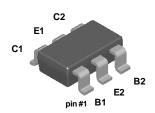


# FFB3904

# E2 B2 C1 SC70-6 B1 Mark: .1A pin#1 E1

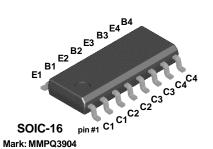
NOTE: The pinouts are symmetrical; pin 1 and pin 4 are interchangeable. Units inside the carrier can be of either orientation and will not affect the functionality of the device.

# FMB3904



SuperSOT<sup>TM</sup>-6 Mark: .1A Dot denotes pin #1

# **MMPQ3904**



# **NPN Multi-Chip General Purpose Amplifier**

This device is designed as a general purpose amplifier and switch. The useful dynamic range extends to 100 mA as a switch and to 100 MHz as an amplifier. Sourced from Process 23.

## **Absolute Maximum Ratings\***

 $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Value	Units	
$V_{CEO}$	Collector-Emitter Voltage	40	V	
V <sub>CBO</sub>	Collector-Base Voltage	60	V	
V <sub>EBO</sub>	Emitter-Base Voltage	6.0	V	
I <sub>C</sub>	Collector Current - Continuous	200	mA	
T <sub>J</sub> , T <sub>stg</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C	

<sup>\*</sup>These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

### NOTES:

- 1) These ratings are based on a maximum junction temperature of 150 degrees C.
- 2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.
- 3) All voltages (V) and currents (A) are negative polarity for PNP transistors.

### **Thermal Characteristics**

 $T_A = 25$ °C unless otherwise noted

Symbol	Characteristic	Max			Units
		FFB3904	FMB3904	MMPQ3904	
$P_D$	Total Device Dissipation Derate above 25°C	300 2.4	700 5.6	1,000 8.0	mW mW/°C
R <sub>θ</sub> JA	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	415	180	125 240	°C/W °C/W

(continued)

Electri		

 $\Gamma_{\Lambda} = 25^{\circ}$ C unless otherwise note

ACTERISTICS					
Collector-Emitter Breakdown Voltage	$I_C = 1.0 \text{ mA}, I_B = 0$	40			V
Collector-Base Breakdown Voltage	$I_C = 10 \mu A, I_E = 0$	60			V
Emitter-Base Breakdown Voltage	$I_E = 10 \ \mu A, \ I_C = 0$	6.0			V
Base Cutoff Current	V <sub>CE</sub> = 30 V, V <sub>EB</sub> = 0			50	nA
Collector Cutoff Current	V <sub>CE</sub> = 30 V, V <sub>EB</sub> = 0			50	nA
	Collector-Emitter Breakdown Voltage Collector-Base Breakdown Voltage Emitter-Base Breakdown Voltage Base Cutoff Current	Collector-Emitter Breakdown Voltage $I_C = 1.0$ mA, $I_B = 0$ Collector-Base Breakdown Voltage $I_C = 10$ $\mu$ A, $I_E = 0$ Emitter-Base Breakdown Voltage $I_E = 10$ $\mu$ A, $I_C = 0$ Base Cutoff Current $V_{CE} = 30$ V, $V_{EB} = 0$	Collector-Emitter Breakdown Voltage $I_C = 1.0$ mA, $I_B = 0$ 40 Collector-Base Breakdown Voltage $I_C = 10$ $\mu$ A, $I_E = 0$ 60 Emitter-Base Breakdown Voltage $I_E = 10$ $\mu$ A, $I_C = 0$ 6.0 Base Cutoff Current $V_{CE} = 30$ V, $V_{EB} = 0$	Collector-Emitter Breakdown Voltage $I_C = 1.0$ mA, $I_B = 0$ 40  Collector-Base Breakdown Voltage $I_C = 10$ $\mu$ A, $I_E = 0$ 60  Emitter-Base Breakdown Voltage $I_E = 10$ $\mu$ A, $I_C = 0$ 6.0  Base Cutoff Current $V_{CE} = 30$ V, $V_{EB} = 0$	Collector-Emitter Breakdown Voltage $I_C = 1.0 \text{ mA}, I_B = 0$ 40 Collector-Base Breakdown Voltage $I_C = 10 \mu\text{A}, I_E = 0$ 60 Emitter-Base Breakdown Voltage $I_E = 10 \mu\text{A}, I_C = 0$ 6.0 Base Cutoff Current $V_{CE} = 30 \text{ V}, V_{EB} = 0$ 50

### ON CHARACTERISTICS\*

h <sub>FE</sub>	DC Current Gain	$I_C = 0.1 \text{ mA}, V_{CE} = 1.0 \text{ V}$	40		
		MMPQ3904	30		
		$I_C = 1.0 \text{ mA}, V_{CE} = 1.0 \text{ V}$	70		
		MMPQ3904	50		
		$I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$	100	300	
		MMPQ3904	75		
		$I_C = 50 \text{ mA}, V_{CE} = 1.0 \text{ V}$	60		
		$I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}$	30		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$		0.2	V
		$I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$		0.3	V
V <sub>BE(sat)</sub>	Base-Emitter Saturation Voltage	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$	0.65	0.85	V
		$I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$		0.95	V

## SMALL SIGNAL CHARACTERISTICS (MMPQ3904 only)

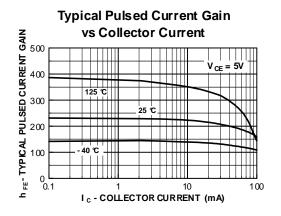
f⊤	Current Gain - Bandwidth Product	$I_C = 10 \text{ mA}, V_{CE} = 20 \text{ V},$ f = 100  MHz	250	MHz
C <sub>obo</sub>	Output Capacitance	$V_{CB} = 5.0 \text{ V}, I_{E} = 0,$ f = 140 kHz	4.0	pF
C <sub>ibo</sub>	Input Capacitance	$V_{EB} = 0.5 \text{ V}, I_{C} = 0,$ f = 140  kHz	8.0	pF

