VC5035 Series

CMOS output Oscillator ASIC 70 to 220 MHz
1.8V, 2.5V & 3.3V -55°C to 125° Operation

FEATURES
- **Rugged , reliable, CMOS clock**
- **Single Chip 5x7mm solution**
- **Overtone or Fundamental crystal**
- **3.3, 2.5, 1.8 volt supply (1.6 to 3.63V)**
- **Excellent startup from V_{DD} power-on**
- **Low Phase noise & jitter**

BENEFITS
- **Stable low power operation**
- **Small board Footprint**

APPLICATIONS
- **System clocks**
- **Where power management is needed**
- **Data and voice Communications**
- **Packages ranging from 5x7 to 2.5x2.0mm**

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**

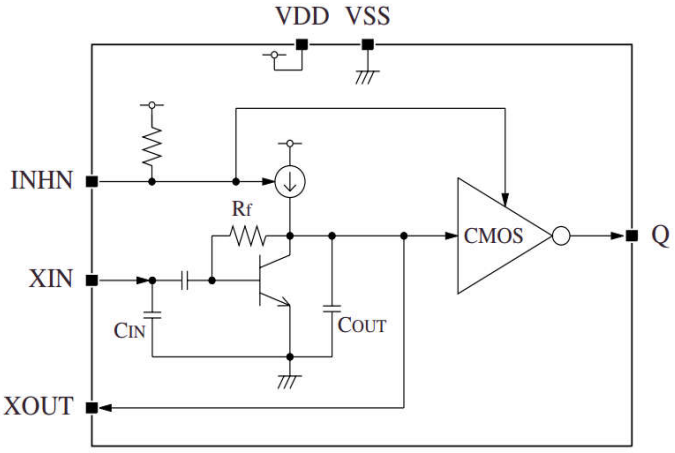
GENERAL DESCRIPTION

The VC5035 series set the standard for rugged and reliable high frequency CMOS oscillator ICs built in 5x7 and 5x3.2 mm ceramic packages. They support 70 MHz to 220MHz output operation for 3.3V and 2.5V operation using fundamental or overtone crystals and operate from 70 to 165MHz at 1.8 volts.

The devices are fabricated using a proprietary BiCMOS process and the oscillator circuit is a bipolar (Colpitts) design with built-in capacitors and feedback resistors. A unique startup circuit assures stable oscillation prior to clock output being enabled..

The VC5035 series is specified for –55°C to 125°C operation. For applications requiring processing to Mil-PRF-38534 or Mil-PRF-38535, refer to ordering guide.

BLOCK DIAGRAM (equivalent circuit)



SERIES CONFIGURATION

-55 °C to 125°C Operation	Voltage Range	Frequency Range (MHz)	Fundamental	Overtone
VC5035ALA	1.6V to 3.63V	70 to 95	Yes	Yes
VC5035ALB		95 to 125	Yes	Yes
VC5035ALC		125 to 165	Yes	Yes
VC5035ALD	2.25V to 3.63V	165 to 220	Yes	Yes

See page 6 for ordering IC processed to Mil-PRF-55310 Appendix B table B-I Class “B” or Mil-PRF-38534 Class H / K

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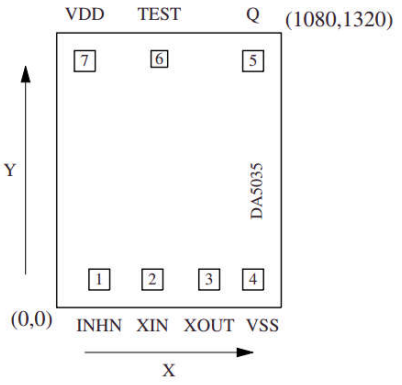
PHYSICAL DIMENSIONS AND PAD LAYOUT

Chip Size	Micron	Mils
Chip length X	1080	42.6
Chip length Y	1320	51.2
Chip thickness	330	13.0
Pad size (all but test)	100x100	3.93x3.93
Test pad	80x80	3.14x3.14



Chip size: 1.08 × 1.32mm
Chip thickness: 300 ± 30μm
PAD size: 100μm × 100μm (TEST: 80μm × 80μm)
Chip base: V_{SS} potential

