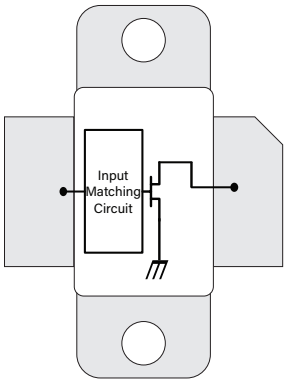
L-Band, GaN/SiC, RF Power Transistor

1030 and 1090 MHz | 700 W typ | 65% Efficiency typ | 17 dB Gain typ | 50 V | 128μs Pulse Length, 2% Duty Cycle

IGN1011M600 and IGN1011M600S 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 1030 and 1090 MHz. Under 128μs pulse length, 2% duty cycle pulse conditions they supply a minimum of 600 W of peak output power with typically 16.5dB of associated gain and 55% efficiency. They operate from a 50V 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 >700 W
- Pre-matched Input Impedance
- High Efficiency - up to 65% 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. RF Electrical Characteristics (Case temperature = 30 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
RF Input Power	$P_{IN, RF}$	7.5	12.0	18.0	W	P_{OUT} = 600W f = 1030, 1090 MHz 128μs pulse length, 2% duty cycle V_{DS} = 50V, I_{DQ} = 90mA
Gain	G	15	16.5	19	dB	
Drain Efficiency	η	50	55	65	%	
Pulse Droop	D	-0.4	-0.25	+0.2	dB	
Input Return Loss	IRL	10	14	20	dB	
Load Mismatch Stability	VSWR-S	2:1				
VSWR Withstand	VSWR-LMT	3:1				

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

Note 2: The efficiency in Table 1 is the drain efficiency during the RF pulse with the current measured with a current probe. If the current is determined by measuring the average DC current and dividing by the duty cycle then the drain efficiency may be lower due to any finite quiescent current flowing when there is no applied RF pulse.

Table 2. 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	72	A	25 °C
DC Gate Current	I_G	7.2	mA	25 °C
RF Input Power	$P_{RF,IN}$	40	W	25 °C
Operating Channel Temperature	T_{CH}	-55 to +225	°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 3. 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_{DQ} = 90mA

Table 4. Test Fixture Source & Load Impedances (Case temperature = 25 °C unless otherwise stated)

Frequency (MHz)	Z_{IF}	Z_{OF}	Units	Test Conditions
1030	2.7 - j 1.0	1.4 - j 0.5	Ω	P_{OUT} = 600W f = 1030, 1090 MHz 128µs pulse length, 2% duty cycle V_{DS} = 50V, I_{DQ} = 90mA
1090	2.7 - j 0.3	1.4 - j 0.4	Ω	

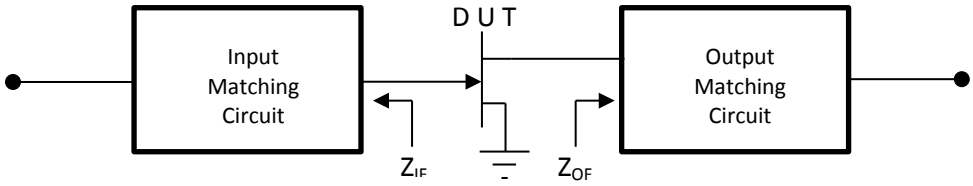


Table 5. Thermal Resistance (Case temperature = 85 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Peak Thermal Resistance, Channel to Case	R_{TH}		0.24		°C/W	P_{DISS} = 491W 128µs pulse length, 2% duty cycle V_{DS} = 50V

