

40V COMPLEMENTARY NPN-PNP SMALL SIGNAL TRANSISTOR IN 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)**

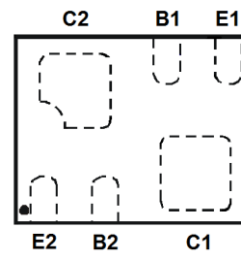
Mechanical Data

- Case: X2-DFN1310-6 (Type B)
- Case 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 (e4)
- 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)

Product	Standard	Marking	Reel Size (inches)	Tape Width (mm)	Quantity Per Reel
MMDT3946FL3-7	AEC-Q101	47	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/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



47 = Product Type Marking Code

Absolute Maximum Ratings, NPN 3904 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CB0}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6.0	V
Collector Current	I_C	200	mA

Absolute Maximum Ratings, PNP 3906 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CB0}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-6.0	V
Collector Current	I_C	-200	mA

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

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	370	mW
Thermal Resistance, Junction to Ambient Air (Note 5)	$R_{\theta JA}$	339	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

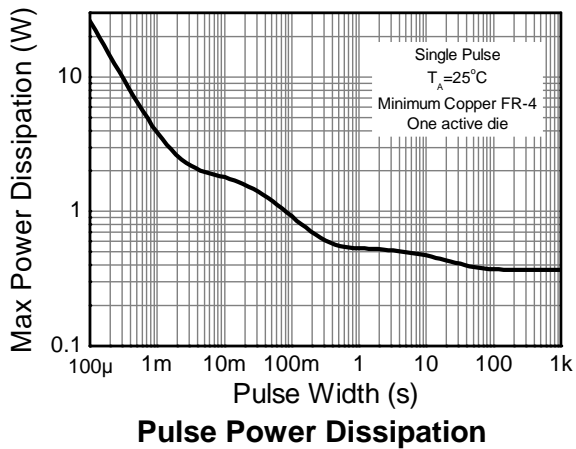
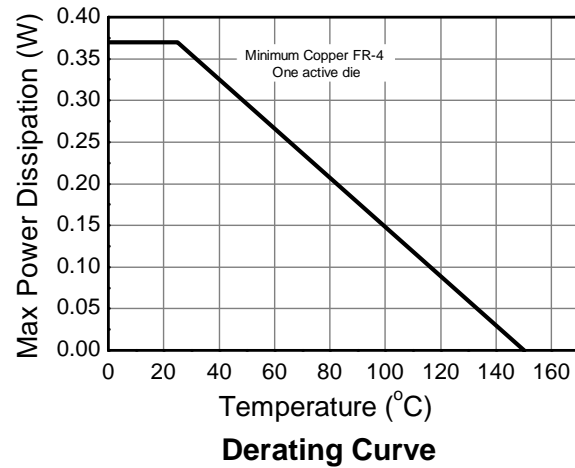
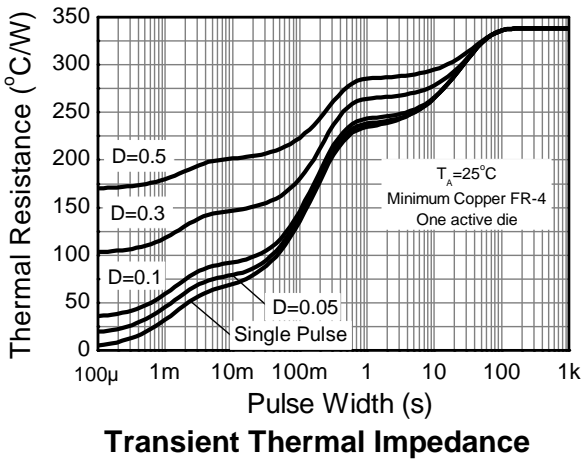
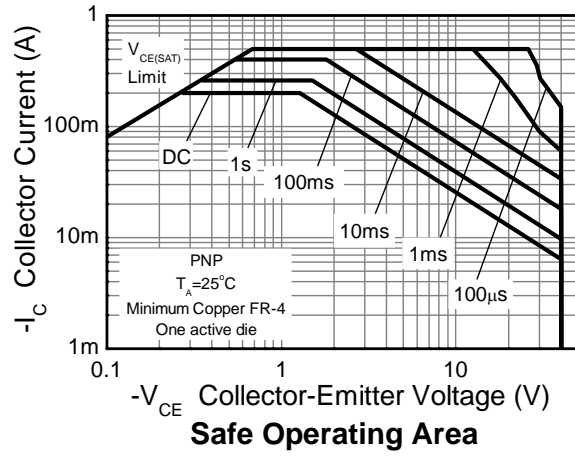
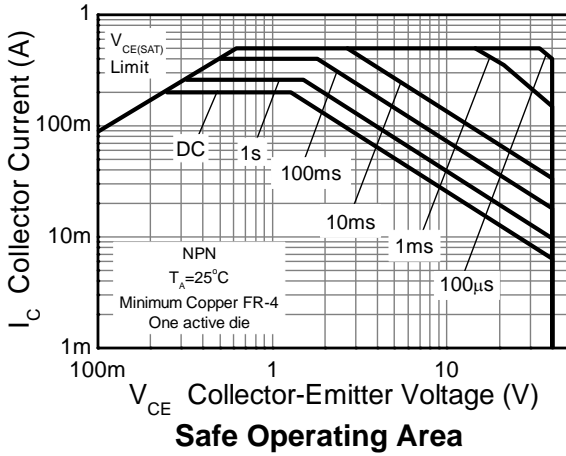
ESD Ratings (Note 6)

