

# HVV1012-250 High Voltage, High Ruggedness

*L-Band Avionics Pulsed Power Transistor*

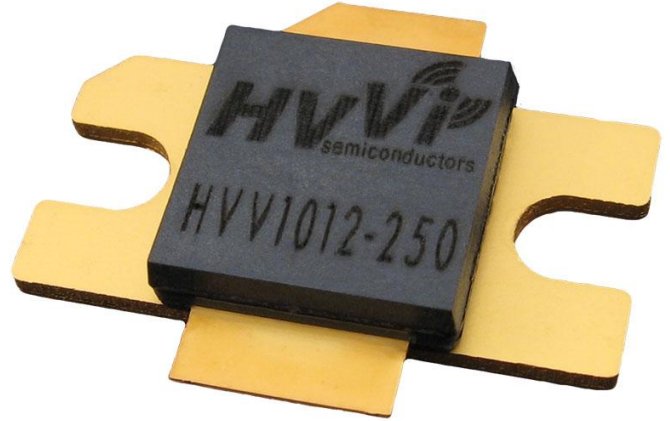
*1025-1150 MHz, 10 $\mu$ s Pulse, 1% Duty Cycle*

*For Airborne DME, TCAS and IFF Applications*



## 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



## TYPICAL PERFORMANCE

High voltage vertical technology is well suited for high power pulsed applications in the L-Band including Airborne DME, IFF, TCAS and Mode-S applications.

MODE	FREQUENCY (MHz)	VDD (V)	IDQ (mA)	Power (W)	GAIN (dB)	$\eta$ (%)	IRL (dB)	VSWR
Class AB	1150	50	100	250	19.5	48	-7	20:1

Table 1: Typical RF Performance in broadband test fixture at 25°C temperature with RF pulse conditions of pulse width = 10 $\mu$ s and pulse period = 1ms.

## DESCRIPTION

The high power HVV1012-250 device is an enhancement mode RF MOSFET power transistor designed for pulsed applications in the L-Band from 1025MHz to 1150MHz. The high voltage HVVFET™ technology produces over 250W 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: HVV1012-250

Demo Kit Part Number: HVV1012-250-EK

Available through Richardson Electronics (<http://www.rell.com/>)

**HVV1012-250 High Voltage, High Ruggedness***L-Band Avionics Pulsed Power Transistor**1025-1150 MHz, 10 $\mu$ s Pulse, 1% Duty Cycle**For Airborne DME, TCAS and IFF Applications***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	$V_{GS}=0V, V_{DS}=48V$	-	50	200	$\mu A$
$I_{GSS}$	Gate Leakage Current	$V_{GS}=5V, V_{DS}=0V$	-	1	5	$\mu A$
$G_P^1$	Power Gain	$F=1150MHz$	17.5	19.5	-	dB
$IRL^1$	Input Return Loss	$F=1150MHz$	-	-7	-4	dB
$\eta_D^1$	Drain Efficiency	$F=1150MHz$	46	48	-	%
$V_{GS(Q)}^2$	Gate Quiescent Voltage	$V_{DD}=50V, I_{DQ}=100mA$	1.1	1.45	1.8	V
$V_{TH}$	Threshold Voltage	$V_{DD}=5V, I_D=300\mu A$	0.7	1.2	1.7	V

**PULSE CHARACTERISTICS**

Symbol	Parameter	Conditions	Min	Typical	Max	Units
$t_r^1$	Rise Time	$F=1150MHz$	-	<40	50	ns
$t_f^1$	Fall Time	$F=1150MHz$	-	<15	50	ns
$PD^1$	Pulse Droop	$F=1150MHz$	-	0.25	0.5	dB

**THERMAL PERFORMANCE**

Symbol	Parameter	Max	Unit
$\theta_{JC}^1$	Thermal Resistance	0.10	$^{\circ}C/W$

**RUGGEDNESS PERFORMANCE**

Symbol	Parameter	Test Condition	Max	Units
$LMT^1$	Load Mismatch Tolerance	$F = 1150 MHz$	20:1	VSWR

The HVV1012-250 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.

1.) NOTE: All parameters measured under pulsed conditions at 250W output power measured at the 10% point of the pulse with pulse width = 10 $\mu$ sec, duty cycle = 1% and  $V_{DD} = 50V$ ,  $I_{DQ} = 100mA$  in a broadband matched test fixture.

