HEF4794B

8-stage shift-and-store register LED driver Rev. 8 — 4 April 2016

Product data sheet

1. **General description**

The HEF4794B 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 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 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.

Features and benefits 2.

- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40 °C to +85 °C and -40 °C to +125 °C
- Complies with JEDEC standard JESD 13-B

3. **Ordering information**

Ordering information

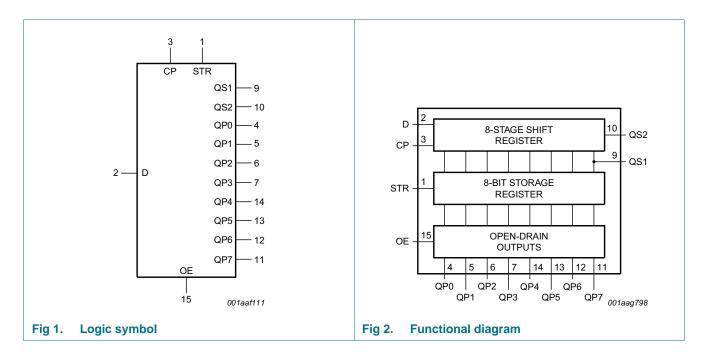
All types operate from $-40 \,^{\circ}\text{C}$ to $+125 \,^{\circ}\text{C}$.

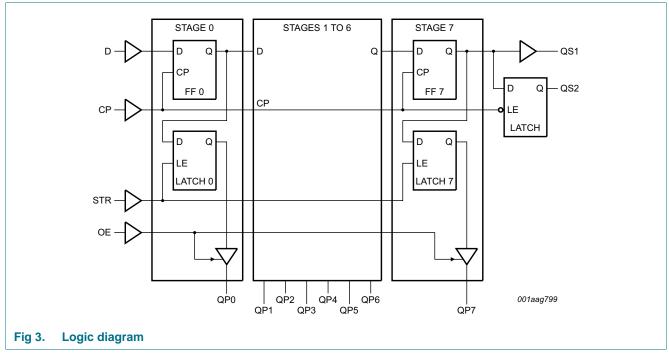
Type number	Package		
	Name	Description	Version
HEF4794BT	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1



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4. Functional diagram

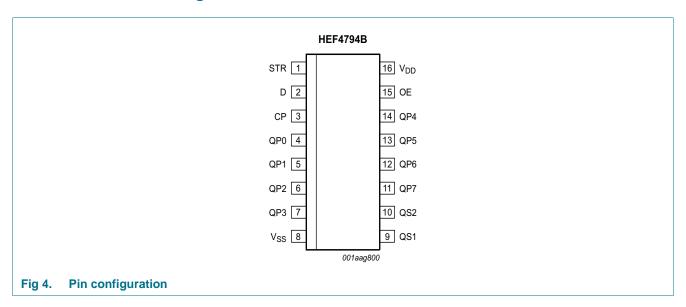




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5. Pinning information

5.1 Pinning



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
QS1	9	serial output
QS2	10	serial output
СР	3	clock input
STR	1	strobe input
OE	15	output enable input
V_{DD}	16	supply voltage
V _{SS}	8	ground (0 V)

Product data sheet

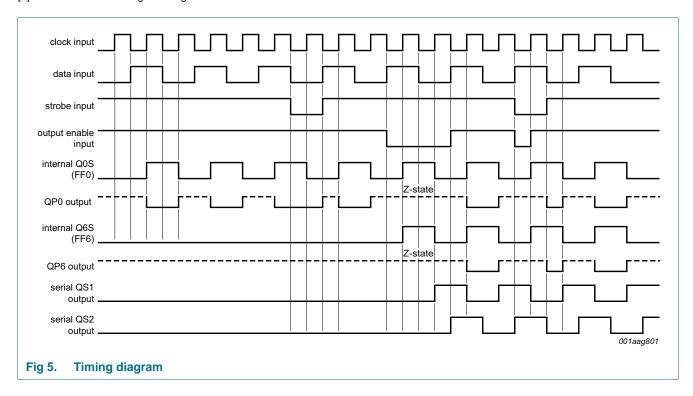
8-stage shift-and-store register LED driver

