

**Type 2N5238**  
**Geometry 3111**  
**Polarity NPN**  
**Qual Level: JAN - JANTXV**

**Generic Part Number:**  
**2N5238**

**REF: MIL-PRF-19500/394**

#### Features:

- Silicon power transistor for use in high speed switching applications.
- Housed in a [TO-5](#) case.
- Also available in chip form using the 3111 chip geometry.
- The Min and Max limits shown are per [MIL-PRF-19500/394](#) which Semicoa meets in all cases.

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[TO-5](#)

#### Maximum Ratings

$T_C = 25^{\circ}\text{C}$  unless otherwise specified

| Rating                                                                                   | Symbol    | Rating      | Unit                                 |
|------------------------------------------------------------------------------------------|-----------|-------------|--------------------------------------|
| Collector-Emitter Voltage                                                                | $V_{CEO}$ | 170         | V                                    |
| Collector-Base Voltage                                                                   | $V_{CBO}$ | 200         | V                                    |
| Emitter-Base Voltage                                                                     | $V_{EBO}$ | 10          | V                                    |
| Collector Current, Continuous                                                            | $I_C$     | 10          | A                                    |
| Power Disipation $T_A = 25^{\circ}\text{C}$ ambient<br>Derate above $25^{\circ}\text{C}$ | $P_T$     | 1.0<br>5.7  | mW<br>$\text{mW}/^{\circ}\text{C}$   |
| Power Disipation $T_A = 25^{\circ}\text{C}$ ambient<br>Derate above $25^{\circ}\text{C}$ | $P_T$     | 5.0<br>50   | Watt<br>$\text{mW}/^{\circ}\text{C}$ |
| Thermal Impedance                                                                        | $R_{JC}$  | 0.020       | $^{\circ}\text{C}/\text{mW}$         |
|                                                                                          | $R_{JA}$  | 0.175       | $^{\circ}\text{C}/\text{mW}$         |
| Operating Junction Temperature                                                           | $T_J$     | -65 to +200 | $^{\circ}\text{C}$                   |
| Storage Temperature                                                                      | $T_{STG}$ | -65 to +200 | $^{\circ}\text{C}$                   |

