ESCUELA UNIVERSITARIA POLITÉCNICA
DE LA ALMUNIA DE DOÑA GODINA (ZARAGOZA)

ANEXOS

Captura y monitorización de señales mioeléctricas del músculo biceps

Capture and monitoring a myoelectric signals from the biceps musle

424. . 17 62

Autor: **Alberto Segarra Español**

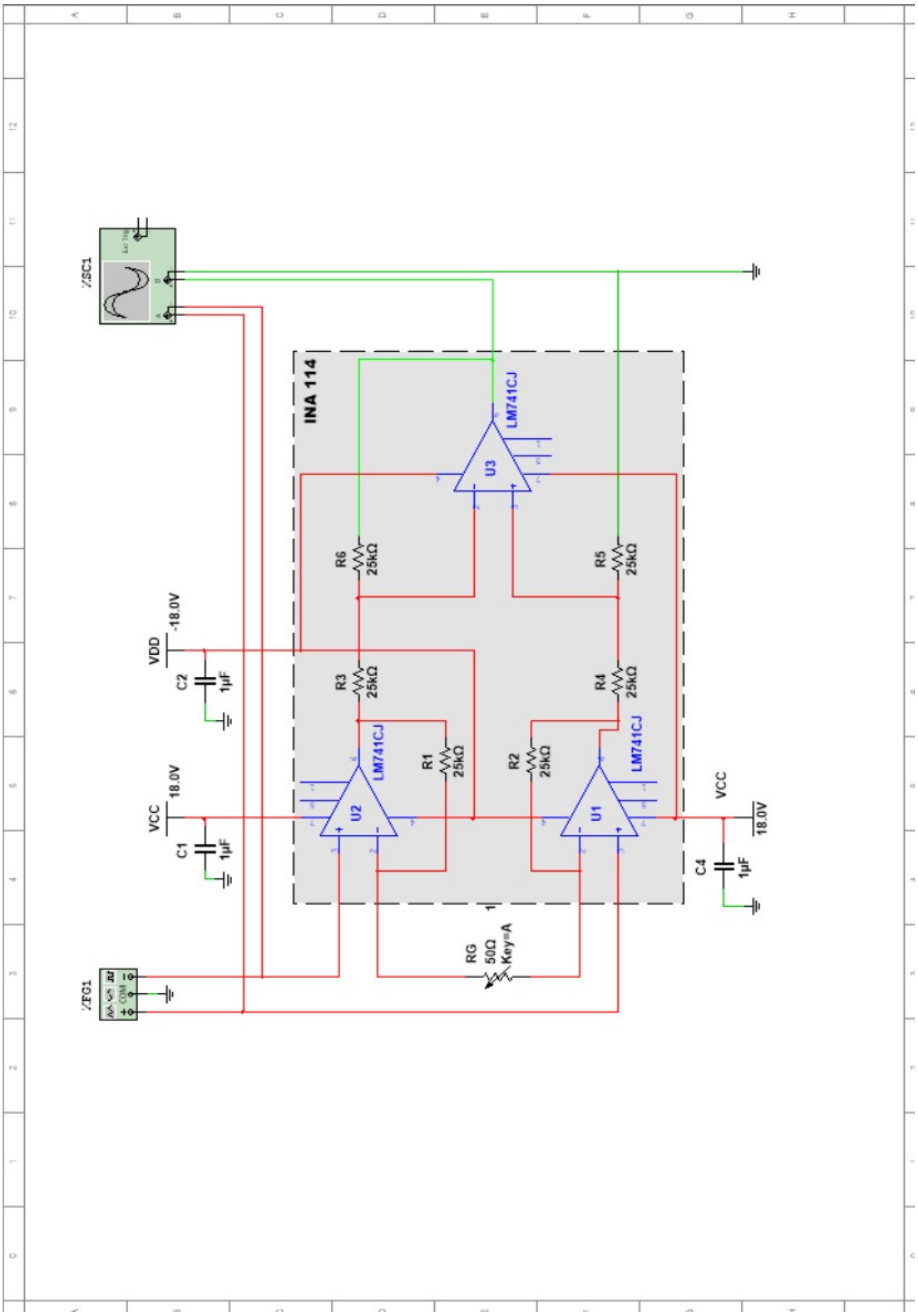
Director: **Jesús Ponce de León Vázquez**

