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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

December 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.

Block Diagram

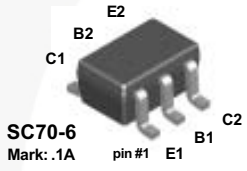

Figure 1. FFB3904 Device Package

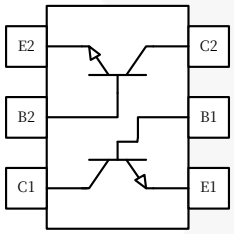

Figure 2. FFB3904 Internal Connection

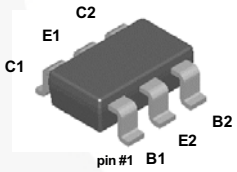

Figure 3. FMB3904 Device Package

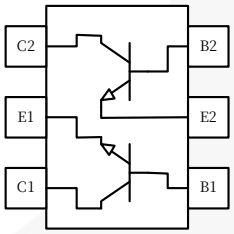

Figure 4. FMB3904 Internal Connection

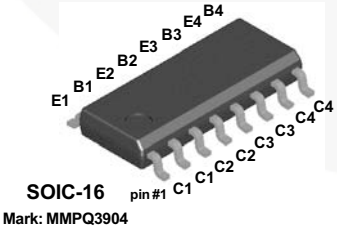

Figure 5. MMPQ3904 Device Package

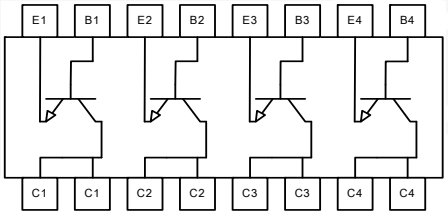

Figure 6. MMPQ3904 Internal Connection

Ordering Information

Part Number	Top Mark	Package	Packing Method
FFB3904	.1A	SC70 6L	Tape and Reel
FMB3904	.1A	SSOT 6L	Tape and Reel
MMPQ3904	MMPQ3904	SOIC 16L	Tape and Reel

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	Unit
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	°C

Note:

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.

Thermal Characteristics(2)

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

Symbol	Parameter	Max.			Unit
		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
	Thermal Resistance, Junction to Ambient, Effective 4 Die			125	
	Thermal Resistance, Junction to Ambient, Each Die			240	

Note:

2. PCB 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

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

Symbol	Parameter		Conditions	Min.	Typ.	Max.	Unit
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, V_{BE} = -3 V			50	nA
I_{CEX}	Collector Cut-Off Current		V_{CE} = 30 V, V_{BE} = -3 V			50	nA
On Characteristics[3]							
h_{FE}	DC Current Gain	FFB3904, FMB3904	I_C = 0.1 mA, V_{CE} = 1.0 V	40			
		MMPQ3904		30			
		FFB3904, FMB3904	I_C = 1.0 mA, V_{CE} = 1.0 V	70			
		MMPQ3904		50			
		FFB3904, FMB3904	I_C = 10 mA, V_{CE} = 1.0 V	100		300	
		MMPQ3904		75			
		All Devices	I_C = 50 mA, V_{CE} = 1.0 V	60			
		All Devices	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_{BE}(sat)	Base-Emitter Saturation 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	
Small-Signal Characteristics (MMPQ3904 only)							
f_T	Current Gain-Bandwidth Product		I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz		250		MHz
C_{ob}	Output Capacitance		V_{CB} = 5.0 V, I_E = 0, f = 140 kHz		4.0		pF
C_{ib}	Input Capacitance		V_{BE} = 0.5 V, I_C = 0, f = 140 kHz		8.0		pF

Note:

3. Pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2.0%.

Typical Performance Characteristics

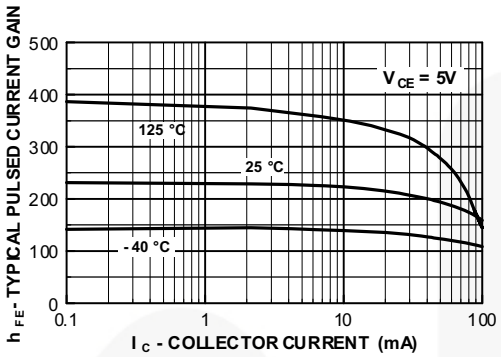

Figure 7. Typical Pulsed Current Gain vs. Collector Current

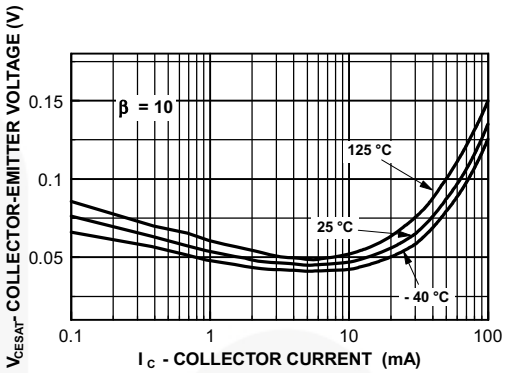

Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

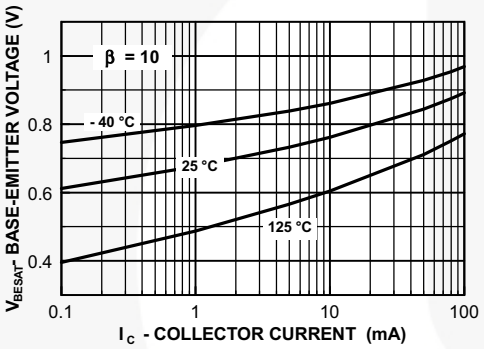

Figure 9. Base-Emitter Saturation Voltage vs. Collector Current

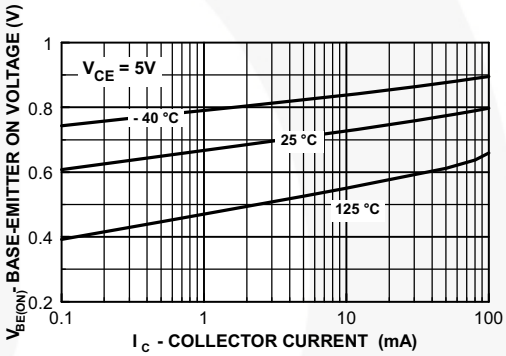

Figure 10. Base-Emitter On Voltage vs. Collector Current

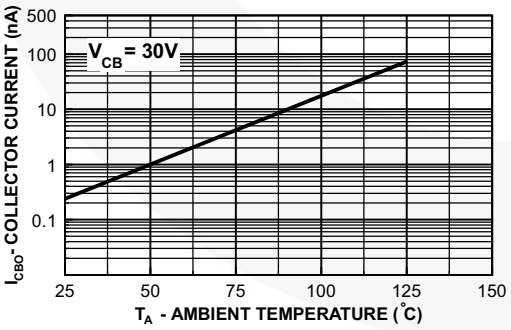

Figure 11. Collector Cut-Off Current vs. Ambient Temperature

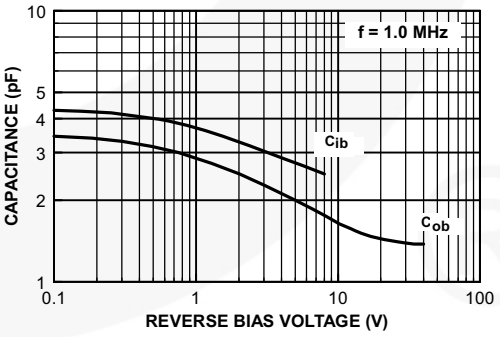

Figure 12. Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (Continued)

