FLATLINK™ TRANSMITTER

Check for Samples: SN75LVDS83B

FEATURES

- **LVDS Display Serdes Interfaces Directly to LCD Display Panels with Integrated LVDS**
- **Package Options: 4.5mm x 7mm BGA, and 8.1mm x 14mm TSSOP**
- **1.8V up to 3.3V Tolerant Data Inputs to Connect Directly to Low-Power, Low-Voltage Application and Graphic Processors**
- **Transfer Rate up to 135Mpps (Mega Pixel Per Second); Pixel Clock Frequency Range 10MHz to 135MHz**
- **Suited for Display Resolutions Ranging From HVGA up to HD With Low EMI**
- **Operates From a Single 3.3V Supply and 170mW (typ.) at 75MHz**
- **28 Data Channels Plus Clock In Low-Voltage TTL to 4 Data Channels Plus Clock Out Low-Voltage Differential**
- **Consumes Less Than 1mW When Disabled**
- **Selectable Rising or Falling Clock Edge Triggered Inputs**
- **ESD: 5kV HBM**
- **Support Spread Spectrum Clocking (SSC)**
- **Compatible with all OMAP™2x, OMAP™3x, and DaVinci™ Application Processors**

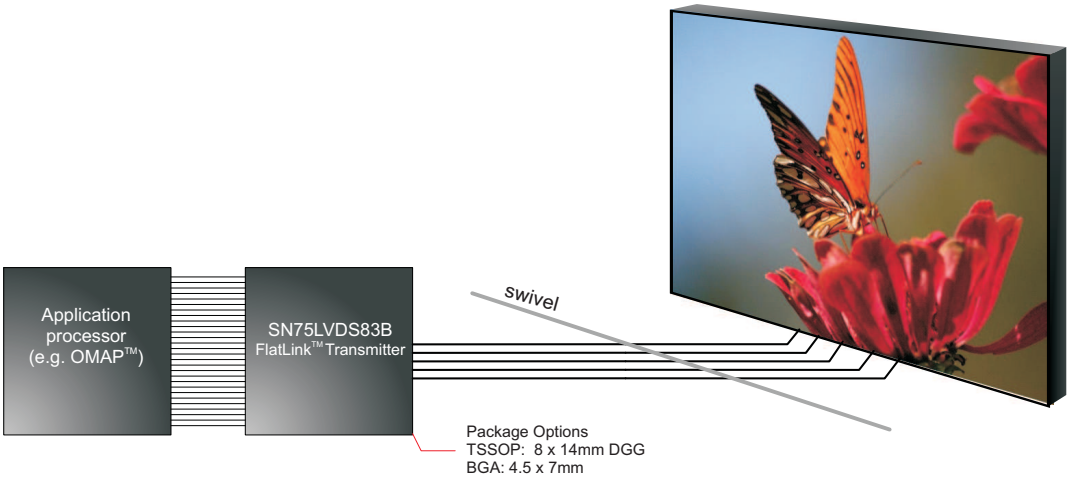
APPLICATIONS

- **LCD Display Panel Driver**
- **UMPC and Netbook PC**
- **Digital Picture Frame**

DESCRIPTION

The SN75LVDS83B FlatLink™ transmitter contains four 7-bit parallel-load serial-out shift registers, a 7X clock synthesizer, and five Low-Voltage Differential Signaling (LVDS) line drivers in a single integrated circuit. These functions allow 28 bits of single-ended LVTTL data to be synchronously transmitted over five balanced-pair conductors for receipt by a compatible receiver, such as the SN75LVDS82 and LCD panels with integrated LVDS receiver.

When transmitting, data bits D0 through D27 are each loaded into registers upon the edge of the input clock signal (CLKIN). The rising or falling edge of the clock can be selected via the clock select (CLKSEL) pin. The frequency of CLKIN is multiplied seven times, and then used to unload the data registers in 7-bit slices and serially. The four serial streams and a phase-locked clock (CLKOUT) are then output to LVDS output drivers. The frequency of CLKOUT is the same as the input clock, CLKIN.



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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DESCRIPTION (CONTINUED)

The SN75LVDS83B requires no external components and little or no control. The data bus appears the same at the input to the transmitter and output of the receiver with the data transmission transparent to the user(s). The only user intervention is selecting a clock rising edge by inputting a high level to CLKSEL or a falling edge with a low-level input, and the possible use of the Shutdown/Clear ($\overline{SHTDN}$). $\overline{SHTDN}$ is an active-low input to inhibit the clock, and shut off the LVDS output drivers for lower power consumption. A low-level on this signal clears all internal registers to a low-level.

The SN75LVDS83B is characterized for operation over ambient air temperatures of -10°C to 70°C.

Alternative device option: The SN75LVDS83A (SLLS980) is an alternative to the SN75LVDS83B for clock frequency range of 10MHz-100MHz only. The SN75LVDS83A is available in the TSSOP package option only.

ORDERING INFORMATION(1)

PART NUMBER	PART MARKING	PACKAGE
SN75LVDS83BZQLR	LVDS83B in BGA package	56-pin ZQL LARGE T&R
SN75LVDS83BDGG	LVDS83B in TSSOP package	56-pin DGG TUBE
SN75LVDS83BDGGR	LVDS83B in TSSOP package	56-pin DGG LARGE T&R

(1) For the most current package and ordering information, see the Package Option Addendum located at the end of this data sheet, or refer to our web site at www.ti.com.

ABSOLUTE MAXIMUM RATINGS(1)

		VALUE	UNIT
Supply voltage range, VCC, IOVCC, LVDSVCC, PLLVCC(2)		-0.5 to 4	V
Voltage range at any output terminal		-0.5 to VCC + 0.5	V
Voltage range at any input terminal		-0.5 to IOVCC + 0.5	V
Continuous power dissipation		See the dissipation rating table	
Storage temperature, T_s		–65 to 150	°C
ESD rating	Human Body Model (HBM)(3) all pins	5	kV
	Charged Device Model (CDM)(4) all pins	500	V
	Machine Model (MM)(5) all pins	150	V

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
(2) All voltages are with respect to the GND terminals.
(3) In accordance with JEDEC Standard 22, Test Method A114-A.
(4) In accordance with JEDEC Standard 22, Test Method C101.
(5) In accordance with JEDEC Standard 22, Test Method A115-A.

RECOMMENDED OPERATING CONDITIONS

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

PARAMETER		MIN	NOM	MAX	UNIT
Supply voltage, VCC		3	3.3	3.6	V
LVDS output Supply voltage, LVDSVCC		3	3.3	3.6	
PLL analog supply voltage, PLLVCC		3	3.3	3.6	
IO input reference supply voltage, IOVCC		1.62	1.8 / 2.5 / 3.3	3.6	
Power supply noise on any VCC terminal				0.1	
High-level input voltage, V_{IH}	IOVCC = 1.8V	IOVCC/2 + 0.3V			V
	IOVCC = 2.5V	IOVCC/2 + 0.4V			
	IOVCC = 3.3V	IOVCC/2 + 0.5V			
Low-level input voltage, V_{IL}	IOVCC = 1.8V			IOVCC/2 - 0.3V	V
	IOVCC = 2.5V			IOVCC/2 - 0.4V	
	IOVCC = 3.3V			IOVCC/2 - 0.5V	
Differential load impedance, Z_L		90		132	Ω
Operating free-air temperature, T_A		-10		70	C

DISSIPATION RATINGS

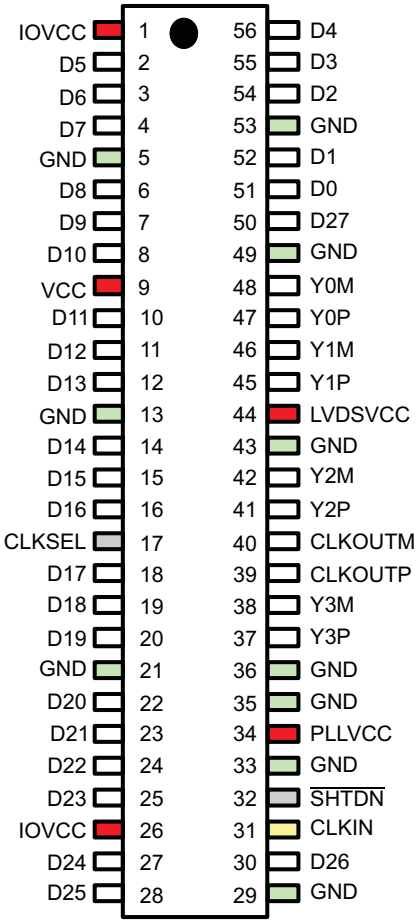
PACKAGE	CIRCUIT BOARD MODEL (1)	T_{JA} ≤ 25°C	DERATING FACTOR (2) ABOVE T_{JA} = 25°C	T_{JA} = 70°C POWER RATING
DGG	Low-K	1111mW	12.3mW/°C	555mW
ZQL		1034mW	11.5mW/°C	517mW
DGG (3)	High-K	1730mW	19mW/°C	865mW
ZQL		2000mW	22mW/°C	1000mW

(1) In accordance with the High-K and Low-K thermal metric definitions of EIA/JESD51-2.
(2) This is the inverse of the junction-to-ambient thermal resistance when board-mounted and with no air flow.
(3) DGG junction to case thermal reistance (θ_{JC}) is 15.4°C/W.

TIMING REQUIREMENTS

PARAMETER		MIN	MAX	UNIT
Input clock period, t_c		7.4	100	ns
Input clock modulation	with modulation frequency 30kHz		8%	
	with modulation frequency 50kHz		6%	
High-level input clock pulse width duration, t_w		0.4 t_c	0.6 t_c	ns
Input signal transition time, t_t			3	ns
Data set up time, D0 through D27 before CLKIN (See Figure 3)		2		ns
Data hold time, D0 through D27 after CLKIN		0.8		ns

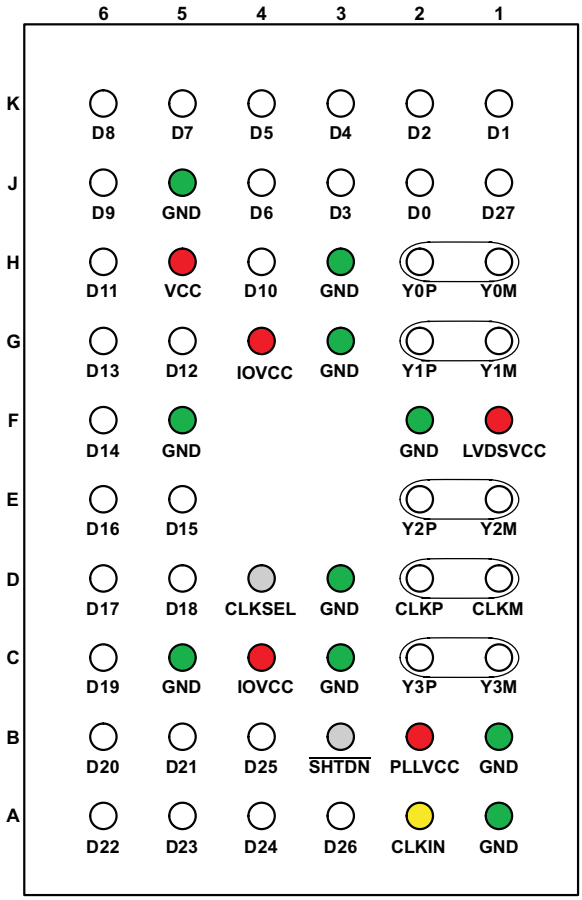
DGG PACKAGE
(TOP VIEW)



