
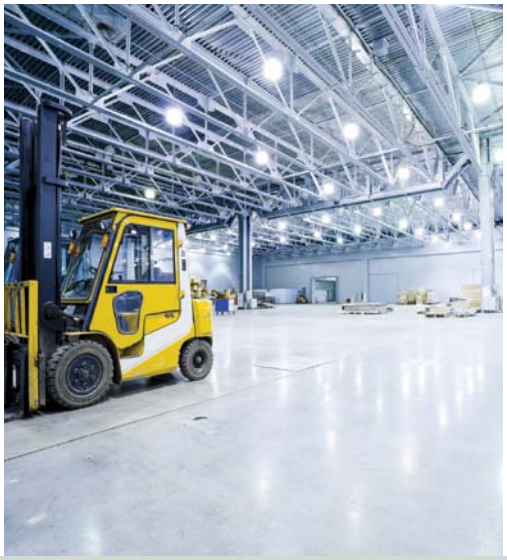


Freescale's Industrial, Scientific and Medical RF Semiconductors

ISM Solutions

Advanced technology for top RF power performance

Industrial systems include hundreds of applications that operate at frequencies from DC up to 6 GHz and beyond. Freescale's Industrial portfolio of RF power amplifiers are designed for very high power applications in the HF/VHF/UHF frequency range (1.8 to 600 MHz) and for applications at 2.45 GHz. Freescale's RF industrial solutions range from the very rugged (up to 65:1 VSWR) to the high power output (up to 1.25 kW).

The increase from 28V to a 50V supply voltage in RF Power LDMOS technology allows the designer to achieve higher power levels, greater power densities and attain performance levels exceeding those available in industrial markets today. In addition, availability of some devices in over-molded plastic packaging allows for the most cost-effective industrial solutions available.

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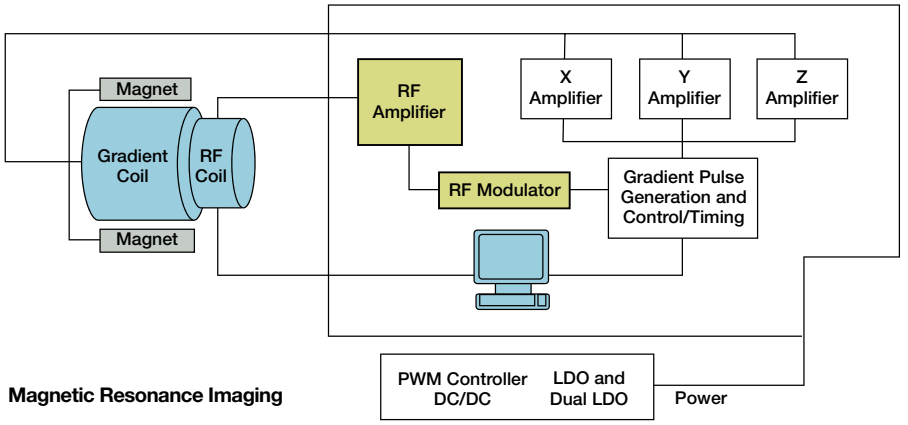
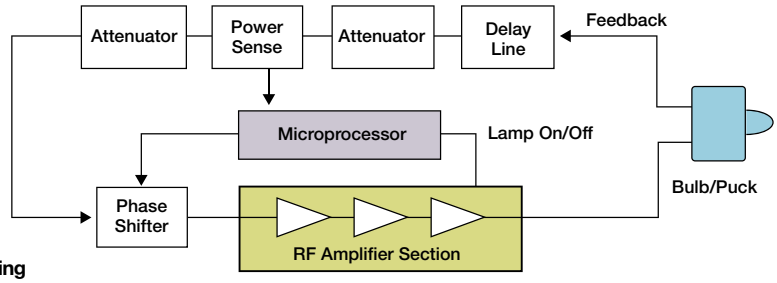
Application Examples

- Plasma generators
- Laser exciters
- RF heating
- Magnetic Resonance Imaging (MRI)
- RF plasma lighting

Typical ISM Applications



Magnetic Resonance Imaging



RF Lighting

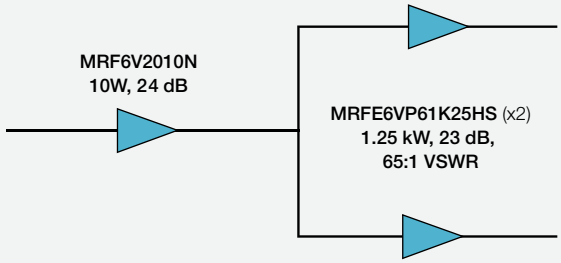
freescale semiconductor

Freescale Competitive Advantages

- Highest ruggedness capability in the industry—up to 65:1 VSWR
- Highest gain figures in the industry—up to 26 dB
- Highest efficiency in the industry—up to 80% at P1dB
- Available in a wide frequency range—1.8 to 600 MHz, 2.45 GHz
- Cost-effective, over-molded plastic packaging options
- Low thermal resistance air cavity packaging options
- Backed by Freescale's secure volume manufacturing capability
- Proven reliability, quality and consistency
- Integrated ESD protection with greater negative gate-source voltage range for improved Class C operation
- World-class, global applications and design support
- RoHS compliant
- Proven high voltage LDMOS process

