

TL5812, TL5812I VACUUM FLUORESCENT DISPLAY DRIVERS

SLDS011B – OCTOBER 1985 – REVISED MAY 1993

- Drives up to 20 Lines
- 70-V Output Voltage Swing Capability
- 40-mA Output Source Current Capability
- High-Speed Serially-Shifted Data Input
- CMOS-Compatible Inputs
- Direct Replacement for Sprague UCN5812A

description

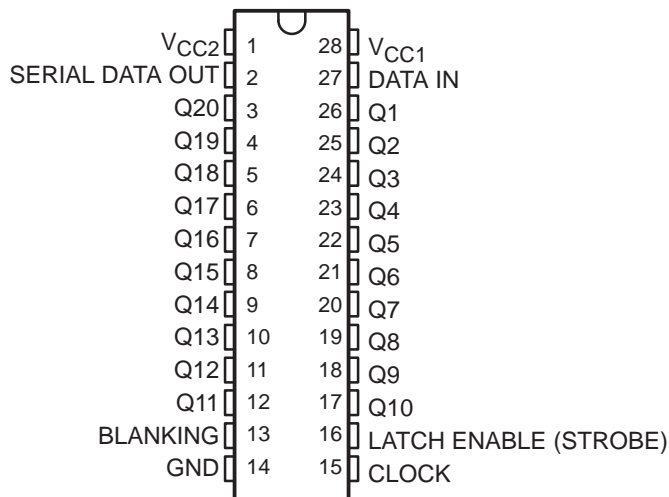
The TL5812 and TL5812I are monolithic BIFDFT† integrated circuits designed to drive a dot matrix or segmented vacuum fluorescent display (VFD). Each device features a serial data output to cascade additional devices for large display arrays.

A 20-bit data word is serially loaded into the shift register on the low-to-high transition of CLOCK. Parallel data is transferred to the output buffers through a 20-bit D-type latch while LATCH ENABLE is high and is latched when LATCH ENABLE is low. When BLANKING is high, all outputs are low.

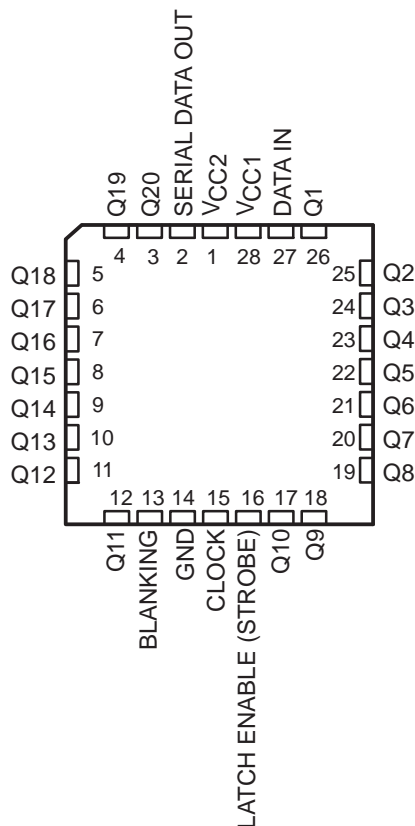
The outputs are totem-pole structures formed by npn emitter-follower and double-diffused MOS (DMOS) transistors with output voltage ratings of 70 V and a source-current capability of 40 mA. All inputs are CMOS compatible.

The TL5812 is characterized for operation from 0°C to 70°C. The TL5812I is characterized for operation from -40°C to 85°C.

