VNA7NV04D

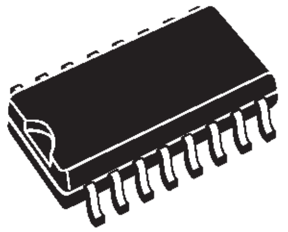
"OMNIFET II": FULLY AUTOPROTECTED POWER MOSFETS

TARGET SPECIFICATION

TYPE	$R_{DS(on)}$	I_{lim}	V_{clamp}
VNA7NV04D	60 mΩ (*)	6 A (*)	40 V (*)

(*) Per each device

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

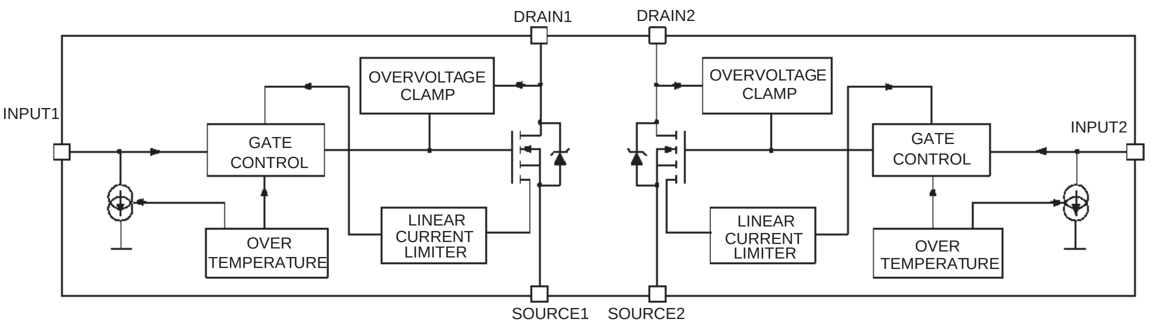


SO-16 (DOUBLE ISLAND)

DESCRIPTION

The VNA7NV04D is a device formed by two monolithic OMNIFET II chips housed in a standard SO-16 package with double island.
The OMNIFET II are designed in STMicroelectronics VIPower M0 Technology; they are intended for replacement of standard Power MOSFETS from DC up to 50KHz applications. Built in thermal shutdown, linear current limitation and overvoltage clamp protect the chips in harsh environments.
Fault feedback can be detected by monitoring the voltage at the input pins.

BLOCK DIAGRAM

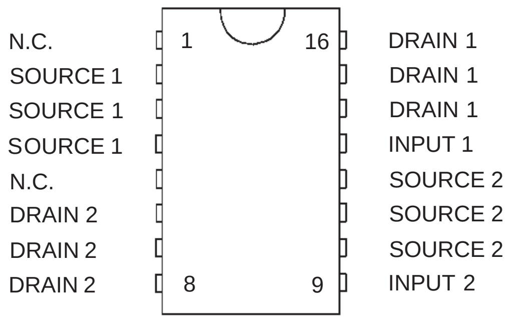


ABSOLUTE MAXIMUM RATING

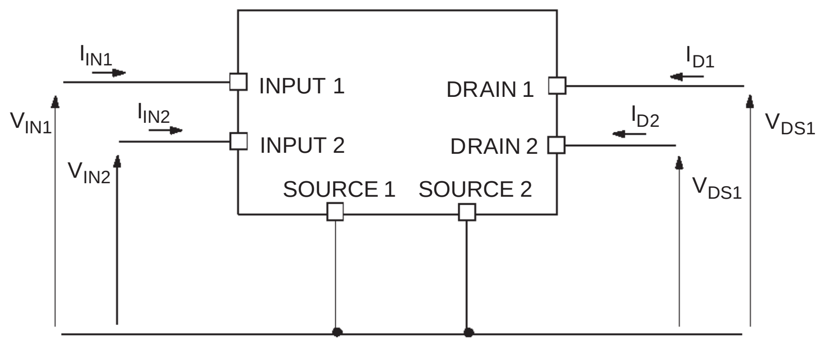
(per each device)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{IN}=0V)	Internally clamped	V
V_{IN}	Input Voltage	Internally clamped	V
I_{IN}	Input Current	+/- 20	mA
I_D	Drain Current	Internally Limited	A
I_R	Reverse DC Output Current	- 12	A
V_{ESD}	Electrostatic Discharge (R=1.5KΩ; C=100pF)	4000	V
P_{tot}	Total Dissipation at T_c=25°C	TBD	W
T_j	Operating Junction Temperature	Internally Limited	°C
T_c	Case Operating Temperature	Internally Limited	°C
T_{stg}	Storage Temperature	-55 to 150	°C

