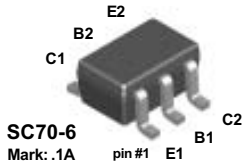
ON Semiconductor®

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



The pinouts are symmetrical; pin 1 and pin 4 are interchangeable. Units inside the carrier tape can be of either orientation (0 deg and 180 deg) and will not affect the functionality of the device.

Figure 1. FFB3904 Device Package

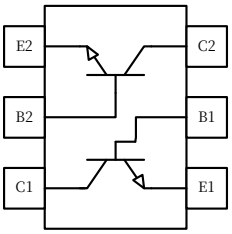


Figure 2. FFB3904 Internal Connection

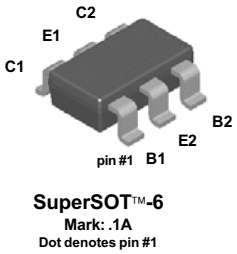


Figure 3. FMB3904 Device Package

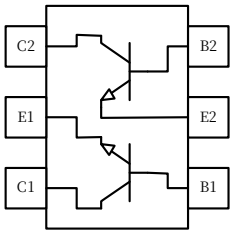


Figure 4. FMB3904 Internal Connection

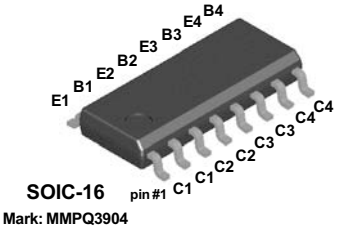


Figure 5. MMPQ3904 Device Package

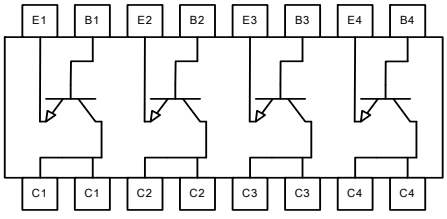


Figure 6. MMPQ3904 Internal Connection

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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. ON 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

