DESCRIPTION

GNS TrafficChip TC5000 is designed for easy integration of TMC hardware feature in PDA/PND/ embedded navigation devices.
With extended features on very small chip-size space GNS TrafficChip TC5000 upgrades TMC hardware to a new level.

High integration level, easy handling and new features like internal antenna switch and external clock option make the TC5000 a very cost effective solution.

TC5000 is the industry's first and most highly integrated full FM RDS/TMC data receiver system with a micro-controller (MCU) "on chip". The combination of the industry-leading FM receiver with the MCU allows full GNS protocol support including all proven features known from GNS' industry leading FM*x* module series.

TC5000 supports user memory array for secure storage of user data like manufacturer- & country codes and expiry dates

Some new features like dual antenna support, internal antenna matching and switch and digital audio out have been added.

The receiver makes RDS and associated data streams such as TMC and other Open Data Applications (ODA) available in complete, error-corrected groups.

The integrated MCU provides one UART for host communication and a second one for connection of a GPS receiver (GNS protocol 3.5).

TrafficChip TC5000 is easy to integrate and needs just a very few external components for operation

For TMC software integration a software development kit (SDK) containing complete API functions for various O/S is also available from GNS.
The GNS API is implemented in most portable dynamic navigation SW-products on the market, so units using TC5000 will work without further SW development.
Software platforms that have been designed for GNS FMx products will work with TC5000 without any modification. However, new features will not be supported, then.

For shared-antenna (multituner-) applications, please refer to application note AN140110 for more information.

FEATURES

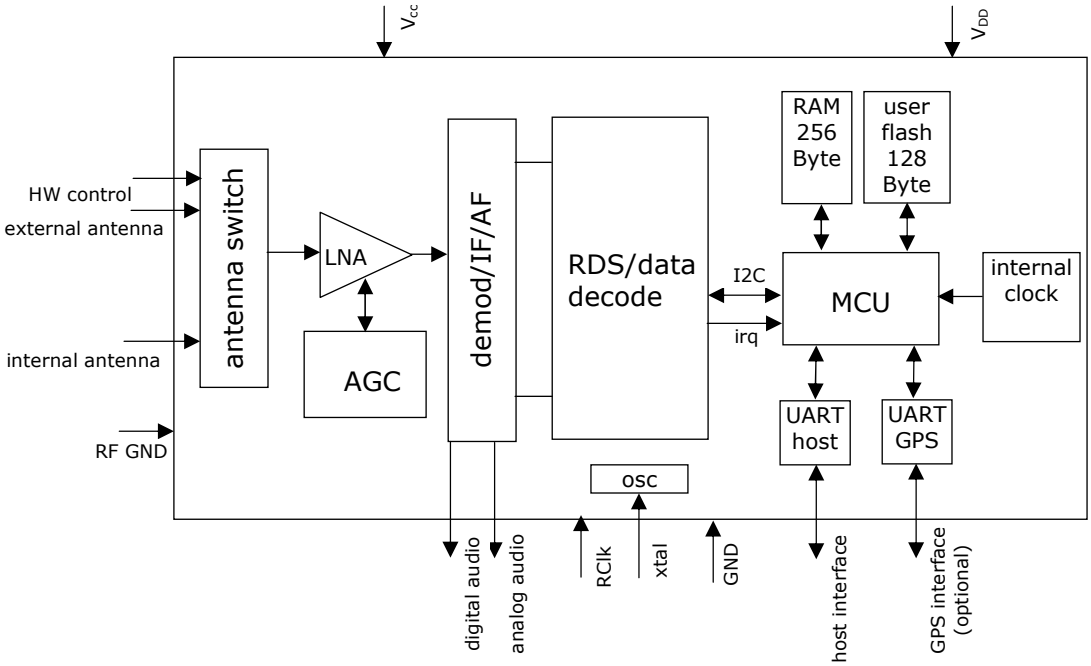
- complete FM/RDS receiver chip for TMC applications
- 3.5 x 5.5mm QFN package, easy SMT mounting
- few external components
- *GNS protocol 3.5* [1)] enabled, allows GPS/RDS combined data over single UART.
- host computer (PDA / Notebook / embedded / phones) software API available for TMC application integration
- only one single power supply (2.7V..3.5V)
- external clock option reduces BOM costs
- automatic antenna matching for internal antenna
- internal antenna switch saves external RF components
- low power consumption < 60mW
- serial TTL/CMOS interface (3.3V)
- universal RAW RDS TMC output
- high quality stereo audio output, DSP processor for IF,AF, digital Audio
- programmable audio volume

APPLICATIONS

- in-vehicle equipment for RDS TMC
- navigation cell phones
- dynamic navigation
- handheld and notebook computers, mobile phones
- RDS TMC monitoring equipment

revision history			
V0.10	Sep, 20 2007	PS	initial objective
V0.20	Oct 5 2007	PS	PINOUT revised
V0.50	Aug 13 2008	PS	preliminary specification
V0.60	Sep, 15 2008	PS	application notes inserted
V0.65	Oct,20 2008	PS	mechanical outline & rec. pads revised
V0.70	Nov,5 2008	PS	rev of application circuits,pcb recommendation
V0.71	Nov7,2008	PS	cream mask recommendation (pcb design rules)
V0.72	Jul 28 2009	PS	firmware spec containing sub-release info
V0.74	Sep 2 2009	MH	TC5000 weight confirmed
V1.00	Sep 9 2009	PS	final DS, New firmware release, corrections in application circuit: (pg 15) C5 circuit, L2 value
V1.10	Nov 24 2009	PS	Added MSL, layout improvement
V1.11	Jan 25 2010	PS	Reference to AN140110 added
V1.12	Mar 16 2011	MR	Corrections in application circuit (pg14,15,16), RF-GND conditions

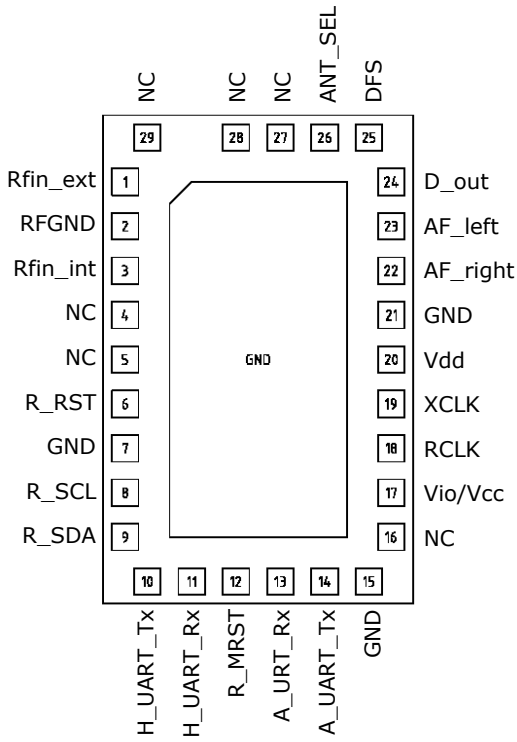
FUNCTIONAL DIAGRAM



DEVICE PINOUT DIAGRAM (TOP VIEW)

