

Introduces

## M31x Series Multiple Frequency LVPECL/LVDS/CML/HCMOS VCXO

Featuring **QIK Chip™** Technology

### Features:

- Multiple Output Frequencies (2, 3, or 4) - Selectable
- Superior Jitter Performance (less than 0.25 ps RMS, 12 kHz - 20 MHz)
- Frequencies from 50 MHz to 1.4 GHz (LVDS/LVPECL/CML), and 10 MHz to 150 MHz (HCMOS)

### Applications:

- Where more than one selectable frequency is required for different global regions, FEC (Forward Error Correction) or selectable functionality are required.
- Telecommunications such as SONET / SDH / DWDM / FEC / SERDES / OC-3 thru OC-192
- Wireless base stations / WLAN / Gigabit Ethernet
- Avionic flight controls and military communications

### MtronPTI

Corporate Headquarters  
100 Douglas Avenue  
PO Box 630  
Yankton, SD 57078-0630  
1-800-762-8800  
[www.mtronpti.com](http://www.mtronpti.com)





## Applications Note:

The M31x series is ideally suited for a wide range of applications, specifically applications where extremely tight jitter performance is needed with a wide range of flexibility in the frequencies available. In video applications where line-rate timing-jitter is crucial, the QiK Chip M31x is a critical component of success for the circuit design. Jitter performance and Phase Noise performance well exceed the required SMPTE standards established for video applications.

In addition, the QiK Chip M31x product series provides multiple output frequencies from a single, highly stable crystal. Using a standard 5x7mm package provides access to up to 4 arbitrary output frequencies from the same oscillator, simplifying the performance-sensitive design testing and validation that requires frequency margining.

Industry leading jitter and phase noise performance, reduction in testing costs, increased flexibility in reducing PCB real estate for multiple output frequency demands, and an order to delivery time of less than 2 weeks, provides engineering and production advantages that have not been available in a small 5x7mm package in the past. The M31x produces outputs from 10MHz to 1.4GHz with unlimited margining increments. These independent frequencies can be a few parts per million or hundreds of MHz apart.

Frequency Select Truth Table		
	FS1	FS0
Frequency 1	High	High
Frequency 2	High	Low
Frequency 3	Low	High
Frequency 4	Low	Low

NOTE: Logic Low = 20% Vcc max.  
Logic High = 80% Vcc min.

# M31x Series Multiple Frequency LVPECL/LVDS/CML/HCMOS VCXO – 3.3/2.5/1.8 Volt – 5x7 mm

## Product Features

- Multiple Output Frequencies (2, 3, or 4) - Selectable
- *Qik Chip™* Technology
- Superior jitter performance (less than 0.25 ps RMS, 12 kHz - 20 MHz)
- APR from  $\pm 50$  to  $\pm 300$  ppm over industrial temperature range
- SAW replacement - better performance
- Frequencies from 50 MHz - 1.4 GHz (LVDS/LVPECL/CML)
- Frequencies from 10 MHz to 150 MHz (HCMOS)

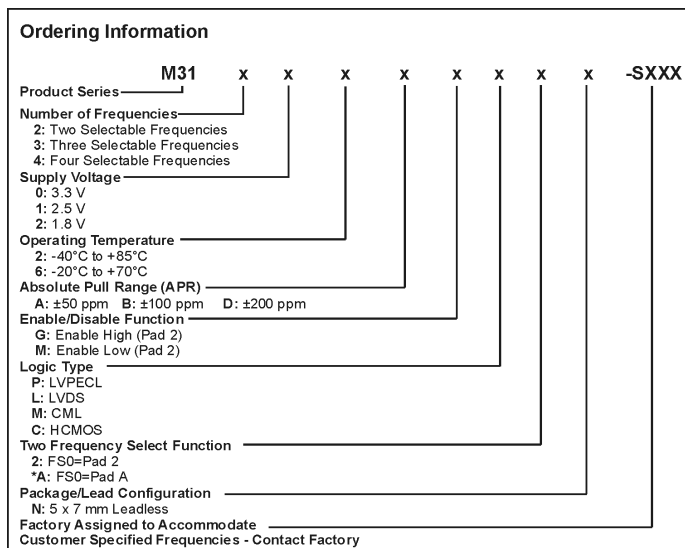
## Product Description

The multiple frequency VCXO utilizes MtronPTI's Qik Chip™ technology to provide a very low jitter clock for all output frequencies. The M31x is available with up to 4 different frequency outputs from 10MHz through 1.4 GHz. Unlike traditional VCXO's where multiple crystals are required for each frequency, the M31x utilizes a rock solid fundamental 3rd overtone crystal and the Qik Chip™ IC to provide the wide range of output frequencies. Using this design approach, the M31x provides exceptional performance in frequency stability, jitter, phase noise and long term reliability.

