# TDMA ANTENNA SWITCH GaAs MMIC

## ■GENERAL DESCRIPTION

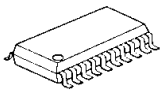
NJG1515AVB2 is an antenna switch IC for a digital cellular phone of 800MHz and 1.5GHz band.

The parallel control signals of three bits connect T/R circuits to internal two antennas or external two antennas.

The termination ports with external matching circuits make low interference between diversity antennas.

NJG1515AVB2 features very low insertion loss and low current consumption in a very small SSOP20 package.

## ■PACKAGE OUTLINE



NJG1515AVB2

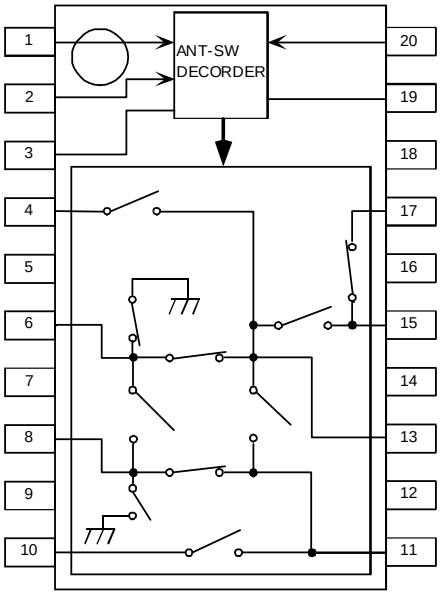
## ■FEATURES

| | |
|---|---|
| ●Low voltage operation | -2.5V (Tx only) and +3.5V |
| ●Low current consumption | 10uA typ. @$P_{in}$=30dBm (Transmit) |
| | 2uA typ. @$P_{in}$=10dBm (Receiving) |
| ●Low insertion loss | 0.5dB typ. @(TX-ANT1, TX-EXT1) f=940MHz, $P_{in}$=30dBm |
| | 0.6dB typ. @(TX-ANT1, TX-EXT1) f=1453MHz, $P_{in}$=30dBm |
| ●Low Adjacent Channel | -63dBc typ. @$V_{DD}$=+3.5V, $V_{SS}$=-2.5V, f=940MHz, $P_{in}$=30dBm |
| Leakage Power | -64dBc typ. @$V_{DD}$=+3.5V, $V_{SS}$=-2.5V, f=1453MHz, $P_{in}$=30dBm |
| ●Package | SSOP20-B2 (Mount Size: 6.4x5.0x1.25mm) |

## ■PIN CONFIGURATION

VB2 Type

(Top View)




Pin Connection

| | |
|---|---|
| 1. CTL2 | 11. ANT1 |
| 2. CTL3 | 12. GND |
| 3. $V_{SS}$ | 13. RX |
| 4. EXT2 | 14. GND |
| 5. GND | 15. ANT2 |
| 6. EXT1 | 16. GND |
| 7. GND | 17. TER1 |
| 8. TX | 18. GND |
| 9. GND | 19. $V_{DD}$ |
| 10. TER2 | 20. CTL1 |

## ■ABSOLUTE MAXIMUM RATINGS

($T_a$=25°C)

| PARAMETER | SYMBOL | CONDITIONS | RATINGS | UNITS |
|---|---|---|---|---|
| Supply voltage 1 | $V_{DD}$ | $V_{DD}$ Terminal | 6.0 | V |
| Supply voltage 2 | $V_{SS}$ | $V_{SS}$ Terminal | -4.0 | V |
| Control voltage | $V_{CTR}$ | CTL1, CTL2, CTL3 Each Terminals | 6.0 | V |
| Input power | $P_{in}$ | TX, ANT1, EXT1 Terminals | 37 | dBm |
| | | RX, ANT2, EXT2 Terminals | 28 | dBm |
| Power dissipation | $P_D$ | | 600 | mW |
| Operating temp. | $T_{opr}$ | | -40~85 | °C |
| Storage temp. | $T_{stg}$ | | -55~125 | °C |

## ■ELECTRICAL CHARACTERISTICS 1 [DC CHARACTERISTICS]

Common conditions: $T_a$=25°C, $V_{DD}$=3.5V, $V_{SS}$=-2.5V
TX, RX, ANT1, ANT2, EXT1, EXT2: terminated (50Ω)
TER1, TER2: connected to GND by 5pF capacitors

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Positive supply voltage | $V_{DD}$ | $V_{DD}$ Terminal | 2.7 | 3.5 | 5.0 | V |
| Negative supply voltage | $V_{SS}$ | $V_{SS}$ Terminal | -3.5 | -2.5 | -2.0 | V |
| Current consumption 1 | $I_{DD1}$ | $V_{DD}$ Terminal No RF Signal | - | 2.0 | 5.0 | uA |
| Current consumption 2 | $I_{SS1}$ | $V_{SS}$ Terminal No RF Signal | -0.1 | - | 0 | uA |
| Current consumption 3 | $I_{DD2}$ | f=0.1~2GHz, $P_{in}$=30dBm Transmitting state | - | 10 | 30 | uA |
| Current consumption 4 | $I_{SS2}$ | f=0.1~2GHz, $P_{in}$=30dBm Transmitting state | -30 | -10 | - | uA |
| Control voltage (H) | $V_{CTL\ (H)}$ | CTL1, CTL2, CTL3 terminals | 2.0 | 3.0 | $V_{DD}$ | V |
| Control voltage (L) | $V_{CTL\ (L)}$ | CTL1, CTL2, CTL3 terminals | 0 | 0 | 0.6 | V |
| Control current | $I_{CTL}$ | CTL1, CTL2, CTL3=VDD or CTL1, CTL2, CTL3=0V | -1.3 | - | 1.3 | uA |
| Control terminal Input Impedance | $R_{in}$ | CTL1, CTL2, CTL3 each Terminal | 4 | - | - | MΩ |

* The voltage of this terminal should be supplied before or same time with other DC supplying terminals. (CTL1~3, $V_{SS}$).

■**ELECTRICAL CHARACTERISTICS 2** [800MHz TX Mode]

Common Conditions: f=960MHz, $T_a$=25°C, $V_{DD}$=3.5V, $V_{SS}$=-2.5V
Tested on PCB circuit as shown below.
Insertion loss of each connectors, striplines, and capacitors are excluded.
TX, RX, ANT1, ANT2, EXT1 and EXT2 are terminated to 50Ω.
TER1 and TER2 are connected to GND through 5pFcapacitor.

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Frequency range 1 | fin1 | | 885 | - | 960 | MHz |
| TX-ANT1 Insertion Loss | LOSS1 | $P_{in}$=30dBm | - | 0.5 | 0.65 | dB |
| TX-EXT1 Insertion Loss | LOSS2 | $P_{in}$=30dBm | - | 0.5 | 0.65 | dB |
| TX-RX Isolation | ISL1 | $P_{in}$=30dBm<br>TX-ANT1, TX-EXT1 passing | 24 | 29 | - | dB |
| TX-ANT1 Isolation | ISL2 | $P_{in}$=30dBm<br>TX-EXT1 passing | 22 | 27 | - | dB |
| TX-ANT2 Isolation | ISL3 | $P_{in}$=30dBm<br>TX-ANT1, TX-EXT1 passing | 33 | 38 | - | dB |
| TX-EXT1 Isolation | ISL4 | $P_{in}$=30dBm<br>TX-ANT1 passing | 21 | 26 | - | dB |
| TX-EXT2 Isolation | ISL5 | $P_{in}$=30dBm<br>TX-ANT1, TX-EXT1 passing | 32 | 37 | - | dB |
| Pin at 0.5dB compression point 1 | $P_{-0.5dB}$(1) | TX-ANT1, TX-EXT1 passing | 33 | 34 | - | dBm |
| Adjacent Channel Leakage Power 1 | ACP1 | PDC Standard, ±50kHz offset<br>$P_{in}$=30dBm, Input Signal<br>ACP=-64dBc @30dBm | - | -63 | -60 | dBc |
| Adjacent Channel Leakage Power 3 | ACP2 | PDC Standard, ±100kHz offset<br>$P_{in}$=30dBm, Input Signal<br>ACP=-76dBc @30dBm | - | -74 | -70 | dBc |
| 2nd Harmonics 1 | 2f0(1) | $P_{in}$=30dBm, Input Signal 2nd Harmonics=-68dBc | - | -63 | -60 | dBc |
| 3rd Harmonics 1 | 3f0(1) | $P_{in}$=30dBm, Input Signal 2nd Harmonics=-69dBc | - | -63 | -60 | dBc |
| VSWR1 | VSWR1 | TX-ANT1, TX-EXT1 passing | - | 1.3 | 1.5 | |
| Switching time | TD1 | CTL1~3 | - | 120 | 500 | nsec |

■**ELECTRICAL CHARACTERISTICS 3** [800MHz Rx Mode]

Common Conditions: f=885MHz, $T_a$=25°C, $V_{DD}$=3.5V, $V_{SS}$=0V
Tested on PCB circuit as shown below
Insertion loss of each connectors, striplines, and capacitors are excluded.
TX, RX, ANT1, ANT2, EXT1 and EXT2 are terminated to 50Ω.
TER1 and TER2 are connected to GND through 5pFcapacitor.

