



1164 PACKAGES QUICK REFERENCE CARD

Revision 2.2

()	Grouping	[]	Optional
{}	Repeated		Alternative
	As is	CAPS	User Identifier
<i>italic</i>	VHDL-93	c	commutative
b	::= BIT		
bv	::= BIT_VECTOR		
u/l	::= STD_ULOGIC/STD_LOGIC		
uv	::= STD_ULOGIC_VECTOR		
lv	::= STD_LOGIC_VECTOR		
un	::= UNSIGNED		
sg	::= SIGNED		
in	::= INTEGER		
na	::= NATURAL		
sm	::= SMALL_INT (subtype INTEGER range 0 to 1)		

1. IEEE's STD_LOGIC_1164

1.1 LOGIC VALUES

'U'	Uninitialized
'X'/'W'	Strong/Weak unknown
'0'/'L'	Strong/Weak 0
'1'/'H'	Strong/Weak 1
'Z'	High Impedance
'-'	Don't care

1.2 PREDEFINED TYPES

STD_ULOGIC Base type

Subtypes:

STD_LOGIC	Resolved STD_ULOGIC
X01	Resolved X, 0 & 1
X01Z	Resolved X, 0, 1 & Z
UX01	Resolved U, X, 0 & 1
UX01Z	Resolved U, X, 0, 1 & Z

STD_ULOGIC_VECTOR(na to | downto na)
Array of STD_ULOGIC

STD_LOGIC_VECTOR(na to | downto na)
Array of STD_LOGIC

1.3 OVERLOADED OPERATORS

Description	Left	Operator	Right
bitwise-and	u/l,uv,lv	and, nand	u/l,uv,lv
bitwise-or	u/l,uv,lv	or, nor	u/l,uv,lv
bitwise-xor	u/l,uv,lv	xor, xnor	u/l,uv,lv
bitwise-not		not	u/l,uv,lv

1.4 CONVERSION FUNCTIONS

From	To	Function
u/l	b	TO_BIT (from[, xmap])
uv,lv	bv	TO_BITVECTOR (from[, xmap])
b	u/l	TO_STDULOGIC (from)
bv,uv	lv	TO_STDLOGICVECTOR (from)
bv,lv	uv	TO_STDULOGICVECTOR (from)

2. IEEE's NUMERIC_STD

2.1 PREDEFINED TYPES

UNSIGNED (na to downto na)	Array of STD_LOGIC
SIGNED (na to downto na)	Array of STD_LOGIC

2.2 OVERLOADED OPERATORS

Left	Op	Right	Return
	abs	sg	sg
	-	sg	sg
un	+, -, *, /, rem, mod	un	un
sg	+, -, *, /, rem, mod	sg	sg
un	+, -, *, /, rem, mod c	na	un
sg	+, -, *, /, rem, mod c	in	sg
un	<, >, <=, >=, =, /=	un	bool
sg	<, >, <=, >=, =, /=	sg	bool
un	<, >, <=, >=, =, /= c	na	bool
sg	<, >, <=, >=, =, /= c	in	bool

2.3 PREDEFINED FUNCTIONS

SHIFT_LEFT (un, na)	un
SHIFT_RIGHT (un, na)	un
SHIFT_LEFT (sg, na)	sg
SHIFT_RIGHT (sg, na)	sg
ROTATE_LEFT (un, na)	un
ROTATE_RIGHT (un, na)	un
ROTATE_LEFT (sg, na)	sg
ROTATE_RIGHT (sg, na)	sg
RESIZE (sg, na)	sg
RESIZE (un, na)	un
STD_MATCH (u/l, u/l)	bool
STD_MATCH (uv, uv)	bool
STD_MATCH (lv, lv)	bool
STD_MATCH (un, un)	bool
STD_MATCH (sg, sg)	bool

2.4 CONVERSION FUNCTIONS

From	To	Function
un,lv	sg	SIGNED (from)
sg,lv	un	UNSIGNED (from)
un,sg	lv	STD_LOGIC_VECTOR (from)
un,sg	in	TO_INTEGER (from)
na	un	TO_UNSIGNED (from, size)
in	sg	TO_SIGNED (from, size)

