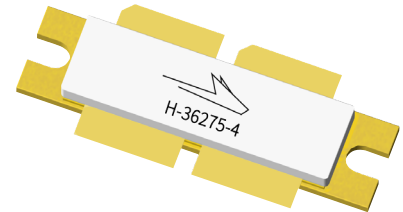


# GTVA101K42EV

## Thermally-Enhanced High Power RF GaN on SiC HEMT 1400 W, 50 V, DC – 1400 MHz

### Description

The GTVA101K42EV is a 1400-watt GaN on SiC high electron mobility transistor (HEMT) for use in the DC to 1400 MHz frequency band. It is a input matched, high efficiency device in a thermally-enhanced package with bolt-down flange.



GTVA101K42EV  
Package H-36275-4

### Features

- GaN on SiC HEMT technology
- Input matched
- Typical Pulsed CW performance, 960 – 1400 MHz, 50 V, single side, 128  $\mu$ s pulse width, 10% duty cycle
  - Output power at  $P_{3dB}$  = 1400 W
  - Efficiency = 68%
  - Gain = 17 dB
- Pb-free and RoHS compliant

### RF Characteristics<sup>1</sup>

#### Pulsed CW Specifications (tested in Wolfspeed test fixture)

$V_{DD}$  = 50 V,  $I_{DQ}$  = 75 mA,  $P_{OUT}$  ( $P_{3dB}$ ) = 1400 W peak,  $f$  = 1030 MHz, Pulse Width = 128  $\mu$ s, Duty Cycle = 10%

Characteristic	Symbol	Min	Typ	Max	Unit
Linear Gain	$G_{ps}$	17	19	—	dB
Return Loss	R	—	-19	-12	dB
Drain Efficiency	$\eta_D$	65	69	—	%
Output Mismatch Stress <sup>2</sup>	VSWR	—	—	10:1	$\Psi$

Note <sup>1</sup>: All published data at  $T_{CASE}$  = 25°C unless otherwise indicated.

Note <sup>2</sup>: No damage at all phase angles,  $V_{DD}$  = 50 V,  $I_{DQ}$  = 75mA,  $P_{OUT}$  = 1400 W Pulsed.

Note <sup>3</sup>: ESD: Electrostatic discharge sensitive device—observe handling precautions!

## DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	$V_{GS} = -8\text{ V}$ , $I_D = 83.6\text{ mA}$	$V_{(BR)DSS}$	125	—	—	V
Drain-source Leakage Current	$V_{GS} = -6\text{ V}$ , $V_{DS} = 2\text{ V}$	$I_{DSS}$	62.7	75.5	—	A
Gate Threshold Voltage	$V_{DS} = 10\text{ V}$ , $I_D = 83.6\text{ mA}$	$V_{GS(th)}$	-3.8	-3.0	-2.7	V

## Recommended Operating Conditions

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Drain Operating Voltage		$V_{DD}$	0	—	50	V
Gate Quiescent Voltage	$V_{DS} = 50\text{ V}$ , $I_D = 100\text{ mA}$	$V_{GS(Q)}$	—	-3.1	—	V

## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source Voltage	$V_{DSS}$	150	V
Gate-source Voltage	$V_{GS}$	-10 to +2	V
Gate Current	$I_G$	167	mA
Drain Current	$I_D$	48	A
Junction Temperature	$T_J$	225	°C
Storage Temperature Range	$T_{STG}$	-65 to +150	°C

Operation above the maximum values listed here may cause permanent damage. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the component. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. For reliable continuous operation, the device should be operated within the operating voltage range ( $V_{DD}$ ) specified above.

## Thermal Characteristics

Parameter	Symbol	Value	Units
Thermal Resistance, Junction to case <sup>1</sup>	$R_{\theta JC}$	.127	°C/W
Thermal Resistance, Junction to case <sup>2</sup>	$R_{\theta JC}$	.167	°C/W
Thermal Resistance, Junction to case <sup>3</sup>	$R_{\theta JC}$	.166	°C/W

<sup>1</sup> Tcase = 85°C, P<sub>DISS</sub> = 700 W, 100 μs Pulse Width, 10% Duty Cycle

<sup>2</sup> Tcase = 85°C, P<sub>DISS</sub> = 700 W, 500 μs Pulse Width, 10% Duty Cycle

<sup>3</sup> Tcase = 85°C, P<sub>DISS</sub> = 700 W, Mode-S Signal

## Electrical Characteristics When Tested in GTVA101K42EV-AMP2

Characteristics	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>RF Characteristics<sup>1</sup> (<math>T_C = 25^\circ\text{C}</math>, <math>F_0 = 1.2 - 1.4\text{ GHz}</math> unless otherwise noted)</b>						
Output Power <sup>2</sup>	$P_{OUT}$	-	61	-	dBm	$V_{DD} = 50\text{ V}$ , $I_{DQ} = 1.8\text{ A}$ , $P_{IN} = 44\text{ dBm}$
Power Added Efficiency <sup>2</sup>	$\eta$	-	55	-	%	$V_{DD} = 50\text{ V}$ , $I_{DQ} = 1.8\text{ A}$ , $P_{IN} = 44\text{ dBm}$
Gain <sup>2</sup>	$G$	-	17	-	dB	$V_{DD} = 50\text{ V}$ , $I_{DQ} = 1.8\text{ A}$ , $P_{IN} = 44\text{ dBm}$

<sup>1</sup> Measured in the GTVA101K42EV-AMP2 Application Circuit

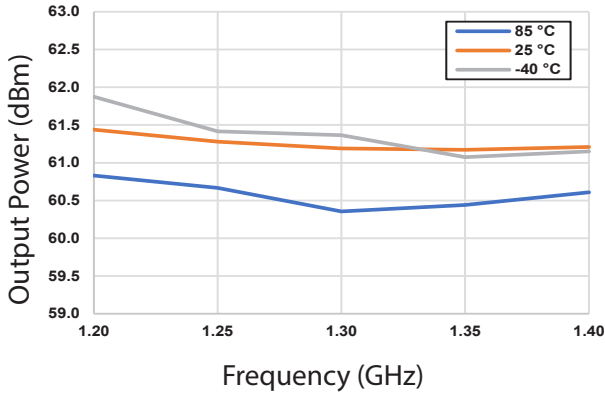
<sup>2</sup> Pulsed 500 μs, 10% Duty Cycle



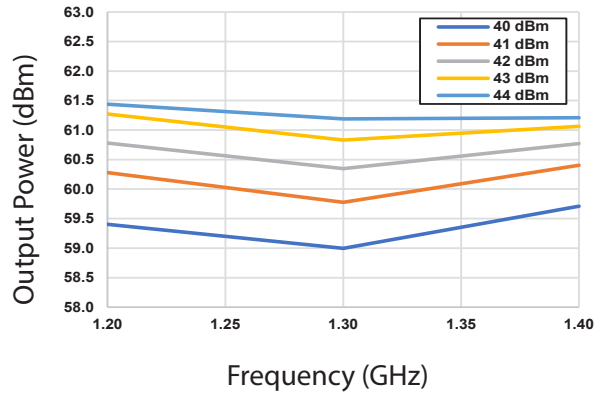
### Typical Performance of the GTVA101K42EV-AMP2

