■ Description

IPV045*HA Series IC is a single chip VCXO IC with can replace IPV005*H series.

The performance of IPV045*HA series is same or better than IPV005*H series and wafer manufacturing site is different from IPV005*H, so IPV045*HA series ensures business continuity of IPV005*H series.

■ Features

- Operation temperature : -40℃~125℃ 【IPV0455H0A(F) : -40℃~105℃】
- Power supply voltage : 2.97V~3.63V
- Vc Input impedance : 5MΩ
- Standby function : Oscillation stop (Straight pad type)
- Crystal frequency : 20MHz~125MHz
- Output : CMOS
- Divide function : 1/2, 1/4 and 1/8
- Small chip size : 0.63mm × 0.75mm
- Frequency stability to V_{DD} : Within ±1ppm
- Wide pulling range : ±100ppm minimum / Vc=1.65V±1.35V
- Duty cycle : Within 50%±5%

1. Part number rule

IPV 045 x H z A q －W 3

Series Name For VCXO

Product Series

Frequency Range

x	Frequency Range
2	20~36MHz
3	35~70MHz
4	60~90MHz
5	90~125MHz

V_{DD}

Recommended V_{DD}	
H	3.3V

Divide Function
0: 1/1
1: 1/2 Divide
2: 1/4 Divide
3: 1/8 Divide

Optional code

Code	Definition
A	Lower Phase Noise version

Pad Layout
Blank : Straight
F : Flip

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

※Please contact us for wafer thickness.

2. Series

Part Number	Crystal Frequency f (MHz)		Divide	Output Frequency F0 (MHz)		Remarks
	Min.	Max.		Min.	Max.	
IPV045 2 H 0 A	20.00	36.00	1/1	20.00	36.00	Pad Layout Straight Type
IPV045 2 H 1 A			1/2	10.00	18.00	
IPV045 2 H 2 A			1/4	5.00	9.00	
IPV045 2 H 3 A			1/8	2.50	4.50	
IPV045 3 H 0 A	35.00	70.00	1/1	35.00	70.00	
IPV045 3 H 1 A			1/2	17.50	35.00	
IPV045 3 H 2 A			1/4	8.75	17.50	
IPV045 3 H 3 A			1/8	4.38	8.75	
IPV045 4 H 0 A	60.00	90.00	1/1	60.00	90.00	
IPV045 5 H 0 A	90.00	125.00	1/1	90.00	125.00	

Part Number	Crystal Frequency f (MHz)		Divide	Output Frequency F0 (MHz)		Remarks
	Min.	Max.		Min.	Max.	
IPV045 2 H 0 A F	20.00	36.00	1/1	20.00	36.00	Pad Layout Flip Type
IPV045 2 H 1 A F			1/2	10.00	18.00	
IPV045 2 H 2 A F			1/4	5.00	9.00	
IPV045 2 H 3 A F			1/8	2.50	4.50	
IPV045 3 H 0 A F	35.00	70.00	1/1	35.00	70.00	
IPV045 3 H 1 A F			1/2	17.50	35.00	
IPV045 3 H 2 A F			1/4	8.75	17.50	
IPV045 3 H 3 A F			1/8	4.38	8.75	
IPV045 4 H 0 A F	60.00	90.00	1/1	60.00	90.00	
IPV045 5 H 0 A F	90.00	125.00	1/1	90.00	125.00	

Please contact us for gray color models.

3. Absolute Maximum Ratings

V_{SS}=0V, Ta=25℃± 2℃

Parameter	Symbol	Condition	Ratings		
			Min	Max	Unit
Supply Voltage	V_{DD}		V_{SS}-0.5	5.0	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}			25	mA
Junction Temperature	Tj		-55	150	℃
Storage Temperature	Tstg		-55	125	℃

4. Recommended Operating Condition

V_{SS}=0V, Ta=-40℃~125℃

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}×0.7			V	CE
“L” Input Voltage	V_{IL}				V_{DD}×0.3	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 1	Topt	Except IPV0455H0A	-40		125	℃	
Ambient Temperature 2	Topt	IPV0455H0A	-40		105		

