# Device Modeling Report

COMPONENTS: Insulated Gate Bipolar Transistor (IGBT)
PART NUMBER: CM200HA-24H
MANUFACTURER: MITSUBISHI
*REMARK: Free-Wheeling Diode Standard Model

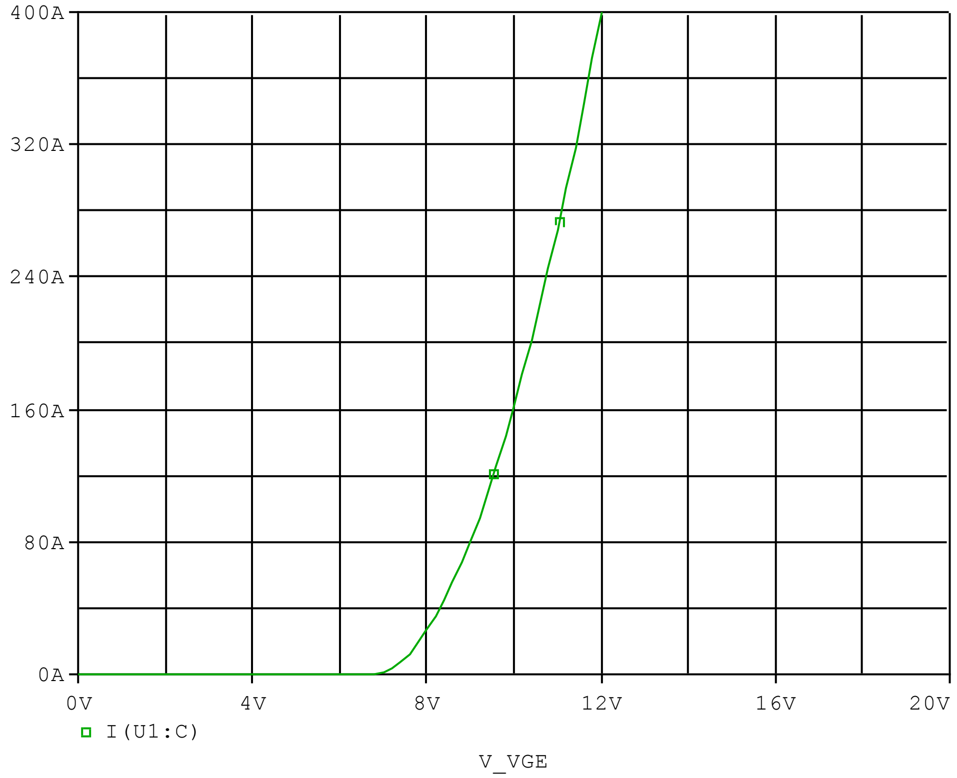
**Bee Technologies Inc.**

## IGBT SPICE Model Parameters

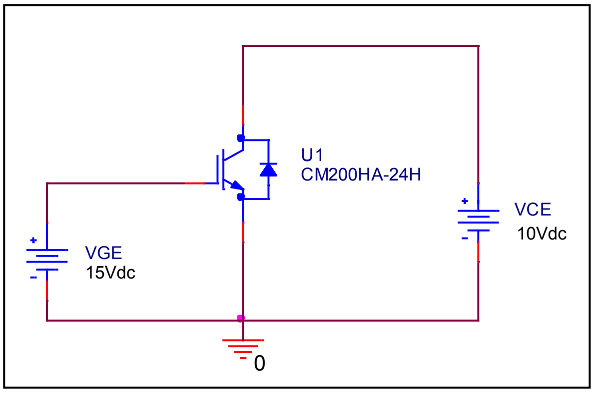
| PSpice model parameter | Model description |
|---|---|
| TAU | Ambipolar Recombination Lifetime |
| KP | MOS Transconductance |
| AREA | Area of the Device |
| AGD | Gate-Drain Overlap Area |
| WB | Metallurgical Base Width |
| VT | Threshold Voltage |
| KF | Triode Region Factor |
| CGS | Gate-Source Capacitance per Unit Area |
| COXD | Gate-Drain Oxide Capacitance per Unit Area |
| VTD | Gate-Drain Overlap Depletion Threshold |

