Data Sheet | July 1999 | File Number 2431.3

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

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

## Ordering Information

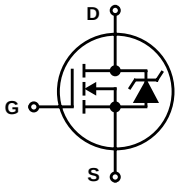
| PART NUMBER | PACKAGE | BRAND |
|---|---|---|
| RFG40N10 | TO-247 | RFG40N10 |
| RFP40N10 | TO-220AB | RFP40N10 |
| RF1S40N10SM | TO-263AB | F1S40N10 |

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.

## Features

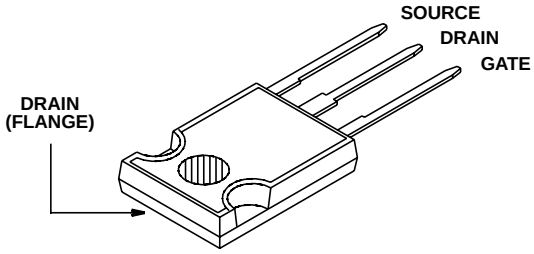
- 40A, 100V
- $r_{DS(ON)} = 0.040\Omega$
- UIS Rating Curve
- SOA is Power Dissipation Limited
- $175^{o}C$ Operating Temperature
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

## Symbol

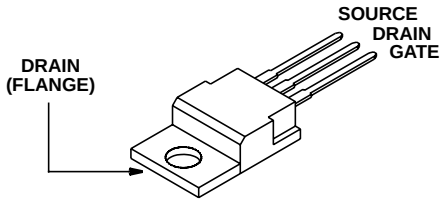



## Packaging

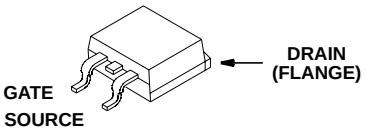
JEDEC STYLE TO-247




JEDEC TO-220AB




JEDEC TO-263AB



## Absolute Maximum Ratings $T_C = 25^oC$, Unless Otherwise Specified

| | RFG40N10, RFP40N10, RF1S40N10SM | UNITS |
|---|---|---|
| Drain to Source Breakdown Voltage (Note 1) . . . . . $V_{DSS}$ | 100 | V |
| Drain to Gate Voltage ($R_{GS}$ = 1MΩ) (Note 1) . . . . . $V_{DGR}$ | 100 | V |
| Gate to Source Voltage . . . . . $V_{GS}$ | ±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 $25^oC$ . . . . . | 1.07 | $W/^oC$ |
| Operating and Storage Temperature . . . . . $T_J$, $T_{STG}$ | -55 to 175 | $^oC$ |
| Maximum Temperature for Soldering | | |
| Leads at 0.063in (1.6mm) from case for 10s . . . . . $T_L$ | 300 | $^oC$ |
| Package Body for 10s, see Techbrief 334 . . . . . $T_{pkg}$ | 260 | $^oC$ |

*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.*

NOTES:

1. $T_J = 25^oC$ to $150^oC$.
2. Repetitive Rating: pulse width limited by maximum junction temperature.

## Electrical Specifications $T_C = 25^oC$, Unless Otherwise Specified

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Drain to Source Breakdown Voltage | $BV_{DSS}$ | $I_D$ = 250μA, $V_{GS}$ = 0V (Figure 9) | | 100 | - | - | V |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA (Figure 8) | | 2 | - | 4 | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 80V, $V_{GS}$ = 0V | $T_C = 25^oC$ | - | - | 1 | μA |
| | | | $T_C = 150^oC$ | - | - | 50 | μA |
| Gate to Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20V | | - | - | ±100 | nA |
| Drain to Source On Resistance | $r_{DS(ON)}$ | $I_D$ = 40A, $V_{GS}$ = 10V (Figure 7) | | - | - | 0.040 | Ω |
| Turn-On Time | $t_{ON}$ | $V_{DD}$ = 50V, $I_D$ = 20A, $R_L$ = 2.5Ω, $V_{GS}$ = 10V, $R_{GS}$ = 4.2 Ω (Figure 11) | | - | - | 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 | $Q_{g(TOT)}$ | $V_{GS}$ = 0V to 20V | $V_{DD}$ = 80V, $I_D$ = 40A, $R_L$ = 2.0Ω (Figures 11) | - | - | 300 | nC |
| Gate Charge at 10V | $Q_{g(10)}$ | $V_{GS}$ = 0V to 10V | | - | - | 150 | nC |
| Threshold Gate Charge | $Q_{g(TH)}$ | $V_{GS}$ = 0V to 2V | | - | - | 7.5 | nC |
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | | | - | - | 0.94 | $^oC/W$ |
| Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | TO-247 | | - | - | 30 | $^oC/W$ |
| | | TO-220AB and TO-263AB | | - | - | 62 | $^oC/W$ |

