

FAIRCHILD SEMICONDUCTOR

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**FAIRCHILD**

A Schlumberger Company

**IRF220-223/IRF620-623**  
**MTP7N18/7N20** *T-39-11*  
**N-Channel Power MOSFETs,**  
**7 A, 150-200 V**

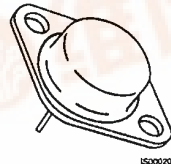
Power And Discrete Division

**Description**

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

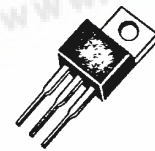
- Low  $R_{DS(on)}$
- $V_{GS}$  Rated at  $\pm 20$  V
- Silicon Gate for Fast Switching Speeds
- $I_{DSS}, V_{DS(on)}$  Specified at Elevated Temperature
- Rugged
- Low Drive Requirements
- Ease of Paralleling

TO-204AA



IRF220  
 IRF221  
 IRF222  
 IRF223

TO-220AB



IRF620  
 IRF621  
 IRF622  
 IRF623  
 MTP7N18  
 MTP7N20

**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
IRF220	200 V	0.8 $\Omega$	5.0 A	3.0 A	TO-204AA
IRF221	150 V	0.8 $\Omega$	5.0 A	3.0 A	
IRF222	200 V	1.2 $\Omega$	4.0 A	2.5 A	
IRF223	150 V	1.2 $\Omega$	4.0 A	2.5 A	
IRF620	200 V	0.8 $\Omega$	5.0 A	3.0 A	TO-220AB
IRF621	150 V	0.8 $\Omega$	5.0 A	3.0 A	
IRF622	200 V	1.2 $\Omega$	4.0 A	2.5 A	
IRF623	150 V	1.2 $\Omega$	4.0 A	2.5 A	
MTP7N18	180 V	0.7 $\Omega$	7.0 A	4.5 A	
MTP7N20	200 V	0.7 $\Omega$	7.0 A	4.5 A	

**Notes**

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



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**Maximum Ratings**

Symbol	Characteristic	Rating IRF220/222 IRF620/622 MTP7N20	Rating MTP7N18	Rating IRF222/223 IRF622/623	Unit
V <sub>DSS</sub>	Drain to Source Voltage <sup>1</sup>	200	180	150	V
V <sub>DGR</sub>	Drain to Gate Voltage <sup>1</sup> R <sub>GS</sub> = 20 kΩ	200	180	150	V
V <sub>GS</sub>	Gate to Source Voltage	± 20	± 20	± 20	V
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperatures	-55 to +150	-55 to +150	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5 s	275	275	275	°C

**Maximum Thermal Characteristics**

		IRF220 - 223/IRF620 - 623	MTP7N18/20	
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	3.12	1.67	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	30/80	80	°C/W
P <sub>D</sub>	Total Power Dissipation at T <sub>C</sub> = 25°C	40	75	W
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	20	20	A

**Electrical Characteristics (T<sub>C</sub> = 25°C unless otherwise noted)**

Symbol	Characteristic	Min	Max	Unit	Test Conditions
V <sub>(BR)DSS</sub>	Drain Source Breakdown Voltage <sup>1</sup> IRF220/222/620/622/ MTP7N20 MTP7N18 IRF221/223/621/623	200		V	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA
		180			
		150			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		250	μA	V <sub>DS</sub> = Rated V <sub>DSS</sub> , V <sub>GS</sub> = 0 V
			1000	μA	V <sub>DS</sub> = 0.8 x Rated V <sub>DSS</sub> , V <sub>GS</sub> = 0 V, T <sub>C</sub> = 125°C
I <sub>GSS</sub>	Gate-Body Leakage Current IRF220-223 IRF620-623/MTP7N18/20		± 100 ± 500	nA	V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> = 0 V

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

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>On Characteristics</b>					
$V_{GS(th)}$	Gate Threshold Voltage			V	
	IRF220-223/IRF620-623	2.0	4.0		$I_D = 250 \mu\text{A}$ , $V_{DS} = V_{GS}$
	MTP7N18/20	2.0	4.5		$I_D = 1 \text{ mA}$ , $V_{DS} = V_{GS}$
$R_{DS(on)}$	Static Drain-Source On-Resistance <sup>2</sup>			$\Omega$	$V_{GS} = 10 \text{ V}$ , $I_D = 2.5 \text{ A}$
	IRF220/221/620/621		0.8		
	IRF222/223/622/623		1.2		
	MTP7N18/7N20		0.7		$I_D = 3.5 \text{ A}$
$V_{DS(on)}$	Drain-Source On-Voltage <sup>2</sup>		2.45	V	$V_{GS} = 10 \text{ V}$ ; $I_D = 3.5 \text{ A}$
	MTP7N18/7N20		5.9	V	$V_{GS} = 10 \text{ V}$ ; $I_D = 7.0 \text{ A}$
			5.0	V	$V_{GS} = 10 \text{ V}$ , $I_D = 3.5 \text{ A}$ $T_C = 100^\circ\text{C}$
$g_{fs}$	Forward Transconductance	1.3		S ( $\Omega$ )	$V_{DS} = 10 \text{ V}$ , $I_D = 2.5 \text{ A}$

