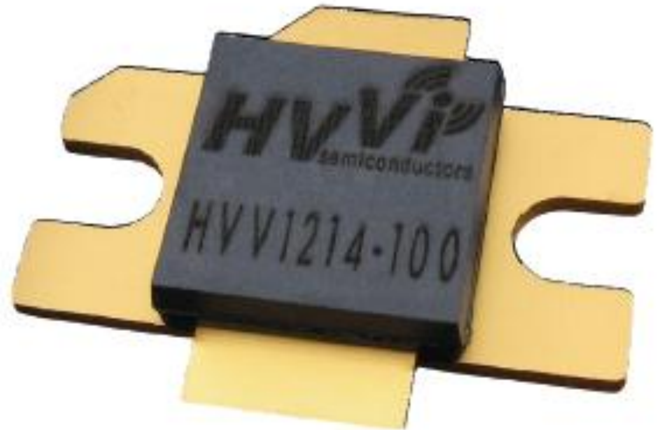
HVV1214-100 High Voltage, High Ruggedness

L-Band Pulsed Power Transistor
1200-1400 MHz, 200μs Pulse, 10% Duty Cycle
For Ground Based Radar Applications

The innovative Semiconductor Company!

FEATURES



- Silicon MOSFET Technology
- Operation from 24V to 50V
- High Power Gain
- Extreme Ruggedness
- Internal Input and Output Matching
- Excellent Thermal Stability
- All Gold Bonding Scheme
- Pb-free and RoHS Compliant

TYPICAL PERFORMANCE

High voltage vertical technology is well suited for high power pulsed applications such as L-Band ground based radars.

MODE	FREQUENCY (MHz)	VDD (V)	IDQ (mA)	Power (W)	GAIN (dB)	η(%)	IRL (dB)	VSWR
Class AB	1400	50	100	120	20.5	43	-8	20:1

Table 1: Typical RF Performance in broadband text fixture at 25°C temperature with RF pulse conditions of pulse width = 200μs and pulse duty cycle = 10%.

DESCRIPTION

The high power HVV1214-100 device is an enhancement mode RF MOSFET power transistor designed for pulsed applications in the L-Band from 1200MHz to 1400MHz. The high voltage HVVFET™ technology produces over 120W of pulsed output power while offering high gain, high efficiency, and ease of matching with a 50 V supply. The vertical device structure assures high reliability and ruggedness as the device is specified to withstand a 20:1 VSWR at all phase angles under full rated output power.

ORDERING INFORMATION

Device Part Number: HVV1214-100
Evaluation Kit Part Number: HVV1214-100-EK
Available through Richardson Electronics (http://www.rell.com/)

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ABSOLUTE MAXIMUM RATING (IEC 134)

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	95	V
V_{GSS}	Gate-Source Voltage	-10, 10	V
$I_{DS(max)}$	Drain Current	14	A
P_D[1]	Power Dissipation	324	W
P_{in}	Input Power	3.4	W
T_S	Storage Temperature	-40 to +150	°C
T_J	Junction Temperature	200	°C

THERMAL/RUGGEDNESS PERFORMANCE

Symbol	Parameter	Max	Unit
θ_{JC}[2]	Thermal Resistance	0.54	°C/W

Symbol	Parameter	Test Condition	Max	Units
LMT[2]	Load Mismatch Tolerance	F = 1400 MHz	20:1	VSWR

The HVV1214-100 device is capable of withstanding an output load mismatch corresponding to a 20:1 VSWR at rated output power and nominal operating voltage across the frequency band of operation.

