รายการอ้างอิง

ภาษาไทย

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ภาคผนวก ก

ข้อมูลของไอซีหมายเลข 7107

ICL7106/ICL7107
3½-Digit LCD/LED Single-Chip A/D Converter

INTERSIL

GENERAL DESCRIPTION

The Intersil ICL7106 and 7107 are high performance, low power 3½-digit A/D converters containing all the necessary active devices on a single CMOS I.C. Included are seven-segment decoders, display drivers, a reference, and a clock. The 7106 is designed to interface with a liquid crystal display (LCD) and includes a backplane drive; the 7107 will directly drive an instrument-size light emitting diode (LED) display.

The 7106 and 7107 bring together an unprecedented combination of high accuracy, versatility, and true economy. It features auto-zero to less than 10μV, zero drift of less than 1μV/°C, input bias current of 10 pA max., and rollover error of less than one count. True differential inputs and reference are useful in all systems, but give the designer an uncommon advantage when measuring load cells, strain gauges and other bridge-type transducers. Finally, the true economy of single power supply operation (7106), enables a high performance panel meter to be built with the addition of only 10 passive components and a display.

FEATURES

- Guaranteed Zero Reading for 0 Volts Input on All Scales
- True Polarity at Zero for Precise Null Detection
- 1pA Typical Input Current
- True Differential Input and Reference
- Direct Display Drive — No External Components Required — LCD ICL7106
  — LED ICL7107
- Low Noise – Less Than 15μV p-p
- On-Chip Clock and Reference
- Low Power Dissipation – Typically Less Than 10mW
- No Additional Active Circuits Required
- New Small Outline Surface Mount Package Available
- Evaluation Kit Available

ORDERING INFORMATION

Part Number	Temperature Range	Package
ICL7106CPL	0°C to +70°C	40 pin plastic DIP
ICL7106CJL	0°C to +70°C	40 pin CERDIP
ICL7106CM44	0°C to +70°C	44 pin Surface Mount
ICL7107CJL	0°C to +70°C	40 pin CERDIP
ICL7107CPL	0°C to +70°C	40 pin plastic DIP
ICL7106EV/Kit ICL7107EV/Kit	Evaluation kits contain IC, display, circuit board, passive components and hardware.	

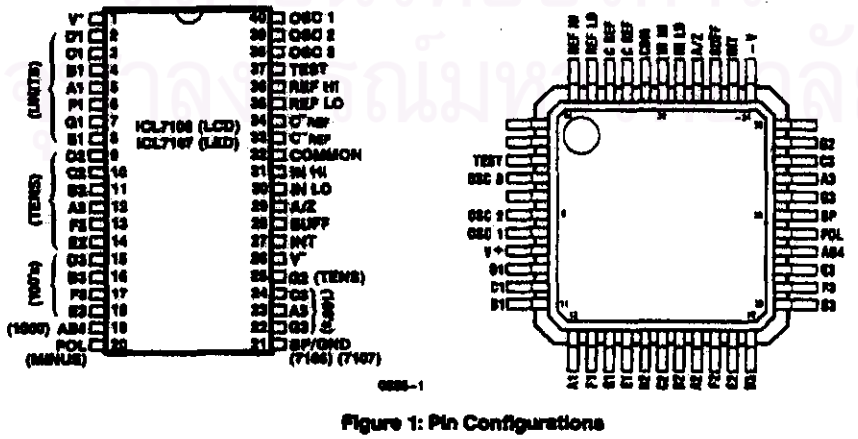


Figure 1: Pin Configurations

ICL7106/ICL7107

INTERSIL

ABSOLUTE MAXIMUM RATINGS

Supply Voltage
- ICL7106, V+ to V− ..... ±5V
- ICL7107, V+ to GND ..... +6V
- ICL7107, V− to GND ..... −9V

Analog Input Voltage (either input)(Note 1) ..... V+ to V−
Reference Input Voltage (either input) ..... V+ to V−
Clock Input
- ICL7106 ..... TEST to V+
- ICL7107 ..... GND to V+

Power Dissipation (Note 2)
- Ceramic Package 1000mW
- Plastic Package 800mW

Operating Temperature ..... 0°C to +70°C
Storage Temperature ..... −65°C to +150°C
Lead Temperature (Soldering, 10sec) ..... 300°C

NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 1: Input voltages may exceed the supply voltages provided the input current is limited to ±100μA.