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

5. Electrical Specification

5-1 IPV0452HzA(F)

Unless otherwise stated, V_{DD}=2.97V~3.63V, V_{SS}=0V, Ta=-40℃~125℃

Parameter	Symbol	Condition		Specification Min	Specification Typ	Specification Max	Unit
"H" input current	I_{IH}	V_{IN}=V_{DD}				10	μA
"L" input current	I_{IL}	V_{IN}=V_{SS}				1.0	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}=3.3V CE≧V_{DD}-0.3V f=30.72MHz	IPV0452H0A			7.0	mA
			IPV0452H1A			5.5	
			IPV0452H2A			4.5	
			IPV0452H3A			4.0	
Current consumption at oscillation stop (※)	I_{DDD}	CL=15pF, V_{DD}=3.63V CE=GND				10	uA
Output off leak at oscillation stop	I_Z	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 30.72MHz Crystal *1		±100	±150		ppm
Rise time	Tr	CL=15pF, 10%~90% V_{DD}				5.0	ns
Fall time	Tf	CL=15pF, 90%~10% V_{DD}				5.0	ns
Output Enable Time	Tpe					2.0	ms
Output Disable Time	Tpd					100	ns
Oscillation start up time	Tstart					2.0	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB		15			kHz

※ : Only Straight Pad Type

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

Phase Noise

F0=30.72MHz, Vc=1.65V, Room Temperature

Offset	IPV0452H0A
1kHz	-138 dBc/Hz
10kHz	-155 dBc/Hz
100kHz	-159 dBc/Hz
1MHz	-159 dBc/Hz
Phase Jitter 12kHz~5MHz	176 fs

5-2 IPV0453HzA(F)

Unless otherwise stated, V_{DD}=2.97V~3.63V, V_{SS}=0V, Ta=-40℃~125℃

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}				1.0	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}=3.3V CE≧V_{DD}-0.3V f=70MHz	IPV0453H0A			17.0	mA
			IPV0453H1A			12.0	
			IPV0453H2A			10.0	
			IPV0453H3A			9.0	
Current consumption at oscillation stop	I_{DDD}	CL=15pF, V_{DD}=3.63V CE=GND				10	uA
Output off leak at oscillation 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 70MHz Crystal *1		±130	±160		ppm
Rise time	Tr	CL=15pF, 10%~90% V_{DD}				5.0	ns
Fall time	Tf	CL=15pF, 90%~10% V_{DD}				5.0	ns
Output Enable Time	Tpe					2.0	ms
Output Disable Time	Tpd					100	ns
Oscillation start up time	Tstart					2.0	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB		15	20		kHz

※ : Only Straight Pad Type

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1≒290

Phase Noise

F0=61.44MHz, Vc=1.65V, Room Temperature

Offset	IPV0453H0A
1kHz	-128 dBc/Hz
10kHz	-151 dBc/Hz
100kHz	-159 dBc/Hz
1MHz	-161 dBc/Hz
Phase Jitter 12kHz~20MHz	144 fs

5-3 IPV0454H0A(F)

Unless otherwise stated, V_{DD}=2.97V~3.63V, V_{SS}=0V, Ta=-40℃~125℃

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1.0	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}=3.3V CE≧V_{DD}-0.3V, f=90MHz			24.0	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, V_{DD}=3.63V CE=GND			10	uA
Output off leak at oscillation 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 90MHz Crystal *1	±120	±160		ppm
Rise time	Tr	CL=15pF, 10%~90% V_{DD}			5.0	ns
Fall time	Tf	CL=15pF, 90%~10% V_{DD}			5.0	ns
Output Enable Time	Tpe				2.0	ms
Output Disable Time	Tpd				100	ns
Oscillation start up time	Tstart				2.0	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		kHz

※ ：Only Straight Pad Type

Crystal *1 ; Equivalent Parameter of Crystal is γ=C0/C1≒315

Phase Noise

F0=61.44MHz, Vc=1.65V, Room Temperature

Offset	IPV0454H0A
1kHz	-128 dBc/Hz
10kHz	-151 dBc/Hz
100kHz	-161 dBc/Hz
1MHz	-162 dBc/Hz
Phase Jitter 12kHz~20MHz	116 fs

