

ECLinPS Plus™ SPICE Modeling Kit

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APPLICATION NOTE

Objective

The objective of this kit is to provide customers with enough circuit schematic and SPICE parameter information to allow them to perform system level interconnect modeling for the current devices of the ECLinPS Plus logic line, ON Semiconductor's high performance ECL family. **The kit is not intended to provide information necessary to perform circuit level modeling on ECLinPS Plus devices.** With packaged gate delays of 160 ps and output edge rates as low as 80 ps, this family defines the state-of-the-art in ECL logic. The ECLinPS Plus line is one of ON Semiconductor's high performance ECL/PECL family of products.

Schematic Information

The kit contains representative input and output schematics, netlists, and waveform used for the ECLinPS Plus devices. This application note will be modified as new devices are added. The subcircuit models such as the input or output buffer, package, input ESD and output ESD may be interconnected as subcircuits to simulate specific device characteristics as shown in Figure 1 below. The block diagram in Figure 2 illustrates a typical situation which can be modeled using the information in this kit.

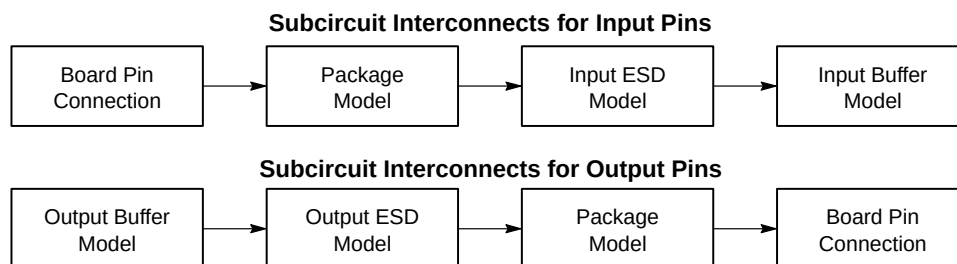


Figure 1. Input and Output Pins Interconnects

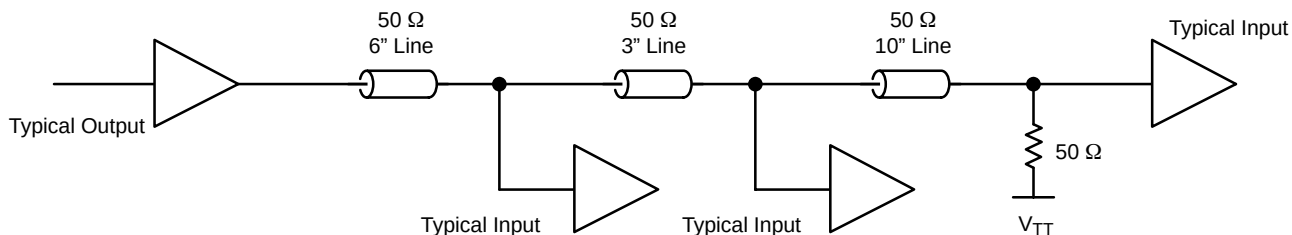


Figure 2. Typical Application for I/O SPICE Modeling Kit

There are four terminals on all transistor models: Emitter, Base, Collector, and Substrate (biased to V_{EE}). It should be noted that circuits can be used single ended by replacing INB with V_{BB} . Table 1 describes the nomenclature used in the schematics and netlists.

To simulate a different operating modes all levels, except V_{CS} , are adjusted with respect to V_{CC} . The V_{CS} is adjusted with respect to V_{EE} ($\approx V_{EE} + 1.1 \text{ V} \pm 50 \text{ mV}$)

Table 1. Schematics and Netlist Nomenclature

Parameter	Function Description
V_{CC}	3.3 V FOR LVPECL OR (0 V) FOR LVECL
V_{CCO}	1.6 V – 2.0 V HSTL Output Positive Supply
V_{CS}	Internal Reference Voltage ($\approx V_{EE} + 1.1 \text{ V} \pm 50 \text{ mV}$)
V_{HSTL}	HSTL Internal Constant Voltage Source
V_{EE}	–3.3 V FOR LVECL OR (0 V) FOR LVPECL
GND	0 V
V_{TT}	$V_{CC} - 2 \text{ V}$ TERMINATION PLANE
IN	TRUE INPUT TO CKT
INB or $\overline{\text{IN}}$	INVERTED INPUT TO CKT
Q	TRUE OUTPUT OF CKT
QB or $\overline{\text{Q}}$	INVERTED OUTPUT OF CKT

Input Buffer

The Typical Input Buffer schematic (see Table 2) and netlist are representing structure currently in use on the existing devices in this family. The schematics require the addition of ESD models (Figure 15) and package models (see Table 3) to more accurate model behavior. The internal input pulldown resistor is shown in the ESD network, Figure 15. Some devices may also display an internal pullup resistor to V_{CC} . Refer to specific device data sheet pinout and logic diagram. It is unnecessary to include an ESD or package model for the V_{BB} pins of the models because V_{BB} is intended as an internal node for most applications. If V_{BB} is modeled as an external node it is usually bypassed because it is a constant voltage, and adding ESD and Package parameters provide no additional benefit.

Output Buffer

The output buffer schematics (see Table 2) and netlists may contain the temperature compensation structure, so only the ESD and package models need to be added. Any input or output that is driving or being driven by an off chip signal should include the ESD and package models. The output buffers show differential inputs and outputs. When simulating a single ended output, the termination or load resistor, package model, ESD structure and output emitter follower, of the unused output, should not be eliminated to simplify the system model. The output buffer listing can be seen in Table 2.

Table 2. Buffer Model Figures

Buffer Model	Figure Number	Page Number
TYPICAL INBUF	3	6
OBUF01	4	7
OBUF02	5	8
OBUF03	6	9
OBUF04	7	10
OBUF05	8	11
OBUF06	9	12
OBUF07	10	13
OBUF08	11	14
OBUF09	12	15
OBUF10	13	16
OBUF11	14	17

Package

A case model for various package types is included to improve the accuracy of the system model (see Table 3). The package model represents the parasitics as they are measured on a pin. The package pin model should be placed on each device input pin connecting to an input model, all device output pins connecting to an output model, V_{CC} , and V_{EE} . A model can be used at the V_{EE} pin: but is not necessary since the current in the V_{EE} pin is a constant. Explanations of the Package Model modes can be found in Appendix A.

Table 3. Available Packages

Package Model	Page Number
8-Lead SO	22
8-Lead TSSOP	24
20-Lead SO	26
20-Lead TSSOP	32
24-Lead QFN	37
32-Lead TQFP	43
52-Lead LQFP	51
64-Lead LQFP	58

EP16 Buffer Model

The EP16 interconnect has been completely modeled to provide a working schematic and output waveforms as examples of the ECLinPS Plus line. The typical input buffer may be driven with the output buffer, OBUF01. (See Figure 17, simplified EP16 SPICE model and Figure 18 typical output waveform.)

SPICE Netlists

The netlists are organized as a group of subcircuits. In each subcircuit model netlist, the model name is followed by a list of external node interconnects.

Temperature Compensation Network for 100EP

The output netlists include temperature compensation network circuitry for 100EP style output buffers. The circuit components of the temperature compensation networks are shown in Figure 18. For simulating 10EP style outputs these components should either be deleted or commented out of the subcircuit netlists. Subcircuit models such as the Input or Output Buffer, Package, Input ESD and Output ESD should connect to supplies through hierarchical, passed parameters such as V_{CC} , V_{EE} , etc., for proper simulation and not separately attached to independent power supplies.

SPICE Parameter Information

In addition to the schematics and netlists is a listing of the SPICE parameters for the transistors referenced in the schematics and netlists. These parameters represent a typical device of a given transistor. Varying the typical parameters will affect the DC and AC performance of the structures; but for the type of modeling intended by this note, the actual delay times are not necessary and are not modeled, as a result variation of the device parameters are meaningless. The performance levels are more easily varied by other methods and will be discussed in the next section. The resistors referenced in the schematics are polysilicon and have no parasitic capacitance in the real circuit and none is required in the model. The schematics display the only devices needed in the SPICE netlists.

Modeling Information

The bias drivers for the devices are not detailed since their circuitry would result in a substantial increase of model complexity and simulation time. Instead, these internal

reference voltages (V_{BB} , V_{CS} , V_{HSTL} , etc.) should be driven with ideal constant voltage sources.

The schematics and SPICE parameters will provide a typical output waveshape, which can be seen in Figures 18, 19, and 20. Simple adjustments can be made to the models allowing output characteristics to simulate conditions at or near the corners of the data book specifications. Consistent cross-point voltages need to be maintained.

- To adjust rise and fall times:

Produce the desired rise and fall times output slew rates by adjusting collector load resistors to change the gates tail current. The V_{CS} voltage will affect the tail current in the output differential, which will interact with the load resistor and collector resistor to determine t_r and t_f at the output.

- To adjust the V_{OH} :

Adjust the V_{OH} and V_{OL} level by the same amount by varying V_{CC} . The output levels will follow changes in V_{CC} at a 1:1 ratio.

- To adjust the V_{OL} only:

Adjust the V_{OL} level independently of the V_{OH} level by increasing or decreasing the collector load resistance. Note that the V_{OH} level will also change slightly due to a I_{BASER} drop across the collector load resistor. V_{OL} can be changed by varying the V_{CS} supply, and therefore the gate current through the current source resistor.

Summary

The information included in this kit provides adequate information to run a SPICE level system interconnect simulation. Device input or output models are presented in Table 4. For EP and LVEP series devices not listed in Table 4, consult www.onsemi.com (Tech Support).

Table 4. ECLinPS Plus Input/Output Selection Table

Device	Package A	Package B	Input ESD	Input Buffer	Output Buffer	Output ESD
EP01	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP05	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP08	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP11	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP14	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
EP16	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP17	20-lead SO	20-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF06	OUT_ESD
EP29	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
EP31	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP32	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP33	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF02	OUT_ESD
EP35	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP40	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF09	OUT_ESD
EP51	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP52	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP56	20-lead SO	20-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP57	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP58	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
EP89	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF05	OUT_ESD
EP90	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP016	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF02	OUT_ESD
EP016A	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF02	OUT_ESD
EP101	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF06	OUT_ESD
EP105	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF06	OUT_ESD
EP116	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF06	OUT_ESD
EP131	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF02	OUT_ESD
EP139	20-lead SO	20-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF07	OUT_ESD
EP140	8-lead SO	N/A	IN_ESD	TYPICAL INBUF	OBUF09	OUT_ESD
EP142	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
EP195	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP196	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP210S	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF10	OUT_ESD
EP223	64-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF11	OUT_ESD
EP445	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
EP446	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF04	OUT_ESD
EP451	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
EP809	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF11	OUT_ESD

Table 4. ECLinPS Plus Input/Output Selection Table (continued)

LVEP11	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF08	OUT_ESD
LVEP14	20-lead TSSOP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP16	8-lead SO	8-lead TSSOP	IN_ESD	TYPICAL INBUF	OBUF08	OUT_ESD
LVEP17	20-lead TSSOP	24-lead QFN	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP34	16-lead SO*	16-lead TSSOP*	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP56	20-lead TSSOP	24-lead QFN	IN_ESD	TYPICAL INBUF	OBUF01	OUT_ESD
LVEP111	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP210	32-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP221	52-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP222	52-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD
LVEP224	64-lead LQFP	N/A	IN_ESD	TYPICAL INBUF	OBUF03	OUT_ESD

*For package model, please consult manufacturer at www.onsemi.com (Tech Support).

Netlists and Schematics

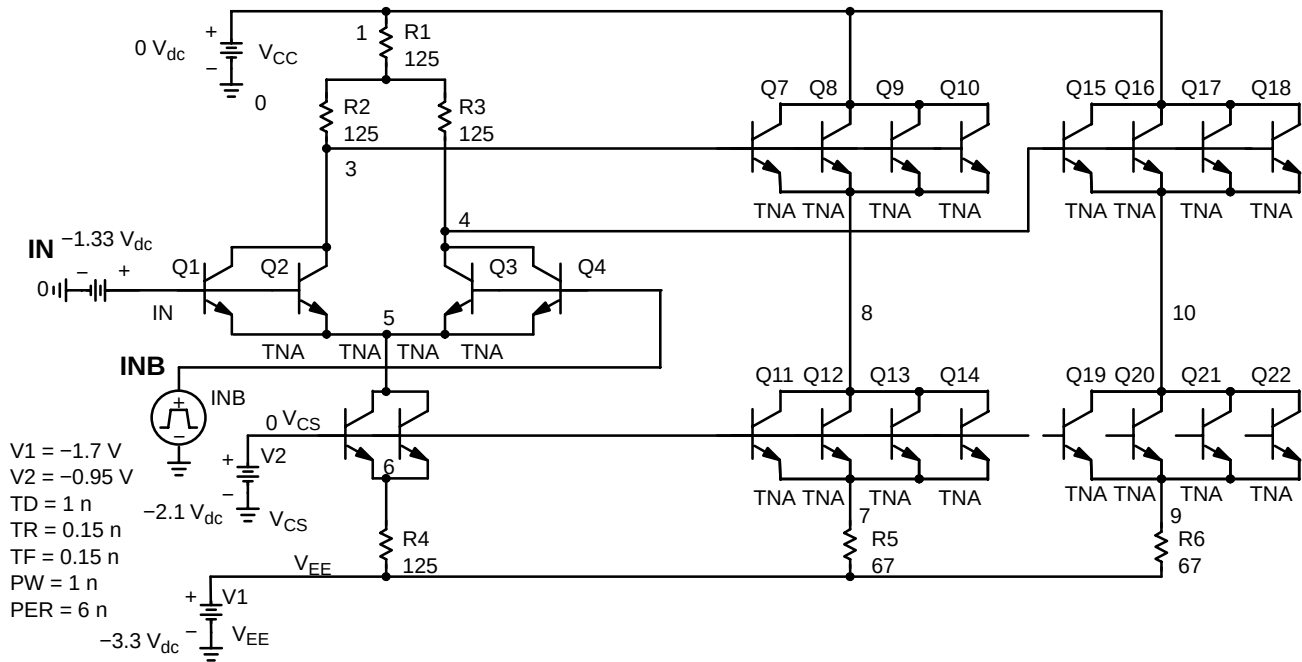


Figure 3. Typical INBUF

```
.SUBCKT TYPICAL INBUF IN INB VCS VEE
```

```

Q_Q1      3 IN 5 TNA
Q_Q2      3 IN 5 TNA
Q_Q3      4 INB 5 TNA
Q_Q4      4 INB 5 TNA
Q_Q5      5 VCS 6 TNA
Q_Q6      5 VCS 6 TNA
Q_Q7      1 3 8 TNA
Q_Q8      1 3 8 TNA
Q_Q9      1 3 8 TNA
Q_Q10     1 3 8 TNA
Q_Q11     8 VCS 7 TNA
Q_Q12     8 VCS 7 TNA
Q_Q13     8 VCS 7 TNA
Q_Q14     8 VCS 7 TNA
Q_Q15     1 4 10 TNA
Q_Q16     1 4 10 TNA
Q_Q17     1 4 10 TNA
Q_Q18     1 4 10 TNA
Q_Q19     10 VCS 9 TNA
Q_Q20     10 VCS 9 TNA
Q_Q21     10 VCS 9 TNA
Q_Q22     10 VCS 9 TNA
R_R1      2 1 125
R_R2      3 2 125
R_R3      4 2 125
R_R4      VEE 6 125
R_R5      VEE 7 67
R_R6      VEE 9 67
V_V1      VEE 0 -3.3Vdc
V_V2      VCS 0 -2.1Vdc
V_IN      IN 0 -1.33Vdc
V_VCC     1 0 0Vdc
V_INB     INB 0
+PULSE -1.7V -0.95V 1n 0.15n 0.15n 1n 6n
.END TYPICAL INBUF

```

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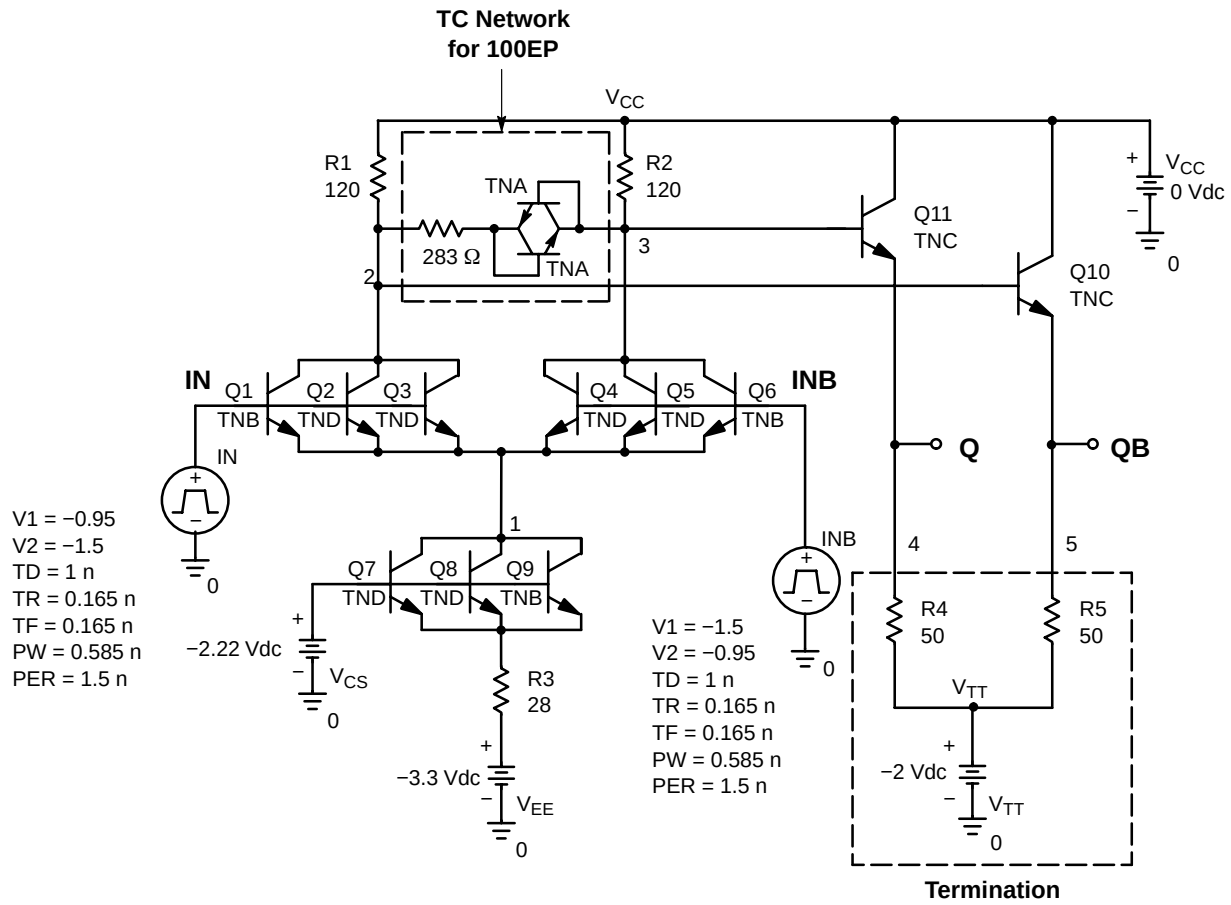


Figure 4. OBUF01

```
.SUBCKT OBUF01 IN INB VCS VCC VEE VTT
Q_Q1      2 IN 1 TNB
Q_Q2      2 IN 1 TND
Q_Q3      2 IN 1 TND
Q_Q4      3 INB 1 TND
Q_Q5      3 INB 1 TND
Q_Q6      3 INB 1 TNB
Q_Q7      1 VCS 10 TND
Q_Q8      1 VCS 10 TND
Q_Q9      1 VCS 10 TNB
Q_Q10     VCC 2 5 TNC
Q_Q11     VCC 3 4 TNC
R_R1      2 VCC 120
R_R2      3 VCC 120
R_R3      VEE 10 28
R_R4      VTT 4 50
R_R5      VTT 5 50
V_IN      IN 0
+PULSE -0.95 -1.5 1n 0.165n 0.165n 0.585n 1.5n
V_INB     INB 0
+PULSE -1.5 -0.95 1n 0.165n 0.165n 0.585n 1.5n
V_VCC     VCC 0 0Vdc
V_VEE     VEE 0 -3.3Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.22Vdc
.END OBUF01
```

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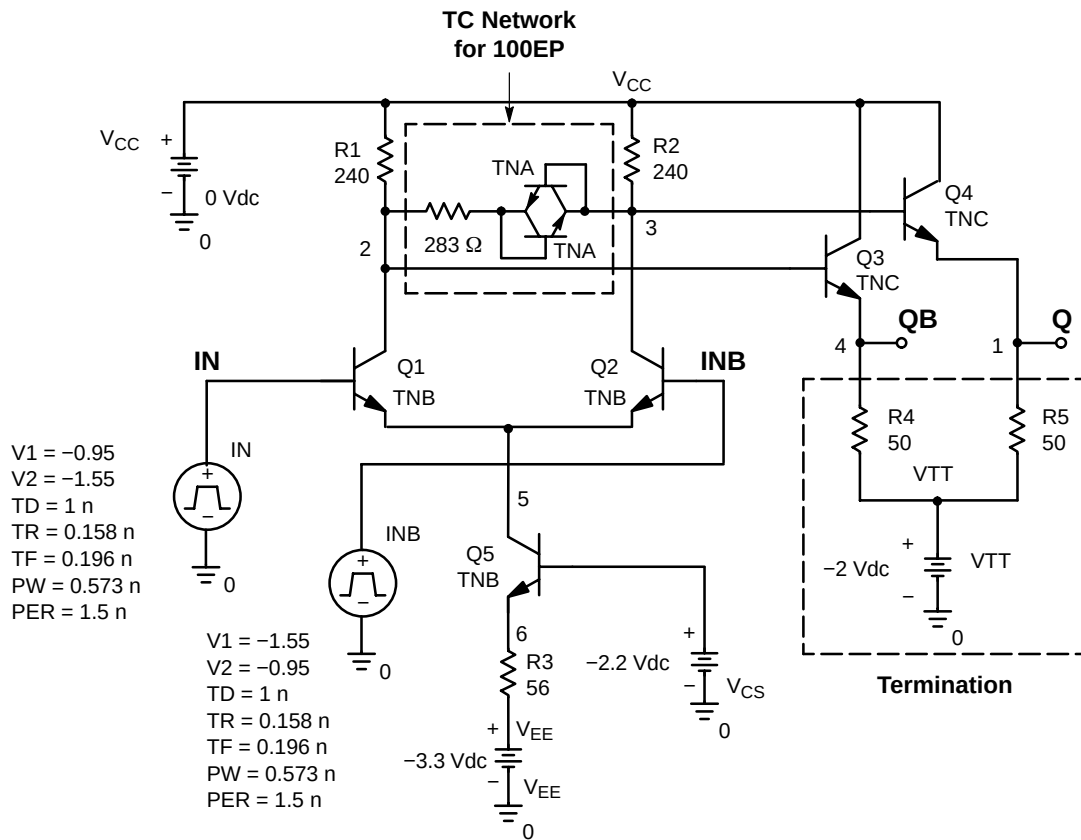