TOP VIEW

case PQFP 29

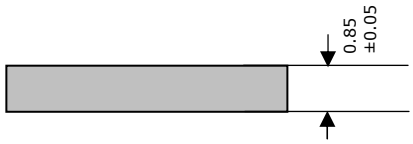


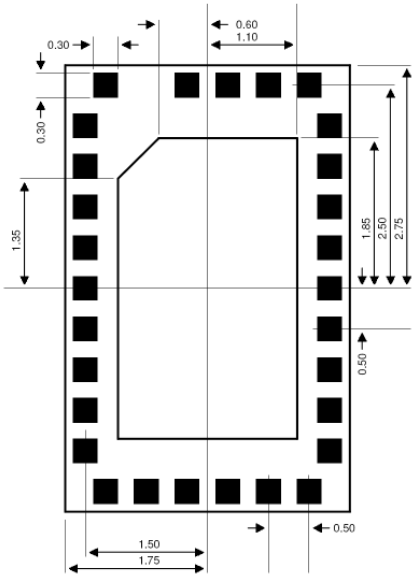
NO	NAME	DESCRIPTION
1	Rfin_ext	external antenna input
2	RFGND	RF Ground
3	Rfin_int	internal antenna input
4	NC	do not connect
5	NC	do not connect
6	R_RST	connect pull-down*
7	GND	tie to GND
8	R_SCL	connect pull-up*
9	R_SDA	connect pull-up*
10	H_UART_TX	data to host UART
11	H_UART_RX	data from host UART
12	R_MRST	connect pull-up*
13	A_UART_Rx	auxilary & GPS UART Rx
14	A_UART_Tx	do not connect
15	GND	ground

NO	NAME	DESCRIPTION
16	NC	do not connect
17	Vio/Vcc	supply
18	RCLK	external clk or xtal (32,768kHz)**
19	XCLK	DCLK or xtal (32,768kHz)**
20	Vdd	digital supply
21	GND	GND
22	AF_right	audio output right chn
23	AF_left	audio output left chn
24	D_out	I^2S digital audio output data ***
25	DFS	I^2S digital audio output frame signal ***
26	ANT_SEL	antenna selector input
27	NC	do not connect
28	NC	do not connect
29	NC	do not connect
GND	GND	die chip base to ground !

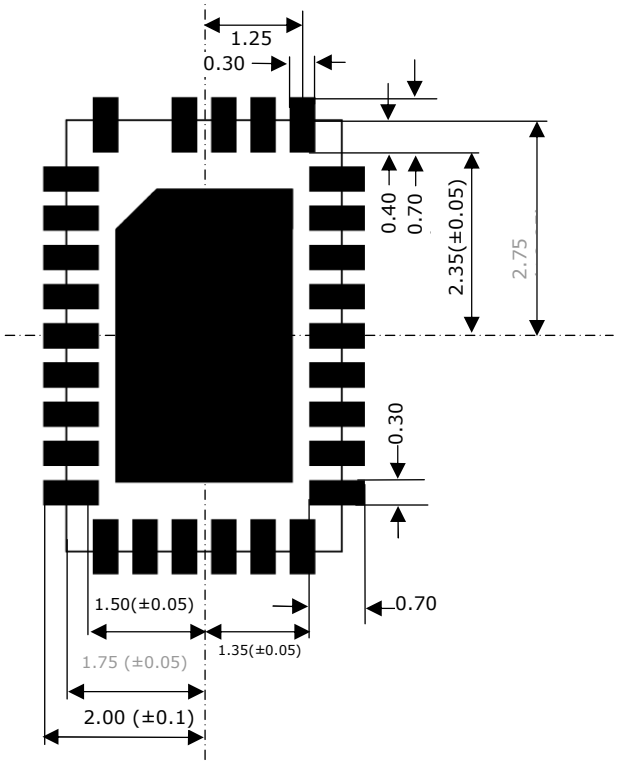
*see chapter *application circuit*
**see chapter *clock options*
*** see chapter *digital audio*

PHYSICAL DIMENSIONS





RECOMMENDED PAD LAYOUT TOP VIEW



ELECTRICAL SPECIFICATION

absolute maximum ratings		
ambient	Storage	- 50..+150°C
	operational	- 20..+85°C
power supply voltage	Pin 17,20	3.8V DC
DC input voltage RFin	pin 1,3 Rfin	6V DC
RF input voltage Rfin	pin 1,3 Rfin	400mV$_{pk}$

general data		
	SMD QFN chip for FM TMC applications	
Weight	38 (±1%) mg	
Size	5.5 (±0.1)*3.5(±0.1)*0.85 (±0.05) mm^3	
ambient temperature	Non condensing	-40°C...+85°C
power supply , power requirements	Operation	2.7V … 3.5V DC / <25mA
Type	Digital-Synthesizer tuner, integrated R(B)DS processor , DSP processing	
Sensitivity	appr. 2.2 µV (S+N)/N=26dB	

DC characteristics					
	min	**typ**	**max**	**unit**	**note**
supply voltage Vcc	2.7	3.0	3.5	V	
supply current	18	20	25	mA	
setup delay time after power up	-	-	500	ms	Host software should wait before issueing first command
power on rise time	10	-	1000	µs	10..90% of Vcc
digital interfaces					
	min	**typ**	**max**	**unit**	**note**
low level input voltage	-0.3	-	0.3 * Vcc	V	pin,11,13,26 serial CMOS Vcc=3.3V
high level input voltage	0.7 * Vcc	-	Vcc+0.3V	V	pin,11,13,26 serial CMOS Vcc=3.3V
low level output voltage	0.0	-	0.2 * Vcc	V	pin 10,14 serial CMOS Vcc=3.3V
high level output voltage	0.8 * Vcc	-	Vcc	V	pin 10,14 serial CMOS Vcc=3.3V
baud rate	38000	38400	38800	bit /sec	host interface pin 10,11
baud rate	-	4800, 9600	-	bit /sec	auxiliary (GPS-) interface,pin 13,14 baud rate as factory option, refer to order information
serial settings		8N1noP			
oscillator circuit					
	min	**typ**	**max**	**unit**	**note**
xtal frequency		32768		1/s	internal or external
xtal capacity		12		pF	internal osc with xtal
freq tolerance	-100	-	+100	ppm	internal or external total value, includes initial, aging and TC tolerance
low level input voltage	-0.3	-	0.3 * Vcc		external clk on Pin RCLK
high level input voltage	0.7 * Vcc	-	Vcc+0.3V		external clk on Pin RCLK

digital audio interface					
	min	**typ**	**max**	**unit**	**note**
protocol	-	-	-		I2S
bus member	-	-	-		TC5000=client device
clk generator	-	-	-		external (host)
clk rates	-	32.0, 44.1, 48.0	-	kHz	selectable via tool software, will be persistant in TC5000
analog audio output					
	min	**typ**	**max**	**unit**	**note**
DC voltage	-	0.5Vcc	-		use output caps
AF output voltage	70	80	90		
THD	-	0.1	0.5	%	external clk on Pin RCLK
frequency response	30		15,000	1/s	-3dB
Audio Stereo Separation	25	-	-	dB	
signal to noise ratio	57	63	-	dB	Vrf=1mV
output impedance	-	-	10	kOhms	pins 22,23
FM characteristics					
	min	**typ**	**max**	**unit**	**note**
DC input voltage RFi	-	-	6	V	pin 1,3 Rfin
RFinput resistance	-	4	-	kOhms	pin 1,3 Rfin
RFinput capacitance	-	5	-	pF	pin 1,3 Rfin
AM Suppression	-	40	50	dB	m = 0.3
Adjacent Channel Selectivity	-	35	50	dB	±200 kHz
Alternate Channel Selectivity	-	60	70	dB	±400 kHz
sensitivity audio	-	2.2	3.5	uV	(S+N)/N =26dB
sensitivity RDS	-	-90	-	dBm	for 50% RDS Group quality
frequency range	87.5	-	108.0	MHz	others on request
frequency grid	-	100	-	kHz	