DGG PIN LIST

Pin #	Signal	Pin #	Signal	Pin #	Signal	Pin #	Signal
1	IOVCC	15	D15	29	GND	43	GND
2	D5	16	D16	30	D26	44	LVDSVCC
3	D6	17	CLKSEL	31	CLKIN	45	Y1P
4	D7	18	D17	32	$\overline{\text{SHTDN}}$	46	Y1M
5	GND	19	D18	33	GND	47	Y0P
6	D8	20	D19	34	PLLVCC	48	Y0M
7	D9	21	GND	35	GND	49	GND
8	D10	22	D20	36	GND	50	D27
9	VCC	23	D21	37	Y3P	51	D0
10	D11	24	D22	38	Y3M	52	D1
11	D12	25	D23	39	CLKOUTP	53	GND
12	D13	26	IOVCC	40	CLKOUTM	54	D2
13	GND	27	D24	41	Y2P	55	D3
14	D14	28	D25	42	Y2M	56	D4

ZQL PACKAGE
(TOP VIEW)



ZQL PIN LIST

Ball #	Signal	Ball #	Signal	Ball #	Signal
A1	GND	A2	CLKIN	A3	D26
A4	D24	A5	D23	A6	D22
B1	GND	B2	PLLVCC	B3	$\overline{\text{SHTDN}}$
B4	D25	B5	D21	B6	D20
C1	Y3M	C2	Y3P	C3	GND
C4	IOVCC	C5	GND	C6	D19
D1	CLKM	D2	CLKP	D3	GND
D4	CLKSEL	D5	D18	D6	D17
E1	Y2M	E2	Y2P	E3	ball not populated
E4	ball not populated	E5	D15	E6	D16
F1	LVDSVCC	F2	GND	F3	ball not populated
F4	ball not populated	F5	GND	F6	D14
G1	Y1M	G2	Y1P	G3	GND
G4	IOVCC	G5	D12	G6	D13
H1	Y0M	H2	Y0P	H3	GND
H4	D10	H5	VCC	H6	D11
J1	D27	J2	D0	J3	D3
J4	D6	J5	GND	J6	D9

ZQL PIN LIST (continued)

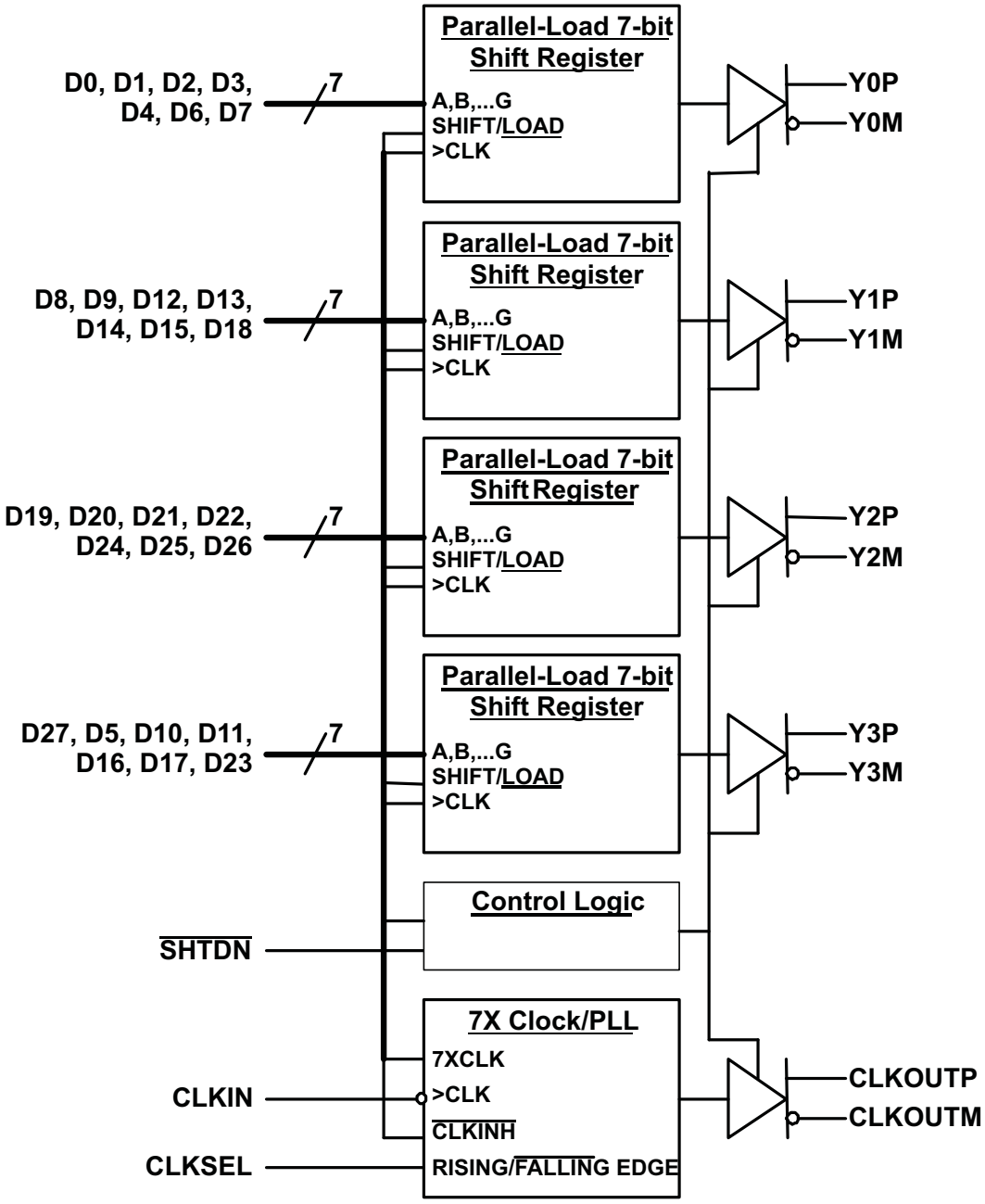
K1	D1	K2	D2	K3	D4
K4	D5	K5	D7	K6	D8

PIN FUNCTIONS

TERMINAL	I/O	DESCRIPTION
Y0P, Y0M, Y1P, Y1M, Y2P, Y2M	LVDS Out	Differential LVDS data outputs. Outputs are high-impedance when $\overline{\text{SHTDN}}$ is pulled low (de-asserted)
Y3P, Y3M		Differential LVDS Data outputs. Output is high-impedance when $\overline{\text{SHTDN}}$ is pulled low (de-asserted). Note: if the application only requires 18-bit color, this output can be left open.
CLKP, CLKM		Differential LVDS pixel clock output. Output is high-impedance when $\overline{\text{SHTDN}}$ is pulled low (de-asserted).
D0 – D27	CMOS IN with pulldn	Data inputs; supports 1.8V to 3.3V input voltage selectable by VDD supply. To connect a graphic source successfully to a display, the bit assignment of D[27:0] is critical (and not necessarily intuitive). For input bit assignment see Figure 14 to Figure 17 for details. Note: if application only requires 18-bit color, connect unused inputs D5, D10, D11, D16, D17, D23, and D27 to GND.
CLKIN		Input pixel clock; rising or falling clock polarity is selectable by Control input CLKSEL.
$\overline{\text{SHTDN}}$		Device shut down; pull low (de-assert) to shut down the device (low power, resets all registers) and high (assert) for normal operation.
CLKSEL		Selects between rising edge input clock trigger (CLKSEL = V_{IH}) and falling edge input clock trigger (CLKSEL = V_{IL}).
VCC	Power Supply(1)	3.3V digital supply voltage
IOVCC		I/O supply reference voltage (1.8V up to 3.3V matching the GPU data output signal swing)
PLLVCC		3.3V PLL analog supply
LVDSVCC		3.3V LVDS output analog supply
GND		Supply ground for VCC, IOVCC, LVDSVCC, and PLLVCC.

(1) For a multilayer pcb, it is recommended to keep one common GND layer underneath the device and connect all ground terminals directly to this plane.

