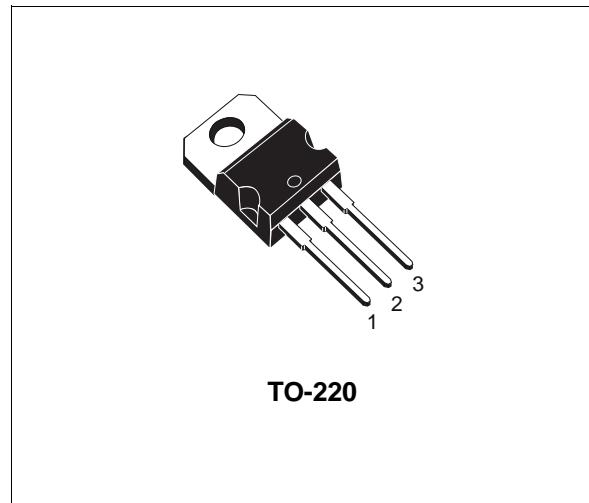


## "OMNIFET": FULLY AUTOPROTECTED POWER MOSFET

TYPE	$V_{\text{clamp}}$	$R_{\text{DS(on)}}$	$I_{\text{lim}}$
VNP5N07	70 V	0.2 Ω	5 A

- LINEAR CURRENT LIMITATION
- THERMAL SHUT DOWN
- SHORT CIRCUIT PROTECTION
- INTEGRATED CLAMP
- LOW CURRENT DRAWN FROM INPUT PIN
- DIAGNOSTIC FEEDBACK THROUGH INPUT PIN
- ESD PROTECTION
- DIRECT ACCESS TO THE GATE OF THE POWER MOSFET (ANALOG DRIVING)
- COMPATIBLE WITH STANDARD POWER MOSFET
- STANDARD TO-220 PACKAGE



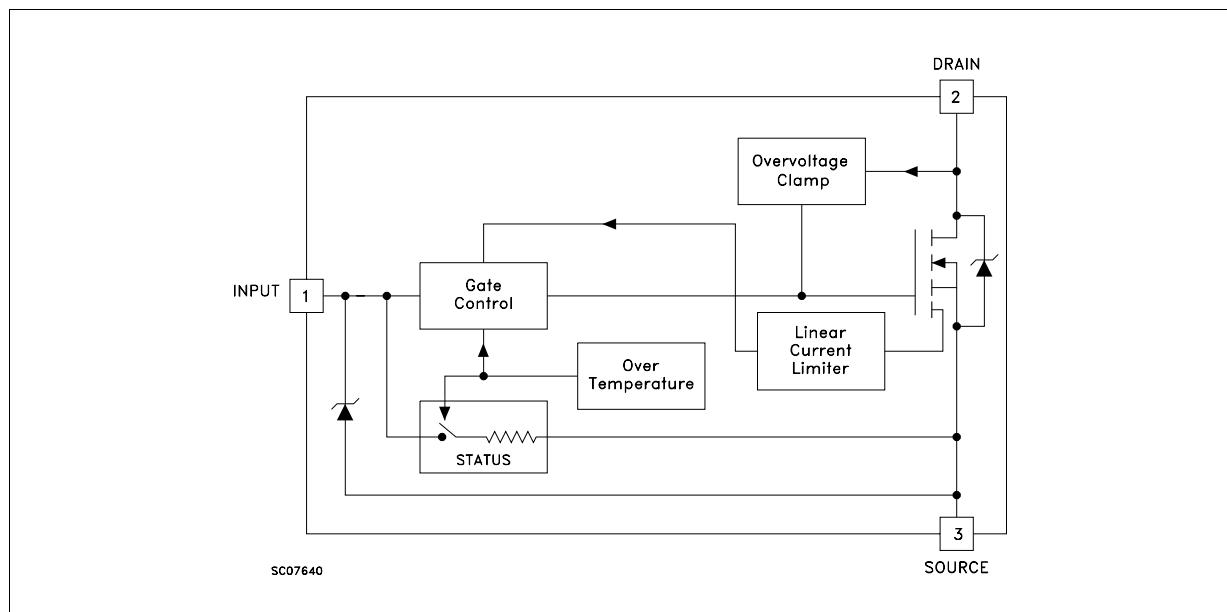
### DESCRIPTION

The VNP5N07 is a monolithic device made using STMicroelectronics VIPower M0 Technology, intended for replacement of standard power MOSFETS in DC to 50 KHz applications. Built in thermal shut-down, linear current limi-

tation and overvoltage clamp protect the chip in harsh environments.

Fault feedback can be detected by monitoring the voltage at the input pin.