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typical	Max	Unit
$V_{BR(DSS)}$	Drain-Source Breakdown	V_{GS}=0V,I_D=5mA	95	102	-	V
I_{DSS}	Drain Leakage Current	V_{GS}=0V,V_{DS}=50V	-	50	100	μA
I_{GSS}	Gate Leakage Current	V_{GS}=5V,V_{DS}=0V	-	10	100	nA
G_P[2]	Power Gain	F=1400MHz	18.5	20	-	dB
IRL[2]	Input Return Loss	F=1400MHz	-	-8	-5	dB
η_D[2]	Drain Efficiency	F=1400MHz	41	43	-	%
$V_{GS(Q)}$[3]	Gate Quiescent Voltage	V_{DD}=50V,I_{DQ}=100mA	1.1	1.45	1.8	V
V_{TH}	Threshold Voltage	V_{DD}=5V, I_D=300μA	0.7	1.2	1.7	V

PULSE CHARACTERISTICS

Symbol	Parameter	Conditions	Min	Typical	Max	Units
t_r[4]	Rise Time	F=1400MHz	-	<25	50	nS
t_f[4]	Fall Time	F=1400MHz	-	<15	50	nS
PD[4]	Pulse Droop	F=1400MHz	-	0.55	0.8	dB

Notes:
1) Rated at T_{CASE} = 25°C

2) All parameters measured under pulsed conditions at 120W output power measured at the 10% point of the pulse with pulse width = 200μsec, duty cycle = 10% and V_{DD} = 50V, I_{DQ} = 100mA in a broadband matched test fixture.

3) Amount of gate voltage required to attain nominal quiescent current.

4) Guaranteed by design.

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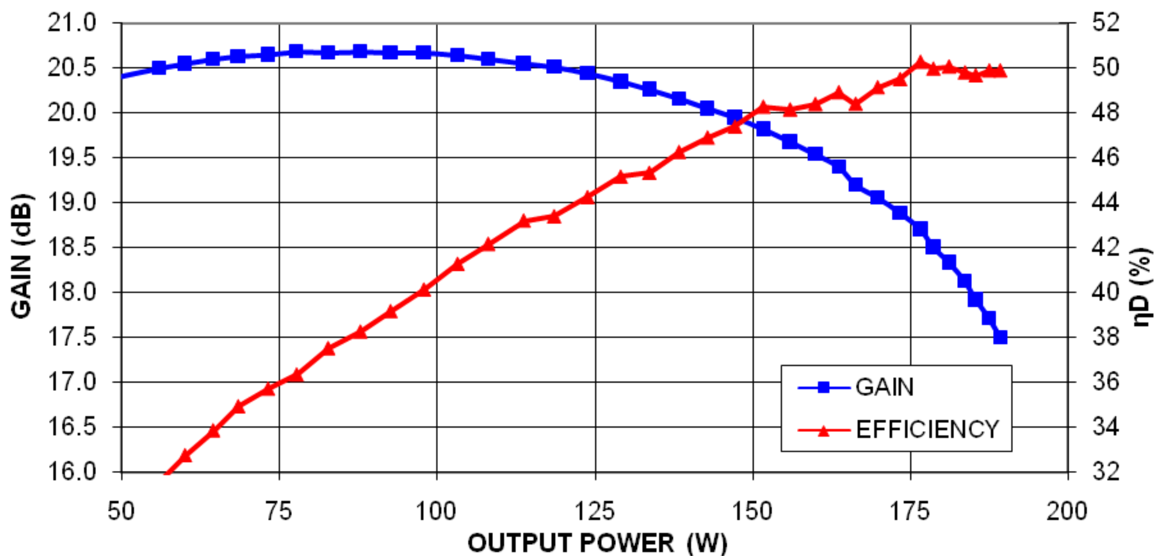
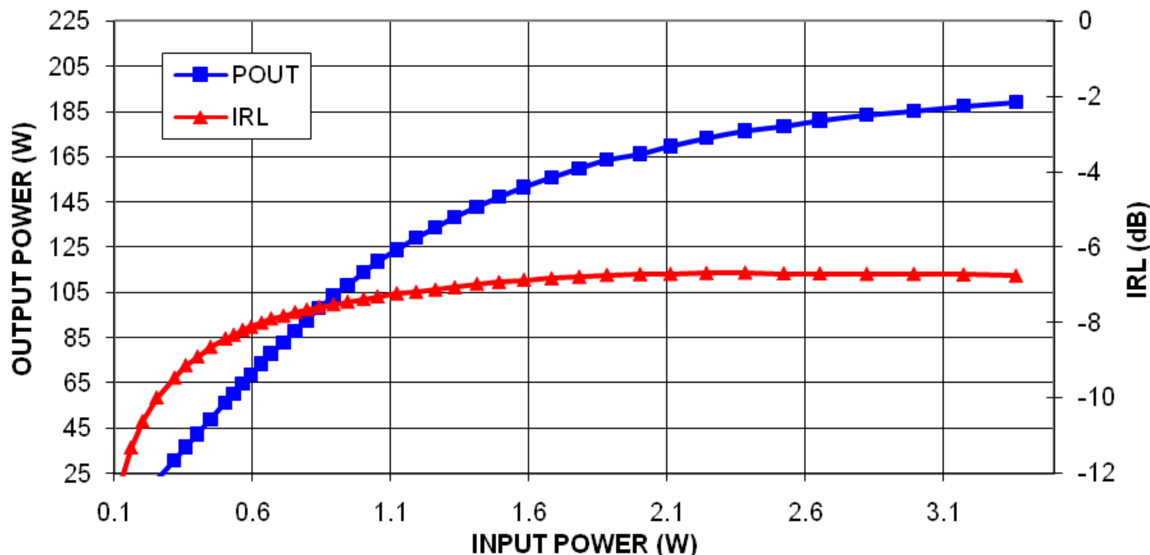