FUNCTIONAL BLOCK DIAGRAM



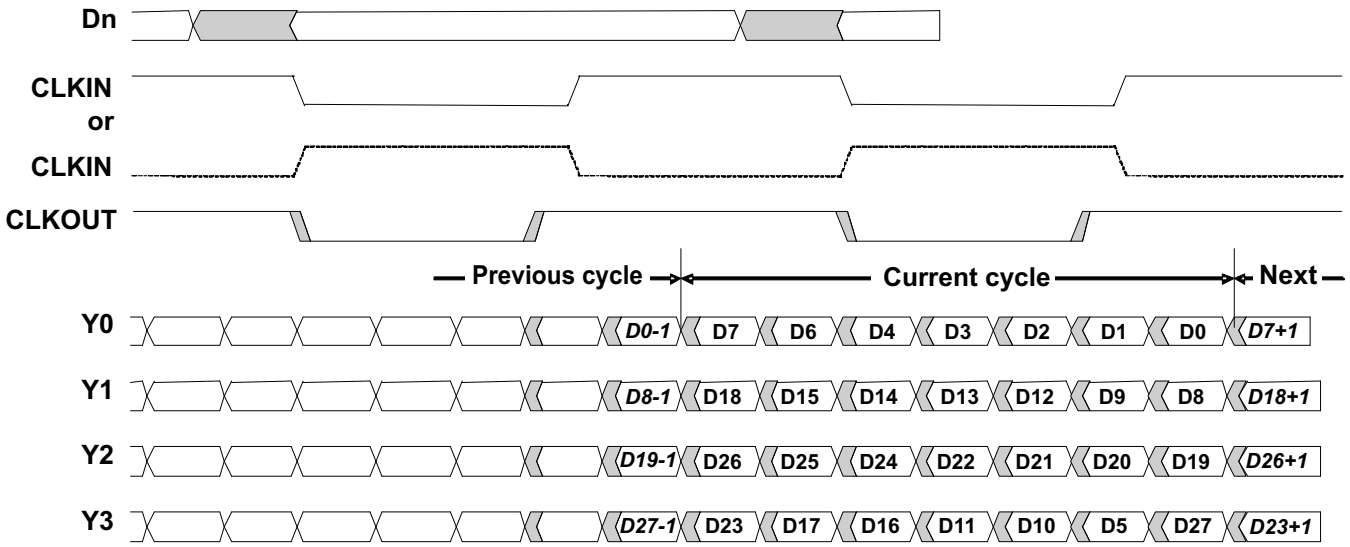


Figure 1. Typical SN75LVDS83B Load and Shift Sequences

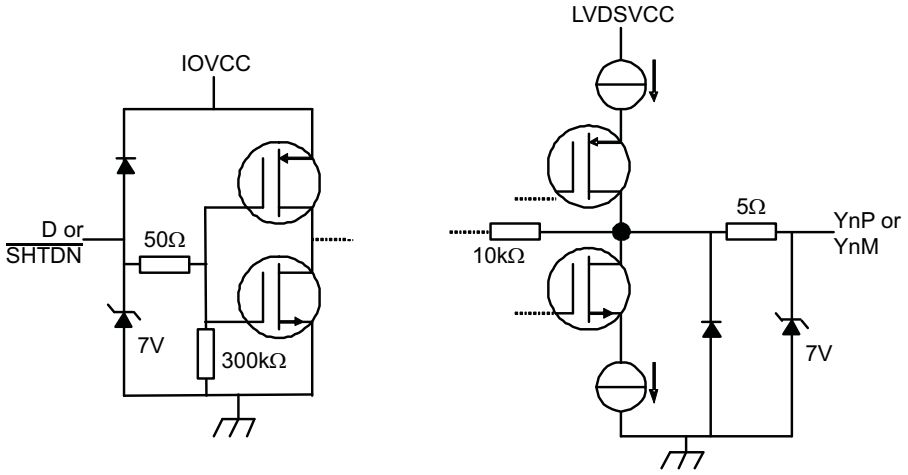


Figure 2. Equivalent Input and Output Schematic Diagrams

ELECTRICAL CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
V_T	Input voltage threshold	R_L = 100Ω, See Figure 4		IOVCC/2		V
$\|V_{OD}\|$	Differential steady-state output voltage magnitude		250		450	mV
$\Delta\|V_{OD}\|$	Change in the steady-state differential output voltage magnitude between opposite binary states			1	35	mV
$V_{OC(SS)}$	Steady-state common-mode output voltage	See Figure 4 $t_{R/F}$ (Dx, CLKin) = 1ns	1.125		1.375	V
$V_{OC(PP)}$	Peak-to-peak common-mode output voltage				35	mV
I_{IH}	High-level input current	V_{IH} = IOVCC			25	µA
I_{IL}	Low-level input current	V_{IL} = 0 V			±10	µA
I_{OS}	Short-circuit output current	V_{OY} = 0 V			±24	mA
		V_{OD} = 0 V			±12	mA
I_{OZ}	High-impedance state output current	V_O = 0 V to VCC			±20	µA
R_{pdn}	Input pull-down integrated resistor on all inputs (Dx, CLKSEL, $\overline{SHTDN}$, CLKIN)	IOVCC = 1.8V		200		kΩ
		IOVCC = 3.3V		100		
I_Q	Quiescent current (average)	disabled, all inputs at GND; $\overline{SHTDN}$ = V_{IL}		2	100	µA
I_{CC}	Supply current (average)	$\overline{SHTDN}$ = V_{IH}, R_L = 100Ω (5 places), grayscale pattern (Figure 5) VCC = 3.3V, f_{CLK} = 75MHz				
		$I_{(VCC)}$ + $I_{(PLLVCC)}$ + $I_{(LVDSVCC)}$		51.9		mA
		$I_{(IOVCC)}$ with IOVCC = 3.3V		0.4		
		$I_{(IOVCC)}$ with IOVCC = 1.8V		0.1		
		$\overline{SHTDN}$ = V_{IH}, R_L = 100Ω (5 places), 50% transition density pattern (Figure 5), VCC = 3.3V, f_{CLK} = 75MHz				
		$I_{(VCC)}$ + $I_{(PLLVCC)}$ + $I_{(LVDSVCC)}$		53.3		mA
		$I_{(IOVCC)}$ with IOVCC = 3.3V		0.6		
		$I_{(IOVCC)}$ with IOVCC = 1.8V		0.2		
		$\overline{SHTDN}$ = V_{IH}, R_L = 100Ω (5 places), worst-case pattern (Figure 6), VCC = 3.6V, f_{CLK} = 75MHz				
		$I_{(VCC)}$ + $I_{(PLLVCC)}$ + $I_{(LVDSVCC)}$		63.7		mA
		$I_{(IOVCC)}$ with IOVCC = 3.3V		1.3		
		$I_{(IOVCC)}$ with IOVCC = 1.8V		0.5		
		$\overline{SHTDN}$ = V_{IH}, R_L = 100Ω (5 places), worst-case pattern (Figure 6), f_{CLK} = 100MHz				
		$I_{(VCC)}$ + $I_{(PLLVCC)}$ + $I_{(LVDSVCC)}$		81.6		mA
		$I_{(IOVCC)}$ with IOVCC = 3.6V		1.6		
		$I_{(IOVCC)}$ with IOVCC = 1.8V		0.6		
		$\overline{SHTDN}$ = V_{IH}, R_L = 100Ω (5 places), worst-case pattern (Figure 6), f_{CLK} = 135MHz				
		$I_{(VCC)}$ + $I_{(PLLVCC)}$ + $I_{(LVDSVCC)}$		102.2		mA
		$I_{(IOVCC)}$ with IOVCC = 3.6V		2.1		
		$I_{(IOVCC)}$ with IOVCC = 1.8V		0.8		
C_I	Input capacitance			2		pF

(1) All typical values are at VCC = 3.3V, T_A = 25°C.

SWITCHING CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
t_0	Delay time, CLKOUT↑ after Yn valid (serial bit position 0, equal D1, D9, D20, D5)	See Figure 7, t_C = 10ns, |Input clock jitter| < 25ps (2)	-0.1	0	0.1	ns
t_1	Delay time, CLKOUT↑ after Yn valid (serial bit position 1, equal D0, D8, D19, D27)		$^1/_7$ t_c - 0.1		$^1/_7$ t_c + 0.1	ns
t_2	Delay time, CLKOUT↑ after Yn valid (serial bit position 2, equal D7, D18, D26. D23)		$^2/_7$ t_c - 0.1		$^2/_7$ t_c + 0.1	ns
t_3	Delay time, CLKOUT↑ after Yn valid (serial bit position 3; equal D6, D15, D25, D17)		$^3/_7$ t_c - 0.1		$^3/_7$ t_c + 0.1	ns
t_4	Delay time, CLKOUT↑ after Yn valid (serial bit position 4, equal D4, D14, D24, D16)		$^4/_7$ t_c - 0.1		$^4/_7$ t_c + 0.1	ns
t_5	Delay time, CLKOUT↑ after Yn valid (serial bit position 5, equal D3, D13, D22, D11)		$^5/_7$ t_c - 0.1		$^5/_7$ t_c + 0.1	ns
t_6	Delay time, CLKOUT↑ after Yn valid (serial bit position 6, equal D2, D12, D21, D10)		$^6/_7$ t_c - 0.1		$^6/_7$ t_c + 0.1	ns
$t_{c(o)}$	Output clock period			t_c		ns
$\Delta t_{c(o)}$	Output clock cycle-to-cycle jitter (3)	t_C = 10ns; clean reference clock, see Figure 8		±26		ps
		t_C = 10ns with 0.05UI added noise modulated at 3MHz, see Figure 8		±44		
		t_C = 7.4ns; clean reference clock, see Figure 8		±35		
		t_C = 7.4ns with 0.05UI added noise modulated at 3MHz, see Figure 8		±42		
t_w	High-level output clock pulse duration			$^4/_7$ t_c		ns
$t_{r/f}$	Differential output voltage transition time (t_r or t_f)	See Figure 4		225	500	ps
t_{en}	Enable time, $\overline{SHTDN}$↑ to phase lock (Yn valid)	$f_{(clk)}$ = 135MHz, See Figure 9		6		µs
t_{dis}	Disable time, $\overline{SHTDN}$↓ to off-state (CLKOUT high-impedance)	$f_{(clk)}$ = 135MHz, See Figure 10		7		ns

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
(2) |Input clock jitter| is the magnitude of the change in the input clock period.
(3) The output clock cycle-to-cycle jitter is the largest recorded change in the output clock period from one cycle to the next cycle observed over 15,000 cycles.Tektronix TDSJIT3 Jitter Analysis software was used to derive the maximum and minimum jitter value.

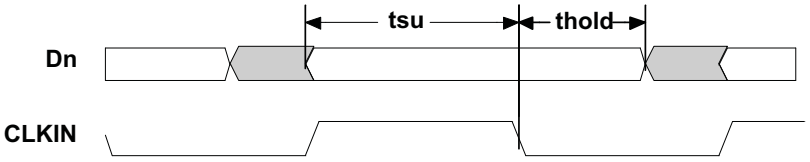
THERMAL CHARACTERISTICS

PARAMETER		TEST CONDITIONS	ZQL			DGG			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
θ_{JA}	Junction-to-free-air thermal resistance	Low-K JEDEC test board, 1s (single signal layer), no air flow		85					°C/W
		High-K JEDEC test board, 2s2p (double signal layer, double buried power plane), no air flow		67.1			63.4		
θ_{JC}	Junction-to-case thermal resistance	Cu cold plate measurement process		25.2			15.9		°C/W
θ_{JB}	Junction-to-board thermal resistance	EIA/JESD 51-8		31.0			32.5		°C/W
ψ_{JT}	Junction-to-top of package	EIA/JESD 51-2		0.8			0.4		°C/W

THERMAL CHARACTERISTICS (continued)

PARAMETER		TEST CONDITIONS	ZQL			DGG			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
ψ_{JB}	Junction-to-board	EIA/JESD 51-6		30.3			32.2		°C/W
T_A	Operating ambient temperature range		–10		70	-10		70	°C
T_J	Virtual junction temperature		0		105	0		105	°C

PARAMETER MEASUREMENT INFORMATION



All input timing is defined at IOVDD / 2 on an input signal with a 10% to 90% rise or fall time of less than 3 ns. CLKSEL = 0V.

Figure 3. Set Up and Hold Time Definition

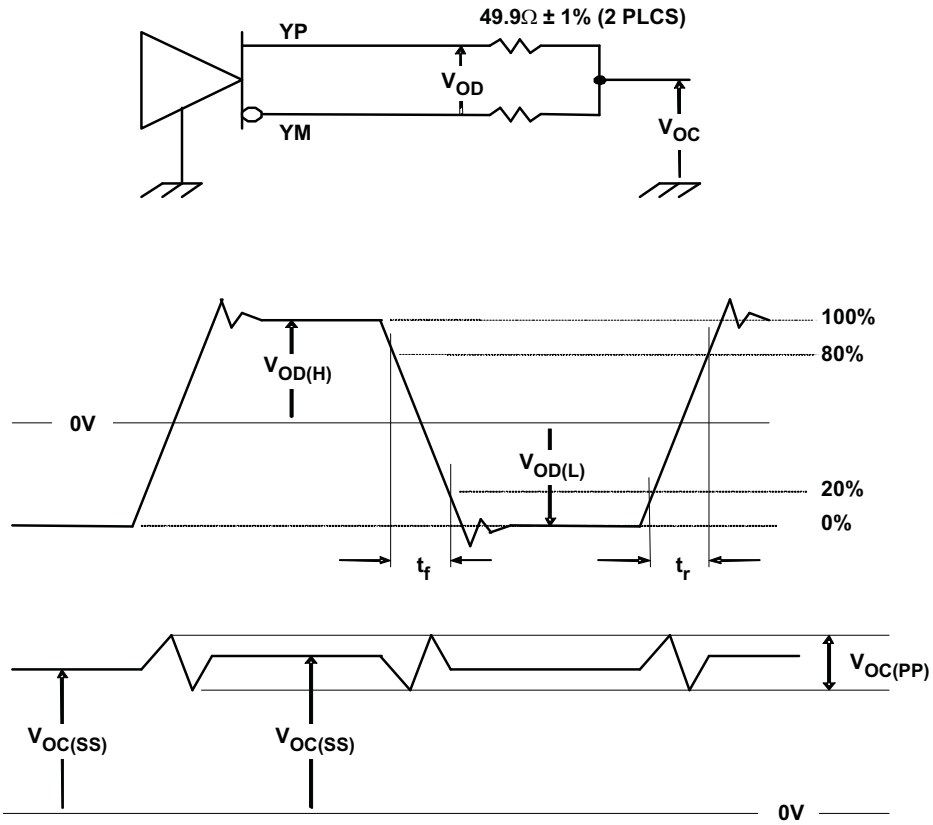
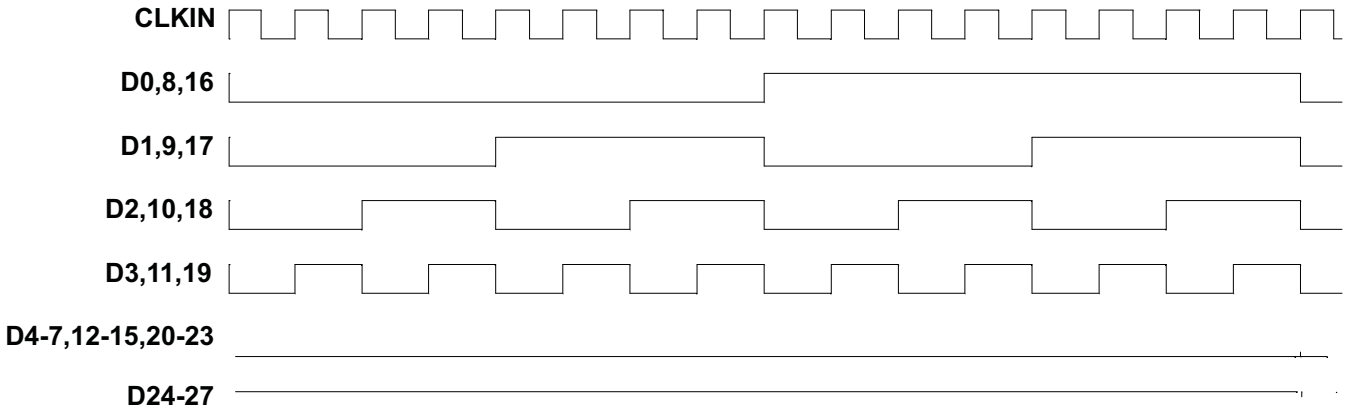


