H03F

AMPLIFIERS; (measuring, testing G01R; optical parametric amplifiers G02F; circuit arrangement with secondary emission tubes H01J43/30; masers, lasers H01S; control of amplification H03G; coupling arrangements independent of the nature of the amplifiers, voltage dividers H03H; amplifiers capable only of dealing with pulses H03K; repeater circuits in transmission lines H04B3/36, H04B3/58; application of speech amplifiers in telephonic communication H04M1/60, H04M3/40)

Definition statement

This subclass/group covers:

The subclass covers:

- Linear amplification, there being linear relationship between the amplitudes of input and output, and the output having substantially the same waveform as the input;
- Dielectric amplifiers, magnetic amplifiers, and parametric amplifiers when used as oscillators or frequency-changers;
- Constructions of active elements of dielectric amplifiers and parametric amplifiers if no provision exists elsewhere.

The user is otherwise referred to the IPC definitions for the individual main groups of H03F which follow hereinafter, although the following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups: H03F 1/44 covered by H03F 1/42 H03F 1/46 covered by H03F 1/42 H03F 3/18 covered by H03F 3/00 H03F 3/32 covered by H03F 3/30 H03F 7/06 covered by H03F 7/00

Provisions that are valid at a general level (e.g. of a kind appropriate to more than one of the main groups) are provided in the sections that follow.

The following list is intended to assist the user.

Relationship between large subject matter areas

The structural association with elements coupled with amplifiers can be classified either in H03F or in the subclass covering the element (or in both the subclasses), depending on which aspect is more relevant.

In particular H03F units represented as "black boxes" in a specific application (e.g. a servo loop control circuit for a motor) are in general not classified in H03F, unless a specific technical effect which is relevant for H03F is achieved (e.g. linearity of amplification).

Components covered by specific subclasses (e.g. resistors, inductors, transmission lines, etc.):

- if relevant for their structural association with the amplifier are classified in H03F;

- if relevant only per se are not classified in H03F, but in the specific subclass.

References relevant to classification in this subclass

This subclass/group does not cover:

Biomedical instrumentation amplifiers	A61B 5/04
Measuring, testing	G01R
Optical parametric amplifiers	G02F
Circuit arrangements with secondary emission tubes	H01J 43/30
Masers, lasers	H01S
Amplifiers capable only of dealing with pulses, electronic switches, comparators, logic circuits, PWM signals	H03K
Application of speech amplifiers in telephonic communication	H04M 1/60 H04M 3/40
Repeater circuits in transmission lines	H04B 3/36 H04B 3/58
Circuits for transducers, public address systems	H04R 3/00, H04R 27/00
Sense amplifiers	G11C 7/06
Analog calculators	G06G 7/12
Variable transformers	H01F 29/14
Digital transmitters	H04L 27/04
Optical transmitters	H04B 10/00
Digital receivers	H04L 27/06

Baseband systems	H04L 25/00
Aerials	H01Q
Sound producing devices	G10K
Transference of modulation from one carrier to another	H03D 7/00
Analog transmitter circuits	H04B 1/04
Analog receiver circuits	H04B 1/16
Optical receivers	H04B 10/158
Television systems with video amplifiers, IF amplifiers	H04N 5/148, H04N 9/647
Musical instrument amplifiers (case of linear amplification)	G10H
Frequency-division multiplex system	H04J 1/00,H04J 1/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of amplification	H03G
Semiconductors or other solid state devices	H01L
Waveguides, resonators	H01P
Coupling arrangements independent of the nature of the amplifiers, voltage dividers, attenuators	H03H
A/D and D/A converters, sigma delta modulators	H03M
Modulation	H03C
Demodulation	H03D

Generation of oscillations	H03B
Control of generators of electronic oscillations or pulses, e.g. phase locked loops	H03L
AC/DC, DC/DC, AC/AC power converters	H02M
Nanotube transistors	H01L 51/00
Emergency protection circuit arrangements	H02H

Special rules of classification within this subclass

As general remark, it must be noted that multiple classification symbols may be given. The philosophy is to classify documents in several sub-groups as the case may be, i.e. the classifier should not stop the classification task once that the first suitable EC symbol is found, but he should continue to assign EC symbols until all the aspects have been properly classified.

The subclass has a very large number of related technical areas, e.g.:

- "application" fields such as transmitters, receivers, voltage regulators, multimedia devices, etc.

Indexing Code orthogonal classification

In addition to one or more classification symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to orthogonal classification (H03F 2200/03 - H03F 2200/555), i.e. covering aspects which are spanning over one or more groups, should be allocated for the following ranges:

H03F 1/00 - H03F 1/565

H03F 3/181 - H03F 3/213

H03F 3/24 - H03F 3/72

Vacuum tube amplifiers classification

The following IPC groups, which are mostly related to discharge tube amplifiers or general type amplifiers, are used to classify circuit topologies based also on vacuum tubes, valve amplifiers, due to historical reasons (see vacuum tube amplifier in the "Glossary of terms" section below):

H03F 1/04-H03F 1/07

H03F 1/13

H03F 1/16

H03F 1/20

H03F 1/24

H03F 1/28

H03F 1/33

H03F 1/36

H03F 1/40

H03F 1/50

H03F 1/54

H03F 3/02

H03F 3/181

H03F 3/189

H03F 3/22

H03F 3/28

H03F 3/36

H03F 3/40

H03F 3/44

H03F 3/48

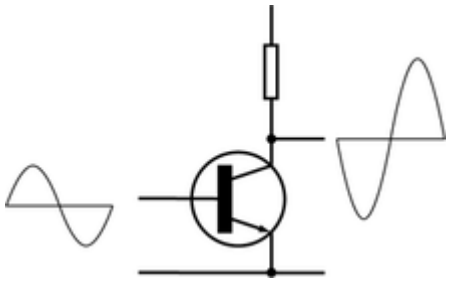
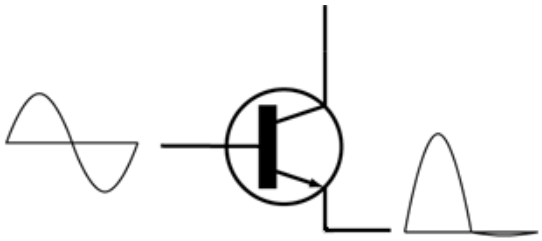
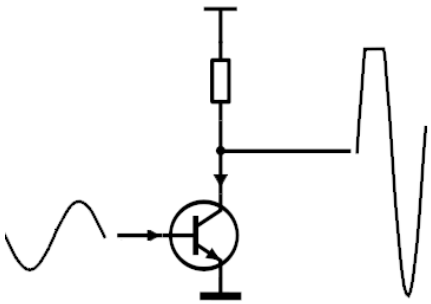
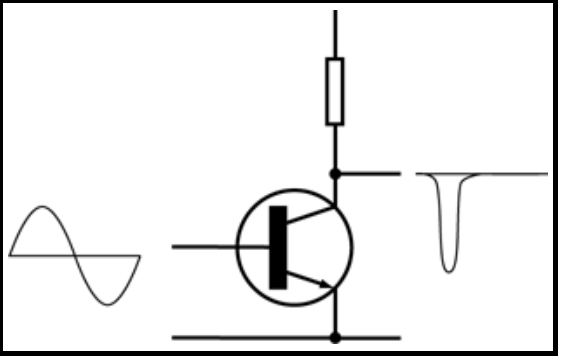
H03F 3/52

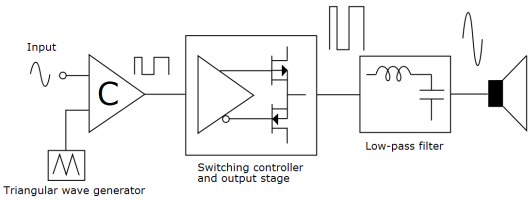
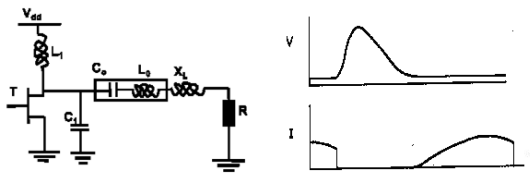
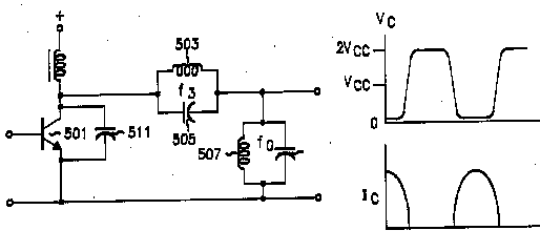
H03F 3/64

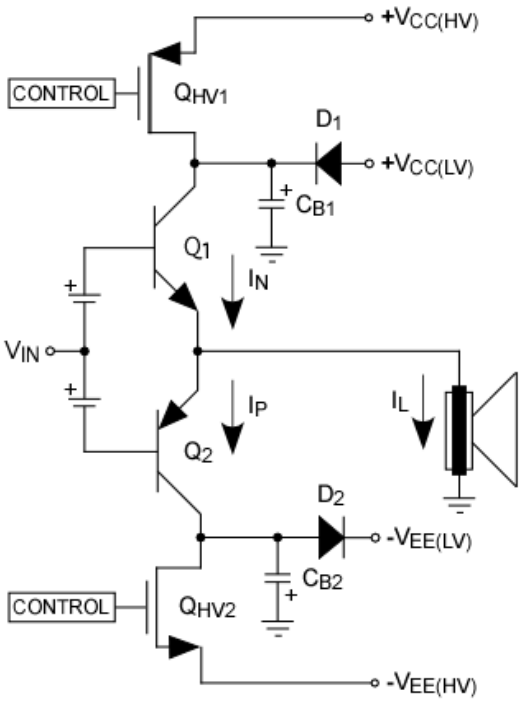
Glossary of terms

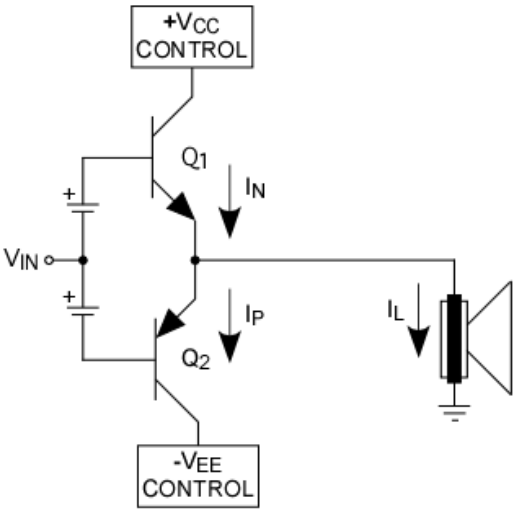
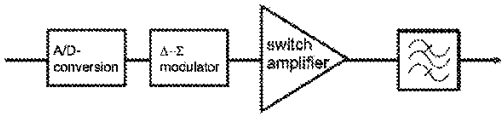
In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

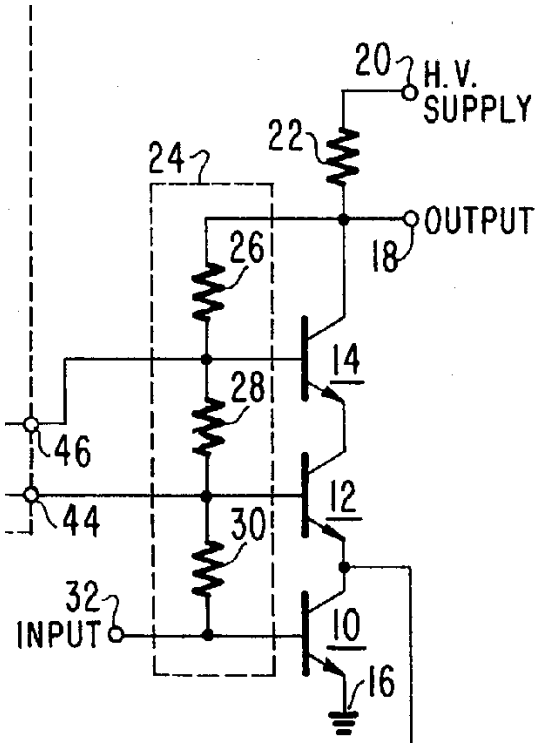
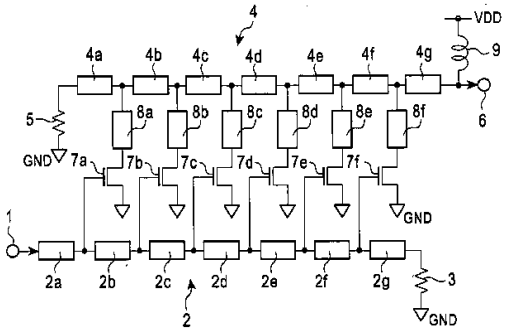
Class A	

