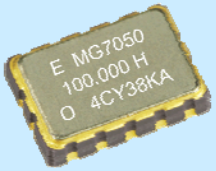
SAW-Based Differential Multi Output (HCSL) : MG7050HAN

Features

- Ultra Low jitter : 0.3 ps Max.
- 2 or 4 outputs and it is able to reduce fan-out buffers
- Frequency range : 100 MHz to 200 MHz
- Supply voltage : 2.5 V / 3.3 V
- External dimensions : 7.0 × 5.0 × 1.6 mm
- Output : HCSL (2 or 4 outputs)
- Output impedance select by ZSEL
- Pb free.
- Complies with EU RoHS directive.



Applications

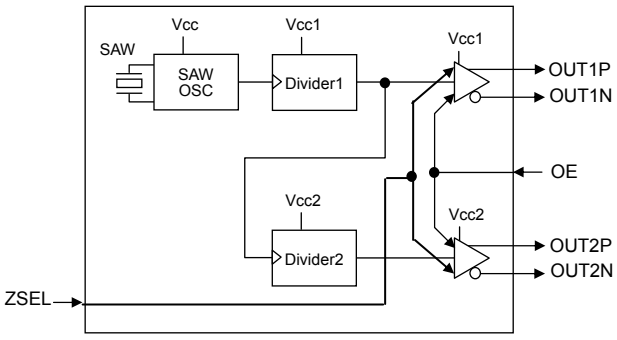
- Server, Storage,
- Networking etc.

Description

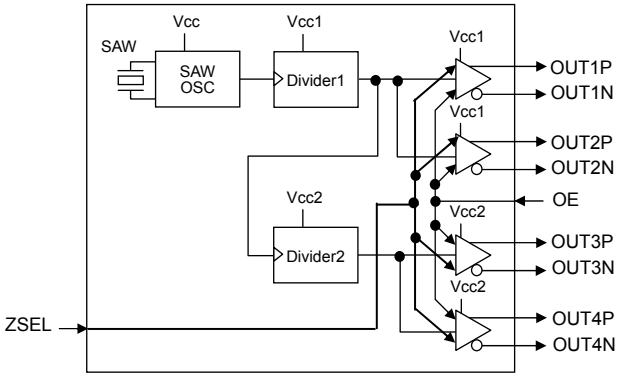
This product is high frequency oscillator of HCSL outputs using fundamental oscillation of SAW resonator. This has realized a low-jitter and low noise in frequency 100 to 200 MHz, and is suitable for the reference clock include Server, Storage and others.

Block Diagram

2 outputs



4 outputs



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/Medical instruments to sustain life
/Submarine transmitters
/Power stations and related
/Fire work equipment and security equipment
/Traffic control equipment /and others requiring equivalent reliability.
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Date: Feb. 13th 2014

1. Electrical characteristics

1) Absolute maximum ratings

Parameter	Symbol	Unit	Min.	Typ.	Max	Notes
Supply voltage	V_{CC}	V	-0.5	-	+4.0	
Storage temperature	T_{STG}	°C	-55	-	+125	Store as bare product after packing
Input voltage	V_{IN}	V	-0.5	-	V_{CC}+0.5	

2) Operating conditions

Parameter	Symbol	Unit	Min.	Typ.	Max	Notes	
Supply voltage	V_{CC}	V	2.97	3.3	3.63	Part C	Vcc, Vcc1, Vcc2 need same voltage
			2.375	2.5	2.625	Part D	
Output frequency	fo	MHz	100	-	200		
Operating temperature range	T_{use}	°C	0	-	+70	Part A	
			-20	-	+70	Part B	
			-5	-	+85	Part D	
Output load condition	C_L	pF	2				
	Rs	Ω	33			ZSEL=HIGH	
			27			ZSEL=LOW	
	L_HCSL	Ω	50			ZSEL=HIGH	
			42.2			ZSEL=LOW	

3) Frequency characteristics

Parameter	Symbol	Unit	Min.	Typ.	Max	Notes	
Frequency tolerance	f_tol	× 10^{-6}	-50	-	+50	Part J	
			-100	-	+100	Part L	
Frequency aging	f_age	× 10^{-6}	-10	-	+10	Part N	First year、25°C
			Include on frequency tolerance			Part A *1	10 years、25°C

*1 “A” is not acceptable when Frequency tolerance is “J” and Operating temperature is “B” or “D”.

