

## P-Channel Enhancement-Mode Power Field-Effect Transistors

10 A, -120V and -150 V

$r_{DS(on)} = 0.5 \Omega$

### Features:

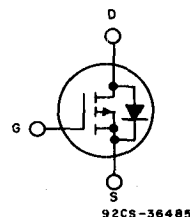
- SOA is power-dissipation limited
- Nanosecond switching speeds
- Linear transfer characteristics
- High input impedance
- Majority carrier device

The RFM10P12 and RFM10P15 and the RFP10P12 and RFP10P15\* are p-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.

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

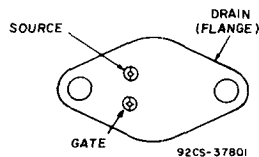
\*The RFM and RFP series were formerly developmental TA9404 and TA9405, respectively.

### TERMINAL DIAGRAM



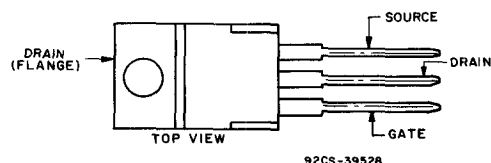
### P-CHANNEL ENHANCEMENT MODE

### TERMINAL DESIGNATION



### JEDEC TO-204AA

### TERMINAL DESIGNATION



### JEDEC TO-220AB

### MAXIMUM RATINGS, Absolute-Maximum Values ( $T_C = 25^\circ\text{C}$ ):

|                                                           | RFM10P12       | RFM10P15    | RFP10P12 | RFP10P15 |      |                     |
|-----------------------------------------------------------|----------------|-------------|----------|----------|------|---------------------|
| DRAIN-SOURCE VOLTAGE .....                                | $V_{DS}$       | -120        | -150     | -120     | -150 | V                   |
| DRAIN-GATE VOLTAGE ( $R_{gs} = 1 \text{ M}\Omega$ ) ..... | $V_{DGR}$      | -120        | -150     | -120     | -150 | V                   |
| GATE-SOURCE VOLTAGE .....                                 | $V_{GS}$       | $\pm 20$    |          |          |      | V                   |
| DRAIN CURRENT, RMS Continuous .....                       | $I_D$          | 10          |          |          |      | A                   |
| Pulsed .....                                              | $I_{DM}$       | 30          |          |          |      | A                   |
| POWER DISSIPATION @ $T_C = 25^\circ\text{C}$ .....        | $P_T$          | 100         | 100      | 75       | 75   | W                   |
| Derate above $T_C = 25^\circ\text{C}$ .....               |                | 0.8         | 0.8      | 0.6      | 0.6  | W/ $^\circ\text{C}$ |
| OPERATING AND STORAGE TEMPERATURE .....                   | $T_J, T_{sto}$ | -55 to +150 |          |          |      | $^\circ\text{C}$    |

## RFM10P12, RFM10P15, RFP10P12, RFP10P15

ELECTRICAL CHARACTERISTICS, At Case Temperature ( $T_C = 25^\circ\text{C}$ ) unless otherwise specified

