# 45V NPN HIGH GAIN MEDIUM POWER TRANSISTOR

## Features

- $BV_{CEO}$ > 45V
- $I_C$ = 3A High Continuous Collector Current
- $I_{CM}$ = 6A Peak Pulse Current
- High Gain Device >400 @1A
- $R_{CE(SAT)}$ = 77mΩ for Low Equivalent On-Resistance
- $h_{FE}$ Specified Up to 6A for a High Gain Hold Up
- **Lead-Free Finish; 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

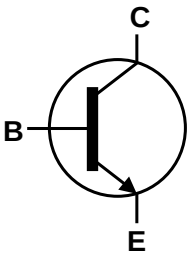
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.34 grams (Approximate)

## Applications

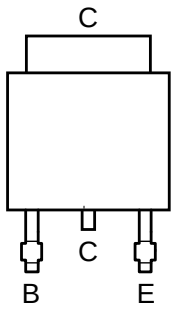
- DC-DC Converters
- Power Switches
- IGBT & MOSFET Gate Drivers
- Motor Control
- Automotive Circuits
- Siren Drivers

TO252 (DPAK)

Top View




Equivalent Circuit



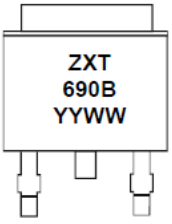

Package Pin Configuration

## Ordering Information (Note 5)

| Product | Compliance | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|---|---|---|---|---|---|
| ZXT690BKTC | AEC-Q101 | ZXT690B | 13 | 16 | 2,500 |
| ZXT690BKQTC | Automotive | ZXT690B | 13 | 16 | 2,500 |

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

## Marking Information




ZXT690B = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Digit of Year (ex: 17 = 2017)
WW = Week Code (01 – 53)

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

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $BV_{CBO}$ | 60 | V |
| Collector-Emitter Voltage | $BV_{CEO}$ | 45 | V |
| Emitter-Base Voltage | $BV_{EBO}$ | 7 | V |
| Continuous Collector Current | $I_C$ | 3 | A |
| Peak Pulse Current | $I_{CM}$ | 6 | A |
| Base Current | $I_B$ | 0.5 | A |

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

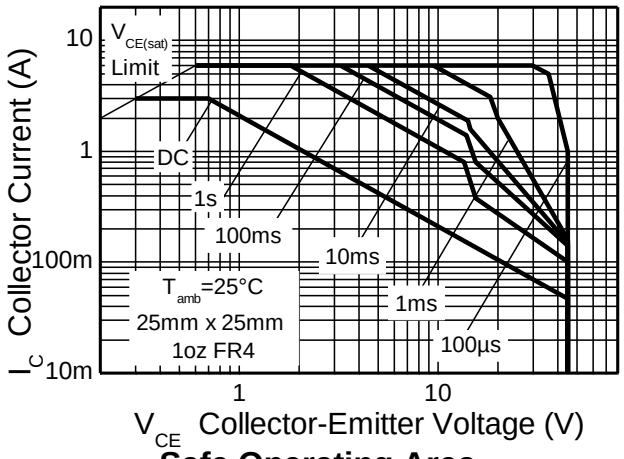
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 6) | $P_D$ | 4.0 | W |
| | (Note 7) | | 3.4 | |
| | (Note 8) | | 2.1 | |
| | (Note 9) | | 1.6 | |
| Thermal Resistance, Junction to Ambient Air | (Note 6) | $R_{\theta JA}$ | 32 | °C/W |
| | (Note 7) | | 36 | |
| | (Note 8) | | 59 | |
| | (Note 9) | | 80 | |
| Thermal Resistance, Junction to Leads | (Note 10) | $R_{\theta JL}$ | 3 | |
| Thermal Resistance, Junction to Case | (Note 11) | $R_{\theta JC}$ | 14.6 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 12)

