OVERVIEW

The CF5036 series are 2.5V operation, differential PECL output oscillator ICs. They support 50MHz to 250MHz 3rd overtone oscillation and 50MHz to 700MHz fundamental oscillation. The devices are fabricated using a proprietary BiCMOS process, enabling a high-frequency oscillator circuit and differential LVPECL output buffer to be incorporated on a single chip. The CF5036 series can be used to construct high-frequency PECL output oscillators.

FEATURES

- 2.375 to 3.6V operating supply voltage range
- Operating frequency range (varies with version)
  - 50MHz to 700MHz fundamental oscillation
  - 50MHz to 250MHz 3rd overtone oscillation
- – 40 to 85°C operating temperature range
- Differential LVPECL output
- 50Ω output load (terminated to V_{CC} – 2V)
- 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 (CF5036××)

SERIES CONFIGURATION

Version	Oscillation mode	Recommended operating frequency range*1 [MHz]	Output frequency
CF5036G1	Fundamental or 3rd overtone	50 to 80	f_O
CF5036G2			$f_O/2$
CF5036A1		80 to 120	f_O
CF5036A2			$f_O/2$
CF5036B1		100 to 180	f_O
CF5036B2			$f_O/2$
CF5036C1		150 to 250	f_O
CF5036C2			$f_O/2$
CF5036D1	Fundamental	250 to 400	f_O
CF5036D2			$f_O/2$
CF5036E1		400 to 600	f_O
(CF5036E2)			$f_O/2$
CF5036F1		600 to 700	f_O
(CF5036F2)			$f_O/2$
(CF5036V1)	Oscillator constants determined by external components (R_f, C_{XIN}, C_{XOUT})	80 to 400	f_O
(CF5036V2)			$f_O/2$
(CF5036W1)		400 to 700	f_O
(CF5036W2)			$f_O/2$

*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.

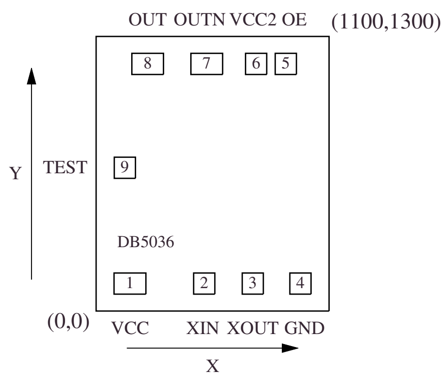
Note. These versions in parentheses ( ) are under development. Please ask our Sales & Marketing section for further detail.

ORDERING INFORMATION

Device	Package
CF5036××–1	Chip form

PAD LAYOUT

(Unit: µm)

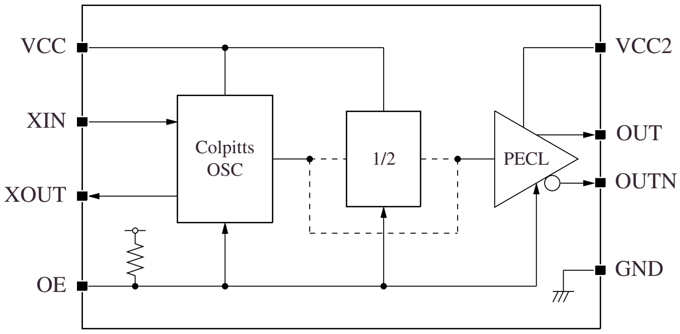


Chip size: 1.10 × 1.30mm
Chip thickness: 300 ± 30µm
PAD size: 150µm × 100µm (VCC, OUT, OUTN pins)
100µm × 100µm (excluding VCC, OUT, OUTN pins)
Chip base: GND potential
Note: The TEST pin is not used during normal operation.

