



Integrated  
Circuit  
Systems, Inc.

# ICS8761

Low Voltage, Low Skew,  
PCI / PCI-X Clock Generator

## GENERAL DESCRIPTION

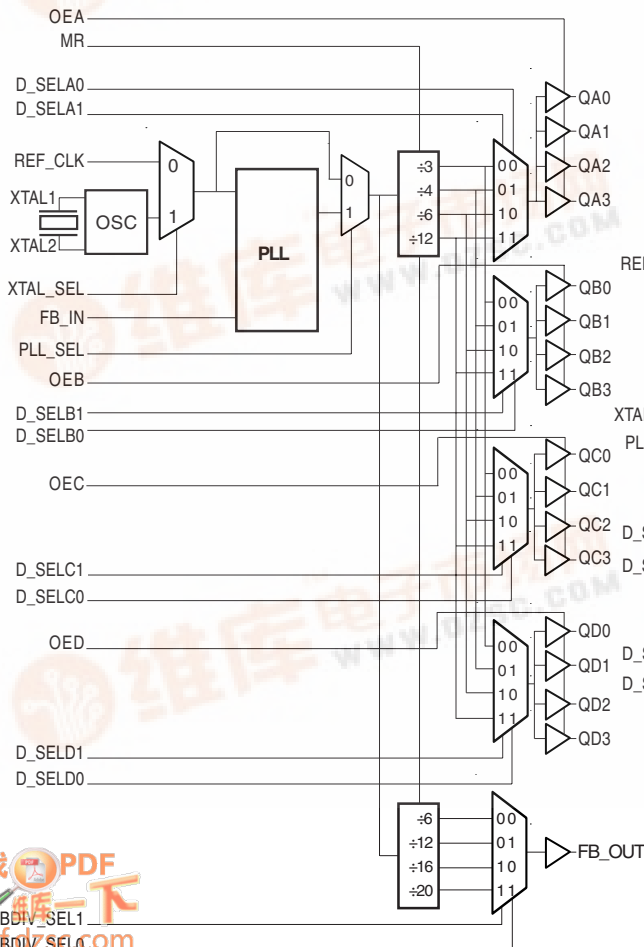
The ICS8761 is a low voltage, low skew PCI / PCI-X Clock Generator and a member of the HiPerClock<sup>SM</sup> family of High Performance Clock Solutions from ICS. The ICS8761 has a selectable REF\_CLK or crystal input. The REF\_CLK input accepts LVCMOS or LVTTTL input levels. The ICS8761 has a fully integrated PLL along with frequency configurable clock and feedback outputs for multiplying and regenerating clocks with "zero delay". Using a 20MHz or 25MHz crystal or a 33.333MHz or 66.666MHz reference frequency, the ICS8761 will generate output frequencies of 33.333MHz, 66.666MHz, 100MHz and 133.333MHz simultaneously.

The low impedance LVCMOS/LVTTTL outputs of the ICS8761 are designed to drive 50Ω series or parallel terminated transmission lines.

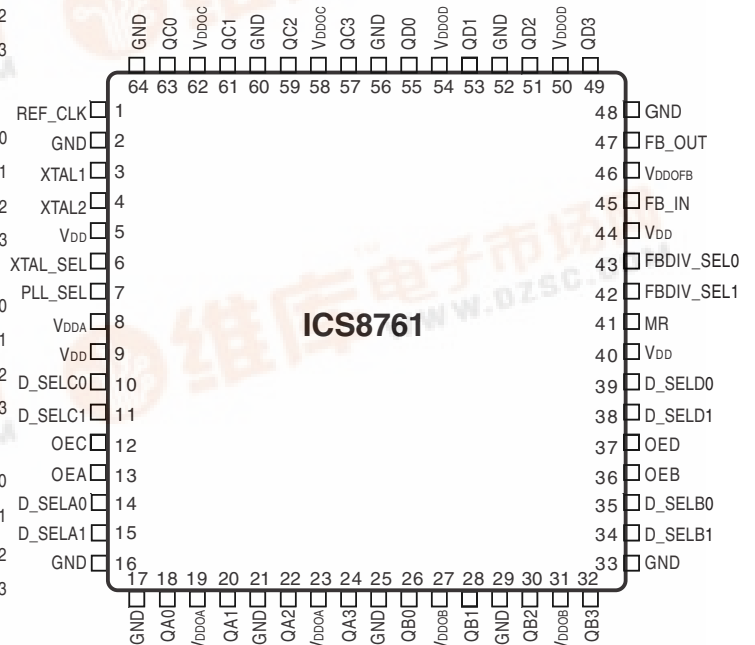
## FEATURES

- Fully integrated PLL
- 17 LVCMOS/LVTTTL outputs, 15Ω typical output impedance
- Selectable crystal oscillator interface or LVCMOS/LVTTTL REF\_CLK
- Maximum output frequency: 166.67MHz
- Maximum crystal input frequency: 38MHz
- Maximum REF\_CLK input frequency: 83.33MHz
- Individual banks with selectable output dividers for generating 33.333MHz, 66.66MHz, 100MHz and 133.333MHz simultaneously
- Separate feedback control for generating PCI / PCI-X frequencies from a 20MHz or 25MHz crystal or 33.333MHz or 66.666MHz reference frequency
- Cycle-to-cycle jitter: 70ps (maximum)
- Period jitter, RMS: 17ps (maximum)
- Output skew: 230ps (maximum)
- Bank skew: 40ps (maximum)
- Static phase offset: 0 ± 150ps (maximum)
- Full 3.3V or 3.3V core, 2.5V multiple output supply modes
- 0°C to 85°C ambient operating temperature
- Lead-Free package available