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Frequency range 2 | fin2 | | 810 | - | 885 | MHz |
| RX-ANT1 Insertion Loss | LOSS3 | $P_{in}$=10dBm | - | 0.65 | 0.80 | dB |
| RX-ANT2 Insertion Loss | LOSS4 | $P_{in}$=10dBm | - | 0.60 | 0.75 | dB |
| RX-EXT1 Insertion Loss | LOSS5 | $P_{in}$=10dBm | - | 0.70 | 0.85 | dB |
| RX-EXT2 Insertion Loss | LOSS6 | $P_{in}$=10dBm | - | 0.65 | .80 | dB |
| RX-ANT1 Isolation | ISL6 | $P_{in}$=10dBm, RX-ANT2, RX-EXT1, RX-EXT2 passing | 21 | 24 | - | dB |
| RX-ANT2 Isolation | ISL7 | $P_{in}$=10dBm, RX-ANT1, RX-EXT1, RX-EXT2 passing | 22 | 25 | - | dB |
| RX-EXT1 Isolation | ISL8 | $P_{in}$=10dBm, RX-ANT1, RX-ANT2, RX-EXT2 passing | 22 | 25 | - | dB |
| RX-EXT2 Isolation | ISL9 | $P_{in}$=10dBm, RX-ANT1, RX-ANT2, RX-EXT1 passing | 20 | 23 | - | dB |
| Pin at 1dB compression point 1 | $P_{-1}$(1) | RX-ANT1, RX-ANT2, RX-EXT1, RX-EXT2 passing | 20 | 26 | - | dBm |
| VSWR 2 | VSWR2 | RX-ANT1, RX-ANT2, RX-EXT1, RX-EXT2 passing | - | 1.4 | 1.6 | |
| Switching time 2 | TD2 | CTL1~3 | - | 120 | 500 | nsec |

■**ELECTRICAL CHARACTERISTICS 4** [1.5GHz Tx Mode]

Common Condition: f=1453MHz, $T_a$=25°C, $V_{DD}$=3.5V, $V_{SS}$=-2.5V
Tested on PCB circuit as shown below
Insertion loss of each connectors, striplines, and capacitors are excluded.
TX, RX, ANT1, ANT2, EXT1 and EXT2 are terminated to 50Ω.
TER1 and TER2 are connected to GND through 5pFcapacitor.

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Frequency range 3 | fin3 | | 1429 | - | 1453 | MHz |
| TX-ANT1 Insertion Loss | LOSS7 | $P_{in}$=30dBm | - | 0.55 | 0.70 | dB |
| TX-EXT1 Insertion Loss | LOSS8 | $P_{in}$=30dBm | - | 0.65 | 0.80 | dB |
| TX-RX Isolation | ISL10 | $P_{in}$=30dBm TX-ANT1, TX-EXT1 passing | 28 | 33 | - | dB |
| TX-ANT1 Isolation | ISL11 | $P_{in}$=30dBm TX-EXT1 passing | 30 | 35 | - | dB |
| TX-ANT2 Isolation | ISL12 | $P_{in}$=30dBm TX-ANT1, TX-EXT1 passing | 30 | 35 | - | dB |
| TX-EXT1 Isolation | ISL13 | $P_{in}$=30dBm TX-ANT1 passing | 20 | 24 | - | dB |
| TX-EXT2 Isolation | ISL14 | $P_{in}$=30dBm TX-ANT1, TX-EXT1 passing | 35 | 40 | - | dB |
| Pin at 0.5dB compression point 2 | $P_{-0.5dB}$ (2) | TX-ANT1, TX-EXT1 passing | 33.5 | 35.5 | - | dBm |
| Adjacent channel leakage power5 | ACP3 | PDC Standard, ±50KHz offset $P_{in}$=30dBm, Input Signal ACP=-67dBc @ 30dBm | - | -64 | -60 | dBc |
| Adjacent channel leakage power 7 | ACP4 | PDC Standard, ±100kHz offset $P_{in}$=30dBm, Input Signal ACP=-76dBc @ 30dBm | - | -75 | -70 | dBc |
| 2nd Harmonics 2 | $2f_0$(2) | Input Signal 2nd Harmonics =-68dBc, $P_{in}$=30dBm | - | -62 | -60 | dBc |
| 3rd Harmonics 2 | $3f_0$(2) | Input Signal 2nd Harmonics =-69dBc, $P_{in}$=30dBm | - | -62 | -60 | dBc |
| VSWR3 | VSWR3 | TX-ANT1, TX-EXT1 passing | - | 1.4 | 1.6 | |
| Switching time3 | TD3 | CTL1~3 | - | 120 | 500 | nsec |

■**ELECTRICAL CHARACTERISTICS 5** [1.5GHz Rx Mode]

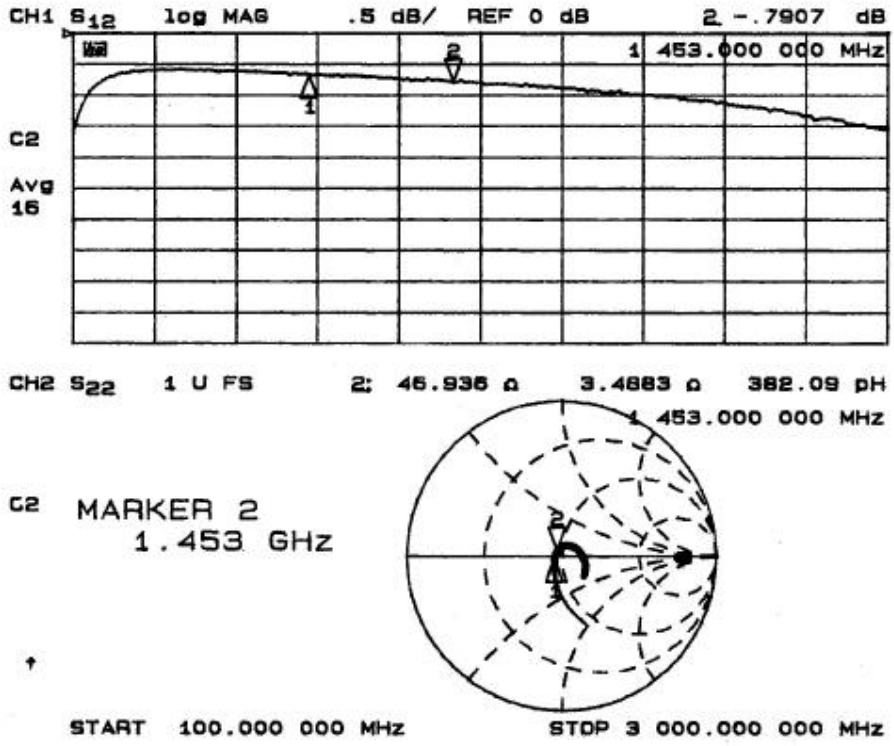
Common Condition: f=1501MHz, $T_a$=25°C, $V_{DD}$=3.5V, $V_{SS}$=0V
Tested on PCB circuit as shown below
Insertion loss of each connectors, striplines, and capacitors are excluded.
TX, RX, ANT1, ANT2, EXT1 and EXT2 are terminated to 50Ω.
TER1 and TER2 are connected to GND through 5pFcapacitor.

