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Agilent AT-42036
Up to 6 GHz Medium Power Silicon Bipolar Transistor

Data Sheet

Description

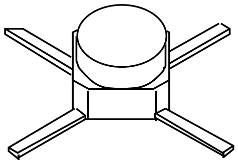
Agilent's AT-42036 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-42036 is housed in a cost effective surface mount 100 mil micro-X package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many different functions. The 20 emitter finger interdigitated geometry yields a medium sized transistor with impedances that are easy to match for low noise and medium power applications. This device is designed for use in low noise, wideband amplifier, mixer and oscillator applications in the VHF, UHF, and microwave frequencies. An optimum noise match near 50 Ω up to 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-42036 bipolar transistor is fabricated using Agilent's 10 GHz f_T Self-Aligned-Transistor (SAT) process. The die is nitride passivated for surface protection. Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metalization in the fabrication of this device.

Features

- **High output power:**
  21.0 dBm typical $P_{1\,dB}$ at 2.0 GHz
  20.5 dBm typical $P_{1\,dB}$ at 4.0 GHz
- **High gain at 1 dB compression:**
  14.0 dB typical $G_{1\,dB}$ at 2.0 GHz
  9.5 dB typical $G_{1\,dB}$ at 4.0 GHz
- **Low noise figure:**
  1.9 dB typical NF_0 at 2.0 GHz
- **High gain-bandwidth product:**
  8.0 GHz typical f_T
- **Cost effective ceramic microstrip package**

36 micro-X Package



AT-42036 Absolute Maximum Ratings[1]

Symbol	Parameter	Units	Absolute Maximum
V_{EBO}	Emitter-Base Voltage	V	1.5
V_{CBO}	Collector-Base Voltage	V	20
V_{CEO}	Collector-Emitter Voltage	V	12
I_C	Collector Current	mA	80
P_T	Power Dissipation[2,3]	mW	600
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature[4]	°C	-65 to 150

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 5.7 mW/°C for $T_C > 95$°C.
4. Storage above +150°C may tarnish the leads of this package making it difficult to solder into a circuit.
5. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

Thermal Resistance[2,5]:

θ_{jc} = 175°C/W

Electrical Specifications

$T_A = 25$°C

Symbol	Parameters and Test Conditions[1]	Frequency	Units	Min.	Typ.	Max.
$\lvert S_{21E}\rvert^2$	Insertion Power Gain; $V_{CE} = 8$ V, $I_C = 35$ mA	f = 2.0 GHz f = 4.0 GHz	dB	10.0	11.0 5.0	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression $V_{CE} = 8$ V, $I_C = 35$ mA	f = 2.0 GHz f = 4.0 GHz	dBm		21.0 20.5	
$G_{1\,dB}$	1 dB Compressed Gain; $V_{CE} = 8$ V, $I_C = 35$ mA	f = 2.0 GHz f = 4.0 GHz	dB		14.0 9.5	
NF_0	Optimum Noise Figure: $V_{CE} = 8$ V, $I_C = 10$ mA	f = 2.0 GHz f = 4.0 GHz	dB		2.0 3.0	
G_A	Gain @ NF_0; $V_{CE} = 8$ V, $I_C = 10$ mA	f = 2.0 GHz f = 4.0 GHz	dB		13.5 10.0	
f_T	Gain Bandwidth Product: $V_{CE} = 8$ V, $I_C = 35$ mA		GHz		8.0	
h_{FE}	Forward Current Transfer Ratio; $V_{CE} = 8$ V, $I_C = 35$ mA		—	30	150	270
I_{CBO}	Collector Cutoff Current; $V_{CB} = 8$ V		μA			0.2
I_{EBO}	Emitter Cutoff Current; $V_{EB} = 1$ V		μA			2.0
C_{CB}	Collector Base Capacitance[1]: $V_{CB} = 8$ V, f = 1 MHz		pF		0.28	

Note:

1. For this test, the emitter is grounded.

AT-42036 Typical Performance, $T_A = 25°C$

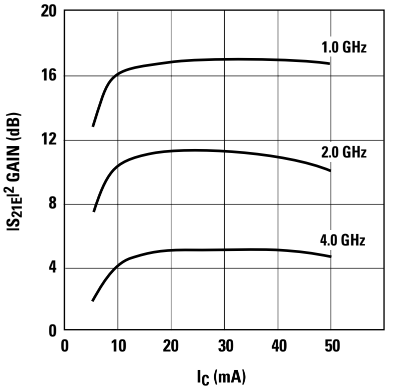


Figure 1. Insertion Power Gain vs. Collector Current and Frequency. $V_{CE} = 8$ V.

