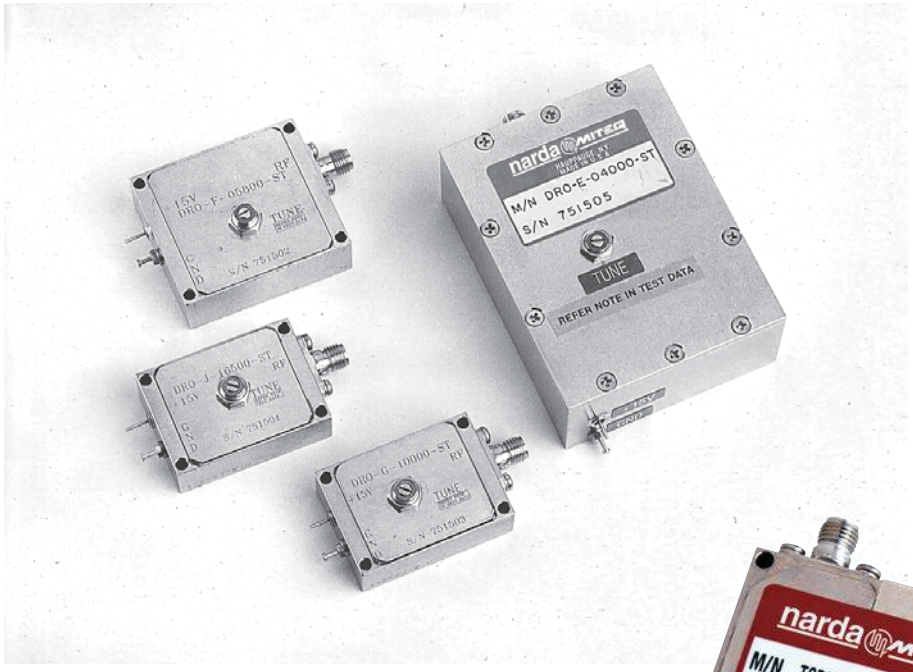
FREE-RUNNING DIELECTRIC RESONATOR OSCILLATOR



INTRODUCTION TO DROs

Dielectric Resonator Oscillators (DROs) are microwave oscillators that use a dielectric resonator (DR) as the frequency stabilizing element in order to achieve excellent frequency stability, high Q and very low microphonics. The DR, when used as part of the resonating circuit of any active microwave device, produces a steady state oscillation under the right conditions at the resonant frequency of the DR.

OSCILLATOR THEORY AND CIRCUIT DESIGN

Narda-MITEQ's DRO circuits utilize both silicon bipolar transistors and GaAs MESFET devices. All microwave oscillators are designed by adding resonating elements (L, C or R) in various configurations to different ports of a transistor. These elements generate a negative resistance at a certain resonant frequency and set the device into oscillation. In the case of a DRO, the resonating element is the DR, which can be modeled electrically as an L, C, R network, as shown in Figure 1.

DIELECTRIC RESONATOR ELECTRICAL MODEL

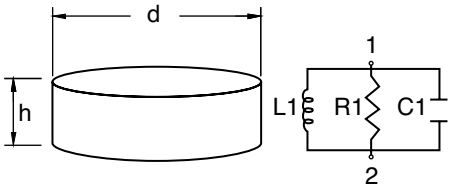


FIGURE 1

The Dielectric Resonator is made of a high dielectric constant (e = 30 to 80) ceramic material, often barium titanate (Ba2Ti9O20). This material exhibits a high Q (9000 @ 10 GHz) and low temperature coefficient of frequency (TC to ±6 ppm/°C typical).

The cylindrical shape as shown in Figure 1 is the most popular. It has good separation between the desired TEd(0,1) mode and other higher order resonant modes, making it easier to couple to microstrip circuits, as well as easy to mount.

The resonator is magnetically coupled to one or more ports of the transistor using a transmission line, as shown in Figure 2.

