

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

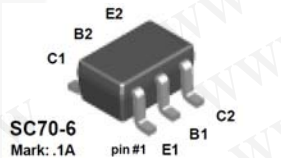
Description

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



SC70-6
Mark: .1A
pin #1

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.

Figure 1. FFB3904 Device Package

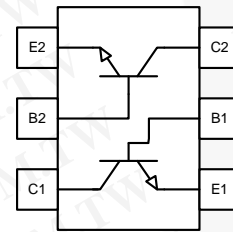
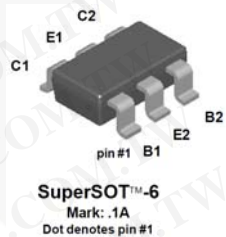


Figure 2. FFB3904 Internal Connection



SuperSOT™-6
Mark: .1A
Dot denotes pin #1

Figure 3. FMB3904 Device Package

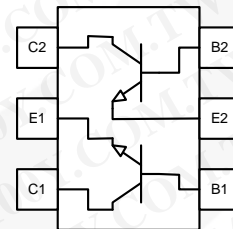
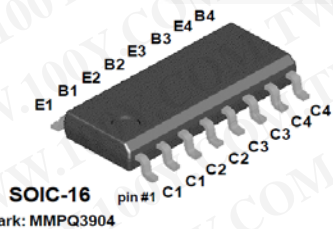


Figure 4. FMB3904 Internal Connection



SOIC-16
Mark: MMPQ3904
pin #1

Figure 5. MMPQ3904 Device Package

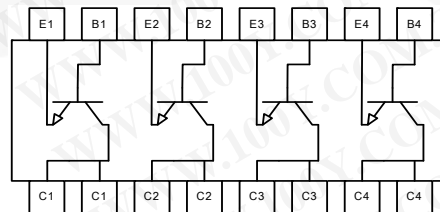


Figure 6. MMPQ3904 Internal Connection

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 $T_A = 25^\circ\text{C}$ 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}	Junction and Storage Temperature	-55 to +150	$^\circ\text{C}$

Notes:

- 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 $T_A = 25^\circ\text{C}$ 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/ $^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	415	180		$^\circ\text{C}/\text{W}$
	Effective 4 Die			125	$^\circ\text{C}/\text{W}$
	Each Die			240	$^\circ\text{C}/\text{W}$

Note:

- PCB Board Size: FR-4 76 x 114 x 0.6T mm³(3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics⁽³⁾

Values are at $T_A = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristics						
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 1.0\text{ mA}, I_B = 0$	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 Cut-Off Current	$V_{CE} = 30\text{ V}, I_E = 0$			50	nA
I_{CEX}	Collector Cut-Off Current	$V_{CE} = 30\text{ V}, I_C = 0$			50	nA
On Characteristics⁽⁴⁾						
h_{FE}	DC Current Gain	$I_C = 0.1\text{ mA}, V_{CE} = 1.0\text{ V}$	40		300	
		MMPQ3904	30			
		$I_C = 1.0\text{ mA}, V_{CE} = 1.0\text{ V}$	70			
		MMPQ3904	50			
		$I_C = 10\text{ mA}, V_{CE} = 1.0\text{ V}$	100			
		MMPQ3904	75			
$V_{CE(sat)}$	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 On 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	$I_C = 10\text{ mA}, V_{CE} = 20\text{ V},$ $f = 100\text{ MHz}$		250		MHz
C_{obo}	Output Capacitance	$V_{CB} = 5.0\text{ V}, I_E = 0, f = 140\text{ MHz}$		4.0		pF
C_{ibo}	Input Capacitance	$V_{BE} = 0.5\text{ V}, I_C = 0, f = 140\text{ MHz}$		8.0		pF

Notes:

3. All voltages (V) and currents (A) are negative polarity for PNP transistors.
4. Pulse Test: Pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2.0\%$.

