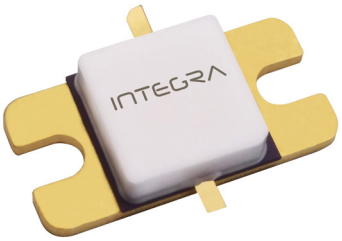
C-Band, GaN/SiC, RF Power Transistor

5.4 - 5.9 GHz | 25 W | 48% Efficiency | 17 dB Gain | 45 V | 100μs Pulse Length, 10% Duty Cycle

IGT5459M25 and IGT5459M25S are high power GaN-on-SiC RF power transistors that have been designed to suit the unique needs of C-Band Radar Systems. They operate over the full bandwidth of 5.4-5.9 GHz. Under 100μs, 10% duty cycle conditions, they supply 25 W of RF output power, with typically 17dB of associated gain and 48% efficiency. They operate from a 45 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 25 W
- Fully matched to 50 Ω Impedance at both Input and Output
- High Efficiency - up to 50 %
- 100% RF Tested
- RoHS and REACH Compliant
- IGT5459M25 has a bolt-down flange, IGT5459M25S is the earless flange option

APPLICATIONS

- C-band Radar Systems

Table 1. RF Electrical Characteristics (Case temperature = 30 °C unless otherwise stated)

Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Input Return Loss	IRL	5	14	25	dB	P_{OUT} = 25W f = 5.4, 5.65, 5.9GHz 100μs Pulse Length, 10% Duty Cycle V_{DS} = 45V, I_{DS} = 5mA
Gain	G	14	17	18.5	dB	
Drain Efficiency	η	30	48	55	%	
Pulse Droop	D	-0.3	-0.1	0	dB	
Load Mismatch Stability	VSWR-S	2:1				
VSWR Withstand	VSWR-LMT	3:1				

Table 2. Absolute Maximum Ratings (Not Simultaneous)

Parameter	Symbol	Value	Units	Test Conditions
DC Drain-Source Voltage	V_{DS}	130	V	25 °C
DC Gate-Source Voltage	V_{GS}	-8 to +1.0	V	25 °C
DC Drain Current	I_D	4.8	A	25 °C
DC Gate Current	I_G	0.48	mA	25 °C
RF Input Power	$P_{RF,IN}$	2.5	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 10s	°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)

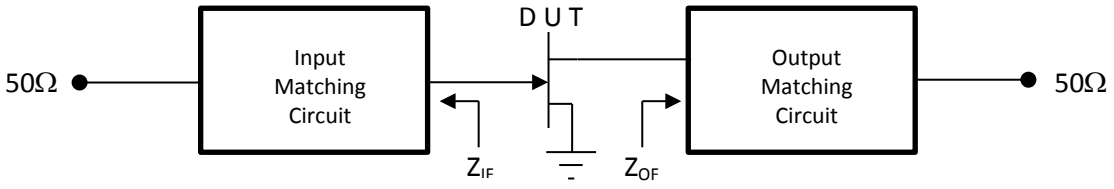
Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Gate Pinch-Off Voltage	V_P	-5.0			V	V_{DS} = 45V, I_{DS} = 1mA
Quiescent Gate Voltage	V_Q		-2.5		V	V_{DS} = 45V, I_{DS} = 5mA

Table 4. 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}				°C/W	P_{DISS} = 41 W 100µs Pulse Length, 10% Duty Cycle V_{DS} = 45V

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

Frequency (GHz)	Z_{IF}	Z_{OF}	Units	Test Conditions
5.2	50 + j0	50 + j0	Ω	P_{OUT} = 25W 100µs Pulse Length, 10% Duty Cycle V_{DS} = 45V, I_{DS} = 5mA
5.55	50 + j0	50 + j0	Ω	
5.9	50 + j0	50 + j0	Ω	



DC Bias Sequencing

TURN ON SEQUENCE	TURN OFF SEQUENCE
1. Turn RF Power OFF 2. Set V_{GS} = -5V (Negative Voltage to pinch off FET) 3. Measure I_{DS} current, should be <1mA. 4. Turn ON V_{DS} voltage. 5. Slowly increase V_{GS} until bias current reaches I_{DQ}. 6. Turn ON RF Power	1. Turn OFF RF Power 2. Turn OFF V_{DS} voltage 3. After V_{DS} is discharged, set V_{GS} = -5V 4. Turn OFF V_{GS} voltage.

