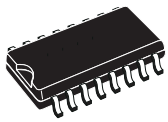
M74HC42

BCD to decimal decoder

Datasheet - production data



SO-16

Features

- High speed: t_{pd} = 14 ns (typ.) at V_{CC} = 6 V
- Low power dissipation:
  I_{CC} = 4 µA (max.) at T_A = 25 °C
- High noise immunity:
  $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min.)
- Symmetrical output impedance:
  $|I_{OH}| = I_{OL}$ = 4 mA (min.)
- Balanced propagation delays: $t_{PLH} \cong t_{PHL}$
- Wide operating voltage range:
  $V_{CC\ (OPR)}$ = 2 to 6 V
- Pin and function compatible with 74 series 42

Description

The M74HC42 is a high-speed CMOS BCD to decimal decoder manufactured with silicon gate C^2MOS technology.

A BCD code applied to the four inputs A-D selects one of ten decimal outputs $\overline{Y}_0$ to $\overline{Y}_9$. All outputs are HIGH when binary codes greater than nine are applied to the inputs.This device can also be used as a 1 of 8 decoder when the D input is assigned as an inhibit input. This device is useful for code conversion, address decoding, memory selection, demultiplexing or readout decoding.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

Table 1. Order code

Order code	Package
M74HC42RM13TR	SOP

Contents

1 Pin connections

Figure 1. Pin connections and IEC logic symbols

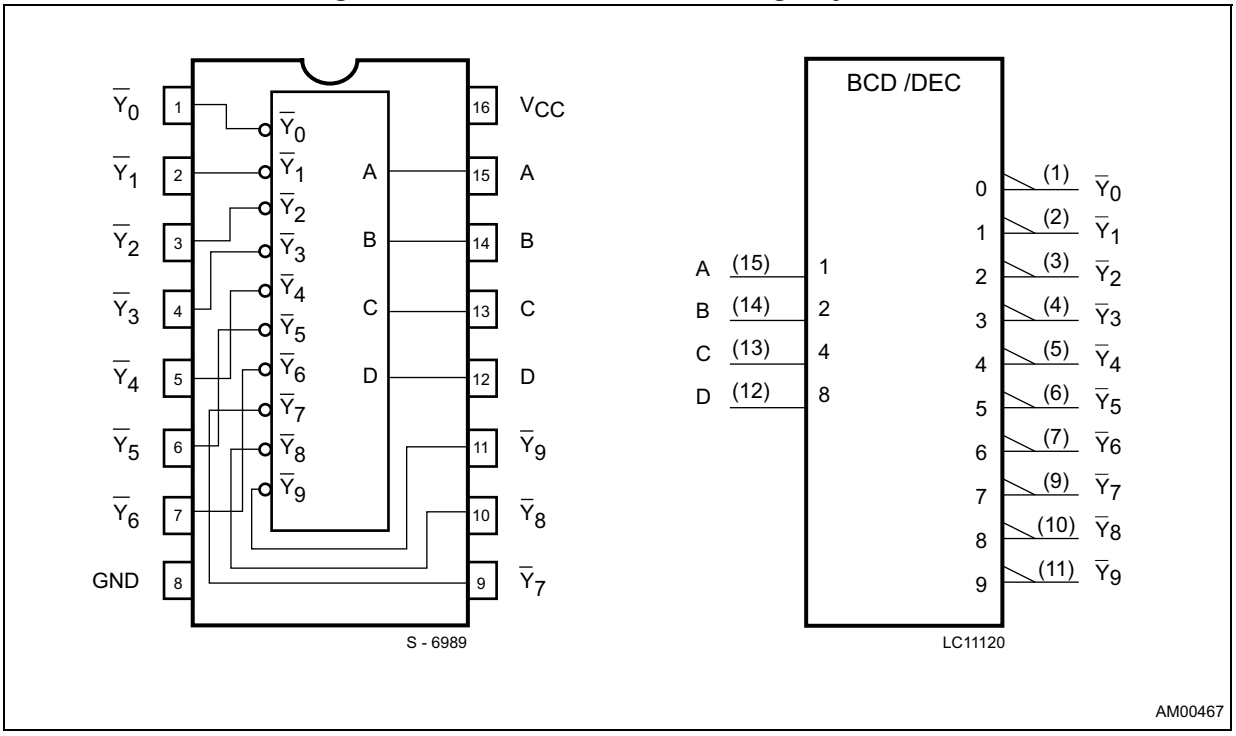


Table 2. Pin descriptions

Pin number	Symbol	Name and function
15, 14, 13, 12	A, B, C, D	Data inputs
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	$\overline{Y}_0$ to $\overline{Y}_9$	Multiplexer outputs
8	GND	Ground (0 V)
16	VCC	Positive supply voltage