DIELECTRIC RESONATOR MAGNETICALLY COUPLED TO DIFFERENT PORTS OF TRANSISTOR USING TRANSMISSION LINE

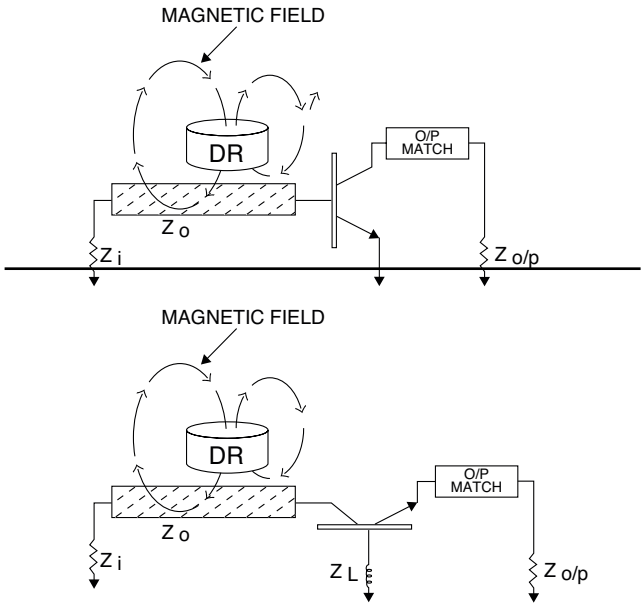
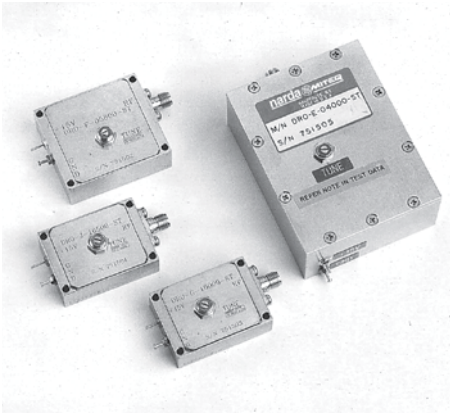


FIGURE 2

DRO SERIES



FEATURES

- Ultra-clean source ideal for low spur application
- Miniaturized designs
- High-reliability construction
- Low-phase noise

OPTIONS

- High power (-HP-ST)
- Voltage tuning (-VT-ST)
- Special (-SP) (please contact factory before ordering)
  Special is defined as a requirement with a specification(s) different than the standard catalog. For example, extended mechanical and electrical tuning, extended or narrowed temperature range, lower output power, different DC power requirement, etc.

ELECTRICAL SPECIFICATIONS

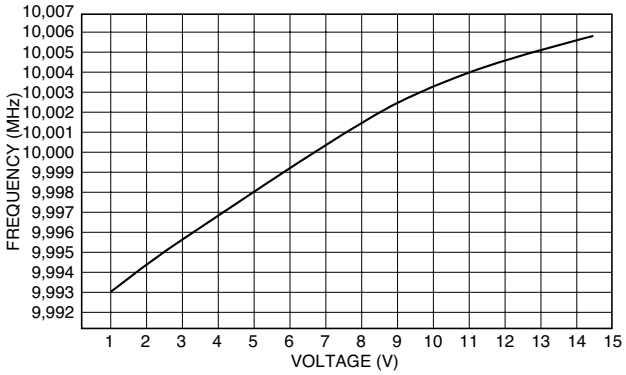
PARAMETERS	UNITS	SERIES - ST (STANDARD)												
		D	E	EF	F	G	H	J	K	L	M	N	P	R
Operating frequency range (Note 2)	GHz	2.4 to 3.7	3.7 to 4.8	4.8 to 6.5	6.5 to 8.8	8.8 to 12	12 to 16	16 to 18	18 to 20	20 to 22	22 to 24	24 to 26	26 to 33	33 to 40
Output power (Note 1)	dBm, min.	+13	+13	+13	+13	+13	+13	+11	+11	+11	+11	+11	+11	+11
Output power variation over temperature range	dB, max.	±2	±2	±2	±2	±2	±2	±2	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5
Fundamental	dBc, max.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-20	-20	-20	-20	-20	-20
Harmonics	dBc, max.	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Spurious	dBc, max.	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80
Mechanical tuning	MHz, min.	±3	±5	±10	±10	±10	±10	±10	±10	±10	±10	±10	±10	±10
Frequency pushing	kHz/V, max.	10	10	15	15	15	20	25	30	30	30	30	40	50
Frequency pulling (1.5:1 VSWR)	MHz, peak-to-peak max.	2	2	3	5	5	5	5	1	1	1	1	1	1
Frequency drift temp. coefficient (Note 3)	ppm/°C, max.	5	5	5	5	5	5	5	5	5	5	5	5	5
Phase noise @ 10 kHz offset	dBc/Hz, typ.	105	105	95	90	85	80	80	80	80	80	75	75	70
DC power	Volts (Note 4)	15	15	15	15	15	15	15	15	15	15	15	15	15
Current	mA, max.	150	150	60	60	06	60	120	120	120	120	120	200	200
Outline drawing		1	1	2	3	4	4	4	5	5	5	5	5	5
Temperature range	°C	-20 to +70												

