HEWLETT hp PACKARD

APPLICATION NOTE INDEX

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ABOUT THESE PUBLICATIONS

Listings in this Index cover the application publications of the many Hewlett-Packard laboratories. So that you know you have the latest available information, a date is included with each listing of revised application information; no date with a listing indicates there has been no revision.

Due to the specialized nature of these publications, they are distributed only upon request; they are available without charge at your nearby Hewlett-Packard Sales and Service Office (see back pages).

As information presented in individual application publications becomes common knowledge or is superseded by improved methods, publications may be discontinued.

For specific application information relating to measurement, your Hewlett-Packard Field Engineer is always happy to help; you will find him in the HP Sales and Service Office nearest you.

HEWLETT-PACKARD APPLICATION NOTES

AN 3

MEASUREMENT OF RF PULSE CARRIER FREQUENCY

The problem of accurately determining carrier frequency during short rf pulses is discussed. Several methods are presented, with typical data for making such measurements from UHF to X band. 7 pages.

AN 12

HOW A HELIX BACKWARD-WAVE TUBE WORKS

The backward-wave oscillator provides a flexible source of microwave energy that can be voltage-tuned over octave bandwidths. This Note discusses basics of the operation of the helical backward-wave tube. 4 pages. R: 18 June 59

AN 16

WAVES ON TRANSMISSION LINES

Wave equations are developed for the lossless transmission line. The effects of termination, reflection losses, and standing waves are discussed. An explanation of the Smith Chart as used for both lossless and lossy line calculations is included with an example of how to use the Chart. R: 15 Feb. 64

AN 17

SQUARE WAVE AND PULSE TESTING

A discussion of square-wave and pulse testing of linear systems. The transformation from the time-to-frequency-to-time domain is explained, and a table of selected Fourier and LaPlace Transforms is included. The response of linear systems to both impulse and square-wave excitation is discussed with particular emphasis placed on the physical significance of such responses. 15 pages.

AN 20

HEWLETT-PACKARD SIGNAL GENERATOR OUTPUT ATTENUATORS

A short discussion of the waveguide-beyond-cutoff type of attenuator. Since the geometry of this type of attenuator and probe frequency response determine its operation, the control of these two variables assures specified attenuator accuracy. 2 pages.
R: 1 June 65

AN 25

CATHODE RAY TUBE PHOSPHORS AND THE INTERNAL GRATICULE CATHODE RAY TUBE

A definitive analysis of different phosphors commonly used in CRTs: their advantages and application. Design features of Hewlett-Packard's Internal Graticule are covered, and the aluminizing process used for Hewlett-Packard CRTs is discussed. 5 pages.

AN 29

A CONVENIENT METHOD FOR MEASURING PHASE SHIFT

A method for reading phase shift directly with an oscilloscope is presented. Method uses the Hewlett-Packard Webb Mask available from Hewlett-Packard Sales and Service Offices. 2 pages

AN 36

SAMPLING OSCILLOGRAPHY

A comprehensive discussion of sampling oscillography including history of the technique, general sampling considerations (plotting points, sampling time limits, bandwidth, and a block diagram with related circuit explanation). 6 pages.

AN 48

APPLICATIONS OF THE HEWLETT-PACKARD MODEL 218A, A VERSATILE GENERAL-PURPOSE PULSE AND DELAY GENERATOR

Describes the uses of Model 218A as a general-purpose laboratory pulse generator. A 218A often can take the place of several special-purpose pulse generators when the appropriate plug-in unit is used. 12 pages.

AN 52

FREQUENCY AND TIME STANDARDS

Explains the principles of precision frequency and time standards, with emphasis on practical working methods of establishing and maintaining them. This up-to-date revision gives comprehensive coverage, including the new atomic resonance standards. Describes system operation, methods of precise frequency intercomparisons, time scales, world-wide F & T standards broadcasts. 100 pages.

