

HEF4794B-Q100

8-stage shift-and-store register LED driver

Rev. 2 — 7 November 2018

Product data sheet

1. General description

The HEF4794B-Q100 is an 8-stage serial shift register. It has a storage latch associated with each stage for strobing data from the serial input (D) to the parallel LED driver outputs (QP0 to QP7). Data is shifted on the positive-going clock (CP) transitions. The data in each shift register stage is transferred to the storage register when the strobe input (STR) is HIGH. Data in the storage register appears at the outputs whenever the output enable input (OE) signal is HIGH.

Two serial outputs (QS1 and QS2) are available for cascading a number of HEF4794B-Q100 devices. Serial data is available at QS1 on positive-going clock edges to allow high-speed operation in cascaded systems with a fast clock rise time. The same serial data is available at QS2 on the next negative going clock edge. This is used for cascading HEF4794B-Q100 devices when the clock has a slow rise time.

It operates over a recommended V_{DD} power supply range of 3 V to 15 V referenced to V_{SS} (usually ground). Unused inputs must be connected to V_{DD} , V_{SS} , or another input.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF; R = 0 Ω)
- Complies with JEDEC standard JESD 13-B

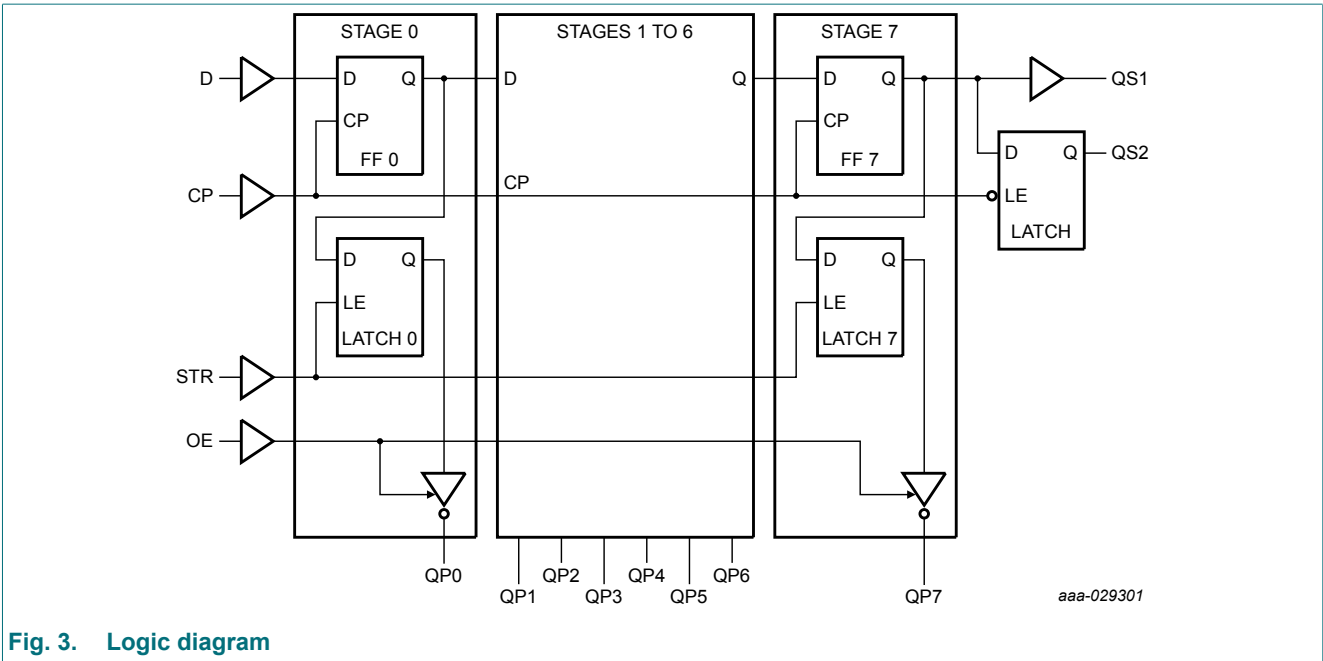
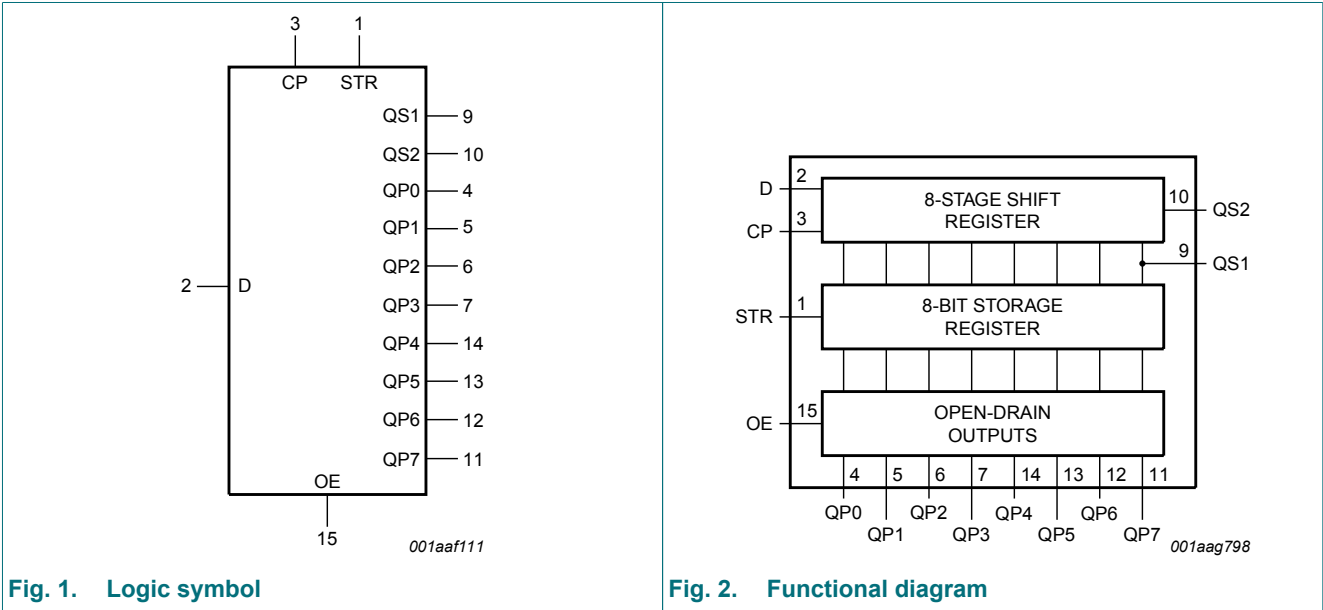
3. Ordering information