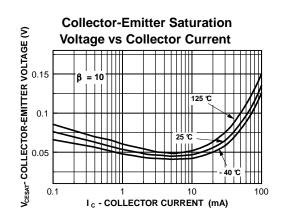
<sup>\*</sup>Pulse Test: Pulse Width  $\leq$  300  $\mu$ s, Duty Cycle  $\leq$  2.0%

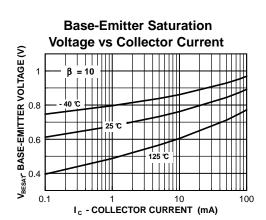
**NOTE:** All voltages (V) and currents (A) are negative polarity for PNP transistors.

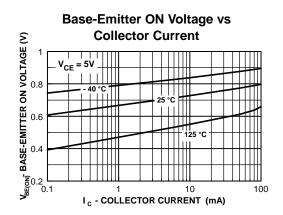
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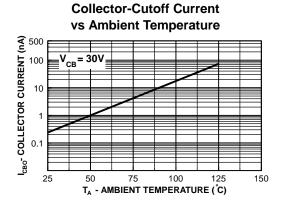
# **Typical Characteristics**

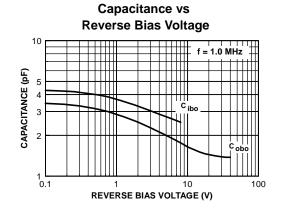








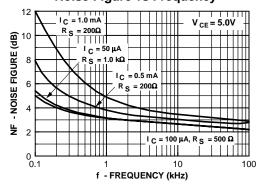




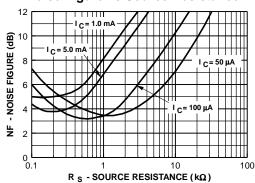
(continued)

## Typical Characteristics (continued)

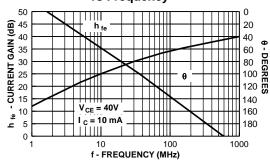




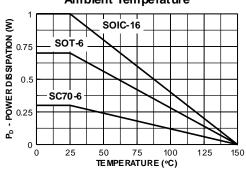
### Noise Figure vs Source Resistance



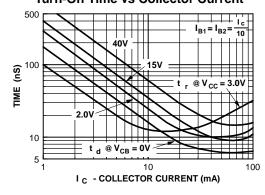
# Current Gain and Phase Angle vs Frequency



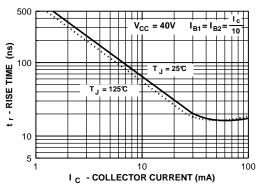
## Power Dissipation vs Ambient Temperature



## **Turn-On Time vs Collector Current**



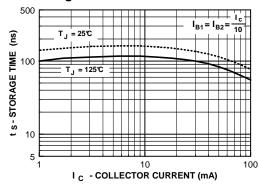
### **Rise Time vs Collector Current**



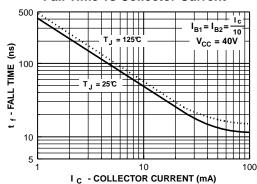
(continued)

## Typical Characteristics (continued)

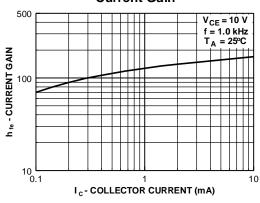




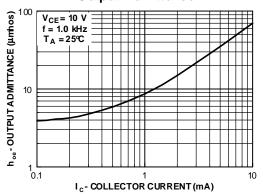
### **Fall Time vs Collector Current**



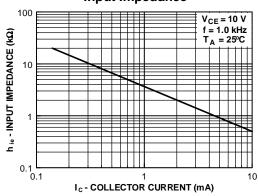
**Current Gain** 



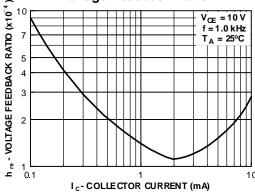
Output Admittance



Input Impedance



Voltage Feedback Ratio



(continued)

# **Test Circuits**

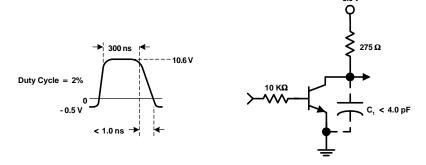


FIGURE 1: Delay and Rise Time Equivalent Test Circuit

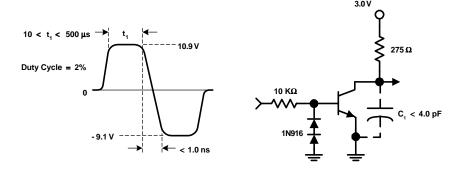


FIGURE 2: Storage and Fall Time Equivalent Test Circuit

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DOME™ Quiet Series™ ISOPLANAR™ E<sup>2</sup>CMOS<sup>TM</sup> MICROWIRE™ SILENT SWITCHER® EnSigna™ **OPTOLOGIC™** SMART START™ FACT™ **OPTOPLANAR™** SuperSOT™-3 FACT Quiet Series™ PACMAN™ SuperSOT™-6 **РОР**ТМ SuperSOT™-8 FAST®

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