

MOS INTEGRATED CIRCUIT

μ PD30500, 30500A, 30500B

VR5000™, VR5000A™, VR5000B™ 64-BIT MICROPROCESSOR

DESCRIPTION

The μ PD30500 (VR5000), μ PD30500A (VR5000A), and μ PD30500B^{Note} (VR5000B) are a high-performance, 64-bit RISC (Reduced Instruction Set Computer) type microprocessors employing the RISC architecture developed by MIPS™ Technologies Inc.

The instructions of the VR5000, VR5000A, and VR5000B are compatible with those of the VR3000™ Series and VR4000™ Series and higher, and completely compatible with those of the VR10000™. Therefore, present applications can be used as they are.

Note Under development

Detailed functions are described in the following manual. Be sure to read the manual when designing your system.

- VR5000, VR5000A, VR5000B User's Manual (U11761E)

FEATURES

- Employs 64-bit MIPS-based RISC architecture
- High-speed processing
 - 2-way super scalar 5-stage pipeline
 - 5.5 SPECint95, 5.5 SPECfp95, 278 MIPS (μ PD30500)
 - 6.6 SPECint95, 6.6 SPECfp95, 353 MIPS (μ PD30500A)
 - 8 SPECint95, 8 SPECfp95, 423 MIPS (μ PD30500B)
- High-speed translation buffer mechanism (TLB) (48 entries)
- Address space Physical: 36 bits, Virtual: 40 bits
- Floating-point unit (FPU)
 - Sum-of-products operation instruction supported
- Primary cache memory (instruction/data: 32 Kbytes each)
- Secondary cache controller
- Maximum operating frequency Internal: 200 MHz (μ PD30500), 250 MHz (μ PD30500A), 300 MHz (μ PD30500B)
External: 100 MHz
 - Selectable external/internal multiple rate from twice to eight times
- Instruction set compatible with VR3000 and VR4000 Series and higher (conforms to MIPS I, II, III, and IV)
- Supply voltage: 3.3 V $\pm$ 5% (μ PD30500)
 - Core: 2.5 V $\pm$ 5%, I/O: 3.3 V $\pm$ 5% (μ PD30500A)
 - Core: 1.8 V $\pm$ 0.1 V, I/O: 3.3 V $\pm$ 5% (μ PD30500B)

Unless otherwise specified, the VR5000 (μ PD30500) is treated as the representative model throughout this document.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

APPLICATIONS

- High-performance embedded systems
- Multimedia systems
- Entry-class computers
- Image processing systems

★ ORDERING INFORMATION

Part number	Package	Maximum operating frequency (MHz)
μPD30500RJ-150	223-pin ceramic PGA (48 × 48)	150
μPD30500RJ-180	223-pin ceramic PGA (48 × 48)	180
μPD30500RJ-200	223-pin ceramic PGA (48 × 48)	200
μPD30500S2-150	272-pin plastic BGA (C/D advanced type) (29 × 29)	150
μPD30500S2-180	272-pin plastic BGA (C/D advanced type) (29 × 29)	180
μPD30500S2-200	272-pin plastic BGA (C/D advanced type) (29 × 29)	200
μPD30500AS2-250	272-pin plastic BGA (C/D advanced type) (29 × 29)	250
μPD30500BS2-300 ^{Note}	272-pin plastic BGA (C/D advanced type) (29 × 29)	300

Note Under development

MAIN DIFFERENCES BETWEEN V_R5000, V_R5000A, AND V_R5000B

Parameter	V _R 5000	V _R 5000A	V _R 5000B ^{Note 1}
★ Maximum internal operating frequency	150/180/200 MHz	250 MHz	300 MHz
Internal multiplication ratio for clock interface input	2, 3, 4, 5, 6, 7, 8	2, 2.5 ^{Note 2} , 3, 4, 5, 6, 7, 8	
Supply voltage	3.3 V ±5%	Core: 2.5 V ±5% I/O: 3.3 V ±5%	Core: 1.8 V ±0.1 V I/O: 3.3 V ±5%
Package	• 223-pin ceramic PGA • 272-pin plastic BGA (C/D advanced type)	• 272-pin plastic BGA (C/D advanced type)	

Notes 1. Under development

2. Selectable only when SysClock = 100 MHz

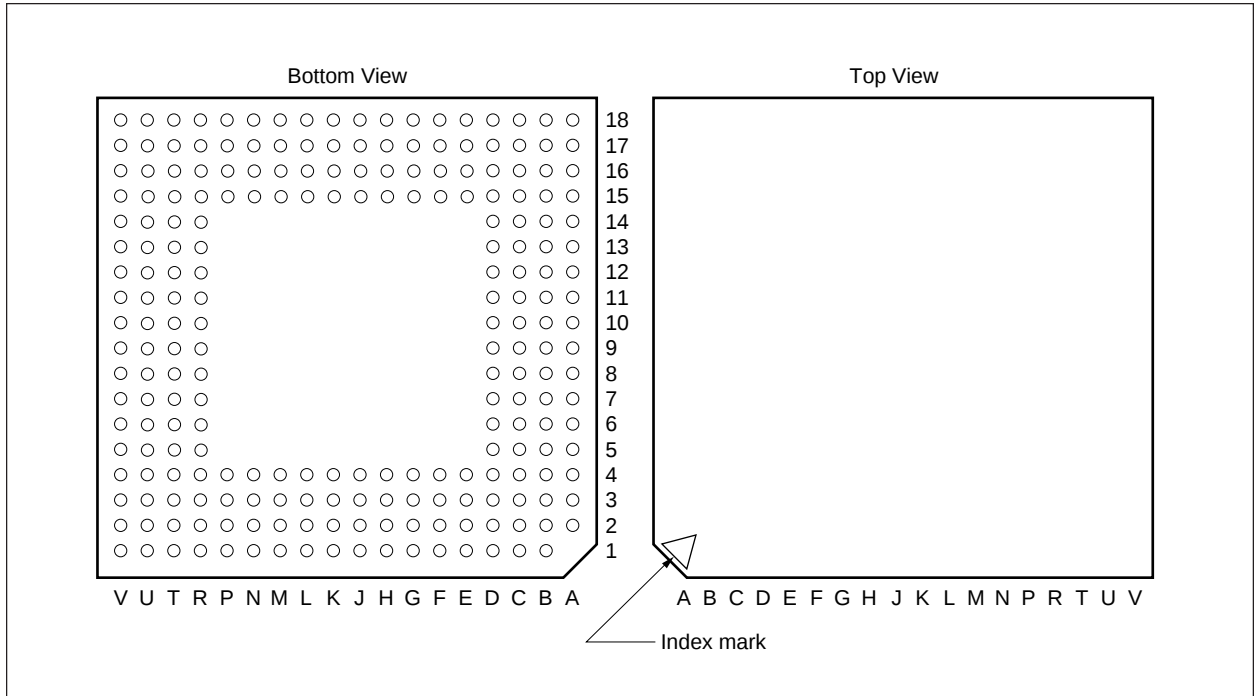
PIN CONFIGURATION

- 223-pin ceramic PGA (48 × 48)

μPD30500RJ-150

μPD30500RJ-180

μPD30500RJ-200



No.	Name	No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A2	V _{DD}	C5	SysADC6	E18	V _{DD}	K17	GNDP	R6	SysAD51	U9	SysAD63
A3	GND	C6	SysAD16	F1	V _{DD}	K18	GND	R7	SysAD55	U10	SysAD13
A4	V _{DD}	C7	SysAD50	F2	Reserved	L1	GND	R8	SysAD27	U11	SysAD11
A5	GND	C8	SysAD22	F3	ScValid	L2	SysCmd8	R9	SysAD31	U12	SysAD9
A6	GND	C9	SysAD24	F4	Int1	L3	SysCmd7	R10	SysAD43	U13	SysAD37
A7	V _{DD}	C10	SysAD28	F15	ScDCE0	L4	SysCmd5	R11	SysAD39	U14	SysAD3
A8	GND	C11	SysAD62	F16	ScCWE0	L15	ScLine12	R12	SysAD35	U15	ScWord0
A9	V _{DD}	C12	SysAD44	F17	ScTDE	L16	ScLine14	R13	SysAD1	U16	V _{DD}
A10	GND	C13	SysAD10	F18	GND	L17	ScLine15	R14	ScWord1	U17	GND
A11	V _{DD}	C14	SysAD38	G1	GND	L18	V _{DD}	R15	ScLine0	U18	GND
A12	GND	C15	SysAD4	G2	Reserved	M1	V _{DD}	R16	ScLine3	V1	GND
A13	V _{DD}	C16	SysAD34	G3	Reserved	M2	SysCmd6	R17	ScLine6	V2	GND
A14	GND	C17	SysAD2	G4	Reserved	M3	SysCmd4	R18	GND	V3	V _{DD}
A15	GND	C18	GND	G15	ScCLR	M4	SysCmd1	T1	GND	V4	GND
A16	V _{DD}	D1	GND	G16	ScTCE	M15	ScLine8	T2	SysAD15	V5	GND
A17	GND	D2	Int3	G17	Modeln	M16	ScLine10	T3	SysAD47	V6	V _{DD}
A18	GND	D3	Int5	G18	V _{DD}	M17	ScLine13	T4	SysAD17	V7	GND
B1	GND	D4	Release	H1	V _{DD}	M18	GND	T5	SysAD19	V8	V _{DD}
B2	GND	D5	V _{DD}	H2	Reserved	N1	GND	T6	SysAD23	V9	GND
B3	V _{DD}	D6	SysADC2	H3	Reserved	N2	SysCmd3	T7	SysAD57	V10	V _{DD}
B4	SysADC4	D7	SysAD48	H4	Reserved	N3	SysCmd2	T8	SysAD29	V11	GND
B5	SysADC0	D8	SysAD52	H15	V _{DD} Ok	N4	SysADC7	T9	V _{DD}	V12	V _{DD}
B6	SysAD18	D9	SysAD56	H16	ModeClock	N15	ScLine5	T10	SysAD45	V13	GND
B7	SysAD20	D10	SysAD60	H17	SysClock	N16	ScLine7	T11	SysAD41	V14	V _{DD}
B8	SysAD54	D11	SysAD14	H18	GND	N17	ScLine11	T12	SysAD7	V15	GND
B9	SysAD26	D12	SysAD42	J1	GND	N18	V _{DD}	T13	SysAD5	V16	GND
B10	SysAD58	D13	SysAD8	J2	WrRdy	P1	V _{DD}	T14	SysAD33	V17	V _{DD}
B11	SysAD30	D14	SysAD36	J3	ValidIn	P2	SysCmd0	T15	Reset	V18	GND
B12	SysAD46	D15	ColdReset	J4	ExtRqst	P3	SysCmdP	T16	ScLine1		
B13	SysAD12	D16	SysAD0	J15	Reserved	P4	SysADC1	T17	V _{DD}		
B14	SysAD40	D17	ScTOE	J16	Reserved	P15	ScLine2	T18	V _{DD}		
B15	SysAD6	D18	V _{DD}	J17	Reserved	P16	ScLine4	U1	V _{DD}		
B16	GND	E1	GND	J18	V _{DD}	P17	ScLine9	U2	V _{DD}		
B17	V _{DD}	E2	Int0	K1	V _{DD}	P18	GND	U3	GND		
B18	V _{DD}	E3	Int2	K2	ScMatch	R1	V _{DD}	U4	SysAD21		
C1	V _{DD}	E4	Int4	K3	RdRdy	R2	SysADC5	U5	SysAD53		
C2	V _{DD}	E15	SysAD32	K4	ScDOE	R3	SysADC3	U6	SysAD25		
C3	ValidOut	E16	ScDCE1	K15	Reserved	R4	BigEndian	U7	SysAD59		
C4	NMI	E17	ScCWE1	K16	V _{DD} P	R5	SysAD49	U8	SysAD61		