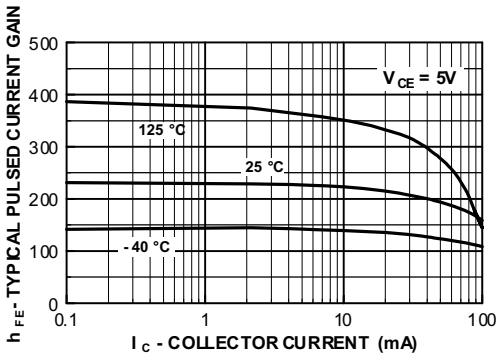


Figure 7. Typical Pulsed Current Gain vs. Collector Current

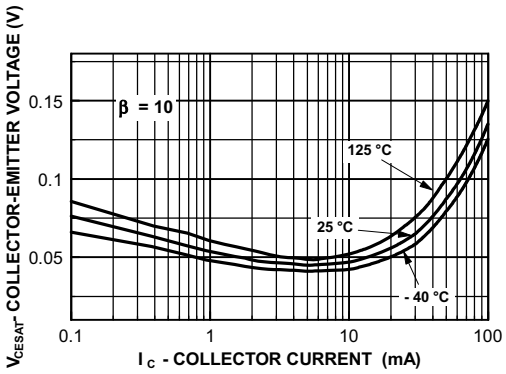


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

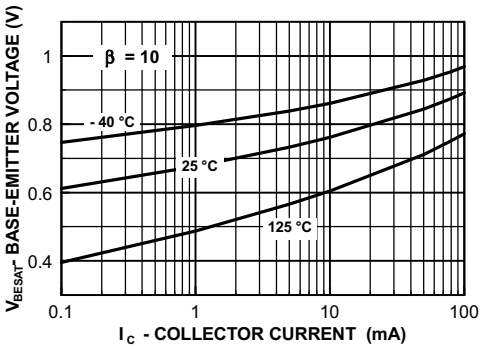


Figure 9. Base-Emitter Saturation Voltage vs. Collector Current

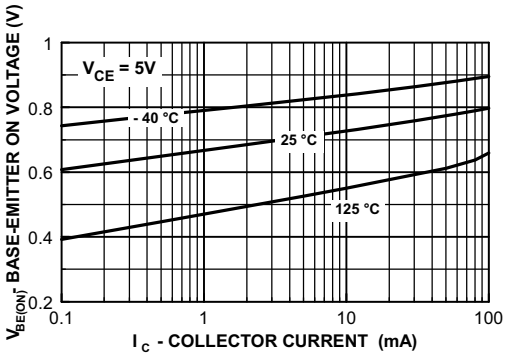


Figure 10. Base-Emitter On Voltage vs. Collector Current

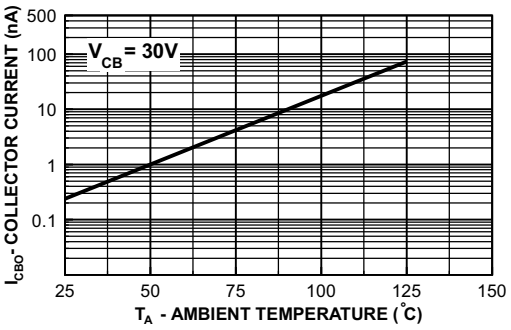


Figure 11. Collector Cut-Off Current vs. Ambient Temperature

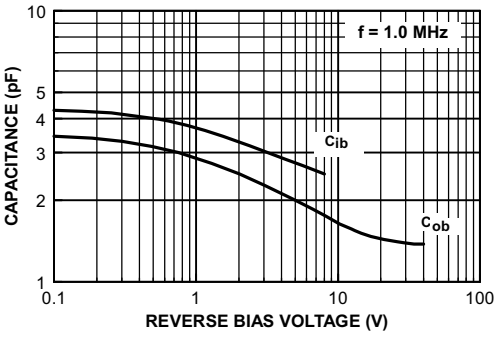


Figure 12. Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (Continued)