CONNECTION DIAGRAM (TOP VIEW)



CURRENT AND VOLTAGE CONVENTIONS



THERMAL DATA

Symbol	Parameter		Value	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	Max	13	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	TBD	°C/W

ELECTRICAL CHARACTERISTICS (per each device) -40°C < T_j < 150°C, unless otherwise specified

OFF

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{CLAMP}	Drain-source Clamp Voltage	V_{IN}=0V; I_D=3.5A	40	45	50	V
V_{CLTH}	Drain-source Clamp Threshold Voltage	V_{IN}=0V; I_D=2mA	36			V
V_{INTH}	Input Threshold Voltage	V_{DS}=V_{IN}; I_D=1mA	0.5		2.5	V
I_{ISS}	Supply Current from Input Pin	V_{DS}=0V; V_{IN}=5V		100	250	µA
V_{INCL}	Input-Source Clamp Voltage	I_{IN}=1mA I_{IN}=-1mA	6.5 -1.0	7.4	8.5 -0.3	V
I_{DSS}	Zero Input Voltage Drain Current (V_{IN}=0V)	V_{DS}=13V; V_{IN}=0V; T_j=25°C V_{DS}=25V; V_{IN}=0V			50 150	µA

ON

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$R_{DS(on)}$	Static Drain-source On Resistance	V_{IN}=5V; I_D=3.5A; T_j=25°C V_{IN}=5V; I_D=3.5A			60 120	mΩ

DYNAMIC

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
g_{fs} (*)	Forward Transconductance	V_{DD}=13V; I_D=3.5A		10		S
C_{OSS}	Output Capacitance	V_{DS}=13V; f=1MHz; V_{IN}=0V		230		pF

SWITCHING

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=15V; I_D=3.5A V_{gen}=5V; R_{gen}=10Ω (see figure 1)		40	TBD	ns
t_r	Rise Time			100	TBD	ns
$t_{d(off)}$	Turn-off Delay Time			250	TBD	ns
t_f	Fall Time			90	TBD	ns
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=15V; I_D=3.5A V_{gen}=5V; R_{gen}=1000 Ω (see figure 1)		0.6	TBD	µs
t_r	Rise Time			4.7	TBD	µs
$t_{d(off)}$	Turn-off Delay Time			7.6	TBD	µs
t_f	Fall Time			4.6	TBD	µs
$(dI/dt)_{on}$	Turn-on Current Slope	V_{DD}=15V; I_D=3.5A V_{gen}=5V; R_{gen}=0Ω		28		A/µs
Q_i	Total Input Charge	V_{DD}=12V; I_D=3.5A; V_{IN}=5V (see figure 5)		TBD		nC

ELECTRICAL CHARACTERISTICS (continued) (T_j=25°C, unless otherwise specified)

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD} (*)	Forward On Voltage	I_{SD}=3.5A; V_{IN}=0V		0.8		V
t_{rr}	Reverse Recovery Time	I_{SD}=3.5A; dI/dt=20A/µs		TBD		ns
Q_{rr}	Reverse Recovery Charge	V_{DD}=30V		TBD		µC
I_{RRM}	Reverse Recovery Current	(see test circuit, figure 2)		TBD		A

PROTECTIONS (-40°C < T_j < 125°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{lim}	Drain Current Limit	V_{IN}=6.5V; V_{DS}=13V	6	9	12	A
t_{dlim}	Step Response Current Limit	V_{IN}=6.5V; V_{DS}=13V		20	TBD	µs
T_{jsh}	Overtemperature Shutdown		150	175		°C
T_{jrs}	Overtemperature Reset		135			°C
I_{gf}	Fault Sink Current	V_{IN}=5V; V_{DS}=13V; T_j=T_{jsh}		15		mA
E_{as}	Single Pulse Avalanche Energy	starting T_j=25°C; V_{DD}=24V V_{IN}=5V; R_{gen}=TBD; L=TBD (see figures 3 & 4)	200			mJ

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

PROTECTION FEATURES (per each device)

During normal operation, the INPUT pin is electrically connected to the gate of the internal power MOSFET through a low impedance path.