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

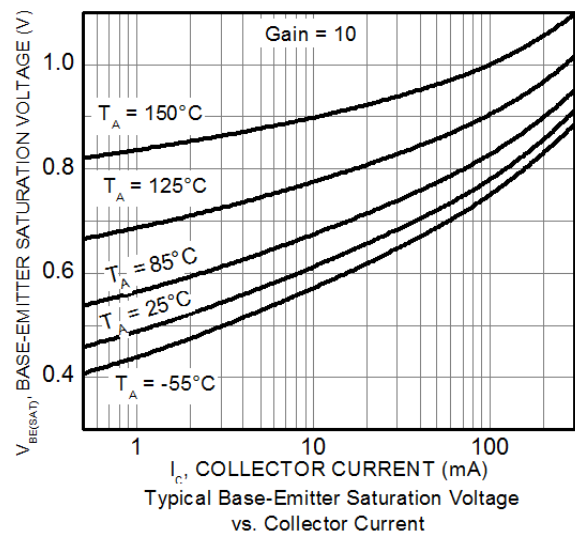
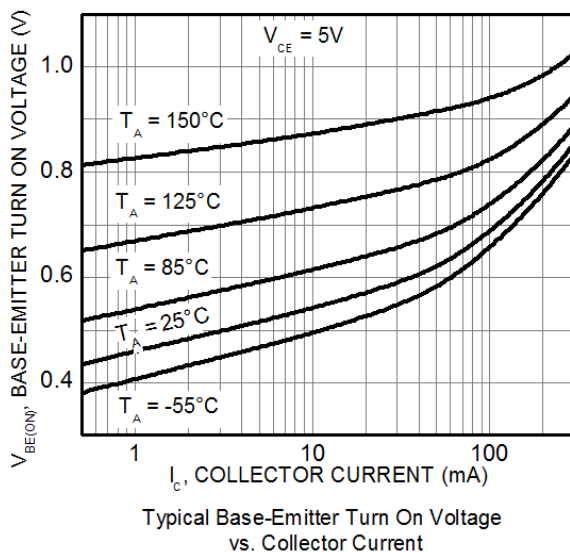
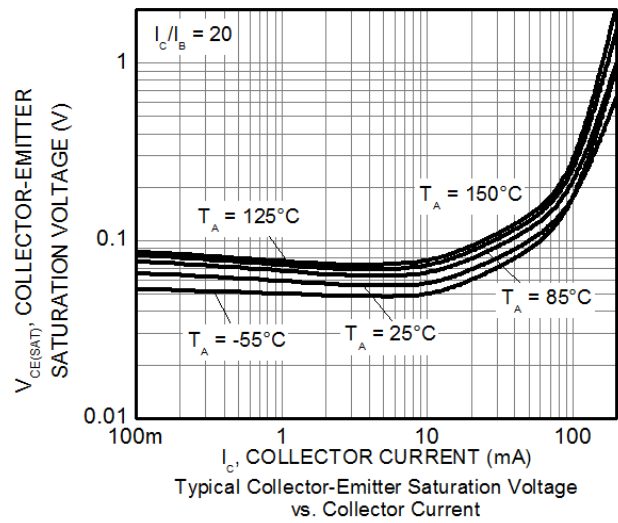
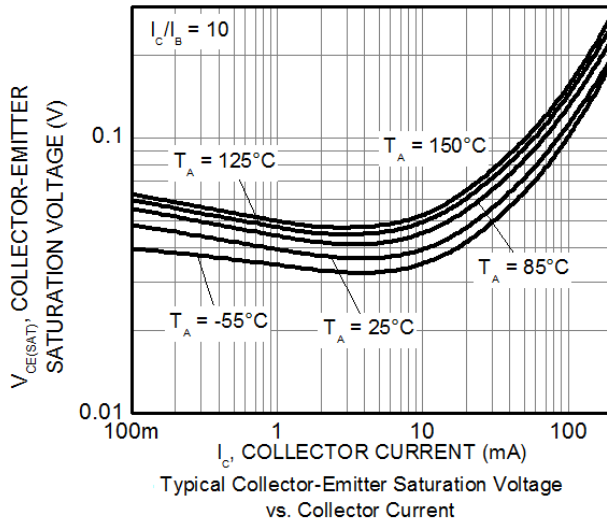
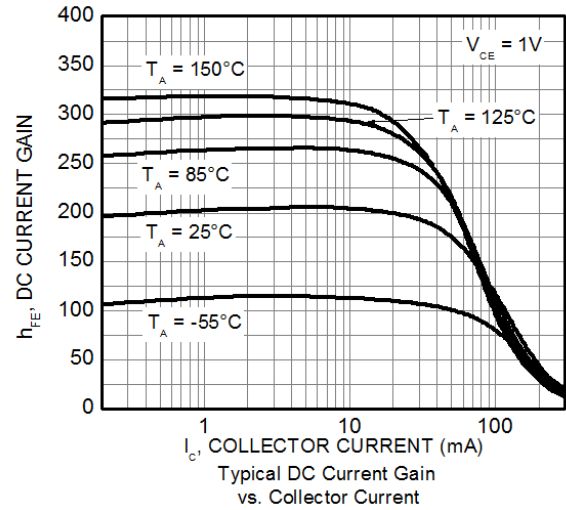
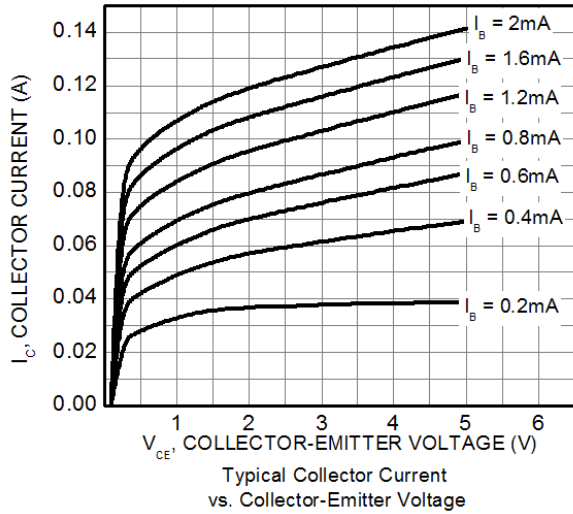


Electrical Characteristics, NPN 3904 (@T_A = +25°C, unless otherwise specified.)

