MILITARY SPECIFICATION

CV7335

SEMICONDUCTOR DEVICE, TRANSISTOR, AFZ12

Description:- This specification covers the detail requirements for a PNP Germanium Transistor and is in accordance with specification K1007, except as otherwise stated.

Mechanical Dimensions and Outlines:- K1007, Section D, Appendix 1. D14A and D14D.

Connections:- 1. Base. 2. Emitter. 3. Collector. 4. Shield and Case.

Absolute Maximum Ratings:-

Rating	V_{CB}	V_{CE}	V_{CE}	I_{CM}	I_{CAV}	I_{EM}	I_{EAV}	I_{BM}	I_{BAV}	Rev. I_{EM}	Rev. I_{EAV}	P_{tot}
Unit	-V	- V	- V	mA	mA	mA	mA	mA	mA	mA	mA	mW
Min.	-	-	-	-	-	-	-	-	-	-	-	-
Max.	20	20	10	10	10	10	10	1.0	1.0	1.0	1.0	83
Note		1	2		5		5		5	3	3, 5	4

Rating	T_{amb}	$T_{(stg)}$	Shock	Vibration
Unit	°C	°C	g	g
Min.	-55	-55	-	-
Max.	75	75	1500	20
Note			6	

NOTES:-

1. $+V_{BE}$ >500 mV.
2. I_c = 10 mA.
3. If the reverse emitter-base current is not limited to this value, then the reverse emitter-base voltage must be limited to 0.5V.
4. See derating curve on Page 9.
5. Averaged over any 50 mS period.
6. 0.5 mS duration.

Characteristic		I_{CBO}	I_{EBO}	V_{BE}		h_{FEL}		g_p	F		f_T	r_{ib}	C_{re}	$R_{th(j-a)}$
Unit		/uA	/uA	mV				dB	dB		Mc/s	ohms	pF	°C/mW
Minimum				220		20	25	10			135			
Typical		2.6	2.0	310	380	60	60	13		6.0	180		1.0	
Maximum		50	27	380		100	200		5	7.5	250	49	1.5	0.6
Conditions	V_{CB} V	-20				-6	-2	-6		-6		-3	-6	
	V_{CE} V			-6	-2				-6		-6			
	V_{EB} V		-0.5											
	I_C mA		0											
	I_E mA	0		1.0	10	1.0	10	1.0	1.0	1.0	1.0	10	1.0	
	I_B mA													
	f Mc/s							200	10.7	200	≥20	0.45		
	T_{amb} °C	25	25	25	25	25	25	25	25	25	25	25	25	

REQUIREMENTS:-

Marking: K1007, Section B, 1.3.4.

QUALITY ASSURANCE PROVISIONS

Destructive Tests. The tests listed in Table II Group B Inspection, subgroups 2, 3 and 4 and in Table III Group C Inspection, subgroup 2 are considered destructive.

Group C Inspection. Inspection shall be conducted on the initial lot and thereafter every 90 days or every fifth lot whichever occurs first.

PREPARATION FOR DELIVERY:-

Packaging: The device shall be packed according to K1007, Section A 1.2(c).

JOINT SERVICE CATALOGUE NUMBER:- 5960-99-037-3135

This specification has been prepared by and the Qualification Approval Authority is:-

Admiralty Surface Weapons Establishment,
Portsdown, Cosham,
Portsmouth, Hants., England.

Table I

GROUP A INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 1			0.65	I				
Visual and Mechanical Inspection	5.1	Excluding Physical Dimensions						
SUBGROUP 2			0.65	II				
Collector Base Cut-off Current (1)	7.2.5.1	V_{CB} =-20V I_E = 0			I_{CBO}		50	/uA
Inherent Large Signal Forward Current Transfer Ratio (1)	7.3.5	V_{CB} = -6V I_E = 1 mA			h_{FEL}	20	100	
Input Resistance		V_{CB} = -3V I_E = 10 mA f = 450 kc/s See Fig. 2 Page 10			R_i		49	ohms
SUBGROUP 3			4.0	I				
Inherent Large Signal Forward Current Transfer Ratio (2)	7.3.5	V_{CB} = -2V I_C = 10 mA			h_{FEL}	25	200	
Emitter Base Cut-off Current	7.2.6	V_{EB} = -0.5V I_C = 0			I_{EBO}		27	/uA

Table I

GROUP A INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Sym-bol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 3 (Cont'd.)								
Feedback Capacitance		V_{CE} = -6V I_E = 1 mA f = 450 kc/s See Fig. 3 Page 12			C_{re}		1.5	pF
Transition Frequency	7.5.2	V_{CE} = -6V I_E = 1 mA f $\geqslant$ 20 Mc/s			f_T	135	250	Mc/s
Base Emitter Voltage		V_{CE} = -6V I_C = 1 mA			V_{BE}	220	380	mV
SUBGROUP 4			4.0	IA				
Collector Base Cut-off Current (2)	7.2.5.1	T_{amb} = 55°C V_{CB} = -6V I_E = 0			I_{CBO}		90	/uA
Power Gain, Small Signal		V_{CB} = -6V I_C = 1 mA f = 200 Mc/s See Fig. 4 Page 12			g_p	10		dB
Noise Figure (1)		V_{CB} = -6V I_E = 1 mA f = 200 Mc/s See Fig. 4 Page 12			F		7.5	dB

Table I

GROUP A INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 4 (Cont'd.)								
Noise Figure (2)		V_{CE} = -6V I_E = 1 mA f = 10.7 Mc/s			F		5	dB

Table II

GROUP B INSPECTION

See Page 3, Quality Assurance Provisions

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 1			6.5	IC				
Physical Dimensions	5.1	According to Drawings D14A and D14D.						
SUBGROUP 2			4.0	IA				
Solderability	5.13							
Temperature Cycling	5.5	-55°C to +70°C						
Moisture Resistance	5.3							
SUBGROUP 3			4.0	IA				
Vibration Fatigue	5.15	Non-operating						
SUBGROUP 4			6.5	IA				
Lead Fatigue	5.10.1	1 cycle						
SUBGROUP 5								
Omitted								
SUBGROUP 6								
Omitted								

Table II

GROUP B INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 7			4.0	IA				
High Temperature Life (Non-operating)	6.2.1 6.6.1.2.2	T_{amb} = 75°C t = 1000 hours						
SUBGROUP 8			4.0	IA				
Operating Life	6.3 6.5 6.6.1.1 6.6.1.2.2	T_{amb} between 25° and 60°C V_{CB} = -10V P_{tot} = max. value given by derating curve on Page 9 corresponding to the chosen T_{amb}						
Post Test End Points for Subgroups 2, 3, 7 and 8								
Collector Base Cut-off Current (1)	7.2.5.1	As in Group A, Subgroup 2			I_{CBO}		62	/uA
Inherent Large Signal Forward Current Transfer Ratio	7.3.5	As in Group A, Subgroup 2			h_{FEL}	15	120	

Table III

GROUP C INSPECTION

See Page 3, Quality Assurance Provision

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUBGROUP 1								
Omitted								
SUBGROUP 2			6.5	IA				
Shock	5.17	Non-operating. Five blows each orientation: Y1, Y2, X and Z.						
Post Test End Points for Subgroup 2								
Collector, Base Cut-off Current (1)	7.2.5.1	As in Group A, Subgroup 2			I_{CBO}		62	/uA
Inherent Large Signal Forward Current Transfer Ratio (1)	7.3.5	As in Group A, Subgroup 2			h_{FEL}	15	120	