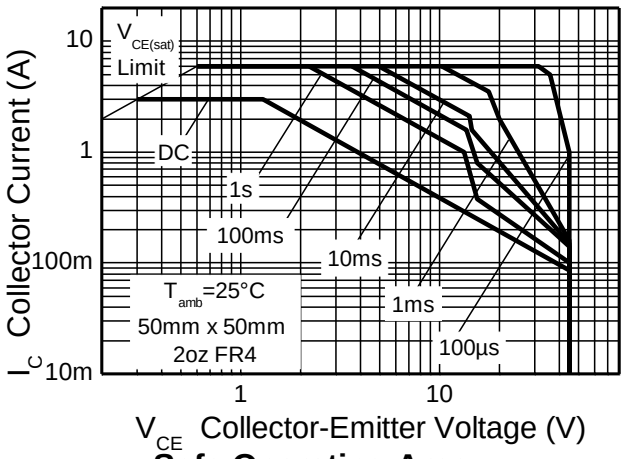
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

Notes:
6. For a device mounted with the exposed collector pad 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.
7. Same as Note (6), except mounted on 25mm x 25mm 2oz copper.
8. Same as Note (6), except mounted on 25mm x 25mm 1oz copper.
9. Same as Note (6), except mounted on minimum recommended pad (MRP) layout.
10. Thermal resistance from junction to solder-point (on the exposed collector pad).
11. Thermal resistance from junction to the top of the case.
12. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

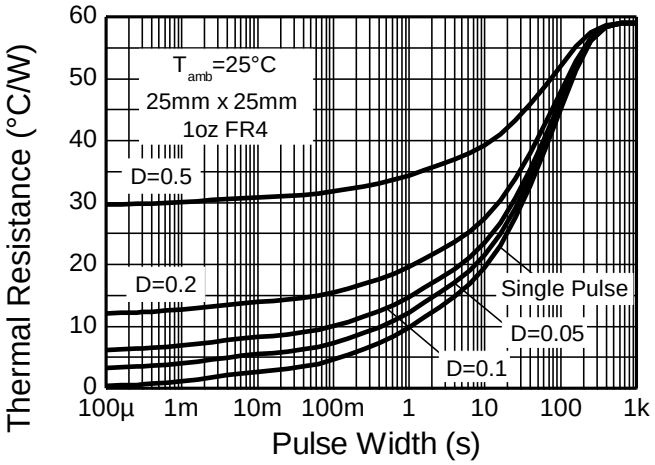
## Thermal Characteristics and Derating Information