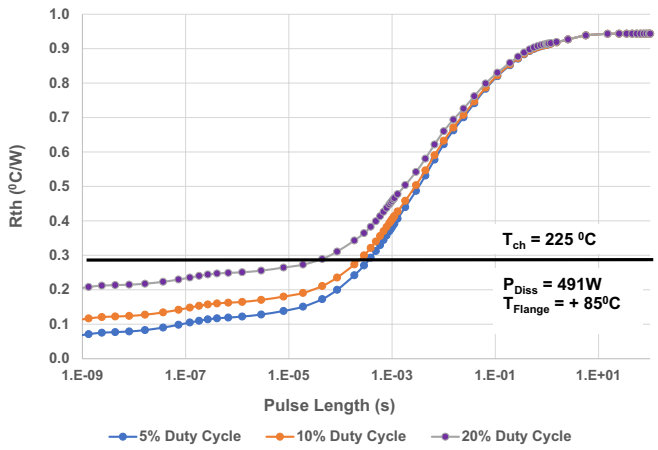


Figure 1

TYPICAL RF PERFORMANCE

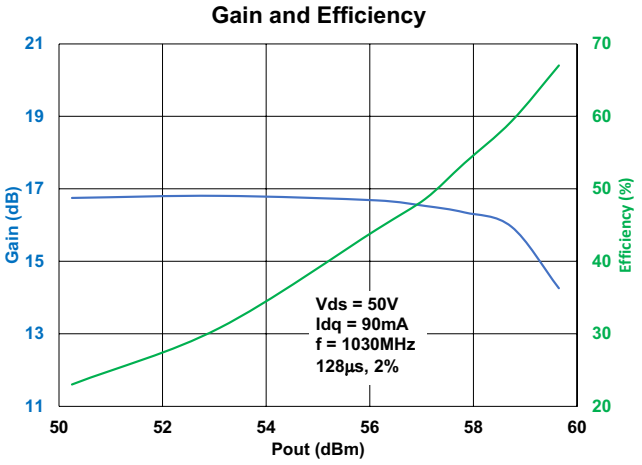


Figure 2

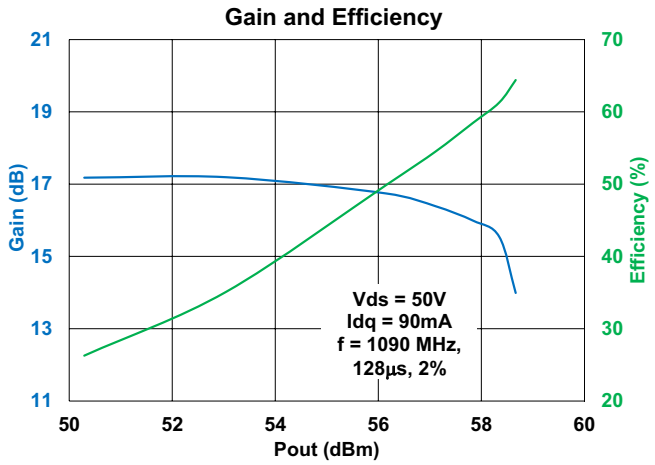


Figure 3

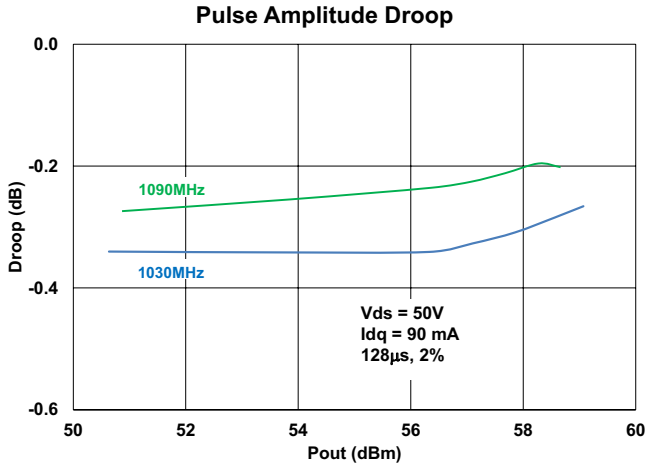
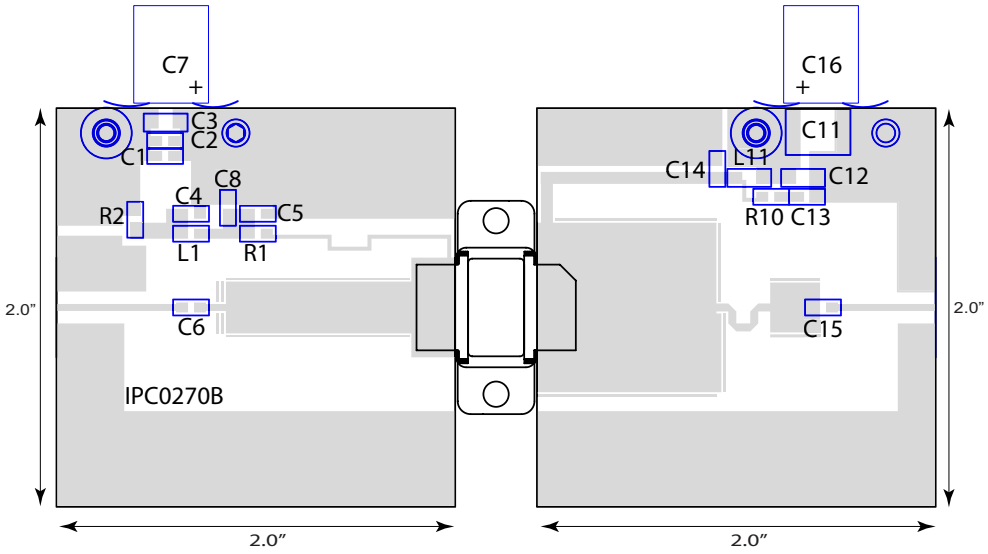


Figure 4

Note: The efficiency shown in Figures 2 & 3 is the drain efficiency during the RF pulse with the current measured with a current probe. If the current is determined by measuring the average DC current and dividing by the duty cycle then the drain efficiency may be lower due to any finite quiescent current flowing when there is no applied RF pulse.

