VC5037 Series

LVDS Oscillator ASIC

-55°C to 125°C   80-600 MHz

FEATURES

- **Rugged , reliable, LVDS clock**
- **Single Chip 5x7mm solution**
- **Work with Overtone, Fundamental, or SAW resonator**
- **3.3 or 2.5 volt supply**
- **Excellent startup**
- **Low Phase noise &jitter**
- **Typical 300pS rise and fall times**

BENEFITS

- **Work over wide range of system loads**
- **Small board footprint**

APPLICATIONS

- **LTE and wireless**
- **Data and Voice Communications**
- **Internet infrastructure**

DEFENSE, AEROSPACE and MEDICAL APPLICATIONS

- **Controlled Baseline**
- **Single Fabrication Site**
- **Single Assembly/Test site**
- **Temperature Range –55°C to 125°C**
- **Extended Product Life-Cycle**
- **Extended Product-Change   Notification**
- **Product Traceability**

GENERAL DESCRIPTION

The VC5037 series set the standard for high frequency differential LVDS oscillator ICs built in 5x7mm ceramic packages. They support 80 MHz to 600MHz output operation using fundamental crystals and 80 MHz to 400 MHz using 3rd overtone crystals

The devices are fabricated using a proprietary BiCMOS process with LVDS current limiting output to prevent short circuit and reduce EMI.

The VC5037 series is specified for –55°C to 125°C operation for extended range operation. For applications requiring processing to Mil-PRF-38534, refer to ordering guide table on page 8.

BLOCK DIAGRAM

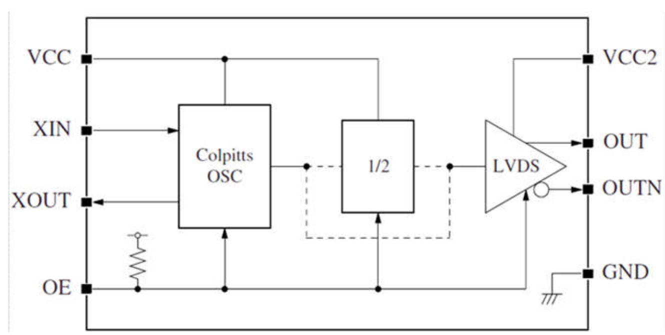

TABLE 1. ORDERING INFORMATION

Temperature Range	Frequency Range	Output	Fundamental	Overtone	SAW	Standard
-55°C to 125°C	80-120	F0	Yes	Yes	Yes	VC5037A1
-55°C to 125°C	100-180	F0	Yes	Yes	Yes	VC5037B1
-55°C to 125°C	120-180 Oscillation /60-90 output*	F0/2	Yes	Yes	Yes	VC5037B2
-55°C to 125°C	150-250	F0	Yes	Yes	Yes	VC5037C1
-55°C to 125°C	150-250 Oscillation/75-125 output*	F0/2	Yes	Yes	Yes	VC5037C2
-55°C to 125°C	250-400	F0	Yes	Yes	Yes	VC5037D1T
-55°C to 125°C	400-600	F0	Yes	-	Yes	VC5037E1
-55°C to 125°C	80-120	F0	Yes	-	Yes	VC5037A1N
-55°C to 125°C	100-180	F0	Yes	-	Yes	VC5037B1N

*3.3 volt operation only below 80MHz

email sales@vcamerica.com

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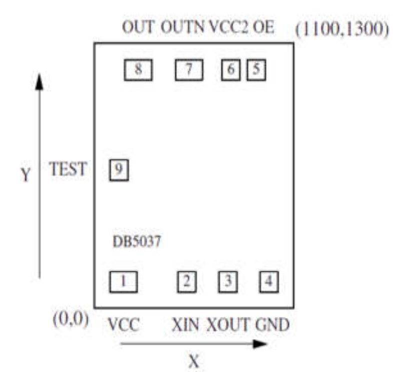
PHYSICAL DIMENSIONS AND PAD LAYOUT

Chip Size	Micron	Mils
Chip length X	1100	43.4
Chip length Y	1300	51.2
Chip thickness	330	13.0
Pad size VCC, OUT, OUTN All other pads	 150x100 100x100	 5.90x3.93 3.93x3.93



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 DESCRIPTIONS AND PAD LOCATIONS

Pad No.	Name	I/O	Function	Pad dim. [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

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
Junction temperature	T_J	Mounted	+175	°C

TABLE III Electrical Characteristics

ELECTRICAL DC CHARACTERISTICS over recommended operating temperature range (unless noted otherwise)

