

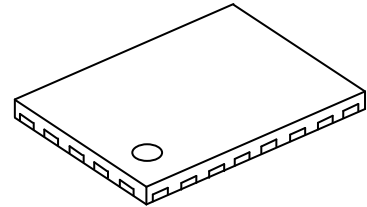
SP10T ANTENNA SWITCH GaAs MMIC

■ GENERAL DESCRIPTION

NJG1686MHH is a GaAs SP10T antenna switch MMIC suitable for LTE/3G/GSM multimode applications. This switch includes on-chip decoder circuits and low pass filters for GSM transmit port. This switch has six transmit/receive ports that provide more efficient band selection for multimode cellular application.

NJG1686MHH offers low insertion loss, high isolation, low harmonics and high linearity. The integrated ESD protection circuits in the switch IC bring excellent ESD performances. In addition, no DC blocking capacitors are required for the RF ports unless DC is biased externally. The small and thin package is adopted.

■ PACKAGE OUTLINE



NJG1686MHH

■ APPLICATIONS

Multi-mode LTE, UMTS, CDMA and GSM applications

Mobile phone, Tablet PC, Data card, Modem, Router and others mobile device applications

■ FEATURES

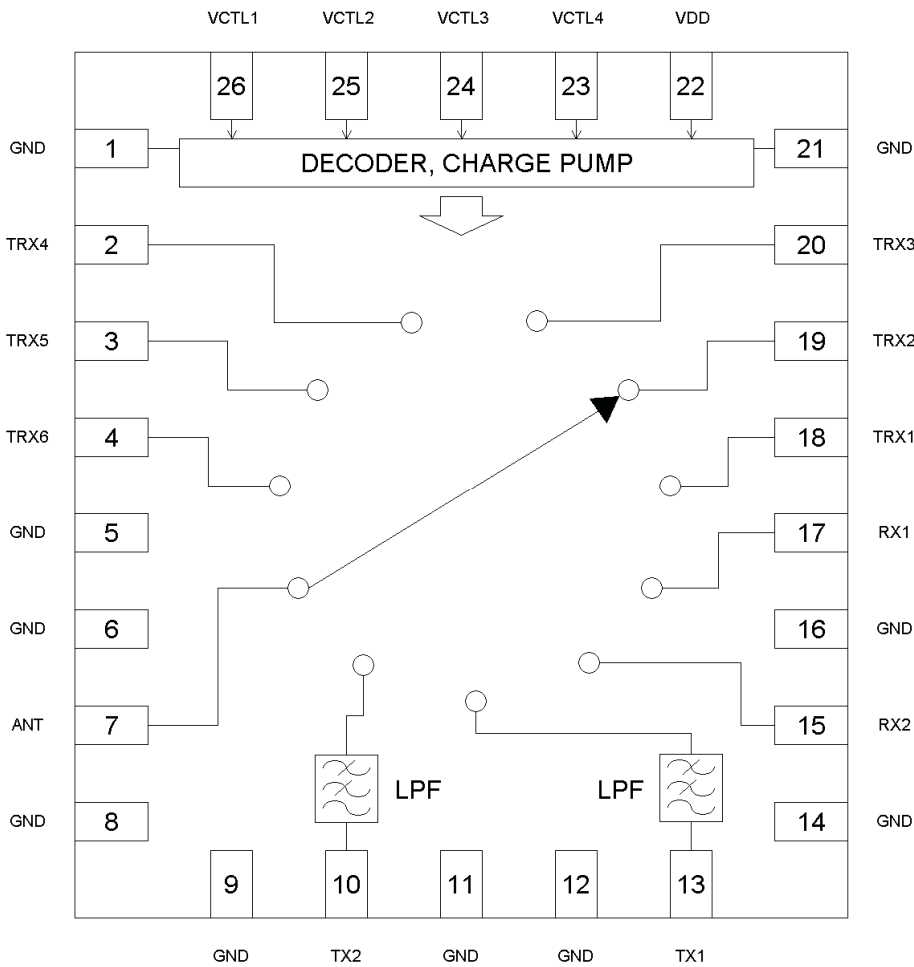
- Low voltage operation $V_{DD}=+2.5V$ min.
- Low voltage logic control $V_{CTL(H)}=+1.8V$ typ.
- Low insertion loss
 - 0.65dB typ. @ 452 to 960MHz, TRX1 to 3,5,6-ANT
 - 0.30dB typ. @ 452 to 960MHz, TRX4-ANT
 - 0.75dB typ. @ 1710 to 2170MHz, TRX1 to 3,5,6-ANT
 - 0.45dB typ. @ 1710 to 2170MHz, TRX4-ANT
 - 1.10dB typ. @ 2300 to 2690MHz, TRX1 to 3,5,6-ANT
 - 0.45dB typ. @ 2300 to 2690MHz, TRX4-ANT
 - 1.05dB typ. @ GSM850/900, TX1-ANT
 - 1.20dB typ. @ GSM1800/1900, TX2-ANT
- High isolation
 - 38dB typ. @GSM850/900, TX1-TRX1 to 3,5,6
 - 34dB typ. @GSM1800/1900, TX2-TRX 1 to 3,5,6
 - 25dB typ. @f=452 to 2690MHz, TRX1-TRX3, TRX4-TRX6
 - 36dB typ. @f=1805 to 1990MHz, ANT-RX1,2,
 - 33dB typ. @f=452 to 2690MHz, opposed TRX ports
- High linearity
 - 2nd harmonics=-80dBm typ. @f=786.5MHz
 - IIP2=+95.5dBm min. @CDMA2000(AWS, PCS)
 - IIP2=+102dBm min. @UMTS
- No DC blocking capacitor unless DC is biased externally
- Small package size EQFN26-HH (Package size: 2.6 x 3.4 x 0.7 mm typ.)
- RoHS compliant and Pb free, Halogen Free, MSL1

NOTE: The information in this document is subject to change without notice.