### BLOCK DIAGRAM



## VNP5N07

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### ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage ( $V_{in} = 0$ )	Internally Clamped	V
$V_{in}$	Input Voltage	18	V
$I_D$	Drain Current	Internally Limited	A
$I_R$	Reverse DC Output Current	-7	A
$V_{esd}$	Electrostatic Discharge ( $C = 100 \text{ pF}, R = 1.5 \text{ k}\Omega$ )	2000	V
$P_{tot}$	Total Dissipation at $T_c = 25^\circ\text{C}$	31	W
$T_j$	Operating Junction Temperature	Internally Limited	$^\circ\text{C}$
$T_c$	Case Operating Temperature	Internally Limited	$^\circ\text{C}$
$T_{stg}$	Storage Temperature	-55 to 150	$^\circ\text{C}$

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	4	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^\circ\text{C}/\text{W}$

### ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CLAMP}$	Drain-source Clamp Voltage	$I_D = 200 \text{ mA} \quad V_{in} = 0$	60	70	80	V
$V_{CLTH}$	Drain-source Clamp Threshold Voltage	$I_D = 2 \text{ mA} \quad V_{in} = 0$	55			V
$V_{INCL}$	Input-Source Reverse Clamp Voltage	$I_{in} = -1 \text{ mA}$	-1		-0.3	V
$I_{DSS}$	Zero Input Voltage Drain Current ( $V_{in} = 0$ )	$V_{DS} = 13 \text{ V} \quad V_{in} = 0$ $V_{DS} = 25 \text{ V} \quad V_{in} = 0$			50 200	$\mu\text{A}$ $\mu\text{A}$
$I_{ISS}$	Supply Current from Input Pin	$V_{DS} = 0 \text{ V} \quad V_{in} = 10 \text{ V}$		250	500	$\mu\text{A}$

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IS(th)}$	Input Threshold Voltage	$V_{DS} = V_{in} \quad I_D + I_{in} = 1 \text{ mA}$	0.8		3	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{in} = 10 \text{ V} \quad I_D = 2.5 \text{ A}$ $V_{in} = 5 \text{ V} \quad I_D = 2.5 \text{ A}$			0.200 0.280	$\Omega$ $\Omega$

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} \text{ (*)}$	Forward Transconductance	$V_{DS} = 13 \text{ V} \quad I_D = 2.5 \text{ A}$	3	4		S
$C_{oss}$	Output Capacitance	$V_{DS} = 13 \text{ V} \quad f = 1 \text{ MHz} \quad V_{in} = 0$		200	300	pF

**ELECTRICAL CHARACTERISTICS** (continued)  
**SWITCHING (\*\*)**

<b>Symbol</b>	<b>Parameter</b>	<b>Test Conditions</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 15 \text{ V}$ $I_d = 2.5 \text{ A}$		50	100	ns
$t_r$	Rise Time	$V_{gen} = 10 \text{ V}$ $R_{gen} = 10 \Omega$		60	100	ns
$t_{d(off)}$	Turn-off Delay Time	(see figure 3)		150	300	ns
$t_f$	Fall Time			40	80	ns
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 15 \text{ V}$ $I_d = 2.5 \text{ A}$		150	250	ns
$t_r$	Rise Time	$V_{gen} = 10 \text{ V}$ $R_{gen} = 1000 \Omega$		400	600	ns
$t_{d(off)}$	Turn-off Delay Time	(see figure 3)		3900	5000	ns
$t_f$	Fall Time			1100	1600	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 15 \text{ V}$ $I_D = 2.5 \text{ A}$ $V_{in} = 10 \text{ V}$ $R_{gen} = 10 \Omega$		35		A/ $\mu\text{s}$
$Q_i$	Total Input Charge	$V_{DD} = 12 \text{ V}$ $I_D = 2.5 \text{ A}$ $V_{in} = 10 \text{ V}$		18		nC

## SOURCE DRAIN DIODE

<b>Symbol</b>	<b>Parameter</b>	<b>Test Conditions</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 2.5 \text{ A}$ $V_{IN} = 0$			1.6	V
$t_{rr} (**)$	Reverse Recovery Time	$I_{SD} = 2.5 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$		150		ns
$Q_{rr} (**)$	Reverse Recovery Charge	$V_{DD} = 30 \text{ V}$ $T_j = 25^\circ\text{C}$		0.3		$\mu\text{C}$
$I_{RRM} (**)$	Reverse Recovery Current	(see test circuit, figure 5)		5.7		A

## PROTECTION

<b>Symbol</b>	<b>Parameter</b>	<b>Test Conditions</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>
$I_{lim}$	Drain Current Limit	$V_{in} = 10 \text{ V}$ $V_{DS} = 13 \text{ V}$ $V_{in} = 5 \text{ V}$ $V_{DS} = 13 \text{ V}$	3.5 3.5	5 5	7 7	A A
$t_{dlim} (**)$	Step Response Current Limit	$V_{in} = 10 \text{ V}$ $V_{in} = 5 \text{ V}$		15 40	20 60	$\mu\text{s}$
$T_{jsh} (**)$	Overtemperature Shutdown		150			$^\circ\text{C}$
$T_{jrs} (**)$	Overtemperature Reset		135			$^\circ\text{C}$
$I_{gf} (**)$	Fault Sink Current	$V_{in} = 10 \text{ V}$ $V_{DS} = 13 \text{ V}$ $V_{in} = 5 \text{ V}$ $V_{DS} = 13 \text{ V}$		50 20		mA
$E_{as} (**)$	Single Pulse Avalanche Energy	starting $T_j = 25^\circ\text{C}$ $V_{DD} = 20 \text{ V}$ $V_{in} = 10 \text{ V}$ $R_{gen} = 1 \text{ K}\Omega$ $L = 30 \text{ mH}$	0.2			J

