

Technical Specification (TF24IENE)

FCC ID : BEJTF24IENE
IC : 2703H-TF24IENE
Model Name : TF24IENE

History

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1.0	2022.12.02					

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1. Product Introduction

The **TF24IENE** are designed for the automotive industry. They support 5G NR, LTE and WIFI air Interface standards. The NAD module which is called as TM15FNNATY0 are based on the Qualcomm SA515M wireless chipsets and support the following bands.

It's a telematics device that LGE is developing for the Toyota vehicles.

It is a small box installed deep inside passenger cars, and in charge of wireless communications in LTE and 5GNR, WiFi network.

Table 1. Supported Band

Region		NA (North America)
Band	NR	n2/n5/n12/n66/n77
	LTE	B2/4/5/12/14/66
	WCDMA	-

1.1 Environmental Specifications

The environmental specification for operating and storage of the **TF24IENE** are defined in the table below.

Table 2. Environmental Specifications

Parameter	Temperature Range
Operating Temperature	-30°C to 95°C
Storage Temperature	-40°C to 95°C
Humidity	85% or less

1.2 Electrical Specifications

This section provides details for some of the key electrical specifications of the TM15FNNATY0 embedded modules.

1.2.1 Absolute Maximum Rating

This section defines the Absolute Maximum Ratings of the **TF24IENE** embedded modules.

Warning: If these parameters are exceeded, even momentarily, damage may occur to the device.

Table 3. Absolute Maximum Ratings (input voltage of PMIC)

Parameter		Min	Max	Units
VPH_PWR	Power Supply Input (NAD module)	-	6	V
VIN	Voltage on any digital input or output pin	-	6	V
EUT	Power Supply Input (TF24IENE)	-	12	V

1.3 Mechanical Specifications

1.3.1 Physical Dimensions and Connection Interface

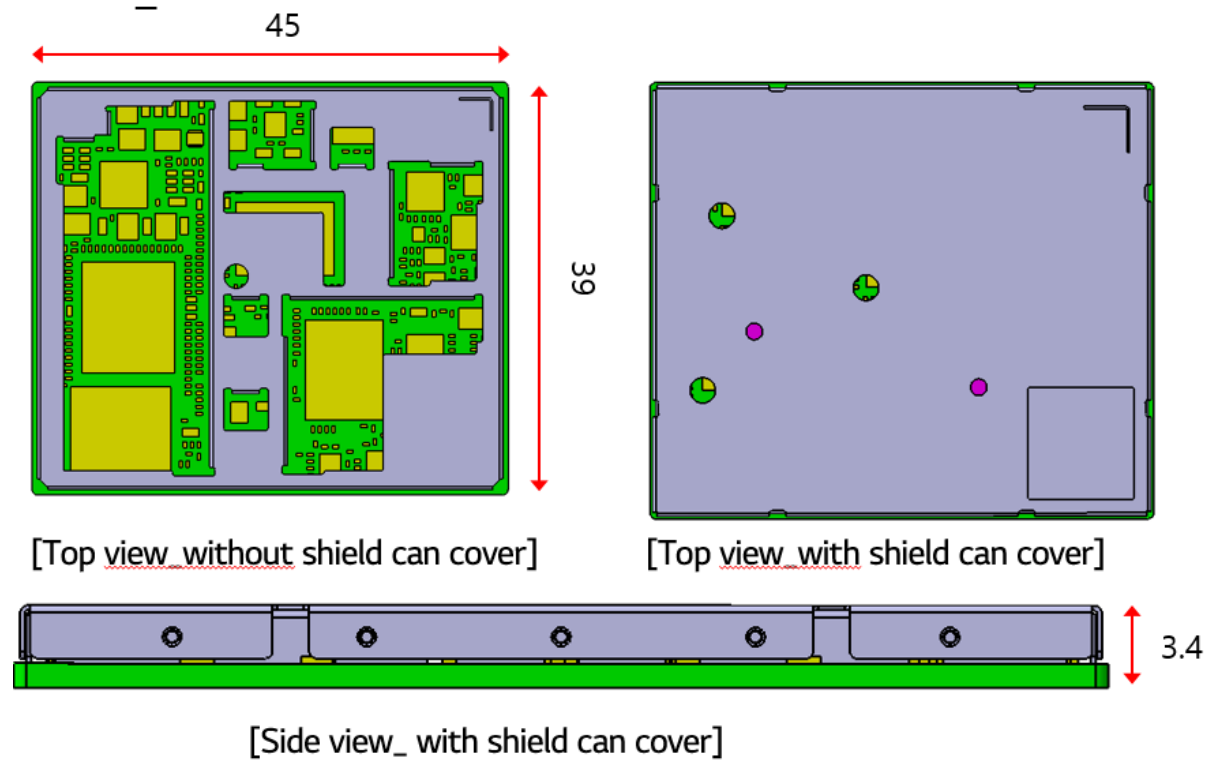
The TM15FNNATY0 embedded modules are a Land Grid Array(LGA) form factor device. The device does not have a System or RF connectors. All electrical and mechanical connections are made via the LGA pad on the underside of the PCB.