DC Characteristics tested at 3.3 Volts unless otherwise specified							
Parameter	**Symbol**	**Condition**		**Rating Min**	**Typ**	**Max**	**Unit**
Current Consumption 1	I_{EE1}	Measurement Circuit 1, OE= open	VC5037Gx, Ax, Bx, Bxx, Cx, Cxx, Dx, Dxx	-	-	66	mA
			VC5037Ex	-	-	73	mA
Current Consumption 2	I_{EE2}	Measurement Circuit 1 OE=LOW		-	-	30	µA
HIGH-level output voltage	V_{OH}	Measurement Circuit 1, OE=open, RL=100Ω, OUT, OUTN pins f=100MHz		-	-	1.6	V
LOW-level output voltage	V_{OL}			0.9	-	-	V
Differential output voltage	V_{OD}	Measurement Circuit 1, OE=open, RL=100Ω, OUT- OUTN differential voltage, f=100MHz		247	-	454	mV
Differential output error	ΔV_{OD}			-	-	50	mV
Offset Voltage	V_{OS}	Measurement circuit 1, OE = open, RL= 100Ω, OUT–OUTN mid-level potential, f = 100MHz		1.125		1.375	V
Offset error	ΔV_{OS}					50	mV
Output leakage current	I_Z	OUT, OUTN pins: Measurement circuit 2, OE = LOW		-	-	10	µA
HIGH-level input voltage	V_{IH}	Measurement circuit 1, OE pin		0.7 VCC	-	-	V
LOW-level input voltage	V_{IL}			-	-	0.3 VCC	V
LOW-level input current 1	I_{IL1}	Measurement circuit 1, V_{IL} = 0V, OE pin		-2		-20	µA
LOW-level input current 2	I_{IL2}	Measurement circuit 1, V_{IL}= 0.7VCC, OE pin		-20		-200	µA
INHN pull-down resistance	RPD1	Measurement circuit 2, XIN pin		12	-	48	kΩ

DC Characteristics tested at 2.5 Volts unless otherwise specified							
Parameter	**Symbol**	**Condition**		**Rating Min**	**Typ**	**Max**	**Unit**
Current Consumption 1	I_{EE1}	Measurement Circuit 1, OE= open	VC5037Gx, Ax, Bx, Bxx, Cx, Cxx, Dx, Dxx	-	-	63	mA
			VC5037Ex	-	-	70	mA
Current Consumption 2	I_{EE2}	Measurement Circuit 1 OE=LOW		-	-	30	µA
HIGH-level output voltage	V_{OH}	Measurement Circuit 1, OE=open, RL=100Ω, OUT, OUTN pins f=100MHz		-	-	1.6	V
LOW-level output voltage	V_{OL}			0.9	-	-	V
Differential output voltage	V_{OD}	Measurement Circuit 1, OE=open, RL=100Ω, OUT- OUTN differential voltage, f=100MHz		247	-	454	mV
Differential output error	ΔV_{OD}			-	-	50	mV
Offset Voltage	V_{OS}	Measurement circuit 1, OE = open, RL= 100Ω, OUT–OUTN mid-level potential, f = 100MHz		1.125		1.375	V
Offset error	ΔV_{OS}					50	mV
Output leakage current	I_Z	OUT, OUTN pins: Measurement circuit 2, OE = LOW		-	-	10	µA
HIGH-level input voltage	V_{IH}	Measurement circuit 1, OE pin		0.7 VCC	-	-	V
LOW-level input voltage	V_{IL}			-	-	0.3 VCC	V
LOW-level input current 1	I_{IL1}	Measurement circuit 1, V_{IL} = 0V, OE pin		-2		-20	µA
LOW-level input current 2	I_{IL2}	Measurement circuit 1, V_{IL}= 0.7VCC, OE pin		-20		-200	µA
INHN pull-down resistance	RPD1	Measurement circuit 2, XIN pin		12	-	48	kΩ

