for leading and lagging phase difference between the input and VCO frequency. This is to allow for greater precision of VCO control.

The charge pump produces these signals by holding the integrated frequency information on the external loop-filter capacitor, C_{LF}. The instantaneous frequency information is the result of the current flowing through an internal resistor connected to the loop-filter capacitor.

4.4 Frequency Acquisition Loop — The Phase-Frequency Detector

An external crystal of 14.140MHz is used as a reference to keep the VCO centered at the last known data rate. This allows the device to achieve a fast synchronous lock, especially in cases where a known data rate is interrupted. The crystal reference is also used to clock internal timers and counters. To keep the optimal performance of the reclocker over all operating conditions, the crystal frequency must be 14.140MHz, +/-50ppm. The GO1535 meets this specification and is available from Gennum.

The GO1535 requires an external resistor to be placed in series with the crystal. The optimal value of this resistor can range from 100 to 150 ohms, and this value will depend upon the design. For systems which expect to see a higher noise floor, the higher resistor value is recommended. The higher resistor value will work to decrease the loop gain of the oscillator, as well as attenuate noise.

The VCO is divided by a selected ratio which is dependant on the input data rate. The resultant is then compared to the crystal frequency. If the divided VCO frequency and the crystal frequency are within 1% of each other, the PLL is considered to be locked to the input data rate.

4.5 Phase Acquisition Loop — The Phase Detector

The phase detector is a digital quadrature phase detector. It indicates whether the input data is leading or lagging with respect to a clock that is in phase with the VCO (I-clk) and a quadrature clock (Q-clk). When the phase acquisition loop (PA loop) is locked, the input data transition is aligned to the falling edge of I-clk and the output data is re-timed on the rising edge of I-clk. During high input jitter conditions (>0.25UI), Q-clk will sample a different value than I-clk. In this condition, two extra phase correction signals will be generated which instructs the charge pump to create larger frequency corrections for the VCO.

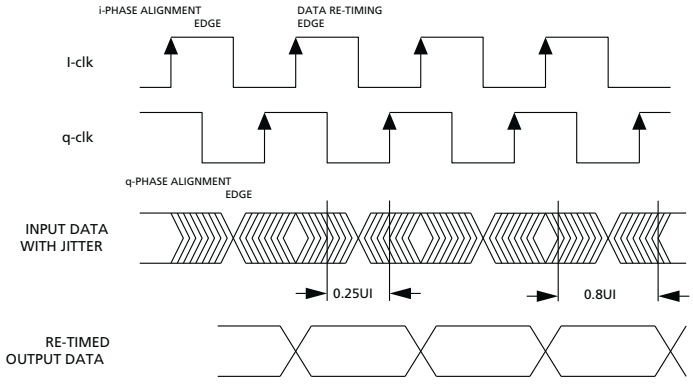


Figure 4-2: Phase Detector Characteristics

When the PA loop is active, the crystal frequency and the incoming data rate are compared. If the resultant is more that 2%, the PLL is considered to be unlocked and the system jumps to the FA loop.

4.6 4:1 Input Mux

The 4:1 input mux allows the connection of four independent streams of video/data. There are four differential inputs (DDI[3:0] and $\overline{\text{DDI[3:0]}}$). The active channel can be selected via the DDI_SEL[1:0] pins. Table 4-1 shows the input selected for a given state at DDI_SEL[1:0].

Table 4-1: Bit Pattern for Input Select

DDI_SEL[1:0]	Selected Input
00	DDI0
01	DDI1
10	DDI2
11	DDI3

The DDI inputs are designed to be DC interfaced with the output of the GS2974 Cable Equalizer. There are on-chip 50Ω termination resistors which come to a common point at the DDI_VT pins. Connect a 10nF capacitor to this pin and connect the other end of the capacitor to ground. This terminates the transmission line at the inputs for optimum performance.

