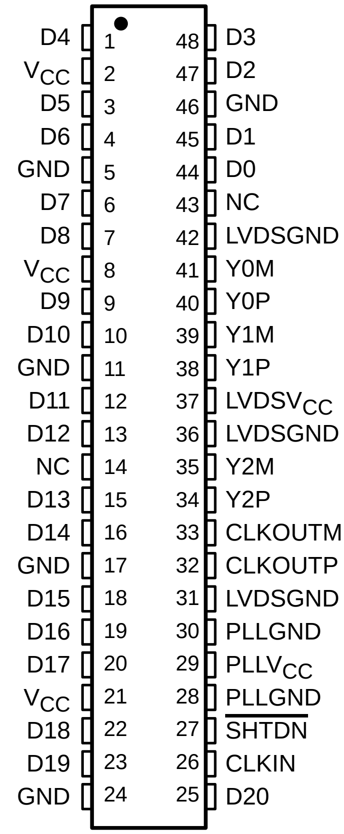
- **21:3 Data Channel Compression at up to 196 Million Bytes per Second Throughput**
- **Suited for SVGA, XGA, or SXGA Data Transmission From Controller to Display With Very Low EMI**
- **21 Data Channels Plus Clock In Low-Voltage TTL Inputs and 3 Data Channels Plus Clock Out Low-Voltage Differential Signaling (LVDS) Outputs**
- **Operates From a Single 3.3-V Supply and 89 mW (Typ)**
- **Ultralow-Power 3.3-V CMOS Version of the SN75LVDS84. Power Consumption About One Third of the ’LVDS84**
- **Packaged in Thin Shrink Small-Outline Package (TSSOP) With 20 Mil Terminal Pitch**
- **Consumes Less Than 0.54 mW When Disabled**
- **Wide Phase-Lock Input Frequency Range: 31 MHz to 75 MHz**
- **No External Components Required for PLL**
- **Outputs Meet or Exceed the Requirements of ANSI EIA/TIA-644 Standard**
- **SSC Tracking Capability of 3% Center Spread at 50-kHz Modulation Frequency**
- **Improved Replacement for SN75LVDS84 and NSC’s DS90CF363A 3-V Device**
- **Available in Q-Temp Automotive**
  - **High Reliability Automotive Applications**
  - **Configuration Control / Print Support**
  - **Qualification to Automotive Standards**

DGG PACKAGE
(TOP VIEW)



NC – Not Connected

description

The SN75LVDS84A and SN65LVDS84AQ FlatLink transmitters contains three 7-bit parallel-load serial-out shift registers, and four low-voltage differential signaling (LVDS) line drivers in a single integrated circuit. These functions allow 21 bits of single-ended LVTTL data to be synchronously transmitted over 3 balanced-pair conductors for receipt by a compatible receiver, such as the SN75LVDS82 or SN75LVDS86/86A.

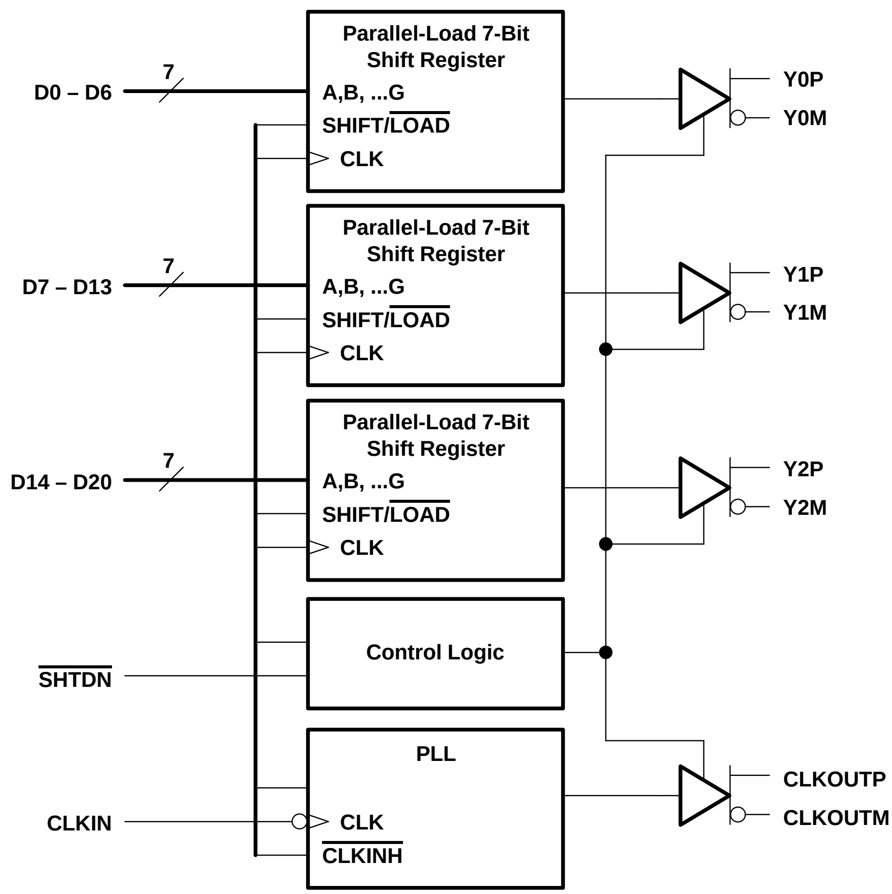
When transmitting, data bits D0 – D20 are each loaded into registers of the ’LVDS84A upon the falling edge. The internal PLL is frequency-locked to CLKIN and then used to unload the data registers in 7-bit slices. The three serial streams and a phase-locked clock (CLKOUT) are then output to LVDS output drivers. The frequency of CLKOUT is the same as the input clock, CLKIN.

description (continued)

