

# Moderate Power, 3 Volt, High $f_T$ NPN Silicon Transistor

## MA4T6380 Series

V 2.00

### Features

- Low Voltage Operation (3-5 Volts)
- High Output Power  
+21 dBm  $P_{1dB}$  at 1 GHz  
16 dBm at 2 GHz
- High  $f_T$  10 GHz
- Low Noise Figure (1.5 dB)
- Low Noise Oscillator  
Low Phase Noise with 3-5 Volt  $V_{CE}$

### Description

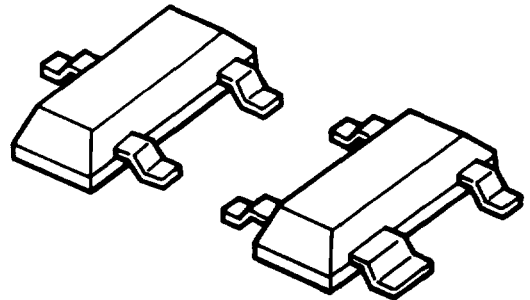
The MA4T6380 series of moderate power low voltage NPN transistors provide low noise at 3-5 volts operating voltage. These transistors are designed to optimize at moderate collector currents (20-60 mA) and low voltage.

They are useful as moderate power (+15 to +20 dBm) low noise amplifiers at 0.5-2 GHz or as a low noise VCO transistor in portable battery operated RF systems from 100 MHz to 3.0 GHz.

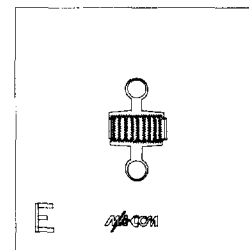
These inexpensive transistors are available in the SOT-23 (MA4T638033), the SOT-143 (MA4T638039), and the Micro-X (MA4T638035) packages. They are also available as chips (MA4T638000) for hybrid circuits. The plastic packages SOT-23 and SOT-143 are normally supplied on tape and reel.

The MA4T6380 series are useful for moderate power low noise amplifiers or oscillators from VHF to approximately 3.0 GHz.

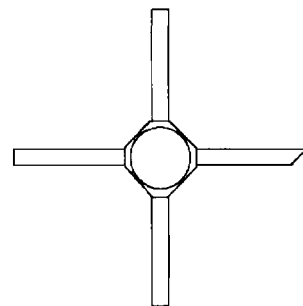
SOT-23



SOT-143



Chip



Micro-X

Specifications Subject to Change Without Notice.

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

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8-25

Maximum Ratings @ 25°C

Parameter	Symbol	Maximum
Collector-Base Voltage	$V_{CBO}$	8 V
Collector-Emitter Voltage	$V_{CEO}$	6 V
Emitter-Base Voltage	$V_{EBO}$	1.5 V
Collector Current	mA	80 mA
Junction Temperature	$T_j$	200 °C
Storage Temperature Chips or Ceramic Packages Plastic Packages	$T_{STG}$	-65°C to +200°C -65°C to +125°C
Power Dissipation	$P_D$	500 mW <sup>1</sup>

Note: 1. See power derating curves.

Electrical Specifications @ +25°C  
MA4T6380 Series

Parameter	Condition	Symbol	Units	MA4T638000 Chip	MA4T638033 SOT-23	MA4T638035 Micro-X	MA4T638039 SOT-143
Gain Bandwidth Product	$V_{CE} = 3\text{ V}$ $I_C = 50\text{ mA}$	$f_T$	GHz	9 typ.	9 typ.	9 typ.	9 typ.
Insertion Power Gain	$V_{CE} = 3\text{ V}$ $I_C = 20\text{ mA}$ $f = 1\text{ GHz}$	$ S_{21E} ^2$	dB	10 typ.	9 typ.	10 typ.	9 typ.
Noise Figure	$V_{CE} = 3\text{ V}$ $I_C = 10\text{ mA}$ $f = 1\text{ GHz}$	NF	dB	1.6 typ.	1.6 typ.	1.5 typ.	1.6 typ.
Collector Capacitance	$V_{CE} = 3\text{ V}$	$C_{OB}$	pF	1.0 typ.	1.15 typ.	1.1 typ.	1.15 typ.
Associated Gain	$V_{CE} = 3\text{ V}$ $I_C = 20\text{ mA}$ $f = 1\text{ GHz}$	GA	dB	11.5 typ.	11 typ.	11.5 typ.	11 typ.
Output Power at 1 dB Compression	$V_{CE} = 3\text{ V}$ $I_C = 60\text{ mA}$ $f = 1\text{ GHz}$	$P_{1dB}$	dBm	21 typ.	20 typ.	21 typ.	20 typ.
Thermal Resistance	Junction/ Ambient (Free Air)	$R_{TH(J-A)}$	°C/W	—	600 max.	550 max.	600 max.
Thermal Resistance	Junction/Case	$R_{TH(J-C)}$	°C/W	60 max. <sup>1</sup>	200 typ.	200 typ.	200 typ.

