KRATOS | GENERAL MICROWAVE
Microwave Electronics Division

VOLTAGE CONTROLLED OSC. (VCO)
DIGITALLY TUNED OSC. (DTO)
SYNTHESIZERS

FREQUENCY SOURCES

TABLE OF CONTENT

The information contained in this data sheet is basic marketing information and does not contain any export controlled information.

COMPANY PROFILE

ABOUT KRATOS GENERAL MICROWAVE

KRATOS General Microwave incorporates engineering innovation and excellence with high-quality design and production to deliver special requirements and mission critical needs.

Having built numerous products for the most rigid requirements and demanding environments, KRATOS General Microwave has become a leader in Innovative Microwave Solutions. Whether it is off-the-shelf, or custom made, KRATOS General Microwave designs provide top performance at a competitive price and uncompromised quality, while powering many military, governmental and commercial applications.

For more than 50 years, our multi-disciplinary expertise in RF technology, signal processing, hardware and firmware have been utilized worldwide in state-of-the-art microwave components and subassemblies for a wide range of defense and civil applications.

TYPICAL APPLICATIONS

Military and Defense - Electronic Warfare (EW) Systems, Radars, Missiles, UAVs, Smart Munition/ Precision Guided Munition, GPS Immune/Navigation Warfare, Communications, Homeland Security (HLS), Simulators, Munition Proximity Sensors and Software Defined Radio (SDR).

Commercial - In-Flight Connectivity, Maritime and Train Connectivity, Airborne Weather Radars, IFF, Test Equipment, RF and Fiber Optic Communications, Industry Manufacturing Instrumentation, Research Laboratories and Medical Instruments.

PRODUCT LINES

MICROWAVE PRODUCT SOLUTIONS

Broadband Oscillators and Synthesizers - This product line covers 0.5 to 18 GHz band (and beyond) and includes Fast Indirect Synthesizers with less than 1 microsecond settling time with modulation, Direct Coherent Synthesizers with 40 nanosecond settling time, Digitally Tuned Oscillators (DTOs), Phase Locked Oscillator PLOs) and Voltage Controlled Oscillators (VCOs).

Solid State Power Amplifiers (SSPAs) - Up to 1KW in X, Ku and Ka-bands for missiles, airborne Radars and HLS radars. Up to 1 KW in VHF for military and non-military applications as well as for Pulse Power Amplifiers for IFF systems and Low Noise Amplifiers.

Data-Links - A variety of customized DATA-LINKS subsystems, from small, simple, low cost and low power to complex, high-end and high-power products that incorporate stat-of-the-art microwave technology, mixed signal processing, System on Chip (SoC) devices, high power FPGAs and other Digital technologies.

INTEGRATED MICROWAVE ASSEMBLIES (IMAS) AND SUB-SYSTEMS

Beam Forming Modules - A versatile line of complex, high-density modules, utilizing Surface Mount Technology for Phase Array Radars.

Transceivers and Receivers - Superior performance and cost-effective product line that includes both Narrowband and Broadband products and covers 0.5 – 18 GHz bands. A perfect fit for various applications, such as Direction Finder subsystem for ELINT and ESM airborne systems, Data Links for Missiles, Smart Munition, UAVs, Centric Network Warfare, JDAM/BDI and more.

Custom IMAs - Integrated Microwave Assemblies (IMA) built per specific requirements such as: RF Front-Ends, Complicated Switching Assemblies and Frequency Up and Down Converters.

CONTROL COMPONENTS

Control Components (0.1 – 40 GHz) - Based on PIN diode and proprietary coupler technology, this product line includes low, medium, and high-power switches (SPST up to SP16T), Switched Filter Banks, Attenuators, Limiters, Modulators, Phase Shifters, Frequency Translators. All control components are available with either digital or analog control.

STANDARDS AND CERTIFICATIONS

KRATOS General Microwave Quality Management has been certified to AS9100 and ISO9001. General Microwave Corporation US is certified to ISO 9001:2015. Certain companies within the Microwave Electronics Division are FAA certified to maintain microwave modules for commercial aircraft and is in process of being certified by the European Union Aviation Safety Agency (EASA). KRATOS Microwave Electronics Division shares the concern for a better world for all, and certain companies within the division are certified to ISO 14001. Our products can be ordered to be REACH or RoHS compliant.

Kratos General Microwave detailed product line catalog is available online at www.kratosmed.com/gmcatalog.

HTGSWGPE["UQWTEGU"IGPGTCN

Kratos General Microwave has been a leader in the development of microwave frequency sources for more than 30 years. Our microwave frequency sources product line consists of state of the art high performance Synthesizers and Free Running Oscillators.

Kratos General Microwave offers a broad range of microwave frequency sources: Direct Synthesizers, Fast Indirect Synthesizers, Digitally Tunes Oscillators (DTO) and VCOs. In addition to catalog, COTS (Commercial Off The Shelf), MOTS (Modified Off The Shelf) products. Kratos General Microwave is offering a variety of custom frequency sources for demanding requirements and severe environmental conditions such as fighter aircraft and missiles.

Kratos General Microwave frequency sources are used in various applications such as: RF missile seekers, EW, SIGINT, Smart Munitions, Data Links, radar, and simulators.

If your system requirements demand a frequency source which cannot be found in this catalog, please do not hesitate to contact Kratos General Microwave directly.

Frequency Sources Final Testing

F GHKP KV KQP "QH"P C T C MGVGT U

Htgqwgpe{ 'Ugvvrkpi /P quv-Vwpkpi 'F tkhv: The maximum deviation in frequency at a given time, following a change in tuning command, relative to the frequency one second after the change in tuning command. The worst-case condition usually occurs for frequency steps from one end of the band to the other. (Results of a typical measurement are shown in Fig. 1.) Settling time usually refers to the response up to several hundred microseconds, while post-tuning-drift usually refers to the variation from several hundred microseconds to as long as several hours.

Mqf wrcvkqp 'Ugpukvkxkv{ 'Tcvkq: The ratio between the maximum and minimum slopes of the frequency vs. voltage tuning curve of a VCO over its frequency band. (For a DTO, this is defined at the FM modulation port.)

Htgqwgpe{ 'F gxkcvkqp 'Bcpf y kf vj : The peak-to-peak frequency deviation obtained for a given peak-to-peak voltage swing at the modulation port of a VCO or DTO.

Mqf wrcvkqp "Bcpf y kf vj :" The modulation frequency at which the frequency deviation bandwidth of a VCO or DTO decreases by 3 dB relative to the deviation bandwidth at low frequencies.

P j cug "P qkug:" The sideband noise level at a given deviation, f_m, from the oscillator frequency, relative to the carrier power level and normalized to a bandwidth of 1 Hz.

Tgukf wcn'HM:" The peak-to-peak frequency deviation of an oscillator at its –3 dBc points, when measured on a spectrum analyzer with a resolution bandwidth of 1 kHz. (See Fig. 2).

Vgorgtcwtg 'Uvcdkrkv{ : The total oscillator frequency variation over the rated operating temperature, usually expressed in ppm/°C.

P wrnkpi :" The maximum variation in oscillator frequency relative to its frequency when operating with a matched load, when the output load is rotated through a full 360° phase change. The peak-to-peak variation in oscillator frequency is approximately twice the pulling figure defined above. By using the following approximate formula, the pulling figure may be scaled as a function of the VSWR:

$$\Delta f \text{ peak-to-peak} = \frac{f_o}{2\,Q_{EXT}} (S - 1/S)$$

where f_o is the oscillator frequency, Q_{EXT} is the external Q of the circuit, and S is the load VSWR.

P wuj kpi :" The incremental change in oscillator frequency that results from an incremental change in power supply voltage.

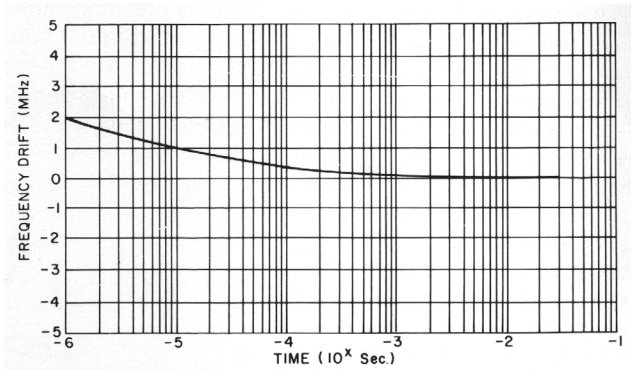


Fig. 1-Measured settling time of 8-12 GHz VCO

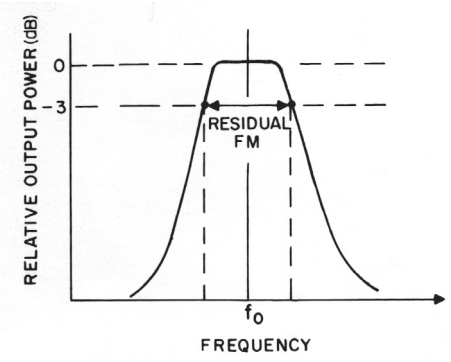


Fig 2–Residual FM

Mkctqy cvg"Htgqwgpe{ "U{pvj guk|gtu

Kratos General Microwave has developed a broad line of general-purpose synthesizers to be used in various applications. Our synthesizer catalog product line consists of high performance, broadband, and fast indirect synthesizers (FIS). We provide a cost-effective solution to the requirements of a high performance frequency source for various electronic systems.
To provide optimum solutions for diverse requirements, Kratos General Microwave has developed a variety of Fast Indirect Synthesizers (FIS) with different parameter trade-offs: The standard SF series synthesizer product line for fast tuning speed, the SM series synthesizer with frequency modulation capability while in synthesizer mode, and the low cost compact synthesizer SW series.

In addition to the catalog synthesizers product lines, KRATOS General Microwave supports specific customers' requirements, by providing synthesizers built per customer's specifications. Custom synthesizers are provided for missile seekers and EW applications.

HTGSWGPE["U[PVJGUKZGTU""-"UGNGEVKQP "IWKFG

HTGSWGPE["TCPIG"*IJ|+ 0.5 2 4 6 12 18 40	MQFGN"	PCIG	EQMMGPVU
0.5 — 3	SF6053	7	1 µsec Indirect Synthesizer
2 — 18	SF6218		
2 — 19	SF6219		
2 — 18	SM6218	14	1 µsec Indirect Synthesizer with frequency modulation
6 — 18	SM6618		
2 — 20	SM6220		
""005"" — "8"	SW0580	20	Compact Indirect Synthesizers
1.25 — 20	SW0120		
2 — 20	SW0220		
6 — 18	SW0618		
005"" — "40	FE0P540	24	Frequency Extender
2"" — "40	FE0240		
"005"" — "40	FE0P520		
"0025"" — "20	FE0P240		
0025"" — "40		28	Custom Direct Synthesizers
		29	Custom Synthesizer
		30	Narrow Band Synthesizers

Ugtkgu"UH60"Hcuv"Kpf ktgev"U{ pvj guk| gt

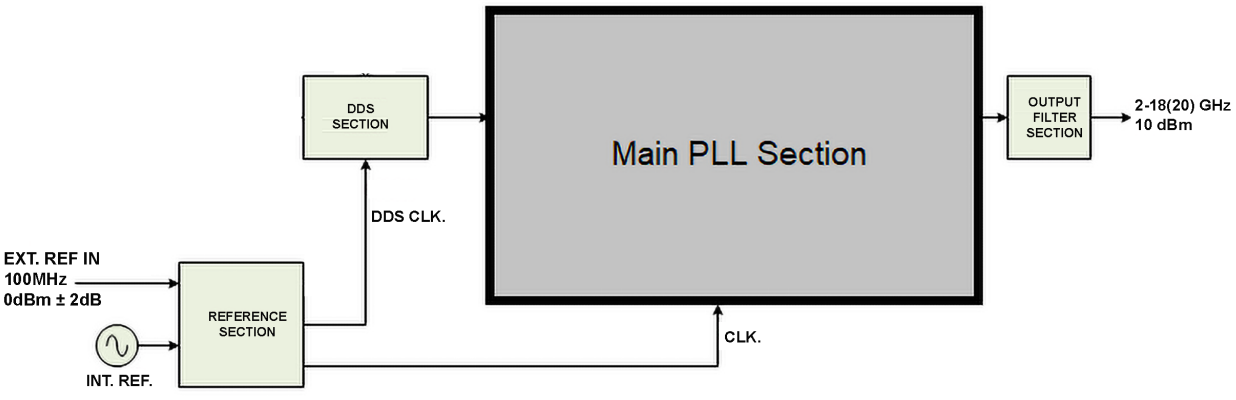
- "J ki j "Upggf :"1 "µuge
- "Y kf g"Htgqwgpe{ "Tcpi g:"005"vq"19"1 J |
- "Kpvgt pcn"Tgf gt gpeg"Et{ uvcn
- "Nqy "Pj cug"Pqkug
- "Umcm'Uk| g
- "J ki j "Tgrkcbkrkv{
- "Ugvgt g"Gpvkt qpmgpvcn'Eqpf kvkqpu

Synthesizer Model SF6218

KRATOS General Microwave has developed the series SF60 fast, broadband, low phase noise and small size synthesizer, to meet the needs of a general purpose fast synthesizer for applications such as Signal Generators and Automatic Test Equipment at an affordable price.

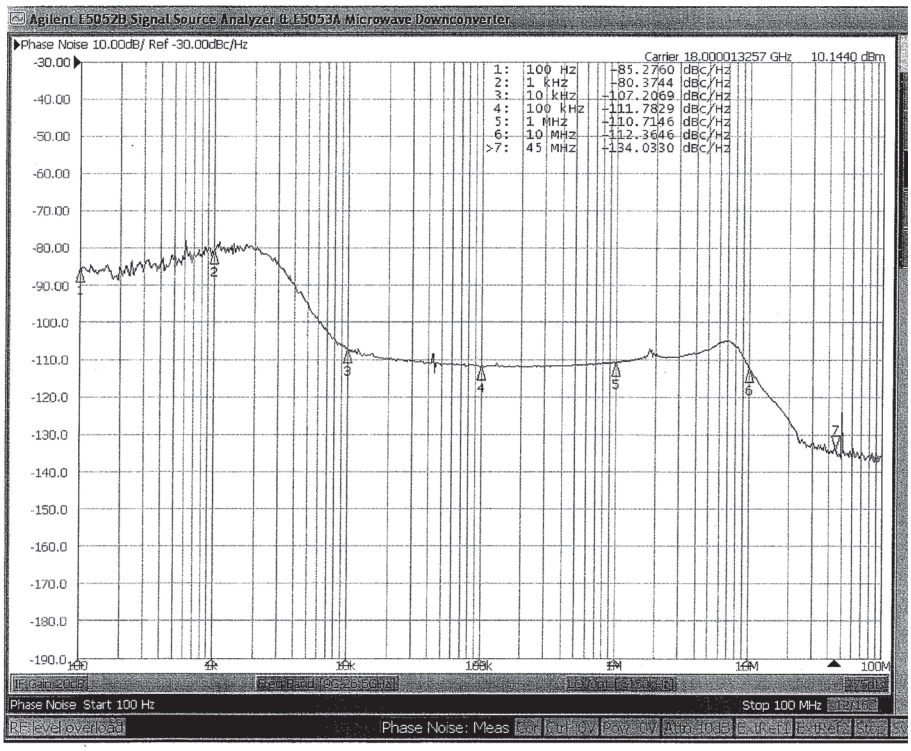
For military applications, this synthesizer requires option G09 to comply with Military Standards. The specific environmental MIL STD requirements as well as the EMI/RFI specifications should be provided by the customer.

Each synthesizer is supplied with an internal reference crystal oscillator. The customer has the option of connecting an external reference crystal oscillator.

