

1.65V – 3.6V, 1x Ultra Low Power Mobile EMI Reduction IC

Features

- FCC approved method of EMI attenuation
- Proprietary “SaΦic™” technology, a non-PLL phase controlled Active EMI management architecture
- Generates a 1X low EMI Phase Modulated replication of the input signal.
- Vdd 1.65V - 3.6V 10 MHz to 40 MHz
- Multiple Deviation Selections
- Minimum frequency deviation selection capability
- Power Down Mode
- 8-pin WDFN package
- Supports automotive reliability standard:
AEC-Q100 Grade 1 and Grade 2 certified

Product Description

The LX504 is a versatile 1x Active EMI management IC designed to provide system wide reduction of Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI) from clock and data sources. The LX504 allows significant system cost savings by reducing the number of circuit board layers, ferrite beads, shielding and other passive components that are traditionally required to pass EMI regulations. The LX50x family of mobile active EMI management

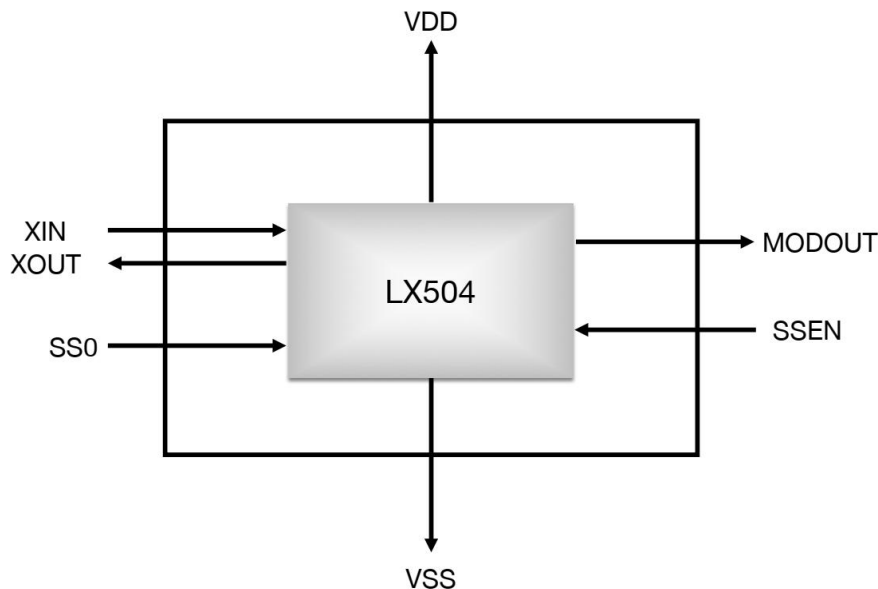
ICs is unique in it’s design and is based on LFC’s proprietary “SaΦic” phase controlled Active EMI management technology. This allows operation on aperiodic as well periodic signals. By the precise placement of the edges of the reconstructed input signal, the peak energy of the output is distributed over a wider and controlled energy band thereby significantly lowering system EMI compared to the typical narrow band signal produced by oscillators and most frequency generators.

The LX504 has an input frequency range of 10 MHz to 40MHz over a wide voltage range of 1.65V to 3.6V. The device can be placed in a “non-modulated clock mode” by setting the SSEN pin to GND where sets the MODOUT pin to no modulated clock output. The device has one “deviation control pins” SS0 to allow flexibility and optimization of both EMI compliance as well as in system design. The device is available in an 8 pin DFN package.

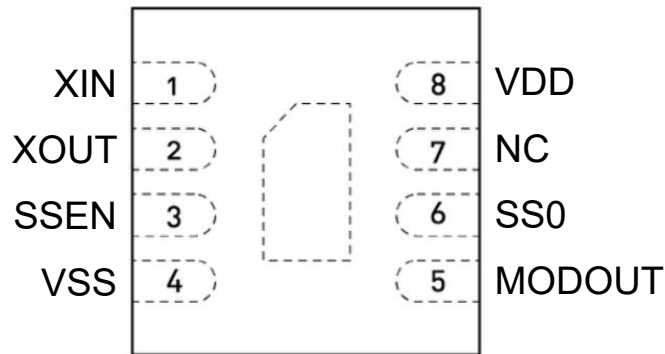
Applications

The LX504 is targeted towards mobile platforms such as cell phones, MIDs, notebooks and other “power and space” sensitive applications.

