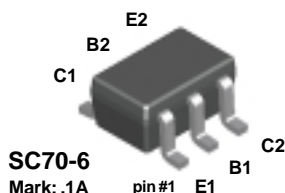


## FFB3904

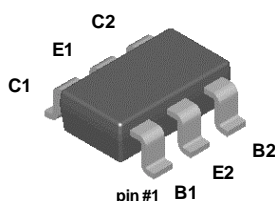


SC70-6

Mark: .1A

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

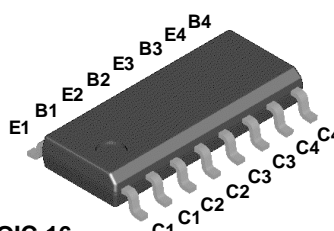


SuperSOT™-6

Mark: .1A

Dot denotes pin #1

## MMPQ3904



SOIC-16

Mark: 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\*

$T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Value	Units
$V_{CEO}$	Collector-Emitter Voltage	40	V
$V_{CBO}$	Collector-Base Voltage	60	V
$V_{EBO}$	Emitter-Base Voltage	6.0	V
$I_C$	Collector Current - Continuous	200	mA
$T_J, T_{stg}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

\*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

$T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Characteristic	Max			Units
		FFB3904	FMB3904	MMPQ3904	
$P_D$	Total Device Dissipation	300	700	1,000	mW
	Derate above $25^\circ\text{C}$	2.4	5.6	8.0	mW/ $^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	415	180		$^\circ\text{C}/\text{W}$
	Effective 4 Die			125	$^\circ\text{C}/\text{W}$
	Each Die			240	$^\circ\text{C}/\text{W}$

# NPN Multi-Chip General Purpose Amplifier

(continued)

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1.0 \text{ mA}, I_B = 0$	40			V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10 \mu\text{A}, I_E = 0$	60			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \mu\text{A}, I_C = 0$	6.0			V
$I_{BL}$	Base Cutoff Current	$V_{CE} = 30 \text{ V}, V_{EB} = 0$			50	nA
$I_{CEX}$	Collector Cutoff Current	$V_{CE} = 30 \text{ V}, V_{EB} = 0$			50	nA

