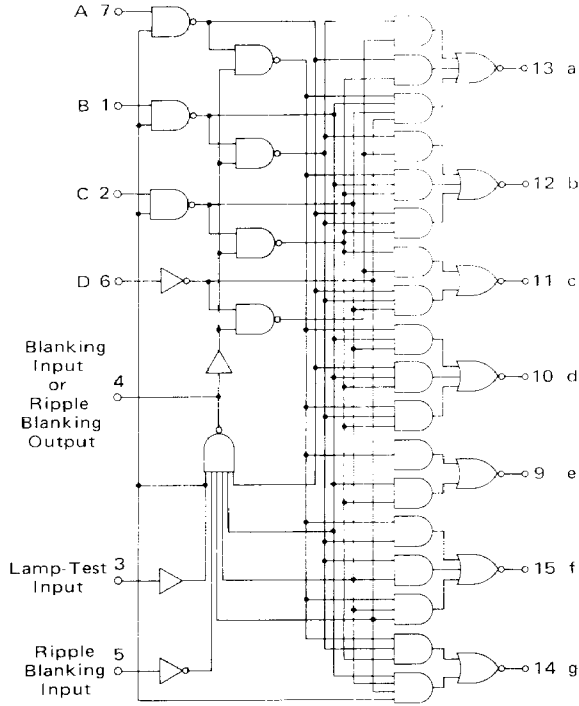# BCD-TO-SEVEN SEGMENT DECODER/DRIVERS

MC5448 · MC7448
MC9358 · MC8358

ISSUE B

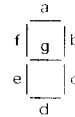Add Suffix L for 16-Pin dual in-line ceramic package (Case 620).
Suffix P for 16-Pin dual in-line plastic package (Case 648) MC7448, MC8358

This device decodes 4-bit binary coded decimal input data in a format suitable for use with incandescent, seven-segment, display indicators. It is intended for use with other logic elements or discrete components rather than for the direct driving of display indicators as is the case with the MC5446/7446 and MC5447/7447 which are similar.

Ripple blanking inputs provide capability for suppression of non-significant zeros in a system. The blanking input may be used to control lamp intensity.
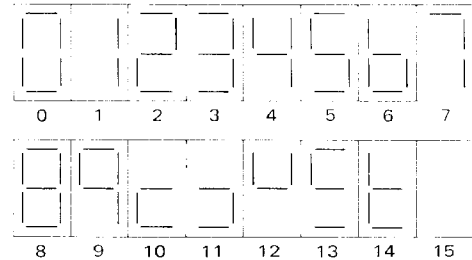

SEGMENT IDENTIFICATION

NUMERICAL DESIGNATION – SEGMENTS ILLUMINATED

V_{CC} = Pin 16
Gnd = Pin 8

Input Loading Factor:
BI/RBO = 2.6
Other Inputs = 1

Output Loading Factor:
BI/RBO = 5
a thru g = 4

Total Power Dissipation =
265 mW typ/pkg

ORIG

004473

4473

MOT   **TRUTH TABLE**

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

X = Don't care

1

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one data input and the blanking input, and for one driver output and the ripple blanking output. Test other inputs and outputs in the same manner according to the truth table. Test all input-output combinations according to the truth table.

Pin connections:

Input	Pin		Output	Pin
A	7		a	13
B	1		b	12
C	2		c	11
D	6		d	10
LT	3		e	9
RBI	5		f	15
BI/RBO	4		g	14