Figure 5. OBUF02

```
.SUBCKT OBUF02 IN INB VCC VCS VEE VTT
Q_Q1      2 IN 5 TNB
Q_Q2      3 INB 5 TNB
Q_Q3      VCC 2 4 TNC
Q_Q4      VCC 3 1 TNC
Q_Q5      5 VCS 6 TNB
R_R1      2 VCC 240
R_R2      3 VCC 240
R_R3      VEE 6 56
R_R4      VTT 4 50
R_R5      VTT 1 50
V_IN      IN 0
+PULSE -0.95 -1.55 1n 0.158n 0.196n 0.573n 1.5n
V_INB     INB 0
+PULSE -1.55 -0.95 1n 0.158n 0.196n 0.573n 1.5n
V_VCC     VCC 0 0Vdc
V_VEE     VEE 0 -3.3Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.2Vdc
.END OBUF02
```


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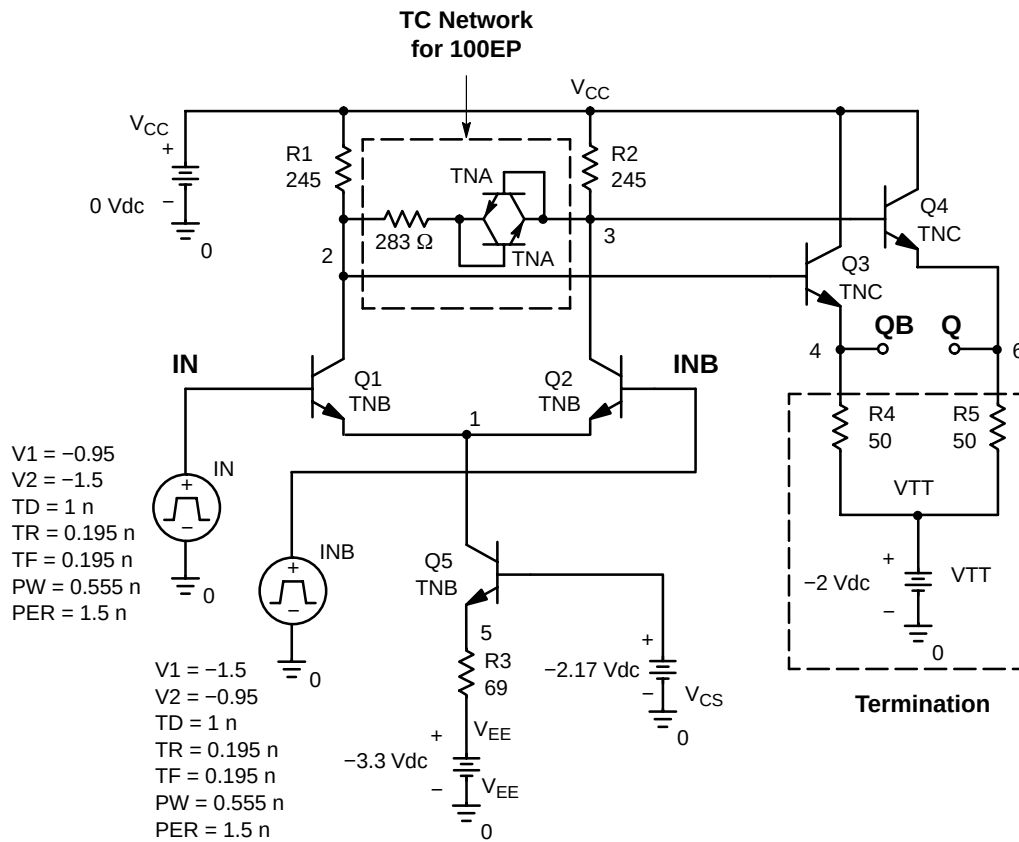


Figure 6. OBUF03

```
.SUBCKT OBUF03 IN INB VCC VCS VEE VTT
Q_Q1      2 IN 1 TNB
Q_Q2      3 INB 1 TNB
Q_Q3      VCC 2 4 TNC
Q_Q4      VCC 3 6 TNC
Q_Q5      1 VCS 5 TNB
R_R1      2 VCC 245
R_R2      3 VCC 245
R_R3      VEE 5 69
R_R4      VTT 4 50
R_R5      VTT 6 50
V_IN      IN 0
+PULSE -0.95 -1.5 1n 0.195n 0.195n 0.555n 1.5n
V_INB     INB 0
+PULSE -1.5 -0.95 1n 0.195n 0.195n 0.555n 1.5n
V_VCC     VCC 0 0Vdc
V_VEE     VEE 0 -3.3Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.17Vdc
.END OBUF03
```

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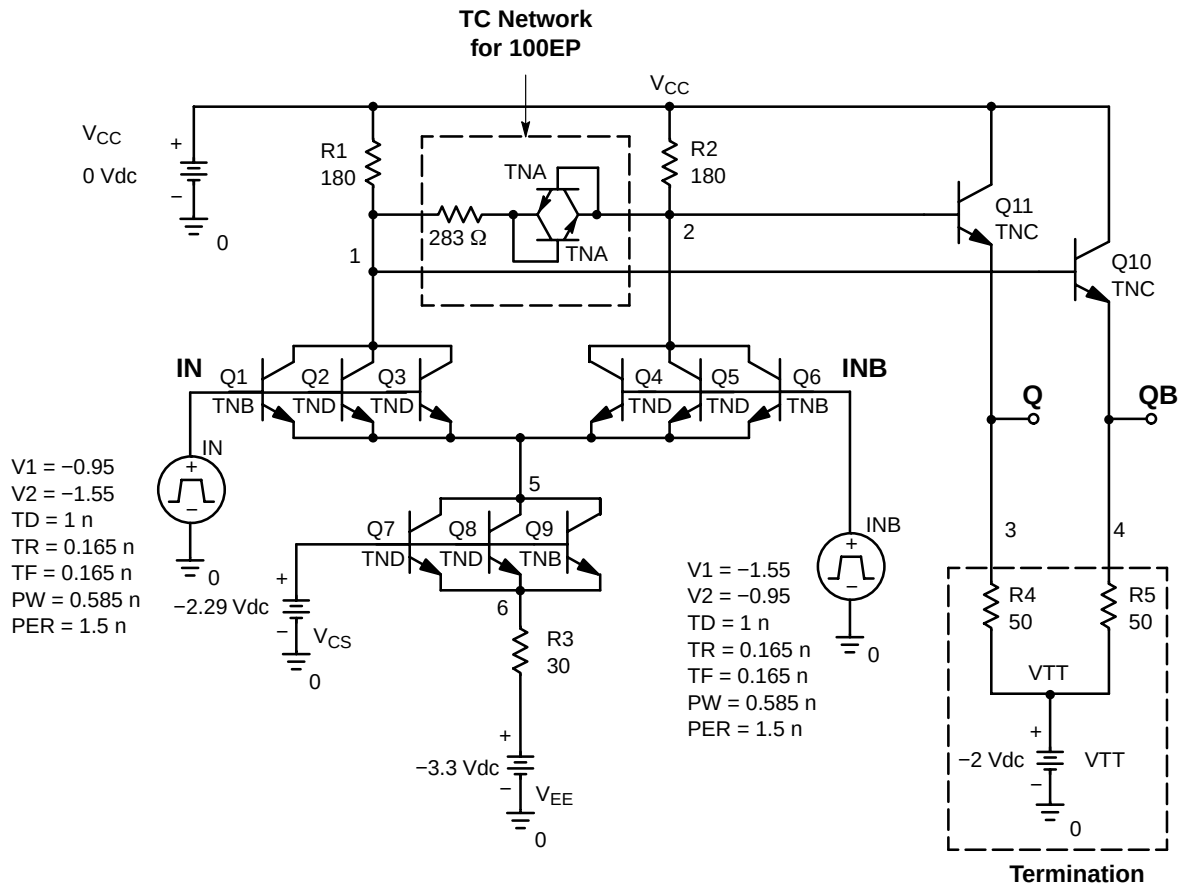


Figure 7. OBUF04

.SUBCKT OBUF04 IN INB VCS VCC VEE VTT

```

Q_Q1      1 IN 5 TNB
Q_Q2      1 IN 5 TND
Q_Q3      1 IN 5 TND
Q_Q4      2 INB 5 TND
Q_Q5      2 INB 5 TND
Q_Q6      2 INB 5 TNB
Q_Q7      5 VCS 6 TND
Q_Q8      5 VCS 6 TND
Q_Q9      5 VCS 6 TNB
Q_Q10     VCC 1 4 TNC
Q_Q11     VCC 2 3 TNC
R_R1      1 VCC 180
R_R2      2 VCC 180
R_R3      VEE 6 20
R_R4      VTT 3 50
R_R5      VTT 4 50
V_IN      IN 0
+PULSE -0.95 -1.55 1n 0.165n 0.165n 0.585n 1.5n
V_INB     INB 0
+PULSE -1.55 -0.95 1n 0.165n 0.165n 0.585n 1.5n
V_VCC     VCC 0 0Vdc
V_VEE     VEE 0 -3.3Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.29Vdc
.END OBUF04

```

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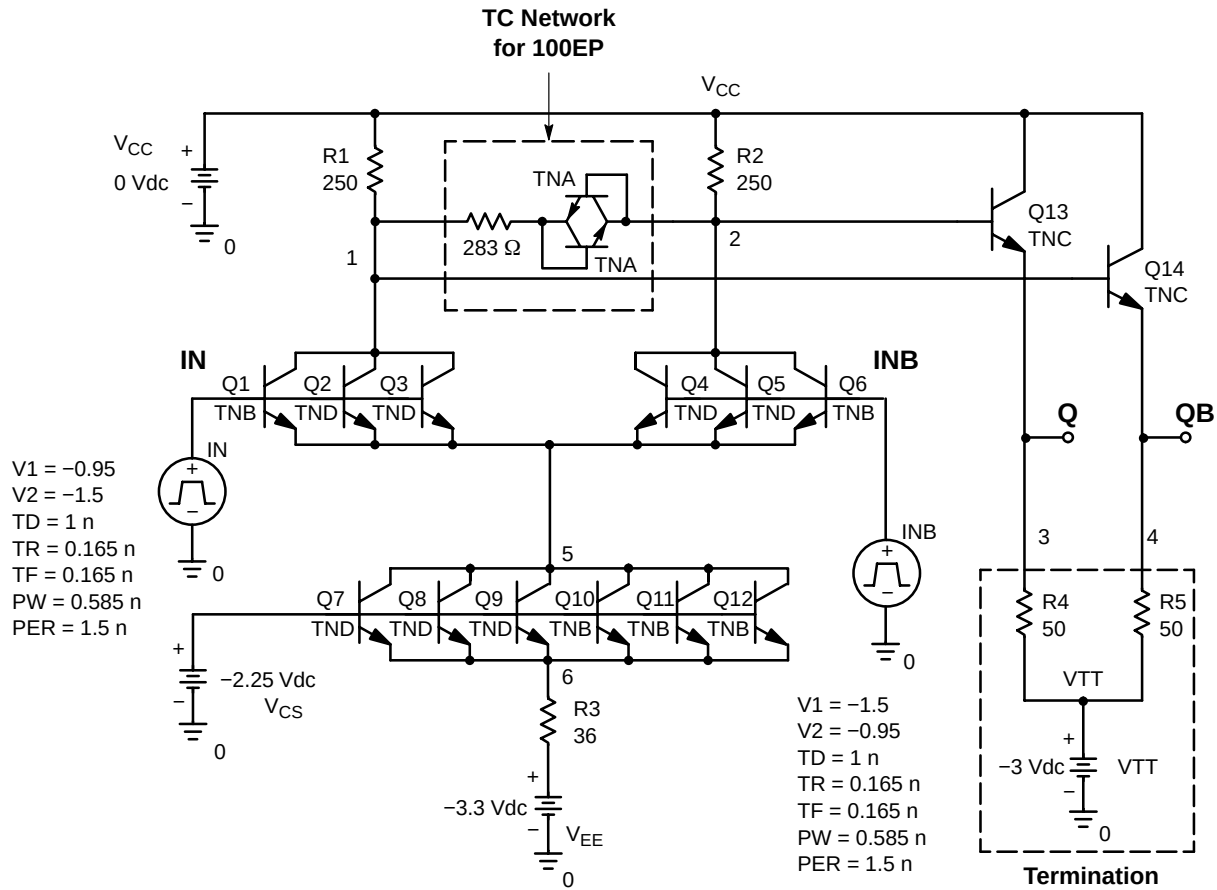


Figure 8. OBUF05

```
.SUBCKT OBUF05 IN INB VCS VCC VTT VEE
Q_Q1      1 IN 5 TNB
Q_Q2      1 IN 5 TND
Q_Q3      1 IN 5 TND
Q_Q4      2 INB 5 TND
Q_Q5      2 INB 5 TND
Q_Q6      2 INB 5 TNB
Q_Q7      5 VCS 6 TND
Q_Q8      5 VCS 6 TND
Q_Q9      5 VCS 6 TND
Q_Q10     5 VCS 6 TNB
Q_Q11     5 VCS 6 TNB
Q_Q12     5 VCS 6 TNB
Q_Q13     VCC 2 3 TNC
Q_Q14     VCC 1 4 TNC
R_R1      1 VCC 285
R_R2      2 VCC 285
R_R3      VEE 6 38
R_R4      VTT 3 50
R_R5      VTT 4 50
V_IN      IN 0 -1.33Vdc
+PULSE    -0.95 -1.5 1n 0.165n 0.165n 0.585n 1.5n
V_INB     INB 0
+PULSE    -1.5 -0.95 1n 0.165n 0.165n 0.585n 1.5n
V_VEE     VEE 0 -3.3Vdc
V_VCC     VCC 0 0Vdc
V_VTT     VTT 0 -3Vdc
V_VCS     VCS 0 -2.25Vdc
.END OBUF05
```

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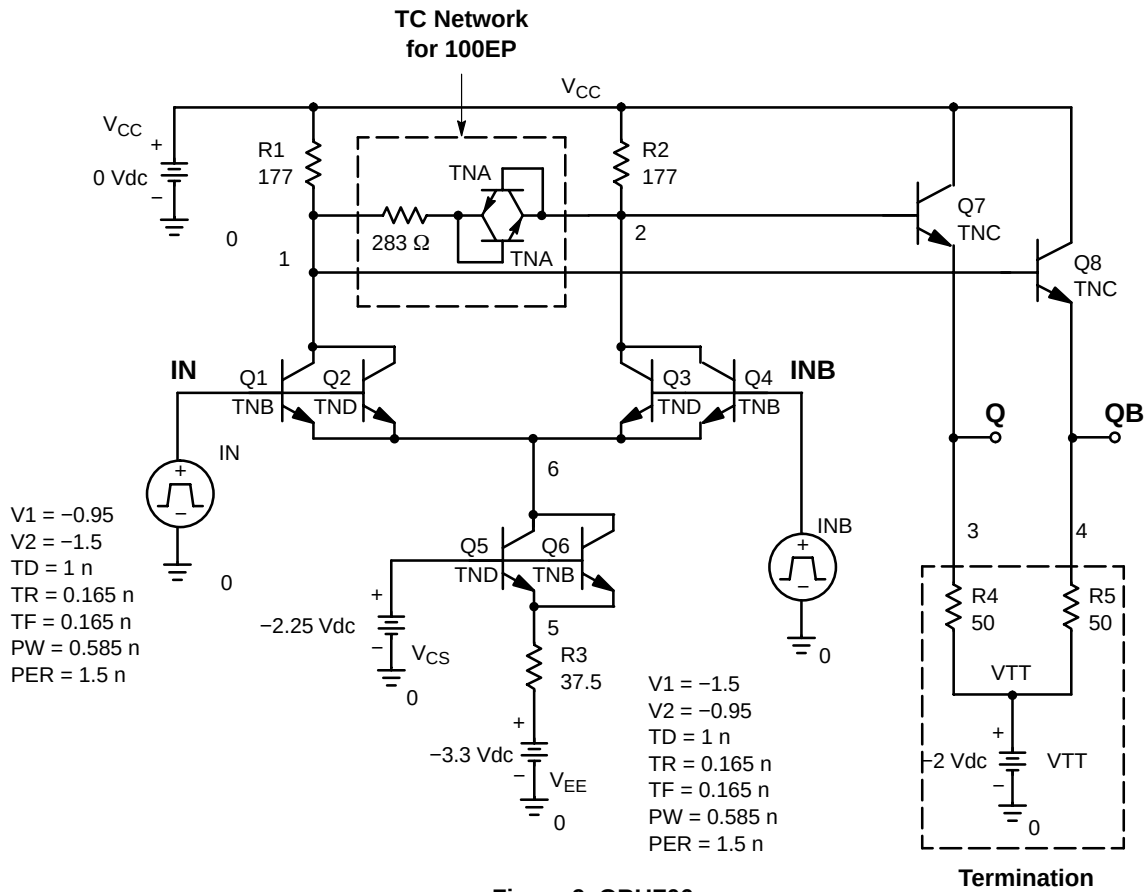
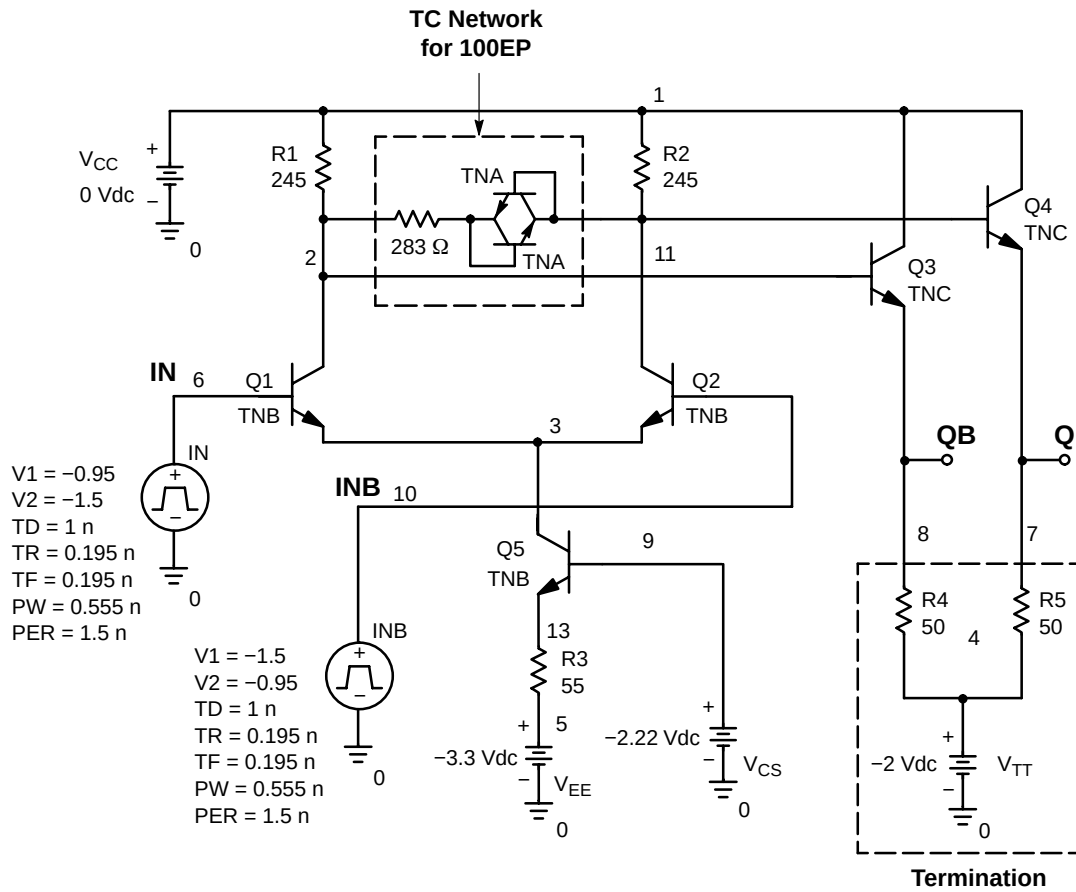


Figure 9. OBUF06

```
.SUBCKT OBUF06 IN INB VCC VCS VEE VTT
Q_Q1      1 IN 6 TNB
Q_Q2      1 IN 6 TND
Q_Q3      2 INB 6 TND
Q_Q4      2 INB 6 TNB
Q_Q5      6 VCS 5 TND
Q_Q6      6 VCS 5 TNB
Q_Q7      VCC 2 3 TNC
Q_Q8      VCC 1 4 TNC
R_R1      1 VCC 177
R_R2      2 VCC 177
R_R3      VEE 5 37.5
R_R4      VTT 3 50
R_R5      VTT 4 50
V_IN      IN 0
+PULSE -0.95 -1.5 1n 0.165n 0.165n 0.585n 1.5n
V_INB     INB 0
+PULSE -1.5 -0.95 1n 0.165n 0.165n 0.585n 1.5n
V_VEE     VEE 0 -3.3Vdc
V_VCC     VCC 0 0Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.25Vdc
.END OBUF06
```

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.SUBCKT OBUF07

```

Q_Q1      2 6 3 TNB
Q_Q2      11 10 3 TNB
Q_Q3      1 2 8 TNC
Q_Q4      1 11 7 TNC
Q_Q5      3 9 13 TNB
R_R1      2 1 245
R_R2      11 1 245
R_R3      5 13 55
R_R4      4 8 50
R_R5      4 7 50
V_IN      6 0
+PULSE -0.95 -1.5 1n 0.195n 0.195n 0.555n 1.5n
V_INB     10 0
+PULSE -1.5 -0.95 1n 0.195n 0.195n 0.555n 1.5n
V_VEE     5 0 -3.3Vdc
V_VCC     1 0 0Vdc
V_VTT     4 0 -2Vdc
V_VCS     9 0 -2.22Vdc
.END OBUF07

