HSPICE Quick Reference Card

Input Deck Format

```
TITLE
* COMMENT
$ COMMENT
(.OPTIONS)
(.TEMP temperatures)
(.Analysis)
(.PRINT/PLOT)
Circuit Description
+ CONTINUATIONS
.INCLUDE modelfiles
(.LIB library-files)
(.ALTER
    .DEL LIB
    .LIB
    Circuit Description
    Restricted Commands
)
.END
```

File Inclusion

.INCLUDE 'filename'

Library Definitions

General form of a library file is

```
.LIB entry_name1
(valid HSPICE syntax)
.ENDL entry_name1
.LIB entry_name2
(valid HSPICE syntax)
.ENDL entry_name2
```

Library Call Statement

.LIB 'lib_file_name' entry_name

Library Delete Statement

.DEL LIB 'lib_file_name' entry_name

Subcircuit Definition

```
.SUBCKT subname (local nodes) (parameters)
    Subcircuit Description
.ENDS subname
```

Subcircuit Call Statement

Xyyyyyyy nodes subname (parameters) (M = mult)

Types of Analysis

.OP (ALL | VOLTAGE | CURRENT) (time)

.DC var1 start1 stop1 incr1 (var2 start2 stop2 incr2)
.DC var1 start1 stop1 incr1 (SWEEP var2 type np start2 stop2)
.DC var1 type np start1 stop1 (SWEEP MONTE = val)
.DC var1 type np start1 stop1 (SWEEP DATA = dataname)
.DC DATA = dataname (var2 start2 stop2 incr2)

.AC type np fstart fstop
.AC type np fstart fstop (SWEEP var pstart pstop pstep)
.AC type np fstart fstop (SWEEP var type np start stop)
.AC type np fstart fstop (SWEEP DATA = dataname)
.AC type np fstart fstop (SWEEP MONTE = val)

.TRAN step1 stop1 (step2 stop2...) (START = printtime UIC)
+ (SWEEP var pstart pstop pstep)
.TRAN step1 stop1 (step2 stop2...) (START = printtime UIC)
+ (SWEEP var type np pstart pstop)
.TRAN step1 stop1 (step2 stop2...) (START = printtime UIC)
+ (SWEEP DATA = dataname)
.TRAN step1 stop1 (step2 stop2...) (START = printtime UIC)
+ (SWEEP MONTE = val)

– For .DC, .AC or .TRAN as follows:
1) type may be one of the following keynames DEC, OCT, LIN, and POI.
2) Two distributions,Gaussian and Uniform, are available for Monte Carlo analysis by using
.PARAM xx = UNIF(nom_val,variation)
or
.PARAM xx = GAUSS(nom_val,variation,sigma).

.PZ output input
– Output may be node voltage or branch current. Input may be independent voltage or current source.

.NET input (RIN = val) or .NET input (val) – one port network
.NET output input (ROUT = val) (RIN = val) or .NET output input (val) (val) – two port network

.TF output_variable input_source

.SENS output_variables

.DISTO output_load_resistor (inter (skw2 (refpwr (spwf))))
– 1e-3 < skw2 < 1

.NOISE output_variable source print_interval

.SAMPLE FS = fs (TOL = val) (NUMF = nf) (MAXFLD = nfold)
+ (BETA = val)
– Sample noise. fs is a sample frequency in hertz.

.FOUR freq output_variables

Passive Devices

Rxxxxxxx n1 n2 rval (TC = tc1 (tc2 (scale))) (M = mult)
– Effective resistance is
$r(T) = r(T0) * scale * (1 + (tc1 * \Delta T) + (tc2 * (\Delta T)2))$
Cxxxxxxx n1 n2 cval (tc1(tc2(scale))) IC = v0) M = mult)
– v0 is used in .TRAN and is overridden by .IC

Cxxxxxxx n1 n2 POLY c0 c1 c2 ... (IC = v0)
– Non-linear capacitor; effective capacitance is
$C(v) = c0 + c1 * v(t) + c2 * v^2(t) + ...$

Lxxxxxxx n1 n2 lval (tc1) (tc2) (IC = i0)

Lxxxxxxx n1 n2 POLY c0 c1 c2 ...l (IC = i0)
– Non-linear inductor

Kxxxxxxx Lyyyyyyy Lzzzzzzz kval

Kxxxxxxx Lyyyyyyy (Lzzzzzzz, ...) modelname (MAG = mval)
– magnetic core transformer

Lxxxxxxx n1 n2 NT = ntval (R = rval) (IC = ival)
– magnetic core winding element

Txxxxxxx n1 nr1 n2 nr2 Z0 = val TD = val (IC = v1,i1,v2,i2)

Sources

Vxxxxxxx n + n- (DC = dcval) (AC = mag (phase)) scrtype
Ixxxxxxx n + n- (DC = dcval) (AC = mag (phase)) scrtype

Valid source types are:

```
PULSE vlo vhi (tdelay trise tfall width period)
PWL t1 v1 (t2 v2...) (R)
PL v1 t1 (v2 t2...) (R)
SIN vo va (freq td theta phase)
EXP v1 v2 (td1 tau1 td2 tau2)
SFFM vo va (fc mdi fs)
```

Linear and non-linear dependent sources are also available. Consult manual Chapter 8 for more info.

