

FAIRCHILD

A Schlumberger Company

IRF140-143/IRF540-543 T-39-13
N-Channel Power MOSFETs,
27 A, 60-100 V

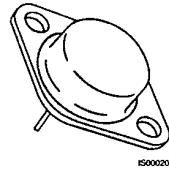
Power And Discrete Division

Description

These devices are n-channel, enhancement mode, power MOSFETs designed especially for high power, high speed applications, such as switching power supplies, UPS, AC and DC motor controls, relay and solenoid drivers and high energy pulse circuits.

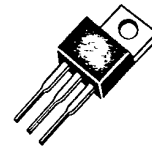
- Low $R_{DS(on)}$
- V_{GS} Rated at ± 20 V
- Silicon Gate for Fast Switching Speeds
- I_{DSS} , $V_{DS(on)}$, Specified at Elevated Temperature
- Rugged
- Low Drive Requirements
- Ease of Paralleling

TO-204AE



IRF140
 IRF141
 IRF142
 IRF143

TO-220AB



IRF540
 IRF541
 IRF542
 IRF543

Product Summary

| Part Number | V_{DSS} | $R_{DS(on)}$ | I_D at $T_C = 25^\circ C$ | I_D at $T_C = 100^\circ C$ | Case Style |
|-------------|-----------|----------------|-----------------------------|------------------------------|------------|
| IRF140 | 100 V | 0.085 Ω | 27 A | 17 A | TO-204AE |
| IRF141 | 60 V | 0.085 Ω | 27 A | 17 A | |
| IRF142 | 100 V | 0.11 Ω | 24 A | 15 A | |
| IRF143 | 60 V | 0.11 Ω | 24 A | 15 A | |
| IRF540 | 100 V | 0.085 Ω | 27 A | 17 A | TO-220AB |
| IRF541 | 60 V | 0.085 Ω | 27 A | 17 A | |
| IRF542 | 100 V | 0.11 Ω | 24 A | 15 A | |
| IRF543 | 60 V | 0.11 Ω | 24 A | 15 A | |

Notes

For information concerning connection diagram and package outline, refer to Section 7.

IRF140-143/IRF540-543

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Maximum Ratings

| Symbol | Characteristic | Rating IRF140/142 IRF540/542 | Rating IRF141/143 IRF541/543 | Unit |
|-----------------------------------|---|------------------------------------|------------------------------------|------|
| V _{DSS} | Drain to Source Voltage ¹ | 100 | 60 | V |
| V _{DGR} | Drain to Gate Voltage ¹ R _{GS} = 20 kΩ | 100 | 60 | V |
| V _{GS} | Gate to Source Voltage | ± 20 | ± 20 | V |
| T _J , T _{stg} | Operating Junction and Storage Temperatures | -55 to +150 | -55 to +150 | °C |
| T _L | Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5 s | 275 | 275 | °C |

Maximum Thermal Characteristics

| | | IRF140-143 | IRF540-543 | |
|------------------|---|------------|------------|------|
| R _{θJC} | Thermal Resistance, Junction to Case | 1.0 | 1.0 | °C/W |
| P _D | Total Power Dissipation at T _C = 25°C | 125 | 125 | W |
| I _{DM} | Pulsed Drain Current ² | 108 | 108 | A |

Electrical Characteristics (T_C = 25°C unless otherwise noted)