Typical Performance Characteristics

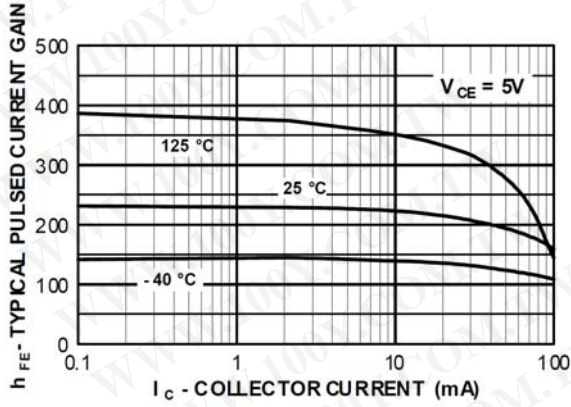


Figure 7. Typical Pulsed Current Gain vs. Collector Current

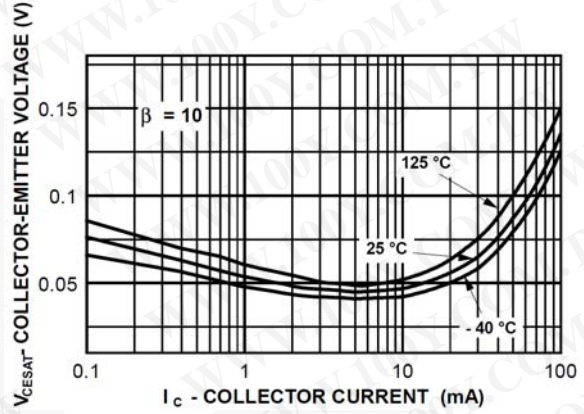


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

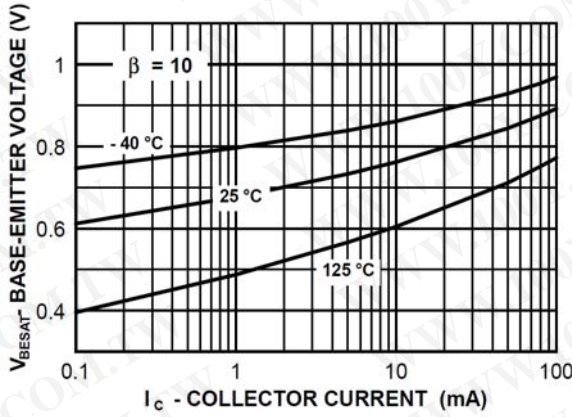


Figure 9. Base-Emitter Saturation Voltage vs. Collector Current

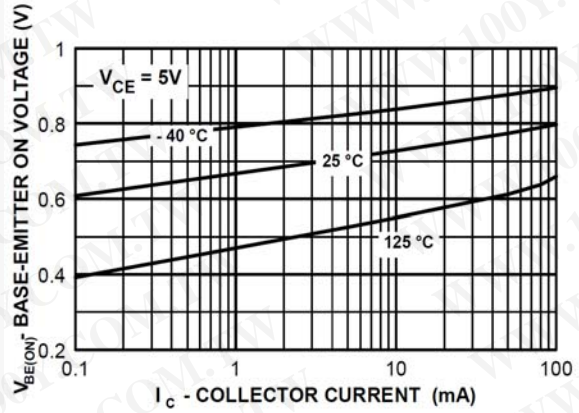


Figure 10. Base-Emitter ON Voltage vs. Collector Current

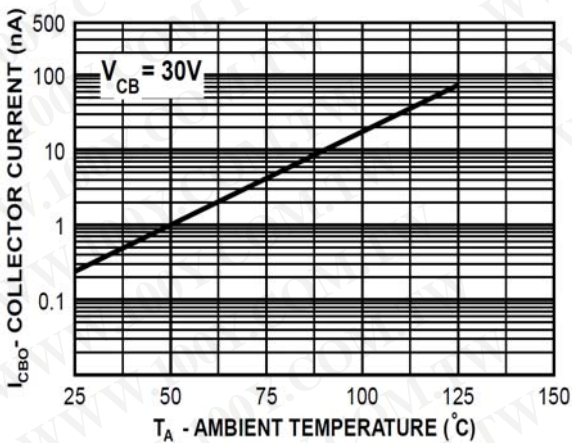


Figure 11. Collector Cut-Off Current vs. Ambient Temperature

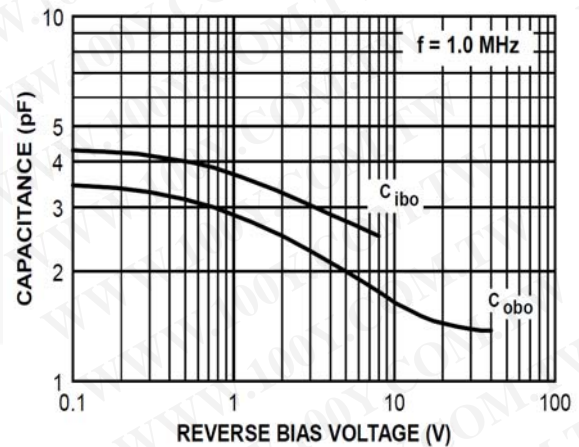


Figure 12. Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (Continued)

