SGS-THOMSON MICROELECTRONICS

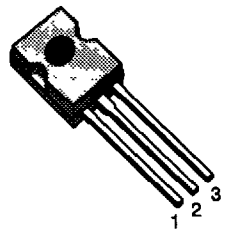
VNK10N06

"OMNIFET": FULLY AUTOPROTECTED POWER MOSFET

ADVANCE DATA

TYPE	V_{clamp}	$R_{DS(on)}$	I_{lim}
VNK10N06	60 V	0.15 Ω	10 A

- LINEAR CURRENT LIMITATION
- THERMAL SHUT DOWN
- SHORT CIRCUIT PROTECTION
- INTEGRATED CLAMP
- LOW CURRENT DRAWN FROM INPUT PIN
- ESD PROTECTION
- LOGIC LEVEL INPUT THRESHOLD
- SCHMITT TRIGGER ON INPUT
- HIGH NOISE IMMUNITY

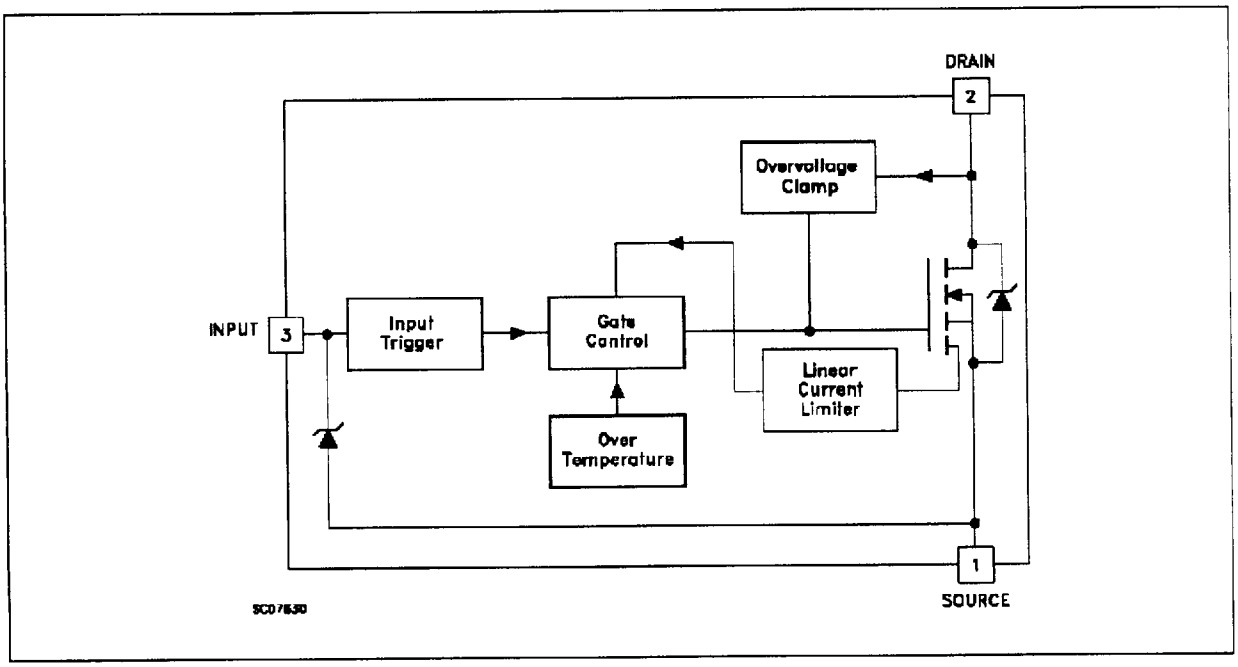


SOT-82

DESCRIPTION

The VNK10N06 is a monolithic device made using SGS-THOMSON Vertical Intelligent Power M0 Technology, intended for replacement of standard power MOSFETS in DC to 50 KHz applications. Built-in thermal shut-down, current limitation and overvoltage clamp combined with high avalanche energy rating makes this device ideally suited for driving unclamped inductive load in harsh environments.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{IN} = 0)	50 (*)	V
V_{in}	INPUT Voltage	Internally Clamped	V
I_{IN}	DC Input Current	± 20	mA
I_D	Drain Current	Internally Limited	A
I_R	Reverse Output Current	-15	A
V_{esd1}	Electrostatic Discharge (C= 100 pF, R=1.5 KΩ) Between INPUT and SOURCE pins	4000	V
V_{esd2}	Electrostatic Discharge (C= 200 pF, R=0), 5 Pulses at 1 Second interval Between INPUT or DRAIN and SOURCE pins	± 1000	V
V_{esd3}	Electrostatic Discharge (C= 500 pF, R=0), 5 Pulses at 1 Second interval Between INPUT or DRAIN and SOURCE pins	± 150	V
V_{esd4}	Electrostatic Discharge (C= 150 pF, R=150 Ω), 10 Pulses at 1 Second interval Between DRAIN and SOURCE pins	± 25000	V
P_{tot}	Total Dissipation at T_c = 25 °C	21	W
T_j	Operating Junction Temperature	150 (**)	°C
T_c	Case Operating Temperature	-40 to 150	°C
T_{stg}	Storage Temperature	-55 to 150	°C

(*) Higher voltage is allowed during clamping phase provided maximum clamping energy and maximum junction temperature are not exceeded
(**) Higher temperature is allowed during overload condition. At Tj=Tjsh, the device will automatically shut off

THERMAL DATA

$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	6	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{CLAMP}	Drain-source Clamp Voltage	R_L = 27 Ω L_L = 100 mH V_{DD} = 16 V	50	60	70	V