PAD COORDINATES AND PIN DESCRIPTIONS

Pad No.	Name	I/O	Function		Pad dim. [μm]	
					X	Y
1	IHN	I	Output Stable control input. Oscillator stops when LOW. Power –saving pull-up resistor built-in.		205	135
2	XIN	I	Oscillator input	Crystal connection pins connect Crystal to XIN and XOUT	461	135
3	XOUT	O	Oscillator output		734	135
4	VSS	-	(-) ground pin		945	130
5	Q	O	Output pin. Output frequency. High impedance in standby mode		945	1185
6	TEST	I	IC test pin. Leave open circuit for normal operation		494	1195
7	VCC	-	(+) supply voltage		135	1185

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ABSOLUTE MAXIMUM RATINGS

Vss= 0

Parameter	Symbol	Conditions	Rating	Unit
Supply voltage range	V_{DD}	Between V_{DD} and V_{SS}	0.5 to +5.0	V
Input voltage range	V_{IN}	Input pins	V_{SS}-0.5 to V_{CC}+0.5	V
Output voltage range	V_{OUT}	Output pins	V_{SS}-0.5 to V_{CC}+0.5	V
Output current	I_{OUT}	Q pin	25	mA
Storage temperature range	T_{STG}	Chip form	-65 to +150	°C
Junction temperature	T_J	Mounted	+175	°C

[*1] Parameter rating values must never exceed even for a moment or this product may suffer breakdown. Operation and characteristics are guaranteed only when the product is operated at recommended operating conditions.
[*2] V_{DD} is a value of recommended operating conditions.
[*3] Do not exceed absolute maximum ratings or device characteristics and reliability will be degraded.
[*4] When stored in nitrogen or vacuum atmosphere applied to IC itself only (excluding packaging materials).

RECOMMENDED OPERATING CONDITIONS

V_{SS}=0V

$C_L \leq 15pF$

Parameter	Symbols	Condition		MIN	MAX	Unit
Oscillator frequency [*5]	f_{OSC}	V_{DD} = 1.70 to 3.63V CLOUT <15pF	VC5035ALA	70	95	MHz
			VC5035ALB	95	125	
			VC5035ALC	125	165	
		V_{DD} = 2.25 to 3.63V CLOUT <15pF	VC5035ALD	165	220	
Operating supply voltage	V_{DD}	Between V_{DD} and V_{SS} [*6] Input pins	VC5035ALA VC5035ALB VC5035ALC	1.60	3.63	V
			VC5035ALD	2.25	3.63	V
Input voltage	V_{IN}			V_{SS}	V_{DD}	V
Operating temperature	T_{OP}			-55	+125	°C
Output load capacitance	C_L	Q output		-	15	pF

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TABLE III Electrical Characteristics (DC Tests)

V_{DD}=1.60V to 3.63V, V_{SS} = 0V, T = -55°C to 125°C unless otherwise noted.

Parameter	Symbol	Condition		Rating		Unit
				Min	Max	
Current Consumption*1	I_{DD}	VC5035ALA, F_{OUT}= 95 MHz Measurement cct 1, INHN=open, CL=15pF	V_{DD}= 1.6 to 2.0V	-	19	mA
			V_{DD}= 2.25 to 2.75V	-	26	mA
			V_{DD}= 2.75 to 3.63V	-	33	mA
		VC5035ALB, F_{OUT} = 125 MHz Measurement cct 1, INHN=open, CL=15pF	V_{DD}= 1.6 to 2.0V	-	27	mA
			V_{DD}= 2.25 to 2.75V		36	mA
			V_{DD}= 2.75 to 3.63V	-	46	mA
		VC5035ALC, F_{OUT} = 165 MHz Measurement cct 1, INHN=open, CL=15pF	V_{DD}= 1.6 to 2.0V	-	37	mA
			V_{DD}= 2.25 to 2.75V		51	mA
			V_{DD}= 2.75 to 3.63V	-	65	mA
		VC5035ALD, F_{OUT} = 220 MHz Measurement cct 1, INHN=open, CL=15pF	V_{DD}= 2.25 to 2.75V	-	58	mA
			V_{DD}= 2.75 to 3.63V	-	73	mA
Standby Current	I_{STB}	Measurement cct 1, INHN=LOW		-	10	µA
HIGH-level output voltage	V_{OH}	Q:Measurement cct 3, I_{OH}=- 8mA		V_{DD}-0.4	-	V
LOW-level output voltage	V_{OL}	Q:Measurement cct 3, I_{OL}= 8mA		-	0.4	V
Output leakage current	I_{ZH}	Q:Measurement cct 5, INHN = LOW	V_{OH} = V_{DD}	-	10	µA
	I_{ZL}		V_{OL} = V_{SS}	-	10	µA
HIGH-level input voltage	V_{IH}	INHN, Measurement cct 4		0.7V_{DD}	-	V
LOW-level input voltage	V_{IL}	INHN, Measurement cct 4		-	0.3V_{DD}	V
INHN pull-up resistance	R_{PU1}	Measurement cct 6	INHN=0	0.4	4	MΩ
	R_{PU2}		INHN=0.7 x V_{DD}	30	150	kΩ

*1. The operating current consumption includes the output load of CL = 15pF capacitance.

