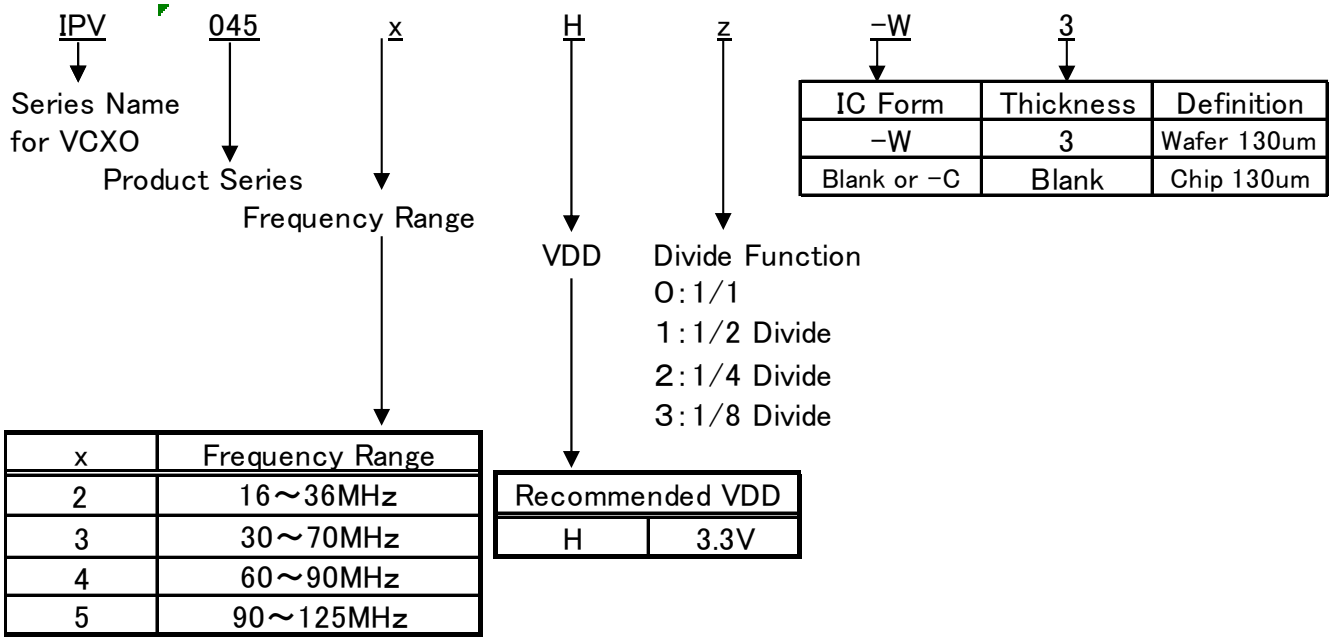
■ Description

IPV045 Series IC is a single chip VCXO IC which can replace IPV005xH series. The performance of IPV045 series is same or better than IPV005xH series and wafer manufacturing site is different from IPV005xH, so IPV045 series ensures business continuity of IPV005xH series.

■ Features

- Operation temperature : 105℃
- Power supply voltage : 3.3V
- Vc Input impedance : 5MΩ
- Standby function : Oscillation stop
- Crystal frequency : 16～125MHz
- Output : CMOS
- Divide function : 1/2, 1/4 and 1/8
- Small chip size : 0.63mm × 0.75mm
- Pull ability : ±100ppm minimum / Vc=1.65±1.65V
- Duty cycle : Within 50±5%

1. Part number rule



IC Form	Thickness	Definition
-W	3	Wafer 130um
Blank or -C	Blank	Chip 130um

x	Frequency Range
2	16～36MHz
3	30～70MHz
4	60～90MHz
5	90～125MHz

Recommended VDD	
H	3.3V

2. Series

Part Number	Output Frequency (MHz)		Divide	Remarks
	Min.	Max.		
IPV045 2 H 0	16.00	36.00	1/1	3.3V Operation
IPV045 2 H 1	8.00	18.00	1/2	
IPV045 2 H 2	4.00	9.00	1/4	
IPV045 2 H 3	2.00	4.50	1/8	
IPV045 3 H 0	30.00	70.00	1/1	
IPV045 4 H 0	60.00	90.00	1/1	
IPV045 5 H 0	90.00	125.00	1/1	