Table 1. Ordering information

All types operate from -40 °C to +125 °C.

| Type number | Package | | |
|----------------|---------|--|----------|
| | Name | Description | Version |
| HEF4794BT-Q100 | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |

4. Functional diagram



5. Pinning information

5.1. Pinning

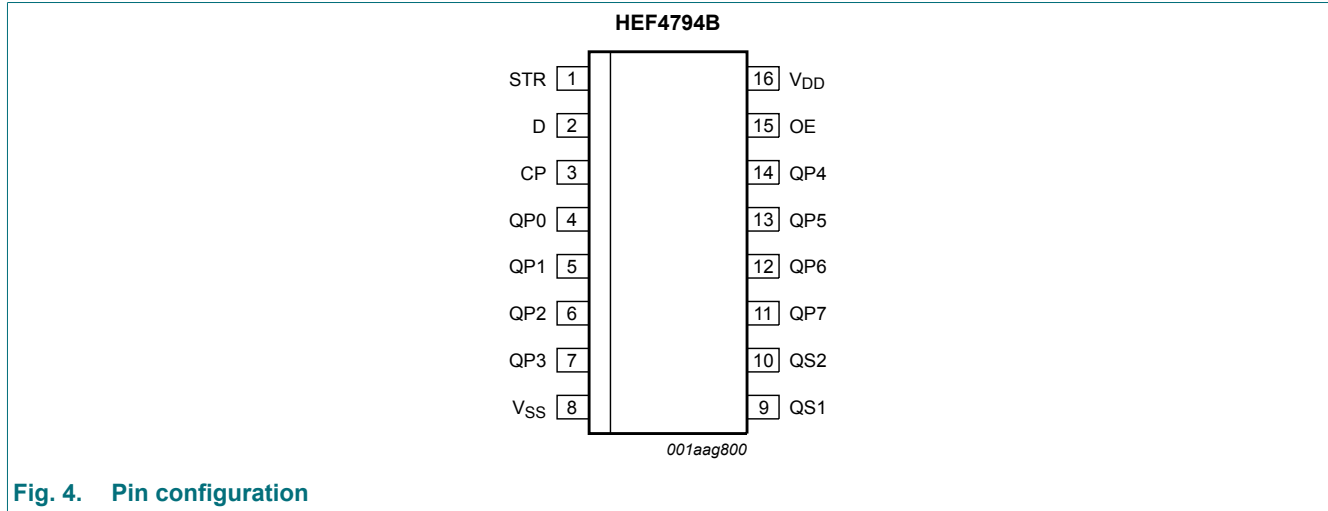


Fig. 4. Pin configuration

5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-----------------|----------------------------|------------------------------|
| D | 2 | serial input |
| QP0 to QP7 | 4, 5, 6, 7, 14, 13, 12, 11 | parallel output (open-drain) |
| QS1 | 9 | serial output |
| QS2 | 10 | serial output |
| CP | 3 | clock input |
| STR | 1 | strobe input |
| OE | 15 | output enable input |
| V _{DD} | 16 | supply voltage |
| V _{SS} | 8 | ground (0 V) |

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state;
 ↑ = LOW-to-HIGH clock transition; ↓ = HIGH-to-LOW clock transition.

| Input | | | | Parallel output | | Serial output | |
|-------|----|-----|---|-----------------|-----------|---------------|-----------|
| CP | OE | STR | D | QP0 | QPn | QS1[1] | QS2[2] |
| ↑ | L | X | X | Z | Z | Q6S | no change |
| ↓ | L | X | X | Z | Z | n.c. | Q7S |
| ↑ | H | L | X | no change | no change | Q6S | no change |
| ↑ | H | H | L | Z | QPn - 1 | Q6S | no change |
| ↑ | H | H | H | L | QPn - 1 | Q6S | no change |
| ↓ | H | H | H | no change | no change | no change | Q7S |

- [1] Q6S = the data in register stage 6 before the LOW to HIGH clock transition.
- [2] Q7S = the data in register stage 7 before the HIGH to LOW clock transition.

