

2N3906 / MMBT3906 / PZT3906 PNP General Purpose Amplifier

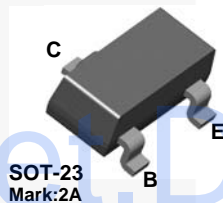
Description

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

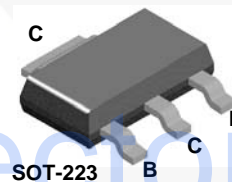
2N3906



MMBT3906



PZT3906



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 $T_A = 25^\circ\text{C}$ 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	$^\circ\text{C}$

Note:

- 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 $T_A = 25^\circ\text{C}$ 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/ $^\circ\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3			$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	125	$^\circ\text{C}/\text{W}$

Notes:

- Device mounted on FR-4 PCB 1.6 inch X 1.6 inch X 0.06 inch.
- 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 $T_A = 25^\circ\text{C}$ unless otherwise noted.

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

Note:

4. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Typical Performance Characteristics

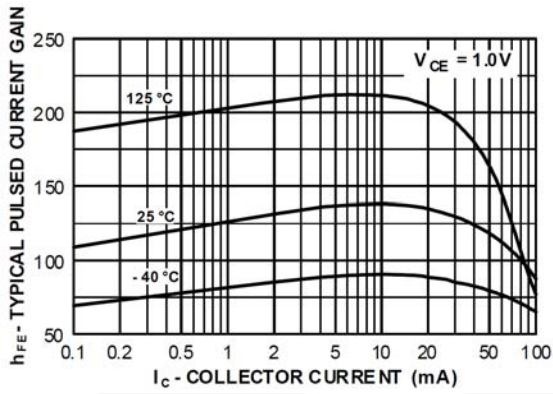


Figure 1. Typical Pulsed Current Gain vs. Collector Current

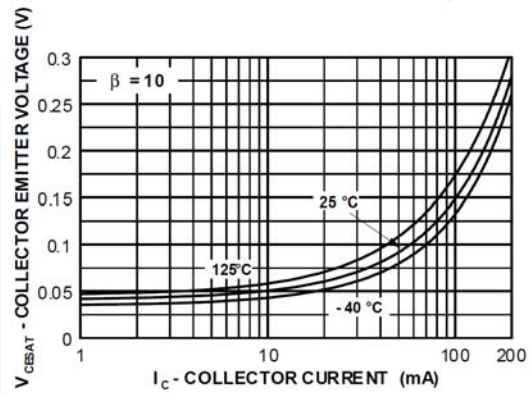


Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

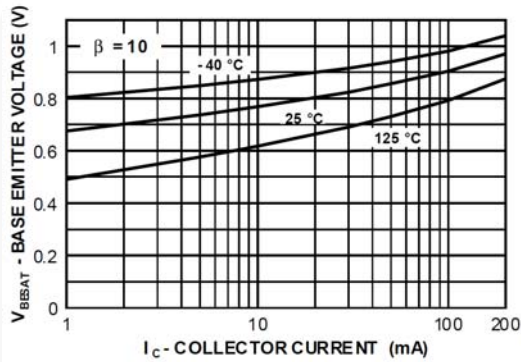


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

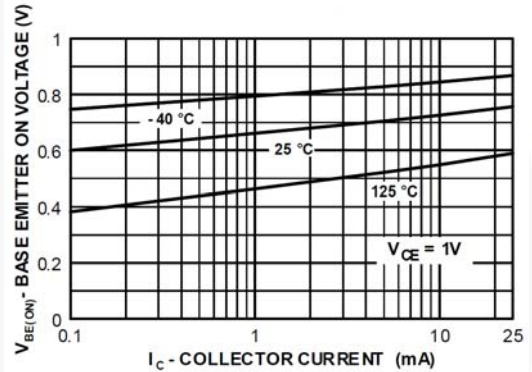


Figure 4. Base-Emitter On Voltage vs. Collector Current

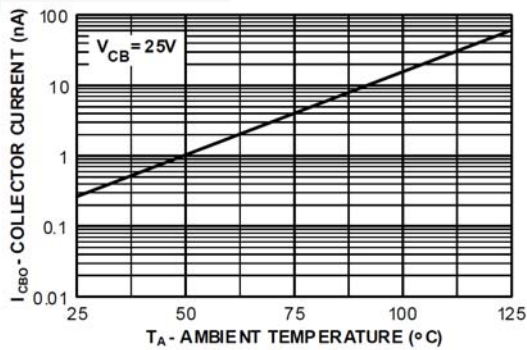


Figure 5. Collector Cut-Off Current vs. Ambient Temperature

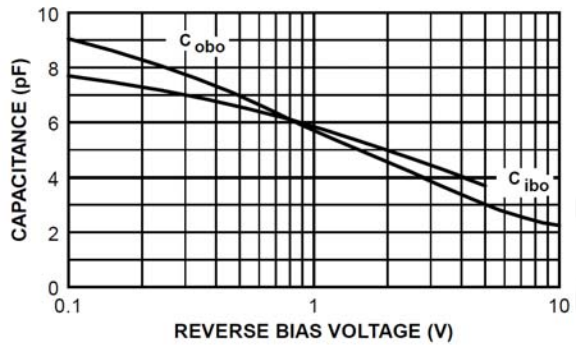


Figure 6. Common-Base Open Circuit Input and Output Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (continued)