## BLOCK DIAGRAM



## PIN ASSIGNMENT



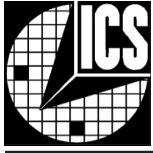
64-Lead LQFP

10mm x 10mm x 1.4mm package body

Y package

Top View





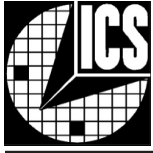
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TABLE 1. PIN DESCRIPTIONS

Number	Name	Type		Description
1	REF_CLK	Input	Pulldown	Reference clock input. LVCMOS / LVTTTL interface levels.
2, 16, 17, 21, 25, 29, 33, 48, 52, 56, 60, 64	GND	Power		Power supply ground.
3, 4	XTAL1, XTAL2	Input		Crystal oscillator interface. XTAL1 is the input. XTAL2 is the output.
5, 9, 40, 44	V <sub>DD</sub>	Power		Core supply pins.
6	XTAL_SEL	Input	Pullup	Selects between crystal oscillator or reference clock as the PLL reference source. Selects XTAL inputs when HIGH. Selects REF_CLK when LOW. LVCMOS / LVTTTL interface levels.
7	PLL_SEL	Input	Pullup	Selects between PLL and bypass mode. When HIGH, selects PLL. When LOW, selects reference clock. LVCMOS / LVTTTL interface levels.
8	V <sub>DDA</sub>	Power		Analog supply pin. See Applications Note for filtering.
10, 11	D_SELCO, D_SELCO1	Input	Pulldown	Selects divide value for Bank C outputs as described in Table 3. LVCMOS / LVTTTL interface levels.
12	OEC	Input	Pullup	Determines state of Bank C outputs. When HIGH, outputs are enabled. When LOW, outputs are disabled. LVCMOS / LVTTTL interface levels.
13	OEA	Input	Pullup	Determines state of Bank A outputs. When HIGH, outputs are enabled. When LOW, outputs are disabled. LVCMOS / LVTTTL interface levels.
14, 15	D_SELA0, D_SELA1	Input	Pulldown	Selects divider value for Bank A outputs as described in Table 3. LVCMOS / LVTTTL interface levels.
18, 20, 22, 24	QA0, QA1, QA2, QA3	Output		Bank A clock outputs. 15Ω typical output impedance. LVCMOS / LVTTTL interface levels.
19, 23	V <sub>DDOA</sub>	Power		Output supply pins for Bank A outputs.
26, 28, 30, 32	QB0, QB1, QB2, QB3	Output		Bank B clock outputs. 15Ω typical output impedance. LVCMOS / LVTTTL interface levels.
27, 31	V <sub>DDOB</sub>	Power		Output supply pins for Bank B outputs.
34, 35	D_SELB1, D_SELB0	Input	Pulldown	Selects divider value for Bank B outputs as described in Table 3. LVCMOS / LVTTTL interface levels.
36	OEB	Input	Pullup	Determines state of Bank B outputs. When HIGH, outputs are enabled. When LOW, outputs are disabled. LVCMOS / LVTTTL interface levels.
37	OED	Input	Pullup	Determines state of Bank D outputs. When HIGH, outputs are enabled. When LOW, outputs are disabled. LVCMOS / LVTTTL interface levels.
38, 39	D_SELD1, D_SELD0	Input	Pulldown	Selects divider value for Bank D outputs as described in Table 3. LVCMOS / LVTTTL interface levels.
41	MR	Input	Pulldown	Active HIGH Master reset. When logic HIGH, the internal dividers are reset causing the outputs to go low. When logic LOW, the internal dividers and the outputs are enabled. LVCMOS / LVTTTL interface levels.
42	FBDIV_SEL1	Input	Pulldown	Selects divider value for bank feedback output as described in Table 3. LVCMOS / LVTTTL interface levels.
43	FBDIV_SELO	Input	Pullup	Selects divider value for bank feedback output as described in Table 3. LVCMOS / LVTTTL interface levels.
45	FB_IN	Input	Pulldown	Feedback input to phase detector for generating clocks with "zero delay". LVCMOS / LVTTTL interface levels.



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Number	Name	Type	Description
46	V <sub>DDO<sub>FB</sub></sub>	Power	Output supply pin for FB_Out output.
47	FB_OUT	Output	Feedback output. Connect to FB_IN. 15Ω typical output impedance. LVCMOS / LVTTTL interface levels.
49, 51, 53, 55	QD3, QD2, QD1, QD0	Output	Bank D clock outputs. 15Ω typical output impedance. LVCMOS / LVTTTL interface levels.
50, 54	V <sub>DDOD</sub>	Power	Output supply pins for Bank D outputs.
57, 59, 61, 63	QC3, QC2, QC1, QC0	Output	Bank C clock outputs. 15Ω typical output impedance. LVCMOS / LVTTTL interface levels.
58, 62	V <sub>DDOC</sub>	Power	Output supply pins for Bank C outputs.

NOTE: Pullup and Pulldown refer 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>PULLDOWN</sub>	Input Pulldown Resistor				51	KΩ
C <sub>PD</sub>	Power Dissipation Capacitance (per output); NOTE 1	V <sub>DD</sub> , V <sub>DDA</sub> = 3.465V; V <sub>DDOx</sub> = 3.465V			9	pF
		V <sub>DD</sub> , V <sub>DDA</sub> = 3.465V; V <sub>DDOx</sub> = 2.625V			11	pF
R <sub>OUT</sub>	Output Impedance			15		Ω

NOTE 1: V<sub>DDOx</sub> denotes V<sub>DDOA</sub>, V<sub>DDOB</sub>, V<sub>DDOC</sub>, V<sub>DDOD</sub>, V<sub>DDO<sub>FB</sub></sub>.