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(\*\*) Parameters guaranteed by design/characterization

## PROTECTION FEATURES

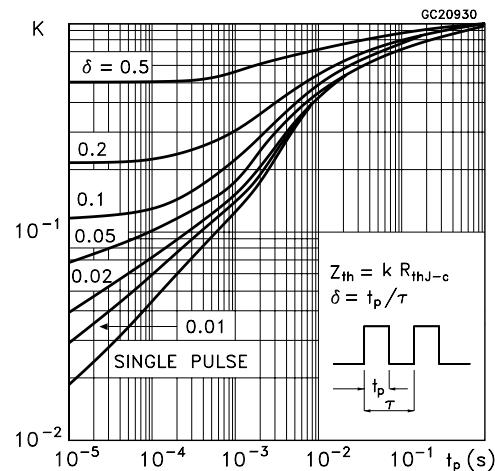
During normal operation, the Input pin is electrically connected to the gate of the internal power MOSFET. The device then behaves like a standard power MOSFET and can be used as a switch from DC to 50 KHz. The only difference from the user's standpoint is that a small DC current ( $I_{iss}$ ) flows into the Input pin in order to supply the internal circuitry.

The device integrates:

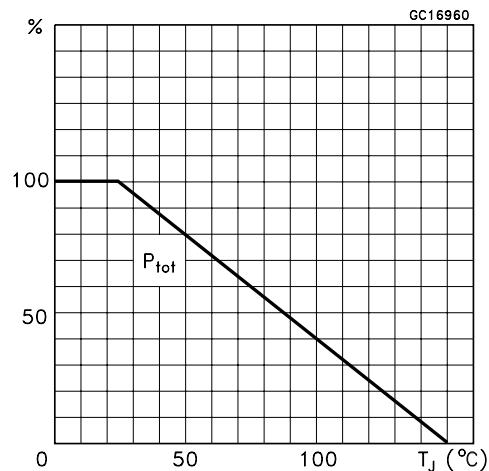
- OVERVOLTAGE CLAMP PROTECTION: internally set at 70V, along with the rugged avalanche characteristics of the Power MOSFET stage give this device unrivalled ruggedness and energy handling capability. This feature is mainly important when driving inductive loads.
- LINEAR CURRENT LIMITER CIRCUIT: limits the drain current  $I_d$  to  $I_{lim}$  whatever the Input pin voltage. When the current limiter is active, the device operates in the linear region, so power dissipation may exceed the capability of the heatsink. Both case and junction temperatures increase, and if this phase lasts long enough, junction temperature may reach the overtemperature threshold  $T_{jsh}$ .
- OVERTEMPERATURE AND SHORT CIRCUIT PROTECTION: these are based on sensing the chip temperature and are not dependent on the input voltage. The location of the sensing element on the chip in the power stage area ensures fast, accurate detection of the junction temperature. Overtemperature cutout occurs at minimum 150°C. The device is automatically restarted when the chip temperature falls below 135°C.
- STATUS FEEDBACK: In the case of an overtemperature fault condition, a Status Feedback is provided through the Input pin. The internal protection circuit disconnects the input from the gate and connects it instead to ground via an equivalent resistance of 100 Ω. The failure can be detected by monitoring the voltage at the Input pin, which will be close to ground potential.

Additional features of this device are ESD protection according to the Human Body model and the ability to be driven from a TTL Logic circuit (with a small increase in  $R_{DS(on)}$ ).