4) Characteristics

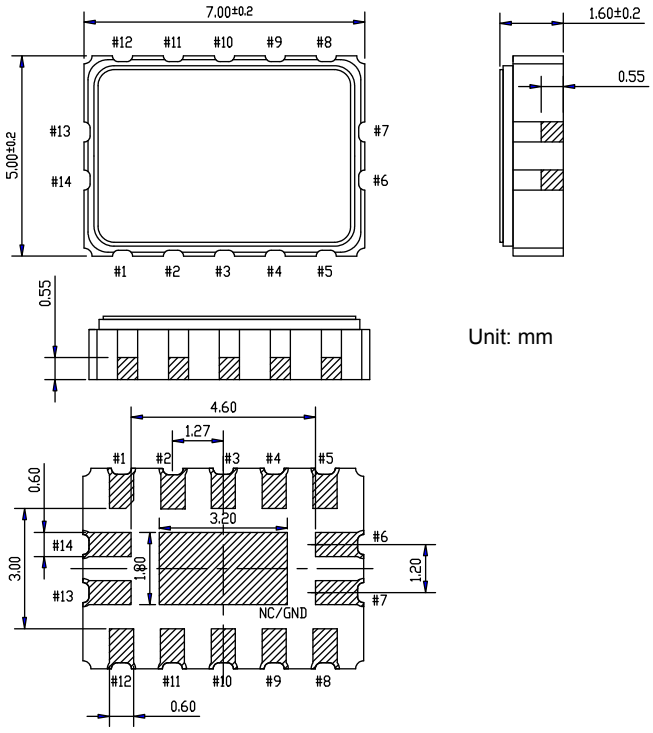
[GND=0.0 V]

Parameter	Symbol	Unit	Min.	Typ.	Max	Notes	
Oscillation start up time	T_str	ms	-	5	10		
Current consumption	I_{CC}	mA	-	60	90	V_{CC}=3.3V、2-outputs	OE= V_{CC}、with output load
			-	100	136	V_{CC}=3.3V、4-outputs	
			-	55	84	V_{CC}=2.5V、2-outputs	
			-	95	128	V_{CC}=2.5V、4-outputs	
Disable current	I_dis	mA	-	12	25	V_{CC}=3.3V、2-outputs	OE=GND
				16	30	V_{CC}=3.3V、4-outputs	
				11	23	V_{CC}=2.5V、2-outputs	
			-	15	28	V_{CC}=2.5V、4-outputs	
Rise skew rate	Rr	V/ns	1	-	4	at outputs crossing point	
Fall skew rate	Rf	V/ns	1	-	4	at outputs crossing point	
Symmetry	SYM	%	45	50	55		
High output voltage	V_{OH}	V	0.66	-	0.85	DC characteristics	
Low output voltage	V_{OL}	V	-0.15	0	+0.15	DC characteristics	
High input voltage	V_{IH}	V	70 %Vcc	-	Vcc+0.3	OE, ZSEL terminal	
Low Input voltage	V_{IL}	V	-0.3	-	30 %Vcc	OE, ZSEL terminal	
Input current	I_{IH}	μA	-	-	2	V_{IN}=Vcc, OE, ZSEL terminal	
	I_{IL}		-60	-	-20	V_{CC}=3.3V	V_{IN}=GND
			-45	-	-15	V_{CC}=2.5V	
Disable delay time	t_{pxz}	ns	-	-	100	OE terminal “H” → “L”	
Enable delay time	t_{pzx}	ns	-	-	100	OE terminal “L” → “H”	
Skew	t_{skew}	ps	-	20	50	ZSEL=HIGH	
Phase Jitter *2	t_{PJ}	ps	-	0.16(0.19)	0.3	f0=100MHz, Vcc=3.3V(2.5V)	
			-	0.15(0.18)		f0=125MHz, Vcc=3.3V(2.5V)	
			-	0.13(0.16)		f0=156.25MHz, Vcc=3.3V(2.5V)	
			-	0.12(0.14)		f0=200MHz, Vcc=3.3V(2.5V)	

*2 Offset frequency: 12 kHz to 20 MHz

2. Outline

2-1) Outline dimensions and Pin information



Unit: mm

Pin	Connections	
	2-outputs	4-outputs
1	$V_{CC}1$	
2	GND	OUT1P
3	OUT1P	OUT1N
4	OUT1N	OUT2P
5	GND	OUT2N
6	ZSEL	
7	OE	
8	GND	OUT3N
9	OUT2N	OUT3P
10	OUT2P	OUT4N
11	GND	OUT4P
12	$V_{CC}2$	
13	V_{CC}	
14	GND	