TABLE 3A. OUTPUT CONTROL PIN FUNCTION TABLE

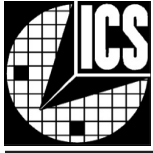
Inputs					Outputs			
MR	OEA	OEB	OEC	OED	QA0:QA3	QB0:QB3	QC0:QC3	QD0:QD3
1	1	1	1	1	LOW	LOW	LOW	LOW
0	1	1	1	1	Active	Active	Active	Active
X	0	0	0	0	HiZ	HiZ	HiZ	HiZ

TABLE 3B. OPERATING MODE FUNCTION TABLE

Inputs	Operating Mode
PLL_SEL	
0	Bypass
1	PLL

TABLE 3C. PLL INPUT FUNCTION TABLE

Inputs	
XTAL_SEL	PLL Input
0	REF_CLK
1	XTAL Oscillator



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TABLE 3D. CONTROL FUNCTION TABLE

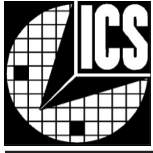
Inputs					Outputs		
					PLL_SEL =1	Frequency	
D_SELx1	D_SELx0	FBDIV_SEL1	FBDIV_SELO	Reference Frequency Range (MHz)	QX0:QX3	QX0:QX3 (MHz)	FB_OUT (MHz)
0	0	0	0	41.6 - 83.33	x 2	83.33 - 166.67	41.6 - 83.33
0	0	0	1	20.83 - 41.67	x 4	83.33 - 166.67	20.83 - 41.67
0	0	1	0	15.62 - 31.25	x 5.33	83.33 - 166.67	15.62 - 31.25
0	0	1	1	12.5 - 25	x 6.67	83.33 - 166.67	12.5 - 25
0	1	0	0	41.6 - 83.33	x 1.5	62.4 - 125	41.6 - 83.33
0	1	0	1	20.83 - 41.67	x 3	62.4 - 125	20.83 - 41.67
0	1	1	0	15.62 - 31.25	x 4	62.4 - 125	15.62 - 31.25
0	1	1	1	12.5 - 25	x 5	62.4 - 125	12.5 - 25
1	0	0	0	41.6 - 83.33	x 1	41.6 - 83.33	41.6 - 83.33
1	0	0	1	20.83 - 41.67	x 2	41.6 - 83.33	20.83 - 41.67
1	0	1	0	15.62 - 31.25	x 2.67	41.6 - 83.33	15.62 - 31.25
1	0	1	1	12.5 - 25	x 3.33	41.6 - 83.33	12.5 - 25
1	1	0	0	41.6 - 83.33	÷ 2	20.8 - 41.67	41.6 - 83.33
1	1	0	1	20.83 - 41.67	÷ 1	20.8 - 41.67	20.83 - 41.67
1	1	1	0	15.62 - 31.25	x 1.33	20.8 - 41.67	15.62 - 31.25
1	1	1	1	12.5 - 25	x 1.67	20.8 - 41.67	12.5 - 25

NOTE: D\_SELx1 denotes D\_SELA1, D\_SELB1, D\_SELc1, and D\_SELD1. D\_SELx0 denotes D\_SELA0, D\_SELB0, D\_SELc0, and D\_SELD0. QX0:QX3 denotes QA0:QA3, QB0:QB3, QC0:QC3, and QD0:QD3.

TABLE 3E. CONTROL FUNCTION TABLE (PCI CONFIGURATION)

Inputs					Outputs		
					PLL_SEL = 1	Frequency	
D_SELx1	D_SELx0	FBDIV_SEL1	FBDIV_SELO	Reference Frequency (MHz)	QX0:QX3	QX0:QX3 (MHz)	FB_OUT (MHz)
0	0	0	0	66.67	x 2	133	66.67
0	0	0	1	33.33	x 4	133	33.33
0	0	1	0	25	x 5.33	133	25
0	0	1	1	20	x 6.67	133	20
0	1	0	0	66.67	x 1.5	100	66.67
0	1	0	1	33.33	x 3	100	33.33
0	1	1	0	25	x 4	100	25
0	1	1	1	20	x 5	100	20
1	0	0	0	66.67	x 1	66.67	66.67
1	0	0	1	33.33	x 2	66.67	33.33
1	0	1	0	25	x 2.67	66.67	25
1	0	1	1	20	x 3.33	66.67	20
1	1	0	0	66.67	÷ 2	33.33	66.67
1	1	0	1	33.33	÷ 1	33.33	33.33
1	1	1	0	25	x 1.33	33.33	25
1	1	1	1	20	x 1.67	33.33	20

NOTE: D\_SELx1 denotes D\_SELA1, D\_SELB1, D\_SELc1, and D\_SELD1. D\_SELx0 denotes D\_SELA0, D\_SELB0, D\_SELc0, and D\_SELD0. QX0:QX3 denotes QA0:QA3, QB0:QB3, QC0:QC3, and QD0:QD3.



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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 $V_{DDOX} + 0.5V$
Package Thermal Impedance, $\theta_{JA}$	41.1°C/W (0 lfpm)
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,  $V_{DD} = V_{DDA} = V_{DDOX} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{DD}$	Core Supply Voltage		3.135	3.3	3.465	V
$V_{DDA}$	Analog Supply Voltage		3.135	3.3	3.465	V
$V_{DDOX}$	Output Supply Voltage; NOTE 1		3.135	3.3	3.465	V
$I_{DD}$	Power Supply Current				175	mA
$I_{DDA}$	Analog Supply Current				55	mA
$I_{DDOX}$	Output Supply Current; NOTE 2				25	mA

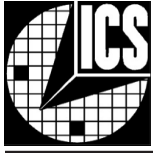
NOTE 1:  $V_{DDOX}$  denotes  $V_{DDOA}$ ,  $V_{DDOB}$ ,  $V_{DDOC}$ ,  $V_{DDOD}$ , and  $V_{DDOFB}$ .

NOTE 2:  $I_{DDOX}$  denotes  $I_{DDOA}$ ,  $I_{DDOB}$ ,  $I_{DDOC}$ ,  $I_{DDOD}$ , and  $I_{DDOFB}$ .