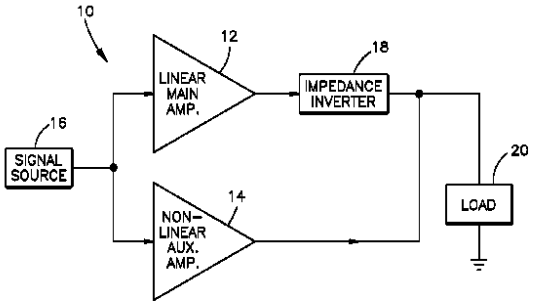
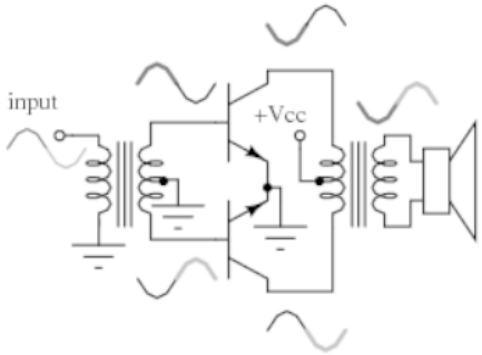
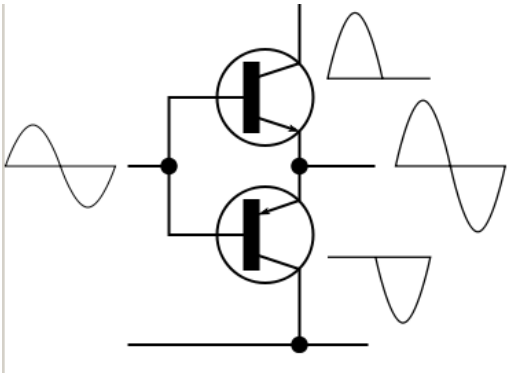
	 Amplifying devices operating in class A conduct in their linear range over the whole of the input cycle.
Class B	 Amplifying devices operating in class B conduct in their linear range half of the time and are turned off for the other half
Class AB	 Amplifying devices operating in class AB conduct in their linear range for more than half of the time
Class C	

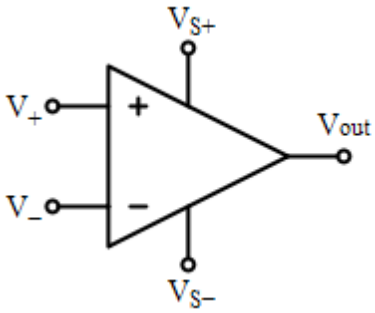
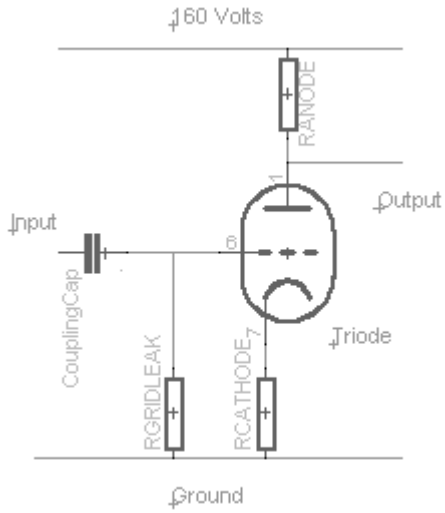
	Amplifying devices operating in class C conduct in their linear range for less than half of the time
Class D	 In the basic class-D amplifier the input signal is converted into a sequence of pulse width modulated (PWM) pulses via a comparator (C). Said PWM sequence is amplified via switching amplifying devices and filtered in order to produce an amplified replica of said input signal at the output.
Class E	 The basic topology of class-E amplifier includes a transistor T, operated as a switch, a shunt capacitor (C1) which includes the intrinsic transistor output capacitance, RF choke inductor (L1), a load resistor R, a series resonance circuit (Co, Lo), and an excess inductance XL. The reactive elements shape the current and voltage waveforms across the transistor as shown. Thus as current flows, there is essentially no voltage across the device and a highly efficient switching power amplifier is achieved.
Class F	 In realizing a class F amplifier, the

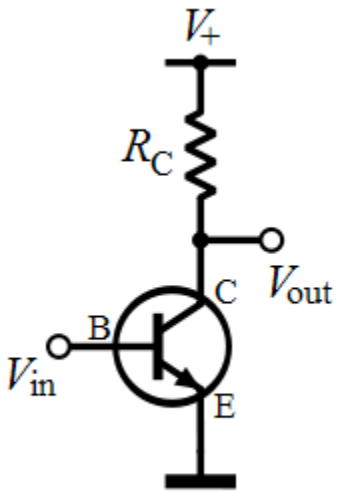
	active device operates primarily as a switch and the output network, generally, is designed to yield short circuit impedances at even harmonics of the fundamental frequency and to yield open circuit impedances at odd harmonics of the fundamental frequency. (drawing extracted from US4717884)
Class G	 The Class G amplifiers (which use "rail switching" to decrease power consumption and increase efficiency) provide several power rails at different voltages (HV, LV) and switch between them as the signal output approaches each level. Thus, the amplifier increases efficiency by reducing the wasted power at the output transistors.
Class H	

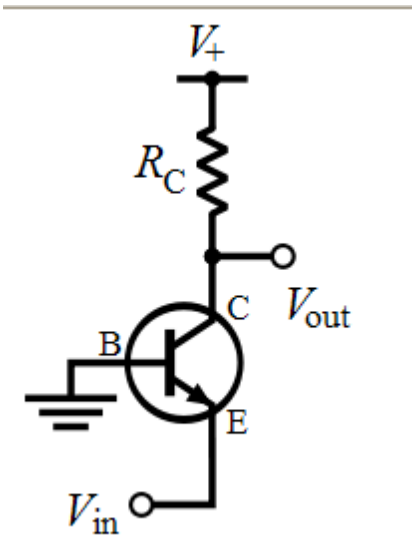
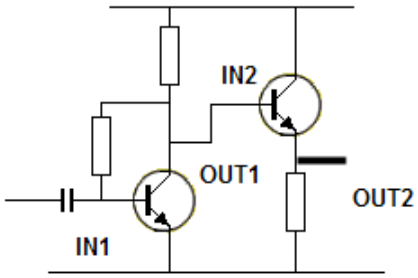
	 Class-H amplifiers take the idea of class G one step further creating an infinitely variable supply rail. This is done by modulating the supply rails (VCC, VEE) so that the rails are only a few volts larger than the output signal at any given time. The output stage operates at its maximum efficiency all the time. Switched-mode power supplies can be used to create the tracking rails.
Class S	 Class S amplifiers are used essentially for RF transmitters or as tracking power supply building blocks. The basic architecture consists of a modulator, e.g., of delta-sigma type, a fast broadband switch-mode amplifier, and an advanced filter at the output. The big advantage of the concept is that it can potentially be driven with a digital input without A/D conversion at the input.
Totem pole	

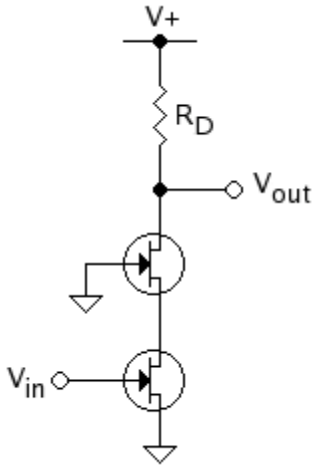
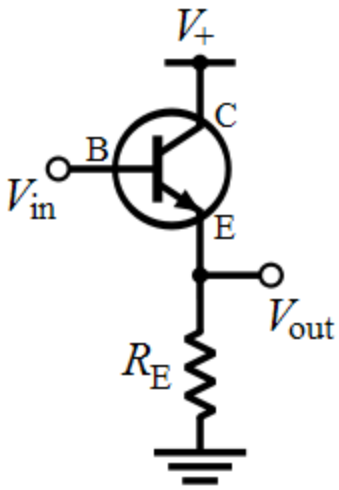
	 Amplifier with two or more amplifying elements having their DC paths in series with the load, the control electrode of each element being excited by at least part of the input signal (drawing extracted from US3986132).
Distributed amplifier	 The input/output terminals of the amplifying elements are connected in series through respective distributed elements. (drawing extracted from US2005285680)
Doherty Amplifier	

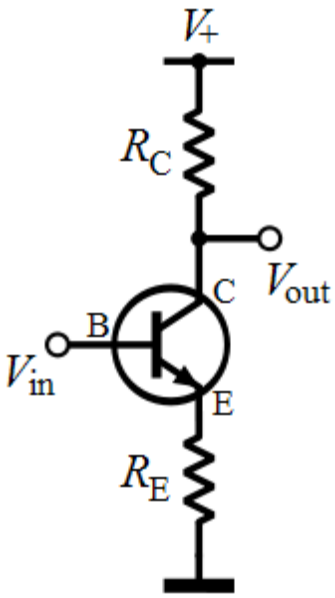
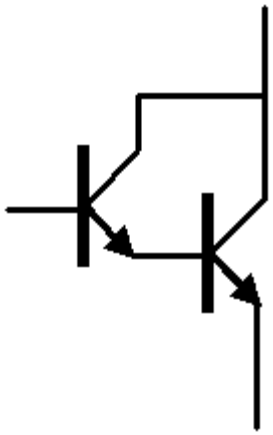
	 Amplifier using a main and one or several auxiliary peaking amplifiers wherein the load is connected to the main amplifier using an impedance inverter. (drawing extracted from WO2011097114)
Push Pull	 The amplifying devices are each used for amplifying the opposite halves of the input signal.
Single Ended Push Pull	 Push pull amplifier wherein the output terminals of the amplifying elements are tied together as a single ended output without additional balun elements.