AN 56

MICROWAVE MISMATCH ERROR ANALYSIS

Discusses the possible error in microwave power and attenuation measurements due to mismatch loss. Presents a method of determining the limits of these errors through the use of mismatch-loss charts. 12 pages. R: 12 Oct 65

AN 57

NOISE FIGURE PRIMER

Detection-system sensitivity depends upon noise present with the signal and noise contributed by the system. This Note defines Noise Figure, and illustrates its use in minimizing system-contributed noise. 8 pages.
R: 15 Jan 65

AN 58

THE PIN DIODE AS A MICROWAVE MODULATOR

The PIN diode is an absorption attenuator which permits high-speed, complex modulation of klystron and backward-wave sources with virtually no frequency pulling. This Note includes a brief description of the PIN diode, its operating characteristics as a function of frequency, bias, and temperature, and some of its many applications. 8 pages. R: 1 Sept 65

AN 59

LOOP GAIN MEASUREMENTS WITH HEWLETT-PACKARD WAVE ANALYZERS

Describes methods of measuring loop gain in negative-feedback circuits without breaking the loop. By using Hewlett-Packard wave analyzers and clip-on current probes, a once complicated procedure is made easy. 4 pages. R: 15 Jan 65

AN 60

WHICH AC VOLTMETER?

AC voltmeters are of three basic types: average-responding, peak-responding, and rms-responding. Although meters of all three types are commonly calibrated in rms values, and all three give accurate rms readings of sine waves within their respective frequency-range capabilities, their indications differ in response to non-sinusoidal waveforms. The reasons for the differences, possible compensations, and incompatibilities are explained in this Note. Most economical choices for various services. 14 pages.

AN 62

TIME DOMAIN REFLECTOMETRY

Describes an extremely useful transmission line measuring technique that 1) simultaneously displays the transmission quality of a system for frequencies from dc to a few gigacycles, and 2) isolates each discontinuity in a system so that it can be individually compensated on a broadband basis. This Note also describes how Time Domain Reflectometry can be used to measure such cable parameters as characteristic impedance, Z_0 (either its absolute value or its uniformity with distance), loss (either series or shunt), and length. The Note includes basic principles of the technique as well as accuracy considerations. 17 pages.

AN 63

SPECTRUM ANALYSIS

Briefly introduces and reviews general principles of spectrum analysis, as well as discussing some of the major design considerations of a microwave spectrum analyzer. Covers new applications (RFI measurements, spectrum signatures, and multiplier chain alignment, for example), as well as more conventional measurements (pulse analysis, modulation characteristics, etc.). Specific, well-illustrated applications demonstrate the usefulness and convenience of making otherwise difficult measurements with the HP Spectrum Analyzer. 41 pages

AN 63A

MORE ON SPECTRUM ANALYSIS

This note supplements AN63 and contains detailed descriptions of new measurement techniques made possible with the development of the HP Spectrum Analyzer. A sampling of the topics covered includes:

Achieving high sensitivity through proper use of low-noise preamps

FM deviation measurements and klystron linearity tests

Spectrum analysis of microwave semiconductor phenomena

Making fast, accurate RFI measurements

Proper use of preselection filters to obtain spectrum signatures

Calibrating a wide range, swept receiver

Analyzing selected RF pulses in a pulse train

Improving X-Y recording of RF pulses. 31 pages.
R: Aug 67

AN 63B

THE 8441A PRESELECTOR: ADVANCEMENT IN THE ART OF SPECTRUM ANALYSIS

Discusses how to use the 8441A Preselector to restrict Analyzer responses to the band of interest. Includes explanation of Analyzer multiple responses. Also discusses how to use the 8441A to reduce harmonic content in the output of a sweep oscillator, and how the 8441A can be used as a simple spectrum analyzer of the tuned radio-frequency type. 8 pages.

AN 63C

MEASUREMENT OF WHITE NOISE POWER DENSITY WITH THE H10-851B/8551B SPECTRUM ANALYZER

Describes a new application for the spectrum analyzer, including a discussion of analyzer theory affecting the measurement and the routine procedure for operating the equipment to assist with setting up and easily making accurate measurements. 6 pages.

AN 63D

FREQUENCY CALIBRATING THE 851/8551 SPECTRUM ANALYZER WITH THE 8406A FREQUENCY COMB GENERATOR

Describes expansion of spectrum analyzer capability through accurate frequency calibration. Frequency accuracy is 0.01% through 5 GHz and slightly less through 40 GHz. Theory, set-up procedures, and examples are included. 10 pages.

AN 64

MICROWAVE POWER MEASUREMENTS

This comprehensive Note covers virtually all phases of microwave power measurement. The various types of power-measuring devices are described, including principles of operation, techniques of measurement, interpretation of results, and accuracy considerations. Evaluation of measurement errors is extensively treated, with particular emphasis on topics like power standards and traceability, calibration factor, effective efficiency, mismatch loss, etc. Practical suggestions for minimizing measurement uncertainties are presented. 69 pages.