**N PACKAGE
(TOP VIEW)**



**FN PACKAGE
(TOP VIEW)**



† BIFDFT – Bipolar, double-diffused, N-channel and P-channel MOS transistors on same chip. This is a patented process.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



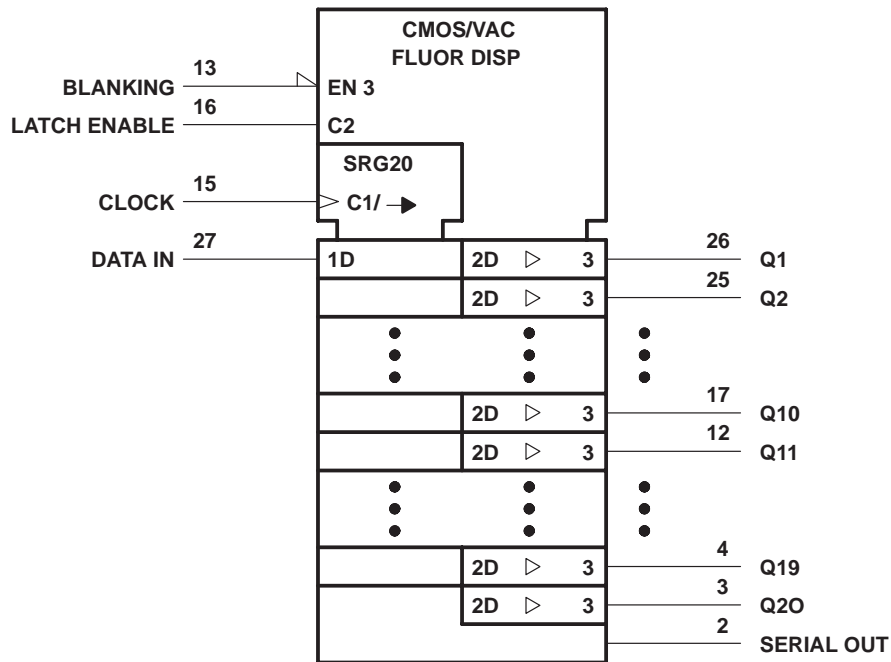
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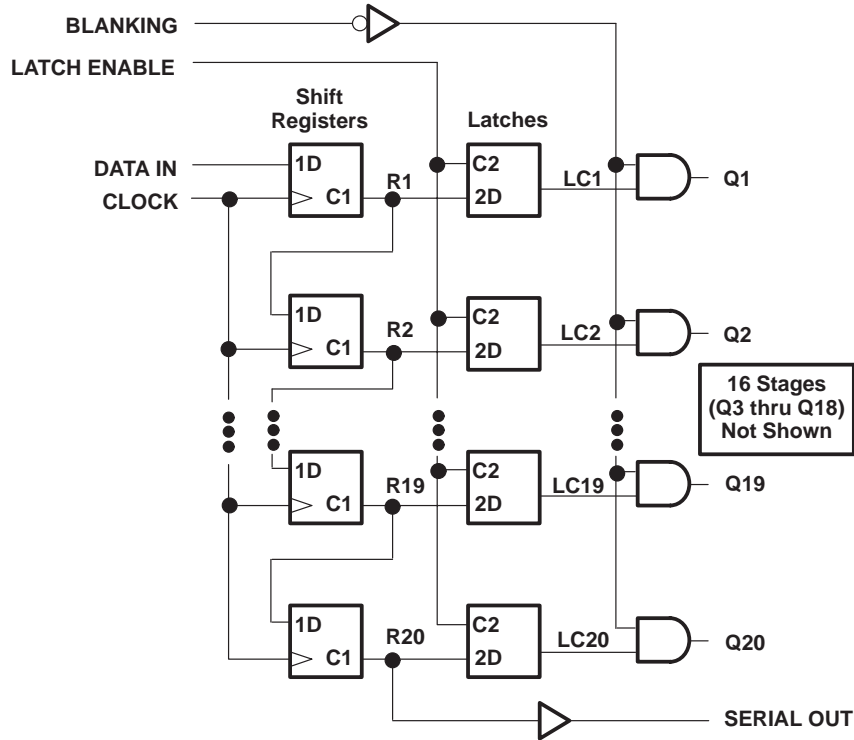
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



