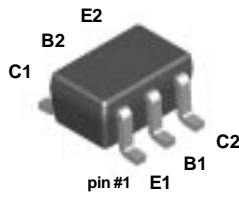
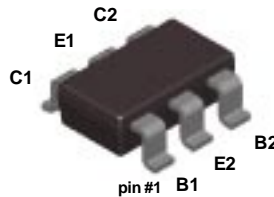


FFB3904



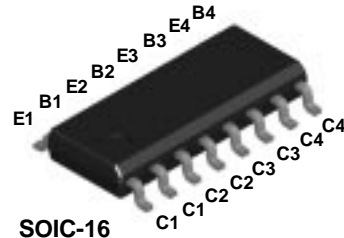
SC70-6
Mark: .1A

FMB3904



SuperSOT™-6
Mark: .1A

MMPQ3904



SOIC-16

NPN 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.

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°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
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OFF CHARACTERISTICS

$V_{(BR)CEO}$	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	$I_C = 0.1\text{ mA}, V_{CE} = 1.0\text{ V}$	40			
		$I_C = 1.0\text{ mA}, V_{CE} = 1.0\text{ V}$	70			
		$I_C = 10\text{ mA}, V_{CE} = 1.0\text{ V}$	100		300	
		$I_C = 50\text{ mA}, V_{CE} = 1.0\text{ V}$	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
$V_{BE(sat)}$	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

f_T	Current Gain - Bandwidth Product	$I_C = 10\text{ mA}, V_{CE} = 20\text{ V},$ $f = 100\text{ MHz}$		450		MHz
C_{obo}	Output Capacitance	$V_{CB} = 5.0\text{ V}, I_E = 0,$ $f = 1.0\text{ MHz}$		2.5		pF
C_{ibo}	Input Capacitance	$V_{EB} = 0.5\text{ V}, I_C = 0,$ $f = 1.0\text{ MHz}$		6.0		pF
NF	Noise Figure (except MMPQ3904)	$I_C = 100\ \mu\text{A}, V_{CE} = 5.0\text{ V},$ $R_S = 1.0\text{ k}\Omega, f = 10\text{ Hz to } 15.7\text{ kHz}$		2.0		dB

SWITCHING CHARACTERISTICS

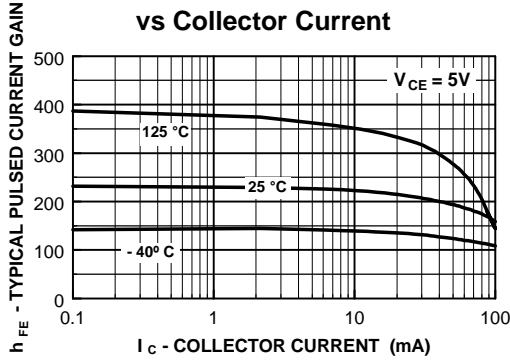
t_d	Delay Time	$V_{CC} = 3.0\text{ V}, V_{BE} = 0.5\text{ V},$		18		ns
t_r	Rise Time	$I_C = 10\text{ mA}, I_{B1} = 1.0\text{ mA}$		20		ns
t_s	Storage Time	$V_{CC} = 3.0\text{ V}, I_C = 10\text{ mA}$		150		ns
t_f	Fall Time	$I_{B1} = I_{B2} = 1.0\text{ mA}$		25		ns

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

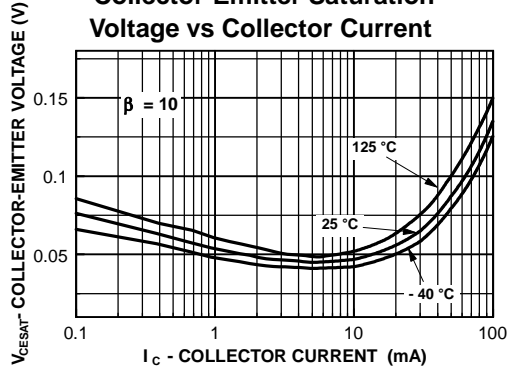
FFB3904 / FMB3904 / MMPQ3904

Typical Characteristics

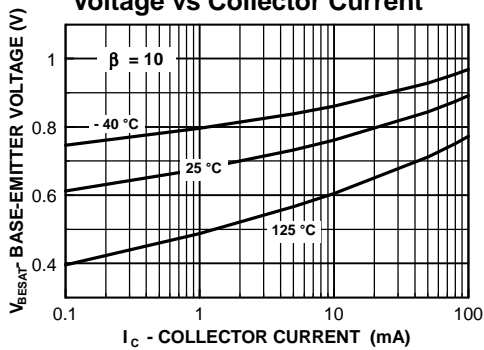
Typical Pulsed Current Gain vs Collector Current