5-4 IPV0455H0A(F)

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

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
"H" input current	I_{IH}	$V_{IN}=V_{DD}$			10	μA
"L" input current	I_{IL}	$V_{IN}=V_{SS}$			1.0	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}=3.3V CE≧V_{DD}-0.3V, f=122.88MHz			27.0	mA
Current consumption at oscillation stop	I_{DDD}	CL=15pF, V_{DD}=3.63V CE=GND			10	uA
Output off leak at oscillation 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 122.88MHz Crystal *1	±80	±120		ppm
Rise time	Tr	CL=15pF, 10%~90% V_{DD}			3.0	ns
Fall time	Tf	CL=15pF, 90%~10% V_{DD}			3.0	ns
Output Enable Time	Tpe				2.0	ms
Output Disable Time	Tpd				100	ns
Oscillation start up time	Tstart				2.0	ms
Modulation Band Width	Fc	Vc=1.35sinωt+1.65V, -3dB	15	20		kHz

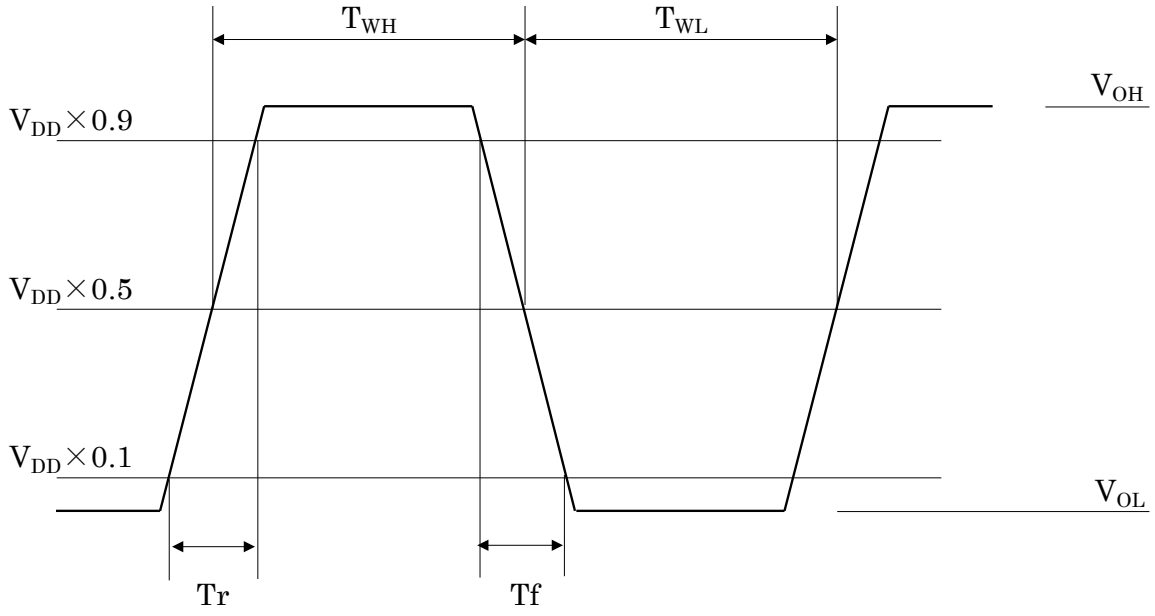
※ : Only Straight Pad Type

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

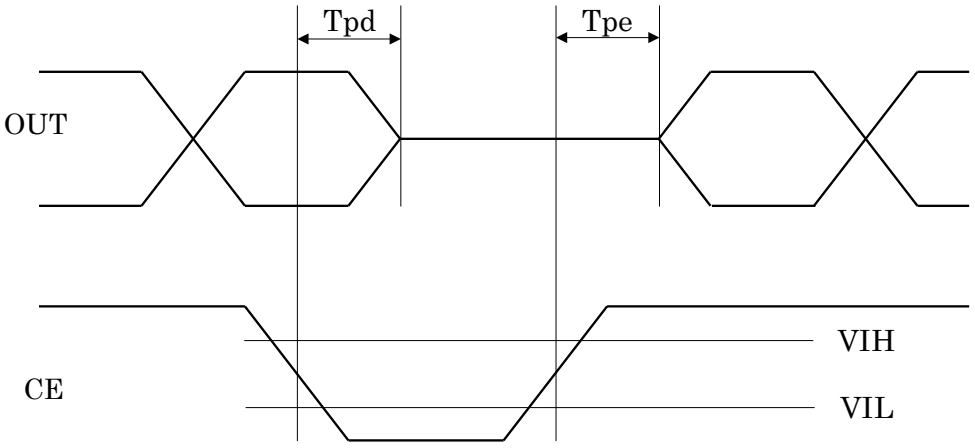
Phase Noise

F0=122.88MHz, Vc=1.65V, Room Temperature

Offset	IPV0455H0A
1kHz	-125 dBc/Hz
10kHz	-147 dBc/Hz
100kHz	-159 dBc/Hz
1MHz	-162 dBc/Hz
Phase Jitter 12kHz~20MHz	58 fs



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



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

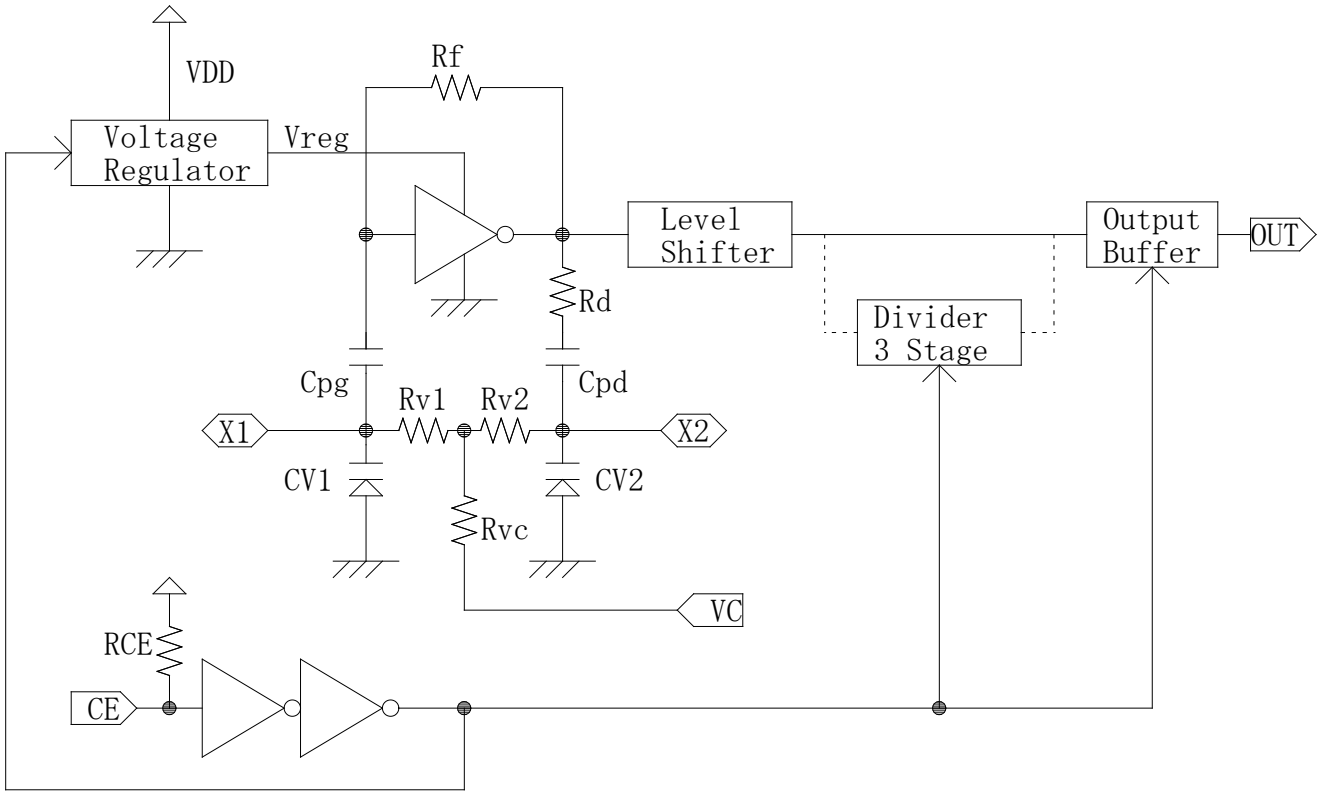
Fig. 5-1 Output Wave Form (Duty, Tr, Tf, Tpd, Tpe)

