


**40V COMPLEMENTARY NPN-PNP SMALL-SIGNAL TRANSISTOR IN X2-DFN1310-6**

**Features**

- Complementary Pair One 3904-Type NPN  
One 3906-Type PNP
- Ultra-Small Surface-Mount Package
- Epitaxial Planar Die Construction
- Ideal for Low-Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](#) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

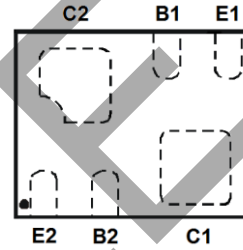
**Mechanical Data**

- Package: X2-DFN1310-6
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - NiPdAu, Solderable per MIL-STD-202, Method 208 
- Weight: 0.006 grams (Approximate)

X2-DFN1310-6 (Type B)



Top View



Pinout  
Top View

E1, B1, C1 = PNP 3906  
E2, B2, C2 = NPN 3904

**Ordering Information (Note 4)**

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
MMDT3946FL3-7	X2-DFN1310-6 (Type B)	47	7	8	3,000	Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

**Marking Information**



47 = Product Type Marking Code

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**Absolute Maximum Ratings, NPN 3904** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CB0</sub>	60	V
Collector-Emitter Voltage	V <sub>CE0</sub>	40	V
Emitter-Base Voltage	V <sub>EBO</sub>	6.0	V
Collector Current	I <sub>C</sub>	200	mA

**Absolute Maximum Ratings, PNP 3906** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CB0</sub>	-40	V
Collector-Emitter Voltage	V <sub>CE0</sub>	-40	V
Emitter-Base Voltage	V <sub>EBO</sub>	-6.0	V
Collector Current	I <sub>C</sub>	-200	mA

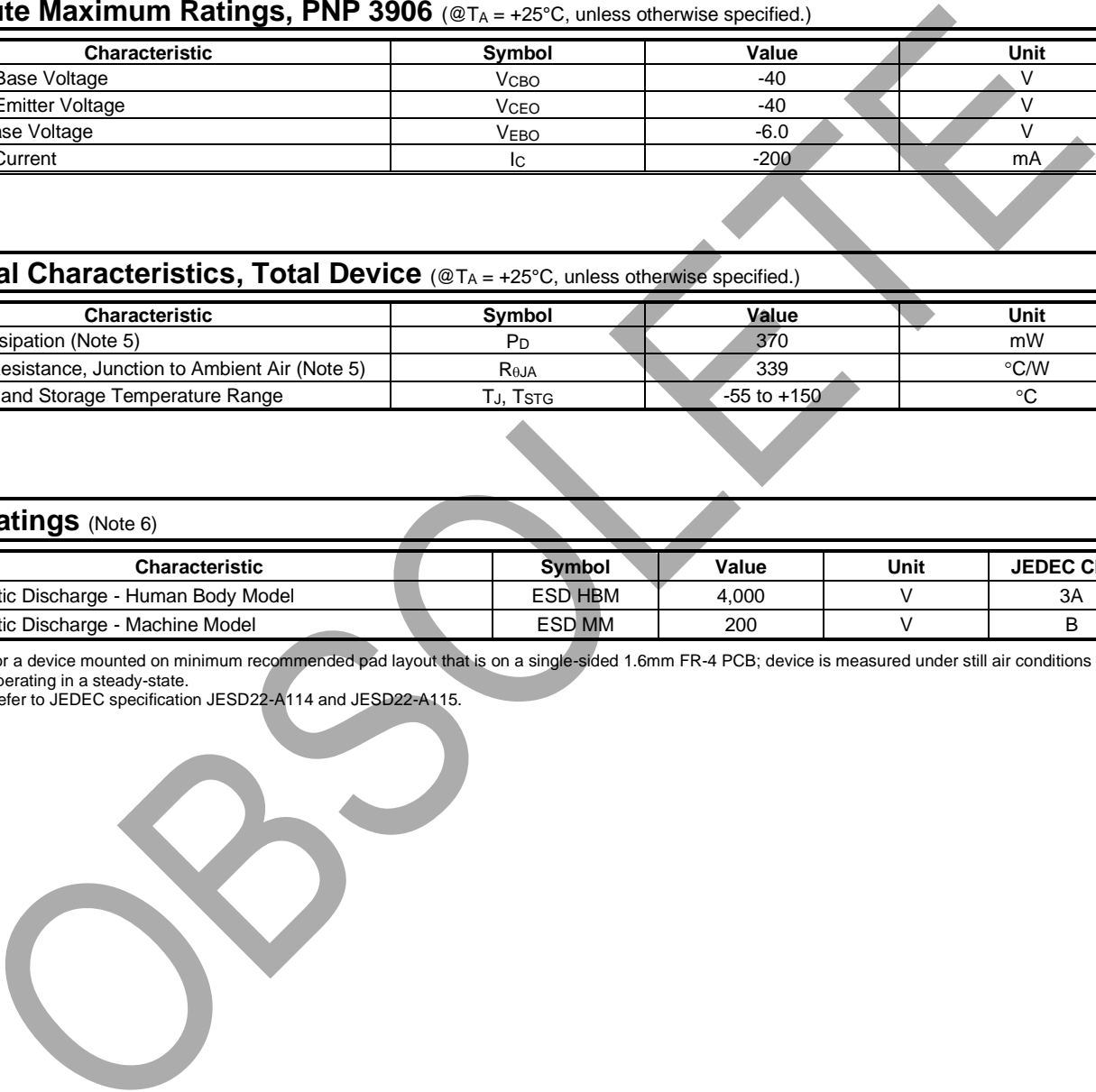
**Thermal Characteristics, Total Device** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P <sub>D</sub>	370	mW
Thermal Resistance, Junction to Ambient Air (Note 5)	R <sub>θJA</sub>	339	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**ESD Ratings** (Note 6)

