# APT13003E

## 465V NPN HIGH VOLTAGE POWER TRANSISTOR

## Features

- $BV_{CEO}$ > 465V
- $BV_{CES}$ > 700V
- $BV_{EBO}$ > 9V
- $I_C$ = 1.5A High Continuous Collector Current
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Mechanical Data

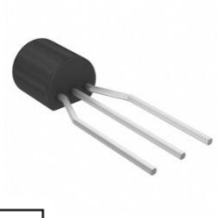
- Case: TO92 or TO126
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Terminals: Matte Tin Finish; Solderable per MIL-STD-202, Method 208 e3
- Weight: TO92: 200mg (Approximate)
  TO126: 400mg (Approximate)

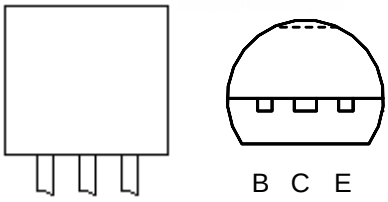
## Applications

Low Power AC-DC SMPS for:

- Battery Chargers for Mobile Phone / Tablets / Smartphones
- Power Supply for DVD / STB
- LED Lighting

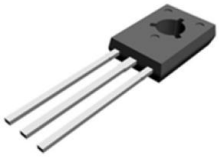
TO92

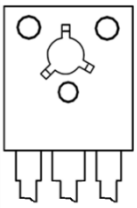




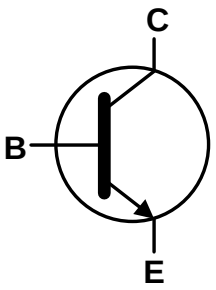

Pin-Out

TO126






Pin-Out



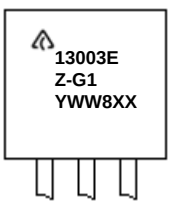

Device Schematic

## Ordering Information (Note 4)

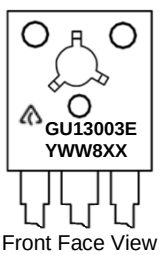
| Product | Package | Marking | Quantity |
|---|---|---|---|
| APT13003EZTR-G1 | TO92 (Joggled Legs) | 13003EZ-G1 | 2,000 Taped, per Ammo Box |
| APT13003EU-G1 | TO126 | GU13003E | 4,000 Bulk, Loose per Box |

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




Flat Face View




Front Face View

= Manufacturers' code marking
For TO92: 13003EZ-G1 = Product Type Marking ID
For TO126: GU13003E = Product Type Marking ID
YWW = Date Code Marking
e.g. 312 = Year 2013, Week 12.
8 = Assembly site code
XX = Batch Number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## Absolute Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage ($V_{BE}$ = 0V) | $V_{CES}$ | 700 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 465 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 9 | V |
| Continuous Collector Current | $I_C$ | 1.5 | A |
| Peak Pulse Collector Current (Note 5) | $I_{CM}$ | 3 | A |
| Continuous Base Current | $I_B$ | 0.75 | A |
| Peak Pulse Base Current (Note 5) | $I_{BM}$ | 1.5 | A |

Note: 5. Pulse test for pulse width < 5ms, duty cycle ≤ 10%.

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

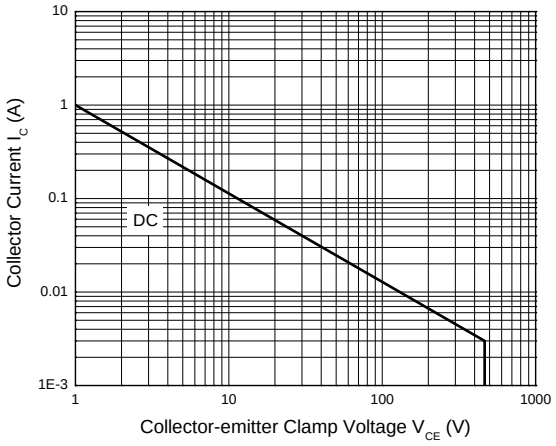
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | For TO92 | $P_D$ | 1.1 | W |
| | For TO126 @ $T_C$ = +25°C | | 20 | |
| Thermal Resistance, Junction to Ambient Air | For TO92 | $R_{\theta JA}$ | 113.6 | °C/W |
| | For TO126 | | 96 | |
| Thermal Resistance, Junction to Case | For TO92 | $R_{\theta JC}$ | 83.3 | °C/W |
| | For TO126 | | 6.25 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -65 to +150 | °C |

