

**COMPLEMENTARY 40V HIGH PERFORMANCE TRANSISTOR**

**Features**

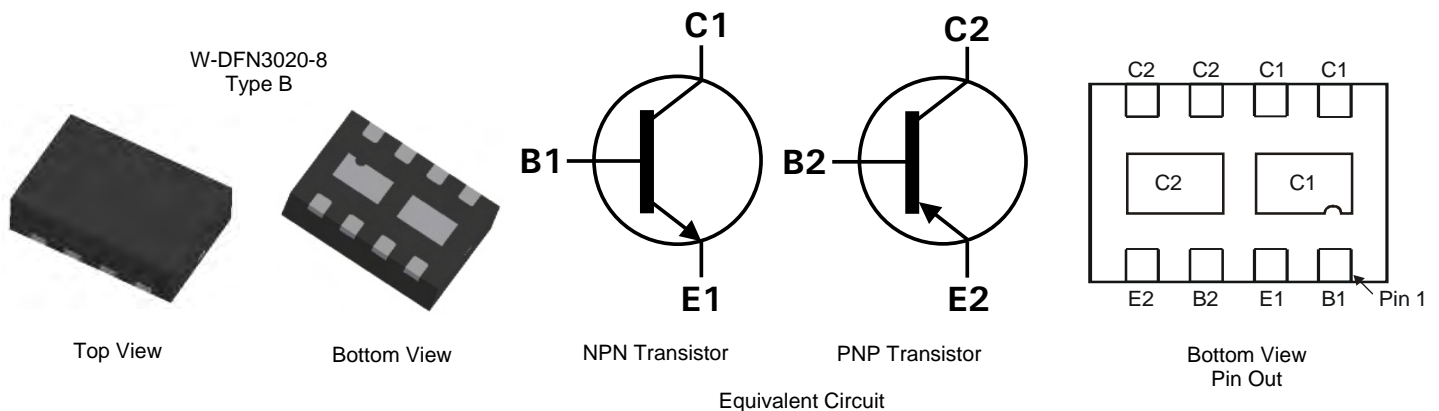
- NPN Transistor
- $BV_{CEO} > 40V$
  - $I_C = 3A$  Continuous Collector Current
  - Low Saturation Voltage (500mV max @ 1A)
  - $R_{SAT} = 195m\Omega$  for a low equivalent On-Resistance
- PNP Transistor
- $BV_{CEO} > -40V$
  - $I_C = -3A$  Continuous Collector Current
  - Low Saturation Voltage (-500mV max @ -1A)
  - $R_{SAT} = 350m\Omega$  for a low equivalent On-Resistance
- $h_{FE}$  characterized up to 2A for high current gain hold up
  - Low profile 0.8mm high package for thin applications
  - $R_{\theta JA}$  efficient, 40% lower than SOT26
  - 6mm<sup>2</sup> footprint, 50% smaller than TSOP6 and SOT26
  - **Totally Lead-Free & Fully 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: W-DFN3020-8 Type B
- Nominal package height: 0.8mm
- Case material: molded plastic. "Green" molding compound.
- UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - NiPdAu, Solderable per MIL-STD-202, Method 208 (e4)
- Weight: 0.013 grams (approximate)

**Applications**

- DC – DC Converters
- Charging circuits
- Power switches
- LED Backlighting circuits
- Motor control
- Portable applications

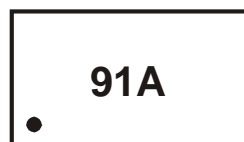


**Ordering Information (Note 5)**

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXTC4591AMCTA	AEC-Q101	91A	7	8	3,000
ZXTC4591AMCQTA	Automotive	91A	7	8	3,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See <http://www.diodes.com> 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.
  5. For packaging details, go to our website at <http://www.diodes.com>