Test Limits

Characteristic	Symbol	Pin Under Test	MC5448/MC9358 −55 to +125°C Min	Max	Unit	MC7448/MC8358 0 to +75°C Min	Max	Unit
Input Forward Current	I_{IL}	1	—	−1.6	mAdc	—	−1.6	mAdc
		4	—	−4.0	mAdc	—	−4.0	mAdc
Leakage Current	I_{IH}	1	—	40	µAdc	—	40	µAdc
	I_{IHH}		—	1.0	mAdc	—	1.0	mAdc
Output Output Voltage	V_{OL}	9*	—	0.4	Vdc	—	0.4	Vdc
		4**	—	0.4	Vdc	—	0.4	Vdc
	V_{OH}	9*	2.4	—	Vdc	2.4	—	Vdc
		4**	2.4	—	Vdc	2.4	—	Vdc
Load Current	I_{Load}	9*	−1.3	—	mAdc	−1.3	—	mAdc
Short-Circuit Current	$I_{OS}†$	9*	—	−4.0	mAdc	—	−4.0	mAdc
		4**	—	−4.0	mAdc	—	−4.0	mAdc
Power Requirements (Total Device) Power Supply Drain	I_{CC}	16	—	76	mAdc	—	90	mAdc
Switching Parameters Turn-On Delay	tpHL	13	—	100#	ns	—	100#	ns
Turn-Off Delay	tpLH	13	—	100#	ns	—	100#	ns
Turn-On Delay	tpHL	13	—	100#	ns	—	100#	ns
Turn-Off Delay	tpLH	13	—	100#	ns	—	100#	ns

TEST CURRENT/VOLTAGE VALUES (All Temperatures)

Device	mA I_{OL1}	I_{OL2}	I_{OH1}	I_{OH2}	I_{IL}	I_{IH}	I_{IHH}	Volts V_{Load}	V_{ILT}	V_{IHT}	V_{CC}	V_{CCL}	V_{CCH}	V_{IHX}	Gnd
MC5448, MC9358	6.4	8.0	−0.4	−0.2	0.4	2.4	5.5	0.85	0.8	2.0	5.0	4.5	5.5	4.5	8
MC7448, MC8358	6.4	8.0	−0.4	−0.2	0.4	2.4	5.5	0.85	0.8	2.0	5.0	4.75	5.25	4.5	3,8

TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW:

Symbol	I_{OL1}	I_{OL2}	I_{OH1}	I_{OH2}	I_{IL}	I_{IH}	I_{IHH}	V_{Load}	V_{ILT}	V_{IHT}	V_{CC}	V_{CCL}	V_{CCH}	V_{IHX}	Gnd
I_{IL}	—	—	—	—	1	—	—	—	1,2,6	3,4,5,7	—	3	16	2,3,5	8
	—	—	—	—	4	—	—	—	1,2,5,6,7	3	—	5	16	2,3,5	3,8
I_{IH}	—	—	—	—	—	1	—	—	—	—	—	—	16	—	3,8
I_{IHH}	—	—	—	1	—	—	1	—	—	—	—	—	16	—	8
V_{OL}	9	4	—	—	—	—	—	—	1,2,6	—	—	16	—	—	8,8
			9	4					3 1,2,6,7	3.5		16	16		8,8
V_{OH}	—	—	9	—	—	—	—	—	—	—	—	16	—	—	3,8
I_{Load}	—	—	—	—	—	—	—	9	—	—	—	16	—	—	3,8,9
I_{OS}	—	—	—	—	—	—	—	—	—	—	—	3.5	—	—	1,2,4,6,7,8
I_{CC}	—	—	—	—	—	—	—	—	—	—	16	—	16	—	8
tpHL	Pulse In 7			Pulse Out 13							16			2,3,5	1,6,8
tpLH	7			13							16			2,3,5	1,6,8
tpHL	5			13							16			3	1,2,6,7,8
tpLH	5			13							16			3	1,2,6,7,8

