Logic Gates

Related Devices

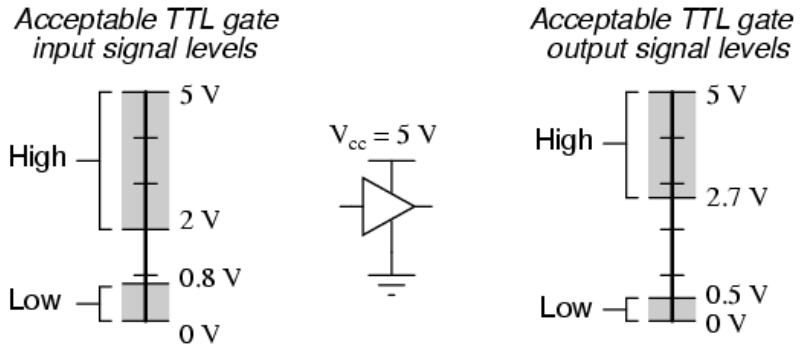
Outline

1. Logic level and Status
2. Logic gates
3. Truth table
4. Logic gates series
5. ICs Package
6. Datasheet

Logic Circuit

Laboratory

Logic level



TTL : Transistor-Transistor Logic

Logic gates

Name	NOT	AND	NAND	OR	NOR	XOR	XNOR
Alg. Expr.	$\overline{A}$	AB	$\overline{AB}$	$A+B$	$\overline{A+B}$	$A \oplus B$	$\overline{A \oplus B}$
Symbol							
Truth Table	A X 0 1 1 0	B A X 0 0 0 0 1 0 1 0 0 1 1 1	B A X 0 0 1 0 1 1 1 0 1 1 1 0	B A X 0 0 0 0 1 1 1 0 1 1 1 1	B A X 0 0 1 0 1 0 1 0 0 1 1 0	B A X 0 0 0 0 1 1 1 0 1 1 1 0	B A X 0 0 1 0 1 0 1 0 0 1 1 1

