

# HVV1214-140 (Preliminary Datasheet)

L-Band Pulsed Power Transistor

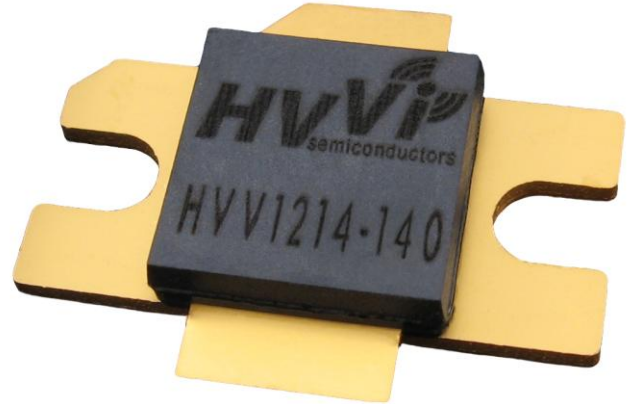
1200-1400 MHz, 200 $\mu$ s Pulse, 10% Duty Cycle

For Ground Based Radar 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
- 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)	$\eta$ (%)	IRL (dB)	VSWR
Class AB	1400	50	100	140	19.5	46	-7	20:1

Table 1: Typical RF Performance in broadband test fixture at 25°C temperature with RF pulse conditions of pulse width = 200 $\mu$ s and pulse duty cycle = 10%.

## DESCRIPTION

The high power HVV1214-140 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 140W 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: HVV1214-140

Evaluation Kit Part Number: HVV1214-140-EK

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

**HVV1214-140 (Preliminary Datasheet)***L-Band Pulsed Power Transistor**1200-1400 MHz, 200 $\mu$ s Pulse, 10% Duty Cycle**For Ground Based Radar Applications***ABSOLUTE MAXIMUM RATING (IEC 134)****THERMAL/RUGGEDNESS PERFORMANCE**

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	95	V
V <sub>GSS</sub>	Gate-Source Voltage	-10, 10	V
I <sub>DS(max)</sub>	Drain Current	14	A
P <sub>D</sub> <sup>1</sup>	Power Dissipation	324	W
P <sub>in</sub>	Input Power	3.4	W
T <sub>S</sub>	Storage Temperature	-40 to +150	°C
T <sub>J</sub>	Junction Temperature	200	°C

Symbol	Parameter	Max	Unit
$\theta_{JC}^2$	Thermal Resistance	0.54	°C/W

Symbol	Parameter	Test Condition	Max	Units
LMT <sup>2</sup>	Load Mismatch Tolerance	F = 1400 MHz	20:1	VSWR

The HVV1214-140 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 <sub>BR(DSS)</sub>	Drain-Source Breakdown	VGS=0V, ID=5mA	95	102	-	V
I <sub>DSS</sub>	Drain Leakage Current	VGS=0V, VDS=50V	-	50	100	$\mu$ A
I <sub>GSS</sub>	Gate Leakage Current	VGS=5V, VDS=0V	-	10	100	nA
G <sub>p</sub> <sup>2</sup>	Power Gain	F=1400MHz	18	19.5	-	dB
IRL <sup>2</sup>	Input Return Loss	F=1400MHz	-	-7	-5	dB
$\eta_D^2$	Drain Efficiency	F=1400MHz	44	46	-	%
VGS(Q) <sup>3</sup>	Gate Quiescent Voltage	VDD=50V, IDQ=100mA	1.1	1.45	1.8	V
VTH	Threshold Voltage	VDD=5V, ID=300 $\mu$ A	0.7	1.2	1.7	V

**PULSE CHARACTERISTICS**

Symbol	Parameter	Conditions	Min	Typical	Max	Units
t <sub>r</sub> <sup>4</sup>	Rise Time	F=1400MHz	-	<25	50	nS
t <sub>f</sub> <sup>4</sup>	Fall Time	F=1400MHz	-	<15	50	nS
PD <sup>4</sup>	Pulse Droop	F=1400MHz	-	0.55	0.8	dB

## Notes:

- 1) Rated at T<sub>CASE</sub> = 25°C
- 2) All parameters measured under pulsed conditions at 140W output power measured at the 10% point of the pulse with pulse width = 200 $\mu$ sec, duty cycle = 10% and VDD = 50V, IDQ = 100mA in a broadband matched test fixture.
- 3) Amount of gate voltage required to attain nominal quiescent current.
- 4) Guaranteed by design.