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Frequency range 4 | fin4 | | 1477 | - | 1501 | MHz |
| RX-ANT1 Insertion Loss | LOSS9 | $P_{in}$=10dBm | - | 0.80 | 0.95 | dB |
| RX-ANT2 Insertion Loss | LOSS10 | $P_{in}$=10dBm | - | 0.80 | 0.95 | dB |
| RX-EXT1 Insertion Loss | LOSS11 | $P_{in}$=10dBm | - | 1.00 | 1.15 | dB |
| RX-EXT2 Insertion Loss | LOSS12 | $P_{in}$=10dBm | - | 0.80 | 0.95 | dB |
| RX-ANT1 Isolation | ISL15 | RX-ANT2, RX-EXT1, RX-EXT2 passing, $P_{in}$=10dBm | 18 | 22 | - | dB |
| RX-ANT2 Isolation | ISL16 | RX-ANT1, RX-EXT1, RX-EXT2 passing, $P_{in}$=10dBm | 19 | 24 | - | dB |
| RX-EXT1 Isolation | ISL17 | RX-ANT1, RX-ANT2, RX-EXT2 passing, $P_{in}$=10dBm | 23 | 28 | - | dB |
| RX-EXT2 Isolation | ISL18 | RX-ANT1, RX-ANT2, RX-EXT1passing, $P_{in}$=10dBm | 17 | 22 | - | dB |
| Pin at 1dB compression point2 | $P_{-1}$(2) | RX-ANT1, RX-ANT2, RX-EXT1, RX-EXT2 passing | 20 | 26 | - | dBm |
| VSWR4 | VSWR4 | RX-ANT1, RX-ANT2, RX-EXT1, RX-EXT2 passing | - | 1.4 | 1.6 | |
| Switching time 4 | TD4 | CTL1~3 | - | 120 | 500 | nsec |

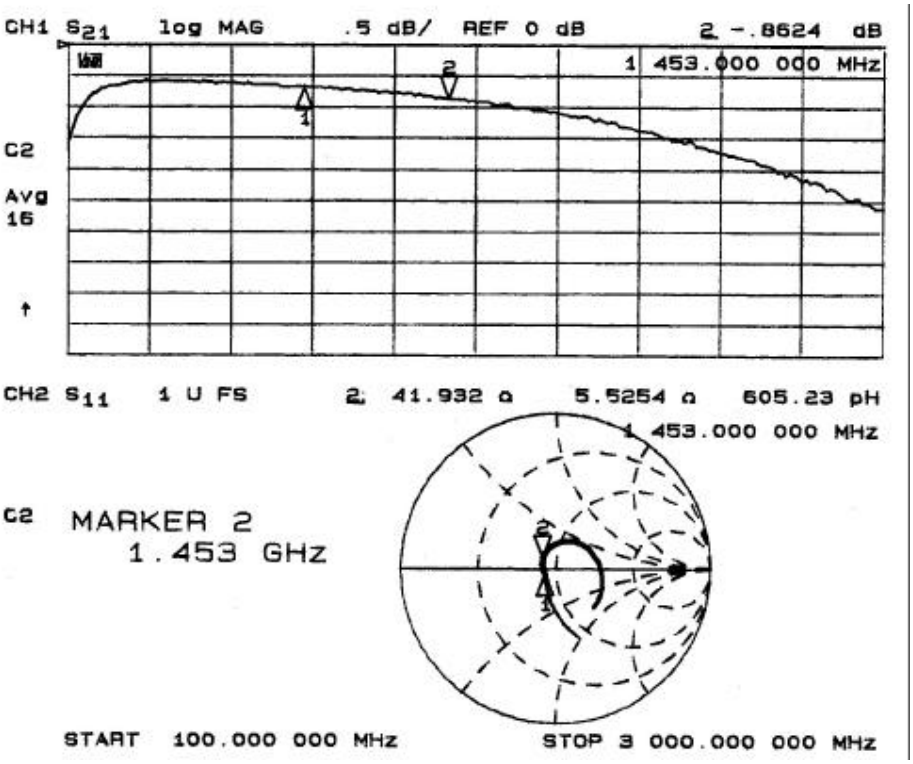
## ■TERMINAL INFORMATION

| PIN NO. | SYMBOL | DESCRIPTIONS |
|---|---|---|
| 1 | CTL2 | High-impedance C-MOS input terminal. This terminal is set to High-Level by 2V~$V_{DD}$, and Low-Level by +0.6V~0V. In case of open or unstable level, connect this terminal by 100KΩ resistor with GND terminal or $V_{DD}$ terminal. |
| 2 | CTL3 | High-impedance C-MOS input terminal. This terminal is set to High-Level by 2V~$V_{DD}$, and Low-Level by +0.6V~0V. In case of open or unstable level, connect this terminal by 100KΩ resistor with GND terminal or $V_{DD}$ terminal. |
| 3 | $V_{SS}$ | Negative voltage supply terminal. The negative voltage (-3.5~-2.0V) have to be supplied on transmitting. Otherwise negative voltage of -2.5~0V can be used or this terminal can be stayed open, because internal level of this terminal is automatically set to GND level on receiving. The bypass capacitor have to be connected with GND terminal for excellent RF performance. |
| 4 | EXT2 | RF receiving port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 6 | EXT1 | RF transmitting/receiving port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 8 | TX | RF transmitting port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 10 | TER2 | ANT1 termination port. The influence of ANT1 port to ANT2 port is suppressed by terminating this port by an appropriate termination. An external capacitor (5pF) is required to block DC voltage ($V_{DD}$). |
| 11 | ANT1 | RF transmitting/receiving port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 13 | RX | RF receiving port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 15 | ANT2 | RF receiving port. An external capacitor of 56pF~100pF is required to block DC voltage ($V_{DD}$). |
| 17 | TER1 | ANT2 termination port. The influence of ANT2 port to ANT1 port is suppressed by terminating this port with appropriate termination. An external capacitor (5pF) is required to block DC voltage ($V_{DD}$). |
| 19 | $V_{DD}$ | Positive voltage supply terminal. The positive voltage (2.7~5.0V) have to be supplied. The bypass capacitor have to be connected with GND terminal for excellent RF performance. |
| 20 | CTL1 | High-impedance C-MOS input terminal. This terminal is set to High-Level by 2V~$V_{DD}$, and Low-Level by +0.6~0V. In case of open or unstable level, connect this terminal by 100kΩ resistor with GND terminal or $V_{DD}$ terminal. |
| 5,7,9,12, 14,16,18 | GND | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance. |

■**TYPICAL CHARACTERISTICS** (Measured on the PCB evaluation circuit as shown below.
All external circuit losses are included. Please refer the table of estimated losses.)

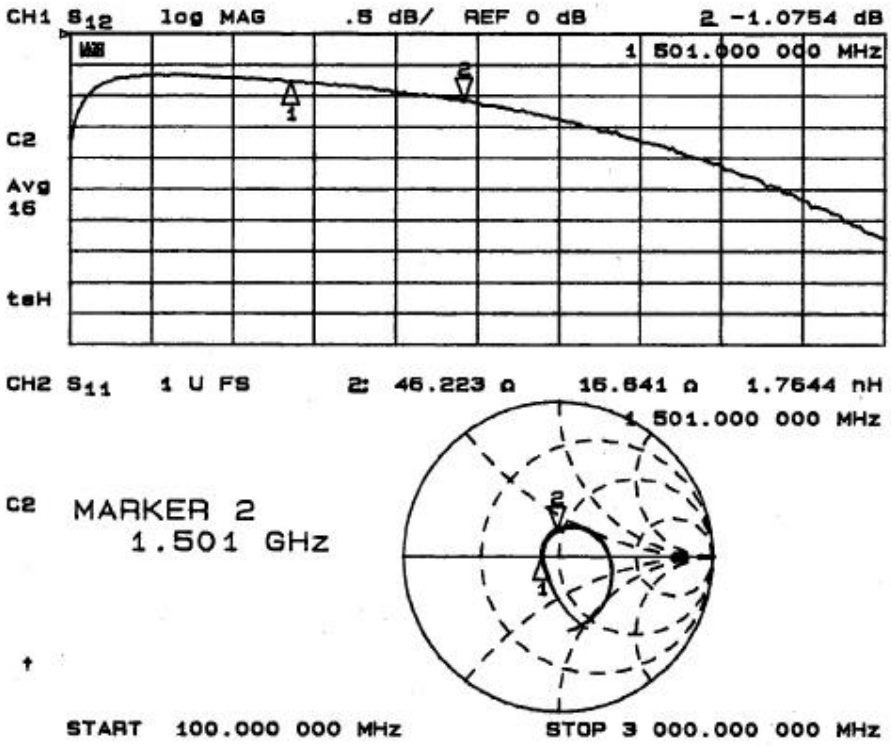



TX-ANT1 Insertion Loss, TX port reflection (Marker1: 940MHz, Marker 2: 1453MHz)

