



Integrated  
Circuit  
Systems, Inc.

## PRELIMINARY

# ICS840-77

77.76MHz, LVCMOS/LVTTL  
OSCILLATOR REPLACEMENT

### GENERAL DESCRIPTION



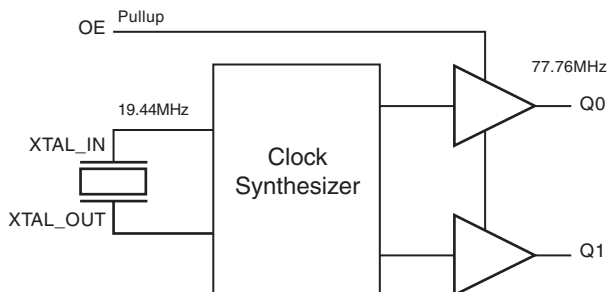
The ICS840-77 is a SONET Oscillator Replacement and a member of the HiPerClocks™ family of high performance devices from ICS. The ICS840-77 uses a 19.44MHz crystal to synthesize 77.76MHz. The ICS840-77 has excellent jitter performance. The ICS840-77 is packaged in a small 8-pin TSSOP, making it ideal for use in systems with limited board space.

### FEATURES

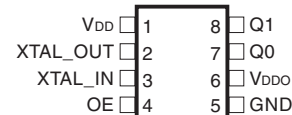
- One LVCMOS/LVTTL output, 15Ω output impedance
- Crystal oscillator interface designed for 19.44MHz, 18pF parallel resonant crystal
- Output frequency: 77.76MHz
- Random jitter: 2.82ps (typical)
- Deterministic jitter: 0.205ps (typical)
- 3.3V operating supply
- 0°C to 70°C ambient operating temperature
- Available in both standard and lead-free RoHS-compliant packages

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### BLOCK DIAGRAM



### PIN ASSIGNMENT



#### ICS840-77

##### 8-Lead TSSOP

4.40mm x 3.0mm x 0.925mm package body

##### G Package

Top View

#### ICS840-77

##### 8-Lead SOIC

3.90mm x 4.92mm x 1.37mm package body

##### M Package

Top View

The Preliminary Information presented herein represents a product in prototyping or pre-production. The noted characteristics are based on initial product characterization. Integrated Circuit Systems, Incorporated (ICS) reserves the right to change any circuitry or specifications without notice.



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**TABLE 1. PIN DESCRIPTIONS**

Number	Name	Type		Description
1	V <sub>DD</sub>	Power		Power supply pin.
2, 3	XTAL_OUT, XTAL_IN	Input		Crystal oscillator interface. XTAL_IN is the input, XTAL_OUT is the output.
4	OE	Input	Pullup	Output enable pin. When HIGH, outputs are enabled. When LOW, forces outputs to HiZ state. LVCMOS/LVTTL interface levels.
5	GND	Power		Power supply ground.
6	V <sub>DDO</sub>	Power		Output supply pin.
7, 8	Q0, Q1	Output		Single-ended clock outputs. LVCMOS/LVTTL interface levels. 15Ω output impedance.

NOTE: *Pullup* refers to internal input resistors. See Table 2, Pin Characteristics, for typical values.

**TABLE 2. PIN CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
C <sub>IN</sub>	Input Capacitance			4		pF
R <sub>PULLUP</sub>	Input Pullup Resistor			51		kΩ
R <sub>OUT</sub>	Output Impedance			15		Ω

**TABLE 3. CONTROL FUNCTION TABLE**

Control Inputs	Output
OE	Q0, Q1
0	Hi-Z
1	Active



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### ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $V_{DD}$	4.6V
Inputs, $V_I$	-0.5V to $V_{DD} + 0.5V$
Outputs, $V_O$	-0.5V to $V_{DDO} + 0.5V$
Package Thermal Impedance, $\theta_{JA}$	
8 Lead TSSOP	101.7°C/W (0 mps)
8 Lead SOIC	112.7°C/W (0 lfpw)
Storage Temperature, $T_{STG}$	-65°C to 150°C

NOTE: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics* or *AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

TABLE 4A. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{DD}$	Power Supply Voltage		3.0	3.3	3.6	V
$V_{DDO}$	Output Supply Voltage		3.0	3.3	3.6	V
$I_{DD}$	Power Supply Current	OE = $V_{DD}$ (output enabled)		TBD		mA
$I_{DDO}$	Output Supply Current			TBD		

