# RFM10N12, RFM10N15, RFP10N12, RFP10N15

HARRIS Semiconductor

Data Sheet | October 1998 | File Number 1445.2

## 10A, 120V and 150V, 0.300 Ohm, N-Channel Power MOSFETs

These are N-channel enhancement-mode silicon-gate power field effect transistors designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. These types can be operated directly from integrated circuits.

Formerly developmental type TA09192.

## Ordering Information

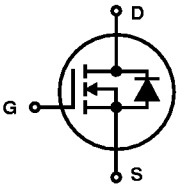
| PART NUMBER | PACKAGE | BRAND |
|---|---|---|
| RFM10N12 | TO-204AA | RFM10N12 |
| RFM10N15 | TO-204AA | RFM10N15 |
| RFP10N12 | TO-220AB | RFP10N12 |
| RFP10N15 | TO-220AB | RFP10N15 |

NOTE: When ordering, include the entire part number.

## Features

- 10A, 120V and 150V
- $r_{DS(ON)} = 0.3\Omega$
- Related Literature
  - TB334 “Guidelines for Soldering Surface Mount Components to PC Boards”

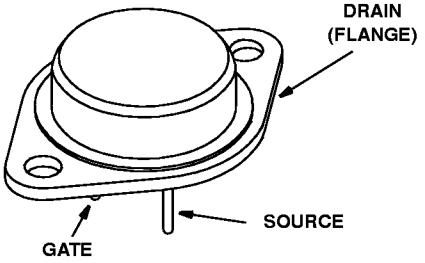
## Symbol



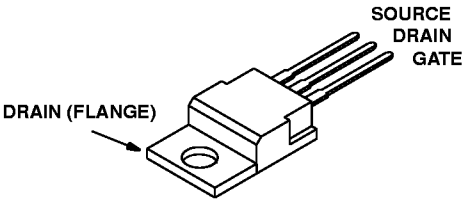

## Packaging



TO-204AA




TO-220AB



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

| | | RFM10N12 | RFM10N15 | RFP10N12 | RFP10N15 | UNITS |
|---|---|---|---|---|---|---|
| Drain to Source Voltage (Note 1) | $V_{DS}$ | 120 | 150 | 120 | 150 | V |
| Drain to Gate Voltage ($R_{GS}$ = 20kΩ) (Note 1) | $V_{DGR}$ | 120 | 150 | 120 | 150 | V |
| Continuous Drain Current | $I_D$ | 10 | 10 | 10 | 10 | A |
| Pulsed Drain Current (Note 3) | $I_{DM}$ | 25 | 25 | 25 | 25 | A |
| Gate to Source Voltage | $V_{GS}$ | ±20 | ±20 | ±20 | ±20 | V |
| Maximum Power Dissipation | $P_D$ | 75 | 75 | 60 | 60 | W |
| Linear Derating Factor | | 0.6 | 0.6 | 0.48 | 0.48 | W/$^o$C |
| Operating and Storage Temperature | $T_J$, $T_{STG}$ | -55 to 150 | -55 to 150 | -55 to 150 | -55 to 150 | $^o$C |
| Maximum Temperature for Soldering | | | | | | |
| Leads at 0.063in (1.6mm) from Case for 10s | $T_L$ | 300 | 300 | 300 | 300 | $^o$C |
| Package Body for 10s, See TB334 | $T_{pkg}$ | 260 | 260 | 260 | 260 | $^o$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. $T_J = 25^oC$ to $125^oC$.

