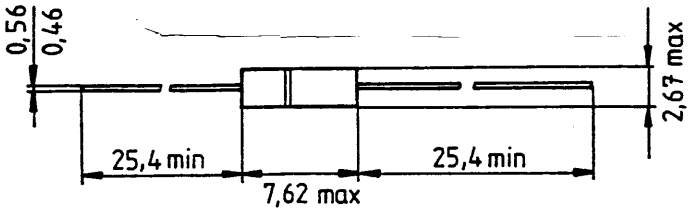
Kapazitätsdiode

Anwendungskode nach 5N 0819 Teil 1			
Erzeugnis-Klasse	Klima-Klasse n. DIN 40040		
K	E	J	C
Prüf-Ber. Nr:			
Datum:			

Symbol : Microwave Associaties, Inc. MA 44604 1985



1 Mechanische Ausführung

1.1 Gehäuse JEDEC DO 7 /DIN

1.2 Gehäusewerkstoff : Glas

1.3 Gehäuseoberfläche : --

1.4 Anschlußdrähte: lötbar verzinnt/vergoldet; Lötbarkeitsprüfung nach DIN-IEC 68 Teil 2 - 20

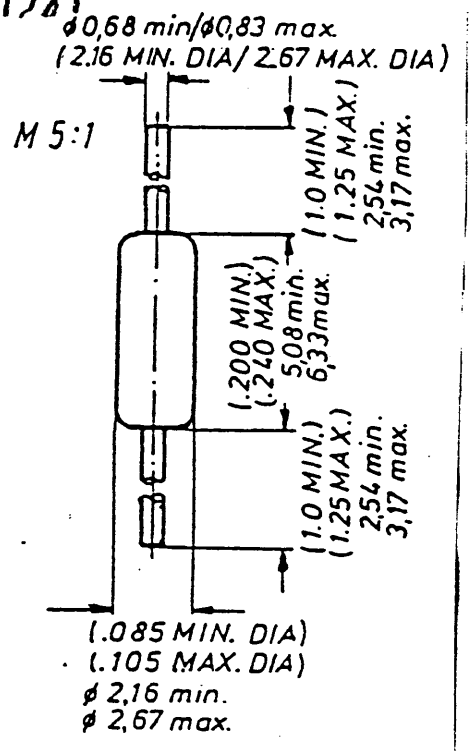
1.5 Kennzeichnung : Kathodenband und Farbringe

2 Grenzwerte		Formelzeichen	Wert		Meßbedingungen
2.1 Sperrspannung	:	U_R	--	V	I_R = -- A; ϑ_u = °C
2.2 Spitzensperrspannung	:	U_{Rsp}	40	V	ϑ_u = -- °C
2.3 Stoßspannung	:	U_{Rstoss}	--	V	ϑ_u = -- °C
2.4 Durchlaßstrom	:	I_F	--	A	ϑ_u = -- °C
2.5 Durchlaß-Spitzenstrom	:	I_{Fsp}	--	A	ϑ_u = -- °C
2.6 Durchlaß-Stoßstrom	:	I_{Fstoss}	--	A	ϑ_u = -- °C; t = ms
2.7 Verlustleistung	:	P	0,5	W	ϑ_u = 50 °C
2.8 Temperaturbereich (Lagerung)	:	ϑ_s	65...150	°C	
2.9 Sperrschichttemperatur	:	ϑ_j	65...150	°C	
2.10 Löttemperatur	:	ϑ_l	245	°C	t ≦ 5 s
3 Kennwerte bei 25° C					
3.1 Durchbruchsspannung	:	U_{RS}	> 40	V	I_F = 10 µA
3.2 Sperrstrom	:	I_R	--	A	U_R = -- V
		I_R	--	A	U_R = 6 V; ϑ_u = -- °C
3.3 Thermischer Widerstand	:	$R_{th\ J-C}$	≦ 0,3	°C/mW	
3.4 Sperrschicht-Kapazität	:	C_j	3,0 ÷ 5,0	pF	U_R = 6 V; f = 1 MHz
3.5 Gehäuse-Kapazität	:	C_G	0,07	pF	
3.6 Rückwärtserholzeit	:		--	s	I_F = -- A auf I_R = -- A
3.7 Effekt. Minoritäts-Ladungsträger Lebensdauer		τ	≦ 120	ns	$I_R \approx 6mA$, $I_F \approx 10mA$
3.8 Sprungzeit		t_t	≦ 225	ps	Q_s = 1500 C
3.9 Gehäuse-Induktivität		L_G	2,5	nH	
3.10 Max. Ausgangsfrequenz		f_{0max}	1,5	GHz	

