

Technical Specification (TM03LNNAHK0)

History

| Ver. | Date | Contents | Written by | Checked by | Approved by | Note |
|------|------------|----------|------------|------------|-------------|------|
| 1.0 | 2016.12.16 | | | | | |
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1. Product Introduction

The **TM03LNNAHK0** are designed for the automotive industry. They support LTE and CDMA air Interface standards. The **TM03LNNAHK0** are based on the Qualcomm MDM9628 wireless chipsets and support the following bands.

Table 1. Supported Band

| Region | | US |
|--------|------|---------|
| Band | LTE | B4/B13 |
| | CDMA | BC0/BC1 |

1.1 Block Diagram

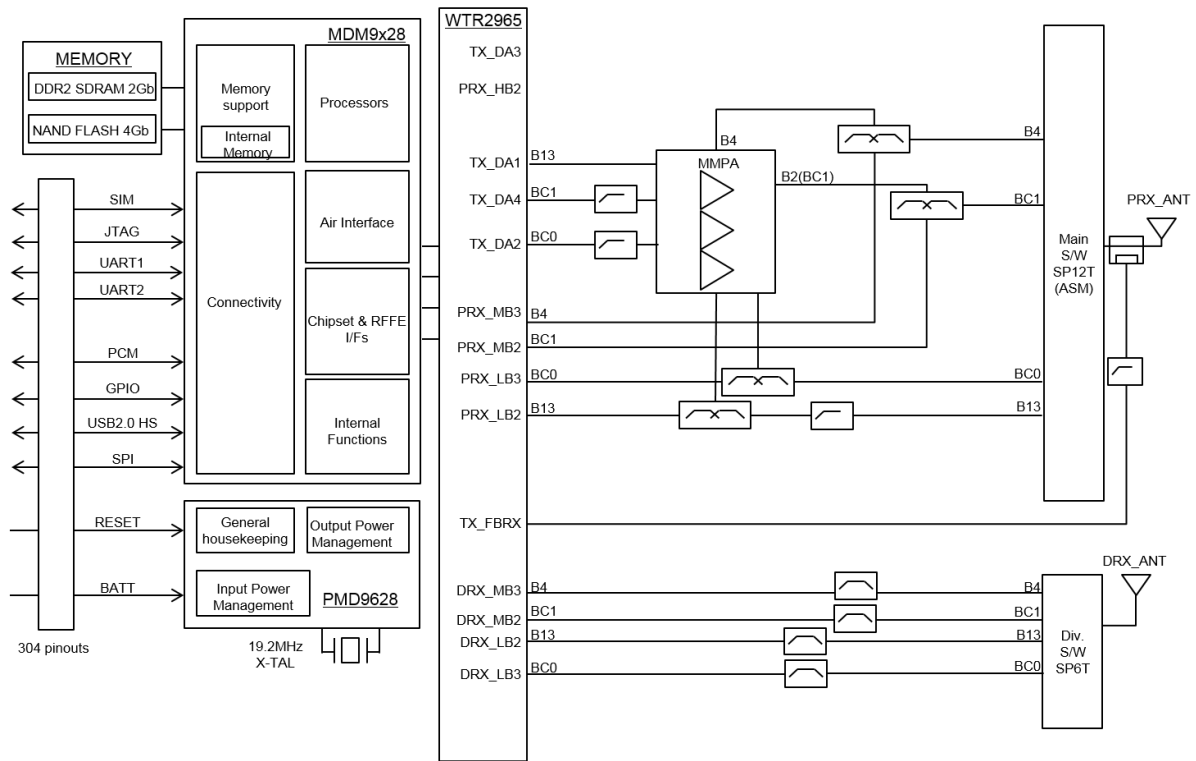


Figure 1.1. TM03LNNAHK0 Block diagram

1.2 Environmental Specifications

The environmental specification for operating and storage of the **TM03LNNAHK0** are defined in the the table below.

Table 2. Environmental Specifications

| Parameter | Temperature Range |
|-----------------------|-------------------|
| Operating Temperature | -40°C to 85°C |
| Storage Temperature | -40°C to +90°C |
| Humidity | 95% or less |

1.3 Electrical Specifications

This section provides details for some of the key electrical specifications of the **TM03LNNAHK0** embedded modules.