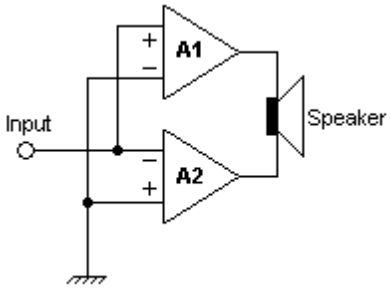
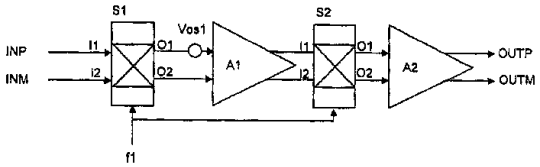
Differential amplifier	 the basic differential amplifier amplifies the difference between two voltages; the output voltage is determined according to the following equation: $V_{\text{out}} = A_{\text{d}}(V_{\text{in}}^{+} - V_{\text{in}}^{-}) + A_{\text{c}}\left(\frac{V_{\text{in}}^{+} + V_{\text{in}}^{-}}{2}\right)$ wherein Ac is the common mode gain and Ad is the differential mode gain.
Common mode rejection ratio	the common-mode rejection ratio (CMRR) indicates the ability of the amplifier to accurately cancel voltages that are common to both inputs. The common-mode rejection ratio is defined as: $\text{CMRR} = 10\log_{10}\left(\frac{A_{\text{d}}}{A_{\text{cm}}}\right)^2 = 20\log_{10}\left(\frac{A_{\text{d}}}{\lvert A_{\text{cm}}\rvert}\right)$
Vacuum tube amplifier	 Until the invention of the transistor in 1947, all practical amplifiers were made using Vacuum tubes, which rely on thermionic emission of electrons

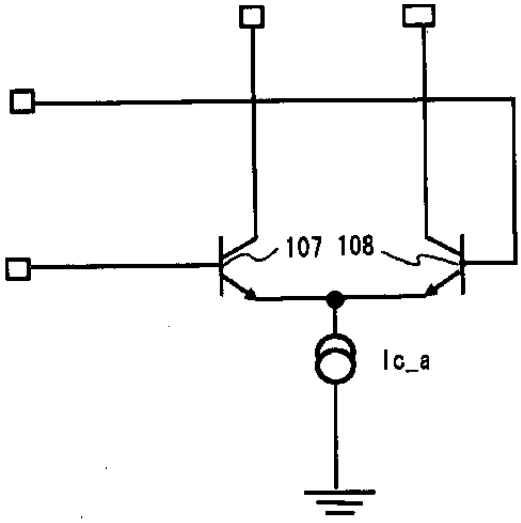
	from a hot filament (cathode), that then travel through a vacuum toward a collecting electrode (anode). The simplest vacuum tube was invented by John Ambrose Fleming while working for the Marconi Company in London in 1904 and named the diode, as it had two electrodes. The diode conducted electricity in one direction only and was used as a radio detector and a rectifier. In 1906 Lee De Forest added a third electrode (grid) and invented the first electronic amplifying device, the triode, which he named the Audion. This additional control grid modulates the current that flows between cathode and anode. (drawing and historical background extracted from Wikipedia).
Common emitter/source /cathode	 Amplifying device wherein the emitter/source/cathode terminal is connected to RF ground/earth and the input (control) terminal is the base/gate/grid.
Common base/gate /grid	

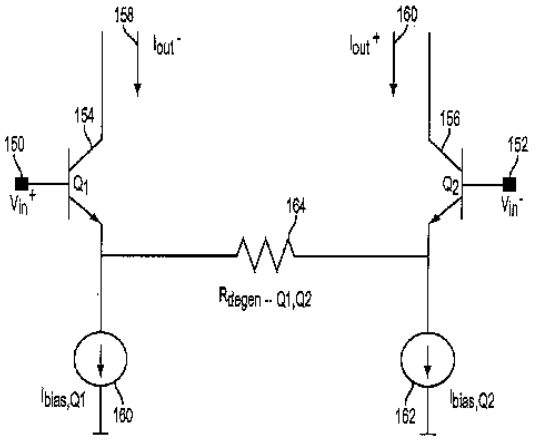
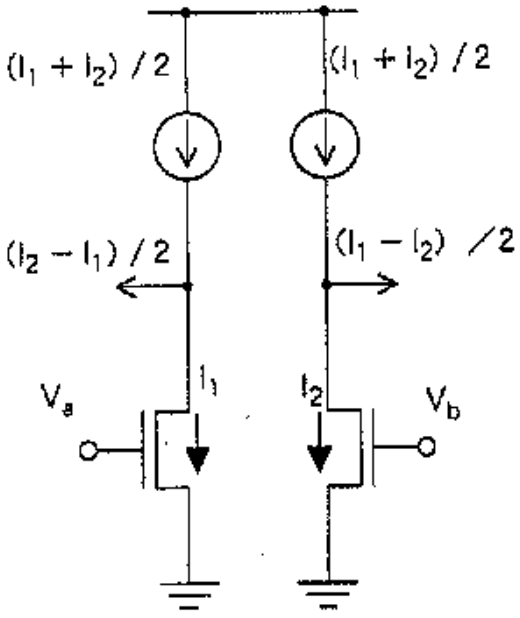
	 Amplifying device wherein the base/gate/grid terminal is connected to RF ground/earth and the input (control) terminal is the emitter/source/cathode.
Cascade coupling	 Two or more amplifying devices wherein the output terminal of the first device is connected to the input (control) terminal of the second device in order to form a chain of amplifying elements.
Cascode coupling	

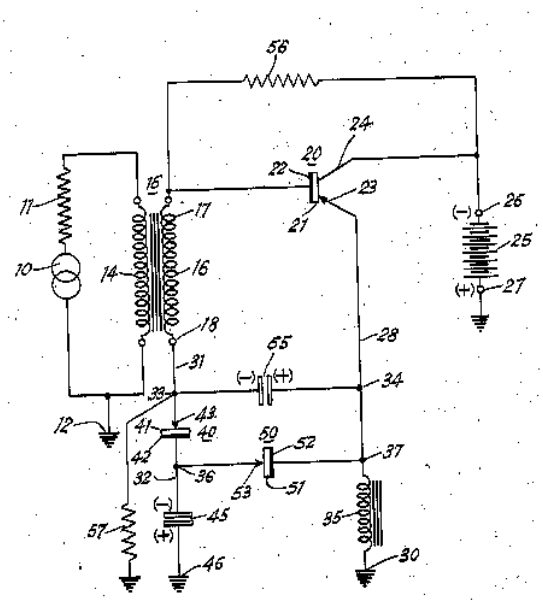
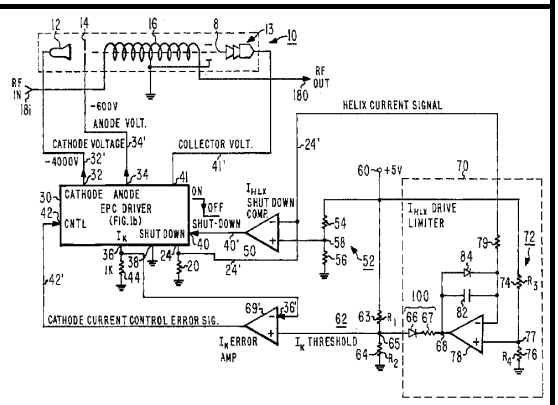
	 A cascade coupling of a common emitter/source/cathode amplifying device followed by a common base/gate/grid amplifying device.
Common collector/drain/anode, i.e. Emitter/source /cathode follower	 Amplifying device wherein the input (control) terminal is the base/gate/grid, and the output terminal is the emitter/source/cathode. The output voltage "follows" the input voltage, because the voltage gain almost equals one.
Emitter/Source degeneration	

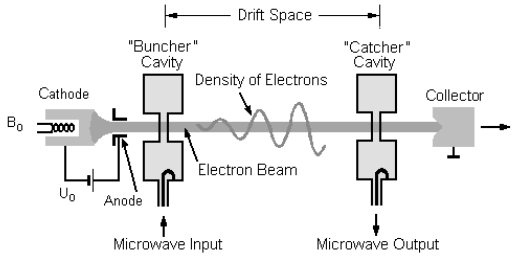
	 Amplifying device in common emitter/source/cathode configuration wherein an additional element (degeneration element) is connecting the emitter/source/cathode terminal with the RF ground/earth.
Darlington amplifier	 Bipolar transistors are in Darlington configuration when they have the collector terminals tied together and the emitter of the first transistor is connected to the base of the second transistor so that the current gain of the composite transistor is increased.
Bridge type	

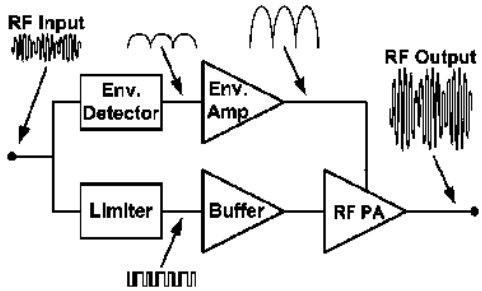
	 Two amplifying devices are in bridge type when the output signal of one device is in opposition of phase with the output signal of the other device. A load is connected between the two amplifying device outputs, bridging the output terminals. This can double the voltage swing at the load as compared with the same amplifying device used alone without bridging.
Esaki diode	 Esaki diode is a type of semiconductor diode which is capable of very fast operation, well into the microwave frequency region, by using quantum mechanical effects. When forward-biased, an odd effect occurs called “quantum mechanical tunnelling” which gives rise to a region where an increase in forward voltage is accompanied by a decrease in forward current (negative resistance region)
Chopper amplifier	 A basic chopper amplifier is formed by adding so-called choppers S1 and S2 before and after an input stage A1. The choppers consist of switches with two positions. In the first position, the inputs I1 and I2 are connected to

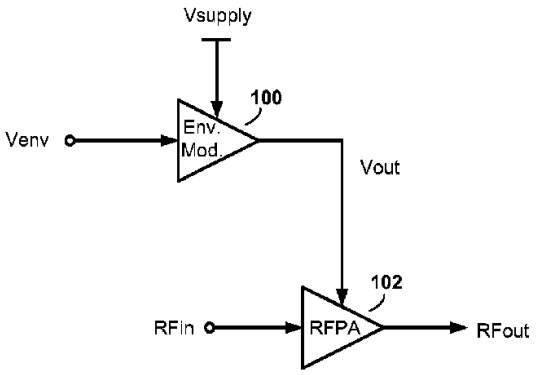
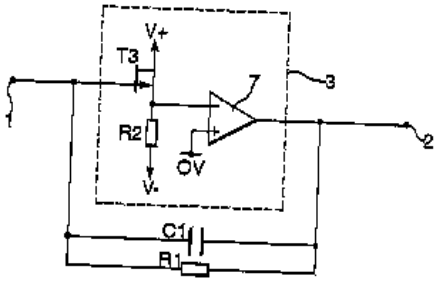
	the outputs O1 and O2, respectively. In the second position, the inputs I1 and I2 are connected to the outputs O2 and O1, respectively. The choppers S1 and S2 are synchronized to repeatedly switch between the first and the second positions at the rate of a clock signal f1. This configuration is commonly used to reduce the offset (e.g. Vos1) and the flicker noise. (drawing extracted from US2003189461)
Differential amplifier long tail pair	 The basis configuration of a long-tailed pair (LTP) differential amplifier consists of two amplifying transistors, which are connected so that the BJT emitters (or FET sources, or valve cathodes) are connected together. The common electrodes are then connected to a circuit, forming the "long tail" of the name, the long tail providing a current source, i.e. having a very high equivalent impedance in parallel, so that high common mode rejection ratio is achieved. (drawing extracted from US2011090010).
Differential amplifier PI type	

