FAIRCHILD SEMICONDUCTOR®

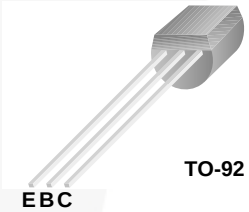
September 2013

2N3906 / MMBT3906 / PZT3906
PNP General Purpose Amplifier

Description

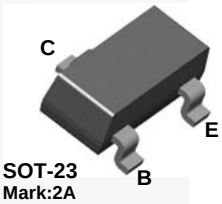
This device is designed for general purpose amplifier and switching applications at collector currents of 10 mA to 100 mA.

2N3906



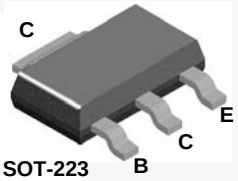
TO-92

MMBT3906



SOT-23
Mark:2A

PZT3906



SOT-223

Ordering Information

Part Number	Marking	Package	Packing Method	Pack Quantity
2N3906BU	2N3906	TO-92	Bulk	10000
2N3906TA	2N3906	TO-92	Ammo	2000
2N3906TAR	2N3906	TO-92	Ammo	2000
2N3906TF	2N3906	TO-92	Tape and Reel	2000
2N3906TFR	2N3906	TO-92	Tape and Reel	2000
MMBT3906	2A	SOT-23	Tape and Reel	3000
PZT3906	3906	SOT-223	Tape and Reel	2500

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	-40	V
V_{EBO}	Emitter-Base Voltage	-5.0	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

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

Symbol	Parameter	Max.			Units
		2N3906	MMBT3906(2)	PZT3906(3)	
P_D	Total Device Dissipation	625	350	1,000	mW
	Derate above 25°C	5.0	2.8	8.0	mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3			°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	125	°C/W

Notes:

2. Device mounted on FR-4 PCB 1.6 inch X 1.6 inch X 0.06 inch.
3. Device mounted on FR-4 PCB 36 mm X 18 mm X 1.5 mm; mounting pad for the collector lead minimum 6 cm^2.

Electrical Characteristics

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

Symbol	Parameter	Test Condition	Min.	Max.	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage[4]	I_C = -1.0 mA, I_B = 0	-40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = -10 μA, I_E = 0	-40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = -10 μA, I_C = 0	-5.0		V
I_{BL}	Base Cutoff Current	V_{CE} = -30 V, V_{BE} = 3.0 V		-50	nA
I_{CEX}	Collector Cutoff Current	V_{CE} = -30 V, V_{BE} = 3.0 V		-50	nA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain[4]	I_C = -0.1 mA, V_{CE} = -1.0 V	60		
		I_C = -1.0 mA, V_{CE} = -1.0 V	80		
		I_C = -10 mA, V_{CE} = -1.0 V	100	300	
		I_C = -50 mA, V_{CE} = -1.0 V	60		
		I_C = -100 mA, V_{CE} = -1.0V	30		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = -10 mA, I_B = -1.0 mA		-0.25	V
		I_C = -50 mA, I_B = -5.0 mA		-0.4	V
$V_{BE(sat)}$	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	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 = 100 kHz		4.5	pF
C_{ibo}	Input Capacitance	V_{EB} = -0.5 V, I_C = 0, f = 100 kHz		10.0	pF
NF	Noise Figure	I_C = -100 μA, V_{CE} = -5.0 V, R_S = 1.0 kΩ, f = 10 Hz to 15.7 kHz		4.0	dB
SWITCHING CHARACTERISTICS					
t_d	Delay Time	V_{CC} = -3.0 V, V_{BE} = -0.5 V, I_C = -10 mA, I_{B1} = -1.0 mA		35	ns
t_r	Rise Time			35	ns
t_s	Storage Time	V_{CC} = -3.0 V, I_C = -10 mA, I_{B1} = I_{B2} = -1.0 mA		225	ns
t_f	Fall Time			75	ns

Note:

4. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%.