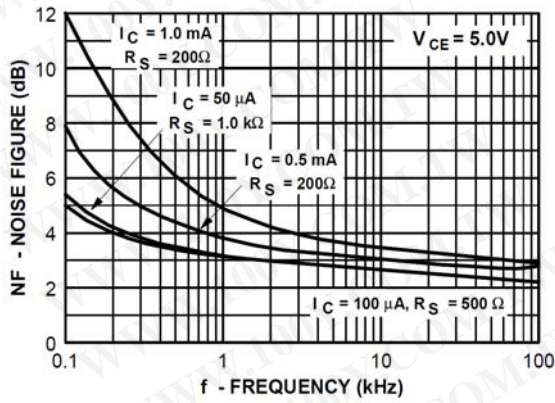


Figure 13. Noise Figure vs. Frequency

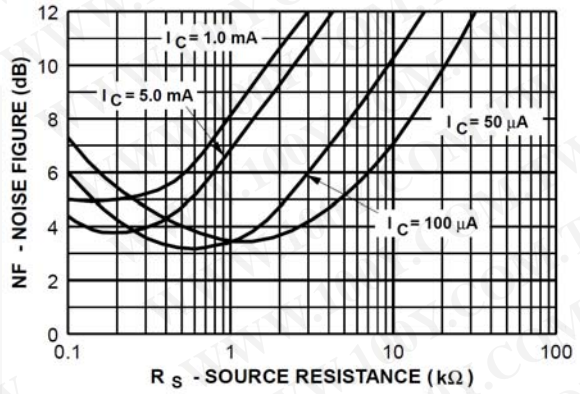


Figure 14. Noise Figure vs. Source Resistance

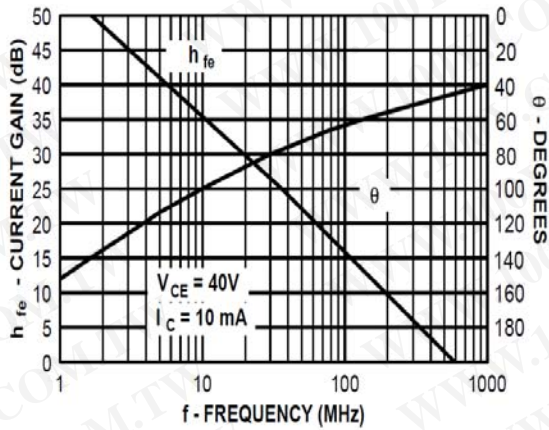


Figure 15. Current Gain and Phase Angle vs. Frequency

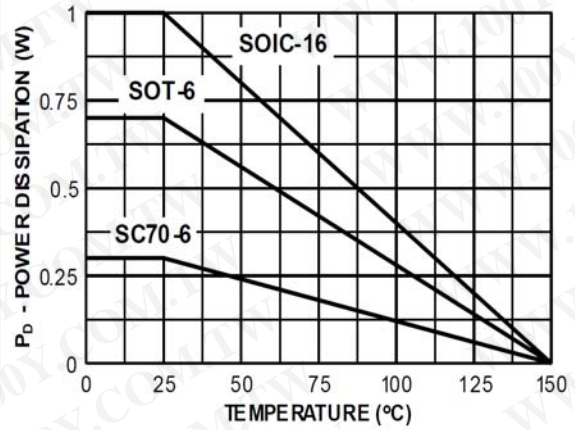


Figure 16. Power Dissipation vs. Ambient Temperature

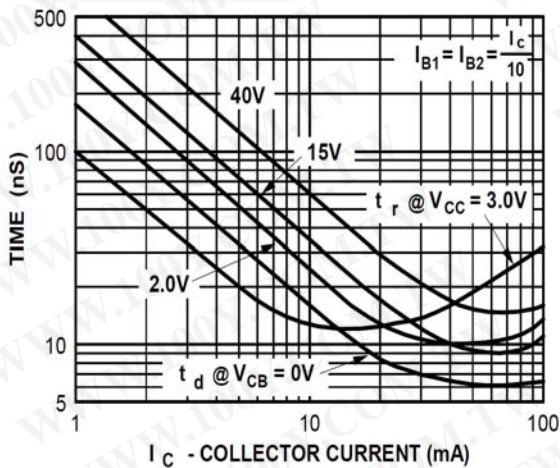


Figure 17. Turn-On Time vs. Collector Current

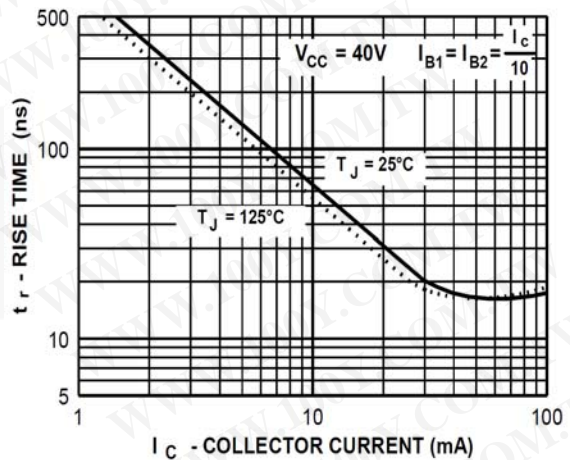


Figure 18. Rise Time vs. Collector Current

Typical Performance Characteristics (Continued)