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ , Pulse Width =  $500\text{ }\mu\text{s}$ , Duty Cycle = 10%,  $P_{in} = 44\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

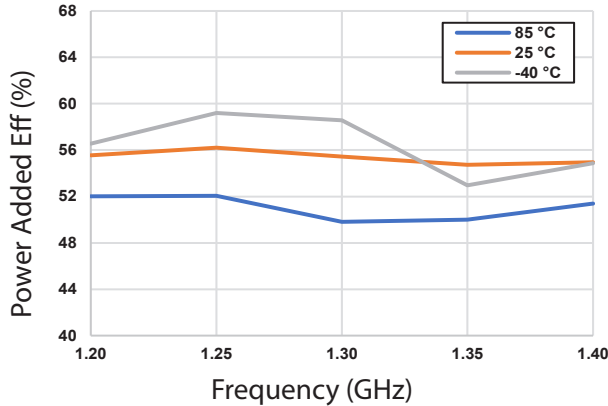
**Figure 1. Output Power vs Frequency as a Function of Temperature**



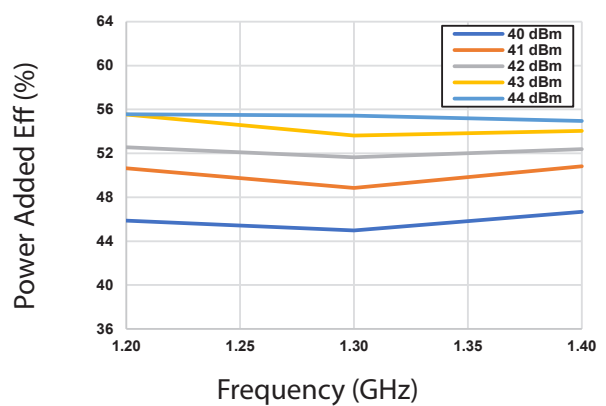
**Figure 2. Output Power vs Frequency as a Function of Input Power**



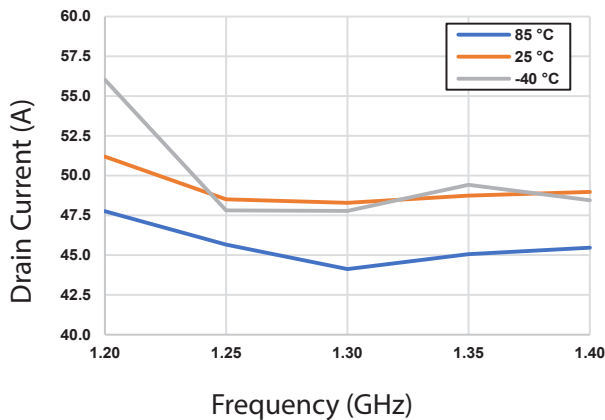
**Figure 3. Power Added Eff. vs Frequency as a Function of Temperature**



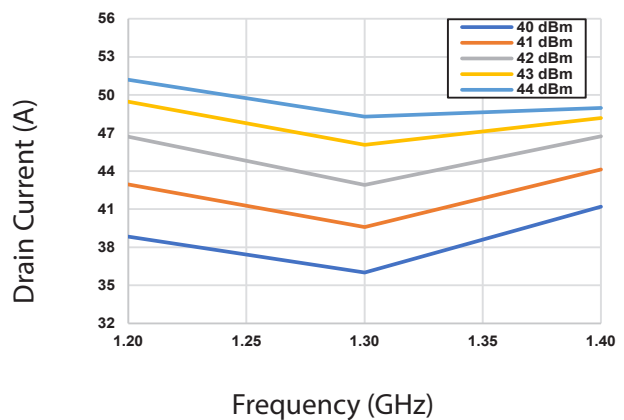
**Figure 4. Power Added Eff. vs Frequency as a Function of Input Power**



**Figure 5. Drain Current vs Frequency as a Function of Temperature**



**Figure 6. Drain Current vs Frequency as a Function of Input Power**

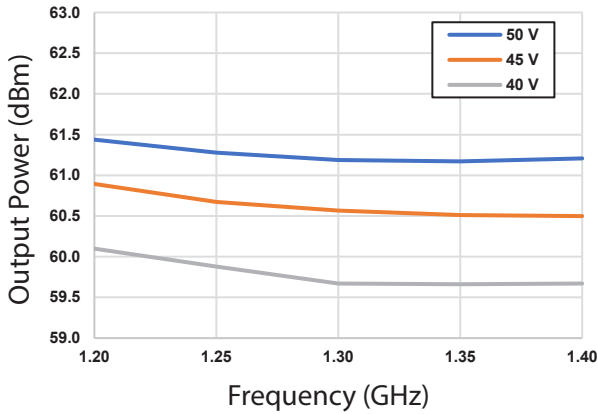




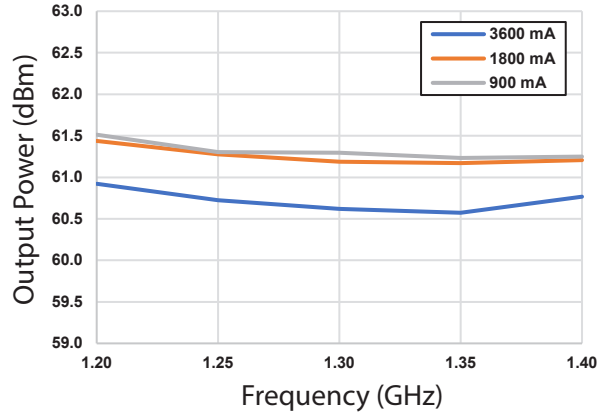
**Typical Performance of the GTVA101K42EV-AMP2**

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ , Pulse Width =  $500\text{ }\mu\text{s}$ , Duty Cycle = 10%, Pin = 44 dBm,  $T_{BASE} = +25\text{ }^\circ\text{C}$

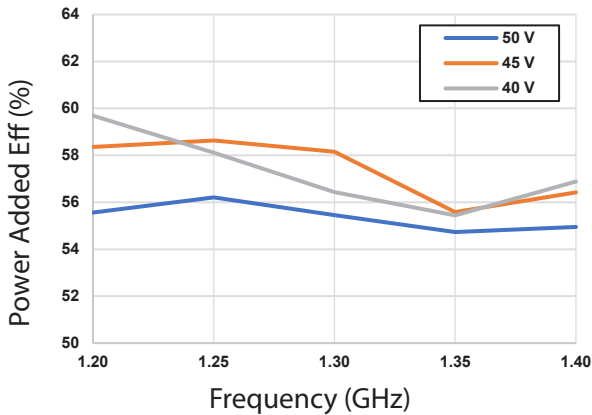
**Figure 7. Output Power vs Frequency as a Function of VD**



