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

Features

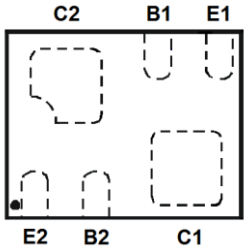
- Complementary Pair One 3904-Type NPN
  One 3906-Type PNP
- Ultra-Small Surface Mount Package
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

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



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

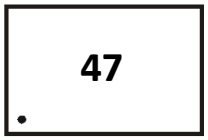
Pinout
Top View

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°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	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°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	-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°C, unless otherwise specified.)

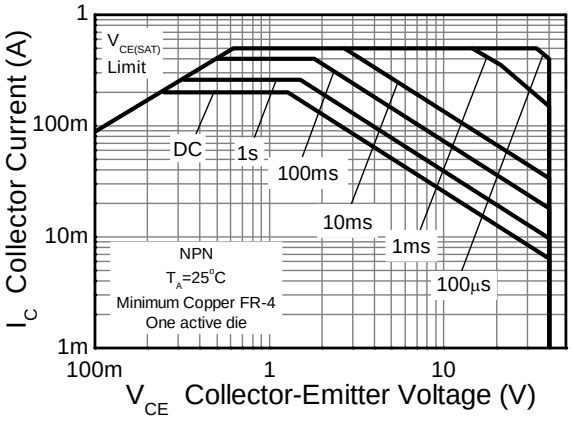
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	370	mW
Thermal Resistance, Junction to Ambient Air (Note 5)	$R_{\theta JA}$	339	°C/W
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

ESD Ratings (Note 6)

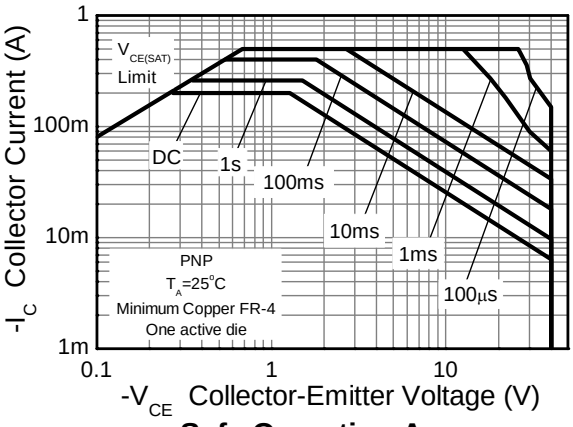
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	200	V	B

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.

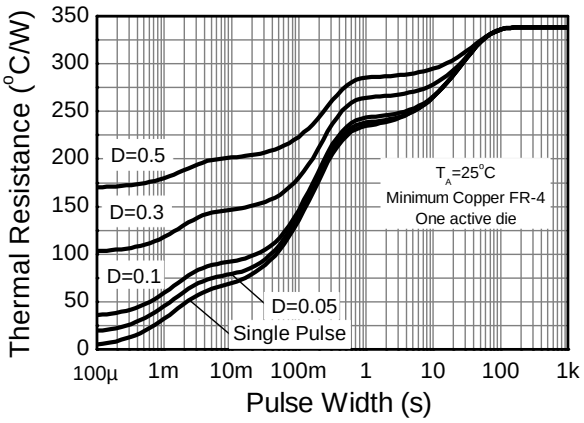
Thermal Characteristics and Derating Information



