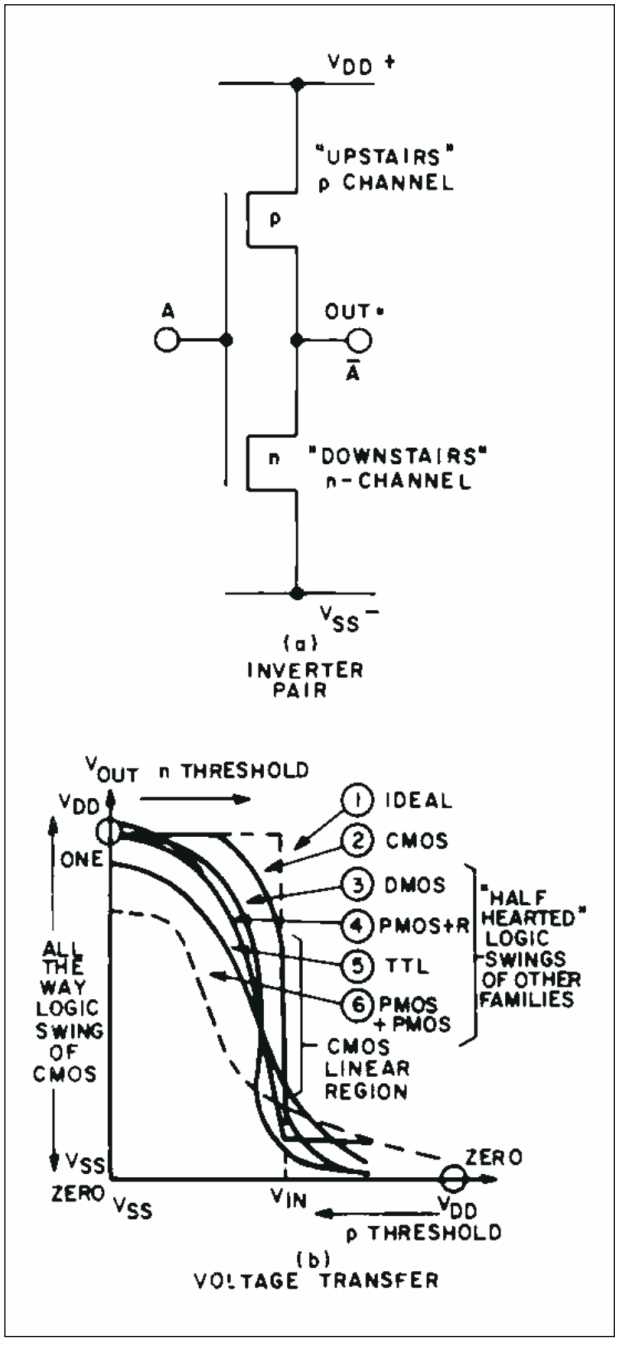
CMOS en Logic



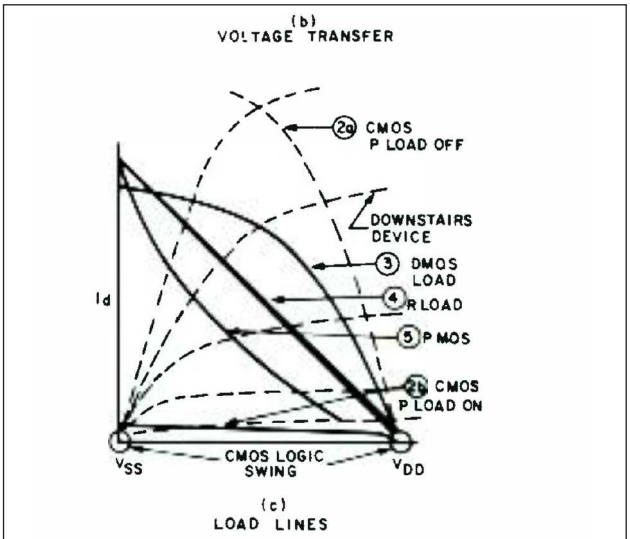


Fig. 1—COS/MOS inverter pair (a), and comparison of switching characteristics (b) and load lines (c) for various combinations of complementary pairs.

CMOS en Logic

Verkorte inhoudsopgave

pag.

CMOS en Logic

4 goede CMOS gebruiken

1.
Alle ingangen moeten ergens naar toe lopen, dus op de juiste manier zijn afgesloten.
Een ongebruikte ingang moet ofwel naar massa of naar de plus lopen, direct of middels een weerstand. De ingang van de CMOS poort heeft een hoge impedantie, waardoor een ‘vrije’ ingang gemakkelijk zelf kan bepalen wat de schakeling gaat doen. Met ruis en onvoorziene uitkomsten incl. een hoger stroomgebruik aan toe.

2.
Ingangen die van het (Printed) circuit board af gaan dienen een belastingsweerstand te krijgen van 1 MOhm naar massa.

CMOS IC’s zijn gevoelig voor statische elektriciteit. Ze hebben weliswaar ingebouwde beveiligings diodes, maar dat boedt lang niet altijd genoeg bescherming.
Het is een goede gewoonte om een anti-statische armband te dragen, die met aarde is verbonden.

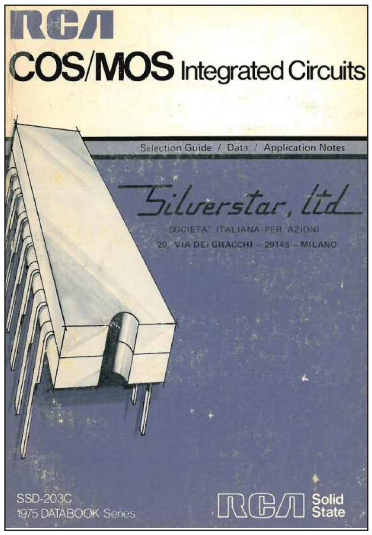
3.
CMOS IC’s hebben een enorm bereik aan voedingsspanningen (in het algemeen van + 3 V tot aan + 15 V en soms zelfs nog hoger), maar het een goed gebruik om EERST de Datasheet te raadplegen voor dat type IC. En let daarbij ook altijd even op de achtervoegsels van UB, A, AE en B, het zijn echt verschillende schakelingen.
In het algemeen zal de voedingsspaning in het gebied van + 4 - + 9 Volt worden gebruikt.

4.
Afsluitweerstanden zijn vaak in CMOS schakelingen nodig. Ze worden gebruikt om een hoge- of juist lage stand van de ingang te bewerkstelligen, als deze niet behoeft te veranderen.
Zoals bij niet in gebruik zijnde extra poorten van digitale schakelingen.

Maar ook bij verandering (dus wèl gebruik van de poort) kunnen ze nuttig zijn. Meestal met een hoge waarde tussen de 10 kOhm - 100 kOhm naar massa (pulldown resistor). Of de pullup variant van de ingang naar de + van de voedingsspanning.