Note: 1. Junction to infinite heat sink.

Specifications Subject to Change Without Notice.

**Electrical Specifications @ +25°C**

**MA4T6380 Series**

Parameter	Condition	Symbol	Min	Typical	Max	Unit
Collector Cut-off Current	$V_{CB} = 3\text{ V}$ $I_E = 0$	$I_{CBO}$	—	—	100	$\mu\text{A}$
Emitter Cut-off Current	$V_{EB} = 1\text{ V}$ $I_C = 0$	$I_{EBO}$	—	—	1	$\mu\text{A}$
Forward Current Gain	$V_{CE} = 3\text{ V}$ $I_C = 10\text{ mA}$	$h_{FE}$	20	100	250	—
Collector-Base Junction Capacitance	$V_{CB} = 3\text{ V}$ $f = 1\text{ MHz}$	$C_{OB}$	—	1.0	1.2	$\text{pF}$

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

**MA4T638035**

$V_{CE} = 3\text{ Volts}, I_C = 5\text{ mA}$

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
400	0.642	-159.5	5.80	80.2	0.110	12.4	0.436	-115.3
800	0.630	147.3	3.16	36.0	0.132	11.9	0.304	-167.4
1200	0.626	109.6	2.20	-0.4	0.153	32.4	0.275	154.5
1600	0.623	75.8	1.72	-34.6	0.179	53.9	0.269	120.7
2000	0.621	43.7	1.43	-67.3	0.208	76.4	0.274	90.8
2400	0.618	12.6	1.25	-99.1	0.238	100.2	0.280	59.9
2800	0.611	-18.2	1.12	-129.9	0.270	124.9	0.289	32.5
3200	0.606	-49.3	1.04	-160.1	0.304	150.3	0.301	2.7
3600	0.602	-80.1	.97	170.3	0.337	176.3	0.311	-26.2
4000	0.599	-110.3	.91	141.4	0.373	157.1	0.327	-56.6

**MA4T638035**

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

Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
400	0.627	179.2	6.87	73.6	0.079	19.5	0.377	-144.6
800	0.629	135.9	3.61	33.8	0.111	2.1	0.313	163.8
1200	0.626	101.4	2.48	-0.6	0.147	18.7	0.301	127.8
1600	0.621	69.0	1.93	-33.5	0.185	42.6	0.299	96.0
2000	0.616	37.8	1.61	-65.3	0.223	67.8	0.298	67.1
2400	0.611	7.4	1.40	-96.5	0.261	94.0	0.300	37.6
2800	0.601	-23.0	1.26	-127.1	0.299	120.8	0.300	10.9
3200	0.593	-53.7	1.16	-157.2	0.335	148.0	0.305	-18.3
3600	0.586	-84.1	1.08	173.1	0.369	175.4	0.305	-45.7
4000	0.580	-113.9	1.02	144.0	0.404	157.0	0.313	-74.1

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**8-27**

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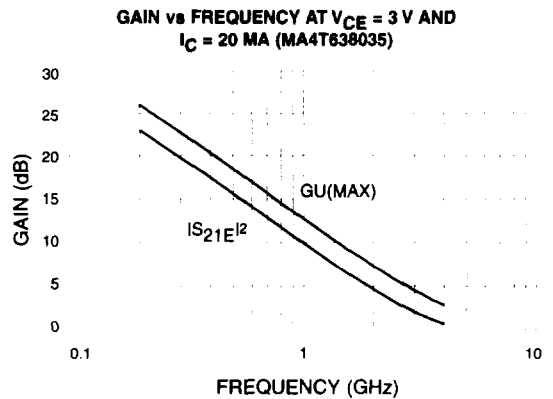
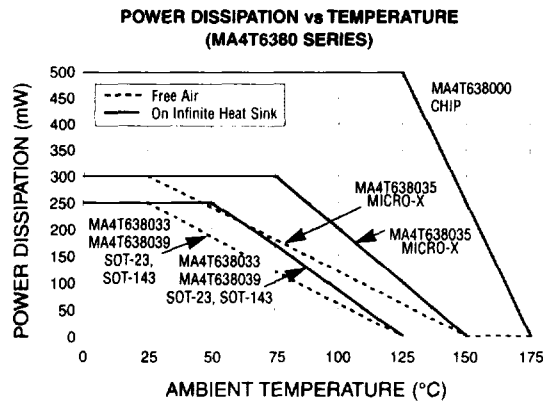
Typical Scattering Parameters in the Micro-X Package (Con't)

