

ELECTRONIC VALVE SPECIFICATIONS  
SPECIFICATION CV7404

ISSUE NO.1 DATED 28.6.1963  
AMENDMENT NO.2

Page 2, Primary Electrical Characteristics,  
The fourth line of Conditions to be  
amended from  $I_C$  to  $I_E$ .

Page 5, SUB GROUP 3,  
Static forward current transfer ratio,  
Min Limit Column,  
Delete 40 Insert 35.

Ministry of Aviation/RRE

March, 1964

(222282)

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION CV7404

ISSUE 1 DATED 28th JUNE 1963

AMENDMENT NO. 3

Page 7 Table 2 Group B Inspection Sub Group 7

Against "Storage Life" in Test Conditions Column  
Insert ..... "Note 2"

Page 11 Notes

Add: Note 2. "Less clause 1.3.3.2 for this particular  
test".

September 1964

Ministry of Aviation/R.R.E.

MILITARY SPECIFICATION

**CV 7404**

SEMICONDUCTOR DEVICE, TRANSISTOR

2N1893

**Description:** This specification covers the detail requirements for a NPN Silicon Planar High Voltage transistor and is in accordance with K1007, Issue 3, except as otherwise stated.

**Mechanical Dimensions and Outlines:-**

K1007, Section B. 10.3.2.2. and 10.4.2.2.

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

**Absolute Maximum Ratings:-**

Rating	$V_{CBO}$	$V_{CER}$	$V_{CEO}$	$V_{EBO}$	Total Dissipation		
					Case 25°C	Case 100°C	Amb 25°C
Unit	V	V	V	V	W	W	W
Min	-	-	-	-	-	-	-
Max	120	100	80	7.0	3.0	1.7	0.8
Note		A	A		B & C	B & C	

Rating	$T_{stg}$	$T_j$	Shock	Vibration
Unit	°C	°C	g	g
Min	-65	-	-	-
Max	+200	+200	1500	20
Notes			D	

Notes:- A. Rating refers to a high current point where collector-to-emitter voltage is lowest.

B. These are steady state limits.

C. These ratings give a maximum junction temperature of 200°C and junction-to-case thermal resistance of 58.3°C/watt. (derating factor of 17.2mW/°C).

D. Duration 0.5 ms.

# CV7404

## Primary Electrical Characteristics

Characteristic	$I_{CBO}$	$V_{CE}$ (sat)	$V_{BE}$ (sat)	$h_{FE}$	$h_{FE}$	$h_{FE}$	$h_{FE}$	$h_{fe}$	$C_{ob}$	$C_{cb}$
Unit	nA	V	V						pF	pF
Min	-	-	-	20	35	40	20	3	-	-
Max	10	1.2	1.0	-	-	120	-	-	15	85
CONDITIONS	Temp. °C	25	25	25	25	25	25	-55	25	25
	$V_{CB}$ V	90								
	$V_{CE}$ V				10	10	10	10	10	10
	$I_C$ mA	0							0	
	$I_C$ mA		50	50	0.1	10	150	10	50	0
	$I_B$ mA		5	5						
	f Mc/s.								20	
	$V_{EB}$ V									0.5

Characteristic	$h_{fe}$	$h_{fe}$	$h_{ib}$	$h_{ib}$	$h_{rb}$	$h_{rb}$	$h_{ob}$	$h_{ob}$	Switch Time
Unit			ohms	ohms			$\mu$ mho	$\mu$ mho	nS
Min	35	45	20	4	-	-	0.1	-	-
Max	100	-	30	8	$1.25 \times 10^{-4}$	$1.5 \times 10^{-4}$	0.5	0.5	30
CONDITIONS	Temp. °C.	25	25	25	25	25	25	25	25
	$V_{CB}$ V			5	10	5	10	5	10
	$V_{CE}$ V	5	10						
	$I_C$ mA	1	5	1	5	1	5	1	5

Reliability Assurance Requirements: Under discussion

Requirements

CV7404

Marking. The device shall be marked as K1007. Section B. 1.3.4.1.(a), (c), (d) and (f) as space permits, any other marking shall be on the pack.

