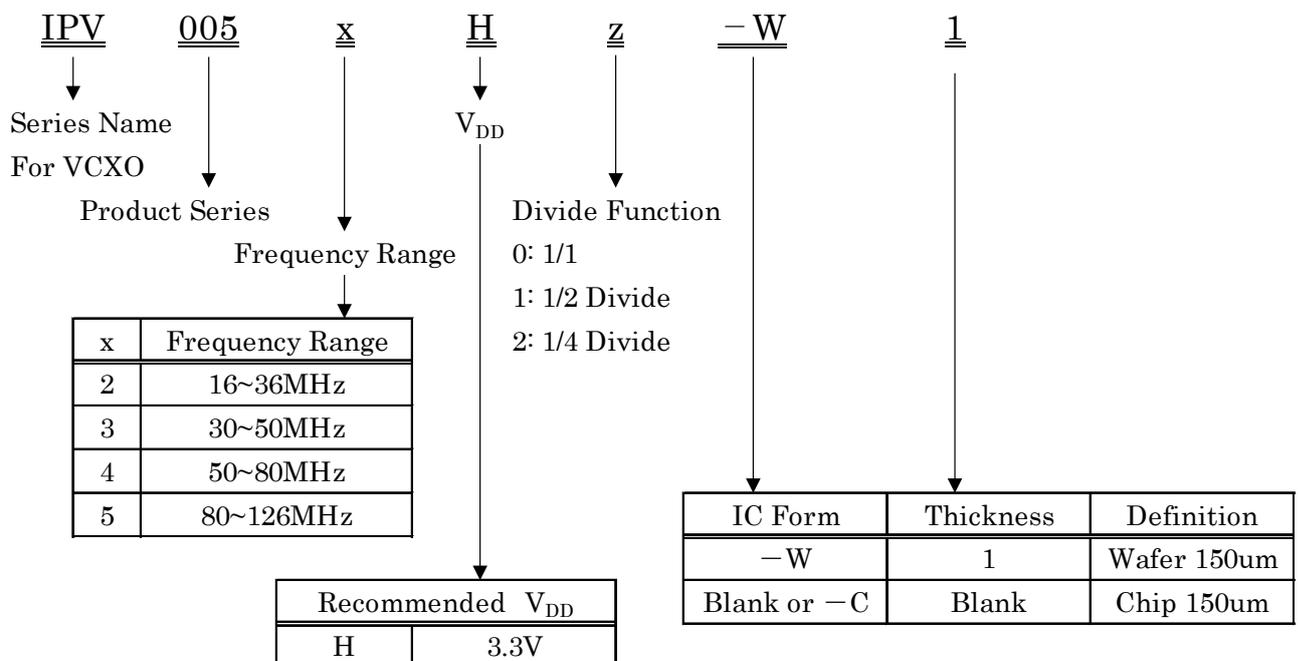


■ Description

IPV005xH Series IC is a single chip VCXO IC with built-in Variable Capacitor. This product has the features of the wide pulling range, the low power consumption and a stable output against voltage fluctuation by the built-in the original voltage variable capacitor and high precision constant voltage circuit. Also the small chip size of this product enables a smaller VCXO having output frequency from 7.5MHz to 126MHz.

■ Features

- Operation temperature : -40°C~125°C (Except IPV0055)
- Power supply voltage : 2.97V~3.63V
- Vc Input impedance : 5MΩ
- Standby function : Output disable
- Crystal frequency : 16MHz~126MHz
- Low power consumption : 3mA (IPV0052H)
- Output : CMOS
- Divide function : 1/2 and 1/4
- Small chip size : 0.75mm × 1.00mm
- Frequency stability to V_{DD} : Within ±1ppm
- Wide pulling range : ±100ppm minimum / V_c=1.65V±1.35V
- Duty cycle : Within 50%±5%

