SEMICONDUCTOR

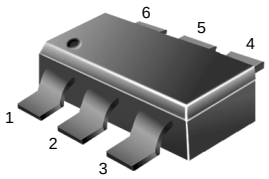
DATA SHEET

MMBT3946DW

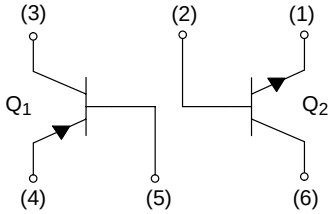
COMPLEMENTARY NPN/PNP TRANSISTOR

FEATURES

- Complementary Pair
- One 3904-Type NPN,
  One 3906-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching



SOT–363/SC–88
CASE 419B STYLE 1



MAKING: 46

MAXIMUM RATINGS (T_A=25℃ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	40	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current -Continuous	0.2	A
P_C	Collector Power Dissipation	0.2	W
T_J	Junction Temperature	150	℃
T_{stg}	Storage Temperature	-55-150	℃

NPN 3904 ELECTRICAL CHARACTERISTICS (Tamb=25℃ unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	MAX	UNIT
Collector-base breakdown voltage	$V_{(BR)CBO}$	I_C = 10μA, I_E=0	60		V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	I_C= 1mA, I_B=0	40		V
Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E= 10μA, I_C=0	5		V
Collector cut-off current	I_{CBO}	V_{CB}= 30 V , I_E=0		0.05	μA
Collector cut-off current	I_{CEO}	V_{CE}= 30 V , I_B=0		0.5	μA
Emitter cut-off current	I_{EBO}	V_{EB}= 5V , I_C=0		0.05	μA
DC current gain	$h_{FE(1)}$	V_{CE}= 1V, I_C= 0.1mA	40		
	$h_{FE(2)}$	V_{CE}= 1V, I_C= 1mA	70		
	$h_{FE(3)}$	V_{CE}= 1V, I_C= 10mA	100	300	
	$h_{FE(4)}$	V_{CE}= 1V, I_C= 50mA	60		
	$h_{FE(5)}$	V_{CE}= 1V, I_C= 100mA	30		
Collector-emitter saturation voltage	$V_{CE(sat)1}$	I_C=10 mA, I_B= 1mA		0.2	V
	$V_{CE(sat)2}$	I_C=50 mA, I_B= 5mA		0.3	V
Base-emitter saturation voltage	$V_{BE(sat)1}$	I_C= 10 mA, I_B= 1mA	0.65	0.85	V
	$V_{BE(sat)2}$	I_C= 50 mA, I_B= 5mA		0.95	V
Transition frequency	f_T	V_{CE}=20V,I_C=20mA, f=100MHz	300		MHz
Noise figure	NF	V_{CE}=5V,I_c=0.1mA, f=1KHz,Rg=1KΩ		5	dB
Output Capacitance	C_{ob}	V_{CB}=5V,I_E=0,f=1MHz		4	pF
Delay time	t_d	V_{CC}=3V, V_{BE}=0.5V		35	nS
Rise time	t_r	I_C=10mA , I_{B1}=- I_{B2}=1mA		35	nS
Storage time	t_S	V_{CC}=3V, I_C=10mA		200	nS
Fall time	t_f	I_{B1}=-I_{B2}= 1mA		50	nS

DEVICE CHARACTERISTICS

MMBT3946DW

MAXIMUM RATINGS(T_A=25℃ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	-40	V
V_{CEO}	Collector-Emitter Voltage	-40	V
V_{EBO}	Emitter-Base Voltage	-5	V
I_C	Collector Current -Continuous	-0.2	A
P_C	Collector Power Dissipation	0.2	W
T_J	Junction Temperature	150	℃
T_{stg}	Storage Temperature	-55-150	℃