Typical device performance under Class AB mode of operation and RF pulse conditions of 200µs pulse width and 10% duty cycle with V_{DD} = 50V and I_{DQ} = 100mA. The device was measured at 1400MHz.



Typical device performance under Class AB mode of operation and RF pulse conditions of 200µs pulse width and 10% duty cycle with V_{DD} = 50V and I_{DQ} = 100mA. The device was measured at 1400MHz.

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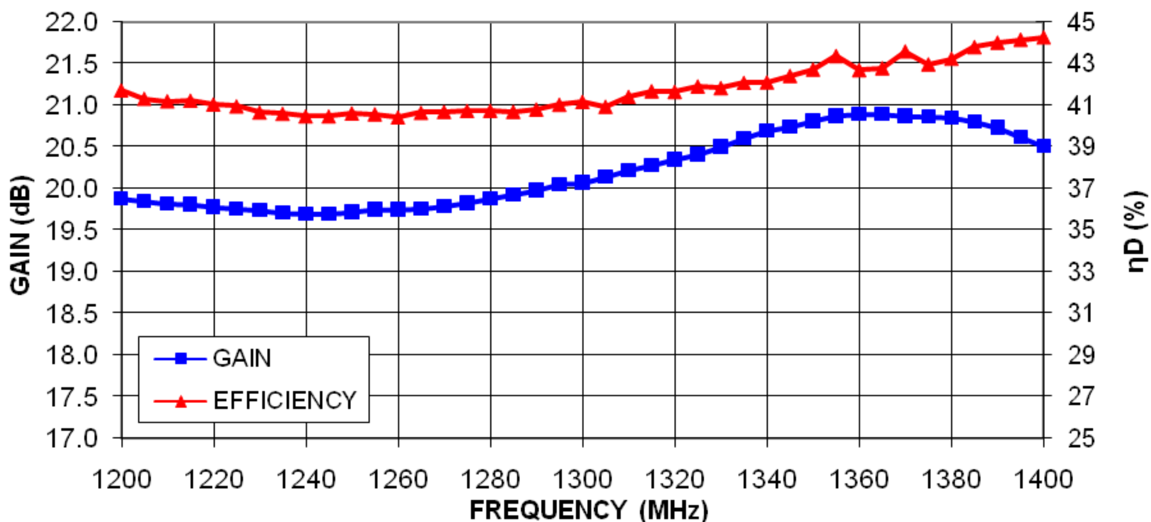