*Test procedure for outputs a thru g.
**Test procedure for BI/RBO only.
#Tested only at 25°C.
†Only one output should be shorted at a time
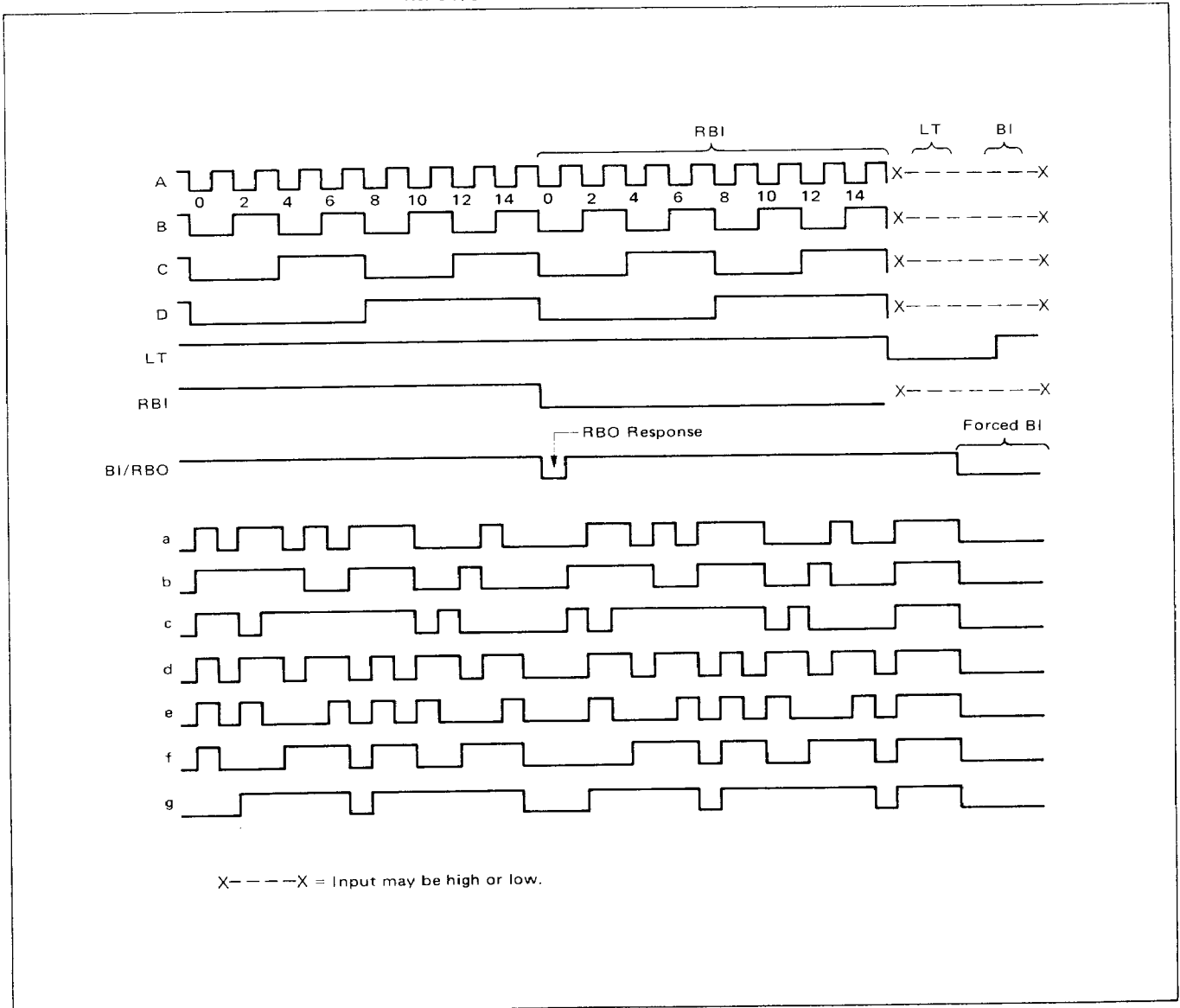
2

OPERATING CHARACTERISTICS

This monolithic integrated circuit provides the logic necessary to decode a BCD input and drive a seven-segment numerical indicator. It is intended for use primarily as a driver for discrete, active components or logic elements. If direct driving of display indicators is desired, the MC5446/7446 (30 volts maximum output voltage) or the MC5447/7447 (15 volts) should be used, since they are designed to handle the relatively high voltages and sink currents (20 mA) of incandescent indicators.

