MILITARY SPECIFICATION

CV 7490-91

SEMICONDUCTOR DEVICE, TRANSISTOR

Description:- This specification covers the detailed requirements for NPN Silicon Planar Transistors which may be used in amplifying circuits at high frequencies and is in accordance with Specification K1007, Issue 3, except where otherwise stated.

Mechanical Dimensions and Outlines:- K1007, Section B 10.3.1., CV-A 10.3.2.2., 10.4.1., 10.4.2.2. (Note 1).
CV-B 10.3.2.4., 10.4.1., 10.4.2.4.

Connections:- Collector connected to case.
Lead 1. Emitter, Lead 2. Base, Lead 3. Collector.

Absolute Maximum Ratings:-

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RATING	V_{CB}	V_{CE}	V_{EB}	I_C mean	I_C peak	I_B mean	I_B peak	I_E mean	I_E peak	P_{tot}	T_{stg}	T_j	Shock	Vib.
Unit	V	V	V	mA	mA	mA	mA	mA	mA	W	°C	°C	g	g
Min	-	-	-	-	-	-	-	-	-	-	-55	-55	-	-
Max	40	24	3	100	200	100	200	100	200	0·6	+175	+175	1500	20
Note				A_1	A_2	A_1	A_2	A_1	A_2	B				

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RATING	V_{CB}	V_{CE}	V_{EB}	I_C mean	I_C peak	I_B mean	I_B peak	I_E mean	I_E peak	P_{tot}	T_{stg}	T_j	Shock	Vib.
Unit	V	V	V	mA	mA	mA	mA	mA	mA	W	°C	°C	g	g
Min	-	-	-	-	-	-	-	-	-	-	-55	-55	-	-
Max	40	24	3	100	200	100	200	100	200	0·3	+175	+175	1500	20
Note				A_1	A_2	A_1	A_2	A_1	A_2	B				

NOTE A1 Average over a period greater than 100μsecs. A2 For a period less than 100μS.
B See derating curves.
C Commercial equivalent CV-7490 BFY17; CV-7491 BFY18.

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Primary Electrical Characteristics

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Characteristic		I_{CBO}	$V_{CE(sat)}$	$V_{BE(sat)}$	h_{fe}	f_T	C_{cb}	Noise Figure
Unit		nA	V	V		Mc/s	pF	dB
Min		-	-	-	40	200	-	-
Max		10	0·25	0·75	160	-	5·5	18
T_{case}	°C	25	25	25	25	25	25	25
V_{CB}	V	9	-	-	-	-	6	-
V_{CE}	V	-	-	-	9	9	-	4·5
I_C	mA	-	1	1	10	10	-	0·5
I_B	mA	-	0·1	0·1	-	-	-	-
I_E	mA	0	-	-	-	-	0	-
f	Mc/s	-	-	-	1×10^{-3}	100	1	1×10^{-3}

Reliability Assurance Requirements: Under discussion

Requirements:

Marking As K1007, Section B.1.3.4

Quality Assurance Provisions

Destructive Tests The tests listed in Table 2, Group B Inspection, Sub-Group 2, 3 and 4 are considered destructive.

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

Preparation for Delivery

Packaging The device shall be packed according to K1007, Issue 3, Section A., 1.2.(c). AIS Size 6

Joint Service Catalogue Numbers

CV 7490 - 5960-99-037-3701
CV 7491 - 5960-99-037-3702

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

Engineer-in-Chief
'S' Branch
Post Office, London.

