100V GaN FETs for Solar Power Applications

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Introduction

Due to its capacity to give much better performance than standard silicon while using less energy and physical area to accomplish that performance, GaN is relevant to solar designs. According on the implementation, the figure of merit for GaN relative to silicon can range from 5 to 20 times when calculated as the product of normalized $r_{DS(ON)}$ and Qg.

Switching speeds can be 100 times faster thanks to ultra-low resistance and capacitance being made possible by significantly smaller transistors and shorter current channels. The enhanced switching rates not only guarantee superior system performance but also enable size reduction of the magnetic and passive components. When employing GaN, this decrease in passive and magnetic components further lowers system costs.

GaN Integration

When comparing GaN technologies for solar power applications, one of the most crucial factors to consider is how much circuitry can be added with additional devices against the functionality and protection provided by the power transistor.

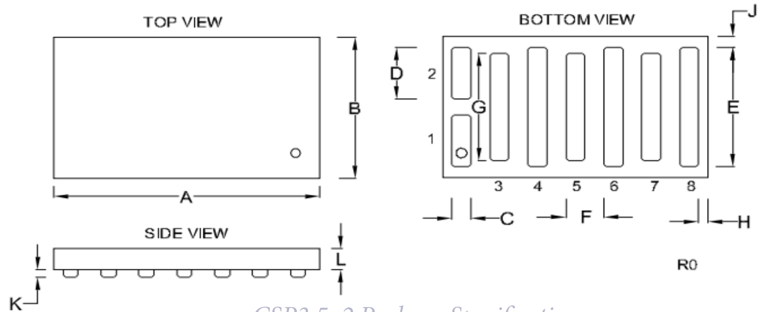
The goal is to create an ideal switch that utilizes GaN's advantages and makes the device simple to use. Another degree of performance advantage is the protection of the GaN device. GaN HEMTs were an early attempt to integrate the switching performance of GaN into power systems, but due to the complexity of their system design and subpar performance in high-power systems, they were not widely used.

GaN enhancement mode high-electron-mobility transistors (HEMTs) often serve a single purpose and need to be implemented alongside numerous other circuit elements to create a functional system.

Additionally, the GaN HEMT discrete lacks any protective measures and is extremely susceptible to ESD. The gate of the GaN HEMT can be protected using external circuitry, however doing so introduces speed-limiting parasitic and lossy elements, lowering GaN's potential performance.

Integrated GaN power ICs, on the other hand, consolidate various power electronics functionalities onto a single GaN chip and deliver the most critical features required from a single device. As a result, in addition to optimizing solar system efficiency and power capacity, the integrated GaN power IC minimizes system complexity, cost, and size (when compared to GaN HEMT discrete solutions).

The GaN power IC's protective features and ESD robustness strengthen its position as the power transistor of choice. Keeping this in mind, Central's 100V GaN FETs are essentially designed as power FETs for low gate charge, low output charge and ultra-high switching frequency applications.



CSP3.5x2 Package Specifications

DIMENSIONS				
	INCHES		MILLIMETERS	
SYMBOL	MIN	MAX	MIN	MAX
A	0.137	0.139	3.47	3.53
B	0.083	0.085	2.10	2.16
C	0.009	0.011	0.23	0.27
D	0.030	0.031	0.75	0.80
E	0.070	0.072	1.78	1.82
F	0.020		0.50	
G	0.063	0.065	1.60	1.65
H	0.005		0.125	
J	0.006		0.165	
K	0.004	0.006	0.10	0.14
L	0.011	0.013	0.29	0.33

CSP3.5X2 (REV: R0)

LEAD CODE:

1) Gate
2) Source
3) Drain
4) Source
5) Drain
6) Source
7) Drain
8) Source

MARKING:
CSP 1060 D/C

MAXIMUM RATINGS: (T_J=25°C)	**SYMBOL**		**UNITS**
Drain-Source Voltage	V_{DS}	100	V
Gate-Source Voltage	V_{GS}	-4.0 to +6.0	V
Continuous Drain Current (T_C=25°C)	I_D	60	A
Power Dissipation (T_A=25°C)	P_D	1.1	W
Operating and Storage Junction Temperature	T_J, T_{stg}	-40 to +150	°C

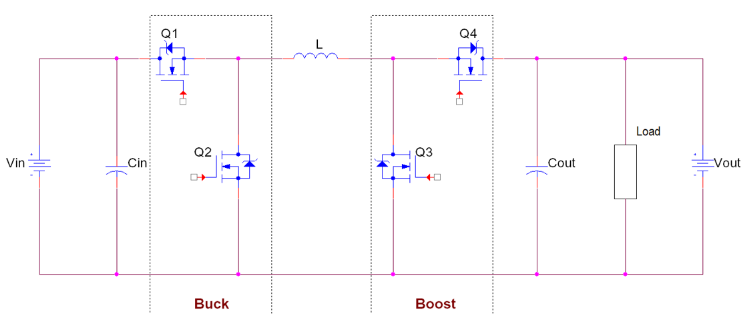
ELECTRICAL CHARACTERISTICS: (T_J=25°C unless otherwise noted)

SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
I_{GSSF}	V_{GS}=5.0V, V_{DS}=0		20	5000	µA
I_{GSSR}	V_{GS}=4.0V, V_{DS}=0		60	400	µA
I_{DSS}	V_{DS}=80V, V_{GS}=0			350	µA
BV_{DSS}	V_{GS}=0, I_D=400µA	100			V
$V_{GS(th)}$	V_{GS}= V_{DS}, I_D=9.0mA	0.8	1.1	2.5	V
$r_{DS(ON)}$	V_{GS}=5.0V, I_D=25A		2.4	5.5	mΩ
V_{FSD}	V_{GS}=0, I_S=0.5A		2.3		V
C_{iss}	V_{DS}=50V, V_{GS}=0, f=1MHz		1000		pF
C_{oss}	V_{DS}=50V, V_{GS}=0, f=1MHz		460		pF
C_{rss}	V_{DS}=50V, V_{GS}=0, f=1MHz		8.2		pF
$C_{oss(er)}$	V_{DS}=0 to 50V, V_{GS}=0		700		pF
$C_{oss(tr)}$	V_{DS}=0 to 50V, V_{GS}=0		1020		pF
Q_g	V_{DS}=50V, V_{GS}=0 to 5V, I_D=25A		9.2		nC
Q_{gd}	V_{DS}=50V, V_{GS}=0 to 5V, I_D=25A		1.9		nC
Q_{gs}	V_{DS}=50V, V_{GS}=0 to 5V, I_D=25A		1.7		nC

CCSPG1060N Electrical Characteristics

Industrial 100V GaN Applications

Solar Optimizer



Buck and Boost Controller

GaN is a material that has been used in the development of solar optimizer technology. It helps to increase the efficiency of solar panels by optimizing the power output.

GaN technology allows for the creation if smaller, more efficient optimizers that can be integrated into solar panel systems. These optimizers help to improve the performance of the panels by monitoring and adjusting the power output of each individual panel.

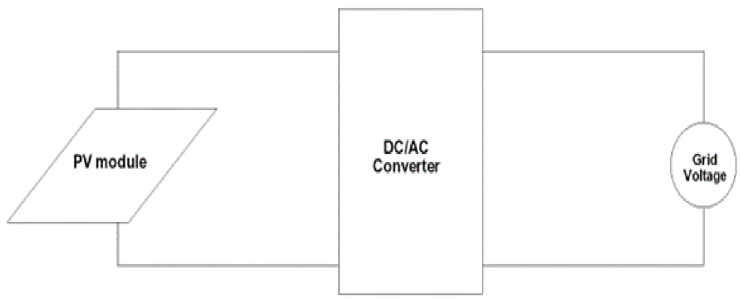
The low voltage operation of solar optimizers helps to reduce the overall system cost by allowing for the use of smaller, less expensive components. While solar optimizers are typically designed to operate at low voltages, they have been used with 100V GaN technology in solar energy systems.

This technology potentially allows for the development of more efficient and cost-effective solar optimizers that can operate at higher voltages.

Microinverters

Microinverters are an important component of solar energy systems, as they allow for the conversion of DC power generated by solar panels into AC power that can be used by homes and businesses. The use of 100V GaN technology in the development of these inverters has several potential benefits, including increased efficiency, improved reliability, and reduced cost.

GaN-based microinverters can operate at higher frequencies, which allows for greater efficiency and smaller, more compact designs. Additionally, GaN technology is more durable and reliable than traditional silicon-based technology, resulting in a more stable and consistent power output. This makes microinverters a more viable and cost-effective option for solar energy systems.



Single Stage Microinverter

Energy Storage Systems

100V GaN technology has been used in the development of energy storage systems, which are used to store excess energy generated by solar panels or other renewable energy sources. The use of GaN technology in these systems allows for greater efficiency and reliability resulting in stable power output.

Conclusion

In conclusion, the use of 100V GaN technology in solar power applications has the potential to revolutionize the solar energy industry. GaN based solar optimizers, microinverters, and energy storage systems offer increased efficiency, improved reliability, and reduced cost, making the solar energy systems more viable and cost-effective.

While further research and development is needed to fully explore the potential benefits of this approach, the future looks bright for GaN technology in solar power applications.