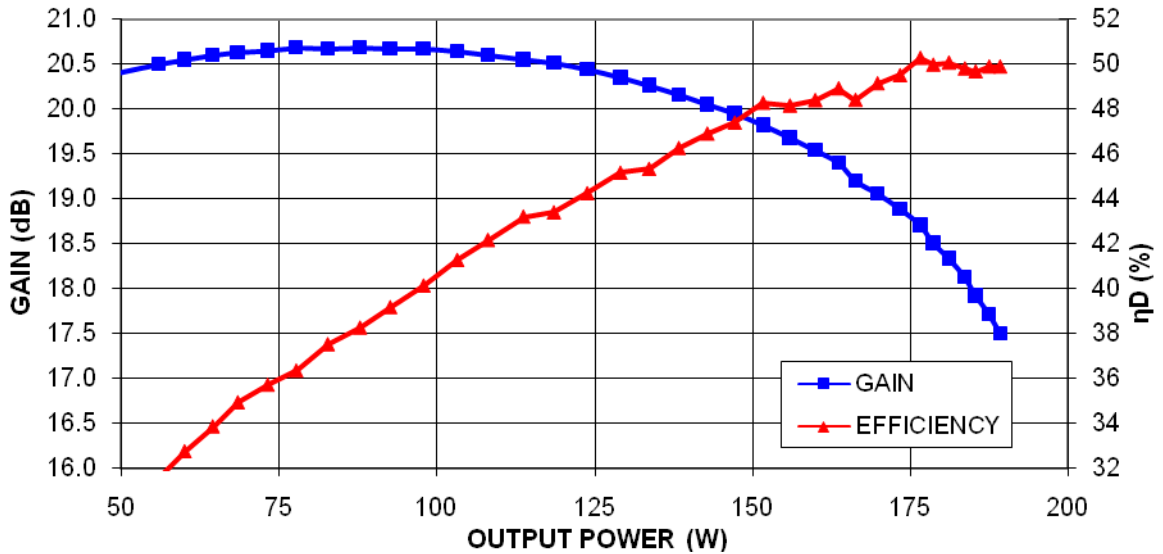
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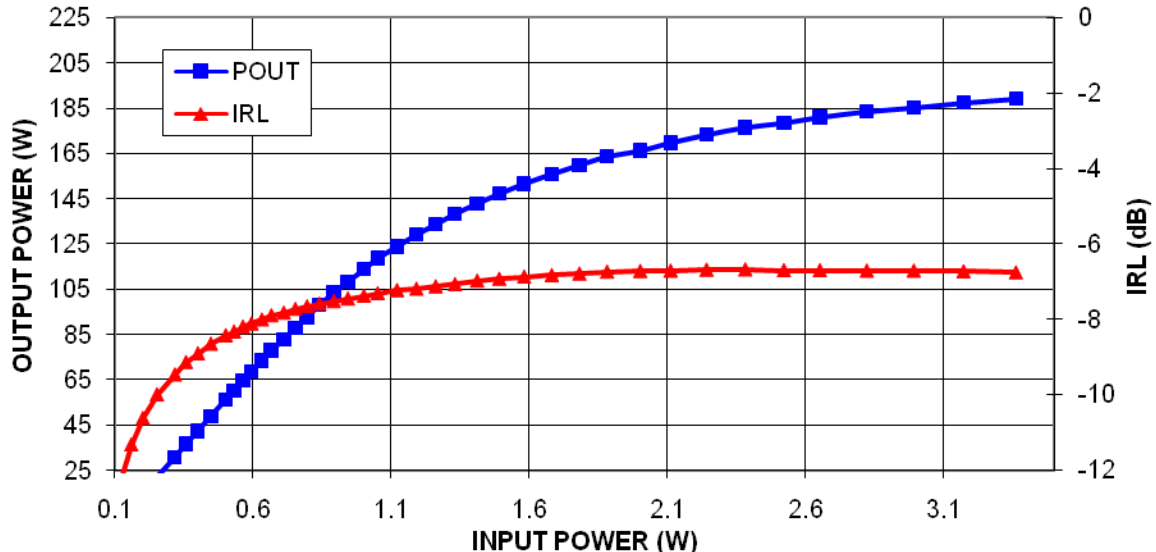
For Ground Based Radar Applications