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

Ta=25℃, Vc= V_{SS}~V_{DD}

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Feedback Resistor	IPV0452H0A(F)	Rf	Refer to Fig. 6-1		180		kΩ
	Others				120		
Driving Resistor	IPV0452HzA(F)	Rd			1200		Ω
	IPV0453HzA(F)				500		
	IPV0454H0A(F)				300		
	IPV0455H0A(F)				100		
Bias Resistor		R_{V1}			240		kΩ
		R_{V2}			120		kΩ
Input Resistor	IPV0455H0A(F)	R_{VC}			80		kΩ
	Others				40		
DC cut Capacitor		Cpg			15.0		pF
		Cpd			37.5		
VC Input impedance		Zvc	VC terminal to GND	5			MΩ

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

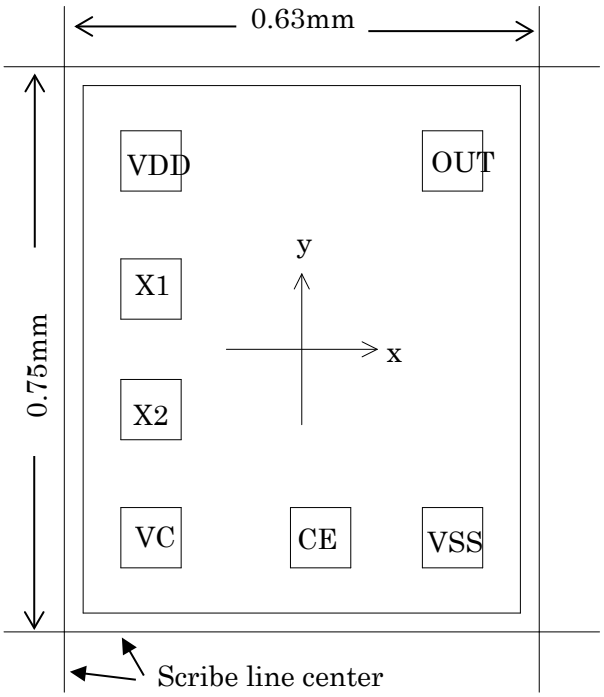


(The Flip type does not have the CE function.)

Fig. 6-1 Block Diagram (Straight type)