TABLE 1. GROUP A INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO REF.	Specific Conditions				Min.	Max.	
SUB GROUP 1			0·65	I				
Visual and Mechanical Inspection	5·1	Excluding Physical Dimensions						
SUB GROUP 2			1·0	II				
Collector-Base Cut-off current (1)	7.2.5.1	V_{CB} = 9V I_E = 0			I_{CBO_1}		10	nA
Collector-Base Cut-off current (2)	7.2.5.1	V_{CB} = 40V I_E = 0			I_{CBO_2}		1	µA
Collector Emitter Cut-off current (1)	7.2.5.2	V_{CE} = 9V I_B = 0			$I_{CEO(1)}$		50	nA
Transition Frequency		I_C = 10 mA V_C = 9V f = 100 Mc/s (min)			f_T	200		Mc/s
Output Capacitance	7.4.8.	V_{CB} = 6V I_E = 0 f = 1 Mc/s			C_{ob}		5·5	pF
SUB GROUP 3			4·0	I				
Collector Emitter Saturation Voltage	7.3.3	I_C = 1 mA I_B = 0·1 mA			$V_{CE(sat)}$		0·25	V

TABLE 1. GROUP A INSPECTION (Cont'd)

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUB GROUP 3 (Cont'd)								
Base Emitter Saturation Voltage	7.3.3	I_C = 1 mA I_B = 0·1 mA			$V_{BE(sat)}$		0·75	V
Small Signal Short Circuit Forward Current Transfer Ratio	7.4.2	I_C = 10 mA V_{CE} = 9V f = 1 kc/s			h_{fe}	40	160	
Noise Factor	7.6.3	I_C = 0·5 mA V_{CE} = 4·5V f = 1 kc/s			N		18	dB
Emitter Base Cut-off Current	7.2.6	V_{EB} = 3V I_C = 0			I_{EBO}		1	µA
SUB GROUP 4			4·0	IA				
Breakdown Voltage Collector to Emitter		I_C = 10 mA (see Note 2) I_B = 0			$V_{(BR)CEO}$	24		V
Collector Emitter Cut-off Current	7.2.5.1	V_{CE} = 9V I_B = 0 T_{amb} = +150°C			I_{CEO} (2)		100	µA

TABLE 2. GROUP B INSPECTION

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUB GROUP 1 Physical Dimensions	5.1	Check dimensions to drawings CV-A 10.3.2.2 and 10.4.2.2 (Note 1) CV-B 10.3.4 and 10.4.2.4	6·5	IC				
SUB GROUP 2 Solderability Temperature Cycling Moisture Resistance	5.13 5.5 5.3	-55°C to +175°C	4·0	IA				
SUB GROUP 3 Vibration Fatigue	5.15.1		4·0	IC				
SUB GROUP 4 Lead Fragility	5.10.2	2 cycles	6·5	IA				
SUB GROUP 5 Omitted								
SUB GROUP 6 Omitted								
SUB GROUP 7 High Temperature Life (Non Operating)	6.2.1 6.6.1.2.2	T_{stg} + 175°C Duration 1000 hrs	4·0	I Maximum 125 Devices				

TABLE 2. GROUP B INSPECTION (Cont'd)

Examination or Test	Test Conditions		AQL %	Insp. Level	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Conditions				Min.	Max.	
SUB GROUP 8			6·5	IA				
Operating Life	6.3 6.6.1.2.2	V_{CB} = 20V MIN Duration 1000 hrs. T_{amb} may be at any single temperature between +25°C and +125°C with P_{tot} corresponding to that given on the derating curve Page 12.						
Post Test End Points for SUB GROUPS 2 to 8 (inclusive)								
Collector Base Cut-off Current	7.2.5.1	V_{CB} = 9V I_E = 0			I_{CBO}		20	nA
Small Signal Short Circuit Forward Current Transfer Ratio	7.4.2	I_C = 10 mA V_{CE} = 9V f = 1 kc/s			h_{fe}	35	180	

