Display Drivers

DM7880/DM8880 high voltage 7-segment decoder/driver (for driving Sperry and Panaplex II™ displays)

general description

The DM7880/DM8880 is custom designed to decode four lines of BCD and drive a gas-filled seven-segment display tube.

The design employs a 112-bit read-only memory which provides BCD input to full hexadecimal output decoding in the standard DM7880/DM8880 product. For applications desiring other fonts, or not using standard BCD coding, the ROM contents can be custom modified to produce any 16 output displays for the 16 binary input combinations.

Each output constitutes a switchable, adjustable current sink which provides constant current to the tube segment, even with high tube anode supply tolerance or fluctuation. These current sinks have a voltage compliance from 3V to at least 80V; typically the output current varies 1% for output voltage changes of 3 to 50V. Each bit line of the ROM switches a current sink on or off as prescribed by the input code. Each current sink is ratioed to the b-output current as required for even illumination of all segments.

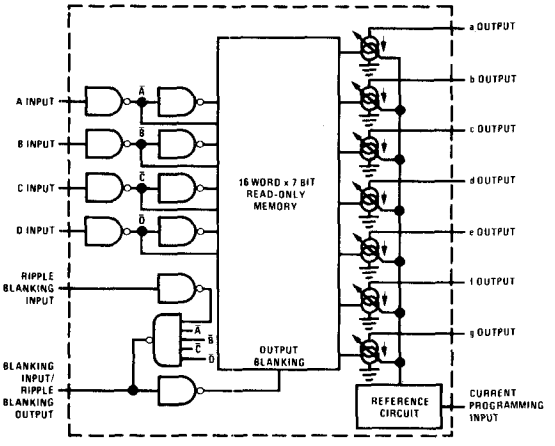
Output currents may be varied over the 0.2 to 1.5 mA range for driving various tube types or multiplex operation. The output current is adjusted by connecting an external program resistor (R_P) from V_{CC} to the Program input in accordance with the programming curve. The circuit design provides a one-to-one correlation between program input current and b-segment output current.

The Blanking Input provides unconditional blanking of any output display, while the Ripple Blanking pins allow simple leading- or trailing-zero blanking.

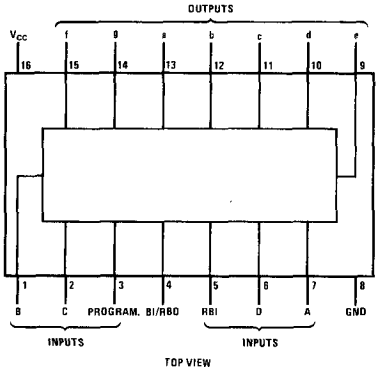
features

- Current sink outputs
- Adjustable output current – 0.2 to 1.5 mA
- High output breakdown voltage – 110V typ
- Suitable for multiplex operation
- Blanking and Ripple Blanking provisions
- Low fan-in and low power

logic and connection diagrams



Dual-In-Line Package



TOP VIEW

Order Number DM7880J or DM8880J
See Package 17
Order Number DM8880N
See Package 23

absolute maximum ratings

V_{CC}	7V
Input Voltage (Except BI)	6V
Input Voltage (BI)	V_{CC}
Segment Output Voltage	80V
Power Dissipation (Note 1)	600 mW
Transient Segment Output Current (Note 2)	50 mA
Storage Temperature Range	−65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

operating conditions

	MIN	MAX	UNITS
Supply Voltage (V_{CC})			
DM7880	4.5	5.5	V
DM8880	4.75	5.25	V
Temperature (T_A)			
DM7880	−55	+125	C
DM8880	0	+70	C

