

High Linearity 3V Gain Block Amplifier

Product Description

RG511 is a high linearity and low noise Gain Block Amplifier in a low-cost surface mount package and provides 33.5dBm high OIP3 and 1.6dB Noise Figure at 900MHz. It is fabricated on a compound semiconductor material and conventional device technology. RG511 is available in a lead-free / green / RoHS-compliant SOT363(SC70) package. The performance target is designed for use as a receiver and transmitter in wireless infrastructure system where high linearity and low noise is required. Internal active bias circuitry allows RG511 to maintain high linearity and gain performance over temperature and operate directly off a single +3.3V supply. All devices are 100% RF and DC tested.

Features

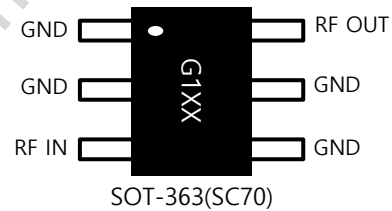
- High OIP3 33.5dBm at 900MHz
- 19dB Gain at 900MHz
- P1dB=20dBm at 900MHz
- 1.6dB Noise Figure at 900MHz
- Unconditionally stable
- Single 3.3V supply, 50mA current
- No dropping resistor required
- Industry standard SOT363(SC70) package
- Lead-free, RoHS compliant, Green



Applications

- Broadband Gain Block
- Wireless infrastructure
- Cellular, PCS, GSM, WCDMA, WiBro, LTE

Component Diagram



| Parameter | Specification | | | Condition | Units |
|----------------------------------|---------------|-------|------|------------------|-------|
| | Min. | Typ. | Max. | | |
| Small Signal Gain | 17.6 | 19.0 | | 900MHz | dB |
| | 12.3 | 13.6 | | 1900MHz | dB |
| | 11.5 | 12.8 | | 2140MHz | dB |
| Output power at 1-dB Compression | 18.5 | 20.0 | | 900MHz | dBm |
| | 18.2 | 19.7 | | 1900MHz | dBm |
| Third Order Intercept Point | 31.5 | 33.5 | | 900MHz | dBm |
| | 31.1 | 33.1 | | 1900MHz | dBm |
| Input Return Loss | | -19.8 | | 900MHz | dB |
| Output Return Loss | | -16.7 | | 900MHz | dB |
| Reverse Isolation | | -25.3 | | 900MHz | dB |
| Noise Figure | | 1.6 | | 900MHz | dB |
| Device Voltage | | 3.3 | | | V |
| Device current (Icq) | 35 | 49 | | | mA |
| Thermal Resistance | | 41.6 | | Junction to lead | °C/W |

Test condition: Vcc=3.3V, I_b=49mA Typ., OIP₃ Tone Spacing=1MHz, P_{out} per tone=6dBm T_L=25°C, Z_s=Z_L=50

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50-4000MHz
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Absolute Maximum Ratings

| Parameter | Rating | Unit |
|--------------------------------|-------------|------|
| Max Device Voltage(V_D) | 5.0 | V |
| Max Device Current(I_D) | 100 | mA |
| Max RF Input Power | 10 | dBm |
| Max Operating Dissipated Power | 0.5 | W |
| Junction Temperature(T_J) | +150 | °C |
| Operating Temperature(T_L) | -40 to +85 | °C |
| Storage Temperature | -65 to +150 | °C |
| ESD Sensitivity(HBM) | Class 1B | |
| Moisture Sensitivity Level | MSL1 | |



Typical Electrical Specification

| Parameter | 70MHz | 150MHz | 700MHz | 900MHz | Unit |
|-----------|-------|--------|--------|--------|------|
| S21 | 25.8 | 25.1 | 20.2 | 19.0 | dB |
| OIP3 | 31.0 | 31.2 | 32.7 | 33.5 | dBm |
| P1dB | 19.0 | 18.8 | 19.8 | 20.0 | dBm |
| S11 | -17.8 | -20.1 | -19.8 | -19.8 | dB |
| S22 | -18.2 | -27.8 | -17.2 | -16.3 | dB |
| S12 | -30.1 | -29.9 | -26.6 | -25.3 | dB |
| NF | 1.63 | 16.2 | 1.61 | 1.60 | dB |

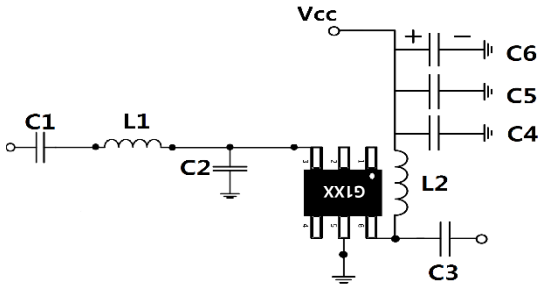
| Parameter | 1900MHz | 2140MHz | 2650MHz | | Unit |
|-----------|---------|---------|---------|--|------|
| S21 | 13.6 | 12.8 | 11.3 | | dB |
| OIP3 | 33.1 | 33.3 | 31.7 | | dBm |
| P1dB | 19.7 | 19.8 | 19.7 | | dBm |
| S11 | -16.7 | -16.8 | -28.7 | | dB |
| S22 | -16.9 | -22.1 | -18.4 | | dB |
| S12 | -20.0 | -19.3 | -17.6 | | dB |
| NF | 1.60 | 1.65 | 1.70 | | dB |

Test condition: $V_{CC}=3.3V$, $I_D=49mA$ Typ., OIP_3 Tone Spacing=1MHz, P_{out} per tone=6dBm $T_L=25^\circ C$, $Z_S=Z_L=50$

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50-4000MHz High Linearity 3V Gain Block Amplifier

