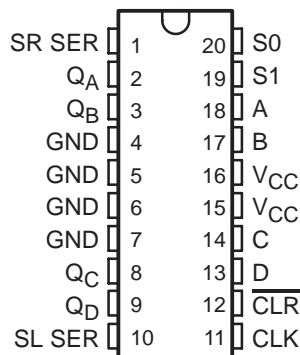


- Parallel-to-Serial, Serial-to-Parallel Conversions
- Left or Right Shifts
- Parallel Synchronous Loading
- Direct Overriding Clear
- Temporary Data Latching Capability
- Flow-Through Architecture to Optimize PCB Layout
- Center-Pin  $V_{CC}$  and GND Configurations to Minimize High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1- $\mu$ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic Small-Outline Packages, and Standard Plastic 300-mil DIPs

DW OR N PACKAGE  
(TOP VIEW)



## description

This bidirectional shift register features parallel outputs, right-shift and left-shift serial inputs, operating-mode-control inputs, and a direct overriding clear line. The register has four distinct modes of operation:

- Parallel (broadside) load
- Shift right (in the direction  $Q_A$  toward  $Q_D$ )
- Shift left (in the direction  $Q_D$  toward  $Q_A$ )
- Inhibit clocking (do nothing).

Synchronous parallel loading is accomplished by applying the 4 bits of data and taking both mode control inputs, S0 and S1, high. The data are loaded into the associated flip-flops and appear at the outputs after the positive transition of the clock input. During loading, serial data flow is inhibited.

Shift right is accomplished synchronously with the rising edge of the clock pulse when S0 is high and S1 is low. Serial data for this mode is entered at the shift-right data input. When S0 is low and S1 is high, data shifts left synchronously, and new data is entered at the shift-left serial inputs. Clocking of the flip-flop is inhibited when both mode control inputs are low.

The 74AC11194 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

EPIC is a trademark of Texas Instruments Incorporated.

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.



# 74AC11194 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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Function Table

INPUTS										OUTPUTS			
CLEAR	MODE		CLOCK	SERIAL		PARALLEL				Q <sub>A</sub>	Q <sub>B</sub>	Q <sub>C</sub>	Q <sub>D</sub>
	S <sub>1</sub>	S <sub>0</sub>		LEFT	RIGHT	A	B	C	D				
L	X	X	X	X	X	X	X	X	X	L	L	L	L
H	X	X	L	X	X	X	X	X	X	Q <sub>AO</sub>	Q <sub>BO</sub>	Q <sub>CO</sub>	Q <sub>DO</sub>
H	H	H	↑	X	X	a	b	c	d	a	b	c	d
H	L	H	↑	X	H	X	X	X	X	H	Q <sub>An</sub>	Q <sub>Bn</sub>	Q <sub>Cn</sub>
H	L	H	↑	X	L	X	X	X	X	L	Q <sub>An</sub>	Q <sub>Bn</sub>	Q <sub>Cn</sub>
H	H	L	↑	H	X	X	X	X	X	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	H
H	H	L	↑	L	X	X	X	X	X	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	L
H	L	L	X	X	X	X	X	X	X	Q <sub>AO</sub>	Q <sub>BO</sub>	Q <sub>CO</sub>	Q <sub>DO</sub>

H = high level (steady state)

L = low level (steady state)

X = irrelevant (any input, including transitions)