1. Part number rule


2. Series

Part Number	Crystal Frequency f (MHz)		Divide	Output Frequency F0 (MHz)		Remarks
	Min.	Max.		Min.	Max.	
IPV005 2 H 0	16.00	36.00	1/1	16.00	36.00	
IPV005 2 H 1			1/2	8.00	18.00	
IPV005 3 H 0	30.00	50.00	1/1	30.00	50.00	
IPV005 3 H 2			1/4	7.50	12.50	
IPV005 4 H 0	50.00	80.00	1/1	50.00	80.00	
IPV005 5 H 0	80.00	126.00	1/1	80.00	126.00	

3. Absolute Maximum Ratings

 $V_{SS}=0V, T_a=25^{\circ}C \pm 2^{\circ}C$

Parameter	Symbol	Condition	Ratings		
			Min	Max	Unit
Supply Voltage	V_{DD}		$V_{SS}-0.5$	7.0	V
Input Voltage	V_{IN}	All Input Pin	$V_{SS}-0.5$	$V_{DD}+0.5$	V
Output Voltage	V_{OUT}		$V_{SS}-0.5$	$V_{DD}+0.5$	V
Output Current	I_{OUT}			30	mA
Junction Temperature	T_j		-55	150	$^{\circ}C$
Storage Temperature	T_{stg}		-55	125	$^{\circ}C$

4. Recommended Operating Condition

 $V_{SS}=0V, T_a=-40^{\circ}C \sim 125^{\circ}C$ (85 $^{\circ}C$ with IPV0055)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage	V_{DD}		2.97	3.30	3.63	V	V_{DD}
“H” Input Voltage	V_{IH}		$V_{DD} \times 0.7$			V	OE
“L” Input Voltage	V_{IL}				$V_{DD} \times 0.3$	V	OE
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V	OE
Control Voltage	V_C		0		$V_{DD} + 1.0$	V	VC
Output Load Capacitance	IPV0052H	CMOS		15	30	pF	OUT
	Others				15		
Ambient Temperature 1	T_{opt}	Except IPV0055	-40		125	$^{\circ}C$	
Ambient Temperature 2	T_{opt}	IPV0055	-40		85	$^{\circ}C$	

This IC has enough immunity against ESD and Latch-up, but handle with care.

5. Electrical Specification
 5-1 IPV0052Hz, 53Hz, 54H0

 Unless otherwise stated, $V_{DD}=2.97V\sim 3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim 125^{\circ}C$

Parameter	Symbol	Condition	Specification			Unit		
			Min	Typ	Max			
“H” input current	I_{IH}	$V_{IN}=V_{DD}$			1.0	μA		
“L” input current	I_{IL}	$V_{IN}=V_{SS}$		1.3	10	μA		
“H” output voltage	V_{OH}	$I_{OH}=-5mA, -40^{\circ}C\sim 85^{\circ}C$ $I_{OH}=-3mA, 85^{\circ}C\sim 125^{\circ}C$	V_{DD} -0.4			V		
“L” output voltage	V_{OL}	$I_{OL}=5mA, -40^{\circ}C\sim 85^{\circ}C$ $I_{OL}=3mA, 85^{\circ}C\sim 125^{\circ}C$			0.4	V		
Current consumption	I_{DD}	$CL=15pF, V_{DD}=3.63V$ $OE\geq V_{DD}-0.3V, f=27MHz$		3.0	5.0	mA		
Current consumption at output disable	I_{DDD}	$CL=15pF, V_{DD}=3.63V$ $OE=GND, f=27MHz$		1.0	2.0	mA		
Output off leak at output disable	I_o	$OE\leq 0.3V$			10	μA		
Output Duty Ratio	Duty	$CL=15pF$ $f=27MHz$ $V_c=1/2V_{DD}$	$-40^{\circ}C\sim 85^{\circ}C$	45	55	%		
			$85^{\circ}C\sim 125^{\circ}C$	43	57			
Pull Range	Fentr	$V_c=+1.65\pm 1.35V, 27MHz$ Crystal *1	± 110			ppm		
Rise time	Tr	$V_{DD}=3.3V, CL=15pF, 10\sim 90\% V_{DD}$	$-40^{\circ}C\sim 85^{\circ}C$		3.0	4.5	ns	
				$85^{\circ}C\sim 125^{\circ}C$				6.0
			$-40^{\circ}C\sim 85^{\circ}C$	IPV0053Hz		2.5		3.5
					$85^{\circ}C\sim 125^{\circ}C$			
			$-40^{\circ}C\sim 85^{\circ}C$	IPV0054H0		2.0		3.0
					$85^{\circ}C\sim 125^{\circ}C$			
Fall time	Tf	$V_{DD}=3.3V, CL=15pF, 90\sim 10\% V_{DD}$	$-40^{\circ}C\sim 85^{\circ}C$		3.0	4.5	ns	
				$85^{\circ}C\sim 125^{\circ}C$				6.0
			$-40^{\circ}C\sim 85^{\circ}C$	IPV0053Hz		2.5		3.5
					$85^{\circ}C\sim 125^{\circ}C$			
			$-40^{\circ}C\sim 85^{\circ}C$	IPV0054H0		2.0		3.0
					$85^{\circ}C\sim 125^{\circ}C$			
Output Enable Time	Tpe				100	ns		
Output Disable Time	Tpd				100	ns		
Modulation Band Width	Fc	$V_c=1.35\sin\omega t+1.65V$	15	20		kHz		

