

## 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.

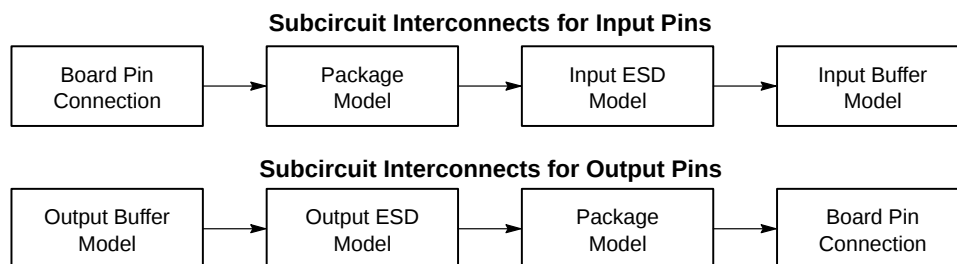


Figure 1. Input and Output Pins Interconnects

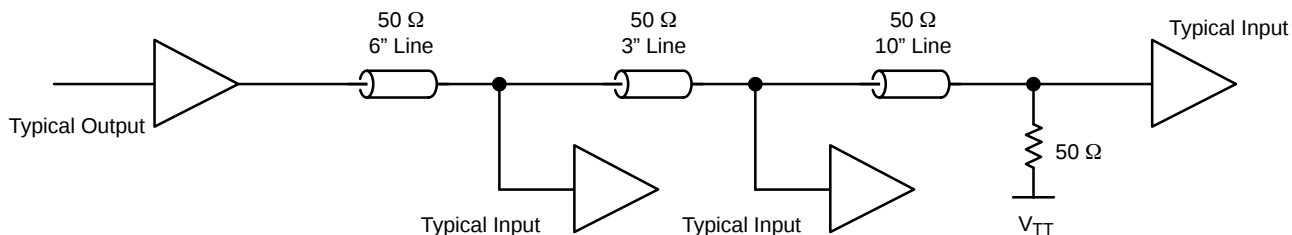


Figure 2. Typical Application for I/O SPICE Modeling Kit

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](http://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](http://www.onsemi.com) (Tech Support).

## Netlists and Schematics

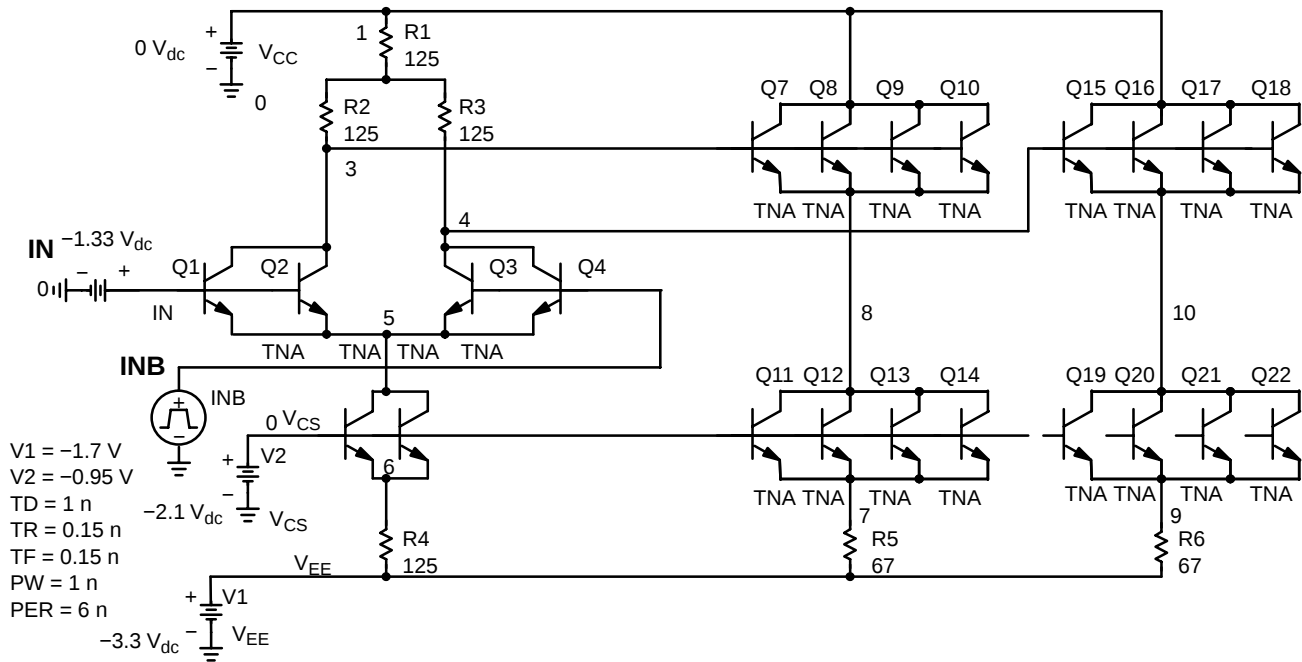


Figure 3. Typical INBUF

## .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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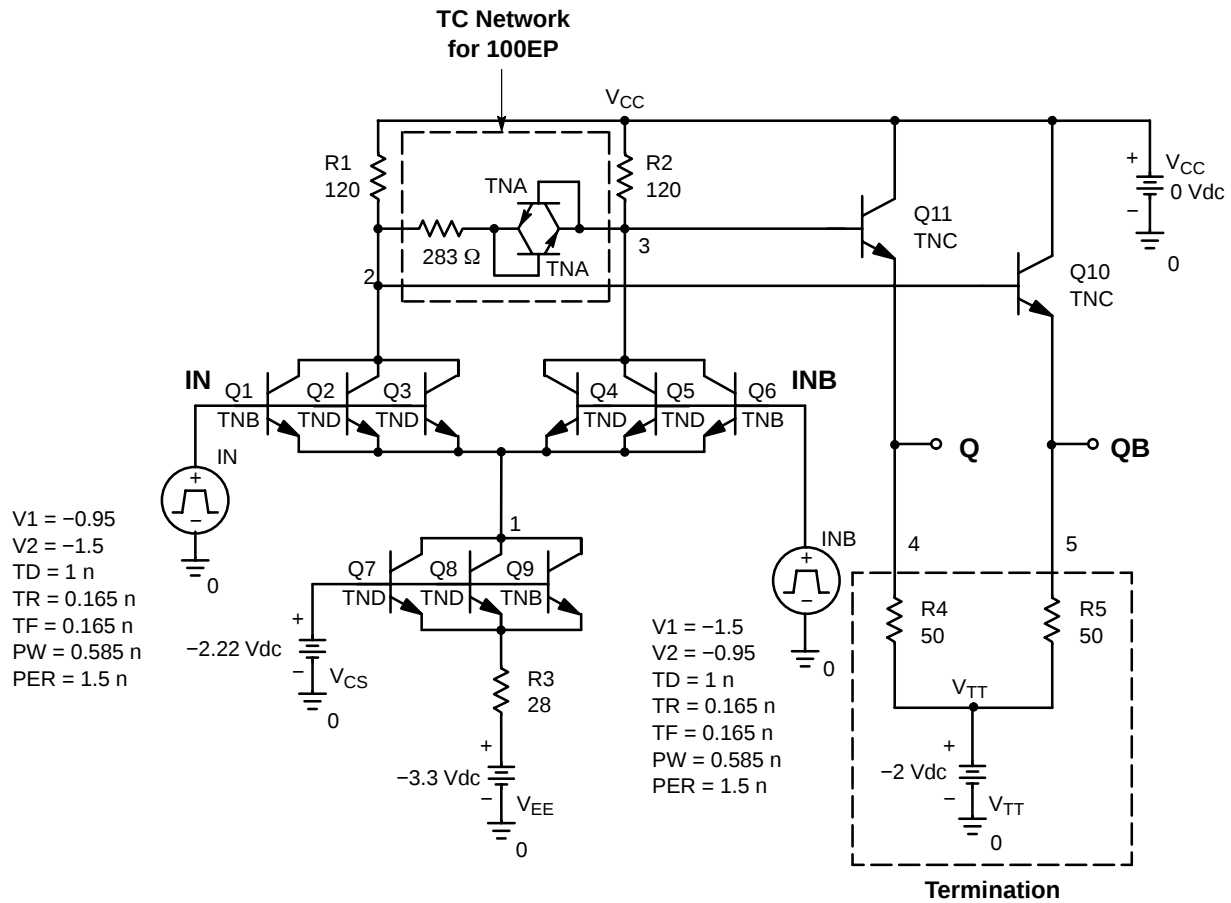


