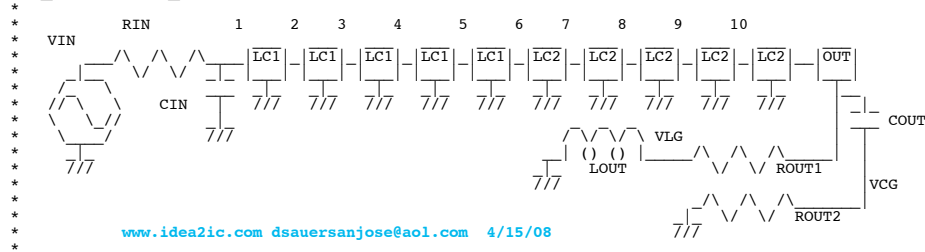


# LC\_transLine\_LRC



```
.OPTIONS GMIN=1e-18 METHOD=euler ABSTOL=1e-18 TEMP=27 srcsteps = 1 gminsteps = 1
VIN VIN 0 PWL( 0 0 2n 0 3.0n 1 18n 1 19.0n 0)
RIN VIN 1 50
C1 VIN 0 -1.6p
XLC1 1 2 LC1
XLC2 2 3 LC1
XLC3 3 4 LC1
XLC4 4 5 LC1
XLC5 5 6 LC1
XLC6 6 7 LC1
XLC7 7 8 LC1
XLC8 8 9 LC1
XLC9 9 10 LC1
XLC10 10 OUT LC1
C2 OUT 0 -1.6p

ROUT1 OUT VLG 50
LOUT VLG 0 1p
COUT OUT VCG 30f
ROUT2 VCG 0 5k

.tran 0.01n 30n 0 30n
```

```
##0===The_Goal_Play_With_Reflections=====
.control
##1===First_50_Ohms=====
run
plot v(1) v(6) out title R1_R2_L_C_50_5K_1p_8f
##2===Next_80_Ohms=====
alter ROUT1 resistance = 80
run
plot v(1) v(6) out title R1_R2_L_C_80_5K_80n_8f
##3===Next_20_Ohms=====
alter ROUT1 resistance = 20
run
plot v(1) v(6) out title R1_R2_L_C_20_5K_80n_8f
##4===Next_80nH_series_50_Ohms=====
alter ROUT1 resistance = 50
alter LOUT inductance = 80n
run
plot v(1) v(6) out title R1_R2_L_C_50_5K_80n_8f
##4===Next_30pF_Shunt_50_Ohms=====
alter LOUT inductance = 1p
alter COUT capacitance = 30p
alter ROUT2 resistance = 1m
run
plot v(1) v(6) out title R1_R2_L_C_50_1m_1p_30p
##4===Next_30pF_Shunt_50_Ohms=====
alter LOUT inductance = 80n
alter COUT capacitance = 30u
alter ROUT1 resistance = 1m
alter ROUT2 resistance = 50
run
plot v(1) v(6) out title R1_R2_L_C_1m_50_80n_30u
```

```

*#4===Next_30pF_series_50_Ohms=====
alter      LOUT      inductance  =   1p
alter      COUT      capacitance  =  30p
alter      ROUT1     resistance   = 10k
alter      ROUT2     resistance   =   50
run
plot      v(1) v(6) out title      R1_R2_L_C_10k_50_1p_30p

```

```
.endc
```

```

.SUBCKT LC1 IN OUT
L1 IN OUT 8n
C1 OUT 0 3.2p
.ENDS LC1

```

```

*      .SUBCKT LC1 IN OUT
*      IN ( ) ( ) OUT
*      L1
*      C1
*      //
*      8nH_3.2pF =>50Ohms @ 1Ghz 50*3.2p =160ps

```

```

* http://www.idea2ic.com/PlayWithJavascript/L\_C\_R\_F.html
*

```

```
.END
```

```
=====END_OF_SPICE=====
```

```
*#0===The_Goal_Play_With_Reflections=====
```

Adding all the various output impedances to the end of a transmission line appear to produce all the results describe in the HP app note..

## Time Domain Reflectometry Theory

Application Note 1304-2

All mismatches have their own characteristics  
Using a reflection method makes sense.