```

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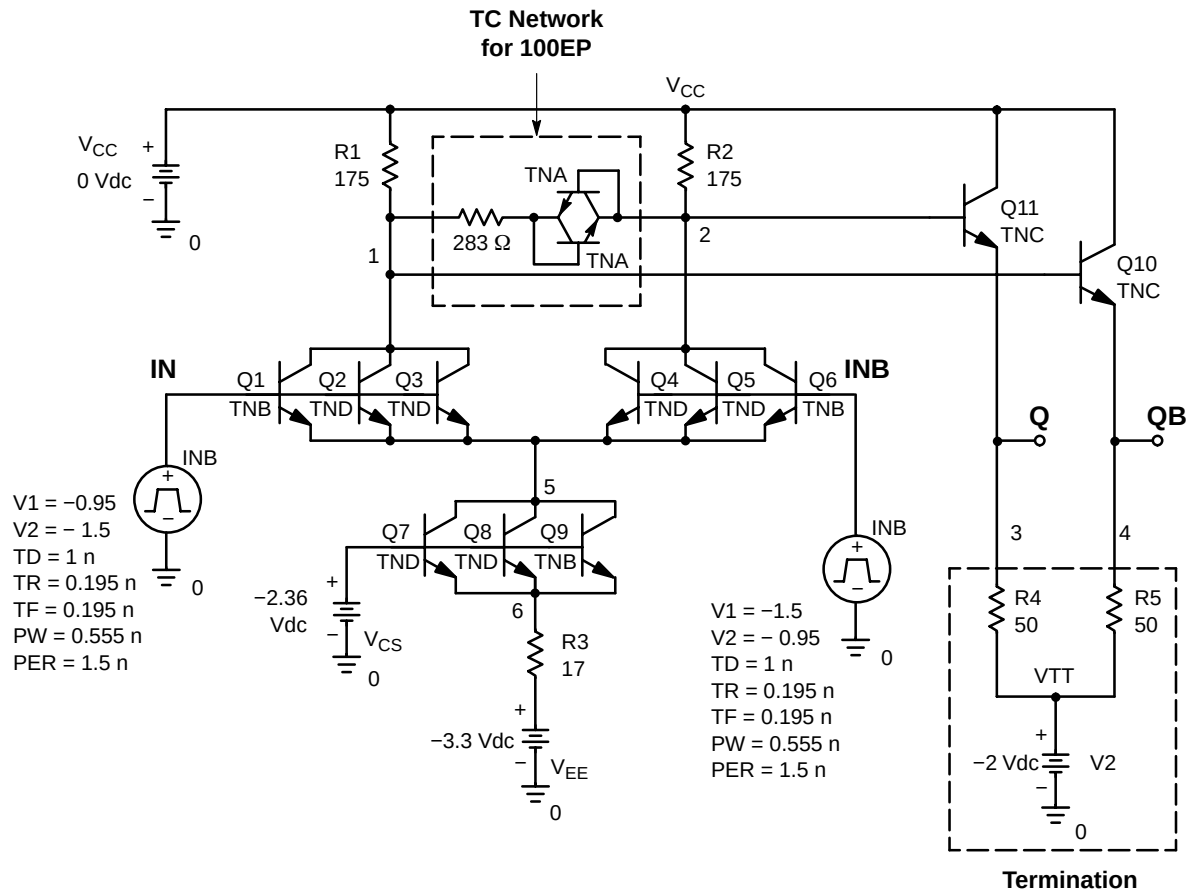


Figure 11. OBUF08

```
.SUBCKT OBUF08 IN INB VCC VCS VEE VTT
Q_Q1      1 IN 5 TNB
Q_Q2      1 IN 5 TND
Q_Q3      1 IN 5 TND
Q_Q4      2 INB 5 TND
Q_Q5      2 INB 5 TND
Q_Q6      2 INB 5 TNB
Q_Q7      5 VCS 6 TND
Q_Q8      5 VCS 6 TND
Q_Q9      5 VCS 6 TNB
Q_Q10     VCC 1 4 TNC
Q_Q11     VCC 2 3 TNC
R_R1      1 VCC 175
R_R2      2 VCC 175
R_R3      VEE 6 17
R_R4      VTT 3 50
R_R5      VTT 4 50
V_INB     INB 0
+PULSE -1.5 -0.95 1n 0.195n 0.195n 0.555n 1.5n
V_IN      IN 0
+PULSE -0.95 -1.5 1n 0.195n 0.195n 0.555n 1.5n
V_VEE     VEE 0 -3.3Vdc
V_VTT     VTT 0 -2Vdc
V_VCS     VCS 0 -2.36Vdc
V_VCC     VCC 0 0Vdc
.END OBUF08
```

AND8009/D

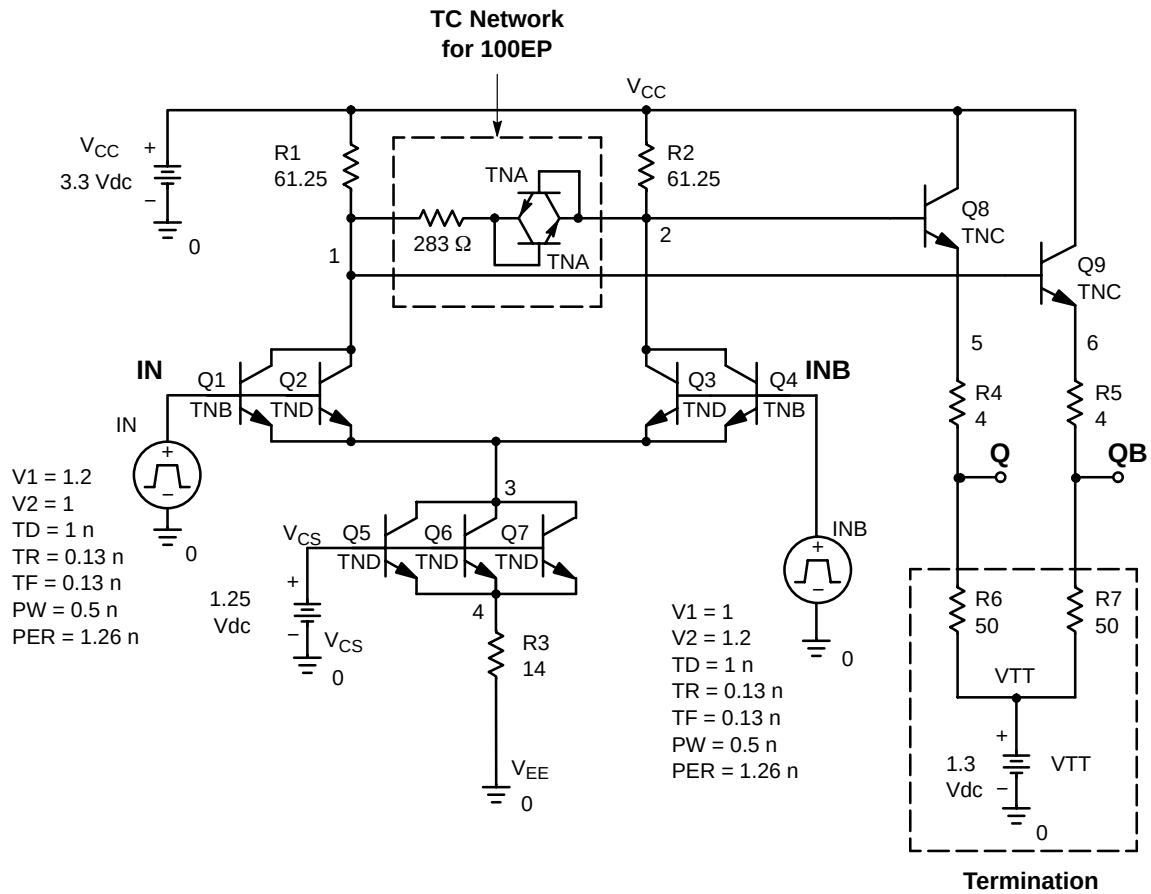
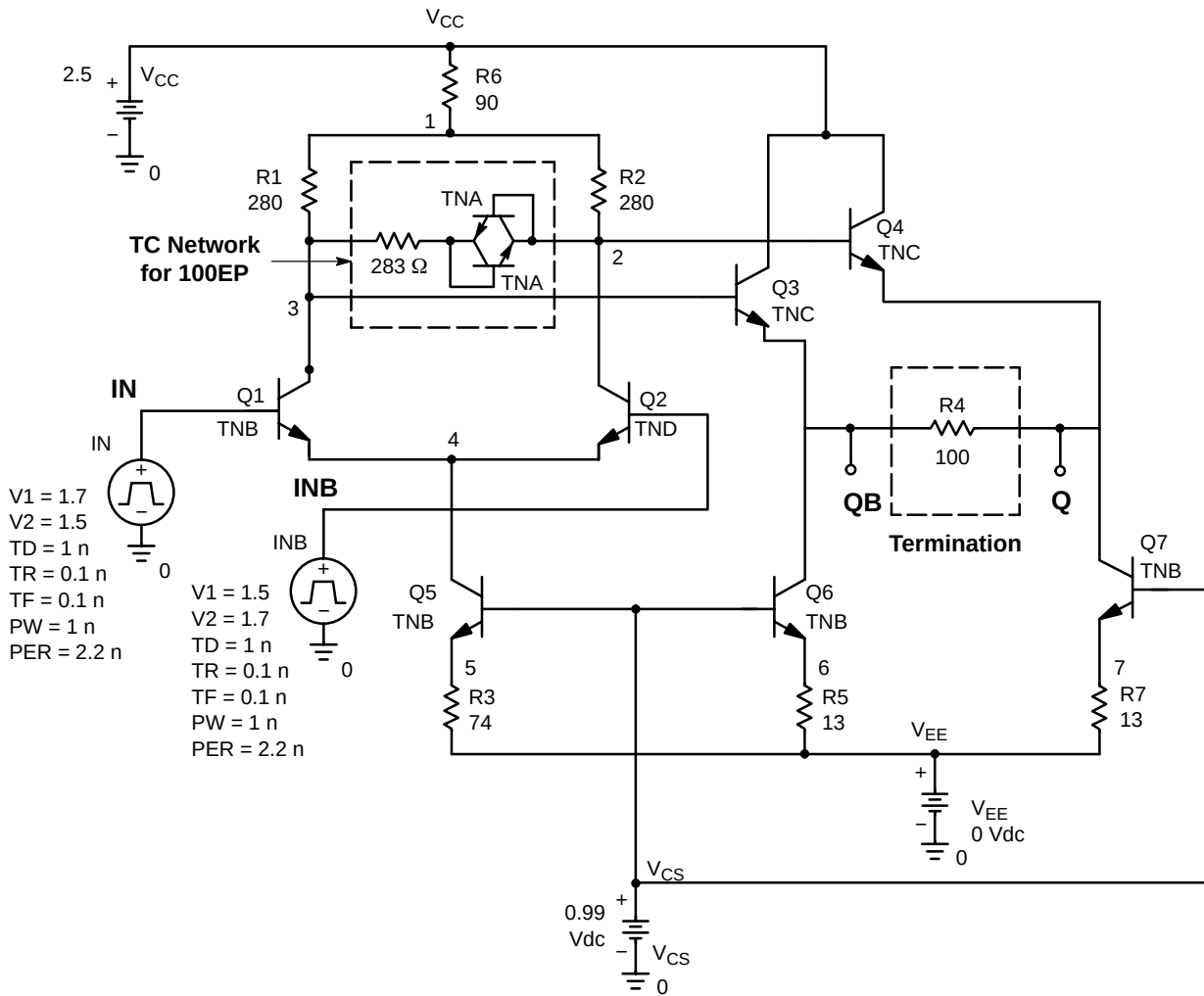


Figure 12. OBUF09

```
.SUBCKT OBUF09 IN INB VCC VCS VTT VEE Q QB
Q_Q1      1 IN 3 TNB
Q_Q2      1 IN 3 TND
Q_Q3      2 INB 3 TND
Q_Q4      2 INB 3 TNB
Q_Q5      3 VCS 4 TND
Q_Q6      3 VCS 4 TND
Q_Q7      3 VCS 4 TND
Q_Q8      VCC 2 5 TNC
Q_Q9      VCC 1 6 TNC
R_R1      1 VCC 61.25
R_R2      2 VCC 61.25
R_R3      VEE 4 14
R_R4      Q 5 4
R_R5      QB 6 4
R_R6      VTT Q 50
R_R7      VTT QB 50
V_INB     INB 0
+PULSE 1 1.2 1n 0.13n 0.13n 0.5n 1.26n
V_IN      IN 0
+PULSE 1.2 1 1n 0.13n 0.13n 0.5n 1.26n
V_VCS     VCS 0 1.25Vdc
V_VCC     VCC 0 3.3Vdc
V_VTT     VTT 0 1.3Vdc
.END OBUF09
```

AND8009/D



.SUBCKT OBUF10 IN INB VCC VCS VEE Q QB

```

Q_Q1      3 IN 4 TNB
Q_Q2      2 INB 4 TNB
Q_Q3      VCC 3 QB TNC
Q_Q4      VCC 2 Q TNC
Q_Q5      4 VCS 5 TNB
Q_Q6      QB VCS 6 TNB
Q_Q7      Q VCS 7 TNB
R_R1      3 1 295
R_R2      2 1 295
R_R3      VEE 5 64.3
R_R4      QB Q 100
R_R5      VEE 6 10
R_R6      1 VCC 61.25
R_R7      VEE 7 10
V_IN      IN 0
+PULSE 1.5 1.7 1n 0.1n 0.1n 1n 2.6n
V_INB     INB 0
+PULSE 1.7 1.5 1n 0.1n 0.1n 1n 2.6n
V_VCC     VCC 0 2.5
V_VEE     VEE 0 0Vdc
V_VCS     VCS 0 0.99Vdc
.END OBUF10

```


AND8009/D

V_{HSTL} Internal Constant Voltage Source

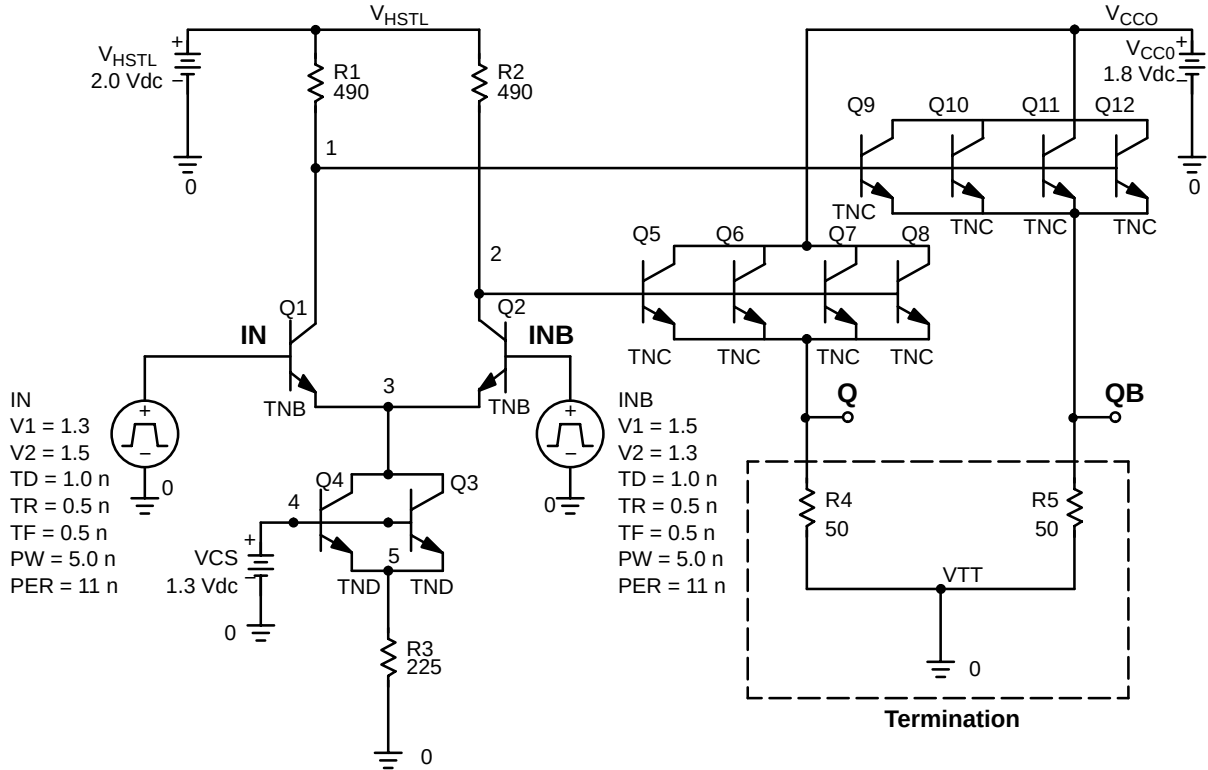
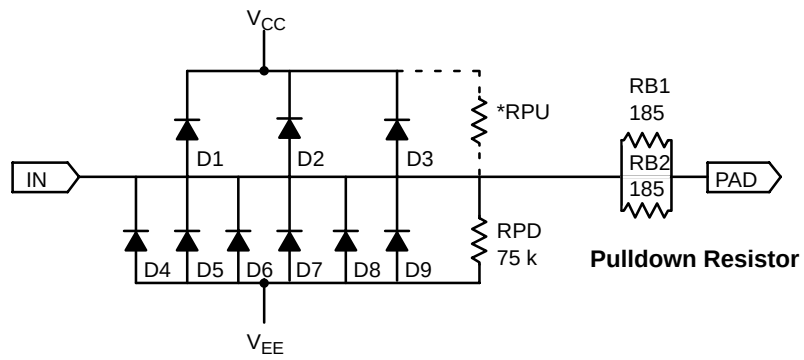


Figure 14. OBUF11

```
.SUBCKT OBUF11 IN INB VCC0 VHSTL Q QB
Q_Q1      1 IN 3 TNB
Q_Q2      2 INB 3 TNB
Q_Q3      3 4 5 TND
Q_Q4      3 4 5 TND
Q_Q5      VCC0 2 Q TNC
Q_Q6      VCC0 2 Q TNC
Q_Q7      VCC0 2 Q TNC
Q_Q8      VCC0 2 Q TNC
Q_Q9      VCC0 1 QB TNC
Q_Q10     VCC0 1 QB TNC
Q_Q11     VCC0 1 QB TNC
Q_Q12     VCC0 1 QB TNC
R_R1      1 VHSTL 490
R_R2      2 VHSTL 490
R_R3      0 5 225
R_R4      0 Q 50
R_R5      0 QB 50
V_IN      IN 0
+PULSE 1.3 1.5 1n 0.5n 0.5n 5n 11n
V_INB     INB 0
+PULSE 1.5 1.3 1n 0.5n 0.5n 5n 11n
V_VCC0    VCC0 0 1.8Vdc
V_VHSTL   VHSTL 0 2.0Vdc
V_VCS     4 0 1.3Vdc
.END OBUF11
```

AND8009/D



* See device data sheet

Figure 15. Input ESD

```
.SUBCKT IN_ESD VCC VEE IN PAD
D1      IN      VCC      ESDM
D2      IN      VCC      ESDM
D3      IN      VCC      ESDM
D4      VEE     IN       ESDM
D5      VEE     IN       ESDS
D6      VEE     IN       ESDM
D7      VEE     IN       ESDS
D8      VEE     IN       ESDM
D9      VEE     IN       ESDS
RPD     IN      VEE      75K
RPU     IN      VCC      36.5K
RB1     IN      PAD      185
RB2     IN      PAD      185
.ENDS IN_ESD
```

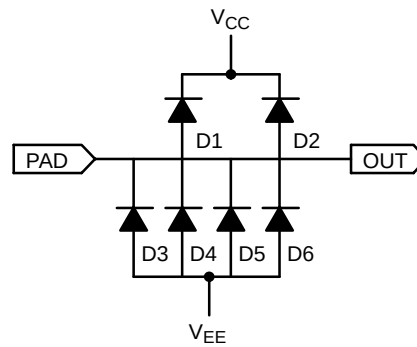


Figure 16. Output ESD

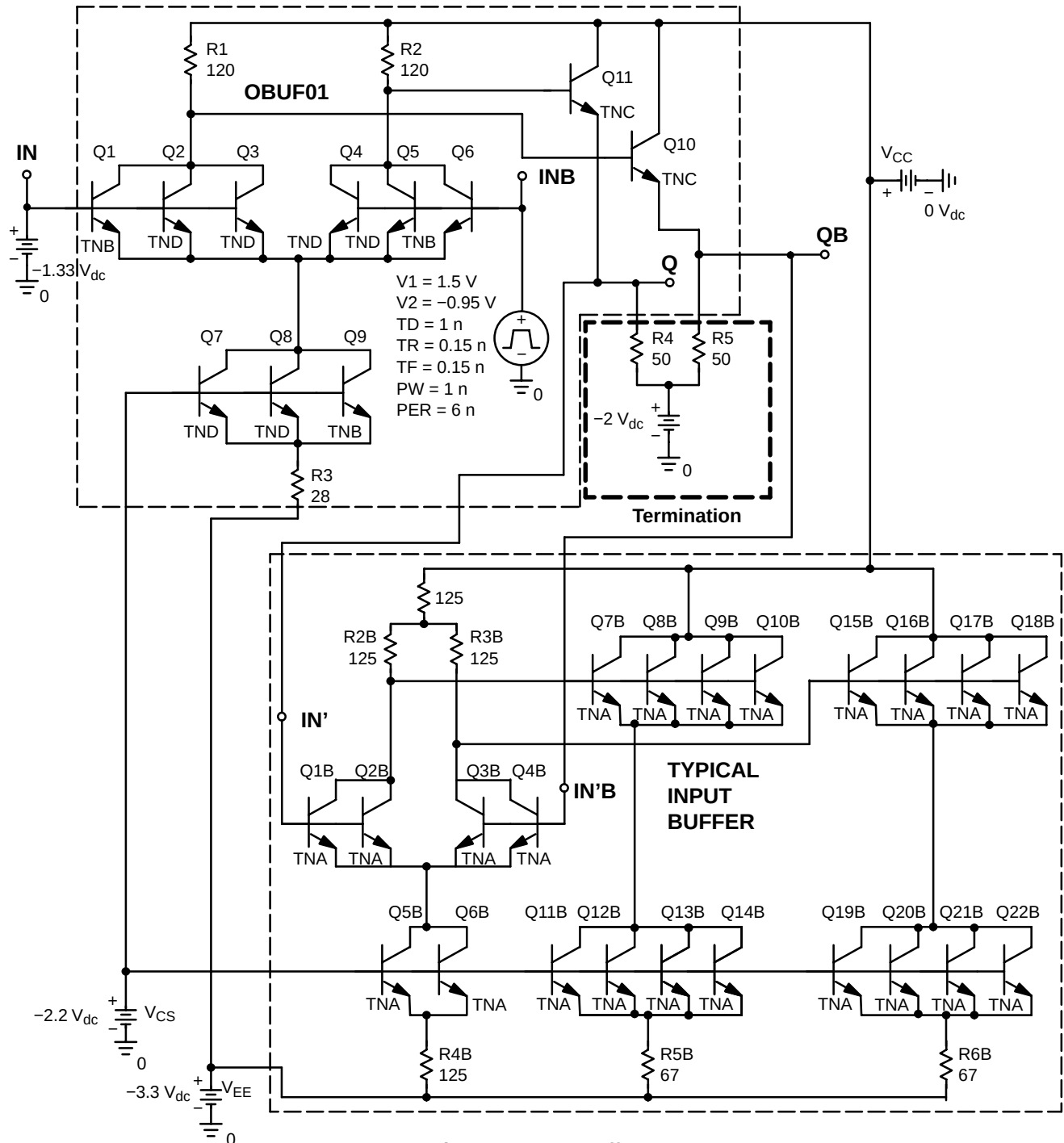
```
.SUBCKT OUT_ESD VCC VEE OUT
D1      OUT     VCC      ESDM
D2      OUT     VCC      ESDM
D3      VEE     OUT      ESDM
D4      VEE     OUT      ESDS
D5      VEE     OUT      ESDM
D6      VEE     OUT      ESDS
.ENDS OUT_ESD
```

AND8009/D

The following is an example of a typical run-deck file which might be used to simulate Figure 17 to produce output waveform shown in Figure 18.

