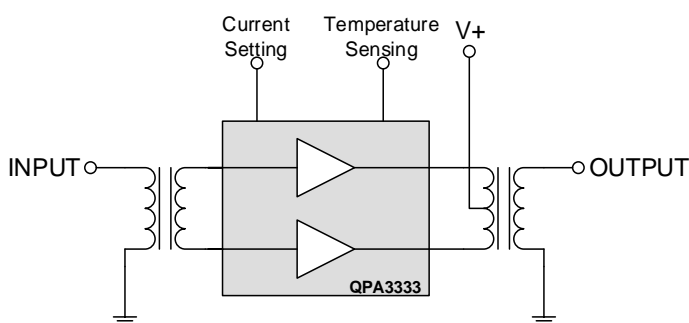


Product Description

The QPA3333 is a Power Doubler amplifier SMD Module. The part employs GaAs MESFET, GaAs pHEMT and GaN HEMT die and is operated from 45MHz to 1218MHz. It provides excellent linearity and superior return loss performance with low noise and optimal reliability. DC current of the device can be externally adjusted for optimum distortion performance versus power consumption over a wide range of output level.

Functional Block Diagram



9 pin, 11.0 mm x 8.5 mm x 1.375 mm package

Product Features

- Excellent Linearity
- Superior Return Loss Performance
- Extremely Low Distortion
- Optimal Reliability
- Low Noise
- Unconditionally Stable Under all Terminations
- 27.0dB Min Gain at 1218 MHz
- 470mA max at 24 VDC

Applications

- 45 – 1218 MHz CATV Amplifier Systems

Ordering Information

| Part No. | Description |
|-----------------|----------------------------------|
| QPA3333SB | Sample bag 5 pcs |
| QPA3333SR | 7" Reel with 100 pcs |
| QPA3333TR7 | 7" Reel with 500 pcs |
| QPA3333PCBA-410 | Fully assembled Evaluation Board |

Absolute Maximum Ratings

| Parameter | Value / Range |
|--|----------------|
| DC Supply over-voltage (5 minutes) | +30V |
| Storage Temperature | -40 to +100 °C |
| Operating Mounting Base Temperature | -30 to +100 °C |
| Moisture Sensitivity Level IPC/JEDEC J-STD-20 | MSL3 @ 260 °C |
| RF Input Voltage (single tone; on Evaluation Board) | 75dBmV |

Operation of this device outside the parameter ranges given above may cause permanent damage.