Typical Power Performance  
in a Broadband Matched Circuit



Typical device performance under Class AB mode of operation and RF pulse conditions of 200 $\mu$ s pulse width and 10% duty cycle with VDD = 50V and IDQ = 100mA. The device was measured at 1400MHz.

Typical Power Performance  
in a Broadband Matched Circuit



Typical device performance under Class AB mode of operation and RF pulse conditions of 200 $\mu$ s pulse width and 10% duty cycle with VDD = 50V and IDQ = 100mA. The device was measured at 1400MHz.

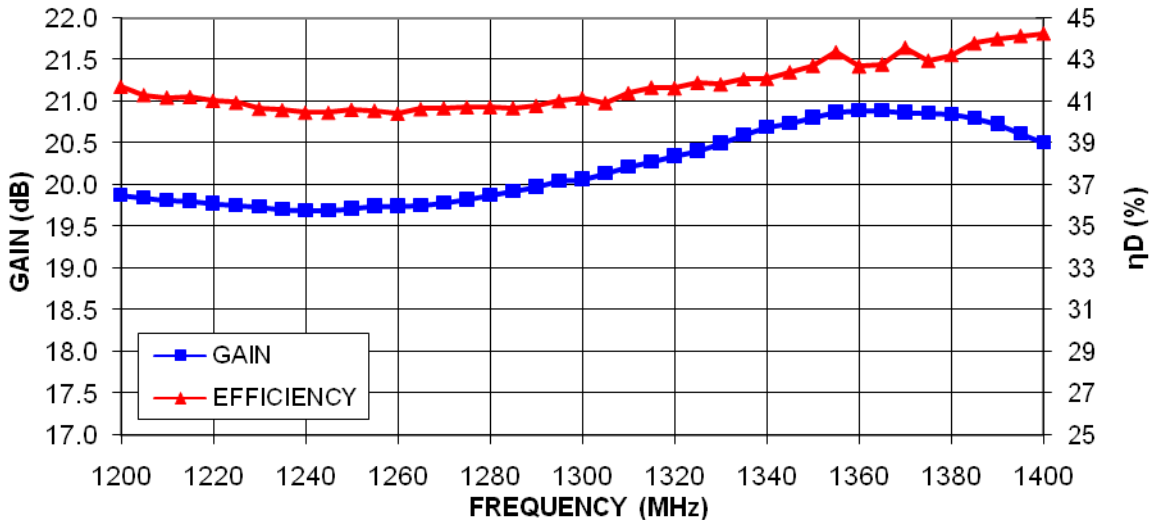
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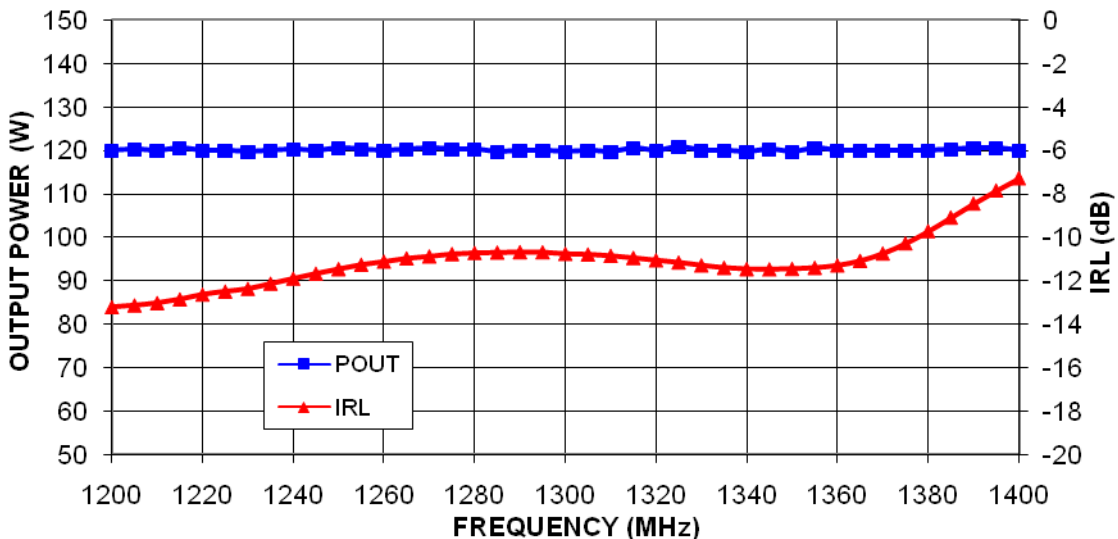
For Ground Based Radar Applications