AN 65

SWEPT FREQUENCY TECHNIQUES

Swept-frequency measurements have become one of the most useful tools available to the microwave engineer. Practically all important microwave parameters, including impedance (that is, SWR or reflection coefficient), attenuation, power, and frequency -- can be examined quickly and accurately over broad frequency ranges utilizing swept measurement techniques. This Note describes the newest methods for making these measurements, and includes numerous illustrations and examples.

The techniques are approached on a "systems" basis with each of the factors affecting system accuracy discussed. Special attention is paid to "closed-loop leveled" sweep oscillators, which permit new flexibility in selection of the detection and readout portion of the swept system. 41 pages.

AN 67

CABLE TESTING WITH TIME DOMAIN REFLECTOMETRY

A summary of cable-testing techniques using TDR. Discusses ways of simplifying cable measurements when multiple reflections or spurious signals are present. Includes a slide rule for quick measurements of distance and impedance. 20 pages.

AN 68

ACCURATE RECEIVER SENSITIVITY MEASUREMENTS

This brief Note describes a simple but accurate technique for measuring receiver sensitivity. A signal generator or source, power meter with thermistor mount, and directional coupler are used in a manner which greatly reduces the measurement uncertainties often encountered in receiver measurements. 2 pages.

AN 69

WHICH DC VOLTMETER?

Appropriate selection of DC voltage measurement equipment involves an understanding of its capabilities and performance. Several types of versatile, modern voltmeters are reviewed here, with an entire chapter devoted to a specifying guide. Another chapter is given to analysis of the measurement situation as a means of avoiding costly errors in instrument selection. Universally accepted definitions and standards, basic to all voltage measurement, are derived and explained in the closing chapter. AN69 is probably one of the most authoritative pieces ever published on the subject of voltmeters. 40 pages.

AN 70

PRECISION DC VOLTAGE MEASUREMENTS

Although the standards laboratory environment is still the ideal for precision DC measurements, several recently-designed Hewlett-Packard instruments provide much of the standards lab precision in a wide range of situations. No longer is it necessary to use specialized personnel under exacting environmental conditions in order to get precise DC calibration measurements. AN70 gives step-by-step procedures for obtaining transfer and calibration measurements of unusual accuracy. 8 pages.

AN 71

ADVANCES IN RF MEASUREMENTS USING MODERN SIGNAL GENERATORS, 50 kHz-480 MHz

Describes how the 8708A Synchronizer phase-locks the 606B (50KHz-65MHz) and 608F (10MHz-455MHz) generators at any frequency -- with frequency stability of 2 parts in 10^7 per 10 minutes. Shows how speed and accuracy can be improved by the automatic amplitude leveling features of the 606B, 608F. Also discusses many of the uses for signals of high stability. 22 pages.

AN 72

INTEGRAL COUNTING

Describes gamma ray counting of the integral type, where all pulses above a preset minimum level are counted. Presents plateau curves for Hewlett-Packard scintillation detectors. 4 pages. R: Apr 67

AN 73

CALIBRATION OF A GAMMA RAY SPECTROMETER

Presents step-by-step procedures for the calibration of a single-channel gamma ray spectrometer, including details specific to the Hewlett-Packard scaler-timer, spectrum scanner, high-voltage power supply, and scintillation detectors. Describes the functions essential to a gamma ray spectrometer. 30 pages.
R: July 67

AN 75

SELECTED ARTICLES ON TIME DOMAIN REFLECTOMETRY APPLICATIONS

Includes 1) Time Domain Reflectometery - Theory and Applications, 2) Transmission Line Pulse Reflectometry, 3) Mechanical Scaling Enhances Time Domain Reflectometry Use, 4) Some Uses of Time Domain Reflectometry in the Design of Broadband UHF Components, 5) Thermocouple Fault Location by Time Domain Reflectometry. 44 pages.

AN 76

USING THE 230A POWER AMPLIFIER

Describes the many ways to use the 230A, a tuned RF power amplifier. Includes techniques for testing receivers for overload characteristics, cross modulation, adjacent channel desensitization. How to use the Amplifier for attenuation measurements, frequency multiplication, antenna testing, and in RFI testing. Discusses how the low noise of the 230A makes it useful as a tuned preamplifier for counters, voltmeters, and other low-level uses. 11 pages.