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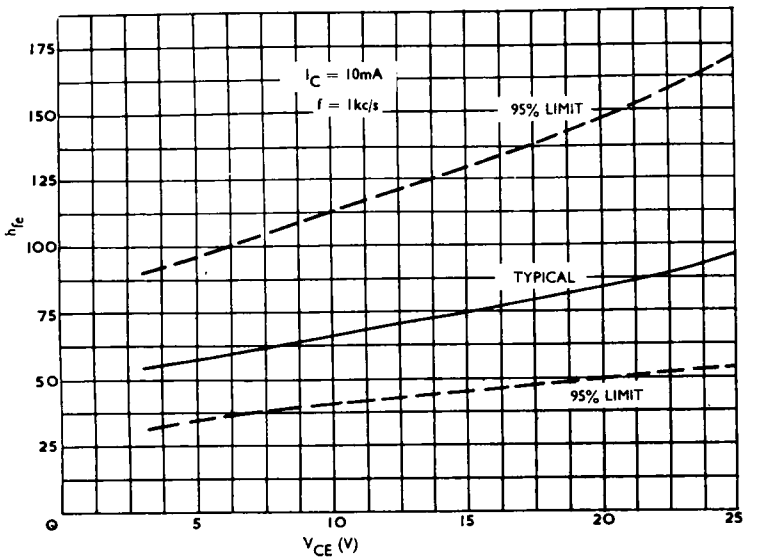
TABLE 3. GROUP C INSPECTION

Examination or Test	Test Condition		AQL %	INSP. LEVEL	Symbol	Limits		Units
	K1007/ NATO Ref.	Specific Condition				Min.	Max.	
SUB GROUP 1 Omitted								
SUB GROUP 2 Shock	5.17.1	Non operating	6·5	IA				
Post Test End Points for SUB GROUP 2								
Collector Base Cut-off Current	7.2.5.1	V_{CB} = 9V I_E = 0			I_{CBO}		20	nA
Small Signal Short Circuit Forward Current Transfer Ratio		I_C = 10 mA V_{CE} = 9V f = 1 kc/s			h_{fe}	35	180	

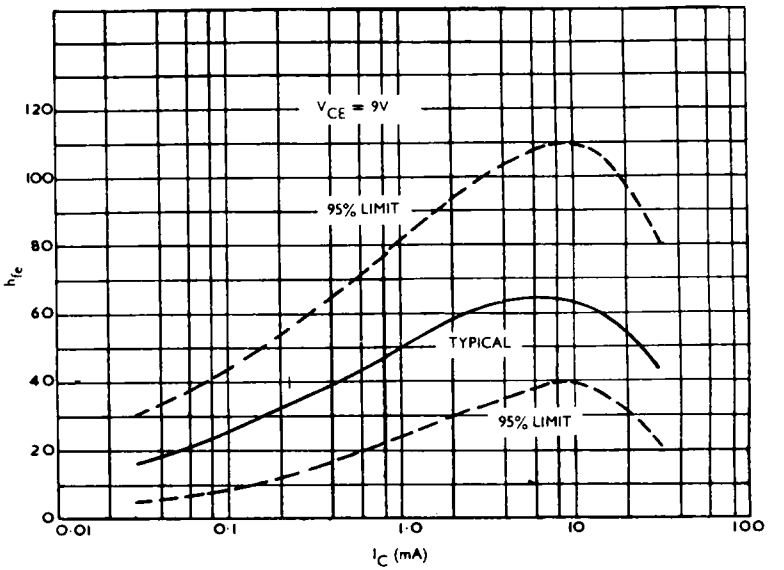
NOTES

1. Lead length 0·3 in. min.
2. 300 µSec. pulse; maximum duty cycle 2%

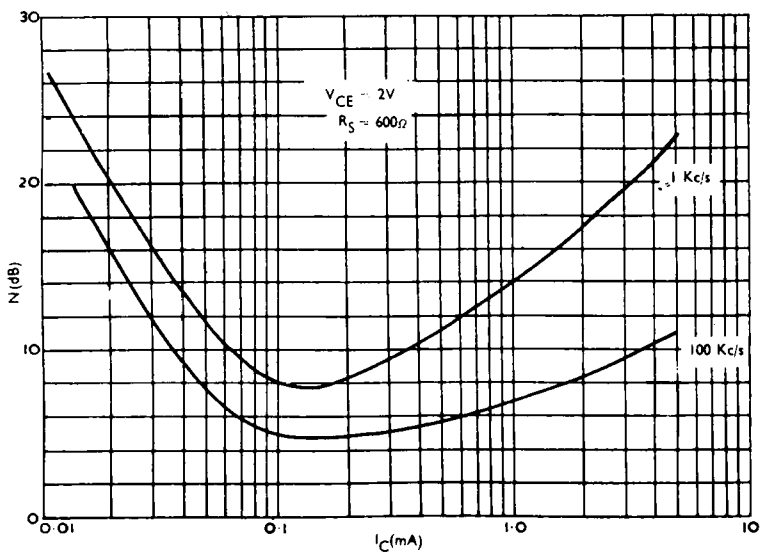
Small Signal Common Emitter Forward Current Transfer Ratio v. Collector Voltage