ELECTRCIAL AC CHARACTERISTICS tested at 3.3 and 2.5 volts unless otherwise specified								
Parameter	**Symbol**	**Condition**			**Rating**			**Unit**
					Min	**Typ**	**Max**	
Output Duty cycle	Duty	Measurement circuit 3 measured at 0V differential output (crossing point)			45	-	55	%
Output Swing	V_{Opp}	Measurement circuit 3 differential output waveform peak-to-peak	VCA5037Gx: f-80MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037Ax: -120MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037Bx: f-180MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037Cx: f-250MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037Dx: f-400MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037E1: f-600MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
			VCA5037D1T: f-400MHz	VCC=3.3V	0.40	-	-	V
				VCC=2.5V	0.20	-	-	V
Output Rise Time	Tr	Measurement circuit 3, 20 to 80% differential output swing		VCC=3.3V	-	-	0.7	ns
				VCC=2.5V	-	-	0.7	ns
Output Fall Time[7]	Tf	Measurement circuit 3, 80 to 20% differential output swing		VCC=3.3V	-	-	0.7	ns
				VCC=2.5V	-	-	0.7	ns
Output enable time	T_{OE}	Measurement circuit 1			-	-	2	ms
Output Disable time	T_{OD}	Measurement circuit 1			-	-	200	nS

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 F0 or F0/2**	**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 stage), 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.

Oscillation Detector Function

The VC5037 series features an oscillation detector circuit. This circuit functions to disable the outputs until the oscillator circuit starts and oscillation becomes stable. This alleviates the danger of abnormal oscillator output at oscillator start-up when power is applied or when OE is switched.

OSCILLATOR CIRCUIT CONSTANT

The VC5037 oscillator setting varies with the device version to optimize characteristics over the recommended operating frequency range.

The VC5037A1/Bx/Cx/Dx versions are suitable for use of crystals units with large C0 value (approximately C0≥2.0pF and for VC5037D1T C0≥2.5pF. The VC5037Ex version is suitable for use of crystal unit with C0 value or approximately 2.0pF.

Version	Recommended crystal unit or resonator	Built-in Capacitance [pF] (note 1)		Recommended oscillation frequency range [MHz] (note 2)
		C_{XIN}	C_{XOUT}	
VC5037A1	Fundamental, 3rd overtone, SAW	12	12	80 to 120
VC5037Bx		8	8	100 to 180
VC5037Cx		6	6	150 to 250
VC5037A1N	Fundamental, SAW	12	16	80 to 120
VC5037B1N		11	13	110 to 180
VC5037Dx		5	5	250 to 400
VC5037Ex		5	5	400 to 600
VC5037D1T	Fundamental, 3rd overtone, SAW	5	5	250 to 400

1. The oscillator internal capacitance value includes parasitic capacitance
2. The recommended oscillation frequency is a yardstick value derived from the crystal used for characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically the characteristics can vary greatly due to crystal characteristics (motional parameters and Quartz Q) and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.,

Oscillator equivalent circuit

Versions with cancellation circuit

VC5037A1 and VC5037A2N

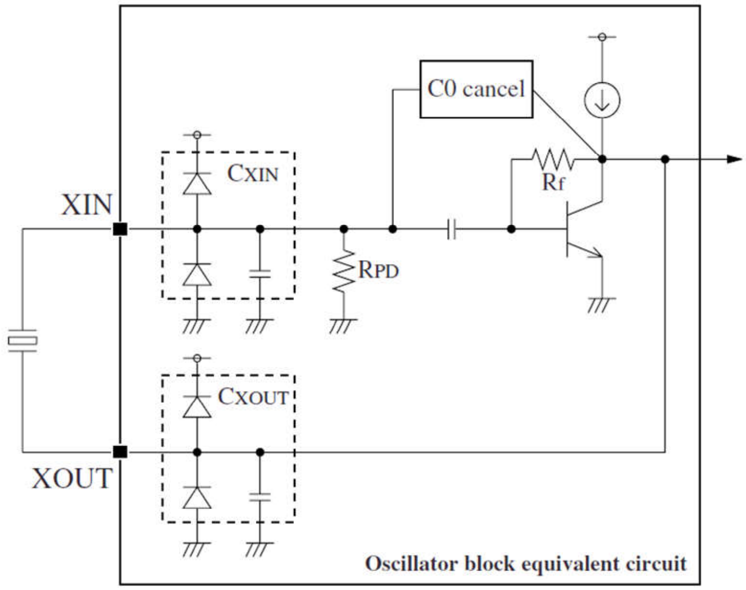
VC5037B1 and VC5037B2N

VC5037C1 and VC5037C1N

VC5037D1 and VC5037D2

VC5037D1T

VC5037E1 and VC5037E2



The VC5037 series oscillator circuit listed above have a C0 cancellation circuit built-in to improve the oscillator margins. If power is applied when there is an open circuit between XIN and XOUT, self oscillation (at approx 80MHz) may occur, which is not abnormal. Users should confirm that the oscillator operates normally when a crystal unit is connected. Note: Abnormally high crystal resistance may also result in self-oscillation.