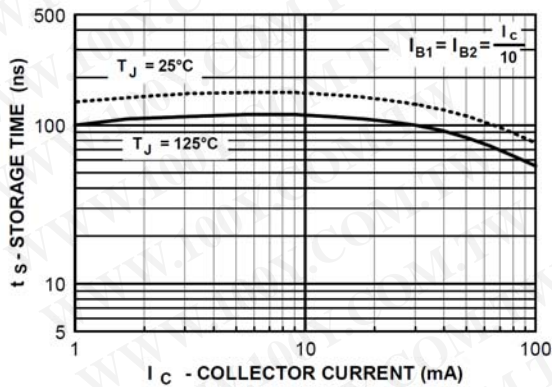


Figure 19. Storage Time vs. Collector Current

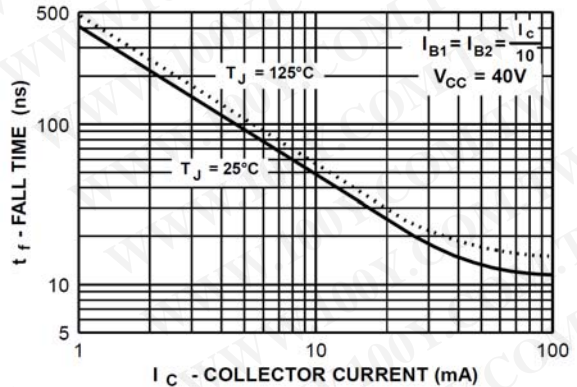


Figure 20. Fall Time vs. Collector Current

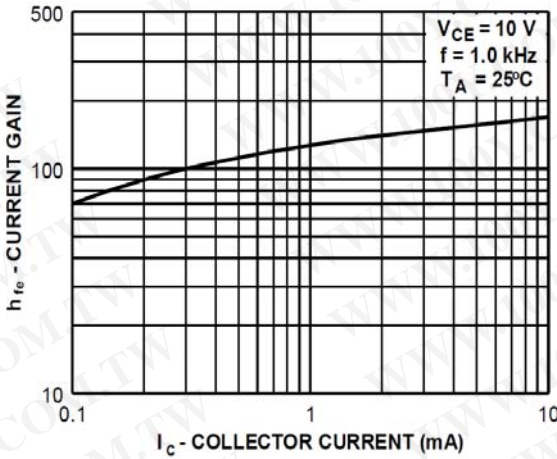


Figure 21. Current Gain

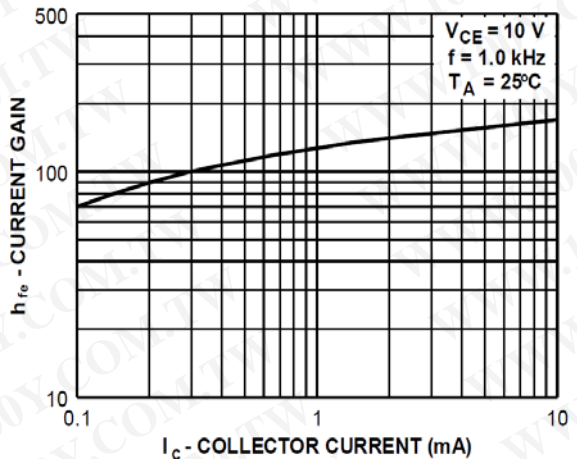


Figure 22. Output Admittance

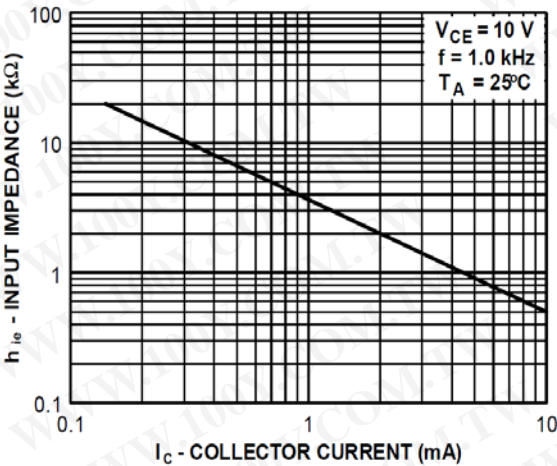


