



VHDL QUICK REFERENCE CARD

Revision 2.2

()	Grouping	[]	Optional
{}	Repeated		Alternative
bold	As is	CAPS	User Identifier
<i>italic</i>	VHDL-1993		

1. LIBRARY UNITS

```
{[use_clause]}
entity ID is
  [generic ({ID : TYPEID := expr;});]
  [port ({ID : in | out | inout TYPEID := expr;});]
  {[declaration]}
begin
  {parallel_statement}
end [entity] ENTITYID;

{[use_clause]}
architecture ID of ENTITYID is
  {[declaration]}
begin
  {[parallel_statement]}
end [architecture] ARCHID;

{[use_clause]}
package ID is
  {[declaration]}
end [package] PACKID;

{[use_clause]}
package body ID is
  {[declaration]}
end [package body] PACKID;

{[use_clause]}
configuration ID of ENTITYID is
for ARCHID
  {[block_config | comp_config]}
end for;
end [configuration] CONFID;

use_clause ::=
  library ID;
  {[use LIBID.PKGID[. all | DECLID];]}
```

block_config ::=

```
for LABELID
  {[block_config | comp_config]}
end for;

comp_config ::=
for all | LABELID : COMPID
  (use entity [LIBID.]ENTITYID [( ARCHID )]
  [[generic map ( {GENID => expr ,} )]
  port map ({PORTID => SIGID | expr ,});]
  for ARCHID
  {[block_config | comp_config]}
  end for;]
end for; |
  (use configuration [LIBID.]CONFID
  [[generic map ({GENID => expr ,})]
  port map ({PORTID => SIGID | expr ,});)
end for;
```

2. DECLARATIONS

2.1. TYPE DECLARATIONS

```
type ID is ( {ID ,} );
type ID is range number downto | to number;
type ID is array ( {range | TYPEID ,} ) of TYPEID;
type ID is record
  {ID : TYPEID;}
end record;
type ID is access TYPEID;
type ID is file of TYPEID;
subtype ID is SCALARTYPID range range;
subtype ID is ARRAYTYPID ( {range ,} );
subtype ID is RESOLVFCTID TYPEID;
range ::=
  (integer | ENUMID to | downto integer | ENUMID) |
  (OBJID[reverse_range] | (TYPEID range <>))
```

2.2. OTHER DECLARATIONS

```
constant ID : TYPEID := expr;
[shared] variable ID : TYPEID := expr;
signal ID : TYPEID := expr;
file ID : TYPEID (is in | out string;) |
  (open read_mode | write_mode |
  append_mode is string;)
alias ID : TYPEID is OBJID;
attribute ID : TYPEID;
attribute ATTRID of OBJID | others | all : class is expr;
class ::=
  entity | architecture | configuration |
  procedure | function | package | type |
  subtype | constant | signal | variable |
  component | label
```

```
component ID [is]
  [generic ( {ID : TYPEID := expr; } );]
  [port ({ID : in | out | inout TYPEID := expr;});]
end component [COMPID];

[impure | pure] function ID
  [( {constant | variable | signal | file ID :
  [in]TYPEID := expr;})]
  return TYPEID [is]
begin
  {sequential_statement}
end [function] ID;

procedure ID[( {constant | variable | signal ID :
  in | out | inout TYPEID := expr;})]

[is begin
  {sequential_statement}
end [procedure] ID];

for LABELID | others | all : COMPID use
  (entity [LIBID.]ENTITYID [( ARCHID )] |
  (configuration [LIBID.]CONFID)
  [[generic map ( {GENID => expr ,} )]
  port map ( {PORTID => SIGID | expr ,} )];
```

3. EXPRESSIONS

```
expression ::=
  (relation and relation) | (relation nand relation) |
  (relation or relation) | (relation nor relation) |
  (relation xor relation) | (relation xnor relation)

relation ::= shexpr [relop shexpr]
shexpr ::= sexpr [shop sexpr]
sexpr ::= [+|-] term {addop term}
term ::= factor {mulop factor}
factor ::=
  (prim [** prim]) | (abs prim) | (not prim)
prim ::=
  literal | OBJID | OBJID'ATTRID | OBJID({expr ,}
  | OBJID(range) | ({choice [{ choice}] => expr ,}
  | FCTID({[PARID =>] expr ,} | TYPEID'(expr) |
  TYPEID(expr) | new TYPEID['(expr)] | ( expr )
choice ::= sexpr | range | RECFID | others
```

3.1. OPERATORS, INCREASING PRECEDENCE

logop	and or xor nand nor xnor
relop	= /= < <= > >=
shop	sll srl sla sra rol ror
addop	+ - &
mulop	* / mod rem
miscop	** abs not

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See reverse side for additional information.