• 272-pin plastic BGA (C/D advanced type) (29 × 29)

μPD30500S2-150

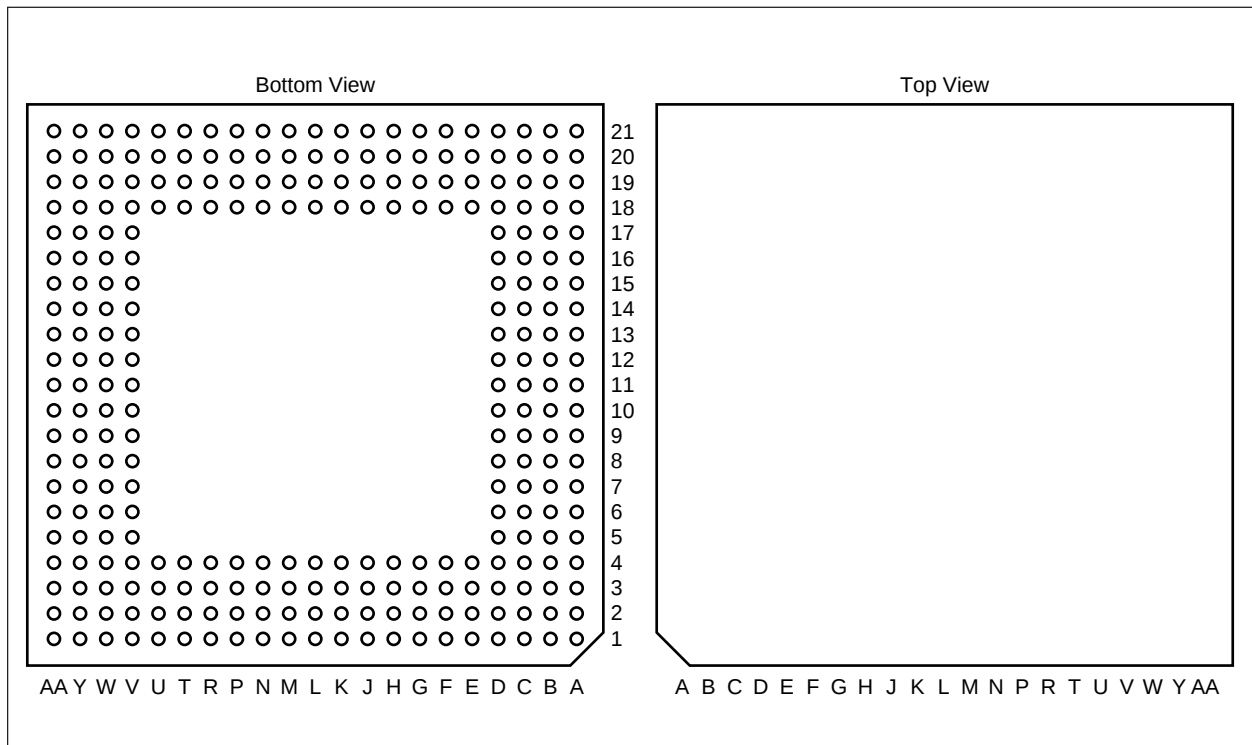
μPD30500S2-180

μPD30500S2-200

μPD30500AS2-250

μPD30500BS2-300^{Note}

★



Note Under development

(1) μPD30500

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	GND	C5	ScDCE1	F1	SysAD8	L20	SysAD63	U18	V _{DD}	Y1	V _{DD}
A2	V _{DD}	C6	ScDCE0	F2	SysAD38	L21	GND	U19	SysAD17	Y2	V _{DD}
A3	GND	C7	ScCWE0	F3	SysAD6	M1	SysAD26	U20	SysAD49	Y3	V _{DD}
A4	SysAD32	C8	ScTCE	F4	GND	M2	SysAD56	U21	GND	Y4	Release
A5	GND	C9	Modeln	F18	GND	M3	SysAD24	V1	V _{DD}	Y5	Int3
A6	ScCWE1	C10	Reserved	F19	SysAD1	M4	V _{DD}	V2	V _{DD}	Y6	Int2
A7	GND	C11	GNDP	F20	SysAD33	M18	V _{DD}	V3	V _{DD}	Y7	ScValid
A8	V _{DD} Ok	C12	Reserved	F21	SysAD3	M19	SysAD29	V4	GND	Y8	Reserved
A9	GND	C13	ScLine13	G1	GND	M20	SysAD61	V5	NMI	Y9	Reserved
A10	SysClock	C14	ScLine11	G2	SysAD10	M21	SysAD31	V6	GND	Y10	Reserved
A11	GND	C15	ScLine8	G3	SysAD40	N1	GND	V7	V _{DD}	Y11	ExtRqst
A12	ScLine15	C16	ScLine5	G4	V _{DD}	N2	SysAD54	V8	V _{DD}	Y12	RdRdy
A13	GND	C17	ScLine4	G18	V _{DD}	N3	SysAD22	V9	GND	Y13	SysCmd8
A14	ScLine12	C18	ScLine0	G19	SysAD35	N4	GND	V10	V _{DD}	Y14	SysCmd5
A15	GND	C19	Reset	G20	SysAD5	N18	GND	V11	V _{DD}	Y15	SysCmd3
A16	ScLine7	C20	V _{DD}	G21	GND	N19	SysAD27	V12	V _{DD}	Y16	SysCmd0
A17	GND	C21	GND	H1	SysAD42	N20	SysAD59	V13	GND	Y17	SysCmdP
A18	ScLine2	D1	V _{DD}	H2	SysAD44	N21	GND	V14	V _{DD}	Y18	SysADC1
A19	GND	D2	V _{DD}	H3	SysAD12	P1	SysAD50	V15	V _{DD}	Y19	SysAD15
A20	V _{DD}	D3	V _{DD}	H4	V _{DD}	P2	SysAD52	V16	GND	Y20	V _{DD}
A21	GND	D4	GND	H18	V _{DD}	P3	SysAD20	V17	V _{DD}	Y21	V _{DD}
B1	V _{DD}	D5	V _{DD}	H19	SysAD7	P4	V _{DD}	V18	GND	AA1	GND
B2	V _{DD}	D6	GND	H20	SysAD39	P18	V _{DD}	V19	V _{DD}	AA2	V _{DD}
B3	V _{DD}	D7	V _{DD}	H21	SysAD37	P19	SysAD25	V20	V _{DD}	AA3	GND
B4	SysAD2	D8	V _{DD}	J1	GND	P20	SysAD57	V21	V _{DD}	AA4	ValidOut
B5	SysAD0	D9	GND	J2	SysAD46	P21	SysAD55	W1	GND	AA5	GND
B6	ScTOE	D10	V _{DD}	J3	SysAD14	R1	GND	W2	V _{DD}	AA6	Int0
B7	ScCLR	D11	V _{DD} P	J4	GND	R2	SysAD18	W3	V _{DD}	AA7	GND
B8	ScTDE	D12	V _{DD}	J18	GND	R3	SysAD48	W4	V _{DD}	AA8	Reserved
B9	ModeClock	D13	GND	J19	SysAD9	R4	V _{DD}	W5	Int5	AA9	GND
B10	Reserved	D14	V _{DD}	J20	SysAD41	R18	V _{DD}	W6	Int4	AA10	WrRdy
B11	Reserved	D15	V _{DD}	J21	GND	R19	SysAD53	W7	Int1	AA11	GND
B12	NC	D16	GND	K1	SysAD60	R20	SysAD23	W8	Reserved	AA12	ScMatch
B13	ScLine14	D17	V _{DD}	K2	SysAD30	R21	GND	W9	Reserved	AA13	GND
B14	ScLine10	D18	GND	K3	SysAD62	T1	SysAD16	W10	Reserved	AA14	SysCmd6
B15	ScLine9	D19	V _{DD}	K4	V _{DD}	T2	SysADC0	W11	ValidIn	AA15	GND
B16	ScLine6	D20	V _{DD}	K18	V _{DD}	T3	SysADC2	W12	ScDOE	AA16	SysCmd2
B17	ScLine3	D21	V _{DD}	K19	SysAD11	T4	GND	W13	SysCmd7	AA17	GND
B18	ScLine1	E1	GND	K20	SysAD43	T18	GND	W14	SysCmd4	AA18	SysADC3
B19	V _{DD}	E2	SysAD36	K21	SysAD13	T19	SysAD19	W15	SysCmd1	AA19	GND
B20	V _{DD}	E3	SysAD4	L1	GND	T20	SysAD51	W16	SysADC7	AA20	V _{DD}
B21	V _{DD}	E4	V _{DD}	L2	SysAD58	T21	SysAD21	W17	SysADC5	AA21	GND
C1	GND	E18	V _{DD}	L3	SysAD28	U1	GND	W18	SysAD47		
C2	V _{DD}	E19	ScWord1	L4	V _{DD}	U2	SysADC4	W19	BigEndian		
C3	ColdReset	E20	ScWord0	L18	V _{DD}	U3	SysADC6	W20	V _{DD}		
C4	SysAD34	E21	GND	L19	SysAD45	U4	V _{DD}	W21	GND		

