

1. Introduction

The GNS *FM6A* macro component is designed for easy integration of TMC functionality in your PDA/embedded or mobile navigation equipment. It provides extended features on chip-sized PCB space requirements. A software development kit (SDK) containing complete API functions for various O/S is also available from GNS for the TMC software integration. The GNS API is implemented in most portable dynamic navigation SW-products on the market, so units using *FM6A* will work without further SW development.

2. Compatibility with prev. FM6 hardware

The new FM6A hardware replaces both FM6 and FM6V11 versions without any compatibility issues.

3. Features

- complete FM/RDS receiver module
- super miniature sized (9.3 * 10 * 2.0 mm) type
- *GNS protocol 3.0* 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 (2.9V..3.4V)
- low power consumption 75mW
- serial TTL/CMOS interface (3.3V)
- universal RAW RDS output
- high quality stereo audio output, DSP processor for IF,AF
- programmable audio volume



4. Applications

- in-vehicle equipment for RDS TMC
- dynamic navigation
- handheld and notebook computers, mobile phones
- RDS TMC monitoring equipment (application software available)

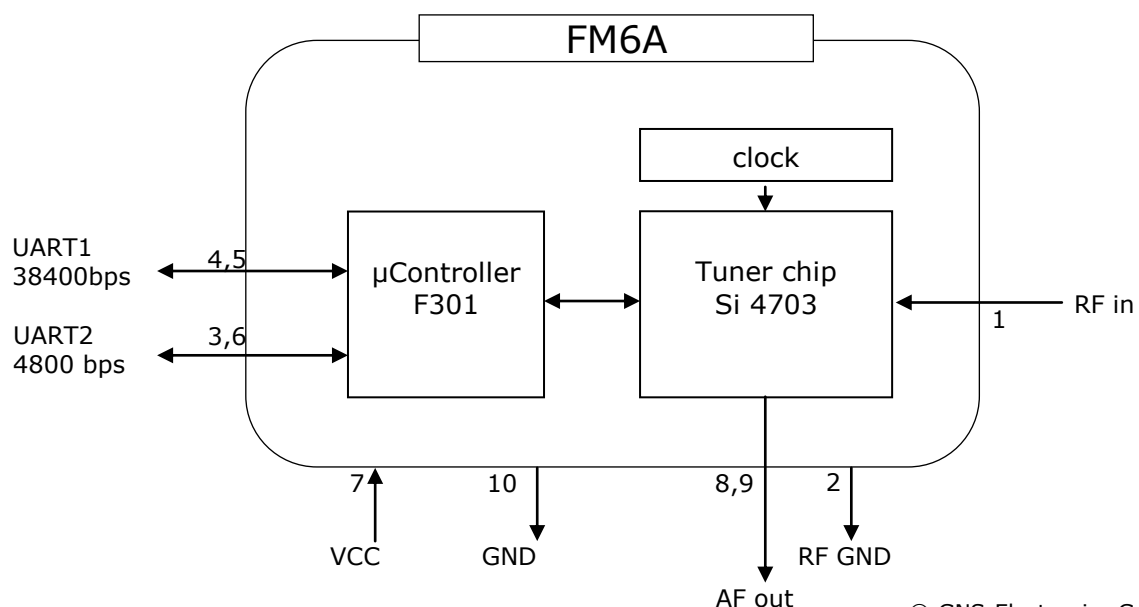
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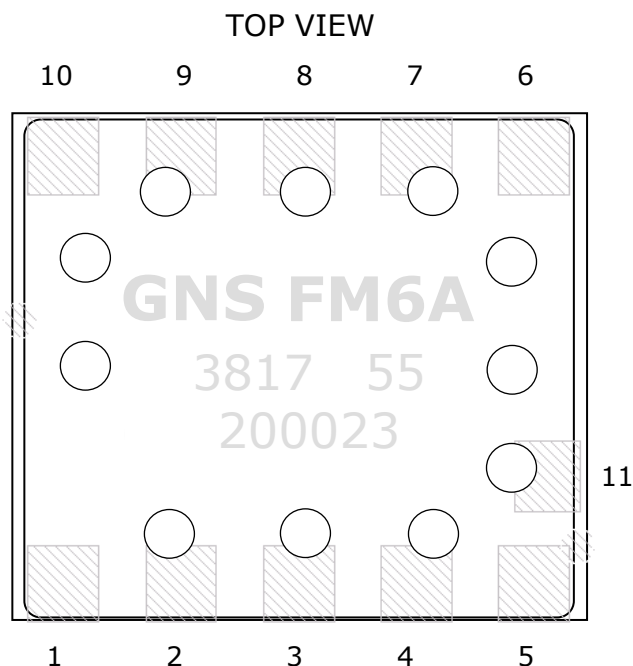
6. Revision history