Figure 2. Input and output equivalent circuit

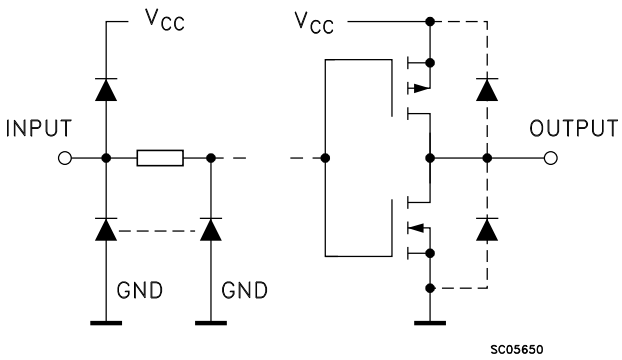
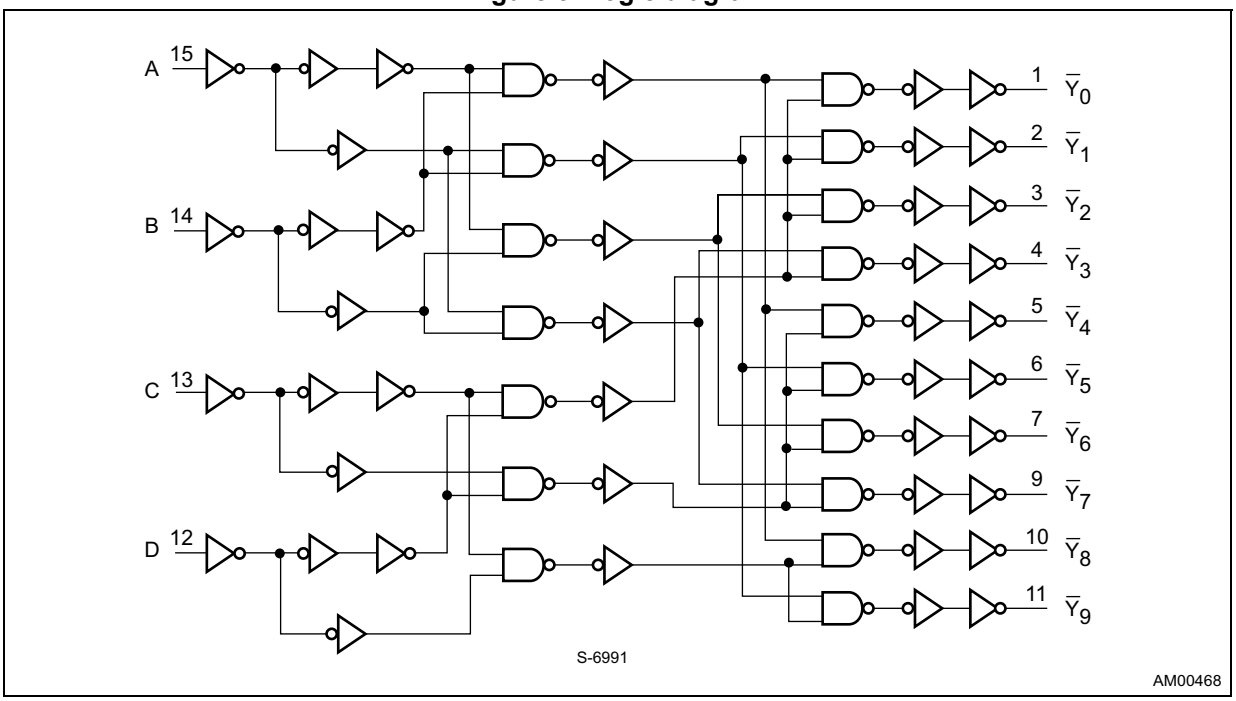