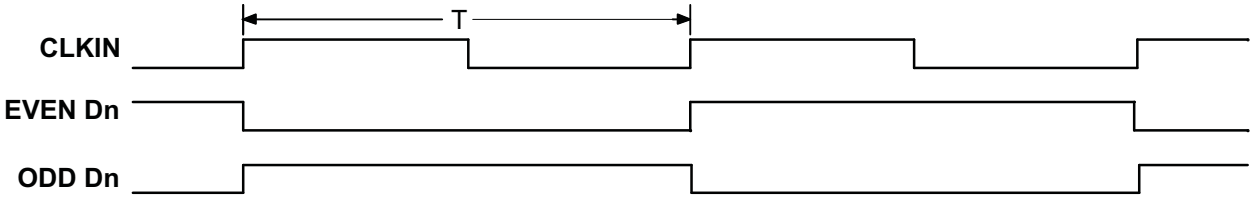
Figure 4. Test Load and Voltage Definitions for LVDS Outputs.

PARAMETER MEASUREMENT INFORMATION (continued)



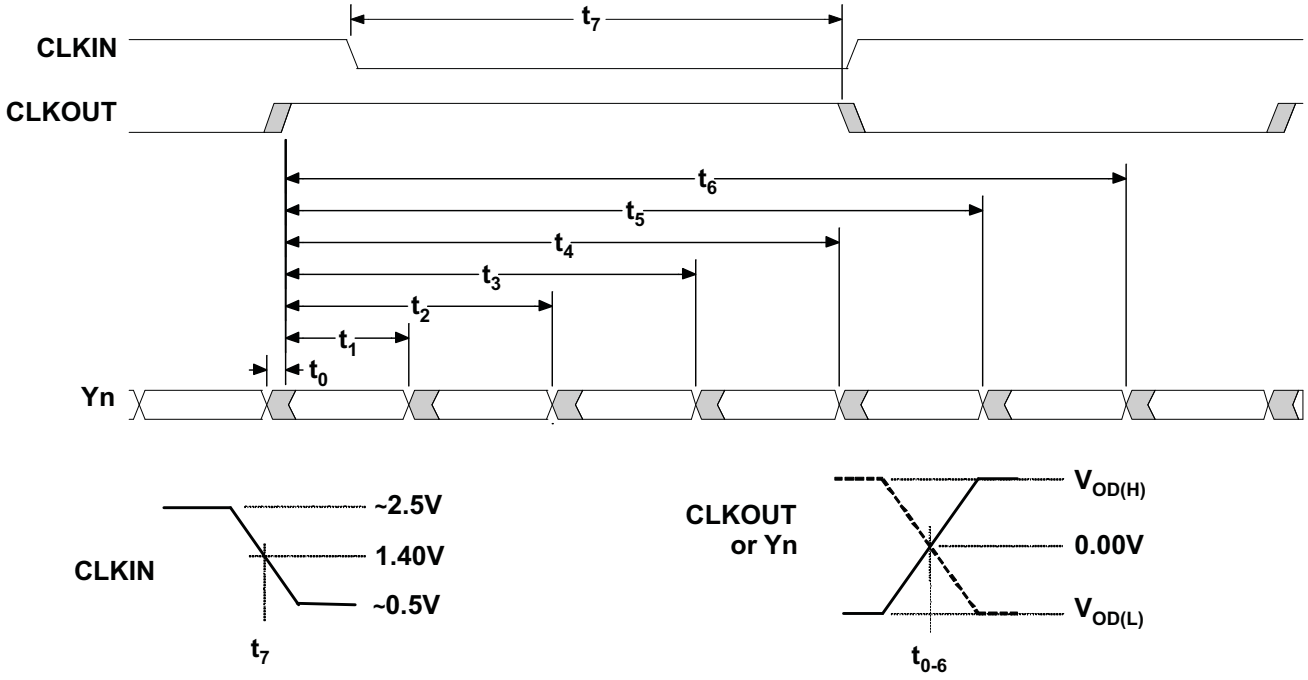
The 16 grayscale test pattern test device power consumption for a typical display pattern.

Figure 5. 16 Grayscale Test Pattern



The worst-case test pattern produces nearly the maximum switching frequency for all of the LVDS outputs.

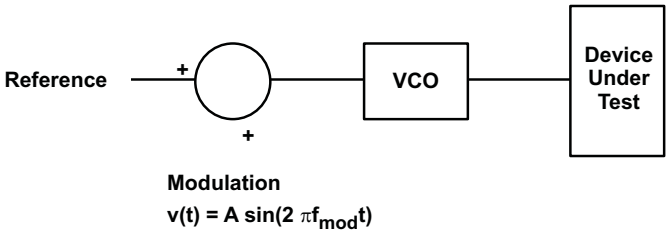
Figure 6. Worst-Case Power Test Pattern



CLKOUT is shown with CLKSEL at high-level.
CLKIN polarity depends on CLKSEL input level.

Figure 7. SN75LVDS83B Timing Definitions

PARAMETER MEASUREMENT INFORMATION (continued)



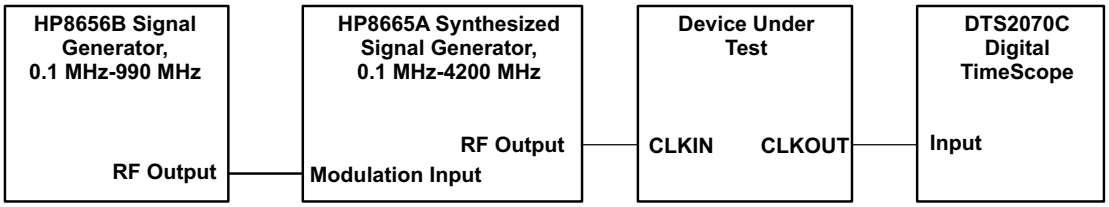


Figure 8. Output Clock Jitter Test Set Up

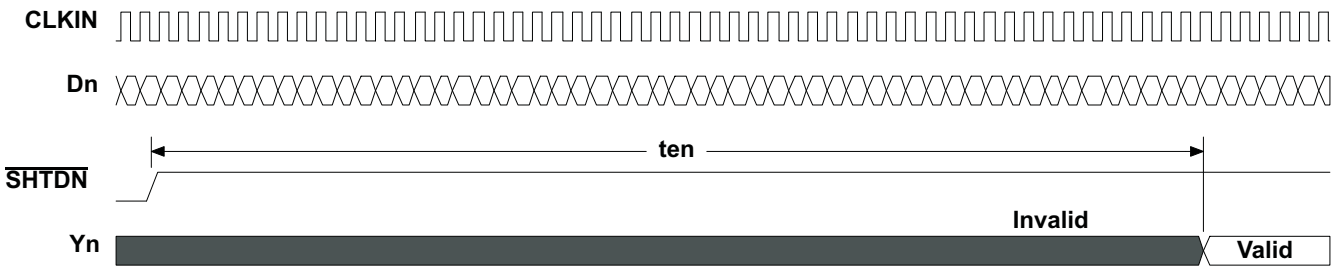


Figure 9. Enable Time Waveforms

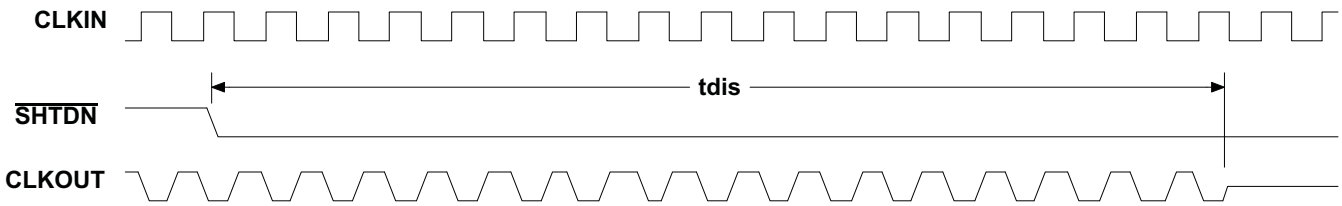


Figure 10. Disable Time Waveforms

TYPICAL CHARACTERISTICS

AVERAGE GRAYSCALE ICC vs CLOCK FREQUENCY

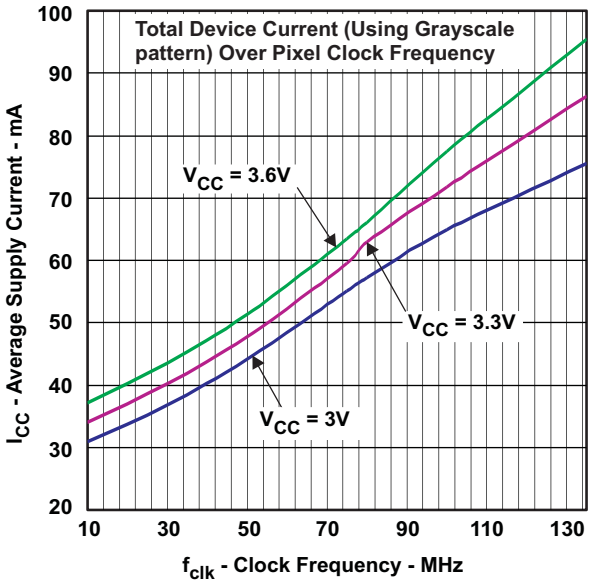


Figure 11.

OUTPUT CLOCK JITTER vs INPUT CLOCK JITTER

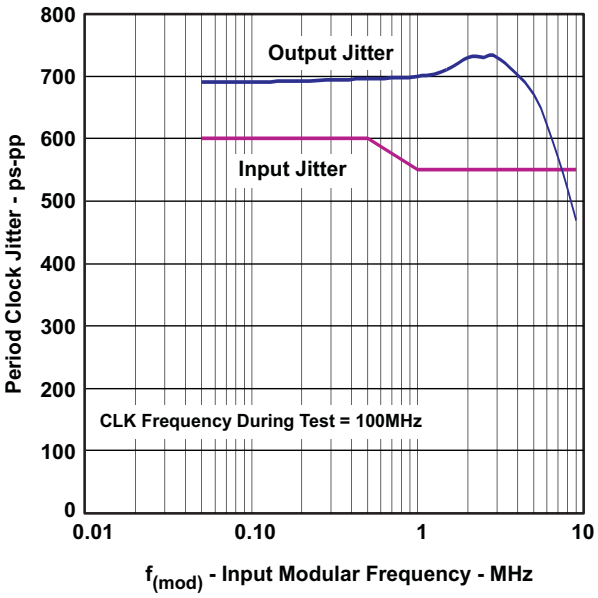


Figure 12.