revision history			
V0.10	Aug 11 2006	P.Skaliks	initial objective
V0.11	Oct 1 2006	P.Skaliks	dimension correction
V1.00	Jan 3 2007	P.Skaliks	final V1.00
V1.01	Jan 9 2007	P.Skaliks	real Foto added, drawing corrected
V1.01	Jan 15 2007		obsolete Pin 11 removed from land pattern
V1.01	Jan 23 2007	P.Skaliks	No of devices per reel raised to 2k
V1.02	Feb 12 2007	P.Skaliks	firmware version 53
V1.03	Feb 20 2007	P.Skaliks	esd information added
V1.05	Jun 11 2007	P.Skaliks	FW V55
V1.06	Sep 25 2007	P.Skaliks	Thickness of module corrected
V1.07	Sep 25 2007	P.Skaliks	New part # assigned for V55
V1.08	Apr4,2008	P.Skaliks	New additional part# for 9600bd GPS uart
V1.09	Apr 21 2008	P.Skaliks	laser marking definition for 9600bd
V1.10	July,15,2008	P.Skaliks	Vcc rise time definition
V1.15	Nov 12 2008	P.Skaliks	MSL data added
V1.16	Nov 10 2010	P.Skaliks	Packing data added , temp range edited,
V1.17	Dec 2 2010	P.Skaliks	Schematic
V1.18	Dec 9 2010	P.Skaliks	Solder profile
V1.19	Feb 24 12	P.Skaliks	Dimensions formatting
V1.30	May 30 14	P.Skaliks	Dimensions formatting
V1.40	Jan 12 15	P.Skaliks	Added Index, diagnostic banner output
V1.50	Sep 18 17	M.Heinzel	FM6A with emproved EMC, RFin allows no DC. GNS-Electronics – new company appearance.
V1.60	Jan 17 2018	M.Heinzel	FM6A complies to RED directive, no compatibility restrictions with previous FM6 hardware.
V1.70	Jun 14 2018	M.Heinzel	Overworked Quality and Environmental Specifications