60~80MHz Reference Application Circuit



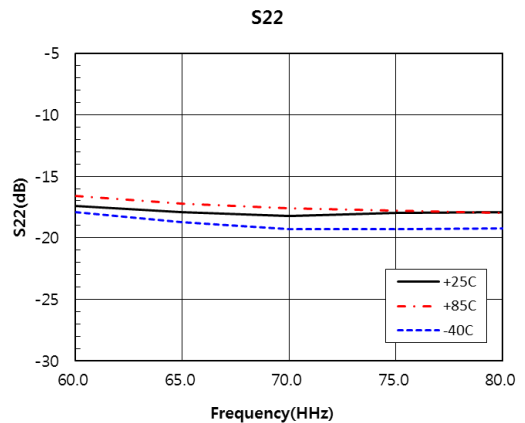
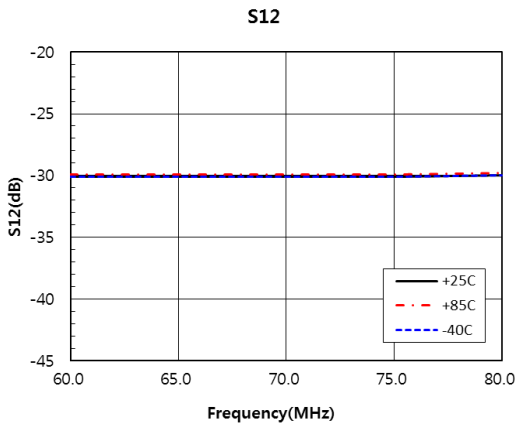
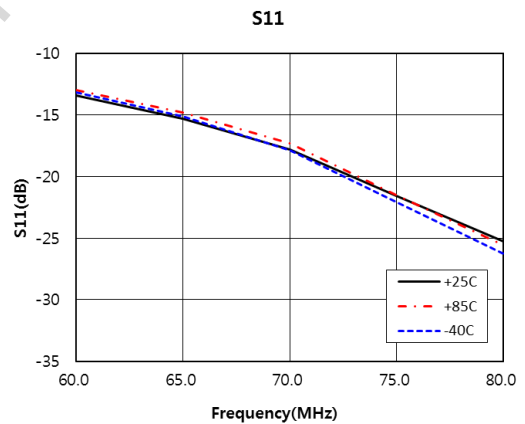
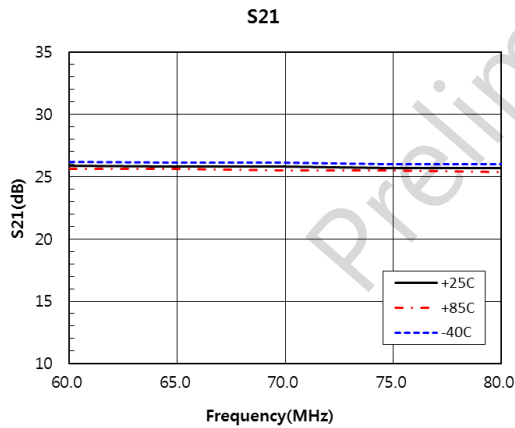
| BOM | Value | BOM | Value | BOM | Value |
|-----|--------|-----|--------|-----|-------|
| C1 | 8200pF | C4 | 100pF | L1 | 120nH |
| C2 | 10pF | C5 | 1000pF | L2 | 560nH |
| C3 | 8200pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

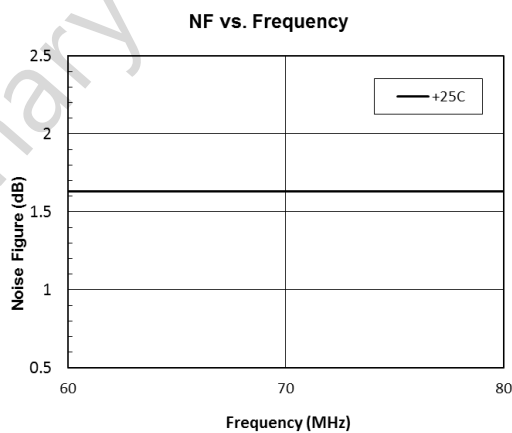
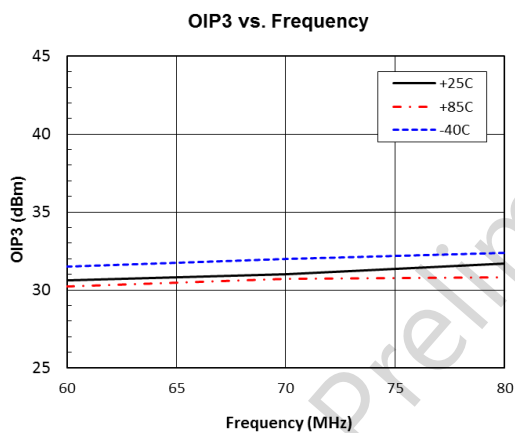
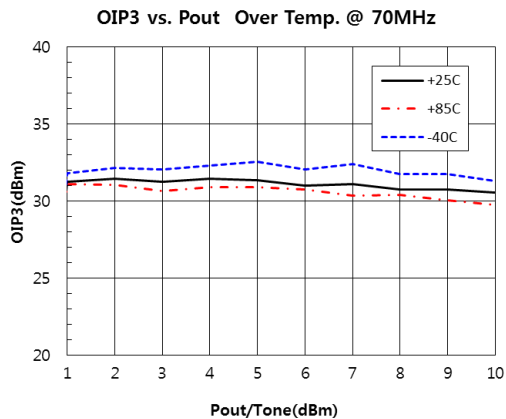
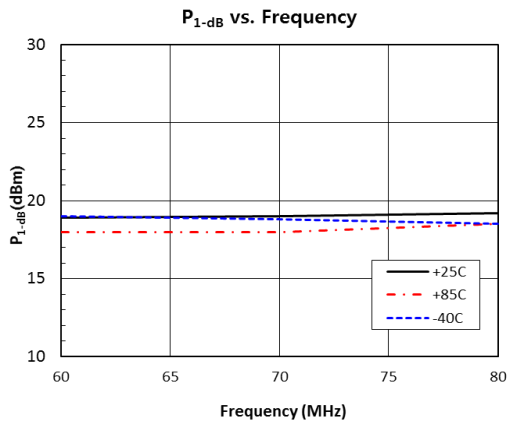
| Parameter/Freq.(MHz) | 60 | 70 | 80 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 25.9 | 25.8 | 25.7 | dB |
| S11 | -13.4 | -17.8 | -25.3 | dB |
| S22 | -17.4 | -18.2 | -17.9 | dB |
| Output P1dB | 18.9 | 19.0 | 19.2 | dBm |
| Output OIP3* | 30.6 | 31.0 | 31.7 | dBm |
| Noise Figure | 1.63 | 1.63 | 1.63 | dB |
| Ic _q | 51 | | | mA |
| Vcc | 3.3 | | | V |

* P_{out}=6dBm/tone

S-Parameter Over Temperature vs. Freq. at 60~80MHz

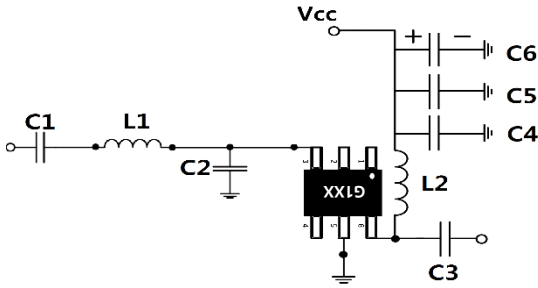


P1dB, OIP3 and Noise Figure Performance at 60~80MHz



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50-4000MHz
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140~150MHz Reference Application Circuit