7. Pad Layout

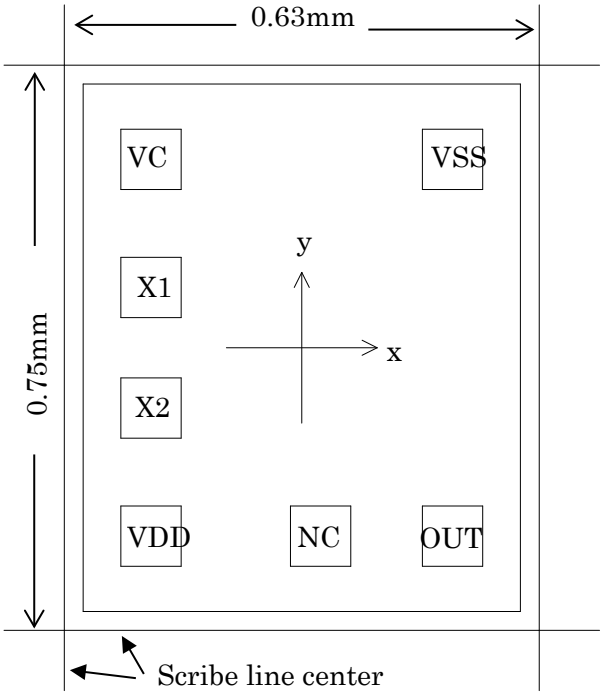
7-1 Straight Type



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

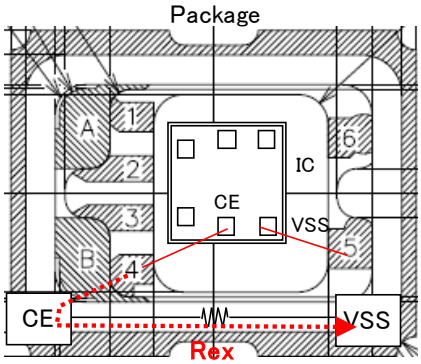
Pad Name	Function	Location (μm)	
		x	y
VDD	(+) Power Supply	-196	256
X1	Crystal Feedback	-196	83
X2	Crystal Drive	-196	-83
VC	Frequency Control Input	-196	-256
CE	Oscillation stop "L": High-Impedance	28	-256
VSS	(−) Ground	196	-256
OUT	Frequency Output	196	256
Chip Center		0	0

7-2 Flip Type



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

Pad Name	Function	Location (μm)	
		x	y
VC	Frequency Control Input	-196	256
X1	Crystal Feedback	-196	83
X2	Crystal Drive	-196	-83
VDD	(+) Power Supply	-196	-256
NC	No connect	28	-256
OUT	Frequency Output	196	-256
VSS	(−) Ground	196	256
Chip Center		0	0



IMPORTANT Notice for CE function

※ Oscillation will not be activated when CE=Open after CE=Low if Rex is not large.

※ Reference value of Rex is over 10MΩ with CE=Open usage.

※ There is no such issue with CE=VDD usage.

Rex： Resistance value between CE and VSS of package

8. IC Part # Identification

LOGO

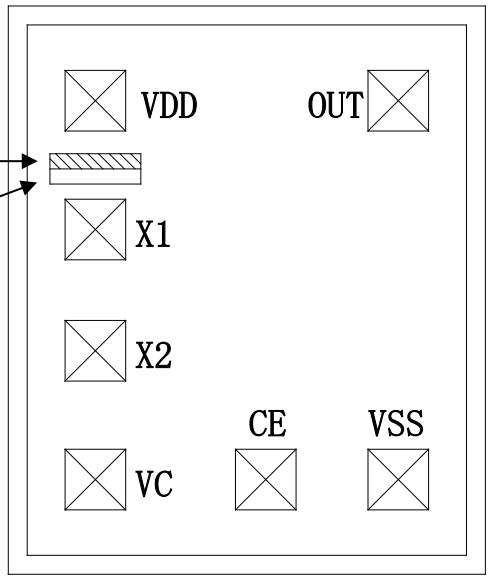
IPV045_H__ (Straight Type)

IPV045_H__F (Flip Type)

IC Identification Code

Fuse □□□ □□ □□□□

Code 1 2 3 4 5 6 7 8 9



Part #	Code 1~9
IPV0452H0Aq	□■□ □□ □□□■
IPV0452H1Aq	□■□ □■ □□□■
IPV0452H2Aq	□■□ ■□ □□□■
IPV0452H3Aq	□■□ ■■ □□□■
IPV0453H0Aq	□■■ □□ □□□■
IPV0453H1Aq	□■■ □■ □□□■
IPV0453H2Aq	□■■ ■□ □□□■
IPV0453H3Aq	□■■ ■■ □□□■
IPV0454H0Aq	■□□ □□ □□□■
IPV0455H0Aq	■□■ □□ □□□■

□ : Fuse no cut

■ : Fuse cut

9. Revision History

Revision No.	Revision Date	Revised items	Before Revision	After Revision
VC-2.3	2025/11/04	Wafer thickness 100um (Flip)	Listed	As requested
		I_{DDD} Condition	CE≦0.3V	CE=GND