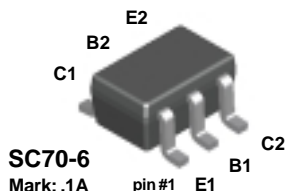


FFB3904

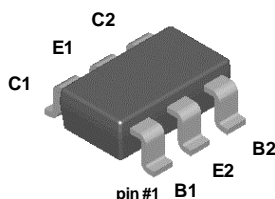


SC70-6

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

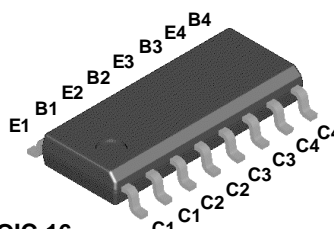


SuperSOT™-6

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°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 |
|----------------------------|-------------------------------------|-------------------------------------|-----|-----|-----|-------|
| 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 | $I_C = 0.1 \text{ mA}, V_{CE} = 1.0 \text{ V}$ MMPQ3904 $I_C = 1.0 \text{ mA}, V_{CE} = 1.0 \text{ V}$ MMPQ3904 $I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$ MMPQ3904 $I_C = 50 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}$ | 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)

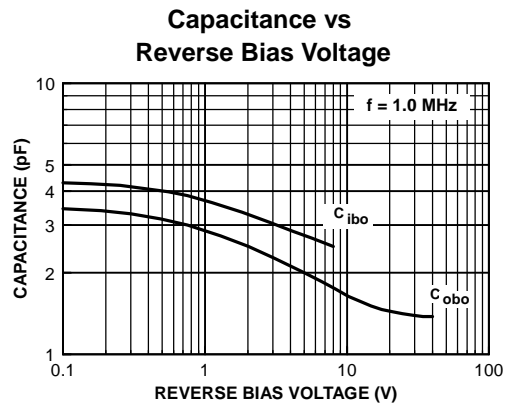
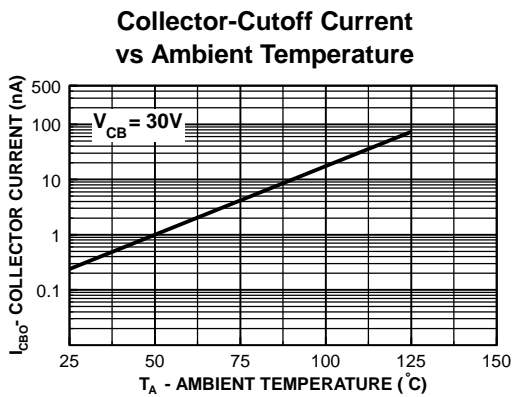
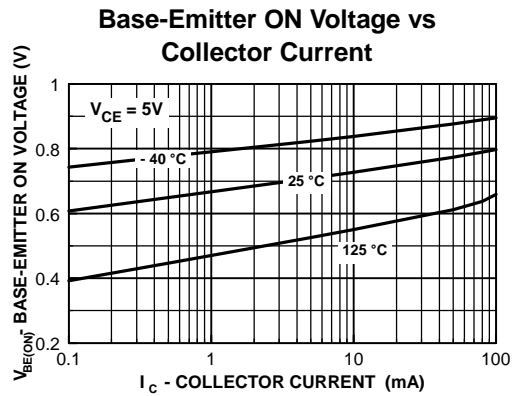
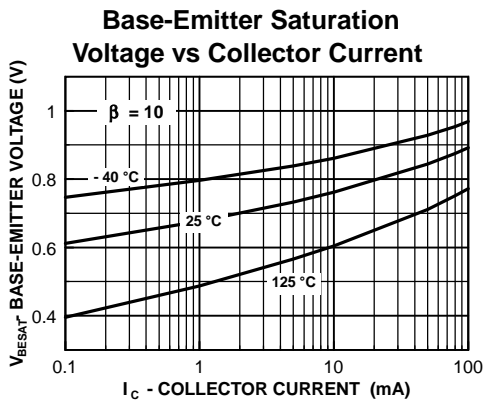
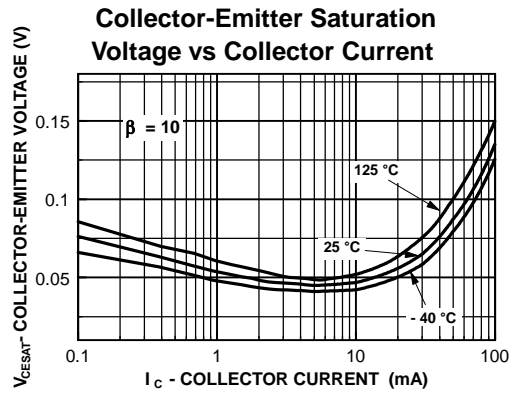
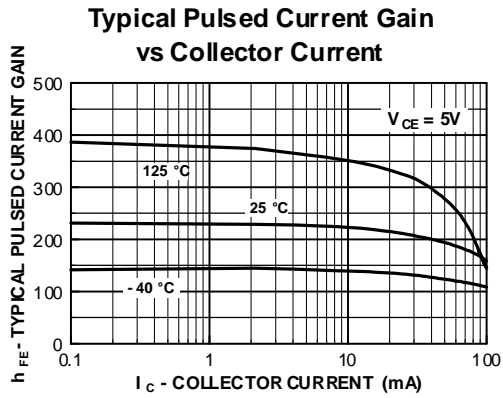
| | | | | | | |
|-----------|----------------------------------|--|--|-----|--|-----|
| f_T | Current Gain - Bandwidth Product | $I_C = 10 \text{ mA}, V_{CE} = 20 \text{ V},$ $f = 100 \text{ MHz}$ | | 250 | | MHz |
| C_{obo} | Output Capacitance | $V_{CB} = 5.0 \text{ V}, I_E = 0,$ $f = 140 \text{ kHz}$ | | 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.