2.) NOTE: Amount of gate voltage required to attain nominal quiescent current.

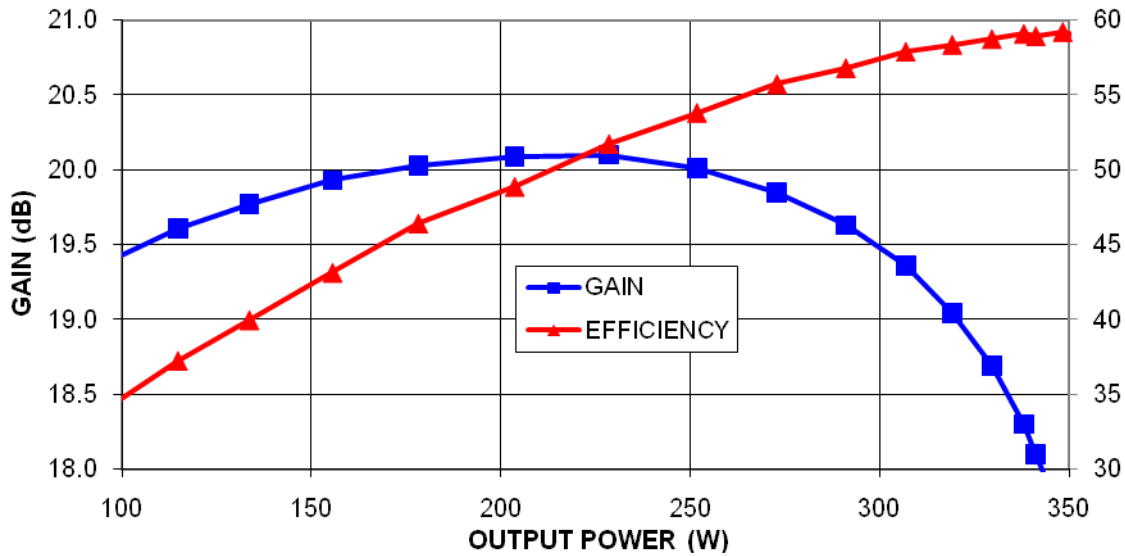
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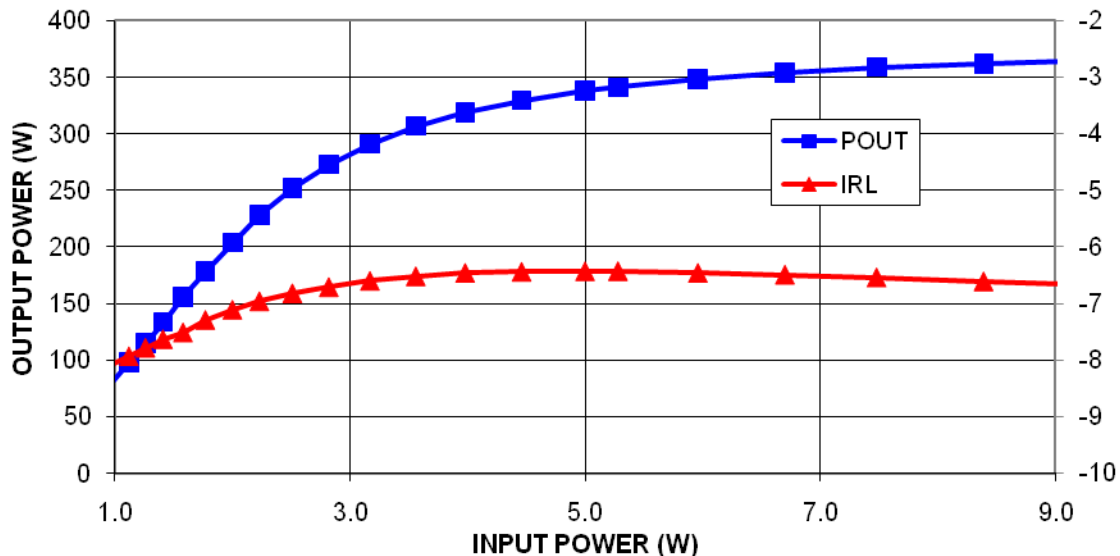
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Typical Power Performance  
in a Broadband Matched Circuit



Typical device performance under Class AB mode of operation and RF pulse conditions of 10µs pulse width and 1% duty cycle with  $V_{DD} = 50V$  and  $I_{DQ} = 100mA$ . The device was measured at 1150MHz.