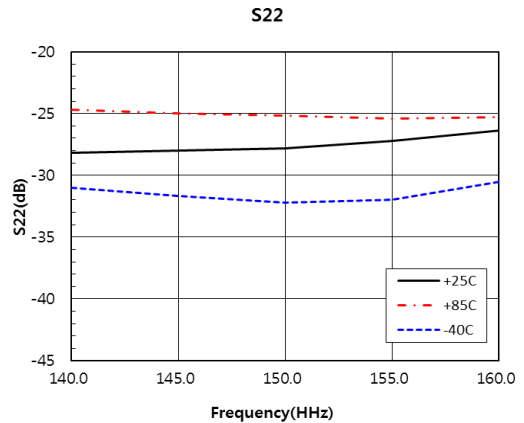
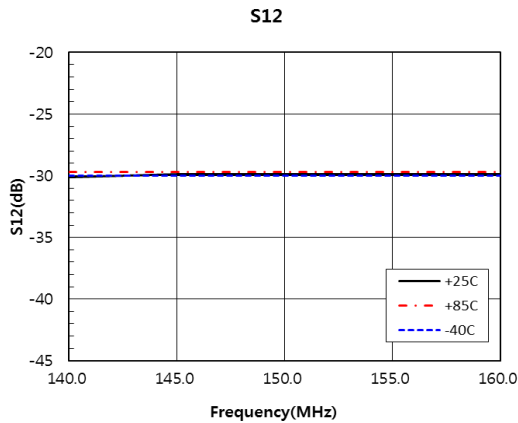
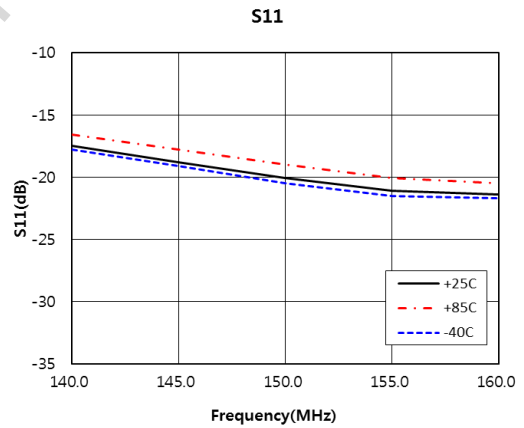
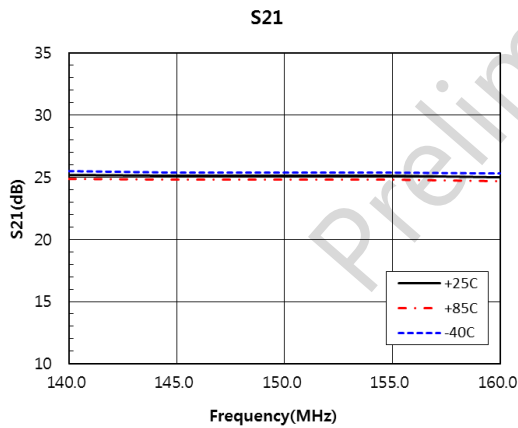
| BOM | Value | BOM | Value | BOM | Value |
|-----|--------|-----|--------|-----|-------|
| C1 | 8200pF | C4 | 100pF | L1 | 47nH |
| C2 | 6pF | C5 | 1000pF | L2 | 560nH |
| C3 | 8200pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

| Parameter/Freq.(MHz) | 140 | 150 | 160 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 25.2 | 25.1 | 25 | dB |
| S11 | -17.5 | -20.1 | -21.4 | dB |
| S22 | -28.2 | -27.8 | -26.4 | dB |
| Output P1dB | 18.7 | 18.8 | 18.9 | dBm |
| Output OIP3* | 30.8 | 31.2 | 61.4 | dBm |
| Noise Figure | 1.62 | 1.62 | 1.62 | dB |
| Ic _q | 51 | | | mA |
| Vcc | 3.3 | | | V |

* Pout=6dBm/tone

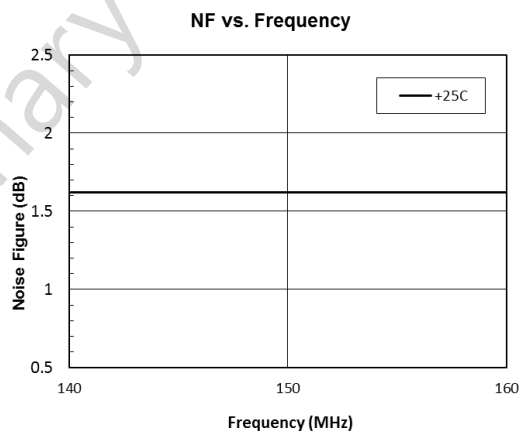
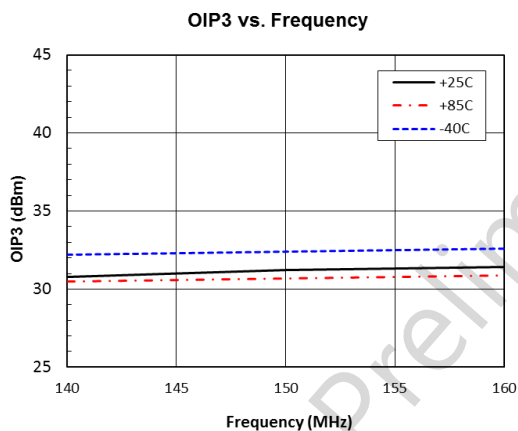
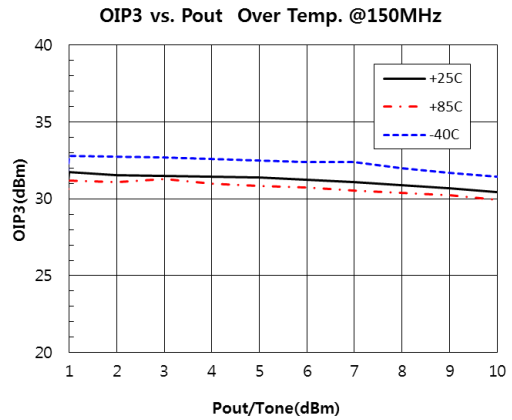
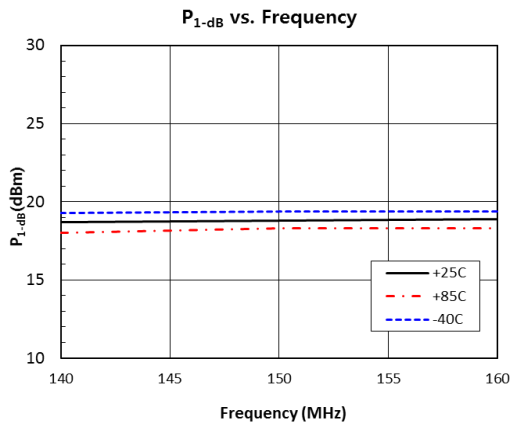
S-Parameter Over Temperature vs. Freq. at 140~150MHz



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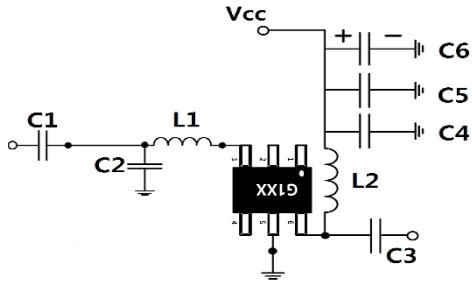