**TABLE 4B. LVCMOS/LVTTL DC CHARACTERISTICS,  $V_{DD} = V_{DDA} = V_{DDOX} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage	OEA:OED, XTAL_SEL, MR, D_SELA0:D_SELD0, FB_IN, D_SELA1:D_SELD1, PLL_SEL, FBDIV_SEL0, FBDIV_SEL1	2		$V_{DD} + 0.3$	V
		REF_CLK	2		$V_{DD} + 0.3$	V
$V_{IL}$	Input Low Voltage	OEA:OED, XTAL_SEL, MR, D_SELA0:D_SELD0, FB_IN, D_SELA1, D_SELD1, PLL_SEL	-0.3		0.8	V
		REF_CLK	-0.3		1.3	V
$I_{IH}$	Input High Current	D_SELA0:D_SELD0, FB_IN, MR, D_SELA1:D_SELD1, REF_CLK, FBDIV_SEL1	$V_{DD} = V_{IN} = 3.465V$		150	$\mu A$
		XTAL_SEL, PLL_SEL, FBDIV_SEL0, OEA:OED	$V_{DD} = V_{IN} = 3.465V$		5	$\mu A$
$I_{IL}$	Input Low Current	D_SELA0:D_SELD0, FB_IN, MR, D_SELA1:D_SELD1, REF_CLK, FBDIV_SEL1	$V_{DD} = 3.465V$ , $V_{IN} = 0V$		-5	$\mu A$
		XTAL_SEL, PLL_SEL, FBDIV_SEL0, OEA:OED	$V_{DD} = 3.465V$ , $V_{IN} = 0V$		-150	$\mu A$
$V_{OH}$	Output High Voltage; NOTE 1		2.6			V
$V_{OL}$	Output Low Voltage; NOTE 1				0.5	V
$I_{OZL}$	Output Tristate Current Low		-5			$\mu A$
$I_{OZH}$	Output Tristate Current High				5	$\mu A$

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



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**TABLE 5A. AC CHARACTERISTICS,  $V_{DD} = V_{DDA} = V_{DDOX} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				166.67	MHz
$t(\emptyset)$	Static Phase Offset; NOTE 1, 7	$f = 50MHz$	-150		150	ps
$tsk(b)$	Bank Skew; NOTE 2, 6				40	ps
$tsk(o)$	Output Skew; NOTE 3, 6				230	ps
$f_{jit}(cc)$	Cycle-to-Cycle Jitter; 6	$f = 50MHz$ ; NOTE 4, 7			70	ps
		$f = 25MHz$ XTAL, 133.3MHz out			190	ps
$f_{jit}(per)$	Period Jitter, RMS; NOTE 4, 6, 7, 8				17	ps
$t_L$	PLL Lock Time				1	ms
$t_R$	Output Rise Time	20% to 80%	300		800	ps
$t_F$	Output Fall Time	20% to 80%	300		800	ps
odc	Output Duty Cycle; NOTE 5, 7		45		55	%

NOTE 1: Defined as the time difference between the input reference clock and the average feedback input signal when the PLL is locked and the input reference frequency is stable. Measured from  $V_{DD}/2$  of the input to  $V_{DDOX}/2$  of the output.

NOTE 2: Defined as skew within a bank of outputs at the same voltages and with equal load conditions.

NOTE 3: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at  $V_{DDOX}/2$ .

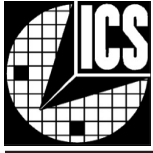
NOTE 4: Jitter performance using LVCMOS inputs.

NOTE 5: Measured using REF\_CLK. For XTAL input, refer to Application Note.

NOTE 6: This parameter is defined in accordance with JEDEC Standard 65.

NOTE 7: Tested with  $D\_SELXX = 10$  (divide by 6);  $FBDIV\_SEL = 00$  (divide by 6).

NOTE 8: This parameter is defined as an RMS value.



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**TABLE 4C. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = V_{DDA} = 3.3V \pm 5\%$ ,  $V_{DDOX} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{DD}$	Core Supply Voltage		3.135	3.3	3.465	V
$V_{DDA}$	Analog Supply Voltage		3.135	3.3	3.465	V
$V_{DDOX}$	Output Supply Voltage; NOTE 1		2.375	2.5	2.625	V
$I_{DD}$	Power Supply Current				160	mA
$I_{DDA}$	Analog Supply Current				50	mA
$I_{DDOX}$	Output Supply Current; NOTE 2				210	mA

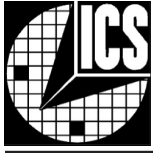
NOTE 1:  $V_{DDOX}$  denotes  $V_{DDOA}$ ,  $V_{DDOB}$ ,  $V_{DDOC}$ ,  $V_{DDOD}$ , and  $V_{DDOFB}$ .

NOTE 2:  $I_{DDOX}$  denotes  $I_{DDOA}$ ,  $I_{DDOB}$ ,  $I_{DDOC}$ ,  $I_{DDOD}$ , and  $I_{DDOFB}$ .