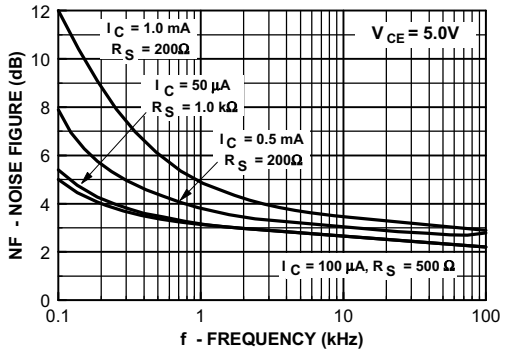


Figure 13. Noise Figure vs. Frequency

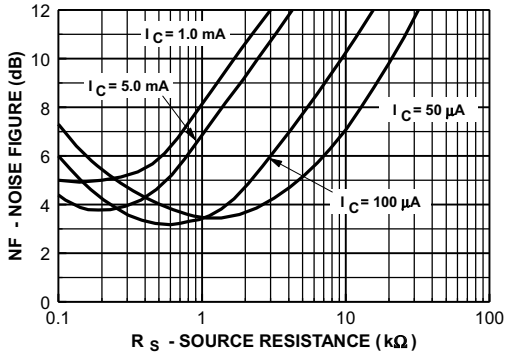


Figure 14. Noise Figure vs. Source Resistance

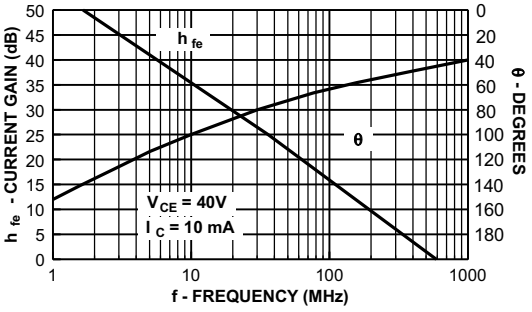


Figure 15. Current Gain and Phase Angle vs. Frequency

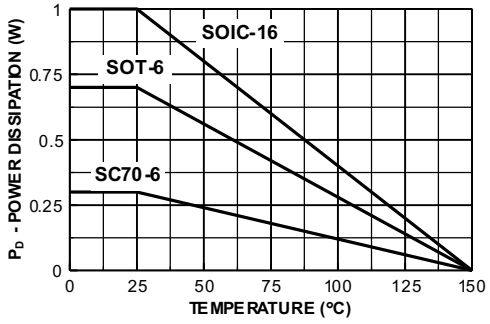


Figure 16. Power Dissipation vs. Ambient Temperature

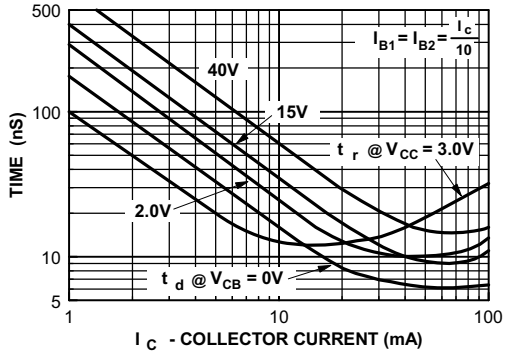


Figure 17. Turn-On Time vs. Collector Current

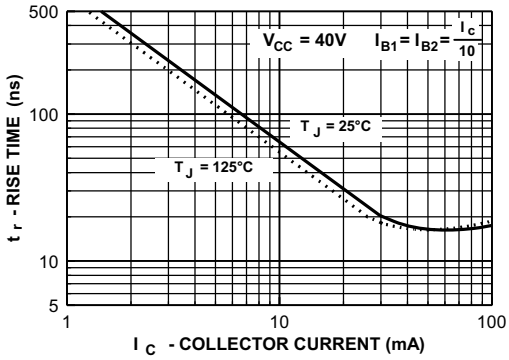


Figure 18. Rise Time vs. Collector Current

Typical Performance Characteristics (Continued)

