



# SP5070

## 2.4GHz Fixed Modulus Frequency Synthesiser

DS3966-2.2 May 996

The SP5070 is a single modulus frequency synthesiser for use in Satellite TV receivers and together with an appropriate voltage controlled oscillator (VCO), forms a complete phase locked loop (PLL) synthesiser. The circuit consists of a prescaler with preamplifier and a fixed modulus divider. The phase comparator is fed with a reference frequency derived from an external oscillator or crystal. The comparator has a charge pump output amplifier stage around which feedback may be applied. Only an external transistor is required for varicap line driving.

### FEATURES

- Low Power Consumption (5V, 47mA typ.)
- Prescaler and Preamplifier Included
- Charge Pump Amplifier with Feedback Point
- Charge Pump Disable Facility
- Synthesises Frequencies up to 2.4GHz
- Pin and Function Compatible with SP5060 and SP5062
- Full ESD Protection\*

\* Normal ESD handling procedures should be observed.

### APPLICATIONS

- Satellite TV
- High IF Cable Tuning Systems
- C-Band with Frequency Doubling Mixer

### ORDERING INFORMATION

- SP5070 DP - (14 Lead Plastic Package)
- SP5070F MP - (14 Lead Miniature Plastic Package)

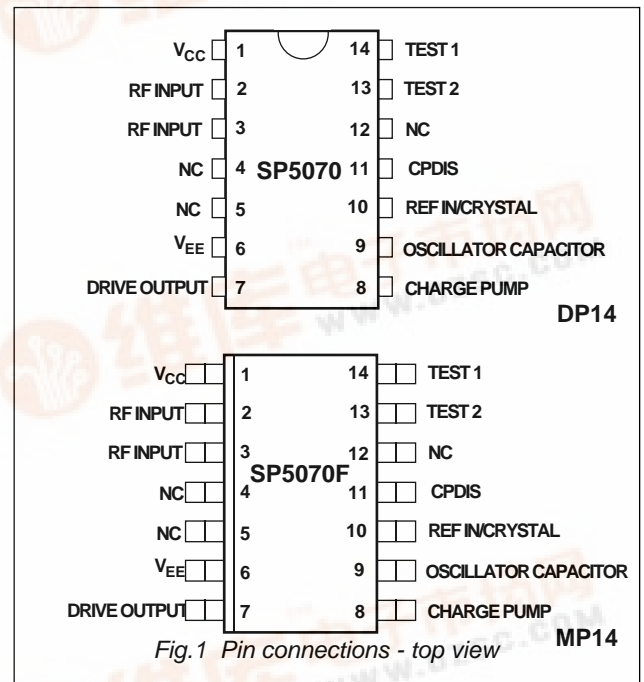


Fig. 1 Pin connections - top view

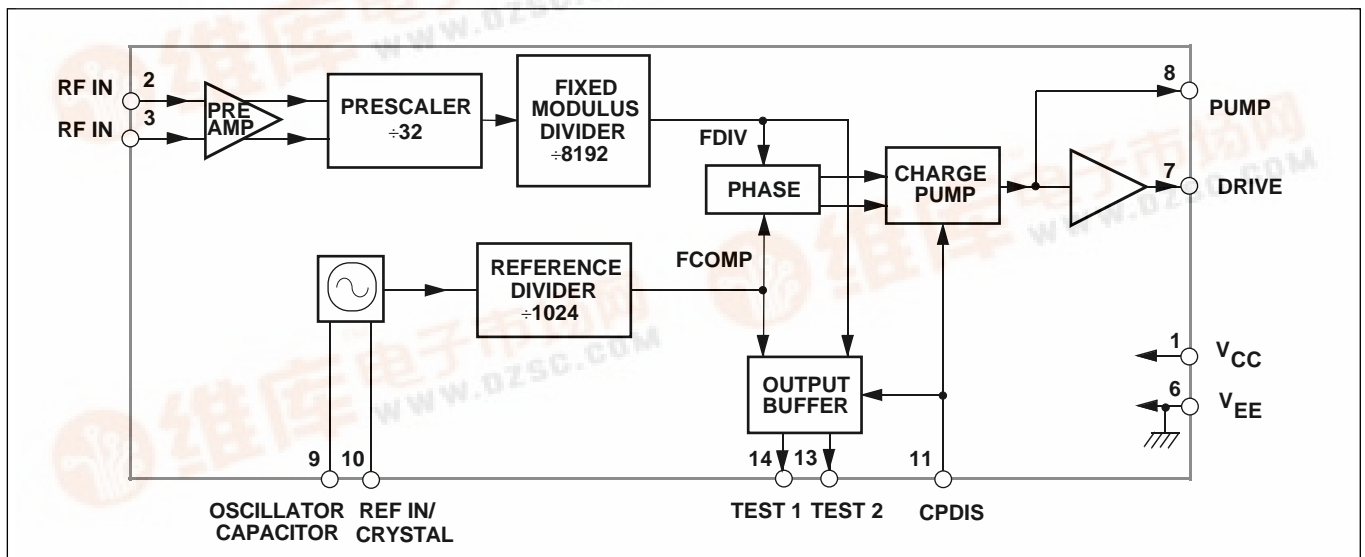


Fig. 2 Block diagram of SP5070



## SP5070

### ELECTRICAL CHARACTERISTICS

Tamb = -40°C to +85°C, VCC = +4.5V to +5.5V. These characteristics are guaranteed by either production test or design. They apply within the specified ambient temperature and supply voltage ranges unless otherwise stated.

Characteristics	Symbol	Pin	Value			Units	Conditions
			Min	Typ	Max		
Supply current	I <sub>CC</sub>	1	-	47	55	mA	V <sub>CC</sub> = 5V
Prescaler input voltage		2,3	50	-	300	mV <sub>RMS</sub>	300MHz to 1.8GHz sinewave 2.4GHz, see Fig.5
Prescaler input voltage		2,3	100	-	300	mV <sub>RMS</sub>	