CV7335

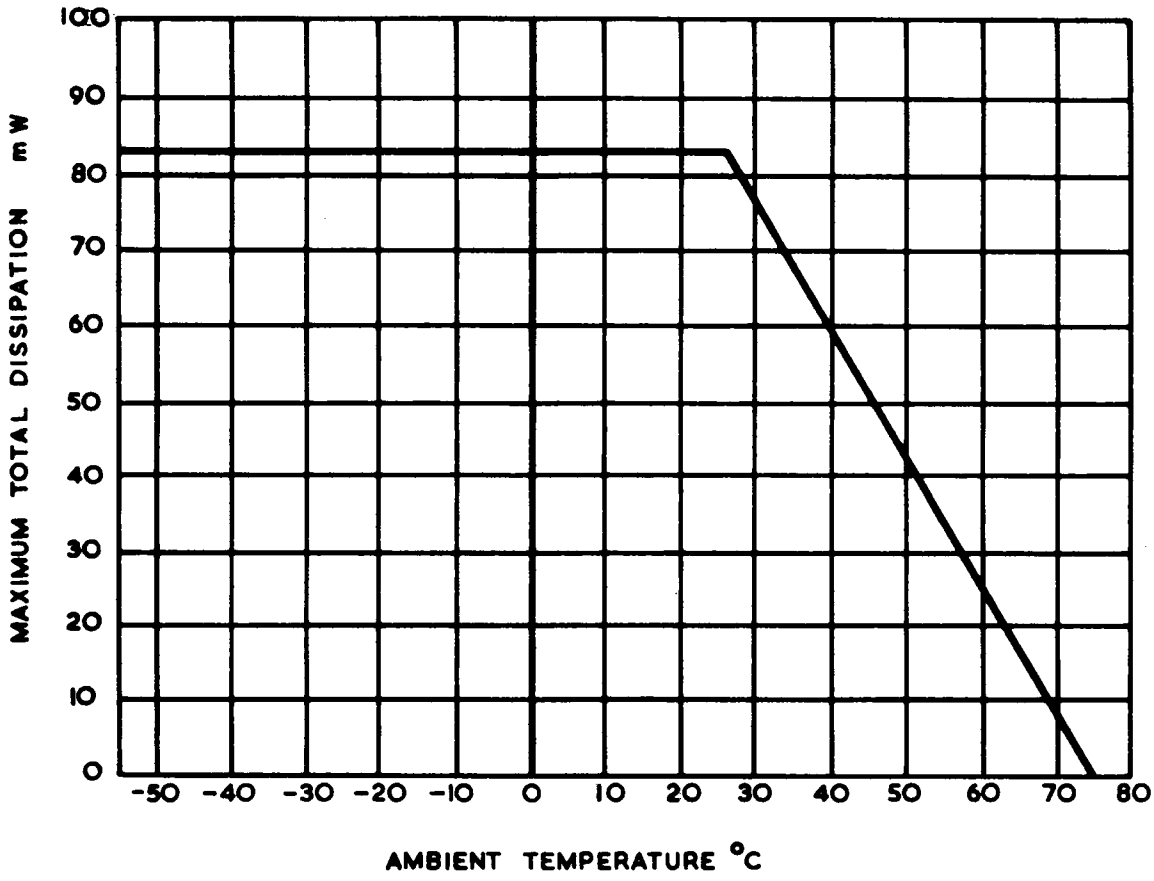
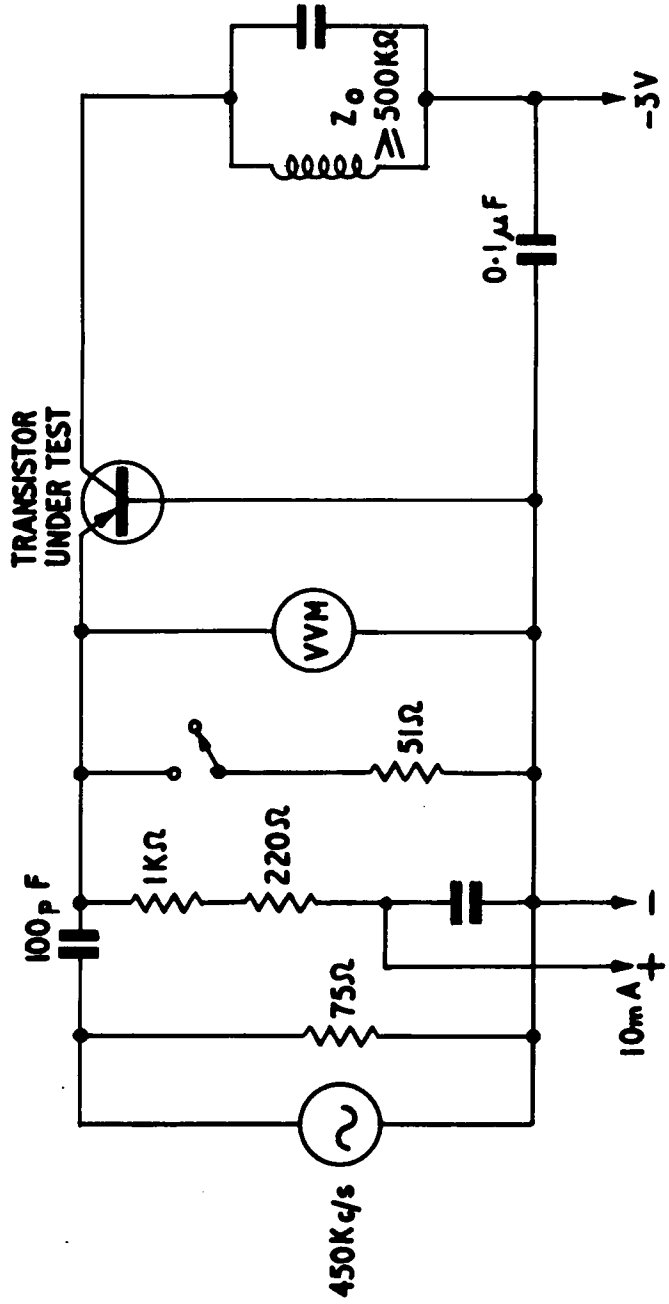
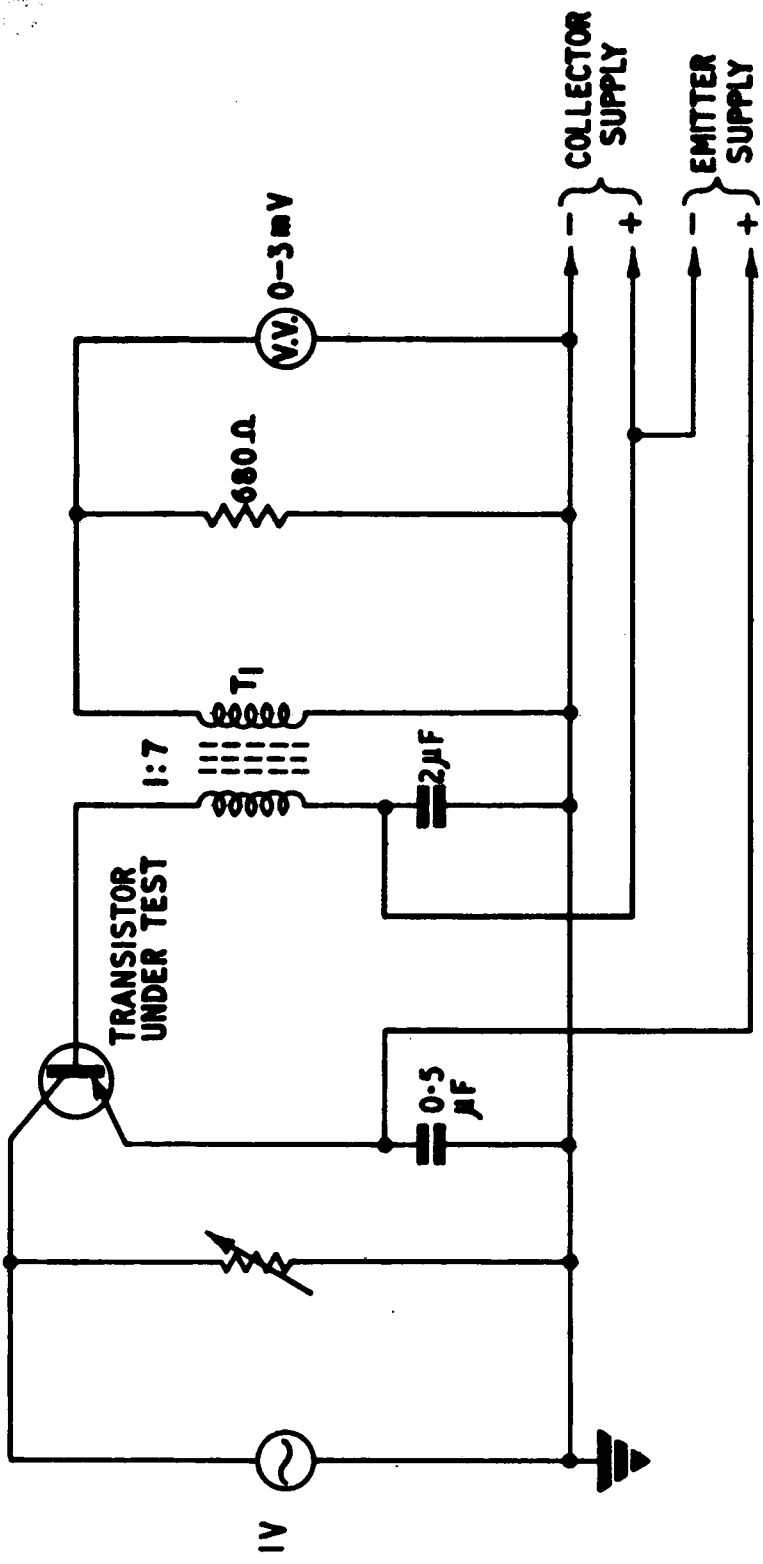

MAXIMUM TOTAL DISSIPATION mW
100
90
80
70
60
50
40
30
20
10
0
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
AMBIENT TEMPERATURE °C

FIG.1.



CIRCUIT FOR MEASURING INPUT RESISTANCE

FIG. 2.



T1 "FERROX-CUBE ASSEMBLY" TYPE LA2503 PRIMARY 24 TURNS 36 S.W.G. ENAMELLED COPPER SECONDARY 168 TURNS 36 S.W.G. ENAMELLED COPPER

TO CALIBRATE, REPLACE TRANSISTOR BY STANDARD CAPACITOR CONNECTED BETWEEN BASE AND COLLECTOR TERMINALS.

FIG. 3. RECOMMENDED CIRCUIT FOR MEASURING FEED-BACK CAPACITANCE

INSTRUCTIONS FOR MEASUREMENT OF POWER GAIN AND NOISE - SEE FIG.4

1. Insert transistor and turn on the power supplies.

2. Connect the generator to the amplifier output and connect the detector to the input; with the generator output approximately 100 mV and maximum detector sensitivity, adjust C_N and R_N for minimum reading on the detector.

3. Reverse the generator and detector connections; reduce the generator output and detector sensitivity and adjust C1, C2, C3 and C4 for maximum output.

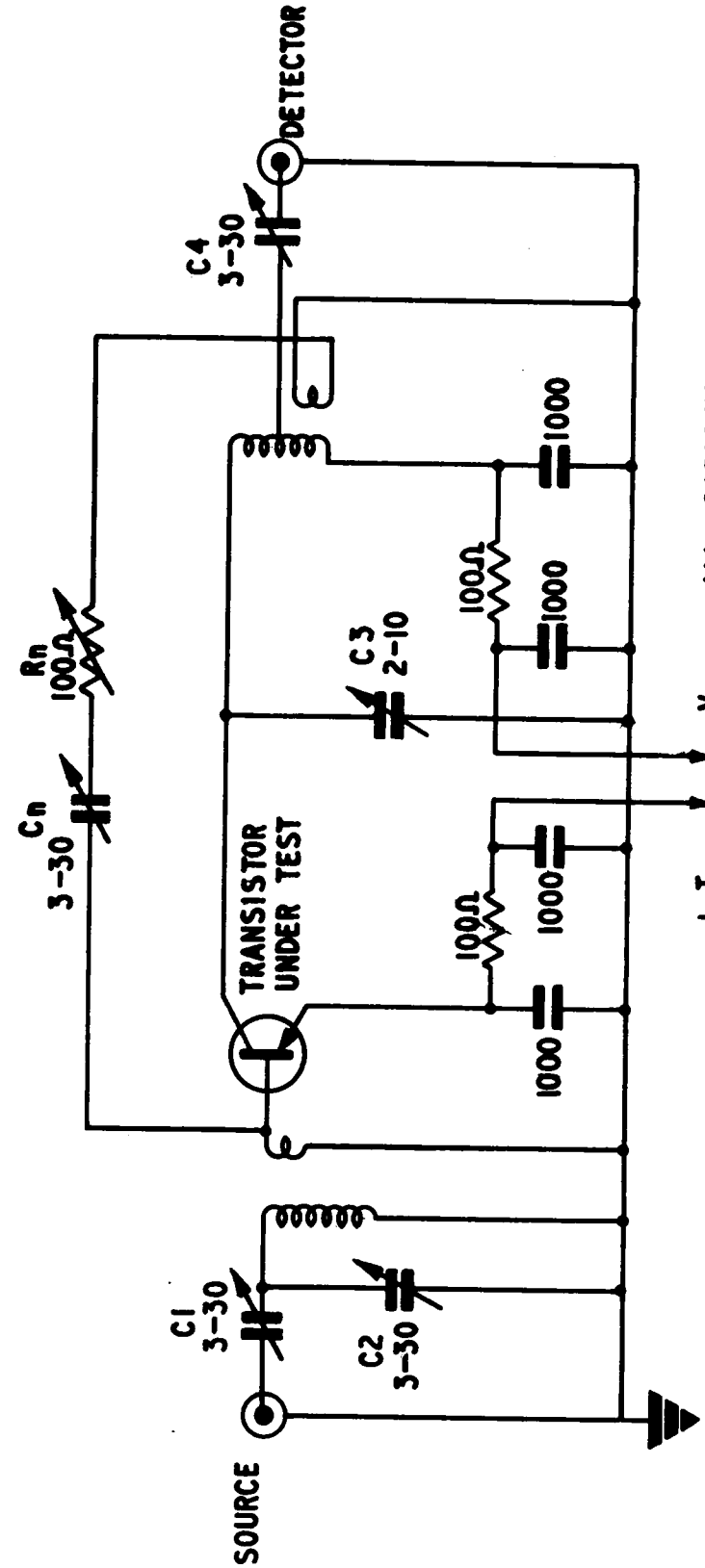
4. Repeat 2 and 3 if necessary.