# Transfer Characteristics

## Circuit Simulation result

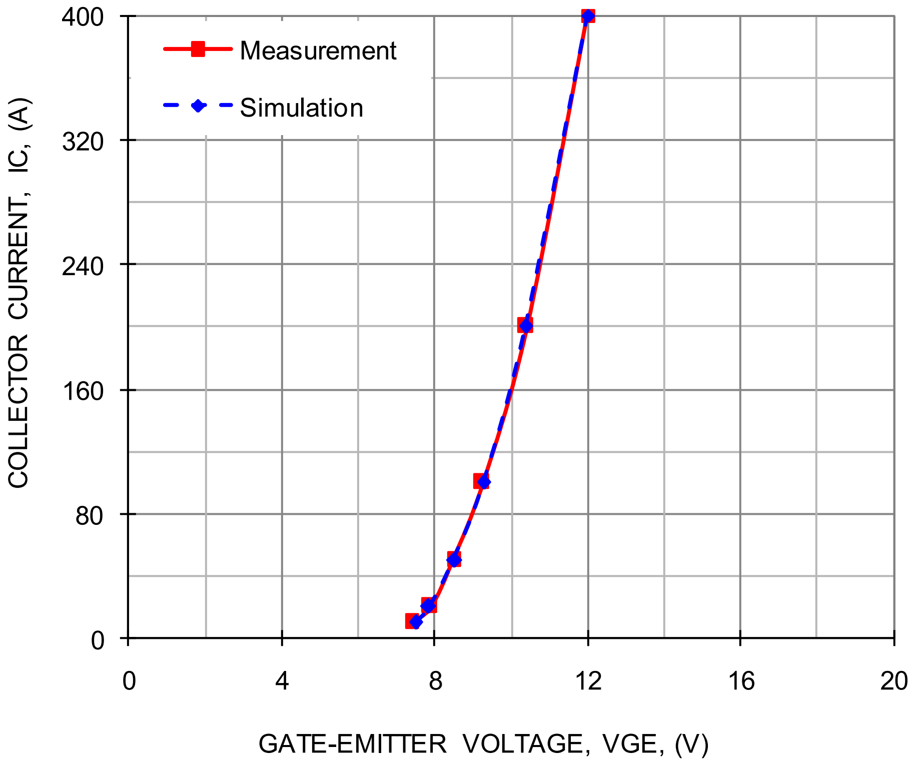


## Evaluation circuit



## Comparison Graph

Circuit Simulation Result



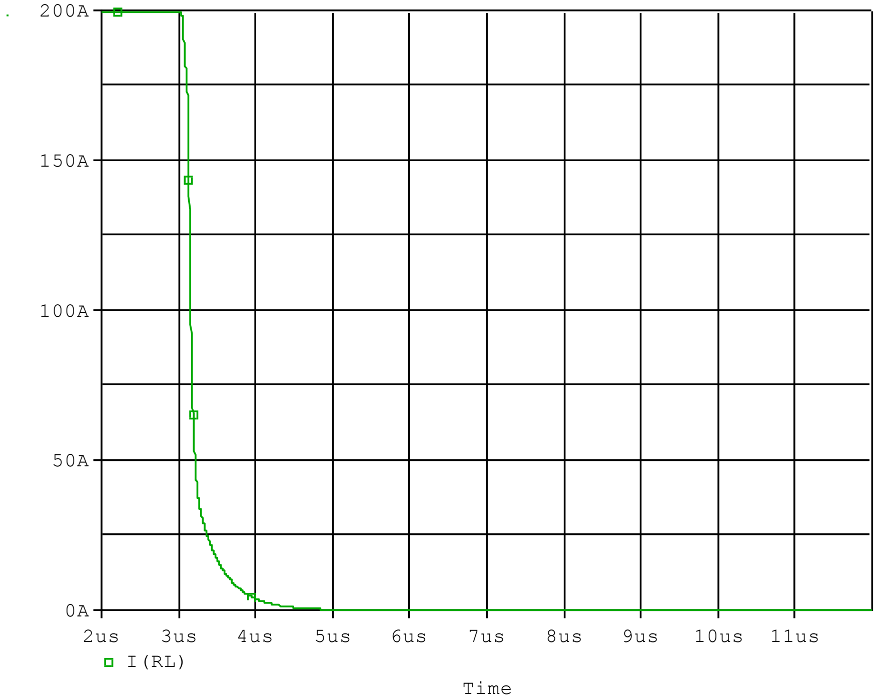
Simulation Result

**Test condition: $V_{CE}$ = 10 V**

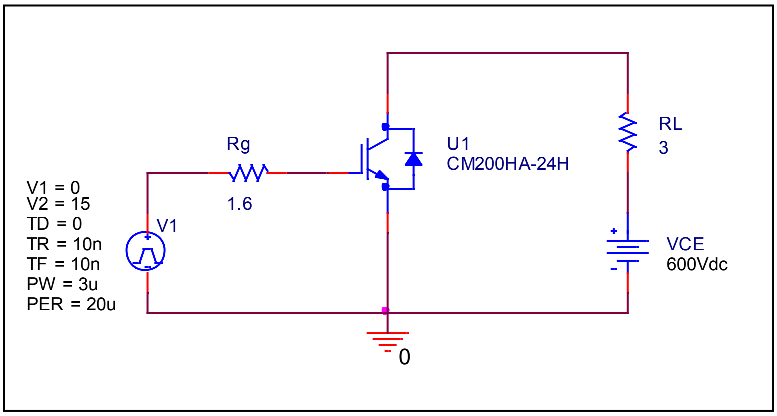
| IC (A) | VGE (V) | | Error (%) |
|---|---|---|---|
| | Measurement | Simulation | |
| 10 | 7.400 | 7.493 | 1.26 |
| 20 | 7.900 | 7.832 | -0.86 |
| 50 | 8.500 | 8.504 | 0.04 |
| 100 | 9.250 | 9.274 | 0.26 |
| 200 | 10.400 | 10.385 | -0.14 |
| 400 | 12.000 | 12.001 | 0.01 |