3. Absolute Maximum Ratings VSS=0V、 Ta=+ 25℃± 2℃

Parameter	Symbol	Condition	Ratings		
			Min	Max	Unit
Supply Voltage	V_{DD}		V_{SS}-0.5	5	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}			25	mA
Junction Temperature	Tj		-55	150	℃
Storage Temperature	T_{stg}		-55	125	℃

4. Recommended Operating Condition VSS=0V、 Ta=－40℃~+105℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Voltage	V_{DD}		2.97	3.3	3.63	V	V_{DD}
“H” Input Voltage	V_{IH}		$V_{DD}\times0.7$			V	CE
“L” Input Voltage	V_{IL}				$V_{DD}\times0.3$	V	CE
Input Voltage	V_{IN}		V_{SS}		V_{DD}	V	CE
Control Voltage	V_C		0		V_{DD}	V	VC
Output Load Capacitance	CL	CMOS			15	pF	OUT
Ambient Temperature	T_{opT}		-40		105	℃	

5. Electrical Specification

Unless otherwise stated, V_{DD} =2.97~3.63V, Vss=0V, Ta=-40~105℃

IPV0452H0

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1	μA
"H" output voltage	V_{OH}	I_{OH}=-5mA	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=5mA			Vss+0.4	V
Current consumption	I_{DD}	CL=15pF, VDD=3.63V, CE≧VDD-0.3V, F0=27MHz			6	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, VDD=3.63V, CE≦0.3V			10	μA
Output off leak at osc. stop	Iz	CE≦0.3V			10	μA
Output Duty Ratio	Duty	CL=15pF, Vc=1/2V_{DD}	45		55	%
Pull Range	Fcntr	Vc=+1.65±1.65V 27MHz, Crystal *1	±100	±150		ppm
Rise time	Tr	CL=15pF, 10～90% VDD			5.0	ns
Fall time	Tf	CL=15pF, 10～90% VDD			5.0	ns
Output Enable Time	Tpe				2	ms
Output Disable Time	Tpd				100	ns
Oscillation start up Time	Tstart				2	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		KHz

Crystal *1 ; Equivalent Parameter of Crystal is γ =C0/C1<300

Phase Noise : Frequency =27MHz, VDD = 3.3V, VC=1.65V

Phase Jitter【12kHz～5MHz】< 0.5ps

Offset	Phase Noise (dBc)
1KHZ	-137
10KHz	-154
100KHz	-158

Unless otherwise stated, V_{DD} =2.97~3.63V, Vss=0V, Ta=-40~105℃

IPV0452Hx【x=1, 2, 3】

Parameter		Symbol	Condition	Specification			Unit
				Min	Typ	Max	
"H" input current		I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current		I_{IL}	$V_{IN}=V_{SS}$			1	μA
"H" output voltage		V_{OH}	I_{OH}=-5mA	V_{DD}-0.4			V
"L" output voltage		V_{OL}	I_{OL}=5mA			Vss+0.4	V
Current consump.	IPV0452H1	I_{DD}	CL=15pF, VDD=3.63V, CE≧VDD-0.3V, Crystal f=27MHz			5	mA
	IPV0452H2					4	
	IPV0452H3					3.5	
Current consumption at oscillation stop		I_{DDD}	CL=15pF, VDD=3.63V, CE≦0.3V			10	μA
Output off leak at osc. stop		Iz	CE≦0.3V			10	μA
Output Duty Ratio		Duty	CL=15pF, Vc=1/2V_{DD}	45		55	%
Pull Range		Fcntr	Vc=+1.65±1.65V 27MHz, Crystal *1	±100	±150		ppm
Rise time		Tr	CL=15pF, 10～90% VDD			5.0	ns
Fall time		Tf	CL=15pF, 90～10% VDD			5.0	ns
Output Enable Time		Tpe				2	ms
Output Disable Time		Tpd				100	ns
Oscillation start up Time		Tstart				2	ms
Modulation Band Width		Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		KHz

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1<300

Phase Noise : IPV0452H1, Crystal Frequency =27MHz〔Output=13.5MHz〕, VDD = 3.3V, VC=1.65V