Table 3. Functional table

Code no	BCD inputs				Decimal outputs									
	D	C	B	A	$\overline{Y}_0$	$\overline{Y}_1$	$\overline{Y}_2$	$\overline{Y}_3$	$\overline{Y}_4$	$\overline{Y}_5$	$\overline{Y}_6$	$\overline{Y}_7$	$\overline{Y}_8$	$\overline{Y}_9$
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	H	L	H	H	H	H	H	H
4	L	H	L	L	H	H	H	H	L	H	H	H	H	H
5	L	H	L	H	H	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	H	H	H	L	H	H
8	H	L	L	L	H	H	H	H	H	H	H	H	L	H
9	H	L	L	H	H	H	H	H	H	H	H	H	H	L
10	H	L	H	L	H	H	H	H	H	H	H	H	H	H
11	H	L	H	H	H	H	H	H	H	H	H	H	H	H
12	H	H	L	L	H	H	H	H	H	H	H	H	H	H
13	H	H	L	H	H	H	H	H	H	H	H	H	H	H
14	H	H	H	L	H	H	H	H	H	H	H	H	H	H
15	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Figure 3. Logic diagram



2 Absolute maximum ratings and operating conditions

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	-0.5 to +7	V
V_I	DC input voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC output voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC input diode current	± 20	mA
I_{OK}	DC output diode current	± 20	mA
I_O	DC output current	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or ground current	± 50	mA
P_D	Power dissipation	500(1)	mW
T_{stg}	Storage temperature	-65 to +150	°C
T_L	Lead temperature (10 sec.)	300	°C

1. 500 mW at 65 °C. Derate to 300 mW by 10 mW/°C from 65 °C to 85 °C.

Table 5. Recommended operating conditions

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage		2 to 6	V
V_I	Input voltage		0 to V_{CC}	V
V_O	Output voltage		0 to V_{CC}	V
T_{op}	Operating temperature		-55 to 125	°C
t_r, t_f	Input rise and fall time	V_{CC} = 2 V	0 to 1000	ns
		V_{CC} = 4.5 V	0 to 500	ns
		V_{CC} = 6 V	0 to 400	ns

Table 6. DC specifications

Symbol	Parameter	Test condition		Value							Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High level input voltage	2.0		1.5			1.5		1.5		V
		4.5		3.15			3.15		3.15		
		6.0		4.2			4.2		4.2		
V_{IL}	Low level input voltage	2.0				0.5		0.5		0.5	V
		4.5				1.35		1.35		1.35	
		6.0				1.8		1.8		1.8	
V_{OH}	High level output voltage	2.0	I_O = -20 µA	1.9	2.0		1.9		1.9		V
		4.5	I_O = -20 µA	4.4	4.5		4.4		4.4		
		6.0	I_O = -20 µA	5.9	6.0		5.9		5.9		
		4.5	I_O = -4.0 mA	4.18	4.31		4.13		4.10		
		6.0	I_O = -5.2 mA	5.68	5.8		5.63		5.60		
V_{OL}	Low level output voltage	2.0	I_O = 20 µA		0.0	0.1		0.1		0.1	V
		4.5	I_O = 20 µA		0.0	0.1		0.1		0.1	
		6.0	I_O = 20 µA		0.0	0.1		0.1		0.1	
		4.5	I_O = 4.0 mA		0.17	0.26		0.33		0.40	
		6.0	I_O = 5.2 mA		0.18	0.26		0.33		0.40	
I_I	Input leakage current	6.0	V_I = V_{CC} or GND			± 0.1		± 1		± 1	µA
I_{CC}	Quiescent supply current	6.0	V_I = V_{CC} or GND			4		40		80	µA

Table 7. AC electrical characteristics (C_L = 50 pF, input $t_r = t_f$ = 6 ns)