	 The basic configuration of a PI type differential amplifier consists of two amplifying transistors, which are connected so that the BJT emitters (or FET sources, or valve cathodes) are connected together via a resistor. The resistor terminals are then respectively connected to a shunting current source, forming the "PI" of the name, so that high common mode rejection ratio is achieved. (drawing extracted from US2009289714).
Pseudo differential amplifier	 The basic configuration of a pseudo differential amplifier consists of two amplifying transistors, wherein the BJT emitters (or FET sources, or valve cathodes) are not connected together but directly coupled to the

	ground. Thus, since the difference between I1 and I2 is output in proportion to the difference between gate signals Va, Vb, the configuration acts as a differential transconductance amplifier (drawing extracted from US2009115461).
Reflex amplifier	 In a basic reflex amplifier an AC input signal is amplified and then rectified and, using the same circuit elements, the fed back resultant rectified DC signal is again amplified. The reflex circuit thus achieves two stages of amplification, plus rectification, in a single stage. (drawing extracted from US2863066).
Travelling Wave Tube Amplifier (TWTA)	 A travelling wave tube (TWT) integrated with a regulated power supply and protection circuits is referred to as a travelling wave-tube amplifier (TWTA). The basic

	configuration of a TWT is an elongated vacuum tube with an electron gun (a heated cathode that emits electrons) at one end. A magnetic containment field around the tube focuses the electrons into a beam, which then passes down the middle of an RF circuit (wire helix or coupled cavity) that stretches from the RF input to the RF output, the electron beam finally striking a collector at the other end. A directional coupler, which can be either a waveguide or an electromagnetic coil, fed with the low-powered radio signal that is to be amplified, is positioned near the emitter, and induces a current into the helix. The RF circuit acts as a delay line, in which the RF signal travels at near the same speed along the tube as the electron beam. The electromagnetic field due to the RF signal in the RF circuit interacts with the electron beam, causing bunching of the electrons (an effect called velocity modulation), and the electromagnetic field due to the beam current then induces more current back into the RF circuit (i.e. the current builds up and thus is amplified as it passes down). A second directional coupler, positioned near the collector, receives an amplified version of the input signal from the far end of the RF circuit. (drawing extracted from US5500621).
Klystron	 A klystron amplifies RF signals by converting the kinetic energy in a DC electron beam into radio frequency power. A beam of electrons is produced by a thermionic cathode (a

	heated pellet of low work function material), and accelerated by high-voltage electrodes (typically in the tens of kilovolts). This beam is then passed through an input cavity. RF energy is fed into the input cavity at, or near, its natural frequency to produce a voltage which acts on the electron beam. The electric field causes the electrons to bunch: electrons that pass through during an opposing electric field are accelerated and later electrons are slowed, causing the previously continuous electron beam to form bunches at the input frequency. To reinforce the bunching, a klystron may contain additional "buncher" cavities. The RF current carried by the beam will produce an RF magnetic field, and this will in turn excite a voltage across the gap of subsequent resonant cavities. In the output cavity, the developed RF energy is coupled out. The spent electron beam, with reduced energy, is captured in a collector.
Envelope Elimination and Restoration (EER)	 The Envelope elimination and restoration technique was first proposed in 1952 by L.R. Kahn as a way to linearise nonlinear amplifiers. In Kahn's approach, an RF input signal is processed by two parallel paths. In one path, the envelope of the RF input signal is "eliminated" using a limiting amplifier that removes any amplitude modulation and which provides a phase modulated signal. In the other path, the RF input signal envelope is detected, amplified, and applied to the PA as an amplitude

	modulating power supply voltage. The EER technique allows the phase modulated signal to be amplified with high efficiency using a saturated power amplifier, which has an amplitude modulating power supply voltage, in order to restore the RF signal envelope at the output of said amplifier and to obtain linear amplification of the RF input signal.
Envelope Tracking (ET)	 In the Envelope Tracking configuration, the power amplifier is fed with a fully-modulated RF signal (RFin) at the input and supplied with a modulated drain bias (Vout) in accordance with the envelope of the modulated signal (Venv). As a result, the power amplifier at all times is kept near saturation where the efficiency is highest. (drawing extracted from US7808323)
Charge amplifier	 A charge amplifier is a current integrator driven by an electrical source with capacitive nature such as a piezoelectric sensor. Contrary to what its name may suggest, a charge amplifier does not amplify the electric

	charge present at its input (it can amplify only the exciting input voltage). The charge amplifier just transfers the input charge to another reference capacitor and produces an output voltage equal to the voltage across the reference capacitor. Thus the output voltage is proportional to the charge of the reference capacitor and, respectively, to the input charge; hence the circuit acts as a charge-to-voltage converter. Charge amplifiers are usually constructed using op-amps with a feedback capacitor. (drawing extracted from GB2381977)

Note: all the drawings of the present section, when not explicitly indicated, have been extracted from Wikipedia.

Synonyms and Keywords

In patent documents the following abbreviations are often used:

RF	Radio Frequency
HF	High Frequency, Hoch-Frequenz (German). Haute Fréquence (French)
NF (German)	Nieder-Frequenz (German)
NF	Noise Figure
LF	Low Frequency
BF (French)	Basse Fréquence (French)
LNA	Low Noise Amplifier
MMIC	Microwave Monolithic Integrated Circuit
IC	Integrated Circuit
OP-AMP	Operational Amplifier

FET	Field Effect Transistor
TEC (French)	Transistor à Effet de Champ (French)
AC	Alternate Current
DC	Direct Current
DAT	Distributed Active Transformer
SEPP	Single Ended Push Pull
BALUN	Balanced/Unbalanced or Unbalanced/Balanced
EMI	Electromagnetic Interference
ESD	Electro Static Discharge
TD	Time Domain
PD	Predistorter
BiFET	Bipolar and Field Effect Transistor
CMMR	Common-Mode Rejection Ratio
CCCS	Current Controlled Current Source
CCVS	Current Controlled Voltage Source
VCVS	Voltage Controlled Voltage Source
VCCS	Voltage Controlled Current Source
TIA	Trans-Impedance Amplifier
OTA	Operational Transconductance Amplifier
TWT	Travelling Wave Tube
PA	Power Amplifier

DPA	Doherty Power Amplifier
MMPA	Multi-Mode Power Amplifier
TWTA	Travelling Wave Tube Amplifier
LTP	Long Tailed Pair
EER	Envelope Elimination and Restoration
ET	Envelope Tracking
BTL	Bridged Tied Load

H03F 1/00

Details of amplifiers with only discharge tubes, only semiconductor devices or only unspecified devices as amplifying elements;

Definition statement

This subclass/group covers:

Details of amplifiers with only discharge tubes, only semiconductor devices or only unspecified devices as amplifying elements, wherein said details are addressing a specific technical effect for the amplification:

Raise the efficiency

Reduce detrimental influences of internal impedances of the amplifying elements

Reduce influence of noise generated by amplifying elements

Reduce influence of variations of temperature or supply voltage or other physical parameters

Reduce non-linear distortion (except when using negative feedback)

Negative feedback with or without positive feedback

Positive feedback without negative feedback

Bandwidth extension

Protection

Modification of input or output impedances

The technical effect is specified according to the IPC definitions for the individual subgroups of H03F 1/00 which follow hereinafter.

Special rules of classification within this group

A document may be temporarily allocated in the main group H03F 1/00 only for EPO internal circulation, e.g. to receive it from neighbouring field classifiers via the classification code.

H03F 1/02

Modifications of amplifiers to raise the efficiency, e.g. gliding Class A stages, use of an auxiliary oscillation

Definition statement

This subclass/group covers:

Modifications of amplifiers to raise the efficiency, wherein said modification comprises the following techniques:

dynamic bias control based on the input/output signal

supply control based on the input/output signal

selection of one or more amplifiers from a plurality of amplifier

reduction of the number of DC current paths

use of particular circuit topologies, e.g. Doherty amplifier, LINC Amplifier

use of discharge tube amplifiers acting also as modulators.

References relevant to classification in this group

This subclass/group does not cover:

Transmitter circuits with power amplifiers having gain or transmission power control, with means for improving efficiency	H04B 2001/0416, H04B 2001/045

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gain control details, gain control by varying the supply voltage, gain	H03G 1/00, H03G 3/004, H03G 3/007

control dependent on the supply voltage	
Amplitude modulation by converting angle modulation to amplitude modulation	H03C 1/50P
Transmission power control	H04W 52/04

H03F 1/08

Modification of amplifiers to reduce detrimental influences of internal impedances of amplifying elements (wide-band amplifiers with inter-stage coupling networks incorporating these impedances H03F1/42; eliminating transit-time effects in vacuum tubes H01J21/34)

Definition statement

This subclass/group covers:

Modification of amplifiers to achieve frequency stabilisation or signal isolation among amplifying stages, wherein said modification comprises the following techniques:

use of particular circuit topologies, e.g. transimpendance amplifier, cascode amplifier

use of amplifying elements with multiple electrode connections

use of attenuating means

use of neutralising means, e.g. Miller effect compensation circuitry, pole/zero cancellations in the transfer function

use of distributed coupling

References relevant to classification in this group

This subclass/group does not cover:

Eliminating transit-time effects in vacuum tubes	H01J 21/34

Differential cascode amplifiers, differential folded cascode amplifiers	H03F 3/45089 H03F 3/45094 H03F 3/45103 H03F 3/45107 H03F 3/45116 H03F 3/45121 H03F 3/4513 H03F

	3/45134 H03F 3/45143 H03F 3/45147 H03F 3/45156 H03F 3/45161 H03F 3/45188 H03F 3/45192 H03F 3/45201 H03F 3/45206 H03F 3/45215 H03F 3/45219 H03F 3/45228 H03F 3/45233 H03F 3/45242 H03F 3/45246 H03F 3/4526 H03F 3/45255 H03F 3/45286 H03F 3/45291 H03F 3/453 H03F 3/45304 H03F 3/45313 H03F 3/45318 H03F 3/45327 H03F 3/45331 H03F 3/4534 H03F 3/45345 H03F 3/45354 H03F 3/45358 H03F 3/45385 H03F 3/4539 H03F 3/45399 H03F 3/45403 H03F 3/45412 H03F 3/45417 H03F 3/45426 H03F 3/4543 H03F 3/45439 H03F 3/45443 H03F 3/45452 H03F 3/45457
Optical receivers with arrangements for optimising the preamplifier	H04B 10/158E2
Transmitter circuits with power amplifiers having gain or transmission power control, with means for improving efficiency	H04B 2001/0416, H04B 2001/045

Informative references

Attention is drawn to the following places, which may be of interest for search:

Wide-band amplifiers with inter-stage coupling networks incorporating these impedences	H03F 1/42
Distributed amplifiers using coupling networks with distributed constants	H03F 3/605
Modifications of control circuit to reduce distortion caused by control	H03G 1/04
Gain control in emitter coupled or cascode amplifiers	H03G 1/0023
Muting circuits	H03G 3/26, H03G 3/34
Amplitude limiters	H03G 11/00

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Current steering cascode	cascode amplifier formed by at least two common gate transistors which are both coupled to the drain terminal of the input common source transistor, in order to steer the current at that terminal among different paths.

Synonyms and Keywords

In patent documents the word "cascade" is often used with the meaning "cascode".

H03F 1/26

Modifications of amplifiers to reduce influence of noise generated by amplifying elements

References relevant to classification in this group

This subclass/group does not cover:

Constructional modification of discharge tubes amplifiers	H01J 23/11
Modifications of amplifiers to reduce influence of variations of supply voltage in case of switching on or off of a power supply, i.e. popping noise reduction	H03F 1/305

Transmitter circuits with means for limiting noise	H04B 1/0475
Chopper amplifiers	H03F 3/38

H03F 1/30

Modifications of amplifiers to reduce influence of variations of temperature or supply voltage [N: or other physical parameters (in differential amplifiers H03F3/45479)]

Definition statement

This subclass/group covers:

Modifications of amplifiers to reduce influence of variations of temperature or supply voltage, or other physical parameters, wherein said modifications comprise:

bias stabilisation circuits

drifting protection circuits

using a switching device and eventually digital means

case of switching on or off a power supply

case of push-pull configuration

References relevant to classification in this group

This subclass/group does not cover:

Differential amplifiers characterised by the way of common mode signal rejection	H03F 3/45479

Examples of places where the subject matter of this subgroup is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Push-pull amplifiers	H03F 3/26
Single-ended push-pull (SEPP)	H03F 3/30

Informative references

Attention is drawn to the following places, which may be of interest for search:

Voltage, current regulators	G05F 1/10, G05F 3/02
Muting circuits	H03G 3/26, H03G 3/34

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

In this subgroup, the following terms (or expressions) are used with the meaning indicated:

Popping noise	audible noise which is present when switching on or off the power supply

Synonyms and Keywords

In patent documents the following expressions are often used as synonyms:

Popping noise	pop effect, plop noise, clic

H03F 1/32

Modifications of amplifiers to reduce non-linear distortion (by negative feedback H03F1/34)

Definition statement

This subclass/group covers:

Modifications of amplifiers to reduce non-linear distortion, wherein said modifications comprise:

using feedforward circuits

using predistortion circuits, which are implemented with feedback, or via multiple paths, or in audio amplifiers, or with nonlinear elements, or acting on cartesian and polar parameters

case of differential amplifiers

case of single ended push pull amplifiers

References relevant to classification in this group

This subclass/group does not cover:

Modifications of amplifiers to reduce non-linear distortion by negative	H03F 1/34

feedback	

Examples of places where the subject matter of this subgroup is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Analog transmitter circuits with means for limiting distortions	H04B 1/0483, H04B 1/0475
Analog transmitter circuits with power amplifiers with linearisation using predistortion and using feed-forward	H04B 2001/0425, H04B 2001/0441
Digital transmitters using predistortion	H04L 27/367

Special rules of classification within this group

Indexing Code orthogonal classification

In addition to one or more classification symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to orthogonal classification (H03F 2201/3203 - H03F 2201/3236), i.e. covering aspects which are spanning over one or more EC subgroups, should be allocated for the following sub-groups range: H03F 1/32 - H03F 1/3241.