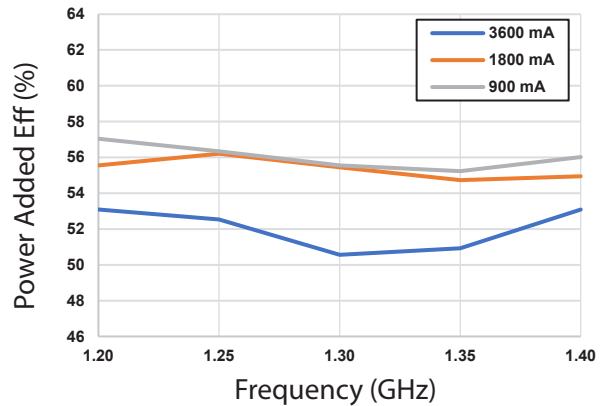
**Figure 8. Output Power vs Frequency as a Function of IDQ**



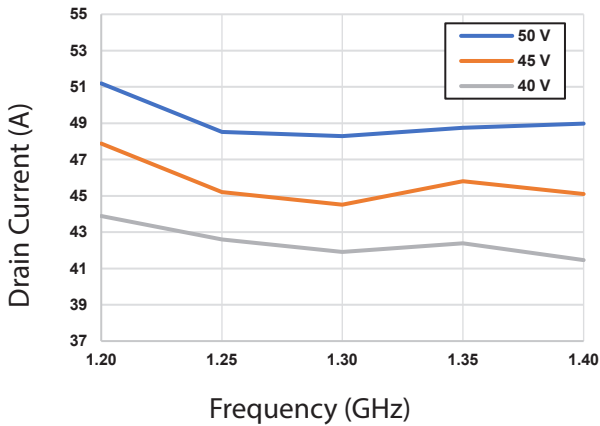
**Figure 9. Power Added Eff. vs Frequency as a Function of VD**



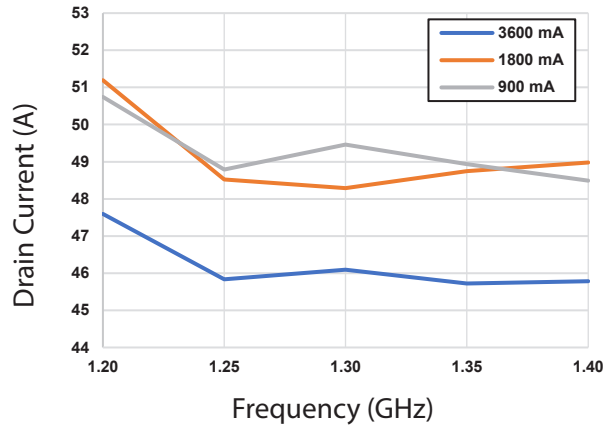
**Figure 10. Power Added Eff. vs Frequency as a Function of IDQ**



**Figure 11. Drain Current vs Frequency as a Function of VD**



**Figure 12. Drain Current vs Frequency as a Function of IDQ**

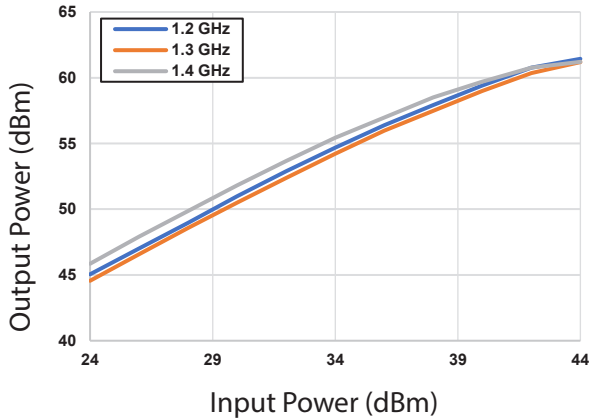




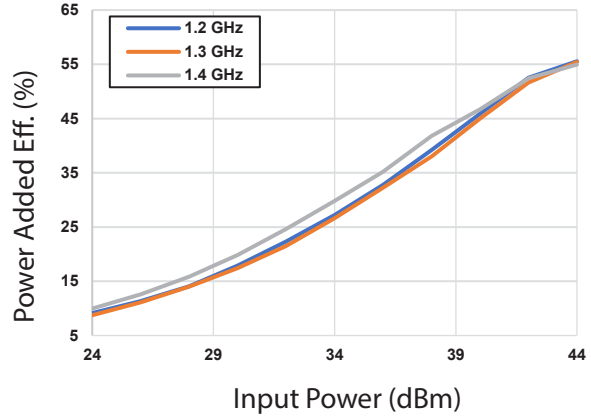
**Typical Performance of the GTVA101K42EV-AMP2**

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ , Pulse Width =  $500\text{ }\mu\text{s}$ , Duty Cycle = 10%,  $P_{in} = 44\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

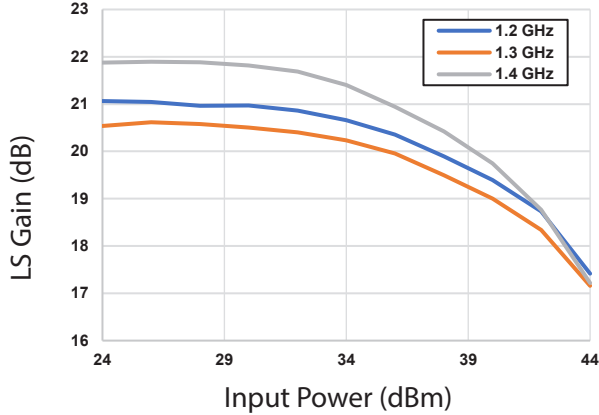
**Figure 13. Output Power vs Input Power as a Function of Frequency**



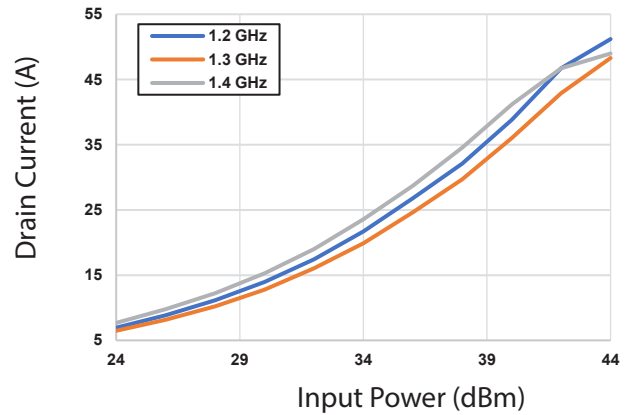
**Figure 14. Power Added Eff. vs Input Power as a Function of Frequency**



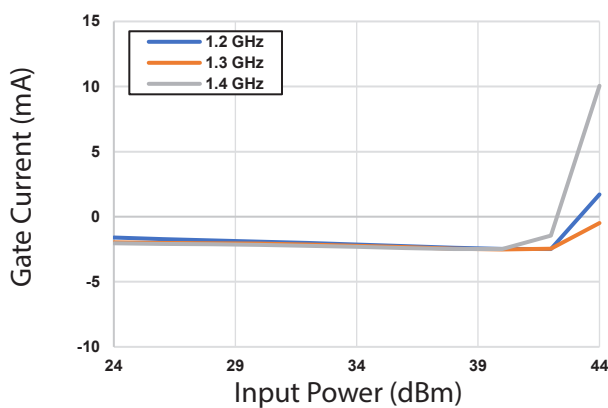
**Figure 15. Large Signal Gain vs Input Power as a Function of Frequency**