Note 2: Dissipation rating assumes device is mounted with all leads soldered to printed circuit board.

ELECTRICAL CHARACTERISTICS (Note 3)

Characteristics	Test Conditions	Min	Typ	Max	Unit
Zero Input Reading	V_{IN} = 0.0V Full Scale = 200.0mV	−000.0	±000.0	+000.0	Digital Reading
Ratiometric Reading	$V_{IN} = V_{REF}$ V_{REF} = 100mV	999	999/1000	1000	Digital Reading
Rollover Error (Difference in reading for equal positive and negative inputs near Full Scale)	$-V_{IN} = +V_{IN}$ = 200.0mV	−1	±.2	+1	Counts
Linearity (Max. deviation from best straight line fit)	Full scale = 200.0mV or full scale = 2.000V (Note 6)	−1	±.2	+1	Counts
Common Mode Rejection Ratio (Note 4)	V_{CM} = ±1V, V_{IN} = 0V Full Scale = 200.0mV		50		μV/V
Noise (Pk-Pk value not exceeded 95% of time)	V_{IN} = 0V Full Scale = 200.0mV		15		μV
Leakage Current Input	V_{IN} = 0 (Note 6)		1	10	pA
Zero Reading Drift	V_{IN} = 0 0° < T_A < 70°C (Note 6)		0.2	1	μV/°C
Scale Factor Temperature Coefficient	V_{IN} = 199.0mV 0° < T_A < 70°C (Ext. Ref. 0ppm/°C) (Note 6)		1	5	ppm/°C
V+ Supply Current (Does not include LED current for 7107)	V_{IN} = 0		0.8	1.8	mA
V− Supply Current (7107 only)			0.6	1.8	mA
Analog Common Voltage (With respect to Pos. Supply)	25kΩ between Common & Pos. Supply	2.4	2.8	3.2	V
Temp. Coeff. of Analog Common (With respect to Pos. Supply)	25kΩ between Common & Pos. Supply		80		ppm/°C

ICL7106/ICL7107

ELECTRICAL CHARACTERISTICS (Note 3) (Continued)

Characteristics	Test Conditions	Min	Typ	Max	Unit
7106 ONLY Pk-Pk Segment Drive Voltage Pk-Pk Backplane Drive Voltage (Note 5)	V^+ to V^- = 9V	4	5	6	V
7107 ONLY Segment Sinking Current (Except Pin 19 & 20)	V^+ = 5.0V Segment voltage = 3V	5	8.0		mA
(Pin 19 only)		10	16		mA
(Pin 20 only)		4	7		

NOTES: 2. Unless otherwise noted, specifications apply to both the 7106 and 7107 at T_A = 25°C, f_{clock} = 48kHz. 7106 is tested in the circuit of Figure 2, 7107 is tested in the circuit of Figure 3.

4. Refer to "Differential Input" discussion.

5. Back plane drive is in phase with segment drive for 'off' segment, 180° out of phase for 'on' segment. Frequency is 20 times conversion rate. Average DC component is less than 50mV.

6. Not tested, guaranteed by design.

TEST CIRCUITS

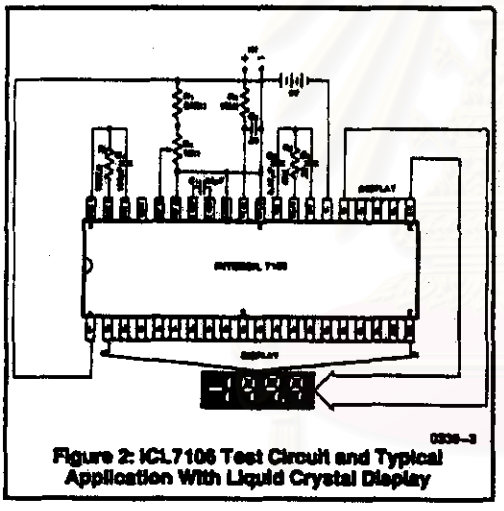


Figure 2: ICL7106 Test Circuit and Typical Application With Liquid Crystal Display

