1. General description

The HEF4894B is a 12-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 QP11). Data is shifted on positive-going clock (CP) transitions. The data in each shift register stage is transferred to the storage register when the strobe (STR) input is HIGH. Data in the storage register appears at the output whenever the output enable (OE) input signal is HIGH.

Two serial outputs (QS1 and QS2) are available for cascading a number of HEF4894B 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 HEF4894B 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.

2. Features and benefits

- Wide supply voltage range from 3.0 V to 15.0 V
- · CMOS low power dissipation
- High noise immunity
- · Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Complies with JEDEC standard JESD 13-B
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

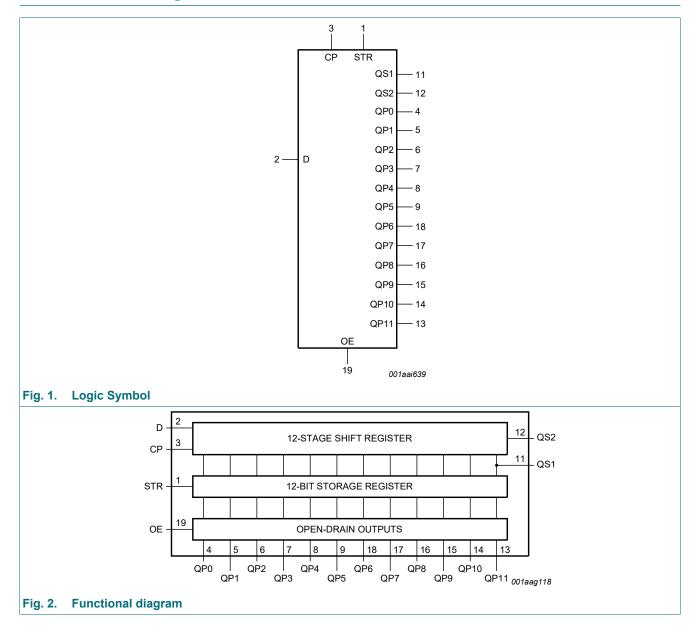
Table 1. Ordering information

Type number	Package	Package							
	Temperature range	Name	Description	Version					
HEF4894BT	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1					
HEF4894BTT	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1					

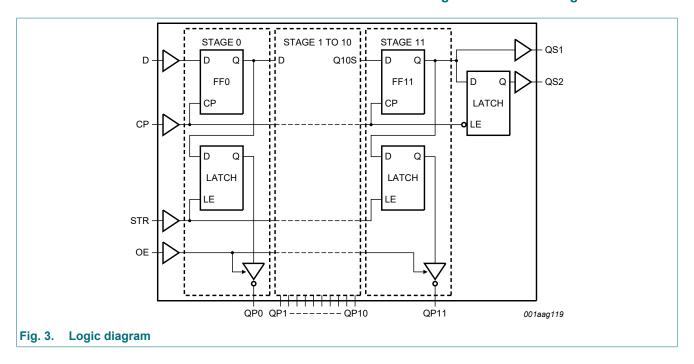


12-stage shift-and-store register LED driver

4. Functional diagram

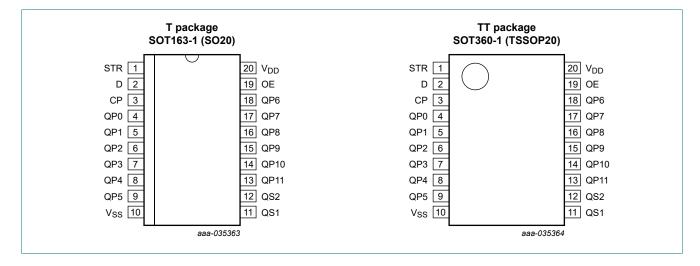


12-stage shift-and-store register LED driver



5. Pinning information

5.1. Pinning



12-stage shift-and-store register LED driver

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
D	2	serial input
QP0 to QP11	4, 5, 6, 7, 8, 9, 18, 17, 16, 15, 14, 13	parallel output
QS1	11	serial output
QS2	12	serial output
СР	3	clock input
STR	1	strobe input
OE	19	output enable input
V_{DD}	20	supply voltage
V _{SS}	10	ground (0 V)

6. Functional description

Table 3. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care; \ \uparrow = LOW-to-HIGH \ clock \ transition;$