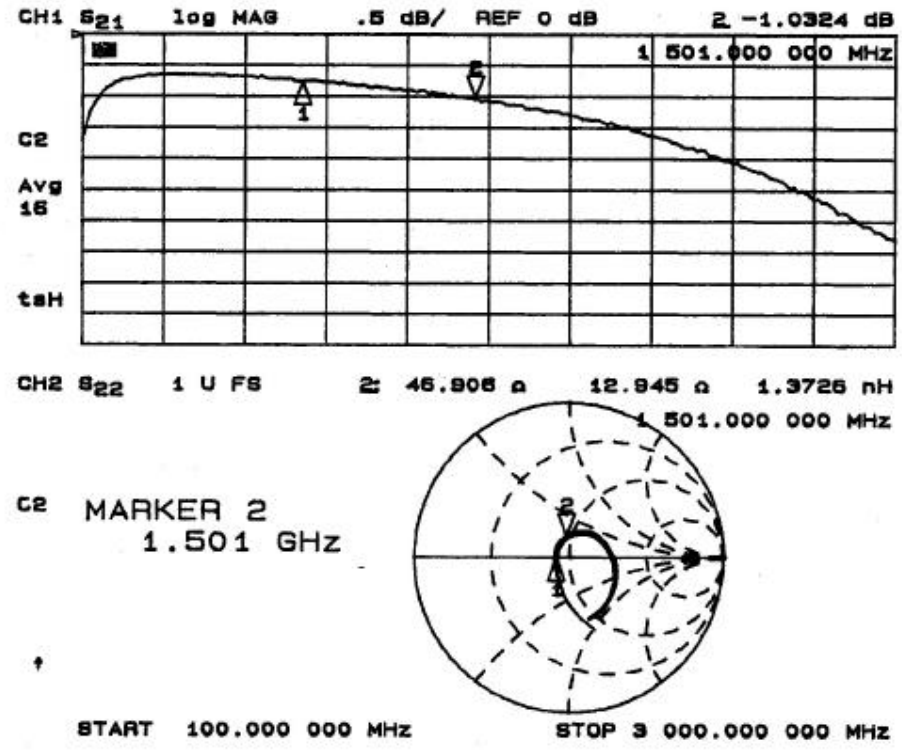



TX-EXT1 Insertion Loss, TX port reflection (Marker 1: 940MHz, Marker 2: 1453MHz)

■**TYPICAL CHARACTERISTICS** (Continued)

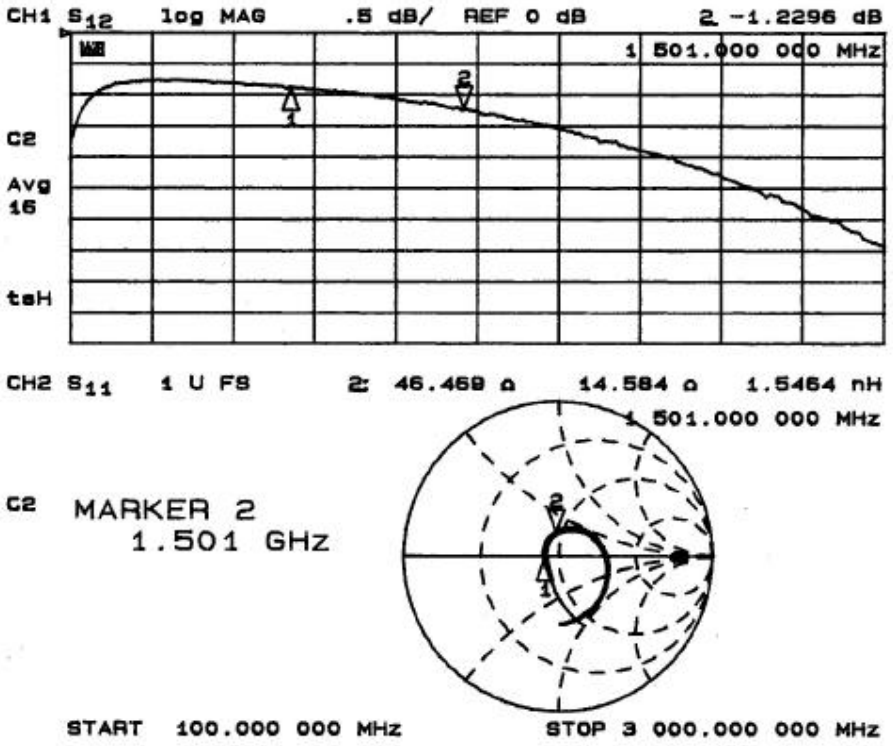



RX-ANT Insertion Loss, RX port reflection (Marker 1: 885MHz, Marker 2: 1501MHz)

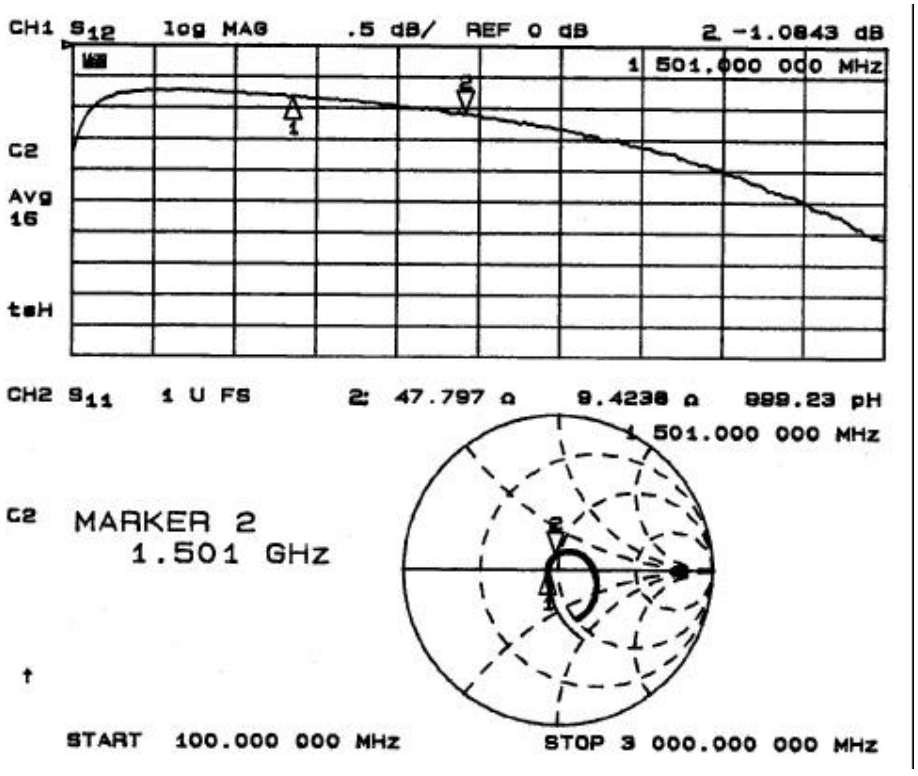



RX-ANT2 Insertion Loss, RX port reflection (Marker 1: 885MHz, Marker 2: 1501MHz)

■**TYPICAL CHARACTERISTICS** (Continued)