If only one input pair is used, connect the unused positive inputs to +3.3V and leave the unused negative inputs floating. This helps to eliminate crosstalk from potential noise that would couple to the unused input pair.

4.7 Automatic and Manual Data Rate Selection

The GS2975A can be configured to manually lock to a specific data rate or automatically search for and lock to the incoming data rate. The AUTO/$\overline{\text{MAN}}$ pin selects automatic data rate detection mode (Auto mode) when HIGH and manual data rate selection mode (Manual mode) when LOW.

In Auto mode, the SS[2:0] bi-directional pins become outputs and the bit pattern indicates the data rate that the PLL is locked to (or previously locked to). The “search algorithm” cycles through the data rates and starts over if that data rate is not found (see Figure 4-3).

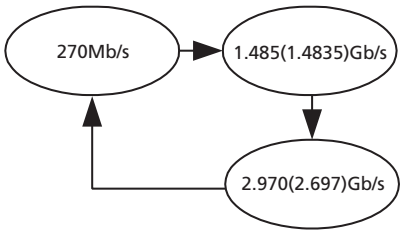


Figure 4-3: Data Rate Search Pattern

In Manual mode, the data rate can be programmed and the SS[2:0] pins become inputs. In this mode, the search algorithm is disabled and the PLL will only lock to the data rate selected.

Table 4-2 shows the SS[2:0] pin settings for either the data rate selected (in Manual mode) or the data rate that the PLL has locked to (in Auto mode).

Table 4-2: Data Rate Indication/Selection Bit Pattern

SS[2:0]	Data Rate (Mb/s)
010	270
101	1485 (1483.5)
110	2970 (2967)

4.8 Bypass Mode

In Bypass mode, the GS2975A passes the data at the inputs directly to the outputs. There are two pins that control the bypass function: BYPASS and AUTOBYPASS.

When BYPASS is set HIGH, the GS2975A will be in Bypass mode.

When AUTOBYPASS is set HIGH, the GS2975A will be configured to enter Bypass mode only when the PLL has not locked to a data rate. When BYPASS is set HIGH, AUTOBYPASS will be ignored.

When the PLL is not locked, and both BYPASS and AUTOBYPASS are set LOW, the serial digital output DDO0/$\overline{\text{DDO0}}$ or DDO1/$\overline{\text{DDO1}}$ will produce invalid data.

4.9 DVB-ASI Operation

The GS2975A will also re-clock DVB-ASI at 270 Mb/s. In auto mode, the device will automatically lock to the incoming 270Mb/s signal. In manual mode, the SS[2:0] pins must be set to 010 (270 Mb/s) to ensure proper operation.

4.10 Lock and LOS

The LOCKED signal is an active high output which indicates when the PLL is locked.

The internal lock logic of the GS2975A includes a system which monitors the Frequency Acquisition Loop and the Phase Acquisition Loop as well as a monitor to detect harmonic lock.

The LOS (Loss of Signal) output is an active HIGH output which indicates the absence of data transitions at the DDIx input. In order for this output to be asserted, transitions must not be present for a period of t_{LA} = 5 - 10µs. After this output has been asserted, LOS will de-assert within t_{LD} = 0 - 5µs after the appearance of a transition at the DDIx input.

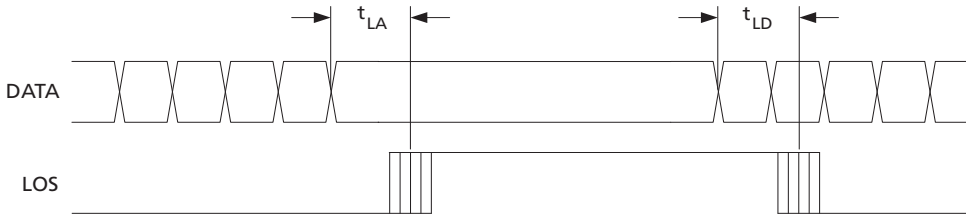


Figure 4-4: LOS signal timing

NOTE: LOS is sensitive to transitions appearing at the input, and does not distinguish between transitions caused by input data, and transitions due to noise.

