

GaNSmart™ PowerIC
GNZ6613

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GaNSmart™ Power IC GNZ661x series

Features

- Integrated with 700V, 180 m~490mohm GaN FET
- Integrated with current sensing
- Built-in high voltage startup
- Wide VCC range, 5 to 80V
- LDO power up PWM controller
- Intelligent GaN driver and protection
- Green mode
- Protection Features
 - CS OCP
 - Transformer Saturation Protection
 - VCC OVP
 - On chip OTP

Description

GNZ661x series product is an intelligent 700V GaN with integrated driver. The newly developed architecture is inherent features to meet regulatory requirements of the industry.

GNZ661x series integrates rich protections and features such as OCP, transformer saturation and over temperature.

Applications

- Offline Charger
- Programmable travel adapter
- USB PD Charger
- TV / Monitor Standby Power
- Notebook Adapter

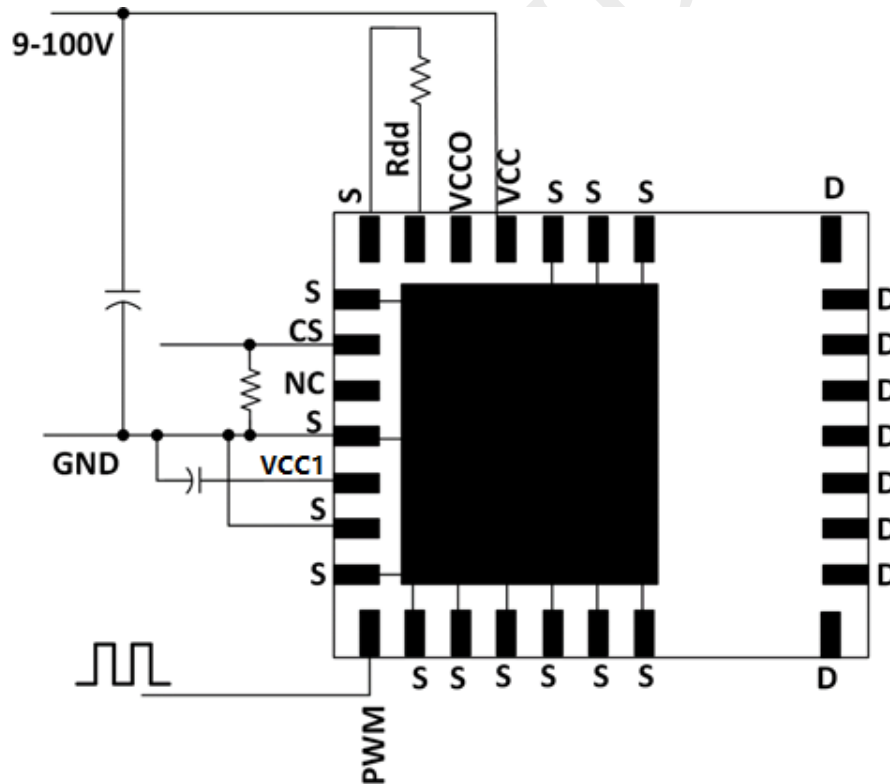


Fig 1. Typical Application Circuit

Product Options

Part Number	Rds-on typical
GNZ6611	150 mohm
GNZ6612	199 mohm
GNZ6613	270 mohm
GNZ6614	350 mohm
GNZ6615	490 mohm

Pin Functional Definitions

No.	Name	Description
29	Rdd	Turn-on speed control pin, connect to S with resistor
2	CS	Current sense
8	PWM	PWM input from the controller, connected to the output of the controller
27	VCC	Power supply of the IC
5	VCC1	Power supply of the IC, same function of VCC
3, 28	NC	No connection
15-23	D	Drain of 700V GaN
1, 4, 6, 7, 9-14, 24-26, 30	S	Power ground, Source of internal MOSFET

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Min.	Max.	Unit
VCC	VCC	-0.3	100.0	V
Drain	High voltage input	-0.3	700.0	V
PWM, VCCO, G-gate, Source	PWM input, VCCO output, Gate, Source output of GAN	-0.3	35.0	V
Rdd	Turn on speed control pin	-35	10	V
CS	CS	-0.3	6.5	V
T _{jct}	Operating junction temperature	-40	150	°C
T _{stg}	Storage temperature	-40	150	°C

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.