5. Set the detector to some convenient level and note the setting of the generator output attenuator.

6. Plug the generator into the detector and increase the generator output until the detector level set in 5 is obtained. The power gain is then the difference between the two attenuator readings.

7. Plug the 75 ohm noise diode probe into the amplifier input and connect the detector to the output; note the reading of the detector.

8. Turn on the noise source and adjust the anode current until the detector reading has increased by 3 dB.



THE SIGNAL GENERATOR, DETECTOR AND NOISE GENERATOR SHALL BE OF THE SAME IMPEDANCE.

FIG. 4. RECOMMENDED CIRCUIT FOR MEASURING NOISE AND POWER GAIN AT 200 Mc/s.

SEE NOTES ON PAGE 13.

Typical y-parameters
Common base

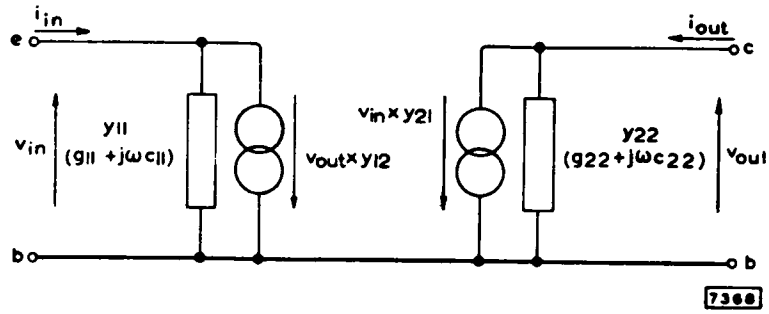


Fig. 1

Measured at $V_{cb} = -12V$, $I_e = 1mA$, $f = 200Mc/s$

		Typical production spread Typ.	
Input conductance (with output short circuited to a.c.)	g_{11}	32.5	mmhos
Input capacitance (with output short circuited to a.c.)	c_{11}	–10	pF
Transfer admittance (with output short circuited to a.c.)	$\lvert y_{21} \rvert$	30	mA/V
Phase angle of transfer admittance (with output short circuited to a.c.)	φ_{21}	115	deg
Output conductance (with input short circuited to a.c.)	g_{22}	220	μmhos
Output capacitance (with input short circuited to a.c.)	c_{22}	2.0	pF
Feedback admittance (with input short circuited to a.c.)	$\lvert y_{12} \rvert$	410	μmhos
Phase angle of feedback admittance (with input short circuited to a.c.)	φ_{12}	–80	deg

Common emitter

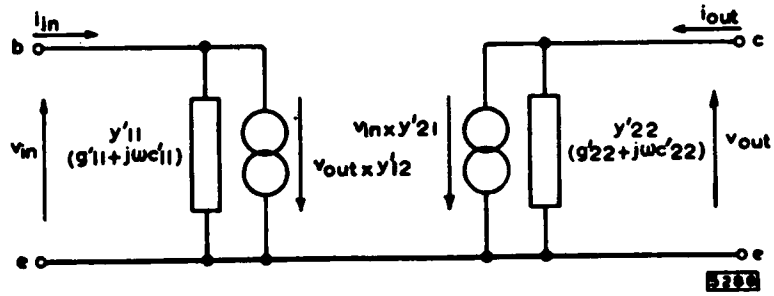
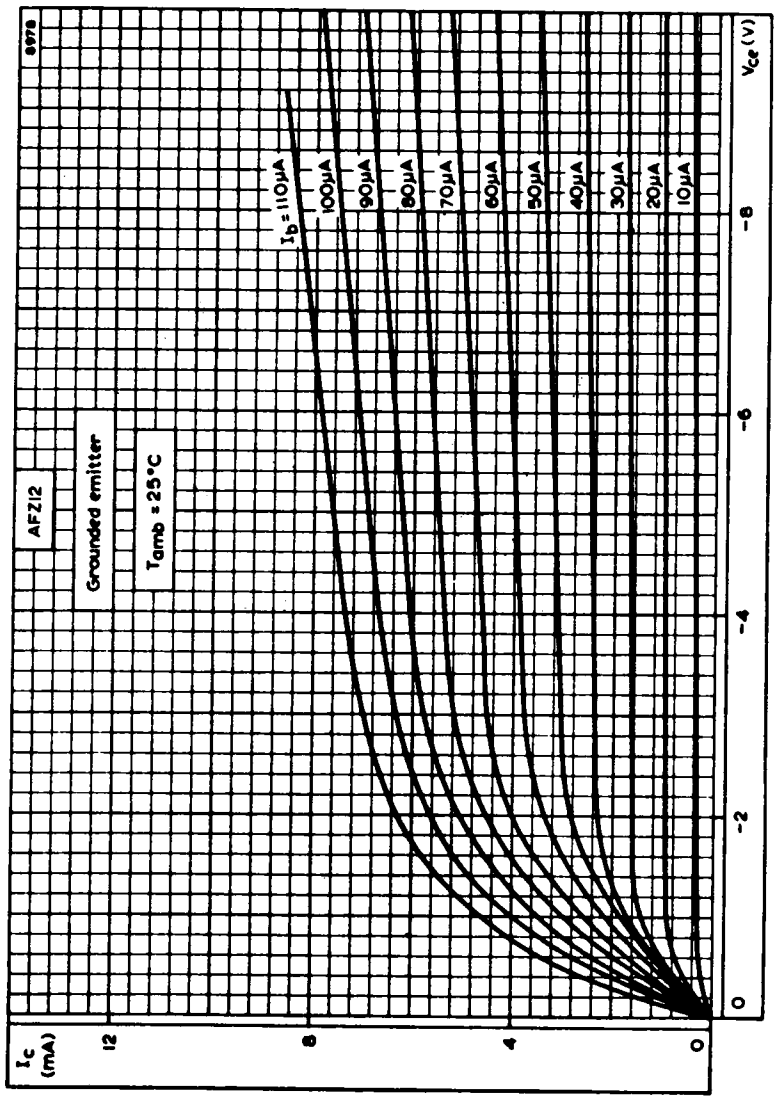
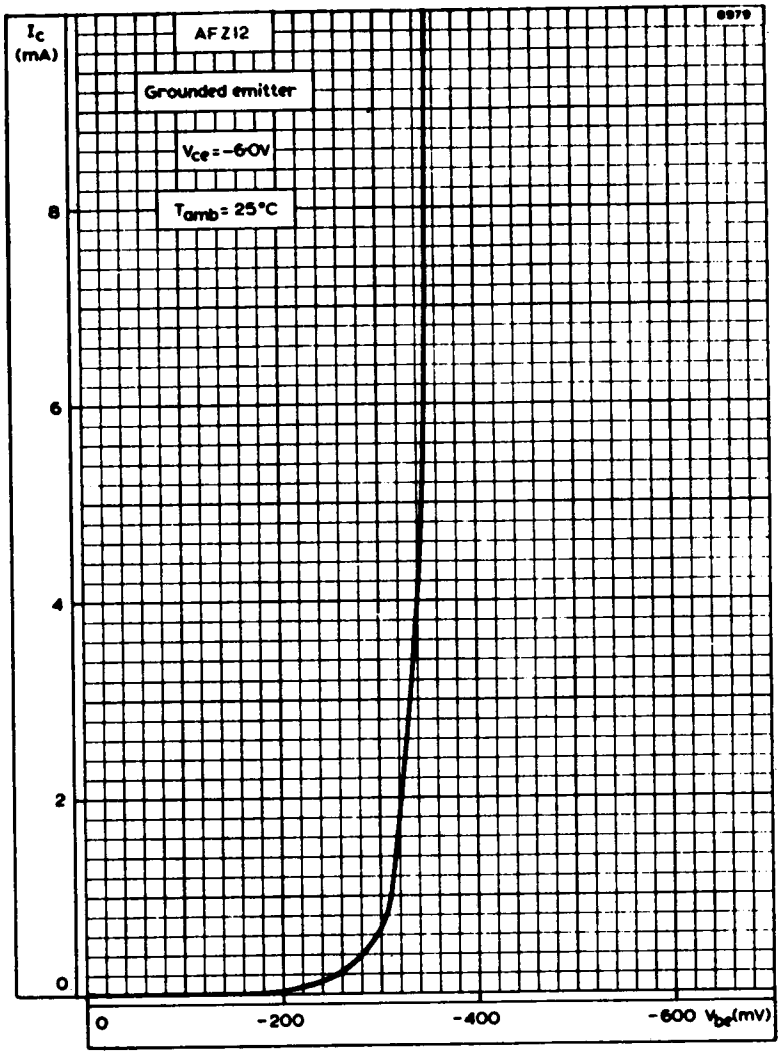


