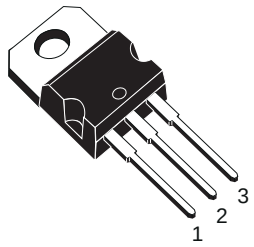
VNP14N04

"OMNIFET": FULLY AUTOPROTECTED POWER MOSFET

TYPE	V_{clamp}	$R_{DS(on)}$	I_{lim}
VNP14N04	42 V	0.07 Ω	14 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



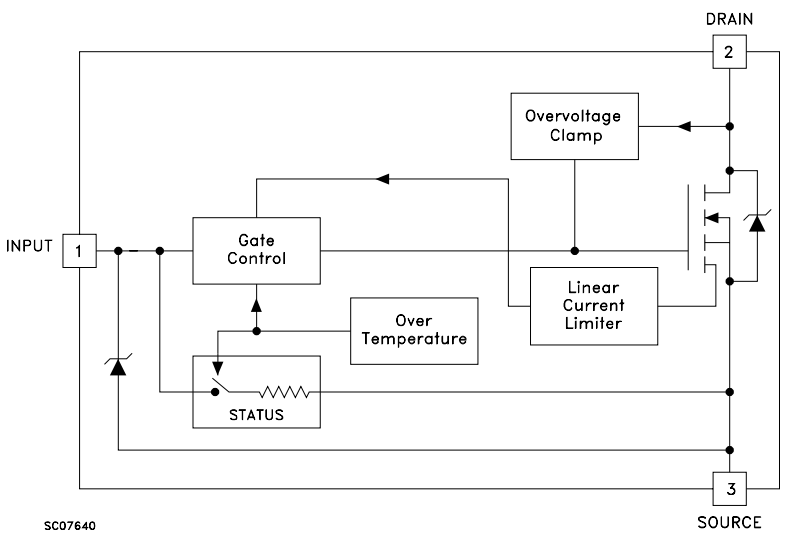
TO-220

DESCRIPTION

The VNP14N04 is a monolithic device made using STMicroelectronics VIPower Technology, Technology, intended for replacement of standard power MOSFETS in DC to 50 KHz applications. Built-in thermal shut-down, linear current limitation and overvoltage clamp protect the chip in harsh enviroments.

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

BLOCK DIAGRAM



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	-14	A
V_{esd}	Electrostatic Discharge (C= 100 pF, R=1.5 KΩ)	2000	V
P_{tot}	Total Dissipation at T_c = 25 ^oC	50	W
T_j	Operating Junction Temperature	Internally Limited	^oC
T_c	Case Operating Temperature	Internally Limited	^oC
T_{stg}	Storage Temperature	-55 to 150	^oC

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case Max	2.5	$^oC/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	62.5	$^oC/W$

ELECTRICAL CHARACTERISTICS (T_{case} = 25 ^oC unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CLAMP}	Drain-source Clamp Voltage	I_D = 200 mA V_{in} = 0	36	42	48	V
V_{CLTH}	Drain-source Clamp Threshold Voltage	I_D = 2 mA V_{in} = 0	35			V
V_{INCL}	Input-Source Reverse Clamp Voltage	I_{in} = -1 mA	-1		-0.3	V
I_{DSS}	Zero Input Voltage Drain Current (V_{in} = 0)	V_{DS} = 13 V V_{in} = 0 V_{DS} = 25 V V_{in} = 0			50 200	µA µA
I_{ISS}	Supply Current from Input Pin	V_{DS} = 0 V V_{in} = 10 V		250	500	µA

ON (∗)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IN(th)}$	Input Threshold Voltage	V_{DS} = V_{in} I_D + I_{in} = 1 mA	0.8		3	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{in} = 10 V I_D = 7 A V_{in} = 5 V I_D = 7 A			0.07 0.1	Ω Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (∗)	Forward Transconductance	V_{DS} = 13 V I_D = 7 A	8	10		S
C_{oss}	Output Capacitance	V_{DS} = 13 V f = 1 MHz V_{in} = 0		400	500	pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING (**)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	V_{DD} = 15 V I_d = 7 A V_{gen} = 10 V R_{gen} = 10 Ω (see figure 3)		60 160 250 100	120 300 400 200	ns ns ns ns
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	V_{DD} = 15 V I_d = 7 A V_{gen} = 10 V R_{gen} = 1000 Ω (see figure 3)		300 1.5 5.5 1.8	500 2.2 7.5 2.5	ns µs µs µs
$(di/dt)_{on}$	Turn-on Current Slope	V_{DD} = 15 V I_D = 7 A V_{in} = 10 V R_{gen} = 10 Ω		120		A/µs
Q_i	Total Input Charge	V_{DD} = 12 V I_D = 7 A V_{in} = 10 V		30		nC

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD} (*)	Forward On Voltage	I_{SD} = 7 A V_{in} = 0			1.6	V
t_{rr} (**) Q_{rr} (**) I_{RRM} (**)	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 7 A di/dt = 100 A/µs V_{DD} = 30 V T_j = 25 °C (see test circuit, figure 5)		110 0.34 6.1		ns µC A