PIN-Diode

Lieferer: Microwave 8016 Feldkirchen | Unitrode | SDI
Typ : MA 47 323 | UM 9512 B | DP-100798P-015

1981



Maße in mm
( ) Maße in Zoll

Ungültig, keine Anwendung
AE-Nr. 400.63 15.11.88

EIGENSCHAFTEN

MATERIAL/PVD = /47081
ASSEMBLY/PVA

T = 25°C UNLESS OTHERWISE SPECIFIED

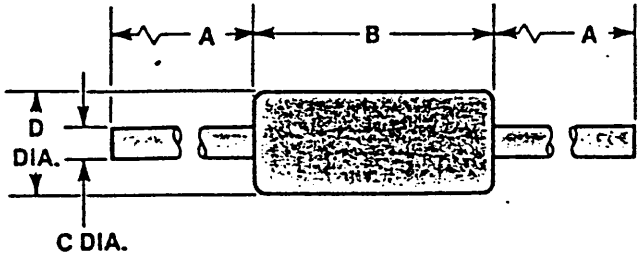
TEST	CONDITIONS	TM	SYM	MIN	MAX	UNIT
Breakdown Voltage:	$I_R \leq 10$ µA	44	V_B:	500	---	Volts
Total Capacitance:	V_R = -100 f = 1 MHz	24	C_T:	0.6	0.95	pf
Series Resistance:	IF = 100 mA f = 500 MHz	40	R_S:	---	.45	ohms
Life Time:	10 mA A = 6 mA 90% P+		T_L:	2.0	---	µsec

MARKING: Digital Branding and Polarity Sumbol or Band

Mikrowellendiode

PIN DIODE

Lieferer : M/A -COM GmbH | SDI
Typ : MA 4P487 | DP-100798-015



1. Mechanische Ausführung

1.1 Gehäuseart M/A-COM 146

1.2 Gehäusewerkstoff: Glas

1.3 Anschlußdrähte lötbar verzinnt

DIM.	INCHES MIN.	INCHES MAX.	MM MIN.	MM MAX.
A	1.000	1.250	25,40	31,75
B	0.200	0.240	5,08	6,10
C	0.027	0.033	0,69	0,84
D	0.085	0.105	2,16	2,67

2. Grenzwerte:

		Formelzeichen	Wert	Meßbedingungen
2.1	Sperrstrom	I_R	$\leq$ 10µA	U_R = 500V, ϑ_u = 25°C
2.2	Sperrstrom	I_R	$\leq$ 1µA	U_R = 400V, ϑ_u = 25°C
2.3	Durchlaßwiderstand	R_S	$\leq$ 0,35 Ω	I_F = 100mA, f = 100MHz
2.4	Sperrkapazität	C_T	$\leq$ 1,5pF	U_R = 100V, f = 100MHz
2.5	Minoritätsträger-Lebensdauer	T_L 90%	$\geq$1,5µs	I_F = 10mA, I_R = 6mA
2.6	Verlustleistung	P	1 W	ϑ_u = 25°C, linear abfallend auf 0 bei 150 °C
2.7	Betriebstemperatur	ϑ_c	-65..+150°C	
2.8	Lagertemperatur	ϑ_s	-65..+175°C	-

