

# digILO – A Wideband PLL Synthesizer

## Features:

The **digILO** is a wideband Fractional-N / Integer-N PLL Synthesizer capable of generating signals from 23.5MHz to 6GHz. Measuring only 2" x 3", it's primarily designed for use as a transverter's local oscillator. But it can also be used as a low-level signal source. It comes pre-programmed with over a hundred popular frequencies. Connection to an external 10MHz reference is recommended. But the **digILO** automatically switches to its on-board TCXO reference when its 10MHz external reference is not detected. A "LOCK" indicator for direct connection to a LED is also provided.

## Operation:

The recommended supply voltage is 9V. But reliable operation is possible down to 7V. The **digILO** is tolerant of supply voltages up to 15V. But operation beyond 9V results in excessive heating of the voltage regulator. If 12V operation is desired, it is recommended to use a 25 Ohm 2-Watt resistor in series with the power connection. This should drop the voltage to the **digILO** to a safer level.

The required supply current decreases as output frequency increases. Below 47MHz, supply current is a maximum of 200mA. And above 3GHz, the supply current drops to 130mA.

The 10MHz External Reference should be from a clean & stable source. Keep in mind that the **digILO**'s output is directly affected by the quality of this reference source. The recommended input range for "REF IN" is 0dBm to +13dBm. At levels below 0dBm, the **digILO** automatically switches over to its internal TCXO reference.

When the **digILO** is locked to its external 10MHz reference, the "LOCK" output switches from 0V to 5V through a 200 Ohm resistor. This output can serve as a simple indication of which reference (external or internal) is sourcing the **digILO**. Up to 20mA can be safely sourced from this connection. Therefore, a LED can be connected directly from the "LOCK" output to ground.

The RF output of the **digILO** appears on the "RF OUT" connection. The output level is virtually flat from 23.5MHz up to 2GHz. And it maintains a level of +2dBm  $\pm$ 2dB up to 3GHz. Beyond 3GHz, the output gradually falls to -10dBm at 6GHz.

Refer to the supplied Frequency Table to select the desired frequency with jumpers or solder bridges. Or install a DIP switch or an external switch. Frequencies can be changed on the fly.

digiLO Frequency Table for Firmware v17.8.3										
INDEX	FREQ	FREQ SELECT JUMPERS								SUGGESTED APPLICATION
		7	6	5	4	3	2	1	0	
0	116.000									144-28
1	194.000								X	222-28
2	404.000							X		432-28
3	758.000							X	X	902-144
4	874.000						X			902-28
5	759.000						X		X	903-144
6	875.000						X	X		903-28
7	1152.000						X	X	X	1296-144
8	1268.000					X				1296-28
9	2160.000					X			X	2304-144
10	2276.000					X		X		2304-28
11	3312.000					X		X	X	3456-144
12	3428.000					X	X			3456-28
13	5616.000					X	X		X	5760-144
14	5732.000					X	X	X		5760-28
32	50.100		X							50 MHz WSS
33	70.100		X						X	70 MHz WSS
34	144.100		X					X		144 MHz WSS
35	222.100		X					X	X	222 MHz WSS
36	432.100		X				X			432 MHz WSS
37	435.100		X				X		X	435 MHz WSS
38	902.100		X				X	X		902 MHz WSS
39	903.100		X				X	X	X	903 MHz WSS
40	915.100		X		X					915 MHz WSS
41	1275.100		X		X				X	1275 MHz WSS
42	1296.100		X		X			X		1296 MHz WSS
43	2304.100		X		X			X	X	2304 MHz WSS
44	3456.100		X		X	X				3456 MHz WSS
45	5760.100		X		X	X			X	5760 MHz WSS
46	3456.033		X		X	X	X			10368 MHz WSS / 3