## 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, $V_{GS}$ = 0 | | | | |
| RFM10N12, RFP10N12 | | | 120 | - | - | V |
| RFM10N15, RFP10N15 | | | 150 | - | - | V |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA, (Figure 8) | 2 | - | 4 | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = Rated $BV_{DSS}$, $V_{GS}$ = 0V | - | - | 1 | μA |
| | | $V_{DS}$ = 0.8 x Rated $BV_{DSS}$, TC = 125$^o$C | - | - | 25 | mA |
| Gate to Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20V, $V_{DS}$ = 0 | - | - | ±100 | nA |
| Drain to Source On Resistance(Note 2) | $r_{DS(ON)}$ | $I_D$ = 10A, $V_{GS}$ = 10V, (Figures 6, 7) | - | - | 0.300 | Ω |
| Drain to Source On Voltage (Note 2) | $V_{DS(ON)}$ | $I_D$ = 10A, $V_{GS}$ = 10V | - | - | 3.0 | V |
| Turn-On Delay Time | $t_{d(ON)}$ | $I_D \approx$ 5A, $V_{DD}$ = 75V, $R_G$ = 50Ω, $V_{GS}$ = 10V, $R_L$ = 14.7Ω (Figures 10, 11, 12) | - | 40 | 60 | ns |
| Rise Time | $t_r$ | | - | 165 | 250 | ns |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | - | 90 | 135 | ns |
| Fall Time | $t_f$ | | - | 90 | 135 | ns |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1MHz, (Figure 9) | - | - | 850 | pF |
| Output Capacitance | $C_{OSS}$ | | - | - | 230 | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | - | - | 100 | pF |
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | RFM10N12, RFM10N15 | - | - | 1.67 | $^o$C/W |
| | | RFP10N12, RFP10N15 | - | - | 2.083 | $^o$C/W |

## Source to Drain Diode Specifications

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Source to Drain Diode Voltage (Note 2) | $V_{SD}$ | $I_{SD}$ = 5A | - | - | 1.4 | V |
| Diode Reverse Recovery Time | $t_{rr}$ | $I_{SD}$ = 4A, $dI_{SD}/dt$ = 100A/μs | - | 200 | - | ns |

NOTE:

2. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
3. Repetitive rating: pulse width is limited by maximum junction temperature.