TYPICAL PRBS OUTPUT SIGNAL OVER ONE CLOCK PERIOD

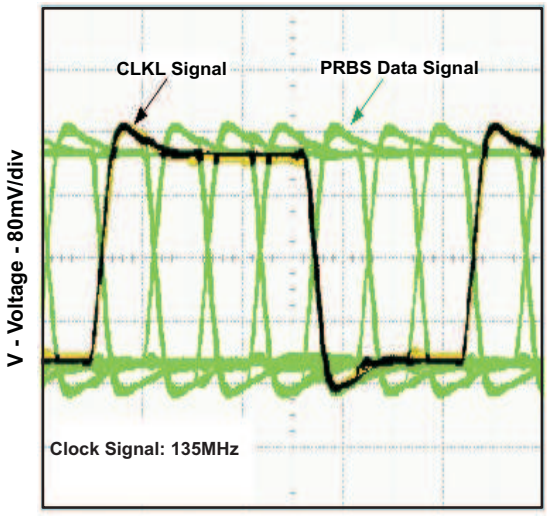


Figure 13.

APPLICATION INFORMATION

This section describes the power up sequence, provides information on device connectivity to various GPU and LCD display panels, and offers a pcb routing example.

Power Up Sequence

The SN75LVDS83B does not require a specific power up sequence.

It is permitted to power up IOVCC while VCC, VCCPLL, and VCCLVDS remain powered down and connected to GND. The input level of the $\overline{\text{SHTDN}}$ during this time does not matter as only the input stage is powered up while all other device blocks are still powered down.

It is also permitted to power up all 3.3V power domains while IOVCC is still powered down to GND. The device will not suffer damage. However, in this case, all the I/Os are detected as logic HIGH, regardless of their true input voltage level. Hence, connecting $\overline{\text{SHTDN}}$ to GND will still be interpreted as a logic HIGH; the LVDS output stage will turn on. The power consumption in this condition is significantly higher than standby mode, but still lower than normal mode.

The user experience can be impacted by the way a system powers up and powers down an LCD screen. The following sequence is recommended:

Power up sequence (SN75LVDS83B $\overline{\text{SHTDN}}$ input initially low):

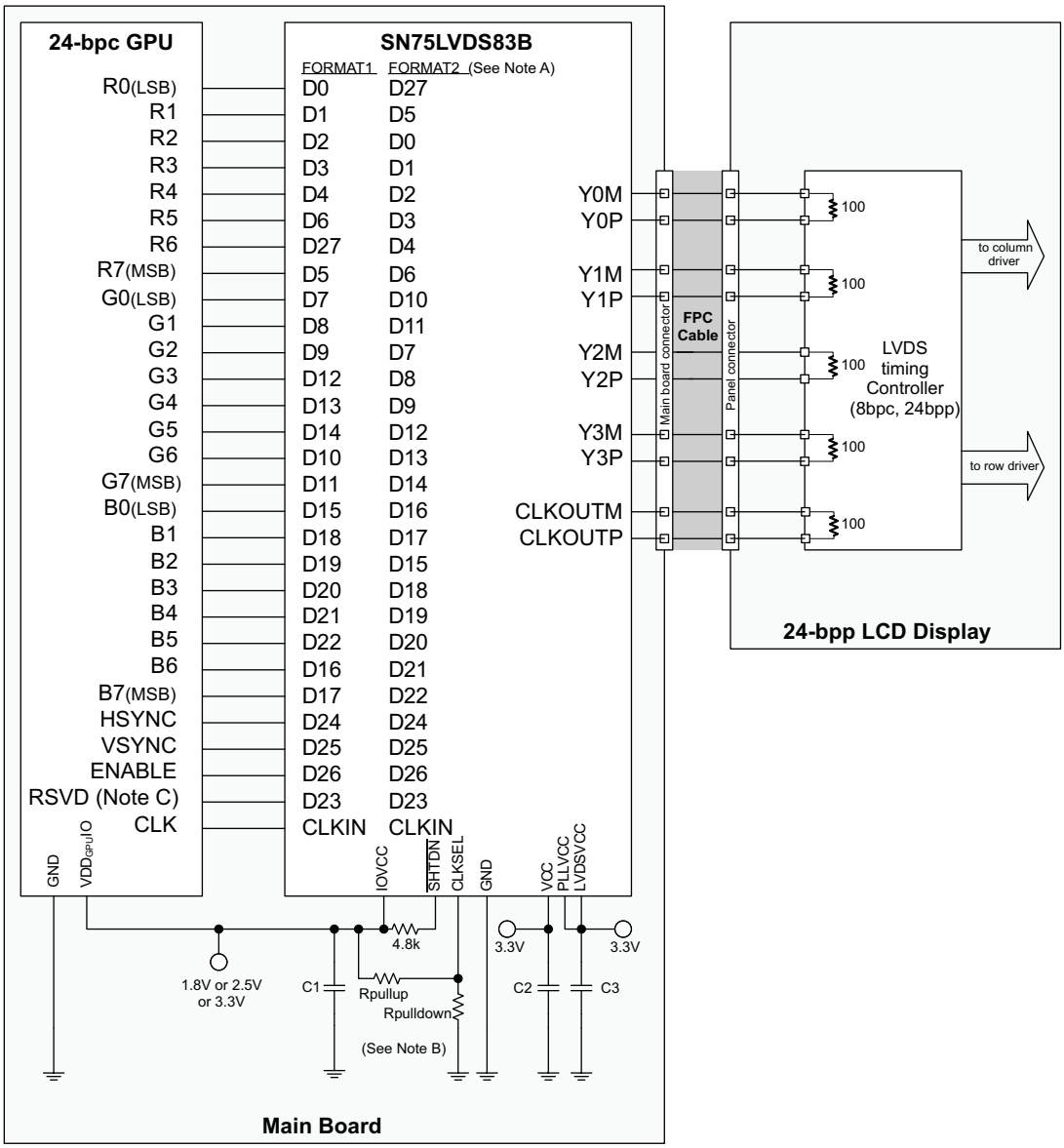
1. Ramp up LCD power (maybe 0.5ms to 10ms) but keep backlight turned off.
2. Wait for additional 0-200ms to ensure display noise won't occur.
3. Enable video source output; start sending black video data.
4. Toggle LVDS83B shutdown to $\overline{\text{SHTDN}} = V_{IH}$.
5. Send >1ms of black video data; this allows the LVDS83B to be phase locked, and the display to show black data first.
6. Start sending true image data.
7. Enable backlight.

Power Down sequence (SN75LVDS83B $\overline{\text{SHTDN}}$ input initially high):

1. Disable LCD backlight; wait for the minimum time specified in the LCD data sheet for the backlight to go low.
2. Video source output data switch from active video data to black image data (all visible pixel turn black); drive this for >2 frame times.
3. Set SN75LVDS83B input $\overline{\text{SHTDN}}$ = GND; wait for 250ns.
4. Disable the video output of the video source.
5. Remove power from the LCD panel for lowest system power.

Signal Connectivity

While there is no formal industry standardized specification for the input interface of LVDS LCD panels, the industry has aligned over the years on a certain data format (bit order). Figure 14 through Figure 17 show how each signal should be connected from the graphic source through the SN75LVDS83B input, output and LVDS LCD panel input. Detailed notes are provided with each figure.



Note A. **FORMAT**: The majority of 24-bit LCD display panels require the two most significant bits (2 MSB) of each color to be transferred over the 4th serial data output Y3. A few 24-bit LCD display panels require the two LSBs of each color to be transmitted over the Y3 output. The system designer needs to verify which format is expected by checking the LCD display data sheet.

- Format 1: use with displays expecting the 2 MSB to be transmitted over the 4th data channel Y3. This is the dominate data format for LCD panels.
- Format 2: use with displays expecting the 2 LSB to be transmitted over the 4th data channel.

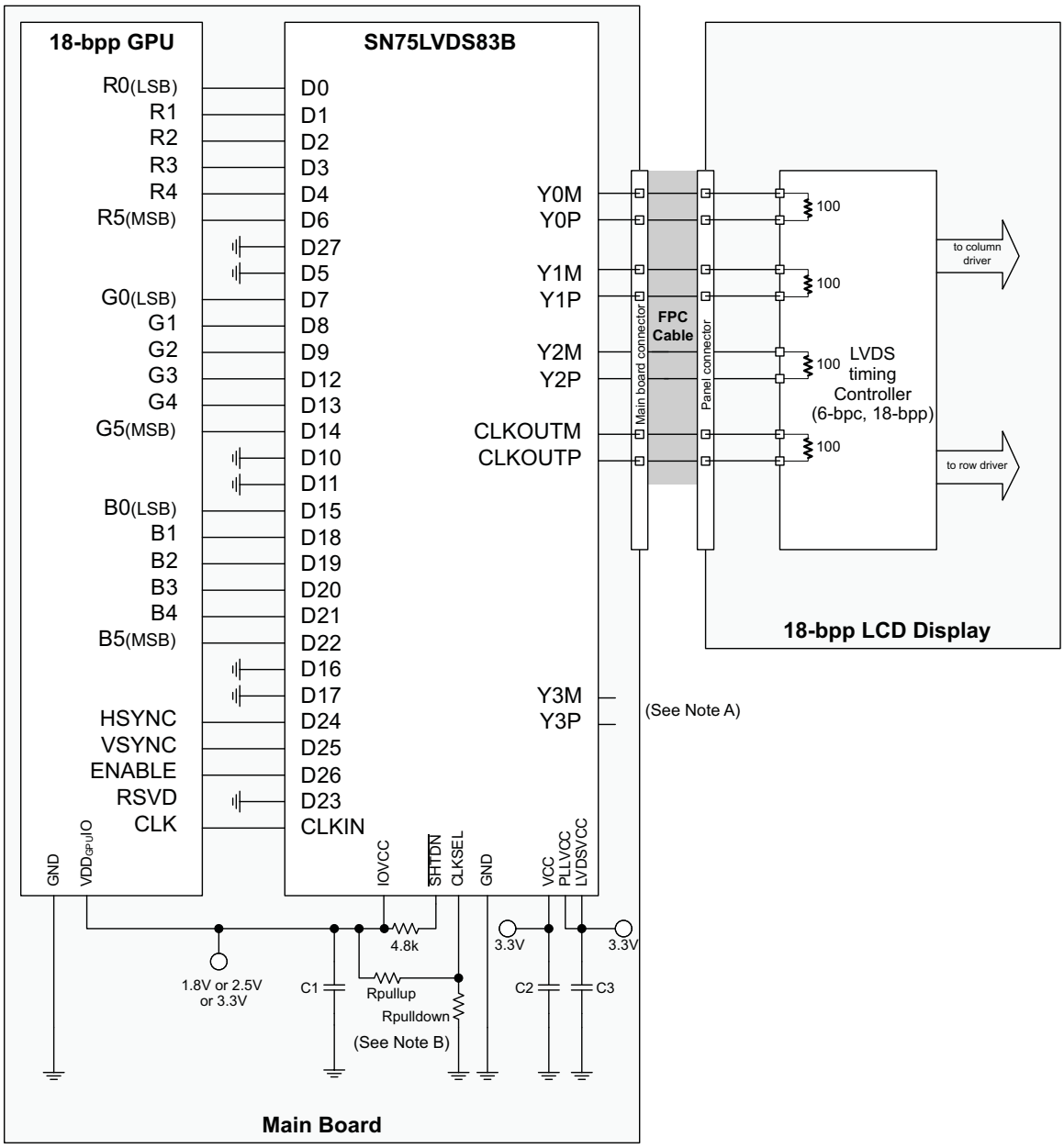
Note B. **Rpullup**: install only to use rising edge triggered clocking.
Rpulldown: install only to use falling edge triggered clocking.

- C1: decoupling cap for the VDDIO supply; install at least 1x0.01µF.
- C2: decoupling cap for the VDD supply; install at least 1x0.1µF and 1x0.01µF.
- C3: decoupling cap for the VDDPLL and VDDLVDS supply; install at least 1x0.1µF and 1x0.01µF.