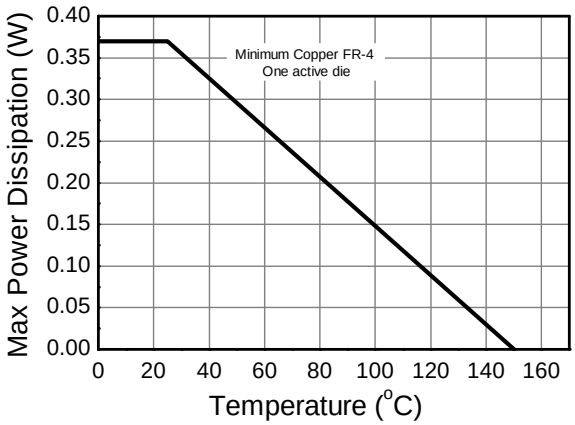
Safe Operating Area



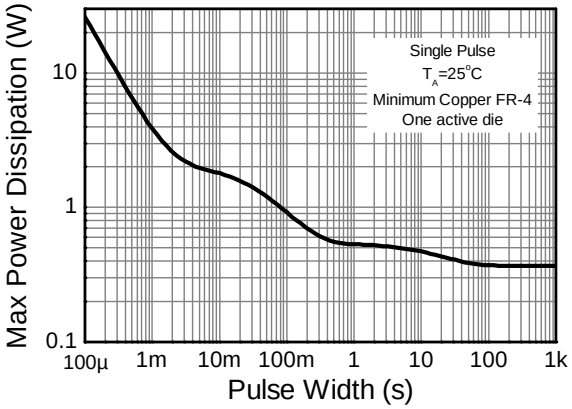
Safe Operating Area



Transient Thermal Impedance



Derating Curve



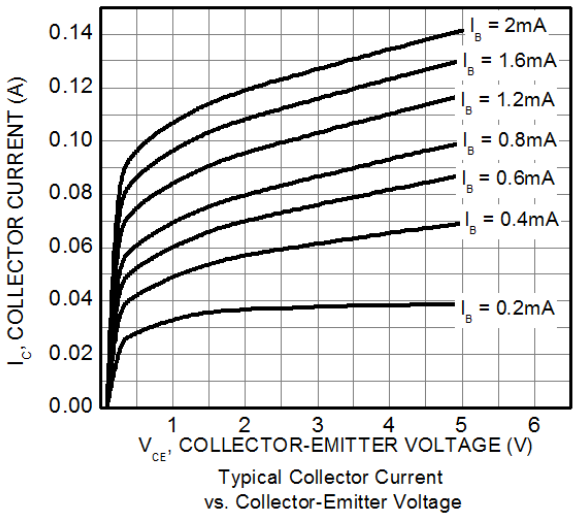
Pulse Power Dissipation

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

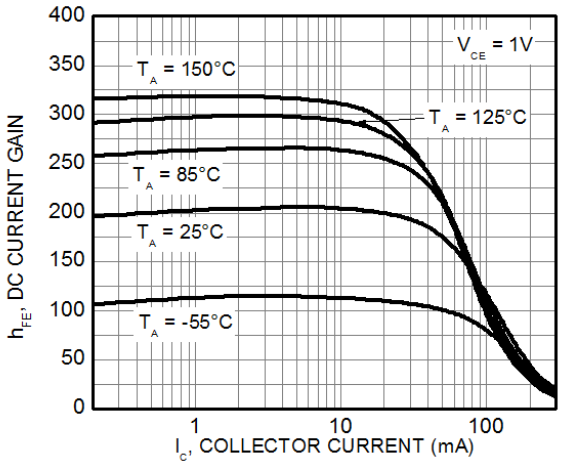
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Collector-Base Breakdown Voltage	BV_{CBO}	60	—	—	V	I_C = 100μA, I_E = 0
Collector-Emitter Breakdown Voltage	BV_{CEO}	40	—	—	V	I_C = 1.0mA, I_B = 0
Emitter-Base Breakdown Voltage	BV_{EBO}	6.0	—	—	V	I_E = 100μA, I_C = 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	
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	

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

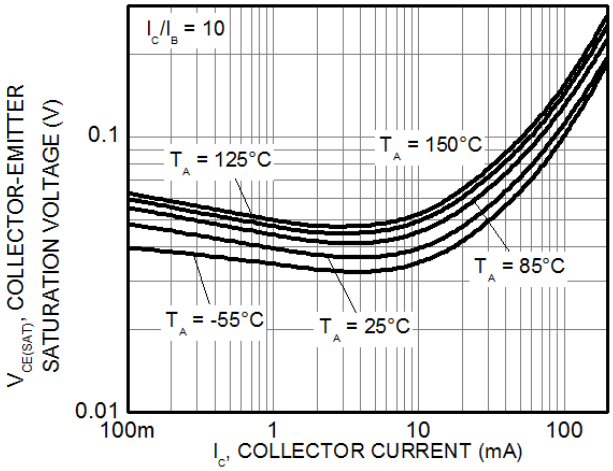
Typical Electrical Characteristics, NPN 3904 (@T_A = +25°C, unless otherwise specified.)