7. Functional schematic



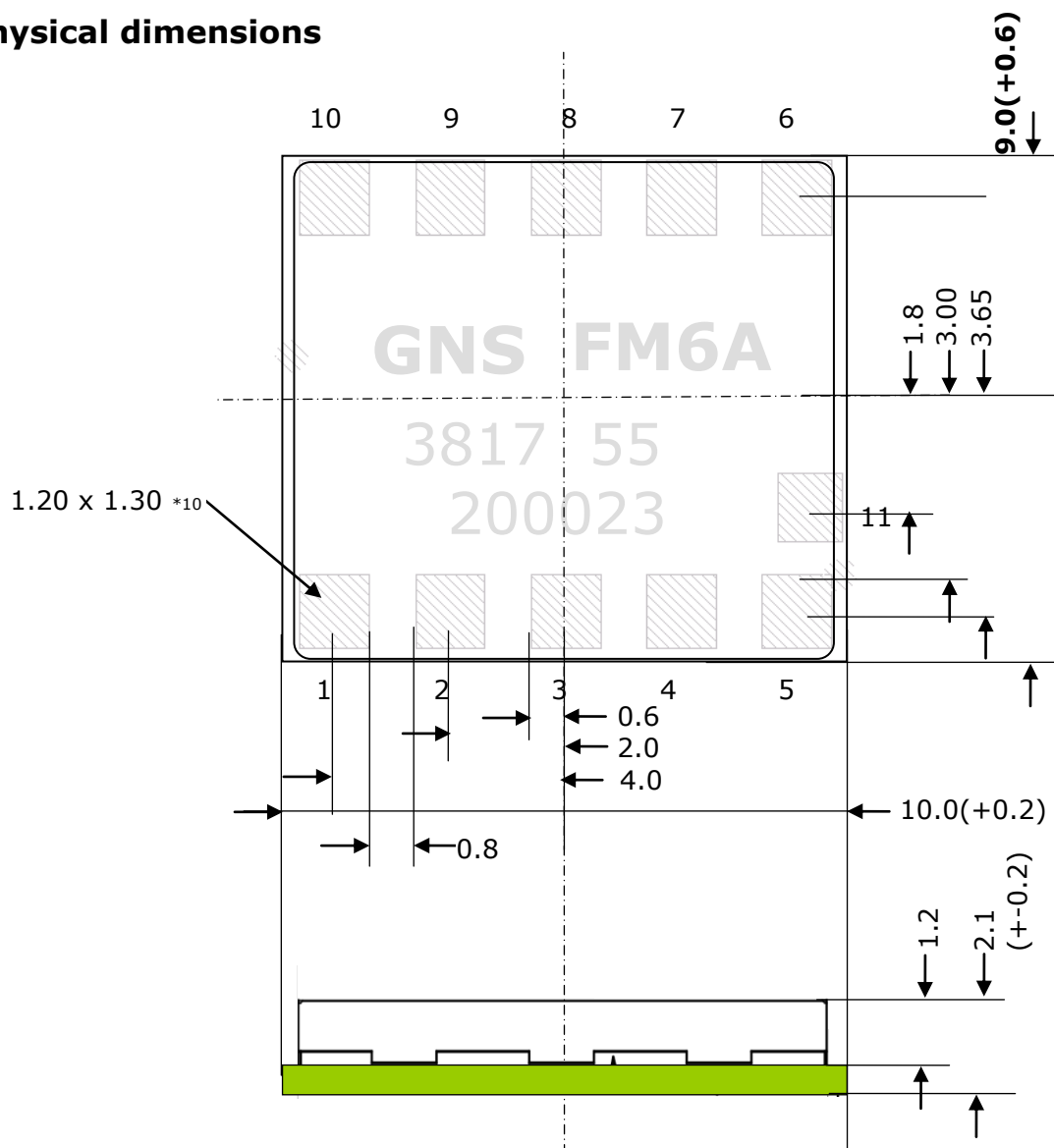
8. Device pinout diagram



9. Pin description

NO	NAME	DESCRIPTION
1	RF in	RF input
2	RF Gnd	RF Ground
3	RXD2	Serial Data from GPS module
4	RxD	Serial Data In
5	TxD	Serial Data Out
6	TXD2	Serial Data to GPS module
7	3V3	power supply
8	AF Left	Left audio output
9	AF Right	Right audio output
10	Gnd	Common Ground
11	internal	test pin, do not connect

10. Physical dimensions



12. Electrical specification

absolute maximum ratings		
ambient	Storage	- 40..+100°C
	operational	- 40..+95°C
power supply voltage	Pin 8 (3.3V in)	3.8V DC

quick reference data		
	SMD super small-sized macro module for FM TMC applications	
Weight	0.39 g	
Size	9.3 (-0.1+0.3)*10.0(+0.2)*2.1 (+-0.2) mm ³	
ambient temperature	Non condensing	-20°C...+85°C
power supply , power requirements	Operation	2.9V ... 3.6V DC / <30mA
Type	Digital-Synthesizer tuner, integrated R(B)DS processor , DSP processing	
AF output level	typ. 80mV @600 Ohms	
Sensitivity	appr. 2.5 µV (S+N)/N=26dB	
Frequency range	87.5 .. 108.0 MHz	
Frequency grid	100kHz	

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electrical data					
	min	typ	max	unit	note
supply voltage Vcc	2.9	3.0	3.6	V	
supply current	22	25	30	mA	
Operating temperature	-20	25	85		Typical, guaranteed performance data
	-40	-	95		Absolute maximum
	-40	-	85		Tested for full performance, not guaranteed, NO function failures
Module setup delay time after power up	-	-	500	ms	Host software should wait before issuing first command
module Vcc supply rise time	25	-	1000	µs	10..90% of Vcc
low level input voltage	-0.5	-	-	V	pin 3,4 serial CMOS Vcc=3.3V
high level input voltage	2.2	-	Vcc+1.0V	V	pin 3,4 serial CMOS Vcc=3.3V
low level output voltage	0.0	-	0.7	V	pin 5,6 serial CMOS Vcc=3.3V
high level output voltage	Vcc-0.3	-	Vcc-0.05	V	pin 5,6 serial CMOS Vcc=3.3V
baud rate	38000	38400	38800	bit /sec	other on demand
serial settings		8N1noP			
Allowed DC input voltage at RFin pin	-	-	6	V	Pin 1 Rfin
RF input resistance	3k	4k	5k	Ohms	V _{EMF} =1mV, f= 87..108MHz, guaranteed by characterization
RF input capacitance	4	5	6	pF	V _{EMF} =1mV, guaranteed by characterization
AF output voltage	70	80	90	mV	RMS pins 8,9
AF output resistance	-	-	10	kOhms	pins 8,9
AF THD	-	0.1	0.5	%	
AF (S+N) / N	57	63	-	dB	V _r f=1mV