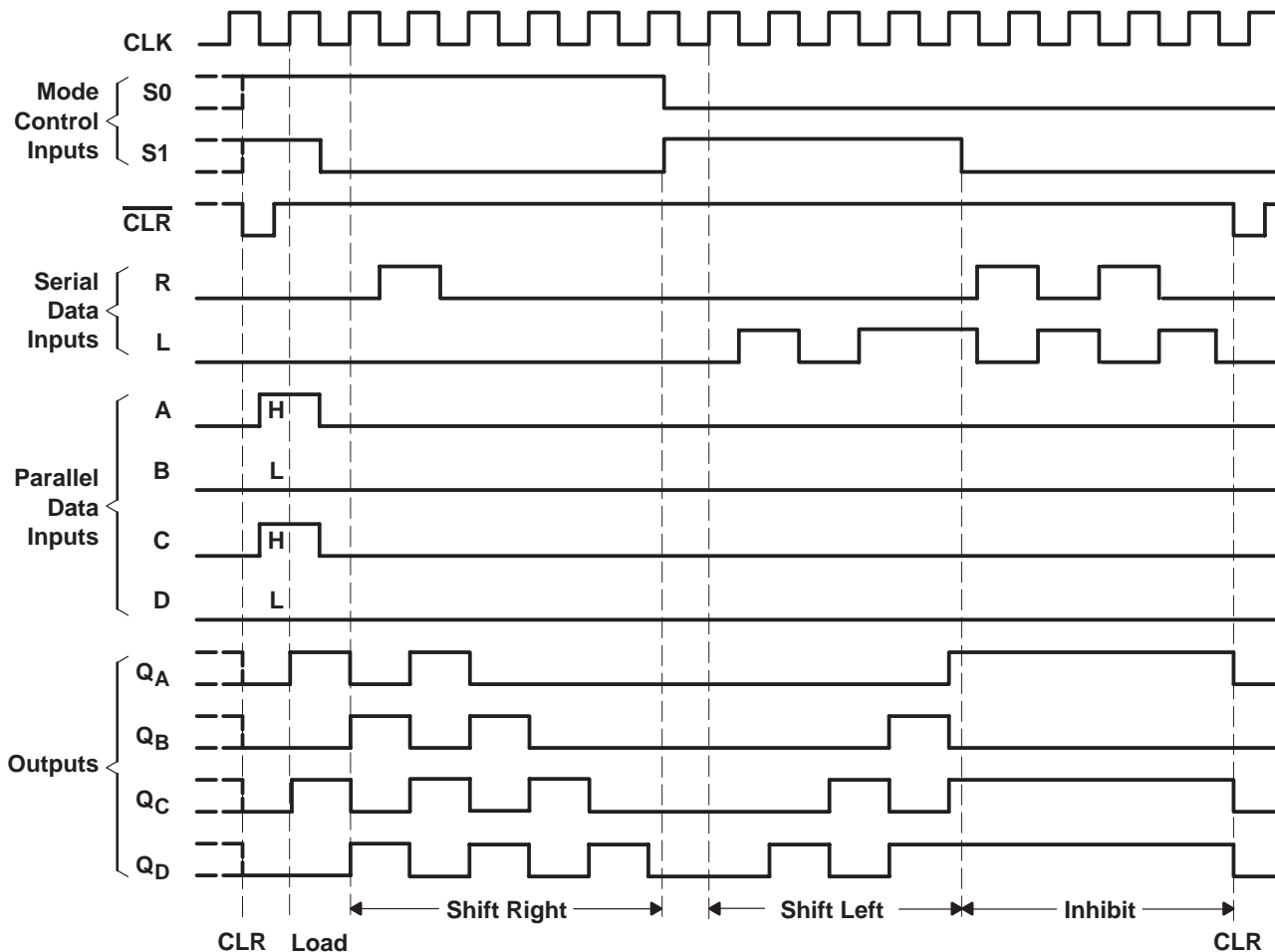
↑ = transition from low to high level

a,b,c,d = the level of steady-state input at inputs A, B, C, or D, respectively.

Q<sub>AO</sub>, Q<sub>BO</sub>, Q<sub>CO</sub>, Q<sub>DO</sub> = the level of Q<sub>A</sub>, Q<sub>B</sub>, Q<sub>C</sub>, or Q<sub>D</sub>, respectively, before the indicated steady-state input conditions were established.

Q<sub>An</sub>, Q<sub>Bn</sub>, Q<sub>Cn</sub>, Q<sub>Dn</sub> = the level of Q<sub>A</sub>, Q<sub>B</sub>, Q<sub>C</sub>, or Q<sub>D</sub> respectively, before the most-recent ↑ transition of the clock.