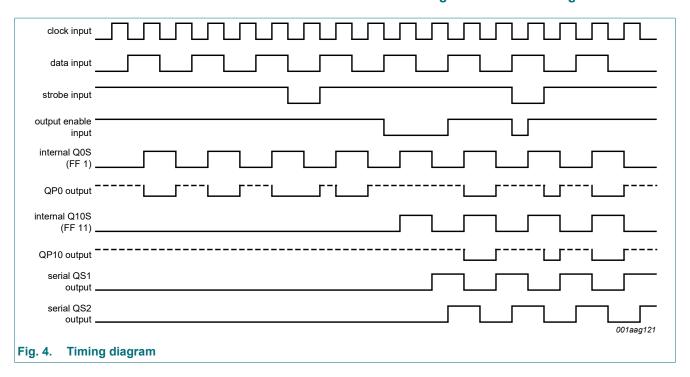
↓ = HIGH-to-LOW clock transition; Z = high-impedance OFF-state.

At the LOW-to-HIGH clock transition, the information in the 10th register stage is transferred to the 11th register stage and the QS output.

Control	Control			Parallel outp	ut	Serial outpu	Serial output		
СР	OE STR		D	QP0	QPn	QS1[1]	QS2[2]		
1	L	X	X	Z	Z	Q10S	no change		
1	L	X	X	Z	Z	no change	Q11S		
1	Н	L	X	no change	no change	Q10S	no change		
1	Н	Н	L	Z	QPn - 1	Q10S	no change		
1	Н	Н	Н	L	QPn - 1	Q10S	no change		
1	Н	Н	Н	no change	no change	no change	Q11S		

- [1] Q10S = the data in register stage 10 before the LOW-to-HIGH clock transition.
- [2] Q11S = the data in register stage 11 before the HIGH-to-LOW clock transition.

12-stage shift-and-store register LED driver



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
lok	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 V	-	40	mA
I _I	input leakage current		-	±10	mA
Io	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 °C to +125 °C	[1] -	500	mW
Р	power dissipation	per output	-	100	mW

^[1] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C. For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

	······································									
Symbol	Parameter	Conditions	Min	Тур	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				

HEF4894B

12-stage shift-and-store register LED driver

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
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

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	onditions V_{DD} $T_{amb} = -40 ^{\circ}\text{C}$ $T_{amb} = +25$		+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 μΑ	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 μA	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	QSn outputs;	5 V	-	0.05	-	0.05	-	0.05	-	0.05	V
	output voltage	e I _O < 1 μA	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 mA	10 V	-	0.75	-	0.75	-	1.5	-	1.5	V
				15 V	-	0.75	-	0.75	-	1.5	-	1.5
I _{OH}	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	-	3.2	-	2.4	-	2.4	-	mA
l _l	input leakage current		15 V	-	±0.1	-	±0.1	-	±1.0	-	±1.0	μA
I _{OZ}	OFF-state	QPn output	5 V	-	2	-	2	-	15	-	15	μA
	output current	is HIGH;	10 V	-	2	-	2	-	15	-	15	μΑ
		V _O = 15 V	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

6 / 15

12-stage shift-and-store register LED driver

10. Dynamic characteristics

Table 7. Dynamic characteristics

 V_{SS} = 0 V; T_{amb} = 25 °C unless otherwise specified. For test circuit see Fig. 9.

Symbol	Parameter	Conditions	V_{DD}		Extrapolation formula	Min	Тур	Max	Unit
t _{PHL}	HIGH to LOW	CP to QS1; see Fig. 5	5 V	[1]	132 ns + (0.55 ns/pF)C _L	-	160	320	ns
	propagation delay		10 V		53 ns + (0.23 ns/pF)C _L	-	65	130	ns
	uciay		15 V		37 ns + (0.16 ns/pF)C _L	-	45	90	ns
		CP to QS2; see Fig. 5	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}		CP to QS1; see Fig. 5	5 V	[1]	102 ns + (0.55 ns/pF)C _L	-	130	260	ns
	propagation delay		10 V		44 ns + (0.23 ns/pF)C _L	-	55	110	ns
	uciay		15 V		32 ns + (0.16 ns/pF)C _L	-	40	80	ns
		CP to QS2; see Fig. 5	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	CP to QPn; see Fig. 5	5 V			-	240	480	ns
	to LOW propagation		10 V			-	80	160	ns
	delay		15 V			-	55	110	ns
		STR to QPn; see Fig. 6	5 V			-	140	280	ns
			10 V			-	70	140	ns
			15 V			-	55	110	ns
t _{PLZ}	LOW to	CP to QPn; see Fig. 5 and Fig. 6 STR to QPn; see Fig. 6	5 V			-	170	340	ns
	OFF-state propagation delay		10 V			-	75	150	ns
			15 V			-	60	120	ns
			5 V			-	100	200	ns
			10 V			-	40	100	ns
			15 V			-	35	70	ns
t _{en}	enable time	OE to QPn; see Fig. 7	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. 7	5 V	[2]		-	80	160	ns
			10 V			-	40	80	ns
			15 V			-	30	60	ns
t _t	transition time	QS1, QS2; see Fig. 5	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;	5 V			60	30	-	ns
		see <u>Fig. 5</u>	10 V			30	15	-	ns
			15 V			24	12	-	ns
		STR; HIGH; see Fig. 6	5 V			80	40	-	ns
			10 V			60	30	-	ns
			15 V			24	12	-	ns

