

# RFG40N10, RFP40N10, RF1S40N10, RF1S40N10SM

40A, 100V, 0.040 Ohm,  
N-Channel Power MOSFETs

October 1997

## Features

- 40A, 100V
- $r_{DS(ON)} = 0.040\Omega$
- UIS Rating Curve
- SOA is Power Dissipation Limited
- 175°C Operating Temperature
- Related Literature
  - TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

## Ordering Information

PART NUMBER	PACKAGE	BRAND
RFG40N10	TO-247	RFG40N10
RFP40N10	TO-220AB	RFP40N10
RF1S40N10	TO-262AA	F1S40N10
RF1S40N10SM	TO-263AB	F1S40N10

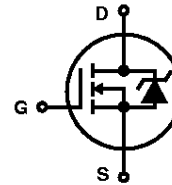
NOTE: When ordering, use the entire part number. Add the suffix, 9A, to obtain the TO-263AB variant in tape and reel, i.e. RF1S40N10SM9A.

## Description

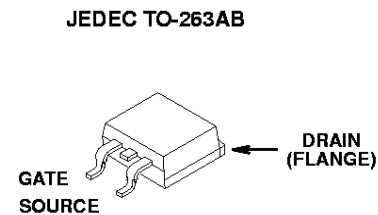
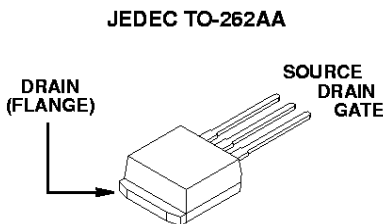
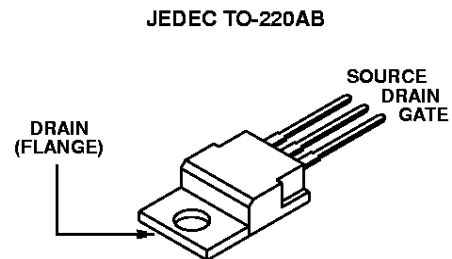
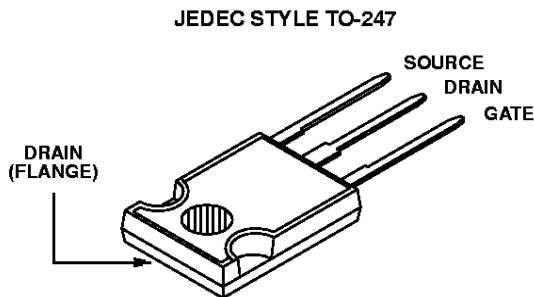
These are N-Channel power MOSFETs manufactured using the MegaFET process. This process, which uses feature sizes approaching those of LSI integrated circuits gives optimum utilization of silicon, resulting in outstanding performance. They were designed for use in applications such as switching regulators,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

Formerly developmental type TA9846

## Symbol



## Packaging



## RFG40N10, RFP40N10, RF1S40N10, RF1S40N10SM

### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$

	RFG40N10, RFP40N10, RF1S40N10, RF1S40N10SM	UNITS
Drain to Source Breakdown Voltage (Note 1).....	$V_{DSS}$ 100	V
Drain to Gate Voltage ( $R_{GS} = 1\text{M}\Omega$ ) (Note 1).....	$V_{DGR}$ 100	V
Gate to Source Voltage .....	$V_{GS}$ $\pm 20$	V
Drain Current		
Continuous (Figure 2) .....	$I_D$ 40	A
Pulsed Drain Current (Note 2) .....	$I_{DM}$ 100	A
Pulsed Avalanche Rating .....	$E_{AS}$ Figures 4, 12, 13	
Power Dissipation .....	$P_D$ 160	W
Derate Above $25^\circ\text{C}$ .....	1.07	$\text{W}/^\circ\text{C}$
Operating and Storage Temperature .....	$T_J, T_{STG}$ -55 to 175	$^\circ\text{C}$
Maximum Temperature for Soldering		
Leads at 0.063in (1.6mm) from case for 10s .....	$T_L$ 300	$^\circ\text{C}$
Package Body for 10s, see Techbrief 334 .....	$T_{pkg}$ 260	$^\circ\text{C}$

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**NOTE:**

1.  $T_J = 25^\circ\text{C}$  to  $150^\circ\text{C}$ .
2. Repetitive Rating: pulse width limited by maximum junction temperature.