MA4T638035

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

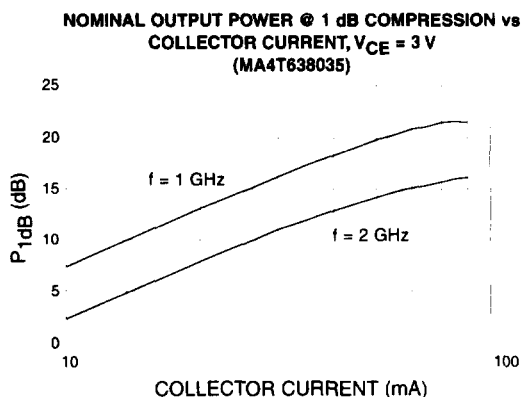
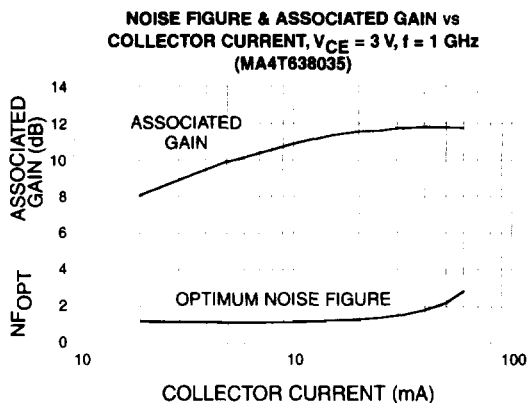
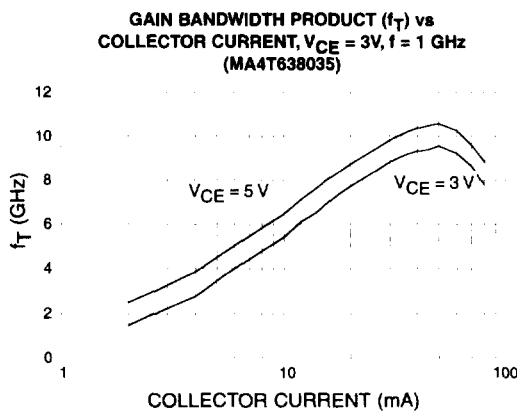
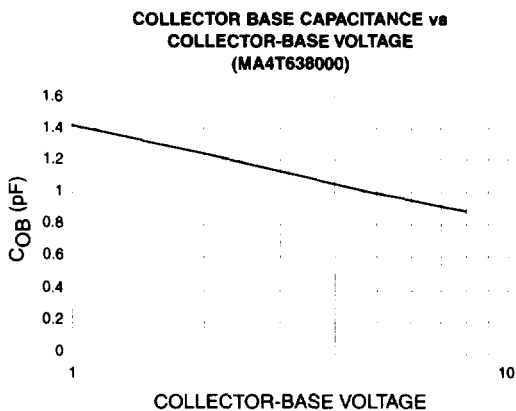
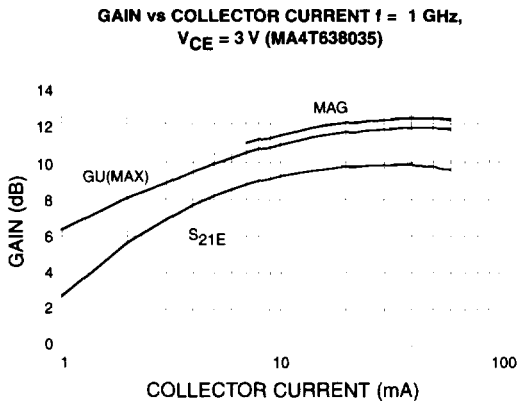
Frequency (MHz)	$S_{11E}$		$S_{21E}$		$S_{12E}$		$S_{22E}$	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
400	0.634	167.5	7.43	69.4	0.063	30.8	0.378	-166.6
800	0.638	129.4	3.84	32.4	0.105	13.3	0.352	147.4
1200	0.634	96.8	2.64	-8	0.148	10.2	0.346	113.9
1600	0.628	65.5	2.05	-32.9	0.192	36.3	0.343	83.0
2000	0.621	34.9	1.70	-64.3	0.235	63.3	0.339	54.4
2400	0.613	4.9	1.48	-95.2	0.276	90.7	0.339	25.0
2800	0.602	-25.1	1.33	-125.5	0.316	118.6	0.332	-4.3
3200	0.592	-55.5	1.22	-155.5	0.354	146.6	0.333	-31.0
3600	0.583	-85.7	1.14	174.9	0.389	174.7	0.328	-58.5
4000	0.575	-115.2	1.08	145.7	0.424	157.2	0.330	-86.6

Typical Performance Curves



Specifications Subject to Change Without Notice.