4.11 Output Drivers and Output Mute

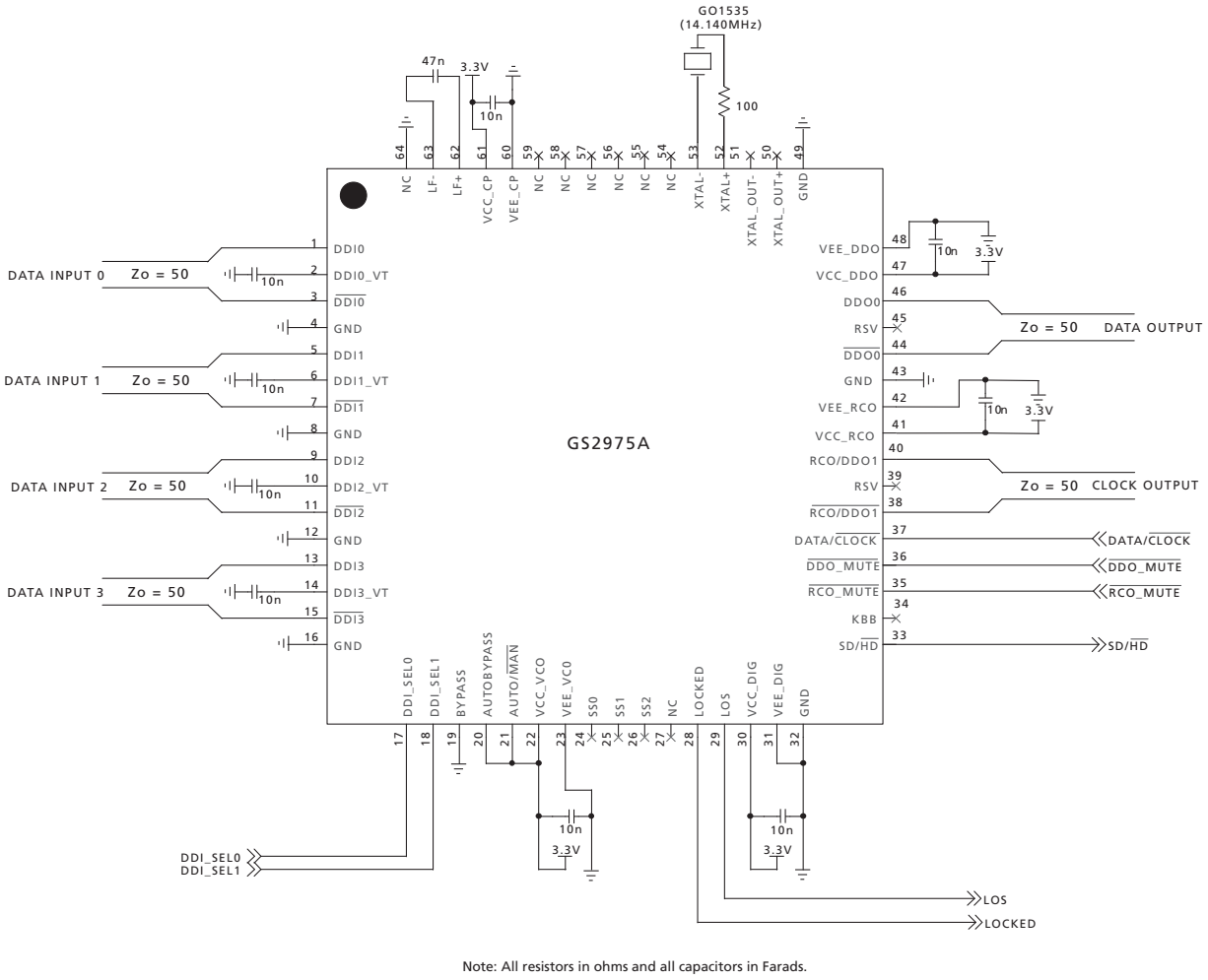
The GS2975A offers a choice of dual reclocked data outputs or one data output and one recovered clock output. Table 4-3 shows the correlation of the output pins to the corresponding input select pins.

