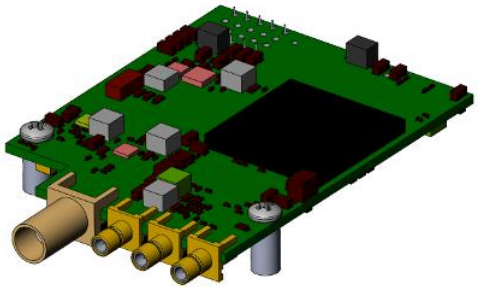
L-Band Tuner/Base Band Down Converter

Overview

The L-Band Tuner operates in the 900 to 2200 MHz L-Band frequency range with 110 MHz of bandwidth. Receiver sensitivity ranges from -104 to +0 dBm. The L-Band Tuner can be externally referenced with 10 MHz. With External reference and 1PPS, data passing through the module can be accurately time-tagged for location-based applications. After the signal input is tuned and down converted data is digitized I/Q with dual 14-bit A2D converters providing excellent dynamic range performance.

Features

- Input Frequency Range: 900 – 2200 MHz
  (For wider 800 – 2300 MHz frequency range Consult Factory)
- Input Power Range: -104 to +0 dBm
- Integrated Switched LNA (Fixed Gain +20 dBm/1.4 dB NF)
- Integrated dual 14-bit A2D converters
- Input Gain/Attenuation controls with 70 dB Gain (See Page 4)
- Multi-module trigger input via Digital I/O port
- Integrated 3-stage RF Pre-selector
- Input Bandwidth: 1-110 MHz (For greater than 110 MHz bandwidth Consult Factory)
- Internal or External 10 MHz Reference
- External 1PPS LVTTL Input
- Input Signal Power Read Back Capabilities
- Single-site module for use with ICE-PIC6 and newer DSP cards



Applications

- L-Band Tuner
- RF to IF conversion
- RF to Base Band Conversion
- Communications
- Instrumentation
- LNB Sub-band Tuner

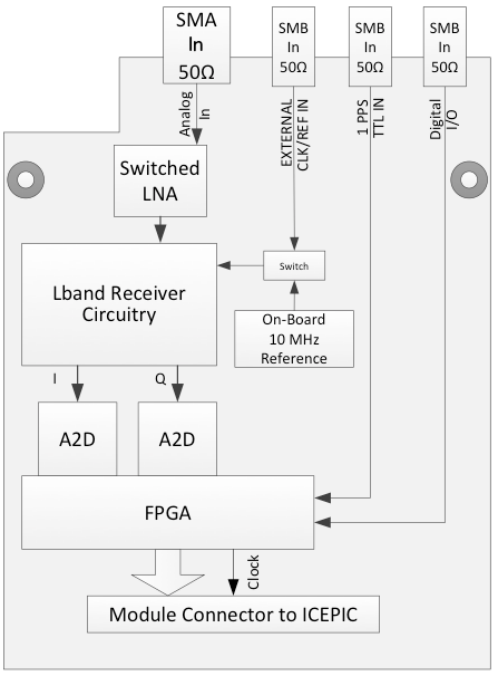
Description

The L-Band Tuner is a single-site module that accepts an input frequency range from 800 to 2300 MHz with input signal power ranging from -104 to +0 dBm. The software interface provided displays amplitude vs. time (oscilloscope), amplitude vs. frequency (spectrum), and frequency vs. time (falling raster). Control of the L-Band tuner is available via the software interface. The receive bandwidth is software-selectable from 1 to 110 MHz. Two ICE-LB2D-M3 modules can be placed on a single ICE-PIC card for dual-channel applications. A single 8-lane PCI-Express slot is required.

An internal 10 MHz reference can be used by selecting the onboard 10 MHz reference, or an external 10 MHz reference can be provided via an SMB connector. An SMB connector for external 1 PPS input is available. The external 1 PPS input can be stored in bit 0 of a 16-bit word that is 14-bit Data MSB aligned. When used for the ICE-PIC7 DSP Card, an IRIG-B002 (DC IRIG-B) stream can be received via an SMB connector on the ICE-PIC card for accurate time tagging reference.