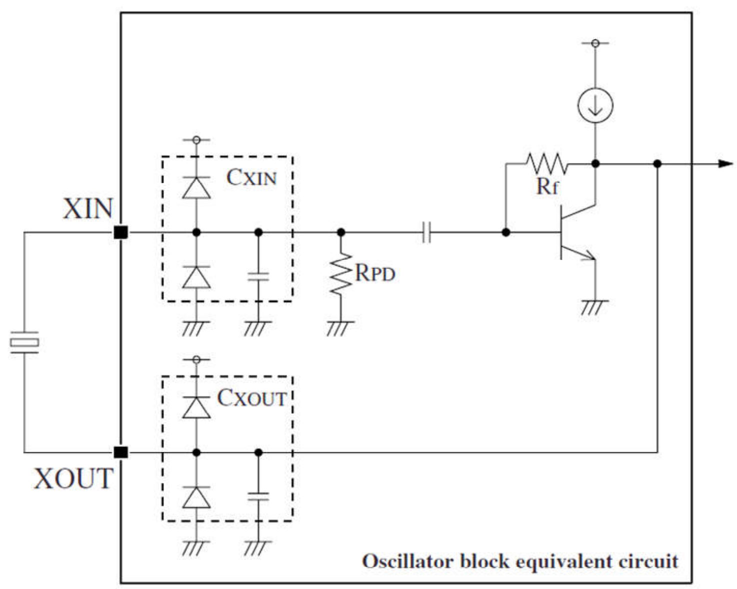
The XOUT pin of the VC5037E1 is sized for high frequency and its ESD protection circuit is smaller; Accordingly, electrostatic protection level is significantly lower than other pins and we recommend all ESD precautions be taken to prevent damage .

Oscillator equivalent circuit

Versions without cancellation circuit

VC5037A1N

VC5037B1N



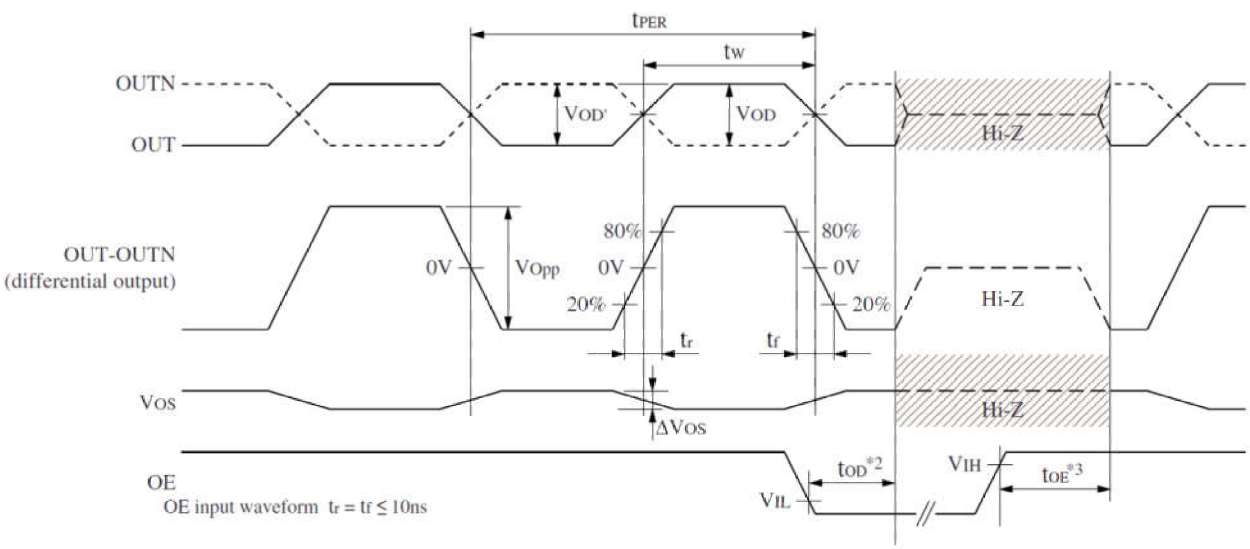
PACKING

IC are shipped as bare die / chip form and packed in 2” square waffle packs 400 chips per tray, nitrogen-purged and vacuum sealed, and labeled at minimum with:

Manufacturer
Part number
Lot code
Quantity

ORDERING GUIDE			
Temperature range	Standard non-military	Class H	Class K
-55°C to 125°C	VC5037A1	VC5037A1H	VC5037A1K
-55°C to 125°C	VC5037B1	VC5037B1H	VC5037B1K
-55°C to 125°C	VC5037B2	VC5037B2H	VC5037B2K
-55°C to 125°C	VC5037C1	VC5037C1H	VC5037C1K
-55°C to 125°C	VC5037C2	VC5037C2H	VC5037C2K
-55°C to 125°C	VC5037D1T	VC5037D1TH	VC5037D1TK
-55°C to 125°C	VC5037E1	VC5037E1H	VC5037E1K
Versions without C0 cancellation circuit			
-55°C to 125°C	VC5037A1N	VC5037A1NH	VC5037A1NK
-55°C to 125°C	VC5037B1N	VC5037B1NH	VC5037B1NK
Please contact sales for current ordering information (price, delivery, order quantities) Email: sales@vcamerica.com Phone: 702-597-2495 Facsimile: 702-920-8405			

SWITCHING TIME MEASUREMENT WAVEFORM

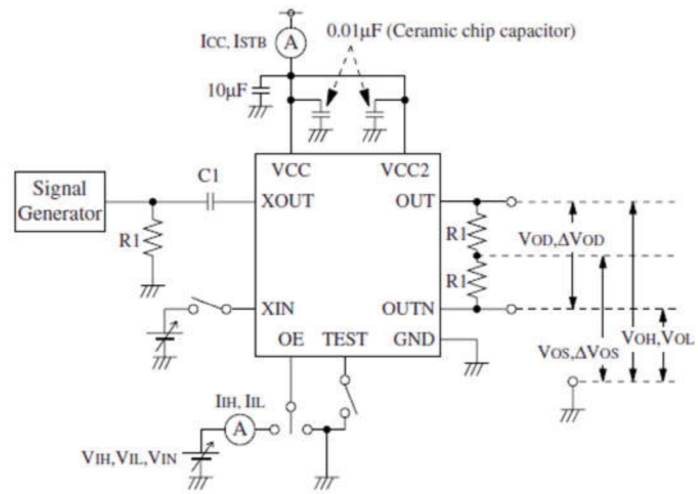


$DUTY = t_W/t_{PER} \times 100$ (%) @ crossing point

$\Delta V_{OD} = |V_{OD}' - V_{OD}|$

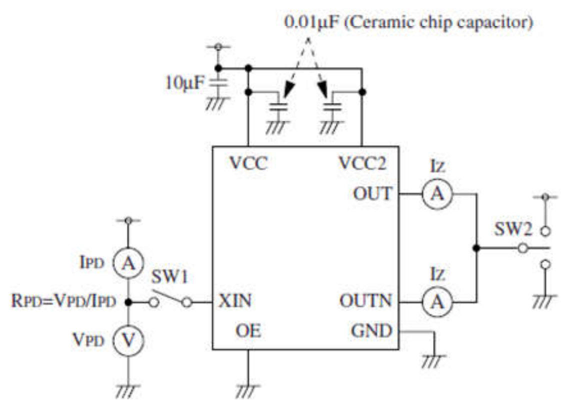
*2. The OUT/OUTN output goes high impedance after the OE is fallen and then the output disable time “t_{OD}” has elapsed.
*3. The normal output occurs after the OE is raised and then the output enable time “t_{OE}” has elapsed.

Measurement Circuit 1

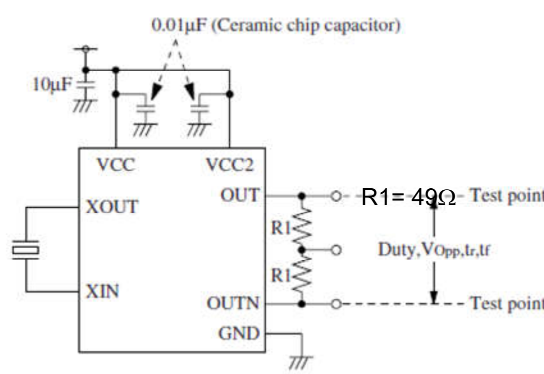


C1: 0.01µF, R1: 49.9Ω

Measurement Circuit 2



Measurement Circuit 3



1. Circuit wiring must be simply as short as possible or required characteristics may not be realized. Locate bypass capacitors directly across supply pins.

2. VC America recommends measurement of waveform parameters requires an oscilloscope and signal path (inclusive of probe/

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