NJG1686MHH

PIN CONFIGURATION

(TOP VIEW)



1. GND
2. TRX4
3. TRX5
4. TRX6
5. GND
6. GND
7. ANT
8. GND
9. GND
10. TX2
11. GND
12. GND
13. TX1
14. GND
15. RX2
16. GND
17. RX1
18. TRX1
19. TRX2
20. TRX3
21. GND
22. VDD
23. VCTL4
24. VCTL3
25. VCTL2
26. VCTL1

TRUTH TABLE

"H"= $V_{CTL(H)}$, "L"= $V_{CTL(L)}$

| On Path | VCTL1 | VCTL2 | VCTL3 | VCTL4 |
|----------|-------|-------|-------|-------|
| TX1-ANT | H | H | L | L |
| TX2-ANT | H | L | L | L |
| ANT-RX1 | L | H | H | L |
| ANT-RX2 | L | H | L | L |
| ANT-TRX1 | L | L | H | L |
| ANT-TRX2 | H | L | H | L |
| ANT-TRX3 | H | H | H | L |
| ANT-TRX4 | H | L | H | H |
| ANT-TRX5 | H | H | H | H |
| ANT-TRX6 | H | L | L | H |

■ ABSOLUTE MAXIMUM RATINGS

($T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$)

| PARAMETER | SYMBOL | CONDITIONS | Duty cycle | RATINGS | UNITS |
|-----------------------|-----------|-----------------------------------------------------------------------------------|------------|-------------|--------------------|
| RF Input Power | Pin | GSM LB TX1 port | 4:8 | 36 | dBm |
| | | GSM HB TX2 port | 4:8 | 34 | dBm |
| | | TRX ports | CW | 32 | dBm |
| | | RX ports | CW | 28 | dBm |
| Supply Voltage | V_{DD} | VDD terminal | | 5.0 | V |
| Control Voltage | V_{CTL} | VCTL terminal | | 5.0 | V |
| Power dissipation | P_D | Four-layer FR4 PCB with through-hole (101.5mmx114.5mm), $T_j=150^{\circ}\text{C}$ | | 2200 | mW |
| Operating Temperature | T_{opr} | | | -40 to +90 | $^{\circ}\text{C}$ |
| Storage Temperature | T_{stg} | | | -65 to +150 | $^{\circ}\text{C}$ |

■ ELECTRICAL CHARACTERISTICS 1 (DC)

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-------------------|--------------|---------------------------------------|------|------|------|---------------|
| Supply Voltage | V_{DD} | | 2.5 | 2.7 | 5.0 | V |
| Operating Current | I_{DD} | | - | 0.40 | 0.65 | mA |
| Control Current | I_{CTL} | $V_{CTL(H)}=1.8\text{V}/1\text{Port}$ | - | 4 | 10 | μA |
| Control Voltage | $V_{CTL(H)}$ | | 1.35 | 1.8 | 5.0 | V |
| | $V_{CTL(L)}$ | | 0 | - | 0.45 | V |

NJG1686MHH

■ ELECTRICAL CHARACTERISTICS 2 (RF)