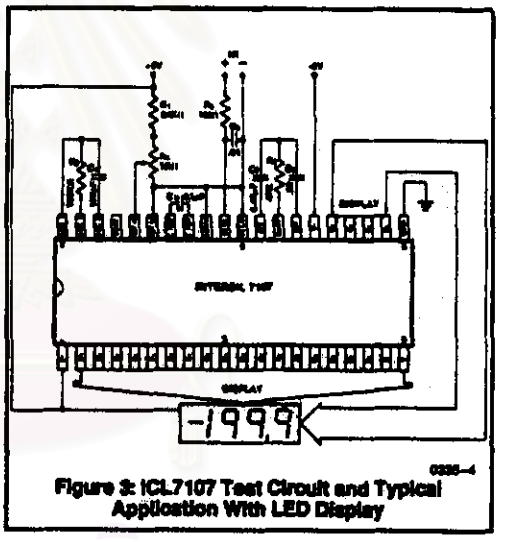


Figure 3: ICL7107 Test Circuit and Typical Application With LED Display

ภาคผนวก ข

ข้อมูลของไอซีหมายเลข 7216D

HARRIS SEMICONDUCTOR

ICM7216A, ICM7216B, ICM7216D

8-Digit, Multi-Function, Frequency Counters/Timers

August 1997

Features All Versions

- Functions as a Frequency Counter (DC to 10MHz)
- Four Internal Gate Times: 0.01s, 0.1s, 1s, 10s in Frequency Counter Mode
- Directly Drives Digits and Segments of Large Multiplexed LED Displays (Common Anode and Common Cathode Versions)
- Single Nominal 5V Supply Required
- Highly Stable Oscillator, Uses 1MHz or 10MHz Crystal
- Internally Generated Decimal Points, Interdigit Blanking, Leading Zero Blanking and Overflow Indication
- Display Off Mode Turns Off Display and Puts Chip into Low Power Mode
- Hold and Reset Inputs for Additional Flexibility

Features ICM7216A and ICM7216B

- Functions Also as a Period Counter, Unit Counter, Frequency Ratio Counter or Time Interval Counter
- 1 Cycle, 10 Cycles, 100 Cycles, 1000 Cycles in Period, Frequency Ratio and Time Interval Modes
- Measures Period From 0.5µs to 10s

Features ICM7216D

- Decimal Point and Leading Zero Banking May Be Externally Selected.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
ICM7216AIJI	-25 to 85	28 Ld CERDIP	F28.6
ICM7216BIPI	-25 to 85	28 Ld PDIP	E28.6
ICM7216DIPI	-25 to 85	28 Ld PDIP	E28.6

Description

The ICM7216A and ICM7216B are fully integrated Timer Counters with LED display drivers. They combine a high frequency oscillator, a decade timebase counter, an 8-decade data counter and latches, a 7-segment decoder, digit multiplexers and 8-segment and 8-digit drivers which directly drive large multiplexed LED displays. The counter inputs have a maximum frequency of 10MHz in frequency and unit counter modes and 2MHz in the other modes. Both inputs are digital inputs. In many applications, amplification and level shifting will be required to obtain proper digital signals for these inputs.

The ICM7216A and ICM7216B can function as a frequency counter, period counter, frequency ratio (f_A/f_B) counter, time interval counter or as a totalizing counter. The counter uses either a 10MHz or 1MHz quartz crystal timebase. For period and time interval, the 10MHz timebase gives a 0.1µs resolution. In period average and time interval average, the resolution can be in the nanosecond range. In the frequency mode, the user can select accumulation times of 0.01s, 0.1s, 1s and 10s. With a 10s accumulation time, the frequency can be displayed to a resolution of 0.1Hz in the least significant digit. There is 0.2s between measurements in all ranges.

