

TYPES SN5446A, '47A, '48, '49, SN54L46, 'L47, SN54LS47, 'LS48, 'LS49, SN7446A, '47A, '48, SN74L46, 'L47, SN74LS47, 'LS48, 'LS49 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

BULLETIN NO. DLS 7611811, MARCH 1974—REVISED OCTOBER 1976

'46A, '47A, 'L46, 'L47, 'LS47
feature

'48, 'LS48
feature

'49, 'LS49
feature

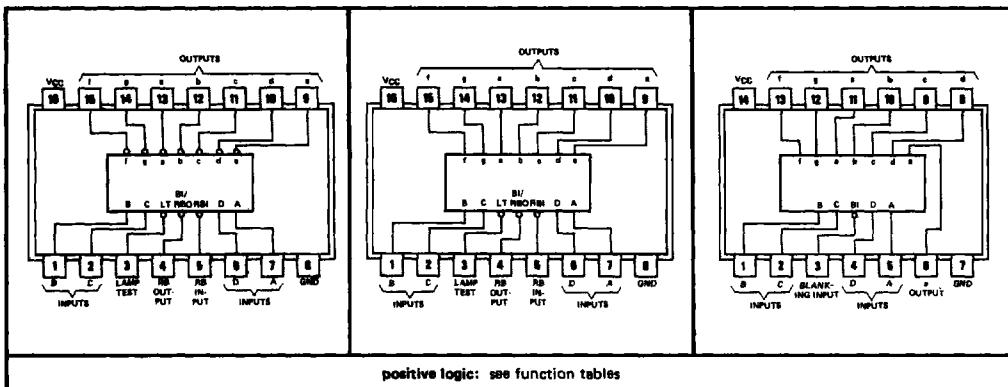
- Open-Collector Outputs Drive Indicators Directly
 - Lamp-Test Provision
 - Leading/Trailing Zero Suppression
 - Internal Pull-Ups Eliminate Need for External Resistors
 - Lamp-Test Provision
 - Leading/Trailing Zero Suppression
 - Open-Collector Outputs
 - Blanking Input
- All Circuit Types Feature Lamp Intensity Modulation Capability

TYPE	DRIVER OUTPUTS				TYPICAL POWER DISSIPATION	PACKAGES
	ACTIVE LEVEL	OUTPUT CONFIGURATION	SINK CURRENT	MAX VOLTAGE		
SN5446A	low	open-collector	40 mA	30 V	320 mW	J, W
SN5447A	low	open-collector	40 mA	15 V	320 mW	J, W
SN5448	high	2-k Ω pull-up	6.4 mA	5.5 V	265 mW	J, W
SN5449	high	open-collector	10 mA	5.5 V	165 mW	W
SN54L46	low	open-collector	20 mA	30 V	160 mW	J
SN54L47	low	open-collector	20 mA	15 V	160 mW	J
SN54LS47	low	open-collector	12 mA	15 V	35 mW	J, W
SN54LS48	high	2-k Ω pull-up	2 mA	5.5 V	125 mW	J, W
SN54LS49	high	open-collector	4 mA	5.5 V	40 mW	J, W
SN7446A	low	open-collector	40 mA	30 V	320 mW	J, N
SN7447A	low	open-collector	40 mA	15 V	320 mW	J, N
SN7448	high	2-k Ω pull-up	6.4 mA	5.5 V	265 mW	J, N
SN74L46	low	open-collector	20 mA	30 V	160 mW	J, N
SN74L47	low	open-collector	20 mA	15 V	160 mW	J, N
SN74LS47	low	open-collector	24 mA	15 V	35 mW	J, N
SN74LS48	high	2-k Ω pull-up	6 mA	5.5 V	125 mW	J, N
SN74LS49	high	open-collector	8 mA	5.5 V	40 mW	J, N

'46A, '47A, 'L46, 'L47, 'LS47
(TOP VIEW)

'48, 'LS48
(TOP VIEW)

'49, 'LS49
(TOP VIEW)



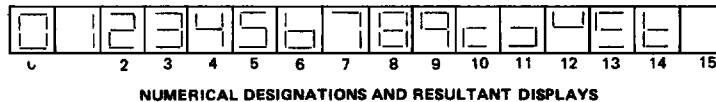
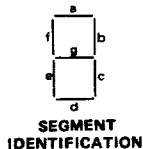
TYPES SN5446A, '47A, '48, '49, SN54L46, 'L47, SN54LS47, 'LS48, 'LS49, SN7446A, '47A, '48, SN74L46, 'L47, SN74LS47, 'LS48, 'LS49 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

description

The '46A, 'L46, '47A, 'L47, and 'LS47 feature active-low outputs designed for driving common-anode VLEDs or incandescent indicators directly, and the '48, '49, 'LS48, 'LS49 feature active-high outputs for driving lamp buffers or common-cathode VLEDs. All of the circuits except '49 and 'LS49 have full ripple-blanking input/output controls and a lamp test input. The '49 and 'LS49 circuits incorporate a direct blanking input. Segment identification and resultant displays are shown below. Display patterns for BCD input counts above 9 are unique symbols to authenticate input conditions.