The device then behaves like a standard power MOSFET and can be used as a switch from DC up to 50KHz. The only difference from the user's standpoint is that a small DC current I_{ISS} (typ. 100μA) flows into the INPUT pin in order to supply the internal circuitry.

The device integrates:

- OVERVOLTAGE CLAMP PROTECTION:

internally set at 45V, 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 voltages. 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 in the range 150 to 190 °C, a typical value being 170 °C. The device is automatically restarted when the chip temperature falls of about 15°C below shut-down temperature.

- STATUS FEEDBACK:

in the case of an overtemperature fault condition ($T_j > T_{jsh}$), the device tries to sink a diagnostic current I_{gf} through the INPUT pin in order to indicate fault condition. If driven from a low impedance source, this current may be used in order to warn the control circuit of a device shutdown. If the drive impedance is high enough so that the INPUT pin driver is not able to supply the current I_{gf}, the INPUT pin will fall to 0V. **This will not however affect the device operation: no requirement is put on the current capability of the INPUT pin driver except to be able to supply the normal operation drive current I_{ISS}.**

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.

Fig.1: Switching Time Test Circuit for Resistive Load (per single chip)

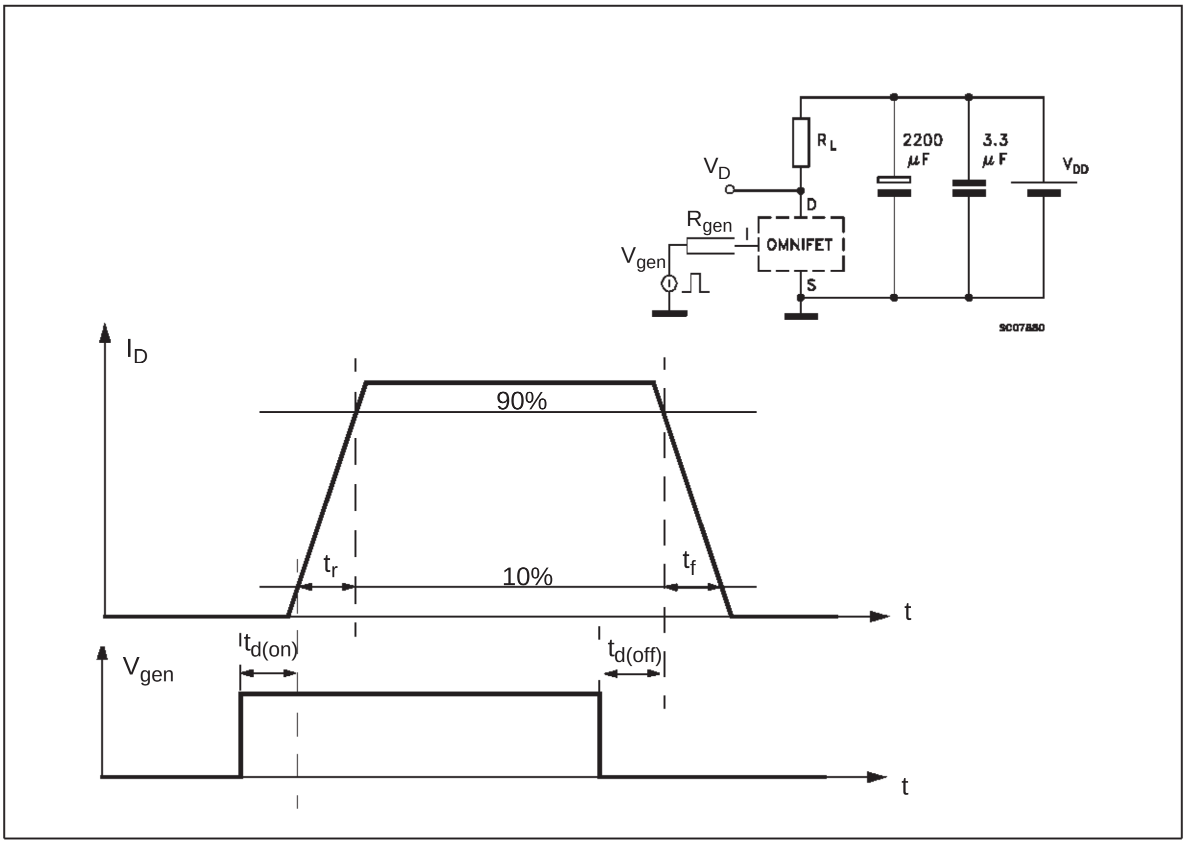


Fig.2: Test Circuit for Diode Recovery Times (per single chip)