Fig. 2

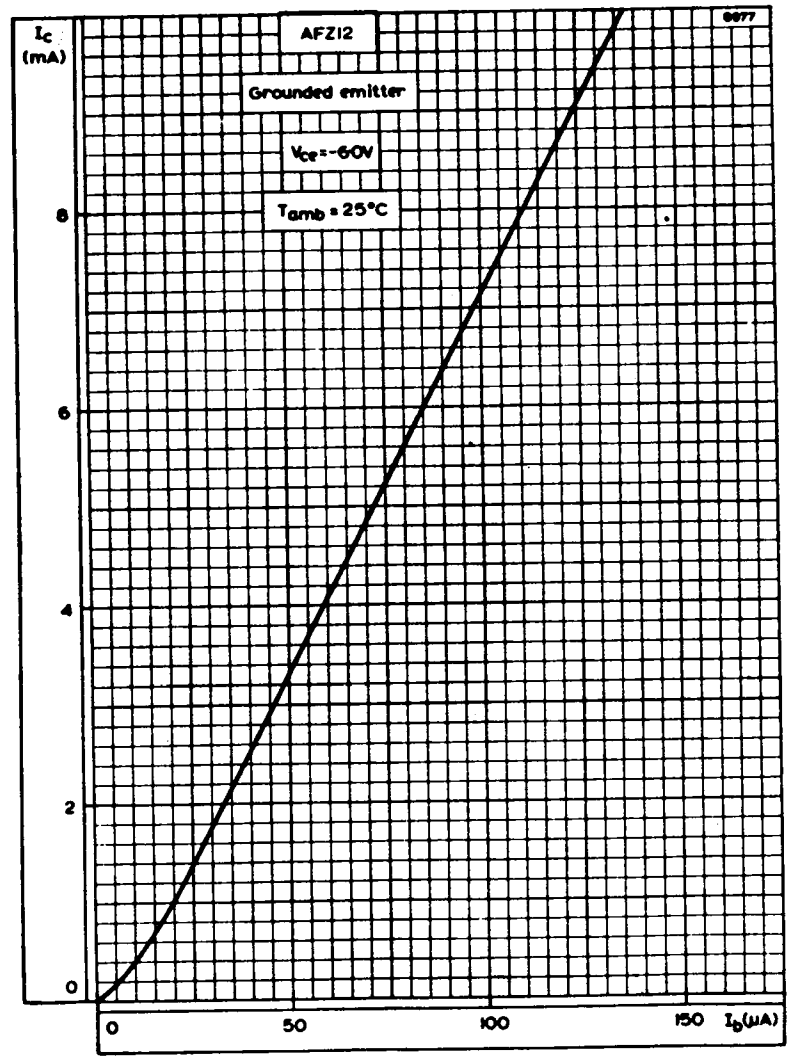
Measured at $V_{eb}=-12V$, $I_e=1mA$, $f=200Mc/s$		Typical production spread Typ.	
Input conductance (with output short circuited to a.c.)	g'_{11}	28	mmhos
Input capacitance (with output short circuited to a.c.)	c'_{11}	13	pF
Transfer admittance (with output short circuited to a.c.)	$\|y'_{21}\|$	34	mA/V
Phase angle of transfer admittance (with output short circuited to a.c.)	ϕ'_{21}	-68	deg
Output conductance (with input short circuited to a.c.)	g'_{22}	220	μmhos
Output capacitance (with input short circuited to a.c.)	c'_{22}	2.0	pF
Feedback admittance (with input short circuited to a.c.)	$\|y'_{12}\|$	500	μmhos
Phase angle of feedback admittance (with input short circuited to a.c.)	ϕ'_{12}	-110	deg



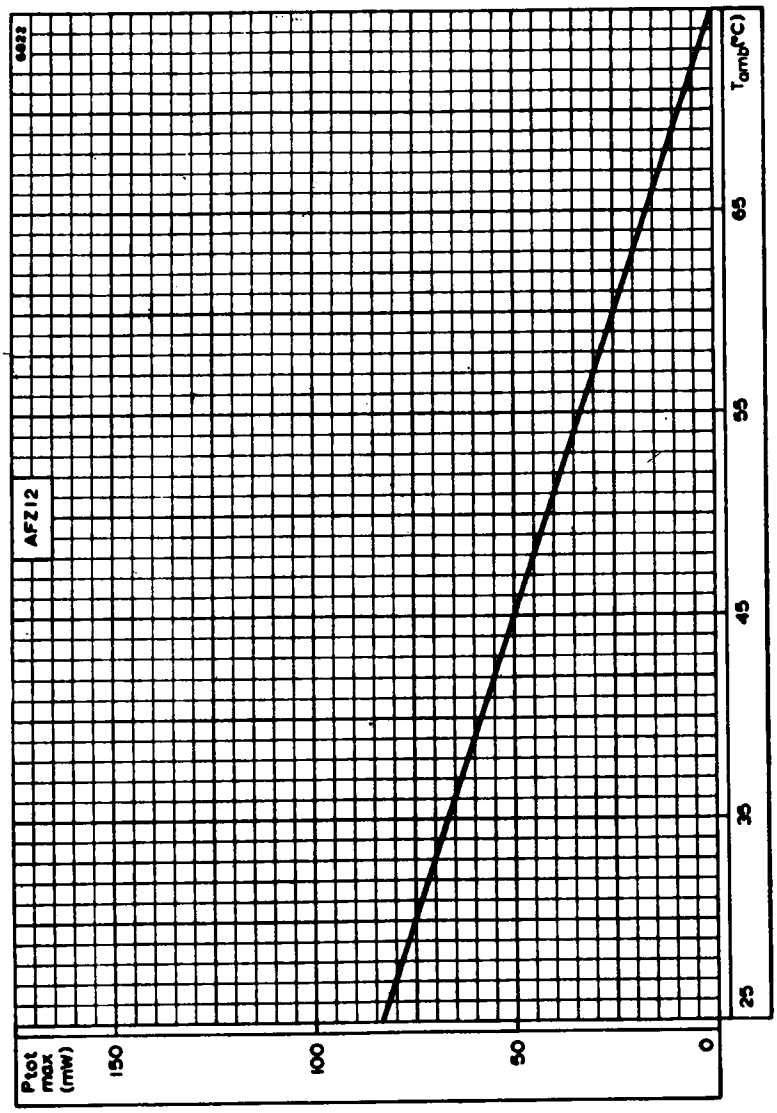
OUTPUT CHARACTERISTIC. COMMON EMITTER



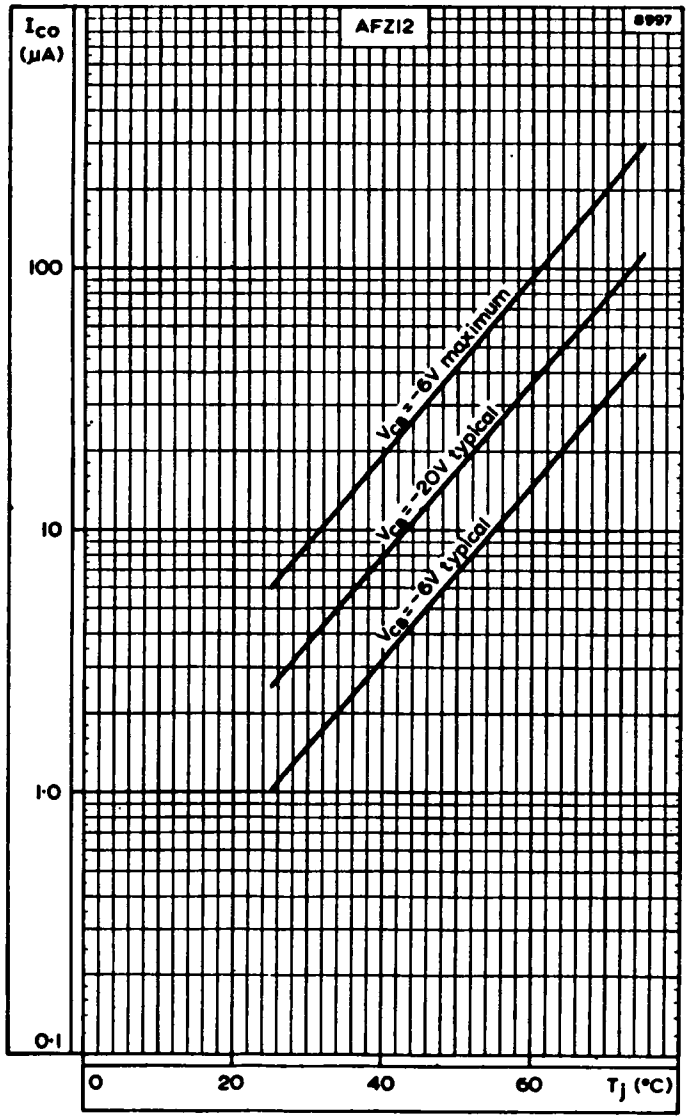
BASE-EMITTER VOLTAGE PLOTTED AGAINST COLLECTOR CURRENT