Fecha: **Noviembre 2019**

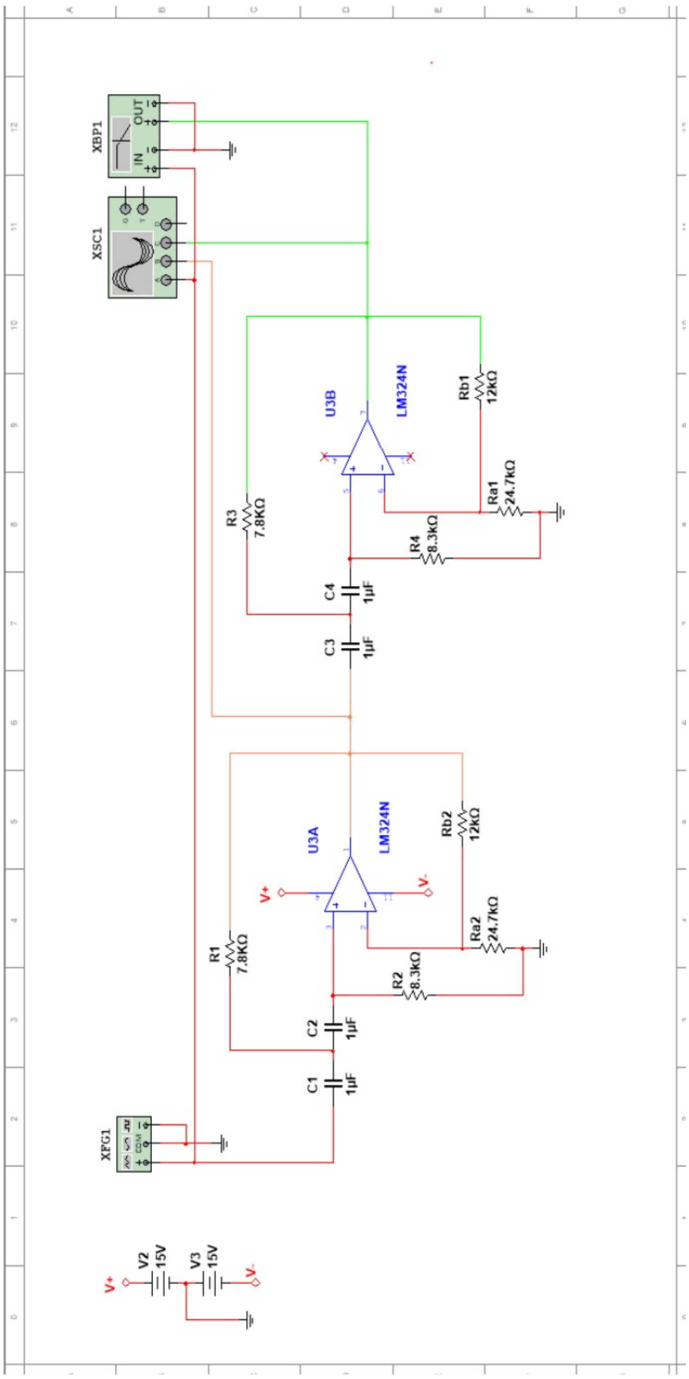
ÍNDICE DE CONTENIDO

1. PLANOS

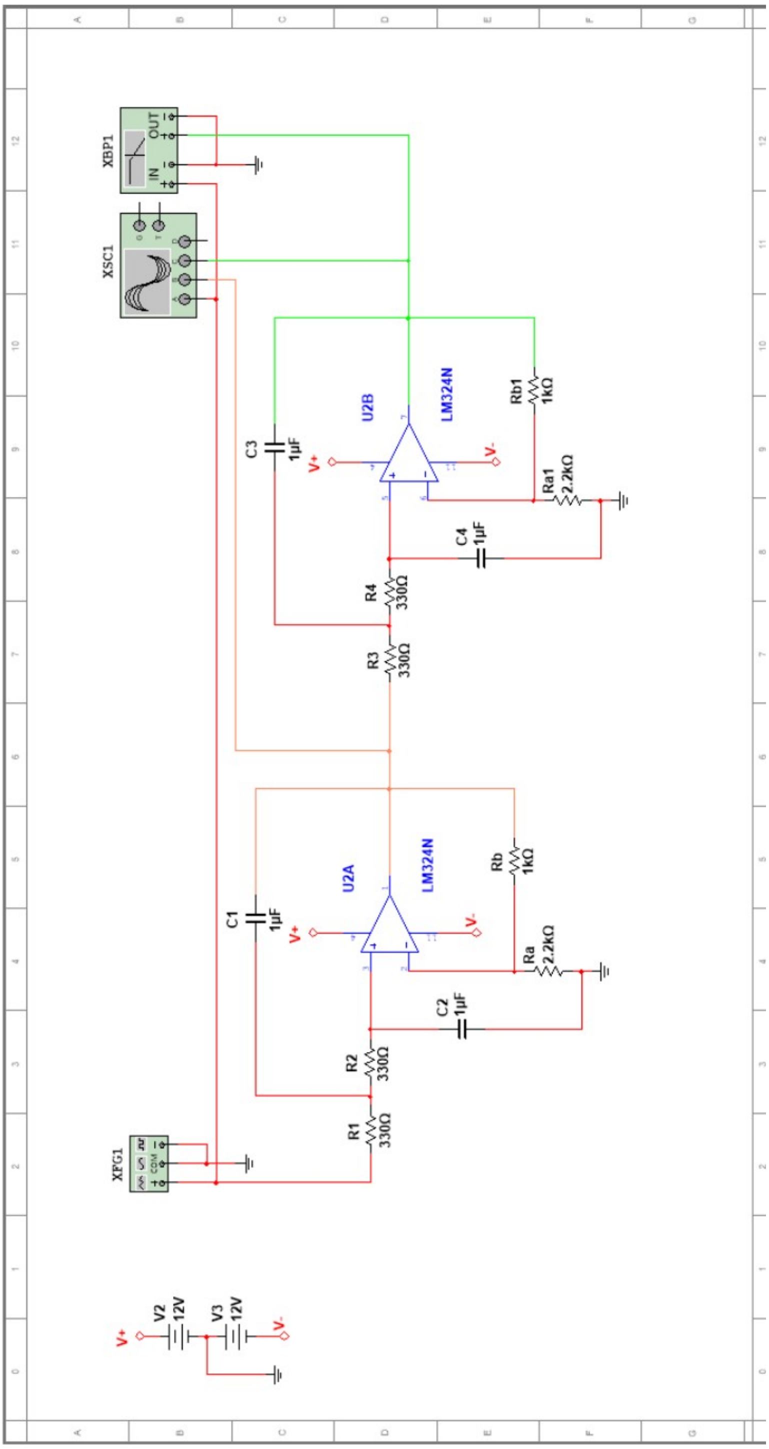
1.1. CIRCUITO AMPLIFICADOR



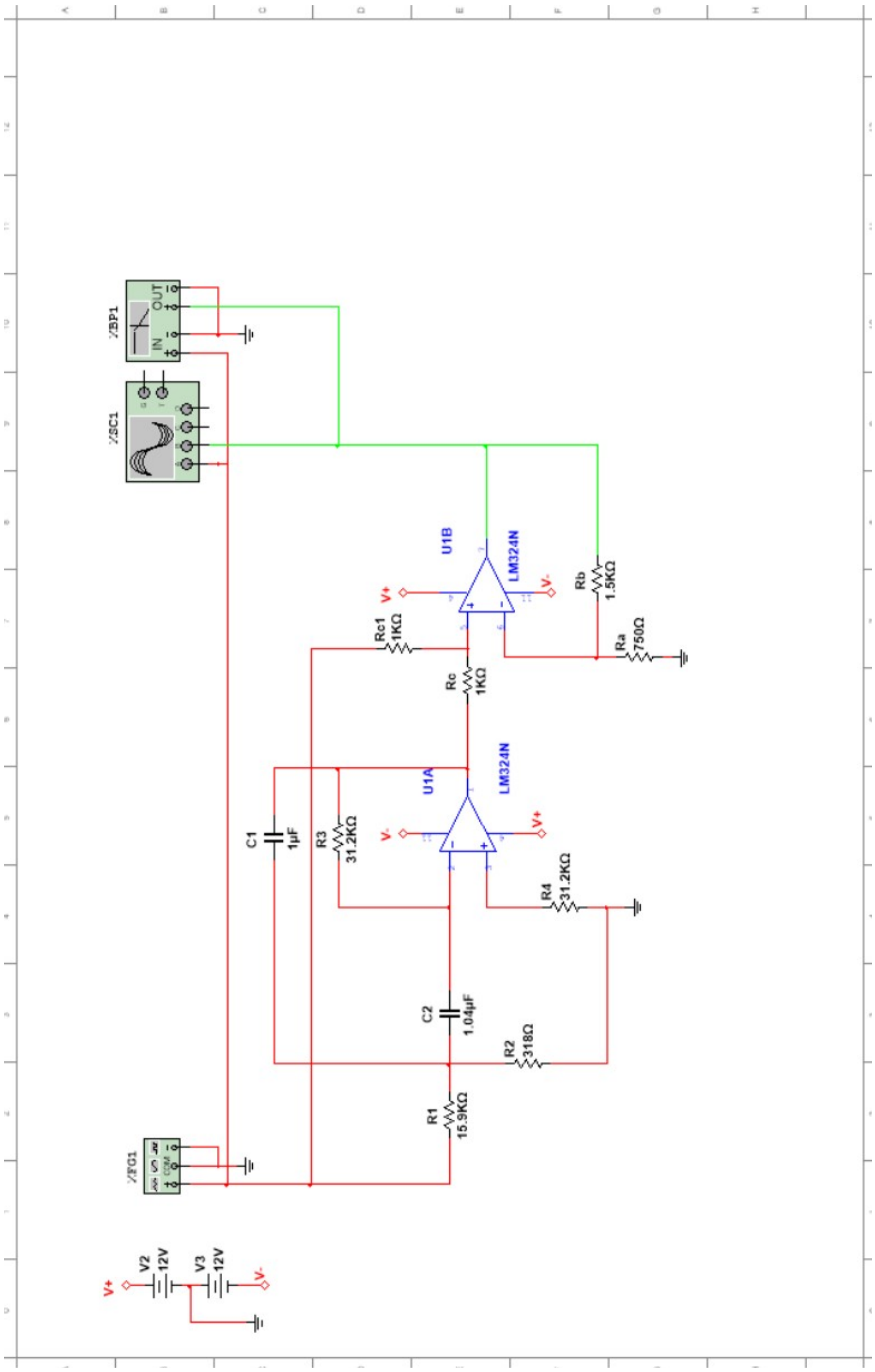
1.2. CIRCUITO FILTRO PASO ALTO



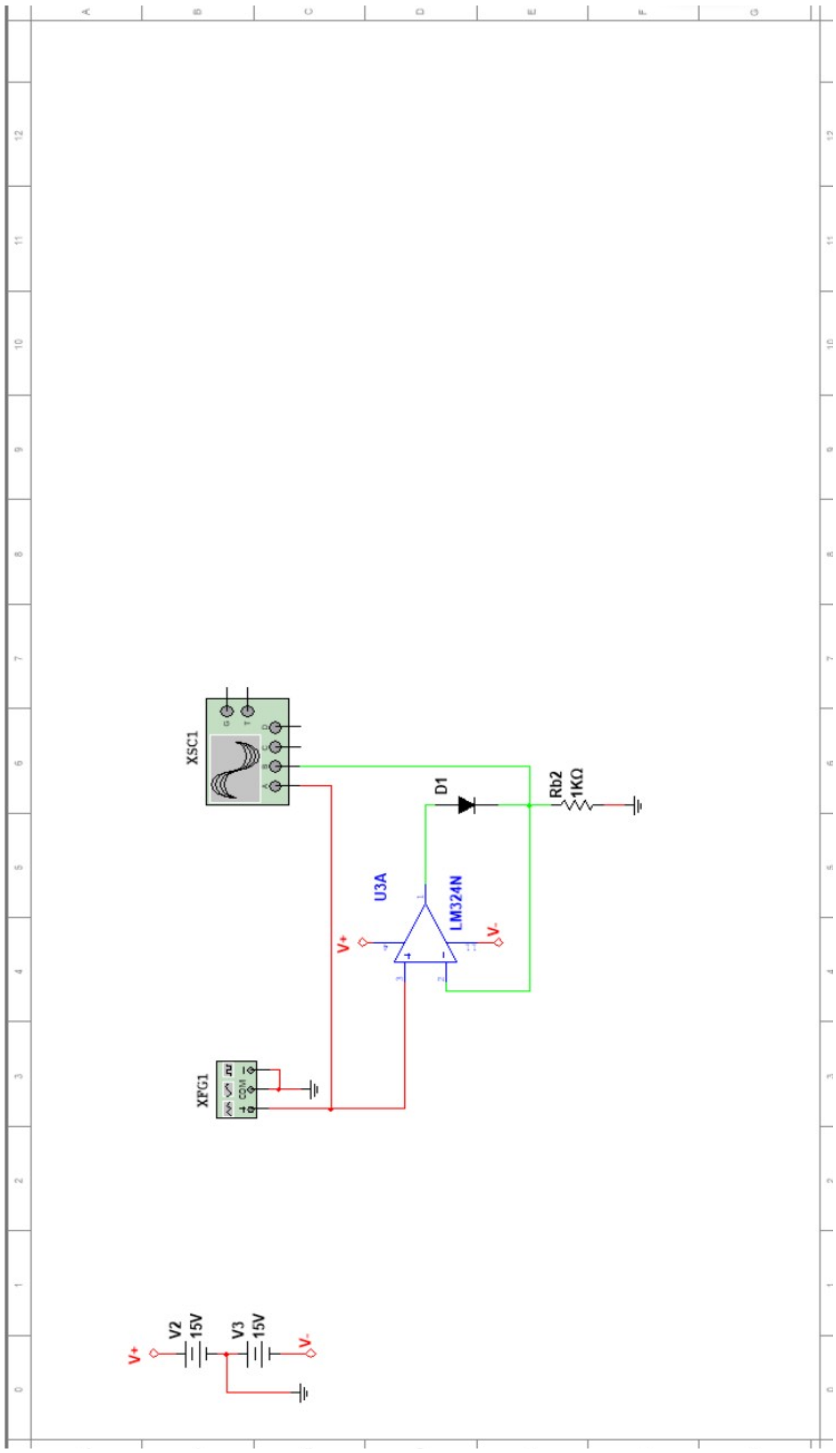
1.3. Circuito filtro paso bajo



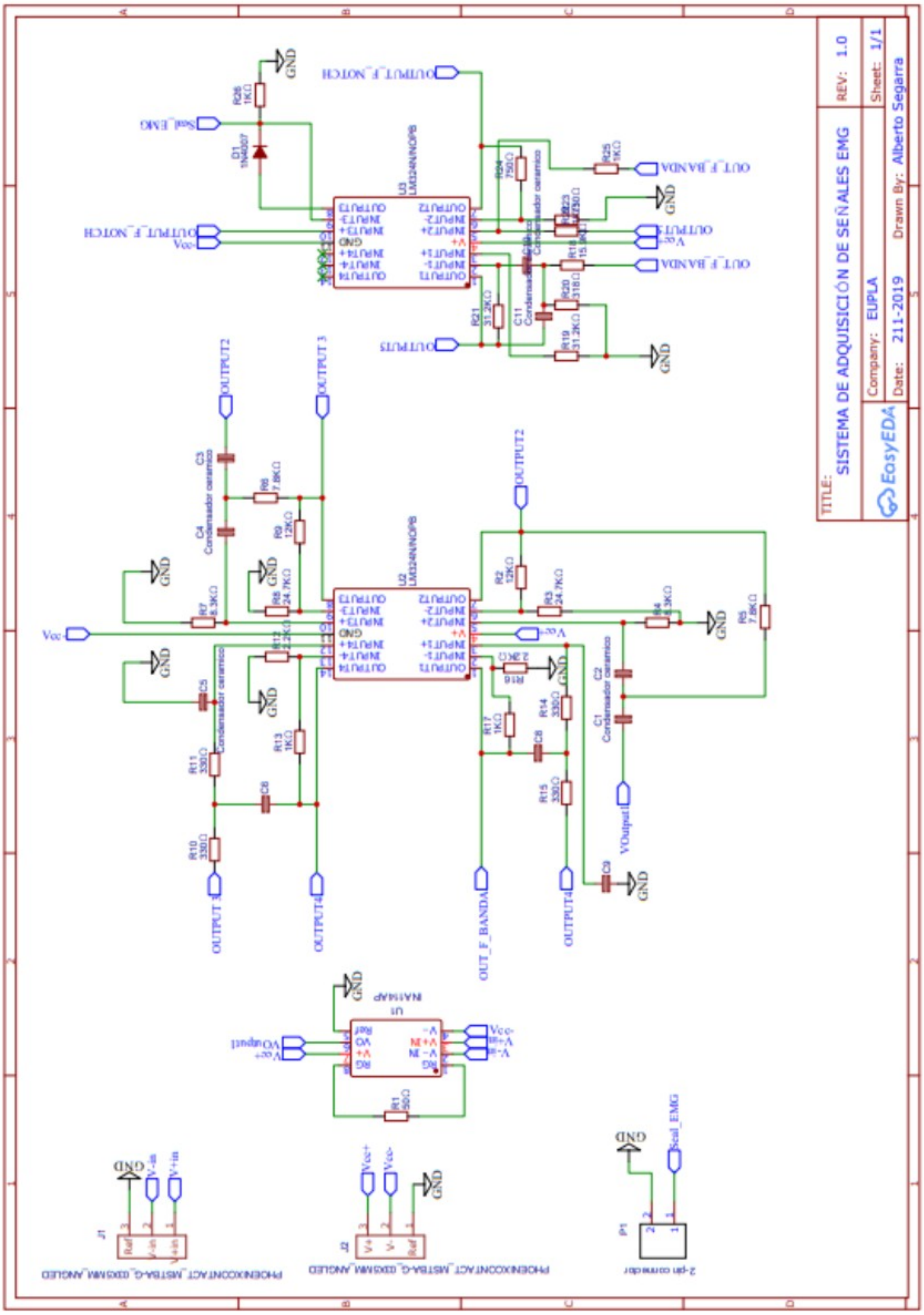
1.4. Circuito filtro rechaza banda



1.5. Circuito rectificador



1.6. Circuito electrónico



2. LISTA DE MATERIALES PARA EL DISEÑO DE LA PCB

Nº	NOMBRE	DESIGNACIÓN	HUELLA	CANTIDAD	PARTE DEL FABRICANTE	FABRICANTE	Supplier	Supplier Part