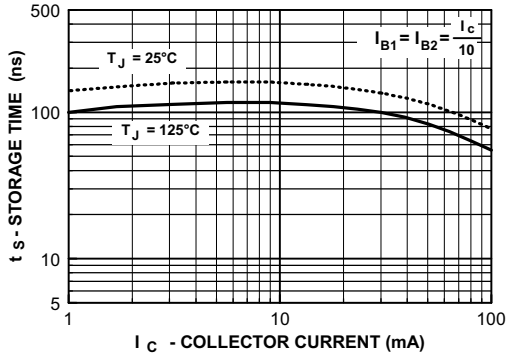


Figure 19. Storage Time vs. Collector Current

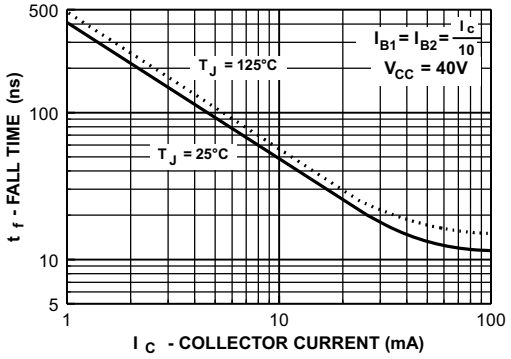


Figure 20. Fall Time vs. Collector Current

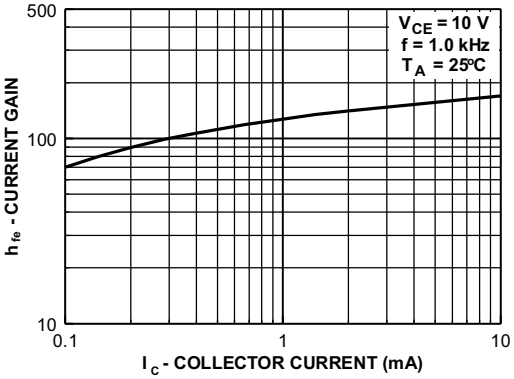


Figure 21. Current Gain

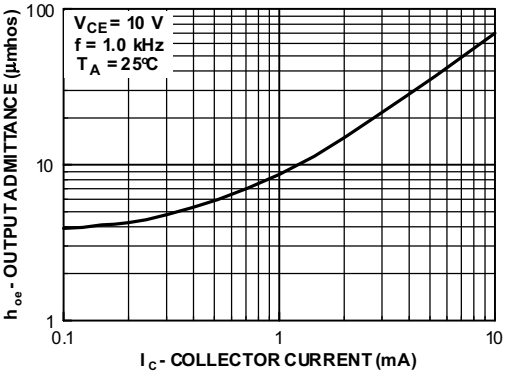


Figure 22. Output Admittance

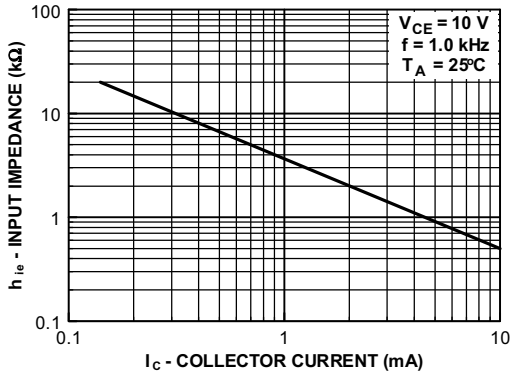