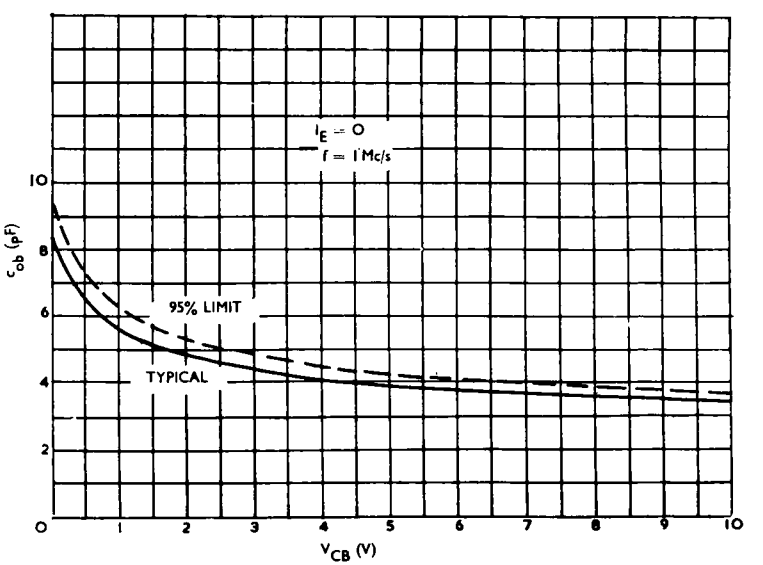
Small Signal Common Emitter Forward Current Transfer Ratio v. Collector Current