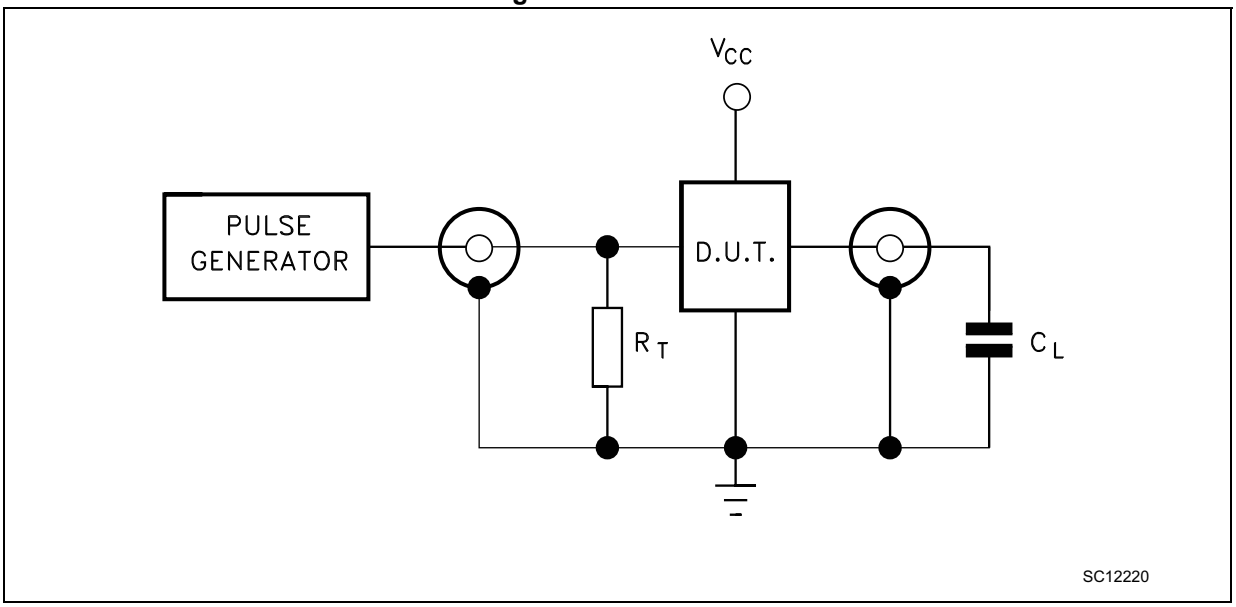
Symbol	Parameter	Test condition		Value							Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output transition time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t_{PLH} t_{PHL}	Propagation delay time	2.0			64	130		165		195	ns
		4.5			16	26		33		39	
		6.0			14	22		28		33	

Table 8. Capacitive characteristics

Symbol	Parameter	Test condition		Value							Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C_{IN}	Input capacitance	5.0			5	10		10		10	pF
C_{PD}	Power dissipation capacitance(1)	5.0			60						pF

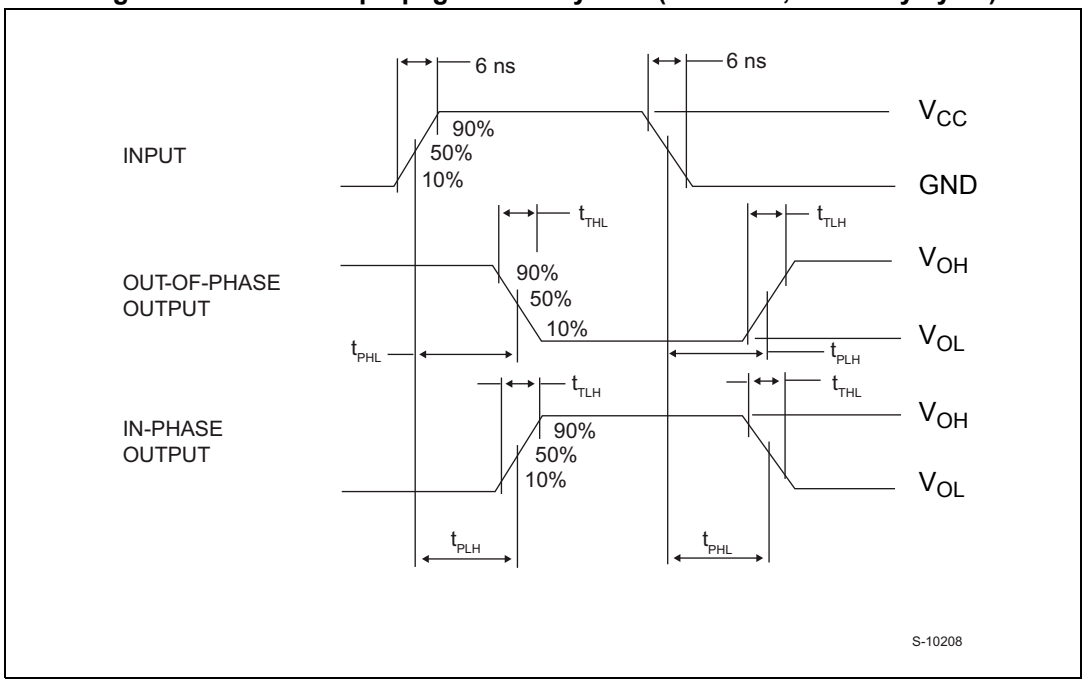
1. C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load (refer to *Figure 4*). The average operating current can be obtained by the following equation: $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$.