 Crystal *1 ; Equivalent Parameter of Crystal is $\gamma=C0/C1<300$

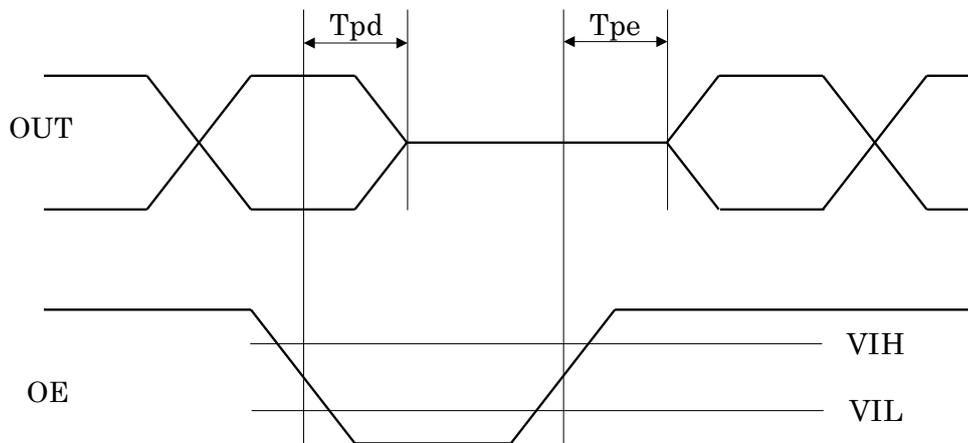
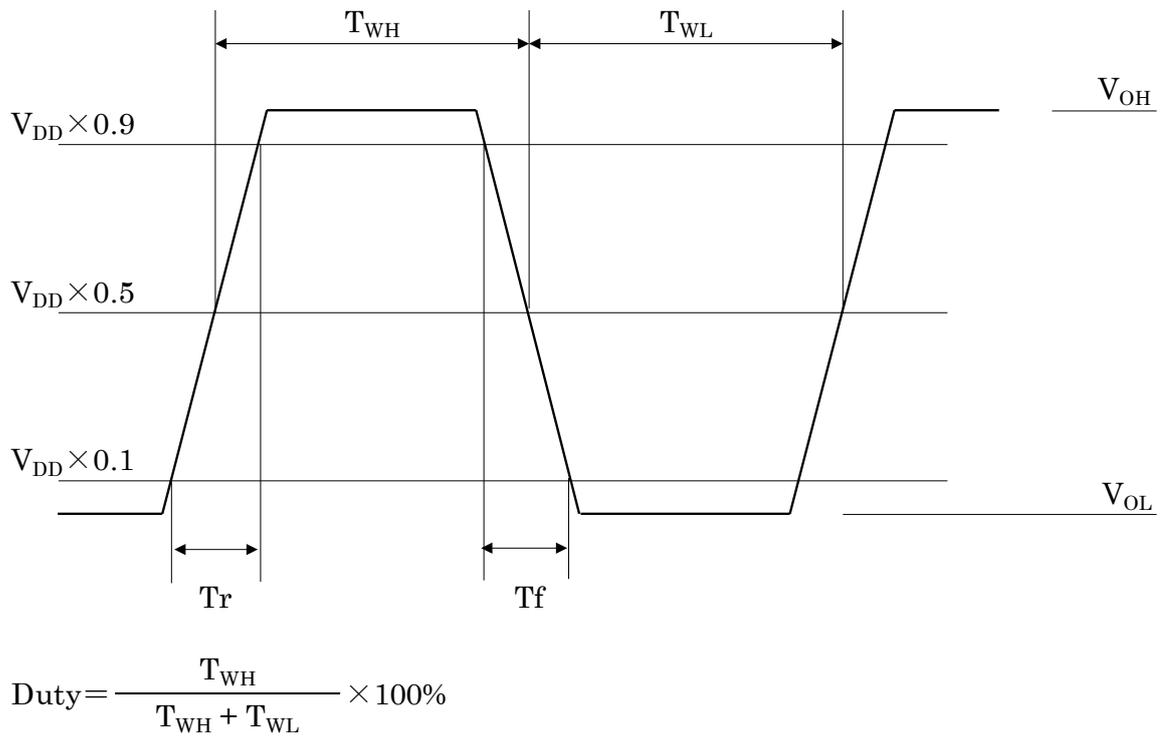
5-2 IPV0055H0