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_L=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|------------------------------|--------------|-------------------------------------------------------------|-----|------|------|-------|
| Insertion Loss 1 (1) TRX1 | LOSS1(1)TRX1 | TRX1 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.65 | 0.8 | dB |
| Insertion Loss 1 (1) TRX2 | LOSS1(1)TRX2 | TRX2 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.65 | 0.8 | dB |
| Insertion Loss 1 (1) TRX3 | LOSS1(1)TRX3 | TRX3 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.65 | 0.8 | dB |
| Insertion Loss 1 (1) TRX4 | LOSS1(1)TRX4 | TRX4 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.3 | 0.45 | dB |
| Insertion Loss 1 (1) TRX5 | LOSS1(1)TRX5 | TRX5 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.65 | 0.8 | dB |
| Insertion Loss 1 (1) TRX6 | LOSS1(1)TRX6 | TRX6 - ANT, 452 to 960MHz, Pin=26dBm | - | 0.65 | 0.8 | dB |
| Insertion Loss 1 (2) TRX1 | LOSS1(2)TRX1 | TRX1 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.75 | 0.95 | dB |
| Insertion Loss 1 (2) TRX2 | LOSS1(2)TRX2 | TRX2 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.9 | 1.1 | dB |
| Insertion Loss 1 (2) TRX3 | LOSS1(2)TRX3 | TRX3 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.85 | 1.05 | dB |
| Insertion Loss 1 (2) TRX4 | LOSS1(2)TRX4 | TRX4 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.45 | 0.65 | dB |
| Insertion Loss 1 (2) TRX5 | LOSS1(2)TRX5 | TRX5 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.85 | 1.05 | dB |
| Insertion Loss 1 (2) TRX6 | LOSS1(2)TRX6 | TRX6 - ANT, 1710 to 2170MHz, Pin=26dBm | - | 0.75 | 0.95 | dB |
| Insertion Loss 1 (3) TRX1 | LOSS1(3)TRX1 | TRX1 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 1.1 | 1.4 | dB |
| Insertion Loss 1 (3) TRX2 | LOSS1(3)TRX2 | TRX2 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 1.25 | 1.55 | dB |
| Insertion Loss 1 (3) TRX3 | LOSS1(3)TRX3 | TRX3 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 1.15 | 1.45 | dB |
| Insertion Loss 1 (3) TRX4 | LOSS1(3)TRX4 | TRX4 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 0.45 | 0.75 | dB |
| Insertion Loss 1 (3) TRX5 | LOSS1(3)TRX5 | TRX5 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 1.1 | 1.4 | dB |
| Insertion Loss 1 (3) TRX6 | LOSS1(3)TRX6 | TRX6 - ANT, 2300 to 2690MHz, Pin=26dBm | - | 1.1 | 1.4 | dB |
| Insertion Loss 2 | LOSS2 | TRX4 - ANT, 704 to 787MHz (Band13, Band17), Pin=26dBm | - | 0.25 | 0.4 | dB |
| Insertion Loss 3 | LOSS3 | TX1 - ANT, 824 to 915MHz, Pin=35dBm | - | 1.05 | 1.3 | dB |
| Insertion Loss 4 | LOSS4 | TX2 - ANT, 1710 to 1910MHz, Pin=32dBm | - | 1.2 | 1.4 | dB |
| Insertion Loss 5(1) | LOSS5(1) | RX1,2 - ANT, 869 to 960MHz, Pin=10dBm | - | 0.9 | 1.1 | dB |
| Insertion Loss 5(2) | LOSS5(2) | RX1,2 - ANT, 1805 to 1990MHz, Pin=10dBm | - | 1.0 | 1.2 | dB |

■ ELECTRICAL CHARACTERISTICS 3 (RF)

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------|----------|--------------------------------------------------------------------------|-----|-----|-----|---------------|
| Isolation 1(1) | ISL1(1) | TX1-TRX1 to 3, TRX5,6, RX1 (TX1 ON) f=824 to 915MHz | 35 | 38 | - | dB |
| Isolation 1(2) | ISL1(2) | TX1-TRX4, RX2 (TX1 ON) f=824 to 915MHz | 33 | 35 | - | dB |
| Isolation 2(1) | ISL2(1) | TX2-TRX1 to 3, TRX5,6, RX1,2 (TX2 ON) f=1710 to 1910MHz | 32 | 35 | - | dB |
| Isolation 2(2) | ISL2(2) | TX2-TRX4 (TX2 ON) f=1710 to 1910MHz | 31 | 34 | - | dB |
| Isolation 3 | ISL3 | TRX1 – TRX3, TRX4 – TRX6, 452 to 2690MHz | 23 | 25 | - | dB |
| Isolation 4 | ISL4 | TRX1 – TRX2, TRX2 – TRX3, TRX4 – TRX5, TRX5 – TRX6, 452 to 2690MHz | 17 | 20 | - | dB |
| Isolation 5 | ISL5 | ANT – RX1 (RX2 ON), ANT – RX2 (RX1 ON), 1805 to 1990MHz | 33 | 36 | - | dB |
| Isolation 6(1) | ISL6(1) | TRX1 to 3 – TRX4 to 6 (TRX1 to 3 ON), 452 to 2690MHz | 25 | 27 | - | dB |
| Isolation 6(2) | ISL6(2) | TRX1 to 3 – TRX4 to 6 (TRX4 to 6 ON), 452 to 2690MHz | 31 | 33 | - | dB |
| VSWR (1) | VSWR (1) | TX1 ON 824 to 915MHz | - | - | 1.5 | - |
| VSWR (2) | VSWR (2) | TX2 ON 1710 to 1910MHz | - | - | 1.6 | - |
| VSWR (3) | VSWR (3) | TRX1 to 6 452 to 2170MHz | - | - | 1.6 | - |
| VSWR (4) | VSWR (4) | TRX1 to 6 452 to 2690MHz | - | - | 1.8 | - |
| VSWR (5) | VSWR (5) | RX1 to 2 869 to 1990MHz | - | - | 1.5 | - |
| Switching Speed | TSW | 50% $V_{CTL(H)}$ to 10/90% RF | - | 3 | 5 | μs |

NJG1686MHH

■ ELECTRICAL CHARACTERISTICS 4 (RF)