Note C. If RSVD is not driven to a valid logic level, then an external connection to GND is recommended.

Note D. RSVD must be driven to a valid logic level. All unused SN75LVDS83B inputs must be tied to a valid logic level.

Figure 14. 24-Bit Color Host to 24-bit LCD Panel Application

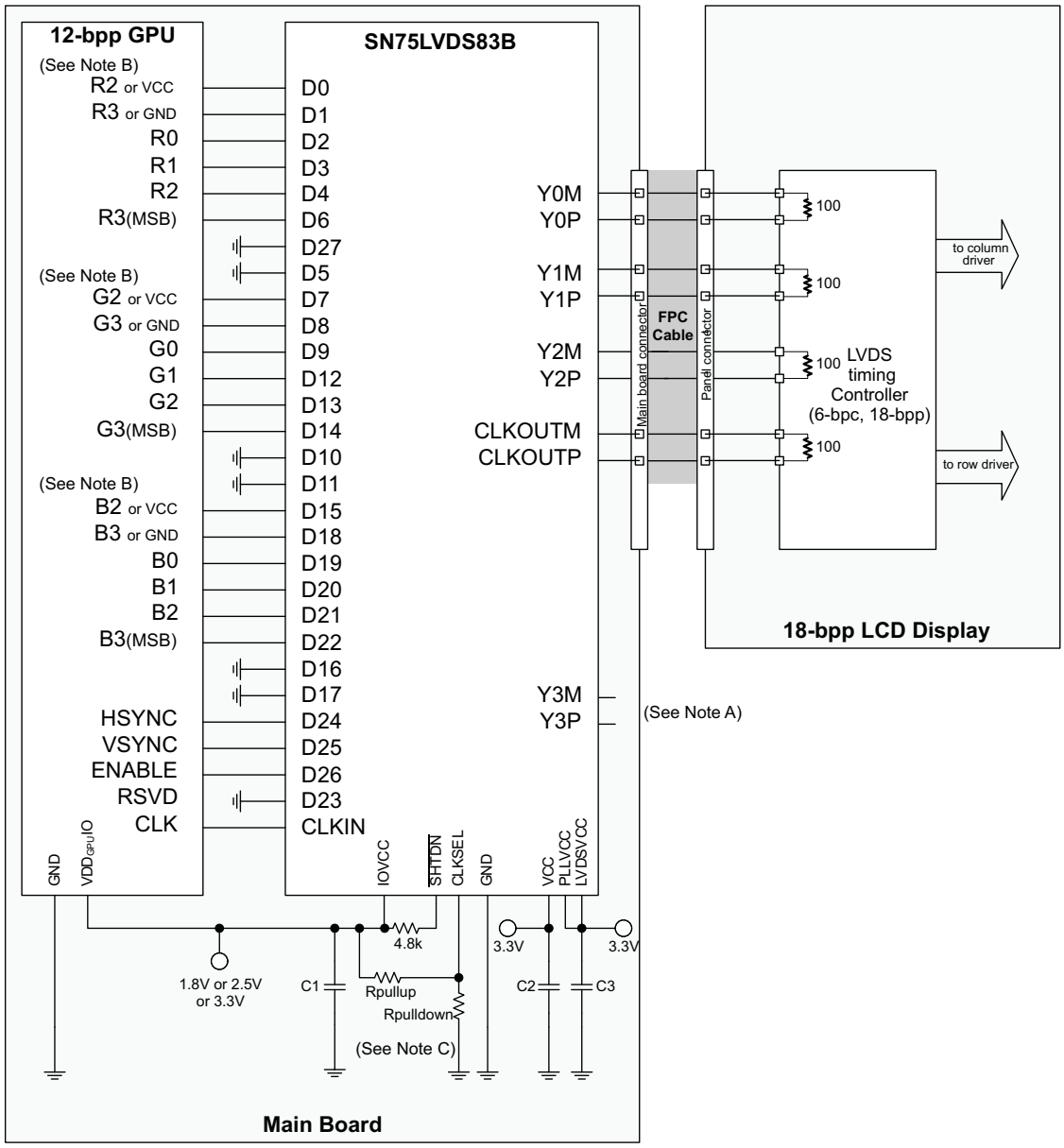


Note A. Leave output Y3 NC.

Note B.**Rpullup**: install only to use rising edge triggered clocking.
Rpulldown: install only to use falling edge triggered clocking.

- C1: decoupling cap for the VDDIO supply; install at least 1x0.01µF.
- C2: decoupling cap for the VDD supply; install at least 1x0.1µF and 1x0.01µF.
- C3: decoupling cap for the VDDPLL and VDDLVDS supply; install at least 1x0.1µF and 1x0.01µF.

Figure 15. 18-Bit Color Host to 18-Bit Color LCD Panel Display Application



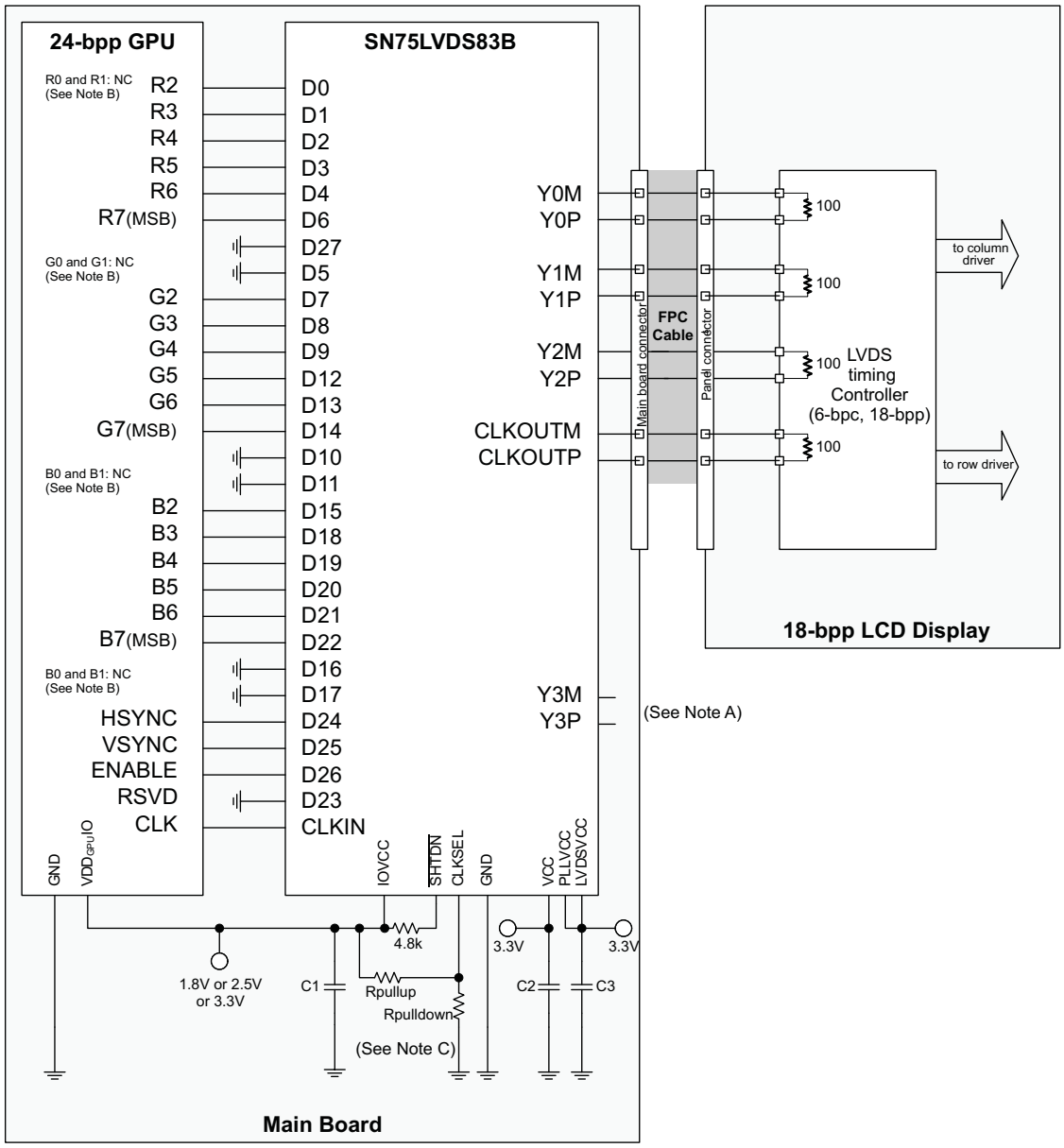
Note A. Leave output Y3 N.C.

Note B. **R3, G3, B3**: this MSB of each color also connects to the 5th bit of each color for increased dynamic range of the entire color space at the expense of none-linear step sizes between each step. For linear steps with less dynamic range, connect D1, D8, and D18 to GND.
R2, G2, B2: these outputs also connects to the LSB of each color for increased, dynamic range of the entire color space at the expense of none-linear step sizes between each step. For linear steps with less dynamic range, connect D0, D7, and D15 to VCC.

Note C.**Rpullup**: install only to use rising edge triggered clocking.
Rpulldown: install only to use falling edge triggered clocking.

- C1: decoupling cap for the VDDIO supply; install at least 1x0.01µF.
- C2: decoupling cap for the VDD supply; install at least 1x0.1µF and 1x0.01µF.
- C3: decoupling cap for the VDDPLL and VDDLVDS supply; install at least 1x0.1µF and 1x0.01µF.

Figure 16. 12-Bit Color Host to 18-Bit Color LCD Panel Display Application



Note A. Leave output Y3 NC.

Note B. **R0, R1, G0, G1, B0, B1**: For improved image quality, the GPU should dither the 24-bit output pixel down to18-bit per pixel.

NoteC.**Rpullup**: install only to use rising edge triggered clocking.
Rpulldown: install only to use falling edge triggered clocking.

- C1: decoupling cap for the VDDIO supply; install at least 1x0.01µF.
- C2: decoupling cap for the VDD supply; install at least 1x0.1µF and 1x0.01µF.
- C3: decoupling cap for the VDDPLL and VDDLVDS supply; install at least 1x0.1µF and 1x0.01µF.

Figure 17. 24-Bit Color Host to 18-Bit Color LCD Panel Display Application

Typical Application Schematic

Figure 18 represents the schematic drawing of the SN75LVDS83B evaluation module.

