

## Features

- $BV_{CEO} > 450V$
- $BV_{CES} > 700V$
- $BV_{EBO} > 9V$
- $I_C = 1.5A$  High Continuous Collector Current
- Integrated Collector-Emitter Diode to Act as Free-wheeling Diode
- Anti-saturation for Faster Switching
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

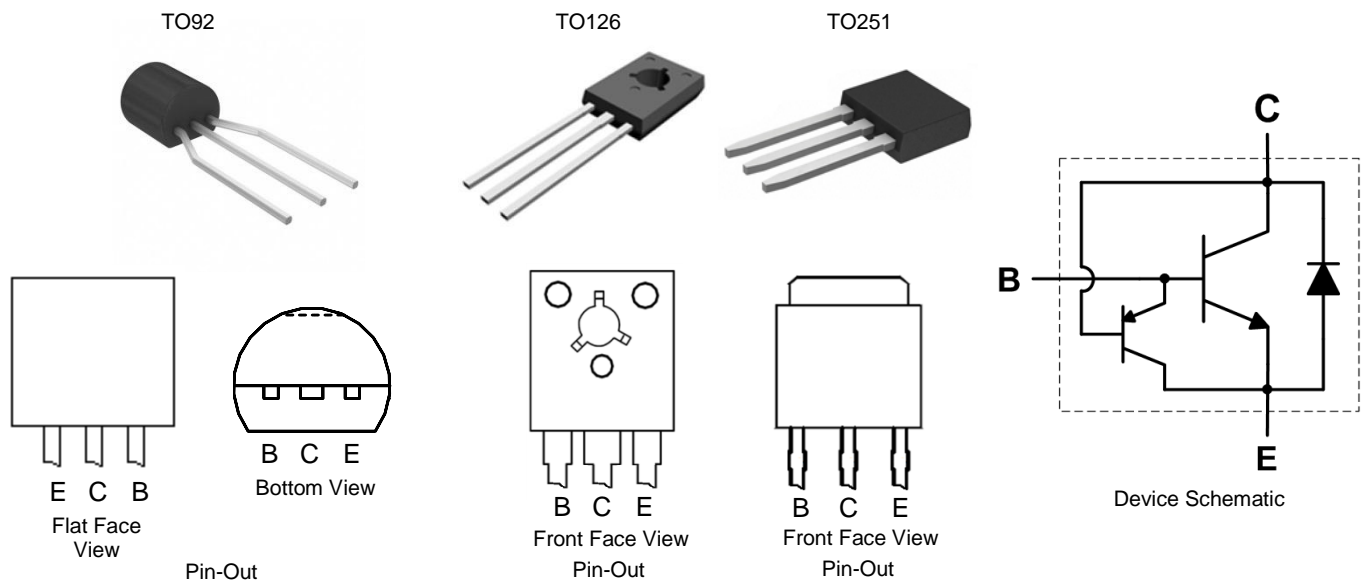
## Mechanical Data

- Case: TO92, TO126 or TO251
- 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)  
TO251: 340mg (Approximate)

## Applications

Low Power AC-DC SMPS for:

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

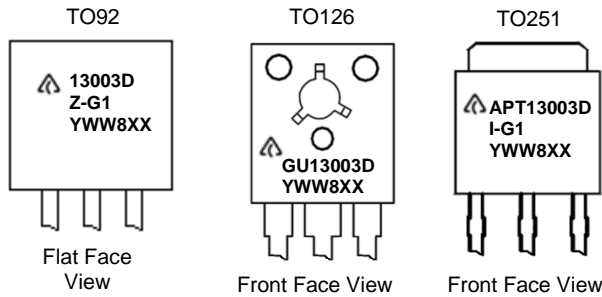


## Ordering Information (Note 4)

Product	Package	Marking	Quantity
APT13003DZTR-G1	TO92 (Joggled Legs)	13003DZ-G1	2,000 Taped, per Ammo Box
APT13003DU-G1	TO126	GU13003D	4,000 Bulk, Loose per Box
APT13003DI-G1	TO251	APT13003DI-G1	3,600 per Box in Tubes