Figure 23. Input Impedance

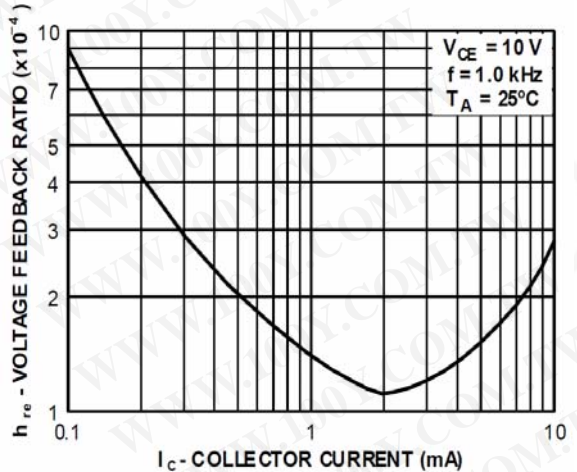


Figure 24. Voltage Feedback Ratio

Physical Dimensions

SC70 6L

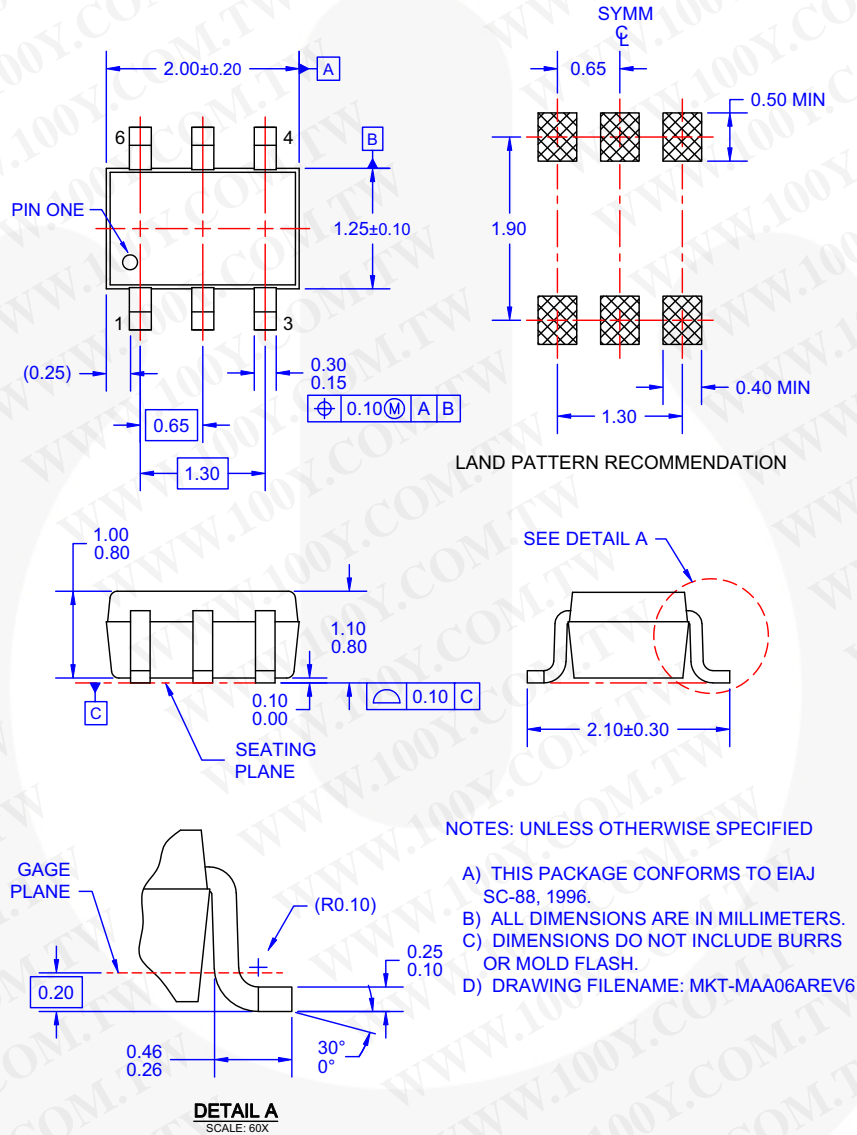


Figure 25. 6-LEAD, SC70, EIAJ SC-88, 1.25 MM WIDE (ACTIVE)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:
http://www.fairchildsemi.com/packing_dwg/PKG-MAA06A_JCET.pdf

Physical Dimensions (Continued)