## Typical Performance Curves

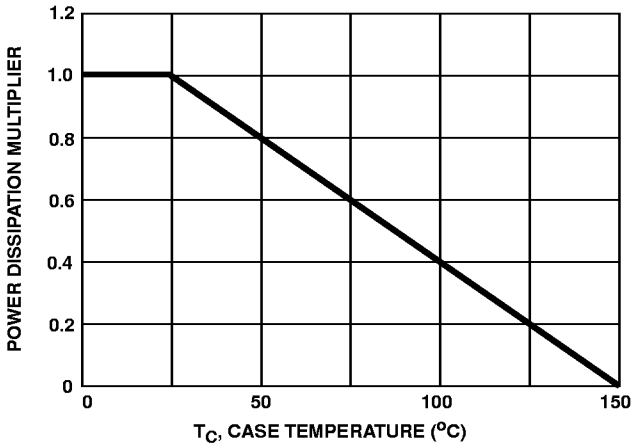



FIGURE 1. NORMALIZED POWER DISSIPATION vs CASE TEMPERATURE

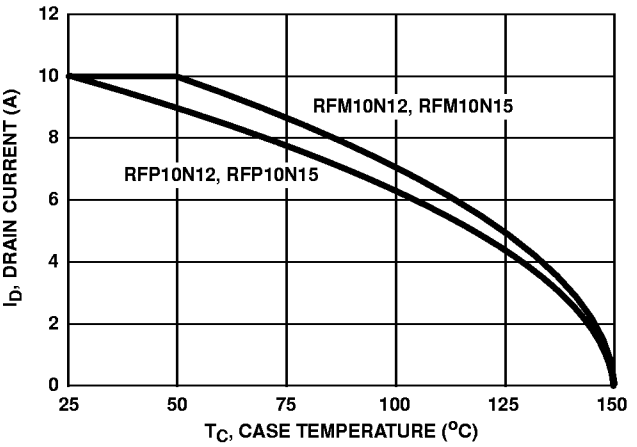



FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs CASE TEMPERATURE

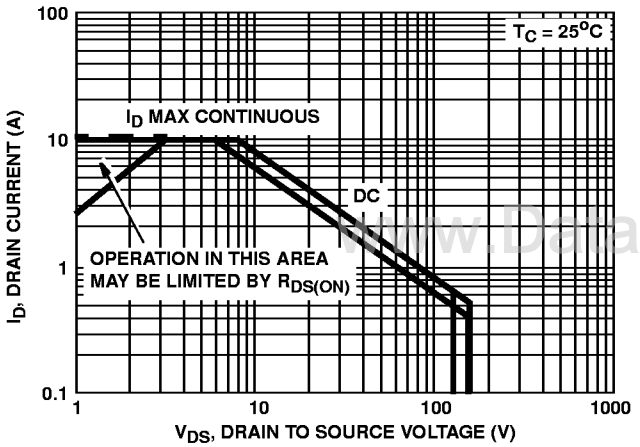



FIGURE 3. FORWARD BIAS SAFE OPERATING AREA

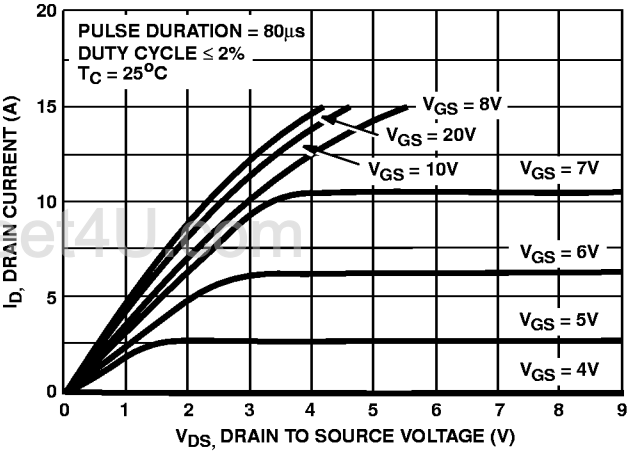



FIGURE 4. SATURATION CHARACTERISTICS

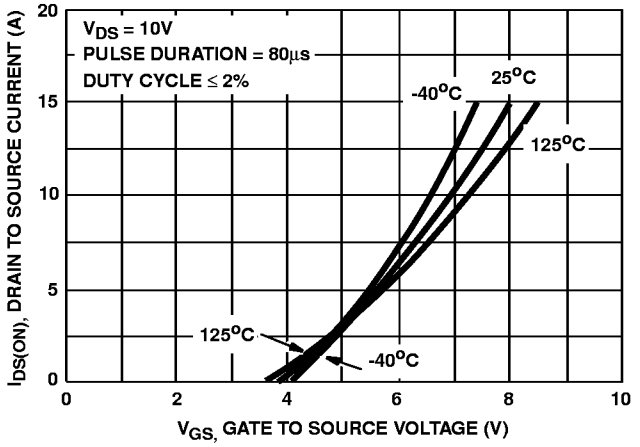