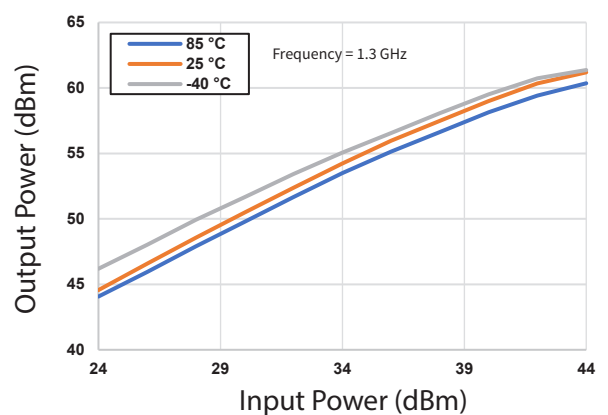
**Figure 16. Drain Current vs Input Power as a Function of Frequency**



**Figure 17. Gate Current vs Input Power as a Function of Frequency**



**Figure 18. Output Power vs Input Power as a Function of Temperature**

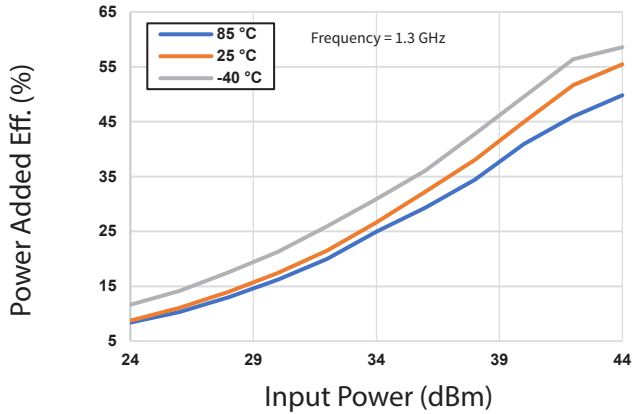




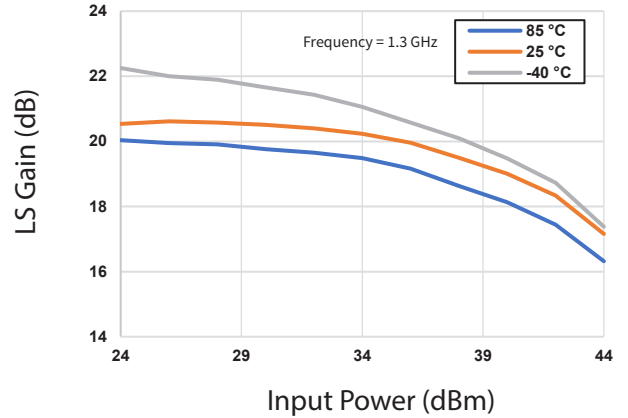
**Typical Performance of the GTVA101K42EV-AMP2**

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ , Pulse Width =  $500\text{ }\mu\text{s}$ , Duty Cycle = 10%,  $P_{in} = 44\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

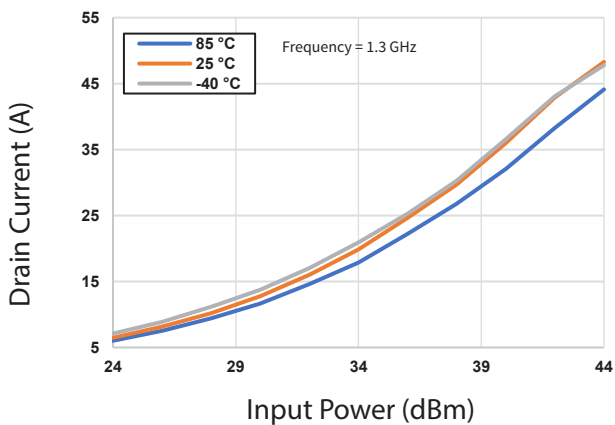
**Figure 19. Power Added Eff. vs Input Power as a Function of Temperature**



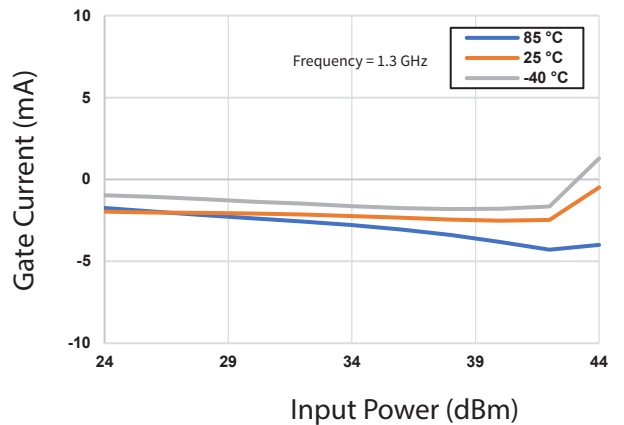
**Figure 20. Large Signal Gain vs Input Power as a Function of Temperature**



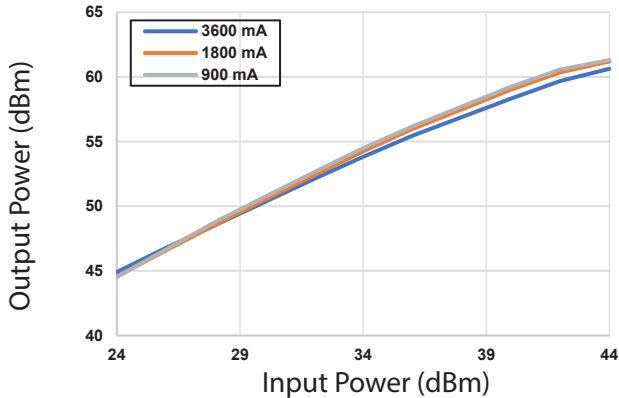
**Figure 21. Drain Current vs Input Power as a Function of Temperature**



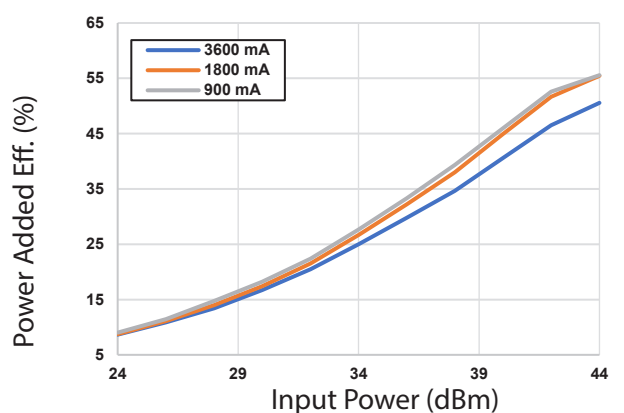
**Figure 22. Gate Current vs Input Power as a Function of Temperature**