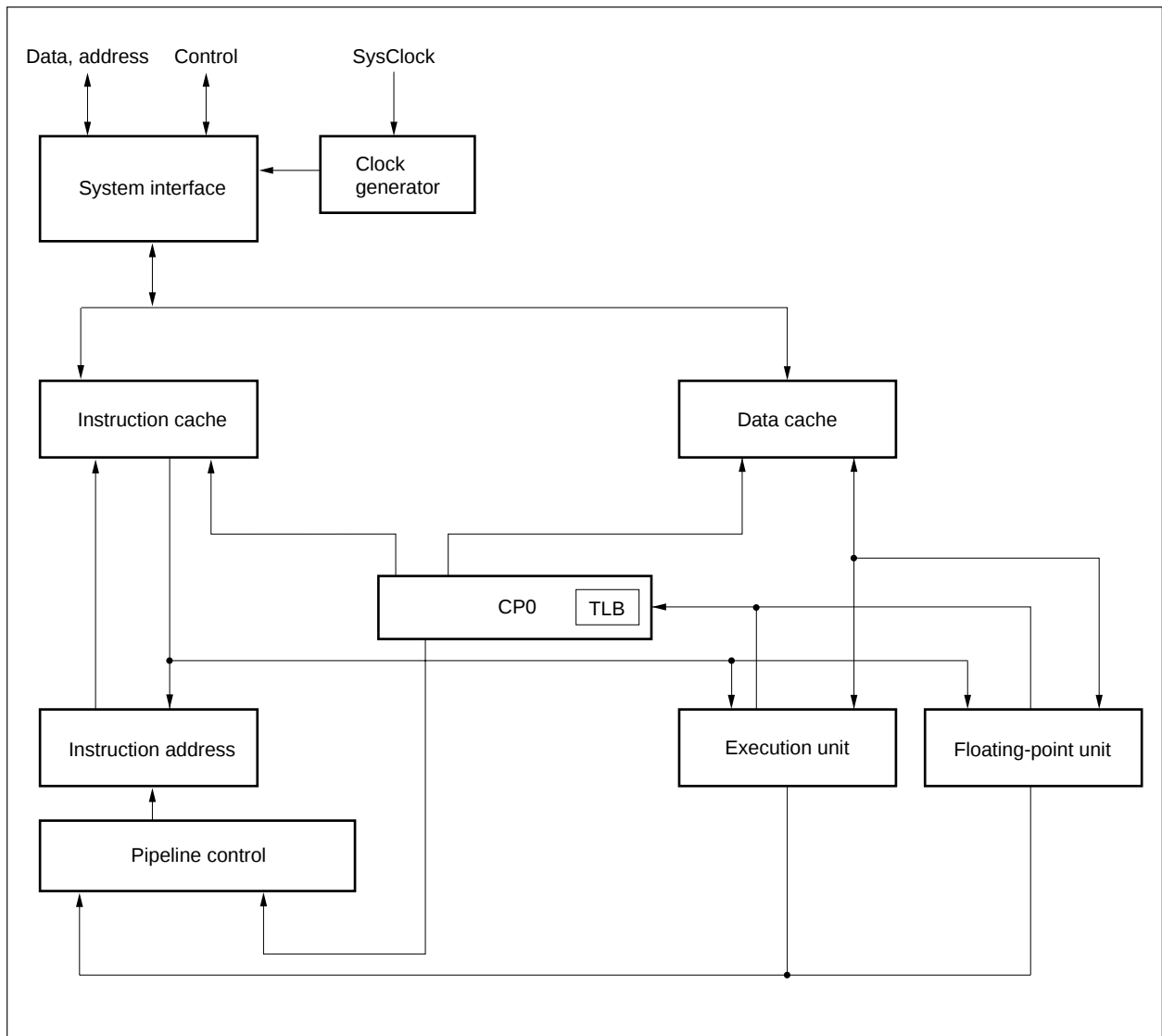
(2) μPD30500A, 30500B

No.	Name	No.	Name	No.	Name	No.	Name	No.	Name	No.	Name
A1	GND	C5	ScDCE1	F1	SysAD8	L20	SysAD63	U18	V _{DD}	Y1	V _{DD} O
A2	V _{DD} O	C6	ScDCE0	F2	SysAD38	L21	GND	U19	SysAD17	Y2	V _{DD} O
A3	GND	C7	ScCWE0	F3	SysAD6	M1	SysAD26	U20	SysAD49	Y3	V _{DD} O
A4	SysAD32	C8	ScTCE	F4	GND	M2	SysAD56	U21	GND	Y4	Release
A5	GND	C9	Modeln	F18	GND	M3	SysAD24	V1	V _{DD}	Y5	Int3
A6	ScCWE1	C10	NC	F19	SysAD1	M4	V _{DD} O	V2	V _{DD}	Y6	Int2
A7	GND	C11	GNDP	F20	SysAD33	M18	V _{DD} O	V3	V _{DD}	Y7	ScValid
A8	V _{DD} Ok	C12	GND	F21	SysAD3	M19	SysAD29	V4	GND	Y8	GND
A9	GND	C13	ScLine13	G1	GND	M20	SysAD61	V5	NMI	Y9	GND
A10	SysClock	C14	ScLine11	G2	SysAD10	M21	SysAD31	V6	GND	Y10	GND
A11	GND	C15	ScLine8	G3	SysAD40	N1	GND	V7	V _{DD}	Y11	ExtRqst
A12	ScLine15	C16	ScLine5	G4	V _{DD} O	N2	SysAD54	V8	V _{DD} O	Y12	RdRdy
A13	GND	C17	ScLine4	G18	V _{DD} O	N3	SysAD22	V9	GND	Y13	SysCmd8
A14	ScLine12	C18	ScLine0	G19	SysAD35	N4	GND	V10	V _{DD}	Y14	SysCmd5
A15	GND	C19	Reset	G20	SysAD5	N18	GND	V11	V _{DD} O	Y15	SysCmd3
A16	ScLine7	C20	V _{DD} O	G21	GND	N19	SysAD27	V12	V _{DD}	Y16	SysCmd0
A17	GND	C21	GND	H1	SysAD42	N20	SysAD59	V13	GND	Y17	SysCmdP
A18	ScLine2	D1	V _{DD}	H2	SysAD44	N21	GND	V14	V _{DD} O	Y18	SysADC1
A19	GND	D2	V _{DD}	H3	SysAD12	P1	SysAD50	V15	V _{DD}	Y19	SysAD15
A20	V _{DD} O	D3	V _{DD}	H4	V _{DD}	P2	SysAD52	V16	GND	Y20	V _{DD} O
A21	GND	D4	GND	H18	V _{DD}	P3	SysAD20	V17	V _{DD} O	Y21	V _{DD} O
B1	V _{DD} O	D5	V _{DD}	H19	SysAD7	P4	V _{DD}	V18	GND	AA1	GND
B2	V _{DD} O	D6	GND	H20	SysAD39	P18	V _{DD}	V19	V _{DD}	AA2	V _{DD} O
B3	V _{DD} O	D7	V _{DD} O	H21	SysAD37	P19	SysAD25	V20	V _{DD}	AA3	GND
B4	SysAD2	D8	V _{DD}	J1	GND	P20	SysAD57	V21	V _{DD}	AA4	ValidOut
B5	SysAD0	D9	GND	J2	SysAD46	P21	SysAD55	W1	GND	AA5	GND
B6	ScTOE	D10	V _{DD} O	J3	SysAD14	R1	GND	W2	V _{DD} O	AA6	Int0
B7	ScCLR	D11	V _{DD} P	J4	GND	R2	SysAD18	W3	V _{DD} O	AA7	GND
B8	ScTDE	D12	V _{DD}	J18	GND	R3	SysAD48	W4	V _{DD} O	AA8	GND
B9	ModeClock	D13	GND	J19	SysAD9	R4	V _{DD} O	W5	Int5	AA9	GND
B10	GND	D14	V _{DD} O	J20	SysAD41	R18	V _{DD} O	W6	Int4	AA10	WrRdy
B11	GND	D15	V _{DD}	J21	GND	R19	SysAD53	W7	Int1	AA11	GND
B12	GND	D16	GND	K1	SysAD60	R20	SysAD23	W8	GND	AA12	ScMatch
B13	ScLine14	D17	V _{DD} O	K2	SysAD30	R21	GND	W9	GND	AA13	GND
B14	ScLine10	D18	GND	K3	SysAD62	T1	SysAD16	W10	V _{DD}	AA14	SysCmd6
B15	ScLine9	D19	V _{DD}	K4	V _{DD} O	T2	SysADC0	W11	ValidIn	AA15	GND
B16	ScLine6	D20	V _{DD}	K18	V _{DD} O	T3	SysADC2	W12	ScDOE	AA16	SysCmd2
B17	ScLine3	D21	V _{DD}	K19	SysAD11	T4	GND	W13	SysCmd7	AA17	GND
B18	ScLine1	E1	GND	K20	SysAD43	T18	GND	W14	SysCmd4	AA18	SysADC3
B19	V _{DD} O	E2	SysAD36	K21	SysAD13	T19	SysAD19	W15	SysCmd1	AA19	GND
B20	V _{DD} O	E3	SysAD4	L1	GND	T20	SysAD51	W16	SysADC7	AA20	V _{DD} O
B21	V _{DD} O	E4	V _{DD}	L2	SysAD58	T21	SysAD21	W17	SysADC5	AA21	GND
C1	GND	E18	V _{DD}	L3	SysAD28	U1	GND	W18	SysAD47		
C2	V _{DD} O	E19	ScWord1	L4	V _{DD}	U2	SysADC4	W19	BigEndian		
C3	ColdReset	E20	ScWord0	L18	V _{DD}	U3	SysADC6	W20	V _{DD} O		
C4	SysAD34	E21	GND	L19	SysAD45	U4	V _{DD}	W21	GND		

PIN NAMES

$\overline{\text{BigEndian}}$:	Endian Mode Select
$\overline{\text{ColdReset}}$:	Cold Reset
$\overline{\text{ExtRqst}}$:	External Request
GND :	Ground
$\overline{\text{GNDP}}$:	Quiet GND for PLL
Int (0:5) :	Interrupt Request
ModeClock :	Boot Mode Clock
ModeIn :	Boot Mode Data In
NC :	No Connection
$\overline{\text{NMI}}$:	Non-maskable Interrupt Request
$\overline{\text{RdRdy}}$:	Read Ready
$\overline{\text{Release}}$:	Release Interface
$\overline{\text{Reset}}$:	Reset
$\overline{\text{ScCLR}}$:	Secondary Cache Block Clear
$\overline{\text{ScCWE (0:1)}}$:	Secondary Cache Write Enable
$\overline{\text{ScDCE (0:1)}}$:	Data RAM Chip Enable
$\overline{\text{ScDOE}}$:	Data RAM Output Enable
ScLine (0:15) :	Secondary Cache Line Index
ScMatch :	Secondary Cache Tag Match
$\overline{\text{ScTCE}}$:	Secondary Cache Tag RAM Chip Enable
$\overline{\text{ScTDE}}$:	Secondary Cache Tag RAM Data Enable
$\overline{\text{ScTOE}}$:	Secondary Cache Tag RAM Output Enable
ScValid :	Secondary Cache Valid
ScWord (0:1) :	Secondary Cache Word Index
SysAD (0:63) :	System Address/Data Bus
SysADC (0:7) :	System Address/Data Check Bus
SysClock :	System Clock
SysCmd (0:8) :	System Command/Data Identifier
$\overline{\text{SysCmdP}}$:	System Command/Data Identifier Bus Parity
$\overline{\text{ValidIn}}$:	Valid Input
$\overline{\text{ValidOut}}$:	Valid Output
V_{DD} :	Power Supply (μ PD30500)
V_{DD} :	Power Supply for Processor Core (μ PD30500A, 30500B)
V_{DDIO} :	Power Supply for Processor I/O (μ PD30500A, 30500B only)
V_{DDOk} :	V_{DD} is OK
$\overline{\text{V}_{\text{DDP}}}$:	Quiet V_{DD} for PLL
$\overline{\text{WrRdy}}$:	Write Ready

INTERNAL BLOCK DIAGRAM



CONTENTS

1. PIN FUNCTIONS	11
2. ELECTRICAL SPECIFICATIONS	13
2.1 μ PD30500	13
2.2 μ PD30500A	16
2.3 μ PD30500B (Preliminary)	19
2.4 Test Condition	22
2.5 Timing Chart	22
3. PACKAGE DRAWING	27
4. RECOMMENDED SOLDERING CONDITIONS	29
APPENDIX DIFFERENCES BETWEEN THE VR5000 AND VR4310™	30

