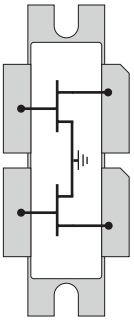
P-Band, GaN/SiC, RF Power Transistor

430-450 MHz | 1500W | 80% Efficiency typ | 20 dB Gain typ | 50 V | 250µs Pulse Length, 1% Duty Cycle

IGN0450M1500 is a high power GaN-on-SiC push-pull RF power transistor that has been designed to suit the unique needs of P band radar systems. It operates over the full 430-450 MHz frequency range. Under 250µs, 1% duty cycle pulse conditions, it supplies a minimum of 1500 W of peak output power, with typically 20 dB of gain and 80% efficiency. It operates from a 50 V supply voltage. For optimal thermal efficiency, the transistor is housed in a metal-based package with thermal enhancement and uses an epoxy-sealed ceramic lid.

FEATURES

- GaN on SiC HEMT Technology
- Output Power >1500W
- Pre-matched Input Impedance
- Exceptionally High Efficiency - up to 80%
- 100% RF Tested Under 250µs, 1% duty cycle pulse conditions
- RoHS and REACH Compliant



APPLICATIONS

- P-band Radar Systems

Table 1. Absolute Maximum Ratings (Not Simultaneous)

Parameter	Symbol	Value	Units	Test Conditions
DC Drain-Source Voltage	V_{DS}	180	V	25 °C
DC Gate-Source Voltage	V_{GS}	-8 to +1.0	V	25 °C
DC Drain Current per side	I_D	61	A	25 °C
DC Gate Current per side	I_G	12	mA	25 °C
RF Input Power	$P_{RF,IN}$	25	W	25 °C
Operating Junction Temperature	T_J	-55 to +200	°C	
Storage Temperature	T_{STG}	-55 to +150	°C	
Soldering Temperature	T_{SOLDER}	260 for 60s	°C	

Note: Operation outside the limits given in this table may cause permanent damage to the transistor

Table 2. DC Electrical Characteristics (Case temperature = 25 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Gate Pinch-Off Voltage	V_P	-5.0			V	V_{DS} = 50V, I_{DS} = 1mA
Quiescent Gate Voltage	V_Q		-2.8		V	V_{DS} = 50V, I_{DS} = 120mA per side

Table 3. RF Electrical Characteristics (Case temperature = 35 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
RF Input Power	$P_{IN, RF}$	9.5	15	20	W	P_{OUT} = 1500W f = 430, 440, 450 MHz 250µs pulse length, 1% duty cycle V_{DS} = 50V, I_{DS} = 120mA per side
Gain	G	18.7	20	22	dB	
Drain Efficiency	η	75	80	85	%	
Pulse Droop	D	-0.4	-0.2	+0.2	dB	
Input Return Loss	IRL	18	12	7	dB	
Load Mismatch Stability	VSWR-S	2:1				
VSWR Withstand	VSWR-LMT	3:1				

Note: Consult Integra Technologies Application Note 001 for information on how RF output power and pulse droop are measured.

Table 4. Thermal Resistance (Case temperature = 35 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Test Conditions
Peak Thermal Resistance, Junction to Case	$R_{TH(JC)}$		0.17	P_{OUT} = 1500W f = 440 MHz 250µs pulse length, 1% duty cycle V_{DS} = 50V, I_{DS} = 120mA per side

Table 5. Optimum Source & Load Impedances (Case temperature = 35 °C unless otherwise stated)

Frequency (MHz)	Z_{IF}	Z_{OF} Fundamental	Z_{OF} Second Harmonic	Units	Test Conditions
430	3.55 - j 0.35	2.75 + j 1.97	0.4 + j 14.9	Ω	P_{OUT} = 1500W 250µs pulse length, 1% duty cycle V_{DS} = 50V, I_{DS} = 120mA per side
440	3.35 + j0.25	2.7 + j 2.1	0.4 + j 16.0	Ω	
450	3.2 + j 0.82	2.65 + j 2.17	0.5 + j 17.1	Ω	

Note: Optimum source and load impedances are terminal to terminal and not terminal to ground and are measured looking into the test fixture