*1 The consumption current $I_{DD}(CL_{OUT})$ with a load capacitance (CL_{OUT}) connected to the Q pin is given by the following equation, where I_{DD} is the no-load consumption current and f_{OUT} is the output frequency (MHz).

$$I_{DD}(CL_{OUT})\ [mA] = I_{DD}\ [mA] + CL_{OUT}\ [pF] \times V_{DD}\ [V] \times f_{OUT}\ [MHz] \times 10^{-3}$$

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TABLE III Electrical Characteristics (AC Tests)

V_{DD}=1.60 to 3.63V, V_{SS} = 0V, T_{OP} = -55°C to 125°C unless otherwise noted.

Parameter	Symbol	Condition		Rating		Unit
				Min	Max	
Output rise time	tr1	Measurement cct 1 C_L=15pF 0.1V_{DD} to 0.9 V_{DD}	V_{DD}= 2.25 to 3.63V	-	2.0	ns
	tr2	Measurement cct 1 C_L=15pF 0.2V_{DD} to 0.8 V_{DD}	V_{DD}=1.6 to 2.25V	-	2.5	ns
Output fall time	tf1	Measurement cct 1 C_L=15pF, 0.1V_{DD} to 0.9 V_{DD}	V_{DD}= 2.25 to 3.63V	-	2	ns
	tf2	Measurement cct 1 C_L=15pF, 0.2V_{DD} to 0.8 V_{DD}	V_{DD}=1.6 to 2.25V	-	2.5	ns
Output Duty cycle	Duty	Measurement cct 1 C_L = 15 pF Ta = 25°C	V_{DD}= 2.25 to 3.63V	45	55	%
			V_{DD}=1.6 to 2.25V	40	60	%
Output enable delay time*1	T_{OE}	Measurement cct 2, Ta = 25°C, C_L ≤ 15 pF, F_{IN}=1Hz INHN=0 to V_{DD} volts		-	2	ms
Output Disable delay	T_{OD}	Measurement cct 2, Ta = 25°C, C_L ≤ 15 pF, F_{IN}=1Hz		-	200	ns

*1 Oscillator stop function is built-in and when INHN goes LOW, oscillation stops. When INHN goes HIGH, normal output is resumed after the oscillator start-up time has elapsed.

TIMING CHART

Figure 1. Output switching waveform

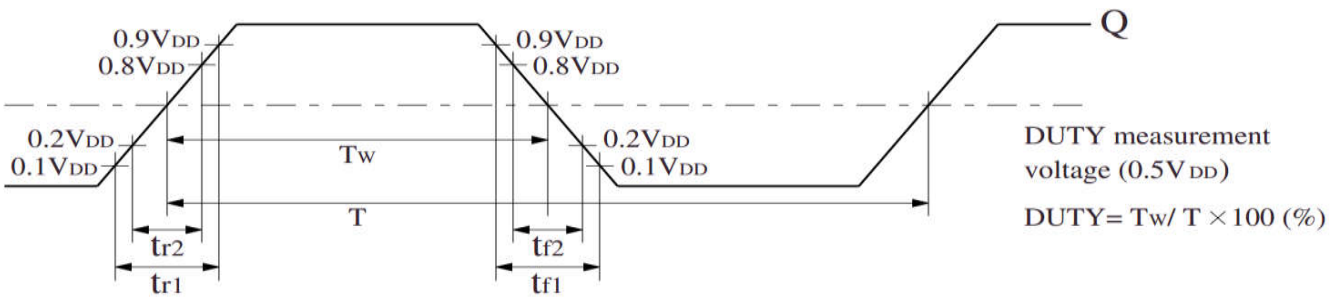
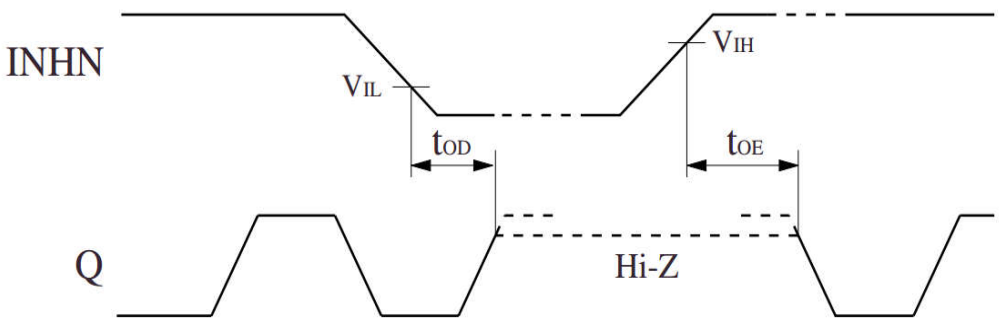