## ESD Ratings (Note 6)

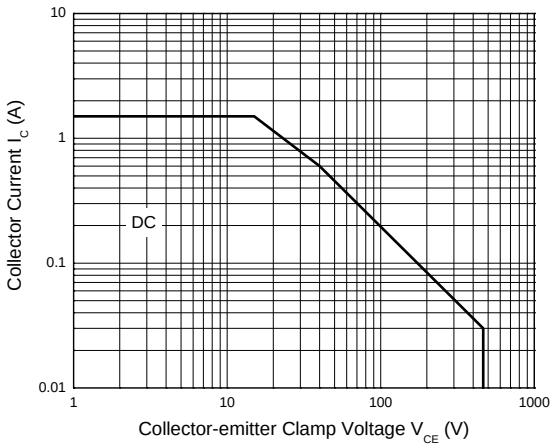
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 8,000 | V | 3B |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

Note: 6. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Safe Operating Area (@$T_A$ = +25°C, unless otherwise specified.)




Safe Operating Areas (TO92 Package)




Safe Operating Areas (TO126 Package)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## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Emitter Breakdown Voltage | $BV_{CES}$ | 700 | — | — | V | $I_C$ = 100μA, $V_{BE}$ = 0V |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 465 | — | — | V | $I_C$ = 100μA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 9 | — | — | V | $I_E$ = 100μA |
| Collector Cutoff Current | $I_{CEV}$ | — | — | 10 | μA | $V_{CE}$ = 700V, $V_{BE}$ = -1.5V |
| DC Current Transfer Static Ratio (Note 7) | $h_{FE}$ | 15<br>13<br>5 | —<br>17<br>— | —<br>30<br>25 | —<br>—<br>— | $I_C$ = 0.3A, $V_{CE}$ = 2V<br>$I_C$ = 0.5A, $V_{CE}$ = 2V<br>$I_C$ = 1.0A, $V_{CE}$ = 2V |
| Collector-Emitter Saturation Voltage (Note 7) | $V_{CE(sat)}$ | —<br>— | 0.17<br>0.29 | 0.3<br>0.4 | V | $I_C$ = 0.5A, $I_B$ = 0.1A<br>$I_C$ = 1A, $I_B$ = 0.25A |
| Base-Emitter Saturation Voltage (Note 7) | $V_{BE(sat)}$ | —<br>— | —<br>— | 1.0<br>1.2 | V | $I_C$ = 0.5A, $I_B$ = 0.1A<br>$I_C$ = 1A, $I_B$ = 0.25A |
| Output Capacitance | $C_{ob}$ | — | 16 | — | pF | $V_{CB}$ = 10V, f = 0.1MHz |
| Transition Frequency | $f_T$ | 4 | — | — | MHz | $I_C$ = 0.1A, $V_{CE}$ = 10V |
| Turn-on Time with Resistive Load | $t_{on}$ | — | 0.3 | 1 | μs | $I_C$ = 1A, $V_{CC}$ = 125V, $I_{B1}$ = 0.2A, $I_{B2}$ = -0.2A, $t_p$ = 25μs |
| Storage Time with Resistive Load | $t_s$ | — | 1.8 | 3 | | |
| Fall Time with Resistive Load | $t_f$ | — | 0.28 | 0.4 | | |

Note: 7. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.