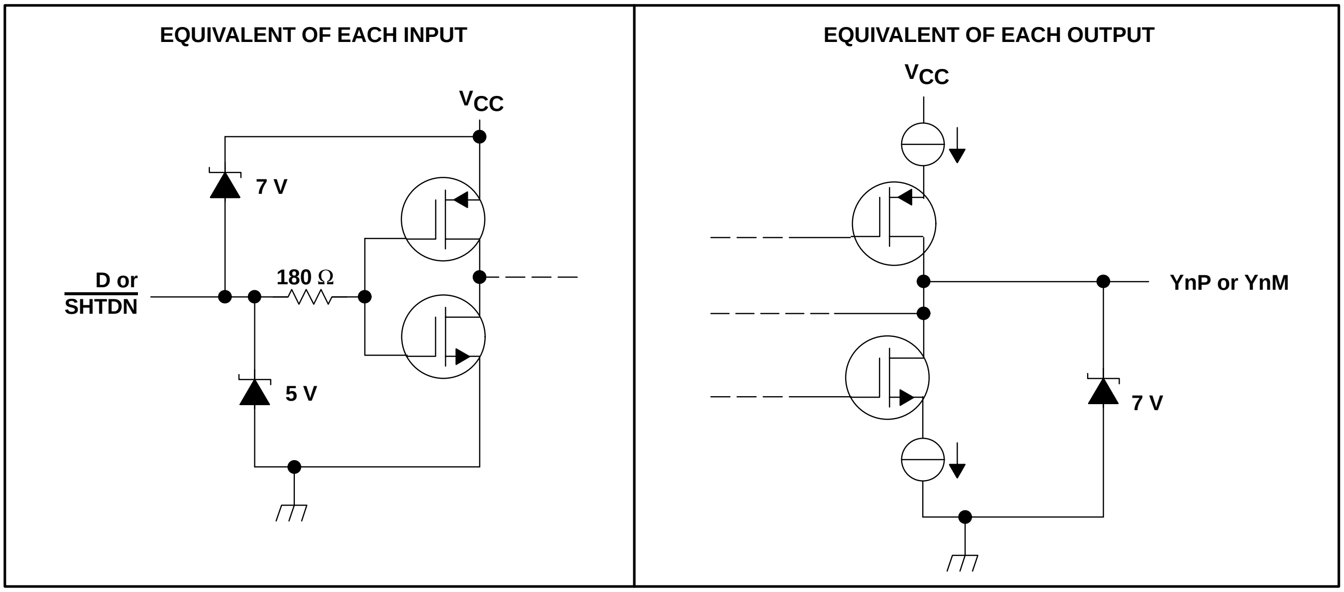
The ’LVDS84A requires no external components and little or no control. The data bus appears the same at the input to the transmitter and output of the receiver with the data transmission transparent to the user(s). The only user intervention is the possible use of the shutdown/clear ($\overline{\text{SHTDN}}$) 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 SN75LVDS84A is characterized for operation over ambient free-air temperatures of 0°C to 70°C. The SN65LVDS84AQ is characterized for operation over the full Automotive temperature range of –40°C to 125°C.

functional block diagram



schematics of input and output



absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1) . . . . –0.5 V to 4 V
Input and output voltage ranges, V_I, V_O (all terminals) . . . . –0.5 V to V_{CC} + 0.5 V
Continuous total power dissipation . . . . See Dissipation Rating Table
Operating virtual junction temperature range, T_J . . . . –40°C to 150°C
Electrostatic discharge: ESD machine model . . . . 200 V
ESD human-body model . . . . 6000 V
ESD charged-device model . . . . 1500 V
Storage temperature range, T_{stg} . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
NOTE 1: All voltage values are with respect to the GND terminals.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR‡ ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 125°C POWER RATING
DGG	1637 mW	13.1 mW/°C	1048 mW	327 mW

‡ This is the inverse of the junction-to-ambient thermal resistance when board mounted and with no air flow.

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		3	3.3	3.6	V
High-level input voltage, V_{IH}		2			V
Low-level input voltage, V_{IL}				0.8	V
Differential load impedance, Z_L		90		132	Ω
Operating free-air temperature, T_A	SN75LVDS84A	0		70	°C
	SN65LVDS84AQ	–40		125	

timing requirements

		MIN	NOM	MAX	UNIT
t_c	Input clock period	13.3	t_c	32.4	ns
t_w	Pulse duration, high-level input clock	$0.4 t_c$		$0.6 t_c$	ns
t_t	Transition time, input signal			5	ns
t_{su}	Setup time, data, D0 – D20 valid before CLKIN↓ (see Figure 2)	3			ns
t_h	Hold time, data, D0 – D20 valid after CLKIN↓ (see Figure 2)	1.5			ns

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IT}	Input threshold voltage				1.4		V
$\|V_{OD}\|$	Differential steady-state output voltage magnitude	R_L = 100 Ω, See Figure 3		247		454	mV
$\Delta\|V_{OD}\|$	Change in the steady-state differential output voltage magnitude between opposite binary states					50	mV
$V_{OC(SS)}$	Steady-state common-mode output voltage	R_L = 100 Ω, See Figure 3		1.125		1.375	V
$V_{OC(PP)}$	Peak-to-peak common-mode output voltage				80	150	mV
I_{IH}	High-level input current	$V_{IH} = V_{CC}$	SN75LVDS84A			20	μA
			SN65LVDS84AQ			25	
I_{IL}	Low-level input current	V_{IL} = 0				±10	μA
I_{OS}	Short-circuit output current	$V_{O(Yn)}$ = 0			–6	±24	mA
		V_{OD} = 0			–6	±12	mA
I_{OZ}	High-impedance output current	V_O = 0 to V_{CC}				±10	μA
$I_{CC(AVG)}$	Quiescent supply current (average)	Disabled, All inputs at GND	SN75LVDS84A		15	150	μA
			SN65LVDS84AQ		15	170	
		Enabled, R_L = 100 Ω (4 places) Gray-scale pattern (see Figure 4)	f = 65 MHz		27	35	mA
			f = 75 MHz		30	38	
		Enabled, R_L = 100 Ω, (4 places) Worst-case pattern (see Figure 5)	f = 65 MHz		28	36	
			f = 75 MHz		31	39	
C_I	Input capacitance				2		pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t_{d0}	Delay time, CLKOUT↑ to serial bit position 0	t_c = 15.38 ns (± 0.2%), |Input clock jitter| < 50 ps‡, See Figure 6	–0.2		0.2	ns
t_{d1}	Delay time, CLKOUT↑ to serial bit position 1		$\frac{1}{7}t_c - 0.2$		$\frac{1}{7}t_c + 0.2$	
t_{d2}	Delay time, CLKOUT↑ to serial bit position 2		$\frac{2}{7}t_c - 0.2$		$\frac{2}{7}t_c + 0.2$	
t_{d3}	Delay time, CLKOUT↑ to serial bit position 3		$\frac{3}{7}t_c - 0.2$		$\frac{3}{7}t_c + 0.2$	
t_{d4}	Delay time, CLKOUT↑ to serial bit position 4		$\frac{4}{7}t_c - 0.2$		$\frac{4}{7}t_c + 0.2$	
t_{d5}	Delay time, CLKOUT↑ to serial bit position 5		$\frac{5}{7}t_c - 0.2$		$\frac{5}{7}t_c + 0.2$	
t_{d6}	Delay time, CLKOUT↑ to serial bit position 6		$\frac{6}{7}t_c - 0.2$		$\frac{6}{7}t_c + 0.2$	
$t_{sk(o)}$	Output skew, $t_n - \frac{n}{7}t_c$		–0.2		0.2	ns
t_{d7}	Delay time, CLKIN↓ to CLKOUT↑	t_c = 15.38 ns (± 0.2%), |Input clock jitter| < 50 ps‡, See Figure 6		2.7		ns
		t_c = 13.33 ns ~ 32.25 ns (± 0.2%), |Input clock jitter| < 50 ps‡, See Figure 6	1		4.5	
$\Delta t_{c(o)}$	Cycle time, output clock jitter§	t_c = 15.38 + 0.308 sin (2π500E3t) ± 0.05 ns, See Figure 7		±62		ps
		t_c = 15.38 + 0.308 sin (2π3E6t) ± 0.05 ns, See Figure 7		±121		
t_w	Pulse duration, high-level output clock			$\frac{4}{7}t_c$		ns
t_t	Transition time, differential output voltage (t_r or t_f)	See Figure 3		700	1500	ps
t_{en}	Enable time, $\overline{SHTDN}$↑ to phase lock (Yn valid)	See Figure 8		1		ms
t_{dis}	Disable time, $\overline{SHTDN}$↓ to off state (CLKOUT low)	See Figure 9		6.5		ns

