National Semiconductor

DM5446A/DM7446A, DM5447A/DM7447A, DM5448/DM7448 BCD to 7-Segment Decoders/Drivers

General Description

The 46A and 47A feature active-low outputs designed for driving common-anode LEDs or incandescent indicators directly; and the 48 features active-high outputs for driving lamp buffers or common-cathode LEDs. All of the circuits have full ripple-blanking input/output controls and a lamp test input. Segment identification and resultant displays are shown on a following page. Display patterns for BCD input counts above nine are unique symbols to authenticate input conditions.

All of the circuits incorporate automatic leading and/or trailing-edge, zero-blanking control (RBI and RBO). Lamp test (LT) of these devices may be performed at any time when the BI/RBO node is at a high logic level. All types contain an overriding blanking input (BI) which can be used to control the lamp intensity (by pulsing) or to inhibit the outputs.

Features

- All circuit types feature lamp intensity modulation capability

5446A/7446A, 5447A/7447A

- Open-collector outputs drive indicators directly
- Lamp-test provision
- Leading/trailing zero suppression

5448/7448

- Internal pull-ups eliminate need for external resistors
- Lamp-test provision
- Leading/trailing zero suppression

Absolute Maximum Ratings (Note 1)

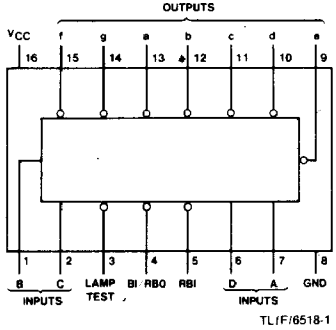
Supply Voltage	7V
Input Voltage	5.5V
Storage Temperature Range	−65°C to 150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device can not be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Type	Driver Outputs				Typical Power Dissipation	Packages
	Active Level	Output Configuration	Sink Current	Max Voltage		
DM5446A	low	open-collector	40 mA	30 V	320 mW	J
DM5447A	low	open-collector	40 mA	15 V	320 mW	J
DM5448	high	2 kΩ pull-up	6.4 mA	5.5 V	265 mW	J
DM7446A	low	open-collector	40 mA	30 V	320 mW	N
DM7447A	low	open-collector	40 mA	15 V	320 mW	N
DM7448	high	2 kΩ pull-up	6.4 mA	5.5 V	265 mW	N

Connection Diagrams

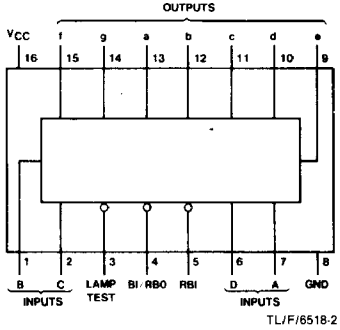
Dual-In-Line Package



TL/F/6518-1

5446A (J) 7446A (N)
5447A (J) 7447A (N)

Dual-In-Line Package



TL/F/6518-2

5448 (J) 7448 (N)

Recommended Operating Conditions

Sym	Parameter	DM5446A			DM7446A			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.8			0.8	V
V_{OH}	High Level Output Voltage (a thru g)			30			30	V
I_{OH}	High Level Output Current (BI/RBO)			−0.2			−0.2	μA
I_{OL}	Low Level Output Current (a thru g)			40			40	mA
I_{OL}	Low Level Output Current (BI/RBO)			8			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C

'46A Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Sym	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −12 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min (BI/RBO) I_{OH} = Max		2.4	3.7		V
I_{CEX}	High Level Output Current (a thru g)	V_{CC} = Max, V_O = 30V V_{IL} = Max, V_{IH} = Min				250	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IH} = Min, V_{IL} = Max			0.3	0.4	V
I_I	Input Current@Max Input Voltage	V_{CC} = Max, V_I = 5.5V (Except BI/RBO)				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4V (Except BI/RBO)				40	μA
I_{IL}	Low Level Input Current	V_{CC} = Max V_I = 0.4V	BI/RBO			−4	mA
			Others			−1.6	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (BI/RBO)				−4	mA
I_{CC}	Supply Current	V_{CC} = Max (Note 2)	DM54		60	85	mA
			DM74		60	103	

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

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

'46A Switching Characteristics at $V_{CC} = 5V$ and $T_A = 25°C$

(See Section 1 for Test Waveforms and Output Load)

Parameter	Conditions	$C_L = 15$ pF, $R_L = 120\Omega$			Units
		Min	Typ	Max	
t_{PLH} Propagation Delay Time Low to High Level Output				100	ns
t_{PHL} Propagation Delay Time High to Low Level Output				100	ns