- 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, 13003DZ-G1 = Product Type Marking ID  
 For TO126, GU13003D = Product Type Marking ID  
 For TO251, APT13003DI-G1 = 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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Emitter Voltage (V <sub>BE</sub> = 0V)	V <sub>CES</sub>	700	V
Collector-Emitter Voltage	V <sub>CEO</sub>	450	V
Emitter-Base Voltage	V <sub>EBO</sub>	9	V
Continuous Collector Current	I <sub>C</sub>	1.5	A
Peak Pulse Collector Current	I <sub>CM</sub>	3	A
Continuous Base Current	I <sub>B</sub>	0.75	A
Peak Pulse Base Current	I <sub>BM</sub>	1.5	A

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

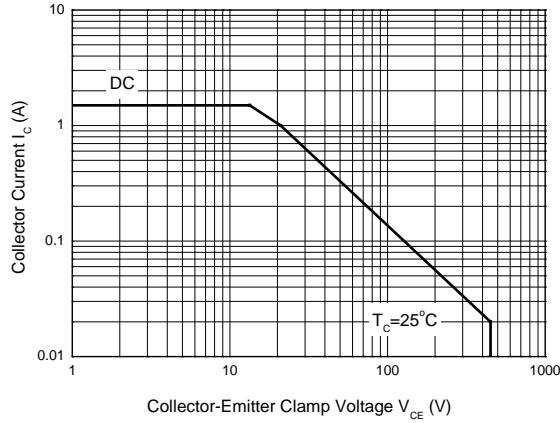
Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>D</sub>	For TO92	1.1
		For TO126 @ T <sub>C</sub> = +25°C	20
		For TO251 @ T <sub>C</sub> = +25°C	24
Thermal Resistance, Junction to Ambient Air	R <sub>θJA</sub>	For TO92	113.6
		For TO126	96
		For TO251	110
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	For TO92	83.3
		For TO126	6.25
		For TO251	5.0
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-65 to +150	°C

## ESD Ratings (Note 5)

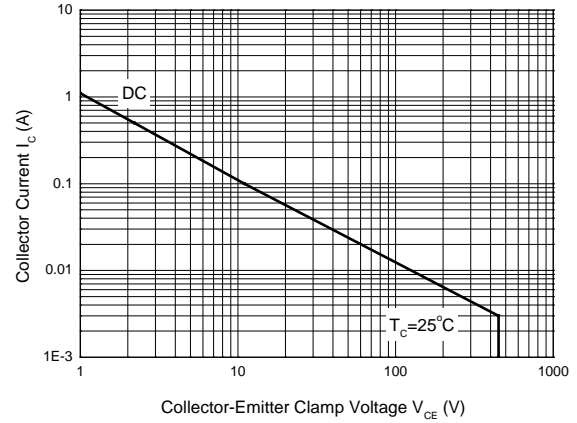
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	8,000	V	3B
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

Note: 5. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

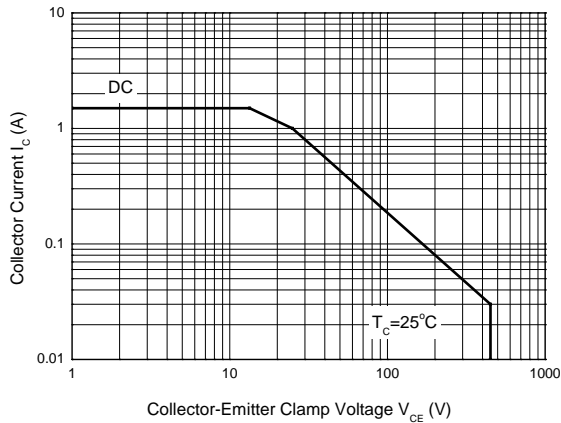
**Safe Operating Areas and Derating Information** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



