FAIRCHILD SEMICONDUCTOR®

June 2013

FFB3904 / FMB3904 / MMPQ3904
NPN Multi-Chip General Purpose Amplifier

Description

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.

Ordering Information

Part Number	Top Mark	Package	Packing Method
2N5551TA	5551	TO-92 3L	Ammo
2N5551TFR	5551	TO-92 3L	Tape and Reel
2N5551TF	5551	TO-92 3L	Tape and Reel

Block Diagram

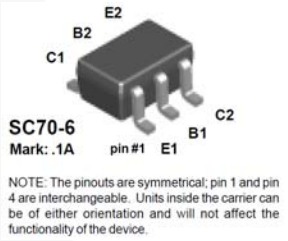

Figure 1. FFB3904 Device Package

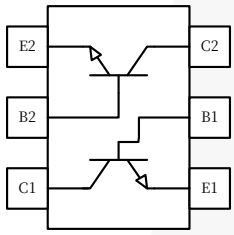

Figure 2. FFB3904 Internal Connection

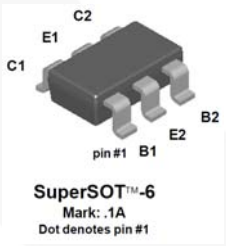

Figure 3. FMB3904 Device Package

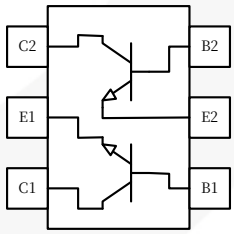

Figure 4. FMB3904 Internal Connection

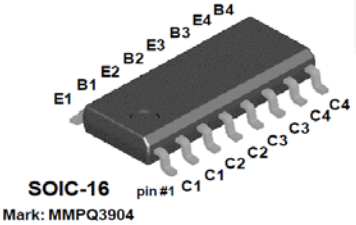

Figure 5. MMPQ3904 Device Package

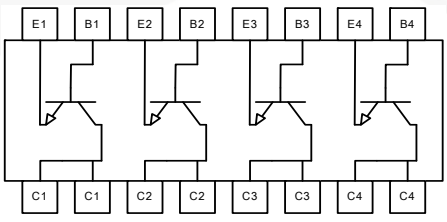

Figure 6. MMPQ3904 Internal Connection

Absolute Maximum Ratings(1)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°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}	Junction and Storage Temperature	-55 to +150	°C

Notes:

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

Thermal Characteristics(2)

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Maximum			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/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	415	180		°C/W
	Effective 4 Die			125	°C/W
	Each Die			240	°C/W

Note:

2. PCB Board Size: FR-4 76 x 114 x 0.6T mm^3(3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics[3]

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristics						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 1.0 mA, I_B = 0	40			V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 μA, I_E = 0	60			V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 μA, I_C = 0	6.0			V
I_{BL}	Base Cut-Off Current	V_{CE} = 30 V, I_E = 0			50	nA
I_{CEX}	Collector Cut-Off Current	V_{CE} = 30 V, I_C = 0			50	nA
On Characteristics[4]						
h_{FE}	DC Current Gain	I_C = 0.1 mA, V_{CE} = 1.0 V	40		300	
		MMPQ3904	30			
		I_C = 1.0 mA, V_{CE} = 1.0 V	70			
		MMPQ3904	50			
		I_C = 10 mA, V_{CE} = 1.0 V	100			
		MMPQ3904	75			
		I_C = 50 mA, V_{CE} = 1.0 V	60			
		I_C = 100 mA, V_{CE} = 1.0 V	30			
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA			0.2	V
		I_C = 50 mA, I_B = 5.0 mA			0.3	V
$V_{BE(sat)}$	Base-Emitter On Voltage	I_C = 10 mA, I_B = 1.0 mA	0.65		0.85	V
		I_C = 50 mA, I_B = 5.0 mA			0.95	V
Small-Signal Characteristics						
f_T	Current Gain-Bandwidth Product	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz		250		MHz
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 140 MHz		4.0		pF
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 140 MHz		8.0		pF