Recommended Operating Conditions

Sym	Parameter	DM5447A			DM7447A			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.8			0.8	V
V_{OH}	High Level Output Voltage (a thru g)			15			15	V
I_{OH}	High Level Output Current (BI/RBO)			−0.2			−0.2	μA
I_{OL}	Low Level Output Current (a thru g)			40			40	mA
I_{OL}	Low Level Output Current (BI/RBO)			8			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C

'47A Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Sym	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −12 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min (BI/RBO) I_{OH} = Max		2.4	3.7		V
I_{CEX}	High Level Output Current (a thru g)	V_{CC} = Max, V_O = 15V V_{IL} = Max, V_{IH} = Min				250	μA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IH} = Min, V_{IL} = Max			0.3	0.4	V
I_I	Input Current@Max Input Voltage	V_{CC} = Max, V_I = 5.5V				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4V				40	μA
I_{IL}	Low Level Input Current	V_{CC} = Max V_I = 0.4V	BI/RBO			−4	mA
			Others			−1.6	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (BI/RBO)				−4	mA
I_{CC}	Supply Current	V_{CC} = Max (Note 2)	DM54		60	85	mA
			DM74		60	103	

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.
Note 2: I_{CC} is measured with all outputs open and all inputs at 4.5V.

'47A Switching Characteristics at V_{CC} = 5V and T_A = 25°C

(See Section 1 for Test Waveforms and Output Load)

Parameter	Conditions	C_L = 15 pF, R_L = 120Ω			Units
		Min	Typ	Max	
t_{PLH} Propagation Delay Time Low to High Level Output				100	ns
t_{PHL} Propagation Delay Time High to Low Level Output				100	ns

Recommended Operating Conditions

Sym	Parameter	DM5448			DM7448			Units
		Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			2			V
V_{IL}	Low Level Input Voltage			0.8			0.8	V
V_{OH}	High Level Output Voltage (a thru g)			5.5			5.5	V
I_{OH}	High Level Output Current (a thru g)			−0.4			−0.4	μA
	High Level Output Current (BI/RBO)			−0.2			−0.2	
I_{OL}	Low Level Output Current (a thru g)			6.4			6.4	mA
I_{OL}	Low Level Output Current (BI/RBO)			8			8	mA
T_A	Free Air Operating Temperature	−55		125	0		70	°C

'48 Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Sym	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −12 mA				−1.5	V
V_{OH}	High Level Output	V_{CC} = Min (a thru g), I_{OH} = Max		2.4	4.2		V
		V_{CC} = Min (BI/RBO), I_{OH} = Max		2.4	3.7		
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max V_{IH} = Min, V_{IL} = Max			0.27	0.4	V
$I_{O(OFF)}$	Off State Output Current (a thru g)	V_{CC} = Max, V_{IH} = Min V_{IL} = Max, V_O = 0.85V		−1.3	2		mA
I_I	Input Current@Max Input Voltage	V_{CC} = Max, V_I = 5.5V (Except BI/RBO)				1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4V (Except BI/RBO)				40	μA
I_{IL}	Low Level Input Current	V_{CC} = Max V_I = 0.4V	BI/RBO			−4	mA
			Others			−1.6	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (BI/RBO)	DM54			−4	mA
			DM74			−4	
I_{CC}	Supply Current	V_{CC} = Max (Note 2)	DM54		50	76	mA
			DM74		50	90	

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.
Note 2: I_{CC} is measured with all outputs open and all inputs at 4.5V.

'48 Switching Characteristics at $V_{CC} = 5V$ and $T_A = 25°C$

(See Section 1 for Test Waveforms and Output Load)

Parameter	Conditions	$C_L = 15$ pF, $R_L = 1k\Omega$			Units
		Min	Typ	Max	
t_{PLH} Propagation Delay Time Low to High Level Output				100	ns
t_{PHL} Propagation Delay Time High to Low Level Output				100	ns

Function Tables

46A, 47A

Decimal or Function	Inputs						BI/RBO(1)	Outputs							Note
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	L	L	L	L	L	L	H	(2)
1	H	X	L	L	L	H	H	H	L	L	H	H	H	H	
2	H	X	L	L	H	L	H	L	L	H	L	L	H	L	
3	H	X	L	L	H	H	H	L	L	L	L	H	H	L	
4	H	X	L	H	L	L	H	H	L	L	H	H	L	L	
5	H	X	L	H	L	H	H	L	H	L	L	H	L	L	
6	H	X	L	H	H	L	H	H	H	L	L	L	L	L	
7	H	X	L	H	H	H	H	L	L	L	H	H	H	H	
8	H	X	H	L	L	L	H	L	L	L	L	L	L	L	
9	H	X	H	L	L	H	H	L	L	L	H	H	L	L	
10	H	X	H	L	H	L	H	H	H	H	L	L	H	L	
11	H	X	H	L	H	H	H	H	H	L	L	H	H	L	
12	H	X	H	H	L	L	H	H	L	H	H	H	L	L	
13	H	X	H	H	L	H	H	L	H	H	L	H	L	L	
14	H	X	H	H	H	L	H	H	H	H	L	L	L	L	
15	H	X	H	H	H	H	H	H	H	H	H	H	H	H	
BI	X	X	X	X	X	X	L	H	H	H	H	H	H	H	(3)
RBI	H	L	L	L	L	L	L	H	H	H	H	H	H	H	(4)
LT	L	X	X	X	X	X	H	L	L	L	L	L	L	L	(5)

