

QUARTZ, OSCILLATOR & FILTER



Innovative Products for Intelligent Applications

endrich ... represents

CITIZEN



mu MARUWA

SiTime™

SMI

TST

QUARTZ, OSCILLATOR & FILTER – SHORT FORM

Endrich Bauelemente GmbH offers a wide range of components supporting your frequency generation and frequency filtering needs with products from SiTime, Citizen, SMI, Chequers, Maruwa and TaiSaw. Depending of your physical and technical design requirements we offer numerous quartz crystals, oscillators, resonators and filters with a broad range of characteristics (freq, BW, tolerance, temp operation/stability, size etc). These devices are used in simple to most complex applications across multiple markets such as automotive, white goods, industrial, metering, medical, wireless and others. Please count on our sales, technical and logistic support for all your frequency generation and frequency filtering needs.

Chequers Electronic Ltd. (China)

Chequers Electronic Ltd. (China) is one of the world experts focusing on frequency-control components based on its own advanced ceramic technology.

Products: kHz/MHz crystals, XO & VCXO, crystal dielectric/SAW filters, ceramic IF filters, SAW/ceramic resonators, others

Citizen Finedevice Co., Ltd. (former Citizen Finetech Miyota)

Citizen is one of the market leaders of kHz range quartz crystals in plastic, metal and ceramic packages for precision watches and other applications.

Products: kHz crystals

TAI-SAW Technology CO., LTD

Former Motorola employees founded TST in 1997. TST is now recognized as the leading SAW device supplier in Taiwan, as well as the key OEM/ODM supplier of SAW devices in the world.

Products: SAW and BAW (Bulk Acoustic Wave) devices. Xtal, XO, VCO, VCTCXO etc). automotive certified products.

SMI INC.

SMI is specialized in the newest miniature precise SMD versions of crystal units, clock OSC, TCXO, VCXO, OCXO & MCF. SMI offers products of high quality in the frequencies from 16.000 kHz (low) to 350.000 MHz (high) with strict quality control and shipping inspection.

Products: kHz / MHz crystals, XO / VCXO / TCXO / VCTCXO, monolithic crystal filters, others

SiTime Corporation

SiTime, an analogue semiconductor company, is revolutionizing the timing industry with silicon MEMS-based oscillators and clock generators. Their timing solutions can replace legacy quartz crystal products by offering higher performance and reliability at a lower cost. With the robust MEMS resonators and high performance analogue ICs, they have developed solutions that overcome the limitations of quartz devices.

The oscillators are 100% drop-in replacements for quartz oscillators without any design changes. Plus, the programmable architecture enables the most flexible products with more features and ultra fast lead-times. For new designs or re-design, customers can use SiTime oscillators in the industry's smallest packages – as small as 1.5 x 0.8 mm.

Products: MEMS XO, MEMS VCO, MEMS TCXO, MEMS VCTCXO, MEMS XO 32.768 kHz etc). Automotive certified

MARUWA CO.,LTD

Maruwa is setting new standards for tomorrow's fine ceramics technology. The compact, high-performance models equipped with a sub miniature VCO or LTCC substrate are developed to support cellular phones, tablets and many other complex applications.

Products: Voltage Controlled Oscillators (VCO) up to 6 GHz, others

1. QUARTZ CRYSTAL UNITS



Crystal Units



Quartz crystals are silicon-dioxide based simple, but critical components. Used in most

electronic circuits mainly for timing and frequency generation applications for clocks, controllers, analogue/digital devices, microprocessors and many others. Although in small size they exhibit extremely high Q (sharp frequency), temperature stability and low frequency shift.

Features

- State-of-the-art 32.768 kHz tuning fork crystals. THT (through-hole) and SMD type.
- Smallest size 1.0 × 1.6 mm
- AT-cut crystals up to 200 MHz SMD or THT. Smallest size 1.6 × 1.2 mm.
- Extended temperature range of -40 ° C to +125 ° C
- Standard and customer specific crystals
- Automotive qualified products

MODEL	FREQUENCY RANGE (MHz)	FREQUENCY TOLERANCE @25°C (ppm)	FREQUENCY STABILITY (ppm)	PACKAGES (mm x mm)	FEATURES
SMD – MHZ					
SMD1612-4	24 to 80	±5 to ±50	±10 to ±50	1.6 x 1.2	Ceramic package
SMD2016-4	16 to 80	±5 to ±50	±10 to ±50	2.0 x 1.6	Ceramic package
SMD2520-4	12 to 80	±5 to ±50	±10 to ±50	2.0 x 2.5	Ceramic package
SMD3225-4	9.9 to 150	±5 to ±50	±10 to ±50	3.2 x 2.5	Ceramic package
SMD5032-4	8.0 to 300	±5 to ±50	±10 to ±50	5.0 x 3.2	Ceramic package
SMD5032-2 (2 PAD)	8.0 to 60	±5 to ±50	±10 to ±50	5.0 x 3.2	Ceramic package
SMD6035-4	9.0 to 150	±5 to ±50	±10 to ±50	6.0 x 3.5	Ceramic package
SMD6035-2 (2 PAD)	10.0 to 67	±5 to ±50	±10 to ±50	6.0 x 3.5	Ceramic package
SMD7050-4	6.0 to 70	±5 to ±50	±10 to ±50	7.0 x 5.0	Ceramic package
SMD7050-2 (2 PAD)	6.0 to 70	±5 to ±50	±10 to ±50	7.0 x 5.0	Ceramic package
SMD8045 (2 PAD)	4.0 to 50	±5 to ±50	±10 to ±50	8.0 x 4.5	Ceramic package
92SMX	3.58 to 40	±5 to ±50	±10 to ±50	11.8 x 5.5	Ceramic package
86SMX	3.58 to 32	±5 to ±50	±10 to ±50	11.8 x 5.5	Plastic mold
HC49S-SMD	3.58 to 80	±5 to ±50	±10 to ±50	12.4 x 4.7	Metal can

