OVERVIEW

The CF5037 series are 2.5V operation, LVDS output oscillator ICs. They support 80MHz to 250MHz 3rd overtone oscillation and 80MHz to 700MHz fundamental oscillation. The CF5037 series can be used to construct high-frequency LVDS output oscillators.

FEATURES

- 2.375 to 3.6V operating supply voltage range
- Operating frequency range (varies with version)
  - 80MHz to 700MHz fundamental oscillation
  - 80MHz to 250MHz 3rd overtone oscillation
- – 40 to 85°C operating temperature range
- LVDS output
- Standby function
  - Outputs are high impedance when OE is LOW. (oscillator stops)
- Power-saving pull-up resistor built-in (pin OE)
- BiCMOS process
- Chip form (CF5037××)

SERIES CONFIGURATION

Version	Oscillation mode	Recommended operating frequency range*1 [MHz]	Output frequency
CF5037A1	Fundamental or 3rd overtone	80 to 120	f_O
CF5037B1		100 to 180	f_O
CF5037B2*2			$f_O/2$
CF5037C1		150 to 250	f_O
CF5037C2			$f_O/2$
CF5037D1	Fundamental	250 to 400	f_O
(CF5037D2)			$f_O/2$
(CF5037E1)		400 to 600	f_O
(CF5037E2)			$f_O/2$
(CF5037F1)		600 to 700	f_O
(CF5037F2)			$f_O/2$
(CF5037V1)	Oscillator constants determined by external components (R_f, C_{XIN}, C_{XOUT})	80 to 400	f_O
(CF5037V2)			$f_O/2$

*1. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.

*2. Minimum output frequency: 80MHz

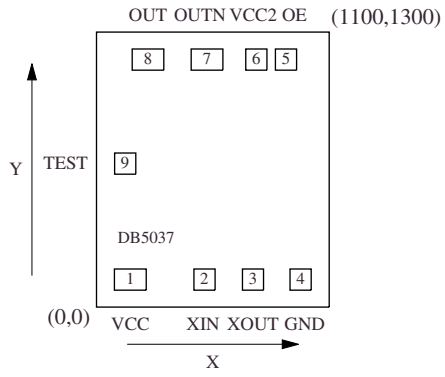
Note. These versions in parentheses ( ) are under development. Please ask our Sales & Marketing section for further detail.

ORDERING INFORMATION

Device	Package
CF5037××–1	Chip form

PAD LAYOUT

(Unit: µm)

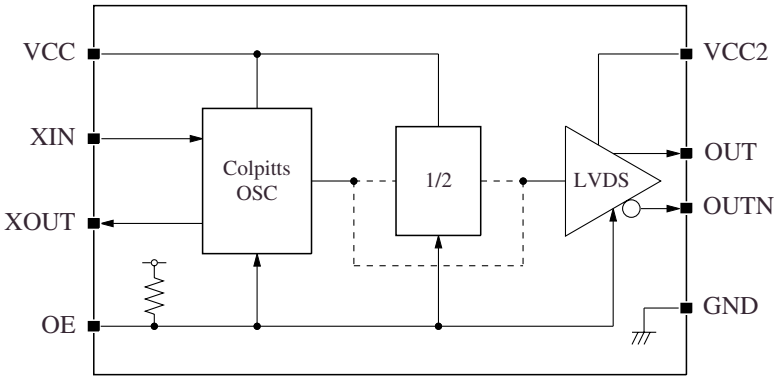


Chip size: 1.10 × 1.30mm
Chip thickness: 300 ± 30µm
PAD size: 150µm × 100µm (VCC, OUT, OUTN pins)
100µm × 100µm (excluding VCC, OUT, OUTN pins)
Chip base: GND potential
Note: The TEST pin is not used during normal operation.

