Directed Energy, Inc.
An IXYS Company

DE150-102N02A
RF Power MOSFET

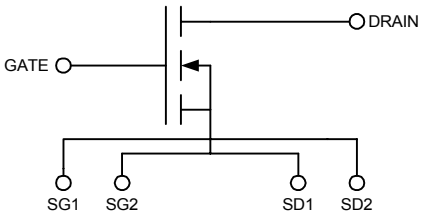
Preliminary Data Sheet

N-Channel Enhancement Mode
Avalanche Rated
Low Q_g and R_g
High dv/dt
Nanosecond Switching

V_{DSS}	=	1000 V
I_{D25}	=	1.5 A
$R_{DS(on)}$	=	11 Ω
P_{DHS}	=	80W

Symbol	Test Conditions	Maximum Ratings	
V_{DSS}	T_J = 25°C to 150°C	1000	V
V_{DGR}	T_J = 25°C to 150°C; R_{GS} = 1 MΩ	1000	V
V_{GS}	Continuous	±20	V
V_{GSM}	Transient	±30	V
I_{D25}	T_c = 25°C	1.5	A
I_{DM}	T_c = 25°C, pulse width limited by T_{JM}	9	A
I_{AR}	T_c = 25°C	1.5	A
E_{AR}	T_c = 25°C	6	mJ
dv/dt	$I_S \le I_{DM}$, di/dt ≤~ 100A/µs, $V_{DD} \le V_{DSS}$, $T_j \le 150°C$, R_G = 0.2Ω	3	V/ns
	I_S = 0	>200	V/ns
P_{DHS}	T_c = 25°C Derate 4.4W/°C above 25°C	80	W
P_{DAMB}	T_c = 25°C	3.5	W
T_J		-55…+150	°C
T_{JM}		150	°C
T_{stg}		-55…+150	°C
T_L	1.6mm (0.063 in) from case for 10 s	300	°C
Weight		2	g

Symbol	Test Conditions	Characteristic Values T_J = 25°C unless otherwise specified			
		min.	typ.	max.	
V_{DSS}	V_{GS} = 0 V, I_D = 3 ma	1000			V
$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 4 ma	2.5		4.5	V
I_{GSS}	V_{GS} = ±20 V_{DC}, V_{DS} = 0			±100	nA
I_{DSS}	V_{DS} = 0.8 V_{DSS} T_J = 25°C V_{GS} = 0 T_J = 125°C			50 500	µA µA
$R_{DS(on)}$	V_{GS} = 15 V, $I_D = 0.5I_{D25}$ Pulse test, t ≤ 300µS, duty cycle d ≤ 2%			11	Ω
g_{fs}	V_{DS} = 15 V, $I_D = 0.5I_{D25}$, pulse test	0.8	1.5		S



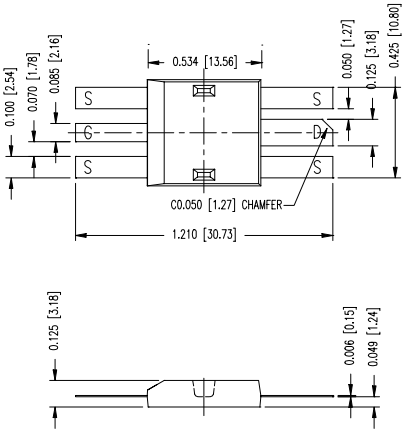
Features

- Isolated Substrate
  - high isolation voltage (>2500V)
  - excellent thermal transfer
  - Increased temperature and power cycling capability
- IXYS advanced low Q_g process
- Low gate charge and capacitances
  - easier to drive
  - faster switching
- Low $R_{DS(on)}$
- Very low insertion inductance (<2nH)
- No beryllium oxide (BeO) or other hazardous materials

Advantages

- Optimized for RF and high speed switching at frequencies to >100MHz
- Easy to mount—no insulators needed
- High power density

