JACK BROWNE | Technical Contributor

Linear Amplifier Module Powers 20 to 512 MHz

This solidly built Class A/AB power amp incorporates numerous monitoring and protection circuits for safe operation even with 350 W output power at 1-dB compression.

Low-distortion modulated signals are required for communications systems, which is the forte of the RFM20-512-350-HSD power-amplifier (PA) module from RF and Microwave Power Technology LLC (www.rfmpt.com): It provides clean amplification of communications signals from 20 to 512 MHz.

The Class A/AB PA module delivers 350 W output power at 1-dB compression, with high gain and high efficiency. It also includes numerous monitoring and protection circuits to help a user achieve safe operation. The PA module is a good fit for commercial and military communications systems that require high gain to transform low-level input signals at typically −2.3 dBm into high-level output signals for transmit purposes.

The RFM20-512-350-HSD *(see figure)* achieves at least 54.7-dB gain and typically 57.7-dB gain across the full frequency range, with worst-case gain flatness of ±1.2 dB and typical gain flatness of ±0.6 dB. It operates on two power supplies, drawing maximum current of 3.5 A from a voltage supply of +24 to +28 V dc and a maximum of 15 A from a voltage supply of +46 to +50 V dc.

The RFM20-512-350-HSD Class A/AB PA module delivers 350 W output power at 1-dB compression from 20 to 512 MHz with flat gain with frequency and high efficiency.

NOT SO HOT

The robust amplifier is built to take whatever excess heat its output stage generates, with a nickel-plated copper base for efficient thermal flow away from the active device. It is also generously equipped with control and monitoring functions for protection, such as output-stage current sensing, an alarm when the package base exceeds +60°C, and an output disable function with a response time of better than 1 µs. When combined, for example, with a user's own VSWR-monitoring circuitry, the amplifier can be quickly shut down in the event of impedance-mismatch conditions.

Also, the amplifier includes an input-stage monolithic microwave integrated circuit (MMIC) with a TTL-compatible enable/disable control pin that allows users to manually enable or disable the MMIC, achieving response times of 50 and 30 µs, respectively. The input-stage MMIC provides additional quieting for applications that may benefit from it, such as over-the-horizon (OTH) radar systems.

In addition to temperature-compensated bias circuitry, the PA makes use of a temperature-monitoring IC that provides an analog output voltage proportional to temperature. At room temperature (+25°C), the IC's nominal level is at +0.75 V dc, and it exhibits a positive voltage slope with temperature of 10 mV/°C for temperature above +25°C. This IC and its associated connection pin are meant to guide a user's choice of PA cooling approach in a system, rather than provide absolute PA temperature measurements.

To control output-power levels, the PA features an integral voltage-variable attenuator (VVA) with attenuation range of better than 30 dB. It operates with control voltages from 0 to +5 V dc, with an attenuation tuning slope of approximately 14 dB/V from +1.4 to +3.6 V dc and maximum attenuation

occurring at +4.4 V dc.

The amplifier's second-harmonic performance is typically −46 dBc, with worst-case levels of −34 dBc. Third harmonics are typically −21 dBc, with worst-case levels of −10 dBc. Input return loss is typically −23 dB and maximum of −14 dB. The output-stage efficiency is at least 48% and typically 53%. Measured at 350 W peak envelope power (PEP) and 100-kHz offset, the third-order intermodulation distortion (IMD) is typically −36 dBc.

The multistage PA module runs with quiescent current (I_{DQ}) of 3.3 A at +28 V dc and 0.8 A at +50 V dc. The amplifier comes in a rugged metal housing measuring 4.50 × 8.40 × 1.35 in. (114.30 × 213.36 × 34.29 mm) and weighing 83.2 oz. (2360 g). It includes an SMA input connector and Type N output connector, as well as a DB-9 connector for monitoring and control.

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