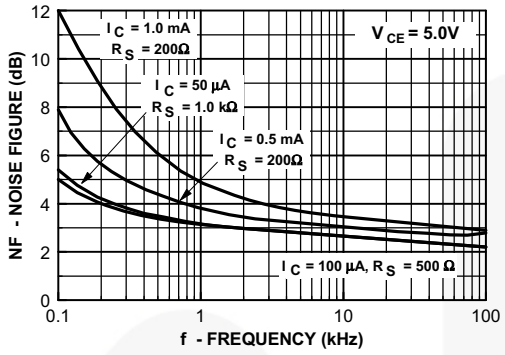

Figure 13. Noise Figure vs. Frequency

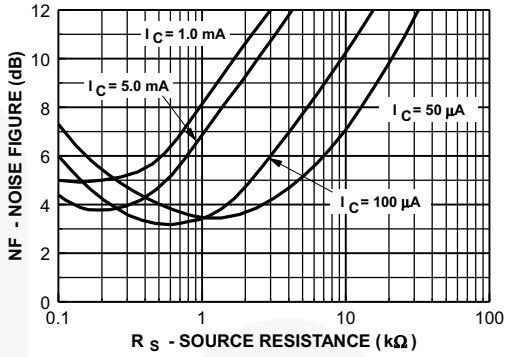

Figure 14. Noise Figure vs. Source Resistance

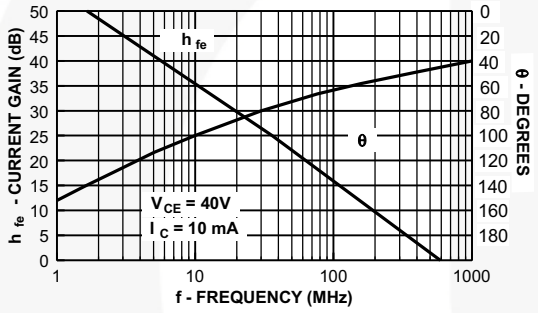

Figure 15. Current Gain and Phase Angle vs. Frequency

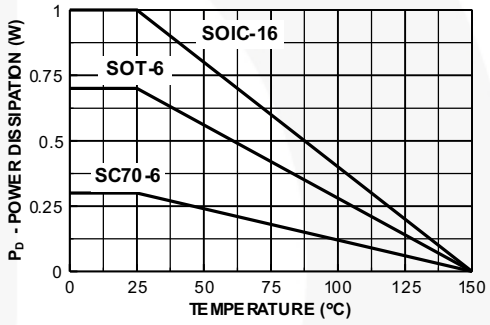

Figure 16. Power Dissipation vs. Ambient Temperature

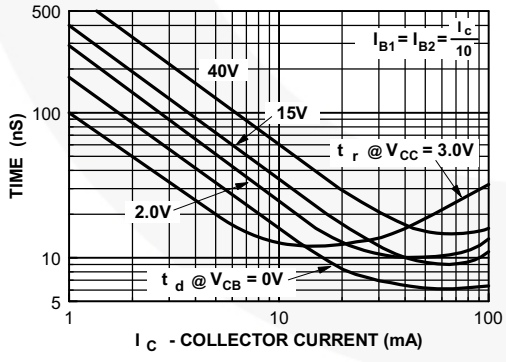

Figure 17. Turn-On Time vs. Collector Current

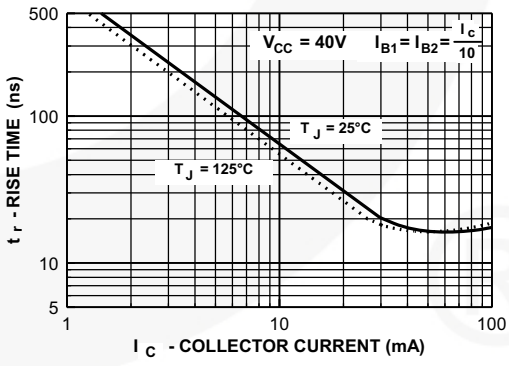

Figure 18. Rise Time vs. Collector Current

Typical Performance Characteristics (Continued)