2.4 kW, 230 MHz CW Lineup

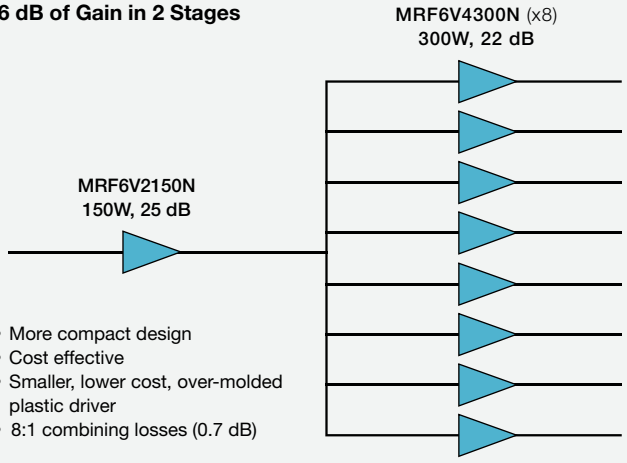
47 dB of Gain in 2 Stages



- Smaller, lower cost, over-molded plastic driver
- Extremely rugged final stage
- High output power
- 2:1 combining losses (0.2 dB)

2.0 kw, 450 MHz Lineup

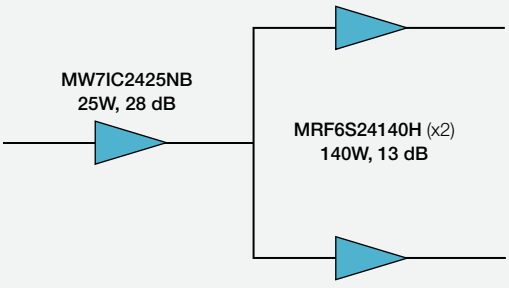
46 dB of Gain in 2 Stages



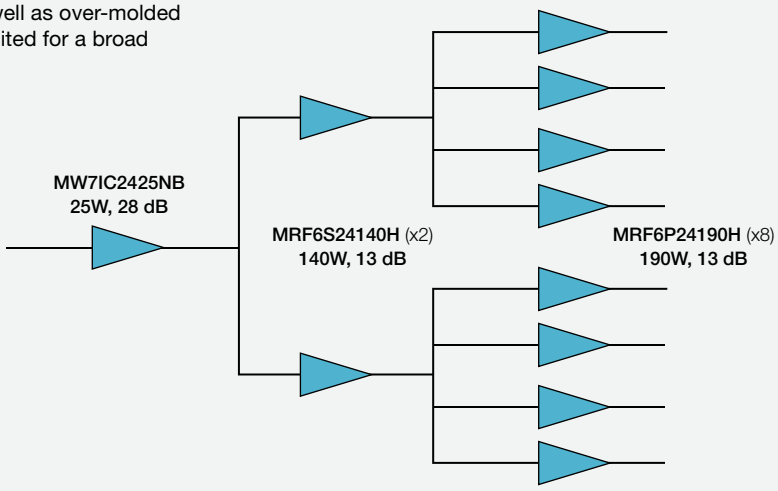
- More compact design
- Cost effective
- Smaller, lower cost, over-molded plastic driver
- 8:1 combining losses (0.7 dB)

2.45 GHz Systems

Freescale's line of 2.45 GHz RF power products provide superior gain and efficiency in thermally enhanced low Rth packaging (140 Watt/190 Watt) as well as over-molded plastic packaging (25 Watt RFIC driver) This makes them ideally suited for a broad array of high power applications.