Figure 4. OBUF01

```
.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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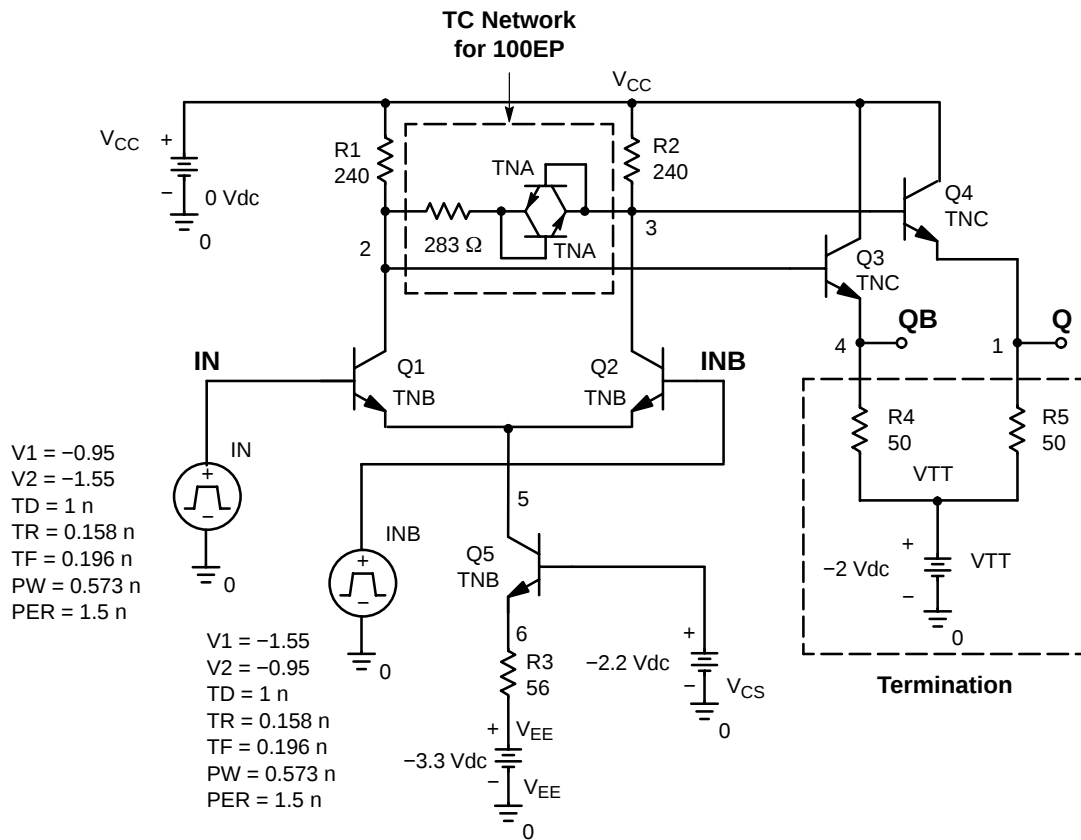


Figure 5. OBUF02

```
.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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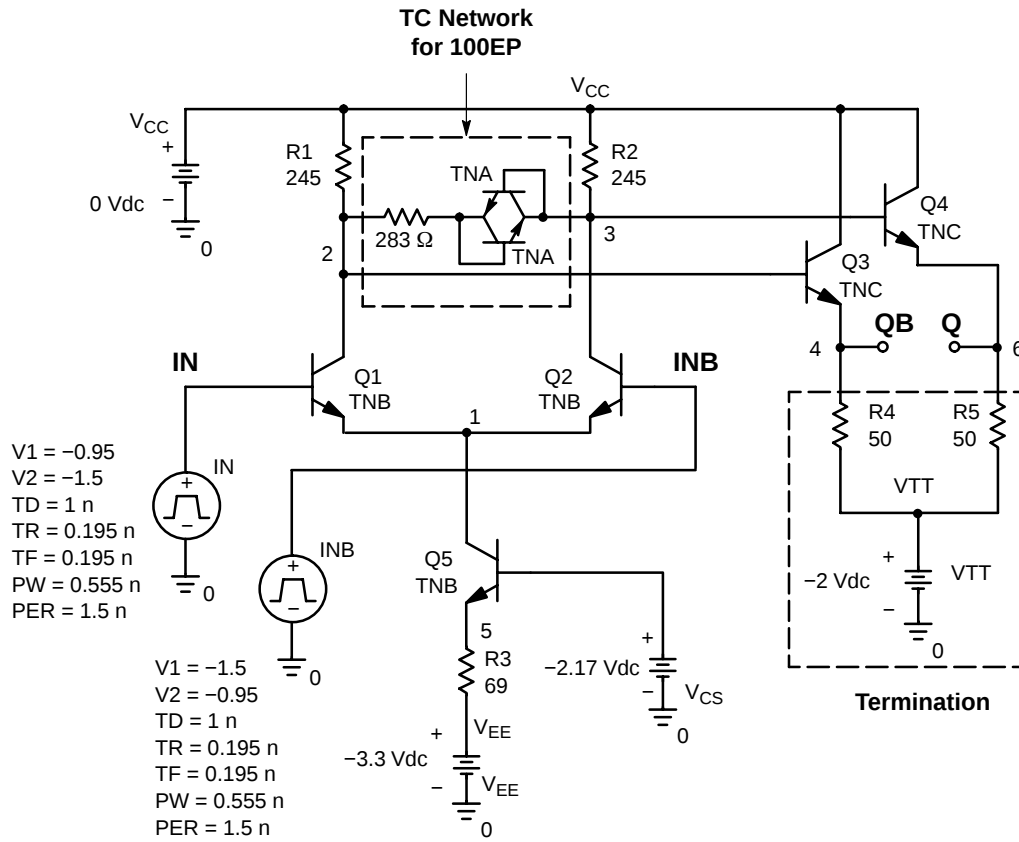