V_{IL}	Input Low Level	I_D = 100 µA V_{DS} = 16V			1.5	V
V_{IH}	Input High Level	R_L = 27 Ω V_{DD} = 16 V V_{DS} = 0.5 V	3.2			V
I_{IH}	Supply Current From Input Pin	V_{IN} = 5 V		150	300	µA
I_{IL}	Supply Current From Input Pin	V_{IN} = 0 V	-10		10	µA
V_{INCL}	Input Source Clamp Voltage	I_{IN} = -1 mA I_{IN} = 1 mA	-1 8		-0.3 11	V
I_{OZ}	Off State Drain Current	V_{DS} = 50 V V_{IN} = V_{IL} V_{DS} < 35 V V_{IN} = V_{IL}			250 100	µA µA
R_{ON}	ON State Resistance	V_{IN} = 3.5 V I_D = 1A T_a = 25 °C DC Operation		0.2	0.4	Ω
R_{ON}	ON State Resistance	V_{IN} = 7 V I_D = 1A T_a < 125 °C		0.15	0.3	Ω
V_{OZ}	Forward Diode Voltage	V_{IN} = V_{IL} I_D = -1 A	-1.5	-0.8		V

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on Time Rise Time Turn-off Time Fall Time	V_{DD} = 16 V R_L = 27 Ω V_{gen} = 5 V R_{gen} = 1 KΩ (See Figure 1)			5 3 5 3	µs µs µs µs

PROTECTION

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{lim}	Drain Current Limit	V_{IN} = 7 V V_{DS} = 13 V	6	10	15	A
t_{dlim}	Step Response Current Limit	V_{IN} = 7 V V_{DS} step from 0 to 13V		20		µs
T_{jsh}	Overtemperature Shutdown	3 V < V_{IN} < 7 V (see Note 1)	150	170	190	°C
T_{jrs}	Overtemperature Reset	3 V < V_{IN} < 7 V	135			°C
E_{as}	Single Pulse Avalanche Energy	V_{DD} = 24 V R_{gen} = 1KΩ V_{IN} = 7V starting T_j = 25°C L = 6 mH	250			mJ

Note 1: The device will withstand continuous short circuit operation with V_{IN} = 7V, V_{DD} = 13 V and R_L < 10 mΩ for 24 hours without any device failure.

PROTECTION FEATURES

During Normal Operation, the INPUT pin is electrically connected to the gate of the internal power MOSFET through a low impedance path as soon as $V_{IN} > V_{IH}$.

The device then behaves like a standard power MOSFET and can be used as a switch from DC to 50KHz. The only difference from the user's standpoint is that a small DC current (typically 150 µA) flows into the INPUT pin in order to supply the internal circuitry.

During turn-off of an unclamped inductive load the output voltage is clamped to a safe level by an integrated Zener clamp between DRAIN pin and the gate of the internal Power MOSFET.

