HARRIS

# RFM10N12L/15L
# RFP10N12L/15L

## N-Channel Logic Level Power Field-Effect Transistors ($L^2FET$)

August 1991

### Features

- 10A, 120V and 150V
- $r_{DS(ON)} = 0.3\Omega$
- Design Optimized for 5V Gate Drives
- Can be Driven Directly from QMOS, NMOS, TTL Circuits
- Compatible with Automotive Drive Requirements
- SOA is Power-Dissipation Limited
- Nanoscecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

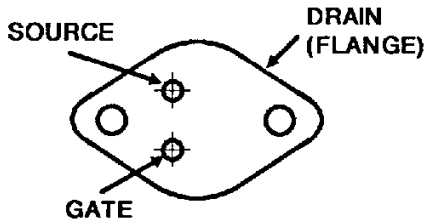
### Description

The RFM10N12L and RFM10N15L and the RFP10N12L and RFP10N15L are N-channel enhancmement-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.

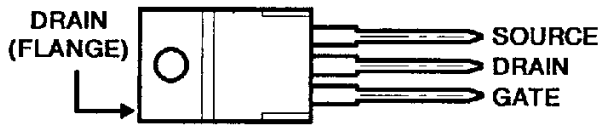
The RFM series types are supplied in the JEDEC TO-204AA steel package and the RFP series types in the JEDEC TO-220AB plastic package.

### Package

TO-204AA
BOTTOM VIEW

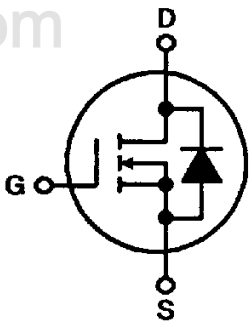



TO-220AB
TOP VIEW




### Terminal Diagram

N-CHANNEL ENHANCEMENT MODE






**Absolute Maximum Ratings** ($T_C = +25^oC$) Unless Otherwise Specified

| | | RFM10N12L | RFM10N15L | RFP10N12L | RFP10N15L | UNITS |
|---|---|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 120 | 150 | 120 | 150 | V |
| Drain-Gate Voltage ($R_{GS} = 1M\Omega$) | $V_{DGR}$ | 120 | 150 | 120 | 150 | V |
| Continuous Drain Current | | | | | | |
| RMS Continuous | $I_D$ | 10 | 10 | 10 | 10 | A |
| Pulsed Drain Current | $I_{DM}$ | 25 | 25 | 25 | 25 | A |
| Gate-Source Voltage | $V_{GS}$ | ±10 | ±10 | ±10 | ±10 | V |
| Maximum Power Dissipation | | | | | | |
| $T_C = +25^oC$ | $P_D$ | 75 | 75 | 60 | 60 | W |
| Above $T_C = +25^oC$, Derate Linearly | | 0.6 | 0.6 | 0.48 | 0.48 | W/$^o$C |
| Operating and Storage Junction Temperature Range | $T_J, T_{STG}$ | -55 to +150 | -55 to +150 | -55 to +150 | -55 to +150 | $^o$C |



