

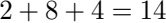
2 + 2 = 4

A pixelated, black and white graphic of the number 1941 repeated twice, separated by a plus sign, forming the year 1941+1941. The digits are rendered in a blocky, digital font style.

2019-2019



Energy Level (n)	1	2	3	4	5	6
Shell Letter	K	L	M	N	O	P
Electron Capacity ($2n^2$)	2	8	18	32	50	72



2 + 9 + 19 + 29



$$I_D = I_0 \left(e^{V_D / \eta V_T} - 1 \right) \approx I_0 e^{V_D / \eta V_T} ,$$

$$V_D = \eta V_T \ln \left(\frac{I_D}{I_0} + 1 \right) \approx \eta V_T \ln(I_D / I_0)$$

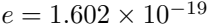




10-10-10













WISCONSIN













I_D	1 mA	5 mA	10 mA	20 mA	100 mA
V_D for Si ($I_0 = 10^{-10}$, $\eta = 1.4$)	0.58V	0.65	0.67V	0.7	0.75V
V_D for Ge ($I_0 = 10^{-4}$, $\eta = 1.0$)	0.06V	0.10	0.12V	0.14	0.18V

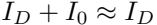




A pixelated, black and white graphic of the word "DODGE" in a stylized, blocky font. The letters are composed of various shades of gray and black pixels, giving it a retro, digital appearance. The word is centered horizontally.

$$R_D = \frac{dV_D}{dI_D} = \frac{d}{dI_D} \left[\eta V_T \ln \left(\frac{I_D + I_0}{I_0} \right) \right] = \eta V_T \frac{I_0}{I_D + I_0} \frac{1}{I_0} = \eta \frac{V_T}{I_D + I_0} \approx \eta \frac{V_T}{I_D}$$





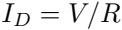
152017



I_D	0.05 mA	0.1 mA	0.2 mA	0.5 mA	1 mA	2 mA	5 mA
R_D for Si ($\eta = 1.4$)	728 Ω	364 Ω	182 Ω	73 Ω	36 Ω	18 Ω	7 Ω













IDEAS FOR A

20

10

2020

A pixelated, black and white graphic of the text "I D E V O S R + R D". The letters are thick and blocky, with a jagged, pixelated edge. The font is a stylized, sans-serif typeface. The text is arranged in a single line, with spaces between the words. The overall style is reminiscent of early digital art or computer graphics.







1234567890



$$D = (V = 2.3 / 1000 = 2.3 \text{ mA})$$



15/3/2020-2.25m

WORLD OF WISDOM

$$\begin{cases} I_D = I_0 (e^{V_D/V_T} - 1) \\ V_D = V - RI_D \end{cases}$$

VB = ADV (ADVERB) =

100% 100%



WORLD OF EVIL

WDSO-TV, Inc. 24th Ave.

100%



14. 25

104v

115110411

12/14/10 = 14/10/12

$x = 100 = 10^2$

ADAS107ms

AVENUE 14th ST. N



0 = 23.4 MV = 23.4 MV

$$i(t) = \frac{V}{R_L} e^{-t/\tau}$$



















$$a = \frac{I_C}{I_E} < 1,$$









1991-1992



The logo for the International Baccalaureate (IB) program, featuring a stylized 'I' and 'B' in a serif font. The 'I' is on the left and the 'B' is on the right, both in a dark blue color. The 'B' has a distinctive design with a horizontal bar that is slightly offset from the vertical stem. The logo is set against a white background.

1 - 0



$$I_E = f(V_{BE}, V_{CB}) \approx f(V_{BE}) = \frac{I_B}{1 - \alpha} = \frac{1}{1 - \alpha} I_0 (e^{V_{BE}/V_T} - 1)$$

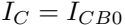
IB = IOEVEI = 1)

THE WORLD OF

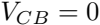
WORLD OF







[illegible]







VERBODEN TOEGANG

VERBODEN TOEGANG



$$\beta = \frac{I_C}{I_B} = \frac{\alpha I_E}{(1 - \alpha) I_E} = \frac{\alpha}{1 - \alpha},$$

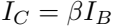


9-0901-0909

$$\beta = \frac{\alpha}{1-\alpha}, \quad \alpha = \frac{\beta}{1+\beta}, \quad 1+\beta = \frac{1}{1-\alpha}, \quad 1-\alpha = \frac{1}{1+\beta}$$

$$I_B = f(V_B, V_C) = f(V_B, V_C - 1)$$

1. *Beitrag* 2. *Verband* 3. *Ergebnis*







$$\frac{I_{out}}{I_{in}}$$
$$=$$
$$\frac{I_C}{I_E},$$



$$\frac{d}{dx} \left(\frac{1}{x} \right) = -\frac{1}{x^2}$$

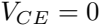


$$\frac{I_{out}}{I_{in}} = \frac{I_C}{I_B},$$











Q = 0.15



WORLD OF



12

5

01234





Ved, I ved, ved, ved, ved, ved

15 FEB 1964





VERBODEN TOEGANG



1995

W E W O W I W



W E S O R

VBVB=1-05mA

019 BOB BOB BOB BOB BOB



WEDNESDAY 27 NOV 2019



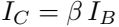
13-05-2020-02-22-14

1919-1920

VB 12 VA 2 V 14 V

WORLD OF

VBVB/BB12/2=5.9mA



W E A R



THE UNIVERSITY OF CHICAGO

A pixelated, grayscale representation of the text "I am a dog" in a stylized, blocky font. The characters are composed of various shades of gray and black pixels, giving it a retro, digital-art appearance. The text is arranged in a single line, with each letter clearly defined by its pixel structure.



