

**MMDT4146** 

#### COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

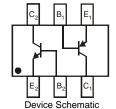
### **Features**

- Complementary Pair
   One 4124-Type NPN
   One 4126-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Medium Power Amplification and Switching
- Ultra-Small Surface Mount Package
- Lead Free/RoHS Compliant (Note 3)
- "Green" Device (Note 4 and 5)

### **Mechanical Data**

- Case: SOT-363
- Case Material: Molded Plastic, "Green" Molding Compound, Note 5. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals: Matte Tin Finish annealed over Alloy 42 leadframe (Lead Free Plating) Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Marking Information: See Page 4
- Ordering Information: See Page 4
- Weight: 0.006 grams (approximate)





E1, B1, C1 = PNP4126 Section E2, B2, C2 = NPN4124 Section

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## Maximum Ratings, NPN 4124 Section @TA = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	30	V
Collector-Emitter Voltage	$V_{CEO}$	25	V
Emitter-Base Voltage	V <sub>EBO</sub>	5.0	V
Collector Current – Continuous (Note 1)	Ic	200	mA

### Maximum Ratings, PNP 4126 Section @TA = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	-25	V
Collector-Emitter Voltage	V <sub>CEO</sub>	-25	V
Emitter-Base Voltage	$V_{EBO}$	-4	V
Collector Current - Continuous (Note 1)	Ic	-200	mA

### Thermal Characteristics - Total Device

Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 1, 2)	$P_{D}$	200	mW
Thermal Resistance, Junction to Ambient	(Note 1)	$R_{ heta JA}$	625	°C/W

Notes:

- 1. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.
- 2. Maximum combined dissipation.
- 3. No purposefully added lead.
- 4. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com/products/lead\_free/index.php.
- Product manufactured with Date Code UO (week 40, 2007) and newer are built with Green Molding Compound. Product manufactured prior to Date Code UO are built with Non-Green Molding Compound and may contain Halogens or Sb2O3 Fire Retardants.



# Electrical Characteristics, NPN 4124 Section @TA = 25°C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 6)					
Collector-Base Breakdown Voltage	V <sub>(BR)CBO</sub>	30	_	V	$I_C = 10\mu A, I_E = 0$
Collector-Emitter Breakdown Voltage	V <sub>(BR)CEO</sub>	25	_	V	$I_C = 1.0 \text{mA}, I_B = 0$
Emitter-Base Breakdown Voltage	V <sub>(BR)EBO</sub>	5.0	_	V	$I_E = 10\mu A, I_C = 0$
Collector Cutoff Current	I <sub>CBO</sub>	_	50	nA	$V_{CB} = 20V, I_{E} = 0V$
Emitter Cutoff Current	I <sub>EBO</sub>	_	50	nA	$V_{EB} = 3.0V, I_{C} = 0V$
ON CHARACTERISTICS (Note 6)					
DC Current Gain	h	120	360		$I_C = 2.0 \text{mA}, V_{CE} = 1.0 \text{V}$
DC Current Gain	h <sub>FE</sub>	60	—		$I_C = 50 \text{mA}, V_{CE} = 1.0 \text{V}$
Collector-Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	_	0.30	V	$I_C = 50 \text{mA}, I_B = 5.0 \text{mA}$
Base-Emitter Saturation Voltage	V <sub>BE(SAT)</sub>	_	0.95	V	$I_C = 50 \text{mA}, I_B = 5.0 \text{mA}$
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C <sub>obo</sub>	1	4.0	pF	$V_{CB} = 5.0V$ , $f = 1.0MHz$ , $I_E = 0$
Input Capacitance	C <sub>ibo</sub>	_	8.0	pF	$V_{EB} = 0.5V$ , $f = 1.0MHz$ , $I_{C} = 0$
Small Signal Current Gain	h <sub>fe</sub>	120	480	_	$V_{CE} = 1.0V, I_{C} = 2.0mA,$
oman orginal outron outr	· ·ie		.00		f = 1.0kHz
Current Gain-Bandwidth Product	f⊤	300	_	MHz	$V_{CE} = 20V, I_{C} = 10mA,$ f = 100MHz
Noise Figure	NF		5.0	dB	$V_{CE} = 5.0V, I_{C} = 100\mu A,$
Invoise Figure	INF	_	5.0	ub	$R_S = 1.0k\Omega$ , $f = 1.0kHz$

# Electrical Characteristics, PNP 4126 Section @TA = 25°C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition				
OFF CHARACTERISTICS (Note 6)									
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-25	_	V	$I_C = -10\mu A, I_E = 0$				
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-25	_	V	$I_C = -1.0 \text{mA}, I_B = 0$				
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-4.0	_	V	$I_E = -10\mu A, I_C = 0$				
Collector Cutoff Current	I <sub>CBO</sub>		-50	nA	$V_{CB} = -20V, I_{E} = 0V$				
Emitter Cutoff Current	I <sub>EBO</sub>		-50	nA	$V_{EB} = -3.0V, I_C = 0V$				
ON CHARACTERISTICS (Note 6)									
DC Current Gain	h	120	360		$I_C = -2.0 \text{mA}, V_{CE} = -1.0 \text{V}$				
DC Current Gain	h <sub>FE</sub>	60			$I_C = -50 \text{mA}, V_{CE} = -1.0 \text{V}$				
Collector-Emitter Saturation Voltage	V <sub>CE</sub> (SAT)		-0.40	٧	$I_C = -50 \text{mA}, I_B = -5.0 \text{mA}$				
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$		-0.95	V	$I_C = -50 \text{mA}, I_B = -5.0 \text{mA}$				
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	$V_{EB} = -0.5V$ , $f = 1.0MHz$ , $I_{C} = 0$				
Small Signal Current Gain	h <sub>fe</sub>	120	480	_	$V_{CE} = -1.0V$ , $I_{C} = -2.0$ mA, $f = 1.0$ kHz				
Current Gain-Bandwidth Product	f <sub>T</sub>	250		MHz	V <sub>CE</sub> = -20V, I <sub>C</sub> = -10mA, f = 100MHz				
Noise Figure	NF	_	4.0	dB	$V_{CE} = -5.0V$ , $I_{C} = -100\mu A$ , $R_{S} = 1.0k\Omega$ , $f = 1.0kHz$				

Notes: 6. Short duration pulse test used to minimize self-heating effect.