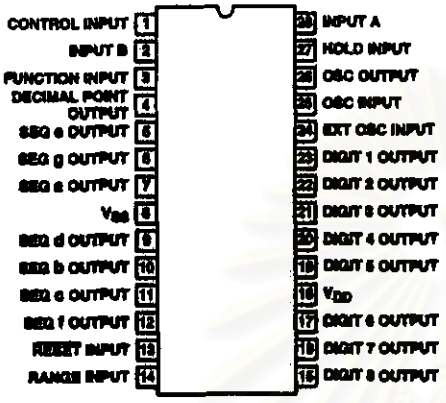
The ICM7216D functions as a frequency counter only, as described above.

All versions of the ICM7216 incorporate leading zero blanking. Frequency is displayed in kHz. In the ICM7216A and ICM7216B, time is displayed in µs. The display is multiplexed at 500Hz with a 12.2% duty cycle for each digit. The ICM7216A is designed for common anode displays with typical peak segment currents of 25mA. The ICM7216B and ICM7216D are designed for common cathode displays with typical peak segment currents of 12mA. In the display off mode, both digit and segment drivers are turned off, enabling the display to be used for other functions.

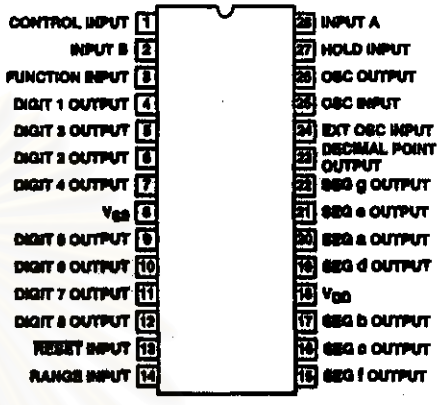
ICM7216A, ICM7216B, ICM7216D

Pinouts

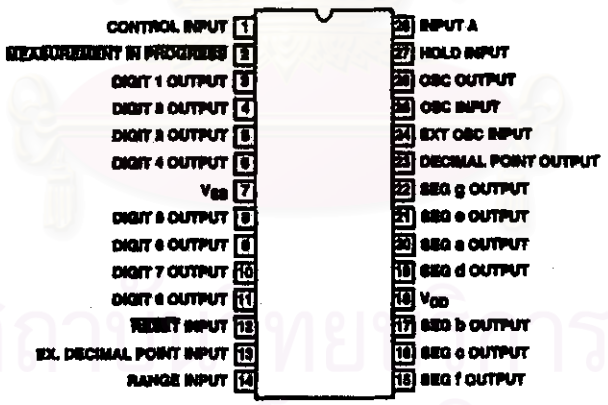
ICM7216A
COMMON ANODE
(CERDIP)
TOP VIEW



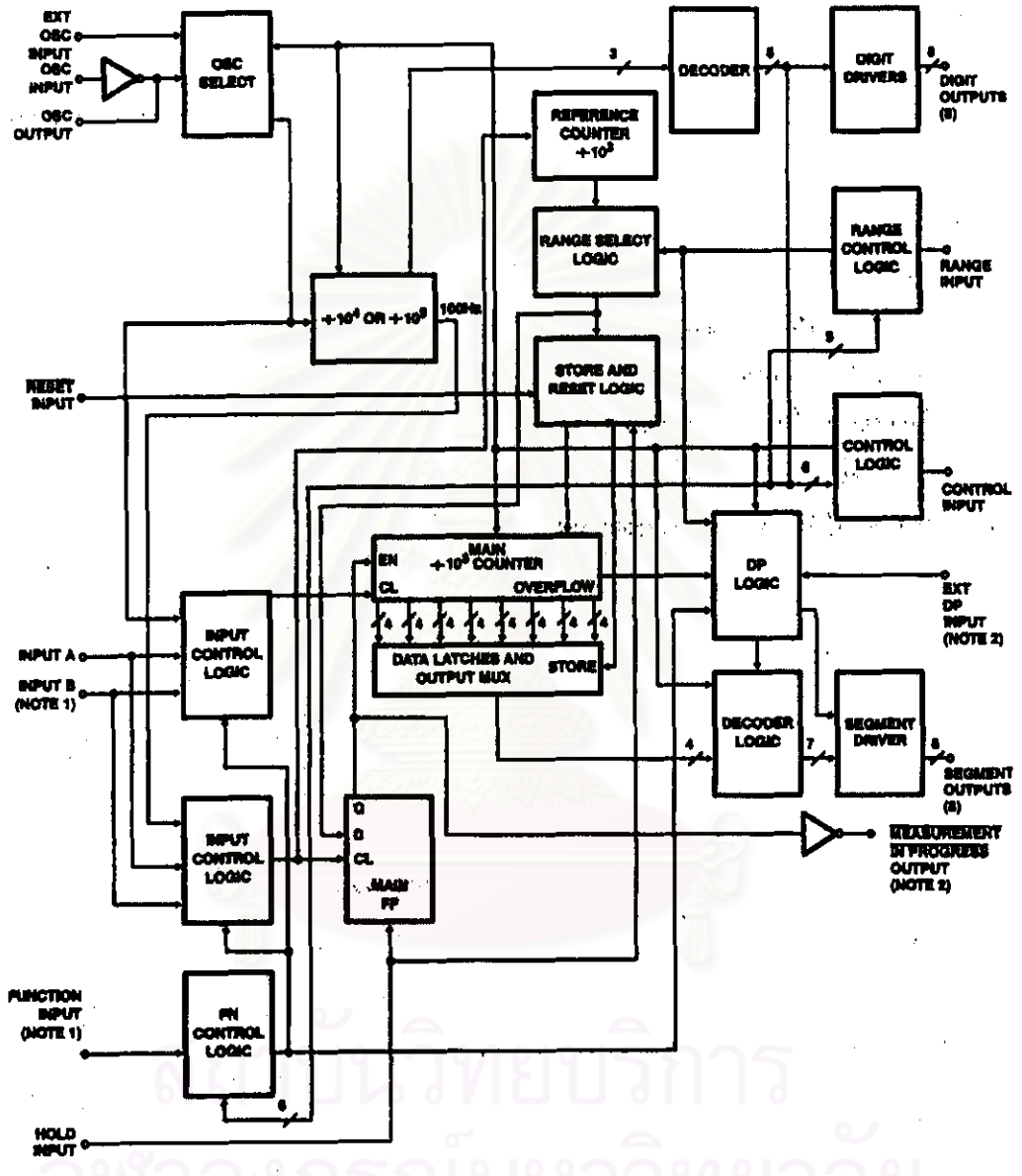
ICM7216B
COMMON CATHODE
(PDIP)
TOP VIEW



ICM7216D
COMMON CATHODE
(PDIP)
TOP VIEW



Functional Block Diagram



NOTES:

1. Function input and Input B available on ICM7216A/B only.
2. Ext DP input and MEASUREMENT IN PROGRESS output available on ICM7216D only.

Absolute Maximum Ratings

Maximum Supply Voltage (V_{DD} - V_{SS}) 6.5V
Maximum Digit Output Current 400mA
Maximum Segment Output Current 60mA
Voltage On Any Input or
Output Terminal (Note 1) ..... (V_{DD} +0.3V) to (V_{SS} -0.3V)

Operating Conditions

Temperature Range ..... -25°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
CERDIP Package	50	10
PDIP Package	55	N/A

Maximum Junction Temperature
CERDIP Package ..... 175°C
PDIP Package ..... 150°C
Maximum Storage Temperature Range ..... -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) ..... 300°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. The ICM7216 may be triggered into a destructive latchup mode if either input signals are applied before the power supply is applied or if input or outputs are forced to voltages exceeding V_{DD} to V_{SS} by more than 0.3V.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