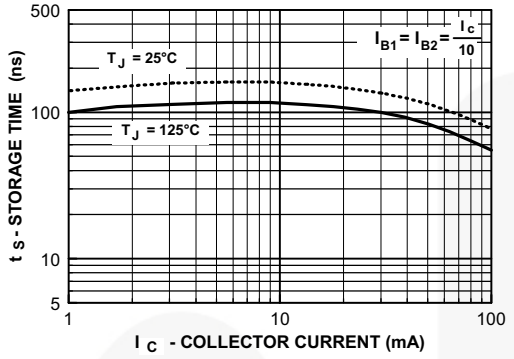

Figure 19. Storage Time vs. Collector Current

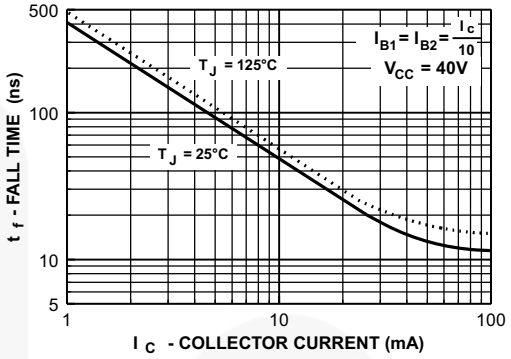

Figure 20. Fall Time vs. Collector Current

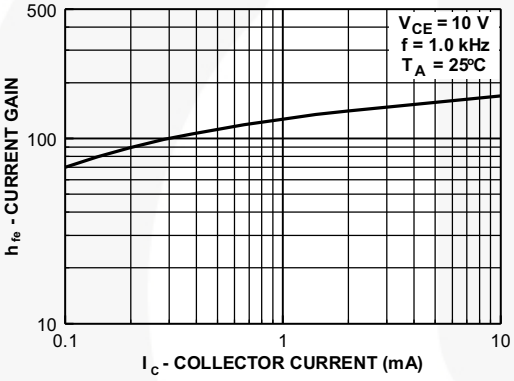

Figure 21. Current Gain

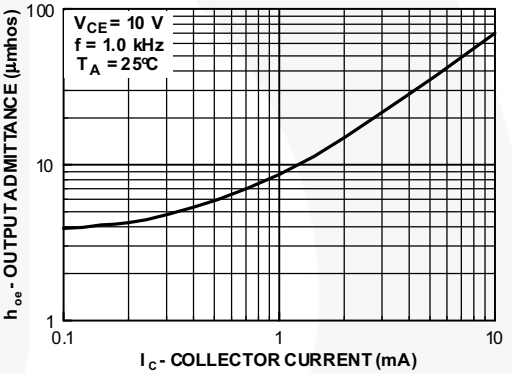

Figure 22. Output Admittance

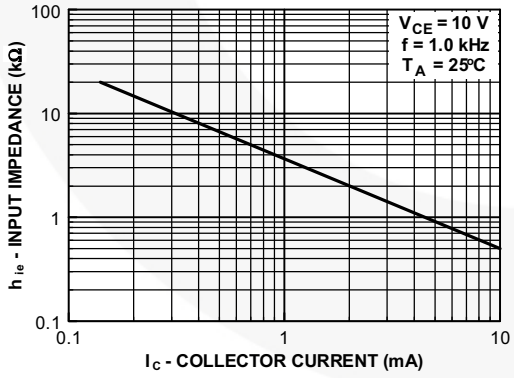

Figure 23. Input Impedance

