

# Bipolar High $f_T$ Low Voltage NPN Silicon Transistors

## MA4T3243 Series

V3.00

### Features

- Designed for 3-5 Volt Operation
- Useable to 6 GHz in Oscillators
- Useable for Low Noise, Low Voltage Driver Amplifiers Through 3 GHz
- Useful for Class C Amplifiers
- Available as Chips, and in Hermetic and Surface Mount Packages
- Can be Screened to JANTX, JANTXV Equivalent Levels
- Tape and Reel Packaging Available

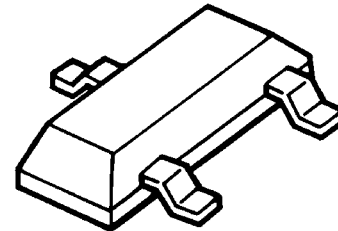
### Description

The MA4T3243 series of high  $f_T$  low voltage NPN medium power silicon bipolar transistors are designed for usage in battery operated systems with 3-5 volt collector bias. They are useful as low phase noise oscillator transistors through 6 GHz and as moderate power driver amplifiers through 3 GHz.

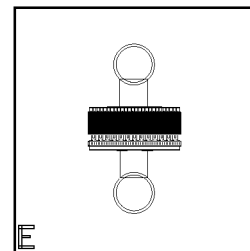
These transistors are available as a chip for hybrid oscillators or in ceramic packages for military or commercial usage. Both the chip and hermetic packages can be screened to JANTXV equivalent levels.

These transistors use M/A-COM's high temperature gold, platinum, titanium metalization with silicon dioxide and silicon nitride passivation. The chip is emitter balasted with polysilicon resistors to prevent current concentration at high current operation.

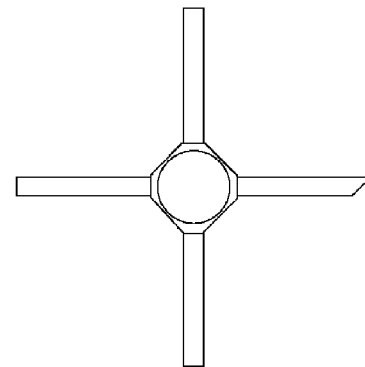
### Case Styles



**SOT-23**



**Chip**



**Micro-X**

Specifications Subject to Change Without Notice.

**M/A-COM, Inc.**

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## Maximum Ratings

Parameter	Symbol	Unit	MA4T324300 Chip	MA4T324333 SOT-23	MA4T324335 Micro-X
Collector-Base Voltage <sup>1</sup>	$V_{CBO}$	Volts	8	8	8
Collector-Emitter Voltage <sup>1</sup>	$V_{CE}$	Volts	6	6	6
Emitter-Base Voltage <sup>1</sup>	$V_{EB}$	Volts	1.5	1.5	1.5
Collector Current <sup>1</sup>	$I_C$	mA	110	110	110
Junction Temperature	$T_j$	°C	200	125	200
Storage Temperature	$T_{STG}$	°C	-65 to +175°C	-65 to +125°C	-65 to +175°C
Power Dissipation <sup>1,3</sup>	$P_T$	mW	600	250	400
Operating Temperature <sup>2</sup>	$T_{op}$	°C	150	125	150

### Note:

- At 25°C case temperature (packaged transistors) or 25°C mounting surface temperature (chip transistors).
- Case or bonding surface temperature. Derate maximum power dissipation rating to zero watts at maximum operating temperature.
- The thermal resistance of the MA4T324300 junction/case is 50°C/watt nominal.

## Electrical Specifications @ 25°C

Parameter	Condition	Symbol	Units	MA4T324300 Chip	MA4T324333 SOT-23	MA4T324335 Micro-X
Gain Bandwidth Product	$V_{CE} = 3$ volts $I_C = 50$ mA	$f_T$	GHz	6 typ	6 typ	6 typ
Insertion Power Gain	$V_{CE} = 3$ volts $I_C = 40$ mA $f = 1$ GHz $f = 2$ GHz	$IS_{21}E^2$	dB	7 min 3 typ	6 min 2.5 typ	7 min 3 typ
Noise Figure	$V_{CE} = 3$ volts $I_C = 10$ mA $f = 1$ GHz	NF	dB	2.2 max	2.4 max	2.2 max
Unilateral Gain	$V_{CE} = 3$ volts $I_C = 40$ mA $f = 1$ GHz $f = 2$ GHz	GTU (max)	dB	10 typ 6 typ	9 typ 4 typ	10 typ 6 typ
Maximum Available Gain	$V_{CE} = 3$ volts $I_C = 40$ mA $f = 2$ GHz	MAG	dB	8.5 typ	7 typ	8.5 typ
Power Out at 1 dB Compression	$V_{CE} = 3$ volts $I_C = 50$ mA $f = 2$ GHz $f = 3$ GHz	$P_{1dB}$	dBm	20 typ 15 typ	19 typ 15 typ	20 typ 15 typ