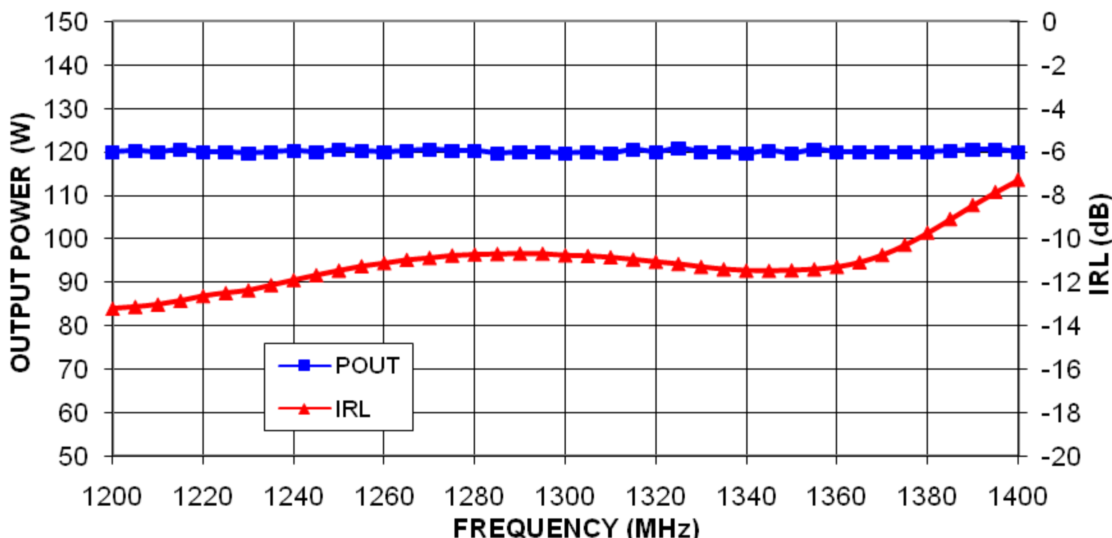


Typical device performance under Class AB mode of operation and RF pulse conditions of 200μs pulse width and 10% duty cycle with V_{DD} = 50V and I_{DQ} = 100mA. The device was measured at 120W.



Typical device performance under Class AB mode of operation and RF pulse conditions of 200μs pulse width and 10% duty cycle with V_{DD} = 50V and I_{DQ} = 100mA. The device was measured at 120W.

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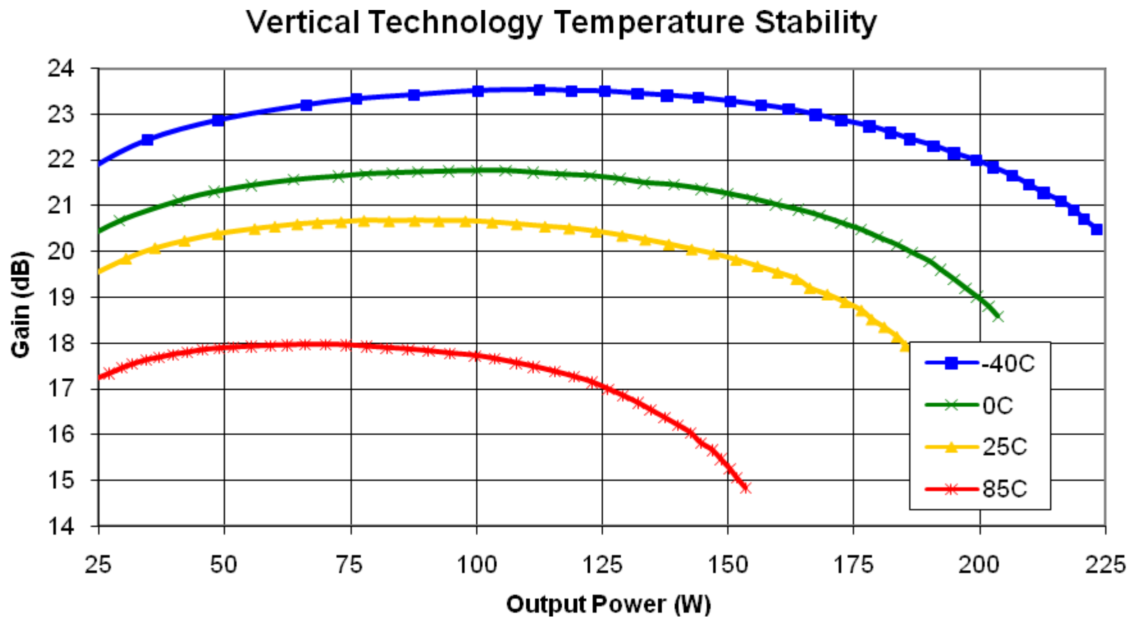