### Electrical Specifications $T_C = 25^\circ\text{C}$ , Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
Drain to Source Breakdown Voltage	$BV_{DSS}$	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$ (Figure 9)	100	-	-	V	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ (Figure 8)	2	-	4	V	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 80\text{V}, V_{GS} = 0\text{V}$	$T_C = 25^\circ\text{C}$	-	-	1	$\mu\text{A}$
			$T_C = 150^\circ\text{C}$	-	-	50	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA	
Drain to Source On Resistance	$r_{DS(ON)}$	$I_D = 40\text{A}, V_{GS} = 10\text{V}$ (Figure 7)	-	-	0.040	$\Omega$	
Turn-On Time	$t_{ON}$	$V_{DD} = 50\text{V}, I_D = 20\text{A}, R_L = 2.5\Omega, V_{GS} = 10\text{V}, R_{GS} = 4.2\Omega$ (Figures 14, 15)	-	-	80	ns	
Turn-On Delay Time	$t_{d(ON)}$		-	17	-	ns	
Rise Time	$t_r$		-	30	-	ns	
Turn-Off Delay Time	$t_{d(OFF)}$		-	42	-	ns	
Fall Time	$t_f$		-	20	-	ns	
Turn-Off Time	$t_{OFF}$		-	-	100	ns	
Total Gate Charge	$Q_g(TOT)$	$V_{GS} = 0\text{V}$ to $20\text{V}$	-	-	300	nC	
Gate Charge at 10V	$Q_g(10)$	$V_{GS} = 0\text{V}$ to $10\text{V}$					
Threshold Gate Charge	$Q_g(TH)$	$V_{GS} = 0\text{V}$ to $2\text{V}$					
Thermal Resistance Junction to Case	$R_{\theta JC}$		-	-	0.94	$^\circ\text{C}/\text{W}$	
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	TO-247	-	-	30	$^\circ\text{C}/\text{W}$	
		TO-220AB, TO-262AA, and TO-263AB	-	-	62	$^\circ\text{C}/\text{W}$	

### Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Source to Drain Diode Voltage	$V_{SD}$	$I_{SD} = 40\text{A}$	-	-	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_{SD} = 40\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	200	ns

