RICOH

RICOH CORP/ ELECTRONIC

CMOS Gate Array 5GV Series

The RICOH gate array 5GV series complies with the CMOS 1.5 μ rule, and offers high speed operation with a gate delay time of 1.0 ns.
The 5GV series inherits the rich library of 5GF gate array series. The cell library is compatible with standard cell RSC-15 series and enables LSI development to suit any system and production scale.

■ FEATURES

1. Gate count

   6 types, from 4180 to 16140 gates.

2. High speed operation (CMOS 1.2 μ design rule)

   Gate delay time ..... 0.8 ns (Typ.)
   I/O cell delay time ..... 3.0 ns (Typ.)
   * Typ. : F.O. = 2, wiring length = 2 mm

3. Extensive cell library

   Macro cell 151
   Macro function cell 251
   Total 402

   The library is perfectly compatible with the cell library of the conventional gate array 5GH, 5GF series and the standard cell RSC-15 series. It is easy to convert from the gate array to the standard cell.

4. Test cell

   10 types of scan-path format test cells are prepared.

5. Design tool

   - RICOH originally developed R-CAD design system based on SUN work station.
   - MENTOR, DAISY EWS

■ ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Condition	Rating	Unit
Vcc	Power Supply Voltage	with respect to GND	-0.3~7	V
VI	Input Voltage		-0.3~Vcc+0.3	V
VO	Output Voltage		-0.3~Vcc+0.3	V
Topr	Operating Temperature		-40~85	°C
Tstg	Storage Temperature		-55~125	°C

■ RECOMMENDED OPERATING CONDITION

Symbol	Parameter	Min.	Typ.	Max.	Unit
Vcc	Power Supply Voltage	4.75	5.00	5.25	V
Ta	Operating Temperature	0	25	70	°C

■ DC ELECTRICAL CHARACTERISTICS

(Ta=0~70°C, Vcc=5V±10%)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
VIH	"H" Input voltage (TTL)		2.2		Vcc+0.3	V
VIL	"L" Input voltage (TTL)		-0.3		0.8	V
VIH	"H" Input voltage (CMOS)		Vcc× 0.7		Vcc+0.3	V
VIL	"L" Input voltage (CMOS)		-0.3		Vcc× 0.3	V
VOH	"H" Output voltage	IOH=-4mA	2.4			V
VOL	"L" Output voltage	IOL= 4mA			0.4	V
ILI	Input Current	VI =0~Vcc	-10		10	μA
IOZ	Output Current for off state	VO =0~Vcc	-10		10	μA
Icc	Power Supply Current			*		mA

* The power supply current depends on gate count, clock frequency, etc.

■ AC ELECTRICAL CHARACTERISTICS

(Ta=0~70°C, Vcc=5V±10%)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Tpdo	I/O Output delay time	CL =15pF		1.7		ns
Tpdi	I/O Input delay time	F.O.=2, wiring length=2mm		3.0		ns
Tpd	Inner gate delay time	F.O.=2, wiring length=2mm		0.8		ns

■ 5GV SERIES LINE-UP

Series		5GV041	5GV053	5GV073	5GV094	5GV124	5GV161
Gate count		4,180	5,330	7,370	9,450	12,490	16,140
Number of I/O*1		106	118	136	154	178	204
Package	DIP	24, 28, 40	24, 28, 40	24, 28, 40	24, 28, 40		
	SDIP	64	42, 64	42, 64	42, 64	42, 64	42, 64
	FLAT	60, 64, 80 100	60, 64, 80 100, 128	60, 64, 80 100, 128, 144	64, 80, 100 128, 144	64, 80, 100 128, 144, 160	80, 100*2 128, 144*2, 160
	PLCC	44, 68, 84	44, 68, 84	44, 68, 84	44, 68, 84	44, 68, 84	44, 68, 84

*1 Eight of I/O pads are dedicated to VCC and GND
*2 Under Development

■ DEVELOPMENT TOOL (CAD Interface)