TYPICAL RF PERFORMANCE

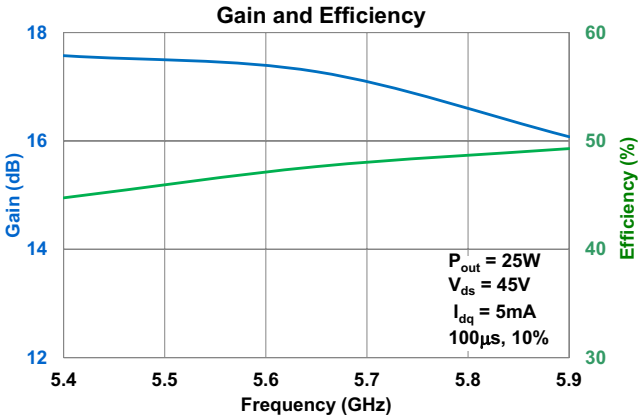


Figure 1

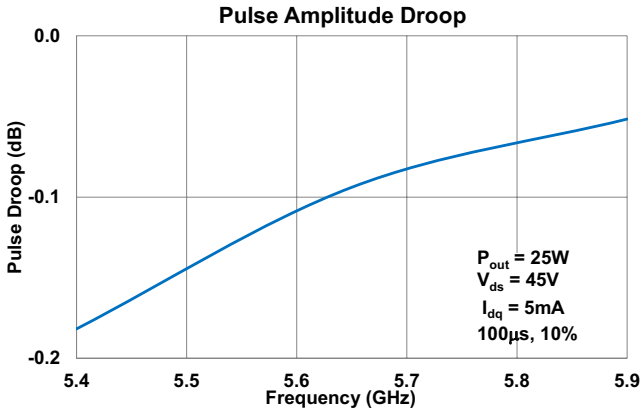


Figure 2

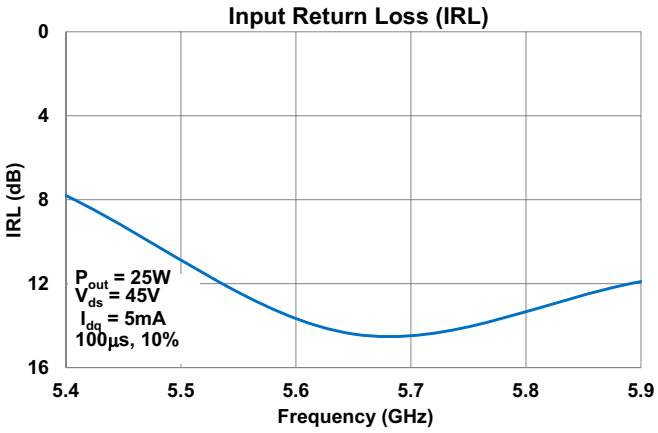
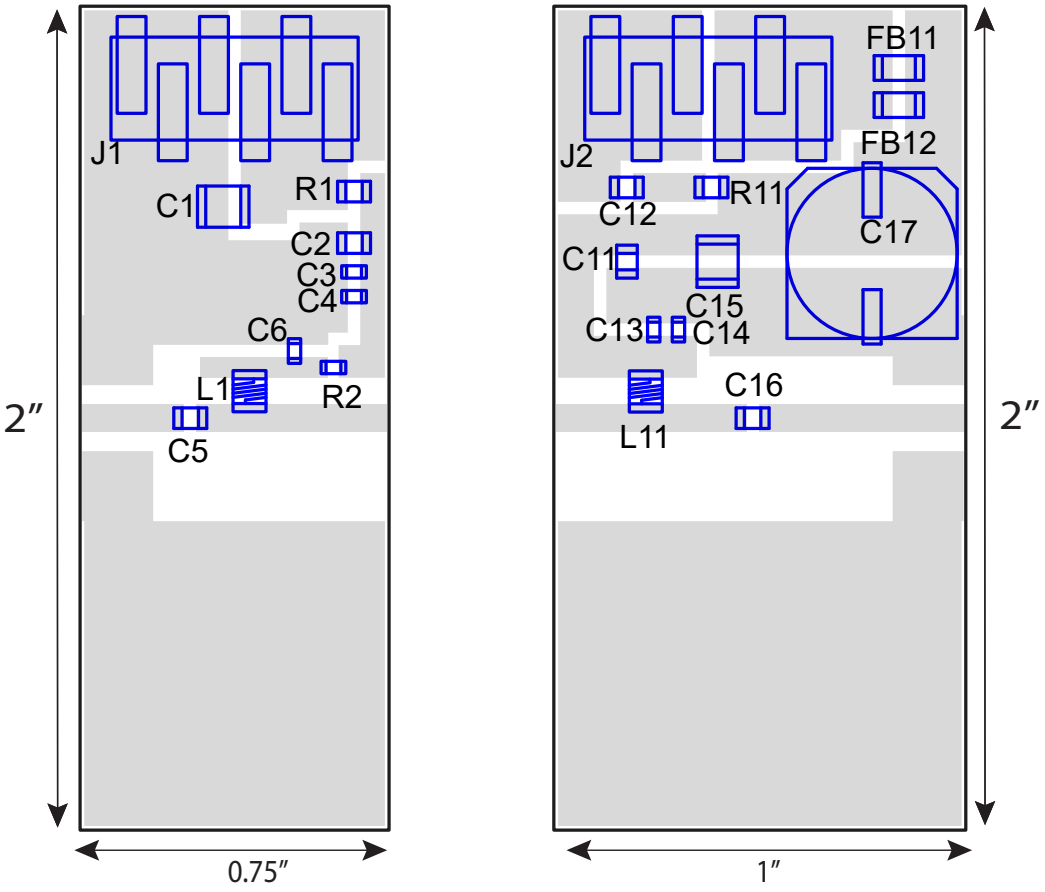