RX-EXT1 Insertion Loss, RX port reflection (Marker 1: 885MHz, Marker 2: 1501MHz)

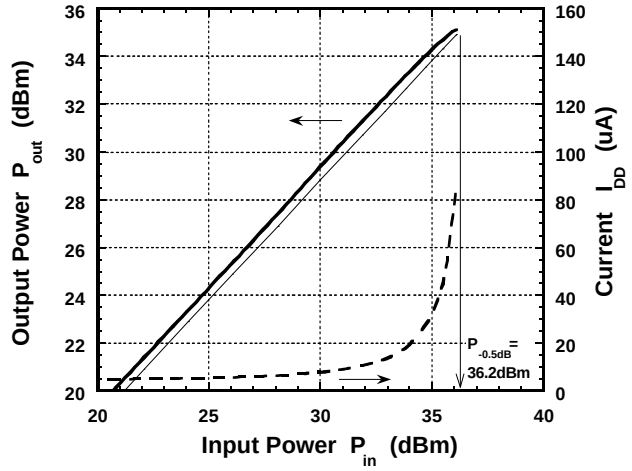



RX-EXT2 Insertion Loss, RX port reflection (Marker 1: 885MHz, Marker 2: 1501MHz)

■**TYPICAL CHARACTERISTICS** (800MHz Band: Measured on the PCB evaluation circuit)

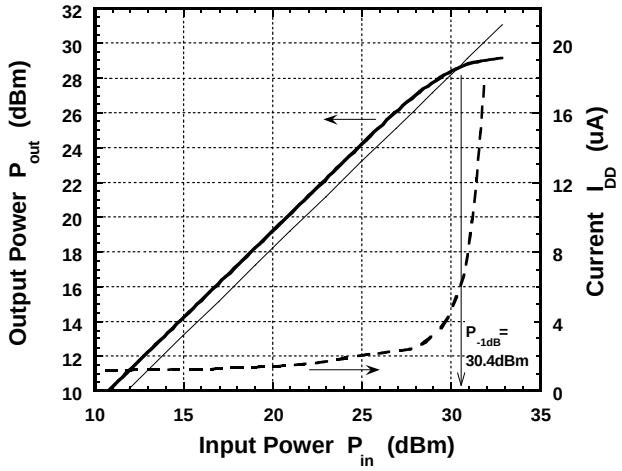
**Input Power vs. Output Power,I$_{DD}$**

(Tx-Ant1, f=940MHz, V$_{DD}$=3.5V, V$_{SS}$=-2.5V)



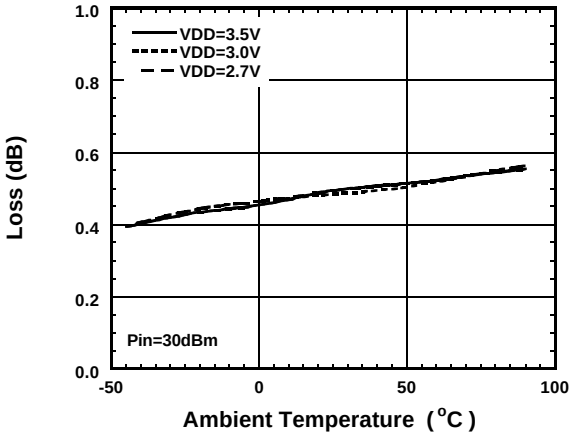

**Input Power vs. Output Power,I$_{DD}$**

(Rx-Ant1, f=885MHz, V$_{DD}$=3.5V, V$_{SS}$=0V)



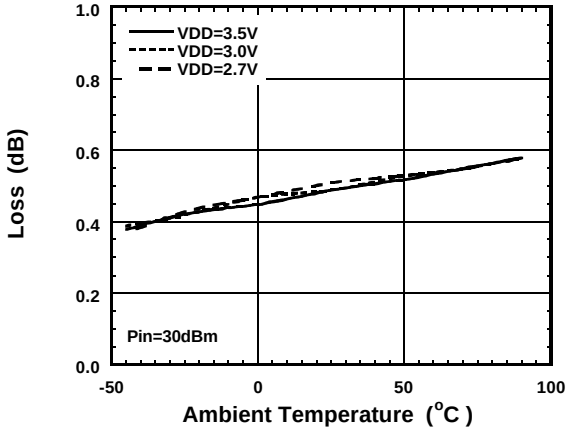

**Loss vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ant1, f=940MHz, V$_{SS}$=-2.5V)



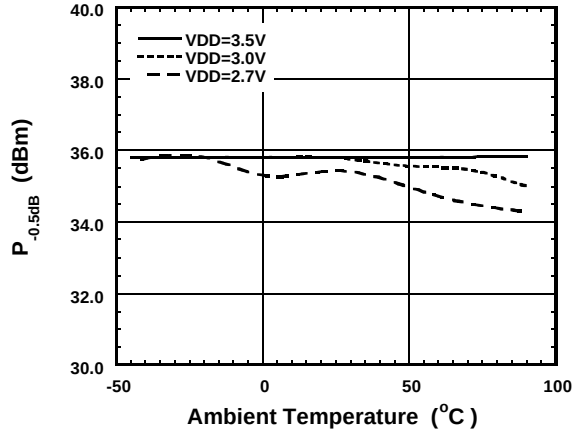

**Loss vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ext1, f=940MHz, V$_{SS}$=-2.5V)



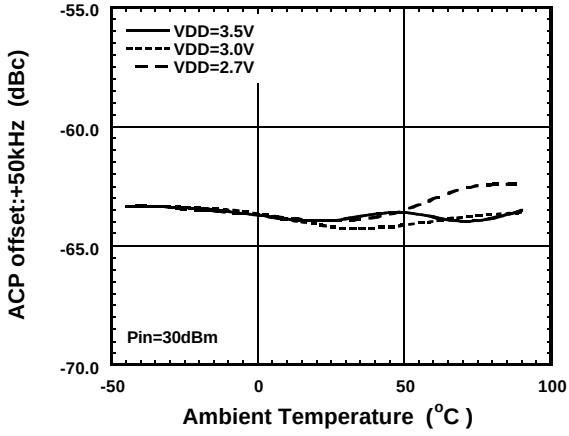

**P$_{-0.5dB}$ vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ant1, f=940MHz, V$_{SS}$=-2.5V)




**ACP(+50kHz) vs. Ambient Temperature vs. V$_{DD}$**

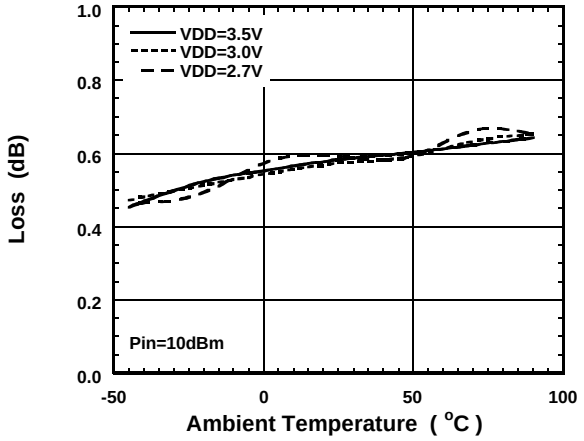
(Tx-Ant1, f=940MHz, V$_{SS}$=-2.5V)



■**TYPICAL CHARACTERISTICS** (800MHz Band: Measured on the PCB evaluation circuit)

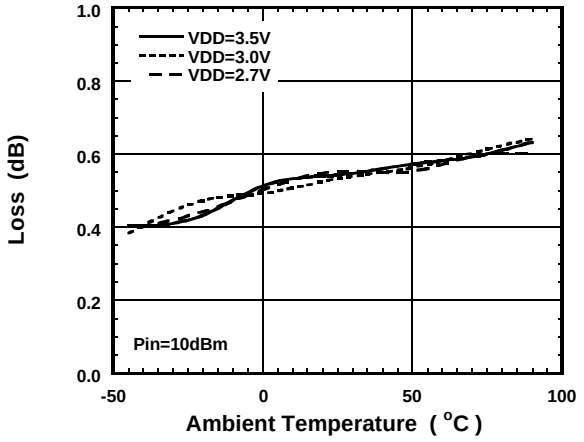
**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ant1, f=885MHz, $V_{SS}$=0V)**