THE UNIVERSITY OF CHICAGO



ABSTRACT

Q I B E V O W I

WORLDWIDE





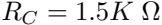




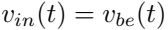








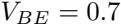




www.002code.vv

$\ln B + \ln ve = 0.7 + 0.02 \ln ve$





$$r_{be} = \frac{\Delta v_{be}}{\Delta i_b} = \frac{40 \text{ mV}}{0.1 \text{ mA}} = 400 \, \Omega$$



$$I_B + i_b(t) \approx 0.1 + \frac{\Delta v_{be}}{r_{be}} = 0.1 + \frac{20 \cos(\omega t)}{400} = (0.1 + 0.05 \cos(\omega t)) \text{ mA}$$



$$I_B + i_b(t) = \frac{V_{BE} + v_{be}(t)}{r_{be}} = \frac{0.7 + 0.02 \cos(\omega t)}{400} = (1.75 + 0.05 \cos(\omega t)) \text{ mA}$$



$$\begin{cases} I_C = 0 \\ V_{CE} = V_{CC} = 15V \end{cases}$$

$$\begin{cases} V_{CE} = 0 \\ I_C = V_{CC}/R_C = 15V/1.5k\Omega = 10mA \end{cases}$$

$$I_C + i_C(t) = \beta(I_B + i_B(t)) = 10 \times (0.1 + 0.05 \cos \omega t) = (1 + 2 \cos \omega t) \text{ mA}$$

$$V_c + v_c(t) = V_c + Re(I_c + i i_c(t)) = 15 + 1.5(4 + 2 \cos(\omega t)) = (9 + 3 \cos(\omega t)) V$$

A pixelated, black and white graphic of the text "O.O.C.O.S." in a stylized, blocky font. The letters are composed of a grid of black and white pixels, giving it a retro, digital appearance. The text is centered horizontally and occupies the middle portion of the image.

[illegible]

3/0025-150













VIEWER'S VIEW





THE WORLD OF THE

VORLESUNG

THE UNIVERSITY OF CHICAGO



THE UNIVERSITY OF CHICAGO

$$10^5 = 10^5 \times 10^3 = 10^8$$

FOR THE
FOR THE



2017

$$V_D = V_D - 15 - 20 \times 10^{-3} \times 1.5 \times 10^3 = -15V$$

2020

$10^{-15} \text{V} / 10^{-15} \text{A} = 10 \text{mA}$



123456789

$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$I_C = \beta I_B = \beta \frac{V_{CC} - V_{BE}}{R_B}$$



THE 2020 AWARDS



W E

5

10

W



W E S O W

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{12 - 0.6}{2000} = 0.057 \text{ mA}, \quad I_C = \beta I_B = 5.7 \text{ mA}$$

VERBODEN TOEGANG

$$R_c = \frac{6V}{5.6mA} \approx 1.05k\Omega$$

$$\frac{V_{CC}}{R_C} = \frac{12V}{R_C} = 2 \times I_C = 11.4 \text{ mA},$$

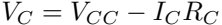
$$R_C = \frac{12V}{11.4mA} \approx 1.05k\Omega$$

VBOBBOBB12V105x57mmABV



W E A I E

Q = 50, 100, 200



TESTING

$V_0 = 10$, $V_1 = 12$, $V_2 = 12$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B} = \frac{12 - 0.6}{200 \times 10^3} = 0.057 \text{ mA}$$

	$\beta = 50$	$\beta = 100$	$\beta = 200$
$I_C = \beta I_B \text{ (mA)}$	2.85	5.70	11.4
$V_C = V_{CC} - R_C I_C \text{ (V)}$	9.15	6.3	0.6

$V_0 = 12/2 = 6$ m/s





B B B B B B B B B B B B B B B











$$V_B = V_{CC} \frac{R_2}{R_1 + R_2}$$

$$V_B - V_{BE} - I_{BE} R_E = V_B - V_{BE} (I_B + I_{BE} R_E = V_B - V_{BE} (\beta + 1) I_B R_E = 0$$

$$I_B = \frac{V_B - V_{BE}}{(\beta + 1)R_E}, \quad I_C = \beta I_B = \frac{\beta(V_B - V_{BE})}{(\beta + 1)R_E} \approx \frac{V_B - V_{BE}}{R_E} = \frac{V_E}{R_E}$$





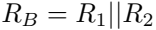


$$R_{Tn} = R_B = R_1 || R_2 = \frac{R_1 R_2}{R_1 + R_2}$$

$$VB - IBB - VB - (Ib + IBB) = VB - VBB - IBB - Ib + 1 IBB = 0$$

$$I_B = \frac{V_B - V_{BE}}{(\beta + 1)R_E + R_B},$$

$$I_C = \beta I_B = \frac{\beta (V_B - V_{BE})}{(\beta + 1) R_E + R_B}$$



ARIZONA ARIZONA

QWERTY UIO P

$$I_C \approx \frac{\beta(V_B - V_{BE})}{(\beta + 1)R_E} \approx \frac{V_B - V_{BE}}{R_E} = \frac{V_E}{R_E}$$