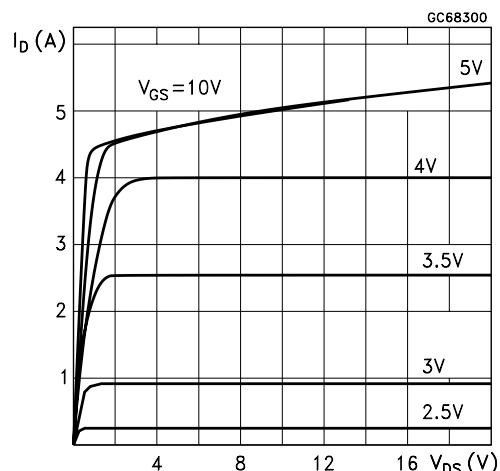
Thermal Impedance



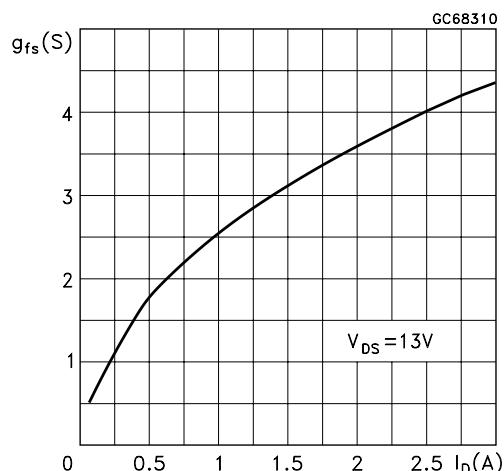
Derating Curve



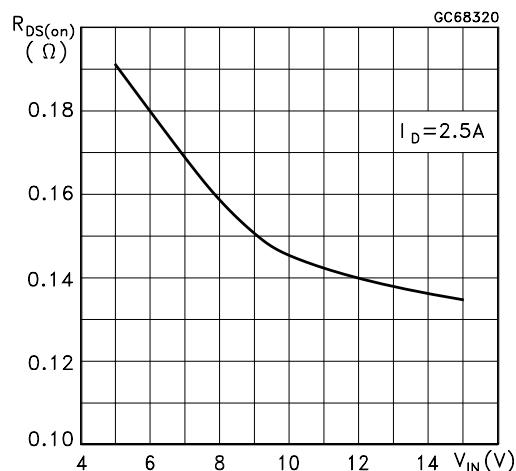
Output Characteristics



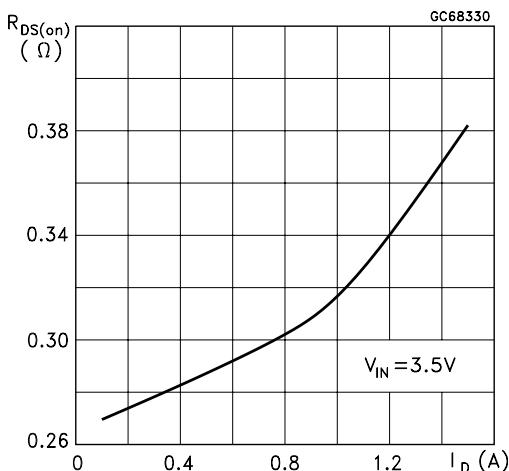
Transconductance



Static Drain-Source On Resistance vs Input Voltage



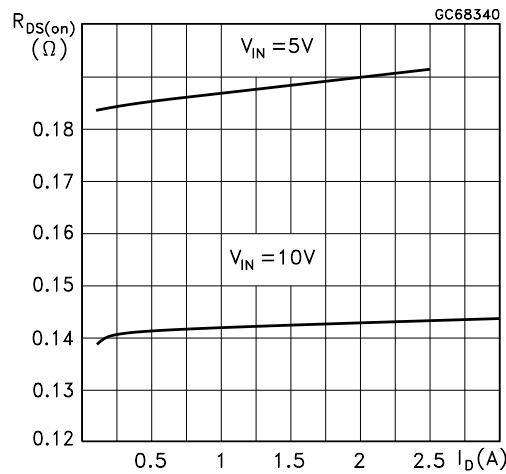
Static Drain-Source On Resistance



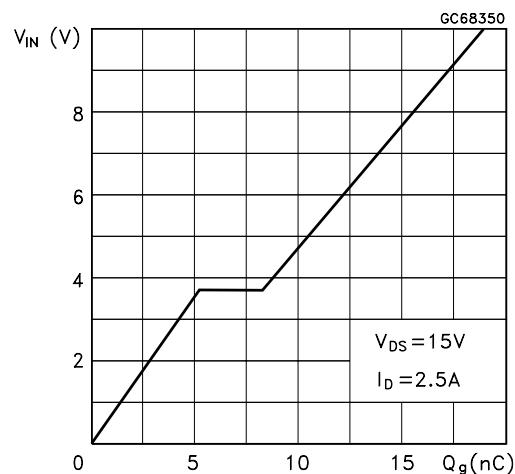
## VNP5N07

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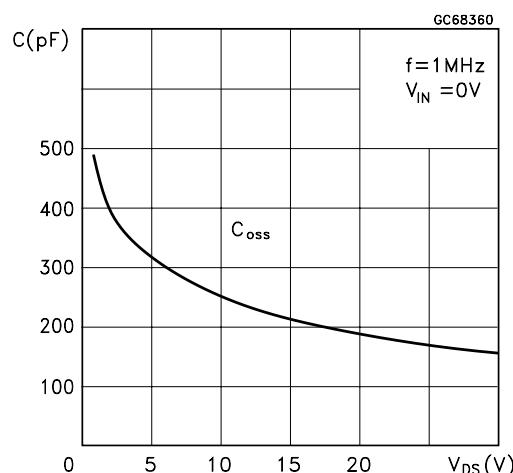
Static Drain-Source On Resistance