PIN DESCRIPTION and PAD DIMENSIONS

Pad No.	Name	I/O	Function	Pad dimensions [µm]	
				X	Y
1	VCC	–	(+) supply pin	160	130
2	XIN	I	Oscillator input pin	511	130
3	XOUT	O	Oscillator output pin	740	130
4	GND	–	(–) ground pin	965	130
5	OE	I	Output enable pin. Outputs are high impedance when LOW (oscillator stopped). Power-saving pull-up resistor built-in.	896	1170
6	VCC2	–	(+) output buffer supply pin	756	1170
7	OUTN	O	Output pin (complementary)	523	1170
8	OUT	O	Output pin (true)	244	1170
9	TEST	I	IC test pin. Leave open circuit for normal operation.	136	678

BLOCK DIAGRAM



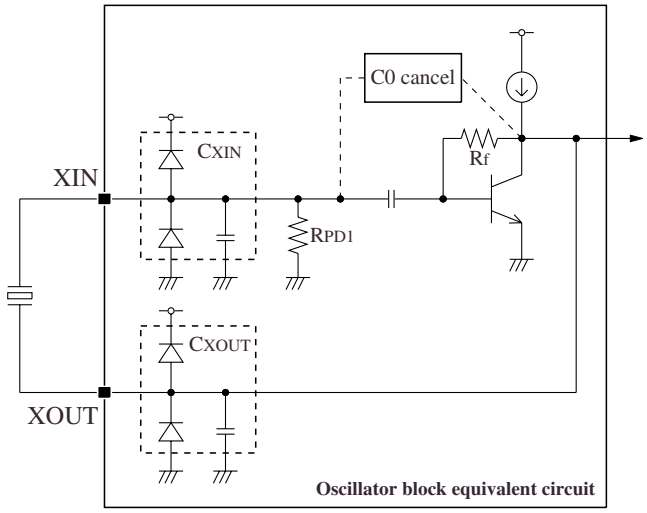
OSCILLATOR CIRCUIT CONSTANT

The CF5037 series oscillator setting varies with device version to optimize characteristics over the recommended operating frequency range.

Version	Oscillation mode	Built-in capacitance*1 *2[pF]		Recommended operating frequency range*2 *3 [MHz]
		C_{XIN}	C_{XOUT}	
CF5037A1	Fundamental or 3rd overtone	12	12	80 to 120
CF5037B×		8	8	100 to 180
CF5037C×		6	6	150 to 250
CF5037D×	Fundamental	5	5	250 to 400
CF5037E×		(5)	(5)	(400 to 600)
CF5037F×		(4)	(4)	(600 to 700)

*1. The oscillator internal capacitance values includes parasitic capacitance.
*2. Values in parentheses ( ) are provisional only.
*3. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.

Oscillator Equivalent Circuit



The CF5037 series oscillator circuit has a C0 cancel circuit built-in to improve the oscillator margin. If power is applied when there is an open circuit between XIN and XOUT, self oscillation may occur, which is not abnormal. Users should confirm that the oscillator operates normally when a crystal unit is connected.

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Rating	Unit
Supply voltage range	V_{CC}		–0.5 to +5.0	V
Input voltage range	V_{IN}		GND – 0.5 to V_{CC} + 0.5	V
Output voltage range	V_{OUT}		GND – 0.5 to V_{CC} + 0.5	V
Storage temperature range	T_{STG}	Chip form	–65 to +150	°C

Recommended Operating Conditions

Parameter	Symbol	Conditions	Rating			Unit
			Min	Typ	Max	
Operating supply voltage	V_{CC}		2.375	–	3.6	V
Input voltage	V_{IN}		GND	–	V_{CC}	V
Operating temperature	T_{OPR}		–40	+25	+85	°C
Output load	R_L	Between OUT and OUTN	99	100	101	Ω
Output frequency	f_{OUT}		80	–	700	MHz