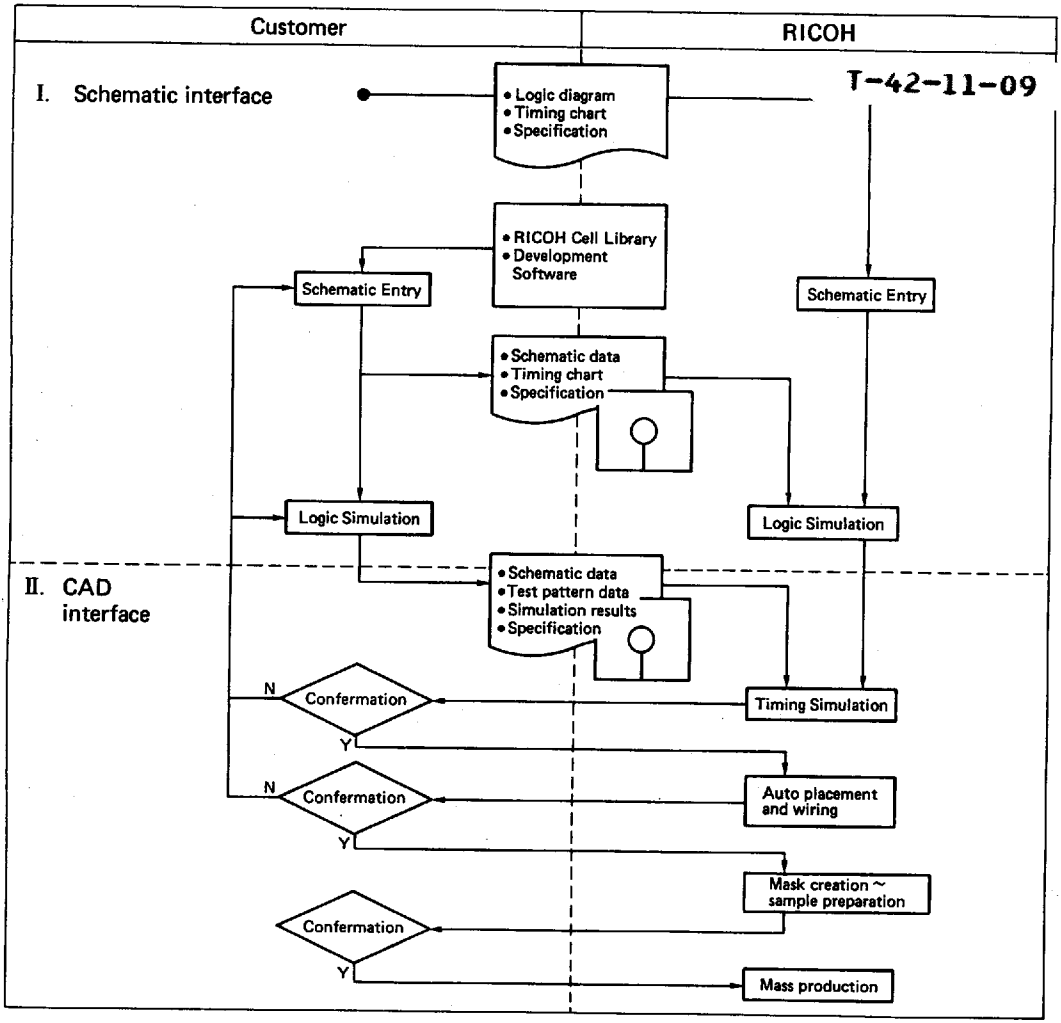
Hardware

- EWS ..... R-CAD (SUN3, SUN4)
  LOGICIAN (Daisy)
  IDEA1000 (Mentor)

Software

- O RICOH Library
- O RICOH Development Software
- O R-CAD (C-CAD : Schematic Entry, Simulation
  KBSC : Logic Synthesis)

5GV DEVELOPMENT FLOW



CMOS GATE ARRAY 5GV series

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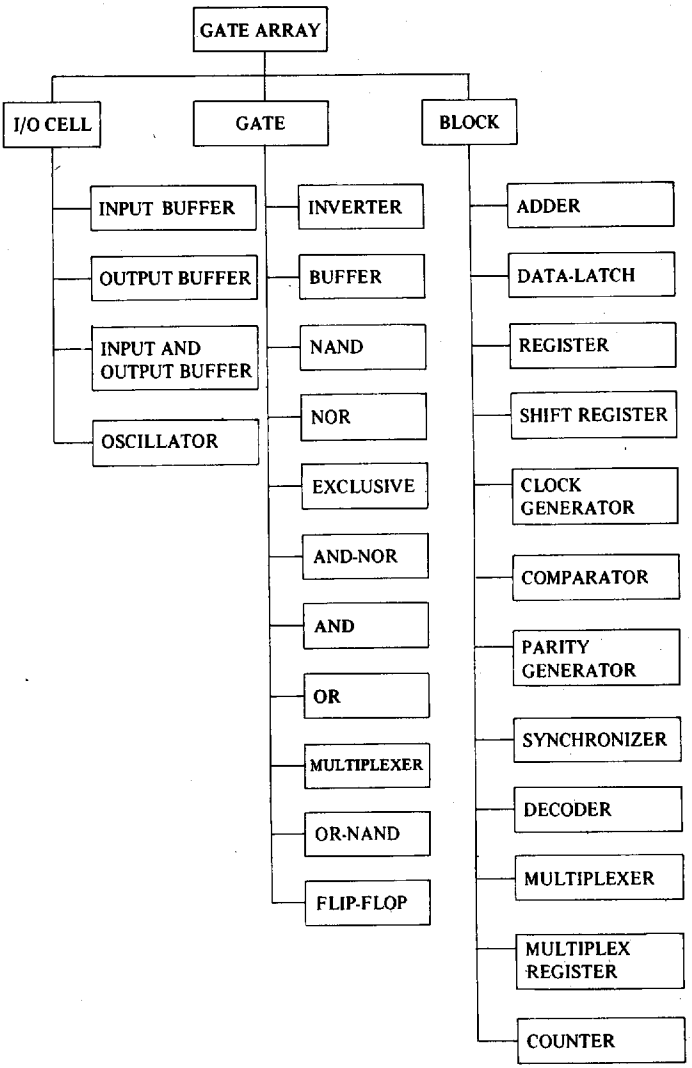
Cell List

RICOH CORP/ ELECTRONIC



I/O CELL

INPUT BUFFER

STANDARD

CELL	FUNCTION	
INT01	TTL Compatible	Inverter
INT02	TTL	Buffer
INTSCH	TTL	Schmitt Trigger
INC01	CMOS Compatible	Inverter
INC02	CMOS	Buffer
INCSCH	CMOS	Schmitt Trigger

with Resistance for pull-up

INT1U1	TTL Compatible	Inverter
INT2U1	TTL	Buffer
INTSU1	TTL	Schmitt Trigger
INC1U1	CMOS Compatible	Inverter
INC2U1	CMOS	Buffer
INCSU1	CMOS	Schmitt Trigger

with Resistance for pull-down

INT1D1	TTL Compatible	Inverter
INT2D1	TTL	Buffer
INTSD1	TTL	Schmitt Trigger
INC1D1	CMOS Compatible	Inverter
INC2D1	CMOS	Buffer
INCSD1	CMOS	Schmitt Trigger