ELECTRICAL SPECIFICATIONS														
PARAMETERS	UNITS	SERIES - ST (STANDARD)												
		D	E	EF	F	G	H	J	K	L	M	N	P	R
		VOLTAGE TUNABLE OPTION (VT-ST)												
Electrical tuning @ Vvar = 1 V to 15 V	MHz, min.	N/A	N/A	N/A	8	12	16	20	25	25	25	25	32	40
Phase noise @ 10 kHz offset	dBc/Hz, typ.	N/A	N/A	N/A	85	80	75	75	75	75	75	70	70	65
		HIGH POWER OPTION (HP-ST)												
Output power	dBm, min.	+17	+17	+17	+17	+17	+17	+17	+17	+17	+14	+14	+14	+14
Current	mA, max.	220	220	220	220	220	230	230	230	230	220	220	220	300
Frequency pulling (1.5:1 VSWR)	MHz, peak-to-peak max.	2	2	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1	1
Outline drawing		2	1	2	3	5	5	5	5	5	5	5	5	5

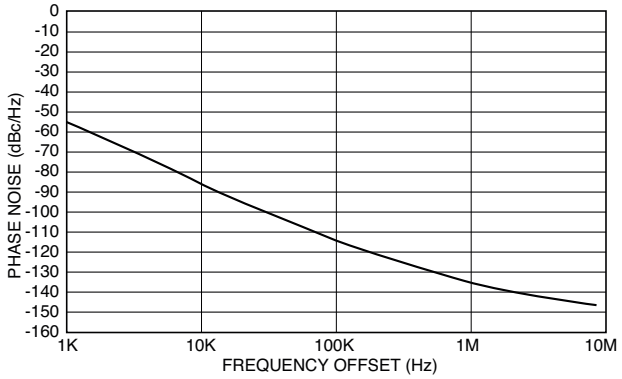
Notes:
1. Output power is guaranteed into 50 ohm load.
2. Operating frequency must be specified.
3. Averaged over the full temperature range.
4. Alternate DC voltage available

Narda-MITEQ also offers DROs with enhanced specifications as special models (-SP).

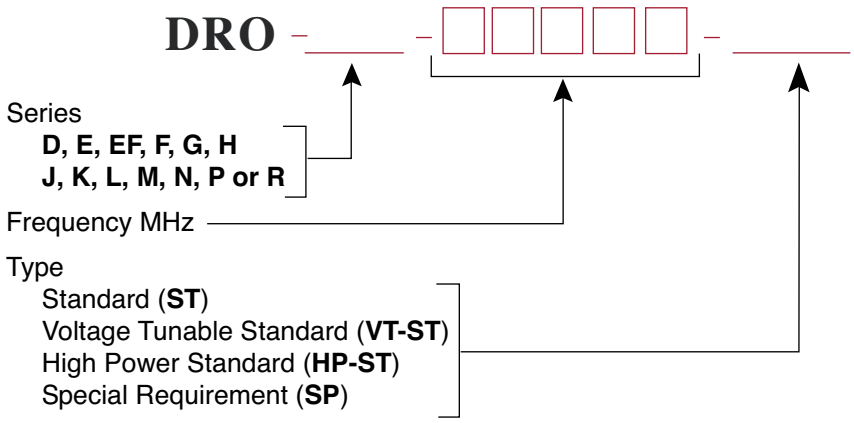
TYPICAL TUNING CURVE (F = 10 GHz)



TYPICAL PHASE NOISE CURVE (F = 10 GHz)



ORDERING INFORMATION



Note: When specifying type, include applicable detailed information.

