

TOSHIBA Transistor Silicon NPN Epitaxial Type

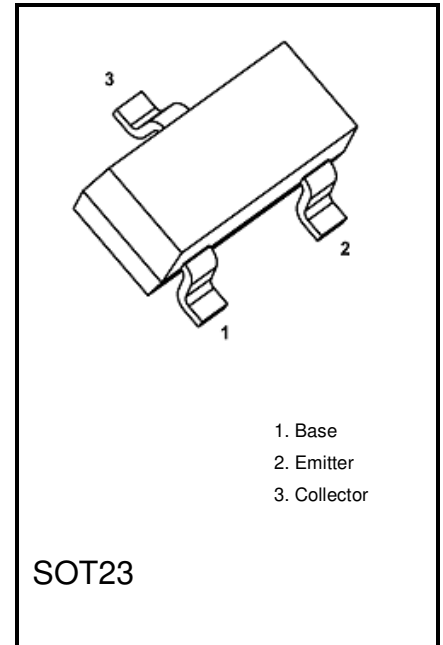
## TMBT3904

Audio Frequency General Purpose Amplifier Applications

- High voltage and high current  
:  $V_{CEO} = 50\text{ V}$ ,  $I_C = 200\text{ mA (max)}$
- Complementary to TMBT3906

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	60	V
Collector-emitter voltage	$V_{CEO}$	50	V
Emitter-base voltage	$V_{EBO}$	5	V
Collector current	$I_C$	200	mA
Base current	$I_B$	30	mA
Collector power dissipation	PC (Note 1)	320	mW
	PC (Note 2)	1000	mW
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 150	$^\circ\text{C}$

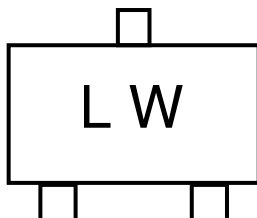


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Mounted on an FR4 board.  
(25.4mm x 25.4mm x 1.6mm, Cu Pad: 0.42mm<sup>2</sup> x 3)

Note 2: Mounted on an FR4 board.  
(25.4mm x 25.4mm x 1.6mm, Cu Pad: 645mm<sup>2</sup>)