**Figure 23. Output Power vs Input Power as a Function of IDQ**



**Figure 24. Power Added Eff. vs Input Power as a Function of IDQ**

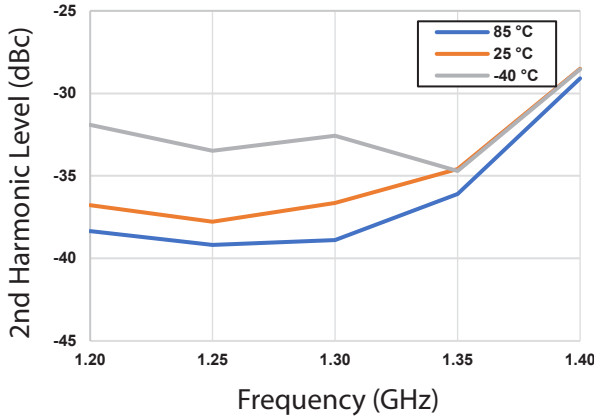




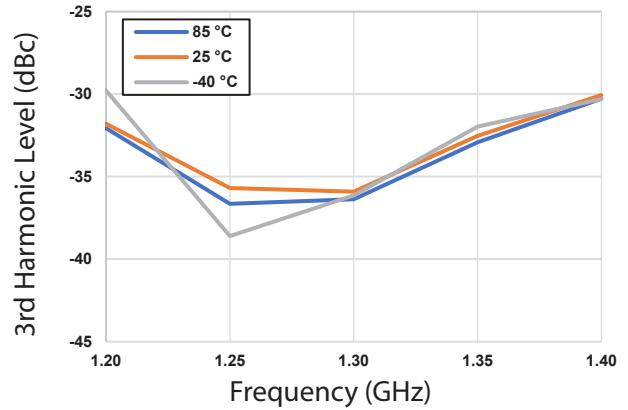
### Typical Performance of the GTVA101K42EV-AMP2

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ , Pulse Width =  $500\text{ }\mu\text{s}$ , Duty Cycle = 10%, Pin = 44 dBm,  $T_{BASE} = +25\text{ }^\circ\text{C}$

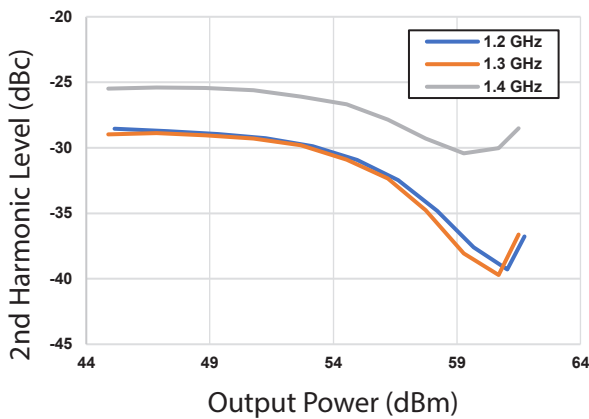
**Figure 25. 2nd Harmonic vs Frequency as a Function of Temperature**



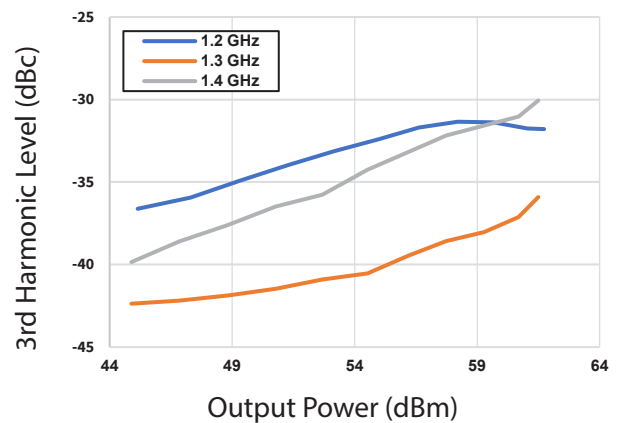
**Figure 26. 3rd Harmonic vs Frequency as a Function of Temperature**



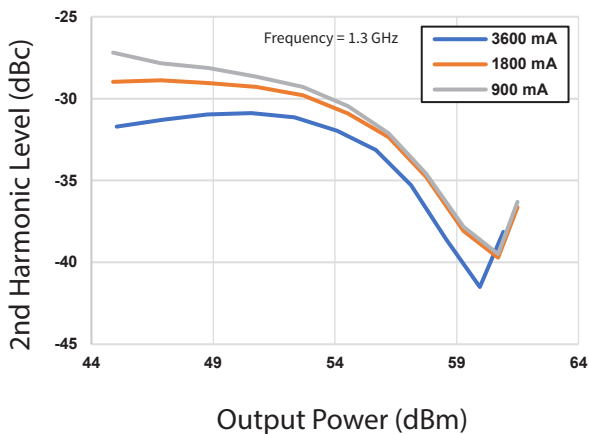
**Figure 27. 2nd Harmonic vs Output Power as a Function of Frequency**



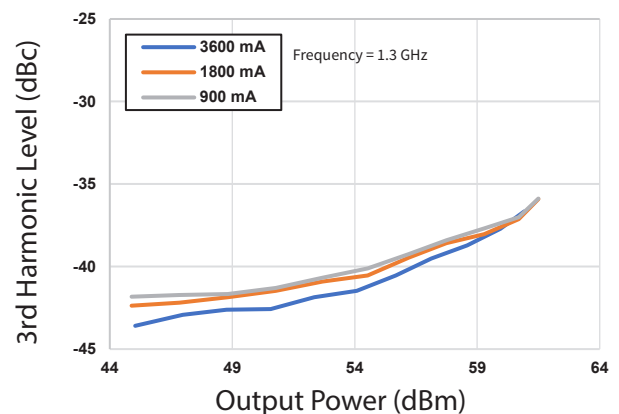
**Figure 28. 3rd Harmonic vs Output Power as a Function of Frequency**



**Figure 29. 2nd Harmonic vs Output Power as a Function of IDQ**



**Figure 30. 3rd Harmonic vs Output Power as a Function of IDQ**

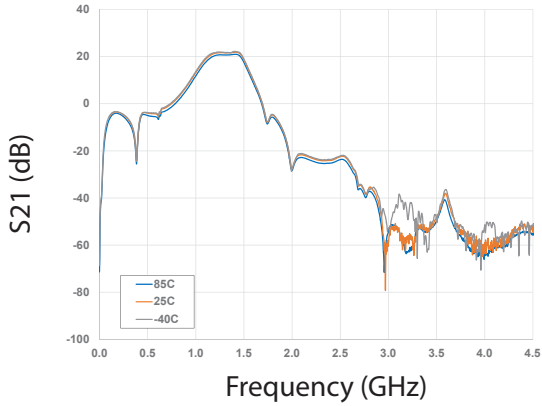




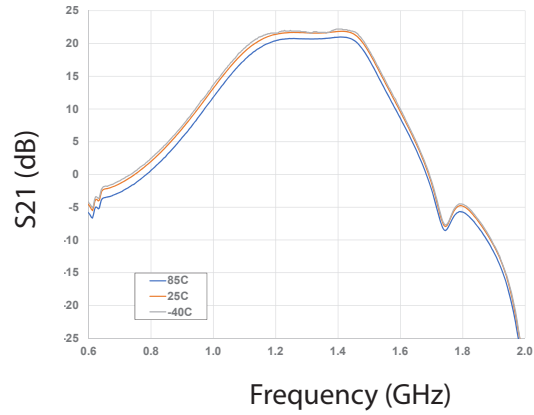
**Typical Performance of the GTVA101K42EV-AMP2**