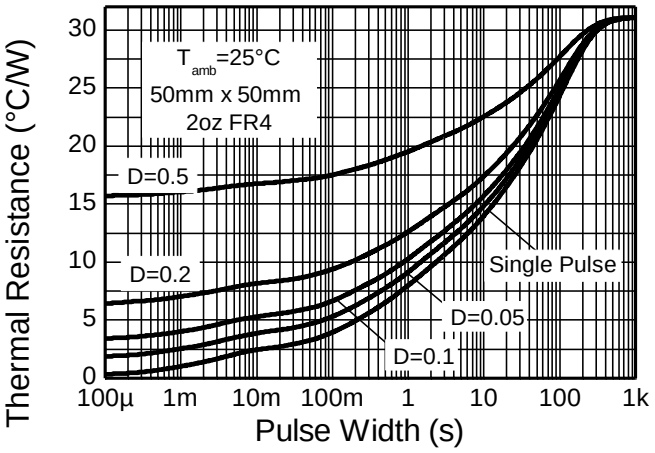

**Safe Operating Area**



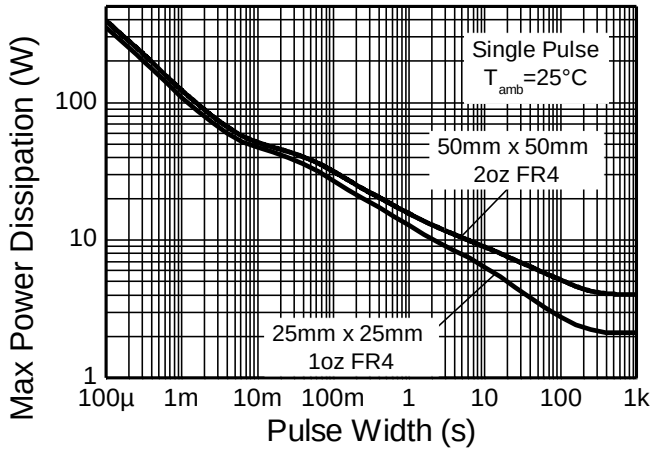

**Safe Operating Area**



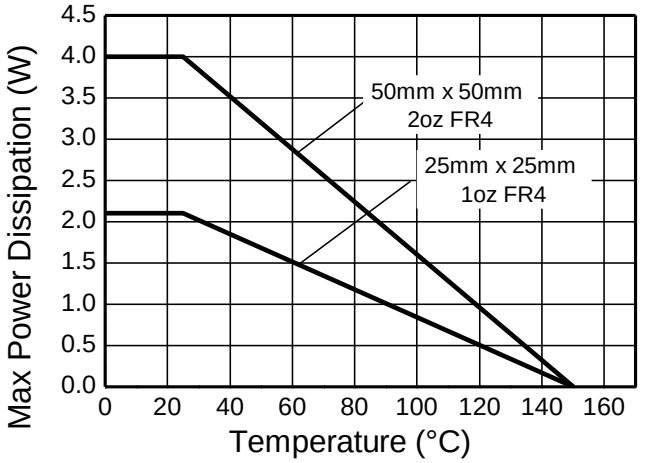

**Transient Thermal Impedance**




**Transient Thermal Impedance**




**Pulse Power Dissipation**



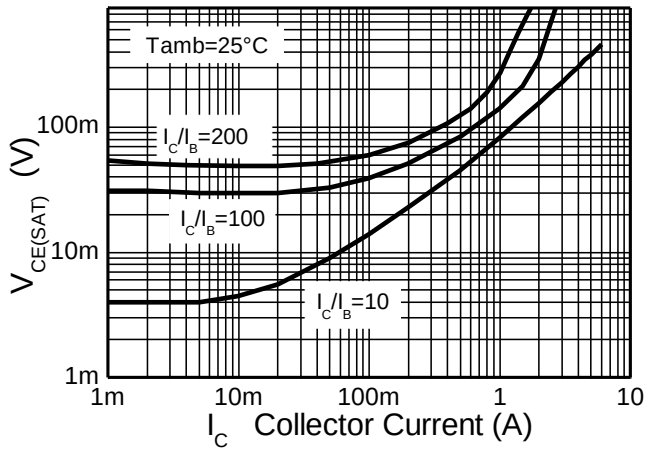

**Derating Curve**

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

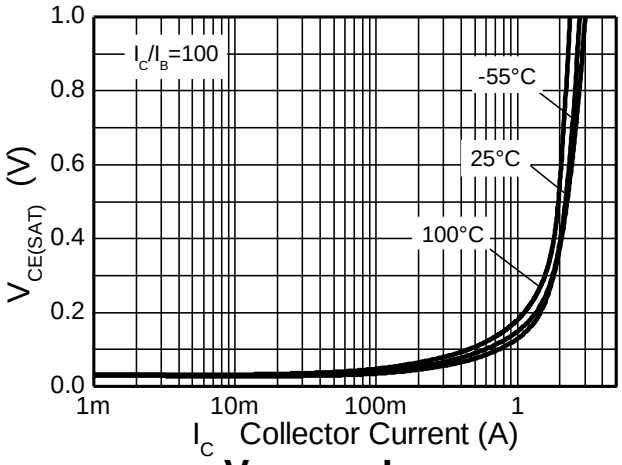
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 60 | 145 | — | V | $I_C$ = 100µA |
| Collector-Emitter Breakdown Voltage (Note 13) | $BV_{CEO}$ | 45 | 65 | — | V | $I_C$ = 10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 7 | 8.2 | — | V | $I_E$ = 100µA |
| Collector Cutoff Current | $I_{CBO}$ | — | <1 | 20 | nA | $V_{CB}$ = 35V |
| Collector Cutoff Current | $I_{CES}$ | — | <1 | 20 | nA | $V_{CE}$ = 35V |
| Emitter Cutoff Current | $I_{EBO}$ | — | <1 | 20 | nA | $V_{EB}$ = 5.6V |
| Collector-Emitter Saturation Voltage (Note 13) | $V_{CE(SAT)}$ | — | 50 | 85 | mV | $I_C$ = 0.1A, $I_B$ = 0.5mA |