TABLE 4B. LVCMOS/LVTTL DC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage		2		$V_{DD} + 0.3$	V
$V_{IL}$	Input Low Voltage		-0.3		0.8	V
$I_{IH}$	Input High Current	$V_{DD} = V_{IN} = 3.6V$			5	$\mu A$
$I_{IL}$	Input Low Current	$V_{DD} = 3.6V, V_{IN} = 0V$	-150			$\mu A$
$V_{OH}$	Output High Voltage; NOTE 1		2.6			V
$V_{OL}$	Output Low Voltage; NOTE 1				0.5	V

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{DDO}/2$ . See Parameter Measurement Information Section, "3.3V Output Load Test Circuit".

TABLE 5. CRYSTAL CHARACTERISTICS

Parameter	Test Conditions	Minimum	Typical	Maximum	Units
Mode of Oscillation		Fundamental			
Frequency			19.44		MHz
Equivalent Series Resistance (ESR)			TBD		$\Omega$
Shunt Capacitance				7	pF
Drive Level				TBD	$\mu W$



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TABLE 6. AC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{OUT}$	Output Frequency			77.76		MHz
$t_{DJ}$	Deterministic Jitter; NOTE 1			0.205		ps
$t_{RJ}$	Random Jitter; NOTE 1			2.82		ps
$t_{RMS}$	RMS of Total Distribution ( $\sigma$ ); NOTE 1			2.85		ps
$t_{p-p}$	Peak-to-Peak Jitter; NOTE 1			2.18		ps
$t_{acc}$	Accumulated Jitter ( $\sigma$ ); NOTE 1	n = 2 to 50000 cycles		4.0		ps
$t_{OSC}$	Oscillation Start Up Time	Time at minimum operating voltage to be 0 s			10	ms
$t_R / t_F$	Output Rise/Fall Time	20% to 80%		650		ps
odc	Output Duty Cycle			50		%

NOTE 1: Measured using Wavecrest SIA-3000.

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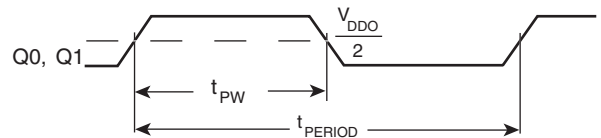
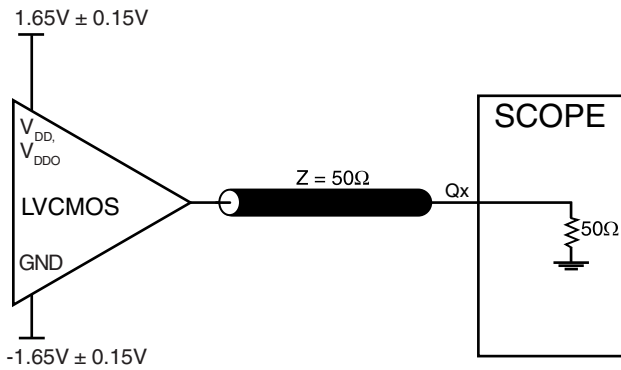


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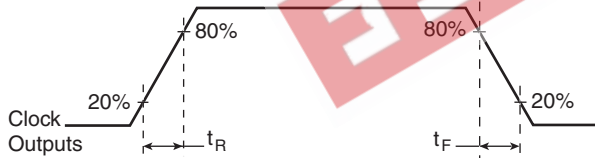
**PARAMETER MEASUREMENT INFORMATION**



$$odc = \frac{t_{PW}}{t_{PERIOD}} \times 100\%$$

**3.3V OUTPUT LOAD AC TEST CIRCUIT**

**OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD**



**OUTPUT RISE/FALL TIME**



### APPLICATION INFORMATION

#### RECOMMENDATIONS FOR UNUSED INPUT AND OUTPUT PINS

##### INPUTS:

###### CRYSTAL INPUT:

For applications not requiring the use of the crystal oscillator input, both XTAL\_IN and XTAL\_OUT can be left floating. Though not required, but for additional protection, a 1kΩ resistor can be tied from XTAL\_IN to ground.

###### SELECT PINS:

All select pins have internal pull-ups and pull-downs; additional resistance is not required but can be added for additional protection. A 1kΩ resistor can be used.