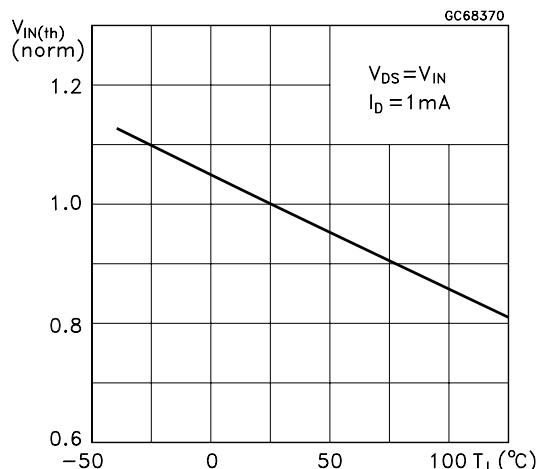
Input Charge vs Input Voltage



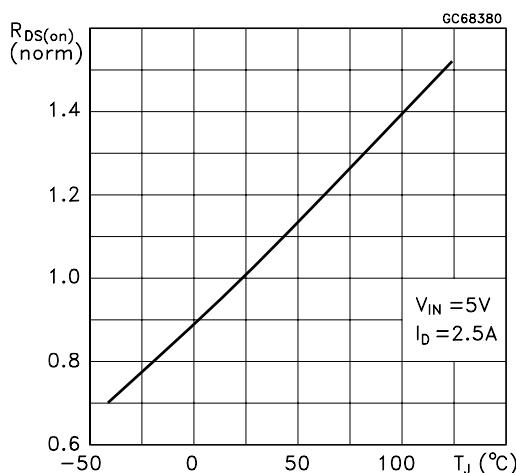
Capacitance Variations



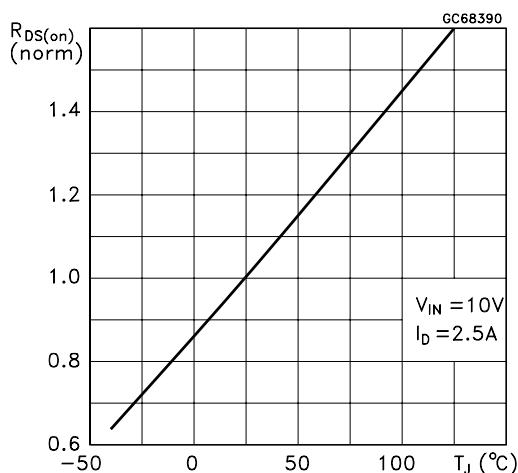
Normalized Input Threshold Voltage vs Temperature