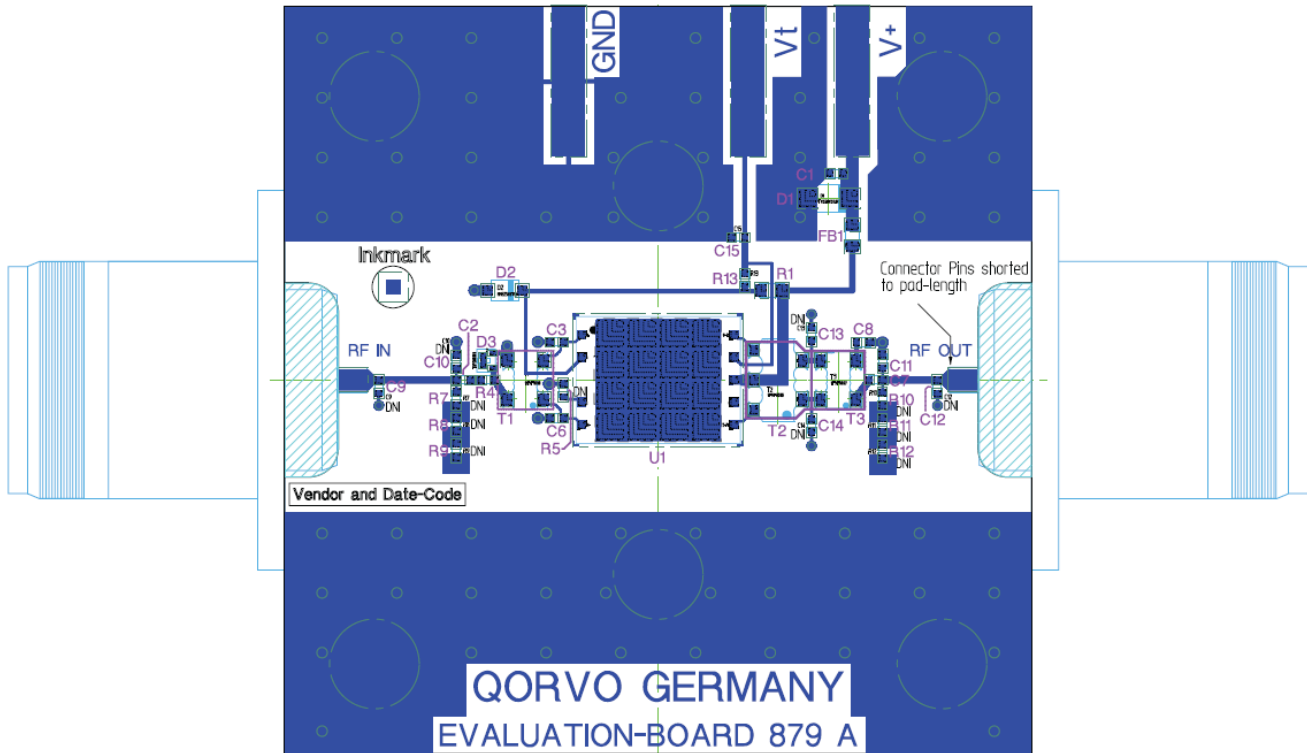
Electrical Specifications

| Parameter | Conditions (V+=24V, TMB=30°C, ZS=ZL=75Ω, Pin3 not connected) | Min | Typ | Max | Units |
|--|---|------|------|------|-------|
| Operational Frequency Range | – | 45 | – | 1218 | MHz |
| Current (I _{DD}) | – | | 450 | 470 | mA |
| Gain | f _o = 45 MHz | | 26.3 | | dB |
| Gain | f _o = 1218 MHz | 27.0 | 27.8 | 29.0 | |
| Gain Slope | 45 to 1218 MHz ^[1] | | 1.4 | | |
| Gain Flatness | 45 to 1218 MHz | | 0.6 | | |
| Input Return Loss (-S ₁₁) | f _o = 45 to 320 MHz | 20 | | – | dB |
| | f _o = 320 to 640 MHz | 19 | | – | |
| | f _o = 640 to 870 MHz | 19 | | – | |
| | f _o = 870 to 1003 MHz | 17 | | – | |
| | f _o = 1003 to 1218 MHz | 16 | | – | |
| Output Return Loss (-S ₂₂) | f _o = 45 to 320 MHz | 20 | | – | dB |
| | f _o = 320 to 640 MHz | 19 | | – | |
| | f _o = 640 to 870 MHz | 19 | | – | |
| | f _o = 870 to 1003 MHz | 17 | | – | |
| | f _o = 1003 to 1218 MHz | 16 | | – | |
| Noise Figure | f _o = 50 to 1218 MHz | | 4.6 | 5.0 | dB |
| Thermal Resistance | Junction to Mounting Base | | 3.6 | | K/W |
| CTB | V _o = 58dBmV at 1218MHz, 16.5dB extrapolated tilt, 79 analog channels plus 111 digital channels (-6dB offset) ^[2,3] , TCP ^[4] = 70.0dBmV | | -80 | -76 | dBc |
| XMOD | | | -75 | -70 | dBc |
| CSO | | | -74 | -70 | dBc |
| CIN | | 56 | 60 | | dB |

Notes:

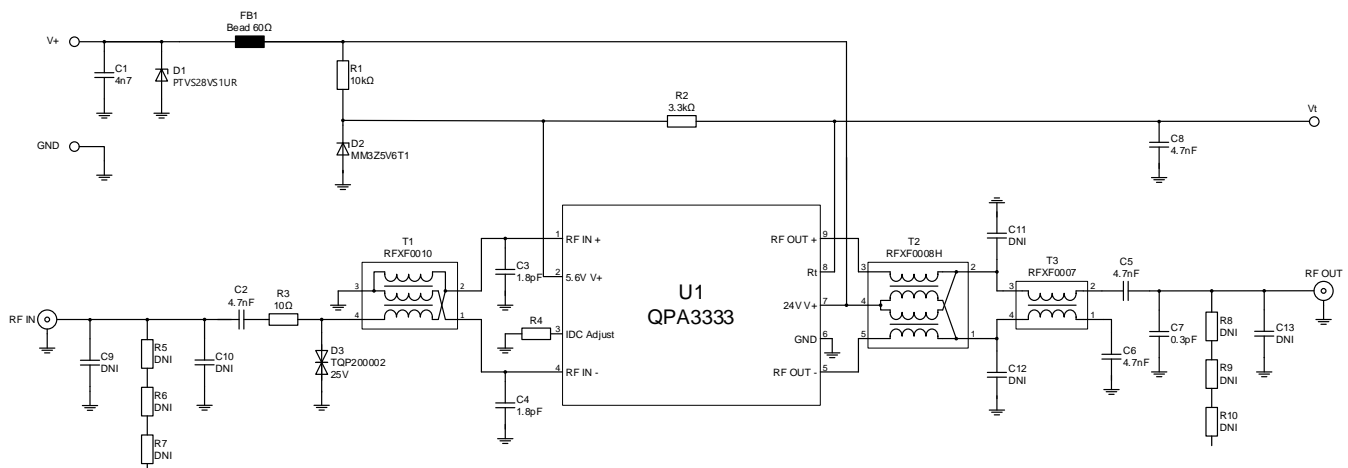
- The slope is defined as the difference between the gain at the start frequency and the gain at the stop frequency.
- 79 analog channels, NTSC frequency raster: 55.25MHz to 547.25MHz, +41.5dBmV to +48.5dBmV tilted output level, plus 111 digital channels, -6dB offset relative to the equivalent analog carrier.
- Composite Second Order (CSO) – The CSO parameter (both sum and difference products) is defined by ANSI/SCTE 6. Composite Triple Beat (CTB) – The CTB parameter is defined by ANSI/SCTE 6. Cross Modulation (XMOD) – Cross modulation (XMOD) is measured at baseband (selective voltmeter method), referenced to 100% modulation of carrier being tested, Carrier to Intermodulation Noise (CIN) – The CIN parameter is defined by ANSI/SCTE 17 (Test procedure for carrier to noise)
- Total Composite Power

Evaluation Board Assembly Drawing



Note:
 Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. A via drill diameter of 0.4mm and a minimum via wall copper plating thickness of 25um is recommended. Open vias are preferred to allow flux and gases to escape during reflow soldering and therefore to minimize voiding. Underneath this via array a heat sink with thermal grease needs to be placed which is able to dissipate the complete module DC power (up to 11.5 Watts). In any case the module backside temperature should not exceed 100 °C.

Evaluation Board Schematic



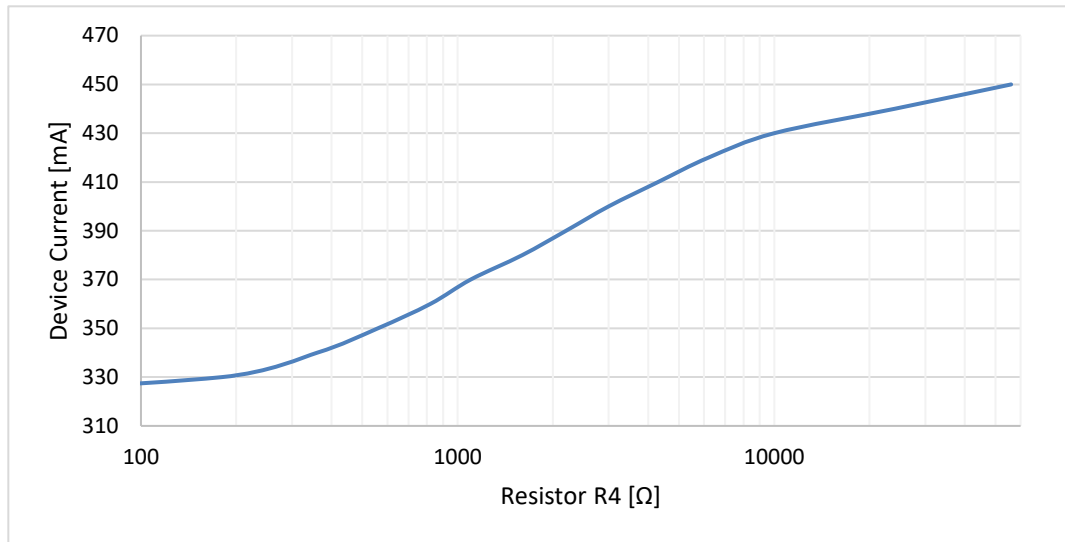
Evaluation Board Bill of Materials (BOM)

