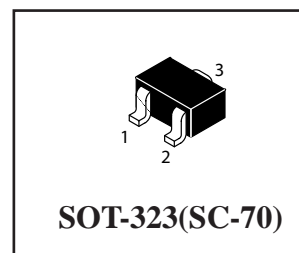
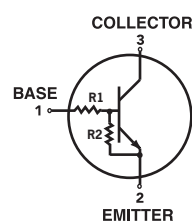


### NPN Silicon Bias Resistor Transistor

\* “G” Lead(Pb)-Free



### Maximum Ratings (T<sub>A</sub>=25 °C unless otherwise noted)

| Rating                       | Symbol           | Value | Unit |
|------------------------------|------------------|-------|------|
| Collector-Emitter Voltage    | V <sub>CEO</sub> | 50    | Vdc  |
| Collector-Base Voltage       | V <sub>CBO</sub> | 50    | Vdc  |
| Collector Current-Continuous | I <sub>C</sub>   | 100   | mAdc |

### Thermal Characteristics

| Characteristics   | Symbol                           | Max         | Unit         |
|---|----------------------------------|-------------|--------------|
| Total Device Dissipation FR-5 Board<br>(1)T <sub>A</sub> =25 °C<br>Derate above 25 °C | P <sub>D</sub>                   | 202<br>1.6  | mW<br>mW/ °C |
| Thermal Resistance, Junction to Ambient (1)   | R <sub>θJA</sub>                 | 618         | °C/W         |
| Junction and Storage, Temperature Range   | T <sub>J</sub> ,T <sub>stg</sub> | -55 to +150 | °C           |

1.FR-4 @ minimum pad

2.FR-4 @ 1.0×1.0 inch Pad

### Device Marking and Resistor Values

| Device  | Marking | R1(K) | R2(K) | Device  | Marking | R1(K) | R2(K) |
|---------|---------|-------|-------|---------|---------|-------|-------|
| MUN5211 | 8A      | 10    | 10    | MUN5231 | 8H      | 2.2   | 2.2   |
| MUN5212 | 8B      | 22    | 22    | MUN5232 | 8J      | 4.7   | 4.7   |
| MUN5213 | 8C      | 47    | 47    | MUN5233 | 8K      | 4.7   | 47    |
| MUN5214 | 8D      | 10    | 47    | MUN5234 | 8L      | 2.2   | 47    |
| MUN5215 | 8E      | 10    | ∞     | MUN5235 | 8M      | 2.2   | 47    |
| MUN5216 | 8F      | 4.7   | ∞     | MUN5236 | 8N      | 100   | 100   |
| MUN5230 | 8G      | 1.0   | 1.0   | MUN5237 | 8P      | 47    | 22    |

**Electrical Characteristics** (TA=25°C Unless Otherwise noted)

| Characteristics | Symbol | Min | Typ | Max | Unit |
|-----------------|--------|-----|-----|-----|------|
|-----------------|--------|-----|-----|-----|------|

**Off Characteristics**

|   |          |    |   |      |    |
|---|----------|----|---|------|----|
| Collector-Emitter Breakdown Voltage<br>( $I_C=2.0\text{mA}$ , $I_B=0$ )       | V(BR)CEO | 50 | - | -    | V  |
| Collector-Base Breakdown Voltage<br>( $I_C=10\text{ }\mu\text{A}$ , $I_E=0$ ) | V(BR)CBO | 50 | - | -    | V  |
| Collector-Base Cutoff Voltage<br>( $V_{CB}=50\text{V}$ , $I_E=0$ )            | ICBO     | -  | - | 100  | nA |
| Collector-Emitter Cutoff Current<br>( $I_{CE}=50\text{V}$ , $I_B=0$ )         | ICEO     | -  | - | 500  | nA |
| Emitter-Base Cutoff Current<br>( $V_{EB}=6.0\text{V}$ , $I_C=0$ )             | IEBO     | -  | - | 0.5  | mA |
| MUN5211   |          | -  | - | 0.2  |    |
| MUN5212   |          | -  | - | 0.1  |    |
| MUN5213   |          | -  | - | 0.2  |    |
| MUN5214   |          | -  | - | 0.9  |    |
| MUN5215   |          | -  | - | 1.9  |    |
| MUN5216   |          | -  | - | 4.3  |    |
| MUN5230   |          | -  | - | 2.3  |    |
| MUN5231   |          | -  | - | 1.5  |    |
| MUN5232   |          | -  | - | 0.18 |    |
| MUN5233   |          | -  | - | 0.13 |    |
| MUN5234   |          | -  | - | 0.2  |    |
| MUN5235   |          | -  | - | 0.05 |    |
| MUN5236   |          | -  | - | 0.13 |    |
| MUN5237   |          | -  | - |      |    |