# Fall Time Characteristics

## Circuit Simulation result



## Evaluation circuit

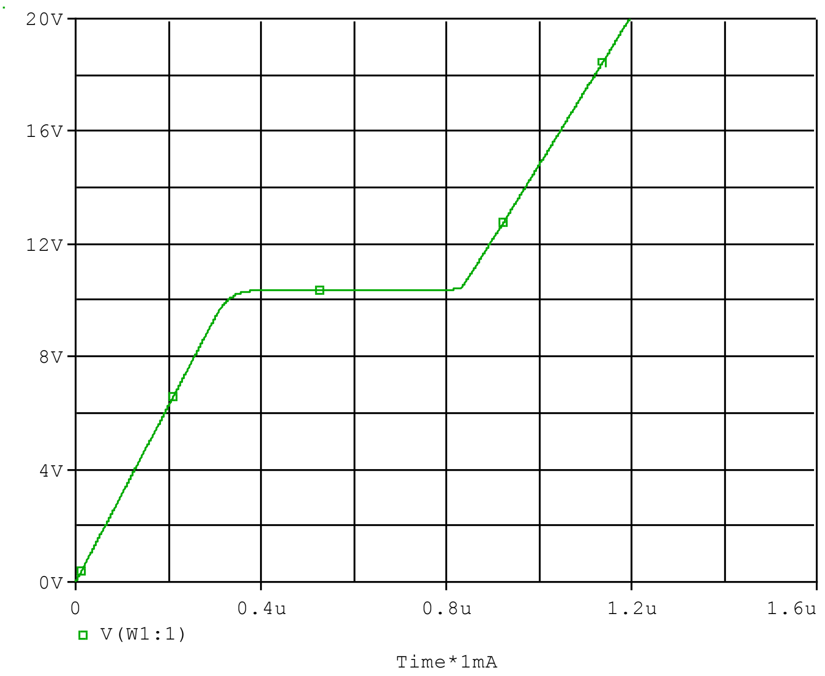


## Test condition IC=200 (A), VCC=600(V)

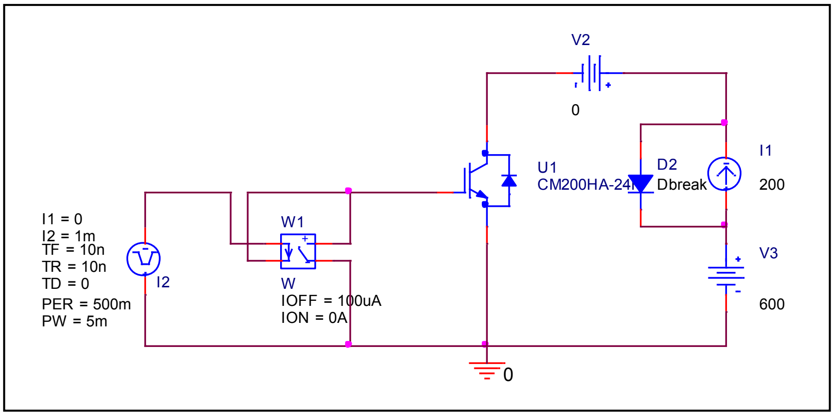
| Parameter | Unit | Measurement | Simulation | Error |
|---|---|---|---|---|
| tf | ns | 350.000 | 350.129 | 0.037 |