| Reference Des. | Value | Description | Manuf. | Part Number |
|-------------------------|-----------------------|-------------------------------------|------------------|----------------|
| n/a | n/a | Printed Circuit Board | Qorvo | |
| C1, C2, C5, C6, C8 | 4.7nF | Cap., 0402, 10%, 50V, X7R | various | |
| C3, C4 | 1.8pF | Cap., 0402, ± 0.25 pF, 50V, C0G | various | |
| C7 | 0.3pF | Cap., 0402, ± 0.1 pF, 50V, C0G | various | |
| C9, C10, C11, C12, C13 | DNI | | | |
| R1 | 10k Ω | Res., 0603, $\pm 1\%$, TK100 | various | |
| R2 | 3.3k Ω | Res., 0402, $\pm 1\%$, TK100 | various | |
| R3 | 10 Ω | Res., 0402, $\pm 1\%$, TK100 | various | |
| R4 | See page 5 | Optional to set current value | various | |
| R5, R6, R7, R8, R9, R10 | DNI | Res., 0402, 0 Ω , TK100 | various | |
| FB1 | 60 Ω at 100MHz | Impedance Bead | Taiyo Yuden | BK 1608 HS 600 |
| D1 | 28V | Transient Voltage Suppressor Diode | NXP | PTVS28VS1UR |
| D2 | 5.6V | Zener Diode | ON Semiconductor | MM3Z5V6T1G |
| D3 | 25V | ESD Diode | Qorvo / Unisem | TQP200002 |
| T1 | RFXF0010 | Transformer | Qorvo | RFXF0010 |
| T2 | RFXF0008H | Transformer | Qorvo | RFXF0008H |
| T3 | RFXF0007 | Transformer | Qorvo | RFXF0007 |
| U1 | QPA3333 | CATV Power Doubler Module | Qorvo | QPA3333 |

Current Adjustment

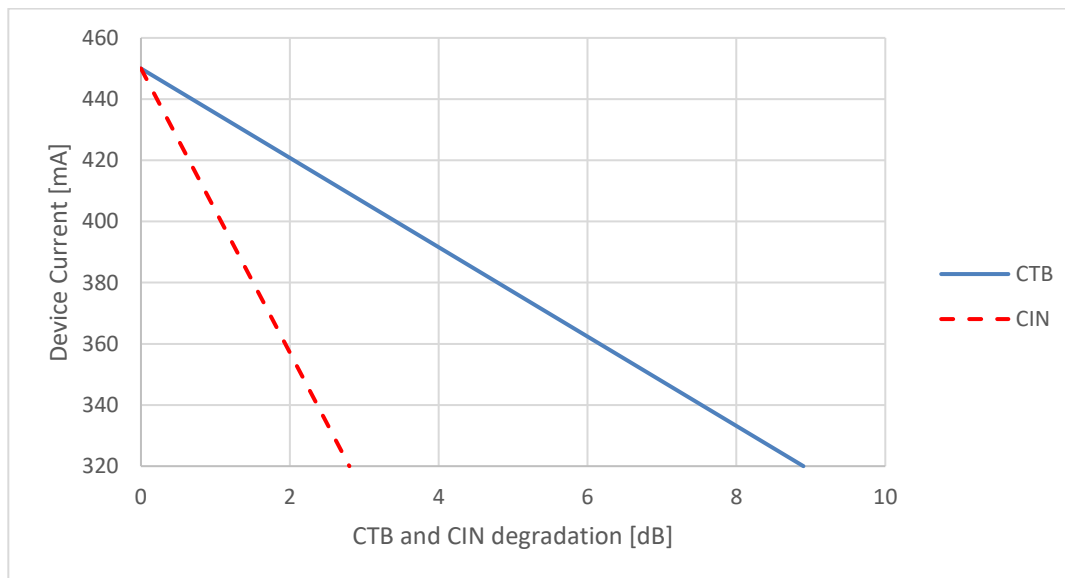
The QPA3333 can be operated over a wide range of current to provide maximum required performance with minimum current consumption. Changing the value of resistor R4 on application circuit allows a variation of the current between 450 mA and 320 mA (typ.). Within the recommended range of current between 450 mA and 320 mA gain (S21) change is less than 0.4 dB (typ.) and noise figure change is less than 0.2 dB (typ.).