AN 77-1

TRANSISTOR PARAMETER MEASUREMENTS

Details techniques for using the 8405A Vector Voltmeter for measuring "s" (scattering) parameters of transistors above 100 MHz where h and y parameters are difficult to measure. Describes measurement systems and use of "s" parameters in design. Includes an appendix equating "s" parameters to h, y, and z parameters. 12 pages.

AN 77-2

PRECISION FREQUENCY COMPARISON

Discusses how to use the 8405A Vector Voltmeter for the precise measurement of frequency drift between two equal frequencies. Includes setups and step-by-step instructions for making high-resolution frequency comparisons with quartz oscillator and atomic beam frequency standards. 9 pages.

AN 77-3

COMPLEX IMPEDANCE MEASUREMENTS

Presents techniques for accurate determination of the magnitude and phase angle of impedance through use of the HP 8405A Vector Voltmeter. One of the techniques discussed involves use of precision wide-band, high-directivity directional couplers to measure reflection coefficient. Another method employs an accurate power splitter and precise terminations. Practical measurement examples are offered and accuracy considerations are discussed. 11 pages

AN 78-1

CALIBRATING THE QUARTZ THERMOMETER

Describes 1) the factory calibration procedure which establishes accuracy specifications traceable to the National Bureau of Standards, 2) the field calibration required to maintain the thermometer within its original specs, and 3) special calibration techniques which can be used to secure maximum accuracy under restricted measurement conditions. 7 pages.

AN 78-2

MOLECULAR WEIGHT DETERMINATION WITH THE QUARTZ THERMOMETER

The freezing point of a solvent is lowered and the boiling point elevated by a predictable amount by the addition of a nonvolatile non-ionizable solute which does not react with the solvent. Appropriate data obtained from the change in a solvent's boiling and freezing points can be used to determine the purity of a solvent or to measure the molecular weight of some substances. Prior to the advent of the Quartz Thermometer, use of this technique was extremely time-consuming. AN 78-2 discusses how to use the Quartz Thermometer for such measurements, and provides pertinent data such as molal elevation and depression constants for some solvents. 4 pages.

AN 78-3

CALORIMETRY AND THE QUARTZ THERMOMETER

Discusses the broad area of calorimetry. Pages 1-4 provide a general introduction to types of calorimeters, plus a brief review of the various kinds of thermometers used in calorimetric measurements. Pages 5, 6 describe the important characteristics of the Quartz Thermometer. The typical calorimetric determination described, starting on page 7, clearly illustrates just how well suited the Quartz Thermometer is to this type of work. 11 pages.

AN 79

STATISTICAL COMPARISON OF A DIGITAL SYSTEM AND A RATEMETER FOR NUCLEAR MEASUREMENTS

Compares the response from a scaler-timer combined with a digital-to-analog converter with that of an analog ratemeter and shows statistically that the digital system offers significantly improved accuracy for most measurements. Includes graphs for the two approaches to indicate the relationship accuracy bears to count rate, to rate of change of count rate, and to measurement interval or time constant. 6 pages.

AN 81

LOW FREQUENCY PHASE SHIFT MEASUREMENT TECHNIQUES

Describes techniques for measuring signal phase shift at low frequencies (to less than .01 Hz), in servo systems and other low-frequency devices, with the HP Model 203A Variable Phase Function Generator. Also described are methods for deriving multiple-phase outputs, for hysteresis curve plotting, and for calibrating the continuously-variable phase-shift control of the Model 203A. 11 pages.

AN 82

POWER SUPPLY/AMPLIFIER CONCEPTS AND MODES OF OPERATION

Describes the basic circuit configuration, lists salient features, indicates some of the many applications, and illustrates in detail the rear terminal strapping pattern and associated circuit configuration for many possible operating modes. 23 pages.

AN 83

INCREASED OUTPUT RESISTANCE FOR DC REGULATED POWER SUPPLIES

Describes a method for increasing the output resistance of a well-regulated constant-voltage power supply in a predictable and controlled fashion. 3 pages.