1.3.1 Absolute Maximum Rating and ESD Ratings

This section defines the Absolute Maximum and Electrostatic Discharge (ESD) Ratings of the **TM03LNNAHK0** embedded modules.

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

Table 3. Absolute Maximum Ratings

| Parameter | | Min | Max | Units |
|-------------------|--|-----|---------------|-------|
| +4.0_VPWR | Power Supply Input | - | 4.4V | V |
| VIN | Voltage on any digital input or output pin | - | VREG_MDME+0.5 | V |
| ESD Ratings | | | | |
| ESD ¹⁾ | Primary, Diversity antenna pads - Contact | | 10 | kV |

1) The ESD Simulator configured with 330pF, 2000Ω.

Caution: The **TM03LNNAHK0** embedded modules are sensitive to Electrostatic Discharge. ESD countermeasures and handling methods must be used when handling the **TM03LNNAHK0** devices.

1.3.2 Current Consumption

Table 4. **TM03LNNAHK0** Current Consumption (TBD)

| Mode | Parameter | Typical | Max | Units |
|------|--------------------------------|---------|-----|-------|
| LTE | Band4, Max TX Output /Full RB | 600 | 650 | mA |
| | Band13, Max TX Output /Full RB | 550 | 600 | |
| CDMA | 800MHz | 550 | 600 | mA |
| | 1900MHz | 600 | 650 | |
| LTE | Idle, Registered | 1.8 | 2.2 | mA |
| CDMA | Idle, Registered | 1.8 | 2.2 | mA |
| LTE | Sleep Mode, Average Current | 1.8 | 2.2 | mA |
| CDMA | Sleep Mode, Average Current | 1.8 | 2.2 | mA |

1.4 Mechanical Specifications

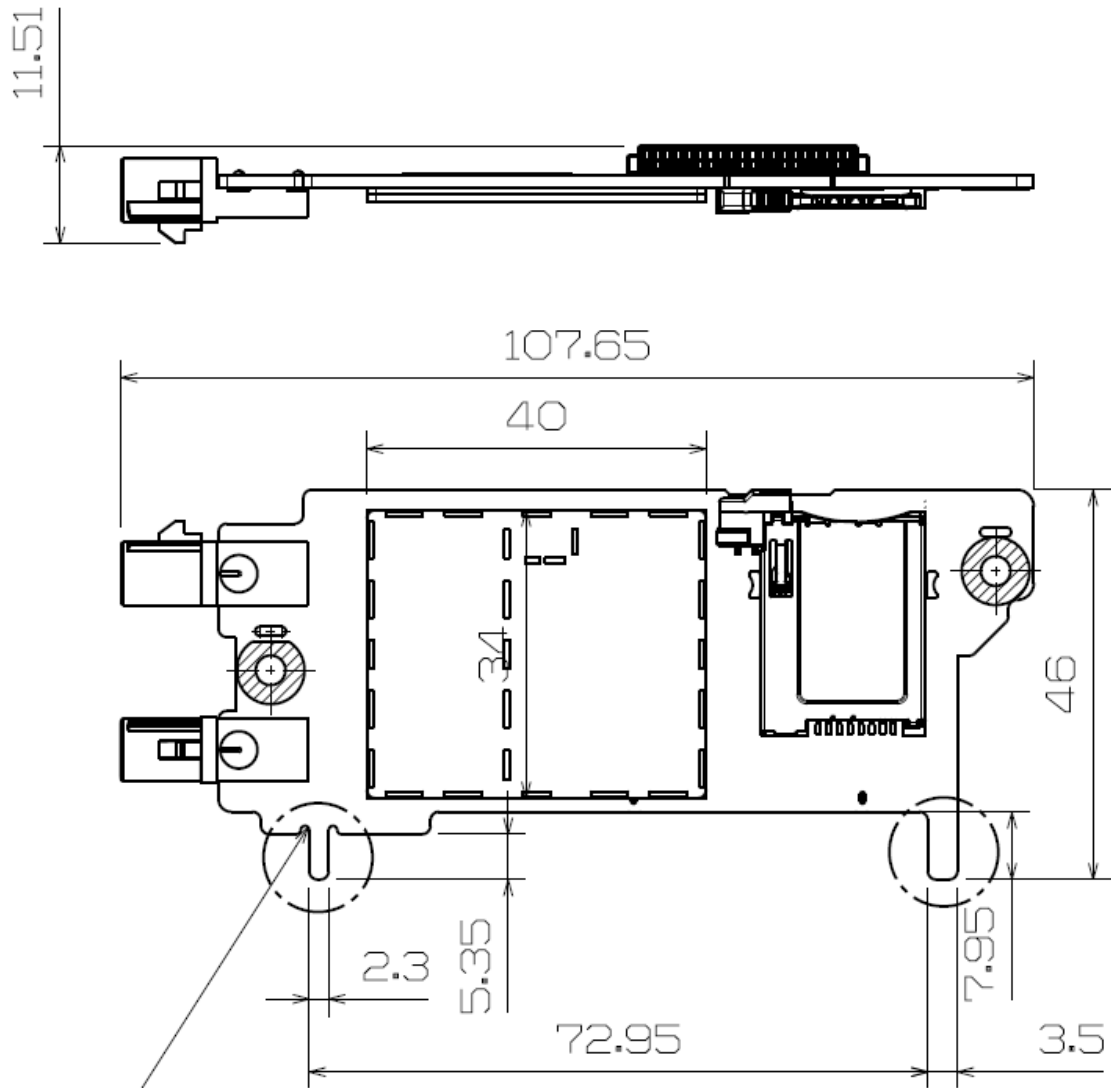
1.4.1 Physical Dimensions and Connection Interface

