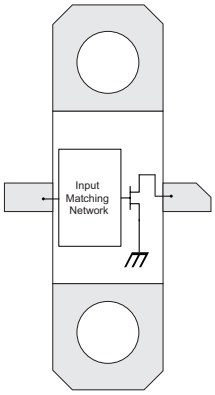
L-Band, GaN/SiC, RF Power Transistor

1025 and 1150 MHz | 50 W typ | 60% Efficiency typ | 21 dB Gain typ | 50 V | Mode S ELM

IGN1012L40 and IGN1012L40S are high power GaN-on-SiC RF power transistors that have been designed to suit the unique needs of IFF/SSR avionics systems. They operate at both 1025 and 1150 MHz. Under ELM Mode S [48x (32µs on, 18µs off), 6.4% Long Term Duty Cycle] pulse conditions, they supply a minimum of 40 W of peak output power, with typically >21 dB of gain and 60% efficiency. They operate from a 50 V supply voltage. For optimal thermal efficiency, the transistors are housed in a metal-based package with an epoxy-sealed ceramic lid.

FEATURES

- GaN on SiC HEMT Technology
- Output Power >40 W
- Pre-matched Input Impedance
- High Efficiency - up to 60% during the RF pulse
- 100% RF Tested
- RoHS and REACH Compliant



APPLICATIONS

- L-band Avionics IFF & SSR Systems
- Suitable for both uplink and downlink (Transponder)

Table 1. Absolute Maximum Ratings (Not Simultaneous)

Parameter	Symbol	Value	Units	Test Conditions
DC Drain-Source Voltage	V_{DS}	150	V	25 °C
DC Gate-Source Voltage	V_{GS}	-8 to +1.0	V	25 °C
DC Drain Current	I_D	3.6	A	25 °C
DC Gate Current	I_G	3.6	mA	25 °C
RF Input Power	$P_{RF,IN}$	0.4	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		-2.5		V	V_{DS} = 50V, I_{DS} = 20mA

Table 3. RF Electrical Characteristics (Case temperature = 30 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
RF Output Power	$P_{OUT, RF}$	40	50	70	W	P_{IN} = 0.4W f = 1025, 1090, 1150 MHz Mode S ELM pulse conditions (48 x [32µs on, 18µs off]), LTDC = 6.4% V_{DS} = 50V, I_{DS} = 20mA,
Gain	G	19	21	23	dB	
Drain Efficiency	η	55	60	70	%	
Pulse Droop	D	-0.4	-0.2	+0.2	dB	
Input Return Loss	IRL	10	12	18	dB	
Load Mismatch Stability	VSWR-S	2:1				
VSWR Withstand	VSWR-LMT	5:1				

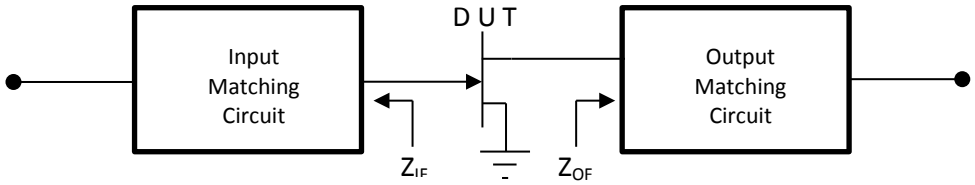
Note 1: Consult Integra Technologies Application Note 001 for information on how RF output power and pulse droop are measured.

Table 4. Thermal Resistance (Case temperature = 25 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Peak Thermal Resistance, Junction to Case	$R_{TH(JC)}$			5.0	°C/W	P_{OUT} = 40W Efficiency = 60% f = 1025, 1090, 1150 MHz Mode S ELM pulse conditions (48 x [32µs on, 18µs off]), LTDC = 6.4% V_{DS} = 50V, I_{DS} = 20mA

Table 5. Optimum Source & Load Impedances (Case temperature = 25 °C unless otherwise stated)

Frequency (MHz)	Z_{IF}	Z_{OF}	Units	Test Conditions
1025	3.0 - j 3.0	10.9 - j 4.4	Ω	P_{OUT} =40W Mode S ELM pulse conditions (48 x [32µs on, 18µs off]), LTDC = 6.4% V_{DS} = 50V, I_{DS} = 20mA
1090	3.0 - j2.2	10.5 - j 4.2	Ω	
1150	2.9 - j 1.6	10.0 - j 4.1	Ω	



