

■ Description

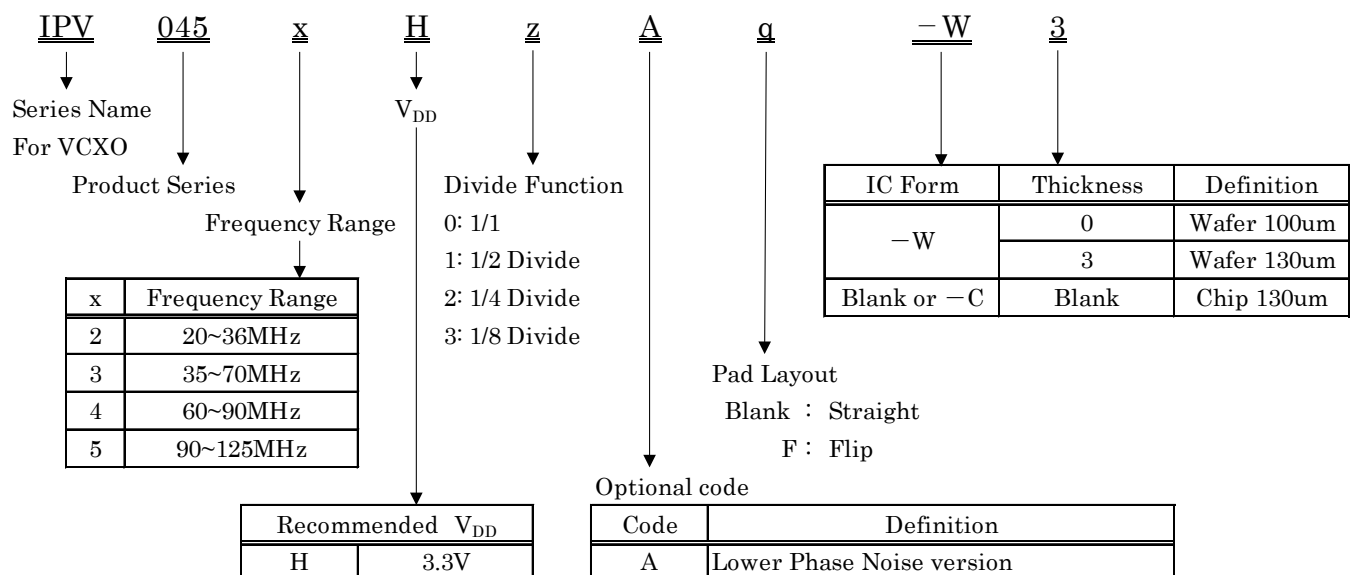
IPV045*HA Series IC is a single chip VCXO IC with can replace IPV005xH series.

The performance of IPV045*HA series is same or better than IPV005xH series and wafer manufacturing site is different from IPV005xH, so IPV045*HA series ensures business continuity of IPV005xH series.

■ Features

- Operation temperature : -40°C~125°C 【IPV0455H0A(F) : -40°C~105°C】
- 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 / V_c=1.65V±1.35V
- Duty cycle : Within 50%±5%

1. Part number rule



※Please contact us about Flip type.

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

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

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	T_j		-55	150	$^{\circ}C$
Storage Temperature	T_{stg}		-55	125	$^{\circ}C$

4. Recommended Operating Condition

 $V_{SS}=0V, T_a=-40^{\circ}C \sim 125^{\circ}C$

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	CE
“L” Input Voltage	V_{IL}				$V_{DD} \times 0.3$	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	T_{opt}	Except IPV0455H0A	-40		125	$^{\circ}C$	
Ambient Temperature 2	T_{opt}	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, $V_{DD}=2.97V\sim 3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim 125^{\circ}C$