AN 84

SWEPT SWR MEASUREMENT IN COAX

Describes a technique for making slotted line SWR measurements, quickly and accurately, from 1.8 to 18.0 GHz with swept-frequency techniques. SWR over wide frequency ranges is observed on a variable persistence oscilloscope for instantaneous display or recorded on a time-exposed photograph taken on a conventional oscilloscope. Accuracy is inherently that of the residual SWR of the slotted line. Setups and equipment to make the measurements are fully described. 7 pages. 1 Feb 67

AN 85

USING A REVERSIBLE COUNTER

Surveys wide range of measurement and control situations in which a reversible counter is useful, and provides diagrams for most of the applications discussed. The Note also discusses capabilities of the reversible counter, its input requirements, and characteristics required of associated equipments such as transducers, recorders, scanners, and devices for transmitting data to a data acquisition system or indicating instrument. 39 pages.

AN 86

USING THE VECTOR IMPEDANCE METERS

Useful information on making impedance measurements with the 4800A and 4815A Vector Impedance Meters (5Hz-108MHz). Includes a Vector Impedance Calculator and information on evaluation of components, transmission line measurements, transformer measurements, measurements on devices biased with dc, measurements in the presence of noise or external ac, in-circuit measurements, plotting of impedance on an X-Y recorder, general data on impedance and Q, transmission line equations, how to use the Calculator. 30 pages.

AN 87

FM AND PM MEASUREMENTS

Discusses utilization of Discriminator feature of 5210A Frequency Meter/PM Discriminator. Following frequency-modulation and phase-modulation measurements are covered: direct FM, down-converted FM, measurement of small deviations, flutter measurements, incidental FM on Signal Generators, FM microwave demodulation, swept-frequency measurements, phase-modulation measurements, signal bursts and chirped pulses. 17 pages.

AN 88

LOGIC SYMBOLOGY

Describes in detail the system of logic circuit representation used by Hewlett-Packard. At the present time no single system is used by all manufacturers of digital equipment. The HP system is based on MIL-STD-806B, adapted to gain advantages in versatility, clarity, coverage, and simplicity. AN 88 includes a comparison of the HP system and that set forth in MIL-STD-806B. 30 pages.

AN 89

MAGNETIC TAPE RECORDING HANDBOOK

The purpose of this handbook is to give those people concerned with operation and maintenance of analog tape recorders a better understanding of the theories and techniques of magnetic recording. Practical considerations are offered relating to the application and limitations of the Direct and FM recording processes.

AN 90

DC POWER SUPPLY HANDBOOK

A basic reference book for any power supply user. It contains details on specifications, circuit principles, operating features, performance measurements, and special applications. 48 pages.

AN 91

HOW VECTOR MEASUREMENTS EXPAND DESIGN CAPABILITIES - 1 to 1,000 MHz

Many voltage, or amplitude, ratio measurements are in reality vector quantities. That is, they have both magnitude and phase angle associated with the measurments. These vector measurements can speed up engineering design efforts by providing useful phase information that is normally inconvenient to measure. This note will describe just a few of the many ways to effectively use a vector voltmeter that operates over a 1 to 1,000 MHz frequency band. Among the subjects covered in this note are:

1) Measuring the phase and gain margins of amplifiers.
2) Transmission line electrical length measurements.
3) Matching the electrical length of cables very accurately.
4) Measuring group delay or phase nonlinearities.
5) Determining resonant frequencies with high resolution.
6) Using the vector voltmeter as an automatically tuned selective analyzer.
7) Making amplitude molulation measurements easily from 1 to 1,1000 MHz with the vector voltmeter.

AN 101

MULTIPLICATION AND DIVISION BY LOGARITHMS

Describes the use of Moseley Logarithmic Converters as computing elements. Used in pairs with suitable readout devices, such as a Moseley X-Y Recorder, multiplication or division of two independent voltages may be accomplished. Any readout may be used provided the total load resistance corresponds to the values established in the suggested circuits. 4 pages.

AN 102

PROGRAM CONTROLLERS

Presents an interesting method of directing a process or machine via analog programming. Programs are simply drawn on a paper chart, up to 120 feet long. The Moseley Type F-3 Optical Line Follower is fitted in place of the pen on a Moseley X-Y Recorder equipped with chart drive, and Line Follower output directs the process. 4 pages.

AN 105

POLAROGRAPHY

Chemical analysis frequently requires the determination of the metallic ions present in a given solution as well as their chemical properties in the particular solution. This is readily accomplished for many systems by polarography. The Note describes the development of an improved Polarograph utilizing specially modified Moseley X-Y Recorder. 4 pages.