Figure 4. Test circuit



1. C_L = 50 pF or equivalent (includes jig and probe capacitance). $R_T = Z_{OUT}$ of pulse generator (typically 50 Ω).

Figure 5. Waveform - propagation delay time (f = 1 MHz, 50% duty cycle)



3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

Figure 6. SO-16 package outline

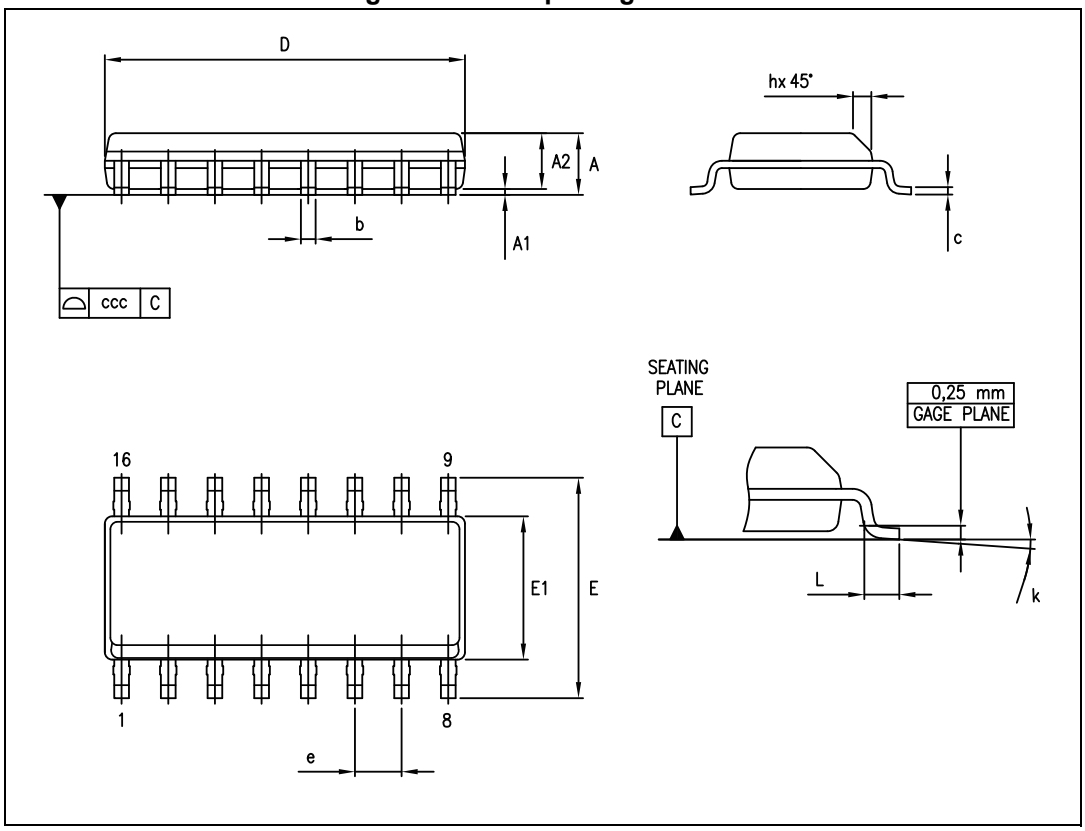


Table 9. SO-16 package mechanical data

Symbol	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.31		0.51	0.012		0.020
c	0.17		0.25	0.007		0.010
D	9.80	9.90	10.00	0.386	0.390	0.394
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	0		8			
ccc			0.10			0.004

4 Ordering information

Table 10. Order code

Order code	Package	Packaging
M74HC42RM13TR	SO-16	Tape and reel

5 Revision history

Table 11. Document revision history

Date	Revision	Changes
01-Jul-2001	1	Initial release.
15-May-2013	2	Removed: “Obsolete Product” watermark. Updated *Description*. Removed M74HC42B1R and M74HC42TTR device in *Table 1* and *Table 10*. Removed DIP and TSSOP package from *Table 1*, *Table 10*, and *Chapter 4*. Removed note below *Figure 3*. Updated package information in *Chapter 4*. Minor corrections throughout document.