TYPICAL TEST CIRCUIT

```
VCC      VCC      0      0V
VEE      VEE      0      -3.3V
VCS      VCS      0      -2.2V
VTT      VTT      0      -2.0V
VIN      IN       0      PULSE(-1.7 -0.95 5NS 5NS 5NS 50NS 110NS)
VINB     INB      0      PULSE(-0.95 -1.7 5NS 5NS 5NS 50NS 110NS)
.GROUND  0
.TRAN    0.2NS    120NS
```



AND8009/D

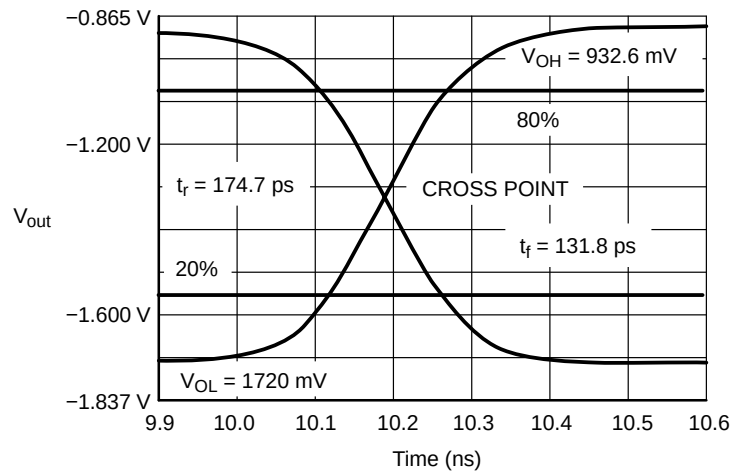


Figure 18. Typical Generic Output Waveform

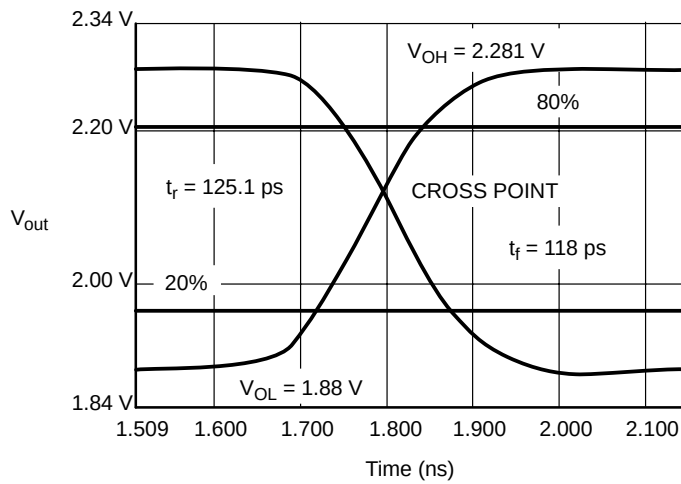


Figure 19. OBUF09 Reduced Swing Output Waveform (EP40/140)

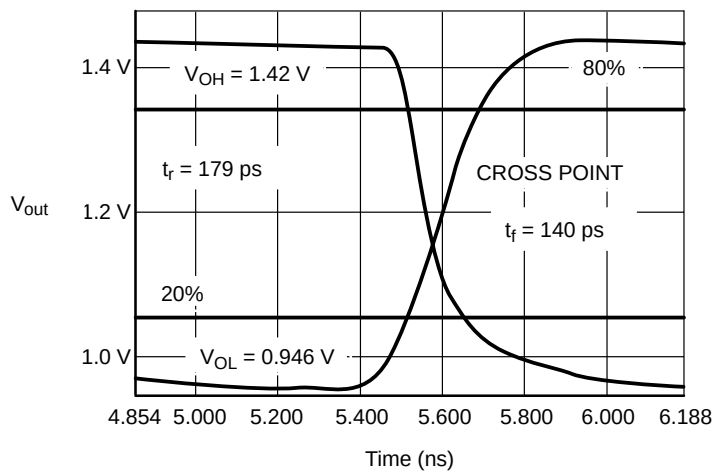


Figure 20. LVDS Output Waveform (EP210's)

AND8009/D

***** Transistor and Diodes Nominal SPICE Models* *****

```
*****
.MODEL TNA NPN (IS=8.12e-18 BF=192 NF=1 VAF=75.6 IKF=1.49e-02
+ ISE=9.14e-17 NE=2 BR=15.8 VAR=2.76 IKR=2.2e-03 ISC=2.62e-16
+ NC=1.578 RB=327 IRB=4.8e-05 RBM=0.001 RE=10 RC=15 CJE=2.0e-14
+ VJE=.8867 MJE=.2868 TF=9.02e-12 ITF=7.6e-03 XTF=2.8 VTF=3.4 PTF=41.56 TR=1NS
+ CJC=5.6e-15 VJC=.6324 MJC=.3006 XCJC=.3 CJS=4.8e-15 VJS=.4193 MJS=.2563
+ EG=1.119 XTI=3.999 XTB=0.8826 FC=0.9)
*****
.MODEL TNB NPN (IS=2.71e-17 BF=172 NF=1 VAF=71.4 IKF=4.38e-02
+ ISE=1.33e-15 NE=2 BR=17.9 VAR=2.76 IKR=3.0e-03 ISC=2.22e-16
+ NC=1.578 RB=67 IRB=6.47e-05 RBM=0.001 RE=3 RC=4 CJE=5.09e-14
+ VJE=.8867 MJE=.2868 TF=9.02e-12 ITF=2.53e-02 XTF=2.8 VTF=3.4 PTF=41.56 TR=1NS
+ CJC=20.6e-15 VJC=.6324 MJC=.3006 XCJC=.3 CJS=1.7e-14 VJS=.4193 MJS=.2563
+ EG=1.119 XTI=3.999 XTB=0.8826 FC=0.9)
*****
.MODEL TNC NPN (IS=6.55e-17 BF=103 NF=1 VAF=90 IKF=2.91e-01
+ ISE=8.85e-15 NE=2 BR=15.7 NR=1 VAR=3.82 IKR=2.01e-02 ISC=1.48e-15
+ NC=2 RB=10.5 IRB=4.39e-04 RBM=0.29 RE=0.351 RC=9 CJE=3.5e-13
+ VJE=.8867 MJE=.1973 TF=8.99e-12 ITF=1.3e-01 XTF=5.67 VTF=1.86 PTF=41.43 TR=6.405e-10
+ CJC=1.4e-13 VJC=.6401 MJC=.2674 XCJC=1 CJS=9.3e-14 VJS=.5002 MJS=.1706
+ EG=1.135 XTI=4.177 XTB=0.6322 FC=0.961)
*****
.MODEL TND NPN (IS=1.36e-17 BF=180 NF=1 VAF=87.6 IKF=2.19e-02
+ ISE=6.65e-16 NE=2 BR=16.9 VAR=2.76 IKR=1.5e-03 ISC=1.11e-16
+ NC=1.578 RB=136 IRB=3.24e-05 RBM=0.001 RE=6 RC=8 CJE=1.02e-13
+ VJE=.8867 MJE=.2868 TF=9.02e-12 ITF=1.27e-02 XTF=2.8 VTF=3.4 PTF=41.56 TR=1NS
+ CJC=10.3e-15 VJC=.6324 MJC=.3006 XCJC=.3 CJS=9.94e-15 VJS=.4193 MJS=.2563
+ EG=1.119 XTI=3.999 XTB=0.8826 FC=0.9)
*****
.MODEL TNE NPN (IS=2.68e-18 BF=223 NF=1 VAF=56.0 IKF=3.96e-03
+ ISE=3.07e-17 NE=2 BR=13.9 VAR=2.76 IKR=7.23e-04 ISC=6.08e-17
+ NC=1.578 RB=386 IRB=1.3e-05 RBM=0.001 RE=26 RC=28 CJE=6.0e-15
+ VJE=.8867 MJE=.2868 TF=9.02PS ITF=2.6e-03 XTF=2.8 VTF=3.4 PTF=41.56 TR=1NS
+ CJC=3.4e-15 VJC=.6324 MJC=.3006 XCJC=.3 CJS=3.4e-15 VJS=.4193 MJS=.2563
+ EG=1.119 XTI=3.999 XTB=0.8826 FC=0.9)
*****
.MODEL ESDM D (IS=1.55E-14 CJO=160fF RS=12 VJ=.58 M=.25 BV=9)
*****
.MODEL ESDS D (IS=1.55E-14 CJO=29fF VJ=.624 M=.571)
*****
*SPICE MODELS 4.5
```

Package: S0-8

```

* SPICE subcircuit file of coupled transmission lines
*
* Transmission line model
*
* Conductor number-pin designation cross reference:
*   Conductor      Pin
*       1           1
*       2           2
*       3           3
*       4           4
*       5           5
*       6           6
*       7           7
*       8           8
*
* number of lumps:      1
* FASTEST APPLICABLE EDGE RATE:      0.076 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
* Connect chip side to N**I and board side to N**O
*
.SUBCKT LINES N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O
L01WB  N01I  N01M  1.367e-09
L01     N01M  N01O  7.794e-10
C01     N01M  0     2.445e-13
L02WB  N02I  N02M  1.287e-09
L02     N02M  N02O  5.473e-10
C02     N02M  0     1.888e-13
L03WB  N03I  N03M  1.287e-09
L03     N03M  N03O  5.473e-10
C03     N03M  0     1.901e-13
L04WB  N04I  N04M  1.367e-09
L04     N04M  N04O  7.723e-10
C04     N04M  0     2.443e-13
L05WB  N05I  N05M  1.367e-09
L05     N05M  N05O  7.710e-10
C05     N05M  0     2.478e-13
L06WB  N06I  N06M  1.287e-09
L06     N06M  N06O  5.489e-10
C06     N06M  0     1.916e-13
L07WB  N07I  N07M  1.287e-09
L07     N07M  N07O  5.495e-10
C07     N07M  0     1.930e-13
L08WB  N08I  N08M  1.367e-09
L08     N08M  N08O  7.786e-10
C08     N08M  0     2.451e-13
K0102  L01    L02    0.1687
K0102WB L01WB L02WB  0.3400
C0102  N01O  N02O  3.674e-14
K0103  L01    L03    0.0702
K0103WB L01WB L03WB  0.1847
K0203  L02    L03    0.1822
K0203WB L02WB L03WB  0.3505
C0203  N02O  N03O  3.521e-14
K0204  L02    L04    0.0682
K0204WB L02WB L04WB  0.1847
K0304  L03    L04    0.1694
K0304WB L03WB L04WB  0.3400

```

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C0304	N030	N040	3.675e-14
K0305WB	L03WB	L05WB	0.1847
K0405WB	L04WB	L05WB	0.3455
K0406WB	L04WB	L06WB	0.1847
K0506	L05	L06	0.1697
K0506WB	L05WB	L06WB	0.3400
C0506	N050	N060	3.720e-14
K0507	L05	L07	0.0682
K0507WB	L05WB	L07WB	0.1847
K0607	L06	L07	0.1824
K0607WB	L06WB	L07WB	0.3505
C0607	N060	N070	3.570e-14
K0608	L06	L08	0.0702
K0608WB	L06WB	L08WB	0.1847
K0708	L07	L08	0.1691
K0708WB	L07WB	L08WB	0.3400
C0708	N070	N080	3.632e-14

.ENDS LINES

Package: TSSOP-8

```

* SPICE subcircuit file of coupled transmission lines
*
* Transmission line model
*
* Conductor number-pin designation cross reference:
* counter-clockwise
*   Conductor      Pin
*       1           1
*       2           2
*       3           3
*       4           4
*       5           5
*       6           6
*       7           7
*       8           8
*
* number of lumps:      1
* FASTEST APPLICABLE EDGE RATE:      0.048 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
R_SHORT 0 GND 0.0001
*
X_777 N01I N010 N02I N020 N03I N030 N04I N040
+ N05I N050 N06I N060 N07I N070 N08I N080 GND PACKAGE
*
.SUBCKT PACKAGE N01I N010 N02I N020 N03I N030 N04I N040
+ N05I N050 N06I N060 N07I N070 N08I N080 GND
R01WB  N01I  N01W  4.727e-02
L01WB  N01W  N01R  1.158e-09
R01    N01R  N01C  9.680e-04
C01    N01C  GND   8.978e-14
L01    N01C  N010  7.466e-10
R02WB  N02I  N02W  3.815e-02
L02WB  N02W  N02R  9.835e-10
R02    N02R  N02C  9.680e-04
C02    N02C  GND   7.711e-14
L02    N02C  N020  7.466e-10
R03WB  N03I  N03W  3.815e-02
L03WB  N03W  N03R  9.835e-10
R03    N03R  N03C  9.680e-04
C03    N03C  GND   7.704e-14
L03    N03C  N030  7.465e-10
R04WB  N04I  N04W  4.727e-02
L04WB  N04W  N04R  1.158e-09
R04    N04R  N04C  9.680e-04
C04    N04C  GND   8.983e-14
L04    N04C  N040  7.460e-10
R05WB  N05I  N05W  4.727e-02
L05WB  N05W  N05R  1.158e-09
R05    N05R  N05C  9.680e-04
C05    N05C  GND   8.983e-14
L05    N05C  N050  7.460e-10
R06WB  N06I  N06W  3.815e-02
L06WB  N06W  N06R  9.835e-10
R06    N06R  N06C  9.680e-04
C06    N06C  GND   7.704e-14
L06    N06C  N060  7.465e-10
R07WB  N07I  N07W  3.815e-02

```


AND8009/D

L07WB	N07W	N07R	9.835e-10
R07	N07R	N07C	9.680e-04
C07	N07C	GND	7.711e-14
L07	N07C	N070	7.466e-10
R08WB	N08I	N08W	4.727e-02
L08WB	N08W	N08R	1.158e-09
R08	N08R	N08C	9.680e-04
C08	N08C	GND	8.978e-14
L08	N08C	N080	7.466e-10
K0102	L01	L02	0.2481
K0102WB	L01WB	L02WB	0.1729
C0102	N01C	N02C	2.283e-14
K0103	L01	L03	0.1067
K0103WB	L01WB	L03WB	0.0598
K0104	L01	L04	0.0593
K0203	L02	L03	0.2479
K0203WB	L02WB	L03WB	0.1463
C0203	N02C	N03C	2.136e-14
K0204	L02	L04	0.1068
K0204WB	L02WB	L04WB	0.0598
K0304	L03	L04	0.2481
K0304WB	L03WB	L04WB	0.1729
C0304	N03C	N04C	2.279e-14
K0506	L05	L06	0.2481
K0506WB	L05WB	L06WB	0.1513
C0506	N05C	N06C	2.279e-14
K0507	L05	L07	0.1068
K0507WB	L05WB	L07WB	0.0615
K0508	L05	L08	0.0593
K0607	L06	L07	0.2479
K0607WB	L06WB	L07WB	0.1729
C0607	N06C	N07C	2.136e-14
K0608	L06	L08	0.1067
K0608WB	L06WB	L08WB	0.0615
K0708	L07	L08	0.2481
K0708WB	L07WB	L08WB	0.1513
C0708	N07C	N08C	2.283e-14
.ENDS PACKAGE			

Package: S0-20

```

* SPICE subcircuit file of coupled transmission lines
*
* Transmission line model
*
* Conductor number-pin designation cross reference:
*   Conductor      Pin
*       1           1
*       2           2
*       3           3
*       4           4
*       5           5
*       6           6
*       7           7
*       8           8
*       9           9
*      10          10
*      11          11
*      12          12
*      13          13
*      14          14
*      15          15
*      16          16
*      17          17
*      18          18
*      19          19
*      20          20
*
* number of lumps:      1
* FASTEST APPLICABLE EDGE RATE:      0.275 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
.SUBCKT PACKAGE N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O N09I N09O
+ N10I N10O N11I N11O N12I N12O N13I N13O N14I N14O
+ N15I N15O N16I N16O N17I N17O N18I N18O N19I N19O
+ N20I N20O BD_GND
R01WB  N01I  N01W  3.732e-02
L01WB  N01W  N01R  9.678e-10
R01     N01R  N01C  1.700e-02
C01     N01C  BD_GND 4.680e-13
L01     N01C  N01O  3.814e-09
R02WB  N02I  N02W  8.086e-02
L02WB  N02W  N02R  1.822e-09
R02     N02R  N02C  1.300e-02
C02     N02C  BD_GND 1.924e-13
L02     N02C  N02O  2.724e-09
R03WB  N03I  N03W  9.122e-02
L03WB  N03W  N03R  2.033e-09
R03     N03R  N03C  9.000e-02
C03     N03C  BD_GND 1.377e-13
L03     N03C  N03O  1.814e-09
R04WB  N04I  N04W  7.878e-02
L04WB  N04W  N04R  1.780e-09
R04     N04R  N04C  8.000e-02
C04     N04C  BD_GND 1.484e-13
L04     N04C  N04O  1.551e-09
R05WB  N05I  N05W  6.634e-02
L05WB  N05W  N05R  1.531e-09
R05     N05R  N05C  7.000e-02

```

AND8009/D

C05	N05C	BD_GND	1.635e-13
L05	N05C	N050	1.508e-09
R06WB	N06I	N06W	6.634e-02
L06WB	N06W	N06R	1.531e-09
R06	N06R	N06C	7.000e-02
C06	N06C	BD_GND	1.584e-13
L06	N06C	N060	1.508e-09
R07WB	N07I	N07W	7.878e-02
L07WB	N07W	N07R	1.780e-09
R07	N07R	N07C	8.000e-02
C07	N07C	BD_GND	1.476e-13
L07	N07C	N070	1.553e-09
R08WB	N08I	N08W	4.976e-02
L08WB	N08W	N08R	1.206e-09
R08	N08R	N08C	9.000e-02
C08	N08C	BD_GND	1.322e-13
L08	N08C	N080	1.820e-09
R09WB	N09I	N09W	8.086e-02
L09WB	N09W	N09R	1.822e-09
R09	N09R	N09C	1.300e-02
C09	N09C	BD_GND	1.864e-13
L09	N09C	N090	2.725e-09
R10WB	N10I	N10W	7.256e-02
L10WB	N10W	N10R	1.655e-09
R10	N10R	N10C	1.700e-02
C10	N10C	BD_GND	4.681e-13
L10	N10C	N100	3.814e-09
R11WB	N11I	N11W	3.732e-02
L11WB	N11W	N11R	9.678e-10
R11	N11R	N11C	1.700e-02
C11	N11C	BD_GND	4.761e-13
L11	N11C	N110	3.795e-09
R12WB	N12I	N12W	8.086e-02
L12WB	N12W	N12R	1.822e-09
R12	N12R	N12C	1.300e-02
C12	N12C	BD_GND	1.888e-13
L12	N12C	N120	2.745e-09
R13WB	N13I	N13W	9.122e-02
L13WB	N13W	N13R	2.033e-09
R13	N13R	N13C	9.000e-02
C13	N13C	BD_GND	1.346e-13
L13	N13C	N130	1.879e-09
R14WB	N14I	N14W	7.878e-02
L14WB	N14W	N14R	1.780e-09
R14	N14R	N14C	8.000e-02
C14	N14C	BD_GND	1.496e-13
L14	N14C	N140	1.436e-09
R15WB	N15I	N15W	6.634e-02
L15WB	N15W	N15R	1.531e-09
R15	N15R	N15C	7.000e-02
C15	N15C	BD_GND	1.550e-13
L15	N15C	N150	1.464e-09
R16WB	N16I	N16W	6.634e-02
L16WB	N16W	N16R	1.531e-09
R16	N16R	N16C	7.000e-02
C16	N16C	BD_GND	1.568e-13
L16	N16C	N160	1.465e-09
R17WB	N17I	N17W	7.878e-02
L17WB	N17W	N17R	1.780e-09
R17	N17R	N17C	8.000e-02
C17	N17C	BD_GND	1.492e-13
L17	N17C	N170	1.437e-09

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R18WB	N18I	N18W	9.122e-02
L18WB	N18W	N18R	2.033e-09
R18	N18R	N18C	9.000e-02
C18	N18C	BD_GND	1.346e-13
L18	N18C	N18O	1.892e-09
R19WB	N19I	N19W	8.086e-02
L19WB	N19W	N19R	1.822e-09
R19	N19R	N19C	1.300e-02
C19	N19C	BD_GND	1.880e-13
L19	N19C	N19O	2.767e-09
R20WB	N20I	N20W	7.256e-02
L20WB	N20W	N20R	1.655e-09
R20	N20R	N20C	1.700e-02
C20	N20C	BD_GND	4.712e-13
L20	N20C	N20O	3.825e-09
K0102	L01	L02	0.4539
K0102WB	L01WB	L02WB	0.1239
C0102	N01C	N02C	2.674e-13
K0103	L01	L03	0.2557
K0104	L01	L04	0.1742
K0105	L01	L05	0.1290
K0106	L01	L06	0.1011
K0107	L01	L07	0.0834
K0108	L01	L08	0.0636
K0111	L01	L11	-0.0789
K0112	L01	L12	-0.0755
K0113	L01	L13	-0.0716
K0114	L01	L14	-0.0594
K0115	L01	L15	-0.0669
K0116	L01	L16	-0.0657
K0117	L01	L17	-0.0672
K0118	L01	L18	-0.0625
K0203	L02	L03	0.3964
K0203WB	L02WB	L03WB	0.1239
C0203	N02C	N03C	1.529e-13
K0204	L02	L04	0.2341
K0205	L02	L05	0.1587
K0206	L02	L06	0.1206
K0207	L02	L07	0.0974
K0208	L02	L08	0.0760
K0209	L02	L09	0.0554
K0211	L02	L11	-0.0743
K0212	L02	L12	-0.0723
K0213	L02	L13	-0.0707
K0214	L02	L14	-0.0604
K0215	L02	L15	-0.0678
K0216	L02	L16	-0.0677
K0217	L02	L17	-0.0685
K0218	L02	L18	-0.0682
K0304	L03	L04	0.3767
K0304WB	L03WB	L04WB	0.1239
C0304	N03C	N04C	1.006e-13
K0305	L03	L05	0.2211
K0306	L03	L06	0.1564
K0307	L03	L07	0.1219
K0308	L03	L08	0.0956
K0309	L03	L09	0.0762
K0310	L03	L10	0.0639
K0311	L03	L11	-0.0654
K0312	L03	L12	-0.0662
K0313	L03	L13	-0.0688
K0314	L03	L14	-0.0614