Block Diagram



Pin Configuration



Pin Description

Pin#	Pin Name	Type	Description
1	XIN	I	Crystal Oscillator Input.
2	XOUT	O	Crystal Oscillator Output.
3	SSEN	I	Modulated Clock Output if Pull-Up. No Modulated Clock Output if Pull-Down. Internal Pull-Up Resistor.
4	VSS	P	System ground reference input.
5	MODOUT	O	1X phase modulated buffered output.
6	SS0	I	Deviation Control Pin (refer Functionality Table) Internal Pull-Up Resistor. Recommend external Pull-Down Resistor 0Ω.
7	NC	I	No Connection Pin.
8	VDD	O	System Power Supply Pin.

Operating Conditions

Parameter	Description	Min	Max	Unit
V _{DD} (3.3V)	Supply Voltage	1.65	3.6	V
T _A	Operating Temperature (Ambient Temperature)	-40	+125	°C
C _L	Load Capacitance		20	pF
C _{IN}	Input Capacitance		5	pF

Note: Please refer to ordering information for TA

Absolute Maximum Rating

Symbol	Parameter	Rating	Unit
V _{in}	Voltage on any pin with respect to Ground	-0.5 to +4.6	V
T _{STG}	Storage temperature	-65 to +125	°C
T _S	Max. Soldering Temperature (10 sec)	260	°C
T _J	Junction Temperature	150	°C
T _{DV}	Static Discharge Voltage (As per JEDEC STD22- A114-B)	2	KV

Note: These are stress ratings only and are not implied nor guaranteed for functional use. Exposure to absolute maximum ratings for prolonged periods of time may affect device reliability.

DC Electrical Characteristics (3.3V +/-0.3V)

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
V _{DD}	Supply Voltage		3.0	3.3	3.6	V
V _{IH}	Input HIGH Voltage		0.66*V _{DD}			V
V _{IL}	Input LOW Voltage				0.33*V _{DD}	V
I _{IH}	Input HIGH Current (pin 3 and 6)	V _{IN} = V _{DD}			10	μA
I _{IL}	Input LOW Current (pin 3 and 6)	V _{IN} = 0V			10	μA
V _{OH}	Output HIGH Voltage	I _{OH} = -8mA	0.75*V _{DD}			V
V _{OL}	Output LOW Voltage	I _{OL} = +8mA			0.25*V _{DD}	V
I _{DD}	Dynamic Supply Current (SS0=1)	27 MHz	Unloaded		11.0	mA
			15pF load		13.0	
Z _o	Output Impedance			25		Ω
Deviation	Modulation	27MHz	1.8V	0.46	0.72	±
			3.3V	0.22	0.33	±

Switching Characteristics (3.3V +/-0.3V)

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
INPUT	Input Frequency		10	24	40	MHz
MODOUT	Output Frequency		10	24	40	
T _d	Duty Cycle ^{1,2} = (t ₂ / t ₁) * 100	Measured at V _{DD} /2	45	50	55	%
t ₃	Output Rise Time ^{1,2}	Measured between 20% to 80%	0.8	1.8	2.8	nS
t ₄	Output Fall Time ^{1,2}	Measured between 80% to 20%	1.0	2	3.0	nS

Notes:

1. All parameters specified with 27MHz without loaded outputs and V_{DD} 3.3V
2. Parameter is guaranteed by design and characterization. Not 100% tested in production

DC Electrical Characteristics (1.8V +/-0.15V)