## Electrical Characteristics (TA=25°C Unless Otherwise noted)

| Characteristics | Symbol | Min | Typ | Max | Unit |
|-----------------|--------|-----|-----|-----|------|
|-----------------|--------|-----|-----|-----|------|

### On Characteristics (3)

|   |   |                      |     |     |      |     |     |
|---|---|----------------------|-----|-----|------|-----|-----|
| DC Current Gain<br>(VCE=10V, IC=5.0mA)  | MUN5211   | h <sub>FE</sub>      | 35  | 60  | -    |     |     |
|   | MUN5212   |                      | 60  | 100 | -    |     |     |
|   | MUN5213   |                      | 80  | 140 | -    |     |     |
|   | MUN5214   |                      | 80  | 140 | -    |     |     |
|   | MUN5215   |                      | 160 | 350 | -    |     |     |
|   | MUN5216   |                      | 160 | 350 | -    |     |     |
|   | MUN5230   |                      | 3.0 | 5.0 | -    |     |     |
|   | MUN5231   |                      | 8.0 | 15  | -    |     |     |
|   | MUN5232   |                      | 15  | 30  | -    |     |     |
|   | MUN5233   |                      | 80  | 200 | -    |     |     |
|   | MUN5234   |                      | 80  | 150 | -    |     |     |
|   | MUN5235   |                      | 80  | 140 | -    |     |     |
|   | MUN5236   |                      | 80  | 150 | -    |     |     |
|   | MUN5237   |                      | 80  | 140 | -    |     |     |
| Collector-Emitter Saturation Voltage<br>(IC=10mA, IB=0.3mA)<br>(IC=10mA, IB=5mA)<br>(IC=10mA, IB=1mA) | MUN5230/MUN5231<br>MUN5215/MUN5216<br>MUN5232/MUN5233/MUN5234   | V <sub>CE(sat)</sub> | -   | -   | 0.25 | Vdc |     |
| Output Voltage(on)<br>(VCC=5.0V, VB=2.5V, RL=1.0kΩ)   | MUN5211<br>MUN5212<br>MUN5214<br>MUN5215<br>MUN5216<br>MUN5230<br>MUN5231<br>MUN5232<br>MUN5233<br>MUN5234<br>MUN5235 | V <sub>OL</sub>      | -   | -   | 0.2  | Vdc |     |
| (VCC=5.0V, VB=3.5V, RL=1.0kΩ)   | MUN5213   | -                    | -   | 0.2 |      |     |     |
| (VCC=5.0V, VB=5.5V, RL=1.0kΩ)   | MUN5236   | -                    | -   | 0.2 |      |     |     |
| (VCC=5.0V, VB=4.0V, RL=1.0kΩ)   | MUN5237   | -                    | -   | 0.2 |      |     |     |
| Output Voltage(off)<br>(VCC=5.0V, VB=0.5V, RL=1.0kΩ)  |   | V <sub>OH</sub>      | 4.9 | -   | -    |     | Vdc |
| (VCC=5.0V, VB=0.050V, RL=1.0kΩ)   | MUN5230   |                      |     |     |      |     |     |
| (VCC=5.0V, VB=0.25V, RL=1.0kΩ)  | MUN5215/MUN5216/MUN5233   |                      |     |     |      |     |     |

3. Pulse Test: Pulse Width<300 us, Duty Cycle<2.0%

## Electrical Characteristics (TA=25°C Unless Otherwise noted)

| Characteristics | Symbol | Min | Typ | Max | Unit |
|-----------------|--------|-----|-----|-----|------|
|-----------------|--------|-----|-----|-----|------|