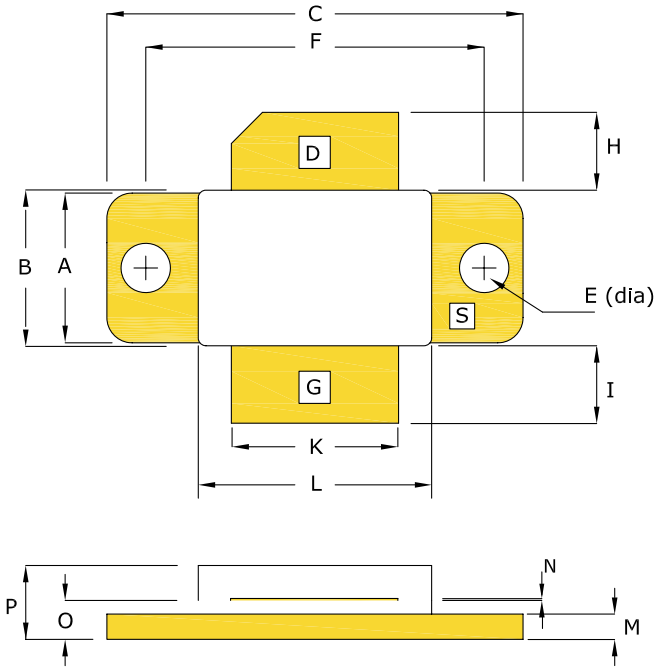
TEST FIXTURE



Bill of Materials for IGN1011M600 Test Fixture

Designator	Description	Part Number
C1, C4, C13	CAP 0.1μF, 0805, 50V, X7R	08051C104K4T2A
C2, C5, C6, C14, C15	CAP 33pF, 0805	ATC600F330
C3, C12	CAP 1μF, 1206, 100V, X7R	12061C105K4T2A
C7, C16	CAP 68μF, 63V, Electrolytic	UPW1J680MPD
C8	CAP 1000pF, 0805, 100V	08051A102J4T2A
L1	IND, FB, 120 OHM, 0805, 5A	ILHB0805ER121V
L11	IND , FB, 33 OHM, 1206, 6A	BLM31PG330SN1L
R1, R10	RES, 15 OHM, 0805	ERJ-6ENF150V
R2	RES, 100 OHM, 0805	ERJ-6ENF2000V
PC Board Type	ROGERS RT6006, 25mil, 1/1oz. Copper	

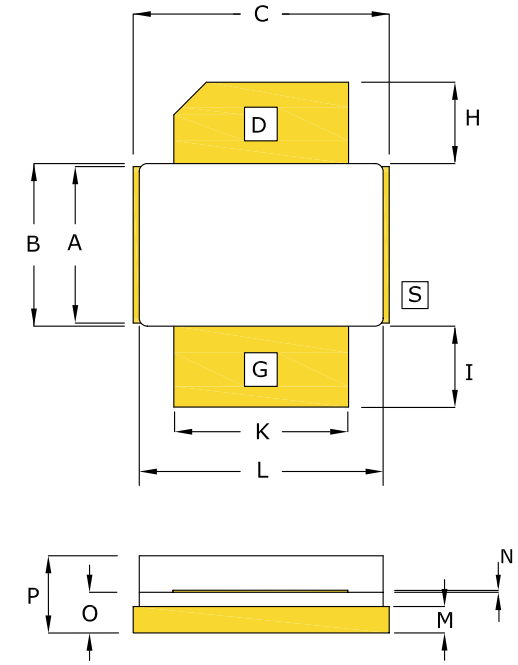
PACKAGE PL64A1



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.380	0.390		
B	0.395	0.405		
C	1.065	1.075	27.05	27.31
E	0.124	0.130	3.15	3.30
F	0.865	0.875	21.97	22.23
H	0.190	0.223	4.83	5.66
I	0.190	0.223	4.83	5.66
J	--	--	--	--
K	0.425	0.435	10.80	11.05
L	0.595	0.605	15.11	15.37
M	0.060	0.070	1.52	1.78
N	0.004	0.006	0.10	0.15
□	0.096	0.106	2.44	2.69
P	0.181	0.214	4.60	5.44

PIN SCHEDULE	
D	DRAIN
S	SOURCE
G	GATE

BOLT-DOWN FLANGE OPTION
IGN1011M600



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.380	0.390	9.65	9.91
B	0.395	0.405	10.03	10.29
C	0.625	0.635	15.88	16.13
E	--	--	--	--
F	--	--	--	--
H	0.190	0.223	4.83	5.66
I	0.190	0.223	4.83	5.66
J	--	--	--	--
K	0.425	0.435	10.80	11.05
L	0.595	0.605	15.11	15.37
M	0.060	0.070	1.52	1.78
N	0.004	0.006	0.10	0.15
□	0.096	0.106	2.44	2.69
P	0.181	0.214	4.60	5.44

PIN SCHEDULE	
D	DRAIN
S	SOURCE
G	GATE

EARLESS FLANGE OPTION
IGN1011M600S

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.

Disclaimer

Integra Technologies Inc. reserves the right to make changes without further notice to any products herein. Integra Technologies Inc. makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Integra Technologies Inc. assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Integra Technologies Inc. products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Integra Technologies Inc. customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Integra Technologies Inc. for any damages resulting from such improper use or sale.

DEFINITIONS:
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.

Integra Technologies, 321 Coral Circle, El Segundo, CA 90245-4620 | Phone: 310-606-0855 | Fax: 310-606-0865