The **TM03LNNAHK0** 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 323 pad **TM03LNNAHK0** on the underside of the PCB.

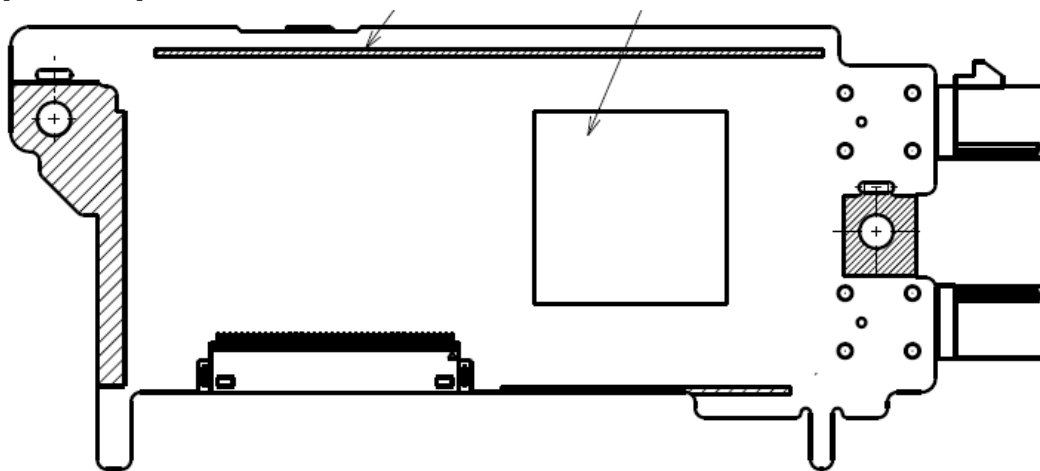
Table5. **TM03LNNAHK0** Embedded Module Dimensions

| Parameter | Nominal | Max | Units |
|------------------------|---------|---------------|-------|
| Overall Dimension | 34 x 40 | 34.35 x 40.35 | mm |
| Overall Module Height | 3.5 | 3.85 | mm |
| PCB Thickness | 1.0 | 1.1 | mm |
| Flatness Specification | | 0.1 | mm |
| Weight | TBD | | g |

1.4.2 Mechanical Drawing
1.4.2.1 Carrier PCB



[TOP View]