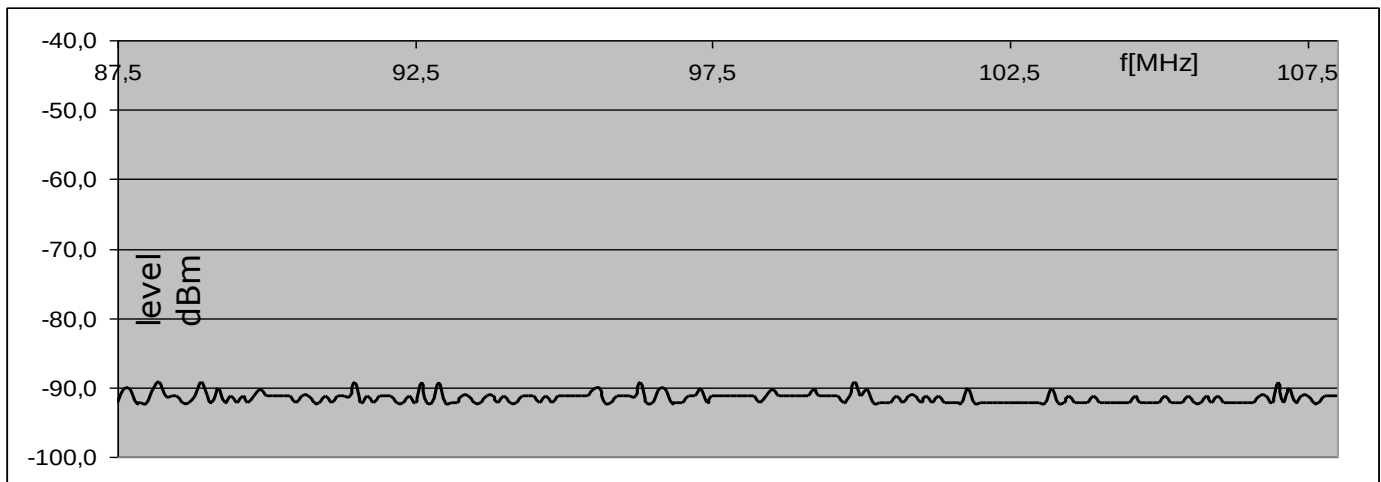
13. ESD specification

esd data				
	min	unit	pins	reference
human body model	2000	V	3,4,5,6,7	JESD22-A114-B / C=100pF, R=1k5
machine model	200	V	3,4,5,6,7	JESD22-A115-A / C=200pF, R=0r
human body model	2000	V	1,8,9	JESD22-A114 / C=100pF, R=1k5
machine model	250	V	1,8,9	JESD22-C101

14. RDS performance diagram

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

- RF fed via coupled wire
- RDS modulation is 2.7% of total modulation (75kHz)
- Criterion for RDS sensitivity is : 50% correct (no error) RDS groups



15. Ordering information

type	part#	laser marking*	description
FM6A-001-G3	4037735106111	GNS FM6A yyww ff ttttt	data interface for serial TTL, GNS 3.0 Protocol, GPS interface 4800bd

*ff = firmware ; yy = production year; mm = production month ttttt = tracecode, serial#

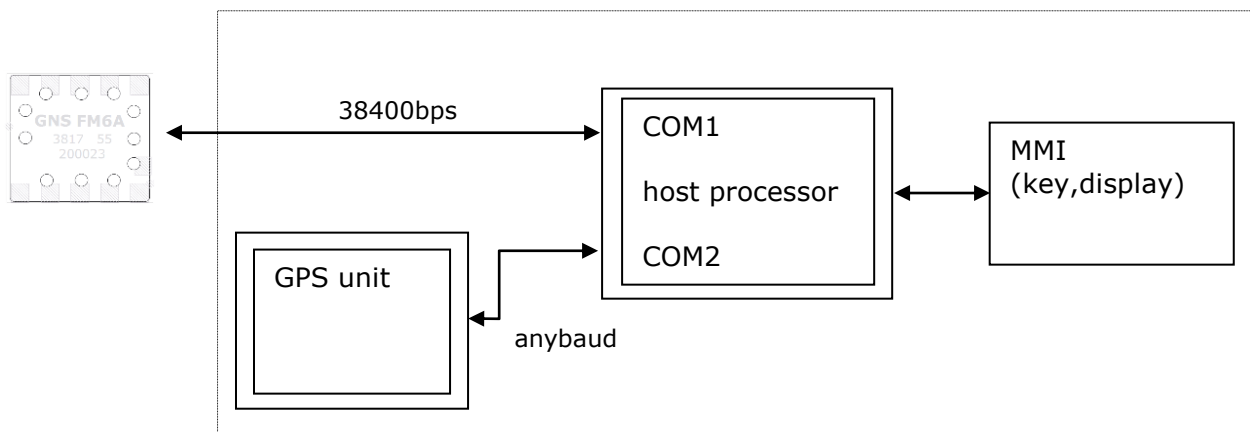
16. Application notes

FM6A 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 .

