


```

Vphas2 Vphase 0 DC 0
BREF REF 0 V = u(cos(6.2831*V(VFreq1)*V(VTime)))
BVCO VCO 0 V = u(cos(6.2831*V(VFreq2)*V(VTime)+V(Vphase)))
*XDRS_FF D CLK RST Q DRS_FF
XDRS_FF1 VCC REF RST DWN DRS_FF
XDRS_FF2 VCC VCO RST UP DRS_FF
BAND3 RS 0 V = u(u(v(DWN))-0.5)*u(v(UP)-0.5)
XD_tau4 RS RST D_tau

```

.control

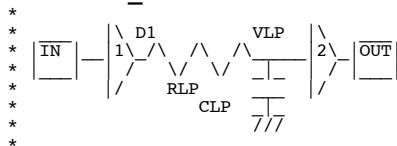
```

set pensize = 2
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title REFfreq_GT_VCOfreq
alter Vfreq1 dc = 1100
alter Vfreq2 dc = 1000
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title REFfreq_LT_VCOfreq
alter Vfreq1 dc = 1000
alter Vfreq2 dc = 1000
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title REFfreq_EQ_VCOfreq
alter Vphas2 dc = -1.57
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title VCOPhase_EQ_neg90
alter Vphas2 dc = 1.57
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title VCOPhase_EQ_90
alter Vphas2 dc = 3.14
tran lu 20m 0 1u
plot ref+.1 vco-1.1 up-2.2 dwn-3.3 title VCOPhase_EQ_180

```

.endc

*****D_tau*****

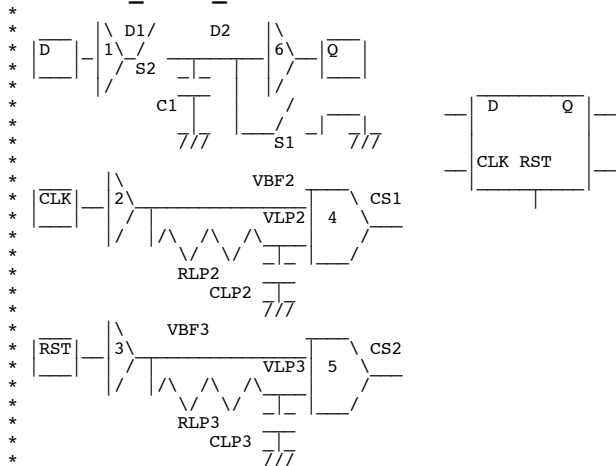


```

.SUBCKT D_tau IN OUT
B1 D1 0 V = u(v(IN)-0.5)
RLP D1 VLP 1K
CLP VLP 0 1n
B2 OUT 0 V = u(v(VLP)-0.5)
.ENDS D_tau

```

*****D_reset_FF*****



```

.SUBCKT DRS_FF D CLK RST Q
B1 D1 0 V = u(v(D)-0.5)
S1 D1 D2 CS1 0 SW
S2 D2 0 CS2 0 SW
C2 D2 0 10n
R1 D2 0 100G
B6 Q 0 V = u(v(D2)-0.5)
B2 VBF2 0 V = u(v(CLK)-0.5)
RLP2 VBF2 VLP2 1K
CLP2 VLP2 0 .1n
BAND4 CS1 0 V = u(u(v(VBF2)-0.5)*u(.5-v(VLP2))-.5)
B3 VBF3 0 V = u(v(RST)-0.5)
RLP3 VBF3 VLP3 1K
CLP3 VLP3 0 .1n
BAND5 CS2 0 V = u(u(v(VBF3)-0.5)*u(.5-v(VLP3))-.5)
.ENDS DRS_FF

```

```

.MODEL SW SW(VT=.5 VH=.1 RON=1 ROFF=100MEG)

```

.end