### On Characteristics

|                                |         |       |       |       |      |    |
|--------------------------------|---------|-------|-------|-------|------|----|
| Input Resistor                 | MUN5211 | R1    | 7.0   | 10    | 13   | kΩ |
|                                | MUN5212 |       | 15.4  | 22    | 28.6 |    |
|                                | MUN5213 |       | 32.9  | 47    | 61.1 |    |
|                                | MUN5214 |       | 7.0   | 10    | 13   |    |
|                                | MUN5215 |       | 7.0   | 10    | 13   |    |
|                                | MUN5216 |       | 3.3   | 4.7   | 6.1  |    |
|                                | MUN5230 |       | 0.7   | 1.0   | 1.3  |    |
|                                | MUN5231 |       | 1.5   | 2.2   | 2.9  |    |
|                                | MUN5232 |       | 3.3   | 4.7   | 6.1  |    |
|                                | MUN5233 |       | 3.3   | 4.7   | 6.1  |    |
|                                | MUN5234 |       | 15.4  | 22    | 28.6 |    |
|                                | MUN5235 |       | 1.54  | 2.2   | 2.86 |    |
|                                | MUN5236 |       | 70    | 100   | 130  |    |
|                                | MUN5237 |       | 32.9  | 47    | 61.1 |    |
| Resistor Ratio MUN5211/MUN5212 | R1/R2   | 0.8   | 1.0   | 1.2   |      |    |
| MUN5213/MUN5236                |         | 0.17  | 0.21  | 0.25  |      |    |
| MUN5214                        |         | -     | -     | -     |      |    |
| MUN5215/MUN5216                |         | 0.8   | 1.0   | 1.2   |      |    |
| MUN5230/MUN5231/MUN5232        |         | 0.055 | 0.1   | 0.185 |      |    |
| MUN5233                        |         | 0.38  | 0.47  | 0.56  |      |    |
| MUN5234                        |         | 0.038 | 0.047 | 0.056 |      |    |
| MUN5235                        |         | 1.7   | 2.1   | 2.6   |      |    |
| MUN5237                        |         |       |       |       |      |    |

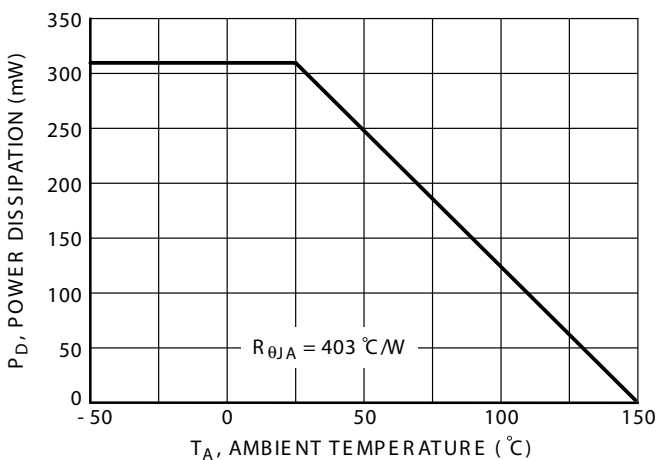


FIG 1. Derating Curve

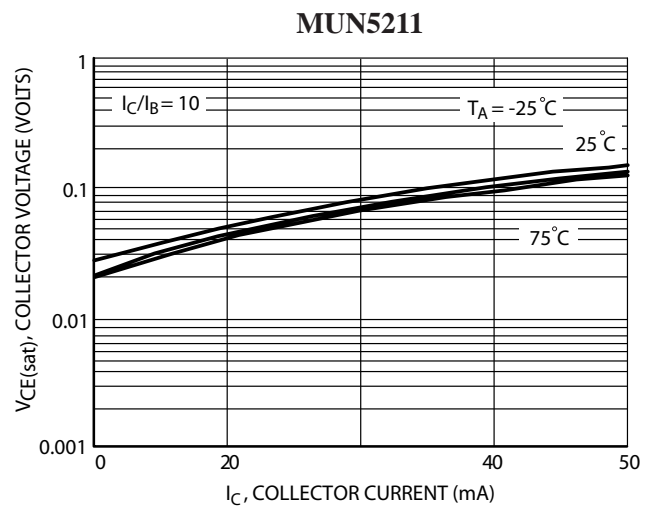
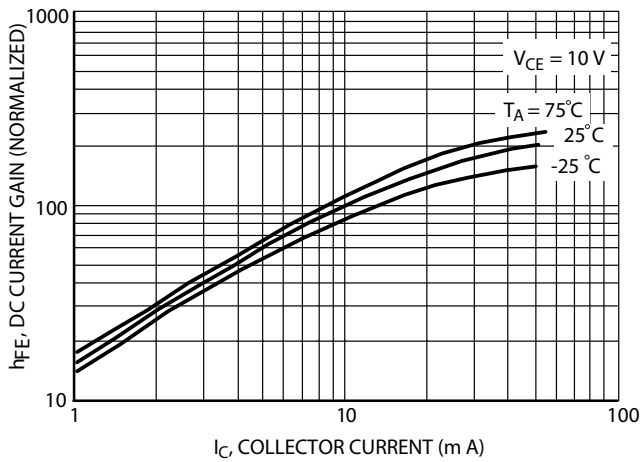
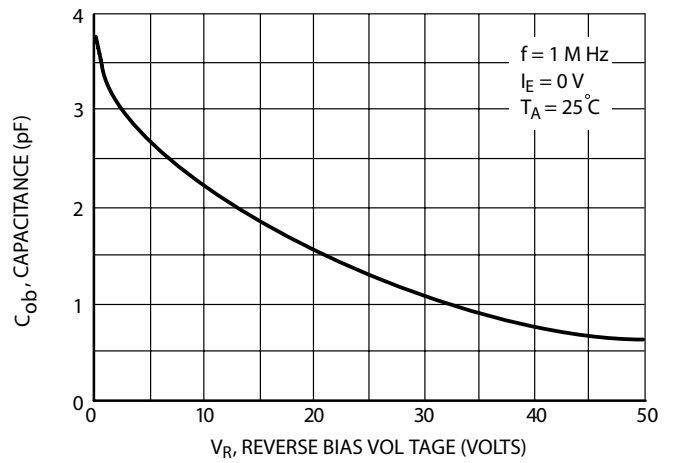