## ON CHARACTERISTICS\*

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

## SMALL SIGNAL CHARACTERISTICS (MMPQ3904 only)

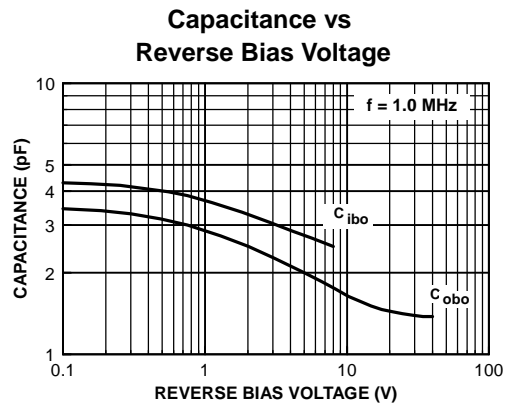
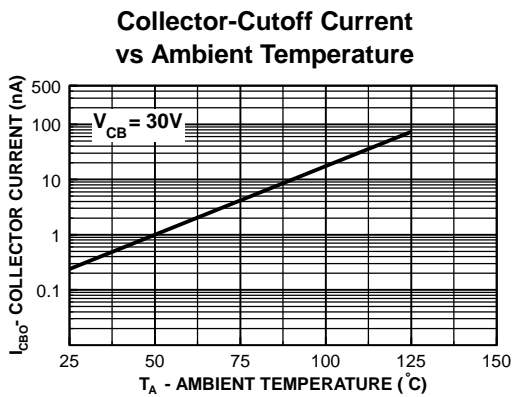
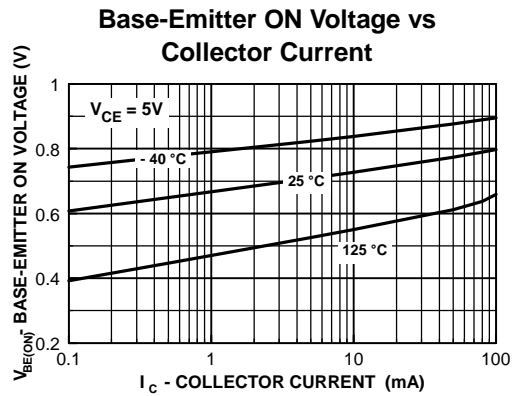
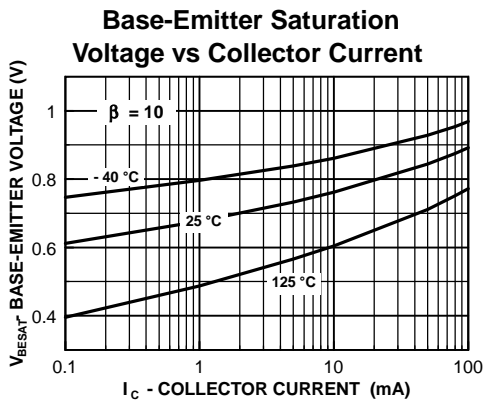
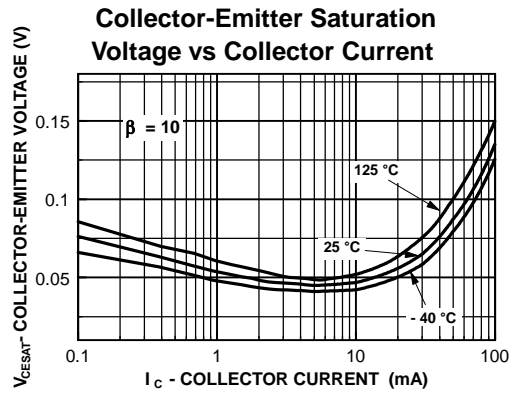
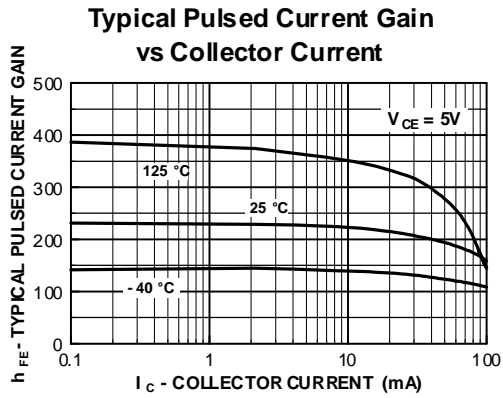
$f_T$	Current Gain - Bandwidth Product	$I_C = 10 \text{ mA}, V_{CE} = 20 \text{ V},$ $f = 100 \text{ MHz}$		250		MHz
$C_{obo}$	Output Capacitance	$V_{CB} = 5.0 \text{ V}, I_E = 0,$ $f = 140 \text{ kHz}$		4.0		pF
$C_{ibo}$	Input Capacitance	$V_{EB} = 0.5 \text{ V}, I_C = 0,$ $f = 140 \text{ kHz}$		8.0		pF

\*Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

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

FFB3904 / FMB3904 / MMPQ3904

Typical Characteristics



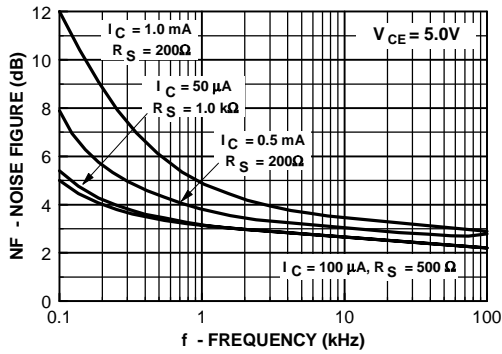
# NPN Multi-Chip General Purpose Amplifier

(continued)