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K0315	L03	L15	-0.0683
K0316	L03	L16	-0.0692
K0317	L03	L17	-0.0684
K0318	L03	L18	-0.0730
K0319	L03	L19	-0.0609
K0320	L03	L20	-0.0501
K0405	L04	L05	0.3731
K0405WB	L04WB	L05WB	0.1239
C0405	N04C	N05C	8.137e-14
K0406	L04	L06	0.2290
K0407	L04	L07	0.1637
K0408	L04	L08	0.1218
K0409	L04	L09	0.0976
K0410	L04	L10	0.0836
K0411	L04	L11	-0.0645
K0412	L04	L12	-0.0673
K0413	L04	L13	-0.0722
K0414	L04	L14	-0.0658
K0415	L04	L15	-0.0724
K0416	L04	L16	-0.0733
K0417	L04	L17	-0.0708
K0418	L04	L18	-0.0763
K0419	L04	L19	-0.0673
K0420	L04	L20	-0.0597
K0506	L05	L06	0.3775
K0506WB	L05WB	L06WB	0.1239
C0506	N05C	N06C	8.844e-14
K0507	L05	L07	0.2293
K0508	L05	L08	0.1565
K0509	L05	L09	0.1208
K0510	L05	L10	0.1013
K0511	L05	L11	-0.0636
K0512	L05	L12	-0.0679
K0513	L05	L13	-0.0742
K0514	L05	L14	-0.0683
K0515	L05	L15	-0.0737
K0516	L05	L16	-0.0741
K0517	L05	L17	-0.0704
K0518	L05	L18	-0.0760
K0519	L05	L19	-0.0684
K0520	L05	L20	-0.0622
K0607	L06	L07	0.3743
K0607WB	L06WB	L07WB	0.1239
C0607	N06C	N07C	7.898e-14
K0608	L06	L08	0.2214
K0609	L06	L09	0.1591
K0610	L06	L10	0.1293
K0611	L06	L11	-0.0607
K0612	L06	L12	-0.0668
K0613	L06	L13	-0.0752
K0614	L06	L14	-0.0700
K0615	L06	L15	-0.0741
K0616	L06	L16	-0.0742
K0617	L06	L17	-0.0690
K0618	L06	L18	-0.0754
K0619	L06	L19	-0.0697
K0620	L06	L20	-0.0652
K0708	L07	L08	0.3762
K0708WB	L07WB	L08WB	0.1239
C0708	N07C	N08C	1.016e-13
K0709	L07	L09	0.2343
K0710	L07	L10	0.1746

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K0711	L07	L11	-0.0581
K0712	L07	L12	-0.0657
K0713	L07	L13	-0.0756
K0714	L07	L14	-0.0707
K0715	L07	L15	-0.0736
K0716	L07	L16	-0.0730
K0717	L07	L17	-0.0667
K0718	L07	L18	-0.0735
K0719	L07	L19	-0.0692
K0720	L07	L20	-0.0661
K0809	L08	L09	0.3970
K0809WB	L08WB	L09WB	0.1239
C0809	N08C	N09C	1.545e-13
K0810	L08	L10	0.2564
K0812	L08	L12	-0.0591
K0813	L08	L13	-0.0723
K0814	L08	L14	-0.0685
K0815	L08	L15	-0.0698
K0816	L08	L16	-0.0693
K0817	L08	L17	-0.0624
K0818	L08	L18	-0.0702
K0819	L08	L19	-0.0681
K0820	L08	L20	-0.0670
K0910	L09	L10	0.4542
K0910WB	L09WB	L10WB	0.1239
C0910	N09C	N10C	2.677e-13
K0913	L09	L13	-0.0675
K0914	L09	L14	-0.0688
K0915	L09	L15	-0.0687
K0916	L09	L16	-0.0693
K0917	L09	L17	-0.0618
K0918	L09	L18	-0.0723
K0919	L09	L19	-0.0742
K0920	L09	L20	-0.0759
K1011WB	L10WB	L11WB	0.1239
K1013	L10	L13	-0.0616
K1014	L10	L14	-0.0675
K1015	L10	L15	-0.0668
K1016	L10	L16	-0.0685
K1017	L10	L17	-0.0609
K1018	L10	L18	-0.0731
K1019	L10	L19	-0.0773
K1020	L10	L20	-0.0803
K1112	L11	L12	0.4562
K1112WB	L11WB	L12WB	0.1239
C1112	N11C	N12C	2.679e-13
K1113	L11	L13	0.2725
K1114	L11	L14	0.1533
K1115	L11	L15	0.1161
K1116	L11	L16	0.0901
K1117	L11	L17	0.0702
K1118	L11	L18	0.0567
K1213	L12	L13	0.4103
K1213WB	L12WB	L13WB	0.1239
C1213	N12C	N13C	1.538e-13
K1214	L12	L14	0.2091
K1215	L12	L15	0.1398
K1216	L12	L16	0.1055
K1217	L12	L17	0.0812
K1218	L12	L18	0.0684
K1314	L13	L14	0.3577
K1314WB	L13WB	L14WB	0.1239

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C1314	N13C	N14C	1.026e-13
K1315	L13	L15	0.2088
K1316	L13	L16	0.1474
K1317	L13	L17	0.1074
K1318	L13	L18	0.0930
K1319	L13	L19	0.0693
K1320	L13	L20	0.0578
K1415	L14	L15	0.3383
K1415WB	L14WB	L15WB	0.1239
C1415	N14C	N15C	7.843e-14
K1416	L14	L16	0.1987
K1417	L14	L17	0.1302
K1418	L14	L18	0.1078
K1419	L14	L19	0.0825
K1420	L14	L20	0.0715
K1516	L15	L16	0.3631
K1516WB	L15WB	L16WB	0.1239
C1516	N15C	N16C	9.179e-14
K1517	L15	L17	0.1988
K1518	L15	L18	0.1480
K1519	L15	L19	0.1072
K1520	L15	L20	0.0918
K1617	L16	L17	0.3380
K1617WB	L16WB	L17WB	0.1239
C1617	N16C	N17C	7.810e-14
K1618	L16	L18	0.2096
K1619	L16	L19	0.1419
K1620	L16	L20	0.1183
K1718	L17	L18	0.3595
K1718WB	L17WB	L18WB	0.1239
C1718	N17C	N18C	1.034e-13
K1719	L17	L19	0.2122
K1720	L17	L20	0.1565
K1819	L18	L19	0.4140
K1819WB	L18WB	L19WB	0.1239
C1819	N18C	N19C	1.536e-13
K1820	L18	L20	0.2766
K1920	L19	L20	0.4603
K1920WB	L19WB	L20WB	0.1239
C1920	N19C	N20C	2.679e-13
.ENDS PACKAGE			

Package: TSSOP-20

```

* SPICE subcircuit file of coupled transmission lines
*
* Transmission line model
*
* Conductor number-pin designation cross reference:
*   Conductor      Pin
*       1           1
*       2           2
*       3           3
*       4           4
*       5           5
*       6           6
*       7           7
*       8           8
*       9           9
*      10          10
*      11          11
*      12          12
*      13          13
*      14          14
*      15          15
*      16          16
*      17          17
*      18          18
*      19          19
*      20          20
*
* number of lumps: 1
* FASTEST APPLICABLE EDGE RATE:  0.114 ns
* Equivalent bandwidth:           3.07GHz
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
**CONNECT CHIP SIDE TO N**I AND BOARD SIDE TO N**O
* ECLinPS PLUS usage requires the input nodes used in the subcircuit call
* statement(X_777) that are tied to global ports(VCC, VCCO, and VEE internal
* to the die) to have the same global names in the subcircuit call statement(X_777) .
* For example, if VCC is wirebonded to pin 20 for a certain design, then N20I
* should be relabeled to VCC. Again, the change needs only to be incorporated
* in the X_777 subcircuit callout statement. Since this requires a change to
* the netlist below, it is necessary for each design to have a copy of this file with
* the appropriate changes made that are required for that design.
*
R_SHORT 0 GND 0.0001
X_777 N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O N09I N09O
+ N10I N10O N11I N11O N12I N12O N13I N13O N14I N14O
+ N15I N15O N16I N16O N17I N17O N18I N18O N19I N19O
+ N20I N20O GND PACKAGE
.SUBCKT PACKAGE N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O N09I N09O
+ N10I N10O N11I N11O N12I N12O N13I N13O N14I N14O
+ N15I N15O N16I N16O N17I N17O N18I N18O N19I N19O
+ N20I N20O GND
R01WB N01I N01W 5.225e-02
L01WB N01W N01R 1.254e-09
R01 N01R N01C 2.100e-03
C01 N01C GND 1.840e-13
L01 N01C N01O 1.603e-09

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R02WB N02I N02W 5.473e-02
 L02WB N02W N02R 1.303e-09
 R02 N02R N02C 2.500e-03
 C02 N02C GND 8.995e-14
 L02 N02C N020 1.187e-09
 R03WB N03I N03W 5.266e-02
 L03WB N03W N03R 1.262e-09
 R03 N03R N03C 2.500e-03
 C03 N03C GND 7.204e-14
 L03 N03C N030 9.073e-10
 R04WB N04I N04W 3.690e-02
 L04WB N04W N04R 9.599e-10
 R04 N04R N04C 2.100e-03
 C04 N04C GND 8.838e-14
 L04 N04C N040 9.053e-10
 R05WB N05I N05W 3.151e-02
 L05WB N05W N05R 8.581e-10
 R05 N05R N05C 1.700e-03
 C05 N05C GND 9.879e-14
 L05 N05C N050 9.065e-10
 R06WB N06I N06W 3.151e-02
 L06WB N06W N06R 8.581e-10
 R06 N06R N06C 1.700e-03
 C06 N06C GND 9.879e-14
 L06 N06C N060 9.065e-10
 R07WB N07I N07W 3.690e-02
 L07WB N07W N07R 9.599e-10
 R07 N07R N07C 2.100e-03
 C07 N07C GND 8.838e-14
 L07 N07C N070 9.053e-10
 R08WB N08I N08W 5.266e-02
 L08WB N08W N08R 1.262e-09
 R08 N08R N08C 2.500e-03
 C08 N08C GND 7.204e-14
 L08 N08C N080 9.073e-10
 R09WB N09I N09W 5.473e-02
 L09WB N09W N09R 1.303e-09
 R09 N09R N09C 2.500e-03
 C09 N09C GND 8.995e-14
 L09 N09C N090 1.187e-09
 R10WB N10I N10W 5.225e-02
 L10WB N10W N10R 1.254e-09
 R10 N10R N10C 2.100e-03
 C10 N10C GND 1.840e-13
 L10 N10C N100 1.603e-09
 R11WB N11I N11W 5.225e-02
 L11WB N11W N11R 1.254e-09
 R11 N11R N11C 2.100e-03
 C11 N11C GND 1.840e-13
 L11 N11C N110 1.603e-09
 R12WB N12I N12W 5.473e-02
 L12WB N12W N12R 1.303e-09
 R12 N12R N12C 2.500e-03
 C12 N12C GND 8.995e-14
 L12 N12C N120 1.187e-09
 R13WB N13I N13W 5.266e-02
 L13WB N13W N13R 1.262e-09
 R13 N13R N13C 2.500e-03
 C13 N13C GND 7.204e-14
 L13 N13C N130 9.073e-10
 R14WB N14I N14W 3.690e-02
 L14WB N14W N14R 9.599e-10

R14 N14R N14C 2.100e-03
 C14 N14C GND 8.838e-14
 L14 N14C N140 9.053e-10
 R15WB N15I N15W 3.151e-02
 L15WB N15W N15R 8.581e-10
 R15 N15R N15C 1.700e-03
 C15 N15C GND 9.879e-14
 L15 N15C N150 9.065e-10
 R16WB N16I N16W 3.151e-02
 L16WB N16W N16R 8.581e-10
 R16 N16R N16C 1.700e-03
 C16 N16C GND 9.879e-14
 L16 N16C N160 9.065e-10
 R17WB N17I N17W 3.690e-02
 L17WB N17W N17R 9.599e-10
 R17 N17R N17C 2.100e-03
 C17 N17C GND 8.838e-14
 L17 N17C N170 9.053e-10
 R18WB N18I N18W 5.266e-02
 L18WB N18W N18R 1.262e-09
 R18 N18R N18C 2.500e-03
 C18 N18C GND 7.204e-14
 L18 N18C N180 9.073e-10
 R19WB N19I N19W 5.473e-02
 L19WB N19W N19R 1.303e-09
 R19 N19R N19C 2.500e-03
 C19 N19C GND 8.995e-14
 L19 N19C N190 1.187e-09
 R20WB N20I N20W 5.225e-02
 L20WB N20W N20R 1.254e-09
 R20 N20R N20C 2.100e-03
 C20 N20C GND 1.840e-13
 L20 N20C N200 1.603e-09
 K0102 L01 L02 0.2780
 K0102WB L01WB L02WB 0.2168
 C0102 N01C N02C 1.222e-13
 K0103 L01 L03 0.1016
 K0103WB L01WB L03WB 0.0788
 K0104 L01 L04 0.0559
 K0120WB L01WB L20WB 0.1061
 K0119WB L01WB L19WB 0.0542
 K0203 L02 L03 0.2333
 K0203WB L02WB L03WB 0.1970
 C0203 N02C N03C 7.150e-14
 K0204 L02 L04 0.1006
 K0204WB L02WB L04WB 0.0729
 K0205 L02 L05 0.0577
 K0220WB L02WB L20WB 0.0542
 K0304 L03 L04 0.2384
 K0304WB L03WB L04WB 0.1787
 C0304 N03C N04C 5.860e-14
 K0305 L03 L05 0.1055
 K0305WB L03WB L05WB 0.0542
 K0306 L03 L06 0.0577
 K0405 L04 L05 0.2370
 K0405WB L04WB L05WB 0.1281
 C0405 N04C N05C 5.812e-14
 K0406 L04 L06 0.0939
 K0407 L04 L07 0.0583
 K0506 L05 L06 0.1951
 K0506WB L05WB L06WB 0.0908
 C0506 N05C N06C 3.558e-14

K0507 L05 L07 0.0939
 K0508 L05 L08 0.0577
 K0607 L06 L07 0.2370
 K0607WB L06WB L07WB 0.1281
 C0607 N06C N07C 5.812e-14
 K0608 L06 L08 0.1055
 K0608WB L06WB L08WB 0.0542
 K0609 L06 L09 0.0577
 K0708 L07 L08 0.2384
 K0708WB L07WB L08WB 0.1787
 C0708 N07C N08C 5.860e-14
 K0709 L07 L09 0.1006
 K0709WB L07WB L09WB 0.0729
 K0710 L07 L10 0.0559
 K0809 L08 L09 0.2333
 K0809WB L08WB L09WB 0.1970
 C0809 N08C N09C 7.150e-14
 K0810 L08 L10 0.1016
 K0810WB L08WB L10WB 0.0788
 K0910 L09 L10 0.2780
 K0910WB L09WB L10WB 0.2168
 C0910 N09C N10C 1.222e-13
 K0911WB L09WB L11WB 0.0542
 K1011WB L10WB L11WB 0.1061
 K1012WB L10WB L12WB 0.0542
 K1112 L11 L12 0.2780
 K1112WB L11WB L12WB 0.2168
 C1112 N11C N12C 1.222e-13
 K1113 L11 L13 0.1016
 K1113WB L11WB L13WB 0.0788
 K1114 L11 L14 0.0559
 K1213 L12 L13 0.2333
 K1213WB L12WB L13WB 0.1970
 C1213 N12C N13C 7.150e-14
 K1214 L12 L14 0.1006
 K1214WB L12WB L14WB 0.0729
 K1215 L12 L15 0.0577
 K1314 L13 L14 0.2384
 K1314WB L13WB L14WB 0.1787
 C1314 N13C N14C 5.860e-14
 K1315 L13 L15 0.1055
 K1315WB L13WB L15WB 0.0542
 K1316 L13 L16 0.0577
 K1415 L14 L15 0.2370
 K1415WB L14WB L15WB 0.1281
 C1415 N14C N15C 5.812e-14
 K1416 L14 L16 0.0939
 K1417 L14 L17 0.0583
 K1516 L15 L16 0.1951
 K1516WB L15WB L16WB 0.0908
 C1516 N15C N16C 3.558e-14
 K1517 L15 L17 0.0939
 K1518 L15 L18 0.0577
 K1617 L16 L17 0.2370
 K1617WB L16WB L17WB 0.1281
 C1617 N16C N17C 5.812e-14
 K1618 L16 L18 0.1055
 K1618WB L16WB L18WB 0.0542
 K1619 L16 L19 0.0577
 K1718 L17 L18 0.2384
 K1718WB L17WB L18WB 0.1787
 C1718 N17C N18C 5.860e-14

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K1719 L17 L19 0.1006
K1719WB L17WB L19WB 0.0729
K1720 L17 L20 0.0559
K1819 L18 L19 0.2333
K1819WB L18WB L19WB 0.1970
C1819 N18C N19C 7.150e-14
K1820 L18 L20 0.1016
K1820WB L18WB L20WB 0.0788
K1920 L19 L20 0.2780
K1920WB L19WB L20WB 0.2168
C1920 N19C N20C 1.222e-13
.ENDS PACKAGE

Package:24 Lead QFN

```

*
*
*****
* Note:
* 1. The model assume ground plane is 15 mil below package
* 2. The model assume flag is grounded
* 3. the model assume single wires are used for each pin.
*****
* Lead Frame drawing: 4 x 4 mm QFN
* Case Outline :
*****
*
* Package: 24 pin QFN
* Model for 24 pins
*
*
* Conductor number-pin designation cross reference:
*
*   Conductor   Pin
*       1         1
*       2         2
*       3         3
*       4         4
*       5         5
*       6         6
*       7         7
*       8         8
*       9         9
*      10        10
*      11        11
*      12        12
*      13        13
*      14        14
*      15        15
*      16        16
*      17        17
*      18        18
*      19        19
*      20        20
*      21        21
*      22        22
*      23        23
*      24        24
*
* number of lumps:      1
* FASTEST APPLICABLE EDGE RATE:      0.005 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
.SUBCKT PACKAGE N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O N09I N09O
+ N10I N10O N11I N11O N12I N12O N13I N13O N14I N14O
+ N15I N15O N16I N16O N17I N17O N18I N18O N19I N19O
+ N20I N20O N21I N21O N22I N22O N23I N23O N24I N24O BD_GND
R01WB  N01I  N01W  5.556e-02
L01WB  N01W  N01R  1.319e-09
R01    N01R  N01C  5.000e-03
C01    N01C  BD_GND 5.826e-14
L01    N01C  N01O  1.349e-11

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R02WB	N02I	N02W	4.976e-02
L02WB	N02W	N02R	1.206e-09
R02	N02R	N02C	5.000e-03
C02	N02C	BD_GND	4.590e-14
L02	N02C	N020	1.328e-11
R03WB	N03I	N03W	4.665e-02
L03WB	N03W	N03R	1.146e-09
R03	N03R	N03C	5.000e-03
C03	N03C	BD_GND	4.486e-14
L03	N03C	N030	1.329e-11
R04WB	N04I	N04W	4.665e-02
L04WB	N04W	N04R	1.146e-09
R04	N04R	N04C	5.000e-03
C04	N04C	BD_GND	4.453e-14
L04	N04C	N040	1.328e-11
R05WB	N05I	N05W	4.976e-02
L05WB	N05W	N05R	1.206e-09
R05	N05R	N05C	5.000e-03
C05	N05C	BD_GND	4.608e-14
L05	N05C	N050	1.324e-11
R06WB	N06I	N06W	5.556e-02
L06WB	N06W	N06R	1.319e-09
R06	N06R	N06C	5.000e-03
C06	N06C	BD_GND	5.836e-14
L06	N06C	N060	1.342e-11
R07WB	N07I	N07W	5.556e-02
L07WB	N07W	N07R	1.319e-09
R07	N07R	N07C	5.000e-03
C07	N07C	BD_GND	5.857e-14
L07	N07C	N070	1.339e-11
R08WB	N08I	N08W	4.976e-02
L08WB	N08W	N08R	1.206e-09
R08	N08R	N08C	5.000e-03
C08	N08C	BD_GND	4.581e-14
L08	N08C	N080	1.324e-11
R09WB	N09I	N09W	4.665e-02
L09WB	N09W	N09R	1.146e-09
R09	N09R	N09C	5.000e-03
C09	N09C	BD_GND	4.446e-14
L09	N09C	N090	1.328e-11
R10WB	N10I	N10W	4.665e-02
L10WB	N10W	N10R	1.146e-09
R10	N10R	N10C	5.000e-03
C10	N10C	BD_GND	4.450e-14
L10	N10C	N100	1.331e-11
R11WB	N11I	N11W	4.976e-02
L11WB	N11W	N11R	1.206e-09
R11	N11R	N11C	5.000e-03
C11	N11C	BD_GND	4.587e-14
L11	N11C	N110	1.329e-11
R12WB	N12I	N12W	5.556e-02
L12WB	N12W	N12R	1.319e-09
R12	N12R	N12C	5.000e-03
C12	N12C	BD_GND	5.815e-14
L12	N12C	N120	1.345e-11
R13WB	N13I	N13W	5.556e-02
L13WB	N13W	N13R	1.319e-09
R13	N13R	N13C	5.000e-03
C13	N13C	BD_GND	5.840e-14
L13	N13C	N130	1.344e-11
R14WB	N14I	N14W	4.976e-02
L14WB	N14W	N14R	1.206e-09