FUNCTION TABLE

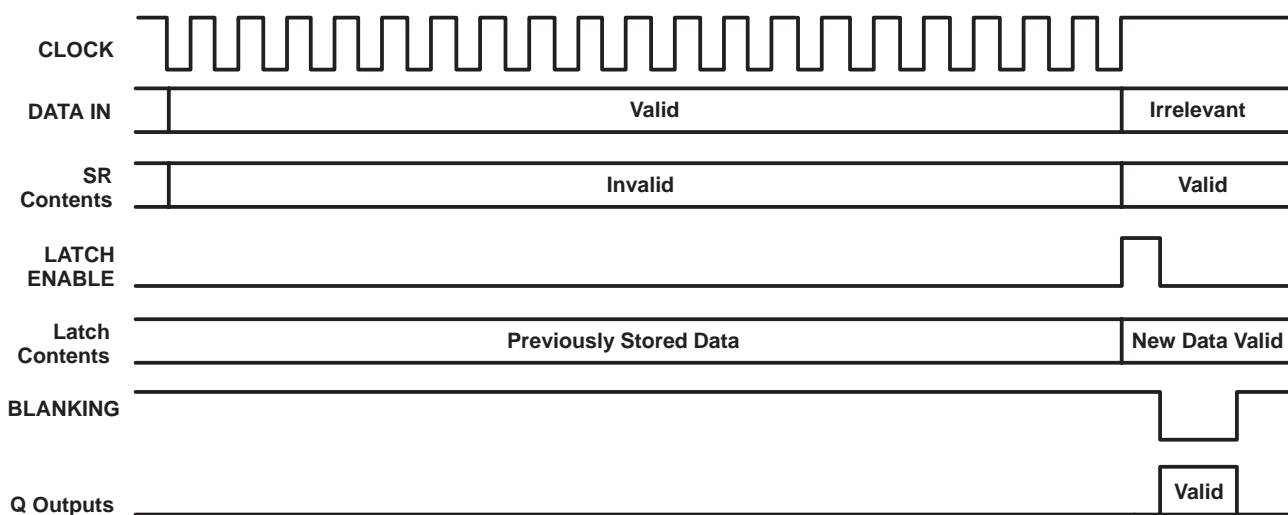
| FUNCTION | CONTROL INPUTS | | | SHIFT REGISTERS R1 THRU R20 | LATCHES LC1 THRU LC20 | OUTPUTS | |
|----------|----------------|-----------------|----------|--------------------------------|--------------------------------|------------|--------------------------------------|
| | CLOCK | LATCH ENABLE | BLANKING | | | SERIAL | Q1 THRU Q20 |
| Load | ↑ No↑ | X X | X X | Load and shift† No change | Determined by LATCH ENABLE‡ | R20 R20 | Determined by BLANKING |
| Latch | X X | L H | X X | As determined above | Stored data New data | R20 R20 | Determined by BLANKING |
| Blank | X X | X X | H L | As determined above | Determined by LATCH ENABLE‡ | R20 R20 | All L LC1 thru LC10, respectively |

H = high level, L = low level, X = irrelevant, ↑ = low-to-high-level transition.