## Source to Drain Diode Specifications

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

## Typical Performance Curves Unless Otherwise Specified

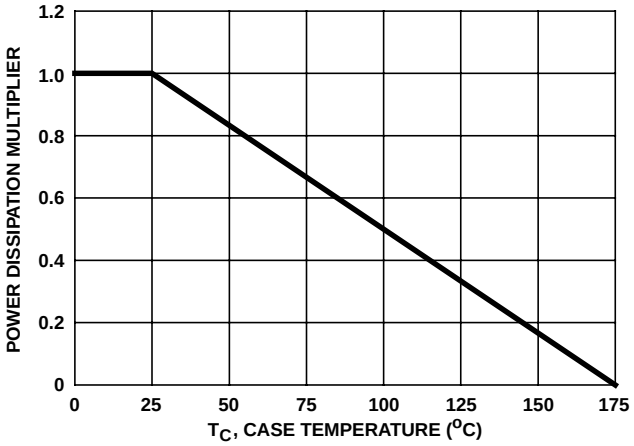



FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

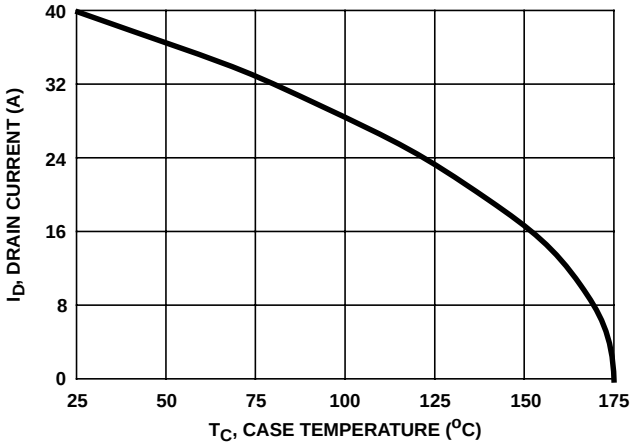



FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

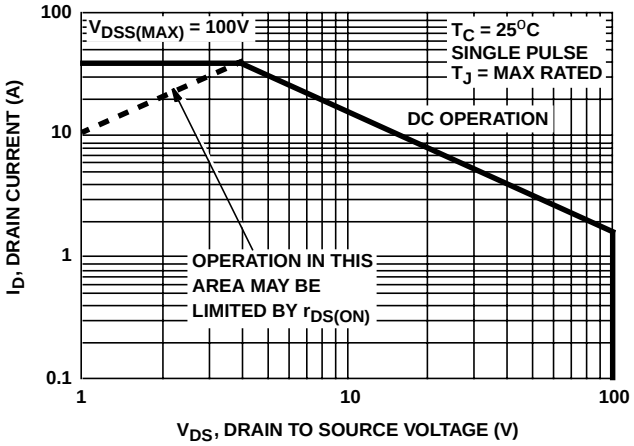
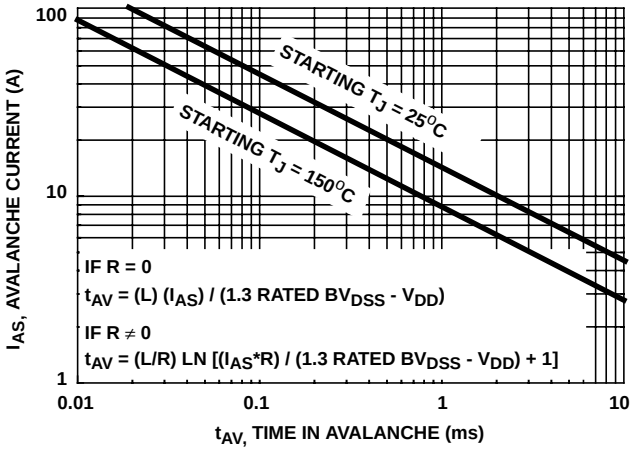



FIGURE 3. FORWARD BIAS SAFE OPERATING AREA




NOTE: Refer to Intersil application notes AN9321 and AN9322.