1992-1993

101

10

100

100

12

1

20

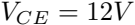
20

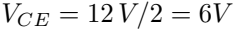




Vocals + Rhythm

$$10 = 10/10 + 1 = 11$$





10-11-2011



$$R_1 || R_2 = \frac{R_1 R_2}{R_1 + R_2} = 26.5 \, k\Omega$$





$$V_{CC} \frac{R_2}{R_1 + R_2} = 3.18 \text{ V}$$



VIBRA VIBRA VIBRA VIBRA VIBRA VIBRA VIBRA VIBRA VIBRA VIBRA

$$I_E = \frac{V_E}{R_E} = 2.48 \text{ mA}$$



V30-12-24B-704V

NOV 24 2 45 PM '91

$$V_B - V_{BE}$$

$$(\beta + 1)R_E + R_B$$



1990-1991







	$\beta = 50$	$\beta = 100$	$\beta = 200$
I_C (mA)	1.60	1.94	2.18
V_E (V)	1.63	1.96	2.19
V_C (V)	8.80	8.11	7.65
V_B (V)	2.33	2.66	2.89
V_{CE} (V)	7.17	6.15	5.46

123456789



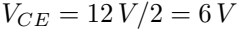
A pixelated, black and white graphic of the text "RIP 1000". The letters are rendered in a bold, blocky font with a dithered or pixelated texture. The "R" and "P" are on the left, followed by a space, then "1000" on the right. The overall style is reminiscent of early digital art or low-resolution computer graphics.



$$R_{Th} = R_B = R_1 || R_2 = 50 \text{ k}\Omega, \quad V_{Th} = V_B = V_{CC} \frac{R_2}{R_1 + R_2} = 6 \text{ V}$$

$$I_C = \beta I_B = \frac{\beta(V_B - V_{BE})}{(\beta + 1)R_E + R_B} = \frac{100 \times (6 - 0.7)}{101 \times 2 + 50} = \frac{530}{250} = 2.12$$

$$V_E = V_C - (I_C + I_E) R_E = 12 - 2.12 \times (2 + R_C)$$



THE WORLD IS A VILLAGE



I do I do I do I do I do I do

$$Vc = R(I_B + I_c) \quad V_B = R(I_B + I_c) \quad Vc = R(I_B + I_c) \quad V_B = R(I_B + I_c)$$

$$I_B = \frac{V_{CC} - 0.7}{(\beta + 1)R_C + R_B}, \quad I_C = \beta I_B = \frac{\beta(V_{CC} - 0.7)}{(\beta + 1)R_C + R_B}$$

Vocals + 1B 1B

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

W E

5

10x

123456789

2024



[illegible]

$$I_B = I_{c/A} = 0.02 \text{ m}^4, \quad I_B = (5 - 0.7) / 0.02 = 4.3 / 0.02 = 215 \text{ K}$$

$$I_C = \beta I_B, \quad V_{CE} = V_{CC} - I_C R_C = V_{CC} - \beta I_B R_C + 1 I_B R_C$$

	$\beta = 50$	$\beta = 100$	$\beta = 200$
I_B (mA)	0.027	0.02	0.013
I_C (mA)	1.36	2	2.6
V_C (V)	6.6	5	3.5

view = view, view = view, view = view

[illegible]

$$\begin{cases} v_1 = f_1(i_1, i_2) \\ v_2 = f_2(i_1, i_2) \end{cases}, \quad \begin{cases} i_1 = f_3(v_1, v_2) \\ i_2 = f_4(v_1, v_2) \end{cases}, \quad \begin{cases} v_1 = f_5(i_1, v_2) \\ i_2 = f_6(i_1, v_2) \end{cases}$$



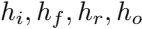


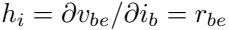




$$\begin{cases} v_{be} = v_{be}(i_b, v_{ce}) \\ i_c = i_c(i_b, v_{ce}) \end{cases}$$

$$dv_{be} = \frac{\partial v_{be}}{\partial i_b} di_b + \frac{\partial v_{be}}{\partial v_{ce}} dv_{ce} = h_i di_b + h_r dv_{ce} \quad di_c = \frac{\partial i_c}{\partial i_b} di_b + \frac{\partial i_c}{\partial v_{ce}} dv_{ce} = h_f di_b + h_o dv_{ce}$$







1997

—

2000

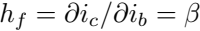
2001



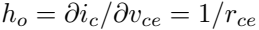






















$$v_{be} = \frac{\partial v_{be}}{\partial i_b} i_b + \frac{\partial v_{be}}{\partial v_{ce}} v_{ce} = h_i i_b + h_r v_{ce} \approx h_i i_b \quad i_c = \frac{\partial i_c}{\partial i_b} i_b + \frac{\partial i_c}{\partial v_{ce}} v_{ce} = h_f i_b + h_o v_{ce} \approx h_f i_b$$





A pixelated, grayscale image of the number 5, rendered in a blocky, digital style. The number is composed of various shades of gray and black pixels, giving it a textured, almost mosaic-like appearance. It is positioned on the right side of the image, with its top extending towards the right edge.