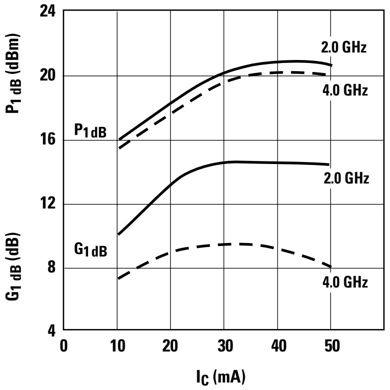


Figure 2. Output Power and 1 dB Compressed Gain vs. Collector Current and Frequency. $V_{CE} = 8$ V.

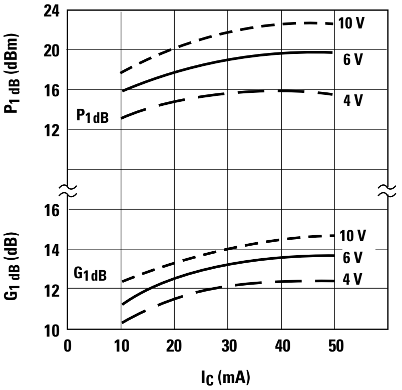


Figure 3. Output Power and 1 dB Compressed Gain vs. Collector Current and Voltage. f = 2.0 GHz.

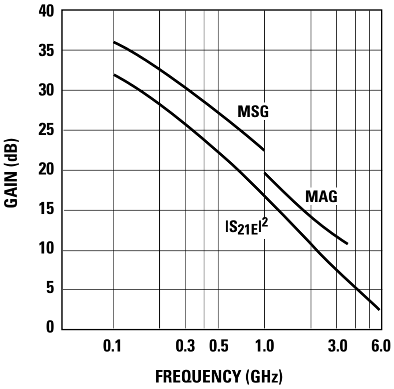


Figure 4. Insertion Power Gain, Maximum Available Gain and Maximum Stable Gain vs. Frequency. $V_{CE} = 8$ V, $I_C = 35$ mA.

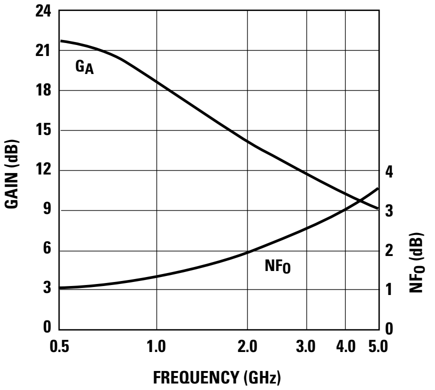


Figure 5. Noise Figure and Associated Gain vs. Frequency. $V_{CE} = 8$ V, $I_C = 10$ mA.

AT-42036 Typical Scattering Parameters,

Common Emitter, $Z_0 = 50\ \Omega$, $T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 10$ mA

Freq. GHz	S_{11} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.1	.72	-46	28.3	26.09	152	-37.0	.014	73	.92	-14
0.5	.59	-137	20.9	11.13	102	-31.0	.028	44	.58	-27
1.0	.56	-171	15.4	5.91	80	-28.2	.039	47	.51	-29
1.5	.56	169	12.1	4.03	67	-26.6	.047	52	.50	-33
2.0	.58	155	9.7	3.06	55	-24.2	.062	55	.48	-38
2.5	.59	147	8.0	2.50	48	-22.6	.074	61	.47	-42
3.0	.61	137	6.5	2.10	38	-20.8	.092	65	.46	-51
3.5	.63	128	5.2	1.82	27	-19.6	.105	62	.47	-63
4.0	.63	117	4.0	1.60	17	-18.0	.126	57	.49	-72
4.5	.63	106	3.1	1.43	7	-16.5	.149	53	.51	-80
5.0	.64	93	2.3	1.30	-3	-15.4	.169	48	.52	-87
5.5	.67	79	1.5	1.19	-13	-14.3	.193	41	.51	-94
6.0	.72	70	0.6	1.07	-23	-13.4	.215	35	.46	-105

AT-42036 Typical Scattering Parameters,

Common Emitter, $Z_0 = 50\ \Omega$, $T_A = 25°C$, $V_{CE} = 8$ V, $I_C = 35$ mA

Freq. GHz	S_{11} Mag.	S_{11} Ang.	S_{21} dB	S_{21} Mag.	S_{21} Ang.	S_{12} dB	S_{12} Mag.	S_{12} Ang.	S_{22} Mag.	S_{22} Ang.
0.1	.50	-88	33.2	45.64	135	-42.0	.008	68	.77	-22
0.5	.52	-164	22.4	13.24	92	-32.8	.023	57	.45	-25
1.0	.53	174	16.6	6.75	76	-28.2	.039	63	.42	-26
1.5	.53	160	13.1	4.55	64	-25.6	.053	66	.41	-30
2.0	.55	148	10.8	3.45	53	-23.2	.069	65	.41	-36
2.5	.57	142	9.0	2.81	47	-21.6	.084	67	.39	-40
3.0	.59	134	7.5	2.37	37	-20.0	.101	64	.38	-49
3.5	.60	125	6.3	2.06	27	-18.4	.120	61	.39	-61
4.0	.60	116	5.2	1.81	17	-17.0	.141	57	.41	-71
4.5	.60	104	4.2	1.62	7	-16.0	.158	50	.43	-78
5.0	.61	92	3.4	1.47	-2	-14.9	.179	45	.44	-84
5.5	.64	79	2.6	1.35	-13	-14.1	.198	37	.43	-91
6.0	.69	70	1.7	1.21	-23	-13.2	.219	30	.38	-102

A model for this device is available in the DEVICE MODELS section.