Notes:

3. All voltages (V) and currents (A) are negative polarity for PNP transistors.

4. Pulse Test: Pulse width ≤ 300 μs, duty cycle ≤ 2.0%.

Typical Performance Characteristics

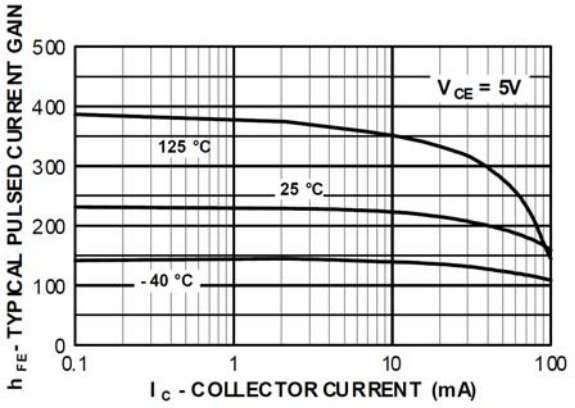

Figure 7. Typical Pulsed Current Gain vs. Collector Current

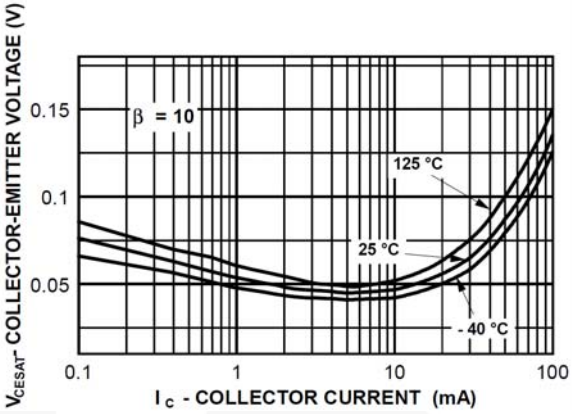

Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

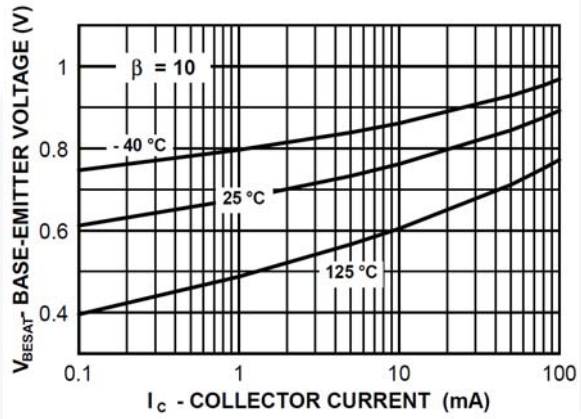

