

Electronics II Formula Sheet by Mark W.

- Over drive Voltage: $V_{OV} = (V_{GS} - V_t)$ • $k'_n = \mu_n C_{ox} (A/V^2)$
- Cut off ($i_D = 0$): $v_{GS} < V_{th}$; • Channel induced and Mosfet is in triode or saturation: $v_{GS} = v_{DS} + V_{OV}$

Stats	Triode region	Saturation Region
Conditions	$v_{GS} > V_t$ $v_{DS} < v_{GS}$	$v_{GS} \leq V_t$ $v_{DS} \geq v_{GS}$
i_D	$\frac{1}{2} k'_n \frac{W}{L} (v_{OV} - \frac{1}{2} v_{DS}) v_{DS}$	$\frac{1}{2} k'_n \frac{W}{L} v_{OV}^2$

- $g_m = \frac{\partial i_D}{\partial v_{GS}} = k'_n \frac{W}{L} v_{OV} = g_m = \sqrt{2K'_n i_D} \sqrt{\left(\frac{v_{GS}}{V_t}\right)} = \frac{2i_D}{v_{OV}} (4.6, 2.6)$, • $V_A = \frac{1}{\lambda}$, • $r_o = \frac{V_A}{i_D}$, • $A_v = -g_m (R_D || r_o)$.

Characteristic Parameters

MOSFET	Voltage Gain, A_v	G_v	Input Resistance, R_i	Output Resistance, R_o
Common Source (Hybrid model)	$-g_m (R_D r_o R_L)$	$-\frac{R_C}{R_C + R_{sig}} g_m (R_D r_o R_L)$	∞	$R_D r_o$
Common Source with a source resistance (T-Model)	$\frac{-g_m (R_D R_L)}{1 + g_m R_s}$	$-\frac{R_C}{R_C + R_{sig}} \frac{g_m (R_D R_L)}{1 + g_m R_s}$	∞	R_D
Common Gate (T-Model)	$g_m (R_D R_L)$	$\frac{1}{1 + g_m R_{sig}} g_m (R_D R_L)$	$\frac{1}{g_m}$	R_D
Common Drain (T-Model)	$\frac{r_o R_L}{(r_o R_L) + \frac{1}{g_m}}$	$\frac{R_C}{R_C + R_{sig}} \frac{r_o R_L}{(r_o R_L) + \frac{1}{g_m}}$	∞	$\frac{1}{g_m}$

- $f_t = \frac{g_m}{2\pi(C_{gs} + C_{gd})}$ (Unity Gain Frequency) • $R_L' = R_D || r_o || R_L$ • $C_{eq} = C_{gs}(1 + g_m R_L)$ • $C_{in} = C_{gs} + C_{eq}$
- $f_{Hf} = \frac{1}{2\pi C_{in}(R_{sig} || R_C)}$ (Upper 3-dB freq.)

Differential and multi-stage amplifier

Let I be the total current in common mode voltage

- $v_{DS1} = v_{DS2} = V_{DD} - \frac{I}{2} R_D$, • $i_{D1} = i_{D2} = \frac{I}{2} = k'_n \frac{W}{L} v_{GS}^2$

The value of v_{GS} at which the entire bias current I is steered into Q1 is $v_{GSmax} = v_{GS1} + v_s = \sqrt{2} V_{OV}$

Output of differential pair taken single ended:

- Common-mode gain = $|A_{CM}| = \frac{R_D}{2R_{sig}}$, • Differential gain = $|A_d| = \frac{1}{2} g_m R_D$, • $CMMR = \left| \frac{A_d}{A_{CM}} \right| = g_m R_{sig}$

Output of differential pair taken differentially:

- Common-mode gain = $|A_{CM}| = 0$, • Differential gain = $|A_d| = g_m R_D$, • $CMMR = \left| \frac{A_d}{A_{CM}} \right| = \infty$

Mismatch effect (g_m and R_D):

- $A_{CM} = -\frac{\Delta R_D}{2R_{sig}}$ (Rd mismatch), • $CMMR = \left| \frac{A_d}{A_{CM}} \right| = 2g_m R_{sig} / \left(\frac{\Delta R_D}{R_D}\right)$, • $A_{CM} = \frac{R_D}{2R_{sig}} \frac{\Delta g_m}{g_m}$ (g_m mismatch), • $CMMR = \left| \frac{A_d}{A_{CM}} \right| = 2g_m R_{sig} / \left(\frac{\Delta g_m}{g_m}\right)$