The '46A, '47A, '48, 'L46, 'L47, 'LS47, and 'LS48 circuits incorporate automatic leading and/or trailing-edge zero-blanking control (RBI and RBO). Lamp test (LT) of these types may be performed at any time when the BI/RBO node is at a high level. All types (including the '49 and 'LS49) contain an overriding blanking input (BI) which can be used to control the lamp intensity by pulsing or to inhibit the outputs. Inputs and outputs are entirely compatible for use with TTL or DTL logic outputs.

The SN54246/SN74246 through '249 and the SN54LS247/SN74LS247 through 'LS249 compose the $\overline{6}$ and the $\overline{9}$ with tails and have been designed to offer the designer a choice between two indicator fonts. The SN54249/SN74249 and SN54LS249/SN74LS249 are 16-pin versions of the 14-pin SN5449 and 'LS49. Included in the '249 circuit and 'LS249 circuits are the full functional capability for lamp test and ripple blanking, which is not available in the '49 or 'LS49 circuit.



'46A, '47A, 'L46, 'L47, 'LS47 FUNCTION TABLE

DECIMAL OR FUNCTION	INPUTS						BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	OFF
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	ON
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	ON
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	ON
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	ON
6	H	X	L	H	H	L	H	OFF	OFF	ON	ON	ON	ON	ON	ON
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	ON
9	H	X	H	L	L	H	H	ON	ON	ON	ON	OFF	OFF	ON	ON
10	H	X	H	L	H	L	H	OFF	OFF	OFF	ON	ON	OFF	ON	ON
11	H	X	H	L	H	H	H	OFF	OFF	ON	ON	OFF	OFF	ON	ON
12	H	X	H	H	L	L	H	OFF	ON	OFF	OFF	OFF	ON	ON	ON
13	H	X	H	H	L	H	H	ON	OFF	OFF	ON	OFF	ON	ON	ON
14	H	X	H	H	H	L	H	OFF	OFF	OFF	ON	ON	ON	ON	ON
15	H	X	H	H	H	H	H	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
RBI	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	ON

H = high level, L = low level, X = irrelevant

- NOTES:
- The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.
 - When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.
 - When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).
 - When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

**TYPES SN5446A, '47A, '48, '49, SN54L46, 'L47, SN54LS47, 'LS48, 'LS49,
SN7446A, '47A, '48, SN74L46, 'L47, SN74LS47, 'LS48, 'LS49
BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS**

**'48, 'LS48
FUNCTION TABLE**

DECIMAL OR FUNCTION	INPUTS					BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B		A	a	b	c	d	e	f	
0	H	H	L	L	L	L	H	H	H	H	H	H	H	L
1	H	X	L	L	L	H	H	L	H	H	L	L	L	L
2	H	X	L	L	H	L	H	H	H	L	H	H	L	H
3	H	X	L	L	H	H	H	H	H	H	L	L	L	H
4	H	X	L	H	L	L	H	L	H	H	L	L	H	H
5	H	X	L	H	L	H	H	H	L	H	H	L	H	H
6	H	X	L	H	H	L	H	L	L	H	H	H	H	H
7	H	X	L	H	H	H	H	H	H	H	L	L	L	L
8	H	X	H	L	L	L	H	H	H	H	H	H	H	H
9	H	X	H	L	L	H	H	H	H	L	L	L	H	H
10	H	X	H	L	H	L	H	L	L	L	H	H	L	H
11	H	X	H	L	H	H	H	L	L	H	H	L	L	H
12	H	X	H	H	L	L	H	L	H	L	L	L	H	H
13	H	X	H	H	L	H	H	H	L	L	L	H	L	H
14	H	X	H	H	H	L	H	L	L	L	H	H	H	H
15	H	X	H	H	H	H	H	L	L	L	L	L	L	L
BI	X	X	X	X	X	X	L	L	L	L	L	L	L	L
RBI	H	L	L	L	L	L	L	L	L	L	L	L	L	L
LT	L	X	X	X	X	X	H	H	H	H	H	H	H	H

H = high level, L = low level, X = irrelevant

- NOTES: 1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high, if blanking of a decimal zero is not desired.
2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are low regardless of the level of any other input.
3. When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp-test input high, all segment outputs go low and the ripple-blanking output (RBO) goes to a low level (response condition).
4. When the blanking input/ripple-blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are high.

