HARRIS

RFA100N05E

N-Channel Enhancement-Mode Power Field-Effect Transistor (MegaFET)

January 1993

Features

- 100A, 50V
- $r_{DS(on)} = 0.008\Omega$
- Electrostatic Discharge Rated
- UIS SOA Rating Curve (Single Pulse)
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- +175°C Operating Temperature
- Temperature Compensated SPICE Model Provided

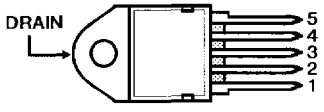
Description

The RFA100N05E n-channel ESD rated power MOSFET is manufactured using the MegaFET process. This process, which uses feature sizes approaching those of LSI integrated circuits, gives optimum utilization of silicon, resulting in outstanding performance. They were designed for use in applications such as switching regulators, switching converters, motor drivers, relay drivers and emitter switches for bipolar transistors. These transistors can be operated directly from integrated circuits.

The RFA100N05E is supplied in the MO-093 plastic package.

Package

MO-093
TOP VIEW

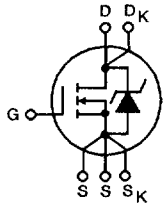


TERMINAL CONNECTIONS

1 - Gate
2 - Source Kelvin
3 - Drain Kelvin
4 - Source Current
5 - Source Current

Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings (T_C = +25°C), Unless Otherwise Specified

		RFA100N05E	UNITS
Drain-Source Voltage	V_{DSS}	50	V
Drain-Gate Voltage (R_{GS} = 1 MΩ)	V_{DGR}	50	V
Continuous Drain Current	I_D	100	A
Pulsed Drain Current	I_{DM}	300	A
Gate-Source Voltage	V_{GS}	±20	V
Maximum Power Dissipation			
T_C = +25°C	P_D	240	W
Derated Above 25°C		1.6	W/°C
Operating and Storage Junction Temperature Range	T_{JC}, T_{STG}	-55 to +175	°C
Electrostatic Discharge Rating			
MIL-STD-883, Category B(2)	E_{SD}	2	kV
Single-Pulse Avalanche Rating		Refer to UIS SOA Curves	

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

File Number 2869.2

Electrical Characteristics At Case Temperature (T_C) = +25°C, Unless Otherwise Specified

CHARACTERISTICS	SYMBOL	TEST CONDITIONS		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Drain-Source Breakdown Voltage	BV_{DSS}	I_D =0.25mA, V_{GS} = 0V		50	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}$, I_D = 0.25mA		2	-	4	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} =40V, V_{GS} = 0V		-	-	1	μA
		T_C =+150°C		-	-	50	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS} = ±20V		-	-	100	nA
On Resistance	$r_{DS(on)}$	I_D = 100A, V_{GS} = 10V		-	-	0.008	Ω
Turn-On Time	$t_{(on)}$	V_{DD} = 25V, I_D = 50A		-	-	60	ns
Turn-On Delay Time	$t_{d(on)}$	R_L = 0.50Ω		-	17	-	ns
Rise Time	t_r	$I_{G1} = I_{G2}$ = 3A		-	8	-	ns
Turn-Off Delay Time	$t_{d(off)}$	$V_{GS(clamp)}$ = +10V, -0.6V		-	50	-	ns
Fall Time	t_f			-	10	-	ns
Turn-Off Time	$t_{(off)}$			-	-	100	ns
Total Gate Charge	$Q_{g(tot)}$	V_{GS} = 0, 20V	V_{DD} = 40V	-	-	430	nC
Gate Charge at 10V	$Q_{g(10)}$	V_{GS} = 0, 10V	I_D = 100A	-	-	230	nC
Threshold Gate Charge	$Q_{g(th)}$	V_{GS} =0, 2V	R_L = 0.40Ω	-	-	15	nC
Plateau Voltage	$V_{(plateau)}$	I_D = 100A, V_{DS} = 15V		-	-	7.5	V
Turn-Off Energy Loss per Cycle	E_{off}	V_{DD} = 25V, I_D = 50A, $I_{G1} = I_{G2}$ = 3A, $V_{GS(clamp)}$ = +10V, -0.6V, L = 0.2μH, R_L = 0.50Ω		-	-	500	μJ
Thermal Resistance Junction to Case	$R_{\theta JC}$			-	-	0.625	°C/W
Thermal Resistance Diode Junction to Ambient	$R_{\theta JA}$			-	-	80	°C/W

