



Fig 1.a:
TC2 Top view
Size:
22 x 33 m x 3.5 mm



(Actual Size)

Fig 1.b:
TC2 Bottom view

FEATURES & BENEFITS:

- **Digital Voice:** 2400 bps MELPe/TWELP Vocoder
- **Encryption:** 56-bit for Data/Voice
- **Low Cost:** Hardware Installation
- **Activation Keys:** Unlock Functionality
- **Low Power:** 600 m W (HF), 200 mW (VHF) typ.
- **Compact Size:** 22 x 33 x 3.5 mm

OTHER SOFTWARE OPTIONS (DATASHEETS AVAILABLE):

- **HF Modem:** Up to 9 600 bps SSB, 19 200 bps ISB
- **MIL-STD 110C Modes:** 32,000 bps in 6 kHz
- **2G ALE:** MIL-STD-188-141B/C App A & B
- **3G ALE:** STANAG 4538 FLSU
- **Packet Modem:** STANAG 4538 xDL
- **Encryption:** 56-bit for Data/Voice
- **VHF / UHF Modem:** Up to 128 000 bps (24 kHz)

RELATED PRODUCTS (DATASHEETS AVAILABLE):

- **EF-256 Embedded Functions for Secure Voice & Data:**
 - AES-256 Encryption
 - Vocoder (600 – 4800 bps) TWELP* or MELPe**
 - AUTO Data Rate Change
 - Best-in-class Voice Modem
 - Extended Range, const. amplitude modulation

* TWELP voice coding by DSP Innovations Inc.(www.dspini.com)
** MELPe for US customers only

TC2 MODULE HARDWARE

The TC2 is optimized for size and provides very low power consumption. It is intended for integration into HF & V/UHF transceivers and other communication devices. The typical consumption for HF operation is 600 mWatt and 200 mWatt for VHF. This hardware platform can host a number of S/W functions.

2400 DIGITAL VOICE – OPTION

The 2400 bps Digital Voice solution encompasses the MELPe/ TWELP Vocoder plus modem waveform for HF and V/UHF operation with any radio.

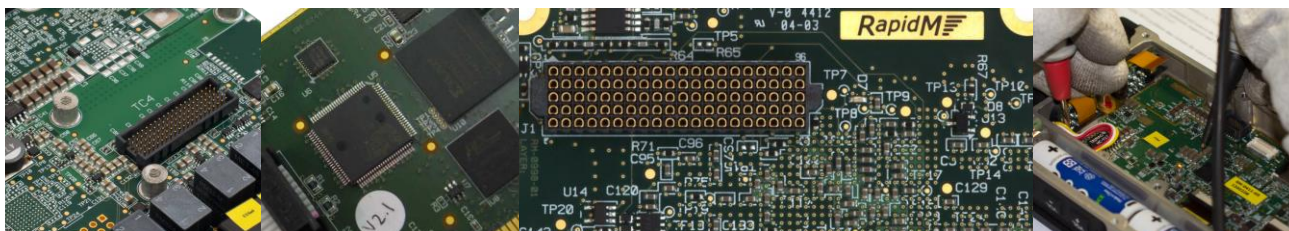
The 2400 bps digital MELPe/TWELP vocoder offers the ability to digitally encrypt voice communications. Sound quality is improved on noisy channels.

2400 SECURE DIGITAL VOICE

BANDWIDTH:	3 kHz	MODULATION:	BPSK
DATA RATES [bps]:	2400		2400, robust
LATENCY [ms]:	450		1400

56-BIT ENCRYPTION – OPTION

The 56-bit encryption offers an appropriate level of security for HF & V/UHF communication. Voice and data traffic is encrypted.



TC2 HARDWARE MODULE

TC2 HARDWARE		
SIZE	22 x 33 x 3.5 mm (w x d x h)	
POWER	3.3 VDC, (Hunt < 650 mW), (Deep-Sleep < 50 mW), (Off < 1 mW)	
TEMPERATURE	-40°C to +85°C (operating); -40°C to +85°C (storage)	
CONNECTORS	3x40-way fine pitch connector, Module Side: Hirose DF40C-40DP-0.4V(51), Host Side: DF40C-40DS-0.4V(51)	
PRIMARY INTERFACES	NOMINAL USE	DETAILS
UART A	Data, Config, Control	Default Rate: 115200 bps (300 to 921600 bps) Electrical: 3.3V LVCMOS
UART B	Radio Control	Rate: 50 to 921600 bps, Electrical: 3.3V LVCMOS
UART C	Spare (Customisable)	Rate: 50 to 921600 bps, Electrical: 3.3V LVCMOS
USART	DTE (TX, RX, RTS, CTS, DTR, DSR, DCD, TCLK, RCLK, RTCLK)	Rate: 128 000 to 300 bps in sync with modem Electrical: 3.3V LVCMOS (for external EIA-530-A)
ETHERNET	Data, Config, Control (optional)	On-board PHY, only requires external connector with integrated magnetics for full 10/100 Base T solution
ANALOGUE AUDIO	Baseband Audio In	Input: 1.4 Vp-p, ~ 20 kΩ input impedance
	Baseband Audio Out	Output: 2.2 Vp-p, ~ 16 Ω min. output load impedance
	Voice Microphone-In	Input: 1.4 Vp-p, ~ 20 kΩ input impedance
	Voice Headphone-Out (independent volume control)	Output: 2.2 Vp-p, ~ 16 Ω min. output load impedance
	Voice Line-Out	Output: 2.2 Vp-p, ~ 600 Ω min. output load impedance
	Microphone Bias	Analogue Input
MCBSP 0	Data, Config, Control (build option)	Synchronous serial I/F McBSP port
MCBSP 1	Digital Baseband Audio (build option), and/or Digital Ear & Mic Audio (build option)	Synchronous serial I/F McBSP port
DISCRETES INPUTS	PTT Sense	Zeroise
	Deep Sleep	PPS (GPS Time Sync.)
	Reset	Hold-up Battery (RTC, Mem)
DISCRETE OUTPUTS	Radio Keyline	Ready