TYPICAL PERFORMANCE

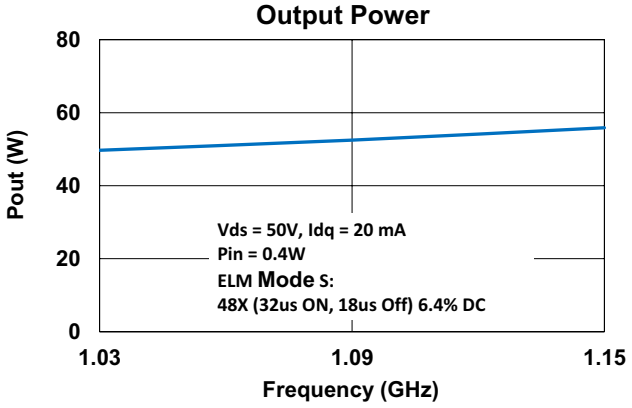


Figure 1

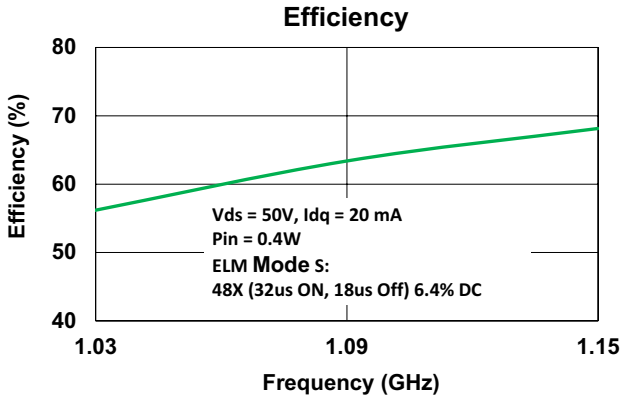


Figure 2

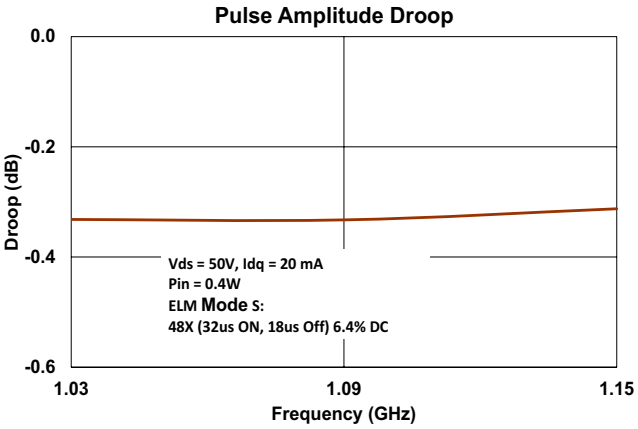


Figure 3

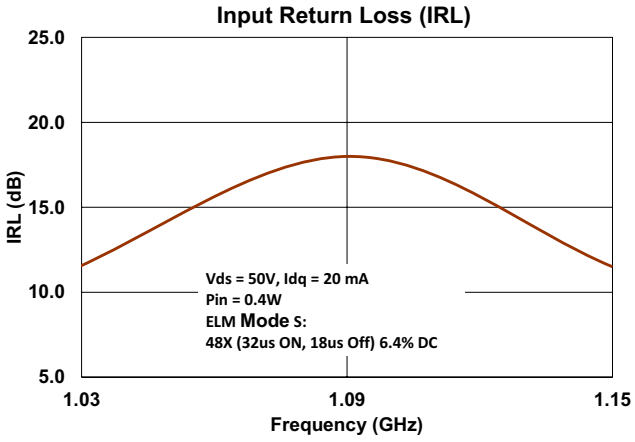
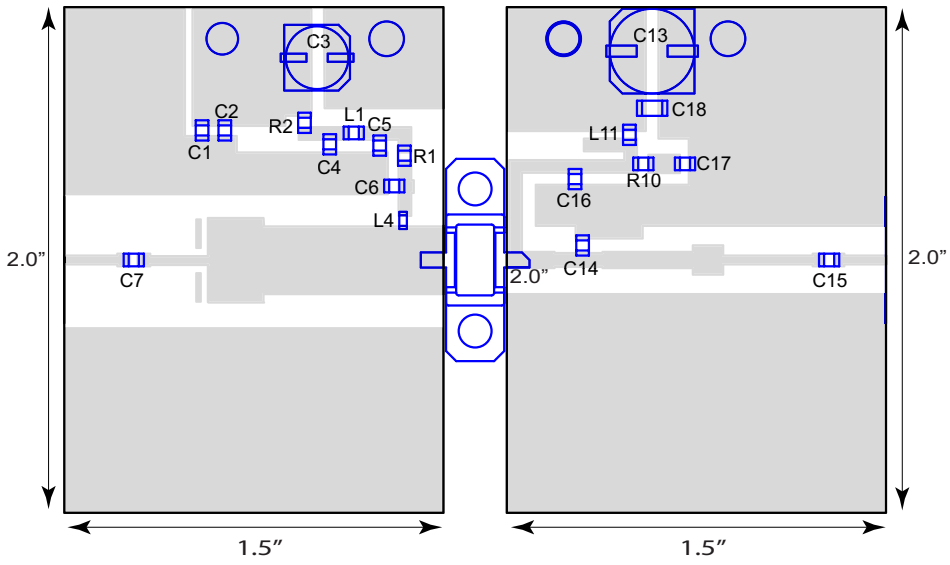


