# FZT658

## 400V NPN HIGH VOLTAGE TRANSISTOR IN SOT223

## Features

- $BV_{CEO}$ > 400V
- $I_C$ = 500mA High Continuous Current
- $I_{CM}$ = 1A Peak Pulse Current
- Low Saturation Voltage $V_{CE(SAT)}$ < 250mV @ 50mA
- $h_{FE}$ > 40 Specified up to 200mA for High Current Gain Hold-Up
- Complementary PNP Type: FZT758
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

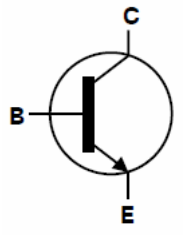
## Mechanical Data

- Case: SOT223
- Case Material: Molded Plastic. "Green" Molding Compound; UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.112 grams (Approximate)

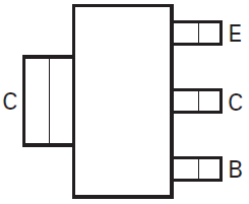
SOT223



Top View




Device Symbol




Top View
Pin-Out

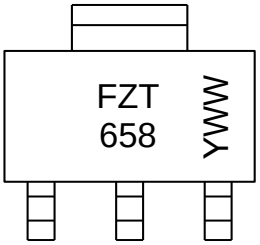
## Ordering Information (Note 4)

| Product | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|---|---|---|---|---|
| FZT658TA | FZT658 | 7 | 12 | 1,000 |

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See 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. For packaging details, go to our website at http"//www.diodes.com/products/packages.html.

## Marking Information

SOT223




FZT 658 = Product Type Marking Code
YWW = Date Code Marking
Y or $\overline{Y}$ = Last Digit of Year (ex: 5= 2015)
WW or $\overline{WW}$ = Week Code (01~53)


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## Absolute Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 400 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 400 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 7 | V |
| Continuous Collector Current | $I_C$ | 0.5 | A |
| Peak Pulse Current | $I_{CM}$ | 1 | A |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 5) | $P_D$ | 3.0 | W |
| | (Note 6) | | 2.0 | |
| | (Note 7) | | 1.6 | |
| | (Note 8) | | 1.2 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 41.7 | °C/W |
| | (Note 6) | | 62.5 | |
| | (Note 7) | | 78.1 | |
| | (Note 8) | | 104 | |
| Thermal Resistance Junction to Lead | (Note 9) | $R_{\theta JL}$ | 12.9 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

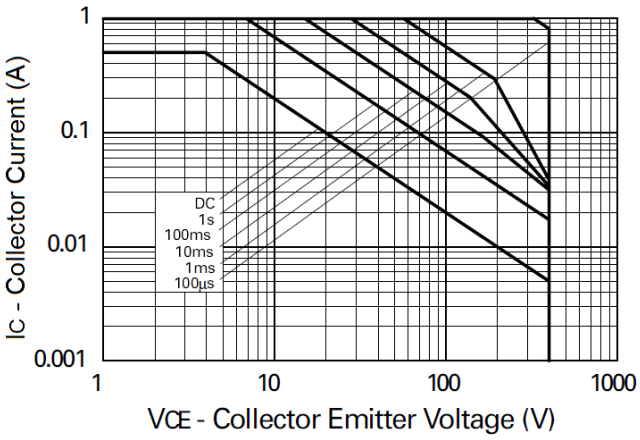
## ESD Ratings (Note 10)

| 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 |

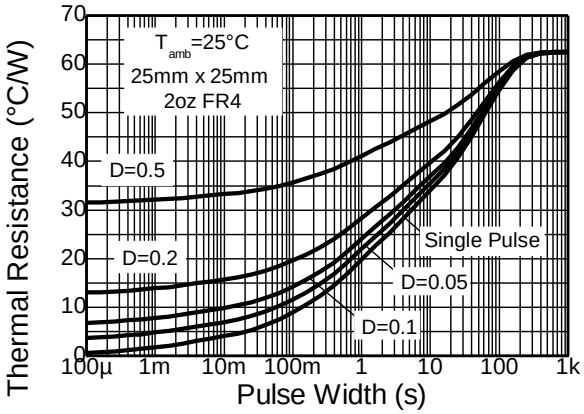
Notes:
5. For a device mounted with the collector lead on 50mm x 50mm 2oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
6. Same as Note 5, except the device is mounted on 25mm x 25mm 2oz copper.
7. Same as Note 5, except the device is mounted on 25mm x 25mm 1oz copper.
8. Same as Note 5, except the device is mounted on minimum recommended pad layout.
9. Thermal resistance from junction to solder-point (at the end of the collector lead).
10. Refer to JEDEC specification JESD22-A114 and JESD22-A115.