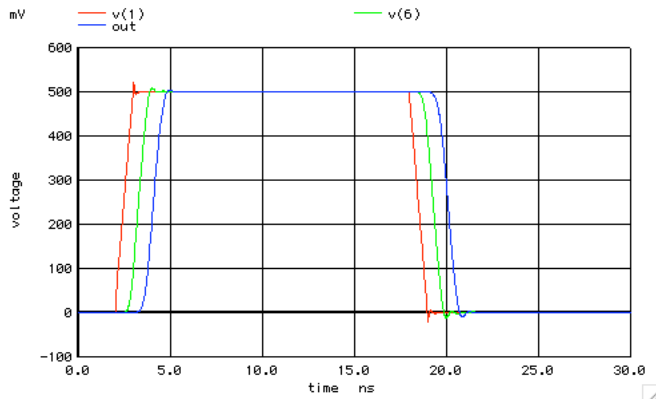
```
*#1===First_50_Ohms=====
```

```

run
plot      v(1) v(6) out title      R1_R2_L_C_50_5K_1p_8f
Ideal 50 Ohms

```

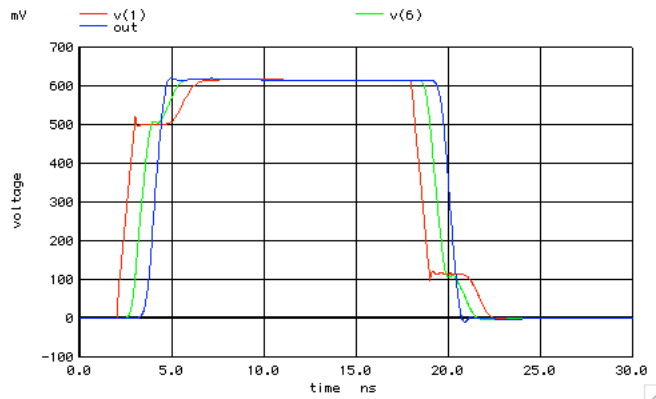
Graph 72 - tran73: R1\_R2\_L\_C\_50\_5K\_1p\_8f



```
*#2===Next_80_Ohms=====
alter ROUT1 resistance = 80
run
plot v(1) v(6) out title R1_R2_L_C_80_5K_80n_8f
```

80 Ohms

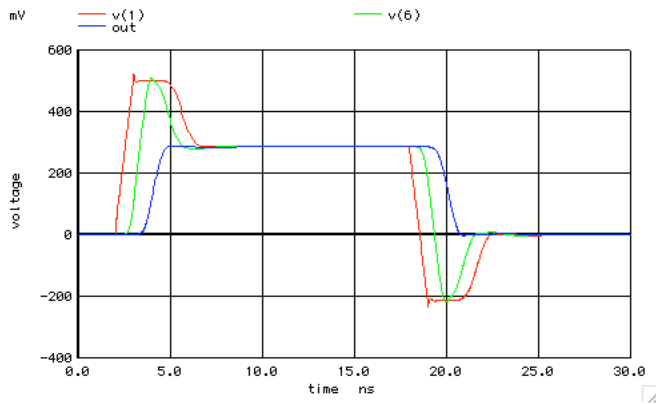
Graph 73 - tran74: R1\_R2\_L\_C\_80\_5K\_80n\_8f



```
*#3===Next_20_Ohms=====
alter ROUT1 resistance = 20
run
plot v(1) v(6) out title R1_R2_L_C_20_5K_80n_8f
```

