

**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)**

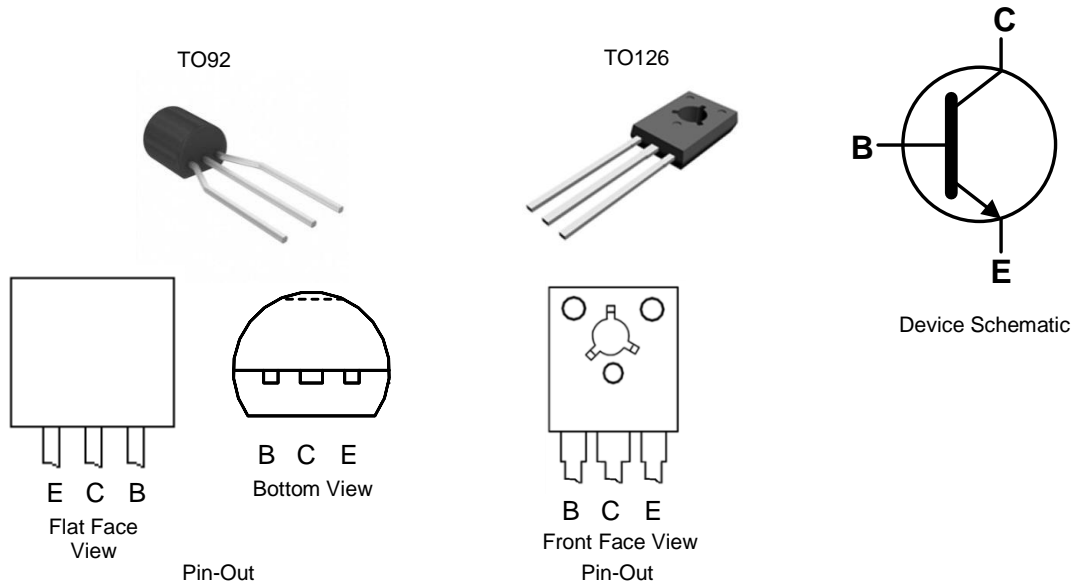
**Applications**

Low Power AC-DC SMPS for:

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

**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 <sup>③</sup>
- Weight: TO92: 200mg (Approximate)  
TO126: 400mg (Approximate)

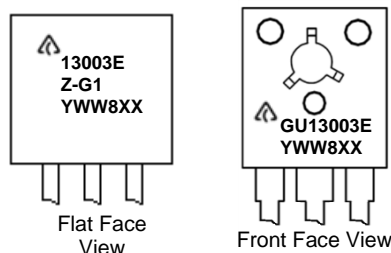


**Ordering Information** (Note 4)

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](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**



▲ = 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

**Absolute Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Emitter Voltage ( $V_{BE} = 0\text{V}$ )	$V_{CES}$	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  $\leq 10\%$ .

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

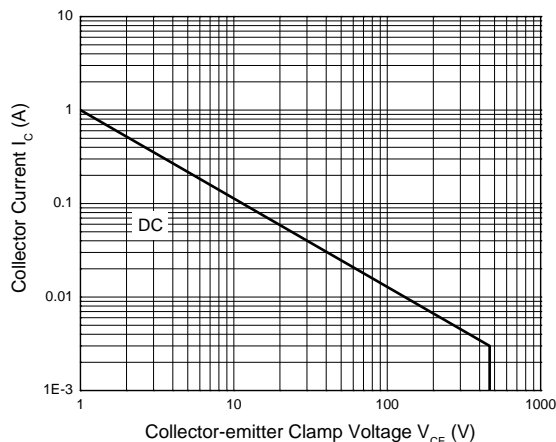
Characteristic	Symbol	Value	Unit
Power Dissipation	$P_D$	For TO92	1.1
		For TO126 @ $T_C = +25^\circ\text{C}$	20
Thermal Resistance, Junction to Ambient Air	$R_{\theta JA}$	For TO92	113.6
		For TO126	96
Thermal Resistance, Junction to Case	$R_{\theta JC}$	For TO92	83.3
		For TO126	6.25
Operating and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

**ESD Ratings** (Note 6)

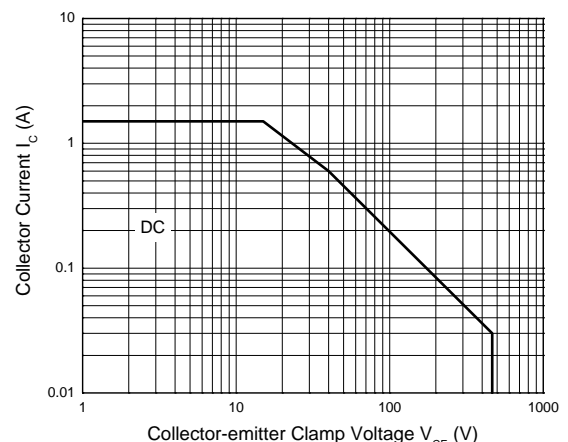
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	8,000	V	3B
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