Prescaler input impedance		2,3	-	50	-	pF	
Input capacitance		2,3	-	2	-		
Charge pump output current		8	-	±100	-	μA	V pin 8 = 2.0V V pin 8 = 2.0V At collector of External Varicap Drive transistor
Charge pump output leakage		8	-	-	±5	nA	
Drift due to leakage		-	-	-	5	mV/s	
Charge pump drive output current		7	1	-	-	mA	V pin 7 = 0.7V
Charge pump amplifier gain		-	-	6400	-	-	pin 7 current 100μa
Oscillator temperature stability		9,10	-	-	2	ppm/°C	
Oscillator stability with supply voltage		9,10	-	-	2	ppm/V	
Reference clock frequency		10	2	-	10	MHz	
External reference amplitude		10	150	-	500	mV <sub>RMS</sub>	
Charge pump disable/TEST 1 and TEST 2/enable		11	-250	-	-500	μA	V <sub>IN</sub> <0V
Charge pump disable leakage		11	-	-	10	μA	V pin 11= V <sub>CC</sub>
TEST 1/TEST 2 sink current		13,14	1	-	-	mA	V <sub>OUT</sub> = 0.7V
TEST 1/TEST 2 leakage current		13,14	-	-	10	μA	V <sub>OUT</sub> = V <sub>CC</sub> +0.3V
TEST 1/TEST 2 voltage		13,14	-	-	V <sub>CC</sub> +0.3	V	

### ABSOLUTE MAXIMUM RATINGS

All voltages are referred to V<sub>EE</sub> = 0V

Characteristics	Pin	Value		Units
		Min	Max	
Supply voltage	1	-0.3	7	V
RF input voltage	2,3	-	2.5	Vp-p
RF input DC offset	2,3	-0.3	V <sub>CC</sub> +0.3	V
Charge pump DC offset	8	-0.3	V <sub>CC</sub> +0.3	V
Charge pump disable	11	-0.7	V <sub>CC</sub> +0.3	V
Drive DC offset	7	-0.3	V <sub>CC</sub> +0.3	V
Crystal oscillator DC offset	9,10	-0.3	V <sub>CC</sub> +0.3	V
TEST outputs	13,14	-0.3	V <sub>CC</sub> +0.3	V
Storage temperature	-	-55	150	°C
Junction temperature	-	-	+150	°C
DP14 thermal resistance, chip-to-ambient	-	-	78	°C/W
DP14 thermal resistance, chip-to-case	-	-	30	°C/W
MP14 thermal resistance, chip-to-ambient	-	-	123	°C/W
MP14 thermal resistance, chip-to-case	-	-	45	°C/W
Power consumption at 5.5V	-	-	275	mW

**FUNCTIONAL DESCRIPTION**

The SP5070, when used with a voltage controlled oscillator, forms a complete phase locked loop frequency synthesiser.