Typical Performance Curves Unless Otherwise Specified

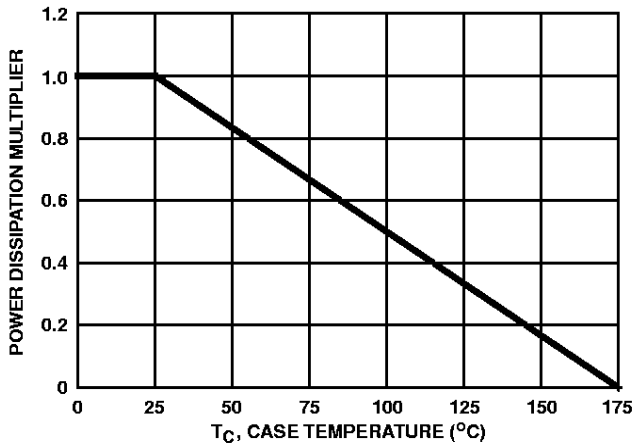


FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

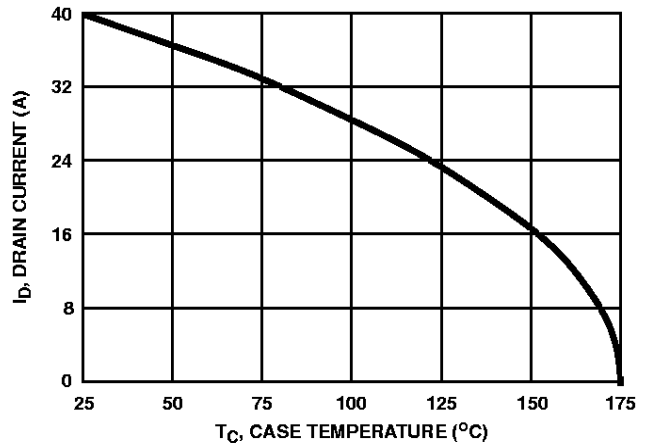


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

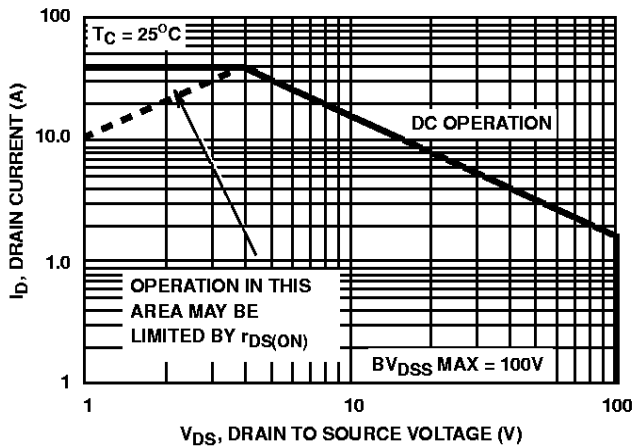
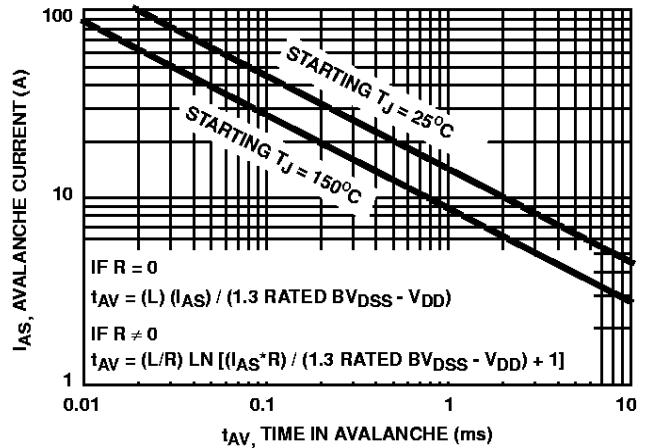


FIGURE 3. FORWARD BIAS SAFE OPERATING AREA



NOTE: Refer to Harris application notes AN9321 and AN9322.