Voorbeeld bij een oscillator. Als deze ‘uit’ is willen we dat de uitgang van de oscillator naar massa gaat. Daartoe dient dan een optrek weerstand naar de + van de voedingsspanning (er van uitgaande dat het een inverterende poort is), zodat de uitgang bij het uitzetten naar de nul gaat.

CMOS design and Operating Considerations



RCA COSMOS Integrated Circuits.pdf
Oud handboek met Applicatie Notes uit 1975, gratis te downloaden.

Zie bv. vanaf pagina 21:
Hier zien we dat de “A” series van +3 tot 15 Volt lopen en de “B” series van +3 V - 18 V.
De minimale voedingsspanning bedraagt + 4 Volt.

Fig. 2 CMOS inverter met beveiligingsdiodes.

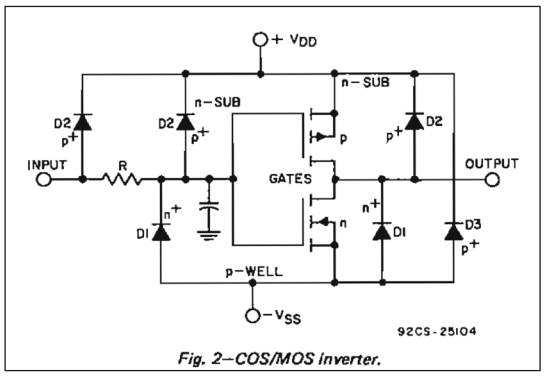


Fig. 2—COS/MOS inverter.

Pag. 446:
Output Short Circuits

Ingangen van bv. de CD4049 en CD4050 kunnen defect raken als ze niet afgesloten worden. Gemakkelijk kan de 200 milliwatt worden overschreden met het gevolg een defect.

Ze moeten een weerstand in de orde grootte van 10 kOhm - 1 MOhm hebben.
De oudere type zoals CD4007, CD4041, CD4049 en CD4050 kunnen defect raken als ze direct met de plus of de massa worden verbonden. Tot aan 5 Volt is dat nog wel mogelijk, maar bij hogere voedingsspanningen dient er een weerstand aan te pas te komen.

Pag. 450.

Pag. 531: De Hex buffers CD4009A, CD4049A en Quad Buffer CD4041A worden niet aanbevolen voor het gebruik als multivibrator. Daartoe dient de CD4059**B** te worden gebruikt.

CMOS en Logic

19 april 2021

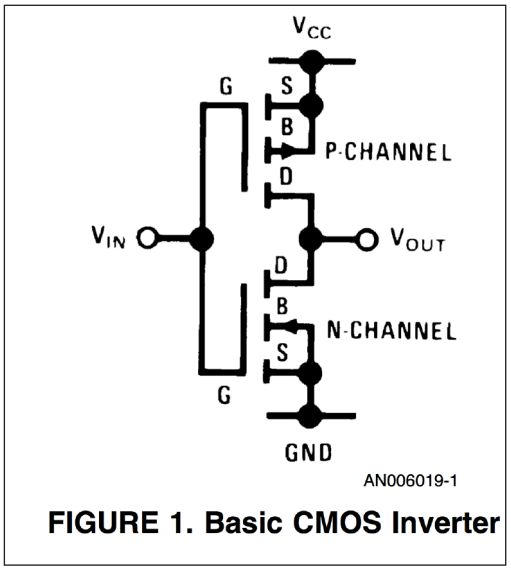


FIGURE 1. Basic CMOS Inverter

4000 serie

CMOS (COSMOS) 4000 series
Links rechtstreeks naar de Datasheets

https://en.wikipedia.org/wiki/List_of_4000-series_integrated_circuits

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Geschiedenis

4000 series integrated circuits

https://en.wikipedia.org/wiki/4000-series_integrated_circuits

Texas Instruments
From concept to cosmos: ‘**How Jack Kilby's integrated circuit transformed the electronics industry’.**

In 1958, as one of the few employees working through summer vacation at our company, electrical engineer **Jack Kilby** had the lab to himself. And it was during those two solitary weeks that he hit upon an insight that would transform the electronics industry.

https://news.ti.com/blog/2019/09/17/from-concept-to-cosmos-how-jack-kilbys-integrated-circuit-transformed-electronics-industry

CMOS
https://en.wikipedia.org/wiki/CMOS

RCA
RCA commercialized the technology with the trademark "COS-MOS" in the late 1960s, forcing other manufacturers to find another name, leading to "CMOS" becoming the standard name for the technology by the early 1970s.
CMOS eventually overtook NMOS as the dominant MOSFET fabrication process for very large-scale integration (VLSI) chips in the 1980s, while also replacing earlier transistor–transistor logic (TTL) technology.

CMOS has since remained the standard fabrication process for MOSFET semiconductor devices in VLSI chips. As of 2011, 99% of IC chips, including most digital, analog and mixed-signal ICs, are fabricated using CMOS technology.

https://en.wikipedia.org/wiki/CMOS

AN77
Application Notes
CMOS, the ideal Logic Family (Farchild) 10 pag's PDF download

(Fig. 1: 'Basic CMOS inverter' vorige pagina)

https://www.fairchildsemi.com/application-notes/AN/AN-77.pdf

SNELHEID

Speed limitations were eventually overcome with newer fabrication methods, leaving the older TTL chips to be phased out.
The series was extended in the late 1970s and 1980s with new models that were given 45xx and 45xxx designations, but are usually still regarded by engineers as part of the 4000 series.

In the 1990s, some manufacturers (e.g. ***Texas Instruments) ported the 4000 series to newer HCMOS based designs to provide greater speeds.***

DOC

Typenummer lijst

Low voltage complementary metal oxide semiconductor (LVCMOS) is a low voltage class of CMOS technology digital integrated circuits.

* lijst 4000 CMOS Logische IC's.pdf
met uitgebreide references

http://users.telenet.be/egg/5EE/Lijst%204000%20CMOS%20logische%20ICs.pdf

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Quad 2-Input NAND = 4093 (schmitt trigger inputs), pinout compatible with 4011
Dual 2-Input NAND = 40107 (32x CMOS drive, 136 mA open drain outputs)

Texas Instruments

****

Understanding Buffered and Unbuffered CD4xxxB Series Device Characteristics
R. E. Funk
Standard Linear & Logic

Application SCHA004 - oct. 2002

* scha004.pdf
17 pag’s

https://www.ti.com/lit/an/scha004/scha004.pdf

HCMOS Design Considerations

* SCHLA007A.pdf

Texas Instruments
40 pag’s

The high-speed CMOS logic family from TI contains a broad spectrum of SSI/MSI functions. Within this family are TTL functions, HCT devices, HC4000 series, and an HCU device.2 Entire CMOS systems can be implemented using this logic family.

https://www.ti.com/lit/an/scla007a/scla007a.pdf

Advanced High-Speed CMOS Logic

AHC / AHCT
Military brief
vol. 12 july 1998 issue 2

5 pag’s

Advanced High-Speed CMOS Logic (AHC and AHCT) provide the HCMOS user an excellent migration path to upgrade their speed performance in low power / low noise / low drive applications. AHC devices are fully compatible with CMOS switching levels while AHCT devices are TTL switching level compatible. These technologies have been fully qualified per the requirements of

MIL-PRF-38535 (QML).