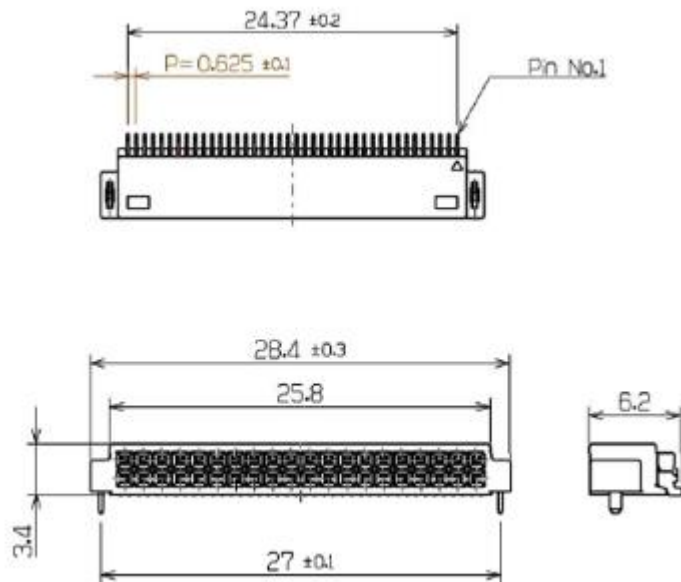
[Bottom View]

2. Pin Definitions

Table6. PIN Definitions

40pin connector
KM17E-40DS-1.25H (Hirose)

| Level | 모듈 신호 | | | | 모뎀신호 | Level | |
|-------|------------------|----------------|----|----|----------------|-----------|-------|
| 1.8V | MDM UART2 | DEBUG_UART_TXD | 1 | 2 | DEBUG_UART_RXD | MDM UART2 | 1.8V |
| | | NC | 3 | 4 | NC | - | |
| | | NC | 5 | 6 | NC | - | |
| 3.3V | MDM UART1 | UART_RFR | 7 | 8 | UART_CTS | MDM UART1 | 1.8V |
| | | NC | 9 | 10 | NC | - | |
| 1.8V | MDM GPIO | BOOT_OK | 11 | 12 | MSG | MDM GPIO | 1.8V |
| | | NC | 13 | 14 | NC | - | |
| | | NC | 15 | 16 | PCM_3.3V_TXD | MDM PCM | 1.8V |
| | | NC | 17 | 18 | PCM_3.3V_RXD | MDM PCM | 1.8V |
| 1.8V | MDM PCM | PCM_3.3V_CLK | 19 | 20 | PCM_3.3V_SYNC | MDM PCM | 1.8V |
| | | GND | 21 | 22 | GND | - | |
| | | NC | 23 | 24 | NC | - | |
| | | NC | 25 | 26 | NC | - | |
| 1.8V | MDM GPIO | 96H_END | 27 | 28 | RESET_IN | PMIC | 1.8V |
| 5.0V | PMIC | USB_VBUS | 29 | 30 | ACC_ON_SLEEP | MDM GPIO | 1.8V |
| 4.0V | PMIC | V_BATT | 31 | 32 | V_BATT | PMIC | 4.0V |
| | | GND | 33 | 34 | GND | - | |
| 400mV | MDM USB | USB_D+ | 35 | 36 | USB_D- | MDM USB | 400mV |
| 1.8V | MDM UART_RX D | UART_RXD | 37 | 38 | NC | - | |
| 1.8V | MDM UART | UART_TXD | 39 | 40 | GND | - | |



3. RF Specification

The specifications for the LTE and CDMA interfaces are defined.

TM03LNNAHK0 is designed to be compliant with the standard shown in the table below.

Table20. Standards Compliance

| Technology | Standards |
|------------|-------------------------------|
| LTE | • 3GPP Release 8 |
| CDMA | • 3GPP2 Release 1xEVDO, REV.H |

3.1 LTE B4, B13 Specification

3.1.1 LTE TX Output Power

The Maximum / Minimum Transmitter Output Power of the **TM03LNNAHK0** are specified in the following table.