Figure 9. Base-Emitter Saturation Voltage vs. Collector Current

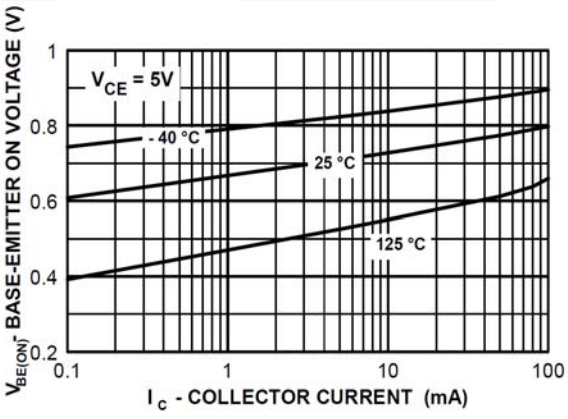

Figure 10. Base-Emitter ON Voltage vs. Collector Current

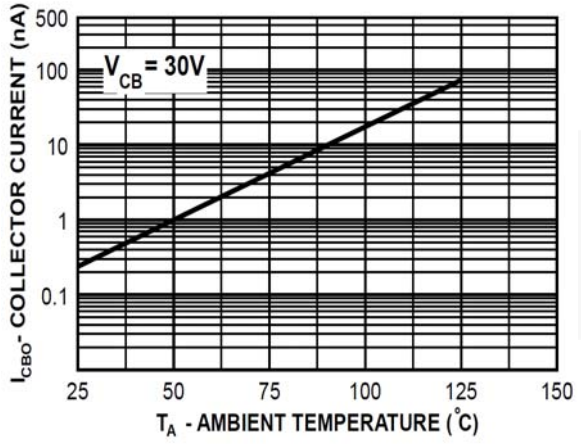

Figure 11. Collector Cut-Off Current vs. Ambient Temperature

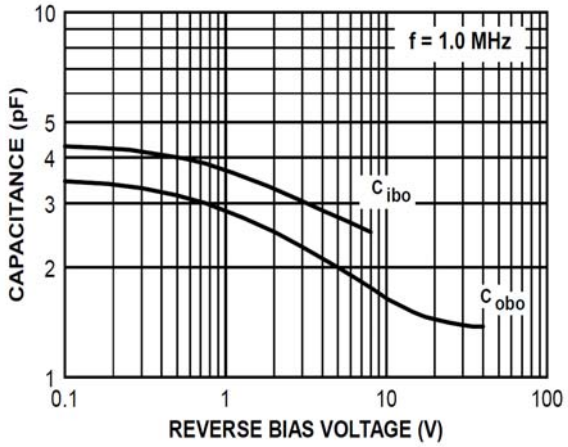

Figure 12. Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (Continued)