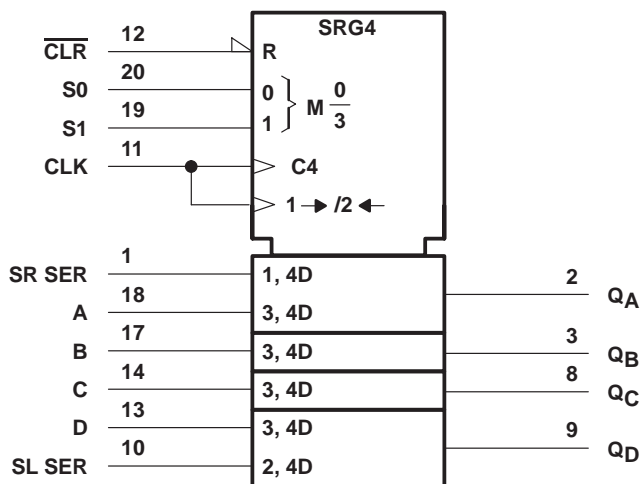
## timing clear, load, right-shift, inhibit, and clear sequences



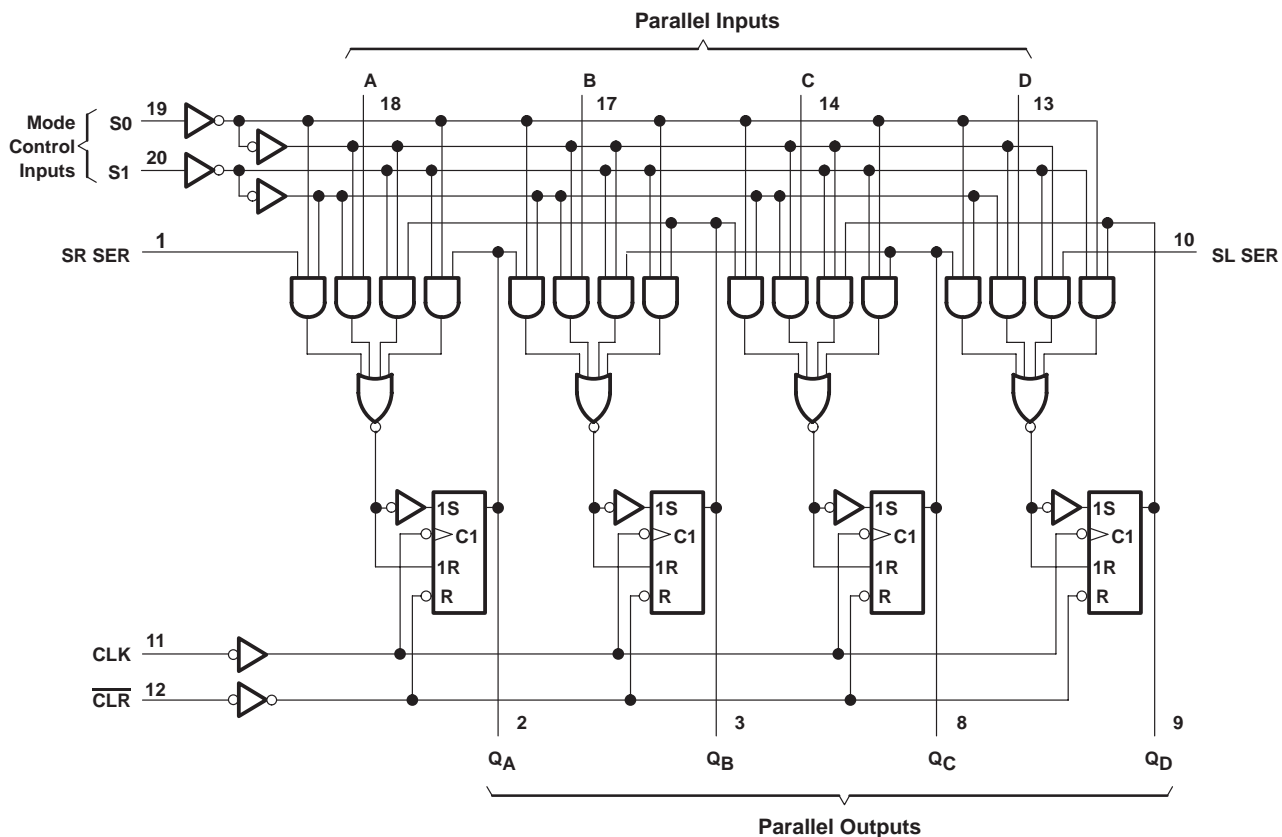
4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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logic symbol†



logic diagram (positive logic)