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
‡ \|Input clock jitter\| is the magnitude of the change in the input clock period.
§ Output clock jitter is the change in the output clock period from one cycle to the next cycle observed over 15 000 cycles.

PARAMETER MEASUREMENT INFORMATION

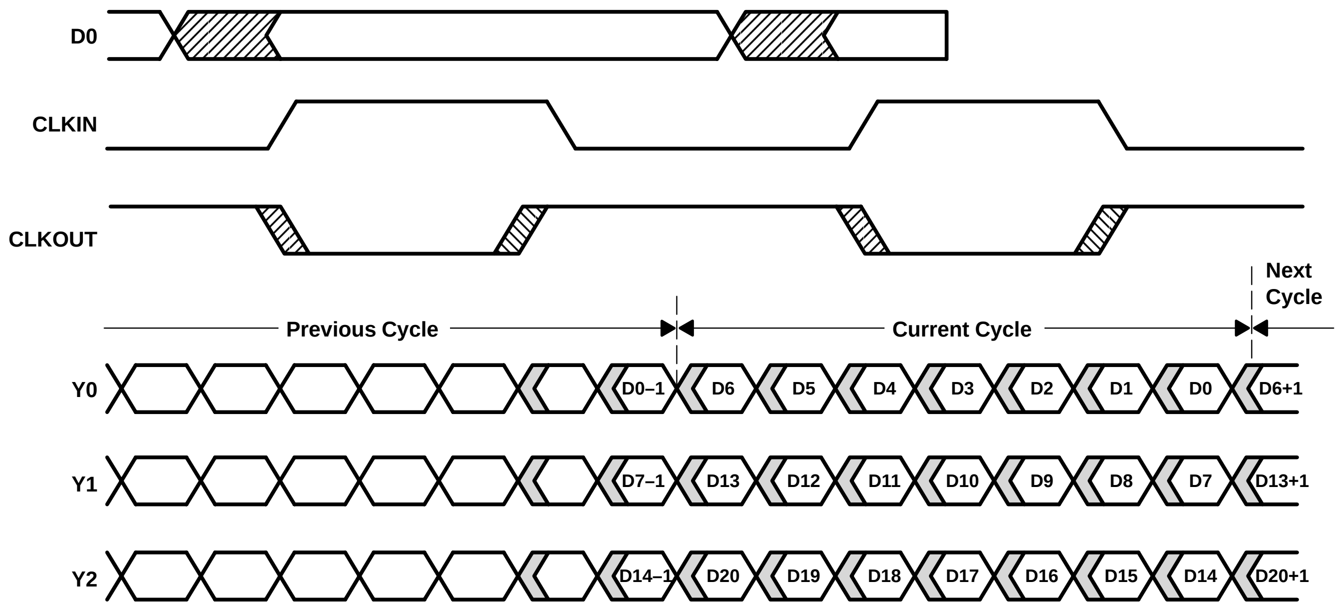
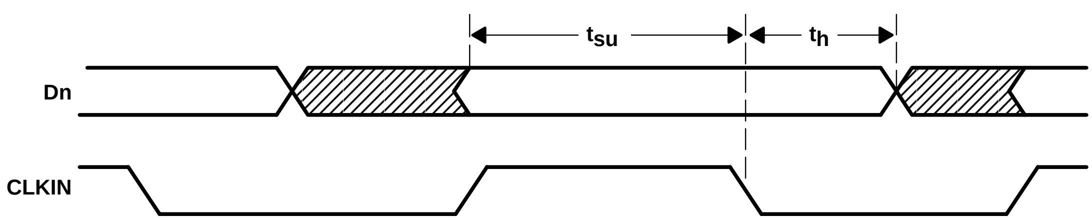
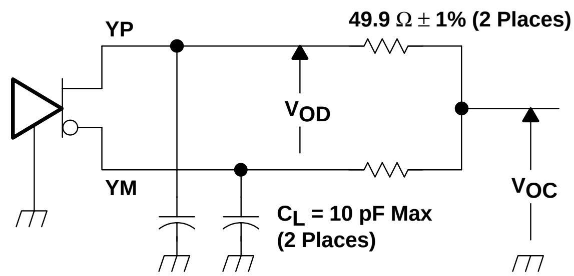


