

La scheda in origine svolge la funzione di amplificatore IF e demodulatore in un ponte radio a microonde per impieghi professionali. Le funzioni primarie sono: amplificatore di prima IF, seconda conversione, OL, demodulatore IF con uscita in banda base e misuratore di campo RSSI. Questo prodotto è stato costruito con tutte le "tecniche" necessarie per quando si opera a frequenze oltre il GHz, ad esempio gli stadi di amplificazione, filtri e VCO sono separati in tre distinti schermi metallici (facilmente dissaldabili), la maggior parte delle induttanze è della serie AVX AccuL ad alto Q, il circuito stampato è a 4 strati di rame, l'utilizzo di componenti in case ceramico, ecc...

A bordo sono presenti molti componenti elettronici per RF di alta qualità, costruiti dalle più famose case del settore, si stima un valore di circa 170 euro dei soli componenti.

Questa scheda viene venduta con lo scopo del recupero dei componenti, ma i tecnici elettronici più esperti ed attenti riusciranno a "riciclare" il prodotto in base alle proprie esigenze od anche a riutilizzarlo per applicazioni che ne ricalcano la filosofia di progetto. Grazie allo schema elettrico fornito, è possibile comprendere meglio le caratteristiche del circuito.

Per il funzionamento sono necessarie due tensioni di alimentazione +12V, -12V riferite a massa.

This board originally was used as last conversion in a professional microwave radio link. Its main functions are: first IF amplifier, second IF conversion, LO, demodulator with base-band output and RSSI field strength indicator. This product was built with all the necessary "techniques" when operating at frequencies beyond 1 GHz, such as amplifier stages, filters and VCOs are separated into three distinct metal covers (easy to desolder them), most of inductors are high Q AccuL AVX Series, the PCB has 4 copper layers, the use of many components with ceramic case, etc...

There are many high quality RF electronic components on board made from the most famous brands, it is estimated a value of about 170 euros for components only.

This board is sold with the purpose to recover the components, but the most experienced electronic technicians will be able to "recycle" the product to suit their needs or even to reuse it for applications conform to the design philosophy. Thanks to the supplied electric diagram, you can better understand the characteristics of the circuit.

For operation purposes it has to supply two voltages +12V and -12V to ground.

L'ingresso è centrato sulla frequenza di 1880 MHz, dove è presente uno stadio amplificatore con transistor Agilent AT42035 in case ceramico e due filtri gigafil passa-banda in ingresso ed uscita. Segue un doppio attenuatore con diodi PIN Agilent HSMP-3814, il segnale entra poi nel mixer Mini-Circuits RMS-11X, da cui esce convertito a 70MHz. L'oscillatore locale è un oscillatore a DR con transistor Infineon BFP183 a basso rumore, controllato da un PLL Fujitsu MB1502 e prescaler NEC UPB1508. La frequenza di riferimento per il PLL è generata da un VCXO a 8.192 MHz. I tre segnali della porta seriale del PLL MB1502 sono disponibili sui connettori, per essere gestiti da un sistema a microcontrollore esterno.

Il segnale IF a 70 MHz viene amplificato da un altro transistor Agilent AT42035, per poi passare in un filtro SAW a 70 MHz di tipo professionale con ritardo di gruppo costante e banda passante di 2,5 MHz a -3dB con fronti ripidi (vedi datasheet allegato).

L'amplificazione IF e demodulazione del segnale è affidata a due circuiti integrati Motorola MC13155D configurati in cascata, come da application circuit che Motorola suggerisce.

La principale caratteristica di questa configurazione è quella di garantire un elevato guadagno di amplificazione IF, inoltre l'uscita RSSI che fornisce una tensione proporzionale all'intensità del segnale ricevuto risulta essere a range esteso di ben 70dB.

Il segnale RSSI opportunamente amplificato e filtrato viene anche impiegato per pilotare l'attenuatore a diodi PIN presente prima del mixer, così facendo si ottiene un anello con controllo di AGC molto efficace.

L'integrato MC13155, ha una larghezza di banda video e demodulatore banda/base fino a 12MHz e può funzionare con frequenza in ingresso fino a 300MHz.

L'uscita demodolata viene amplificata da due amplificatori connessi in cascata, si tratta dell'Analog Device AD817 ad elevate prestazioni, fra i due stadi è interposto un filtro L-C.

Sulla scheda sono anche presenti i circuiti integrati stabilizzatori di tensione per generare le varie tensioni necessarie al funzionamento del circuito.

The input is centered on the frequency of 1880 MHz, where there is an amplifier stage with Agilent AT42035 transistor with ceramic case and two band-pass gigafil filters at the input and output.

It follows a double attenuator with Agilent HSMP-3814 PIN diodes, the signal then enters in the Mini-Circuits RMS-11X mixer and the output is converted to 70MHz.