P1dB, OIP3 and Noise Figure Performance at 140~150MHz



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High Linearity 3V Gain Block Amplifier

600~800MHz Reference Application Circuit



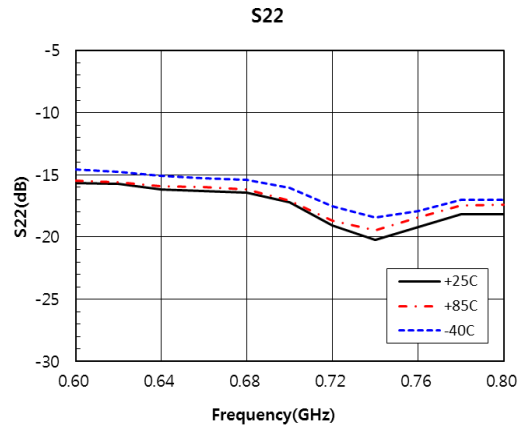
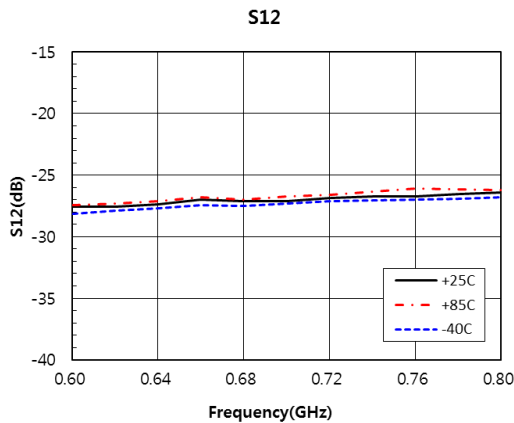
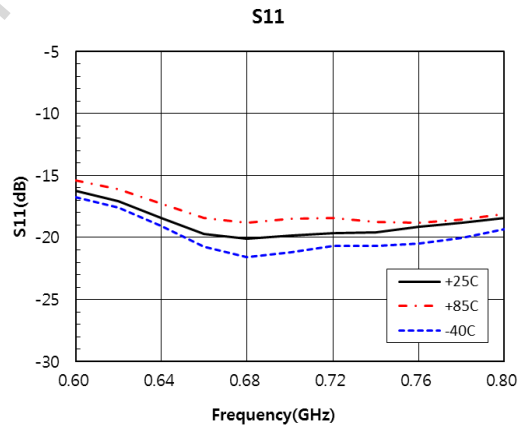
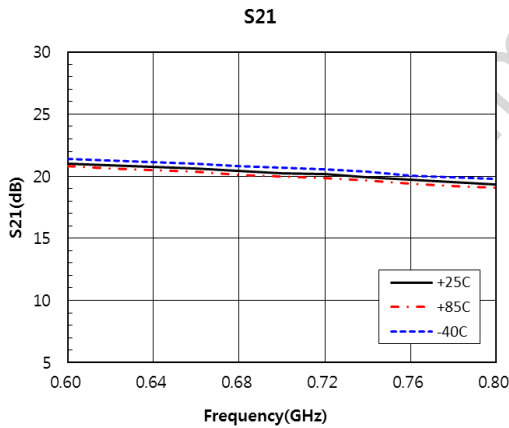
| BOM | Value | BOM | Value | BOM | Value |
|-----|-------|-----|--------|-----|-------|
| C1 | 100pF | C4 | 100pF | L1 | 10nH |
| C2 | 1.8pF | C5 | 1000pF | L2 | 56nH |
| C3 | 100pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

| Parameter/Freq.(MHz) | 600 | 700 | 800 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 21.0 | 20.2 | 19.3 | dB |
| S11 | -16.2 | -19.8 | -18.4 | dB |
| S22 | -15.6 | -17.2 | -18.1 | dB |
| Output P1dB | 19.0 | 19.8 | 19.9 | dBm |
| Output OIP3* | 31.6 | 32.7 | 33.1 | dBm |
| Noise Figure | 1.61 | 1.61 | 1.61 | dB |
| Icq | 49 | | | mA |
| Vcc | 3.3 | | | V |

* Pout=6dBm/tone

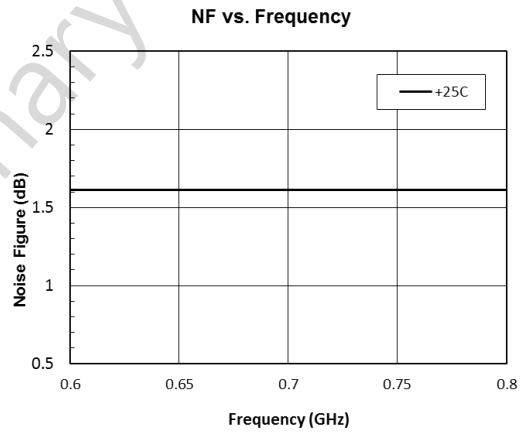
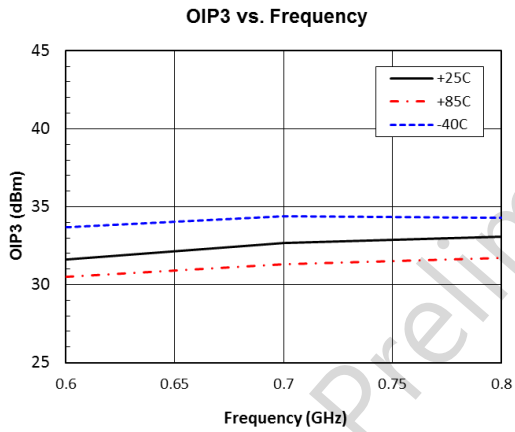
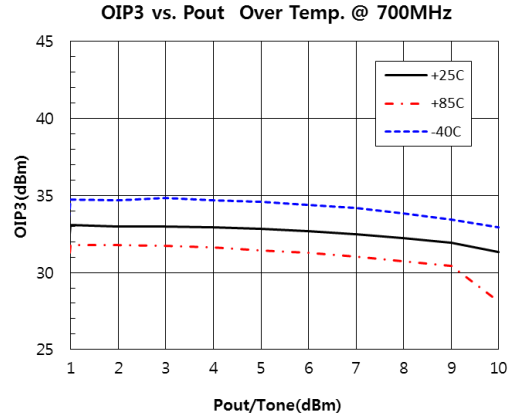
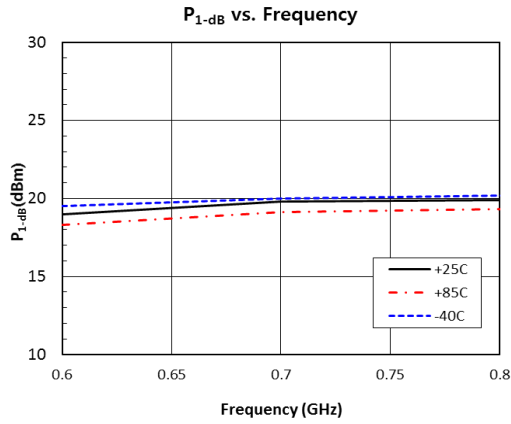
S-Parameter Over Temperature vs. Freq. at 600~800MHz