12-stage shift-and-store register LED driver

Symbol	Parameter	Conditions	V_{DD}	Extrapolation formula	Min	Тур	Max	Unit
t _{su}	set-up time	D to CP; see Fig. 8	5 V		60	30	-	ns
			10 V		20	10	-	ns
			15 V		15	5	- n:	ns
t _h	hold time	D to CP; see Fig. 8	5 V		+5		ns	
			10 V		20		ns	
			15 V		20	5	- n - n - n - n - n - n	ns
f _{clk(max)}	maximum CP; see Fig. 5 clock frequency	CP; see Fig. 5	5 V		5	10	-	MHz
			10 V		11	22	-	MHz
	licquerioy		15 V		14	28	-	MHz

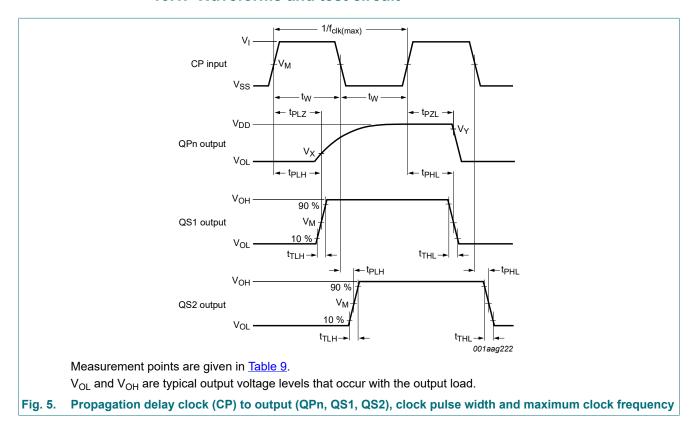
- [1] The typical values of the propagation delay and transition times are calculated from the extrapolation formulas shown (C_L in pF).
- [2] t_{en} is the same as t_{PZL} and t_{dis} is the same as t_{PLZ} .
- [3] t_t is the same as t_{TLH} and t_{THL} .

Table 8. Dynamic power dissipation

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

Symbol	Parameter	V_{DD}	Typical formula	Where
-	dynamic power	5 V	1 (0 2) 55 1	f _i = input frequency in MHz;
	lissipation 10 V	10 V	Pn = 3330 × 1; + Z(1, × C;) × Vnn	f _o = output frequency in MHz; C _I = output load capacitance in pF;
		15 V		$\Sigma(f_o \times C_L)$ = sum of the outputs; V_{DD} = supply voltage in V.

10.1. Waveforms and test circuit

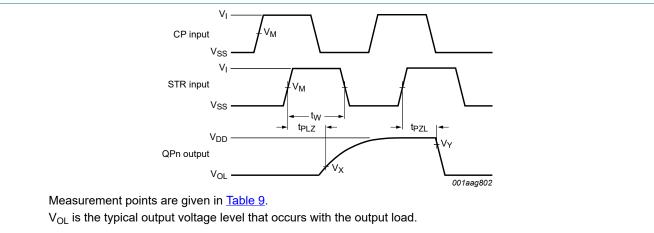


8 / 15

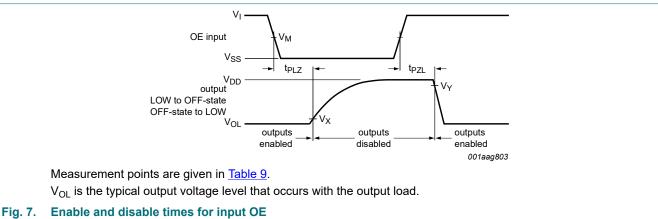
12-stage shift-and-store register LED driver