INDEX	FREQ	FREQ SELECT JUM PERS								SUGGESTED APPLICATION	
		7	6	5	4	3	2	1	0		
128	42.000	X								70-28 & (50-29) x 2	
129	44.000	X							X	(50-28) x 2	
130	77.000	X							X	222-145	
131	78.000	X							X	X	222-144
132	79.000	X						X			223-144
133	84.000	X						X		X	(50-29) x 4
134	88.000	X						X	X		(50-28) x 4
135	95.000	X						X	X	X	(220-30) / 2
136	95.250	X				X					(220-29.5) / 2
137	95.500	X				X				X	(220-29) / 2
138	96.000	X				X			X		(220-28) / 2
139	96.250	X				X			X	X	(222-29.5) / 2
140	96.500	X				X	X				(222-29) / 2
141	96.750	X				X	X			X	(222-28.5) / 2
142	97.000	X				X	X	X			(222-28) / 2
143	97.500	X				X	X	X	X		(222-27) / 2
144	98.000	X			X						(222-26) / 2
145	100.625	X			X					X	(432-29.5) / 4
146	100.875	X			X				X		(432-28.5) / 4
147	100.750	X			X				X	X	(432-29) / 4
148	101.000	X			X			X			(432-28) / 4
149	101.250	X			X			X		X	(432-27) / 4
150	101.500	X			X			X	X		(432-26) / 4
151	101.750	X			X			X	X	X	(435-28) / 4
152	102.000	X			X	X					(435-27) / 4
153	102.250	X			X	X				X	(435-26) / 4
154	114.000	X			X	X			X		144-30
155	114.500	X			X	X			X	X	144-29.5
156	115.000	X			X	X	X				144-29
157	115.500	X			X	X	X			X	144.28.5
158	117.000	X			X	X	X	X			144-27
159	118.000	X			X	X	X	X	X		144-26
160	119.000	X		X							144-25
161	120.000	X		X						X	144-24
162	170.000	X		X					X		220-50
163	171.000	X		X					X	X	222-51
164	172.000	X		X				X			222-50
165	190.000	X		X				X		X	220-30
166	191.000	X		X				X	X		220-29
167	192.000	X		X				X	X	X	220-28
168	192.500	X		X		X					222-29.5
169	193.000	X		X		X				X	222-29
170	193.500	X		X		X			X		222-28.5
171	195.000	X		X		X			X	X	222-27
172	196.000	X		X		X	X				222-26

INDEX	FREQ	FREQ SELECT JUMPERS								SUGGESTED APPLICATION
		7	6	5	4	3	2	1	0	
173	381.000	X		X		X	X		X	432-51
174	382.000	X		X		X	X	X		432-50
175	383.000	X		X		X	X	X	X	435-52
176	384.000	X		X	X					435-51
177	385.000	X		X	X				X	435-50
178	402.000	X		X	X			X		432-30
179	402.500	X		X	X			X	X	432-29.5
180	403.000	X		X	X		X			432-29
181	403.500	X		X	X		X		X	432-28.5
182	405.000	X		X	X		X	X		432-27
183	406.000	X		X	X		X	X	X	435-29
184	407.000	X		X	X	X				435-28
185	408.000	X		X	X	X			X	435-27
186	409.000	X		X	X	X		X		435-26
192	984.000	X	X							(24048-432) / 24
193	990.000	X	X						X	(24192-432) / 24
194	996.000	X	X					X		(24048-144) / 24
195	1002.000	X	X					X	X	(24192-144) / 24
196	1008.000	X	X				X			(10368-1296) / 9
197	1022.400	X	X				X		X	(10368-144) / 10
198	1065.000	X	X				X	X		(5760-435) / 5
199	1065.600	X	X				X	X	X	(5760-432) / 5
200	1080.000	X	X			X				(2304-144) / 2
201	1079.000	X	X			X			X	(2304-146) / 2
202	1078.000	X	X			X		X		(2300-144) / 2
203	1088.000	X	X			X		X	X	(2320-144) / 2
204	1104.000	X	X			X	X			(3456-144) / 3 & (10368-432) / 9
205	1116.000	X	X			X	X		X	(5760-1296) / 4
206	1122.600	X	X			X	X	X		(5760-147) / 5
207	1123.000	X	X			X	X	X	X	(5760-145) / 5
208	1123.200	X	X		X					(5760-144) / 5
209	1127.000	X	X		X				X	(2304-50) / 2
210	1128.000	X	X		X			X		(2400-144) / 2
211	1135.000	X	X		X			X	X	(3456-51) / 3
212	1136.000	X	X		X		X			(10368-144) / 9
213	1140.000	X	X		X		X		X	(2424-144) / 2
214	1142.000	X	X		X		X	X		(5760-50) / 5
215	1242.000	X	X		X		X	X	X	(10368-432) / 8
216	1246.000	X	X		X	X				1296-50
217	1267.000	X	X		X	X			X	1296-29
218	1276.000	X	X		X	X		X		1420-144
219	1278.000	X	X		X	X		X	X	(10368-144) / 8
220	1656.000	X	X		X	X	X			(10368-432) / 6
221	1704.000	X	X		X	X	X		X	(10368-144) / 6
222	1987.200	X	X		X	X	X	X		(10368-432) / 5