Phase Jitter【12kHz～5MHz】< 0.8ps

Offset	Phase Noise (dBc)
1kHz	-135
10kHz	-145
100kHz	-150

Unless otherwise stated, V_{DD} =2.97~3.63V, Vss=0V, Ta=-40~105℃

IPV0453H0

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1	μA
"H" output voltage	V_{OH}	I_{OH}＝-5mA	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=5mA			Vss+0.4	V
Current consumption	I_{DD}	CL=15pF, VDD=3.63V, CE≧VDD-0.3V, F0=52MHz			10	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, VDD=3.63V, CE≦0.3V			10	μA
Output off leak at osc. stop	Iz	CE≦0.3V			10	μA
Output Duty Ratio	Duty	CL=15pF, Vc=1/2V_{DD}	45		55	%
Pull Range	Fcntr	Vc=+1.65±1.65V 52MHz, Crystal *1	±130	±180		ppm
Rise time	Tr	CL=15pF, 10～90% VDD			5.0	ns
Fall time	Tf	CL=15pF, 90～10% VDD			5.0	ns
Output Enable Time	Tpe				2	ms
Output Disable Time	Tpd				100	ns
Oscillation start up Time	Tstart				2	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		KHz

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1≒270

Phase Noise : Frequency =52MHz, V_{DD} = 3.3V, VC=1.65V

Phase Jitter【12kHz～20MHz】< 0.3ps

Offset	Phase Noise (dBc)
1kHz	-130
10kHz	-150
100kHz	-160

Unless otherwise stated, V_{DD} =2.97~3.63V, Vss=0V, Ta=-40~105℃

IPV0454H0

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1	μA
"H" output voltage	V_{OH}	I_{OH}=-5mA	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=5mA			Vss+0.4	V
Current consumption	I_{DD}	CL=15pF, VDD=3.63V, CE≧VDD-0.3V, F0=77MHz			16	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, VDD=3.63V, CE≦0.3V			10	μA
Output off leak at osc. stop	Iz	CE≦0.3V			10	μA
Output Duty Ratio	Duty	CL=15pF, Vc=1/2V_{DD}	45		55	%
Pull Range	Fcntr	Vc=+1.65±1.65V 77MHz, Crystal *1	±120	±170		ppm
Rise time	Tr	CL=15pF, 10～90% VDD			5.0	ns
Fall time	Tf	CL=15pF, 90～10% VDD			5.0	ns
Output Enable Time	Tpe				2	ms
Output Disable Time	Tpd				100	ns
Oscillation start up Time	Tstart				2	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		KHz

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1≒350

Phase Noise : Frequency =77MHz, V_{DD} = 3.3V, VC=1.65V

Phase Jitter【12kHz～20MHz】< 0.2ps

Offset	Phase Noise (dBc)
1kHz	-126
10kHz	-147
100kHz	-159

Unless otherwise stated, V_{DD} =2.97~3.63V, Vss=0V, Ta=-40~105℃

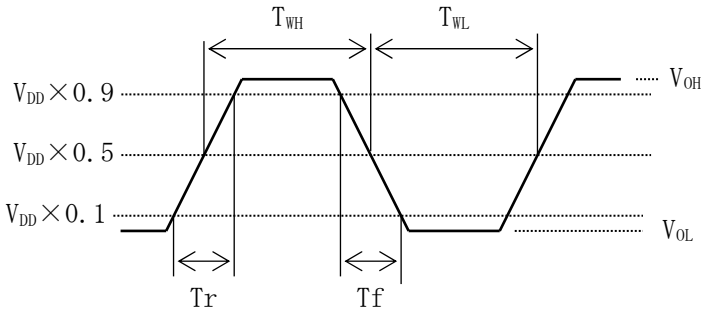
IPV0455H0

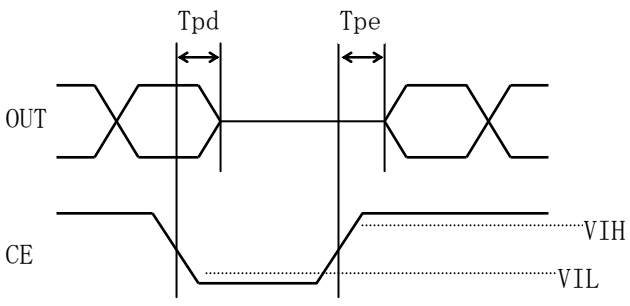
Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1	μA
"H" output voltage	V_{OH}	I_{OH}=-5mA	V_{DD}-0.4			V
"L" output voltage	V_{OL}	I_{OL}=5mA			Vss+0.4	V
Current consumption	I_{DD}	CL=15pF, VDD=3.63V, CE≧VDD-0.3V, F0=100MHz			24	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, VDD=3.63V, CE≦0.3V			10	μA
Output off leak at osc. stop	Iz	CE≦0.3V			10	μA
Output Duty Ratio	Duty	CL=15pF, Vc=1/2V_{DD}	45		55	%
Pull Range	Fcntr	Vc=+1.65±1.65V 100MHz, Crystal *1	±80	±120		ppm
Rise time	Tr	CL=15pF, 10～90% VDD			3.0	ns
Fall time	Tf	CL=15pF, 90～10% VDD			3.0	ns
Output Enable Time	Tpe				2	ms
Output Disable Time	Tpd				100	ns
Oscillation start up Time	Tstart				2	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		KHz