Quality Assurance Provisions

Destructive Tests. The tests listed in Table 2. Group B Inspection, Sub Group 2,3 and Table 3 Group C Inspection Sub Group 2 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. Section A, 1.2.(c).

Joint Service Catalogue Number

5960-99-037-3438

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

Ministry of Aviation, Royal Radar Establishment, Malvern, Worcs. England.

TABLE 1 GROUP A INSPECTION

Examination or Test	TEST CONDITIONS		AQL %	Insp. Level	Sym- bol	LIMITS		Units
	K1007/NATO Ref	SPECIFIC CONDITIONS				Min.	Max.	
<u>SUB GROUP 1</u> Visual and Mechanical Inspection	5.1	Excluding Physical Dimensions	0.65	II				
<u>SUB GROUP 2</u> Collector-emitter sustaining voltage	7.2.2.2	$R_{BE} = 10 \text{ ohms}$ $I_C = 100 \text{ mA}$ $t_p < 300 \mu\text{Sec} \leq 2\% \text{ duty cycle}$	1.0	II	$V_{CER} \text{ (sust)}$	100	-	V
Collector-base breakdown voltage	7.2.1	$I_E = 0$ $I_C = 100 \mu\text{A}$			$BV_{CBO}$	120	-	V
Collector-base cut-off current (1)	7.2.5.1	$V_{CB} = 90\text{V}$ $I_E = 0$			$I_{CBO}$	-	10	nA
Emitter-base cut-off current	7.2.6	$V_{EB} = 5\text{V}$			$I_{EBO}$	-	10	nA
Emitter-base breakdown voltage	7.2.3	$I_C = 0$ $I_E = 100 \mu\text{A}$			$BV_{EBO}$	7	-	V
Collector-emitter sustaining voltage	7.3.4	$I_C = 30 \text{ mA}$ $I_B = 0$ $t_p < 300 \mu\text{Sec} \leq 2\% \text{ duty cycle}$ $I_C = 150 \text{ mA}$ $V_C = 10\text{V}$ $t_p \leq 300 \mu\text{Sec} \leq 2\% \text{ duty cycle}$			$V_{CEO} \text{ (sust)}$ $h_{FE}$	80	-	V
Static-forward current transfer ratio (1)						40	120	

TABLE 1 GROUP A INSPECTION (Cont'd)

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Sym-bol	LIMITS		Units			
		SPECIFIC CONDITIONS					Min.	Max.				
Base-emitter saturation voltage (1)	7.3.1	$I_C = 50 \text{ mA}$	I	2.5		$V_{BE} \text{ (sat)}$	-	1.0	V			
Collector-emitter saturation voltage (1)	7.3.3	$I_B = 5 \text{ mA}$					-	1.2	V			
<u>SUB GROUP 3</u>		$I_C = 50 \text{ mA}$										
Static-forward current transfer ratio (2)	7.3.4	$I_B = 5 \text{ mA}$										
Static-forward current transfer ratio (3)	7.3.4	$I_C = 10 \text{ mA}$	IA	6.5		$h_{FE}$	40					
Base-emitter saturation voltage (2)	7.3.1	$V_{CE} = 10V$										
Collector-emitter saturation voltage (2)	7.3.3	$I_C = 0.1 \text{ mA}$					20					
<u>SUB GROUP 4</u>		$V_{CE} = 10V$										
Collector-Base cut-off current (2)	7.2.5.1	$I_C = 150 \text{ mA}$				$V_{BE} \text{ (sat)}$	-	1.3	V			
		$I_B = 15 \text{ mA}$				$V_{CE} \text{ (sat)}$	-	5	V			
		$I_C = 150 \text{ mA}$				$I_{CBO}$	-	15	$\mu\text{A}$			
		$I_B = 15 \text{ mA}$										
		$T = 150^\circ\text{C} \pm 3^\circ\text{C}$										
		$V_{CB} = 90V$										
		$I_E = 0$										

