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Rev 3; 9/06

DALLAS SEMICONDUCTOR MAXIM

50MHz to 122.88MHz VCXO

DS4077

General Description

The DS4077 is an integrated voltage-controlled crystal oscillator (VCXO) module designed to provide reference clock generation in base stations, telecom/datacom, and wireless applications. The DS4077 is developed using a fundamental quartz crystal plus a unique integrated circuit design. The internal fundamental quartz crystal determines the frequency of operation. Custom frequencies are available. Contact the factory for availability.

The DS4077 is designed for use with applications requiring low phase noise and jitter. Jitter performance of better than 0.8ps RMS is achieved over the 12kHz to 20MHz range. Phase noise performance of better than -125dBc/Hz at 1kHz is achieved with this design.

Applications

Clock-Data Recovery in Telecom/Datacom Applications

Data Retiming

Reference Clock Generation in Base Stations and Wireless Applications

Features

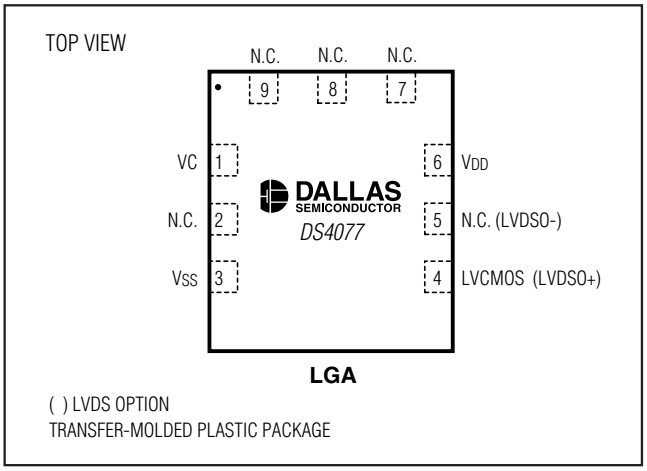
- **50MHz to 122.88MHz Frequency**
- **3.135V to 3.465V Operation**
- **Low Jitter: < 0.8ps RMS**
- **±69ppm Absolute Pull Range (APR)**
- **Output Options:**
  - **LVCMOS Output Buffer**
  - **LVDS Complementary Output Buffer**
- **Minimum ±110ppm Tuning Range (+25°C)**
- **14mm x 9mm x 3.06mm Plastic LGA Package**

Ordering Information

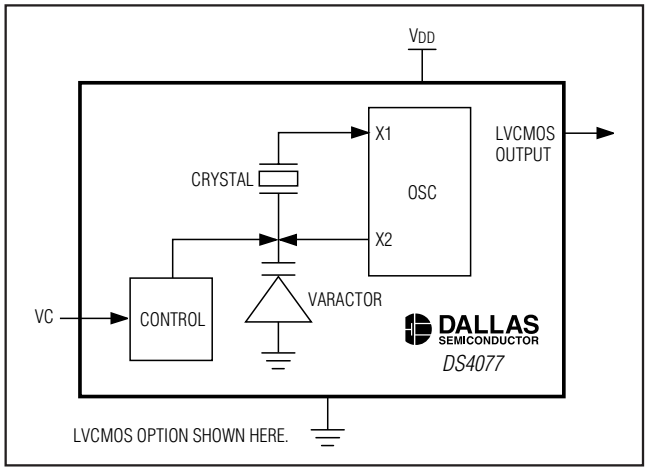
PART	TEMP RANGE	OUTPUT TYPE	FREQUENCY (f_{NOM}) (MHz)	PIN-PACKAGE	TOP MARK
DS4077L-DCN	-40°C to +85°C	LVCMOS	54	9 LGA	DS4077L-DCN
DS4077L-DDN	-40°C to +85°C	LVDS	54	9 LGA	DS4077L-DDN
DS4077L-CCN	-40°C to +85°C	LVCMOS	61.44	9 LGA	DS4077L-CCN
DS4077L-CDN	-40°C to +85°C	LVDS	61.44	9 LGA	DS4077L-CDN

Ordering Information continued at end of data sheet.

