Integrated Circuit Systems, Inc.

ICS95V842I

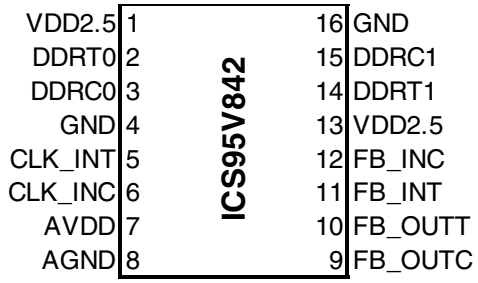
DDR Phase Lock Loop Clock Driver (60MHz - 220MHz)

Recommended Application:
1:2 DDRI Clock Driver

Product Description/Features:
- Low skew, low jitter PLL clock driver
- Feedback pins for input to output synchronization
- Spread Spectrum tolerant inputs
- With bypass mode mux
- Operating frequency 60 to 220 MHz

Switching Characteristics:
- CYCLE - CYCLE jitter: <75ps
- OUTPUT - OUTPUT skew: <60ps
- Period jitter: ±75ps
- Half-Period jitter: ±75ps

Pin Configuration

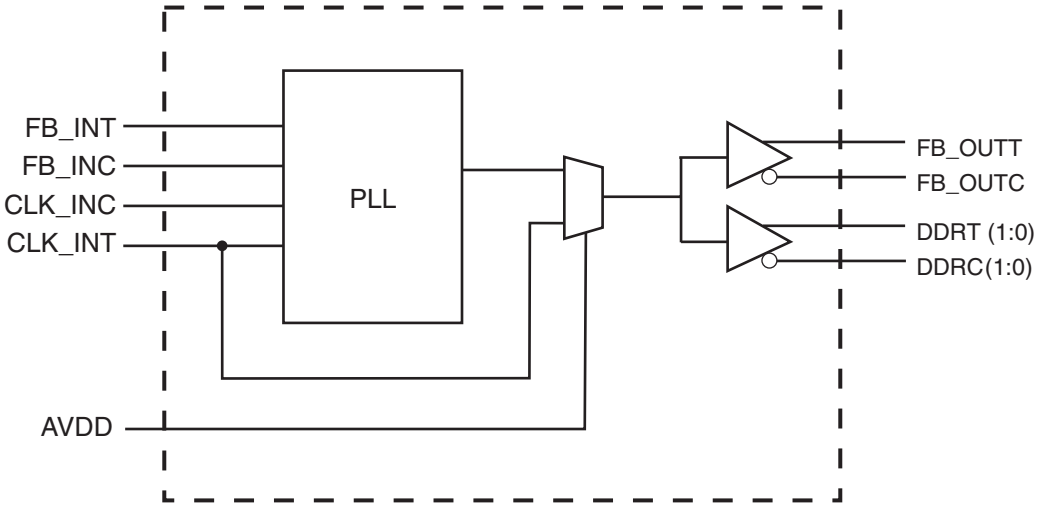


16 pin SSOP

Functionality

INPUTS			OUTPUTS				PLL State
AVDD	CLK_INT	CLK_INC	CLKT	CLKC	FB_OUTT	FB_OUTC	
GND	L	H	L	H	L	H	Bypassed/Off
GND	H	L	H	L	H	L	Bypassed/Off
2.5V (nom)	L	H	L	H	L	H	On
2.5V (nom)	H	L	H	L	H	L	On

Block Diagram



Pin Descriptions

PIN #	PIN NAME	PIN TYPE	DESCRIPTION
1	VDD2.5	PWR	Power supply, nominal 2.5V
2	DDRT0	OUT	"True" Clock of differential pair output.
3	DDRC0	OUT	"Complementary" Clock of differential pair output.
4	GND	PWR	Ground pin.
5	CLK_INT	IN	"True" reference clock input.
6	CLK_INC	IN	"Complementary" reference clock input.
7	AVDD	PWR	3.3V Analog Power pin for Core PLL
8	AGND	PWR	Analog Ground pin for Core PLL
9	FB_OUTC	OUT	Complement single-ended feedback output, dedicated external feedback. It switches at the same frequency as other DDR outputs.
10	FB_OUTT	OUT	True single-ended feedback output, dedicated external feedback. It switches at the same frequency as other DDR outputs.
11	FB_INT	IN	True single-ended feedback input, provides feedback signal to internal PLL for synchronization with CLK_INT to eliminate phase error.
12	FB_INC	IN	Complement single-ended feedback input, provides feedback signal to internal PLL for synchronization with CLK_INT to eliminate phase error.
13	VDD2.5	PWR	Power supply, nominal 2.5V
14	DDRT1	OUT	"True" Clock of differential pair output.
15	DDRC1	OUT	"Complementary" Clock of differential pair output.
16	GND	PWR	Ground pin.