Typical Performance Characteristics

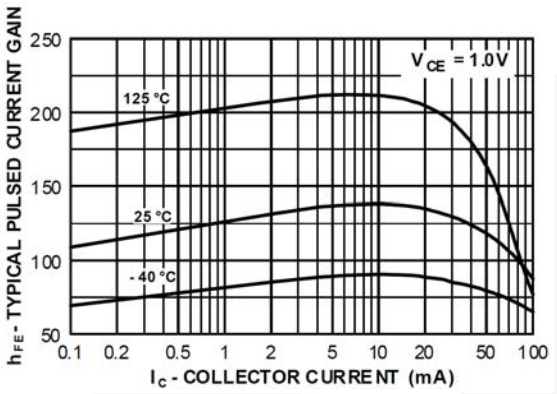


Figure 1. Typical Pulsed Current Gain vs. Collector Current

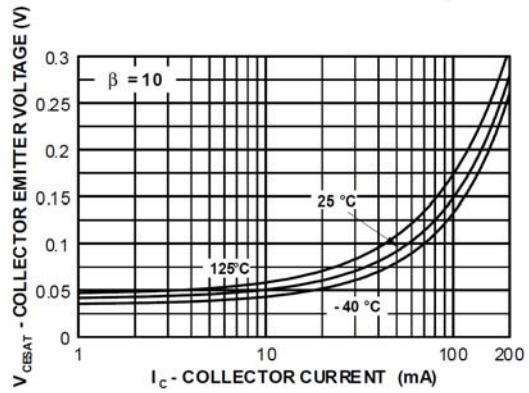


Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

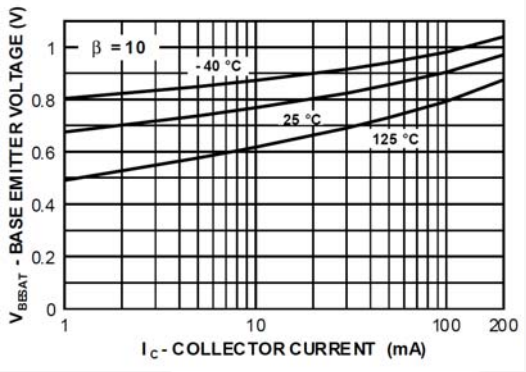


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

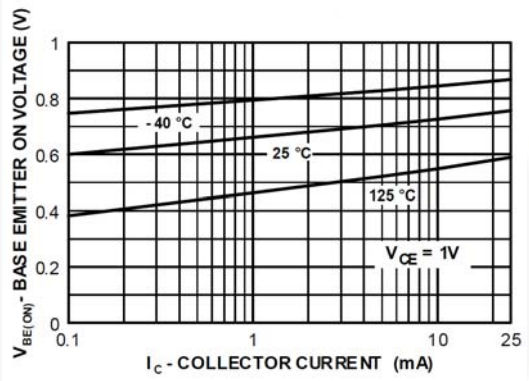


Figure 4. Base-Emitter On Voltage vs. Collector Current

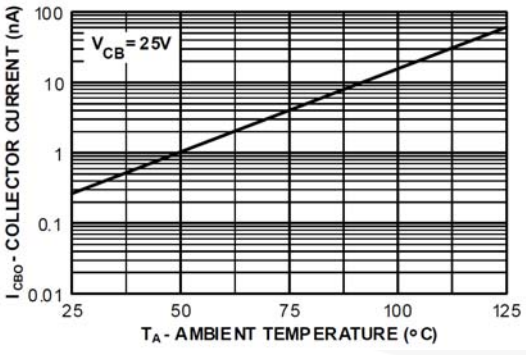


Figure 5. Collector Cut-Off Current vs. Ambient Temperature

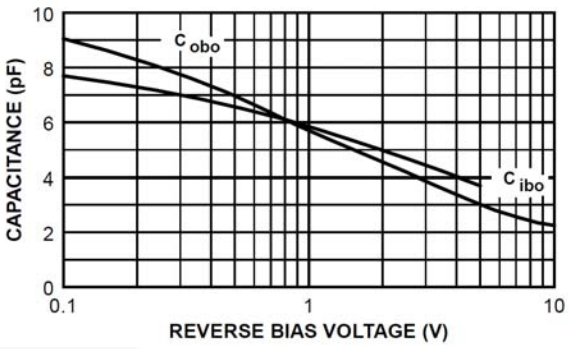


Figure 6. Common-Base Open Circuit Input and Output Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (continued)