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ ,  $P_{in} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

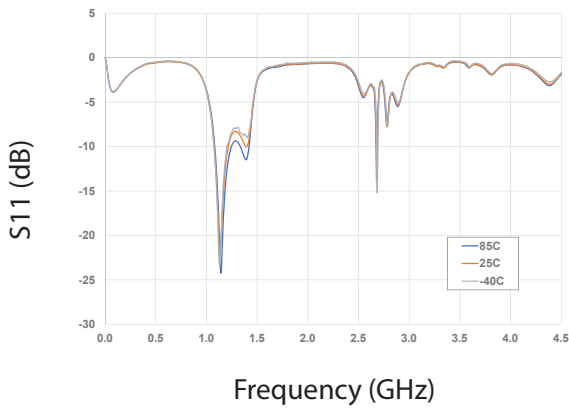
**Figure 31. Gain vs Frequency as a Function of Temperature**



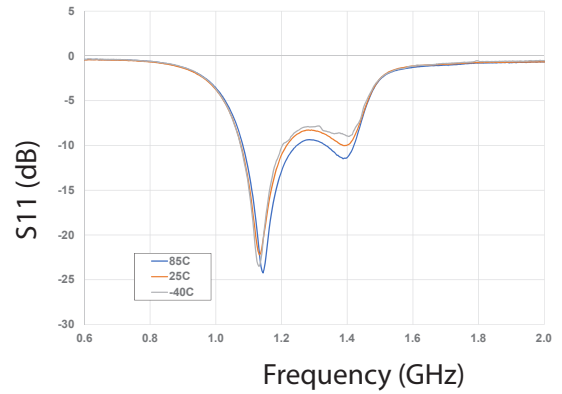
**Figure 32. Gain vs Frequency as a Function of Temperature**



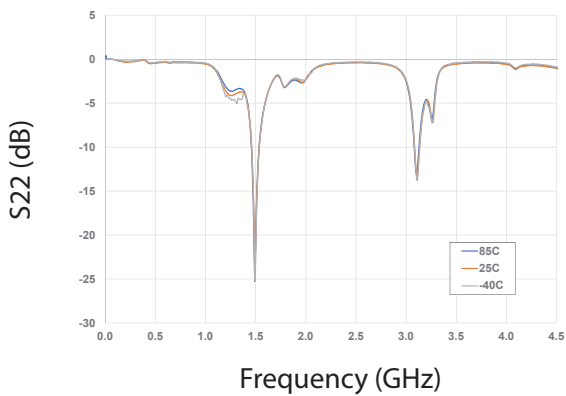
**Figure 33. Input RL vs Frequency as a Function of Temperature**



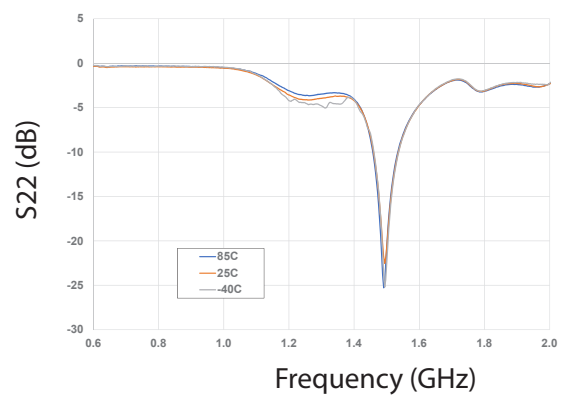
**Figure 34. Input RL vs Frequency as a Function of Temperature**



**Figure 35. Output RL vs Frequency as a Function of Temperature**



**Figure 36. Output RL vs Frequency as a Function of Temperature**



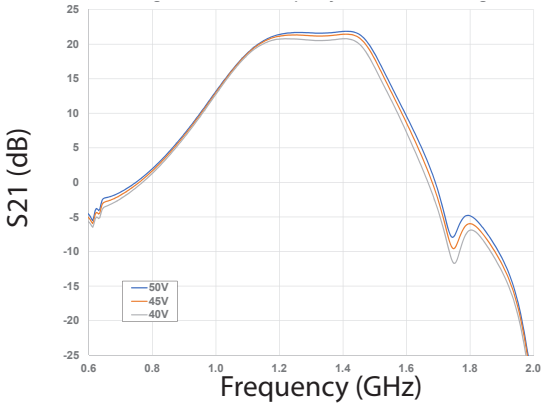




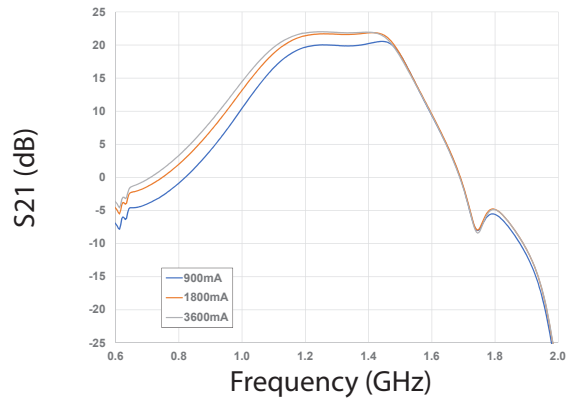
**Typical Performance of the GTVA101K42EV-AMP2**

Test conditions unless otherwise noted:  $V_D = 50\text{ V}$ ,  $I_{DQ} = 1800\text{ mA}$ ,  $P_{in} = -20\text{ dBm}$ ,  $T_{BASE} = +25\text{ }^\circ\text{C}$

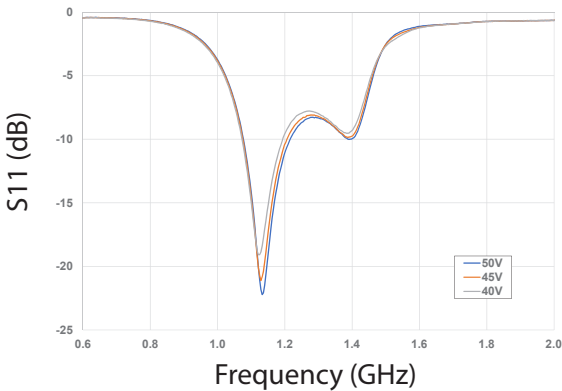
**Figure 37. Gain vs Frequency as a Function of Voltage**



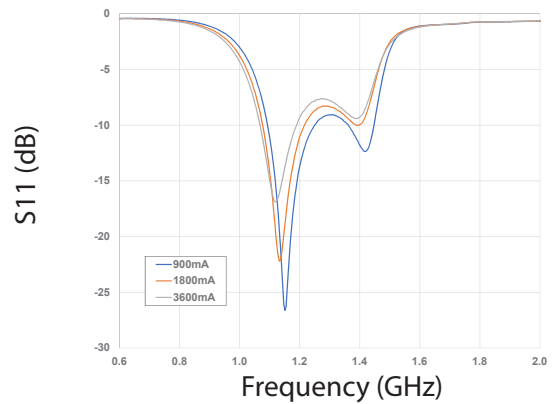
**Figure 38. Gain vs Frequency as a Function of IDQ**