## Product Applications

- Global/Regional selection
- Forward Error Correction (FEC) / Selectable Functionality applications
- Telecommunications such as SONET / SDH / DWDM / FEC / SERDES / OC-3 thru OC-192
- 1-2-4-10 Gigabit Fibre Channel
- Wireless base stations / WLAN / Gigabit Ethernet
- xDSL, Network Communications
- Avionic flight controls
- Military Communications
- Clock and data recovery
- Low jitter clock generation
- Frequency margining

## Product Ordering Information



\*For three and four frequency selections, FS0=Pad A.

M3120Sxxx, M3121Sxxx, M3122Sxxx  
M3130Sxxx, M3131Sxxx, M3132Sxxx  
M3140Sxxx, M3141Sxxx, M3142Sxxx  
Contact factory for datasheets.

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## Performance Characteristics

PARAMETER	Symbol	Min.	Typ.	Max.	Units	Condition/Notes	
Frequency Range	F	50 10		1400 150	MHz MHz	See Note 1 LVPECL/LVDS/CML HCMOS	
Operating Temperature	T <sub>A</sub>	-20°C to +70°C or -40°C to +85°C					Customer Specified
Storage Temperature	T <sub>s</sub>	-55		+125	°C		
Frequency Stability	ΔF/F		±25		ppm		
Aging 1st Year Thereafter (per year)		-3 -1		+3 +1	ppm ppm		
Pullability/APR		See Ordering Information					See Note 2
Gain Transfer Function			90 135 180		ppm/V ppm/V Ppm/V	For ± 50 ppm APR For ± 100 ppm APR For ± 200 ppm APR	
Control Voltage	V <sub>c</sub>	0.18 0.25 0.30	0.90 1.25 1.65	1.62 2.25 3.0	V V V	@ 1.8V V <sub>cc</sub> @ 2.5V V <sub>cc</sub> @ 3.3V V <sub>cc</sub>	
Linearity			1	5	%	Positive Monotonic	
Modulation Bandwidth	f <sub>m</sub>	10			KHz	-3 dB bandwidth	
Input Impedance	Z <sub>in</sub>	500k	1M		Ohms	@ DC	
Supply Voltage	V <sub>cc</sub>	1.71 2.375 3.135	1.8 2.5 3.3	1.89 2.625 3.465	V V V		
Input Current	I <sub>cc</sub>			125 80	mA mA	LVPECL/LVDS/CML HCMOS	
Load		50 Ohms to (V <sub>cc</sub> - 2) V <sub>dc</sub> 100 Ohm differential load					See Note 3 LVPECL Waveform LVDS/CML Waveform CMOS Waveform
Symmetry (Duty Cycle)		45		55	%	LVPECL: V <sub>dd</sub> - 1.3 V LVDS: 1.25 V	
Output Skew			20 15 20		ps ps ps	LVPECL CML LVDS	
Differential Voltage	V <sub>od</sub>	250	350	450	mV	LVDS	
	V <sub>od</sub>	0.7	0.95	1.20	V <sub>pp</sub>	CML	
Common Mode Output Voltage	V <sub>cm</sub>		1.2		V	LVDS	
Logic "1" Level	V <sub>oh</sub>	V <sub>cc</sub> - 1.02 90% V <sub>dd</sub>			V	LVPECL HCMOS	
Logic "0" Level	V <sub>ol</sub>			V <sub>cc</sub> - 1.63 10% V <sub>dd</sub>	V	LVPECL HCMOS	
Rise/Fall Time	Tr/Tf		0.23	0.35 6.0	ns ns	@ 20/80% LVPECL Ref. 10%-90% V <sub>dd</sub> HCMOS	
Enable Function Option G		80% V <sub>cc</sub> min or N/C: Output active 0.5V max: Output disables to high-Z					Customer Specified (Pad 2)
Enable Function Option M		0.5V max or N/C: Output active 80% V <sub>cc</sub> min: Output disables to high-Z					Customer Specified (Pad 2)
Frequency Selection		See Truth Table					
Settling Time				10	ms	To within ± 1 ppm of frequency	
Start up Time				10	ms		
Phase Jitter @ 622.08 MHz @ 125 MHz	φ <sub>J</sub> φ <sub>J</sub>		0.50	1.0	ps RMS ps RMS	Integrated 12 kHz – 20 MHz HCMOS (12kHz – 20 MHz)	
Mechanical Shock		Per MIL-STD-202, Method 213, Condition C (100 g's, 6 mS duration, ½ sinewave)					
Vibration		Per MIL-STD-202, Method 201 & 204 (10 g's from 10-2000 Hz)					
Hermeticity		Per MIL-STD-202, Method 112, (1x10 <sup>-8</sup> atm. cc/s of Helium)					
Thermal Cycle		Per MIL-STD-883, Method 1010, Condition B (-55°C to +125°C, 15 min. dwell, 10 cycles)					
Solderability		Per EIAJ-STD-002					
Max. Soldering Cond.		See solder profile, Figure 1					