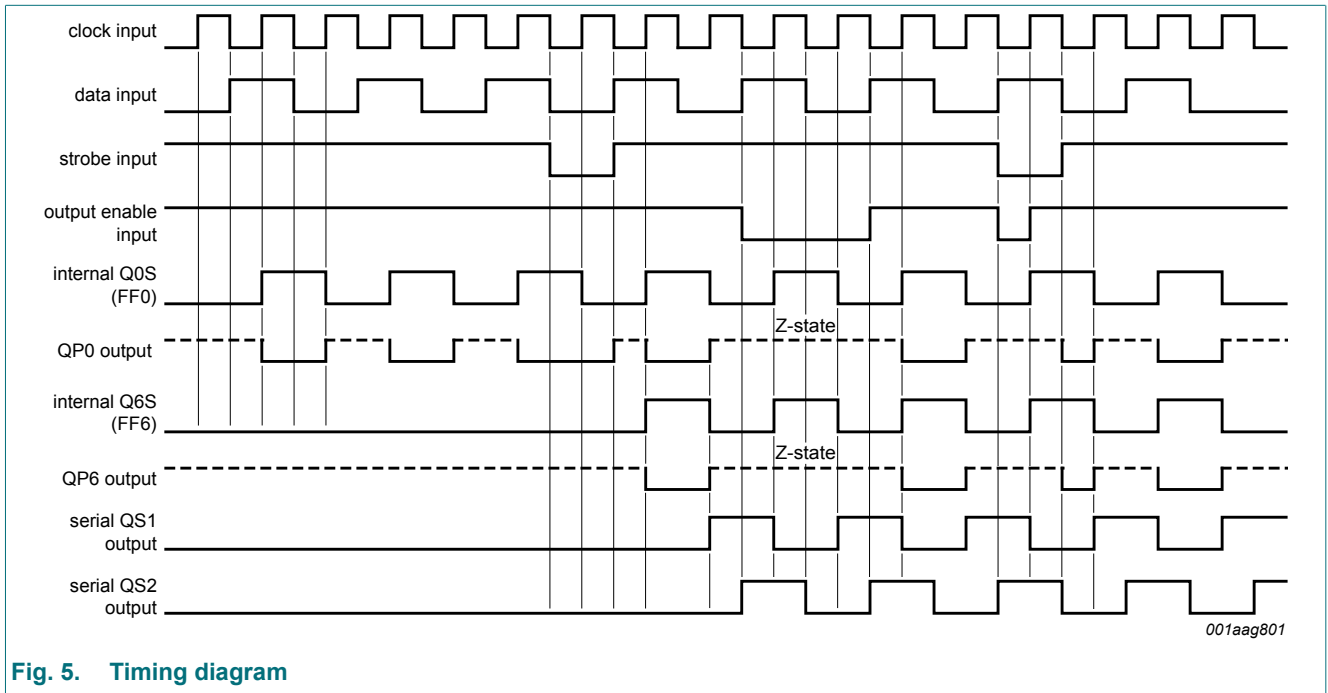


Fig. 5. Timing diagram

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|----------------|------|
| V_{DD} | supply voltage | | -0.5 | +18 | V |
| I_{IK} | input clamping current | $V_I < -0.5\text{ V}$ or $V_I > V_{DD} + 0.5\text{ V}$ | - | ± 10 | mA |
| V_I | input voltage | | -0.5 | $V_{DD} + 0.5$ | V |
| I_{OK} | output clamping current | QSn outputs; $V_O < -0.5\text{ V}$ or $V_O > V_{DD} + 0.5\text{ V}$ | - | ± 10 | mA |
| | | QPn outputs; $V_O < -0.5\text{ V}$ | - | 40 | mA |
| I_I | input leakage current | | - | ± 10 | mA |
| I_O | output current | QSn outputs | - | ± 10 | mA |
| | | QPn outputs | - | 40 | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| T_{amb} | ambient temperature | | -40 | +125 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ | | | |
| | | SO16 package [1] | - | 500 | mW |
| P | power dissipation | per output | - | 100 | mW |

[1] For SO16 package: P_{tot} derates linearly with 8 mW/K above 70 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------|-------------------------------------|------------------------|-----|----------|-----------------|
| V_{DD} | supply voltage | | 3 | 15 | V |
| V_I | input voltage | | 0 | V_{DD} | V |
| T_{amb} | ambient temperature | in free air | -40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{DD} = 5\text{ V}$ | - | 3.75 | $\mu\text{s/V}$ |
| | | $V_{DD} = 10\text{ V}$ | - | 0.5 | $\mu\text{s/V}$ |
| | | $V_{DD} = 15\text{ V}$ | - | 0.08 | $\mu\text{s/V}$ |