TYPICAL PERFORMANCE

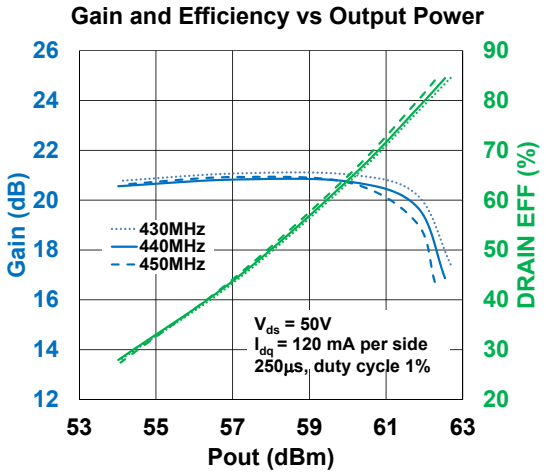


Figure 1

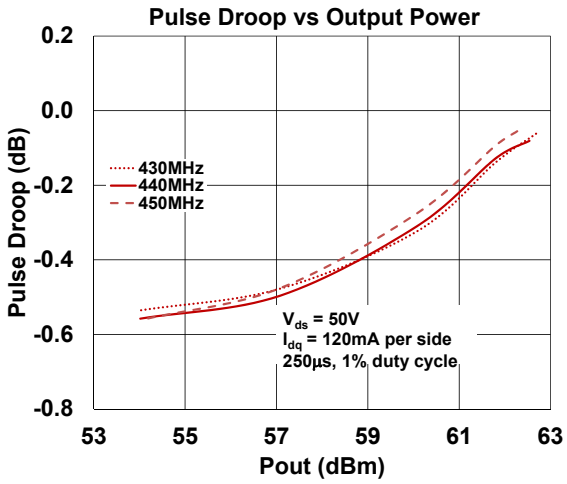


Figure 2

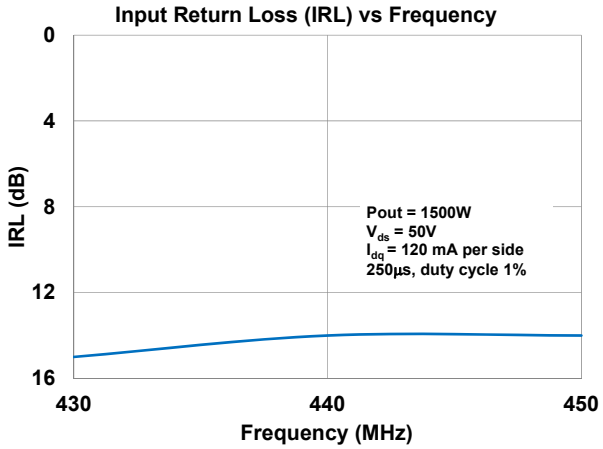
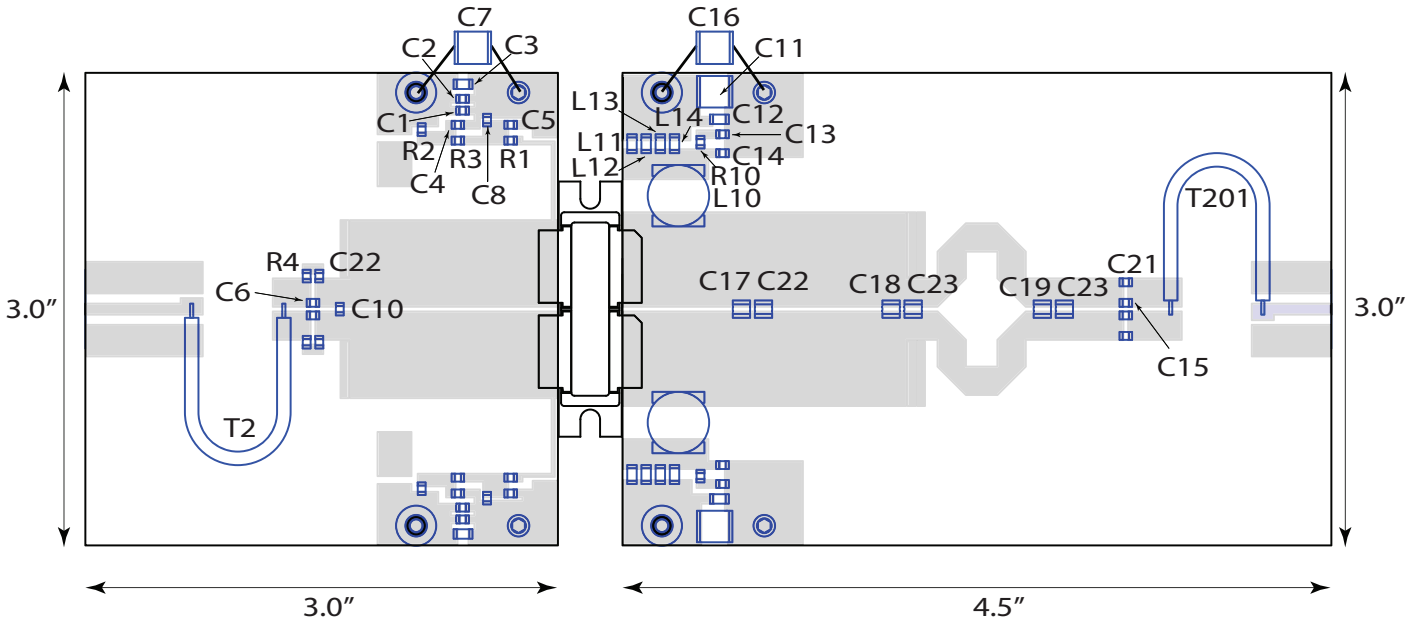