Typical Performance vs Frequency  
in a Broadband Matched Circuit



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

Typical Performance vs Frequency  
in a Broadband Matched Circuit



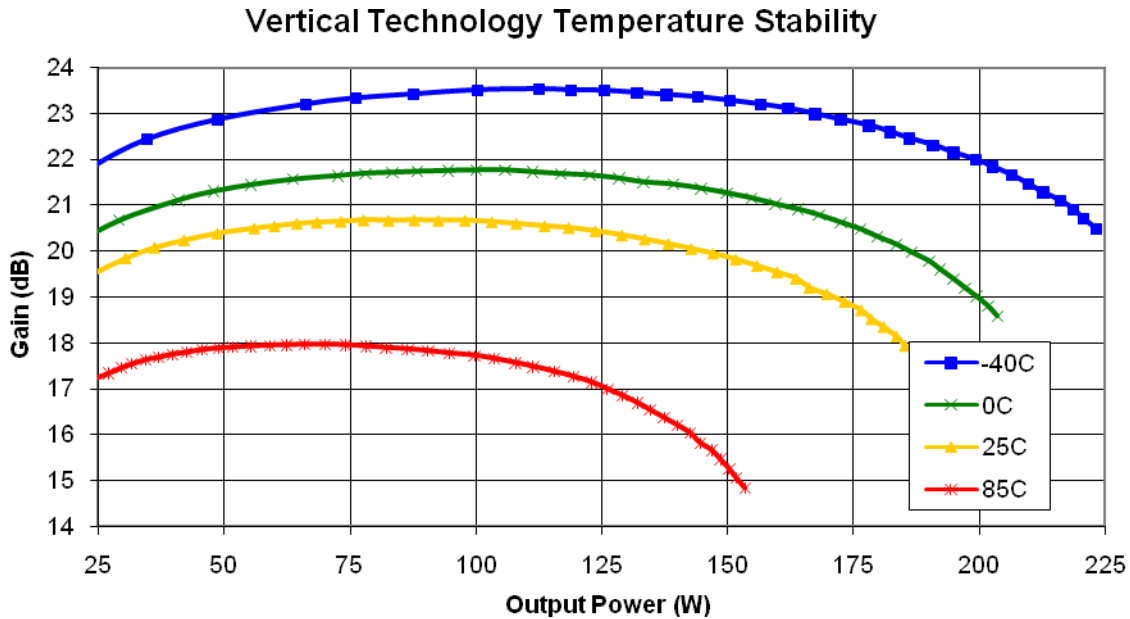
Typical device performance under Class AB mode of operation and RF pulse conditions of 200µs pulse width and 10% duty cycle with VDD = 50V and IDQ = 100mA. The device was measured at 120W.