FIGURE 4. UNCLAMPED INDUCTIVE SWITCHING CAPABILITY

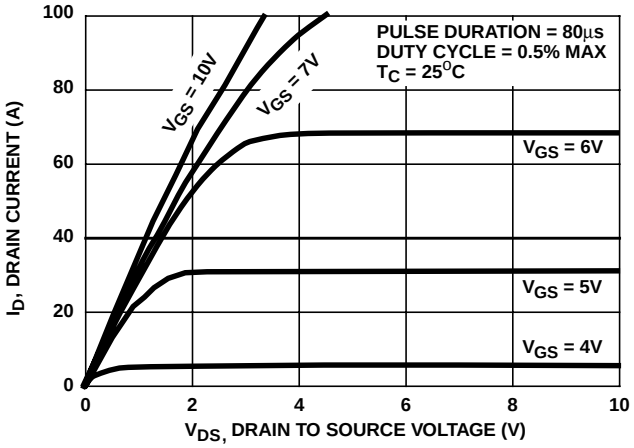



FIGURE 5. SATURATION CHARACTERISTICS

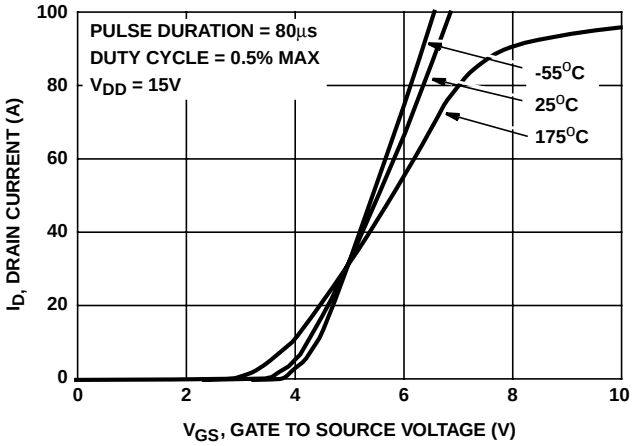



FIGURE 6. TRANSFER CHARACTERISTICS

## Typical Performance Curves Unless Otherwise Specified **(Continued)**

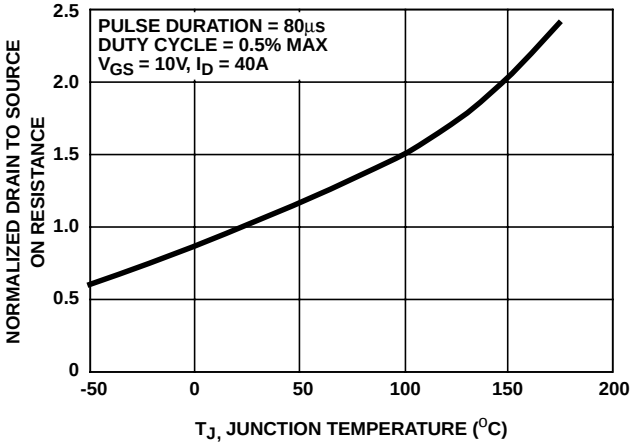



**FIGURE 7. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE**

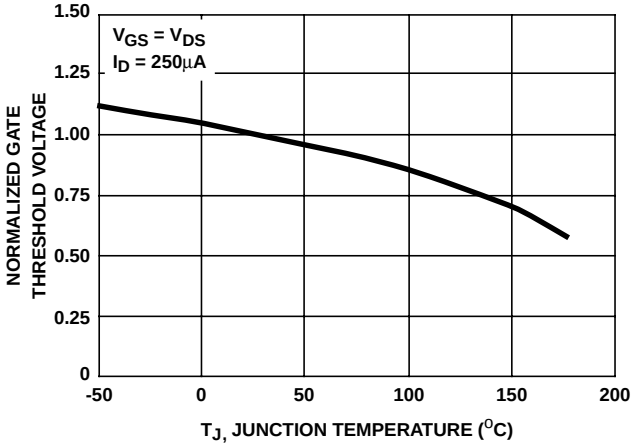



