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package STD_1149_1_2012 is

-- Give component conformance declaration.

attribute COMPONENT_CONFORMANCE : string;

-- Give pin mapping declarations

attribute PIN_MAP : string;
subtype PIN_MAP_STRING is string;

-- Give TAP control declarations

type CLOCK_LEVEL is (LOW, BOTH);
type CLOCK_INFO is record
    FREQ : real;
    LEVEL: CLOCK_LEVEL;
end record;

attribute TAP_SCAN_IN    : boolean;
attribute TAP_SCAN_OUT  : boolean;
attribute TAP_SCAN_CLOCK: CLOCK_INFO;
attribute TAP_SCAN_MODE : boolean;
attribute TAP_SCAN_RESET: boolean;

-- Give instruction register declarations

attribute INSTRUCTION_LENGTH : integer;
attribute INSTRUCTION_OPCODE : string;
attribute INSTRUCTION_CAPTURE : string;
attribute INSTRUCTION_PRIVATE : string;

-- Give ID and USER code declarations

type ID_BITS is ('0', '1', 'x', 'X');
type ID_STRING is array (31 downto 0) of ID_BITS;
attribute IDCODE_REGISTER : ID_STRING;
attribute USERCODE_REGISTER: ID_STRING;

-- Give register declarations

attribute REGISTER_ACCESS : string;
attribute REGISTER_MNEMONICS : string;
attribute REGISTER_FIELDS : string;
attribute REGISTER_ASSEMBLY : string;
attribute REGISTER_CONSTRAINTS : string;
attribute POWER_PORT_ASSOCIATION : string;
attribute REGISTER_ASSOCIATION : string;

-- Give boundary cell declarations

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type BSCAN_INST is (EXTEST, SAMPLE, INTEST);
type CELL_TYPE is (INPUT, INTERNAL, CLOCK, OBSERVE_ONLY,
CONTROL, CONTROLR, OUTPUT2,
OUTPUT3, BIDIR_IN, BIDIR_OUT);
type CAP_DATA is (PI, PO, UPD, CAP, X, ZERO, ONE);
type CELL_DATA is record
  CT : CELL_TYPE;
  I  : BSCAN_INST;
  CD : CAP_DATA;
end record;
type CELL_INFO is array (positive range <>) of CELL_DATA;

-- Boundary cell deferred constants (see package body)

constant BC_0  : CELL_INFO;
constant BC_1  : CELL_INFO;
constant BC_2  : CELL_INFO;
constant BC_3  : CELL_INFO;
constant BC_4  : CELL_INFO;
constant BC_5  : CELL_INFO;
constant BC_7  : CELL_INFO;
constant BC_8  : CELL_INFO;
constant BC_9  : CELL_INFO;
constant BC_10 : CELL_INFO;

-- Boundary-scan register declarations

attribute BOUNDARY_LENGTH : integer;
attribute BOUNDARY_REGISTER : string;
attribute ASSEMBLED_BOUNDARY_LENGTH : array (0 to 1) of integer;
attribute BOUNDARY_SEGMENT : string;

-- Miscellaneous

attribute PORT_GROUPING : string;
attribute RUNBIST_EXECUTION : string;
attribute INTEST_EXECUTION : string;
attribute SYSCLOCK_REQUIREMENTS : string;
subtype BSDL_EXTENSION is string;
attribute COMPLIANCE_PATTERNS : string;
attribute DESIGN_WARNING : string;