†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

**'49, 'LS49
FUNCTION TABLE**

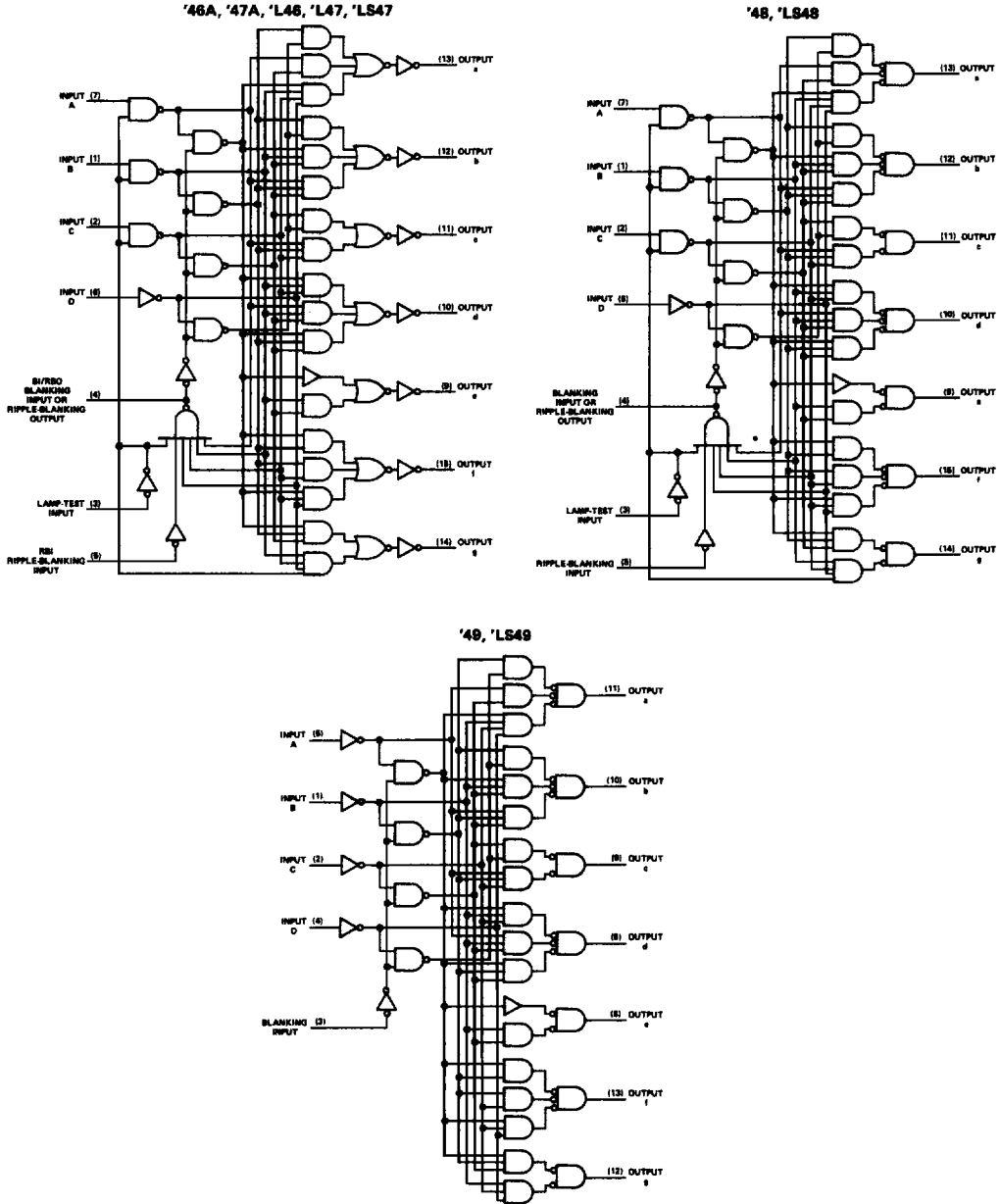
DECIMAL OR FUNCTION	INPUTS					BI	OUTPUTS							NOTE
	D	C	B	A	a		b	c	d	e	f	g		
0	L	L	L	L	H	H	H	H	H	H	H	L		
1	L	L	L	H	H	L	H	H	L	L	L	L		
2	L	L	H	L	H	H	H	L	H	H	L	H		
3	L	L	H	H	H	H	H	H	H	L	L	H		
4	L	H	L	L	H	L	H	H	L	L	H	H		
5	L	H	L	H	H	H	L	H	H	L	H	H		
6	L	H	H	L	H	L	L	H	H	H	H	H		
7	L	H	H	H	H	H	H	H	L	L	L	L		
8	H	L	L	L	H	H	H	H	H	H	H	H		
9	H	L	L	H	H	H	H	H	L	L	H	H		
10	H	L	H	L	H	L	L	L	H	H	L	H		
11	H	L	H	H	H	L	L	H	H	L	L	H		
12	H	H	L	L	H	L	H	L	L	L	H	H		
13	H	H	L	H	H	H	L	L	L	H	L	H		
14	H	H	H	L	H	L	L	L	H	H	H	H		
15	H	H	H	H	H	L	L	L	L	L	L	L		
BI	X	X	X	X	X	L	L	L	L	L	L	L		

H = high level, L = low level, X = irrelevant

- NOTES: 1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired.
2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are low regardless of the level of any other input.