A pixelated, grayscale image of the letters 'L' and 'E'. The 'L' is on the left, and the 'E' is on the right. Both letters are rendered in a blocky, digital style with varying shades of gray and black pixels. The background is white.

The image displays two horizontal bar charts, one for 'How often do you use the Internet?' and one for 'How often do you use a mobile phone?'. Each chart has five bars representing different frequency categories: 'Never', 'Rarely', 'Sometimes', 'Often', and 'Always'. The bars are color-coded: light gray for 'Never', medium gray for 'Rarely', dark gray for 'Sometimes', black for 'Often', and white for 'Always'. The 'Always' category is only present in the 'How often do you use a mobile phone?' chart.

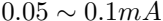
Frequency	How often do you use the Internet?	How often do you use a mobile phone?
Never	~10%	~10%
Rarely	~10%	~10%
Sometimes	~60%	~60%
Often	~15%	~15%
Always	0%	~5%

A pixelated, grayscale image of the letters 'E', 'I', and 'B' arranged horizontally. The letters are rendered in a blocky, digital style with varying shades of gray and black pixels. The 'E' is on the left, the 'I' is in the center, and the 'B' is on the right. The image has a low-resolution, dithered appearance.



$$h_i = r_{be} \approx \eta \frac{V_T}{I_B}$$

W E 20 17











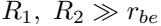


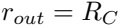






$$r_{in} = R_1 || R_2 || r_{be} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{r_{be}} \right)^{-1} = \frac{R_1 R_2 r_{be}}{R_1 R_2 + R_1 r_{be} + R_2 r_{be}} \approx r_{be}$$







$$v_b \approx v_{in} \frac{r_{be}}{r_{be} + R_s}, \quad i_b = \frac{v_b}{r_{be}} \approx \frac{v_{in}}{r_{be} + R_s}$$



$$v_{out} = v_c \approx -i_c (R_C || R_L) = -\beta i_b (R_C || R_L) = -\beta \frac{v_{in}}{r_{be} + R_s} (R_C || R_L)$$



$$A = \frac{v_{out}}{v_{in}} = \frac{v_c}{v_{in}} \approx -\beta \frac{R_C || R_L}{r_{be} + R_s}$$

$B_0 \in B_1 \mid B_2 \mid B_3 \mid B_4 \mid B_5$

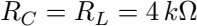
$$A = \frac{v_{out}}{v_{in}} \approx -\beta \frac{R_C}{r_{be}}$$







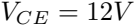
THE WORLD IS A VILLAGE





$$I_B = \frac{V_{CC} - V_{BE}}{R_B} \approx \frac{V_{CC}}{R_B} = \frac{12}{300 \times 10^3} = 40 \times 10^{-6} \text{ A} = 40 \mu\text{A}$$





A pixelated, grayscale representation of the word "EQU". The letters are composed of various shades of gray and black pixels, giving it a retro, digital appearance. The "E" is formed by a vertical bar and three horizontal bars. The "Q" is a circle with a short tail. The "U" is a simple U-shape. The overall style is reminiscent of early computer graphics or video game sprites.

$$I_C = \frac{V_{CC}}{R_C} = \frac{12\text{ V}}{4 \times 10^3 \Omega} = 3 \times 10^{-3} \text{ A} = 3 \text{ mA}$$

$$I_c = 10 \text{ A} \quad I_B = 10 \times 10^{-4} \text{ A} = 1.0 \text{ mA} \quad V_{CE} = 12 \text{ V} \quad V_{CE} = 1.0 \text{ V}$$

BRIDGES

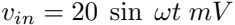
1992

==

1992

$$V_{ACO} - 6 = \frac{1.5}{2} \Rightarrow V_{ACO} = 8.8V$$

$$\frac{I_{ACO} - 1.5}{6} = \frac{1}{2} \Rightarrow I_{ACO} = 4.4 \text{ mA}$$



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we've been + 0.6 + 0.02 sid we've

$\psi(t) = IB + 20 \sin \omega t$

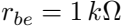


$$r_{be} = \frac{\Delta v_{be}}{\Delta i_b} = \frac{20 \text{ mV}}{20 \text{ }\mu\text{A}} = 1 \text{ k}\Omega$$

$$i_2(t) = \beta i_1(t) = 10 \times (10 + 20 \sin \omega t) \mu A = (1.6 + 0.8 \sin \omega t) mA$$

$$v_c(t) = V_{AC} - R_L i_c(t) = 8.8 - 2 \times (1.6 + 0.8 \sin \omega t) = (5.6 - 1.6 \sin \omega t) V = v_{av}(t)$$

$$A_v = \frac{|v_{out}|}{|v_{in}|} = \frac{1.6}{0.02} = 80$$



VBC VB AB

912-402-4024

V30-12-10x4-B0V

www.bec = 100

$$A_v = \frac{v_c}{v_{in}} = \frac{\beta i_b (R_C || R_L)}{r_{be} i_b} = \frac{\beta (R_C || R_L)}{r_{be}} = \frac{(40 \times 2) k\Omega}{1 k\Omega} = 80$$

an AB -free AD







$$\frac{v_c - v_s}{R_B} + \beta i_b + \frac{v_c}{R_C} = \frac{v_c - v_s}{R_B} + \beta \frac{v_s}{r_{be}} + \frac{v_c}{R_C} = 0$$

$$v_c \left(\frac{1}{R_B} + \frac{1}{R_C} \right) = v_s \left(\frac{1}{R_B} - \beta \frac{1}{r_{be}} \right)$$