TABLE 1 GROUP A INSPECTION (Cont'd)

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Sym-bol	LIMITS		Units
		SPECIFIC CONDITIONS					Min.	Max.	
Static-forward current transfer ratio (4)	7.3.4	T = -55°C				h <sub>FE</sub>	20	-	
		I <sub>C</sub> = 10mA							
Switching time		V <sub>CE</sub> = 10V				t <sub>on</sub> +t <sub>off</sub>	-	30	nS
		See Fig: 2. Page 13							
Output capacitance	7.4.8	I <sub>C</sub> = 0				C <sub>ob</sub>	-	15	pF
		V <sub>CB</sub> = 10V							
Input capacitance		I <sub>C</sub> = 0				C <sub>ib</sub>	-	85	pF
		V <sub>EB</sub> = -0.5V							
Noise Factor		I <sub>C</sub> = 0.300mA				F	-	12	dB
		V <sub>C</sub> = 10V							
		R <sub>g</sub> = 510 ohms							
		b <sub>W</sub> = 200 cycles							
		f = 1kc/s							

TABLE 2 GROUP B INSPECTION  
 See Page 3, Quality Assurance Provisions, Destructive tests.

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Sym-bol	LIMITS		Units
		SPECIFIC CONDITIONS					Min.	Max.	
<u>SUB GROUP 1</u> Physical Dimensions	5.1	According to drawing		6.5	IC				
<u>SUB GROUP 2</u> Solderability	5.13	65°C to +200°C		4.0	IA				
Temperature Cycling	5.5	100°C to 0°C							
Thermal Shock	5.6.1								
Moisture Resistance	5.3.1								
<u>SUB GROUP 3</u> Vibration Fatigue	5.15.1	Non-operating		4.0	I Note 1				
<u>SUB GROUP 4</u> Lead Fatigue	5.10.1			6.5	IA				
<u>SUB GROUP 5</u> Omitted									
<u>SUB GROUP 6</u> Omitted									
<u>SUB GROUP 7</u> Storage Life	6.2.1 6.6.1.2.2	T <sub>stg</sub> = +200°C Duration = 1000hours		4.0	I Note 1				



TABLE 2 GROUP B INSPECTION (Cont'd)

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Symbol	LIMITS		Units
		SPECIFIC CONDITIONS					Min.	Max.	
<u>SUB GROUP 8</u>									
Operating Life	6.3	T = 25°C V <sub>CB</sub> = 40V P <sub>C</sub> = 800mW I <sub>C</sub> = 20.0 mA		4.0	IA				
<u>Post Test End Points for Sub Groups 2 &amp; 3</u>									
Collector Base Cut-off current (1)	7.2.5.1	V <sub>CB</sub> = 90V				I <sub>CBO</sub>	-	20	nA
Collector-emitter saturation voltage (1)	7.3.3	I <sub>E</sub> = 0 I <sub>C</sub> = 50mA				V <sub>CE (sat)</sub>	-	1.32	V
Base-emitter saturation voltage (1)	7.3.1	I <sub>B</sub> = 5mA I <sub>C</sub> = 50mA I <sub>B</sub> = 5mA				V <sub>BE (sat)</sub>	-	1.10	V
<u>Post Test End Points for Sub Groups 7 &amp; 8</u>									
Collector-base cut-off current (1)	7.2.5.1	V <sub>CB</sub> = 90V I <sub>E</sub> = 0				I <sub>CBO</sub>	-	0.1	μA

TABLE 2 GROUP B INSPECTION (Cont'd)

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Sym- bol	LIMITS		Units
		SPECIFIC CONDITIONS					Min.	Max.	
Static-forward current transfer ratio (1)	7.3.4	$I_C = 150 \text{ mA}$ $V_{CE} = 10V$	$t_p \leq 300 \mu\text{Sec}$ $\leq 2\%$ duty cycle $V_{EB} = 5V$			$\Delta h_{FE}$	$\pm 25\%$		
	7.2.6					$I_{EBO}$	0.1	$\mu\text{A}$	

TABLE 3 GROUP C INSPECTION

See Page 3, Quality Assurance Provisions, Group C Destructive Tests.