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
“H” input current	I_{IH}	$V_{IN}=V_{DD}$			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}	$CL=15pF$ $V_{DD}=3.3V$ $CE\geq V_{DD}-0.3V$ $f=30.72MHz$	IPV0452H0A		7.0	mA
			IPV0452H1A		5.5	
			IPV0452H2A		4.5	
			IPV0452H3A		4.0	
Current consumption at oscillation stop (※)	I_{DDD}	$CL=15pF$, $V_{DD}=3.63V$ $CE\leq 0.3V$			10	μA
Output off leak at oscillation stop	I_z	$CE\leq 0.3V$			10	μA
Output Duty Ratio	Duty	$CL=15pF$, $V_c=1/2V_{DD}$	45		55	%
Pull Range	F_{cntr}	$V_c=+1.65\pm 1.65V$ 30.72MHz Crystal *1	± 100	± 150		ppm
Rise time	T_r	$CL=15pF$, 10%~90% V_{DD}			5.0	ns
Fall time	T_f	$CL=15pF$, 90%~10% V_{DD}			5.0	ns
Output Enable Time	T_{pe}				2.0	ms
Output Disable Time	T_{pd}				100	ns
Oscillation start up time	T_{start}				2.0	ms
Modulation Band Width	F_c	$V_c=1.35\sin\omega t+1.65V$, -3dB	15			kHz

※ : Only Straight Pad Type

Crystal *1 ; Equivalent Parameter of Crystal is $\gamma=C0/C1\div 270$

Phase Noise

$F_0=30.72MHz$, $V_c=1.65V$, 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, $V_{DD}=2.97V\sim3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim125^{\circ}C$

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}	$CL=15pF$ $V_{DD}=3.3V$ $CE \geq V_{DD}-0.3V$ $f=70MHz$	IPV0453H0A			17.0	mA
			IPV0453H1A			12.0	
			IPV0453H2A			10.0	
			IPV0453H3A			9.0	
Current consumption at oscillation stop	I_{DDD}	$CL=15pF$, $V_{DD}=3.63V$ $CE \leq 0.3V$				10	μA
Output off leak at oscillation stop (※)	I_z	$CE \leq 0.3V$				10	μA
Output Duty Ratio	Duty	$CL=15pF$, $V_c=1/2V_{DD}$		45		55	%
Pull Range	Fcntr	$V_c=+1.65 \pm 1.65V$ 70MHz Crystal *1		± 130	± 160		ppm
Rise time	T_r	$CL=15pF$, 10%~90% V_{DD}				5.0	ns
Fall time	T_f	$CL=15pF$, 90%~10% V_{DD}				5.0	ns
Output Enable Time	T_{pe}					2.0	ms
Output Disable Time	T_{pd}					100	ns
Oscillation start up time	T_{start}					2.0	ms
Modulation Band Width	F_c	$V_c=1.35\sin\omega t+1.65V$, -3dB		15	20		kHz

 ※ : Only Straight Pad Type
 Crystal *1 ; Equivalent Parameter of Crystal is $\gamma=C0/C1 \div 290$
Phase Noise
 $F0=61.44MHz$, $V_c=1.65V$, 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, $V_{DD}=2.97V\sim 3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim 125^{\circ}C$

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
“H” input current	I_{IH}	$V_{IN}=V_{DD}$			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}	$CL=15pF$, $V_{DD}=3.3V$ $CE\geq V_{DD}-0.3V$, $f=90MHz$			24.0	mA
Current consumption at oscillation stop	I_{DDD}	$CL=15pF$, $V_{DD}=3.63V$ $CE\leq 0.3V$			10	μA
Output off leak at oscillation stop (※)	I_z	$CE\leq 0.3V$			10	μA
Output Duty Ratio	Duty	$CL=15pF$, $V_c=1/2V_{DD}$	45		55	%
Pull Range	F_{entr}	$V_c=+1.65\pm 1.65V$ 90MHz Crystal ^{*1}	± 120	± 160		ppm
Rise time	T_r	$CL=15pF$, 10%~90% V_{DD}			5.0	ns
Fall time	T_f	$CL=15pF$, 90%~10% V_{DD}			5.0	ns
Output Enable Time	T_{pe}				2.0	ms
Output Disable Time	T_{pd}				100	ns
Oscillation start up time	T_{start}				2.0	ms
Modulation Band Width	F_c	$V_c=1.35\sin\omega t+1.65V$, -3dB	15	20		kHz