# Gate Charge Characteristics

## Circuit Simulation result



## Evaluation circuit

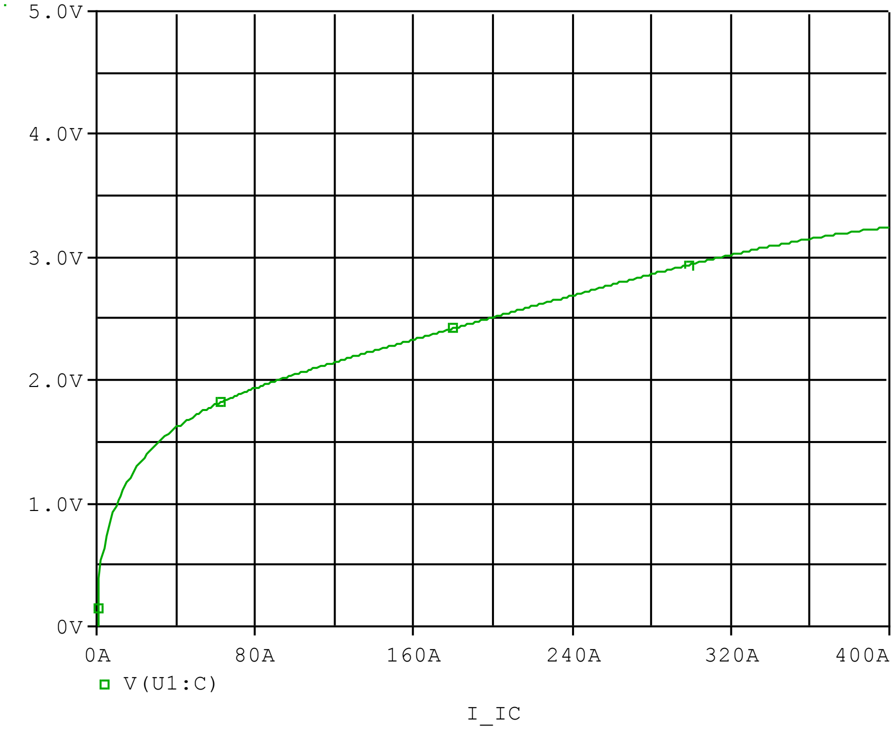


### Test condition: $V_{CC}$=600 (V), $I_C$=200(A) ,$V_{GE}$=15(V)

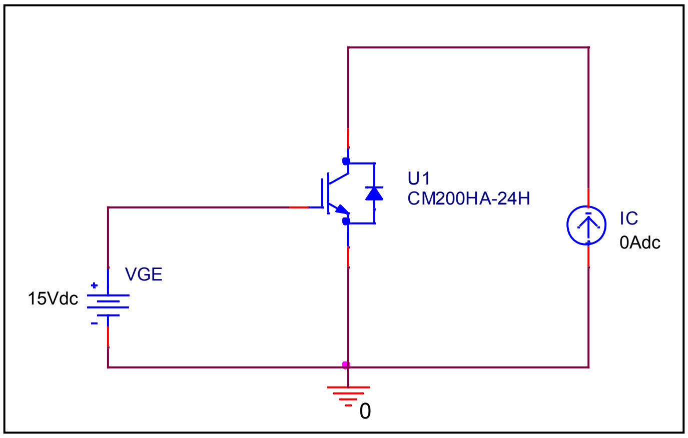
| Parameter | Unit | Measurement | Simulation | Error(%) |
|---|---|---|---|---|
| Qge | nc | 350.000 | 350.000 | 0.000 |
| Qgc | nc | 480.000 | 479.167 | -0.174 |
| Qg | nc | 1000.000 | 1008.200 | 0.820 |