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### Electrical Specifications @ 25°C

#### MA4T243 Series

Parameter	Condition	Symbol	Min	Typical	Max	Units
Collector Cut-off Current	$V_{CB} = 4$ Volts $I_E = 0$ $\mu$ A	$I_{CBO}$	—	—	10	$\mu$ A
Emitter Cut-off Current	$V_{EB} = 1$ Volt $I_C = 0$ $\mu$ A	$I_{EBO}$	—	—	1	$\mu$ A
Forward Current Gain	$V_{CE} = 3$ Volts $I_C = 20$ mA	$h_{FE}$	20	125	250	—
Collector Base Junction Capacitance	$V_{CB} = 3$ Volts $I_E = 0$ $\mu$ A $f = 1$ MHz	$C_{OB}$	—	0.8	1.0	pF

### Typical Scattering Parameters in the Micro-X Package

#### MA4T324335

$V_{CE} = 3$  Volts,  $I_C = 10$  mA

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.647	172	2.480	73.2	0.137	51.4	0.311	-165.8
2000	0.666	149	1.408	51.2	0.225	49.0	0.365	172.5
3000	0.694	128	1.135	34.1	0.336	43.8	0.366	156.0
4000	0.714	109	1.005	17.3	0.427	32.1	0.412	142.1
5000	0.748	90	0.948	4.0	0.507	22.8	0.453	127.2
6000	0.772	70	0.930	-9.1	0.605	11.8	0.499	111.9

#### MA4T324335

$V_{CE} = 3$  Volts,  $I_C = 20$  mA

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.661	168	2.632	73.3	1 0.137	60.8	0.373	178.5
2000	0.677	146	1.493	53.1	0.238	53.0	0.421	161.3
3000	0.697	125	1.210	36.5	0.359	44.8	0.415	144.6
4000	0.715	107	1.067	19.3	0.451	31.0	0.450	130.3
5000	0.744	89	1.007	5.4	0.525	20.7	0.480	115.5
6000	0.762	69	0.990	-8.5	0.619	9.1	0.510	101.6

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## Typical Scattering Parameters in the Micro-X Package (Cont'd)

MA4T324335

 $V_{CE} = 3$  Volts,  $I_C = 40$  mA

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.675	164	2.678	73.3	0.139	66.2	0.424	176.6
2000	0.692	143	1.528	54.1	0.244	55.0	0.470	158.6
3000	0.707	121	1.230	37.7	0.368	45.9	0.455	141.6
4000	0.719	104	1.095	20.8	0.463	31.5	0.481	128.1
5000	0.749	86	1.035	6.5	0.537	20.4	0.504	113.3
6000	0.763	66	1.017	-7.8	0.629	8.4	0.523	99.2

MA4T324335

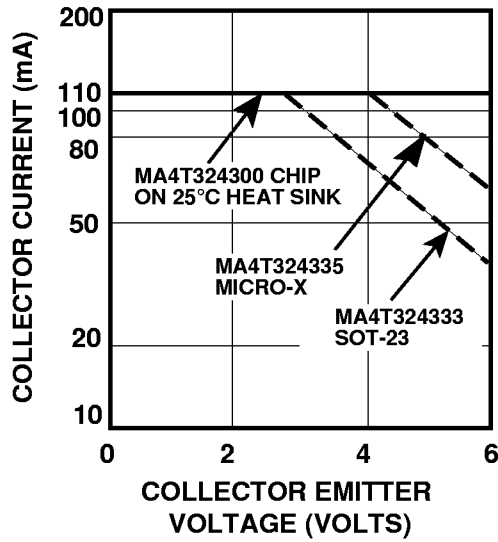
 $V_{CE} = 3$  Volts,  $I_C = 60$  mA

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.685	164	2.678	73.1	0.140	68.1	0.446	173.9
2000	0.698	143	1.528	54.2	0.251	56.1	0.492	156.8
3000	0.719	122	1.245	37.7	0.380	45.6	0.480	139.4
4000	0.727	104	1.103	20.7	0.474	31.0	0.502	125.4
5000	0.754	86	1.045	6.5	0.549	19.8	0.520	110.6
6000	0.767	67	1.025	-7.9	0.641	7.4	0.540	96.0