# Electrical Characteristics

 $T_C = 25^{\circ}\text{C}$  unless otherwise specified

| OFF Characteristics                                                                                                                                                                                                                                                                    | Symbol                                                                                              | Min                  | Max                      | Unit                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------|--------------------------|-------------------------------------------------|
| Collector-Base Breakdown Voltage<br>$I_C = 10\ \mu\text{A}$                                                                                                                                                                                                                            | $V_{(BR)CBO}$                                                                                       | 200                  | ---                      | V                                               |
| Collector-Emitter Breakdown Voltage<br>$I_C = 0.1\ \text{A}$ , pulsed                                                                                                                                                                                                                  | $V_{(BR)CEO}$                                                                                       | 170                  |                          | V                                               |
| Emitter-Base Breakdown Voltage<br>$I_E = 10\ \mu\text{A}$                                                                                                                                                                                                                              | $V_{(BR)EBO}$                                                                                       | 7.0                  | ---                      | V                                               |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 160\ \text{V}$<br>$V_{BE} = 0.5\ \text{V}$ , $V_{CE} = 200\ \text{V}$<br>$V_{BE} = -0.5\ \text{V}$ , $V_{CE} = 200\ \text{V}$ , $T_C = +150^{\circ}\text{C}$                                                                             | $I_{CEO1}$<br>$I_{CEX}$<br>$I_{CEX2}$                                                               | ---<br>---<br>---    | 10<br>10<br>100          | $\mu\text{A}$<br>$\mu\text{A}$<br>$\mu\text{A}$ |
| Base-Emitter Cutoff Current<br>$V_{EB} = 5\ \text{V}$                                                                                                                                                                                                                                  | $I_{EBO}$                                                                                           | ---                  | 0.1                      | $\mu\text{A}$                                   |
| Collector-Base Cutoff Current<br>$V_{CB} = 80\ \text{V}$                                                                                                                                                                                                                               | $I_{CBO}$                                                                                           | ---                  | 0.1                      | $\mu\text{A}$                                   |
| ON Characteristics                                                                                                                                                                                                                                                                     | Symbol                                                                                              | Min                  | Max                      | Unit                                            |
| <b>Forward Current Transfer Ratio</b><br>$I_C = 1\ \text{A}$ , $V_{CE} = 5\ \text{V}$ , pulsed<br>$I_C = 5\ \text{A}$ , $V_{CE} = 5\ \text{V}$ , pulsed<br>$I_C = 10\ \text{A}$ , $V_{CE} = 5\ \text{V}$<br>$I_C = 5\ \text{A}$ , $V_{CE} = 5\ \text{V}$ , $T_C = -55^{\circ}\text{C}$ | $h_{FE1}$<br>$h_{FE2}$<br>$h_{FE3}$<br>$h_{FE4}$                                                    | 50<br>40<br>10<br>20 | 225<br>120<br>---<br>--- | ---<br>---<br>---<br>---                        |
| <b>Base-Emitter Saturation Voltage</b><br>$I_C = 5\ \text{A}$ , $I_B = 0.5\ \text{A}$ , pulsed<br>$I_C = 10\ \text{A}$ , $I_B = 1\ \text{A}$ , pulsed                                                                                                                                  | $V_{BE(sat)1}$<br>$V_{BE(sat)2}$                                                                    | ---<br>---           | 1.5<br>2.5               | V dc<br>V dc                                    |
| <b>Collector-Emitter Saturation Voltage</b><br>$I_C = 5\ \text{A}$ , $I_B = 0.5\ \text{A}$ , pulsed<br>$I_C = 10\ \text{A}$ , $I_B = 1\ \text{A}$ , pulsed                                                                                                                             | $V_{CE(sat)1}$<br>$V_{CE(sat)2}$                                                                    | ---<br>---           | 0.6<br>2.5               | V dc<br>V dc                                    |
| <b>Safe Operating Area, Continuous DC</b><br>$T_C = 25^{\circ}\text{C}$ , $t = 1.0\ \text{s}$                                                                                                                                                                                          | $V_{CE} = 40\ \text{V}$ , $I_C = 0.22\ \text{A}$<br>$V_{CE} = 70\ \text{V}$ , $I_C = 90\ \text{mA}$ |                      |                          |                                                 |
| Small Signal Characteristics                                                                                                                                                                                                                                                           | Symbol                                                                                              | Min                  | Max                      | Unit                                            |
| Magnitude of Common Emitter Small Signal Short Circuit Forward Current Transfer Ratio<br>$V_{CE} = 10\ \text{V}$ , $I_C = 0.2\ \text{A}$ , $f = 10\ \text{MHz}$                                                                                                                        | $ h_{fe} $                                                                                          | 1.5                  | 7.5                      | ---                                             |
| Small Signal, Short Circuit Forward Current Transfer Ratio<br>$V_{CE} = 10\ \text{V}$ , $I_C = 50\ \text{mA}$ , $f = 1\ \text{kHz}$                                                                                                                                                    | $h_{fe}$                                                                                            | 40                   | 250                      | ---                                             |
| Open Circuit Output Capacitance<br>$V_{CB} = 10\ \text{V}$ , $I_E = 0$ , $100\ \text{kHz} < f < 1\ \text{MHz}$                                                                                                                                                                         | $C_{OBO}$                                                                                           | ---                  | 350                      | pF                                              |
| Switching Time                                                                                                                                                                                                                                                                         | Symbol                                                                                              | Min                  | Max                      | Unit                                            |
| Delay Time<br>Per figure 4, MIL-PRF-19500/394C                                                                                                                                                                                                                                         | $t_d$                                                                                               | ---                  | 50                       | ns                                              |
| Rise Time<br>Per figure 4, MIL-PRF-19500/394C                                                                                                                                                                                                                                          | $t_r$                                                                                               | ---                  | 500                      | ns                                              |
| Storage Time<br>Per figure 4, MIL-PRF-19500/394C                                                                                                                                                                                                                                       | $t_s$                                                                                               | ---                  | 1.5                      | ns                                              |
| Fall Time<br>Per figure 4, MIL-PRF-19500/394C                                                                                                                                                                                                                                          | $t_f$                                                                                               | ---                  | 50                       | ns                                              |