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



File Number 1559.1

**ELECTRICAL CHARACTERISTICS, At Case Temperature ($T_C$ = 25° C) unless otherwise specified**

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | LIMITS | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | RFM10N12L RFP10N12L | | RFM10N15L RFP10N15L | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $I_D$ = 1 mA<br>$V_{GS}$ = 0 | 120 | — | 150 | — | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$ = $V_{DS}$<br>$I_D$ = 2 mA | 1 | 2 | 1 | 2 | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 100 V<br>$V_{DS}$ = 120 V | —<br>— | 1<br>— | —<br>— | —<br>1 | μA |
| | | $T_C$ = 125° C<br>$V_{DS}$ = 100 V<br>$V_{DS}$ = 120 V | —<br>— | 50<br>— | —<br>— | —<br>50 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±10 V<br>$V_{DS}$ = 0 | — | 100 | — | 100 | nA |
| Drain-Source On Voltage | $V_{DS(on)}$[a] | $I_D$ = 5 A<br>$V_{GS}$ = 5 V | — | 1.5 | — | 1 5 | V |
| | | $I_D$ = 10 A<br>$V_{GS}$ = 5 V | — | 4 | — | 4 | V |
| Static Drain-Source On Resistance | $r_{DS(on)}$[a] | $I_D$ = 5 A<br>$V_{GS}$ = 5 V | — | 0.3 | — | 0.3 | Ω |
| Forward Transconductance | $g_{fs}$[a] | $V_{DS}$ = 10 V<br>$I_D$ = 5 A | 4.0 | — | 4.0 | — | mho |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 25 V<br>$V_{GS}$ = 0 V<br>f = 1MHz | — | 1200 | — | 1200 | pF |
| Output Capacitance | $C_{oss}$ | | — | 250 | — | 250 | pF |
| Reverse-Transfer Capacitance | $C_{rss}$ | | — | 120 | — | 120 | pF |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 75 V<br>$I_D$ = 5 A<br>$R_{gen}$ = ∞<br>$R_{gs}$ = 6.25 Ω<br>$V_{GS}$ = 5 V | 15(typ) | 60 | 15(typ) | 60 | ns |
| Rise Time | $t_r$ | | 50(typ) | 135 | 50(typ) | 135 | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | 90(typ) | 135 | 90(typ) | 135 | ns |
| Fall Time | $t_f$ | | 90(typ) | 135 | 90(typ) | 135 | ns |
| Thermal Resistance Junction-to-Case | $R\theta_{JC}$ | RFM10N12L, RFM10N15L | — | 1.67 | — | 1 67 | °C/W |
| | | RFP10N12L, RFP10N15L | — | 2 083 | — | 2 083 | °C/W |

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | LIMITS | | | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | RFM10N12L RFP10N12L | | RFM10N15L RFP10N15L | | |
| | | | MIN. | MAX. | MIN. | MAX. | |
| Diode Forward Voltage | $V_{SD}$[a] | $I_{SD}$ = 5A | — | 1.4 | — | 1 4 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 4A, $d_{IF}/d_t$ = 100 A/μs | 150 (typ ) | | 150 (typ ) | | ns |