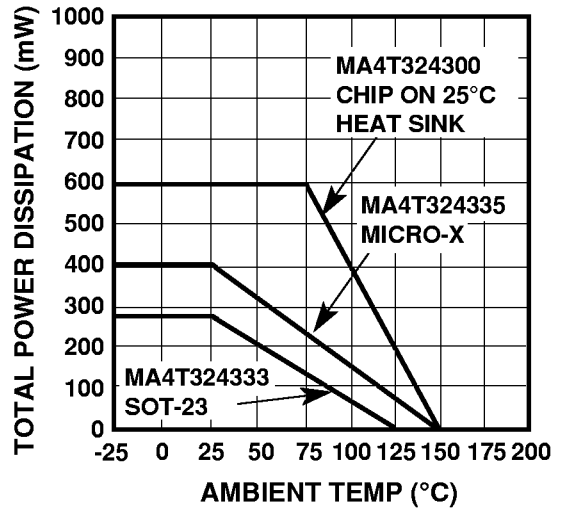
Specifications Subject to Change Without Notice.

Typical Performance Curves

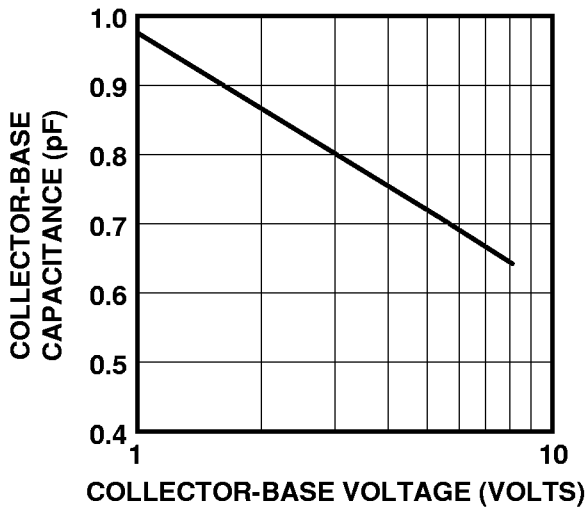
DC SAFE OPERATING RANGE AT 25°C



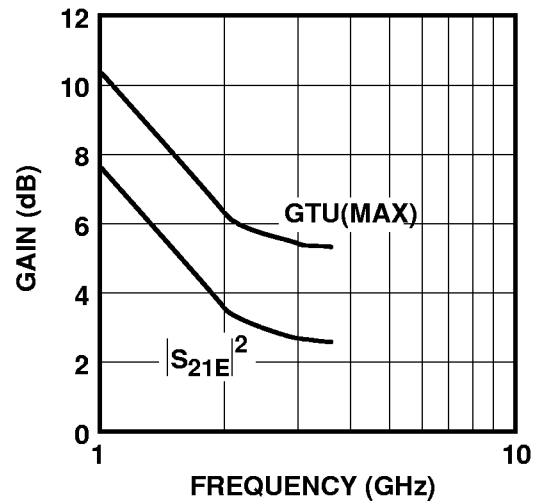
NOMINAL POWER DERATING CURVES



NOMINAL COLLECTOR-BASE CAPACITANCE ( $C_{OB}$ ) vs COLLECTOR-BASE VOLTAGE (MA4T324335)



NOMINAL GAIN vs FREQUENCY AT  $V_{CE} = 3$  VOLTS AND  $I_C = 20$  mA (MA4T324335)



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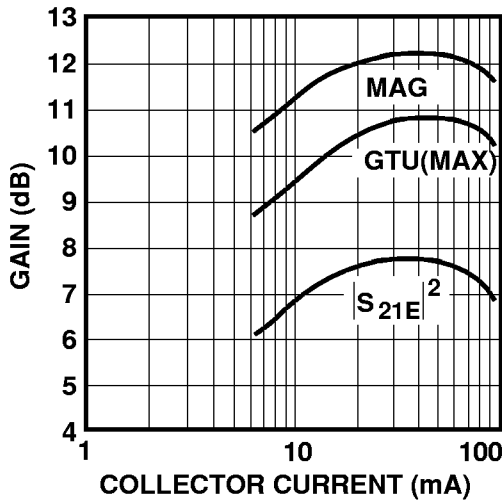
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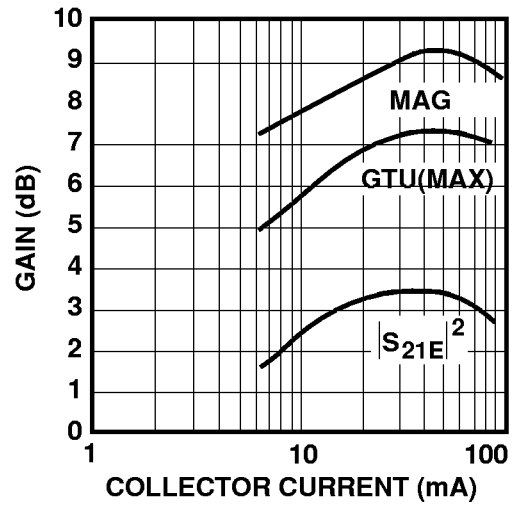
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Typical Performance Curves (Cont'd)

