FAIRCHILD
A Schlumberger Company

IRF440-443/IRF840-843 MTM7N45/7N50 N-Channel Power MOSFETs, 8 A, 450 V/500 V

Power And Discrete Division

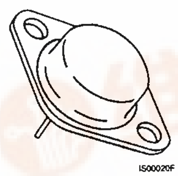
T-39-11

Description

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

- **V_{GS} Rated at ±20 V**
- **Silicon Gate for Fast Switching Speeds**
- **I_{DSS}, $V_{DS(on)}$, SOA and $V_{GS(th)}$ Specified at Elevated Temperature**
- **Rugged**

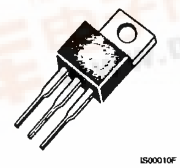
TO-204AA



IS00020F

IRF440
IRF441
IRF442
IRF443
MTM7N45
MTM7N50

TO-220AB



IS00010F

IRF840
IRF841
IRF842
IRF843

Maximum Ratings

Symbol	Characteristic	Rating IRF440/442 IRF840/842 MTM7N50	Rating IRF441/443 IRF841/843 MTM7N45	Unit
V_{DSS}	Drain to Source Voltage	500	450	V
V_{DGR}	Drain to Gate Voltage R_{GS} = 20 kΩ	500	450	V
V_{GS}	Gate to Source Voltage	±20	±20	V
T_J, T_{stg}	Operating Junction and Storage Temperature	−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 On-State Characteristics

		IRF440/441 IRF840/841	IRF442/443 IRF842/843	MTM7N45 MTM7N50	
$R_{DS(on)}$	Static Drain-to-Source On Resistance	0.85	1.1	0.8	Ω
I_D	Drain Current Continuous Pulsed	8 32	7 28	7 40	A

Maximum Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.0	1.0	0.83	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	60	60	60	°C/W
P_D	Total Power Dissipation at T_C = 25°C	125	125	150	W

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

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]			V	V_{GS} = 0 V, I_D = 250 μA
	IRF440/442/840/842	500			
	IRF441/443/842/843	450			
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			nA	V_{GS} = ±20 V, V_{DS} = 0 V
	IRF440-443		±100		
	IRF840-843		±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]			Ω	V_{GS} = 10 V, I_D = 4.0 A
	IRF440/441/840/841		0.85		
	IRF442/443/842/843		1.10		
g_{fs}	Forward Transconductance	4.0		S (℧)	V_{DS} = 10 V, I_D = 4.0 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		1600	pF	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz
C_{oss}	Output Capacitance		350	pF	
C_{rss}	Reverse Transfer Capacitance		150	pF	
Switching Characteristics (T_C = 25°C, *Figures 9, 10*)					
$t_{d(on)}$	Turn-On Delay Time		35	ns	V_{DD} = 220 V, I_D = 4.0 A, V_{GS} = 10 V, R_{GEN} = 4.7 Ω, R_{GS} = 4.7 Ω
t_r	Rise Time		15	ns	
$t_{d(off)}$	Turn-Off Delay Time		90	ns	
t_f	Fall Time		30	ns	
Q_g	Total Gate Charge		60	nC	V_{GS} = 10 V, I_D = 12 A, V_{DD} = 400 V

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
Source-Drain Diode Characteristics					
V_{SD}	Diode Forward Voltage IRF440/441/840/841		2.0	V	I_S = 8.0 A; V_{GS} = 0 V
	IRF442/443/842/843		1.9	V	I_S = 7.0 A; V_{GS} = 0 V
t_{rr}	Reverse Recovery Time	700		ns	I_S = 8.0 A; dI_S/dt = 100 A/μS

Notes
1. T_J = +25°C to +150°C
2. Pulse test: Pulse width ≤ 80 μs, Duty cycle ≤ 1%

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]			V	V_{GS} = 0 V, I_D = 5.0 mA
	MTM7N50	500			
	MTM7N45	450			
I_{DSS}	Zero Gate Voltage Drain Current		0.25	mA	V_{DS} = 0.85 x Rated V_{DSS}, V_{GS} = 0 V
			2.5	mA	V_{DS} = 0.85 x Rated V_{DSS}, V_{GS} = 0 V, T_C = 100°C
I_{GSS}	Gate-Body Leakage Current		±500	nA	V_{GS} = ±20 V, V_{DS} = 0 V
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage	2.0	4.5	V	I_D = 1.0 mA, V_{DS} = V_{GS}
		1.5	4.0	V	I_D = 1.0 mA, V_{DS} = V_{GS} T_C = 100°C
$R_{DS(on)}$	Static Drain-Source On-Resistance[2]		0.8	Ω	V_{GS} = 10 V, I_D = 3.5 A
$V_{DS(on)}$	Drain-Source On-Voltage[2]		2.8	V	V_{GS} = 10 V, I_D = 3.5 A
			7.0	V	V_{GS} = 10 V, I_D = 7.0 A
			5.6	V	V_{GS} = 10 V, I_D = 3.5 A T_C = 100°C
g_{fs}	Forward Transconductance	4.0		S (℧)	V_{DS} = 10 V, I_D = 4.0 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		1800	pF	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz
C_{oss}	Output Capacitance		350	pF	
C_{rss}	Reverse Transfer Capacitance		150	pF	
Switching Characteristics (T_C = 25°C, *Figures 9, 10*)[3]					
$t_{d(on)}$	Turn-On Delay Time		60	ns	V_{DD} = 25 V, I_D = 3.5 A V_{GS} = 10 V, R_{GEN} = 50 Ω R_{GS} = 50 Ω
t_r	Rise Time		150	ns	
$t_{d(off)}$	Turn-Off Delay Time		200	ns	
t_f	Fall Time		120	ns	
Q_g	Total Gate Charge		60	nC	V_{GS} = 10 V, I_D = 12 A V_{DD} = 400 V