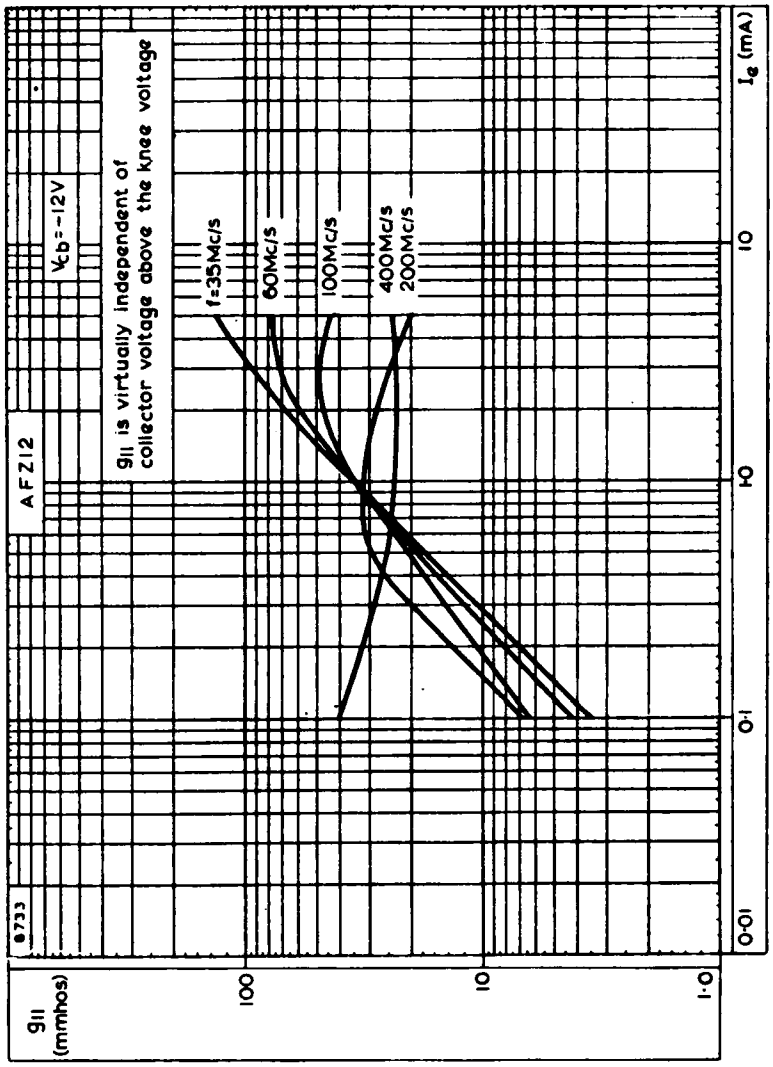
TRANSFER CHARACTERISTIC. COMMON EMITTER



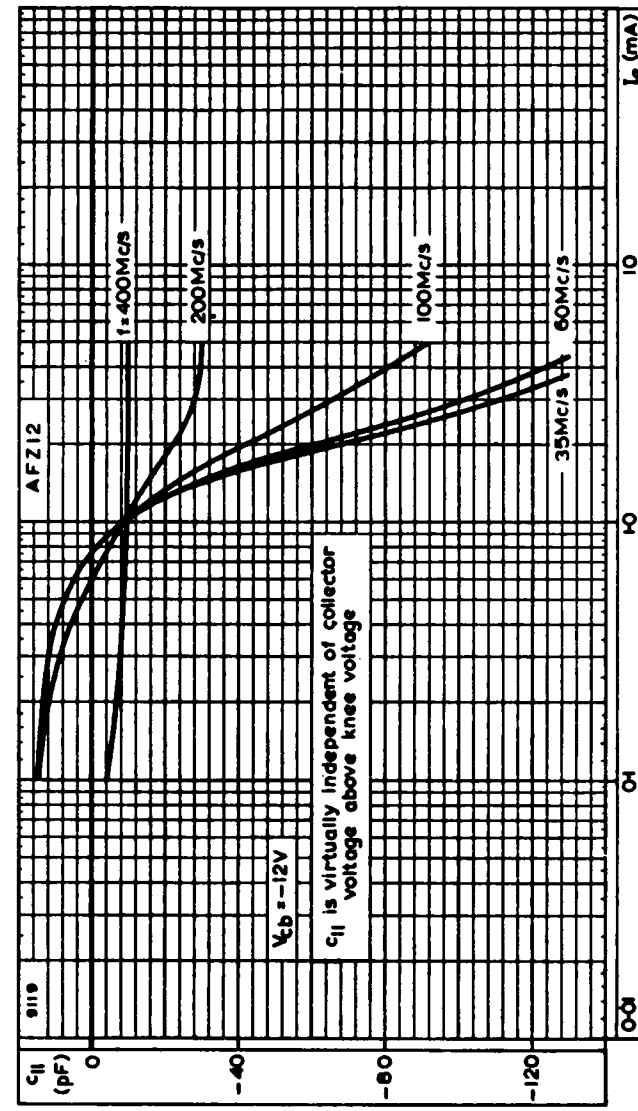
MAXIMUM TOTAL DISSIPATION PLOTTED AGAINST AMBIENT TEMPERATURE



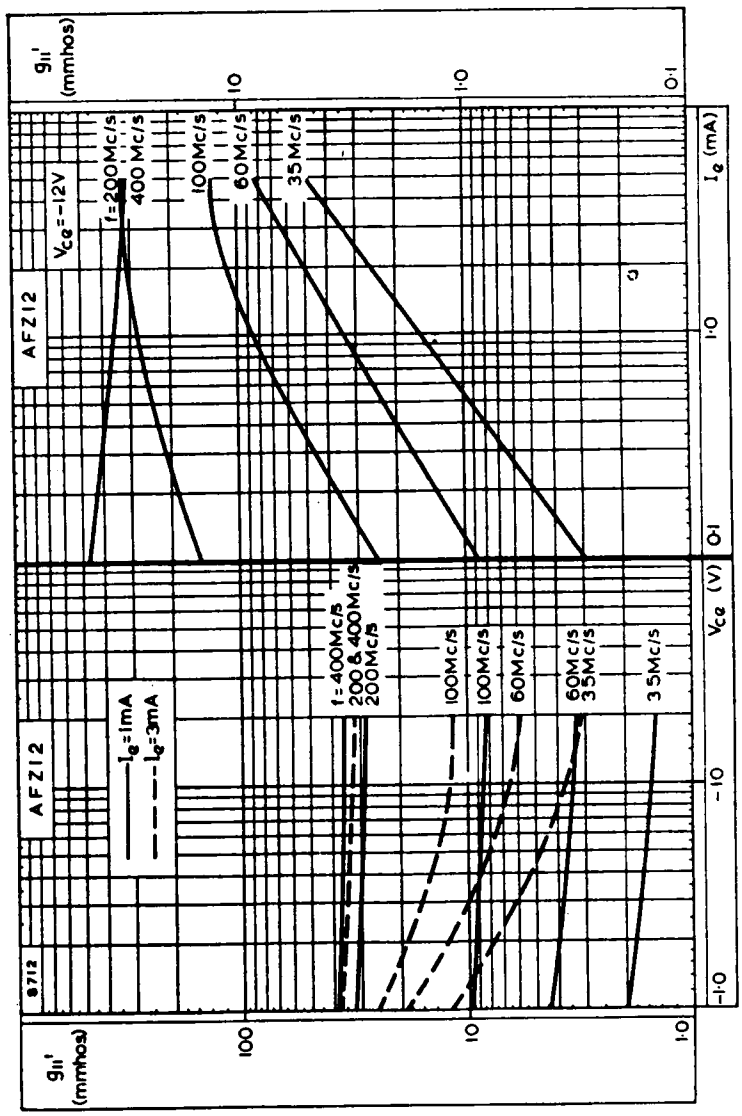
COLLECTOR LEAKAGE CURRENT PLOTTED AGAINST JUNCTION TEMPERATURE



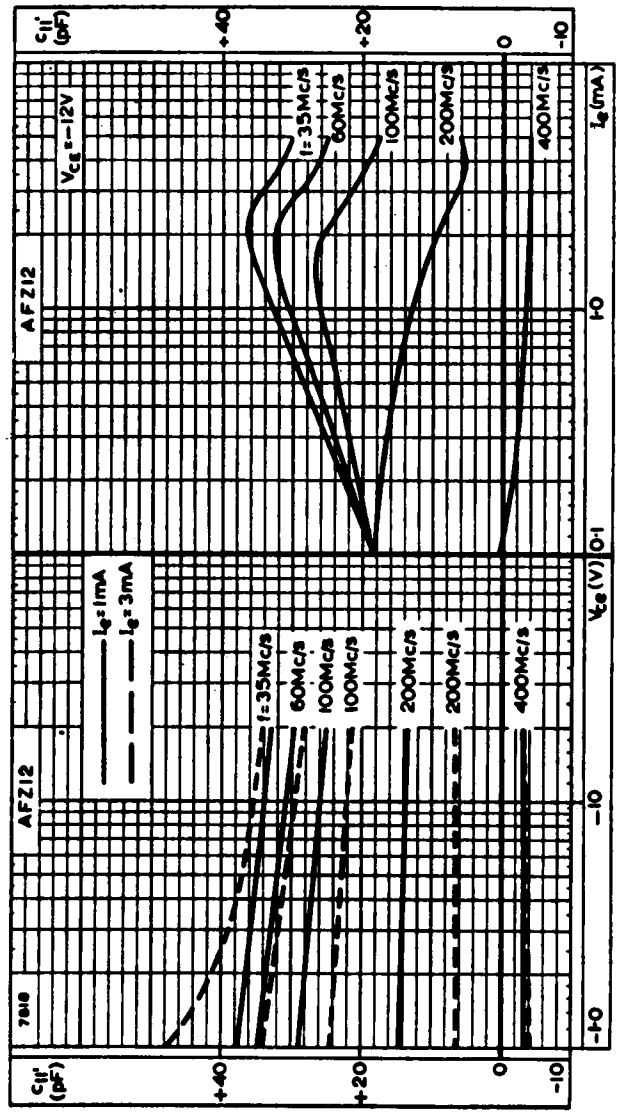
INPUT CONDUCTANCE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



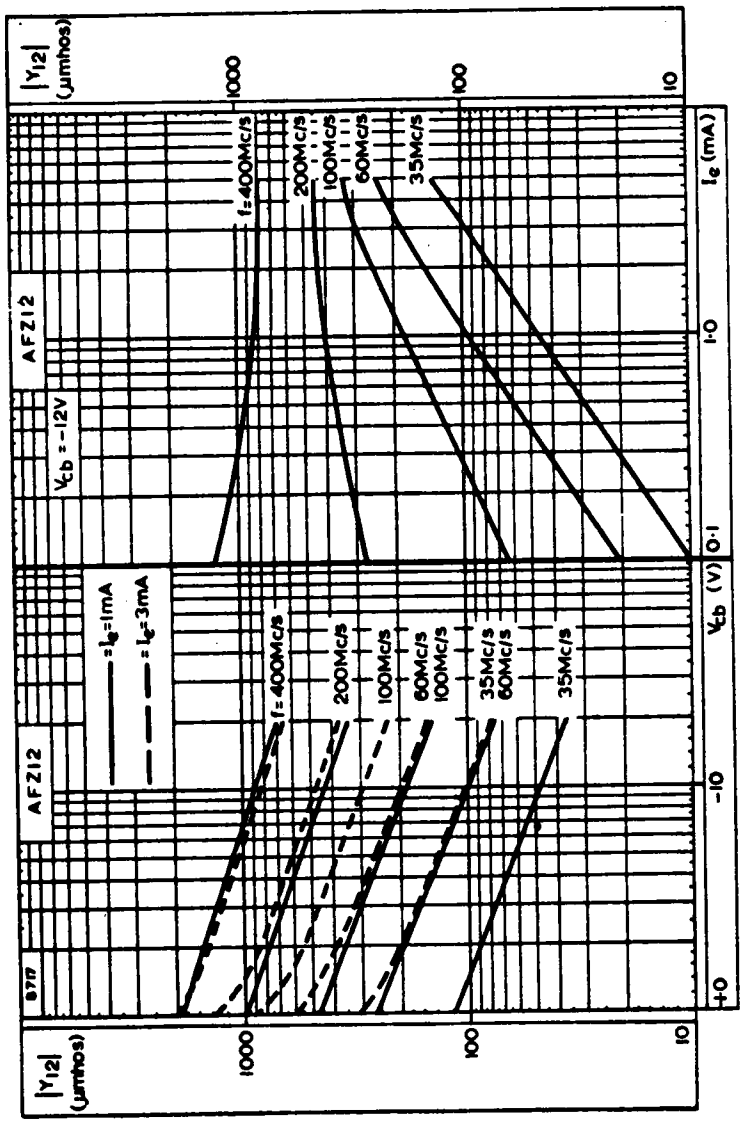
INPUT CAPACITANCE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