| Symbol | Characteristic | Min | Max | Unit | Test Conditions |
|----------------------------|--|-----|-------|-------|---|
| Off Characteristics | | | | | |
| V _{(BR)DSS} | Drain Source Breakdown Voltage ¹ IRF140/142/540/542 IRF141/143/541/543 | 100 | | V | V _{GS} = 0 V, I _D = 250 μA |
| | | 60 | | | |
| I _{DSS} | Zero Gate Voltage Drain Current | | 250 | μA | V _{DS} = Rated V _{DSS} , V _{GS} = 0 V |
| | | | 1000 | μA | V _{DS} = 0.8 x Rated V _{DSS} , V _{GS} = 0 V, T _C = 125°C |
| I _{GSS} | Gate-Body Leakage Current IRF140-143 IRF540-543 | | ± 100 | nA | V _{GS} = ± 20 V, V _{DS} = 0 V |
| | | | ± 500 | | |
| On Characteristics | | | | | |
| V _{GS(th)} | Gate Threshold Voltage | 2.0 | 4.0 | V | I _D = 250 μA, V _{DS} = V _{GS} |
| R _{DS(on)} | Static Drain-Source On-Resistance ² IRF140/141/540/541 IRF142/143/542/543 | | | Ω | V _{GS} = 10 V, I _D = 15 A |
| | | | 0.085 | | |
| | | | 0.11 | | |
| g _{fs} | Forward Transconductance | 6.0 | | S (Ω) | V _{DS} = 10 V, I _D = 15 A |

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Electrical Characteristics (Cont.) ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Characteristic | Min | Max | Unit | Test Conditions |
|---|------------------------------|-----|------|------|--|
| Dynamic Characteristics | | | | | |
| C_{iss} | Input Capacitance | | 1600 | pF | $V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$ $f = 1.0\text{ MHz}$ |
| C_{oss} | Output Capacitance | | 800 | pF | |
| C_{rss} | Reverse Transfer Capacitance | | 300 | pF | |
| Switching Characteristics ($T_C = 25^\circ\text{C}$, Figures 1, 2), ³ | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | | 30 | ns | $V_{DD} = 45\text{ V}$, $I_D = 15\text{ A}$ $V_{GS} = 10\text{ V}$, $R_{GEN} = 4.7\ \Omega$ $R_{GS} = 4.7\ \Omega$ |
| t_r | Rise Time | | 60 | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 80 | ns | |
| t_f | Fall Time | | 30 | ns | |
| $t_{d(on)}$ | Turn-On Delay Time | | 60 | ns | $V_{DD} = 25\text{ V}$, $I_D = 15\text{ A}$ $V_{GS} = 10\text{ V}$, $R_{GEN} = 50\ \Omega$ $R_{GS} = 50\ \Omega$ |
| t_r | Rise Time | | 450 | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 150 | ns | |
| t_f | Fall Time | | 200 | ns | |
| Q_g | Total Gate Charge | | 60 | nC | $V_{GS} = 10\text{ V}$, $I_D = 34\text{ A}$ $V_{DD} = 35\text{ V}$ |

| Symbol | Characteristic | Typ | Max | Unit | Test Conditions |
|---|---|-----|-----|------|--|
| Source-Drain Diode Characteristics | | | | | |
| V_{SD} | Diode Forward Voltage IRF140/141/540/541 IRF142/143/542/543 | 2.0 | 2.5 | V | $I_S = 27\text{ A}$; $V_{GS} = 0\text{ V}$ $I_S = 24\text{ A}$; $V_{GS} = 0\text{ V}$ |
| | | 2.0 | 2.3 | V | |
| t_{rr} | Reverse Recovery Time | 300 | | ns | $I_S = 4.0\text{ A}$; $di_S/dt = 25\text{ A}/\mu\text{S}$ |

Notes

- $T_J = +25^\circ\text{C}$ to $+150^\circ\text{C}$
- Pulse width limited by T_J
- Switching time measurements performed on LEM TR-58 test equipment.

Typical Electrical Characteristics

Figure 1 Switching Test Circuit

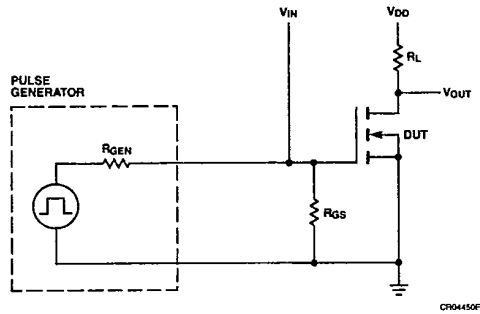
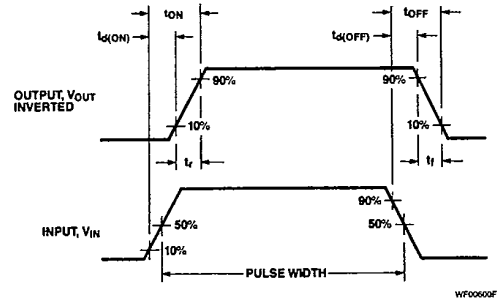