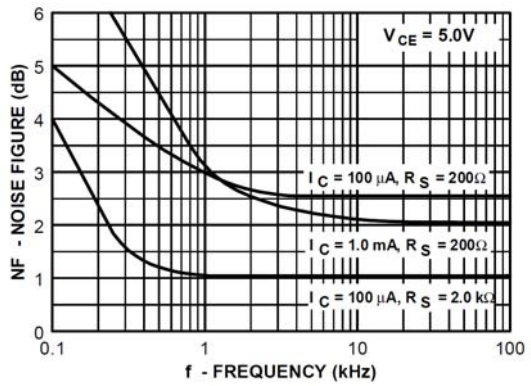


Figure 7. Noise Figure vs. Frequency

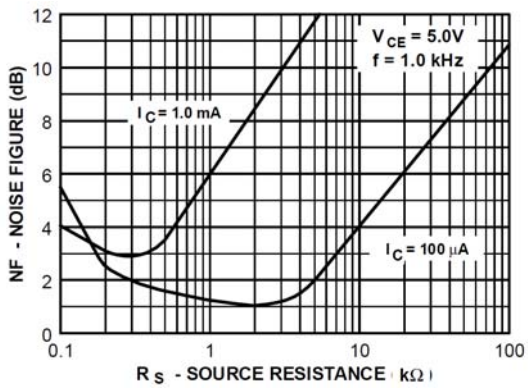


Figure 8. Noise Figure vs. Source Resistance

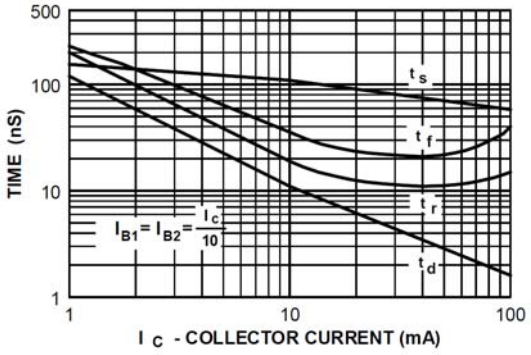


Figure 9. Switching Times vs. Collector Current

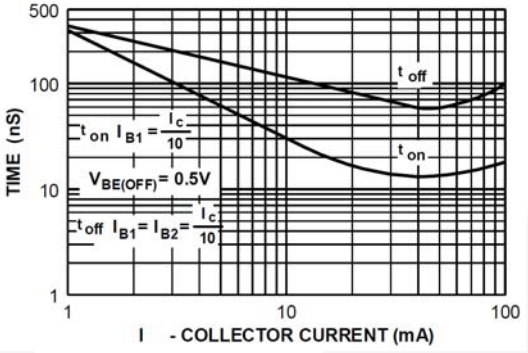


Figure 10. Turn On and Turn Off Times vs. Collector Current

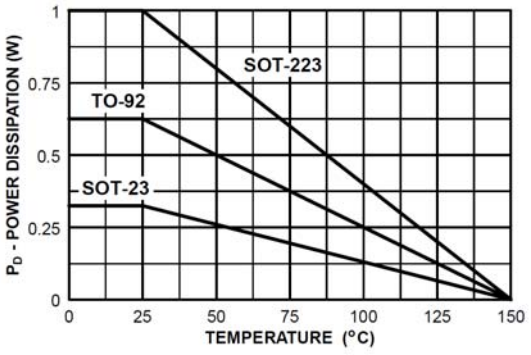


Figure 11. Power Dissipation vs. Ambient Temperature

Typical Performance Characteristics (continued)