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Decimal or Function	Inputs						BI/RBO(1)	Outputs							Note
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	H	H	H	H	H	H	L	(2)
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	H	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	H	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	H	L	H	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	(3)
RBI	H	L	L	L	L	L	L	L	L	L	L	L	L	L	(4)
LT	L	X	X	X	X	X	H	H	H	H	H	H	H	H	(5)

Note 1: BI/RBO is a wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

Note 2: 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.

Note 3: When a low logic level is applied directly to the blanking input (BI), all segment outputs are H (46, 47); L (48) regardless of the level of any other input.

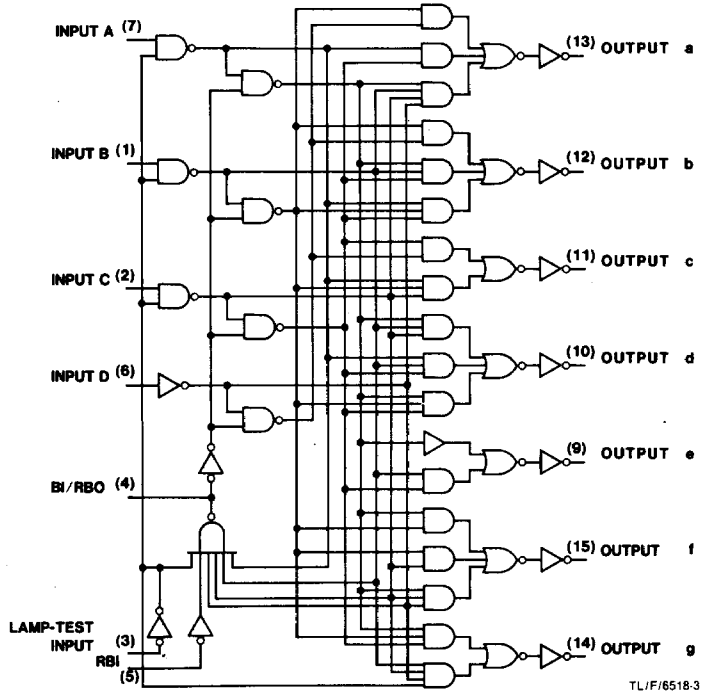
Note 4: When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go H and the ripple-blanking output (RBO) goes to a low level (response condition).

Note 5: 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 L.

H = High level, L = Low level, X = Don't Care

Logic Diagrams

46A, 47A



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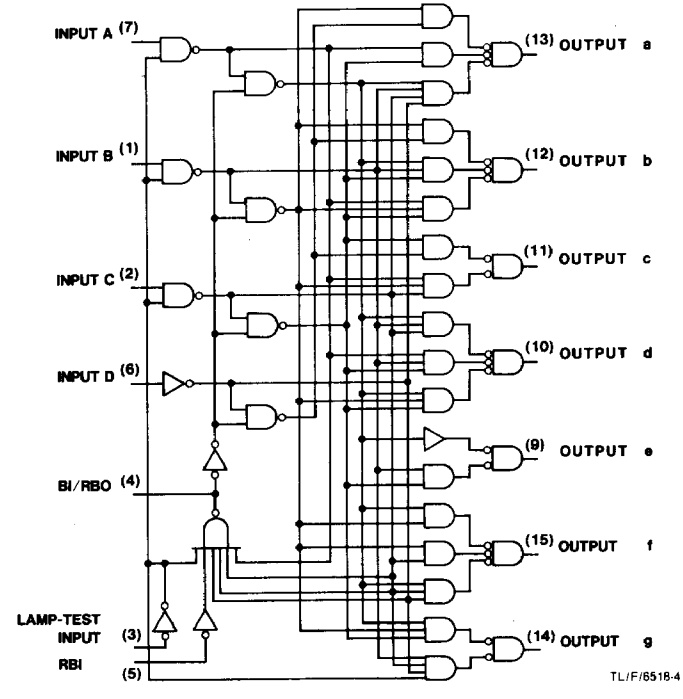

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