**Marking Information**



91A = Product type marking code  
Top view, dot denotes pin 1

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

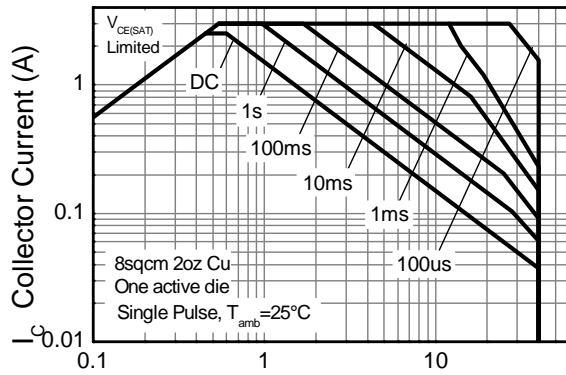
Parameter	Symbol	NPN	PNP	Unit
Collector-Base Voltage	V <sub>CBO</sub>	40	-40	V
Collector-Emitter Voltage	V <sub>CEO</sub>	40	-40	
Emitter-Base Voltage	V <sub>EBO</sub>	7	-7	
Peak Pulse Current	I <sub>CM</sub>	3	-3	A
Continuous Collector Current	(Notes 6 & 9)	2	-1.5	
		(Notes 7 & 9)	2.5	
Base Current	I <sub>B</sub>	300		mA

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

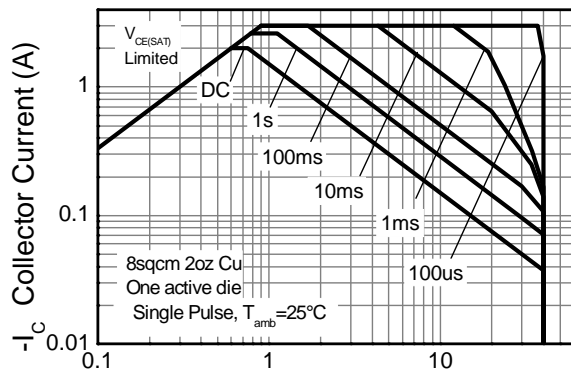
Characteristic	Symbol	NPN	PNP	Unit
Power Dissipation Linear Derating Factor	P <sub>D</sub>	(Notes 6 & 9)		W mW/°C
		(Notes 7 & 9)		
		(Notes 8 & 9)		
		(Notes 8 & 10)		
		(Notes 8 & 10)		
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	(Notes 6 & 9)		°C/W
		(Notes 7 & 9)		
		(Notes 8 & 9)		
		(Notes 8 & 10)		
Thermal Resistance, Junction to Lead	R <sub>θJL</sub>	(Notes 9 & 11)		°C
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150		°C

- Notes:
6. For a dual device surface mounted on 28mm x 28mm (8cm<sup>2</sup>) FR4 PCB with high coverage of single sided 2 oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The heatsink is split in half with the exposed collector pads connected to each half.
  7. Same as note (6), except the device is measured at t <5 sec.
  8. Same as note (6), except the device is surface mounted on 31mm x 31mm (10cm<sup>2</sup>) FR4 PCB with high coverage of single sided 1oz copper.
  9. For a dual device with one active die.
  10. For dual device with 2 active die running at equal power.
  11. Thermal resistance from junction to solder-point (on the exposed collector pad).

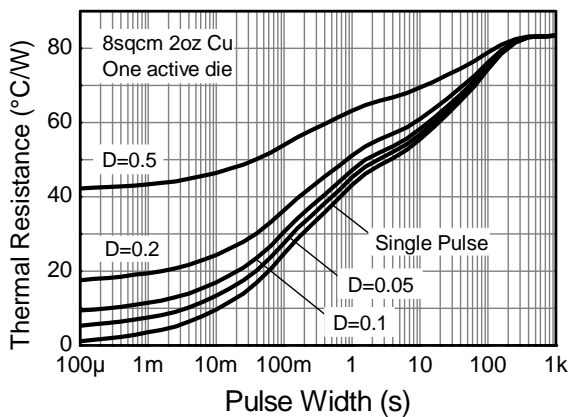
**Thermal Characteristics and Derating Information**