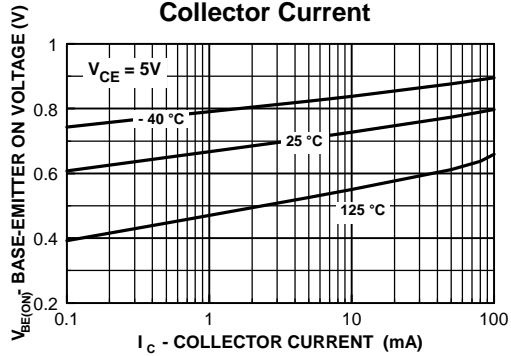
Collector-Emitter Saturation Voltage vs Collector Current



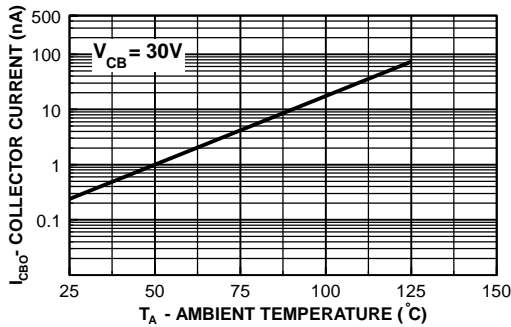
Base-Emitter Saturation Voltage vs Collector Current



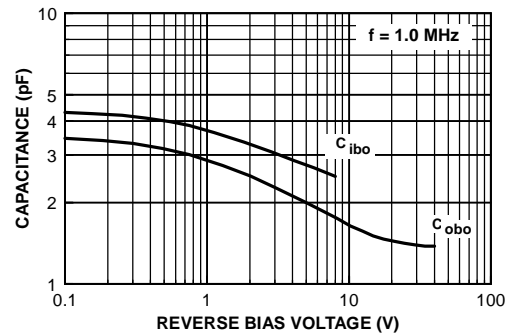
Base-Emitter ON Voltage vs Collector Current



Collector-Cutoff Current vs Ambient Temperature



Capacitance vs Reverse Bias Voltage



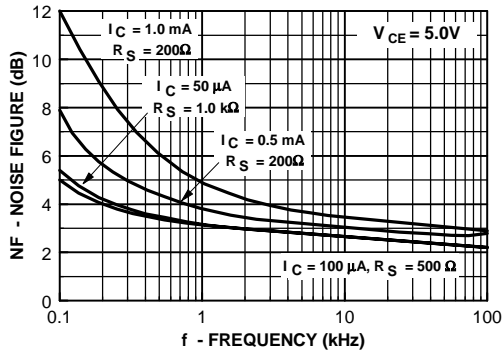
NPN Multi-Chip General Purpose Amplifier

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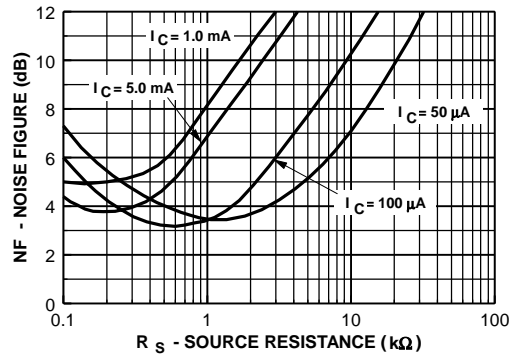
FFB3904 / FMB3904 / MMPQ3904

Typical Characteristics (continued)

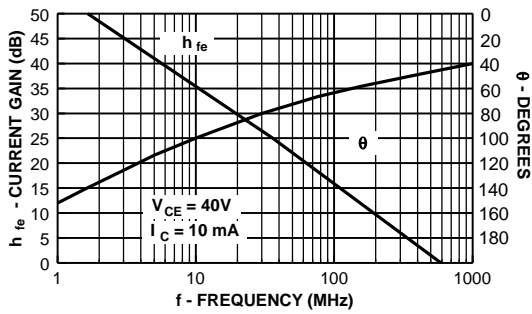
Noise Figure vs Frequency



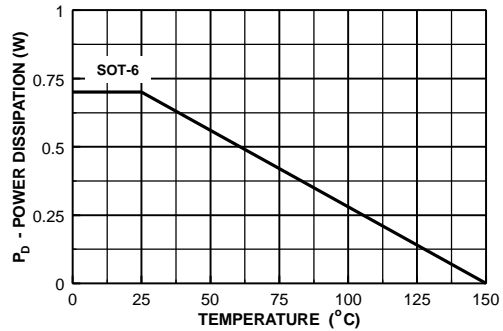
Noise Figure vs Source Resistance



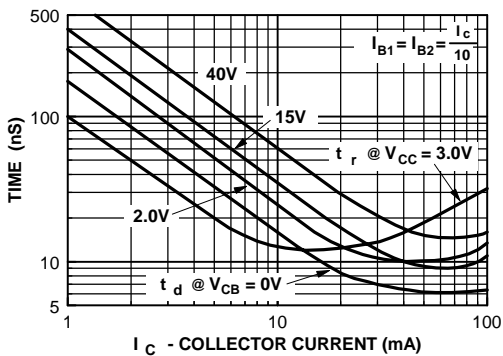
Current Gain and Phase Angle vs Frequency