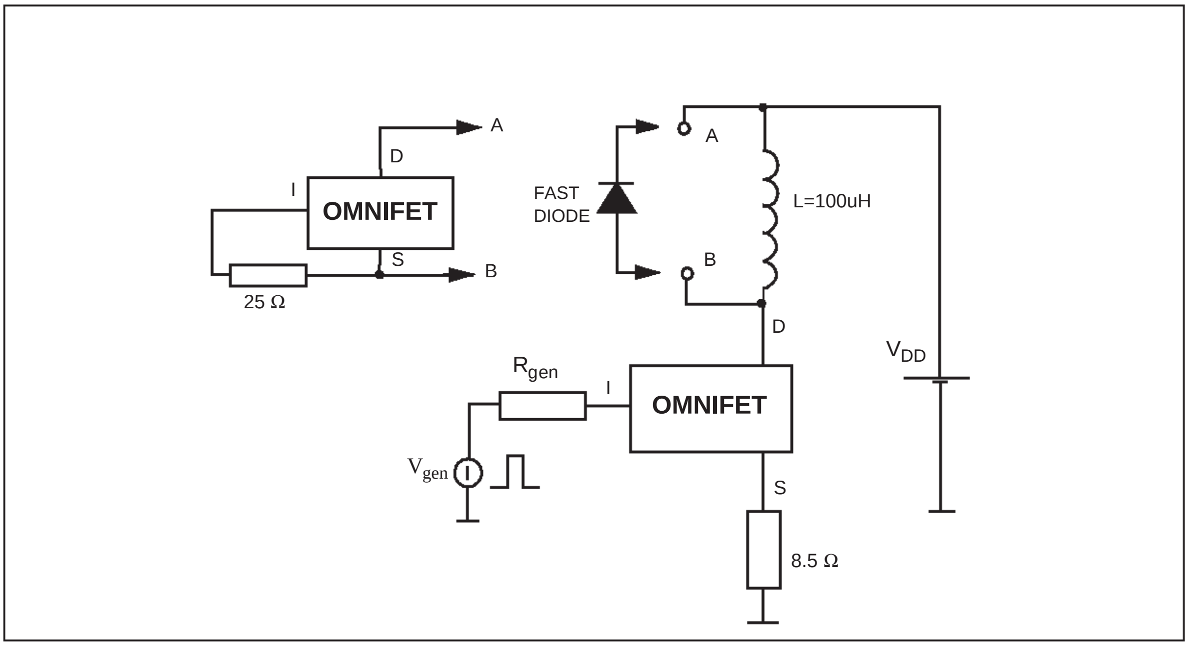


Fig. 3: Unclamped Inductive Load Test Circuits (per single chip)

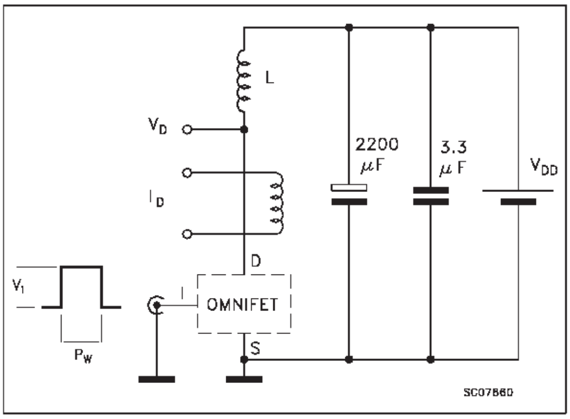


Fig. 4: Unclamped Inductive Waveforms (per single chip)