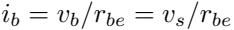
$$\frac{v_{out}}{v_{in}} = \frac{v_c}{v_s} = \frac{1/R_B - \beta/r_{be}}{1/R_B + 1/R_C} = \frac{R_C(r_{be} - \beta R_B)}{(R_B + R_C)r_{be}} \approx -\beta \frac{R_C R_B}{(R_B + R_C)r_{be}}$$

$$-\beta \frac{R_B || R_C}{r_{be}} = -\beta \frac{R_C}{r_{be}} \frac{R_B}{R_B + R_C} \xrightarrow{R_B \rightarrow \infty} -\beta \frac{R_C}{r_{be}}$$













$$v_i = \frac{v_b - (-R_c \beta i_b)}{R_B + R_c} = \frac{v_b + R_c \beta v_b / r_{be}}{R_B + R_c} = v_b \frac{1 + R_c \beta / r_{be}}{R_B + R_c} \approx v_b \frac{\beta R_c / r_{be}}{R_B + R_c}$$

$$r_{in} = \frac{v_b}{i} = \frac{R_B + R_C}{\beta R_C / r_{be}} = \frac{R_B + R_C}{\beta R_C} r_{be}$$

$$r_{in} = r_{be} \parallel r'_{in} = r_{be} \frac{1}{1 + \beta R_c / (R_B + R_c)} = r_{be} \frac{R_B + R_c}{R_B + (\beta + 1) R_c} = \begin{cases} r_{be} & R_B \rightarrow \infty \\ r_{be} / \beta & R_B \rightarrow 0 \end{cases}$$

$$v_{oc} = A v_b = -\beta \frac{R_c}{r_{be} (1 + R_c / R_B)} v_b$$



12-20-2020

$$i_{sc} = i' + i'' = v_b \left(\frac{1}{R_B} + \frac{\beta}{r_{be}} \right)$$



$$\frac{v_{oc}}{i_{sc}} = \frac{-\beta \frac{R_c}{r_{be}} \frac{1}{1+R_c/R_B}}{1/R_B - \beta/r_{be}} = \frac{-\beta \frac{R_c}{r_{be}} \frac{1}{1+R_c/R_B}}{\frac{r_{be} - \beta R_B}{R_B r_{be}}}$$

$$\begin{aligned}
 & \frac{-\beta \frac{R_c}{r_{be}} \frac{R_B}{R_B + R_c}}{\frac{-\beta R_B}{R_B r_{be}}} = \frac{R_c R_B}{R_c + R_B} = R_c || R_B \xrightarrow{R_B \rightarrow \infty} R_c
 \end{aligned}$$

$$V_{CC} - V_{BE} = I_B R_B + (\beta + 1) I_B R_E, \quad I_B = \frac{V_{CC} - V_{BE}}{R_B + (\beta + 1) R_E}$$

$$I_C = \beta I_B = \beta \frac{V_{CC} - V_{BE}}{R_B + (\beta + 1)R_E}, \quad V_{CE} \approx V_{CC} - I_C(R_C + R_E)$$

VC=12V, AB=0.1V, AB=100

1990

1990

1990

1990

1990

1990

1990

$$I_E = \frac{V_{CC} - V_{CE}}{R_C + R_E} = \frac{6}{0.1 + 1.9} = 3 \text{ mA}, \quad I_B = \frac{I_C}{\beta} = 0.03 \text{ mA}$$

$$R_B + (\beta + 1)R_E = \frac{V_{CC} - V_{BE}}{I_B} = \frac{12 - 0.7}{0.03} = 377 \text{ k}\Omega$$

APR 27 - 100X.1500

THESE ARE THE

$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta R_E} = \frac{12 - 0.7}{250 + 100 \times 0.1} = \frac{11.3}{260} = 0.044$$

$$\frac{V_{CC} - V_{CE}}{R_C + R_E} = \frac{6}{0.1 + R_C} = I_C = \beta I_B = 4.4 \text{ mA}$$

1234567890

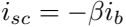
$$i_b + \beta i_b = (\beta + 1) i_b = \frac{v_e}{R_E} = \frac{v_{in} - r_{be} i_b}{R_E}$$

$$v_b = \frac{v_{in}}{r_{be} + (\beta + 1)R_E}$$

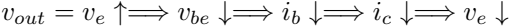
$$r_{in} = \frac{v_{in}}{i_{in}} = \frac{v_{in}}{i_b} = r_{be} + (\beta + 1)R_E \approx \beta R_E$$

$$A = \frac{v_{out}}{v_{in}} = \frac{\beta i_b (R_C || R_L)}{v_{in}} = \frac{\beta (R_C || R_L)}{r_{be} + (\beta + 1) R_E} \frac{v_{in}}{v_{in}} = \frac{\beta R_C || R_L}{r_{be} + (\beta + 1) R_E} \approx \frac{R_C || R_L}{R_E}$$