Example 1: 12 GHz DRO standard: DRO-G-12000-ST.
Example 2: 4.5 GHz DRO with +17 dBm power: DRO-E-04500-HP-ST.
Example 3: 15 GHz DRO with voltage tuning: DRO-H-15000-VT-ST.
Example 4: 8 GHz DRO with any specification different than listed in catalog: DRO-F-08000-SP, please contact Narda-MITEQ.

MECHANICAL SPECIFICATIONS

Size per outline number
- 1 ..... 2.1" x 2.75" x 1.08"
- 2 ..... 1.75" x 2" x 0.85"
- 3 ..... 1.39" x 1.6" x 0.7"
- 4 ..... 1.05" x 1.45" x 0.63"
- 5 ..... 1.05" x 1.45" x 0.63"

Weight ..... Frequency dependent, please consult Narda-MITEQ where critical
RF connectors ..... SMA female
DC connectors ..... Feedthru filter

ENVIRONMENTAL SPECIFICATIONS

Narda-MITEQ's standard dielectric resonator oscillators have been designed to meet the below maximum environmental conditions (for standard specification, see pages 000 and 000).

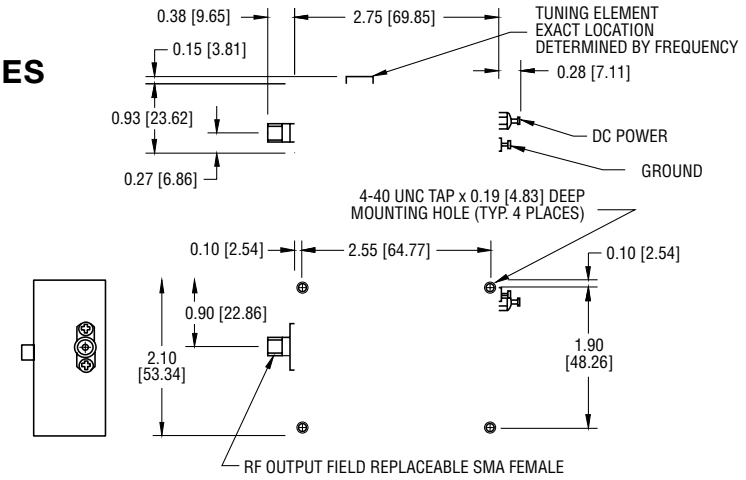
Temperature
- Operating ..... -55 °C to +95 °C
- Storage ..... -65 °C to +115°C

Humidity ..... 95% at 40 °C noncondensing
Shock (survival) ..... 30 g's, 10 ms pulse
Vibration (survival) ..... 20 Hz to 2000 Hz random to 4 g's rms

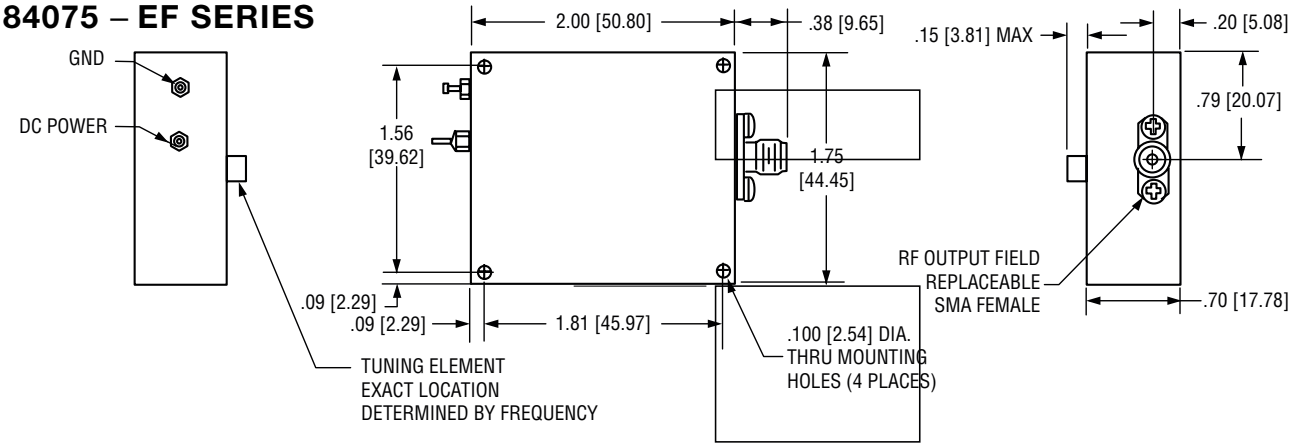
NOTE: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.