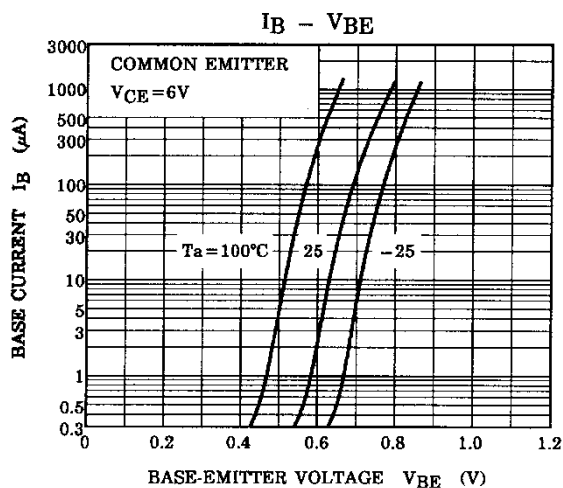
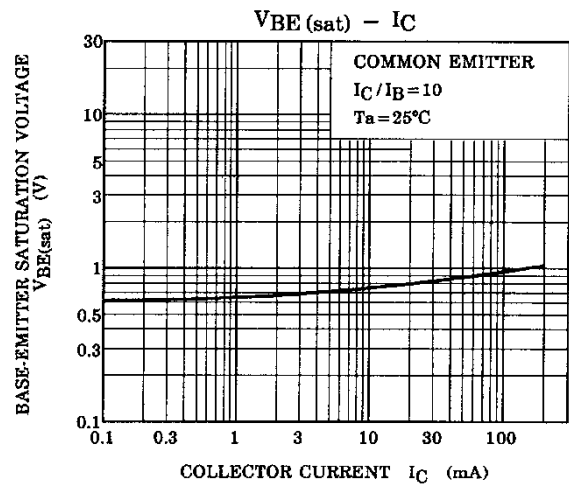
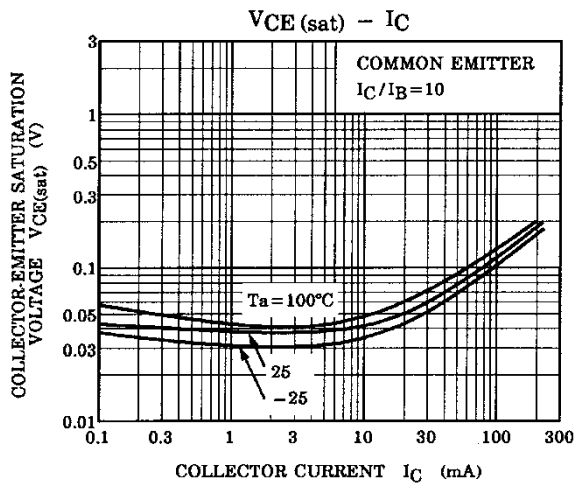
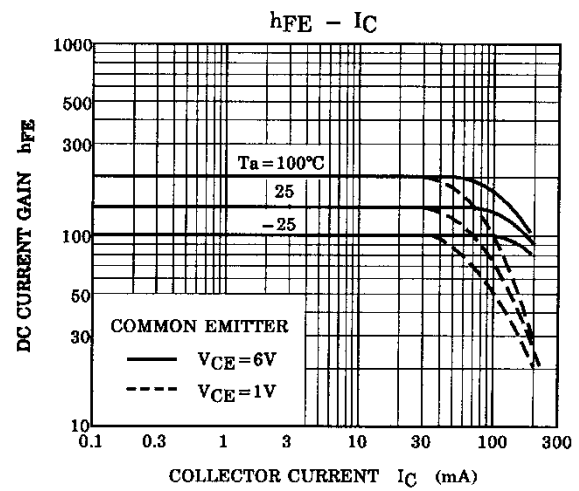
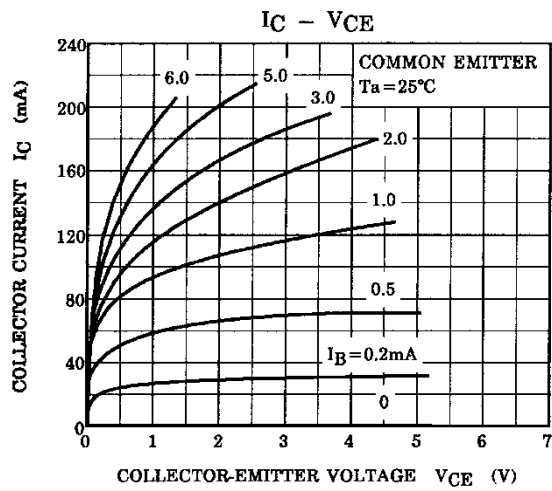
### Marking