OUTPUT BUFFER

OUTINV	Inverter
OUTTRI	3-State Output
OUTOPN	Open Drain Output

OUTPUT AND INPUT BUFFER

STANDARD

IOT01 IOT1	TTL Compatible	Inverter & 3-State Output
IOT02 IOT2	TTL Compatible	Buffer & 3-State Output
IOTSCH IOTSH	TTL Compatible	Schmitt Trigger & 3-State Output
IOC01 IOC1	CMOS Compatible	Inverter & 3-State Output
IOC02 IOC2	CMOS Compatible	Buffer & 3-State Ouptut
IOCSCH IOCSH	CMOS Compatible	Schmitt Trigger & 3-State Output

with Resistance for pull-up

IOT1U1 IOTU1	TTL Compatible	Inverter & 3-State Output
IOT2U1	TTL Compatible	Buffer & 3-State Output
IOC1U1 IOCU1	CMOS Compatible	Inverter & 3-State Output
IOC2U1	CMOS Compatible	Buffer & 3-State Output

with Resistance for pull-down

IOT1D1 IOTD1	TTL Compatible	Inverter & 3-State Ouptut
IOC1D1 IOCD1	CMOS Compatible	Inverter & 3-State Output

OSCILLATOR

XIN01	Input
XOUT	Oscillator Output
XIO	Oscillator

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GATE

INVERTER	STANDARD	INV01	Inverter
	POWER Type	NBUF02	Power Inverter(X2), NBUF06 Power Inverter(X6)
		NBUF03	Power Inverter(X3), NBUF10 Power Inverter(X10)
		NBUF04	Power Inverter(X4), NBUF16 Power Inverter(X16)
	3-STATE	TINVBF	3-State Inverter
		TINVB3	3-State Inverter (X3)
		TBF368	Quad 3-State Inverter
		M368C	Quad 3-State Inverter
		M240C	Octal 3-State Inverter (74LS240)
		M540C	Octal 3-State Inverter (74LS540)
BUFFER	STANDARD	BUF11	Buffer
	POWER Type	BUF12	Power Buffer (X2), BUF06 Power Buffer (X6)
		BUF13	Power Buffer (X3), BUF010 Power Buffer (X10)
		BUF26	Power Buffer (X6), BUF015 Power Buffer (X15)
	3-STATE	3BUF02	3-State Buffer Driver
		M125C	3-State Buffer, M125-D 3-State Buffer (X3)
		M367C	Quad 3-State Buffer
		M244C	Octal 3-State Buffer (74LS244)
		M245C	Octal 3-State Bus Transceiver (74LS245)
		M541C	Octal 3-State Buffer (74LS541)
		M640C	Octal 3-State Bus Transceiver (74LS640)
NAND	STANDARD	NAND02	2-Input
		NAND03	3-Input
		NAND04	4-Input
		NAND05	5-Input
		NAND06	6-Input
		NAND08	8-Input
	POWER Type	DNAND2	Power 2-Input
NOR	STANDARD	NOR02	2-Input
		NOR03	3-Input
		NOR04	4-Input
		NOR05	5-Input
		NOR06	6-Input
		NOR08	8-Input
	POWER Type	DNOR02	Power 2-Input
EXCLUSIVE		XOR02	2-Input Exclusive OR
		XNOR02	2-Input Exclusive NOR
AND-NOR		AOI21	2-AND-NOR
		AOI31	3-AND-NOR
		AOI41	4-AND-NOR
		AOI22	2-Input, 2-Wide
		AOI32	3-Input, 2-Wide
		AOI23	2-Input, 3-Wide
		AOI33	3-Input, 3-Wide
		AOI24	2-Input, 4-Wide
		AOI211	2-AND Into 3-NOR
		AOOI22	2-AND, 2-NOR Into 2-NOR
		MAJ23	Inverting 2 of 3 Majority

GATE ARRAY 5GV CELL LIST

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AND	AND02	2-Input
	AND03	3-Input
	AND04	4-Input
OR	OR02	2-Input
	OR03	3-Input
	OR04	4-Input
MULTIPLEXER	MUX21H	2 bit non Inverting MUX
OR-NAND	OAI21	2-OR-NAND
	OAI31	3-OR-NAND
	OAI41	4-OR-NAND
	OAI22	2-Input, 2-Wide
	OAI32	3-Input, 2-Wide
	OAI23	2-Input, 3-Wide
	OAI33	3-Input, 3-Wide
	OAI24	2-Input, 4-Wide
	OAI211	2-OR Into 3-NAND
	OAAI22	2-OR, 2-NAND Into 2-NAND

