

# Device Modeling Report

COMPONENTS:

DIODE/ GENERAL PURPOSE RECTIFIER/ PROFESSIONAL

PART NUMBER: D1NL20U

MANUFACTURER: SHINDENGEN

REMARK: TC=25C

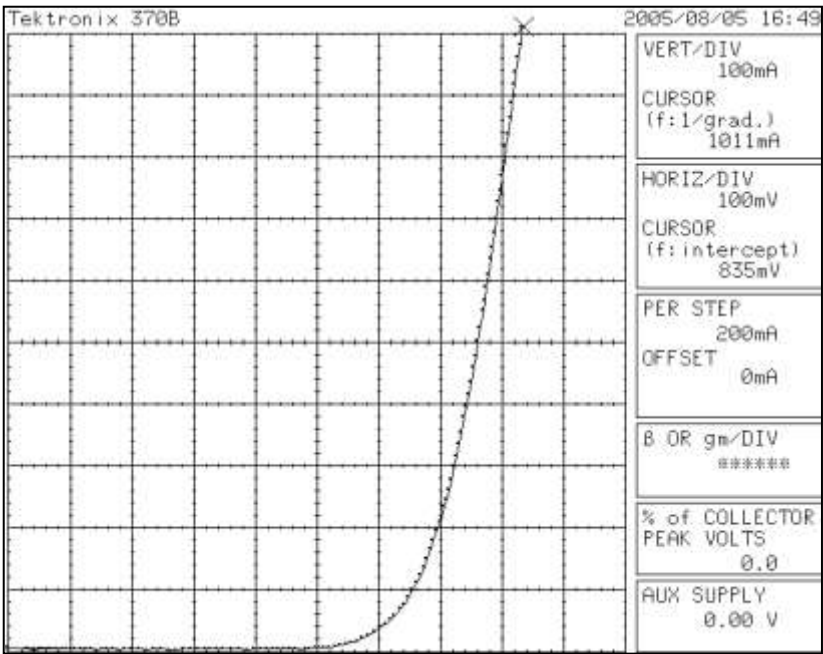


**Bee Technologies Inc.**

| PSpice model parameter | Model description                           |
|------------------------|---------------------------------------------|
| IS                     | Saturation Current                          |
| N                      | Emission Coefficient                        |
| RS                     | Series Resistance                           |
| IKF                    | High-injection Knee Current                 |
| CJO                    | Zero-bias Junction Capacitance              |
| M                      | Junction Grading Coefficient                |
| VJ                     | Junction Potential                          |
| ISR                    | Recombination Current Saturation Value      |
| BV                     | Reverse Breakdown Voltage(a positive value) |
| IBV                    | Reverse Breakdown Current(a positive value) |
| TT                     | Transit Time                                |
| EG                     | Energy-band Gap                             |