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



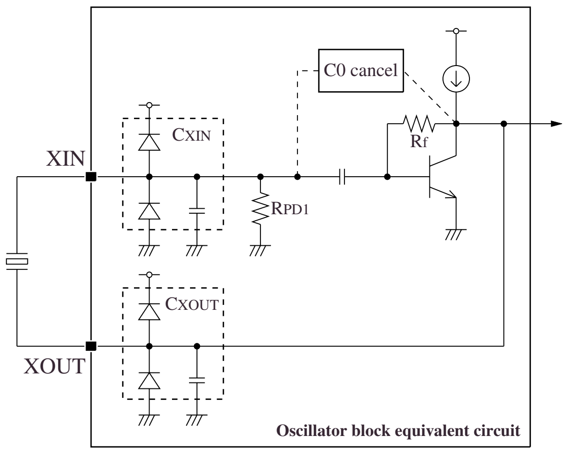
OSCILLATOR CIRCUIT CONSTANT

The CF5036 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*3 [MHz]
		C_{XIN}	C_{XOUT}	
CF5036G×	Fundamental or 3rd overtone	16	16	50 to 80
CF5036A×		12	12	80 to 120
CF5036B×		8	8	100 to 180
CF5036C×		6	6	150 to 250
CF5036D×	Fundamental	5	5	250 to 400
CF5036E×		5	5	400 to 600
CF5036F×		4	4	600 to 700
CF5036V×	Setting by external components (C0 cancel is not built-in.)	(4)	(4)	80 to 400
CF5036W×		(4)	(4)	400 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 CF5036 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	Terminated to V_{CC} – 2V	49.5	50	50.5	Ω
Output frequency	f_{OUT}		25	–	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			Unit
				Min	Typ	Max	
Current consumption 1	I_{EE1}	Measurement cct. 1, OE = open	5036G×, A×, B×, C×, D×	–	55	88	mA
			5036E×, F×	–	64	98	mA
Current consumption 2	I_{EE2}	Measurement cct. 1, OE = LOW		–	–	30	μA
HIGH-level output voltage	V_{OH}	Measurement cct. 2, V_{CC} = 3.3V, OE = open, OUT, OUTN pins	Ta = 0 to 85°C	2.275	2.350	2.420	V
			Ta = –40°C	2.215	2.295	2.420	V
LOW-level output voltage	V_{OL}		Ta = 0 to 85°C	1.490	1.600	1.680	V
			Ta = –40°C	1.470	1.605	1.745	V
Output leakage current	I_Z	Measurement cct. 3, 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. 3, XIN pin		12	24	48	kΩ

2.5V operation

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

Parameter	Symbol	Conditions		Rating			Unit
				Min	Typ	Max	
Current consumption 1	I_{EE1}	Measurement cct. 1, OE = open	5036G×, A×, B×, C×, D×	–	55	88	mA
			5036E×, F×	–	64	98	mA
Current consumption 2	I_{EE2}	Measurement cct. 1, OE = LOW		–	–	30	μA
HIGH-level output voltage	V_{OH}	Measurement cct. 2, V_{CC} = 2.5V, OE = open, OUT, OUTN pins	Ta = 0 to 85°C	1.475	1.550	1.760	V
			Ta = –40°C	1.415	1.495	1.620	V
LOW-level output voltage	V_{OL}		Ta = 0 to 85°C	0.690	0.800	1.095	V
			Ta = –40°C	0.670	0.805	1.195	V
Output leakage current	I_Z	Measurement cct. 3, 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. 3, XIN pin		12	24	48	kΩ

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			Unit
				Min	Typ	Max	
Output duty cycle 1	Duty1	Measurement cct. 4, measured at output crossing point, Ta = 25°C, V_{CC} = 3.3V	f < 350MHz	45	–	55	%
			f ≥ 350MHz	40	–	60	%
Output duty cycle 2	Duty2	Measurement cct. 4, measured at 50% output swing, Ta = 25°C, V_{CC} = 3.3V	f < 350MHz	45	–	55	%
			f ≥ 350MHz	40	–	60	%
Output swing*1	V_{Opp}	Measurement cct. 4, Ta = T_{OPR}, Peak to peak of single output waveform	5036G×: f = 80MHz	0.4	–	–	V
			5036A×: f = 120MHz	0.4	–	–	V
			5036B×: f = 180MHz	0.4	–	–	V
			5036C×: f = 250MHz	0.4	–	–	V
			5036D×: f = 400MHz	0.4	–	–	V
			5036E×: f = 600MHz	0.4	–	–	V
			5036F×: f = 700MHz	0.4	–	–	V
Output rise time	t_r	Measurement cct. 4, 20 to 80% output swing		–	0.3	0.7	ns
Output fall time	t_f	Measurement cct. 4, 80 to 20% output swing		–	0.3	0.7	ns
Output enable time*2	t_{OE}	Measurement cct. 1, Ta = 25°C		–	–	2	ms
Output disable time	t_{OD}	Measurement cct. 1, Ta = 25°C		–	–	200	ns

*1. The said values are measured by using the NPC standard jig.

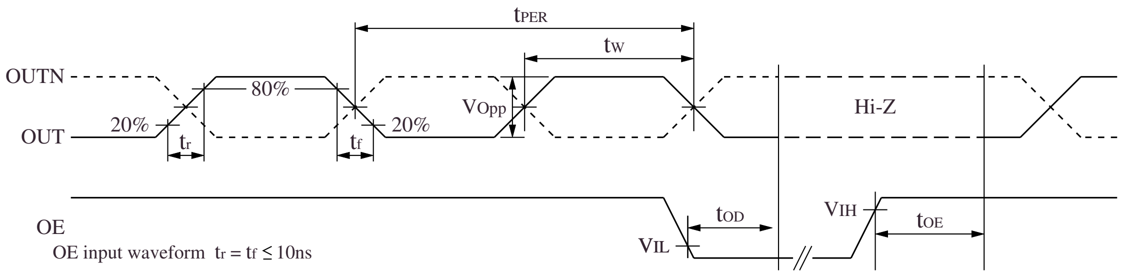
*2. The built-in oscillator stop function does not operate with normal output immediately when OE goes HIGH. Instead, normal output occurs after the oscillator startup time has elapsed.