56-BIT ENCRYPTION - OPTION

ENCRYPTION	
KEY LENGTH	56-bit
KEY STORAGE	Up to 256 keys Keys are securely stored (encrypted). Zeroise function to permanently erase all stored keys.
KEY FILL	Key Management System 56-bit (PC Application) or RAP1 control protocol
ENCRYPTED TRAFFIC	Digital Voice, HF Modem Data, 3G Packet Data

2400 DIGITAL VOICE - OPTION

DIGITAL VOICE									
VOCODER	MELPe*: TWELP**:	Mixed Excitation Linear Prediction enhanced RapidM Low Rate Vocoder & Modem							
VOCODER RATES	2400 bps								
MODEM	RapidM proprietary digital voice modem. Insures tight coupling between vocoder, encryption and modem.								
PERFORMANCE	VOCODER RATE [BPS]	LATENCY [ms]	PESQ	CHANNEL USE	SPEECH QUALITY			UNDERSTAND-ABILITY LIMIT SNR [dB]	
					INTELLIGIBILITY	SPEAKER RECOGNITION	LATENCY & EMOTIONAL CONTENT	CCIR POOR	AWGN
	2 400	450	3.1	Gnd/W	Very Good	Good	Acceptable	6.5	0.5
2 400, robust***	1400	3.0	Sky/W	Good	Acceptable	Acceptable	5.0	-0.5	

* TWELP voice coding by DSP Innovations Inc.(www.dspini.com)

** MELPe US & NATO end-users (subject to approval)

*** Future feature

ORDERING INFORMATION	STOCK NUMBER	DESCRIPTION
TC2 (Hardware only)	TC2-02-M-M0-6.5	Module: TC2 V2 SDM M0 (H/W) V6.5
Hardware Activation (Required)	TC2-02-HWAC-KEY	Key: TC2 H/W Activation (required)
Digital Voice 2400 bps	TC2-SW-O-DH-6.5	SW MDL-SDVS 2400bps Vocoder, Modem V6.5
Encryption 56-bit	TC2-SW-O-ED-6.5	SW MDL-COMSEC 56bt HVM/xDL/Voc V6.5
OTHER SOFTWARE OPTIONS*	STOCK NUMBER	DESCRIPTION
HF Modem M1 Software Option	TC2-SW-O-M1-6.5	SW MDL-M1 (HF 110B, ISB, 110C 6kHz) V6.5
HF Modem M2 Software Option	TC2-SW-O-M2-6.5	SW MDL-M2 (HF S4285, S4539 9600) V6.5
HF Modem M3 Software Option	TC2-SW-O-M3-6.5	SW MDL-M3 (HF 110A, 4415 2400) V6.5
HF Modem M4 Software Option	TC2-SW-O-M4-6.5	SW MDL-M4 (HF MdM S4539 9600 bps) V6.5
2G ALE	TC2-SW-O-2G-6.5	SW MDL-2G ALE / MS 141B, App. A, B V6.5
3G ALE Fast Link Setup	TC2-SW-O-3G-6.5	SW MDL-3G ALE 4538 FLSU, Rad. Ctrl V6.5
3G ALE xDL Packet Data	TC2-SW-O-3D-6.5	SW MDL-3G ALE 4538 xDL Pckt Modem V6.5
V/UHF Modem L1 (Wideband)	TC2-SW-O-L1-6.5	SW MDL-L1 (VHF B≤24kHz ≤128kbps) V6.5
V/UHF Modem L4 (Narrowband)	TC2-SW-O-L4-6.5	SW MDL-L4 (VHF B≤3kHz ≤16kbps) V6.5
EVALUATION KIT*	STOCK NUMBER	DESCRIPTION
TC2 Eval. Kit (Carrier Card, Break-out Cable, PSU)	TC2-EV-0000-SPC	Bundle: TC2 Eval Kit (TC2 excl.) V02

* Contact RapidM for Datasheets

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