**TYPES SN5446A, '47A, '48, '49, SN54L46, 'L47, SN54LS47, 'LS48, 'LS49,
SN7446A, '47A, '48, SN74L46, 'L47, SN74LS47, 'LS48, 'LS49
BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS**

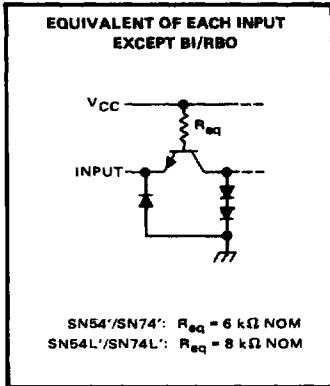
functional block diagrams



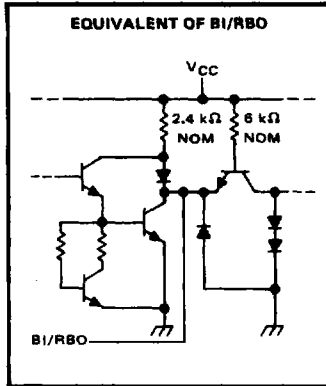
TYPES SN5446A, '47A, '48, '49, SN54L46, 'L47, SN7446A, '47A, '48, SN74L46, 'L47 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

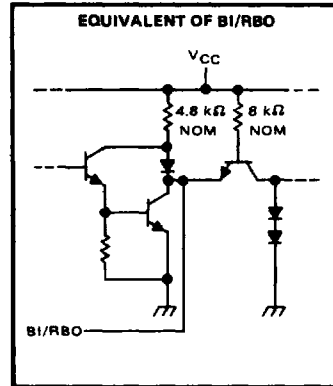
'46A, '47A, '48, '49, 'L46, 'L47



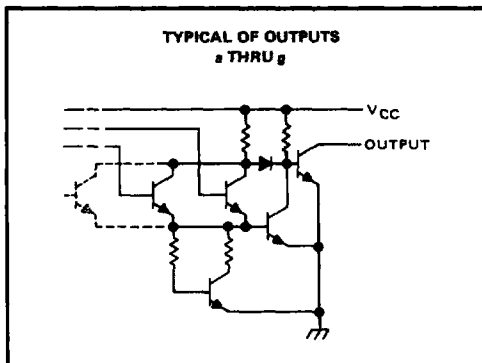
'46A, '47A, '48



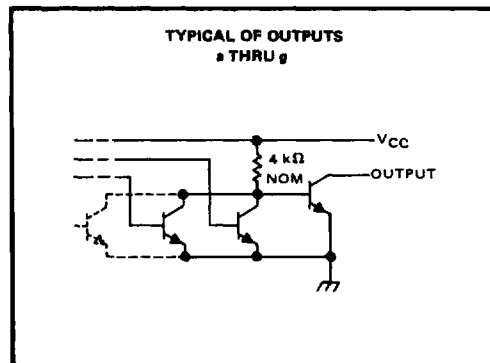
'L46, 'L47



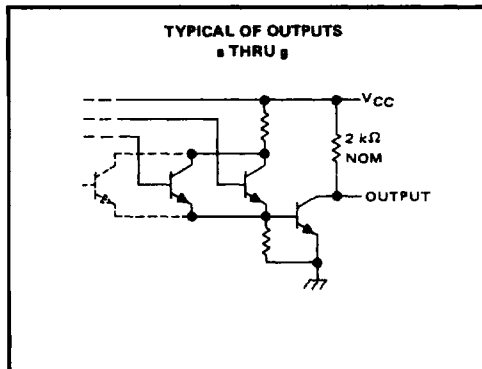
'46A, '47A



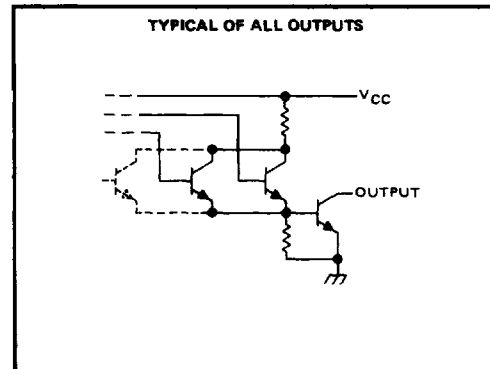
'L46, 'L47



'48



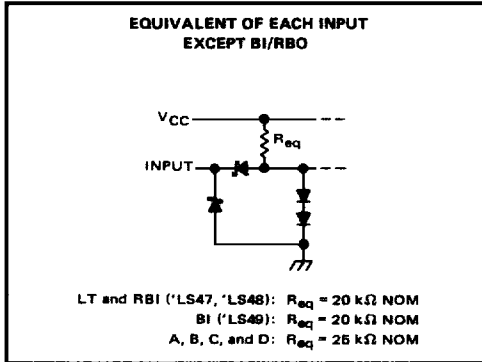
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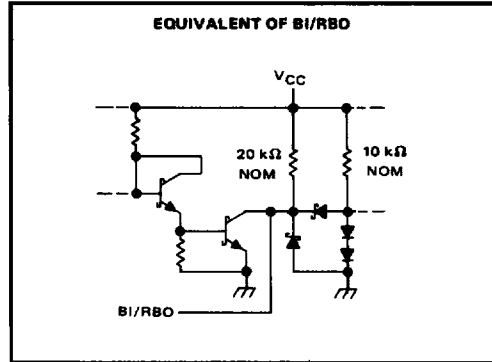
TYPES SN54LS47, 'LS48, 'LS49, SN74LS47, 'LS48, 'LS49 BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