3. IEEE's NUMERIC_BIT

3.1 PREDEFINED TYPES

UNSIGNED (na to downto na)	Array of BIT
SIGNED (na to downto na)	Array of BIT

3.2 OVERLOADED OPERATORS

Left	Op	Right	Return
	abs	sg	sg
	-	sg	sg
un	+, -, *, /, rem, mod	un	un
sg	+, -, *, /, rem, mod	sg	sg
un	+, -, *, /, rem, mod c	na	un
sg	+, -, *, /, rem, mod c	in	sg
un	<, >, <=, >=, =, /=	un	bool
sg	<, >, <=, >=, =, /=	sg	bool
un	<, >, <=, >=, =, /= c	na	bool
sg	<, >, <=, >=, =, /= c	in	bool

3.3 PREDEFINED FUNCTIONS

SHIFT_LEFT (un, na)	un
SHIFT_RIGHT (un, na)	un
SHIFT_LEFT (sg, na)	sg
SHIFT_RIGHT (sg, na)	sg
ROTATE_LEFT (un, na)	un
ROTATE_RIGHT (un, na)	un
ROTATE_LEFT (sg, na)	sg
ROTATE_RIGHT (sg, na)	sg
RESIZE (sg, na)	sg
RESIZE (un, na)	un

3.4 CONVERSION FUNCTIONS

From	To	Function
un,bv	sg	SIGNED (from)
sg,bv	un	UNSIGNED (from)
un,sg	bv	BIT_VECTOR (from)
un,sg	in	TO_INTEGER (from)
na	un	TO_UNSIGNED (from)
in	sg	TO_SIGNED (from)

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4.SYNOPSISYS' STD_LOGIC_ARITH

4.1 PREDEFINED TYPES

UNSIGNED (na to downto na)	Array of STD_LOGIC
SIGNED (na to downto na)	Array of STD_LOGIC
SMALL_INT	Integer subtype, 0 or 1

4.2 OVERLOADED OPERATORS

Left	Op	Right	Return
	abs	sg	sg,lv
	-	sg	sg,lv
un	+,*,*	un	un,lv
sg	+,*,*	sg	sg,lv
sg	+,*,*	un	sg,lv
un	+,~c	in	un,lv
sg	+,~c	in	sg,lv
un	+,~c	u/l	un,lv
sg	+,~c	u/l	sg,lv
un	<,>,<=,>=,/=	un	bool
sg	<,>,<=,>=,/=	sg	bool
un	<,>,<=,>=,/= c	in	bool
sg	<,>,<=,>=,/= c	in	bool

4.3 PREDEFINED FUNCTIONS

SHL (un, un)	un	SHR (un, un)	un
SHL (sg, un)	sg	SHR (sg, un)	sg
EXT (lv, in)	lv	zero-extend	
SEXT (lv, in)	lv	sign-extend	

4.4 CONVERSION FUNCTIONS

From	To	Function
un,lv	sg	SIGNED (from)
sg,lv	un	UNSIGNED (from)
sg,un	lv	STD_LOGIC_VECTOR (from)
un,sg	in	CONV_INTEGER (from)
in,un,sg,u	un	CONV_UNSIGNED (from, size)
in,un,sg,u	sg	CONV_SIGNED (from, size)
in,un,sg,u	lv	CONV_STD_LOGIC_VECTOR (from, size)

5.SYNOPSISYS' STD_LOGIC_UNSIGNED

5.1 OVERLOADED OPERATORS

Left	Op	Right	Return
	+	lv	lv
lv	+,*,*	lv	lv
lv	+,~c	in	lv
lv	+,~c	u/l	lv
lv	<,>,<=,>=,/=	lv	bool
lv	<,>,<=,>=,/= c	in	bool

5.2 CONVERSION FUNCTIONS

From	To	Function
lv	in	CONV_INTEGER (from)