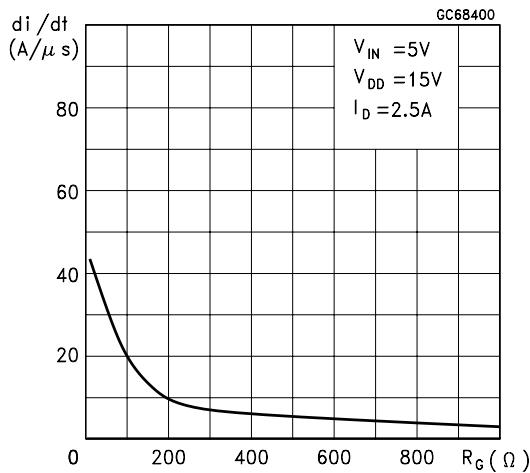
Normalized On Resistance vs Temperature



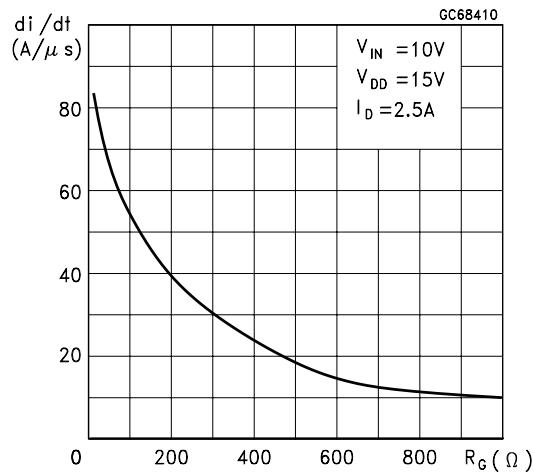
Normalized On Resistance vs Temperature



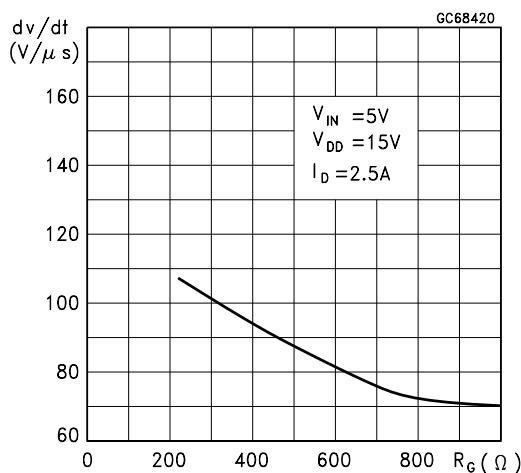
Turn-on Current Slope



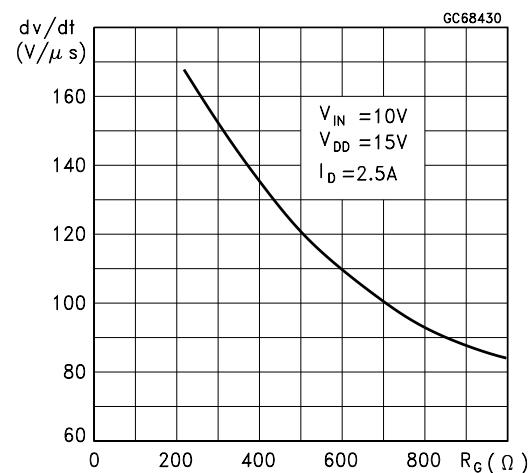
Turn-on Current Slope



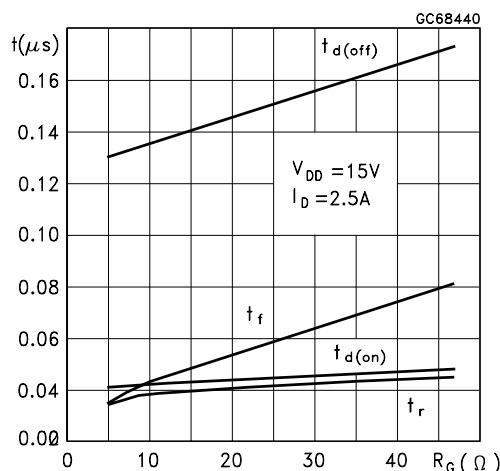
Turn-off Drain-Source Voltage Slope



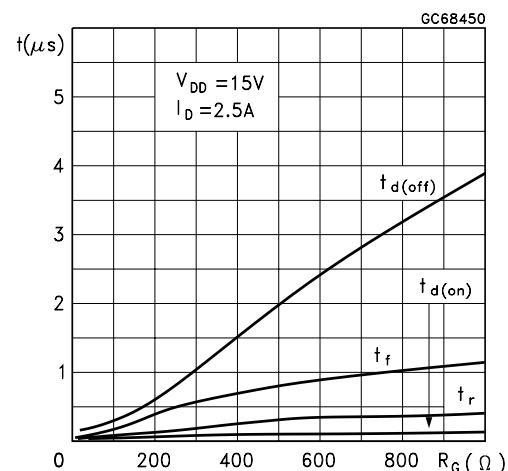
Turn-off Drain-Source Voltage Slope



Switching Time Resistive Load



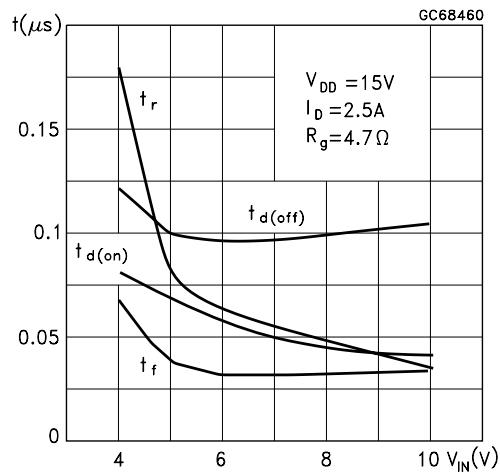
Switching Time Resistive Load



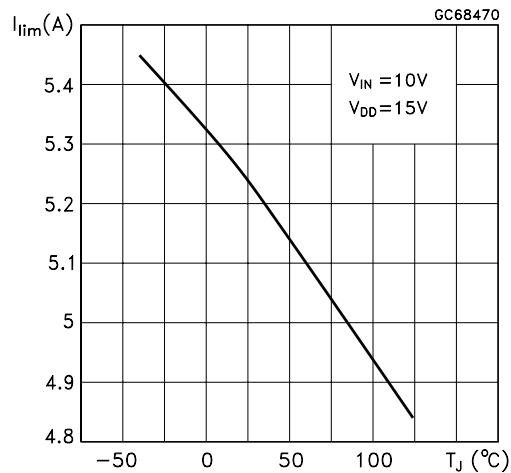
## VNP5N07

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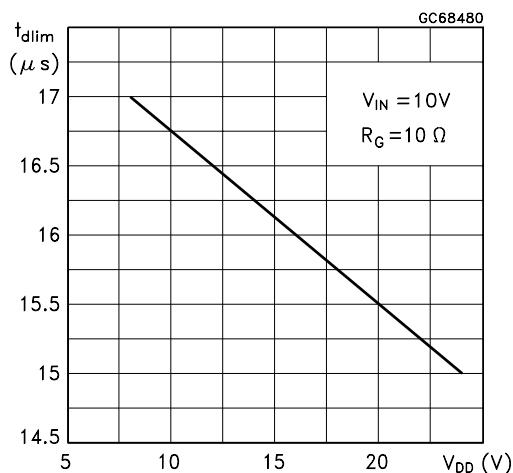
Switching Time Resistive Load