Figure 1. Typical Load and Shift Sequences



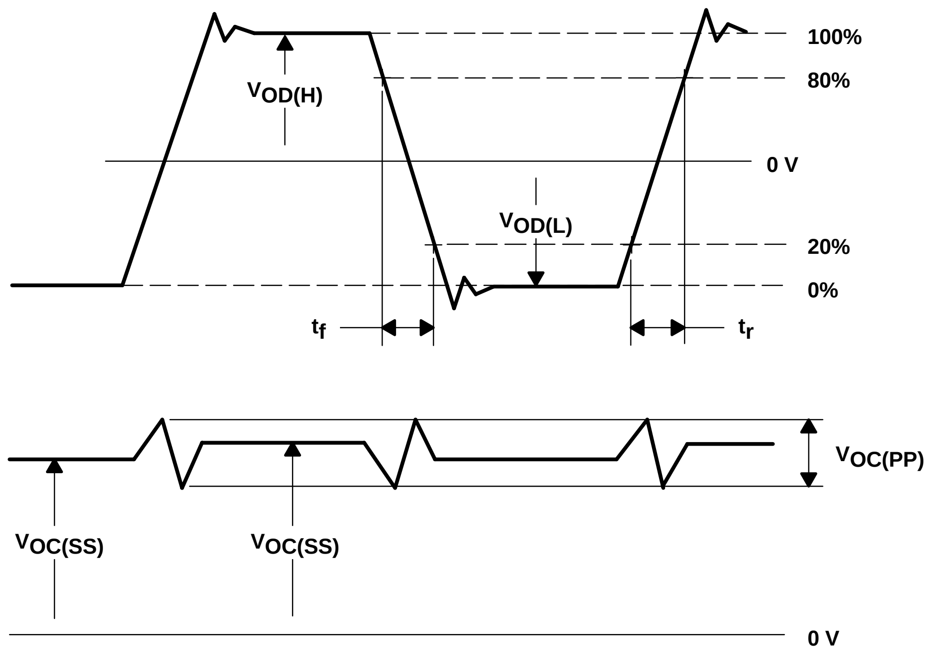
NOTE A: All input timing is defined at 1.4 V on an input signal with a 10%-to-90% rise or fall time of less than 5 ns.

Figure 2. Setup and Hold Time Definition



NOTE A: The lumped instrumentation capacitance for any single-ended voltage measurement is less than or equal to 10 pF. When making measurements at YP or YM, the complementary output is similarly loaded.

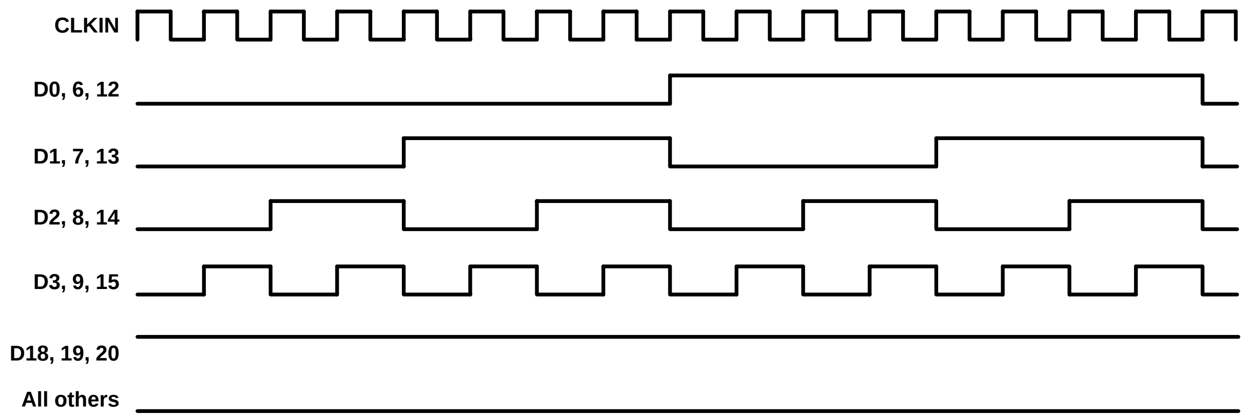
(a) SCHEMATIC



(b) WAVEFORMS

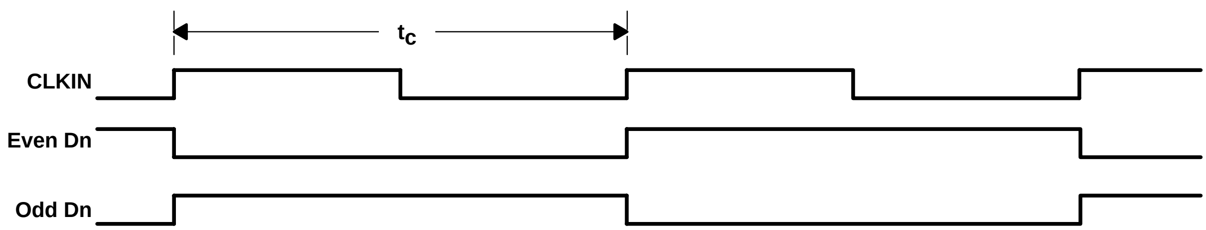
Figure 3. Test Load and Voltage Definitions for LVDS Outputs

PARAMETER MEASUREMENT INFORMATION



NOTES: A. The 16-grayscale test-pattern test device power consumption for a typical display pattern.
B. V_{IH} = 2 V and V_{IL} = 0.8 V

Figure 4. 16-Grayscale Test-Pattern Waveforms



NOTES: A. The worst-case test pattern produces nearly the maximum switching frequency for all of the LVDS outputs.
B. V_{IH} = 2 V and V_{IL} = 0.8 V