HC and AHCT are well suited for communications and hand-held (battery powered) equipment such as man-pack radios, hand-held FLIRs, helmet-mounted displays, smart munitions and hand-held SAMs.

* sgyn133.pdf

https://www.ti.com/lit/ml/sgyn133/sgyn133.pdf

- - - - - - - - - - - - - - -

Literature Information

1997 AHC/AHCT Logic Data Book
- Literature Number SCLD003A

1997 SLL CD-ROM
- Literature Number SCBC001A

Individual Data Sheets
- Available from the TI Product Information Center at (972) 644-5580 or via TI's internet:

http://www.ti.com/sc

Logic Selection Guide
Texas Instruments

*****

Goed algemeen overzicht mogelijkheden diverse families
202 pag's

* sdyu001y.pdf

http://users.ugent.be/~jvncampe/digel/ppt/logicoverv.pdf

http://www.securetech.com.uy/documentos/electronics/sdyu001y.pdf

Logic Selection Guide

Febr. 2000
TI
264 pag's

AVC
Advanced very low voltage CMOS logic
see section 4

* sdyu001m.pdf

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uit TI Handbook (SDYU001m.pdf blz. A-6)

CMOS TYPENUMMER VERKLARING:

CD 4011 B E xx

1. Harris Digital Logic IC

2. typenumer met 4 - 5 cijfers

3. voedingsspanning
A = 12 V max.
B = 18 V max.
UB = 18 V max. unbuffered

4. Packages
Examples :

D – Ceramic Side-Brazed Dual-In-Line Package (DIP)
E – Plastic DIP
F – Ceramic DIP
K – Ceramic Flatpack
M – Plastic Surface-Mount
Small-Outline Integrated Circuit (SOIC)

SM – Plastic Shrink SOIC (SSOP)
M96 – Reeled Plastic Surface-Mount SOIC
SM96 – Reeled Plastic Shrink SOIC (SSOP)

5. High-Reliability Screening
Military Products Only
Examples:
3 – Noncompliant With MIL-STD-883, Class B
3A – Fully Compliant With MIL-STD-883, Class B

HCMOS

HCMOS ("high-speed CMOS") is the set of specifications for electrical ratings and characteristics, forming the 74HC00 family, a part of the 7400 series of integrated circuits.
Also for microprocessors, microcontrollers and complex integrated circuits.

https://en.wikipedia.org/wiki/HCMOS

7400 series
TTL

https://en.wikipedia.org/wiki/7400-series_integrated_circuits

- - - - - - - - - - - -

Books

50 Circuits Using 7400 Series IC's
1st Ed; R.N. Soar
Bernard Babani Publishing
76 pages; 1979; ISBN 0900162775. (archive)

https://worldradiohistory.com/UK/Bernards-And-Babani/Bernards/Babani-58-50-Circuits-Using-7400-ICs.pdf

* Babani-58-50-Circuits-Using-7400-ICs

- - - - - - - - - - - -

TTL Cookbook
1st Ed; Don Lancaster
Sams Publishing; 412 pages;
1974; ISBN 978-0672210358. (archive)
****
https://web.archive.org/web/20190407130333/https://www.tinaja.com/ebooks/TTLCB1.pdf

* TTLCB1.pdf
340 pag’s

- - - - - - - - - - - -

Designing with TTL Integrated Circuits; 1st Ed; Robert Morris, John Miller; Texas Instruments and McGraw-Hill; 322 pages; 1971; ISBN 978-0070637450. (archive)

https://archive.org/details/bitsavers_tiTexasInsSeriesMorrisDesigningWithTTLIntegratedCi_11927910

* Morris_Designing_With_TTL_Integrated_Circuits_1971.pdf
- - - - - - - - - - -

App Notes

Understanding and Interpreting Standard-Logic Data Sheets; Stephen Nolan, Jose Soltero, Shreyas Rao; Texas Instruments; 60 pages; 2016.

Comparison of 74HC, 74S, 74LS, 74ALS Logic; Fairchild; 6 pages, 1983.

Interfacing to 74HC Logic; Fairchild; 10 pages; 1998.

Fairchild Semiconductor / ON Semiconductor

Historical Data Books: TTL (1978, 752 pages), FAST (1981, 349 pages)

Logic Selection Guide (2008, 12 pages)

Nexperia / NXP Semiconductor

Logic Selection Guide (2020, 234 pages)

Texas Instruments / National Semiconductor

Historical Catalog: (1967, 375 pages)

Historical Databooks: TTL Vol1 (1984, 339 pages), TTL Vol2 (1985, 1402 pages), TTL Vol3 (1984, 793 pages), TTL Vol4 (1986, 445 pages)
Digital Logic Pocket Data Book (2007, 794 pages), Logic Reference Guide (2004, 8 pages), Logic Selection Guide (1998, 215 pages)
Little Logic Guide (2018, 25 pages), Little Logic Selection Guide (2004, 24 pages)
Toshiba
General-Purpose Logic ICs (2012, 55 pages)

External links

Wikimedia Commons has media related to 7400 Series.

Understanding 7400-series digital logic ICs - Nuts and Volts magazine
Thorough list of 7400-series ICs - Electronics Club

Een aantal webshops, leveranciers, winkeliers van 4000 serie IC's 'vergeten' te vermelden, of het om een B, UB of A(E) type gaat.

De schakelingen en technische gegevens van het IC verschillen aanzienlijk !

Fabrikanten CMOS ICs

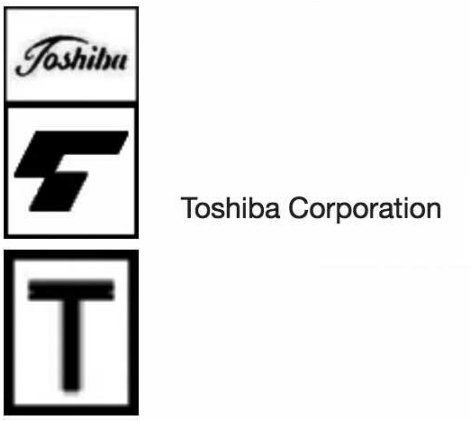
- Hitachi Japan
- Intersil United States
- NXP/Philips Semiconductors Netherlands United States
- ON Semiconductor / Fairchild Semiconductor United States
- RCA United States
- Renesas Electronics Japan
- ST Microelectronics France Italy
- Texas Instruments / National Semiconductor United States
- Toshiba Semiconductor Japan
- VEB Kombinat Mikroelektronik (defunct; was active in the 1980s East Germany
  Kombinat Mikroelektronik Erfurt
  VEB Kombinat Mikroelektronik Erfurt was an important manufacturer of active electronic components in East Germany.
- Tesla Piešťany, s.p. (defunct; was active in the 1980s and 1990s) Czechoslovakia.