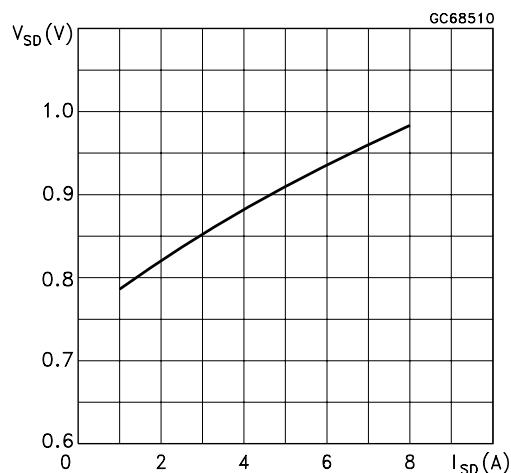
Current Limit vs Junction Temperature



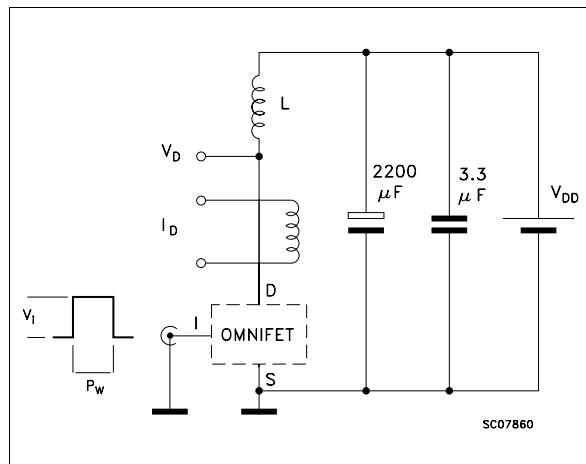
Step Response Current Limit



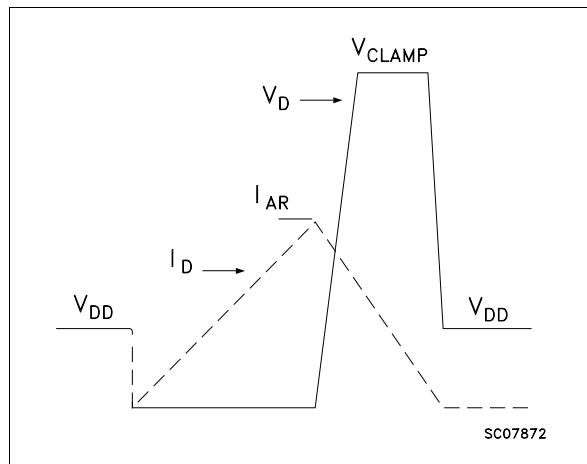
Source Drain Diode Forward Characteristics



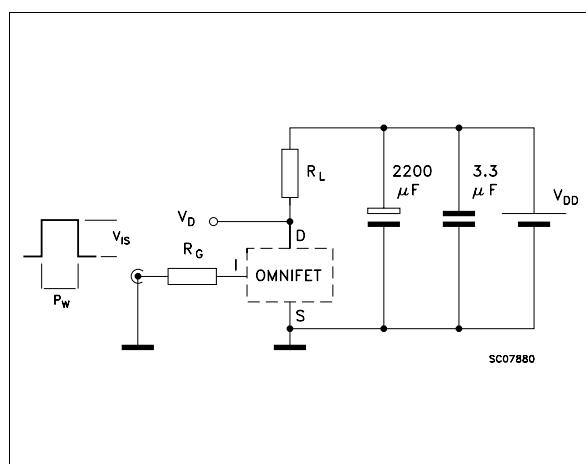
**Fig. 1:** Unclamped Inductive Load Test Circuits



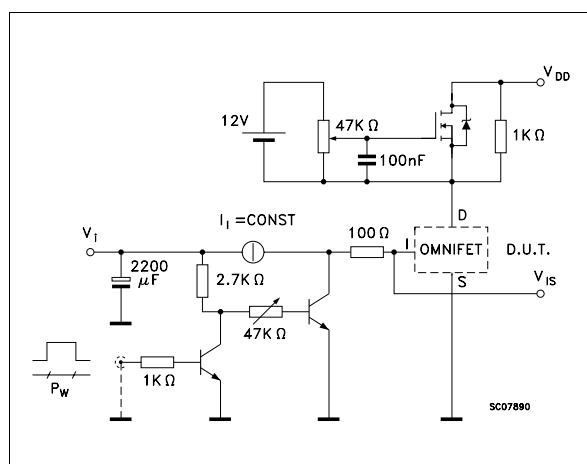
**Fig. 2:** Unclamped Inductive Waveforms