WORLDWIDE



$$r_{out} = \frac{v_{oc}}{i_{sc}} = R_C$$



$VcB + VB + VB(B+1)B$

$$I_B = \frac{V_{CC} - V_{BE}}{(\beta + 1)R_E + R_B}$$

$$I_E = (\beta + 1) I_B = \frac{(\beta + 1)(V_{CC} - V_{BE})}{(\beta + 1)R_E + R_B}$$



100%

1000

1000

1000

Vb = 10 - Vb = 5



$$V_E = I_E R_E = R_E \frac{(\beta + 1)(V_{CC} - V_{BE})}{(\beta + 1)R_E + R_B} = \frac{101 R_E (10 - 0.7)}{101 R_E + 100} = 5 \text{ V}$$

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$$I_B = \frac{V_{CC} - V_{BE}}{(\beta + 1)R_E + R_B} = 0.043 \text{ mA}, \quad I_C = \beta I_B = 100 I_B = 4.3 \text{ mA}$$

VB=1 VB=1.34 mA, VB=1 VB=1 VB=5 V





$$\begin{cases} v_{out} = v_e = (R_E || R_L) i_e = (R_E || R_L) (i_c + i_b) = (R_E || R_L) (\beta + 1) i_b \\ v_{in} = (R_s + r_{be}) i_b + v_{out} = (R_s + r_{be}) i_b + (R_E || R_L) (\beta + 1) i_b \end{cases}$$

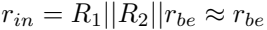
$$A = \frac{v_{out}}{v_{in}} = \frac{(\beta + 1)(R_E || R_L)}{(R_s + r_{be}) + (\beta + 1)(R_E || R_L)} \approx 1$$

[illegible]

$$v_b = i_b v_{be} + v_{ov} = i_b [v_{be} + v_{ov} + 1] R_E / R_E$$

$$r'_{in} = \frac{v_b}{v_b} = r_{be} + (\beta + 1)(R_E || R_L) \approx r_{be} + \beta(R_E || R_L) \approx \beta(R_E || R_L)$$

an = RB an = RB an = RB







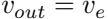




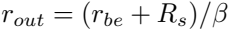
$$i_{sc} = i_e = (\beta + 1)i_b = (\beta + 1) \frac{v_{in}}{r_{be} + R_s} \approx \beta \frac{v_{in}}{r_{be} + R_s}$$

$$r_{out} = \frac{v_{oc}}{i_{sc}} \approx \frac{r_{be} + R_s}{\beta}$$

$$r_{out} = R_E || r'_{out} = R_E || \left(\frac{r_{be} + R_s}{\beta} \right) \approx \frac{r_{be} + R_s}{\beta}$$



W E R E I N









Forwards



1994





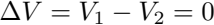


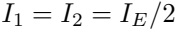


















Vibrant Vibrations



11/11/2024



0 1 2 3 4 5 6 7 8









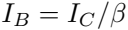




$$I_{ref} = \frac{V_{cc} - V_B}{R_C}$$







$$V_B = V_T \ln \left(\frac{I_B}{I_0} + 1 \right) \approx V_T \ln \left(\frac{I_B}{I_0} \right)$$



$$V_B \uparrow \Rightarrow I_B \uparrow \Rightarrow V_{CE} \uparrow \Rightarrow I_C \uparrow \Rightarrow V_{CE} \uparrow$$



1012 = 1012





1992

1992

1992

1992

1992



[illegible]

$$I_L = I_C = I_{ref} / (1 + 2/\beta) \approx I_{ref} = \frac{V_{CC} - V_B}{R_C}$$





$$(I_1 \rightarrow I_2) \rightarrow (I_2 \rightarrow I_3) \rightarrow (I_1 \rightarrow I_3)$$







10 = 1000







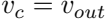


$$\sin \left(\sqrt{1 + \frac{1}{x^2}} \right) + \sin \left(\sqrt{1 + \frac{1}{x^2}} \right)$$





$$w_0 = 1/\sqrt{10^2 + 2}$$

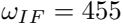


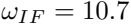
$$v_{\text{feedback}} = v_c \frac{Z_{L_1}}{Z_{L_1} + Z_{L_2}} = v_c \frac{L_1}{L_1 + L_2}, \quad v_{\text{feedback}} = v_c \frac{Z_{C_2}}{Z_{C_2} + Z_{C_3}} = v_c \frac{C_3}{C_2 + C_3}$$

ve ↑ ve ↓ ve ↑ ve ↓ ve ↑ ve ↑









$$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!},$$

$$e^x - 1 = x + \frac{1}{2}x^2 + \frac{1}{3!}x^3 + \cdots \approx x + \frac{1}{2}x^2$$