H03F 1/34

Negative-feedback-circuit arrangements with or without positive feedback (H03F1/02 to H03F1/30, H03F1/38 to H03F1/50, H03F3/50 take precedence; [N: for rejection of common mode signals H03F3/45479])

Definition statement

This subclass/group covers:

Negative-feedback-circuit arrangements with or without positive feedback, wherein said arrangements comprises:

adaptations for reducing the non-linear distortion

hybrid or directional couplers

transformers.

References relevant to classification in this group

This subclass/group does not cover:

Differential amplifiers for the rejection of common mode signals	H03F 3/45479

Examples of places where the subject matter of this subgroup is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Analog transmitter circuits with means for limiting distortions	H04B 1/0483, H04B 1/0475

H03F 1/38

Positive-feedback circuit arrangements without negative feedback

Informative references

Attention is drawn to the following places, which may be of interest for search:

Generation of oscillation	H03B

H03F 1/42

Modifications of amplifiers to extend the bandwidth

Definition statement

This subclass/group covers:

Modifications of amplifiers to extend the bandwidth, wherein the modifications comprise:

periodic amplifiers

aperiodic amplifiers, i.e. wherein aperiodic means that there is no resonant circuit present.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when

specially adapted, used for a particular purpose, or incorporated in a larger system:

Analog transmitter circuits with means for limiting distortions	H04B 1/0483, H04B 1/0475
Pulse shaping by amplifying	H03K 5/02
Optical receivers with bandwidth control	H04B 10/158E2B

Glossary of terms

In this subclass/group, the following terms (or expressions) are used with the meaning indicated:

Inductive peaking	an inductor is placed in the amplifying circuit to extend the bandwidth of amplification.

H03F 1/52

Circuit arrangements for protecting such amplifiers [N: (monitoring arrangements G01R31/28; increasing reliability in communication systems, e.g. using redundancy H04B1/74)]

Definition statement

This subclass/group covers:

Circuit arrangements for protecting such amplifiers, wherein the arrangements comprises:

using redundant amplifying elements

using protective devices, e.g. diodes.

References relevant to classification in this group

This subclass/group does not cover:

Protection from temperature drifting	H03F 1/30
Vacuum tube testing	G01R 31/25

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Monitoring arrangements	G01R 31/28
Analog transmitter details for increasing reliability	H04B 1/74

Informative references

Attention is drawn to the following places, which may be of interest for search:

Emergency protective circuit arrangements	H02H 7/20
Over voltage protection in integrated circuits	H02H 9/046
Frequency-division multiplex system with monitoring arrangements	H04J 1/16, H04J 1/16

H03F 1/56

Modifications of input or output impedances, not otherwise provided for

Definition statement

This subclass/group covers:

Modifications of input or output impedances, not otherwise provided for, wherein said modifications may comprise:

matching and tuning circuits which are specifically designed for RF amplifiers

circuit adaptations in class E,F,E/F amplifiers.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

High frequency amplifiers	H03F 3/189

Amplifiers in which coupling networks have distributed constants	H03F 3/60
Switching amplifiers in general	H03F 3/217
Class E amplifiers	H03F 3/2176

Informative references

Attention is drawn to the following places, which may be of interest for search:

Matching with passive networks	H03H 7/38
Matching with active networks	H03H 11/28

H03F 3/00

Amplifiers with only tubes or only semiconductor devices as amplifying elements.

Definition statement

This subclass/group covers:

Electronic amplifiers based on tubes or semiconductors.

Amplifiers are classified according to topology (e.g., push-pull, emitter follower, differential) and/or according to use (e.g., LF, HF) and/or according to the amplifying element (e.g., tubes, tunnel diodes) and/or according to special functionality (e.g., multi-channel amplifiers, gated amplifiers).

Amplifiers with both tubes and semiconductors are classified in H03F 5/00.

Amplifiers based on other amplification principles such as magnetic, dielectric, mechanical/acoustic, superconductivity, etc., are classified in subgroups H03F 7/00-H03F 21/00.

Special rules of classification within this group

A document may be temporarily allocated in the main group H03F 3/00 only for EPO internal circulation, e.g. to receive it from neighbouring field classifiers via the classification code.

H03F 3/005

[N: Using switched capacitors, e.g. dynamic amplifiers; using switched capacitors as resistors in differential amplifiers. (H03F3/45 takes precedence)]

Definition statement

This subclass/group covers:

Amplifiers with switched capacitors used as synthesized resistors.

References relevant to classification in this group

This subclass/group does not cover:

Modulator/demodulator (chopper) amplifiers	H03F 3/38
Chopper/auto-zero amplifiers for offset/noise reduction in differential amplifiers	H03F 3/45
Amplifiers with charge pump- or other switched capacitor based power supplies	H03F 1/02

Informative references

Attention is drawn to the following places, which may be of interest for search:

Switched capacitor filters	H03H 319/00B

H03F 3/02

With tubes only (subsequent sub-groups take precedence)

References relevant to classification in this group

This subclass/group does not cover:

Travelling wave tube amplifiers	H03F 3/58

H03F 3/04

With semiconductor devices only (subsequent sub-groups

take precedence)

H03F 3/06

using hole storage effect.

H03F 3/08

Amplifiers controlled by light

Definition statement

This subclass/group covers:

Amplifiers controlled by light, that is, for optically generated or transferred signals, e.g., transimpedance amplifiers for fiber optic links, optical isolation amplifiers.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Optical receivers	H04B 10/158

H03F 3/082

[N: with FET`s (H03F3/085 takes precedence)]

Definition statement

This subclass/group covers:

Amplifiers controlled by light, wherein the amplifier comprises FETs, e.g., JFET or CMOS transimpedance amplifiers for fiber optic links.

H03F 3/085

[N: using opto-couplers between stages]

Definition statement

This subclass/group covers:

Amplifiers controlled by light, wherein the amplifier comprises optically coupled stages, e.g., optical isolating amplifiers.

H03F 3/087

[N: with IC amplifier blocks (H03F3/085 takes precedence)]

Definition statement

This subclass/group covers:

Amplifiers controlled by light, wherein the amplifier has functional units such as op-amps, i.e., not showing transistor level circuit details.

H03F 3/10

with diodes (H03F3/12 takes precedence) [N: (parametric amplifiers H03F7/00)]

Definition statement

This subclass/group covers:

Amplifiers using diodes as an amplifying element, e.g., negative resistance diodes such as Gunn, IMPATT, Esaki (tunnel) diodes.

References relevant to classification in this group

This subclass/group does not cover:

Switching amplifiers with freewheeling diodes	H03F 3/217

H03F 3/12

with Esaki diodes

Definition statement

This subclass/group covers:

Amplifiers using Esaki (tunnel) diodes as an amplifying element.

H03F 3/14

with amplifying devices having more than three electrodes or more than two PN junctions (H03F1/223 takes precedence).

Definition statement

This subclass/group covers:

Amplifiers with semiconductor amplifying devices having more than three

electrodes, e.g., dual-gate MOSFETs, back-gate controlled MOSFETs, multi-emitter/collector BJTs. Note: by semiconductor amplifying devices is understood transistors; opamps and the like are not included, even if they have more than three terminals. Cascode amplifiers using dual-gate MOSFETs are classified in H03F 1/223.

H03F 3/16

with field-effect devices (H03F3/165 takes precedence; other sub-groups take precedence)

Definition statement

This subclass/group covers:

Amplifiers with semiconductor field-effect amplifying devices, e.g., MOSFETs, JFETs, MESFETs.

H03F 3/165

[N: with junction-FET`s (other sub-groups take precedence)]

Definition statement

This subclass/group covers:

Amplifiers with semiconductor junction field-effect amplifying devices, e.g., JFETs, MESFETs (but not MOSFETs).

H03F 3/181

Low frequency amplifiers, e.g. audio preamplifiers

Definition statement

This subclass/group covers:

Low frequency amplifiers, in most cases which are suitable for amplification of audio signals.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Switching amplifiers	H03F 3/217
Gain control in low frequency amplifiers	H03G 3/3005, H03G 7/002, H03G 7/007, H03G 3/3089
Circuits for loudspeakers, microphones	H04R 3/00

H03F 3/189

High frequency amplifiers, e.g. radio frequency amplifiers

Definition statement

This subclass/group covers:

High frequency amplifiers, e.g. radio frequency amplifiers, as detailed circuits or integrated circuit blocks.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Amplifiers in which coupling networks have distributed constant	H03F 3/60
IF amplifier circuits specially adapted for B&W TV	H04N 5/4446

Informative references

Attention is drawn to the following places, which may be of interest for search:

Switching amplifiers	H03F 3/217
High frequency adaptations of semiconductors	H01L 23/66
Gain control in high frequency amplifiers, bandpass amplifiers	H03G 3/3036, H03G 3/3052

Synonyms and Keywords

In patent documents the following abbreviations are often used:

HBT	Heterojunction Bipolar Transistor
HEMT	High Electron Mobility Transistor

H03F 3/20

Power amplifiers, e.g. Class B amplifiers, Class C amplifiers (H03F3/26 TO H03F3/30 take precedence)

Definition statement

This subclass/group covers:

Power amplifiers in general. e.g. class B amplifiers, Class C amplifiers, Class D amplifiers, Class E amplifiers, Class F amplifiers, Class G amplifiers, Class H amplifiers, Class S amplifiers, or combination of power amplifiers, or integrated circuits wherein the circuit topology is based on lumped elements.

References relevant to classification in this group

This subclass/group does not cover:

Push pull amplifiers	H03F 3/26
Single ended push pull amplifiers	H03F 3/30
Combination of amplifiers in which coupling networks have distributed constant	H03F 3/602

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Analog transmitters	H04B 1/02
Digital transmitters	H04L 27/04
Multi-channel amplifiers	H03F 3/68

Special rules of classification within this group

Documents which are addressing a power amplifier in general are usually not classified in this subgroup, but are allocated to the corresponding subgroups:

H03F 3/21

H03F 3/211

H03F 3/213

H03F 3/217

H03F 3/22

H03F 3/24

Indexing Code deep-indexing classification

In addition to one or more classification symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to deep-indexing classification (H03F 2203/21103 - H03F 2203/21196), i.e. covering embodiment aspects, should be allocated for the following sub-group: H03F 3/211

H03F 3/217

Class D power amplifiers; Switching amplifiers

Definition statement

This subclass/group covers:

Amplifiers using switches as amplifying elements, e.g., class D audio amplifiers, class E, class F, class S RF amplifiers, as well as control circuitry such as PCM-PWM conversion etc.

Gated amplifiers	H03F 3/72
Chopper/auto-zero amplifiers	H03F 3/38; H03F 3/45
Amplifiers with switched-mode (e.g., tracking) power supplies	H03F 1/02

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

MRI gradient amplifiers	G01R 33/3852
Stereophonic systems	H04S
Deaf-aid sets	H04R 25/00
DC-AC converters	H02M 3/00

Special rules of classification within this group

Multiple classification symbols may be given, e.g., a stereo full-bridge class D audio power amplifier with protection means and anti pop-noise means would be classified in H03F 3/68, H03F 3/2173, H03F 1/52, H03F 1/305, and possibly also somewhere in H04S. A class D MRI gradient amplifier would be classified in both G01R 33/3852 and H03F 3/217. An RF amplifier with a class D amplifier used as a tracking power supply (aka class S) would be classified in the relevant H03F 1/02 sub-group, as well as in H03F 3/217 (provided that the class D amplifier is shown in some detail), and possibly also in H03F 3/189, for example.