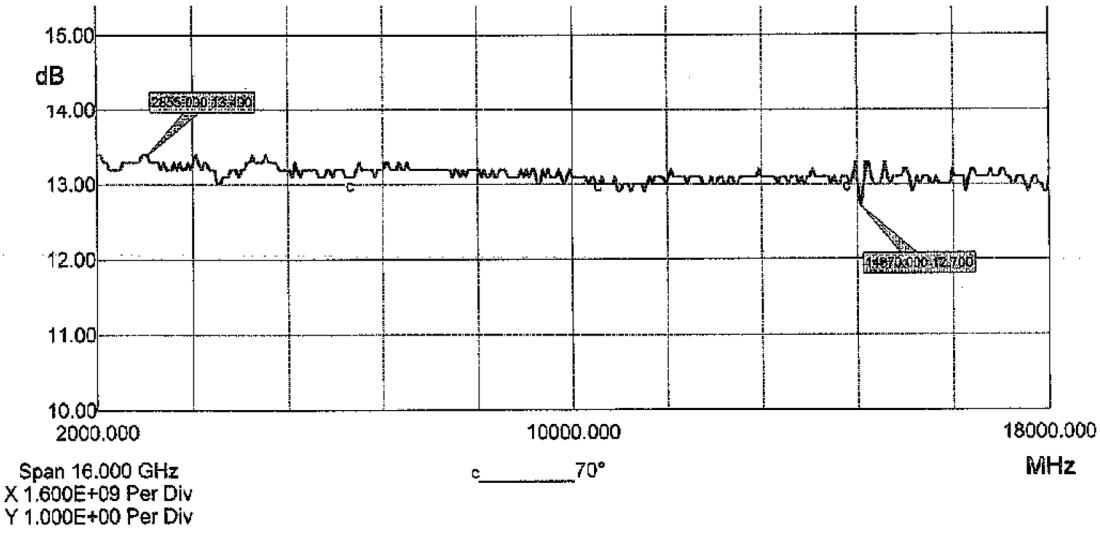


Synthesizer Block Diagram

V[PKECN"PGTHQTMCPEG

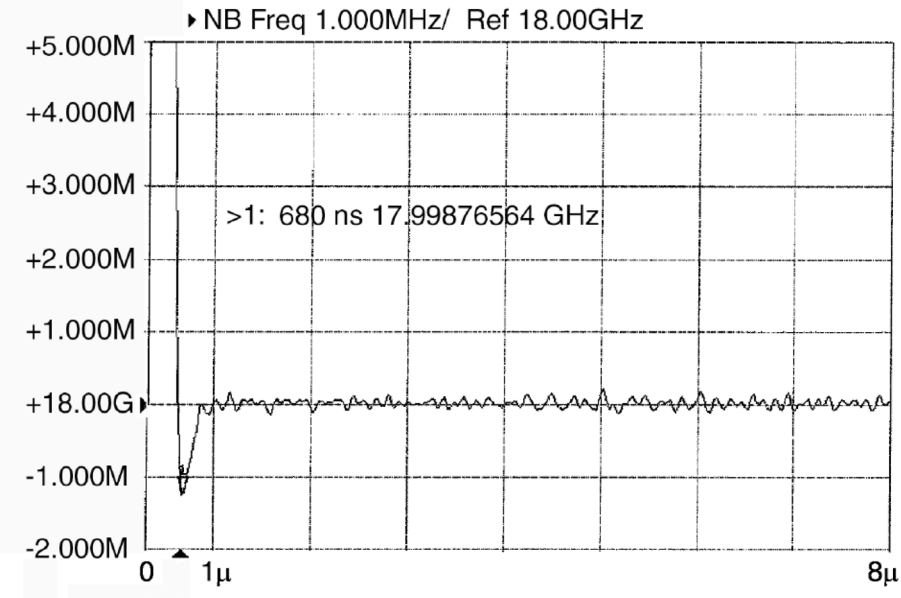


Pjcug"Pqkug"@"18"I J|

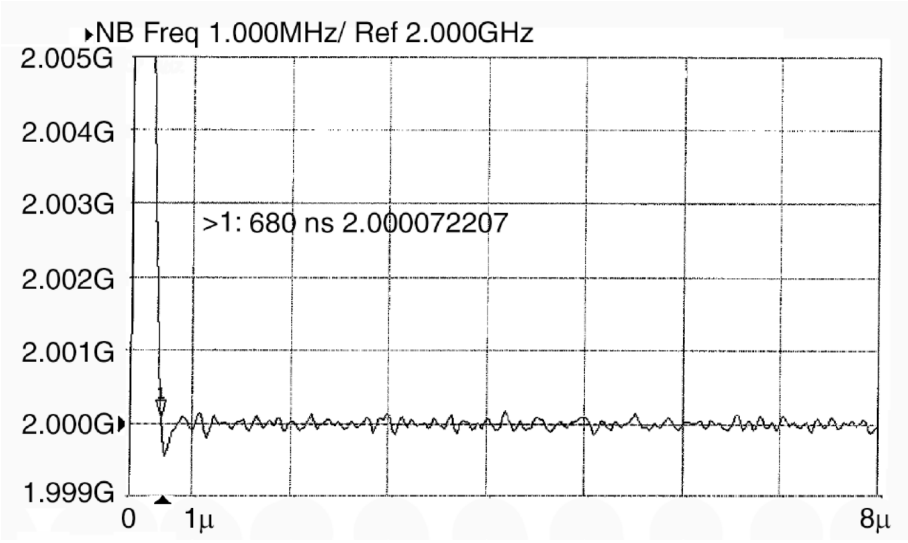


Qwvpw"Pqy gt "Hncvpguu"@70°

V[PkEC N"P GT HQT MC P EG



Ugvvrkpi "Vkmg"2"vq"18"I J|



Ugvvrkpi "Vkmg"18"vq"2"I J|

UGTKGU"UH60"U[PVJGUKGT"UPGEKHKECVKQPU

		UPGEKHKECVKQP		
PCTCMGVGT		MQFGN"UH6053	MQFGN"UH6218	MQFGN"UH6219
1	HTGSWGPE["TCPIG"*IJ| +	0.5 to 3 (1)	2 to 18 (1)	2 to 19 (1)
2	CEEWTCE[	±2		
3	HTGSWGPE["CIKPI	±2 First year.	±1 per year, after first year	
4	QWVPWV"PQYGT			
4.1	""""Min.. (dBm) *1+	10		
4.2	""" Variation, over freq. and temp., max. (dB)	±2.5		
5	UGVVNKPI "VKMG"*2+","mcx0"*µuge+	1		
6	UUB"PJCUG"PQKUG"*3+,"mcx"*f Be/J| +			
6,1	@ 100 Hz Offset	-87	-77	
6.2	@ 1 kHz Offset	-100	-90	-90 (3)
6.3	@ 10 kHz Offset	-110	-100	-100 (3)
6.4	@ 100 kHz Offset	-114	-104	-104 (3)
6.5	@ 1 MHz Offset	-114	-104	-104 (3)
6.6	@ 10 MHz Offset	-119	-106	-106 (3)
7	JCTMQPKEU,"mcx"*f Be+	–20		
8	UWB-JCTMQPKEU,"mcx"*f Be+	–50		
9	UPWTKQWU,"mcx"*f Be+	–50	–50	–50 (3)
10	PWNNKPI "@"XUY T"2:1"mcx"*mJ| +	<1		
11	PWUJKPI ,"mcx"*mJ| /X+	±1		
12	HTGSWGPE["EQPVTQN"*PCTCNNGN+	18 BITS	21 BITS	
13	HTGS0"UVGP"UKG,"pqmkpcn"NUB"*mJ| +"*1+	10		
14	TGHGTGPEG"ET[UVCN"QUEKNNCVQT ""*4+			
14.1	"""KPPWV"HTGSWGPE[,"*MJ| +"*5+	100		
14.2	"""KPPWV"PQYGT,""*f Bm+	0 ±2		
15	PQYGT"UWPPN["TGSWKTGMGPV,"*mC+: (12V ±5% –12V ±5% (5V ±5%	1,800 300 1,500		
16	PQYGT"EQPUWMPVKQP,"mcx"*Y +	30		
17	QPGTCVKPI "VGMP0"*°C) *1+"	-20 to (70		
18	QVJGT'GPXKTQPMGPVCNPCTCMGVGTU	APPLICABLE FOR AIRBORNE APPLICATIONS		
19	FKMGPUKQPU,"Kpej gu"*mm+	6 x 6 x 1.1, (152.4 x 152.4 x 27.9)		

(1) Other values are Optional
(2) To within ±1 MHz from final frequency
(3) Degraded by 3 dB @ 18 to 19 GHz
(4) External reference oscillator optional
(5) 10 MHz Optional

QPVKQP"*I 09+"GPXKTQPMGPVCN"EQPFKVKQPU

10"Uvqtcig"Vgmpgtcvwtg" -40"vq"+120E

20"Mgejcpkecn"Ujqem" MKN-UVF-810E,"Mgvjqf"51602 Ptqegfwtg"K

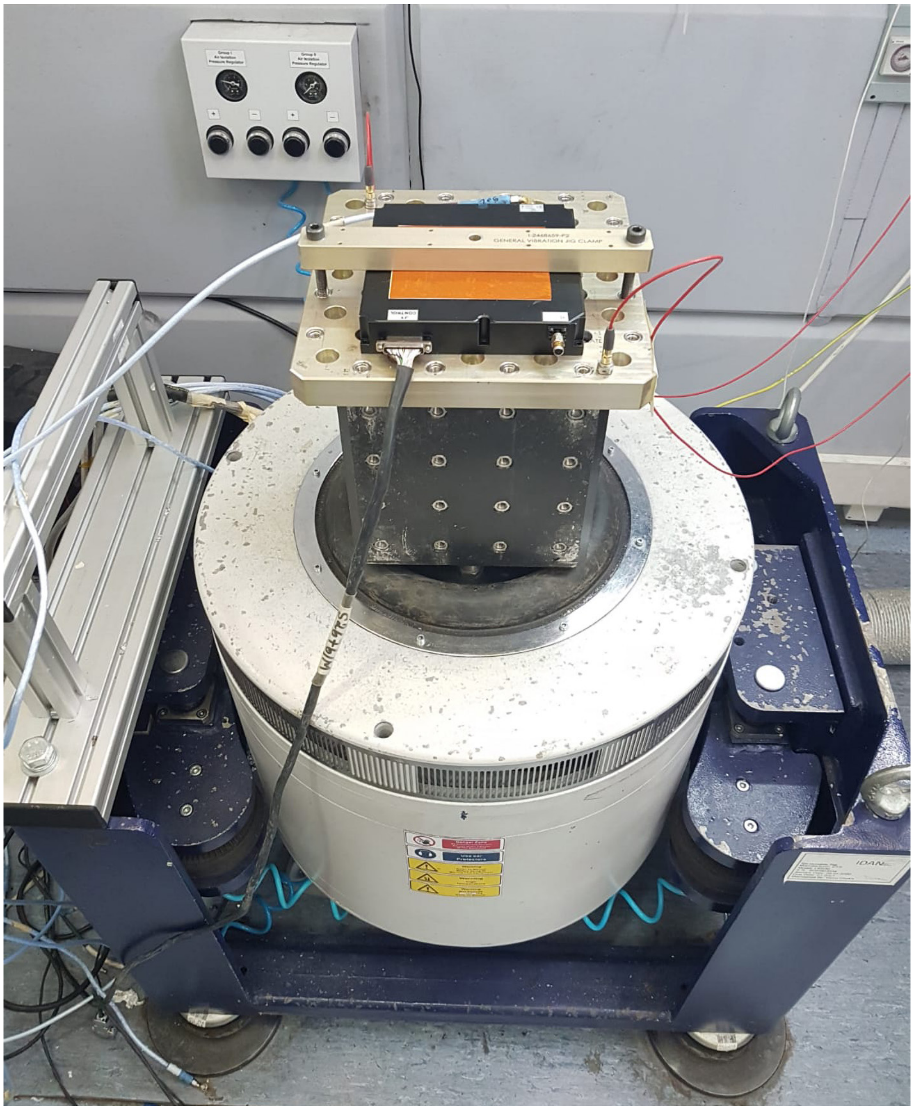
30"Tcpfqm"Xkbtcvkqp" MKN-UVF-810E,"Mgvjqf"51402 Hki wtg"51402-5,"Ewtvg"CI,"903"Itmu

40"Jwmkfkv{" MKN-UVF-810G,"Mgvjqf"50703 Ptqegfwtg"KKK

50"Cnvkvwfg" 50,000"fv0

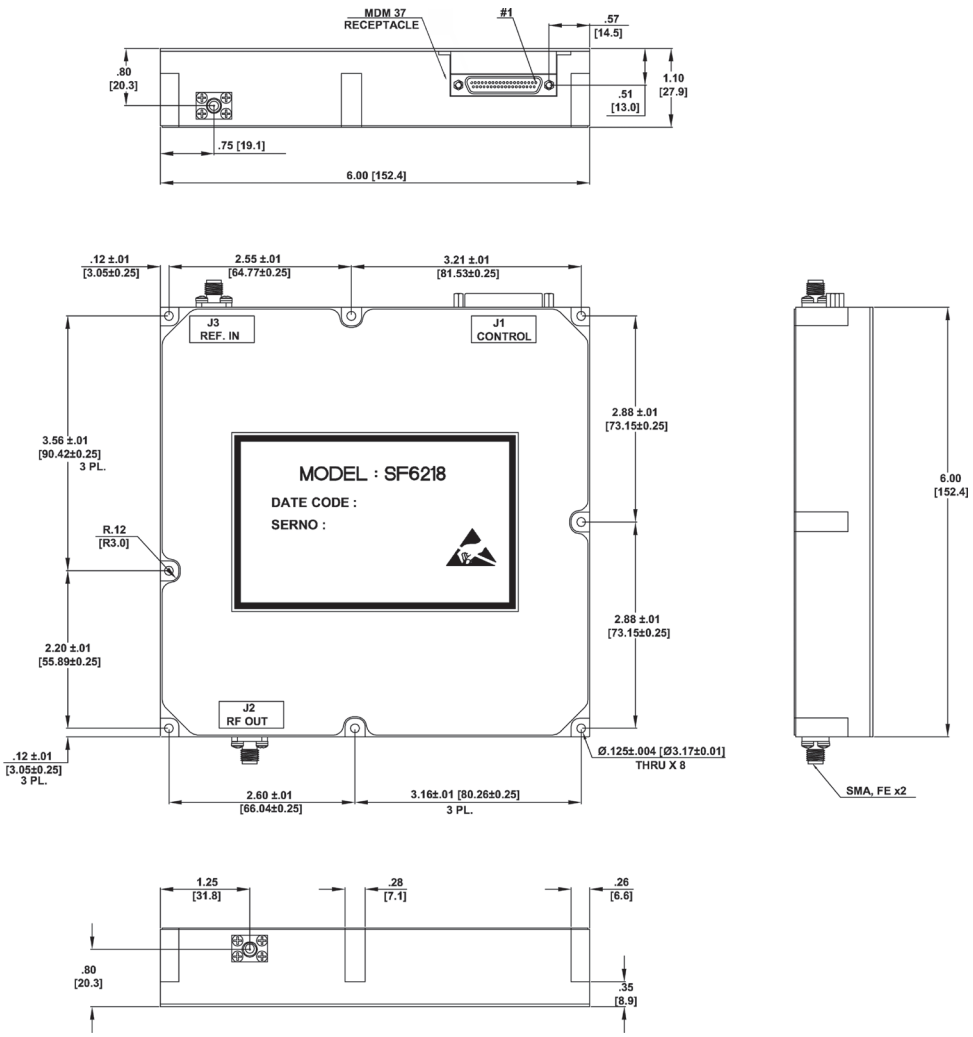
CXCKNCBNG"QPVKQPU

Qpvkqp"Pq0	Fguetkpvkqp
I02	Qpgtcvkpi"Vgmpgtcvwtg" -40"vq"+85°E
I08	10"MJ|"Tgfgtgpeg
I09	"Iwctcpvggf"vq"mggv" Gpvktqpmgpvcn"Tcvkpiu



XKBTCVKQP"VGUVKPI

F KMGP UKQP U"cpf "Y GK JV



Weight (Approx.): 1,0 Kg (2.2 Pounds)

DIMENSIONS IN INCHES (mm)

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

P kp"Cuuki pmgpv"f qt "Eqppgevqt "L1

P kp"Cuuki pmgpv"f qt "Eqppgevqt "L1:			
P kpP q0	Uki pcn'P cmg	P kpP q0	Uki pcn'P cmg
1	Strobe	20	+12V
2	+12V	21	+12V
3	GND	22	GND
4	+5V	23	+5V
5	+5V	24	GND
6	GND	25	-12V
7	-12V	26	Frequency Bit 0
8	Frequency Bit 1	27	Frequency Bit 2
9	Frequency Bit 3	28	Frequency Bit 4
10	Frequency Bit 5	29	Frequency Bit 6
11	Frequency Bit 7	30	Frequency Bit 8
12	Frequency Bit 9	31	Frequency Bit 10
13	Frequency Bit 11	32	Frequency Bit 12
14	Frequency Bit 13	33	Frequency Bit 14
15	Frequency Bit 15	34	Frequency Bit 16
16	Frequency Bit 17	35	Frequency Bit 18 *2+
17	Frequency Bit 19 *2+	36	Frequency Bit 20 *2+
18	N.C. *1+	37	N.C. *1+
19	Lock Indicator		

Note:

(1) For factory use only. All N.C. pins should not be connected

(2) For Model SF6053 - Not Connected

- "Jkij "Upggf :"1"µuge
- "Ykf g"Htgqwgpe{"Tcpi g:"2"vq"18"I J|
- "Mqf wrcvkqp"Upcp:"1"I J|
- "Cpcrqi "&"Fkikvcn"Mqf wrcvkqp"Kprwv
- "Umcrn"Uk| g
- "Jkij "Tgnkcdkrkv{
- "Ugvgtg"Gpvkt qpmgpvcn"Eqpf kvkqpu

Synthesizer Model SM6218

UgtkguUM60Hcuvkpf kt gevU{ pvj guk| gt y kvj "Htgqwgpe{ "Mqf wrcvkqp

KRATOS General Microwave has enhanced the series SF60 fast, broadband, indirect synthesizer by adding a modulation function. With this function, the synthesizer is well suited for use in various test systems where the signal output of the signal generator needs to be modulated rather than be just a CW signal.

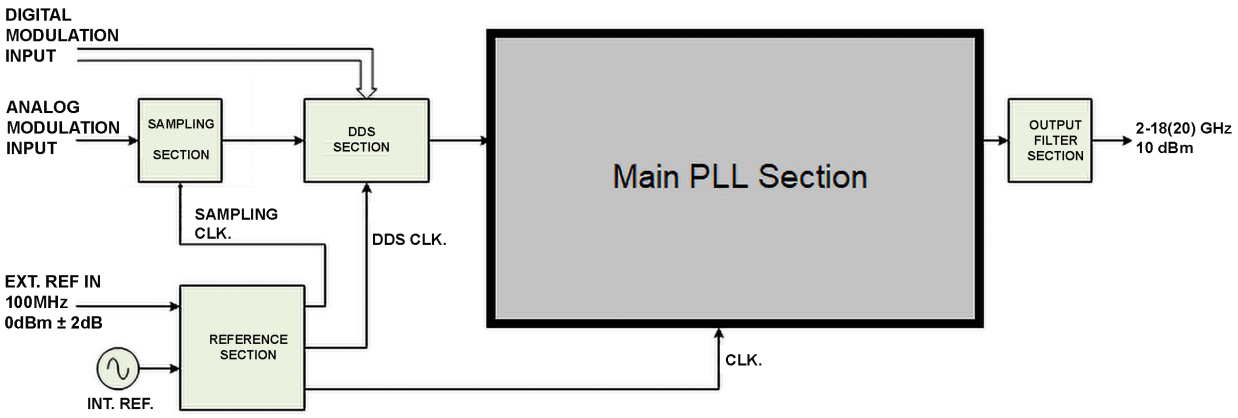
The modulation input can be an analog voltage or a digital signal. This provides the system designer with more flexibility and possibilities in his application for complex modulation options. Fig. 1 is the spectrum of the output signal with a 1 MHz sine-wave modulation input.

Of special importance is the fact, that this synthesizer remains fully locked even during Frequency Modulation. As a result of it, the high frequency accuracy and other key performances of the synthesizer are kept all of the time. For this reason, in this synthesizer there isn't the "movement" of the center frequency nor the problem of non linearized modulation.

Each synthesizer is supplied with an internal reference crystal oscillator. The customer has the option of connecting an external reference crystal oscillator.

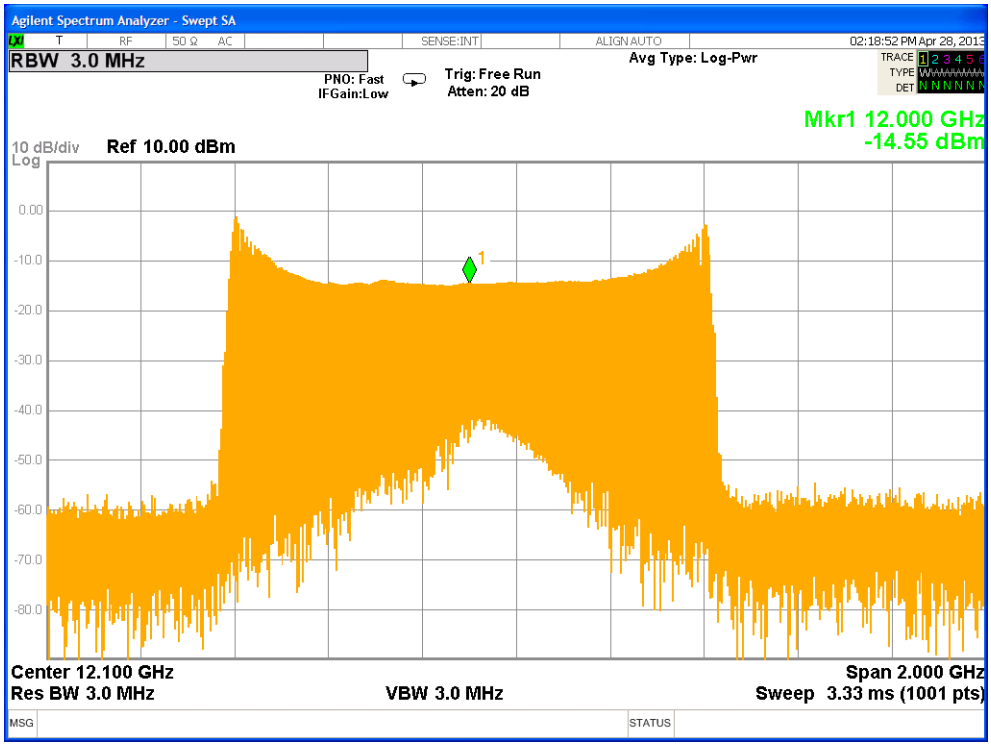
APPLICATIONS

The Model SM6218 Fast Synthesizer with Frequency Modulation capability, has been developed as an enhancement to the existing Series SF60 1 usec, CW Synthesizer family. It offers a higher performance and a cost effective alternative to signal generators currently used in various applications such as Electronic Warfare (EW), Simulators, and Test Systems that require improved frequency accuracy, phase noise and frequency modulation capabilities. In addition, the Model SM6218 design allows the flexibility to customize performance to specific application requirements.