1. PIN FUNCTIONS

Pin Name	I/O	Function
SysAD (0:63)	I/O	System address/data bus. 64-bit bus for communication between processor, secondary cache and external agent.
SysADC (0:7)	I/O	System address/data check bus. 8-bit bus including check bits for the SysAD bus.
SysCmd (0:8)	I/O	System command/data ID bus. 9-bit bus for communication of commands and data identifiers between processor and external agent.
SysCmdP	I/O	System command/data ID bus parity. 1-bit even number parity bit for the SysCmd bus.
$\overline{\text{ValidIn}}$	Input	Valid in. Signal indicating that external agent has transmitted valid address or data onto SysAD bus and valid command or data identifier onto SysCmd bus.
$\overline{\text{ValidOut}}$	Output	Valid out. Signal indicating that processor has transmitted valid address or data onto SysAD bus and valid command or data identifier onto SysCmd bus.
$\overline{\text{ExtRqst}}$	Input	External request. Signal used by external agent to request for its use by system interface.
$\overline{\text{Release}}$	Output	Interface release. Signal indicating that the processor has released the system interface to the slave state.
$\overline{\text{WrRdy}}$	Output	Write ready. Signal indicating that the external agent can accept a processor write request.
$\overline{\text{RdRdy}}$	Input	Read ready. Signal indicating that external agent can accept a processor read request.
$\overline{\text{ScCLR}}$	Output	Secondary cache block clear. Clears all the valid bits of the tag RAM.
$\overline{\text{ScCWE}} (0:1)$	Output	Secondary cache write enable. Write enable signal for the secondary cache RAM.
$\overline{\text{ScDCE}} (0:1)$	Output	Data RAM chip select. Chip select signal for secondary cache RAM.
$\overline{\text{ScDOE}}$	Input	Data RAM output enable. Data output enable signal from the external agent.
ScLine (0:15)	Output	Secondary cache line index. Cache line index output of the secondary cache.
ScMatch	Input	Secondary cache tag match. Tag match signal from secondary cache tag RAM.
$\overline{\text{ScTCE}}$	Output	Secondary cache tag RAM chip select. Chip select signal of the secondary cache tag RAM.
$\overline{\text{ScTDE}}$	Output	Secondary cache tag RAM data enable. Data enable signal from the secondary cache tag RAM.
$\overline{\text{ScTOE}}$	Output	Secondary cache tag RAM output enable. Output enable signal from the secondary cache tag RAM.
ScWord (0:1)	I/O	Secondary cache word index. Signal indicating that the double word of the secondary cache index is correct.
ScValid	I/O	Secondary cache valid. Signal indicating that the data of the secondary cache is valid.

Pin Name	I/O	Function															
$\overline{\text{Int}} (0:5)$	Input	Interrupt. General-purpose processor interrupt requests whose input statuses can be confirmed by bits 15 through 10 of cause register.															
$\overline{\text{NMI}}$	Input	Non-maskable interrupt. Interrupt request that cannot be masked.															
$\overline{\text{ColdReset}}$	Input	Cold reset. Signal initializing the internal status of the processor. Inactivate this signal in synchronization with SysClock.															
$\overline{\text{Reset}}$	Input	Reset. Signal generating a reset exception, without initializing the internal status of the processor. Inactivate this signal in synchronization with SysClock.															
SysClock	Input	System clock. Clock input signal to processor.															
BigEndian	Input	Endian mode setting. This signal sets the endian mode of the system interface. When setting the endian mode with this signal, specify little endian with the data from the ModeIn pin that is input at reset. To set the endian mode with the data from the ModeIn pin, fix this signal to 0. <table> <tr> <th>BigEndian</th><th>Bit 8 of boot mode</th><th>Mode</th></tr> <tr> <td>1</td><td>1</td><td>—</td></tr> <tr> <td>1</td><td>0</td><td>Big endian</td></tr> <tr> <td>0</td><td>1</td><td>Big endian</td></tr> <tr> <td>0</td><td>0</td><td>Little endian</td></tr> </table>	BigEndian	Bit 8 of boot mode	Mode	1	1	—	1	0	Big endian	0	1	Big endian	0	0	Little endian
BigEndian	Bit 8 of boot mode	Mode															
1	1	—															
1	0	Big endian															
0	1	Big endian															
0	0	Little endian															
ModeClock	Output	Boot mode clock. Successive boot mode data clock output resulting from dividing SysClock by 256.															
ModeIn	Input	Boot mode data input. Input of initialization bit stream.															
V _{DD} Ok	Input	V _{DD} and V _{DDIO} ^{Note1} are valid. Signal indicating that the voltage supplied to the V _{R5000} is reached to the rated level ^{Note2} for 100 ms or more, and that that status is stabilized. When V _{DD} Ok is asserted active, the V _{R5000} starts an initialization sequence.															
V _{DD} P	—	PLL V _{DD} . Power supply for internal PLL.															
GNDP	—	PLL GND. Ground for internal PLL.															
V _{DD}	—	• V_{R5000} Positive power supply pin (3.3 V) • V_{R5000A} Power supply pin for core (2.5 V) • V_{R5000B} Power supply pin for core (1.8 V)															
V _{DDIO} ^{Note1}	—	Power supply pin for I/O (3.3 V)															
GND	—	Ground pin.															

Notes 1. V_{DDIO} is only for V_{R5000A} and V_{R5000B}.

2. V_{R5000}: V_{DD} = 3.135 V

V_{R5000A}: V_{DD} = 2.375 V, V_{DDIO} = 3.135 V

V_{R5000B}: V_{DD} = 1.7 V, V_{DDIO} = 3.135 V

2. ELECTRICAL SPECIFICATIONS

2.1 μPD30500

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V _{DD}		−0.5 to +4.0	V
Input voltage ^{Note}	V _I		−0.5 to V _{DD} + 0.3	V
		Pulse of less than 10 ns	−1.5 to V _{DD} + 0.3	V
Operating case temperature	T _C	PGA package	0 to +70	°C
		BGA package	0 to +85	°C
Storage temperature	T _{stg}	PGA package	−65 to +150	°C
		BGA package	−40 to +125	°C

Note The upper limit of the input voltage (V_{DD} + 0.3) is +4.0 V.

Cautions 1. Do not short circuit two or more outputs at the same time.

- 2.** The quality of the product may be degraded if the absolute maximum rating of even one of the above parameters is exceeded, even momentarily. Absolute maximum ratings, therefore, specify the values which if exceeded may physically damage the product. Use the product never exceeding these ratings.

The specifications and conditions shown in the following DC Characteristics and AC Characteristics are the range within which the product can normally operate and the quality can be guaranteed.

DC Characteristics (T_C = 0 to +70°C (PGA Package), T_C = 0 to +85°C (BGA Package), V_{DD} = 3.3 V ±5%)

Parameter	Symbol	Condition	MIN.	MAX.	Unit
High-level output voltage	V _{OH}	V _{DD} = MIN., I _{OH} = −4 mA	2.4		V
Low-level output voltage	V _{OL}	V _{DD} = MIN., I _{OL} = 4 mA		0.4	V
High-level input voltage ^{Note 1}	V _{IH}		2.0	V _{DD} + 0.3	V
Low-level input voltage ^{Note 1}	V _{IL}		−0.5	+0.8	V
		Pulse of less than 10 ns	−1.5	+0.8	V
High-level input voltage ^{Note 2}	V _{IHC}		0.8 × V _{DD}	V _{DD} + 0.3	V
Low-level input voltage ^{Note 2}	V _{ILC}		−0.5	0.2 × V _{DD}	V
		Pulse of less than 10 ns	−1.5	0.2 × V _{DD}	V
Supply current	I _{DD}	Normal operation	150 MHz	2.16	A
			180 MHz	2.54	A
			200 MHz	2.8	A
		Standby		0.25	A
Input leakage current	I _{LI}		−5	+5	μA
Input/output leakage current	I _{LIO}		−5	+5	μA

Notes 1. Not applied to the SysClock pin.

2. Applied to the SysClock pin only.

Remark The operating supply current is almost proportional to the operating clock frequency.

Capacitance

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Input capacitance	C _{in}			5	pF
Output capacitance	C _{out}			7	pF

AC Characteristics (T_c = 0 to +70°C (PGA Package), T_c = 0 to +85°C (BGA Package), V_{DD} = 3.3 V $\pm$ 5%)

Clock parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
System clock high-level width	t _{CH}		3.0		ns
System clock low-level width	t _{CL}		3.0		ns
System clock frequency ^{Notes 1, 2}		150 MHz	20	75	MHz
		180 MHz	20	90	MHz
		200 MHz	20	100	MHz
System clock cycle	t _{CP}	150 MHz	13.3	50	ns
		180 MHz	11.1	50	ns
		200 MHz	10	50	ns
System clock jitter	t _{ji}	System clock frequency > 66 MHz		$\pm$ 125	ps
		System clock frequency $\leq$ 66 MHz		$\pm$ 250	ps
System clock rise time	t _{CR}			2.0	ns
System clock fall time	t _{CF}			2.0	ns
Mode clock cycle	t _{MOC}		256 $\times$ t _{CP}		ns

Notes 1. The operation of the V_R5000 is guaranteed only when the PLL is operating

2. The operation is guaranteed if the internal operating frequency 100 MHz or higher.

System Interface Parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Data output hold time	t _{DM}	Modebit (14 : 13) = 10	1.0		ns
		Modebit (14 : 13) = 11	1.1		ns
		Modebit (14 : 13) = 00	1.3		ns
		Modebit (14 : 13) = 01	1.3		ns
Data output delay time	t _{DO}			5.0	ns
Data input setup time	t _{DS}		1.6		ns
Data input hold time	t _{DH}		0.5		ns

Boot Mode Interface Parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
More data setup time	t _{MDS}		t _{CP} × 0.35		ns
Mode data hold time	t _{MDH}		t _{CP} × 0.35		ns

Load Coefficient

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Load coefficient	CLD			1.5	ns/25 pF

★ 2.2 μ PD30500A

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{DDIO}		−0.5 to +4.0	V
	V_{DD}		−0.3 to +3.3	V
Input voltage ^{Note}	V_I		−0.5 to $V_{DDIO} + 0.3$	V
		Pulse of less than 10 ns	−1.5 to $V_{DDIO} + 0.3$	V
Operating case temperature	T_C		0 to +85	°C
Storage temperature	T_{stg}		−40 to +125	°C

Note The upper limit of the input voltage ($V_{DDIO} + 0.3$) is +4.0 V.

Cautions 1. Do not short circuit two or more outputs at the same time.

2. The quality of the product may be degraded if the absolute maximum rating of even one of the above parameters is exceeded, even momentarily. Absolute maximum ratings, therefore, specify the values which if exceeded may physically damage the product. Use the product never exceeding these ratings.

The specifications and conditions shown in the following DC Characteristics and AC Characteristics are the range within which the product can normally operate and the quality can be guaranteed.