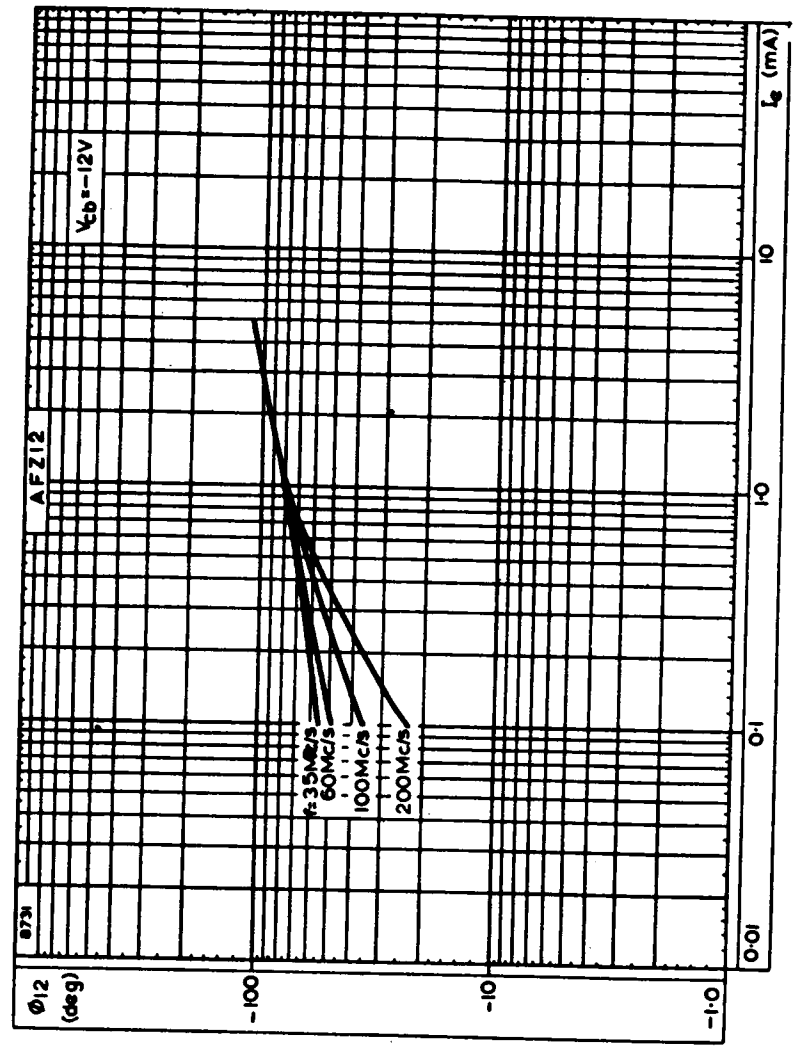
INPUT CONDUCTANCE PLOTTED AGAINST EMITTER CURRENT AND COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON EMITTER



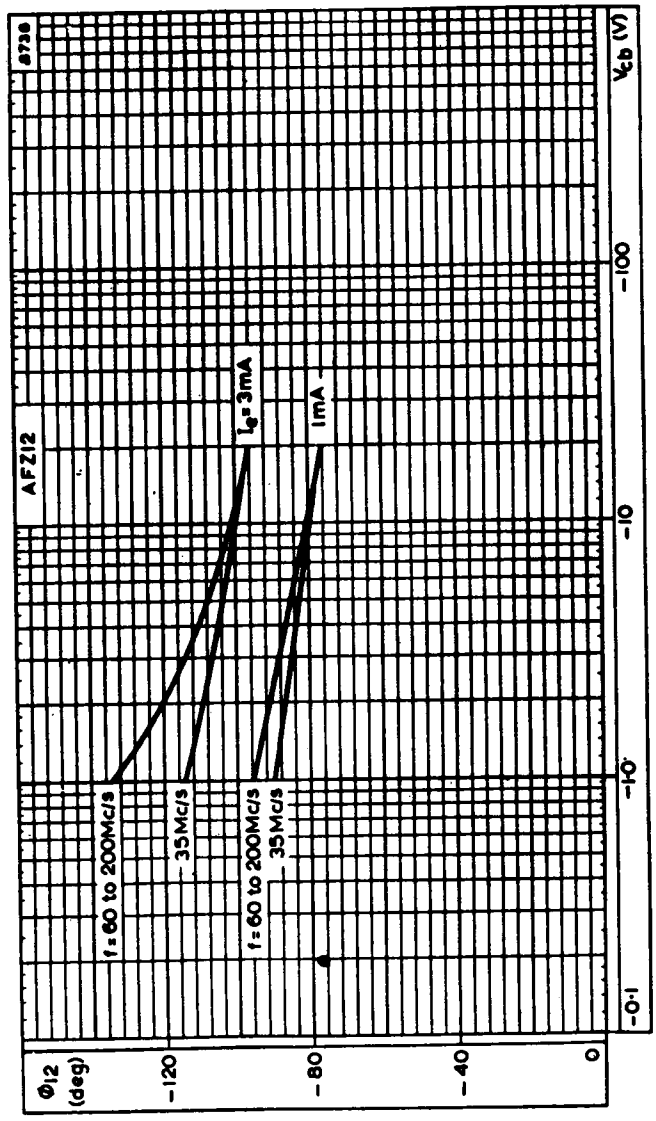
INPUT CAPACITANCE PLOTTED AGAINST EMITTER CURRENT AND COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON EMITTER



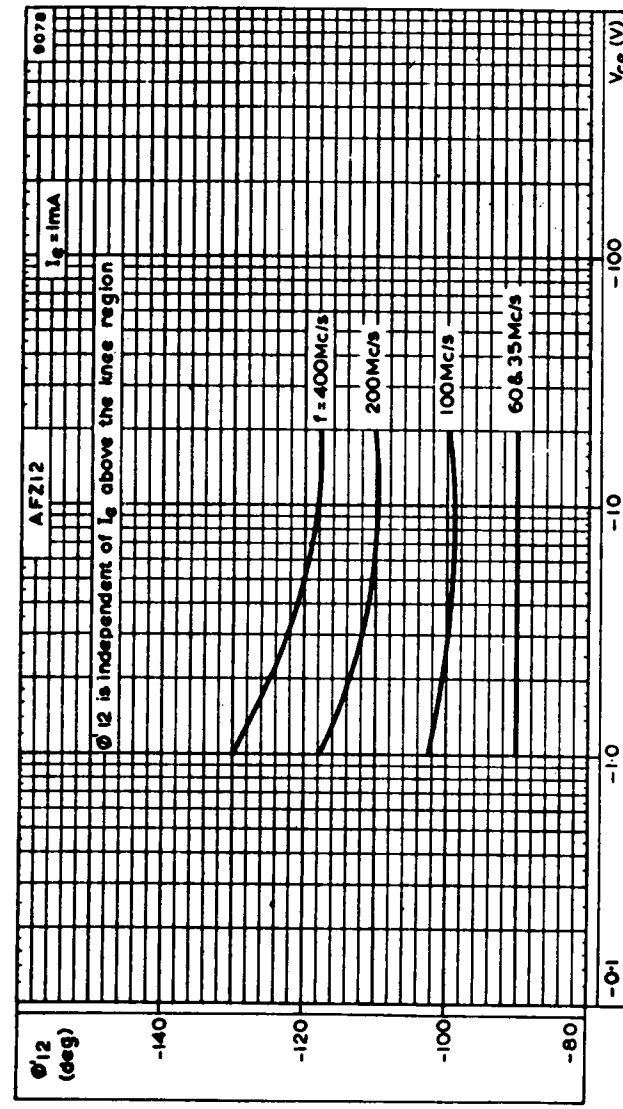
FEEDBACK ADMITTANCE PLOTTED AGAINST COLLECTOR VOLTAGE AND EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



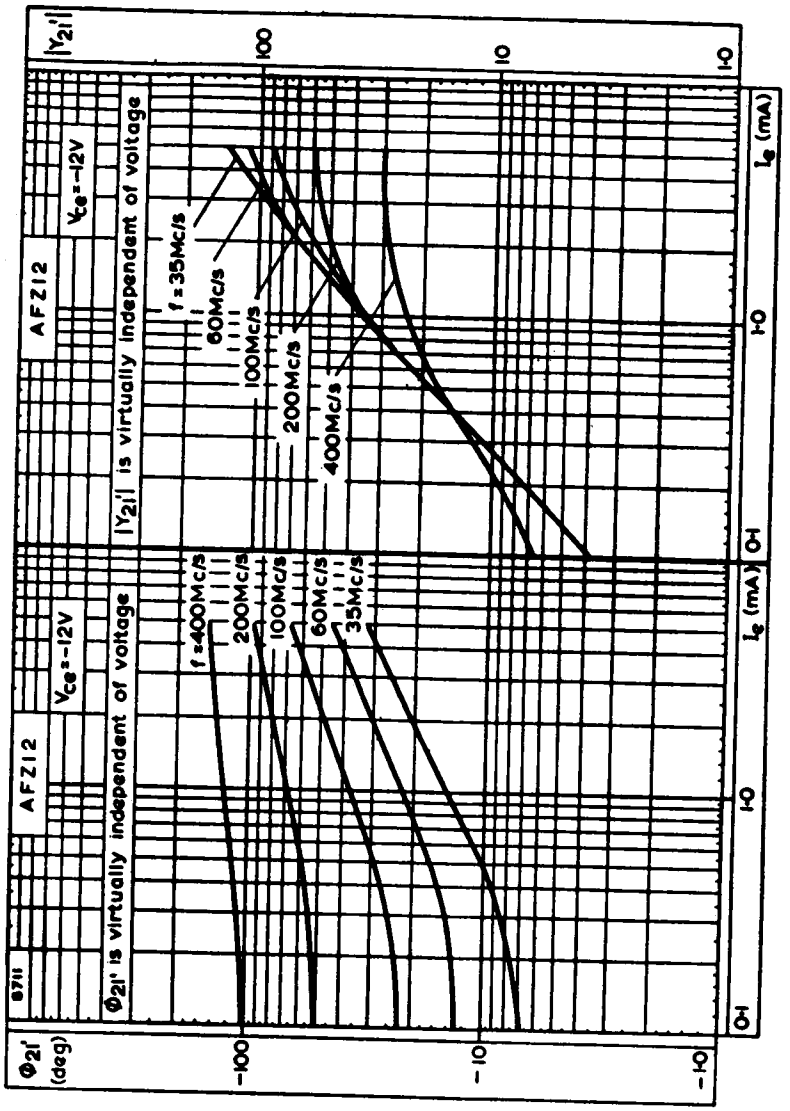
PHASE ANGLE OF FEEDBACK ADMITTANCE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