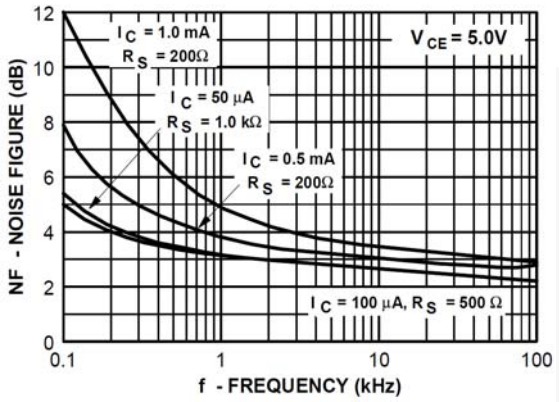

Figure 13. Noise Figure vs. Frequency

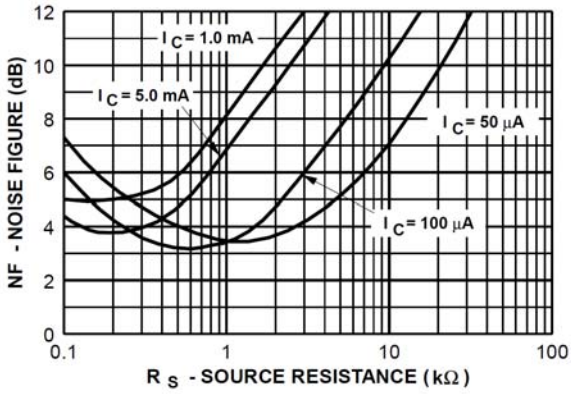

Figure 14. Noise Figure vs. Source Resistance

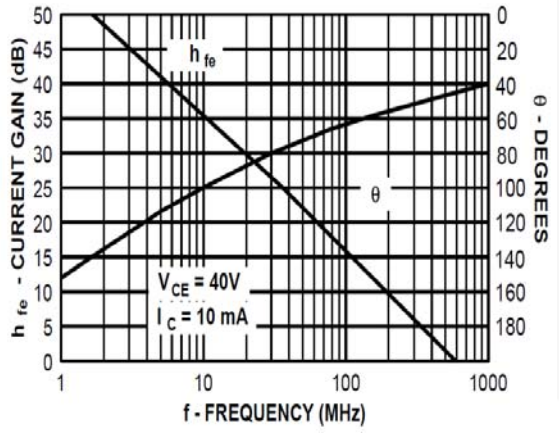

Figure 15. Current Gain and Phase Angle vs. Frequency

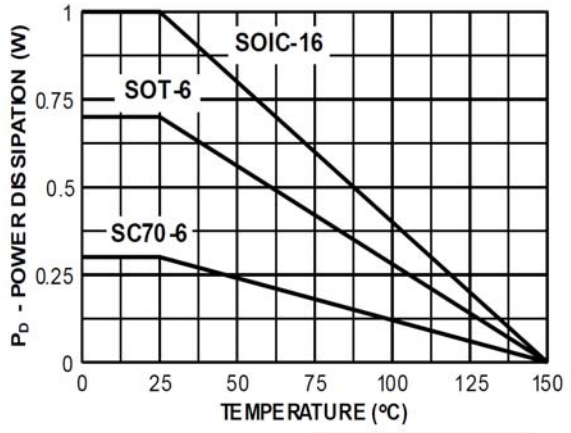

Figure 16. Power Dissipation vs. Ambient Temperature

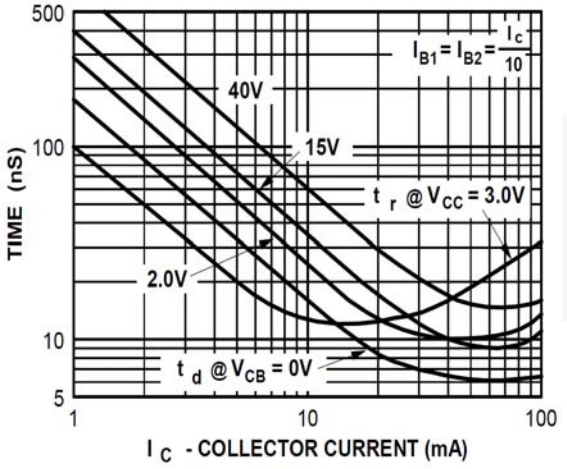

Figure 17. Turn-On Time vs. Collector Current

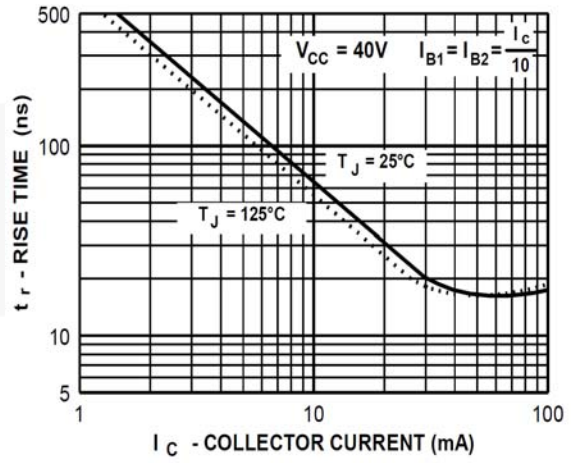

Figure 18. Rise Time vs. Collector Current

Typical Performance Characteristics (Continued)

