Voltage Variable RF Attenuator

**GENERAL DESCRIPTION**

The F2255 is a low insertion loss Voltage Variable RF Attenuator (VVA) designed for a multitude of wireless and other RF applications. This device covers a broad frequency range from 1MHz to 3000MHz. In addition to providing low insertion loss, the F2255 provides excellent linearity performance over its entire voltage control and attenuation range.

The F2255 uses a single positive supply voltage of 3.15V to 5.25V. Other features include the VMODE pin allowing either positive or negative voltage control slope vs attenuation and multi-directional operation meaning the RF input can be applied to either RF1 or RF2 pins. Control voltage ranges from 0V to 3.6V using either positive or negative control voltage slope.

**COMPETITIVE ADVANTAGE**

The F2255 provides extremely low insertion loss and superb IIP3, IIP2, Return Loss and Slope Linearity across the control range. Comparing to competitive VVAs this device is better as follows:

- Operation down to 1MHz
- Insertion Loss @ 500MHz: 1.1dB
- Maximum Attenuation Slope: 33dB/Volt
- Minimum Output IIP3: 35dBm
- Minimum Input IIP2: 74dBm
- High Operating Temperature: +105°C

**APPLICATIONS**

- Base Station 2G, 3G, 4G
- Portable Wireless
- Repeaters and E911 systems
- Digital Pre-Distortion
- Point to Point Infrastructure
- Public Safety Infrastructure
- Satellite Receivers and Modems
- WiMAX Receivers and Transmitters
- Military Radios covering HF, VHF, UHF
- RFID handheld and portable readers
- Cable Infrastructure
- Wireless LAN
- Test / ATE Equipment

**FEATURES**

- Low Insertion Loss: 1.1dB @ 500MHz
- Typical / Min IIP3:  60dBm / 46dBm
- Typical / Min IIP2:  98dBm / 74dBm
- 33dB Attenuation Range
- Bi-directional RF ports
- +36dBm Input P1dB compression
- VMODE pin allows either positive or negative control response
- Linear-in-dB attenuation characteristic
- Supply voltage: 3.15V to 5.25V
- $V_{CTRL}$ range: 0V to 3.6V using 5V supply
- +105°C max operating temperature
- 3mm x 3mm, 16-pin QFN package

**DEVICE BLOCK DIAGRAM**

**ORDERING INFORMATION**

**PART# MATRIX**

<table>
<thead>
<tr>
<th>Part#</th>
<th>RF Freq Range (MHz)</th>
<th>Insertion Loss (dB)</th>
<th>IIP3 (dBm)</th>
<th>Pinout Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2250</td>
<td>50 - 6000</td>
<td>1.4 (at 2GHz)</td>
<td>+65</td>
<td>RFMD</td>
</tr>
<tr>
<td>F2255</td>
<td>1 - 3000</td>
<td>1.1 (at 500MHz)</td>
<td>+60</td>
<td></td>
</tr>
<tr>
<td>F2258</td>
<td>50 - 6000</td>
<td>1.4 (at 2GHz)</td>
<td>+65</td>
<td>Hittite</td>
</tr>
</tbody>
</table>
**Voltage Variable RF Attenuator**  
1MHz to 3000MHz