Device Current vs. Resistor R4 (typical values)



| Device Current [mA] (typical) | R4 [Ω] |
|-------------------------------|--------|
| 450 | open |
| 430 | 10000 |
| 410 | 4300 |
| 390 | 2200 |
| 370 | 1100 |
| 350 | 560 |
| 330 | 180 |
| 320 | 0 |

Device Current vs. Distortion Degradation (typical values)

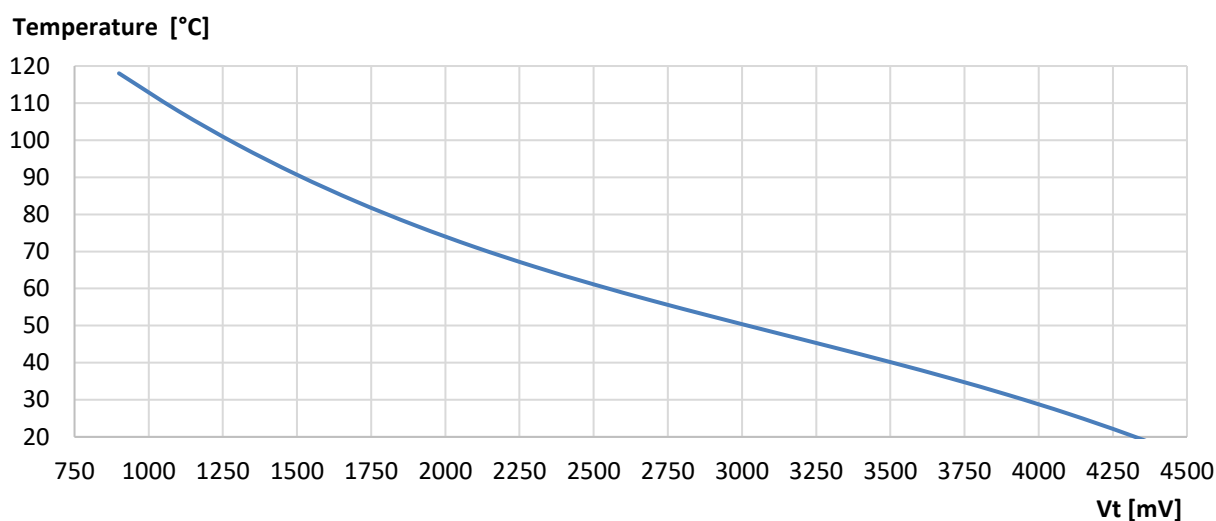


Test Condition: V+=24V, TMB=30°C, ZS=ZL=75Ω, IDC=IDC (typ.), NTSC, 79ch analog: 48.5dBmV @ 547.25 MHz; 7 dB tilt, with 111 J.83/B QAM256 channels (6 dB down)