ESD Ratings

Item	Description	Value	Unit
Electrostatic Discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 (HV Pin)	±2k	V
	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 (all pins except HV Pin)	±2k	V
	Charged device model (CDM), per JEDEC specification JESD22-C101	±500	V

Thermal Specification (Note 2)

Item	Value	Unit
R _{θJA} Junction-to-ambient thermal resistance	40	°C/W
R _{θJC(top)} Junction-to-case (top) thermal resistance	1.9	°C/W

Note 2: The maximum allowable power dissipation is a function of the maximum junction temperature T_J(MAX), the junction-to-ambient thermal resistance R_{θJA}, and the ambient temperature T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D(MAX)=(T_J(MAX)-T_A)/R_{θJA}. Exceeding the maximum allowable power dissipation produces an excessive die temperature, causing the regulator to go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.

Electrical Characteristics

VCC = 12V, T_{AMB} = 25°C, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
VCC Section						
V _{CC}	Bias Power Supply				100	V
V _{CC_ON}	Power-On Threshold	V _{CC} Rising		6.5		V
V _{CC_UVLO}	UVLO Threshold	V _{CC} Falling		6		V
V _{CC_CHG}	VCC charging voltage	Charging current=50uA	16			V
I _{CC_NGT}	Quiescent Current	DRV Pin Open			300	μA
I _{CC_UVLO}	Quiescent Current under UVLO				50	μA
I _{CC_GM}	Quiescent Current in Green Mode				150	μA
I _{CC_WGT}	Operating Current with Load	fs=89kHz, 1nF Load on DRV Pin		1		mA
I _{VCC_CHG}	VCC charging current	VCC=10v		2.5		mA
		VCC=1v		1		mA
I _{VCC_CHG_MAX}	Maximum VCC charging voltage			24		V
Drain Section						
V _{drain}	Drain Pin Operating Voltage				700	V
I _{LK}	HV Leakage Current	HV=600V, V _{CC} =20V		3.0	5.0	μA
CS Section						
N _{CS_ratio}	Current sense ratio	I = 1A		2200		
		I = 0.5A		2000		
I _{OCP_1}	Over current protection at CS			5.5		A

V _{DS_OVP}	Over voltage at low side MOSFET			1		V
PWM Section						
T _{DELAY}	Delay from PWM to GaN			40		ns
T _{LEB}	Blanking time for OCP			100		ns
Green Mode Section						
T _{GM_ENT}	Timing to enter GM			100		us
T _{GM_EXIT_DLY}	Delay to exit GM			1		us
OTP Section						
T _{OTP}	Over Temp Protection	(Note 3)	140	145		°C
T _{OTP_HYS}	OTP Hysteresis	(Note 3)		50		°C
Turn on speed control						
R _{dd}	R _{dd} to Source		0		1k	Ω

Note 3. Guaranteed by design.

Detailed Function Description

GNZ661x series is the GaN FET with integrated driver. It's compatible with traditional Silicon MOSFET controller. There is no extra special design for the driver of the controller. It integrates with the current sensing circuit. The external power resistor which was used for current detection is replaced by a configuration resistor. The current in the sensing configuration resistor is much smaller than the tradition design, which makes the converter more efficiency. GNZ661x series also has the internal protections as shown in the Protections section.

Current Sensing

GNZ661x series is integrated with current sensing function. It detect the current in the low side MOSFET and generate the 1/2200 of the current at the CS Pin. By this, there is no resistor at the major current path, the power loss is more reduced.

VCC Start-up

GNZ661x series has the VCC start-up function. It can charging VCC internally, by which, no extra charging circuit necessary in the controller. The maximum charging current is 2.5mA, and the maximum charging voltage is 24V. The charging function will be triggered when VCC is lower than 6V (UVLO). It will be stopped when the first input PWM detected.

Green Mode

When the frequency of the input of PWM is very low, GNZ661x series will operate at green mode, whose operation current will be reduced to less than 100uA. GNZ661x series will count the time between the

PWM input pulses. If the input keeps low during 100us, GNZ661x series will enter the Green Mode, the operation current will be less than 100uA. GNZ661x series will exit green mode once the input PWM detected. It will be back to the normal operation.

Protections

GNZ661x series achieves various protections as listed in below table, including over current protection (OCP), low side MOSFET over voltage protection (LSOVP) and on chip over temperature protection (OTP).

CS Over Current Protection (OCP)

When the current at GaN is over 5.5A after LEB (100ns), the driver will be turn off as protection. This protection is protected cycle by cycle. GNZ661x series won't be shut down.