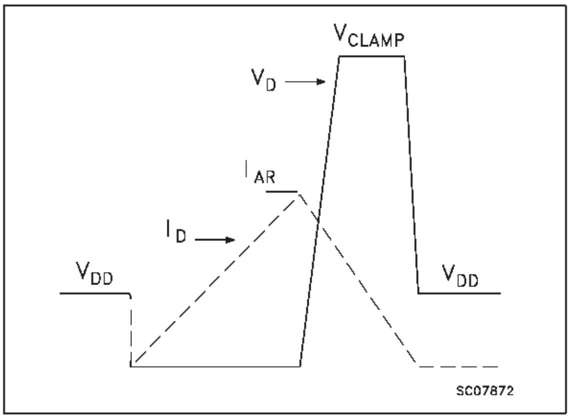
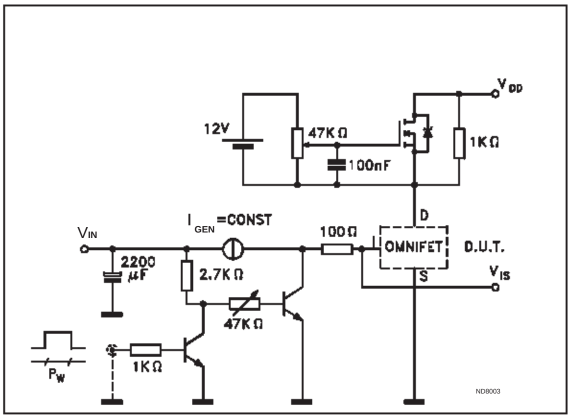
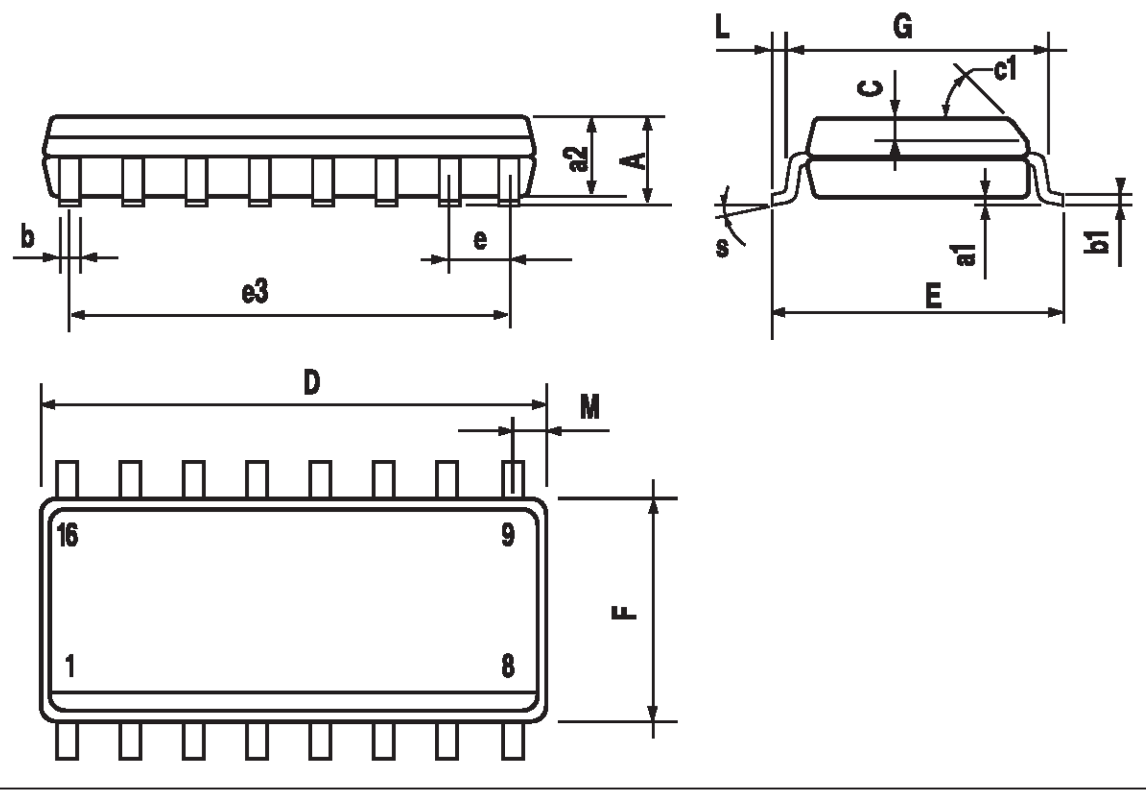


Fig. 5: Input Charge Test Circuit (per single chip)