1	INA114AP	U1	DIP-8	1	INA114AP	Texas Instruments	LCSC	C38890
2	LM324N/NOPB	U2,U3	PDIP-14	2	LM324N/NOPB	Texas Instruments	LCSC	C352847
3	2-pin connector	P1	2-PIN CONNECTOR	1	Phoenix Contact - MCV 1,5/ 2-G-5,08			
4	PHOENIXCONTACT_03X5MM	J1,J2	PHOENIXCONTACT_03X5.00MM	2			Element14	
5	24.7KΩ	R3,R8	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
6	8.3KΩ	R4,R7	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
7	12KΩ	R2,R9	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
8	7.8KΩ	R5,R6	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
9	330Ω	R10,R11,R14,R15	AXIAL-0.4	4	CFR0W4J0102A50	UniOhm	LCSC	C61293
10	2.2KΩ	R12,R16	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
11	1KΩ	R13,R17,R22,R25,R26	AXIAL-0.4	5	CFR0W4J0102A50	UniOhm	LCSC	C61293
12	15.9KΩ	R18	AXIAL-0.4	1	CFR0W4J0102A50	UniOhm	LCSC	C61293
13	31.2KΩ	R19,R21	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
14	318Ω	R20	AXIAL-0.4	1	CFR0W4J0102A50	UniOhm	LCSC	C61293
15	750Ω	R23,R24	AXIAL-0.4	2	CFR0W4J0102A50	UniOhm	LCSC	C61293
16	50Ω	R1	AXIAL-0.4	1	CFR0W4J0102A50	UniOhm	LCSC	C61293
17	1N4007	D1	DIODO	1	1N4007	LRC	LCSC	C78540
18	Condensador ceramico	C1,C2,C3,C4,C5,C6,C8,C9,C10,C11	CONDENSADOR CERAMICO	10				

