Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!


## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Microsemi LAWRENCE

**TECHNICAL DATA**

# NPN HIGH POWER SILICON TRANSISTOR

***Qualified per MIL-PRF-19500/439***

| *Devices* | | *Qualified Level* |
|---|---|---|
| **2N5038** | **2N5039** | **JAN<br>JANTX<br>JANTXV** |

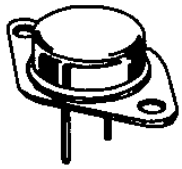
**MAXIMUM RATINGS**

| Ratings | Symbol | 2N5038 | 2N5039 | Units |
|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 90 | 75 | Vdc |
| Collector-Base Voltage | $V_{CBO}$ | 150 | 125 | Vdc |
| Emitter-Base Voltage | $V_{EBO}$ | 7.0 | | Vdc |
| Base Current | $I_B$ | 5.0 | | Adc |
| Collector Current | $I_C$ | 20 | | Adc |
| Total Power Dissipation @ $T_C = +25^0C$ (1) | $P_T$ | 140 | | W |
| Operating & Storage Temperature Range | $T_{op}$, $T_{stg}$ | -65 to +200 | | $^0C$ |

**THERMAL CHARACTERISTICS**

| Characteristics | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 1.25 | $^0C/W$ |

1) Derate linearly 800 mW/$^0$C for $T_C > +25^0C$



TO-3*
(TO-204AA)

*See appendix A for package outline

**ELECTRICAL CHARACTERISTICS ($T_A = 25^0C$ unless otherwise noted)**

| Characteristics | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Breakdown Voltage<br>$I_C$ = 200 mAdc | 2N5038<br>2N5039 | $V_{(BR)CEO}$ | 90<br>75 | | Vdc |
| Emitter-Base Breakdown Voltage<br>$I_E$ = 25 mAdc | | $V_{(BR)EBO}$ | 7.0 | | Vdc |
| Collector-Base Cutoff Current<br>$V_{CE}$ = 150 Vdc<br>$V_{CE}$ = 125 Vdc | 2N5038<br>2N5039 | $I_{CBO}$ | | 1.0<br>1.0 | µAdc |
| Collector-Base Cutoff Current<br>$V_{CE}$ = 70 Vdc<br>$V_{CE}$ = 55 Vdc | 2N5038<br>2N5039 | $I_{CEO}$ | | 1.0<br>1.0 | µAdc |
| Emitter-Base Cutoff Current<br>$V_{EB}$ = 5.0 Vdc | | $I_{EBO}$ | | 1.0 | µAdc |
| Collector-Emitter Cutoff Current<br>$V_{BE}$ = -1.5 Vdc $V_{CE}$ = 100 Vdc<br>$V_{BE}$ = -1.5 Vdc $V_{CE}$ = 85 Vdc | 2N5038<br>2N5039 | $I_{CEX}$ | | 5.0<br>5.0 | µAdc |

**ELECTRICAL CHARACTERISTICS (con't)**

| Characteristics | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| **ON CHARACTERISTICS** [2] | | | | | |
| Forward-Current Transfer Ratio | | | | | |
| $I_C$ = 0.5 Adc, $V_{CE}$ = 5.0 Vdc | 2N5038 | $h_{FE}$ | 50 | | |
| | 2N5039 | | 30 | | |
| $I_C$ = 2.0 Adc, $V_{CE}$ = 5.0 Vdc | 2N5038 | | 50 | 200 | |
| | 2N5039 | | 30 | 150 | |
| $I_C$ = 12 Adc, $V_{CE}$ = 5.0 Vdc | 2N5038 | | 15 | | |
| $I_C$ = 10 Adc, $V_{CE}$ = 5.0 Vdc | 2N5039 | | 15 | | |
| Collector-Emitter Saturation Voltage | | | | | |
| $I_C$ = 12 Adc, $I_B$ = 1.2 Adc | 2N5038 | $V_{CE(sat)}$ | | 1.0 | Vdc |
| $I_C$ = 10 Adc, $I_B$ = 1.0 Adc | 2N5039 | | | 1.0 | |
| $I_C$ = 20 Adc, $I_B$ = 5.0 Adc | Both | | | 2.5 | |
| Base-Emitter Saturation Voltage | | $V_{BE(sat)}$ | | | Vdc |
| $I_C$ = 20 Adc, $I_B$ = 5.0 Adc | | | | 3.3 | |
| Base-Emitter Voltage | | | | | |
| $I_C$ = 12 Adc, $V_{CE}$ = 5.0 Vdc | 2N5038 | $V_{BE}$ | | 1.8 | Vdc |
| $I_C$ = 10 Adc, $V_{CE}$ = 5.0 Vdc | 2N5039 | | | 1.8 | |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Forward Current Transfer Ratio | | $\lvert h_{FE} \rvert$ | 12 | 48 | |
| $I_C$ = 2.0 Adc, $V_{CE}$ = 10 Vdc, f = 5.0 MHz | | | | | |
| Output Capacitance | | $C_{obo}$ | | 500 | pF |
| $V_{CB}$ = 10 Vdc, $I_E$ = 0, 100 kHz ≤ f ≤ 1.0 MHz | | | | | |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Turn-On Time | | | | | |
| $V_{CC}$ = 30 ± 2 Vdc; $I_C$ = 12 Adc; $I_{B1}$= 1.2 Adc | 2N5038 | $t_{on}$ | | 0.5 | µs |
| $V_{CC}$ = 30 ± 2 Vdc; $I_C$ = 10 Adc; $I_{B1}$= 1.0 Adc | 2N5039 | | | | |
| Turn-Off Time | | | | | |
| $V_{CC}$ = 30 ± 2 Vdc; $I_C$ = 12 Adc; $I_{B1}$ = -$I_{B2}$ = 1.2 Adc | 2N5038 | $t_{off}$ | | 2.0 | µs |
| $V_{CC}$ = 30 ± 2 Vdc; $I_C$ = 10 Adc; $I_{B1}$ = -$I_{B2}$ = 1.0 Adc | 2N5039 | | | | |

**SAFE OPERATING AREA**

**DC Tests**

$T_C$ = +25$^0$C, 1 Cycle, t = 1.0 s

**Test 1**

$V_{CE}$ = 28 Vdc, $I_C$ = 5.0 Adc

**Test 2**

$V_{CE}$ = 45 Vdc, $I_C$ = 0.9 Adc

**Test 3**

$V_{CE}$ = 7.0 Vdc, $I_C$ = 20 Adc

**Test 4**

$V_{CE}$ = 90 Vdc, $I_C$ = 0.23 Adc 2N5038

**Test 4**

$V_{CE}$ = 75 Vdc, $I_C$ = 0.32 Adc 2N5039

(2) Pulse Test: Pulse Width = 300µs, Duty Cycle ≤ 2.0%.