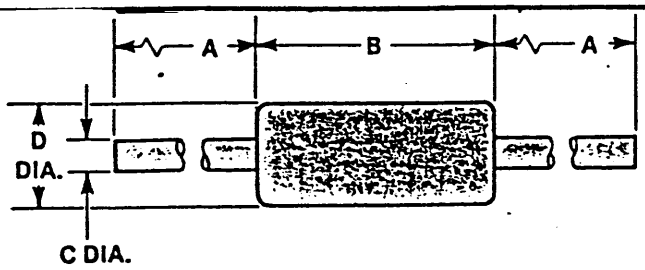
3. Alle übrigen Daten nach Datenblatt 4306G Typ MA 47266 Fa. M/A-COM

Mikrowellendiode

PIN-DIODE

Hersteller: Microwave Ass.
Lieferer: M/A -COM GmbH
Typ : MA 4P 232

SDI
DP-100858-015



1. Mechanische Ausführung

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B	0.200	0.240	5,08	6,10
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Ungültig, keine Anwendung

AE-Nr. 400.63 15.11.88

2. Grenzwerte:	Formelzeichen	Wert	Meßbedingungen
2.1 Sperrstrom	I_R	$\leq$ 10µA	U_R = 500V ϑ_u = 25°C
2.2 Sperrstrom	I_R	$\leq$ 1µA	U_R = 400V, ϑ_u = 25°C
2.3 Durchlaßwiderstand	R_S	$\leq$ 0,6 Ω	I_F = 100mA, f = 100MHz
2.4 Sperrkapazität	C_T	$\leq$ 1,5pF	U_R = 100V, f = 100MHz
2.5 Minoritätsträger-Lebensdauer	T_L 90%	$\geq$ 1,5µs	I_F = 10mA, I_R = 6mA
2.6 Verlustleistung	P	1 W	ϑ_u = 25°C, linear abfallend auf 0 bei 150 °C
2.7 Betriebstemperatur	ϑ_c	-65..+150°C	
2.8 Lagertemperatur	ϑ_s	-65..+175°C	-

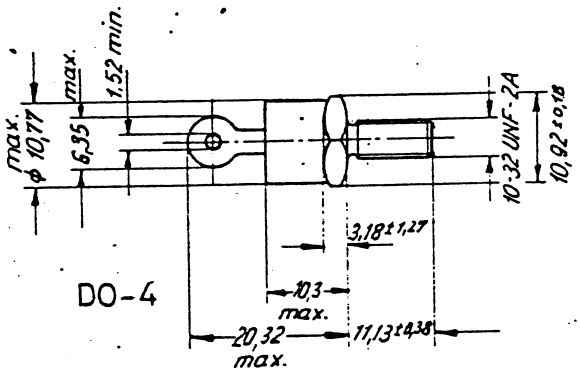
3. Alle übrigen Daten nach Datenblatt 4306G Typ MA 47266 Fa. M/A-COM

Si - Diode

Schottky

Motorola MBR 3545

1985



MECHANICAL CHARACTERISTICS

CASE: Welded, hermetically sealed

FINISH: All external surfaces corrosion-resistant and terminal leads are readily solderable.

POLARITY: Cathode to case

MOUNTING POSITIONS: Any

STUD TORQUE: 15 in. lb. max

MAXIMUM RATINGS

Rating	Symbol	MBR3520	MBR3535	MBR3545 MBR3545H, H1	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	20	35	45	Volts
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 kHz)	I_{FRM}	70 T_C = 90°C	70 T_C = 90°C	70 T_C = 90°C	Amp
Average Rectified Forward Current (Rated V_R)	I_O	30 T_C = 90°C	30 T_C = 90°C	30 T_C = 90°C	Amp
Case Temperature (Rated V_R)	T_C	140	140	140	°C
Non-repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz)	I_{FSM}	600	600	600	Amp
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150	-65 to +150	-65 to +150	°C
Peak Operating Junction Temperature (Forward Current Applied)	$T_{J(pk)}$	175	175	175	°C
Voltage Rate of Change (Rated V_R)	dv/dt	1000	1000	1000	V/µs