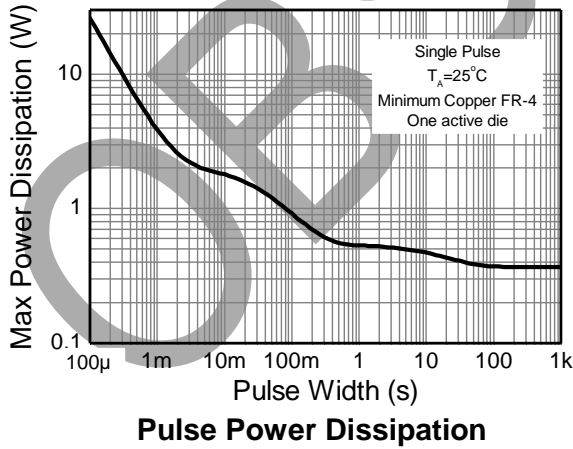
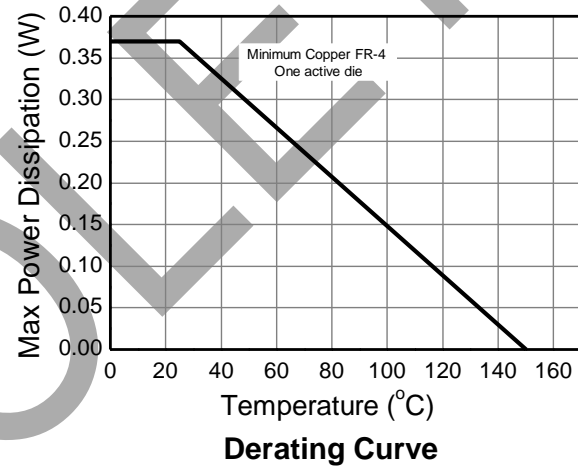
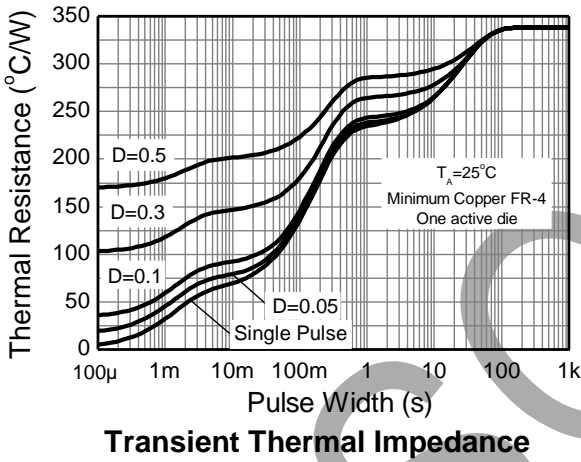
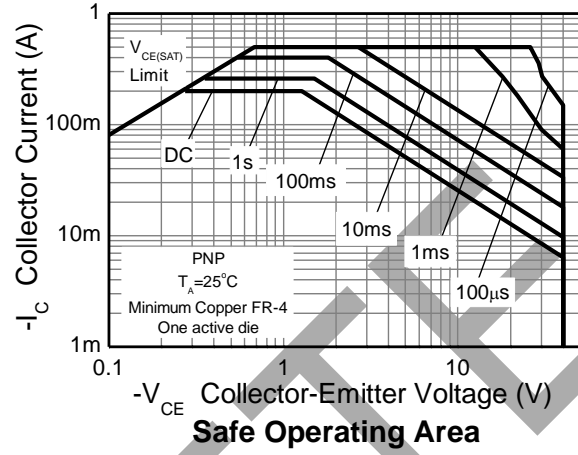
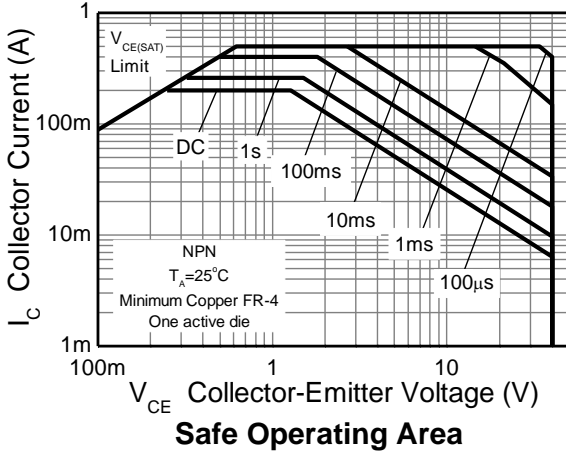
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	200	V	B

