



MMDT3946

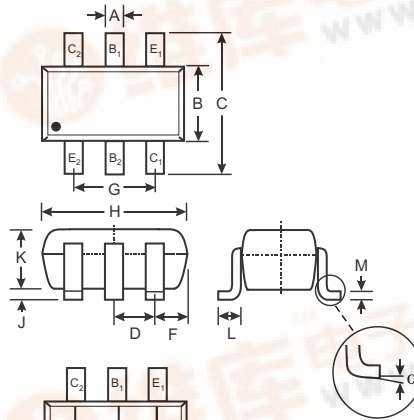
COMPLEMENTARY NPN / PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

Features

- Complementary Pair
- One 3904-Type NPN,
- One 3906-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- Ultra-Small Surface Mount Package
- Lead Free/RoHS Compliant (Note 3)

Mechanical Data

- Case: SOT-363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking (See Page 3): K46
- Ordering & Date Code Information: See Page 3
- Weight: 0.006 grams (approximate)



E₁, B₁, C₁ = PNP3906 Section
E₂, B₂, C₂ = NPN3904 Section

SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Nominal	
F	0.30	0.40
H	1.80	2.20
J	0.10	
K	0.90	1.00
L	0.25	0.40
M	0.10	0.25
	0°	8°
All Dimensions in mm		

Maximum Ratings, NPN 3904 Section @ T_A = 25 C unless otherwise specified

Characteristic	Symbol	NPN 3904 Section	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 - Continuous (Note 1)	I _C	200	mA
Power Dissipation (Note 1, 2)	P _d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R _{JA}	625	C/W

Maximum Ratings, PNP 3906 Section @ T_A = 25 C unless otherwise specified

Characteristic	Symbol	PNP 3906 Section	Unit
Collector-Base Voltage	V _{CBO}	-40	V
Collector-Emitter Voltage	V _{CEO}	-40	V
Emitter-Base Voltage	V _{EBO}	-5.0	V
Collector Current - Continuous (Note 1)	I _C	-200	mA
Power Dissipation (Note 1, 2)	P _d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R _{JA}	625	C/W

- Notes:
- 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>.
 - Maximum combined dissipation.
 - No purposefully added lead.





Electrical Characteristics, NPN 3904 Section

@ T_A = 25 °C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 4)					
Collector-Base Breakdown Voltage	V _{(BR)CBO}	60		V	I _C = 10 A, I _E = 0
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	40		V	I _C = 1.0mA, I _B = 0
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	5.0	6.0	V	I _E = 10 A, 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 4)					
DC Current Gain	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}		8.0	pF	V _{EB} = 0.5V, f = 1.0MHz, I _C = 0
Input Impedance	h _{ie}	1.0	10	k	V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h _{re}	0.5	8.0	x 10 ⁻⁴	
Small Signal Current Gain	h _{fe}	100	400		
Output Admittance	h _{oe}	1.0	40	S	
Current Gain-Bandwidth Product	f _T	300		MHz	V _{CE} = 20V, I _C = 20mA, f = 100MHz
Noise Figure	NF		5.0	dB	V _{CE} = 5.0V, I _C = 100 A, R _S = 1.0k f = 1.0kHz
SWITCHING CHARACTERISTICS					
Delay Time	t _d		35	ns	V _{CC} = 3.0V, I _C = 10mA, V _{BE(off)} = - 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} = I _{B2} = 1.0mA
Fall Time	t _f		50	ns	

Note: 4. Short duration pulse test used to minimize self-heating effect.