Figure 4

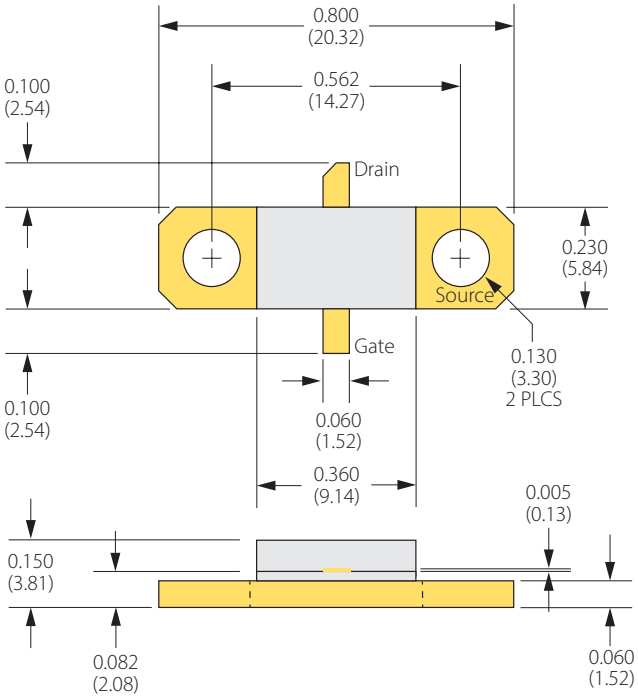
TEST FIXTURE



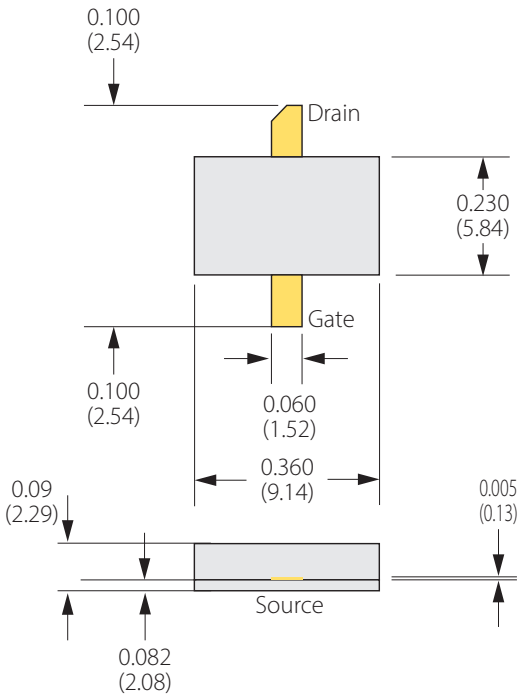
Bill of Materials for IGN1012L40 Test Fixture

Designator	Description	Part Number
C1, C4, C17	CAP 0.1μF, 50V, 0805, X7R	08051C104K4T2A
C2, C5	CAP 1000pF, 0805, X7R	08051A102J4T2A
C3	CAP 47μF, 25V	PCV1E470MCL2GS
C6, C7, C15, C16	CAP 18pF, 0603, Edge Mount	600F180JT250XT
C13	CAP 68μF, 63V, Electrolytic	EEE-FK1J680P
C14	CAP 3.3pF, Edge Mount	600F3R3AT250XT
C18	CAP 1μF, 50V, 1206, X7R	12061C105K4T2A
L1, L11	IND, FB, 120 OHM, 0805	ILHB0805ER121V
L4	IND, 120nH, 0603	0603HP-R12XJB
R1, R10	RES, 5.1 OHM, 0805	ERJ-6GEYJ5R1V
R2	RES 200 OHM, 0805	ERJ-6ENF2000V
PC Board Type	ROGERS RT6006, 25mil, 1/1oz. Copper	

PACKAGE PL32A2



BOLT-DOWN FLANGE OPTION
IGN1012L40



EARLESS FLANGE OPTION
IGN1012L40S

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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