Note 1: Contact factory for standard frequency availability over 945 MHz.

Note 2: APR specification is inclusive of initial tolerance, deviation over temperature, shock, vibration, supply voltage, and aging for one year at 50°C mean ambient temperature.

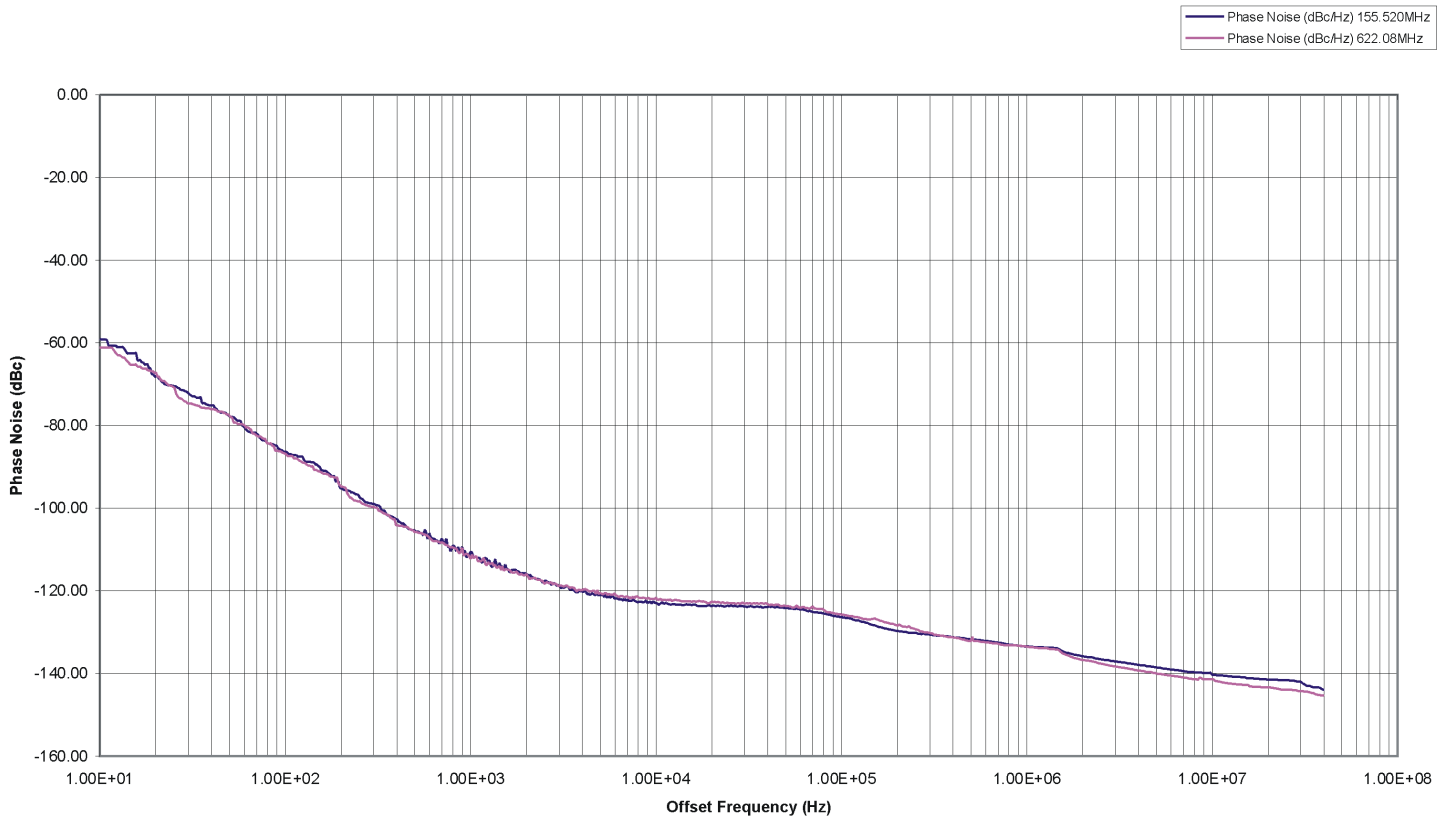
Note 3: See Load Circuit Diagram in this Datasheet. Consult factory with nonstandard output load requirements.

