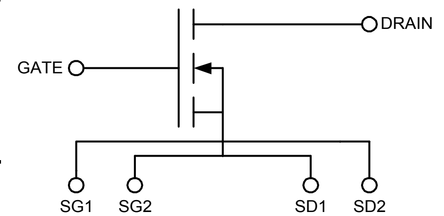
IXYSRF

DE150-501N04A
RF Power MOSFET

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

V_{DSS}	=	500 V
I_{D25}	=	4.5 A
$R_{DS(on)}$	=	1.5 Ω
P_{DC}	=	200W

Symbol	Test Conditions	Maximum Ratings	
V_{DSS}	T_J = 25°C to 150°C	500	V
V_{DGR}	T_J = 25°C to 150°C; R_{GS} = 1 MΩ	500	V
V_{GS}	Continuous	±20	V
V_{GSM}	Transient	±30	V
I_{D25}	T_c = 25°C	4.5	A
I_{DM}	T_c = 25°C, pulse width limited by T_{JM}	27	A
I_{AR}	T_c = 25°C	4.5	A
E_{AR}	T_c = 25°C	-	mJ
dv/dt	$I_S \le I_{DM}$, di/dt $\le$ 100A/µs, $V_{DD} \le V_{DSS}$, $T_j \le$ 150°C, R_G = 0.2Ω	3.5	V/ns
	I_S = 0	>200	V/ns
P_{DC}		200	W
P_{DHS}	T_c = 25°C Derate 4.4W/°C above 25°C	80	W
P_{DAMB}	T_c = 25°C	3.5	W
R_{thJC}		0.74	C/W
R_{thJHS}		1.50	C/W



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	500			V
$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 4 ma	2	3	4	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			25 250	µA µA
$R_{DS(on)}$	V_{GS} = 15 V, I_D = 0.5I_{D25} Pulse test, t ≤ 300µS, duty cycle d ≤ 2%			1.5	Ω
g_{fs}	V_{DS} = 15 V, I_D = 0.5I_{D25}, pulse test	2.7	4.0		S
T_J		-55		+175	°C
T_{JM}			175		°C
T_{stg}		-55		+175	°C
T_L	1.6mm (0.063 in) from case for 10 s		300		°C
Weight			2		g

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

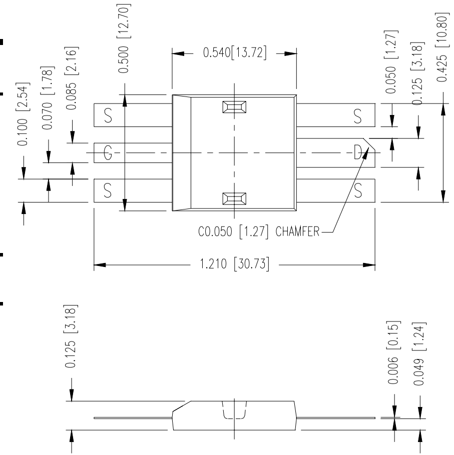
Advantages

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

IXYS RF

DE150-501N04A
RF Power MOSFET

Symbol	Test Conditions	Characteristic Values (T_J = 25°C unless otherwise specified) min.	typ.	max.	
R_G				5	Ω
C_{iss}	V_{GS} = 0 V, V_{DS} = 0.8 $V_{DSS(max)}$, f = 1 MHz		700		pF
C_{oss}			90		pF
C_{rss}			5		pF
C_{stray}	Back Metal to any Pin		16		pF
$T_{d(on)}$	V_{GS} = 15 V, V_{DS} = 0.8 V_{DSS} I_D = 0.5 I_{DM} R_G = 0.2 Ω (External)		4		ns
T_{on}			4		ns
$T_{d(off)}$			4		ns
T_{off}			4		ns
$Q_{g(on)}$	V_{GS} = 10 V, V_{DS} = 0.5 V_{DSS} I_D = 0.5 I_{D25}	16		40	nC
Q_{gs}		2.0		6.0	nC
Q_{gd}		8.0		20	nC