Figure 5. Worst-Case Test-Pattern Waveforms

PARAMETER MEASUREMENT INFORMATION

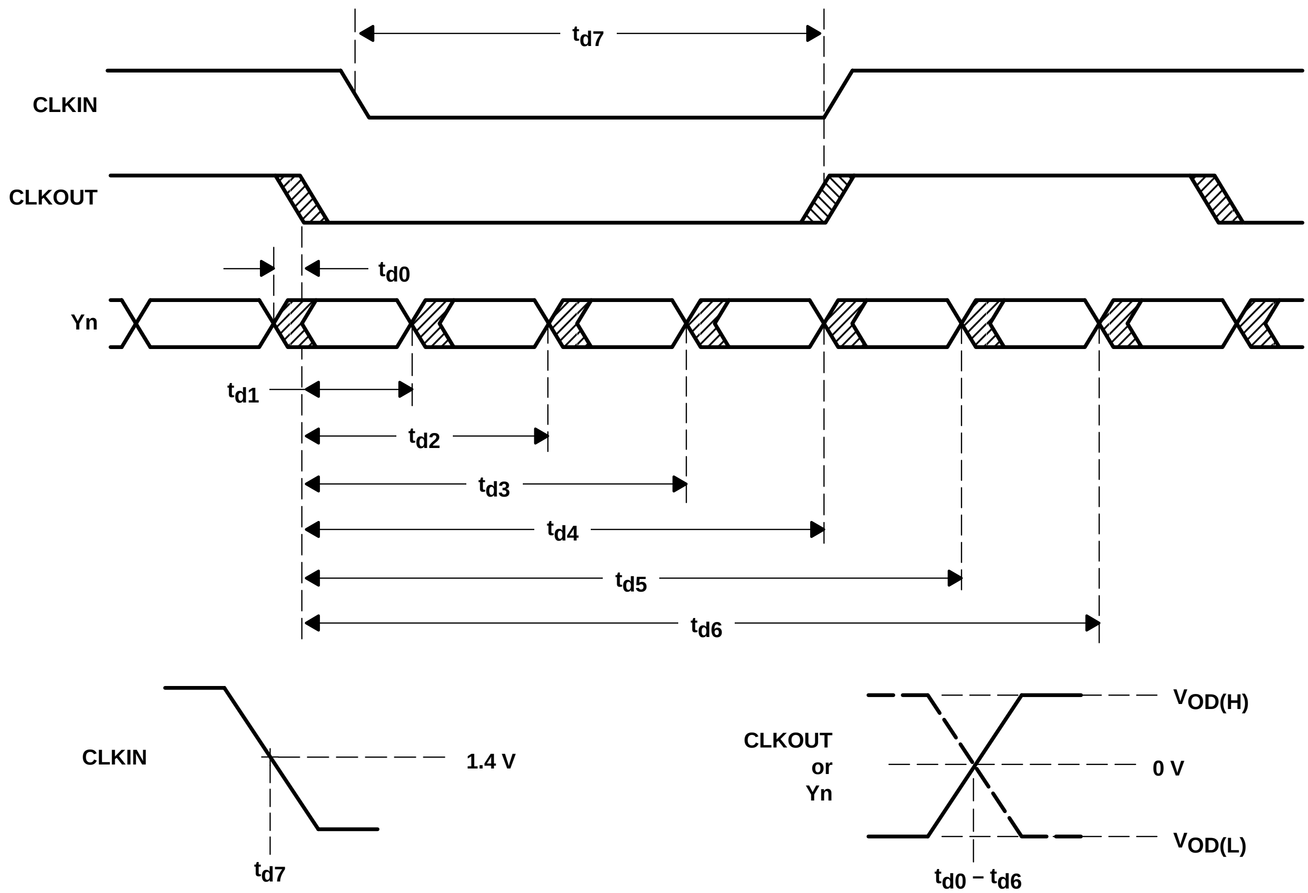


Figure 6. Timing Definitions

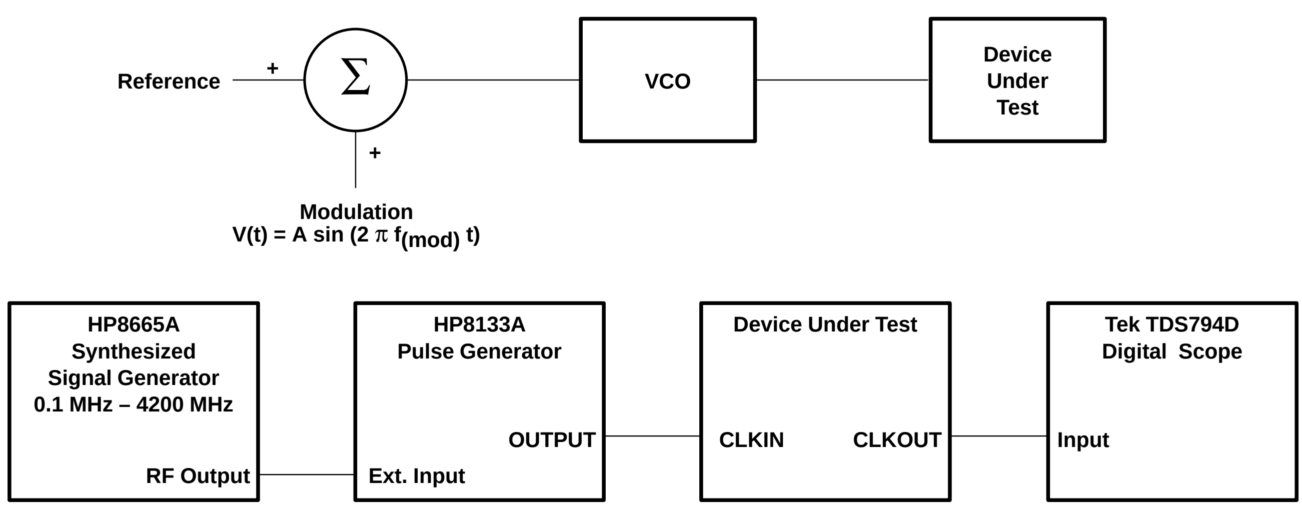


Figure 7. Clock Jitter Test Setup

TYPICAL CHARACTERISTICS

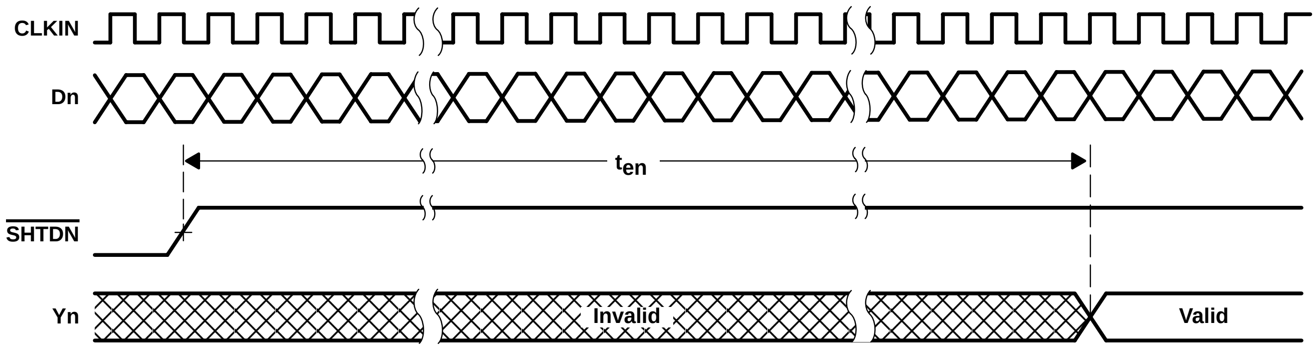


