



Display Drivers

DM5446A/DM7446A DM5447A/DM7447A DM5448/DM7448 BCD-to-7-segment decoder/drivers

general description

This versatile series of 7-segment display drivers fulfills a wide variety of requirements for most active high (common cathode) and active low (common anode) Light Emitting Diodes (LED) or lamp displays. Each device fully decodes a 4-bit BCD input into a number from 0 through 9 in the standard 7-segment display format, and BCD numbers above 9 into unique patterns that verify operation. All circuits operate from a single 5.0V supply.

The DM5446A/DM7446A has active-low, open-collector outputs that will drive segments requiring up to 40 mA of current. The outputs are capable of withstanding 30V at a maximum leakage current of 250 μ A. This configuration is particularly well suited for common anode LED displays or higher voltage lamp displays. The high sink current capability also allows this circuit to be used in the multiplex or nonmultiplex mode of display drive. In addition, the device may be used to drive logic circuits since its normalized fanout is 25.

The DM5447A/DM7447A has the same output characteristics as the DM5446A/DM7446A except that the outputs withstand 15V at a maximum

leakage current of 250 μ A. Since its output configuration is the same as the DM5446A/DM7446A its applications will also be the same, the only restriction is that a lower voltage type display be used because of the reduced output voltage limit of 15V.

The DM5448/DM7448 has active-high, passive-pull up outputs with a fanout of 4. Typical source current is 2.0 mA at an output voltage of 0.85V. The sink capability is 6.4 mA at a maximum voltage of 0.4V. It is normally used to drive logic circuits, operate high-voltage loads such as electro-luminescent displays through buffer transistors or SCR switches, and in low current common cathode Non-Multiplex LED applications.

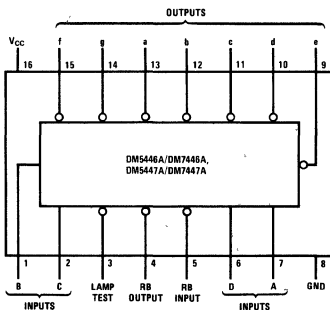
features

- Lamp-test input
- Leading/trailing zero suppression (RBI and RBO)
- Blanking input that may be used to modulate lamp intensity or inhibit output
- TTL and DTL compatible
- Input clamping diodes

DM5446A/DM7446A, DM5447A/DM7447A, DM5448/DM7448

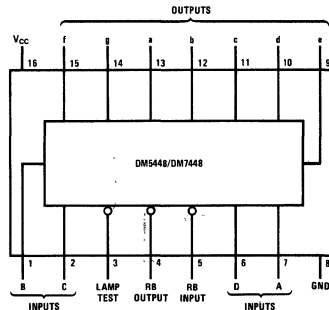
connection diagrams

Dual-In-Line and Flat Package



TOP VIEW

Dual-In-Line and Flat Package



TOP VIEW

Order Number DM5446AJ, DM7446AJ,
DM5447AJ, DM7447AJ, DM5448J,
or DM7448J
See Package 17

Order Number DM5446AN, DM7446AN,
DM5447AN, DM7447AN, DM5448N,
or DM7448N
See Package 23

Order Number DM5446AW, DM7446AW,
DM5447AW, DM7447AW,
DM5448W or DM7448W
See Package 28

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absolute maximum ratings (Note 1) **operating conditions**

		MIN	MAX	UNITS
Supply Voltage	7.0V			
Input Voltage	5.5V			
Storage Temperature Range	-65°C to +150°C			
Lead Temperature (Soldering, 10 seconds)	300°C			
Supply Voltage (V _{CC})	DM5446A, DM5447A, DM5448	4.5	5.5	V
	DM7446A, DM7447, DM7448	4.75	5.25	V
Temperature (T _A)	DM5446A, DM5447A, DM5448	-55	+125	°C
	DM7446A, DM7447A, DM7448	0	+70	°C
Output Voltage	DM5446A, DM7446A		30	V
	DM5447A, DM7447A		15	V
	DM5448, DM7448		5.5	V
Output Sink Current (per segment)	DM5446A, DM7446A, DM5447A, DM7447A		40	mA
	DM5448, DM7448		6.4	mA

electrical characteristics (Note 2) The following is applicable to all parts.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logical "1" Input Voltage		2.0			V
Logical "0" Input Voltage				0.8	V
Logical "1" Output Voltage BI/RBO Node	V _{CC} = Min, I _{OUT} = -200μA	2.4	3.7		V
Logical "0" Output Voltage at BI/RBO Node	V _{CC} = Min, I _{IN} = 8.0 mA		0.3	0.4	V
Logical "1" Input Current at any Input Except BI/RBO Node	V _{CC} = Max, V _{IN} = 2.4V V _{CC} = Max, V _{IN} = 5.5V			40 1.0	μA mA
Logical "0" Input Current (Except BI/RBO Node)	V _{CC} = Max, V _{IN} = 0.4V			-1.6	mA
Logical "0" Input Current BI/RBO Node	V _{CC} = Max, V _{IN} = 0.4V			-4.2	mA
Output Short Circuit Current at BI/RBO Node	V _{CC} = Max			-4.0	mA
Input Clamp Voltage	V _{CC} = 5.0V, T _A = 25°C, I _{IN} = -12 mA			-1.5	V