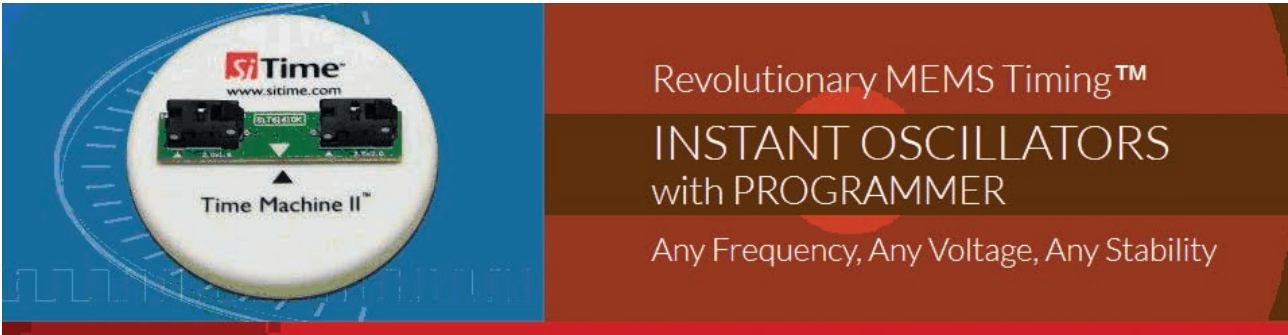
MODEL	FREQUENCY RANGE (MHz)	FREQUENCY TOLERANCE @25°C (ppm)	FREQUENCY STABILITY (ppm)	PACKAGES (mm x mm)	FEATURES
THT (THROUGH HOLE TYPE) / GULL WING (SMD)					
HC49U	1.84 to 200	±10 to ±50	±10 to ±50	11.3 x 4.9 x 13.5	Metal can
HC49S	3.58 to 610	±10 to ±50	±10 to ±50	10.5 x 5.0 x 3.5	Metal can
UM1	1.0 to 200	±3 to ±50	±10 to ±50	7.9 x 3.2 x 8.0	Metal can
UM-5	10.0 to 200	±3 to ±20	±10 to ±50	7.9 x 3.2 x 6.0	Metal can
UM-4	20.0 to 200	±3 to ±20	±10 to ±50	7.9 x 3.2 x 4.5	Metal can
HC49U/MJ	1.84 to 200	±10 to ±50	±10 to ±50	13.5 x 11.3 x 4.9	Metal can / SMD Gull Wing
UM-1MJ	1.0 to 200	±5 to ±50	±10 to ±50	7.8 x 8.0 x 3.1	Metal can / SMD Gull Wing
UM-5MJ	10.0 to 200	±5 to ±20	±10 to ±50	5.8 x 8-0 x 3.1	Metal can
UM-4MJ	20.0 to 200	±5 to ±20	±10 to ±50	4.4 x 8.0 x 4.4	Metal can

MODEL	FREQ. RANGE (kHz)	FREQUENCY TOLERANCE @25°C (ppm)	TEMPERATURE COEFFICIENT	SIZE (MAX. mm)	TYPE
TUNING FORK CRYSTAL UNITS					
CFS-145	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	Ø:1,5 x H:5.1	Cylinder / Through hole
CFS-206	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	Ø:2.1 x H:6.2	Cylinder / Through hole
CFV-206	30 to 100	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	Ø:2.1 x H:6.2	Cylinder / Through hole
CMR200T	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	Ø:2.1 x H:6.2	Cylinder / Lead formed SMD
CMJ206T	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:8.6 x W:2.7 x H2.4	Cylinder / With jacket SMD
CM250C	30 to 100	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:8.0 x W:3.8 x H2.55	Plastic mold / SMD
CM200C	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:8.0 x W:3.8 x H2.55	Plastic mold / SMD
CM130	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:7.0 x W:1.5 x H1.4	Plastic mold / SMD
CM519	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:5.05 x W:1.95 x H1.0	Ceramic package /SMD
CM415	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:4.2 x W:1.6 x H0.9	Ceramic package /SMD
CM315D	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:3.3 x W:1.6 x H0.9	Ceramic package /SMD
CM315DL	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:3.3 x W:1.6 x H0.9	Low ESR Ver. of CM315D (50 kΩ Max.)
CM315E	32.768	±5 to ±30	-0.034 ppm/°C ² ±0.006 ppm/°C ²	L:3.3 x W:1.6 x H0.9	3 pads / Li cover connected to GND
CM2012H	32.768	±5 to ±30	-0.04 ppm/°C ² Max	L:2.15 x W:1.3 x H0.6	Ceramic package /SMD
CM1610H	32.768	±5 to ±30	-0.04 ppm/°C ² Max	L:1.7 x W:1.1 x H0.5	Ceramic package /SMD



Ceramic resonators are positioned between quartz crystal oscillators and LC/RC oscillators in regard of accuracy, but they are considerably smaller, require no adjustments, have improved start-up times, and are very inexpensive. Their oscillation frequency depends on the mechanical resonance linked with their piezoelectric crystalline structure.

MODEL	FREQUENCY RANGE (MHz)	FREQUENCY TOLERANCE @25°C (%)	FREQUENCY STABILITY (%)	PACKAGES (mm x mm)	FEATURES
CERAMIC RESONATORS					
ZTACP / ZTTCP	2.0 to 8.0	±0.3 to ±0.5	±0.3	7.4 x 3.4 x 1.8 6.0 x 3.0 x 1.7	SMD (With or without integrated Capacitor)
ZTAGS / ZTTCS ZTACV / ZTTCV	6.0 to 60.0 8.0 to 60.0	±0.5	±0.3 to ±0.4	4.7 x 4.1 x 1.9 3.7 x 3.1 x 1.7	SMD (With or without integrated Capacitor)
ZTACR / ZTTCR ZTACE / ZTTCE ZTACW / ZTTCW	6.0 to 8.0 8.0 to 12.0 20.0 to 60.0	±0.5	±0.3	4.5 x 2.0 x 1.2 3.2 x 1.3 x 1.0 2.5 x 2.0 x 1.2	SMD (With or without integrated Capacitor)
ZTAWs / ZTTWs ZTALS / ZTTLS ZTARS / ZTTRS	1.79 to 6.0 3.0 to 8.0 3.0 to 60.0	±0.3 to ±0.5 ±0.3 to ±0.5 ±0.3 to ±0.5	±0.3		THT Type (With or without integrated Capacitor)



Oscillators

Complexity-wise, on one extreme, there are the inexpensive, simple, easy to design/control-, quartz crystals and on the other extreme, oscillators. Oscillators incorporate a quartz crystal, few LNAs, and a varicap diode, thus providing more stable, accurate, and higher output level than simple crystals.

Oscillators, originally the luxury version of quartzes, have been in the meantime also suitable/available for cheaper/low price applications as freq. generators components. An oscillator offers the complete solutions of an oscillator circuit in factory level/type quality, reliability, accuracy and reliable start up oscillation.

Endrich offers a wide range of oscillators at different kHz & MHz frequencies, voltages, packages (SMD, THT) and other characteristics. Based on MEMS or quartz oscillator technology.

