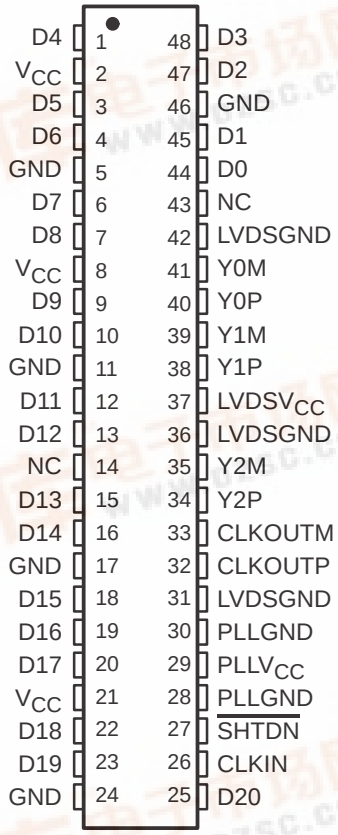
# SN75LVDS84, SN75LVDS85
# FLATLINK™ TRANSMITTERS

SLLS270C – MARCH 1997 – REVISED NOVEMBER 1999

- 21:3 Data Channel Compression at up to 163 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 and 3 Data Channels Plus Clock Out Low-Voltage Differential
- Operates From a Single 3.3-V Supply and 250 mW (Typ)
- 5-V Tolerant Data Inputs
- ESD Protection Exceeds 6 kV
- SN75LVDS84 Has Falling Clock-Edge Triggered Inputs, SN75LVDS85 Has Rising Clock-Edge-Triggered Inputs
- Packaged in Thin Shrink Small-Outline Package (TSSOP) With 20-Mil Terminal Pitch
- Consumes Less Than 1 mW When Disabled
- Wide Phase-Lock Input Frequency Range: 31 MHz to 68 MHz
- No External Components Required for PLL
- Outputs Meet or Exceed the Requirements of ANSI EIA/TIA-644 Standard
- Improved Replacement for the DS90C561

**DGG PACKAGE**
**(TOP VIEW)**




NC – Not Connected

## description

The SN75LVDS84 and SN75LVDS85 FlatLink transmitters each contain three 7-bit parallel-load serial-out shift registers, a 7× clock synthesizer, and four low-voltage differential signaling (LVDS) line drivers in a single integrated circuit. These functions allow 21 bits of single-ended low-voltage TTL (LVTTL) data to be synchronously transmitted over three balanced-pair conductors for receipt by a compatible receiver, such as the SN75LVDS82 or SN75LVDS86.

When transmitting, data bits D0 – D20 are each loaded into registers of the SN75LVDS84 upon the falling edge and into the registers of the SN75LVDS85 on the rising edge of the input clock signal (CLKIN). The frequency of CLKIN is multiplied seven times and then used to unload the data registers in 7-bit slices and serially. 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.

**AVAILABLE OPTIONS†**

| LATCHING CLOCK EDGE | |
|---|---|
| **FALLING** | **RISING** |
| SN75LVDS84DGG<br>SN75LVDS84DGGR | SN75LVDS85DGG<br>SN75LVDS85DGGR |

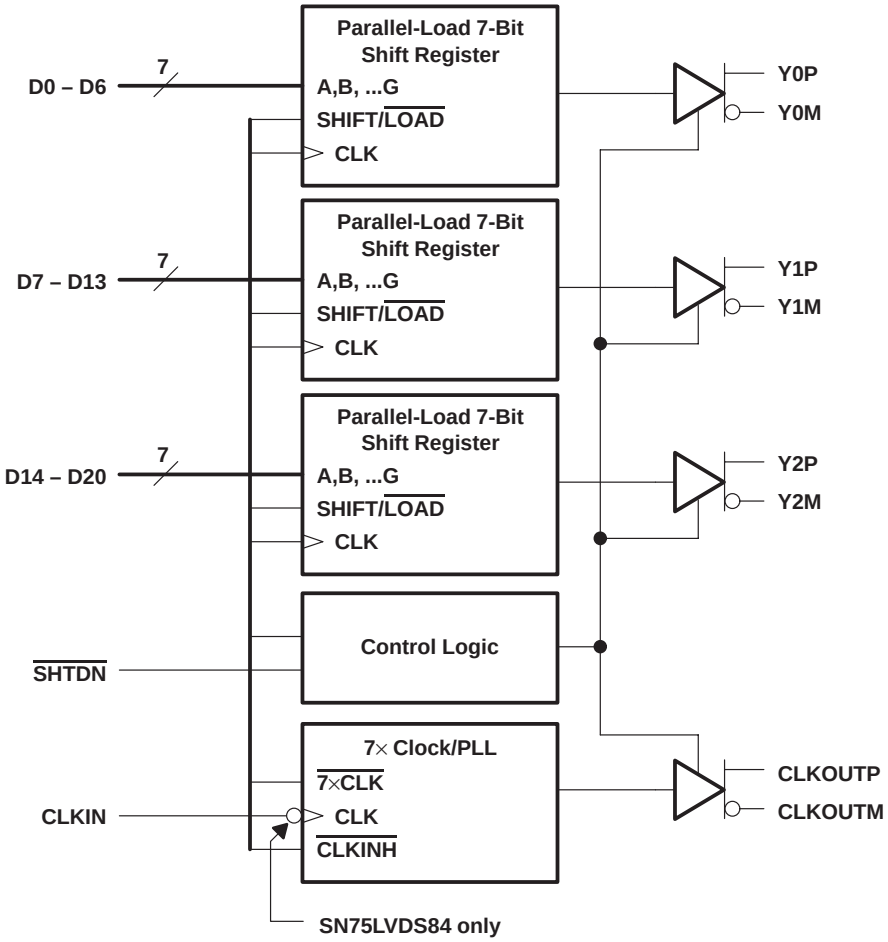
† The R suffix indicates taped and reeled packaging.