The phase comparator comparison frequency is obtained by dividing the reference frequency. This may be generated on-chip by means of an external crystal, or from an external reference oscillator.

The output of the prescaler is divided by the fixed modulus divider, producing an output frequency which is phased locked to the comparison frequency.

The divider stages are arranged to give a fixed ratio between the synthesised frequency and the reference of 256:1. Any frequency within the range of 300MHz to 2.4GHz may be achieved by using the appropriate reference or crystal frequency.

A single external transistor, driven from the charge pump output, provides the output drive necessary for the oscillator varicap line.

A test facility which disables the charge pump is also provided. This is activated when a negative voltage is applied to pin 11, see electrical characteristics above. When the device is in this mode,  $F_{COMP}$  and  $F_{DIV}$  are also available at outputs TEST1 and TEST2 respectively. These are open collector outputs and are each capable of sinking a minimum of 1mA. In normal mode of operation these outputs are high impedance.

For compatibility with SP5060/SP5062, pin 11 may be connected to  $V_{CC}$

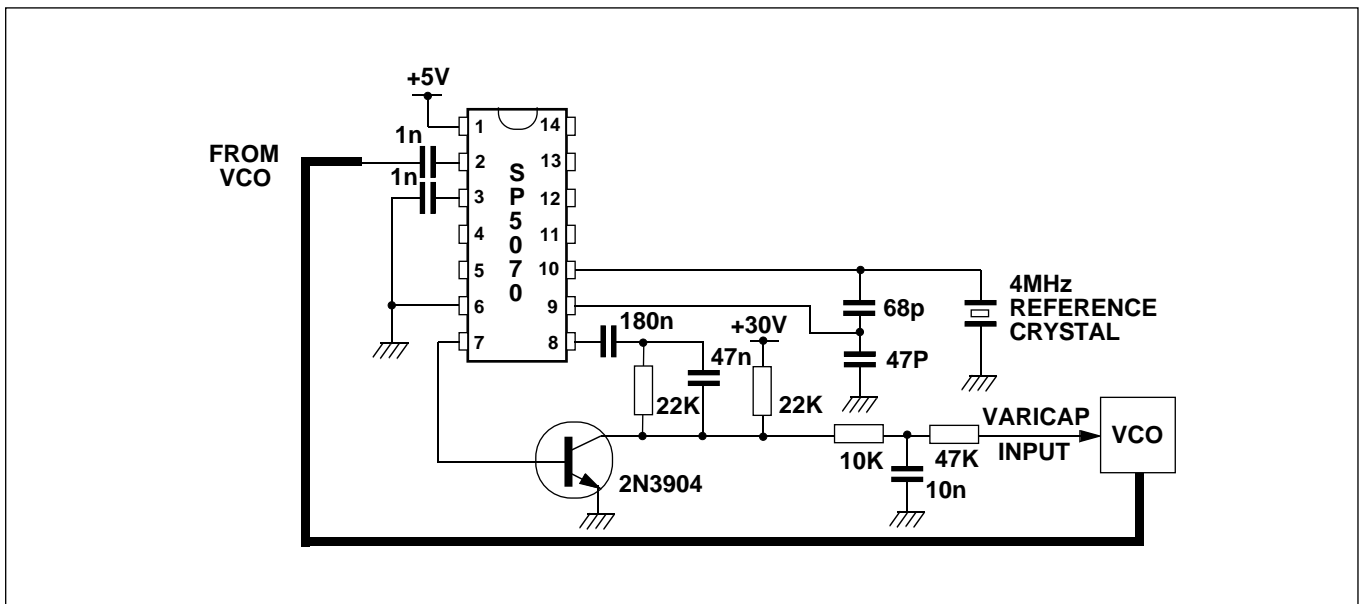


Fig.3 Typical application and test circuit (1024MHz with 4MHz reference crystal)