Features

- PXO Clock Oscillators
- VCXO / VCO
- TCXO
- VCTCXO
- One time programmable crystal oscillators
- OCXO

MODEL	OUTPUT FREQUENCY	FREQUENCY STABILITY (ppm)	SUPPLY VOLTAGE (V)	SUPPLY CURRENT (TYP.)	PACKAGES (mm x mm)	OUTPUT LOGIC	FEATURES
µPOWER 32 KHZ SOLUTION (XTAL AND XO REPLACEMENTS, ULTRA SMALL SIZE)							
SiT1532 SiT1533	32.768 kHz	10, 20 room 75, 100, 250 over temp.	1.2 to 3.63	0.9 µA	1.5x0.8x0.6 (CSP) 2.0x1.2x0.6 (QFN)	NanoDrive™ LVCMOS	Smallest XO
SiT1534	1 Hz to 32.768 kHz (16 Frequencies)	20 room 75, 100 over temp.	1.2 to 3.63	0.9 µA	1.5x0.8x0.6 (CSP) 2.0x1.2x0.6 (QFN)	NanoDrive™ LVCMOS	Smallest XO
SiT1630	32.768 kHz	20 room 75, 100, 150 over temp.	1.5 to 3.63	1.0 µA	2.0x1.2x0.6 (QFN)	LVCMOS	-40 to +105°C
SiT1552 TCXO	32.768 kHz	±10, ±13, ±22, over all	1.5 to 3.63	0.99 µA	1.5x0.8x0.6 (CSP)	NanoDrive™ LVCMOS	Smallest XO
SiT1566/68** Super TCXO	32.768 kHz	±3 over all ±5 over all	1.8 1.62 to 3.63	4.5 µA	1.5x0.8x0.6 (CSP)	LVCMOS	Smallest XO
SiT1572	32.768 kHz	±50 ppm over all	1.5 to 3.63	4.5 µA	1.5x0.8x0.6 (CSP)	LVCMOS	

3. MEMS OSCILLATOR PRODUCT PORTFOLIO



Revolutionary MEMS Timing™

µPower MHz Oscillator

90% Lower Power • 40% Smaller

MEMS OSCILLATOR PRODUCT PORTFOLIO

MODEL	OUTPUT FREQ	FREQUENCY STABILITY (ppm)	SUPPLY VOLTAGE (V)	SUPPLY CURRENT (TYP.)	PACKAGES (mm x mm)	OUTPUT LOGIC	FEATURES
µPOWER OSCILLATORS & TCXO (1 TO 280 µA POWER CONSUMPTION, ULTRA SMALL SIZE)							
SiT1569	1 Hz to 462.5 kHz	±50 ppm over all	1.62 to 3.63	1.7 to 10 4.5 µA	1.5x0.8x0.6 (CSP)	LVC MOS	
SiT1579	1 Hz to 2.5 MHz	±50 ppm over all	1.62 to 3.63	6µA (100 kHz)	1.5x0.8x0.6 (CSP)	LVC MOS	Low Jitter
SiT1576 Super TCXO	1 Hz to 2.5 MHz	±5 to ±20 ppm over all	1.62 to 3.63	6.0 µA (100 kHz)	1.5x0.8x0.6 (CSP)	LVC MOS	Smallest XO
SiT8021	1 to 26 MHz	±100	1.8 2.25 to 3.63	60 to 280 µA (0.9 µA stby)	1.5x0.8x0.6 (CSP)	NanoDrive™ LVC MOS	Smallest XO
LOW-POWER OSCILLATORS (3.1 TO 5.5 MA POWER CONSUMPTION)							
SiT1602 SiT8008/9	1 to 137 MHz	±20, ±25, ±50	1.8 2.5 to 3.3	3.1. to 5.5 mA (0.6 to 1.0 µA stby)	2.0 x 1.6, 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVC MOS	Field Prog. with TMII
SiT2001 SiT2002	1 to 137 MHz	±20, ±25, ±50	1.8 2.5 to 3.3	3.6 to 5.4 mA (1.0 µA stby)	2.9 x 2.8 (SOT23-5)	LVC MOS	Field Prog. with TMII
LOW-JITTER OSCILLATORS (0.23 TO 0.6 PS RMS INTEGRATED PHASE JITTER TYP.)							
SiT9365/ SiT9366/67 Elite.	10 to 700 MHz	±10, ±20, ±25, ±50	2.5 to 3.3	76 to 84 mA	3.2 x 2.5, 7.0 x 5.0 (QFN)	LVPECL, LVDS, HCSL	0,23 RMS Phase Jitter
SiT9120 SiT9121/22	10 to 625 MHz	±10, ±20, ±25, ±50	2.5 to 3.3	54 to 69 mA	3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVPECL, LVDS	Field Prog. with TMII
SiT8208 SiT8209	1 to 220 MHz	±20, ±25, ±50	1.8 2.5 to 3.3	29 to 36 mA (10 µA stby)	2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVC MOS	Field Prog. with TMII
SiT9386	1 to 220 MHz	±25, ±50	2.5 to 3.63	90 mA	3.2 x 2.5 , 7.0 x 5.0	LVPECL LVDS, HCSL	ultra low Jitter / Automotive
SiT9387	220 to 750 MHz	±25, ±50	2.5 to 3.63	94 mA	3.2 x 2.5 , 7.0 x 5.0	LVPECL LVDS, HCSL	ultra low Jitter / Automotive

3. MEMS OSCILLATOR PRODUCT PORTFOLIO



MODEL	OUTPUT FREQ	FREQUENCY STABILITY (ppm)	SUPPLY VOLTAGE (V)	SUPPLY CURRENT (TYP.)	PACKAGES (mm x mm)	OUTPUT LOGIC	FEATURES
HIGH-TEMP. AND AUTOMOTIVE OSCILLATORS (+125 OPERATING TEMPERATURE, 01 PPB/G (G-SENSITIVITY))							
SIT1618 SIT8918/19	1 to 137 MHz	±20, ±25, ±30, ±50	1.8 2.5 to 3.3	3.6. to 5.4 mA (1.0 µA stby)	2.0 x 1.6, 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0x5.0 (QFN)	LVC MOS	-40 °C to 125 °C Field Prog. with TMI I
SIT2018 SIT2019	1 to 137 MHz	±20, ±25, ±30, ±50	1.8 2.5 to 3.3	3.6 to 5.4 mA (1.0 µA stby)	2.9 x 2.8 (SOT23-5)	LVC MOS	-40 °C to 125 °C Field Prog. with TMI I
SIT8920/21 SIT8924/25	1 to 137 MHz	±20, ±25, ±30, ±50	1.8 2.5 to 3.3	3.6. to 5.4 mA (1.0 µA stby)	2.0 x 1.6, 2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVC MOS	-55 °C to 125 °C Field Prog. with TMI I
SIT2020/21 SIT2024/25	1 to 137 MHz	±20, ±25, ±30, ±50	1.8 2.5 to 3.3	3.6 to 5.4 mA (1.0 µA stby)	2.9 x 2.8 (SOT23-5)	LVC MOS	-40 °C to 125 °C Field Prog. with TMI I
SIT8926	137 to 150 MHz	±20, ±25, ±50	1.8 to 3.63	6.5 mA	2.0 x 1.6, 2.5 x 2.0 3.2 x 2.5	LVC MOS	Field Prog. with TMI I / Automotive