## description (continued)

The SN75LVDS84 or SN75LVDS85 require 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 possible user intervention is the 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 SN75LVDS84 and SN75LVDS85 are characterized for operation over ambient free-air temperatures of 0°C to 70°C.

## functional block diagram



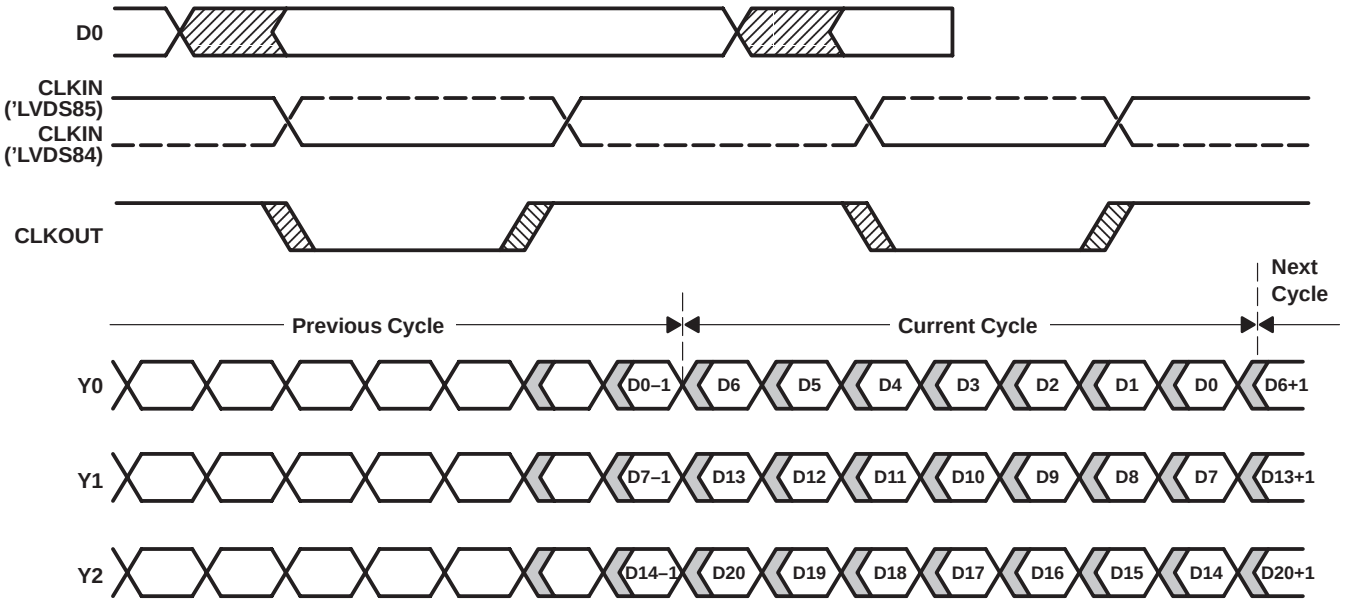
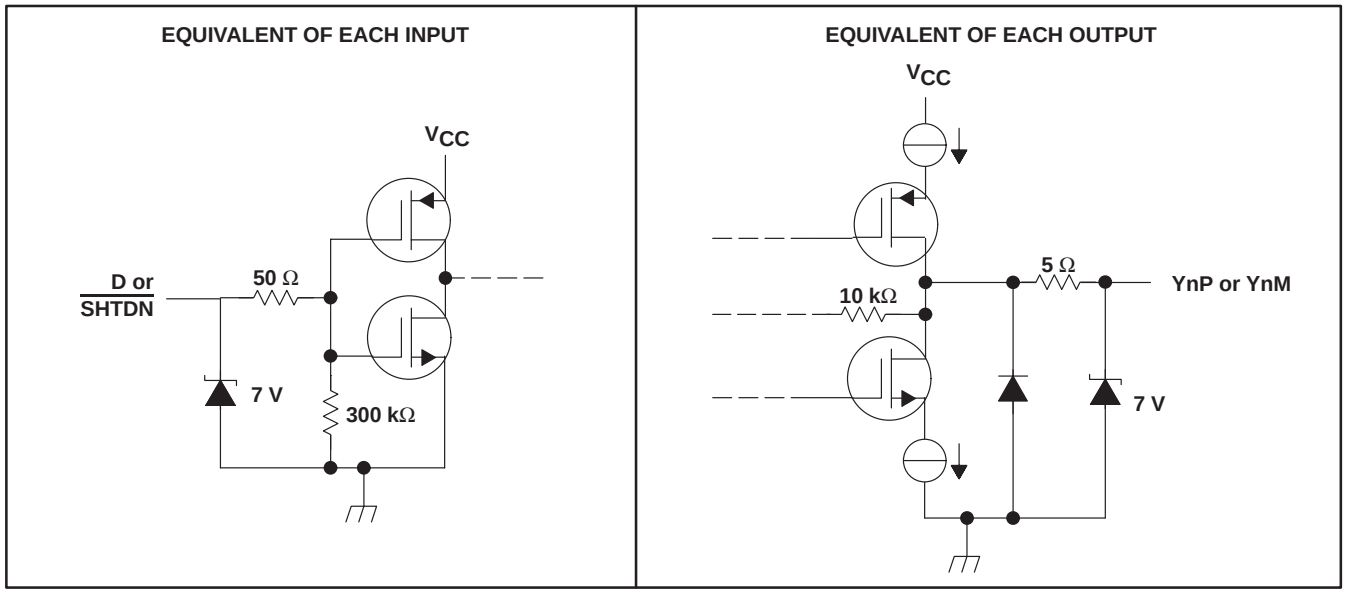