Pin 4 serves as both a blanking input and a ripple blank-ing output (BI/RBO). For displaying digits 0 thru 15 the blanking input must be held at a logic "1" or open (see the truth table). For a decimal 0 output the ripple blank-ing input (RBI) must also be at a logic "1" or open.

When a logic "0" is applied to BI, outputs a thru g go to a logic "0" regardless of the state of any other input. With RBI at a logic "0" and A = B = C = D also at a logic "0", outputs a thru g and RBO go to a logic "0". When a logic "0" is applied to lamp-test and BI/RBO is open or held at a logic "1", outputs a thru g go to a logic "1".

INPUT/OUTPUT VOLTAGE WAVEFORMS

X— — — —X = Input may be high or low.

3

These devices are useful in applications requiring higher output currents and/or voltages than is available with the MC5446/7446. The decoder/driver may be used to drive buffer transistors selected for the required output characteristics. A suitable interface circuit is shown in Figure 1, where each decoder/driver output drives two lamp segments.
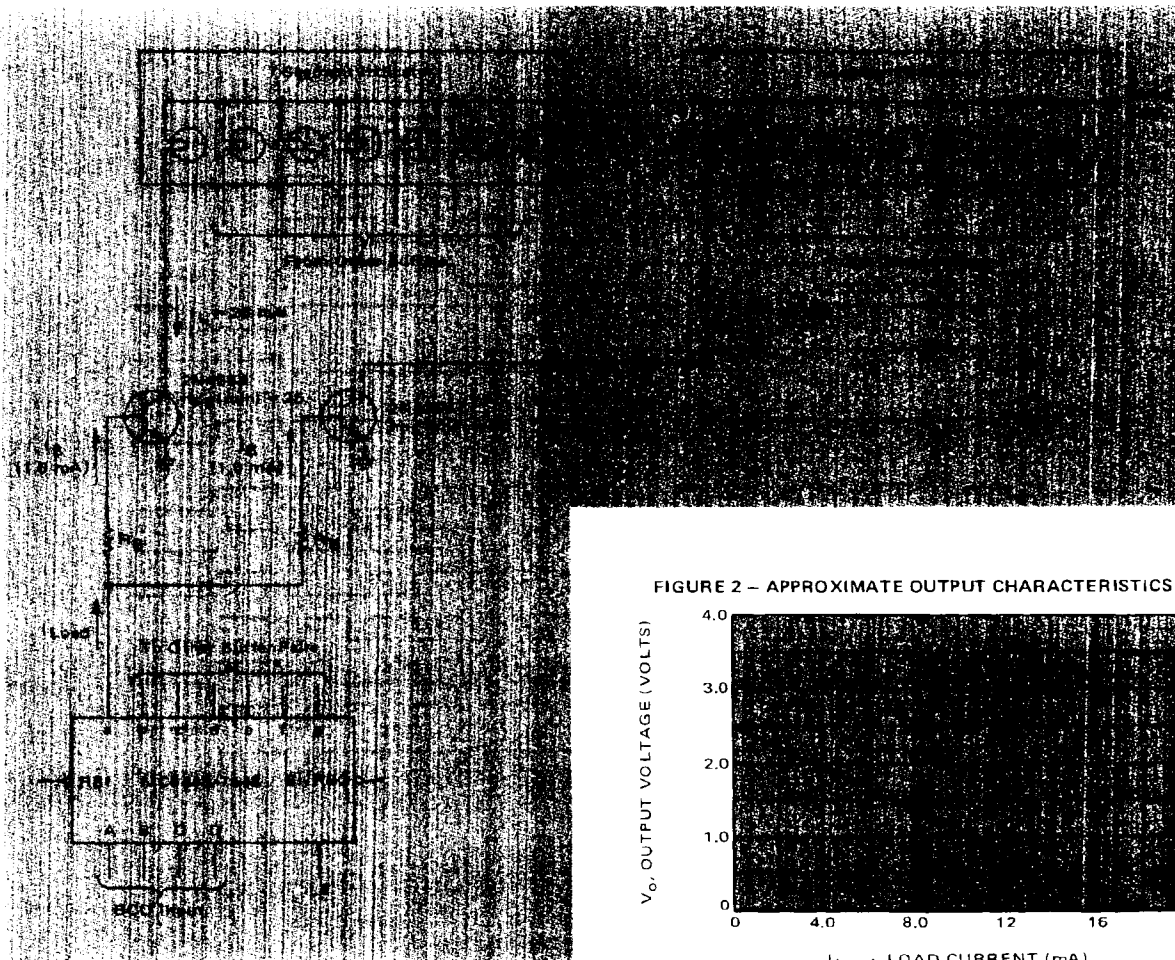