1. TWO- SERIAL- PORT CONFIGURATION

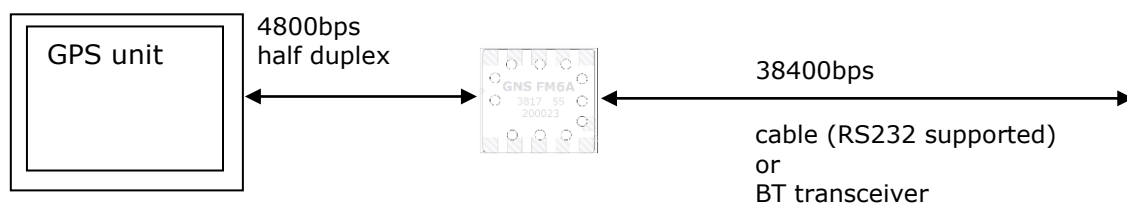
for example:

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



2. SINGLE - SERIAL- PORT CONFIGURATION (WITH GNS 3.0 PROTOCOL ¹⁾)

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



17. Startup timing

Due to internal circuitry self test and firmware initialization, *Module 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 issuing the first command.

Especially in case of software controlled power supply for FM6A, you should take care to implement a delay in software.

18. Startup diagnostics

After an successful power on reset, FM6A will output a start up information via the Tx pin of the UART. This banner is outputted without any command after internal startup procedures are finished. FM6A will provide some information and also an error code if initialization could not be finished successfully.

Startup output	
Output	meaning
GNS FM6 V55 - YY/WW - OCD G0	Initialization successful
GNS FM6 V55 - YY/WW - OCC-4 G0	'Tuner not initialized' – Tuner device could not start successfully. The most likely explanation is failure of the internal xtal (for example xtal damage by excessive heat)
GNS FM6 V55 - YY/WW - OCC-1 G0	'I2C error' – Internal I2C bus not working correctly, FM hardware problem or supply problem

19. Recommended PCB design

FM6A is easy to integrate and needs only single power supply.

Please note the following design rules for proper operation

- Do not connect RF GND (2) to common GND(10)
- RF GND should be connected to antenna connector ground pin only
- care for clean supply line (7)
- ensure power-on rise time below 5ms
- do not short-circuit AF-out PINs (8,9), leave open if not used
- connect common GND (10) to system ground with Ground plane of PCB
- connect RFin PIN (1) to antenna connector with a short (below 15mm) or impedance- matched line.

20. Material information

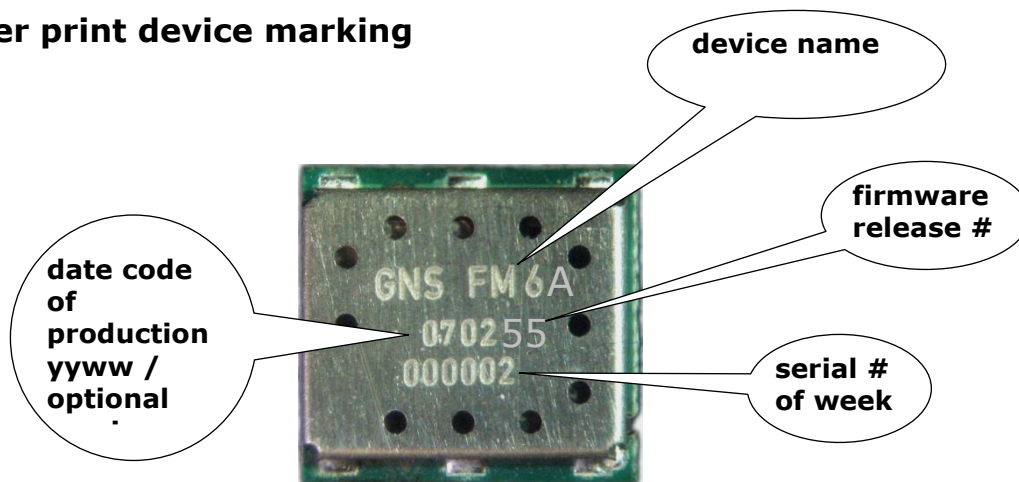
complies to ROHS standard
ROHS documentations are available on request