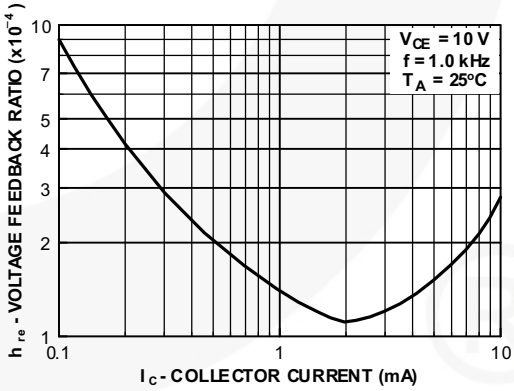

Figure 24. Voltage Feedback Ratio

Physical Dimensions

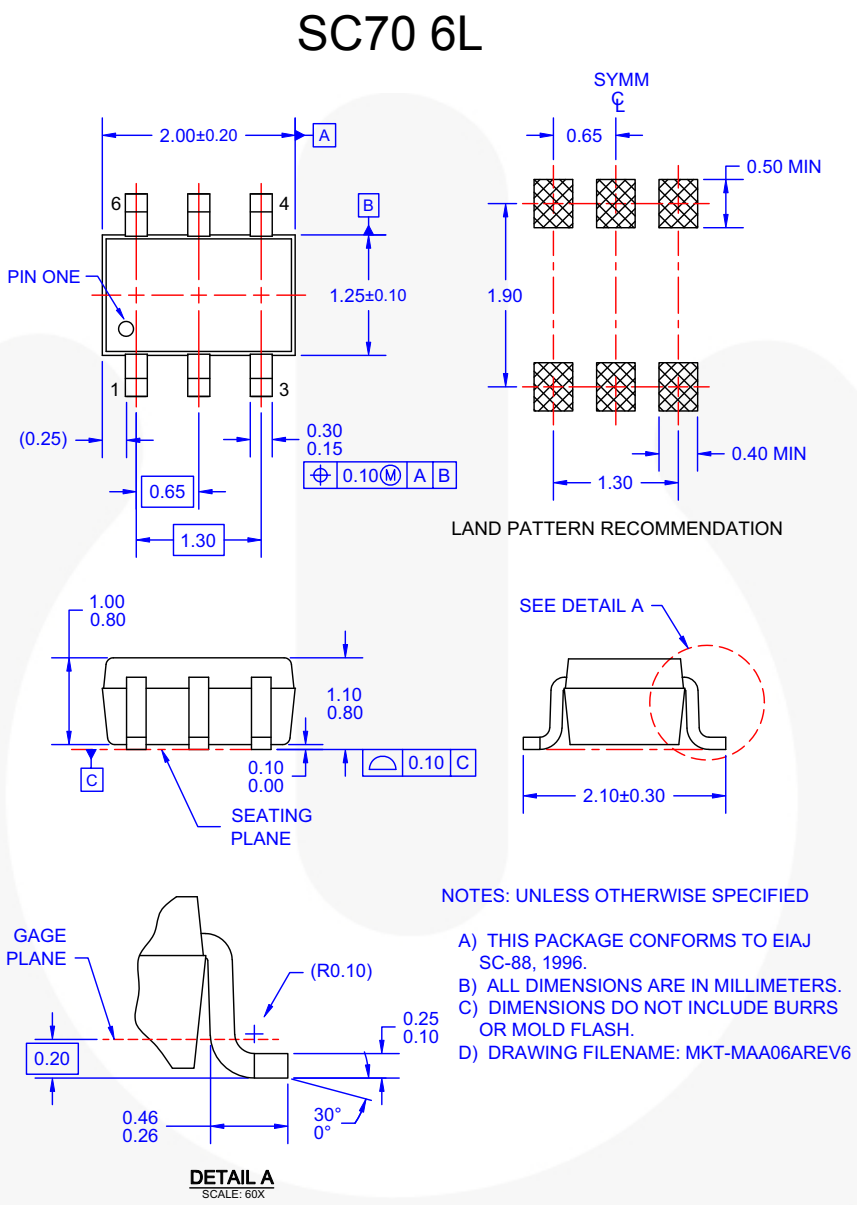

Figure 25. 6-LEAD, SC70, EIAJ SC-88, 1.25 MM WIDE (ACTIVE)

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Physical Dimensions (Continued)

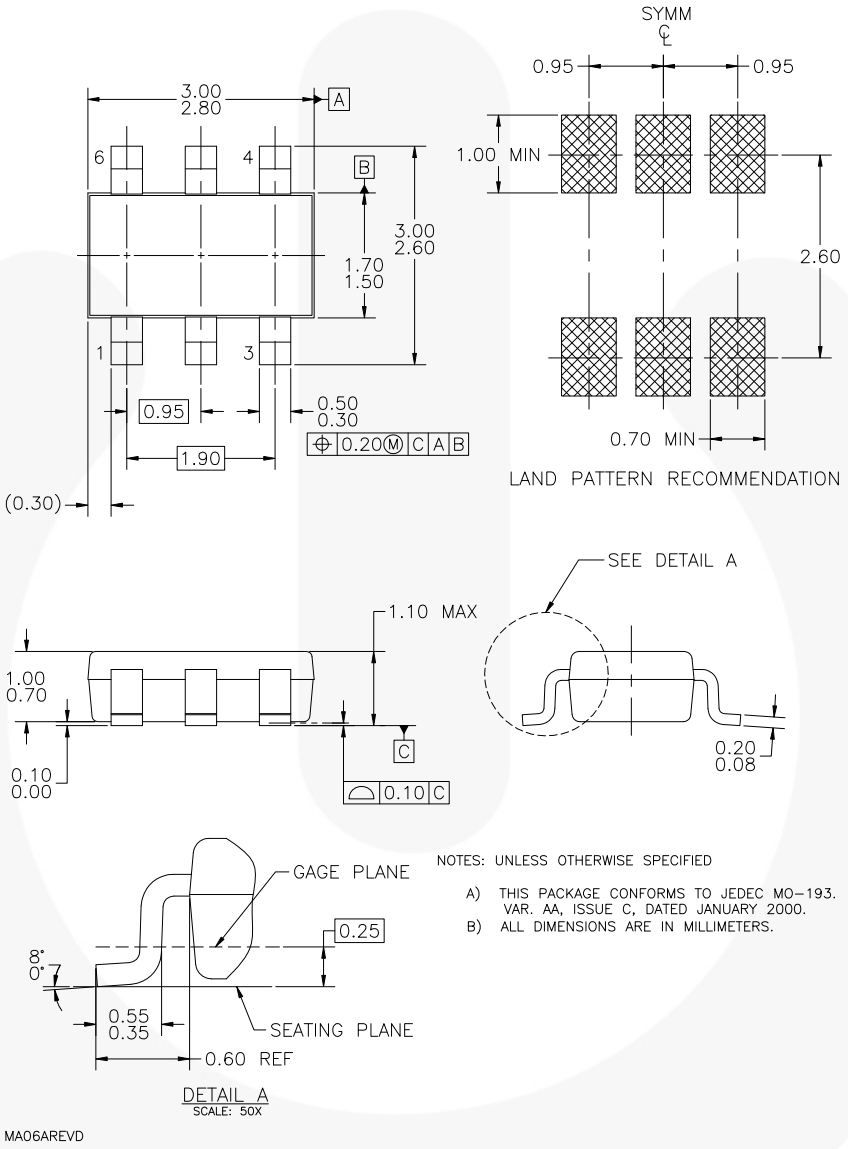

Figure 26. 6-LEAD, SUPERSOT-6, JEDEC MO-193, 1.6 MM WIDE (ACTIVE)