Typical Noise Factor v. Collector Current



Common Base Output Capacitance v. Collector Voltage



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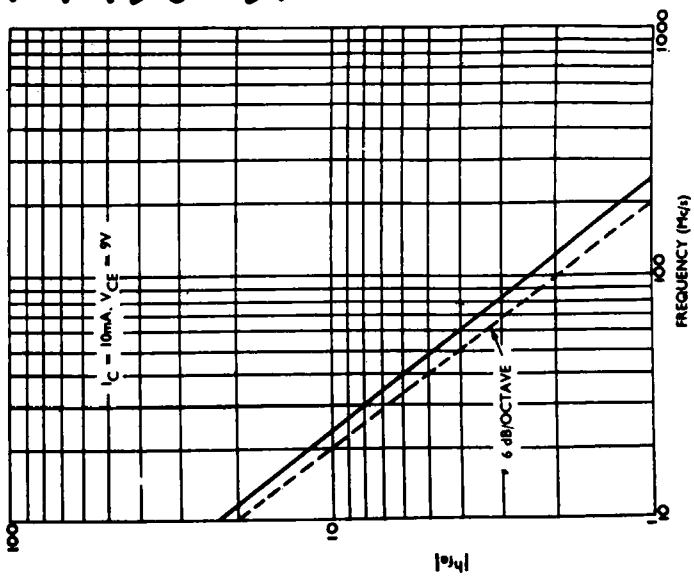
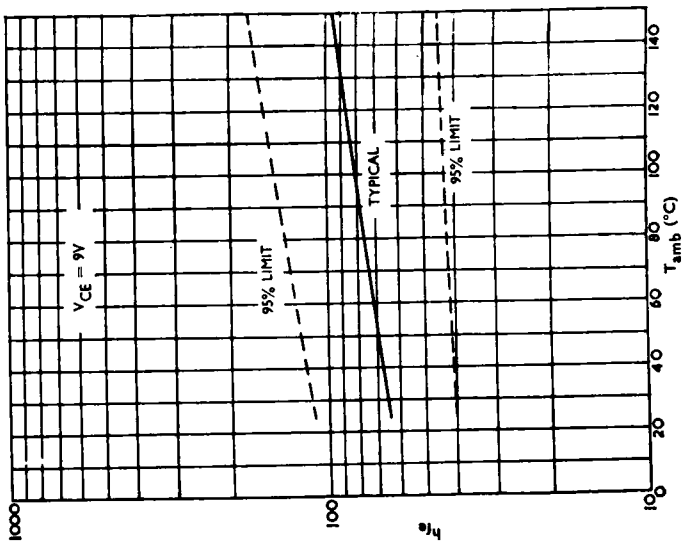
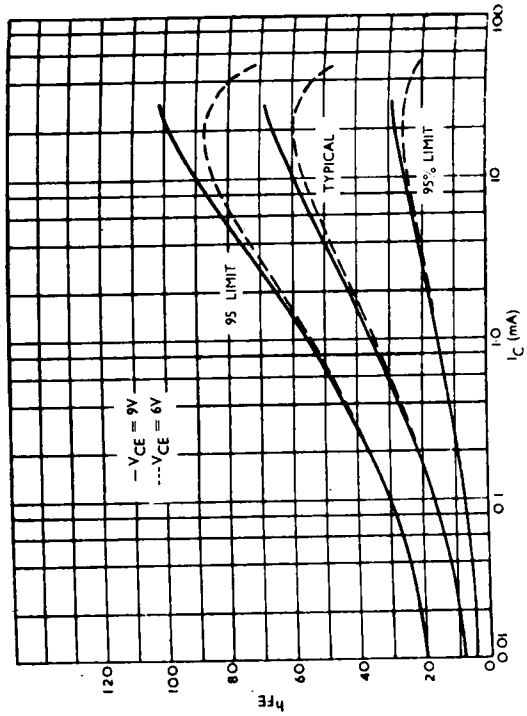
Typical Modulus of Small Signal Common Emitter Forward Current Transfer Ratio v. Frequency



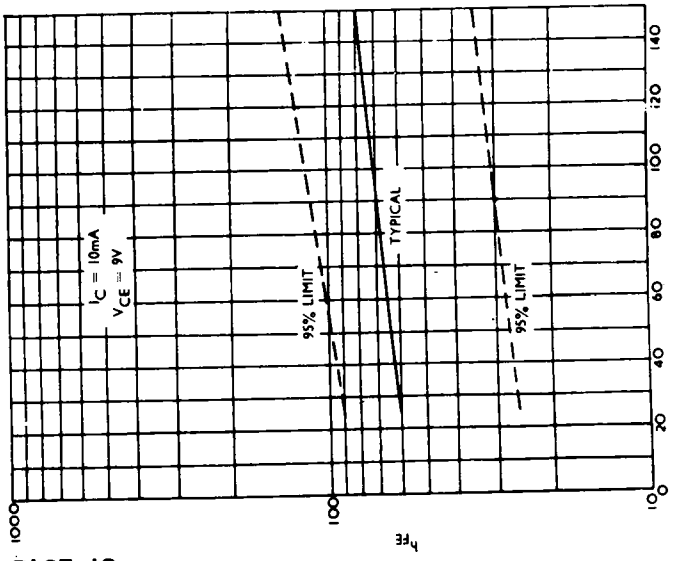
Small Signal Common Emitter Forward Current Transfer Ratio v. Temperature