SSOT 6L

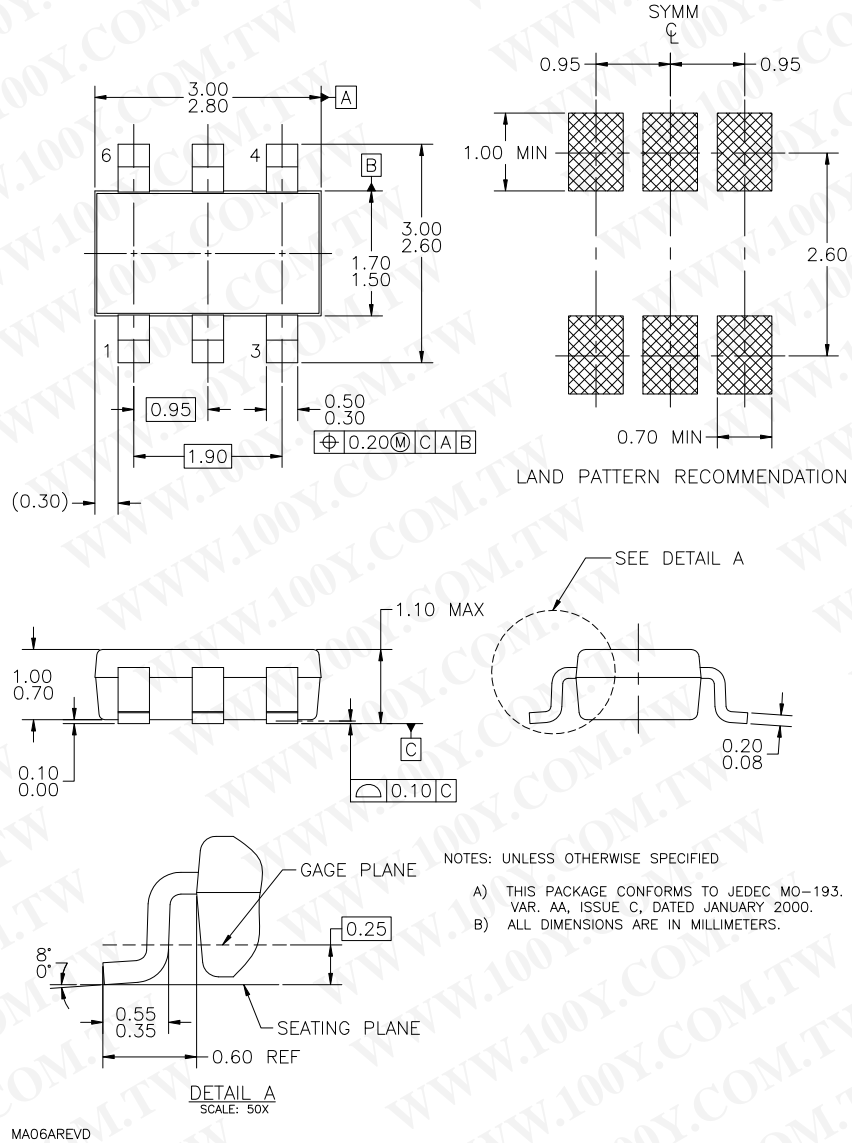


Figure 26. 6-LEAD, SUPER SOT-6, JEDEC MO-193, 1.6 MM WIDE (ACTIVE)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:
http://www.fairchildsemi.com/packing_dwg/PKG-MA06A.pdf

Physical Dimensions (Continued)