**Figure 1. Load and Shift Timing Sequences**

## 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
Output voltage range, $V_O$ (all terminals) . . . . . –0.5 V to $V_{CC}$ + 0.5 V
Input voltage range, $V_I$ (all terminals) . . . . . –0.5 V to 5.5 V
Continuous total power dissipation . . . . . See Dissipation Rating Table
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 |
|---|---|---|---|
| DGG | 1316 mW | 13.1 mW/°C | 726 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, $T_A$ | 0 | | 70 | °C |

## timing requirements

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $t_c$ | Input clock period | 14.7 | | 32.4 | ns |
| $t_w$ | Pulse duration, high-level input clock | $0.4t_c$ | | $0.6t_c$ | ns |
| $t_t$ | Transition time, input signal | | | 5 | ns |
| $t_{su}$ | Setup time, data, D0 – D27 valid before CLKIN↓ ('84) or CLKIN↑ ('85) (See Figure 2) | 3 | | | ns |
| $t_h$ | Hold time, data, D0 – D27 valid after CLKIN↓ ('84) or CLKIN↑ ('85) (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 | 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 | $V_{IH} = V_{CC}$ | | | 20 | µA |
| $I_{IL}$ | Low-level input current | $V_{IL}$ = 0 | | | ±10 | µA |
| $I_{OS}$ | Short-circuit output current | $V_{O(Yn)}$ = 0 | | | ±24 | mA |
| | | $V_{OD}$ = 0 | | | ±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 | | | 280 | µA |
| | | Enabled, $R_L$ = 100 Ω (4 places) Gray-scale pattern (see Figure 4), $V_{CC}$ = 3.3 V, $t_c$ = 15.38 ns | | 68 | 80 | mA |
| | | Enabled, $R_L$ = 100 Ω, (4 places) Worst-case pattern (see Figure 5), $t_c$ = 15.38 ns | | 75 | 100 | mA |
| $C_I$ | Input capacitance | | | 3 | | pF |

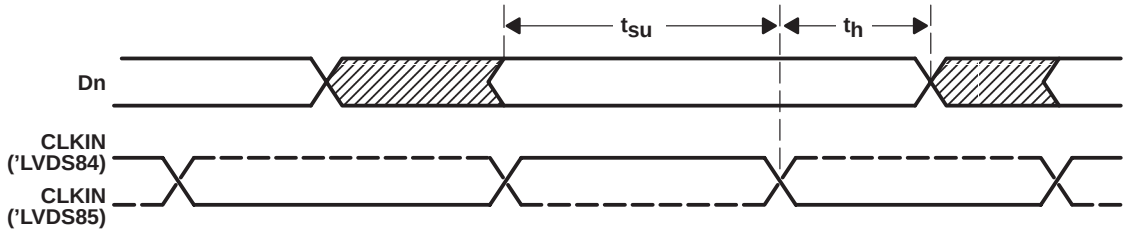
† All typical values are at $V_{CC}$ = 3.3 V, $T_A$ = 25°C.

## 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 | 0.2 | ns |
| $t_{d1}$ | Delay time, CLKOUT↑ to serial bit position 1 | | $\frac{1}{7}t_c - 0.2$ | | $\frac{1}{7}t_c + 0.2$ | ns |
| $t_{d2}$ | Delay time, CLKOUT↑ to serial bit position 2 | | $\frac{2}{7}t_c - 0.2$ | | $\frac{2}{7}t_c + 0.2$ | ns |
| $t_{d3}$ | Delay time, CLKOUT↑ to serial bit position 3 | | $\frac{3}{7}t_c - 0.2$ | | $\frac{3}{7}t_c + 0.2$ | ns |
| $t_{d4}$ | Delay time, CLKOUT↑ to serial bit position 4 | | $\frac{4}{7}t_c - 0.2$ | | $\frac{4}{7}t_c + 0.2$ | ns |
| $t_{d5}$ | Delay time, CLKOUT↑ to serial bit position 5 | | $\frac{5}{7}t_c - 0.2$ | | $\frac{5}{7}t_c + 0.2$ | ns |
| $t_{d6}$ | Delay time, CLKOUT↑ to serial bit position 6 | | $\frac{6}{7}t_c - 0.2$ | | $\frac{6}{7}t_c + 0.2$ | ns |
| $t_{sk(o)}$ | 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 | | 4.2 | | ns |
| $\Delta t_{c(o)}$ | Cycle time, Output clock jitter§ | $t_c$ = 15.38 + 0.75 sin (2π500E3t) ± 0.05 ns, See Figure 7 | | ±70 | | ps |
| | | $t_c$ = 15.38 + 0.75 sin (2π3E6t) ± 0.05 ns, See Figure 7 | | ±187 | | ps |
| $t_w$ | 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 | 260 | 700 | 1500 | ps |
| $t_{en}$ | Enable time, $\overline{\text{SHTDN}}$↑ to phase lock (Yn valid) | See Figure 8 | | 1 | | ms |
| $t_{dis}$ | Disable time, $\overline{\text{SHTDN}}$↓ to off state (CLKOUT low) | See Figure 9 | | 250 | | ns |

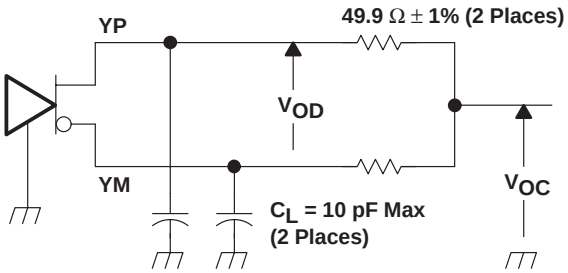
† All typical values are at $V_{CC}$ = 3.3 V, $T_A$ = 25°C.
‡ |Input clock jitter| is the magnitude of the change in the input clock period.
§ Output clock jitter is the change in the output clock period from one cycle to the next cycle observed over 15000 cycles.