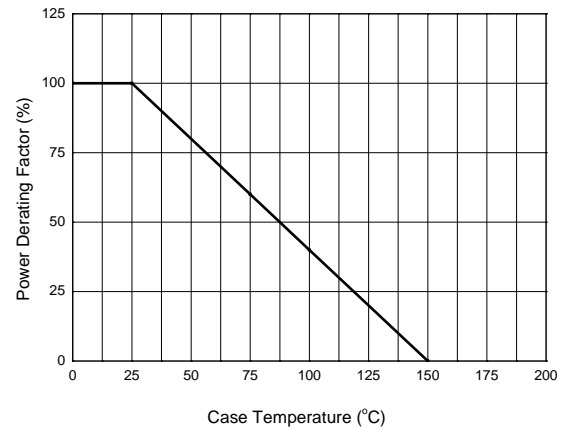
Safe Operating Areas  
(TO126 Package)



Safe Operating Areas  
(TO92 Package)



Safe Operating Areas  
(TO251 Package)



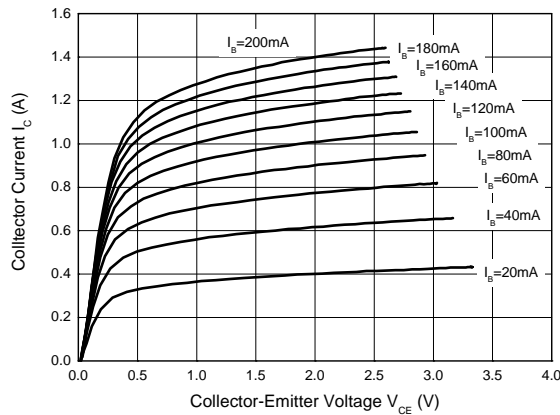
Power Derating Curve

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

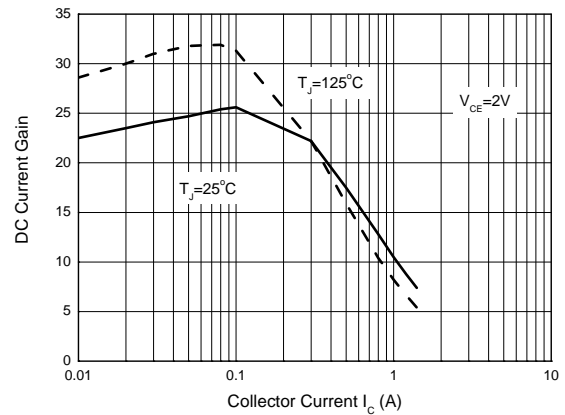
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Emitter Breakdown Voltage	$BV_{CES}$	700	–	–	V	$I_C = 100\mu\text{A}$ , $V_{BE} = 0\text{V}$
Collector-Emitter Breakdown Voltage	$BV_{CEO}$	450	–	–	V	$I_C = 100\mu\text{A}$
Emitter-Base Breakdown Voltage	$BV_{EBO}$	9	–	–	V	$I_E = 100\mu\text{A}$
Collector Cutoff Current	$I_{CEV}$	–	–	10	$\mu\text{A}$	$V_{CE} = 700\text{V}$ , $V_{BE} = -1.5\text{V}$
DC Current Transfer Static Ratio (Note 6)	$h_{FE}$	16 5.0	–	30 25	–	$I_C = 0.5\text{A}$ , $V_{CE} = 2\text{V}$ $I_C = 1.0\text{A}$ , $V_{CE} = 2\text{V}$
Collector-Emitter Saturation Voltage (Note 6)	$V_{CE(sat)}$	–	–	0.3 0.4	V	$I_C = 0.5\text{A}$ , $I_B = 0.1\text{A}$ $I_C = 1\text{A}$ , $I_B = 0.25\text{A}$
Base-Emitter Saturation Voltage (Note 6)	$V_{BE(sat)}$	–	–	1.0 1.2	V	$I_C = 0.5\text{A}$ , $I_B = 0.1\text{A}$ $I_C = 1\text{A}$ , $I_B = 0.25\text{A}$
Output Capacitance	$C_{ob}$	–	18	–	pF	$V_{CB} = 10\text{V}$ , $f = 0.1\text{MHz}$
Transition Frequency	$f_T$	4	–	–	MHz	$I_C = 0.1\text{A}$ , $V_{CE} = 10\text{V}$
Turn-on Time with Resistive Load	$t_{on}$	–	–	0.7	$\mu\text{s}$	$I_C = 1\text{A}$ , $V_{CC} = 125\text{V}$ , $I_{B1} = 0.2\text{A}$ , $I_{B2} = -0.2\text{A}$
Storage Time with Resistive Load	$t_s$	–	–	3.0		
Fall Time with Resistive Load	$t_f$	–	–	0.35		