FIGURE 5. TRANSFER CHARACTERISTICS

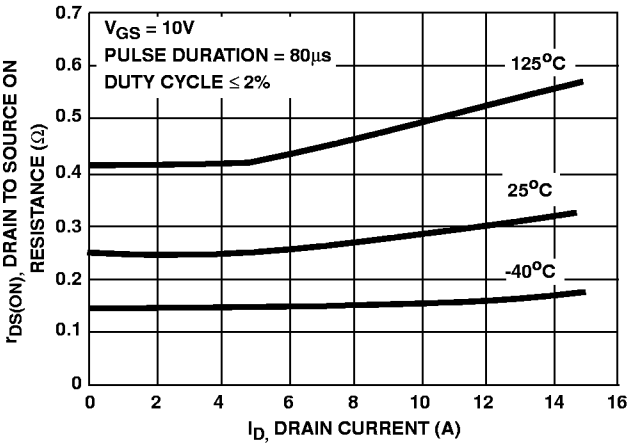



FIGURE 6. DRAIN TO SOURCE ON RESISTANCE vs DRAIN CURRENT

## Typical Performance Curves (Continued)

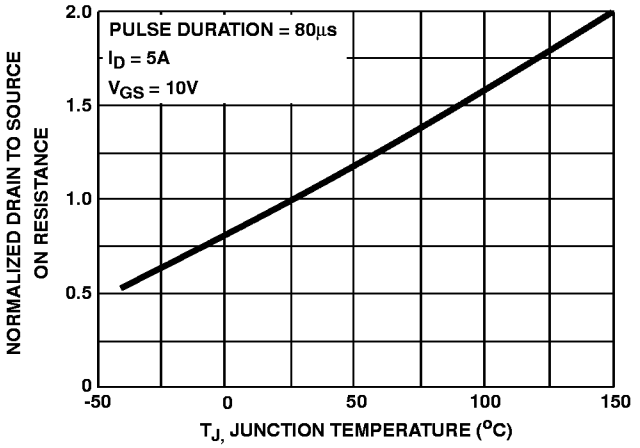



FIGURE 7. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

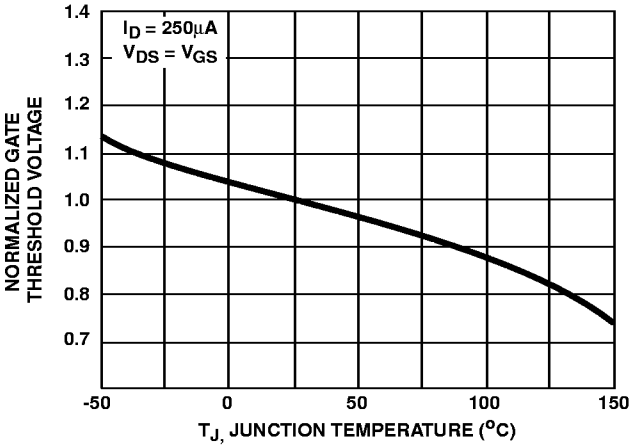



FIGURE 8. NORMALIZED GATE THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

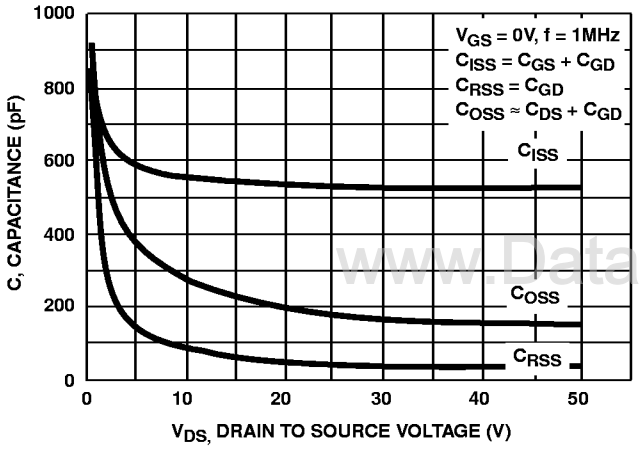
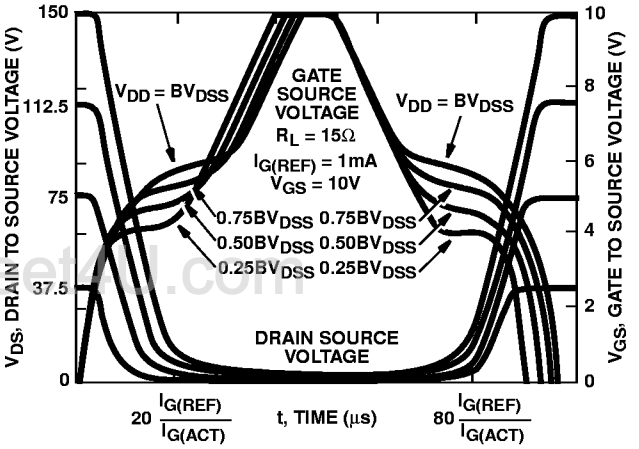