Notes: 5. For a device mounted on minimum recommended pad layout that is on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady-state.  
 6. Refer to JEDEC specification JESD22-A114 and JESD22-A115.



**Thermal Characteristics and Derating Information**

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**Electrical Characteristics, NPN 3904** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>						
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	60	—	—	V	I <sub>C</sub> = 100μA, I <sub>E</sub> = 0
Collector-Emitter Breakdown Voltage	BV <sub>CEO</sub>	40	—	—	V	I <sub>C</sub> = 1.0mA, I <sub>B</sub> = 0
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	6.0	—	—	V	I <sub>E</sub> = 100μA, I <sub>C</sub> = 0
Collector Cutoff Current	I <sub>CEX</sub>	—	—	50	nA	V <sub>CE</sub> = 30V, V <sub>EB(OFF)</sub> = 3.0V
Base Cutoff Current	I <sub>BL</sub>	—	—	50	nA	V <sub>CE</sub> = 30V, V <sub>EB(OFF)</sub> = 3.0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Static Forward Current Transfer Ratio	h <sub>FE</sub>	40 70 100 60 30	—	— — 300 — —	—	I <sub>C</sub> = 100μA, V <sub>CE</sub> = 1.0V I <sub>C</sub> = 1.0mA, V <sub>CE</sub> = 1.0V I <sub>C</sub> = 10mA, V <sub>CE</sub> = 1.0V I <sub>C</sub> = 50mA, V <sub>CE</sub> = 1.0V I <sub>C</sub> = 100mA, V <sub>CE</sub> = 1.0V
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	—	—	0.20 0.30	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 1.0mA I <sub>C</sub> = 50mA, I <sub>B</sub> = 5.0mA
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub>	0.65 —	—	0.85 0.95	V	I <sub>C</sub> = 10mA, I <sub>B</sub> = 1.0mA I <sub>C</sub> = 50mA, I <sub>B</sub> = 5.0mA
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>obo</sub>	—	—	4.0	pF	V <sub>CB</sub> = 5.0V, f = 1.0MHz, I <sub>E</sub> = 0
Input Capacitance	C <sub>ibo</sub>	—	—	9.5	pF	V <sub>EB</sub> = 0.5V, f = 1.0MHz, I <sub>C</sub> = 0
Current Gain-Bandwidth Product	f <sub>T</sub>	—	300	—	MHz	V <sub>CE</sub> = 20V, I <sub>C</sub> = 20mA, f = 100MHz
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	t <sub>D</sub>	—	—	35	ns	V <sub>CC</sub> = 3.0V, I <sub>C</sub> = 10mA, V <sub>BE</sub> = 0.5V, I <sub>B1</sub> = 1.0mA
Rise Time	t <sub>R</sub>	—	—	35	ns	V <sub>BE</sub> = 0.5V, I <sub>B1</sub> = 1.0mA
Storage Time	t <sub>S</sub>	—	—	200	ns	V <sub>CC</sub> = 3.0V, I <sub>C</sub> = 10mA, I <sub>B1</sub> = 1.0mA, I <sub>B2</sub> = -1.0mA
Fall Time	t <sub>F</sub>	—	—	50	ns	I <sub>B1</sub> = 1.0mA, I <sub>B2</sub> = -1.0mA