OUTLINE DRAWINGS

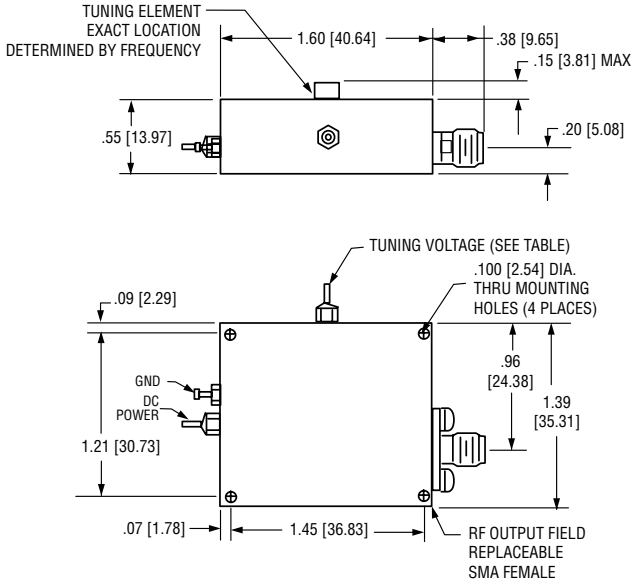
OUTLINE 1
184074 – D, E SERIES



OUTLINE 2
184075 – EF SERIES



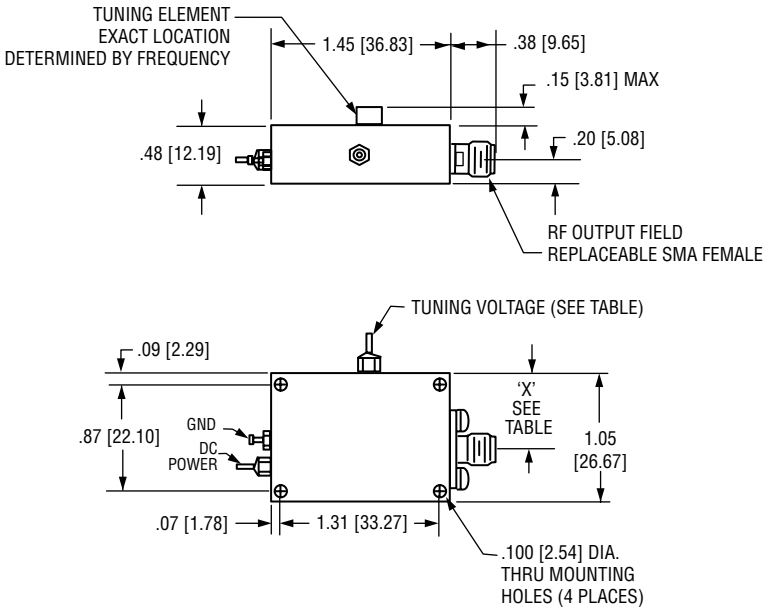
OUTLINE 3
184076 – F SERIES



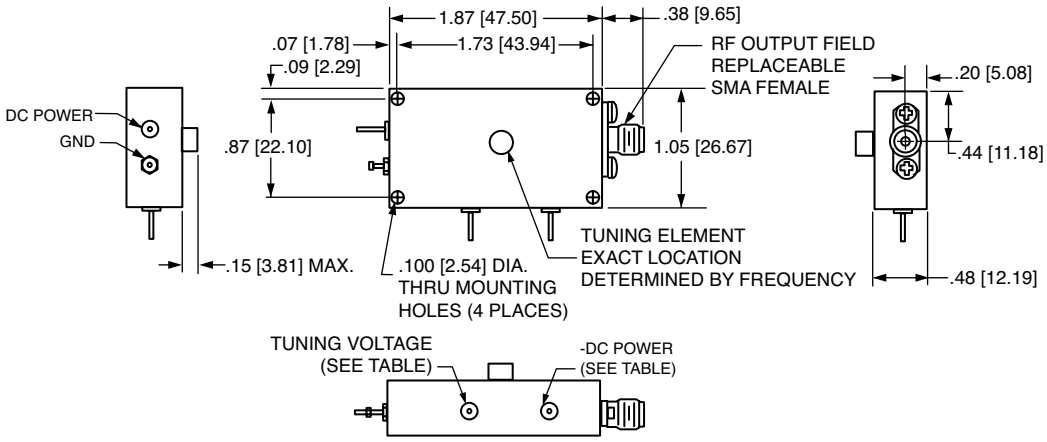
NOTE: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.

OUTLINE DRAWINGS

OUTLINE 4
184077 – G, H, J, K, L, M, N SERIES



OUTLINE 5
184090 – P, R SERIES



NOTE: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.

TCDRO SERIES

FEATURES

- Ultra-clean source ideal for low spur application
- High-reliability design
- Very low frequency drift over temperature
- Buffered output
- 100% burn-in

OPTIONS

- Special (-SP) (please contact factory before ordering)
  Special is defined as a requirement with a specification(s) different than the standard catalog. For example, extended or narrowed temperature range, different output power, different DC power requirement, etc.extended or narrowed temperature range, lower output power, different DC power requirement, etc.

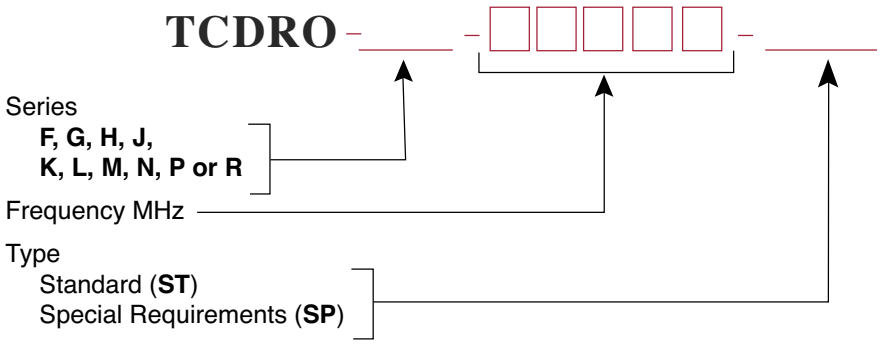
ELECTRICAL SPECIFICATIONS

PARAMETERS	UNITS	SERIES - ST (STANDARD)									
		F	G	H	J	K	L	M	N	P	R