Pin Configuration



Block Diagram



50MHz to 122.88MHz VCXO

ABSOLUTE MAXIMUM RATINGS

VC, V_{DD}, LVCMOS, LVDSO+, LVDSO- Output .....-0.3V, +3.6V
Operating Temperature Range
(noncondensing) .....-40°C to +85°C
Junction Temperature.....+150°C
Thermal Resistance
Junction to Ambient .....91.06°C/W
Junction to Case .....44.51°C/W

Storage Temperature Range .....-55°C to +125°C
Soldering Temperature
(reflow, 2 passes max)....See IPC/JEDEC STD-020 Specification

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{DD} = 3.135V to 3.465V, T_A = -40°C to +85°C, unless otherwise noted.) (Typical values at +25°C, V_{DD} = 3.3V, unless otherwise noted.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
V_{DD} Operating Supply Range	V_{DD}			3.135	3.3	3.465	V
V_{DD} Supply Current	I_{DD}	Output open	$f_{OUT} \le 106.25MHz$		20	30	mA
			$f_{OUT} > 106.25MHz$		25	35	
Frequency	f_{OUT}	VC = 1.6V, V_{DD} = 3.3V, T_A = +25°C (Note 2)		f_{NOM} –8ppm	f_{NOM}	f_{NOM} +8ppm	MHz
Frequency vs. V_{DD} Sensitivity	V_{DD}ppm	V_{DD} = 3.3V ±5%		-3.5		+11.5	ppm
Frequency vs. Load Sensitivity	LOADpmm	10pF to 20pF (Note 3)			-1		ppm/pF
Frequency vs. Temperature	TEMPppm	From +25°C		-20		+20	ppm
VC Voltage Range	VC_{RANGE}			0.3	1.60	2.8	V
Frequency Tuning Sensitivity	VC_{SEN}			41		164	ppm/V
Tuning Voltage Bandwidth	VC_{BW}	(Note 3)		10			kHz
Absolute Pull Range	f_{TUNE}	VC = 0.3V to 2.8V (Note 2)		-69		+69	ppm
VC Input Leakage	I_{LCV}	VC = 0V to V_{DD}		-500		+500	nA
Aging, First Year	AGEppm			-5		+5	ppm
Aging, Years 0–10	t_{AGE}	Total aging		-10		+10	ppm
LVDS OUTPUT							
Output High Voltage	$V_{OHLVDSO}$	(Note 4)				1.475	V
Output Low Voltage	$V_{OLLVDSO}$	(Note 4)		0.925			V
Differential Output Voltage	$V_{ODLVDSO}$	(Note 4)		250		400	mV
Output Common-Mode Variation	$V_{LVDSOCOM}$	(Note 4)				150	mV
Offset Output Voltage	$V_{OFFLVDSO}$	(Note 4)		1.125		1.275	V
Differential Output Impedeance	R_{OLVDSO}	(Note 3)		80		140	Ω
Output Current	$I_{VSSLVDSO}$	Short ground				40	mA
Output Current	I_{LVDSO}	Short together (Note 3)				12	mA
Output Rise Time (Differential)	t_{RLVDSO}	20% to 80% (Note 3)		150			ps
Output Fall Time (Differential)	t_{FLVDSO}	80% to 20% (Note 3)		150			ps

ELECTRICAL CHARACTERISTICS (continued)

(V_{DD} = 3.135V to 3.465V, T_A = -40°C to +85°C, unless otherwise noted.) (Typical values at +25°C, V_{DD} = 3.3V, unless otherwise noted.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
LVCMOS OUTPUT						
Output Logic 0	V_{OL}	Output Current -450µA	0		0.4	V
Output Logic 1	V_{OH}	Output Current +450µA	V_{DD} - 0.8V		V_{DD}	V
Output Rise Time	t_R	Load condition: 10pF to ground; 10% to 90% V_{DD} (Note 3)			2	ns
Output Fall Time	t_F	Load condition: 10pF to ground; 90% to 10% V_{DD} (Note 3)			2	ns
Duty Cycle	D_{CYC}	Load condition: 10pF, V_{DD} / 2 (Note 3)	40		60	%
Harmonics	H	V_{DD} = 3.3V, T_A = +25°C (Note 3)		-18	-8	dBc/Hz
SSB PHASE NOISE AND JITTER, V_{DD} = 3.3, T_A = +25°C (Note 3)						
10Hz Offset		LVCMOS		-70		dBc/Hz
100Hz Offset				-100		
1kHz Offset				-125		
10kHz Offset				-145		
100kHz Offset				-150		
Jitter (12kHz to 20MHz)				0.8		ps_{RMS}

Note 1: Limits at -40°C are guaranteed by design and not production tested.
Note 2: 10pF, LVCMOS.
Note 3: Guaranteed by design and not production tested.
Note 4: 100Ω differential load.