Figure 8. Enable Time Waveforms

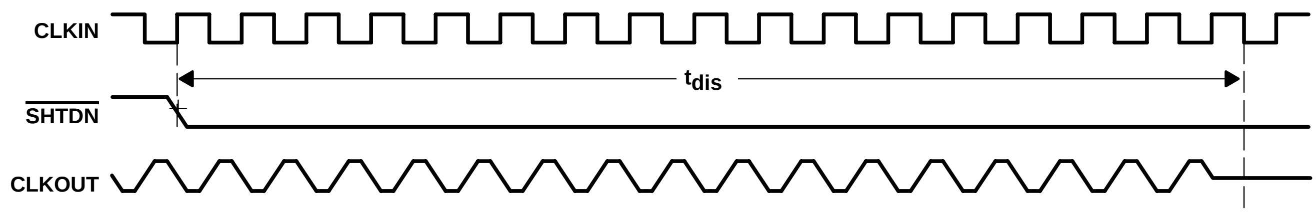


Figure 9. Disable Time Waveforms

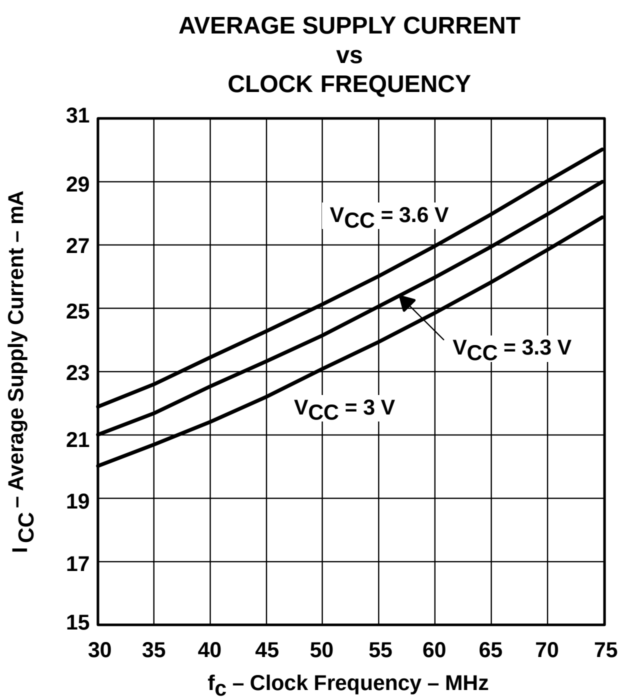


Figure 10. Grayscale Input Pattern

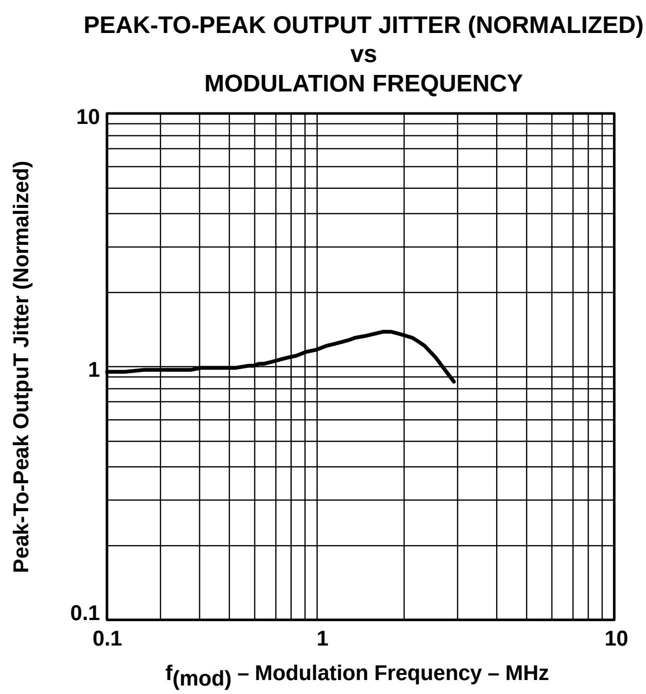
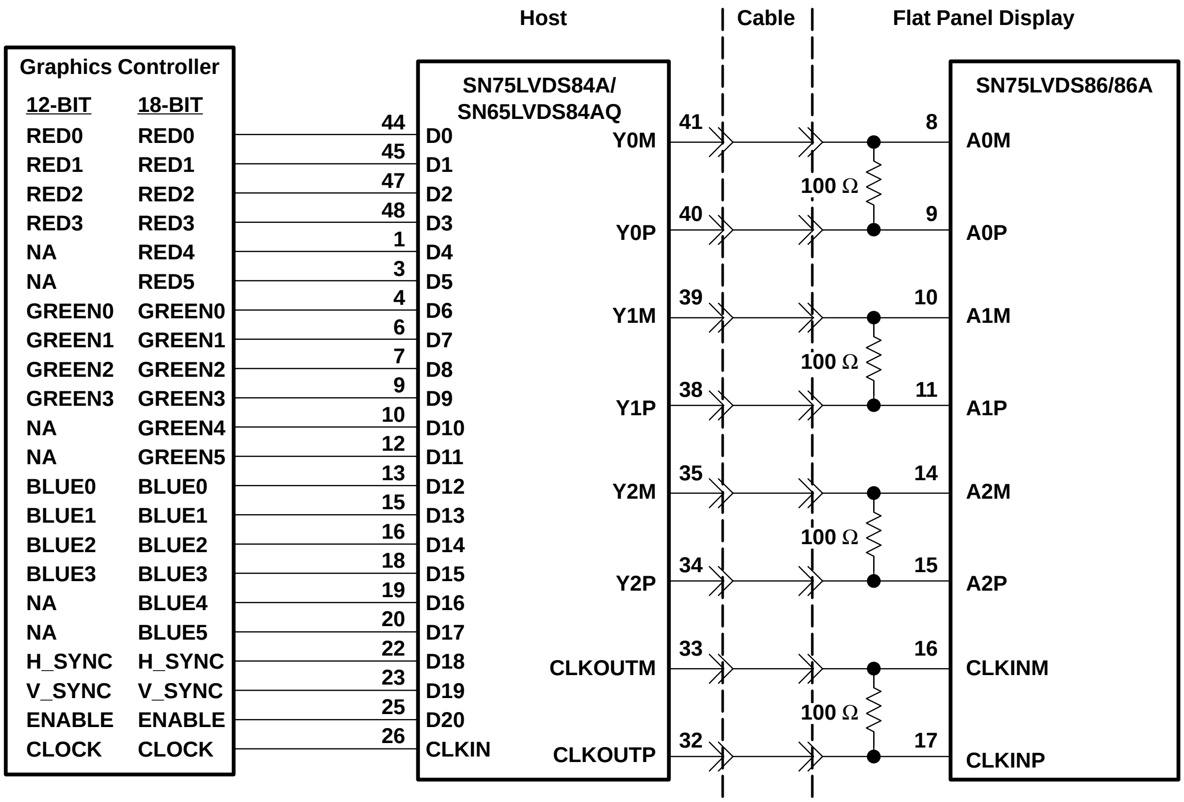