Source-Drain Diode Ratings and Characteristics

CHARACTERISTICS	SYMBOLS	TEST CONDITIONS	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Forward Voltage	V_{SD}	I_{SD} = 100A	-	-	1.5	V
Reverse Recovery Time	t_{rr}	I_f = 100A, dI_f/dt = 100A/μs	-	-	125	ns

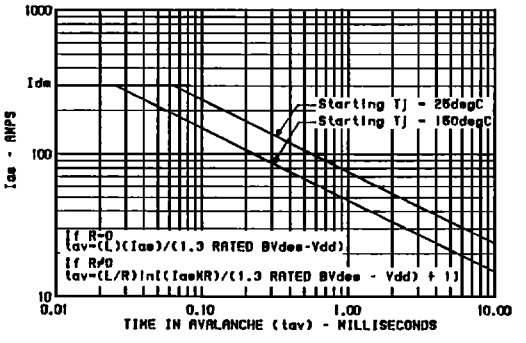


FIGURE 1. UNCLAMPED-INDUCTIVE-SWITCHING SOA (SINGLE PULSE UIS SOA)

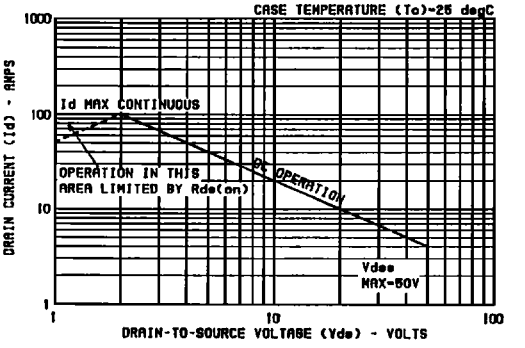


FIGURE 2. SAFE-OPERATING-AREA CURVE. (CURVES MUST BE DERATED LINEARLY WITH INCREASE IN CASE TEMPERATURE)