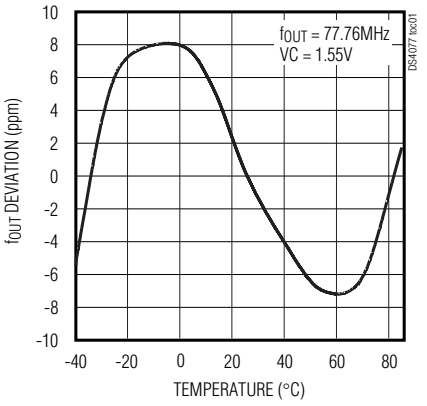
Pin Description

PIN		NAME	FUNCTION
LVCMOS	LVDS		
1	1	VC	VCXO Control Voltage
2, 5, 7, 8, 9	2, 7, 8, 9	N.C.	No Connection
3	3	V_{SS}	Ground
4	—	LVCMOS	LVCMOS Output
6	6	V_{DD}	DC Power
—	4, 5	LVDSO+/LVDSO-	LVDS Positive and Negative Outputs

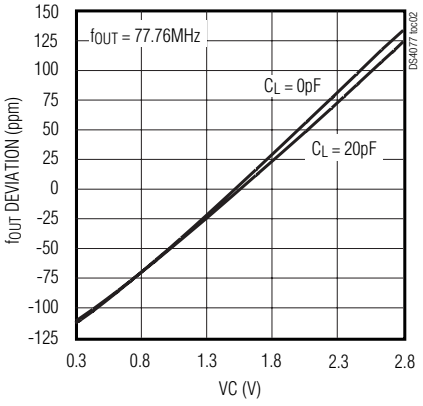
Typical Operating Characteristics

(V_{CC} = +3.3V, T_A = +25°C, unless otherwise noted.)

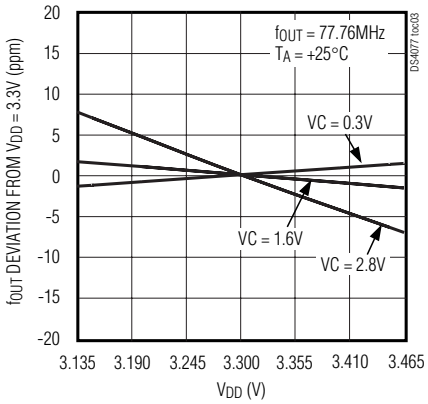
FREQUENCY vs. TEMPERATURE



LVCMOS OUTPUT FREQUENCY vs. LOAD CAPACITANCE vs. VC



OUTPUT FREQUENCY vs. SUPPLY VOLTAGE vs. VC



50MHz to 122.88MHz VCXO

Ordering Information (continued)

PART	TEMP RANGE	OUTPUT TYPE	FREQUENCY (f_{NOM}) (MHz)	PIN-PACKAGE	TOP MARK
DS4077L-ECN	-40°C to +85°C	LVCMOS	74.17582	9 LGA	DS4077L-ECN
DS4077L-EDN	-40°C to +85°C	LVDS	74.17582	9 LGA	DS4077L-EDN
DS4077L-FCN	-40°C to +85°C	LVCMOS	74.25	9 LGA	DS4077L-FCN
DS4077L-FDN	-40°C to +85°C	LVDS	74.25	9 LGA	DS4077L-FDN
DS4077L-ACN	-40°C to +85°C	LVCMOS	76.8	9 LGA	DS4077L-ACN
DS4077L-ADN	-40°C to +85°C	LVDS	76.8	9 LGA	DS4077L-ADN
DS4077L-0CN	-40°C to +85°C	LVCMOS	77.76	9 LGA	DS4077L-0CN
DS4077L-0DN	-40°C to +85°C	LVDS	77.76	9 LGA	DS4077L-0DN
DS4077L-GCN	-40°C to +85°C	LVCMOS	106.25	9 LGA	DS4077L-GCN
DS4077L-GDN	-40°C to +85°C	LVDS	106.25	9 LGA	DS4077L-GDN
DS4077L-BDN	-40°C to +85°C	LVDS	122.88	9 LGA	DS4077L-BDN

Package Information

For the latest package outline information and land patterns, go to **www.maxim-ic.com/packages**.

PACKAGE TYPE	PACKAGE CODE	DOCUMENT NO.
9 LGA	L949A-1	**21-0265**

Revision History

Rev 0; 8/05: Initial release.

Rev 1; 12/05: Added LVDS option.

Rev 2; 6/06: Changed device description/frequency range; changed jitter typical value from 1 to 0.8psRMS; added new parts numbers to Ordering Information table; changed jitter range upper limits from 80MHz to 20MHz.

Rev 3; 9/06: Changed V_{DD}ppm units from ppm/PF to ppm; added separate I_{DD} parameter for parts with f_{OUT} greater than 106.25MHz.