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R14	N14R	N14C	5.000e-03
C14	N14C	BD_GND	4.612e-14
L14	N14C	N140	1.329e-11
R15WB	N15I	N15W	4.665e-02
L15WB	N15W	N15R	1.146e-09
R15	N15R	N15C	5.000e-03
C15	N15C	BD_GND	4.473e-14
L15	N15C	N150	1.332e-11
R16WB	N16I	N16W	4.665e-02
L16WB	N16W	N16R	1.146e-09
R16	N16R	N16C	5.000e-03
C16	N16C	BD_GND	4.464e-14
L16	N16C	N160	1.328e-11
R17WB	N17I	N17W	4.976e-02
L17WB	N17W	N17R	1.206e-09
R17	N17R	N17C	5.000e-03
C17	N17C	BD_GND	4.582e-14
L17	N17C	N170	1.325e-11
R18WB	N18I	N18W	5.556e-02
L18WB	N18W	N18R	1.319e-09
R18	N18R	N18C	5.000e-03
C18	N18C	BD_GND	5.818e-14
L18	N18C	N180	1.343e-11
R19WB	N19I	N19W	5.556e-02
L19WB	N19W	N19R	1.319e-09
R19	N19R	N19C	5.000e-03
C19	N19C	BD_GND	5.829e-14
L19	N19C	N190	1.343e-11
R20WB	N20I	N20W	4.976e-02
L20WB	N20W	N20R	1.206e-09
R20	N20R	N20C	5.000e-03
C20	N20C	BD_GND	4.615e-14
L20	N20C	N200	1.332e-11
R21WB	N21I	N21W	4.665e-02
L21WB	N21W	N21R	1.146e-09
R21	N21R	N21C	5.000e-03
C21	N21C	BD_GND	4.467e-14
L21	N21C	N210	1.336e-11
R22WB	N22I	N22W	4.665e-02
L22WB	N22W	N22R	1.146e-09
R22	N22R	N22C	5.000e-03
C22	N22C	BD_GND	4.476e-14
L22	N22C	N220	1.340e-11
R23WB	N23I	N23W	4.976e-02
L23WB	N23W	N23R	1.206e-09
R23	N23R	N23C	5.000e-03
C23	N23C	BD_GND	4.582e-14
L23	N23C	N230	1.340e-11
R24WB	N24I	N24W	5.556e-02
L24WB	N24W	N24R	1.319e-09
R24	N24R	N24C	5.000e-03
C24	N24C	BD_GND	5.872e-14
L24	N24C	N240	1.347e-11
K0102	L01	L02	0.2857
K0102WB	L01WB	L02WB	0.2034
C0102	N01C	N02C	1.685e-14
K0103	L01	L03	0.1556
K0103WB	L01WB	L03WB	0.0777
K0104	L01	L04	0.1042
K0105	L01	L05	0.0778
K0106	L01	L06	0.0624
K0121	L01	L21	0.0549

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K0122	L01	L22	0.0661
K0123	L01	L23	0.0819
K0124	L01	L24	0.1047
K0203	L02	L03	0.2817
K0203WB	L02WB	L03WB	0.2034
C0203	N02C	N03C	1.681e-14
K0204	L02	L04	0.1540
K0204WB	L02WB	L04WB	0.0777
K0205	L02	L05	0.1042
K0206	L02	L06	0.0778
K0221	L02	L21	0.0503
K0222	L02	L22	0.0584
K0223	L02	L23	0.0691
K0224	L02	L24	0.0832
K0304	L03	L04	0.2838
K0304WB	L03WB	L04WB	0.2034
C0304	N03C	N04C	1.690e-14
K0305	L03	L05	0.1553
K0305WB	L03WB	L05WB	0.0777
K0306	L03	L06	0.1051
K0307	L03	L07	0.0550
K0308	L03	L08	0.0504
K0322	L03	L22	0.0514
K0323	L03	L23	0.0585
K0324	L03	L24	0.0670
K0405	L04	L05	0.2816
K0405WB	L04WB	L05WB	0.2034
C0405	N04C	N05C	1.695e-14
K0406	L04	L06	0.1555
K0406WB	L04WB	L06WB	0.0777
K0407	L04	L07	0.0679
K0408	L04	L08	0.0596
K0409	L04	L09	0.0525
K0424	L04	L24	0.0542
K0506	L05	L06	0.2840
K0506WB	L05WB	L06WB	0.2034
C0506	N05C	N06C	1.698e-14
K0507	L05	L07	0.0843
K0507WB	L05WB	L07WB	0.0563
K0508	L05	L08	0.0706
K0509	L05	L09	0.0597
K0510	L05	L10	0.0505
K0607	L06	L07	0.1065
K0607WB	L06WB	L07WB	0.1166
K0608	L06	L08	0.0843
K0608WB	L06WB	L08WB	0.0563
K0609	L06	L09	0.0681
K0610	L06	L10	0.0550
K0708	L07	L08	0.2837
K0708WB	L07WB	L08WB	0.2034
C0708	N07C	N08C	1.663e-14
K0709	L07	L09	0.1556
K0709WB	L07WB	L09WB	0.0777
K0710	L07	L10	0.1047
K0711	L07	L11	0.0781
K0712	L07	L12	0.0625
K0809	L08	L09	0.2826
K0809WB	L08WB	L09WB	0.2034
C0809	N08C	N09C	1.677e-14
K0810	L08	L10	0.1556
K0810WB	L08WB	L10WB	0.0777
K0811	L08	L11	0.1052

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K0812	L08	L12	0.0781
K0910	L09	L10	0.2843
K0910WB	L09WB	L10WB	0.2034
C0910	N09C	N10C	1.677e-14
K0911	L09	L11	0.1562
K0911WB	L09WB	L11WB	0.0777
K0912	L09	L12	0.1047
K0913	L09	L13	0.0546
K1011	L10	L11	0.2846
K1011WB	L10WB	L11WB	0.2034
C1011	N10C	N11C	1.684e-14
K1012	L10	L12	0.1555
K1012WB	L10WB	L12WB	0.0777
K1013	L10	L13	0.0674
K1014	L10	L14	0.0588
K1015	L10	L15	0.0518
K1112	L11	L12	0.2838
K1112WB	L11WB	L12WB	0.2034
C1112	N11C	N12C	1.695e-14
K1113	L11	L13	0.0836
K1113WB	L11WB	L13WB	0.0563
K1114	L11	L14	0.0696
K1115	L11	L15	0.0589
K1213	L12	L13	0.1064
K1213WB	L12WB	L13WB	0.1166
K1214	L12	L14	0.0836
K1214WB	L12WB	L14WB	0.0563
K1215	L12	L15	0.0674
K1216	L12	L16	0.0546
K1314	L13	L14	0.2838
K1314WB	L13WB	L14WB	0.2034
C1314	N13C	N14C	1.687e-14
K1315	L13	L15	0.1558
K1315WB	L13WB	L15WB	0.0777
K1316	L13	L16	0.1050
K1317	L13	L17	0.0784
K1318	L13	L18	0.0626
K1415	L14	L15	0.2849
K1415WB	L14WB	L15WB	0.2034
C1415	N14C	N15C	1.673e-14
K1416	L14	L16	0.1564
K1416WB	L14WB	L16WB	0.0777
K1417	L14	L17	0.1054
K1418	L14	L18	0.0780
K1516	L15	L16	0.2845
K1516WB	L15WB	L16WB	0.2034
C1516	N15C	N16C	1.684e-14
K1517	L15	L17	0.1559
K1517WB	L15WB	L17WB	0.0777
K1518	L15	L18	0.1047
K1519	L15	L19	0.0543
K1617	L16	L17	0.2828
K1617WB	L16WB	L17WB	0.2034
C1617	N16C	N17C	1.678e-14
K1618	L16	L18	0.1557
K1618WB	L16WB	L18WB	0.0777
K1619	L16	L19	0.0674
K1620	L16	L20	0.0591
K1621	L16	L21	0.0521
K1718	L17	L18	0.2843
K1718WB	L17WB	L18WB	0.2034
C1718	N17C	N18C	1.690e-14

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K1719	L17	L19	0.0838
K1719WB	L17WB	L19WB	0.0563
K1720	L17	L20	0.0702
K1721	L17	L21	0.0595
K1722	L17	L22	0.0503
K1819	L18	L19	0.1062
K1819WB	L18WB	L19WB	0.1166
K1820	L18	L20	0.0841
K1820WB	L18WB	L20WB	0.0563
K1821	L18	L21	0.0679
K1822	L18	L22	0.0549
K1920	L19	L20	0.2849
K1920WB	L19WB	L20WB	0.2034
C1920	N19C	N20C	1.688e-14
K1921	L19	L21	0.1568
K1921WB	L19WB	L21WB	0.0777
K1922	L19	L22	0.1059
K1923	L19	L23	0.0792
K1924	L19	L24	0.0638
K2021	L20	L21	0.2853
K2021WB	L20WB	L21WB	0.2034
C2021	N20C	N21C	1.689e-14
K2022	L20	L22	0.1589
K2022WB	L20WB	L22WB	0.0777
K2023	L20	L23	0.1074
K2024	L20	L24	0.0799
K2122	L21	L22	0.2877
K2122WB	L21WB	L22WB	0.2034
C2122	N21C	N22C	1.678e-14
K2123	L21	L23	0.1591
K2123WB	L21WB	L23WB	0.0777
K2124	L21	L24	0.1072
K2223	L22	L23	0.2878
K2223WB	L22WB	L23WB	0.2034
C2223	N22C	N23C	1.690e-14
K2224	L22	L24	0.1588
K2224WB	L22WB	L24WB	0.0777
K2324	L23	L24	0.2873
K2324WB	L23WB	L24WB	0.2034
K2301WB	L23WB	L01WB	0.0563
C2324	N23C	N24C	1.693e-14
K2401WB	L24WB	L01WB	0.1166
K2402WB	L24WB	L02WB	0.0563
.ENDS PACKAGE			
*			
*			

Package: 32-TQFP

```
* SPICE subcircuit file of coupled transmission lines
*
* Transmission line model
*
* Conductor number-pin designation cross reference:
*   Conductor      Pin
*       1           1
*       2           2
*       3           3
*       4           4
*       5           5
*       6           6
*       7           7
*       8           8
*       9           9
*      10          10
*      11          11
*      12          12
*      13          13
*      14          14
*      15          15
*      16          16
*      17          17
*      18          18
*      19          19
*      20          20
*      21          21
*      22          22
*      23          23
*      24          24
*      25          25
*      26          26
*      27          27
*      28          28
*      29          29
*      30          30
*      31          31
*      32          32
*
* number of lumps: 1
* FASTEST APPLICABLE EDGE RATE:  0.135 ns
* Equivalent bandwidth:           2.6   GHz
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
**CONNECT CHIP SIDE TO N**I AND BOARD SIDE TO N**O
* ECLinPS PLUS usage requires the input nodes used in the subcircuit call
* statement(X_777) that are tied to global ports(VCC, VCC0, and VEE internal
* to the die) to have the same global names in the subcircuit call statement(X_777).
* For example, if VCC is wirebonded to pin 1, 9, 16, and 32 for a certain design, then
* N01I, N09I, N16I, and N32I should be relabeled to VCC. Again, the change needs only to
* be incorporated in the X_777 subcircuit callout statement. Since this requires a change
* to the netlist below, it is necessary for each design to have a copy of this file with
* the appropriate changes made that are required for that design.
*
R_SHORT 0 ground 0.0001
*
X_777 N01I N010 N02I N020 N03I N030 N04I N040
+ N05I N050 N06I N060 N07I N070 N08I N080 N09I N090
+ N10I N100 N11I N110 N12I N120 N13I N130 N14I N140
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+ N15I N150 N16I N160 N17I N170 N18I N180 N19I N190
+ N20I N200 N21I N210 N22I N220 N23I N230 N24I N240
+ N25I N250 N26I N260 N27I N270 N28I N280 N29I N290
+ N30I N300 N31I N310 N32I N320 ground PACKAGE
*
.SUBCKT PACKAGE N01I N010 N02I N020 N03I N030 N04I N040
+ N05I N050 N06I N060 N07I N070 N08I N080 N09I N090
+ N10I N100 N11I N110 N12I N120 N13I N130 N14I N140
+ N15I N150 N16I N160 N17I N170 N18I N180 N19I N190
+ N20I N200 N21I N210 N22I N220 N23I N230 N24I N240
+ N25I N250 N26I N260 N27I N270 N28I N280 N29I N290
+ N30I N300 N31I N310 N32I N320 ground
*
R01WB N01I N01W 5.432e-02
L01WB N01W N01R 1.295e-09
R01 N01R N01C 1.560e-03
C01 N01C ground 2.813e-13
L01 N01C N010 1.584e-09
R02WB N02I N02W 4.976e-02
L02WB N02W N02R 1.206e-09
R02 N02R N02C 1.330e-03
C02 N02C ground 1.308e-13
L02 N02C N020 1.437e-09
R03WB N03I N03W 4.810e-02
L03WB N03W N03R 1.174e-09
R03 N03R N03C 1.170e-03
C03 N03C ground 1.235e-13
L03 N03C N030 1.321e-09
R04WB N04I N04W 4.561e-02
L04WB N04W N04R 1.126e-09
R04 N04R N04C 1.100e-03
C04 N04C ground 1.207e-13
L04 N04C N040 1.259e-09
R05WB N05I N05W 4.561e-02
L05WB N05W N05R 1.126e-09
R05 N05R N05C 1.100e-03
C05 N05C ground 1.207e-13
L05 N05C N050 1.259e-09
R06WB N06I N06W 4.810e-02
L06WB N06W N06R 1.174e-09
R06 N06R N06C 1.170e-03
C06 N06C ground 1.235e-13
L06 N06C N060 1.321e-09
R07WB N07I N07W 4.976e-02
L07WB N07W N07R 1.206e-09
R07 N07R N07C 1.330e-03
C07 N07C ground 1.308e-13
L07 N07C N070 1.437e-09
R08WB N08I N08W 5.432e-02
L08WB N08W N08R 1.295e-09
R08 N08R N08C 1.560e-03
C08 N08C ground 2.813e-13
L08 N08C N080 1.584e-09
R09WB N09I N09W 5.432e-02
L09WB N09W N09R 1.295e-09
R09 N09R N09C 1.560e-03
C09 N09C ground 2.813e-13
L09 N09C N090 1.584e-09
R10WB N10I N10W 4.976e-02
L10WB N10W N10R 1.206e-09
R10 N10R N10C 1.330e-03
C10 N10C ground 1.308e-13
```

L10 N10C N100 1.437e-09
R11WB N11I N11W 4.810e-02
L11WB N11W N11R 1.174e-09
R11 N11R N11C 1.170e-03
C11 N11C ground 1.235e-13
L11 N11C N110 1.321e-09
R12WB N12I N12W 4.561e-02
L12WB N12W N12R 1.126e-09
R12 N12R N12C 1.100e-03
C12 N12C ground 1.207e-13
L12 N12C N120 1.259e-09
R13WB N13I N13W 4.561e-02
L13WB N13W N13R 1.126e-09
R13 N13R N13C 1.100e-03
C13 N13C ground 1.207e-13
L13 N13C N130 1.259e-09
R14WB N14I N14W 4.810e-02
L14WB N14W N14R 1.174e-09
R14 N14R N14C 1.170e-03
C14 N14C ground 1.235e-13
L14 N14C N140 1.321e-09
R15WB N15I N15W 4.976e-02
L15WB N15W N15R 1.206e-09
R15 N15R N15C 1.330e-03
C15 N15C ground 1.308e-13
L15 N15C N150 1.437e-09
R16WB N16I N16W 5.432e-02
L16WB N16W N16R 1.295e-09
R16 N16R N16C 1.560e-03
C16 N16C ground 2.813e-13
L16 N16C N160 1.584e-09
R17WB N17I N17W 5.432e-02
L17WB N17W N17R 1.295e-09
R17 N17R N17C 1.560e-03
C17 N17C ground 2.813e-13
L17 N17C N170 1.584e-09
R18WB N18I N18W 4.976e-02
L18WB N18W N18R 1.206e-09
R18 N18R N18C 1.330e-03
C18 N18C ground 1.308e-13
L18 N18C N180 1.437e-09
R19WB N19I N19W 4.810e-02
L19WB N19W N19R 1.174e-09
R19 N19R N19C 1.170e-03
C19 N19C ground 1.235e-13
L19 N19C N190 1.321e-09
R20WB N20I N20W 4.561e-02
L20WB N20W N20R 1.126e-09
R20 N20R N20C 1.100e-03
C20 N20C ground 1.207e-13
L20 N20C N200 1.259e-09
R21WB N21I N21W 4.561e-02
L21WB N21W N21R 1.126e-09
R21 N21R N21C 1.100e-03
C21 N21C ground 1.207e-13
L21 N21C N210 1.259e-09
R22WB N22I N22W 4.810e-02
L22WB N22W N22R 1.174e-09
R22 N22R N22C 1.170e-03
C22 N22C ground 1.235e-13
L22 N22C N220 1.321e-09
R23WB N23I N23W 4.976e-02

L23WB N23W N23R 1.206e-09
 R23 N23R N23C 1.330e-03
 C23 N23C ground 1.308e-13
 L23 N23C N230 1.437e-09
 R24WB N24I N24W 5.432e-02
 L24WB N24W N24R 1.295e-09
 R24 N24R N24C 1.560e-03
 C24 N24C ground 2.813e-13
 L24 N24C N240 1.584e-09
 R25WB N25I N25W 5.432e-02
 L25WB N25W N25R 1.295e-09
 R25 N25R N25C 1.560e-03
 C25 N25C ground 2.813e-13
 L25 N25C N250 1.584e-09
 R26WB N26I N26W 4.976e-02
 L26WB N26W N26R 1.206e-09
 R26 N26R N26C 1.330e-03
 C26 N26C ground 1.308e-13
 L26 N26C N260 1.437e-09
 R27WB N27I N27W 4.810e-02
 L27WB N27W N27R 1.174e-09
 R27 N27R N27C 1.170e-03
 C27 N27C ground 1.235e-13
 L27 N27C N270 1.321e-09
 R28WB N28I N28W 4.561e-02
 L28WB N28W N28R 1.126e-09
 R28 N28R N28C 1.100e-03
 C28 N28C ground 1.207e-13
 L28 N28C N280 1.259e-09
 R29WB N29I N29W 4.561e-02
 L29WB N29W N29R 1.126e-09
 R29 N29R N29C 1.100e-03
 C29 N29C ground 1.207e-13
 L29 N29C N290 1.259e-09
 R30WB N30I N30W 4.810e-02
 L30WB N30W N30R 1.174e-09
 R30 N30R N30C 1.170e-03
 C30 N30C ground 1.235e-13
 L30 N30C N300 1.321e-09
 R31WB N31I N31W 4.976e-02
 L31WB N31W N31R 1.206e-09
 R31 N31R N31C 1.330e-03
 C31 N31C ground 1.308e-13
 L31 N31C N310 1.437e-09
 R32WB N32I N32W 5.432e-02
 L32WB N32W N32R 1.295e-09
 R32 N32R N32C 1.560e-03
 C32 N32C ground 2.813e-13
 L32 N32C N320 1.584e-09
 K0102 L01 L02 0.3413
 K0102WB L01WB L02WB 0.2544
 C0102 N01C N02C 1.426e-13
 K0103 L01 L03 0.1426
 K0103WB L01WB L03WB 0.1061
 K0104 L01 L04 0.0720
 K0104WB L01WB L04WB 0.0674
 K0130 L01 L30 0.0607
 K0131 L01 L31 0.1053
 K0131WB L01WB L31WB 0.0799
 K0132 L01 L32 0.1899
 K0132WB L01WB L32WB 0.1729
 K0203 L02 L03 0.3211

K0203WB L02WB L03WB 0.2628
 C0203 N02C N03C 1.205e-13
 K0204 L02 L04 0.1333
 K0204WB L02WB L04WB 0.1162
 K0205 L02 L05 0.0701
 K0205WB L02WB L05WB 0.0697
 K0231 L02 L31 0.0706
 K0232 L02 L32 0.1053
 K0232WB L02WB L32WB 0.0799
 K0304 L03 L04 0.3070
 K0304WB L03WB L04WB 0.2809
 C0304 N03C N04C 1.038e-13
 K0305 L03 L05 0.1301
 K0305WB L03WB L05WB 0.1200
 K0306 L03 L06 0.0683
 K0306WB L03WB L06WB 0.0719
 K0332 L03 L32 0.0607
 K0405 L04 L05 0.3070
 K0405WB L04WB L05WB 0.2717
 C0405 N04C N05C 1.041e-13
 K0406 L04 L06 0.1301
 K0406WB L04WB L06WB 0.1200
 K0407 L04 L07 0.0701
 K0407WB L04WB L07WB 0.0697
 K0506 L05 L06 0.3070
 K0506WB L05WB L06WB 0.2809
 C0506 N05C N06C 1.038e-13
 K0507 L05 L07 0.1333
 K0507WB L05WB L07WB 0.1162
 K0508 L05 L08 0.0720
 K0508WB L05WB L08WB 0.0674
 K0607 L06 L07 0.3211
 K0607WB L06WB L07WB 0.2628
 C0607 N06C N07C 1.205e-13
 K0608 L06 L08 0.1426
 K0608WB L06WB L08WB 0.1061
 K0609 L06 L09 0.0607
 K0708 L07 L08 0.3413
 K0708WB L07WB L08WB 0.2544
 C0708 N07C N08C 1.426e-13
 K0709 L07 L09 0.1053
 K0709WB L07WB L09WB 0.0799
 K0710 L07 L10 0.0706
 K0809 L08 L09 0.1899
 K0809WB L08WB L09WB 0.1729
 K0810 L08 L10 0.1053
 K0810WB L08WB L10WB 0.0799
 K0811 L08 L11 0.0607
 K0910 L09 L10 0.3413
 K0910WB L09WB L10WB 0.2544
 C0910 N09C N10C 1.426e-13
 K0911 L09 L11 0.1426
 K0911WB L09WB L11WB 0.1061
 K0912 L09 L12 0.0720
 K0912WB L09WB L12WB 0.0674
 K1011 L10 L11 0.3211
 K1011WB L10WB L11WB 0.2628
 C1011 N10C N11C 1.205e-13
 K1012 L10 L12 0.1333
 K1012WB L10WB L12WB 0.1162
 K1013 L10 L13 0.0701
 K1013WB L10WB L13WB 0.0697