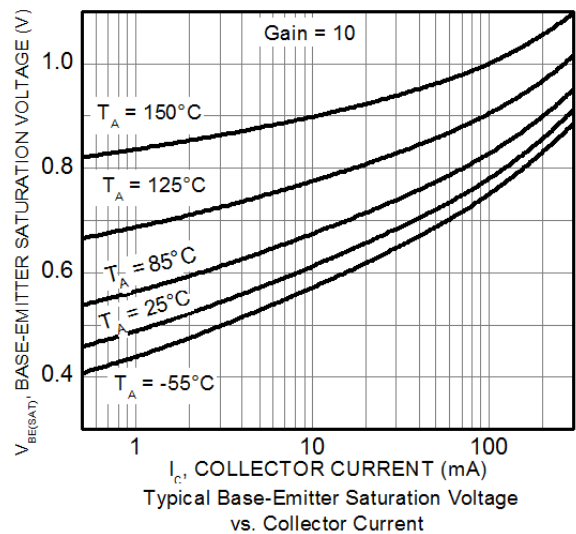
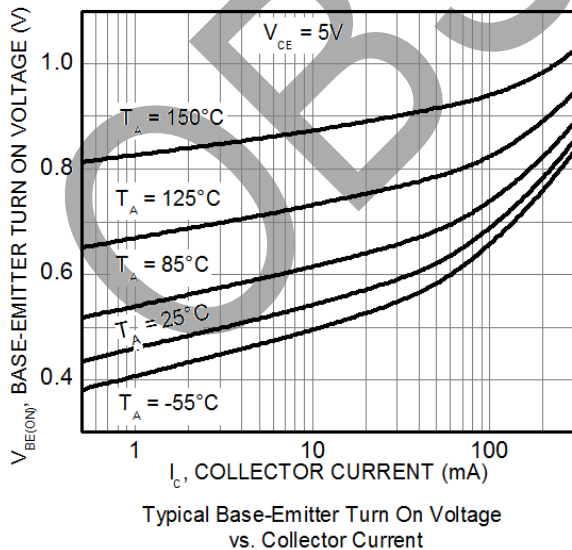
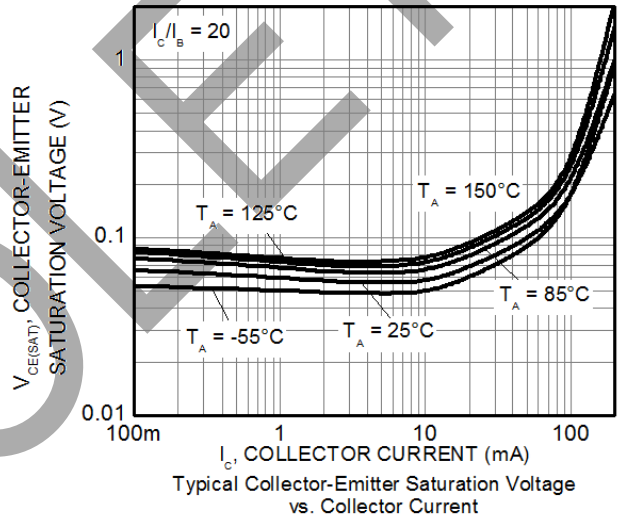
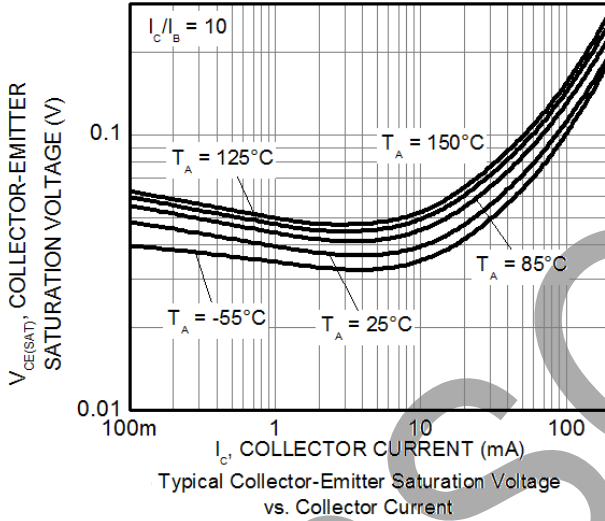
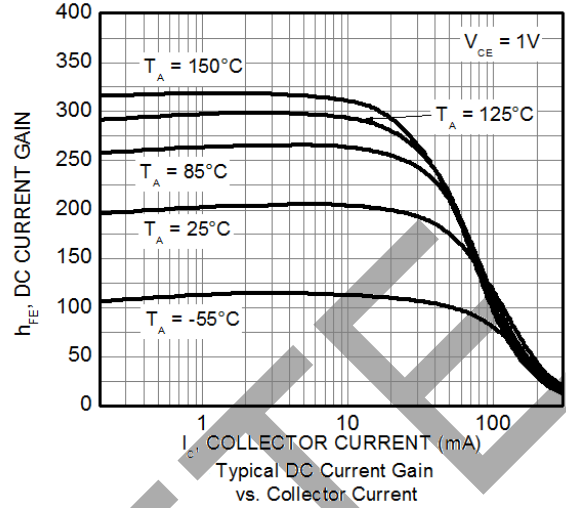
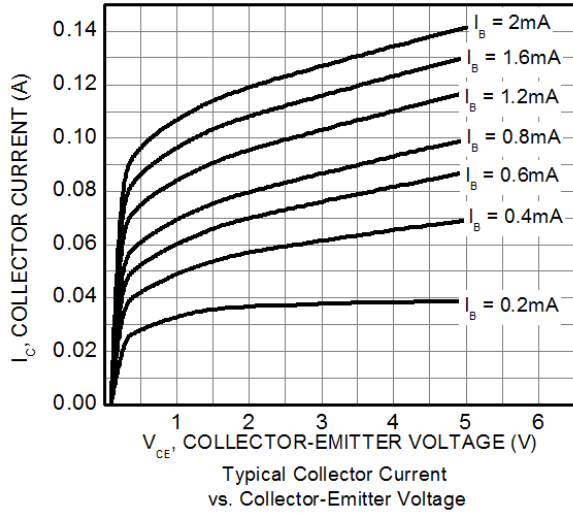
Note: 7. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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**Typical Electrical Characteristics, NPN 3904** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