PNP 3906 ELECTRICAL CHARACTERISTICS (Tamb=25℃ unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Collector-base breakdown voltage	$V_{(BR)CBO}$	I_C=-10μA,I_E=0	-40			V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	I_C=-1mA,I_B=0	-40			V
Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E=-10μA,I_C=0	-5			V
Collector cut-off current	I_{CBO}	V_{CB}=-30V,I_E=0			-0.05	μA
Emitter cut-off current	I_{EBO}	V_{EB}=-5V,I_C=0			-0.05	μA
DC current gain	$h_{FE(1)}$	V_{CE}=-1V,I_C=-0.1mA	60			
	$h_{FE(2)}$	V_{CE}=-1V,I_C=-1mA	80			
	$h_{FE(3)}$	V_{CE}=-1V,I_C=-10mA	100		300	
	$h_{FE(4)}$	V_{CE}=-1V,I_C=-50mA	60			
	$h_{FE(5)}$	V_{CE}=-1V,I_C=-100mA	30			
Collector-emitter saturation voltage	$V_{CE(sat)1}$	I_C=-10mA,I_B=-1mA			-0.25	V
	$V_{CE(sat)2}$	I_C=-50mA,I_B=-5mA			-0.4	V
Base-emitter saturation voltage	$V_{BE(sat)1}$	I_C=-10mA,I_B=-1mA	-0.65		-0.85	V
	$V_{BE(sat)2}$	I_C=-50mA,I_B=-5mA			-0.95	V
Transition frequency	f_T	V_{CE}=-20V,I_C=-10mA,f=100MHz	250			MHz
Collector output capacitance	C_{ob}	V_{CB}=-5V,I_E=0,f=1MHz			4.5	pF
Noise figure	NF	V_{CE}=-5V,I_c=-0.1mA, f=1KHZ,Rg=1KΩ			4	dB
Delay time	t_d	V_{CC}=-3V, V_{BE}=-0.5V I_C=-10mA , I_{B1}=-I_{B2}=-1mA			35	nS
Rise time	t_r				35	nS
Storage time	t_S	V_{CC}=-3V, I_C=-10mA I_{B1}=-I_{B2}=- 1mA			225	nS
Fall time	t_f				75	nS

DEVICE CHARACTERISTICS

MMBT3946DW

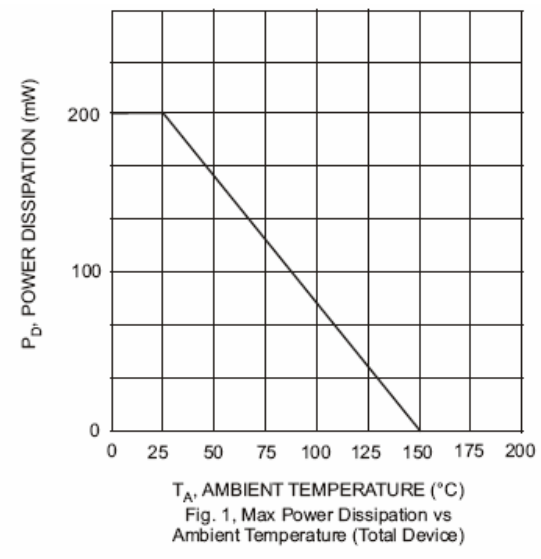


Fig. 1, Max Power Dissipation vs Ambient Temperature (Total Device)

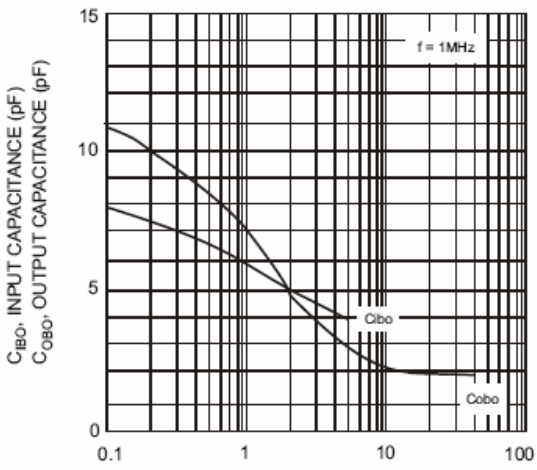


Fig. 2, Input and Output Capacitance vs. Collector-Base Voltage (NPN-3904)