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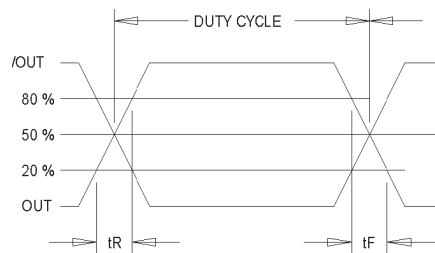
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## Phase Noise Plot



## Output Waveform



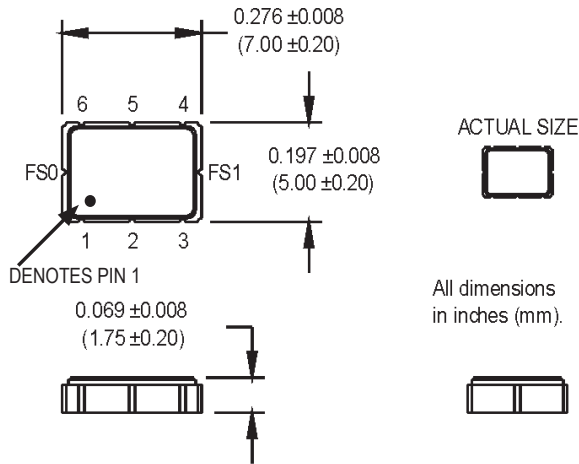
Output Waveform: LVDS / CML / LVPECL

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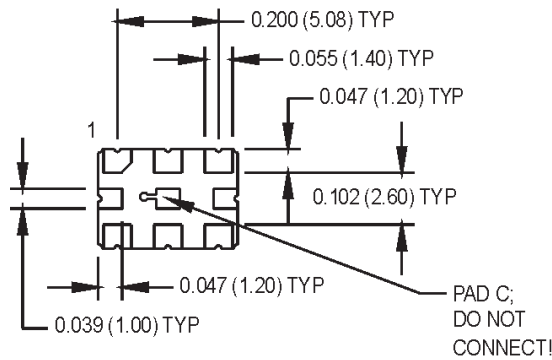
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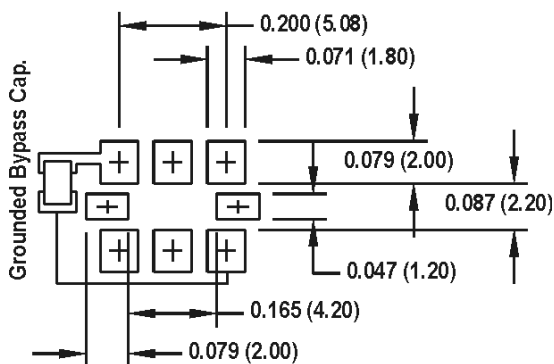
## Product Dimension & Pinout Information



- Pad1: Voltage Control
- Pad2: Enable/Disable N/C or FS0
- Pad3: Ground
- Pad4: Output Q (LVPECL, LVDS, CML)
- Pad5: Output  $\bar{Q}$  (LVPECL, LVDS, CML)
- Pad6: Vcc
- PadA: FS0 or N/C
- PadB: FS1
- PadC: Do not connect!