FIGURE 4. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

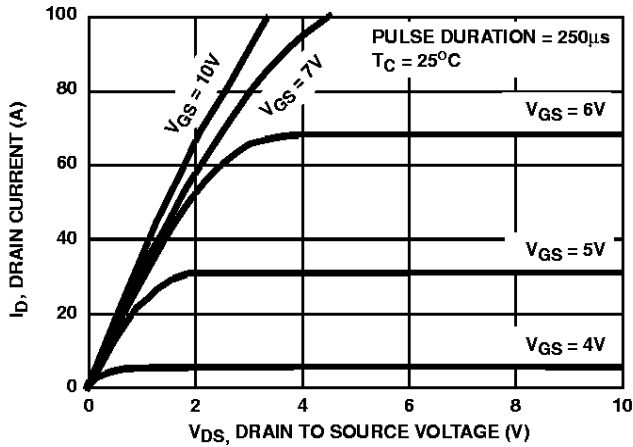


FIGURE 5. SATURATION CHARACTERISTICS

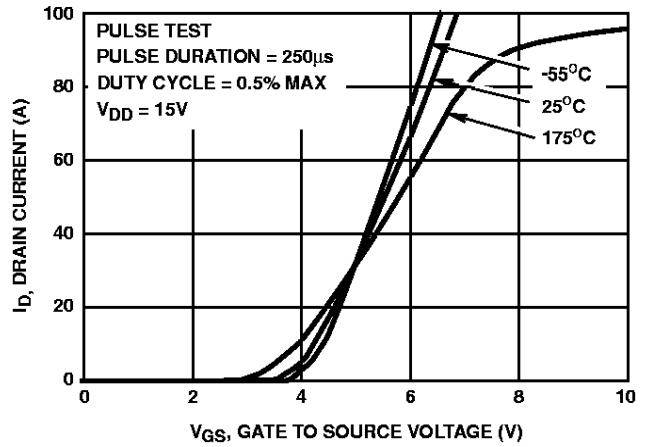


FIGURE 6. TRANSFER CHARACTERISTICS

Typical Performance Curves Unless Otherwise Specified (Continued)