ANSI, IEEE, IEC Standard Symbol

Truth table

AND $Y = AB$

OR $Y = A + B$

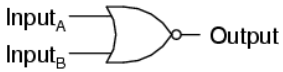
NOT $Y = \overline{A}$

NOR $Y = \overline{A + B}$

NAND $Y = \overline{AB}$

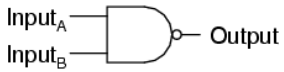
XOR $Y = A \oplus B$

NOR gate



A	B	Output
0	0	1
0	1	0
1	0	0
1	1	0

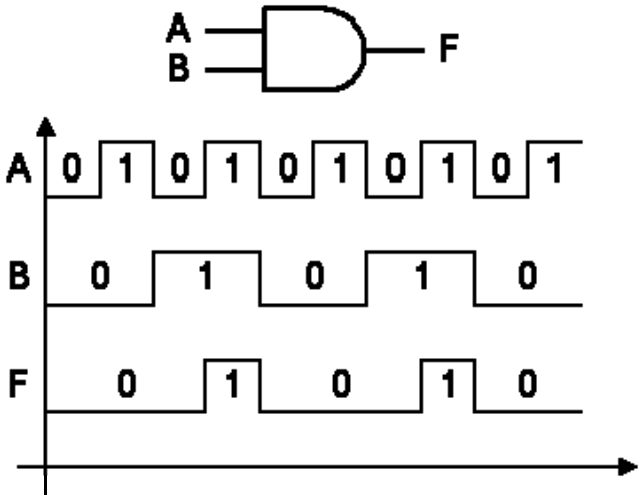
NAND gate



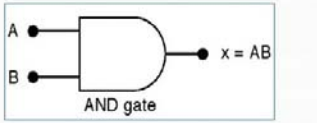
A	B	Output
0	0	1
0	1	1
1	0	1
1	1	0

ANSI, IEEE, IEC Standard Symbol

Time diagram



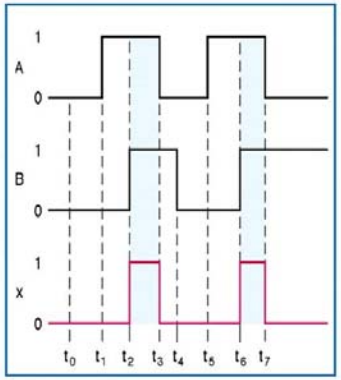
Logic gate



a) Gate Symbol & Boolean Equation

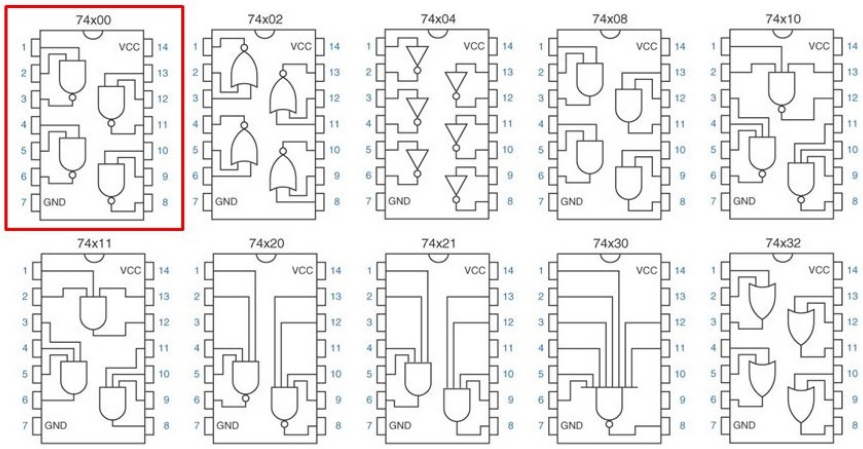
AND		
A	B	x = A · B
0	0	0
0	1	0
1	0	0
1	1	1

b) Truth Table



c) Timing Diagram

7400-series Pin Diagrams



ไอซีลอจิก	ชนิดของลอจิกเกต
7400	Quad 2-input NAND gate
7402	Quad 2-input NOR gate
7404	Hex (Inverter) NOT gate
7408	Quad 2-input AND gate
7432	Quad 2-input OR gate

ตระกูลลอจิกเกต	ความหมาย
74-	Standard TTL
74L-	Low-Power TTL
74S-	Schottky TTL
74LS-	Low-power Schottky TTL
74AS-	Advanced Schottky TTL
74ALS-	Advanced Low-Power Schottky TTL
74F-	Fast Advanced Schottky TTL

TTL : Transistor-Transistor Logic

TTL จะใช้ BJT (Bi-Junction Transistor) ขับเกต เป็นเทคโนโลยีเก่า

ปัจจุบันส่วนมากจะใช้ Transistor ชนิด MOSFET ในการขับเกตแทน

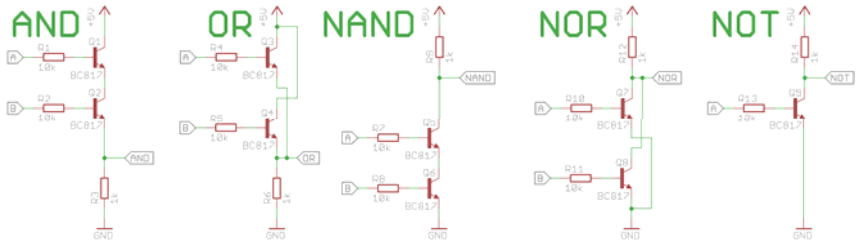
ตระกูลลอจิกเกต	ความหมาย
74HC-	High-Speed CMOS
7HCT-	High-Speed CMOS (TTL-compatible input)
74AC-	Advanced CMOS
74AHC-	Advanced High-Speed CMOS
74LVC-	Low-Voltage CMOS
74VHC-	Very High-Speed CMOS

TTL : Transistor-Transistor Logic

CMOS ข้อดีจะเด่นด้านกำลังขับและการใช้พลังงาน แต่จะออกแบบภายในค่อนข้างซับซ้อน

ดังนั้นถ้าจะทำ Logic gates จาก Transistor แนะนำใช้การต่อแบบ TTL จะดีกว่า

Logic gates series



TTL : Transistor-Transistor Logic

CMOS ข้อดีจะเด่นด้านกำลังขับและการใช้พลังงาน แต่จะออกแบบภายในค่อนข้างซับซ้อน ดังนั้นถ้าจะทำ Logic gates จาก Transistor แนะนำใช้การต่อแบบ TTL จะดีกว่า