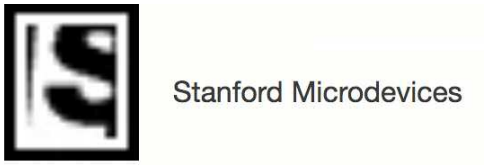
Voorvoegsels typenummers per fabrikant

Intersil	CD4000B
Nexperia	HEF4000B (Philips)
On	MC14000B
ST	HCF400B
TI	CD40001B
Thosiba	TC4001B

Zo herkent u de fabrikant van de chips aan z’n logo

https://how-to.fandom.com/wiki/How_to_identify_integrated_circuit_(chip)_manufacturers_by_their_logos/all_logos





COSMOS 4000 series en hoger

Type	soort	aantal	omschrijving
4000	Logic Gates	2	Dual 3-input NOR gate + 1 NOT gate DIP14, SO14
4001	Logic Gates	4	Quad 2-input NOR gate DIP14, SO14, TSSOP14
4002	Logic Gates	2	Dual 4-input NOR gate DIP14, SO14
4006	Shift Registers	1	18-stage shift register (four independent with common clock: two 4-stage, two 5-stage with Q4 tap) DIP14
4007	Analog/Digital	2	Dual complementary enhanced-MOS transistor pair +1 NOT gate DIP14, SO14, TSSOP14
4008	Adders	1	4-bit binary full adder DIP16, SO16
4009	Buffers	6	OBSOLETE Hex inverter gate, dual power supply, can drive 1 TTL/DTL load (replaced by 4049) DIP16, SO16, TSSOP16
4010	Buffers	6	OBSOLETE Hex buffer gate, dual power supply, can drive 1 TTL/DTL load (replaced by 4050) DIP16, SO16, TSSOP16
4011	Logic Gates	4	Quad 2-input NAND gate DIP14, SO14, TSSOP14
4012	Logic Gates	2	Dual 4-input NAND gate DIP14, SO14, TSSOP14
4013	Flip-Flops	2	Dual D-type flip-flop DIP14, SO14
4014	Shift Registers	1	8-stage parallel in shift register (synchronous parallel load, serial in, Q6/Q7/Q8 out) (see 4021) DIP16, SO16, TSSOP16
4015	Shift Registers	2	Dual 4-stage shift register (two independent: serial in, Q1/Q2/Q3/Q4 out, reset, clock) DIP16, SO16, TSSOP16
4016	Analog Switches	4	Quad bilateral switch DIP14, SO14, TSSOP14
4017	Counters	1	Decade counter with 10 decoded outputs (5-stage Johnson counter) DIP16, SO16, TSSOP16
4018	Counters	1	Presettable divide-by-N counter DIP16, SO16, TSSOP16
4019	Logic Gates	4	Quad AND/OR select gate DIP16, SO16, TSSOP16
4020	Counters	1	14-stage binary ripple counter DIP16, SO16, TSSOP16
4021	Shift Registers	1	8-stage parallel in shift register (asynchronous parallel load, serial in, Q6/Q7/Q8 out) (see 4014) DIP16, SO16, TSSOP16
4022	Counters	1	Octal counter with 8 decoded outputs (4-stage Johnson counter) DIP16, SO16, TSSOP16
4023	Logic Gates	3	Triple 3-input NAND gate DIP14, SO14, TSSOP14
4024	Counters	1	7-stage binary ripple counter DIP14, SO14, TSSOP14
4025	Logic Gates	3	Triple 3-input NOR gate DIP14, SO14, TSSOP14
4026	7-Segment Decod	1	Decade counter with decoded 7-segment display outputs and display enable DIP16, SO16, TSSOP16
4027	Flip-Flops	2	Dual J-K master-slave flip-flop DIP16, SO16, TSSOP16
4028	Multiplexers	1	BCD to decimal (1-of-10) decoder active HIGH output DIP16, SO16, TSSOP16
4029	Counters	1	Presettable up/down counter, binary or BCD-decade DIP16, SO16, TSSOP16

4030	Logic Gates	4	OBSOLETE Quad XOR gate (replaced by 4070, 4077 of 4507) DIP14, SO14, TSSOP14
4031	Shift Registers	1	64-stage shift register DIP16, TSSOP16
4032	Adders	3	Triple serial adder DIP16, PLCC20
4033	7-Segment Decoders	1	Decade counter with decoded 7-segment display outputs and ripple blanking DIP16, SO16, TSSOP16
4034	Registers	1	8-stage bidirectional parallel/serial input/output register DIP24, SO24
4035	Shift Registers	1	4-stage parallel-in/parallel-out shift register DIP16, SO16, TSSOP16
4038	Adders	3	Triple serial adder DIP16, PLCC20
4040	Counters	1	12-stage binary ripple counter DIP16, SO16, TSSOP16
4041	Buffers	4	Quad buffer/inverter (two outputs for each input) (4 times standard "B" drive) DIP14, SO14, TSSOP14
4042	Latches	4	Quad D-type latch DIP16, SO16, TSSOP16
4043	Latches	4	Quad NOR R-S latch with tri-state outputs DIP16, SO16, TSSOP16
4044	Latches	4	Quad NAND R-S latch with tri-state outputs DIP16, SO16, TSSOP16
4045	Counters	1	21-stage counter DIP16, SO16, TSSOP16
4046	PLL	1	Phase-locked loop with VCO DIP16, SO16, TSSOP16
4047	Multivibrators	1	Monostable/astable multivibrator DIP14, SO14, TSSOP14
4048	Logic Gates	1	Expandable 8-input 8-function gate with tri-state output, choice of: NOR, OR, NAND, AND, AND-NOR (AOI), AND-OR, OR-NAND (OAI), OR-AND DIP16, SO16, TSSOP16
4049	Buffers	6	Hex inverter gate, can drive 2 TTL/RTL loads or 4 four 74LS loads DIP16, SO16, TSSOP16
4050	Buffers	6	Hex buffer gate, can drive 2 TTL/RTL loads or 4 four 74LS loads DIP16, SO16, TSSOP16
4051	Analog Switches	1	8-channel analog multiplexer/demultiplexer DIP16, SO16, TSSOP16
4052	Analog Switches	2	Dual 4-channel analog multiplexer/demultiplexer DIP16, SO16, TSSOP16
4053	Analog Switches	3	Triple 2-channel analog multiplexer/demultiplexer DIP16, SO16, TSSOP16
4054	LCD Drivers	1	BCD to 7-segment decoder/LCD driver DIP16, SO16, TSSOP16
4055	LCD Drivers	1	BCD to 7-segment decoder/LCD driver with "display-frequency" output DIP16, SO16, TSSOP16
4056	LCD Drivers	1	BCD to 7-segment decoder/LCD driver with strobed-latch function DIP16, SO16, TSSOP16
4059	Counters	1	Programmable divide-by-N counter DIP24, SO24
4060	Counters	1	14-stage binary ripple counter and oscillator, schmitt trigger inputs DIP16, SO16, TSSOP16
4062		?	Logic dual 3 majority gate