##### OUTPUTS:

###### LVC MOS OUTPUT:

All unused LVC MOS output can be left floating. We recommend that there is no trace attached.

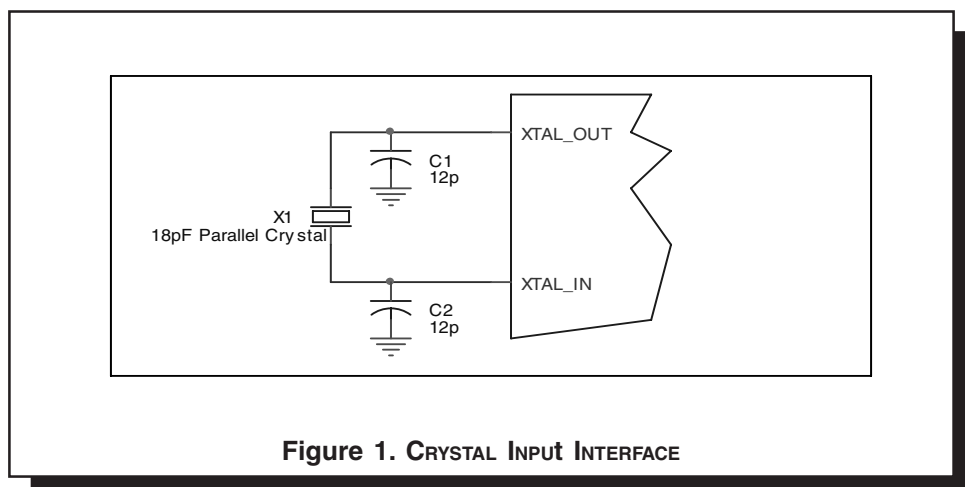
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#### CRYSTAL INPUT INTERFACE

The ICS840-77 has been characterized with 18pF parallel resonant crystals. The capacitor values, C1 and C2, shown in Figure 1 below were determined using a 19.44MHz, 18pF paral-

lel resonant crystal and were chosen to minimize the ppm error. The optimum C1 and C2 values can be slightly adjusted for different board layouts.





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## RELIABILITY INFORMATION

TABLE 7A.  $\theta_{JA}$  VS. AIR FLOW TABLE FOR 8 LEAD TSSOP

$\theta_{JA}$ by Velocity (Meters per Second)			
	0	1	2.5
Multi-Layer PCB, JEDEC Standard Test Boards	101.7°C/W	90.5°C/W	89.8°C/W

TABLE 7B.  $\theta_{JA}$  VS. AIR FLOW TABLE 8 LEAD SOIC

$\theta_{JA}$ by Velocity (Linear Feet per Minute)			
	0	200	500
Single-Layer PCB, JEDEC Standard Test Boards	153.3°C/W	128.5°C/W	115.5°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	112.7°C/W	103.3°C/W	97.1°C/W

**NOTE:** Most modern PCB designs use multi-layered boards. The data in the second row pertains to most designs.

### TRANSISTOR COUNT

The transistor count for ICS840-77 is: 2423



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PACKAGE OUTLINE - G SUFFIX FOR 8 LEAD TSSOP

