

**60V PNP MEDIUM POWER TRANSISTOR IN SOT23**

**Features**

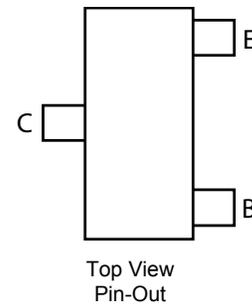
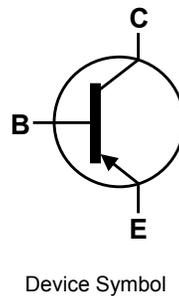
- $BV_{CEO} > -60V$
- $I_C = -1A$  High Continuous Collector Current
- $I_{CM} = -2A$  Peak Pulse Current
- $R_{SAT} = 295m\Omega$  for a Low Equivalent On-Resistance
- Excellent  $h_{FE}$  Characteristics up to  $-2A$
- Complementary NPN Type: FMMT491
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

**Mechanical Data**

- Case: SOT23
- Case Material: molded plastic, "Green" Molding Compound
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 @3
- Weight 0.008 grams (approximate)

**Applications**

- MOSFET Gate Driving
- Power Switches
- Motor Control

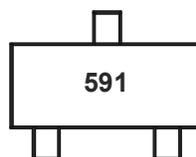


**Ordering Information** (Notes 4 & 5)

| Part Number | Compliance | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|-------------|------------|---------|--------------------|-----------------|-------------------|
| FMMT591TA   | AEC-Q101   | 591     | 7                  | 8               | 3,000             |
| FMMT591QTA  | Automotive | 591     | 7                  | 8               | 3,000             |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

**Marking Information**



591 = Product Type Marking Code

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic               | Symbol           | Value | Unit |
|------------------------------|------------------|-------|------|
| Collector-Base Voltage       | V <sub>CB0</sub> | -80   | V    |
| Collector-Emitter Voltage    | V <sub>CEO</sub> | -60   | V    |
| Emitter-Base Voltage         | V <sub>EBO</sub> | -7    | V    |
| Continuous Collector Current | I <sub>C</sub>   | -1    | A    |
| Peak Pulse Current           | I <sub>CM</sub>  | -2    | A    |
| Base Current                 | I <sub>B</sub>   | -200  | mA   |

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

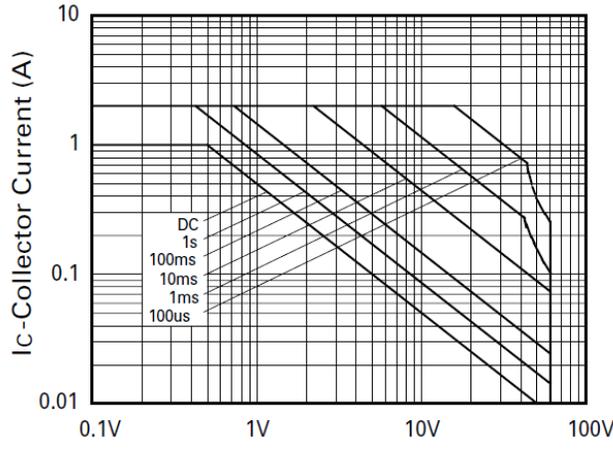
| Characteristic                                   | Symbol                            | Value       | Unit |
|--|-----------------------------------|-------------|------|
| Power Dissipation (Note 6)                       | P <sub>D</sub>                    | 500         | mW   |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | 250         | °C/W |
| Thermal Resistance, Junction to Lead (Note 7)    | R <sub>θJL</sub>                  | 197         | °C/W |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

**ESD Ratings** (Note 8)

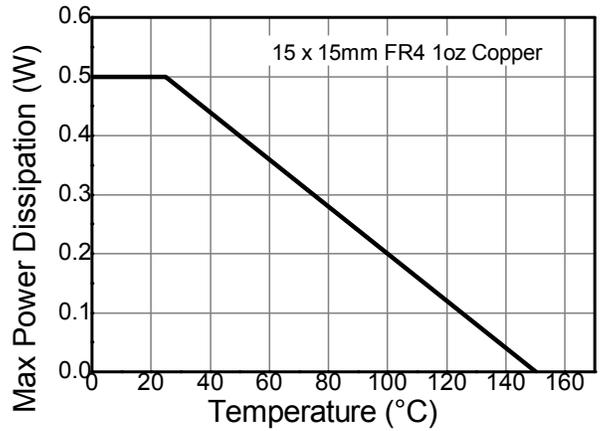
| Characteristic                             | Symbol  | Value   | Unit | JEDEC Class |
|--|---------|---------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | ≥ 4,000 | V    | 3A          |
| Electrostatic Discharge - Machine Model    | ESD MM  | ≥ 400   | V    | C           |