Table 4-3: Configuration of Output Drivers and Output Mute Pins

$\overline{\text{DDO\_MUTE}}$	$\overline{\text{RCO\_MUTE}}$	DATA/$\overline{\text{CLOCK}}$	DDO0	RCO/DDO1
1	1	0	DATA	CLOCK
1	1	1	DATA	DATA
0	1	0	MUTE	CLOCK
0	1	1	MUTE	MUTE
1	0	X	DATA	Power Down
0	0	X	MUTE	Power Down

NOTE:
MUTE = Outputs latched at previous data bit.
Power down = Outputs pulled to V_{cc} through 50Ω resistor.

5. Typical Application Circuit



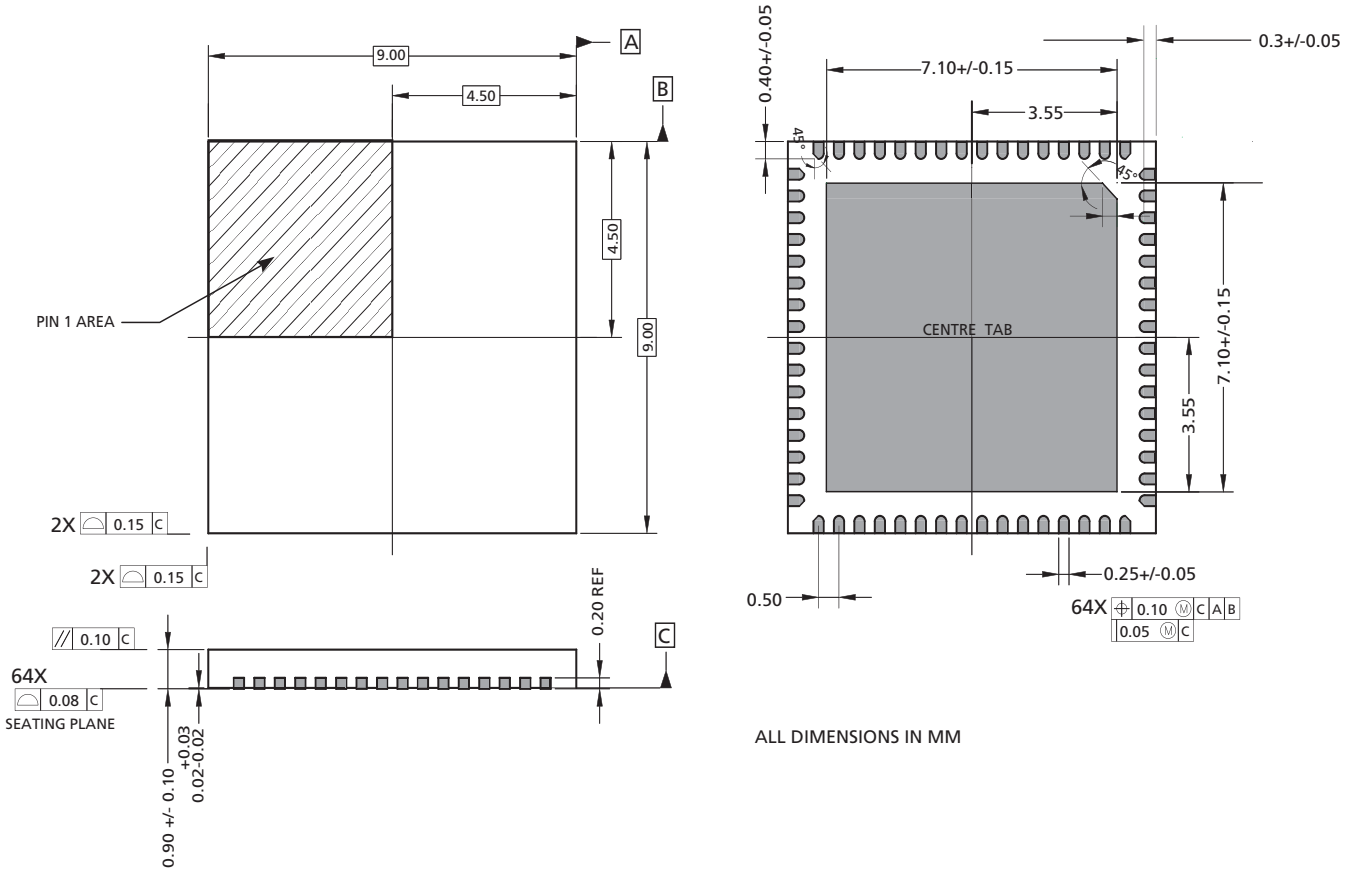
Note: All resistors in ohms and all capacitors in Farads.