ELITE Platform™
Vibration-Resistant VCXOs

±25 to ±3200 ppm pull, 0.1 ppb/g, 95°C

Elite High-Reliability VCXOs

For Networking, Telecom and Instrumentation

MODEL	OUTPUT FREQ	FREQUENCY STABILITY (ppm)	SUPPLY VOLTAGE (V)	SUPPLY CURRENT (TYP.)	PACKAGES (mm x mm)	OUTPUT LOGIC	FEATURES
VCXO (±25 to ±3600 ppm pull range, <1% linearity)							
SIT3372/73 Elite	10 to 700 MHz	±10, ±25, ±50	2.5 to 3.3	76 to 84 mA	3.2 x 2.5, 7.0 x 5.0 (QFN)	LVPECL, LVDS, HCSL	0,23 RMS Phase Jitter
SIT3807/8/9	1 to 22 MHz	±10, ±25, ±50	1,8 2.5 to 3.3	29 to 34 mA (10 to 70 µA stby)	2.5 x 2.0, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVC MOS	Field Prog. with TMI I
In-System Programmable (I2C/SPI Oscillators)							
SIT3521	1 to 340 MHz	±20, ±25, ±50	2.5 to 3.63	89 mA	5.0 x 3.2	LVPECL, LVDS, HCSL	I2C/SPI Oscillators
SIT3522	340 to 725 MHz	±20, ±25, ±50	2.5 to 3.63	89 mA	5.0 x 3.2	LVPECL, LVDS, HCSL	2C/SPI Oscillators
In-System Programmable (Digital-Controlled Oscillator, ±25 to ±1600 ppm pull range, <1% linearity, 0.5ps RMS integrated phase jitter)							
SIT3907	1 to 220 MHz	±10, ±20, ±50	1.8 to 3.3	32 mA	3.2 x 2.5, 5.0 x 3.2 7.0 x 5.0 (QFN)	LVC MOS	Field Prog. with TMI I
SIT3921/22	1 to 625 MHz	±20, ±25, ±50	1.8 to 3.3	55 to 69 mA	3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0, 7.0 x 5.0 (QFN)	LVPECL LVDS, HCSL	Field Prog. with TMI I

3. MEMS OSCILLATOR PRODUCT PORTFOLIO



±500 ppb at 105°C, 0.1 ppb/g

Elite Super-TCXOs

For GNSS and Automotive Applications

MEMS OSCILLATOR PRODUCT PORTFOLIO

MODEL	OUTPUT FREQ	FREQUENCY STABILITY (ppm)	SUPPLY VOLTAGE (V)	SUPPLY CURRENT (TYP.)	PACKAGES (mm x mm)	OUTPUT LOGIC	FEATURES
TCXO/VCTCXO (±6.24 to ±25 ppm pull range, 0.35 to 0.6 ps RMS integrated phase jitter)							
SiT5356/57 Elite.	1 to 220 MHz	±0.1, ±0.2, ±0.25	2.5 to 3.3	40 to 45 mA	6.0 x 4.9 (SOIC-8)	LVC MOS Clipped Sinewave	-40 to +105 °C 1 ppb/°C
SiT5155 SiT5156/57 Elite	1 to 220 MHz	±0.5, ±1, ±2.5	2.5 to 3.3	40 to 45 mA	6.0 x 4.9 (SOIC-8)	LVC MOS Clipped Sinewave	-40 to +105 °C
SiT5021/229	1 to 625 MHz	±5	2.5 to 3.3	55 to 69 mA	3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVPECL, LVDS	-40 to +85 °C
SSXO (Spread Spectrum Oscillator, ±0.25 to ±2.0% center spread, ±0.5 to ±4.0% down spread)							
SiT9003	1 to 110 MHz	±25, ±50	1.8 2.5, 3.3	3.2 to 4.1 mA (0.4 to 4.0 µA stby)	2.5 x 2.0, 3.2 x 2.5, 5.0 x 3.2, 7.0 x 5.0 (QFN)	LVC MOS	Field Prog. with TMII
SiT9002	1 to 220 MHz	±25, ±50	1.8 2.5, 3.3	48 to 75 mA	5.0 x 3.2, 7.0 x 5.0 (QFN)	LVPECL, CML, LVDS, HCSL	Field Prog. with TMII
SiT9005	1 to 141 MHz	±20, ±25, ±50	1.8 to 3.6	6.5 mA	2.0 x 1.6, 2.5 x 2.0 3.2 x 2.5	LVC MOS	Field Prog. with TMII
SiT9025	1 to 150 MHz	±20, ±25, ±50	1.8 to 3.6	6.5 mA	2.0 x 1.6, 2.5 x 2.0 3.2 x 2.5	LVC MOS	Field Prog. with TMII / Automotive