※ : Only Straight Pad Type

 Crystal ^{*1} ; Equivalent Parameter of Crystal is $\gamma=C0/C1\div 315$
Phase Noise
 $F0=61.44MHz$, $V_c=1.65V$, 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)

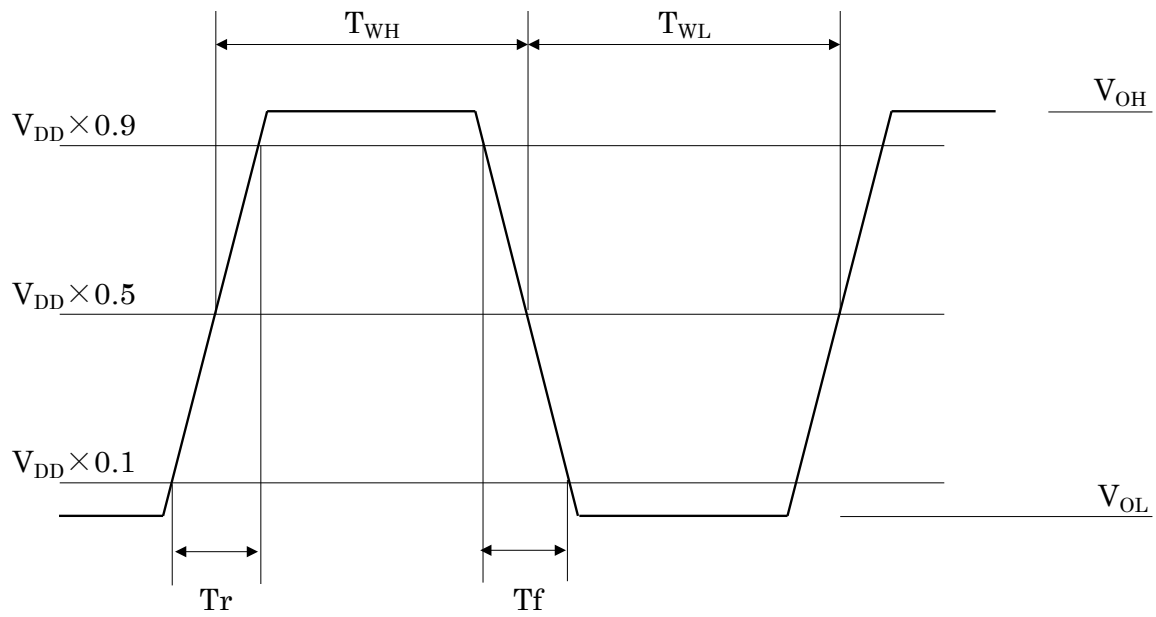
 Unless otherwise stated, $V_{DD}=2.97V\sim 3.63V$, $V_{SS}=0V$, $T_a=-40^{\circ}C\sim 105^{\circ}C$

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}	$CL=15pF$, $V_{DD}=3.3V$ $CE\geq V_{DD}-0.3V$, $f=122.88MHz$			27.0	mA
Current consumption at oscillation stop	I_{DDD}	$CL=15pF$, $V_{DD}=3.63V$ $CE\leq 0.3V$			10	μA
Output off leak at oscillation stop (※)	I_z	$CE\leq 0.3V$			10	μA
Output Duty Ratio	Duty	$CL=15pF$, $V_c=1/2V_{DD}$	45		55	%
Pull Range	Fentr	$V_c=1.65\pm 1.65V$ 122.88MHz Crystal *1	± 80	± 120		ppm
Rise time	T_r	$CL=15pF$, 10%~90% V_{DD}			3.0	ns
Fall time	T_f	$CL=15pF$, 90%~10% V_{DD}			3.0	ns
Output Enable Time	T_{pe}				2.0	ms
Output Disable Time	T_{pd}				100	ns
Oscillation start up time	T_{start}				2.0	ms
Modulation Band Width	F_c	$V_c=1.35\sin\omega t+1.65V$, -3dB	15	20		kHz