2-2) Pin map and Function of terminals

2-outputs

Connection	No.	Type	Remarks
Vcc1	1	-	Vcc pin (for OUT1)
GND	2	-	GND pin
OUT1P	3	OUTPUT	Output pin
OUT1N	4	OUTPUT	Output pin, inversion of #3
GND	5	-	GND pin
ZSEL	6	INPUT	Output load impedance select pin. "H" : differential 100Ω "L" : differential 85Ω
OE	7	INPUT	Output enable pin. As per below table. Input level / Oscillation / Outputs "H" / Enable / Enable : specified frequency "L" / Enable / Disable : Hi-Z
GND	8	-	GND pin
OUT2N	9	OUTPUT	Output pin, inversion of #10
OUT2P	10	OUTPUT	Output pin
GND	11	-	GND pin
Vcc2	12	-	Vcc pin (for OUT2)
Vcc	13	-	Vcc pin (for Oscillation circuit)
GND	14	-	GND pin

4-outputs

Connection	No.	Type	Remarks
Vcc1	1	-	Vcc pin (for OUT1,OUT2)
OUT1P	2	OUTPUT	Output pin
OUT1N	3	OUTPUT	Output pin, inversion of #2
OUT2P	4	OUTPUT	Output pin
OUT2N	5	OUTPUT	Output pin, inversion of #4
ZSEL	6	INPUT	Output load impedance select pin. "H" : differential 100Ω "L" : differential 85Ω
OE	7	INPUT	Output enable pin. As per below table. Input level / Oscillation / Outputs "H" / Enable / Enable : specified frequency "L" / Enable / Disable : Hi-Z
OUT3N	8	OUTPUT	Output pin, inversion of #9
OUT3P	9	OUTPUT	Output pin
OUT4N	10	OUTPUT	Output pin, inversion of #11
OUT4P	11	OUTPUT	Output pin
Vcc2	12	-	Vcc pin (for OUT3,OUT4)
Vcc	13	-	Vcc pin (for Oscillation circuit)
GND	14	-	GND pin

* The metal part of the surface (metal cap) and the center electrode of the pin side are connected to GND(#14).

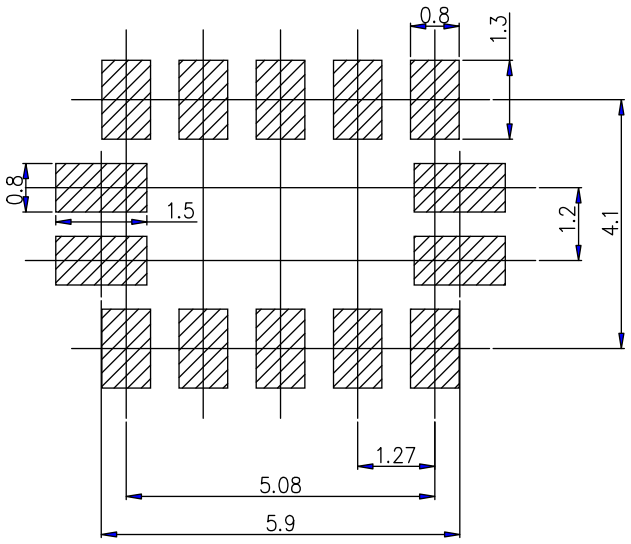
* The center electrode of the pin side is non-connection or GND.

* Unused output pairs may be left floating.

2-3) Soldering pattern

Example of patterning design indicated as follows. In an actual design, please consider mounting density, the reliability of soldering, etc. and check whether performance is optimal.

•Soldering pattern



3. Part Number

MG7050HAN 156.250000MHz 4 A C J A N

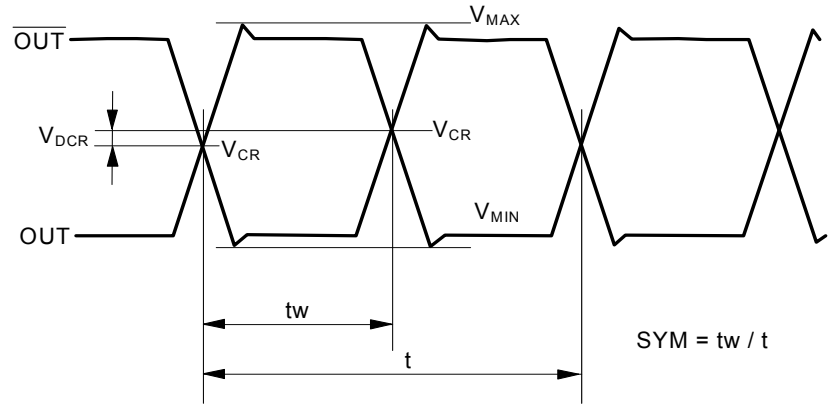
* Unavailable Combination : xAxJDA and xAxJBA