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**Electrical Characteristics, PNP 3906** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>						
Collector-Base Breakdown Voltage	BV <sub>CBO</sub>	-40	—	—	V	I <sub>C</sub> = -100μA, I <sub>E</sub> = 0
Collector-Emitter Breakdown Voltage	BV <sub>CEO</sub>	-40	—	—	V	I <sub>C</sub> = -1.0mA, I <sub>B</sub> = 0
Emitter-Base Breakdown Voltage	BV <sub>EBO</sub>	-6.0	—	—	V	I <sub>E</sub> = -100μA, I <sub>C</sub> = 0
Collector Cutoff Current	I <sub>CEX</sub>	—	—	-50	nA	V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -3.0V
Base Cutoff Current	I <sub>BL</sub>	—	—	-50	nA	V <sub>CE</sub> = -30V, V <sub>EB(OFF)</sub> = -3.0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Static Forward Current Transfer Ratio	h <sub>FE</sub>	60 80 100 60 30	—	— — 300 — —	—	I <sub>C</sub> = -100μA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -1.0mA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -10mA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -50mA, V <sub>CE</sub> = -1.0V I <sub>C</sub> = -100mA, V <sub>CE</sub> = -1.0V
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	—	—	-0.25 -0.40	V	I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub>	-0.65 —	—	-0.85 -0.95	V	I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>obo</sub>	—	—	4.5	pF	V <sub>CB</sub> = -5.0V, f = 1.0MHz, I <sub>E</sub> = 0
Input Capacitance	C <sub>ibo</sub>	—	—	10	pF	V <sub>EB</sub> = -0.5V, f = 1.0MHz, I <sub>C</sub> = 0
Current Gain-Bandwidth Product	f <sub>T</sub>	—	300	—	MHz	V <sub>CE</sub> = -20V, I <sub>C</sub> = -10mA, f = 100MHz
<b>SWITCHING CHARACTERISTICS</b>						
Delay Time	t <sub>D</sub>	—	—	35	ns	V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA, V <sub>BE</sub> = -0.5V, I <sub>B1</sub> = -1.0mA
Rise Time	t <sub>R</sub>	—	—	35	ns	V <sub>BE</sub> = -0.5V, I <sub>B1</sub> = -1.0mA
Storage Time	t <sub>S</sub>	—	—	225	ns	V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA, I <sub>B1</sub> = -1.0mA, I <sub>B2</sub> = 1.0mA
Fall Time	t <sub>F</sub>	—	—	75	ns	I <sub>B1</sub> = -1.0mA, I <sub>B2</sub> = 1.0mA