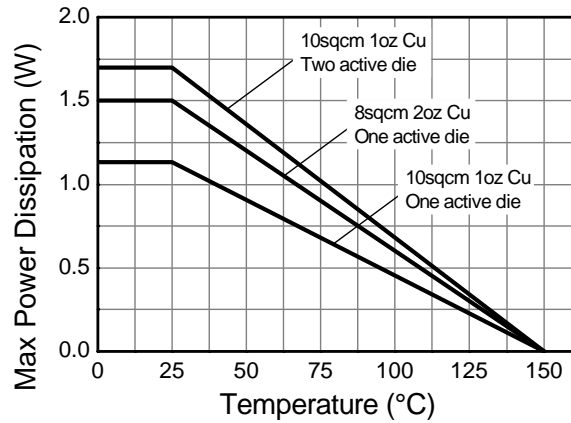
$V_{CE}$  Collector-Emitter Voltage (V)  
**NPN Safe Operating Area**



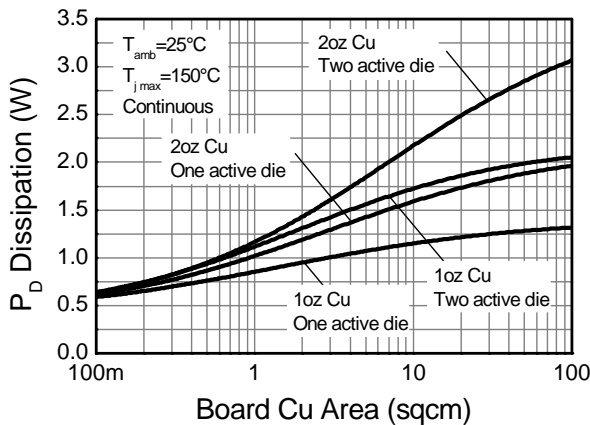
$-V_{CE}$  Collector-Emitter Voltage (V)  
**PNP Safe Operating Area**