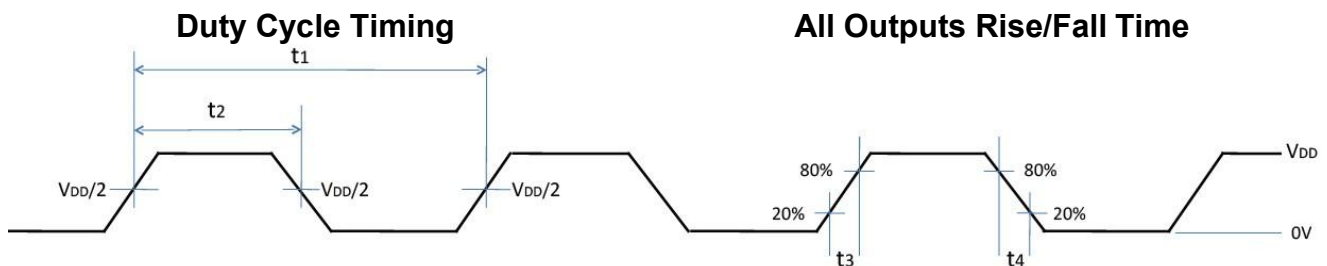
Parameter	Description	Test Conditions	Min	Typ	Max	Unit
V _{DD}	Supply Voltage		1.65	1.8	1.95	V
V _{IH}	Input HIGH Voltage		0.66*V _{DD}			V
V _{IL}	Input LOW Voltage				0.33*V _{DD}	V
I _{IH}	Input HIGH Current (pin 5 and 6)	V _{IN} = V _{DD}			10	μA
I _{IL}	Input LOW Current (pin 5 and 6)	V _{IN} = 0V			10	μA
V _{OH}	Output HIGH Voltage	I _{OH} = -4mA	0.75*V _{DD}			V
V _{OL}	Output LOW Voltage	I _{OL} = +4mA			0.25*V _{DD}	V
I _{DD}	Dynamic Supply Current (SS0=1)	27 MHz	Unloaded	5.0		mA
			15pF load	7.5		
Z _o	Output Impedance			25		Ω

Switching Characteristics (1.8V +/-0.15V)

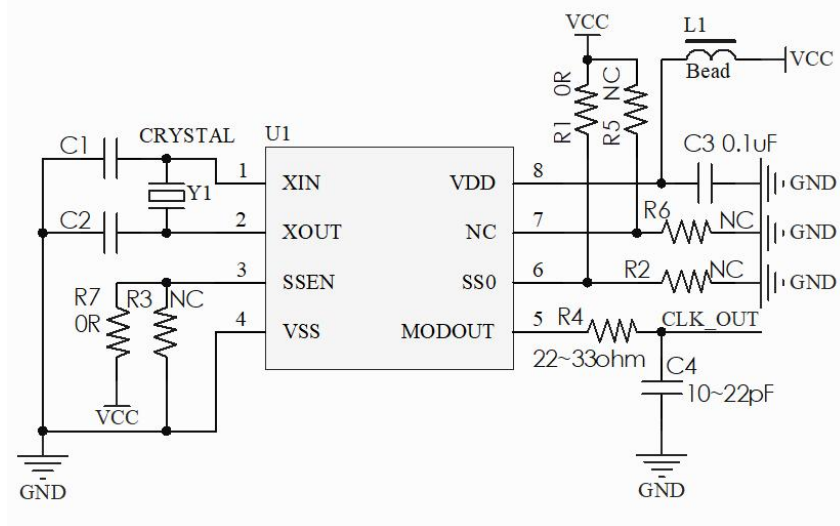
Parameter	Description	Test Conditions	Min	Typ	Max	Unit
INPUT	Input Frequency		10	24	40	MHz
MODOUT	Output Frequency		10	24	40	
T _d	Duty Cycle ^{1,2} = (t ₂ / t ₁) * 100	Measured at V _{DD} / 2	45	50	55	%
t ₃	Output Rise Time ^{1,2}	Measured between 20% to 80%	1.2	2.2	TBD	nS
t ₄	Output Fall Time ^{1,2}	Measured between 80% to 20%	1.2	2.2	TBD	nS