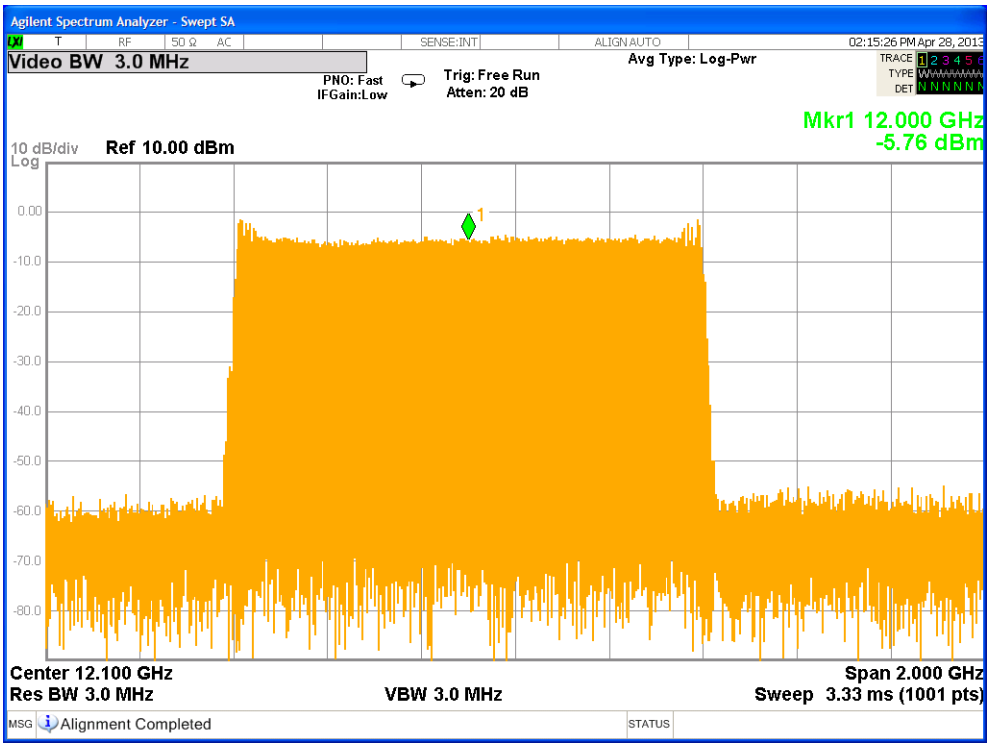


Synthesizer Block Diagram

MQF GN"UM6218"–"V[P KECN"MQF WNCVKQP "UP GEVTWMU



Hki 0'1"-"1"I J | "Mqf wncvkqp"Upgevtwm"wukpi "c"Ukpg"y cvg"uki pcn



Hki 0'2"-"1"I J | "Mqf wncvkqp"Upgevtwm"wukpi "c"Vtkcpi rg"uki pcn

UGT KGU"UM60'U[P VJ GUK GT "UP GEKHKECVKQP U

		UP GEKHKECVKQP "-"MQF GN		
PCTCMGVGT		UM6218	UM6618	UM6220
1	HTGSWGPE["TCPI G"*I J | +	2 to 18 *1+	6 to 18 *1+	2 to 20 *1+
2	CEEWTCE["*P P M+	±2		
3	HTGSWGPE["CI KPI "*P P M+	±2 First year. ±1 per year, after first year		
4	QWVPWV"PQY GT			
4.1	"""Mkp00"*f Bm+"*1+	10		
4.2	"Xctkcvkqp,"qvgt f tgq0cvc f kvgp"vgmpQ,"mcx0"*f B+	±1.5		
4.3	"""Xctkcvkqp,"qvgt "vgmpgtcvwtg,"mcx0"*f B+	±2.5		
5	UGVVNKPI "VKMG"*2+","mcx0"*µuge+	1		
6	UUB"PJCUG"PQKUG","mcx"*f Be/J | +			
6.1	"""""""@"100'J | "Qf f ugv	-60		-60
6.2	"""""""@"1"mJ | "Qf f ugv	-85		-84
6.3	"""""""@"10'mJ | "Qf f ugv	-97		-96
6.4	"""""""@"100'mJ | "Qf f ugv	-97		-96
6.5	"""""""@"1"MJ | "Qf f ugv	-97		-96
6.6	"""""""@"10'MJ | "Qf f ugv	-100		-99
7	JCTMQPKEU,"mcx"*f Be+	–30 up to 24 GHz -40 from 24 GHz to 40 GHz		
8	UWB-JCTMQPKEU,"mcx"*f Be+	NA		
9	UPWTKQWU,"mcx"*f Be+"*3+	-55		-54
10	HTGSWGPE["EQPVTQN"*PCTCNNGN+	18 BITS		
11	HTGS0"UVGP "UKG,"pqmkpcn'NUB"*mJ | +"*1+	100		
12	TGHGTGPEG"ET[UVCN"QUEKNNCVQT"*4+			
12.1	"""KP PWV"HTGSWGPE[,"*MJ | +"*5+	100		
12.2	"""KP PWV"PQY GT,""*f Bm+	0 ±2		
13	MQFWNCVKQP			
13.1	"""""""Bcpf y kf vj ,"*MJ | +	DC to 10		
13.2	"""""""Htgqwgpe{ "Fgvkcvkqp,"mkp"*MJ | +	± 500		
13.3	""""Ugpukvkvkv{ 'eqpvtqn"*3'hgvgru'pnwu'Mqf 0'QHH+	2 BITS		
13.4	"""""""Fkikvcn'Mqf wncvkqp"Eqpvtqn	10 BITS		
13.4	"""""""Fkikvcn'Ugpukvkvkv{ ,"pqmkpcn"*MJ | /bkv+	1, 1/4, 1/16, Mod. OFF		
13.5	"""""""Cpcnqi "Eqpvtqn,"*X+	±1		
13.6	"""""""Cpcnqi "Ugpukvkvkv{ ,"pqmkpcn"*MJ | /X+	500, 125, 31.25, Mod. OFF		

(1) Other values are available. Please contact Sales.
(2) To within ±1 MHz from the final frequency
(3) Spurious level is guaranteed during modulation at OFF state. When modulation is set to ON, the spurious level is -50 dBc typical.
(4) External reference crystal oscillator- optional
(5) 10 MHz Optional

UGTKGU"UM60"U[PVJGUK\GT"UPGEKHKECVKQPU

		UPGEKHKECVKQP"-"MQFGN		
PCTCMGVGT		UM6218	UM6618	UM6220
14	PQYGT"UWPPN["TGSWKTGMGPV,"mcx0"*C+			
14.1	""""""+12X"vq"+15X	3.3		
14.2	""""""-12X"vq"-15X	0.45		
14.3	""""""+5X"±5%	2.1		
15	QPGTCVKPI"VGMP0"*˚C) *1+"	-20 to (70		
16	QVJGT"GPXKTQPMGPVCN"PCTCMGVGTU	APPLICABLE FOR AIRBORNE APPLICATIONS		
17	FKMGPUKQPU,"Kpejgu"*mm+	6.48 (164.6) x 6.23 (158.2) x 1.24 (31.5)		

(1) Other Parameters are Optional

QPVKQP"*I09+"GPXKTQPMGPVCN"EQPFKVKQPU

10""Uvqtcig"Vgmpgtcvwtg""""-40⁰"vq"+120⁰E
20""Mgejcpkecn"Ujqem"   """"MKN"UVF-202H,"Mgvjqf
"""213B,"Eqpf0"B"*75I,"6"mugе+
30""Xkbtcvkqp"""""""""""""""""""""""""MKN"UVF-202H,""Mgvjqf"
"""204F,"Eqpf0"B"*006""fqwbng"cmpnkvwfg
""qt"15I,"yjkejgvgt"ku"nguu+
40""Jwmkfkv{" """""""""""""""""""""""""""MKN"UVF-202H,""Mgvjqf"
""103B,"Eqpf0"B"*96"jtu0"cv"95%+
50""Cnvkvwfg"   """"""""""""""""""MKN-UVF-202H,"Mgvjqf"105E,"Eqpf0B
"""*50,000"fv0+

CXCKNCBNG"QPVKQPU

Qpvkqp"Pq0   Fguetkpvkqp

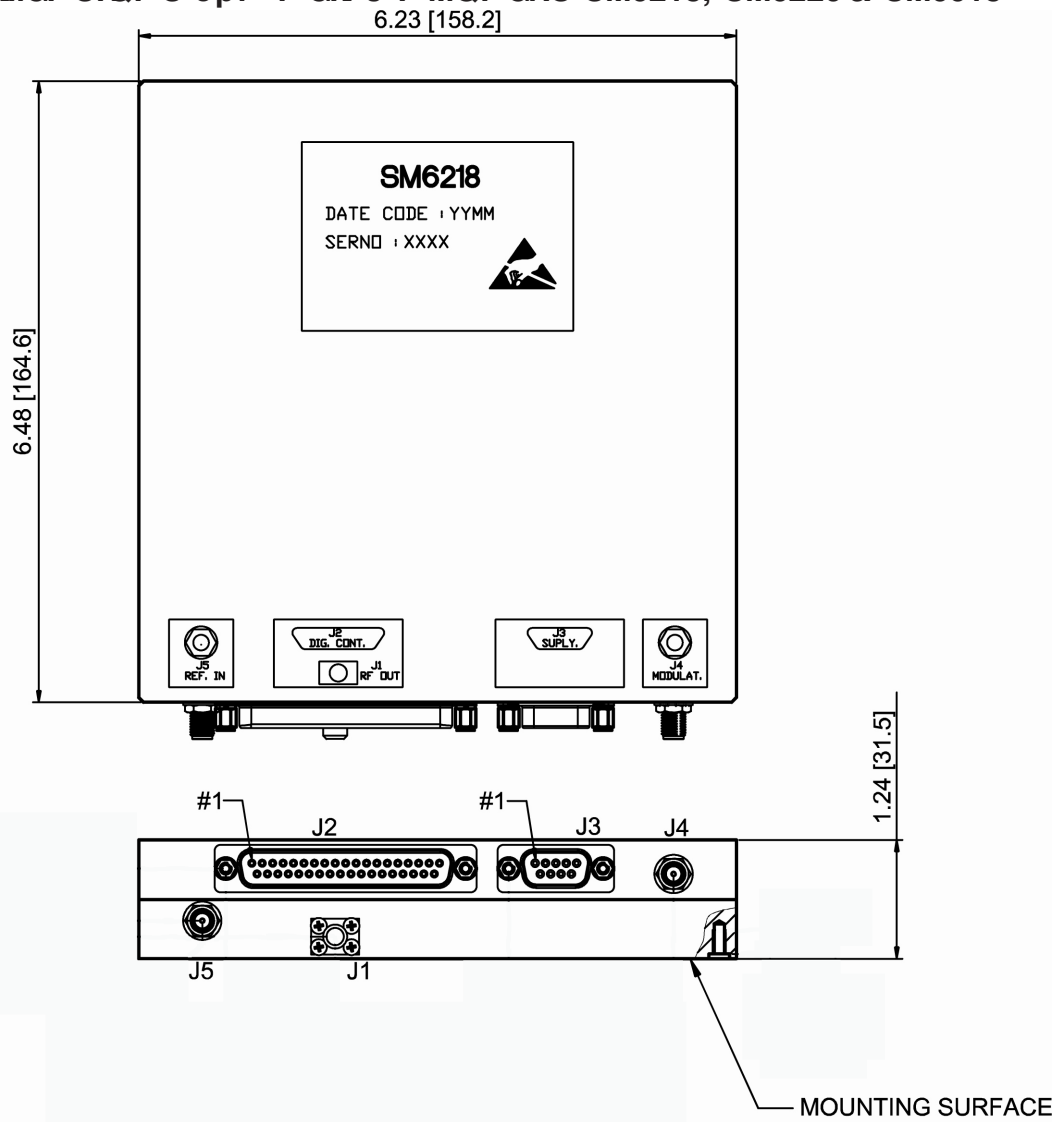
I02   Operating"Temperature

-40^{0} to ∗70^{0}C

"""""I08   10 MHz Reference

I09   Guaranteed to meet Environmental Ratings

F KMGP UKQP U"cpf "Y GK J V "MQF GNU"UM6218,"UM6220"&"UM6618



Weight (Approx.): 1,4 Kg (3.1 Pounds)

SYM	FUNCTION	DESCRIPTION
J1	RF OUTPUT	COAX. CONN. SMA FEMALE
J2	DIGITAL CONTROL	D-TYPE CONN. "DC-37P" (MALE)
J3	SUPPLY	D-TYPE CONN. "DE-9P" (MALE)
J4	MODULATION	COAX. CONN. SMA FEMALE
J5	REF. IN	COAX. CONN. SMA FEMALE

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

P kpC uuki pmgpv"Mqf gnUM6218

Power Connector J3

Pin No.	Function
1.	+5V
2.	-12V
3.	+12V
4.	GND
5.	+5V
6.	GND
7.	GND
8.	GND
9.	+12V

Control Connector J2

Pin No.		Function
1.		A14 Tuning Word
2.		A12 Tuning Word
3.		A10 Tuning Word
4.		A8 Tuning Word
5.		A6 Tuning Word
6.		A4 Tuning Word
7.		A2 Tuning Word
8.		A15 Tuning Word
9.		STROBE
10.		M0 Modulation Word (LSB)
11.		GND
12.		M1 Modulation Word
13.		M3 Modulation Word
14.		M5 Modulation Word
15.		M7 Modulation Word
16.		M9 Modulation Word (MSB)
17.		Modulation Analog(1)/Digital(0)
18.		RF on (1) / RF off (0)
19.	(*)	Normal (1)/Transparent (0) MODE
20.		A13 Tuning Word
21.		A11 Tuning Word
22.		A9 Tuning Word
23.		A7 Tuning Word
24.		A5 Tuning Word
25.		A3 Tuning Word
26.		A1 Tuning Word
27.		A0 Tuning Word (LSB)
28.		A17 Tuning Word (MSB)
29.		M4 Modulation Word
30.		D0 Max Deviation Control
31.		D1 Max Deviation Control
32.		Lock Detect
33.		M6 Modulation Word
34.		M8 Modulation Word
35.		M2 Modulation Word
36.		Internal Ref (0) / External (1)
37.		A16 Tuning Word

(*) This pin is for factory use only and should be left not connected.

- ""Umcm'Uk g:"3"x"3"x"1028”
- ""Y kf g"Htgqwgpe{ "Tcpi g:"2"vq"20"I J|
- ""J ki j "Tguqnwvkqp:"100"J|
- ""Nqy "Equv
- ""Kpvgtpcn'Tgf gtgpeg

Synthesizer Model SW0120

Ugtkgu"UY "Nqy "Equv"Eqmpcev" Hcuv"Kpf kt gev"U{ pvj guk| gt

Kratos General Microwave introduces the Synthesizer General Purpose Series SW Compact, Wide Band, Indirect Synthesizers offering exceptionally high performance at a low cost.

Each synthesizer is supplied with an internal reference crystal oscillator. The customer has the option of connecting an external reference crystal oscillator.

APPLICATIONS

The Series SW synthesizer has been designed to be used in applications where small size, low cost and wideband operation are important requirements. It can be used as a Signal Generator in Portable Test Equipment, as a microwave source in Built In Test (BIT) subassembly or in a broad frequency range electronic system.

For military applications, this synthesizer requires option G09 to comply with Military Standards. The specific environmental MIL STD requirements as well as the EMI/RFI specifications should be provided by the customer.

UGTKGU"UY "U[PVJGUK GT "UPGEKHKECVKQPU

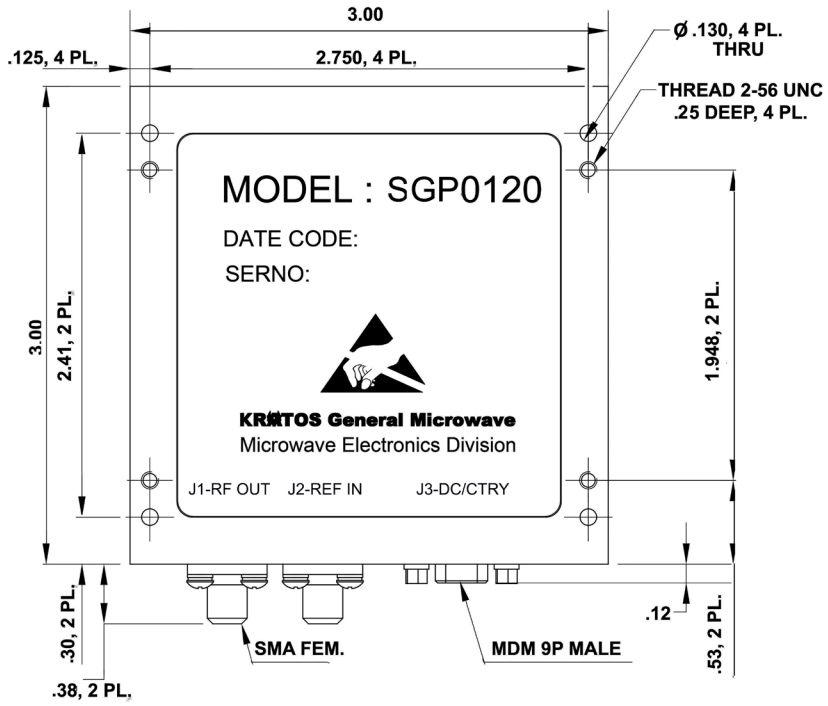
		UPGEKHKECVKQP "-"MQFGN			
PCTCMGVGT		UY 0580	UY 0120	UY 0220	UY 0618
1	HTGSWGPE["TCPIG"*I J | +"[2+	0.5 to 8"[1+	1.25 to 20	2 to 20	6 to 18
2	CEEWTCE["cv"25ºE","*ppm+	±2			
3	HTGSWGPE["CIKPI ,"*ppm/[gct+	±2 First year. ±1 per year, after first year			
4	HTGSWGPE['UVCBKNKV['QXGT 'VGMP0,'ppm	±1			
5	QWVPWV "PQY GT "mkp0","*f Bm+"[2+	(7			
5.1	Pgcmïvq'Pgcmï Xctkcvkqp'Qvgt f tgqwgpe{ 'cpf " vgmpgtcvwtg"*f B+	6			
6	UGVVNKPI "VKMG","*µuge+"[3+	120±15			
7	UUB"PJCUG"PQKUG","mcx"*f Be/J | +				
7.1	@"100'J | "Qf f ugv	–65	–57		-57
7.2	"""""""@"1"mJ | "Qf f ugv"	-86	-78		-78
7.3	"""""""@"10'mJ | "Qf f ugv"	-93	-87		-87
7.4	"""""""@"100'mJ | "Qf f ugv"	-93	-87		-87
7.5	"""""""@"1"MJ | "Qf f ugv	-93	-87		-87
7.6	"""""""@"10'MJ | "Qf f ugv	-130	-125		-125
8	JCTMQPKEU,"V{p0"*f Be+"	–20			
9	NQEM"FGVGEV	TTL High			
10	UPWTKQWU,"mcx"*f Be+"	–65	-60		-60
11	HTGSWGPE["EQPVTQN	Serial Control			
12	HTGS0'UVGP "UKG,"pqmkpcn'NUB"*mJ | +"[2+	0.1			
13	TGHGTGPEG"QUEKNNCVQT "*4+[1]"				
13.1	"""""""KP PWV "HTGSWGPE["*MJ | +	100			
13.2	"""""""KP PWV "PQY GT "*f Bm+	0 ±2			
14	UWPPN["XQNVCIG"				
14.1	"""""XFE,"mC	(12 ±5%, 700			
14.2	"""""XFE,"mC	-12 ±5%, 250			
15	FKMGPUKQPU,"Kpej "*mm+	~ 3 x 3 x 1 (76.2 x 76.2 x 25.4)			
16	TH"KP/QWV "EQPPGEVQTU	SMA Female			
17	EQPVTQN"EQPPGEVQT	MDM			
18	QPGTCVKPI "VGMPGTCVWTG,"*ºE+	-40 to (85			
19	UVQTCIG"VGMPGTCVWTG,"*ºE+	-65 to + 85			
20	GPXKTQPMGPVCN"EQPFKVKQPU	Ckt bqtpg"cpf "Pcvcn			
21	NQEM"FGVGEV"QWVPWV	VVN"Jkj			