Examination or Test	K1007/NATO Ref.	TEST CONDITIONS		AQL %	Insp. Level	Sym-bol	LIMITS		Units
		SPECIFIC CONDITIONS					Min.	Max.	
<u>SUB GROUP 1</u>				2.5	II				
Small signal forward current transfer ratio (1)	7.4.2	$I_C = 1 \text{ mA}$ $V_C = 5V$ $f = 1\text{kc/s}$				$h_{fe}$	35	100	
(2)	7.4.2	$I_C = 5 \text{ mA}$ $V_C = 10V$				$h_{fe}$	45		
(3)	7.5.2	$f = 1\text{kc/s}$ $I_C = 50 \text{ mA}$ $V_C = 10V$ $f = 20\text{Mc/s.}$				$h_{fe}$	3.0		
Input resistance (1)	7.4.1.	$I_C = 1 \text{ mA}$ $V_C = 5V$				$h_{ie}$	900	3600	ohms
(2)	7.4.1	$f = 1\text{kc/s.}$ $I_C = 5 \text{ mA}$ $V_C = 10V$				$h_{ie}$	250	1300	ohms
Voltage feedback ratio (1)	7.4.3	$f = 1\text{kc/s.}$ $I_C = 1\text{mA}$ $V_C = 5V$ $f = 1\text{kc/s.}$				$h_{re}$	-	$6 \times 10^{-4}$	