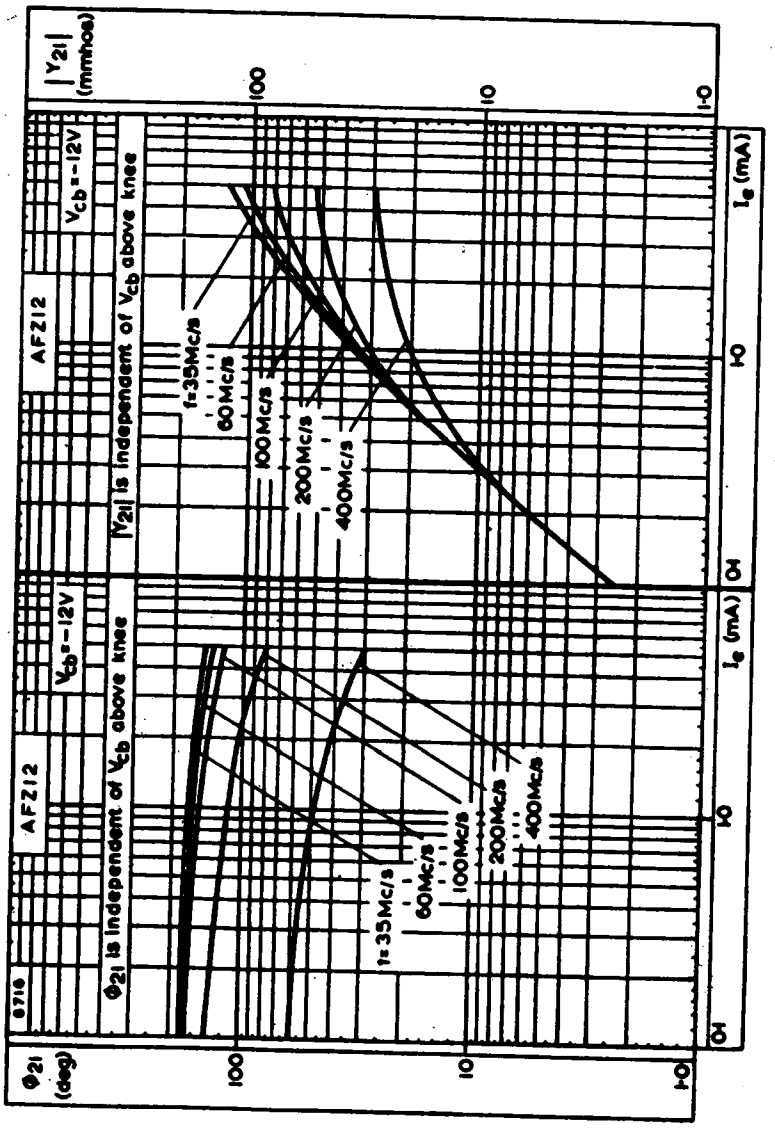
PHASE ANGLE OF FEEDBACK ADMITTANCE PLOTTED AGAINST COLLECTOR VOLTAGE WITH EMITTER CURRENT AS PARAMETER. COMMON BASE



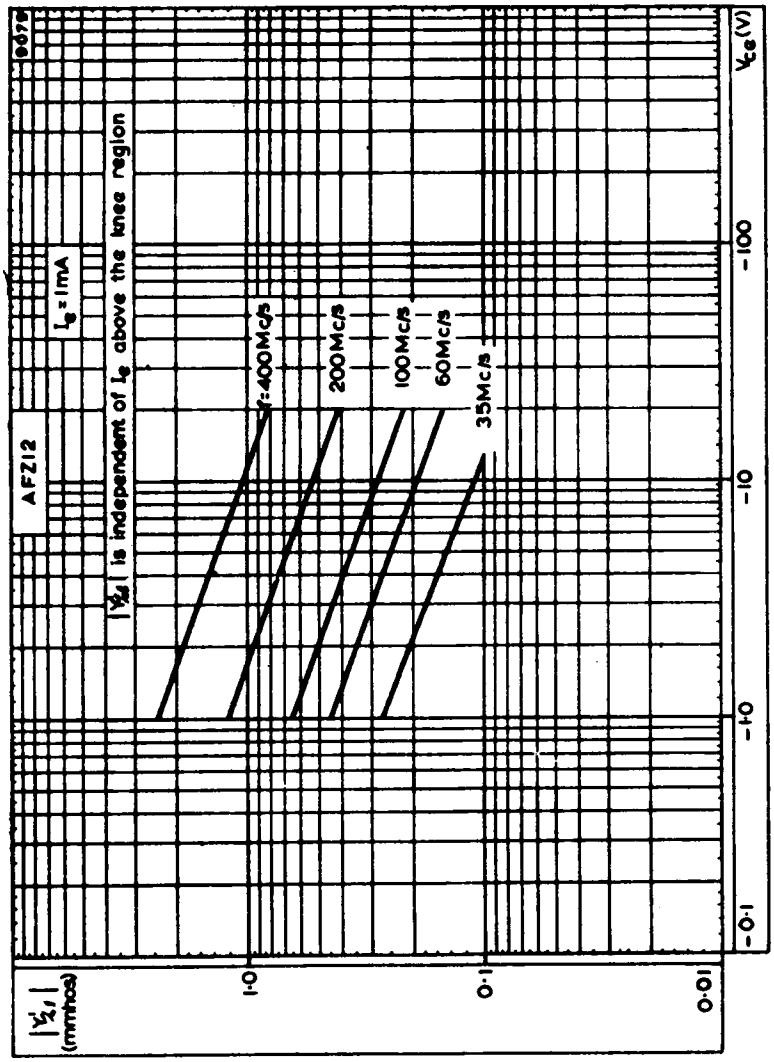
PHASE ANGLE OF FEEDBACK ADMITTANCE PLOTTED AGAINST COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON EMITTER



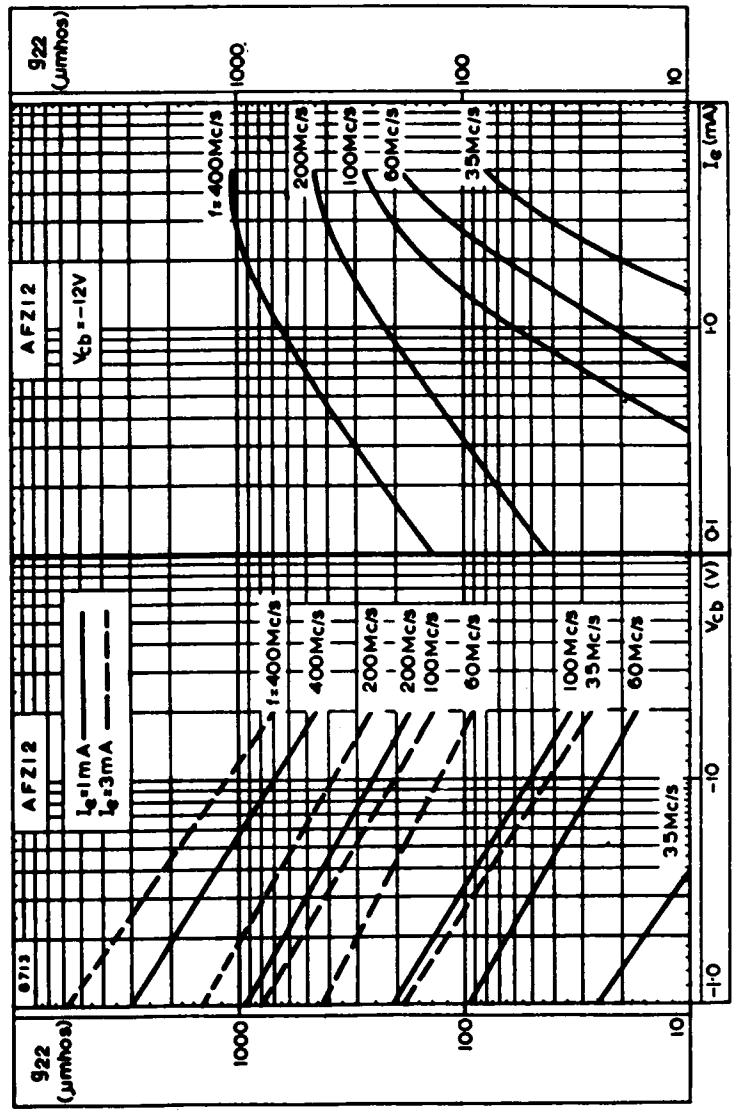
TRANSFER ADMITTANCE AND PHASE ANGLE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON EMITTER



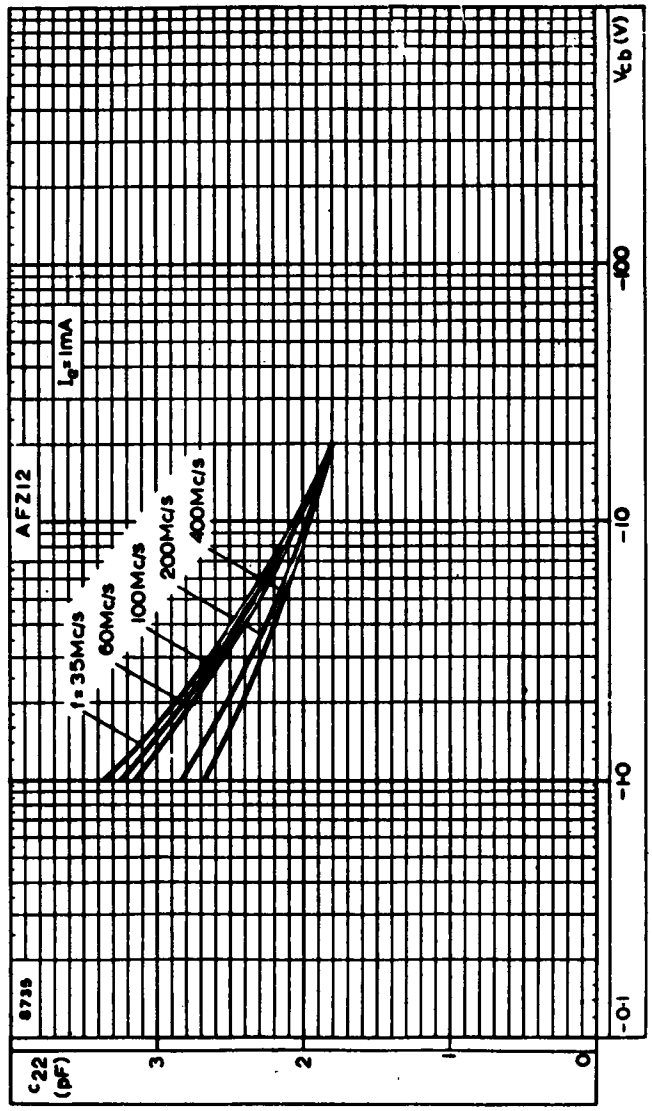
TRANSFER ADMITTANCE AND PHASE ANGLE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



