DM7856/DM8856, DM8857, DM7858/DM8858
BCD-to-7-segment LED drivers

general description

This series of 7-segment display drivers fulfills a wide variety of requirements for most active high (common cathode) Light Emitting Diodes (LEDs). 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 off of a single 5.0V supply.

The DM7856/DM8856 has active-high, passive pull-up outputs which provide a typical source current of 6.0 mA at an output voltage of 1.7V. The applications are the same as for the DM5448/DM7448 except that more design freedom is allowed with higher source current levels. This circuit was designed to drive the MAN-4 or equivalent type display directly without the use of external current limit resistors.

The DM8857 has active-high outputs and is designed to be used with common cathode LED's in the multiplex mode. It provides a typical source current of 50 mA at an output voltage of 2.3V.

In addition, with the use of an external current limit resistor per segment, this circuit can be used in higher current nonmultiplex LED applications.

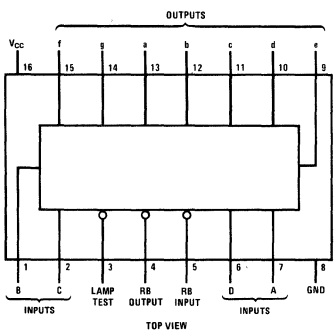
The DM7858/DM8858 has active high outputs with source current adjustable with the use of external current limit resistors, one per segment. This feature allows extreme flexibility in source current value selection for either multiplex or non-multiplex common cathode LED drive applications. It allows the system designer freedom to tailor the drive current for his particular 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

connection diagram

Dual-In-Line and Flat Package



Order Number DM7856J, DM8856J, DM8857J, DM7858J, DM8858J
See Package 17

Order Number DM7856N, DM8856N, DM7858N or DM8858N
See Package 23

Order Number DM7856W, DM8856W, DM7858W or DM8858W
See Package 28

output display

6

absolute maximum ratings (Note 1)

Supply Voltage	7.0V
Input Voltage	5.5V
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C

operating conditions

	MIN	MAX	UNITS
Supply Voltage (V_{CC})			
DM7856, DM7858	4.5	5.5	V
DM8856, DM8857, DM8858	4.75	5.25	V
Temperature (T_A)			
DM7856, DM7858	−55	+125	°C
DM8856, DM8857, DM8858	0	+70	°C
Output Voltage			
All Circuits		5.5	V
Output Sink Current (per Segment)			
DM7856, DM8856		6.4	mA
Output Source Current (per Segment)			
DM8857		60	mA
DM7858, DM8858		50	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 Votlage				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

DM7856/DM8856 (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logical "0" Output Voltage Outputs a through g	V_{CC} = Min, I_{OUT} = 6.4 mA		0.25	0.4	V
Logical "1" Load Current Available, Outputs a through g	V_{CC} = 5 0V, V_{OUT} = 1.7V	−4.7	−6 0	−7.5	mA
Output Short Circuit Current Outputs a through g (Note 3)	V_{CC} = Max		−12	−15	mA
Supply Current					
DM7856	V_{CC} = Max		90	120	mA
DM8856			90	130	mA

output characteristics and supply current (con't)

DM8857, DM7858/DM8858 (Notes 2 and 3)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logical "1" Load Current Available, Outputs a through g					
DM8857	V_{CC} = 5.0V, V_{OUT} = 2 3V	−40		−60	mA
DM7858 (Note 4)	V_{CC} = 5 0V, I_{OUT} = −50 mA	2 7	3 2		V
DM8858 (Note 4)	V_{CC} = 5 0V, I_{OUT} = −50 mA	2.9	3 2		V
Supply Current	V_{CC} = Max			60	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°C temperature range for DM7856, and DM7858 and across the 0°C to +70°C range for DM8856, DM8857, and DM8858. All typicals are given for V_{CC} = 5.0V and T_A = 25°C.

Note 3: Care must be taken in not shorting the outputs to ground while they are in the "1" state because excessive current flow would result from the Darlington upper stages.

Note 4: Special care must be taken in the use of the DM7858 ceramic (J) and the DM8858 plastic (N) DIP's with regard to not exceeding the maximum operating junction temperature of the devices. The maximum junction temperature of the DM7858J is 150°C and must be derated based on a thermal resistance of 80°C/watt, junction to ambient. The maximum junction temperature for the DM8858N is 150°C and must be derated based on a thermal resistance of 140°C/watt junction to ambient.

truth table

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

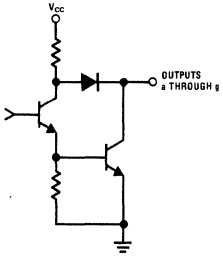
Note 1: BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO). The blanking input (BI) must be open or held at a logical 1 when output functions 0 through 15 are desired, and the ripple-blanking input (RBI) must be open or at a logical 1 if blanking of a decimal 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 1 regardless of the state of any other input condition

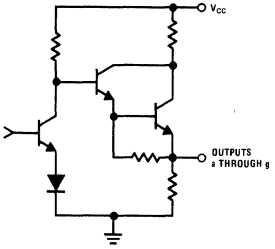
Note 3: When the ripple-blanking input (RBI) and inputs A, B, C, and D are at logical 0, with the lamp test input at logical 1, all segment outputs go to a logical 1 and the ripple-blanking output (RBO) goes to a logical 0 (response condition).

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.

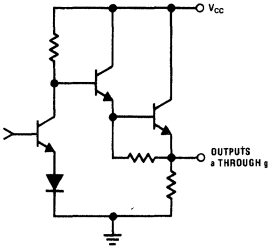
output stage schematics



DM7856/DM8856



DM8857



DM7858/DM8858