Typical Power Performance  
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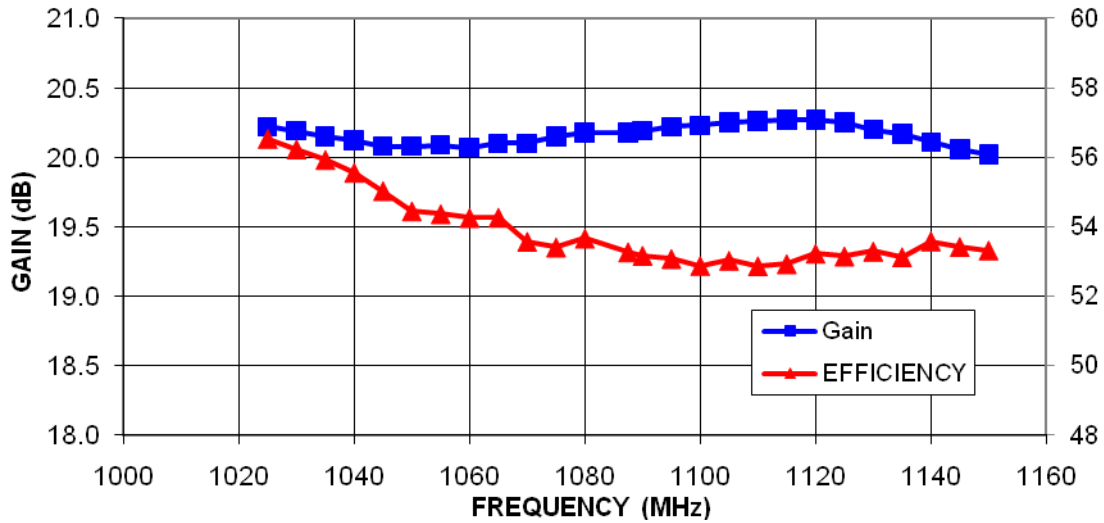
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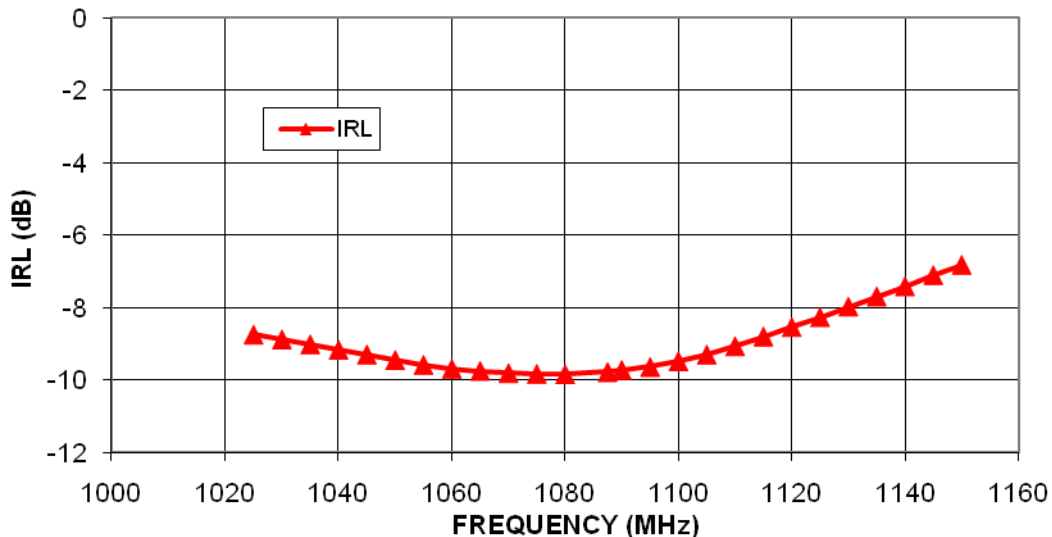
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**Typical Performance vs Frequency  
in a Broadband Matched Circuit**



Typical device performance under Class AB mode of operation and RF pulse conditions of 10 $\mu$ s pulse width and 1% duty cycle with  $V_{DD} = 50V$  and  $I_{DQ} = 100mA$ . The device was measured at an output power of 250W.