H03F 3/2171

[N: with field-effect devices (H03F3/2173 to H03F3/2178 take precedence)]

Definition statement

This subclass/group covers:

Switching amplifiers using FET switches as amplifying elements.

H03F 3/2173

[N: of the bridge type]

Definition statement

This subclass/group covers:

Switching amplifiers with half- or full-bridges.

H03F 3/2175

[N: using analogue-digital or digital-analogue conversion (H03F3/2173 takes precedence)]

Definition statement

This subclass/group covers:

Switching amplifiers for digital input signals, or having explicit ADCs or DACs.

H03F 3/2176

[N: Class E amplifiers]

Definition statement

This subclass/group covers:

Class E RF amplifiers.

References relevant to classification in this group

This subclass/group does not cover:

Class F RF amplifiers (see the "Glossary of terms" section above). These are classified in other relevant H03F 3/217 subgroups.

H03F 3/2178

[N: using more than one switch or switching amplifier in parallel or in series (H03F3/2173, H03F3/2175 take precedence)]

Definition statement

This subclass/group covers:

Switching amplifiers with one or more switches (e.g., segmented transistors in RF amplifiers) or output stages (such as in staggered phase class D amplifiers) in parallel or in series, cooperating to produce a common output signal.

References relevant to classification in this group

This subclass/group does not cover:

Multi-channel amplifiers	H03F 3/68
Combinations of a switching amplifier and a linear amplifier to produce a single output signal (but a H03F 3/217 sub-group should still be given, by virtue of the switching amplifier).	H03F 3/211

H03F 3/22

Power amplifiers with tubes only (H03F3/24, H03F3/28, H03F3/30 take precedence)

Definition statement

This subclass/group covers:

Power amplifiers with tubes (thermionic valves only).

References relevant to classification in this group

This subclass/group does not cover:

Tube power amplifiers for radio transmitters	H03F 3/24
Tube push-pull amplifiers (two tubes connected to either side of a transformer primary with a center tap connected to a supply voltage and driven out of phase).	H03F 3/28
Tube single-ended push-pull amplifiers (tubes connected in series across two supply rails and the output signal taken at the node common to the tubes)	H03F 3/30

H03F 3/26

Push-pull amplifiers; Phase-splitters therefor (duplicated single-ended push-pull arrangements or phase-splitters therefor H03F3/30)

Definition statement

This subclass/group covers:

Push-pull amplifiers (see the push-pull configuration in the "Glossary of terms" section above) and phase-splitters therefor, i.e. the phase splitter circuitry which is suitable for driving them.

References relevant to classification in this group

This subclass/group does not cover:

Duplicated single-ended push-pull arrangements or phase-splitters therefor	H03F 3/30
Single-ended sense amplifiers	G11C 7/067

H03F 3/30

Single-ended push-pull [N: (SEPP)] amplifiers [N:

(single-ended sense amplifiers G11C7/067)]; and Phase-splitters therefor

Definition statement

This subclass/group covers:

Single-ended push-pull amplifiers (see the SEPP configuration in the "Glossary of terms" section above) and phase-splitters therefor, i.e. the phase splitter circuitry which is suitable for driving them.

References relevant to classification in this group

This subclass/group does not cover:

Switching amplifiers	H03F 3/217
Single-ended sense amplifiers	G11C 7/067

Special rules of classification within this group

It must be noted that the expression "common drain output", which is present in the definition of subgroup H03F 3/301, relates to a common drain configuration for the output transistors (see the "Glossary of terms" section above), therefore it relates to the source terminals of the output transistors being tied together to form the output terminal.

Similar consideration applies for the expression "common source output", which is present in the definition of subgroup H03F 3/3022, and which relates to a common source configuration of the output transistors (see the "Glossary of terms" section above), i.e. the drain terminals of the output transistors being tied together to form the output terminal.

Furthermore, in the following subgroups the expression "symmetrical driving of the end stage" is present:

H03F 3/3016

H03F 3/3028

H03F 3/305

H03F 3/3059

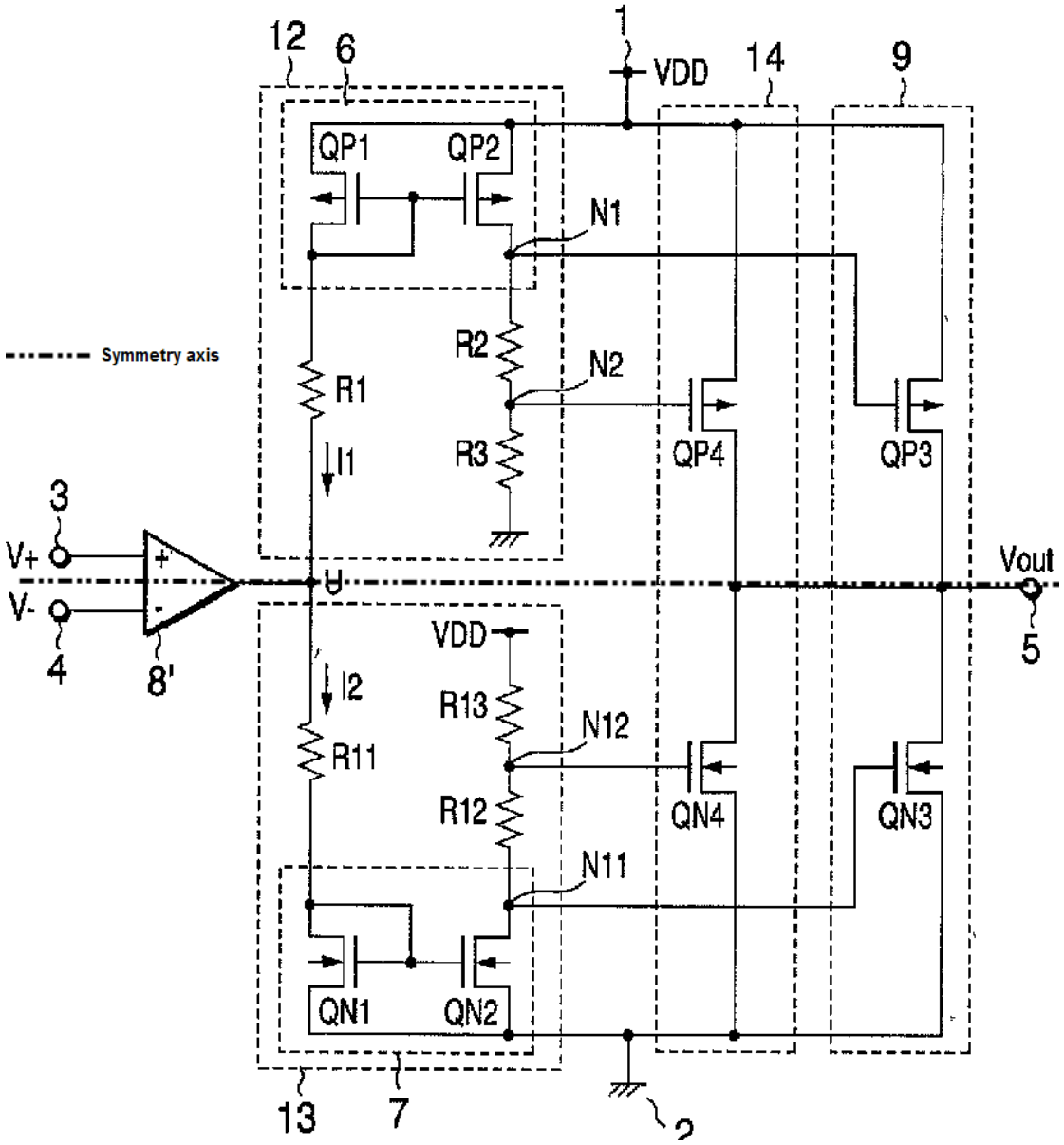
H03F 3/3064

H03F 3/3076

From a circuital topology point of view, it relates to the presence of symmetry in the driving stage circuitry of the SEPP, i.e. if the driving signal path for one

of the output transistor has the same/corresponding/complementary elements of the driving signal path of the other output transistor.

As clarifying example the following circuit topology is shown.



Example of SEPP with symmetrical driving of the end stage (drawing extracted from US2002109548).

Mostly of the times the presence of symmetry can be easily detected on the circuit topology by considering a virtual axis (see the dotted line "Symmetry axis" in the drawing above) passing through the output terminal to determine two sub-circuits which are located above and below said axis, respectively, and by examining the similarities/corresponding elements among the two sub-circuits.

If no symmetry is detected then the SEPP circuit is of the type having "asymmetrical driving of the end stage" and it has to be classified in one of the

following subgroups:

H03F 3/30B55A

H03F 3/3023

H03F 3/3037

H03F 3/3042

H03F 3/3045

H03F 3/3057

H03F 3/3062

H03F 3/3067

H03F 3/3071

H03F 3/3088

Furthermore, it must be noted that, when two SEPPs are configured as class B or AB bridges, they are classified in H03F 3/3081 and when they are implemented with FETs they are classified in H03F 3/3061. Switching amplifiers in bridge configuration are classified in H03F 3/2173.

Indexing Code orthogonal classification

In addition to one or more EC symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to orthogonal classification (H03F 2203/30003 - H03F 2203/30156), i.e. covering aspects which are spanning over one or more EC subgroups, should be allocated for this subgroup.

H03F 3/34

Dc amplifiers in which all stages are dc-coupled (H03F3/45 takes precedence)

Definition statement

This subclass/group covers:

DC amplifiers which are formed by IC blocks, semiconductors or tubes, in which all the amplifying stages are DC coupled, e.g. without using capacitive or switching elements, which are not specific for RF amplifiers or audio amplifiers and which have circuit topologies that are not related to other H03F classification symbols.

References relevant to classification in this group

This subclass/group does not cover:

Differential amplifiers	H03F 3/45

Places in relation to which this subgroup is residual:

High frequency amplifiers	H03F 3/189
Low frequency amplifiers	H03F 3/181
Power amplifiers	H03F 3/20

Informative references

Attention is drawn to the following places, which may be of interest for search:

DC current or voltage control circuits	G05F 3/02

H03F 3/38

Dc amplifiers with modulator at input and demodulator at output; Modulators or demodulators specially adapted for use in such amplifiers ([N: switched capacitor amplifiers H03F3/005]; modulators in general H03C; demodulators in general H03D; amplitude modulation of pulses in general H03K7/02; amplitude demodulation of pulses in general H03K9/02)

Definition statement

This subclass/group covers:

DC amplifiers wherein only the AC signal is passed through the amplifying units, the DC signal is decoupled via switching elements, e.g. see the Chopper amplifier configuration in the "Glossary of terms" section above.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Arrangements for measuring currents	G01R 19/18

or voltages or for indicating presence or sign thereof by using conversion of dc into ac	
Arrangements for measuring bio-electric currents or voltages	A61B 5/04
Differential amplifiers	H03F 3/45
Switched capacitor amplifiers	H03F 3/005
Switching amplifiers	H03F 3/217

Informative references

Attention is drawn to the following places, which may be of interest for search:

Modulation	H03C
Amplitude modulation of pulses in general	H03K 7/02
Demodulation	H03D
Amplitude demodulation of pulses in general	H03K 9/02
Switched capacitor networks	H03H 19/004
Modifications of amplifiers to reduce influence of noise generated by amplifying elements	H03F 1/26

H03F 3/42

Amplifiers with two or more amplifying elements having their dc paths in series with the load, the control electrode of each element being excited by at least part of the input signal, e.g. so-called totem-pole amplifiers

Definition statement

This subclass/group covers:

In most cases totem-pole amplifiers, see the "Glossary of terms" section above, which are implemented via semiconductor elements or tubes.

H03F 3/45

Differential amplifiers (differential sense amplifiers G11C7/062)

Definition statement

This subclass/group covers:

Differential amplifiers in general and characterised by the technology used, the circuit topologies, and the way that the common mode signals are rejected.