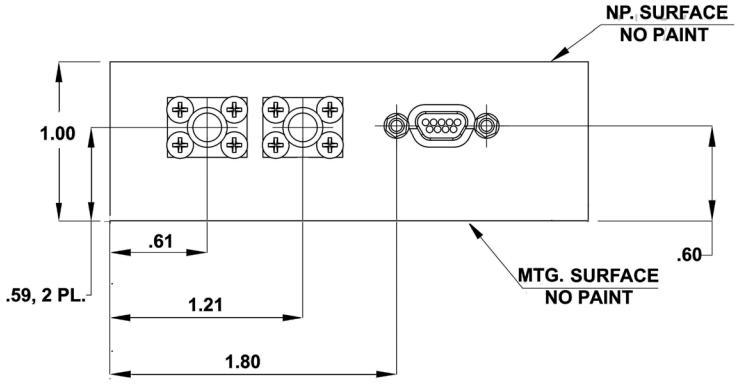
(1) Special order product
(2) Other Parameters are Optional
(3) For 50 µuge settling time, order option G17.
(4) Specification is for internal reference. The unit can be configured to work with the internal reference or with an external reference.

CXCKNCBNG"QPVKQPU

Qpvkqp"Pq0	Fguetkpvkqp
I 09	Guaranteed to meet Environmental Ratings
I 17	50'µuge settling time"

F KMGP UKQP U"cpf "Y GK J V





DIMENSIONS IN INCHES (mm)

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.010

L3"-"Pkp"Cuukipmgpv"

PKP" Pq0	HWP EVKQP
1	VIN positive +12V ±10%
2	SDI (Serial Com.)
3	SCLK (Serial Com.)
4	STROBE (Serial Com.)
5	Lock Detect
6	VIN negative -12V ±10%
7	For Factory Use - Do not connect
8	For Factory Use - Do not connect
9	GND

Ht gqwgpe{ 'Gxvgpf gt

Kratos General Microwave has introduced the series FE Frequency Extender to complement the Fast Indirect Synthesizer product line.

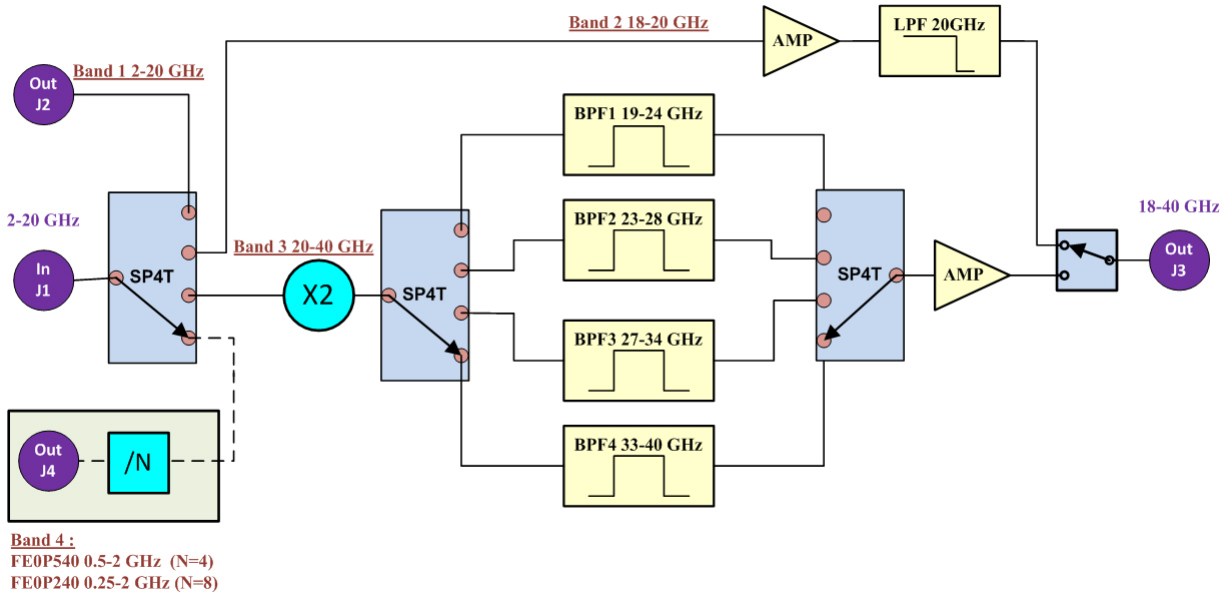
The series FE Frequency Extender has been designed to extend, at a low cost, the frequency range of the high performance Fast Indirect Synthesizers enabling operation from 0.5 to 40 GHz.

The following frequency synthesizers product lines can be can be extended by the FE Frequency Extender: SF, SM, SW.

The SM frequency synthesizer is capable of wideband frequency modulation. The FE supports this capability through 40 GHz. The result of combining the SM with the FE is a wideband synthesizer capable of wideband frequency modulation with a span of 1 GHz up to 40 GHz.

- ""Kpwv"Htgqwgpe{ "y kvj kp"2"vq"20"I J |
- ""Qwvpwv"Htgqwgpe{ "2"vq"40"I J |
  - """""""""""""""""""""""""""""""Qpvkqpcn"005"vq"40"I J |
  - """""""""""""""""""""""""""""""Qpvkqpcn"00250"vq"40"I J |
- ""Eqmpcev"Uk| g
- ""Ckt bqtpg
- ""Nqy "Equv

Frequency Extender
Model FE0P240



UGT KGU"HG"-"UP GEKHKECVKQP U

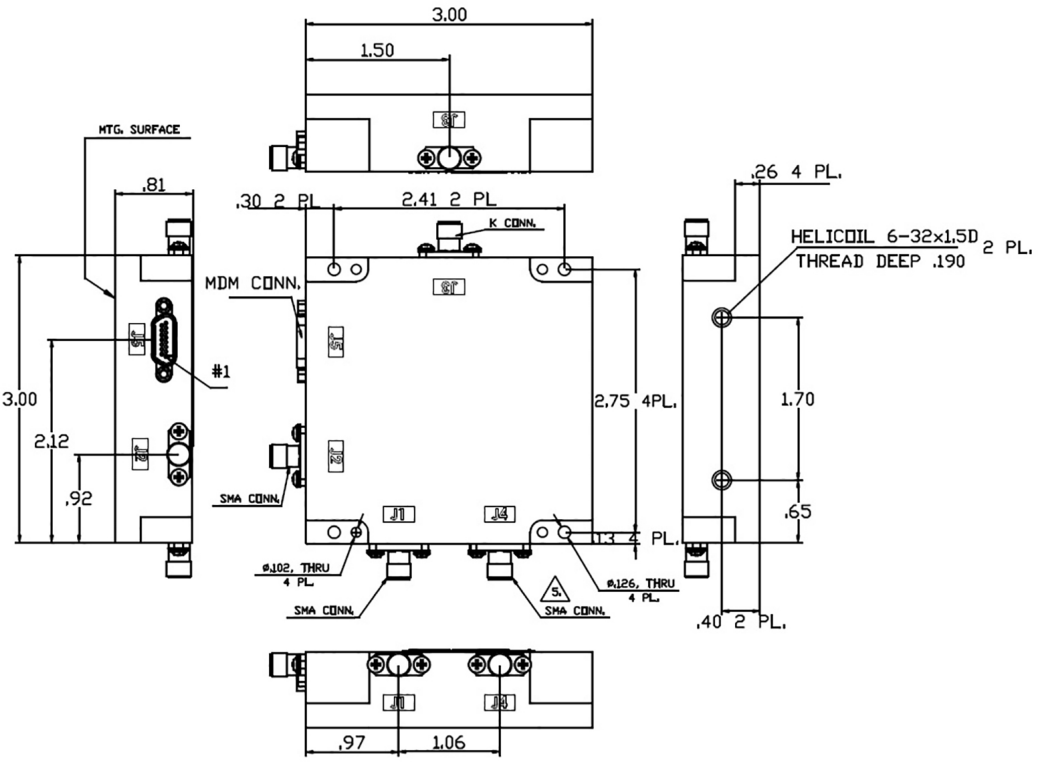
PCTCMGVGT		UP GEKHKECVKQP			
Mqf gn		HG0P 540	HG0240	HG0P 520	HG0P 240
1	KP PWV"HTGSWGPE["TCPI G"*I J | +"	2 to 20	2 to 20	2 to 20	2 to 20
2	QWVPWV"HTGSWGPE["TCPI G"*I J | +"	0.5 to 40	2 to 40	0.5 to 20	0.25 to 40
2.1	"""""""L2"	2 to 20	2 to 20	2 to 20	2 to 20
2.2	"""""""L3"	18 to 40	18 to 40	N A	18 to 40
2.3	"""""""L4	0.5 to 2	N/A	0.5 to 2	0.25 to 2
3	KP PWV"PQY GT"*f Bm+	(8 to (12	(8 to (12	(8 to (12	(8 to (12
4	QWVPWV"PQY GT"*f Bm+				
4.1	"""""""2"vq"20"I J | "@""L2"mkp00	: (Input Power-4dB)			
4.2	"""""""18"vq"40"I J | "@"L3"v{ p0	(10 to (15	(10 to (15	N A	(10 to (15
4.3	"""""""005"vq"2"I J | "@"L4"v{ p0	0	N/A	0	0
5	KP PWV"XUY T,"mcx0	2.0:1	2.0:1	2.0:1	2.0:1
6	QWVPWV"XUY T				
6.1	"""""""005"vq"2"I J | "@L4"mcx0	2.0:1	N/A	2.0:1	2.0:1
6.2	"""""""2"vq"18"I J | "@L2"mcx0	2.0:1	2.0:1	2.0:1	2.0:1
6.3	"""""""18"vq"40"I J | "@L3"mcx0	2.5:1	2.5:1	N A	2.5:1
7	2pf "JCTMQPKEU"&"UPWTKQWU"*f Be+				
7.1	"""""""200"vq"20"I J | ,"mkp00""	-50	-50	-50	-50
7.2	"""""""18"vq"40"I J | ,"mkp00"*f Be+"	-50	-50	N A	-50
8	UY KVEJKPI "VKMG,"mcx"*pUge+"	250	250	250	250
9	UWPPN["XQNVCI G"*C+				
9.1	"""""""12"vq"15"XFE"*C+	1.5	1.5	0.85	1.5
9.2	"""""""-12"vq"-15"XFE"mcx0"	0.25	0.25	0.25	0.25
10	HKNVGT"QXGTNCP,"mkp00"*I J | +	1	1	N A	1
11	HKNVGT'EQPVTQN,'VVN,'Nqi ke'1,'BKVU	7	7	N A	7
12	QPGTCVKPI "VGMPGTCVWTG,"*qE+"	-40 to (85	-40 to (85	-40 to (85	-40 to (85
13	CKTBQTPG'GPXKTQPMGPV"*Qpvkqp" I 09+	YES	YES	YES	YES
14	NCUGT"UGCNKPI	YES	YES	YES	YES
15	TH"EQPPGEVQTU				
15.1	"""""""L1,"L2,"L4	SMA FEMALE			
15.2	"""""""L3"QWVPWV	K FEMALE		N A	K FEMALE
16	EQPVTQN"EQPPGEVQT	MDM 15 PINS			
17	FKMGPUKQPU,"*mm+	76.2 x 76.2 x 20.32			
17.1	FKMGPUKQPU,"*Kpej gu+"	3.0 x 3.0 x 0.8			

PQVGU"

10'Y kvj "Qpvkqp"I 09"-40'vq"+85"qE

20'Tgqwktgu"Qpvkqp"I 09"

F KMGP UKQP U"cpf "Y GK J V



DIMENSIONS IN INCHES (mm)

C X C KNC BNG"QP V KQP U

Qpvkqp"P q0 F guet kpvkqp

I 09 Guaranteed to meet Environmental Ratings

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

NQI KE"VCBNG

	U0	U1	U2
Uj wpv-F qy p"Mqf g	0	0	0
2"vq"20"l J | "*L2+	0	0	1
18"vq"20"l J | "*L3+	0	1	0
19"vq"24"l J | "*L3+	0	1	1
23"vq"28"l J | "*L3+	1	0	0
27"vq"34"l J | "*L3+	1	0	1
33"vq"40"l J | "*L3+	1	1	0
005"vq"2"l J | "*L4+	1	1	1

P KP QWV "VCBNG

L5"P KP P q0	HWP EVKQP
"1	"+12"X
"2	"+12"X
"3	"l P F
"4	"U0
"5	"U1
"6	"U2
"7	"P /E
"8""	"l P F
"9	"-12"X
"10	"l P F
"11	"P /E
"12	"l P F
"13	"P /E
"14	"P /E
"15	"l P F

P QVGU:

TTL Logic Levels:
“0” - -0.3 to ∗0.8 V
“1” - ∗2 to ∗5 V

EQP VTQN"EQMMCP F

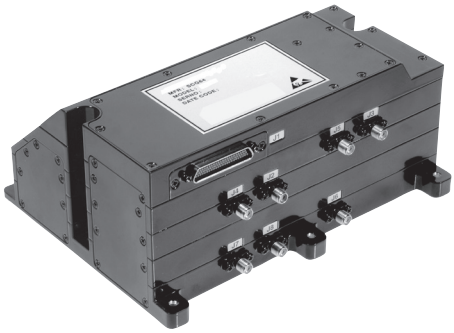
- ""Switch control logic signals shall be 3 line binary coded TTL logic, as described in the Logic Table.

- ""Shut-Down Mode – the unit is set to J4 and there is no current to the frequency divider.

F KT GEV "U[P VJ GUK GT

HO>QL PLDbkbo^iLJ f`d t ^sb$bLAfb`dLPvkqebpfwbqpL^dbLr pqj LabpfdkbaLmd ar`qp-ELebvL^dbLabpfdkbaLdqjL_bL
rpbaLkLbib`qdkfLpvpdpj pLqe^qdbnrfdbL^LefdeLmbodgj ^k`blLdbnrbk`vLplrobLlfqeLqebLdiilt fkdLdb^qdbpZefdeL
^``ro^`v)LefdeLpq^_fifqvLlsbdLpj mbo^qdbL^kaLdfj b)Llt Lme^pbLklfpbL^kaLme^pbLlebdbk`v-ELebvL^dbLrpbaLkL
Pvpdpj pLpr`eL^pLBT)LPHDFKQL^kaLpfj ri^qdqp-EkL^aafqlkLqebvL^dbLrpbaLkL^rqj ^qLqppdpvpdpj pL^kaLqppdpL
bnrfmj bkq+
QebLdiilt fkdLpbL^LqymfL^iLrpqj LpvkqebpfwbqeLe^qlL^pLabsbillmbaLdL^kLBT LpvpdpjL+

- Broad Frequency Range
- Settling Time: 40 nsec.
- Phase Noise
  @ 1 kHz: -91 dBc/Hz
  @ 100 kHz: -114 dBc/Hz
  @ 1 MHz: -116 dBc/Hz
- Coherency Guaranteed

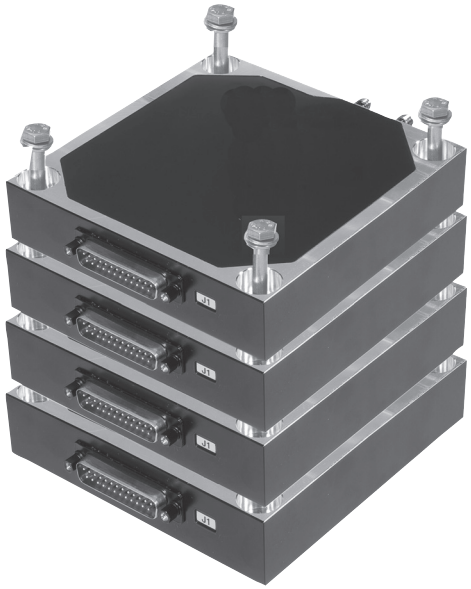


EWUVQM"HTGSWGPE["U[PVJGUKZGTU

Kratos General Microwave is focusing on providing custom Frequency Synthesizers to meet specific customers requirements. Most of these custom synthesizers were designed for missiles and airborne Electronic Warfare systems.

BCPM"QH"U[PVJGUKZGTU

- Low Spurious
- Wide Frequency Range
- High Reliability



XMG"EQPVTQNNGF"U[PVJGUKZGT

- Wide Frequency Range
- Fast Settling Time
- Low Power Consumption
- VME mechanical and control Interface

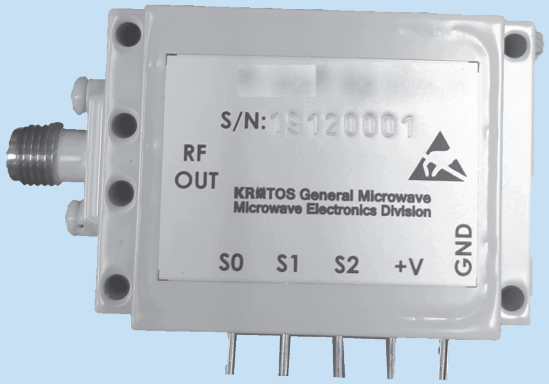
PCTTQY "BCPF "U[PVJ GUK GTU

KRATOS General Microwave supplies Narrow Band Synthesizers for operation at fixed frequencies. These are custom designed high performance, low cost alternatives to a fixed frequency sources.