 Unless otherwise stated, $V_{DD}=2.97V\sim 3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim 85^{\circ}C$

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
“H” input current	I_{IH}	$V_{IN}=V_{DD}$			1.0	μA
“L” input current	I_{IL}	$V_{IN}=V_{SS}$			100	μA
“H” output voltage	V_{OH}	$I_{OH}=-5mA$	$V_{DD}-0.4$			V
“L” output voltage	V_{OL}	$I_{OL}=5mA$			0.4	V
Current consumption	I_{DD}	$CL=15pF$, $V_{DD}=3.63V$ $OE\geq V_{DD}-0.3V$, $f=126MHz$		16.0	20.0	mA
Current consumption at output disable	I_{DDD}	$CL=15pF$, $V_{DD}=3.63V$ $OE=GND$, $f=126MHz$		8.6	10.0	mA
Output off leak at output disable	I_o	$OE\leq 0.3V$			10	μA
Output Duty Ratio	Duty	$CL=15pF$ $V_c=1/2V_{DD}$	$f=80MHz$	45	55	%
			$f=100MHz$	45	55	%
			$f=126MHz$	40	60	%
Pull Range	F_{cntr}	$V_c=1.65\pm 1.65V$ Crystal ^{*1}	$f=80MHz$	± 110		ppm
			$f=100MHz$	± 100		ppm
			$f=126MHz$	± 90		ppm
Rise time	T_r	$CL=15pF$, $10\sim 90\% V_{DD}$		1.5	1.9	ns
Fall time	T_f	$CL=15pF$, $90\sim 10\% V_{DD}$		1.4	1.9	ns
Output Enable Time	T_{pe}				100	ns
Output Disable Time	T_{pd}				100	ns
Modulation Band Width	F_c	$V_c=1.35\sin\omega t+1.65V$	15			kHz

 Crystal ^{*1} ; Equivalent Parameter of Crystal is $\gamma=C0/C1<300$
Phase Noise
 $F_0=122MHz$, $V_c=1.65V$, Room Temperature

Offset	IPV0055H0
10Hz	-69 dBc/Hz
100Hz	-101 dBc/Hz
1kHz	-126 dBc/Hz
10kHz	-140 dBc/Hz
100kHz	-154 dBc/Hz
1MHz	-160 dBc/Hz
10MHz	-162 dBc/Hz
Phase Jitter 12kHz~20MHz	



