



APT13003D

### 450V NPN HIGH VOLTAGE POWER TRANSISTOR

### **Features**

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

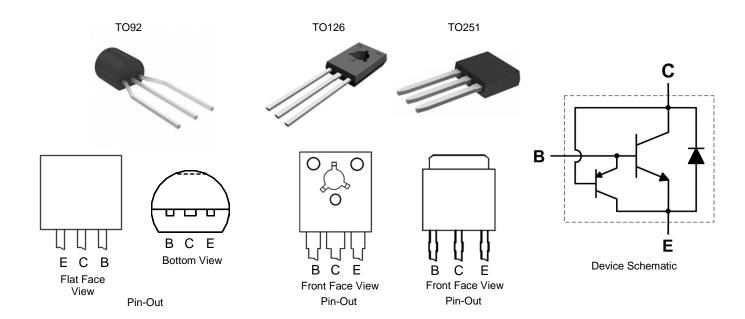
## **Mechanical Data**

- 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 @3
- 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:

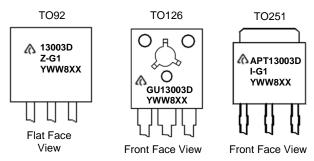
- 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
- 2. See http://www.diodes.com/quality/lead\_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- 3. Halogen- and Antimony-free "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





APT13003D

# **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 (@TA = +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	$V_{CEO}$	450	V
Emitter-Base Voltage	$V_{EBO}$	9	V
Continuous Collector Current	Ic	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
	For TO92		1.1	
Power Dissipation	For TO126@ T <sub>C</sub> = +25°C	P <sub>D</sub>	20	W
	For TO251@ T <sub>C</sub> = +25°C		24	
	For TO92	$R_{ heta JA}$	113.6	
Thermal Resistance, Junction to Ambient Air	For TO126		96	°C/W
	For TO251		110	1
	For TO92	Rejc	83.3	
Thermal Resistance, Junction to Case	For TO126		6.25	°C/W
	For TO251		5.0	
Operating and Storage Temperature Range		$T_{J_{\cdot}}T_{STG}$	-65 to +150	°C

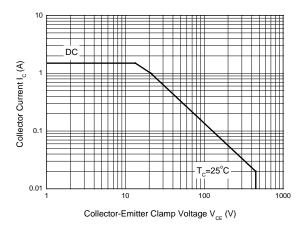
## ESD Ratings (Note 5)

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	С

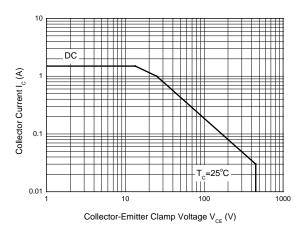
Note: 5. Refer to JEDEC specification JESD22-A114 and JESD22-A115.



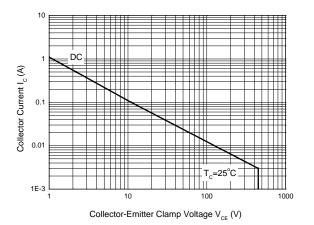
# Safe Operating Areas and Derating Information (@T<sub>A</sub> = +25°C, unless otherwise specified.)



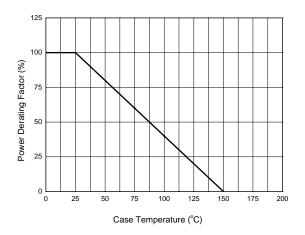
Safe Operating Areas (TO126 Package)



Safe Operating Areas (TO251 Package)



Safe Operating Areas (TO92 Package)



Power Derating Curve





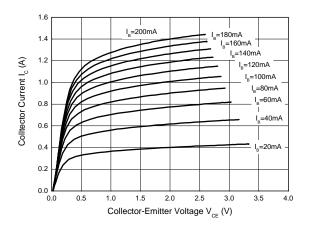
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# **Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