BLOCK		
ADDER	HA1	Half Adder
	FA1	Full Adder
	M80C	Gated Full Adder (7480)
	FA2	2 Bit Binary Full Adder
	FAS2	2 Bit Binary 2's Complement Full Adder, or Substractor
	M82C	2 Bit Binary Full Adder (7482)
	FA4	4 Bit Binary Full Adder
	M83C	4 Bit Binary Full Adder with Fast Carry (74LS83)
	CLA1	Carry Look Ahead for 4 Bit Adder (Least Significant Nibble)
	CLA2	Carry Look Ahead for 4 Bit Adder
	FA16	16 Bit Fast Adder
DATA-LATCH	L4	4 Bit Data Latch
	L8	8 Bit Data Latch
REGISTER	R41	4 Bit Data Register
	R42	4 Bit Data Register, Clear Direct
	R81	8 Bit Data Register
	R82	8 Bit Data Register, Clear Direct
SHIFT REGISTER	SR41	4 Bit Shift Register
	SR42	4 Bit Shift Register, Clear Direct
	M95C	4 Bit Shift Register (74LS95)
	SR43	4 Bit Shift Register, Set Direct
	SR44	4 Bit Shift Register, Synchronous Parallel Load
	SR45	4 Bit Shift Register, Synchronous Parallel Load and Clear
	SR46	4 Bit Shift Register, Asynchronous Parallel Load
	SR47	4 Bit Shift Register, Sync Clear
	M94C	4 Bit Shift Register (7494)
	M179C	4 Bit Parallel Access Shift Register (74179)
	M195C	4 Bit Parallel-Access Shift Register (74LS195)
	M96C	5 Bit Shift Register (74LS96)
	M91C	8 Bit Shift Register (74LS91)
	M164C	8 Bit Parallel Output Serial Shift Register (74LS164)
	M165C	Parallel Load 8 Bit Shift Register (74LS165)
	M166C	8 Bit Shift Register (74LS166)
	M198C	8 Bit Bidirectional Universal Shift Register (74198)
	M199C	8 Bit Bidirectional Universal Shift Register (74199)
CLOCK GENERATOR	CPG1	Two Phase Clock Generator, Unbuffered, Hi Underlap, Lo Drive
	CPG2	Two Phase Clock Generator, Unbuffered, Lo Underlap, Lo Drive
	CPG3	Two Phase Clock Generator, Unbuffered, Hi Underlap, Hi Drive
	CPG4	Two Phase Clock Generator, Unbuffered, Lo Underlap, Hi Drive
COMPARATOR	MAG2H	2 Bit Magnitude Comparator
	MAG2	2 Bit Extendable Magnitude Comparator
	MAG4	4 Bit Extendable Magnitude Comparator
	CMP4	4 Bit Equality Comparator
	M85C	4 Bit Magnitude Comparator Expandable
	CMP8	8 Bit Equality Comparator
PARITY GENERATOR	PAR8	8 Bit Odd Parity Detector
	PAR9	9 Bit Odd Parity Detector
	M180C	9 Bit Odd/Even Parity Generator (74180)
SYNCHRONIZER	SYNC01	Synchronizer for Asynchronous 0 to 1 Event
	SYNC10	Synchronizer for Asynchronous 1 to 0 Event