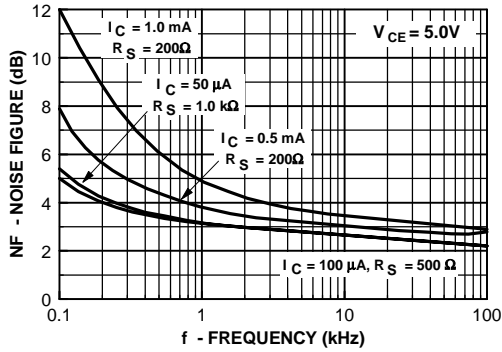
FFB3904 / FMB3904 / MMPQ3904

Typical Characteristics

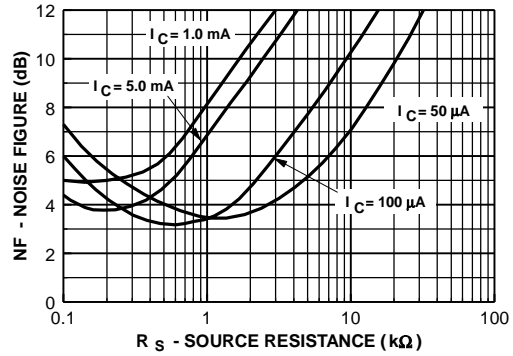


Typical Characteristics (continued)