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

**Safe Operating Area** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



Safe Operating Areas (TO92 Package)



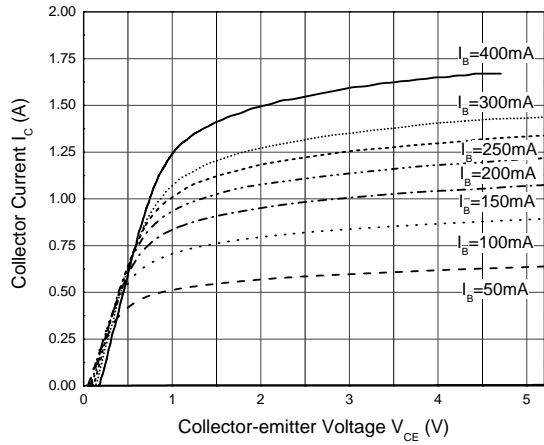
Safe Operating Areas (TO126 Package)

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

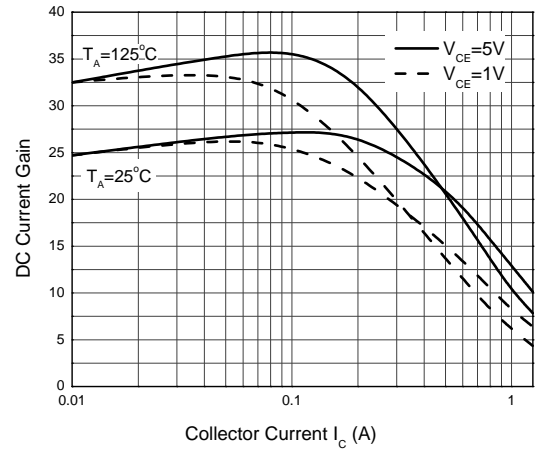
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Emitter Breakdown Voltage	$V_{CES}$	700	—	—	V	$I_C = 100\mu A, V_{BE} = 0V$
Collector-Emitter Breakdown Voltage	$V_{CEO}$	465	—	—	V	$I_C = 100\mu A$
Emitter-Base Breakdown Voltage	$V_{EBO}$	9	—	—	V	$I_E = 100\mu A$
Collector Cutoff Current	$I_{CEV}$	—	—	10	$\mu A$	$V_{CE} = 700V, V_{BE} = -1.5V$
DC Current Transfer Static Ratio (Note 7)	$h_{FE}$	15	—	—	—	$I_C = 0.3A, V_{CE} = 2V$
		13	17	30	—	$I_C = 0.5A, V_{CE} = 2V$
		5	—	25	—	$I_C = 1.0A, V_{CE} = 2V$
Collector-Emitter Saturation Voltage (Note 7)	$V_{CE(sat)}$	—	0.17	0.3	V	$I_C = 0.5A, I_B = 0.1A$
		—	0.29	0.4		$I_C = 1A, I_B = 0.25A$
Base-Emitter Saturation Voltage (Note 7)	$V_{BE(sat)}$	—	—	1.0	V	$I_C = 0.5A, I_B = 0.1A$
		—	—	1.2		$I_C = 1A, I_B = 0.25A$
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	$\mu s$	$I_C = 1A, V_{CC} = 125V, I_{B1} = 0.2A, I_{B2} = -0.2A, t_p = 25\mu s$
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  $\leq 300\mu s$ . Duty cycle  $\leq 2\%$ .

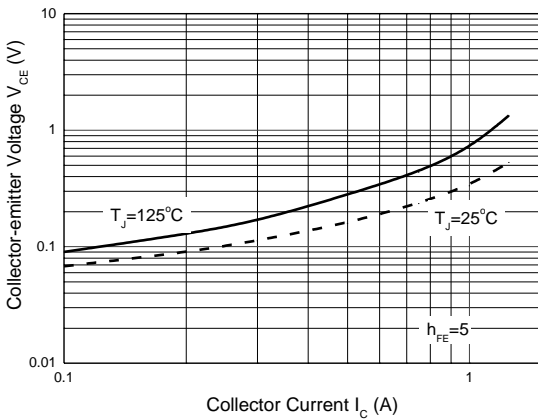
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