Figure 3

TEST FIXTURE

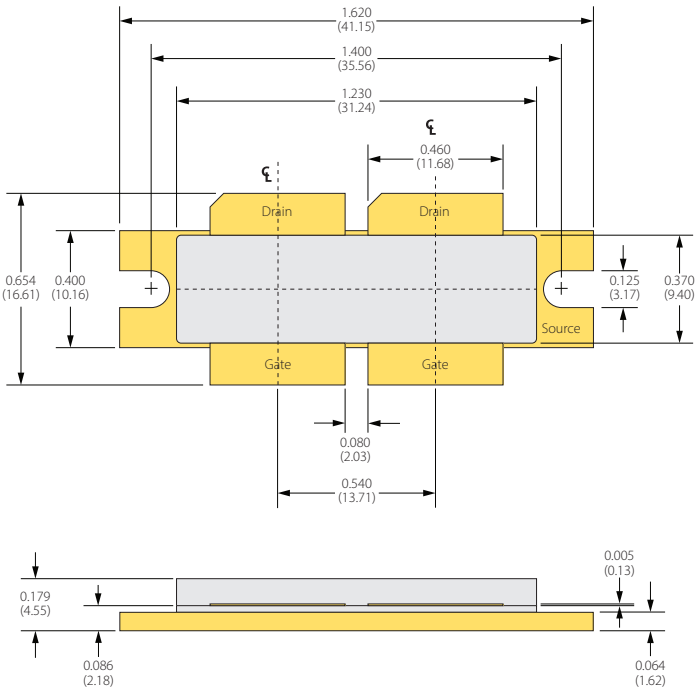


Note: Component values symmetrical about horizontal centre line

Bill of Materials for IGN0450M1500 Test Fixture

Designator	Description	Part Number
C1, C4, C13	CAP 0.1μF, 0805, 100V , X7R	C08051C104K4T2A
C2, C5, C6, C14, C15, C21	CAP 240pF, 0805	ATC600F241JT250XT
C3, C12	CAP 1μF, 1206, 100V, X7R	C12061C105K4T2A
C7, C16	CAP 68μF, 63V, Electrolytic	UPJ1J680MPD6TD
C8, C22	CAP 1000pF, 0805, 100V	08051A102J4T2A
C10	CAP 22pF, 0805	ATC600F220FT250XT
C11	CAP 10μF, 2220, 100V, X7R	22201C106MAT2A
C17	CAP 39PF, 0712	ATC600R390GT500XT
C18	CAP 22PF, 0712	ATC600R220GT500XT
C19	CAP 8.2pF, 0712	ATC600R8R2BT500XT
C22, C24	CAP 1.5pF, 0712	ATC600R1R5BT500XT
C23	CAP 2pF, 0712	ATC600R2R0BT500XT
L10	IND 46.5nH	COILCRAFT 1010VS-46NMEB
L11, L12, L13, L14	IND, FB, 33 OHM, 1206, 6A	BLM31PG330SN1L
R1	RES, 10Ω, 0805	ERJ-6ENF10R0V
R2	RES, 100Ω, 0805	ERJ-6ENF1000V
R3, R10	RES, 5.1Ω, 0805	ERJ-6GEYJ5R1V
R4	RES 22Ω, 0805	ERJ-6GEYJ220V
T2, T202	COAXIAL BALUN, RG402, 2.1" Long, 0.5" Radius	
PC Board	ROGERS RO4003 32mil, 1/1oz. Copper	

PACKAGE PL124A1



Dimensions: Inches (mm)

ESD & MSL Rating

Parameter	Rating	Standard
ESD Human Body Model (HBM)	TBD	ESDA/JEDEC JS-001-2012
ESD Charged Device Model (CDM)	TBD	JEDEC JESD22-C101F
Moisture Sensitivty Level (MSL)	Unlimited Shelf Life	IPC/JEDEC J-STD-020

RoHS Compliance

Integra Technologies, Inc declares that its GaN and LDMOS Transistor Products comply with EU Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS2), as adopted by EU member states on January 2, 2013 and amended on March 31, 2015 by EU Directive 2015/863/EU.

REACH Compliance

Integra Technologies supports EU Regulation number 1907/2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) as these apply to Integra semiconductor products, development tools, and shipping packaging.

In support of the REACH regulation, Integra will:

- Inform customers and recipients of Integra product if they contain any substances that are of very high concern (SVHC) per the European Chemical Agency (ECHA) website.
- Notify ECHA if any Integra product that contains any SVHCs which exceed guidelines for REACH chemicals by weight per part number and for total content weight per year for all products produced in or imported to the European market.
- Cease shipments of product containing REACH Annex XIV substances until authorization has been obtained.
- Cease shipment of product containing REACH Annex XVII chemicals when restrictions apply.

Integra has evaluated its materials, BOMs, and product specifications and product and has determined that this transistor conforms to all REACH and SVHC regulations and guidelines. Integra has implemented actions and control programs that will assure continued compliance.

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DATA SHEET STATUS
Advanced Specification - This data sheet contains Advanced specifications.
Preliminary Specification - This data sheet contains specifications based on preliminary measurements and data.
Final Specification - This data sheet contains final product specifications.
MAXIMUM RATINGS Stress above one or more of the maximum ratings may cause permanent damage to the device. These are maximum ratings only operation of the device at these or at any other conditions above those given in the characteristics sections of the specification is not implied. Exposure to maximum values for extended periods of time may affect device reliability.

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