Notes:

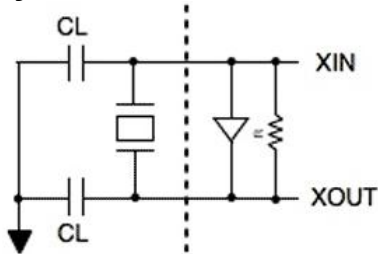
1. All parameters specified with 27MHz without loaded outputs and V_{DD} 1.8V
2. Parameter is guaranteed by design and characterization. Not 100% tested in production



Application Schematic



Crystal Oscillator Circuit

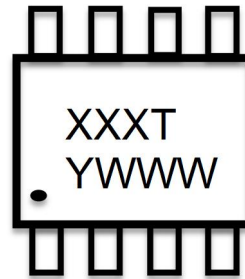


$$CL = 2 \times (C_p - C_s)$$

C_p : load capacitance of Crystal

C_s : Stray capacitance (PCB trace + Input cap. of IC)

Marking Information



XXX: Part Number

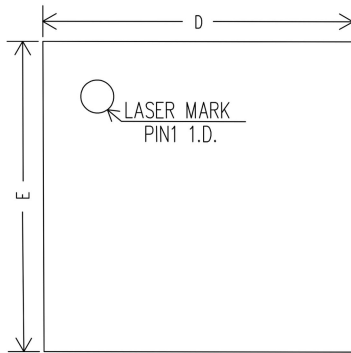
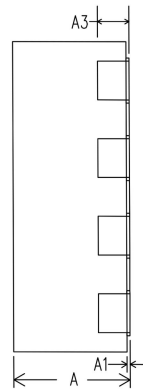
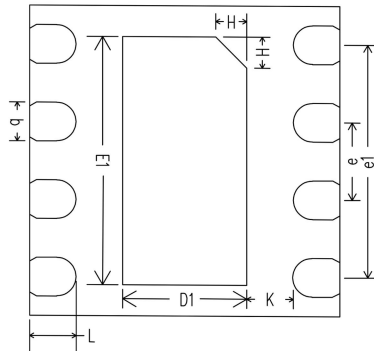
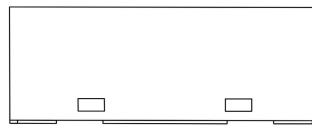
T: Temperature Grade

Y: Year of Production

WWW: Work Order No.

Ordering Information

Part Number	Temp. Grade Indicator	Temp Grade	Temp Range	IC Marking	IC Package	Tape & Reel
LX504C	C	Commercial	0°~70°C	504C	2mm x 2mm 8L WDFN	4,000pcs/Reel
LX504I	I	Industrial	-40°~85°C	504I		
LX504E	E	Automotive AEC Q100 Grade 2	-40°~105°C	504E		
LX504A	A	Automotive AEC Q100 Grade 1	-40°~125°C	504A		

**Package Dimension
WDFN**

TOP VIEW

SIDE VIEW

BOTTOM VIEW

SIDE VIEW

COMMON DIMENSIONS

(UNITS OF MEASURE = MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.203REF		
B	0.20	0.25	0.30
D	1.95	2.00	2.05
E	1.95	2.00	2.05
D1	0.75	0.80	0.85
E1	1.55	1.60	1.65
e	0.40	0.50	0.60
E1	1.40	1.50	1.60
H	0.20REF		
K	0.20	0.30	0.40
L	0.25	0.30	0.35

Revision History

Revision Number	Date of Release	Changes
1.1	3/15/2019	1) Preliminary specification
1.2	10/25/2019	1) Deviation updates
1.3	7/16/2020	1) t3/t4 updates
1.4	5/13/2021	1) Update D2, L and E2 package dimension
1.5	7/23/2023	1) Update application schematic 2) Update the deviation