**FIGURE 8. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE**

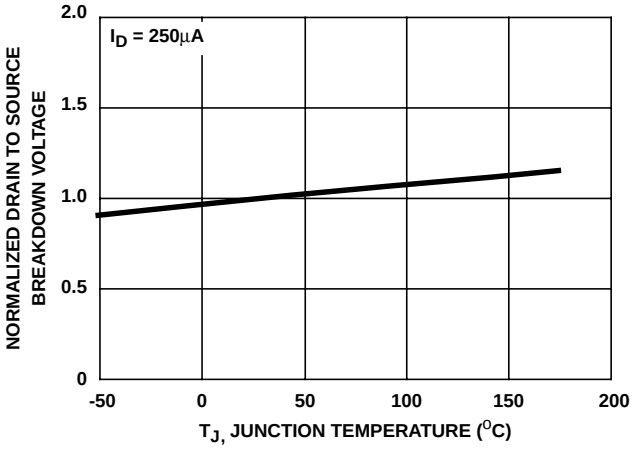



**FIGURE 9. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE**

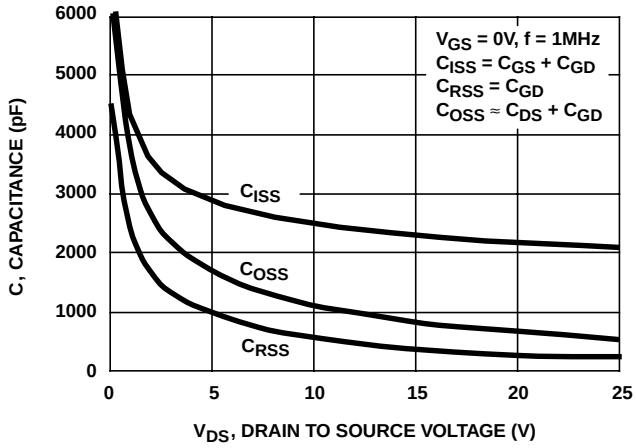
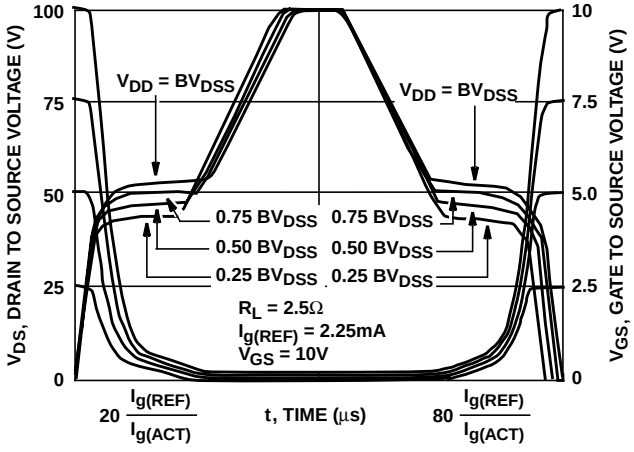



**FIGURE 10. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE**




NOTE: Refer to Intersil Application Notes AN7254 and AN7260.