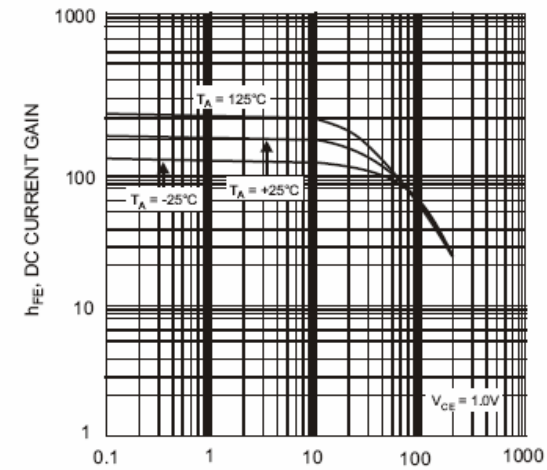


Fig. 3, Typical DC Current Gain vs Collector Current (NPN-3904)

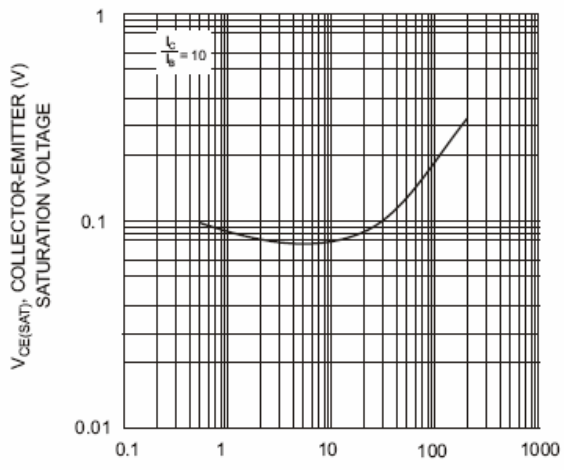


Fig. 4, Typical Collector-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

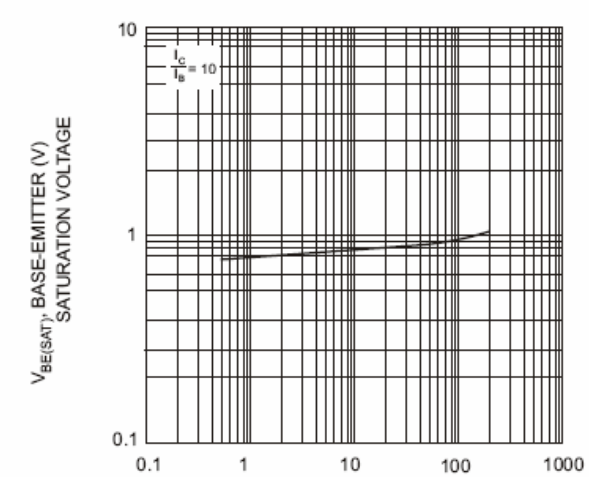


Fig. 5, Typical Base-Emitter Saturation Voltage vs. Collector Current (NPN-3904)

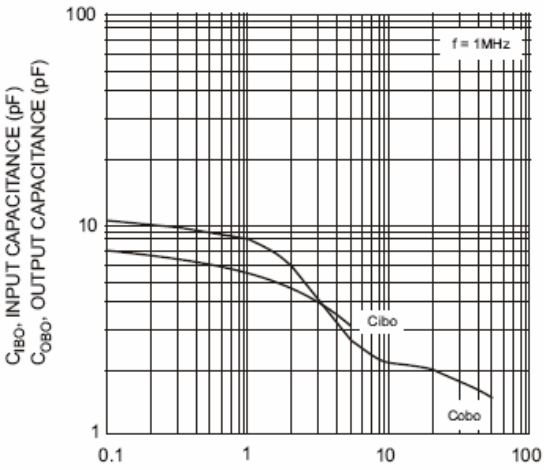


Fig. 6, Input and Output Capacitance vs. Collector-Base Voltage (PNP-3906)

PACKAGE OUTLINE & DIMENSIONS

MMBT3946DW

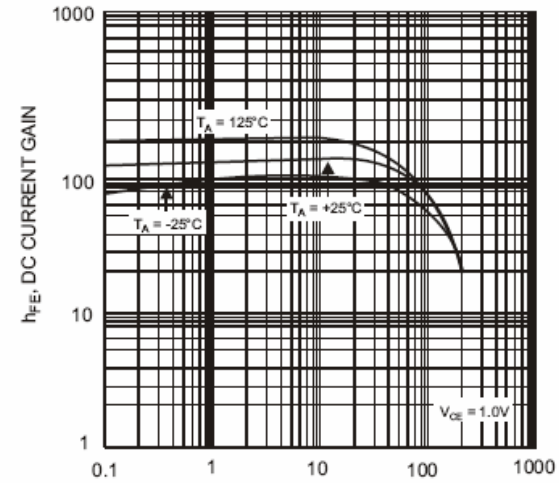


Fig. 7, Typical DC Current Gain vs Collector Current (PNP-3906)