9. Static characteristics

Table 6. Static characteristics

$V_{SS} = 0\text{ V}$; $V_I = V_{SS}$ or V_{DD} ; unless otherwise specified.

| Symbol | Parameter | Conditions | V _{DD} | T _{amb} = -40 °C | | T _{amb} = 25 °C | | T _{amb} = 85 °C | | T _{amb} = 125 °C | | Unit |
|-----------------|---------------------------|--|-----------------|---------------------------|-------|--------------------------|------|--------------------------|-------|---------------------------|-------|------|
| | | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| V _{IH} | HIGH-level input voltage | I _o < 1 μA | 5 V | 3.5 | - | 3.5 | - | 3.5 | - | 3.5 | - | V |
| | | | 10 V | 7.0 | - | 7.0 | - | 7.0 | - | 7.0 | - | V |
| | | | 15 V | 11.0 | - | 11.0 | - | 11.0 | - | 11.0 | - | V |
| V _{IL} | LOW-level input voltage | I _o < 1 μA | 5 V | - | 1.5 | - | 1.5 | - | 1.5 | - | 1.5 | V |
| | | | 10 V | - | 3.0 | - | 3.0 | - | 3.0 | - | 3.0 | V |
| | | | 15 V | - | 4.0 | - | 4.0 | - | 4.0 | - | 4.0 | V |
| V _{OH} | HIGH-level output voltage | QSn outputs; I _o < 1 μA | 5 V | 4.95 | - | 4.95 | - | 4.95 | - | 4.95 | - | V |
| | | | 10 V | 9.95 | - | 9.95 | - | 9.95 | - | 9.95 | - | V |
| | | | 15 V | 14.95 | - | 14.95 | - | 14.95 | - | 14.95 | - | V |
| V _{OL} | LOW-level output voltage | QSn outputs; I _o < 1 μA | 5 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| | | | 10 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| | | | 15 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| | | QPn outputs; I _o < 20 mA | 5 V | - | 0.75 | - | 0.75 | - | 1.5 | - | 1.5 | V |
| | | | 10 V | - | 0.75 | - | 0.75 | - | 1.5 | - | 1.5 | V |
| | | | 15 V | - | 0.75 | - | 0.75 | - | 1.5 | - | 1.5 | V |
| I _{OH} | HIGH-level output current | QSn outputs | | | | | | | | | | |
| | | V _O = 2.5 V | 5 V | - | -1.7 | - | -1.4 | - | -1.1 | - | -1.1 | mA |
| | | V _O = 4.6 V | 5 V | - | -0.64 | - | -0.5 | - | -0.36 | - | -0.36 | mA |
| | | V _O = 9.5 V | 10 V | - | -1.6 | - | -1.3 | - | -0.9 | - | -0.9 | mA |
| | | V _O = 13.5 V | 15 V | - | -4.2 | - | -3.4 | - | -2.4 | - | -2.4 | mA |
| I _{OL} | LOW-level output current | QSn outputs | | | | | | | | | | |
| | | V _O = 0.4 V | 5 V | 0.64 | - | 0.5 | - | 0.36 | - | 0.36 | - | mA |
| | | V _O = 0.5 V | 10 V | 1.6 | - | 1.3 | - | 0.9 | - | 0.9 | - | mA |
| | | V _O = 1.5 V | 15 V | 4.2 | - | 3.4 | - | 2.4 | - | 2.4 | - | mA |
| I _I | input leakage current | | 15 V | - | ±0.1 | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| I _{OZ} | OFF-state output current | QPn output is HIGH; V _O = 15 V | 5 V | - | 2 | - | 2 | - | 15 | - | 15 | μA |
| | | | 10 V | - | 2 | - | 2 | - | 15 | - | 15 | μA |
| | | | 15 V | - | 2 | - | 2 | - | 15 | - | 15 | μA |
| I _{DD} | supply current | I _O = 0 A | 5 V | - | 5 | - | 5 | - | 150 | - | 150 | μA |
| | | | 10 V | - | 10 | - | 10 | - | 300 | - | 300 | μA |
| | | | 15 V | - | 20 | - | 20 | - | 600 | - | 600 | μA |
| C _I | input capacitance | | - | - | - | - | - | 7.5 | - | - | - | pF |