- Notes:
6. For a device mounted with the collector lead on 15mm x 15mm 1oz copper that is on a single-sided FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
  7. Thermal resistance from junction to solder-point (at the end of the collector lead).
  8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

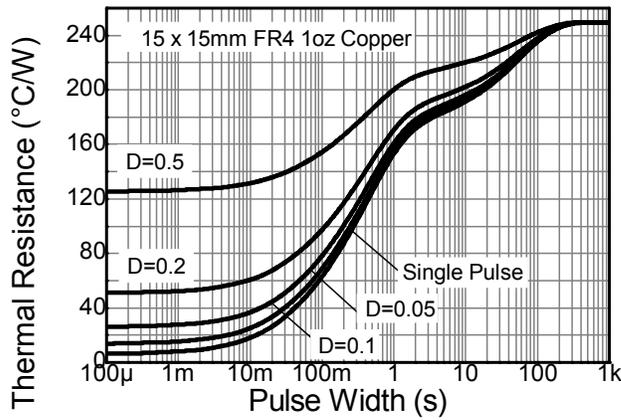
**Thermal Characteristics and Derating Information**



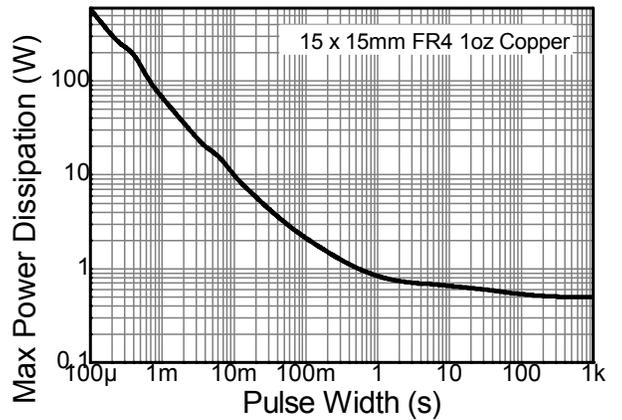
VCE - Collector Emitter Voltage (V)  
**Safe Operating Area**