3. Datasheet de componentes electrónicos

3.1. INA 114

BURR - BROWN®

INA114

Precision
INSTRUMENTATION AMPLIFIER

FEATURES

- LOW OFFSET VOLTAGE: 50µV max
- LOW DRIFT: 0.25µV/°C max
- LOW INPUT BIAS CURRENT: 2nA max
- HIGH COMMON-MODE REJECTION: 115dB min
- INPUT OVER-VOLTAGE PROTECTION: ±40V
- WIDE SUPPLY RANGE: ±2.25 to ±18V
- LOW QUIESCENT CURRENT: 3mA max
- 8-PIN PLASTIC AND SOL-16

APPLICATIONS

- BRIDGE AMPLIFIER
- THERMOCOUPLE AMPLIFIER
- RTD SENSOR AMPLIFIER
- MEDICAL INSTRUMENTATION
- DATA ACQUISITION

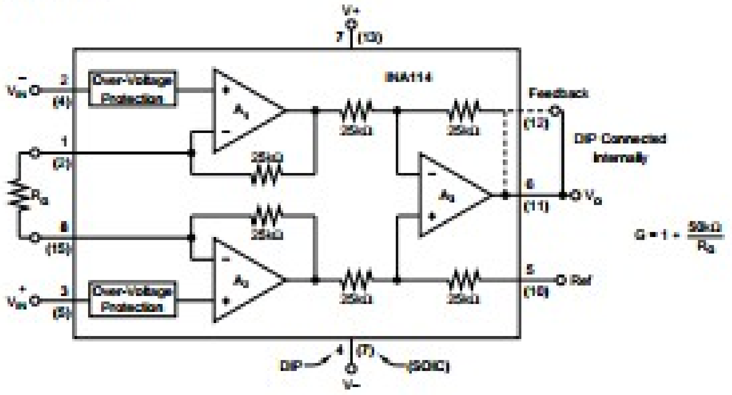
DESCRIPTION

The INA114 is a low cost, general purpose instrumentation amplifier offering excellent accuracy. Its versatile 3-op amp design and small size make it ideal for a wide range of applications.

A single external resistor sets any gain from 1 to 10,000. Internal input protection can withstand up to ±40V without damage.

The INA114 is laser trimmed for very low offset voltage (50µV), drift (0.25µV/°C) and high common-mode rejection (115dB at G = 1000). It operates with power supplies as low as ±2.25V, allowing use in battery operated and single 5V supply systems. Quiescent current is 3mA maximum.

The INA114 is available in 8-pin plastic and SOL-16 surface-mount packages. Both are specified for the –40°C to +85°C temperature range.



International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111
Internet: http://www.burr-brown.com/ • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

SPECIFICATIONS

ELECTRICAL

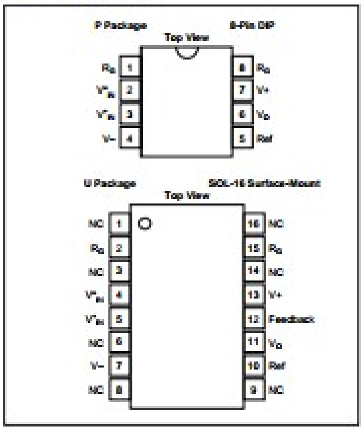
At T_A = +25°C, V_S = ±15V, R_L = 2kΩ, unless otherwise noted.

