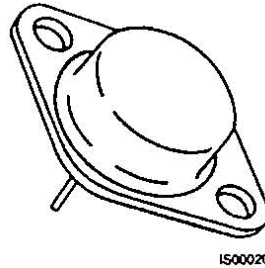


### Description

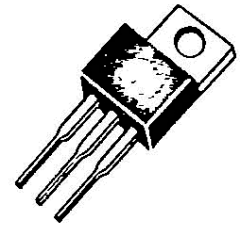
These devices are n-channel, enhancement mode, power MOSFETs designed especially for high voltage, high speed applications, such as off-line switching power supplies, UPS, AC and DC motor controls, relay and solenoid drivers.

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

**TO-204AA**



**TO-220AB**



IRF440  
 IRF441  
 IRF442  
 IRF443  
 MTM7N45  
 MTTM7N50

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 $R_{GS}=20k\ \Omega$	500	450	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	$\pm 20$	V
$T_J, T_{stg}$	Operating Junction and Storage Temperature	-50 to +150	-50 to +150	
TL	Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5S	275	275	

### 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	$\Omega$
$I_D$	Drain Current				A
	Continuous	8	7	7	
	Pulsed	32	28	40	

### Maximum Thermal Characteristics

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

### Notes

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



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

**Electrical Characteristics** (Tc=25 unless otherwise noted)

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>Off Characteristics</b>					
V <sub>(BR)DSS</sub>	Drain Source Breakdown Voltage1			V	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA
	IRF440/442/840/842	500			
	IRF441/443/842/843	450			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		250	μA	V <sub>DS</sub> =Rated V <sub>DSS</sub> , V <sub>GS</sub> =0V
			100	μA	V <sub>DS</sub> =0.8 x Rated V <sub>DSS</sub> , V <sub>GS</sub> =0V, Tc=125
I <sub>GSS</sub>	Gate-Body Leakage Current			nA	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V
	IRF440-443		±100		
	IRF840-843		±500		
<b>On Characteristics</b>					
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	4.0	V	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance 2			Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =4.0A
	IRF440/441/840/841		0.85		
	IRF442/443/842/843		1.10		
g <sub>fs</sub>	Forward Transconductance	4.0		S(Ω)	V <sub>DS</sub> =10V, I <sub>D</sub> =4.0A
<b>Dynamic Characteristics</b>					
C <sub>iss</sub>	Input Capacitance		1600	pF	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V f=1.0MHz
C <sub>oss</sub>	Output Capacitance		350	pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		150	pF	
<b>Switching Characteristics</b> (Tc=25, Figure 9, 10)					
t <sub>d(on)</sub>	Turn-On Delay Time		35	ns	V <sub>DD</sub> =220V, I <sub>D</sub> =4.0A V <sub>GS</sub> =10V, R <sub>GEN</sub> =4.7 Ω R <sub>GS</sub> =4.7 Ω
t <sub>r</sub>	Rise Time		15	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		90	ns	
t <sub>f</sub>	Fall Time		30	ns	
Q <sub>g</sub>	Total Gate Charge		60	nC	V <sub>GS</sub> =10V, I <sub>D</sub> =12A V <sub>DD</sub> =400V
<b>Symbol Characteristic</b>					
Symbol	Characteristic	Typ	Max	Unit	Test Conditions
<b>Source-Drain Diode Characteristics</b>					
V <sub>SD</sub>	Diode Forward Voltage		2.0	V	I <sub>S</sub> =8.0A; V <sub>GS</sub> =0V
	IRF440/441/840/841		1.9	V	I <sub>S</sub> =7.0A; V <sub>GSA</sub> =0V
	IRF442/443/842/843				
t <sub>rr</sub>	Reverse Recovery Time	700		ns	I <sub>S</sub> =8.0A; dI <sub>S</sub> /dt=100A/μs