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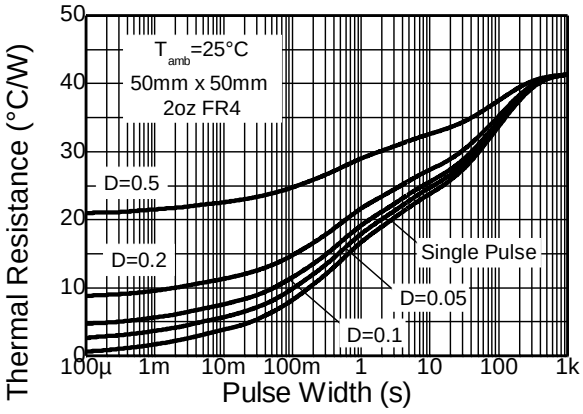
## Thermal Characteristics and Derating Information



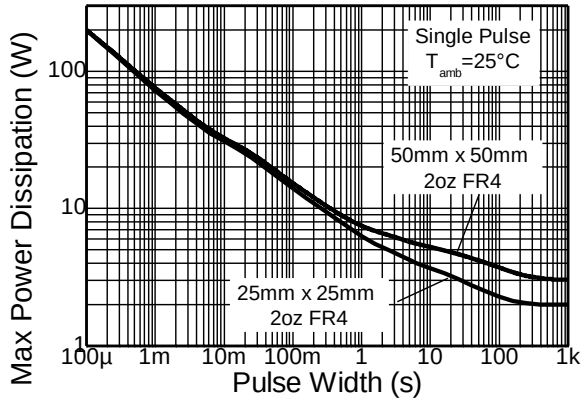

**Safe Operating Area**



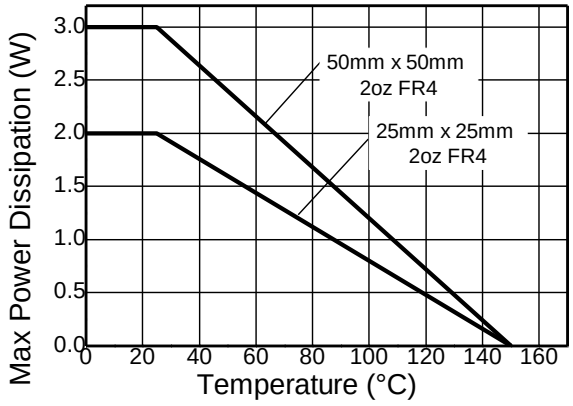

**Transient Thermal Impedance**




**Transient Thermal Impedance**




**Pulse Power Dissipation**




**Derating Curve**


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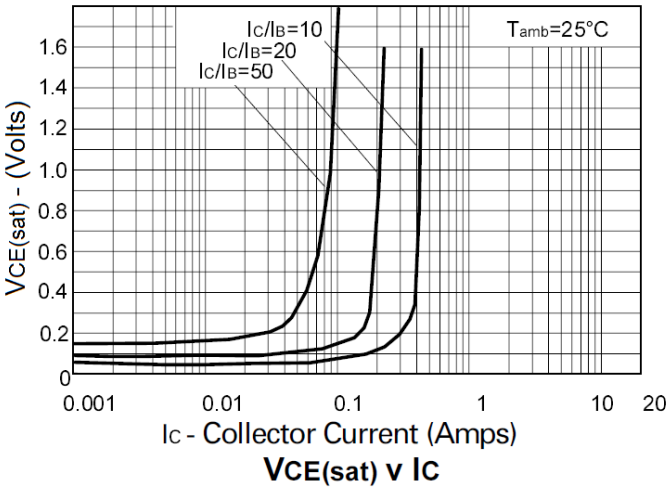
## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 400 | – | – | V | $I_C$ = 100µA |
| Collector-Emitter Breakdown Voltage (Note 9) | $BV_{CEO}$ | 400 | – | – | V | $I_C$ = 10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 7 | – | – | V | $I_E$ = 100µA |
| Collector Cut-Off Current | $I_{CBO}$ | – | – | 100 | nA | $V_{CB}$ = 320V |
| Emitter Cut-Off Current | $I_{EBO}$ | – | – | 100 | nA | $V_{EB}$ = 6V |
| Collector-Emitter Saturation Voltage (Note 9) | $V_{CE(sat)}$ | – | – | 0.30 | V | $I_C$ = 20mA, $I_B$ = 1mA |
| | | | | 0.25 | | $I_C$ = 50mA, $I_B$ = 5mA |
| | | | | 0.50 | | $I_C$ = 100mA, $I_B$ = 10mA |
| Base-Emitter Saturation Voltage (Note 9) | $V_{BE(sat)}$ | – | – | 0.9 | V | $I_C$ = 100mA, $I_B$ = 10mA |
| Base-Emitter Turn-On Voltage (Note 9) | $V_{BE(on)}$ | – | – | 1.0 | V | $I_C$ = 100mA, $V_{CE}$ = 5V |
| DC Current Gain (Note 9) | $h_{FE}$ | 50 | – | – | – | $I_C$ = 1mA, $V_{CE}$ = 5V |
| | | 50 | – | – | | $I_C$ = 100mA, $V_{CE}$ = 5V |
| | | 40 | – | – | | $I_C$ = 200mA, $V_{CE}$ = 10V |
| Current Gain-Bandwidth Product (Note 9) | $f_T$ | 50 | – | – | MHz | $V_{CE}$ = 20V, $I_C$ = 10mA, f = 20MHz |
| Output Capacitance (Note 9) | $C_{obo}$ | – | 10 | – | pF | $V_{CB}$ = 20V, f = 1MHz |
| Switching Times | $t_{on}$ | – | 130 | – | ns | $I_C$ = 100mA, $V_{CC}$ = 100V |
| | $t_{off}$ | – | 3,300 | – | | $I_{B1}$ = 10mA, $I_{B2}$ = -20mA |