References relevant to classification in this group

This subclass/group does not cover:

Differential sense amplifiers	G11C 7/062
Measuring currents or voltages from sources with high internal resistance by means of measuring circuits with high input impedance, e.g. OP-amplifiers	G01R 19/0023
Operational amplifiers for addition or subtraction in analog calculators	G06G 7/14
Optical receivers with offset control of the differential preamplifier	H04B 10/158E2C
Differential drivers	H04L 25/0272
Logic comparators	H03K 5/24

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gain control in emitter coupled or cascode amplifiers	H03G 1/0023
Tuned filters, switched capacitor networks	H03H 7/12, H03H 19/004

Special rules of classification within this group

Pseudo differential amplifiers (see the "Glossary of terms" section above) are usually classified in H03F 3/4508, H03F 3/45179, H03F 3/45278, H03F 3/45376.

Furthermore, it is common practice at EPO, when classifying semiconductor differential amplifiers, to consider first the technology of the amplifying transistors and the circuit topology information, in order to classify under one of the subgroups belonging to H03F 3/45076.

About circuit topology, the expression "Complementary long tailed pairs having parallel inputs and being supplied in parallel" is present in the following subgroups:

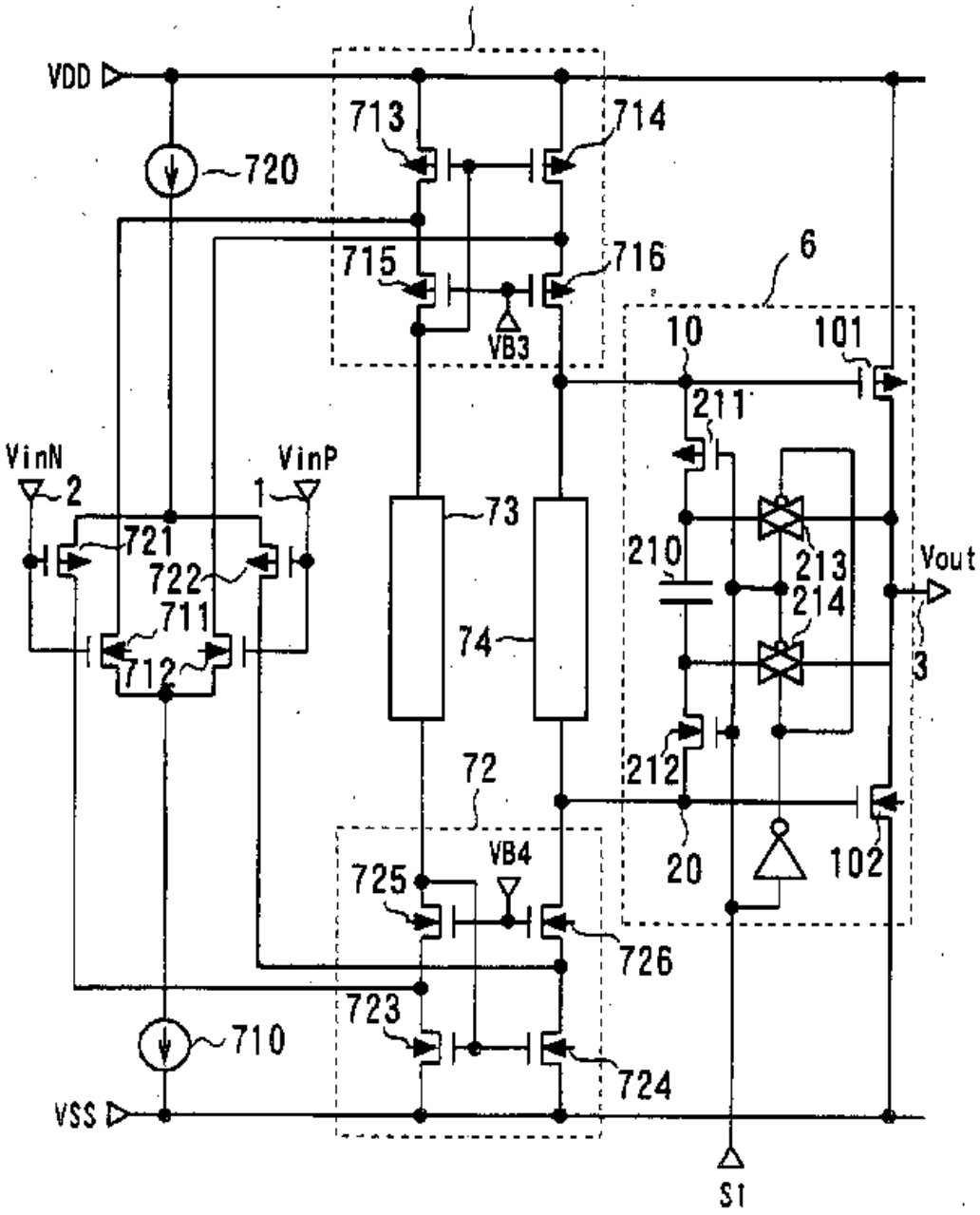
H03F 3/45112

H03F 3/4521

H03F 3/45309

H03F 3/45408

As clarifying example the following circuit topology is shown:



Example of differential amplifier with complementary long tailed pairs having parallel inputs and being supplied in parallel: the first transistor pair (711,712) and the second transistor pair (721,722) constitute two complementary transistor pairs, which, together with the corresponding current sources (710,720) constitute long tail pairs (see the "Glossary of terms" section above), and wherein said pairs have parallel inputs (see the common input terminals (VinN, VinP) and are supplied in parallel (see the common supplies VDD, VSS), (drawing extracted from US2005040889).

Similar consideration applies to the expression "Complementary PI types having parallel inputs and being supplied in parallel", wherein the complementary transistor pairs are forming differential amplifiers of the PI type, (see the "Glossary of terms" section above), and which are classified in the following subgroups:

H03F 3/45125

H03F 3/45224

H03F 3/45322

H03F 3/45421

About the expression "Complementary long tailed pairs having parallel inputs and being supplied in series", which is present in the following subgroups:

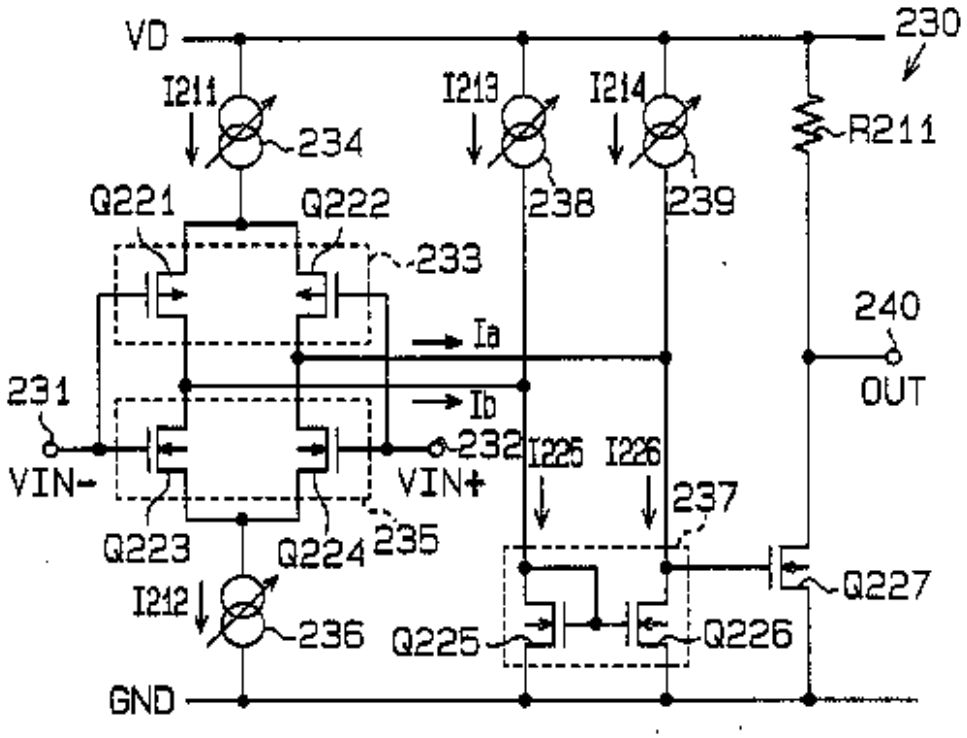
H03F 3/45139

H03F 3/45237

H03F 3/45336

H03F 3/45434

As clarifying example the following circuit topology is shown:



Example of differential amplifier with complementary long tailed pairs having parallel inputs and being supplied in series: the first transistor pair (Q221,Q222) and the second transistor pair (Q223, Q224) constitute two complementary transistor pairs, which, together with the corresponding current sources (234,236) constitute long tail pairs (see the "Glossary of terms" section above), and wherein said pairs have parallel inputs (see the common input terminals (VIN-, VIN+) and are supplied in series (see the

series connecting path from VD to GND, which is formed by element 234, the first transistor pair (Q221,Q222), the second transistor pair (Q223, Q224), element 236), (drawing extracted from FR2814554).

Similar consideration applies to the expression "Complementary PI types having parallel inputs and being supplied in series", wherein the complementary transistor pairs are forming differential amplifiers of the PI type, (see the "Glossary of terms" section above), and which are classified in the following subgroups:

H03F 3/45152

H03F 3/45251

H03F 3/45349

H03F 3/45448

Once that the technology and the circuit topology related to the differential amplifier are classified, a possible classification under one of the subgroups belonging to H03F 3/45479 has to be considered. It must be noted that the expression "common mode signal rejection", which is present in the definition of subgroup H03F 3/45479, has to be interpreted with a broader meaning than the one used in common practice (see the "Glossary of terms" section above). In practice common mode rejection has to be meant as operating point/DC level control/offset reduction, and said control can be implemented at sub-circuit level.

Hence all the subgroups of H03F 3/45479 are addressing all the possible implementations of said common mode rejection within the sub-circuits that are forming the differential amplifier architecture (for a detailed definition of said sub-circuits see the following section).

Indexing Code orthogonal classification

In addition to one or more EC symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to orthogonal classification (H03F 2203/45002 - H03F 2203/45732), i.e. covering aspects which are spanning over one or more EC subgroups, should be allocated for this subgroup.

Said aspects are mainly based on the following sub-circuits, which can be determined in a long tailed pair, PI type, and, although with limitations, in special types of differential amplifiers, e.g. pseudo-differential amplifier:

AAC = Active Amplifying Circuit, i.e. the elements comprising the amplifying transistors.

CSC = Common Source Circuit, i.e. the elements forming the long tailed circuit or the PI circuit.