schematics of inputs and outputs

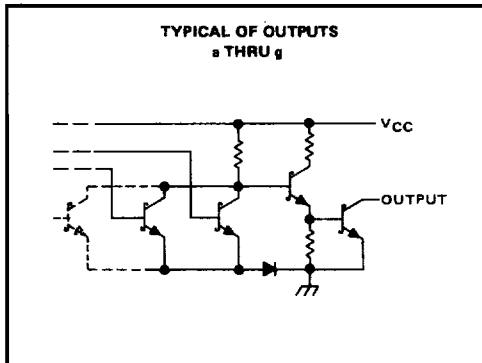
'LS47, 'LS48, 'LS49



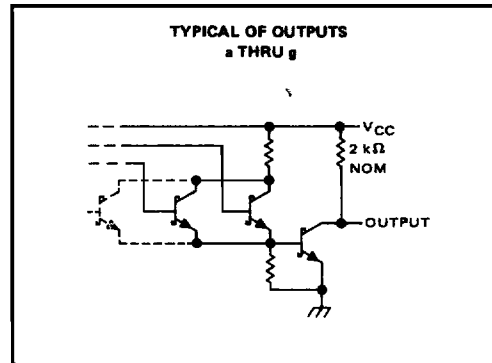
'LS47, 'LS48, 'LS49



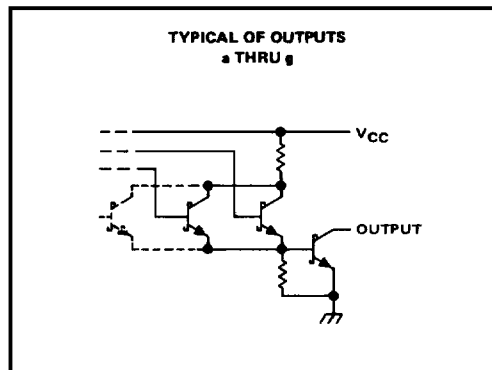
'LS47



'LS48



'LS49



TYPES SN5446A, SN5447A, SN7446A, SN7447A

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN5446A, SN5447A	-55°C to 125°C
SN7446A, SN7447A	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN5446A			SN5447A			SN7446A			SN7447A			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.5	5	5.5	4.75	5	5.25	4.75	5	5.25	V
Off-state output voltage, $V_{O(off)}$ a thru g	30			15			30			15			V
On-state output current, $I_{O(on)}$ a thru g	40			40			40			40			mA
High-level output current, I_{OH} BI/RBO	-200			-200			-200			-200			μ A
Low-level output current, I_{OL} BI/RBO	8			8			8			8			mA
Operating free-air temperature, T_A	-55 125			-55 125			0 70			0 70			°C