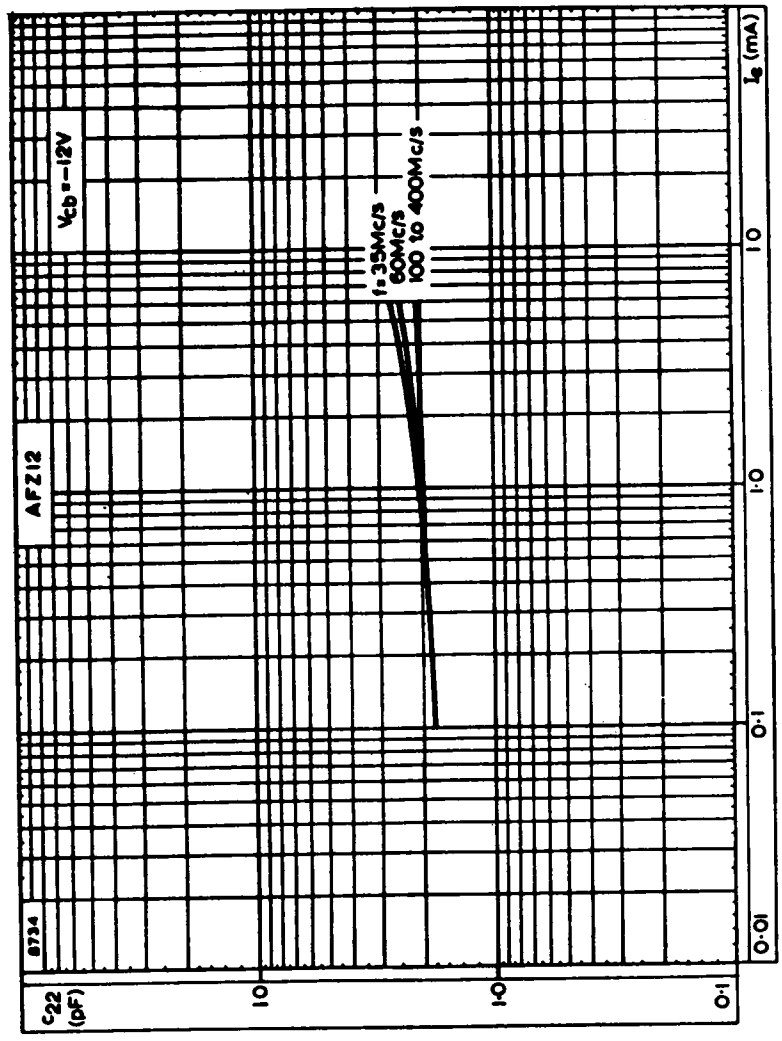
TRANSFER ADMITTANCE PLOTTED AGAINST COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON EMITTER



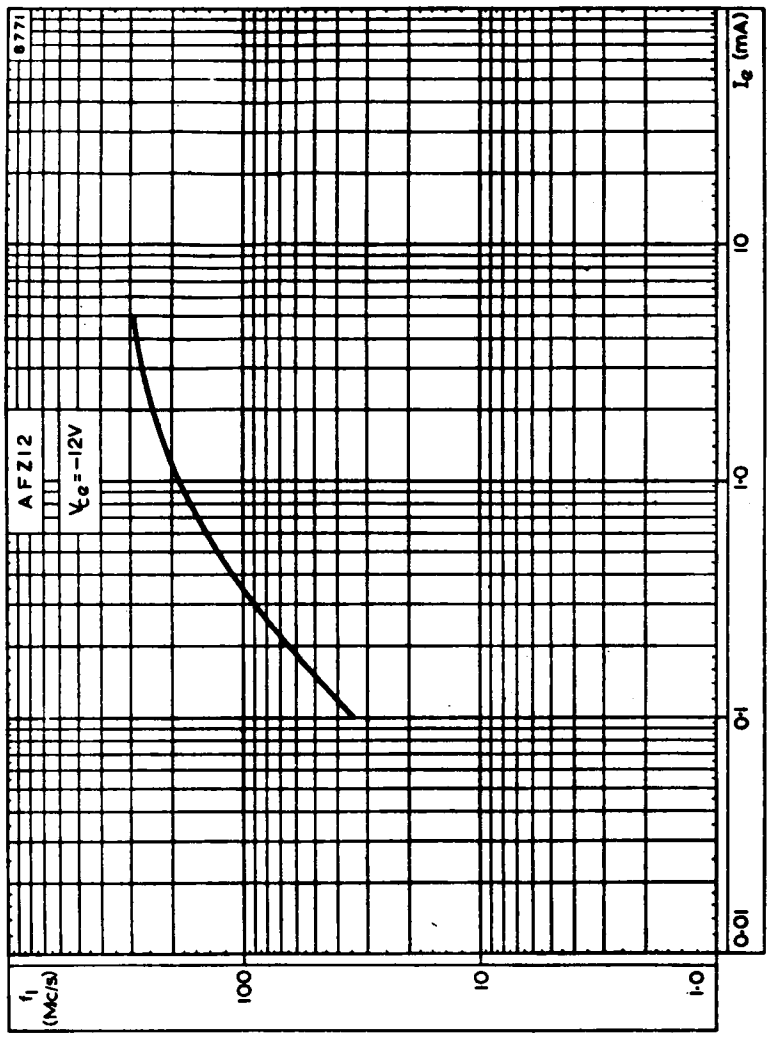
OUTPUT CONDUCTANCE PLOTTED AGAINST EMITTER CURRENT AND COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON BASE



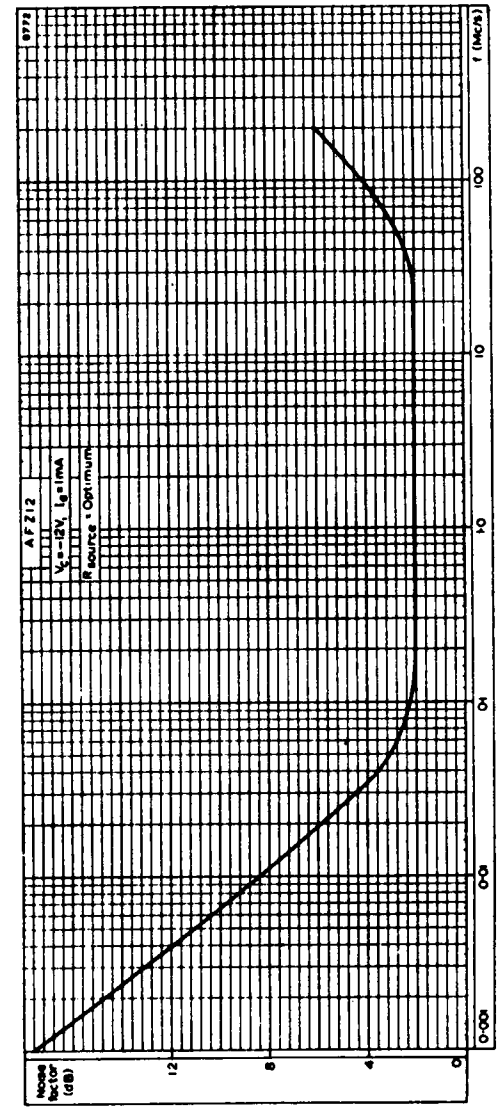
OUTPUT CAPACITANCE PLOTTED AGAINST COLLECTOR VOLTAGE WITH FREQUENCY AS PARAMETER. COMMON BASE



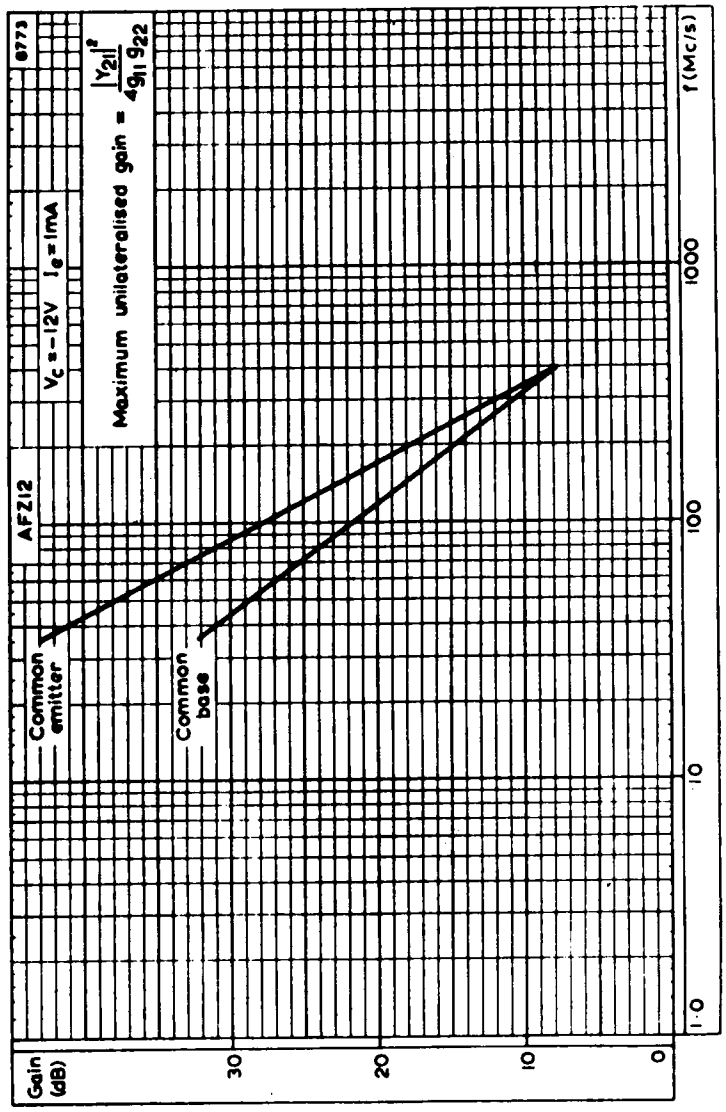
OUTPUT CAPACITANCE PLOTTED AGAINST EMITTER CURRENT WITH FREQUENCY AS PARAMETER. COMMON BASE



FREQUENCY AT WHICH |α'| EQUALS 1 PLOTTED AGAINST EMITTER CURRENT



NOISE FACTOR PLOTTED AGAINST FREQUENCY



MAXIMUM UNILATERALISED GAIN PLOTTED AGAINST FREQUENCY