4063	Comparators	1	4-bit digital comparator DIP16, SO16
4066	Analog Switches	4	Quad analog switch (low "ON" resistance) DIP14, SO14, TSSOP14
4067	Analog Switches	1	16-channel analog multiplexer/demultiplexer (1-of-16 switch) DIP24, SO24, TSSOP24
4068	Logic Gates	1	8-input NAND/AND gate (2 outputs) DIP14, SO14, TSSOP14
4069	Logic Gates	6	Hex inverter DIP14, SO14, TSSOP14
4070	Logic Gates	4	Quad 2-input XOR gate DIP14, SO14, TSSOP14
4071	Logic Gates	4	Quad 2-input OR gate DIP14, SO14, TSSOP14
4072	Logic Gates	2	Dual 4-input OR gate DIP14, SO14, TSSOP14
4073	Logic Gates	3	Triple 3-input AND gate DIP14, SO14, TSSOP14
4075	Logic Gates	3	Triple 3-input OR gate DIP14, SO14, TSSOP14
4076	Registers	4	Quad D-type register with tri-state outputs DIP16, SO16, TSSOP16
4077	Logic Gates	4	Quad 2-input XNOR gate DIP14, SO14, TSSOP14
4078	Logic Gates	1	8-input NOR/OR gate (2 outputs) DIP14, SO14, TSSOP14
4081	Logic Gates	4	Quad 2-input AND gate DIP14, SO14, TSSOP14
4082	Logic Gates	2	Dual 4-input AND gate DIP14, SO14, TSSOP14
4085	Logic Gates	2	Dual 2-wide, 2-input AND-OR-Invert (AOI) DIP14, SO14, TSSOP14
4086	Logic Gates	?	Expandable 4-wide, 2-input AND-OR-Invert (AOI) DIP14, SO14
4089	Rate Multipliers	1	Binary rate multiplier DIP16, SO16, TSSOP16
4093	Logic Gates	4	Quad 2-input NAND gate, schmitt trigger inputs DIP14, SO14, TSSOP14
4094	Shift Registers	1	8-stage shift-and-store bus DIP16, SO16, TSSOP16
4095	Flip-Flops	1	Gated J-K flip-flop (non-inverting) DIP14, SO14, PLCC20
4096	Flip-Flops	1	Gated J-K flip-flop (inverting and non-inverting) DIP14, SO14, PLCC20
4097	Analog Switches	1	Differential 8-channel analog multiplexer/demultiplexer DIP24, SO24, TSSOP24
4098	Multivibrators	2	Dual one-shot monostable DIP16, SO16, TSSOP16
4099	Latches	1	8-bit addressable latch DIP16, SO16, TSSOP16
4104	Translators	4	Quad low-to-high voltage translator with tri-state outputs SO16
4106	Logic Gates	6	Hex inverter gate, schmitt trigger inputs SO14, TSSOP14
4160	Counters	1	Decade counter with asynchronous clear
4161	Counters	1	4-bit binary counter with asynchronous clear
4162	Counters	1	Decade counter with synchronous clear
4163	Counters	1	4-bit binary counter with synchronous clear
4174	Flip-Flops	6	Hex D-type Flip-Flop DIP16, SO16

4175	Flip-Flops	4	Quad D-type flip-flop SO16
4192	Counters	1	Presettable up-down counter
4490		6	Hex contact bounce eliminator DIP16, SO16
4500		1	Industrial control unit
4502		6	Hex inverting buffer (tri-state) DIP16, SO16, TSSOP16
4503		6	Hex non-inverting buffer with tri-state outputs DIP16, SO16, TSSOP16
4504	Translators	6	Hex voltage level shifter for TTL-to-CMOS or CMOS-to-CMOS operation DIP16, SO16, TSSOP16
4505		1	64-bit, 1-bit per word random access memory (RAM) DIP14
4508	Latches	2	Dual 4-bit latch with tri-state outputs DIP24, SO24, TSSOP24
4510	Counters	1	Presettable 4-bit BCD up/down counter DIP16, SO16, TSSOP16
4511	7-Segment Decod	1	BCD to 7-segment latch/decoder/driver DIP16, SO16
4512	Multiplexers	1	8-input multiplexer (data selector) with tri-state output DIP16, SO16, TSSOP16
4513	7-Segment Decod	1	BCD to 7-segment latch/decoder/driver (4511 plus ripple blanking) DIP18
4514	Multiplexers	1	1-of-16 decoder/demultiplexer active HIGH output DIP24, SO24
4515	Multiplexers	1	1-of-16 decoder/demultiplexer active LOW output DIP24, SO24
4516	Counters	1	Presettable 4-bit binary up/down counter DIP16, SO16, TSSOP16
4517	Shift Registers	2	Dual 64-stage shift register DIP16
4518	Counters	2	Dual BCD up counter DIP16, SO16, TSSOP16
4519		4	Quad 2-input multiplexer (data selector) DIP16, SO16
4520	Counters	2	Dual 4-bit binary up counter DIP16, SO16, TSSOP16
4521			1 24-stage frequency divider
4522			1 Programmable BCD divide-by-N counter
4526	Counters	1	Programmable 4-bit binary down counter
4527			1 BCD rate multiplier
4528			2 Dual retriggerable monostable multivibrator with reset
4529	Analog	2	Dual 4-channel analog data selector/multiplexer
4530		2	Dual 5-input majority logical gate
4531		1	12-bit parity tree
4532	Multiplexers	1	8-bit priority encoder
4536	Timers	1	Programmable timer
4538			2 Dual retriggerable precision monostable multivibrator
4539		2	Dual 4-input multiplexer
4541	Timers	1	Programmable timer
4543	7-Segment Decod	1	BCD to 7-segment latch/decoder/driver with phase input