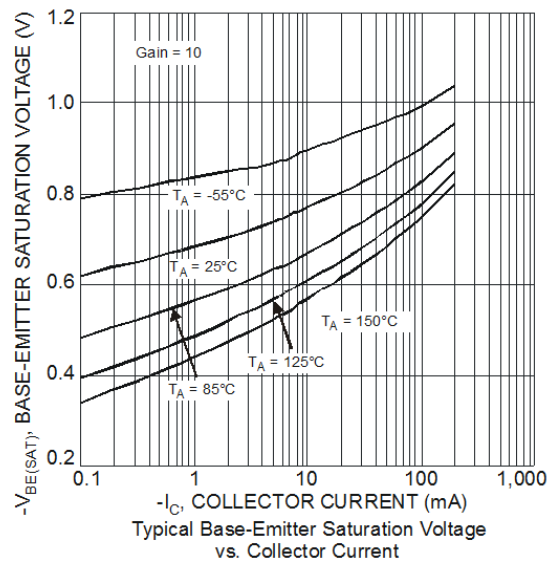
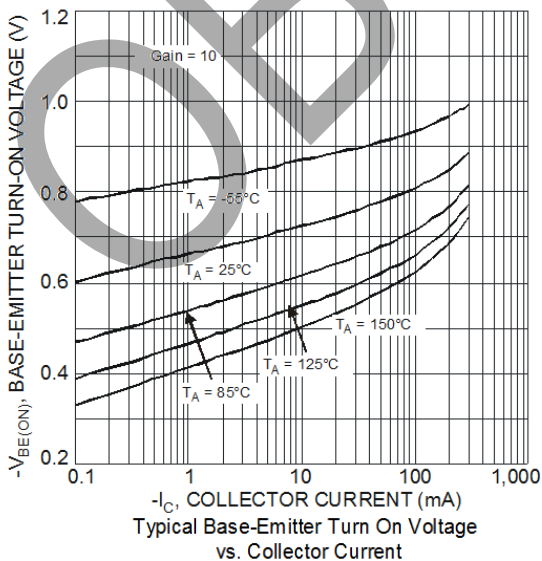
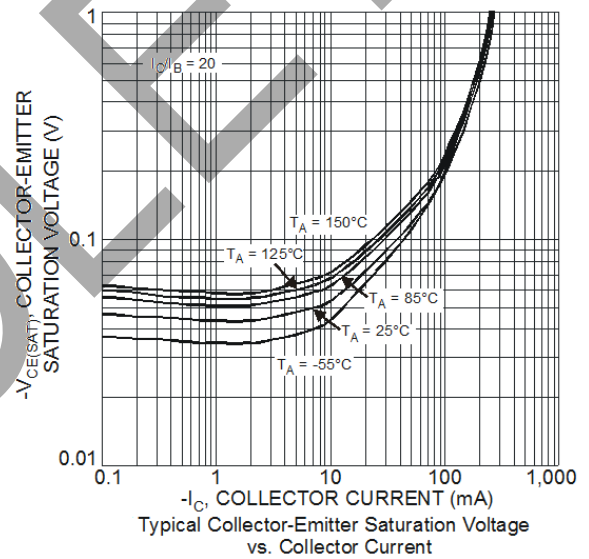
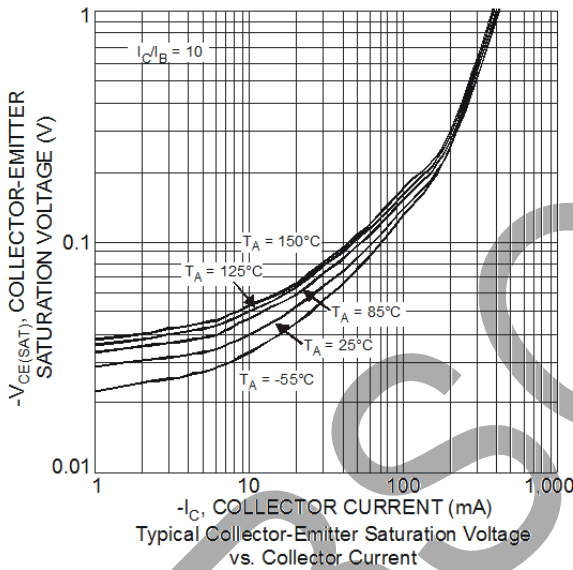
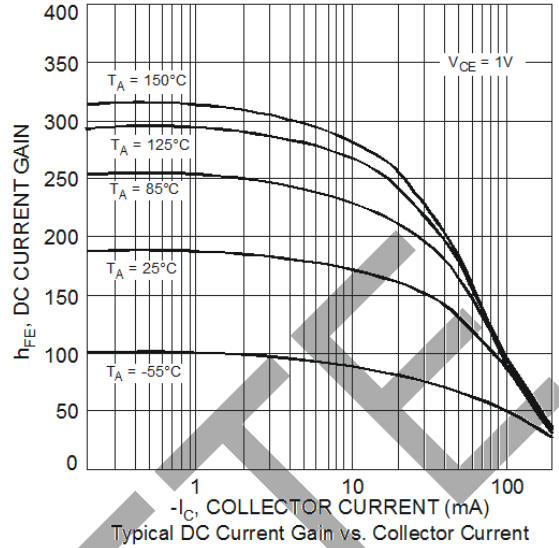
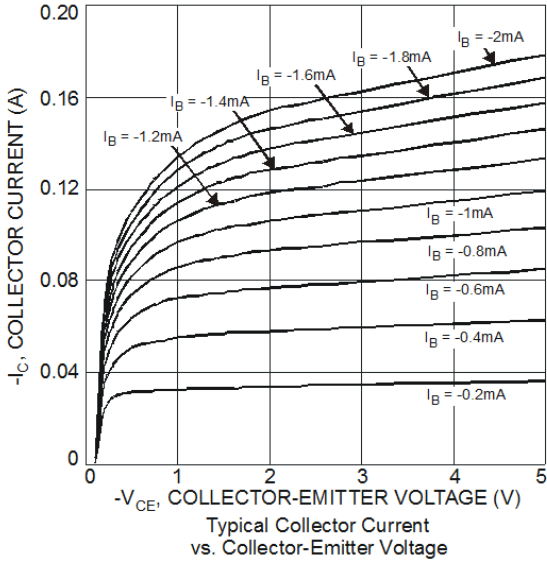
Note: 7. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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**Typical Electrical Characteristics, PNP 3906 (@T<sub>A</sub> = +25°C, unless otherwise specified.)**