### SUGGESTED SOLDER PAD LAYOUT



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## M31x Series Multiple Frequency LVPECL/LVDS/CML/HCMOS VCXO – 3.3/2.5/1.8 Volt – 5x7 mm

### Handling Information

Although protection circuitry has been designed into the M31x oscillator, proper precautions should be taken to avoid exposure to electrostatic discharge (ESD) during handling and mounting. MtronPTI utilizes a human-body model (HBM) and a charged-device model (CDM) for ESD-susceptibility testing and protection design evaluation. ESD voltage thresholds are dependent on the circuit parameters used to define the mode. Although no industry-wide standard has been adopted for the CDM, a standard HBM (resistance = 1500  $\Omega$ , capacitance = 100 pF) is widely used and therefore can be used for comparison purposes. The HBM ESD threshold presented here was obtained using these circuit parameters.

Model	ESD Threshold, Minimum	Unit
Human Body	1500*	V
Charged Device	1500*	V

\* MIL-STD-883D, Method 3015, Class 1



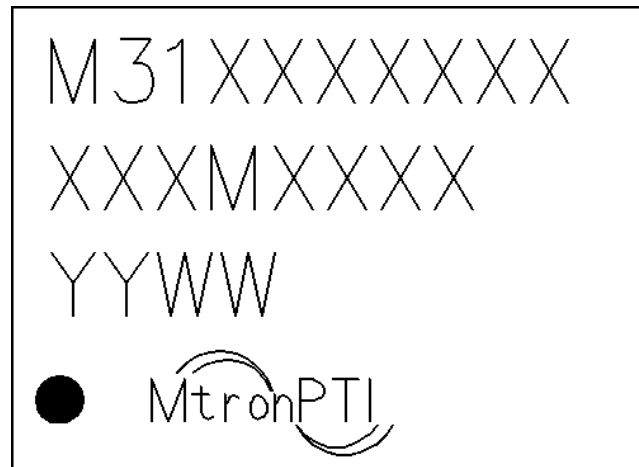
ATTENTION  
Static Sensitive  
Devices  
Handle only at  
Static Safe Work  
Stations

### Quality Parameters

Environmental Specifications/Qualification Testing Performed on the M31x VCXO		
Test	Test Method	Test Condition
Electrical Characteristics	Internal Specification	Per Specification
Frequency vs. Temperature	Internal Specification	Per Specification
Mechanical Shock	MIL-STD-202, Method 213, C	100 g's
Vibration	MIL-STD-202, Method 201-204	10 g's from 10-2000 Hz
Thermal Cycle	MIL-STD-883, Method 1010, B	-55 Deg. C to +125 Deg. C, 15 minute Dwell, 10 cycles
Aging	Internal Specification	168 Hours at 105 Degrees C
Gross Leak	MIL-STD-202, Method 112	30 Second Immersion
Fine Leak	MIL-STD-202, Method 112	Must meet $1 \times 10^{-8}$
Solderability	MIL-STD-883, Method 2003	8 Hour Steam Age – Must Exhibit 95% coverage
Resistance to Solvents	MIL-STD-883, Method 2015	Three 1 minute soaks
Terminal Pull	MIL-STD-883, Method 2004, A	2 Pounds
Lead Bend	MIL-STD-883, Method 2004, B1	1 Bending Cycle
Physical Dimensions	MIL-STD-883, Method 2016	Per Specification
Internal Visual	Internal Specification	Per Internal Specification

### Part Marking Guide

- Line 1: Model Number
- Line 2: Frequency
- Line 3: Date Code
- Line 4: Pin 1 Indicator / MtronPTI