## PARAMETER MEASUREMENT INFORMATION




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.

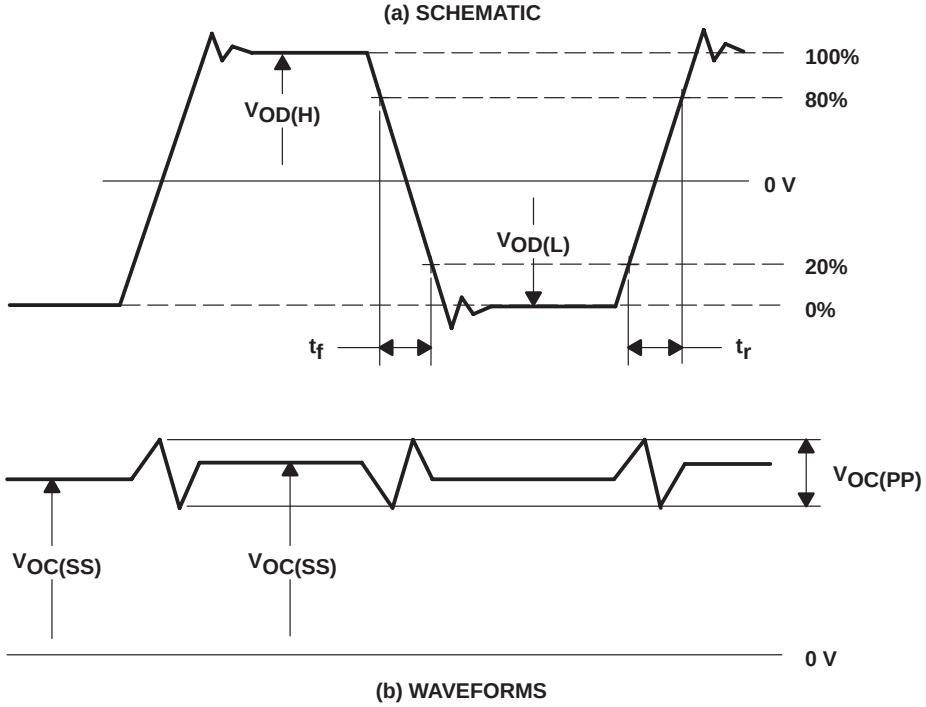
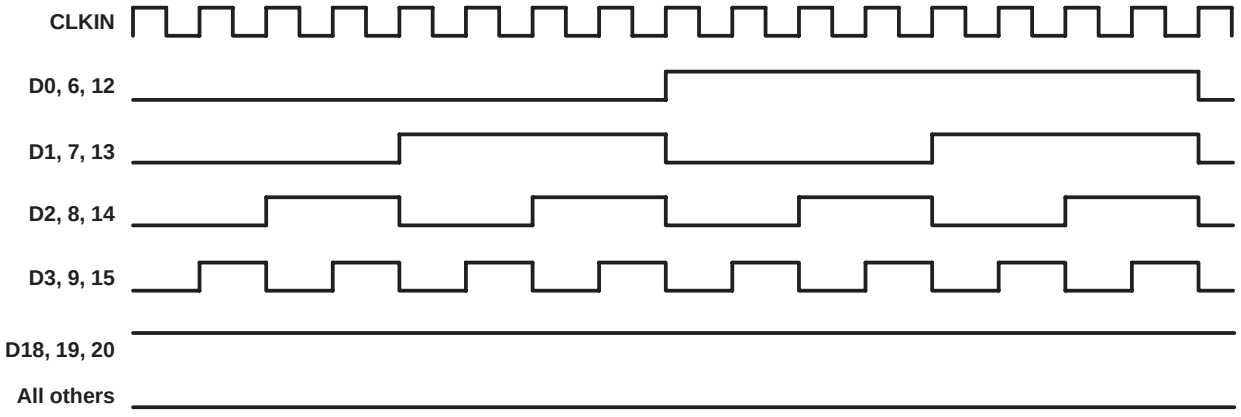