© 2020 ICE Enterprises, Inc. ◆ 10302 Eaton Place, Suite 100, Fairfax, VA 22030
Phone 703-934-4879 ◆ Fax 703-591-3048 ◆ Info@ice-online.com ◆ www.ice-online.com

Functional Block Diagram / Actual Module

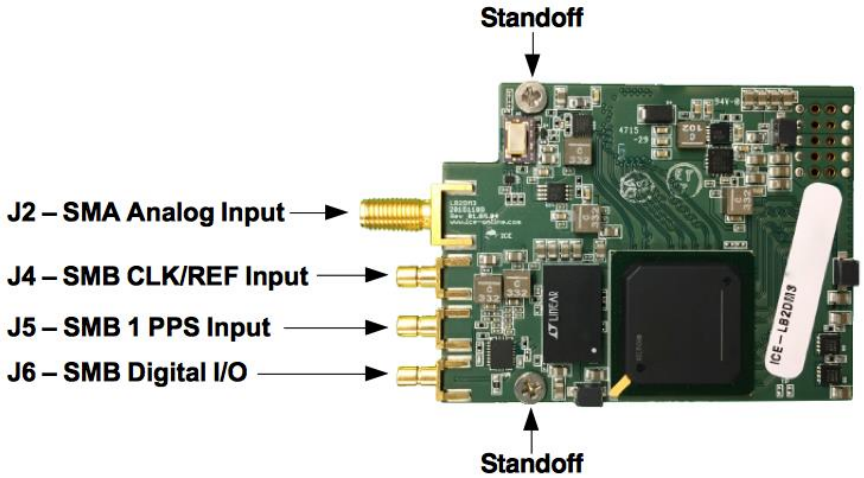


Specifications

Functional

Connector	Manufacturer	Part Number	Description	J-Number
Signal Connections				
Analog Input	Emerson	142-0701-871	Edge launch SMA	J2
Reference Input	Amphenol	903-518J-51P	Edge launch SMB	J4
PPS/Trigger Input	Amphenol	903-518J-51P	Edge launch SMB	J5
Digital I/O	Amphenol	903-518J-51P	Edge launch SMB	J6
Board Connection				
Data Connection	Samtec	QTE-020-03-F-D-A	40-pin header	J3
Power Connection	Global	BG 190-10-A-3-N-D	2-pin header	J1
Physical Connection				
Standoff (2 each)				
Mating Connectors				
SMB	AMP	414946-1		J4, J5, J6
	Huber Suhner	11 SMB-50-2-40		
Data	Samtec	QTE-020-03-F-D-A		J3

© 2020 ICE Enterprises, Inc. ◆ 10302 Eaton Place, Suite 100, Fairfax, VA 22030
Phone 703-934-4879 ◆ Fax 703-591-3048 ◆ Info@ice-online.com ◆ www.ice-online.com



Electrical

Parameter	Impedance	Minimum	Typical	Maximum	Unit
SMA Analog Input	50 ohm	-104	-40 to -10	+5 (see Graph on Page 4)	dBm
SMB External Reference (AC-coupled)	50 ohm	+/- 0.5	+/- 1.0	+/- 2.0	V_{p-p}
SMB External 1 PPS / Trigger (DC-coupled LVTTL)	50 ohm	+ 0.5	+ 3.3	+ 3.6	V_{p-p}
SMB Digital I/O (LVTTL)	50 ohm	+ 0.5	+ 3.3	+ 3.6	V_{p-p}

Mechanical

Width	2.0 in
Length	2.6 in
Height	The edge-launch low profile module, installed on the ICE-PIC card complies with PCI slot width specifications

Absolute Maximum Ratings

Parameter	Value	Units	Conditions
Electrical			
AV_{CC}	3.3	VDC	
DV_{CC}	3.3	VDC	
PPS Input LVTTL	3.6	V_{P-P}	
External Reference Input LVTTL	3.6	V_{P-P}	
Analog Input Power	+10	dBm	50 ohm
Environmental			
Operating Temperature	-10 to +65	°C	Airflow required[1]
Storage Temperature	-40 to +85	°C	

Warning: Operation of this module beyond any of these parameters may cause permanent damage to the module and any ICE-PIC cards on which it is installed. Exposure to absolute maximum ratings for extended periods may affect reliability. Operation of the module beyond the absolute maximum rating parameters voids the factory warranty.