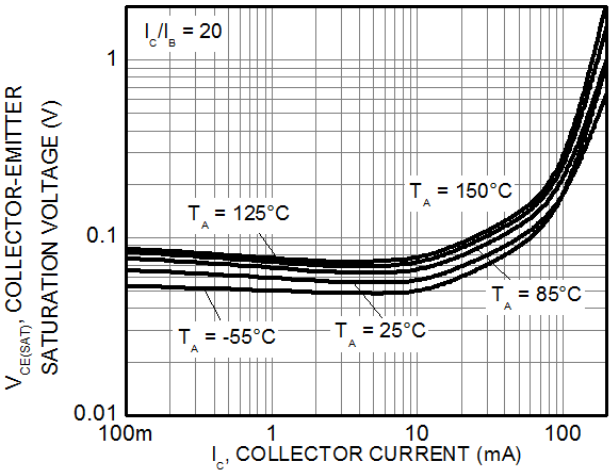
Typical Collector Current
vs. Collector-Emitter Voltage



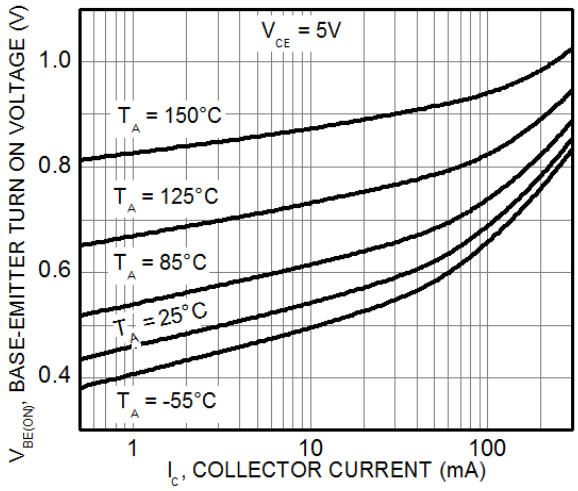
Typical DC Current Gain
vs. Collector Current



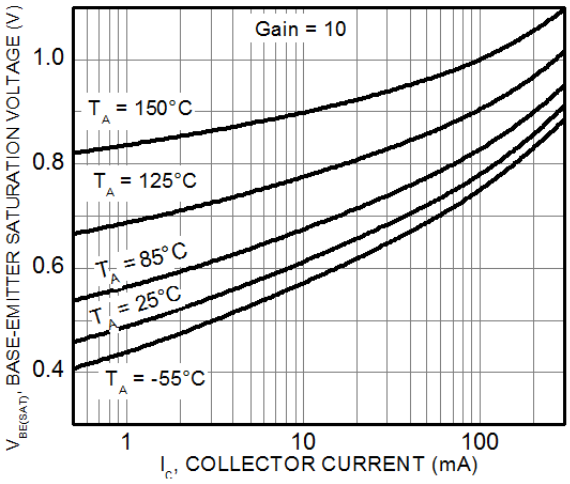
Typical Collector-Emitter Saturation Voltage
vs. Collector Current



Typical Collector-Emitter Saturation Voltage
vs. Collector Current



Typical Base-Emitter Turn On Voltage
vs. Collector Current



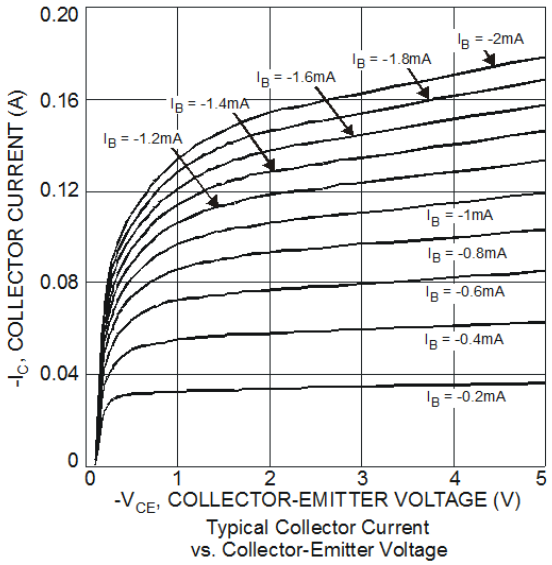
Typical Base-Emitter Saturation Voltage
vs. Collector Current

Electrical Characteristics, PNP 3906 (@T_A = +25°C, unless otherwise specified.)