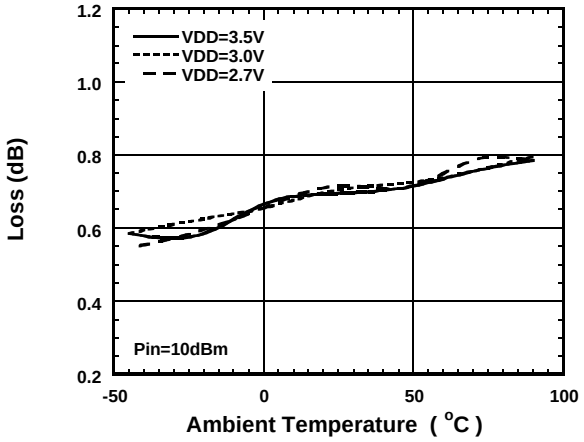

**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ant2, f=885MHz, $V_{SS}$=0V)**



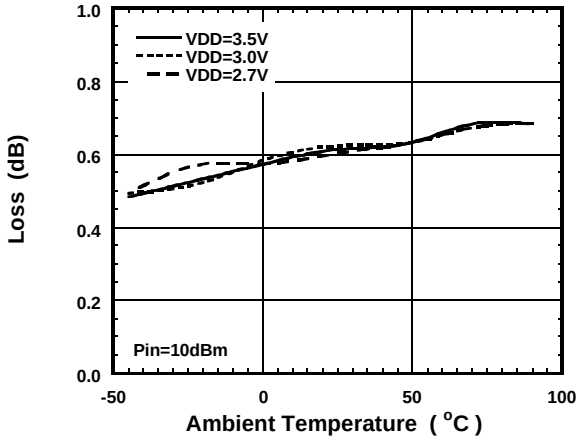

**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ext1, f=885MHz, $V_{SS}$=0V)**




**Loss vs. Ambient Temperature vs. $V_{DD}$**

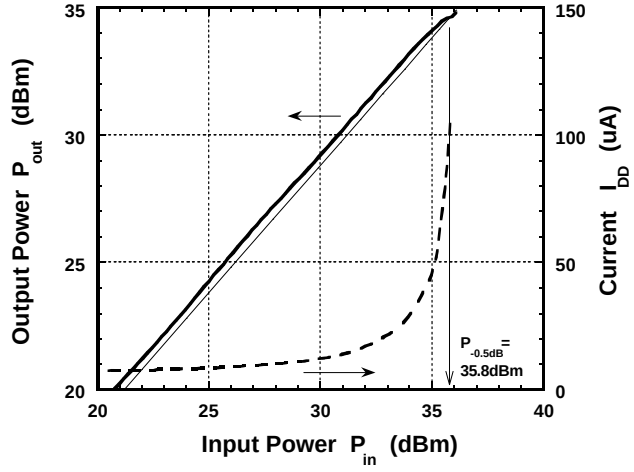
**(Rx-Ext2, f=885MHz, $V_{SS}$=0V)**



■**TYPICAL CHARACTERISTICS** (1.5GHz Band: Measured on the PCB evaluation circuit)

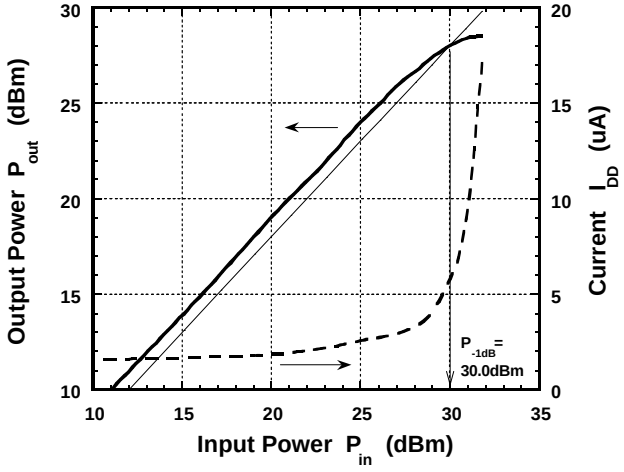
**Input Power vs. Output Power,I$_{DD}$**

(Tx-Ant1, f=1453MHz, V$_{DD}$=3.5V, V$_{SS}$=-2.5V)



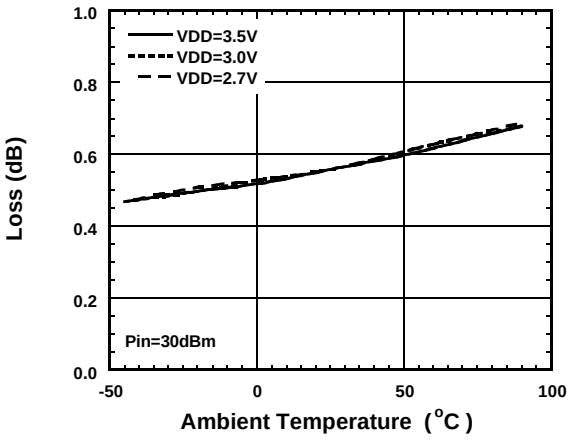

**Input Power vs. Output Power,I$_{DD}$**

(Rx-Ant1, f=1501MHz, V$_{DD}$=3.5V, V$_{SS}$=0V)



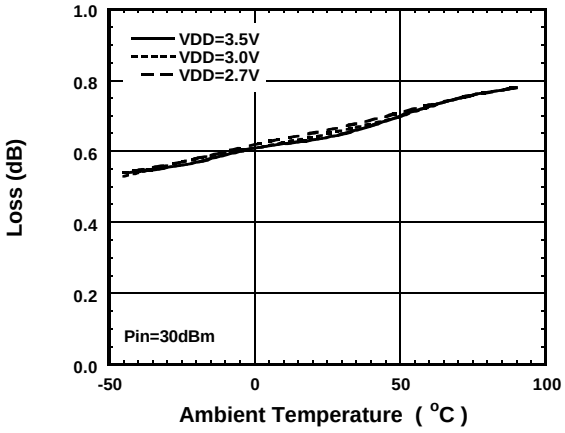

**Loss vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ant1, f=1453MHz, V$_{SS}$=-2.5V)



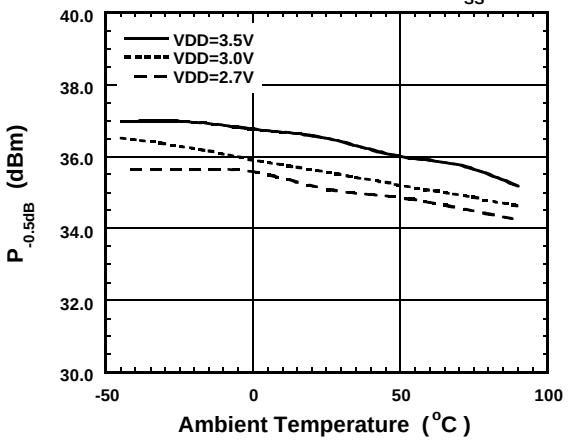

**Loss vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ext1, f=1453MHz, V$_{SS}$=-2.5V)



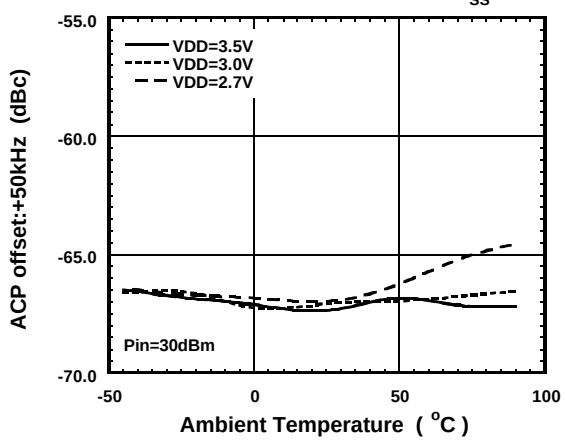

**P$_{-0.5dB}$ vs. Ambient Temperature vs. V$_{DD}$**

(Tx-Ant1, f=1453MHz, V$_{SS}$=-2.5V)