APPLICATIONS

The fixed frequency synthesizers are desigend to be used as the L.O. in various up and down frequency converters. They can be used as a replacement of a DRO, in applications that require high frequency stability over temperature while operation under sever vibrations.

- ""Qpgtcvkpi "Htgqwgpe{ "ykvj kp "005" """""vq "18"I J|
- ""Jkij "Htgqwgpe{ "Ceewtce{
- ""Jkij "Htgqwgpe{ "Uvcdkrkv{
- ""Nqy "Equv
- ""Eqmpcev"Uk| g
- ""Jkij "Tgnkcdkrkv{



Synthesizer

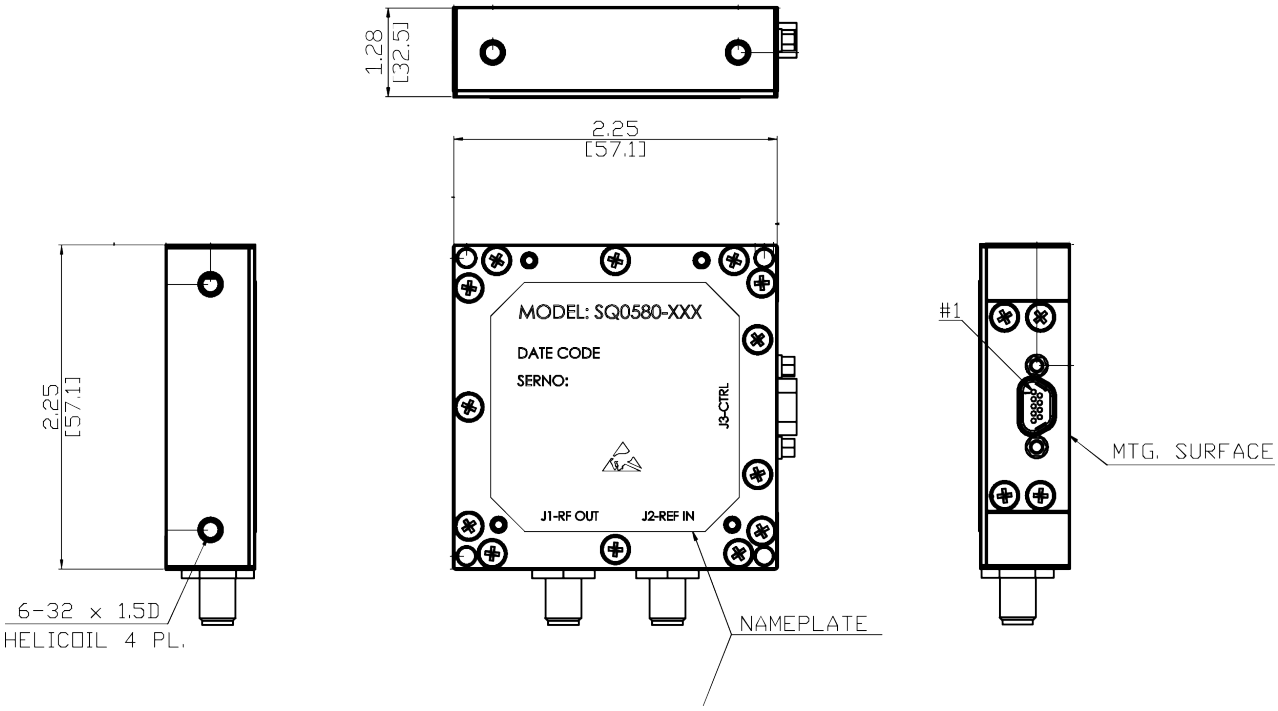
V[PKECN"-"UP GEKHKECVKQP U

PCTCMGVGT		UP GEKHKECVKQP
1	FREQUENCY RANGE (GHz)	7.935
2	ACCURACY, (ppm)	Same as of the ref. crystal
3	FREQUENCY AGING, (ppm)	Same as of the ref. crystal
4	FREQUENCY STABILITY, (ppm)	Same as of the ref. crystal
5	OUTPUT POWER, (dBm)	+10 to +14
6	SSB PHASE NOISE , max (dBc/Hz) (2)	@ 8 GHz
6.1	@ 100 Hz Offset	-70
6.2	@ 1 kHz Offset	-90
6.3	@ 10 kHz Offset	-99
6.4	@ 100 kHz Offset	-125
6.5	@ 1 MHz Offset	-142
7	HARMONICS, (dBc) typ	-60
8	SUB-HARMONICS, max (dBc)	-60
9	SPURIOUS, max (dBc)	-80
10	CONTROL	Serial Control
11	EXTERNAL REFERENCE OSCILLATOR	
11.1	INPUT FREQUENCY (MHz)	100
11.2	INPUT POWER (dBm)	0 2
12	SUPPLY VOLTAGE , (VDC)	12 0.4V @ 290 mA
13	DIMENSIONS, Inch (mm)	2.25 (57.2) x 2.25 (57.2) x 1.28 (32.5)
14	RF OUTPUT & REF INPUT CONNECTORS	SMA Female
15	CONTROL CONNECTOR	MDM (9 PINS)
16	OPERATING TEMPERATURE, (C)	-40 to +85
17	STORAGE TEMPERATURE, (C)	-65 to +125
18	ENVIRONMENTAL CONDITIONS	Airborne
19	LOCK DETECT OUTPUT	TTL High

V[PKECN"-"UPGEKHKECVKQPU

PCTCMGVGT		UPGEKHKECVKQP
7	HARMONICS, (dBc) typ	-60
8	SUB-HARMONICS, max (dBc)	-60
9	SPURIOUS, max (dBc)	-80
10	CONTROL	Serial Control
11	EXTERNAL REFERENCE OSCILLATOR	
11.1	INPUT FREQUENCY (MHz)	100
11.2	INPUT POWER (dBm)	0 2
12	SUPPLY VOLTAGE , (VDC)	12 0.4V @ 290 mA
13	DIMENSIONS, Inch (mm)	2.25 (57.2) x 2.25 (57.2) x 1.28 (32.5)
14	RF OUTPUT & REF INPUT CONNECTORS	SMA Female
15	CONTROL CONNECTOR	MDM (9 PINS)
16	OPERATING TEMPERATURE, (C)	-40 to +85
17	STORAGE TEMPERATURE, (C)	-65 to +125
18	ENVIRONMENTAL CONDITIONS	Airborne
19	LOCK DETECT OUTPUT	TTL High

V[PHECN"QWVNKPG



Weight (Approx.): Gr. (Oz)

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

F K KVC NN["VWP GF "QUEKNNC VQT

KRATOS General Microwave offers a broad line of DTOs covering the 2 to 18 GHz frequency range based upon its catalog line of broadband VCOs. A block diagram of the DTO is shown in Fig. 1. By appropriate design of the electronic circuitry, settling times of less than 300 nanoseconds are achieved. To obtain a frequency accuracy of the order of ±1%, including the effects of temperature, a proportionally-controlled heater is required for the VCO and the electronic circuitry is temperature compensated. A latch mode is provided as a standard feature.

To enable analog frequency modulation of the DTO, a separate frequency modulation port is provided. Since the slope of the frequency vs. voltage curve of the VCO varies over the frequency band, compensation is required to obtain a relatively constant deviation bandwidth. Compensation to within ±5% is achieved (Option 2) by utilizing a PROM to vary the attenuation applied to the modulating signal. The DTO may be frequency modulated at rates of greater than 15 MHz.

UGNGEVKQP "I WKF G"F K KVC NN["VWP GF "QUEKNNC VQT U"*F VQ+

HTGS WGP E["TCPI G"*I J| + 0.5 2 4 6 8 12 18 19	MQF GN"	PCI G	EQMMGP VU
1 — 2	D6010C	33	Octave Band Digitally Tuned Oscillators
2 — 4	D6020C		
2.6 — 5.2	D6026C		
4 — 8	D6040C		
8 — 12	D6080C		
12 — 18	D6120C		
0.5 — 2	D6052	36	Multi-Band Digitally Tuned Oscillators
2 — 6	D6206		
6 — 18	D6618		
2 — 18	D6218		
2 — 6	DC6206 DC6618	41	Compact Airborne DTO
6 — 18			
0.5 — 18	------	46	Custom Multi-Band Digitally Tuned Oscillators

Ugtkgu"F60"Qevcvg"Bcpf "FVQ

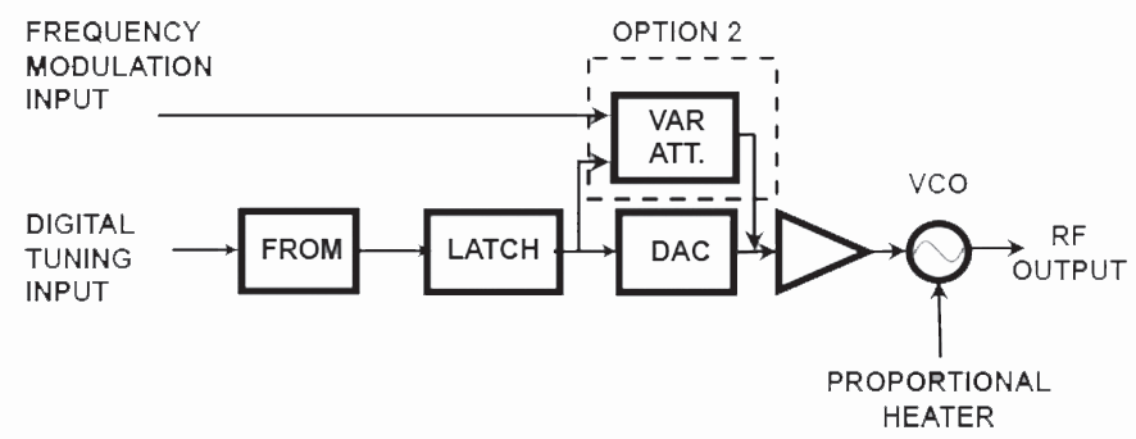
The Series D60 single-band DTO covers the frequency range of 0.5 to 18 GHz in 6 DTOs. Fig. 2 is the basic block diagram of the single band DTO.

When constant deviation bandwidth is required across the entire frequency band of the DTO, Option 2 should be used.

For military applications, these DTOs require option G09 to comply with Military Standards. The specific environmental MIL STD requirements as well as the EMI/RFI specifications should be provided by the customer.

- "1"vq"18"J\ "kp"Xctkqwu"Uwb-Bcpf
- "Hcuv"Ugvvrkpi "Vkog
- "Mqf wrcvkqp"Ecpcbkrkvkgu
- "Jkj "Tgnkcbkrkv{

DTO Model D6040C



QEVCXG"BCP F "F VQ"UP GEKHKECVKQP U

	MQF GN					
PCTCMGVGT	F 6010E	F 6020E	F 6026E	F 6040E	F 6080E	F 6120E
HTGSWGPE["TCPIG"*I J | +	1-2	2-4	2.6-5.2	4-8	8-12	12-18
CEEWTCE[,"Kper0'vgmp0"*MJ | +	±2	±2	±3	±4		±6
HTGSWGPE["UGVVKPI "*1+,"*MJ | + within 1 µsec	±2			±3		±4
MQFWNCVKQP *2+						
Band Width ""Standard unit, min. (MHz)	DC to 15					
""With Option G4(6), min. (MHz)	DC to 30					
Sensitivity variation ""Standard unit, typ	3:1					
""With Option 2, max	1.1:1					
Frequency deviation bandwidth, min. @ 2v P-P (MHz)	100	200	260	400		600
TH"PQY GT Output, min. (dBm)	(10					
Variation, incl. temp. and freq. max (dB)	±2	±1.5		±2.0		
TGUKFWCN'HM,'P-P '@"–3'f Be,'v{ p*mJ | +	50		75	100		150
JCTMQPKEU,"mcx"*f Be+	–15				–40	–20
f/2, 3f/2,max (dBc)	N/A					–20
UPWTKQWU,"mcx"*f Be+	–60					
PWNNKPI "XUY T"2:1"mcx"*MJ | +	1					
PWUJKPI ,"mcx"*mJ | /X+	250					
PQMKPCN"NUB"*MJ | +	0.5			1.0		1.5
MQPQVQPKEKV[	Guaranteed					
VWTP"QP "VKMG,"*mkpwvgu+ to specified accuracy @ (25Õ	2					
EQPPGEVQTU Control/Power	25 pin, D type male(4)					
RF output	SMA female					
FM input	SMC male					
PQY GT "UWPPN["TGSWKTGMGPV Voltage @ Current	(15V ± 0.5V @ 375 mA max –15V ± 0.5V @ 200 mA max (5V ± 0.5V @ 100 mA max (28V –4V, (2V@ 1,000 mA max					
Turn-On Current @ 28 volts	3 amps max					
GPXKTQPMGPVCN"*5+ Operating temperature (ÕC)	0 to (70					
Storage temperature (ÕC)	–54 to (100					
MGEJCPKECN"FKMGPUKQPU Inches	5.67 x 3.55 x 1.69					
Millimeters	144,0 x 90,2 x 42,9					

*1+Xf relative to f after 1 sec.
*2+50 Ohm input impedance.
*3+12 Bit TTL input.
*4+Mating connector furnished
*5+RF section and driver components hermetically sealed)
*6+Please consult us for further Modulation Band Width improvement:

CXCKNCBNG"QPVKQPU

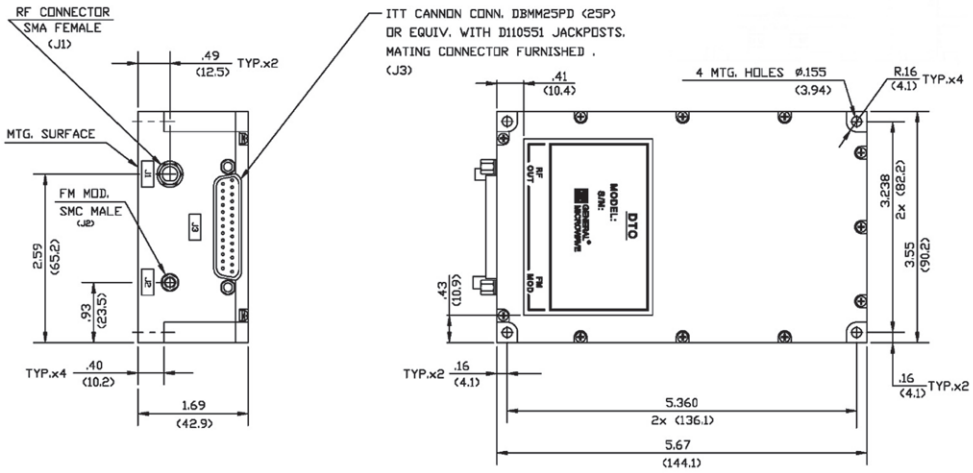
Qpvkqp"Pq0 F guetkpvkqp

2 Reduced Modulation Sensitivity Variation

I 4 Modulation Band Width: DC to 30 MHz *6+"

"""""""I 09 Guaranteed to meet Environmental Ratings

FKMGPUKQPU"CPF"Y GKJVU



MODELS D6010C, D6020C, D6026C, D6040C, D6080C, D6120C DTOs
Wt. 23.1 oz. (655 gr) approx.

EQPVTQN/PQY GT"EQPPGEVQT	
PkpPq0	Hwpevkqp
1	∗28V
2	∗28V
3	Temp. monitor thermistor (VCO)
4	Tuning Word Bit 1 (LSB)
5	Tuning Word Bit 3
6	Tuning Word Bit 5
7	Tuning Word Bit 7
8	Tuning Word Bit 9
9	Tuning Word Bit 11
10	Not used
11	∗5V (digital)
12	∗15V (analog)
13	Analog ground

EQPVTQN/PQY GT"EQPPGEVQT	
PkpPq0	Hwpevkqp
14	∗28V (return)
15	∗28V (return)
16	Not used
17	Tuning Word Bit 2
18	Tuning Word Bit 4
19	Tuning Word Bit 6
20	Tuning Word Bit 8
21	Tuning Word Bit 10
22	Tuning Word Bit 12 (MSB)
23	Latch(1)
24	Digital ground
25	–15V (analog)

*1+ Logic “0” to latch input word.
Logic “1” to unlatch input word.

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

MWNVKBCPF"FVQu

- '005'vq"18'I J\ 'kp'Xctkqwu'Uwb-Bcpf
- "Ykf g"Htgqwgpe{ "Tcpi g
- "Hcuv"Ugvvrkpi "Vkog
- "Ykf g"Mqf wrcvkqp"Ecpcbkrkvkgu
- "Jki j "Tgrkcbkrkv{

DTO Model D6218

Ukmwrcvqt "cpf "qvj gt "Vguv"U{ uvgou" Cpprkecvkqpu

To obtain broadband frequency coverage, as well as to improve settling speed, two or more VCOs can be combined, as shown in Fig. 1. A high-isolation RF switch is required to suppress all but the desired VCO. A switched lowpass filter is included in the output to reduce harmonic levels. The harmonic level for catalog units is specified at –20 dBc. However, –55 dBc suppression is available as an option.

General Microwave offers multi-band DTOs covering the 0.5-2, 2-6, 6-18 and 2-18 GHz frequency ranges. The units feature high speed, high accuracy and low phase noise. The specifications are summarized on page 190. The modular design of the DTOs enables the user to select narrower frequency coverage if desired. Please consult the factory for individual requirements.

For military applications, these DTOs require option G09 to comply with Military Standards. The specific environmental MIL STD requirements as well as the EMI/RFI specifications should be provided by the customer.