Figure 2. Output disable/enable timing chart



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FUNCTIONAL DESCRIPTION

INHN	Q	Oscillator
HIGH (or open)	F_{OUT}	Normal Operation
LOW	High Impedance	Stopped

Standby Function

When INHN logic state is LOW (= = V_{SS}), oscillation stops and output state is high impedance (standby mode).

Power Saving Pull-up Resistor

The INHN pin pull-up resistance changes its value to R_{PU1} or R_{PU2} in response to the input level (High or Low). When INHN is tied to Low level, the pull-up resistance increases (R_{PU1}), thus reducing the current consumed.

When INHN is left open circuit or tied to High level, the pull-up resistance is smaller (R_{PU2}). In addition to changing INHN state to High, the lower pull-up resistance increases immunity from noise, keeping the oscillator in the high /On-state and working properly.

Oscillation Detector Function

The VC5035 series incorporates an oscillation detection circuit. The oscillation detection circuit disables the output until the oscillator circuit starts up, which avoids the problem where the oscillator does not start due to abnormal oscillation conditions, when power is applied or when the oscillator is restarted using INHN.

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 with:

Manufacturer
Part number
Lot code
Wafer number [class K]
Quantity

Devices processed to Mil-PRF-55310 Appendix B table B-I Class “B” or Mil-PRF=38534 Class H and K include qualification reports. Class K include SEM report when ordered. Variables Data may be specified. Certificate of Conformance / compliance is included with each order and shipment.

ORDERING GUIDE

Frequency Range	Standard	Level B	Class H	Class K
70 to 95 MHz	VC5035ALA	VC5035ALAB	VC5035ALAH	VC5035ALAK
95 to 125MHz	VC503ALB	VC5035ALBB	VC5035ALBH	VC5035ALBK
125 to 165MHz	VC5035ALC	VC5035ALCB	VC5035ALCH	VC5035LCK
165 to 220 MHz	VC5035ALD	VC5035ALDB	VC5035ALDH	VC5035ALDK

Please contact sales for current ordering information (price, delivery, order quantities)
Email: sales@vcamerica.com Phone: 702-597-2495

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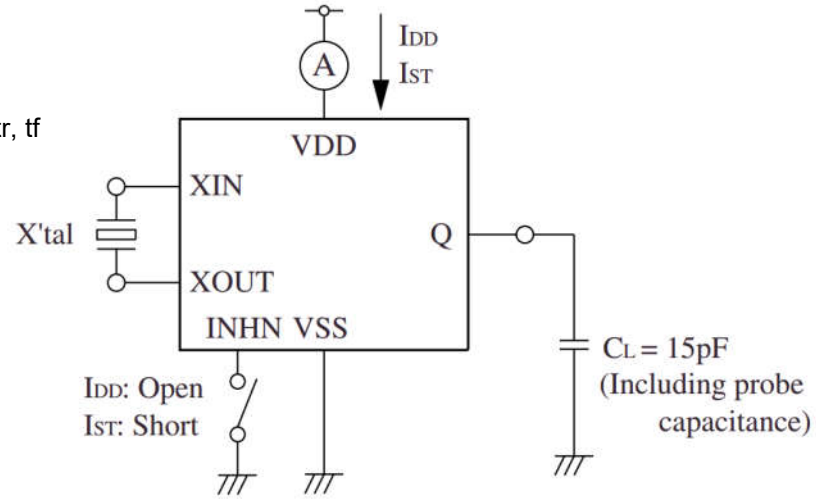
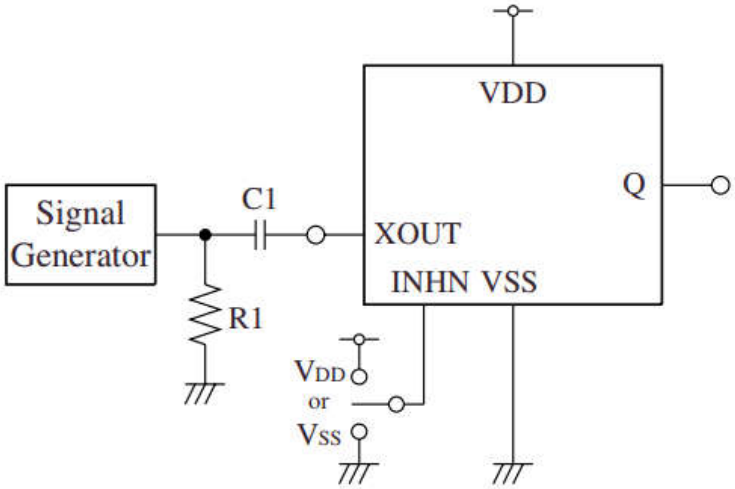
MEASUREMENT CIRCUITS