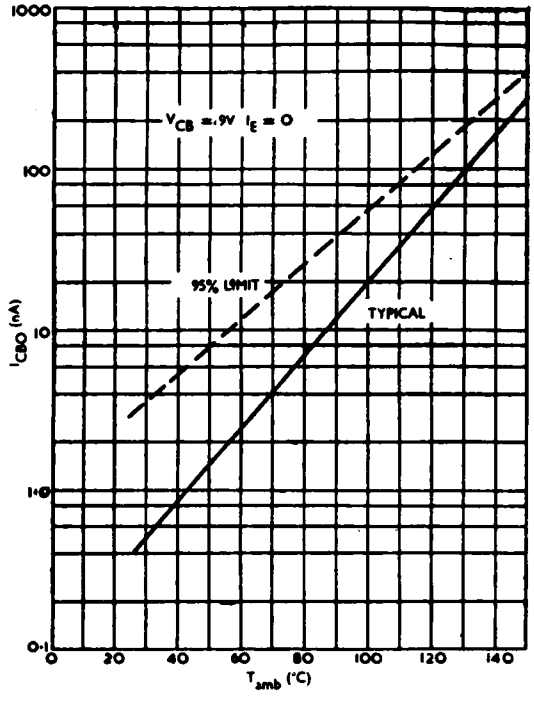
Large Signal Common Emitter Forward Current Transfer Ratio v. Collector Current



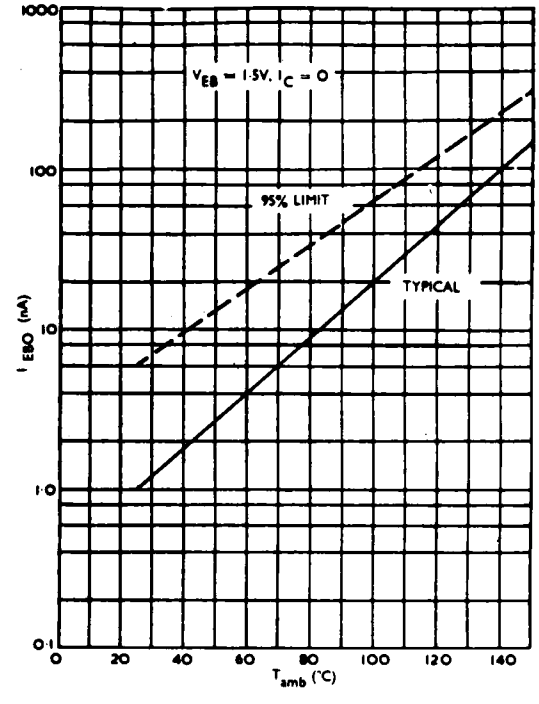
Large Signal Common Emitter Forward Current Transfer Ratio v. Temperature



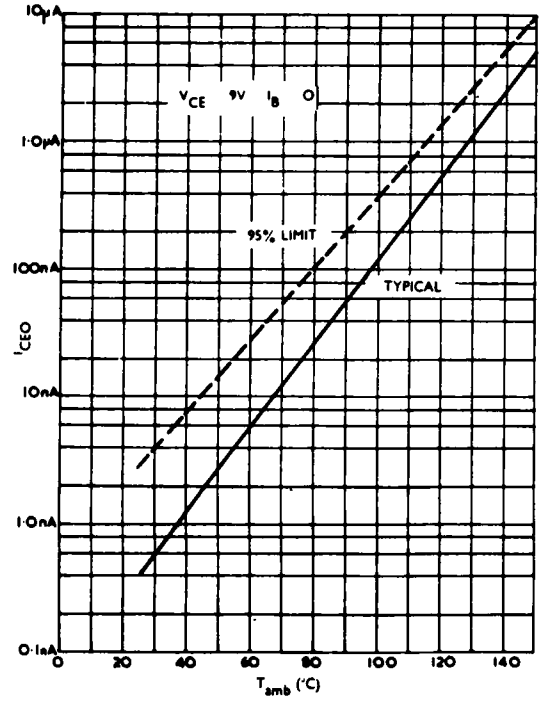
Collector-Base Cut-off Current v. Temperature