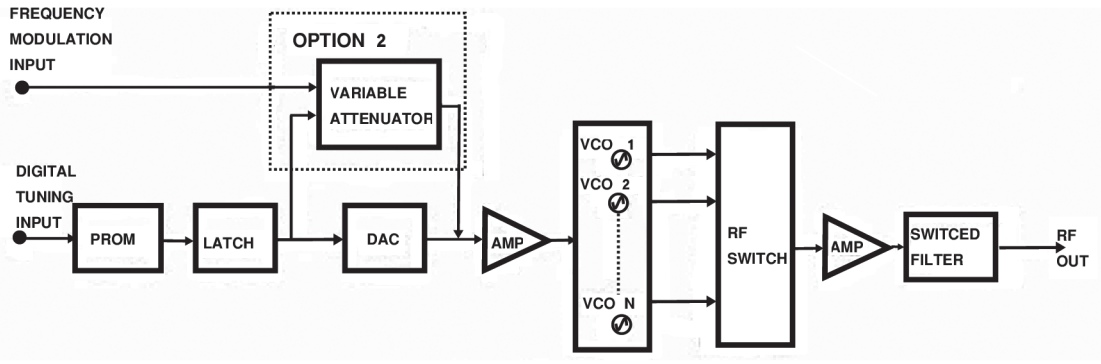


Fig. 1–Multi-Band DTO Block Diagram

MWNVKBCP F "F VQ"UP GEKHHECVKQP U

	MQF GN			
PCTCMGVGT	F 6052	F 6205	F 6618	F 6218
HTGSWGP E["TCPI G"*I J | +	0.5-2	2-6	6-18	2-18
CEEWTCE["@+25°E,"mcx"*MJ | +	±2			
HTGSWGP E["F TKHV,"mcx"*MJ | /°E+	±0.1			
HTGSWGP E['UGVVNKP I "*1+,'mcx'*MJ | +'y kvj kp'1" µuge	±2		±3 (6-12 GHz) ±4 (12-18 GHz)	±2 (2-6 GHz) ±3 (6-12 GHz) ±4 (12-18 GHz)
MQF WNCVKQP *2+				
Bcpf y kf vj				
Standard unit, min. (MHz)	DC to 10			
With Option G4 *5+, min. (MHz)	DC to 30			
Ugpukvkvkv{ "vctkcvkqp				
Standard unit, typ	4:1			
Option 2 Unit, max	1.1:1			
Frequency deviation bandwidth, min. @ 2v P-P (MHz) – with option 2	100	500		
THP"PQY GT Output, min. (dBm)	(10			
Variation, incl. temp. and freq., max (dB)	±2		±2.5	
PJCUG"PQKUG,"v{ p'*f Be/J | + @ 100 kHz offset	–65			
TGUKF WCN"HM,"P-P "@"–3"f Be,"v{ p'*mJ | +	50	75	150	
JCTMQPKEU,"mcx"*f Be+ Standard Unit	–20			
Option 3 Unit	N/A	-55	–55	
f/2, 3f/2,max (dBc)	N/A		–55	
UPWTKQWU,"mcx"*f Be+	–60			
PWNNKP I "XUY T"2:1"mcx"*MJ | +	1			
PWUJ KP I ,"mcx"*mJ | /X+	± 125	±250	± 500	
PQMKP CN"NUB*3+"*MJ | +	0.5			
MQP QVQP KEKV[	Guaranteed			
EQP PGEVQTU Power	9 pin, D type male(4)			
Control	37 pin, D type male(4)			
RF output	SMA female			
Modulation Input	SMC male			
PQY GT "UWPP N["TGSWKTGMGP V Voltage @ Current (15V ± 0.5V	450	700	1,000	1,250
–15V ± 0.5V	250	250	300	300
(5V ± 0.5V	150	150	500	500
(28V ±2V	1,000	1,000	3,000	3,000
Turn-ON Current @ 28 volts	3 amps max		6 amps max	
GPXKTQP MGPVCN Operating temperature (ÕC)	0 to (70			
Storage temperature (ÕC)	–20 to (100			
MGEJCPKECN"FKMGPUKQPU				
Inches	5.70 x 4.80 x 2.50	6.48 x 6.23 x 2.00		
Millimeters	144,8 x 121,9 x 63,5	164,6 x 158,2 x 50,8		

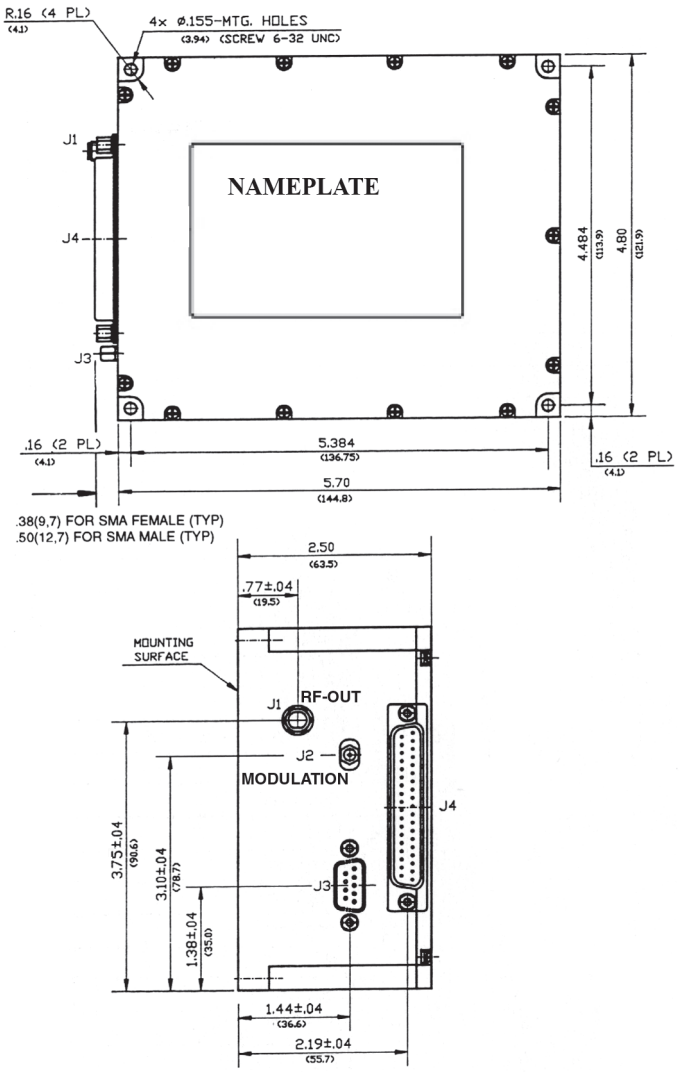
*1+ Δf relative to f after 1 sec.
*2+ 50 Ohm input impedance.
*3+ 16 Bit TTL input, including VCO control.
*4+ Mating connector furnished
*5+ Please consult us for further Modulation Band Width improvement:

CXCKNCBNG"QPVKQPU

Qpvkqp"Pq0 F guetkpvkqp

2	Reduced Modulation Sensitivity Variation
3	Improved Harmonic Suppression
4	SMA Female Modulation Connector
B09	13 to 20 GHz Operation
B11	Operating Temp. range -5 (°C) to +70 (°C)
B12	With options 2 & 3. Operating Temp. range -10 (°C) to +70 (°C
I 09	Guaranteed to meet Environmental Ratings)

FKMGPUKQPU"C P F "Y GK J V "–"MQF GN"F 6052



MQF GNU"F 6052 Eqpvtqn'Eqppgevqt '*L4+	
P KP "P Q0	HWP EVKQP
1	A13 Tuning Word (MSB)
2	A11 Tuning Word
3	A9 Tuning Word
4	A7 Tuning Word
5	A5 Tuning Word
6	A3 Tuning Word
7	A1 Tuning Word
8	V1 VCO Control (MSB)
9	L1 Latch 1 (Strobe)
10	L3 Latch 3
11	OE Memory Output Enable
12	D1 Data Bus
13	D3 Data Bus
14	D5 Data Bus
15	D7 Data Bus
16	W2 Write 2
17	OET2 Output Enable Transceiver 2
18	G Ground
19	WE Write Enable
20	A12 Tuning Word
21	A10 Tuning Word
22	A8 Tuning Word
23	A6 Tuning Word
24	A4 Tuning Word
25	A2 Tuning Word
26	A0 Tuning Word
27	V0 VCO Control (LSB)
28	L2 Latch 2
29	G Ground
30	D0 Data Bus
31	D2 Data Bus
32	D4 Data Bus
33	D6 Data Bus
34	W1 Write 1
35	OET1 Output Enable Transceiver 1
36	OET3 Output Enable Transceiver 3
37	G Ground

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

MQF GNU"F 6052 Pqy gt"Eqppgevqt "*L3+			
PKP"PQ0	HWPEVKQP	PKP"PQ0	HWPEVKQP
1	∗5V	6	Return for:∗5V, -15V, ∗15V
2	–15V	7	Return for:∗5V, -15V, ∗15V
3	∗15V	8	∗28V (return)
4	∗28V (return)	9	∗28V
5	∗28V		

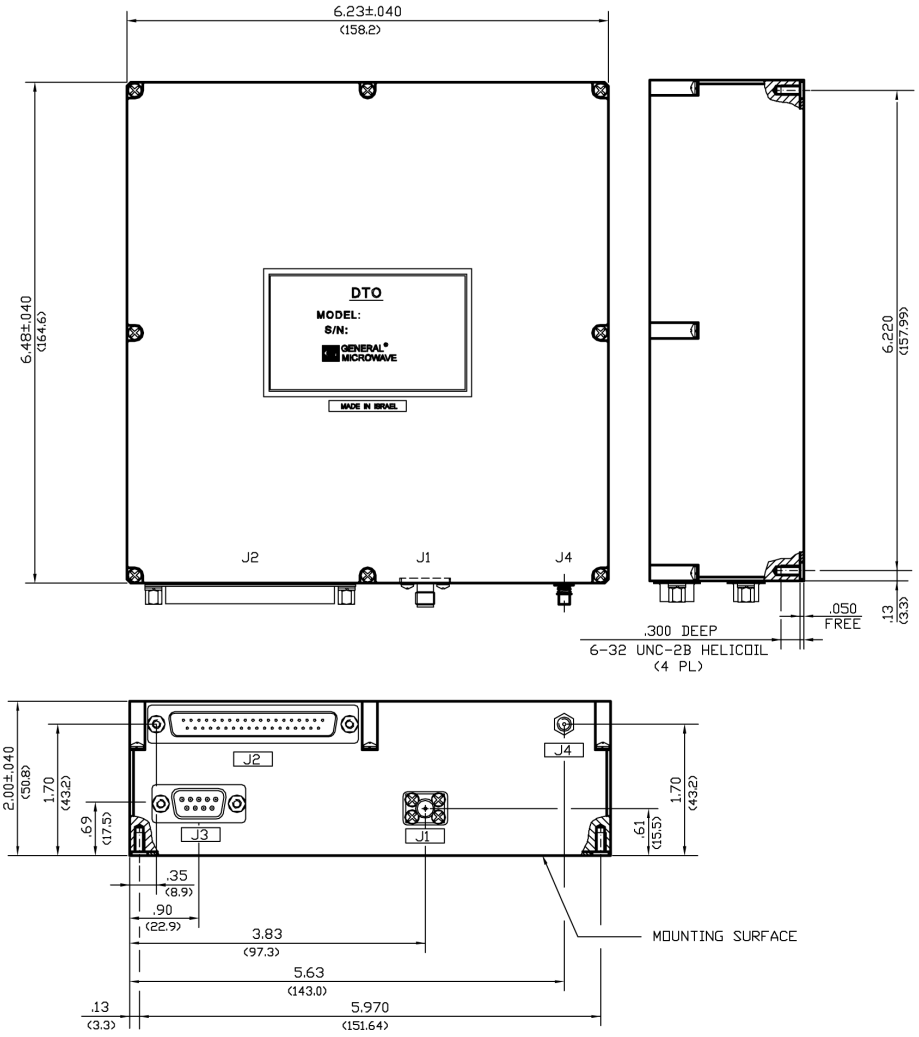
PQVGU:"Hqt "Pqtmcn'Qpgtcvkqp"qf 'vj g'F VQ

1+ PIN nos. 9, 10 and 28 should be connected together.

2) PIN no. 11 should be grounded.

3) PIN nos. 12, 13, 14, 15, 16, 17, 19, 30, 31, 32, 33, 34, 35 and 36 are for FACTORY PROGRAMMING ONLY and should not be connected.

FKMGP UKQP U"CP F "Y GK J V"–"MQF GNU"F 6206,"F 6218"cpf "F 6618



Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

MQF GNU"F 6206,"F 6218"cpf "F 6618 Pqy gt "Eqppgevqt "*L3+			
P KP "P QO	HWP EV KQP	P KP "P QO	HWP EV KQP
1	∗5V	6	Return for:∗5V, -15V, ∗15V
2	–15V	7	Return for:∗5V, -15V, ∗15V
3	∗15V	8	∗28V (return)
4	∗28V (return)	9	∗28V
5	∗28V		

P QVGU:"Hqt "P qt mcn'Qpgt cvkqp"qf "vj g"F VQ

1+ PIN nos. 9, 10 and 28 should be connected together (Latch enable).

2+ PIN no. 11 should be grounded.

3+ PIN nos. 12, 13, 14, 15, 16, 17, 19, 30, 31, 32, 33, 34, 35 and 36 are for FACTORY PROGRAMMING ONLY and should not be connected.

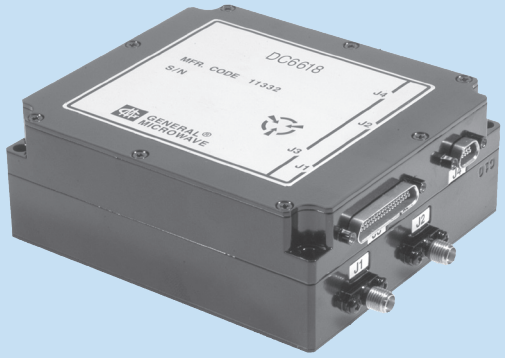
MQF GNU"F 6206,"F 6218"cpf "F 6618 Eqpvt qn'Eqppgevqt "*L2+		
P KP "P QO	HWP EV KQP	
1	A14	Tuning Word (MSB)
2	A12	Tuning Word
3	A10	Tuning Word
4	A8	Tuning Word
5	A6	Tuning Word
6	A4	Tuning Word
7	A2	Tuning Word
8	V0	VCO Control Bit
9	L1	Latch 1 of 3 (Strobe)
10	L3	Latch 3 of 3 (Strobe)
11	OE	Memory Output Enable
12	D1	Data Bus
13	D3	Data Bus
14	D5	Data Bus
15	D7	Data Bus
16	W2	Write select 2
17	OET2	Output Enable Transceiver 2
18	GND	Ground
19	WE	Write Enable
20	A13	Tuning Word
21	A11	Tuning Word
22	A9	Tuning Word
23	A7	Tuning Word
24	A5	Tuning Word
25	A3	Tuning Word
26	A1	Tuning Word
27	A0	Tuning Word (LSB)
28	L2	Latch 2 of 3 (Strobe)
29	G	Ground
30	D0	Data Bus
31	D2	Data Bus
32	D4	Data Bus
33	D6	Data Bus
34	W1	Write select 1
35	OET1	Output Enable Transceiver 1
36	OET3	Output Enable Transceiver 3
37	GND	Ground

Ugtkgu"F E"Eqmpcev"F VQ

HQT "TY T,"GUM"CPF "QVJ GT "CPPNKECVKQPU

KRATOS General Microwave offers compact multi-band DTOs for various airborne, naval and ground based applications, covering the 2-6 and 6-18 GHz frequency ranges. The units feature high speed, high accuracy and low phase noise. The modular design of the DTOs enable the user to select narrower frequency coverage if desired. Please consult the factory for individual requirements.

- Hcuv"Ugvvrkpi "Vkog
- 2'vq"18'l J | 'kp'Xctkqwu'Uwb-Bcpf u
- Umcm'Uk| g
- Hqt "Ckt bqtpg"Cpprkecvkqpu



DTO Model DC6618

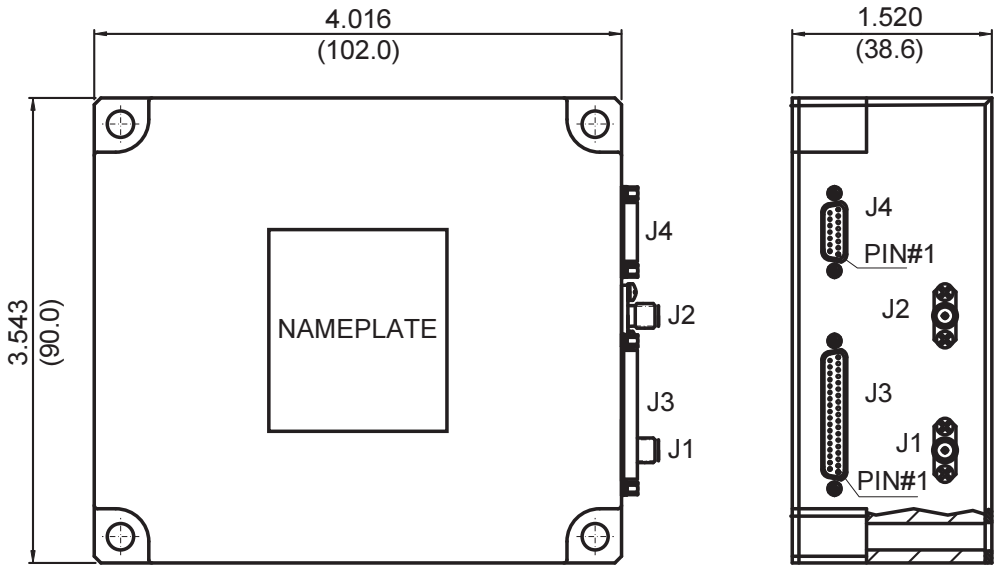
EQMP CEV"CKT BQT P G"F VQ"UP GEKHKECVKQP U

	MQF GN	
P CTCMGVGT	F E6206	F E6618
HTGS WGP E["TCPI G"*I J | +	2"vq"6	6"vq"18
CEEWTCE["@"+25°E,"mcx"*MJ | +	± 2	
HTGS WGP E["F TKHV,"mcx"*MJ | /°E+	± 001	
HTGS WGP E["UGVVNKPI "y kvj kp"1"µuge,"mcx"*MJ | +	± 2	± 3
MQF WNCVKQP *1+ Bcpf y kf vj		
"mkp0"*MJ | +"	F E"vq"15	F E"vq"10
Ugpukvkvkv{ "vctkcvkqp,"mcx	101 :1	
Htgqwgpe{ "f gvkcvkqp"*MJ | /X+"mcx	± 250@ 5X "P VP	± 250@ 2X "P VP
TH"PQY GT Qwvpwv,"mkp0"*f Bm+	2-8	+10
Xctkcvkqp,"kper0'vgmp0'cpf "f tgqwgpe{ ,"mcx"*f B+	± 2	± 205
PJCUG"PQKUG,"mcx"*f Be/J | + @"100'mJ | "qf f ugv	–70	–65
TGUKF WCN"HM,"p-p"@"–3"f Be,"mcx"*mJ | +	200	150
JCTMQPKEU,"mcx"*f Be+	–45	–55
UWB-JCTMQPKEU,"mcx"*f Be+	–45	–55
UPWTKQWU,"mcx"*f Be+	–60	
PWNNKPI "@"XUY T"2:1,"mcx"*MJ | +	± 2	± 1
PWUJKPI ,"mcx"*MJ | /X+	± 205	± 005
HTGS WGP E["UVGP "pgt "NUB,"*MJ | +"P qmkpcn	1	""005
MQPQVQPKEKV[	I wctcpvggf	
QPGTCVKPI "VGMPGTCVWTG"*°E+*2+	0'vq"+70	
EQPPGEVQTU Pqy gt	9"P kp"MF M"Mcrg	
Eqpvtqn	37"P kp"MF M"Mcrg	
TH"qwvpwv	UMC "f gmcrg	
Mqf wncvkqp"Kppwv	UMC "f gmcrg	
PQY GT "UWPPN["TGS WKTGMGPV"*X+	+15,"–15,"+5"&"+28	
MGEJCPKECN"FKMGPUKQPU Kpej gu	400"x"305"x"105	
Mkmkmgvgtu	10200"x"9000"x"3806	

*1+ Option
*2+ Other operating temperature option

Logic Level	Input Level
"0"	–0.3 to 0.8V
"1"	2.0 to 5.0V

EQMP C EV "C KT BQT P G"F VQ "F KMGP UKQP U



EQP P GEVQT U"VCBNG		
	F guet kpvkqp	Hwpevkqp
J1	COAX. CONN., SMA FEMALE	RF OUT
J2	COAX. CONN., SMA FEMALE	MODULATION
J3	“ITT CANNON” CONN. MDM-37SH003P OR EQUIV.	CONTROL
J4	“ITT CANNON” CONN. MDM-9SH003P OR EQUIV.	POWER

MODELS DC6206, DC6618

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

L3"EQP VTQN"EQP PGEVQT "–"PKP "CUUKI PMGPV

Pkp "Pq0	Hwpevkqp		Fguetkpvkqp
	F E6206	F E6218	
1	N.C.	A14	Tuning Word (MSB)
2	A11	A12	Tuning Word
3	A9	A10	Tuning Word
4	A7	A8	Tuning Word
5	A5	A6	Tuning Word
6	A3	A4	Tuning Word
7	A1	A2	Tuning Word
8	V1	V0	VCO Control Bit
9	LE\	LE\	Latch
10	N.C.	N.C.	N.C.
11	OE\	N.C.	OE
12	N.C.	N.C.	N.C.
13	N.C.	N.C.	N.C.
14	N.C.	N.C.	N.C.
15	N.C.	N.C.	N.C.
16	N.C.	N.C.	N.C.
17	N.C.	N.C.	N.C.
18	GND	N.C.	Ground/N.C.
19	N.C.	GND	Ground
20	A12	A13	Tuning Word
21	A10	A11	Tuning Word
22	A8	A9	Tuning Word
23	A6	A7	Tuning Word
24	A4	A5	Tuning Word
25	A2	A3	Tuning Word
26	A0	A1	Tuning Word
27	V0	A0	VCO Control/Tuning Word (LSB)
28	N.C.	GND	Ground
29	GND	N.C.	Ground/N.C.
30	N.C.	N.C.	N.C.
31	N.C.	N.C.	N.C.
32	N.C.	N.C.	N.C.
33	N.C.	N.C.	N.C.
34	N.C.	N.C.	N.C.
35	N.C.	N.C.	N.C.
36	N.C.	N.C.	N.C.
37	GND	GND	Ground

Pqvgu:

C0'Hqt "Mqf grl'F E6218

1. Pins 19, 28 and 37 should be grounded.
2. Pins 10 through 18 and 29 through 36 should not be connected (for factory use only).