Figure 6. OBUF03

```
.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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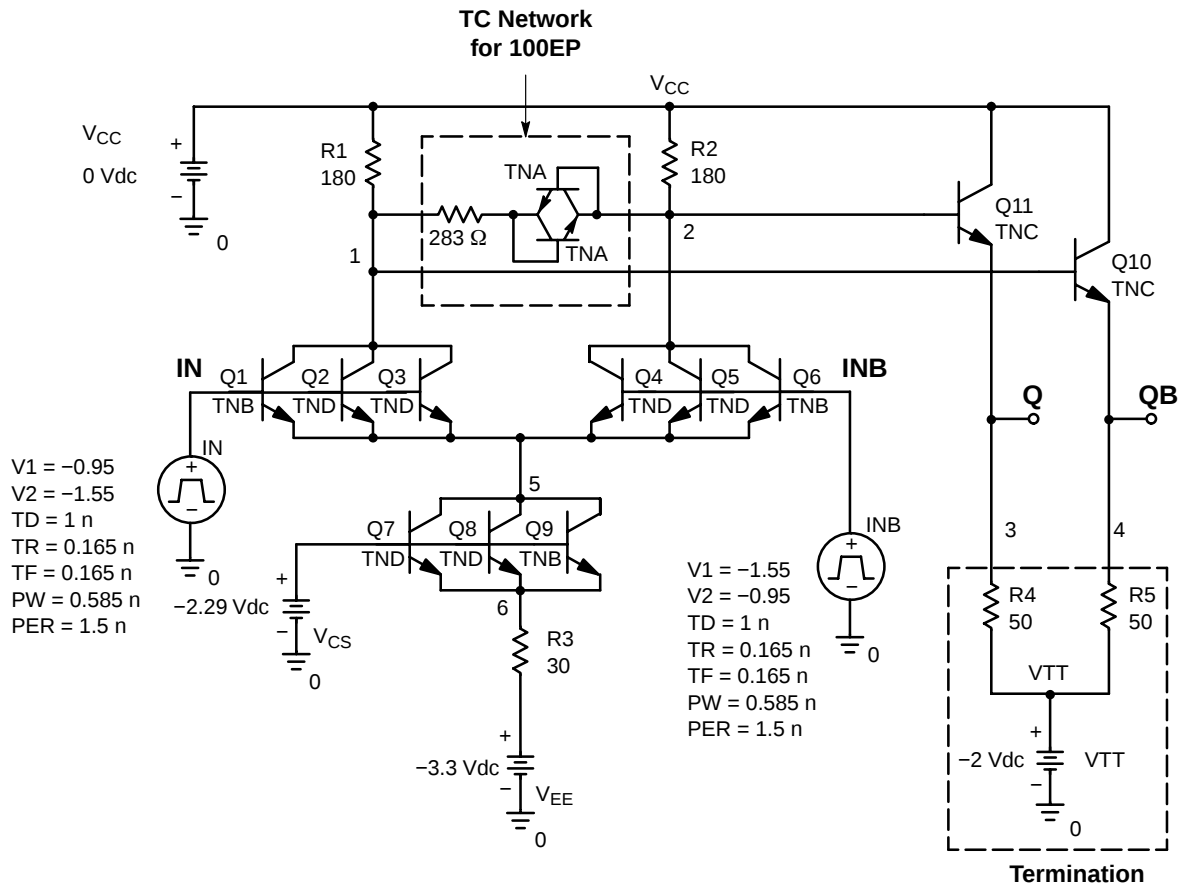


Figure 7. OBUF04