SO 16L NB

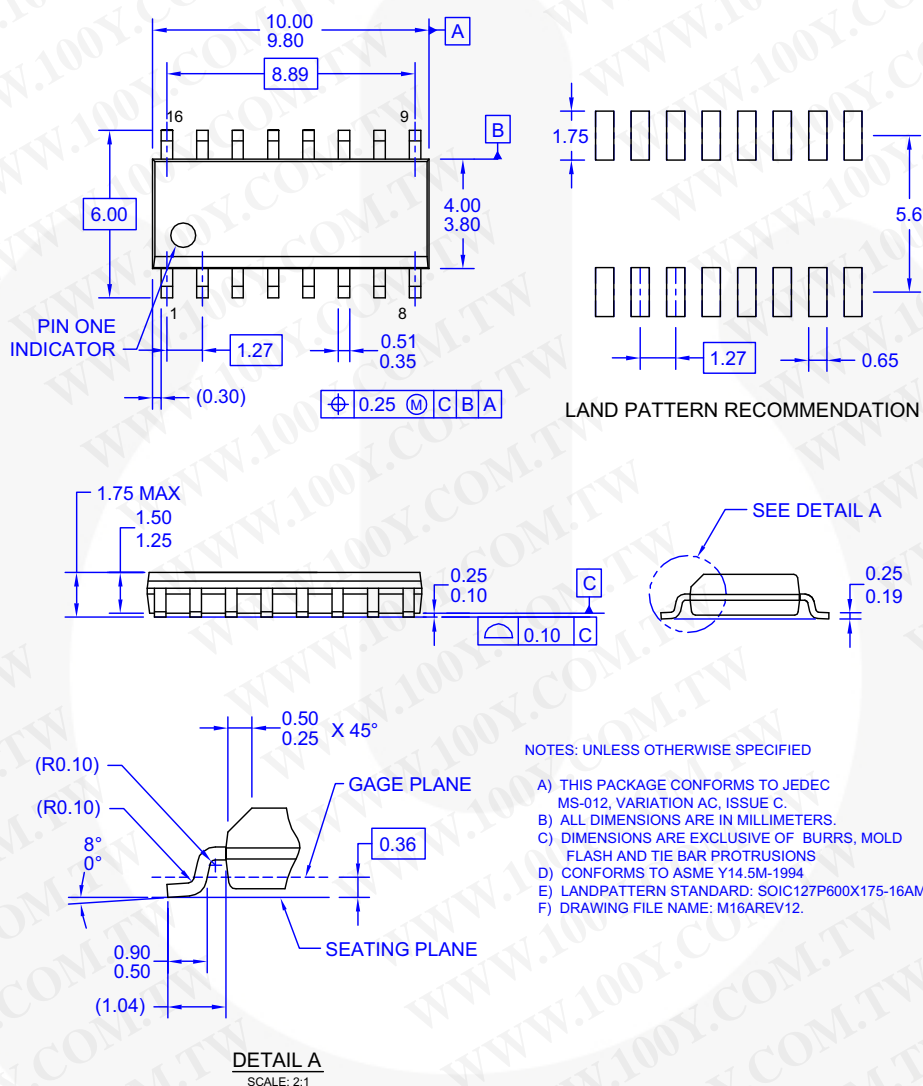


Figure 27. 16-LEAD, SOIC, JEDEC MS-012, 0.150 inch, NARROW BODY (ACTIVE)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.





Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:
http://www.fairchildsemi.com/packing_dwg/PKG-M16A.pdf



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|--|--|---|---|
| 2Cool™ | FPS™ | | Sync-Lock™ |
| AccuPower™ | F-PFS™ | |  SYSTEM GENERAL® |
| AX-CAP®* | FRFET® | | TinyBoost™ |
| BitSiC™ | Global Power Resource SM | PowerTrench® | TinyBuck™ |
| Build it Now™ | GreenBridge™ | PowerXS™ | TinyCalc™ |
| CorePLUS™ | Green FPS™ | Programmable Active Droop™ | TinyLogic® |
| CorePOWER™ | Green FPS™ e-Series™ | QFET® | TINYOPTO™ |
| CROSSVOLT™ | Gmax™ | QS™ | TinyPower™ |
| CTL™ | GTO™ | Quiet Series™ | TinyPWM™ |
| Current Transfer Logic™ | IntelliMAX™ | RapidConfigure™ | TinyWire™ |
| DEUXPEED® | ISOPLANAR™ |  Saving our world, 1mW/W/kW at a time™ | TranSiC™ |
| Dual Cool™ | Making Small Speakers Sound Louder and Better™ | SignalWise™ | TriFault Detect™ |
| EcoSPARK® | MegaBuck™ | SmartMax™ | TRUECURRENT®* |
| EfficientMax™ | MICROCOUPLER™ | SMART START™ | µSerDes™ |
| ESBC™ | MicroFET™ | Solutions for Your Success™ |  SerDes® |
|  Fairchild® | MicroPak™ | SPM® | UHC® |
| Fairchild Semiconductor® | MicroPak2™ | STEALTH™ | Ultra FRFET™ |
| FACT Quiet Series™ | MillerDrive™ | SuperFET® | UniFET™ |
| FACT® | MotionMax™ | SuperSOT™-3 | VCX™ |
| FAST® | mWSaver™ | SuperSOT™-6 | VisualMax™ |
| FastvCore™ | OptoHiT™ | SuperSOT™-8 | VoltagePlus™ |
| FETBench™ | OPTOLOGIC® | SupreMOS® | XS™ |
| | OPTOPLANAR® | SyncFET™ | |

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

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.