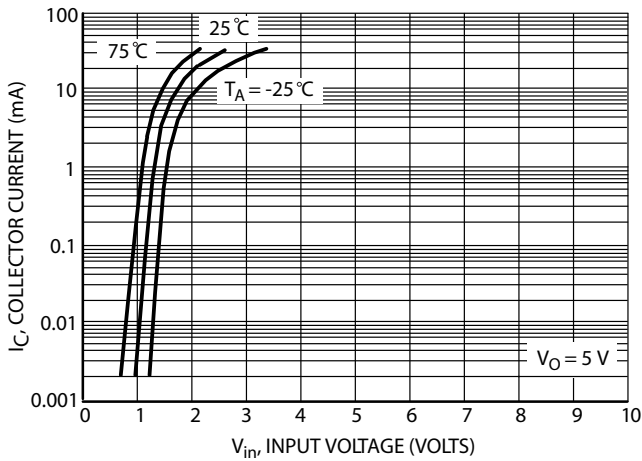
FIG.2  $V_{CE(sat)}$  versus  $I_C$



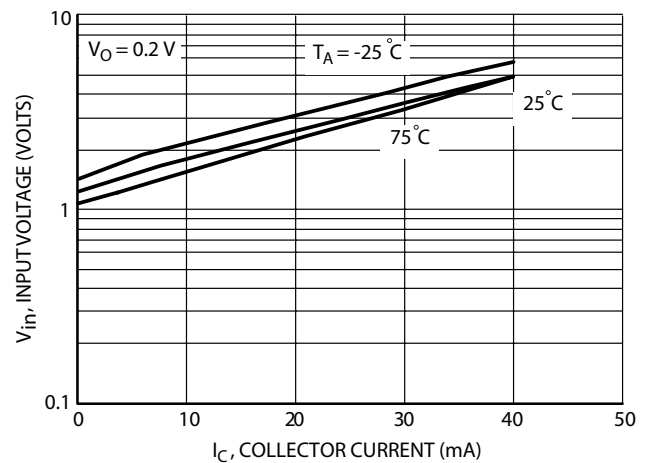
**FIG.3 DC Current Gain**



**FIG.4 Output Capacitance**

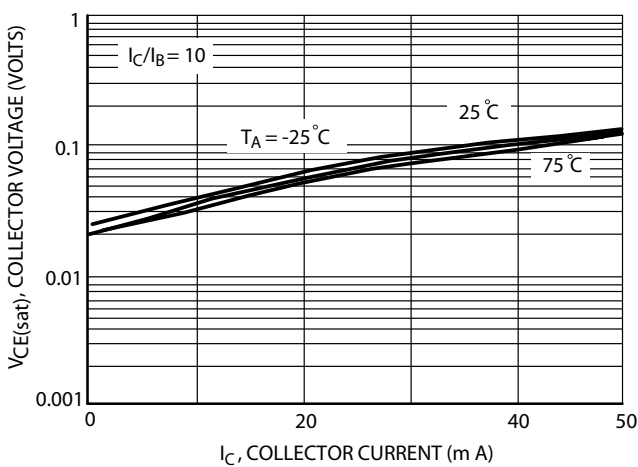


**FIG.5 Output Current versus Input Voltage**

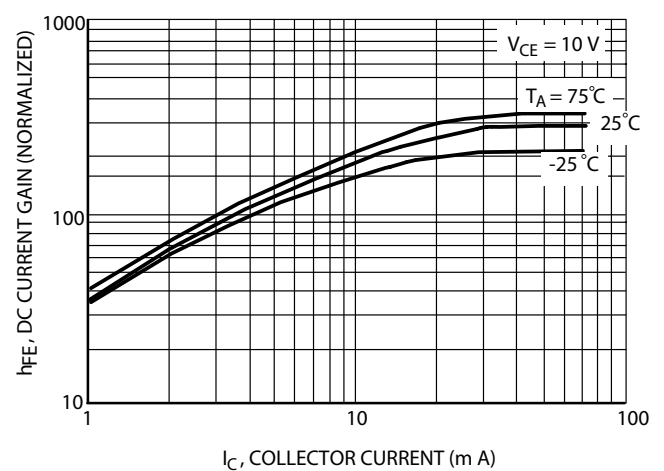