PARAMETER	CONDITIONS	INA114BP, BU MIN	INA114BP, BU TYP	INA114BP, BU MAX	INA114AP, AU MIN	INA114AP, AU TYP	INA114AP, AU MAX	UNITS
INPUT								
Offset Voltage, RTI								
Initial	T_A = +25°C		±10 + 20/G	±50 + 100/G		±25 + 30/G	±125 + 500/G	μV
vs Temperature	T_A = T_{MIN} to T_{MAX}		±0.1 + 0.5/G	±0.25 + 5/G		±0.25 + 5/G	±1 + 10/G	μV/°C
vs Power Supply	V_S = ±2.25V to ±18V		0.5 + 2/G	3 + 10/G		*	*	μV/V
Long-Term Stability			±0.2 + 0.5/G			*		μV/mo
Impedance, Differential			10^{10} ‖ 6			*		Ω ‖ pF
Common-Mode			10^{10} ‖ 6			*		Ω ‖ pF
Input Common-Mode Range		±11	±13.5		*	*		V
Safe Input Voltage				±40			*	V
Common-Mode Rejection	V_{CM} = ±10V, ΔR_S = 1kΩ							
	G = 1	80	96		75	90		dB
	G = 10	96	115		90	106		dB
	G = 100	110	120		106	110		dB
	G = 1000	115	120		106	110		dB
BIAS CURRENT			±0.5	±2		*	±5	nA
vs Temperature			±8			*		pA/°C
OFFSET CURRENT			±0.5	±2		*	±5	nA
vs Temperature			±8			*		pA/°C
NOISE VOLTAGE, RTI	G = 1000, R_S = 0Ω							
f = 10Hz			15			*		nV/√Hz
f = 100Hz			11			*		nV/√Hz
f = 1kHz			11			*		nV/√Hz
f_B = 0.1Hz to 10Hz			0.4			*		μVp-p
Noise Current								
f=10Hz			0.4			*		pA/√Hz
f=1kHz			0.2			*		pA/√Hz
f_B = 0.1Hz to 10Hz			18			*		pAp-p
GAIN								
Gain Equation			1 + (50kΩ/R_G)			*		V/V
Range of Gain		1		10000	*		*	V/V
Gain Error	G = 1		±0.01	±0.05		*	*	%
	G = 10		±0.02	±0.4		*	±0.5	%
	G = 100		±0.05	±0.5		*	±0.7	%
	G = 1000		±0.5	±1		*	±2	%
Gain vs Temperature	G = 1		±2	±10		*	±10	ppm/°C
50kΩ Resistance(1)			±25	±100		*	*	ppm/°C
Nonlinearity	G = 1		±0.0001	±0.001		*	±0.002	% of FSR
	G = 10		±0.0005	±0.002		*	±0.004	% of FSR
	G = 100		±0.0005	±0.002		*	±0.004	% of FSR
	G = 1000		±0.002	±0.01		*	±0.02	% of FSR
OUTPUT								
Voltage	I_O = 5mA, T_{MIN} to T_{MAX}	±13.5	±13.7		*	*		V
	V_S = ±11.4V, R_L = 2kΩ	±10	±10.5		*	*		V
	V_S = ±2.25V, R_L = 2kΩ	±1	±1.5		*	*		V
Load Capacitance Stability			1000			*		pF
Short Circuit Current			+20/–15			*		mA
FREQUENCY RESPONSE								
Bandwidth, –3dB	G = 1		1			*		MHz
	G = 10		100			*		kHz
	G = 100		10			*		kHz
	G = 1000		1			*		kHz
Slew Rate	V_O = ±10V, G = 10	0.3	0.6		*	*		V/μs
Settling Time, 0.01%	G = 1		18			*		μs
	G = 10		20			*		μs
	G = 100		120			*		μs
	G = 1000		1100			*		μs
Overload Recovery	50% Overdrive		20			*		μs
POWER SUPPLY								
Voltage Range		±2.25	±15	±18	*	*	*	V
Current	V_{IN} = 0V		±2.2	±3		*	*	mA
TEMPERATURE RANGE								
Specification		–40		85	*		*	°C
Operating		–40		125	*		*	°C
θ_{JA}			80			*		°C/W

* Specification same as INA114BP/BU.

NOTE: (1) Temperature coefficient of the "50kΩ" term in the gain equation.

PIN CONFIGURATIONS



ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

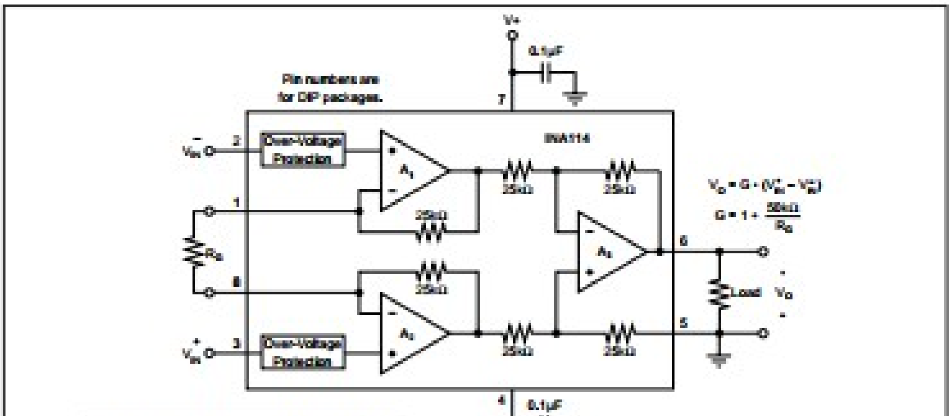
PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER(1)	TEMPERATURE RANGE
INA114AP	8-Pin Plastic DIP	006	–40°C to +85°C
INA114BP	8-Pin Plastic DIP	006	–40°C to +85°C
INA114AU	SOL-16 Surface-Mount	211	–40°C to +85°C
INA114BU	SOL-16 Surface-Mount	211	–40°C to +85°C

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book.

ABSOLUTE MAXIMUM RATINGS(1)

Supply Voltage	±18V
Input Voltage Range	±40V
Output Short-Circuit (to ground)	Continuous
Operating Temperature	–40°C to +125°C
Storage Temperature	–40°C to +125°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C

NOTE: (1) Stresses above these ratings may cause permanent damage.



DESIRED GAIN	R_G (Ω)	NEAREST 1% R_G (Ω)
1	No Connection	No Connection
2	50.00k	49.9k
5	12.50k	12.4k
10	5.556k	5.62k
20	2.632k	2.61k
50	1.02k	1.02k
100	505.1	511
200	251.3	249
500	100.2	100
1000	50.05	49.9
2000	25.01	24.9
5000	10.00	10
10000	5.001	4.99

Also drawn in simplified form:

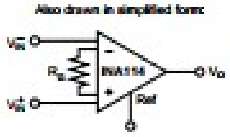


FIGURE 1. Basic Connections.