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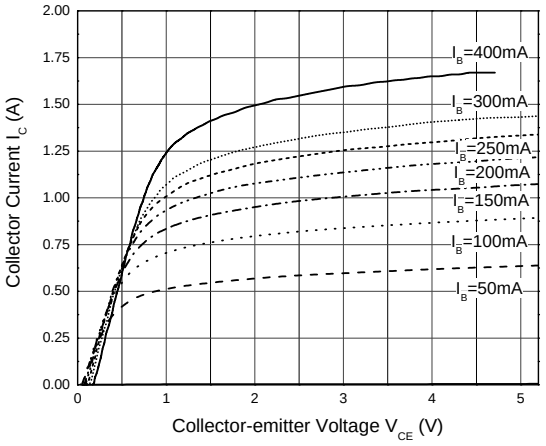
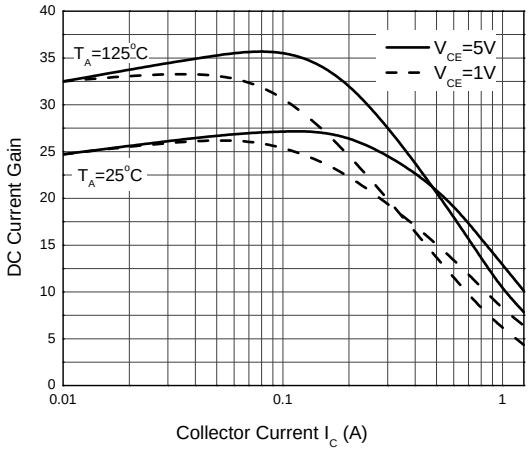
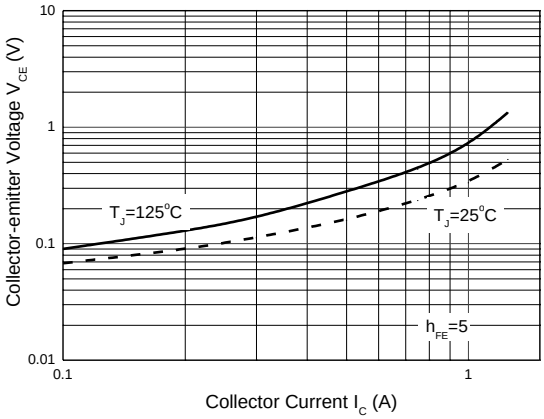
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