Electrical Characteristics, PNP 3906 Section

@ T_A = 25 C unless otherwise specified

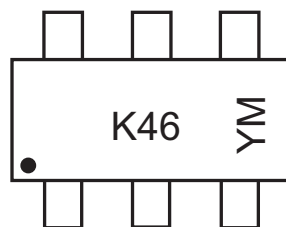
Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 4)					
Collector-Base Breakdown Voltage	V _{(BR)CBO}	-40		V	I _C = -10 A, I _E = 0
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	-40		V	I _C = -1.0mA, I _B = 0
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	-5.0		V	I _E = -10 A, 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 4)					
DC Current Gain	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
Input Impedance	h _{ie}	2.0	12	k	V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h _{re}	0.1	10	x 10 ⁻⁴	
Small Signal Current Gain	h _{fe}	100	400		
Output Admittance	h _{oe}	3.0	60	S	
Current Gain-Bandwidth Product	f _T	250		MHz	
Noise Figure	NF		4.0	dB	V _{CE} = -5.0V, I _C = -100 A, R _S = 1.0k f = 1.0kHz
SWITCHING CHARACTERISTICS					
Delay Time	t _d		35	ns	V _{CC} = -3.0V, I _C = -10mA, V _{BE(off)} = 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} = I _{B2} = -1.0mA
Fall Time	t _f		75	ns	

Ordering Information (Note 5)

Device	Packaging	Shipping
MMDT3946-7-F	SOT-363	3000/Tape & Reel

- Notes: 4. Short duration pulse test used to minimize self-heating effect.
5. For Packaging Details, go to our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

Marking Information

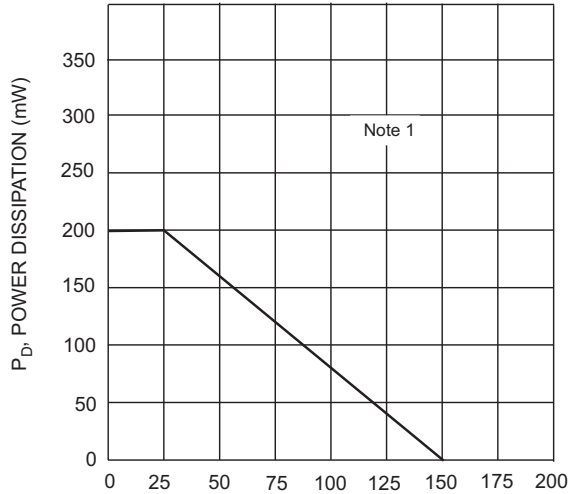


K46 = Product Type Marking Code
YM = Date Code Marking
Y = Year ex: N = 2002
M = Month ex: 9 = September

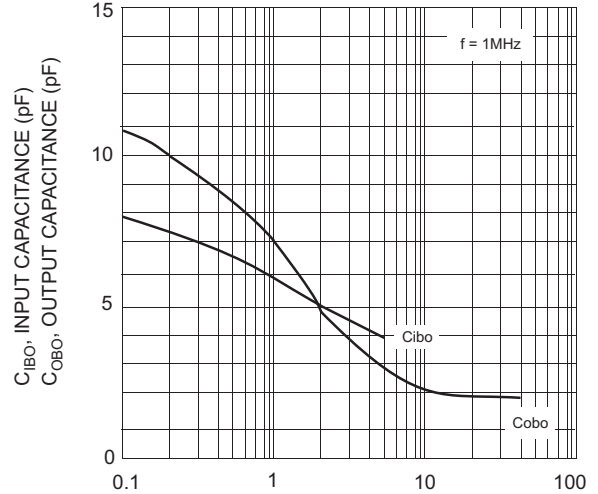
Date Code Key

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Code	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	Z

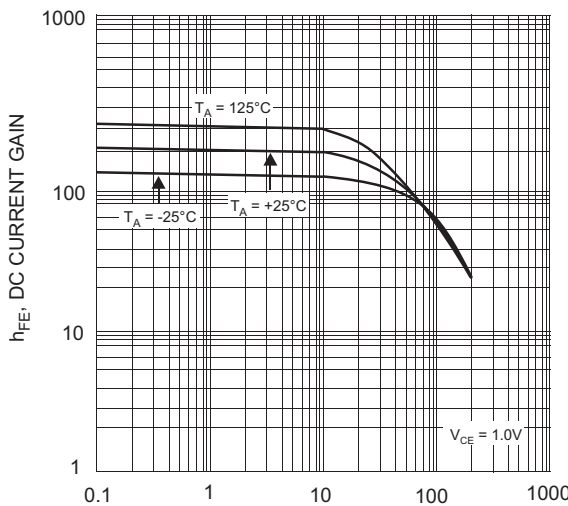
Month	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D