output characteristics and supply current

DM5446A/DM7446A, DM5447A/DM7447A (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logical "1" Output Voltage Outputs a through g DM5446A, DM7446A DM5447A, DM7447A	V _{CC} = Max, I _{OUT} = 250μA	30 15			V V
Logical "0" Output Voltage Outputs a through g	V _{CC} = Min, I _{OUT} = 40 mA		0.3	0.4	V
Supply Current DM5446A, DM5447A DM7446A, DM7447A	V _{CC} = Max		60 60	85 103	mA mA

output characteristics and supply current

DM5448/DM7448 (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logical "1" Output Voltage Outputs a through g DM5448, DM7448	$V_{CC} = \text{Min}, I_{OUT} = -400\mu\text{A}$	2.4	3.2		V
Logical "0" Output Voltage Outputs a through g	$V_{CC} = \text{Min}, I_{OUT} = 6.4 \text{ mA}$		0.25	0.4	V
Logical "1" Load Current Available, Outputs a through g	$V_{CC} = \text{Min}, V_{OUT} = 0.85\text{V}$	-1.3	-2.0		mA
Output Short Circuit Current Outputs a through g (Note 3)	$V_{CC} = \text{Max}$		-3.0	-4.0	mA
Supply Current DM5448 DM7448	$V_{CC} = \text{Max}$		50 50	76 90	mA mA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Unless otherwise specified min/max limits apply across the -55°C to $+125^{\circ}\text{C}$ temperature range for DM5446A, DM5447A, and DM5448, and across the 0°C to $+70^{\circ}\text{C}$ range for DM7446A, DM7447A, and DM7448. All typicals are given for $V_{CC} = 5.0\text{V}$ and $T_A = 25^{\circ}\text{C}$.

switching characteristicsDM5446A/DM7446A, DM5447A/DM7447A, DM5448/DM7448 ($V_{CC} = 5.0\text{V}$, $T_A = 25^{\circ}\text{C}$)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Propagation Delay to a Logical "0" from A Input to any Output (t_{pd0}) DM5446A/DM7446A DM5447A/DM7447A DM5448 DM7448	$\left\{ \begin{array}{l} C_L = 15 \text{ pF} \\ R_L = 120\Omega \\ C_L = 15 \text{ pF}, R_L = 1\text{k}\Omega \\ C_L = 15 \text{ pF}, R_L = 667\Omega \end{array} \right.$			100 100 100 100	ns ns ns ns
Propagation Delay to a Logical "0" from RBI to any Output (t_{pd0}) DM5446A/DM7446A DM5447A/DM7447A DM5448 DM7448	$\left\{ \begin{array}{l} C_L = 15 \text{ pF} \\ R_L = 120\Omega \\ C_L = 15 \text{ pF}, R_L = 1\text{k}\Omega \\ C_L = 15 \text{ pF}, R_L = 667\Omega \end{array} \right.$			100 100 100 100	ns ns ns ns
Propagation Delay to a Logical "1" from A Input to any Output (t_{pd1}) DM5446A/DM7446A DM5447A/DM7447A DM5448 DM7448	$\left\{ \begin{array}{l} C_L = 15 \text{ pF} \\ R_L = 120\Omega \\ C_L = 15 \text{ pF}, R_L = 1\text{k}\Omega \\ C_L = 15 \text{ pF}, R_L = 667\Omega \end{array} \right.$			100 100 100 100	ns ns ns ns
Propagation Delay to a Logical "1" from RBI to any Output (t_{pd1}) DM5446A/DM7446A DM5447A/DM7447A DM5448 DM7448	$\left\{ \begin{array}{l} C_L = 15 \text{ pF} \\ R_L = 120\Omega \\ C_L = 15 \text{ pF}, R_L = 1\text{k}\Omega \\ C_L = 15 \text{ pF}, R_L = 667\Omega \end{array} \right.$			100 100 100 100	ns ns ns ns

truth tables

DM5446A/DM7446A, DM5447A/DM7447A

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

Note 1: BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO). The blanking input (BI) must be open or held at a logical 1 when output functions 0 through 15 are desired, and the ripple-blanking input (RBI) must be open or at a logical 1 if blanking of a decimal 0 is not desired. X = input may be high or low.

Note 2: When a logical 0 is applied directly to the blanking input (forced condition) all segment outputs go to a logical 1 regardless of the state of any other input condition.