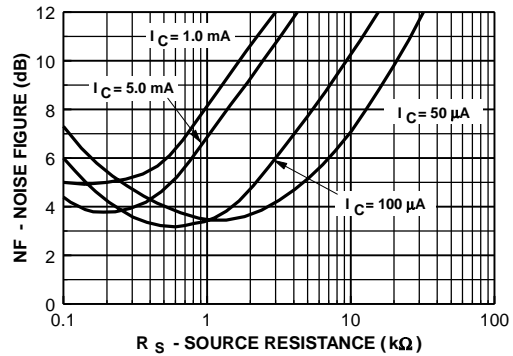
FFB3904 / FMB3904 / MMPQ3904

## Typical Characteristics (continued)

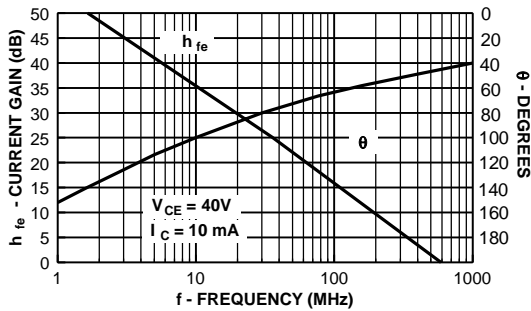
### Noise Figure vs Frequency



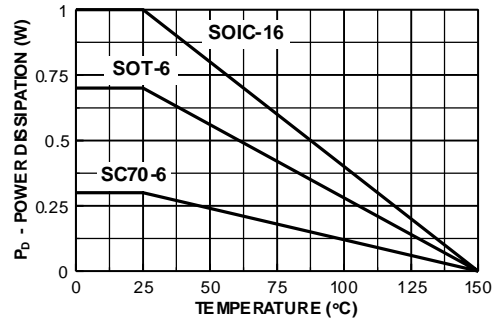
### Noise Figure vs Source Resistance



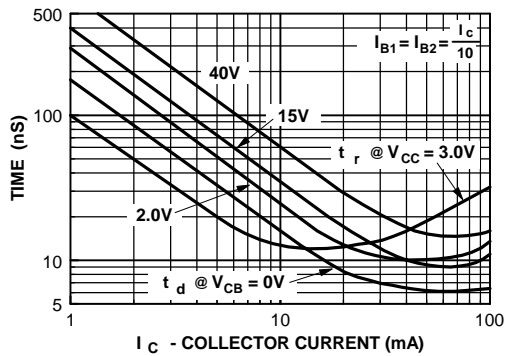
### Current Gain and Phase Angle vs Frequency



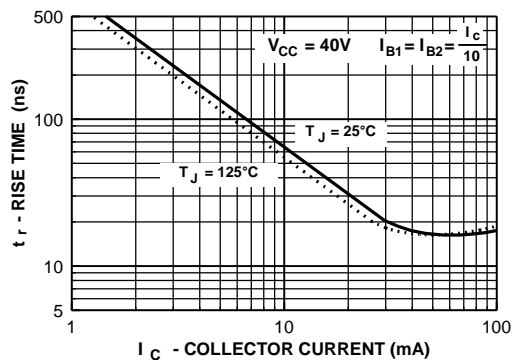
### Power Dissipation vs Ambient Temperature



### Turn-On Time vs Collector Current



### Rise Time vs Collector Current



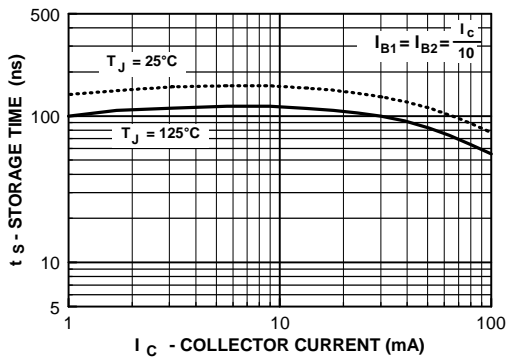
# NPN Multi-Chip General Purpose Amplifier

(continued)