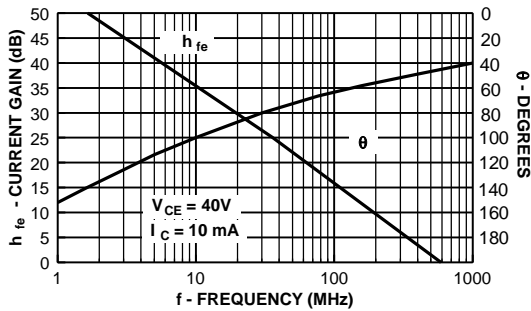
Noise Figure vs Frequency



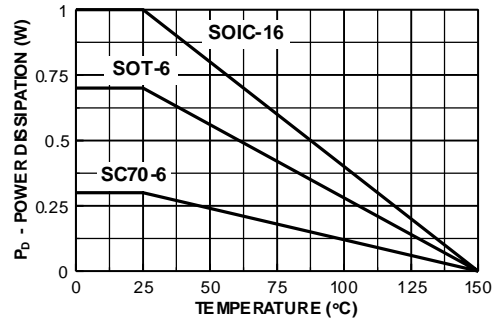
Noise Figure vs Source Resistance



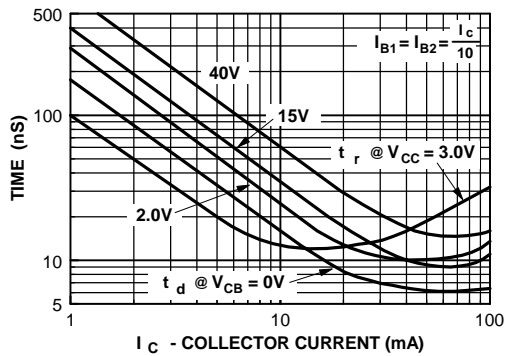
Current Gain and Phase Angle vs Frequency



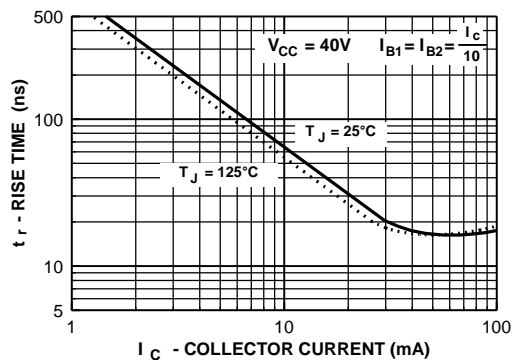
Power Dissipation vs Ambient Temperature



Turn-On Time vs Collector Current



Rise Time vs Collector Current



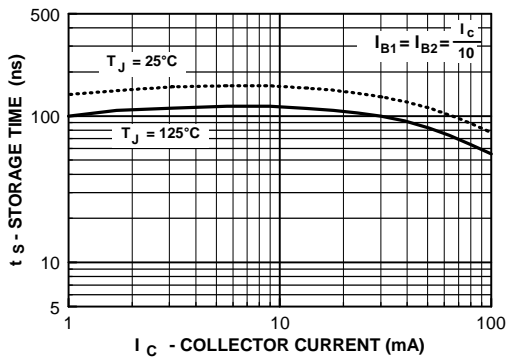
NPN Multi-Chip General Purpose Amplifier

(continued)

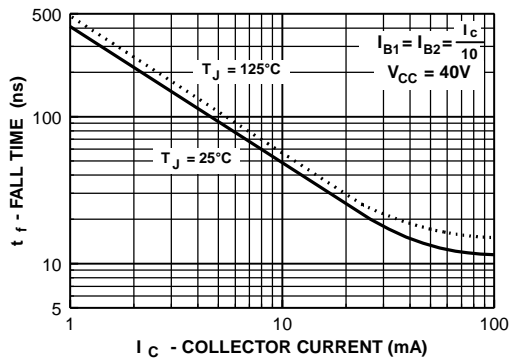
FFB3904 / FMB3904 / MMPQ3904

Typical Characteristics (continued)