**TABLE 4D. LVCMOS/LVTTL DC CHARACTERISTICS,  $V_{DD} = V_{DDA} = 3.3V \pm 5\%$ ,  $V_{DDOX} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage	OEA:OED, XTAL_SEL, MR, D_SELA0:D_SELD0, FB_IN, D_SELA1:D_SELD1, PLL_SEL, FBDIV_SEL0, FBDIV_SEL1	2		$V_{DD} + 0.3$	V
		REF_CLK	2		$V_{DD} + 0.3$	V
$V_{IL}$	Input Low Voltage	OEA:OED, XTAL_SEL, MR, D_SELA0:D_SELD0, FB_IN, D_SELA1:D_SELD1, PLL_SEL, FBDIV_SEL0, FBDIV_SEL1	-0.3		0.8	V
		REF_CLK	-0.3		1.3	V
$I_{IH}$	Input High Current	D_SELA0:D_SELD0, FB_IN, MR, D_SELA1:D_SELD1, REF_CLK, FBDIV_SEL1 $V_{DD} = V_{IN} = 3.465V$			150	$\mu A$
		XTAL_SEL, PLL_SEL, FBDIV_SEL0, OEA:OED $V_{DD} = V_{IN} = 3.465V$			5	$\mu A$
$I_{IL}$	Input Low Current	D_SELA0:D_SELD0, FB_IN, MR, D_SELA1:D_SELD1, REF_CLK, FBDIV_SEL1 $V_{DD} = 3.465V$ , $V_{IN} = 0V$	-5			$\mu A$
		XTAL_SEL, PLL_SEL, FBDIV_SEL0, OEA:OED $V_{DD} = 3.465V$ , $V_{IN} = 0V$	-150			$\mu A$
$V_{OH}$	Output High Voltage; NOTE 1		1.8			V
$V_{OL}$	Output Low Voltage; NOTE 1				0.5	V
$I_{OZL}$	Output Tristate Current Low		-5			$\mu A$
$I_{OZH}$	Output Tristate Current High				5	$\mu A$

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{DDOX}/2$ . See Parameter Measurement Information section, "3.3V/2.5V Output Load Test Circuit".



**TABLE 5B. AC CHARACTERISTICS,  $V_{DD} = V_{DDA} = 3.3V \pm 5\%$ ,  $V_{DDOX} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				166.67	MHz
$t(\emptyset)$	Static Phase Offset; NOTE 1, 7	$f = 50MHz$	-350		20	ps
$tsk(b)$	Bank Skew; NOTE 2, 6				40	ps
$tsk(o)$	Output Skew; NOTE 3, 6				230	ps
$f_{jit(cc)}$	Cycle-to-Cycle Jitter; NOTE 6	$f = 50MHz$ ; NOTE 4, 7			70	ps
		$f = 25MHz$ XTAL, 133.3MHz out			190	ps
$f_{jit(per)}$	Period Jitter, RMS; NOTE 4, 6, 7, 8				17	ps
$t_L$	PLL Lock Time				1	ms
$t_R$	Output Rise Time	20% to 80%	300		800	ps
$t_F$	Output Fall Time	20% to 80%	300		800	ps
odc	Output Duty Cycle; NOTE 5, 7		45		55	%

NOTE 1: Defined as the time difference between the input reference clock and the average feedback input signal when the PLL is locked and the input reference frequency is stable. Measured from  $V_{DD}/2$  of the input to  $V_{DDOX}/2$  of the output.

NOTE 2: Defined as skew within a bank of outputs at the same voltages and with equal load conditions.

NOTE 3: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at  $V_{DDOX}/2$ .

NOTE 4: Jitter performance using LVCMOS inputs.

NOTE 5: Measured using REF\_CLK. For XTAL input, refer to Application Note.

NOTE 6: This parameter is defined in accordance with JEDEC Standard 65.

NOTE 7: Tested with  $D\_SELXX = 10$  (divide by 6);  $FBDIV\_SEL = 00$  (divide by 6).

NOTE 8: This parameter is defined as an RMS value

**TABLE 6. CRYSTAL CHARACTERISTICS**

Parameter	Test Conditions	Minimum	Typical	Maximum	Units
Mode of Oscillation		Fundamental			
Frequency		10		38	MHz
Equivalent Series Resistance (ESR)				70	$\Omega$
Shunt Capacitance			7		pF

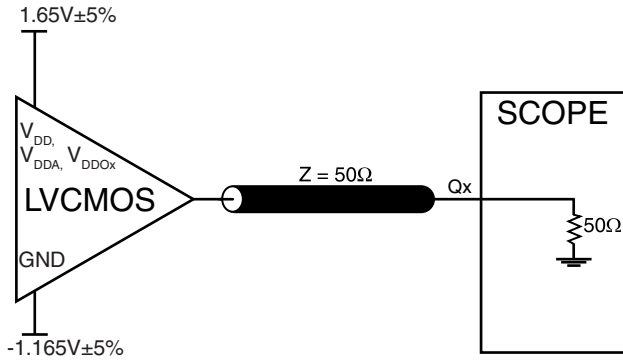
**TABLE 7. PLL INPUT REFERENCE CHARACTERISTICS,  $V_{DD} = V_{DDA} = V_{DDOX} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{REF}$	Reference Frequency		10		83.33	MHz