Performance Curves

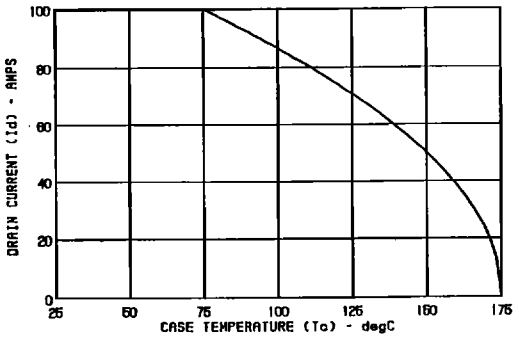


FIGURE 3. MAXIMUM CONTINUOUS DRAIN CURRENT VS. TEMPERATURE

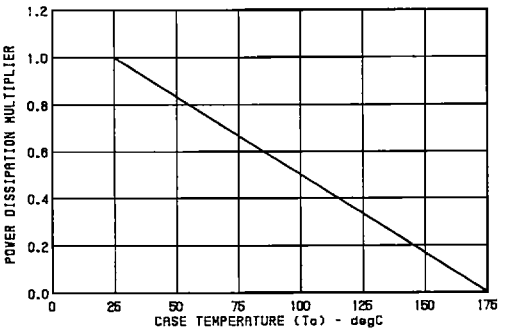


FIGURE 4. NORMALIZED POWER DISSIPTION VS. TEMPERATURE DERATING CURVE

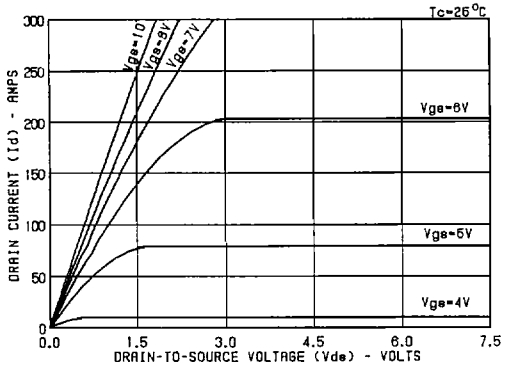


FIGURE 5. TYPICAL SATURATION CHARACTERISTICS

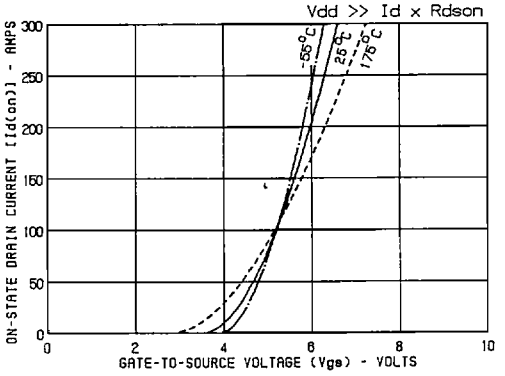


FIGURE 6. TYPICAL TRANSFER CHARACTERISTICS

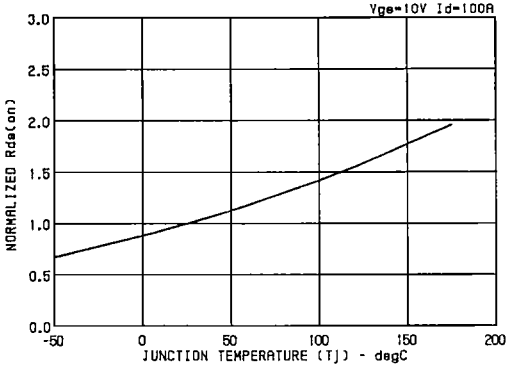


FIGURE 7. NORMALIZED $r_{DS(on)}$ VS. JUNCTION TEMPERATURE

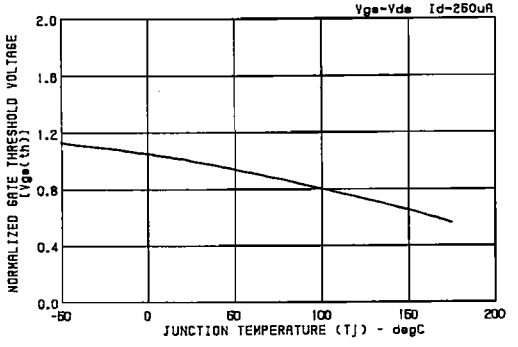


FIGURE 8. NORMALIZED GATE THRESHOLD VOLTAGE

Performance Curves (Continued)

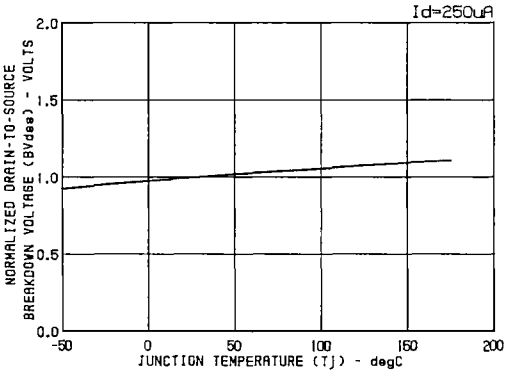


FIGURE 9. NORMALIZED DRAIN-TO-SOURCE BREAKDOWN VOLTAGE VS. TEMPERATURE

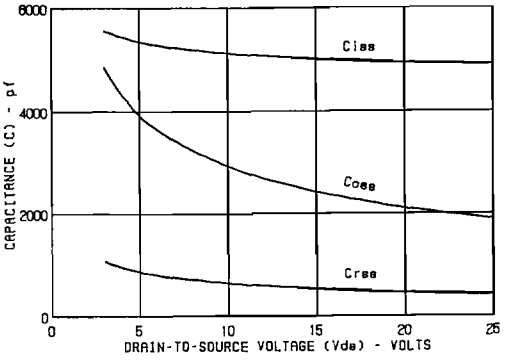


FIGURE 10. TYPICAL CAPACITANCE VS. VOLTAGE FOR ALL TYPES

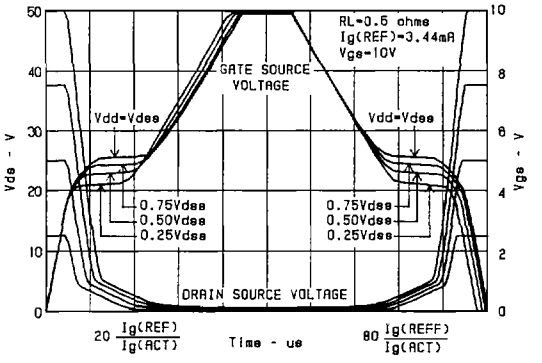


FIGURE 11. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE-CURRENT. (REFER TO HARRIS APPLICATION NOTES AN-7254 AND AN-7260)

