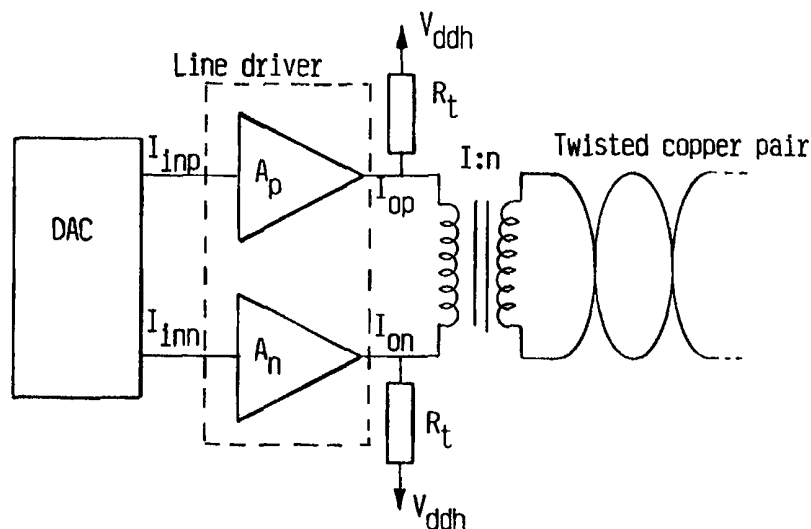




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| <p>(51) International Patent Classification⁶ : H04B 3/02, H04L 25/02</p> | <p>A3</p> | <p>(11) International Publication Number: WO 99/45656 (43) International Publication Date: 10 September 1999 (10.09.99)</p> |
| <p>(21) International Application Number: PCT/SE99/00299 (22) International Filing Date: 2 March 1999 (02.03.99) (30) Priority Data: 9800635-6 2 March 1998 (02.03.98) SE (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventors: NIANXIONG, Tan; Lomvägen 39 NB, S-192 56 Sollentuna (SE). ERLANDS, Johan; Skomakarevägen 6, S-582 36 Linköping (SE). WIKNER, Jacob; Rydsvägen 378 B, S-584 39 Linköping (SE). (74) Agents: GRENNBERG, B. et al.; Albihns Patentbyrå Stockholm AB, P.O. Box 5581, S-114 85 Stockholm (SE).</p> | <p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p> <p>(88) Date of publication of the international search report: 14 October 1999 (14.10.99)</p> | |

(54) Title: A DIFFERENTIAL LINE DRIVER



(57) Abstract

A fully differential line driver, especially for twisted copper pairs. It comprises two current amplifiers (A_p , A_n), made in standard CMOS technique, each having an input (I_{inp} , I_{inn}) and an output (I_{op} , I_{on}), which latter are connected via terminal resistors (R_t) to a voltage source, which may be set to a larger voltage than that used for driving the CMOS amplifiers. With this invention, a low output impedance can be combined with a large swing. Further, feedback is not necessary, avoiding problems like potential instability. A preferred embodiment also has a very low-impedance input, making it appropriate for connecting to a DAC, thus reducing distortion of its output signal. The invention is suitable for very-high-speed-digital-subscriber-line modems.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00299

| A. CLASSIFICATION OF SUBJECT MATTER | | |
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| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| A | US 5381112 A (MATHEW A. RYBICKI ET AL), 10 January 1995 (10.01.95), see whole document -- | 1-4 |
| A | US 5204880 A (STEFAN M. WURSTER ET AL), 20 April 1993 (20.04.93), figure 2, abstract -- | 1-4 |
| A | US 5418478 A (ROGER VAN BRUNT ET AL), 23 May 1995 (23.05.95), abstract -- ----- | 1-4 |
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|-------------------------|------------------|
| US 5381112 A | 10/01/95 | NONE | |
| US 5204880 A | 20/04/93 | NONE | |
| US 5418478 A | 23/05/95 | US 5694060 A | 02/12/97 |