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

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

Typical Electrical Characteristics, NPN 3904 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

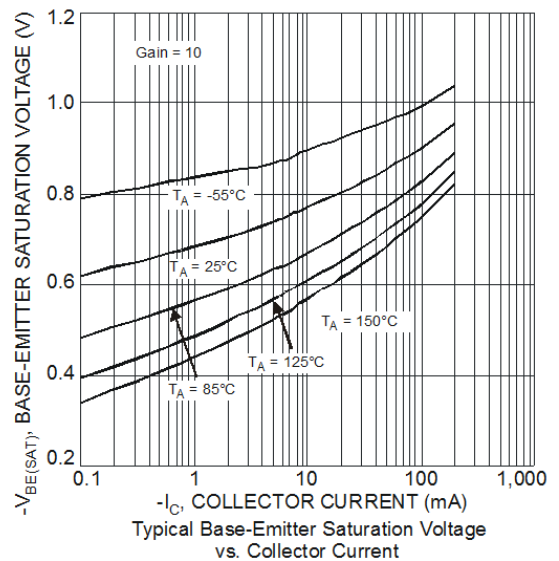
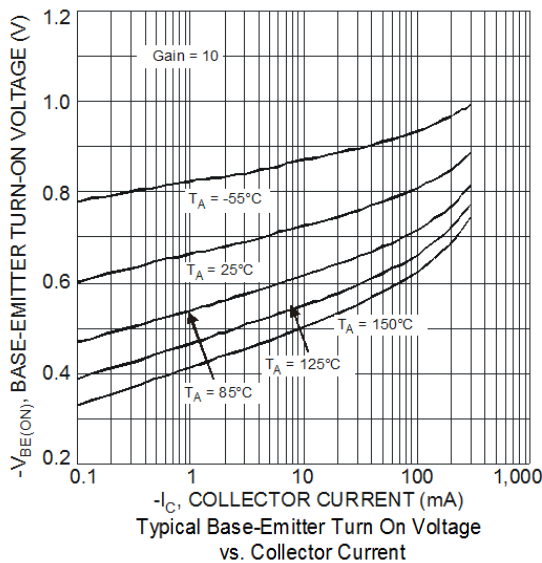
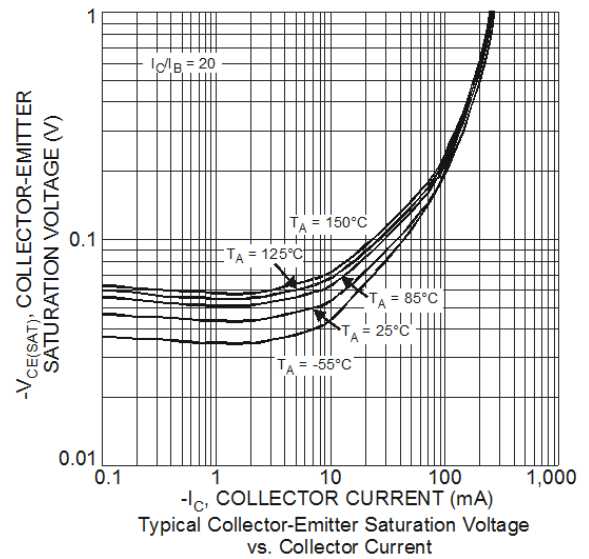
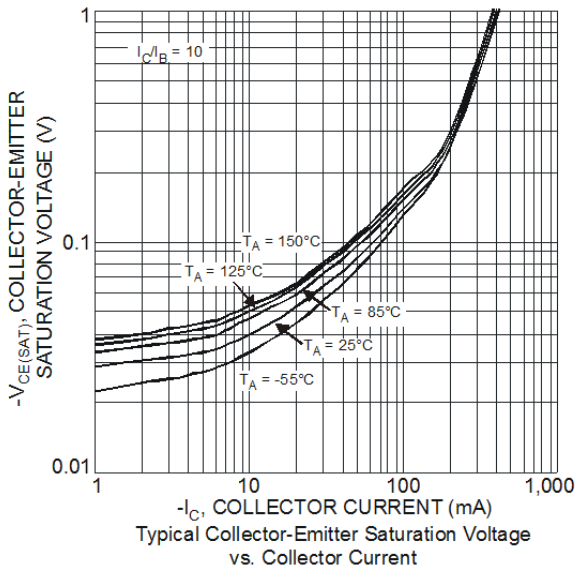
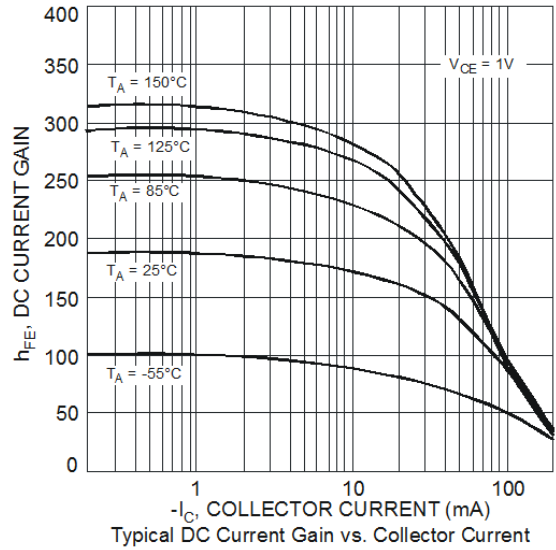
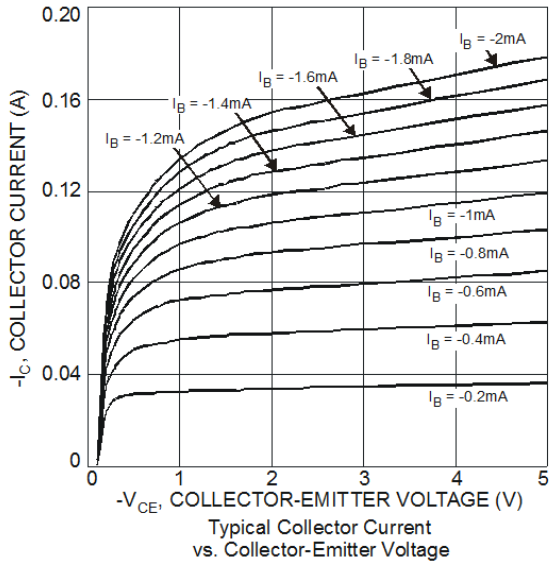


