TRI-STATE® 7-Segment to BCD Decoder

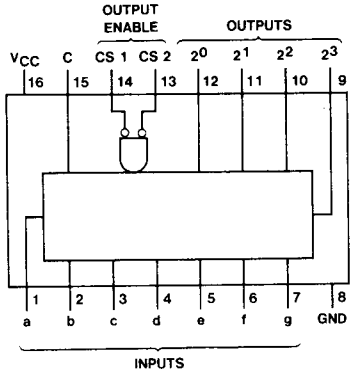
General Description

These circuits are low power converters which accept 7-segment data on the inputs, and provide binary-coded decimal (BCD) data on the outputs. An input control line is also provided, in the event that the 7-segment input data is presented in inverted form. The BCD outputs are normally of the standard totem-pole TTL type, however they may also be converted to high-impedance (TRI-STATE) types by applying a high logic level to either of the two output enable pins.

Features

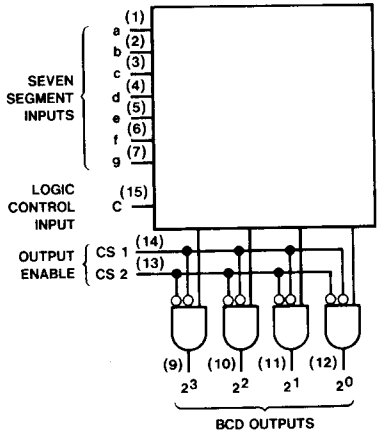
- TRI-STATE outputs
- Typical power dissipation 75 mW
- Typical propagation delay 70 ns

Connection Diagram

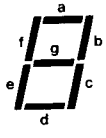


76L25(J,W); 86L25 (N)

Logic Diagram



Segment Identification



Truth Table

Digit	a	b	c	d	e	f	g	CTL	CS 1	CS 2	2^3	2^2	2^1	2^0
0	H	H	H	H	H	H	L	H	L	L	L	L	L	L
1	L	H	H	L	L	L	L	H	L	L	L	L	L	H
2	H	H	L	H	H	L	H	H	L	L	L	L	H	L
3	H	H	H	H	L	L	H	H	L	L	L	L	H	H
4	L	H	H	L	L	H	H	H	L	L	L	H	L	L
5	H	L	H	H	L	H	H	H	L	L	L	H	L	H
6	L	L	H	H	H	H	H	H	L	L	L	H	H	L
6	H	L	H	H	H	H	H	H	L	L	L	H	H	L
7	H	H	H	L	L	L	L	H	L	L	L	H	H	H
8	H	H	H	H	H	H	H	H	L	L	H	L	L	L
9	H	H	H	L	L	H	H	H	L	L	H	L	L	H
9	H	H	H	H	L	H	H	H	L	L	H	L	L	H
BLANK	L	L	L	L	L	L	L	H	L	L	H	H	H	H
L	L	L	L	H	H	H	L	H	L	L	H	H	L	H
E	H	L	L	H	H	H	H	H	L	L	H	H	H	L
A	H	H	H	L	H	H	H	H	L	L	H	L	H	L
P	H	H	L	L	H	H	H	H	L	L	H	L	H	H
-	L	L	L	L	L	L	H	H	L	L	H	H	L	L
0	L	L	L	L	L	L	H	L	L	L	L	L	L	L
1	H	L	L	H	H	H	H	L	L	L	L	L	L	H
2	L	L	H	L	L	H	L	L	L	L	L	L	H	L
3	L	L	L	L	H	H	L	L	L	L	L	L	H	H
4	H	L	L	H	H	L	L	L	L	L	L	H	L	L
5	L	H	L	L	H	L	L	L	L	L	L	H	L	H
6	H	H	L	L	L	L	L	L	L	L	L	H	H	L
6	L	H	L	L	L	L	L	L	L	L	L	H	H	L
7	L	L	L	H	H	H	H	L	L	L	L	H	H	H
8	L	L	L	L	L	L	L	L	L	L	H	L	L	L
9	L	L	L	H	H	L	L	L	L	L	H	L	L	H
9	L	L	L	L	H	L	L	L	L	L	H	L	L	H
BLANK	H	H	H	H	H	H	H	L	L	L	H	H	H	H
L	H	H	H	L	L	L	H	L	L	L	H	H	L	H
E	L	H	H	L	L	L	L	L	L	L	H	H	H	L
A	L	L	L	H	L	L	L	L	L	L	H	L	H	L
P	L	L	H	H	L	L	L	L	L	L	H	L	H	H
-	H	H	H	H	H	H	L	L	L	L	H	H	L	L
	X	X	X	X	X	X	X	X	H	X	Z	Z	Z	Z
	X	X	X	X	X	X	X	X	X	H	Z	Z	Z	Z
	All Other Input Combinations								L	L	H	H	H	H

H = High Level (Steady State)
L = Low Level (Steady State)
Z = High Impedance
X = Don't Care