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High Linearity 3V Gain Block Amplifier



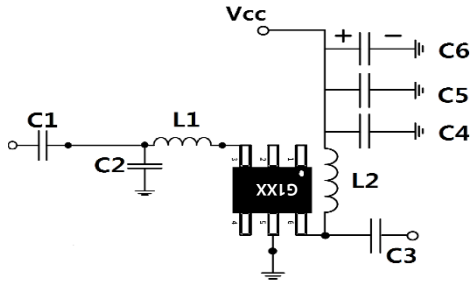
P1dB, OIP3 and Noise Figure Performance at 600~800MHz



RG511

50-4000MHz
High Linearity 3V Gain Block Amplifier

850~950MHz Reference Application Circuit



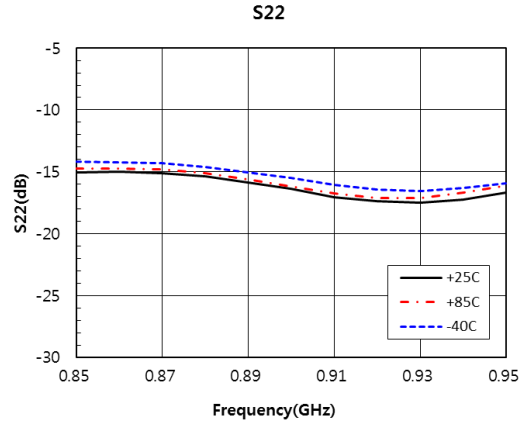
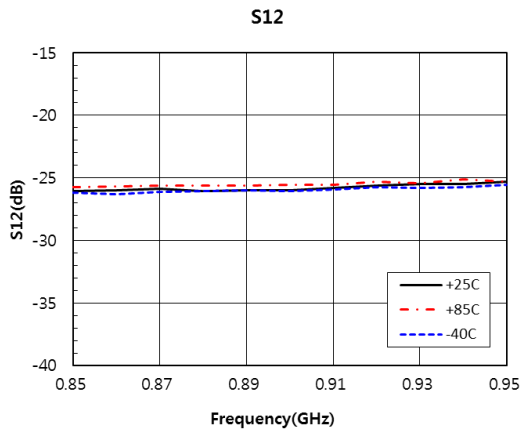
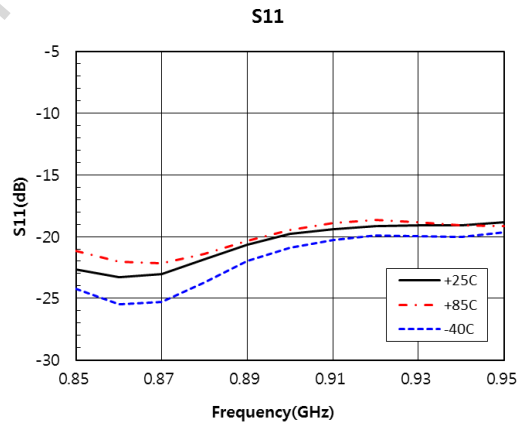
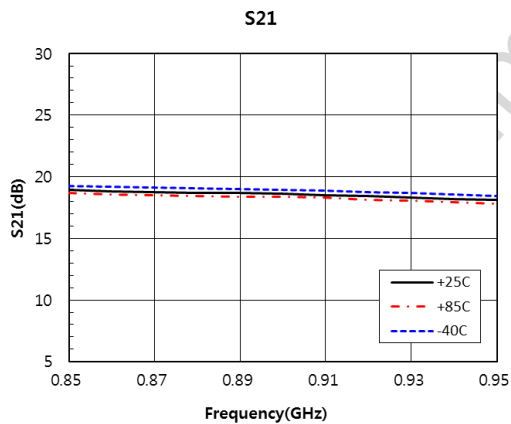
| BOM | Value | BOM | Value | BOM | Value |
|-----|-------|-----|--------|-----|-------|
| C1 | 100pF | C4 | 100pF | L1 | 8.2nH |
| C2 | 1.8pF | C5 | 1000pF | L2 | 39nH |
| C3 | 100pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

| Parameter/Freq.(MHz) | 850 | 900 | 950 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 19.3 | 19.0 | 18.1 | dB |
| S11 | -22.6 | -19.8 | -19.2 | dB |
| S22 | -15.0 | -16.3 | -16.6 | dB |
| Output P1dB | 19.5 | 20.0 | 19.9 | dBm |
| Output OIP3* | 32.5 | 33.5 | 32.8 | dBm |
| Noise Figure | 1.60 | 1.60 | 1.60 | dB |
| Ic _q | 49 | | | mA |
| Vcc | 3.3 | | | V |

* P_{out}=6dBm/tone

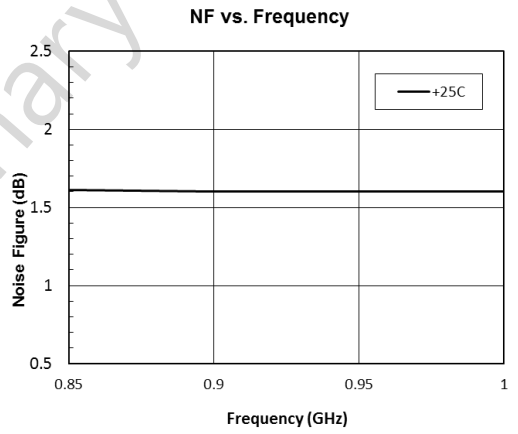
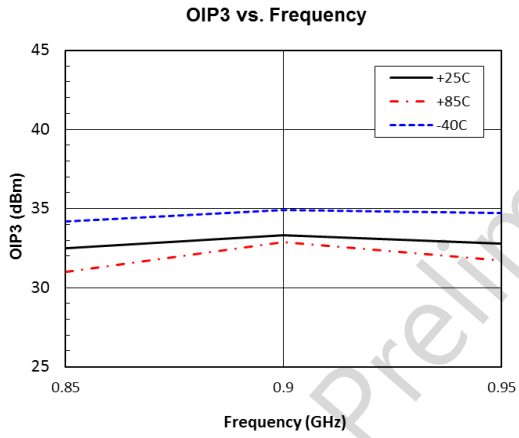
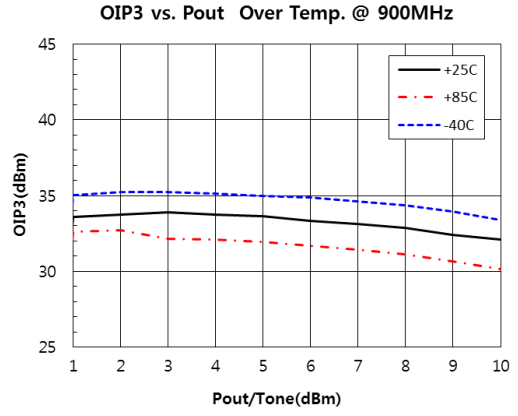
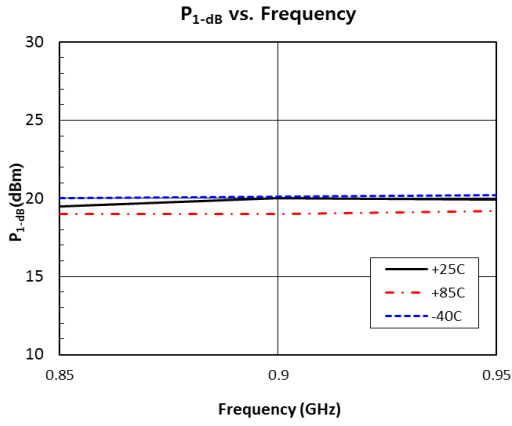
S-Parameter Over Temperature vs. Freq. at 850~950MHz