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Physical Dimensions (Continued)

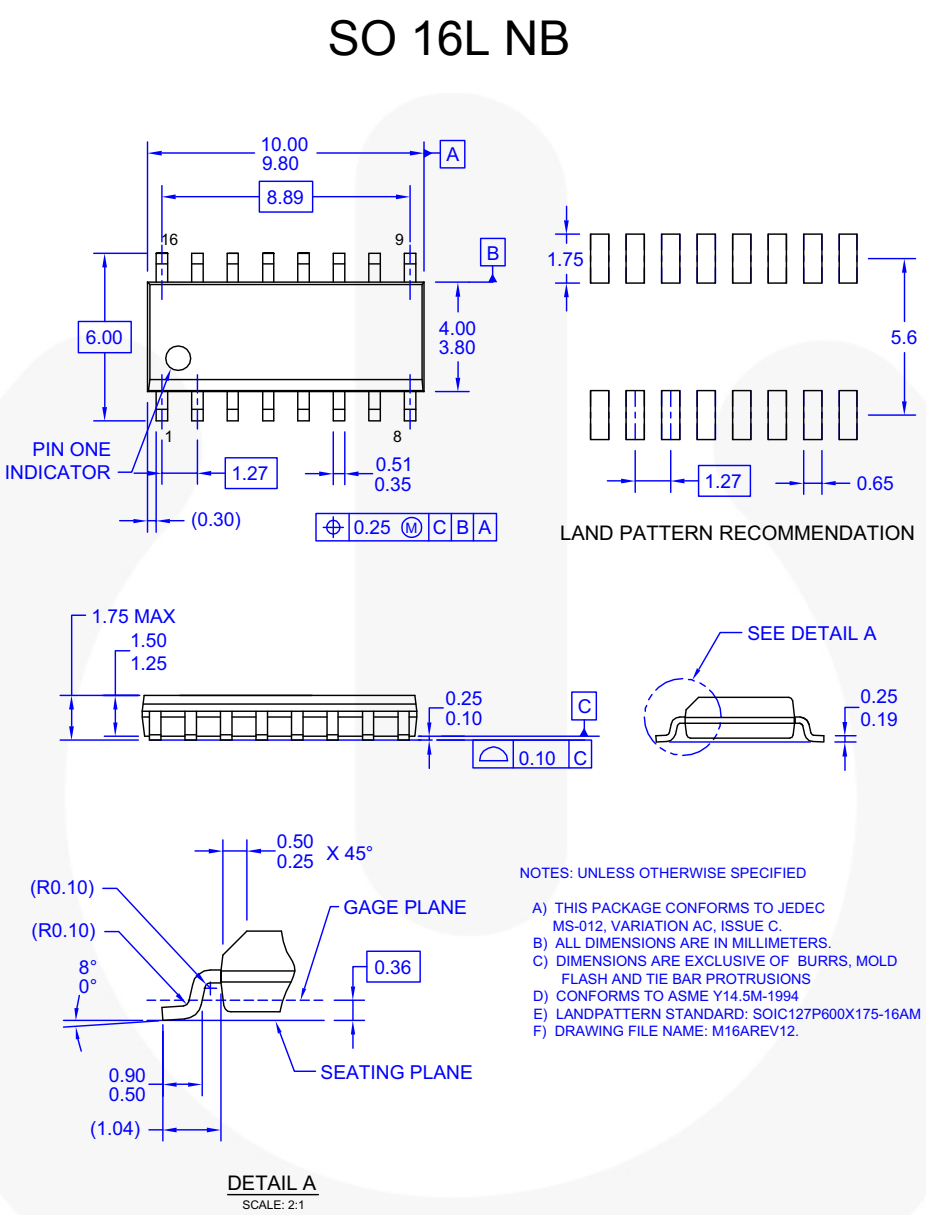

Figure 27. 16-LEAD, SOIC, JEDEC MS-012, 0.150 inch, NARROW BODY (ACTIVE)

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.

Rev. I66

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