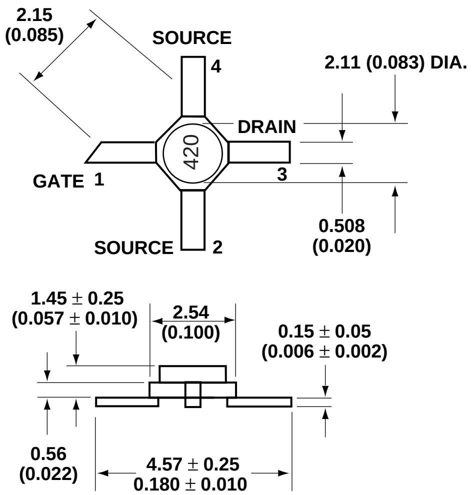
AT-42036 Noise Parameters, $V_{CE} = 8$ V, $I_C = 10$ mA

Freq. GHz	NF_O dB	Γ_{opt} Mag	Γ_{opt} Ang	$R_N/50$
0.1	1.0	.04	10	0.13
0.5	1.1	.04	66	0.12
1.0	1.3	.07	150	0.12
2.0	2.0	.20	-178	0.12
4.0	3.0	.51	-110	0.36

Part Number Ordering Information

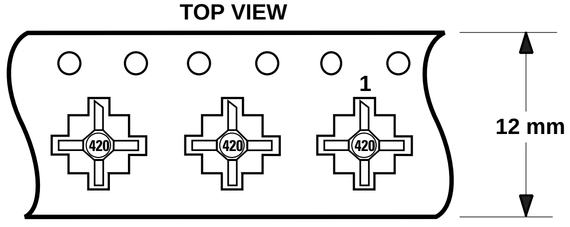
Part Number	Devices per Reel	Reel Size
AT-42036-TR1	1000	7″
AT-42036-BLK	10	STRIP

36 micro-X Package Dimensions



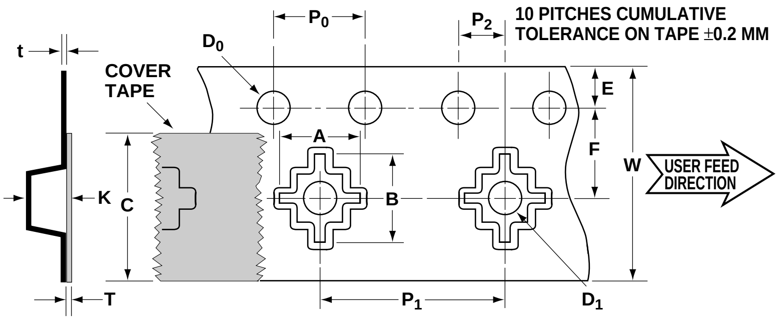
Notes:
1. Dimensions are in millimeters (inches)
2. Tolerances: in .xxx = ± 0.005
mm .xx = ± 0.13

Device Orientation



1 INDICATES PIN 1 ORIENTATION.

Tape Dimensions



DESCRIPTION		SYMBOL	SIZE (mm)	SIZE (INCHES)
CAVITY	LENGTH	A	5.77 ± 0.10	0.227 ± 0.004
	WIDTH	B	6.10 ± 0.10	0.240 ± 0.004
	DEPTH	K	1.70 ± 0.10	0.067 ± 0.004
	PITCH	P_1	8.00 ± 0.10	0.314 ± 0.004
	BOTTOM HOLE DIAMETER	D_1	1.50 min.	0.059 min.
PERFORATION	DIAMETER	D_0	1.50 + 0.10/-0.05	0.059 + 0.004/-0.002
	PITCH	P_0	4.00 ± 0.10	0.157 ± 0.004
	POSITION	E	1.75 ± 0.10	0.069 ± 0.004
CARRIER TAPE	WIDTH	W	12.00 ± 0.20	0.472 ± 0.008
	THICKNESS	t	0.30 ± 0.05	0.012 ± 0.002
COVER TAPE	WIDTH	C	9.30 ± 0.10	0.366 ± 0.004
	TAPE THICKNESS	T	0.065 ± 0.010	0.0026 ± 0.0004
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION (WIDTH DIRECTION)	F	5.50 ± 0.05	0.217 ± 0.002
	CAVITY TO PERFORATION (LENGTH DIRECTION)	P_2	2.00 ± 0.05	0.079 ± 0.002

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