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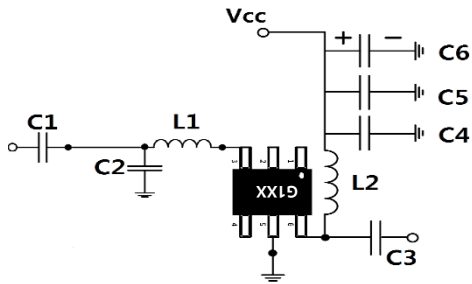


P1dB, OIP3 and Noise Figure Performance at 850~950MHz



RG511
50-4000MHz
High Linearity 3V Gain Block Amplifier

1800~2200MHz Reference Application Circuit



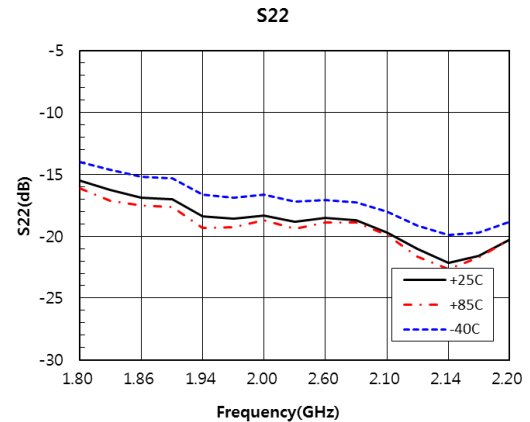
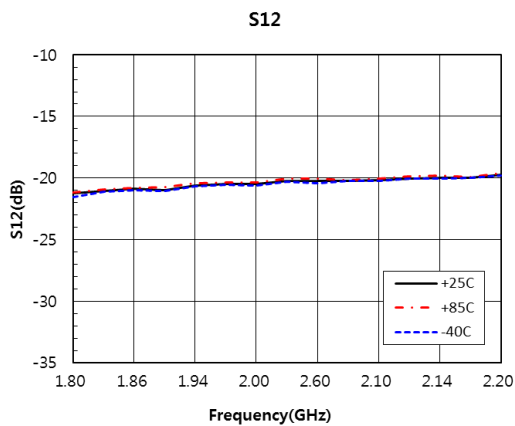
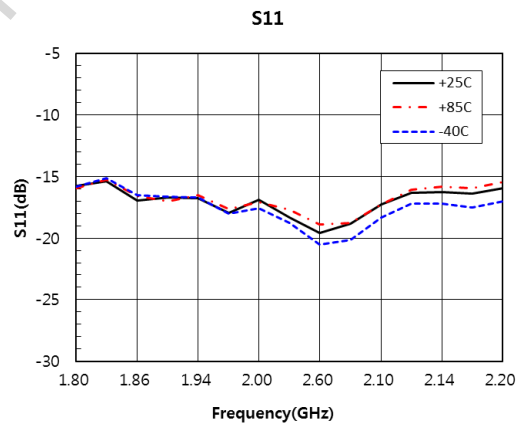
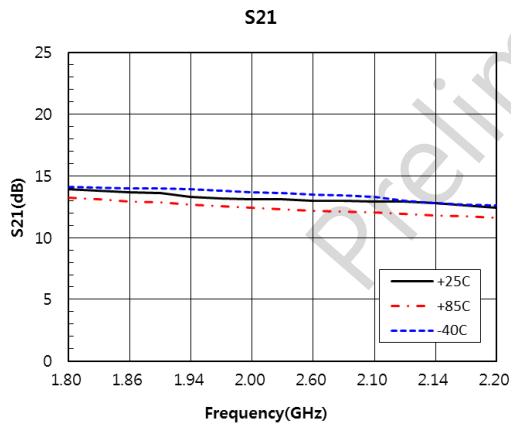
| BOM | Value | BOM | Value | BOM | Value |
|-----|-------|-----|--------|-----|-------|
| C1 | 100pF | C4 | 100pF | L1 | 1.5nH |
| C2 | 1pF | C5 | 1000pF | L2 | 8.2nH |
| C3 | 100pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