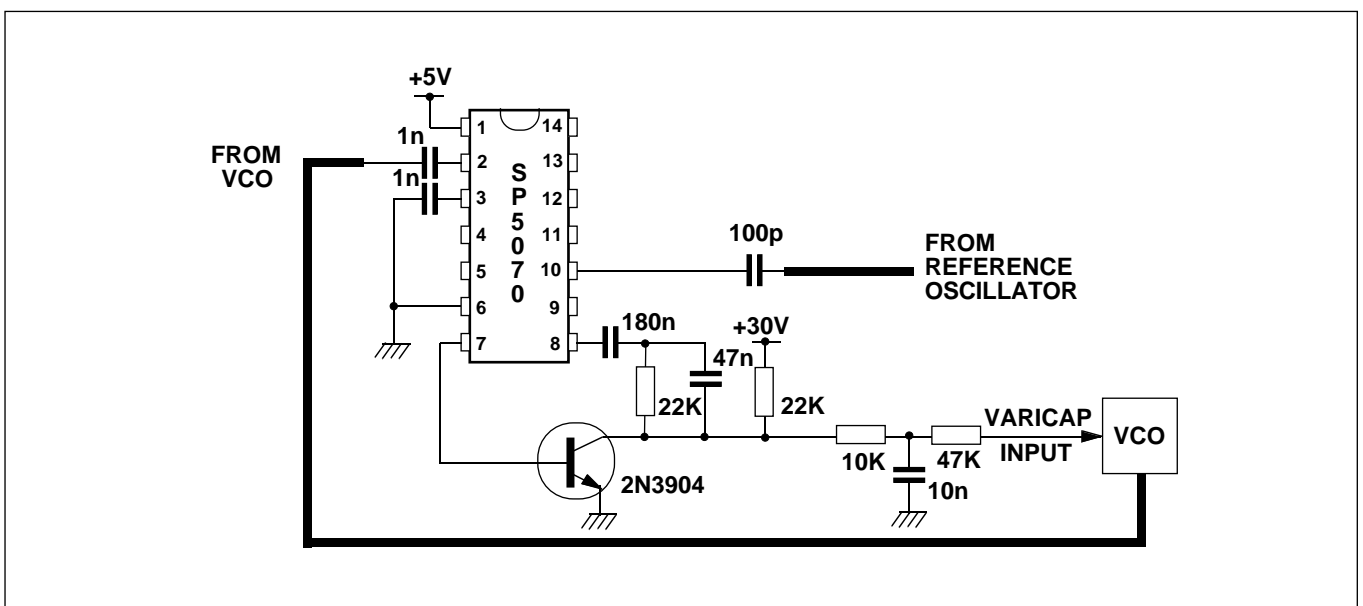


Fig.4 Application using external reference oscillator

SP5070