Absolute Maximum Ratings

Supply Voltage: (VDD & AVDD) . . . . . -0.5V to 3.6V

Input clamp current: I_{IK} (VI < 0 or VI > VDD) . . . . . +/- 50mA

Output clamp current: I_{OK} (VO < 0 or VO > VDD) . . +/- 50mA

Continuous output current: I_O (VO = 0 to VDD) . . . . +/- 50mA

Package thermal impedance, theta JA: DGG package +89°C/Ω

Storage Temperature . . . . . –65°C to +150°C

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

Electrical Characteristics - Input/Supply/Common Output Parameters

TA = -40°C to +85°C; Supply Voltage AVDD, VDD = 2.5 V +/- 0.2V (unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input High Current	I_{IH}	$V_I = V_{DD}$ or GND	5			µA
Input Low Current	I_{IL}	$V_I = V_{DD}$ or GND			5	µA
Operating Supply Current	$I_{DD2.5}$	C_L = 0pF, $R_L = \infty\Omega$			160	mA
	I_{DDPD}	C_L = 0pF, $R_L = \infty\Omega$			100	µA
Output High Current	I_{OH}	V_{DD} = 2.3V, V_{OUT} = 1V	-18			mA
Output Low Current	I_{OL}	V_{DD} = 2.3V, V_{OUT} = 1.2V	26			mA
High Impedance Output Current	I_{OZ}	V_{DD}=2.7V, Vout=V_{DD} or GND			±10	µA
Input Clamp Voltage	V_{IK}	Iin = -18mA			-1.2	V
High-level output voltage	V_{OH}	V_{DD} = min to max, I_{OH} = -1 mA	V_{DD} - 0.1			V
		V_{DD} = 2.3V, I_{OH} = -12 mA	1.7			V
Low-level output voltage	V_{OL}	V_{DD} = min to max I_{OL}=1 mA			0.1	
		V_{DD} = 2.3V I_{OH}=12 mA			0.6	V
Input Capacitance[1]	C_{IN}	VI = V_{DD} or GND		3		pF
Output Capacitance[1]	C_{OUT}	VI = V_{DD} or GND		3		pF

[1]Guaranteed by design and characterization, not 100% tested in production.

DC Electrical Characteristics

TA = -40°C to +85°C; Supply Voltage AVDD, VDD = 2.5 V +/- 0.2V (unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{DDQ}, A_{VDD}		2.3	2.5	2.7	V
Low level input voltage	V_{IL}	CLK_INT, CLK_INC, FB_INC, FB_INT		0.4	$V_{DD}/2$ - 0.18	V
High level input voltage	V_{IH}	CLK_INT, CLK_INC, FB_INC, FB_INT	$V_{DD}/2$ + 0.18	2.1		V
DC input signal voltage (note 1,2)	V_{IN}		-0.3		V_{DD} + 0.3	V
Differential input signal voltage (note 3)	V_{ID}	CLK_INT, CLK_INC, FB_INC, FB_INT	0.36		V_{DD} + 0.6	V
Differential output voltage (note 3)	V_{OD}	CLK_INT, CLK_INC, FB_INC, FB_INT	0.7		V_{DD} + 0.6	V
Output differential cross-voltage (note 4)	V_{OX}		$V_{DD}/2$ - 0.15		$V_{DD}/2$ + 0.15	V
Input differential cross-voltage (note 4)	V_{IX}		$V_{DD}/2$ - 0.2	$V_{DD}/2$	$V_{DD}/2$ + 0.2	V
Operating free-air temperature	T_A		-40		85	°C

Notes:

1 Unused inputs must be held high or low to prevent them from floating.

2 DC input signal voltage specifies the allowable DC excursion of differential input.

3 Differential input signal voltage specifies the differential voltage [VTR-VCP] required for switching, where VTR is the true input level and VCP is the complementary input level.

4 Differential cross-point voltage is expected to track variations of VDD and is the voltage at which the differential signal must be crossing.