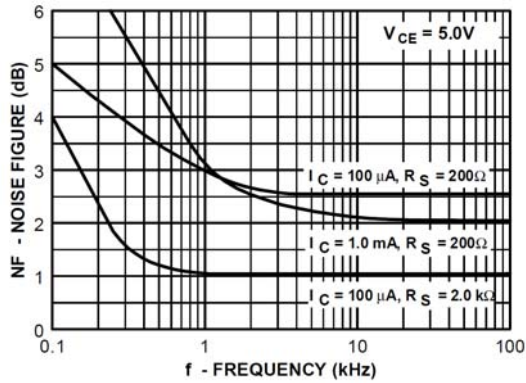


Figure 7. Noise Figure vs. Frequency

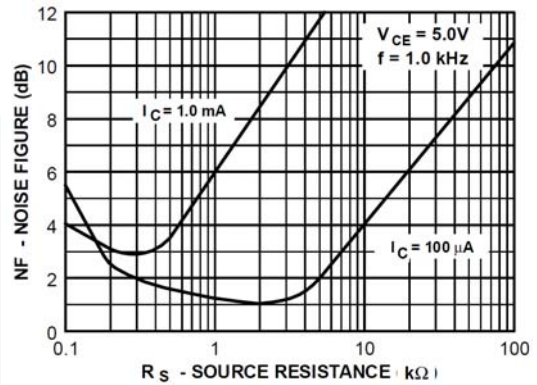


Figure 8. Noise Figure vs. Source Resistance

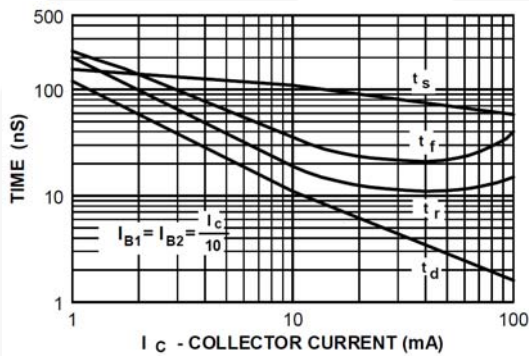


Figure 9. Switching Times vs. Collector Current

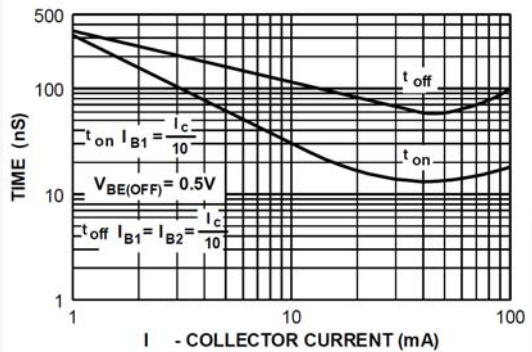


Figure 10. Turn On and Turn Off Times vs. Collector Current

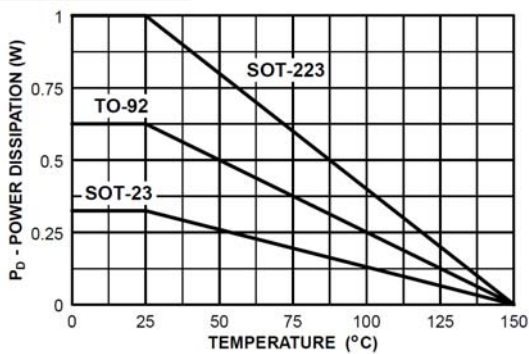


Figure 11. Power Dissipation vs. Ambient Temperature

Typical Performance Characteristics (continued)