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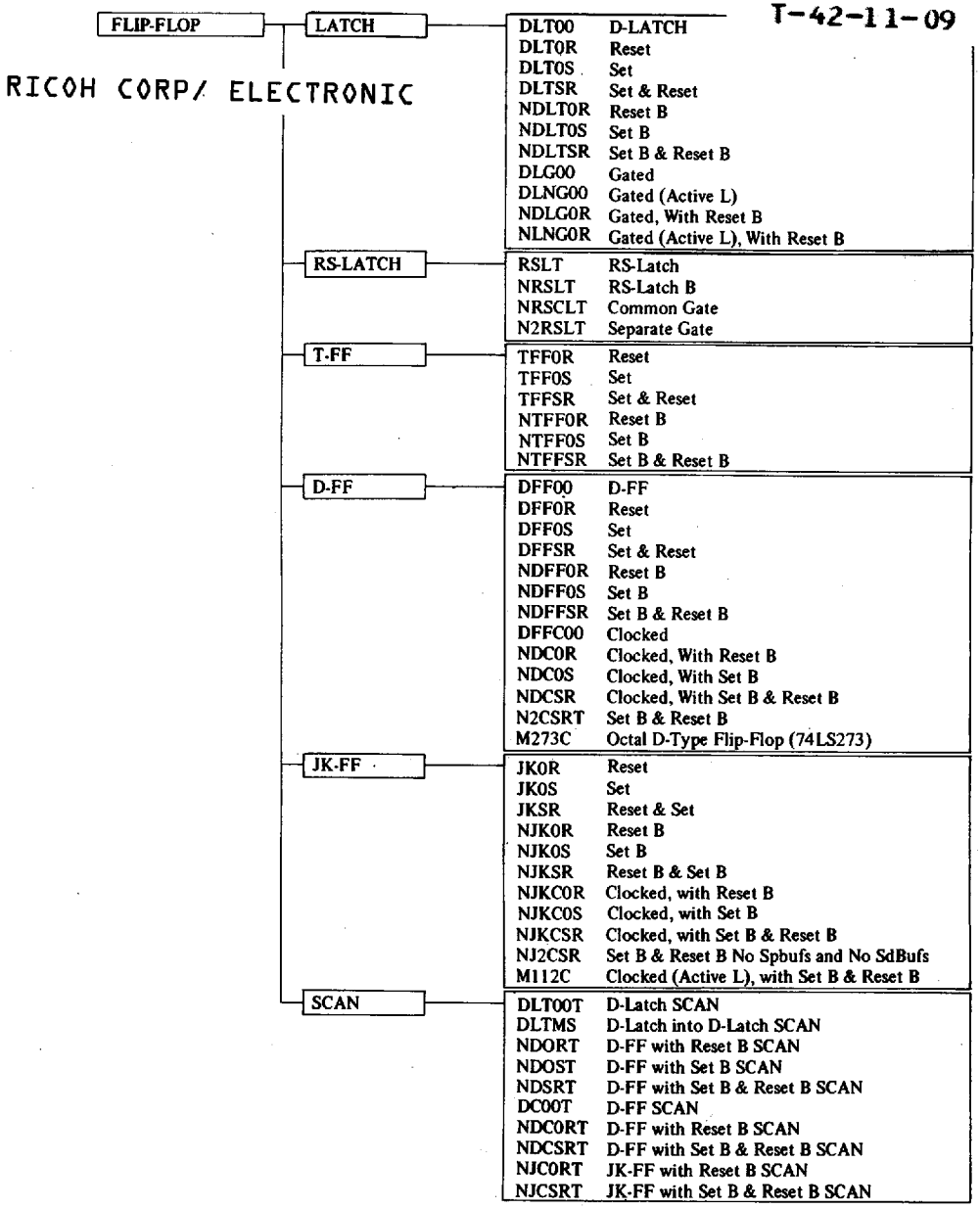
FLIP-FLOP
LATCH
DLT00 D-LATCH
DLT0R Reset
DLT0S Set
DLTSR Set & Reset
NDLT0R Reset B
NDLT0S Set B
NDLTSR Set B & Reset B
DLG00 Gated
DLNG00 Gated (Active L)
NDLG0R Gated, With Reset B
NLNG0R Gated (Active L), With Reset B
RICOH CORP/ ELECTRONIC
RS-LATCH
RSLT RS-Latch
NRSLT RS-Latch B
NRSCLT Common Gate
N2RSLT Separate Gate
T-FF
TFF0R Reset
TFF0S Set
TFFSR Set & Reset
NTFF0R Reset B
NTFF0S Set B
NTFFSR Set B & Reset B
D-FF
DFF00 D-FF
DFF0R Reset
DFF0S Set
DFFSR Set & Reset
NDFF0R Reset B
NDFF0S Set B
NDFFSR Set B & Reset B
DFFC00 Clocked
NDC0R Clocked, With Reset B
NDC0S Clocked, With Set B
NDCSR Clocked, With Set B & Reset B
N2CSRT Set B & Reset B
M273C Octal D-Type Flip-Flop (74LS273)
JK-FF
JK0R Reset
JK0S Set
JKSR Reset & Set
NJK0R Reset B
NJK0S Set B
NJKSR Reset B & Set B
NJKC0R Clocked, with Reset B
NJKC0S Clocked, with Set B
NJKCSR Clocked, with Set B & Reset B
NJ2CSR Set B & Reset B No Spbufs and No SdBufs
M112C Clocked (Active L), with Set B & Reset B
SCAN
DLT00T D-Latch SCAN
DLTMS D-Latch into D-Latch SCAN
NDORT D-FF with Reset B SCAN
NDOST D-FF with Set B SCAN
NDSRT D-FF with Set B & Reset B SCAN
DC00T D-FF SCAN
NDC0RT D-FF with Reset B SCAN
NDCSRT D-FF with Set B & Reset B SCAN
NJC0RT JK-FF with Reset B SCAN
NJCSRT JK-FF with Set B & Reset B SCAN

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DECODER

M4555C	Binary to 1 of 4 Decoder
M139C	2 to 4 Decoder (74LS139)
M155C	Dual 2 to 4 Decoders
D24H	2 to 4 Decoder, Output Active Hi
D24L	2 to 4 Decoder, Output Active Lo
D24GH	2 to 4 Decoder, Gated Output Active Hi
D24GL	2 to 4 Decoder, Gated Output Active Lo
D38H	3 to 8 Decoder, Output Active Hi
D38L	3 to 8 Decoder, Output Active Lo
D38GH	3 to 8 Decoder, Gated Output Active Hi
D38GL	3 to 8 Decoder, Gated Output Active Lo
M138C	Gated 3 to 8 Decoder (74LS138)
M138D	Gated 3 to 8 Decoder (74LS138)
D410H	4 to 10 Decoder, Output Active Hi
D410L	4 to 10 Decoder, Output Active Lo
M154C	4 to 16 Decoder (74LS154)
DM6JH	Spike Free Decoder for MOD 6 Johnson Counter, Active Hi
DM6JL	Spike Free Decoder for MOD 6 Johnson Counter, Active Lo
DM8JH	Spike Free Decoder for MOD 8 Johnson Counter, Active Hi
DM8JL	Spike Free Decoder for MOD 8 Johnson Counter, Active Lo
DM10JH	Spike Free Decoder for MOD 10 Johnson Counter, Active Hi
DM10JL	Spike Free Decoder for MOD 10 Johnson Counter, Active Lo
DM12JH	Spike Free Decoder for MOD 12 Johnson Counter, Active Hi
DM12JL	Spike Free Decoder for MOD 12 Johnson Counter, Active Lo
DM14JH	Spike Free Decoder for MOD 14 Johnson Counter, Active Hi
DM14JL	Spike Free Decoder for MOD 14 Johnson Counter, Active Lo
DM16JH	Spike Free Decoder for MOD 16 Johnson Counter, Active Hi
DM16JL	Spike Free Decoder for MOD 16 Johnson Counter, Active Lo
M43C	Excess-3 to Decimal Decoder (7443)
M44C	Excess-3 Gray to Decimal Decoder (74LS44)
M47C	Bcd to 7 Segment Decoders/Drivers (74LS47)
M49C	Bcd to 7 Segment Decoders/Drivers (74LS49)
M42C	Bcd to Decimal Decoder (7442)
M145C	Bcd to Decimal Decoder (74LS145)
M4028C	Bcd to Decimal Decoder (4028)