**Derating Curve**



**Transient Thermal Impedance**



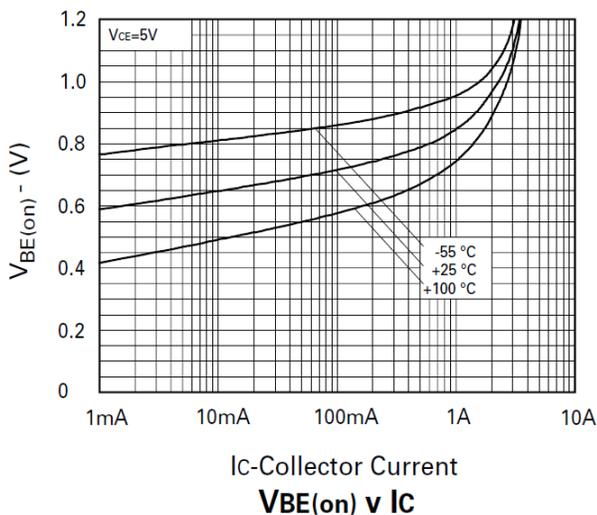
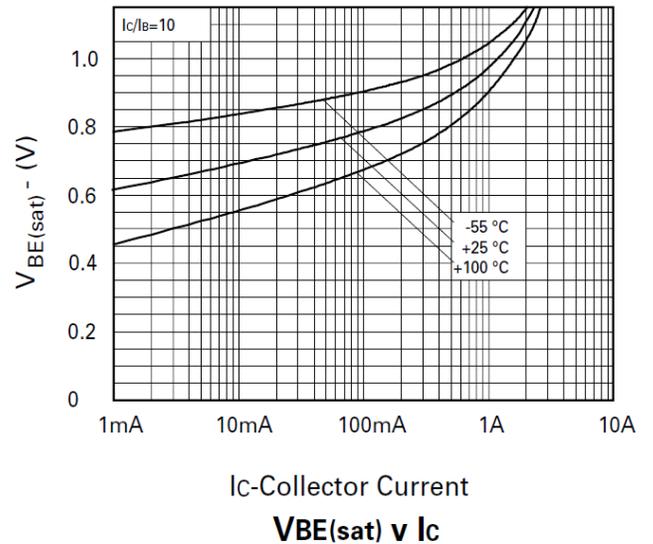
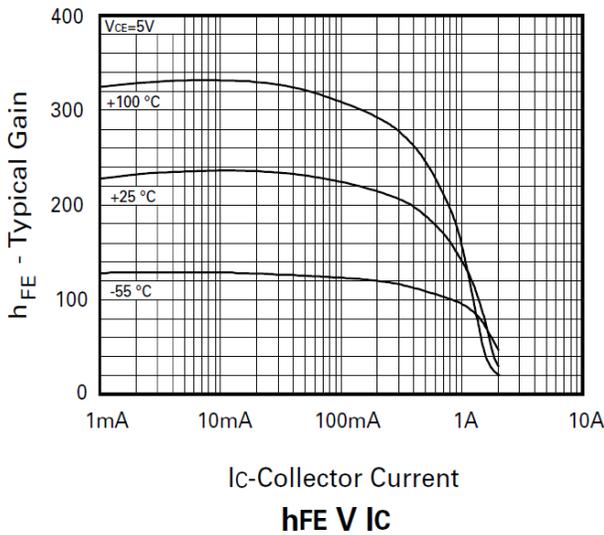
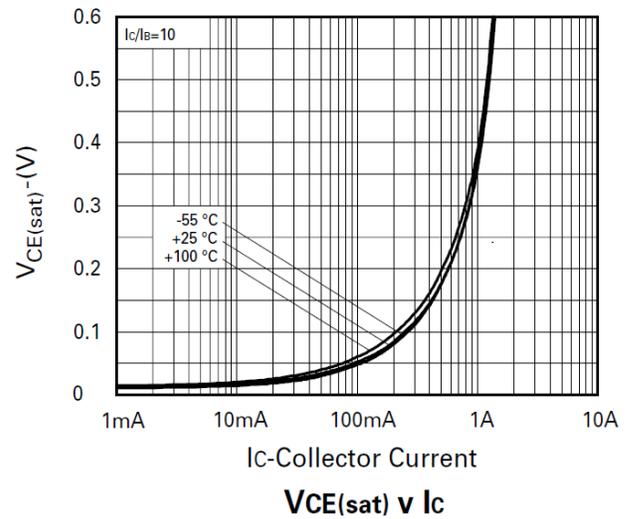
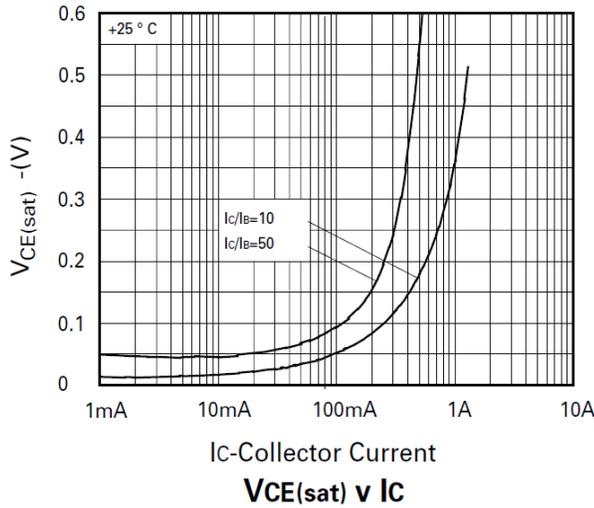
**Pulse Power Dissipation**