Typical Performance Curves (Con't)



Specifications Subject to Change Without Notice.

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8-29

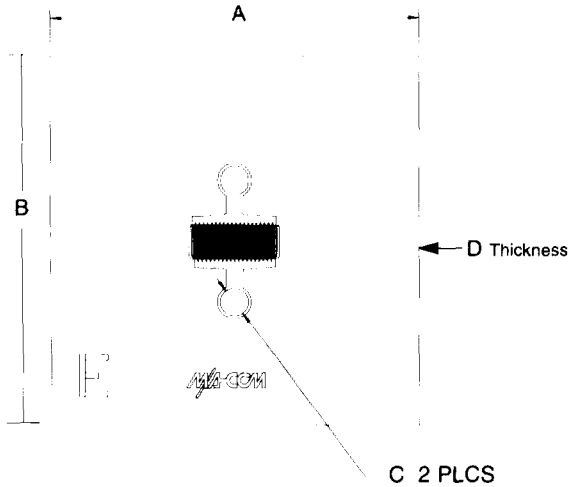
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Case Styles

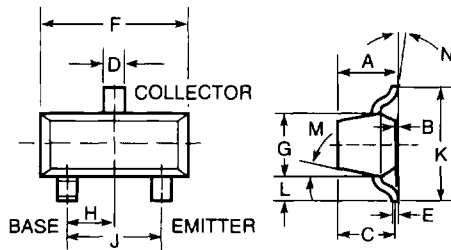
Chip — MA4T638000  
Case Style 1169



MA4T638000

DIM.	INCHES (Nominal)	MM (Nominal)
A	0.013	0.35
B	0.013	0.35
C	0.0012	0.03
D	0.0045	0.11

SOT-23 — MA4T638033



MA4T638033

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

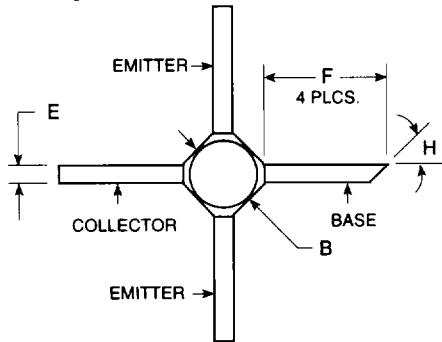
DIM.	GRADIENT
M	10° max.1
N	2°...30°

Note:  
1. Applicable on all sides

Specifications Subject to Change Without Notice.

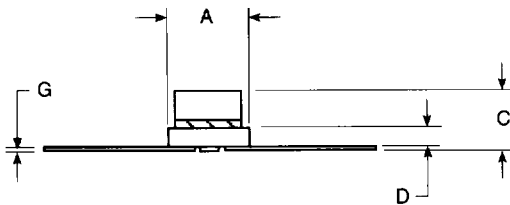
Case Styles (Con't)

Micro-X — MA4T630535  
Case Style 1139



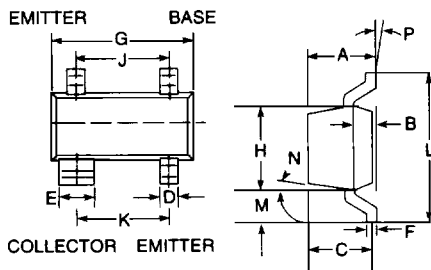
MA4T630535

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	0.046	0.56
F	0.150	—	3.81	—
G	0.003	0.006	0.08	0.15
H	45°		45°	



MA4T630539

SOT-143 — MA4T630539



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	—	0.044	—	1.10
B	—	0.044	—	1.10
C	—	0.040	—	1.00
D	0.030	0.035	0.75	0.90
E	0.013	0.020	0.35	0.50
F	0.003	0.006	0.08	0.15
G	0.110	0.119	2.80	3.00
H	0.047	0.056	1.20	1.40
J	0.075 TYPICAL		1.90 TYPICAL	
K	0.075 TYPICAL		1.90 TYPICAL	
L	—	0.103	—	2.6
M	—	0.024	—	0.6

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

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