```
.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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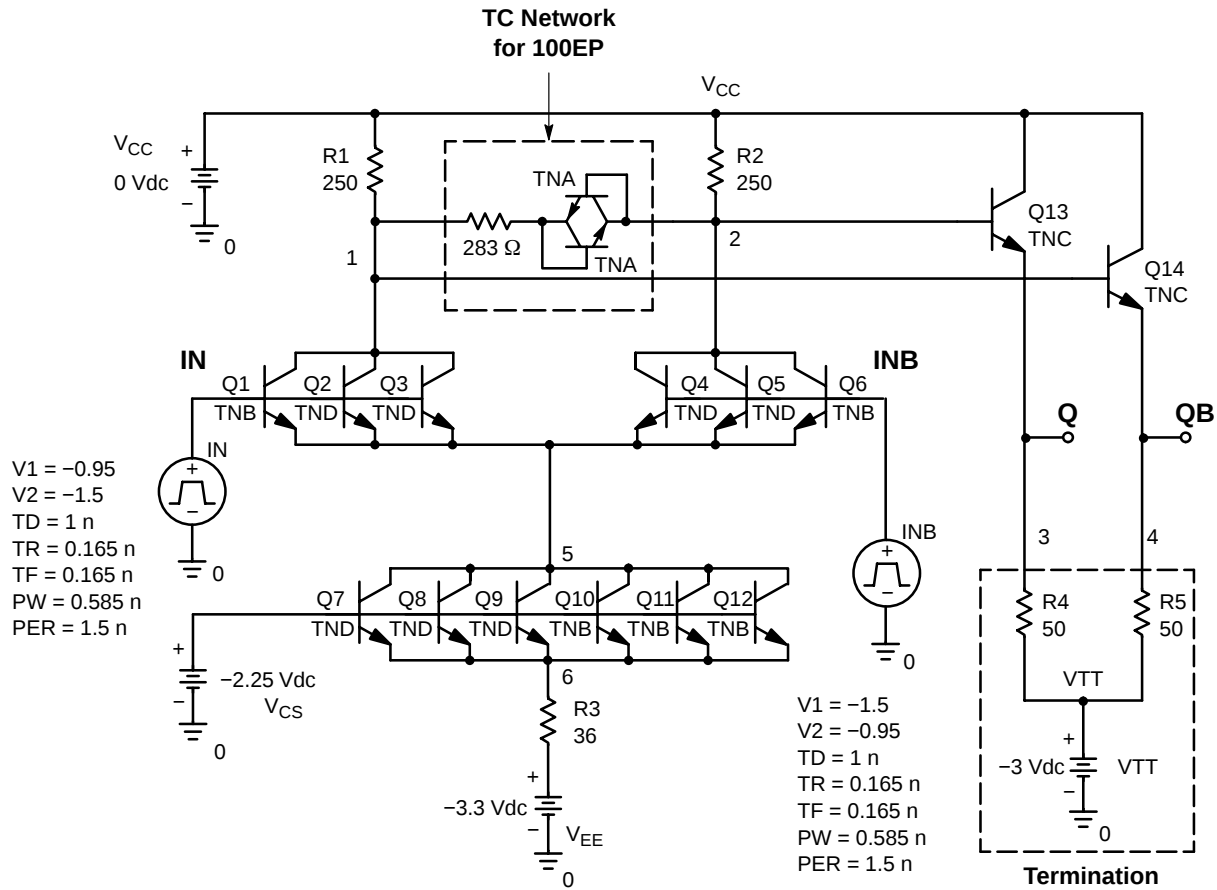
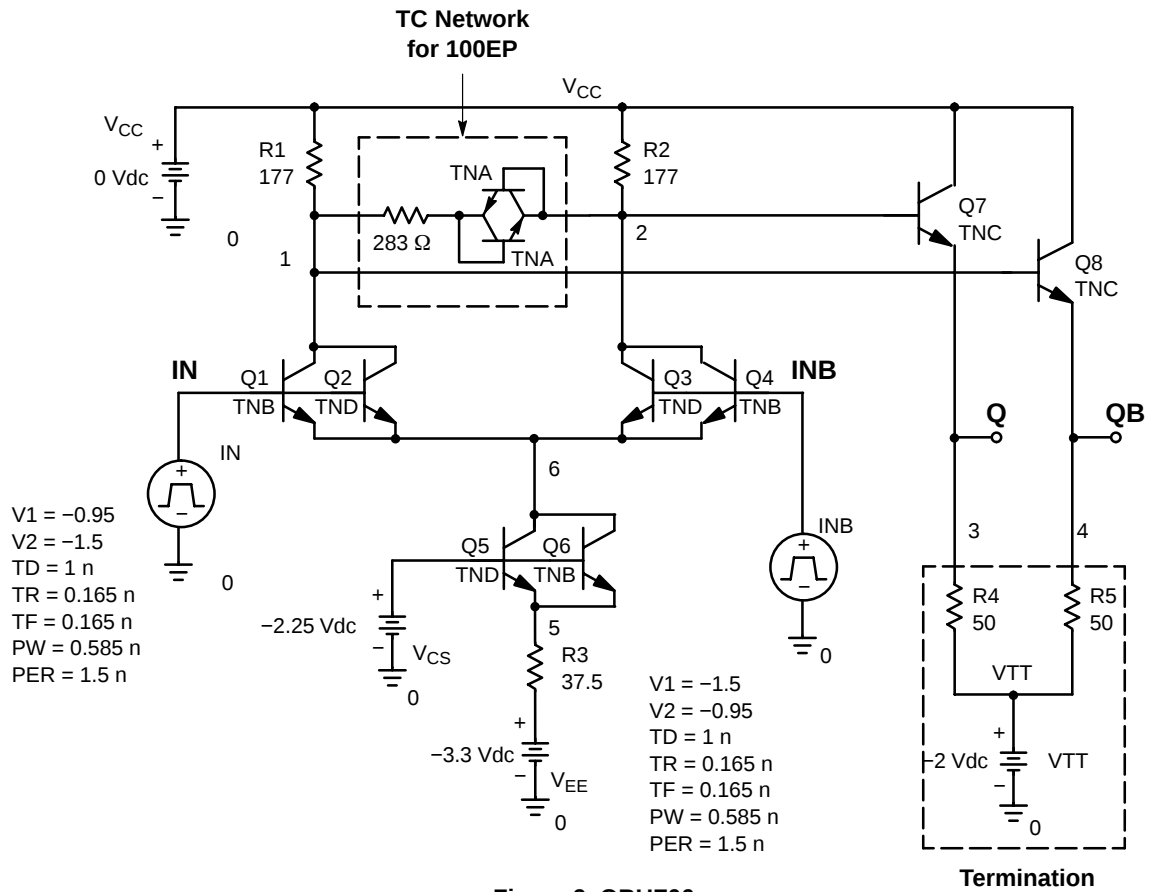


Figure 8. OBUF05

```
.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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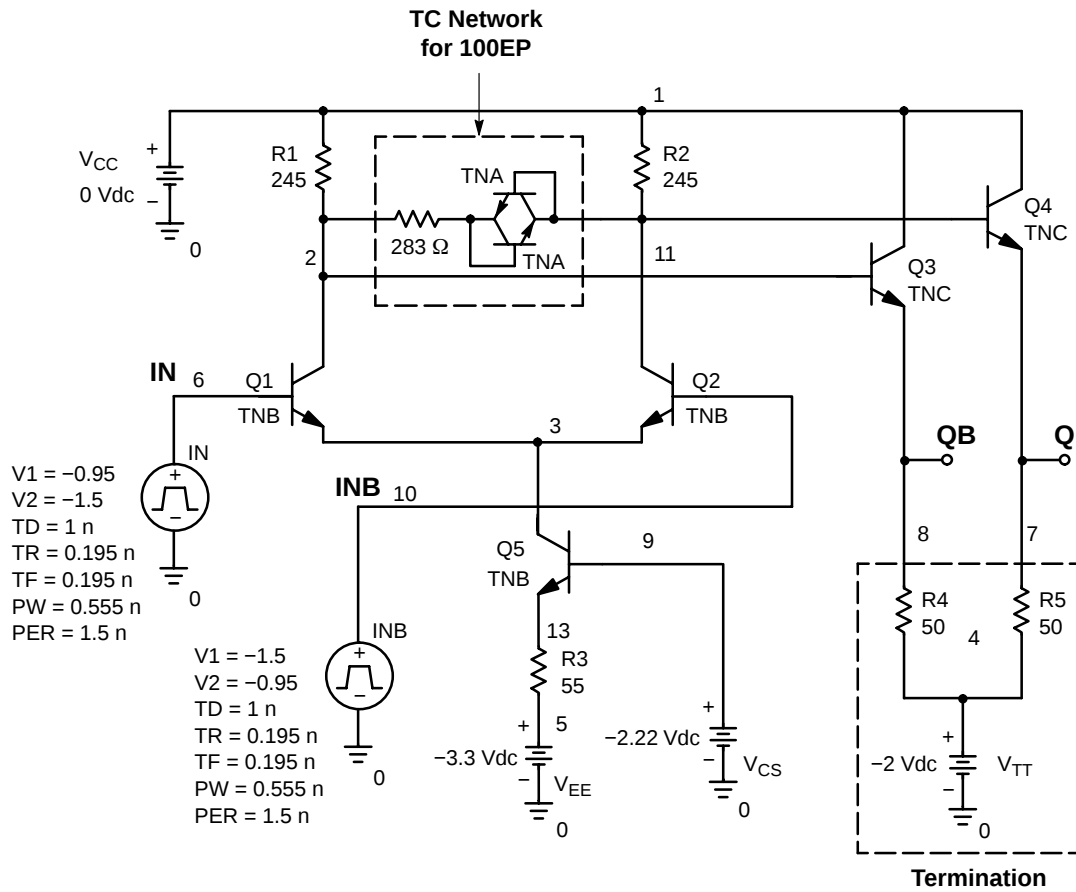
**.SUBCKT OBUF06 IN INB VCC VCS VEE VTT**