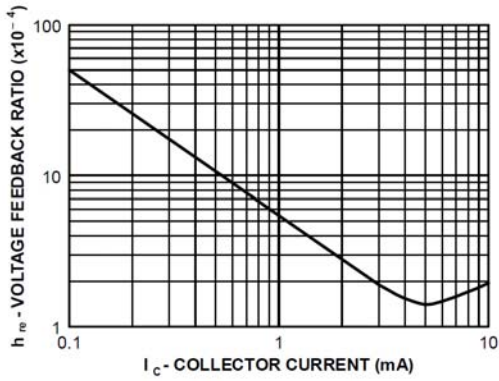


Figure 12. Voltage Feedback Ratio

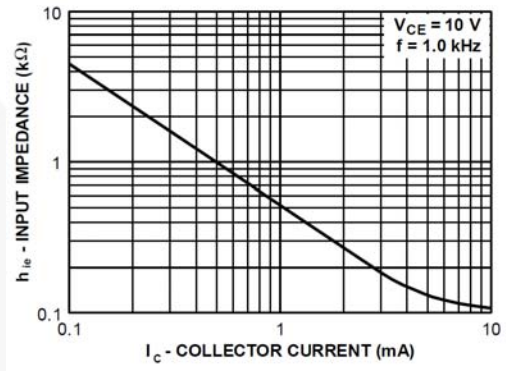


Figure 13. Input Impedance

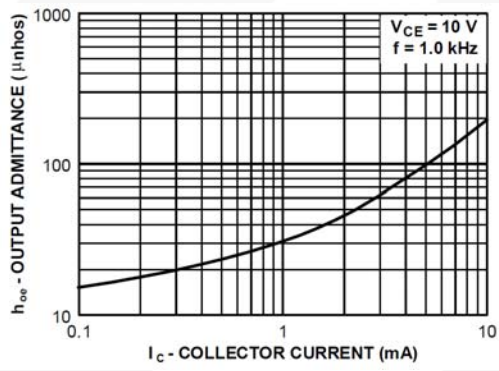


Figure 14. Output Admittance

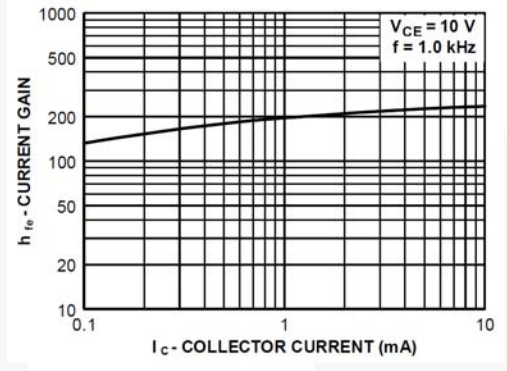
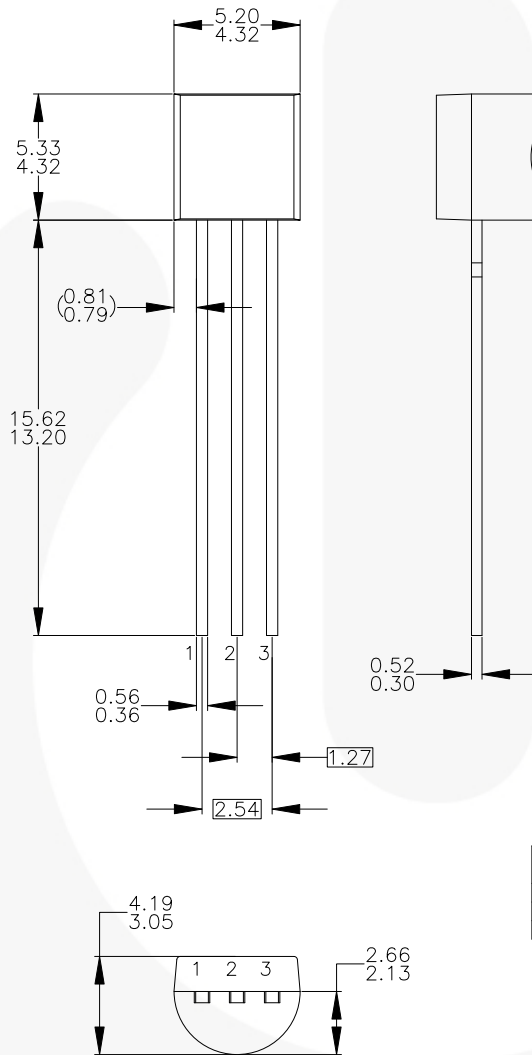


Figure 15. Current Gain

Physical Dimensions

TO-92



NOTES: UNLESS OTHERWISE SPECIFIED

- A) DRAWING WITH REFERENCE TO JEDEC TO-92 RECOMMENDATIONS.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DRAWING CONFORMS TO ASME Y14.5M-1994.
- D) TO-92 (92,94,96,97,98) PIN CONFIGURATION:

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

LEGEND:

P - BIPOLAR E - EMITTER D - DRAIN
 F - JFET B - BASE S - SOURCE
 M - DMOS C - COLLECTOR G - GATE

- E) FOR PACKAGE 92, 94, 96, 97 AND 98: PIN CONFIGURATION DRAIN "D" AND SOURCE "S" ARE INTERCHANGEABLE AT JFET "F" OPTION.
- F) DRAWING FILENAME: MKT-ZA03DREV3.

Figure 16. 3-LEAD, TO92, MOLDED 0.200 IN LINE SPACING LD FORM (J61Z OPTION) (ACTIVE)

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

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Physical Dimensions (continued)