4549		1	Successive approximation registers
4551	Analog Switches	4	Quad 2-channel analog multiplexer/demultiplexer
4553	Counters	1	3-digit BCD counter
4555	Multiplexers	2	Dual 1-of-4 decoder/demultiplexer active HIGH output
4556	Multiplexers	2	Dual 1-of-4 decoder/demultiplexer active LOW output
4557	Shift Registers	1	1-to-64 stage variable length shift register
4558	7-Segment Decod	1	BCD to 7-segment decoder (enable, RBI and provides active–high output)
4559		1	Successive approximation registers
4560	Adders	1	NBCD adder
4561		1	9's complementer DIP16
4562		1	128–bit static shift register
4566		1	Industrial time-base generator
4569	Counters	1	Programmable divide-By-N, dual 4-Bit binary/ BCD down counter
4572	Logic Gates	6	Hex gate: quad inverter gate, single 2-input NAND gate single 2-input NOR gate
4583		2	Dual adjustable schmitt trigger inputs, each with buffer and inverter outputs, and XOR output
4584	Logic Gates	6	Hex inverter gate, schmitt trigger inputs
4585		1	4-bit digital comparator
4724		1	8-bit addressable latch
4750		1	Frequency synthesizer
4751		1	Universal divider
4794		1	8-stage shift-and-store register LED driver
4894		1	12-stage shift-and-store register LED driver
4938		2	Dual retriggerable precision monostable multivibrator with reset
4952	Analog	1	8-channel analog multiplexer/demultiplexer
40098		6	Hex 3-state inverting buffer
40100	Shift Registers	1	32-stage left/right shift register
40101		1	9-bit parity generator/checker
40102	Counters	1	Presettable 2-decade BCD down counter
40103	Counters	1	Presettable 8-bit binary down counter
40104		1	4-bit bidirectional parallel-in/parallel-out shift reg tri-state
40105		1	4-bit x 16 word FIFO register
40106	Logic Gates	6	Hex inverter gate, schmitt trigger inputs
40107		2	Dual 2-input NAND gate with 136 mA open-drain driver (32 times standard "B" sink) DIP8
40108		1	4x4-bit (tri-state) synchronous triple-port register file

40109	Translators	4	Quad level shifter
40110		1	Up/down decade counter, latch, 7-seg decod, LED driver
40116	Translators	1	8-bit bidirectional CMOS-to-TTL level converter
40117		1	Programmable dual 4-bit terminator
40147		1	10-line to 4-line (BCD) priority encoder
40160	Counters	1	Decade counter/asynchronous clear
40161	Counters	1	Binary counter/asynchronous clear
40162	Counters	1	4-bit synchronous decade counter with load, reset, and ripple carry output
40163	Counters	1	4-bit synchronous binary counter with load, reset, and ripple carry output
40174	Flip-Flops	6	Hex D-type flip-flop
40175	Flip-Flops	4	Quad D-type flip-flop
40181		1	4-bit 16-function arithmetic logic unit
40192]	Counters	1	Presettable 4-bit up/down BCD counter
40193	Counters	1	Presettable 4-bit up/down binary counter DIP16, SO16, TSSOP16
40194	Shift Registers	1	4-bit bidirectional universal shift register
40195	Shift Registers	1	4-bit universal shift register

40208		1	4 x 4-bit (tri-state) synchronous triple-port register file
40240		1	Buffer/Line driver; inverting (tri-state)
40244		1	Buffer/line driver; non-inverting (tri-state)
40245		1	Octal bus transceiver; (tri-state) outputs
40257		4	Quad 2-line to 1-line data selector/multiplexer (tri-state)
40373	Latches	1	Octal D-type transparent latch (tri-state)
40374	Flip-Flops	1	Octal D-type flip-flop; positive-edge trigger (tri-state)
40501	Buffers	6	Hex buffer/converter (non-inverting) (pinout variant of 4050) DIP16
40511	7-Segment Decod	1	BCD 7-segment decoder, hexadecimal, active high DIP16
45106		1	Frequency synthesizer

Bij MOTOROLA gaat de typenummering nog hoger in getal

De ***CD45106*** is daar **MC145106** PLL Frequency Synthesizer
met een 1 aan het begin van het typenummer.

Ook bij de bekende CD4011 wordt bij Motorola er een 1 toegevoegd:
waardoor **CD4011** wordt: **MC 14011B** Quad 2 input NAND gate en
MC 1011UB voor de Unbuffered versie.

Analoge switches (CMOS CB.PDF page 406)

Type	switching	circuit	on resistance	package
4007	SPST or SPDT	simple	600 Ohm	14 pin
4016	4 SPST	simple	300 Ohm	14 pin
4066	4 SPST	improved	80 Ohm	14 pin
4051	1 of 8	improved	120 Ohm	16 pin
4052	Dual 1 of 4	improved	120 Ohm	16 pin
4053	Triple 1 of 2	improved	120 Ohm	16 pin
4067	1 of 16	improved	200 Ohm	24 pin
4097	Dual 1 of 8	improved	200 Ohm	24 pin

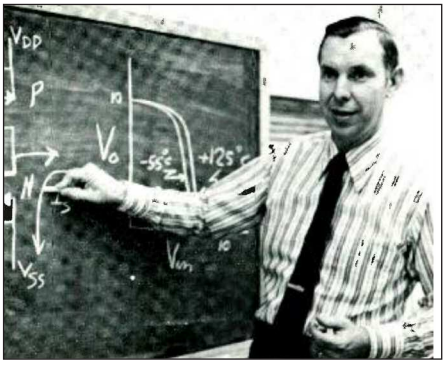
ALGEMENE COSMOS DOCUMENTATIE-LINKS

RCA Engineer
VOl 17 No 1 jun/jul 1971
115 pag's 5 MB
* 1971-06-07.pdf
https://www.americanradiohistory.com/ARCHIVE-RCA/RCA-Engineer/1971-06-07.pdf

page 13:
The inventor and his patent attorney
"Why didn't you ask me?" Patent Counsel: Joseph D. Lazar

page 40 - 47:
New Low-voltage COS/MOS IC's offer 25 ns speed and direct interfacting with saturated logic
R. E. Funk

The COS/MOS CD4000A Series is an new line of 3V-to-15V Complementary-Symetry / Metal-Oxide-Semiconductor (COS/MOS) integrated circuits recently announced by the RCA Solid State Division.
These devices feature 25-nanosecond gate-propagation delay, 10-MHz clock frequency, and can be directly interfaced with saturated-logic IC's.