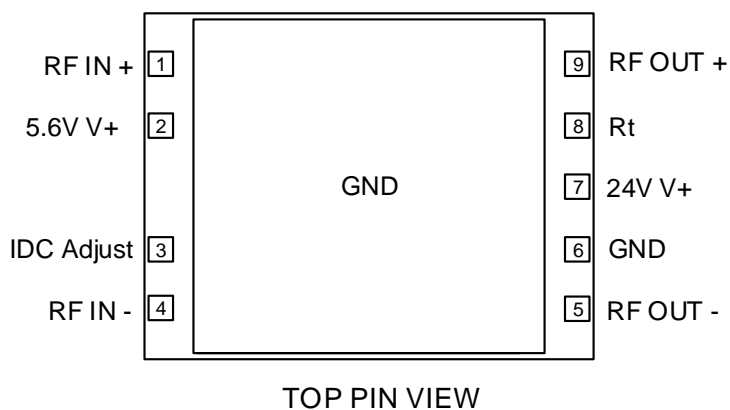
QPA3333 Temperature Sensing Feature

The QPA3333 provides an internal NTC resistor for temperature sensing. This resistor is located right next to the output transistor stage. Within the application circuit the NTC is part of a voltage divider. The output voltage of the voltage divider (V_t) can be correlated to the module backside temperature.

Module Backside Temperature versus V_t (typical values)



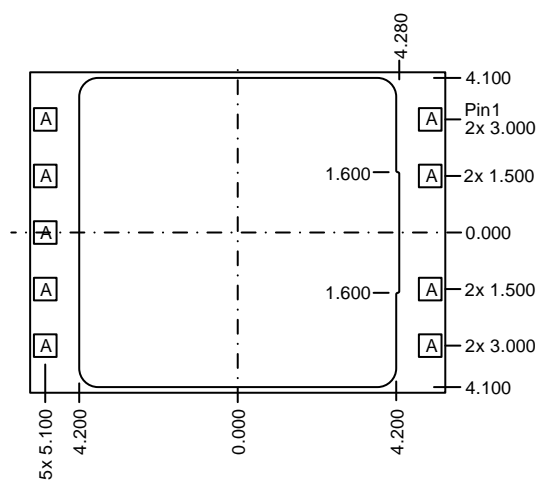
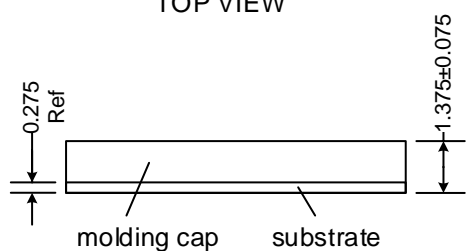
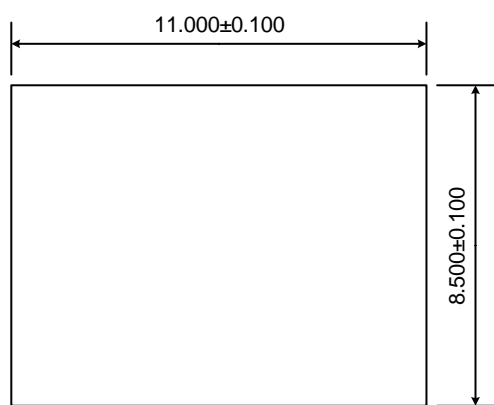
Pin Configuration



Pin Description

| Pin No. | Label | Description |
|---------|------------|------------------------------------|
| 1 | RF IN (+) | RF AMP Positive Input |
| 2 | 5.6V V+ | Supply Voltage 5.6V |
| 3 | IDC Adjust | Current Adjustment |
| 4 | RF IN (-) | RF AMP Negative Input |
| 5 | RF OUT (-) | RF AMP Negative Output |
| 6 | GND | Ground |
| 7 | 24V V+ | Supply Voltage 24V |
| 8 | Rt | NTC Output for Temperature Sensing |
| 9 | RF OUT (+) | RF AMP Positive Output |

Package Outline Drawing (Dimensions in millimeters)



A= 0.600 x 0.600 mm

BOTTOM PIN VIEW

Handling Precautions

| Parameter | Rating | Standard |
|----------------------------------|---------|---------------------|
| ESD – Human Body Model (HBM) | 1B | JEDEC JS-001 |
| ESD – Charged Device Model (CDM) | C3 | JEDEC JS-002 |
| MSL – Moisture Sensitivity Level | Level 3 | IPC/JEDEC J-STD-020 |



Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260°C max. reflow temp.) and tin/lead (245°C max. reflow temp.) soldering processes.
Solder profiles available upon request.

Contact plating: NiPdAu

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Halogen Free (Chlorine, Bromine)

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

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