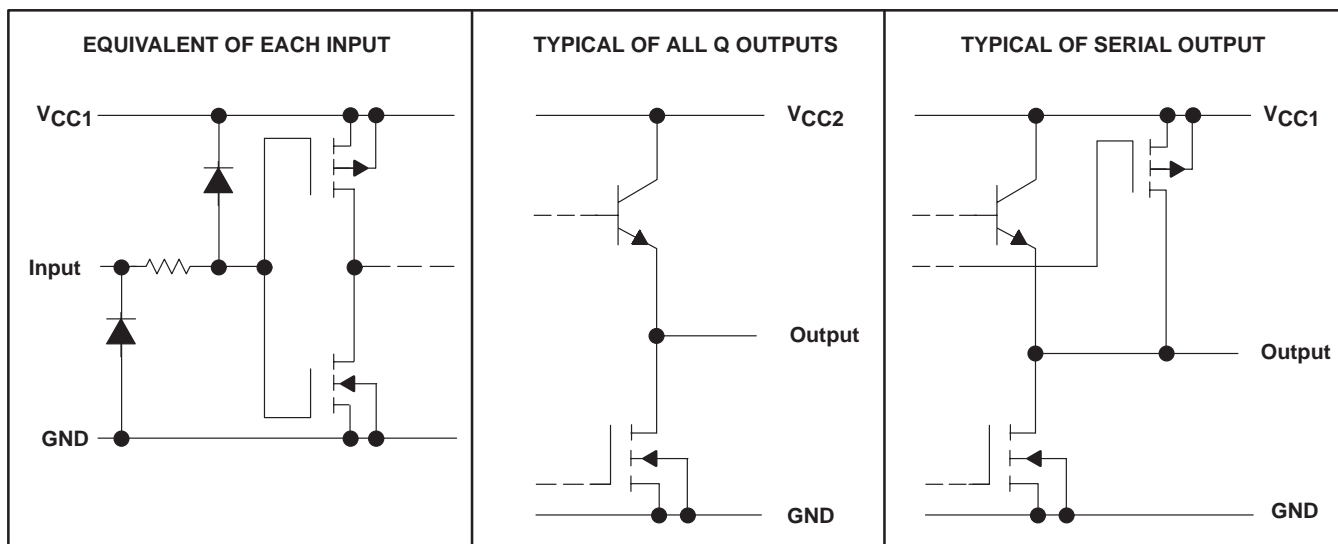
† R20 takes on the state of R19, R19 takes on the state of R18, ... R2 takes on the state of R1, and R1 takes on the state of the data input.

‡ New data enter the latches while LATCH ENABLE is high. These data are stored while LATCH ENABLE is low.

typical operating sequence



schematics of inputs and outputs



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

| | |
|---|------------------------------|
| Supply voltage, V_{CC1} (see Note 1) | 15 V |
| Supply voltage, V_{CC2} | 70 V |
| Output voltage, V_O | 70 V |
| Input voltage range, V_I | -0.3 V to $V_{CC1} + 0.3$ V |
| Output current, I_O | -40 mA |
| Continuous total power dissipation | See Dissipation Rating Table |
| Operating free-air temperature range: TL5812 | 0°C to 70°C |
| TL5812I | -40°C to 85°C |
| Storage temperature range, | -65°C to 150°C |
| Case temperature for 10 seconds: FN package | 260°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: N package | 260°C |

NOTE 1: All voltage values are with respect to GND.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 85^\circ\text{C}$ POWER RATING |
|---------|---|---|--|--|
| FN | 1400 mW | 11.2 mW/°C | 896 mW | 728 mW |
| N | 1150 mW | 9.2 mW/°C | 736 mW | 598 mW |

recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---------------------------------------|-----------------|-----|-----------------|------|
| Supply voltage, V_{CC1} | 4.5 | | 15 | V |
| Supply voltage, V_{CC2} | 0 | | 60 | V |
| High-level input voltage, V_{IH} | $V_{CC1} - 1.5$ | | $V_{CC1} + 0.3$ | V |
| Low-level input voltage, V_{IL} | -0.3† | | 0.8 | V |
| High-level output current, I_{OH} | | | -40 | mA |
| Operating free-air temperature, T_A | TL5812 | | 0 | °C |
| | TL5812I | | -40 | |

† The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for logic voltage levels.