**ACP(+50kHz) vs. Ambient Temperature vs. V$_{DD}$**

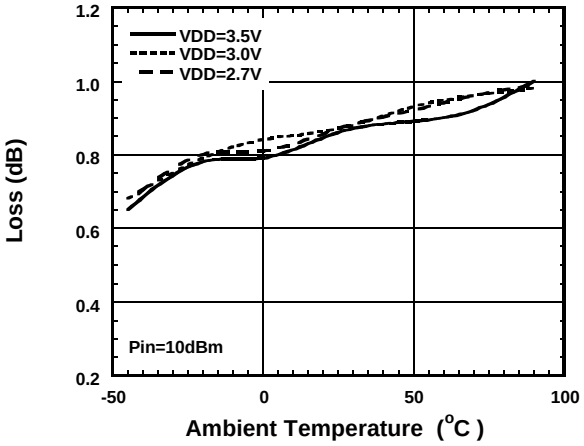
(Tx-Ant1, f=1453MHz, V$_{SS}$=-2.5V)



■**TYPICAL CHARACTERISTICS** (1.5GHz Band: Measured on the PCB evaluation circuit)

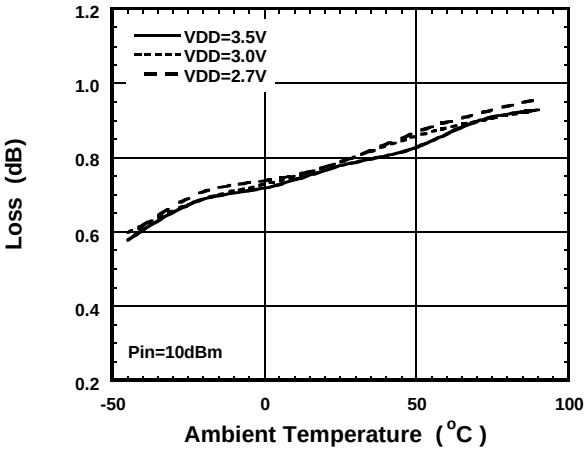
**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ant1, f=1501MHz, $V_{SS}$=0V)**