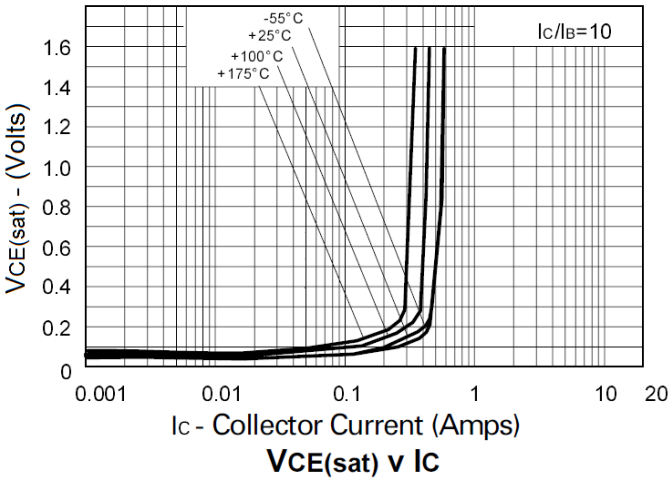
Note: 9. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.


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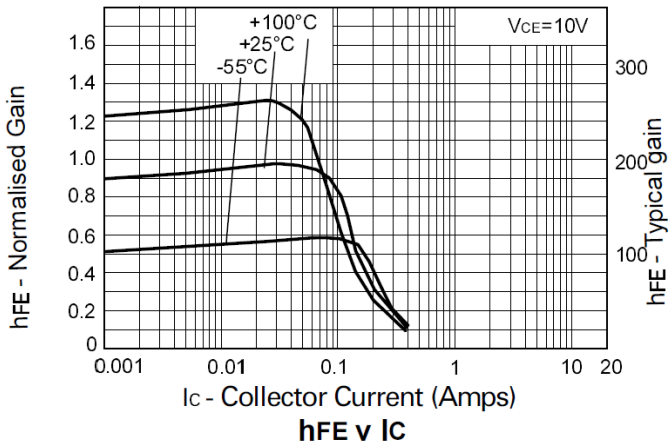
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