3.2. LM 324N

TEXAS INSTRUMENTS

LM124-N, LM224-N
LM2902-N, LM324-N

SNOSC16D – MARCH 2000 – REVISED JANUARY 2015

LMx24-N, LM2902-N Low-Power, Quad-Operational Amplifiers

1 Features

- Internally Frequency Compensated for Unity Gain
- Large DC Voltage Gain 100 dB
- Wide Bandwidth (Unity Gain) 1 MHz (Temperature Compensated)
- Wide Power Supply Range:
  - Single Supply 3 V to 32 V
  - or Dual Supplies ±1.5 V to ±16 V
- Very Low Supply Current Drain (700 µA) —Essentially Independent of Supply Voltage
- Low Input Biasing Current 45 nA (Temperature Compensated)
- Low Input Offset Voltage 2 mV and Offset Current: 5 nA
- Input Common-Mode Voltage Range Includes Ground
- Differential Input Voltage Range Equal to the Power Supply Voltage
- Large Output Voltage Swing 0 V to V^+ − 1.5 V
- **Advantages:**
  - Eliminates Need for Dual Supplies
  - Four Internally Compensated Op Amps in a Single Package
  - Allows Direct Sensing Near GND and V_{OUT} also Goes to GND
  - Compatible With All Forms of Logic
  - Power Drain Suitable for Battery Operation
  - In the Linear Mode the Input Common-Mode, Voltage Range Includes Ground and the Output Voltage
  - Can Swing to Ground, Even Though Operated from Only a Single Power Supply Voltage
  - Unity Gain Cross Frequency is Temperature Compensated
  - Input Bias Current is Also Temperature Compensated

2 Applications

- Transducer Amplifiers
- DC Gain Blocks
- Conventional Op Amp Circuits

3 Description

The LM124-N series consists of four independent, high-gain, internally frequency compensated operational amplifiers designed to operate from a single power supply over a wide range of voltages. Operation from split-power supplies is also possible and the low-power supply current drain is independent of the magnitude of the power supply voltage.

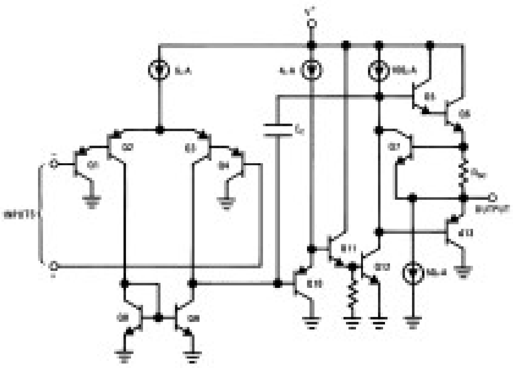
Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM124-N series can directly operate off of the standard 5-V power supply voltage which is used in digital systems and easily provides the required interface electronics without requiring the additional ±15 V power supplies.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LM124-N	CDIP (14)	19.56 mm × 6.67 mm
LM224-N		
LM324-N	CDIP (14)	19.56 mm × 6.67 mm
	PDIP (14)	19.177 mm × 6.35 mm
	SOIC (14)	8.65 mm × 3.91 mm
	TSSOP (14)	5.00 mm × 4.40 mm
LM2902-N	PDIP (14)	19.177 mm × 6.35 mm
	SOIC (14)	8.65 mm × 3.91 mm
	TSSOP (14)	5.00 mm × 4.40 mm

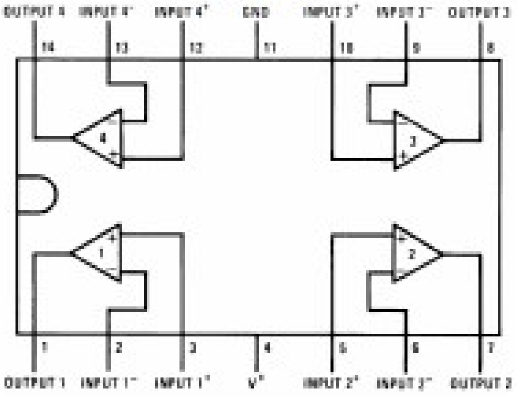
(1) For all available packages, see the orderable addendum at the end of the datasheet.

Schematic Diagram

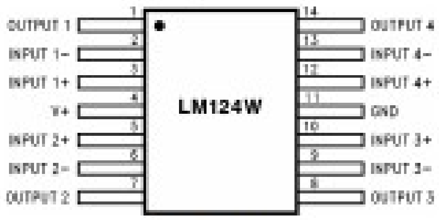


5 Pin Configuration and Functions

J Package
14-Pin CDIP
Top View



D Package
14-Pin SOIC
Top View



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
OUTPUT1	1	O	Output, Channel 1
INPUT1-	2	I	Inverting Input, Channel 1
INPUT1+	3	I	Noninverting Input, Channel 1
V+	4	P	Positive Supply Voltage
INPUT2+	5	I	Nonnverting Input, Channel 2
INPUT2-	6	I	Inverting Input, Channel 2
OUTPUT2	7	O	Output, Channel 2
OUTPUT3	8	O	Output, Channel 3
INPUT3-	9	I	Inverting Input, Channel 3
INPUT3+	10	I	Noninverting Input, Channel 3
GND	11	P	Ground or Negative Supply Voltage
INPUT4+	12	I	Noninverting Input, Channel 4
INPUT4-	13	I	Inverting Input, Channel 4
OUTPUT4	14	O	Output, Channel 4

6 Specifications

6.1 Absolute Maximum Ratings

See [1][2].

			LM124-N/LM224-N/LM324-N LM124A/LM224A/LM324A		LM2902-N		
			MIN	MAX	MIN	MAX	UNIT
Supply Voltage, V^+				32		26	V
Differential Input Voltage				32		26	V
Input Voltage			−0.3	32	−0.3	26	V
Input Current (V_{IN} < −0.3 V)[3]				50		50	mA
Power Dissipation[4]	PDIP			1130		1130	mW
	CDIP			1260		1260	mW
	SOIC Package			800		800	mW
Output Short-Circuit to GND (One Amplifier)[5]		V^+ ≤ 15 V and T_A = 25°C	Continuous		Continuous		
Lead Temperature (Soldering, 10 seconds)				260		260	°C
Soldering Information	Dual-In-Line Package	Soldering (10 seconds)		260		260	°C
	Small Outline Package	Vapor Phase (60 seconds)		215		215	°C
		Infrared (15 seconds)		220		220	°C
Storage temperature, T_{stg}			−65	150	−65	150	°C