K1112 L11 L12 0.3070
K1112WB L11WB L12WB 0.2809
C1112 N11C N12C 1.038e-13
K1113 L11 L13 0.1301
K1113WB L11WB L13WB 0.1200
K1114 L11 L14 0.0683
K1114WB L11WB L14WB 0.0719
K1213 L12 L13 0.3070
K1213WB L12WB L13WB 0.2717
C1213 N12C N13C 1.041e-13
K1214 L12 L14 0.1301
K1214WB L12WB L14WB 0.1200
K1215 L12 L15 0.0701
K1215WB L12WB L15WB 0.0697
K1314 L13 L14 0.3070
K1314WB L13WB L14WB 0.2809
C1314 N13C N14C 1.038e-13
K1315 L13 L15 0.1333
K1315WB L13WB L15WB 0.1162
K1316 L13 L16 0.0720
K1316WB L13WB L16WB 0.0674
K1415 L14 L15 0.3211
K1415WB L14WB L15WB 0.2628
C1415 N14C N15C 1.205e-13
K1416 L14 L16 0.1426
K1416WB L14WB L16WB 0.1061
K1417 L14 L17 0.0607
K1516 L15 L16 0.3413
K1516WB L15WB L16WB 0.2544
C1516 N15C N16C 1.426e-13
K1517 L15 L17 0.1053
K1517WB L15WB L17WB 0.0799
K1518 L15 L18 0.0706
K1617 L16 L17 0.1899
K1617WB L16WB L17WB 0.1729
K1618 L16 L18 0.1053
K1618WB L16WB L18WB 0.0799
K1619 L16 L19 0.0607
K1718 L17 L18 0.3413
K1718WB L17WB L18WB 0.2544
C1718 N17C N18C 1.426e-13
K1719 L17 L19 0.1426
K1719WB L17WB L19WB 0.1061
K1720 L17 L20 0.0720
K1720WB L17WB L20WB 0.0674
K1819 L18 L19 0.3211
K1819WB L18WB L19WB 0.2628
C1819 N18C N19C 1.205e-13
K1820 L18 L20 0.1333
K1820WB L18WB L20WB 0.1162
K1821 L18 L21 0.0701
K1821WB L18WB L21WB 0.0697
K1920 L19 L20 0.3070
K1920WB L19WB L20WB 0.2809
C1920 N19C N20C 1.038e-13
K1921 L19 L21 0.1301
K1921WB L19WB L21WB 0.1200
K1922 L19 L22 0.0683
K1922WB L19WB L22WB 0.0719
K2021 L20 L21 0.3070
K2021WB L20WB L21WB 0.2717
C2021 N20C N21C 1.041e-13

K2022 L20 L22 0.1301
K2022WB L20WB L22WB 0.1200
K2023 L20 L23 0.0701
K2023WB L20WB L23WB 0.0697
K2122 L21 L22 0.3070
K2122WB L21WB L22WB 0.2809
C2122 N21C N22C 1.038e-13
K2123 L21 L23 0.1333
K2123WB L21WB L23WB 0.1162
K2124 L21 L24 0.0720
K2124WB L21WB L24WB 0.0674
K2223 L22 L23 0.3211
K2223WB L22WB L23WB 0.2628
C2223 N22C N23C 1.205e-13
K2224 L22 L24 0.1426
K2224WB L22WB L24WB 0.1061
K2225 L22 L25 0.0607
K2324 L23 L24 0.3413
K2324WB L23WB L24WB 0.2544
C2324 N23C N24C 1.426e-13
K2325 L23 L25 0.1053
K2325WB L23WB L25WB 0.0799
K2326 L23 L26 0.0706
K2425 L24 L25 0.1899
K2425WB L24WB L25WB 0.1729
K2426 L24 L26 0.1053
K2426WB L24WB L26WB 0.0799
K2427 L24 L27 0.0607
K2526 L25 L26 0.3413
K2526WB L25WB L26WB 0.2544
C2526 N25C N26C 1.426e-13
K2527 L25 L27 0.1426
K2527WB L25WB L27WB 0.1061
K2528 L25 L28 0.0720
K2528WB L25WB L28WB 0.0674
K2627 L26 L27 0.3211
K2627WB L26WB L27WB 0.2628
C2627 N26C N27C 1.205e-13
K2628 L26 L28 0.1333
K2628WB L26WB L28WB 0.1162
K2629 L26 L29 0.0701
K2629WB L26WB L29WB 0.0697
K2728 L27 L28 0.3070
K2728WB L27WB L28WB 0.2809
C2728 N27C N28C 1.038e-13
K2729 L27 L29 0.1301
K2729WB L27WB L29WB 0.1200
K2730 L27 L30 0.0683
K2730WB L27WB L30WB 0.0719
K2829 L28 L29 0.3070
K2829WB L28WB L29WB 0.2717
C2829 N28C N29C 1.041e-13
K2830 L28 L30 0.1301
K2830WB L28WB L30WB 0.1200
K2831 L28 L31 0.0701
K2831WB L28WB L31WB 0.0697
K2930 L29 L30 0.3070
K2930WB L29WB L30WB 0.2809
C2930 N29C N30C 1.038e-13
K2931 L29 L31 0.1333
K2931WB L29WB L31WB 0.1162
K2932 L29 L32 0.0720

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K2932WB L29WB L32WB 0.0674
K3031 L30 L31 0.3211
K3031WB L30WB L31WB 0.2628
C3031 N30C N31C 1.205e-13
K3032 L30 L32 0.1426
K3032WB L30WB L32WB 0.1061
K3132 L31 L32 0.3413
K3132WB L31WB L32WB 0.2544
C3132 N31C N32C 1.426e-13
.ENDS PACKAGE

Package: LQFP-52

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*****
* Note:
* 1. The model assume ground plane is 15 mil below package
*****
* Transmission line model
*
* Package: 52 pin LQFP
* Model for 52 pins
*
* Conductor number-pin designation cross reference:
*
*   Conductor      Pin
*   1              1
*   2              2
*   3              3
*   4              4
*   5              5
*   6              6
*   7              7
*   8              8
*   9              9
*  10             10
*  11             11
*  12             12
*  13             13
*  14             14
*  15             15
*  16             16
*  17             17
*  18             18
*  19             19
*  20             20
*  21             21
*  22             22
*  23             23
*  24             24
*  25             25
*  26             26
*  27             27
*  28             28
*  29             29
*  30             30
*  31             31
*  32             32
*  33             33
*  34             34
*  35             35
*  36             36
*  37             37
*  38             38
*  39             39
*  40             40
*  41             41
*  42             42
*  43             43
*  44             44
*  45             45
*  46             46
*  47             47
*  48             48
*  49             49

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*      50      50
*      51      51
*      52      52
*
* number of lumps: 1
* FASTEST APPLICABLE EDGE RATE: 0.160 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
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.SUBCKT PACKAGE N01I N010 N02I N020 N03I N030 N04I N040
+ N05I N050 N06I N060 N07I N070 N08I N080 N09I N090
+ N10I N100 N11I N110 N12I N120 N13I N130 N14I N140
+ N15I N150 N16I N160 N17I N170 N18I N180 N19I N190
+ N20I N200 N21I N210 N22I N220 N23I N230 N24I N240
+ N25I N250 N26I N260 N27I N270 N28I N280 N29I N290
+ N30I N300 N31I N310 N32I N320 N33I N330 N34I N340
+ N35I N350 N36I N360 N37I N370 N38I N380 N39I N390
+ N40I N400 N41I N410 N42I N420 N43I N430 N44I N440
+ N45I N450 N46I N460 N47I N470 N48I N480 N49I N490
+ N50I N500 N51I N510 N52I N520 BD_GND
R01WB N01I N01W 8.625e-02
L01WB N01W N01R 1.931e-09
R01 N01R N01M 1.650e-02
L01l N01M N01C 1.113e-09
C01 N01C BD_GND 2.107e-13
L01r N01C N010 1.113e-09
R02WB N02I N02W 8.376e-02
L02WB N02W N02R 1.880e-09
R02 N02R N02M 1.680e-02
L02l N02M N02C 1.063e-09
C02 N02C BD_GND 6.598e-14
L02r N02C N020 1.063e-09
R03WB N03I N03W 7.878e-02
L03WB N03W N03R 1.780e-09
R03 N03R N03M 1.570e-02
L03l N03M N03C 9.940e-10
C03 N03C BD_GND 5.694e-14
L03r N03C N030 9.940e-10
R04WB N04I N04W 7.630e-02
L04WB N04W N04R 1.730e-09
R04 N04R N04M 1.460e-02
L04l N04M N04C 9.368e-10
C04 N04C BD_GND 5.233e-14
L04r N04C N040 9.368e-10
R05WB N05I N05W 7.422e-02
L05WB N05W N05R 1.688e-09
R05 N05R N05M 1.380e-02
L05l N05M N05C 8.830e-10
C05 N05C BD_GND 4.810e-14
L05r N05C N050 8.830e-10
R06WB N06I N06W 7.381e-02
L06WB N06W N06R 1.680e-09
R06 N06R N06M 1.330e-02
L06l N06M N06C 8.557e-10
C06 N06C BD_GND 4.665e-14
L06r N06C N060 8.557e-10
R07WB N07I N07W 7.298e-02
L07WB N07W N07R 1.663e-09
R07 N07R N07M 1.290e-02
L07l N07M N07C 8.187e-10
C07 N07C BD_GND 4.714e-14
L07r N07C N070 8.187e-10
R08WB N08I N08W 7.464e-02
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L08WB	N08W	N08R	1.696e-09
R08	N08R	N08M	1.330e-02
L08l	N08M	N08C	8.557e-10
C08	N08C	BD_GND	4.665e-14
L08r	N08C	N08O	8.557e-10
R09WB	N09I	N09W	7.422e-02
L09WB	N09W	N09R	1.688e-09
R09	N09R	N09M	1.380e-02
L09l	N09M	N09C	8.830e-10
C09	N09C	BD_GND	4.810e-14
L09r	N09C	N09O	8.830e-10
R10WB	N10I	N10W	7.630e-02
L10WB	N10W	N10R	1.730e-09
R10	N10R	N10M	1.460e-02
L10l	N10M	N10C	9.368e-10
C10	N10C	BD_GND	5.233e-14
L10r	N10C	N10O	9.368e-10
R11WB	N11I	N11W	7.878e-02
L11WB	N11W	N11R	1.780e-09
R11	N11R	N11M	1.570e-02
L11l	N11M	N11C	9.940e-10
C11	N11C	BD_GND	5.694e-14
L11r	N11C	N11O	9.940e-10
R12WB	N12I	N12W	8.376e-02
L12WB	N12W	N12R	1.880e-09
R12	N12R	N12M	1.680e-02
L12l	N12M	N12C	1.063e-09
C12	N12C	BD_GND	6.598e-14
L12r	N12C	N12O	1.063e-09
R13WB	N13I	N13W	8.998e-02
L13WB	N13W	N13R	2.008e-09
R13	N13R	N13M	1.650e-02
L13l	N13M	N13C	1.113e-09
C13	N13C	BD_GND	2.107e-13
L13r	N13C	N13O	1.113e-09
R14WB	N14I	N14W	8.625e-02
L14WB	N14W	N14R	1.931e-09
R14	N14R	N14M	1.650e-02
L14l	N14M	N14C	1.113e-09
C14	N14C	BD_GND	2.107e-13
L14r	N14C	N14O	1.113e-09
R15WB	N15I	N15W	8.086e-02
L15WB	N15W	N15R	1.822e-09
R15	N15R	N15M	1.680e-02
L15l	N15M	N15C	1.063e-09
C15	N15C	BD_GND	6.598e-14
L15r	N15C	N15O	1.063e-09
R16WB	N16I	N16W	7.671e-02
L16WB	N16W	N16R	1.738e-09
R16	N16R	N16M	1.570e-02
L16l	N16M	N16C	9.940e-10
C16	N16C	BD_GND	5.694e-14
L16r	N16C	N16O	9.940e-10
R17WB	N17I	N17W	7.422e-02
L17WB	N17W	N17R	1.688e-09
R17	N17R	N17M	1.460e-02
L17l	N17M	N17C	9.368e-10
C17	N17C	BD_GND	5.233e-14
L17r	N17C	N17O	9.368e-10
R18WB	N18I	N18W	7.298e-02
L18WB	N18W	N18R	1.663e-09
R18	N18R	N18M	1.380e-02

L18l	N18M	N18C	8.830e-10
C18	N18C	BD_GND	4.810e-14
L18r	N18C	N180	8.830e-10
R19WB	N19I	N19W	7.381e-02
L19WB	N19W	N19R	1.680e-09
R19	N19R	N19M	1.330e-02
L19l	N19M	N19C	8.557e-10
C19	N19C	BD_GND	4.665e-14
L19r	N19C	N190	8.557e-10
R20WB	N20I	N20W	7.298e-02
L20WB	N20W	N20R	1.663e-09
R20	N20R	N20M	1.290e-02
L20l	N20M	N20C	8.187e-10
C20	N20C	BD_GND	4.714e-14
L20r	N20C	N200	8.187e-10
R21WB	N21I	N21W	7.464e-02
L21WB	N21W	N21R	1.696e-09
R21	N21R	N21M	1.330e-02
L21l	N21M	N21C	8.557e-10
C21	N21C	BD_GND	4.665e-14
L21r	N21C	N210	8.557e-10
R22WB	N22I	N22W	7.588e-02
L22WB	N22W	N22R	1.721e-09
R22	N22R	N22M	1.380e-02
L22l	N22M	N22C	8.830e-10
C22	N22C	BD_GND	4.810e-14
L22r	N22C	N220	8.830e-10
R23WB	N23I	N23W	7.630e-02
L23WB	N23W	N23R	1.730e-09
R23	N23R	N23M	1.460e-02
L23l	N23M	N23C	9.368e-10
C23	N23C	BD_GND	5.233e-14
L23r	N23C	N230	9.368e-10
R24WB	N24I	N24W	7.878e-02
L24WB	N24W	N24R	1.780e-09
R24	N24R	N24M	1.570e-02
L24l	N24M	N24C	9.940e-10
C24	N24C	BD_GND	5.694e-14
L24r	N24C	N240	9.940e-10
R25WB	N25I	N25W	8.376e-02
L25WB	N25W	N25R	1.880e-09
R25	N25R	N25M	1.680e-02
L25l	N25M	N25C	1.063e-09
C25	N25C	BD_GND	6.598e-14
L25r	N25C	N250	1.063e-09
R26WB	N26I	N26W	8.998e-02
L26WB	N26W	N26R	2.008e-09
R26	N26R	N26M	1.650e-02
L26l	N26M	N26C	1.113e-09
C26	N26C	BD_GND	2.107e-13
L26r	N26C	N260	1.113e-09
R27WB	N27I	N27W	8.625e-02
L27WB	N27W	N27R	1.931e-09
R27	N27R	N27M	1.650e-02
L27l	N27M	N27C	1.113e-09
C27	N27C	BD_GND	2.107e-13
L27r	N27C	N270	1.113e-09
R28WB	N28I	N28W	8.086e-02
L28WB	N28W	N28R	1.822e-09
R28	N28R	N28M	1.680e-02
L28l	N28M	N28C	1.063e-09
C28	N28C	BD_GND	6.598e-14

L28r	N28C	N28O	1.063e-09
R29WB	N29I	N29W	7.671e-02
L29WB	N29W	N29R	1.738e-09
R29	N29R	N29M	1.570e-02
L29l	N29M	N29C	9.940e-10
C29	N29C	BD_GND	5.694e-14
L29r	N29C	N29O	9.940e-10
R30WB	N30I	N30W	7.422e-02
L30WB	N30W	N30R	1.688e-09
R30	N30R	N30M	1.460e-02
L30l	N30M	N30C	9.368e-10
C30	N30C	BD_GND	5.233e-14
L30r	N30C	N30O	9.368e-10
R31WB	N31I	N31W	7.298e-02
L31WB	N31W	N31R	1.663e-09
R31	N31R	N31M	1.380e-02
L31l	N31M	N31C	8.830e-10
C31	N31C	BD_GND	4.810e-14
L31r	N31C	N31O	8.830e-10
R32WB	N32I	N32W	7.381e-02
L32WB	N32W	N32R	1.680e-09
R32	N32R	N32M	1.330e-02
L32l	N32M	N32C	8.557e-10
C32	N32C	BD_GND	4.665e-14
L32r	N32C	N32O	8.557e-10
R33WB	N33I	N33W	7.298e-02
L33WB	N33W	N33R	1.663e-09
R33	N33R	N33M	1.290e-02
L33l	N33M	N33C	8.187e-10
C33	N33C	BD_GND	4.714e-14
L33r	N33C	N33O	8.187e-10
R34WB	N34I	N34W	7.464e-02
L34WB	N34W	N34R	1.696e-09
R34	N34R	N34M	1.330e-02
L34l	N34M	N34C	8.557e-10
C34	N34C	BD_GND	4.665e-14
L34r	N34C	N34O	8.557e-10
R35WB	N35I	N35W	7.588e-02
L35WB	N35W	N35R	1.721e-09
R35	N35R	N35M	1.380e-02
L35l	N35M	N35C	8.830e-10
C35	N35C	BD_GND	4.810e-14
L35r	N35C	N35O	8.830e-10
R36WB	N36I	N36W	7.630e-02
L36WB	N36W	N36R	1.730e-09
R36	N36R	N36M	1.460e-02
L36l	N36M	N36C	9.368e-10
C36	N36C	BD_GND	5.233e-14
L36r	N36C	N36O	9.368e-10
R37WB	N37I	N37W	7.878e-02
L37WB	N37W	N37R	1.780e-09
R37	N37R	N37M	1.570e-02
L37l	N37M	N37C	9.940e-10
C37	N37C	BD_GND	5.694e-14
L37r	N37C	N37O	9.940e-10
R38WB	N38I	N38W	8.376e-02
L38WB	N38W	N38R	1.880e-09
R38	N38R	N38M	1.680e-02
L38l	N38M	N38C	1.063e-09
C38	N38C	BD_GND	6.598e-14
L38r	N38C	N38O	1.063e-09
R39WB	N39I	N39W	8.998e-02

L39WB	N39W	N39R	2.008e-09
R39	N39R	N39M	1.650e-02
L39l	N39M	N39C	1.113e-09
C39	N39C	BD_GND	2.107e-13
L39r	N39C	N39O	1.113e-09
R40WB	N40I	N40W	8.625e-02
L40WB	N40W	N40R	1.931e-09
R40	N40R	N40M	1.650e-02
L40l	N40M	N40C	1.113e-09
C40	N40C	BD_GND	2.107e-13
L40r	N40C	N40O	1.113e-09
R41WB	N41I	N41W	8.086e-02
L41WB	N41W	N41R	1.822e-09
R41	N41R	N41M	1.680e-02
L41l	N41M	N41C	1.063e-09
C41	N41C	BD_GND	6.598e-14
L41r	N41C	N41O	1.063e-09
R42WB	N42I	N42W	7.671e-02
L42WB	N42W	N42R	1.738e-09
R42	N42R	N42M	1.570e-02
L42l	N42M	N42C	9.940e-10
C42	N42C	BD_GND	5.694e-14
L42r	N42C	N42O	9.940e-10
R43WB	N43I	N43W	7.422e-02
L43WB	N43W	N43R	1.688e-09
R43	N43R	N43M	1.460e-02
L43l	N43M	N43C	9.368e-10
C43	N43C	BD_GND	5.233e-14
L43r	N43C	N43O	9.368e-10
R44WB	N44I	N44W	7.298e-02
L44WB	N44W	N44R	1.663e-09
R44	N44R	N44M	1.380e-02
L44l	N44M	N44C	8.830e-10
C44	N44C	BD_GND	4.810e-14
L44r	N44C	N44O	8.830e-10
R45WB	N45I	N45W	7.381e-02
L45WB	N45W	N45R	1.680e-09
R45	N45R	N45M	1.330e-02
L45l	N45M	N45C	8.557e-10
C45	N45C	BD_GND	4.665e-14
L45r	N45C	N45O	8.557e-10
R46WB	N46I	N46W	7.298e-02
L46WB	N46W	N46R	1.663e-09
R46	N46R	N46M	1.290e-02
L46l	N46M	N46C	8.187e-10
C46	N46C	BD_GND	4.714e-14
L46r	N46C	N46O	8.187e-10
R47WB	N47I	N47W	7.464e-02
L47WB	N47W	N47R	1.696e-09
R47	N47R	N47M	1.330e-02
L47l	N47M	N47C	8.557e-10
C47	N47C	BD_GND	4.665e-14
L47r	N47C	N47O	8.557e-10
R48WB	N48I	N48W	7.588e-02
L48WB	N48W	N48R	1.721e-09
R48	N48R	N48M	1.380e-02
L48l	N48M	N48C	8.830e-10
C48	N48C	BD_GND	4.810e-14
L48r	N48C	N48O	8.830e-10
R49WB	N49I	N49W	7.630e-02
L49WB	N49W	N49R	1.730e-09
R49	N49R	N49M	1.460e-02

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L49l  N49M  N49C  9.368e-10
C49   N49C  BD_GND 5.233e-14
L49r  N49C  N490  9.368e-10
R50WB N50I  N50W  7.878e-02
L50WB N50W  N50R  1.780e-09
R50   N50R  N50M  1.570e-02
L50l  N50M  N50C  9.940e-10
C50   N50C  BD_GND 5.694e-14
L50r  N50C  N500  9.940e-10
R51WB N51I  N51W  8.376e-02
L51WB N51W  N51R  1.880e-09
R51   N51R  N51M  1.680e-02
L51l  N51M  N51C  1.063e-09
C51   N51C  BD_GND 6.598e-14
L51r  N51C  N510  1.063e-09
R52WB N52I  N52W  8.998e-02
L52WB N52W  N52R  2.008e-09
R52   N52R  N52M  1.650e-02
L52l  N52M  N52C  1.113e-09
C52   N52C  BD_GND 2.107e-13
L52r  N52C  N520  1.113e-09
.ENDS PACKAGE
*
*
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Package: LQFP-64