DC Characteristics ($T_C = 0$ to +85°C, $V_{DDIO} = 3.3$ V $\pm 5\%$, $V_{DD} = 2.5$ V $\pm 5\%$)

Parameter	Symbol	Condition	MIN.	MAX.	Unit
High-level output voltage	V_{OH}	$V_{DDIO} = \text{MIN.}, I_{OH} = -4$ mA	2.4		V
Low-level output voltage	V_{OL}	$V_{DDIO} = \text{MIN.}, I_{OL} = 4$ mA		0.4	V
High-level input voltage ^{Note 1}	V_{IH}		2.0	$V_{DDIO} + 0.3$	V
Low-level input voltage ^{Note 1}	V_{IL}		−0.5	+0.8	V
		Pulse of less than 10 ns	−1.5	+0.8	V
High-level input voltage ^{Note 2}	V_{IHC}		$0.8 \times V_{DDIO}$	$V_{DDIO} + 0.3$	V
Low-level input voltage ^{Note 2}	V_{ILC}		−0.5	$0.2 \times V_{DDIO}$	V
		Pulse of less than 10 ns	−1.5	$0.2 \times V_{DDIO}$	V
★ Supply current	I_{DD}			1.8	A
	I_{DDIO}	System clock frequency = 50 MHz		0.7	A
		System clock frequency = 67 MHz		0.85	A
		System clock frequency = 83 MHz		0.95	A
		System clock frequency = 100 MHz		1.15	A
Input leakage current	I_{LI}		−5	+5	μ A
Input/output leakage current	I_{LIO}		−5	+5	μ A

Notes 1. Not applied to the SysClock pin.

2. Applied to the SysClock pin only.

Power Application Sequence

Two kinds of power sources are provided with the V_R5000A. The sequence of the power application order is not fixed. However, make sure that either of the power supplies does not remain turned on for 1 second or more while the other remains off.

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Power application delay	t _{DP}		0	1	sec

Capacitance

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Input capacitance	C _{In}			5	pF
Output capacitance	C _{Out}			7	pF

AC Characteristics (T_C = 0 to +85°C, V_{DDIO} = 3.3 V ±5%, V_{DD} = 2.5 V ±5%)

Clock parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
System clock high-level width	t _{CH}		3.0		ns
System clock low-level width	t _{CL}		3.0		ns
System clock frequency ^{Notes 1, 2}			20	100	MHz
System clock cycle	t _{CP}		10	50	ns
System clock jitter	t _{ji}	System clock frequency > 66 MHz		±125	ps
		System clock frequency ≤ 66 MHz		±250	ps
System clock rise time	t _{CR}			2.0	ns
System clock fall time	t _{CF}			2.0	ns
Mode clock cycle	t _{MOC}		256 × t _{CP}		ns

- Notes**
1. The operation of the V_R5000A is guaranteed only when the PLL is operating
 2. The operation is guaranteed if the internal operating frequency 100 MHz or higher.

System Interface Parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Data output hold time	t _{DM}	Modebit (14 : 13) = 10	1.3		ns
		Modebit (14 : 13) = 11	1.4		ns
		Modebit (14 : 13) = 00	1.5		ns
		Modebit (14 : 13) = 01	1.5		ns
★ Data output delay time	t _{DO}	PClock/SysClock division ratio = 2, 3, 4, 5, 6, 7, 8,		5.0	ns
		PClock/SysClock division ratio = 2.5		7.0	ns
Data input setup time	t _{DS}		1.6		ns
Data input hold time	t _{DH}		0.5		ns

Boot Mode Interface Parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Mode data setup time	t _{MDS}		t _{CP} × 0.35		ns
Mode data hold time	t _{MDH}		t _{CP} × 0.35		ns

Load Coefficient

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Load coefficient	CLD			1.5	ns/25 pF

2.3 μ PD30500B (Preliminary)

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{DDIO}		-0.5 to +4.0	V
	V_{DD}		-0.3 to +2.5	V
Input voltage ^{Note}	V_I		-0.5 to $V_{DDIO} + 0.3$	V
		Pulse of less than 10 ns	-1.5 to $V_{DDIO} + 0.3$	V
Operating case temperature	T_C		0 to +85	°C
Storage temperature	T_{stg}		-40 to +125	°C

Note The upper limit of the input voltage ($V_{DDIO} + 0.3$) is +4.0 V.

Cautions 1. Do not short circuit two or more outputs at the same time.

2. The quality of the product may be degraded if the absolute maximum rating of even one of the above parameters is exceeded, even momentarily. Absolute maximum ratings, therefore, specify the values which if exceeded may physically damage the product. Use the product never exceeding these ratings.

The specifications and conditions shown in the following DC Characteristics and AC Characteristics are the range within which the product can normally operate and the quality can be guaranteed.

DC Characteristics ($T_C = 0$ to +85°C, $V_{DDIO} = 3.3$ V $\pm 5\%$, $V_{DD} = 1.8$ V ± 0.1 V)

Parameter	Symbol	Condition	MIN.	MAX.	Unit
High-level output voltage	V_{OH}	$V_{DDIO} = \text{MIN.}, I_{OH} = -4$ mA	2.4		V
Low-level output voltage	V_{OL}	$V_{DDIO} = \text{MIN.}, I_{OL} = 4$ mA		0.4	V
High-level input voltage ^{Note 1}	V_{IH}		2.0	$V_{DDIO} + 0.3$	V
Low-level input voltage ^{Note 1}	V_{IL}		-0.5	+0.8	V
		Pulse of less than 10 ns	-1.5	+0.8	V
High-level input voltage ^{Note 2}	V_{IHC}		$0.8 \times V_{DDIO}$	$V_{DDIO} + 0.3$	V
Low-level input voltage ^{Note 2}	V_{ILC}		-0.5	$0.2 \times V_{DDIO}$	V
		Pulse of less than 10 ns	-1.5	$0.2 \times V_{DDIO}$	V
Input leakage current	I_{LI}		-5	+5	μ A
Input/output leakage current	I_{LIO}		-5	+5	μ A

Notes 1. Not applied to the SysClock pin.

2. Applied to the SysClock pin only.

Power Application Sequence

Two kinds of power sources are provided with the μ R5000B. The sequence of the power application order is not fixed. However, make sure that either of the power supplies does not remain turned on for 1 second or more while the other remains off.

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Power application delay	t_{DP}		0	1	se

Capacitance

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Input capacitance	C _{in}			5	pF
Output capacitance	C _{out}			7	pF

AC Characteristics (T_C = 0 to +85°C, V_{DDIO} = 3.3 V $\pm$ 5%, V_{DD} = 1.8 V $\pm$ 0.1 V)

Clock parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
System clock high-level width	t _{CH}		3.0		ns
System clock low-level width	t _{CL}		3.0		ns
System clock frequency ^{Notes 1, 2}			20	100	MHz
System clock cycle	t _{CP}		10	50	ns
System clock jitter	t _{ji}	System clock frequency > 66 MHz		$\pm$ 125	ps
		System clock frequency $\leq$ 66 MHz		$\pm$ 250	ps
System clock rise time	t _{CR}			2.0	ns
System clock fall time	t _{CF}			2.0	ns
Mode clock cycle	t _{MOC}		256 $\times$ t _{CP}		ns

Notes 1. The operation of the V_R5000B is guaranteed only when the PLL is operating

2. The operation is guaranteed if the internal operating frequency 100 MHz or higher.

System Interface Parameter

Parameter	Symbol	Condition	MIN.	MAX.	Unit
Data output hold time	t _{DM}	Modebit (14 : 13) = 10	1.3		ns
		Modebit (14 : 13) = 11	1.4		ns
		Modebit (14 : 13) = 00	1.5		ns
		Modebit (14 : 13) = 01	1.5		ns
Data output delay time	t _{DO}			5.0	ns
Data input setup time	t _{DS}		1.6		ns
Data input hold time	t _{DH}		0.5		ns

Boot Mode Interface Parameter

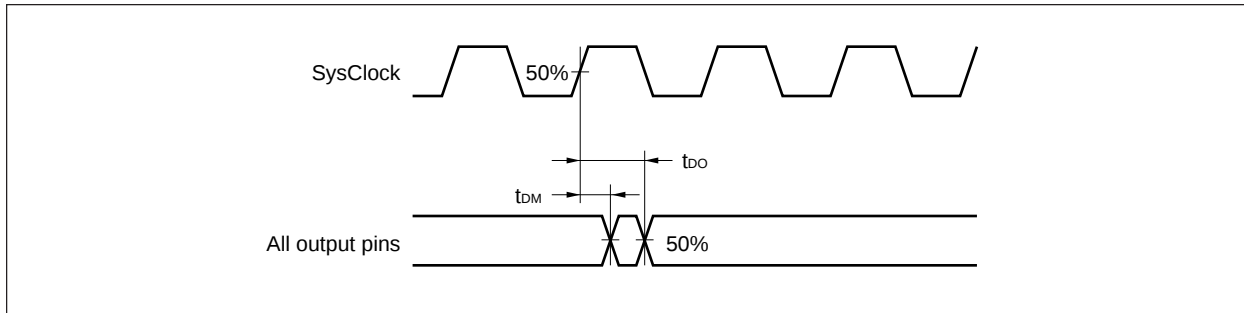
Parameter	Symbol	Condition	MIN.	MAX.	Unit
Mode data setup time	t _{MDS}		t _{CP} × 0.35		ns
Mode data hold time	t _{MDH}		t _{CP} × 0.35		ns

Load Coefficient

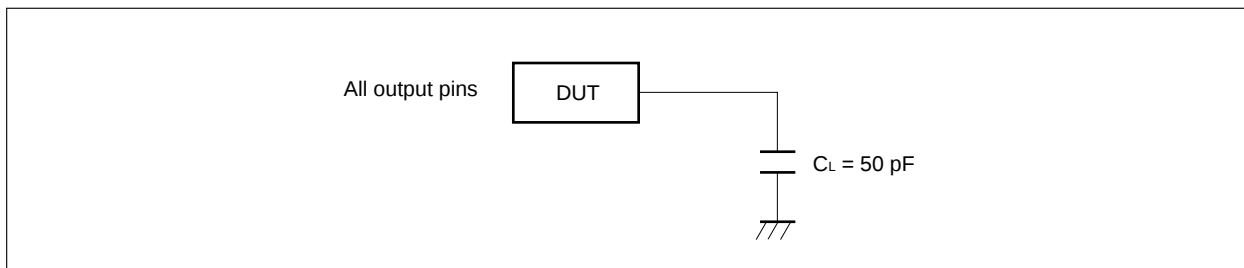
Parameter	Symbol	Condition	MIN.	MAX.	Unit
Load coefficient	CLD			1.5	ns/25 pF