(1) Refer to RETS124AX for LM124A military specifications and refer to RETS124X for LM124-N military specifications.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(3) This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the op amps to go to the V^+voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than −0.3 V (at 25°C).
(4) For operating at high temperatures, the LM324-N/LM324A/LM2902-N must be derated based on a 125°C maximum junction temperature and a thermal resistance of 88°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The LM224-N/LM224A and LM124-N/LM124A can be derated based on a 150°C maximum junction temperature. The dissipation is the total of all four amplifiers—use external resistors, where possible, to allow the amplifier to saturate of to reduce the power which is dissipated in the integrated circuit.
(5) Short circuits from the output to V^+ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40 mA independent of the magnitude of V^+. At values of supply voltage in excess of 15 V, continuous short-circuits can exceed the power dissipation ratings and cause eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001[1]	±250	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply Voltage (V^+ - V^-): LM124-N/LM124A/LM224-N/LM224A/LM324-N/LM324A	3	32	V
Supply Voltage (V^+ - V^-): LM2902-N	3	26	V
Operating Input Voltage on Input pins	0	V+	V
Operating junction temperature, T_J: LM124-N/LM124A	-55	125	°C
Operating junction temperature, T_J: L2902-N	-40	85	°C
Operating junction temperature, T_J: LM224-N/LM224A	-25	85	°C
Operating junction temperature, T_J: LM324-N/LM324A	0	70	°C

4 Submit Documentation Feedback

3.3. Diodo 1N4007

NTE
ELECTRONICS, INC.
44 FARRAND STREET
BLOOMFIELD, NJ 07003
(973) 748-5089
http://www.nteinc.com

1N4001 thru 1N4007
1.0A Standard Recovery Rectifier

Features:
- Diffused Junction
- Low Forward Voltage Drop
- High Current Capability
- High Surge Current Capability
- RoHS Compliant

Mechanical Data:
- Case: DO-41, Molded Plastic
- Terminals: Plated Leads Solderable per MIL-STD-202, Method 208
- Polarity: Cathode Band
- Weight: 0.35 grams (approx.)
- Mounting Position: Any
- Marking: Type Number

Absolute Maximum Ratings and Electrical Characteristics: (T_A = +25°C, unless otherwise specified)

Peak Repetitive Voltage, V_{RRM}
Working Peak Reverse Voltage, V_{RWM}
DC Blocking Voltage, V_R

1N4001	50V
1N4002	100V
1N4003	200V
1N4004	400V
1N4005	600V
1N4006	800V
1N4007	1000V

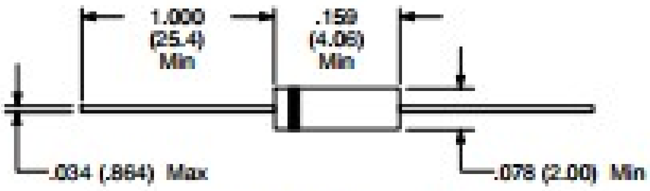
RMS Reverse Voltage, $V_{R(RMS)}$

1N4001	35V
1N4002	70V
1N4003	140V
1N4004	280V
1N4005	420V
1N4006	560V
1N4007	700V

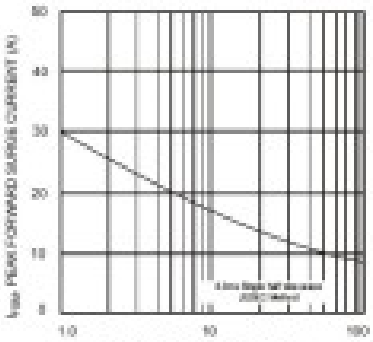
Average Rectified Output Current (T_A = +75°C, Note 1), I_O	1.0A
Non-Repetitive Peak Forward Surge Current, I_{FSM} (8.3ms Single half sine-wave superimposed on rated load, JEDEC Method)	30A
Forward Voltage (I_F = 1.0A), V_{FM}	1.0V
Peak Reverse Current (T_A = +25°C), I_{RM}	5.0µA
At Rated DC Blocking Voltage (T_A = +100°C)	50µA
Typical Junction Capacitance (Note 2), C_j	15pF
Typical Thermal Resistance, Junction-to-Ambient, R_{thJA}	50°C/W
Operating Temperature Range, T_j	-65° to +125°C
Storage Temperature Range, T_{STG}	-65° to +150°C

Note 1. Leads maintained at ambient temperature at a distance of 9.5mm from the case
Note 2. Measured at 1.0MHz and Applied Reverse Voltage of 4.0V D.C.

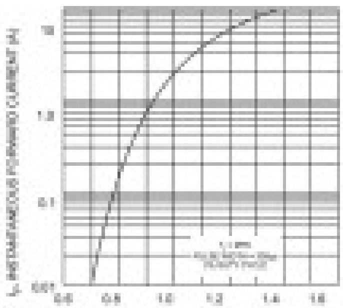
Rev. 11-12



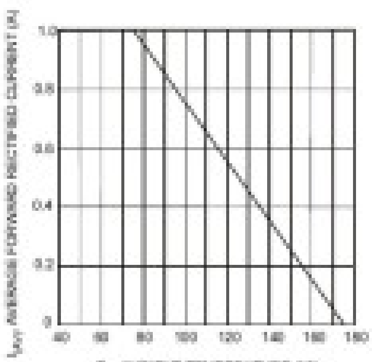
Color Band Denotes Cathode



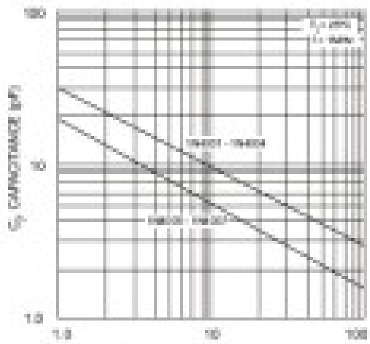
NUMBER OF CYCLES AT 60 Hz
Fig. 3 Max Non-Repetitive Peak Fwd Surge Current



V_F, INSTANTANEOUS FORWARD VOLTAGE (V)
Fig. 2 Typical Forward Characteristics



T_A, AMBIENT TEMPERATURE (°C)
Fig. 1 Forward Current Derating Curve



V_R, REVERSE VOLTAGE (V)
Fig. 4 Typical Junction Capacitance

Relación de documentos

(_) Memoria ....NN   páginas

(X) Anexos ....NN   páginas

La Almunia, a dd de mm de 20aa

Firmado: Alberto Segarra Español