**Typical Performance vs Frequency  
in a Broadband Matched Circuit**



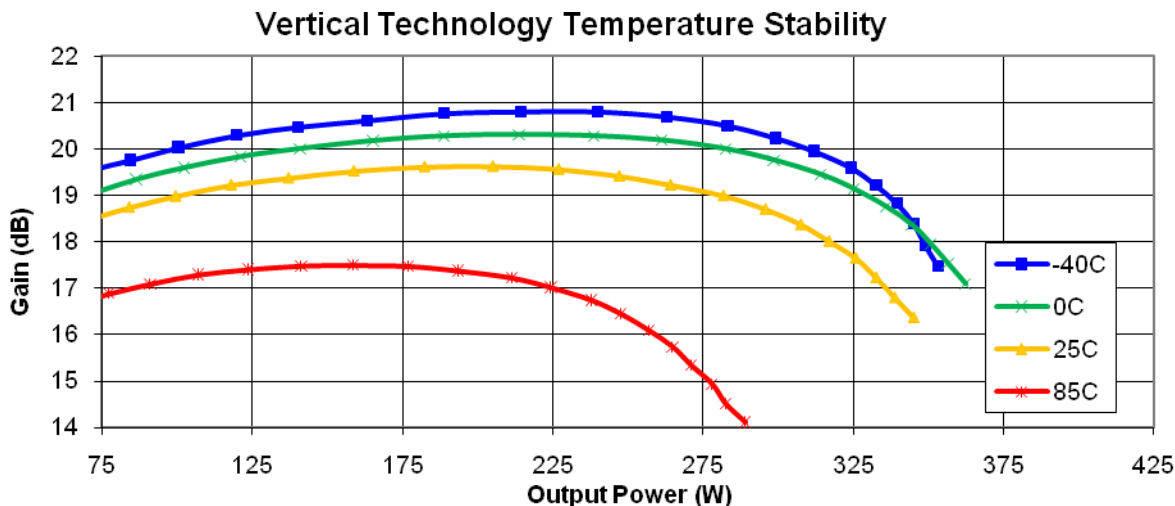
Typical device performance under Class AB mode of operation and RF pulse conditions of 10 $\mu$ s pulse width and 1% duty cycle with  $V_{DD} = 50V$  and  $I_{DQ} = 100mA$ . The device was measured at an output power of 250W.

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Typical device performance under Class AB mode of operation at 1150MHz and RF pulse conditions of 10µs pulse width and 1% duty cycle with  $V_{DD} = 50V$  and  $I_{DQ} = 100mA$ . The high voltage silicon vertical technology shows less than 1.5dB 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	19.8	320	55.1
0C	19.3	320	55.1
25C	18.6	300	54.8
85C	16.5	250	54.0

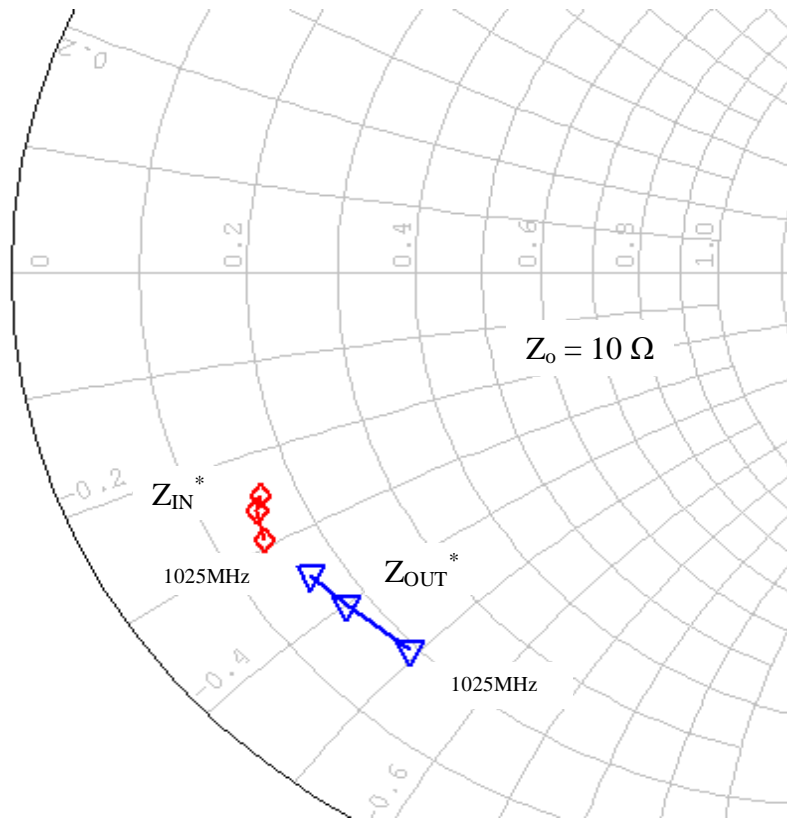
HVV1012-250 Performance over Temperature