6.SYNOPSISYS' STD_LOGIC_SIGNED

6.1 OVERLOADED OPERATORS

Left	Op	Right	Return
	abs	lv	lv
	+,~	lv	lv
lv	+,*,*	lv	lv
lv	+,~c	in	lv
lv	+,~c	u/l	lv
lv	<,>,<=,>=,/=	lv	bool
lv	<,>,<=,>=,/= c	in	bool

6.2 CONVERSION FUNCTIONS

From	To	Function
lv	in	CONV_INTEGER (from)

7.SYNOPSISYS' STD_LOGIC_MISC

7.1 PREDEFINED FUNCTIONS

AND_REDUCE (lv uv)	u/l
[X]OR_REDUCE (lv uv)	u/l
[N]AND_REDUCE (lv uv)	UX01
OR_REDUCE (lv uv)	UX01
NOR_REDUCE (lv uv)	UX01
XOR_REDUCE (lv uv)	UX01
XNOR_REDUCE (lv uv)	UX01

8.EXEMPLAR'S STD_LOGIC_ARITH

8.1 OVERLOADED OPERATORS

Left	Op	Right	Return
	+,*,*	u/l	u/l
	abs	u/l	u/l

8.2 PREDEFINED FUNCTIONS

sl (u/l, in)	u/l
sl2 (u/l, in)	u/l
sr (u/l, in)	u/l
sr2 (u/l, in)	u/l
add (u/l)	u/l
add2 (u/l)	u/l
sub (u/l)	u/l
sub2 (u/l)	u/l
mult (u/l)	u/l
mult2 (u/l)	u/l
extend (u/l, in)	u/l
extend2 (u/l, in)	u/l
comp2 (u/l)	u/l

8.3 CONVERSION FUNCTIONS

From	To	Function
bool	uv	bool2elb
uv	bool	elb2bool
u/l	na	evect2int
in	u/l	int2evect (size)
uv	na	elb2int

9.MENTOR'S STD_LOGIC_ARITH

9.1 PREDEFINED TYPES

UNSIGNED (na to downto na)	Array of STD_LOGIC
SIGNED (na to downto na)	Array of STD_LOGIC

9.2 OVERLOADED OPERATORS

Left	Op	Right	Return
	abs	sg	sg
	-	sg	sg
u/l	+,~	u/l	u/l
uv	+,*,*,/mod,rem,**	uv	uv
lv	+,*,*,/mod,rem,**	lv	lv
un	+,*,*,/mod,rem,**	un	un
sg	+,*,*,/mod,rem,**	sg	sg
un	<,>,<=,>=,/=	un	bool
sg	<,>,<=,>=,/=	sg	bool
	not	un	un
	not	sg	sg
un	and,nand,or,nor,xor	un	un
sg	and,nand,or,nor,xor,xnor	sg	sg
uv	sla,sra,sl, srl,rol,ror	uv	uv
lv	sla,sra,sl, srl,rol,ror	lv	lv
un	sla,sra,sl, srl,rol,ror	un	un
sg	sla,sra,sl, srl,rol,ror	sg	sg

9.3 PREDEFINED FUNCTIONS

ZERO_EXTEND (uv lv un, na)	same
ZERO_EXTEND (u/l, na)	lv
SIGN_EXTEND (sg, na)	sg
AND_REDUCE (uv lv un sg)	u/l
OR_REDUCE (uv lv un sg)	u/l
XOR_REDUCE (uv lv un sg)	u/l

9.4 CONVERSION FUNCTIONS

From	To	Function
u/l,uv,lv,un,sg	in	TO_INTEGER (from)
u/l,uv,lv,un,sg	in	CONV_INTEGER (from)
bool	u/l	TO_STDLOGIC (from)
na	un	TO_UNSIGNED (from,size)
na	un	CONV_UNSIGNED (from,size)
in	sg	TO_SIGNED (from,size)
in	sg	CONV_SIGNED (from,size)
na	lv	TO_STDLOGICVECTOR (from,size)
na	uv	TO_STDLOGICVECTOR (from,size)

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