## Saturation Characteristics

### Circuit Simulation result

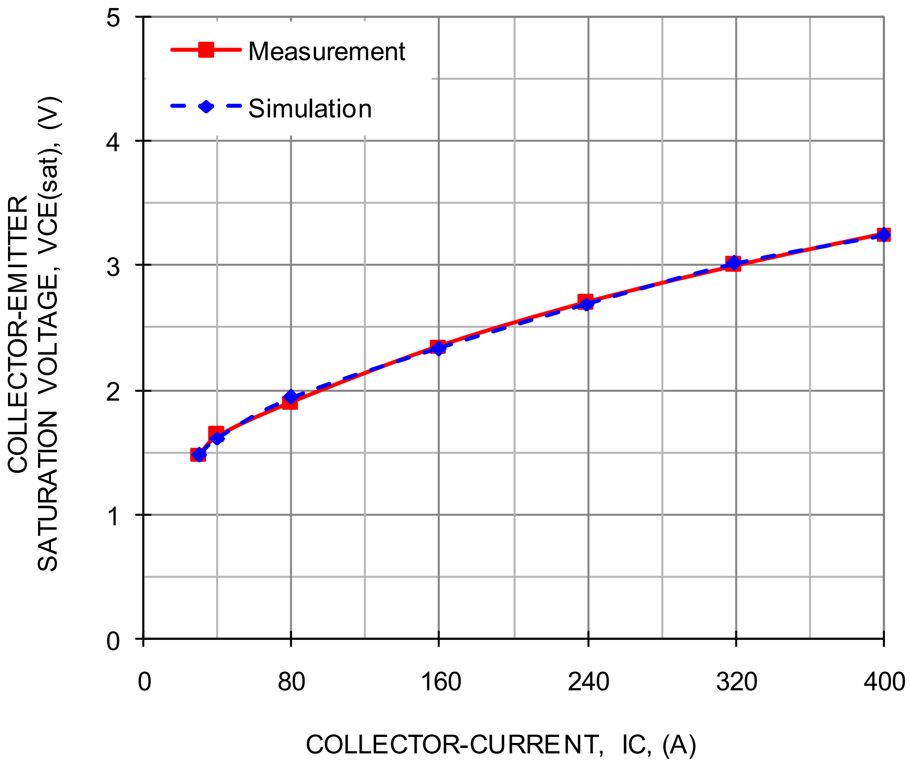


### Evaluation circuit



## Comparison Graph

### Circuit Simulation Result



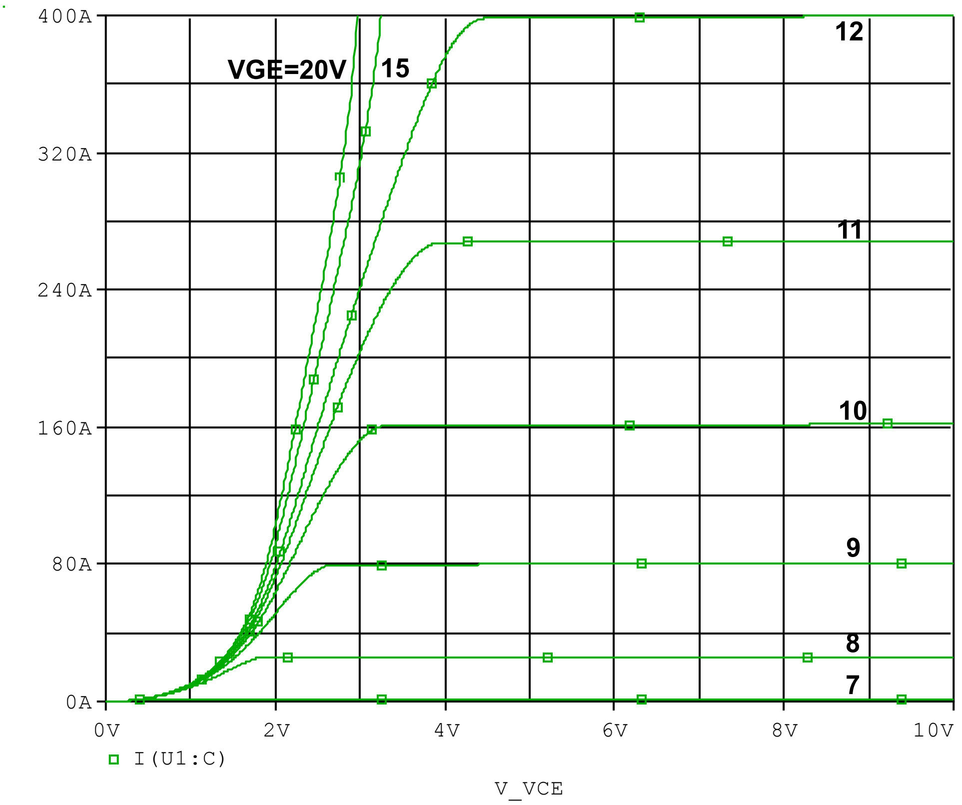
### Simulation Result

**Test condition: $V_{GE}$ = 15 V**

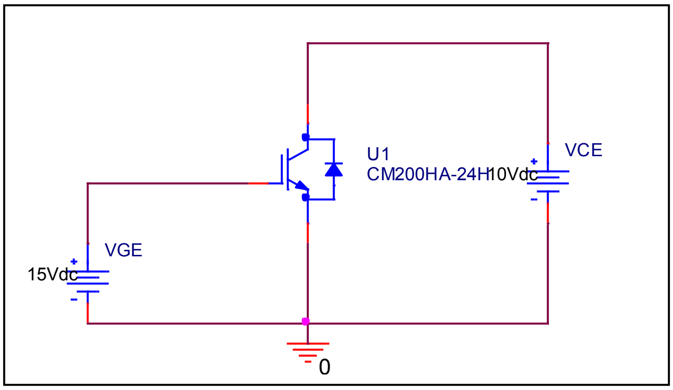
| Ic(A) | VCE (V) | | Error (%) |
|---|---|---|---|
| | Measurement | Simulation | |
| 30 | 1.480 | 1.478 | -0.13 |
| 40 | 1.630 | 1.612 | -1.09 |
| 80 | 1.900 | 1.936 | 1.92 |
| 160 | 2.350 | 2.331 | -0.82 |
| 240 | 2.700 | 2.689 | -0.40 |
| 320 | 3.000 | 3.018 | 0.61 |
| 400 | 3.250 | 3.244 | -0.18 |