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-------------------------|--------|--------------------------------------------------|-----|-----|-----|-------|
| Triple Beat Ratio | TBR | TRX1 to 6 ON, 650 to 900 MHz 1710 to 2155 MHz | - | 80 | - | dBc |
| 2nd Harmonics 1 | 2fo(1) | TRX1 to 6 ON, 452 to 1980 MHz, Pin=26dBm | - | - | -62 | dBc |
| 2nd Harmonics 2 | 2fo(2) | TX1 ON, 824 to 915 MHz Pin=35dBm | - | - | -70 | dBc |
| 2nd Harmonics 3 | 2fo(3) | TX2 ON, 1710 to 1910 MHz Pin=32dBm | - | - | -67 | dBc |
| 2nd Harmonics 4 | 2fo(4) | TRX4 ON, 786.5MHz (Band13), Pin=25dBm | - | -80 | - | dBm |
| 3rd Harmonics 1 | 3fo(1) | TRX1 to 6 ON, 452 to 1980 MHz, Pin=26dBm | - | - | -62 | dBc |
| 3rd Harmonics 2 | 3fo(2) | TX1 ON, 824 to 915 MHz Pin=35dBm | - | - | -70 | dBc |
| 3rd Harmonics 3 | 3fo(3) | TX2 ON, 1710 to 1910 MHz Pin=32dBm | - | - | -67 | dBc |
| GSM Tx Attenuation 1 | ATT(1) | TX1 ON, 2fo, 3fo | 25 | - | - | dB |
| GSM Tx Attenuation 2 | ATT(2) | TX1 ON, Past 3fo to 12.75 GHz | 16 | - | - | dB |
| GSM Tx Attenuation 3 | ATT(3) | TX2 ON, 2fo, 3fo | 25 | - | - | dB |
| GSM Tx Attenuation 4 | ATT(4) | TX2 ON, Past 6.84 to 12.75 GHz | 14 | - | - | dB |

■ ELECTRICAL CHARACTERISTICS 5 (RF)

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|----------------------------------|----------|------------------------|--------|-----|-----|-------|
| IIP3(1) – UMTS mode (2600) | IIP3(1) | *Table 1, TRX1 to 6 ON | +60 | - | - | dBm |
| IIP3(2) – UMTS mode (IMT) | IIP3(2) | *Table 1, TRX1 to 6 ON | +60 | - | - | dBm |
| IIP3(3) – UMTS mode (PCS) | IIP3(3) | *Table 1, TRX1 to 6 ON | +61 | - | - | dBm |
| IIP3(4) – UMTS mode (DCS) | IIP3(4) | *Table 1, TRX1 to 6 ON | +61 | - | - | dBm |
| IIP3(5) – UMTS mode (PDC) | IIP3(5) | *Table 1, TRX1 to 6 ON | +61 | - | - | dBm |
| IIP3(6) – UMTS mode (900) | IIP3(6) | *Table 1, TRX1 to 6 ON | +61 | - | - | dBm |
| IIP3(7) – UMTS mode (US cell) | IIP3(7) | *Table 1, TRX1 to 6 ON | +61 | - | - | dBm |
| IIP2(1) – UMTS mode (2600) | IIP2(1) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(2) – UMTS mode (IMT) | IIP2(2) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(3) – UMTS mode (PCS) | IIP2(3) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(4) – UMTS mode (DCS) | IIP2(4) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(5) – UMTS mode (PDC) | IIP2(5) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(6) – UMTS mode (900) | IIP2(6) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(7) – UMTS mode (US cell) | IIP2(7) | *Table 1, TRX1 to 6 ON | +102 | - | - | dBm |
| IIP2(8) – C2K mode (AWS) | IIP2(8) | *Table 2, TRX1 to 6 ON | +95.5 | - | - | dBm |
| IIP2(9) – C2K mode (PCS) | IIP2(9) | *Table 2, TRX1 to 6 ON | +95.5 | - | - | dBm |
| IIP2(10) – C2K mode (cell) | IIP2(10) | *Table 2, TRX1 to 6 ON | +111.5 | - | - | dBm |

Table 1 IIP2/IIP3 UMTS Mode

| | Band | CW tone 1 (MHz) | CW tone 1 (dBm) | CW tone 2 (MHz) | CW tone 2 (dBm) | Min IIP 2 (dBm) |
|------|---------|-----------------|-----------------|-----------------|-----------------|-----------------|
| IIP2 | 2600 | 2535 | 20 | 120 | -15 | +102 |
| | IMT | 1950 | 20 | 190 | -15 | +102 |
| | PCS | 1880 | 20 | 80 | -15 | +102 |
| | DCS | 1745 | 20 | 95 | -15 | +102 |
| | PDC | 1440 | 20 | 48 | -15 | +102 |
| | 900 | 892 | 20 | 45 | -15 | +102 |
| | US cell | 835 | 20 | 45 | -15 | +102 |
| IIP3 | 2600 | 2535 | 20 | 2415 | -15 | +60 |
| | IMT | 1950 | 20 | 1760 | -15 | +60 |
| | PCS | 1880 | 20 | 1800 | -15 | +61 |
| | DCS | 1745 | 20 | 1650 | -15 | +61 |
| | PDC | 1440 | 20 | 1392 | -15 | +61 |
| | 900 | 892 | 20 | 847 | -15 | +61 |
| | US cell | 835 | 20 | 790 | -15 | +61 |