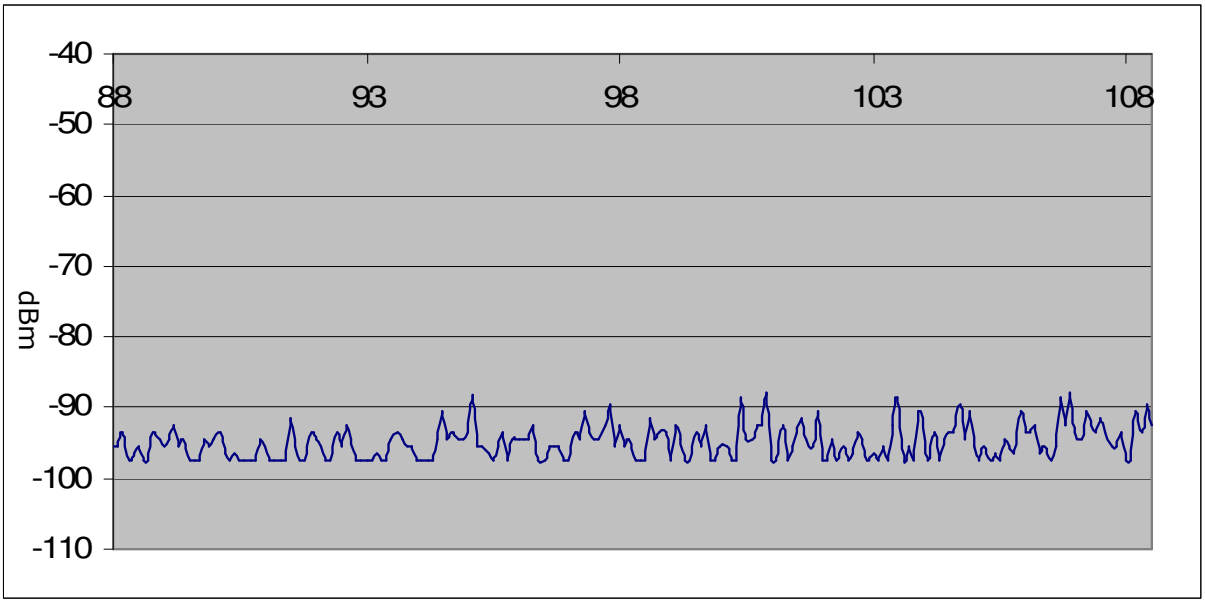
ESD SPECIFICATION TBD

esd data					
	min	**unit**		**pins**	**reference**
human body model	2000	V		tbd	JESD22-A114-B / C=100pF, R=1k5
machine model	200	V		tbd	JESD22-A115-A / C=200pF, R=0r
human body model	2000	V		tbd	JESD22-A114 / C=100pF, R=1k5
machine model	250	V		tbd	JESD22-C101

RDS PERFORMANCE DIAGRAM

Diagram shows RDS sensitivity vs frequency. specification under following conditions:

- RF fed via coupled wire
- RDS modulation is 3.3kHz
- Criterion for RDS sensitivity is : 50% correct (no error) RDS groups



ORDERING INFORMATION

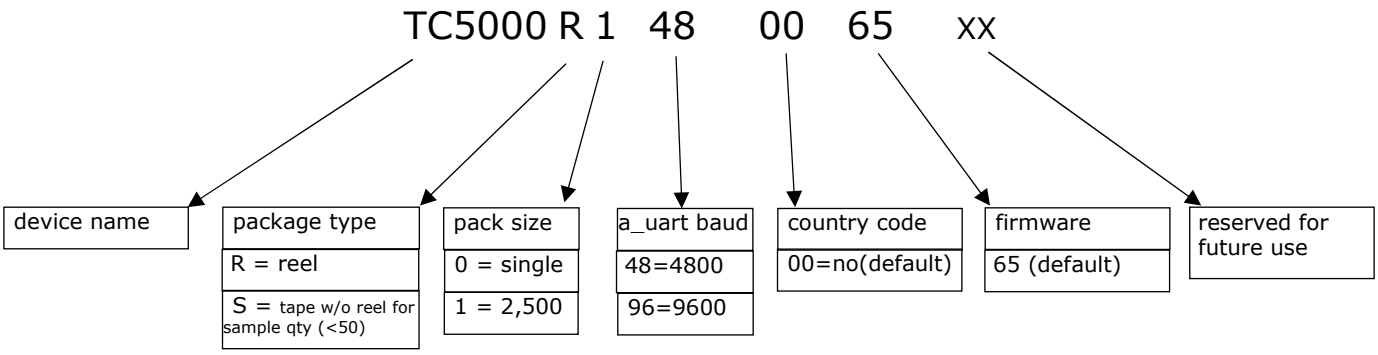


table of Standard products, options to be assigned

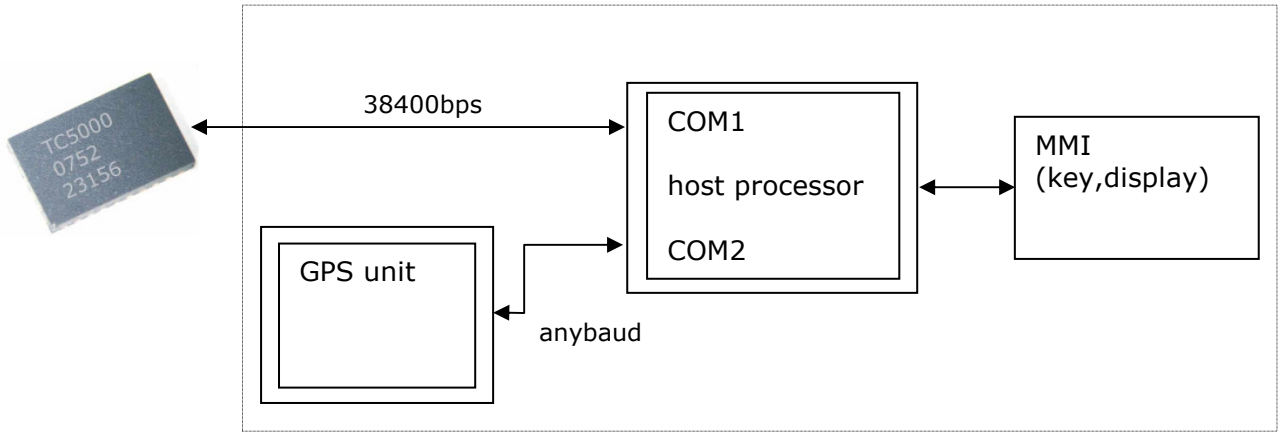
type	**GNS part#**	**description**
TC5000S0 48 00 65xx	4037735104037	*TrafficChip*,data interface for serial TTL, GNS 3.5 Protocol, sample quantities on tape
TC5000R1 48 00 65xx	4037735104037	*TrafficChip*,data interface for serial TTL, GNS 3.5 Protocol, reel of 2,500 pcs

APPLICATION NOTES

TC5000 has been designed to enable portable navigation systems to operate dynamically by the use of RDS-TMC traffic information. Two different typical application configurations can be used .

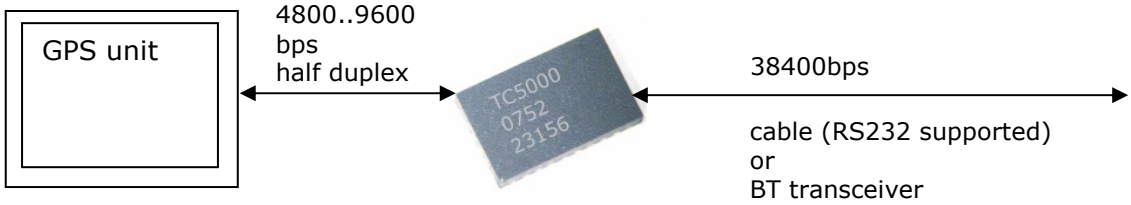
TWO- SERIAL- PORT CONFIGURATION

for example:
stand-alone portable Navigation equipment or PDA with integrated GPS receiver



SINGLE - SERIAL- PORT CONFIGURATION (WITH GNS 3.5 PROTOCOL [1)])

for example: external combined receiver with cable or BT-transceiver, stand alone Navigation with only one serial port.