Note: 6. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

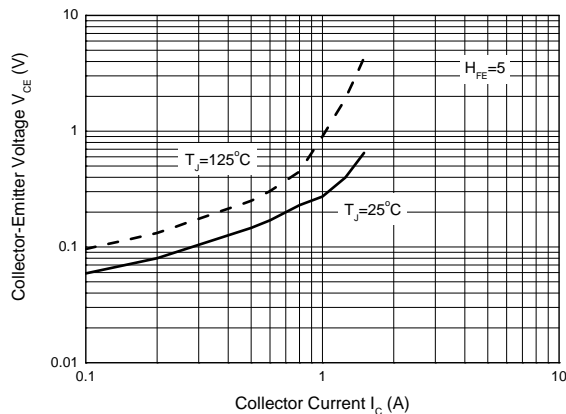
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



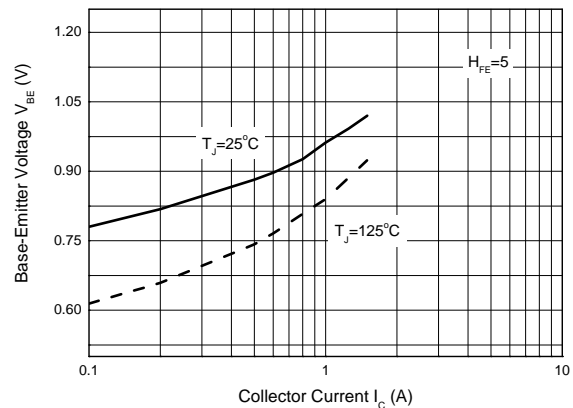
Static Characteristics



DC Current Gain



Collector-Emitter Saturation Region

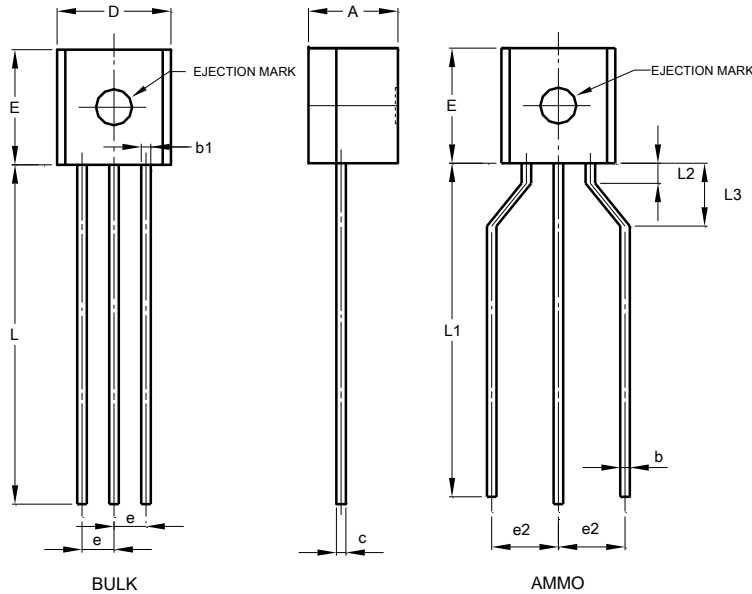


Base-Emitter Saturation Voltage

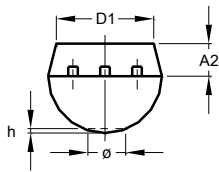
**Package Outline Dimensions**

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

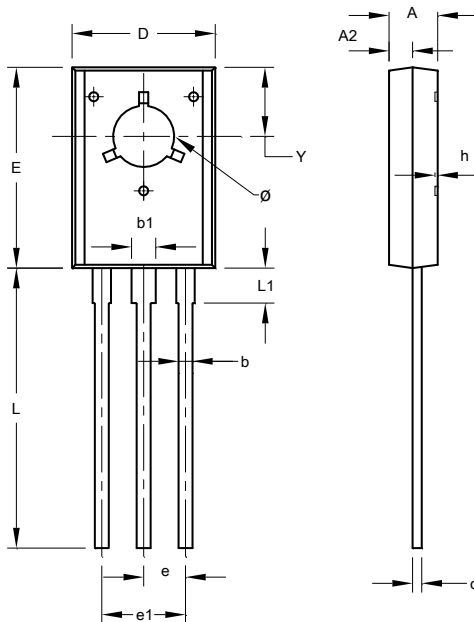
**(1) Package Type: TO92 Type C**



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	-
∅	-	1.60	-
All Dimensions in mm			



**(2) Package Type: TO126**

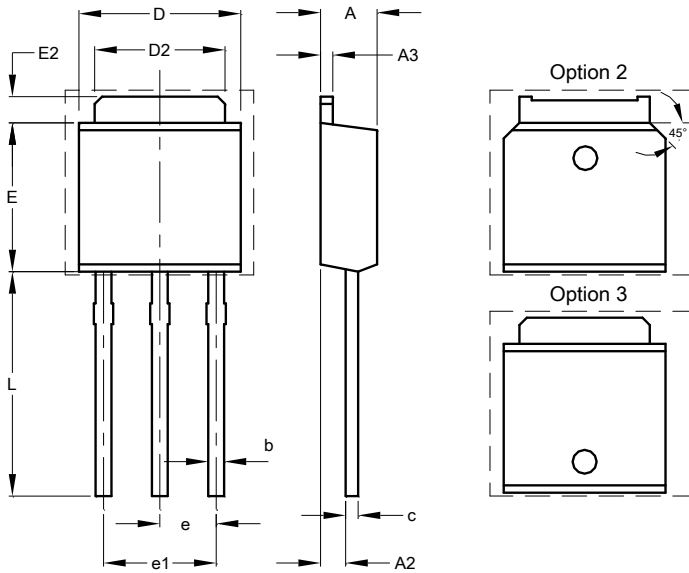


TO126			
Dim	Min	Max	Typ
A	2.400	2.900	-
A2	1.060	1.500	-
b	0.660	0.860	-
b1	1.170	1.470	-
c	0.400	0.600	-
D	7.400	8.200	-
E	10.60	11.20	-
e	-	-	2.280
e1	-	-	4.560
h	0.00	0.30	-
L	14.50	15.90	-
L1	1.700	2.100	-
Y	3.600	3.900	-
∅	3.100	3.550	-
All Dimensions in mm			

**Package Outline Dimensions (cont.)**

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

**(3) Package Type: TO251**



TO251		
Dim	Min	Max
A	2.200	2.400
A2	0.890	1.150
A3	0.450	0.550
b	0.550	0.740
c	0.450	0.570
D	6.400	6.750
D2	5.200	5.400
E	5.950	6.250
E2	0.900	1.250
e	2.240	2.340
e1	4.430	4.730
L	8.900	9.500
<b>All Dimensions in mm</b>		

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

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