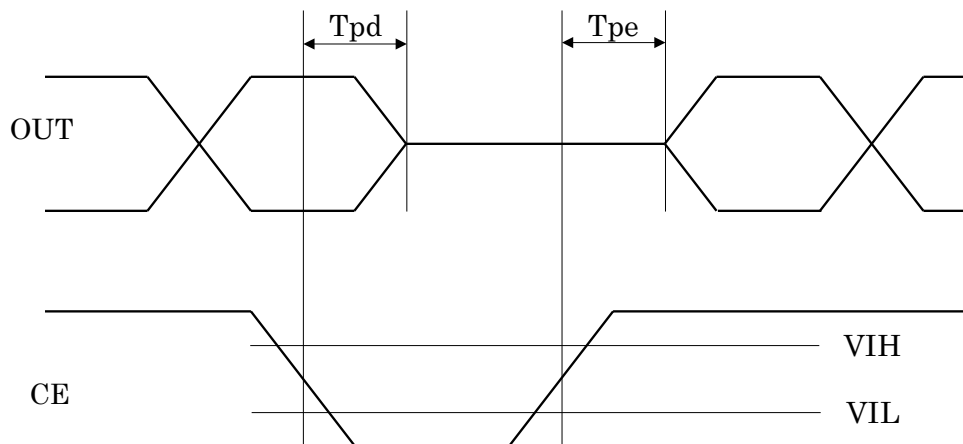
※ : Only Straight Pad Type

 Crystal *1 ; Equivalent Parameter of Crystal is $\gamma=C0/C1\div 320$
Phase Noise
 $F0=122.88MHz$, $V_c=1.65V$, 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



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



V_{IH} : Threshold voltage for Oscillation Start
V_{IL} : 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)

 $T_a=25^{\circ}\text{C}$, $V_c=V_{SS}\sim V_{DD}$

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		Rv1			240		kΩ
		Rv2			120		kΩ
Input Resistor	IPV0455H0A(F)	Rvc			80		kΩ
	Others				40		
DC cut Capacitor		Cpg			15.0		pF
		Cpd			37.5		
VC Input impedance		Zvc		VC terminal to GND	5		