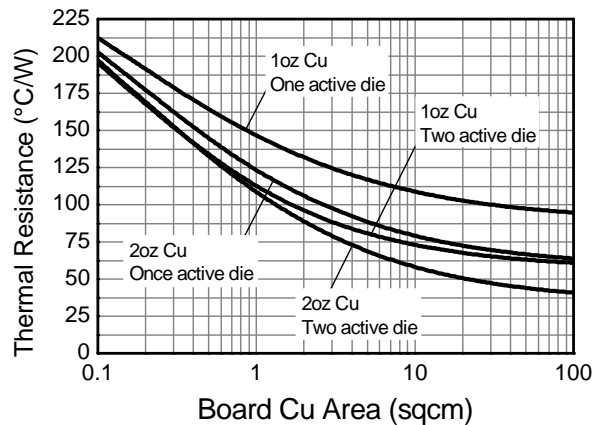
**Transient Thermal Impedance**



**Derating Curve**



**Power Dissipation v Board Area**



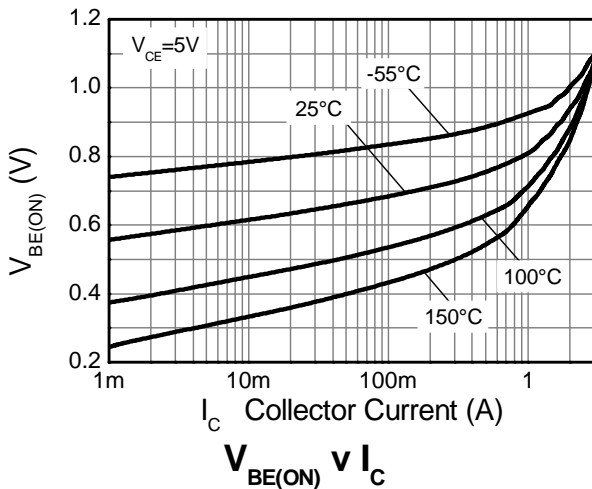
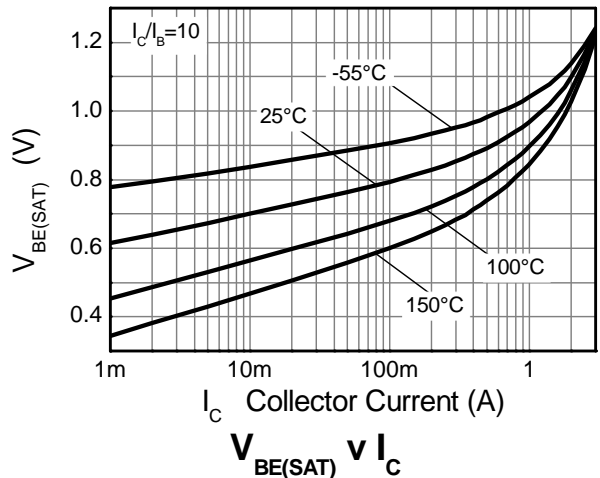
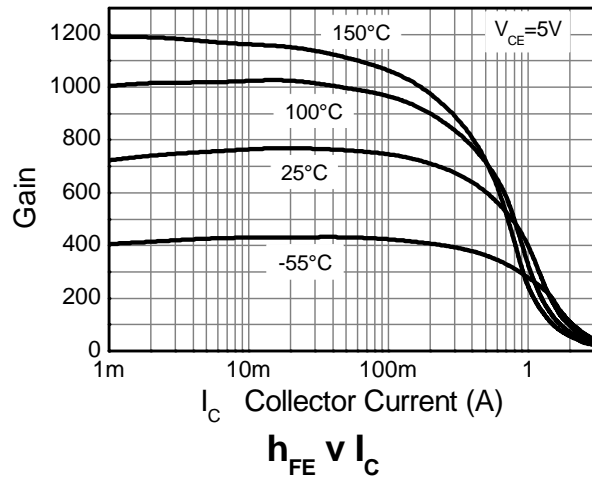
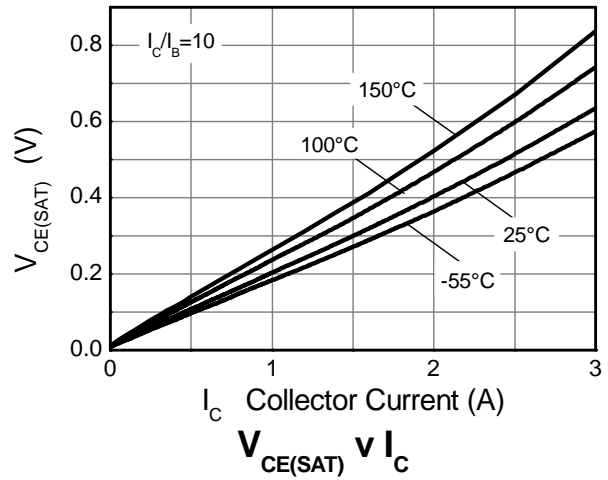
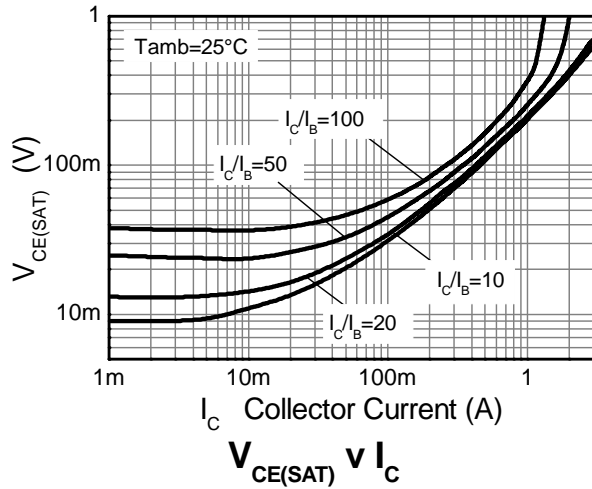
**Thermal Resistance v Board Area**