TWO-ANTENNA SUPPORT

This device provides an internal dual antenna support:

embedded automatic matching circuit for internal antenna

the embedded matching circuit for the internal antenna is based on an automatically switched array of caps. As long as the internal antenna is in specification range, it will be automatically optimized.

embedded antenna switch with HW control or SW control alternatively

- Selection of antenna can be performed either with an HW-Pin contact (ANT_SEL [pin 26] connected to ground will select internal antenna)

-or -

- software command from host. Software control will be available in GNS API. Software control allows to select between 3 states:
  1. antenna selection corresponds to HW-pin
  2. select internal antenna (overrides HW PIN)
  3. select external antenna (overrides HW PIN)

Signal to Noise - Quality output

When using SW-control for antenna switching, a meaningful signal quality value can be used to judge which is the better antenna. The "analogue – signal to noise" value is much more meaningful than the RSSI and therefore gives a good decision about real signal quality.

INTERNAL ANTENNA DESIGN

TC5000 provides internal antenna support.

The internal antenna will be optimized dynamically. The antenna circuit is able to match the small PCB antenna and has relatively narrow bandwidth to avoid interferences.
Although Traffic*Chip* is able to maximize the performance of a small internal antenna, please note the following:

1. Internal antenna is intended for strong-signal areas, only. The reception performance is not as good as for the external antenna.
2. The internal antenna may suffer from internal noise sources inside the PND.
3. Please note, that the internal antenna will need some space ! Please keep a distance of minimum 8mm between any part of the antenna wire (or track) and any other metallic parts ! Keep away from display frame , PND circuitry and do not place any PCB copper planes under the antenna.
4. please always provide an additional external antenna jack in your PND design.
5. Antenna should be 60..80mm long and may be routed straight or max. half loop as shown in above PCB detail. Do NOT route a wound structure to save more space.
   Use track of min 1mm width.
   note : please refer also to **"RECOMMENDED PCB DESIGN"** for antenna structure proposal.
   An evaluation tool for checking the antenna is available on request. It's based on checking the internal caps of TC5000 by readout over the entire FM band.

STARTUP TIMING

Due to internal circuitry self test and firmware initialization, *setup delay time after power up* as specified under electrical data has to be respected by driving software. Delay time has to be kept after power has stabilized before issueing the first command.
Especially in case of software controlled power supply for TC5000 , you should take care to implement a delay in software.

AUDIO OPTIONS

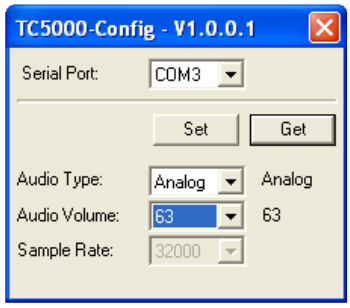
TC5000 supports both, analog and digital outputs.

The audio mode is defined with a persistant setting (flash option).

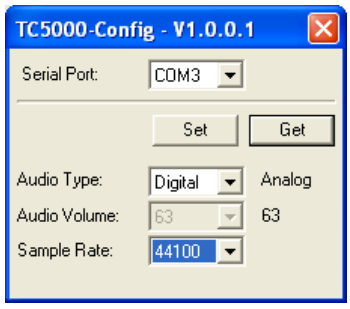
A config tool is available from GNS to set the audio mode and – for the analog mode - the start-up volume setting.
Setting of audio parameters should be performed during production endtest.

By default , TC 5000 is set to analog output at full(63) volume level.
If audio is not used or default settings are useful in your application, there is no need to proceed the setting with the config tool.

The config tool allows both setting and reading of the parameters. Pressing the GET button will do a readout of parameters without manipulating any settings.

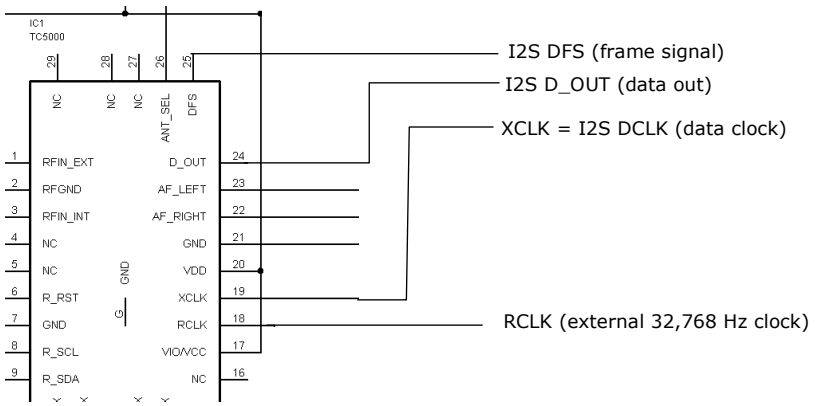


In this window, the TC5000 settings will be modified to digital mode, 44.100kHz sample rate as soon as the SET button is pressed.



I2S DIGITAL AUDIO INTERFACE

TC 5000 supports digital audio interface.
Important note : this option is only available when using external clock source for TC5000. (See OSCILLATOR CONFIGURATIONS) :



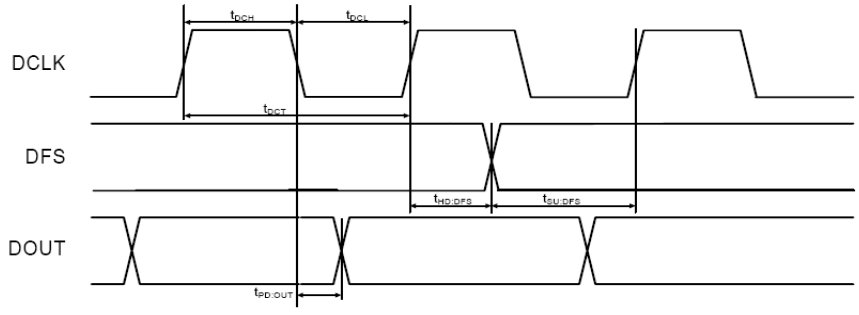
For digital audio, the I2S digital audio protocol is used. I2S is an industry standard three wire bus, that carries clock, frame clock and data.

Sample rates of 32kHz, 44.1kHz and 48kHz can be selected by GNS configuration tool

TC5000 is defined as an I2S slave device, therefore, an external clock and word-clock signal has to be provided by host.

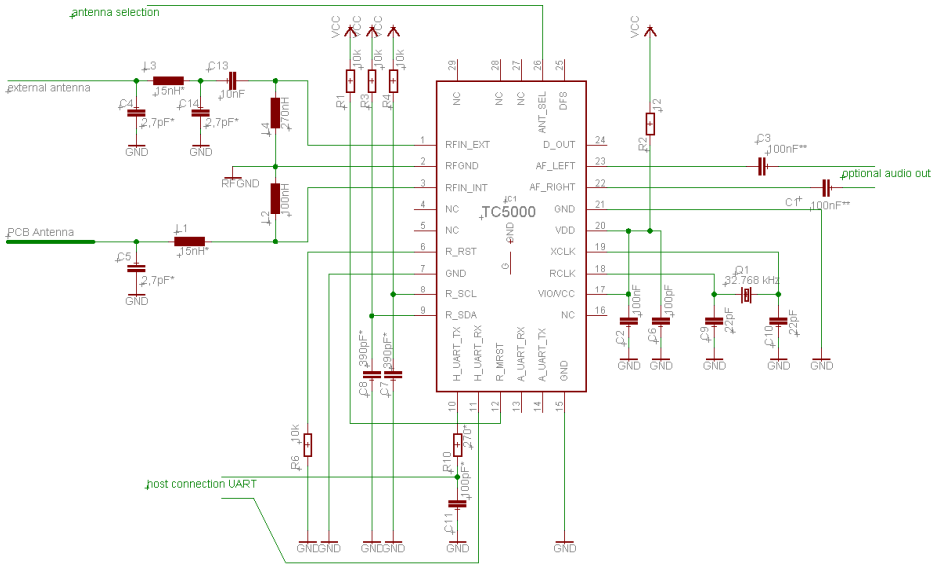
For I2S protocol specifications, please refer to Philips I2S documentation, that is freely available on the web (nxp.com).