Figure 23. Input Impedance

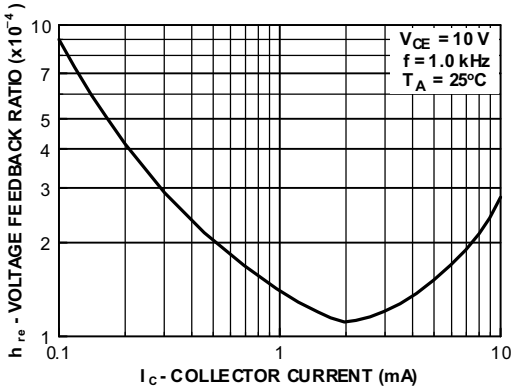


Figure 24. Voltage Feedback Ratio

Physical Dimensions

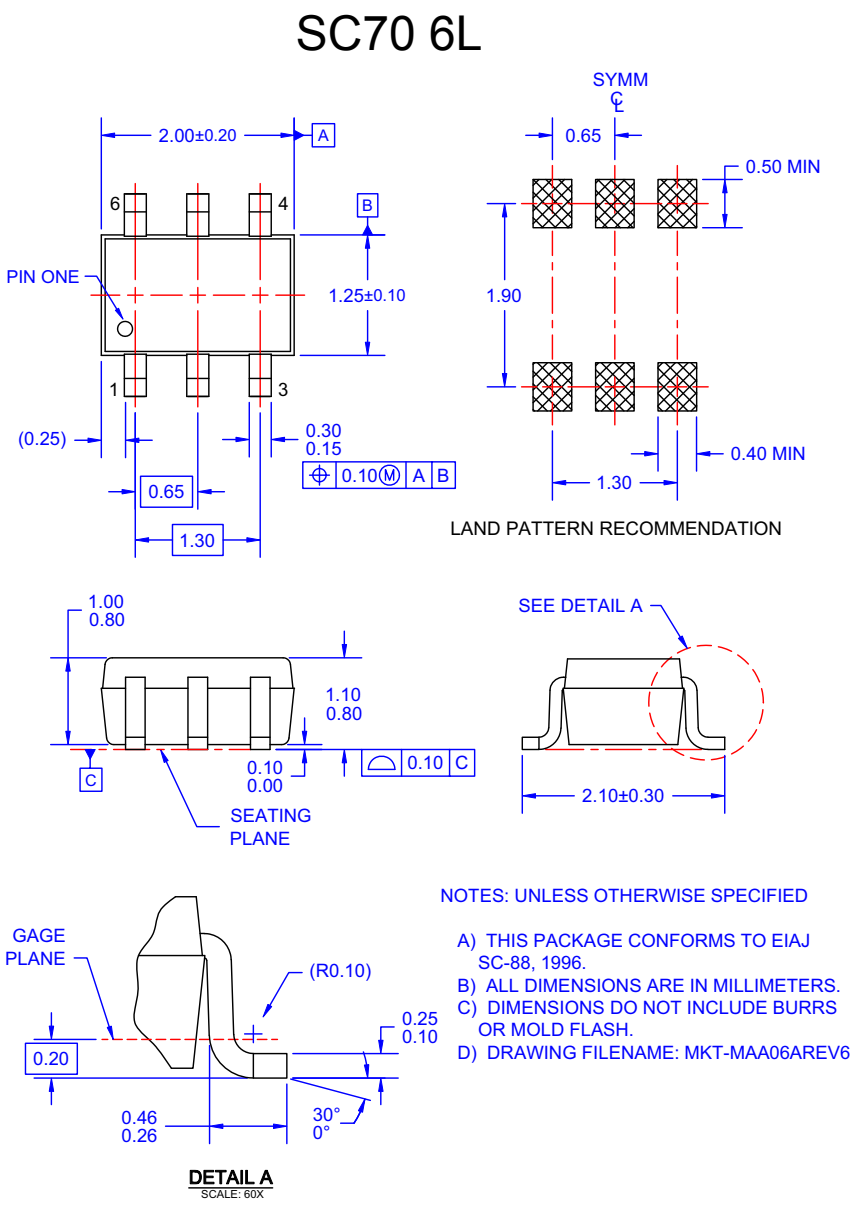


Figure 25. 6-LEAD, SC70, EIAJ SC-88, 1.25 MM WIDE (ACTIVE)

Physical Dimensions (Continued)

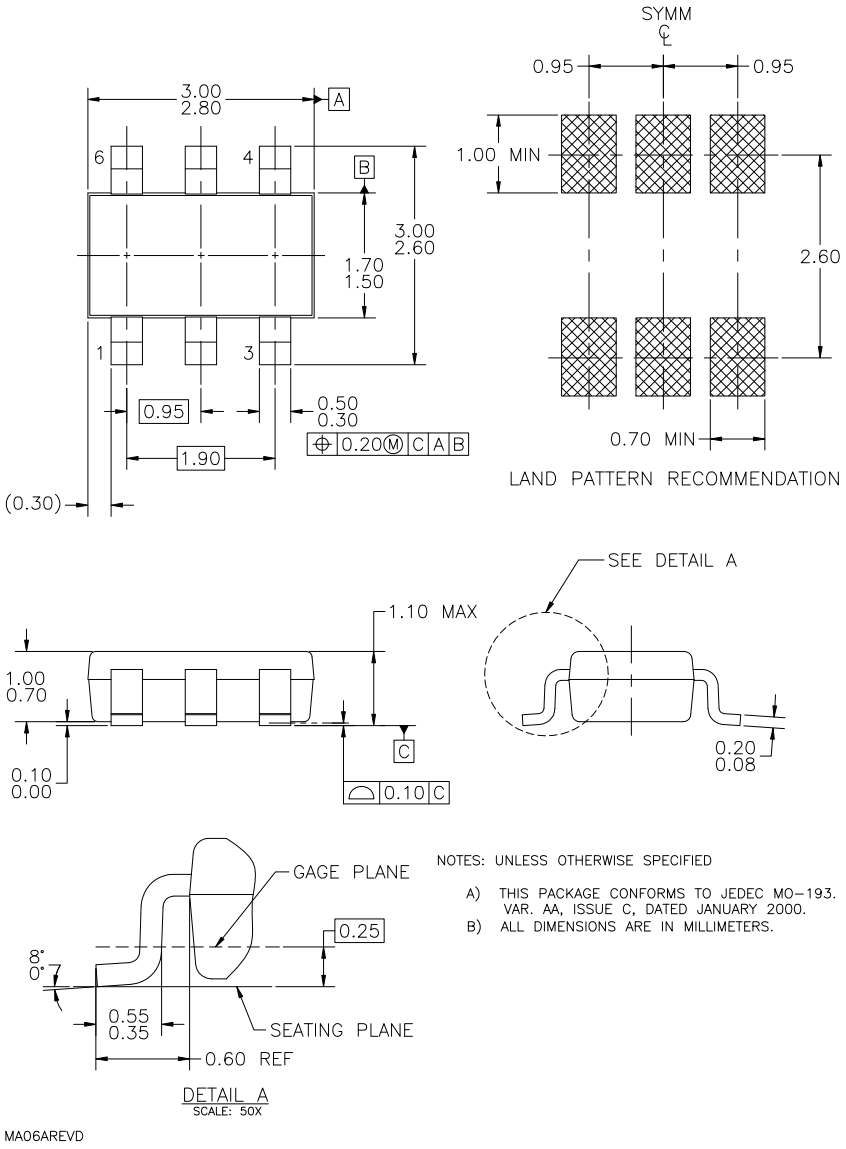


Figure 26. 6-LEAD, SUPERSOT-6, JEDEC MO-193, 1.6 MM WIDE (ACTIVE)