AN 106

ELECTRIC MOTOR PERFORMANCE TESTING

Describes how torque-speed and current-speed of single-phase and polyphase induction motors may be accurately measured and recorded with the rapidity required on a production line. Motors with ratings from fractional to several hundred horsepower can be tested easily by use of a DC tachometer generator, torque adapter, and a Moseley X-Y Recorder. 4 pages.

AN 107

GUARD CIRCUITS

This paper discusses three methods of rejecting common mode voltages frequently originating out of electrostatic and electromagnetic coupling in X-Y recorders. Unless these unwanted common mode voltages are rejected, the high accuracy capabilities of the instrument are of little value. 4 pages.

AN 108

HYSTERESIS CURVE PLOTTING

Discusses how the Moseley 101 Waveform Translator is used to transform high-frequency waveforms to frequencies low enough for an X-Y recorder. Includes several setups using the 101 Waveform Translator. Explains the plotting of permanent records of hysteresis curves obtained from various oscilloscopes. Four methods of obtaining an external trigger are described and advantages of each discussed. Electrical modifications to the oscilloscope and waveform translator for different modes of operation are also described. 7 pages.

AN 904

THE PIN DIODE

The PIN diode is essentially a high-frequency resistance element whose resistance value can be varied by a dc or low-frequency bias signal. This Note describes the important characteristics of the PIN diode and the relationship of these characteristics to its use as a high-frequency switching or attenuating element. Typical application circuits are presented, including 1) a broadband and narrow-band switch using either shunt or series-mounted diodes, 2) a voltage-controlled frequency-shift filter, and 3) a voltage-variable attenuator. 16 pages.

AN 907

THE HOT CARRIER DIODE: THEORY, DESIGN AND APPLICATION.

The Hot Carrier of Schottky barrier diode is virtually an ideal ultra-high-frequency switching device. This Note contains an up-to-date discussion of the physics of its operation, and describes its electrical and physical characteristics. Comparison is made to the PN-junction and point-contact diodes. Various important relationships are developed between the diode intrinsic electrical and noise characteristics and its performance as a high-frequency mixer or detector.

These relationships permit a relatively easy assessment of the expected performance of these diodes in a variety of mixer and detector circuits. A number of graphs are presented which simplify the optimization of these diodes in mixer and detector circuits with respect to sensitivity, optimum bias, impedance, operating frequency, and bandwidth. 14 pages.
R: 15 May 67

AN 909

ELECTRICAL ISOLATION USING THE HPA 4310

In the HPA 4310 Photon Coupled Isolator, a gallium arsenide electroluminescent diode is optically coupled to a silicone photodiode but electrically decoupled. Electrical isolation using this technique is described. The Note also gives the equivalent circuit of the device along with suggested applications and their typical circuits. 4 pages.

AN 910

OPTOELECTRONIC COUPLING FOR CODING, MULTIPLEXING, AND CHANNEL SWITCHING

The stream of photons from a gallium arsenide electroluminescent diode carries enough energy to a silicon photodiode to enable operation of isolated electronic switches. Isolated switching, as with a relay, is thus possible and the Note gives design principles and typical circuits using the HPA 4310 Photon Coupled Isolator. 2 pages.

AN 911

LOW LEVEL DC OPERATION USING HPA PHOTOCHOPPERS.

Threshold performance of chopper amplifiers can be extended to lower signal levels by using photochoppers. A brief discussion is given of the photochopper amplifier technique, showing various arrangements for applying negative feedback. Suggested circuits for driving the neon lamps are also described. 5 pages.

AN 912

AN ATTENUATOR DESIGN USING PIN DIODES

This Note discusses the use of PIN diodes as variable RF resistance elements controlled by dc bias. Through the use of this mechanism a constant impedance R-type attenuator network is developed. Control of attenuation from 1 to 20 dB is obtained through a variable dc bias. A wide frequency range of 10 MHz to 1 GHz in a single design is shown practical. Various curves of attenuation, VSWR, and harmonic distortion with respect to dc bias and RF power level are shown. 4 pages.