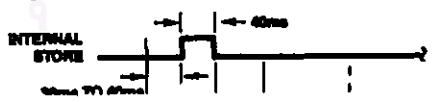
V_{DD} = 5.0V, V_{SS} = 0V, T_A = 25°C, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
ICM7216A/B					
Operating Supply Current, I_{DD}	Display Off, Unused Inputs to V_{SS}	-	2	5	mA
Supply Voltage Range (V_{DD} -V_{SS}), V_{SUPPLY}	INPUT A, INPUT B Frequency at f_{MAX}	4.75	-	6.0	V
Maximum Frequency INPUT A, Pin 28, $f_{A(MAX)}$	Figure 9, Function = Frequency, Ratio, Unit Counter	10	-	-	MHz
	Function = Period, Time Interval	2.5	-	-	MHz
Maximum Frequency INPUT B, Pin 2, $f_{B(MAX)}$	Figure 10	2.5	-	-	MHz
Minimum Separation INPUT A to INPUT B Time Interval Function	Figure 1	250	-	-	ns
Maximum Oscillator Frequency and External Oscillator Frequency, f_{OSC}		10	-	-	MHz
Minimum External Oscillator Frequency, f_{OSC}		-	-	100	kHz
Oscillator Transconductance, g_M	V_{DD} = 4.75V, T_A = 85°C	2000	-	-	µS
Multiplex Frequency, f_{MUX}	f_{OSC} = 10MHz	-	500	-	Hz
Time Between Measurements	f_{OSC} = 10MHz	-	200	-	ms
Input Voltages: Pins 2, 13, 25, 27, 28 Input Low Voltage, V_{INL}		-	-	1.0	V
Input High Voltage, V_{INH}		3.5	-	-	V
Input Resistance to V_{DD} Pins 13, 24, R_{IN}	V_{IN} = V_{DD} -1.0V	100	400	-	kΩ
Input Leakage Pins 27, 28, 2, I_{ILK}		-	-	20	µA
Input Range of Change, dV_{IN}/dt	Supplies Well Bypassed	-	15	-	mV/µs
ICM7216A					
Digit Driver: Pins 15, 16, 17, 19, 20, 21, 22, 23 High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.0V	-140	-160	-	mA
Low Output Current, I_{OL}	V_{OUT} = V_{SS} +1.0V	-	0.3	-	mA
Segment Driver: Pins 4, 5, 6, 7, 9,10, 11, 12 Low Output Current, I_{OL}	V_{OUT} = V_{SS} +1.5V	20	35	-	mA
High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.5V	-	-100	-	µA
Multiplex Inputs: Pins 1, 3, 14 Input Low Voltage, V_{INL}		-	-	0.8	V
Input High Voltage, V_{INH}		2.0	-	-	V
Input Resistance to V_{SS}, R_{IN}	V_{IN} = V_{SS} +1.0V	50	100	-	kΩ

Electrical Specifications V_{DD} = 5.0V, V_{SS} = 0V, T_A = 25°C, Unless Otherwise Specified (Continued)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
ICM7216B					
Digit Driver: Pins 4, 5, 6, 7, 9, 10, 11, 12					
Low Output Current, I_{OL}	V_{OUT} = V_{SS} +1.3V	50	75	-	mA
High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.5V	-	-100	-	µA
Segment Driver: Pins 15, 16, 17, 19, 20, 21, 22, 23					
High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.0V	-10	-	-	mA
Leakage Current, I_{SLK}	V_{OUT} = V_{DD} -2.5V	-	-	10	µA
Multiplex Inputs: Pins 1, 3, 14					
Input Low Voltage, V_{INL}		-	-	V_{DD} -2.0	V
Input High Voltage, V_{INH}		V_{DD} -0.8	-	-	V
Input Resistance to V_{DD}, R_{IN}	V_{IN} = V_{DD} -2.5V	100	360	-	kΩ
ICM7216D					
Operating Supply Current, I_{DD}	Display Off, Unused Inputs to V_{SS}	-	2	5	mA
Supply Voltage Range (V_{DD} -V_{SS}), V_{SUPPLY}	INPUT A Frequency at f_{MAX}	4.75	-	6.0	V
Maximum Frequency INPUT A, Pin 28, $f_{A(MAX)}$	Figure 9	10	-	-	MHz
Maximum Oscillator Frequency and External Oscillator Frequency, f_{OSC}		10	-	-	MHz
Minimum External Oscillator Frequency, f_{OSC}		-	-	100	kHz
Oscillator Transconductance, g_M	V_{DD} = 4.75V, T_A = 85°C	2000	-	-	µS
Multiplex Frequency, f_{MUX}	f_{OSC} = 10MHz	-	500	-	Hz
Time Between Measurements	f_{OSC} = 10MHz	-	200	-	ms
Input Voltages: Pins 12, 27, 28					
Input Low Voltage, V_{INL}		-	-	1.0	V
Input High Voltage, V_{INH}		3.5	-	-	V
Input Resistance to V_{DD}, Pins 12, 24, R_{IN}	V_{IN} = V_{DD} -1.0V	100	400	-	kΩ
Input Leakage, Pins 27, 28, I_{ILK}		-	-	20	µA
Output Current, Pin 2, I_{OL}	V_{OL} = +0.4V	0.36	-	-	mA
Output Current, Pin 2, I_{OH}	V_{OH} = V_{DD} -0.8V	265	-	-	µA
Input Rate of Change, dV_{IN}/dt	Supplies Well Bypassed	-	15	-	mV/µs
Digit Driver: Pins 3, 4, 5, 6, 8, 9, 10, 11					
Low Output Current, I_{OL}	V_{OUT} = +1.3V	50	75	-	mA
High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.5V	-	100	-	µA
Segment Driver: Pins 15, 16, 17, 19, 20, 21, 22, 23					
High Output Current, I_{OH}	V_{OUT} = V_{DD} -2.0V	10	15		mA
Leakage Current, I_{SLK}	V_{OUT} = V_{DD} -2.5V	-	-	10	µA
Multiplex Inputs: Pins 1, 13, 14					
Input Low Voltage, V_{INL}		-	-	V_{DD} -2.0	V
Input High Voltage, V_{INH}		V_{DD} -0.8	-	-	V
Input Resistance to V_{DD}, R_{IN}	V_{IN} = V_{DD} -1.0V	100	360	-	kΩ