The LO is a DR oscillator with Infineon BFP183 low noise transistor, it is controlled by a Fujitsu MB1502 PLL and a NEC UPB1508 prescaler. The reference frequency for PLL is generated by a VCXO at 8,192MHz. The three signals of the serial port of the PLL MB1502 are available on the connectors to be managed from an external microcontroller system.

The 70 MHz IF signal is amplified by another Agilent AT42035 transistor and then it passes through a professional 70 MHz SAW filter with constant group delay and 2.5 MHz 3dB bandwidth with high selectivity (see attached datasheet).

The IF amplification and the signal demodulation are performed by two Motorola MC13155D ICs in cascade, as suggested by a Motorola application circuit.

The main feature of this configuration is to ensure a high gain in IF amplification, moreover the RSSI output that provides a voltage proportional to the received signal strength appears to have an extended range of 70dB.

The amplified and filtered RSSI signal is also used to drive the PIN diodes attenuator before the mixer, by doing so you get a ring with a very effective AGC control.

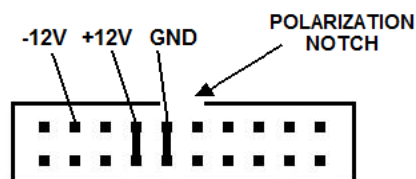
The MC13155 IC has a video bandwidth and base-band demodulator up to 12MHz of bandwidth and it can operate with an input frequency up to 300MHz. The demodulated output is amplified by two amplifiers in cascade, they are the high performance Analog Devices AD817, between the two stages there is also an L-C filter.

On the board there are also the voltage regulator ICs, they generate the required voltages for the circuit.

Collegamento delle alimentazioni al connettore 20 poli:

20 PINS CONNECTOR ON COMPONENTS SIDE

TOP VIEW



Power supply connections to the 20 pins connector:

Componenti interessanti presenti sulla scheda:

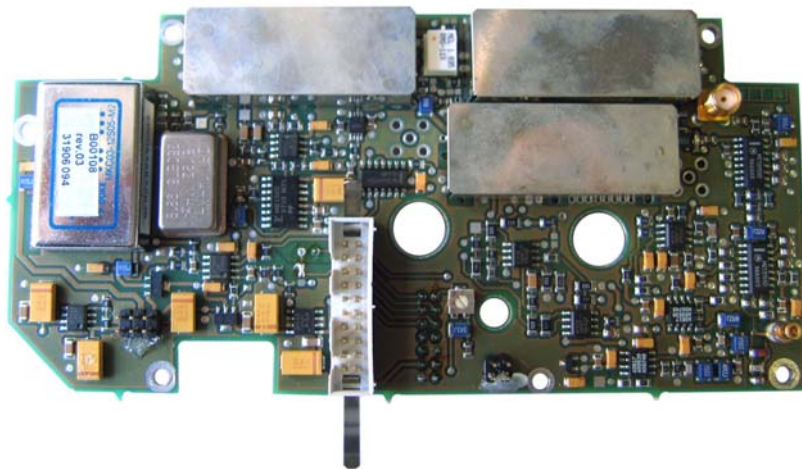
- Risuonatore coassiale
- N° 2 transistor Agilent AT42035
- N° 2 transistor Infineon BFP183
- MMIC Agilent MSA0686 / MAR6
- N° 2 diodi pin Agilent HSMP3814
- Mixer Minicircuits RMS-11X
- Filtro SAW a 70 MHz professionale SAWTEK con ritardo di gruppo costante tipo 851547 (vedi datasheet)
- PLL Fujitsu MB1502
- Prescaler Nec UPB1508
- N° 2 amplificatori IF /demodulatori Motorola MC13155D
- N° 2 amplificatori operazionali Analog Device AD817AR
- Oscillatore VCXO 8.192MHz
- N° 2 Gigafil 1880MHz Murata
- Gigatrimmer 0,5 - 8 pF
- Alimentatore DC/DC converter ingresso 9-18V, uscita +5V 500mA
- Induttanze alto Q
- Ecc...

Interesting components on the board:

- Coaxial resonator
- 2x Agilent AT42035 transistors
- 2x Infineon BFP183 transistors
- Agilent MSA0686 / MAR6 MMIC
- 2x Agilent HSMP3814 pin diodes
- Minicircuits RMS-11X mixer
- 70 MHz Professional SAWTEK SAW filter type 851547 with constant group delay (see datasheet)
- Fujitsu MB1502 PLL
- Nec UPB1508 prescaler
- 2x Motorola MC13155D IF amplifiers/demodulators
- 2x Analog Device AD817AR operational amplifiers
- 8.192MHz VCXO oscillator
- 2x 1880MHz Murata Gigafil filters
- 0,5 - 8 pF Gigatrimmer
- DC/DC converter power supplier, 9-18V input, +5V output, 500mA
- High Q inductors
- Etc...