B0'Hqt "Mqf grl'F E6206

1. Pins 11, 18, 29 and 37 should be grounded.
2. Pins 1, 10, 12 through 17, 19, 28 and 30 through 36 should not be connected (for factory use only).

L4"P QY GT "EQP P GEVQT "–"P kP "CUUKI P MGP V				
P kp"P q0	Hwpevkqp	F guet kpvkqp	P qvgu	Mcx0'Ewtt gpv" Eqpuwmpvkqp *mC+
1	5V	Digital Supply		500
2	–15V	Analog Supply		500
3	(15V	Analog Supply		1,000
4	28V Return	Negative Heater Supply		
5	28V	Positive Heater Supply		
6	Return for:(5V, -15V, (15V	Ground	1	–
7	Return for:(5V, -15V, (15V	Ground	1	–
8	28V Return	Negative Heater Supply		
9	28V	Positive Heater Supply		1,000(2)

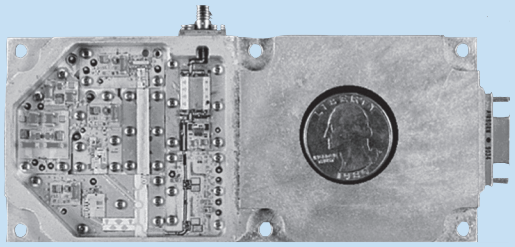
Notes:

1. GND is the DTOs analog ground for the ∗15V, –15V and ∗5V supplies and not the heater's ground.
2. Warm up 3,000 mA, steady state 1,000 mA max.

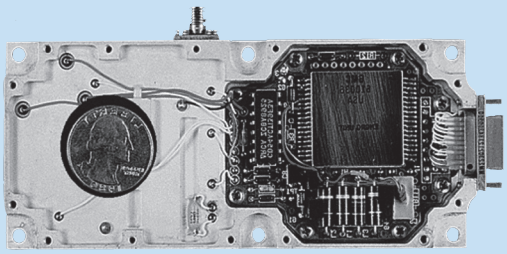
EWUVQM"FVQu

MwnvkBcpf "FVQ"Hqt "
GY "cpf "GUM"Cpprkecvkqpu

General Microwave has developed numerous multi-band DTOs for demanding EW and ESM high-reliability applications. The key requirements for the EW Multi-Band DTO , as seen in Figs. 1 and 2, are compact size, low spurious and harmonic levels, and 45g rms endurance vibration levels. The unit includes 3 VCOs, 3 MMIC amplifiers, a switched lowpass filter, a custom hybrid electronic circuit, and RFI/EMI filtering.

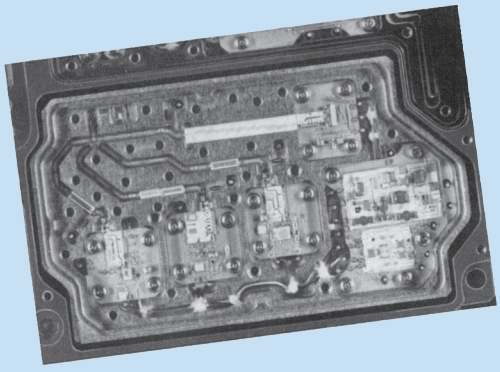


Hki 0'1"-"MwnvkBcpf "FVQ"*THuki g"vkgy +

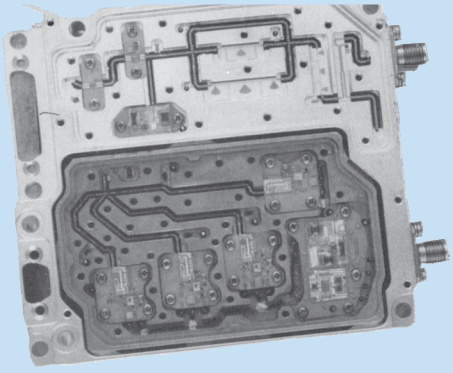


Hki 0'2"-"MwnvkBcpf "FVQ"*Ftkvgt "uki g"vkgy +

The C-Ku band DTO (Fig. 3) includes 3 fundamental mode VCOs and 1 push-push VCO, 4 MMIC amplifiers, a SP4T switch, a switched lowpass filter, and associated electronic circuitry. The key requirements are suppression of the unused VCOs and fast settling tuning. The S-C bands DTO (Fig. 4) meets similar requirements



Hki 0'3"-'E-Mw'Bcpf 'FVQ'TH'Cuugodn{



Hki 0'4"-'U-E'Bcpf 'FVQ'TH'Cuugodn{

MWNVKBCP F "HT GS WGP E["NQEMGF " QUEKNNCVQT "*HNQ+

KRATOS General Microwave has developed a new product line of Multi-Band Frequency Locked Oscillators (FLO). This product line is an enhancement to our free running Digitally Tuned Oscillator (DTO) products. This FLO combines the high speed of DTO with the high accuracy and long-term stability of a frequency locked source. The key specification feature of the FLO is a timing speed of less than 1 µsec to settle within 1 MHz of the desired frequency.

UKMWNCVQT "CP F "VGUV "U[UVGMU" CP P NKECVKQP U

The FLO was specifically designed for test systems and simulator applications. It is a low cost replacement for high cost direct synthesizers, in applications that the frequency setting time of 1 msec is meeting the system requirements.

- Hcuv"Ugvvrkpi "*1MJ | "kp"1"µuge+
- Y kf gbcpf "*2-18"I J | +
- J ki j "Ceewtce{
- Nqy "Pj cug"P qkug

FLO Model FL6618

SPECIAL ORDER PRODUCT
–CONSULT FACTORY BEFORE ORDERING–

UGNGEVKQP "I WKF G"HT GS WGP E["NQEMGF "QUEKNNCVQT U

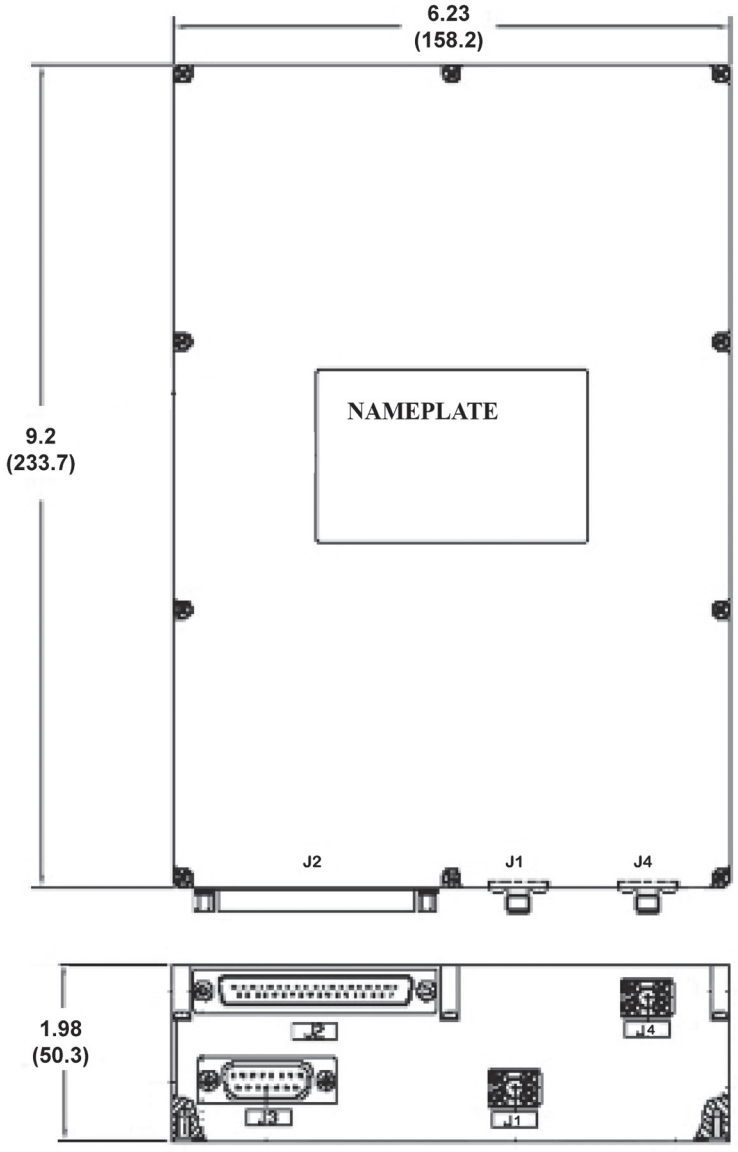
HT GS WGP E["TCPI G"*I J	+							MQF GN"	PCI G	EQMMGPVU
0.5	2	4	6	8	12.0	18.0				
2	———	———	———	———	———	———	18	FL6218	47	Frequency Locked Oscillator
			6	———	———	———	18	FL6618		

Mwnvk-Bcpf "Htgqwgpe{ "Nqemgf "Quekmcvqt "Upgekhkecvkqpu

		UPGEKHKECVKQP	
PCTCMGVGT		HN6218	HN6618
1	HTGSWGPE["TCPIG"*IJ|+	2 to 18	6 to 18
2	CEEWTCE["QXGT "VGMPGTCVWTG"*MJ|+	±1	
3	UGVVNKPI "VKMG'y kvj kp"1"µuge"*MJ|+	±1	
4	TGUKFWCN"HM,"mcx"*mJ|+	10	
5	MQFWNCVKQP [1]		
6	THP"PQY GT		
6.1	Output, min. (dBm)	(10	
6.2	Variation, incl. temp. and freq., max (dB)	±2.5	
7	PJCUG"PQKUG,"mcx"*f Be/J|+"@"100"mJ|"qf f ugv	-80	
8	JCTMQPKEU,"mcx"*f Be+		
8.1	Integer	–55	
8.2	f/2, 3f/2	–55	
9	UPWTKQWU,"mcx"*f Be+	–60	
10	PWNNKPI ,"XUY T"2:1,"mcx"*MJ|+	±1	
11	PWUJKPI ,"mcx"*mJ|/X+	±500	
12	VWPKPI "EQPVTQN		
12.1	Nominal LSB (kHz)	250	
12.2	Tuning (bits)	17	
13	EQPPGEVQTU		
13.1	Power	15-Pin, D type	
13.2	Control	37-Pin, D type	
13.3	RF Output, FM Input	SMA female	
14	PQY GT "UWPPN["TGSWKTGMGPV"mcx"*mC+:		
	(15V	2,000	
	–15V	580	
	(5V	300	
	28V, start up	6,500	
	28V, steady state @25°C	2,000	
15	QPGTCVKPI "VGMPGTCVWTG"(ŒC)	0 to (55	
16	MGEJCPKECN"FKMGPUKQPU		
	Inches	9.20 x 6.2 x 2.00	
	Millimeters	234.6 x 158.1 x 51.0	

(1) In DTO mode. Consult factory for specifications

DIMENSIONS & WEIGHT



Wt. 4.63 lb. (2.1 kg) approx.

EQP P GEVQT "F CVC		
U[M	HWP EVKQP	F GUETKP VKQP
J1	RF OUTPUT	COAX, CONN, SMA FEMALE
J2	DIGITAL CONTROL	DC-37P
J3	SUPPLY	DA-15P
J4	MODULATION INPUT	SMA FEMALE

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

EQP P GEVQT "L2		
P KP " P q0	HWP EVKQP	P QVGU
1	A14	
2	A12	
3	A10	
4	A8	
5	A6	
6	A4	
7	A2	
8	V0	
9	LATCH	
10	D2	1
11	GND	
12	D1	1
13	D0	1
14	CL	1
15	FE\	1
16	N.C.	
17	N.C.	
18	A15	
19	N.C.	
20	A13	
21	A11	
22	A9	
23	A7	
24	A5	
25	A3	
26	A1	
27	A0	
28	WR_RD	1
29	GND	
30	TR_REAL	1
31	FL_DTO	1
32	LD_IND	
33	GND	
34	GND	
35	GND	
36	S_H_DIS	
37	GND	

EQP P GEVQT "L3	
P KP "P q0	HWP EVKQP
1	(5V
2	–15V
3	(15V
4	N.U.
5	28V
6	28V
7	28V
8	28V
9	GND
10	GND
11	N.U.
12	28V Return
13	28V Return
14	28V Return
15	28V Return

P qvg:

1. For factory only use, should not be connected.

Btqcf bcpf "XEQu

General Microwave's catalog line of broadband VCOs covers the 2-18 GHz frequency range in octave (2-4, 2.6-5.2 and 4-8 GHz) and half-octave (8-12 and 12-18) GHz bands. The major features of the VCOs are fast settling time, low phase noise and excellent frequency stability.

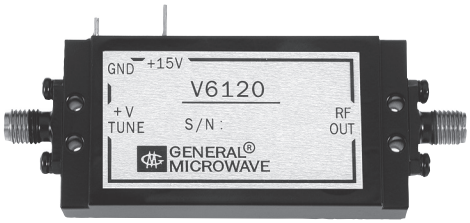
A simplified block diagram is shown in Fig. 3. For optimum performance, the active element used is a silicon bipolar transistor. (This is in lieu of GaAs FETs which typically exhibit 10-20 dB poorer phase noise performance. Although GaAs FETs have extremely low noise in amplifier applications, they suffer from high 1/f noise, which is upconverted in the nonlinear oscillator to phase noise near the carrier.) To vary the frequency of the oscillator, a high Q silicon hyperabrupt varactor is utilized. The capacitance-voltage characteristic is specified to provide as nearly linear frequency vs. voltage tuning curve as possible. In practice, good linearity can only be realized over a small portion of the tuning range because of parasitic reactances present in the physical circuit and the bipolar transistor. Typical ratios of maximum to minimum frequency vs. voltage sensitivity for an octave band are 2:1 and are specified at 3:1. GaAs varactors, although having higher Q's than silicon varactors, suffer from long-term charging effects as well as relatively poor thermal conductivity. Silicon varactors are therefore mandatory in high-speed applications requiring settling times of the order of several hundred nanoseconds and low post-tuning drift.

To minimize pulling effects on the oscillator frequency due to variations in the external load, attenuator pads followed by buffer amplifiers are incorporated at the oscillator output. Voltage regulators are also included to minimize the effect of variations in the power supply voltage on both oscillator frequency and power level.

Finally, filtering is provided to reduce the harmonic content of the output signal.

Of particular note is KRATOS General Microwave's 8-12 GHz VCO, which utilizes a high performance transistor operating in the fundamental, rather than the doubling push-push mode. This mode of operation eliminates all $(2n + 1)\ f_o/2$ frequencies in the output spectrum. The second harmonic signal is specified at –40 dBc maximum but is typically less than –50 dBc.

Because fundamental mode oscillation is not currently achievable with available silicon devices in the 12-18 GHz band, the doubling push-push approach, shown schematically in Fig. 4, is used. Thus, for example, for a 12 GHz output frequency, each oscillator is designed to operate at 6 GHz. If the structure were perfectly symmetrical, all odd harmonics of 6 GHz would be suppressed, and only even harmonics would be present in the output spectrum. By suitable filtering, an essentially pure 12 GHz output signal could be obtained. In practice, imperfect symmetry results in $f_o/2$ and $3f_o/2$ signals, which are filtered to the extent possible. (For the case of a 12 GHz output signal, the undesired $3f_o/2$ signal at 18 GHz cannot be filtered since it is within the 12-18 GHz frequency range of the VCO.)