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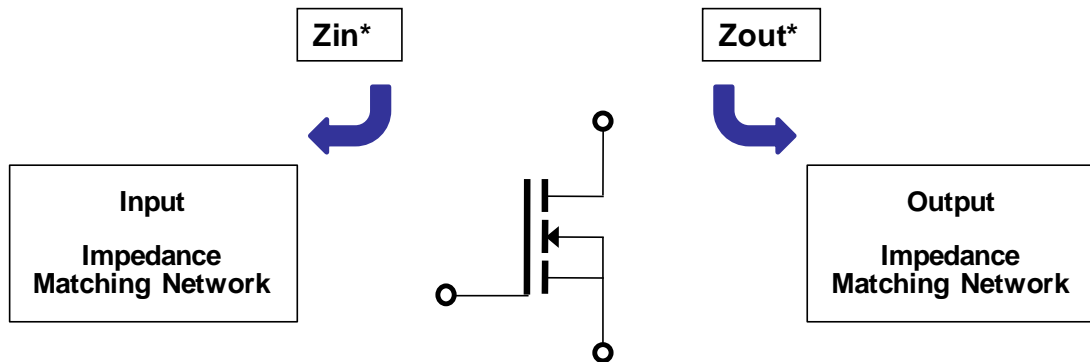
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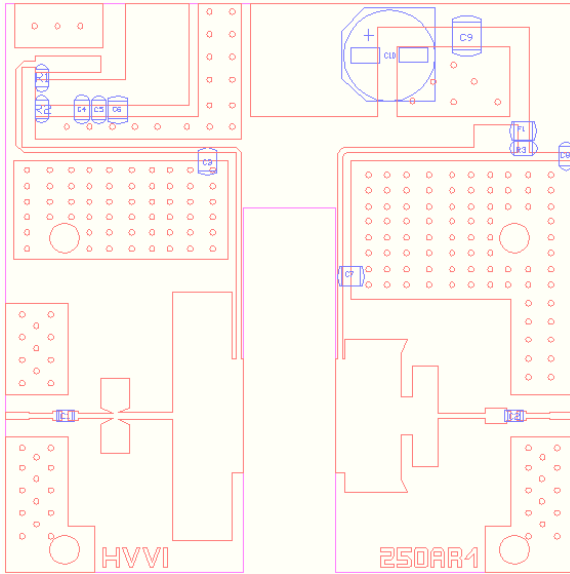


## Test Circuit Impedances

Frequency	Zin*(ohms)	Zout*(ohms)
1025MHz	1.46-j2.73	1.96-j4.67
1090MHz	1.58-j2.45	1.81-j3.99
1150MHz	1.67-j2.32	1.72-j3.51