we = code + code





$$(\cos \omega_1 t + \cos \omega_2 t) + \frac{1}{2}(\cos \omega_1 t + \cos \omega_2 t)^2 + \dots$$

$$\cos \omega_1 t + \cos \omega_2 t + \frac{1}{2} (\cos^2 \omega_1 t + 2 \cos \omega_1 t \cos \omega_2 t + \cos^2 \omega_2 t)$$

$$\cos \omega_1 t + \cos \omega_2 t + \frac{1}{4}(1 + \cos(2\omega_1 t)) + \frac{1}{2} \cos(\omega_1 + \omega_2)t + \frac{1}{2} \cos(\omega_1 - \omega_2)t + \frac{1}{4}(1 + \cos(2\omega_2 t))$$

$$\cos^2 \alpha = \frac{1 + \cos 2\alpha}{2}, \quad \cos \alpha \cos \beta = \frac{\cos(\alpha + \beta) + \cos(\alpha - \beta)}{2}$$















WAVELENGTHS OF THE SPECTRA OF THE
SOLAR WIND

Google

1999







$$V_o = G(V_i + FV_o) = GV_i + GFV_o, \quad \frac{V_o}{V_i} = H = \frac{G}{1 - GF}, \quad V_o = HV_i = \frac{G}{1 - GF} V_i$$





QUESTION



$$\omega_0 = \frac{1}{\sqrt{LC}},$$

$$C_g = \left(\frac{1}{C_1} + \frac{1}{C_2} \right)^{-1}$$



A pixelated, black and white representation of the text "100% 100%". The characters are composed of a grid of black and white pixels, giving it a low-resolution, digital appearance. The first "100%" is on the left, followed by a space, then another "100%". The digits "0" and "1" are particularly stylized with thick, blocky strokes. The percentage signs are also pixelated, with the top bars being horizontal lines of black pixels. The overall style is reminiscent of early computer graphics or a low-quality scan of a printed document.

ve → ve ve → ve ve → ve





ve → *ve* → *ve* → *ve*



$$ve \rightarrow ve + \nu_e$$









$$\frac{V_t - V_i}{R} + \frac{V_t}{1/j\omega C_2} + \frac{V_t}{j\omega L + 1/j\omega C_1} = 0$$

$$V_t \left(\frac{1}{R} + j\omega C_2 + \frac{j\omega C_1}{1 - \omega^2 LC_1} \right) = \frac{V_s}{R}$$

$$V_t = \frac{1}{R(\frac{1}{R} + j\omega C_2 + \frac{j\omega C_1}{1 - \omega^2 LC_1})} V_i$$

$$V_i = \frac{1}{1 + j\omega R(C_2 + C_1/(1 - \omega^2 LC_1))} V_i$$

$$C_2 + \frac{C_1}{1 - \omega_0^2 LC_1} = 0,$$

$$\omega_0 = \frac{1}{\sqrt{LC_1C_2/(C_1+C_2)}} = \frac{1}{\sqrt{LC_s}}$$





WORLDWIDE

$$Z_{C_2} || (Z_{C_1} + Z_L) = \frac{Z_{C_2}(Z_{C_1} + Z_L)}{Z_{C_2} + Z_{C_1} + Z_L} = \frac{(1/j\omega C_1 + j\omega L)/j\omega C_2}{1/j\omega C_2 + 1/j\omega C_1 + j\omega L}$$

$$\frac{(1/j\omega C_1 + j\omega L)/C_2}{1/C_1 + 1/C_2 - \omega^2 L} = \frac{(1/j\omega C_1 + j\omega L)/C_2}{1/C_s - \omega^2 L} \xrightarrow{\omega=\omega_0} \infty$$





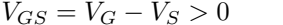
$$V_t = \frac{ZC_2}{ZC_1 + ZC_2} \quad V_o = \frac{C_1}{C_1 + C_2} V_o,$$

$$v_o = \frac{C_1 + C_2}{C_1} v_t = \frac{C_1 + C_2}{C_1} v_i$$

$$H = \frac{V_o}{V_i} = \frac{C_1 + C_2}{C_1}$$







VO

E

VO

E

VO

VO



$$\left\{ \begin{array}{l} V_{GS} \uparrow \Rightarrow I_D \uparrow \Rightarrow \text{conducting} \\ V_{GS} \downarrow \Rightarrow I_D \downarrow \Rightarrow \text{cut off} \end{array} \right.$$

$$I_D = \begin{cases} 0 & \text{if } V_{GS} < V_T \text{ (cutoff)} \\ K(V_{GS} - V_T)^2 & \text{if } V_{GS} \geq V_T \text{ (conducting)} \end{cases}$$



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THE SOUTH ALABAMA

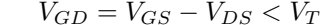




WEDNESDAY







VERGEGEN





WAVE IN

W E W E E

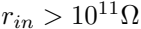
W E I V I

1234567890













$$\begin{cases} I_D = K(V_{in} - V_T)^2 \\ V_{out} = V_{DS} = V_{dd} - I_D R = V_{dd} - KR(V_{in} - V_T)^2 \end{cases}$$