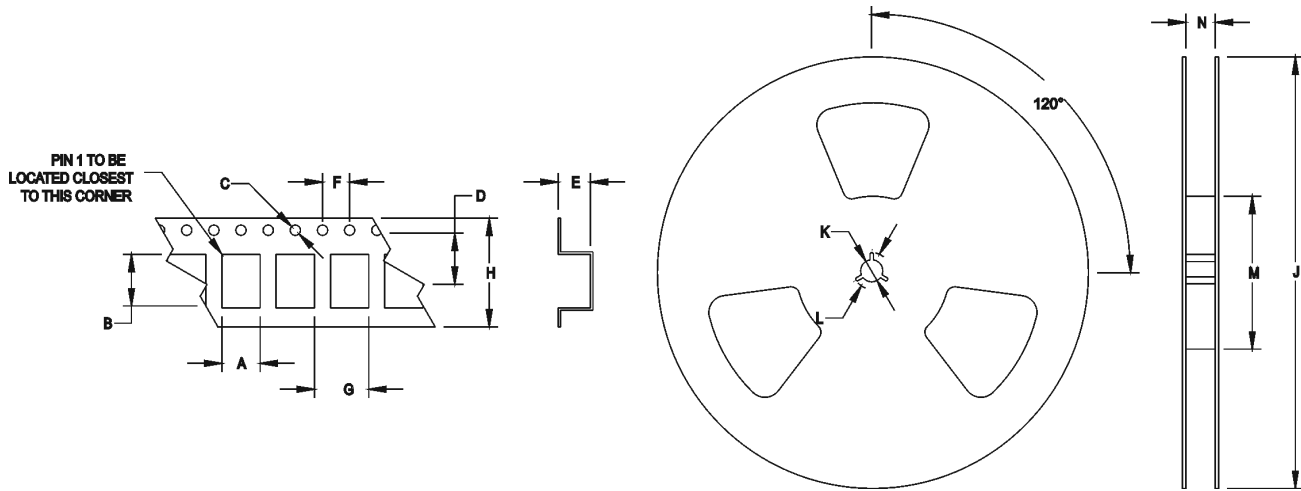
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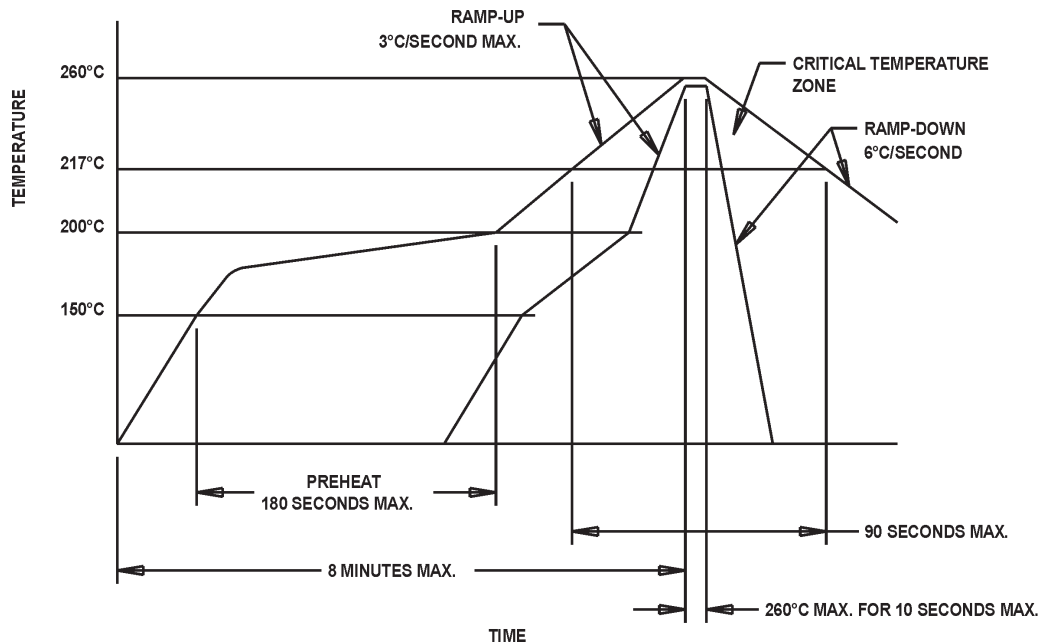
### Tape & Reel Specifications

(all measurements are in mm)	A	B	C	D	E	F	G	H	I	J	K	L
M31x	6.51	9.29	1.5	7.5	2.8	4	8/12	16	180-330	13	21	60-100



Standard Tape and Reel: 1000 parts per reel

### Maximum Soldering Conditions



### Solder Conditions

Note: Exceeding these limits may damage the device.