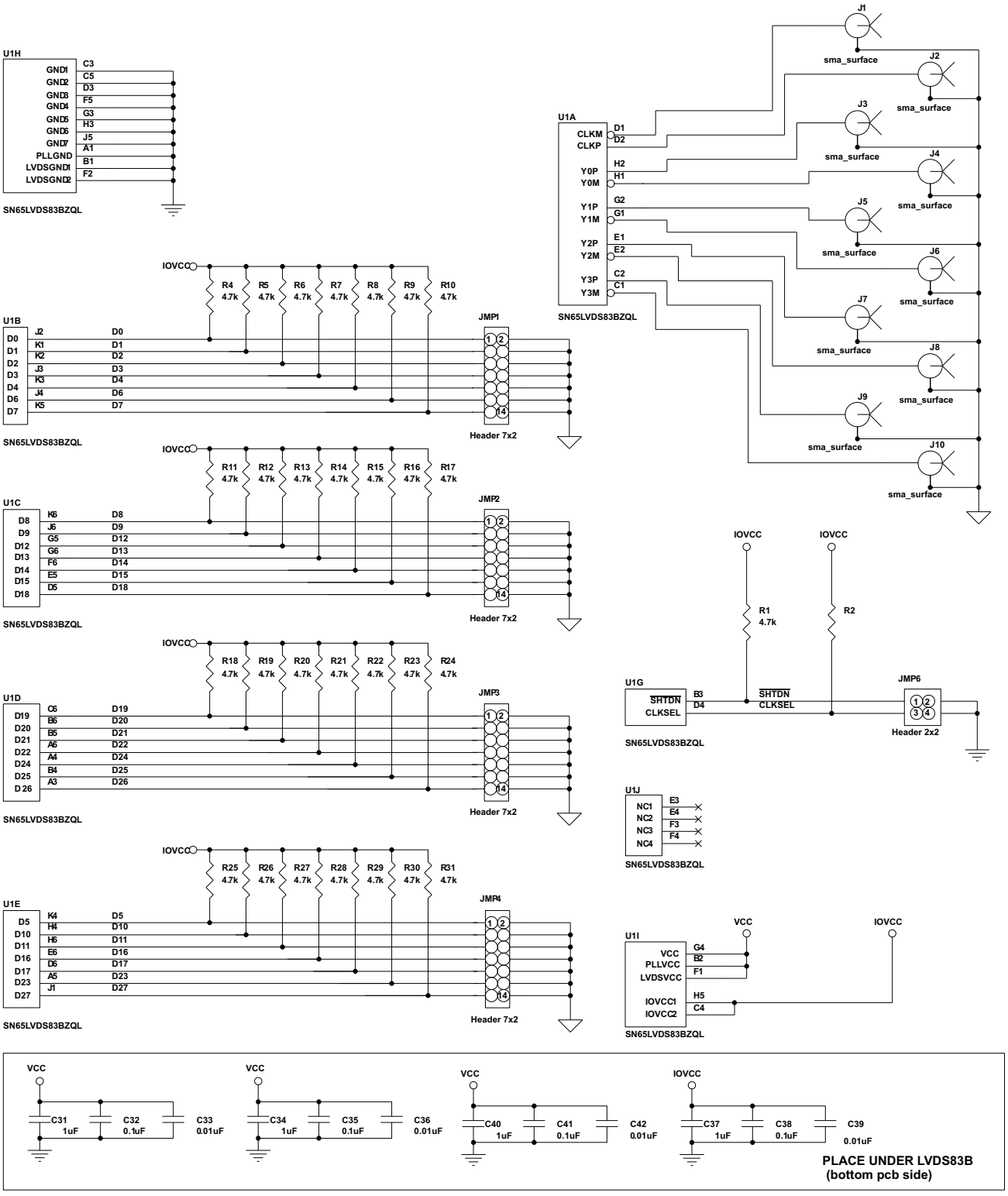


Figure 18. Schematic Example (SN75LVDS83B Evaluation Board)

PCB Routing

Figure 19 and Figure 20 show a possible breakout of the data input and output signals from the BGA package.

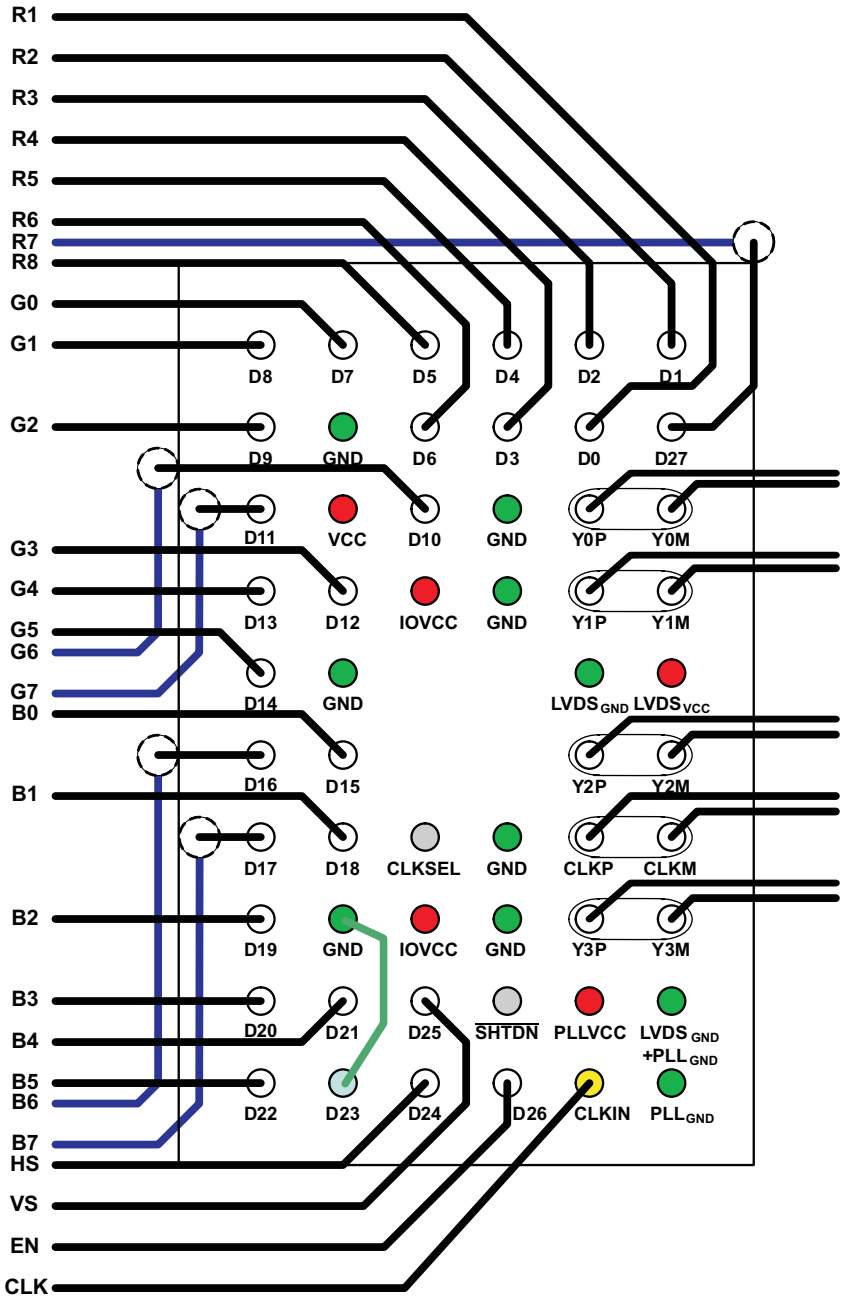


Figure 19. 24-Bit Color Routing (See Figure 14 for the Schematic)

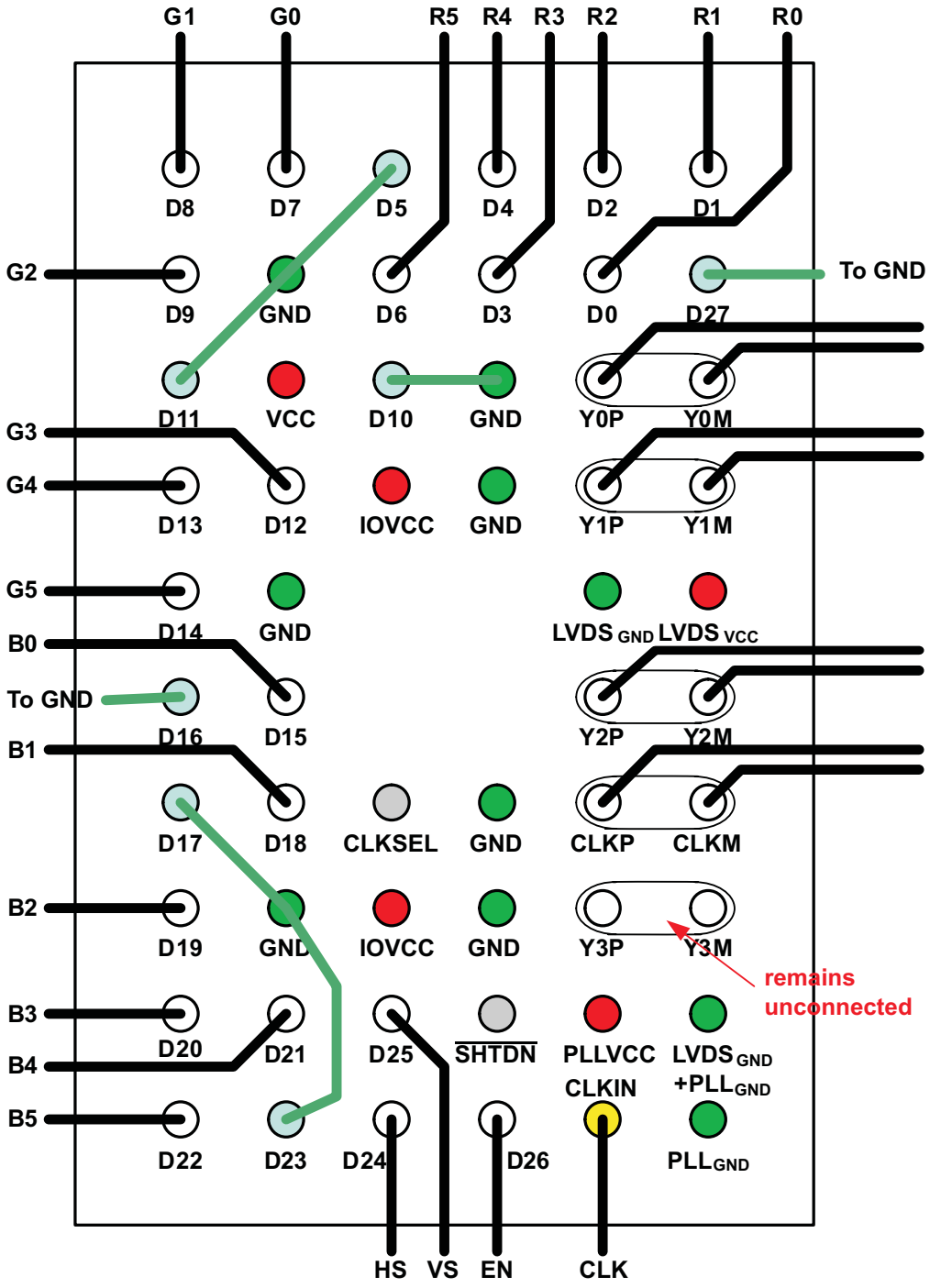


Figure 20. 18-Bit Color Routing (See Figure 15, Figure 16, and Figure 17 for the Schematic)

REVISION HISTORY

Changes from Original (May 2009) to Revision A **Page**

- Changed text and replaced TBDs in Note A and Note B of Figure 14 16
- Changed Note B of Figure 15 - Replaced TBDs. 17
- Changed Note B of Figure 16 - Replaced TBDs. 18
- Changed Note C of Figure 17 - Replaced TBDs. 19
- Changed Figure 19 - removed 3 GND pin locations. 21
- Changed Figure 20 - removed 3 GND pin locations. 22

Changes from Revision A (October 2009) to Revision B **Page**

- Added Storage temperature, T_s to ABSOLUTE MAXIMUM RATINGS 2
- Added Note 3 to DISSIPATION RATINGS 3
- Deleted max values for Supply current (average) 9
- Changed Enable time units from ns to µs 10
- Added Thermal Characteristics table 10
- Changed G7(LSB) to G7(MSB) in Figure 14 16
- Added Note C to Figure 14 16
- Added Note D to Figure 14 16
- Added connection between GND and D23 to Figure 19 21