6. Functional description

Table 3. Function table [1]

Input			Parallel outp	out	Serial outpu	Serial output	
СР	OE	STR	D	QP0	QP0 QPn		QS2[3]
↑	L	Х	Х	Z	Z	Q6S	no change
\downarrow	L	X	Х	Z	Z	n.c.	Q7S
\uparrow	Н	L	Х	no change	no change	Q6S	no change
↑	Н	Н	L	Z	QPn – 1	Q6S	no change
\uparrow	Н	Н	Н	L	QPn – 1	Q6S	no change
\	Н	Н	Н	no change	no change	no change	Q7S

- [1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = ηιγη-ιμπεδανχε ΟΦΦ-στατε; \uparrow = LOW-to-HIGH clock transition; \downarrow = HIGH-to-LOW clock transition.
- [2] Q6S = the data in register stage 6 before the LOW to HIGH clock transition.
- [3] Q7S = the data in register stage 7 before the HIGH to LOW clock transition.



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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
VI	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	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$			
		SO16 package		500	mW
Р	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
VI	input voltage		0	V_{DD}	V
T _{amb}	ambient temperature	in free air	-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{DD} = 5 V	-	3.75	μs/V
		V _{DD} = 10 V	-	0.5	μs/V
		V _{DD} = 15 V	-	0.08	μs/V

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9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	V_{DD}	$T_{amb} = -40 ^{\circ}C$ T_{a}		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	I _O < 1 μA	5 V	3.5	-	3.5	-	3.5	-	3.5	-	V
	input voltage		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	I _O < 1 μA	5 V	-	1.5	-	1.5	-	1.5	-	1.5	V
	input voltage		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	QSn outputs;	5 V	4.95	-	4.95	-	4.95	-	4.95	-	V
	output voltage	$ I_{O} < 1 \mu A$	10 V	9.95	-	9.95	-	9.95	-	9.95	-	V
			15 V	14.95	-	14.95	-	14.95	-	14.95	-	V
V _{OL}	OL LOW-level	QSn outputs;	5 V	-	0.05	-	0.05	-	0.05	-	0.05	V
	output voltage	ut voltage $ I_O < 1 \mu A$	10 V	-	0.05	-	0.05	-	0.05	-	0.05	V
			15 V	-	0.05	-	0.05	-	0.05	-	0.05	V
		QPn outputs;	5 V	-	0.75	-	0.75	-	1.5	-	1.5	V
		$ I_{O} < 20 \text{ mA}$	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-leve	HIGH-level	QSn outputs										
	output current	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	QSn outputs										
	output current	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	μΑ
l _{OZ}	OFF-state	QPn output	5 V	-	2	-	2	-	15	-	15	μΑ
	output current	is HIGH;	10 V	-	2	-	2	-	15	-	15	μΑ
		$V_0 = 15 \text{ V}$	15 V	-	2	-	2	-	15	-	15	μΑ
I _{DD}	supply current	I _O = 0 A	5 V	-	5	-	5	-	150	-	150	μA
			10 V	-	10	-	10	-	300	-	300	μΑ
			15 V	-	20	-	20	-	600	-	600	μA
Cı	input capacitance		-	-	-	-	-	7.5	-	-	-	pF

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10. Dynamic characteristics

Table 7. Dynamic characteristics

 $V_{SS} = 0 \text{ V}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$ unless otherwise specified. For test circuit, see <u>Figure 10</u>.