| | | | 240 | 360 | | $I_C$ = 1A, $I_B$ = 5mA |
| | | | 210 | 320 | | $I_C$ = 2A, $I_B$ = 40mA |
| | | | 230 | 350 | | $I_C$ = 3A, $I_B$ = 150mA |
| Base-Emitter Saturation Voltage (Note 13) | $V_{BE(SAT)}$ | — | 1.0 | 1.2 | V | $I_C$ = 3A, $I_B$ = 150mA |
| Base-Emitter Turn-On Voltage (Note 13) | $V_{BE(ON)}$ | — | 0.9 | 1.1 | V | $I_C$ = 3A, $V_{CE}$ = 2V |
| DC Current Gain (Note 13) | $h_{FE}$ | 500 | 700 | — | — | $I_C$ = 100mA, $V_{CE}$ = 2V |
| | | 400 | 600 | | | $I_C$ = 1A, $V_{CE}$ = 2V |
| | | 150 | 350 | | | $I_C$ = 2A, $V_{CE}$ = 2V |
| | | 60 | 120 | | | $I_C$ = 3A, $V_{CE}$ = 2V |
| Current Gain-Bandwidth Product | $f_T$ | 150 | — | — | MHz | $I_C$ = 50mA, $V_{CE}$ = 5V, f = 50MHz |
| Output Capacitance | $C_{OBO}$ | — | 16 | — | pF | $V_{CB}$ = 10V, f = 1MHz |
| Turn-On Time | $t_{ON}$ | — | 33 | — | ns | $I_C$ = 500mA, $V_{CC}$ = 10V, |
| Turn-Off Time | $t_{OFF}$ | — | 1,300 | — | ns | $I_{B1}$ = -$I_{B2}$ = 50mA |