Figure 2 Switching Waveforms



Typical Performance Curves

Figure 3 Output Characteristics

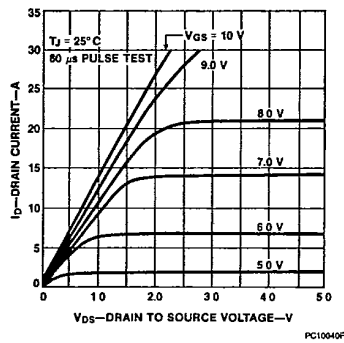


Figure 4 Static Drain to Source Resistance vs Drain Current

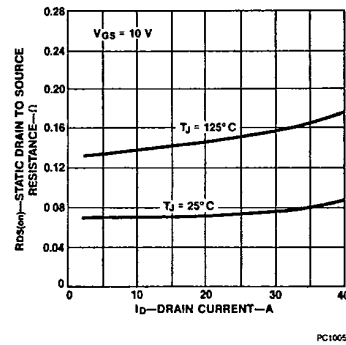


Figure 5 Transfer Characteristics

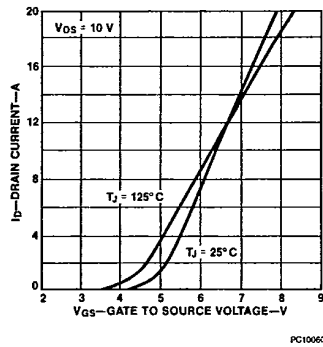
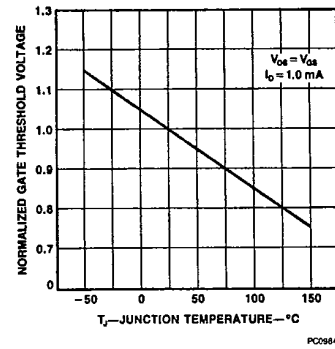


Figure 6 Temperature Variation of Gate to Source Threshold Voltage

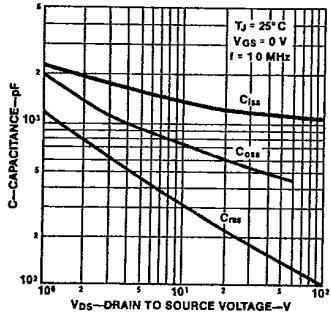


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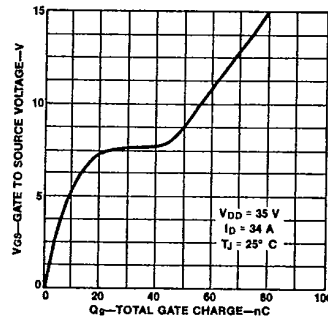
Typical Performance Curves (Cont.)

Figure 7 Capacitance vs Drain to Source Voltage



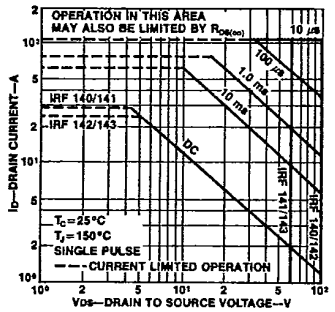
PC10070F

Figure 8 Gate to Source Voltage vs Total Gate Charge



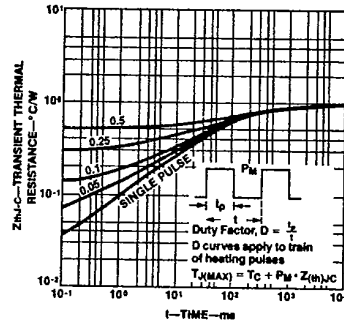
PC10080F

Figure 9 Forward Biased Safe Operating Area



PC10090F

Figure 10 Transient Thermal Resistance vs Time



PC10100F