V_{IH} : Threshold voltage for Output Start
 V_{IL} : Threshold voltage for Output Stop

Fig. 5-1 Output Wave Form (Duty, T_r , T_f , T_{pd} , T_{pe})

6. Circuit Parameters of Oscillator (Reference Data for Circuit Design)
 $V_{DD}=3.3V, V_{SS}=0V, T_a=25^{\circ}C, V_c=V_{SS}\sim V_{DD}$

Parameter		Symbol	Condition	Min	Typ	Max	Unit	
Feedback Resistor		Rf		80	100	120	k Ω	
Driving Resistor	IPV0052Hz	Rd	Refer to Fig. 6-1	0.95	1.20	1.45	k Ω	
	IPV0053Hz			0.50	0.60	0.70		
	IPV0054H0			0.08	0.10	0.12		
	IPV0055H0			0.40	0.50	0.60		
Bias Resistor		Rv1			200	240	280	k Ω
		Rv2			96	120	145	k Ω
Input Resistor		Rvc				20		k Ω
VC Input impedance		Zvc		VC terminal to GND	5			M Ω
Equivalent series (Loading) Capacitance	IPV0052Hz f=27MHz	CLxtal		Vc=0V		10.7		pF
				Vc=1.65V, 1.4V		6.0		
			Vc=3.3V, 3.0V		3.7			
	IPV0053Hz f=47MHz		Vc=0V		10.7			
			Vc=1.65V, 1.4V		6.0			
			Vc=3.3V, 3.0V		3.7			
	IPV0054H0 f=60MHz		Vc=0V		7.5			
			Vc=1.65V		3.0			
			Vc=3.3V		2.3			
	IPV0055H0 f=120MHz		Vc=0V		4.5			
			Vc=1.65V		2.2			
			Vc=3.3V		1.5			
Drive Level	IPV0055H0	DL	Vc=0V		410		μ W	
			Vc=1.65V		390			
			Vc=3.3V		320			
Frequency deviation by IC		$\Delta f_c/f_c$	Crystal fixed			25	ppm	
DC cut Capacitor	All series except below.	Cpg		13	16	19	pF	
		Cpd		40	50	60		
	IPV0055H0	Cpg		10	12	14		
		Cpd		38	48	58		

*The above values are the design values and are not guaranteed by test.