Electronics Engineering Formula For Gate Maschs

RD Boyd



Electronics Engineering Formula For Gate Maschs:

Electronic Engineering Dongxing Wang,2018-07-27 The 4th International Conference of Electronic Engineering and Information Science 2017 ICEEIS2017 was held January 7 8 2017 in Haikou P R China This conference was sponsored by the Harbin University of Science and Technology China The conference continued the tradition of gathering world class researchers engineers and educators engaged in the fields of electronic engineering and information science to meet and present their latest activities The proceedings contains contributions in the fields of Electronic Engineering Information Science and Information Technologies Computational Mathematics and Data Mining Mechatronics Control and Automation and Material Science and Technologies of Processing

Pocket Book of Electrical Engineering Formulas Richard C. Dorf,Ronald J. Tallarida,2018-04-27 Pocket Book of Electrical Engineering Formulas provides key formulas used in practically all areas of electrical engineering and applied mathematics This handy pocket sized guide has been organized by topic field to make finding information quick and easy The book features an extensive index and is an excellent quick reference for electrical engineers educators and students

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Midwest Technical Mathematics with Calculus Eleanor H. Ninestein,1992 *Frontiers in Algorithmics and Algorithmic Aspects in Information and Management* Jack Snoeyink,Pinyan Lu,Kaile Su,Lusheng Wang,2012-04-29 This book constitutes the refereed proceedings of the 6th International Frontiers of Algorithmics Workshop FAW 2012 and the 8th International Conference on Algorithmic Aspects in Information and Management AIM 2012 jointly held in Beijing China in May 2012 The 33 revised full papers presented together with 4 invited talks were carefully reviewed and selected from 81 submissions The papers are organized in topical sections on algorithms and data structures algorithmic game theory and incentive analysis biomedical imaging algorithms communication networks and optimization computational learning theory knowledge discovery and data mining experimental algorithmic methodologies optimization algorithms in economic and operations research pattern recognition algorithms and trustworthy algorithms and trustworthy software

The Military Engineer; Journal of the Society of American Military Engineers ,1928 *Scientific and Technical Aerospace Reports* ,1994 Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database

The Military Engineer ,1929 Directory of members constitution and by laws of the Society of American Military Engineers 1935 inserted in v 27

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Table of Contents Electronics Engineering Formula For Gate Maschs

1. Understanding the eBook Electronics Engineering Formula For Gate Maschs
 - The Rise of Digital Reading Electronics Engineering Formula For Gate Maschs
 - Advantages of eBooks Over Traditional Books
2. Identifying Electronics Engineering Formula For Gate Maschs
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Electronics Engineering Formula For Gate Maschs
 - User-Friendly Interface
4. Exploring eBook Recommendations from Electronics Engineering Formula For Gate Maschs

- Personalized Recommendations
 - Electronics Engineering Formula For Gate Maschs User Reviews and Ratings
 - Electronics Engineering Formula For Gate Maschs and Bestseller Lists
5. Accessing Electronics Engineering Formula For Gate Maschs Free and Paid eBooks
 - Electronics Engineering Formula For Gate Maschs Public Domain eBooks
 - Electronics Engineering Formula For Gate Maschs eBook Subscription Services
 - Electronics Engineering Formula For Gate Maschs Budget-Friendly Options
 6. Navigating Electronics Engineering Formula For Gate Maschs eBook Formats
 - ePub, PDF, MOBI, and More
 - Electronics Engineering Formula For Gate Maschs Compatibility with Devices
 - Electronics Engineering Formula For Gate Maschs Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Electronics Engineering Formula For Gate Maschs
 - Highlighting and Note-Taking Electronics Engineering Formula For Gate Maschs
 - Interactive Elements Electronics Engineering Formula For Gate Maschs
 8. Staying Engaged with Electronics Engineering Formula For Gate Maschs
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Electronics Engineering Formula For Gate Maschs
 9. Balancing eBooks and Physical Books Electronics Engineering Formula For Gate Maschs
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Electronics Engineering Formula For Gate Maschs
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Electronics Engineering Formula For Gate Maschs
 - Setting Reading Goals Electronics Engineering Formula For Gate Maschs
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Electronics Engineering Formula For Gate Maschs

- Fact-Checking eBook Content of Electronics Engineering Formula For Gate Maschs
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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