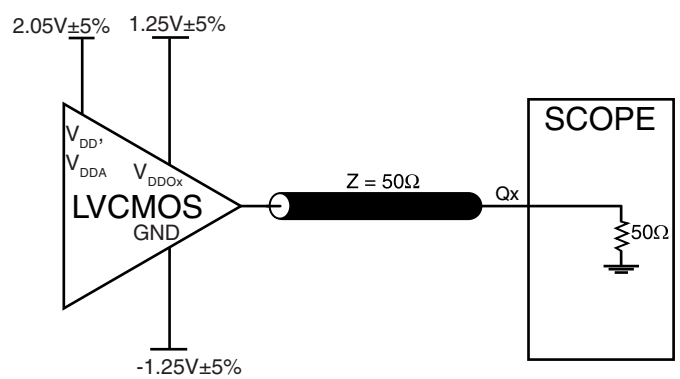




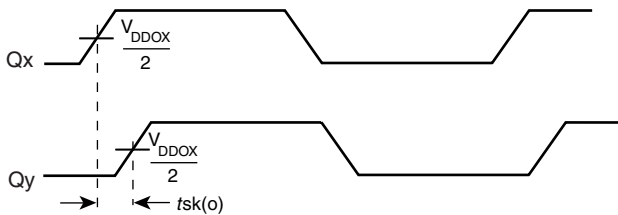
## PARAMETER MEASUREMENT INFORMATION



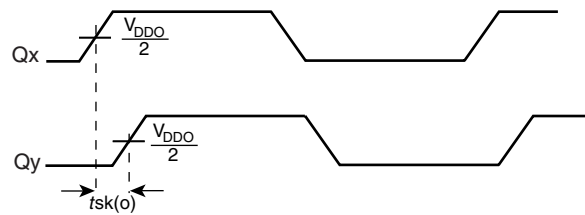
**3.3V OUTPUT LOAD AC TEST CIRCUIT**



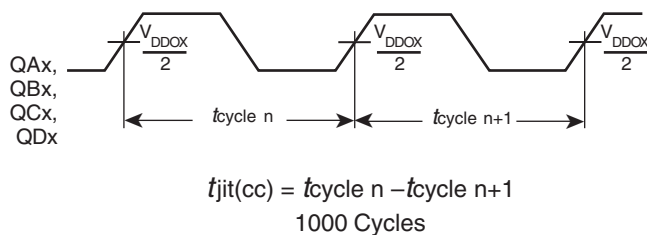
**3.3V/2.5V OUTPUT LOAD AC TEST CIRCUIT**



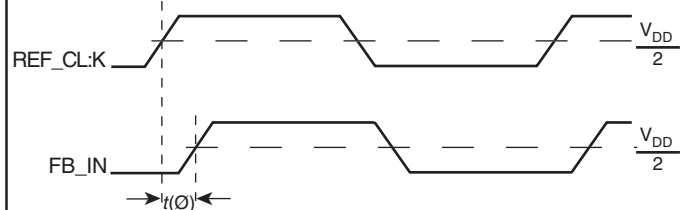
**OUTPUT SKEW**



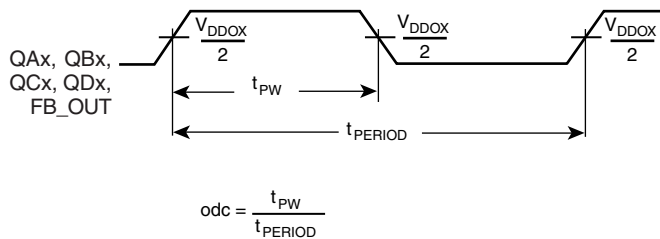
**BANK SKEW (Where X denotes outputs in the same Bank)**



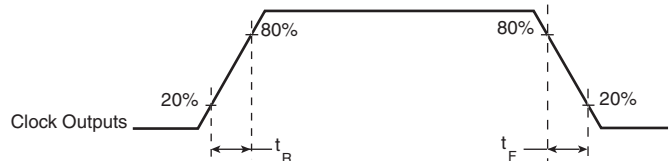
**CYCLE-TO-CYCLE JITTER**



**STATIC PHASE OFFSET**



**$t_{PW}$  &  $t_{PERIOD}$**



**OUTPUT RISE/FALL TIME**



## APPLICATION INFORMATION

### POWER SUPPLY FILTERING TECHNIQUES

As in any high speed analog circuitry, the power supply pins are vulnerable to random noise. The ICS8761 provides separate power supplies to isolate any high switching noise from the outputs to the internal PLL.  $V_{DD}$ ,  $V_{DDA}$ , and  $V_{DDOX}$  should be individually connected to the power supply plane through vias, and bypass capacitors should be used for each pin. To achieve optimum jitter performance, power supply isolation is required. *Figure 1* illustrates how a  $10\Omega$  resistor along with a  $10\mu F$  and a  $.01\mu F$  bypass capacitor should be connected to each  $V_{DDA}$ .

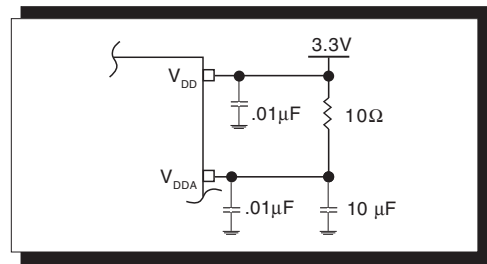


FIGURE 1. POWER SUPPLY FILTERING

### CRYSTAL INPUT INTERFACE

The ICS8761 crystal interface is shown in *Figure 2*. While layout the PC Board, it is recommended to provide C1 and C2 spare footprints for frequency fine tuning. For an 18pF parallel reso-

nant crystal, the C1 and C2 are expected to be  $\sim 10pF$  and  $\sim 5pF$  respectively.

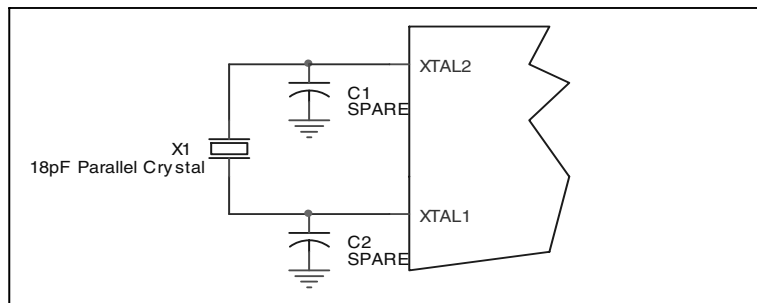


FIGURE 2. CRYSTAL INPUT INTERFACE



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## SCHEMATIC EXAMPLE

Figure 3 shows a schematic example of the ICS8761. In this example, the input is driven by an ICS HiPerClockS LVHSTL driver. The decoupling capacitors should be physically located

near the power pin. For ICS8761, the unused clock outputs can be left floating. The optional C1 and C2 are spare footprints for frequency fine tuning.