[a] Pulse Test Width ≤ 300 μs, Duty cycle ≤ 2%

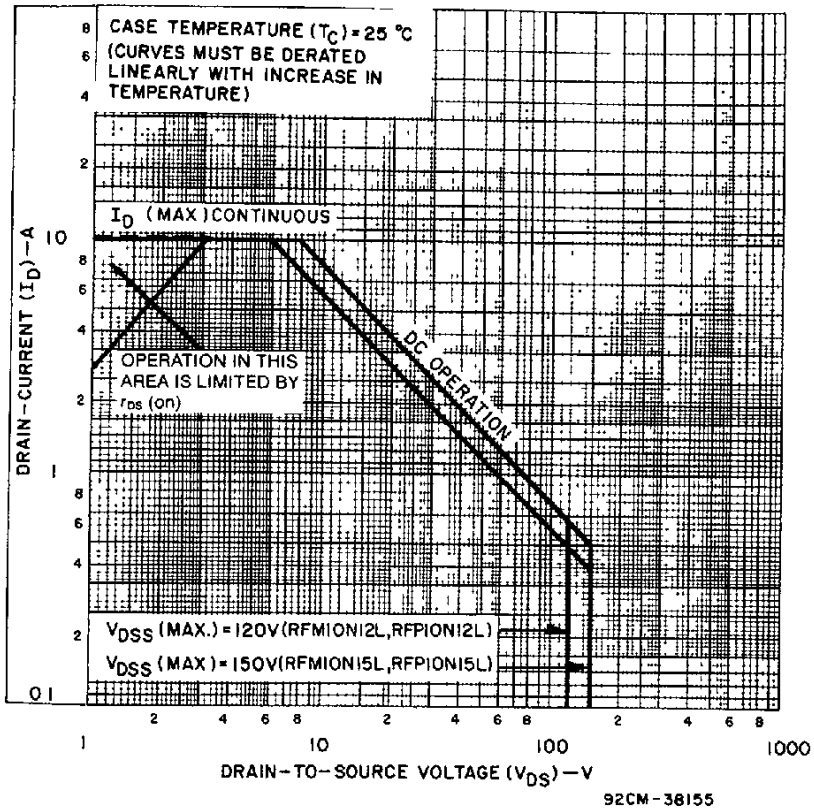



*Fig. 1 - Maximum safe operating areas for all types.*

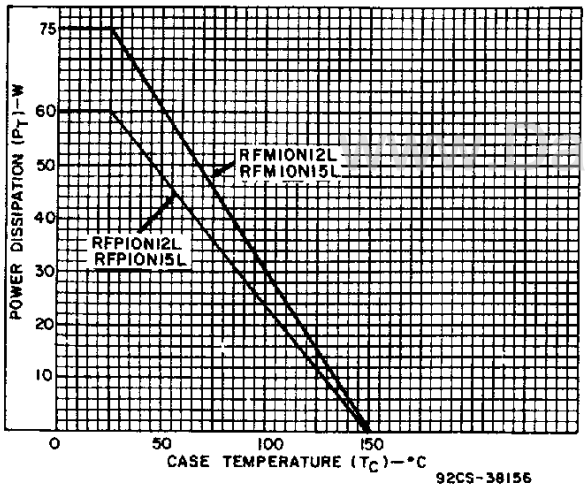



*Fig 2 - Power vs temperature derating curve for all types.*

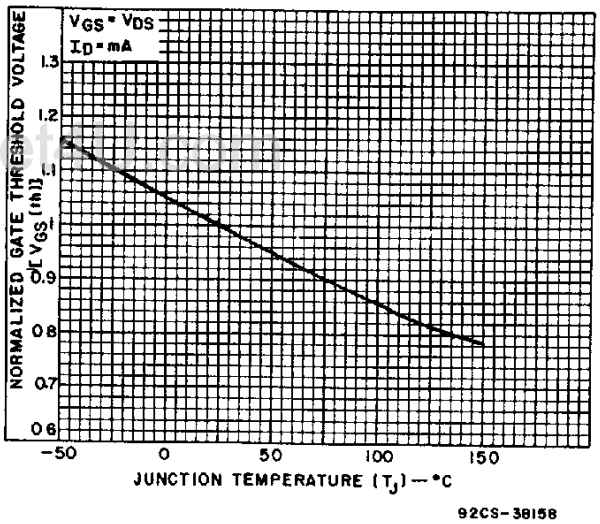



*Fig 3 - Typical normalized gate threshold voltage as a function of junction temperature for all types.*

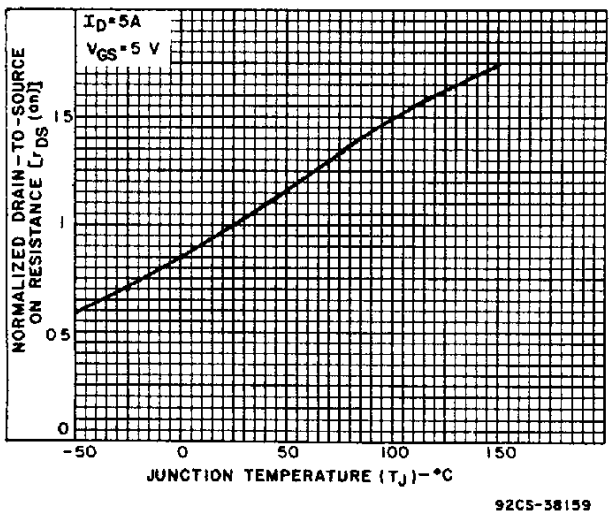



*Fig. 4 - Normalized drain-to-source on resistance vs. junction temperature for all types.*