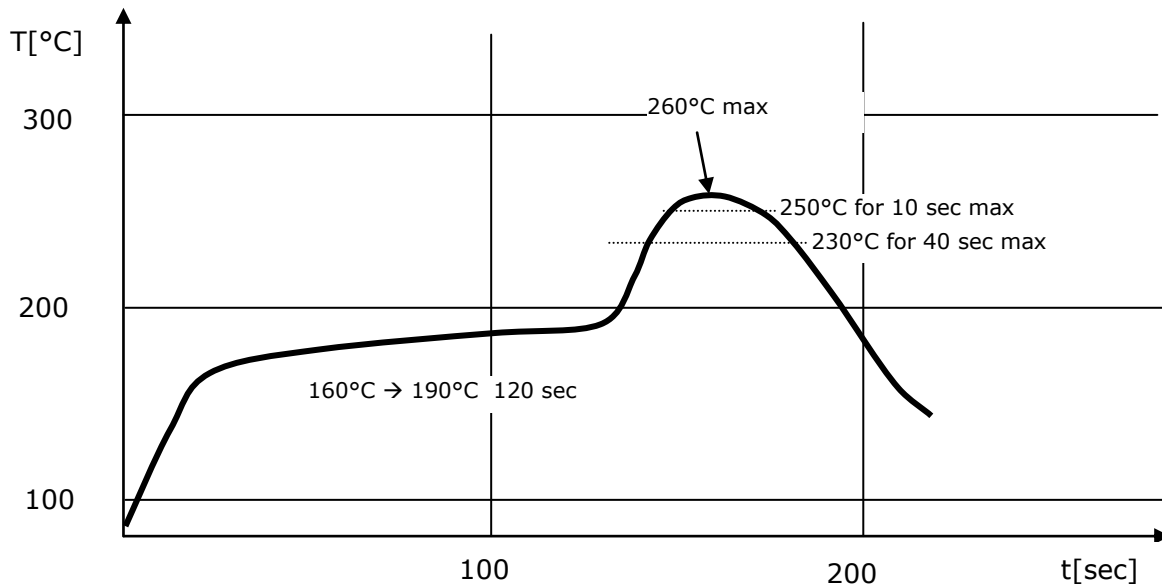
contact surface : gold over nickel

SHIELD MATERIAL INFORMATION

"German Silver " , CuNi18Zn27
Cu: 53.5..56.5%
Ni : 16.5..19.5%
Zn : 24..30%
thickness :0.2mm