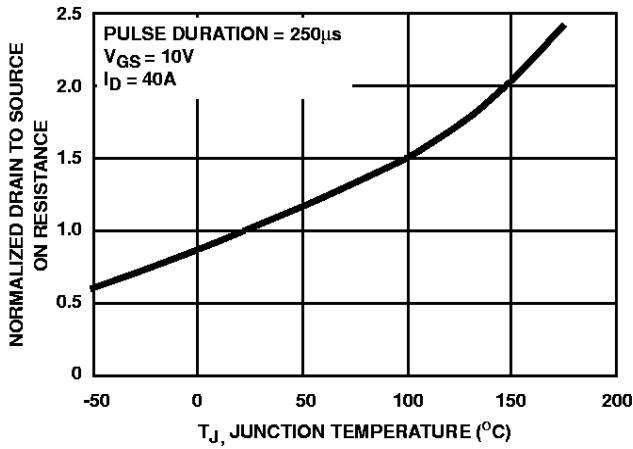


FIGURE 7. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

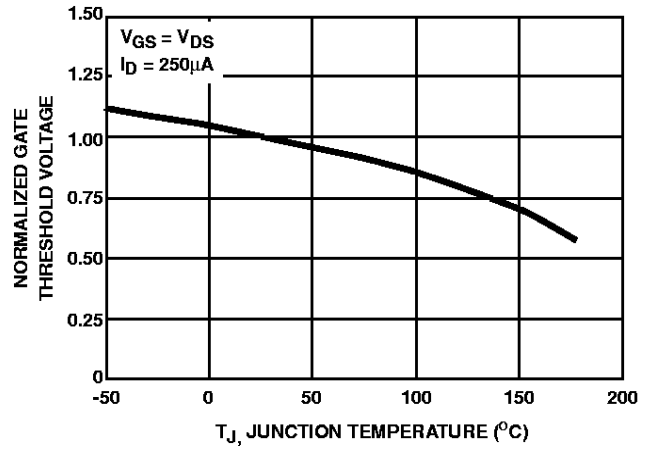


FIGURE 8. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

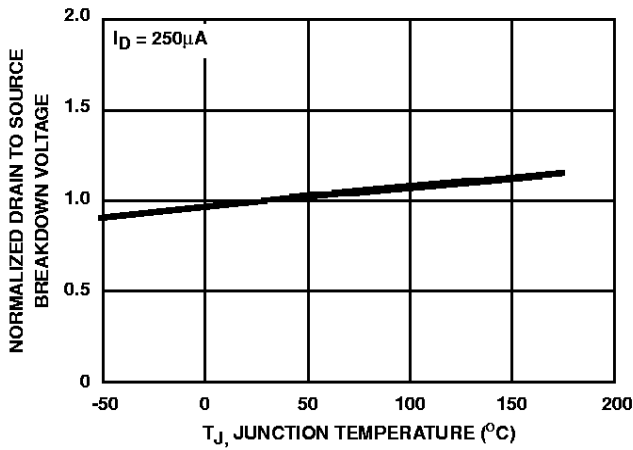


FIGURE 9. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

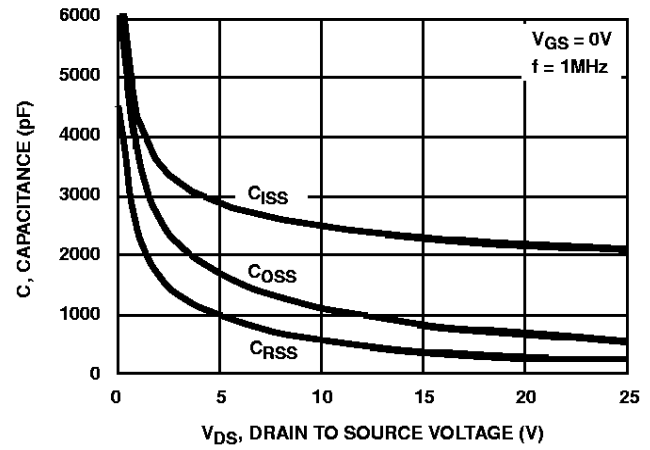
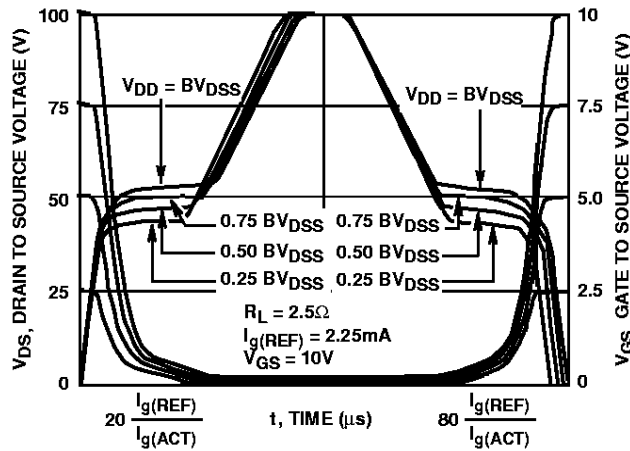


FIGURE 10. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE



NOTE: Refer to Harris Application Notes AN7254 and AN7260.  
FIGURE 11. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