Table 2 IIP2 C2k Mode

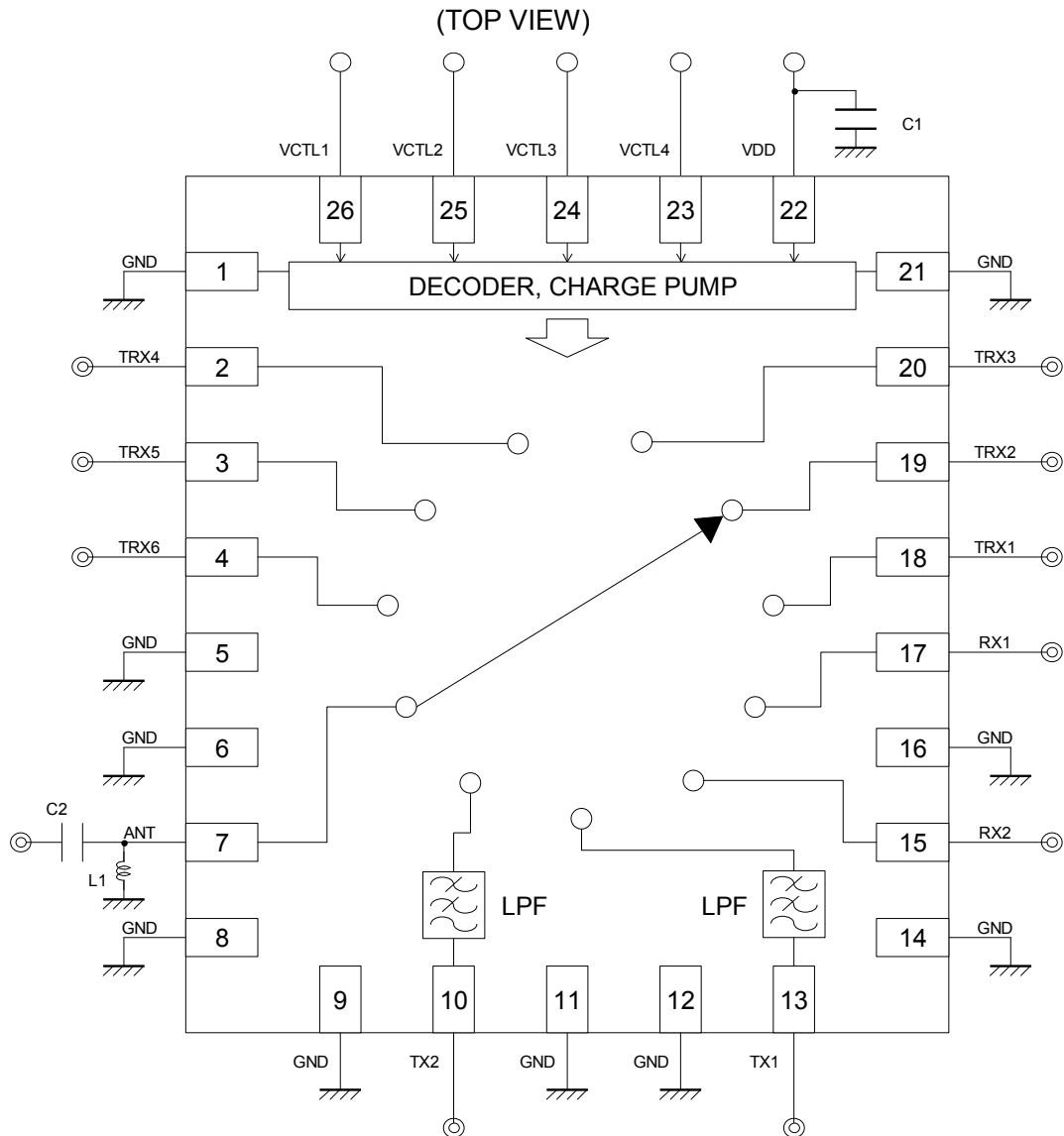
| Band | Temp (°C) | In-band Freq (MHz) | CW tone 1 Freq (MHz) | CW tone Power (dBm) | CW tone 2 Freq (MHz) | CW tone 2 Power (dBm) | Min IIP 2 (dBm) |
|------|-------------|--------------------|----------------------|---------------------|----------------------|-----------------------|-----------------|
| Cell | 25 | 869.28 | 824.28 | 26 | 1693.56 | -20 | +111.5 |
| | -30, 25, 85 | 881.61 | 836.61 | 26 | 1718.22 | -20 | +111.5 |
| | 25 | 893.31 | 848.31 | 26 | 1741.62 | -20 | +111.5 |
| PCS | 25 | 1930.05 | 1850.05 | 26 | 3780.1 | -20 | +95.5 |
| | -30, 25, 85 | 1965 | 1885 | 26 | 3850 | -20 | +95.5 |
| | 25 | 1989.95 | 1909.95 | 26 | 3899.9 | -20 | +95.5 |
| AWS | 25 | 2110 | 1710 | 26 | 3820 | -20 | +95.5 |
| | -30, 25, 85 | 2132.5 | 1732.5 | 26 | 3865 | -20 | +95.5 |
| | 25 | 2155 | 1755 | 26 | 3910 | -20 | +95.5 |