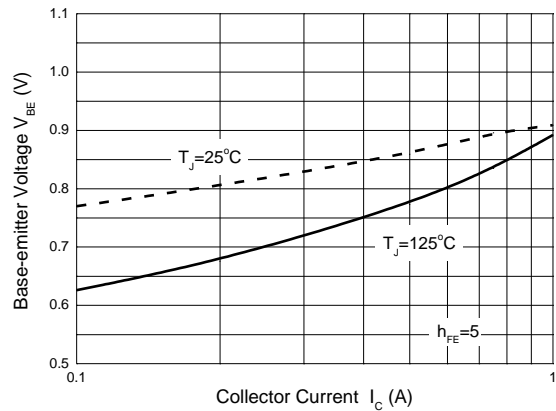
Static Characteristics



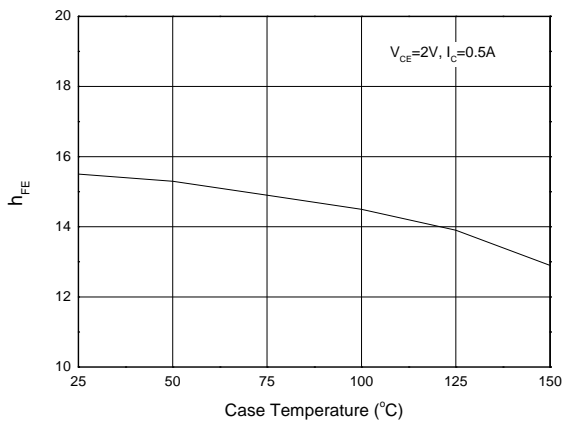
DC Current Gain vs. Collector Current



Collector-emitter Saturation Voltage



Base-emitter Saturation Voltage

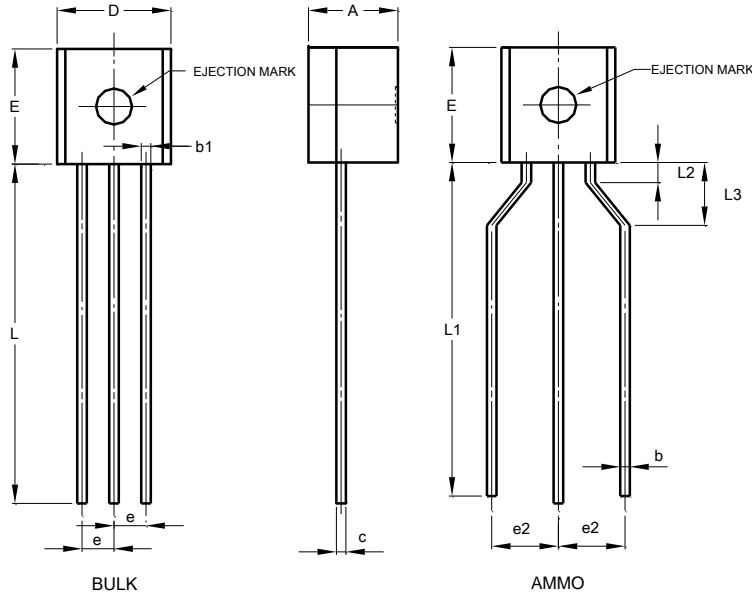


$h_{FE}$  vs. Case Temperature

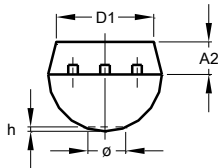
## Package Outline Dimensions

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

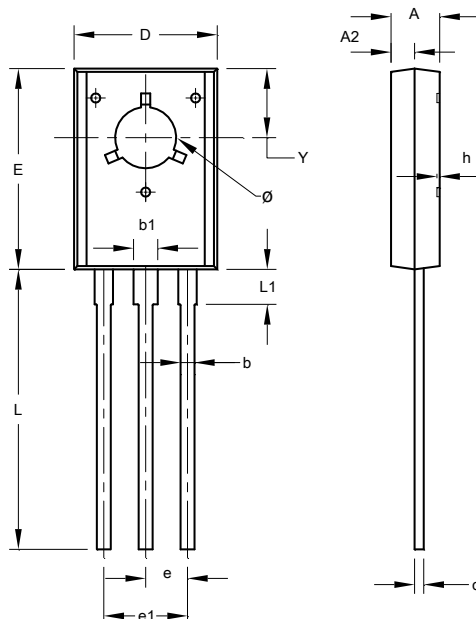
### (1) Package Type: TO92 Type C



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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