267W Line-up—41 dB of Gain in 2 Stages
2:1 combining losses (0.2 dB)

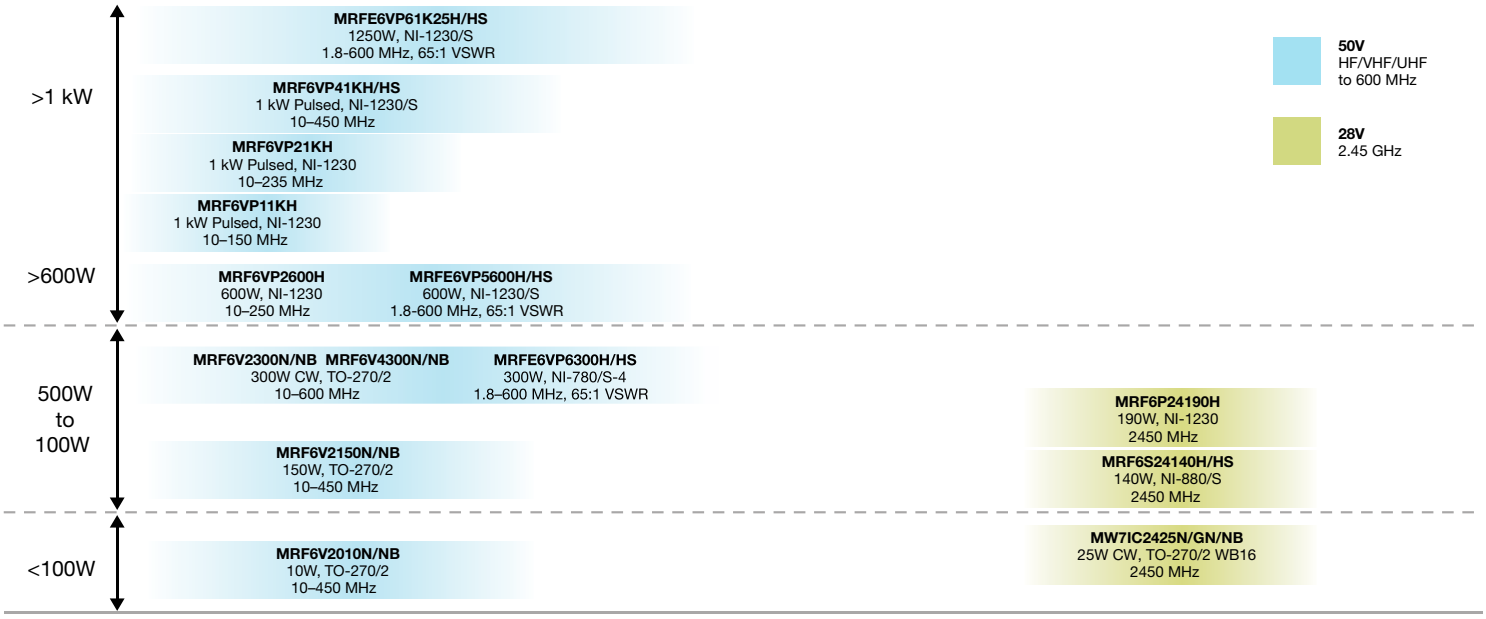


1.3 kW Line-up—54 dB of Gain in 3 Stages
8:1 combining losses (0.7 dB)

Performance Table for ISM LDMOS Devices

Part Number	Voltage (V)	Operating Frequency (MHz)	Rated Power (W)	Technology	Package	$Ø_{JC}$ °C/W	Typical Gain (dB)	Typical Efficiency (%)	Reference Designs (MHz)
HF/VHF/UHF ISM—To 600 MHz Devices – Freescale's line of VHV ISM devices offer high gain and efficiency and can be used up to 600 MHz at 50V supply voltage. Superior gain in the harmonic frequencies makes them highly suitable for higher classes of amplifier operation.									
MRF6V2010N/NB	50	10-450	10 CW	VHV6	Over-molded	3(2)	23.9	62	CW: 64, 88-108, 130, 220, 450
MRF6V2150N/NB	50	10-450	150 CW	VHV6	Over-molded	0.24(2)	25	68.3	CW: 27, 64, 220, 450 Pulsed: 130
MRFE6VP6300H/HS	50	1.8-600	300 CW	VHV6E	Air Cavity	0.19(2)	25	80	CW: 230 Pulsed: 130
MRF6V2300N/NB	50	10-600	300 CW	VHV6	Over-molded	0.24(2)	25.5	68	CW: 27, 88-108, 130, 450 Pulsed: 64, 175-225 Analog, 220
MRF6V4300N/NB	50	10-600	300 CW	VHV6	Over-molded	0.24(2)	22	60	CW: 450
MRF6VP2600H	50	10-250 88-108	600 CW	VHV6	Air Cavity	0.20(2) 0.16(2)	25/125W (OFDM) 24.5/600W (CW)	28.5/125W (OFDM) 74/600W (CW)	CW: 175-225 Analog, 88-108 Pulsed: 225
MRFE6VP5600H/HS*	50	1.8-600	600 CW	VHV6E	Air Cavity	–	24.6	75.2	Pulsed: 230
MRFE6VP61K25H/HS	50	1.8-600	1250 CW	VHV6E	Air Cavity	0.15(2)	22.9	74.6	Pulsed: 230
MRF6VP11KH	50	10-150	1000(1)	VHV6	Air Cavity	0.03(2)	26	71	CW: 81, 88-108, 130 Pulsed: 27
MRF6VP21KH	50	10-235	1000(1)	VHV6	Air Cavity	0.03(2)	24	67.5	Pulsed: 175-225 Analog, 225
MRF6VP41KH/HS	50	10-450	1000(1)	VHV6	Air Cavity	0.03(2)	20	64	CW: 352 Pulsed: 450
ISM Band—2.45 GHz Devices – Derived from Freescale's industry-leading cellular infrastructure portfolios, the MW7IC2425N, MRF6S24140H and MRF6P24190H devices operate at 28V and achieve high levels of performance for 2.45 GHz applications.									
MW7IC2425N/GN/NB	28	2450	20	28 Volt	Over-molded	1.2	27.7	43.8	CW: 2450
MRF6S24140H/HS	28	2450	140	28 Volt	Flanged Air Cavity	0.29	13.2	45	CW: 2450
MRF6P24190HR6	28	2450	190	28 Volt	Flanged Air Cavity	0.22	13.2	46.2	CW: 2450