Electrical Characteristics

3.3V operation

V_{CC} = 3.0 to 3.6V, GND = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Conditions		Rating*1			Unit
				Min	Typ	Max	
Current consumption 1	I_{EE1}	Measurement cct. 1, OE = open	5037A1, B×, C×, D×	–	45	66	mA
			5037E×, F×	–	(53)	(73)	mA
Current consumption 2	I_{EE2}	Measurement cct. 1, OE = LOW		–	–	30	µA
HIGH-level output voltage	V_{OH}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT, OUTN pins, f = 100MHz		–	1.43	1.6	V
LOW-level output voltage	V_{OL}			0.9	1.1	–	V
Differential output voltage	V_{OD}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT–OUTN differential voltage, f = 100MHz		247	330	454	mV
Differential output error	ΔV_{OD}			–	–	50	mV
Offset voltage	V_{OS}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT–OUTN mid-level potential, f = 100MHz		1.125	1.25	1.375	V
Offset error	ΔV_{OS}			–	–	50	mV
Output leakage current	I_Z	Measurement cct. 2, OE = LOW, OUT, OUTN pins		–	–	10	µA
HIGH-level input voltage	V_{IH}	Measurement cct. 1, OE pin		0.7V_{CC}	–	–	V
LOW-level input voltage	V_{IL}	Measurement cct. 1, OE pin		–	–	0.3V_{CC}	V
LOW-level input current 1	I_{IL1}	Measurement cct. 1, V_{IL} = 0V, OE pin		–2	–	–20	µA
LOW-level input current 2	I_{IL2}	Measurement cct. 1, V_{IL} = 0.7V_{CC}, OE pin		–20	–	–200	µA
Pull-down resistance 1	R_{PD1}	Measurement cct. 2, XIN pin		12	24	48	kΩ

*1. Values in parentheses ( ) are provisional only.

2.5V operation

V_{CC} = 2.375 to 2.625V, GND = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Conditions		Rating*1			Unit
				Min	Typ	Max	
Current consumption 1	I_{EE1}	Measurement cct. 1, OE = open	5037A1, B×, C×, D×	–	43	63	mA
			5037E×, F×	–	(51)	(70)	mA
Current consumption 2	I_{EE2}	Measurement cct. 1, OE = LOW		–	–	30	µA
HIGH-level output voltage	V_{OH}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT, OUTN pins, f = 100MHz		–	1.43	1.6	V
LOW-level output voltage	V_{OL}			0.9	1.1	–	V
Differential output voltage	V_{OD}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT–OUTN differential voltage, f = 100MHz		247	330	454	mV
Differential output error	ΔV_{OD}			–	–	50	mV
Offset voltage	V_{OS}	Measurement cct. 1, OE = open, R_L = 100Ω, OUT–OUTN mid-level potential, f = 100MHz		1.125	1.25	1.375	V
Offset error	ΔV_{OS}			–	–	50	mV
Output leakage current	I_Z	Measurement cct. 2, OE = LOW, OUT, OUTN pins		–	–	10	µA
HIGH-level input voltage	V_{IH}	Measurement cct. 1, OE pin		0.7V_{CC}	–	–	V
LOW-level input voltage	V_{IL}	Measurement cct. 1, OE pin		–	–	0.3V_{CC}	V
LOW-level input current 1	I_{IL1}	Measurement cct. 1, V_{IL} = 0V, OE pin		–2	–	–20	µA
LOW-level input current 2	I_{IL2}	Measurement cct. 1, V_{IL} = 0.7V_{CC}, OE pin		–10	–	–150	µA
Pull-down resistance 1	R_{PD1}	Measurement cct. 2, XIN pin		12	24	48	kΩ

*1. Values in parentheses ( ) are provisional only.

Switching Characteristics

3.3V operation

V_{CC} = 3.0 to 3.6V, GND = 0V, Ta = −40 to +85°C unless otherwise noted.