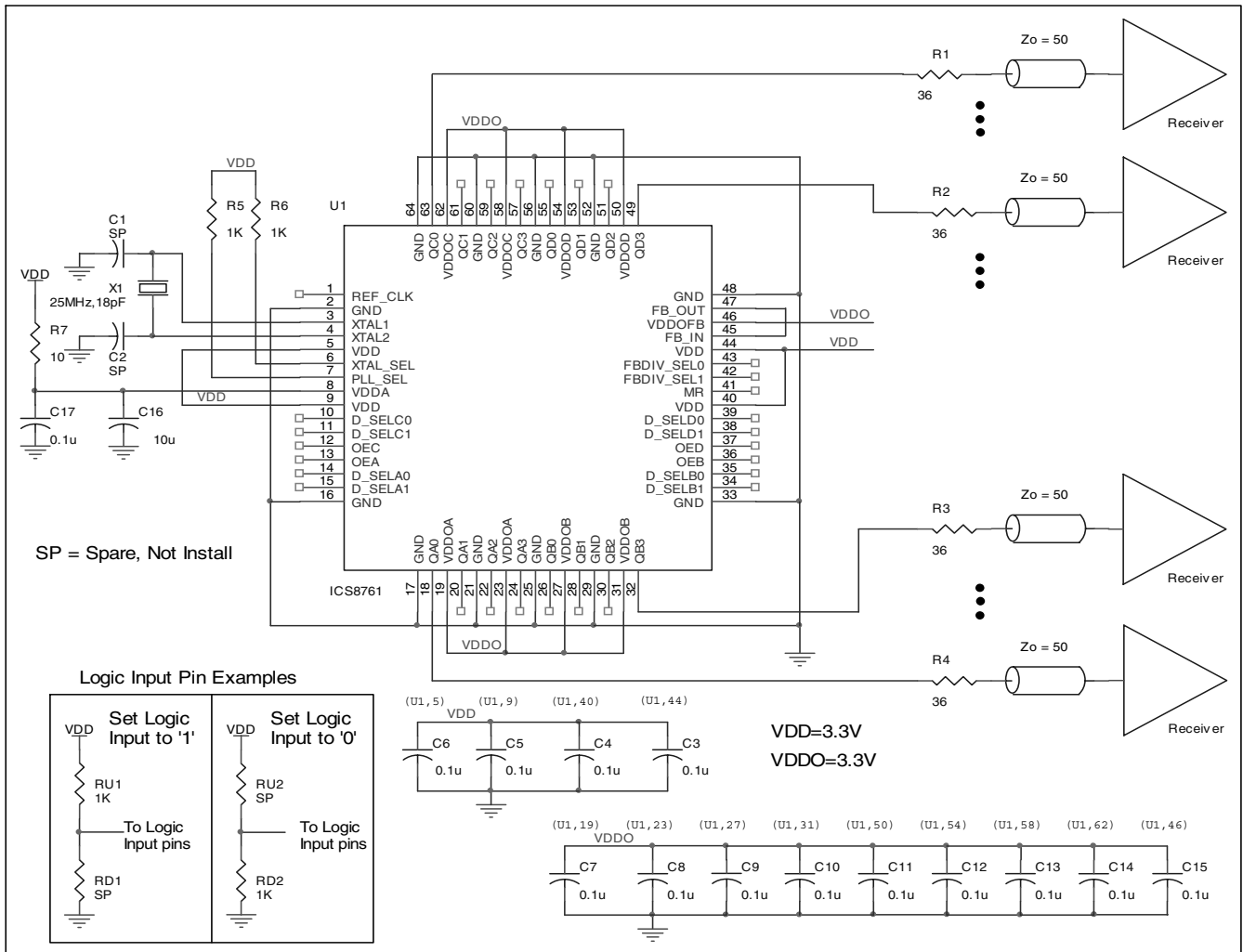
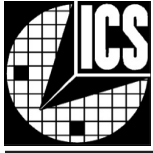


FIGURE 3. ICS8761 CLOCK GENERATOR SCHEMATIC EXAMPLE



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## RELIABILITY INFORMATION

TABLE 8.  $\theta_{JA}$  VS. AIR FLOW TABLE FOR 64 LEAD TSSOP

$\theta_{JA}$ by Velocity (Linear Feet per Minute)			
	0	200	500
Single-Layer PCB, JEDEC Standard Test Boards	58.8°C/W	48.5°C/W	43.2°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	41.1°C/W	35.8°C/W	33.6°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 ICS8761 is: 6040



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## PACKAGE OUTLINE - Y SUFFIX FOR 64 LEAD TSSOP