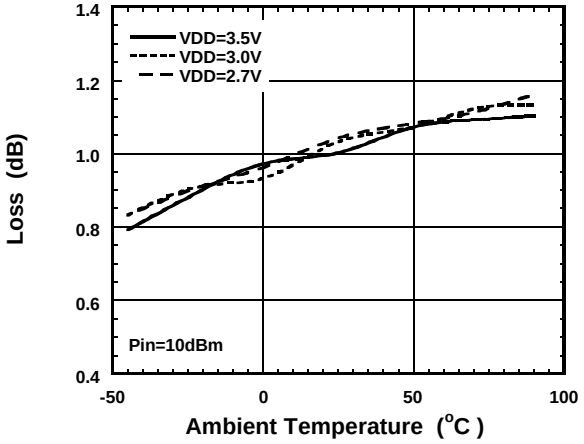

**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ant2, f=1501MHz, $V_{SS}$=0V)**



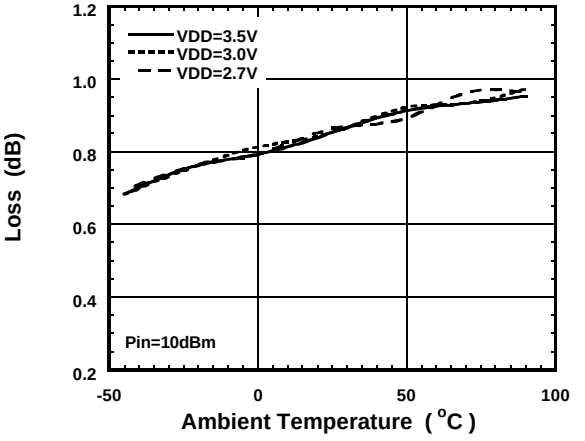

**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ext1, f=1501MHz, $V_{SS}$=0V)**




**Loss vs. Ambient Temperature vs. $V_{DD}$**

**(Rx-Ext2, f=1501MHz, $V_{SS}$=0V)**

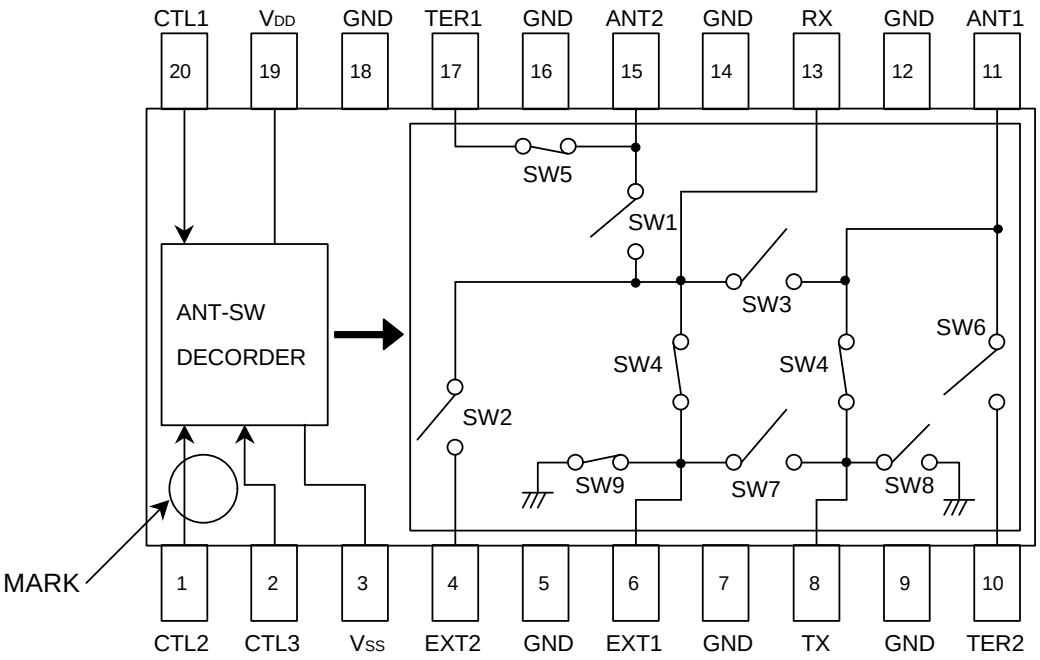


## ■TRUTH TABLE

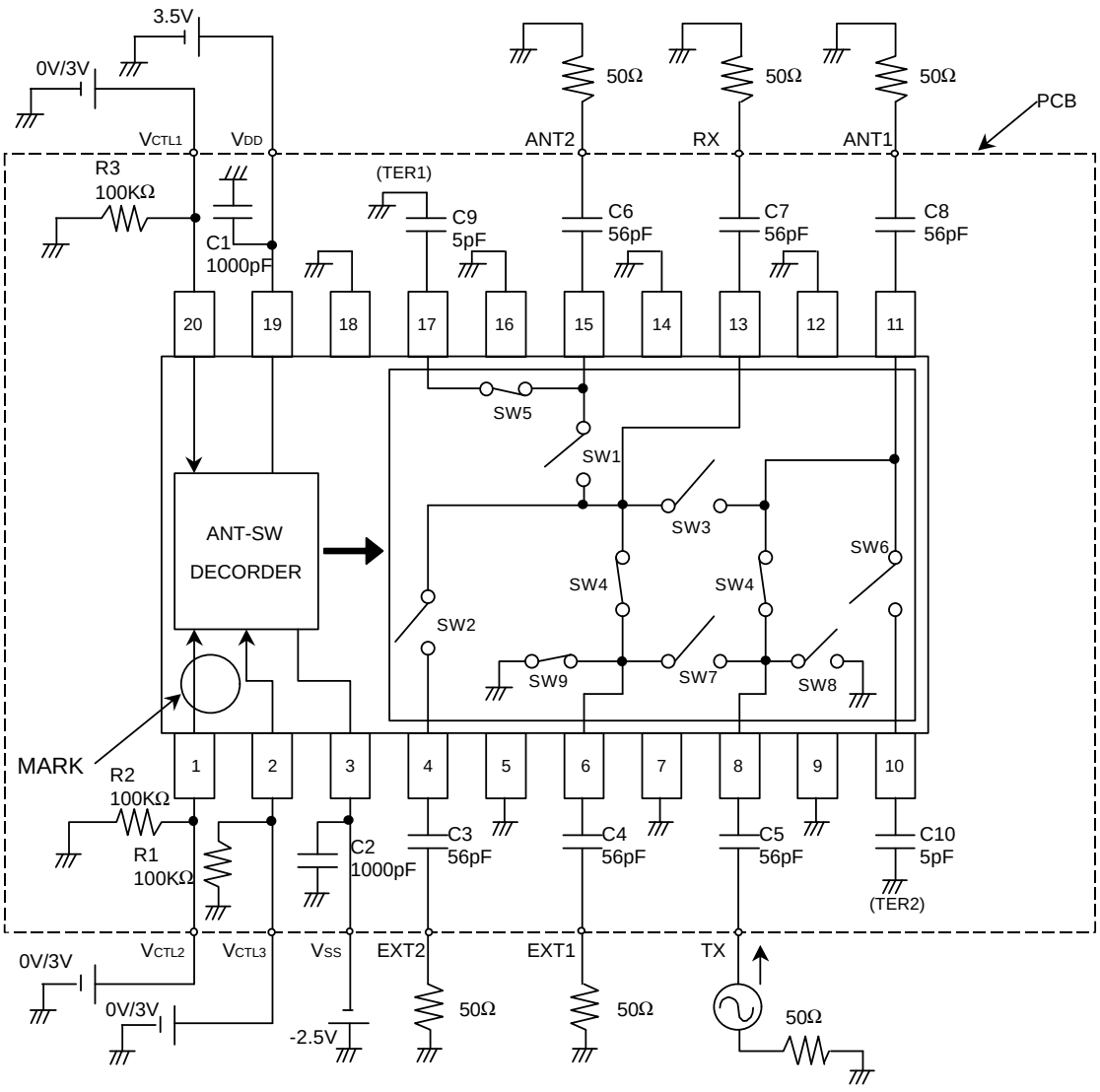
"H"=$V_{CTL\ (H)}$, "L"=$V_{CTL\ (L)}$, "X"=H or L

| ROUTE | CONTROL INPUT | | | CONTROL OUTPUT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RX/TX | Diversity | IN/OUT | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9 |
| | CTL1 | CTL2 | CTL3 | | | | | | | | | |
| TX-ANT1 | H | X | H | OFF | OFF | OFF | ON | ON | OFF | OFF | OFF | ON |
| TX-EXT1 | H | X | L | OFF | OFF | ON | OFF | ON | ON | ON | OFF | OFF |
| RX-ANT1 | L | L | H | OFF | OFF | ON | OFF | ON | OFF | ON | ON | ON |
| RX-ANT2 | L | H | H | ON | OFF | OFF | OFF | OFF | ON | ON | ON | ON |
| RX-EXT1 | L | L | L | OFF | OFF | OFF | ON | ON | ON | OFF | ON | OFF |
| RX-EXT2 | L | H | L | OFF | ON | OFF | OFF | ON | ON | ON | ON | ON |

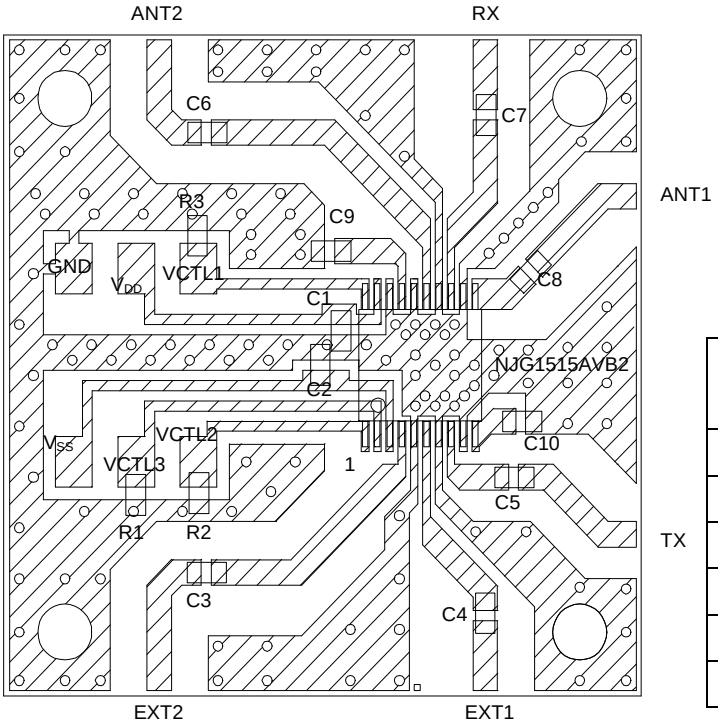
## ■PIN CONFIGURATION (Top View)



■**RECOMMENDED CIRCUIT** (TX-ANT1 passing)



## ■RECOMMENDED PCB DESIGN




PCB: FR-4, t= 0.5mm

Stripline width: 1mm

**Board total Loss**
**(Capacitor, Connector and PCB)**

| Pass route | 800MHz Band (dB) | 1.5GHzBand (dB) |
|---|---|---|
| TX-ANT1 | 0.17 | 0.21 |
| TX-EXT1 | 0.18 | 0.21 |
| RX-ANT1 | 0.17 | 0.23 |
| RX-ANT2 | 0.19 | 0.25 |
| RX-EXT1 | 0.18 | 0.24 |
| RX-EXT2 | 0.19 | 0.25 |

**PARTS LIST**

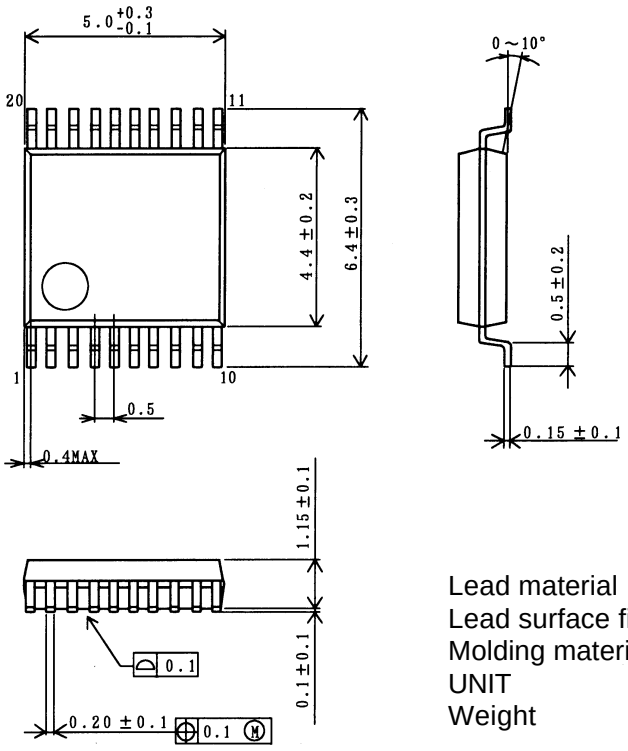
| PART ID | VALUE | COMMENT |
|---|---|---|
| R1~R3 | 100KΩ | TAMA Electronics (CRG16G) |
| C1, C2 | 1000pF | MURATA (GRM36) |
| C3~C8 | 56pF | MURATA (GRM36) |
| C9, C10 | 5pF | MURATA (GRM36) |

**PRECAUTIONS**

[1] The bypass capacitors should be connected to the $V_{DD}$, $V_{SS}$ terminals as close as possible respectively.

[2] For good RF performance, the ground terminals should be directly connected to the ground patterns and through-holes as close as possible using relatively wide pattern.

## ■PACKAGE OUTLINE (SSOP20-B2)




| | |
|---|---|
| Lead material | : Copper |
| Lead surface finish | : Solder plating |
| Molding material | : Epoxy resin |
| UNIT | : mm |
| Weight | : 66mg |

**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.

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