2.4 Test Condition

Test point

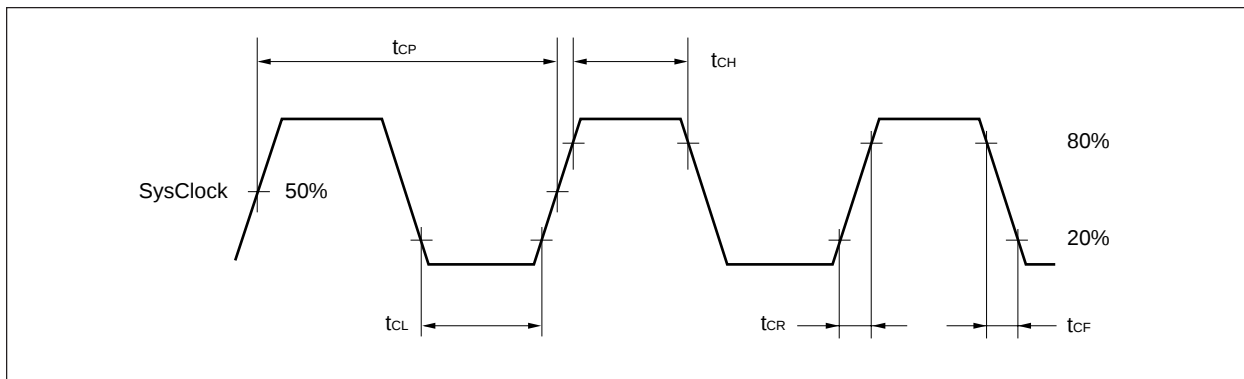


Load Conditions

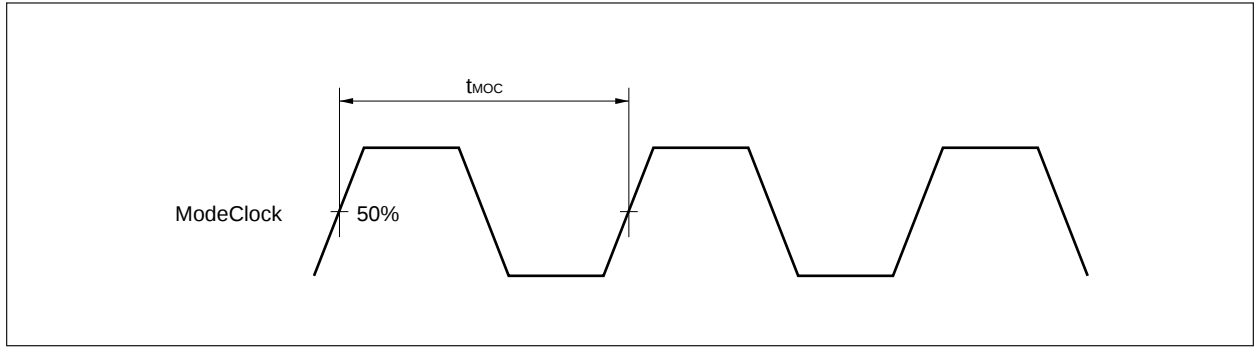


2.5 Timing Chart

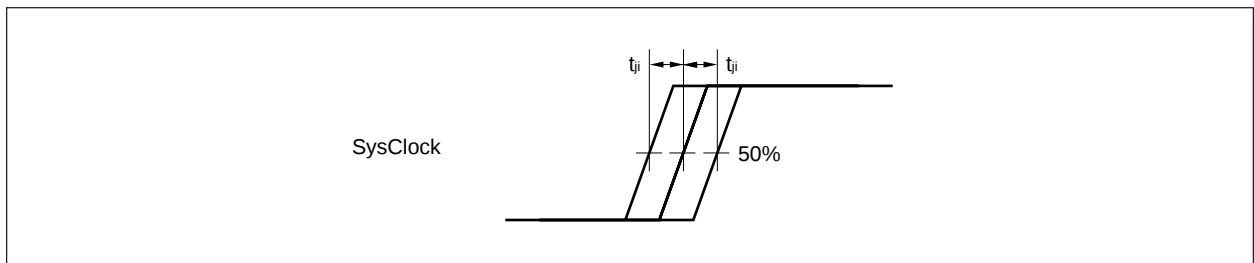
Clock timing



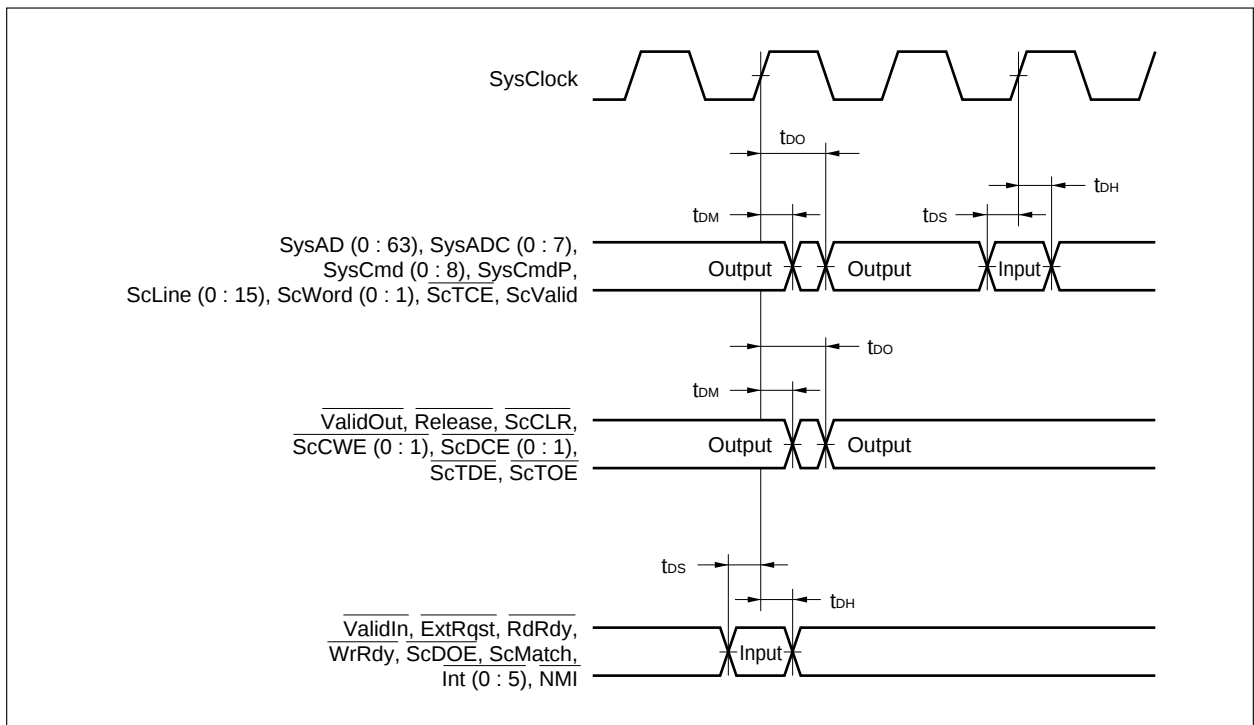
Mode clock timing

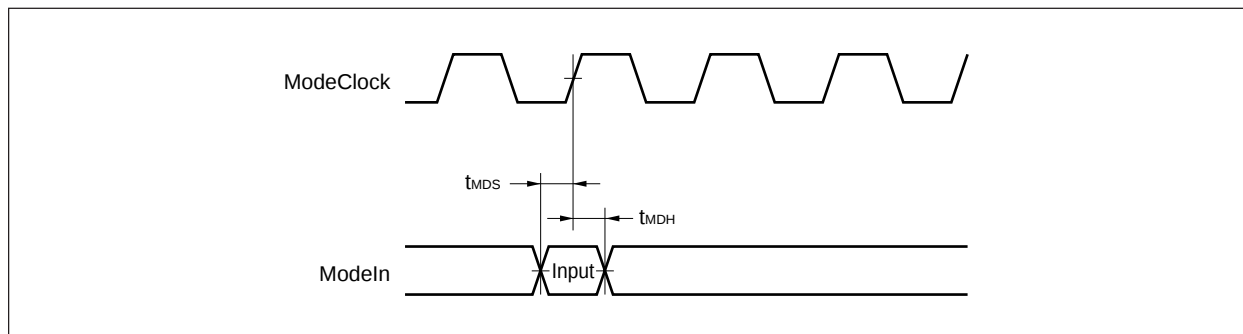
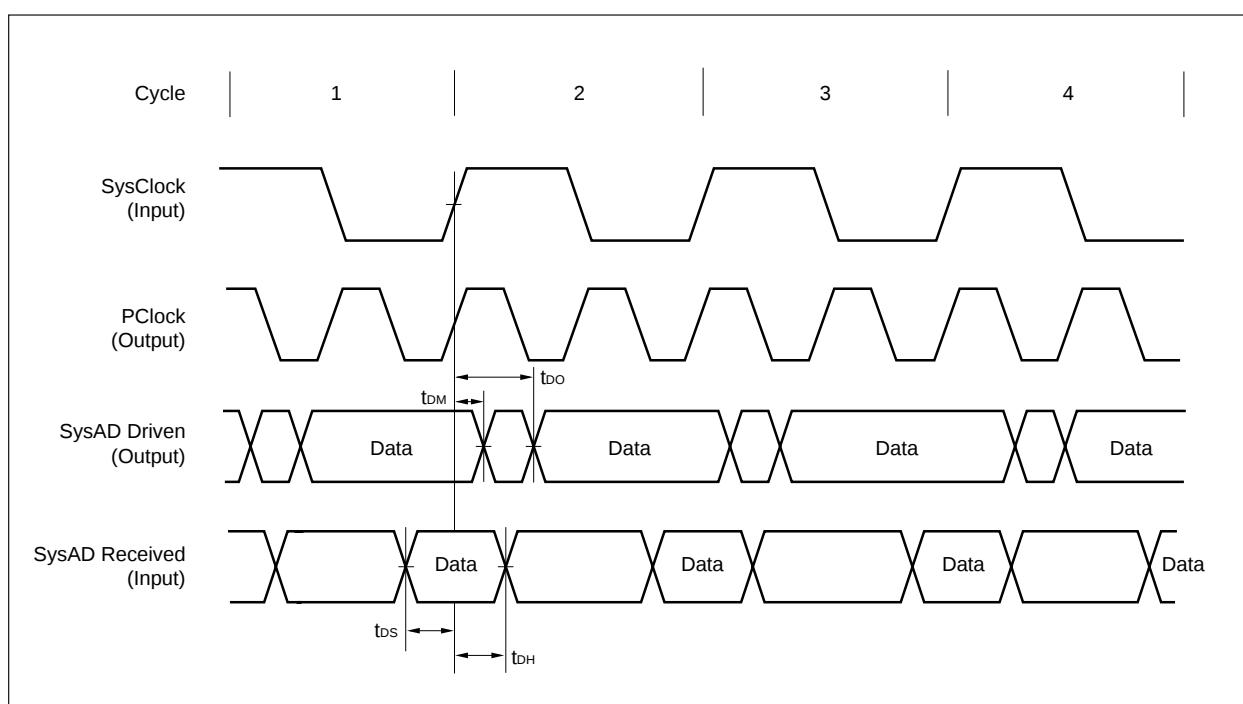
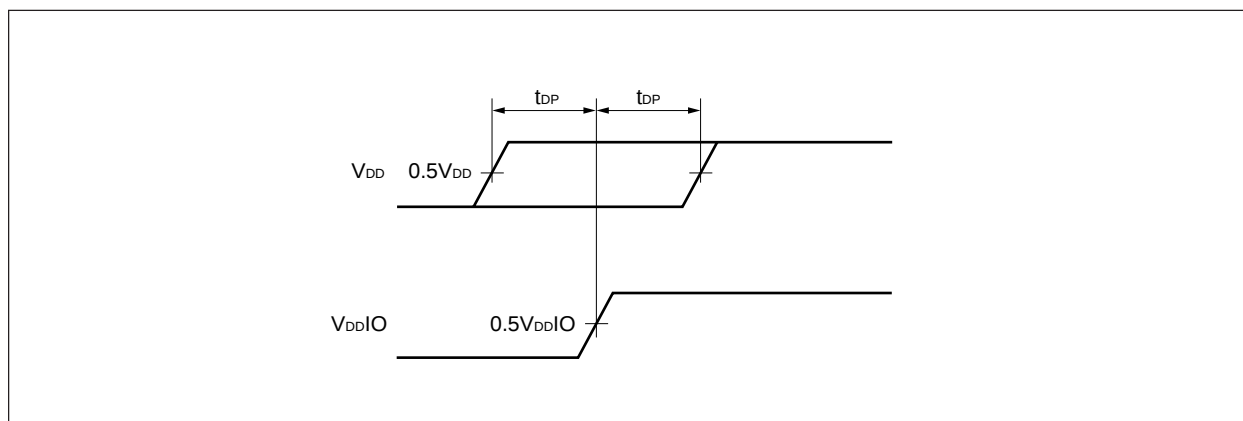