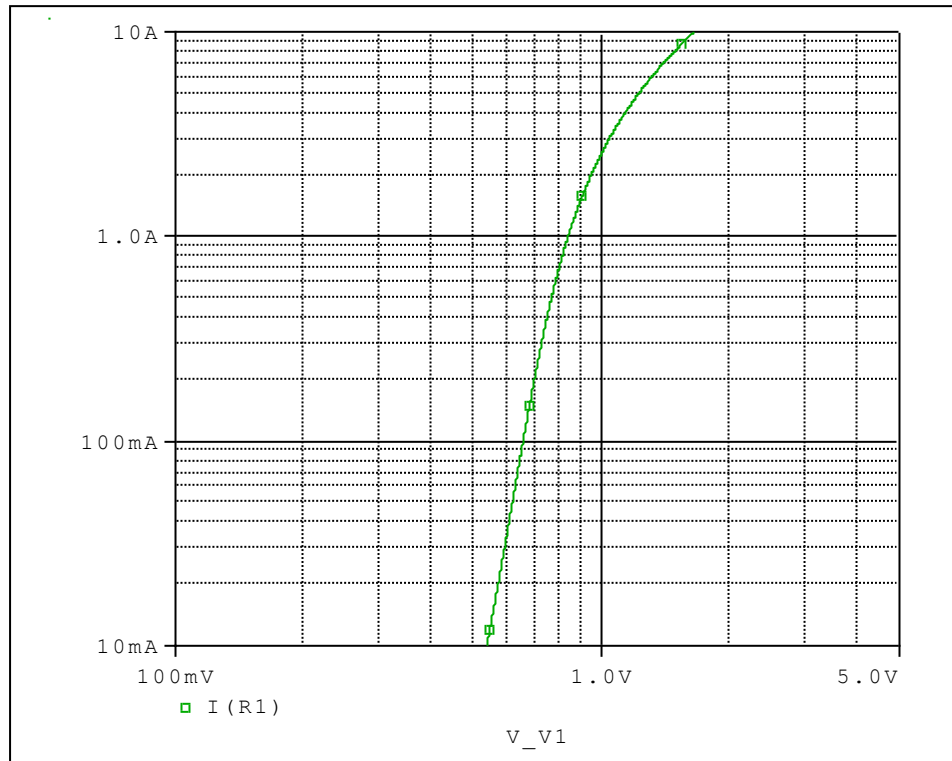
Forward Current Characteristic

Reference

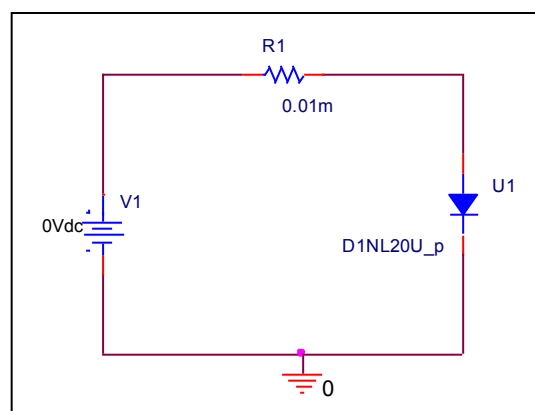


# Forward Current Characteristic

## Circuit Simulation Result

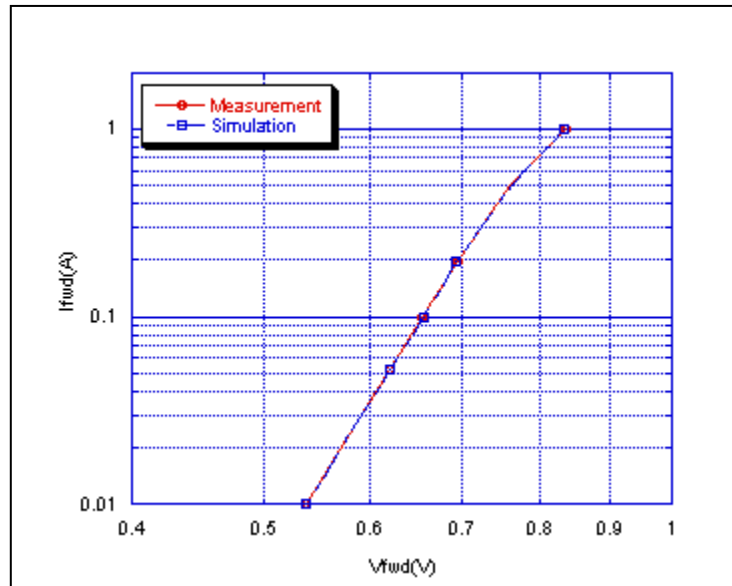


## Evaluation Circuit



## Comparison Graph

### Circuit Simulation Result

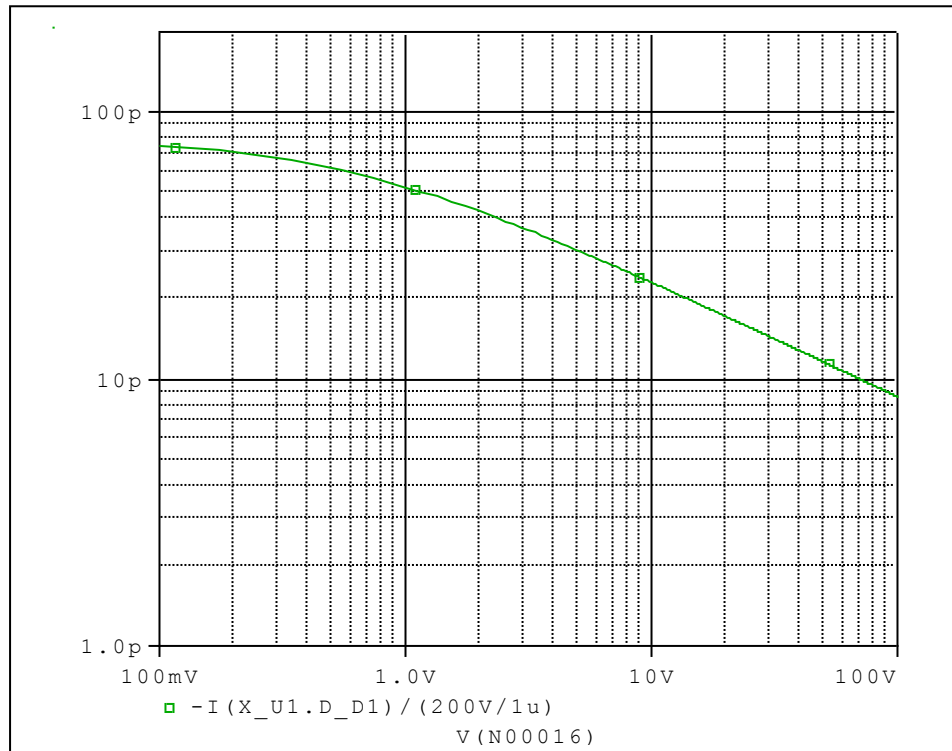


### Simulation Result

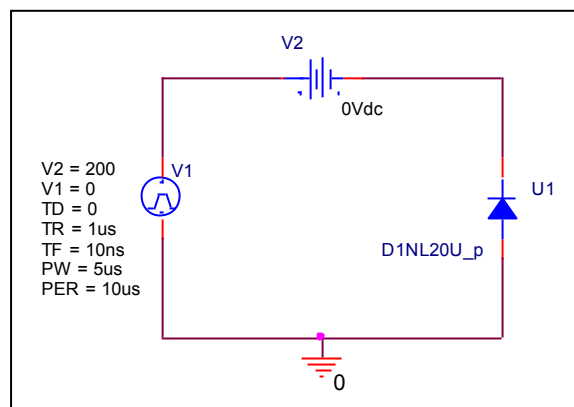
| Ifwd(A) | Vfwd(V)<br>Measurement | Vfwd(V)<br>Simulation | %Error |
|---------|------------------------|-----------------------|--------|
| 0.01    | 0.538                  | 0.537                 | 0.186  |
| 0.02    | 0.575                  | 0.576                 | -0.174 |
| 0.05    | 0.620                  | 0.619                 | 0.161  |
| 0.1     | 0.655                  | 0.656                 | -0.153 |
| 0.2     | 0.695                  | 0.694                 | 0.144  |
| 0.5     | 0.761                  | 0.762                 | -0.131 |
| 1       | 0.835                  | 0.834                 | 0.120  |