Measurement circuit 1
Measurement Parameter. I_{DD}, I_{ST}, DUTY, tr, tf



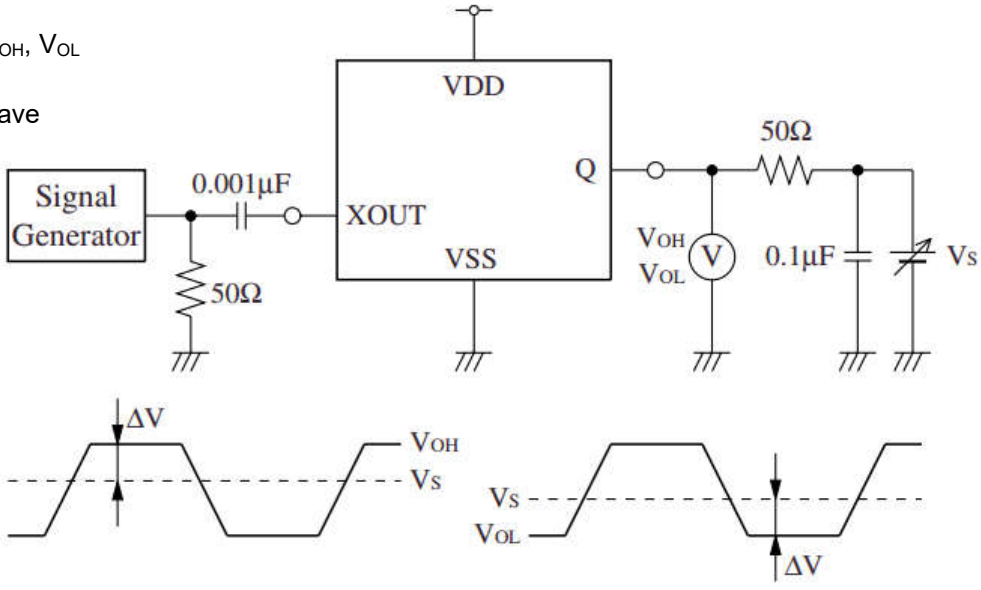
Measurement circuit 2
Measurement Parameter. T_{OE}, T_{OD}

XTN input = ~ 1V p-p sine wave
C1= 0.001µF
R1= 50Ω



Measurement circuit 3
Measurement Parameter. V_{OH}, V_{OL}

XTN input = ~ 1V p-p sine wave



V_S adjusted to $\Delta V = 50 \times I_{OH}$ **V_S adjusted to $\Delta V = 50 \times I_{OL}$**