Clock jitter



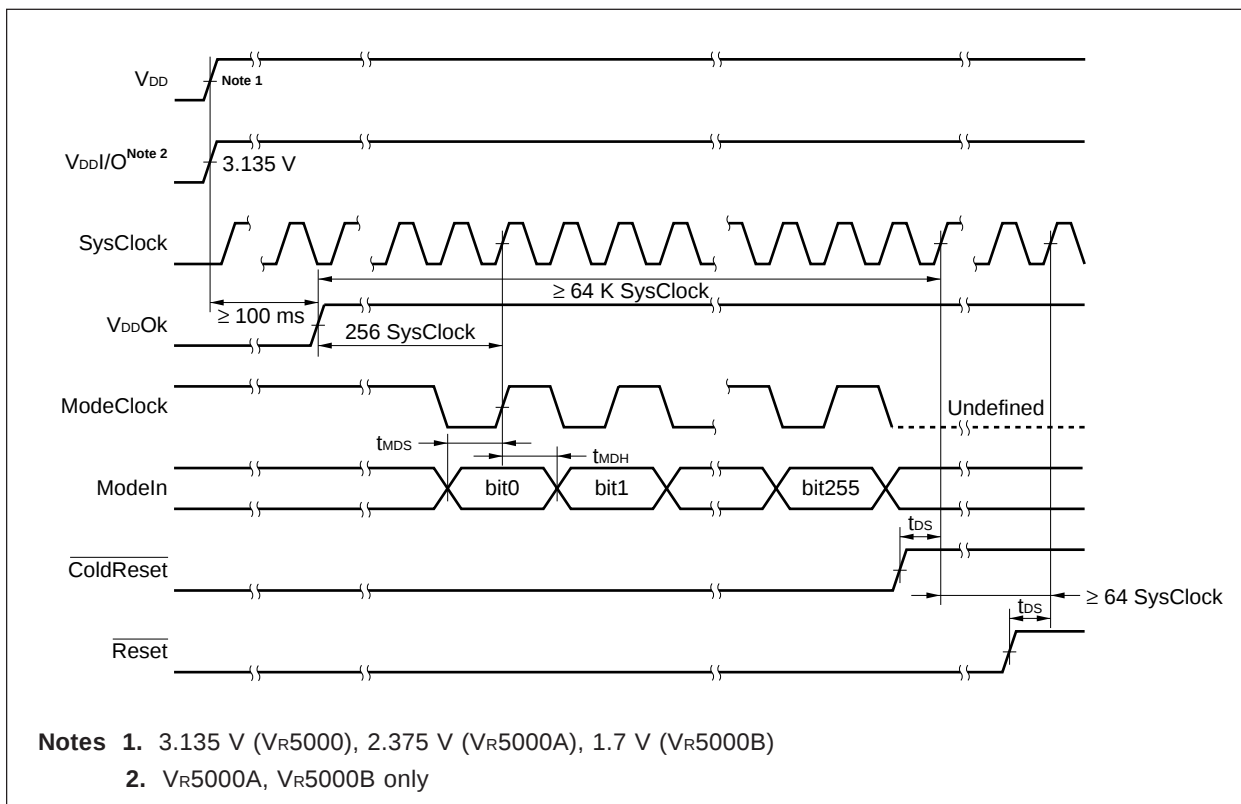
System interface edge timing



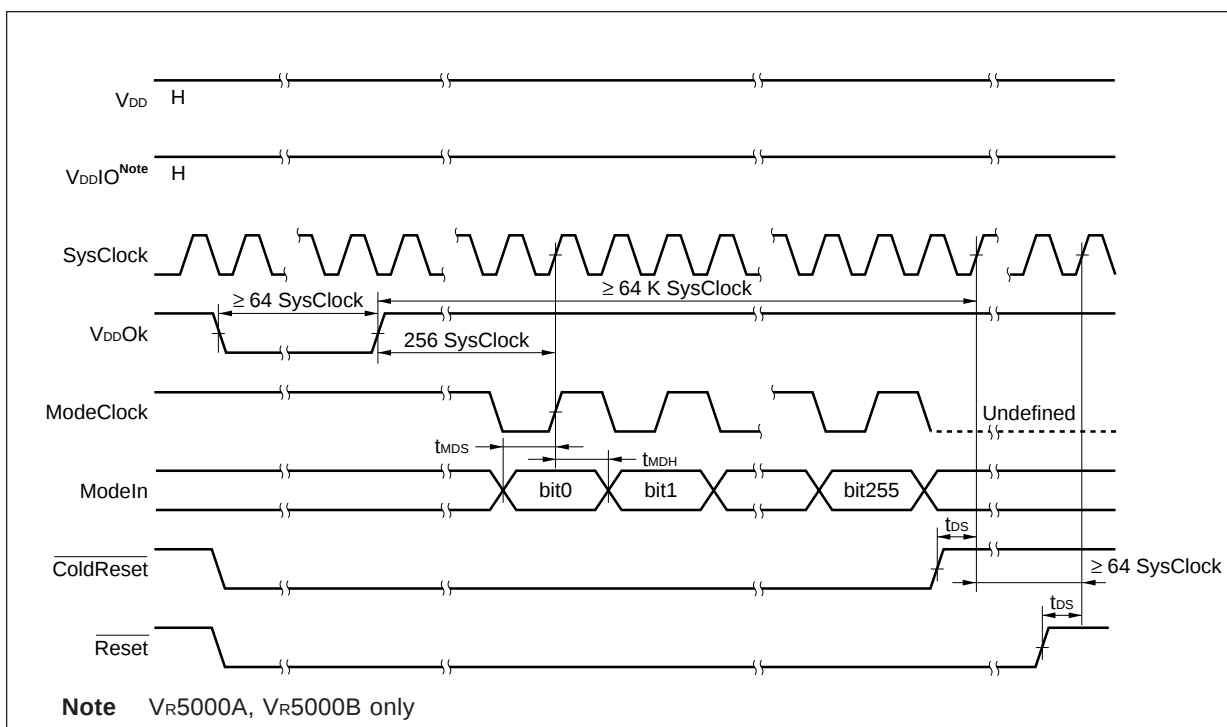
Boot mode interface edge timing**Clocking relations****Power application sequence (V_{R5000A}, V_{R5000B} only)**

Reset Timing

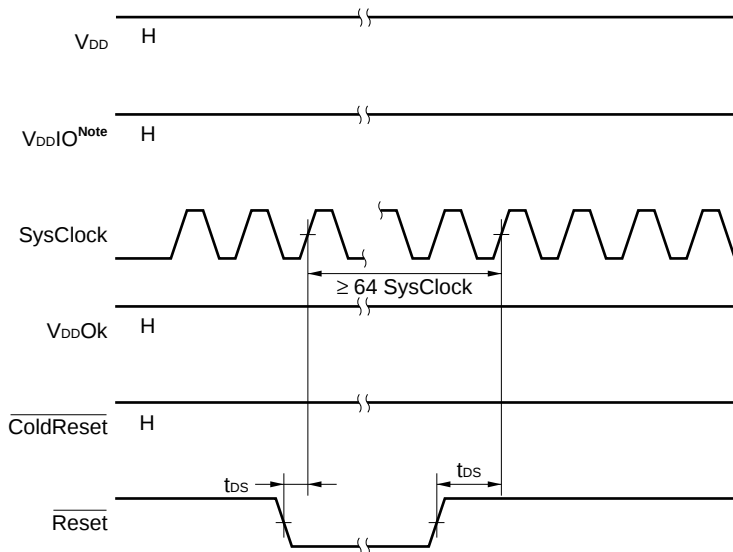
Power-on reset timing



Cold reset timing



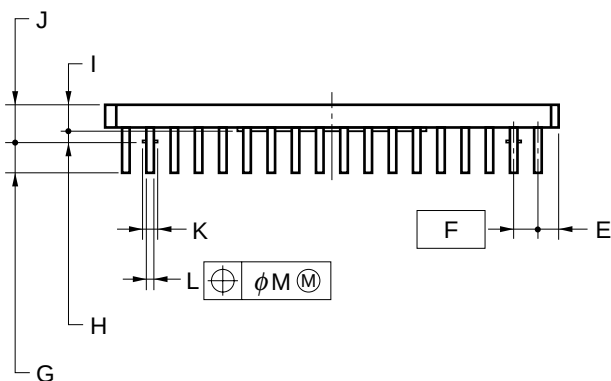
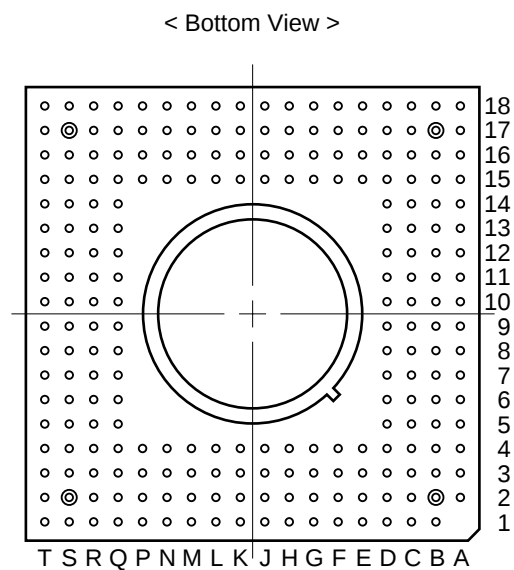
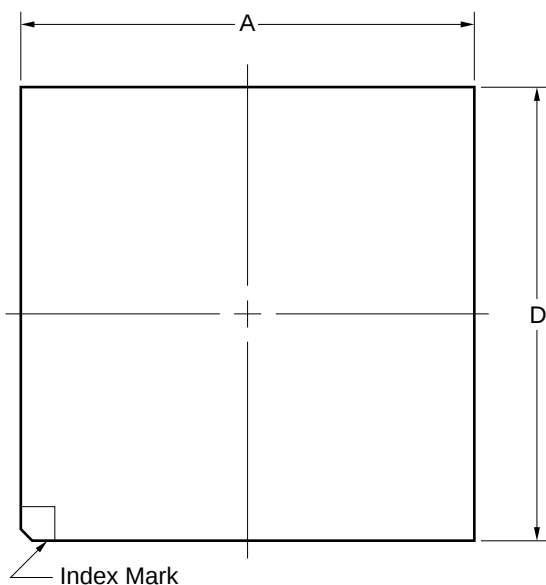
Warm reset timing