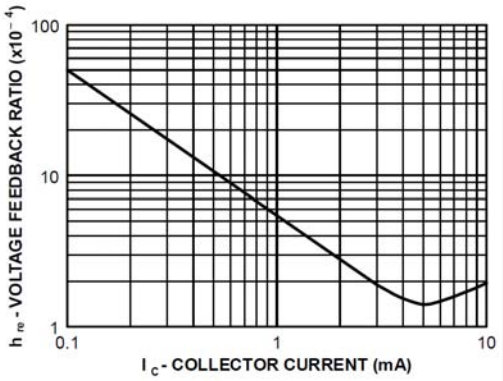


Figure 12. Voltage Feedback Ratio

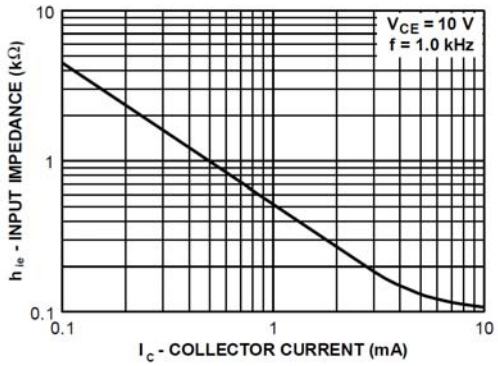


Figure 13. Input Impedance

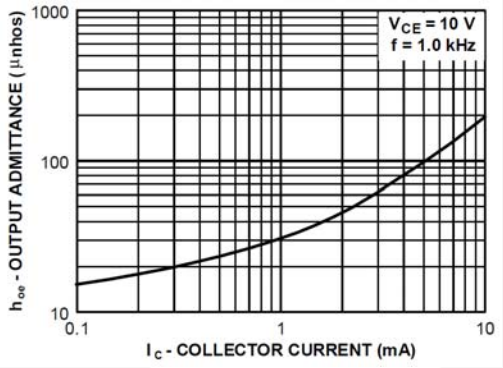


Figure 14. Output Admittance

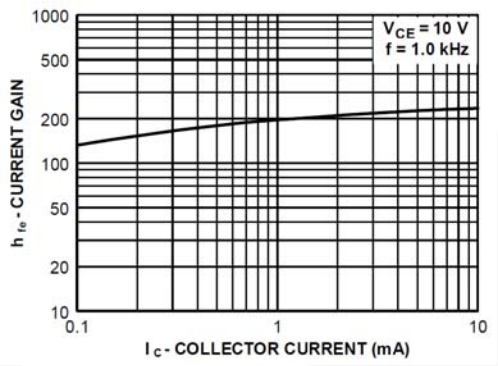
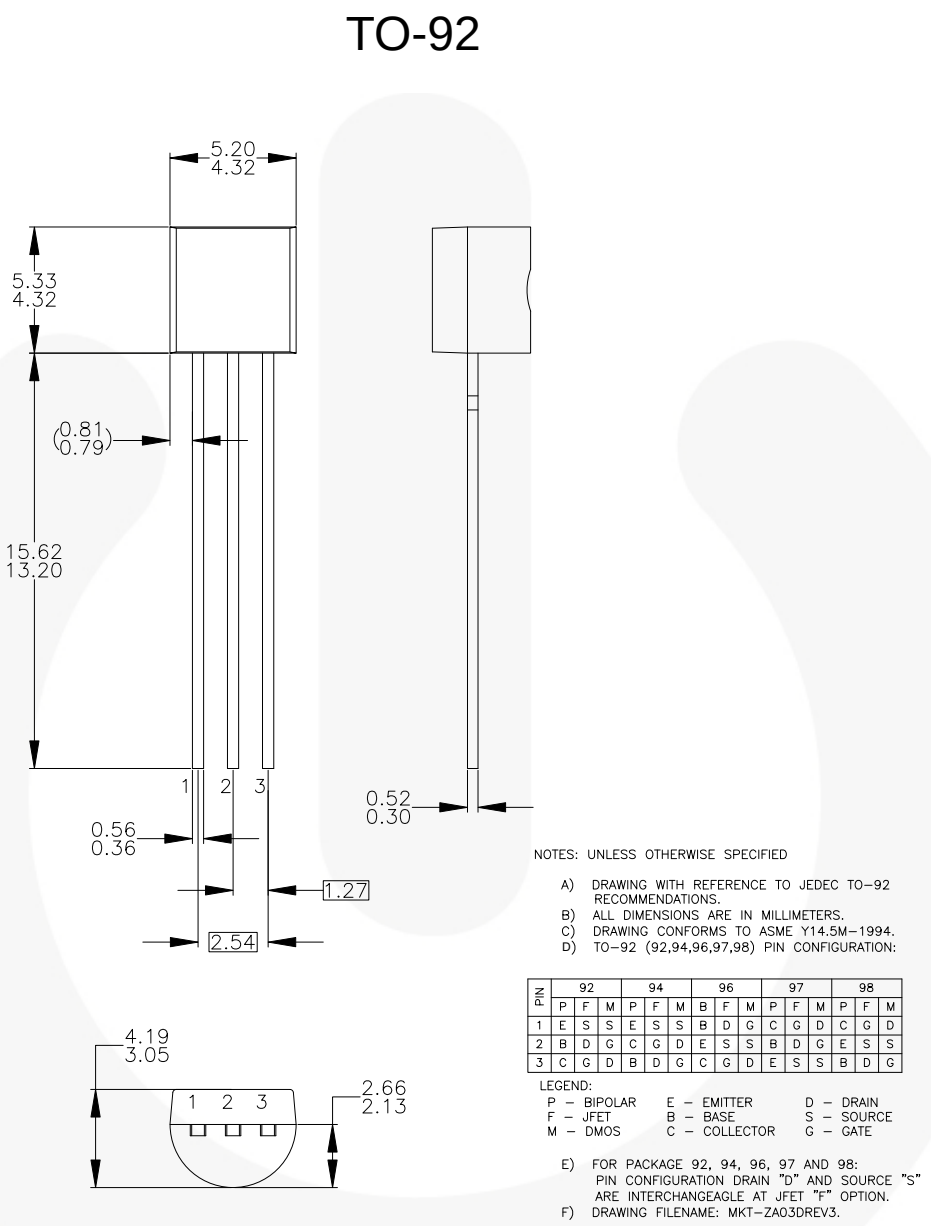