Note: 13. Measured under pulsed conditions. Pulse width ≤ 300µs; duty cycle ≤ 2%.

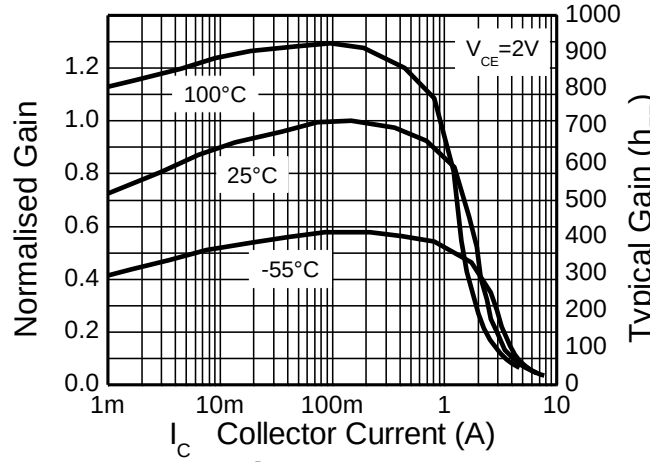
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



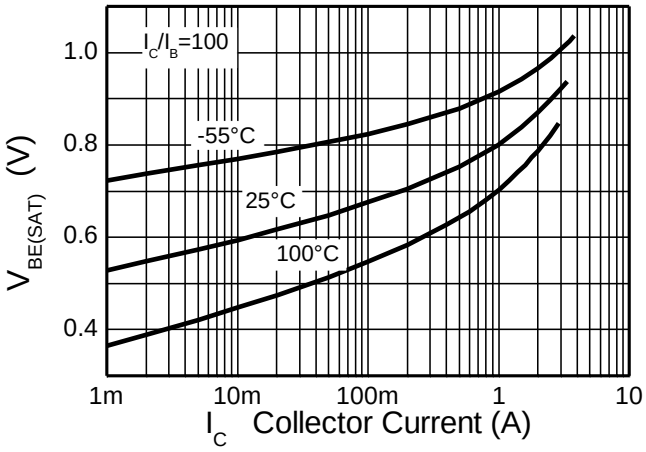

**$V_{CE(SAT)}$ v $I_C$**



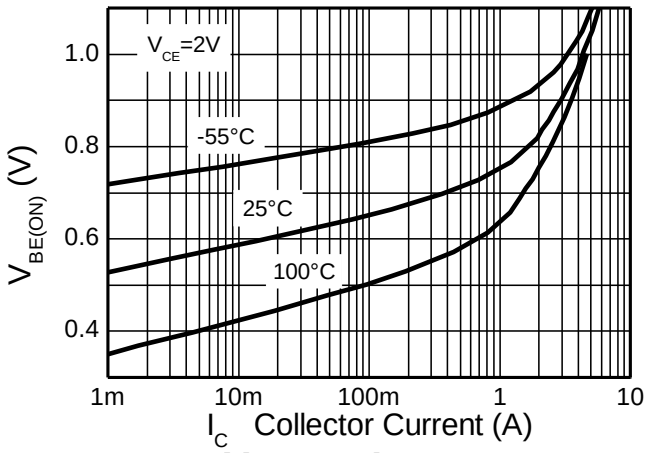

**$V_{CE(SAT)}$ v $I_C$**




**$h_{FE}$ v $I_C$**




**$V_{BE(SAT)}$ v $I_C$**

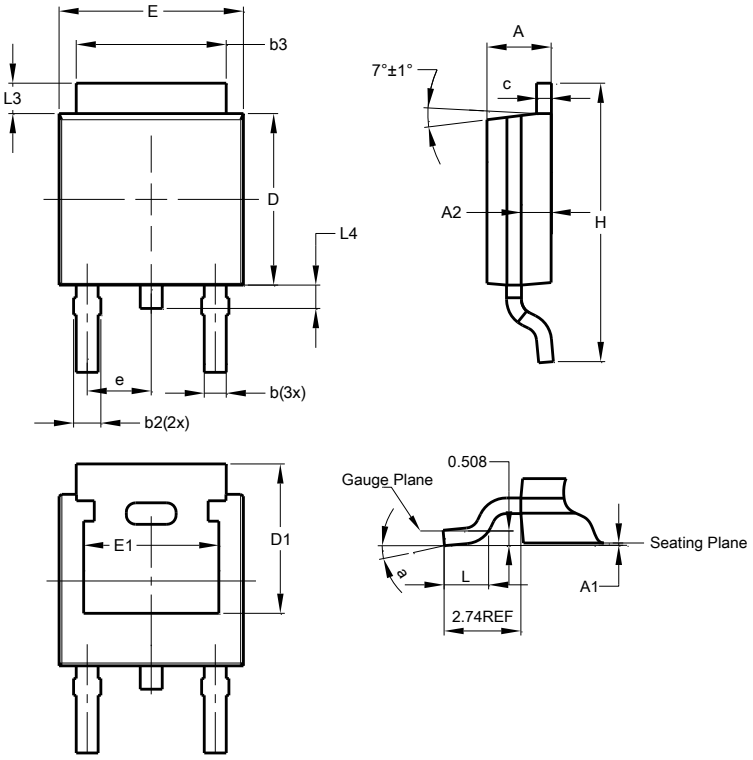



**$V_{BE(ON)}$ v $I_C$**

## Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

**TO252 (DPAK)**

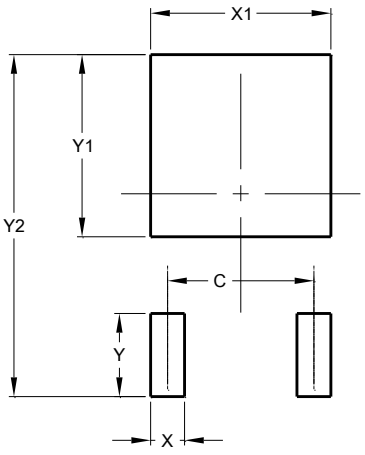



| TO252 (DPAK) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 2.19 | 2.39 | 2.29 |
| **A1** | 0.00 | 0.13 | 0.08 |
| **A2** | 0.97 | 1.17 | 1.07 |
| **b** | 0.64 | 0.88 | 0.783 |
| **b2** | 0.76 | 1.14 | 0.95 |
| **b3** | 5.21 | 5.46 | 5.33 |
| **c** | 0.45 | 0.58 | 0.531 |
| **D** | 6.00 | 6.20 | 6.10 |
| **D1** | 5.21 | - | - |
| **e** | - | - | 2.286 |
| **E** | 6.45 | 6.70 | 6.58 |
| **E1** | 4.32 | - | - |
| **H** | 9.40 | 10.41 | 9.91 |
| **L** | 1.40 | 1.78 | 1.59 |
| **L3** | 0.88 | 1.27 | 1.08 |
| **L4** | 0.64 | 1.02 | 0.83 |
| **a** | 0° | 10° | - |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

**TO252 (DPAK)**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 4.572 |
| **X** | 1.060 |
| **X1** | 5.632 |
| **Y** | 2.600 |
| **Y1** | 5.700 |
| **Y2** | 10.700 |

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