| CHARACTERISTIC                      | SYMBOL                           | TEST CONDITIONS                                                                                                         | LIMITS               |      |                      |      | UNITS |
|-------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------|------|----------------------|------|-------|
|                                     |                                  |                                                                                                                         | RFM10P12<br>RFP10P12 |      | RFM10P15<br>RFP10P15 |      |       |
|                                     |                                  |                                                                                                                         | MIN.                 | MAX. | MIN.                 | MAX. |       |
| Drain-Source Breakdown Voltage      | BV <sub>DSS</sub>                | I <sub>D</sub> = 1 mA<br>V <sub>GS</sub> = 0                                                                            | -120                 | —    | -150                 | —    | V     |
| Gate-Threshold Voltage              | V <sub>GS(th)</sub>              | V <sub>GS</sub> = V <sub>DS</sub><br>I <sub>D</sub> = 1 mA                                                              | -2                   | -4   | -2                   | -4   | V     |
| Zero-Gate Voltage Drain Current     | I <sub>DSS</sub>                 | V <sub>DS</sub> = -100 V                                                                                                | —                    | 1    | —                    | —    | μA    |
|                                     |                                  | V <sub>DS</sub> = -120 V                                                                                                | —                    | —    | —                    | 1    |       |
|                                     |                                  | T <sub>C</sub> = 125° C<br>V <sub>DS</sub> = -100 V                                                                     | —                    | 50   | —                    | —    |       |
|                                     |                                  | V <sub>DS</sub> = -120 V                                                                                                | —                    | —    | —                    | 50   |       |
| Gate-Source Leakage Current         | I <sub>GSS</sub>                 | V <sub>GS</sub> = ±20 V<br>V <sub>DS</sub> = 0                                                                          | —                    | 100  | —                    | 100  | nA    |
| Drain-Source On Voltage             | V <sub>DS(on)</sub> <sup>a</sup> | I <sub>D</sub> = 5 A<br>V <sub>GS</sub> = -10 V                                                                         | —                    | -2.5 | —                    | -2.5 | V     |
|                                     |                                  | I <sub>D</sub> = 10 A<br>V <sub>GS</sub> = -10 V                                                                        | —                    | -6.0 | —                    | -6.0 |       |
| Static Drain-Source On Resistance   | r <sub>DS(on)</sub> <sup>a</sup> | I <sub>D</sub> = 5 A<br>V <sub>GS</sub> = -10 V                                                                         | —                    | 0.5  | —                    | 0.5  | Ω     |
| Forward Transconductance            | g <sub>fs</sub> <sup>a</sup>     | V <sub>DS</sub> = -10 V<br>I <sub>D</sub> = 5 A                                                                         | 2                    | —    | 2                    | —    | mho   |
| Input Capacitance                   | C <sub>iss</sub>                 | V <sub>DS</sub> = -25 V<br>V <sub>GS</sub> = 0 V<br>f = 1 MHz                                                           | —                    | 1700 | —                    | 1700 | pF    |
| Output Capacitance                  | C <sub>oss</sub>                 |                                                                                                                         | —                    | 600  | —                    | 600  |       |
| Reverse Transfer Capacitance        | C <sub>rss</sub>                 |                                                                                                                         | —                    | 350  | —                    | 350  |       |
| Turn-On Delay Time                  | t <sub>d(on)</sub>               | V <sub>DS</sub> = -75 V<br>I <sub>D</sub> = 5 A<br>R <sub>gen</sub> = R <sub>gs</sub> = 50 Ω<br>V <sub>GS</sub> = -10 V | 24(typ)              | 50   | 24(typ)              | 50   | ns    |
| Rise Time                           | t <sub>r</sub>                   |                                                                                                                         | 74(typ)              | 150  | 74(typ)              | 150  |       |
| Turn-Off Delay Time                 | t <sub>d(off)</sub>              |                                                                                                                         | 138(typ)             | 225  | 138(typ)             | 225  |       |
| Fall Time                           | t <sub>f</sub>                   |                                                                                                                         | 61(typ)              | 100  | 61(typ)              | 100  |       |
| Thermal Resistance Junction-to-Case | Rθ <sub>JC</sub>                 | RFM10P12,<br>RFM10P15                                                                                                   | —                    | 1.25 | —                    | 1.25 | °C/W  |
|                                     |                                  | RFP10P12,<br>RFP10P15                                                                                                   | —                    | 1.67 | —                    | 1.67 |       |

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## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| CHARACTERISTIC        | SYMBOL        | TEST CONDITIONS                   | LIMITS               |      |                      |      | UNITS |
|-----------------------|---------------|-----------------------------------|----------------------|------|----------------------|------|-------|
|                       |               |                                   | RFM10P12<br>RFP10P12 |      | RFM10P15<br>RFP10P15 |      |       |
|                       |               |                                   | MIN.                 | MAX. | MIN.                 | MAX. |       |
| Diode Forward Voltage | $V_{SD}^{a)}$ | $I_{SD} = 5A$                     | —                    | 1.4  | —                    | 1.4  | V     |
| Reverse Recovery Time | $t_{rr}$      | $I_F = 4A, dI_F/dt = 100 A/\mu s$ | 210 (typ.)           |      | 210 (typ.)           |      | ns    |

<sup>a</sup> Pulsed: Pulse duration = 300  $\mu\text{s}$  max., duty cycle = 2%.