FIGURE 9. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE




NOTE: Refer to Harris Applications Notes AN7254 and AN7260

FIGURE 10. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

## Test Circuits and Waveforms

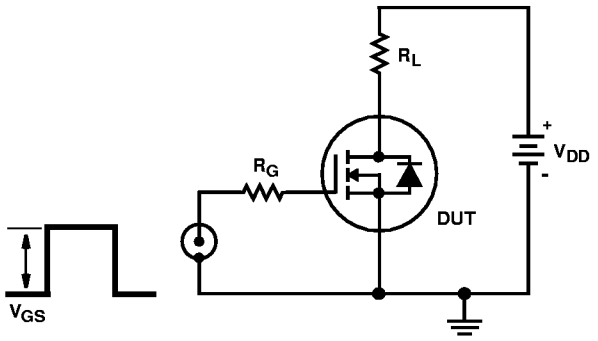



FIGURE 11. SWITCHING TIME TEST CIRCUIT

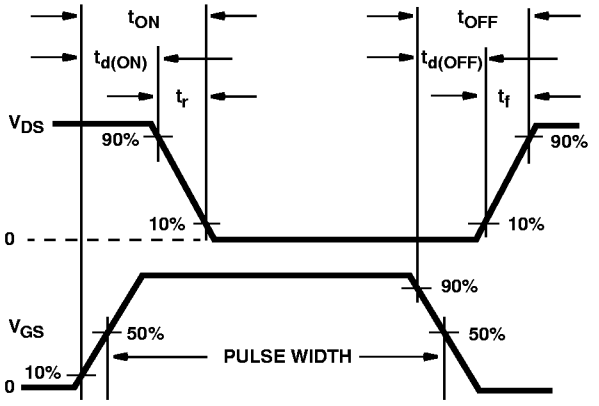



FIGURE 12. RESISTIVE SWITCHING WAVEFORMS

## Test Circuits and Waveforms

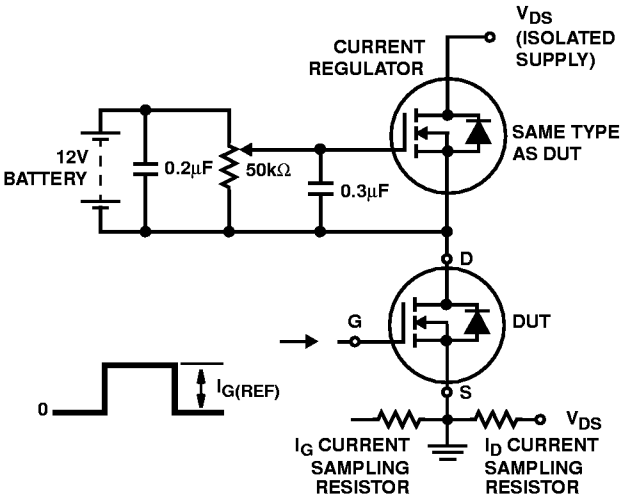



FIGURE 13. GATE CHARGE TEST CIRCUIT

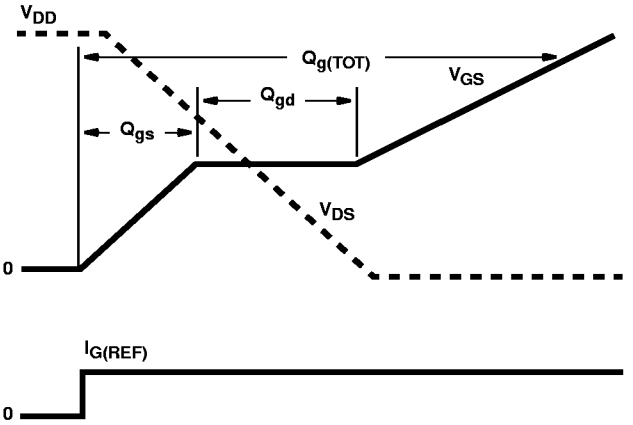



FIGURE 14. GATE CHARGE WAVEFORMS