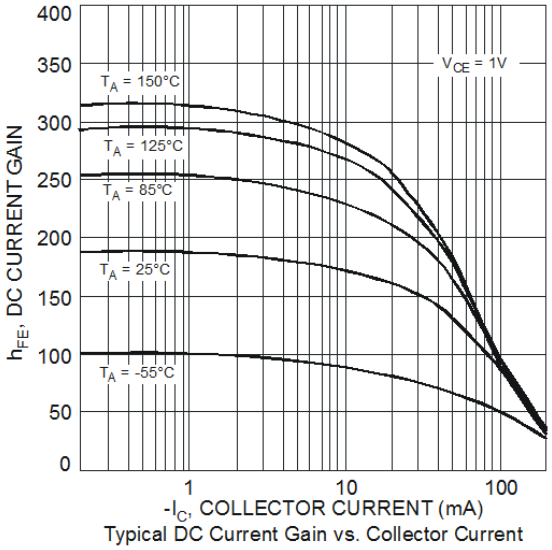
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 7)						
Collector-Base Breakdown Voltage	BV_{CBO}	-40	—	—	V	I_C = -100μA, I_E = 0
Collector-Emitter Breakdown Voltage	BV_{CEO}	-40	—	—	V	I_C = -1.0mA, I_B = 0
Emitter-Base Breakdown Voltage	BV_{EBO}	-6.0	—	—	V	I_E = -100μA, 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}	60 80 100 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	$V_{CE(SAT)}$	—	—	-0.25 -0.40	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}	—	—	4.5	pF	V_{CB} = -5.0V, f = 1.0MHz, I_E = 0
Input Capacitance	C_{ibo}	—	—	10	pF	V_{EB} = -0.5V, f = 1.0MHz, I_C = 0
Current Gain-Bandwidth Product	f_T	—	300	—	MHz	V_{CE} = -20V, I_C = -10mA, 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	
Storage Time	t_S	—	—	225	ns	V_{CC} = -3.0V, I_C = -10mA, I_{B1} = -1.0mA, I_{B2} = 1.0mA
Fall Time	t_F	—	—	75	ns	

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

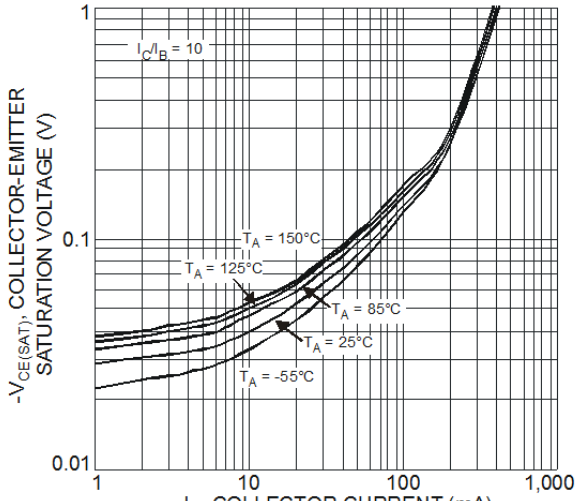
Typical Electrical Characteristics, PNP 3906 (@T_A = +25°C, unless otherwise specified.)



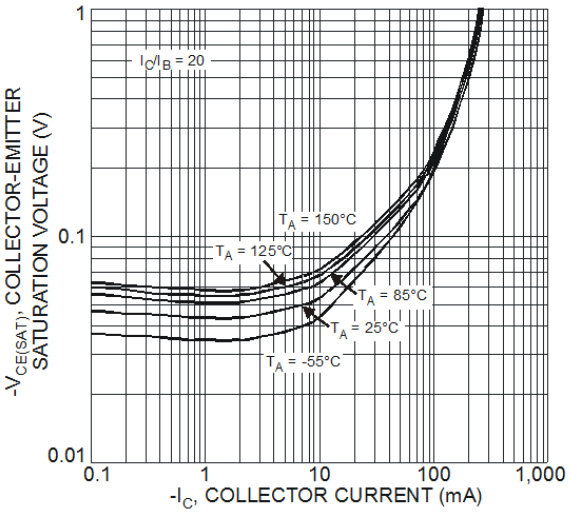
Typical Collector Current
vs. Collector-Emitter Voltage