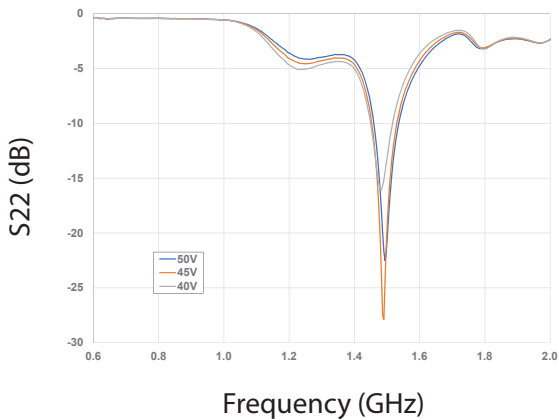
**Figure 39. Input RL vs Frequency as a Function Voltage**



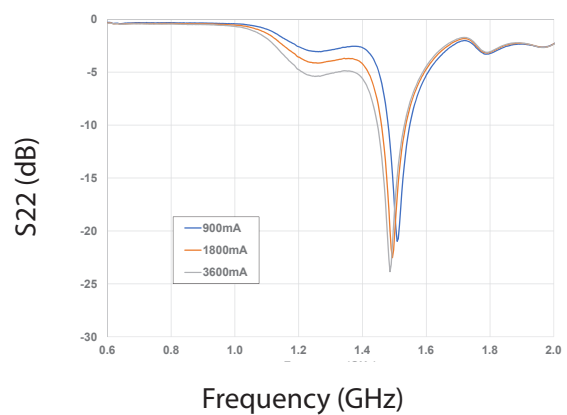
**Figure 40. Input RL vs Frequency as a Function of IDQ**



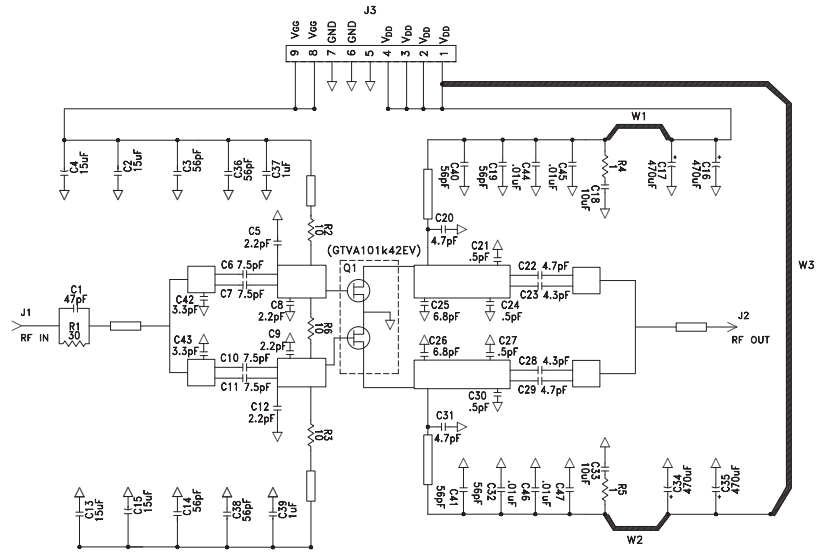
**Figure 41. Output RL vs Frequency as a Function of Voltage**



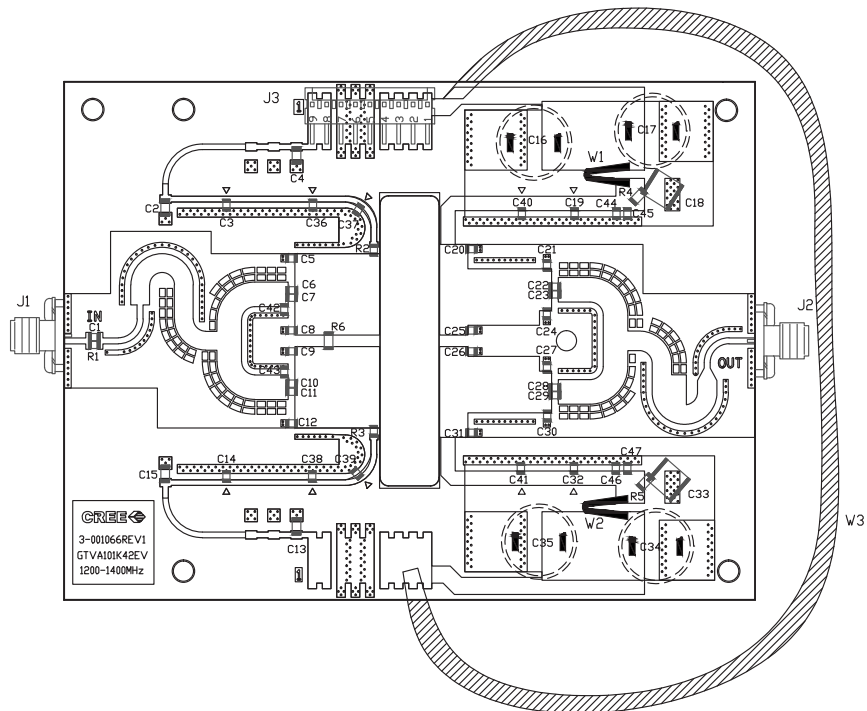
**Figure 42. Output RL vs Frequency as a Function of Voltage**