Operating frequency range (Note 2)	GHz	6.5 to 8.8	8.8 to 12	12 to 16	16 to 18	18 to 20	20 to 22	22 to 24	24 to 26	26 to 33	33 to 40
Output power (Note 1)	dBm, min.	+17	+17	+17	+17	+11	+11	+11	+11	+11	+11
Output power variation over temperature range	dB, max.	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5
Harmonics and fundamental	dBc, min.	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Spurious	dBc, min.	-80	-80	-80	-80	-80	-80	-80	-80	-80	-80
Mechanical tuning	MHz, min.	±10	±10	±10	±10	±10	±10	±10	±10	±10	±10
Frequency pushing	kHz/V, max.	15	15	20	25	30	30	30	30	40	50
Frequency pulling (1.5:1 VSWR)	MHz, peak-to-peak max.	0.5	0.5	0.5	0.5	1	1	1	1	1	2
Frequency drift temperature coefficient (Note 3)	ppm/°C, max.	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Phase noise @ 10 kHz offset	dBc/Hz, typ.	85	80	75	75	75	75	75	75	75	65
DC power requirements	Volts	15	15	15	15	15	15	15	15	15	15
Current	mA, max.	220	220	220	230	120	120	120	120	120	120
Outline drawing		184091					184092				
Temperature range	°C	-20 to +70									

Notes:
1. Output power is guaranteed into 50 ohm load.
2. Operating frequency must be specified.
3. Averaged over the full temperature range.