THERMAL CHARACTERISTICS

Characteristic	Symbol	MBR3520	MBR3535	MBR3545 MBR3545H, H1	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.0			°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	MBR3520	MBR3535	MBR3545 MBR3545H, H1	Unit
Maximum Instantaneous Forward Voltage (1) (i_F = 30 Amp, T_C = 125°C) (i_F = 78.5 Amp, T_C = 70°C) (i_F = 78.5 Amp, T_C = 125°C)	v_F	0.55 — 0.70	0.55 — 0.70	0.55 — 0.70	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, T_C = 125°C)	i_R	75	100	150	mA
Capacitance (V_R = 1.0 Vdc, 100 kHz ≤ f ≤ 1.0 MHz)	C_t	4000	4000	4000	pF

(1) Pulse Test: Pulse Width = 300 µs, Duty Cycle = 2.0%.

FIGURE 1 — TYPICAL FORWARD VOLTAGE

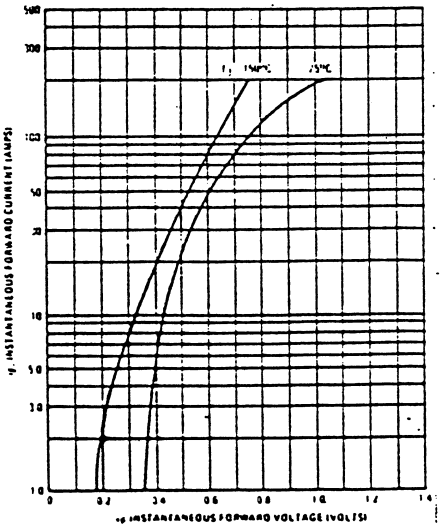


FIGURE 2 — CURRENT DERATING

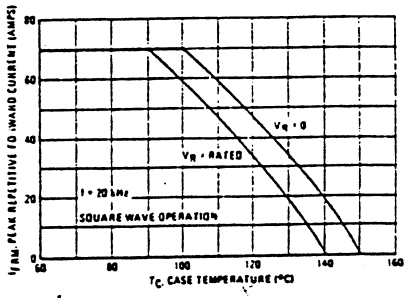
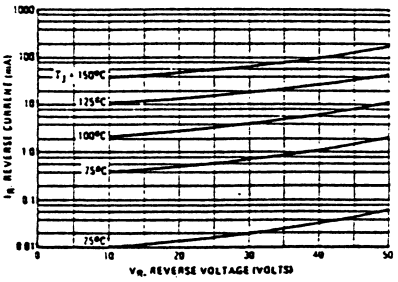


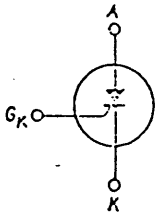
FIGURE 3 — TYPICAL REVERSE CURRENT

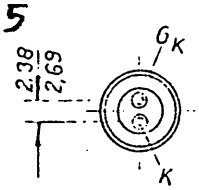


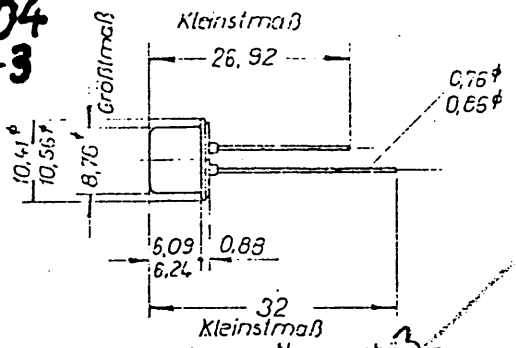
Überige Werte nach: Motorola "Silicon Rectifier" Manual Ausg. 1980