Electrical Characteristics, PNP 3906 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Collector-Base Breakdown Voltage	BV_{CBO}	-40	—	—	V	$I_C = -100\mu\text{A}, I_E = 0$
Collector-Emitter Breakdown Voltage	BV_{CEO}	-40	—	—	V	$I_C = -1.0\text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	-6.0	—	—	V	$I_E = -100\mu\text{A}, I_C = 0$
Collector Cutoff Current	I_{CEX}	—	—	-50	nA	$V_{CE} = -30\text{V}, V_{EB(OFF)} = -3.0\text{V}$
Base Cutoff Current	I_{BL}	—	—	-50	nA	$V_{CE} = -30\text{V}, V_{EB(OFF)} = -3.0\text{V}$
ON CHARACTERISTICS (Note 7)						
Static Forward Current Transfer Ratio	h_{FE}	60 80 100 60 30	—	— — 300 — —	—	$I_C = -100\mu\text{A}, V_{CE} = -1.0\text{V}$ $I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -50\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -100\text{mA}, V_{CE} = -1.0\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	—	—	-0.25 -0.40	V	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	-0.65 —	—	-0.85 -0.95	V	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$
SMALL SIGNAL CHARACTERISTICS						
Output Capacitance	C_{obo}	—	—	4.5	pF	$V_{CB} = -5.0\text{V}, f = 1.0\text{MHz}, I_E = 0$
Input Capacitance	C_{ibo}	—	—	10	pF	$V_{EB} = -0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$
Current Gain-Bandwidth Product	f_T	—	300	—	MHz	$V_{CE} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$
SWITCHING CHARACTERISTICS						
Delay Time	t_D	—	—	35	ns	$V_{CC} = -3.0\text{V}, I_C = -10\text{mA}, V_{BE} = -0.5\text{V}, I_{B1} = -1.0\text{mA}$
Rise Time	t_R	—	—	35	ns	
Storage Time	t_S	—	—	225	ns	$V_{CC} = -3.0\text{V}, I_C = -10\text{mA}, I_{B1} = -1.0\text{mA}, I_{B2} = 1.0\text{mA}$
Fall Time	t_F	—	—	75	ns	