- Model Name
- Frequency
- Aging
  A: Frequency tolerance include 10years aging at 25°C , N: exclude aging
- Operating temperature
  A: 0 °C to +70 °C , B: -20 °C to +70 °C , D: -5 °C to +85 °C
- Frequency tolerance
  J: ± 50 × 10^{-6} , L: ±100 × 10^{-6}
- Supply voltage
  C: 3.3 V , D: 2.5 V
- "A" Fixed
- Number of outputs
  2: 2-outputs , 4: 4-outputs

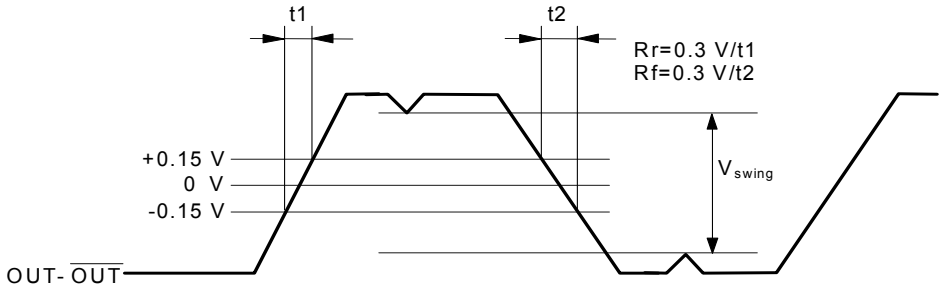
4. Timing chart

1) Output waveform

Each output waveform (OUT*P and OUT*N)

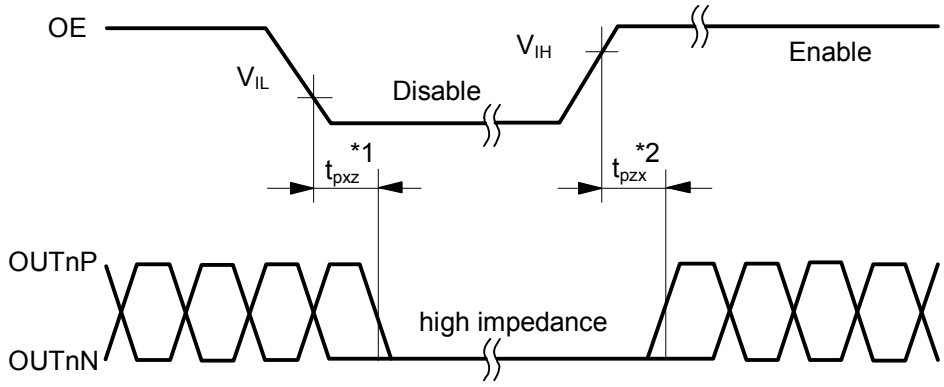


Differential output waveform (OUT*P - OUT*N)



2) OE function and timing

OE input level	Oscillation	Outputs
“H”	Enable	Enable : specified frequency
“L”	Enable	Disable : high impedance



*1 The time taken from OE=V_{IL} to OUTnP/OUTnN=Disable (high impedance).

*2 The time taken from OE=V_{IH} to OUTnP/OUTnN =Enable.

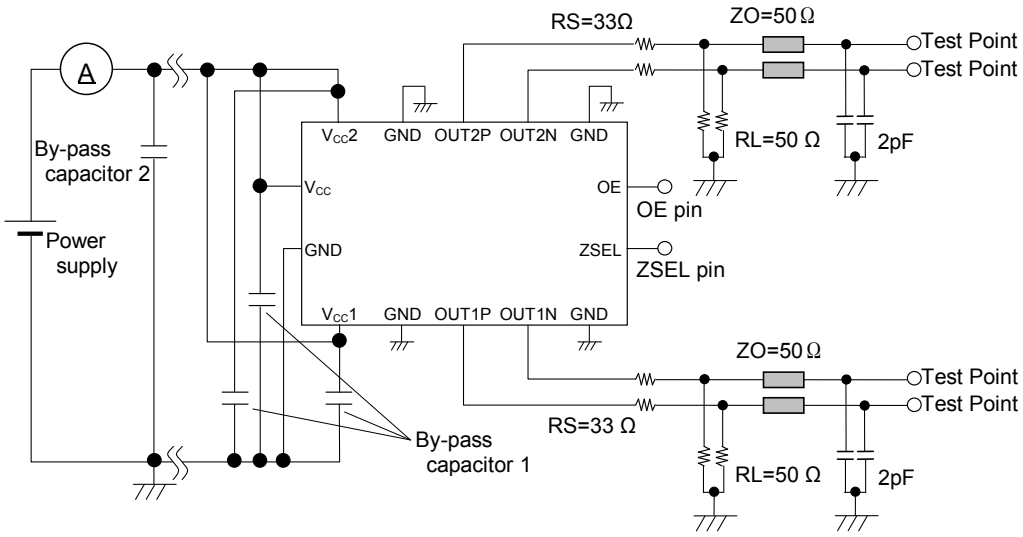
* OE input voltage must be lower than Vcc. Note that rise-up time of OE input voltage must not be shorter than the rise-up time of supply voltage.