## RFM10P12, RFM10P15, RFP10P12, RFP10P15

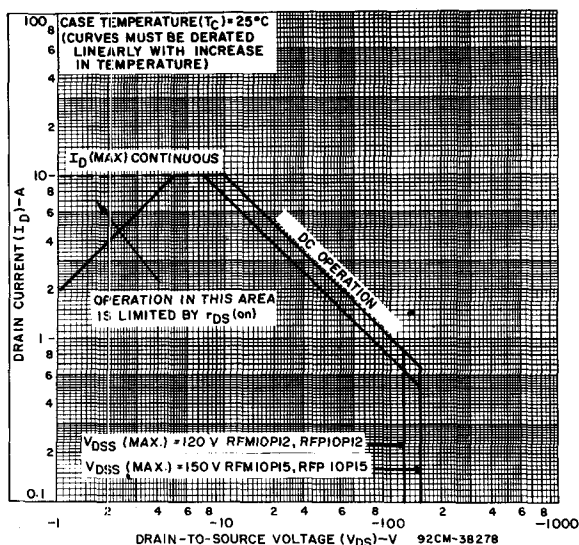


Fig. 1 - Maximum safe operating areas for all types.

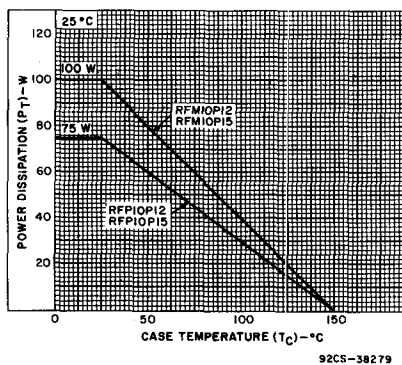


Fig. 2 - Power dissipation vs. case temperature derating curve for all types.

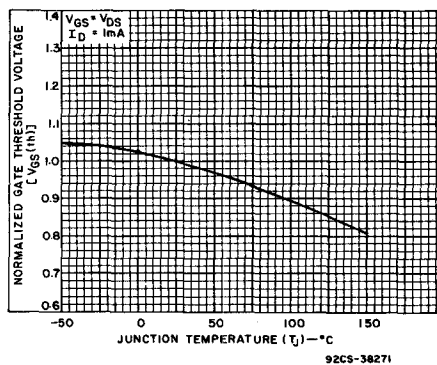


Fig. 3 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

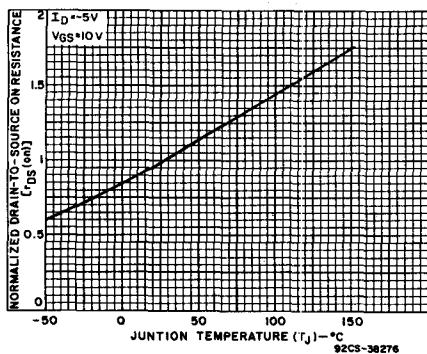


Fig. 4 - Normalized drain-to-source on resistance as a function of junction temperature for all types.

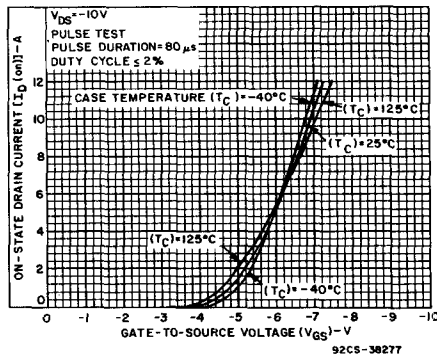


Fig. 5 - Typical transfer characteristics for all types.