* Richard E. Funk, Ldr.
RCA Engineer
15 articles about COSMOS
* 1972-12-01.pdf
100 pag's

pag 5: RCA technogoy COSMOS

* afb Fig. 1 PLL uit boek

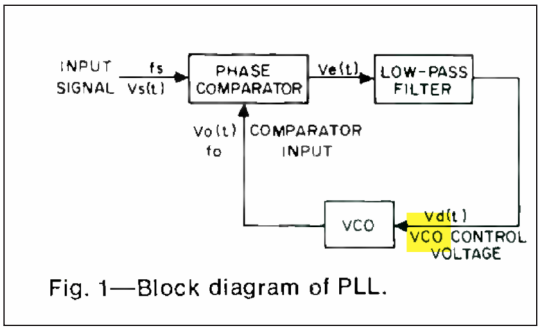


Fig. 1—Block diagram of PLL.

pag 69:
COSMOS phase-locked-loop
a versatile building block for micro-power digital and analog applications
D.K. Morgan en G. Steudel

CD4046A

https://www.americanradiohistory.com/ARCHIVE-RCA/RCA-Engineer/1972-12-01.pdf

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Motorola dataBooks

1988 Motorola CMOS Logic Data (vorige uit 1985)

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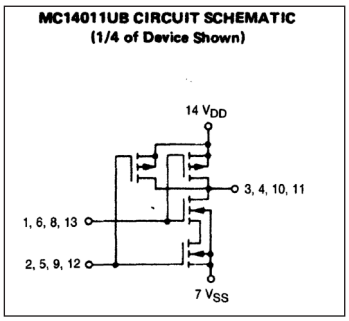
Technical data for the broad line of CMOS logic integrated circuits and demonstrates Motorola's continued commitment to Metal-Gate CMOS.
Complete specifications are provided in the form of data sheets.
In addition, a Product Selector Guide and a Handling and Design Guidelines chapter have been included to familiarize the user with these circuits



MC4011UB circuit schematic (1/4 of Device shown)
* 1988_Motorola_CMOS_Logic_Data.pdf

https://archive.org/details/bitsavers_motoroladaCMOSLogicData_31567161

HEF 4000 serie (oud NXP)

Though HEF4000B series is one of the oldest CMOS logic families around, it is still frequently used in new designs because of its ease of design-in, wide operating supply range (3 V to 15 V), excellent noise immunity, and low power consumption. All of the standard functions are available, plus more specialized functions such as IEEE bus interfaces and PLL frequency synthesizers.

https://web.archive.org/web/20160418115109/http://www.nxp.com/products/discretes-and-logic/logic/hef4000b:GRP_10035

Transistor Arrays

AN5296 Application of the CA3018 Integrated Circuit Transistor Array
Renesas Application Note

* REN_an5296_APN_20120720.pdf

Class H amplifier
Broadband video / HF / RF / IF

https://www.renesas.com/eu/en/products/analog-products/amplifiers/transistor-arrays

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CD4000 serie met verwijzingen naar AUDIO

CMOS - useful chips for DIY Lunetta Synths
Over the past few years of building the odd Synth module I've come across the 4000 series of CMOS (Complementary metal–oxide–semiconductor) chips time and again. I am an analog addict but I must say that the digital 4000 series is very versatile.

Referring to the CMOS family CD4XXXX.
They are typically four or five digits long but always start with a "4".

There are many equivalent chips in the TTL 74XX and 74HCXXX family but these are trickier to use as their power supply range is more restricted (2V to 6V). (Eg: the 74HC4066 was a replacement for the 4066 with slightly different electrical characteristics). In comparison The CMOS 4XXXX has a much wider range (+3 to +15V). Sometimes, the 4000-series has "borrowed" from the 7400 series - such as the CD40193 and CD40161 being pin-for-pin functional replacements for 74C193 and 74C161.

https://djjondent.blogspot.com/2017/08/cmos-useful-chips-for-lunetta-synths.html

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40106 - Hex schmitt trigger inverters.(can also use a 74c14)
This can make 6 square/pulse wave oscillators
Ken stones Psycho LFO ,CGS03
(Ken Stones CGS06 - Burst generator)
Hyve synth

40174 - (CD40174, 74LS174, HCF40174, HEF40174)

40193 - Binary Up/Down Counter

4001 - Quad two-input NOR gate (four NOR gates), (NLC Bools)

(NLC Divine Cmos), CellF Voice
LZX Castle 101 quad gate
Doepfer A-140 ADSR

4006 - shift register (Klee sequencer)

4007 - (CD4007, HCF4007, HEF4007, MC14007...) .- misc gates

4009 - Hex inverter (six NOT gates),

4011 - (CD4011, HEF4011, HCF4011, MC14011...)
Quad two-input NAND gate (four NAND gates), (NLC Bools)
(NLC Divine Cmos)
LZX Castle 101 quad gate
(Ken stones CGS01 - Suboscillator)

4013 - Dual bistable Flip-Flop (MXR Delay pedal), (Ibanez FL-303 flanger pedal),
(MXR Chorus Pedal) Divide & Conquer
Roland SH101 --They fed the main oscillator output to the CMOS 4013 to give the suboscillator waveforms. square at -1 oct, square at -2 octaves, and a pulse at -2 oct.
Plumbutter - Ciat Lonbarde - Deerhorn?, Gong
Ciat Lonbarde - Paper Circuit -Swoop
Ciat Lonbarde - Papercircuit - Esoterica
EDP Wasp

4015 - 8 position shift register. (LZX Castle 110 shift register video module)
(Ken Stones Gated Comparator)
Plumbutter - Ciat Lonbarde - Man with the red Steam
Ciat Lonbarde - Old Mr Grassi -Paper Circuit
Lorre Mill U Tone

4016 - (74HC4016, CD4016, HCF4016, HEF4016,TC4016...) analog bilateral switch

4017 - decade counter (Squid axon),
(1050 mix sequencer)
Baby 10 sequencer.(The 4017 has 10 decoded outputs)
ARSEq Sequencer/EG
(Ken stones CGS01 - Suboscillator)
(Ken Stones CGS06 - Burst generator)
(Ken stones CGS07 - gate sequencer)

4018 - presettable divide by N Counter. The jam inputs can be used t0 preset the counter to a certain count and the reset input can be used to clear to count to zero.

4020 - 14-bit binary Ripple Counter

4022 - Divide-by-8 counter/divider

4024 - shift register- Seven stage ripple carry binary counter (NLC Null A).
NLC Divide & Conquer, ,
(Ken stones CGS01 - Suboscillator)
(Ken Stones CGS08 - V8 Simulator)
(Ken Stones CGS09 - Voltage controlled divider)
Polyfusion octave divider

4027B - J-K Type Flip-Flop

4029 - 4 stage counter-binary/decade (NLC 4SEQ)
(NLC 32:1)
(Null A),
Bindubba sequencer

4030 - Quad two-input XOR gate (four XOR gates), (NLC Bools), (NLC Divine Cmos)
74HC4040 - 12-bit binary Ripple Counter

4034 - 8-Stage tri-state bidirectional parallel/serial input/output bus register. (Klee sequencer)

4040 - divider/ripple counter/Binary counter.
There is an internal chain of divide by 2 circuits. The first output will have half the frequency of the clock, the next output will have half the frequency of that, etc
Vidiffektor

4042 - Quad D-Latch

4046 - (CD4046, 74HC4046, MC14046, HCF4046...)
PLL (Phase Locked Loop), built in VCO, (NLC Vactrol Pill),
RingPull
Giant Bono
Wagernumb
(Ken stones CGS07 - gate sequencer)
EDP Wasp
Lorre Mill U Tone

4049 - INVERTER - also sometimes called a NOT gate or hex invertering buffer (it has 6 gates)
Can be used in linear amplifiers.