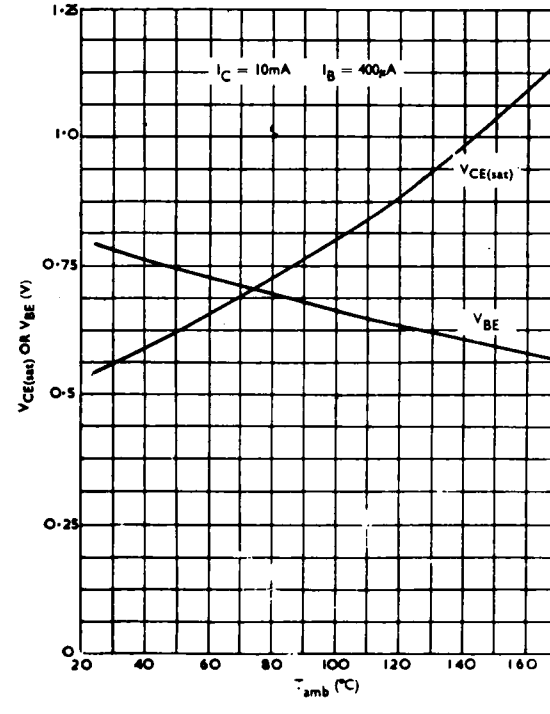
Emitter-Base Cut-Off Current v. Temperature