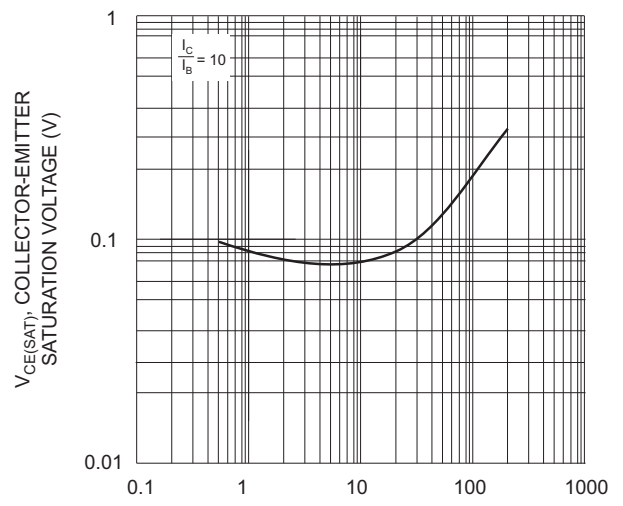
T_A , AMBIENT TEMPERATURE ($^{\circ}\text{C}$)
Fig. 1, Max Power Dissipation vs Ambient Temperature (Total Device)



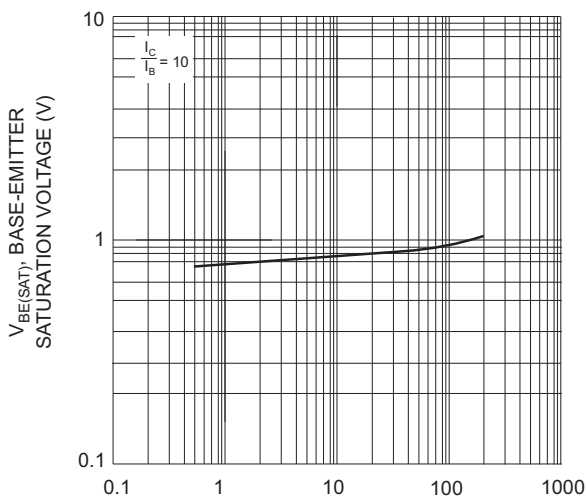
V_{CB} , COLLECTOR-BASE VOLTAGE (V)
Fig. 2, Input and Output Capacitance vs. Collector-Base Voltage (NPN-3904)



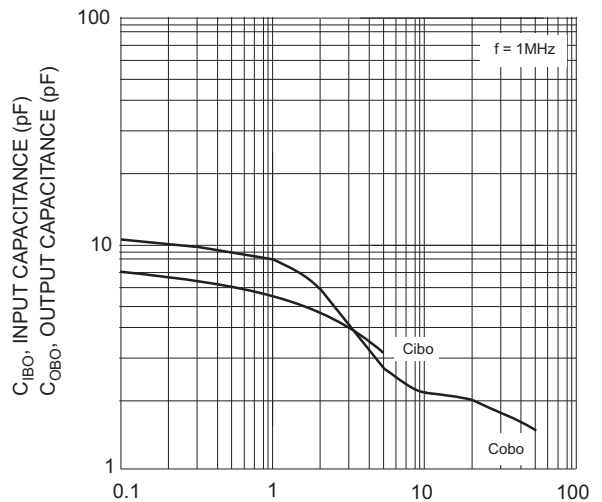
I_C , COLLECTOR CURRENT (mA)
Fig. 3, Typical DC Current Gain vs Collector Current (NPN-3904)