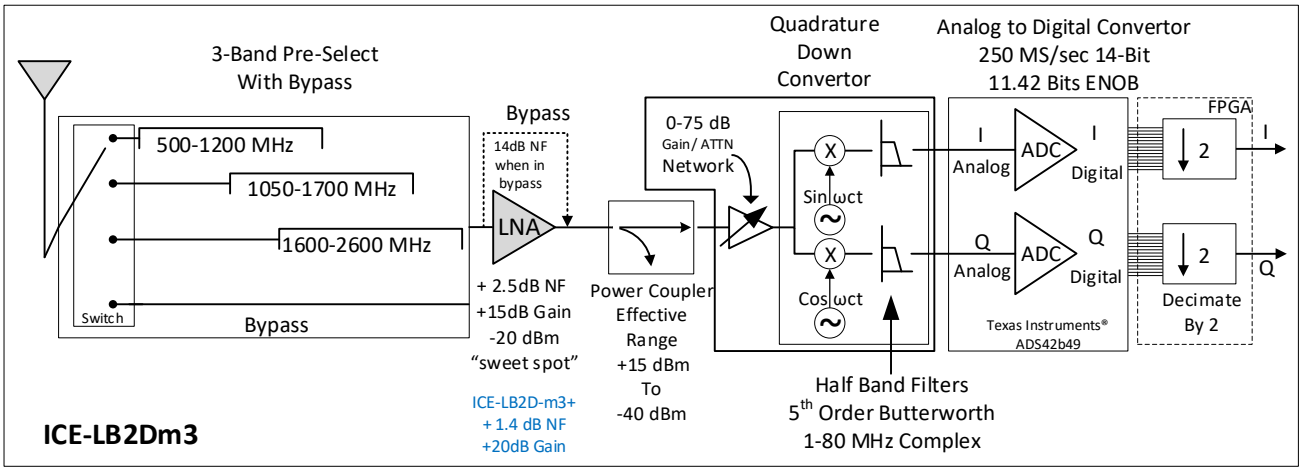
Notes

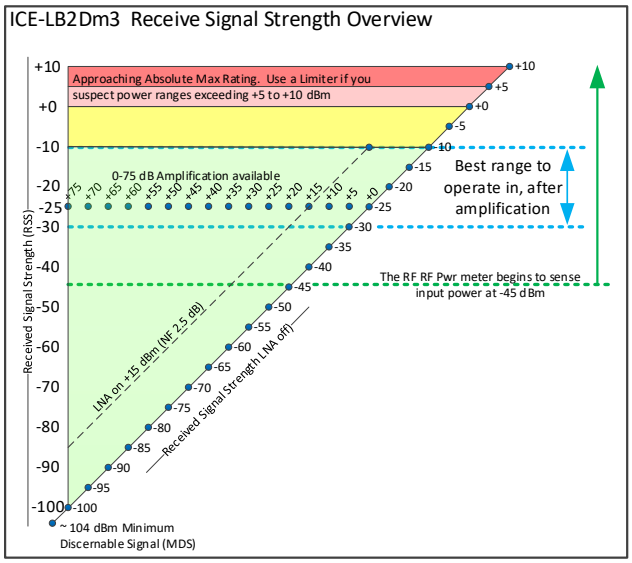
- The headers and components on the board are static sensitive: Do not handle the board without observing proper procedures for the handling of ESD sensitive materials.
- Make sure all connectors are properly oriented before installation

[1] Airflow: Our new ICE-BLOCK and ICE-COOLER products offer sustained airflow in a convenient 1U package. Air flow is 150-180 CFM for a 1U chassis with dual ICE-PIC cards and Quad L-Band Modules.

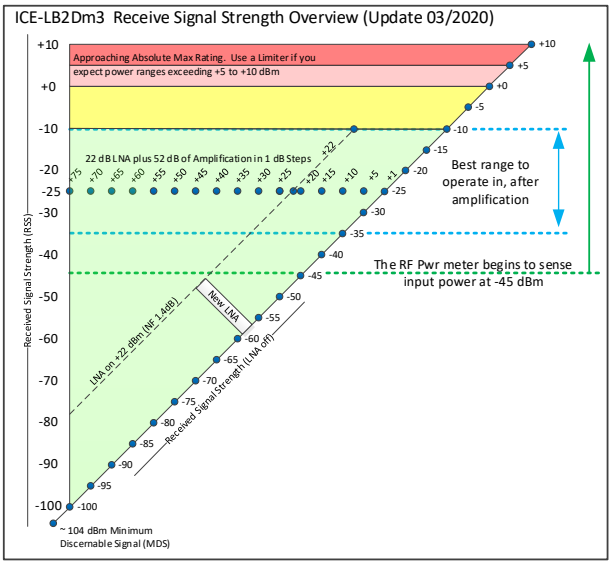
© 2020 ICE Enterprises, Inc. ◆ 10302 Eaton Place, Suite 100, Fairfax, VA 22030
Phone 703-934-4879 ◆ Fax 703-591-3048 ◆ Info@ice-online.com ◆ www.ice-online.com