Typical device performance under Class AB mode of operation at 1400MHz and pulse conditions of 200µs pulse width and 10% duty cycle with V_{DD} = 50V and I_{DQ} = 100mA. The high voltage silicon vertical technology shows less than 1.6dB of power degradation over an extreme case temperature rise of 125°C.

Measured at P1dB Compression Point			
TEMP	Gain (dB)	Power (W)	Power (dBm)
-40C	22.5	186	52.7
0C	20.8	168	52.3
25C	19.7	156	51.9
85C	16.9	129	51.1

HVV1214-100 Performance over Temperature

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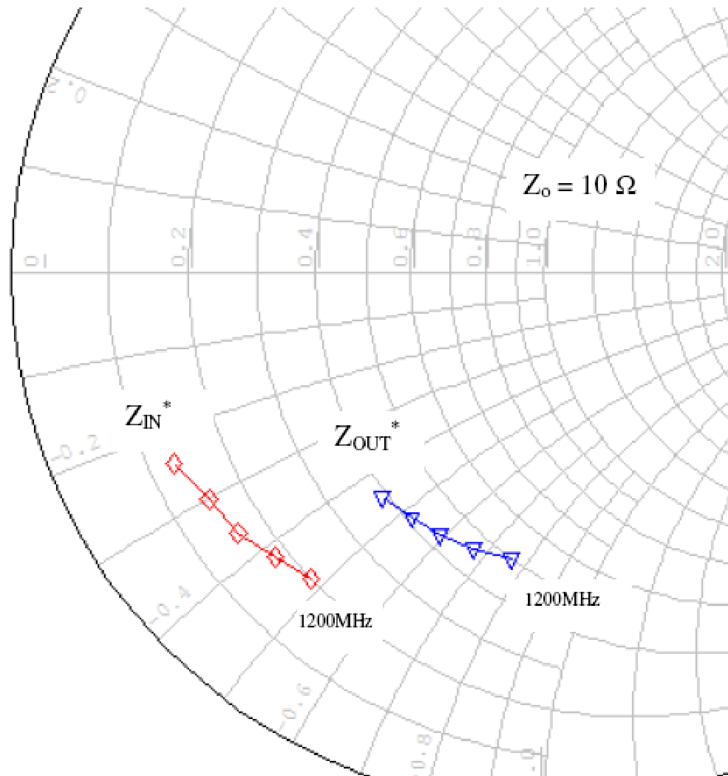
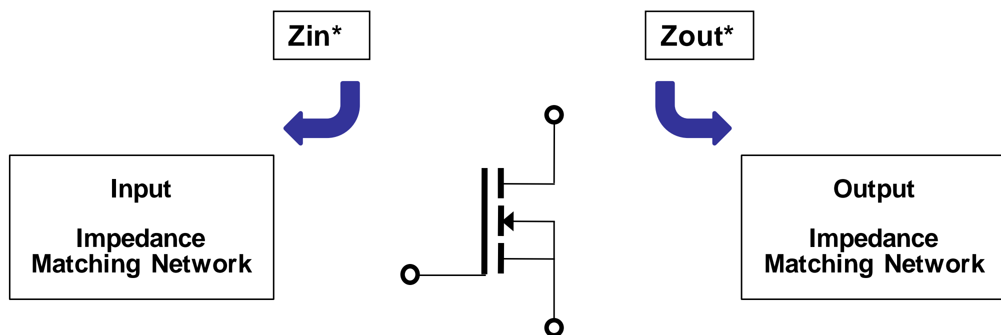