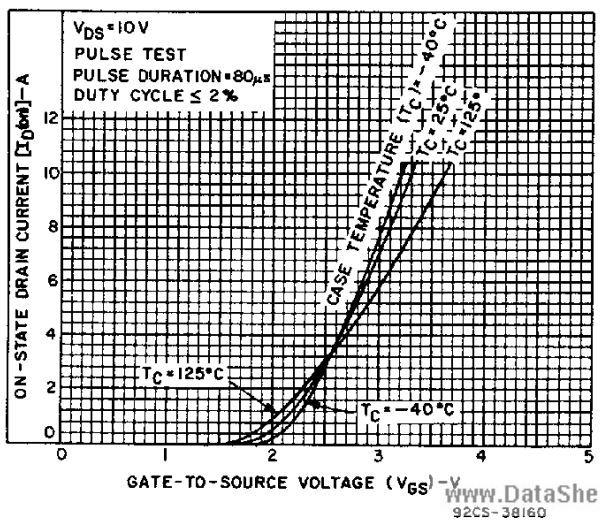



*Fig. 5 - Typical transfer characteristics for all types.*

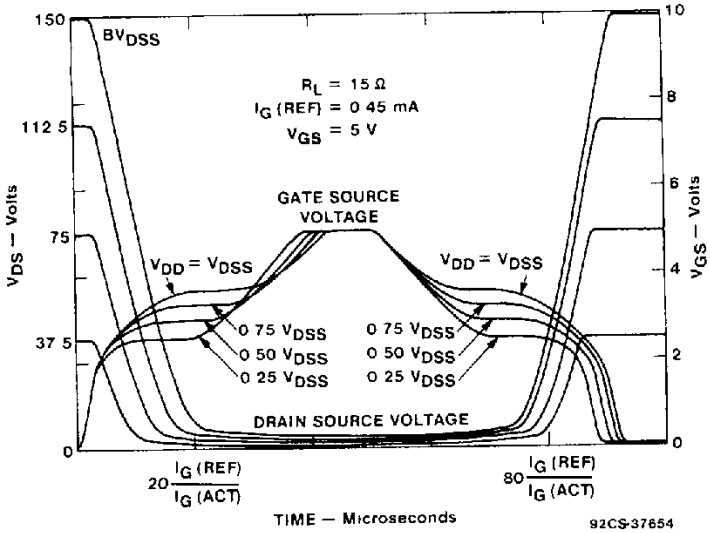



*Fig. 6 – Normalized switching waveforms for constant gate-current. Refer to Harris application notes AN7254 and AN-7260.*