Timing Requirements

T_A = -40°C to +85°C; Supply Voltage AVDD, VDD = 2.5 V +/- 0.2V (unless otherwise stated)

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS
Max clock frequency[3]	$freq_{op}$		33	233	MHz
Application Frequency Range[3]	$freq_{App}$		60	220	MHz
Input clock duty cycle	d_{tin}		40	60	%
CLK stabilization	T_{STAB}			100	µs

Switching Characteristics

T_A = -40°C to +85°C; Supply Voltage AVDD, VDD = 2.5 V +/- 0.2V (unless otherwise stated)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS
Max clock frequency[3]	$freq_{op}$		40		333	MHz
Application Frequency Range[3]	$freq_{App}$		60		220	MHz
Input clock duty cycle	d_{tin}		40		60	%
Input clock slew rate	$t_{sl(I)}$		1		2	v/ns
CLK stabilization	T_{STAB}				100	µs
Low-to high level propagation delay time	t_{PLH}[1]	CLK_IN to any output			5.5	ns
High-to low level propagation delay time	t_{PHL}[1]	CLK_IN to any output			5.5	ns
Output enable time	t_{en}	PD# to any output		5		ns
Output disable time	t_{dis}	PD# to any output		5		ns
Period jitter	$t_{jit\ (per)}$	Over the application frequency range	-75		75	ps
Half-period jitter	$t_{jit(hper)}$		-75		75	ps
Output clock slew rate	$t_{sl(o)}$		1		2.5	v/ns
Cycle to Cycle Jitter	t_{cyc}-t_{cyc}		-75		75	ps
Static Phase Offset	$t_{(spo)}$		-50		50	ps
Output to Output Skew	t_{skew}			40	60	ps

Notes:

1. Refers to transition on noninverting output in PLL bypass mode.
2. While the pulse skew is almost constant over frequency, the duty cycle error increases at higher frequencies. This is due to the formula: duty cycle=twH/tc, were the cycle (tc) decreases as the frequency goes up.
3. Switching characteristics are guaranteed for application frequency range. The PLL Locks over the Max Clock Frequency range, but the device doe not necessarily meet other timing parameters.
4. Does not include jitter.

Parameter Measurement Information

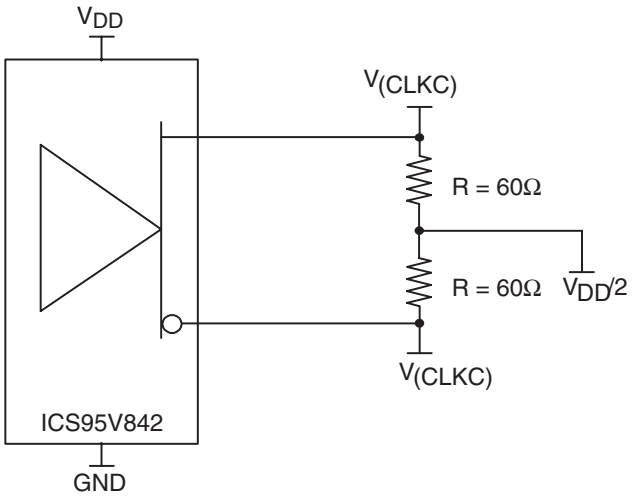
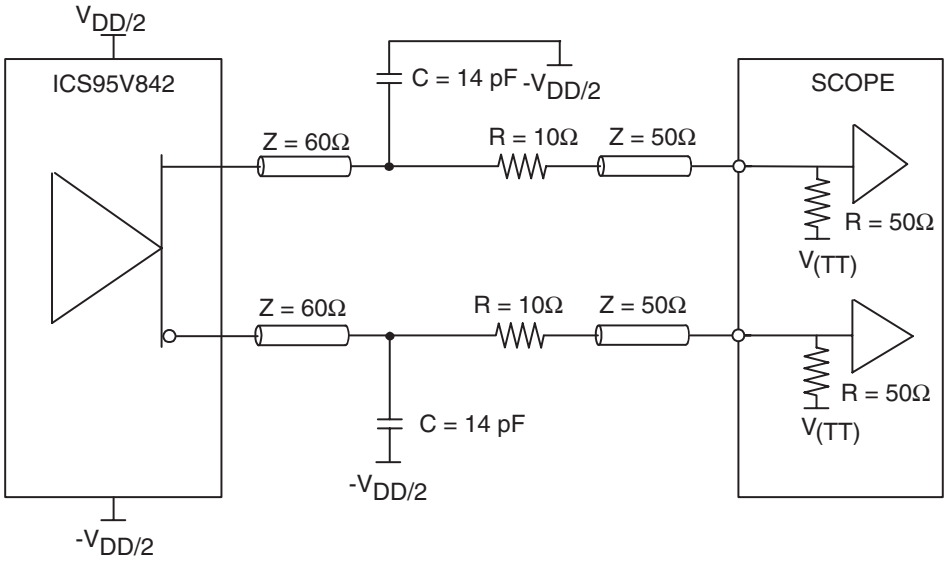
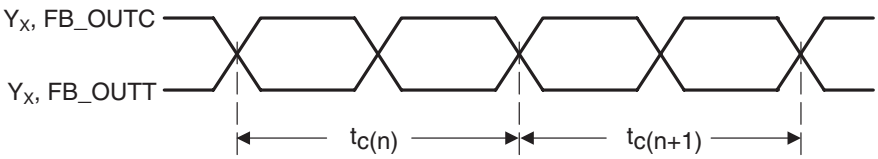