**ABSOLUTE MAXIMUM RATINGS**

<table>
<thead>
<tr>
<th>Parameter / Condition</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{DD} ) to GND</td>
<td>( V_{DD} )</td>
<td>-0.3</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>( V_{MODE} ) to GND</td>
<td>( V_{MODE} )</td>
<td>-0.3</td>
<td>Minimum ( ( V_{DD} ), 3.9 )</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CTRL} ) to GND</td>
<td>( V_{CTRL} )</td>
<td>-0.3</td>
<td>Minimum ( ( V_{DD} ), 4.0 )</td>
<td>V</td>
</tr>
<tr>
<td>RF1, RF2 to GND</td>
<td>( V_{RF} )</td>
<td>-0.3</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td>RF1 or RF2 Input Power applied for 24 hours maximum (( V_{DD} ) applied @ 2GHz and ( T_{C} )=+85°C)</td>
<td>( P_{MAX24} )</td>
<td>30</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>RF1 or RF2 Continuous Operating Power</td>
<td>( P_{MAX_OP} )</td>
<td>See Figure 1</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>( T_{J_MAX} )</td>
<td>+150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>( T_{ST} )</td>
<td>-65</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>Lead Temperature (soldering, 10s)</td>
<td>( T_{LEAD} )</td>
<td>+260</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>ESD Voltage – HBM (Per ESD STM5.1-2007)</td>
<td>( V_{ESDHBM} )</td>
<td></td>
<td></td>
<td>Class 2</td>
</tr>
<tr>
<td>ESD Voltage – CDM (Per ESD STM5.3.1-2009)</td>
<td>( V_{ESDCDM} )</td>
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<td></td>
<td>Class C3</td>
</tr>
</tbody>
</table>

**Figure 1:** Maximum Operating RF Input Powers vs. RF Frequency

Stresses above those listed above may cause permanent damage to the device. Functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**PACKAGE THERMAL AND MOISTURE CHARACTERISTICS**

\( \theta_{JA} \) (Junction – Ambient)  
80.6°C/W

\( \theta_{JC} \) (Junction – Case) The Case is defined as the exposed paddle  
5.1°C/W

Moisture Sensitivity Rating (Per J-STD-020)  
MSL 1
# F2255 OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Operating Frequency Range</td>
<td>$F_{RF}$</td>
<td></td>
<td>1</td>
<td></td>
<td>3000</td>
<td>MHz</td>
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<tr>
<td>Supply Voltage</td>
<td>$V_{DD}$</td>
<td></td>
<td>3.15</td>
<td>5.25</td>
<td></td>
<td>V</td>
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<tr>
<td>$V_{MODE}$ Logic</td>
<td>$V_{IH}$</td>
<td>$V_{DD} &gt; 3.9V$</td>
<td>1.17</td>
<td></td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>$V_{IL}$</td>
<td>$V_{DD} = 3.15$ to 3.9V</td>
<td>1.17</td>
<td></td>
<td>$V_{DD} - 0.3V$</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DD} = 3.15$ to 3.9V</td>
<td>1.17</td>
<td></td>
<td>$V_{DD} - 0.3V$</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CTRL}$ Range</td>
<td>$V_{CTRL}$</td>
<td></td>
<td>0</td>
<td>3.6</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Supply Current</td>
<td>$I_{DD}$</td>
<td>$V_{DD} = 3.9$ to 5.25V</td>
<td>0</td>
<td>3.6</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DD} = 3.15$ to 3.9V</td>
<td>0</td>
<td>3.6</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Logic Current</td>
<td>$I_{MODE}$</td>
<td></td>
<td>-1.0</td>
<td></td>
<td>38</td>
<td>μA</td>
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<tr>
<td>ICTRL Current</td>
<td>$I_{CTRL}$</td>
<td></td>
<td>-1.0</td>
<td></td>
<td>14</td>
<td>μA</td>
</tr>
<tr>
<td>RF Operating Power $^3$</td>
<td>$P_{MAXCW}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>RF1 Port Impedance</td>
<td>$Z_{RF1}$</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>RF2 Port Impedance</td>
<td>$Z_{RF2}$</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>$T_{CASE}$</td>
<td>Exposed Paddle Temperature</td>
<td>-40</td>
<td></td>
<td>+105</td>
<td>°C</td>
</tr>
</tbody>
</table>

**Operating Conditions Notes:**
1 - Items in min/max columns in **bold italics** are Guaranteed by Test.
2 - Items in min/max columns that are not bold/italics are Guaranteed by Design Characterization.
3 - Refer to the Maximum Operating RF Input Power vs. RF Frequency curves in Figure 1.
## F2255 Specifications

Refer to EVKit / Applications Circuit, \( V_{DD} = +3.3V \), \( T_C = +25^\circ C \), signals applied to RF1 input, \( f_{RF} = 500MHz \), minimum attenuation, \( P_{IN} = 0dBm \) for small signal parameters, +20dBm for single tone linearity tests, +20dBm per tone for two tone tests, two tone delta frequency = 80MHz, PCB board traces and connector losses are de-embedded unless otherwise noted. Refer to Typical Operating Curves for performance over entire frequency band.