L-BAND Architecture





ICE-LB2D-m3



ICE-LB2D-m3 (updated – Functionally Equivalent)

Front-end Design Recommendations

If an external front-end LNB is in line prior to the input of the L-Band Tuner, then this external LNB will set the Noise Figure for the system. Most LNBs output a nominal -20 dBm signal strength. This external front-end LNB's -20 dBm signal output, injected into the L-Band Tuner, does not need the additional +15 dBm that the integrated LNA provides. In this use case the integration LNA should be turned off and the LNB will be used to establish the front-end Noise Figure. If an external LNA/LNB is not used, then the Noise Figure (NF) for the integrated LNA of the L-Band (ICE-LB2D-m3) tuner is 2.5 dB and for the L-Band (ICE-LB2D-m3 updated) tuner is 1.4 dB.

LNA Use Recommendations

It is recommended that the LNA be OFF for a received signal strength greater than -10 dBm.
It is recommended that the LNA be ON for a received signal strength less than -30 dBm.
For received signal strengths between -30 and -10 dBm the LNA may be on or off depending on signal characteristics and linearity requirements.

© 2020 ICE Enterprises, Inc. ◆ 10302 Eaton Place, Suite 100, Fairfax, VA 22030
Phone 703-934-4879 ◆ Fax 703-591-3048 ◆ Info@ice-online.com ◆ www.ice-online.com

Revisions

Revision No.	Date	Description
1.0.1	3 April 2017	Data Sheet
1.0.2	6 April 2017	Added Architecture and Received Signal Strength recommendations
1.0.3	10 April 2020	ICE-LB2D-m3 Updated uses new lower noise figure LNA. Updated Received Signal Strength Overview

© 2020 ICE Enterprises, Inc. ◆ 10302 Eaton Place, Suite 100, Fairfax, VA 22030
Phone 703-934-4879 ◆ Fax 703-591-3048 ◆ Info@ice-online.com ◆ www.ice-online.com

ICE Enterprises

Entering The 3rd Decade of Innovative Solutions

1997 — Decade 1 — 2007 — Decade 2 — 2017 Proven 2018 Forward 2019 Clear 2020 Thinking

PCIe Cards

ICEPIC PCI Express Card — ICEPIC1 PCI 32bit, ICEPIC2 PCI 32bit, ICEPIC3 PCI 32bit, ICEPIC4 PCI 64bit, ICEPIC5 PCIX 64bit, ICEPIC6 PCIe Gen1, ICEPIC7 PCIe Gen2 — ICE-PIC8 / PCIe Gen3

Eight Generations of ICE Hardware

ICE-DPI8 (Deep Packet Inspection)
PCI Express Card / Dual 40G or Quad 10G - Intel® XL710 Interface — ICE-DPI8 / PCIe Gen3

Infrastructure

ICE-PIC8Q (Quad 10G)
PCI Express Card / Dual QSFP+ Quad 10G Full Gate Array Control of I/O — ICE-PIC8Q / PCIe Gen3

Digitizers and Processor Modules

L-Band 900-2200 MHz Tuner — 900-2200 MHz 85 MHz BW ICE-LB2Dr2 — ICE-LB2Dm3 900-2200 MHz 120 MHz BW

I/O Modules for the The ICE Hardware

L-Band Tuners, IF and Wideband Digitizers

Digital to Analog / DAC — 160 MS/sec ICE-D2Ar2, 200 MS/sec ICE-D2Ar9, ICE-D2AWGr2 110 MHz BW 0-500MHz IF, ICE-D2RF 50 MHz BW 70-4000MHz RF — ICE-D2AWG-m3 5GSPS DAC / 500 MHz BW 1-2500 MHz Direct RF

Analog to Digital IF and Baseband digitizer A2D 14 Bit / 125 MHz Bandwidth — 105 MS/sec ICE-A2Dr7, 125 MS/sec ICE-A2Dr8, 500 MS/sec ICE-A2Dr10, 250 MS/sec ICE-A2Dr13 — 250 MS/Sec ICE-A2Dm14

Real-Time Gate Arrays

Analog to Digital w/ 4 Digital Down Convertors (DDC)
A2D 14 Bit / Up to 1.0 GHz Bandwidth (See ICE-A2Dm20 Data Sheet for details) — ICE-A2Dm20 Dual Channel 3.0 GSPS Digitizer Dual 500MHz or Single 1GHz Instantaneous BW