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

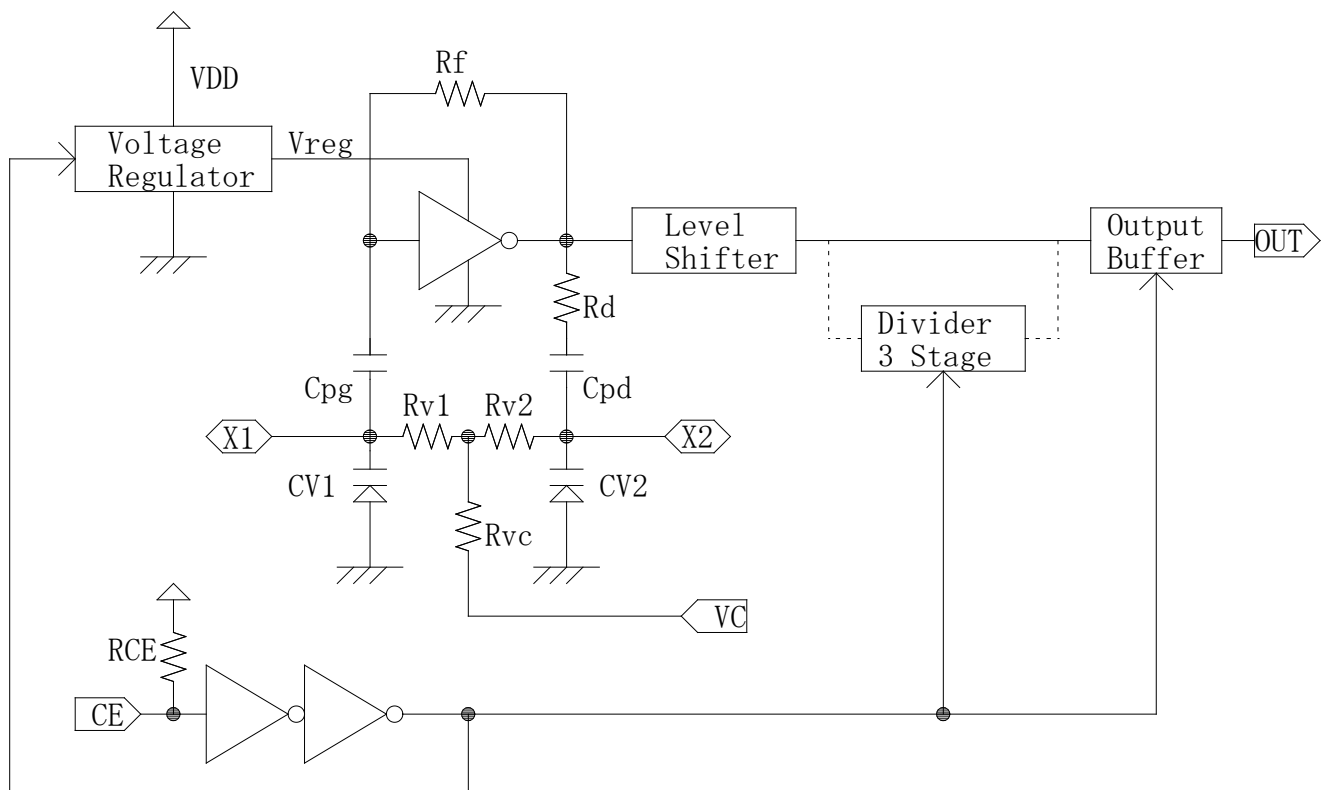
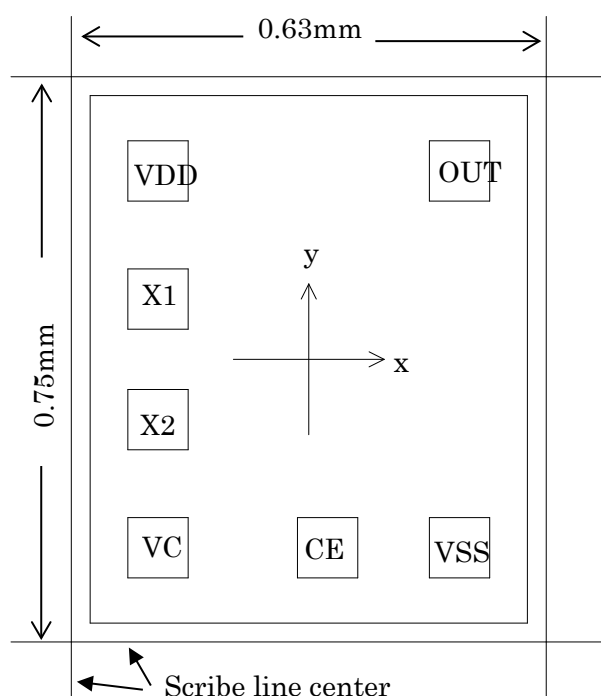