### Parameter | Symbol | Condition | Min | Typ | Max | Units
--- | --- | --- | --- | --- | --- | ---
Insertion Loss, IL | A_{MIN} | Minimum Attenuation | 1.1 | 1.7\(^1\) | dB
Maximum attenuation | A_{MAX} | | 33 | 34.6 | dB
Insertion Phase Δ | \( \Phi_{\Delta \text{MAX}} \) | At 36dB attenuation relative to Insertion Loss | 27 | | deg
| \( \Phi_{\Delta \text{MID}} \) | At 18dB attenuation relative to Insertion Loss | 8 | | |
Input 1dB Compression \(^3\) | P1dB | | 36 | | dBm
Minimum RF1 Return Loss over control voltage range | S11 | 20MHz | 23 | | dB
| | 500MHz | 22 | | |
| | 2000MHz | 23 | | |
| | 3000MHz | 30 | | |
Minimum RF2 Return Loss over control voltage range | S22 | 20MHz | 23 | | dB
| | 500MHz | 22 | | |
| | 2000MHz | 23 | | |
| | 3000MHz | 24 | | |
Input IP3 | IIP3 | | 60 | | dBm
Input IP3 over Attenuation | IIP3_{ATTEN} | All attenuation settings | 44\(^2\) | 46 | dBm
Minimum Output IP3 | OIP3_{MIN} | Maximum attenuation | 35 | | |
Input IP2 | IIP2 | PIN + IM2_{DBC}, IM2 term is F1+F2 | 98 | | dBm
Minimum Input IP2 | IIP2_{MIN} | All attenuation settings | 74 | | dBm
Input IH2 | HD2 | PIN + H2_{DBC} | 82 | | dBm
Input IH3 | HD3 | PIN + (H3_{DBC}/2) | 49 | | dBm
Settling Time | T_{SETTL0.1dB} | Any 1dB step in the 0dB to 33dB control range 50% V_{CTRL} to RF settled to within ± 0.1dB | 15 | | μSec

### Specification Notes:
1 - Items in min/max columns in **bold italics** are Guaranteed by Test.
2 - Items in min/max columns that are not bold/italics are Guaranteed by Design Characterization.
3 - The input 1dB compression point is a linearity figure of merit. Refer to Absolute Maximum Ratings section along with Figure 1 for the maximum RF input power vs. RF frequency.
Typical Operating Curves

Unless otherwise noted, the following conditions apply:

- \( V_{DD} = +3.3V \) or \(+5.0V\)
- \( T_C = +25\degree C \)
- \( V_{MODE} = 0V \)
- RF trace and connector losses are de-embedded for S-parameters
- Pin = 0dBm for all small signal tests
- Pin = +20dBm for single tone linearity tests (RF1 port driven)
- Pin = +20dBm/tone for two tone linearity tests (RF1 port driven)
- Two tone frequency spacing = 80MHz
Typical Operating Conditions [S2P Broadband Performance] (-1-)

Attenuation vs. \text{V}_{CTRL}

![Attenuation vs. VCTRL](image)

Attenuation vs. Frequency

![Attenuation vs. Frequency](image)

Attenuation Delta to 25C vs. \text{V}_{CTRL}

![Attenuation Delta to 25C vs. VCTRL](image)
Voltage Variable RF Attenuator  1MHz to 3000MHz

TYPICAL OPERATING CURVES [S2P vs. VCTRL] (-2-)
Voltage Variable RF Attenuator
1MHz to 3000MHz

**Typical Operating Conditions [S2P vs. Attenuation & Temperature]** (-4-)

**RF1 Return Loss vs. Attenuation**

- RF1 Return Loss vs. Attenuation
- RF2 Return Loss vs. Attenuation
- Insertion Phase $\Delta$ vs. Attenuation