Recommend Electronic Parts

www.es.co.th

Recommend Electronic Parts

ถ้าไม่มีใน www.es.co.th ส่วนมากต้องสั่งจาก ตปท

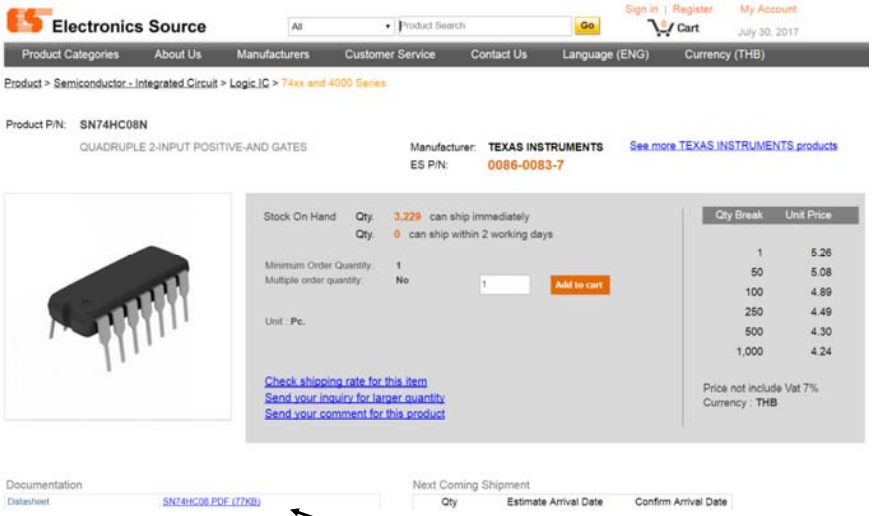
Farnell element14

http://th.element14.com

Digi-Key ELECTRONICS

www.digikey.com

Search Ex. Logic gates -> 74HC08 AND Gate



www.es.co.th → download Datasheet

Search Ex. Logic gates -> 74HC08 AND Gate

SN54HC08, SN74HC08
QUADRUPLE 2-INPUT POSITIVE-AND GATES

SCLS081B – DECEMBER 1982 – REVISED MAY 1997

- **Package Options Include Plastic Small-Outline (D), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

description

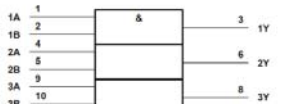
These devices contain four independent 2-input AND gates. They perform the Boolean function $Y = A \cdot B$ or $Y = \overline{\overline{A} + \overline{B}}$ in positive logic.

The SN54HC08 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74HC08 is characterized for operation from –40°C to 85°C.

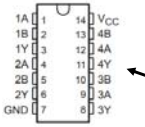
FUNCTION TABLE
(each gate)

INPUTS A	INPUTS B	OUTPUT Y
H	H	H
L	X	L
X	L	L

logic symbol†

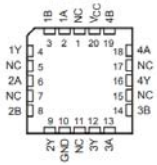


SN54HC08 . . . J OR W PACKAGE
SN74HC08 . . . D, N, OR PW PACKAGE
(TOP VIEW)



PIN

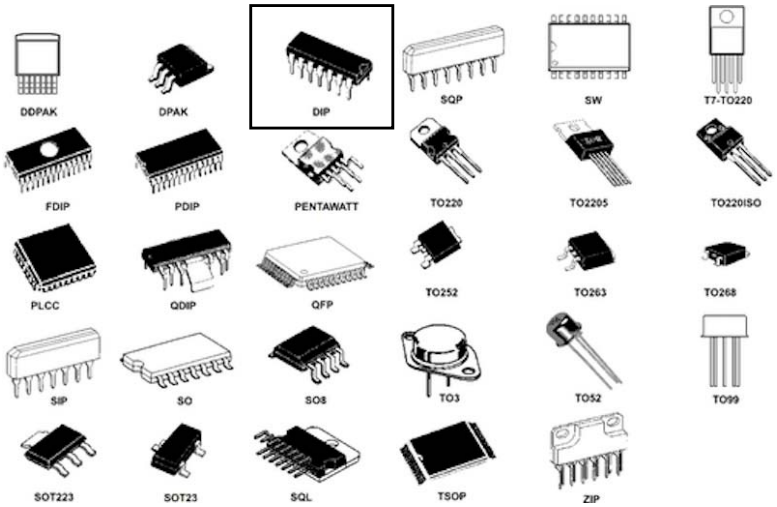
SN54HC08 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

ICs Package

Dual in-line package



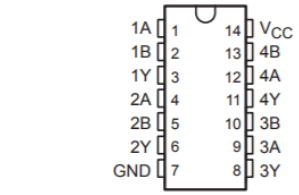
source: SparkFun Electronics

ICs Package

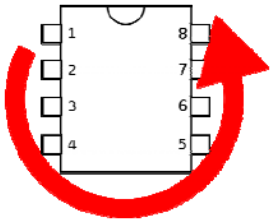
SN54HC08, SN74HC08
QUADRUPLE 2-INPUT POSITIVE-AND GATES

SCLS081B – DECEMBER 1982 – REVISED MAY 1997

SN54HC08 . . . J OR W PACKAGE
SN74HC08 . . . D, N, OR PW PACKAGE
(TOP VIEW)



SN54HC08 . . . FK PACKAGE
(TOP VIEW)



Search Ex. Logic gates -> 74HC08 AND Gate

SN54HC08, SN74HC08
QUADRUPLE 2-INPUT POSITIVE-AND GATES

SCLS081B – DECEMBER 1982 – REVISED MAY 1997

absolute maximum ratings over operating free-air temperature range†

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	±20 mA
Continuous output current, I_O (V_O = 0 to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package	127°C/W
N package	78°C/W
PW package	170°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