Vierschicht-Diode
Silizium

Motorola MCR 1304 -3
1964/65







Anode mit Gehäuse elektr. verbunden

Normgehäuse : —

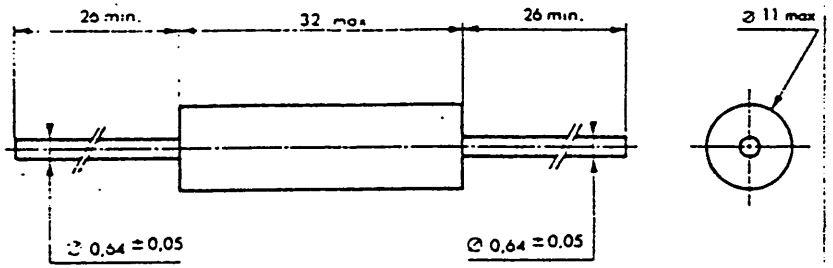
1. Eigenschaften:

1.1. Werkstoff: Gehäuse	:			
.1.1. Oberfläche	:			
.1.2. Anschlußdrähte	:	lötbar, verzinnt		
.1.3. Kennzeichnung	:	Typ aufgestempelt		
1.2. Grenzwerte bei 100 °C				
.2.1. Sperrspannung in Sperrrichtung	:	$U_{SS\ max.}$	100	V
.2.2. Sperrspannung in Durchlaßrichtung	:	$U_{SD\ max.}$	100	V
.2.3. Gleichsperrspannung	:	$U_{-\ max.}$		V
.2.4. Stoßspitzenspannung	:	$U_{Stoß}$		V
.2.5. Dauergrenzstrom	:	$I_{max.}$	8	A
.2.6. Stoßstrom	:	$+I_{Stoß}$	100	A
.2.7. Stoßstrom	:	$-I_{Stoß}$	80	A
.2.8. Grenzlastintegral ($t \leq 8{,}3$ ms)	:	$i^2 t_{max.}$	40	A^2s in Durchlaßrichtung
.2.9. Verlustleistung	:	P_{tot}		W (ϑ_u = °C)
.2.10. Steuerspannung	:	$U_{St\ max.}$	± 10	V
.2.11. Steuerstrom	:	$I_{St\ max.}$	2	A
.2.12. Spitzensteuerverlust	:	$P_{St\ max.}$	—	W
.2.13. Haltespannung	:	U_H	—	V
.2.14. Haltestrom	:	I_H	—	A
.2.15. Sperrschichttemperatur	:	ϑ_j	- 40	°C bis + 100 °C
.2.16. Temperaturbereich	:	ϑ_s	- 40	°C bis + 150 °C
.2.17. Spitzentorverlustleistung	:	P_T	5	W
.2.18. Mittlere Torverlustleistung	:	P_T	0,5	W
.2.19.				
.2.20.				
1.3. Elektr. Werte bei 25 °C:				
× .3.1. Durchlaßspannung	:	U_d	1 < 1,3	V (I_d = 5 A)
× .3.2. Sperrstrom in Sperrrichtung	:	I_R	< 2	mA (Steuerkreis offen) } U_D = 100 (ϑ_U = 100 °C)
× .3.3. Sperrstrom in Durchlaßrichtung	:	I_B	< 2	mA (Steuerkreis offen) }
× .3.4. Steuerspannung (Zündspannung)	:	U_Z	0,5 < 1,5	V (U_{SD} = ≧ 7 V) } (R_L = 100 Ω)
× .3.5. Steuerstrom (Zündstrom)	:	I_Z	8 < 20	mA (U_{SD} = ≧ 7 V) }
.3.6. Wärmeinnenwiderstand	:	R_{thG}	1,5 < 2,7	°C / W
.3.7. Wärmewiderstand	:	R_{thU}	< 40	°C / W
.3.8. Einschaltzeit	:	t_{Ein}	1	µs ($t_{Ein} = t_A + t_V$) (I_d = 5 A, I_g = 20 mA)
.3.9. Anstiegzeit	:	t_A	—	s
.3.10. Verzögerungszeit	:	t_V	—	s
.3.11. Ausschaltzeit	:	t_{Aus}	12	µs (I_d = 5A, I_R = 5A, I_a = 20 mA)
.3.12. Sperrschichtkapazität	:	C_j	—	pF
1.4. Übrige elektr. Werte nach	:	Motorola - Datenblatt Ausg. 64, DS 6502 R1		