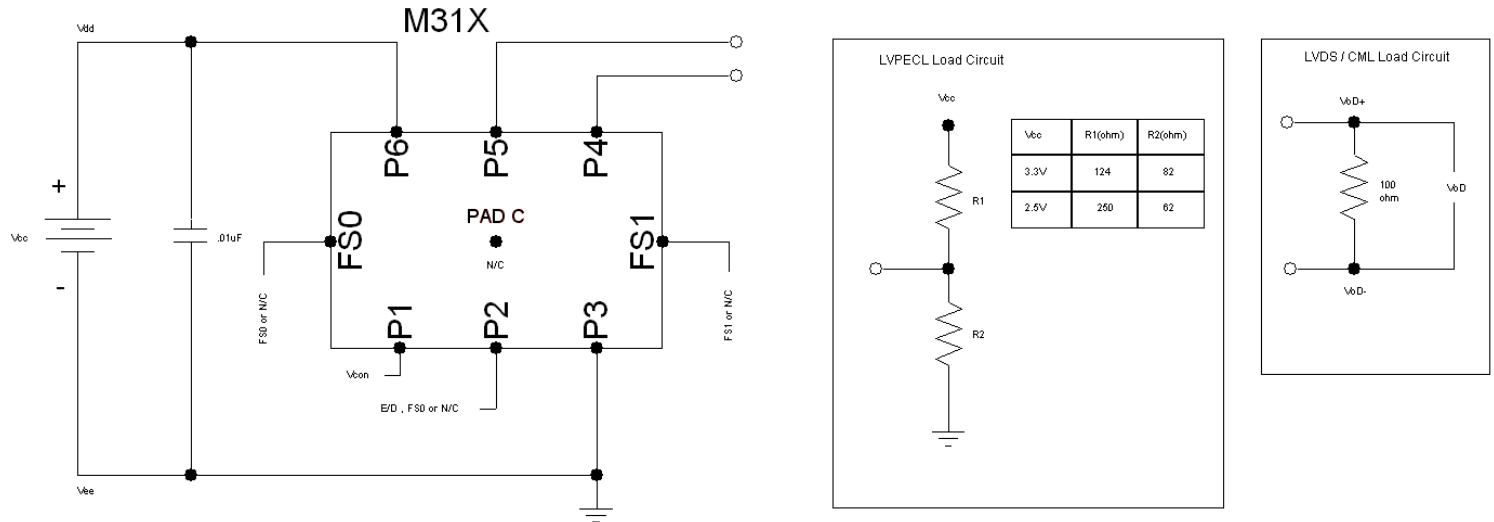
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## Typical Test Circuit & Load Circuit Diagrams



## Product Revision Table

Date	Revision	PCN Number	Details of Revision
7/20/07	A	10118	IC Revision to improve phase noise and electrical performance

For custom products or additional specifications contact our sales team at  
**800.762.8800 (toll free) or 605.665.9321**

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*...when timing matters*

**Yankton**

PO Box 630  
Yankton, SD 57078-0630 USA  
Phone: 605-665-9321  
Toll Free: 800-762-8800  
Fax: 605-665-1709  
Email: SalesYKT@mtronpti.com

**Orlando**

2525 Shader Rd  
Orlando, FL 32804 USA  
Phone: 407-298-2000  
Fax: 407-293-2979  
Email: SalesORL@mtronpti.com

**Connecticut**

755 Main Street  
Suite 2B, Building 2  
Monroe, CT 06470 USA  
Phone: 800.762.8800  
Fax: 203.452.9435  
Email: MilSales@mtronpti.com

**Santa Clara**

1495 Franklin Street  
Santa Clara, CA 95050 USA  
Phone: 408.395.0700  
Fax: 408.395.8074  
Email: SalesCA@mtronpti.com

**Europe**

The Netherlands  
Phone: 31-40-368-6818  
Fax: 011-31-40-368-3501  
Email: SalesEU@mtronpti.com

**Asia Pacific**

1104 Shanghai Industrial  
Investment Building  
48-62 Hennessy Road  
Wanchai, Hong Kong, China  
Phone: 852-2866-8023  
Fax: 852-2529-1822  
Email: SalesHK@mtronpti.com