Test Circuit Impedances

Frequency	Zin* (ohms)	Zout* (ohms)
1200MHz	1.7-j4.1	4.5-j7.6
1250MHz	1.6-j3.4	4.1-j6.7
1300MHz	1.5-j2.9	3.9-j6.0
1350MHz	1.3-j2.4	3.6-j5.2
1400MHz	1.2-j1.8	3.4-j4.5



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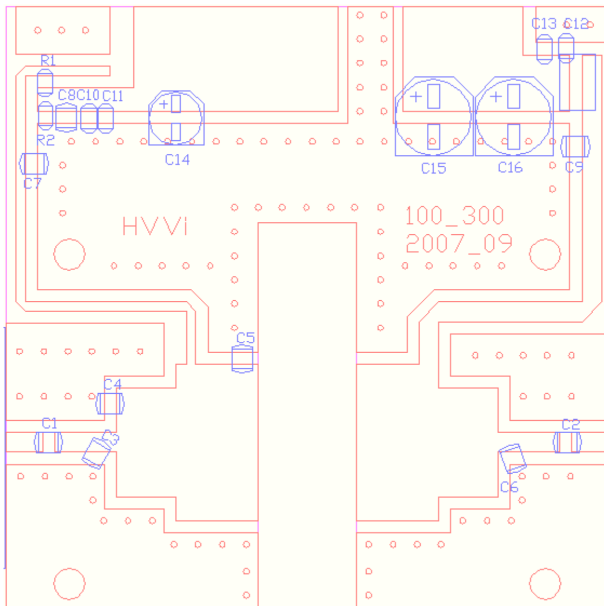

Demonstration Board Outline

Example of a Demonstration Circuit

Part	Description	Part Number	Manufacturer
C1, C2:	100 pF ATC 100B Chip Capacitor	100B101JP500X	ATC
C3:	2.4 pF ATC 100B Chip Capacitor	100B2R4JP500X	ATC
C4:	1.2 Pf ATC 100B Chip Capacitor	100B1R2JP500X	ATC
C5:	3.9 pF ATC 100B Chip Capacitor	100B3R9JP500X	ATC
C6:	2.4 pF ATC 100B Chip Capacitor	100B2R4JP500X	ATC
C7:	15 pF ATC 100B Chip Capacitor	100B150JP500X	ATC
C8,C9:	47 pf ATC 100B Chip Capacitor	100B470JP500X	ATC
C10,C12:	1K pF 100V Chip Capacitor (X7R 1206)	C1206C102K1RACTU	Kemet
C11,C13:	10K pF 100V Chip Capacitor (X7R 1206)	C1206C103K1RACTU	Kemet
C14:	10 uF 63V Elect FK SMD	PCE3479CT-ND	DIGI-KEY
C15, C16:	100 uF 63V Elect FK SMD	PCE3483CT-ND	DIGI-KEY
R1:	10 Ohms Chip Resistor (1206)	ERJ8GEYJ100V	Panasonic
R2:	1 K Ohms Chip Resistor (1206)	ERJ8GEYJ102V	Panasonic
RF Connectors	Type "N" RF connectors	5919CC-TB-7	Coaxicom
DC Drain Conn	Connector Jack Banana Nylon Red	J151-ND	DIGI-KEY
DC Ground Conn.	Connector Jack Banana Nylon Black	J152-ND	DIGI-KEY
DC Gate Conn.	Connector Jack Banana Nylon Green	J153-ND	DIGI-KEY
PCB Board	PCB: Arlon, 30 mils thick, 2.55 Dielectric, 2 oz Copper		DS Electronics
Device Clamp	Cool Innovation Nylon Clamp Foot	FXT000158	Cool Innovation
Heat Sink	Cool Innovations Aluminum Heat Sink	3-252510RS3394	Cool Innovation
S.S. Screws (4)	4-40 X 1/4 Stainless Steel Socket Hex Head	P242393	Copper State Bolt
Alloy Screws (4)	4-40 X 1/2 Alloy Socket Cap screw Hex Head	SCAS-0440-08C	Small Parts Inc
Metal Washer (6)	#4 Washer Zinc PLTD Steel Lock	ZSLW-004-M	Small Parts Inc
Alloy Screws (2)	4-40 X 3/4 Alloy Socket Cap Screw Head	SCAS-0440-12M	Small Parts Inc