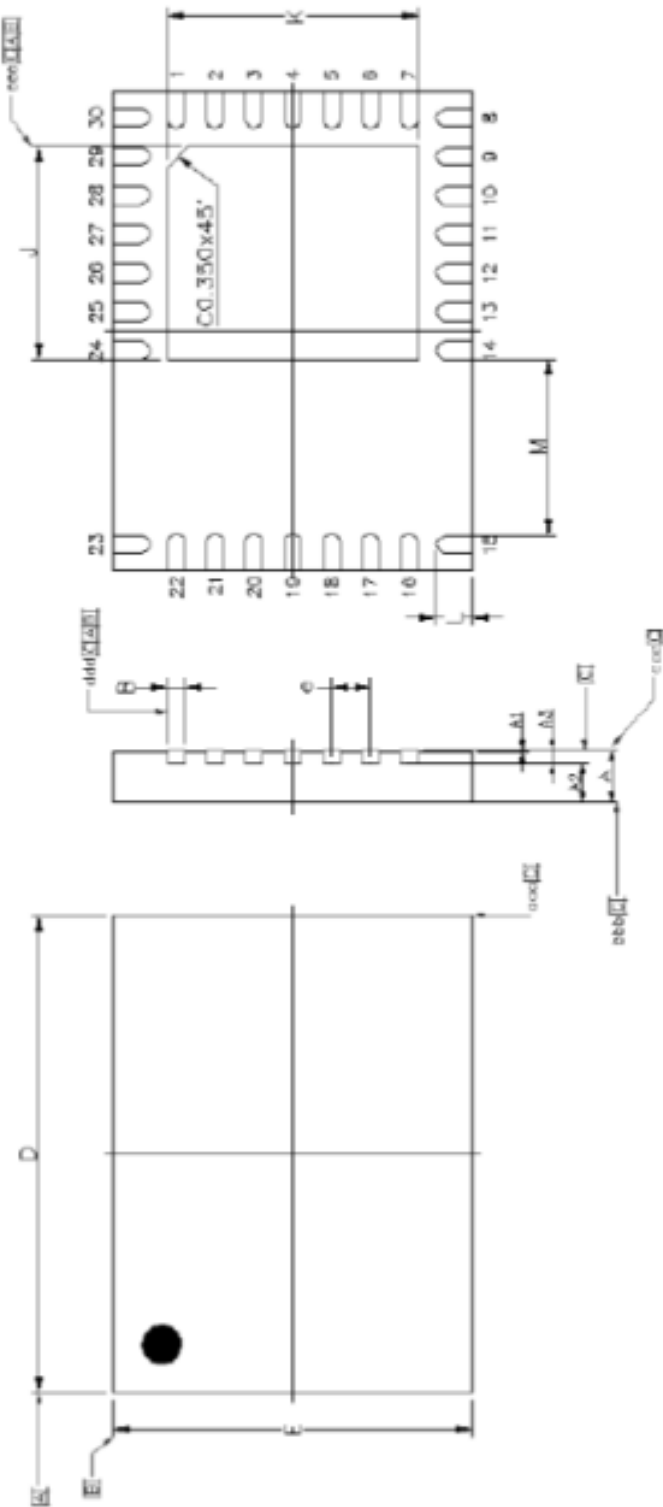
Low Side Over Voltage Protection (LSOVP)

GNZ661x series will detect the voltage between the low side MOSFET. If the voltage at the low side MOSFET is over 1V, the PWM will be shut down. If GNZ661x series detected this by continually 3 cycles. The fault will be triggered and GNZ661x series will be shut down. The fault will be only reset by UVLO.

On Chip Over Temperature Protection (OTP)

The internal die temperature is sensed to prevent from over-heat. The temperature reference for OTP is defined at 145°C typical with 25°C hysteresis. When OTP fault signal is detected, the OTP is activated to shut down PWM. The fault will be only reset by UVLO.

DFN6X8-30L Package



	SYMBOL	MIN	NOM	MAX		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.8	0.85	0.9	EP SIZE	X	J	3.5	3.6
STAND OFF	A1	0.00	0.02	0.05					
MOLD THICKNESS	A2	---	0.65	---	LEAD LENGTH		L	0.55	0.6
L/F THICKNESS	A3		0.203 REF						
LEAD WIDTH	B	0.25	0.3	0.35	PACKAGE EDGE TOLERANCE		aaa	0.1	
BODY SIZE	X		8.00 BSC						
	Y		6.00 BSC		ccc	0.06			
LEAD PITCH	e		0.65 BSC		LEAD OFFSET		ddd	0.1	
					EXPOSED PAD OFFSET		eee	0.1	

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Sales@ ganext.com