```

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

```

# AND8009/D



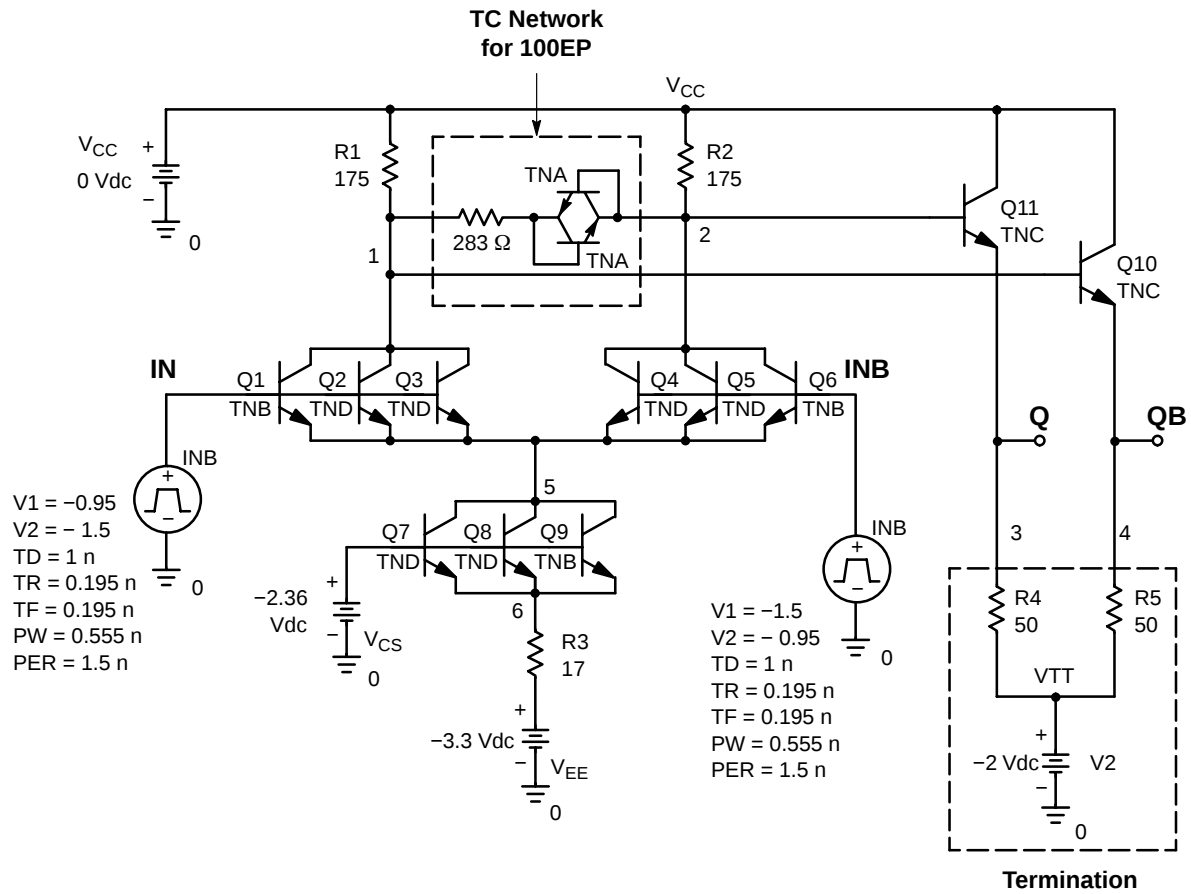
## .SUBCKT OBUF07

```

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

```

# AND8009/D



# AND8009/D

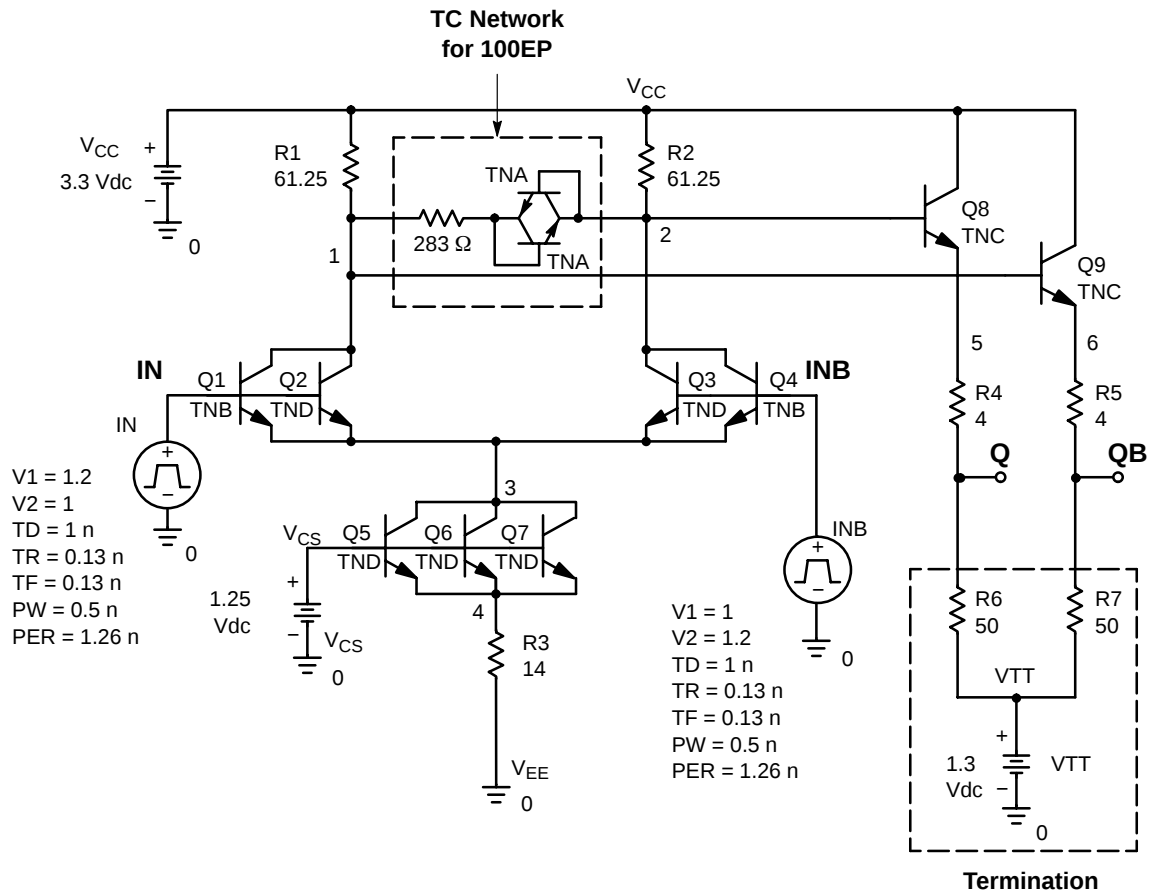


Figure 12. OBUF09