Symbol	Parameter	Conditions	V_{DD}	Extrapolation formula	Min	Тур	Max	Unit
t _{PHL}	HIGH to LOW	CP to QS1;	5 V [1]	132 ns + (0.55 ns/pF)C _L	-	160	320	ns
	propagation delay	see <u>Figure 6</u>	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;	5 V	92 ns + (0.55 ns/pF)C _L	-	120	240	ns
		see <u>Figure 6</u>	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	CP to QS1;	5 V [1]	102 ns + (0.55 ns/pF)C _L	-	130	260	ns
	propagation delay	see Figure 6	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;	5 V	102 ns + (0.55 ns/pF)C _L	-	130	260	ns
	see <u>Figure 6</u>	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	CP to QPn;	5 V		-	240	480	ns
	propagation delay	see <u>Figure 6</u>	10 V		-	80	160	ns
			15 V		-	55	110	ns
		STR to QPn;	5 V		-	140	280	ns
		see <u>Figure 7</u>	10 V		-	70	140	ns
			15 V		-	55	110	ns
t _{PLZ}	LOW to OFF-state	CP to QPn;	5 V		-	170	340	ns
	propagation delay	see Figure 6	10 V		-	75	150	ns
			15 V		-	60	120	ns
		STR to QPn;	5 V		-	100	200	ns
		see Figure 7	10 V		-	40	100	ns
			15 V		-	35	70	ns
t _{en}	enable time	OE to QPn;	5 V [2]		-	100	200	ns
		see Figure 8	10 V		-	55	110	ns
			15 V		-	50	100	ns
t _{dis}	disable time	OE to QPn;	5 V [2]		-	80	160	ns
		see Figure 8	10 V		-	40	80	ns
			15 V		-	30	60	ns
t _t	transition time	QS1, QS2;	5 V [1][3]	35 ns + (1.00 ns/pF)C _L	-	85	170	ns
		see Figure 6	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

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 Table 7.
 Dynamic characteristics ...continued

 $V_{SS} = 0 \text{ V}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$ unless otherwise specified. For test circuit, see <u>Figure 10</u>.

Symbol	Parameter	Conditions	V_{DD}	Extrapolation formula	Min	Тур	Max	Unit
t _W	pulse width	CP; LOW and	5 V		60	30	-	ns
		HIGH;	10 V		30	15	-	ns
		see <u>Figure 6</u>	15 V		24	12	-	ns
		STR; HIGH;	5 V		80	40	-	ns
		see Figure 7	10 V		60	30	-	ns
		15 V		24	12	-	ns	
t _{su} set-up time	set-up time	D to CP; see Figure 9	5 V		60	30	-	ns
			10 V		20	10	-	ns
			15 V		15	5	-	ns
t _h	hold time	D to CP;	5 V		+5	-15	-	ns
		see Figure 9	10 V		20	5	-	ns
			15 V		20	5	-	ns
f _{clk(max)}	maximum clock	CP; see Figure 6	5 V		5	10	-	MHz
	frequency		10 V		11	22	-	MHz
			15 V		14	28	-	MHz

^[1] The typical values of the propagation delay and transition times are calculated from the extrapolation formulas shown (C_L in pF).

Table 8. Dynamic power dissipation

 P_D can be calculated from the formulas shown. $V_{SS} = 0$ V; $t_r = t_f \le 20$ ns; $T_{amb} = 25$ °C.

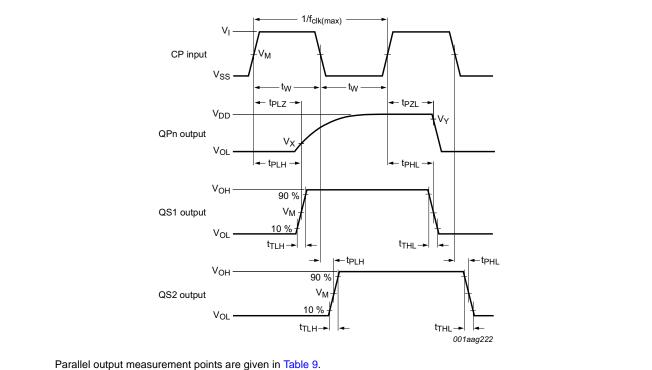
Symbol	Parameter	V_{DD}	Typical formula	Where
P_D	dynamic power dissipation	5 V	$P_D = 1200 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 \mu W$	f_i = input frequency in MHz;
		10 V	$P_D = 5550 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 \mu W$	f _o = output frequency in MHz;
		15 V	$P_D = 15000 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 \mu W$	C _L = output load capacitance in pF;
				$\Sigma(f_0 \times C_L) = \text{sum of the outputs};$
				V_{DD} = supply voltage in V.