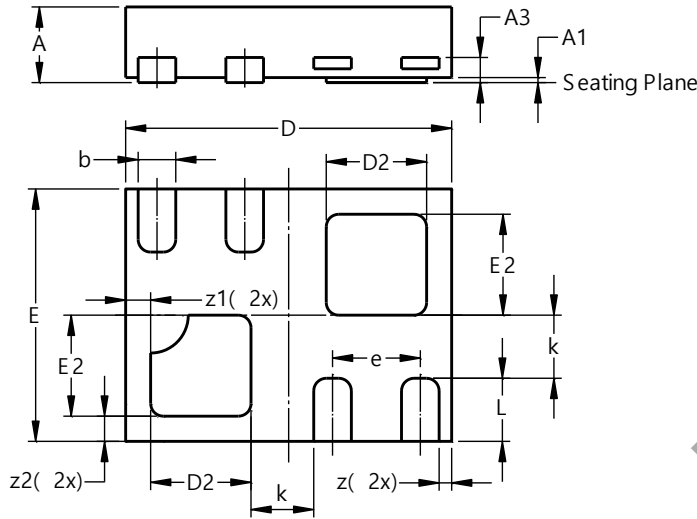
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**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**X2-DFN1310-6 (Type B)**

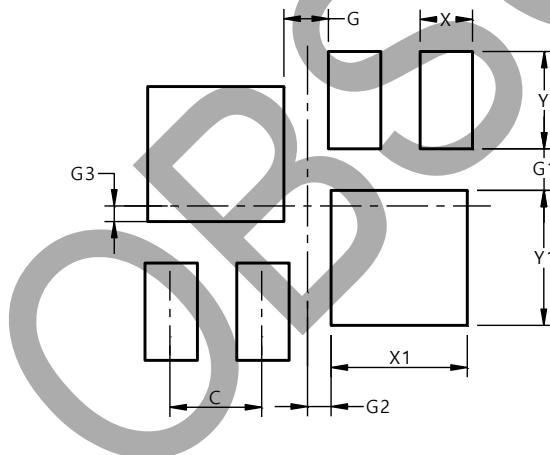


X2-DFN1310-6 (Type B)			
Dim	Min	Max	Typ
A	0.25	0.35	0.30
A1	0	0.05	0.02
A3	--	--	0.100
b	0.10	0.20	0.15
D	1.25	1.35	1.30
D2	0.30	0.50	0.40
E	0.95	1.05	1.00
E2	0.30	0.50	0.40
e	--	--	0.35
k	0.15	--	--
L	0.20	0.30	0.25
z	--	--	0.05
z1	--	--	0.10
z2	--	--	0.10
All Dimensions in mm			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**X2-DFN1310-6 (Type B)**



Dimensions	Value (in mm)
C	0.350
G	0.17
G1	0.16
G2	0.09
G3	0.06
X	0.20
X1	0.52
Y	0.375
Y1	0.52



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