$V_B = V_{out} = V_{in} - V_{in}^2$



$$V_{in} - V_T < \frac{-1 + \sqrt{1 + 4KR V_{dd}}}{2KR},$$

$$V_{in} \left(\frac{-1 + \sqrt{1 + 4KR V_{dd}}}{2KR} \right) + V_T$$



$$V_T < V_{in} < \frac{-1 + \sqrt{1 + 4KR V_{dd}}}{2KR} + V_T$$

$$0 < v_{in} - v_T < \frac{-1 + \sqrt{1 + 4KRv_{dd}}}{2KR}$$

$$g = \frac{dV_{out}}{dV_{in}} = \frac{d}{dV_{in}} (V_{dd} - KR(V_{in} - V_T)^2) = -2KR(V_{in} - V_T)$$





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$$V_n \leq \sqrt{1 + n R d} / 2 n R + V \approx 2.32 V$$

$$V_{out} = V_{dd} - R(V_{in} - V_{th})^2$$

$$g(V_{in}) = \frac{d}{dV_{in}} V_{out}(V_{in}) = -10(V_{in} - 1)$$









$$2\pi \int_0^{\infty} \frac{1}{100} \frac{1}{100} = 2\pi$$









2021-10-21

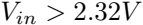
WAVE 2024





Worship











A pixelated, black and white representation of the word "winning". The letters are thick and blocky, with a jagged, pixelated outline. The word is written in a slightly slanted, upward-trending manner. The background is white, and the letters are composed of black and gray pixels, giving it a retro, digital appearance.



Wiederwied = *Wieder* + *Wied*

1995



$$v_{out} = V_{dd} - R_{ID} = V_{dd} - R_{IN}(V_{in} - V_T)^2 = 5 - 10(V_{in} - 1)^2$$

100% 100% 100%





2021

025m A
025m A

$$V_{bias} = V_{dd} \frac{R_1}{R_1 + R_2}$$

11

11

11

12

12

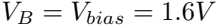
12

19

—

2019

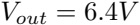
DESIGNATION





$$V_a = V_d R (V_g - V_d)^2 = V_d R (V_B - V_d)^2 = 10 - 10 \times (0.6 - V_d)^2$$







VERBODEN TOEGANG



100%

100%

100%

$$V_{DS} = V_{ov} - V_{in} = (V_{dd} - R_D I_D) - V_{in} = V_{dd} - R_D I (V_B - V_{in} - V_T)^2 - V_{in} \geq V_B - V_{in} - V_T$$

$$V_{out} = V_{in} - R_{VB} - V_{in}^2 - V_{in} - V_{in}$$

$$\ln 10 \approx 2.3026 \approx \ln 2$$

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A pixelated, black and white graphic of the text "LOVE" repeated twice, with a heart symbol in the middle. The text is rendered in a stylized, blocky font with a dithered effect. The entire graphic is set against a white background.

A pixelated, grayscale image of a stylized letter 'T'. The letter is composed of a thick horizontal bar at the top and a vertical stem extending downwards. The image is rendered in a low-resolution, blocky style using various shades of gray and black on a white background. The horizontal bar is solid black, while the vertical stem is composed of a series of gray pixels of varying intensity, creating a textured, almost 3D effect. The overall shape is a simple, bold 'T' that tapers slightly towards the bottom.

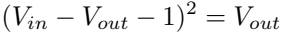
10

10

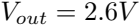
10

1234567890

$$ID = K(Vcs - Vd)^2 = K(Vm - Vd)^2 = Vm / R_s$$



100% 125% 150% 200%



Vogelwiese



100% 200%



$$g = \frac{\Delta V_{out}}{\Delta V_{in}} = \frac{1 - 0.4}{3 - 2} = 0.6 < 1$$

A pixelated, grayscale image of the text "VGG-9" in a stylized, blocky font. The characters are composed of various shades of gray and black pixels, giving it a retro, digital appearance. The background is white.

A pixelated, grayscale image of the text "VDS". The characters are rendered in a blocky, digital font style. The 'V' is on the left, followed by the 'D', then the 'S', and finally a vertical bar or 'I' shape on the far right. The image has a low-resolution, dithered appearance with various shades of gray and black pixels.

$$g_m = \frac{\Delta I_D}{\Delta V_{GS}}$$









19

20

21



vee

ee

vee



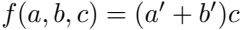




1234567







$$f(a,b,c) = [a + b]c = (a + b)c = ac + bc$$

$f(v_1, v_2) = v_1 v_2$



$\nabla_{\mathbf{v}_1}$

$\nabla_{\mathbf{v}_2}$

$=$

$\nabla_{\mathbf{v}_1}$

$+$

$\nabla_{\mathbf{v}_2}$

$V_{out} = V_1 + V_2$

$$\frac{d}{dt} \left(\frac{1}{2} m v^2 \right) = \frac{d}{dt} \left(\frac{1}{2} m \frac{dx}{dt} \frac{dx}{dt} \right)$$



11

+

12

13

14

15

16

		AND	OR	NAND	NOR
V_1	V_2	$V_1 V_2$	$V_1 + V_2$	$(V_1 V_2)'$	$(V_1 + V_2)'$
0	0	0	0	1	1
0	1	0	1	1	0
1	0	0	1	1	0
1	1	1	1	0	0

for the world's