# 74AC11194

## 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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

Supply voltage range, $V_{CC}$	-0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	$\pm 50$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND pins	$\pm 100$ mA
Storage temperature range	-65°C to 150°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: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### recommended operating conditions

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	3	5	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 3$ V	2.1		V
		$V_{CC} = 4.5$ V	3.15		
		$V_{CC} = 5.5$ V	3.85		
$V_{IL}$	Low-level input voltage	$V_{CC} = 3$ V		0.9	V
		$V_{CC} = 4.5$ V		1.35	
		$V_{CC} = 5.5$ V		1.65	
$I_{OH}$	High-level output current	$V_{CC} = 3$ V		-4	mA
		$V_{CC} = 4.5$ V		-24	
		$V_{CC} = 5.5$ V		-24	
$I_{OL}$	Low-level output current	$V_{CC} = 3$ V		12	mA
		$V_{CC} = 4.5$ V		24	
		$V_{CC} = 5.5$ V		24	
$V_I$	Input voltage	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	V
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	ns/V
$T_A$	Operating free-air temperature	-40		85	°C

## 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
V <sub>OH</sub>	I <sub>OH</sub> = - 50 μA	3 V	2.9			2.9		V
		4.5 V	4.4			4.4		
		5.5 V	5.4			5.4		
	I <sub>OH</sub> = - 4 mA	3 V	2.58			2.48		
		4.5 V	3.94			3.8		
		5.5 V	4.94			4.8		
I <sub>OH</sub> = - 75 mA <sup>†</sup>	5.5 V				3.85			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	3 V				0.1		V
		4.5 V				0.1		
		5.5 V				0.1		
	I <sub>OL</sub> = 12 mA	3 V				0.36		
		4.5 V				0.36		
	I <sub>OL</sub> = 24 mA	4.5 V				0.36		
		5.5 V				0.36		
I <sub>OL</sub> = 75 mA <sup>†</sup>	5.5 V				1.65			
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V				± 0.1		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V				8		μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V				4		pF

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

timing requirements over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER		T <sub>A</sub> = 25°C		MIN	MAX	UNIT
		MIN	MAX			
f <sub>clock</sub>	Clock frequency	0	90	0	90	MHz
t <sub>w</sub>	Pulse duration	CLK high	5.5	5.5		ns
		CLK low	5.5	5.5		
		$\overline{\text{CLR}}$ low	4.5	4.5		
t <sub>su</sub>	Setup time before CLK ↑	Select	5	5		ns
		Data	4	4		
t <sub>h</sub>	Hold time after CLK ↑	Select	1.5	1.5		ns
		Data	0.5	0.5		
t	Recovery time	1	1		ns	



# 74AC11194

## 4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER

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timing requirements over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER		$T_A = 25^\circ\text{C}$		MIN	MAX	UNIT
		MIN	MAX			
$f_{\text{clock}}$	Clock frequency	0	100	0	100	MHz
$t_w$	Pulse duration	CLK high	5	5		ns
		CLK low	5	5		
		$\overline{\text{CLR}}$ low	4.5	4.5		
$t_{\text{su}}$	Setup time before CLK $\uparrow$	Select	4	4		ns
		Data	2.5	2.5		
$t_h$	Hold time after CLK $\uparrow$	Select	1.5	1.5		ns
		Data	1	1		
$t$	Recovery time	1		1		ns

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
			MIN	TYP	MAX			
$f_{\text{max}}$			90	120		90		MHz
$t_{\text{PHL}}$	CLK	Any Q	1	5.8	8.4	1	9.5	ns
$t_{\text{PLH}}$			1	6.6	8.9	1	10.2	
$t_{\text{PHL}}$	$\overline{\text{CLR}}$	Any Q	1.7	7.1	9.5	1.7	10.7	ns