4050 - Buffer (mostly used for interfacing to TLL logic).

4051 - (CD4051, 74HC4051, HCF4051...)
Eight channel multiplexer
Fairlight CMI IIx - Switched resistor filter
Ciat-Lonbarde - Tetrazzi
Ciat Lonbarde - Paper Circuit -Terazzi organus

4052 - (HEF4052, CD4052, 74HC4052, MC14052, MC4052...)
Dual 4 channel multiplexer, (NLC 4SEQ)
(Null A)

Bindubba sequencer
Vectrex Video Game
Ciat Lonbarde - Master Brando - Paper Circuit

4053 - (HEF4053, CD4053, MC14053, 74HC4053...
74HC4060 - 14-bit binary Ripple Counter

4060 - 14-bit binary Ripple Counter. Has a built in oscillator

4066 - (HCF4066, CD4066, 74HC4066...) quad bilateral analog switch.
CellF Voice
Ciat Lonbarde - Ultrasound

4067 - Single 16-Channel Multiplexer/Demultiplexer
Ciat Lonbarde Gerassic Organ

4068 - 8-input NAND/AND gate.

4069 - (CD4069, HEF4069, TC4069, HCF4069...)... WASP filter
INVERTER - also sometimes called a NOT gate or hex invertering buffer (it has 6 gates)
Can be used in linear amplifiers.(get the 4069UB - unbalanced)
4070 - XOR gate (four Exclusive OR gates) (NLC Bools)
(NLC Divine CMOS)
Divide & Conquer
(LZX 101 quad gate) video synth
One of the inputs decides if the gate is inverting or non-inverting by tieing
the input to either +V (non-inverting) or ground (inverting). I

4071 - Quad two-input OR gate (four OR gates) (NLC Bools)
(1050 mix sequencer)
With either or both inputs high, the output will be high.
With both inputs low, the output will be low.
Input A or Input B needs to be high for the output to be high...thus the "OR gate".

4077 - Quad two-input XNOR gate (four XNOR gates), (NLC Bools)
(NLC Divine Cmos)
Ciat_Lonbarde-Madame Brasser Paper Circuit

4081 - Quad two-input AND gate (four AND gates) - (NLC Divine Cmos, Bindubba sequencer)
(NLC Bools)
(1050 mix sequencer)
(Ken stones CGS07 - gate sequencer)
Ciat Lonbarde -Paper Circuit - Multioscillator Superposition control system
So this chip has four AND gates & each gate has two inputs.
With either or both inputs low, the output will be low;
with both inputs high, the output will be high.
Both input A AND input B needs to be high for the output to be high,
hence the name "AND gate"

4089 - binary rate multiplier- it's a divider where the input pattern determines the number of pulses that appear on the output.

4093 - quad schmitt trigger/ NAND gates (can make 4 square wave oscillators.)
4094 - 8 stage serial shift register (8bitcipher)

4096 - shift register

4514 - Four Bit Latch / 4-16 Line Decoder

4520 - Dual Binary up counter (NLC Divine Cmos)

Double Gate CMOS (DG)

Traditional CMOS technology is approaching physicial limitations was we approach the nanoscale regime. One such solution is the double gate transistor, proposed in the 1980s.
"Multigate transistors are one of the several strategies being developed by CMOS semiconductor manufacturers to create ever-smaller microprocessors and memory cells, colloquially referred to as extending Moore's law."

Other possible solutions include SOI devices, Strained-silicon FETs and carbon nanotube FET's

DG 202 - quad SPST CMOS analog switches (NLC Dual LPG) .., (NLC Dual LFO/VCO)
DG 212 - quad SPST CMOS analog switches (NLC Dual LPG)
DG 406 - multiplexer (NLC 32:1)
DG 408 - 1 to 8 multiplixer designed to connect one of eight inputs to a common output as determined by a 3-bit binary address (A0, A1, A2). (NLC Statues)
DG 412 - analog switch (plague of Demons) (router)
DG 508 - 8-channel single-ended analogmultiplexer designed to connect one of eight inputs to acommon output as determined by a 3-bit binary address (A0, A1, A2). (NLC Statues)

In vintage synths the most popular of the 4000-series chips appear to be the analog bilateral switches (4016, 4066), the analog multiplexer/demultiplexers.

4051, 4052, 4053, 4067 and the 4046 phase-locked loop (PLL). These allow the routing of analog control signals.
The 4046 PLL was used in such machines as the OSCar.

The CMOS synth was also made famous by Stanley Lunetta of Sacramento who passed away on March 3, 2016.
His Lunetta Synth inspired the DIY synthesizer community.
He used mainly 4000 series CMOS chips.

Pullup & Pulldown resistors

These are used a lot in CMOS circuits.
They define the default state of the input (whether or not the switch is open, closed or there is nothing connected to it). For example, any spare gates can be tied together or connected to a fixed voltage, using a high value resistor (10k -100K) to either the Vcc voltage, (pull-up) or via a low value resistor to 0V (GND), known as pull-down. Unused inputs should never be left floating about.

Analog Multiplexer/Switches

406 - (DG 406) multiplexer (NLC 32:1)
412 - (DG 412) - analog switch (plague of Demons)
(router)

Building a Lunetta Synth

The modules you will need to build are Oscillators, filters, drums, sequencers, frequency dividers, clock dividers,amplifiers etc

Oscillators
40106 - 6 square wave oscillators
4093 - 4 square wave osc
4060 - It's a counter/divider & Oscillator. eg: The Olegtron
4046 - PLL
4069 - Rene Schmitz's exponential CMOS VCO

Noise
Run a few audio rate oscillators into the inputs of a logic gate (AND/OR/XOR)

Pitch Pattern Makers
4018 - modulo-n counter
http://electro-music.com/forum/topic-23896.html
4046/4017 - frequency synthesizer
4051/4017 - Slacker Melody generator

Sequencers
4017 - baby 10
4051/4017 - Slacker melody generator
4052 /4029

Dividers
4040 - my fav !
4017*
4024*

4018
4089
4060 ?
4516
4520

Filters
4069 WASP filter (CGS 749). The CD4069UB CMOS inverter, is used as opamp.
4007 - The MOSFET transistors of a 4007 are used as variable resistors.

Amplifiers (most of these are not CMOS but you might need them)
4096UB
4070 - quad XOR
LM386
741- (Weird Sound Generator)
LM324 - four op amps in one IC
TL072, TL074, TL08x, etc

Drum Modules
4096UB

Voltage Regulator
7805 - 5V regulator

Shift Registers
4006
4015
4024

Mixers
Use Op-amps (ok not CMOS)
4069

Switches
4066 - four logic controlled single-pole, single-throw switches in one intergated circuit. Nice !!
4067b - eg the Ciat Lonbarde Gerassic Organ. It's a 16 channel multiplexer.