Figure 3

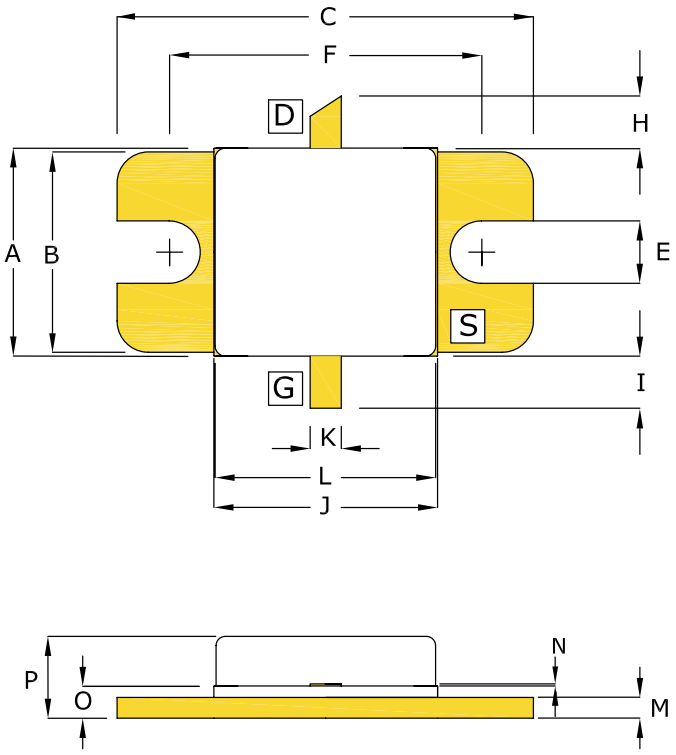
TEST FIXTURE



Bill of Materials for IGT5459M25 Test Fixture

Designator	Description	Part Number
C1	CAP 4.7µF, 1210, 25V	C1210C475K3RACTU
C2, C11, C12	CAP 0.1µF, 0805, 100V	C2012X7R2A104K125
C3,C14	CAP 10pF, 250V, 0603	600S100FT250XT
C4, C6, C13	CAP 3.9pF, 0603, 250V	600S3R9BT250XT
C5, C16	CAP 6.8pF, 0805, 250V	600F6R8BT250XT
C15	CAP 1µF, 1210, 100V, X7R	
C17	CAP 33µF , C10X10, Electrolytic, 100V	UCZ2A330MCL1GS
FB11, FB12	IND, FB, 33 OHM, 1206, 5A	BLM31PG330SN1L
L1, L11	IND, 8nH	CC_A03TGLB
R1	RES 100 OHM, 0805	
R2	RES 15OHM,0603	
R11	RES 10 OHM, 0805	CRCW080510R0JNEA
PC BOARD	TACONIC RF-35TC-0300-E-C1/C1, 0.030", 1oz/1oz Copper	

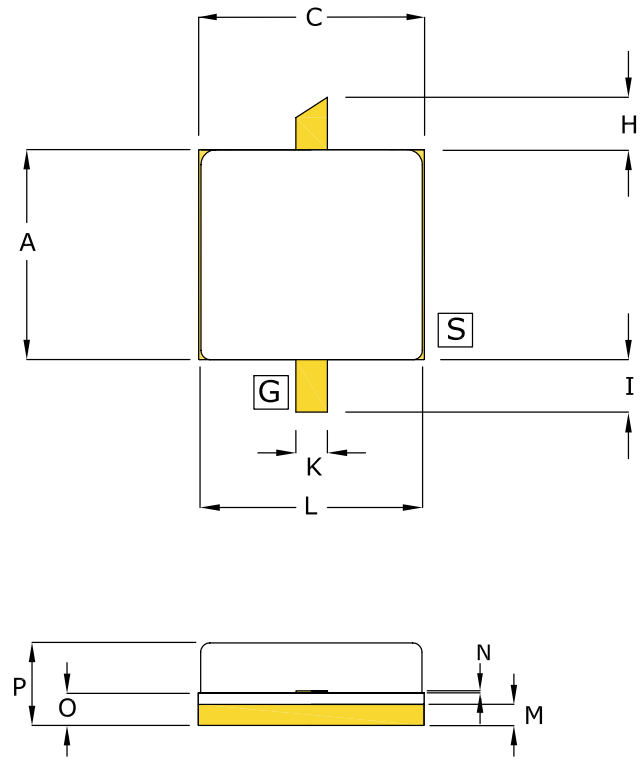
PACKAGE PL44A1



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.395	0.405	10.03	10.29
B	0.380	0.390	9.65	9.91
C	0.795	0.805	20.19	20.45
E	0.115	0.125	2.92	3.18