## RFM10P12, RFM10P15, RFP10P12, RFP10P15

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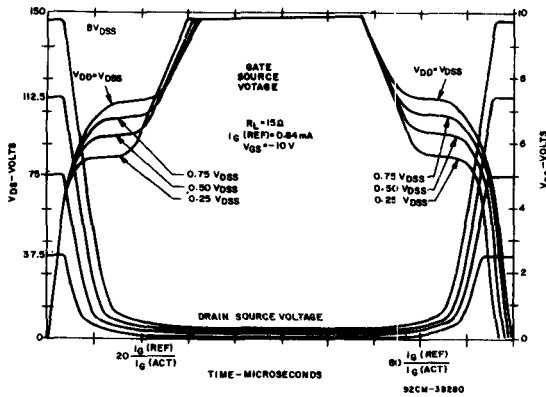


Fig. 6 - Normalized switching waveforms for constant gate-current drive. Refer to RCA application notes AN-7254 and AN-7260.

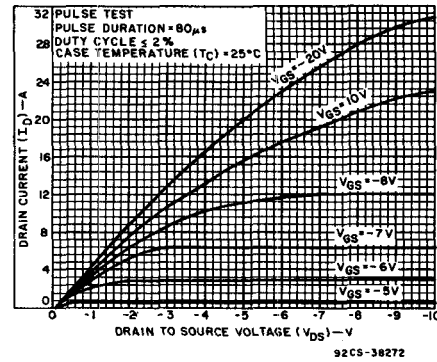


Fig. 7 - Typical saturation characteristics for all types.

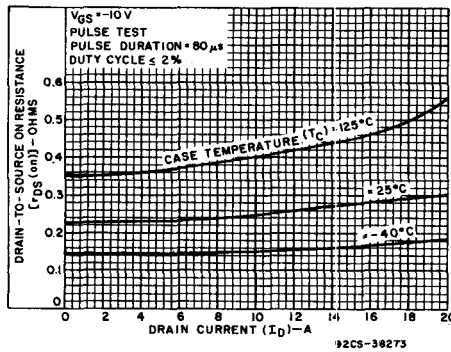


Fig. 8 - Typical drain-to-source on resistance as a function of drain current for all types.

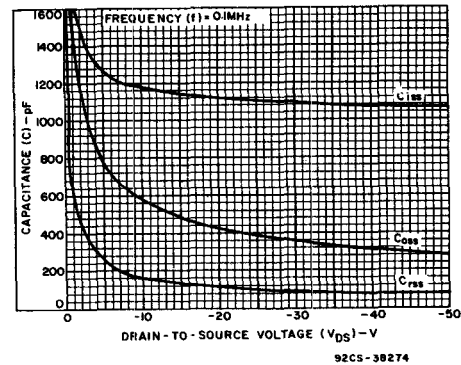


Fig. 9 - Capacitance as a function of drain-to-source voltage for all types.

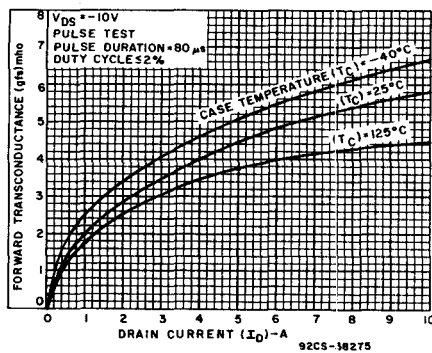


Fig. 10 - Typical forward transconductance as a function of drain current for all types.

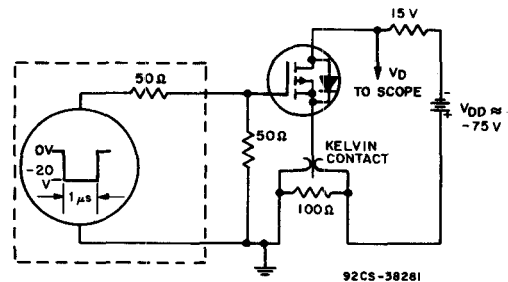


Fig. 11 - Switching Time Test Circuit.