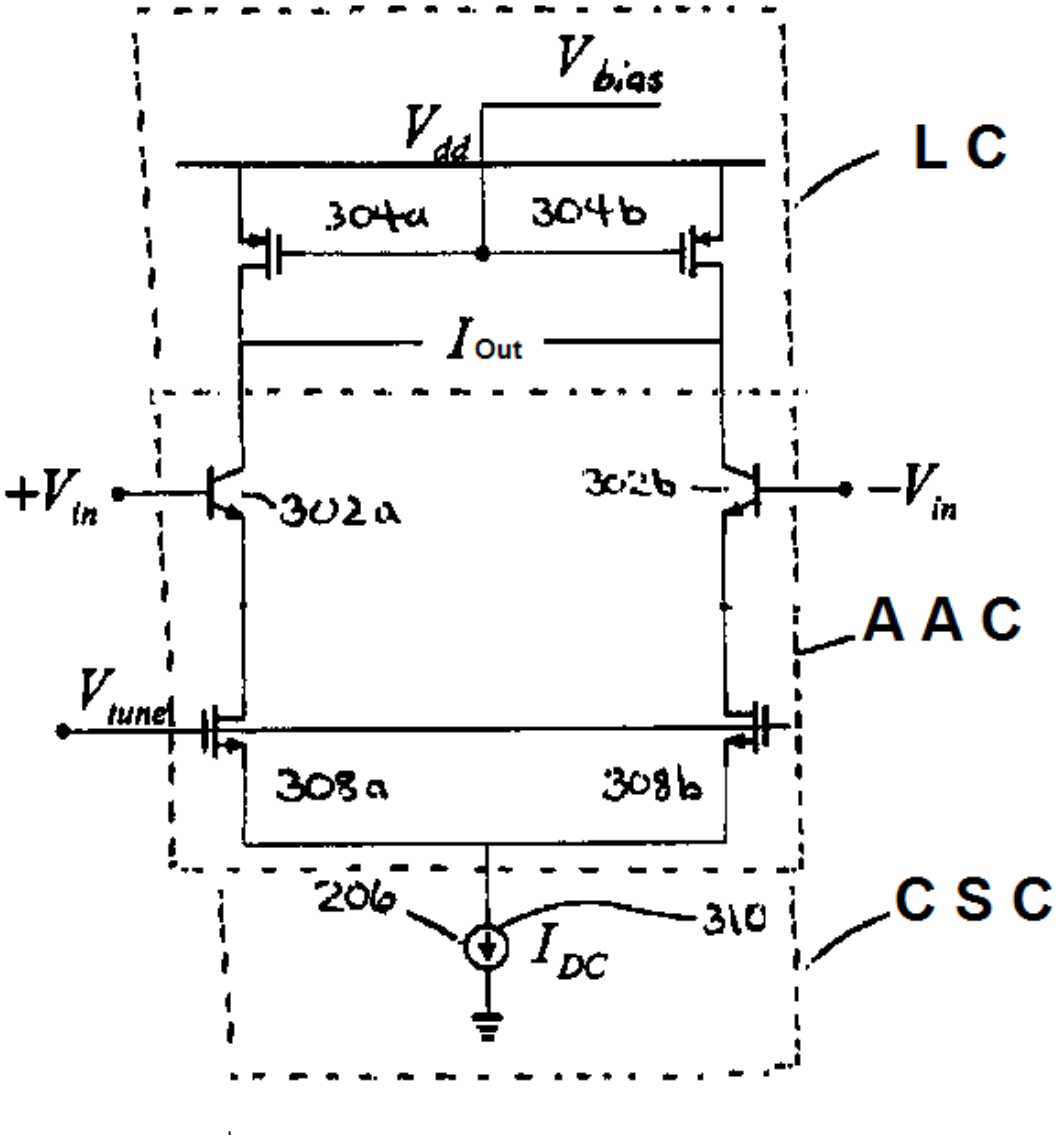
IC = Input Circuit, i.e. the elements coupled to the input terminals of the amplifying transistors.

LC = Loading Circuit, i.e. the elements coupled to the output terminals of the amplifying transistors.

CMCL = Common Mode Controlling Loop, i.e. the elements which are controlling the common mode(s) of the differential amplifier.

FBC = Feed-Back Circuit, i.e. the elements which are introducing feedback signal(s) for the differential amplifier.

Here is an example of some of said sub-circuits above for a long tailed differential pair.



drawing derived from US2006055463

H03F 3/46

Reflex amplifiers [N: (reflection amplifiers H03F3/608)]

Definition statement

This subclass/group covers:

Reflex amplifiers, see the "Glossary of terms" section above, which are implemented via semiconductor elements or tubes.

References relevant to classification in this group

This subclass/group does not cover:

Reflection amplifiers	H03F 3/608

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Receivers comprising at least one semiconductor device having three or more electrodes	H04B 1/24

H03F 3/50

Amplifiers in which input is applied to, or output is derived from, an impedance common to input and output circuits of the amplifying element, e.g. cathode follower

Definition statement

This subclass/group covers:

Amplifiers in cathode follower, source follower, emitter follower configuration (see the "Glossary of terms" section above).

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this group is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Delay circuits	H03K 5/13

Special rules of classification within this group

Indexing Code deep-indexing classification

In addition to one or more classification symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to deep-indexing classification (H03F 2203/5003 - H03F 2203/5045), i.e. covering embodiment aspects, should be allocated for this subgroup.

H03F 3/54

Amplifiers using transit-time effect in tubes or semiconductor devices (parametric amplifiers H03F7/00; solid state travelling-wave devices H01L45/02)

Definition statement

This subclass/group covers:

Amplifiers using transit-time effects, mostly Klystrons or Travelling Wave Tubes (TWT) see the "Glossary of terms" section above.

References relevant to classification in this group

This subclass/group does not cover:

Examples of places where the subject matter of this class is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Solid state travelling-wave devices	H01L 45/02

Informative references

Attention is drawn to the following places, which may be of interest for search:

Resonators of the waveguide type	H01P 7/00
Travelling wave tubes in general	H01J 25/34
Parametric amplifiers	H03F 7/00

H03F 3/60

Amplifiers in which coupling networks have distributed constants, e.g. with waveguide resonators (H03F3/54 takes precedence)

Definition statement

This subclass/group covers:

Amplifiers having distributed coupling networks, e.g. transmission lines, the so called microwave amplifiers.

References relevant to classification in this group

This subclass/group does not cover:

Amplifiers using transit-time effect, e.g. TWTA	H03F 3/54
Parametric amplifiers	H03F 7/00

Examples of places where the subject matter of this class is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Class E amplifiers	H03F 3/2176
Aerials or aerial systems providing at least two radiating patterns, beam-forming means	H01Q 25/00, H01Q 3/40
Reflex amplifiers	H03F 3/46
Multi-channel amplifiers	H03F 3/68

Informative references

Attention is drawn to the following places, which may be of interest for search:

High frequency amplifiers	H03F 3/189
Coupling devices of the waveguide type	H01P 5/00
Amplifiers having more than three electrodes with field-effect devices	H03F 3/16
Modification of amplifiers by use of distributed coupling, i.e. distributed lumped elements	H03F 1/18

High frequency adaptations of semiconductors	H01L 23/66

H03F 3/62

Two-way amplifiers

Definition statement

This subclass/group covers:

Two-way amplifiers, which are implemented via semiconductor elements or tubes and which are typically employed to amplify the signal levels of forward and reverse signals.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Hybrid arrangements for transceivers	H04B 1/58
Multiport networks	H03H 7/48
Intermediate station arrangements for frequency-division multiplex systems	H04J 1/10, H04J 1/10

H03F 3/66

Amplifiers simultaneously generating oscillations of one frequency and amplifying signals of another frequency

Definition statement

This subclass/group covers:

Amplifying-mixing devices for achieving a special technical effect, e.g. interference reduction.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Modifications of amplifiers to reduce non-linear distortion	H03F 1/32
Transference of modulation from one	H03D 7/00

carrier to another	

H03F 3/68

Combinations of amplifiers, e.g. multi-channel amplifiers for stereophonics [N: (power amplifiers using a combination of several semiconductor amplifiers H03F3/211; combinations of amplifiers using coupling networks with distributed constants H03F3/602)]

Definition statement

This subclass/group covers:

Stereo amplifiers or multi-channel amplifiers in the low frequency range.

Multi-band amplifiers in the high frequency range, wherein multiple outputs are present.

References relevant to classification in this group

This subclass/group does not cover:

Aerials, beam-forming means	H01Q 25/00, H01Q 3/40
Circuits for stereophonic arrangements	H04R 5/04

Informative references

Attention is drawn to the following places, which may be of interest for search:

Power amplifiers using a combination of several semiconductor amplifiers	H03F 3/211
Combinations of amplifiers using coupling networks with distributed constants	H03F 3/602
Low frequency amplifiers	H03F 3/181
Switching amplifiers	H03F 3/217

H03F 3/70

Charge amplifiers

Definition statement

This subclass/group covers:

Charge amplifiers, see the "Glossary of terms" section above.

References relevant to classification in this group

This subclass/group does not cover:

Charge pumps for DC/DC power converters	H02M 3/07
Charge pumps for automatic control of frequency or phase circuits	H03L 7/0891

Integrators using operational amplifier and capacitor and resistor in the feedback loop	G06G 7/186
Sense amplifiers	G11C 7/06
Measuring acceleration by piezo-electric pick-up	G01P 15/09

H03F 3/72

Gated amplifiers, i.e. amplifiers which are rendered operative or inoperative by means of a control signal

Definition statement

This subclass/group covers:

Amplifiers which are enabled or disabled by means of a control signal, e.g. via a controlled switch.

Informative references

Attention is drawn to the following places, which may be of interest for search:

Gain control in amplifiers	H03G 3/00

Electronic switching or gating	H03K 17/00

Special rules of classification within this group

Indexing Code deep-indexing classification

In addition to one or more classification symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to deep-indexing classification (H03F 2203/7203 - H03F 2203/7239), i.e. covering embodiment aspects, should be allocated for this subgroup.

H03F 5/00

Amplifiers with both discharge tubes and semiconductor devices as amplifying elements

H03F 7/00

Parametric amplifiers ([N: H03F19/00 takes precedence]; devices or arrangements for the parametric generation or amplification of light, infra-red or ultra-violet waves G02F1/39)

Definition statement

This subclass/group covers:

Parametric amplifiers, i.e., wherein a component parameter such as capacitance or inductance is varied to achieve amplification. .

H03F 7/02

using variable-inductance element; using variable-permeability element

Definition statement

This subclass/group covers:

Parametric amplifiers where inductance/permeability is varied to achieve amplification.

H03F 7/04

using variable-capacitance element; using variable-permittivity element

Definition statement

This subclass/group covers:

Parametric amplifiers where capacitance/permittivity is varied to achieve amplification.

H03F 9/00

Magnetic amplifiers

Definition statement

This subclass/group covers:

Amplifiers using saturable reactors as amplifying elements (aka mag-amps).

H03F 9/02

current-controlled, i.e. the load current flowing in both directions through a main coil

Definition statement

This subclass/group covers:

Magnetic amplifiers where an AC load current flows in a main coil, controlled by the current in a control coil.

H03F 9/04

voltage-controlled, i.e. the load current flowing in only one direction through a main coil, e.g. Logan circuits (H03F9/06 takes precedence)

Definition statement

This subclass/group covers:

Magnetic amplifiers where a load current flows in one direction in a main coil, and typically in the other direction in another main coil, controlled by the current in a control coil, e.g., a control coil in a center leg of a transformer controlling two main coils in two outer legs.

H03F 9/06

Control by voltage time integral, i.e. the load current flowing in only one direction through a main coil, whereby the main coil winding also can be used as a control winding, e.g. Ramey circuits

Definition statement

This subclass/group covers:

Magnetic amplifiers where the load current is auto-commutated by the main coil, the core being periodically reset by a control coil.

H03F 11/00

Dielectric amplifiers

Definition statement

This subclass/group covers:

Amplifiers using non-linear (hysteretic) dielectric elements to achieve amplification.

H03F 13/00

Amplifiers using amplifying element consisting of two mechanically- or acoustically-coupled transducers, e.g. telephone-microphone amplifier

Definition statement

This subclass/group covers:

Amplifiers with intermediate mechanical or acoustic energy transfer .

H03F 15/00

Amplifiers using galvano-magnetic effects not involving mechanical movement, e.g. using Hall effect

Definition statement

This subclass/group covers:

Amplifiers relying on galvano-magnetic effects, i.e., which arise when a conductor or semiconductor placed in a magnetic field carries current, such as the Hall-effect.

H03F 17/00

Amplifiers using electroluminescent element or photocell

Definition statement

This subclass/group covers:

Amplifiers relying on intermediate transformation into light to achieve amplification.

References relevant to classification in this group

This subclass/group does not cover:

Amplifiers controlled by light, e.g., for fiber optic links	H03F 3/08
Amplifiers with optical coupling between stages	H03F 3/085

H03F 19/00

Amplifiers using superconductivity effects

H03F 21/00

[N: Amplifiers not covered by groups H03F3/00 to H03F19/00 (dynamo-electric amplifiers H02K)]

Definition statement

This subclass/group covers:

Amplifiers not covered elsewhere, e.g., relying on radioactivity, or using esoteric semiconductor structures.