MULTIPLEXER

M298C	Quad 2-Input Multiplexer with Storage (74LS298)
M157C	Quad 2 Bit Gated Non Inverting Mux
M158C	Quad 2 Bit Gated Inverting Mux
M257C	Quad 2 Bit Gated Non Inverting Mux with 3-State Output
M258C	Quad 2 Bit Gated Inverting Mux with 3-State Output
M153C	Dual 4 Bit Gated Non Inverting Mux
M353C	Dual 4 Bit Gated Inverting Mux with 3-State Output
M253C	Dual 4 Bit Gated Non Inverting Mux with 3-State Output (74LS253)
M251C	8 Bit Gated Mux with 3-State Output (74LS251)
M151C	8 Bit Gated Mux
M152C	8 Bit Inverting Mux
M150C	16 Bit Gated Inverting Mux (74LS150)
MUX31H	3 Bit Non Inverting Mux
MUX31L	3 Bit Inverting Mux
MUX41H	4 Bit Non Inverting Mux
MUX41GH	4 Bit Gated Non Inverting Mux
MUX41L	4 Bit Inverting Mux
MUX51H	5 Bit Non Inverting Mux
MUX51L	5 Bit Inverting Mux
MUX61H	6 Bit Non Inverting Mux
MUX61L	6 Bit Inverting Mux
MUX71H	7 Bit Non Inverting Mux
MUX71L	7 Bit Inverting Mux
MUX81H	8 Bit Non Inverting Mux
MUX22H	Dual 2 Bit Non Inverting Mux
MUX32H	Dual 3 Bit Non Inverting Mux
MUX42H	Dual 4 Bit Non Inverting Mux
MUX52H	Dual 5 Bit Non Inverting Mux
MUX62H	Dual 6 Bit Non Inverting Mux
MUX72H	Dual 7 Bit Non Inverting Mux
MUX82H	Dual 8 Bit Non Inverting Mux
MUX24H	Quad 2 Bit Non Inverting Mux
MUX24L	Quad 2 Bit Inverting Mux
MUX34H	Quad 3 Bit Non Inverting Mux
MUX44H	Quad 4 Bit Non Inverting Mux
MUX54H	Quad 5 Bit Non Inverting Mux
MUX64H	Quad 6 Bit Non Inverting Mux
MUX74H	Quad 7 Bit Non Inverting Mux
MUX84H	Quad 8 Bit Non Inverting Mux

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MULTIPLEX REGISTER

MR41	4 Bit Register with 2 Bit Multiplexed Input
MR42	4 Bit Register with 2 Bit Multiplexed Input, Clear Direct
MR43	4 Bit Register with 2 Bit Multiplexed Input, Sync Clear
MR44	4 Bit Register with 2 Bit Multiplexed Input, Sync Clear Reset B
MR81	8 Bit Register with 2 Bit Multiplexed Input
MR82	8 Bit Register with 2 Bit Multiplexed Input, Clear Direct

COUNTER

MODULO JOHNSON COUNTER

CM4J	Modulo 4, Johnson Counter, Clear Direct
CM6J	Modulo 6, Johnson Counter, Clear Direct
CM8J	Modulo 8, Johnson Counter, Clear Direct
CM10J	Modulo 10, Johnson Counter, Clear Direct
CM12J	Modulo 12, Johnson Counter, Clear Direct
CM14J	Modulo 14, Johnson Counter, Clear Direct
CM16J	Modulo 16, Johnson Counter, Clear Direct

MODULO GRAY COUNTER

C2G	Modulo 4, Gray Counter, Clear Direct
C3G	Modulo 8, Gray Counter, Clear Direct
C4G	Modulo 16, Gray Counter, Clear Direct
C5G	Modulo 32, Gray Counter, Clear Direct
C6G	Modulo 64, Gray Counter, Clear Direct, Prescaled
C7G	Modulo 128 Gray Counter, Clear Direct, Prescaled
C8G	Modulo 256, Gray Counter, Clear Direct, Prescaled