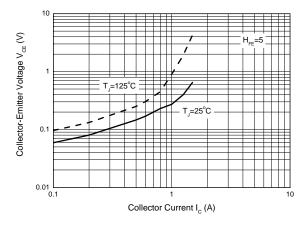
Characteristic	Symbol	Min	Тур	Max	Unit	Test Condition
Collector-Emitter Breakdown Voltage	BV <sub>CES</sub>	700	=	=	V	$I_C = 100 \mu A, V_{BE} = 0 V$
Collector-Emitter Breakdown Voltage	BV <sub>CEO</sub>	450	-	-	V	$I_{C} = 100 \mu A$
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	9	-	-	V	I <sub>E</sub> = 100μA
Collector Cutoff Current	I <sub>CEV</sub>	-	-	10	μΑ	$V_{CE} = 700V, V_{BE} = -1.5V$
DC Current Transfer Static Ratio (Note 6)	h	16	-	30		$I_C = 0.5A, V_{CE} = 2V$
DC Current Transfer Static Ratio (Note 6)	h <sub>FE</sub>	5.0	I	25	_	$I_C = 1.0A$ , $V_{CE} = 2V$
Collector-Emitter Saturation Voltage (Note 6)	V	_	=	0.3	V	$I_C = 0.5A, I_B = 0.1A$
Collector-Entitler Saturation voltage (Note 6)	V <sub>CE(sat)</sub>	-	İ	0.4	V	$I_C = 1A$ , $I_B = 0.25A$
Base-Emitter Saturation Voltage (Note 6)	Vpc()	_	_	1.0	V	$I_C = 0.5A, I_B = 0.1A$
Dase-Emilier Saturation Voltage (Note o)	$V_{BE(sat)}$	_		1.2	V	$I_C = 1A$ , $I_B = 0.25A$
Output Capacitance	$C_ob$	_	18	-	pF	$V_{CB} = 10V, f = 0.1MHz$
Transition Frequency	f <sub>T</sub>	4	I	=	MHz	$I_C = 0.1A, V_{CE} = 10V$
Turn-on Time with Resistive Load	t <sub>on</sub>	_	-	0.7		1 1051/ 1 0 0 0
Storage Time with Resistive Load	t <sub>s</sub>	_	=	3.0	μs	$I_{C} = 1A$ , $V_{CC} = 125V$ , $I_{B1} = 0.2A$ , $I_{B2} = -0.2A$
Fall Time with Resistive Load	t <sub>f</sub>	_	_	0.35		IB2 = -U.ZA

Note:

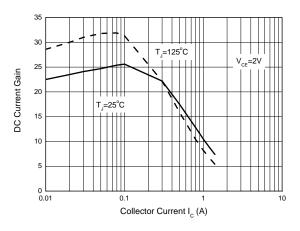
## Typical Electrical Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)



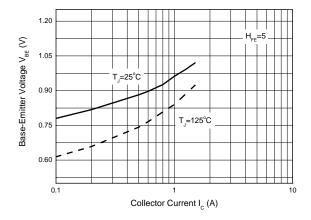
Static Characteristics



Collector-Emitter Saturation Region



DC Current Gain



Base-Emitter Saturation Voltage

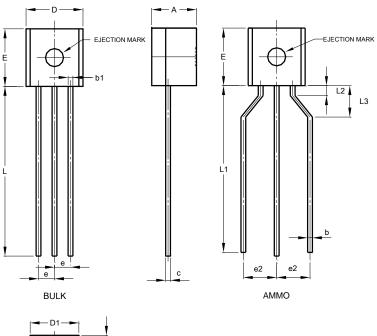
<sup>6.</sup> Measured under pulsed conditions. Pulse width  $\leq$  300 $\mu$ s. Duty cycle  $\leq$  2%.



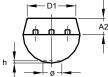
# **Package Outline Dimensions**

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

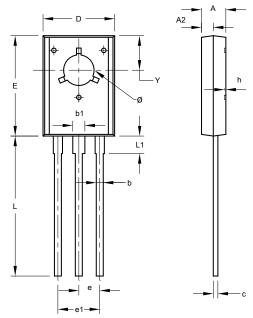
### (1) Package Type: TO92 Type C



TO92 Type C				
Dim	Min	Max	Тур	
Α	3.30	3.70	-	
A2	1.10	1.40	-	
b	0.38	0.55	-	
С	0.36	0.51	-	
D	4.40	4.70	-	
D1	3.430	-	-	
Е	4.30	4.70	-	
е	-	-	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



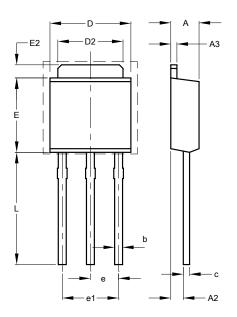
	TO126				
Dim	Min	Max	Тур		
Α	2.400	2.900	-		
A2	1.060	1.500	-		
b	0.660	0.860	-		
b1	1.170	1.470	-		
C	0.400	0.600	-		
D	7.400	8.200	-		
Е	10.60	11.20	-		
е	-	-	2.280		
e1	ı	-	4.560		
h	0.00	0.30	-		
L	14.50	15.90	-		
L1	1.700	2.100	-		
Υ	3.600	3.900	-		
Ø	3.100	3.550	-		
All Dimensions in mm					

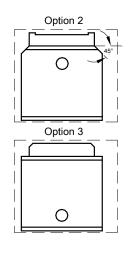


## Package Outline Dimensions (cont.)

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

### (3) Package Type: TO251





TO251				
Dim	Min	Max		
Α	2.200	2.400		
A2	0.890	1.150		
A3	0.450	0.550		
b	0.550	0.740		
С	0.450	0.570		
D	6.400	6.750		
D2	5.200	5.400		
E	5.950	6.250		
E2	0.900	1.250		
е	2.240	2.340		
e1	4.430	4.730		
L	8.900	9.500		
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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