10. Dynamic characteristics

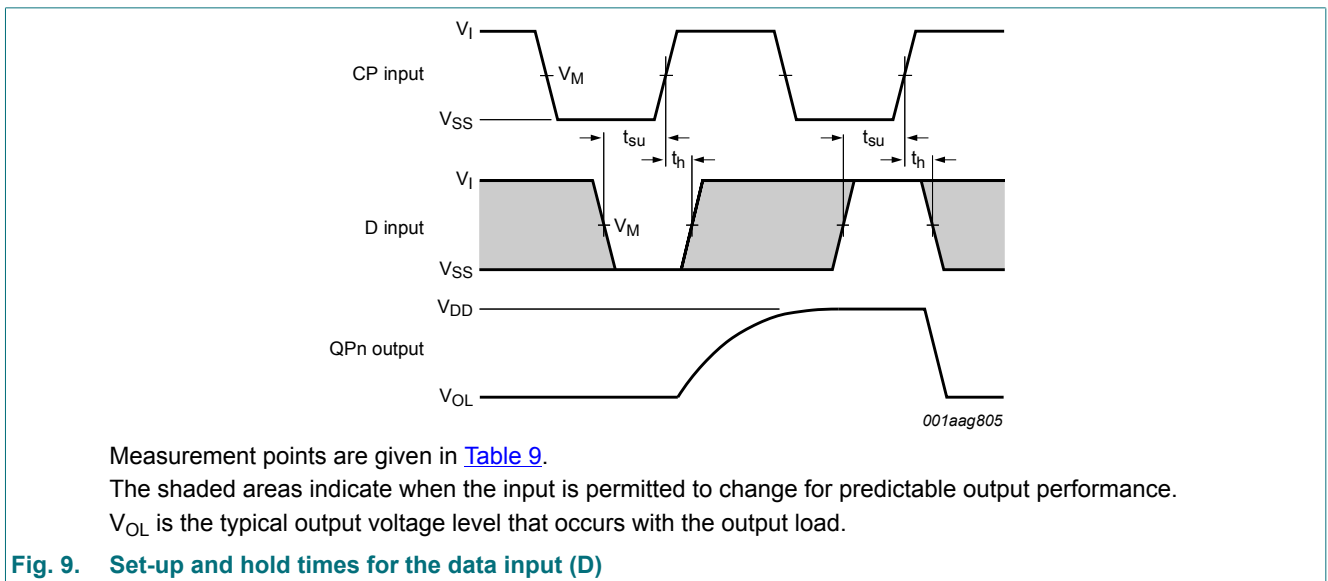
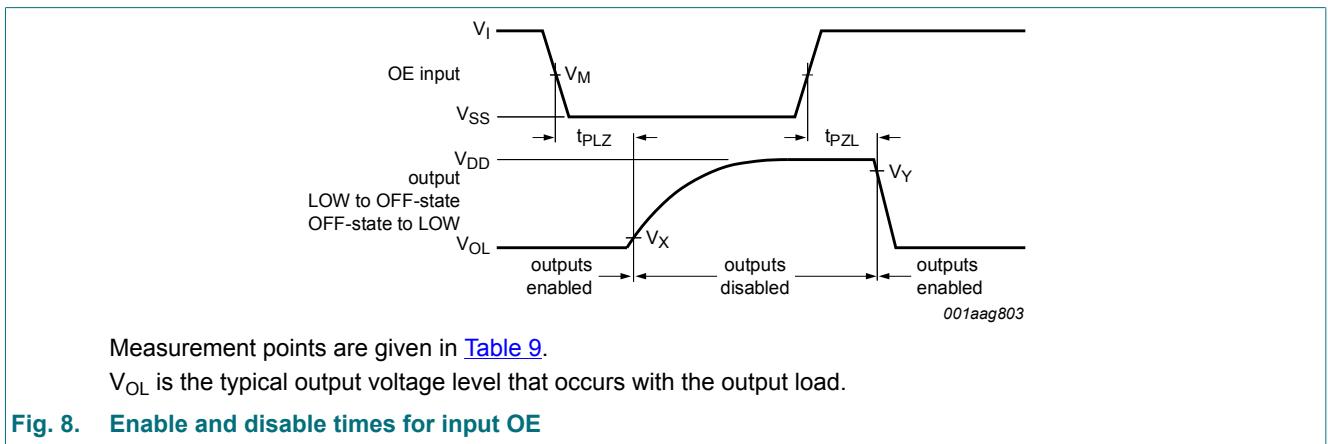
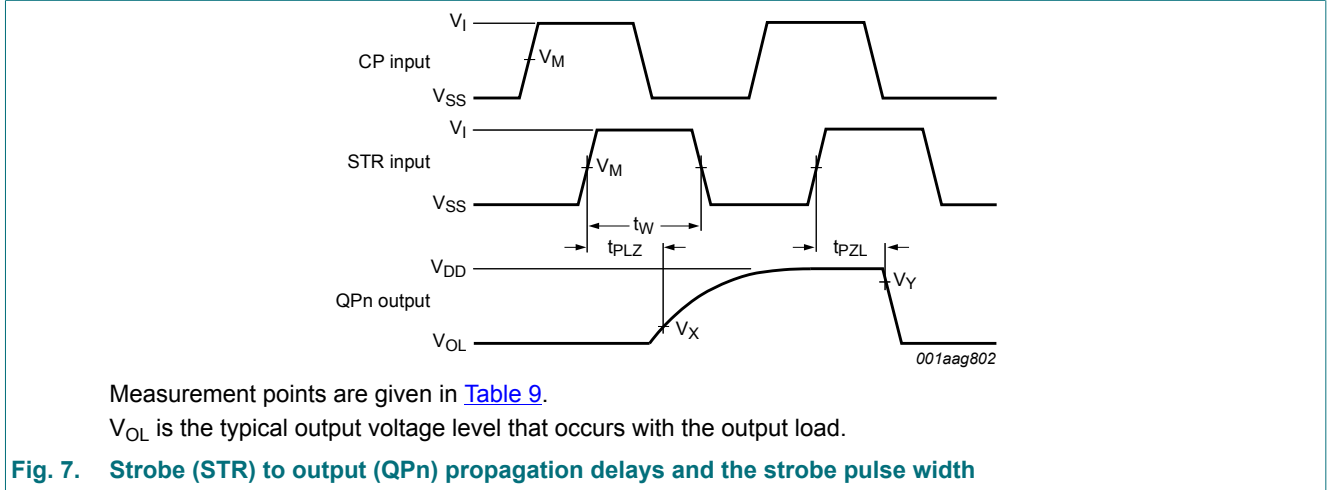
Table 7. Dynamic characteristics