Parameter	Symbol	Conditions		Rating*1			Unit
				Min	Typ	Max	
Output duty cycle	Duty	Measurement cct. 3, measured at 0V differential output (crossing point), Ta = 25°C, V_{CC} = 3.3V	f < 350MHz	45	–	55	%
			f ≥ 350MHz	40	–	60	%
Output swing*2	V_{Opp}	Measurement cct. 3, Ta = T_{OPR}, differential output waveform peak-to-peak	5037A1: f = 120MHz	0.35	–	–	V
			5037B×: f = 180MHz	0.35	–	–	V
			5037C×: f = 250MHz	0.35	–	–	V
			5037D×: f = 400MHz	0.35	–	–	V
			5037E×: f = 600MHz	(0.35)	–	–	V
			5037F×: f = 700MHz	(0.35)	–	–	V
Output rise time	t_r	Measurement cct. 3, 20 to 80% differential output swing		–	0.3	0.7	ns
Output fall time	t_f	Measurement cct. 3, 80 to 20% differential output swing		–	0.3	0.7	ns
Output enable time*3	t_{OE}	Measurement cct. 1, Ta = 25°C		–	–	2	ms
Output disable time	t_{OD}	Measurement cct. 1, Ta = 25°C		–	–	200	ns

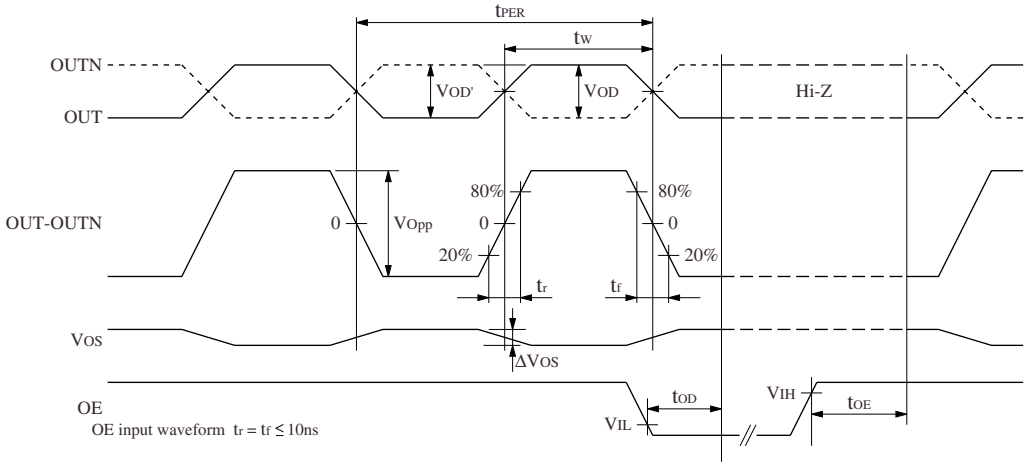
*1. Values in parentheses ( ) are provisional only.
*2. The said values are measured by using the NPC standard jig.
*3. The built-in oscillator stop function does not operate with normal output immediately when OE goes HIGH. Instead, normal output occurs after the oscillator startup time has elapsed.

2.5V operation

V_{CC} = 2.375 to 2.625V, GND = 0V, Ta = −40 to +85°C unless otherwise noted.

Parameter	Symbol	Conditions		Rating*1 Min	Rating*1 Typ	Rating*1 Max	Unit
Output duty cycle	Duty	Measurement cct. 3, measured at 0V differential output (crossing point), Ta = 25°C, V_{CC} = 2.5V	f < 350MHz	45	–	55	%
			f ≥ 350MHz	40	–	60	%
Output swing*2	V_{Opp}	Measurement cct. 3, Ta = T_{OPR}, differential output waveform peak-to-peak	5037A1: f = 120MHz	0.25	–	–	V
			5037B×: f = 180MHz	0.25	–	–	V
			5037C×: f = 250MHz	0.25	–	–	V
			5037D×: f = 400MHz	0.25	–	–	V
			5037E×: f = 600MHz	(0.25)	–	–	V
			5037F×: f = 700MHz	(0.25)	–	–	V
Output rise time	t_r	Measurement cct. 3, 20 to 80% differential output swing		–	0.3	0.7	ns
Output fall time	t_f	Measurement cct. 3, 80 to 20% differential output swing		–	0.3	0.7	ns
Output enable time*3	t_{OE}	Measurement cct. 1, Ta = 25°C		–	–	2	ms
Output disable time	t_{OD}	Measurement cct. 1, Ta = 25°C		–	–	200	ns

*1. Values in parentheses ( ) are provisional only.
*2. The said values are measured by using the NPC standard jig.
*3. The built-in oscillator stop function does not operate with normal output immediately when OE goes HIGH. Instead, normal output occurs after the oscillator startup time has elapsed.