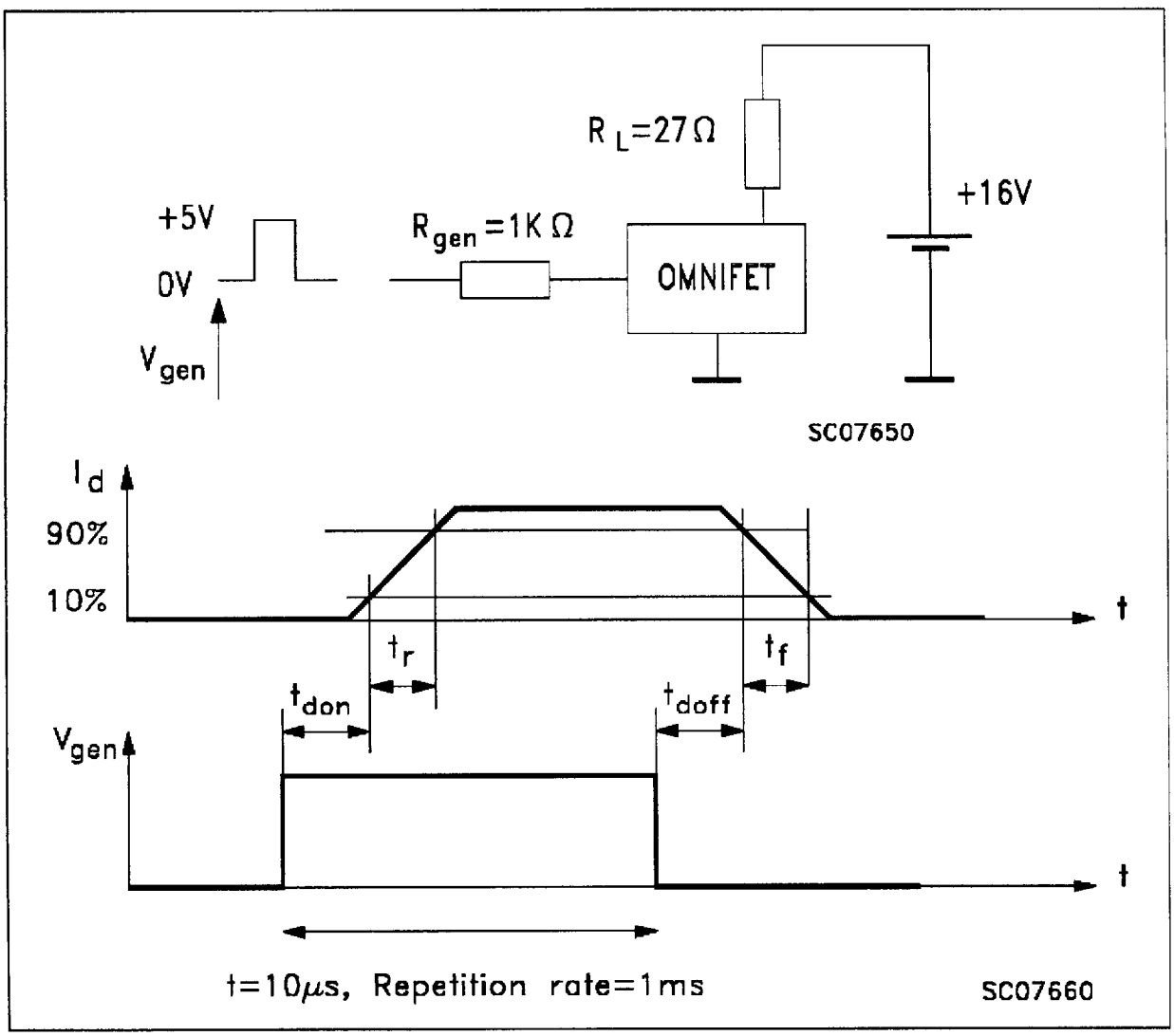
In this condition, the Power MOSFET gate is set to a voltage high enough to sustain the inductive load current even if the INPUT pin is driven to 0V.

The device integrates an active current limiter circuit which 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 heatsinking capability. Both case and junction temperatures increase, and if this phase lasts long enough, junction temperature may reach the overtemperature threshold T_{jsh}.

If T_j reaches T_{jsh}, the device shuts down whatever the INPUT pin voltage. The device will restart automatically when T_j has cooled down to T_{jrs}

Figure 1: SWITCHING PARAMETERS TEST CONDITIONS



SOT-82 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.04		0.106
c1		1.2			0.047	
D		15.7			0.618	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54		0.100