Timing Diagram



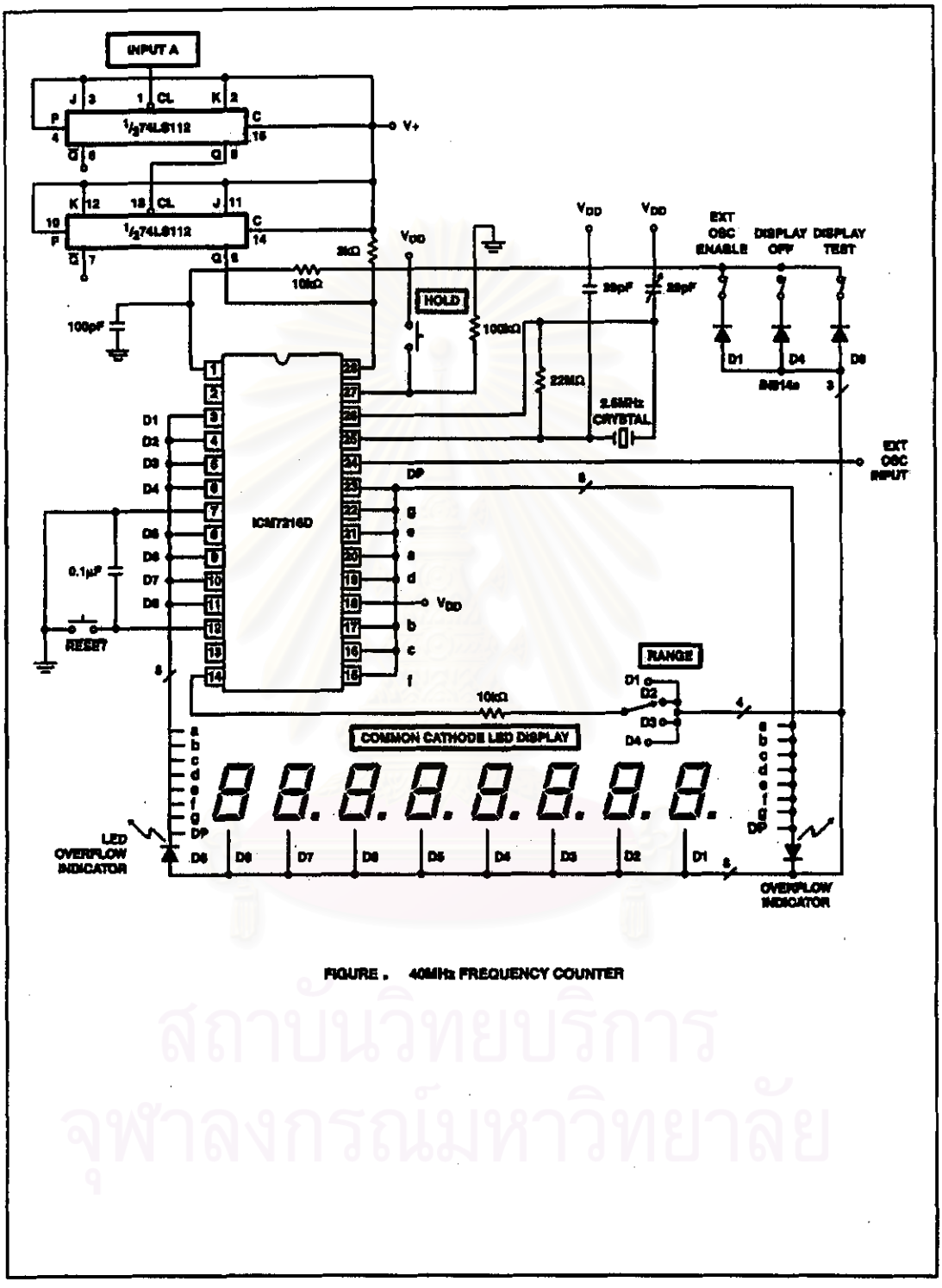


FIGURE . 40MHz FREQUENCY COUNTER

ภาคผนวก ค

รายการอุปกรณ์โรบินสันดีเทคเตอร์

สัญญลักษณ์	อุปกรณ์
T1	BF256A
T2	MPSH11
T3 , T4 , T6	BCY71 or 2N2906
T5	BFY90 or MRF502
T7 , T8	BC182L
T9	BC212L
R1	680Ω
R2	1KΩ
R3	470Ω
R4	8.2KΩ
R5 , R10	15KΩ
R6	4.7KΩ
R7 , R9	3.3KΩ
R8	33KΩ
R11	22KΩ
C1	2pF
C1'	5pF
C2	Trimmer max 100pF
C3	4.7nF//68pF
C4	2 X 4.7nF//68pF
Cปรับค่าได้ วงจรแทงค์	100 pF (max)

ภาคผนวก ง

สมบัติของน้ำมันข้าวโพดที่ใช้ทดลอง

Typical Specifications

Corn Oil, Expeller Pressed

(Zea mays)

Additive	none
AOM Stability (hours)	15+
Appearance	Clear
Cold Test, hours	min.15
Color ($5\frac{1}{4}$ Lovibond Scale)	3.5 R max
Congealing Point/Title, $^{\circ}C$	14-20
FFA (Free Fatty Acid)	0.05 max
Flavor/Taste	Bland
Iodine Value (Wijs or Hanus)	102-130
Moisture %	0.05 max