4. CRYSTAL OSCILLATOR PRODUCT PORTFOLIO



MODEL	FREQUENCY RANGE (MHz)	FREQUENCY STABILITY OVER ALL (ppm)	SUPPLY VOLTAGE (V)	PACKAGES (mm x mm)	FEATURES
Crystal Clock Oscillators					
21SMO	1.5 to 80	±20 to ±100	1.8 to 3.3	1.65 x 2.05	CMOS
22SMO	1.5 to 170.0	±20 to ±100	1.8 to 3.3	2.5 x 2.0	CMOS
22SMOLC	1.25 to 50.0		0.8 to 1.5		
22SMOHG	4.0 to 55.0	±8 to ±15	1.8 to 3.3		
32SMO	1.5 to 170.0	±20 to ±100	1.8 to 3.3	3.2 x 2.5	CMOS
32SMOLC	1.25 to 50.0		0.8 to 1.5		
32SMOHGx	4.0 to 160.0	±8 to ±15	1.8 to 3.3		
99SMO	1.0 to 220.0	±20 to ±100	1.8 to 5.0	5.0 x 3.2	CMOS
99SMOHGx	4.0 to 160.0	±8 to ±15	1.8 to 3.3		
97SMO	1.0 to 220.0	±20 to ±100	1.8 to 5.0	7.0 x 5.0	CMOS
97SMOHGx	4.0 to 160.0	±8 to ±15	1.8 to 3.3		
57SMO	13.5 to 400.0	±20 to ±100	2.5 to 3.5	7.0 x 5.0	LVPECL
97SMOHGx	4.0 to 160.0	±8 to ±15	1.8 to 3.3		
Crystal Clock Oscillators (LVPECL / LVDS / HCSSL)					
22SMO-LVP	6.0 to 175.0	±20 to ±100	2.5 to 3.5	2.0 x 2.5	LVPECL
22SMO-LVD	5.0 to 175.0				LVDS
32SMO-LVP	5.0 to 175.0	±20 to ±100	2.5 to 3.5	3.2 x 2.5	LVPECL
32SMO-LVD	5.0 to 175.0				LVDS
32SMO-HCS	13.5 to 175.0				HCSSL
99SMO-LVP	5.0 to 250.0	±20 to ±100	2.5 to 3.5	7.0 x 5.0	LVPECL
99SMO-LVD	5.0 to 250.0				LVDS
99SMO-HCS	13.5 to 220.0				HCSSL
57SMO	13.5 to 400.0	±20 to ±100	2.5 to 3.5	7.0 x 5.0	LVPECL
67SMO	13.5 to 350.0				LVDS
77SMO	13.5 to 220.0				HCSSL
Crystal Clock Oscillators (32 kHz)					
32SMO(E)	32.768 kHz	+30 to -10 @25°C	1.5 to 5.5	3.2 x 2.5	CMOS 1.5 µA max.
32SMO(J)	32.768 kHz	+28 to -18 @25°C	1.5 to 5.5	3.2 x 1.5	CMOS 1.5 µA max.
32SMO(C)	32.768 kHz	±25 to ±30 over all	1.8 to 5.5	2.5 x 2.0	CMOS 160 µA max.
32SMO(D)	32.768 kHz	±25 to ±30 over all	1.8 to 5.5	3.2 x 2.5	CMOS 80 µA max.
32SMO(F)	32.768 kHz	±25 to ±30 over all	1.8 to 5.5	5.0 x 3.2	CMOS 80 µA max.
32SMO(G)	32.768 kHz	±25 to ±30 over all	1.8 to 5.5	7.0 x 5.0	CMOS 80 µA max.

4. CRYSTAL OSCILLATOR PRODUCT PORTFOLIO



MODEL	FREQUENCY RANGE (MHz)	FREQUENCY STABILITY OVER ALL (ppm)	SUPPLY VOLTAGE (V)	PULLING RANGE (ppm min.)	PACKAGES (mm x mm)	FEATURES
VCXO						
22SMOV	1.3 to 100.0	±20 to ±50	1.8 to 3.3	±90	2.5 x 2.0	CMOS
32SMOVx	1.25 to 170.0		1.8 to 3.3	±90 (±110)		CMOS
53SMOVH	10.0 to 170.0	±20 to ±50	3.3	±80	3.2 x 2.5	LVPECL
63SMOVH	40.0 to 170.0		3.3	±80		LVDS
99SMOVx	1.0 to 170.0		1.8 to 3.3	±90 (±110)		CMOS
55SMOVH	30.0 to 170.0	±20 to ±50	3.3	±80	5.0 x 3.2	LVPECL
65SMOVH	30.0 to 170.0		2.5 or 3.3	±80		LVDS
97SMOVH	1.25 to 170.0		3.3	±100		CMOS
57SMOVH	30.0 to 200.0	±20 to ±50	3.3	±80	7.0 x 5.0	LVPECL
67SMOVH	30.0 to 170.0		2.5 or 3.3	±80		LVDS
VCO						
MVZ Series	200 to 4000				4.5 x 3.2	
MVF Series	700 to 2500				5.0 x 4.0	
MVY Series	100 to 6000				5.5 x 4.8	
MVN Series	700 to 4000				8.0 x 6.0	
MVE Series	100 to 6000	Custom specific	Custom specific	Custom specific	7.0 x 9.0	Analog modulation possible
MW Series	800 to 2500				8.0 x 9.8	
MVU Series	50 to 2500				10.4 x 11.9	
MVS Series	50 to 1000				10.4 x 15.1	
MVH Series	100 to 3000				12.7 x 12.7	