5. Reference circuit

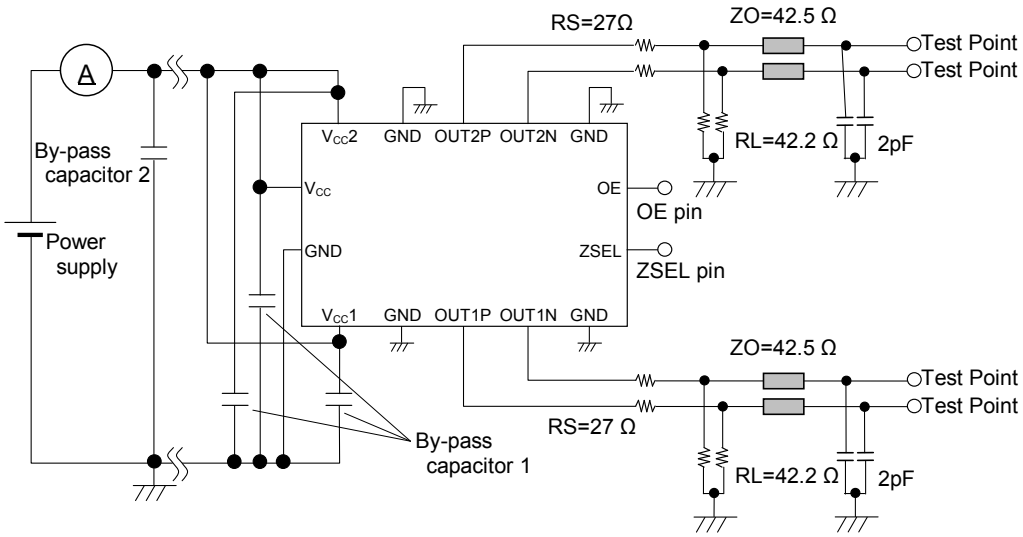
5-1) Test circuit

2-outputs

・Case of ZSEL=H（RS=33Ω/RL=50Ω/ZO=50Ω）

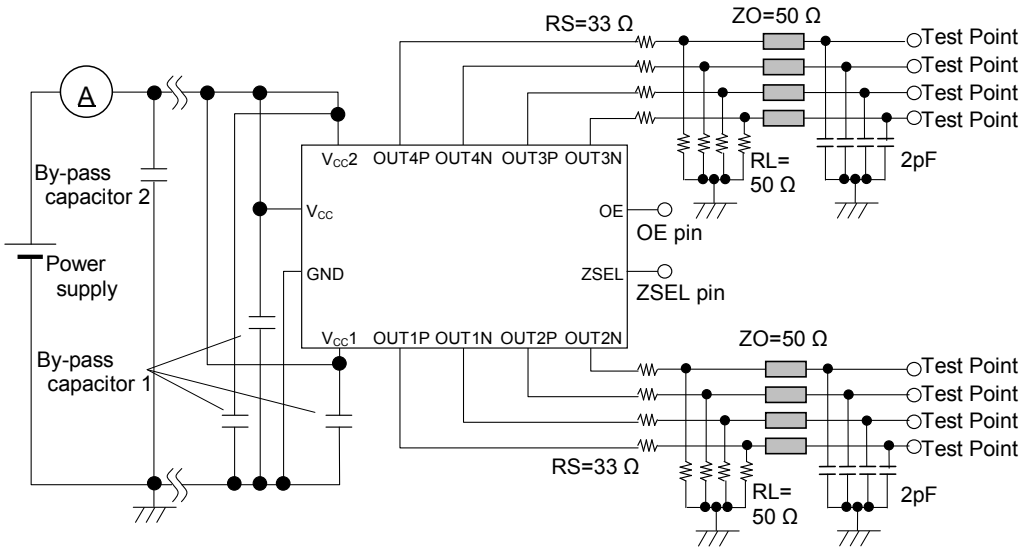


・Case of ZSEL=L（RS=27Ω/RL=42.2Ω/ZO=42.5Ω）

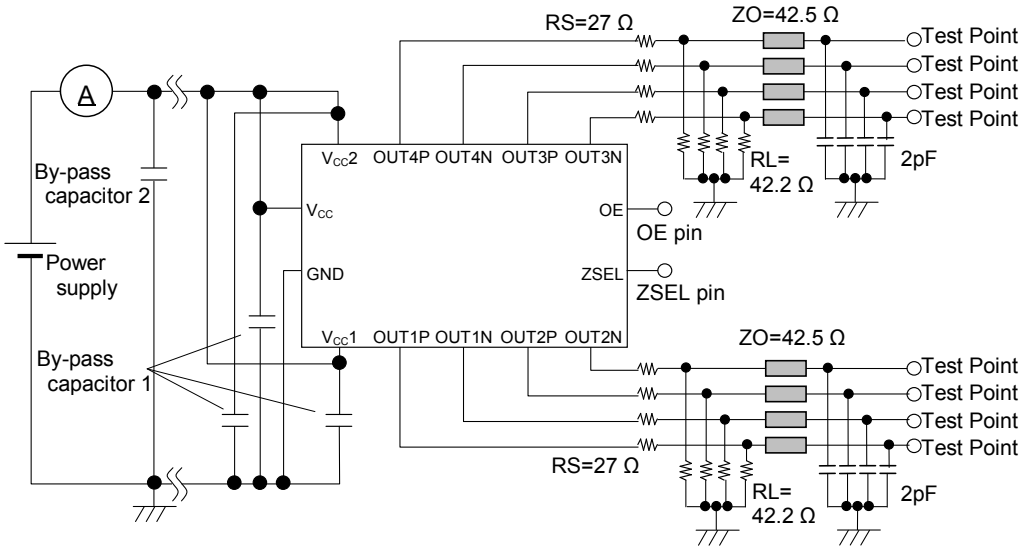


4-outputs

·Case of ZSEL=H（RS=33Ω/RL=50Ω/ZO=50Ω）

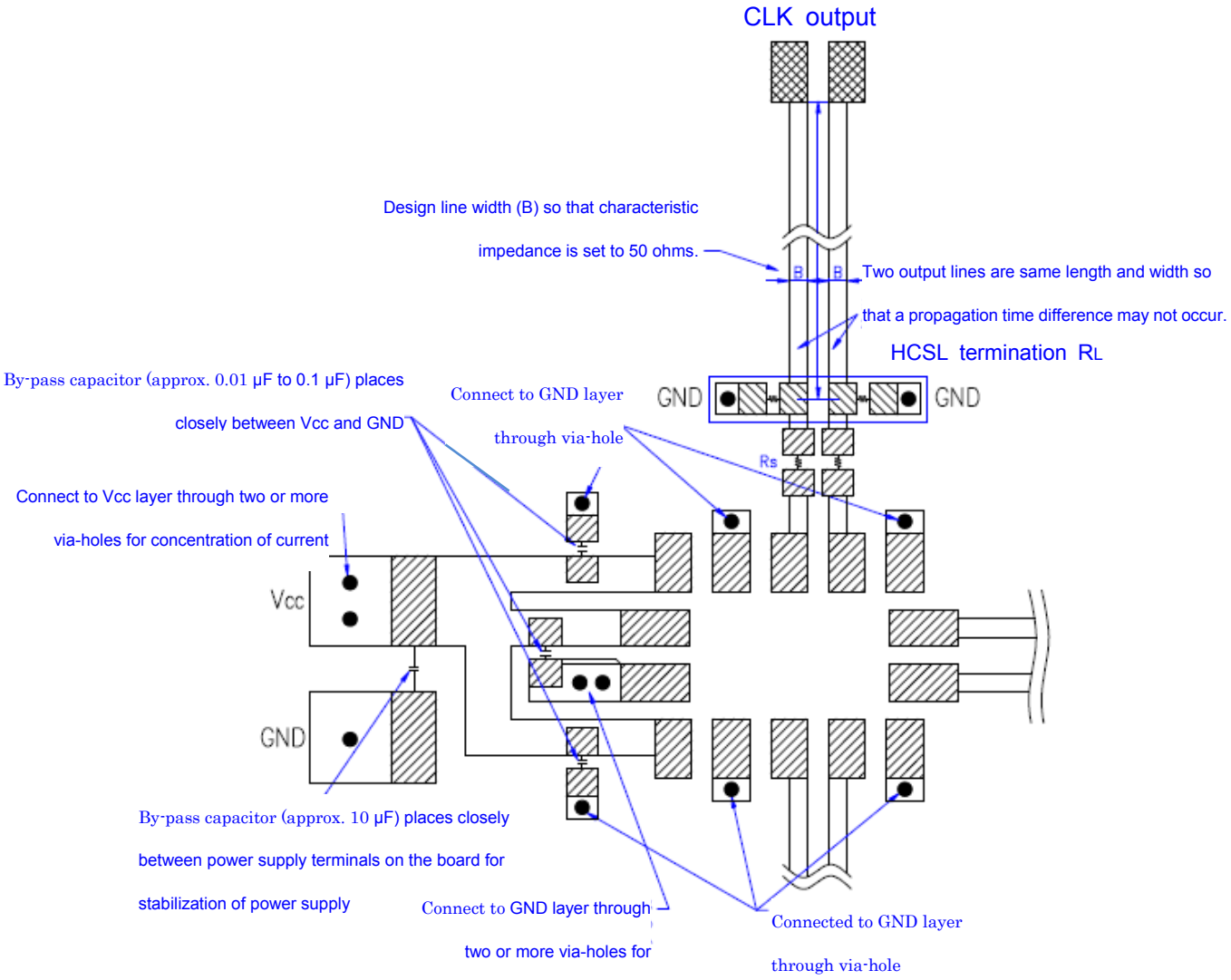


·Case of ZSEL=L（RS=27Ω/RL=42.2Ω/ZO=42.5Ω）

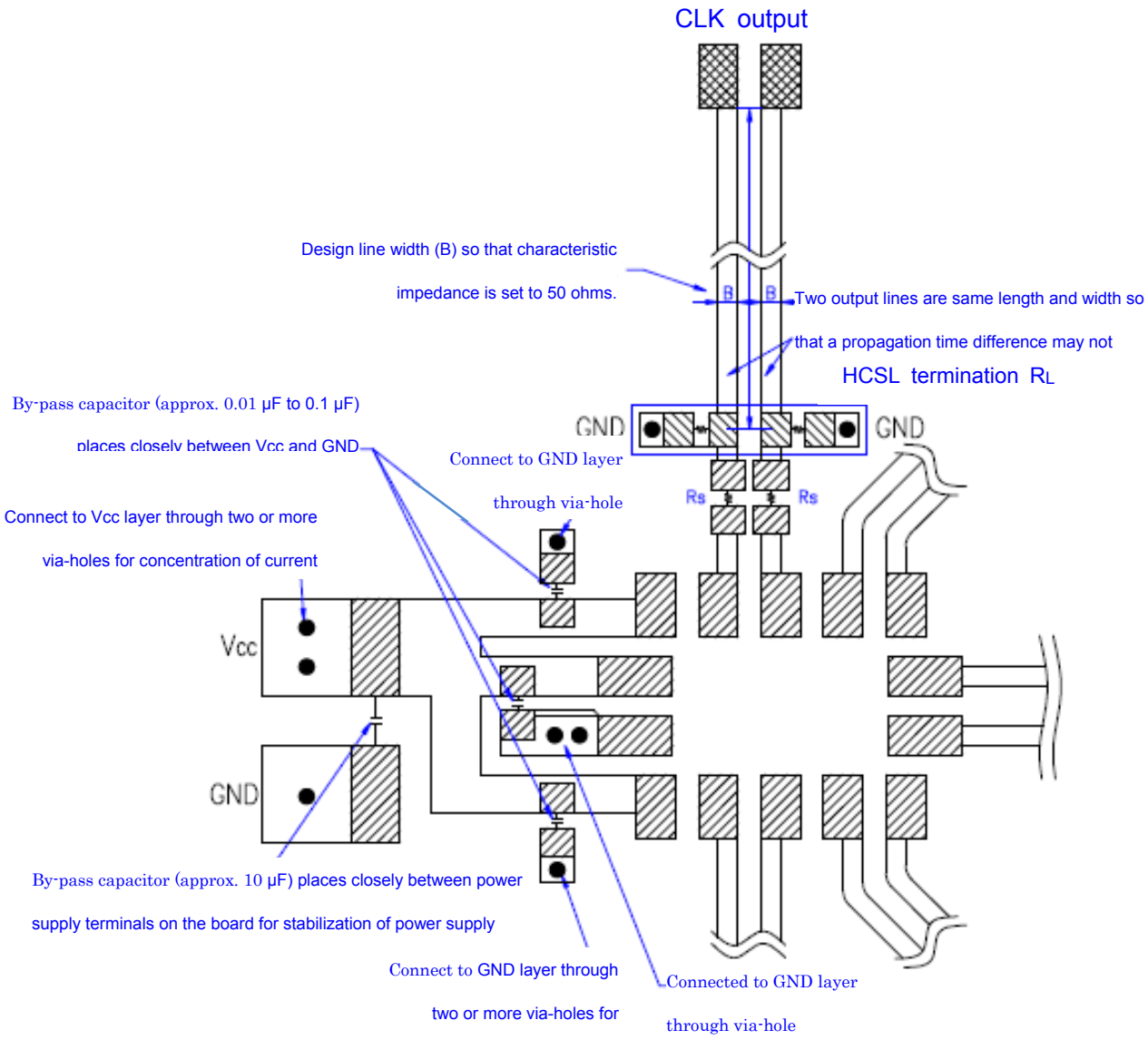


5-2) **PCB layout** (multilayers, with Vcc and GND layer inside)

2-outputs



4-outputs


CLK output
Design line width (B) so that characteristic
impedance is set to 50 ohms.
B
B
Two output lines are same length and width so
that a propagation time difference may not
HCSL termination RL
By-pass capacitor (approx. 0.01 µF to 0.1 µF)
places closely between Vcc and GND
GND
Connect to GND layer
through via-hole
GND
Rs
Rs
Connect to Vcc layer through two or more
via-holes for concentration of current
Vcc
GND
By-pass capacitor (approx. 10 µF) places closely between power
supply terminals on the board for stabilization of power supply
Connect to GND layer through
two or more via-holes for
Connected to GND layer