**GTVA101K42EV-AMP2 Application Circuit Schematic**



**GTVA101K42EV-AMP2 Application Circuit**

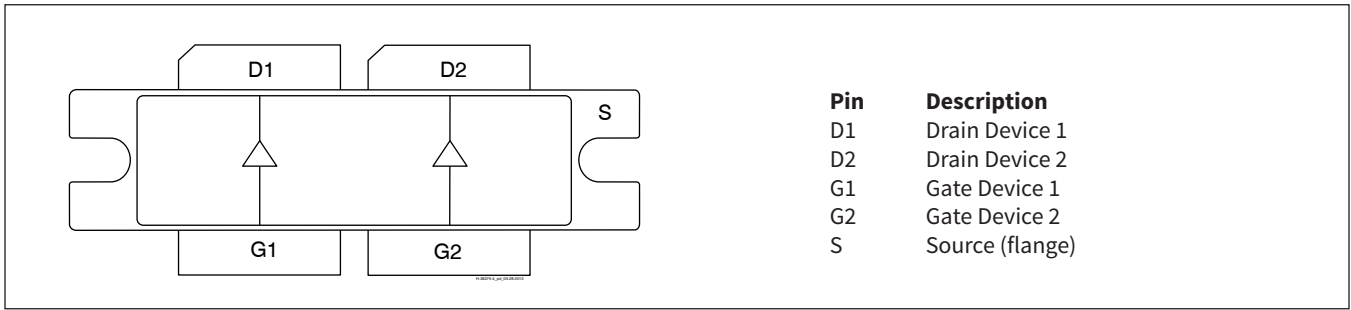


**GTVA101K42EV-AMP2 Application Circuit Bill of Materials**

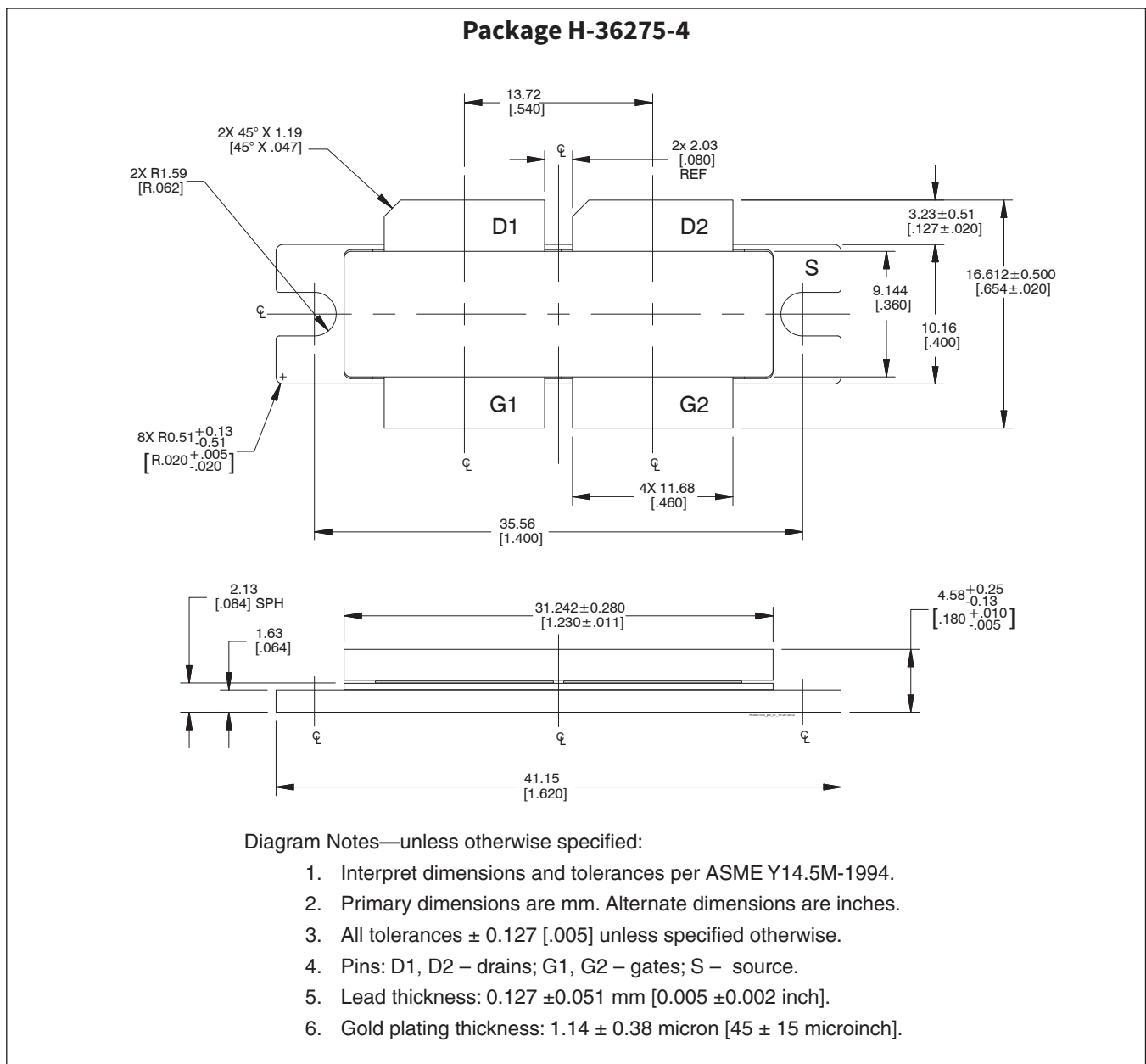
Designator	Description	Qty
R1	RES, 30 OHMS, +/- 1%, 0805, 1/8W, YAGEO	1
R2, R3	RES, 10 OHMS, +/- 1%, 0805, 1/8W, YAGEO	2
R4, R5	RES, 1 OHMS, +/- 5%, 1206, 125mW, AVX	2
R6	RES, 10 OHMS, +/-1%, 1206, 1/4W	1
C1	CAP, 47pF, +/- 5%, 250V, 0805, ATC 600F	1
C2,C4, C13, C15	CAP, 15uF, +/-20%, 10V, X7s, 1206, TDK	4
C3, C14, C19, C32, C36, C38, C40, C41	CAP, 56pF, +/- 5%, 250V, 0805, ATC, 600F	8
C5, C8, C9, C12	CAP, 2.2pF, +/- .1pF, 250V, 0805, ATC 600F	4
C6, C7, C10, C11	CAP, 7.5pF, +/- .25pF, 250V, 0805, ATC 600F	4
C16, C17, C34, C35	CAP, 470uF, +/-20%, 80V, Electrolytic, Vishay	4
C18, C33	CAP, 10uF, +/- 10%, 100V, X7S, 2220, TDK	2
C20, C22, C29, C31	CAP, 4.7pF, +/- .25pF, 250V, 0805, ATC 600F	4
C21, C24, C27, C30	CAP, .5pF, +/- .05pF, 250V, 0805, ATC 600F	4
C23, C28	CAP, 4.3pF, +/- .25pF, 250V, 0805, ATC 600F	2
C25, C26	CAP, 6.8pF, +/- .25pF, 250V, 0805, ATC 600F	2
C37, C39	CAP, 1uF, 100V, X7S, 0805, Murata	2
C44, C45, C46, C47	CAP, .01uF, 50V, X7R	4
C42, C43	CAP, 3.3pF, +/- .1pF, 250V, 0805, ATC 600F	2
W1, W2	Wire, 3.25", 18AWG	2
W3	Wire, 7", 12AWG	1
Q1	Transistor, GTVA101K42EV	1



**Pinout Diagram** (top view)



**Package Outline Specifications**





Product Ordering Information

Order Number	Description	Unit of Measure	Image
GTVA101K42EV-V1-R0	GaN HEMT, Tape & Reel, 50 pcs	Each	
GTVA101K42EV-V1-R2	GaN HEMT, Tape & Reel, 250 pcs	Each	
LTN/GTVA101K42EV V1	Test Board with GaN HEMT installed IFF, 1030 MHz	Each	
GTVA101K42EV-AMP2	Test board with GaN HEMT installed L-Band Radar, 1.2 - 1.4 GHz	Each	



For more information, please contact:

4600 Silicon Drive  
Durham, North Carolina, USA 27703  
[www.wolfspeed.com/RF](http://www.wolfspeed.com/RF)

Sales Contact  
[RFSales@wolfspeed.com](mailto:RFSales@wolfspeed.com)

RF Product Marketing Contact  
[RFMarketing@wolfspeed.com](mailto:RFMarketing@wolfspeed.com)  
919.407.7816

## Notes

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