4. CRYSTAL OSCILLATOR PRODUCT PORTFOLIO



MODEL	FREQUENCY RANGE (MHz)	FREQUENCY STABILITY OVER TEMPERATURE (PPM)	SUPPLY VOLTAGE (V)	VOLTAGE CONTROL (V _{DD})	PACKAGES (mm x mm)	FEATURES	
TCXO/VCTCXO							
SXO-1612x	19.0 to 52.0	±0.5 to ±2	1.8 to 3.3	n.a.	1.65 x 1.25	TCXO Clipped Sine	
SXO-1612xV				±9 ppm to ±13 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-2016x	13.0 to 52.0	±0.5 to ±2	1.8 to 3.3	n.a.	2.0 x 1.6	TCXO Clipped Sine	
SXO-2016xV				±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-2016xED				n.a.		TCXO E/D Control	
SXO-2200x	13.0 to 52.0	±0.5 to ±2	1.8 to 3.3	n.a.	2.5 x 2.0	TCXO Clipped Sine	
SXO-2016xV	13.0 to 52.0	±0.5 to ±2		±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-2016xED	13.0 to 52.0	±0.5 to ±2		n.a.		TCXO E/D Control	
SXO-2016xED	13.0 to 52.0	±0.5 to ±2		±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO E/D Control	
SXO-2520	4.0 to 54.0	±2.5		n.a.		TCXO CMOS	
SXO-3200x	10.0 to 40.0	±0.5 to ±2	1.8 to 3.3	n.a.	3.2 x 2.5	TCXO Clipped Sine	
SXO-3200xV	10.0 to 40.0			±8 ppm to 15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-3225	4.0 to 54.0			n.a.		TCXO CMOS	
SXO-5500	10.0 to 52.0	±0.1 to 20	-2.8 to 5.0	±3.0 ppm min		TCXO Clipped Sine or CMOS	
SXO-5200	6.0 to 45.0	±2.5	2.8 to 3.3	n.a.		TCXO Clipped Sine	
SXO-5200V	6.0 to 45.0	±2.5	2.8 to 3.3	±8 ppm min. (±1.5 V ±1 V)		VC-TCXO Clipped Sine	
SXO-5032	4.0 to 54.0	±2.5	1.8 to 3.3	n.a.		TCXO CMOS	
SXO-4053CS	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	n.a.	5.0 x 3.2	TCXO Clipped Sine	
SXO-4053CSV	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-4053CSE	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	n.a.		TCXO E/D Control	
SXO-4053CM	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	n.a.		TCXO CMOS	
SXO-4053CMV	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO CMOS	
SXO-4053CME	13.0 to 52.0	±0.5 to ±2.5	1.8 to 3.3	n.a.		TCXO E/D Control	
SXO-9000x-CS	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	n.a.		TCXO Clipped Sine	
SXO-9000x-CSV	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	±5 ppm to ±15 ppm (+1.65 ±1.65 V)		VC-TCXO Clipped Sine	
SXO-9000x-CM	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	n.a.		TCXO CMOS	
SXO-9000x-CMV	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	±5 ppm to ±15 ppm (+1.65 ±1.65 V)		VC-TCXO CMOS	
SXO-7100	10.0 to 26.0	±2.5	2.8 to 5.0	n.a.	7.0 x 5.0	TCXO Clipped Sine	
SXO-7100V	10.0 to 26.0	±2.5	2.8 to 5.0	±8 ppm min. (±1.5 V ±1 V)		VC-TCXO Clipped Sine	
SXO-7050	4.0 to 54.0	±2.5	1.8 to 3.3	n.a.		TCXO CMOS	
SXO-4053CS	10.0 to 40.0	±0.5 to ±2.5	1.8 to 3.3	n.a.		TCXO Clipped Sine	
SXO-4053CSV	10.0 to 40.0	±0.5 to ±2.5	1.8 to 3.3	±9 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO Clipped Sine	
SXO-4053CM	10.0 to 40.0	±0.5 to ±2.5	1.8 to 3.3	n.a.		TCXO CMOS	
SXO-4053CMV	10.0 to 40.0	±0.5 to ±2.5	1.8 to 3.3	±8 ppm to ±15 ppm (1/2 VDD ±0.8 V or ±1 V)		VC-TCXO CMOS	
SXO-9000x-CS	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	n.a.		TCXO Clipped Sine	
SXO-9000x-CSV	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	±5 ppm to ±20 ppm (+1.65 ±1.65 V)		VC-TCXO Clipped Sine	
SXO-9000x-CM	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	n.a.		TCXO CMOS	
SXO-9000x-CMV	10.0 to 40.0	±0.1 to ±0.28	2.7 to 5.5	±5 ppm to ±20 ppm (+1.65 ±1.65 V)		VC-TCXO CMOS	
SXO-8000K	5.0 to 400.0	±10ppb to ±50ppb	3.3	±5 ppm (+1.65 ±1.65 V)		14.3 x 9.4	OCXO CMOS



SAW, BAW or MCF filters are essential circuit components used to filter out any unwanted frequency from a signal. There are numerous types of filters available on the market: analogue/digital, passive/active, linear/non-linear, electronic elec-tromechnical. They all perform the same function, and are generally described as Low Pass Filters (LPF), High Pass Filters (HPF), Band Pass Filters (BPF), or Band Stop (notch filter).

The key parameters describing any filters are: frequency band, BW, insertion loss (in pass band), rejection/attenuation (in reject band), temp, and package/size.

Endrich offers a wide range of filters suited for almost any working environment (automotive, industrial, etc), technology (WiFi, BT, GSM, LTE, GNSS, etc), application (RF, DC/DC, EMI filtering, etc), and conditions (high power, high frequency, low insertion loss, etc ...).

5. FILTER PRODUCT PORTFOLIO



MODEL	FREQUENCY RANGE (MHz)	PACKAGES (mm x mm)	FEATURES
SAW Filters / SAW Resonators / Crystal Filters			
TA Series	100 to 1000 MHz	5.0 x 5.0	SMD RF Filter SAW, TX-SAW and BAW
	250 to 2700 MHz	3.8 x 3.8	
	300 to 2800 MHz	3.0 x 3.0	
	400 to 2700 MHz	2.5 x 2.0	
	700 to 2700 MHz	2.0 x 1.6	
	700 to 2700 MHz	1.4 x 1.1	
	750 to 2700 MHz	1.1 x 0.9	
TB Series	30 to 200 MHz	25.0 x 9.0	SMD IF Filter
	30 to 200 MHz	19.0 x 6.5	
	30 to 900 MHz	13.3 x 6.5	
	70 to 200 MHz	11.4 x 5.0	
	70 to 200 MHz	9.0 x 7.0	
	100 to 1000 MHz	5.0 x 5.0	
	100 to 1000 MHz	7.0 x 5.0	
	150 to 1000 MHz	3.8 x 3.8	
TF	310 to 2700 MHz	5.0 x 5.0	SMD Duplexer, SAW and BAW
		3.8 x 3.8	
		2.5 x 2.0	
		2.0 x 1.6	
		1.8 x 1.4	
		1.5 x 1.1	
TY Series 96SMF	21.4 to 90 MHz	7.0 x 5.0	SMD MCF
	14.575 to 150 MHz	7.0 x 5.0	SMD MCF 2-Pol
	21.4 to 90 MHz	7.0 x 5.0	SMD MCF 4-Pol
	45 to 46.34 MHz	3.8 x 3.8	SMD MCF 2-Pol
TC Series	250 to 1100 MHz	5.0 x 5.0	SMD SAW Resonator
	250 to 1100 MHz	5.0 x 3.5	SMD SAW Resonator
	250 to 1100 MHz	3.8 x 3.8	SMD SAW Resonator
	250 to 1100 MHz	3.0 x 3.0	SMD SAW Resonator
	500 to 2400 MHz	2.5 x 2.0	SMD SAW Resonator
	200 to 1100 MHz	TO39	THT SAW Resonator
	200 to 1100 MHz	F11	THT SAW Resonator
TE		3.8 x 3.8	Duplexer & Band, Stop Filter
		3.0 x 3.0	
		1.5 x 1.1	
TL	310 to 5700 MHz		BPF, BP Diplexer, Notch, LTCC, Dielectric Filter, Dual Saw Filter
FEM	GNSS Wifi	2.5 x 2.5	SMD Front End Module
		1.5 x 1.1	
		3.0 x 2.5	

5. FILTER PRODUCT PORTFOLIO



Ceramic filters get their basic frequency selectivity from the mechanical vibration resulting from the piezoelectric effect. Nearly all low and high-end AM/FM commercial radios use ceramic filters. They are also used in cordless telephones, cellular, computers, GPS, mp3 players, DVD recorders, TV, and many others.