**RF2 Return Loss vs. Attenuation**

- RF1 Return Loss vs. Attenuation
- RF2 Return Loss vs. Attenuation
- Insertion Phase $\Delta$ vs. Attenuation

**Insertion Phase $\Delta$ vs. Attenuation**

- Insertion Phase $\Delta$ vs. Attenuation

- (positive phase = electrically shorter)
Voltage Variable RF Attenuator

1MHz to 3000MHz

**Typical Operating Conditions [S2P vs. Frequency]** (-5-)

1. **Min. & Max. Attenuation vs. Frequency**
   - Graph showing Min. & Max. Attenuation vs. Frequency with different temperature conditions.
2. **Worst-Case RF1 Return Loss vs. Frequency**
   - Graph showing Worst-Case RF1 Return Loss vs. Frequency with different temperature conditions.
3. **Max. Insertion Phase \( \Delta \) vs. Frequency**
   - Graph showing Max. Insertion Phase \( \Delta \) vs. Frequency with different temperature conditions.
4. **Gain Compression vs. Frequency**
   - Graph showing Gain Compression vs. Frequency with different RF Input Power levels.

**Note:**
- Frequency (MHz)
- VCTRL varied from 0.8V to 1.7V
- Gain Compression (dB)
- RF Input Power (dBm)
Typical Operating Conditions [S2P @ Low Frequency, Group Delay] (-6-)

Min. & Max. Attenuation vs. Low Frequency

Low-Frequency RF1 Return Loss vs. VCTRL

Low-Frequency RF2 Return Loss vs. VCTRL

Group Delay vs. Frequency
**Typical Operating Conditions 500MHz, V_{DD}=3.3V [IP3, IP2, IH2, IH3 vs. V_{CTRL}, V_{MODE}] (-7-)**

### Input IP3 vs. V_{CTRL}

![Graph showing Input IP3 vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

### Output IP3 vs. V_{CTRL}

![Graph showing Output IP3 vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

### Input IP2 vs. V_{CTRL}

![Graph showing Input IP2 vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

### Output IP2 vs. V_{CTRL}

![Graph showing Output IP2 vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

### 2nd Harm Input Intercept Point vs. V_{CTRL}

![Graph showing 2nd Harm Input Intercept Point vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

### 3rd Harm Input Intercept Point vs. V_{CTRL}

![Graph showing 3rd Harm Input Intercept Point vs. V_{CTRL} for different temperatures and V_{MODE} settings.]

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May 7, 2021
TYPICAL OPERATING CONDITIONS 500MHz, VDD=3.3V [IPX, IHX vs. VCTRL, RF1/RF2 Driven] (-8-)
Typical Operating Conditions 500MHz, $V_{DD}=3.3V$ [IP3, IP2, IH2, IH3 vs. Attenuation] (-9-)

Input IP3 vs. Attenuation

Output IP3 vs. Attenuation

Input IP2 vs. Attenuation

Output IP2 vs. Attenuation

2nd Harm Input Intercept Point vs. Attenuation

3rd Harm Input Intercept Point vs. Attenuation
**TYPICAL OPERATING CONDITIONS 500MHz, \( V_{DD}=3.3V \) \([\mathbf{IPx, IHx vs. ATTEN, RF1/ RF2 Driven}]\ (-10-)\)**

**Input IP3 vs. Attenuation**

![Input IP3 vs. Attenuation Graph]

**Output IP3 vs. Attenuation**

![Output IP3 vs. Attenuation Graph]

**Input IP2 vs. Attenuation**

![Input IP2 vs. Attenuation Graph]

**Output IP2 vs. Attenuation**

![Output IP2 vs. Attenuation Graph]

**2nd Harm Input Intercept Point vs. Attenuation**

![2nd Harm Input Intercept Point vs. Attenuation Graph]

**3rd Harm Input Intercept Point vs. Attenuation**

![3rd Harm Input Intercept Point vs. Attenuation Graph]
**PACKAGE OUTLINE DRAWING**

The package outline drawings are located at the end of this document and are accessible from the Renesas website (see also 16-VFQFPN). The package information is the most current data available and is subject to change without revision of this document.