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

PARAMETER			TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage				2			V
V_{IL}	Low-level input voltage						0.8	V
V_{IK}	Input clamp voltage		$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$				-1.5	V
V_{OH}	High-level output voltage	BI/RBO	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -200 \mu\text{A}$		2.4	3.7		V
V_{OL}	Low-level output voltage	BI/RBO	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 8 \text{ mA}$			0.27	0.4	V
$I_{O(off)}$	Off-state output current	a thru g	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, V_{O(off)} = \text{MAX}$				250	μ A
$V_{O(on)}$	On-state output voltage	a thru g	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{O(on)} = 40 \text{ mA}$			0.3	0.4	V
I_I	Input current at maximum input voltage	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$				1	mA
I_{IH}	High-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$				40	μ A
I_{IL}	Low-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$				-1.6	mA
		BI/RBO					-4	mA
I_{OS}	Short-circuit output current	BI/RBO	$V_{CC} = \text{MAX}$				-4	mA
I_{CC}	Supply current		$V_{CC} = \text{MAX}$, See Note 2				64 85	mA
					SN54'			64 103
							SN74'	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{off}	Turn-off time from A input	$C_L = 15 \text{ pF}, R_L = 120 \Omega,$ See Note 3				100	ns
t_{on}	Turn-on time from A input					100	ns
t_{off}	Turn-off time from RBI input					100	ns
t_{on}	Turn-on time from RBI input					100	ns

NOTE 3: Load circuit and voltage waveforms are shown on page 3-10; t_{off} corresponds to t_{pLH} and t_{on} corresponds to t_{pHL} .

TYPES SN54L46, SN54L47, SN74L46, SN74L47

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Peak output current ($t_w \leq 1$ ms, duty cycle $\leq 10\%$)	200 mA
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN54L46, SN54L47	-55°C to 125°C
SN74L46, SN74L47	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54L46			SN54L47			SN74L46			SN74L47			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.5	5	5.5	4.75	5	5.25	4.75	5	5.25	V
Off-state output voltage, $V_{O(off)}$	a thru g			30			15			30			15
On-state output current, $I_{O(on)}$	a thru g			20			20			20			20
High-level output current, I_{OH}	BI/RBO			-100			-100			-100			-100
Low-level output current, I_{OL}	BI/RBO			4			4			4			4
Operating free-air temperature, T_A	-55			125			-55			125			0
													70

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

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IK}	Input clamp voltage	Any input except BI/RBO	$V_{CC} = \text{MIN}, I_I = -12$ mA			-1.5	V
V_{OH}	High-level output voltage	BI/RBO	$V_{CC} = \text{MIN}, V_{IH} = 2$ V, $V_{IL} = 0.8$ V, $I_{OH} = -100$ μ A	2.4	3.4		V
V_{OL}	Low-level output voltage	BI/RBO	$V_{CC} = \text{MIN}, V_{IH} = 2$ V, $V_{IL} = 0.8$ V, $I_{OL} = 4$ mA	0.2	0.4		V
$I_{O(off)}$	Off-state output current	a thru g	$V_{CC} = \text{MAX}, V_{IH} = 2$ V, $V_{IL} = 0.8$ V, $V_{O(off)} = \text{MAX}$			250	μ A
$V_{O(on)}$	On-state output voltage	a thru g	$V_{CC} = \text{MAX}, V_{IH} = 2$ V, $V_{IL} = 0.8$ V, $I_{O(on)} = 20$ mA	0.3	0.4		V
I_I	Input current at maximum input voltage	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 5.5$ V			1	mA
I_{IH}	High-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 2.4$ V			20	μ A
I_{IL}	Low-level input current	Any input except BI/RBO	$V_{CC} = \text{MAX}, V_I = 0.4$ V			-0.8	mA
		BI/RBO				-2	
I_{OS}	Short-circuit output current	BI/RBO	$V_{CC} = \text{MAX}$			-2	mA
I_{CC}	Supply current	$V_{CC} = \text{MAX},$				32	43
		See Note 2	SN54L'			32	52
			SN74L'				mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡All typical values are at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{off}	Turn-off time from A input	$C_L = 15$ pF, $R_L = 280$ Ω , See Note 3				200	ns
t_{on}	Turn-on time from A input					200	
t_{off}	Turn-off time from RBI input					200	ns
t_{on}	Turn-on time from RBI input					200	

NOTE 3: Load circuit and voltage waveforms are shown on page 3-10; t_{off} corresponds to t_{pLH} and t_{on} corresponds to t_{pHL} .

TYPES SN54LS47, SN74LS47

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

REVISED OCTOBER 1976

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Peak output current ($t_w \leq 1$ ms, duty cycle $\leq 10\%$)	200 mA
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN54LS47	-55°C to 125°C
SN74LS47	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS47			SN74LS47			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
Off-state output voltage, $V_{O(off)}$	a thru g			15			V
On-state output current, $I_{O(on)}$	a thru g			12			24 mA
High-level output current, I_{OH}	BI/RBO			-50			μ A
Low-level output current, I_{OL}	BI/RBO			1.6			3.2 mA
Operating free-air temperature, T_A	-55			125			0 70 °C