^[2] t_{en} is the same as t_{PZL} and t_{dis} is the same as t_{PLZ}

^[3] t_t is the same as t_{TLH} and t_{THL}

8-stage shift-and-store register LED driver

11. Waveforms



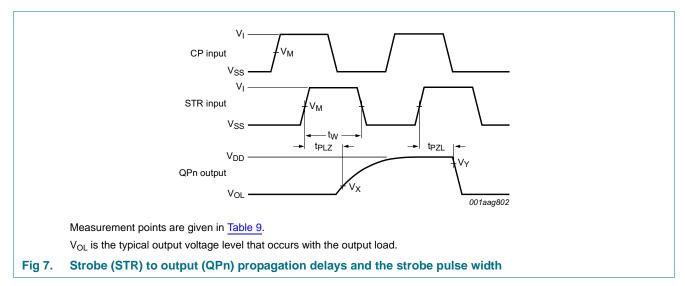
raiallei output measurement points are given in <u>Table 9</u>.

 $V_{\mbox{\scriptsize OL}}$ and $V_{\mbox{\scriptsize OH}}$ are typical output voltage levels that occur with the output load.

Fig 6. Propagation delay clock (CP) to output (QPn, QS1, QS2), clock pulse width and maximum clock frequency

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			



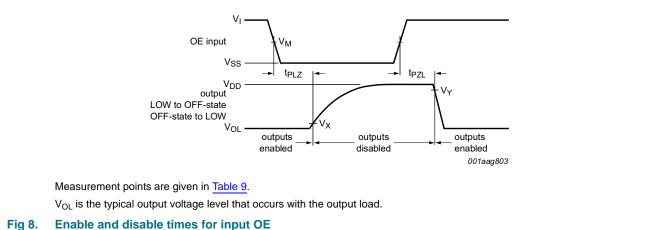
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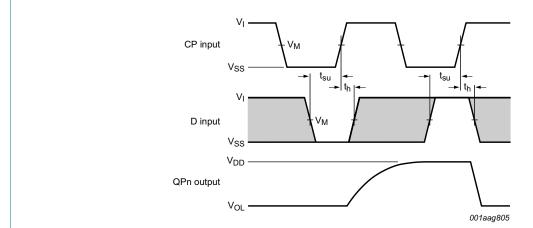
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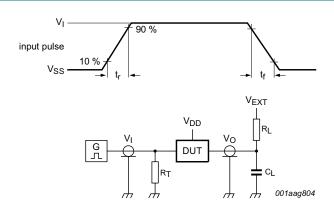
Measurement points are given in Table 9.

The shaded areas indicate when the input is permitted to change for predictable output performance.

V_{OL} is the typical output voltage level that occurs with the output load.

Fig 9. Set-up and hold times for the data input (D)

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Test data is given in Table 10.

Definitions for test circuit:

DUT - Device Under Test.

 R_L = Load resistance.

 C_L = load capacitance.

 R_T = Termination resistance should be equal to output impedance of Z_o of the pulse generator.

 V_{EXT} = External voltage for measuring switching times.