Notes
1. T_J = +25°C to +150°C
2. Pulse test: Pulse width ≤ 80 μs, Duty cycle ≤ 1%
3. Switching time measurements performed on LEM TR-58 test equipment

Typical Performance Curves

Figure 1 Output Characteristics

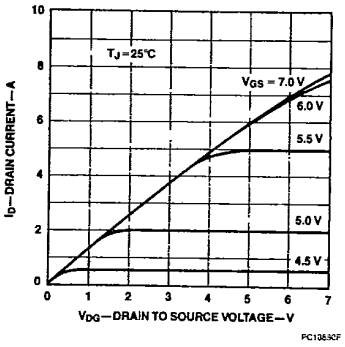


Figure 2 Static Drain to Source Resistance vs Drain Current

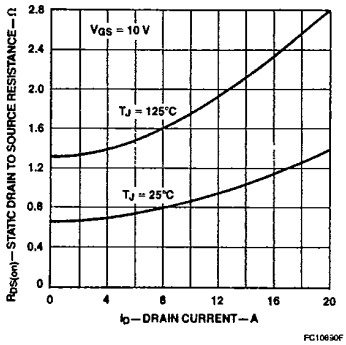


Figure 3 Transfer Characteristics

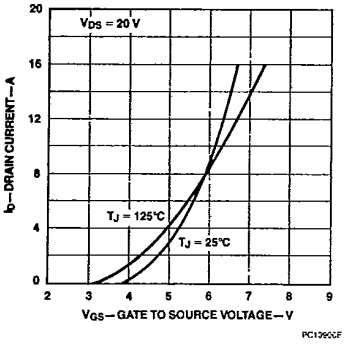


Figure 4 Temperature Variation of Gate to Source Threshold Voltage

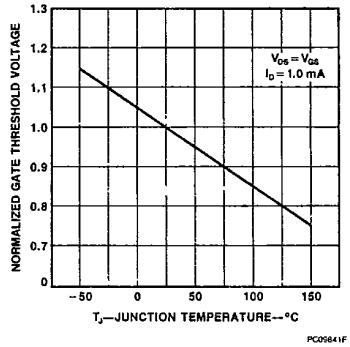


Figure 5 Capacitance vs Drain to Source Voltage

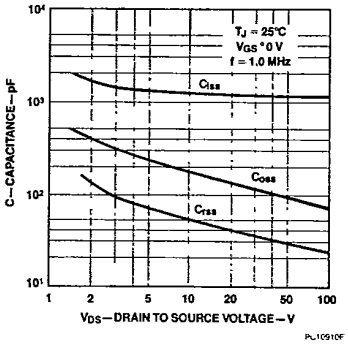
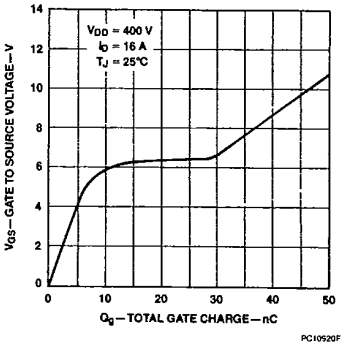


Figure 6 Gate to Source Voltage vs Total Gate Charge



Typical Performance Curves (Cont.)

Figure 7 Forward Biased Safe Operating Area Curves

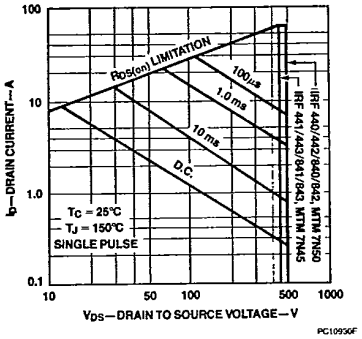
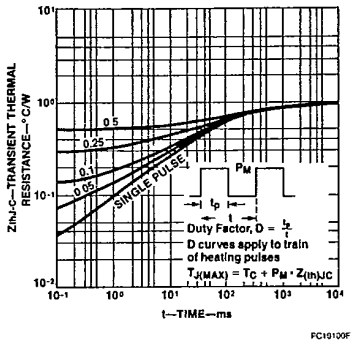


Figure 8 Transient Thermal Resistance vs Time



Typical Electrical Characteristics

Figure 9 Switching Test Circuit

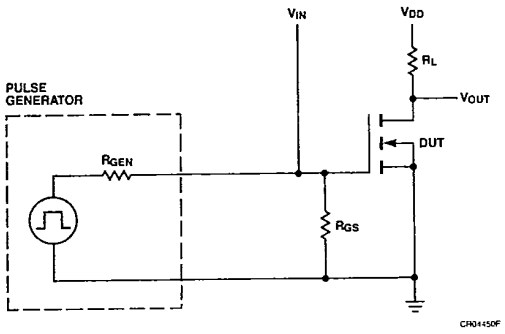


Figure 10 Switching Waveforms