■ TERMINAL INFORMATION

| No. | SYMBOL | DESCRIPTION |
|-----|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 2 | TRX4 | RF transmitting/receiving port. |
| 3 | TRX5 | RF transmitting/receiving port. |
| 4 | TRX6 | RF transmitting/receiving port. |
| 5 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 6 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 7 | ANT | RF transmitting/receiving port. Please connect an inductor and capacitor with GND terminal for enhancing ESD protection, keeping zero DC Voltage at RF ports, and good RF characteristics. |
| 8 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 9 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 10 | TX2 | RF transmitting port. This port is connected the LPF for GSM1800/1900 TX band. |
| 11 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 12 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 13 | TX1 | RF transmitting port. This port is connected the LPF for GSM850/900 TX Band. |
| 14 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 15 | RX2 | RF receiving port. |
| 16 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 17 | RX1 | RF receiving port. |
| 18 | TRX1 | RF transmitting/receiving port. |
| 19 | TRX2 | RF transmitting/receiving port. |
| 20 | TRX3 | RF transmitting/receiving port. |
| 21 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |
| 22 | VDD | Positive voltage supply terminal. The positive voltage (+2.5 to +5.0V) has to be supplied. Please connect a bypass capacitor with GND terminal for excellent RF performance. |
| 23 | VCTL4 | Control signal input terminal. This terminal is set to High-Level (+1.35 to +5.0V) or Low-Level (0 to +0.45V). |
| 24 | VCTL3 | Control signal input terminal. This terminal is set to High-Level (+1.35 to +5.0V) or Low-Level (0 to +0.45V). |
| 25 | VCTL2 | Control signal input terminal. This terminal is set to High-Level (+1.35 to +5.0V) or Low-Level (0 to +0.45V). |
| 26 | VCTL1 | Control signal input terminal. This terminal is set to High-Level (+1.35 to +5.0V) or Low-Level (0 to +0.45V). |

NJG1686MHH

APPLICATION CIRCUIT



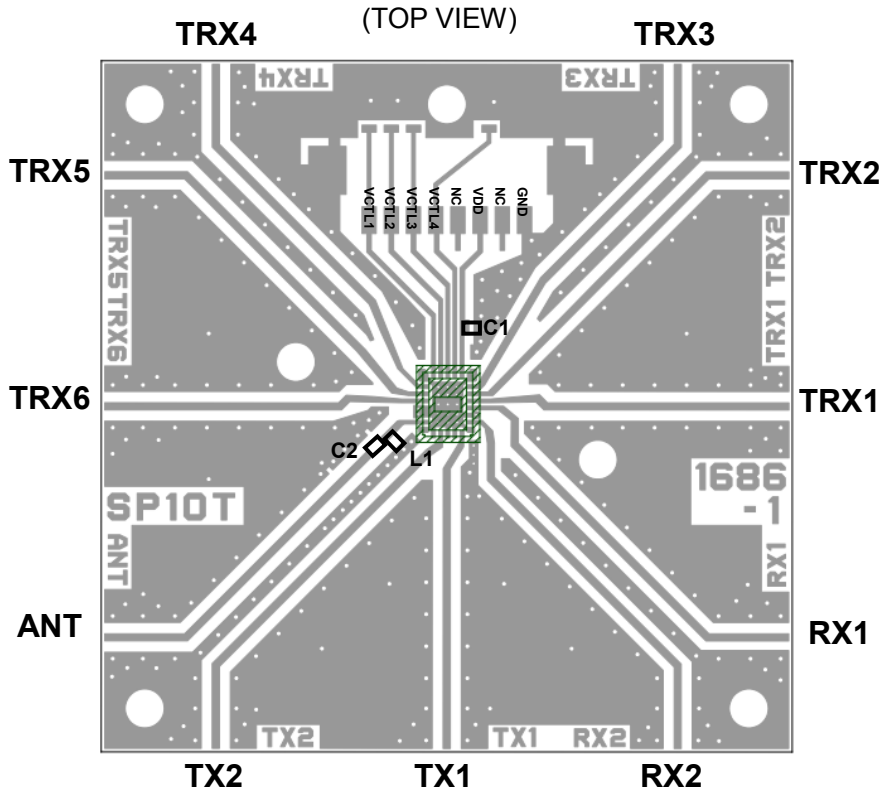
No DC blocking capacitors are required on all RF ports, unless DC is biased externally.

PARTS LIST

| No. | Parameters | Note |
|-------|------------|----------------|
| C1 | 1000 pF | MURATA (GRM15) |
| C2 *1 | 47pF | MURATA (GRM15) |
| L1 *1 | 56 nH | TDK (MLG1005S) |

*1: The use of the inductor L1 and the capacitor C2 are needed in order to keep zero DC Voltage at RF ports, enhancing ESD protection level, and for good RF characteristics.

PCB LAYOUT

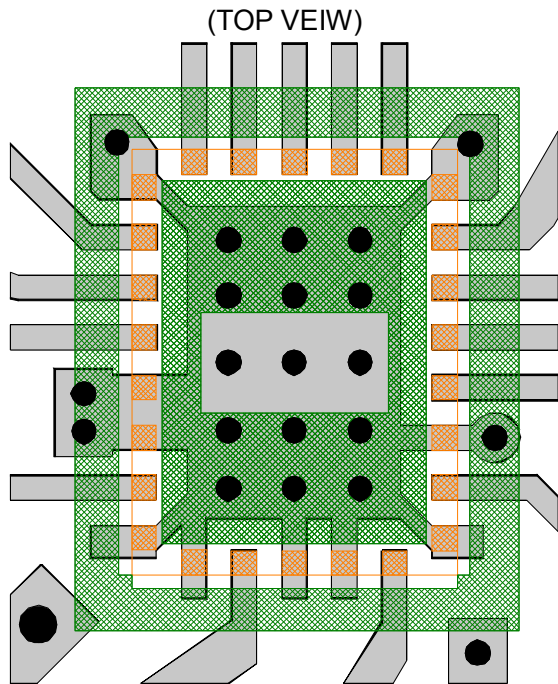







Losses of PCB and connectors, Ta=+25°C

| Frequency (MHz) | ANT-TX2, RX1,2, TRX2,3,4,5 Loss (dB) | ANT-TX1, TRX1,6 Loss (dB) |
|-----------------|--------------------------------------|---------------------------|
| 787 | 0.36 | 0.34 |
| 915 | 0.38 | 0.35 |
| 960 | 0.37 | 0.34 |
| 1910 | 0.58 | 0.53 |
| 2170 | 0.64 | 0.57 |
| 2690 | 0.72 | 0.66 |

PCB SIZE: 38.9 x 38.9 mm
 PCB: FR-4, t=0.2mm
 MICROSTRIP LINE WIDTH: 0.4mm
 Areas being hatched are covered with resist.