# Capacitance Characteristic

## Circuit Simulation Result

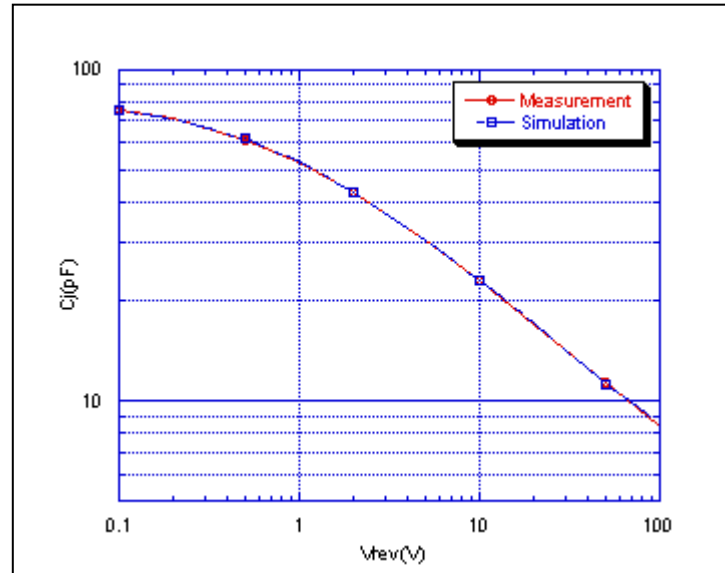


## Evaluation Circuit



## Comparison Graph

### Circuit Simulation Result

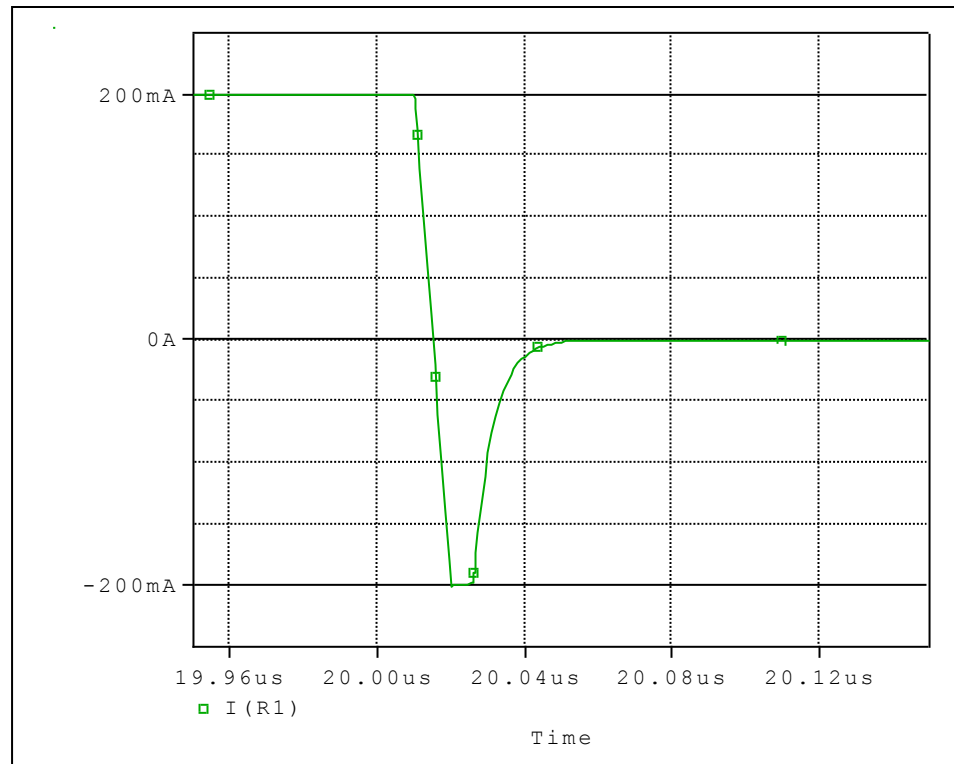


### Simulation Result

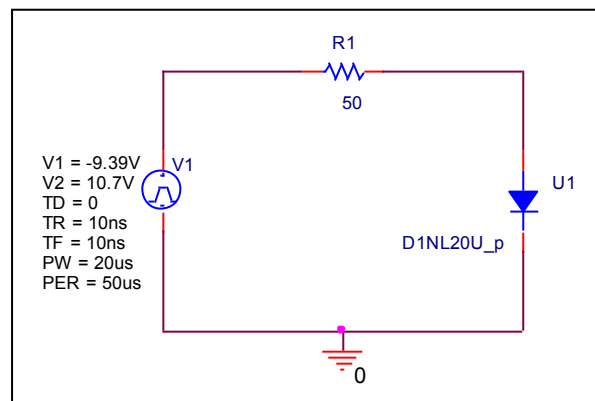
| Vrev(V) | Cj(pF)<br>Measurement | Cj(pF)<br>Simulation | %Error |
|---------|-----------------------|----------------------|--------|
| 0       | 80.123                | 80.123               | 0.000  |
| 0.1     | 74.873                | 75.131               | -0.345 |
| 0.2     | 70.813                | 70.830               | -0.024 |
| 0.5     | 61.405                | 61.746               | -0.555 |
| 1       | 52.473                | 52.521               | -0.091 |
| 2       | 42.600                | 42.458               | 0.333  |
| 5       | 30.635                | 30.433               | 0.659  |
| 10      | 23.100                | 22.981               | 0.515  |
| 20      | 17.150                | 17.218               | -0.397 |
| 50      | 11.448                | 11.161               | 2.507  |
| 100     | 8.418                 | 8.581                | -1.936 |