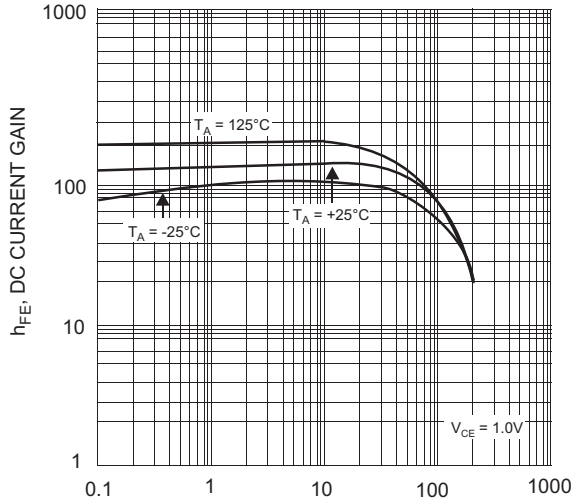
I_C , COLLECTOR CURRENT (mA)
Fig. 4, Typical Collector-Emitter Saturation Voltage vs. Collector Current (NPN-3904)



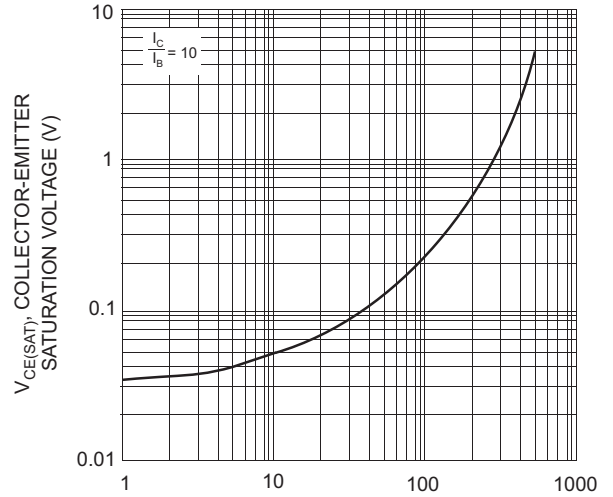
I_C , COLLECTOR CURRENT (mA)
Fig. 5, Typical Base-Emitter Saturation Voltage vs. Collector Current (NPN-3904)



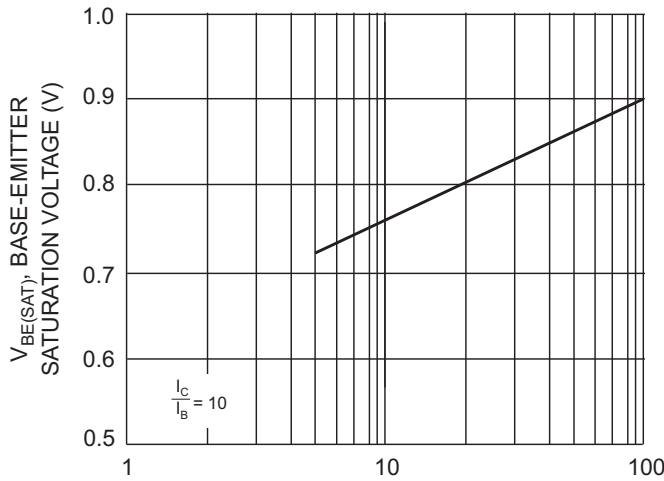
V_{CB} , COLLECTOR-BASE VOLTAGE (V)
Fig. 6, Input and Output Capacitance vs. Collector-Base Voltage (PNP-3906)



I_C , COLLECTOR CURRENT (mA)
 Fig. 7, Typical DC Current Gain vs Collector Current (PNP-3906)



I_C , COLLECTOR CURRENT (mA)
 Fig. 8, Typical Collector-Emitter Saturation Voltage vs. Collector Current (PNP-3906)



I_C , COLLECTOR CURRENT (mA)
 Fig. 9, Typical Base-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

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