**PINOUT & BLOCK DIAGRAM**

![Pinout & Block Diagram](image-url)
## Pin Description

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 7, 12</td>
<td>GND</td>
<td>Ground these pins as close to the device as possible.</td>
</tr>
<tr>
<td>2, 4, 9, 11, 13</td>
<td>NC</td>
<td>No internal connection. Renesas recommends connecting these pins to GND.</td>
</tr>
<tr>
<td>3</td>
<td>RF1</td>
<td>RF Port 1. Matched to 50 ohms. Must use an external AC coupling capacitor as close to the device as possible. For low frequency operation increase the capacitor value to result in a low reactance at the frequency of interest.</td>
</tr>
<tr>
<td>5, 6, 8</td>
<td>RTN</td>
<td>Attenuator Ground Return. Each of these pins require a capacitor to GND to provide an RF return path. Place the capacitor as close to the device as possible.</td>
</tr>
<tr>
<td>10</td>
<td>RF2</td>
<td>RF Port 2. Matched to 50 ohms. Must use an external AC coupling capacitor as close to the device as possible. For low frequency operation increase the capacitor value to result in a low reactance at the frequency of interest.</td>
</tr>
<tr>
<td>14</td>
<td>$V_{CTRL}$</td>
<td>Attenuator control voltage. Apply a voltage in the range as specified in the Operating Conditions Table. See application section for details about $V_{CTRL}$.</td>
</tr>
<tr>
<td>15</td>
<td>$V_{DD}$</td>
<td>Power supply input. Bypass to GND with capacitors close as possible to pin.</td>
</tr>
<tr>
<td>16</td>
<td>$V_{MODE}$</td>
<td>Attenuator slope control. Set to logic LOW to enable negative attenuation slope. Set to logic HIGH to enable positive attenuation slope.</td>
</tr>
<tr>
<td>— EP</td>
<td>Exposed Pad. Internally connected to GND. Solder this exposed pad to a PCB pad that uses multiple ground vias to achieve the specified RF performance.</td>
<td></td>
</tr>
</tbody>
</table>
APPLICATIONS INFORMATION

Default Start-up

V\text{MODE} must be tied to either GND or Logic High. If the V\text{CTRL} pin is left floating, the part will power up in the minimum attenuation state when V\text{MODE} = GND, or the maximum attenuation state when V\text{MODE} = High.

V\text{CTRL}

The voltage level on the V\text{CTRL} pin is used to control the attenuation of the F2255. At V\text{CTRL} =0V, the attenuation is a minimum (maximum) in the negative (positive) slope mode. An increasing (decreasing) voltage on V\text{CTRL} produces an increasing (decreasing) attenuation respectively. The V\text{CTRL} pin has an on-chip pull-up ESD diode so V\text{DD} should be applied before V\text{CTRL} is applied (see Recommended Operating Conditions for details). If this sequencing is not possible, then resistor R2 in the application circuit should be set to 1kΩ to limit the current into the V\text{CTRL} pin.

V\text{MODE}

The V\text{MODE} pin is used to set the slope of the attenuation. The attenuation is varied by V\text{CTRL} as described in the next section. Setting V\text{MODE} to a logic LOW (HIGH) will set the attenuation slope to negative (positive). A negative (positive) slope is defined as an increased (decreased) attenuation with increasing V\text{CTRL} voltage. The Evaluation Kit provides an on-board jumper to manually set the V\text{MODE}. Install a jumper on header J2 from V\text{MODE} to the pin marked Lo (Hi) to set the device for a negative (positive) slope (see application circuit).

RF1 and RF2 Ports

The F2255 is a bi-directional device, allowing RF1 or RF2 to be used as the RF input. RF1 has some enhanced linearity performance, and therefore should be used as the RF input, when possible, for best results. The F2255 has been designed to accept high RF input power levels; therefore, V\text{DD} must be applied prior to the application of RF power to ensure reliability. DC blocking capacitors are required on the RF pins and should be set to a value that results in a low reactance over the frequency range of interest.