Start of commercial production  
2015-01

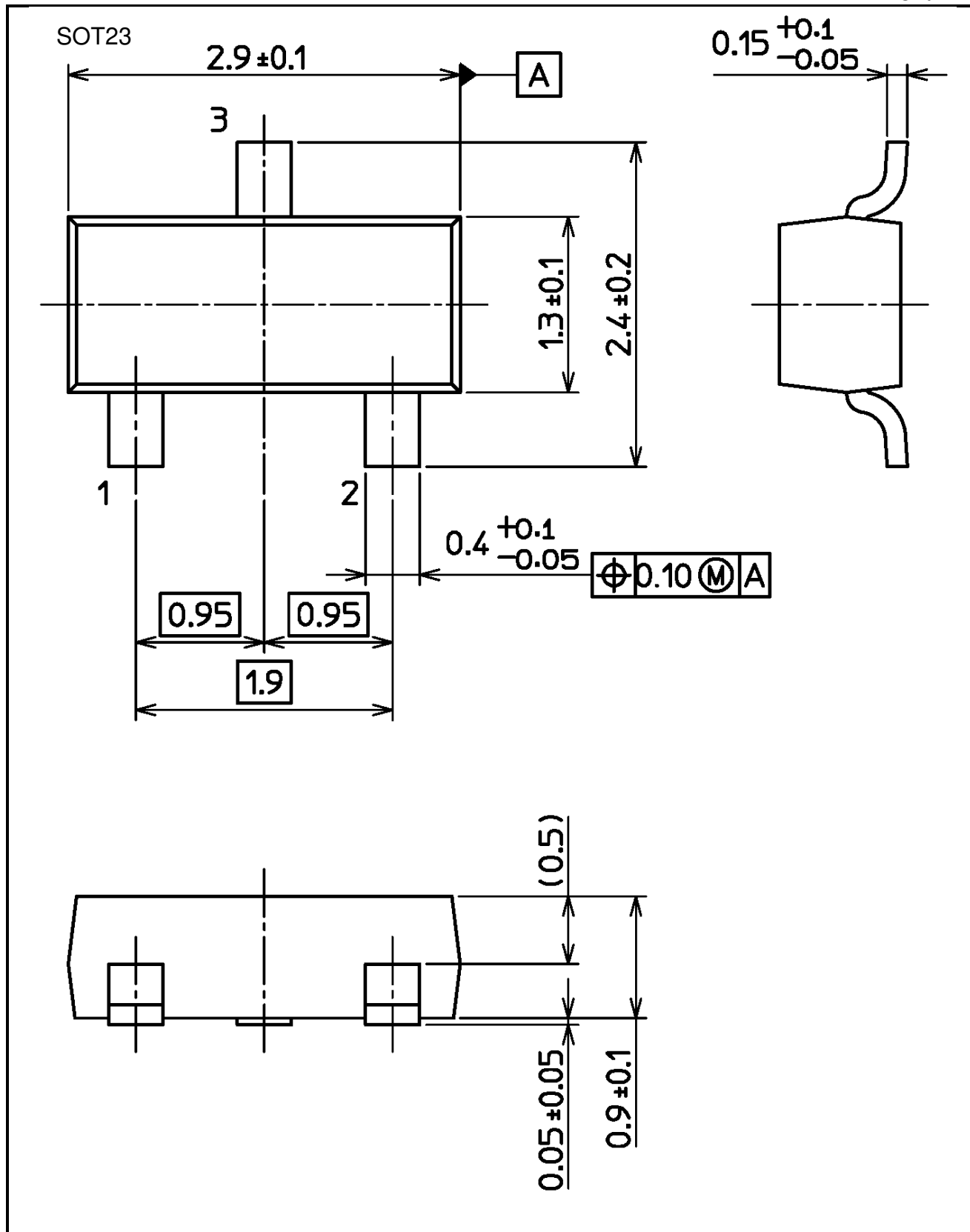
### Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		ICBO	V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0 mA	—	—	0.1	μA
Emitter cut-off current		IEBO	V <sub>EB</sub> = 5 V, I <sub>C</sub> = 0 mA	—	—	0.1	μA
DC current gain		hFE	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 0.1 mA	60	—	—	—
			V <sub>CE</sub> = 1 V, I <sub>C</sub> = 1 mA	80	—	—	
			V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA	100	—	300	
			V <sub>CE</sub> = 1 V, I <sub>C</sub> = 50 mA	60	—	—	
			V <sub>CE</sub> = 1 V, I <sub>C</sub> = 100 mA	30	—	—	
Collector-emitter saturation voltage		V <sub>CE (sat)</sub>	I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA	—	—	0.2	V
			I <sub>C</sub> = 50 mA, I <sub>B</sub> = 5 mA	—	—	0.3	
Base-emitter saturation voltage		V <sub>BE (sat)</sub>	I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA	—	0.65	0.85	
			I <sub>C</sub> = 50 mA, I <sub>B</sub> = 5 mA	—	—	0.95	
Transition frequency		f <sub>T</sub>	V <sub>CE</sub> = 20 V, I <sub>C</sub> = 10 mA	300	—	—	MHz
Collector output capacitance		C <sub>ob</sub>	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0 mA, f = 1 MHz	—	1.7	3.5	pF
Noise figure		NF	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 0.1 mA, f = 1 kHz, R <sub>g</sub> = 1 kΩ	—	—	5	dB
Switching times	delay time	t <sub>d</sub>	<p>INPUT</p> <p>OUTPUT</p> <p>5 V</p> <p>0</p> <p>500 μs</p> <p>56 Ω</p> <p>2.5 kΩ</p> <p>3.9 kΩ</p> <p>V<sub>CC</sub> = 3 V</p> <p>V<sub>BB</sub> = -1.9 V</p> <p>270 Ω</p> <p>I<sub>C</sub> = 10mA, I<sub>B1</sub> = -I<sub>B2</sub> = 1mA</p>	—	—	35	ns
	rise time	t <sub>r</sub>		—	—	35	
	storage time	t <sub>s</sub>		—	—	200	
	fall time	t <sub>f</sub>		—	—	50	



## Package Dimensions

Unit: mm



Weight: 0.009g (typ.)

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