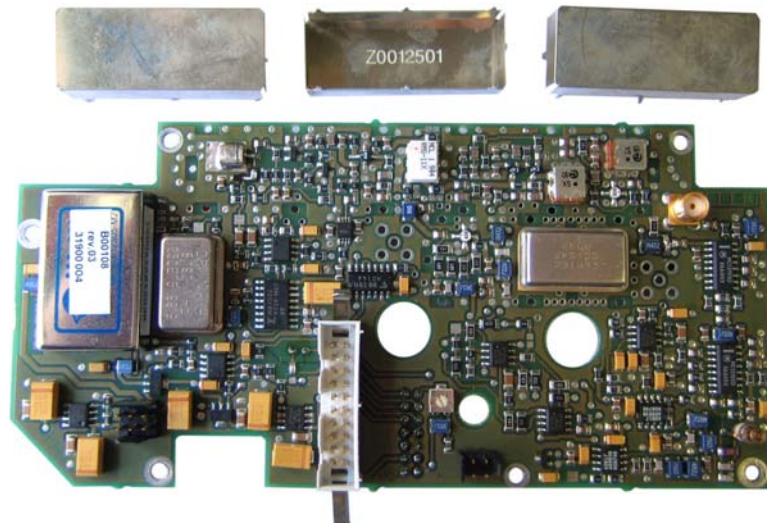
Fotografia della scheda come verrà fornita, è completa dei tre schermi metallici e sono presenti 6 fori metallizzati per il fissaggio a telaio con viti M3

Picture of the board as provided, it has 3 metallic covers and there are 6 metallized holes for chassis mounting with M3 screws



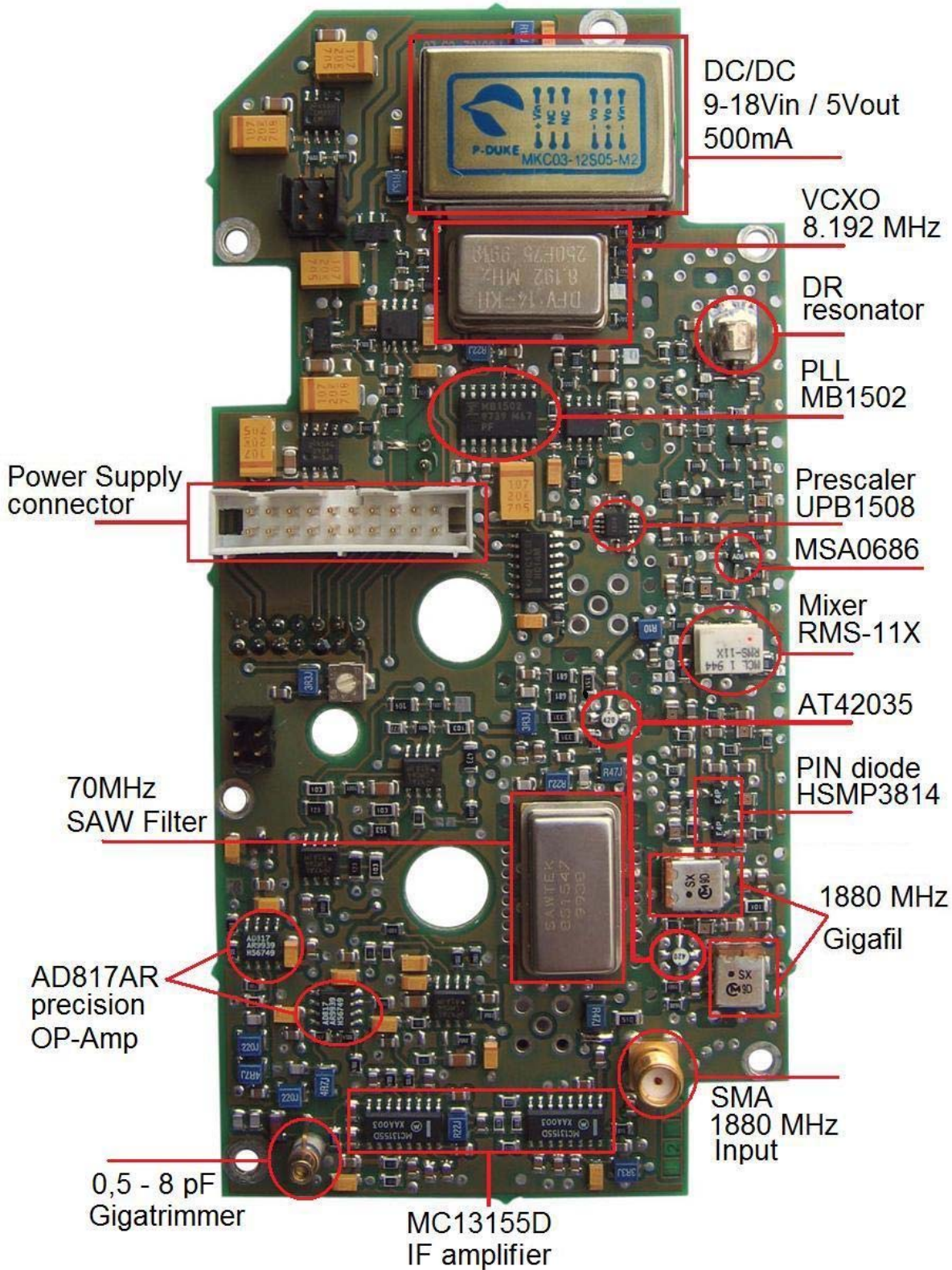
Fotografia con gli schermi metallici rimossi