Power Supplies

The supply pin should be bypassed with external capacitors to minimize noise and fast transients. Supply noise can degrade noise figure and fast transients can trigger ESD clamps and cause them to fail. Supply voltage change or transients should have a slew rate smaller than 1V/20uS. In addition, all control pins should remain at 0V (+/-0.3V) while the supply voltage ramps or while it returns to zero.
Control Pin Interface

If control signal integrity is a concern and clean signals cannot be guaranteed due to overshoot, undershoot, ringing, etc., the following circuit at the input of control pins 14 and 16 is recommended as shown below.
Voltage Variable RF Attenuator

EVKIT / APPLICATIONS CIRCUIT
Short GND pin to VMODE pin to set for negative attenuation slope. For positive attenuation slope move shorting shunt from VMODE to VHI.
Voltage Variable RF Attenuator

EVKit Picture / Layout (Bottom View)
Voltage Variable RF Attenuator

EVKit BOM

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C4, C5</td>
<td>3</td>
<td>10nF ±5%, 50V, X7R Ceramic Capacitors (0803)</td>
<td>GRM188R71H103J</td>
<td>Murata</td>
</tr>
<tr>
<td>C2, C3, C6</td>
<td>3</td>
<td>100nF ±5%, 50V, CD5 Ceramic Capacitors (0402)</td>
<td>GRM1555C1H102J</td>
<td>Murata</td>
</tr>
<tr>
<td>C7, C9, C10, C11</td>
<td>5</td>
<td>100nF ±10%, 16V, X7R Ceramic Capacitors (0402)</td>
<td>GRM155R71C104K</td>
<td>Murata</td>
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<tr>
<td>R1, R2, R5</td>
<td>3</td>
<td>0Ω Resistors (0402)</td>
<td>ERJ-2GE6R00X</td>
<td>Panasonic</td>
</tr>
<tr>
<td>R3, R4</td>
<td>2</td>
<td>100kΩ ±1%, 1/10W, Resistors (0402)</td>
<td>ERJ-2RKF1003X</td>
<td>Panasonic</td>
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<tr>
<td>J1, J3, J4, J5</td>
<td>4</td>
<td>Edge Launch SMA (0.375 inch pitch ground tabs)</td>
<td>142-0701-851</td>
<td>Emerson Johnson</td>
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<tr>
<td>J2</td>
<td>1</td>
<td>CONN HEADER VERT SGL 3 X 1 POS GOLD</td>
<td>961103-6404-AR</td>
<td>3M</td>
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<tr>
<td>U1</td>
<td>1</td>
<td>Voltage Variable Attenuator</td>
<td>F2255NLGK</td>
<td>IDT</td>
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<tr>
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<td>1</td>
<td>Printed Circuit Board</td>
<td>F2255 REV 1</td>
<td>IDT</td>
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Top Markings

- Lot Code
- Assembler Code
- Date Code [YWW] (Week 46 of 2014)
- Part Number

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## Revision History

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Description of Change</th>
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</thead>
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<tr>
<td>May 7, 2021</td>
<td>• Changed the corporate branding to Renesas.</td>
</tr>
<tr>
<td></td>
<td>• Completed other minor changes.</td>
</tr>
<tr>
<td>February 9, 2018</td>
<td>Corrected POD drawing, added revision page.</td>
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<tr>
<td>January 30, 2017</td>
<td>Updated GBT limits for $I_{DD}$, $V_{MODE}$ and $V_{CTRL}$.</td>
</tr>
<tr>
<td>November 5, 2015</td>
<td>Initial release.</td>
</tr>
</tbody>
</table>
NOTES:

1. JEDEC compatible.
2. All dimensions are in mm and angles are in degrees.
3. Use ±0.05 mm for the non-toleranced dimensions.
4. Numbers in ( ) are for references only.
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