Table5. TM15FNNATY0 Embedded Module Dimensions

Parameter	Nominal	Max	Units
Overall Dimension	45 x 39	45.35 x 39.35	mm
Overall Module Height	3.4	3.6	mm
PCB Thickness	1.0	1.1	mm
Flatness Specification		0.15	mm
Weight	TBD		g

1.3.2 Mechanical Drawing

1.3.2.1 NAD PCB



2. RF Specification

The specifications for the 5G NR & LTE interfaces are defined.

TF24IENE is designed to be compliant with the standard shown in the table below.

Table6. Standards Compliance

Technology	Standards
5G NR	• 3GPP Release 15
LTE	• 3GPP Release 11

2.1 5G NR Specification

2.1.1 NR RX Sensitivity

The Receiver Sensitivity of the TM15FNNATY0 are specified in the following table.

Table7. Conducted RX (Receive) Sensitivity – NR Bands

BAND	Method (DL CH)	Specification
n2 Reference sensitivity level	Measure BLER of Mid Channel (392000) in Band2	sensitivity : ≤ -91.8 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n5 Reference sensitivity level	Measure BLER of Mid Channel (176300) in Band5	sensitivity : ≤ -86.8 BLER : $\leq 5\%$ (SCS:15 kHz / BW:20 MHz)
n12 Reference sensitivity level	Measure BLER of Mid Channel (147500) in Band12	sensitivity : ≤ -84.0 BLER : $\leq 5\%$ (SCS:15 kHz / BW:15 MHz)
n66 Reference sensitivity level	Measure BLER of Mid Channel (431000) in Band66	sensitivity : ≤ -90.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:40 MHz)
n77 Reference sensitivity level	Measure BLER of Mid Channel (650000) in Band77	sensitivity : ≤ -88.1 BLER : $\leq 5\%$ (SCS:15 kHz / BW:50 MHz)

2.2 LTE Specification

2.2.1 LTE RX Sensitivity

The Receiver Sensitivity of the **TM15FNNATY0** are specified in the following table.

Table7. Conducted RX (Receive) Sensitivity – LTE Bands

BAND	Method (DL CH)	Specification
BAND 2 Reference sensitivity level	Measure BLER of Mid Channel (900) in Band2	sensitivity : ≤ -94.3 BLER : $\leq 5\%$
BAND 4 Reference sensitivity level	Measure BLER of Mid Channel (2175) in Band4	sensitivity : ≤ -96.3 BLER : $\leq 5\%$

BAND 5 Reference sensitivity level	Measure BLER of Mid Channel (2525) in Band5	sensitivity : ≤ -94.3 BLER : $\leq 5\%$
BAND 12 Reference sensitivity level	Measure BLER of Mid Channel (5095) in Band12	sensitivity : ≤ -93.3 BLER : $\leq 5\%$
BAND 14 Reference sensitivity level	Measure BLER of Mid Channel (5330) in Band14	sensitivity : ≤ -93.3 BLER : $\leq 5\%$
BAND 66 Reference sensitivity level	Measure BLER of Mid Channel (66886) in Band66	sensitivity : ≤ -95.8 BLER : $\leq 5\%$

Notice

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with minimum distance 20cm between the radiating element of this device and the user.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes aux RSS exempts de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:(1) Cet appareil ne doit pas provoquer d'interférences.(2) Cet appareil doit accepter toute interférence, y compris les interférences qui peuvent provoquer un fonctionnement indésirable de l'appareil. This equipment should be installed and operated with minimum 20 cm between the radiator and your body.

Cet appareil doit être installé et utilisé avec un minimum de 20 cm entre le radiateur et votre corps.