.MEASURE (FIND and WHEN)

SYNTAX:

.MEASURE <DC|TRAN| AC> *result*
+ WHEN *out_var* = *val* <TD = *val*>
+ < RISE = *r* | LAST > < FALL = *f* | LAST >
+ < CROSS = *c* | LAST >
+ <GOAL = *val*> <MINVAL = *val*> <WEIGHT = *val*>

.MEASURE <DC|TRAN|AC> *result*
+ WHEN *out_var1* = *out_var2*
+ < TD = *val* > < RISE = *r* | LAST >
+ < FALL = *f* | LAST >
+ < CROSS = *c*| LAST > <GOAL = *val*>
+ <MINVAL = *val*> <WEIGHT = *val*>

.MEASURE <DC|TRAN|AC> *result* FIND *out_var1*
+ WHEN *out_var2* = *val* < TD = *val* >
+ < RISE = *r* | LAST >
+ < FALL = *f* | LAST > < CROSS = *c*| LAST >
+ <GOAL = *val*> <MINVAL = *val*> <WEIGHT = *val*>

.MEASURE <DC|TRAN|AC> *result* FIND *out_var1*
+ WHEN *out_var2* = *out_var3* <TD = *val* >
+ < RISE = *r* | LAST > < FALL = *f* | LAST >
+ <CROSS = *c* | LAST> <GOAL = *val*>
+ <MINVAL = *val*> <WEIGHT = *val*>

.MEASURE <DC|TRAN|AC> *result* FIND *out_var1*
+ AT = *val* <GOAL = *val*> <MINVAL = *val*>
+ <WEIGHT = *val*>

EXAMPLE:

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* MEASURE statement using FIND/WHEN
.MEAS TRAN TRT FIND PAR('V(3)-V(4)')
+ WHEN V(1)=PAR('V(2)/2') RISE = LAST
.MEAS STIME WHEN V(4) = 2.5 CROSS = 3
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In this example, the first measurement, TRT, calculates the difference between V(3) and V(4), when V(1) is half the voltage of V(2) at the last rise event.

The second measurement, STIME, finds the time when V(4) is 2.5V at the third rise-fall event. A CROSS event is a rising or falling edge.

DESCRIPTION:

The FIND and WHEN functions of the **.MEASURE** statement specify to measure:

- Any independent variables (time, frequency, parameter).
- Any dependent variables (voltage or current, for example).
- Derivative of a dependent variable, if a specific event occurs.

Command Argument	Definition
CROSS = c RISE = r FALL = f	Numbers indicate which CROSS, FALL, or RISE event to measure. For example: .meas tran tdlay trig v(1) val=1.5 td=10n + rise=2 targ v(2) val=1.5 fall=2 In the above example, rise=2 specifies to measure the v(1) voltage, only on the first two rising edges of the waveform. The value of these first two rising edges is 1. However, trig v(1) val=1.5 indicates to trigger when the voltage on the rising edge voltage is 1.5, which never occurs on these first two rising edges. So the v(1) voltage measurement never finds a trigger. • RISE = r, the WHEN condition is met, and measurement occurs after the designated signal has risen r rise times. • FALL = f, measurement occurs when the designated signal has fallen f fall times. A crossing is either a rise or a fall, so for CROSS = c, measurement occurs when the designated signal has achieved a total of c crossing times, as a result of either rising or falling. For TARG, the LAST keyword specifies the last event.
LAST	HSPICE measures when the last CROSS, FALL, or RISE event occurs. • CROSS = LAST, measurement occurs the last time the WHEN condition is true, for a rising or falling signal. • FALL = LAST, measurement occurs the last time the WHEN condition is true, for a falling signal. • RISE = LAST, measurement occurs the last time the WHEN condition is true, for a rising signal. LAST is a reserved word; you cannot use it as a parameter name in the above .MEASURE statements.

Command Argument	Definition
AT = val	Special case for trigger specification. *val* is: • Time for TRAN analysis. • Frequency for AC analysis. • Parameter for DC analysis. The trigger determines where measurement starts.
<DC|AC|TRAN>	Analysis type for the measurement. If you omit this parameter, HSPICE assumes the last analysis type that you requested.
FIND	Selects the FIND function.
GOAL	Desired .MEASURE value. Optimization uses this value in ERR calculation. The following equation calculates the error: $ERRfun = (GOAL - result)/GOAL$.
LAST	Starts measurement at the last CROSS, FALL, or RISE event. • For CROSS = LAST, measurement starts the last time the WHEN condition is true, for either a rising or falling signal. • For FALL = LAST, measurement starts the last time the WHEN condition is true, for a falling signal. • For RISE = LAST, measurement starts the last time the WHEN condition is true for a rising signal. LAST is a reserved word. Do not use it as a parameter name in these .MEASURE statements.
MINVAL	If the absolute value of GOAL is less than MINVAL, then MINVAL replaces the GOAL value in the denominator of the ERRfun expression. Used only in ERR calculation for optimization. Default = 1.0e-12.
out_var(1,2,3)	These variables establish conditions that start a measurement.
result	Name of a measured value, in the HSPICE output.
TD	Time at which measurement starts.

Command Argument	Definition
WEIGHT	Multiplies the calculated error by the weight value. Used only in ERR calculation for optimization. Default = 1.0.
WHEN	Selects the WHEN function.