# Output Characteristics

## Circuit Simulation result

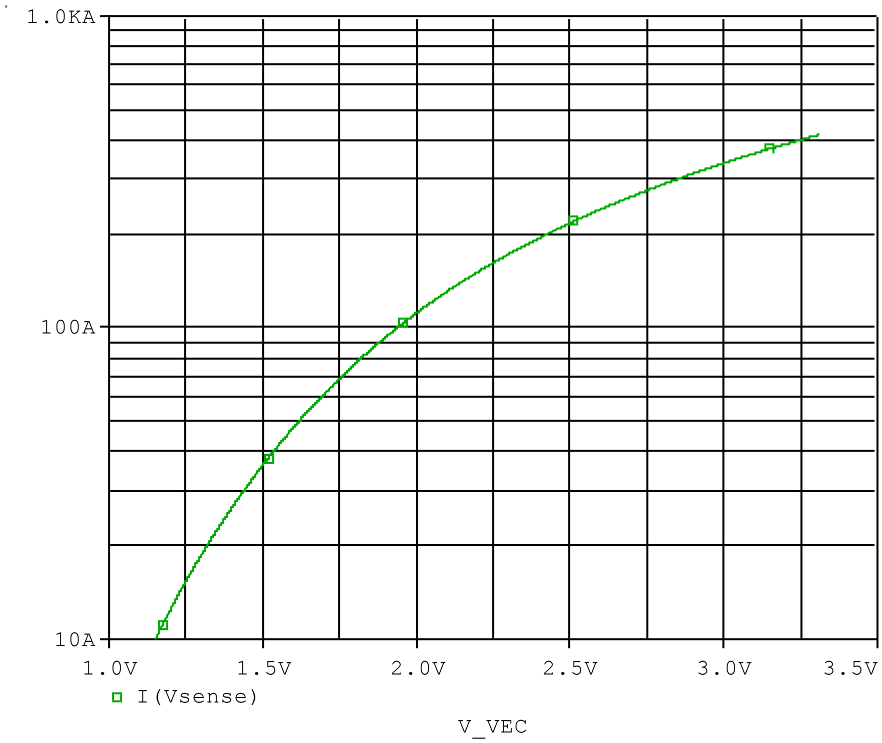


## Evaluation circuit

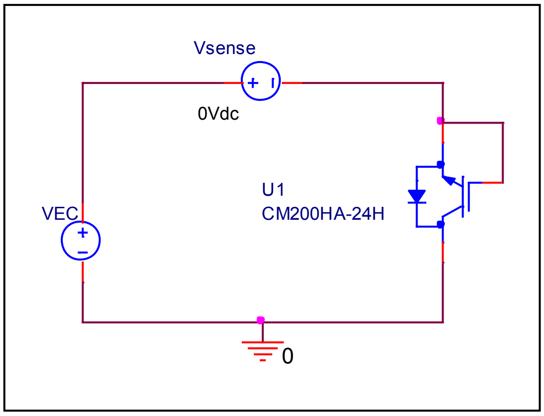


# Forward Current Characteristic

## Circuit Simulation Result

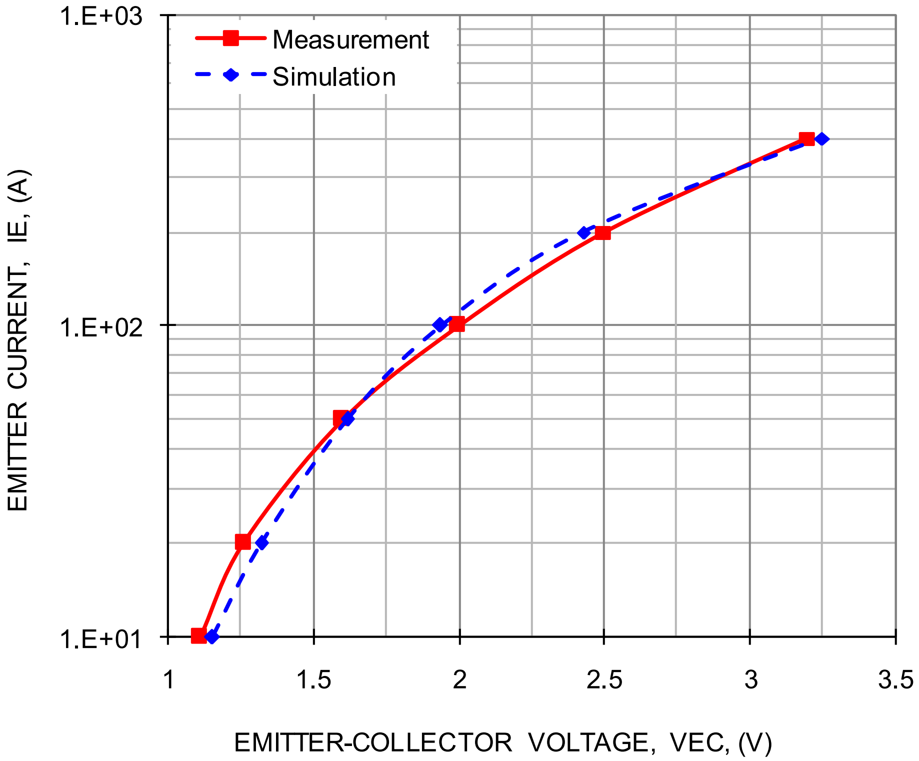


## Evaluation Circuit



## Comparison Graph

Circuit Simulation Result



Simulation Result

| IE(A) | VEC(V) | | %Error |
|---|---|---|---|
| | Measurement | Simulation | |
| 10 | 1.110 | 1.151 | 3.71 |
| 20 | 1.260 | 1.320 | 4.75 |
| 50 | 1.600 | 1.617 | 1.09 |
| 100 | 2.000 | 1.938 | -3.08 |
| 200 | 2.500 | 2.427 | -2.93 |
| 400 | 3.200 | 3.248 | 1.50 |