PACKAGE OUTLINE - M SUFFIX FOR 8 LEAD SOIC

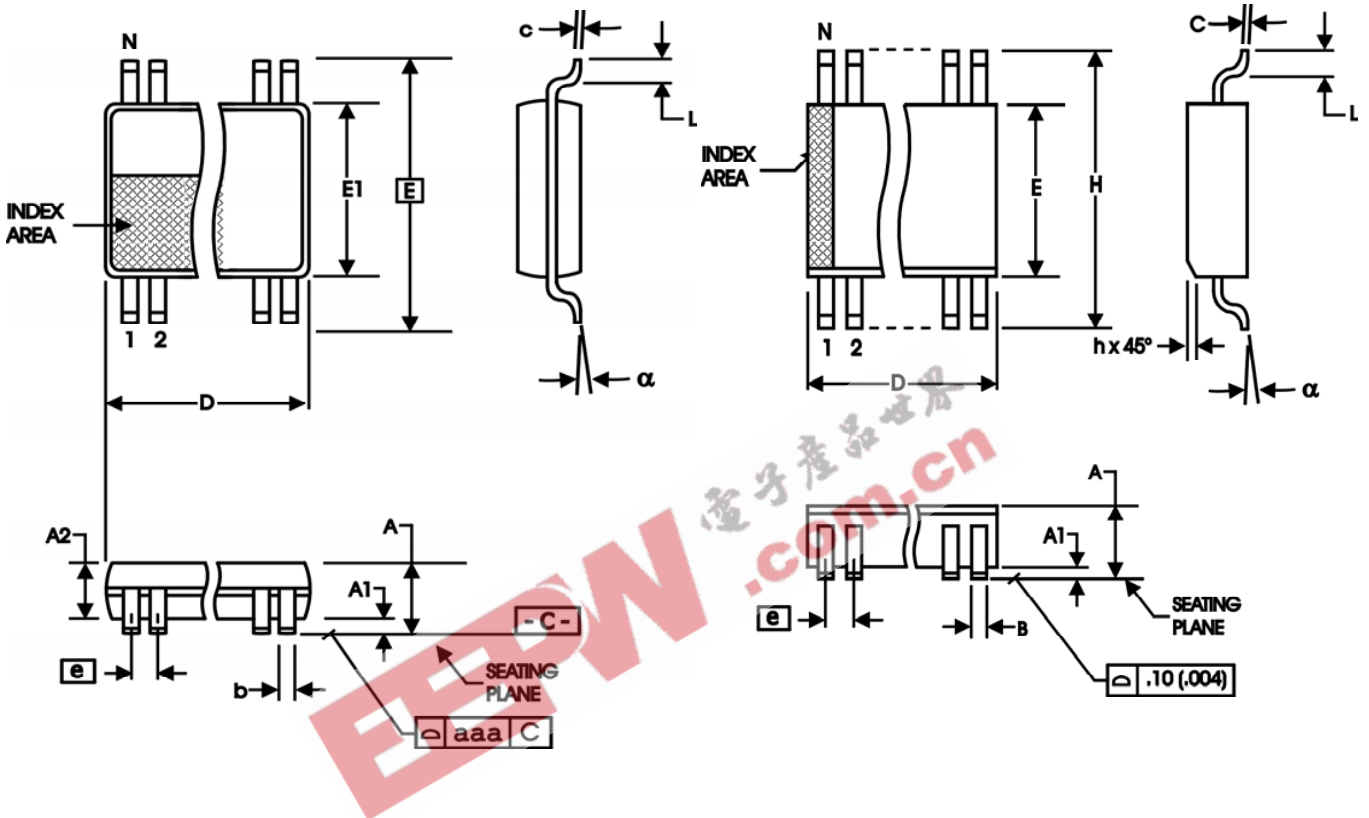


TABLE 8A. PACKAGE DIMENSIONS

SYMBOL	Millimeters	
	Minimum	Maximum
N	8	
A	--	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	2.90	3.10
E	6.40 BASIC	
E1	4.30	4.50
e	0.65 BASIC	
L	0.45	0.75
$\alpha$	0°	8°
aaa	--	0.10

Reference Document: JEDEC Publication 95, MO-153

TABLE 8B. PACKAGE DIMENSIONS

SYMBOL	Millimeters	
	MINIMUM	MAXIMUM
N	8	
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BASIC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
$\alpha$	0°	8°

Reference Document: JEDEC Publication 95, MS-012





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**TABLE 9. ORDERING INFORMATION**

Part/Order Number	Marking	Package	Shipping Packaging	Temperature
ICS840AG-77	40A77	8 lead TSSOP	tube	0°C to 70°C
ICS840AG-77T	40A77	8 lead TSSOP	2500 tape & reel	0°C to 70°C
ICS840AG-77LF	TBD	8 lead "Lead-Free" TSSOP	tube	0°C to 70°C
ICS840AG-77LFT	TBD	8 lead "Lead-Free" TSSOP	2500 tape & reel	0°C to 70°C
ICS840AM-77	TBD	8 lead SOIC	tube	0°C to 70°C
ICS840AM-77T	TBD	8 lead SOIC	2500 tape & reel	0°C to 70°C
ICS840AM-77LF	TBD	8 lead "Lead-Free" SOIC	tube	0°C to 70°C
ICS840AM-77LFT	TBD	8 lead "Lead-Free" SOIC	2500 tape & reel	0°C to 70°C

NOTE: Parts that are ordered with an "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

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