Note V_R5000A, V_R5000B only

3. PACKAGE DRAWING

223 PIN CERAMIC PGA



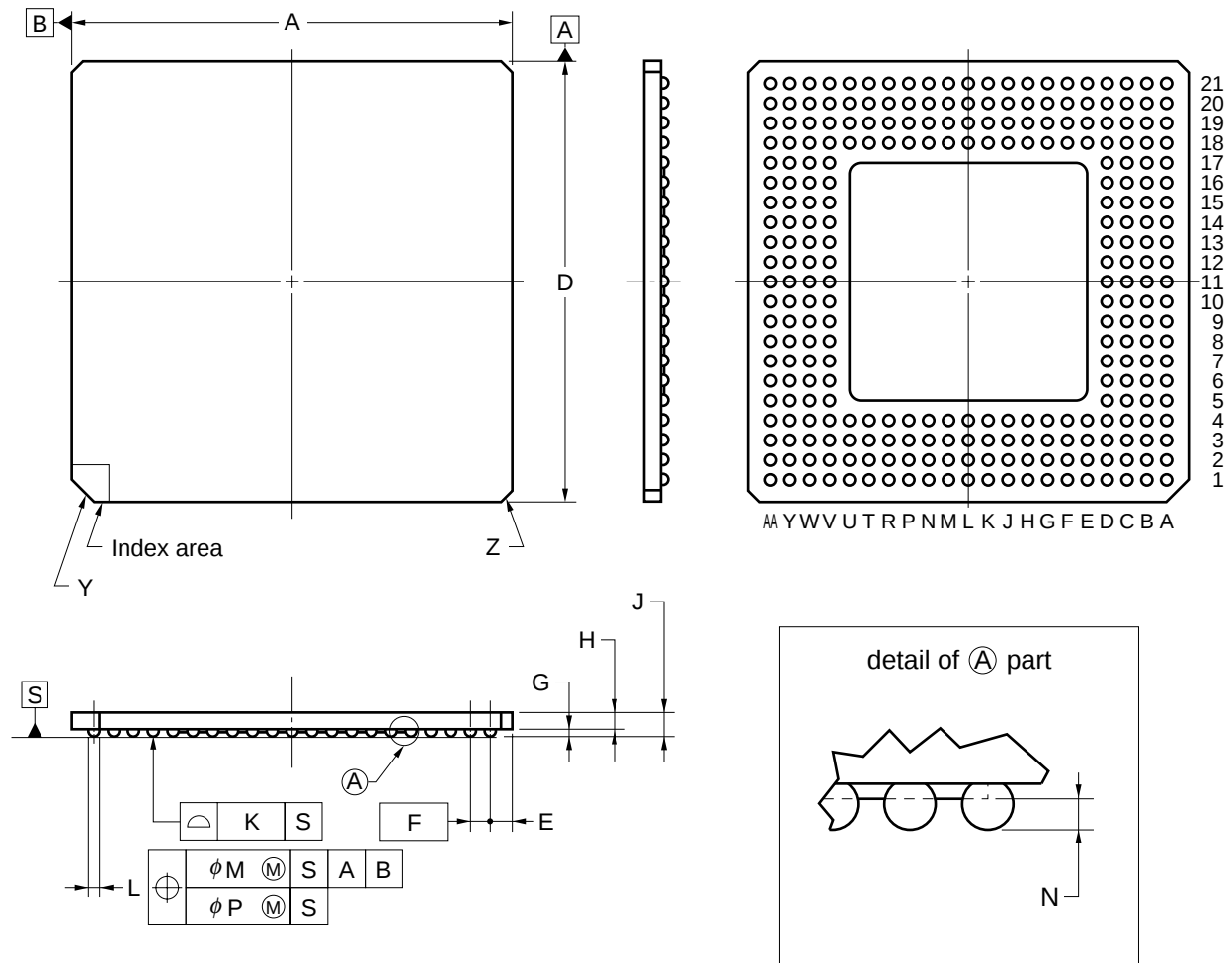
NOTE

Each lead centerline is located within $\phi 0.254$ ($\phi 0.010$ inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	47.24 $\pm$ 0.25	1.860 $\pm$ 0.010
D	47.24 $\pm$ 0.25	1.860 $\pm$ 0.010
E	2.03	0.080
F	2.54(T.P.)	0.100(T.P.)
G	3.30 $\pm$ 0.2	0.130 $\pm$ 0.008
H	0.50 MIN.	0.019 MIN.
I	2.82	0.111
J	3.98 MAX.	0.157 MAX.
K	$\phi 1.27\pm 0.2$	$\phi 0.050\pm 0.008$
L	$\phi 0.46\pm 0.05$	$\phi 0.018\pm 0.002$
M	0.254	0.010

X223RJ-100A-1

★ 272-PIN PLASTIC BGA (C/D advanced type) (29x29)



ITEM	MILLIMETERS
A	29.00±0.20
D	29.00±0.20
E	1.80
F	1.27 (T.P.)
G	0.60±0.10
H	0.90
J	1.50±0.20
K	0.15
L	φ0.75±0.15
M	0.30
N	0.25 MIN.
P	0.10
Y	C1.5
Z	C0.5

S272S2-127-C6-3

4. RECOMMENDED SOLDERING CONDITIONS

Soldering this product under the following soldering conditions is recommended.

For the details of the recommended soldering conditions, refer to Information Document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For the soldering methods and recommended other than those recommended, consult NEC.

(1) Soldering Conditions of Surface Mount Type

- μPD30500S2-150: 272-pin plastic BGA (C/D advanced type) (29 × 29)
- μPD30500S2-180: 272-pin plastic BGA (C/D advanced type) (29 × 29)
- μPD30500S2-200: 272-pin plastic BGA (C/D advanced type) (29 × 29)
- ★ μPD30500AS2-250: 272-pin plastic BGA (C/D advanced type) (29 × 29)
- μPD30500BS2-300^{Note 1}: 272-pin plastic BGA (C/D advanced type) (29 × 29)

Soldering Method	Soldering Conditions	Recommended Conditions Symbol
Infrared reflow	Package peak temperature: 235°C, Time: 30 sec max. (210°C min.), Number of times: 3 times max., Number of days: 3 ^{Note 2} (after that, prebaking is necessary at 125°C for 10 hours)	IR35-103-3
VPS	Package peak temperature: 215°C, Time: 25 to 40 sec max. (200°C min.), Number of times: 3 times max., Number of days: 3 ^{Note 2} (after that, prebaking is necessary at 125°C for 10 hours)	VP15-103-3
Partial heating	Pin temperature: 300°C max., Time: 3 sec max. (per device side)	—

Notes 1. Under development

- 2. Number of days in storage after the dry pack has been opened. The storage conditions are at 25°C, 65% RH MAX.

Caution Do not use two or more soldering methods in combination (except partial heating).

(2) Soldering Conditions of Insertion Type

- μPD30500RJ-150: 223-pin ceramic PGA (48 × 48)
- μPD30500RJ-180: 223-pin ceramic PGA (48 × 48)
- μPD30500RJ-200: 223-pin ceramic PGA (48 × 48)

Soldering Method	Soldering Conditions
Wave soldering (Pin only)	Solder bath temperature: 260°C max., Time: 10 sec max.
Partial heating	Pin temperature: 300°C max., Time: 3 sec max. (per pin)

Caution Wave soldering is only for the lead part in order that jet solder cannot contact with the chip directly.

APPENDIX DIFFERENCES BETWEEN THE V_R5000 AND V_R4310™

Item		V _R 5000	V _R 4310
Operating frequency	Internal	200 MHz MAX.	167 MHz MAX.
	External	100 MHz MAX.	83.3 MHz MAX.
Pipeline		2-way super scalar 5-stage pipeline	5-stage pipeline
Cache	Primary instruction cache	32 Kbytes	16 Kbytes
	Primary data cache	32 Kbytes	8 Kbytes
	Secondary cache interface	Provided	None
	Data protection	Byte parity	None
System bus	Write data transfer rate	9 types (DDDD/DDxDDx/DDxxDDxx/DxDxDxDx/DDxxxDDxxx/DDxxxxDDxxx/DxxDxxDxxDxx/DDxxxxxDDxxxxx/DxxxDxxx)	2 types (D/Dxx)
	Initialization pin at reset	Modeln (dedicated serial pin)	DivMode (0:2)
	Status after last data write	Access ends	Last data retained when transfer rate is set
Integer operation unit	Corresponding instruction	MIPS I, II, III, IV instruction sets	MIPS I, II, III instruction sets
JTAG interface		None	Provided
SyncOut-SyncIn bus		None	Provided
Clock interface	Multiplication ratio of input to internal	2, 3, 4, 5, 6, 7, 8	1.5, 2, 2.5, 3, 4, 5, 6
	Division ratio of internal to bus	2, 3, 4, 5, 6, 7, 8	1.5, 2, 2.5, 3, 4, 5, 6
	Clock output	None	TClock
★ Power management mode		Standby mode (pipeline does not operate)	Not provided
PRId register		Imp = 0x23	Imp = 0x0B

[MEMO]

[MEMO]

[MEMO]

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

Note that this document is not designated as 'preliminary', while some of the related documents are preliminary versions.

V_R3000, V_R4000, V_R4310, V_R5000, V_R5000A, V_R5000B, V_R10000, and V_R Series are trademarks of NEC Corporation.

MIPS is a trademark of MIPS Technologies Inc.

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC product in your application, please contact the NEC office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability
- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

NEC Electronics Inc. (U.S.)

Santa Clara, California
Tel: 408-588-6000
800-366-9782
Fax: 408-588-6130
800-729-9288

NEC Electronics (Germany) GmbH

Duesseldorf, Germany
Tel: 0211-65 03 02
Fax: 0211-65 03 490

NEC Electronics (UK) Ltd.

Milton Keynes, UK
Tel: 01908-691-133
Fax: 01908-670-290

NEC Electronics Italiana s.r.l.

Milano, Italy
Tel: 02-66 75 41
Fax: 02-66 75 42 99

NEC Electronics (Germany) GmbH

Benelux Office
Eindhoven, The Netherlands
Tel: 040-2445845
Fax: 040-2444580

NEC Electronics (France) S.A.

Velizy-Villacoublay, France
Tel: 01-30-67 58 00
Fax: 01-30-67 58 99

NEC Electronics (France) S.A.

Spain Office
Madrid, Spain
Tel: 91-504-2787
Fax: 91-504-2860

NEC Electronics (Germany) GmbH

Scandinavia Office
Taeby, Sweden
Tel: 08-63 80 820
Fax: 08-63 80 388

NEC Electronics Hong Kong Ltd.

Hong Kong
Tel: 2886-9318
Fax: 2886-9022/9044

NEC Electronics Hong Kong Ltd.

Seoul Branch
Seoul, Korea
Tel: 02-528-0303
Fax: 02-528-4411

NEC Electronics Singapore Pte. Ltd.

United Square, Singapore 1130
Tel: 65-253-8311
Fax: 65-250-3583

NEC Electronics Taiwan Ltd.

Taipei, Taiwan
Tel: 02-2719-2377
Fax: 02-2719-5951

NEC do Brasil S.A.

Electron Devices Division
Rodovia Presidente Dutra, Km 214
07210-902-Guarulhos-SP Brasil
Tel: 55-11-6465-6810
Fax: 55-11-6465-6829

Exporting this product or equipment that includes this product may require a governmental license from the U.S.A. for some countries because this product utilizes technologies limited by the export control regulations of the U.S.A.

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**

- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
- NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
- Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
- NEC devices are classified into the following three quality grades:
"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.