Physical Dimensions (Continued)

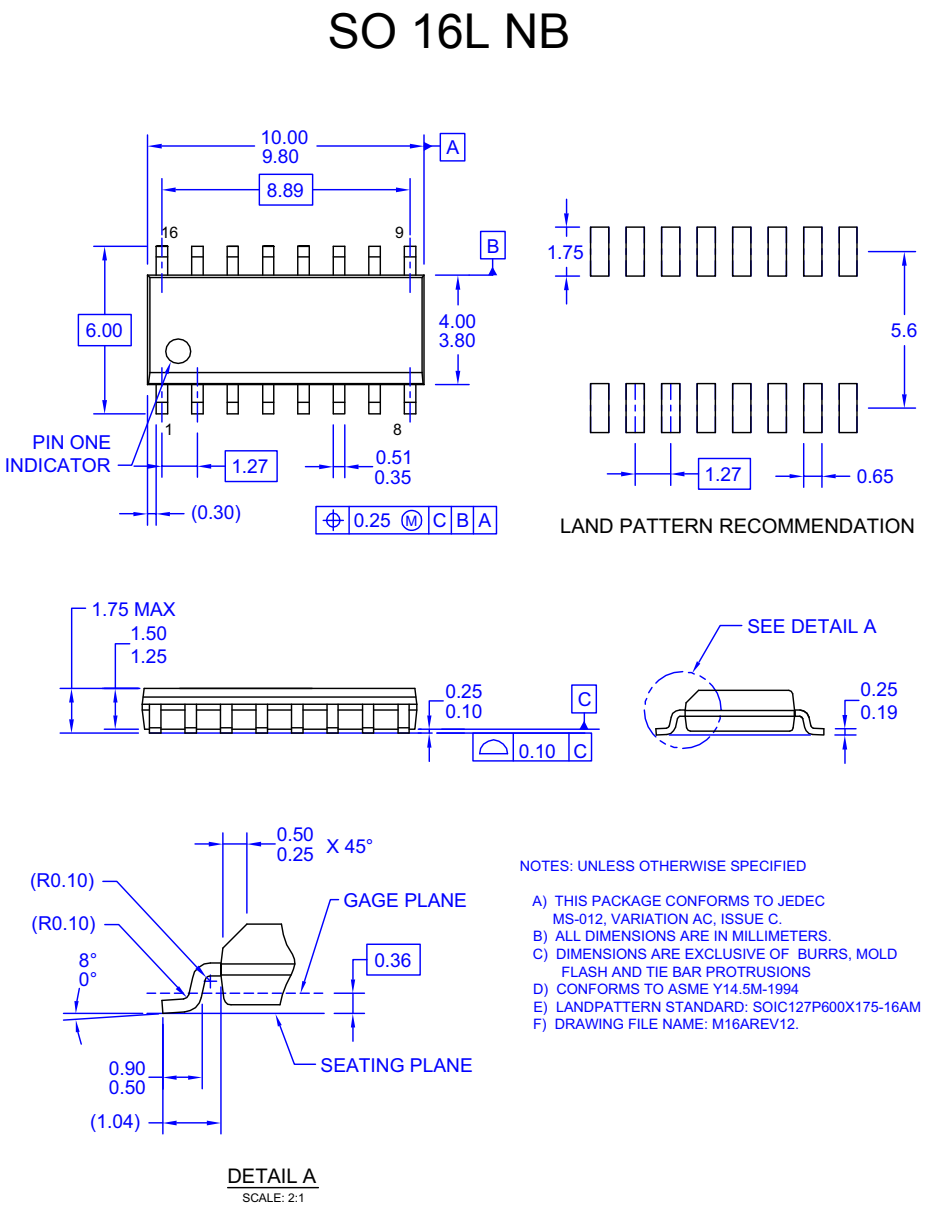


Figure 27. 16-LEAD, SOIC, JEDEC MS-012, 0.150 inch, NARROW BODY (ACTIVE)

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