```
.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

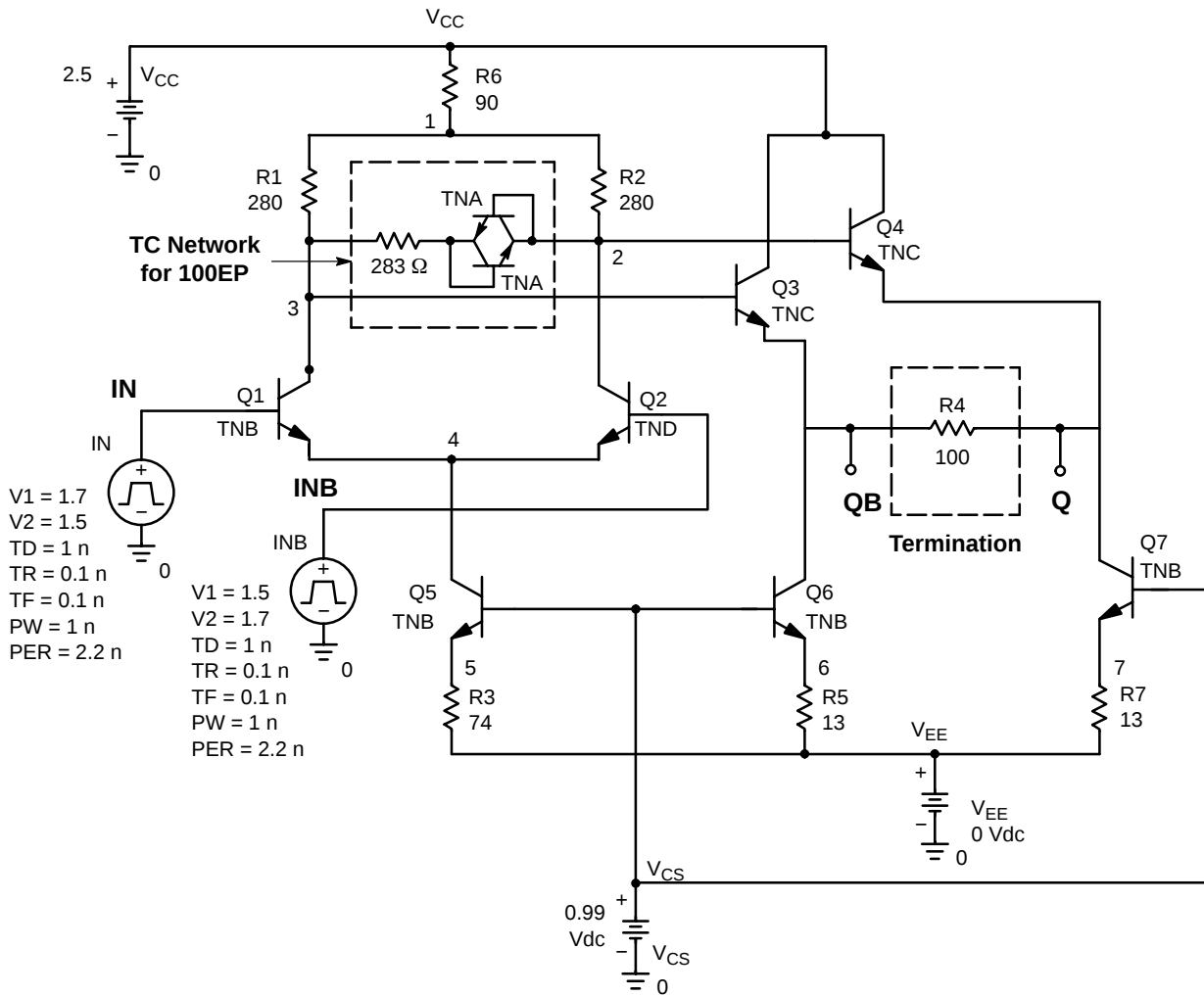


Figure 13. OBUF10

```
.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<sub>HSTL</sub> Internal Constant Voltage Source

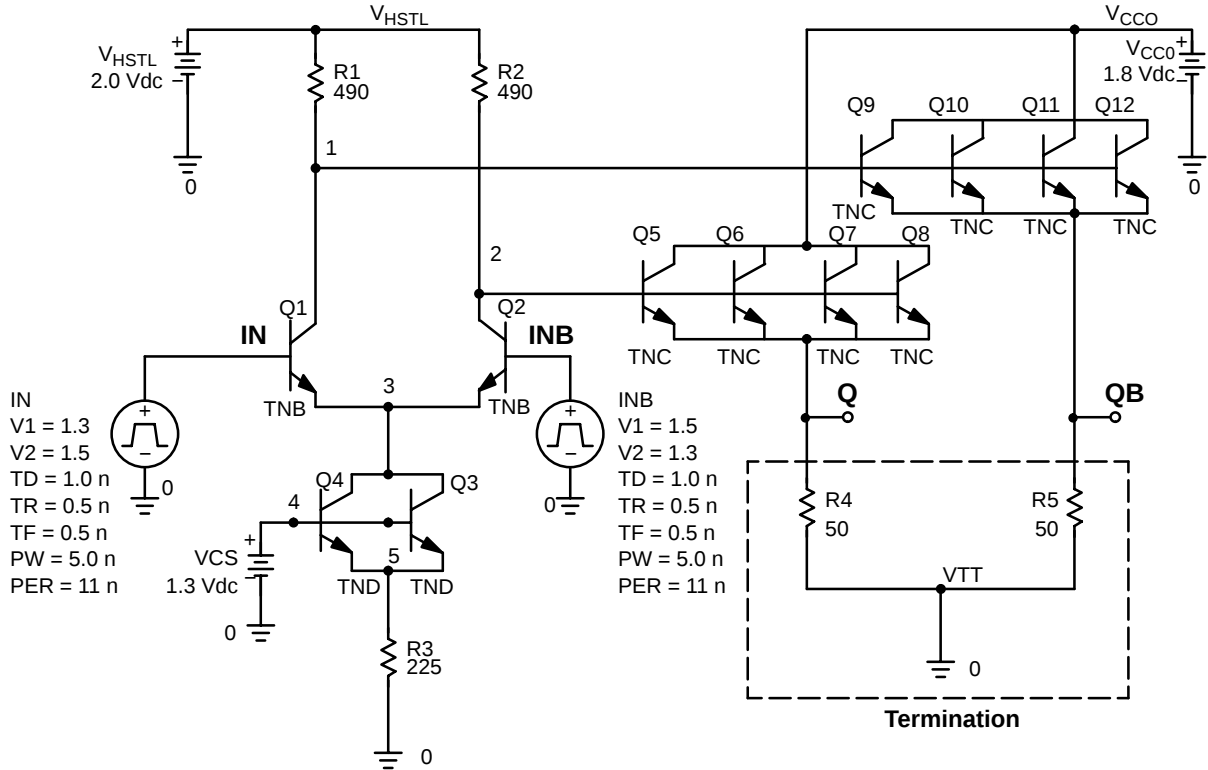


Figure 14. OBUF11