HVV11214-100 Demonstration Circuit Board Bill of Materials

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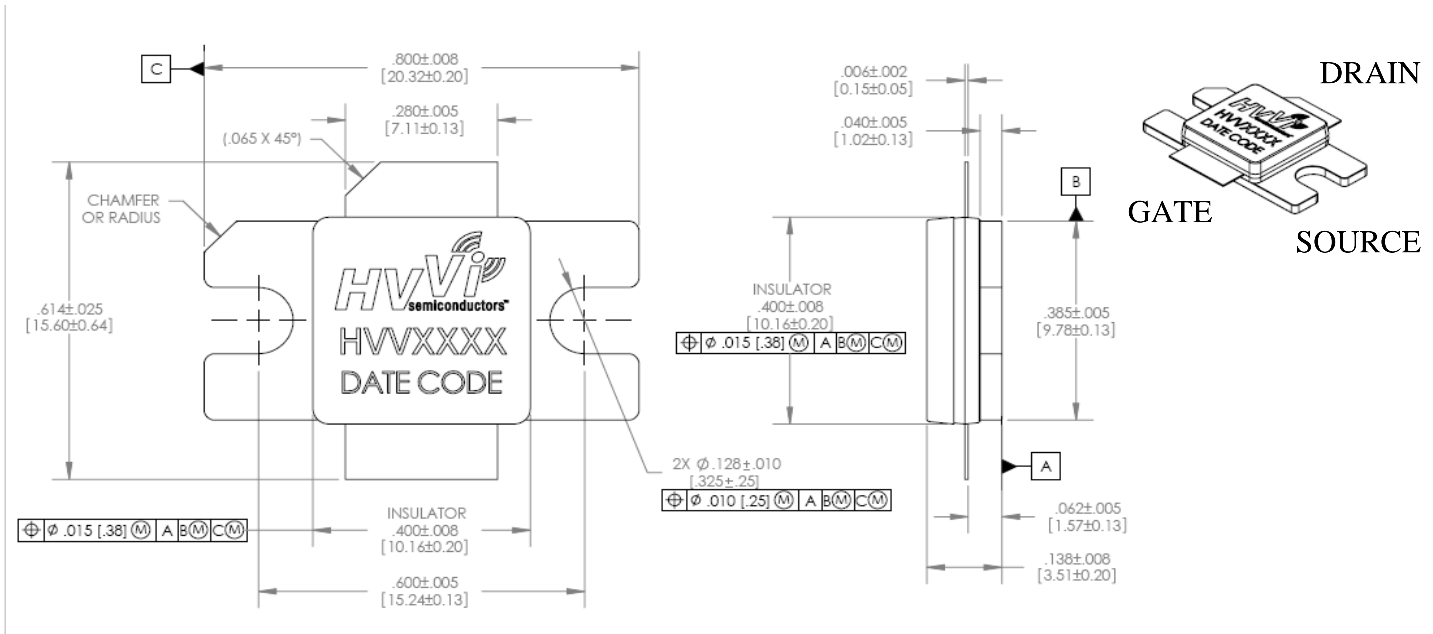
PACKAGE DIMENSIONS



Note: Drawing is not actual size.

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