Source-Drain Diode

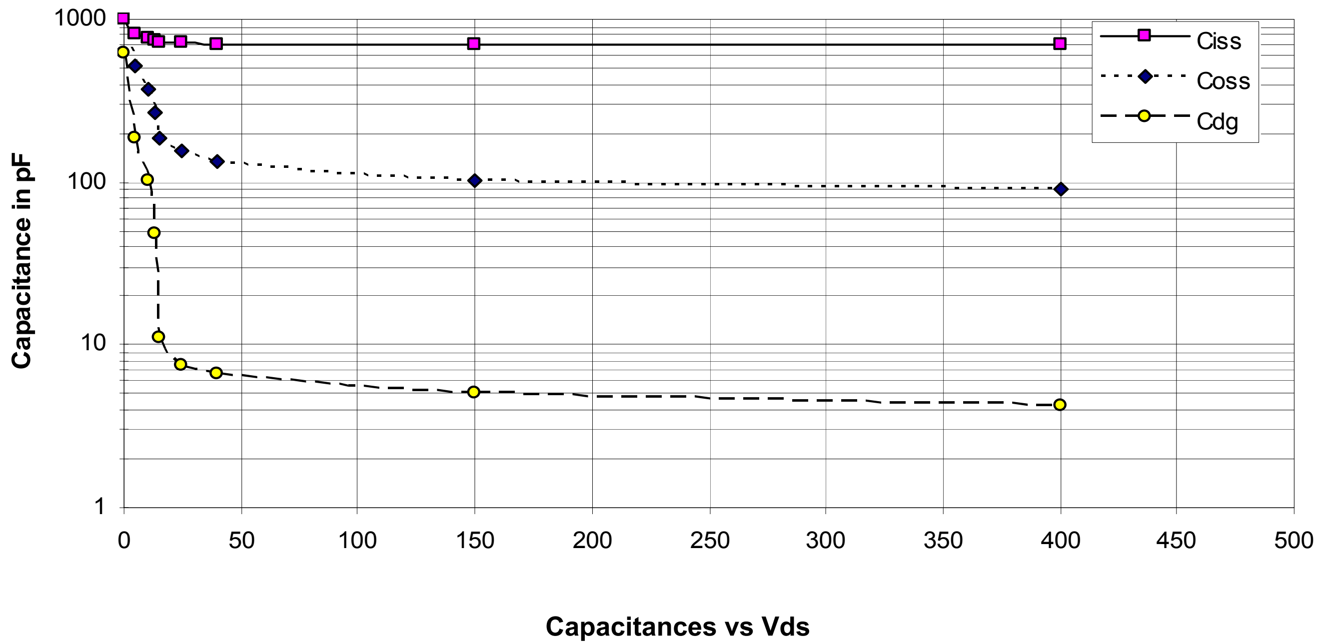
Symbol	Test Conditions	Characteristic Values (T_J = 25°C unless otherwise specified) min.	typ.	max.	
I_S	V_{GS} = 0 V			4.5	A
I_{SM}	Repetitive; pulse width limited by T_{JM}			27	A
V_{SD}	I_F = I_S, V_{GS} = 0 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2%			1.4	V
T_{rr}			900		ns

For detailed device mounting and installation instructions, see the "*DE-Series MOSFET Mounting Instructions*" technical note on IXYS RF's web site at www.ixysrf.com/Technical_Support/App_notes.html

IXYS RF reserves the right to change limits, test conditions and dimensions.

IXYS RF MOSFETS are covered by one or more of the following U.S. patents:

4,835,592	4,850,072	4,881,106	4,891,686	4,931,844	5,017,508
5,034,796	5,049,961	5,063,307	5,187,117	5,237,481	5,486,715
5,381,025	5,640,045				



Capacitances vs Vds

501N04A 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.

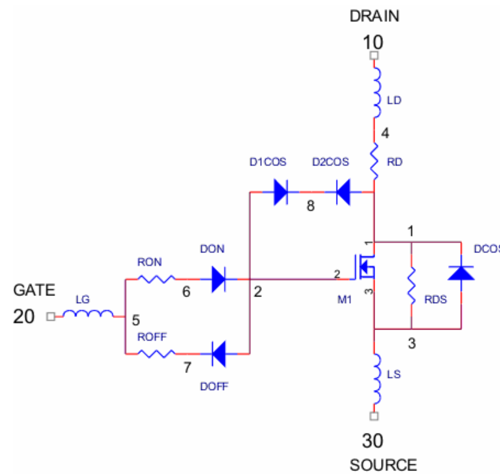


Figure 1 DE-SERIES SPICE Model

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

Net List:

```
*SYM=POWMOSN
.SUBCKT 501N04A  10 20 30
*     TERMINALS:  D  G  S
*  500 Volt  4.5 Amp  1.5 Ohm  N-Channel Power MOSFET  10-30-2001
M1   1 2  3  3  DMOS  L=1U W=1U
RON  5 6  9.5
DON  6 2  D1
ROF  5 7  3.5
DOF  2 7  D1
D1CRS 2 8 D2
D2CRS 1 8 D2
CGS  2 3  .6N
RD   4 1  1.5
DCOS 3 1 D3
RDS  1  3  5.0MEG
LS  3 30 .1N
LD  10 4  1N
LG  20 5  1N
.MODEL DMOS NMOS (LEVEL=3 VTO=3.0 KP=6.0)
.MODEL D1 D (IS=.5F CJO=1P BV=100 M=.5 VJ=.6 TT=1N)
.MODEL D2 D (IS=.5F CJO=175P BV=500 M=.5 VJ=.6 TT=1N RS=10M)
.MODEL D3 D (IS=.5F CJO=250P BV=500 M=.3 VJ=.4 TT=400N RS=10M)
.ENDS
```

Doc #9200-0240 Rev 3
© 2003 IXYS RF

An IXYS Company
2401 Research Blvd., Suite 108
Fort Collins, CO USA 80526
970-493-1901 Fax: 970-493-1903
Email: deiinfo@directedenergy.com
Web: http://www.directedenergy.com