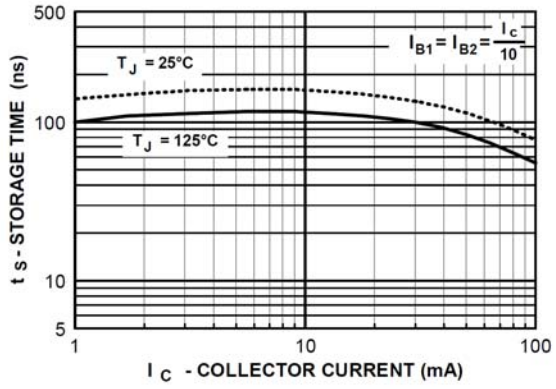

Figure 19. Storage Time vs. Collector Current

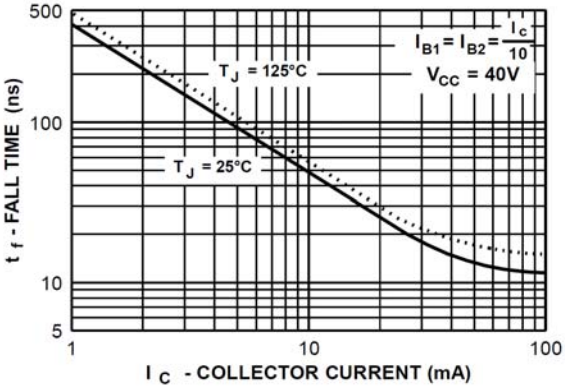

Figure 20. Fall Time vs. Collector Current

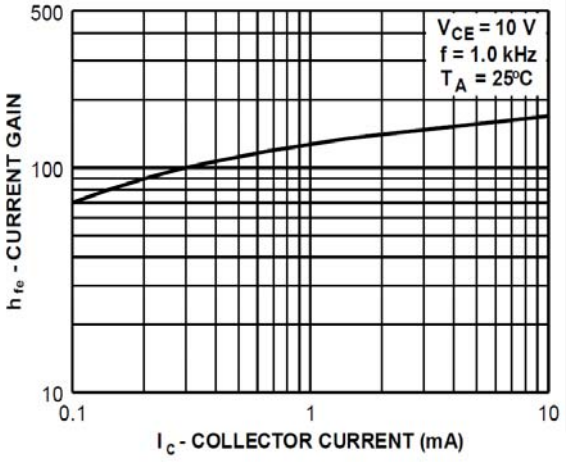

Figure 21. Current Gain

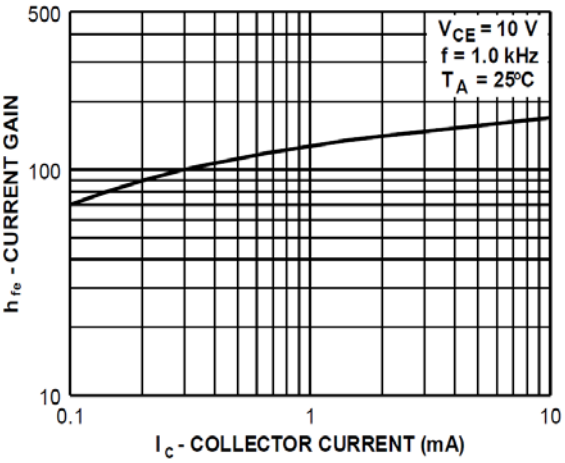