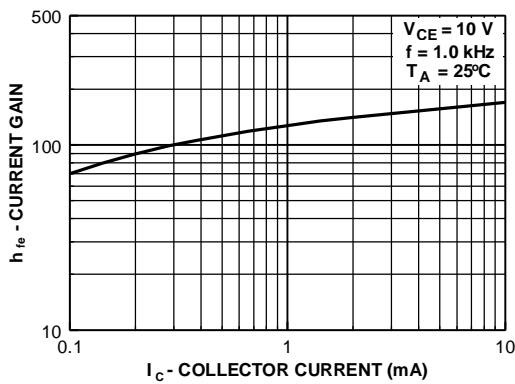
Storage Time vs Collector Current



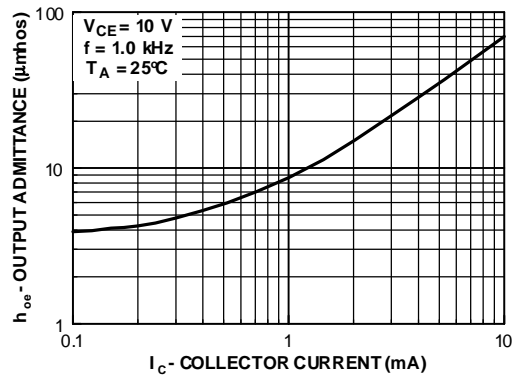
Fall Time vs Collector Current



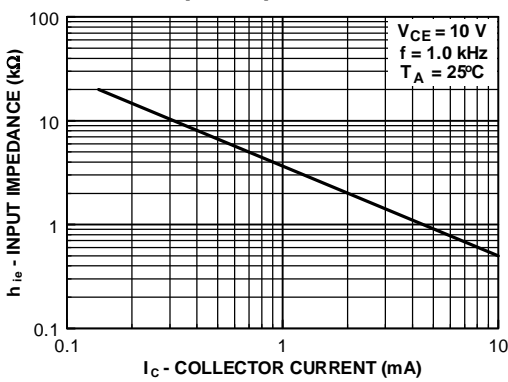
Current Gain



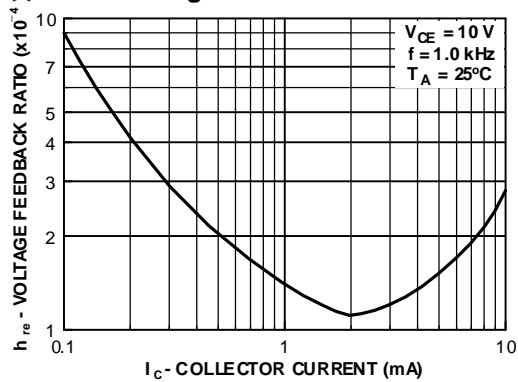
Output Admittance



Input Impedance



Voltage Feedback Ratio



Test Circuits

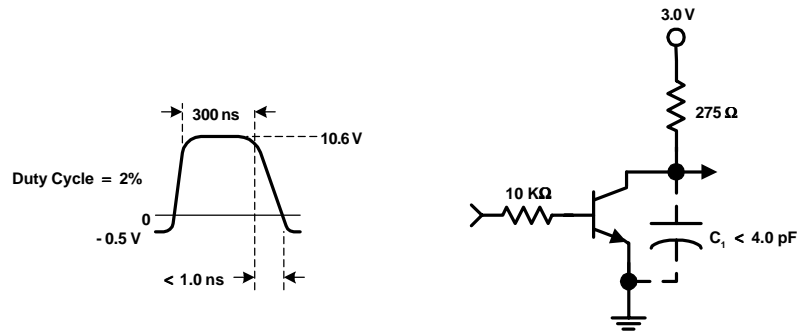


FIGURE 1: Delay and Rise Time Equivalent Test Circuit

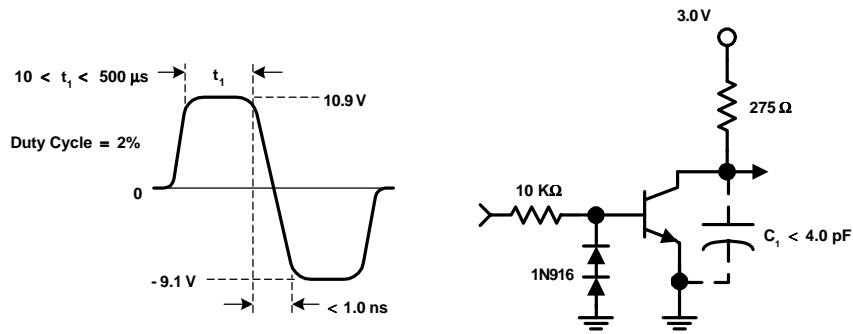


FIGURE 2: Storage and Fall Time Equivalent Test Circuit

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| E ² CMOS™ | MICROWIRE™ | SILENT SWITCHER® | |
| EnSigna™ | OPTOLOGIC™ | SMART START™ | |
| FACT™ | OPTOPLANAR™ | SuperSOT™-3 | |
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| FAST® | POP™ | SuperSOT™-8 | |

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