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Demonstration Board Outline



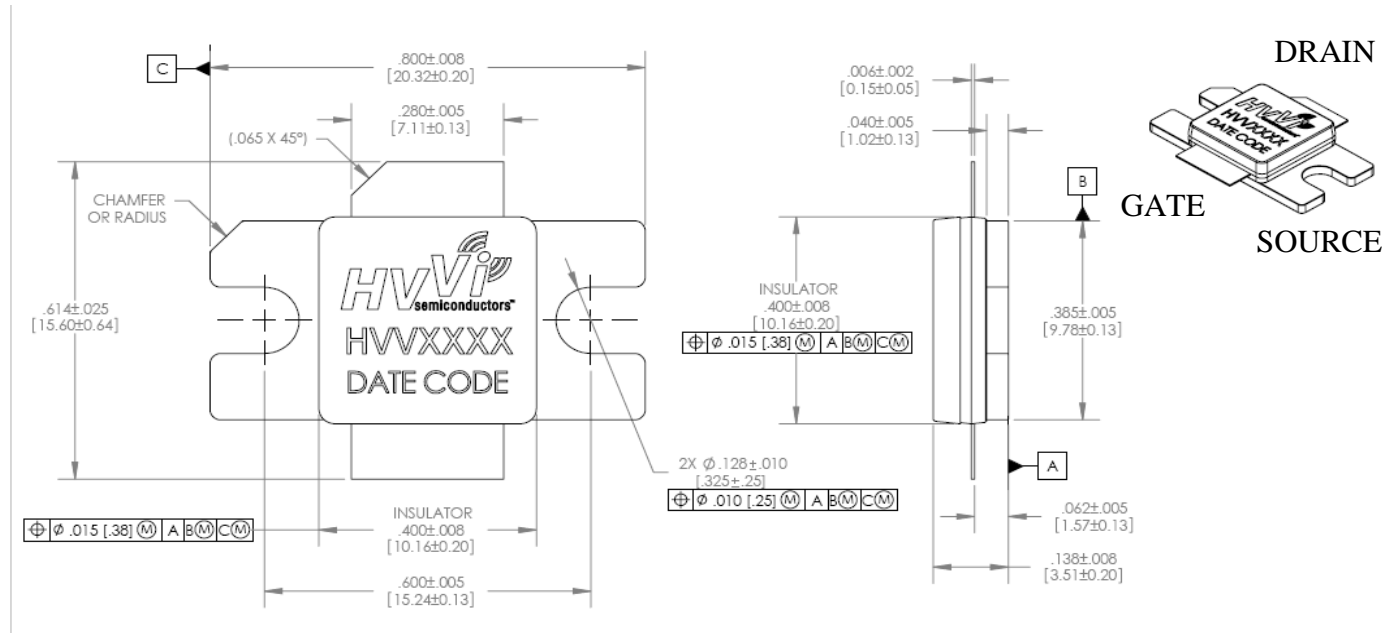
Example of Circuit Fixture

Part	Description	Part Number	Manufacturer
C1, C2:	39 pF Johanson High Q 805 Chip Capacitor	251R15S390JV4E	Johanson
C3:	30 pF ATC 100B Chip Capacitor	100B300JP500X	ATC
C4:	1K pF 100V Chip Capacitor (X7R 1206)	C1206C102K1RACTU	Kemet
C5:	10K pF 100V Chip Capacitor (X7R 1206)	C1206C103K1RACTU	Kemet
C6:	10 uF 6.3V Tant cap	478-3134-1-ND	Digi Key
C7:	39 pF ATC 100B Chip Capacitor	100B390JP500X	ATC
C8:	1K pF 150V AVX (X7R 1210) Chip Capacitor	478-2666-1-ND	Digi Key
C9:	10uF 100V X7R Stacked SMD	445-4109-2-ND	Digi Key
C10:	200 uF 63V Elect FK SMD	PCE3484TR-ND	Digi Key
R1, R2:	10 Ohms Chip Resistor (1206)	ERJ8GEYJ100V	Panasonic
R3:	1.0 K Ohms Chip Resistor (1206)	ERJ8GEYJ102V	Panasonic
F1:	Fair-Rite Bead 43 SM Bead	2743019447	Fair-Rite
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: 25 mils thick, 10 Dielectric, 1 oz Copper		DS Electronics
Device Clamp	Cool Innovation Nylon Clamp Foot	FXT000204	Cool Innovation
Heat Sink	Cool Innovations Aluminum Heat Sink	3-252510RS3394 Rev C	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 H	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

HVV1012-250 Demonstration Circuit Board Bill of Materials

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## PACKAGE DIMENSIONS



Note: Drawing is not actual size.

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