Figure 22. Output Admittance

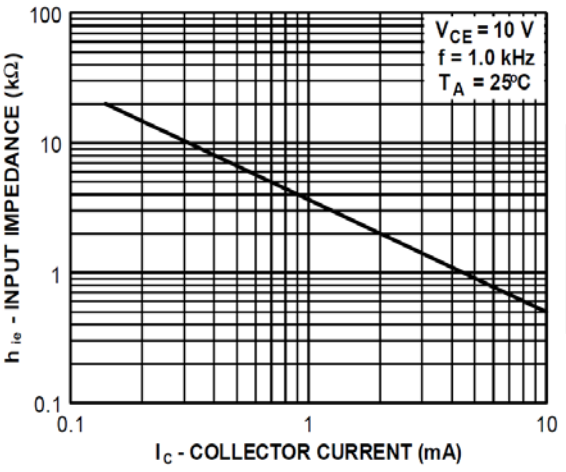

Figure 23. Input Impedance

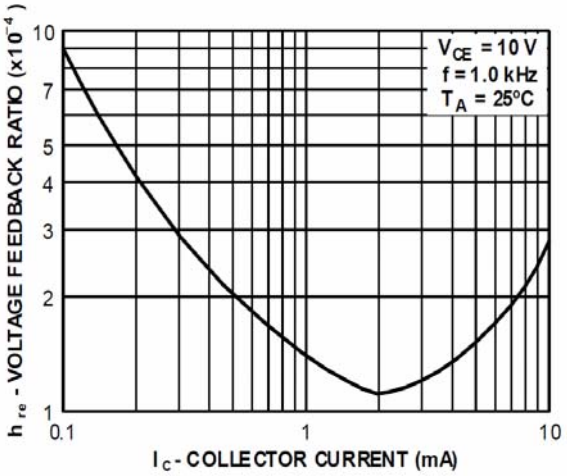

Figure 24. Voltage Feedback Ratio

Physical Dimensions

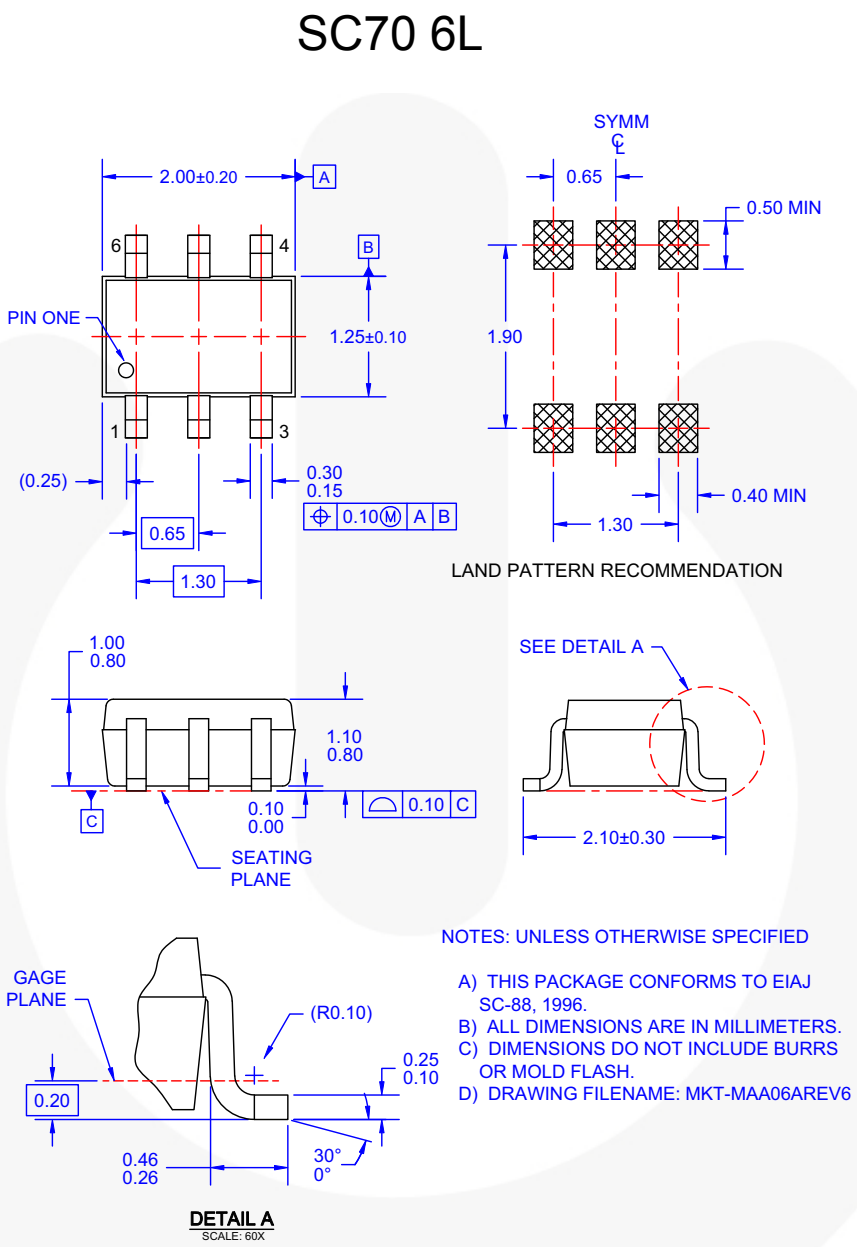

Figure 25. 6-LEAD, SC70, EIAJ SC-88, 1.25 MM WIDE (ACTIVE)