Figure 11. Output Period Jitter vs Modulation Frequency

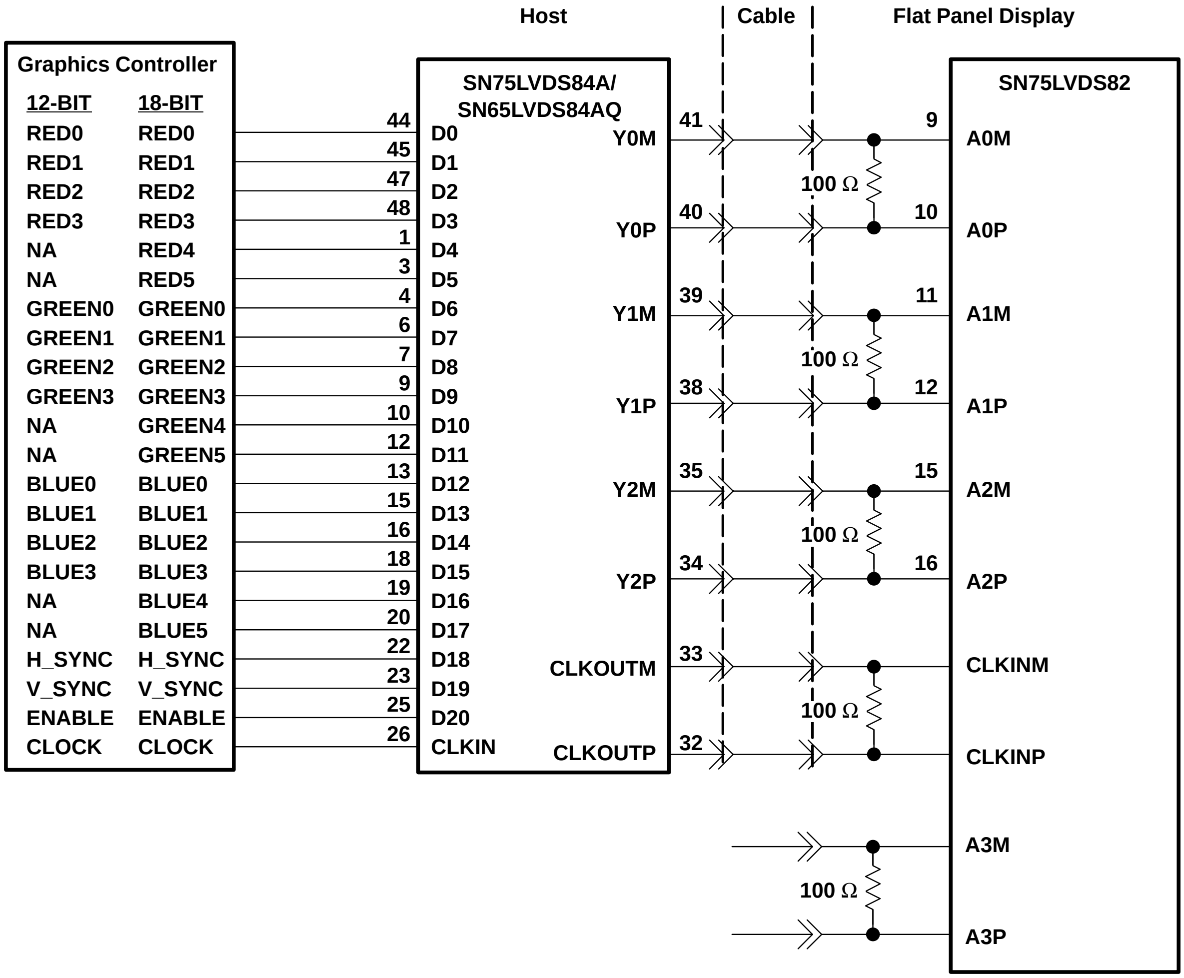
APPLICATION INFORMATION



NOTES: A. The five 100-Ω terminating resistors are recommended to be 0603 types.
B. NA – not applicable, these unused inputs should be left open.

Figure 12. Color Host to LCD Panel Application

APPLICATION INFORMATION



NOTES: A. The four 100-Ω terminating resistors are recommended to be 0603 types.
B. NA – not applicable, these unused inputs should be left open.

Figure 13. 18-Bit Color Host to 24-Bit LCD Display Panel Application

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN65LVDS84AQDGG	ACTIVE	TSSOP	DGG	48	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	65LVDS84AQ	Samples
SN65LVDS84AQDGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	65LVDS84AQ	Samples
SN75LVDS84ADGG	ACTIVE	TSSOP	DGG	48	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	SN75LVDS84A	Samples
SN75LVDS84ADGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	SN75LVDS84A	Samples
SN75LVDS84ADGGRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	SN75LVDS84A	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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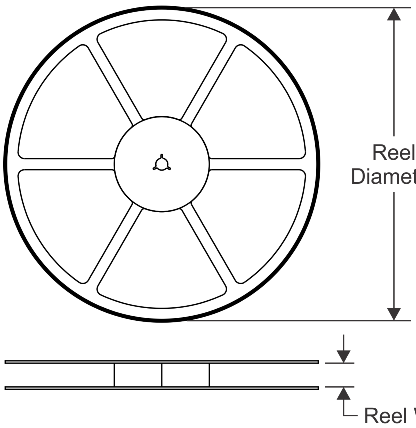
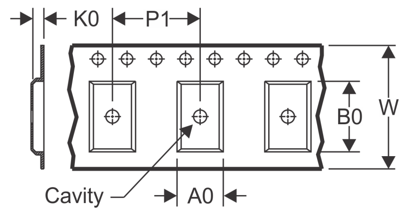
TAPE AND REEL INFORMATION