digital audio timing characteristics (V_{DD} = 2.7 to 5.5 V, V_{IO} = 1.5 to 3.6 V, T_A = –20 to 85 °C)					
	min	**typ**	**max**	**unit**	**note**
DCLK Cycle Time tDCT	26	-	1000	ns	
DCLK Pulse Width High tDCH	10	-	-	ns	
DCLK Pulse Width Low tDCL	10	-	-	ns	
DFS Set-up Time to DCLK Rising Edge tSU:DFS	5	-	-	ns	
DFS Hold Time from DCLK Rising Edge tHD:DFS	5	-	-	ns	
DOUT Propagation Delay from DCLK Falling Edge tPD:DOUT	0	-	12	ns	



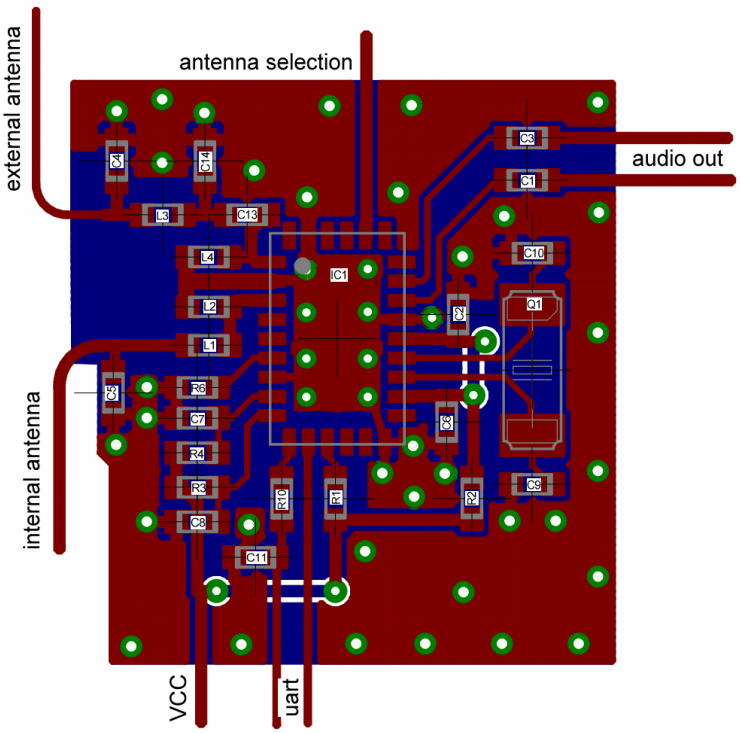
TYPICAL APPLICATION CIRCUITS & RECOMMENDED PCB DESIGNS