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

PARAMETER		TEST CONDITIONS†	SN54LS47			SN74LS47			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage		0.7			0.8			V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -18$ mA	-1.5			-1.5			V
V_{OH}	High-level output voltage	BI/RBO $V_{CC} = \text{MIN}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL \text{ max}}$, $I_{OH} = -50$ μ A	2.4	4.2		2.4	4.2		V
V_{OL}	Low-level output voltage	BI/RBO $V_{CC} = \text{MIN}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL \text{ max}}$	$I_{OL} = 1.6$ mA		0.25	0.4	$I_{OL} = 3.2$ mA		V
					0.35		0.5		
$I_{O(off)}$	Off-state output current	a thru g $V_{CC} = \text{MAX}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL \text{ max}}$, $V_{O(off)} = 15$ V	250			250			μ A
$V_{O(on)}$	On-state output voltage	a thru g $V_{CC} = \text{MAX}$, $V_{IH} = 2$ V, $V_{IL} = V_{IL \text{ max}}$	$I_{O(on)} = 12$ mA		0.25	0.4	$I_{O(on)} = 24$ mA		V
					0.35		0.5		
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}$, $V_I = 7$ V	0.1			0.1			mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}$, $V_I = 2.7$ V	20			20			μ A
I_{IL}	Low-level input current	Any input except BI/RBO BI/RBO $V_{CC} = \text{MAX}$, $V_I = 0.4$ V	-0.4			-0.4			mA
			-1.2			-1.2			
I_{OS}	Short-circuit output current	BI/RBO $V_{CC} = \text{MAX}$	-0.3	-2	-0.3	-2		mA	
I_{CC}	Supply current	$V_{CC} = \text{MAX}$, See Note 2	7	13	7	13		mA	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{off}	Turn-off time from A input			100	ns
t_{on}	Turn-on time from A input			100	ns
t_{off}	Turn-off time from RBI input			100	ns
t_{on}	Turn-on time from RBI input			100	ns

$C_L = 15$ pF, $R_L = 665 \Omega$, See Note 4

NOTE 4: Load circuit and voltage waveforms are shown on page 3-11; t_{off} corresponds to t_{pLH} and t_{on} corresponds to t_{pHL} .

TYPES SN5448, SN7448

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN5448	-55°C to 125°C
SN7448	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

		SN5448			SN7448			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}	a thru g	-400			-400			μ A
	BI/RBO	-200			-200			
Low-level output current, I_{OL}	a thru g	6.4			6.4			mA
	BI/RBO	8			8			
Operating free-air temperature, T_A		-55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage		0.8			V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$	-1.5			V
V_{OH}	High-level output voltage	a thru g	2.4 4.2			V
		BI/RBO	2.4 3.7			
I_O	Output current	$V_{CC} = \text{MIN}, V_O = 0.85 \text{ V}$, Input conditions as for V_{OH}	-1.3	-2		mA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}, I_{OL} = \text{MAX}$	0.27	0.4		V
I_I	Input current at maximum input voltage	Any input except BI/RBO	1			mA
I_{IH}	High-level input current	Any input except BI/RBO	40			μ A
I_{IL}	Low-level input current	Any input except BI/RBO	-1.6			mA
		BI/RBO	-4			
I_{OS}	Short-circuit output current	BI/RBO	-4			mA
I_{CC}	Supply current	$V_{CC} = \text{MIN}$, See Note 2	53 76			mA
			53 90			

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{pHL}	Propagation delay time, high-to-low-level output from A input	$C_L = 15 \text{ pF}, R_L = 1 \text{ k}\Omega$, See Note 5	100			ns
t_{pLH}	Propagation delay time, low-to-high-level output from A input		100			
t_{pHL}	Propagation delay time, high-to-low-level output from RBI input		100			
t_{pLH}	Propagation delay time, low-to-high-level output from RBI input		100			

NOTE 5: Load circuit and voltage waveforms are shown on page 3-10.

TYPES SN54LS48, SN74LS48

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

REVISED OCTOBER 1976

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS48	-55°C to 125°C
SN74LS48	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS48			SN74LS48			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}	a thru g			-100			μ A
	BI/RBO			-50			
Low-level output current, I_{OL}	a thru g			2			mA
	BI/RBO			1.6			
Operating free-air temperature, T_A	-55			125			°C