Note: 7. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

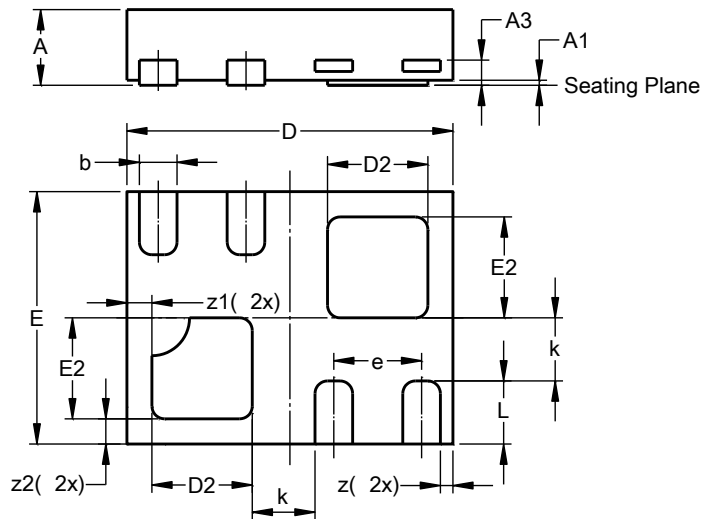
Typical Electrical Characteristics, PNP 3906 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



Package Outline Dimensions

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

X2-DFN1310-6 (Type B)

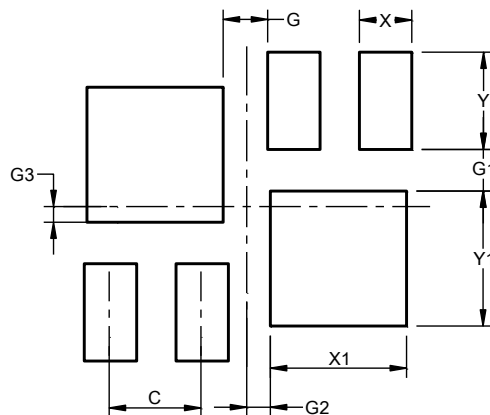


X2-DFN1310-6 (Type B)			
Dim	Min	Max	Typ
A	0.25	0.35	0.30
A1	0	0.05	0.02
A3	--	--	0.100
b	0.10	0.20	0.15
D	1.25	1.35	1.30
D2	0.30	0.50	0.40
E	0.95	1.05	1.00
E2	0.30	0.50	0.40
e	--	--	0.35
k	0.15	--	--
L	0.20	0.30	0.25
z	--	--	0.05
z1	--	--	0.10
z2	--	--	0.10
All Dimensions in mm			

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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