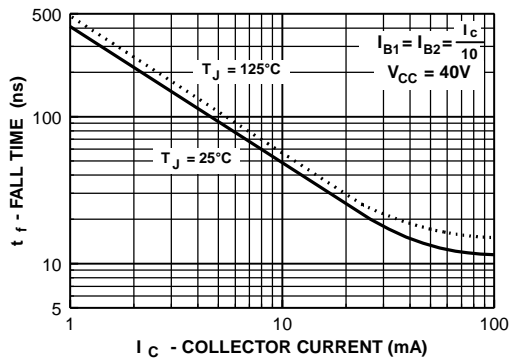
FFB3904 / FMB3904 / MMPQ3904

## Typical Characteristics (continued)

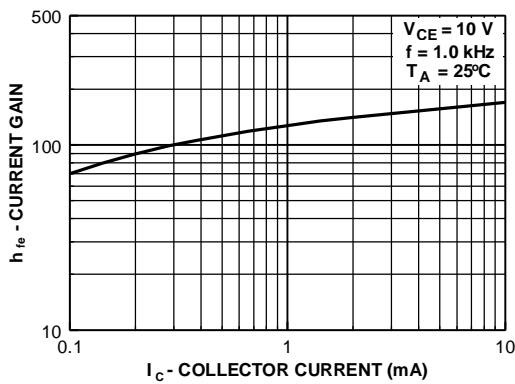
**Storage Time vs Collector Current**



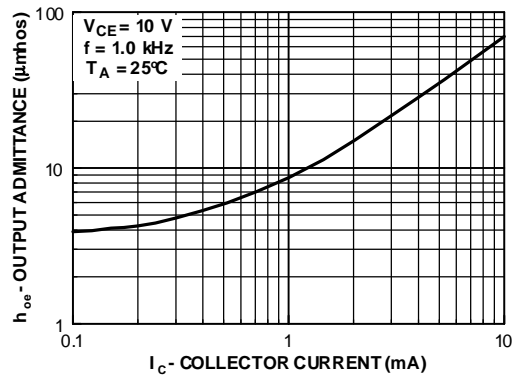
**Fall Time vs Collector Current**



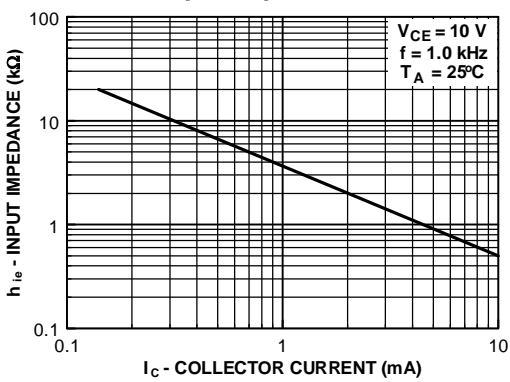
**Current Gain**



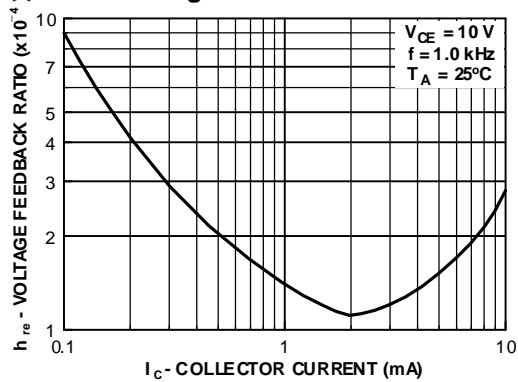
**Output Admittance**



**Input Impedance**



**Voltage Feedback Ratio**



Test Circuits

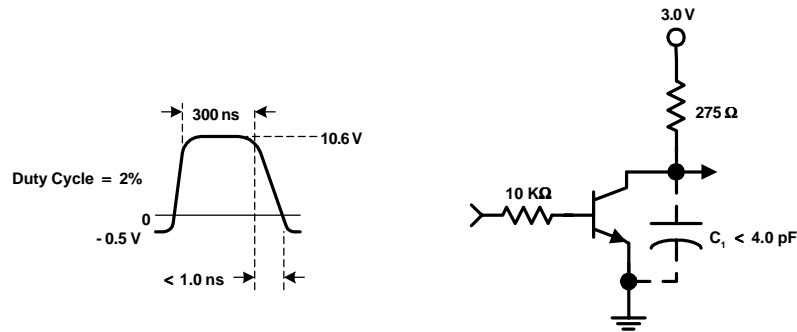


FIGURE 1: Delay and Rise Time Equivalent Test Circuit

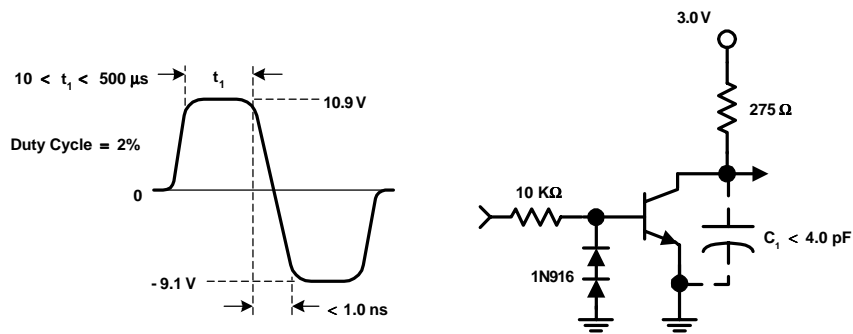


FIGURE 2: Storage and Fall Time Equivalent Test Circuit

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