**Notes**

- T<sub>J</sub>=+25 to +150
- Pulse test: Pulse width ≤80μs, Duty cycle ≤ 1%



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

**Electrical Characteristics** (Tc=25 unless otherwise noted)

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>Off Characteristics</b>					
V <sub>(BR)DSS</sub>	Drain Source Breakdown Voltage1 MTM7N50 MTM7N45			V	V <sub>GS</sub> =0V, I <sub>D</sub> =5.0mA
		500			
		450			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		0.25	mA	V <sub>DS</sub> =0.85 x Rated V <sub>DSS</sub> , V <sub>GS</sub> =0V
			2.5	mA	V <sub>DS</sub> =0.85 x Rated V <sub>DSS</sub> , V <sub>GS</sub> =0V, Tc=100
I <sub>GSS</sub>	Gate-Body Leakage Current		±500	nA	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V
<b>On Characteristics</b>					
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	4.5	V	I <sub>D</sub> =1.0mA, V <sub>DS</sub> =V <sub>GS</sub>
		1.5	4.0	V	I <sub>D</sub> =1.0mA, V <sub>DS</sub> =V <sub>GS</sub> T <sub>C</sub> =100
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance2		0.8	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =3.5A
V <sub>DS(on)</sub>	Drain-Source On-Voltage2		2.8	V	V <sub>GS</sub> =10V, I <sub>D</sub> =3.5A
			7.0	V	V <sub>GS</sub> =10V, I <sub>D</sub> =7.0A
			5.6	V	V <sub>GS</sub> =10V, I <sub>D</sub> =3.5A Tc=100
g <sub>fs</sub>	Forward Transconductance	4.0		S(Ū)	V <sub>DS</sub> =10V, I <sub>D</sub> ≈4.0A
<b>Dynamic Characteristics</b>					
C <sub>iss</sub>	Input Capacitance		1800	pF	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V f=1.0MHz
C <sub>oss</sub>	Output Capacitance		350	pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		150	pF	
<b>Switching Characteristics</b> (Tc=25, Figure 9,10) <sup>3</sup>					
t <sub>d(on)</sub>	Turn-On Delay Time		60	ns	V <sub>DD</sub> =25V, I <sub>D</sub> =3.5A V <sub>GS</sub> =10V, R <sub>GEN</sub> =50 Ω R <sub>GS</sub> =50 Ω
t <sub>r</sub>	Rise Time		150	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		200	ns	
t <sub>f</sub>	Fall Time		120	ns	
Q <sub>g</sub>	Total Gate Charge		60	nC	V <sub>GS</sub> =10V, I <sub>D</sub> =12A V <sub>DD</sub> =400V

**Notes**

1. T<sub>J</sub>=+25 to +150
2. Pulse test: Pulse width ≤ 80μs, Duty cycle ≤ 1%
3. Switching time measurements performed on LEM TR-58 test equipment