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*****
* Note:
* 1. The model assume ground plane is 15 mil below package
*****
* Transmission line model
*
* Package: 64 pins LQFP
* Model for 64 pins
*
* Conductor number-pin designation cross reference:
*
*   Conductor   Pin
*   1           1
*   2           2
*   3           3
*   4           4
*   5           5
*   6           6
*   7           7
*   8           8
*   9           9
*  10          10
*  11          11
*  12          12
*  13          13
*  14          14
*  15          15
*  16          16
*  17          17
*  18          18
*  19          19
*  20          20
*  21          21
*  22          22
*  23          23
*  24          24
*  25          25
*  26          26
*  27          27
*  28          28
*  29          29
*  30          30
*  31          31
*  32          32
*  33          33
*  34          34
*  35          35
*  36          36
*  37          37
*  38          38
*  39          39
*  40          40
*  41          41
*  42          42
*  43          43
*  44          44
*  45          45
*  46          46
*  47          47
*  48          48
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*      49      49
*      50      50
*      51      51
*      52      52
*      53      53
*      54      54
*      55      55
*      56      56
*      57      57
*      58      58
*      59      59
*      60      60
*      61      61
*      62      62
*      63      63
*      64      64
*
* number of lumps:      1
* FASTEST APPLICABLE EDGE RATE:      0.153 ns
* COMPRESSION OF SUBCIRCUITS PERFORMED: discard ratio is 0.050
*
.SUBCKT PACKAGE N01I N01O N02I N02O N03I N03O N04I N04O
+ N05I N05O N06I N06O N07I N07O N08I N08O N09I N09O
+ N10I N10O N11I N11O N12I N12O N13I N13O N14I N14O
+ N15I N15O N16I N16O N17I N17O N18I N18O N19I N19O
+ N20I N20O N21I N21O N22I N22O N23I N23O N24I N24O
+ N25I N25O N26I N26O N27I N27O N28I N28O N29I N29O
+ N30I N30O N31I N31O N32I N32O N33I N33O N34I N34O
+ N35I N35O N36I N36O N37I N37O N38I N38O N39I N39O
+ N40I N40O N41I N41O N42I N42O N43I N43O N44I N44O
+ N45I N45O N46I N46O N47I N47O N48I N48O N49I N49O
+ N50I N50O N51I N51O N52I N52O N53I N53O N54I N54O
+ N55I N55O N56I N56O N57I N57O N58I N58O N59I N59O
+ N60I N60O N61I N61O N62I N62O N63I N63O N64I N64O VEE_EXT
R01WB  N01I  N01W  1.053e-01
L01WB  N01W  N01R  2.326e-09
R01     N01R  N01C  1.650e-02
C01     N01C  VEE_EXT 2.653e-13
L01     N01C  N01O  1.921e-09
R02WB  N02I  N02W  9.827e-02
L02WB  N02W  N02R  2.179e-09
R02     N02R  N02C  1.690e-02
C02     N02C  VEE_EXT 1.034e-13
L02     N02C  N02O  1.801e-09
R03WB  N03I  N03W  9.288e-02
L03WB  N03W  N03R  2.067e-09
R03     N03R  N03C  1.660e-02
C03     N03C  VEE_EXT 8.350e-14
L03     N03C  N03O  1.765e-09
R04WB  N04I  N04W  8.874e-02
L04WB  N04W  N04R  1.982e-09
R04     N04R  N04C  1.600e-02
C04     N04C  VEE_EXT 8.115e-14
L04     N04C  N04O  1.705e-09
R05WB  N05I  N05W  8.708e-02
L05WB  N05W  N05R  1.948e-09
R05     N05R  N05C  1.560e-02
C05     N05C  VEE_EXT 7.954e-14
L05     N05C  N05O  1.650e-09
R06WB  N06I  N06W  8.583e-02
L06WB  N06W  N06R  1.923e-09
R06     N06R  N06C  1.520e-02

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C06	N06C	VEE_EXT	7.774e-14
L06	N06C	N060	1.613e-09
R07WB	N07I	N07W	8.500e-02
L07WB	N07W	N07R	1.906e-09
R07	N07R	N07C	1.470e-02
C07	N07C	VEE_EXT	7.184e-14
L07	N07C	N070	1.550e-09
R08WB	N08I	N08W	8.583e-02
L08WB	N08W	N08R	1.923e-09
R08	N08R	N08C	1.420e-02
C08	N08C	VEE_EXT	7.198e-14
L08	N08C	N080	1.566e-09
R09WB	N09I	N09W	8.583e-02
L09WB	N09W	N09R	1.923e-09
R09	N09R	N09C	1.420e-02
C09	N09C	VEE_EXT	7.198e-14
L09	N09C	N090	1.566e-09
R10WB	N10I	N10W	8.500e-02
L10WB	N10W	N10R	1.906e-09
R10	N10R	N10C	1.470e-02
C10	N10C	VEE_EXT	7.184e-14
L10	N10C	N100	1.550e-09
R11WB	N11I	N11W	8.583e-02
L11WB	N11W	N11R	1.923e-09
R11	N11R	N11C	1.520e-02
C11	N11C	VEE_EXT	7.774e-14
L11	N11C	N110	1.613e-09
R12WB	N12I	N12W	8.708e-02
L12WB	N12W	N12R	1.948e-09
R12	N12R	N12C	1.560e-02
C12	N12C	VEE_EXT	7.954e-14
L12	N12C	N120	1.650e-09
R13WB	N13I	N13W	8.874e-02
L13WB	N13W	N13R	1.982e-09
R13	N13R	N13C	1.600e-02
C13	N13C	VEE_EXT	8.115e-14
L13	N13C	N130	1.705e-09
R14WB	N14I	N14W	9.288e-02
L14WB	N14W	N14R	2.067e-09
R14	N14R	N14C	1.660e-02
C14	N14C	VEE_EXT	8.350e-14
L14	N14C	N140	1.765e-09
R15WB	N15I	N15W	9.827e-02
L15WB	N15W	N15R	2.179e-09
R15	N15R	N15C	1.690e-02
C15	N15C	VEE_EXT	1.034e-13
L15	N15C	N150	1.801e-09
R16WB	N16I	N16W	1.053e-01
L16WB	N16W	N16R	2.326e-09
R16	N16R	N16C	1.650e-02
C16	N16C	VEE_EXT	2.653e-13
L16	N16C	N160	1.921e-09
R17WB	N17I	N17W	1.053e-01
L17WB	N17W	N17R	2.326e-09
R17	N17R	N17C	1.650e-02
C17	N17C	VEE_EXT	2.653e-13
L17	N17C	N170	1.921e-09
R18WB	N18I	N18W	9.827e-02
L18WB	N18W	N18R	2.179e-09
R18	N18R	N18C	1.690e-02
C18	N18C	VEE_EXT	1.034e-13
L18	N18C	N180	1.801e-09

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R19WB	N19I	N19W	9.288e-02
L19WB	N19W	N19R	2.067e-09
R19	N19R	N19C	1.660e-02
C19	N19C	VEE_EXT	8.350e-14
L19	N19C	N190	1.765e-09
R20WB	N20I	N20W	8.874e-02
L20WB	N20W	N20R	1.982e-09
R20	N20R	N20C	1.600e-02
C20	N20C	VEE_EXT	8.115e-14
L20	N20C	N200	1.705e-09
R21WB	N21I	N21W	8.708e-02
L21WB	N21W	N21R	1.948e-09
R21	N21R	N21C	1.560e-02
C21	N21C	VEE_EXT	7.954e-14
L21	N21C	N210	1.650e-09
R22WB	N22I	N22W	8.583e-02
L22WB	N22W	N22R	1.923e-09
R22	N22R	N22C	1.520e-02
C22	N22C	VEE_EXT	7.774e-14
L22	N22C	N220	1.613e-09
R23WB	N23I	N23W	8.500e-02
L23WB	N23W	N23R	1.906e-09
R23	N23R	N23C	1.470e-02
C23	N23C	VEE_EXT	7.184e-14
L23	N23C	N230	1.550e-09
R24WB	N24I	N24W	8.583e-02
L24WB	N24W	N24R	1.923e-09
R24	N24R	N24C	1.420e-02
C24	N24C	VEE_EXT	7.198e-14
L24	N24C	N240	1.566e-09
R25WB	N25I	N25W	8.583e-02
L25WB	N25W	N25R	1.923e-09
R25	N25R	N25C	1.420e-02
C25	N25C	VEE_EXT	7.198e-14
L25	N25C	N250	1.566e-09
R26WB	N26I	N26W	8.500e-02
L26WB	N26W	N26R	1.906e-09
R26	N26R	N26C	1.470e-02
C26	N26C	VEE_EXT	7.184e-14
L26	N26C	N260	1.550e-09
R27WB	N27I	N27W	8.583e-02
L27WB	N27W	N27R	1.923e-09
R27	N27R	N27C	1.520e-02
C27	N27C	VEE_EXT	7.774e-14
L27	N27C	N270	1.613e-09
R28WB	N28I	N28W	8.708e-02
L28WB	N28W	N28R	1.948e-09
R28	N28R	N28C	1.560e-02
C28	N28C	VEE_EXT	7.954e-14
L28	N28C	N280	1.650e-09
R29WB	N29I	N29W	8.874e-02
L29WB	N29W	N29R	1.982e-09
R29	N29R	N29C	1.600e-02
C29	N29C	VEE_EXT	8.115e-14
L29	N29C	N290	1.705e-09
R30WB	N30I	N30W	9.288e-02
L30WB	N30W	N30R	2.067e-09
R30	N30R	N30C	1.660e-02
C30	N30C	VEE_EXT	8.350e-14
L30	N30C	N300	1.765e-09
R31WB	N31I	N31W	9.827e-02
L31WB	N31W	N31R	2.179e-09

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R31	N31R	N31C	1.690e-02
C31	N31C	VEE_EXT	1.034e-13
L31	N31C	N310	1.801e-09
R32WB	N32I	N32W	1.053e-01
L32WB	N32W	N32R	2.326e-09
R32	N32R	N32C	1.650e-02
C32	N32C	VEE_EXT	2.653e-13
L32	N32C	N320	1.921e-09
R33WB	N33I	N33W	1.053e-01
L33WB	N33W	N33R	2.326e-09
R33	N33R	N33C	1.650e-02
C33	N33C	VEE_EXT	2.653e-13
L33	N33C	N330	1.921e-09
R34WB	N34I	N34W	9.827e-02
L34WB	N34W	N34R	2.179e-09
R34	N34R	N34C	1.690e-02
C34	N34C	VEE_EXT	1.034e-13
L34	N34C	N340	1.801e-09
R35WB	N35I	N35W	9.288e-02
L35WB	N35W	N35R	2.067e-09
R35	N35R	N35C	1.660e-02
C35	N35C	VEE_EXT	8.350e-14
L35	N35C	N350	1.765e-09
R36WB	N36I	N36W	8.874e-02
L36WB	N36W	N36R	1.982e-09
R36	N36R	N36C	1.600e-02
C36	N36C	VEE_EXT	8.115e-14
L36	N36C	N360	1.705e-09
R37WB	N37I	N37W	8.708e-02
L37WB	N37W	N37R	1.948e-09
R37	N37R	N37C	1.560e-02
C37	N37C	VEE_EXT	7.954e-14
L37	N37C	N370	1.650e-09
R38WB	N38I	N38W	8.583e-02
L38WB	N38W	N38R	1.923e-09
R38	N38R	N38C	1.520e-02
C38	N38C	VEE_EXT	7.774e-14
L38	N38C	N380	1.613e-09
R39WB	N39I	N39W	8.500e-02
L39WB	N39W	N39R	1.906e-09
R39	N39R	N39C	1.470e-02
C39	N39C	VEE_EXT	7.184e-14
L39	N39C	N390	1.550e-09
R40WB	N40I	N40W	8.583e-02
L40WB	N40W	N40R	1.923e-09
R40	N40R	N40C	1.420e-02
C40	N40C	VEE_EXT	7.198e-14
L40	N40C	N400	1.566e-09
R41WB	N41I	N41W	8.583e-02
L41WB	N41W	N41R	1.923e-09
R41	N41R	N41C	1.420e-02
C41	N41C	VEE_EXT	7.198e-14
L41	N41C	N410	1.566e-09
R42WB	N42I	N42W	8.500e-02
L42WB	N42W	N42R	1.906e-09
R42	N42R	N42C	1.470e-02
C42	N42C	VEE_EXT	7.184e-14
L42	N42C	N420	1.550e-09
R43WB	N43I	N43W	8.583e-02
L43WB	N43W	N43R	1.923e-09
R43	N43R	N43C	1.520e-02
C43	N43C	VEE_EXT	7.774e-14

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L43	N43C	N430	1.613e-09
R44WB	N44I	N44W	8.708e-02
L44WB	N44W	N44R	1.948e-09
R44	N44R	N44C	1.560e-02
C44	N44C	VEE_EXT	7.954e-14
L44	N44C	N440	1.650e-09
R45WB	N45I	N45W	8.874e-02
L45WB	N45W	N45R	1.982e-09
R45	N45R	N45C	1.600e-02
C45	N45C	VEE_EXT	8.115e-14
L45	N45C	N450	1.705e-09
R46WB	N46I	N46W	9.288e-02
L46WB	N46W	N46R	2.067e-09
R46	N46R	N46C	1.660e-02
C46	N46C	VEE_EXT	8.350e-14
L46	N46C	N460	1.765e-09
R47WB	N47I	N47W	9.827e-02
L47WB	N47W	N47R	2.179e-09
R47	N47R	N47C	1.690e-02
C47	N47C	VEE_EXT	1.034e-13
L47	N47C	N470	1.801e-09
R48WB	N48I	N48W	1.053e-01
L48WB	N48W	N48R	2.326e-09
R48	N48R	N48C	1.650e-02
C48	N48C	VEE_EXT	2.653e-13
L48	N48C	N480	1.921e-09
R49WB	N49I	N49W	1.053e-01
L49WB	N49W	N49R	2.326e-09
R49	N49R	N49C	1.650e-02
C49	N49C	VEE_EXT	2.653e-13
L49	N49C	N490	1.921e-09
R50WB	N50I	N50W	9.827e-02
L50WB	N50W	N50R	2.179e-09
R50	N50R	N50C	1.690e-02
C50	N50C	VEE_EXT	1.034e-13
L50	N50C	N500	1.801e-09
R51WB	N51I	N51W	9.288e-02
L51WB	N51W	N51R	2.067e-09
R51	N51R	N51C	1.660e-02
C51	N51C	VEE_EXT	8.350e-14
L51	N51C	N510	1.765e-09
R52WB	N52I	N52W	8.874e-02
L52WB	N52W	N52R	1.982e-09
R52	N52R	N52C	1.600e-02
C52	N52C	VEE_EXT	8.115e-14
L52	N52C	N520	1.705e-09
R53WB	N53I	N53W	8.708e-02
L53WB	N53W	N53R	1.948e-09
R53	N53R	N53C	1.560e-02
C53	N53C	VEE_EXT	7.954e-14
L53	N53C	N530	1.650e-09
R54WB	N54I	N54W	8.583e-02
L54WB	N54W	N54R	1.923e-09
R54	N54R	N54C	1.520e-02
C54	N54C	VEE_EXT	7.774e-14
L54	N54C	N540	1.613e-09
R55WB	N55I	N55W	8.500e-02
L55WB	N55W	N55R	1.906e-09
R55	N55R	N55C	1.470e-02
C55	N55C	VEE_EXT	7.184e-14
L55	N55C	N550	1.550e-09
R56WB	N56I	N56W	8.583e-02

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L56WB	N56W	N56R	1.923e-09
R56	N56R	N56C	1.420e-02
C56	N56C	VEE_EXT	7.198e-14
L56	N56C	N56O	1.566e-09
R57WB	N57I	N57W	8.583e-02
L57WB	N57W	N57R	1.923e-09
R57	N57R	N57C	1.420e-02
C57	N57C	VEE_EXT	7.198e-14
L57	N57C	N57O	1.566e-09
R58WB	N58I	N58W	8.500e-02
L58WB	N58W	N58R	1.906e-09
R58	N58R	N58C	1.470e-02
C58	N58C	VEE_EXT	7.184e-14
L58	N58C	N58O	1.550e-09
R59WB	N59I	N59W	8.583e-02
L59WB	N59W	N59R	1.923e-09
R59	N59R	N59C	1.520e-02
C59	N59C	VEE_EXT	7.774e-14
L59	N59C	N59O	1.613e-09
R60WB	N60I	N60W	8.708e-02
L60WB	N60W	N60R	1.948e-09
R60	N60R	N60C	1.560e-02
C60	N60C	VEE_EXT	7.954e-14
L60	N60C	N60O	1.650e-09
R61WB	N61I	N61W	8.874e-02
L61WB	N61W	N61R	1.982e-09
R61	N61R	N61C	1.600e-02
C61	N61C	VEE_EXT	8.115e-14
L61	N61C	N61O	1.705e-09
R62WB	N62I	N62W	9.288e-02
L62WB	N62W	N62R	2.067e-09
R62	N62R	N62C	1.660e-02
C62	N62C	VEE_EXT	8.350e-14
L62	N62C	N62O	1.765e-09
R63WB	N63I	N63W	9.827e-02
L63WB	N63W	N63R	2.179e-09
R63	N63R	N63C	1.690e-02
C63	N63C	VEE_EXT	1.034e-13
L63	N63C	N63O	1.801e-09
R64WB	N64I	N64W	1.053e-01
L64WB	N64W	N64R	2.326e-09
R64	N64R	N64C	1.650e-02
C64	N64C	VEE_EXT	2.653e-13
L64	N64C	N64O	1.921e-09

.ENDS PACKAGE

*

*

APPENDIX A

Package Models Help

In the SPICE netlist, X_777 is a circuit element (black box) with connections to a subcircuit:

circuit element	connections	subcircuit
X_777	N01I N010 N021 N020 N03I N030 N04I N040 +N05I N050 N061 N060 N07I N070 N08I N080 GND	PACKAGE

The defined connection nodes of the circuit element are declared as:

```
N01I N010 N021 N020 N03I N030 N04I N040
+N05I N050 N061 N060 N07I N070 N08I N080 GND
```

The subcircuit PACKAGE is connected to these same nodes:

```
.SUBCKT PACKAGE N01I N010 N021 N020 N03I N030 N04I N040
+N05I N050 N061 N060 N07I N070 N08I N080 GND
```

where:

```
N01I is the PACKAGE pin #1 internal node connection to the chip pad
N010 is the PACKAGE pin #1 external node connecting to the lead
```

Internal to the subcircuit PACKAGE are several nodes for each pin (See Figure 7). For pin 2, of the 8 pin TSSOP, the netlist:

```
R02WB N02I N02W 3.815e-02
L02WB N02W N02R 9.835e-10
R02 N02R N02C 9.680e-04
C02 N02C GND 7.711e-14
L02 N02C N02O 7.466e-10
```

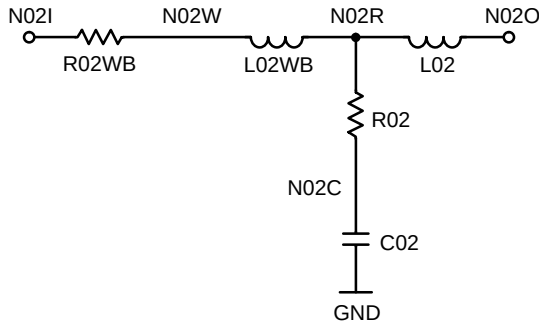


Figure 21.

Parasitic Mutual inductance, K, and capacitance, C, is also represented. Such as “K0102”, where inductance from Lead #1 (L01) to Lead #2 (L02) is indicated.

```
K0102 L01 L02 0.2481
K0102WB L01WB L02WB 0.1729
C0102 N01C N02C 2.283e-14
K0103 L01 L03 0.1067
K0103WB L01WB L03WB 0.0598
K0104 L01 L04 0.0593
K0203 L02 L03 0.2479
K0203WB L02WB L03WB 0.1463
C0203 N02C N03C 2.136e-14
K0204 L02 L04 0.1068
K0204WB L02WB L04WB 0.0598
```

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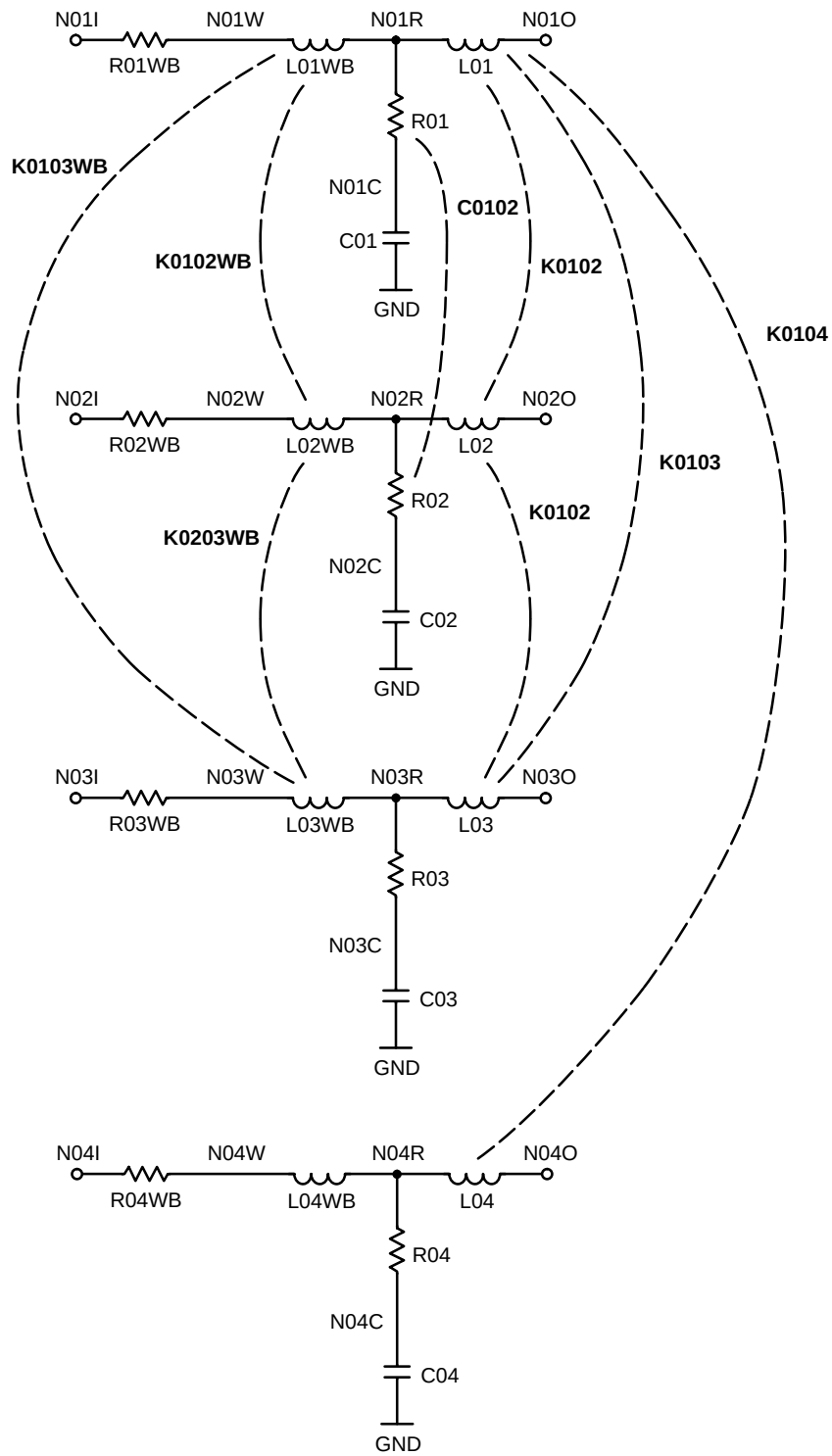


Figure 22.

Notes

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