<PCB LAYOUT GUIDELINE>



-  PCB
-  PKG Terminal
-  PKG Outline
-  Resist
-  GND Via Hole
Diameter: $\phi = 0.15\text{mm}, 0.3\text{mm}$

PRECAUTIONS


- [1] No DC block capacitors are required for RF ports unless DC is biased externally.
- [2] For avoiding the degradation of RF performance, the bypass capacitor (C1) should be placed as close as possible to VDD terminal
- [3] For good RF performance, all GND terminals are must be connected to PCB ground plane of substrate, and through - holes for GND should be placed the IC near.

NJG1686MHH

RECOMMENDED FOOTPRINT PATTERN (EQFN26-HH PACKAGE REFERENCE)

 : Land

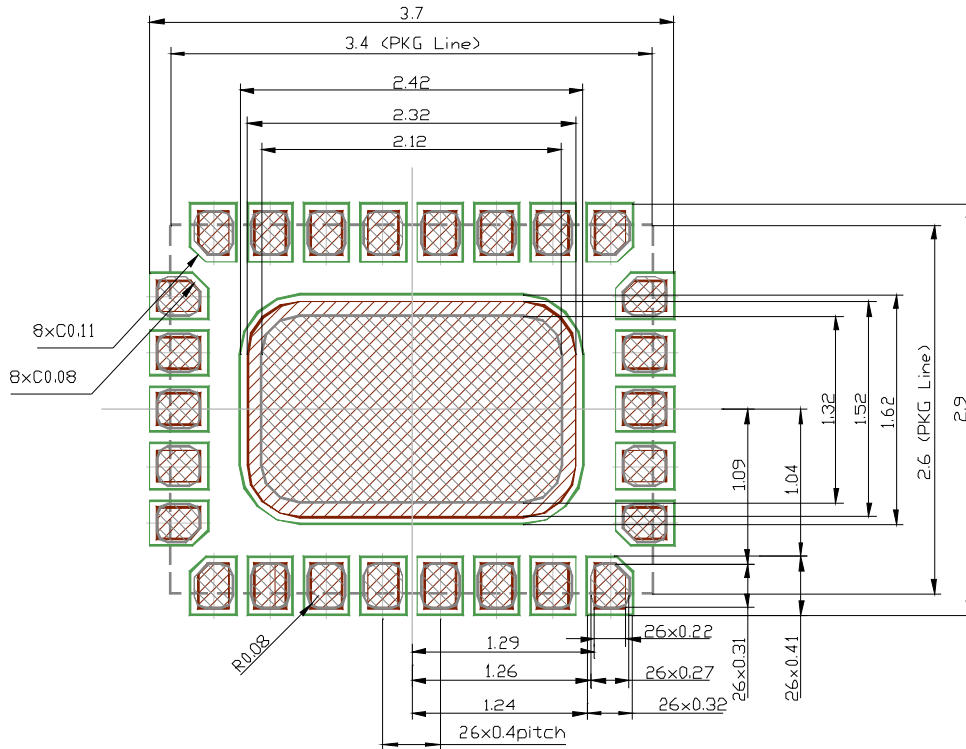
 : Mask (Open area) *Metal mask thickness : 100μm

 : Resist (Open area)