Picture of the 3 metallic covers removed



Fotografia con componenti evidenziati

Picture with highlighted components



2Mbit high performances filter



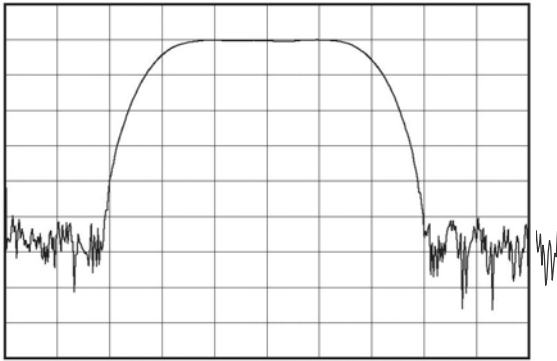
70 MHz Bandpass Filter

2.5 MHz Bandwidth

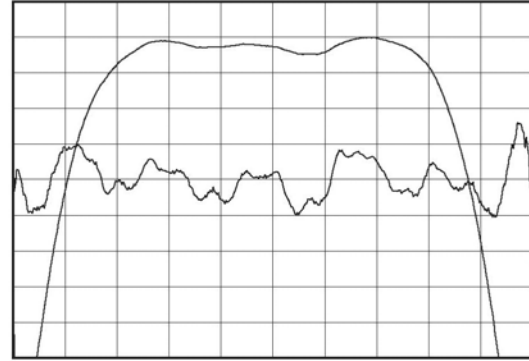
Part Number 851547

Data Sheet

Typical Performance



Horizontal: 700 kHz/Div
Vertical: 10 dB/Div

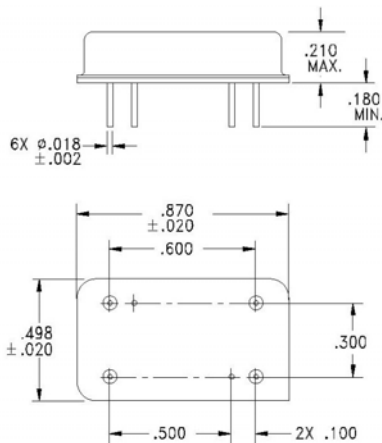


Horizontal: 350 kHz/Div
Vertical: 1 dB/Div
Vertical: 30 nsec/Div

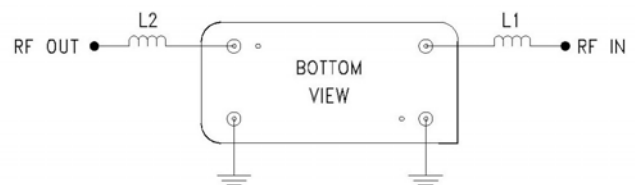
Specifications

Parameter	Unit	Minimum	Typical	Maximum
Center Frequency	MHz	69.92	70	70.08
Insertion Loss at f_o	dB	-	25.2	27
1 dB Bandwidth	MHz	2.1	2.25	-
3 dB Bandwidth	MHz	2.5	2.6	-
40 dB Bandwidth	MHz	-	4.12	4.4
Passband Variation	dB	-	0.28	0.7
Phase Linearity	deg	-	2	4
Group Delay Variation	nsec	-	45	100
Absolute Delay	nsec	-	2.3	-
Ultimate Rejection	dB	50	60	-
Substrate Material	-	-	Quartz	-
Ambient Temperature	°C	-	25	-

Package Outline



Matching Configuration



L1 = 580nH, L2 = 490nH

Nominal Values Measured at 70 MHz

Nominal Source/Load Impedance = 50Ω

Package Style I

11/17/99

Wideband IF amplifier, demodulator and RSSI



Order this document by MC13155/D

MC13055

The MC13155 is a complete wideband FM detector designed for satellite TV and other wideband data and analog FM applications. This device may be cascaded for higher IF gain and extended Receive Signal Strength Indicator (RSSI) range.