Narda-MITEQ also offers TCDROs with enhanced specifications as special models (-SP).

ORDERING INFORMATION



Note: When specifying options, include applicable detailed information.

Example 1: 6.5 GHz TCDRO standard: TCDRO-F-06500-ST.

Example 2: 12 GHz TCDRO with any specification different than listed in catalog: TCDRO-G-12000-SP, please contact Narda-MITEQ.

MECHANICAL SPECIFICATIONS

Outline drawing

Size 184091 ..... 2.5" x 2.34" x 0.8"

184092 ..... 1.8" x 2" x 0.65"

Weight ..... Frequncy dependent, please consult Narda-MITEQ where critical

RF connectors ..... SMA female

DC connectors..... Feedthru filter

ENVIRONMENTAL SPECIFICATIONS

Narda-MITEQ's standard dielectric resonator oscillators have been designed to meet the below maximum environmental conditions (for standard specification, see pages ### and ###).

Temperature

Operating ..... -55 °C to +95 °C

Storage ..... -65 °C to +115°C

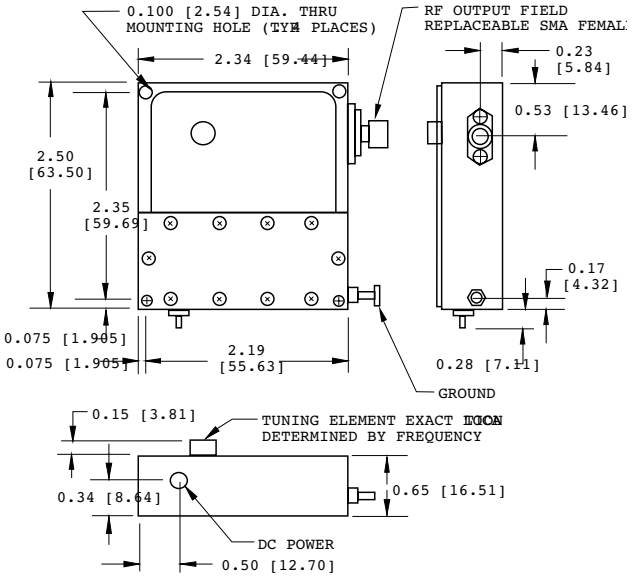
Humidity ..... 95% at 40 °C noncondensing

Shock (survival) ..... 30 g's, 10 ms pulse

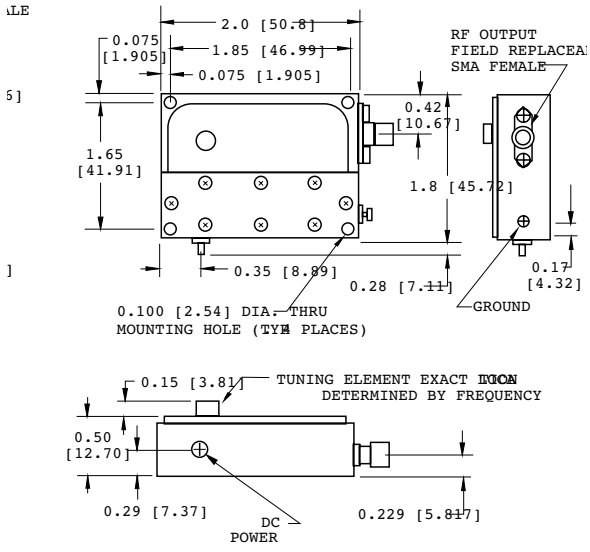
Vibration (survival) ..... 20 Hz to 2000 Hz random to 4 g's rms

OUTLINE DRAWINGS

184091 – F SERIES



184092 – G, H, J, K, L, M, N, P, R SERIES



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