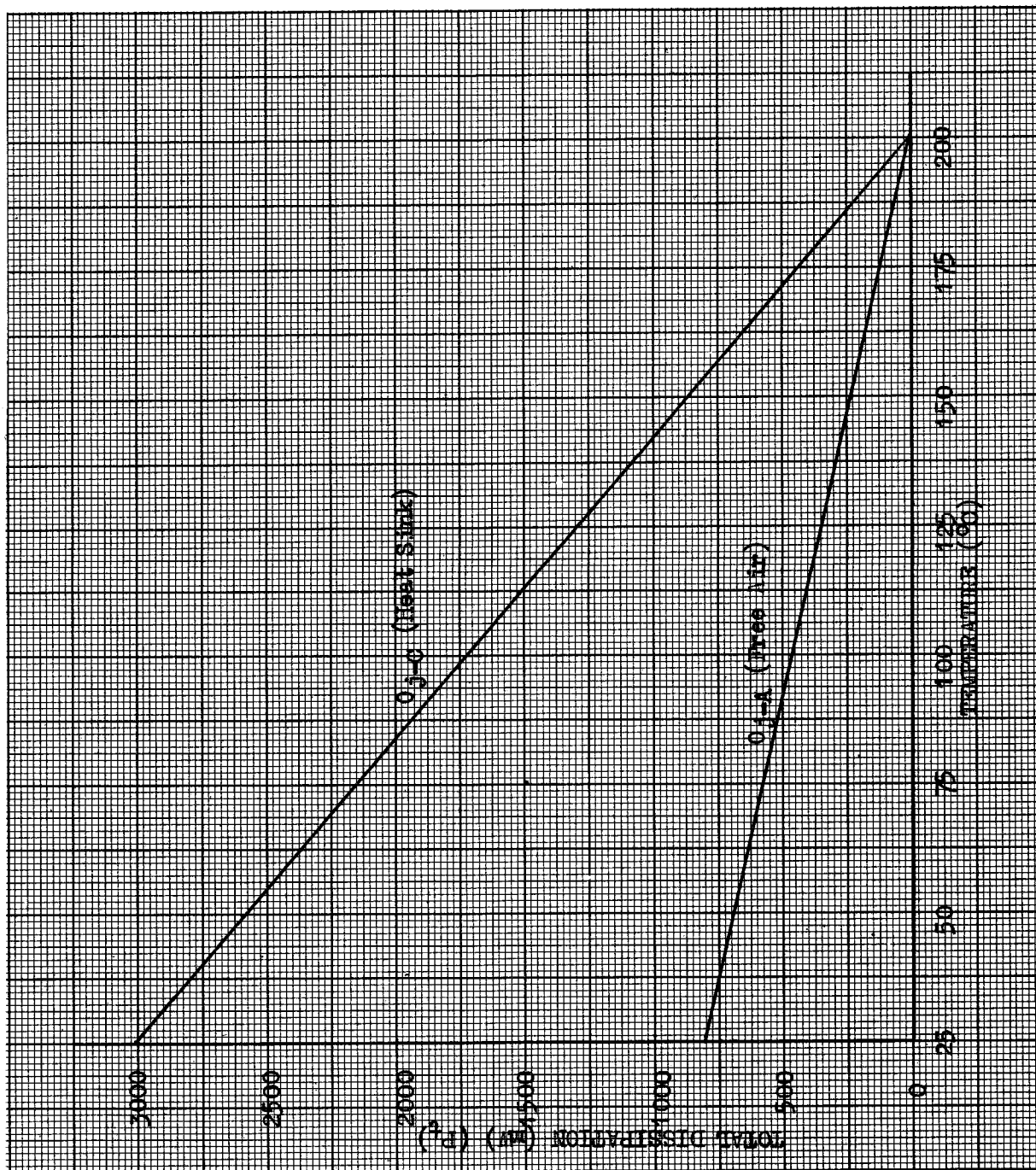
TABLE 3. GROUP C INSPECTION (Contd.)

Examination or Test	TEST CONDITIONS		AQL %	Insp. Level	Sym- bol	LIMITS		Units
	K1007/NATO Ref.	SPECIFIC CONDITIONS				Min.	Max.	
Voltage feedback	7.4.3	$I_C = 5\text{mA}$ $V_C = 10\text{V}$ $f = 1\text{kc/s.}$			$h_{re}$	-	$1.5 \times 10^{-4}$	
Output admittance (1)	7.4.4	$I_C = 1\text{mA}$ $V_C = 5\text{V}$ $f = 1\text{kc/s}$			$h_{oe}$	3.5	20	$\mu\text{mho}$
(2)	7.4.4	$I_C = 5\text{mA}$ $V_C = 10\text{V}$ $f = 1\text{kc/s.}$			$h_{oe}$	5.0	<del>20</del> <del>30</del>	$\mu\text{mho}$
<u>SUB GROUP 2</u> Shock (non operating)	5.17.1	5 blows in each of three mutually perpendicular directions	6.5	IA				
<u>Post test end points</u> As for Group B Inspection, Sub- Groups 2, 3 & 4.								