SOT-223 4L

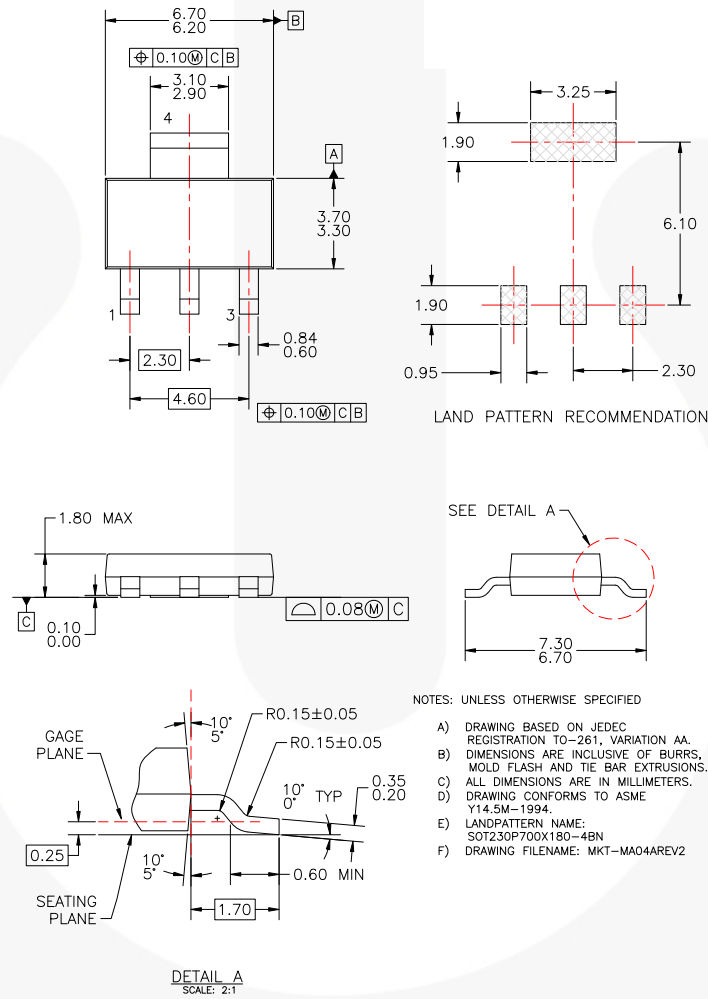


Figure 17. MOLDED PACKAGE, SOT-223, 4-LEAD (ACTIVE)

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Physical Dimensions (continued)

SOT-23

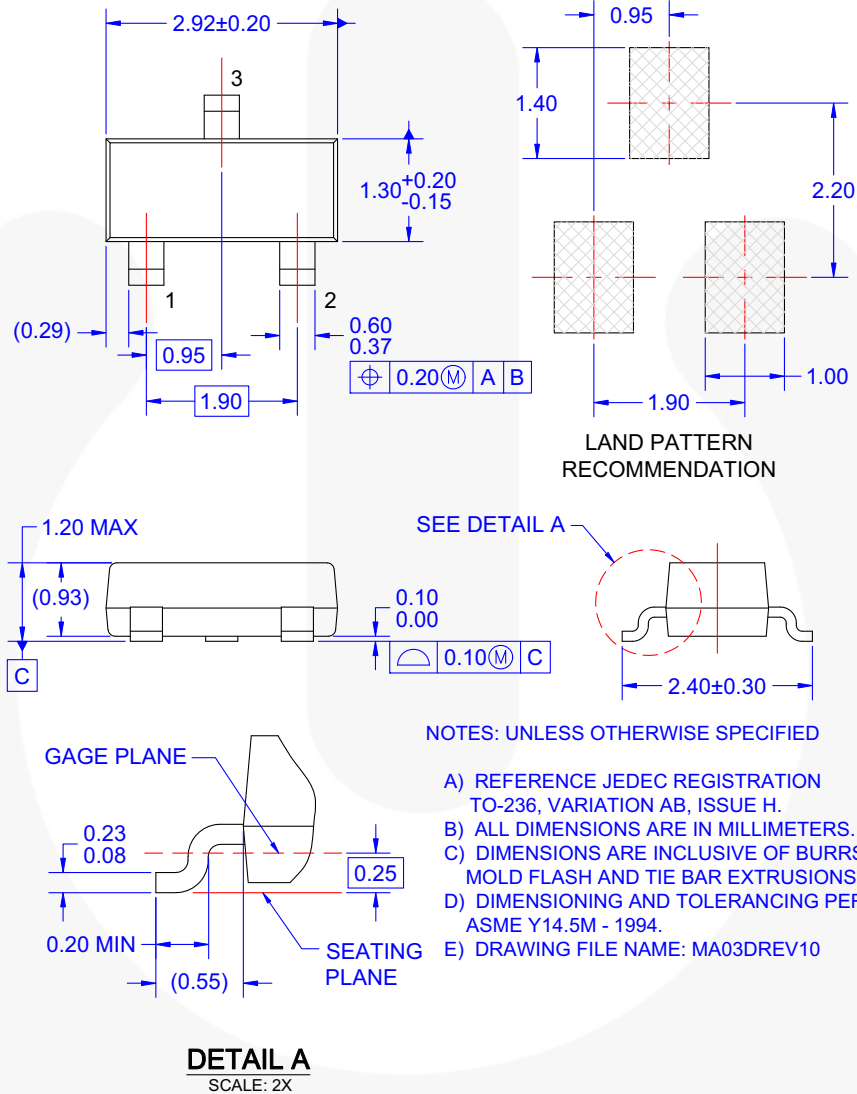


Figure 18. 3-LEAD, SOT23, JEDEC TO-236, LOW PROFILE (ACTIVE)

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Datasheet Identification	Product Status	Definition
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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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