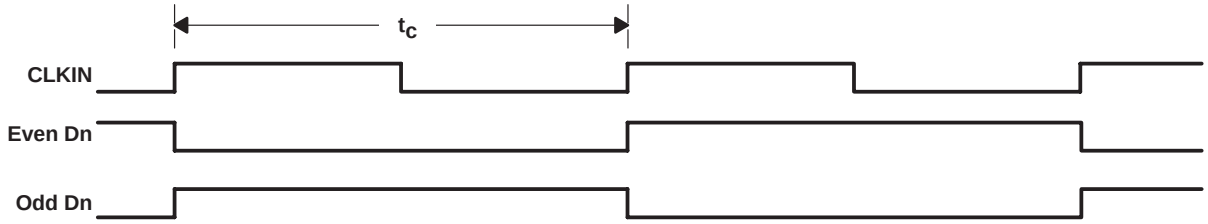

**Figure 3. Test Load and Voltage Definitions for LVDS Outputs**

## 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
C. SN75LVDS84 shown (CLKIN is inverted for SN75LVDS85).

**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
C. SN75LVDS84 shown (CLKIN is inverted for SN75LVDS85).

**Figure 5. Worst-Case Test-Pattern Waveforms**

## PARAMETER MEASUREMENT INFORMATION

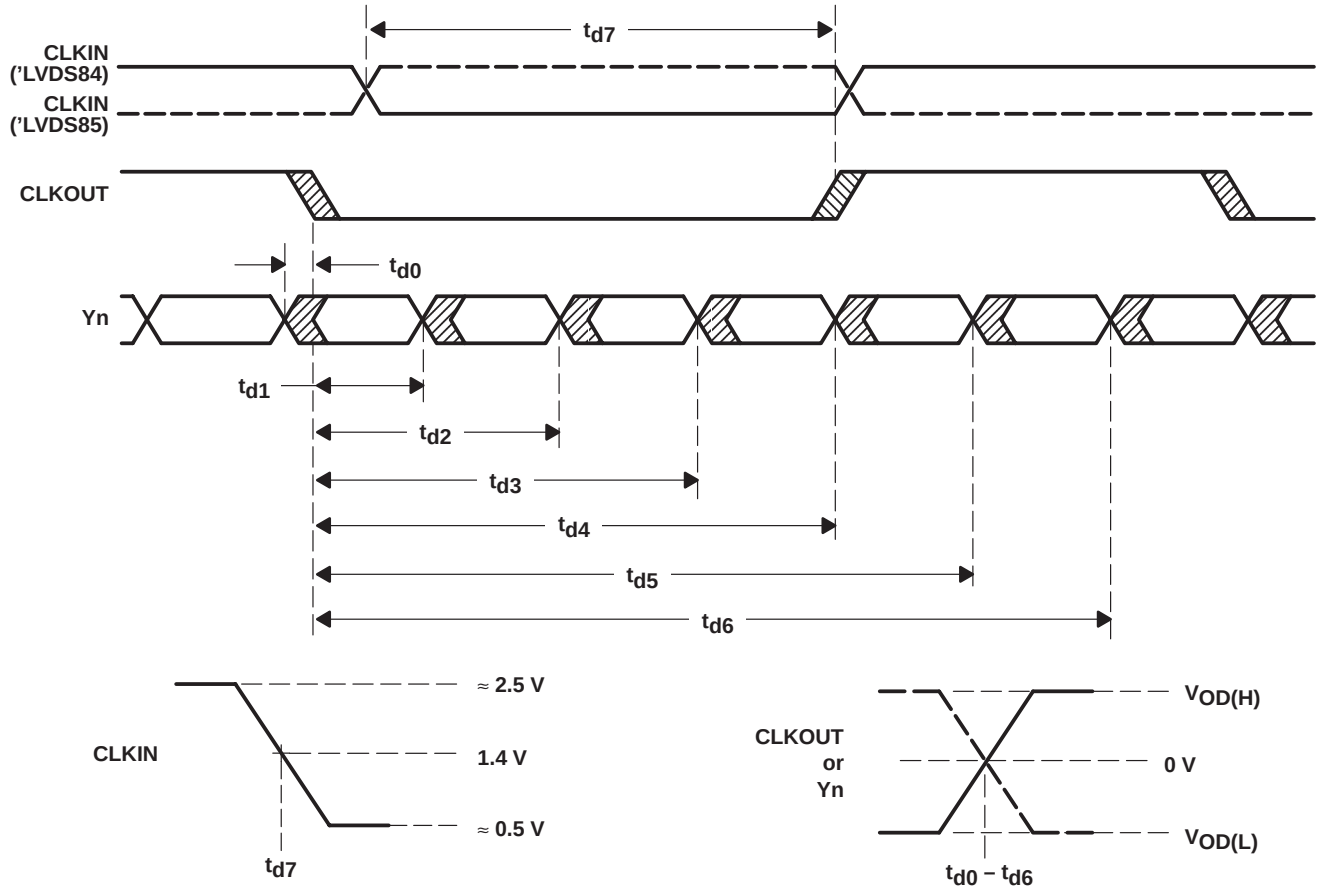



**Figure 6. Timing Definitions**

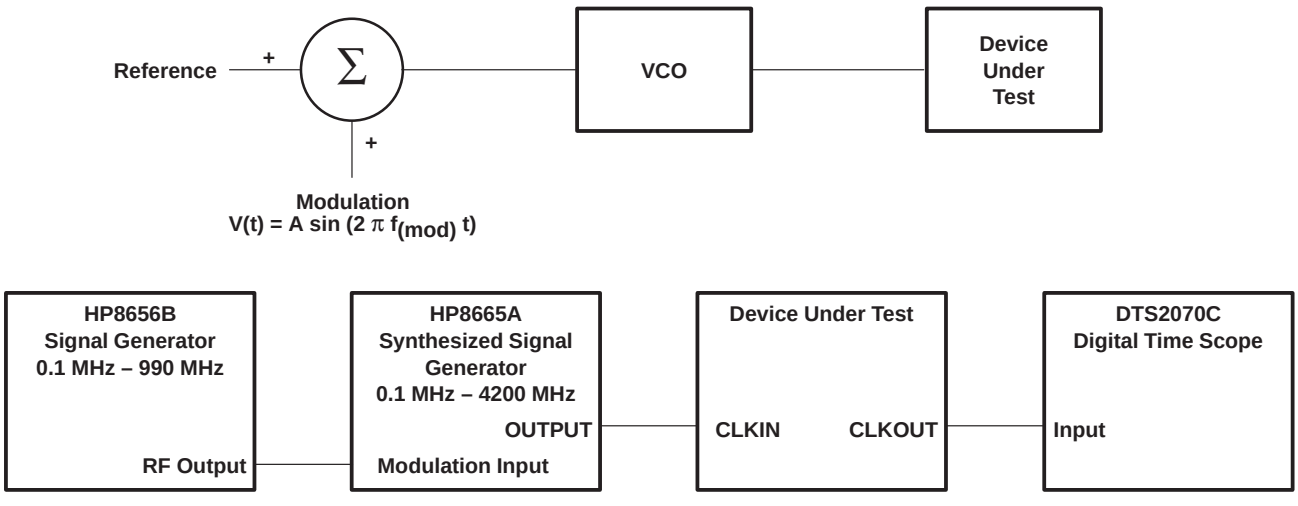
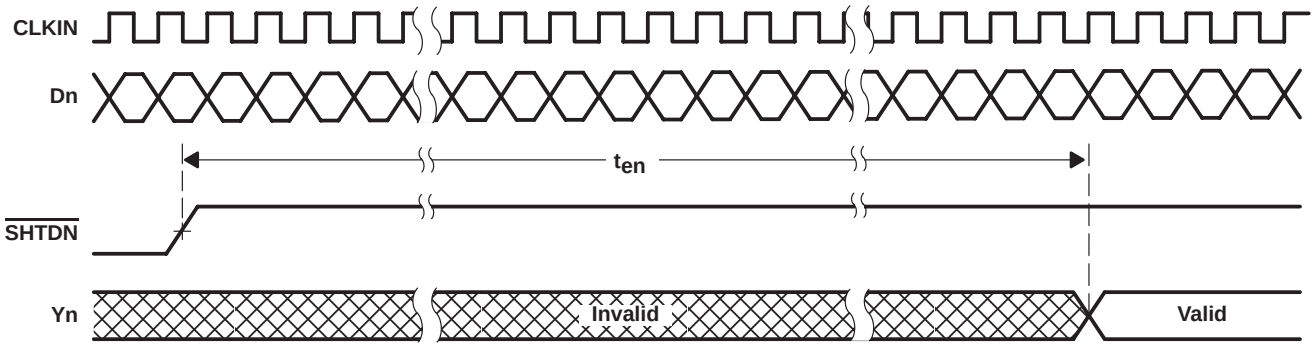


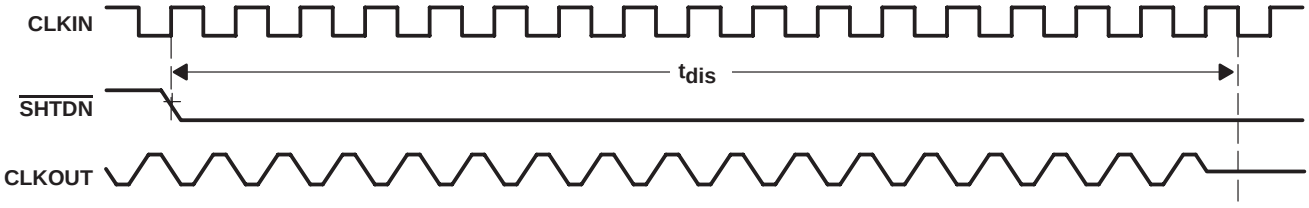

**Figure 7. Clock Jitter Test Setup**

## TYPICAL CHARACTERISTICS




NOTE A: SN75LVDS84 shown.

**Figure 8. Enable Time Waveforms**




NOTE A: SN75LVDS84 shown.