```
.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

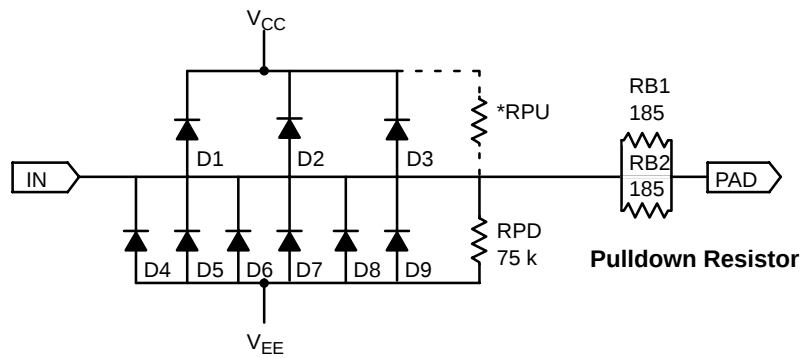


Figure 15. Input ESD

```
.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
```

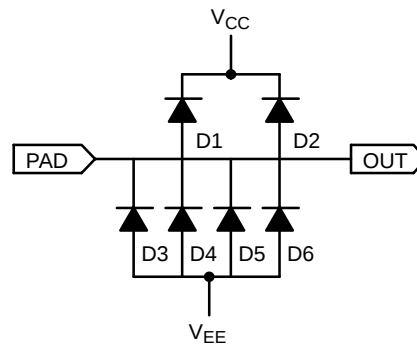


Figure 16. Output ESD

```
.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
```

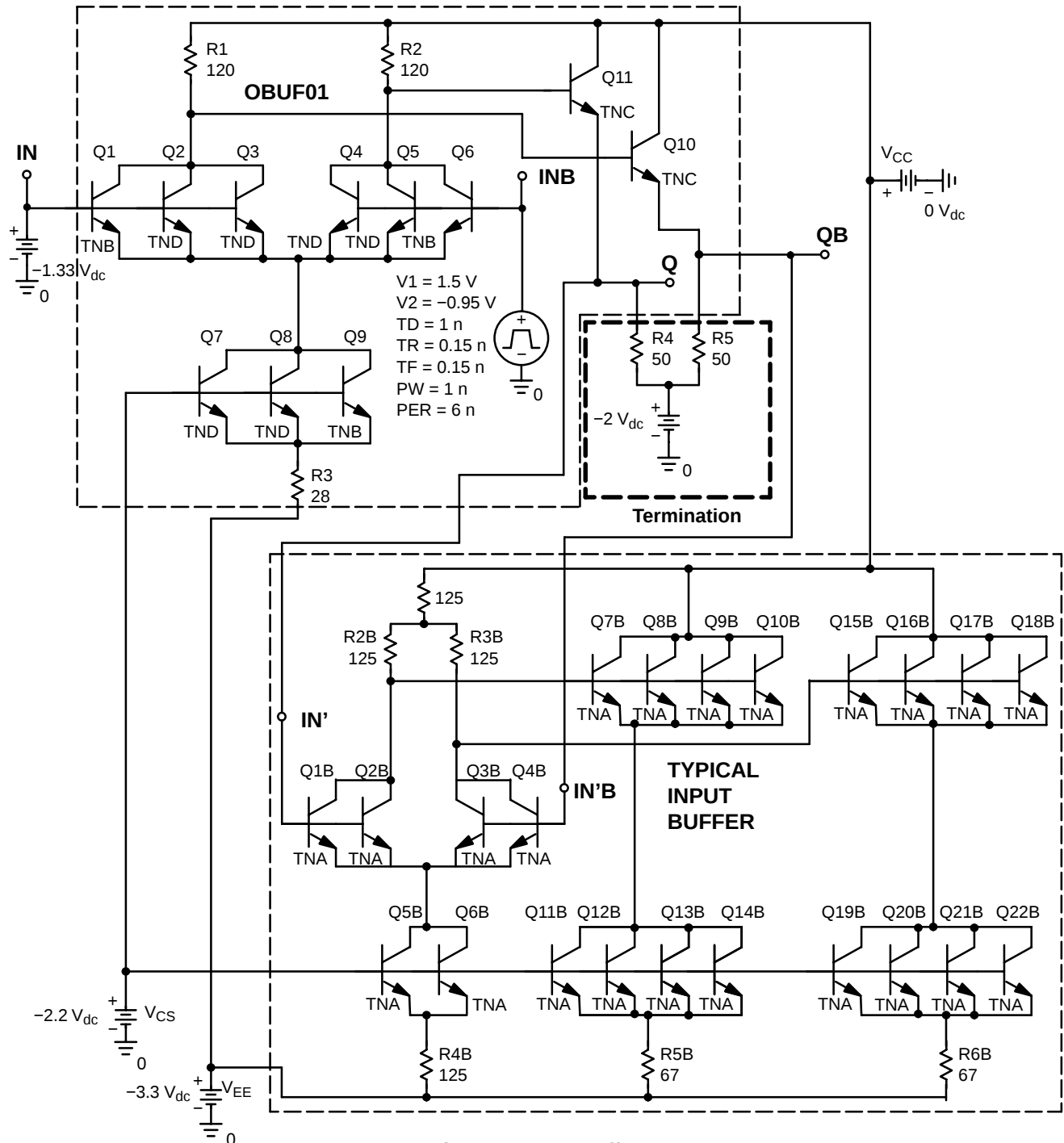


Figure 17. EP16 Buffer

## AND8009/D

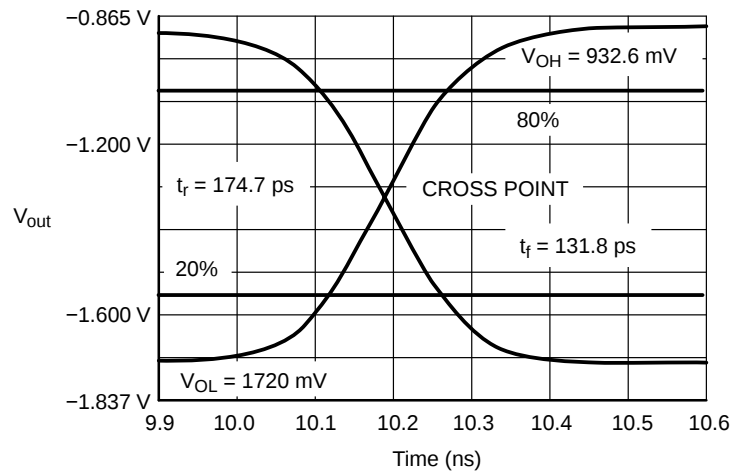


Figure 18. Typical Generic Output Waveform

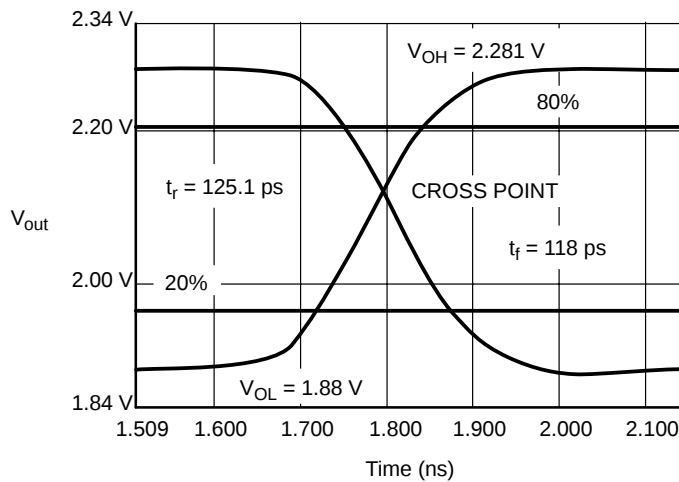


Figure 19. OBUF09 Reduced Swing Output Waveform (EP40/140)