end STD_1149_1_2012; -- End of 1149.1-2012 Package

package body STD_1149_1_2012 is -- Standard boundary cells

-- Generic cell capturing minimum allowed data

constant BC_0 : CELL_INFO :=
  ((INPUT, EXTEST, PI), (OUTPUT2, EXTEST, X),
  (INPUT, SAMPLE, PI), (OUTPUT2, SAMPLE, PI),

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    (INPUT,    INTEST,  X),          (OUTPUT2,  INTEST,  PI),
    (OUTPUT3,  EXTEST,  X),          (INTERNAL,  EXTEST,  X),
    (OUTPUT3,  SAMPLE,  PI),         (INTERNAL,  SAMPLE,  X),
    (OUTPUT3,  INTEST,  PI),         (INTERNAL,  INTEST,  X),
    (CONTROL,  EXTEST,  X),          (CONTROLR,  EXTEST,  X),
    (CONTROL,  SAMPLE,  PI),         (CONTROLR,  SAMPLE,  PI),
    (CONTROL,  INTEST,  PI),         (CONTROLR,  INTEST,  PI),
    (BIDIR_IN,EXTEST,  PI),         (BIDIR_OUT, EXTEST,  X ),
    (BIDIR_IN,SAMPLE,  PI),         (BIDIR_OUT, SAMPLE,  PI),
    (BIDIR_IN,INTEST,  X ),         (BIDIR_OUT, INTEST,  PI),
    (OBSERVE_ONLY, SAMPLE, PI),     (OBSERVE_ONLY, EXTEST, PI) );

-- Description for f11-19, f11-31, f11-35c, f11-35d, f11-37c,
f11-47d

constant BC_1 : CELL_INFO :=
  ((INPUT,    EXTEST,  PI), (OUTPUT2,  EXTEST,  PI),
   (INPUT,    SAMPLE,  PI), (OUTPUT2,  SAMPLE,  PI),
   (INPUT,    INTEST,  PI), (OUTPUT2,  INTEST,  PI),
   (OUTPUT3,  EXTEST,  PI), (INTERNAL,  EXTEST,  PI),
   (OUTPUT3,  SAMPLE,  PI), (INTERNAL,  SAMPLE,  PI),
   (OUTPUT3,  INTEST,  PI), (INTERNAL,  INTEST,  PI),
   (CONTROL,  EXTEST,  PI), (CONTROLR,  EXTEST,  PI),
   (CONTROL,  SAMPLE,  PI), (CONTROLR,  SAMPLE,  PI),
   (CONTROL,  INTEST,  PI), (CONTROLR,  INTEST,  PI) );

-- Description for f11-15, f11-32, f11-36c, f11-36d, f11-38c,
--   f11-39c, f11-40(output) and f11-42c

constant BC_2 : CELL_INFO :=
  ((INPUT,    EXTEST,  PI), (OUTPUT2,  EXTEST,  UPD),
   (INPUT,    SAMPLE,  PI), (OUTPUT2,  SAMPLE,  PI),
   (INPUT,    INTEST,  UPD), -- Intest on output2 not supported
   (OUTPUT3,  EXTEST,  UPD), (INTERNAL,  EXTEST,  PI),
   (OUTPUT3,  SAMPLE,  PI), (INTERNAL,  SAMPLE,  PI),
   (OUTPUT3,  INTEST,  PI), (INTERNAL,  INTEST,  UPD),
   (CONTROL,  EXTEST,  UPD), (CONTROLR,  EXTEST,  UPD),
   (CONTROL,  SAMPLE,  PI), (CONTROLR,  SAMPLE,  PI),
   (CONTROL,  INTEST,  PI), (CONTROLR,  INTEST,  PI) );

-- Description for f11-16

constant BC_3 : CELL_INFO :=
  ((INPUT,  EXTEST,  PĪ), (INTERNAL,  EXTEST,  PI),
   (INPUT,  SAMPLE,  PI), (INTERNAL,  SAMPLE,  PI),
   (INPUT,  INTEST,  PI), (INTERNAL,  INTEST,  PI) );

-- Description for f11-17, f11-18, f11-40(input)

constant BC_4 : CELL_INFO :=
  ((INPUT,  EXTEST,  PĪ), -- Intest on input not supported
   (INPUT,  SAMPLE,  PI),