- 12 MHz Video/Baseband Demodulator
- Ideal for Wideband Data and Analog FM Systems
- Limiter Output for Cascade Operation
- Low Drain Current: 7.0 mA
- Low Supply Voltage: 3.0 to 6.0 V
- Operates to 300 MHz

WIDEBAND FM IF

SEMICONDUCTOR TECHNICAL DATA

MAXIMUM RATINGS

Rating	Pin	Symbol	Value	Unit
Power Supply Voltage	11, 14	V_{EE} (max)	6.5	Vdc
Input Voltage	1, 16	V_{in}	1.0	Vrms
Junction Temperature	–	T_J	+150	°C
Storage Temperature Range	–	T_{stg}	– 65 to +150	°C

NOTE: Devices should not be operated at or outside these values. The "Recommended Operating Conditions" provide for actual device operation.



D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO-16)

PIN CONNECTIONS

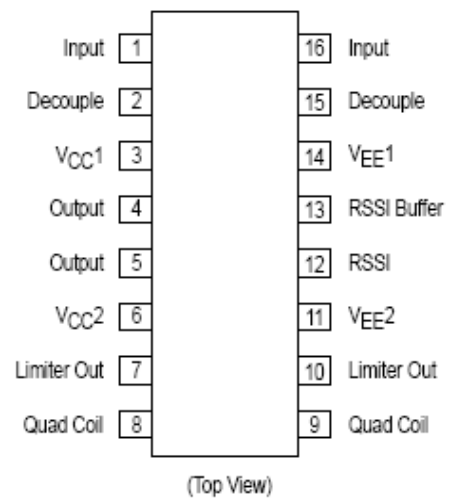
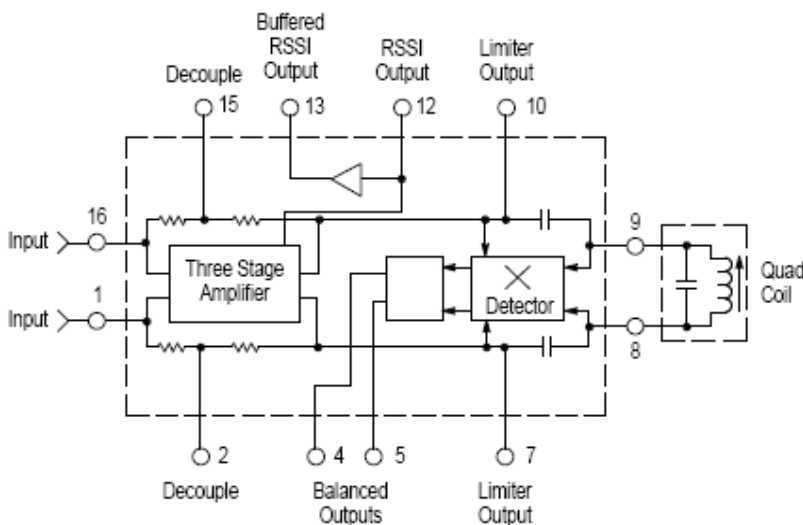


Figure 1. Representative Block Diagram



NOTE: This device requires careful layout and decoupling to ensure stable operation.

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC13155D	$T_A = -40$ to $+85^\circ\text{C}$	SO-16



High Speed, Low Power Wide Supply Range Amplifier

AD817

FEATURES

High Speed

- 50 MHz Unity Gain Bandwidth
- 350 V/ps Slew Rate
- 45 ns Settling Time to 0.1% (10 V Step)

Flexible Power Supply

- Specified for Single (+5 V) and Low Power: 7.5 mA max Supply Current

High Output Drive Capability

- Drives Unlimited Capacitive Load
- 50 mA Minimum Output Current

Excellent Video Performance

- 70 MHz 0.1 dB Bandwidth (Gain = +1)
- 0.04% & 0.08° Differential Gain & Phase Errors @ 3.58 MHz

Available in 8-Pin SOIC and 8-Pin Plastic Mini-DIP

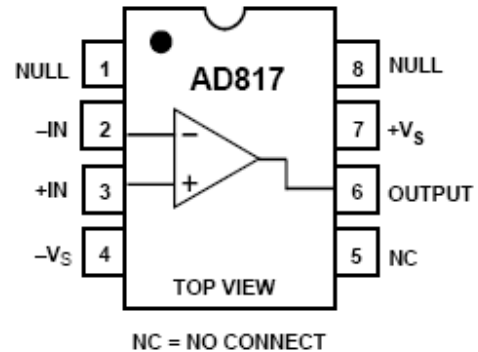
PRODUCT DESCRIPTION

The AD817 is a low cost, low power, single/dual supply, high speed op amp which is ideally suited for a broad spectrum of signal conditioning and data acquisition applications. This breakthrough product also features high output current drive capability and the ability to drive an unlimited capacitive load while still maintaining excellent signal integrity.