$V_{SS} = 0\text{ V}$; $T_{amb} = 25\text{ °C}$ unless otherwise specified. For test circuit, see Fig. 10.

| Symbol | Parameter | Conditions | V _{DD} | Extrapolation formula | Min | Typ | Max | Unit |
|------------------|------------------------------------|--------------------------------|-----------------|-------------------------------------|-----|-----|-----|------|
| t _{PHL} | HIGH to LOW propagation delay | CP to QS1; see Fig. 6 | 5 V [1] | 132 ns + (0.55 ns/pF)C _L | - | 160 | 320 | ns |
| | | | 10 V | 53 ns + (0.23 ns/pF)C _L | - | 65 | 130 | ns |
| | | | 15 V | 37 ns + (0.16 ns/pF)C _L | - | 45 | 90 | ns |
| | | CP to QS2; see Fig. 6 | 5 V | 92 ns + (0.55 ns/pF)C _L | - | 120 | 240 | ns |
| | | | 10 V | 39 ns + (0.23 ns/pF)C _L | - | 50 | 100 | ns |
| | | | 15 V | 32 ns + (0.16 ns/pF)C _L | - | 40 | 80 | ns |
| t _{PLH} | LOW to HIGH propagation delay | CP to QS1; see Fig. 6 | 5 V [1] | 102 ns + (0.55 ns/pF)C _L | - | 130 | 260 | ns |
| | | | 10 V | 44 ns + (0.23 ns/pF)C _L | - | 55 | 110 | ns |
| | | | 15 V | 32 ns + (0.16 ns/pF)C _L | - | 40 | 80 | ns |
| | | CP to QS2; see Fig. 6 | 5 V | 102 ns + (0.55 ns/pF)C _L | - | 130 | 260 | ns |
| | | | 10 V | 49 ns + (0.23 ns/pF)C _L | - | 60 | 120 | ns |
| | | | 15 V | 37 ns + (0.16 ns/pF)C _L | - | 45 | 90 | ns |
| t _{PZL} | OFF-state to LOW propagation delay | CP to QPn; see Fig. 6 | 5 V | | - | 240 | 480 | ns |
| | | | 10 V | | - | 80 | 160 | ns |
| | | | 15 V | | - | 55 | 110 | ns |
| | | STR to QPn; see Fig. 7 | 5 V | | - | 140 | 280 | ns |
| | | | 10 V | | - | 70 | 140 | ns |
| | | | 15 V | | - | 55 | 110 | ns |
| t _{PLZ} | LOW to OFF-state propagation delay | CP to QPn; see Fig. 6 | 5 V | | - | 170 | 340 | ns |
| | | | 10 V | | - | 75 | 150 | ns |
| | | | 15 V | | - | 60 | 120 | ns |
| | | STR to QPn; see Fig. 7 | 5 V | | - | 100 | 200 | ns |
| | | | 10 V | | - | 40 | 100 | ns |
| | | | 15 V | | - | 35 | 70 | ns |
| t _{en} | enable time | OE to QPn; see Fig. 8 | 5 V [2] | | - | 100 | 200 | ns |
| | | | 10 V | | - | 55 | 110 | ns |
| | | | 15 V | | - | 50 | 100 | ns |
| t _{dis} | disable time | OE to QPn; see Fig. 8 | 5 V [2] | | - | 80 | 160 | ns |
| | | | 10 V | | - | 40 | 80 | ns |
| | | | 15 V | | - | 30 | 60 | ns |
| t _t | transition time | QS1, QS2; see Fig. 6 | 5 V [1][3] | 35 ns + (1.00 ns/pF)C _L | - | 85 | 170 | ns |
| | | | 10 V | 19 ns + (0.42 ns/pF)C _L | - | 40 | 80 | ns |
| | | | 15 V | 16 ns + (0.28 ns/pF)C _L | - | 30 | 60 | ns |
| t _w | pulse width | CP LOW and HIGH; see Fig. 6 | 5 V | | 60 | 30 | - | ns |
| | | | 10 V | | 30 | 15 | - | ns |
| | | | 15 V | | 24 | 12 | - | ns |
| | | STR HIGH; see Fig. 7 | 5 V | | 80 | 40 | - | ns |
| | | | 10 V | | 60 | 30 | - | ns |
| | | | 15 V | | 24 | 12 | - | ns |