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Electrical Characteristics over recommended operating free-air temperature range (unless otherwise noted)

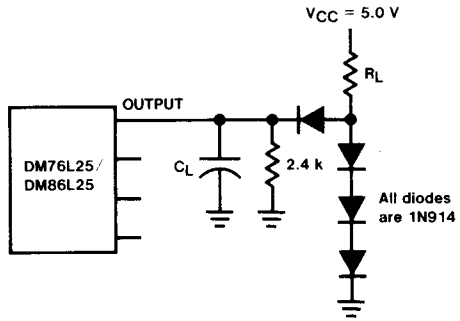
Parameter		Conditions	DM76 L25			DM86 L25			Units
			Min	Typ (1)	Max	Min	Typ (1)	Max	
V_{IH}	High Level Input Voltage		2			2			V
V_{IL}	Low Level Input Voltage				0.7			0.7	V
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −12 mA			−1.5			−1.5	V
I_{OH}	High Level Output Current				−1.0			−1.0	mA
V_{OH}	High Level Output Voltage	V_{CC} = Min, V_{IH} = 2 V, V_{IL} = 0.7 V, I_{OH} = −1.0 mA	2.4			2.4			V
I_{OL}	Low Level Output Current				2.0			3.6	mA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, V_{IH} = 2 V, V_{IL} = 0.7 V, I_{OL} = Max			0.3			0.4	V
$I_{O(OFF)}$	Off State (High Impedance State) Output Current	V_{CC} = Max, V_{IH} = 2 V, V_{IL} = 0.7 V, V_O = 0.3 V			−40			−40	μA
		V_{CC} = Max, V_{IH} = 2 V, V_{IL} = 0.7 V, V_O = 2.4 V			40			40	μA
I_I	Input Current at Maximum Input Voltage	V_{CC} = Max, V_I = 5.5 V			100			100	μA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.4 V			10			10	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.3 V			−180			−180	μA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (2)	−6		−30	−6		−30	mA
I_{CC}	Supply Current	V_{CC} = Max, V_I = 0 V		15	20		15	20	mA

Note 1: All typical values are at V_{CC} = 5 V, T_A = 25°C.
Note 2: Not more than one output should be shorted at a time.

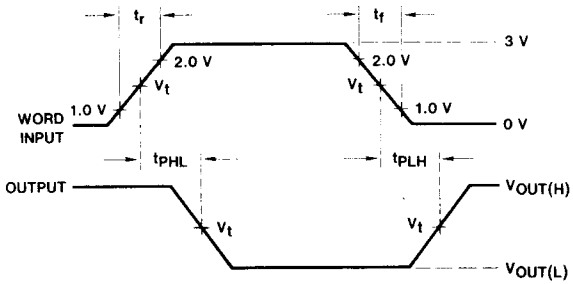
Switching Characteristics V_{CC} = 5 V, T_A = 25°C

Parameter		From (Input)	To (Output)	Conditions	DM76/86 L25			Units
					Min	Typ	Max	
t_{PLH}	Propagation Delay Time, Low-to-High Level Output	Data	Output	C_L = 50 pF, R_L = 4 kΩ		86	130	ns
t_{PHL}	Propagation Delay Time, High-to-Low Level Output	Data	Output			55	85	ns
t_{ZH}	Output Enable Time to High Level					34	51	ns
t_{ZL}	Output Enable Time to Low Level					47	70	ns
t_{HZ}	Output Disable Time from High Level			C_L = 5 pF, R_L = 4 kΩ		15	23	ns
t_{LZ}	Output Disable Time from Low Level					57	86	ns

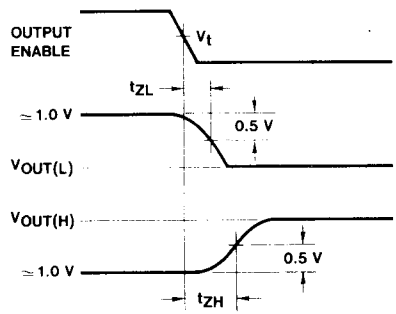
AC Test Circuit



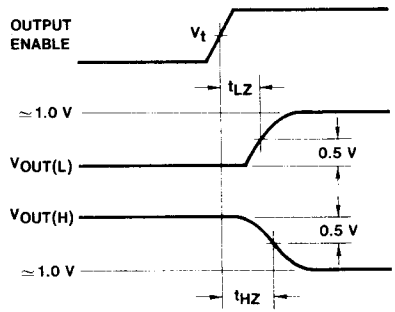
Switching Time Waveforms



t_{ZL} & t_{ZH}



t_{LZ} & t_{HZ}



Note: The pulse generator has the following characteristics: V = 3.0 V, t_r = 15 ns, t_f = 5.0 ns, F = 500 kHz, duty cycle = 50%, Z_{OUT} = 50Ω, V_t = 1.3 V @ 25°C.

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