The 50 MHz unity gain bandwidth, 350 V/μs slew rate and settling time of 45 ns (0.1%) make possible the processing of high speed signals common to video and imaging systems. Furthermore, professional video performance is attained by offering differential gain & phase errors of 0.04% & 0.08° @ 3.58 MHz and 0.1 dB flatness to 70 MHz (gain = +1).

CONNECTION DIAGRAM

8-Pin Plastic Mini-DIP (N) and SOIC (R) Packages



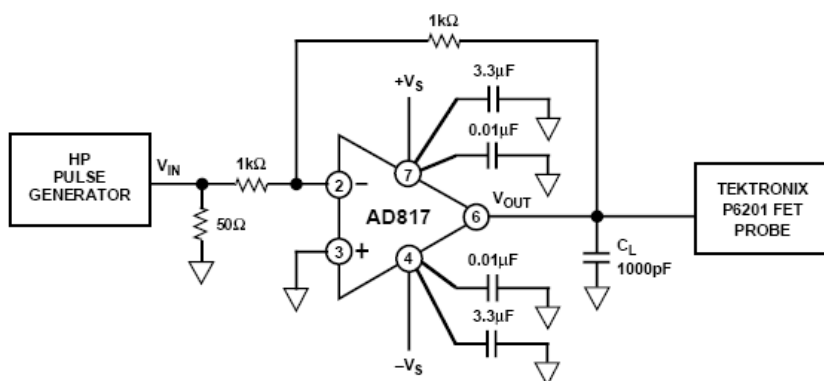
The AD817 is fully specified for operation with a single +5 V power supply and with dual supplies from +5 V to +15 V. This power supply flexibility, coupled with a very low supply current of 7.5 mA and excellent ac characteristics under all power supply conditions, make the AD817 the ideal choice for many demanding yet power sensitive applications.

In applications such as ADC buffers and line drivers the AD817 simplifies the design task with its unique combination of a 50 mA minimum output current and the ability to drive unlimited capacitive loads.

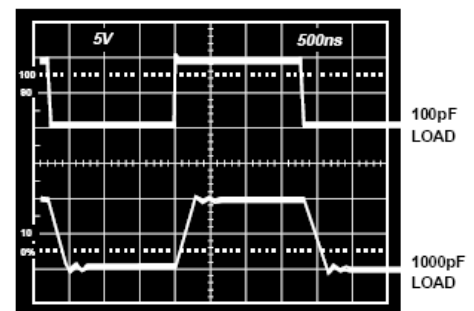
The AD817 is available in 8-pin plastic mini-DIP and SOIC packages.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD817AN	-40°C to +85°C	8-Pin Plastic DIP	N-8
AD817AR	-40°C to +85°C	8-Pin Plastic SOIC	R-8



AD817 Driving a Large Capacitive Load



REV. B

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 617/329-4700 Fax: 617/326-8703

Surface Mount Frequency Mixer

RMS-11X+ RMS-11X

Level 7 (LO Power + 7dBm) 5 to 1900 MH



CASE STYLE: TT240

Maximum Ratings

Operating Temperature	-40°C to 85°C
Storage Temperature	-55°C to 100°C
RF Power	200mW
IF Current	40mA

Pin Connections

LO	1
RF	4
IF	5
GROUND	2,3,6

Features

- excellent L-R isolation, 35 dB typ.
- conversion loss, 7.1 dB typ.
- small size, 0.25"x0.31"x0.2"

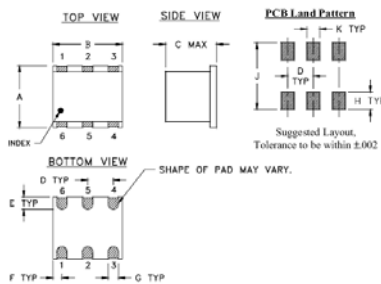
Applications

- PCN
- satellite distribution
- GPS

+ RoHS compliant in accordance with EU Directive (2002/95/EC)

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.

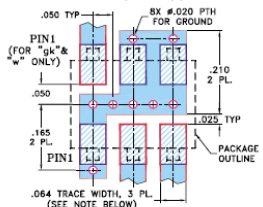
Outline Drawing



Outline Dimensions (inch/mm)

A	B	C	D	E	F
.250	.31	.20	.100	.050	.055
6.35	7.87	5.08	2.54	1.27	1.40
G	H	J	K	wt	
.040	.070	.270	.050	grams	
1.02	1.78	6.86	1.27		0.50

Demo Board MCL P/N: TB-03 Suggested PCB Layout (PL-052) "w" loc. of pin 1 applies.