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1≒320

Phase Noise : Frequency =100MHz, V_{DD} = 3.3V, VC=1.65V / Phase Jitter【12kHz～20MHz】< 0.12ps

Offset	Phase Noise (dBc)
1kHz	-123
10kHz	-145
100kHz	-159





$$Duty=\frac{T_{WH}}{T_{WH}+T_{WL}}\times 100\%$$

VIH : Threshold voltage for Oscillation Start
VIL : Threshold voltage for Oscillation Stop

Fig. 5-1 Output Wave Form (Duty, Tr, Tf, Tpd, Tpe)

6. Circuit Parameters of Oscillator (Reference Data for Circuit Design)

Circuit Parameters of Oscillator (Reference Data for Circuit Design)

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Bias Resistor		R_{V1}			240		KΩ
		R_{V2}			120		KΩ
Input Resistor		R_{VC1}	IPV0452, 3, 4H0		40		KΩ
			IPV0455H0		80		
Feedback Resistor		Rf	IPV0452H0		180		KΩ
			IPV0453, 4, 5H0		120		
Driving Resistor		Rd	IPV0452Hx		1200		Ω
			IPV0453H0		500		
			IPV0454H0		300		
			IPV0455H0		150		
VC Input impedance		Rvc	VC terminal to GND	5			MΩ
DC cut Capacitor		Cpg			15		pF
		Cpd			37.5		
Equivalent series (Loading) Capacitance of IPV0452H		CLxtal	Vc=0V		8.9		pF
			Vc=1.65V		5.5		
			Vc=3.3V		3.5		
Drive Level	IPV0452H	DL	Vc=1.65V		50		μW
	IPV0453H		Vc=1.65V		100		
Frequency deviation by IC		⊿fc/fc	Crystal fixed			25	ppm

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

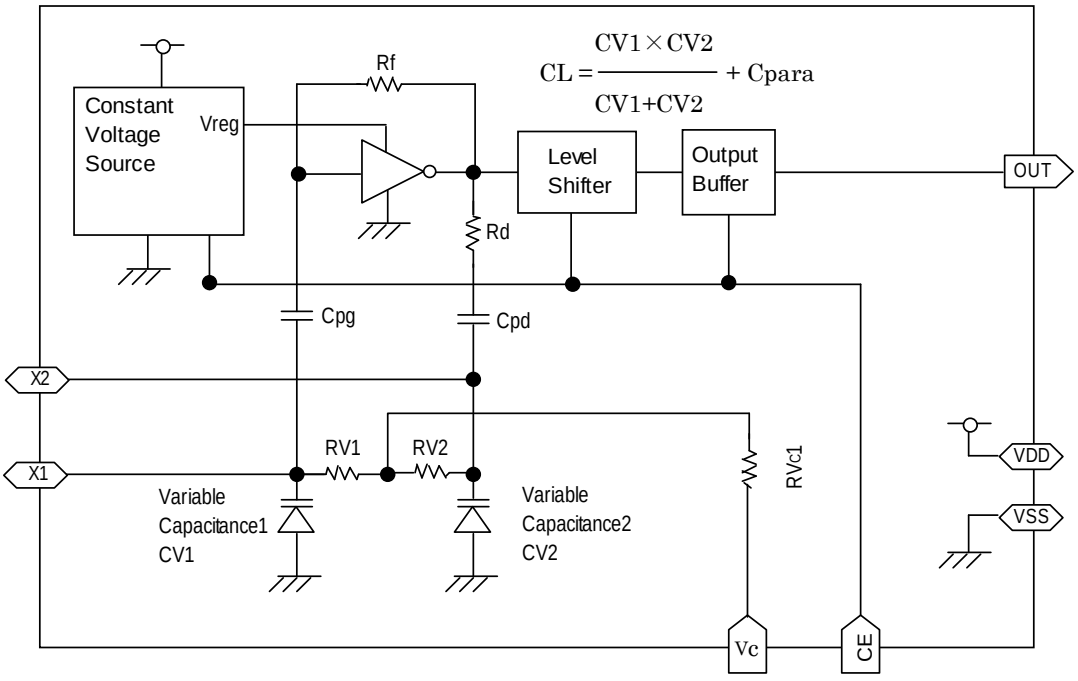
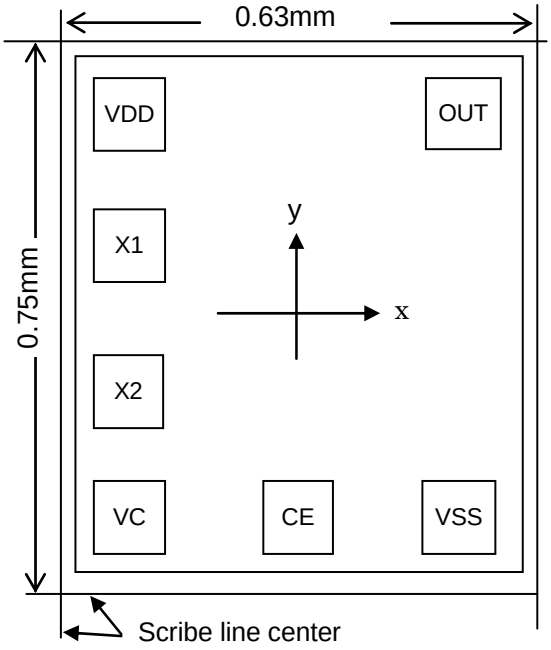