Figure 1. IBIS Model Output Load



NOTE: $V_{(TT)}$ = GND

Figure 2. Output Load Test Circuit



$$t_{jit(cc)} = t_{c(n)} \pm t_{c(n+1)}$$

Figure 3. Cycle-to-Cycle Jitter

Parameter Measurement Information

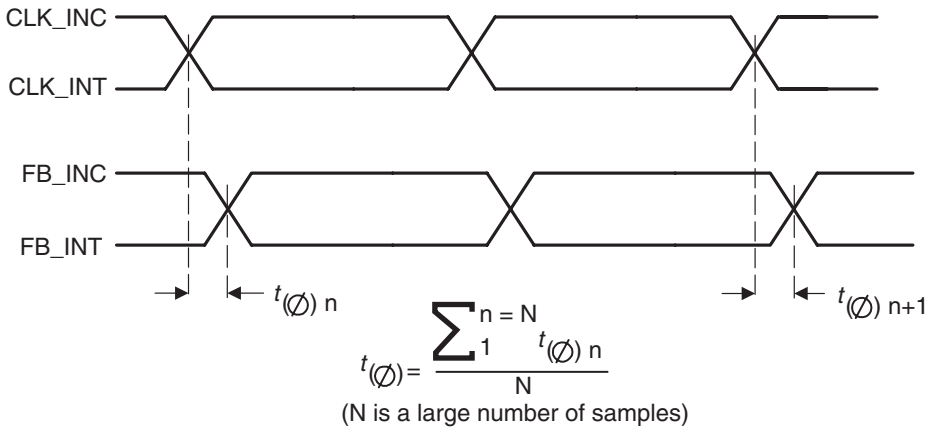


Figure 4. Static Phase Offset

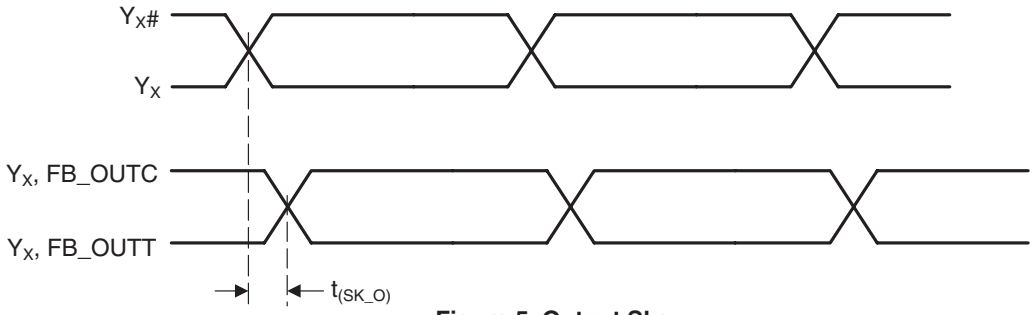


Figure 5. Output Skew

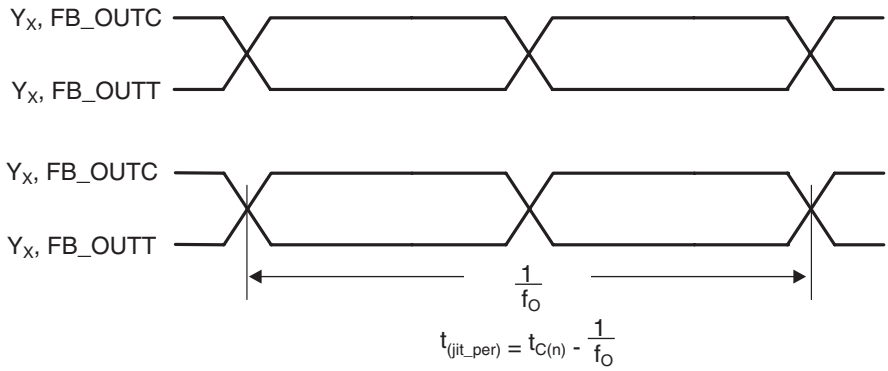


Figure 6. Period Jitter

Parameter Measurement Information

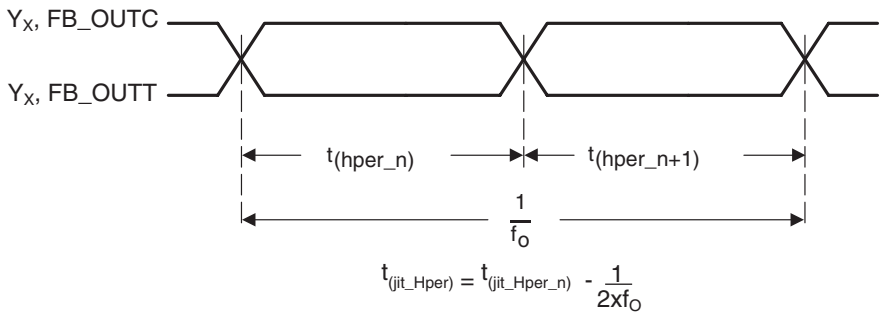


Figure 7. Half-Period Jitter

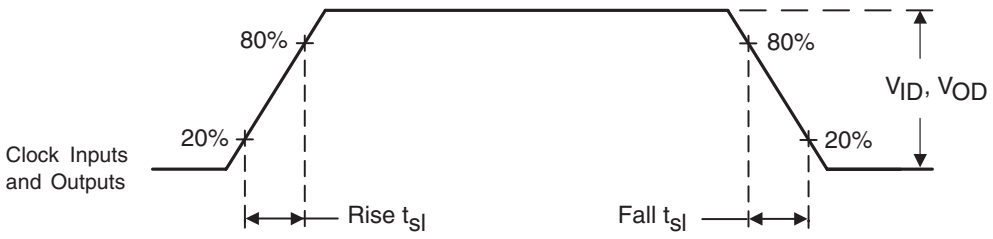
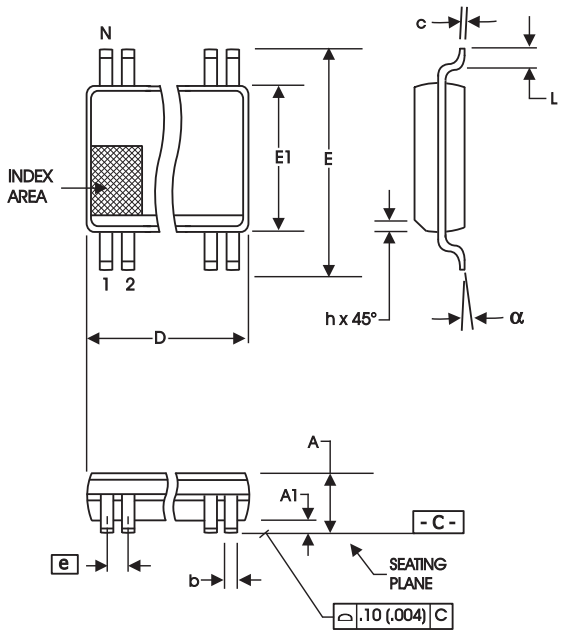


Figure 8. Input and Output Slew Rates



16-Lead, 150 mil SSOP (QSOP)

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	1.35	1.75	.053	.069
A1	0.10	0.25	.004	.010
A2	--	1.50	--	.059
b	0.20	0.30	.008	.012
c	0.18	0.25	.007	.010
D	SEE VARIATIONS		SEE VARIATIONS	
E	5.80	6.20	.228	.244
E1	3.80	4.00	.150	.157
e	0.635 BASIC		0.025 BASIC	
L	0.40	1.27	.016	.050
N	SEE VARIATIONS		SEE VARIATIONS	
a	0°	8°	0°	8°
ZD	SEE VARIATIONS		SEE VARIATIONS	

VARIATIONS

N	D mm.		ZD	D (inch)		ZD
	MIN	MAX	(Ref)	MIN	MAX	(Ref)
16	4.80	5.00	0.23	.189	.197	.009

Reference Doc.: JEDEC Publication 95, MO-137

10-0032

Ordering Information

ICS95V842yFILF-T

Example:

ICS XXXX y F I LF - T

- **Designation for tape and reel packaging**
- **Lead Free, RoHS Compliant (Optional)**
- **I = Industrial Temperature Range**
- **Package Type**
  F = SSOP
- **Revision Designator** (will not correlate with datasheet revision)
- **Device Type**
- **Prefix**
  ICS = Standard Device

1234A—06/13/06