Large Gate Array Processor Modules Xilinx and Altera "Customer Sandbox" — DTDM, DTDMX, V5M, V6M Vertex — Xilinx UltraScale (ICE-K8M); Altera/Intel® Arria 10 (ICE-A8M); Xilinx UltraScale+ (ICE-K8P)

Dev/CEs

ICEPOD Ultra Portable High Speed Recorder (HSR) "Shoe Box Size" — ICEPOD6, ICEPOD6.5 — ICEPOD8 2600MB/sec Removable Storage

Rugged / Fast

icePAC Ultra Portable Device / Quad 10 GbE Network Output — ICEPAC 400MB/sec Dual I/O Site

superPAC superPAC with a dual processor module capability — superPAC

Highly Portable Low SWaP

uPAC microPAC simply add an FPGA to your existing hardware for real-time processing — uPAC

dataPAC Small Form Factor | Multi-Terabyte | Multi-Gigabyte/sec Storage
Add SFF directly attached Multi-Terabyte Storage to a DevICE | Take data with you! — dataPAC

ICE-Tray A laptop sized enclosure with room for an RF frontend New 6 Core 2.8GHz XEON processing power | 1GHz or Dual 500MHz BW input | 16 CH Tuning on 500MHz input — ICE-Tray

PCIe and Network Appliances

ICE BLOCK (Network Attached ICE-Cards/Modules)
Dual 40 GbE or Quad 10 GbE Network-Attached Appliance
(8TB Record/Playback option available) — Network Attached / 1U Appliance Hosting Dual ICEPIC8 Cards

Fits in a 1U

ICE COOLer (PCIe Remoting w/Fiber ICE-Cards/Modules)
Advanced Connection Over Optically Linked er — PCIe Bus Remoting 1U Chassis Hosting Dual ICEPIC Cards

Rack Mount Solutions

ICE 1G and 10G GigEXD (Set and Forget Data Conversion)
1/10 Gigabit Data Conversion device (Stand Alone and upto 4-Channels in 1U Chassis) — GigEXD 1Gbit; TenGigEXD 10Gbit with 4 Tuners

SynchronICE I/II (GPS 1PPS/10MHz/IRIG Option Available)
Synchronize and Reference multiple devices with 1PPS / 10MHz Ref / IRIGB — SynchronICE; SynchronICE II

Rack and Portable Recorders

ICE Recorder Technology Speed Progression (Megabytes/sec) 20 80 320 1250 1400 2800 — **Up to Dual 5 Gigabytes/sec**

Turn-key

Analog Recorders Call for a Solution — ICECAP20, ICECAP80, ICECAP320, ICECAP1250, ICECAP 1600 Quad 400MB/s, ICECAP 1400 — ICECAP10000 (5GBytes/sec x2); Analog A2Dm20 - ICECAP 10000

Rack Mount Optical/Packet Recorders — Tandem OC192 / 10G ICEPIC8 | SONETR7 | UDP10Gr3

High Speed Recorders for Packets or Pre-D

Portable Small Analog Recorders LBAND In / LBAND Out Applications — IF-in: IF Out up to Dual 1000 MB/S

Portable Small 12 Volt DC Optical Recorders — ICEPOD8 HSR SONET OC192 10GICE-SONETr7

Portable ICE Briefcase Recorders "Server-in-a-Briefcase" — Original QT360 Briefcase 2003; ICE Briefcase XEON® Series 48GB RAM Hosting Dual ICEPIC6 Cards; ICE Briefcase Intel® 8th Generation XEON V4 Series - 128GB RAM Hosting Dual ICEPIC8 Cards/Modules

Custom Packet Recorders (4 Channel / 400 Megabytes/sec - 2U) — ICE-CSC-M2012 Quad 400MB/s; ICE-CSC-M2012R-2U Quad 500MB/s RAID5

ICE-GNSS-450 | *flightPAC* Global Navigational Satellite System(GNSS) Recorder
Full Simultaneous L1/L2/L5 (GPS/GLO/GAL/BDS All Frequencies/All GNSS MEO Satellites)
flightPAC30 30TeraByte data pack for 3.5 Hours of full spectrum recording — ICE-GNSS-450; *flightPAC30*

DodD ICE 20200430

Copyright© 2020 All rights reserved| Trademarks are respective to owners | Information is Subject to Change

1997 — Decade 1 — 2007 — Decade 2 — 2017 Proven 2018 Forward 2019 Clear 2020 Thinking

ICE Enterprises, Inc. ◆ 10302 Eaton Place ◆ Fairfax ◆ VA 22030 703-934-4879 info@ice-online.com ◆ www.ice-online.com