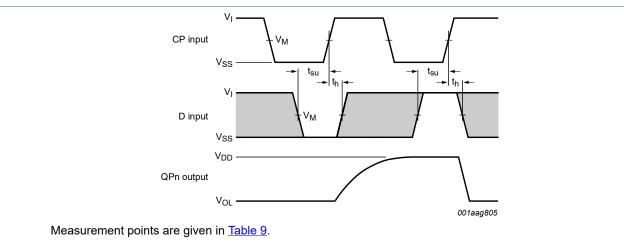
Table 9. Measurement points

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		



Strobe (STR) to output (QPn) propagation delays and the strobe pulse width Fig. 6.



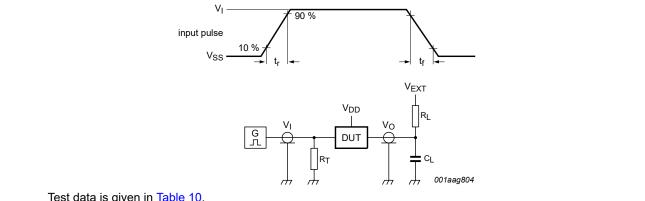


V_{OL} is a typical output voltage level that occurs with the output load.

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

Set-up and hold times for the data input (D) Fig. 8.

12-stage shift-and-store register LED driver



Test data is given in Table 10.

Definitions for test circuit:

R_L = Load resistance;

C_L = load capacitance;

 R_T = Termination resistance should be equal to output impedance of Z_0 of the pulse generator;

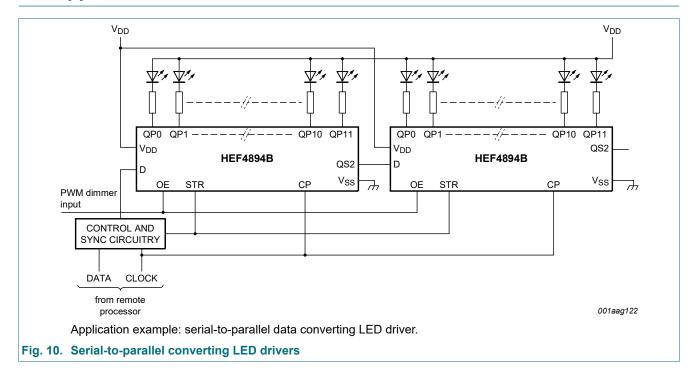
V_{EXT} = External voltage for measuring switching times.

Test circuit for measuring switching times Fig. 9.

Table 10. Test data

Supply Input		V _{EXT}		Load		
V_{DD}	V _I 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

11. Application information

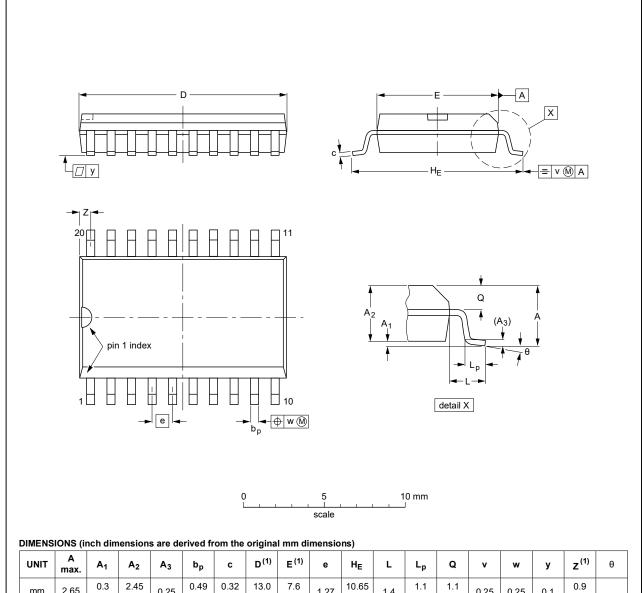


12-stage shift-and-store register LED driver

12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	z ⁽¹⁾	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	0°