Table21. Conducted TX (Transmit) Max output Power Tolerances – LTE Bands

| BAND | Method (UL CH) | Specification |
|--------------------------------------|---|--|
| BAND4 UE Maximum Output Power | Measure Max and Min and Min Transmit Power of Low Channel (20000) | Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm |
| | Measure Max and Min Transmit Power of Mid Channel (20175) | Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm |
| | Measure Max and Min Transmit Power of High Channel (20350) | Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm |
| BAND13 UE Maximum Output Power | Measure Max and Min and Min Transmit Power of Low Channel (23230) | Max Power : 20.3~25.7dBm Min Power : ≤ -39dBm |

3.1.2 LTE RX Sensitivity

The Receiver Sensitivity of the **TM03LNNAHK0** are specified in the following table.

Table22. Conducted RX (Receive) Sensitivity – LTE Bands

| BAND | Method (DL CH) | Specification |
|---|---|-----------------------------------|
| BAND 4 Reference sensitivity level(DUAL) | Measure BLER of Low Channel (2000) in Band4 | sensitivity : ≤-97 BLER : ≤ 5% |
| | Measure BLER of Mid Channel (2175) in Band4 | sensitivity : ≤-97 BLER : ≤ 5% |
| | Measure BLER of High Channel (2350) in Band4 | sensitivity : ≤-97 BLER : ≤ 5% |
| BAND 13 Reference | Measure BLER of Low Channel (23230) in Band13 | sensitivity : ≤-94 BLER : ≤ 5% |

| | | |
|-------------------------|--|--|
| sensitivity level(DUAL) | | |
|-------------------------|--|--|

3.2 CDMA 800/1900 Specification

3.2.1 CDMA TX Output Power

The Maximum Transmitter Output Power of the **TM03LNNAHK0** are specified in the following table.

Table23. Conducted TX (Transmit) Max output Power Tolerances – CDMA Bands

| Item | Method (DL CH) | Specification |
|---------------------|---|----------------------|
| CDMA800 Power Level | Measure Max Transmit Power of Low Channel (CH=384) in CDMA Mode | Max Power : 23~30dBm |
| | Measure Max Transmit Power of Middle Channel (CH=779) in CDMA Mode | Max Power : 23~30dBm |
| | Measure Max Transmit Power of High Channel (CH=1013) in CDMA Mode | Max Power : 23~30dBm |
| PCS1900 Power Level | Measure Max Transmit Power of Low Channel (CH=25) in DCS1900 Mode | Max Power : 23~30dBm |
| | Measure Max Transmit Power of Middle Channel (CH=600) in DCS1900 Mode | Max Power : 23~30dBm |
| | Measure Max Transmit Power of High Channel (CH=1175) in DCS1900 Mode | Max Power : 23~30dBm |

3.2.2 CDMA RX Sensitivity

The Receiver Sensitivity of the **TM03LNNAHK0** are specified in the following table.

Table24. Conducted RX (Receive) Sensitivity – CDMA Bands

| Item | Method (DL CH) | Specification |
|-----------------------------|--|-----------------------|
| CDMA800 BER(Bit Error Rate) | Measure BER of Low Channel (CH=384) in EGSM Mode | 0.5% @ \leq -104dBm |
| | Measure BER of Middle Channel (CH=779) in EGSM Mode | 0.5% @ \leq -104dBm |
| | Measure BER of High Channel (CH=1013) in EGSM Mode | 0.5% @ \leq -104dBm |
| PCS1900 BER(Bit Error Rate) | Measure BER of Low Channel (CH=25) in PCS1900 Mode | 0.5% @ \leq -104dBm |
| | Measure BER of Middle Channel (CH=600) in PCS1900 Mode | 0.5% @ \leq -104dBm |
| | Measure BER of High Channel (CH=1175) in PCS1900 Mode | 0.5% @ \leq -104dBm |

<Warning Statements>

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

RF Exposure Statement

The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

The highest permitted antenna gains including cable loss for use with this device are: CDMA 800 : 0.89 dBi, CDMA1900 : 3.20 dBi, LTE Band 4: 2.41 dBi, LTE Band 13: 0.42 dBi.

End Product Labeling

The module is labeled with its own FCC ID. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

“Contains FCC ID: BEJGEN21NA

OEM Responsibilities to comply with FCC Regulations

The module has been certified for integration into products only by OEM integrators under the following condition:

- The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.
- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

As long as the two condition above is met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions can ' t be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can't be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.