Fig 10. Test circuit for measuring switching times

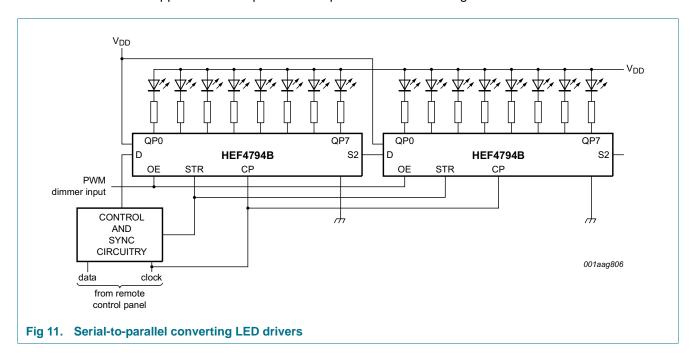
Table 10. Test data

Supply	Supply Input		V _{EXT}		Load		
V_{DD}	$_{\mathrm{D}}$ $\mathrm{V_{l}}$ $\mathrm{t_{r},t_{f}}$		t _{PLZ} , t _{PZL}	t _{PLH} , t _{PHL}	CL	R _L	
5 V to 15 V	V_{DD}	≤ 20 ns	V_{DD}	open	50 pF	1 kΩ	

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12. Application information

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

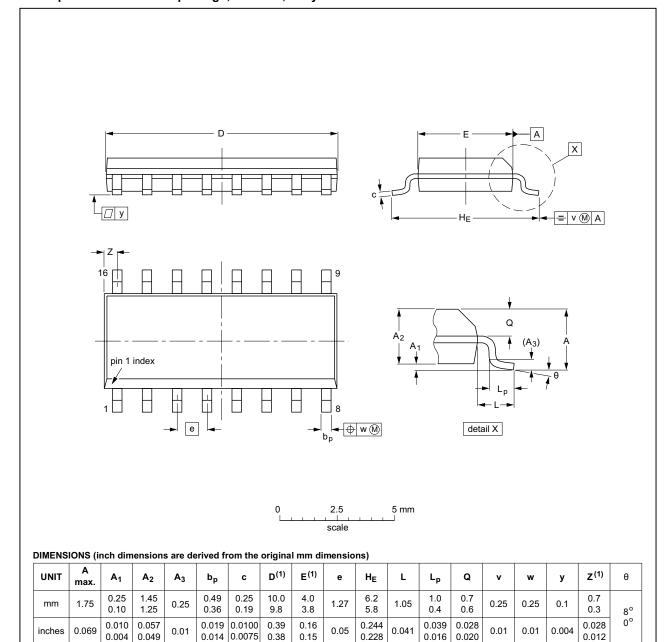


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13. Package outline

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

SOT109-1



Note

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

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA	PROJECTION	1990E DATE	
SOT109-1	076E07	MS-012			99-12-27 03-02-19	

Fig 12. Package outline SOT109-1 (SO16)

HEF4794B

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8-stage shift-and-store register LED driver

14. Revision history

Table 11. Revision history

	•					
Document ID	Release date	Data sheet status	Change notice	Supersedes		
HEF4794B v.8	20160404	Product data sheet	-	HEF4794B v.7		
Modifications:	Type numb	Type number HEF4794BP (SOT38-4) removed.				
HEF4794B v.7	20111116	Product data sheet	-	HEF4794B v.6		
Modifications:	Section Applications removed					
	• <u>Table 6</u> :					
	 I_{OH} minimum values changed to maximum 					
	 added the unit pF for C_I 					
HEF4794B v.6	20100901	Product data sheet	-	HEF4794B v.5		
HEF4794B v.5	20100402	Product data sheet	-	HEF4794B v.4		
HEF4794B v.4	20091222	Product data sheet	-	HEF4794B v.3		
HEF4794B v.3	20080812	Product data sheet	-	HEF4794B v.2		
HEF4794B v.2	19990630	Product specification	-	HEF4794B v.1		
HEF4794B v.1	19940701	Product specification	-	-		

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15. Legal information

15.1 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.

- Please consult the most recently issued document before initiating or completing a design.
- The term 'short data sheet' is explained in section "Definitions"
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8-stage shift-and-store register LED driver

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8-stage shift-and-store register LED driver

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