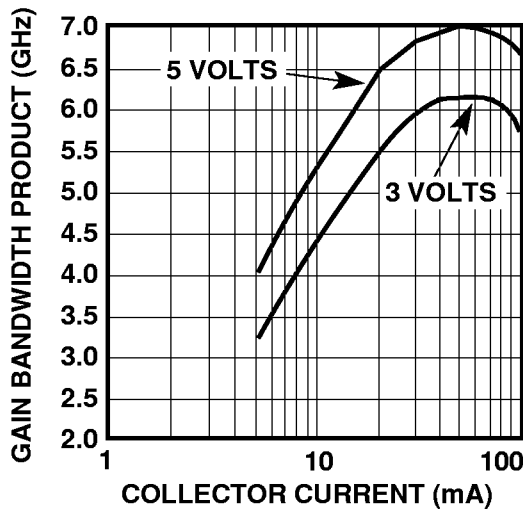
NOMINAL GAIN vs COLLECTOR CURRENT AT  $F = 1$  GHz AND  $V_{CE} = 3$  VOLTS (MA4T32433)



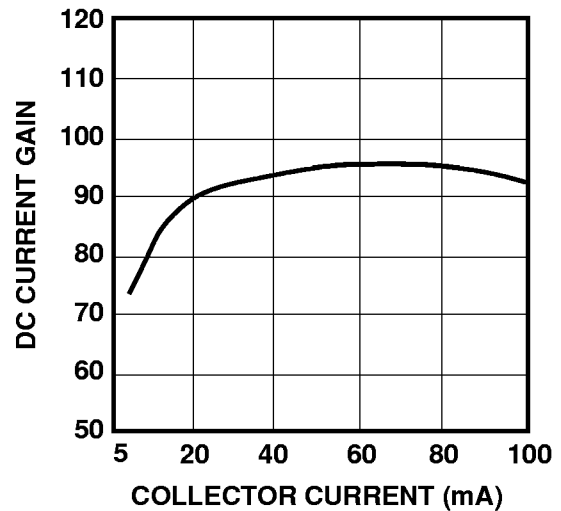
NOMINAL GAIN vs COLLECTOR CURRENT AT  $F = 2$  GHz AND  $V_{CE} = 3$  VOLTS (MA4T324335)



NOMINAL GAIN BANDWIDTH PRODUCT ( $f_T$ ) vs THE COLLECTOR CURRENT AT  $V_{CE} = 3$  AND 5 VOLTS (MA4T324335)



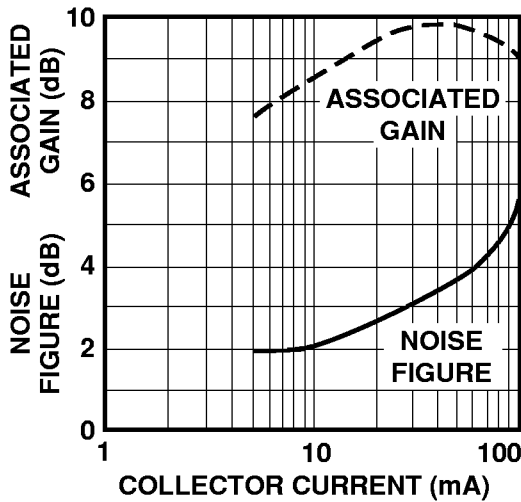
NOMINAL DC CURRENT GAIN ( $h_{FE}$ ) vs COLLECTOR CURRENT AT  $V_{CE} = 3$  VOLTS (MA4T324335)



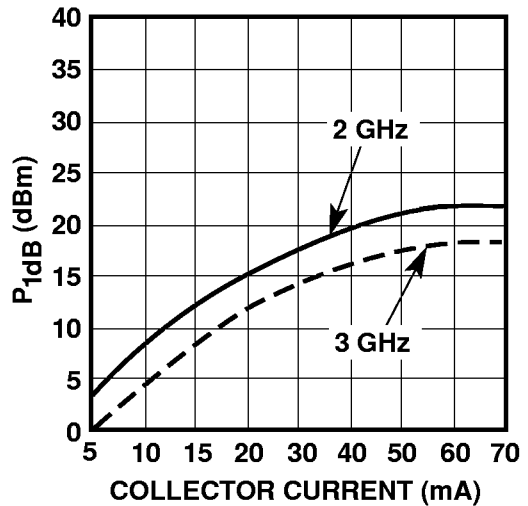
Specifications Subject to Change Without Notice.