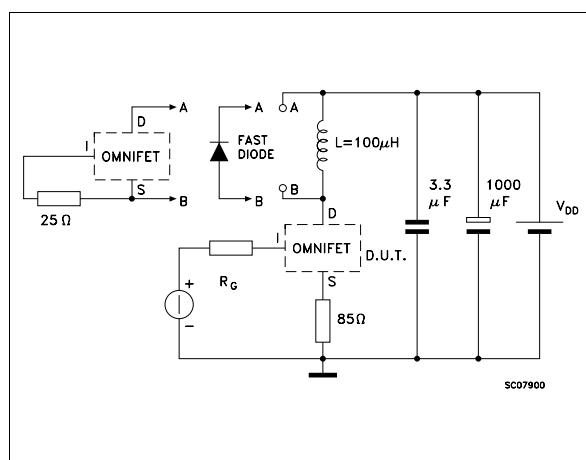
**Fig. 3:** Switching Times Test Circuits For Resistive Load



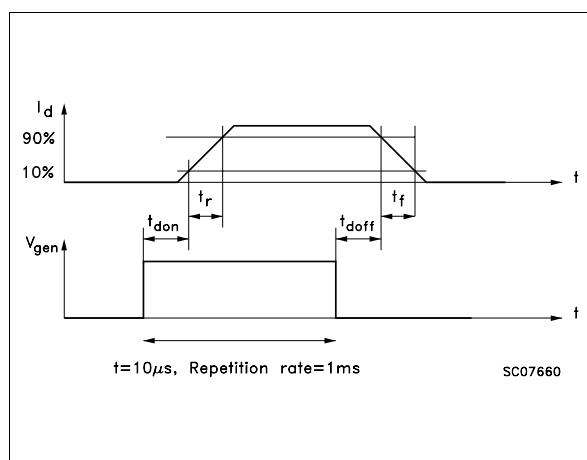
**Fig. 4:** Input Charge Test Circuit



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times

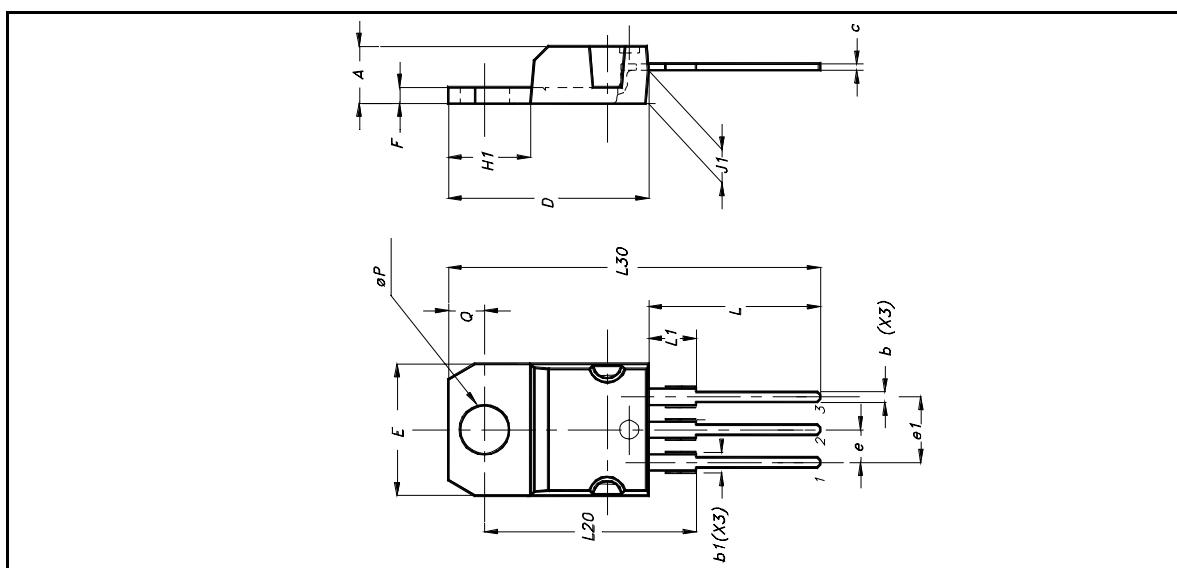


**Fig. 6:** Waveforms



**VNP5N07****TO-220 MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.40		4.60
b	0.61		0.88
b1	1.15		1.70
c	0.49		0.70
D	15.25		15.75
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95
Package Weight	1.9Gr. (Typ.)		



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ООО "ЛайфЭлектроникс"

"LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибуторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибуторских договоров

Мы предлагаем:

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- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
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- Формирование склада под заказчика.
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- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помочь разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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