Table 9. Measurement points

| Supply | Input | Output | | |
|-------------|-------------|-------------|----------|----------|
| V_{DD} | V_M | V_M | V_X | V_Y |
| 5 V to 15 V | $0.5V_{DD}$ | $0.5V_{DD}$ | $0.1V_O$ | $0.9V_O$ |



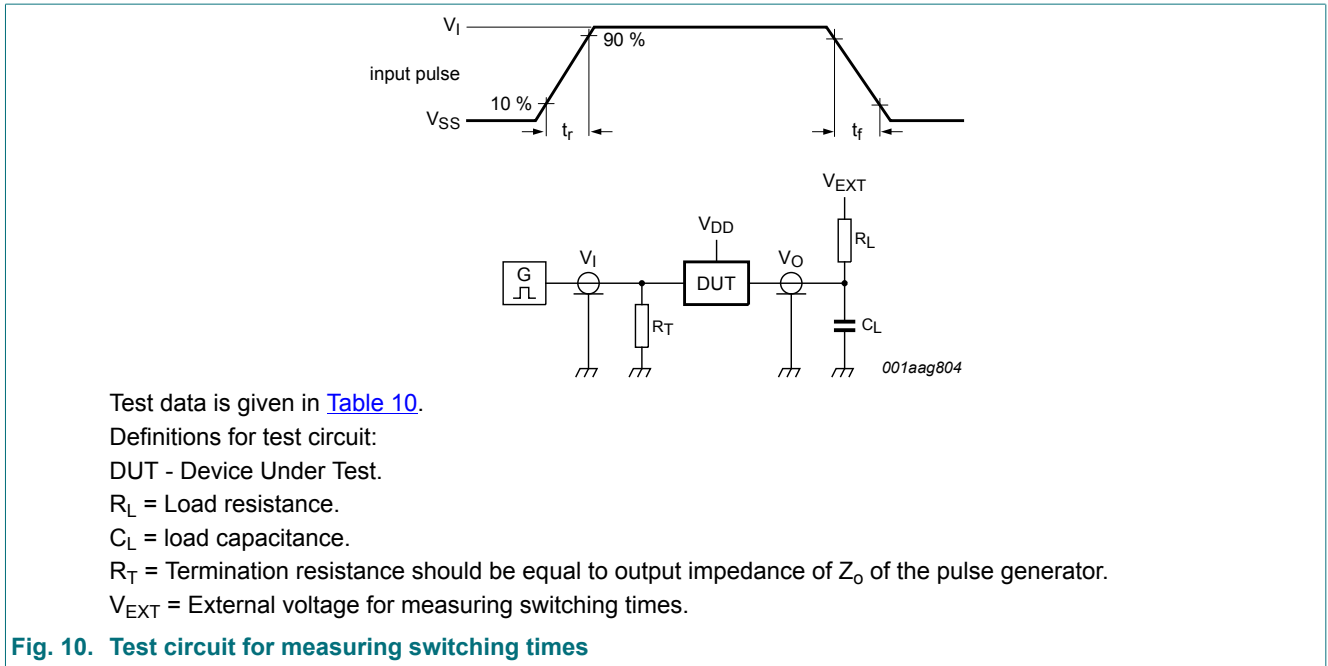


Fig. 10. Test circuit for measuring switching times

Table 10. Test data

| Supply | Input | V_{EXT} | Load |
|-------------|----------|--------------------|--------------|
| V_{DD} | V_I | t_{PLZ}, t_{PZL} | C_L |
| 5 V to 15 V | V_{DD} | t_r, t_f | R_L |
| | | ≤ 20 ns | 50 pF |
| | | V_{DD} | 1 k Ω |
| | | t_{PLH}, t_{PHL} | open |