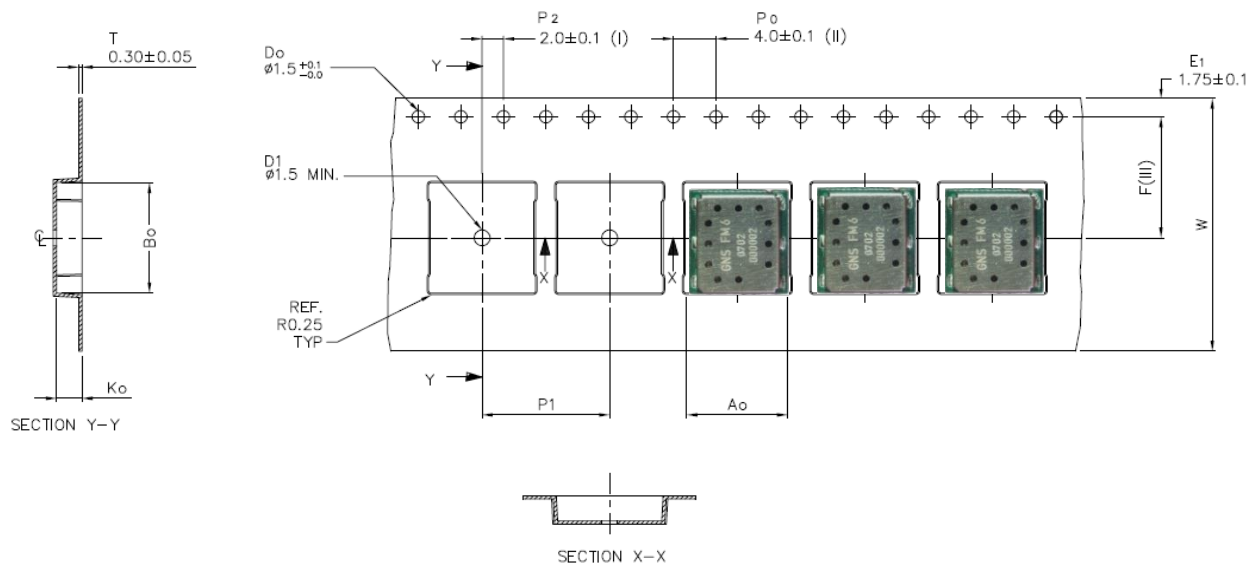
21. Laser print device marking



22. Recommended soldering reflow profile**Notes:**

1. FM6A should be soldered in upright soldering position. In case of head-over soldering, please prevent shielding / FM6A-Module from falling down.
2. Do never exceed maximum peak temperature
3. Reflow cycles allowed : 1

23. Tape information



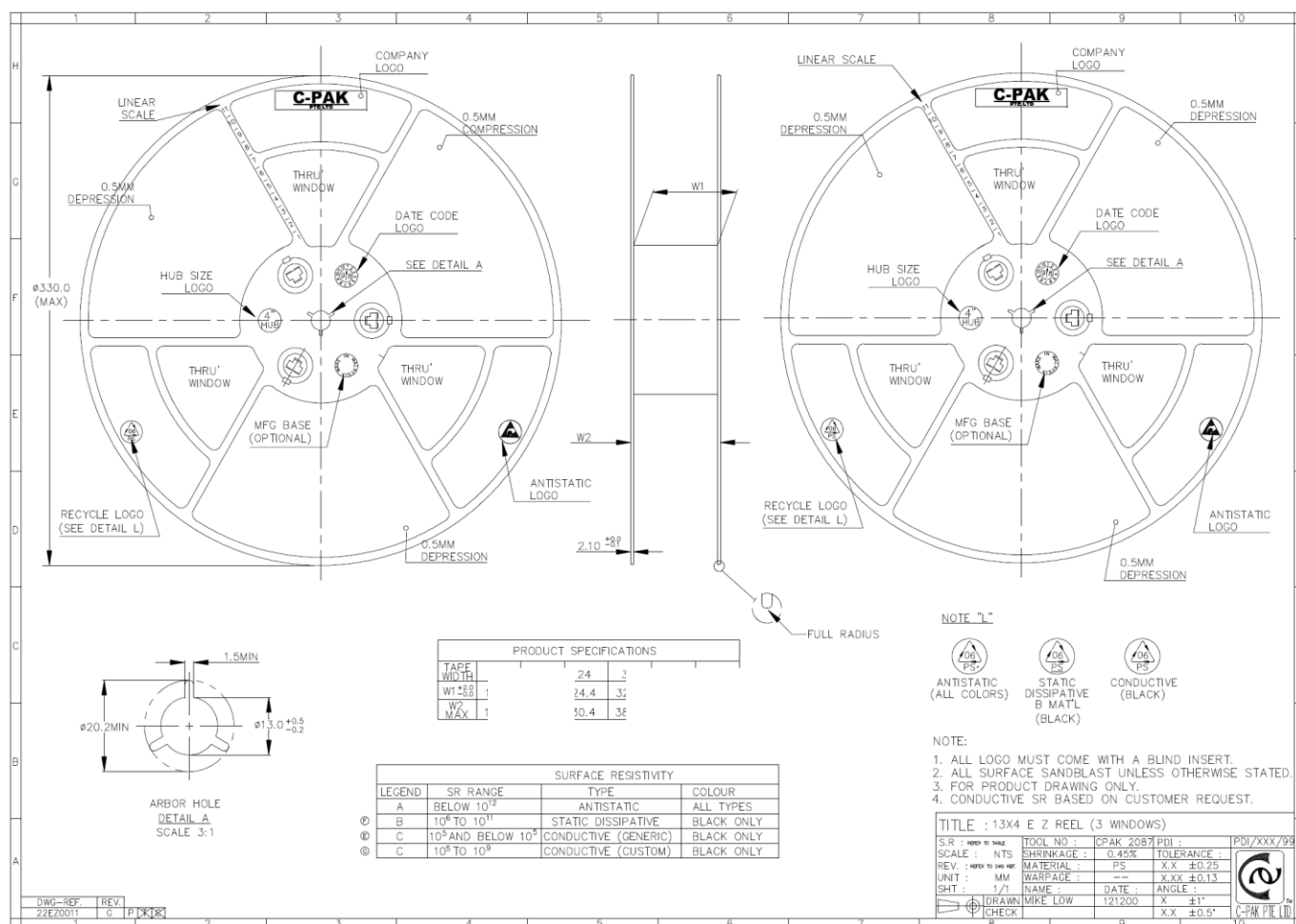
Ao	9.80	+/- 0.1
Bo	10.50	+/- 0.1
Ko	2.40	+/- 0.1
F	11.50	+/- 0.1
P1	12.00	+/- 0.1
W	24.00	+/- 0.3