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002". COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
■ DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
■ DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Electrical Specifications

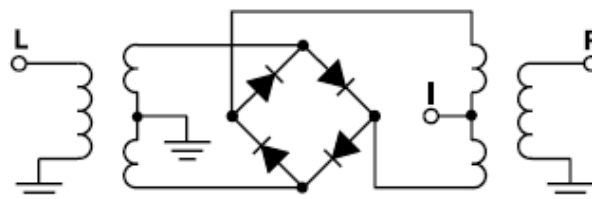
FREQUENCY (MHz)	CONVERSION LOSS (dB)		LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)			IP3 at center band (dBm)
	LO/RF	IF	Total Range	L	M	U	L	M	
$f_L - f_U$	X	σ	Max. Max.	Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.	Typ. Min.
5-1900	5-1000		7.1 .10 8.2 9.8	58 45 35 20 27 18	56 45 37 20 27 20				10

1 dB COMP.: +1 dBm typ. L = low range [f to 10 f] M = mid range [10 f to f / 2] U = upper range [f / 2 to f]
For phase detection, DC output positive with in-phase RF & LO m = mid band [2f to f / 2]

Typical Performance Data

Frequency (MHz)	Conversion Loss (dB)	Isolation L-R (dB)	Isolation L-I (dB)	VSWR RF Port (:1)	VSWR LO Port (:1)	
						LO +7 dBm
5.00	35.00	6.69	57.72	66.80	1.21	2.98
10.01	40.01	6.67	57.22	64.98	1.22	2.83
50.04	80.04	6.66	51.74	53.60	1.23	2.78
103.56	73.56	6.72	46.56	47.68	1.23	2.75
189.86	159.86	6.79	42.32	43.39	1.26	2.72
241.95	211.95	6.90	40.60	41.62	1.31	2.59
308.34	278.34	7.00	38.96	39.89	1.32	2.59
392.94	362.94	7.11	37.54	38.49	1.37	2.56
500.75	470.75	7.20	35.72	37.03	1.44	2.60
638.14	608.14	6.65	34.40	36.08	1.52	2.53
720.38	690.38	7.33	33.17	35.36	1.54	2.52
918.04	888.04	7.35	31.46	34.64	1.53	2.61
950.00	920.00	7.26	30.90	34.39	1.54	2.63
1036.36	1006.36	7.24	30.00	34.46	1.52	2.68
1200.00	1170.00	7.58	30.35	34.77	1.40	2.79
1320.71	1290.71	7.59	32.03	34.21	1.34	2.90
1500.00	1470.00	7.67	35.10	33.40	1.26	2.89
1800.00	1770.00	8.36	38.63	32.68	1.42	3.62
1850.00	1820.00	8.56	36.54	32.31	1.47	3.73
1900.00	1870.00	8.80	34.84	32.78	2.04	3.94

Electrical Schematic



PLL synthesizer



November 1990
Edition 5.0

DATA SHEET

MB1502

SERIAL INPUT PLL FREQUENCY SYNTHESIZER

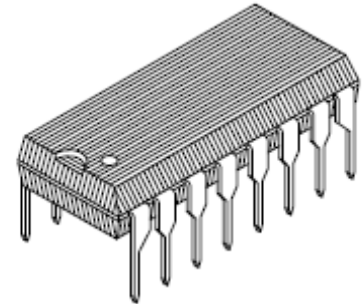
LOW POWER SERIAL INPUT PLL SYNTHESIZER WITH 1.1 GHz PRESCALER

The Fujitsu MB1502, utilizing BI-CMOS technology, is a single chip serial input PLL synthesizer with pulse-swallow function. The MB1502 contains a 1.1GHz two modulus prescaler that can select of either 64/65 or 128/129 divide ratio, control signal generator, 16-bit shift register, 15-bit latch, programmable reference divider (binary 14-bit programmable reference counter), 1-bit switch counter, phase comparator with phase conversion function, charge pump, crystal oscillator, 19-bit shift register, 18-bit latch, programmable divider (binary 7-bit swallow counter and binary 11-bit programmable counter) and analog switch to speed up lock up time.

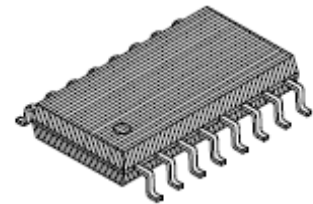
It operates supply voltage of 5V typ. and achieves very low supply current of 8mA typ. realized through the use of Fujitsu Advanced Process Technology.