REEL DIMENSIONS

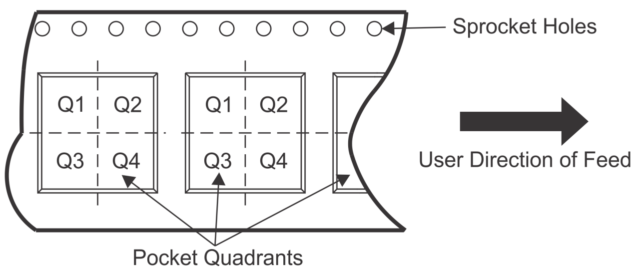


TAPE DIMENSIONS



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

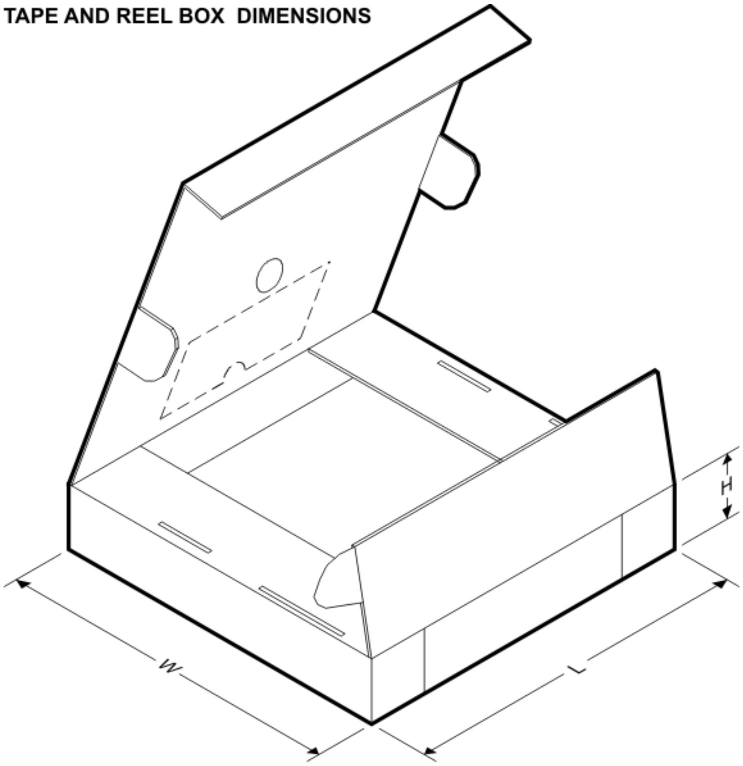
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN65LVDS84AQDGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN75LVDS84ADGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

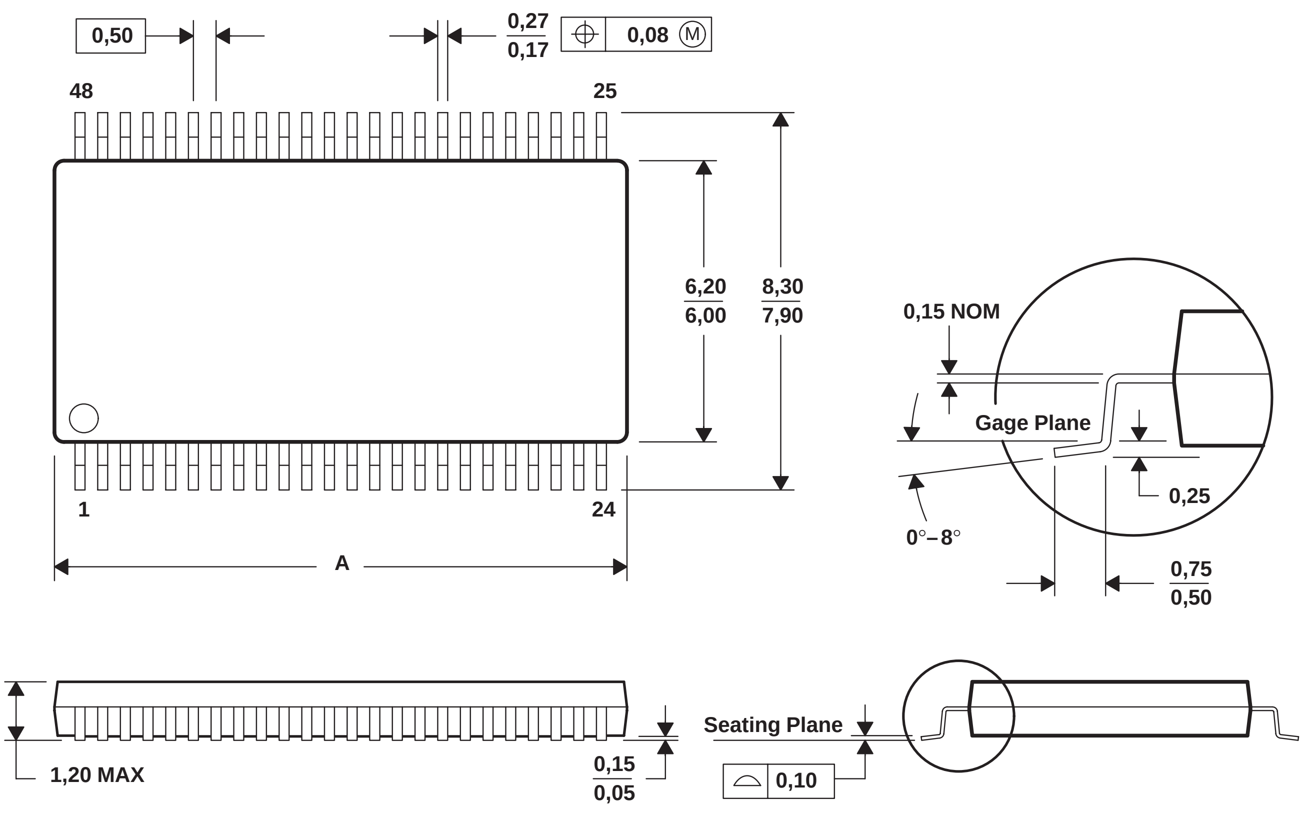


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65LVDS84AQDGGR	TSSOP	DGG	48	2000	350.0	350.0	43.0
SN75LVDS84ADGGR	TSSOP	DGG	48	2000	350.0	350.0	43.0

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

48 PINS SHOWN



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

4040078/F 12/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265