AN 913

STEP RECOVERY DIODE FREQUENCY MULTIPLIER DESIGN

Energy at one frequency can be converted to energy at a higher frequency by utilizing the properties of an impulse. The production of an impulse requires a very fast and properly-timed switch. The Step Recovery Diode is such a switch. AN 913 discusses the considerations involved in and circuits for using the Step Recovery Diode in harmonic generators and frequency comb generators. 24 pages.

AN 914

BIASING AND DRIVING CONSIDERATIONS FOR PIN DIODE RF SWITCHES AND MODULATORS

Discusses application of PIN diodes as RF switches and modulators from the standpoint of the video driving waveforms required and the means available to generate these waveforms. Emphasis is given to methods of achieving very fast switching speeds or high modulation frequencies. Includes 1) charge storage behavior of PIN diodes, 2) drive waveform requirements, 3) suggested forms of drive circuits (but not specific designs), 4) pulse leakage into the RF system, 5) testing and measurement methods and precautions for high-speed switches, and 6) speed measurements taken on a typical HPA 3504 switch under varying drive and RF conditions. 23 pages.

AN 915

THRESHOLD DETECTION AND DEMODULATION OF VISIBLE AND INFRARED RADIATION WITH PIN PHOTODIODES

Solid-state photodetectors, particularly PIN photodiodes, are compared for threshold signal applications with the more traditional multiplier phototubes. Relative functional merits are presented, and a family of spectral sensitivity curves for various types of photodetectors is given. Terminal circuit design principles and realizations are described. 5 pages.

AN 916

HPA GaAs SOURCES

HPA Gallium Arsenide EL (electroluminescent) diodes radiate in a narrow band at a wavelength of 9000 Å° when forward biased. When properly utilized, the radiation from the EL diode can be switched on and off in less than 100 nanoseconds. AN 916 discusses how the characteristics of this EL diode may be applied to optical circuits and describes design principles for obtaining optimum performance. 2 pages.

AN 917

HPA PIN PHOTODIODE

HPA silicon planar PIN photodiodes are ultrafast detectors of visible and near infrared radiation. The

low dark current of the planar diodes enables detection of very low radiation levels. AN 917 discusses how the characteristics of the HPA silicon planar photodiode apply in optical circuits and explains design principles for obtaining optimum performance. 2 pages.

AN 13510A-2

MEASURING TRANSISTOR Y PARAMETERS

Discusses how to use the 13510A Transistor Test Jig with the 250A RX Meter to measure Y parameters. Includes examples of measurements and correction calculations. 4 pages.

ANC 1-67

CLARIFICATION OF SOLUTIONS FOR LIGHT SCATTERING

Removal of all suspended insoluble material, including dust and gel particles, from light scattering solutions is extremely important, and no efforts to improve clarity are wasted. This Note discusses methods for removing insoluble particles, with considerable detail on various types of filters. Includes tables of chemical compatibility and resistance for membrane filters. 7 pages.

TL 2

CONSTANT VOLTAGE/CONSTANT CURRENT REGULATED POWER SUPPLIES

Covers the characteristics of both constant-voltage and constant-current regulated dc power supplies. Traces the evolution of these supplies, and presents specific application information on automatically charging and discharging batteries. 17 pages.

TL 4

MEASUREMENT OF OUTPUT IMPEDANCE OF A CONSTANT -VOLTAGE POWER SUPPLY

Load devices often draw varying amounts of current from a dc supply, so that the output consists of an ac component superimposed on the dc output. This tech letter shows how to determine the output impedance of a constant-voltage dc power supply over a wide band of ac-component frequencies, and illustrates how constant the output voltage can remain in spite of load current variations. 6 pages.

TL 5

METHOD OF ACHIEVING CONSTANT-CURRENT OPERATION UTILIZING A CONSTANT-VOLTAGE POWER SUPPLY

Describes the simple conversion of 16 different H-Lab dc power supplies from constant-voltage to constant-current operation by adding only one external monitoring resistor. 4 pages.

TL 7

NOTES ON DC POWER-SUPPLY ISOLATION MEASUREMENT

When considering a given power supply for use in a floating dc application, the isolation properties of the supply must be understood. Leakage components defining these properties include: shunt capacitance, leakage resistance, and noise current between supply output and ground; ac input to dc output capacitance; and breakdown voltage to ground. Tech Letter 7 contains an analysis of these leakage components and suggests ways to measure them. 8 pages.

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NUMERICAL INDEX (continued)

SUBJECT INDEX

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SUBJECT INDEX (continued)

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