1. Application with EXTERNAL and INTERNAL antenna and INTERNAL clock

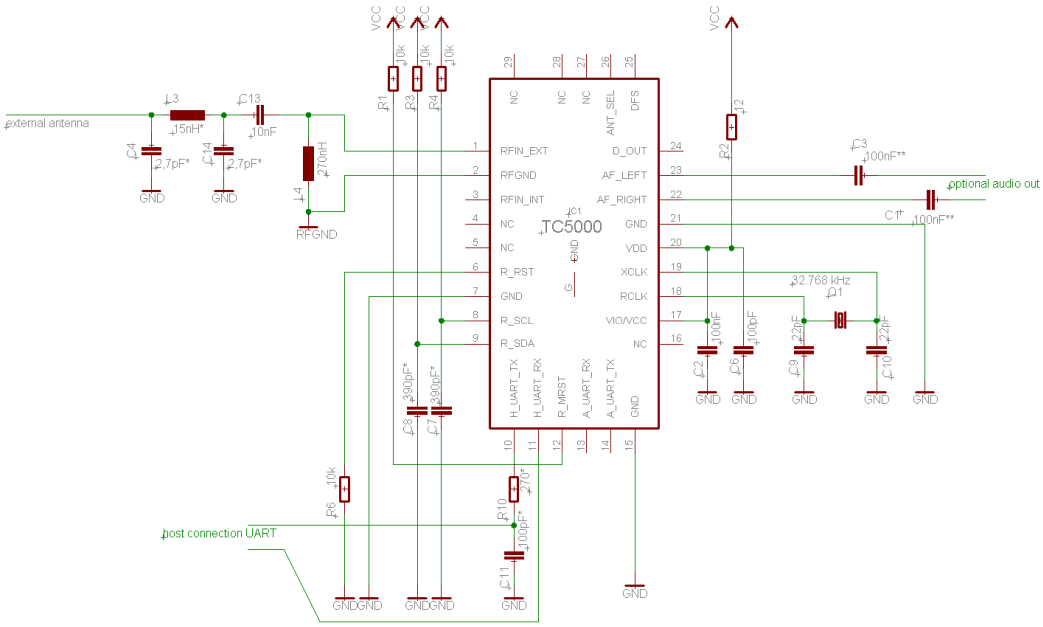


** components are added for EMI suppression.*
*** optional DC decoupling for audio-out*

Connect RFGND to GND using chip die GND, see layout recommendation below

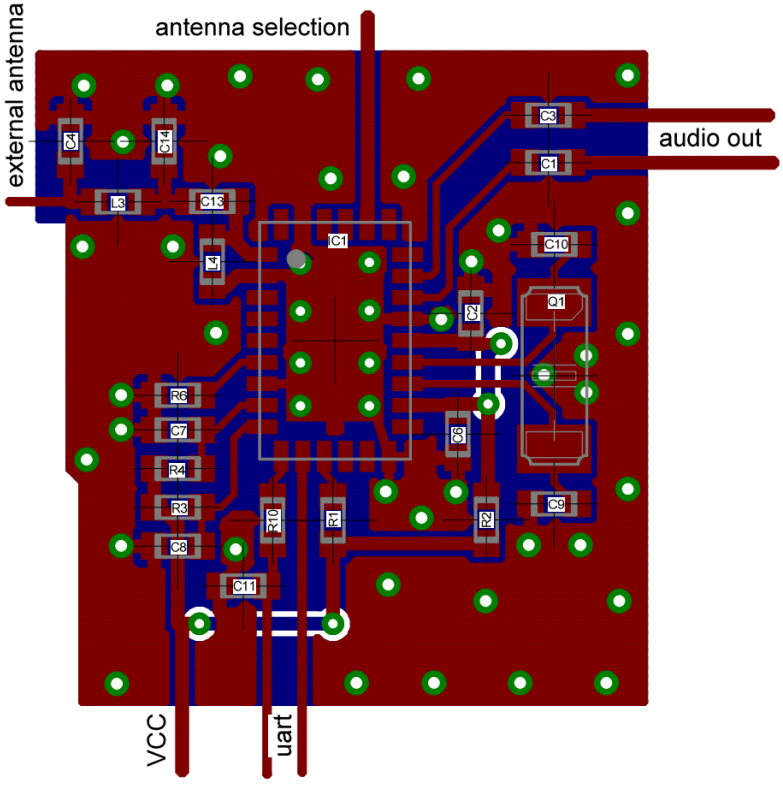


2. Application with EXTERNAL antenna, only and INTERNAL clock.

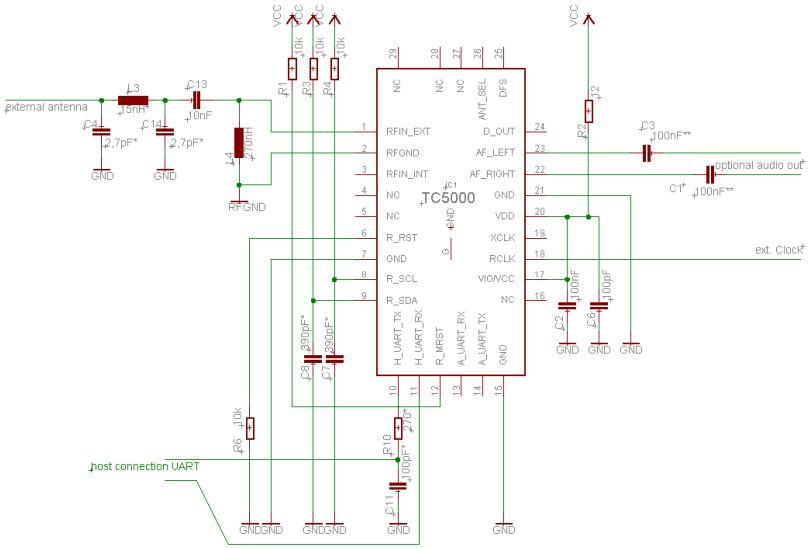


** components are added for EMI suppression.*
*** optional DC decoupling for audio-out*

Connect RFGND to GND using chip die GND, see layout recommendation below

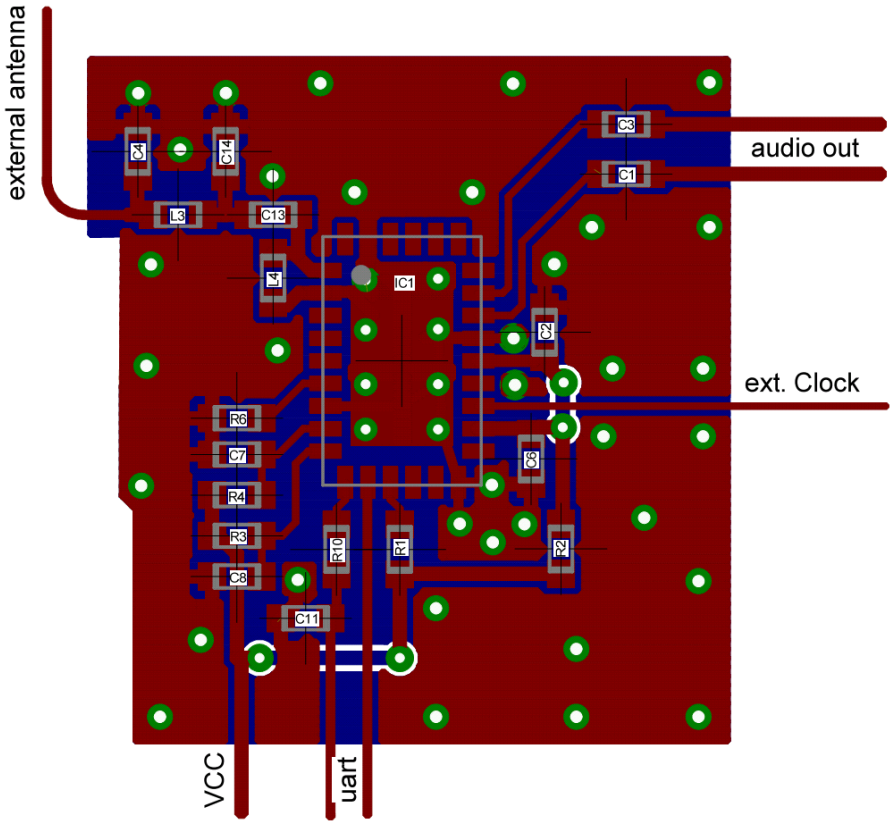


3. Application with EXTERNAL antenna and EXTERNAL clock.



*components are added for EMI suppression.
** optional DC decoupling for audio-out

Connect RFGND to GND using chip die GND, see layout recommendation below



parts list				
	value	**package**	**manufacturer**	**comment**
R1,R3,R4,R6	10k, 5%	402	many	mandatory
C2	100pF/6.3V	402	many	place close to Vdd pin20
C6	100nF	402	many	place close to Vio/Vcc pin17
C7,C8	390pF	402	many	EMI suppression internal I2C bus
L2	100nH, Q>=25	603	murata	needed for internal antenna match
R10	270Ohms, 5%	402	many	EMI supression for Tx data
C11	100pF	402 COG	kemet	EMI supression for Tx data
L1,L3	15nH	402	murata, high frequency film type	EMI supression antenna, extended EMI requirements
C4,C14,C5	2.7pF	402	kemet	EMI supression antenna, extended EMI requirements
C9,C10	27pF	402 COG	kemet	oscillator circuit
Q1	32768 Hz		KDS,Daishinku	oscillator circuit
C1,C3	>100nF/6.3V	402	many	optional : for audio out
L4	270nH, Q>=8	402	many	needed for internal antenna match

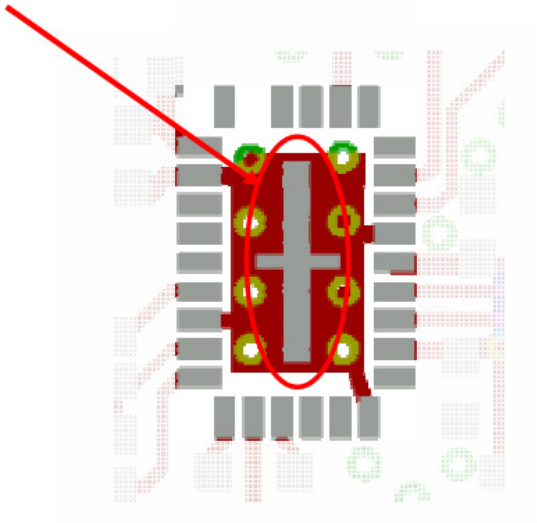
1. EMI components (L1,L3,C4,C14,C5) on the antenna input are added to improve the EMI compliance, if the PND device has to comply to advanced restrictions. In case the PND is classified as a wireless device, test frequencies in EMI measurements are expanded.
2. EMI components on Tx (R10,C11) are added to suppress possible noise , that is caused by the switching waveforms of the digital output of TC5000. Please check your host uart configuration for additional R/C circuits. In case you have already R/C network on the track, please check the resulting waveforms at host CPU input (Rx).
3. Oscillator circuit (Q1,C9,C10) can be saved, if a 32,768Hz source is available in your system. Please refer to **oscillator configurations** section and application circuit 3.
4. besides of the digital (TMC) output for Traffic Applications, an audio out (digital or analogue) is available. Because in TMC applications, tuning is normally done automatically without any user actions, the audio-out is intended for special application cases, only.
   Please leave pins 22,23 open, if audio is not used.

PCB DESIGN RULES

This PCB proposals are based on a two-layer design. It implements internal antenna, external antenna option, internal oscillator with 32.768kHz xtal and all EMI improvements (L1,L3,C4,C5,R10,C11).
important : Keep C2 and C6 connections as short as possible ! Proper grounding is crucial for good performance
Please note, that resistors R3,R4,R1,R6 are mandatory for proper operation !

note the following design rules for proper operation

- care for clean supply lines
- ensure power-on rise & fall times as specified
- do not short-circuit audio-out pins, leave open if not used
- connect common GND to system ground with Ground plane of PCB
- connect external RF input to antenna connector with a short (below 15mm) or impedance-matched line.
- Internal antenna must be routed directly to TC5000 to ensure proper automatic calibration. (see application circuit 1.).
- Big GND Pad (bottom plate) must be soldered to PCB. Refer to picture below. In this example, the cream mask (grey) is designed to perform a soldered connection and to avoid the solder cream flowing off into via holes.