Si - Diode

Thomson CSF
1987 ME 60...

NfN Nicht für Neukonstr.



Types	I_O (mA)	V_{RRM} (V)	I_{FSM} 10 ms (A)	V_F max (V)	/ I_F (mA)	I_R/V_{RRM} max (µA)	$V_{(BR)R}$ min (V)	t_{rr} max (ns)
ME 30		3000		3				
ME 60		6000		6				
ME 100	200	10000	2,5	10	200	10		
ME 120		12000		12				
ME 200		20000		24				

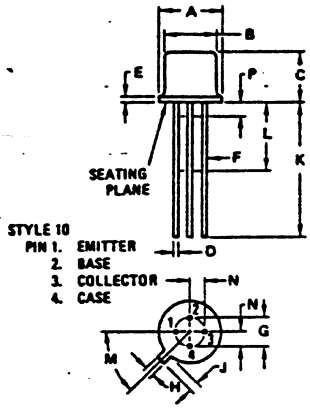
200 mA / T_{amb} = 25°C T_j = 125°C

Si - NPN - Transistor

Motorola ~~MRE~~ MFR 914

1986

Seite 1



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.31	5.84	0.209	0.230
B	4.52	4.95	0.178	0.195
C	4.32	5.33	0.170	0.210
D	0.41	0.53	0.016	0.021
E	–	0.76	–	0.030
F	0.41	0.48	0.016	0.019
G	2.54 BSC		0.100 BSC	
H	0.91	1.17	0.036	0.046
J	0.71	1.22	0.028	0.048
K	12.70	–	0.500	–
L	6.35	–	0.250	–
M	45° BSC		45° BSC	
N	1.27 BSC		0.050 BSC	
P	–	1.27	–	0.050

ALL JEDEC dimensions and notes apply

CASE 20-03
TO-72

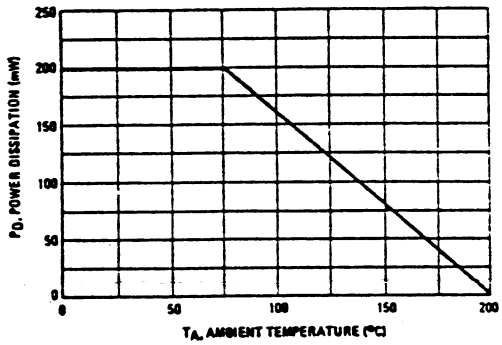
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	12	Vdc
Collector-Base Voltage	V_{CBO}	20	Vdc
Emitter-Base Voltage	V_{EBO}	3.0	Vdc
Collector Current — Peak	I_C	40	mAdc
Total Device Dissipation @ $T_A = 75°C$ Derate Above 75°C	P_D	200 1.6	mW mW/°C
Storage Temperature Range	T_{stg}	-65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	625	°C/W

FIGURE 1 — POWER DERATING



ELECTRICAL CHARACTERISTICS ($T_C = 25°C$ unless otherwise noted).