Typical Performance Curves (Cont'd)

NOMINAL NOISE FIGURE AND ASSOCIATED GAIN AT 1 GHz  
AT  $V_{CE} = 3$  VOLTS AND COLLECTOR CURRENT IN mA  
(MA4T324335)



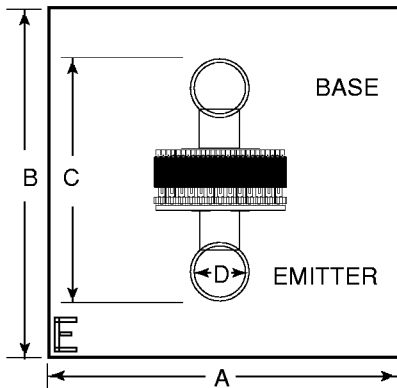
NOMINAL OUTPUT POWER AT THE 1 dB COMPRESSION POINT  
vs COLLECTOR CURRENT AT FREQUENCY = 2 AND 3 GHz,  
 $V_{CE} = 3$  VOLTS (MA4T324335)



Case Styles

MA4T324300

Case Style 1168



MA4T324300

NOMINAL DIM.	INCHES	MILLIMETERS
A	0.013	0.325
B	0.013	0.325
C	0.005	0.25
D (Dia.)	0.002	0.030
E (Chip Thickness)	0.0045	0.114

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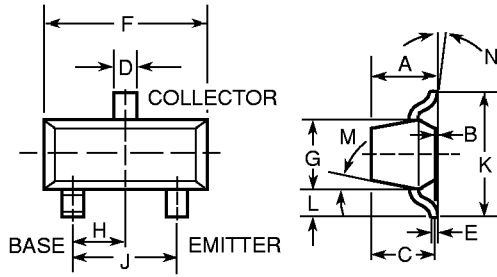
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Case Styles (Cont'd)

SOT-23 — MA4T324333



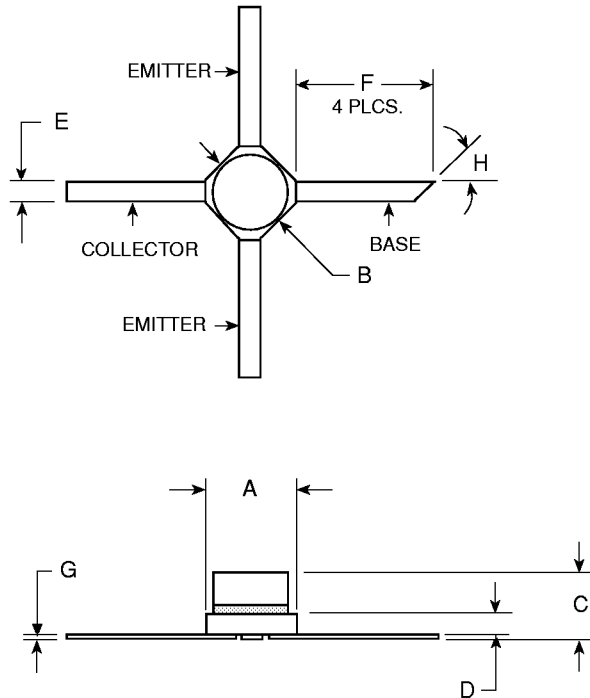
MA4T324333

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	—	0.044	—	1.12
B	—	0.004	—	0.10
C	—	0.040	—	1.00
D	0.013	0.020	0.35	0.50
E	0.003	0.006	0.08	0.15
F	0.110	0.119	2.80	3.00
G	0.047	0.056	1.20	1.40
H	0.037 typical		0.95 typical	
J	0.075 typical		1.90 typical	
K		0.103		2.60
L		0.024		0.60

DIM.	GRADIENT
M	10° max. <sup>1</sup>
N	2°...30°

Note:  
1. Applicable on all sides

Micro-X — MA4T324335



MA4T324335

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.092	0.108	2.34	2.74
B	0.079	0.087	2.01	2.21
C	—	0.070	—	1.78
D	0.019	0.025	0.48	0.64
E	0.018	0.022	0.46	0.56
F	0.150	—	3.81	—
G	0.003	0.006	0.08	0.15
H	45°		45°	

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