Test Circuits and Waveforms

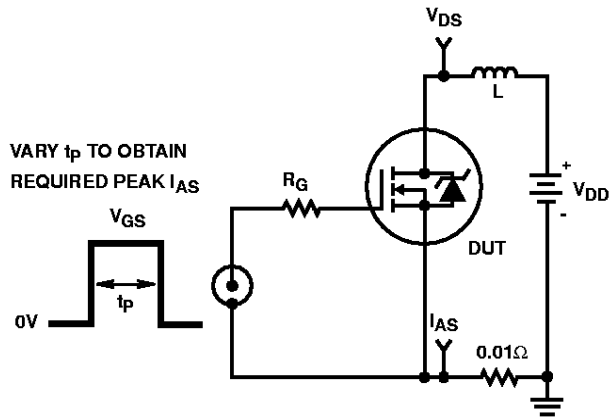


FIGURE 12. UNCLAMPED ENERGY TEST CIRCUIT

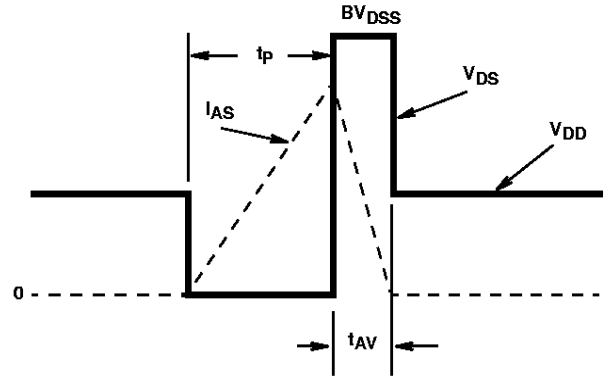


FIGURE 13. UNCLAMPED ENERGY WAVEFORMS

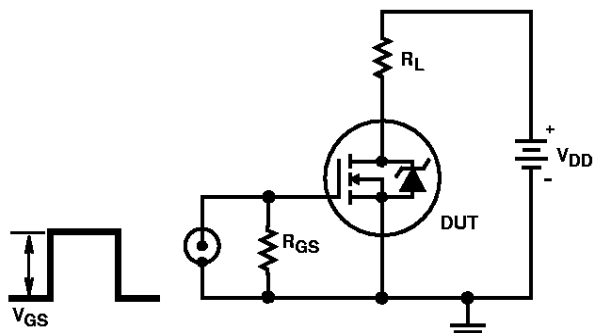


FIGURE 14. SWITCHING TIME TEST CIRCUIT

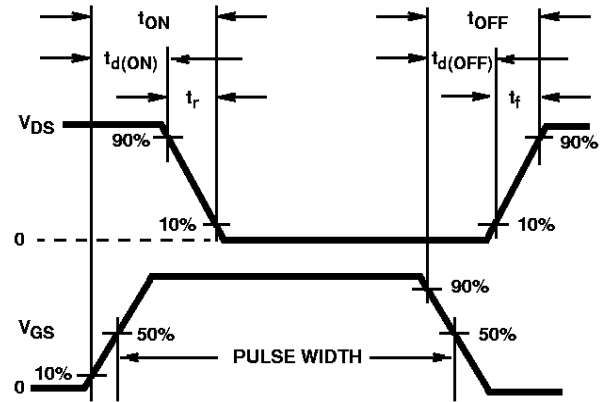


FIGURE 15. RESISTIVE SWITCHING WAVEFORMS

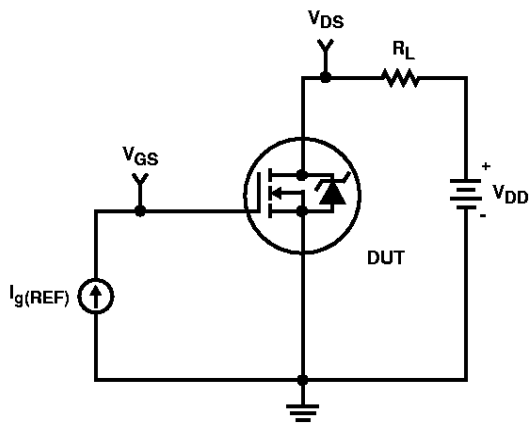


FIGURE 16. GATE CHARGE TEST CIRCUIT

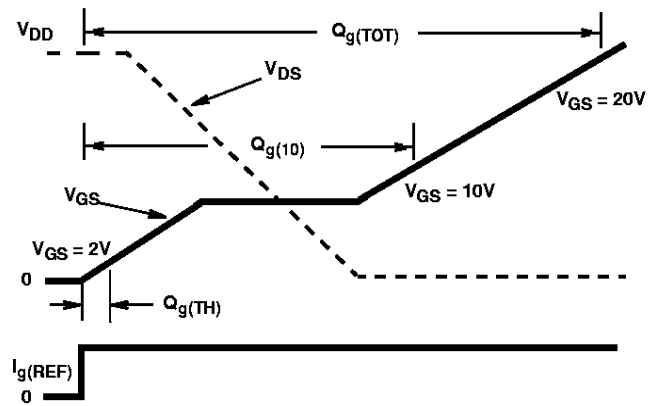


FIGURE 17. GATE CHARGE WAVEFORMS