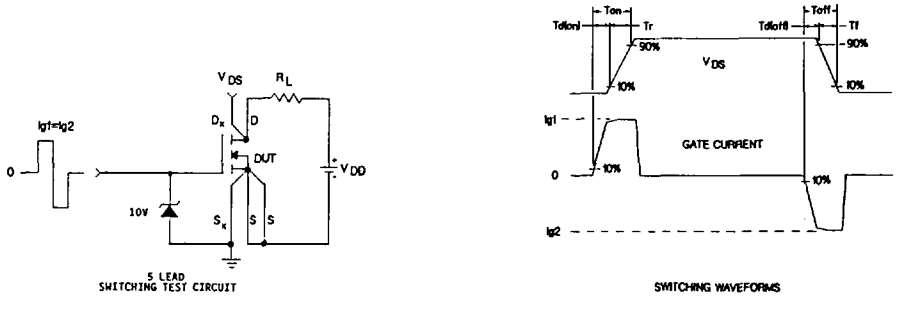
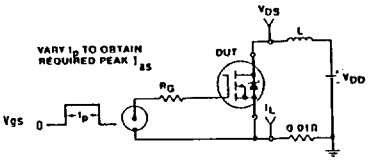


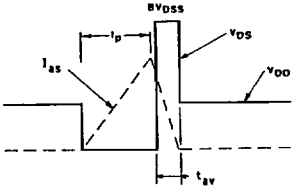
FIGURE 12. RESISTIVE SWITCHING

Performance Curves (Continued)



UIS TEST CIRCUIT.

FIGURE 13. UNCLAMPED ENERGY TEST CIRCUIT



UIS WAVEFORMS.

FIGURE 14. UNCLAMPED ENERGY WAVEFORMS

Spice Model

```
.SUBCKT RFA100N05  6  1  4  5  3  2  ;  rev 10/30/90
*Nominal Temperature = 25°C
CchargeA  12  8  8.98e-9
CchargeB  15  14  8.8e-9
Cin  24  8  4.48e-009
Depletion_cap  10  21  DPLCAPMOD
Dbody  7  21  DBODYMOD
Dbreak  21  11  DBREAKMOD
Eds  14  8  21  8  1
Egs  13  8  24  8  1
Esg  24  10  24  8  1
Ebreak  11  7  17  18  58.4
Evto  20  24  18  8  1
Ipos  8  17  1
Ldkelvin  3  23  1e-9
Ldrain  6  21  2e-10
Lgate  1  9  5e-9
Lskelvin  2  7  5e-9
Lsource1  4  22  6e-9
Lsource2  5  25  6e-9
Mos  16  24  8  8  MOSMOD
Rbreak  17  18  RBREAKMOD  1
Rdrain  21  16  RSOURCEMOD  2.74e-3
Rgate  9  20  1.2
Rkdrain  23  21  0.33e-3
Rksource1  7  22  1.6e-3
Rksource2  7  25  1.6e-3
Rin  24  8  1e+9
Rsource  8  7  RSOURCEMOD  1.2e-3
Rvto  18  19  RVTONEGMOD  1
S1a  24  12  13  8  S1AMOD
S1b  13  12  13  8  S1BMOD
S2a  24  15  14  13  S2AMOD
S2b  13  15  14  13  S2BMOD
Vbat  8  19  DC  1
.MODEL  S1AMOD  VSWITCH  (RON=1e-5  ROFF=0.1  VON=-2.48  VOFF=-0.48)
.MODEL  S1BMOD  VSWITCH  (RON=1e-5  ROFF=0.1  VON=-0.48  VOFF=-2.48)
.MODEL  S2AMOD  VSWITCH  (RON=1e-5  ROFF=0.1  VON=-2.25  VOFF=2.75)
.MODEL  S2BMOD  VSWITCH  (RON=1e-5  ROFF=0.1  VON=2.75  VOFF=-2.25)
.MODEL  DBODYMOD  D  (IS=2.23e-12  RS=2.5e-3  TRS1=2.5e-3  CJO=7.55e-9  TT=4e-8)
.MODEL  DBREAKMOD  D  (RS=8e-2  TRS1=2.5e-3)
.MODEL  DPLCAPMOD  D  (IS=1e-030  N=10  CJO=2.14e-9)
.MODEL  RBREAKMOD  RES  (TC1=9.5e-4  TC2=-1.17e-6)
.MODEL  RSOURCEMOD  RES  (TC1=5.2e-3  TC2=1.37e-5)
.MODEL  RVTONEGMOD  RES  (TC1=-3.78e-3  TC2=-7.5e-7)
.MODEL  MOSMOD  NMOS  (VTO=3.48  N=10  IS=1e-030  KP=78.5  TOX=1  L=1u  W1u)
.ENDS
```