Typical Performance Curves

Figure 1 Output Characteristics

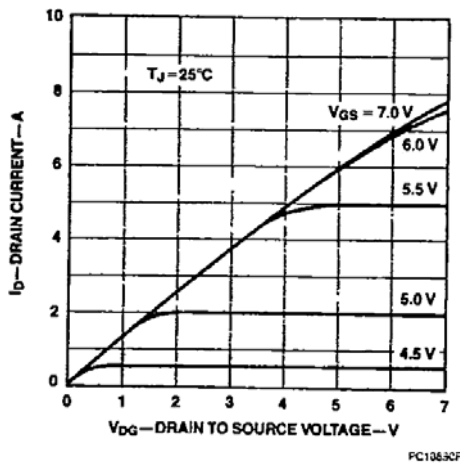


Figure 2 Static Drain to Source Resistance vs Drain Current

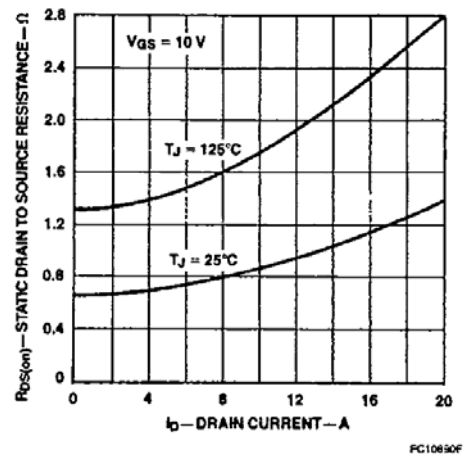


Figure 3 Transfer Characteristics

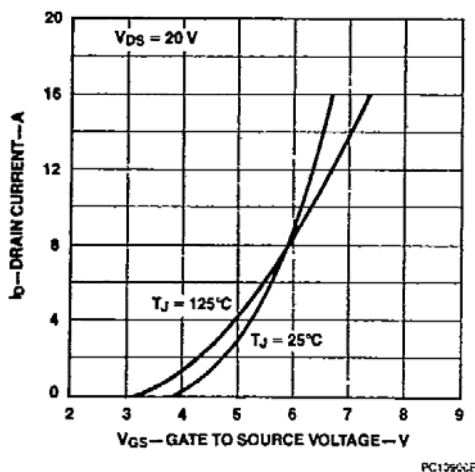


Figure 4 Temperature Variation of Gate to Source Threshold Voltage

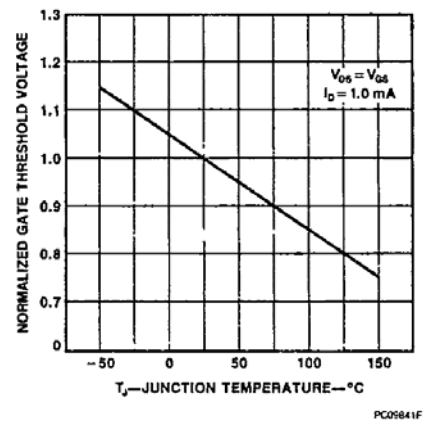


Figure 5 Capacitance vs Drain to Source Voltage

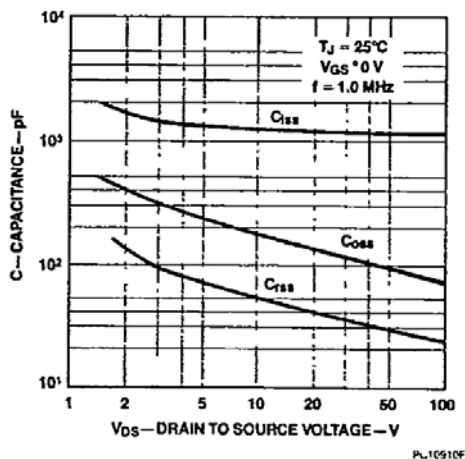
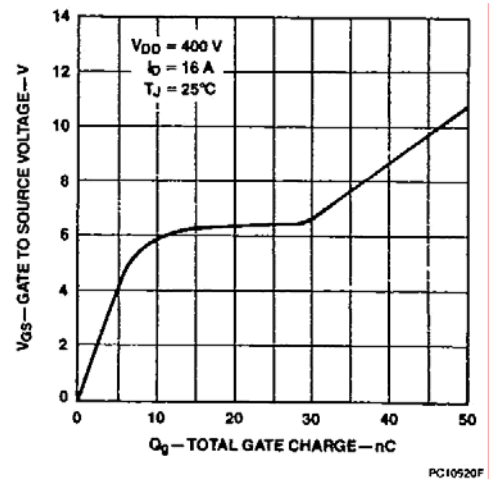


Figure 6 Gate to Source Voltage vs Total Gate Charge



Typical Performance Curves (Cont.)

Figure 7 Forward Biased Safe Operating Area Curves

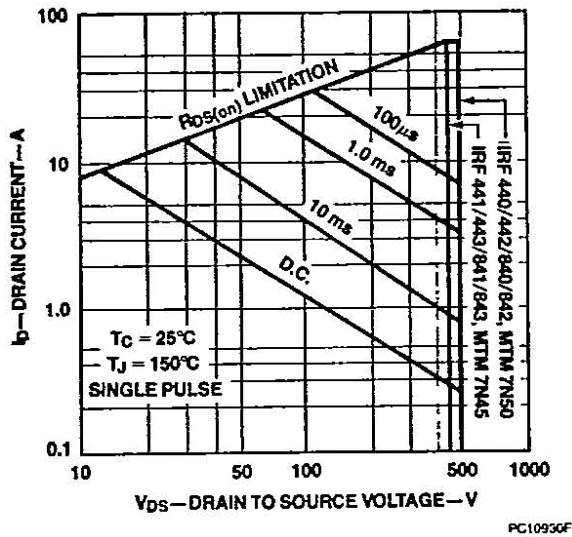
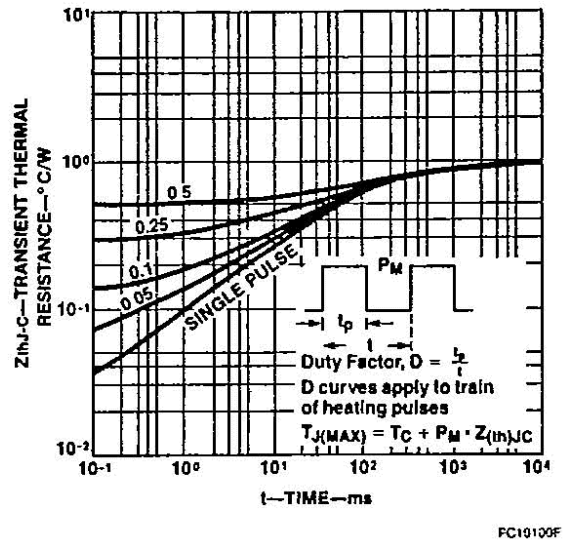


Figure 8 Transient Thermal Resistance vs Time



Typical Electrical Characteristics

Figure 9 Switching Test Circuit

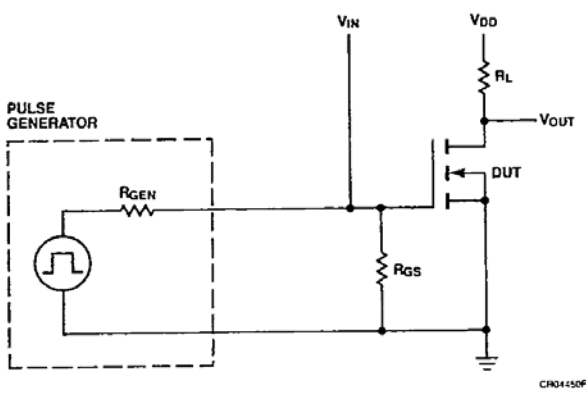


Figure 10 Switching Waveforms