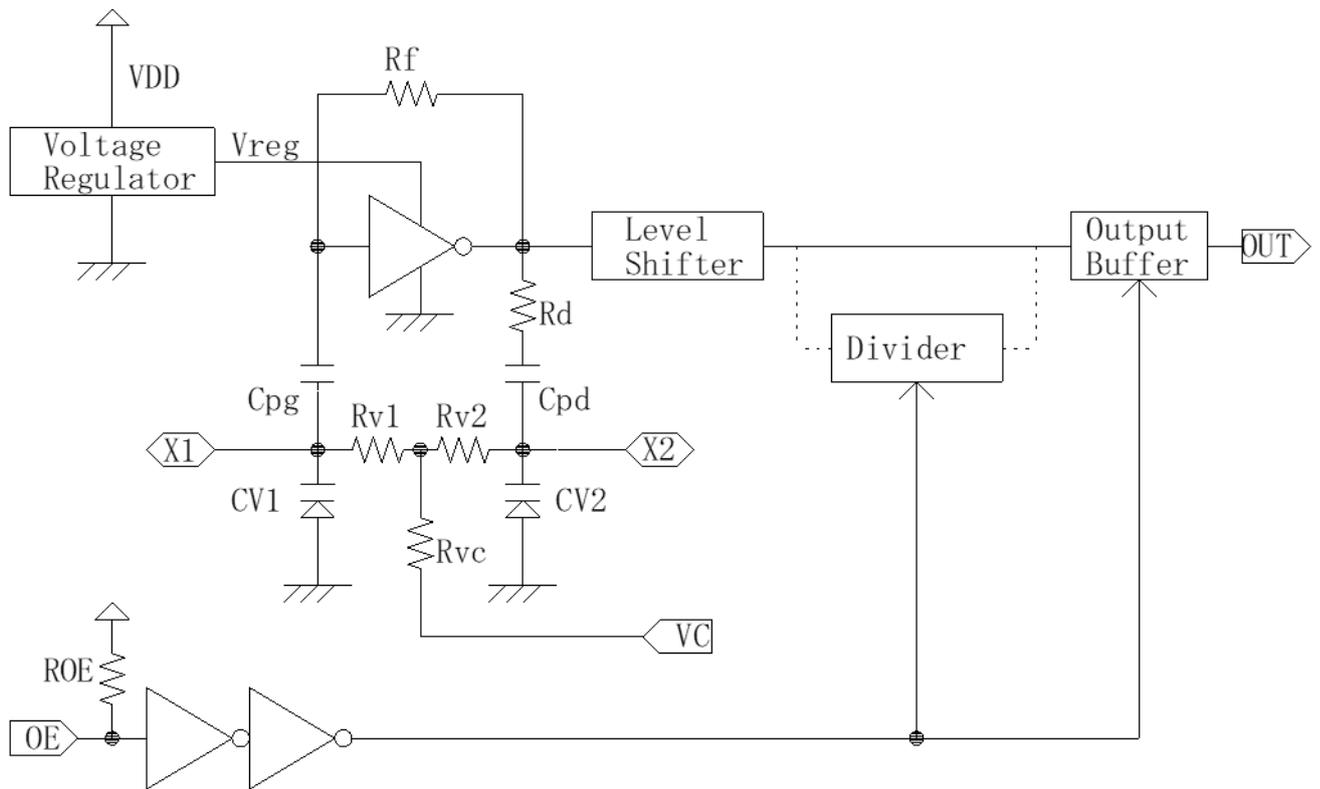
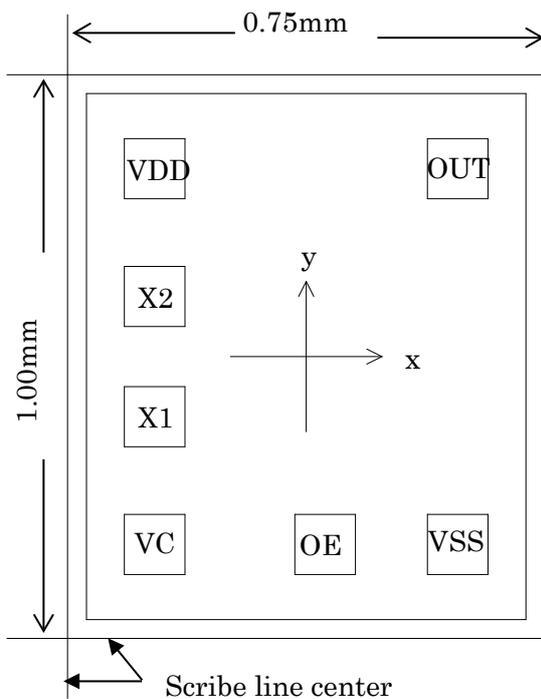


Fig. 6-1 Block Diagram

7. Pad Layout



- Die Size: 0.75mm × 1.00mm
- Pad Size: 80μm □
- Thickness: 150μm±20μm
- IC Backside: Gnd or Open

Pad Name	Function	Location (μm)	
		x	y
VC	Frequency Control Input	-244	-359
OE	Output Enable, "L": High-Impedance *1)	44	-359
VSS	(-) Ground	244	-359
OUT(Q)	Frequency Output	179	359
VDD	(+) Power Supply	-244	359
X2	Crystal Drive	-244	132
X1	Crystal Feedback	-244	-132
Chip Center		0	0

*1) : 2.5MΩ Typ.

8. Revision History

Revision No.	Revision Date	Revised items	Before Revision	After Revision
VC-1.3	2025/11/04	Header / Series Name	IPV005xH	IPV005*H
		Fig. 6-1 Block Diagram	CE	OE
		I _{DDD} Condition	OE ≤ 0.3V	OE=GND