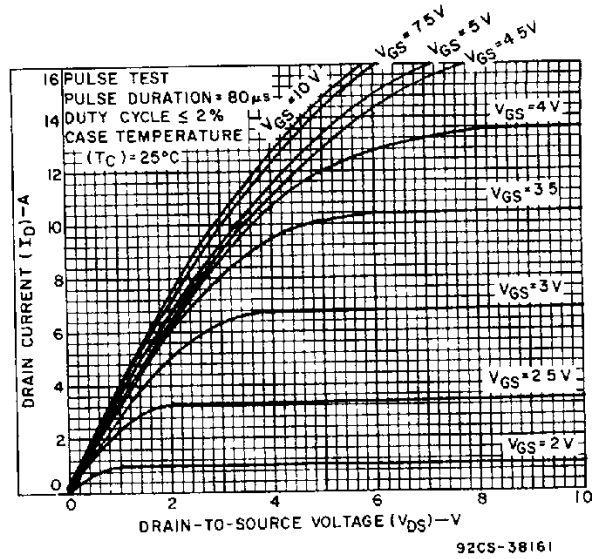



*Fig 7 - Typical saturation characteristics for all types*

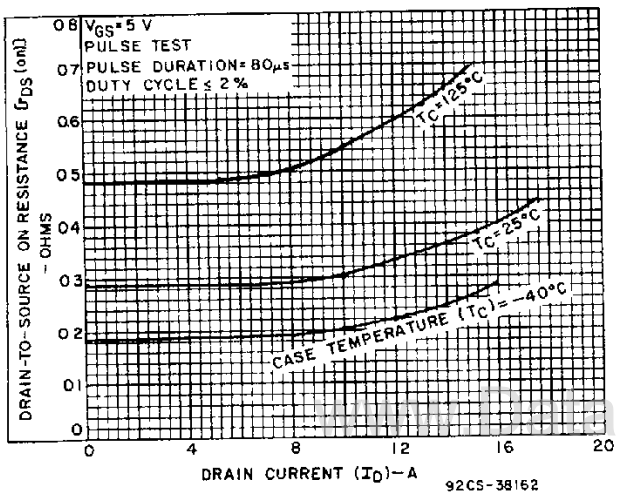



*Fig 8 - Typical drain-to-source on resistance as a function drain current for all types.*

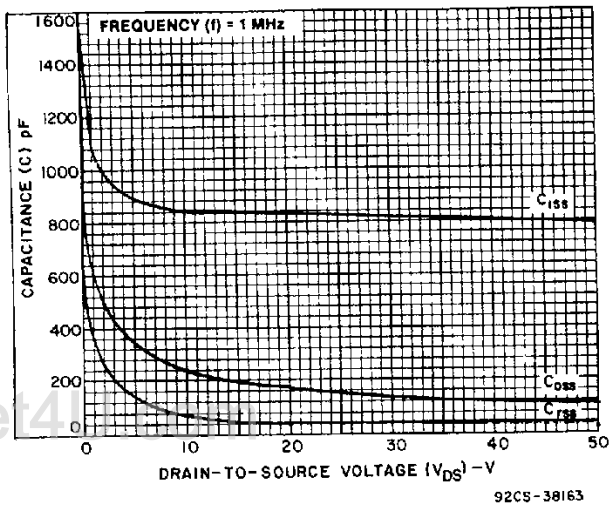



*Fig 9 - Capacitance as a function of drain-to-source voltage for all types*

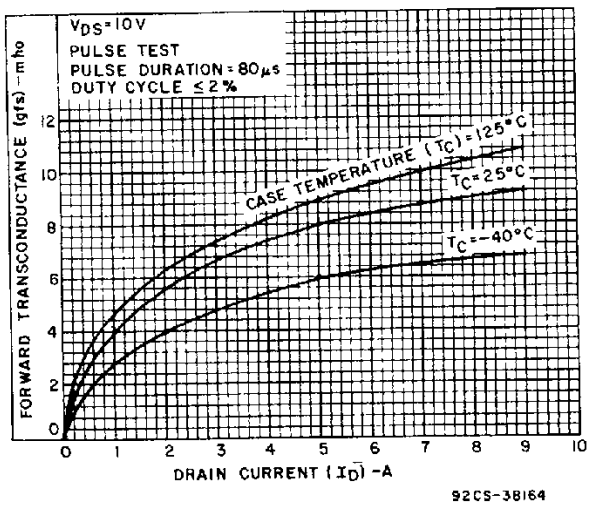



*Fig 10 - Typical forward transconductance as a function of drain current for all types.*

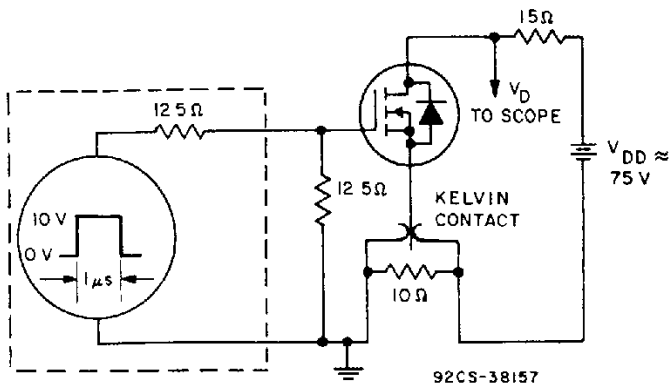



*Fig 11 - Switching Time Test Circuit*