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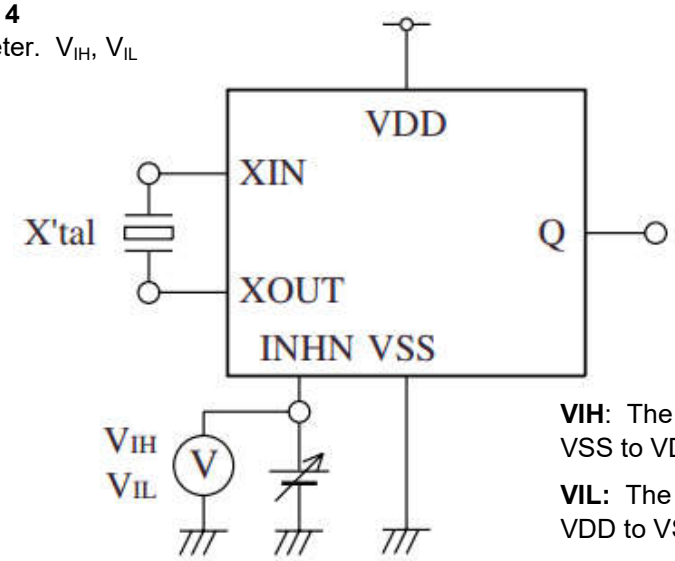
Measurement circuit 4

Measurement Parameter. V_{IH}, V_{IL}



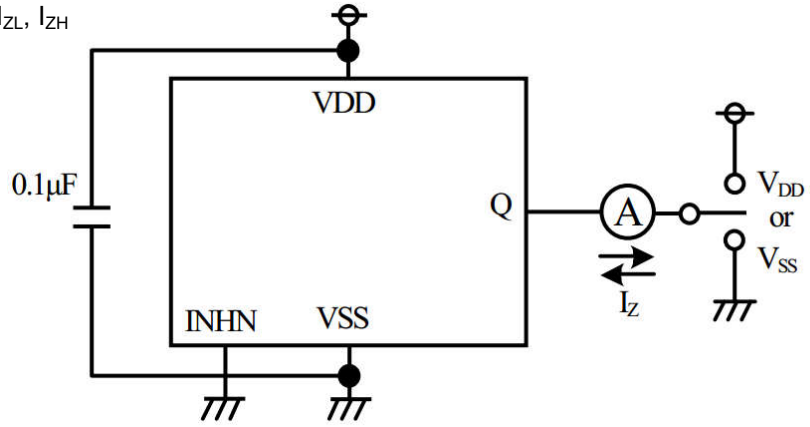
VIH: The Voltage during transition from VSS to VDD that changes output state.

VIL: The Voltage during transition from VDD to VSS that changes output state

INHN has oscillation stop function

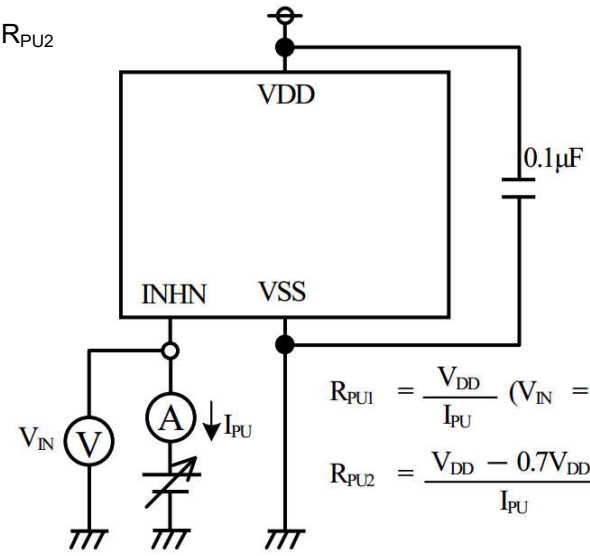
Measurement circuit 5

Measurement Parameter. I_{ZL}, I_{ZH}



Measurement circuit 6

Measurement Parameter. R_{PU1}, R_{PU2}



$$R_{PU1} = \frac{V_{DD}}{I_{PU}} \quad (V_{IN} = 0V)$$

$$R_{PU2} = \frac{V_{DD} - 0.7V_{DD}}{I_{PU}} \quad (V_{IN} = 0.7V_{DD})$$

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DESIGN VALUES

The following design values are monitored by measuring test pattern on wafer, (not tested on each device).

Parameter	Symbol	Device Version	MIN	TYP	MAX	Unit
Oscillator Capacitance: values exclude parasitic capacitance.	C_G	VC5035ALA	3.2	4.0	4.8	pF
	C_D		3.2	4.0	4.8	
	C_G	VC5035ALB	3.2	4.0	4.8	
	C_D		3.2	4.0	4.8	
	C_G	VC5035ALC	1.6	2.0	2.4	
	C_D		1.6	2.0	2.4	
	C_G	VC5035ALD	0.8	1.0	1.2	
	C_D		0.8	1.0	1.2	

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