OSCILLATOR CONFIGURATIONS

This device provides an internal oscillator for operation. Please refer to application circuits 1. and 2. (pg. 15,16) above for xtal connection.
For lower cost and space requirements, an external 32,768 Hz signal (f.e. from system or GPS RTC) can be fed to RCLK Pin18. See application circuit 3. (pg 17)

EXTERNAL ANTENNA DESIGNS

TC5000 is typically used for integration in PNA/PND or in cradle. This gives an acceptable ground situation for the antenna due to the ground mass from navigation device.
For FM application (87.5..108 MHz) , a typical straight antenna design is lambda quarter, which is 75cm at 100MHz. Lambda-half (150cm) antenna is a little bit better in performance , but too long for easy application in vehicle.

Furthermore, the antenna has to be light in weight and easy to mount.
A simple wire antenna is the easiest and cheapest solution and should be acceptable for the user if it can be easily mounted to the windscreen.

GNS offers the simple solution with different connectors (2.5mm stereo phone plug preferred) and with different colours.
The fixiation is made with the help of two suckers.

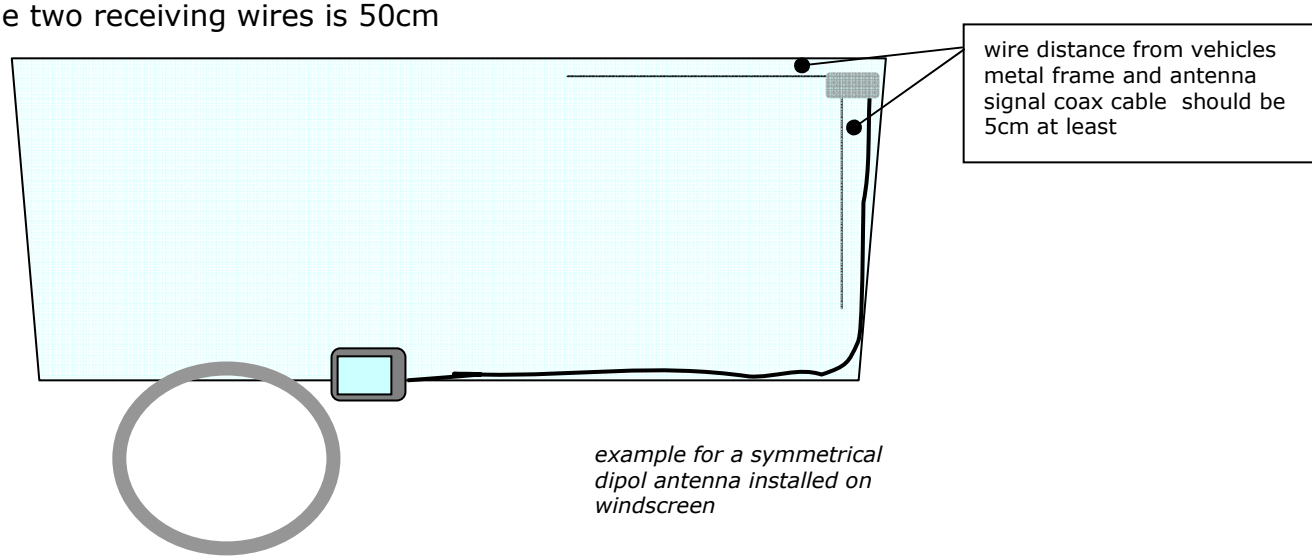
Any reduction of antenna length will reduce the amount of received signal .

SHIELDED WINDSCREENS & IMPROVED RECEPTION USING VEHICLE ROOF ANTENNA

An important reason for unsatisfying performance when using FM receiver with in- vehicle antenna solutions is a *metal coating of the windscreen*.
Also a windscreen heating system (with thin embedded wires) may give a nearly perfect "faraday cage".
In this cases, the receiption INSIDE the vehicle is not longer satisfying.
For this situation, a so-called Y-adaptor is recommended.
The Y-adaptor will be inserted into the in car radio's antenna wiring and will split the Rf.
Typical loss is 3 dB by power sharing plus up to 4 dB path loss.
Sharing the vehicle antenna is recommended in any situation when ever possible, because it will raise level and stability of FM receiption.

IMPROVED ANTENNA DESIGNS

Instead of using the Y-adaptor, improved antenna designs can be used to enhance the signal to noise conditions and to have an improved RDS performance.
Symmetrical dipol antennas are a good approach and will be available soon. Due to their construction, mounting on the windscreen will be a little bit more complicated than for the wire antenna.
length of the two receiving wires is 50cm



example for a symmetrical dipol antenna installed on windscreen

NON-PROMISING CONCEPTS

Customers often do not like a long wire antenna which is attached to the windscreen.
Therefore, everyone wants to have a very small or wound antenna, that should be integrated inside the PNA housing best.
This approach will only work in strong signal environments and should not be promoted as the only antenna solution for a product.
The idea of just adding a LNA/MMIC (low noise amplifier) to have a better signal is not helpful in that situation. The small antenna will not be able to produce sufficient S/N ratio.
The result of amplification will be a higher level with higher noise…
Indeed, there is no reason for additional amplifiers, because input sensitivity of GNS TMC receivers is already very high. Under clean condition a level of below 5uV is sufficient to decode RDS data.

Another known but not satisfying idea is integration of antenna into the data/charging cable of a device. this concept will have the following shortcomings:

- The capacitive coupling between antenna and other wires will cause a low impedance and energy loss for the FM signal
- Normally, on charger wires there are strong noises from switching mode DC/DC converters. This noise will be caught by the antenna wire which is very near to that source of noise
- possible harmonics of the serial data lines will also have an noise impact.

- In most cases, the charger cable will be installed in a low position inside the vehicle. FM fields are not strong and very dependent of driving direction
- The charger cable cannot be kept straight and vertically, because it will be always too long. Straight and nearly vertically mounting is an important issue for FM antenna performance. A curled cable that is placed in curves has an undefinable behaviour regarding the Rf.

ANTENNA CONNECTOR & PLACEMENT RECOMMENDATION

For antenna connector, a cheap and tiny connector like phone plug is sufficient. There is no reason to use special RF material like SMB or MCX in this case.
MCX and MMCX is not really useful in end-user applications because of high forces needed to plug/unplug the connector. Uneducated users will demage these connectors within a short period of time.
2.5mm or 3.5mm Stereo phone plug have become a kind of "industry standard" in PNA designs.

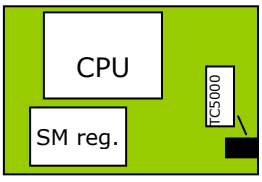
Please do connect the RF Ground of FMx to the antenna jack ground terminal to allow usage of improved antenna solutions.

FMx RF ground terminal should not be connected to PNA device common ground .

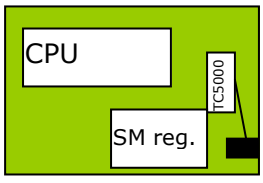
Ground is needed for improved antenna solutions (see chapter "improved antenna designs")
More critical regarding the antenna connection is possible noise impact. Please be sure to avoid radiating components near to antenna tracks or antenna jack.
(SM-) switched mode voltage regulators or data busses may have a relevant spectrum in FM band (87.5 .. 108MHz).

Best way to avoid impact of radiation is to keep the antenna tracks and connection far away from sources of radiation and to keep the antenna track as short as ever possible.

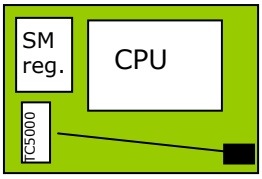
examples of arrangement of components:



this design avoids noise impact



regulator may radiate in antenna wire & antenna jack



CPU circuits may radiate in antenna track on PCB

GNS IMPLEMENTATION AND MASS PRODUCTION SUPPORT TOOLS

GNS has developed test equipment for both implementation stage and mass production stage.

For implementation a RDS source is available. This is absolutely necessary for regions with no RDS or TMC on air to verify functionality. Document ***RMU-6_datasheet_eng_.pdf*** describes test conditions and test arrangements for labatory confirmation and performance testing.