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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 VDD = 50V and IDQ = 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

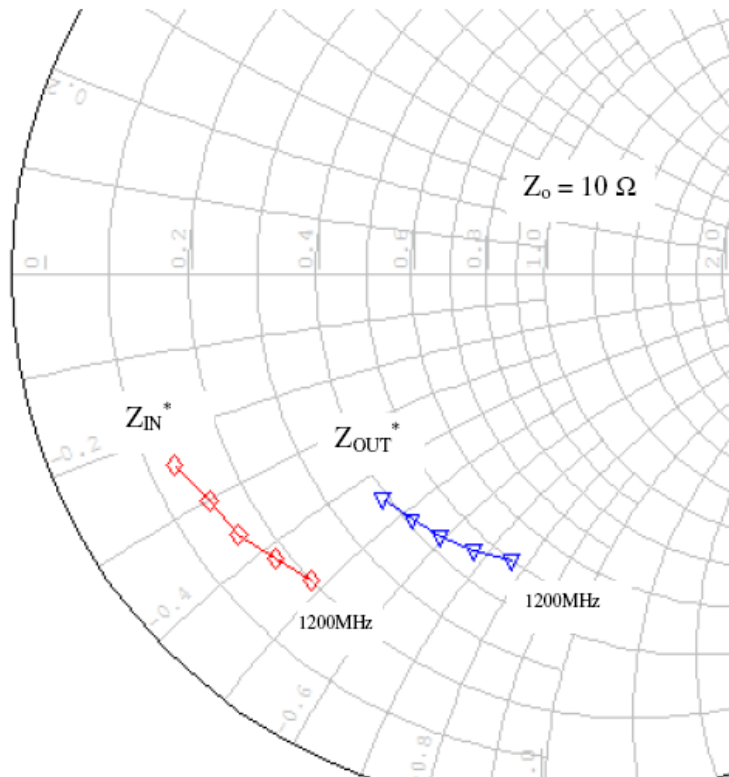
HVV1214-140 Performance over Temperature

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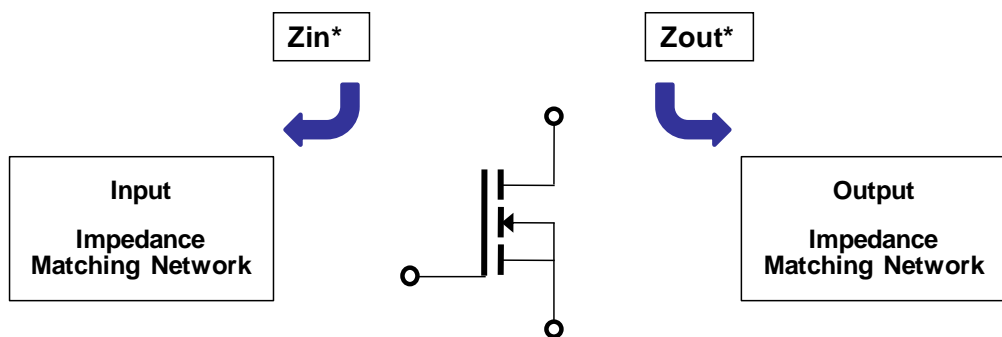
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Test Circuit Impedances

Frequency	Z <sub>in</sub> * (ohms)	Z <sub>out</sub> * (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

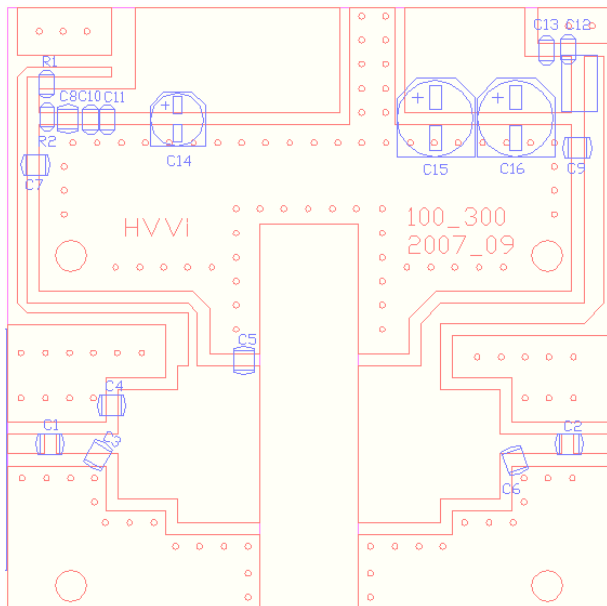


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Demonstration Board Outline



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

HVV1214-140 Demonstration Circuit Board Bill of Materials