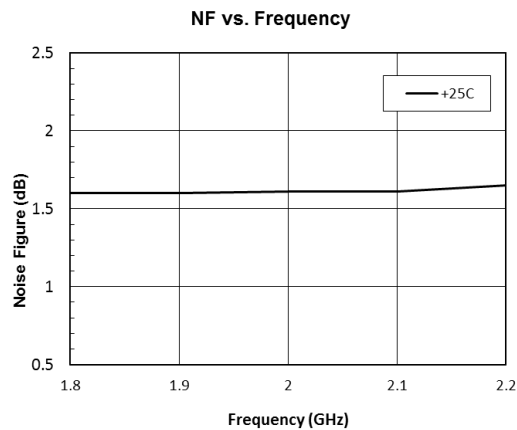
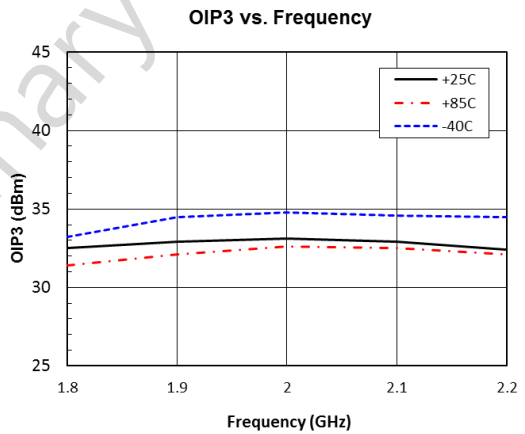
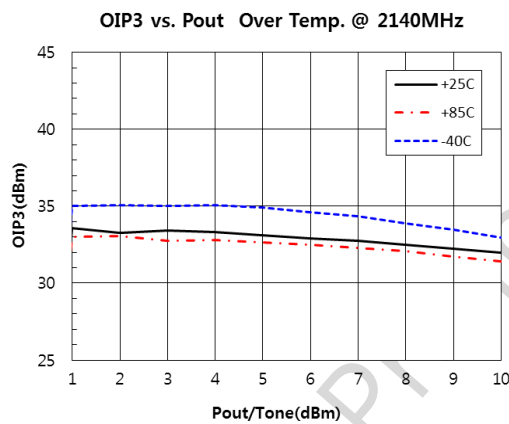
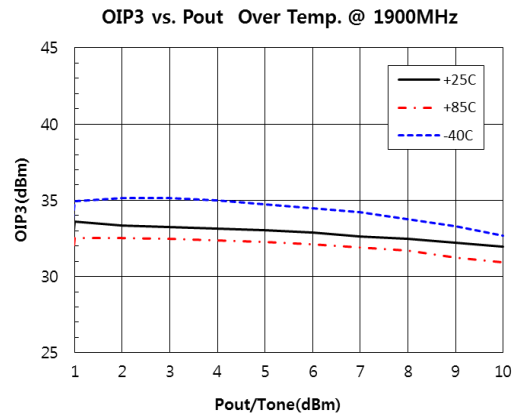
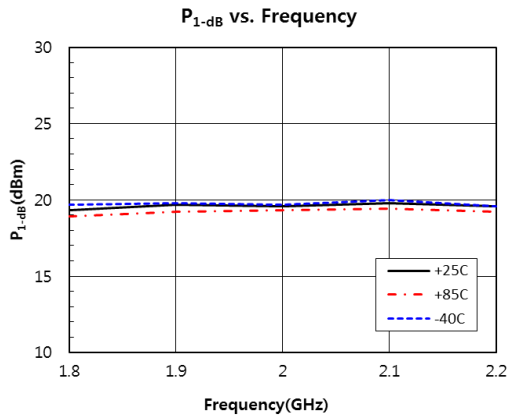
| Parameter/Freq.(MHz) | 1800 | 1900 | 2140 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 13.9 | 13.6 | 12.8 | dB |
| S11 | -15.7 | -16.7 | -16.8 | dB |
| S22 | -15.5 | -16.9 | -22.1 | dB |
| Output P1dB | 19.3 | 19.7 | 19.8 | dBm |
| Output OIP3* | 32.7 | 33.1 | 33.3 | dBm |
| Noise Figure | 1.60 | 1.60 | 1.61 | dB |
| Ic _q | 50 | | | mA |
| Vcc | 3.3 | | | V |

* P_{out}=6dBm/tone

S-Parameter Over Temperature vs. Freq. at 1800~2200MHz

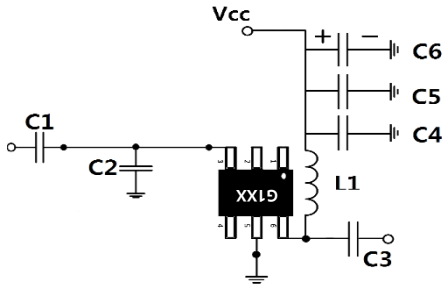


P1dB, OIP3 and Noise Figure Performance at 1800~2200MHz



RG511
50-4000MHz
High Linearity 3V Gain Block Amplifier

2300~2700MHz Reference Application Circuit



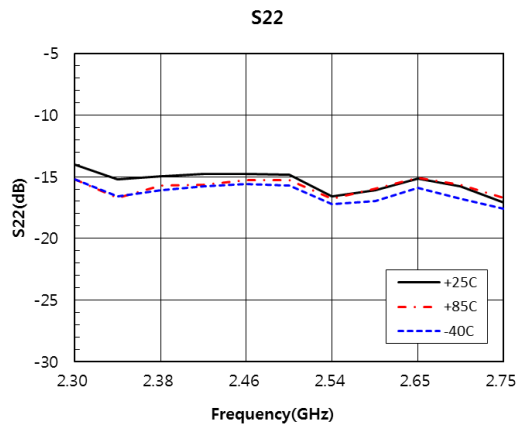
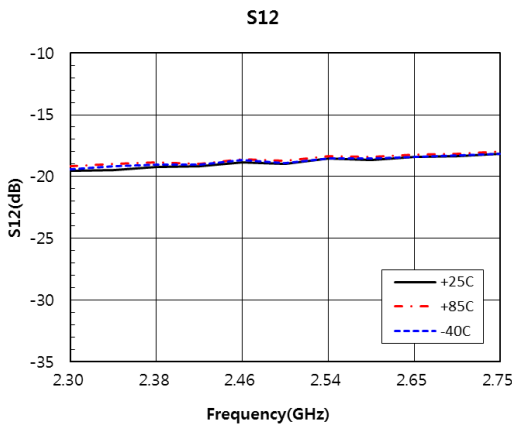
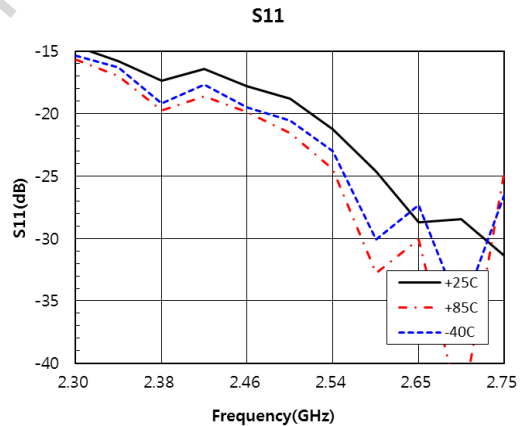
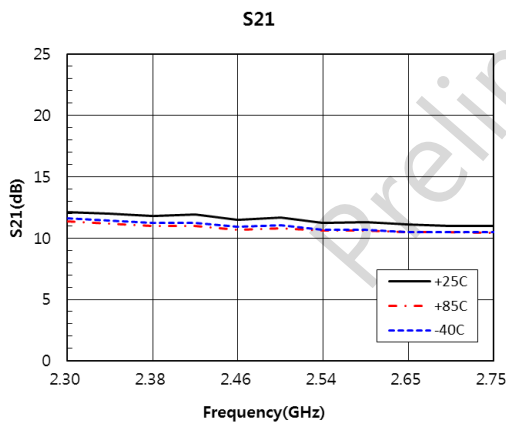
| BOM | Value | BOM | Value | BOM | Value |
|-----|-------|-----|--------|-----|-------|
| C1 | 100pF | C4 | 100pF | L1 | 47nH |
| C2 | 1.0pF | C5 | 1000pF | | |
| C3 | 100pF | C6 | 10uF | | |