FEATURES

- High operating frequency: $f_{IN\ MAX}=1.1\text{GHz}$ ($V_{IN\ MIN}=10\text{dBm}$)
- Pulse swallow function: 64/65 or 128/129
- Low supply current: $I_{CC}=8\text{mA}$ typ.
- Serial input 18-bit programmable divider consisting of:
 - Binary 7-bit swallow counter: 0 to 127
 - Binary 11-bit programmable counter: 16 to 2047
- Serial input 15-bit programmable reference divider consisting of:
 - Binary 14-bit programmable reference counter: 8 to 16383
 - 1-bit switch counter (SW) sets divide ratio of prescaler
- On-chip analog switch achieves fast lock up time
- 2 types of phase detector output
 - On-chip charge pump (Bipolar type)
 - Output for external charge pump
- Wide operating temperature: $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
- 16-pin Plastic DIP Package (Suffix: —P)
16-pin Plastic Flat Package (Suffix: —PF)



Plastic Package
DIP-16P-M04



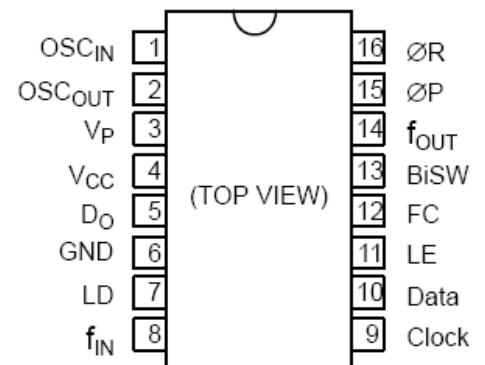
Plastic Package
FPT-16P-M06

ABSOLUTE MAXIMUM RATINGS (See NOTE)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	-0.5 to +7.0	V
	V_P	V_{CC} to 10.0	V
Output Voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Open-drain Voltage	V_{OOP}	-0.5 to 0.8	V
Output Current	I_{OUT}	± 10	mA
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}\text{C}$

NOTE: Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended period may affect device reliability.

Pin Assignment



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.



3GHz prescaler

DATA SHEET

NEC

BIPOLAR DIGITAL INTEGRATED CIRCUIT

μPB1508GV

3 GHz INPUT DIVIDE BY 2 PRESCALER IC FOR DBS TUNERS

μPB1508GV is a 3.0 GHz input divide by 2 prescaler IC for DBS tuner applications. μPB1508GV can make VHF/UHF band PLL frequency synthesizer apply to DBS/ECS tuners. μPB1508GV is a shrink package version of μPB1508GV so that this small package contributes to reduce the mounting space.

μPB1508GV is manufactured using NEC's high fr NESAT™ IV silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformity and reliability.

FEATURES:

- High toggle frequency : fin = 0.5 GHz to 3.0 GHz
- High-density surface mounting : 8 pin plastic SSOP (175 mil)
- Low current consumption : 5 V, 12 mA
- Fixed division : ÷2

APPLICATION

- Prescaler between local oscillator and PLL frequency synthesizer included modulus prescaler
- DBS tuners with kit use of VHF/UHF band PLL frequency synthesizer

ORDERING INFORMATION

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM
μPB1508GV -E1	8 pin plastic SSOP (175 mil)	1508	Embossed tape 8 mm wide. Pin 1 is in tape pull-out direction. 1 000 p/reel.

Remarks To order evaluation samples, please contact your local NEC sales office.
(Part number for sample order: μPB1508GV)

Caution: Electro-static sensitive devices

High dynamic range transistor



Up to 6 GHz Medium Power Silicon Bipolar Transistor

Technical Data

AT-42035

Features

- **High Output Power:**
21.0 dBm Typical $P_{1\text{dB}}$ at 2.0 GHz
20.5 dBm Typical $P_{1\text{dB}}$ at 4.0 GHz
- **High Gain at 1 dB Compression:**
14.0 dB Typical $G_{1\text{dB}}$ at 2.0 GHz
9.5 dB Typical $G_{1\text{dB}}$ at 4.0 GHz
- **Low Noise Figure:**
1.9 dB Typical NF_0 at 2.0 GHz
- **High Gain-Bandwidth Product:** 8.0 GHz Typical f_T
- **Cost Effective Ceramic Microstrip Package**

Description

Hewlett-Packard's AT-42035 is a general purpose NPN bipolar transistor that offers excellent high frequency performance. The AT-42035 is housed in a cost effective surface mount 100 mil micro-X package. The 4 micron emitter-to-emitter pitch enables this transistor to be used in many

different functions. The 20 emitter finger interdigitated geometry yields a medium sized transistor with impedances that are easy to match for low noise and medium power applications. This device is designed for use in low noise, wideband amplifier, mixer and oscillator applications in the VHF, UHF, and microwave frequencies. An optimum noise match near $50\ \Omega$ up to 1 GHz, makes this device easy to use as a low noise amplifier.

The AT-42035 bipolar transistor is fabricated using Hewlett-Packard's 10 GHz f_T Self-Aligned-Transistor (SAT) process. The die is nitride passivated for surface protection. Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metalization in the fabrication of this device.

35 micro-X Package