## Reverse Recovery Characteristic

### Circuit Simulation Result



### Evaluation Circuit

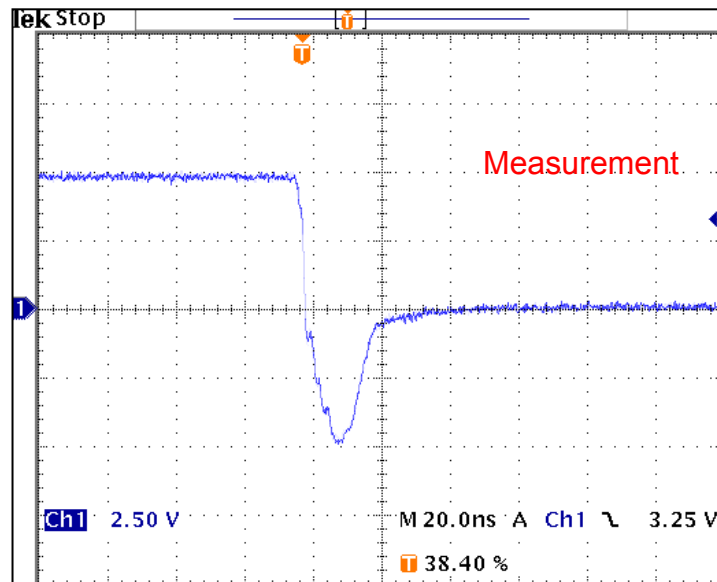


### Compare Measurement vs. Simulation

|     | Measurement |    | Simulation |    | %Error |
|-----|-------------|----|------------|----|--------|
| trj | 10.40       | ns | 10.46      | ns | 0.576  |
| trb | 12.00       | ns | 11.98      | ns | 0.166  |

## Reverse Recovery Characteristic

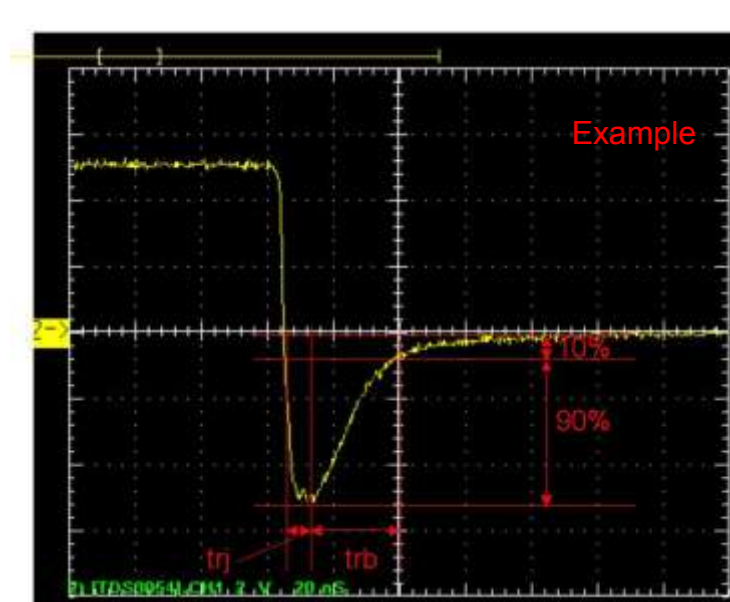
## Reference



$T_{rj} = 10.4 \text{ (ns)}$

$T_{rb} = 12.0 \text{ (ns)}$

Conditions:  $I_{fwd} = I_{rev} = 0.2 \text{ (A)}$ ,  $R_L = 50$



Relation between  $t_{rj}$  and  $t_{rb}$