**Figure 9. Disable Time Waveforms**

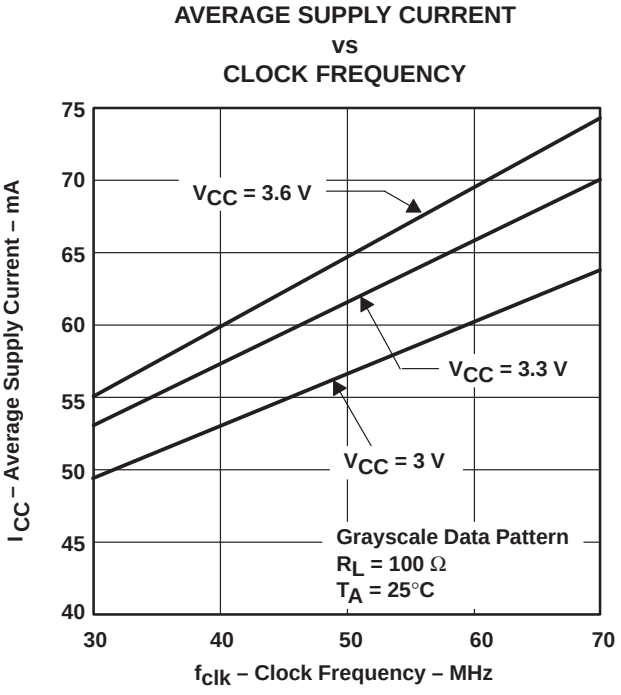



**Figure 10**

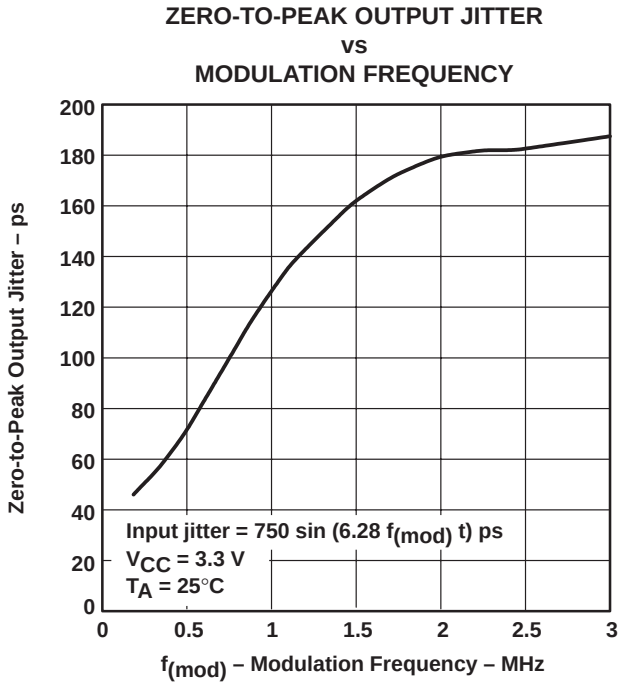
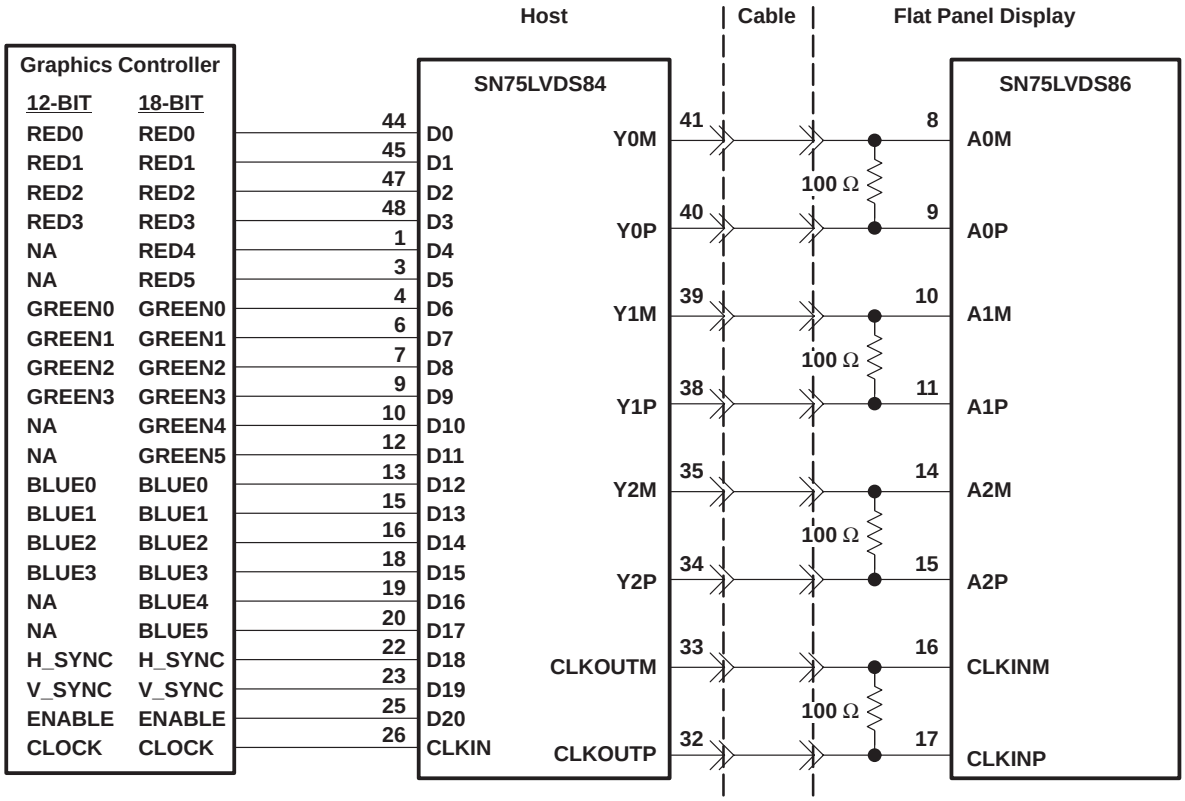