Figure 5-1: GS2975A Typical Application Circuit

NOTE: The GS2975A is drop-in compatible with the GS2975 application circuit. In the GS2975 application circuit pin 37 is connected to ground. If the GS2975A is dropped into the GS2975 application circuit, the RCO/DDO1 and $\overline{\text{RCO/DDO1}}$ pins will output the recovered clock.

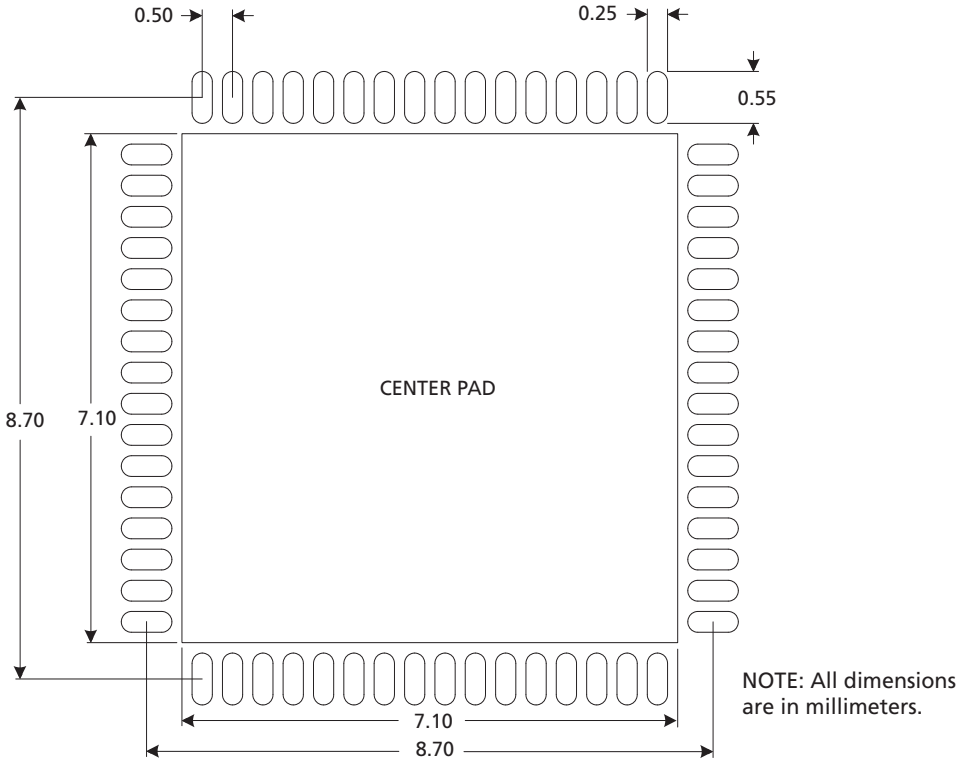
6. Package & Ordering Information

6.1 Package Dimensions



ALL DIMENSIONS IN MM

6.2 Recommended PCB Footprint



The center pad of the PCB footprint should be connected to the ground plane by a minimum of 36 vias.