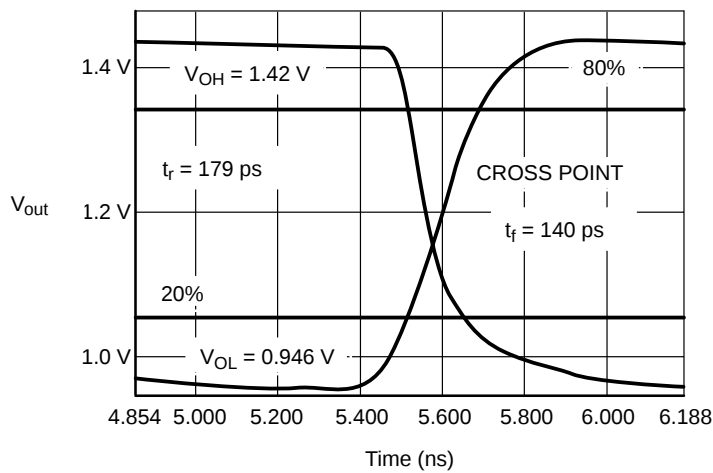


Figure 20. LVDS Output Waveform (EP210's)

## 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

```

## AND8009/D

|         |       |       |           |
|---------|-------|-------|-----------|
| 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 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 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    N010    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    N020    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    N030    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    N040    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 |       |       |           |

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**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, 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 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 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 GND 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 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 N010 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

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**Package:24 Lead QFN**

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*
*
*****
* 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

## AND8009/D

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

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## Package: LQFP-52

```

*****
* 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
*
```

```
.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 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 N01O 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 N02O 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 N03O 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 N04O 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 N05O 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 N06O 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 N07O 8.187e-10
R08WB N08I N08W 7.464e-02
```

|       |      |        |           |
|-------|------|--------|-----------|
| 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
*
*
```

**Package: LQFP-64**

```
*****
* 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 |

|       |      |         |           |
|-------|------|---------|-----------|
| 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<br>+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
```

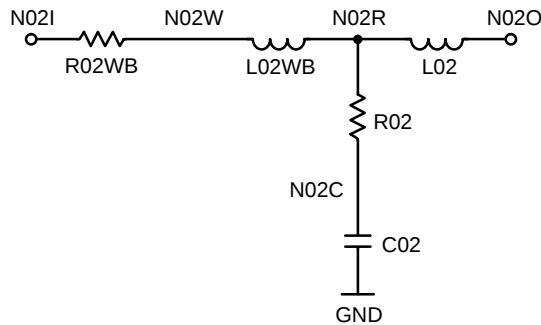


Figure 21.

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
```

# AND8009/D

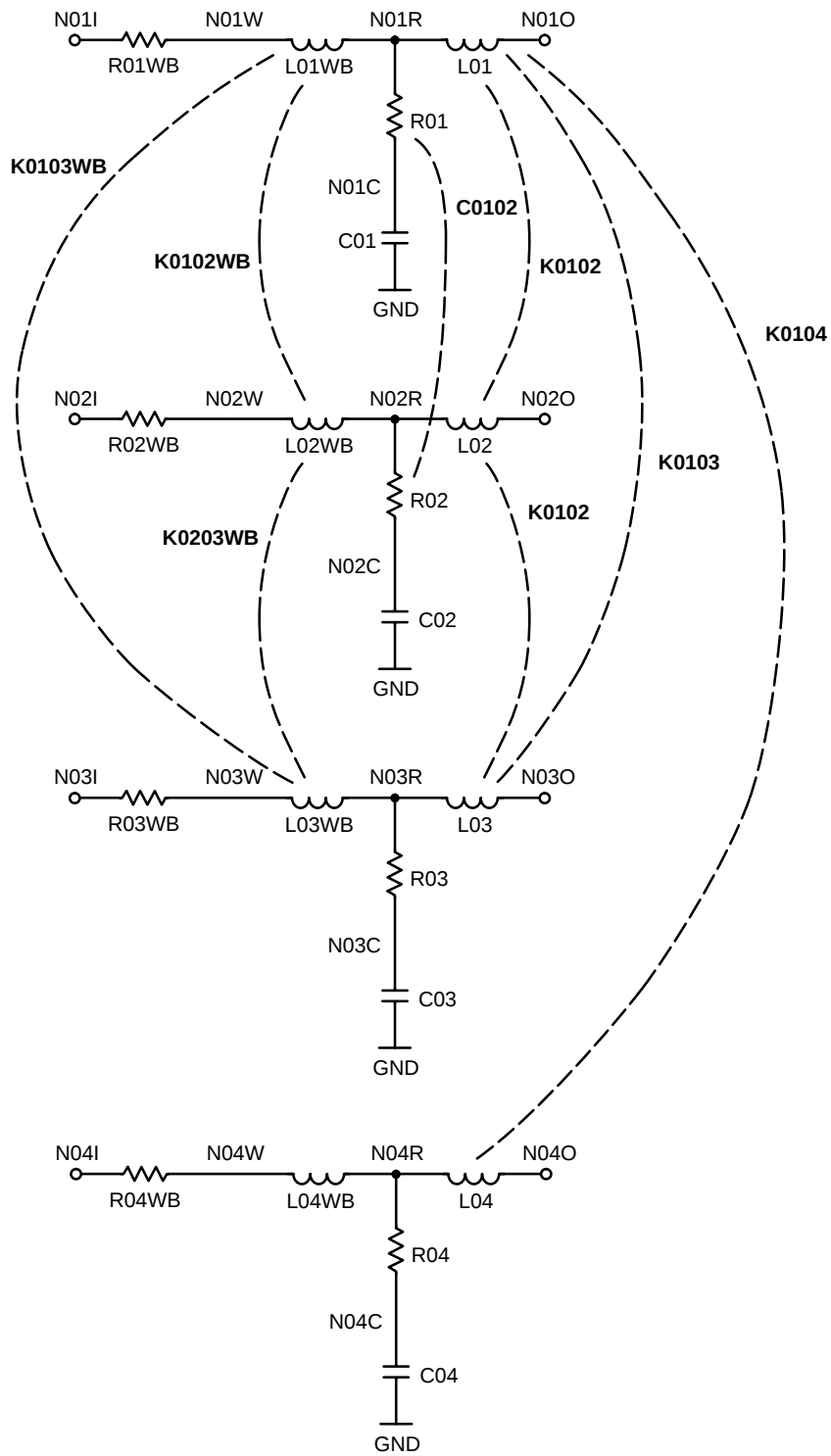


Figure 22.

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