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Physical Dimensions (Continued)

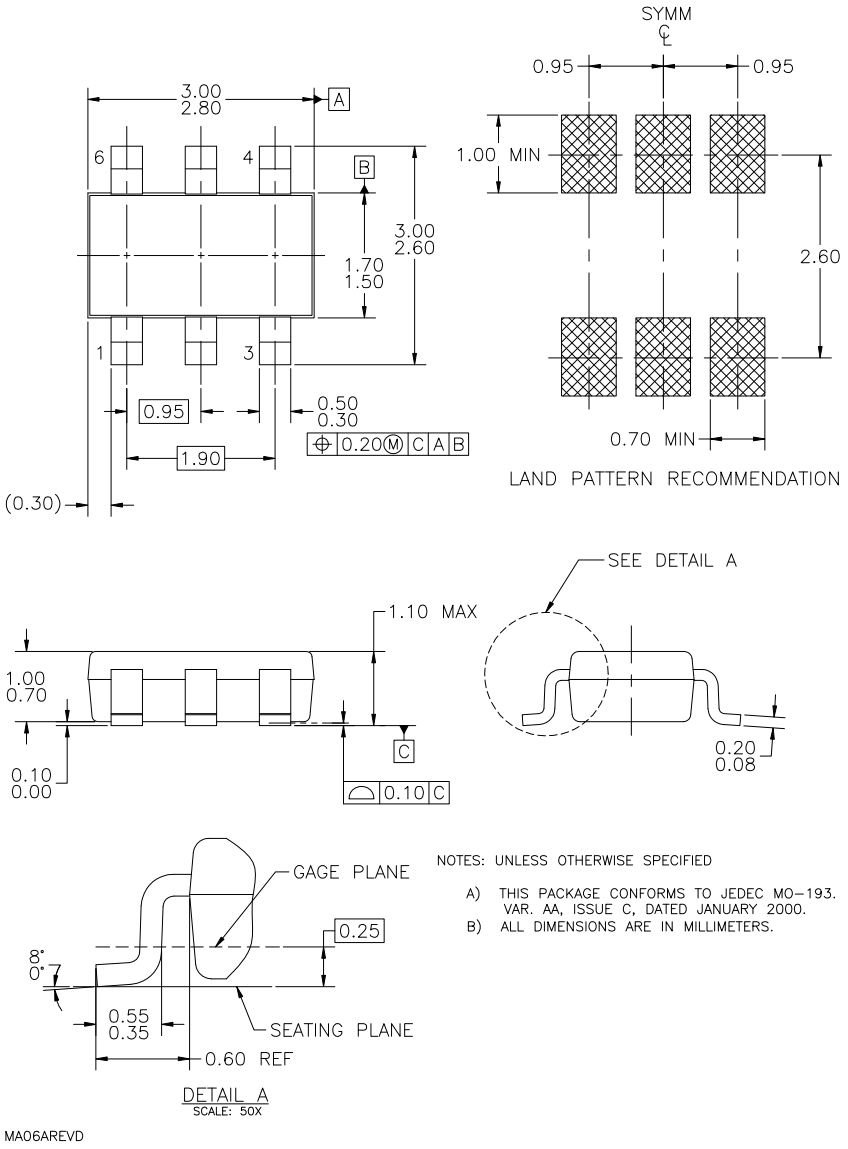

Figure 26. 6-LEAD, SUPER SOT-6, JEDEC MO-193, 1.6 MM WIDE (ACTIVE)

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Physical Dimensions (Continued)