NOTE: Suggested dimensions only. Final dimensions should conform to customer design rules and process optimization.

6.3 Packaging Data

Parameter	Value
Package Type	9mm x 9mm 64-pin QFN
Moisture Sensitivity Level (per JEDEC J-STD-020C)	3
Junction to Case Thermal Resistance, $\theta_{j\text{-}c}$	9.1°C/W
Junction to Air Thermal Resistance, $\theta_{j\text{-}a}$ (at zero airflow)	21.5°C/W
Junction to Board Thermal Resistance, $\theta_{j\text{-}b}$	5.6°C/W
Psi, Ψ	0.2°C/W
Pb-free and RoHS Compliant	Yes

6.4 Marking Diagram

6.5 Solder Reflow Profiles

The device is manufactured with Matte-Sn terminations and is compatible with both standard eutectic and Pb-free solder reflow profiles. MSL qualification was performed using the maximum Pb-free reflow profile shown in Figure 6-1. The recommended standard Pb reflow profile is shown in Figure 6-2.

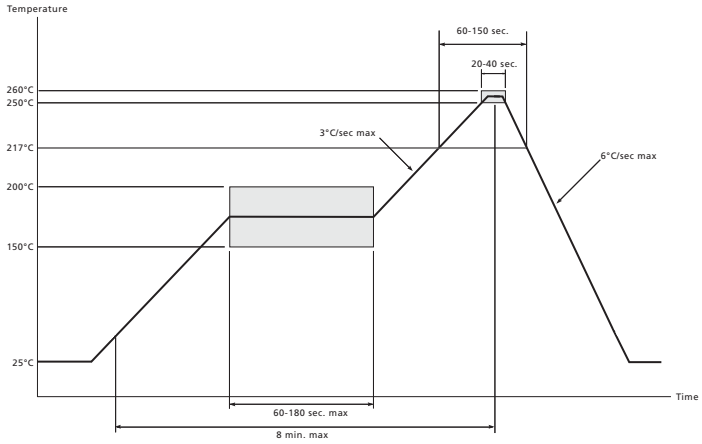


Figure 6-1: Maximum Pb-free Solder Reflow Profile (Preferred)

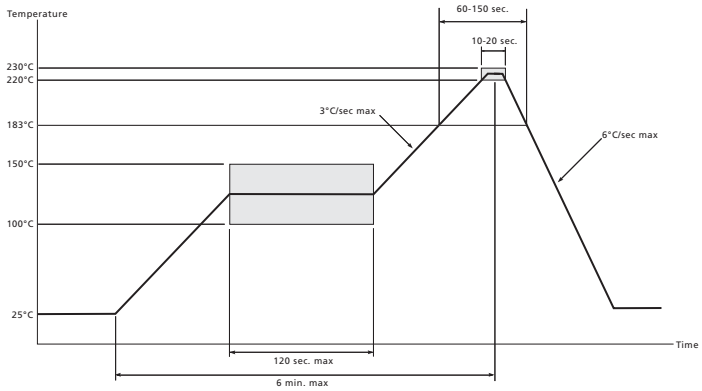


Figure 6-2: Standard Pb Solder Reflow Profile

6.6 Ordering Information

	Part Number	Package	Temperature Range
GS2975A	GS2975ACNE3	Pb-free 64-pin QFN	0°C to 70°C
GS2975A	GS2975ACNTE3Z	Pb-free 64-pin QFN 2,500pc Reel	0°C to 70°C

DOCUMENT IDENTIFICATION
DATA SHEET
The product is in production. Gennum reserves the right to make changes to the product at any time without notice to improve reliability, function or design, in order to provide the best product possible.

CAUTION
ELECTROSTATIC SENSITIVE DEVICES
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