Forming format : Flatbed
Estimated max. length : 60 meter/22B3 reel

- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

24. Reel information



no. of devices : 2000 pcs / reel

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25. Packing standard

1 reel		
contents	2,000pcs	
GNS part#	2 x 6550000003 1x 6550000011	
dimensions	dia: 330mm thickness:30.4mm	
gross weight	1.253 Kg	with full contents
net weight	0.246 Kg	
2 vacuum bag		
GNS part#	6550000006	
dimensions	400mm x 480mm	
gross weight	1.321 kg	with full contents
net weight	0.068 Kg	
air pressure level	<30mbar	
3 moisture indicator		
GNS part#	6550000008	
dimensions	76mm x 51mm	
weight	0.001 Kg	
4 dry pack		
GNS part#	6550000007	
dimensions	145mm x 140mm	
weight	0.068 Kg	
5 Box for reel		
GNS part#	6550000012	
dimensions	350 mm x 350mm x 47mm	
gross weight	1.5357 kg	with full contents
net weight	0.184 kg	
6 Outer box		
contents	max 7 box for reel	(14,000 pcs FM6A)
dimensions	400mm x 370mm x 360mm	
gross weight	11.6 kg	with full contents
net weight	0.85 kg	
special/smaller quantities packaging		
qty	<=50	stripe(s) of tape will be directly vacuum packed with vacuum bag, dry pack, moisture indicator. staples of tape allowed. minimum # parts per stripe is 10. vacuum bag size should fit for easy transportation (A5..A4)
qty	>50	tape will be full length (min 70%) on reel, will be packed originally with 2,3,4,5 above

26. Firmware release information

This product is equipped with firmware V55 with optimized clock frequency

27. Quality and Environmental Specifications

Test	Standard	Parameters
PCB Inspection	IPC-6012B, Class 2. Qualification and Performance Specification for Rigid Printed Boards - Jan 2007	
Assembly Inspection	IPC-A-610-D, Class 2 "Acceptability of electronic assemblies"	
Temperature Range	ETSI EN 300 019-2-7 specification T 7.3	-30 °C, +25 °C, +85 °C, operating
Damp Heat	ETSI EN 300 019-2-7 specification T 7.3	+70 °C, 80% RH, 96 hrs, non-operating
Thermal Shock	ETSI EN 300 019-2-7 specification T 7.3 E	-40 °C ... +85 °C, 200 cycles
Vibration	ISO16750-3	Random vibration, 10~1000Hz, 27.8m/s ² , 8hrs/axis, X, Y, Z 8hrs for each 3 axis non-operating
Shock	ISO16750-3	Half-sinusoidal 50g, 6ms, 10time/face, ±X, ±Y and ±Z non-operating
ESD Sensitivity	JEDEC, JESD22-A114 ESD Sensitivity Testing Human Body Model (HBM), Class 2 JEDEC, JESD22-A115 ESD Sensitivity Testing Machine Model (MM), Class B	+2000V - Human hand assembly +200V - Machine automatic final assembly
Moisture/Reflow Sensitivity	IPC/JEDEC J-STD-020D.1	MSL3
Storage (Dry Pack)	IPC/JEDEC J-STD-033C	MSL3
Solderability	EN/IEC 60068-2-58 Test Td	More than 90% of the electrode should be covered by solder. Solder temperature 245 °C ± 5 °C

Moisture Sensitivity

GNS ships all devices dry packed in tape on reel with desiccant and moisture level indicator sealed in an airtight package. If on receiving the goods the moisture indicator is pink in color or a puncture of the airtight seal packaging is observed, then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

Storage (Out of Bag)

The FM6A modules meet MSL Level 3 of the JEDEC specification J-STD-020D - 168 hours Floor Life (out of bag) ≤30 °C/60% RH. If the stated floor life expires prior to reflow process then follow J-STD-033 "Handling and Use of Moisture/Reflow Sensitive Surface Mount Devices".

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¹⁾ note:
patented technology by GNS-Electronics GmbH