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

PARAMETER	TEST CONDITIONS†	SN54LS48			SN74LS48			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH} High-level input voltage		2			2			V
V_{IL} Low-level input voltage		0.7			0.8			V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$	-1.5			-1.5			V
V_{OH} High-level output voltage	a thru g and BI/RBO $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = \text{MAX}$	2.4	4.2		2.4	4.2		V
I_O Output current	a thru g $V_{CC} = \text{MIN}, V_O = 0.85 \text{ V},$ Input conditions as for V_{OH}	-1.3	-2		-1.3	-2		mA
V_{OL} Low-level output voltage	a thru g	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 2 \text{ mA}$	0.25	0.4	0.25	0.4		V
		$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 6 \text{ mA}$			0.35	0.5		V
	BI/RBO	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 1.6 \text{ mA}$	0.25	0.4	0.25	0.4		V
		$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 3.2 \text{ mA}$			0.35	0.5		V
I_I Input current at maximum input voltage	Any input except BI/RBO $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$	0.1			0.1			mA
I_{IH} High-level input current	Any input except BI/RBO $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	20			20			μ A
I_{IL} Low-level input current	Any input except BI/RBO	-0.4			-0.4			mA
	BI/RBO	-1.2			-1.2			mA
I_{OS} Short-circuit output current	BI/RBO $V_{CC} = \text{MAX}$	-0.3	-2		-0.3	-2		mA
I_{CC} Supply current	$V_{CC} = \text{MAX},$ See Note 2	25	38		25	38		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL} Propagation delay time, high-to-low-level output from A input	$C_L = 15 \text{ pF}, R_L = 4 \text{ k}\Omega,$ See Note 6			100	ns
t_{PLH} Propagation delay time, low-to-high-level output from A input				100	
t_{PHL} Propagation delay time, high-to-low-level output from RBI input	$C_L = 15 \text{ pF}, R_L = 6 \text{ k}\Omega,$ See Note 6			100	ns
t_{PLH} Propagation delay time, low-to-high-level output from RBI input				100	

NOTE 6: Load circuit and voltage waveforms are shown on page 3-11.

TYPE SN5449

BCD-TO-SEVEN-SEGMENT DECODER/DRIVER

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Current forced into any output in the off state	1 mA
Operating free-air temperature range	-55°C to 125°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN5449			UNIT
	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	V
High-level output voltage, V_{OH}			5.5	V
Low-level output current, I_{OL}			10	mA
Operating free-air temperature, T_A	-55		125	°C

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

PARAMETER	TEST CONDITIONS†	SN5449			UNIT
		MIN	TYP‡	MAX	
V_{IH} High-level input voltage		2			V
V_{IL} Low-level input voltage				0.6	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -10 \text{ mA}$			-1.5	V
I_{OH} High-level output current	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, V_{OH} = 5.5 \text{ V}$			250	μA
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 10 \text{ mA}$	0.27	0.4		V
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			40	μA
I_{IL} Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-1.6	mA
I_{CC} Supply current	$V_{CC} = \text{MAX}, \text{ See Note 2}$	33		47	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL} Propagation delay time, high-to-low-level output from A input	$C_L = 15 \text{ pF}, R_L = 667 \Omega,$ See Note 5			100	ns
t_{PLH} Propagation delay time, low-to-high-level output from A input				100	
t_{PHL} Propagation delay time, high-to-low-level output from RBI input				100	ns
t_{PLH} Propagation delay time, low-to-high-level output from RBI input				100	

NOTE 5: Load circuit and voltage waveforms are shown on page 3-10.

TYPES SN54LS49, SN74LS49

BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS

REVISED OCTOBER 1978

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Current forced into any output in the off state	1 mA
Operating free-air temperature range: SN54LS49	-55°C to 125°C
SN74LS49	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS49			SN74LS49			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, V_{OH}			5.5			5.5	V
Low-level output current, I_{OL}			4			8	mA
Operating free-air temperature, T_A	-65		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS49			SN74LS49			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH} High-level input voltage		2			2			V
V_{IL} Low-level input voltage				0.7			0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$			-1.5			-1.5	V
I_{OH} High-level output current	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = V_{IL \text{ max}}$, $V_{OH} = 5.5 \text{ V}$			250			250	μA
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = V_{IL \text{ max}}$		0.25	0.4		0.25	0.4	V
	$I_{OL} = 4 \text{ mA}$					0.35	0.5	
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$			0.1			0.1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$			20			20	μA
I_{IL} Low-level input current	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
I_{CC} Supply current	$V_{CC} = \text{MAX}$, See Note 2		8	15		8	15	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ \text{C}$.

NOTE 2: I_{CC} is measured with all outputs open and all inputs at 4.5 V.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL} Propagation delay time, high-to-low-level output from A input	$C_L = 15 \text{ pF}$, $R_L = 2 \text{ k}\Omega$,			100	ns
t_{PLH} Propagation delay time, low-to-high-level output from A input	See Note 6			100	
t_{PHL} Propagation delay time, high-to-low-level output from RB1 input	$C_L = 15 \text{ pF}$, $R_L = 8 \text{ k}\Omega$,			100	ns
t_{PLH} Propagation delay time, low-to-high-level output from RB1 input	See Note 6			100	

NOTE 6: Load circuit and voltage waveforms are shown on page 3-11.