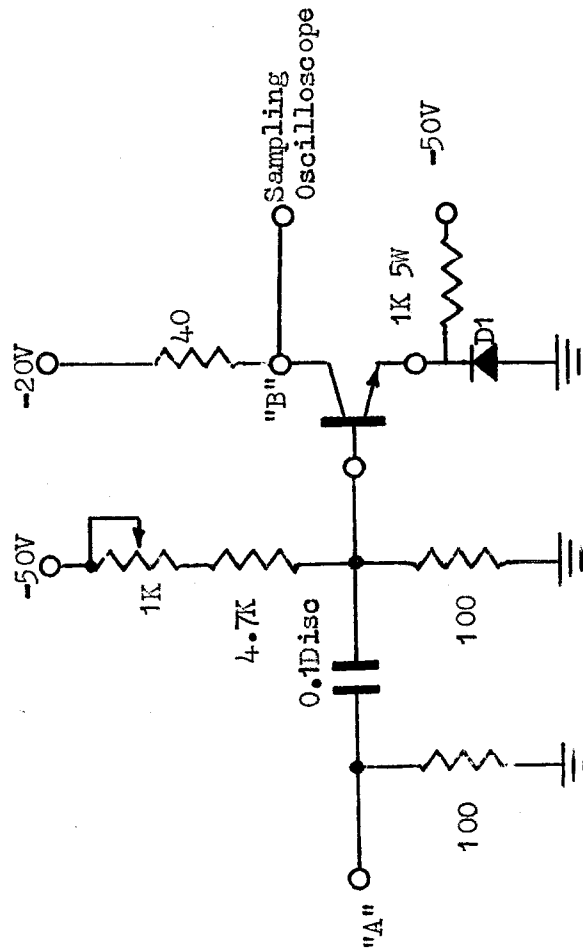
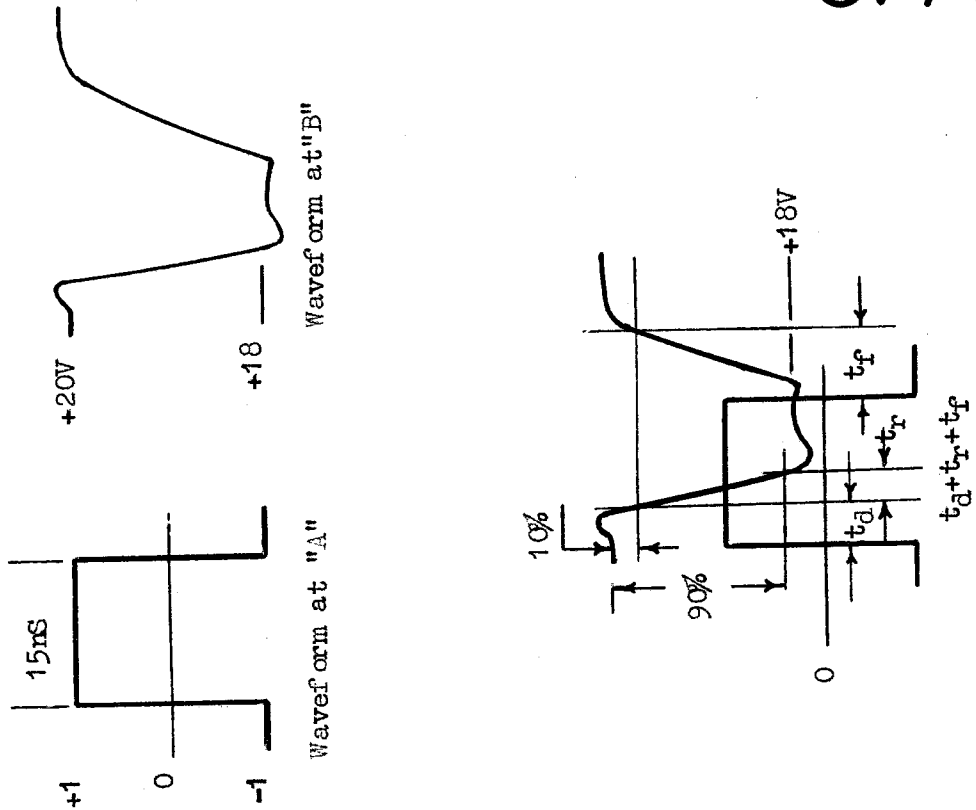
NOTES

1. Maximum sample size is 125

FIG 1  
Derating Curve



**FIG 2**  
Switching Test Circuit



D1, P.I.V. 50V.  
 $t_{rr} = 4.0 \text{ nSec max}$   
 $V_{fr} = 3.0V$