Fig. 6-1 Block Diagram

7. Pad Layout

7-1 Straight Type



•Die Size: 0.63mm × 0.75mm

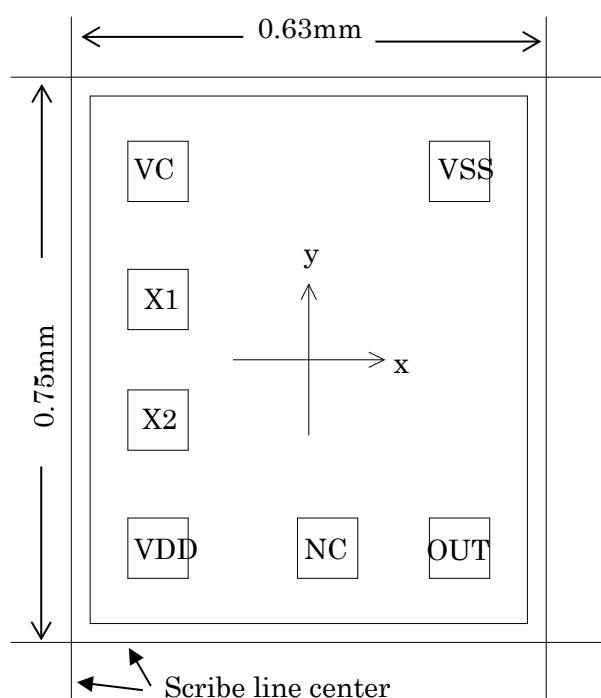
•Pad Size: 80um □

•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



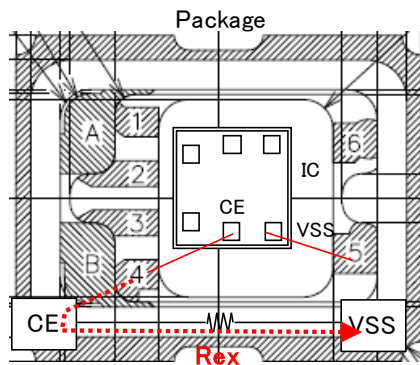
•Die Size: 0.63mm × 0.75mm

•Pad Size: 80um □

•Thickness: 100um±10um / 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

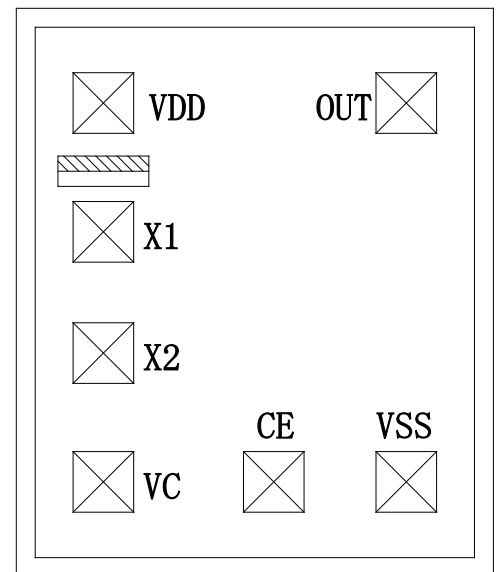
LOGO

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
IPV0452H0A	□ ■ □ □ □ □ ■
IPV0452H1A	□ ■ □ □ ■ □ □ □ ■
IPV0452H2A	□ ■ □ ■ □ □ □ □ ■
IPV0452H3A	□ ■ □ ■ ■ □ □ □ □ ■
IPV0453H0A	□ ■ ■ □ □ □ □ □ ■
IPV0453H1A	□ ■ ■ □ ■ □ □ □ □ ■
IPV0453H2A	□ ■ ■ ■ □ □ □ □ ■
IPV0453H3A	□ ■ ■ ■ ■ □ □ □ □ ■
IPV0454H0A	■ □ □ □ □ □ □ □ ■
IPV0455H0A	■ □ ■ □ □ □ □ □ ■

□ : Fuse no cut

■ : Fuse cut