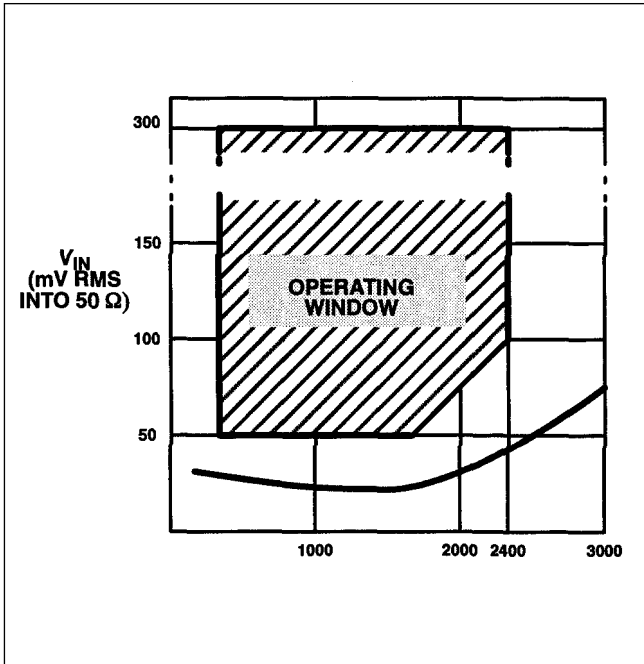


Fig.5 Typical input sensitivity

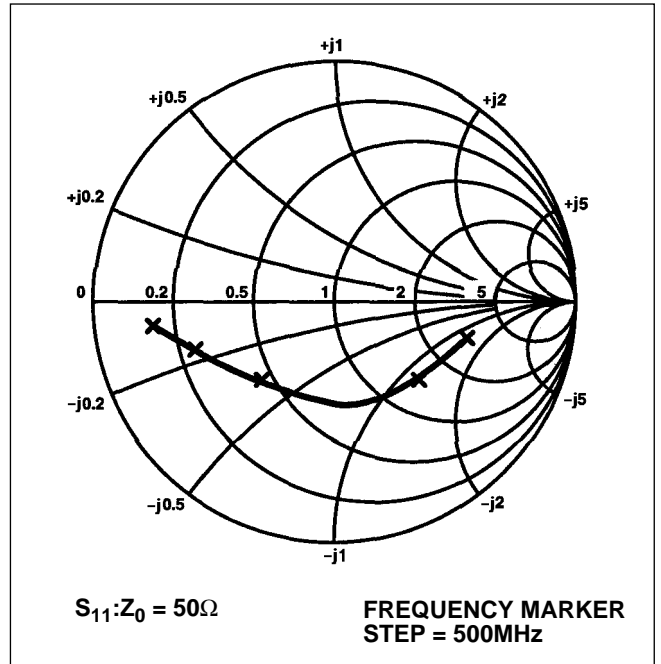