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(OBSERVE_ONLY, EXTEST, PI),
(OBSERVE_ONLY, SAMPLE, PI), -- Intest on observe_only not
supported
(CLOCK, EXTEST, PI), (INTERNAL, EXTEST, PI),
(CLOCK, SAMPLE, PI), (INTERNAL, SAMPLE, PI),
(CLOCK, INTEST, PI), (INTERNAL, INTEST, PI) );

-- Description for f11-47c, a combined input/control

constant BC_5 : CELL_INFO :=
((INPUT, EXTEST, PI), (CONTROL, EXTEST, PI),
(INPUT, SAMPLE, PI), (CONTROL, SAMPLE, PI),
(INPUT, INTEST, UPD), (CONTROL, INTEST, UPD) );

-- Description for f11-39d, a reversible cell
-- !! Not recommended; replaced by BC_7 below !!

-- Description for f11-38d, self-monitor reversible
-- !! Recommended over cell BC_6 !!

constant BC_7 : CELL_INFO :=
((BIDIR_IN, EXTEST, PI), (BIDIR_OUT, EXTEST, PO),
(BIDIR_IN, SAMPLE, PI), (BIDIR_OUT, SAMPLE, PI),
(BIDIR_IN, INTEST, UPD), (BIDIR_OUT, INTEST, PI) );

-- Description for 11-41, f11-42d

constant BC_8 : CELL_INFO :=
-- Intest on bidir not supported
((BIDIR_IN, EXTEST, PI), (BIDIR_OUT, EXTEST, PO),
(BIDIR_IN, SAMPLE, PI), (BIDIR_OUT, SAMPLE, PO) );

-- Description for f11-33

constant BC_9 : CELL_INFO :=
-- Self-monitoring output that supports Intest
((OUTPUT2, EXTEST, PO), (OUTPUT3, EXTEST, PO),
(OUTPUT2, SAMPLE, PI), (OUTPUT3, SAMPLE, PI),
(OUTPUT2, INTEST, PI), (OUTPUT3, INTEST, PI) );

-- Description for fig 11-34

constant BC_10 : CELL_INFO :=
-- Self-monitoring output that does not support Intest
((OUTPUT2, EXTEST, PO), (OUTPUT3, EXTEST, PO),
(OUTPUT2, SAMPLE, PO), (OUTPUT3, SAMPLE, PO) );

-- Register segment field definitions for excludable segments and
-- (power) domain control.

attribute REGISTER_MNEMONICS of STD_1149_1_2012 : package is

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"STD_MUX      (Include (1) < chain segment is included >, " &
"              Exclude (0) < chain segment not included >), " &
"STD_POWER    (On      (1) < Domain is functionally on>, " &
"              Off      (0) < Domain is functionally off>), " &
"STD_DOMSET   (Override (1) < Force domain ON >, " &
"              Normal   (0) < Domain in normal mode>) ";

attribute REGISTER_FIELDS of STD_1149_1_2012 : package is
  "DOMCTRL[1] ( "&
    "(DOMCTRL[1] IS (0)  MON " &
    "                  DEFAULT(STD_DOMSET(Normal)) " &
    "                  RESETVAL(STD_DOMSET(Normal)) ) "&
    "-- A reset type must be specified where this is
instantiated
    ")," &
  "SEGSEL[1] ( "&
    "(SEGSEL[1] IS (0)  DELAYPO " &
    "                  DEFAULT(STD_MUX(Exclude)) "&
    "                  RESETVAL(STD_MUX(Exclude)) "&
    "-- A reset type must be specified where this is
instantiated
    "                  CAPTURES(STD_POWER(-)) ) "&
    ")," &
  "SEGMUX[0]   (( SEGMUX   [0] IS ( ) ) )," &
  "SEGSTART[0] (( SEGSTART [0] IS ( ) ) )";

end STD_1149_1_2012; -- End of IEEE STD 1149.1-2012 Package Body

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