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

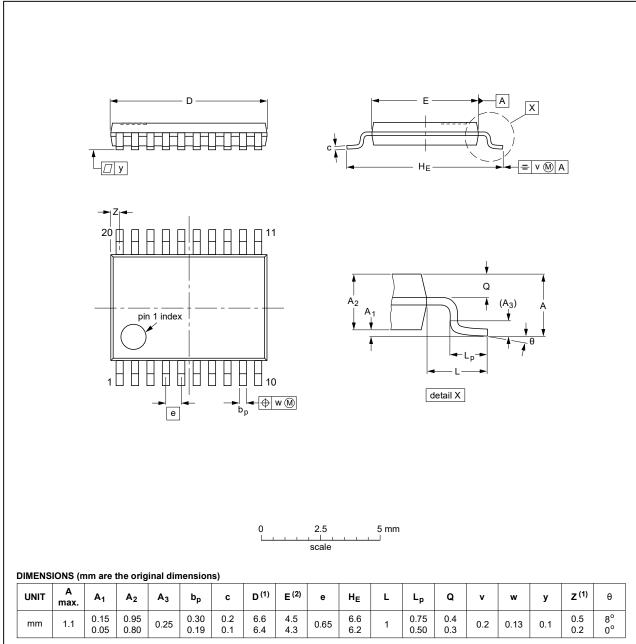
OUTLINE		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	1330E DATE	
SOT163-1	075E04	MS-013				99-12-27 03-02-19	

Fig. 11. Package outline SOT163-1 (SO20)

12-stage shift-and-store register LED driver

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT360-1		MO-153				-99-12-27 03-02-19

Fig. 12. Package outline SOT360-1 (TSSOP20)

12-stage shift-and-store register LED driver

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
НВМ	Human Body Model
JEDEC	Joint Electron Device Engineering Council
LED	Light Emitting Diode

14. Revision history

Table 12. Revision history

Release date	Data sheet status	Change notice	Supersedes		
20240813	Product data sheet	-	HEF4894B v.10		
Section 2: E	SD specification updated a	according to the la	atest JEDEC standard.		
20211123	Product data sheet	-	HEF4894B v.9		
The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.					
Section 2 up	odated.				
		power dissipation	1		
		-	HEF4894B v.8		
Type number	er HEF4894BP (SOT146-1) removed.			
20111122	Product data sheet	-	HEF4894B v.7		
		to maximum			
20100813	Product data sheet	-	HEF4894B v.6		
20100408	Product data sheet	-	HEF4894B v.5		
20091222	Product data sheet	-	HEF4894B v.4		
20080827	Product data sheet	-	HEF4894B_CNV v.3		
19950101	Product specification	-	HEF4894B_CNV v.2		
19950101	Product specification	-	-		
	20240813 • Section 2: E 20211123 • The format of guidelines of e • Legal texts • Section 2 up • Section 7: E 20160418 • Type number 20111122 • Section App • Table 6: I _{OH} 20100813 20100408 20091222 20080827 19950101	20240813 Product data sheet • Section 2: ESD specification updated at 20211123 Product data sheet • The format of this data sheet has been guidelines of Nexperia. • Legal texts have been adapted to the respection 2 updated. • Section 2 updated. • Section 7: Derating values for Ptot total 20160418 Product data sheet • Type number HEF4894BP (SOT146-1 20111122 Product data sheet • Section Applications removed • Table 6: IOH minimum values changed 20100813 Product data sheet 20100408 Product data sheet 20091222 Product data sheet 20080827 Product data sheet 19950101 Product specification	20240813 Product data sheet • Section 2: ESD specification updated according to the late 20211123 Product data sheet • The format of this data sheet has been redesigned to conguidelines of Nexperia. • Legal texts have been adapted to the new company name section 2 updated. • Section 7: Derating values for Ptot total power dissipation 20160418 Product data sheet • Type number HEF4894BP (SOT146-1) removed. 20111122 Product data sheet • Section Applications removed • Table 6: IOH minimum values changed to maximum 20100813 Product data sheet 20100408 Product data sheet 20091222 Product data sheet		

Product data sheet

15. 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.		

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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12-stage shift-and-store register LED driver

Contents

1. General descripti	on′
2. Features and ben	efits
3. Ordering informa	tion
4. Functional diagra	ım:
5. Pinning informati	on
5.1. Pinning	
5.2. Pin description	
6. Functional descri	ption
7. Limiting values	
8. Recommended or	perating conditions
9. Static characteris	tics
10. Dynamic charac	teristics
10.1. Waveforms and	test circuit
11. Application info	rmation10
12. Package outline	1 [,]
13. Abbreviations	1
14. Revision history	[,] 1
15. Legal information	on14

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Product data sheet

15 / 15

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