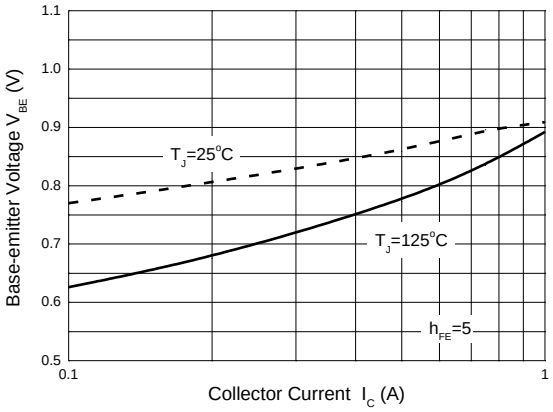

Static Characteristics



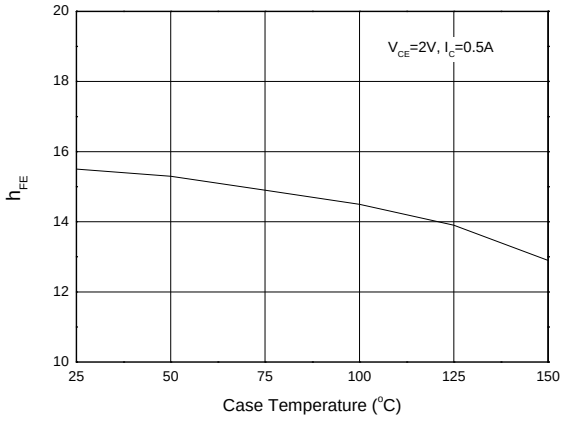

DC Current Gain vs. Collector Current




Collector-emitter Saturation Voltage




Base-emitter Saturation Voltage




$h_{FE}$ vs. Case Temperature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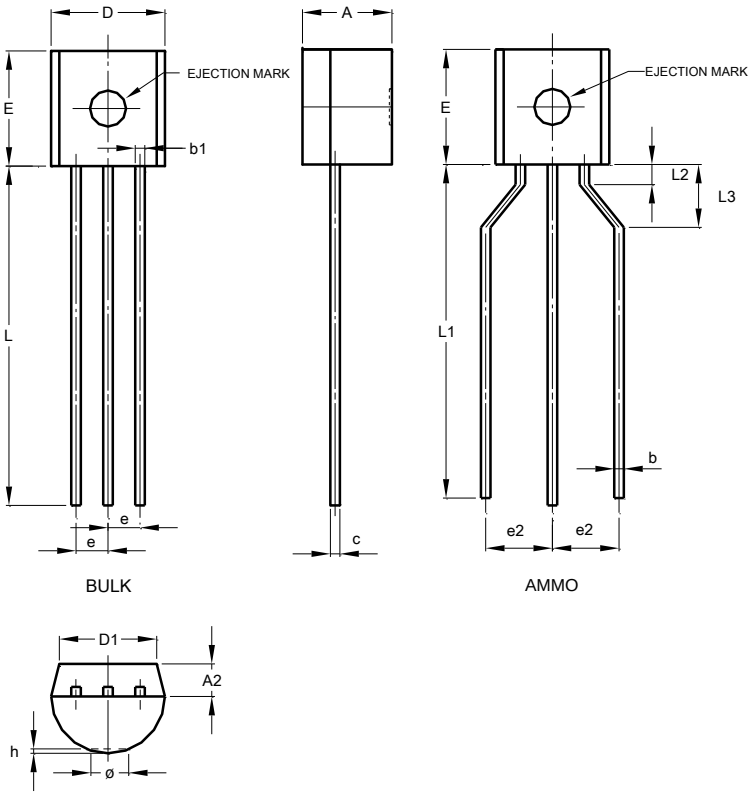
## Package Outline Dimensions

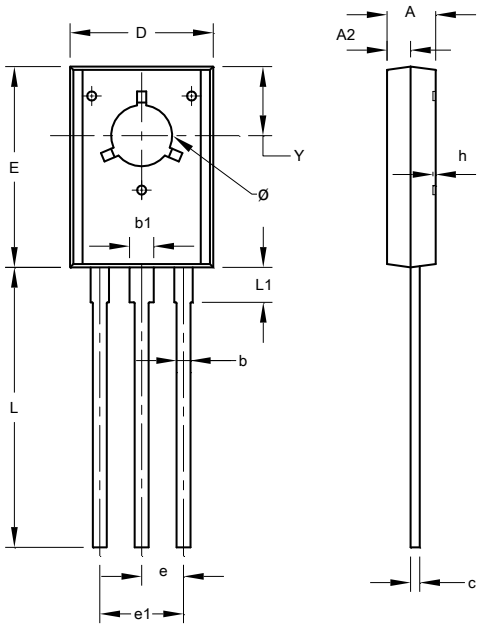
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

**(1) Package Type: TO92 Type C**




| TO92 Type C | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 3.30 | 3.70 | - |
| **A2** | 1.10 | 1.40 | - |
| **b** | 0.38 | 0.55 | - |
| **c** | 0.36 | 0.51 | - |
| **D** | 4.40 | 4.70 | - |
| **D1** | 3.430 | - | - |
| **E** | 4.30 | 4.70 | - |
| **e** | - | - | 1.27 |
| **e2** | 2.440 | 2.640 | - |
| **h** | 0.00 | 0.38 | - |
| **L** | 14.10 | 14.50 | - |
| **L1** | 12.50 | 14.50 | - |
| **L3** | 2.50 | 3.50 | - |
| **ø** | - | 1.60 | - |
| **All Dimensions in mm** | | | |

**(2) Package Type: TO126**




| TO126 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 2.400 | 2.900 | - |
| **A2** | 1.060 | 1.500 | - |
| **b** | 0.660 | 0.860 | - |
| **b1** | 1.170 | 1.470 | - |
| **c** | 0.400 | 0.600 | - |
| **D** | 7.400 | 8.200 | - |
| **E** | 10.60 | 11.20 | - |
| **e** | - | - | 2.280 |
| **e1** | - | - | 4.560 |
| **h** | 0.00 | 0.30 | - |
| **L** | 14.50 | 15.90 | - |
| **L1** | 1.700 | 2.100 | - |
| **Y** | 3.600 | 3.900 | - |
| **ø** | 3.100 | 3.550 | - |
| **All Dimensions in mm** | | | |

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