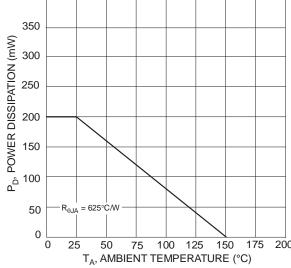
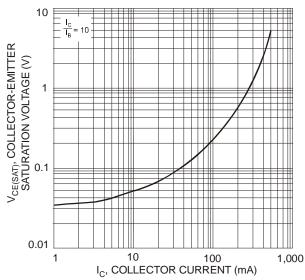


Fig. 1 Power Dissipation vs.

Ambient Temperature (Total Device, Note 1)



I<sub>C</sub>, COLLECTOR CURRENT (mA)

Fig. 3 Typical Collector-Emitter Saturation Voltage vs. Collector Current (PNP-4126)

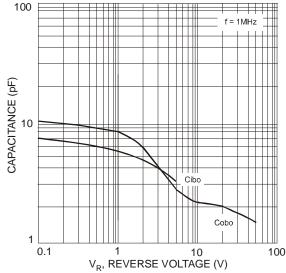
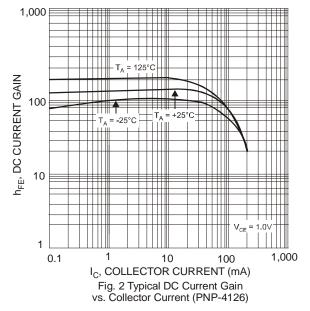


Fig. 5 Typical Capacitance Characteristics (PNP-4126)

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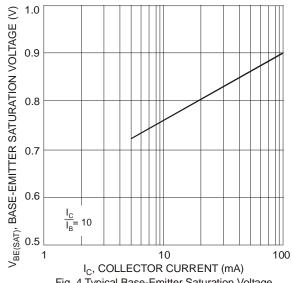
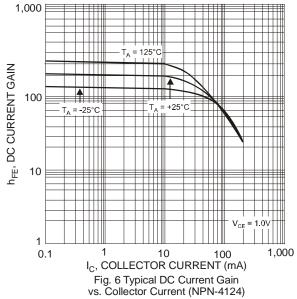


Fig. 4 Typical Base-Emitter Saturation Voltage vs. Collector Current (PNP-4126)





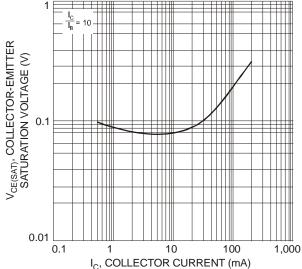
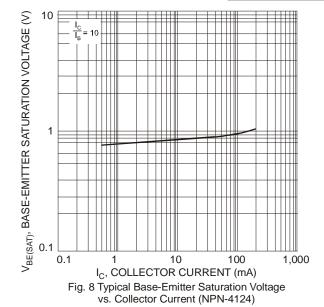
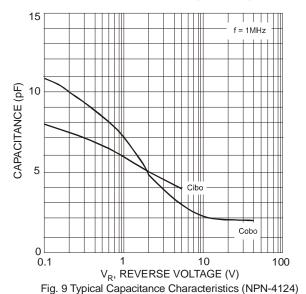


Fig. 7 Typical Collector-Emitter Saturation Voltage vs. Collector Current (NPN-4124)



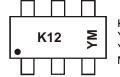


# Ordering Information (Note 7)

Part Number	Case	Packaging
MMDT4146-7-F	SOT-363	3000/Tape & Reel

Notes: 7. For packaging details, go to our website at http://www.diodes.com/datasheets/ap02007.pdf.

# **Marking Information**



K12 = Product Type Marking Code YM = Date Code Marking Y = Year (ex: N = 2002) M = Month (ex: 9 = September)

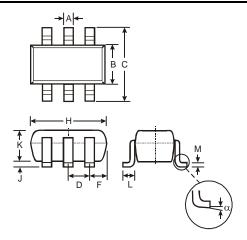
Date Code Key

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Code	J	K	L	M	Ν	Р	R	S	Т	U	V	W	Χ	Υ	Z	Α	В	С
Month	Jan		Feb	Mai	·	Apr	May	,	Jun	Jul		Aug	Sep	)	Oct	Nov	,	Dec
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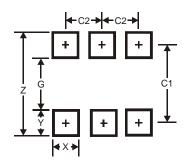


## **Package Outline Dimensions**



	SOT-363							
Dim	Min	Max						
Α	0.10	0.30						
В	1.15	1.35						
С	2.00	2.20						
D	0.65	Тур						
F	0.40	0.45						
Н	1.80	2.20						
J	0	0.10						
K	<b>K</b> 0.90							
L	<b>L</b> 0.25 0.40							
M	<b>M</b> 0.10 0.2							
α	8°							
All Di	mensions	in mm						

# **Suggested Pad Layout**



Dimensions	Value (in mm)
Z	2.5
G	1.3
Х	0.42
Y	0.6
C1	1.9
C2	0.65

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