20 Ohms

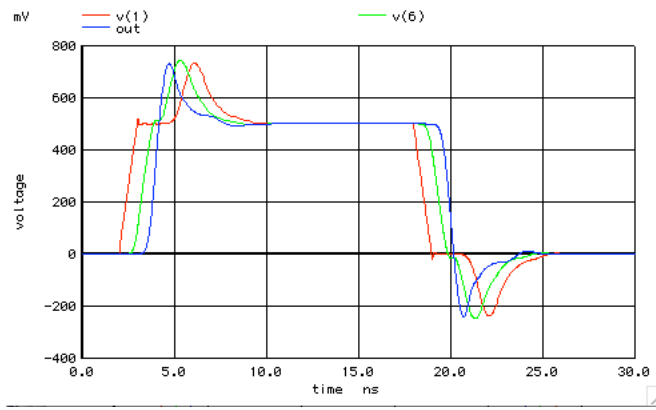
Graph 74 - tran75: R1\_R2\_L\_C\_20\_5K\_80n\_8f



```

*#4===Next_80nH_series_50_Ohms=====
alter      ROUT1    resistance =    50
alter      LOUT     inductance  =    80n
run
plot      v(1) v(6) out title      R1_R2_L_C_50_5K_80n_8f
50 Ohms + 80nH in series
    
```

Graph 75 - tran76: R1\_R2\_L\_C\_50\_5K\_80n\_8f

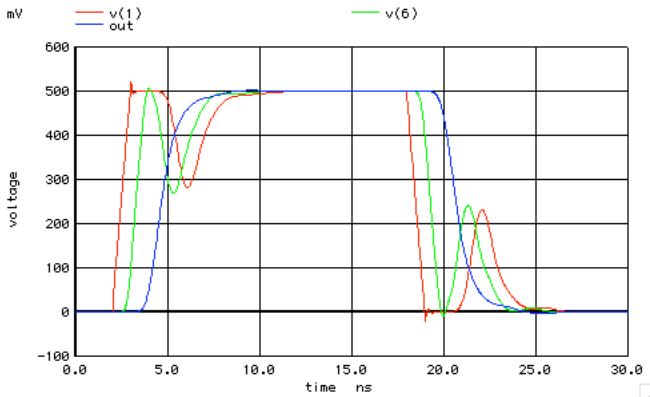


```

*#4===Next_30pF_Shunt_50_Ohms=====
alter      LOUT     inductance  =    1p
alter      COUT     capacitance =    30p
alter      ROUT2    resistance  =    1m
run
plot      v(1) v(6) out title      R1_R2_L_C_50_1m_1p_30p
50 Ohms Shunt by 30pF
    
```

50 Ohms Shunt by 30pF

Graph 76 - tran77: R1\_R2\_L\_C\_50\_1m\_1p\_30p

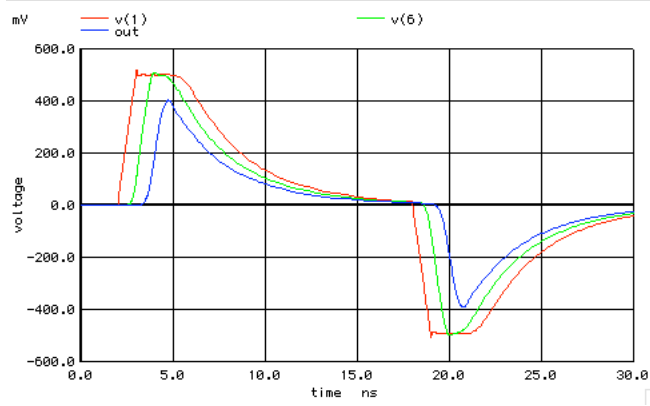


```

*#4===Next_30pF_Shunt_50_Ohms=====
alter      LOUT      inductance  =   80n
alter      COUT      capacitance  =   30u
alter      ROUT1     resistance   =   1m
alter      ROUT2     resistance   =   50
run
plot       v(1) v(6) out  title      R1_R2_L_C_1m_50_80n_30u
    
```

**50 Ohms shunt by 80nH**

Graph 77 - tran78: R1\_R2\_L\_C\_1m\_50\_80n\_30u



```

*#4===Next_30pF_series_50_Ohms=====
alter      LOUT      inductance  =   1p
alter      COUT      capacitance  =   30p
alter      ROUT1     resistance   =  10k
alter      ROUT2     resistance   =   50
run
plot       v(1) v(6) out  title      R1_R2_L_C_10k_50_1p_30p
    
```

**50 Ohms + 30pF in series**

Graph 78 - tran79: R1\_R2\_L\_C\_10k\_50\_1p\_30p