Fig.6 Typical input impedance

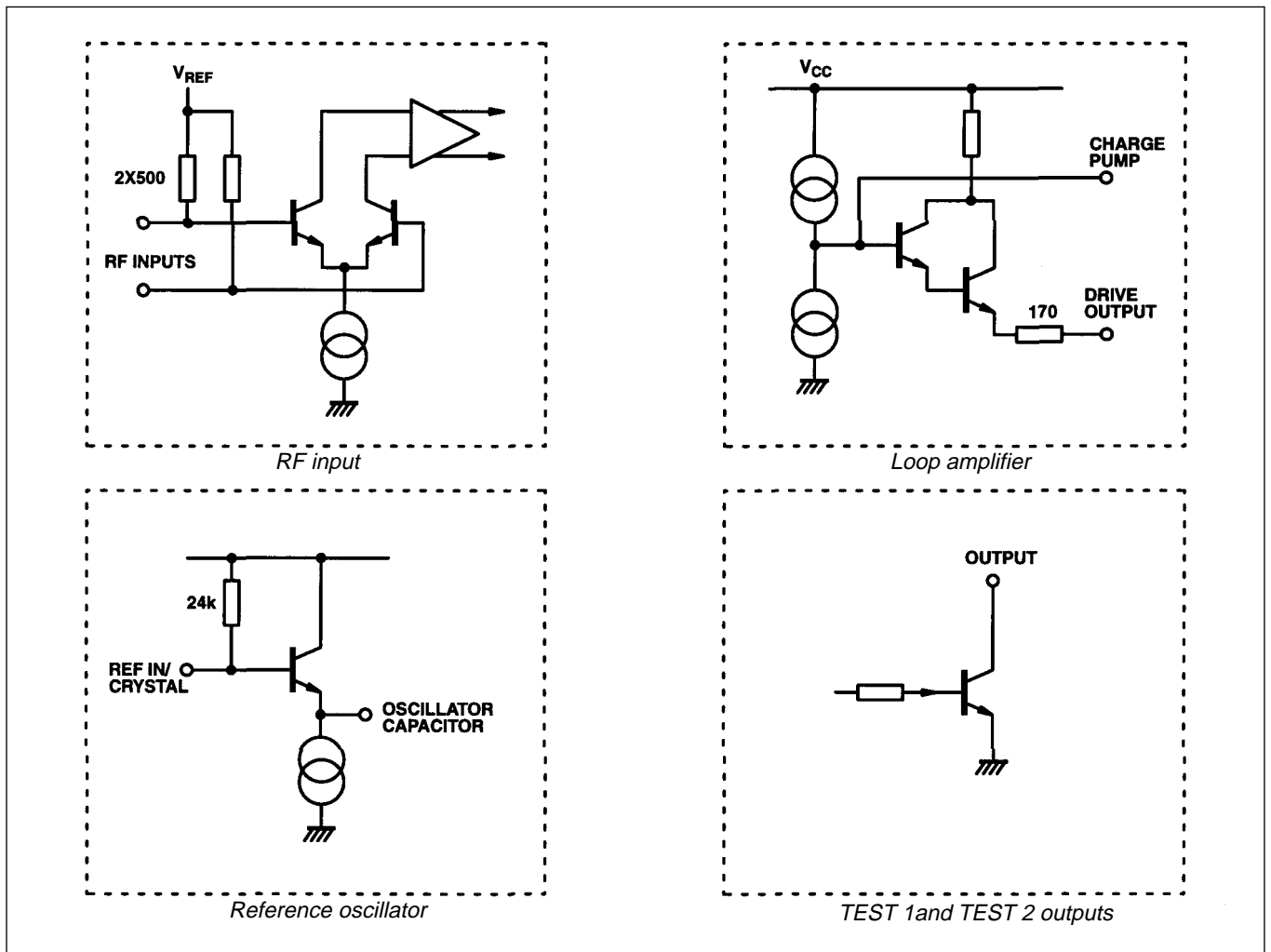
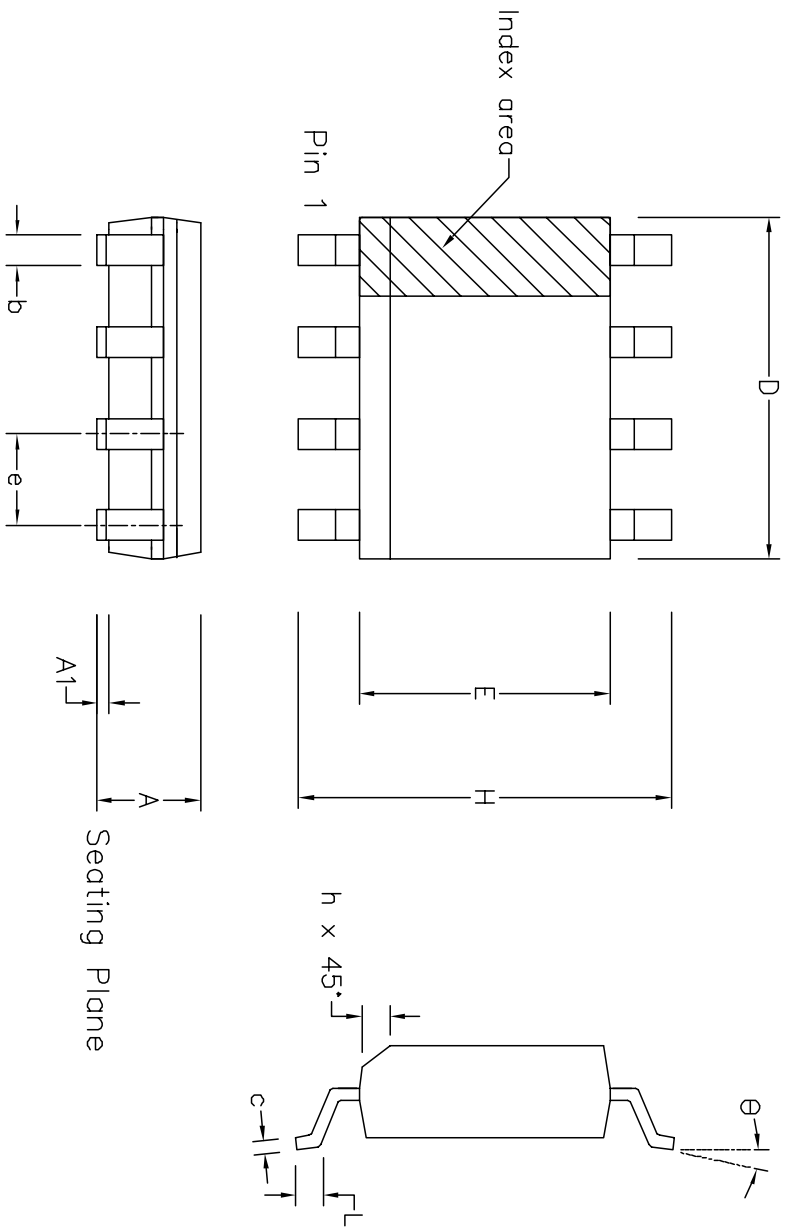