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	40	-	-	V	I <sub>C</sub> = 100μA
Collector-Emitter Breakdown Voltage (Note 12)	BV <sub>CEO</sub>	40	-	-	V	I <sub>C</sub> = 10mA
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	7	-	-	V	I <sub>E</sub> = 100μA
Collector Cutoff Current	I <sub>CBO</sub>	-	-	100	nA	V <sub>CB</sub> = 30V
Emitter Cutoff Current	I <sub>EBO</sub>	-	-	100	nA	V <sub>EB</sub> = 4V
Collector Emitter Cutoff Current	I <sub>CES</sub>	-	-	100	nA	V <sub>CE</sub> = 30V
Static Forward Current Transfer Ratio (Note 12)	h <sub>FE</sub>	300 300 200 35	- - - -	- 900 - -	-	I <sub>C</sub> = 1mA, V <sub>CE</sub> = 5V I <sub>C</sub> = 500mA, V <sub>CE</sub> = 5V I <sub>C</sub> = 1A, V <sub>CE</sub> = 5V I <sub>C</sub> = 2A, V <sub>CE</sub> = 5V
Collector-Emitter Saturation Voltage (Note 12)	V <sub>CE(sat)</sub>	-	-	300 500	mV	I <sub>C</sub> = 0.5A, I <sub>B</sub> = 50mA I <sub>C</sub> = 1A, I <sub>B</sub> = 100mA
Base-Emitter Turn-On Voltage (Note 12)	V <sub>BE(on)</sub>	-	-	1.0	V	I <sub>C</sub> = 1A, V <sub>CE</sub> = 5V
Base-Emitter Saturation Voltage (Note 12)	V <sub>BE(sat)</sub>	-	-	1.1	V	I <sub>C</sub> = 1A, I <sub>B</sub> = 100mA
Output Capacitance	C <sub>obo</sub>	-	-	10	pF	V <sub>CB</sub> = 10V, f = 1MHz
Transition Frequency	f <sub>T</sub>	150	-	-	MHz	V <sub>CE</sub> = 10V, I <sub>C</sub> = 50mA, f = 100MHz

Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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