Collector-Emitter Cut-off Current v. Temperature



Typical Collector-Emitter Voltage and Base-Emitter Voltage v. Temperature



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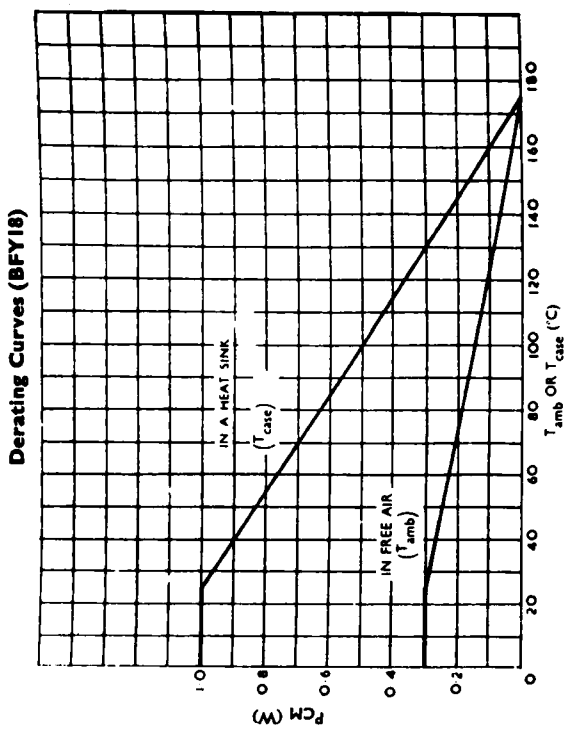
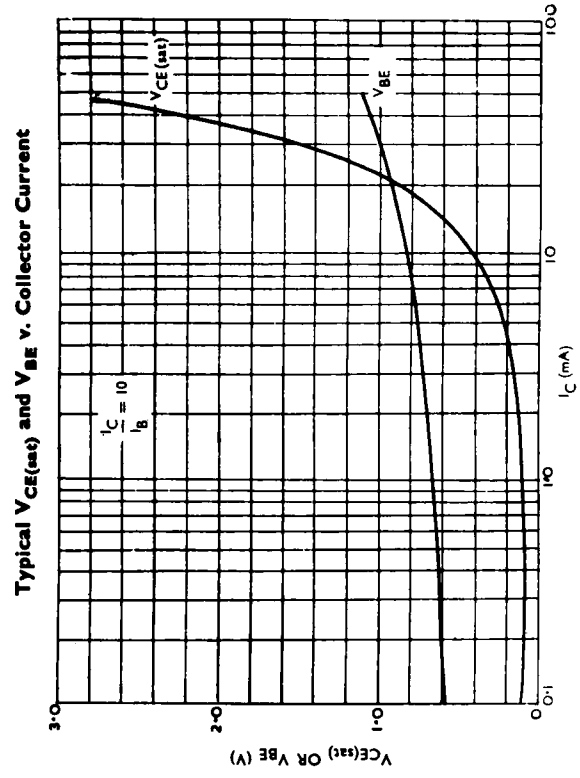
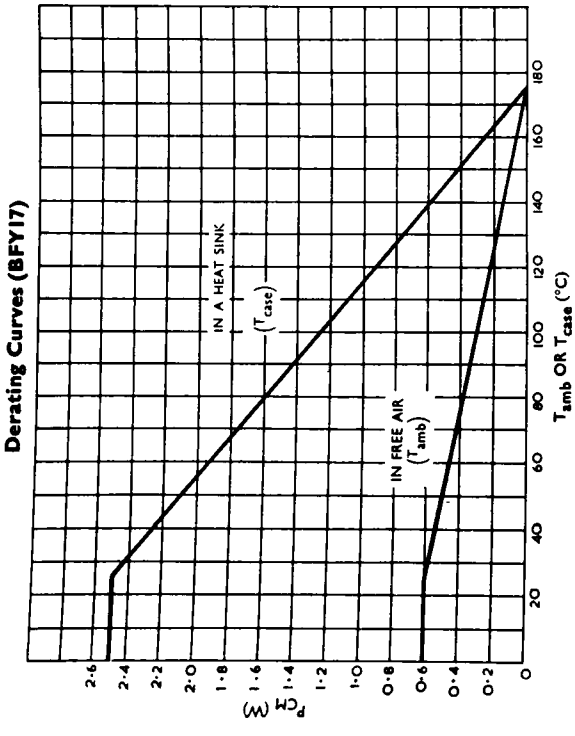
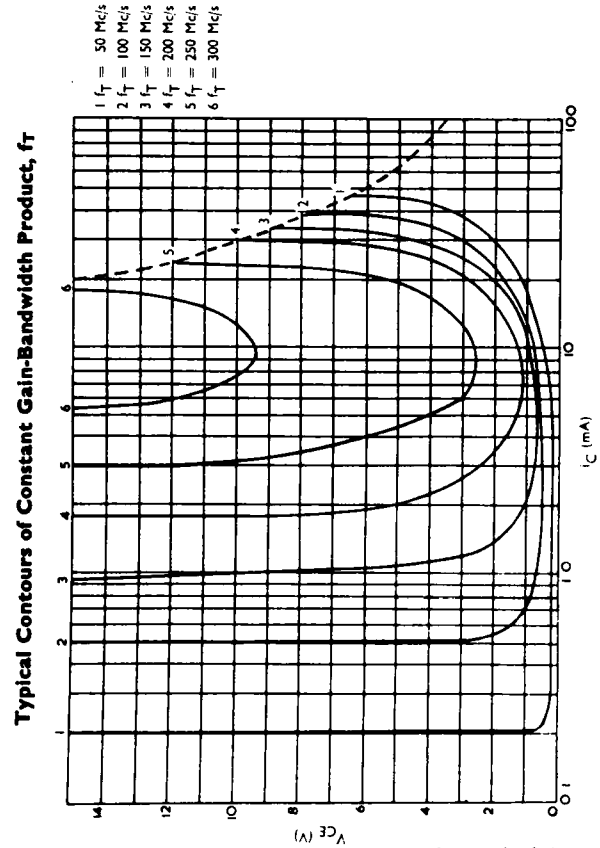

Derating Curves (BFY18)
IN A HEAT SINK
(T_{case})
IN FREE AIR
(T_{amb})
P_{CM} (W)
T_{amb} OR T_{case} (°C)


Typical $V_{CE(sat)}$ and V_{BE} v. Collector Current
$V_{CE(sat)}$
V_{BE}
$\frac{I_C}{I_B} = 10$
$V_{CE(sat)}$ OR V_{BE} (V)
I_C (mA)


Derating Curves (BFY17)
IN A HEAT SINK
(T_{case})
IN FREE AIR
(T_{amb})
P_{CM} (W)
T_{amb} OR T_{case} (°C)


Typical Contours of Constant Gain-Bandwidth Product, f_T
1 f_T = 50 Mc/s
2 f_T = 100 Mc/s
3 f_T = 150 Mc/s
4 f_T = 200 Mc/s
5 f_T = 250 Mc/s
6 f_T = 300 Mc/s
V_{CE} (V)
I_C (mA)