Figure 15. Current Gain

Physical Dimensions



PIN	92			94			96			97			98		
	P	F	M	P	F	M	B	F	M	P	F	M	P	F	M
1	E	S	S	E	S	S	B	D	G	C	G	D	C	G	D
2	B	D	G	C	G	D	E	S	S	B	D	G	E	S	S
3	C	G	D	B	D	G	C	G	D	E	S	S	B	D	G

Figure 16. 3-LEAD, TO92, MOLDED 0.200 IN LINE SPACING LD FORM (J61Z OPTION) (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/dwg/ZA/ZA03D.pdf.

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:

http://www.fairchildsemi.com/packing_dwg/PKG-ZA03D_BK.pdf.

Physical Dimensions (continued)

SOT-223 4L

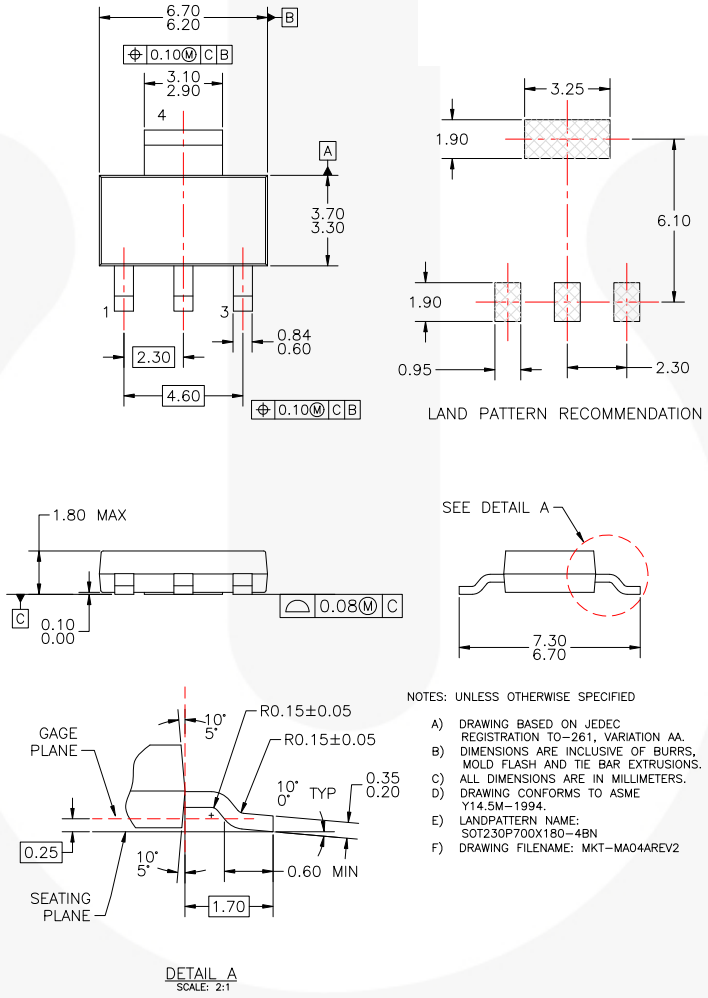


Figure 17. MOLDED PACKAGE, SOT-223, 4-LEAD (ACTIVE)

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/dwg/MA/MA04A.pdf.