Note 3: When the ripple-blanking input (RBI) and inputs A, B, C, and D are at logical 0, with the lamp test input at logical 1, all segment outputs go to a logical 1 and the ripple-blanking output (RBO) goes to a logical 0 (response condition).

Note 4: When the blanking input/ripple-blanking output (BI/RBO) is open or held at a logical 1, and a logical 0 is applied to the lamp-test input, all segment outputs go to a logical 0.

DM5448/DM7448

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

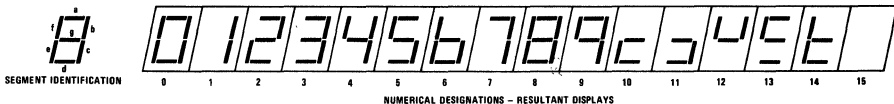
Note 1: BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO). The blanking input (BI) must be open or held at a logical 1 when output functions 0 through 15 are desired, and the ripple-blanking input (RBI) must be open or at a logical 1 if blanking of a decimal 0 is not desired. X = input may be high or low.

Note 2: When a logical 0 is applied directly to the blanking input (forced condition) all segment outputs go to a logical 0 regardless of the state of any other input condition.

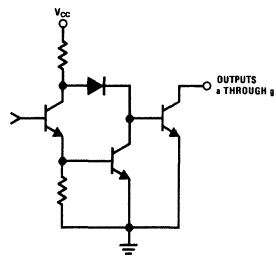
Note 3: When the ripple-blanking input (RBI) and inputs A, B, C, and D are at logical 0, with the lamp test at logical 1 all segment outputs go to the logical 0 and the ripple blanking output (RBO) goes to a logical 0 (response condition).

Note 4: When the blanking input/ripple-blanking output (BI/RBO) is open or held at a logical 1, and a logical 0 is applied to the lamp-test input, all segment outputs go to a logical 1.

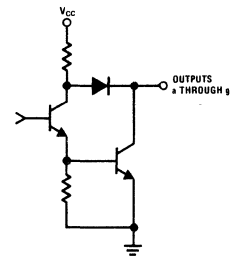
output display



output stage schematics

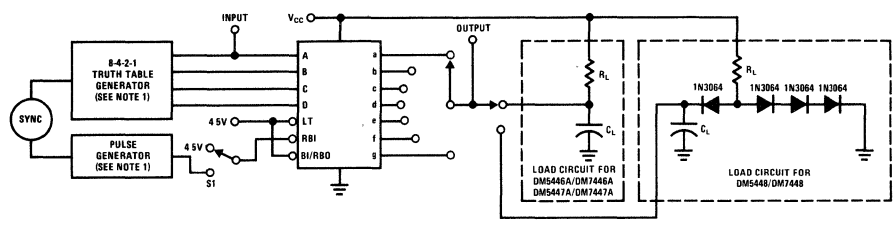


DM5446A/DM7446A
DM5447A/DM7447A

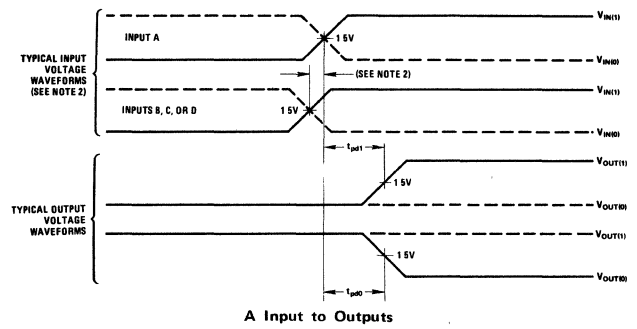


DM5448/DM7448

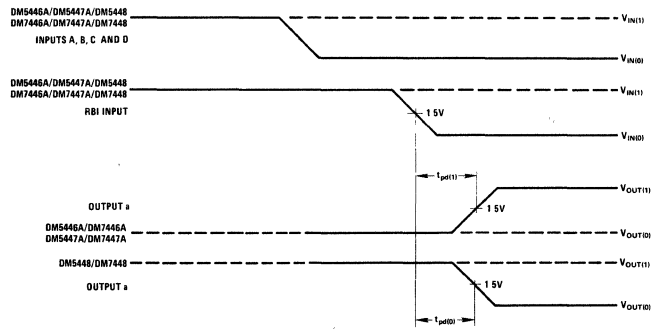
ac test circuit



switching time waveforms



A Input to Outputs



RBI Input to Outputs

Note 1 The truth table generator and pulse generator have the following characteristics:
 $V_{OUT(1)} \geq 2.4V$, $V_{OUT(2)} \leq 0.4V$, t_r and $t_f \leq 10$ ns, and PRR = 10 MHz
 Note 2 Inputs B, C, and D transitions occur simultaneously with or prior to input A transitions. RBI = 4.5V.
 Note 3 C_L includes probe and jig capacitance.