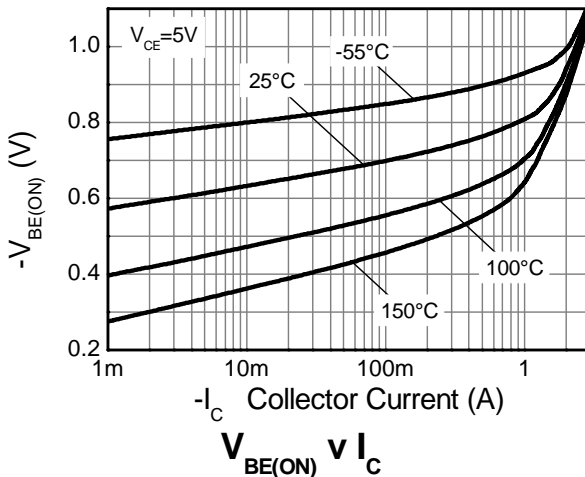
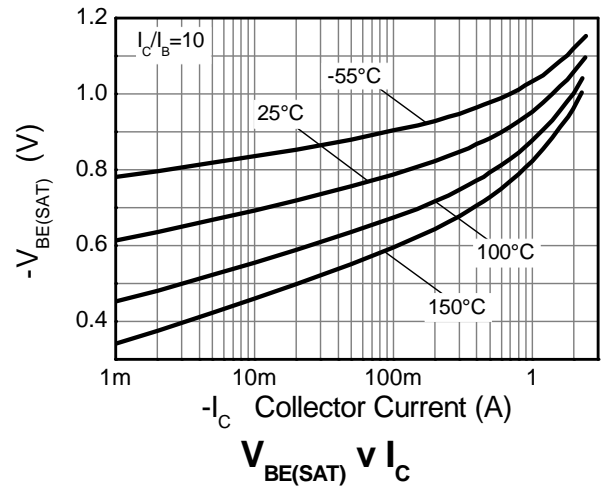
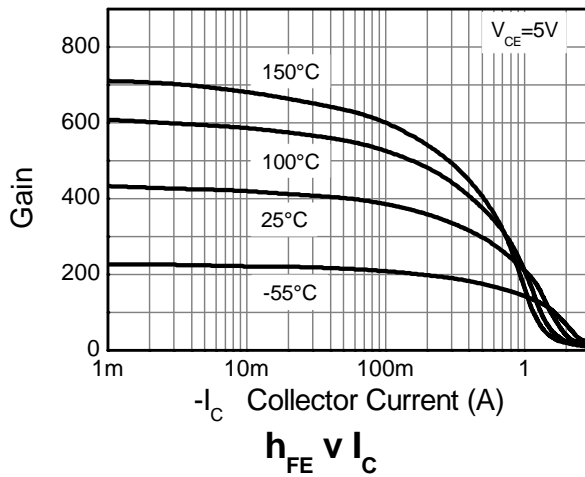
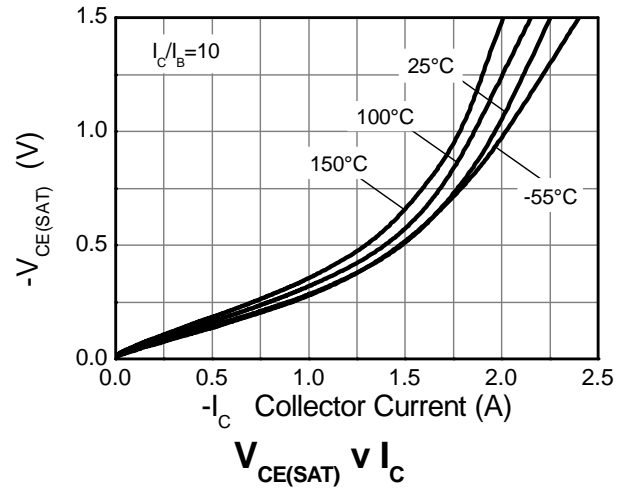
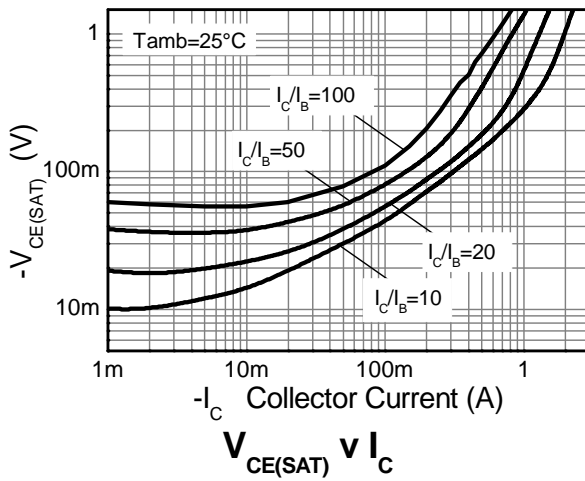