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Parameters

.PARAM name1 = value1...

PN Diodes

Dxxxxxxx n+ n- modelname (area) (IC = vd0) (M = mult)

Bipolar Devices

Qxxxxxxx nc nb ne (ns) modelname (area) (M = mult)
+ (IC = vbe0, vce0)

JFET Devices

Jxxxxxxx nd ng ns modelname (area) (IC = vds0, vgs0)
+ (M = mult)

MOS Devices

Mxxxxxxx nd ng ns (nb) modelname (L = length)
+ (W = width) (IC = vds0, vgs0, vbs0) (M = mult)

MODELS

.MODEL mname type (pname1 = pval1 ..... pnamen = pvaln)

– type - model type must be one of the following 11 types:
(1) R - linear resistor (wire) model.
(2) C - linear capacitance model.
(3) L - magnetic core model.
(4) AMP - OP-AMP model.
(5) D - diode model.
(6) NPN - NPN BJT model.
(7) PNP - PNP BJT model.
(8) NJF - n-channel JFET model.
(9) PJF - p-channel JFET model.
(10) NMOS - n-channel MOSFET model.
(11) PMOS - p-channel MOSFET model.

Measuring Rise/Fall/Delays

.MEAS (DC | TRAN | AC) measname TRIG trig_var
+ VAL = trig_val
+ (TD = time_delay) (CROSS = #crossing) (RISE = #rise)
+ (FALL = #fall)
+ TARG tar_var VAL = tar-val (TD = time_delay)
+ (CROSS = #crossing) (RISE = #rise) (FALL = #fall)

Measuring Average/RMS/MIN/MAX/P2P

.MEAS (DC | TRAN | AC) measname func out_var
+ (FROM = value) (TO = value)
– func may be the one of AVG, RMS, MIN, MAX, or PP.

Measuring ERR

.MEAS (DC | TRAN | AC) measname ERR out_var1 out_var2
+ (MINVAL = val) (IGNOR = val) (FROM = value) (TO = value)

DATA Statement

.DATA data_name pnam1 (pnam2 . . . . . pname9, pname 10)
+ pval1 (pval2 . . . . . pval9 pval10)
+ pval1' (pval2' . . . . . .pval9' pval10')
+ . . . (. . . . . .)

to print/plot differential signals properly:

.OPTION ACOUT = 0
↖ zero

Run-Time Options

.OPT options
– Options may be changed or reset from run to run.
– Some useful options:

LIST		: Print element summary listing.
NODE:		: Print nodal cross-reference table.
NOMOD		: Suppress printing of model parameter data.
NUMDGT	= X	: Number of output digits. (1 < x < 7; default = 4)
OPTS		: Print values of options used.
TNOM	= X	: Reset nominal temperature (default = 25 degrees C)
INGOLD	= 0	: Output numbers in engineering format (using "m" for milli, for example)
	= 1	: Combined format (Regular form for .1 < n < 999; exponential otherwise)
	= 2	: All exponential format
CO	= x	: Set output width (Default = 80; see also .WIDTH below)

.WIDTH (IN = columns_in) (OUT = columns_out)

Printing / Plotting Output

.PRINT analysis_type var1 (var2 ...)
.PLOT analysis_type var1 (lo1, hi1) (var2) (lo2,hi2)

– Each plot variable is plotted using the first set of limits to its right. Each variable need not have its own limits. Program calculates default limits if not specified. Use (0,0) for defaults to be applied to an individual variable.

Output variable format:
V(n1) - Single node voltage.
V(n1, n2) - Voltage between two nodes.

Xij(z), ZIN(z),ZOUT(z),YIN(z),YOUT(z) – AC network analysis.
X may be the one of Z, Y, H, or S. The i or j may be 1 or 2.
z may be the one of the output types R, I, M, P, DB, or T (group time delay).

P(element_name), POWER - The instantaneous element power and total power dissipation for DC or TRAN analysis type.

For group time delay calculation, VT replaces V and ITn replaces In(element_name)
For AC, use VDB, VM, VP,VI, or VR in place of V.

I (vsrc) - Current through a voltage source (+ to -).

I (Xsubckt0.Xsubckt1.vsrc) - Current through voltage source vsrc in subckt1, which itself is part of subckt 0.

In(Xsubckt0.Xsubckt1.element)
- Current through the nth node of an element (as listed in the element statement).
LVnn(XXXX) - To obtain output of user-input statement variables and model parameters.
LXnn(XXXX) - To obtain output of stored charges, capacitance current, capacitances, and variable derivatives.
XXXX represents element name.
See Chapter 10.3.4.