DUTY = $100t_W/t_{PER}$ (%) @ crossing point
$\Delta V_{OD} = |V_{OD}' - V_{OD}|$

Timing chart

FUNCTIONAL DESCRIPTION

Standby Function

When OE goes LOW, the oscillator stops and the output pins (OUT, OUTN) become high impedance.

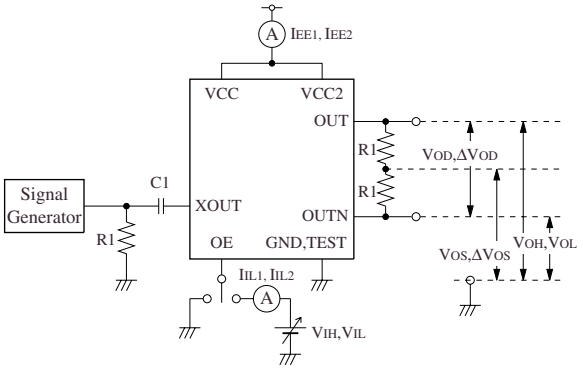
OE	OUT, OUTN	Oscillator
HIGH (or open)	Either f_O or $f_O/2$	Normal operation
LOW	High impedance	Stopped

Power-saving Pull-up Resistor

The OE pin pull-up resistance changes in response to the input level (HIGH or LOW). When OE is tied LOW (standby state), the pull-up resistance becomes large, reducing the current consumed by the resistance. When OE is open circuit, the pull-up resistance becomes small, decreasing the susceptibility to the effects of external noise.

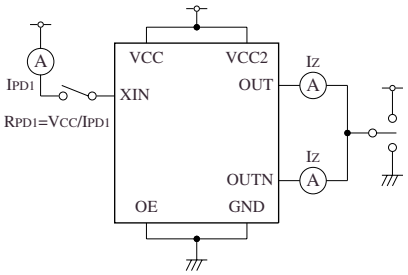
MEASUREMENT CIRCUITS

Measurement Circuit 1

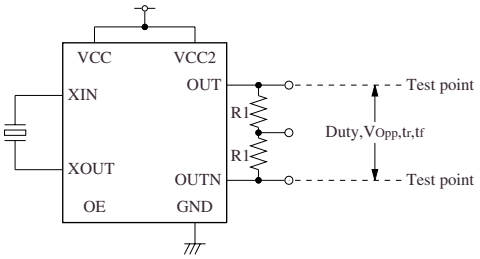


500mVp-p, sine wave
C1: 0.01µF
R1: 49.9Ω
Note. Connect 0.01µF and approximately 10µF bypass capacitors between supply (V_{CC}, V_{CC2}) and GND. Note that the 0.01µF capacitor should have circuit wiring as short as possible.

Measurement Circuit 2



Measurement Circuit 3



R1: 49.9Ω
Note 1. Connect 0.01µF and approximately 10µF bypass capacitors between supply (V_{CC}, V_{CC2}) and GND. Note that the 0.01µF capacitor should have circuit wiring as short as possible.
Note 2. The recommended differential probe used for measurement should have 5GHz analog bandwidth, ≥ 50kΩ impedance, and < 1pF capacitive load.
Note 3. If common-mode noise becomes a problem, a DC decoupling capacitor (approximately 1000pF) and terminating resistor matching the common-mode signal should be connected to the output center tap.

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