through via-hole

6. Handling precaution

Quartz parts are precision parts. Please handle carefully paying attention to the next points

1) This device contains a SAW resonator, so please do not expose to excessive shock or vibration.
2) Ultrasonic cleaning can be used on this product, however, since the oscillator might be damaged under some conditions, please exercise caution in advance.
3) An automatic insertion is available, however, the internal SAW resonator might be damaged in case that too much shock or vibration is produced mechanically.Be sure to check your machine condition in advance.
4) This device is made with C-MOS IC.
   Please take necessary precautions to prevent damage due to electrical static discharge.
5) We recommend placing a 0.01 µF to 0.1 µF capacitor closely between Vcc(#13pin), Vcc1(#1pin), Vcc2(#12pin) and GND(#2pin) to obtain stable operation and protest against power line ripple.
6) Vcc and GND pattern shall be as large as possible so that high frequency impedance shall be small.
7) The metal part of the surface (metal cap) is connected to GND #2pin.
   Please take necessary precautions to prevent short circuit to GND by contact with the metal cap.
8) Start up time (0 to 90% Vcc) of power source should be more than 150 µs and slew rate should be less than 19.8 mV/µs.
   We doesn't recommend to power on from intermediate electric voltage or extreme fast power on.
   Those powering conditions may cause no oscillation or abnormal oscillation.
9) Please design the output lines by characteristic impedance 50 Ω and try to make the output lines as short as possible.
   A long output line may cause irregular output.
10) Other high level signal lines may cause incorrect operation, so please do not place high-level signal line close to this device.
11) We recommend to use and store under room temperature and normal humidity to secure frequency accuracy and prevent moisture.
12) When not use OE pin connection, please use connecting to Vcc.
    We recommend installation of a resistor in between to mitigate effect by surge etc.
13) When distributing output signals, please use the clock divider IC (HCSL fanout buffer).
14) Please arrange HCSL terminal resistance with both outputs, even if only one output signal is used.
15) DUT's surface temperature may rise from surrounding temperature by self heat-generation. Please confirm a rise in temperature with DUT mounted to an actual substrate, because it may change from the mounting condition.
16) Recommendation reflow times are less than 2 times.
    In case that this device is reflow soldered on the back side of your circuit board, please carefully verify the device is properly secured to prevent coming detached from card.
17) The ripple and the noise included in the supplied power supply might be deteriorated of the noise property of this oscillator.
    Please enough consideration to design of power supply.
18) The ripple and the noise included in the supplied power supply might be deteriorated of the noise property of this oscillator.
    Please optionally add the LC filter circuit.

Soldering method	Good or No good
Reflow soldering (top side)	Good
Reflow soldering (back side)	Please carefully verify the device is properly secured to prevent coming detached from card.
Solder pot (static solder pot / flow solder pot)	No good
Iron soldering	Good

7. Contact

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