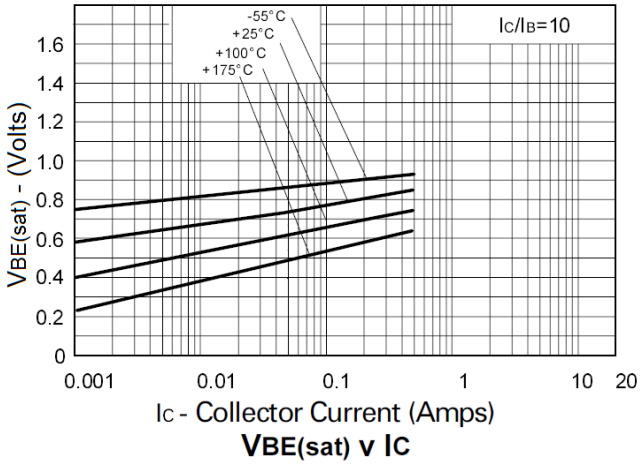

**VCE(sat) v IC**



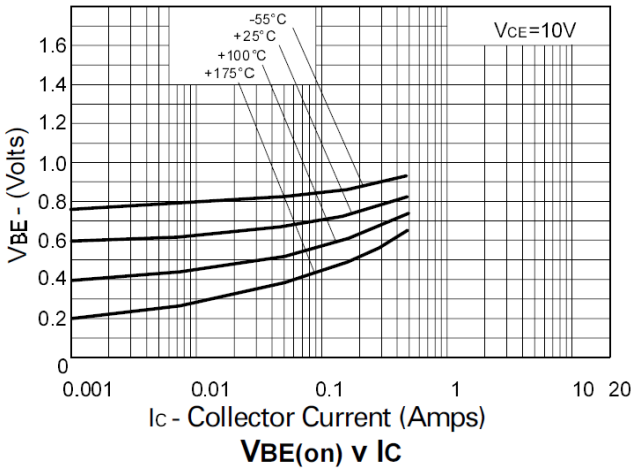

**VCE(sat) v IC**




**hFE v IC**




**VBE(sat) v IC**

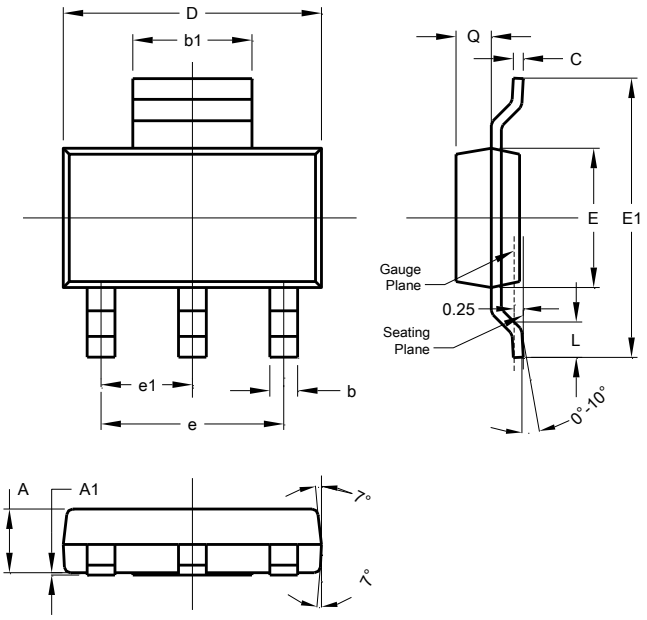



**VBE(on) v IC**


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## Package Outline Dimensions

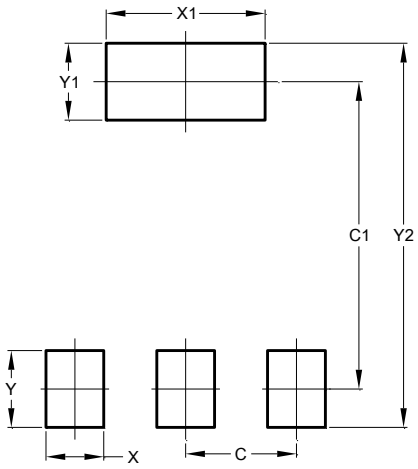
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.




| SOT223 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 1.55 | 1.65 | 1.60 |
| **A1** | 0.010 | 0.15 | 0.05 |
| **b** | 0.60 | 0.80 | 0.70 |
| **b1** | 2.90 | 3.10 | 3.00 |
| **C** | 0.20 | 0.30 | 0.25 |
| **D** | 6.45 | 6.55 | 6.50 |
| **E** | 3.45 | 3.55 | 3.50 |
| **E1** | 6.90 | 7.10 | 7.00 |
| **e** | - | - | 4.60 |
| **e1** | - | - | 2.30 |
| **L** | 0.85 | 1.05 | 0.95 |
| **Q** | 0.84 | 0.94 | 0.89 |
| **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) |
|---|---|
| **C** | 2.30 |
| **C1** | 6.40 |
| **X** | 1.20 |
| **X1** | 3.30 |
| **Y** | 1.60 |
| **Y1** | 1.60 |
| **Y2** | 8.00 |

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to voltage spacing between terminals.


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