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
HPA02272DGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-10 to 70	LVDS83B	Samples
SN75LVDS83BDGG	ACTIVE	TSSOP	DGG	56	35	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-10 to 70	LVDS83B	Samples
SN75LVDS83BDGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-10 to 70	LVDS83B	Samples
SN75LVDS83BZQLR	ACTIVE	BGA MICROSTAR JUNIOR	ZQL	56	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-2-260C-1 YEAR	-10 to 70	LVDS83B	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
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NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
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Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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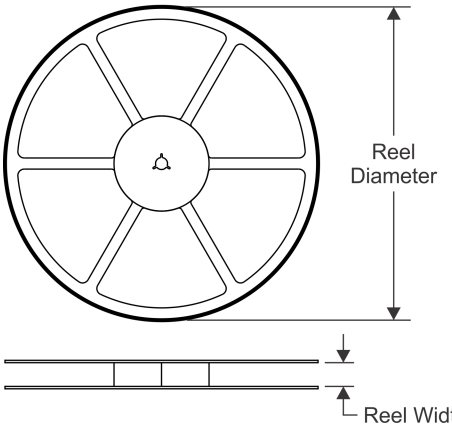
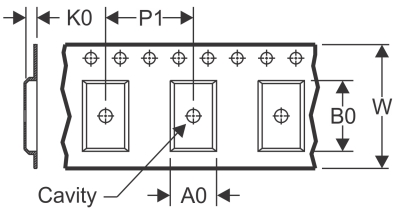
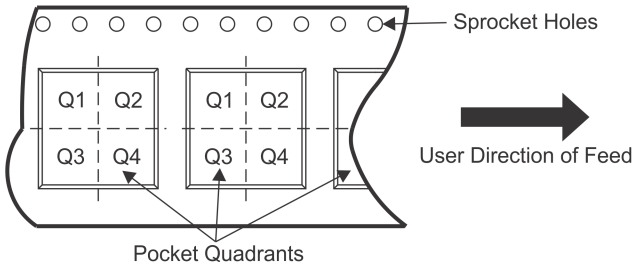


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

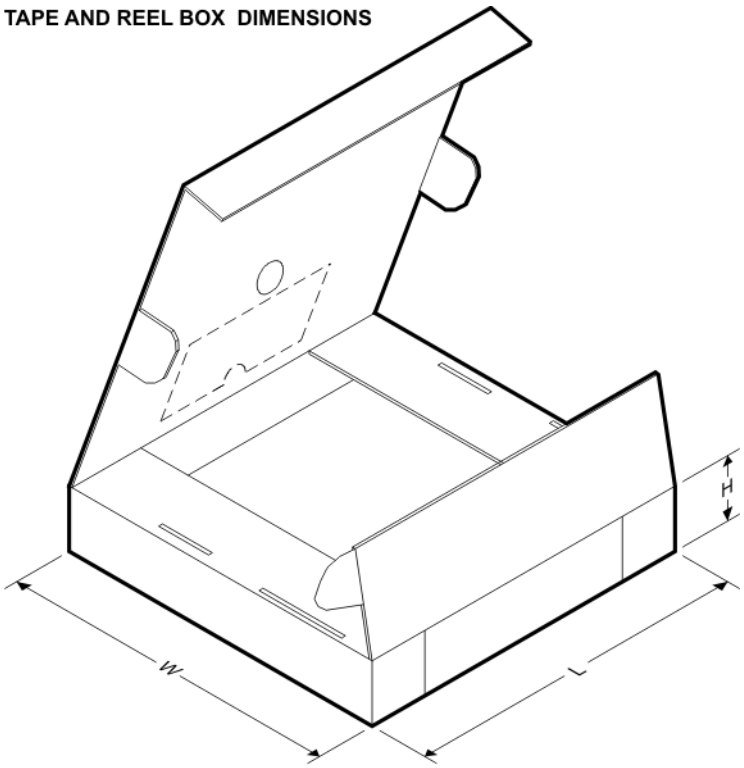
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75LVDS83BZQLR	BGA MICROSTAR JUNIOR	ZQL	56	1000	330.0	16.4	4.8	7.3	1.5	8.0	16.0	Q1

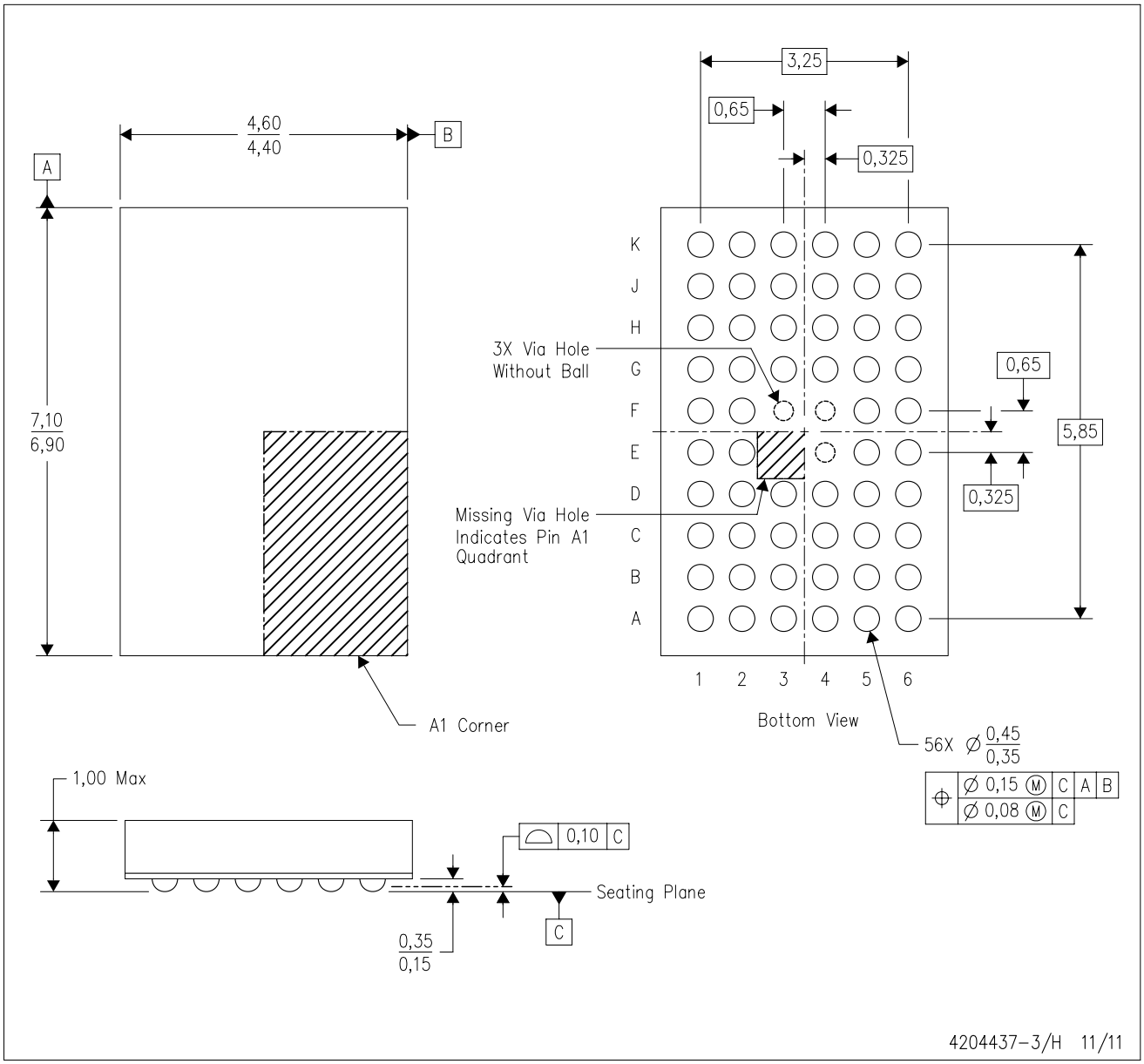
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LVDS83BZQLR	BGA MICROSTAR JUNIOR	ZQL	56	1000	336.6	336.6	28.6

ZQL (R–PBGA–N56) PLASTIC BALL GRID ARRAY



NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–285 variation BA–2.
D. This package is Pb–free. Refer to the 56 GQL package (drawing 4200583) for tin–lead (SnPb).

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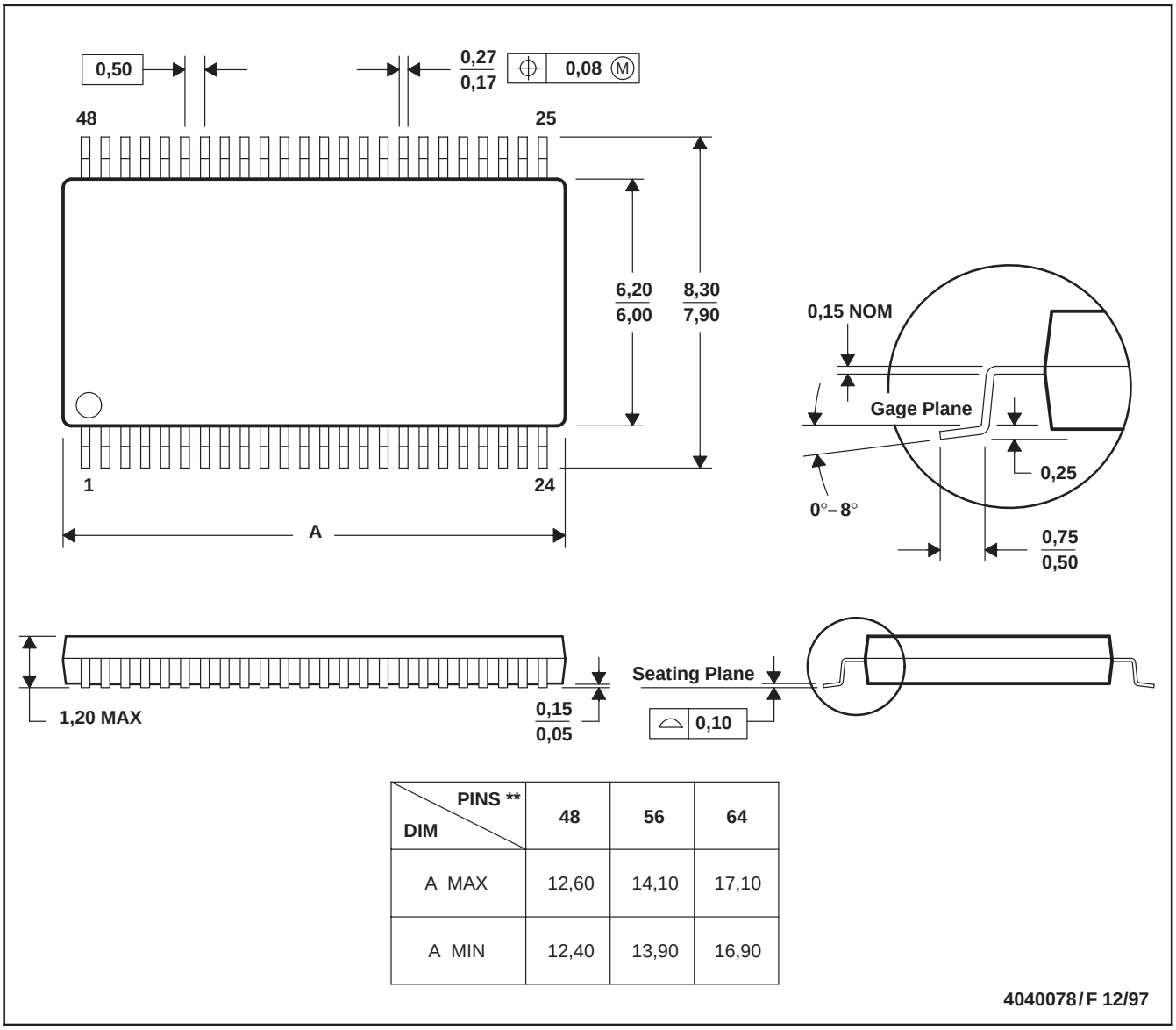
DGG (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN



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

NOTES: A. All linear dimensions are in millimeters.
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C. Body dimensions do not include mold protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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