**FIGURE 11. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT**

## Test Circuits and Waveforms

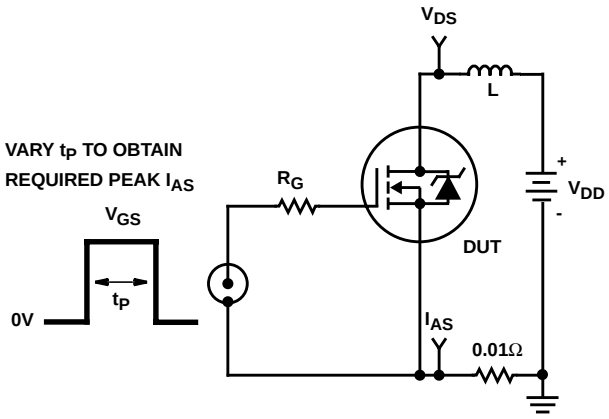



FIGURE 12. UNCLAMPED ENERGY TEST CIRCUIT

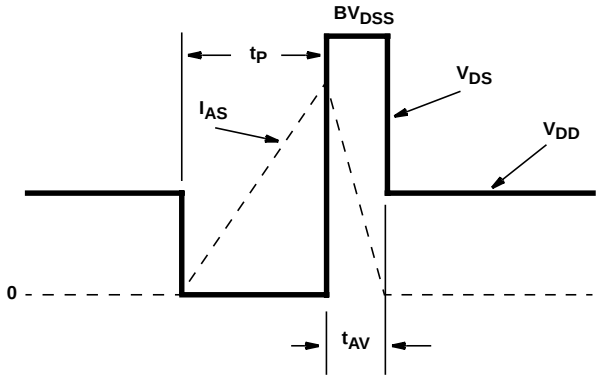



FIGURE 13. UNCLAMPED ENERGY WAVEFORMS

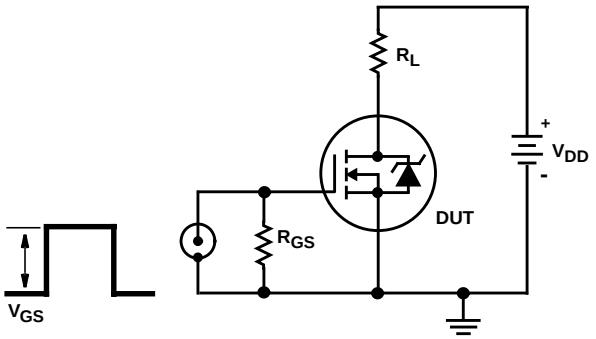



FIGURE 14. SWITCHING TIME TEST CIRCUIT

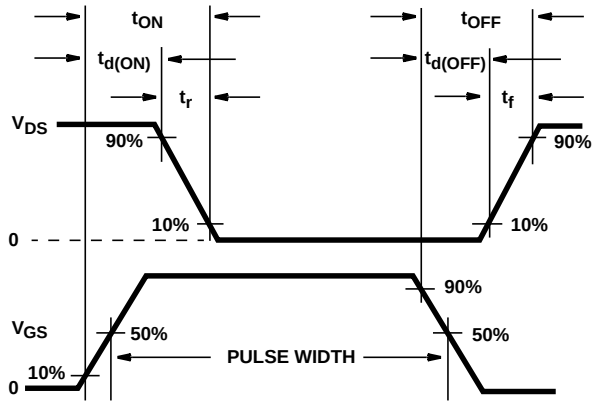



FIGURE 15. RESISTIVE SWITCHING WAVEFORMS

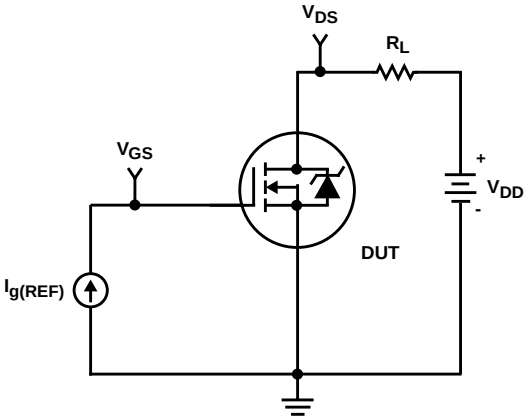



FIGURE 16. GATE CHARGE TEST CIRCUIT

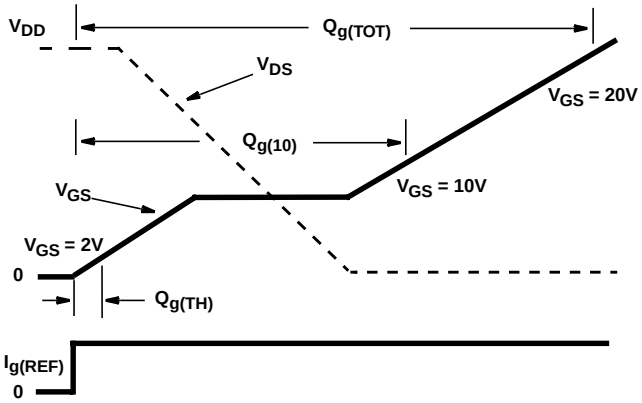



FIGURE 17. GATE CHARGE WAVEFORMS

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