**PNP - Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	-40	-	-	V	I <sub>C</sub> = -100μA
Collector-Emitter Breakdown Voltage (Note 12)	BV <sub>CEO</sub>	-40	-	-	V	I <sub>C</sub> = -10mA
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	-7	-	-	V	I <sub>E</sub> = -100μA
Collector Cutoff Current	I <sub>CBO</sub>	-	-	-100	nA	V <sub>CB</sub> = -30V
Emitter Cutoff Current	I <sub>EBO</sub>	-	-	-100	nA	V <sub>EB</sub> = -4V
Collector Emitter Cutoff Current	I <sub>CES</sub>	-	-	-100	nA	V <sub>CE</sub> = -30V
Static Forward Current Transfer Ratio (Note 12)	h <sub>FE</sub>	300	-	-	-	I <sub>C</sub> = -1mA, V <sub>CE</sub> = -5V
		300	-	800		I <sub>C</sub> = -100mA, V <sub>CE</sub> = -5V
		250	-	-		I <sub>C</sub> = -500mA, V <sub>CE</sub> = -5V
		160	-	-		I <sub>C</sub> = -1A, V <sub>CE</sub> = -5V
		30	-	-		I <sub>C</sub> = -2A, V <sub>CE</sub> = -5V
Collector-Emitter Saturation Voltage (Note 12)	V <sub>CE(sat)</sub>	-	-	-200	mV	I <sub>C</sub> = -0.1A, I <sub>B</sub> = -1mA
		-	-	-350		I <sub>C</sub> = -0.5A, I <sub>B</sub> = -20mA
		-	-	-500		I <sub>C</sub> = -1.0A, I <sub>B</sub> = -100mA
Base-Emitter Turn-On Voltage (Note 12)	V <sub>BE(on)</sub>	-	-	-1.0	V	I <sub>C</sub> = -1A, V <sub>CE</sub> = -5V
Base-Emitter Saturation Voltage (Note 12)	V <sub>BE(sat)</sub>	-	-	-1.1	V	I <sub>C</sub> = -1A, I <sub>B</sub> = -50mA
Output Capacitance	C <sub>obo</sub>	-	-	10	pF	V <sub>CB</sub> = -10V, f = 1MHz
Transition Frequency	f <sub>T</sub>	150	-	-	MHz	V <sub>CE</sub> = -10V, I <sub>C</sub> = -50mA, f = 100MHz

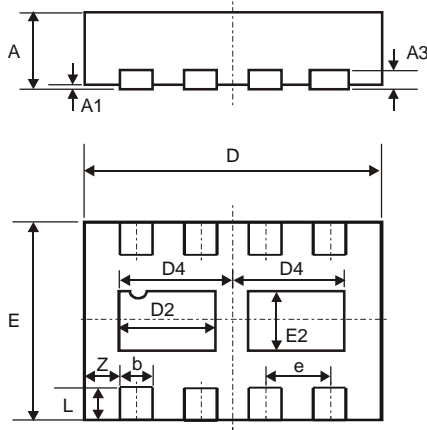
Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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



### Package Outline Dimensions

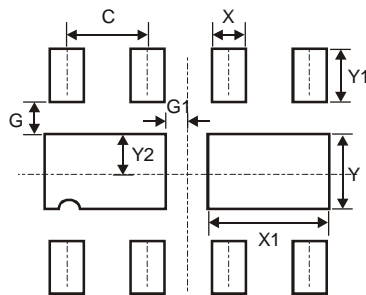
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



W-DFN3020-8 Type B			
Dim	Min	Max	Typ
A	0.77	0.83	0.80
A1	0	0.05	0.02
A3	-	-	0.15
b	0.25	0.35	0.30
D	2.95	3.075	3.00
D2	0.82	1.02	0.92
D4	1.01	1.21	1.11
e	-	-	0.65
E	1.95	2.075	2.00
E2	0.43	0.63	0.53
L	0.25	0.35	0.30
Z	-	-	0.375
All Dimensions in mm			

### Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
C	0.650
G	0.285
G1	0.090
X	0.400
X1	1.120
Y	0.730
Y1	0.500
Y2	0.365



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