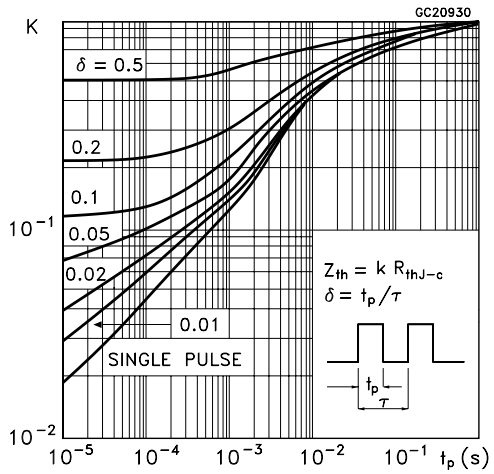
PROTECTION

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{lim}	Drain Current Limit	V_{in} = 10 V V_{DS} = 13 V V_{in} = 5 V V_{DS} = 13 V	10 10	14 14	20 20	A A
t_{dlim} (**)	Step Response Current Limit	V_{in} = 10 V V_{in} = 5 V		30 80	60 150	µs µs
T_{jsh} (**)	Overtemperature Shutdown		150			°C
T_{jrs} (**)	Overtemperature Reset		135			°C
I_{gf} (**)	Fault Sink Current	V_{in} = 10 V V_{DS} = 13 V V_{in} = 5 V V_{DS} = 13 V		50 20		mA mA
E_{as} (**)	Single Pulse Avalanche Energy	starting T_j = 25 °C V_{DD} = 20 V V_{in} = 10 V R_{gen} = 1 KΩ L = 10 mH	0.65			J

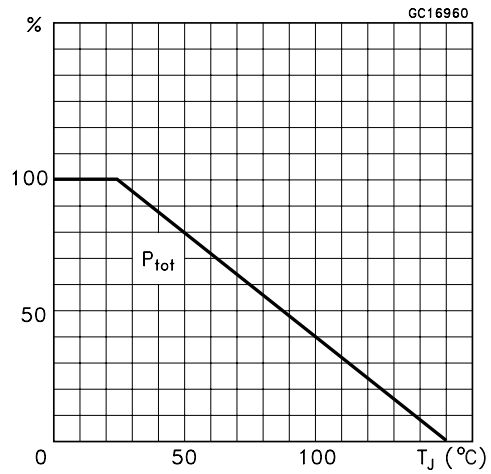
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(**) Parameters guaranteed by design/characterization

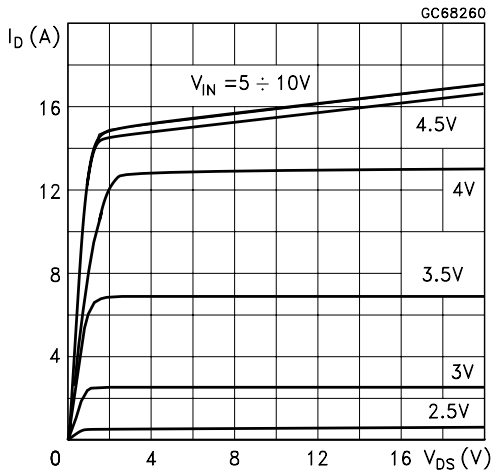
Thermal Impedance



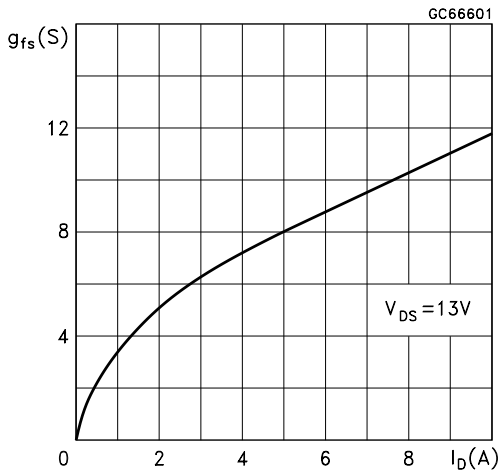
Derating Curve



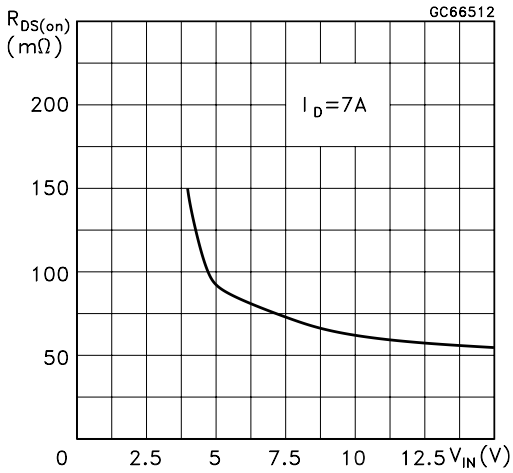
Output Characteristics



Transconductance



Static Drain-Source On Resistance vs Input Voltage



Static Drain-Source On Resistance