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:

http://www.fairchildsemi.com/packing_dwg/PKG-MA04A_BK.pdf.

Physical Dimensions (continued)

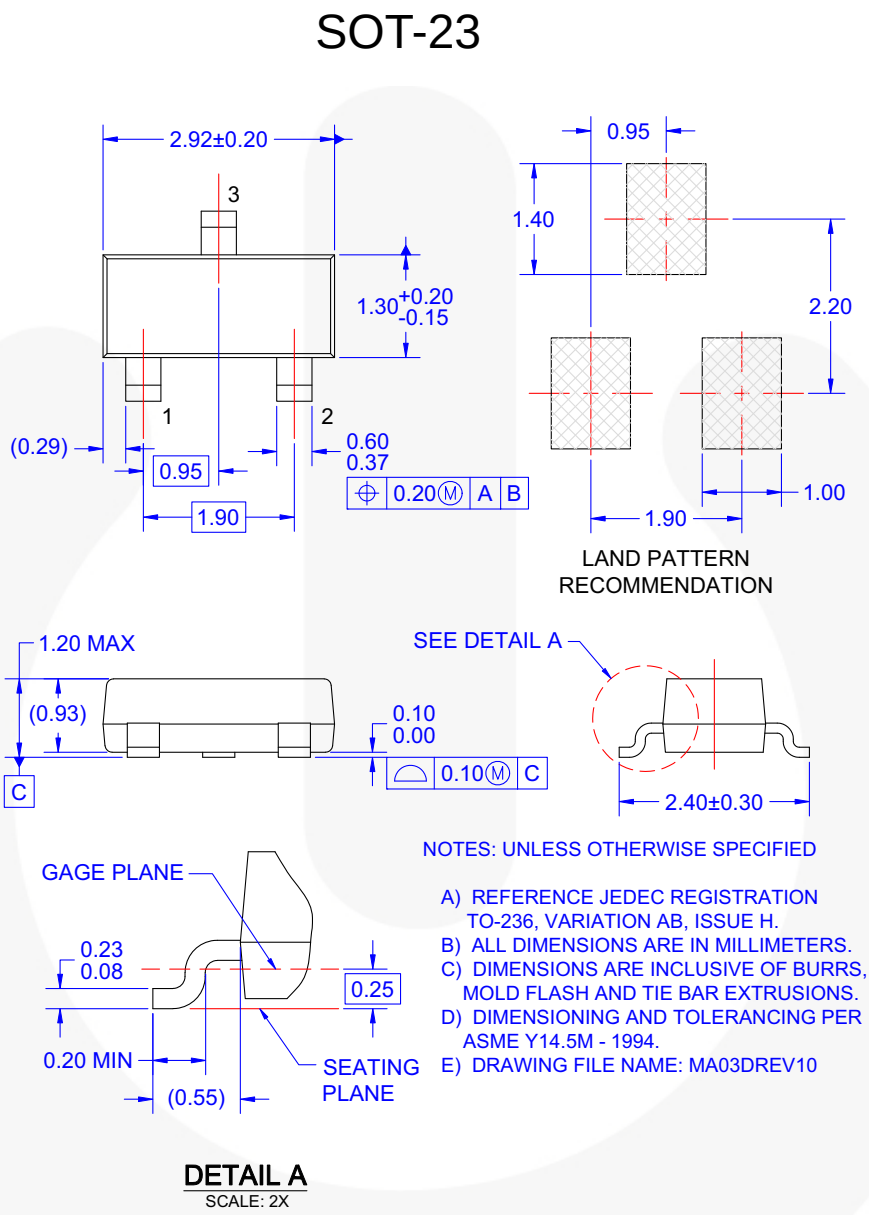


Figure 18. 3-LEAD, SOT23, JEDEC TO-236, LOW PROFILE (ACTIVE)

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/dwg/MA/MA03D.pdf.

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:

http://www.fairchildsemi.com/packaging/tr/SOT23-3L_tr.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.

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

* 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.

Rev. I66