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                 | Symbol               | Min | Typ          | Max          | Unit | Test Condition   |
|--|----------------------|-----|--------------|--------------|------|--|
| Collector-Base Breakdown Voltage               | BV <sub>CBO</sub>    | -80 | —            | —            | V    | I <sub>C</sub> = -100μA  |
| Collector-Emitter Breakdown Voltage (Note 9)   | BV <sub>CEO</sub>    | -60 | —            | —            | V    | I <sub>C</sub> = -10mA   |
| Emitter-Base Breakdown Voltage                 | BV <sub>EBO</sub>    | -7  | -8.1         | —            | V    | I <sub>E</sub> = -100μA  |
| Collector-Base Cutoff Current                  | I <sub>CBO</sub>     | —   | <1           | -100         | nA   | V <sub>CB</sub> = -60V   |
| Emitter-Base Cutoff Current                    | I <sub>EBO</sub>     | —   | <1           | -100         | nA   | V <sub>EB</sub> = -5.6V  |
| Collector-Emitter Cut-Off Current              | I <sub>CES</sub>     | —   | <1           | -100         | nA   | V <sub>CE</sub> = -50V   |
| Static Forward Current Transfer Ratio (Note 9) | h <sub>FE</sub>      | 100 | 220          | —            | —    | I <sub>C</sub> = -1mA, V <sub>CE</sub> = -5V   |
|  |                      | 100 | 175          | 300          |      | I <sub>C</sub> = -500mA, V <sub>CE</sub> = -5V   |
|  |                      | 80  | 155          | —            |      | I <sub>C</sub> = -1A, V <sub>CE</sub> = -5V  |
|  |                      | 15  | 40           | —            |      | I <sub>C</sub> = -2A, V <sub>CE</sub> = -5V  |
| Collector-Emitter Saturation Voltage (Note 9)  | V <sub>CE(SAT)</sub> | —   | -155<br>-295 | -180<br>-350 | mV   | I <sub>C</sub> = -500mA, I <sub>B</sub> = -50mA<br>I <sub>C</sub> = -1A, I <sub>B</sub> = -100mA |
| Base-Emitter Saturation Voltage (Note 9)       | V <sub>BE(SAT)</sub> | —   | 965          | -1200        | mV   | I <sub>C</sub> = -1A, I <sub>B</sub> = -100mA  |
| Base-Emitter Turn-On Voltage (Note 9)          | V <sub>BE(ON)</sub>  | —   | 830          | -1000        | mV   | I <sub>C</sub> = -1A, V <sub>CE</sub> = -5V  |
| Transition Frequency                           | f <sub>T</sub>       | 150 | —            | —            | MHz  | V <sub>CE</sub> = -10V, I <sub>C</sub> = -50mA,<br>f = 100MHz                                    |
| Output Capacitance                             | C <sub>obo</sub>     | —   | —            | 10           | pF   | V <sub>CB</sub> = -10V, f = 1MHz   |

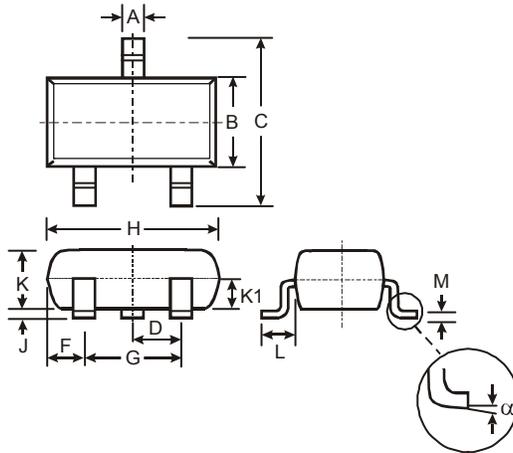
Note: 9. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



## Package Outline Dimensions

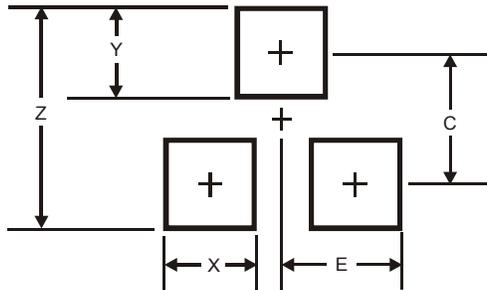
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| SOT23                |       |      |       |
|----------------------|-------|------|-------|
| Dim                  | Min   | Max  | Typ   |
| A                    | 0.37  | 0.51 | 0.40  |
| B                    | 1.20  | 1.40 | 1.30  |
| C                    | 2.30  | 2.50 | 2.40  |
| D                    | 0.89  | 1.03 | 0.915 |
| F                    | 0.45  | 0.60 | 0.535 |
| G                    | 1.78  | 2.05 | 1.83  |
| H                    | 2.80  | 3.00 | 2.90  |
| J                    | 0.013 | 0.10 | 0.05  |
| K                    | 0.903 | 1.10 | 1.00  |
| K1                   | -     | -    | 0.400 |
| L                    | 0.45  | 0.61 | 0.55  |
| M                    | 0.085 | 0.18 | 0.11  |
| α                    | 0°    | 8°   | -     |
| All Dimensions in mm |       |      |       |

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 2.9           |
| X          | 0.8           |
| Y          | 0.9           |
| C          | 2.0           |
| E          | 1.35          |

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