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electrical characteristics over operating free-air temperature range, $V_{DD} = 5\text{ V}$ to 15 V , $V_{BB} = 60\text{ V}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP [‡] | MAX | UNIT | |
|--------------|---|---|---|------------------|------|---------------|---|
| V_{OH} | High-level output | Q outputs | $I_{OH} = -25\text{ mA}$ | | 57.5 | 58.2 | V |
| | | SERIAL DATA OUT | $V_{CC1} = 5\text{ V}$, $I_{OH} = -20\text{ }\mu\text{A}$ | | 4.5 | 4.9 | |
| | | | $V_{CC1} = 15\text{ V}$, $I_{OH} = -20\text{ }\mu\text{A}$ | | 14.5 | 14.9 | |
| V_{OL} | Low-level output voltage | Q outputs | $I_{OL} = 1\text{ mA}$, BLANKING at V_{CC1} | | 0.7 | 1.5 | V |
| | | SERIAL DATA OUT | $V_{CC1} = 5\text{ V}$, $I_{OL} = 20\text{ }\mu\text{A}$ | | 0.06 | 0.3 | |
| | | | $V_{CC1} = 15\text{ V}$, $I_{OL} = 20\text{ }\mu\text{A}$ | | 0.03 | 0.3 | |
| I_{IH} | High-level input current | $V_I = V_{CC1}$ | | 0.3 | 1 | μA | |
| I_{IL} | Low-level input current | $V_I = 0$ | | -0.3 | -1 | μA | |
| I_{OL} | Low-level output current (pulldown current) | $V_O = 60\text{ V}$, BLANKING at V_{CC1} | | 2.5 | 3.2 | μA | |
| $I_{O(off)}$ | Off-state output current | $V_O = 0$, BLANKING at V_{CC1} | | < -1 | -15 | μA | |
| I_{CC2} | Supply current from V_{CC2} | Outputs high | | 3.5 | 8 | mA | |
| | | Outputs low | | 0.02 | 0.5 | | |
| I_{CC1} | Supply current from V_{CC1} | $V_{CC1} = 5\text{ V}$ | | 1.5 | 3 | mA | |
| | | $V_{CC1} = 15\text{ V}$ | | 1.7 | 4 | | |

[‡] All typical characteristics are at $T_A = 25^\circ\text{C}$.

timing requirements over operating free-air temperature range

| | | | MIN | MAX | UNIT |
|-----------------------|---|-------------------------|-----|-----|------|
| $t_w(\text{CKH})$ | Pulse duration, CLOCK high | $V_{CC1} = 5\text{ V}$ | 500 | | ns |
| | | $V_{CC1} = 15\text{ V}$ | 100 | | |
| $t_w(\text{LEH})$ | Pulse duration, LATCH ENABLE high | $V_{CC1} = 5\text{ V}$ | 500 | | ns |
| | | $V_{CC1} = 15\text{ V}$ | 100 | | |
| $t_{su}(\text{D})$ | Setup time, DATA IN before CLOCK \uparrow | $V_{CC1} = 5\text{ V}$ | 150 | | ns |
| | | $V_{CC1} = 15\text{ V}$ | 75 | | |
| $t_h(\text{D})$ | Hold time, DATA IN after CLOCK \uparrow | $V_{CC1} = 5\text{ V}$ | 150 | | ns |
| | | $V_{CC1} = 15\text{ V}$ | 75 | | |
| $t_d(\text{CKH-LEH})$ | Delay time, CLOCK \uparrow to LATCH ENABLE high | $V_{CC1} = 5\text{ V}$ | 150 | | ns |
| | | $V_{CC1} = 15\text{ V}$ | 75 | | |

switching characteristics, $V_{BB} = 60\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | | MIN | TYP | MAX | UNIT |
|-----------|---|-------------------------|-----|-----|---------------|
| t_{pd} | Propagation delay time, LATCH ENABLE to Q outputs | $V_{CC1} = 5\text{ V}$ | | 2.2 | μs |
| | | $V_{CC1} = 15\text{ V}$ | | 0.8 | |



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PARAMETER MEASUREMENT INFORMATION