**FIG.6 Input Voltage versus Output Current**

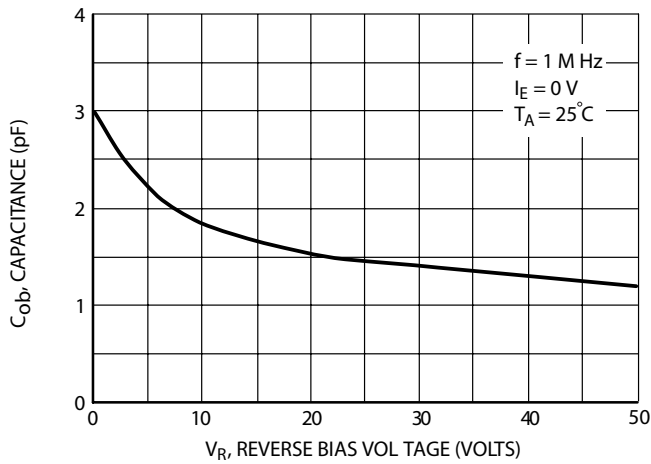
## MUN5212



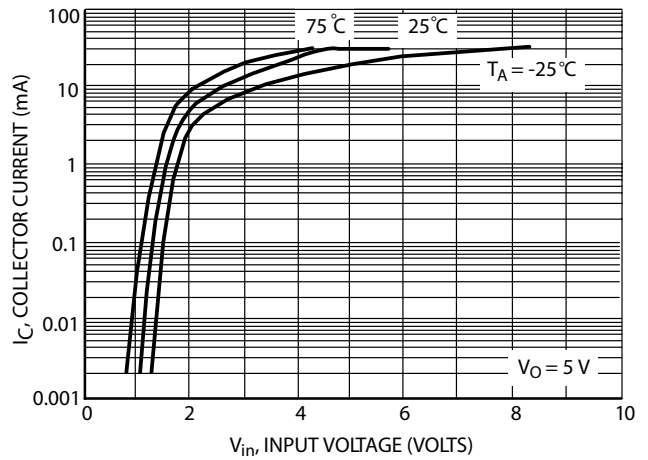
**FIG.7 VCE(sat) versus IC**



**FIG.8 DC Current Gain**

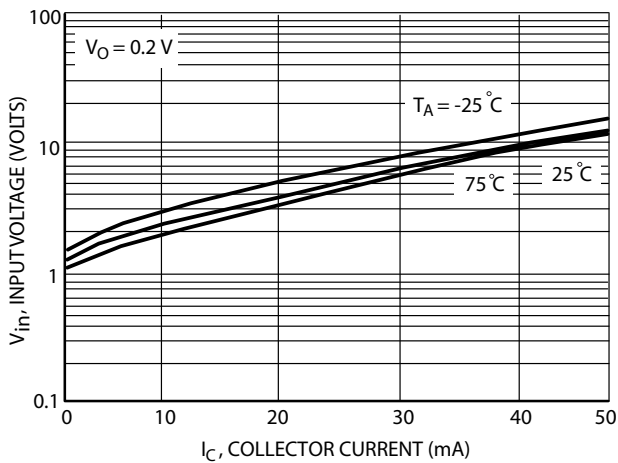


**FIG.9 Output Capacitance**

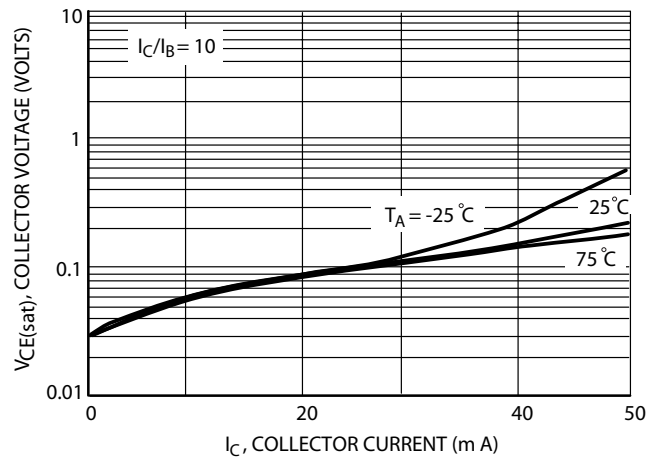