Odor	Bland
Peroxide Value (at time of drumming)	< 0.5
Saponification Value	187-193
Smoke Point, $^{\circ}F$	450
Specitic Gravity at 25 $^{\circ}C$	0.914 -0.921
Unsaponifiable Matter	1.5% max

Fatty Acid Profile

C16 Palmitic	10.0-13.0%	Totel	Saturated Acids	13%
C16:1 Palmitoleic	0.1-0.2%	Totel	Monounsaturated Acid	24%
C18 Stearic	1.5-2.5%	Totel	Polyunsaturated Acid	59%
C18:1 Oleic	25.0-33.0%			
C18:2 Linoleic	52.0-61.0%			
C18:3 Linolenic	0.5-1.5%			

ประวัติผู้เขียน

นายมงคล แจ่มแจ้ง เกิดวันที่ 18 สิงหาคม พ.ศ. 2514 สำเร็จการศึกษาระดับปริญญาตรีวิทยาศาสตรบัณฑิต สาขาวิชาฟิสิกส์ ภาควิชาฟิสิกส์ คณะวิทยาศาสตร์ มหาวิยาลัยบูรพา ในปีการศึกษา 2537 แล้วเข้าศึกษาต่อในหลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชาฟิสิกส์ ที่ภาควิชาฟิสิกส์ คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เมื่อปีการศึกษา 2537