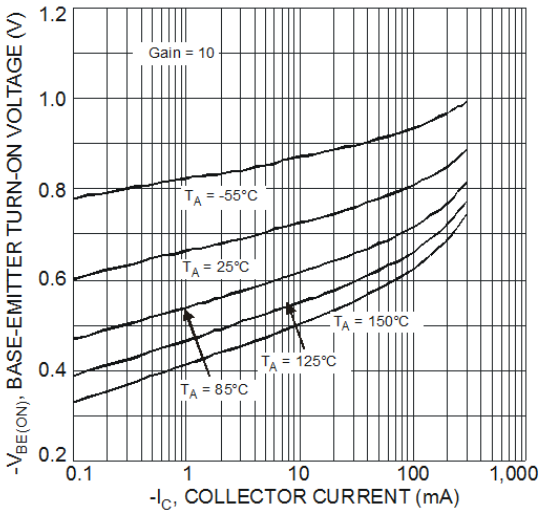
Typical DC Current Gain vs. Collector Current



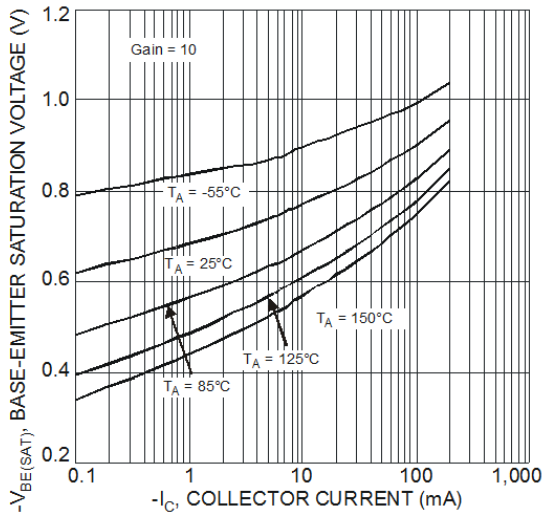
Typical Collector-Emitter Saturation Voltage
vs. Collector Current



Typical Collector-Emitter Saturation Voltage
vs. Collector Current



Typical Base-Emitter Turn On Voltage
vs. Collector Current

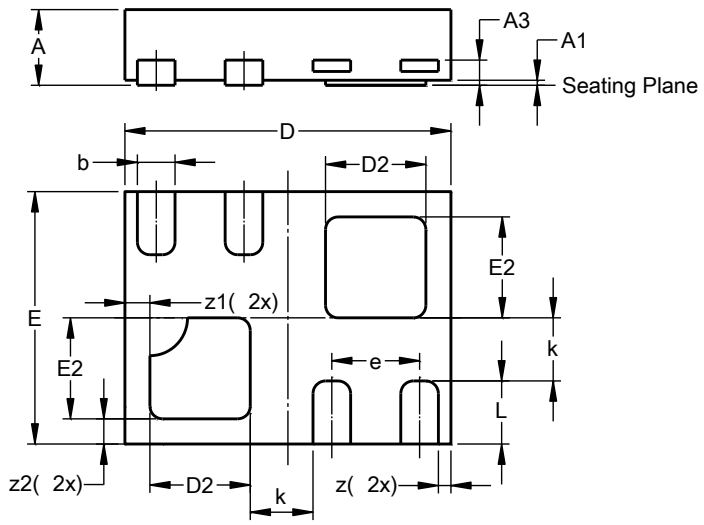


Typical Base-Emitter Saturation Voltage
vs. Collector Current

Package Outline Dimensions

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

X2-DFN1310-6 (Type B)

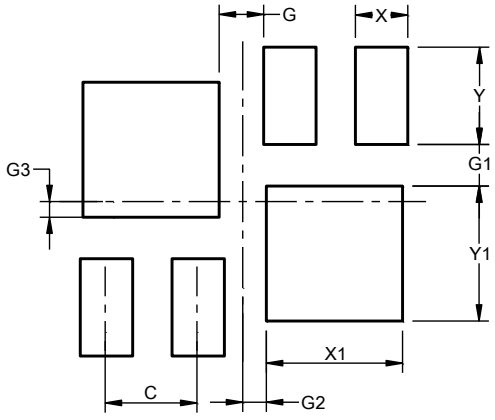


X2-DFN1310-6 (Type B)			
Dim	**Min**	**Max**	**Typ**
A	0.25	0.35	0.30
A1	0	0.05	0.02
A3	--	--	0.100
b	0.10	0.20	0.15
D	1.25	1.35	1.30
D2	0.30	0.50	0.40
E	0.95	1.05	1.00
E2	0.30	0.50	0.40
e	--	--	0.35
k	0.15	--	--
L	0.20	0.30	0.25
z	--	--	0.05
z1	--	--	0.10
z2	--	--	0.10
All Dimensions in mm			

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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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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