If the buffer load current is known, then base current is obtained from $I_B \approx I_L/h_{FE}$. From this and the approximate MC5448/7448, MC9358/8358 output characteristics, suitable values of R_B can be determined. For a given load current, I_{Load}, ($2I_B$ in this example) the output voltage, V_o, is given by V_o 2.5 − 0.139 I_{Load} = 2.22 volts. (See the load line of Figure 2, with I_{Load} = 2.0 mA.) R_B is then found from:
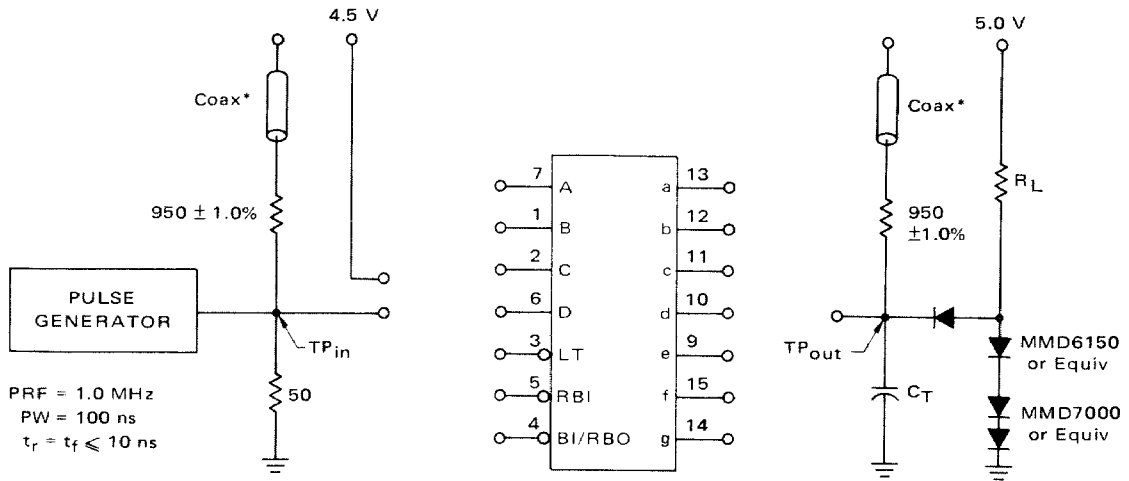
$$R_B = \frac{V_o - V_{BE}}{I_B} \frac{2.22 - 0.75}{10^{-3}} \approx 1.5\,k\Omega$$

Operation of the blanking controls is identical to that of the MC5446/7446 and is illustrated in a typical application on the MC5446/7446 data sheet.

FIGURE 1 − TYPICAL INTERFACE CIRCUIT

FIGURE 2 − APPROXIMATE OUTPUT CHARACTERISTICS

I_{Load}, LOAD CURRENT (mA)

.4

SWITCHING TIME TEST CIRCUIT AND WAVEFORMS

R_L = 1.0 kΩ for MC5448, MC9358; 667 Ω for MC7448, MC8358.

C_T = 15 pF = total parasitic capacitance, which includes probe and wiring capacitances.

*The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe.

A INPUT TO OUTPUTS