**FIG.10 Output Current versus Input Voltage**

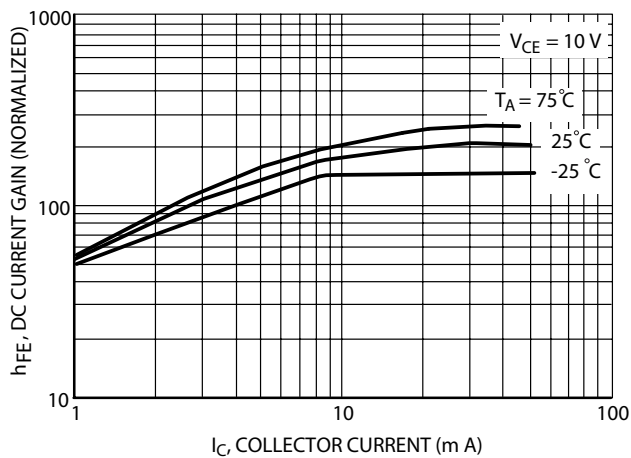
## MUN5213



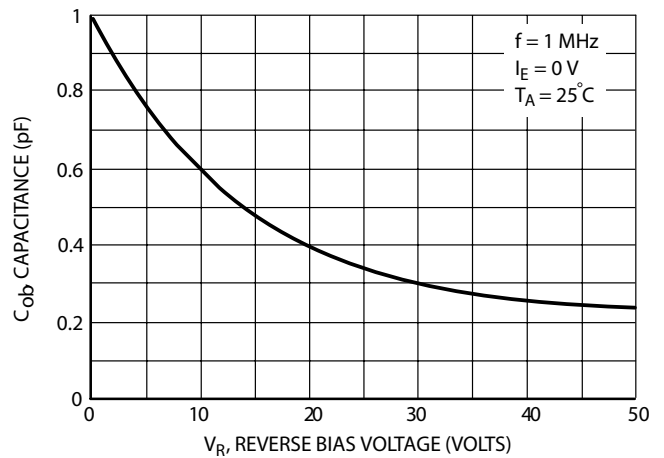
**FIG.11 Input Voltage versus Output Current**



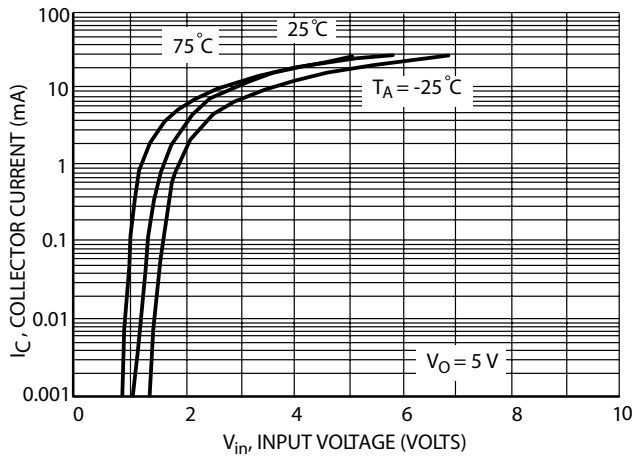
**FIG.12  $V_{CE(sat)}$  versus  $I_C$**