2.5V operation

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

Parameter	Symbol	Conditions		Rating			Unit
				Min	Typ	Max	
Output duty cycle 1	Duty1	Measurement cct. 4, measured at output crossing point, Ta = 25°C, V_{CC} = 2.5V	f < 350MHz	45	–	55	%
			f ≥ 350MHz	40	–	60	%
Output duty cycle 2	Duty2	Measurement cct. 4, measured at 50% output swing, Ta = 25°C, V_{CC} = 2.5V	f < 250MHz	45	–	55	%
			f ≥ 250MHz	40	–	60	%
Output swing*1	V_{Opp}	Measurement cct. 4, Ta = T_{OPR}, Peak to peak of single output waveform	5036G×: f = 80MHz	0.2	–	–	V
			5036A×: f = 120MHz	0.2	–	–	V
			5036B×: f = 180MHz	0.2	–	–	V
			5036C×: f = 250MHz	0.2	–	–	V
			5036D×: f = 400MHz	0.2	–	–	V
			5036E×: f = 600MHz	0.2	–	–	V
			5036F×: f = 700MHz	0.2	–	–	V
Output rise time	t_r	Measurement cct. 4, 20 to 80% output swing		–	0.3	0.7	ns
Output fall time	t_f	Measurement cct. 4, 80 to 20% output swing		–	0.3	0.7	ns
Output enable time*2	t_{OE}	Measurement cct. 1, Ta = 25°C		–	–	2	ms
Output disable time	t_{OD}	Measurement cct. 1, Ta = 25°C		–	–	200	ns

*1. The said values are measured by using the NPC standard jig.
*2. 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.



DUTY1 = $100t_W/t_{PER}$ (%) @ crossing point
DUTY2 = $100t_W/t_{PER}$ (%) @ 50% waveform

Timing chart

FUNCTIONAL DESCRIPTION

Standby Function

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

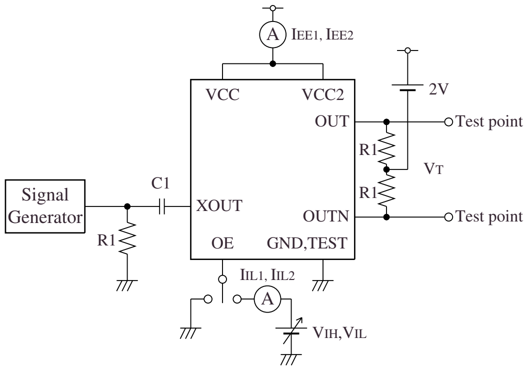
OE	OUT, OUTN	Oscillator
HIGH (or open)	Either f_O or $f_O/2$	Normal operation
LOW	High impedance	Stopped

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.

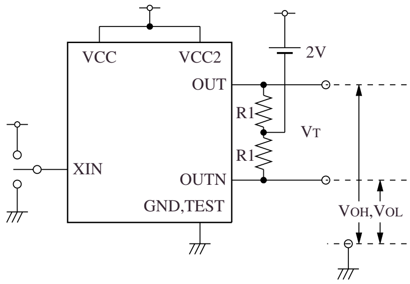
MEASUREMENT CIRCUITS

Measurement Circuit 1



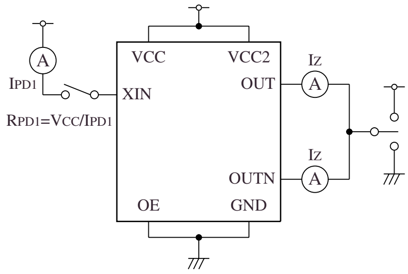
500mVp-p, sine wave
C1: 0.01μF
R1: 49.9Ω
Note. Connect 0.01μF and approximately 10μF bypass capacitors between supply (V_{CC}, V_{CC2}) and GND. Note that the 0.01μF capacitor should have circuit wiring as short as possible.

Measurement Circuit 2

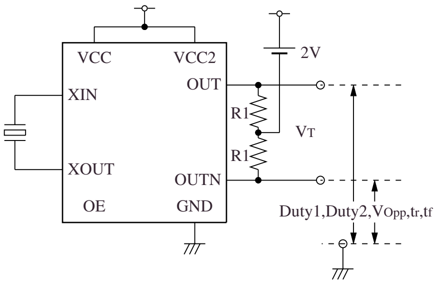


R1: 49.9Ω
XIN = HIGH: OUT = HIGH
XIN = LOW : OUT = LOW

Measurement Circuit 3



Measurement Circuit 4



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.

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