Features

- Ceramic resonators from 190 kHz to 60 MHz (smallest size 2.5 × 2.0 mm, temperature range -40°C to +125 °C)
- Ceramic filters: e.g. 455 kHz / 10.7 MHz / 27 MHz / 45 MHz
- Discriminators and traps
- Printed pass band filter

MODEL	FREQUENCY RANGE (MHz)	3dB BANDWIDTH	6dB BANDWIDTH	INSERTION LOSS [dB]	PACKAGES (mm x mm)	FEATURES
Ceramic Filters / Discriminators						
LTUCG	450/455 MHz		±3 to ±15 kHz	4.0 to 6.0	5.0 x 6.5	IF Filter SMD
LTUGS					5-0 x 6.5	
LTUCP					7.3 x 6.0 (7.5 x 7.0)	
LTCW	450/455 MHz	±2 to ±10 kHz	±2.5 to ±15 kHz	4.0 to 6.0	11.6 x 7.5	IF Filter SMD
LTW	450/455 MHz		±2.0 to ±15 kHz	4.0 to 6.0	8.0 x 4.0	IF Filter THT
LTS					7.5 x 3.5	
LTU					8.0 x 7.0	
LTM					9.5 (6.5) x 6.5	
LTCV10.7 LTCS10.7	10.7 MHz	±110 to ±330 kHz		3.0 to 6.0	7.0 x 3.0 3.45 x 3.1	IF Filter SMD
LT10.7	10.7 MHz	±110 to ±330 kHz		3.0 to 6.0	7.0 x 73.0 3.45 x 3.1	IF Filter THT
LTE LTH	4.5 to 6.5 MHz	±60 to ±130 kHz		2.0 to 6.0	10.0 x 5.0 8.0 x 5.0	IF Filter THT
XT	4.5 to 6.5 MHz					Trap THT
JTBC JTBM	450/455 MHz	±1.5 to ±4 kHz			6.0 x 6,6 6.0 x 6.3	Discriminator SMD Discriminator THT
JT10.7	10.7 MHz	±200 to ±700 kHz			9.0 x 4	Discriminator THT
LPF	76 to 108 MHz			3.0	10.5 (7.5) x 5.0	Printed Band Pass Filter THT

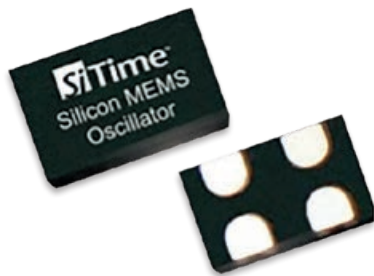
5. FILTER PRODUCT PORTFOLIO



MODEL	FEATURES
Dielectric Units (Spread Spectrum Oscillator, ± 0.25 to $\pm 2.0\%$ center spread, ± 0.5 to $\pm 4.0\%$ down spread) Model Features	
Dielectric Filters SMD (MF Type)	620 to 2450 MHz
Dielectric Filters THT (PF Type)	800 to 1800 MHz
Dielectric Filters SMD (AF Type)	830 to 2145 MHz
Dielectric Filters THT (AF Type)	826 to 2750 MHz
Dielectric Filters SMD (MC/MF/MP Mono Type)	830 to 3600 MHz
LC Dielectric Filters SMD	4 to 200 MHz
LC Dielectric Filters (PF Type)	40 to 2300 MHz
Dielectric Duplexers SMD (AD Array Type)	830 to 2500 MHz
Dielectric Duplexers SMD (Array and Mono Type)	830 to 3500 MHz
LC Dielectric Duplexers	85 to 275 MHz
Dielectric Resonators (Coaxial Type)	400 to 3000 MHz
Dielectric Resonators (Round Shape Ceramic)	500 MHz to 20 GHz
Dielectric Patch Antennas	869 to 2450 MHz

6. TIME MACHINE II

MEMS OSCILLATOR PROGRAMMER



The Time Machine II™ allows you to easily configure SiTime always-in-stock field programmable devices to your exact specification and create drop in replacements for legacy quartz oscillators within seconds.

Benefits

- Optimization of system performance with customized frequencies
- Reduction of EMI with programmable drive strength
- Development of prototypes and reduction of design time with instant oscillators

Field programmable SiTime MEMS devices

- Ultra Performance Oscillators: SiT8208, SiT8209
- Differential Oscillators: SiT9120, SiT9121, SiT9122
- Low Power Oscillators: SiT8008, SiT8009, SiT1602
- Low Power Clocks: SiT2001, SiT2002
- High Temp Oscillators: SiT8918, SiT8919, SiT8920, SiT8921, SiT1618
- High Temp Clocks: SiT2018, SiT2019, SiT2020, SiT2021
- AEC-Q100 Automotive Oscillators/Clocks: SiT8924, SiT8925, SiT2024, SiT2025
- VCXOs: SiT3807, SiT3808, SiT3809
- Differential VCXOs: SiT3821, SiT3822
- Digitally Controlled Oscillators (DCXOs): SiT3907
- Differential DCXOs: SiT3921, SiT3922
- Spread Spectrum Oscillators: SiT9001, SiT9003
- Spread Spectrum Differential Oscillators: SiT9002