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

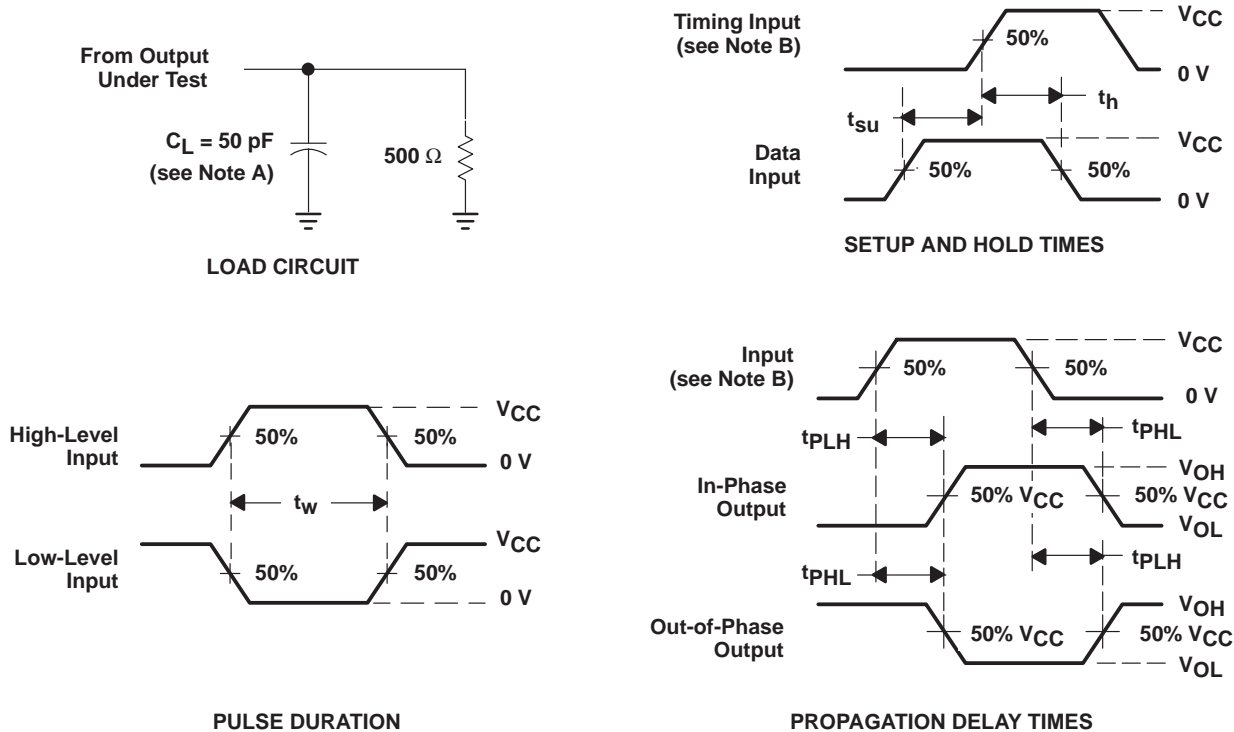
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
			MIN	TYP	MAX			
$f_{\text{max}}$			100	130		100		MHz
$t_{\text{PHL}}$	CLK	Any Q	0.8	3.9	6.2	0.8	6.8	ns
$t_{\text{PLH}}$			1.1	4.4	6.6	1.1	7.7	
$t_{\text{PHL}}$	$\overline{\text{CLR}}$	Any Q	1.5	4.6	7	1.5	7.8	ns

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{\text{pd}}$	$C_L = 50\text{ pF}$ , $f = 1\text{ MHz}$	66	pF



## PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_L$  includes probe and jig capacitance.

B. Input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 3 \text{ ns}$ ,  $t_f = 3 \text{ ns}$ . For testing  $f_{max}$  and pulse duration:  $t_r = 1 \text{ to } 3 \text{ ns}$ ,  $t_f = 1 \text{ to } 3 \text{ ns}$ .

C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
74AC11194DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
74AC11194N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
74AC11194N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>	Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
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RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
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