F	0.595	0.605	15.11	15.37
H	0.090	0.110	2.29	2.79
I	0.090	0.110	2.29	2.79
J	0.425	0.435	10.80	11.05
K	0.055	0.065	1.40	1.65
L	0.420	0.428	10.67	10.87
M	0.035	0.045	0.89	1.14
N	0.004	0.007	0.10	0.18
□	0.053	0.067	1.35	1.70
P	0.143	0.179	3.63	4.55

PIN SCHEDULE	
D	DRAIN
S	SOURCE
G	GATE

IGT5459M25 BOLT-DOWN FLANGE OPTION



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.393	0.408	9.97	10.35
B	--	--	--	--
C	0.423	0.438	10.73	11.11
E	--	--	--	--
F	--	--	--	--
H	0.090	0.110	2.29	2.79
I	0.090	0.110	2.29	2.79
J	--	--	--	--
K	0.055	0.065	1.40	1.65
L	0.420	0.428	10.67	10.87
M	0.035	0.045	0.89	1.14
N	0.004	0.007	0.10	0.18
□	0.053	0.067	1.35	1.70
P	0.143	0.179	3.63	4.55

PIN SCHEDULE	
D	DRAIN
S	SOURCE
G	GATE

IGT5459M25 EARLESS FLANGE OPTION

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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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.