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 1.0$ mAdc, $I_B = 0$)	BV_{CEO}	12	–	–	Vdc
Collector-Base Breakdown Voltage ($I_C = 0.1$ mAdc, $I_E = 0$)	BV_{CBO}	20	–	–	Vdc
Emitter-Base Breakdown Voltage ($I_E = 0.1$ mAdc, $I_C = 0$)	BV_{EBO}	3.0	–	–	Vdc
Collector Cutoff Current ($V_{CB} = 15$ Vdc, $I_E = 0$)	I_{CBO}	–	–	50	nAdc
ON CHARACTERISTICS					
DC Current Gain ($I_C = 20$ mAdc, $V_{CE} = 10$ Vdc)	h_{FE}	30	–	200	–
DYNAMIC CHARACTERISTICS					
Current-Gain Bandwidth Product ($I_C = 20$ mAdc, $V_{CE} = 10$ Vdc, f = 0.5 GHz)	f_T	–	4.5	–	GHz
Collector-Base Capacitance ($V_{CB} = 10$ Vdc, $I_E = 0$, f = 1.0 MHz)	C_{cb}	–	0.7	1.0	pF
FUNCTIONAL TESTS					
Noise Figure ($I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, f = 0.5 GHz) ($I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, f = 1.0 GHz)	NF	 – –	 2.0 2.5	 – –	dB
Power Gain at Optimum Noise Figure ($I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, f = 0.5 GHz) ($I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, f = 1.0 GHz)	G_{NF}	 – –	 12 7.0	 – –	dB
Maximum Available Power Gain (1) ($I_C = 20$ mAdc, $V_{CE} = 10$ Vdc, f = 0.5 GHz) ($I_C = 20$ mAdc, $V_{CE} = 10$ Vdc, f = 1.0 GHz)	G_{max}	 – –	 15 10	 – –	dB

(1) $G_{max} = \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$

Ungültig, keine Anwendung
A.-Nr. 400.61 09.11.88

Hersteller : Motorola
Typ : MFR 914

FIGURE 2 – POWER GAIN AND NOISE FIGURE versus FREQUENCY

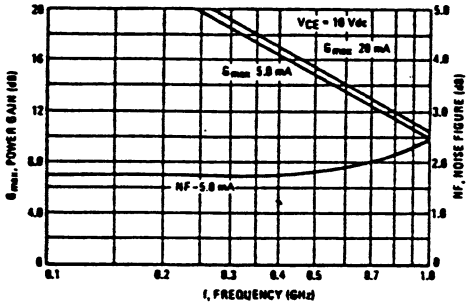


FIGURE 3 – POWER GAIN AND NOISE FIGURE versus COLLECTOR CURRENT

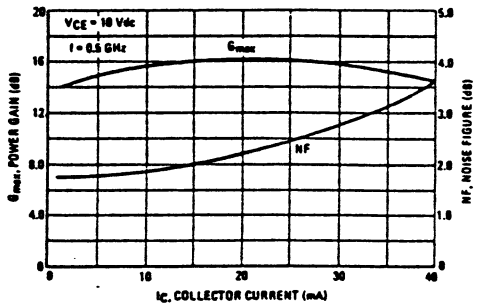


FIGURE 4 – S_{11} PARAMETERS

Frequency (MHz)		100		300		500		700		1000	
V_{CE} (Volts)	I_C (mA)	S11	∠φ	S11	∠φ	S11	∠φ	S11	∠φ	S11	∠φ
5.0	2.0	0.84	-35	0.57	-80	0.42	-115	0.34	-140	0.27	-166
	5.0	0.65	-45	0.34	-85	0.23	-115	0.18	-130	0.16	-150
	10	0.48	-50	0.32	-85	0.14	-105	0.12	-115	0.09	-120
	20	0.33	-50	0.15	-75	0.10	-90	0.09	-100	0.09	-101
	30	0.27	-50	0.13	-70	0.09	-85	0.09	-100	0.09	-101
10	2.0	0.86	-30	0.59	-75	0.42	-105	0.34	-130	0.25	-155
	5.0	0.70	-40	0.37	-75	0.24	-95	0.18	-110	0.13	-125
	10	0.55	-45	0.26	-70	0.17	-80	0.14	-90	0.13	-90
	20	0.41	-45	0.21	-60	0.15	-65	0.13	-75	0.14	-80
	30	0.36	-45	0.19	-55	0.14	-65	0.13	-75	0.13	-80