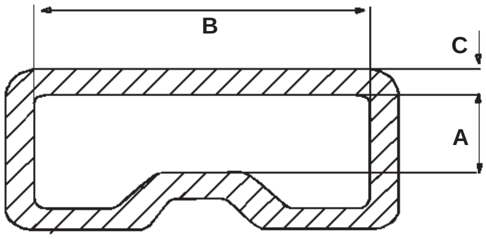


SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
F	3.8		4.0	0.149		1.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



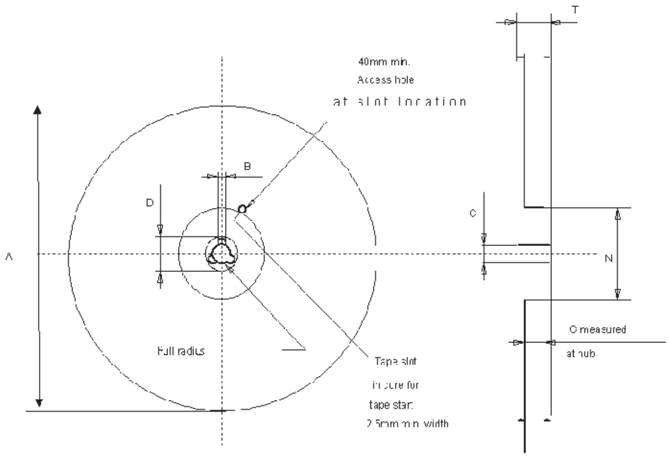
SO-16 TUBE SHIPMENT (no suffix)



Base Q.ty	50
Bulk Q.ty	1000
Tube length (± 0.5)	532
A	3.2
B	6
C (± 0.1)	0.6

All dimensions are in mm.

TAPE AND REEL SHIPMENT (suffix "13TR")



REEL DIMENSIONS

Base Q.ty	1000
Bulk Q.ty	1000
A (max)	330
B (min)	1.5
C (± 0.2)	13
F	20.2
G (+ 2 / -0)	16.4
N (min)	60
T (max)	22.4

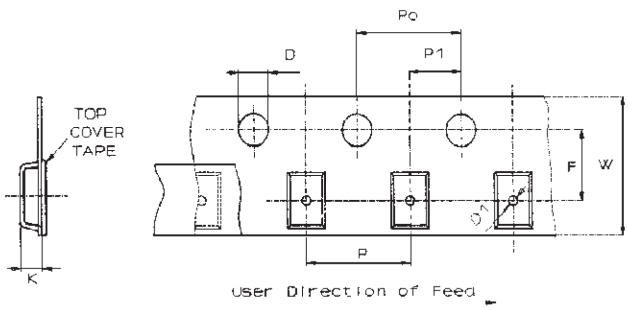
All dimensions are in mm.

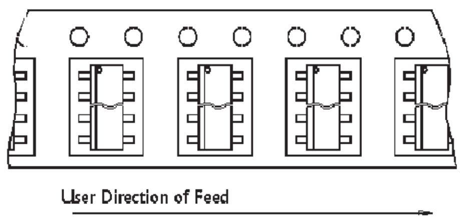
TAPE DIMENSIONS

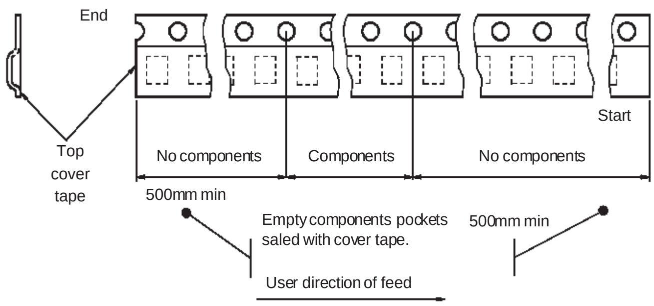
According to Electronic Industries Association (EIA) Standard 481 rev. A, Feb 1986

Tape width	**W**	16
Tape Hole Spacing	**P0 (± 0.1)**	4
Component Spacing	**P**	8
Hole Diameter	**D (± 0.1/-0)**	1.5
Hole Diameter	**D1 (min)**	1.5
Hole Position	**F (± 0.05)**	7.5
Compartment Depth	**K (max)**	6.5
Hole Spacing	**P1 (± 0.1)**	2

All dimensions are in mm.







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