MODULO BINARY COUNTER

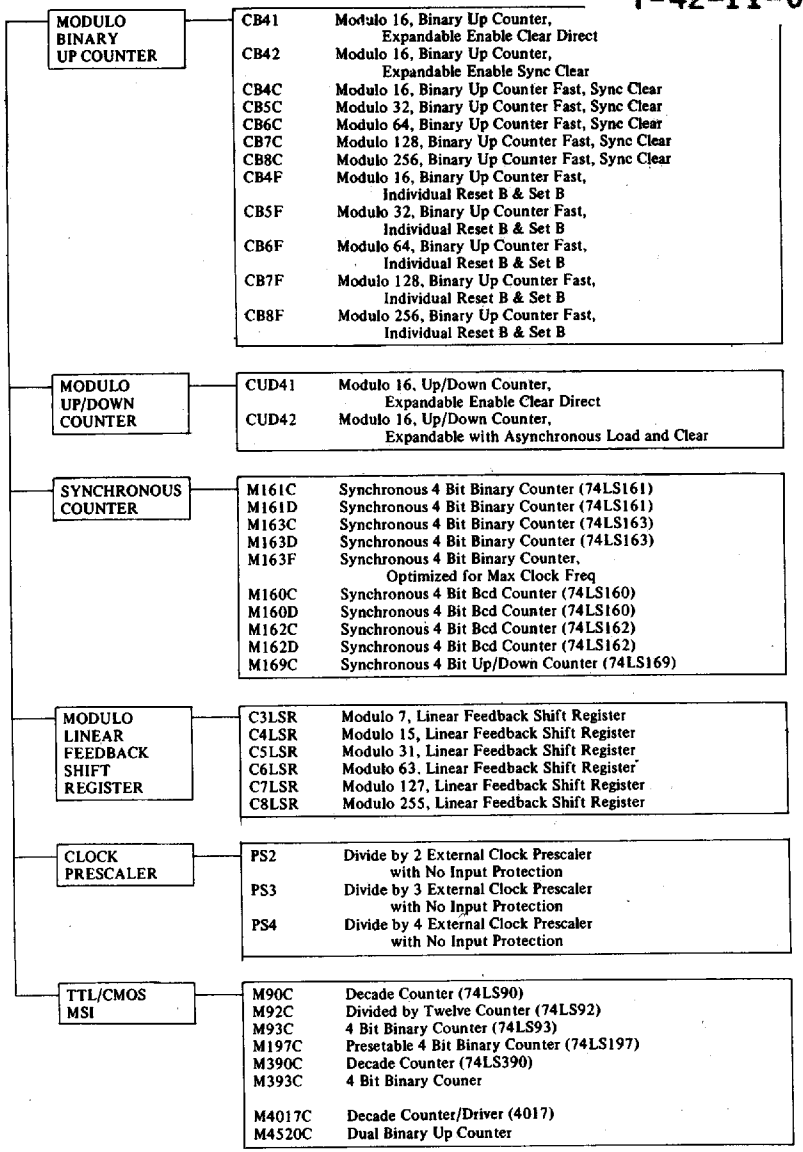
CM3B	Modulo 3, Binary Counter, Clear Direct
CM4B	Modulo 4, Binary Counter, Clear Direct
CM5B	Modulo 5, Binary Counter, Clear Direct
CM6B	Modulo 6, Binary Counter, Clear Direct
CM7B	Modulo 7, Binary Counter, Clear Direct
CM8B	Modulo 8, Binary Counter, Clear Direct
CM9B	Modulo 9, Binary Counter, Clear Direct
CM10B	Modulo 10, Binary Counter, Clear Direct
CM11B	Modulo 11, Binary Counter, Clear Direct
CM12B	Modulo 12, Binary Counter, Clear Direct
CM13B	Modulo 13, Binary Counter, Clear Direct
CM14B	Modulo 14, Binary Counter, Clear Direct
CM15B	Modulo 15, Binary Counter, Clear Direct
CM16B	Modulo 16, Binary Counter, Clear Direct
CM17B	Modulo 17, Binary Counter, Clear Direct

MODULO BINARY RIPPLE COUNTER

CM8BR	Modulo 8, Binary Ripple Counter, Clear Direct
CM9BR	Modulo 9, Binary Ripple Counter, Clear Direct
CM10BR	Modulo 10, Binary Ripple Counter, Clear Direct
CM11BR	Modulo 11, Binary Ripple Counter, Clear Direct
CM12BR	Modulo 12, Binary Ripple Counter, Clear Direct
CM13BR	Modulo 13, Binary Ripple Counter, Clear Direct
CM14BR	Modulo 14, Binary Ripple Counter, Clear Direct
CM15BR	Modulo 15, Binary Ripple Counter, Clear Direct
CM16BR	Modulo 16, Binary Ripple Counter, Clear Direct
CM17BR	Modulo 17, Binary Ripple Counter, Clear Direct
CM18BR	Modulo 18, Binary Ripple Counter, Clear Direct
CM19BR	Modulo 19, Binary Ripple Counter, Clear Direct
CM20BR	Modulo 20, Binary Ripple Counter, Clear Direct
CM21BR	Modulo 21, Binary Ripple Counter, Clear Direct
CM22BR	Modulo 22, Binary Ripple Counter, Clear Direct
CM23BR	Modulo 23, Binary Ripple Counter, Clear Direct
CM24BR	Modulo 24, Binary Ripple Counter, Clear Direct
CM25BR	Modulo 25, Binary Ripple Counter, Clear Direct
CM26BR	Modulo 26, Binary Ripple Counter, Clear Direct
CM27BR	Modulo 27, Binary Ripple Counter, Clear Direct
CM28BR	Modulo 28, Binary Ripple Counter, Clear Direct
CM29BR	Modulo 29, Binary Ripple Counter, Clear Direct
CM30BR	Modulo 30, Binary Ripple Counter, Clear Direct
CM31BR	Modulo 31, Binary Ripple Counter, Clear Direct
CM32BR	Modulo 32, Binary Ripple Counter, Clear Direct

MODULO SHIFT COUNTER

CM5SR	Modulo 5, Shift Counter, Clear Direct
CM8SR	Modulo 8, Shift Counter, Clear Direct
CM9SR	Modulo 9, Shift Counter, Clear Direct
CM10SR	Modulo 10 Shift Counter, Clear Direct
CM12SR	Modulo 12, Shift Counter, Clear Direct