11. Application information

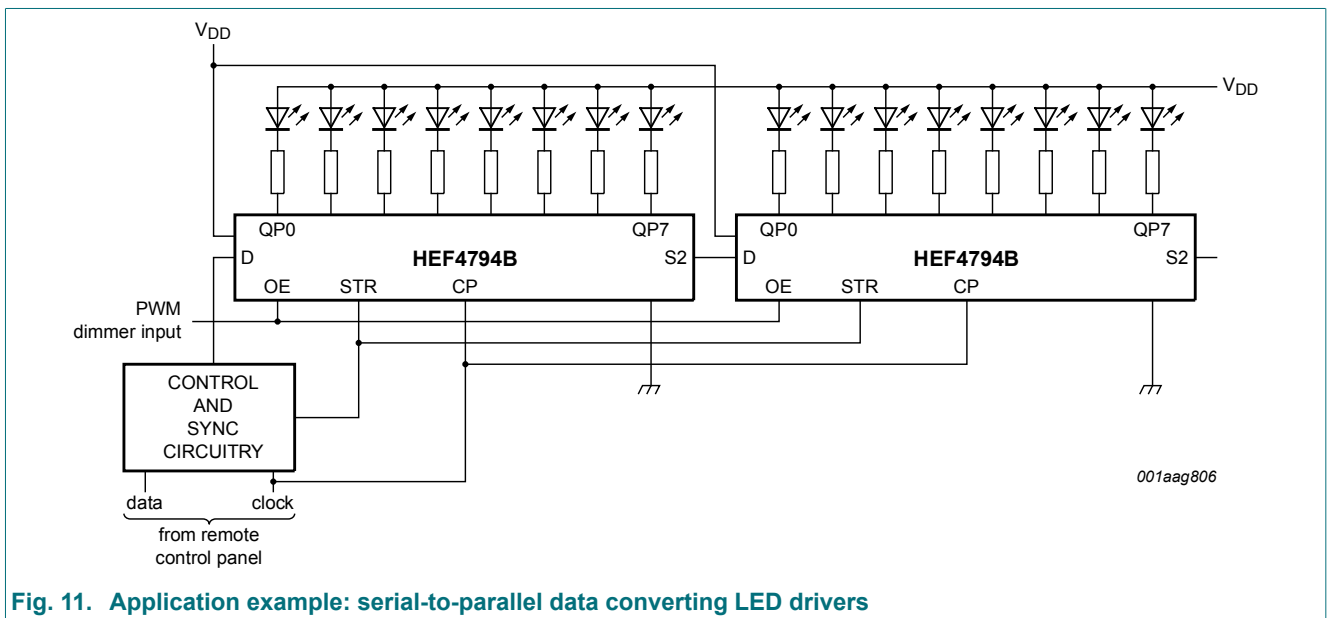
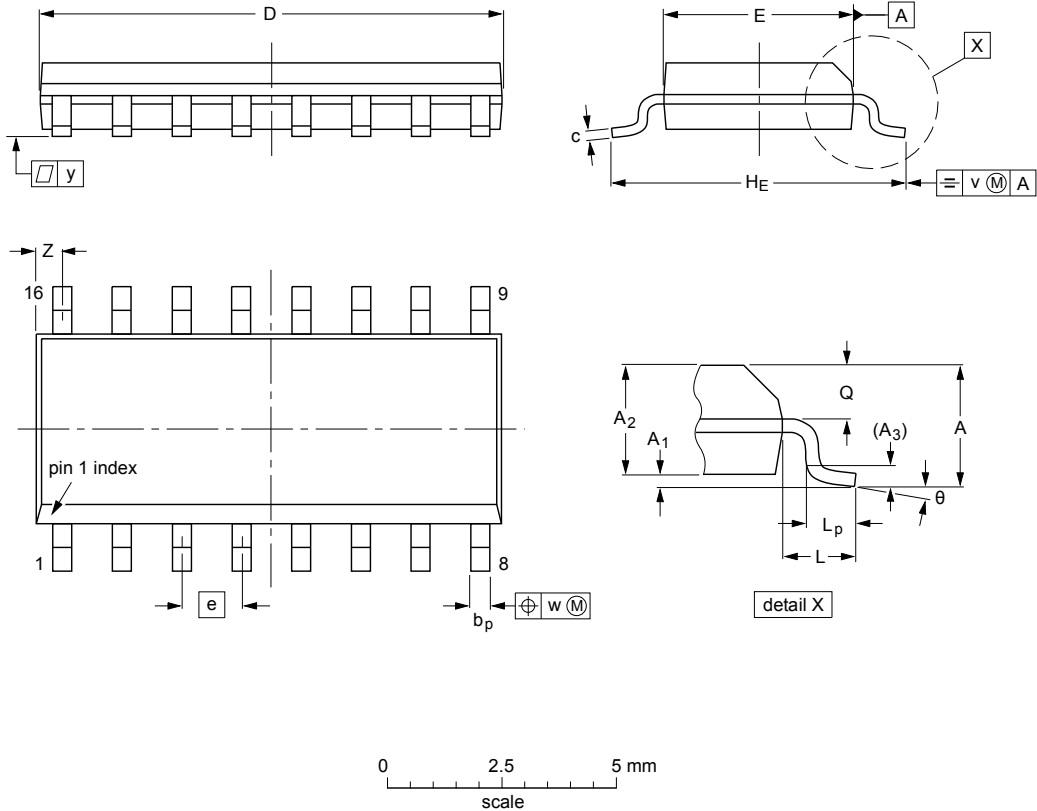


Fig. 11. Application example: serial-to-parallel data converting LED drivers

12. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 1.75 | 0.25 0.10 | 1.45 1.25 | 0.25 | 0.49 0.36 | 0.25 0.19 | 10.0 9.8 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.7 0.6 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 | 0.010 0.004 | 0.057 0.049 | 0.01 | 0.019 0.014 | 0.0100 0.0075 | 0.39 0.38 | 0.16 0.15 | 0.05 | 0.244 0.228 | 0.041 | 0.039 0.016 | 0.028 0.020 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT109-1 | 076E07 | MS-012 | | | | 99-12-27 03-02-19 |

Fig. 12. Package outline SOT109-1 (SO16)

13. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|--|--------------------|---------------|-------------------|
| HEF4794B_Q100 v.2 | 20181107 | Product data sheet | - | HEF4794B_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none">• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.• Legal texts have been adapted to the new company name where appropriate.• Fig. 5 corrected. | | | |
| HEF4794B_Q100 v.1 | 20120807 | Product data sheet | - | - |

14. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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