**Figure 11**

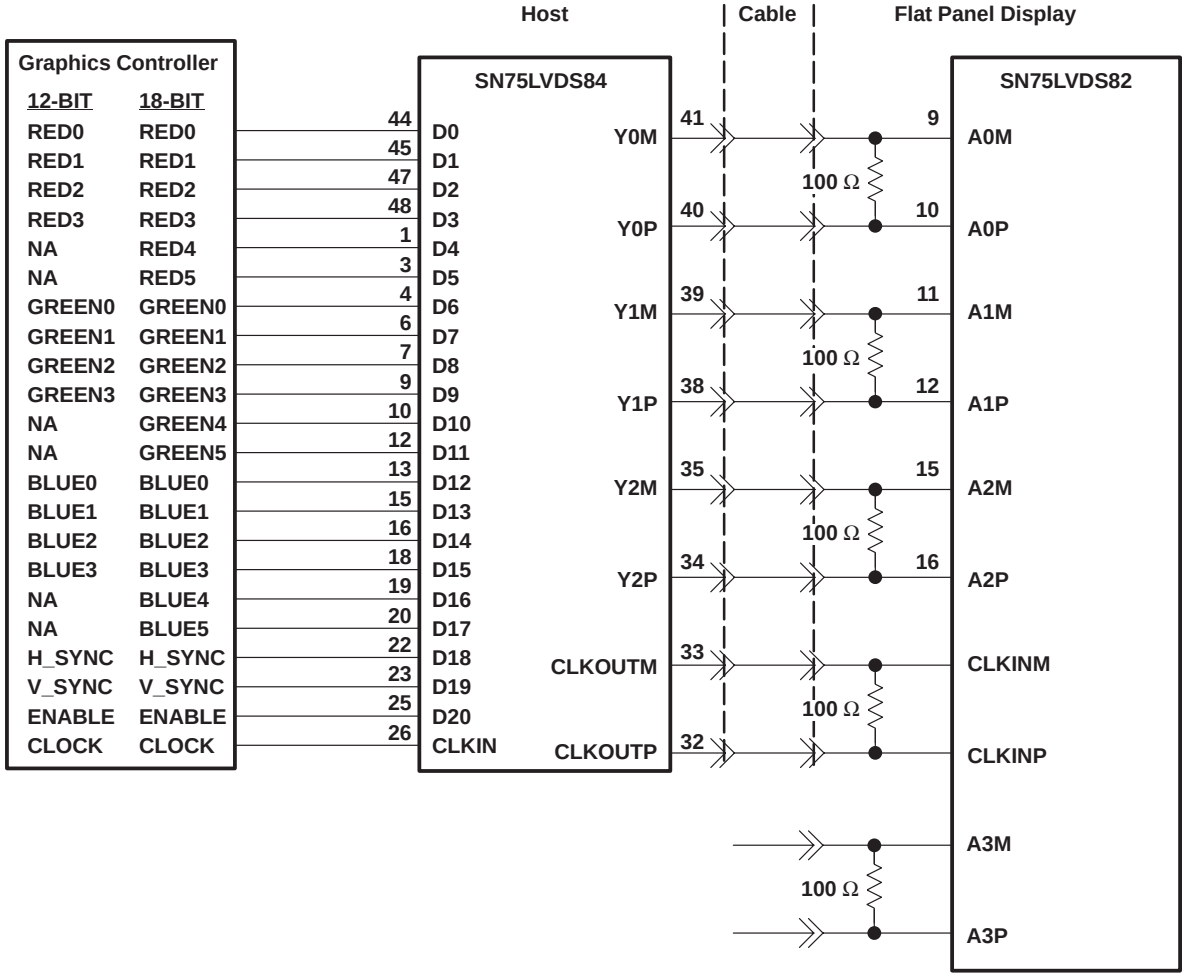
## APPLICATION INFORMATION




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.

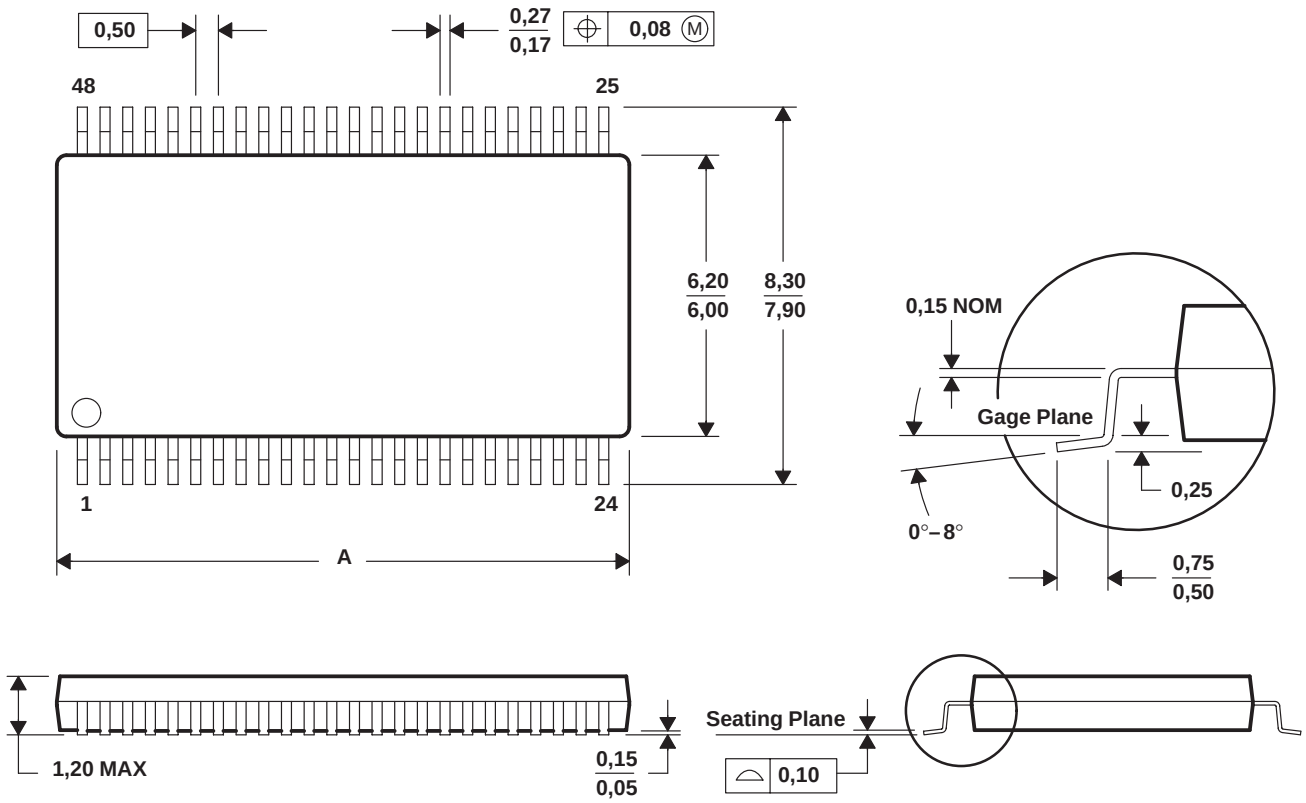
**Figure 13. 18-Bit Color Host to 24-Bit LCD Display Panel Application†**

† See the FlatLink Designer's Guide (SLLA012) for more application information.

## MECHANICAL INFORMATION

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

**48 PIN SHOWN**




| DIM \ PINS ** | 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

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