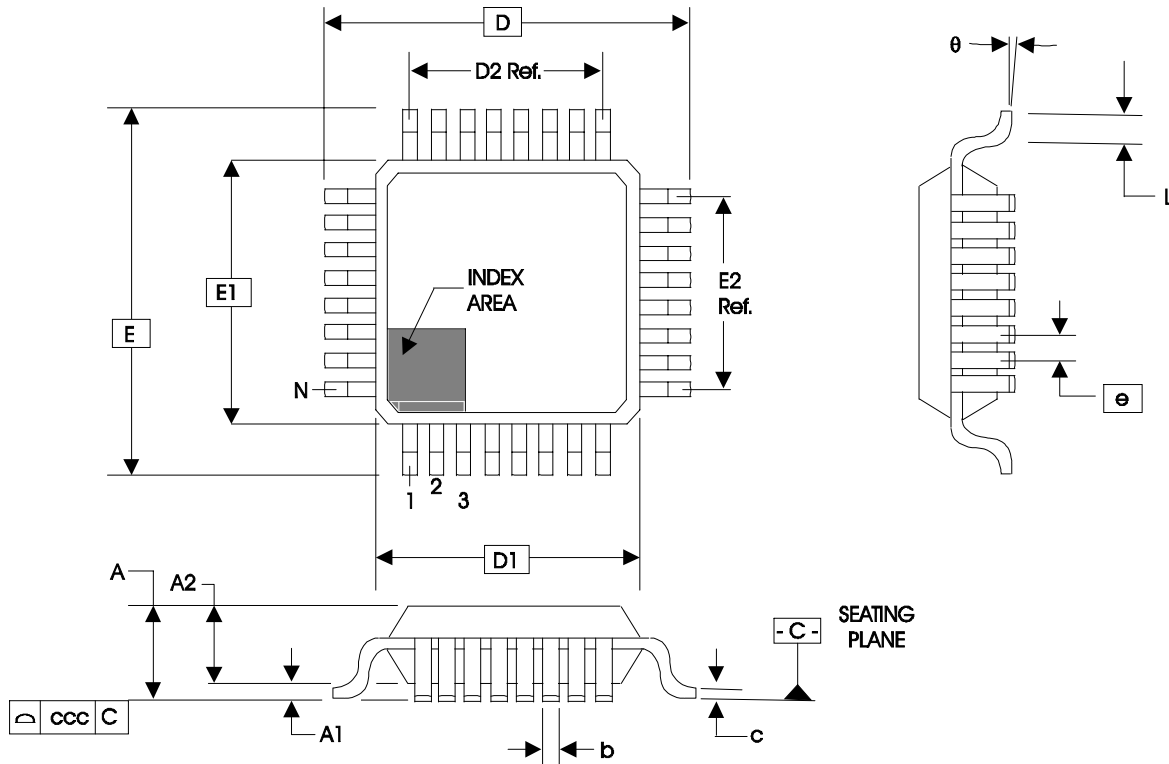
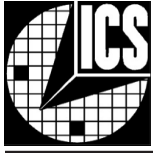


TABLE 9. PACKAGE DIMENSIONS

JEDEC VARIATION ALL DIMENSIONS IN MILLIMETERS			
SYMBOL	BCD		
	MINIMUM	NOMINAL	MAXIMUM
N	64		
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.17	--	0.27
c	0.09	--	0.20
D	12.00 BASIC		
D1	10.00 BASIC		
D2	7.50 Ref.		
E	12.00 BASIC		
E1	10.00 BASIC		
E2	7.50 Ref.		
e	0.50 BASIC		
L	0.45	--	0.75
theta	0°	--	7°
ccc	--	--	0.08



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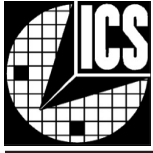
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**TABLE 10. ORDERING INFORMATION**

Part/Order Number	Marking	Package	Count	Temperature
ICS8761CY	ICS8761CY	64 Lead LQFP	160 per tray	0°C to 85°C
ICS8761CYT	ICS8761CY	64 Lead LQFP on Tape and Reel	500	0°C to 85°C
ICS8761CYLN	ICS8761CYLN	64 Lead "Lead-Free/Annealed" LQFP	160 per tray	0°C to 85°C
ICS8761CYLNT	ICS8761CYLN	64 Lead "Lead-Free/Annealed" LQFP on Tape and Reel	500	0°C to 85°C
ICS8761CYLF	ICS8761CYLF	64 Lead "Lead-Free" LQFP	160 per tray	0°C to 85°C
ICS8761CYLFT	ICS8761CYLF	64 Lead "Lead-Free" LQFP on Tape and Reel	500	0°C to 85°C

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REVISION HISTORY SHEET				
Rev	Table	Page	Description of Change	Date
A	T1	2	Pin Description Table, revised Master Reset description.	8/15/02
A	T1	2	Pin Description Table, pin 43 should be labeled at a PULL-UP instead of a PULL-DOWN.	11/05/02
	T4B, T4D	6, 8	LVC MOS DC Characteristics table - in the $I_{IH}$ and $I_{IL}$ rows, FB DIV_SEL0 was deleted from the "pulldown" row and was added to the "pullup" row.	
B	T3D	1	Features section, changed max. output frequency from 200MHz to 183.3MHz, and max. REF_CLK input frequency from 100MHz to 91.6MHz.	11/06/02
		4	Control Function Table - revised Reference Frequency Range column and Frequency columns to reflect the output frequency change.	
	T5A, T5B	7, 9	AC Characteristics tables - changed Output Frequency from 200MHz max. to 183.3MHz max.	
B	T1	2	Pin Description Table, revised crystal description.	1/20/03
	T5A, T5B	7, 9	AC Characteristics tables - changed Period Jitter measurement to Period Jitter, RMS and added NOTE 8.	
		10	Added Crystal information.	
		11	Added Schematic Example in the Application Information Section.	
B	T1	2	Pin Description Table - revised MR description.	3/25/03
	T4A, T4C	5, 7	Power Supply Tables - changed VDD parameter to read "Core Supply Voltage" from "Positive Supply Voltage".	
		10	Deleted Crystal Input Interface section.	
		10	Updated Schematic Example diagram.	
C	T3D	1	Updated Features to reflect T5A 3.3V AC Characteristics (see below).	4/10/03
		4	Adjusted Ref. Frequency Range and Frequency columns.	
	T4A	5	Changed $I_{DD}$ max. from 150mA to 175mA, $I_{DDA}$ max. from 50mA to 55mA, and $I_{DDO}$ max. from 330mA to 25mA.	
	T5A & T5B	6 & 8	Changed $f_{MAX}$ from 183.3MHz max. to 166.67MHz max. Changed RMS tjit(per) from 20ps max. to 17ps max.	
C		1	Features Section - added Lead-Free bullet.	8/2/04
		10	Added Crystal Section.	
C		14	Ordering Information Table - added Lead-Free/Annealed Part Number.	8/7/04
		14	Ordering Information Table - added Lead-Free Part Number.	