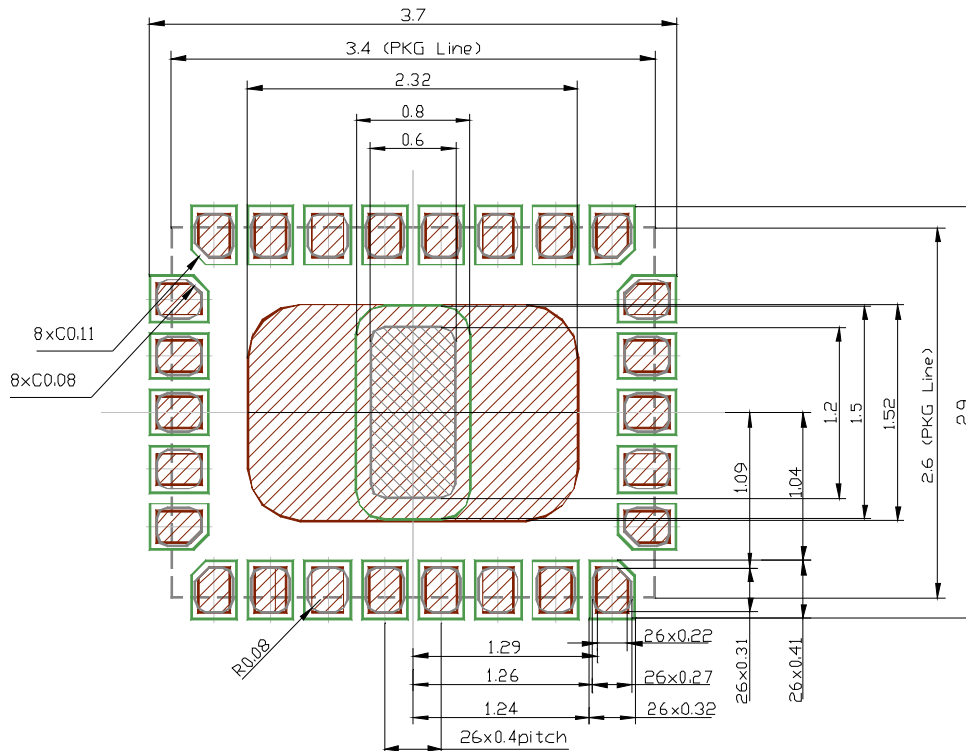
PKG : 3.4mm x 2.6mm

Pin pitch : 0.4mm

<TYPE 1> *

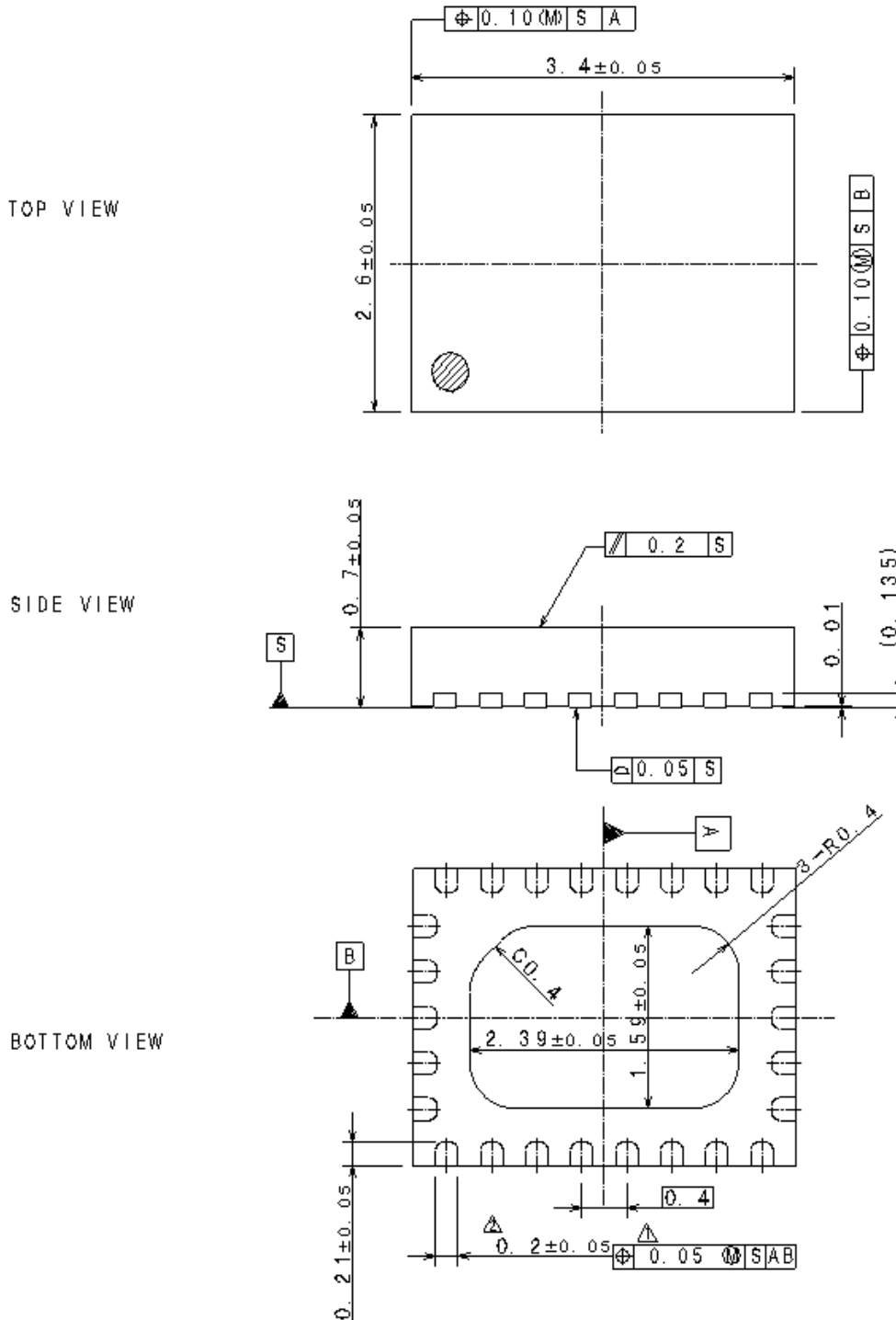


<TYPE 2> *



* There is no difference in the characteristics using both of TYPE 1 and TYPE 2.

■ PACKAGE OUTLINE (EQFN26-HH)



| | |
|------------------|---------------|
| Units | : mm |
| Board | : Cu |
| Terminal treat | : SnBi |
| Molding material | : Epoxy resin |
| Weight | : 18mg |

Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

[CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.