RF Power ISM Portfolio



*Preliminary Data

(1) Peak power

(2) Refer to the respective part number data sheet for thermal measurement operating conditions.

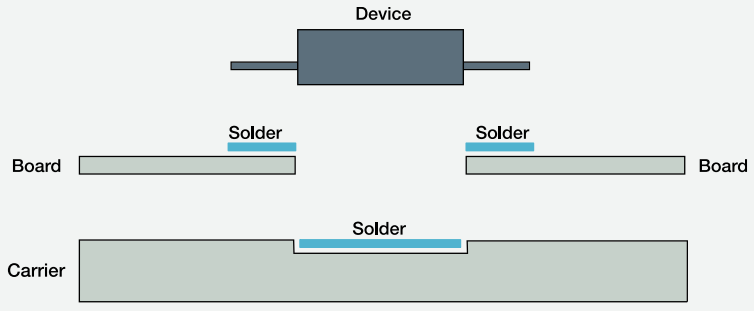
Industry Leading Packaging

With over 80 million RF power devices delivered in over-molded plastic packaging, Freescale has established a proven track record for reliability. Thermally optimized, these packages demonstrate an industry-leading junction thermal resistance with 0.24°C/W for a single-ended part rated at 300 Watts. These RoHS-compliant packages are also available in both solder reflow and bolt down versions.

Why Freescale?

- RF performance leadership
- Package design
  - Freescale JEDEC-registered TO series is the only over-molded plastic package series specifically designed for high power RF applications
  - The OMNI series of over-molded packages are designed to be mechanical drop-ins for their air cavity equivalents
  - Bolt down, clamp down and solder reflow mounting options
  - Multiple mounting configurations
  - 225°C TJ
- Manufacturing
  - Internal dedicated RF power plastic manufacturing line
  - Over 80 million RF power plastic packages shipped with no known package related failures
  - Automated high volume assembly and test
  - Multiple manufacturing locations
- Materials
  - RoHS compliant
- Over-molded plastic
  - Highly conductive die attach for better thermal performance
  - Package with a larger heatsink contact area for optimum thermal performance
- Conventional ceramic packaging
  - Lower thermal resistance flange material
  - Higher on-package impedance matching
  - Higher power > 1 kW
  - Low Au solderable finish

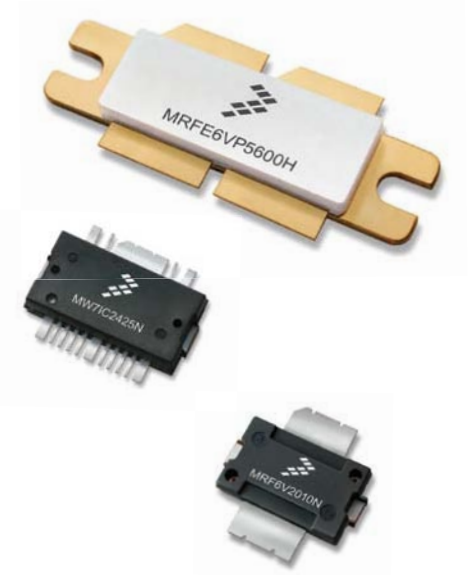
RF Over-Molded Plastic Solder Reflow Process



Design Support

For information on design support for industrial products select Design Support at www.freescale.com/rfindustrial.

- MTTF Calculation Programs
- Application-specific Reference Designs
- RF High Power Models—ADS and AWR Microwave Office®
- RF 50V LDMOS White Paper
- Video introducing Freescale's new 65:1 VSWR 50V LDMOS device designed for high mismatch applications



Learn More: For current information about Freescale RF Solutions, please visit: **www.freescale.com/rfpower**.

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