Fig.7 SP5070 input/output interface circuits



	Min mm	Max mm	Min inch	Max inch
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	8.55	8.75	0.337	0.344
H	5.80	6.20	0.228	0.244
E	3.80	4.00	0.150	0.157
L	0.40	1.27	0.016	0.050
e	1.27 BSC		0.050 BSC	
b	0.33	0.51	0.013	0.020
c	0.19	0.25	0.008	0.010
O	0°	8°	0°	8°
h	0.25	0.50	0.010	0.020
Pin Features				
N	14		14	

Conforms to JEDEC MS-012AB Iss. C

**Notes:**

1. The chamfer on the body is optional. If it not present, a visual index feature, e.g. a dot, must be located within the cross-hatched area.
2. Controlling dimension are in inches.
3. Dimension D do not include mould flash, protusion or gate burrs. These shall not exceed 0.006" per side.
4. Dimension E1 do not include inter-lead flash or protusion. These shall not exceed 0.010" per side.
5. Dimension b does not include dambar protusion/intrusion. Allowable dambar protusion shall be 0.004" total in excess of b dimension.

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ISSUE	1	2	3	4
ACN	006745	201937	202596	203707
DATE	7APR95	27FEB97	12JUN97	9DEC97
APPROVED				

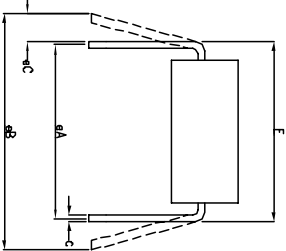
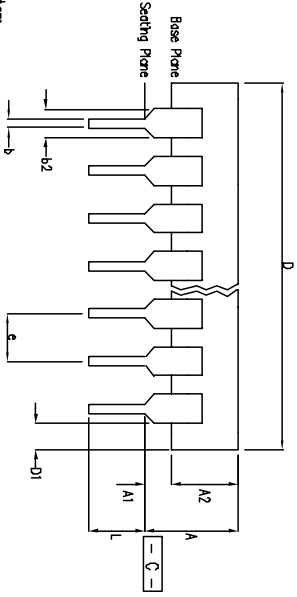
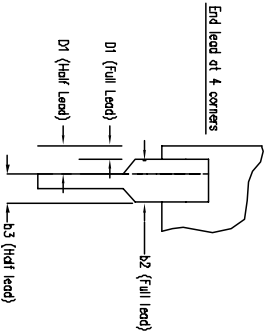
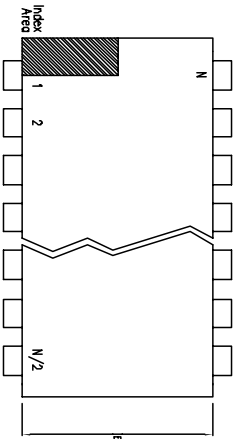
# MITEL SEMICONDUCTOR

ORIGINATING SITE: SWINDON

Title: Package Outline Drawing for  
14 lds SOIC(N)-0.150" Body Width (

Drawing Number

GPD000011



	Min	Max	Min	Max
	mm	mm	Inches	Inches
A	0.38	5.33		0.210
A1	0.38		0.015	
A2	2.92	4.95	0.115	0.195
b	0.36	0.56	0.014	0.022
b2	1.14	1.78	0.045	0.070
b3	n/d	n/d	n/d	n/d
c	0.20	0.36	0.008	0.014
D	18.67	19.69	0.735	0.775
D1	0.13		0.005	
E	7.62	8.26	0.300	0.325
E1	6.10	7.11	0.240	0.280
ø	2.54 BSC		0.100 BSC	
eA	7.62 BSC		0.300 BSC	
eB		10.92		0.430
eC	0.00	1.52	0.000	0.060
L	2.92	3.81	0.115	0.150
N	14		14	

Conforms to Jeduc MS-001AA Issue D

- Notes:
1. Leadframe Material: Copper
  2. Leadframe finish: Solder Plated
  3. Dimensions D, D1 & E1 do not include mold flash or protrusions.
  4. Dimensions E & eA are measured with leads constrained to be perpendicular to datum  $\text{---C---}$
  5. Dimensions eB & eC are measured with the leads unconstrained
  6. Controlling dimensions are inches. Millimeter conversions are not necessarily exact.
  7. N is the maximum of terminal positions.

This drawing supersedes:-  
 Lincoln drawing # X0489  
 Qudrom drawing # TD/D 609  
 Roberough/Swindon drawing # 418/ED/39602/002



ORIGINATING SITE: Swindon

ISSUE 1

Title:

ACN 202539

14 Lead Plastic DIP Outline Drawing

DATE 23MAY97

Drawing Number

MITEL SEMICONDUCTOR

APPROVED

GPD00344



<http://www.mitelsemi.com>

**World Headquarters - Canada**

Tel: +1 (613) 592 2122

Fax: +1 (613) 592 6909

**North America**

Tel: +1 (770) 486 0194

Fax: +1 (770) 631 8213

**Asia/Pacific**

Tel: +65 333 6193

Fax: +65 333 6192

**Europe, Middle East,  
and Africa (EMEA)**

Tel: +44 (0) 1793 518528

Fax: +44 (0) 1793 518581

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