electrical characteristics (Note 3)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Logic "1" Input Voltage	V_{CC} = Min	2.0			V
Logic "0" Input Voltage	V_{CC} = Min			0.8	V
Logic "1" Output Voltage (RBO)	V_{CC} = Min, I_{OUT} = −200 μA	2.4	3.7		V
Logic "0" Output Voltage (RBO)	V_{CC} = Min, I_{OUT} = 8 mA		0.13	0.4	V
Logic "1" Input Current (Except BI)	V_{CC} = Max, V_{IN} = 2.4V		2	15	μA
	V_{CC} = Max, V_{IN} = 5.5V		4	400	μA
Logic "0" Input Current (Except BI)	V_{CC} = Max, V_{IN} = 0.4V		−300	−600	μA
Logic "0" Input Current (BI)	V_{CC} = Max, V_{IN} = 0.4V		−1.2	−2.0	mA
Power Supply Current	V_{CC} = Max, R_P = 2.2k All Inputs = 0V		27	43	mA
Input Diode Clamp Voltage	V_{CC} = Max, T_A = 25°C I_{IN} = −12 mA		−0.9	−1.5	V
Segment Outputs:					
Outputs a, f, g ON Current Ratio	All Outputs = 50V Output b Curr. = Ref.	0.84	0.93	1.02	
Output c ON Current Ratio	All Outputs = 50V, Output b Curr. = Ref.	1.12	1.25	1.38	
Output d ON Current Ratio	All Outputs = 50V Output b Curr. = Ref.	0.90	1.00	1.10	
Output e ON Current Ratio	All Outputs = 50V Output b Curr. = Ref.	0.99	1.10	1.21	
Output b ON Current	V_{CC} = 5V, V_{OUT} b = 50V T_A = 25°C, R_P = 18.1k	0.18	0.20	0.22	mA
	V_{CC} = 5V, V_{OUT} b = 50V T_A = 25°C, R_P = 7.03k	0.45	0.50	0.55	mA
	V_{CC} = 5V, V_{OUT} b = 50V T_A = 25°C, R_P = 3.40k	0.90	1.00	1.10	mA
	V_{CC} = 5V, V_{OUT} b = 50V T_A = 25°C, R_P = 2.20k	1.35	1.50	1.65	mA
Output Saturation Voltage	V_{CC} = Min, R_P = 1k±5% I_{OUT} b = 2 mA (Note 4)		0.8	2.5	V
Output Leakage Current	V_{OUT} = 75V, BI = 0V		.003	3	μA
Output Breakdown Voltage	I_{OUT} = 250 μA, BI = 0V	80	110		V
Propagation Delays:					
BCD Input to Segment Output	V_{CC} = 5V, T_A = 25°C		0.4	10	μs
BI to Segment Output	V_{CC} = 5V, T_A = 25°C		0.4	10	μs
RBI to Segment Output	V_{CC} = 5V, T_A = 25°C		0.7	10	μs
RBI to RBO	V_{CC} = 5V, T_A = 25°C		0.4	10	μs

Note 1: Maximum junction temperature for DM7880 is +150°C whereas that for DM8880 is +130°C. For operating at elevated temperatures the device must be derated based on a thermal resistance of 85°C/W Θ_{JA} for DM8880.

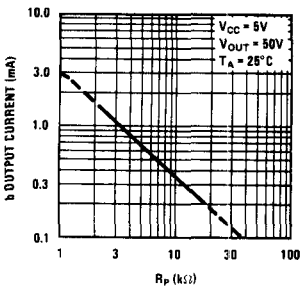
Note 2: In all applications transient segment output current must be limited to 50 mA. This may be accomplished in dc applications by connecting a 2.2k resistor from the anode-supply filter capacitor to the display anode, or by current limiting the anode driver in multiplex applications.

Note 3: Min/max limits apply across the guaranteed operating temperature range of −55°C to +125°C for DM7880 and 0°C to +70°C for DM8880, unless otherwise specified. Typicals are for V_{CC} = 5.0V, T_A = +25°C. Positive current is defined as current into the referenced pin.

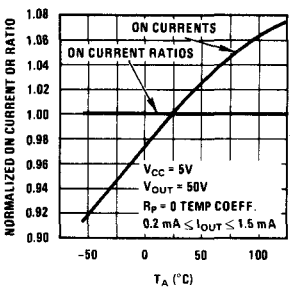
Note 4: For saturation mode the segment output currents are externally limited and ratioed.

typical performance characteristics

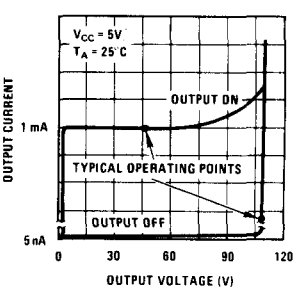
Output Current Programming



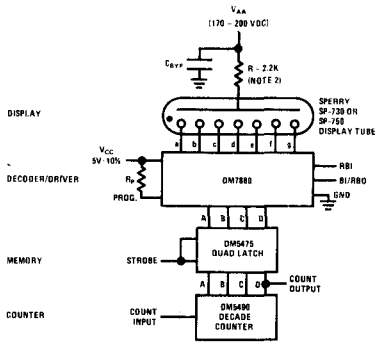
On Currents vs Temperature



Output Characteristic

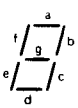


typical application



truth table

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



SEGMENT IDENTIFICATION