Features

Easy to use

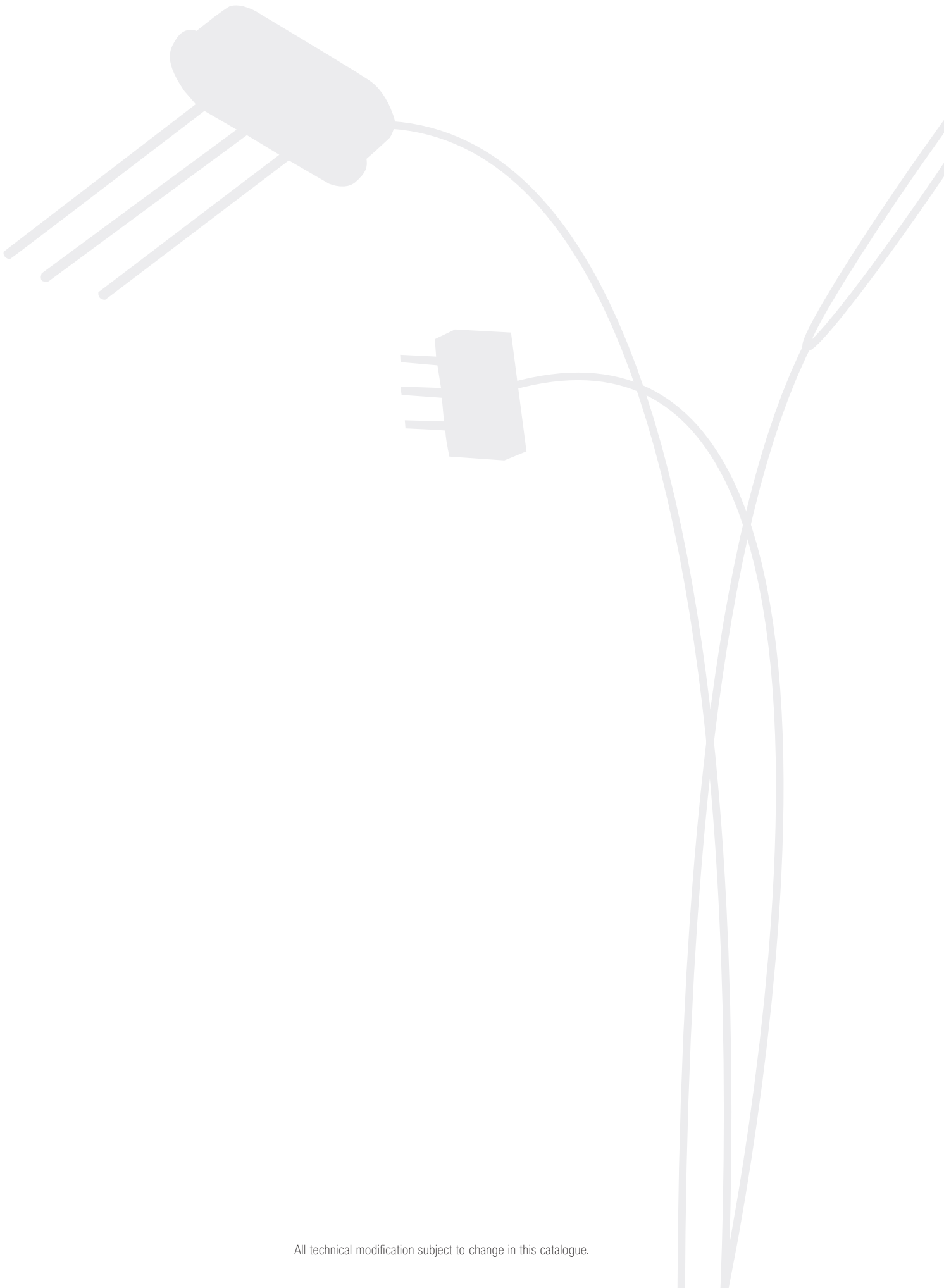
- USB powered programmer
- Add-on cards with directional connectors and indicators
- Anti-slip bumps hold programmer in place
- One-click programming software
- Built-in part number generator
- Programming history
- Auto software update
- Compatible with all PCs and Microsoft Windows

Complete solution

- Small carrying case holds programmer and all accessories
- Add-on cards (socket cards) support 6 oscillator packages
- Sample field programmable device packs
- Complete documentation

Future proof

- Software and hardware upgradable for future products
- Durable socket card connectors rated at 5000 insertions



All technical modification subject to change in this catalogue.

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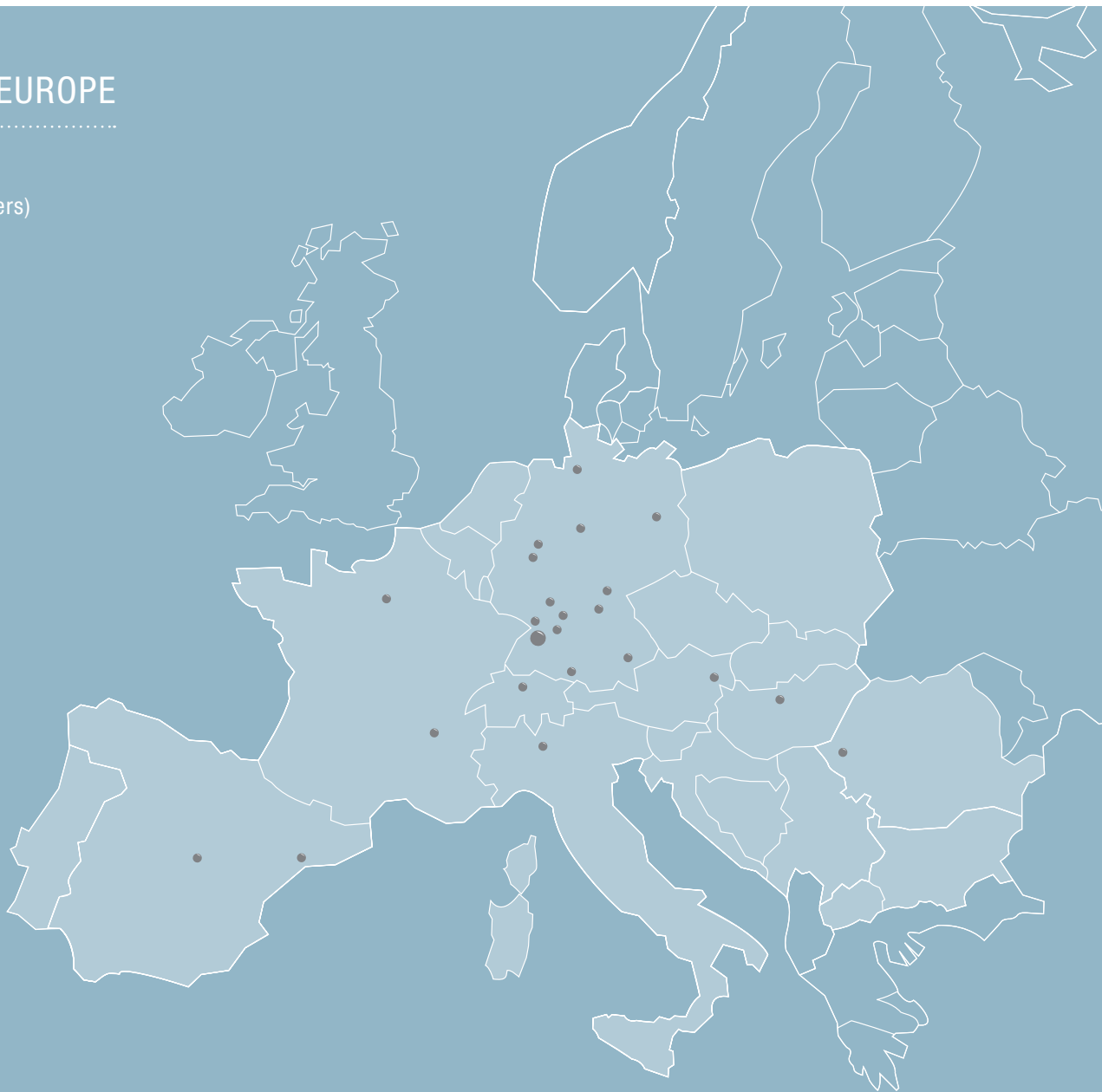
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