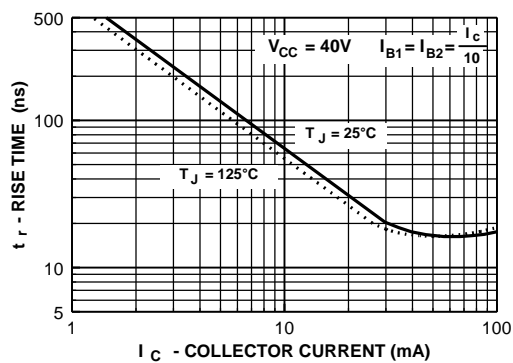
Power Dissipation vs Ambient Temperature



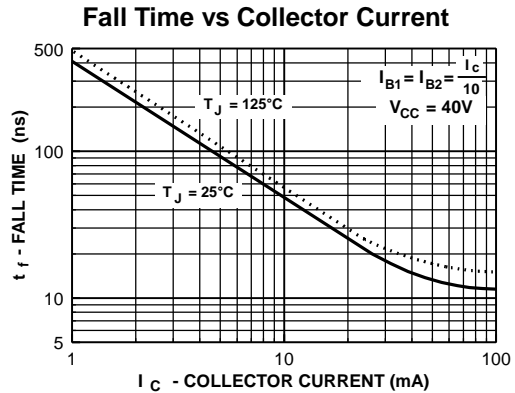
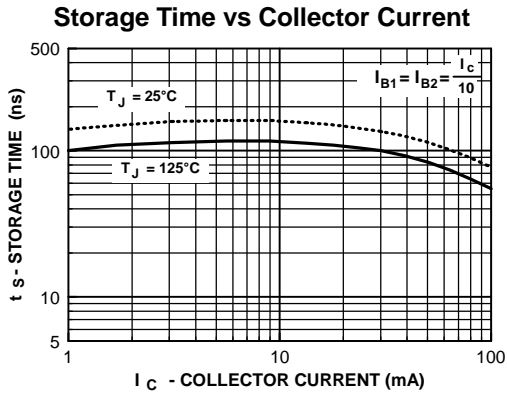
Turn-On Time vs Collector Current



Rise Time vs Collector Current



Typical Characteristics (continued)



Test Circuits

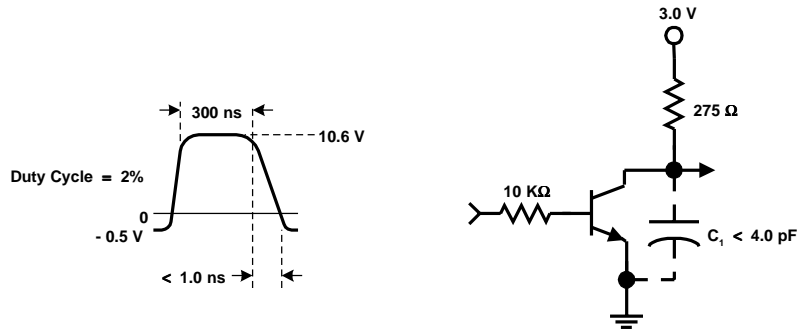


FIGURE 1: Delay and Rise Time Equivalent Test Circuit

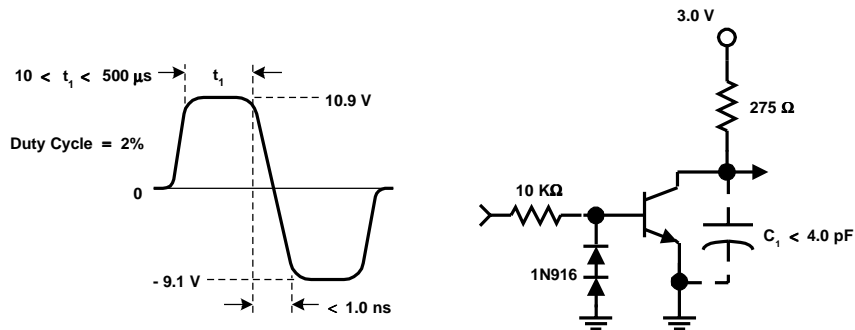


FIGURE 2: Storage and Fall Time Equivalent Test Circuit