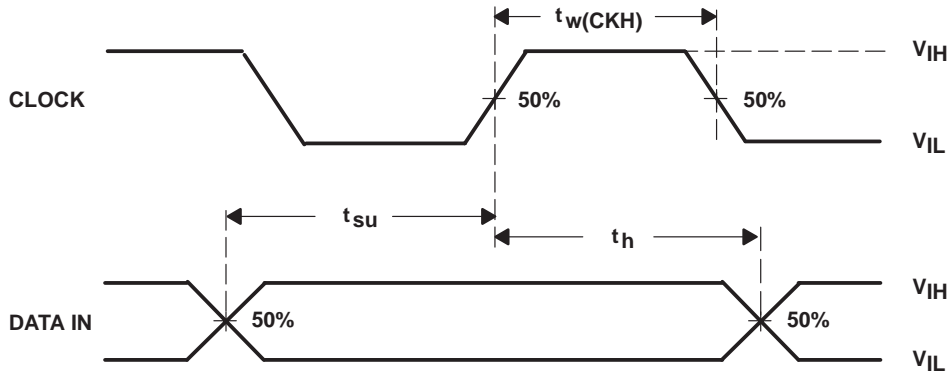


Figure 1. Input Timing

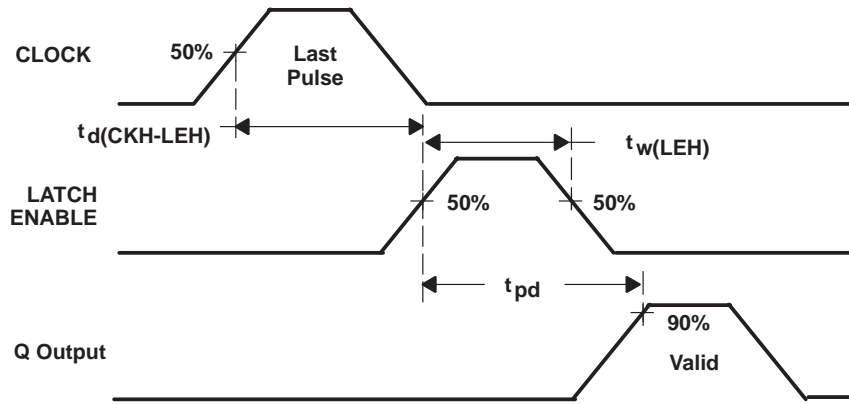


Figure 2. Output Switching Times

THERMAL INFORMATION

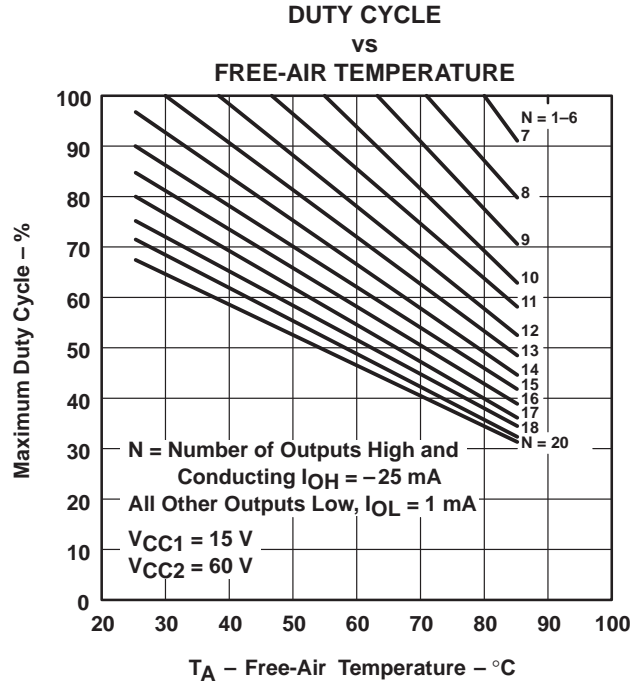


Figure 3

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