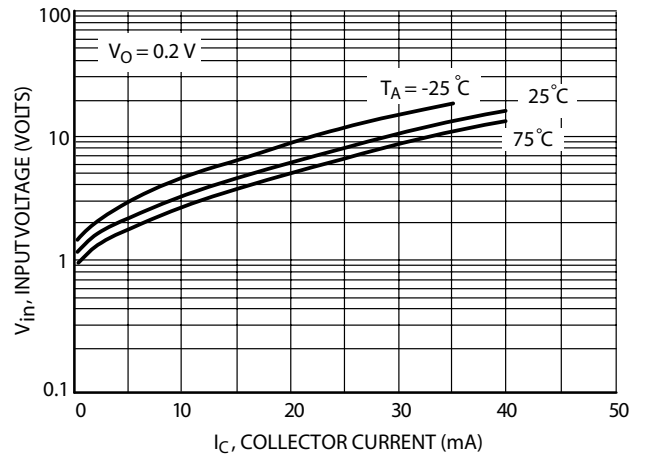
**FIG.13 DC Current Gain**



**FIG.14 Output Capacitance**

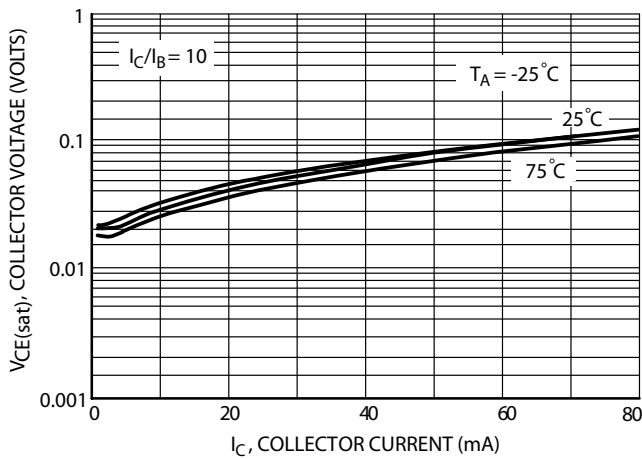


**FIG.15 Output Current versus Input Voltage**

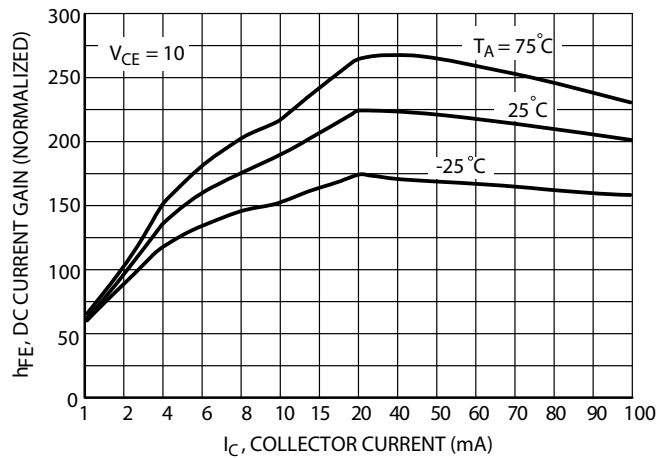


**FIG.16 Input Voltage versus Output Current**

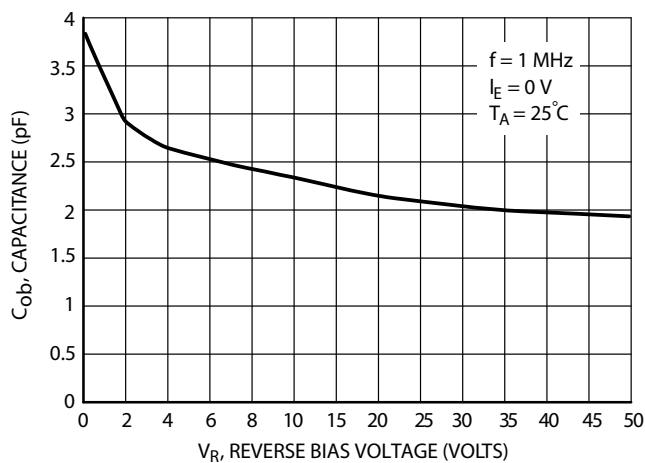
## MUN5214



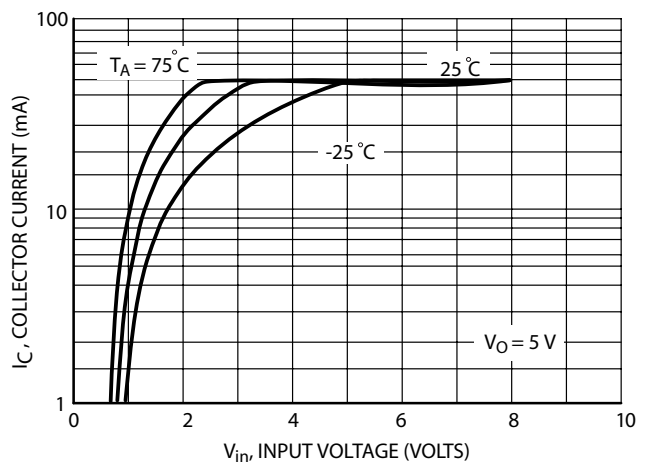
**FIG.17 VCE(sat) versus IC**



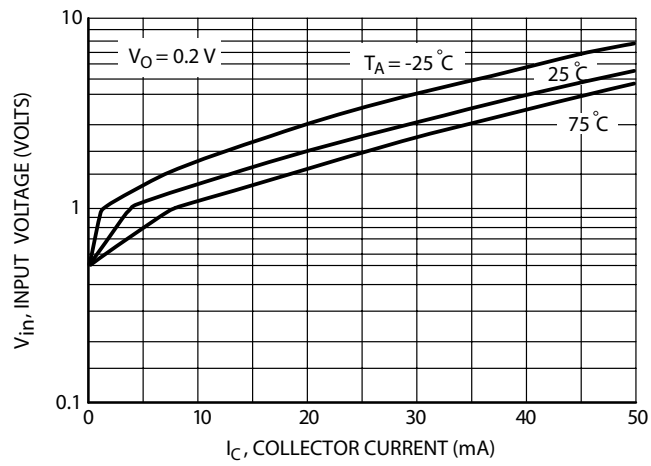
**FIG.18 DC Current Gain**



**FIG.19 Output Capacitance**



**FIG.20 Output Current versus Input Voltage**

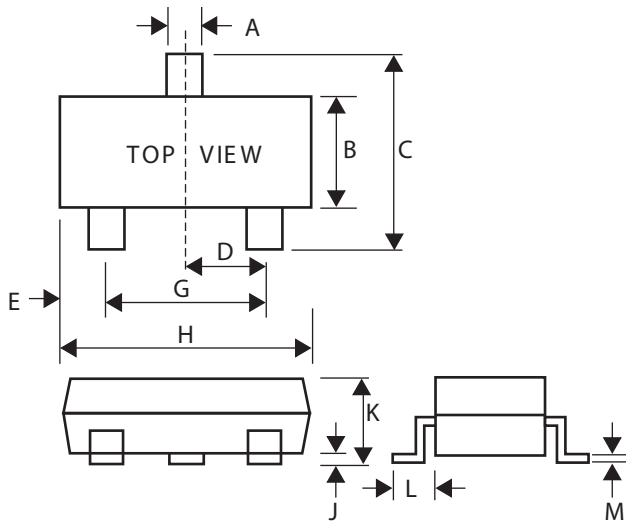


**FIG.21 Input Voltage versus Output Current**



**SOT-323 Outline Demensions**

Unit:mm



| <b>SOT-323</b> |            |            |
|----------------|------------|------------|
| <b>Dim</b>     | <b>Min</b> | <b>Max</b> |
| <b>A</b>       | 0.30       | 0.40       |
| <b>B</b>       | 1.15       | 1.35       |
| <b>C</b>       | 2.00       | 2.40       |
| <b>D</b>       | -          | 0.65       |
| <b>E</b>       | 0.30       | 0.40       |
| <b>G</b>       | 1.20       | 1.40       |
| <b>H</b>       | 1.80       | 2.20       |
| <b>J</b>       | 0.00       | 0.10       |
| <b>K</b>       | 0.80       | 1.00       |
| <b>L</b>       | 0.42       | 0.53       |
| <b>M</b>       | 0.10       | 0.25       |