4. SEQUENTIAL STATEMENTS

```
wait [on {SIGID,}] [until expr] [for time];
assert expr
  [report string]
  [severity note | warning | error | failure];
report string
  [severity note | warning | error | failure];
SIGID <= [transport] | [[reject TIME] inertial]
  {expr [after time],};
VARID := expr;
PROCEDUREID([PARID =>] expr,);
[LABEL:] if expr then
  {sequential_statement}
[[elseif expr then
  {sequential_statement}]]
[else
  {sequential_statement}]
end if [LABEL];
[LABEL:] case expr is
{when choice [{ choice}] =>
  {sequential_statement}}
end case [LABEL];
[LABEL:] [while expr] loop
  {sequential_statement}
end loop [LABEL];
[LABEL:] for ID in range loop
  {sequential_statement}
end loop [LABEL];
next [LOOPLBL] [when expr];
exit [LOOPLBL] [when expr];
return [expression];
null;
```

5. PARALLEL STATEMENTS

```
LABEL: block [is]
  [generic ( {ID : TYPEID; } );]
  [generic map ( {[GENID =>] expr, } );]]
  [port ( {ID : in | out | inout TYPEID } );]
  [port map ( {[PORTID =>] SIGID | expr, } );]]
  [[declaration]]
begin
  [{parallel_statement}]
end block [LABEL];
[LABEL:] [postponed] process [( {SIGID, } )]
  [[declaration]]
begin
  [{sequential_statement}]
end [postponed] process [LABEL];
[LABEL:] [postponed] PROCID([PARID =>] expr,);
```

```
[LABEL:] [postponed] assert expr
  [report string]
  [severity note | warning | error | failure];
[LABEL:] [postponed] SIGID <=
  [transport] | [[reject TIME] inertial]
  [{expr [after TIME,]} | unaffected when expr else}]
  {expr [after TIME,]} | unaffected;
[LABEL:] [postponed] with expr select
  SIGID <= [transport] | [[reject TIME] inertial]
  [{expr [after TIME,]} | unaffected
    when choice [{ choice}]]];
LABEL: COMPID
  [[generic map ( {GENID => expr, } )]
  port map ( {[PORTID =>] SIGID | expr, } )];
LABEL: entity [LIBID.]ENTITYID ([ARCHID])
  [[generic map ( {GENID => expr, } )]
  port map ( {[PORTID =>] SIGID | expr, } )];
LABEL: configuration [LIBID.]CONFID
  [[generic map ( {GENID => expr, } )]
  port map ( {[PORTID =>] SIGID | expr, } )];
LABEL: if expr generate
  [{parallel_statement}]
end generate [LABEL];
LABEL: for ID in range generate
  [{parallel_statement}]
end generate [LABEL];
```

6. PREDEFINED ATTRIBUTES

TYPID'base	Base type
TYPID'left	Left bound value
TYPID'right	Right-bound value
TYPID'high	Upper-bound value
TYPID'low	Lower-bound value
TYPID'pos(expr)	Position within type
TYPID'val(expr)	Value at position
TYPID'succ(expr)	Next value in order
TYPID'pred(expr)	Previous value in order
TYPID'leftof(expr)	Value to the left in order
TYPID'rightof(expr)	Value to the right in order
TYPID'ascending	Ascending type predicate
TYPID'image(expr)	String image of value
TYPID'value(string)	Value of string image
ARYID'left[(expr)]	Left-bound of [nth] index
ARYID'right[(expr)]	Right-bound of [nth] index
ARYID'high[(expr)]	Upper-bound of [nth] index
ARYID'low[(expr)]	Lower-bound of [nth] index
ARYID'range[(expr)]	'left down/to 'right
ARYID'reverse_range[(expr)]	'right down/to 'left
ARYID'length[(expr)]	Length of [nth] dimension
ARYID'ascending[(expr)]	'right >= 'left ?
SIGID'delayed[(TIME)]	Delayed copy of signal
SIGID'stable[(TIME)]	Signals event on signal
SIGID'quiet[(TIME)]	Signals activity on signal
SIGID'transaction	Toggles if signal active

SIGID'event	Event on signal ?
SIGID'active	Activity on signal ?
SIGID'last_event	Time since last event
SIGID'last_active	Time since last active
SIGID'last_value	Value before last event
SIGID'driving	Active driver predicate
SIGID'driving_value	Value of driver
OBJID'simple_name	Name of object
OBJID'instance_name	Pathname of object
OBJID'path_name	Pathname to object

7. PREDEFINED TYPES

BOOLEAN	True or false
INTEGER	32 or 64 bits
NATURAL	Integers >= 0
POSITIVE	Integers > 0
REAL	Floating-point
BIT	'0', '1'
BIT_VECTOR(NATURAL)	Array of bits
CHARACTER	7-bit ASCII
STRING(POSITIVE)	Array of characters
TIME	hr, min, sec, ms, us, ns, ps, fs
DELAY_LENGTH	Time >= 0

8. PREDEFINED FUNCTIONS

NOW Returns current simulation time
DEALLOCATE(ACCESSTYPEOBJ)
Deallocate dynamic object
FILE_OPEN([status], FILEID, string, mode)
Open file
FILE_CLOSE(FILEID) Close file

9. LEXICAL ELEMENTS

Identifier ::= letter { [underline] alphanumeric }
decimal literal ::= integer [. integer] [E[+|-] integer]
based literal ::= integer # hexint [. hexint] # [E[+|-] integer]
bit string literal ::= B|O|X " hexint "
comment ::= -- comment text

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