MODULO BINARY UP COUNTER
CB41 Modulo 16, Binary Up Counter, Expandable Enable Clear Direct
CB42 Modulo 16, Binary Up Counter, Expandable Enable Sync Clear
CB4C Modulo 16, Binary Up Counter Fast, Sync Clear
CB5C Modulo 32, Binary Up Counter Fast, Sync Clear
CB6C Modulo 64, Binary Up Counter Fast, Sync Clear
CB7C Modulo 128, Binary Up Counter Fast, Sync Clear
CB8C Modulo 256, Binary Up Counter Fast, Sync Clear
CB4F Modulo 16, Binary Up Counter Fast, Individual Reset B & Set B
CB5F Modulo 32, Binary Up Counter Fast, Individual Reset B & Set B
CB6F Modulo 64, Binary Up Counter Fast, Individual Reset B & Set B
CB7F Modulo 128, Binary Up Counter Fast, Individual Reset B & Set B
CB8F Modulo 256, Binary Up Counter Fast, Individual Reset B & Set B
MODULO UP/DOWN COUNTER
CUD41 Modulo 16, Up/Down Counter, Expandable Enable Clear Direct
CUD42 Modulo 16, Up/Down Counter, Expandable with Asynchronous Load and Clear
SYNCHRONOUS COUNTER
M161C Synchronous 4 Bit Binary Counter (74LS161)
M161D Synchronous 4 Bit Binary Counter (74LS161)
M163C Synchronous 4 Bit Binary Counter (74LS163)
M163D Synchronous 4 Bit Binary Counter (74LS163)
M163F Synchronous 4 Bit Binary Counter, Optimized for Max Clock Freq
M160C Synchronous 4 Bit Bcd Counter (74LS160)
M160D Synchronous 4 Bit Bcd Counter (74LS160)
M162C Synchronous 4 Bit Bcd Counter (74LS162)
M162D Synchronous 4 Bit Bcd Counter (74LS162)
M169C Synchronous 4 Bit Up/Down Counter (74LS169)
MODULO LINEAR FEEDBACK SHIFT REGISTER
C3LSR Modulo 7, Linear Feedback Shift Register
C4LSR Modulo 15, Linear Feedback Shift Register
C5LSR Modulo 31, Linear Feedback Shift Register
C6LSR Modulo 63, Linear Feedback Shift Register
C7LSR Modulo 127, Linear Feedback Shift Register
C8LSR Modulo 255, Linear Feedback Shift Register
CLOCK PRESCALER
PS2 Divide by 2 External Clock Prescaler with No Input Protection
PS3 Divide by 3 External Clock Prescaler with No Input Protection
PS4 Divide by 4 External Clock Prescaler with No Input Protection
TTL/CMOS MSI
M90C Decade Counter (74LS90)
M92C Divided by Twelve Counter (74LS92)
M93C 4 Bit Binary Counter (74LS93)
M197C Presetable 4 Bit Binary Counter (74LS197)
M390C Decade Counter (74LS390)
M393C 4 Bit Binary Couner
M4017C Decade Counter/Driver (4017)
M4520C Dual Binary Up Counter

TTL/RICOH CELL CORRESPONDENCE TABLE

T-42-11-09

TTL Name	RICOH Cell		TTL Name	RICOH Cell		TTL Name	RICOH Cell	
74LS00	NAND02		74LS138	M138C		74LS244	M244C	F
74LS02	NOR02			M138D		74LS245	M245C	F
74LS04	INV01		74LS139	M139C		74LS251	M251C	F
74LS10	NAND03		74LS145	M145C		74LS253	M253C	F
74LS20	NAND04		74150	M150C		74LS257C	M257C	F
7425	NOR04*1		74LS151	M151C		74LS258	M258C	F
74LS27	NOR03		74LS152	M152C		74S260	NOR05	
74LS30	NAND08		74LS153	M153C		74LS273	M273C	
7442	D410L		74LS154	M154C			R82	
	M42C		74LS155	M155C		74LS279	NRSLT*10	
74LS43	M43C		74LS157	M157C		74LS298	M298C	
74LS44	M44C		74LS158	M158C		74LS353	M353C	F
74LS47	M47C		74LS160	M160C*6		74LS367A	M367C	F
74LS49	M49C			M160D		74LS368A	M368C	F
74LS51	AOI22		74LS161	M161C*7			TINVBF	F
74LS54	AOI24			M161D			TBF368	F
74LS73	NJKCOR*2	F	74LS162	M162C*8		74LS390	M390C	
7474	NDCSR			M162D		74LS393	M393C	
7476	NJKCSR*3		74LS163	M163C*9			CM16BR*11	
74LS80	M80C*4			M163D		74LS399	MR41	
7482	M82C			M163F		74LS540	M540C	F
	FA2		74LS164	M164C		74LS541	M541C	F
74LS83	M83C		74LS165	M165C		74LS640	M640C	F
74LS85	M85C		74LS166	M166C		4017	M4017C	
74LS86	XOR02		74LS169	M169C		4028	M4028C	
74LS90	M90C		74LS171	R42		4520	M4520C	
74LS91	M91C		74LS174	R82		4555	M4555C	
74LS92	M92C		74LS175	R42				
74LS93	M93C		74LS179	M179C				
74LS94	M94C		74LS180	M180C				
74LS95	M95C		74LS195	M195C				
74LS96	M96C		74LS197	M197C				
74100	L4		74LS198	M198C				
74LS113A	NJKCOS*5		74LS199	M199C				
74LS125	M125C	F	74LS240	M240C	F			

F: 5GF, 5GV Series

*1: NOR04 has no strobe terminal.

*2 *3 and *5: 7473, 7476, and 74LS113A are negative edge triggers, but NJKCOR, NJKCSR and NJKCOS are positive edge triggers.

4: M80C has no 74LS80 A or B* terminals.

*6. *7, *8 and *9: M160C, M161C, M162C and M163C have inverted outputs.

*10: NRSLT has a QB terminal.

*11: 74LS393 is a negative edge trigger, but CM16BR is a positive edge trigger.