For mass production test we offer a simple test environment, consisting of a signal box and a small software for CE devices. The test reflects the status in 3 different coloured boxes on PNA screen: red (not good), yellow (test in progress), green (device ok) . Please refer to ***RFM-6_datasheet_eng250110.pdf***

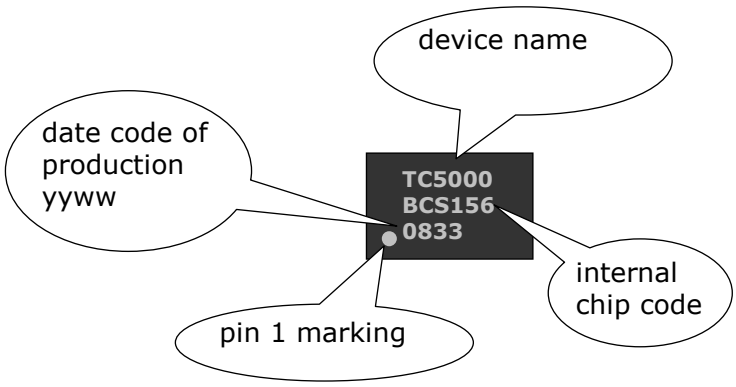
Both documents are available on request.

ADDITIONAL INFORMATION

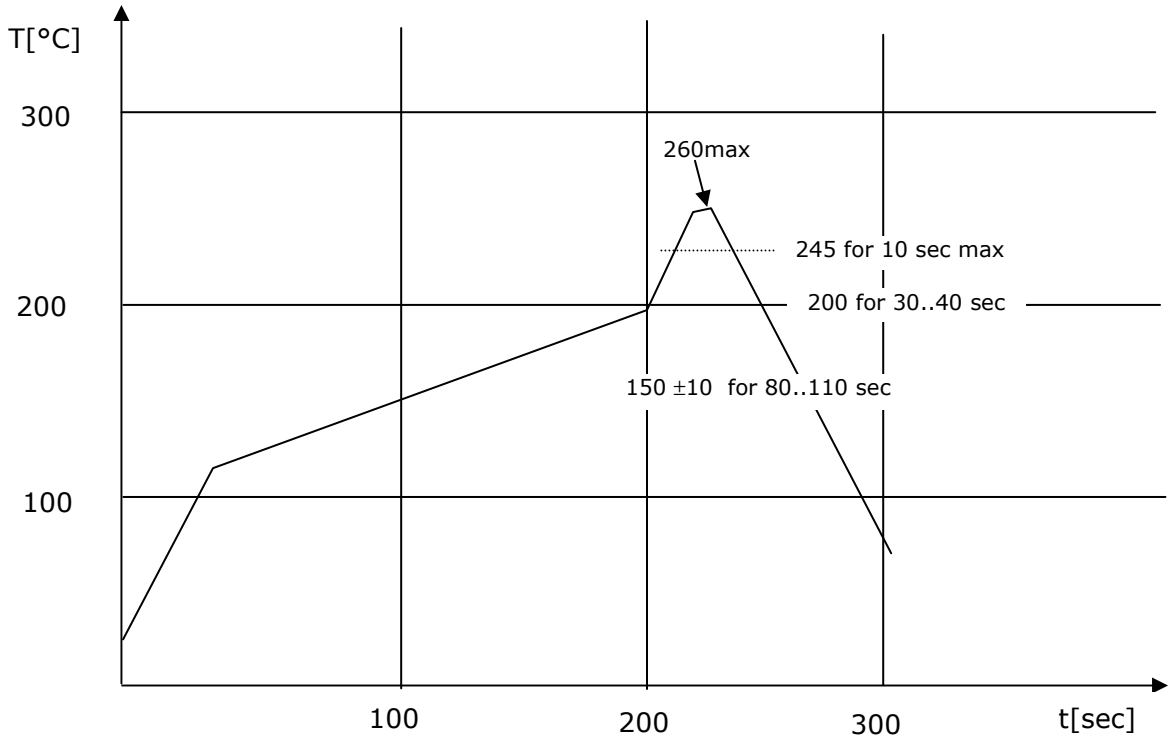
MATERIAL INFORMATION

complies to ROHS standard
ROHS documentations are available on request
contact surface : Au/Ni

DEVICE MARKING



RECOMMENDED SOLDERING REFLOW PROFILE

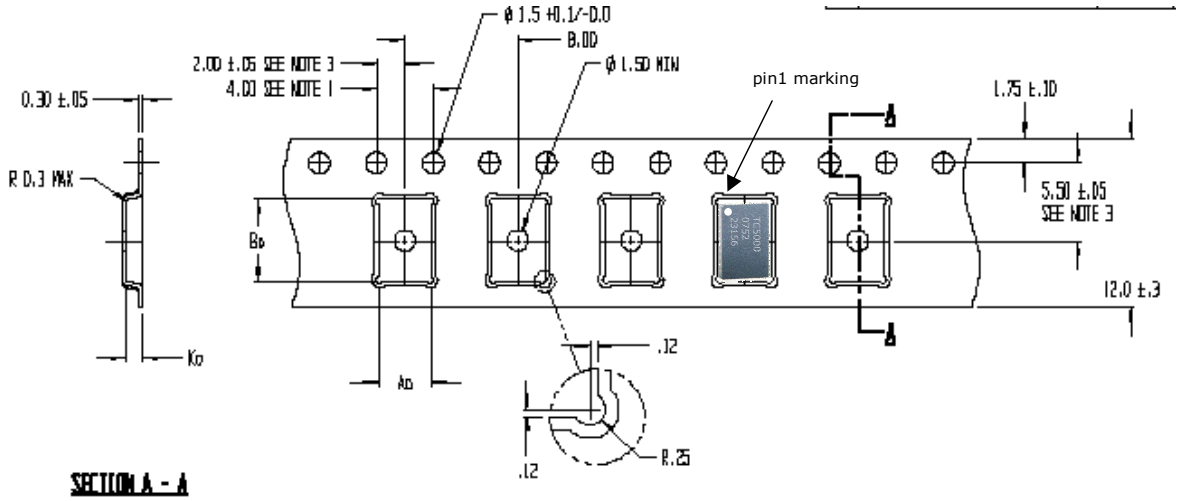


MOISTURE HANDLING

TC 5000 is MSL (moisture sensitive level) 3.

1. Devices are baked and dry-packed before shipment factory. A Humidity Indicator Card (HIC) and drying desiccant are included inside.
2. Shelf life of devices in a sealed bag is 12 months at <40ºC and <90% room humidity (RH).
3. Upon opening of dry pack, the HIC should be checked immediately; devices require baking before board mounting if the HIC is >20% when read at 23ºC ±5ºC.
4. After dry pack is opened, devices should go through reflow for board assembly within 168 hours at factory conditions of <30ºC/60% RH.
5. If baking is required, devices should be baked for a minimum of 8 hours at 125ºC.
6. Any unused devices after the dry pack has been opened for more than 168 hours should be baked before any subsequent reflow and board assembly.
7. Re-baking should be done for a minimum of 8 hours at 125ºC.
8. Unused devices can either be baked and dry-packed first before storage, or they can be baked just before the next board assembly.

TAPE INFORMATION



REEL INFORMATION

no. of devices : 2,500 pcs / reel
reel dia : 13" (330mm)

FIRMWARE RELEASE INFORMATION

This product is equipped with firmware V65 37/9 (standard firmware).

USER MEMORY AREA

This product is equipped with user memory that allows to store user information on the internal flash area. This feature allows to program manufacturer code, Country code (OTP behaviour), expiry dates and other relevant data.
P/L programming software for host UART access available from GNS.

[1)] note:
patented technology by GNS Global Navigation Systems