FIGURE 5 – S_{22} PARAMETERS

Frequency (MHz)		100		300		500		700		1000	
V_{CE} (Volts)	I_C (mA)	S22	∠φ	S22	∠φ	S22	∠φ	S22	∠φ	S22	∠φ
5.0	2.0	0.94	-15	0.77	-25	0.68	-30	0.66	-35	0.64	-45
	5.0	0.85	-20	0.63	-30	0.57	-30	0.55	-35	0.55	-45
	10	0.75	-25	0.55	-25	0.51	-30	0.50	-35	0.50	-40
	20	0.66	-25	0.50	-25	0.47	-30	0.47	-35	0.48	-40
	30	0.62	-25	0.49	-25	0.46	-25	0.46	-30	0.47	-40
10	2.0	0.95	-10	0.81	-20	0.74	-30	0.72	-35	0.71	-40
	5.0	0.87	-15	0.69	-25	0.64	-25	0.63	-30	0.63	-40
	10	0.80	-20	0.63	-20	0.59	-25	0.59	-30	0.60	-40
	20	0.72	-20	0.59	-20	0.57	-23	0.57	-30	0.58	-35
	30	0.70	-20	0.59	-20	0.57	-20	0.57	-30	0.58	-35

FIGURE 6 – S_{21} PARAMETERS

Frequency (MHz)		100		300		500		700		1000	
V_{CE} (Volts)	I_C mA	S21	∠φ	S21	∠φ	S21	∠φ	S21	∠φ	S21	∠φ
5.0	2.0	5.99	150	4.06	110	2.90	90	2.27	75	1.71	55
	5.0	11.38	135	5.91	100	3.90	80	2.93	70	2.17	55
	10	15.21	125	6.78	95	4.34	80	3.23	70	2.38	55
	20	17.98	115	7.27	90	4.58	75	3.40	65	2.50	50
	30	18.78	110	7.37	85	4.64	75	3.42	65	2.50	50
10	2.0	6.05	150	4.20	115	3.04	90	2.37	75	1.75	55
	5.0	11.46	135	6.17	100	4.06	85	3.08	70	2.26	55
	10	15.45	127	7.08	95	4.56	80	3.41	70	2.50	55
	20	18.35	120	7.57	90	4.80	75	3.58	65	2.61	55
	30	19.12	115	7.63	90	4.79	75	3.56	65	2.60	55

FIGURE 7 – S_{12} PARAMETERS

Frequency (MHz)		100		300		500		700		1000	
V_{CE} (Volts)	I_C (mA)	S12	∠φ	S12	∠φ	S12	∠φ	S12	∠φ	S12	∠φ
5.0	2.0	0.04	70	0.09	50	0.11	50	0.12	50	0.16	50
	5.0	0.04	70	0.07	60	0.11	60	0.14	60	0.19	55
	10	0.03	70	0.07	70	0.11	65	0.15	65	0.20	55
	20	0.03	75	0.07	70	0.12	70	0.15	65	0.21	55
	30	0.03	75	0.07	70	0.12	70	0.16	65	0.21	57
10	2.0	0.03	70	0.07	55	0.09	50	0.10	50	0.13	55
	5.0	0.03	70	0.06	60	0.09	65	0.12	60	0.15	60
	10	0.03	70	0.06	65	0.09	65	0.12	65	0.17	60
	20	0.03	75	0.06	70	0.09	70	0.13	65	0.18	60
	30	0.03	75	0.06	70	0.10	70	0.13	65	0.17	60