Symbol	Test Conditions	Characteristic Values (T_J = 25°C unless otherwise specified) min.	typ.	max.	
R_G				5	Ω
C_{iss}			500		pF
C_{oss}	V_{GS} = 0 V, V_{DS} = 0.8 $V_{DSS(max)}$, f = 1 MHz		20		pF
C_{rss}			3		pF
$T_{d(on)}$			4		ns
T_{on}	V_{GS} = 15 V, V_{DS} = 0.8 V_{DSS}		4		ns
$T_{d(off)}$	I_D = 0.5 I_{DM} R_G = 0.2 Ω (External)		4		ns
T_{off}			4		ns
$Q_{g(on)}$			23		nC
Q_{gs}	V_{GS} = 10 V, V_{DS} = 0.5 V_{DSS} I_D = 0.5 I_{D25}		4.5		nC
Q_{gd}			14		nC
R_{thJHS}			1.5		K/W



Source-Drain Diode		Characteristic Values (T_J = 25°C unless otherwise specified)			
Symbol	Test Conditions	min.	typ.	max.	
I_S	V_{GS} = 0 V			1.5	A
I_{SM}	Repetitive; pulse width limited by T_{JM}			9	A
V_{SD}	I_F = I_S, V_{GS} = 0 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2%			1.8	V
T_{rr}			710		ns

102N02A DE-SERIES SPICE Model

The DE-SERIES SPICE Model is illustrated in Figure 1. The model is an expansion of the SPICE level 3 MOSFET model. It includes the stray inductive terms L_G, L_S and L_D. Rd is the $R_{DS(ON)}$ of the device, Rds is the resistive leakage term. The output capacitance, C_{OSS}, and reverse transfer capacitance, C_{RSS} are modeled with reversed biased diodes. This provides a varactor type response necessary for a high power device model. The turn on delay and the turn off delay are adjusted via Ron and Roff.

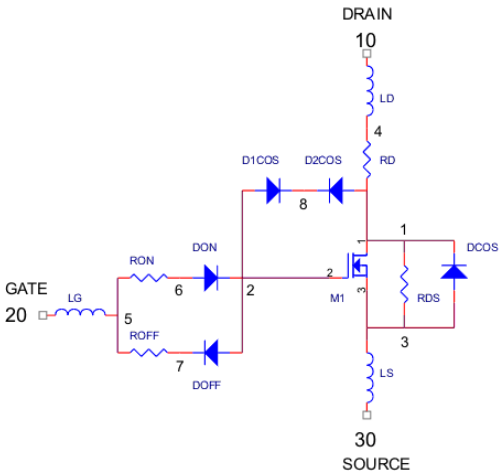


Figure 1 DE-SERIES SPICE Model

This SPICE model may be downloaded as a text file from the DEI web site at www.directedenergy.com/spice.htm

Net List:

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*SYM=POWMOSN
.SUBCKT 102N02A   10 20 30
*     TERMINALS:  D  G  S
*  1000 Volt  1.5 Amp  11.0 ohm  N-Channel Power MOSFET  10-30-2001
M1   1  2  3  3  DMOS L=1U W=1U
RON  5 6  4.0
DON  6 2  D1
ROF  5 7  2.0
DOF  2 7  D1
D1CRS 2 8  D2
D2CRS 1 8 D2
CGS  2 3  500Pf
RD   4 1  11
DCOS 3 1  D3
RDS  1 3  5.0MEG
LS  3 30 .5N
LD  10 4  1N
LG  20 5  1N
.MODEL DMOS NMOS (LEVEL=3 VTO=3 KP=.3)
.MODEL D1 D (IS=.5F CJO=10P BV=100 M=.5 VJ=.2 TT=1N)
.MODEL D2 D (IS=.5F CJO=100P BV=1000 M=.6 VJ=.6 TT=1N RS=10M)
.MODEL D3 D (IS=.5F CJO=150P BV=1000 M=.35 VJ=.6 TT=400N RS=10M)
.ENDS
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