National Semiconductor

MM54C42/MM74C42 BCD-to-Decimal Decoder

General Description

The MM54C42/MM74C42 one-of-ten decoder is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. This decoder produces a logical "0" at the output corresponding to a four bit binary input from zero to nine, and a logical "1" at the other outputs. For binary inputs from ten to fifteen all outputs are logical "1".

- High noise immunity 0.45 V_{CC} (typ.)
- Low power 50 nW (typ.)
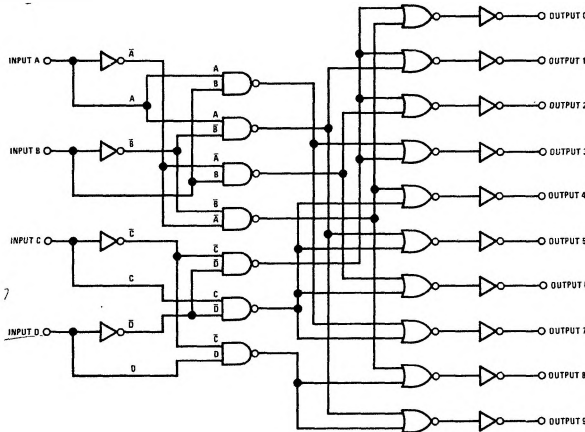- Medium speed operation 10 MHz (typ.) with 10V V_{CC}

Features

- Supply voltage range 3V to 15V
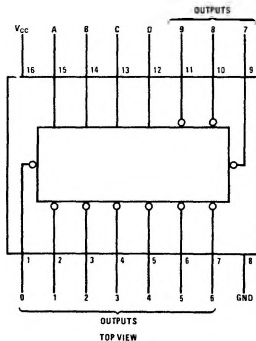- Tenth power TTL compatible drive 2 LPTTL loads

Applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering
- Computers

Schematic Diagram

Connection Diagram

OUTPUTS
TOP VIEW

Truth Table

INPUTS				OUTPUTS									
D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

Absolute Maximum Ratings (Note 1)

Voltage at Any Pin (Note 1) $-0.3V$ to $V_{CC} + 0.3V$
Operating Temperature Range
  MM54C42 $-55°C$ to $+125°C$
  MM74C42 $-40°C$ to $+85°C$
Storage Temperature Range $-65°C$ to $+150°C$

Package Dissipation   500 mW
Operating V_{CC} Range   3.0V to 15V
Absolute Maximum V_{CC} 18V
Lead Temperature (Soldering, 10 seconds)   300°C

DC Electrical Characteristics
Min./max. limits apply across temperature range unless otherwise noted.

Parameter		Conditions	Min.	Typ.	Max.	Units
CMOS to CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5.0V$	3.5			V
		$V_{CC} = 10V$	8.0			V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5.0V$			1.5	V
		$V_{CC} = 10V$			2.0	V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5.0V, I_O = -10\mu A$	4.5			V
		$V_{CC} = 10V, I_O = -10\mu A$	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5.0V, I_O = 10\mu A$			0.5	V
		$V_{CC} = 10V, I_O = 10\mu A$			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$			1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0		300	μA
I_{CC}	Supply Current	$V_{CC} = 15V$		0.05	300	μA
CMOS/LPTTL Interface						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$	$V_{CC}-1.5$			V
		74C, $V_{CC} = 4.75V$	$V_{CC}-1.5$			V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$			0.8	V
		74C, $V_{CC} = 4.75V$			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V, I_O = -360\mu A$	2.4			V
		74C, $V_{CC} = 4.75V, I_O = -360\mu A$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V, I_O = 360\mu A$			0.4	V
		74C, $V_{CC} = 4.75V, I_O = 360\mu A$			0.4	V
Output Drive (See 54C/74C Family Characteristics Data Sheet) $T_A = 25°C$ (short circuit current)						
I_{SOURCE}	Output Source Current	$V_{CC} = 5.0V, V_{IN(0)} = 0V, V_{OUT} = 0V$	-1.75			mA
I_{SOURCE}	Output Source Current	$V_{CC} = 10V, V_{IN(0)} = 0V, V_{OUT} = 0V$	-8.0			mA
I_{SINK}	Output Sink Current	$V_{CC} = 5.0V, V_{IN(1)} = 5.0V, V_{OUT} = V_{CC}$	1.75			mA
I_{SINK}	Output Sink Current	$V_{CC} = 10V, V_{IN(1)} = 10V, V_{OUT} = V_{CC}$	8.0			mA

AC Electrical Characteristics
$T_A = 25°C$, $C_L = 50pF$, unless otherwise specified.

Parameter		Conditions	Min.	Typ.	Max.	Units
t_{pd}	Propagation Delay Time to Logical "0" or "1"	$V_{CC} = 5.0V$		200	300	ns
		$V_{CC} = 10V$		90	140	ns
C_{IN}	Input Capacitance	(See note 2)		5		pF
C_{PD}	Power Dissipation Capacitance	(See note 3)		50		pF

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: Capacitance is guaranteed by periodic testing.
Note 3: C_{PD} determines the no load ac power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note — AN-90.