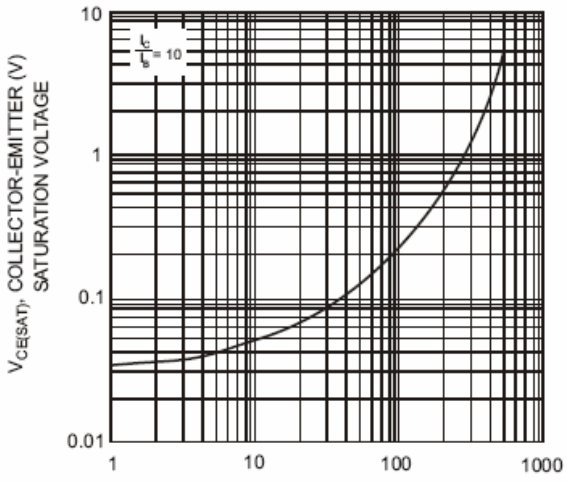


Fig. 8, Typical Collector-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

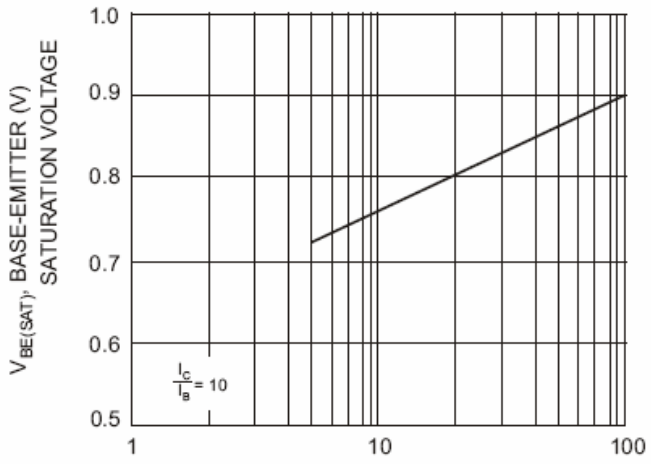
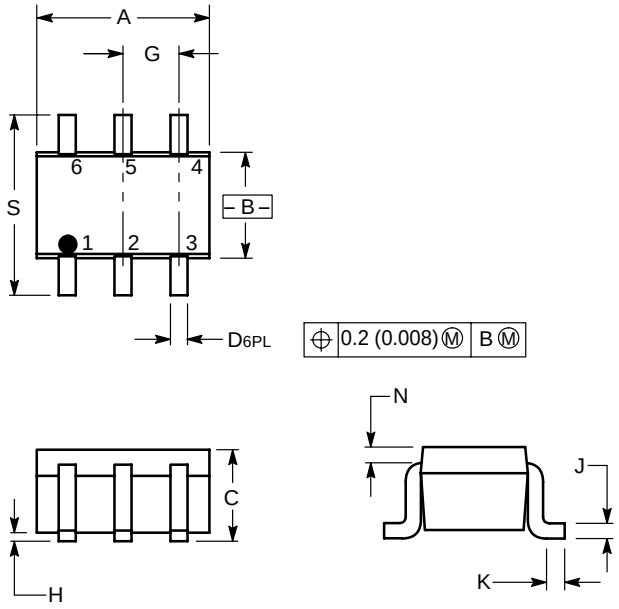


Fig. 9, Typical Base-Emitter Saturation Voltage vs. Collector Current (PNP-3906)

PACKAGE OUTLINE & DIMENSIONS

MMBT3946DW

SC−88/SOT−363



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

PIN 1. EMITTER 1
2. BASE 1
3. COLLECTOR 2
4. EMITTER 2
5. BASE 2
6. COLLECTOR 1