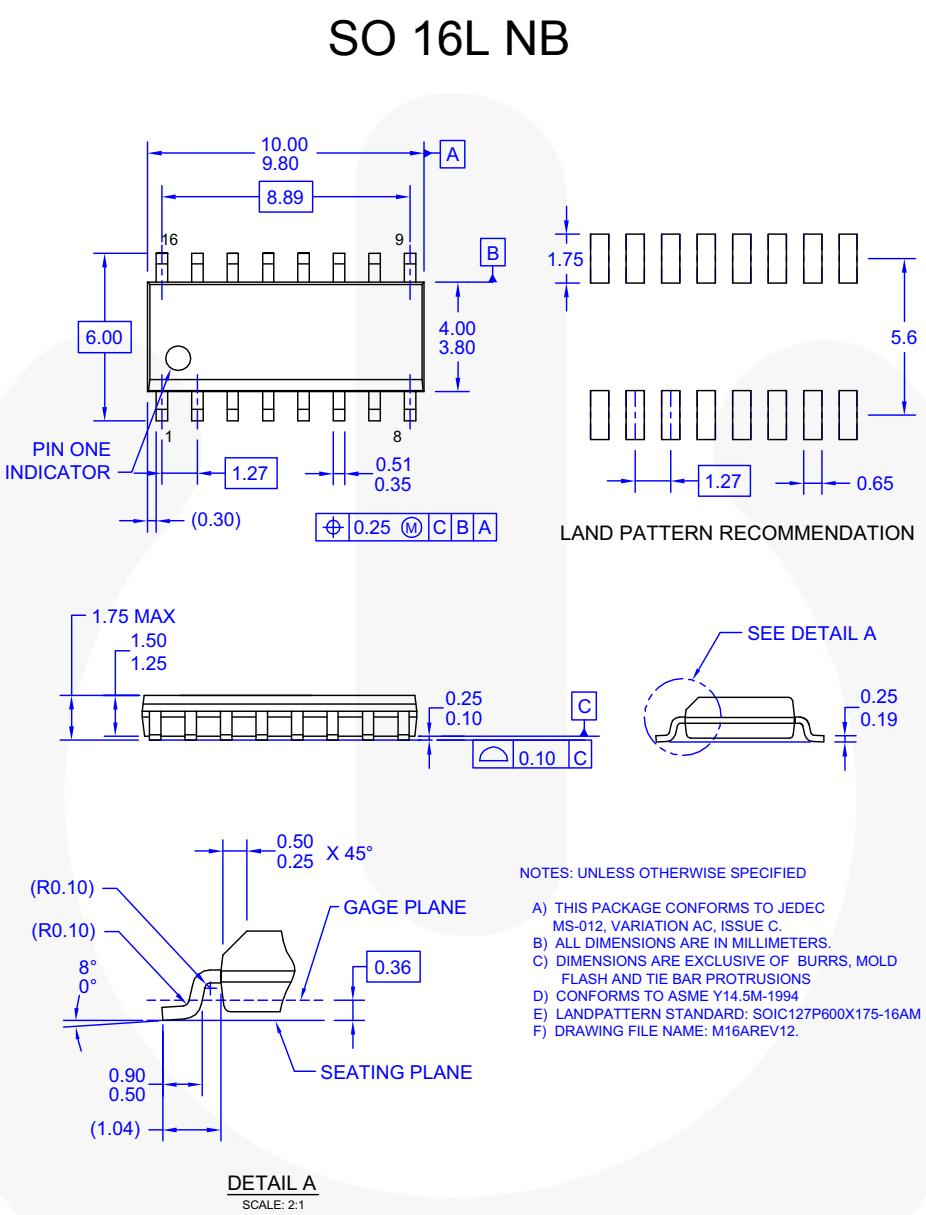

Figure 27. 16-LEAD, SOIC, JEDEC MS-012, 0.150 inch, NARROW BODY (ACTIVE)

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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