



DS7856/DS8856, DS8857, DS7858/DS8858 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 DS7856/DS8856 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, and replaces the MSD101.

The DS8857 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.

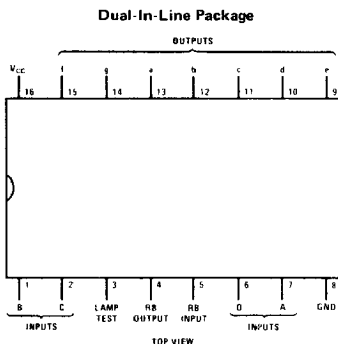
In addition, with the use of an external current limit resistor per segment, this circuit can be used in higher current non-multiplex LED applications. It replaces the MSD102.

The DS7858/DS8858 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



Order Number DS7856J, DS8856J,
DS8857J, DS7858J, DS8858J
See NS Package J16A

Order Number DS8856N
or DS8858N
See NS Package N16A

Order Number DS7856W
or DS7858W
See NS Package W16A

Output Display



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
Power Dissipation	600 mW

Operating Conditions

	MIN	MAX	UNITS
Supply Voltage (V_{CC})			
DS7856, DS7858	4.5	5.5	V
DS8856, DS8857	4.75	5.25	V
DS8858			
Temperature (T_A)			
DS7856, DS7858	-55	+125	°C
DS8856, DS8857	0	+70	°C
DS8858			
Output Voltage			
All Circuits		5.5	V
Output Sink Current (per Segment)			
DS7856, DS8856		6.4	mA
Output Source Current (per Segment)			
DS8857		60	mA
DS7858, DS8858		50	mA

Electrical Characteristics (Note 2) The following is applicable to all parts.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IH} Logical "1" Input Voltage		2.0			V
V_{IL} Logical "0" Input Voltage				0.8	V
V_{OH} Logical "1" Output Voltage	$V_{CC} = \text{Min}$, $I_{OUT} = -200\mu\text{A}$, BI/RBO Node	2.4	3.7		V
V_{OL} Logical "0" Output Voltage	$V_{CC} = \text{Min}$, $I_{IN} = 8.0 \text{ mA}$, BI/RBO Node		0.3	0.4	V
I_{IH} Logical "1" Input Current	$V_{CC} = \text{Max}$, Except BI/RBO Node	$V_{IN} = 2.4\text{V}$		40	μA
		$V_{IN} = 5.5\text{V}$		1.0	mA
I_{IL} Logical "0" Input Current	$V_{CC} = \text{Max}$, $V_{IN} = 0.4\text{V}$	Except BI/RBO Node		-1.6	mA
		BI/RBO Node		-4.2	mA
I_{SC} Output Short Circuit Current	$V_{CC} = \text{Max}$, BI/RBO Node			-4.0	mA
V_{CD} Input Clamp Voltage	$V_{CC} = 5.0\text{V}$, $T_A = 25^\circ\text{C}$, $I_{IN} = -12 \text{ mA}$			-1.5	V

Output Characteristics and Supply Current

DS7856/DS8856 (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OL} Logical "0" Output Voltage Outputs a through g	$V_{CC} = \text{Min}$, $I_{OUT} = 6.4 \text{ mA}$		0.25	0.4	V
I_{OL} Logical "1" Load Current Available, Outputs a through g	$V_{CC} = 5.0\text{V}$, $V_{OUT} = 1.7\text{V}$	-4.7	-6.0	-7.5	mA
I_{SC} Output Short Circuit Current Outputs a through g	$V_{CC} = \text{Max}$, (Note 3)		-12	-15	mA
I_{CC} Supply Current	$V_{CC} = \text{Max}$	DS7856	90	120	mA
		DS8856	90	130	mA

Output Characteristics and Supply Current (Continued)

DS8857, DS7858/DS8858 (Notes 2 and 3)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{OL} Logical "1" Load Current Available, Outputs a through g	$V_{CC} = 5.0V$, $V_{OUT} = 2.3V$, DS8857	-40		-60	mA
V_{OH} Logical "1" Output Voltage, Outputs a through g	$V_{CC} = 5.0V$, $I_{OUT} = -50$ mA, (Note 4)	DS7858 2.7	3.2		V
		DS8858 2.9	3.2		V
I_{CC} Supply Current	$V_{CC} = \text{Max}$			60	mA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" 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 DS7856, and DS7858 and across the 0°C to +70°C range for DS8856, DS8857 and DS8858. All typicals are given for $V_{CC} = 5.0V$ and $T_A = 25^\circ\text{C}$.

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 DS7858 ceramic (J) and the DS8858 plastic (N) DIP's with regard to not exceeding the maximum operating junction temperature of the devices. The maximum junction temperature of the DS7858J is 175°C and must be derated based on a thermal resistance of 90°C/watt, junction to ambient. The maximum junction temperature for the DS8858N is 150°C and must be derated based on a thermal resistance of 120°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 0-15 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.

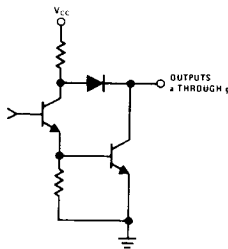
Note 2: When a logical "0" is applied directly to the blanking input (forced condition) all segment outputs go to a logical "1" regardless of the state of any other input condition.

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).

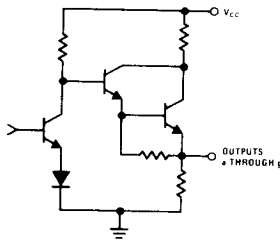
Note 4: When the blanking input/ripple-blanking output (BI/RBO) is open or held at a logical "1," and a logical "0" is applied to the lamp-test input, all segment outputs go to a logical "0."

Output Stage Schematics

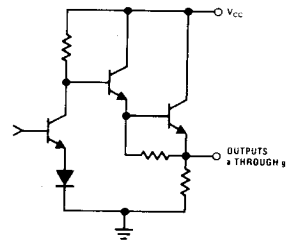
DS7856/DS8856



DS8857



DS7858/DS8858



DS7856/DS8856, DS8857, DS7858/DS8858

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