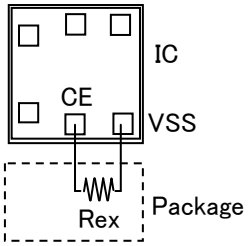
Fig. 6-1 Block Diagram

7. Pad Layout



- Die Size : 0.75mm × 0.63mm
- Pad Size : 80um □
- Thickness : 130±10um
- IC Backside : Gnd or Open

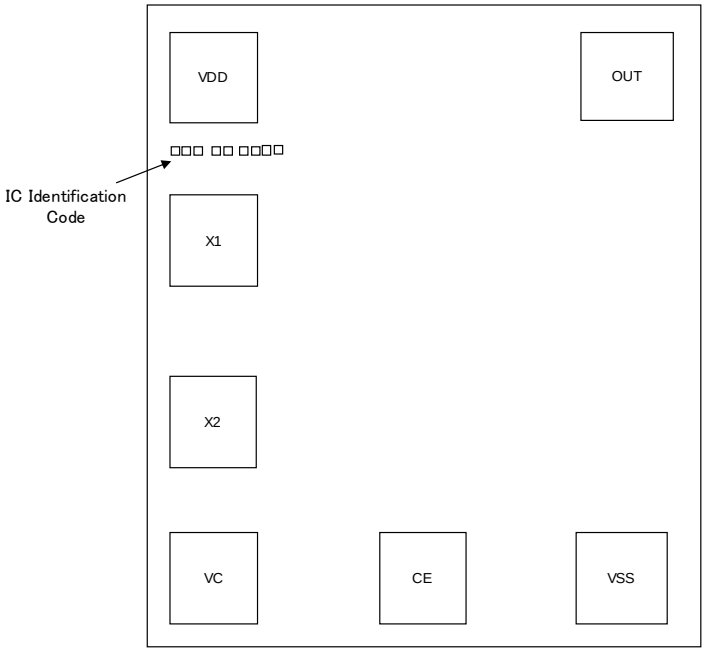
Pad Name	Function	Location (μm)	
		x	y
VDD	(+)Power Supply	−196	256
X1	Crystal Feedback	−196	83
X2	Crystal Drive	−196	−83
VC	Frequency Control Input	−196	−256
CE	Oscillation stop	28	−256
VSS	(−)Ground	196	−256
OUT	Frequency Output	196	256
Chip Center		0	0



IMPORTANT Notice for CE function

* Rex should be over 10MΩ in case of CE = Open usage.
* Oscillation will not be activated when CE = Open after CE = Low if Rex is below 10MΩ.
* There is no such issue in case of CE = VDD usage.
  Rex : External resistance value between CE and VSS of package.

8. IC Part # Identification



Definition of the Code Status

Part #	Fuse
IPV0452H0	□■□ □□ □□□□
IPV0452H1	□■□ □■ □□□□
IPV0452H2	□■□ ■□ □□□□
IPV0452H3	□■□ ■■ □□□□
IPV0453H0	□■■ □□ □□□□
IPV0454H0	■□□ □□ □□□□
IPV0455H0	■□■ □□ □□□□
IPV0456H0	■■□ □□ □□□□

■ Looks Black □ Looks White