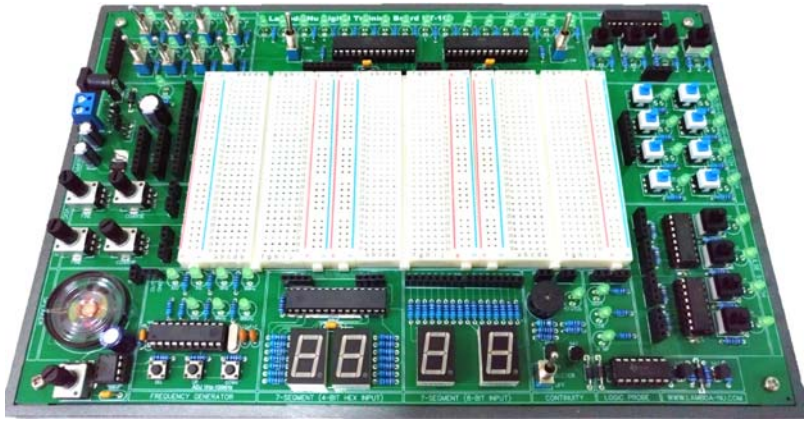
			SN54HC08 MIN	SN54HC08 NOM	SN54HC08 MAX	SN74HC08 MIN	SN74HC08 NOM	SN74HC08 MAX	UNIT
V_{CC}	Supply voltage		2	5	6	2	5	6	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5			1.5			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 6 V	4.2			4.2			
V_{IL}	Low-level input voltage	V_{CC} = 2 V	0		0.5	0		0.5	V
		V_{CC} = 4.5 V	0		1.35	0		1.35	
		V_{CC} = 6 V	0		1.8	0		1.8	
V_I	Input voltage		0		V_{CC}	0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	0		V_{CC}	V
t_t	Input transition (rise and fall) time	V_{CC} = 2 V	0		1000	0		1000	ns
		V_{CC} = 4.5 V	0		500	0		500	
		V_{CC} = 6 V	0		400	0		400	
T_A	Operating free-air temperature		–55		125	–40		85	°C

LAB1

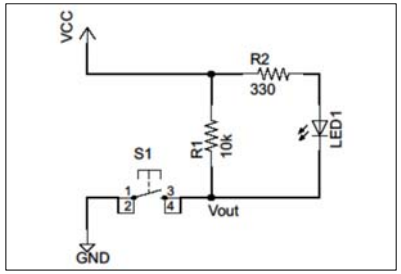
START

LAB1.1 เรียนรู้การใช้งานบอร์ด Logic circuit lab

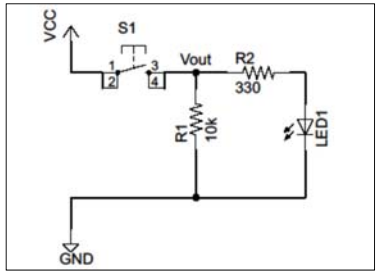
บอร์ดทดลอง Logic circuit



LAB1.2 ทดลองการใช้งานเบื้องต้น ผ่านการต่อ Switch



Pull up



Pull down

LAB1.3 หาข้อมูล ICs

SN54HC08, SN74HC08
QUADRUPLE 2-INPUT POSITIVE-AND GATES

SCLS081B – DECEMBER 1982 – REVISED MAY 1997

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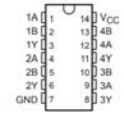
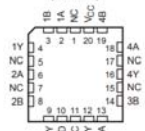
SN54HC08 . . . J OR W PACKAGE
SN74HC08 . . . D, N, OR PW PACKAGE
(TOP VIEW)



SN54HC08 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

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The SN54HC08 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74HC08 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each gate)

INPUTS A	INPUTS B	OUTPUT Y
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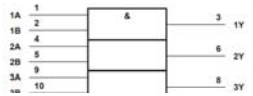
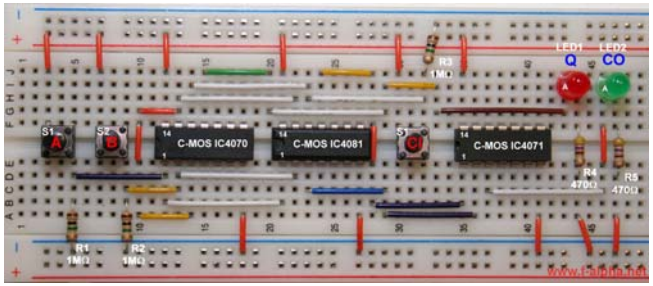
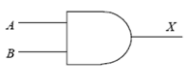
X	L	L

logic symbol†



LAB1.2 ทดลอง Logic gates แบบง่าย

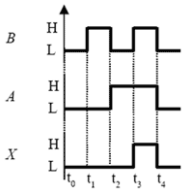




(ก)

A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

(ข)



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