INDEX	FREQ	FREQ SELECT JUMPERS								SUGGESTED APPLICATION
		7	6	5	4	3	2	1	0	
223	2044.800	X	X		X	X	X	X	X	(10368-144) / 5
224	2176.000	X	X	X						2320-144
225	2254.000	X	X	X					X	2304-50
226	2256.000	X	X	X				X		2400-144
227	2280.000	X	X	X				X	X	2424-144
228	2484.000	X	X	X			X			(10368-432) / 4
229	2556.000	X	X	X			X		X	(10368-144) / 4
230	2624.000	X	X	X			X	X		(24048-432) / 9
231	2640.000	X	X	X			X	X	X	(24192-432) / 9
232	2656.000	X	X	X		X				(24048-144) / 9
233	2672.000	X	X	X		X			X	(24192-144) / 9
234	2952.000	X	X	X		X		X		(24048-432) / 8
235	2970.000	X	X	X		X		X	X	(24192-432) / 8
236	2988.000	X	X	X		X	X			(24048-144) / 8
237	3024.000	X	X	X		X	X		X	3456-432
238	3256.000	X	X	X		X	X	X		3400-144
239	3408.000	X	X	X		X	X	X	X	(10368-144) / 3
240	3936.000	X	X	X	X					(24048-432) / 6
241	3960.000	X	X	X	X				X	(24192-432) / 6
242	3984.000	X	X	X	X			X		(24048-144) / 6
243	4008.000	X	X	X	X			X	X	(24192-144) / 6
244	4464.000	X	X	X	X		X			5760-1296
245	4752.000	X	X	X	X		X		X	(24192-432) / 5
246	4780.800	X	X	X	X		X	X		(24048-144) / 5
247	4809.600	X	X	X	X		X	X	X	(24192-144) / 5
248	4968.000	X	X	X	X	X				(10368-432) / 2
249	5112.000	X	X	X	X	X			X	(10368-144) / 2
250	5328.000	X	X	X	X	X		X		5760-432
251	5904.000	X	X	X	X	X		X	X	(24048-432) / 4
252	5940.000	X	X	X	X	X	X			(24192-432) / 4
253	5976.000	X	X	X	X	X	X		X	(24048-144) / 4
255	1000.000	X	X	X	X	X	X	X	X	TEST

digiLO Measured Phase Noise at Various Frequencies and Offsets					
Frequency	Reference	dBc/Hz @ 100Hz	dBc/Hz @ 1KHz	dBc/Hz @ 10KHz	dBc/Hz @ 100KHz
116MHz	INT	-93	-100	-109	-125
	EXT	-90	-101	-111	-125
194MHz	INT	-94	-99	-105	-125
	EXT	-90	-100	-107	-122
404MHz	INT	-92	-90	-99	-120
	EXT	-85	-94	-102	-122
758MHz	INT	-88	-89	-92	-115
	EXT	-85	-91	-95	-118
874MHz	INT	-88	-86	-89	-116
	EXT	-92	-92	-97	-116
1152MHz	INT	-83	-83	-87	-113
	EXT	-84	-86	-90	-115
1268MHz	INT	-83	-82	-86	-110
	EXT	-83	-82	-88	-112
2160MHz	INT	-78	-80	-82	-105
	EXT	-76	-78	-84	-107
3312MHz	INT	-78	-78	-77	-99
	EXT	-81	-83	-83	-105
5760MHz	INT	-65	-63	-70	-100

### digiLO Bill of Materials

DESIGNATOR	QTY	DESCRIPTION
C1	1	3.3nF 10% 50V X7R 0402
C2,C30,C31,C33,C34	5	0.1uF 10% 16V X7R 0402
C3	1	470pF 5% 50V NP0 0402
C4,C5,C21,C22,C23,C24,C25,C26,C27	9	1uF 10% 10v X5R 0402
C6,C10,C12,C14,C16,C18	6	10nF 10% 16V X7R 0402
C7,C9,C11,C13,C15,C17	6	100pF 5% 50V NP0 0402
C8,C19,C20,C32,C35,C36,C38,C39	8	1nF 10% 50VX7R 0402
C28,C29	2	4.7uF 10% 16V SIZE B TANT
C37	1	33pF 5% 50V NP0 0402
D1	1	BAS70-04 SOT-23
J1	0	DO NOT INSTALL
J2	0	DO NOT INSTALL
J3,J4	0	DO NOT INSTALL
R1	1	5K10 1% 0402
R2	1	820R 1% 0402
R3	1	1K20 1% 0402
R4,R5,R6,R7	4	49R9 1% 0402
R8,R11,R14,R16,R17,R18,R19,R20,R21,R22,R23,R24	12	10K0 1% 0402
R9,R10,R13	3	200R 1% 0402
R12,R15	2	100K 1% 0402
S1	0	DO NOT INSTALL
U1	1	MAX2870ETJ+
U2	1	PIC18F14K22-I/SS
U3,U4,U5	3	ADP150AUJZ-3.3-R7
U6	1	L78M05CDT
U7	1	SN74LVC1G3157DBVR
U8	1	MCP6546T-I/OT
U9	1	74LVC1G14GV,125 (NXP)
U10	1	LM4040DEX3-3.3
Y1	0	DO NOT INSTALL