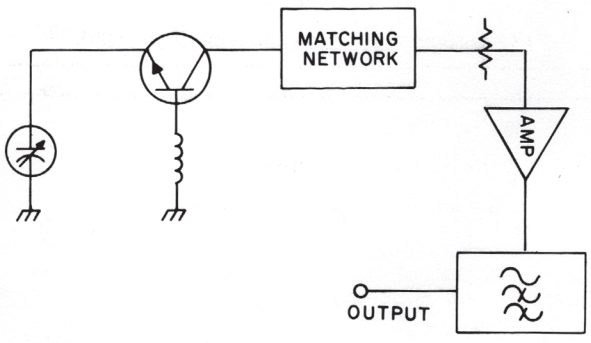


Fig 3–Simplified VCO Block diagram

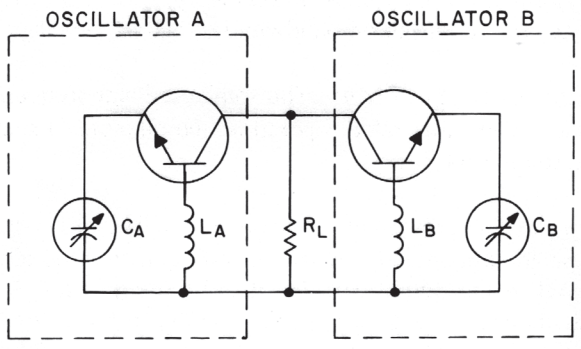
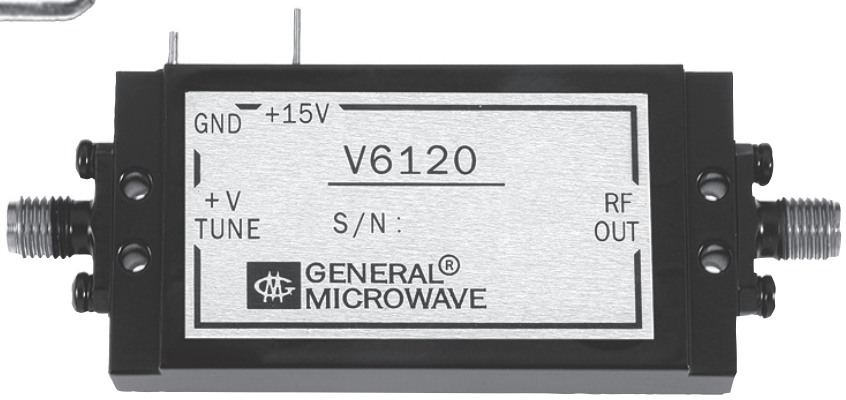


Fig 4–Schematic diagram of Push-Push Oscillator

XQNVCI G"EQPVTQNNGF "QUEKNNCVQTU"*XEQ+"UGNGEVKQP "I WKF G

HTGSWGPE["TCPI G"*I J| + 0.5 2 4 6 8 12.0 18.0	MQFGN"	PCI G	EQMMGPVU
2 — 4	V6020	53	Octave Band VCO
2.6 — 5.2	V6026		
4 — 8	V6040		
8 — 12	V6080		
12 — 18	V6120A		
2 — 2.8	V6020-952C	55	Miniaturized Voltage Controlled Oscillators
2.8 — 3.8	V6020-953C		
3.8 — 4.9	V6020-954C		
4.9 — 6.1	V6020-955C		
1 — 18	------	57	Custom Military and Commercial Voltage Controlled Oscillators



Xqnvci g"Eqpvtqmgf "Quekmcvqt "*XEQ+

QEVCXG"BCP F "XEQ

PCTCMGVGT	MQF GN				
	X6020	X6026	X6040	X6080	X6120C
HTGSWGPE["TCPIG"*I J | +	2-4	2.6-5.2	4-8	8-12	12-18
HTGSWGPE["UGVVNKPI *1+,"mcx"*MJ | + within 50 nsec , Typical	±8				±10
within 200 nsec, Typical	±3		±4		±5
within 1 µsec	±1.5		±3		±4
MQF WNCVKQP Bandwidth, min (MHz)	100				
Sensitivity ratio, max	3:1				
TH"PQY GT Output, min (dBm)	(10				
Variation, Incl. temp. and freq. max (dB)	±2.5		±3.0		
PJCUG"PQKUG,"mcx"*f Be/J | + @ 100 kHz offset	–95		–90	–80	–80
JCTMQPKEU,"mcx"*f Be+	–15			–40	–20
f/2, 3f/2,max (dBc)	N/A				–20
UPWTKQWU,"mcx"*f Be+	–60				
VGMPGTCVWTGUVCBKNKV[,V{p*PPM/ÕE+	100				
PWNNKPI "XUY T "2:1"mcx"*MJ | +	1				
PWUJKPI ,"mcx"*mJ | /X+	250				
EQPPGEVQTU Power supply	Solder terminal				
Tuning voltage	SMA female				
RF output	SMA female				
PQY GT "UWPPN["TGSWKTGMGPV Voltage (VDC)	(15 ±0.5				
Current, max (mA)	150				300
Tuning voltage (VDC)	0 to (20			0 to (15	
KPPWV"ECPCEKVCPEG,"pqmkpcn	25 pF, 10 kΩ				
GPXKTQPMGPVCN*2+ Operating temperature (ÕC)	–54 to (85				
Storage temperature (ÕC)	–54 to (125				
MGEJCPKECN"FKMGPUKQPU Inches	1.79 x 1.10 x 0.45				2.19 x 1.10 x 0.45
Millimeters	45,5 x 27,9 x 11,4				55,6 x 27,9 x 11,4

*1+Δf relative to f after 1 sec.
*2+Hermetically sealed.

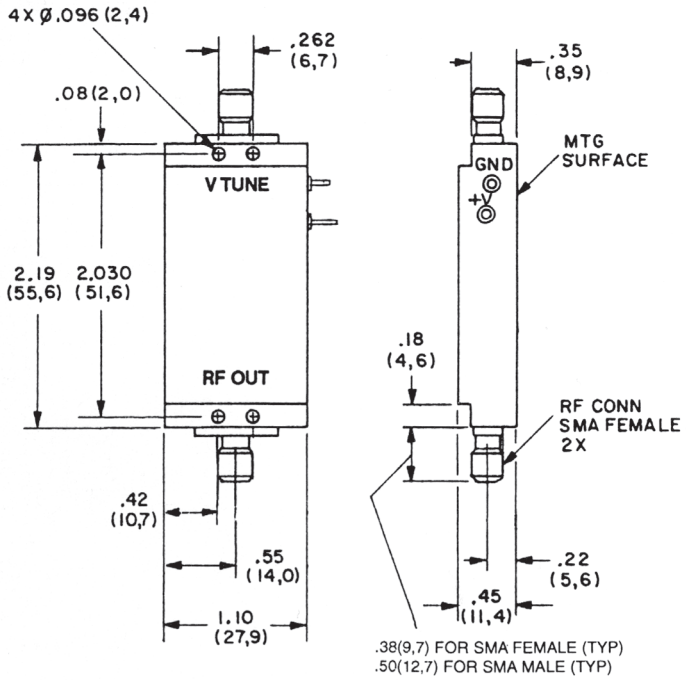
CXCKNCBNG"QPVKQPU

Qpvkqp"Pq0	F guetkpvkqp
49	High Rel screening (see Table 1)
G09	Meeting Environmental Ratings

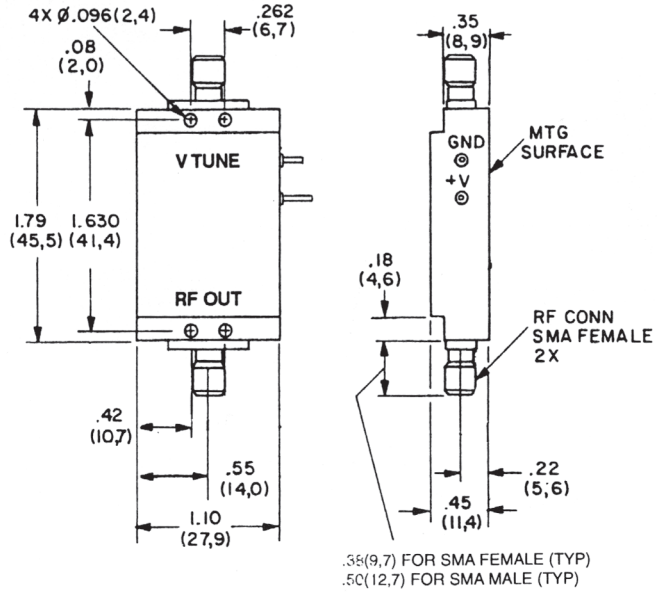
Vcbrg"10"Qpvkqp"49"Jkij "Tgn"Uetggpkpi

VGUV	MKN-UVF-883	PQVGU
Internal Visual	METHOD-2017	–
Temperature Cycle	METHOD 1010	-55 °C to ∗95 °C, 10 CYCLES Dwell time at temperature 20 minutes min.. temp. rise time 3°C/MIN
Mechanical Shock	METHOD 2002, COND. B	1,500g 0.5ms
Burn-In	METHOD 1015, COND. B	48 hours, at ∗110 °C
Leak	METHOD 1014 COND. A1	$5X10^{-8}$

F KMGP UKQP U"C P F "Y GK J VU



MODEL V6120A VCO
Wt: 1:94 oz. (55 gr.) approx.



MODELS V6020, V6026, V6040 AND V6080 VCOs
Wt: 1.27 oz. (36 gr) approx.

Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

MKP KCVWTK GF "*XEQ+

General Microwave has developed a family of high-speed, miniaturized VCOs covering the 2-6 GHz frequency range. These VCOs have been utilized in airborne EW applications, as well as in ground-based simulators. The specifications are summarized below.

Series V6020-95X Miniaturized VCO

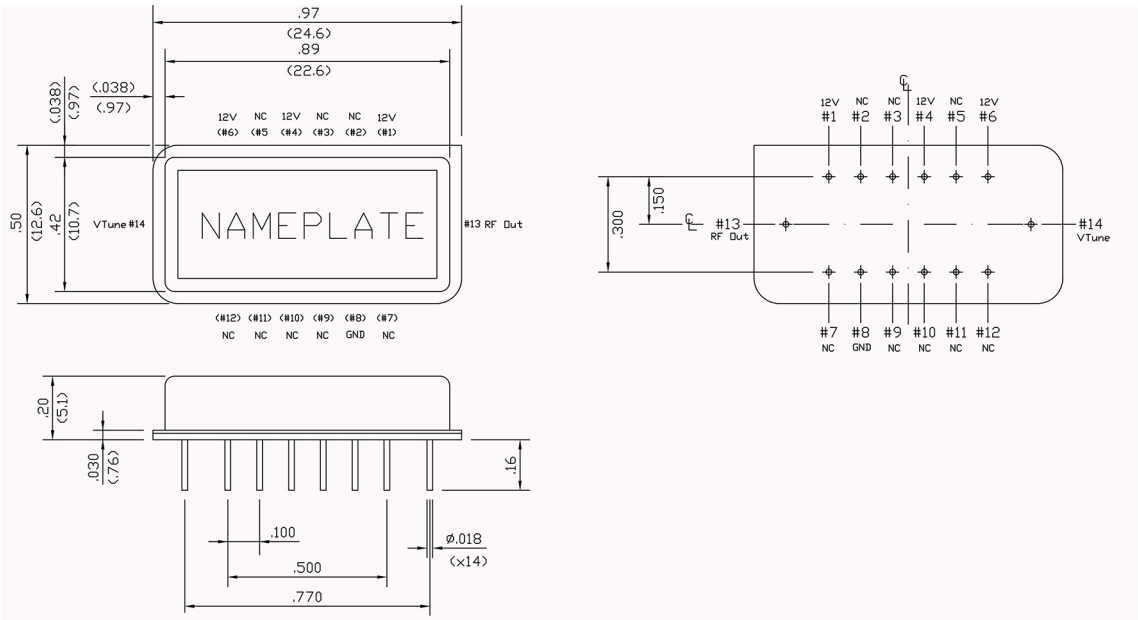
MKP KCVWTK GF "XEQ"UP GEKHKECVKQPU

	MQF GN			
PCTCMGVGT	X6020-952E/L	X6020-953E/L	X6020-954E/L	X6020-955E/L
HTGSWGPE["TCPI G"*I J| +	2.0-2.8	2.8-3.8	3.8-4.9	4.9-6-1
HTGSWGPE["UGVVNKPI *1+,"mcx"*MJ| + within 1 µsec	±1			
TH"PQY GT Output, min. (dBm)	(13			
Variation, max (dB)	±2			
PJCUG"PQKUG,"mcx"*f Be/J| + @ 100 kHz offset	–105		–100	
JCTMQPKEU,"mcx"*f Be+	–20			
UPWTKQWU,"mcx"*f Be+	–60			
VGMPGTCVWTGUVCBKNKV[,V{p"MJ| /°E+	–0.6		–1.0	
PWNNKPI "XUY T"3:1"v{p"*MJ| +	2		3	5
PWUJKPI ,"v{p"*MJ| /X+	6		10	
PQY GT"UWPP N["TGSWKTGMGPV Voltage (VDC)	(12 ±0.5			
Current, max (mA)	125			
Tuning (VDC)	0 to (28			
VWPKPI PQTVECPCEKVCPEG,'mcx"pH+	50			
GPXKTQPMGPVCN Operating temperature (ÕC)	0 to (85			
Storage temperature (ÕC)	–54 to (125			
MGEJCPKECN"FKMGPUKQPU Inches	0.97 x 0.50 x 0.20			
Millimeters	24,6 x 12,7 x 5,1			

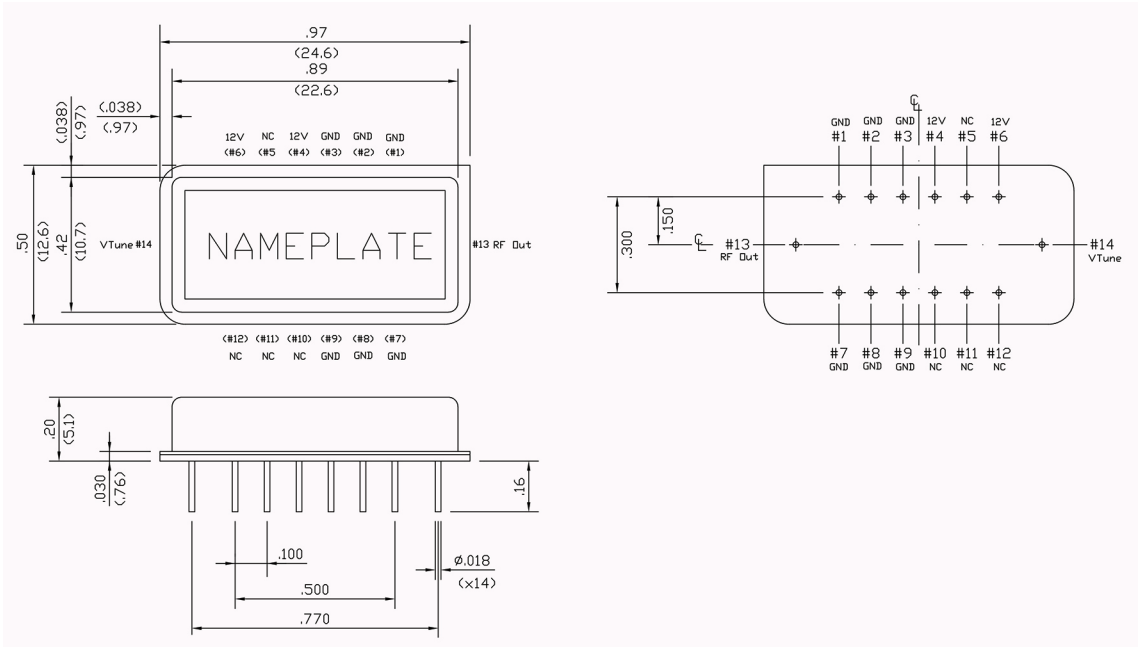
*1+Δf relative to f after 1 millisec

F KMGPUKQPU"cpf "Y GK JVU

Mqf grl'X6020-95xE



Mqf grl'X6020-95xL



Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.008

Cm'Mqf gru:"0015"q|0,"*4034"i tcmu+"cpptqx0

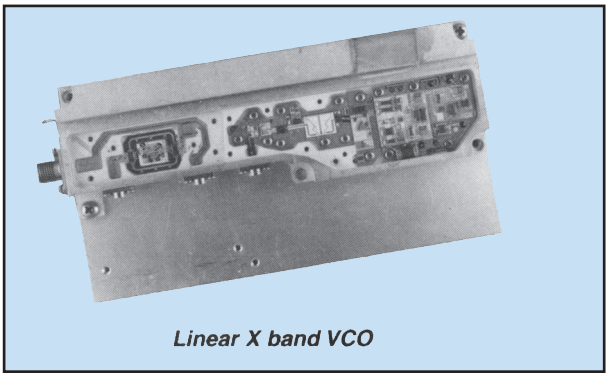
EWUVQM"XEQu"

Nkpgct "XEQu

For narrowband (<5%) applications, KRATOS General Microwave has developed proprietary techniques to achieve a high degree of linearity without the use of external linearizers.

Nkpgct "X "bcpf

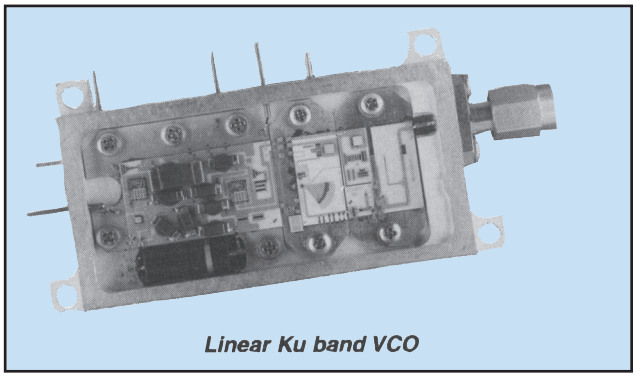
An X-band VCO assembly with linearity of less than ±1% is shown in the photo. The assembly includes two MMIC amplifiers, a medium power MIC amplifier, two filters, a phase shifter and a MMIC SP2T switch. For specific requirements, please consult the factory.



Linear X band VCO

Nkpgct "Mw"bcpf

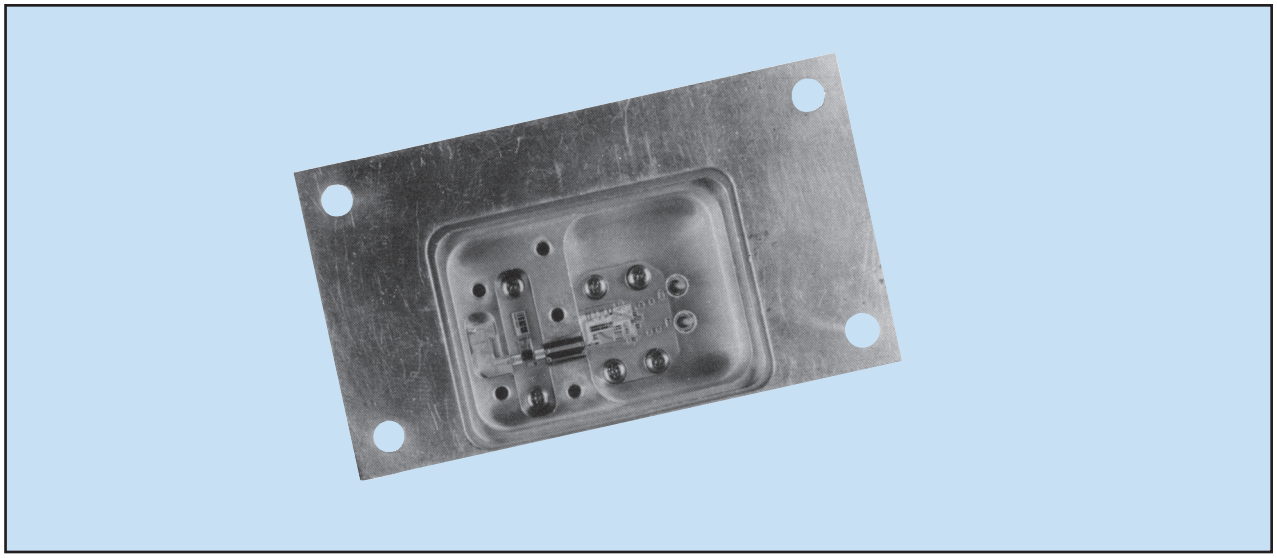
The photo shows a Ku-band VCO with a typical linearity of better than ±5% for an airborne jamming application. The unit is designed for high speed modulation and also includes RFI/EMI filtering.



Linear Ku band VCO

Eqmmgtekcn"Uecng"HGV "X "bcpf

For X- and Ku-band applications where very low post-tuning drift and phase noise are not required, VCOs based upon GaAs FETs provide a cost-effective solution. In the photo, a GaAs FET X-band VCO, developed for a commercial radar application, is shown.



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