*Width and Length of Micro-strip line dimension in mm[mil]

| Parameter/Freq.(MHz) | 2300 | 2650 | 2750 | Unit |
|----------------------|-------|-------|-------|------|
| Small Signal Gain | 12.4 | 11.3 | 11.0 | dB |
| S11 | -14.5 | -28.7 | -31.4 | dB |
| S22 | -19.5 | -18.4 | -18.1 | dB |
| Output P1dB | 19.6 | 19.7 | 19.9 | dBm |
| Output OIP3* | 32.6 | 31.7 | 31.0 | dBm |
| Noise Figure | 1.69 | 1.70 | 1.71 | dB |
| Ic _q | 51 | | | mA |
| Vcc | 3.3 | | | V |

* P_{out}=6dBm/tone

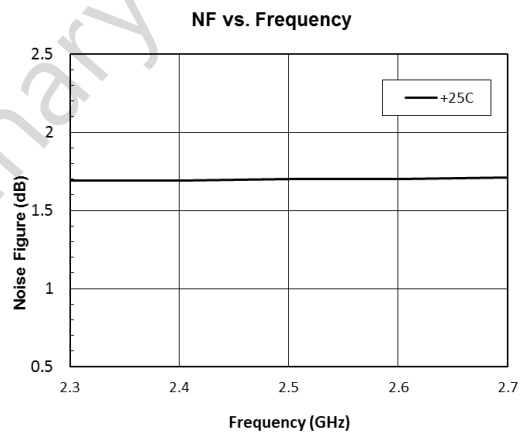
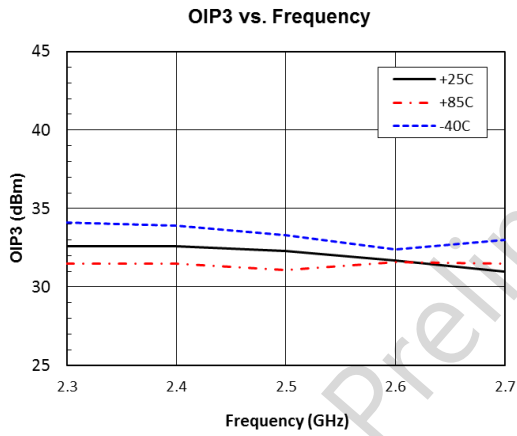
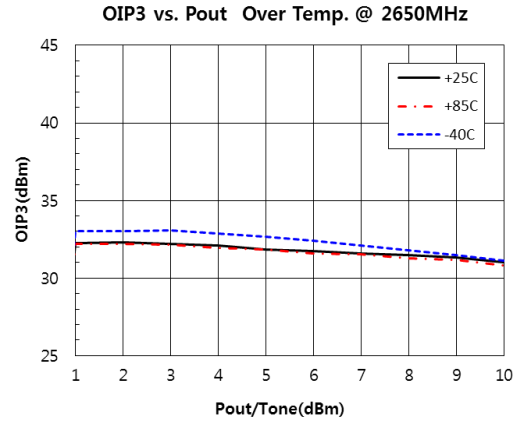
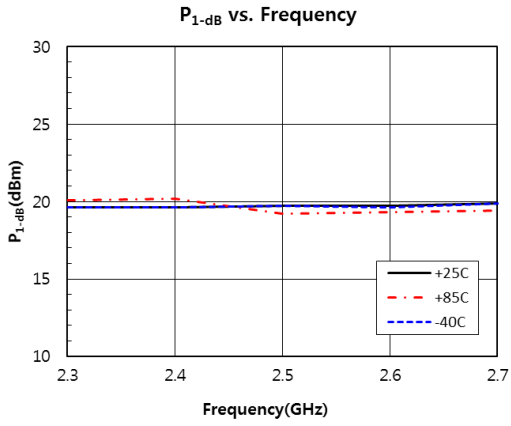
S-Parameter Over Temperature vs. Freq. at 2300~2700MHz



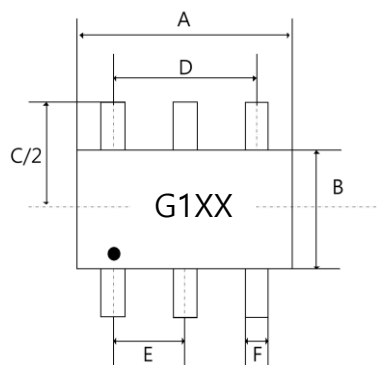
RG511
50-4000MHz
High Linearity 3V Gain Block Amplifier



P1dB, OIP3 and Noise Figure Performance at 2300~2700MHz

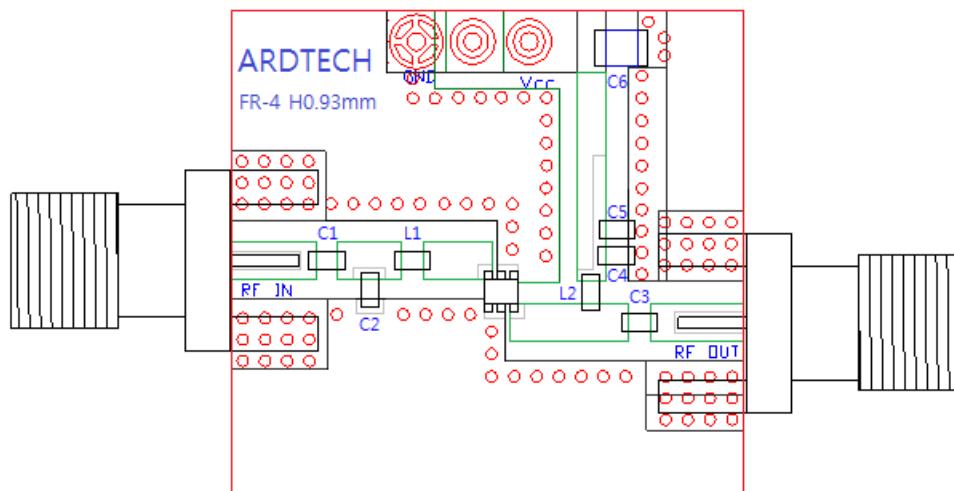


Package Mark and Dimensions



| Symbol | DIMENSIONS MILLIMETER | | | DIMENSIONS INCH | | |
|--------|-----------------------|------|------|-----------------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.90 | 2.10 | 2.15 | 0.074 | 0.082 | 0.084 |
| B | 1.15 | 1.25 | 1.35 | 0.045 | 0.050 | 0.055 |
| C | 2.00 | 2.10 | 2.20 | 0.078 | 0.082 | 0.086 |
| D | 1.3 | | | 0.0512 | | |
| E | 0.65 | | | 0.0255 | | |
| F | 0.15 | - | 0.30 | 0.006 | - | 0.012 |

Evaluation PCB Layout



| PCB Substrate Information[mm] | |
|-------------------------------|-------------|
| Dielectric Constant | FR-4/4.6 |
| Dielectric Height | 0.037[0.93] |
| Copper Thickness | 1 oz. |