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance		600	pF	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ $f = 1.0 \text{ MHz}$
$C_{oss}$	Output Capacitance		300	pF	
$C_{rss}$	Reverse Transfer Capacitance		80	pF	

**Switching Characteristics** ( $T_C = 25^\circ\text{C}$ , Figures 1, 2)<sup>3</sup>

$t_{d(on)}$	Turn-On Delay Time		40	ns	$V_{DD} = 100 \text{ V}$ , $I_D = 2.5 \text{ A}$ $V_{GS} = 10 \text{ V}$ , $R_{GEN} = 50 \Omega$ $R_{GS} = 50 \Omega$
$t_r$	Rise Time		60	ns	
$t_{d(off)}$	Turn-Off Delay Time		100	ns	
$t_f$	Fall Time		60	ns	
$Q_g$	Total Gate Charge		15	nC	$V_{GS} = 10 \text{ V}$ , $I_D = 6.0 \text{ A}$ $V_{DD} = 45 \text{ V}$

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
<b>Source-Drain Diode Characteristics</b>					
$V_{SD}$	Diode Forward Voltage		1.8	V	$I_S = 5.0 \text{ A}$ ; $V_{GS} = 0 \text{ V}$
			1.4	V	$I_S = 4.0 \text{ A}$ ; $V_{GS} = 0 \text{ V}$
$t_{rr}$	Reverse Recovery Time	350		ns	$I_S = 5.0 \text{ A}$ ; $di_S/dt = 25 \text{ A}/\mu\text{S}$

**Notes**

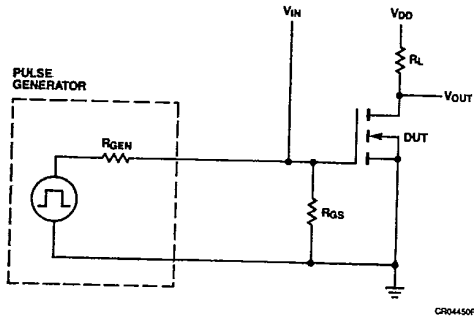
- $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$
- Pulse width limited by  $T_J$
- Switching time measurements performed on LEM TR-58 test equipment.

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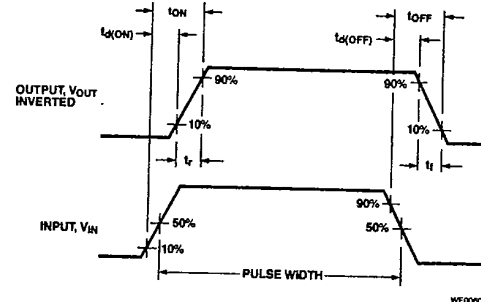
Typical Electrical Characteristics

Figure 1 Switching Test Circuit



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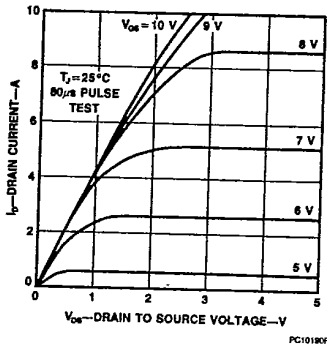
Figure 2 Switching Waveforms



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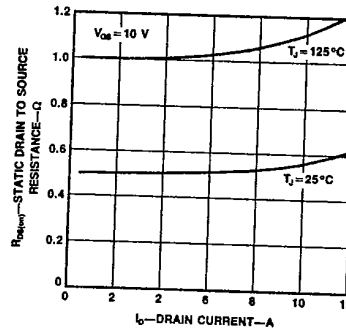
Typical Performance Curves

Figure 3 Output Characteristics



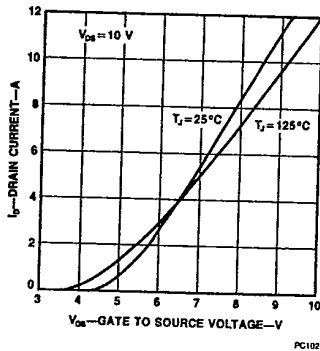
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Figure 4 Static Drain to Source Resistance vs Drain Current



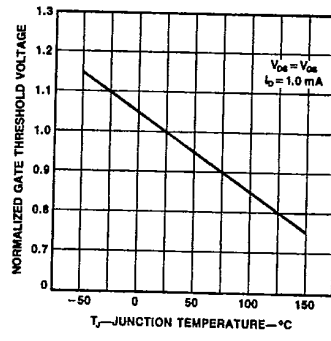
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Figure 5 Transfer Characteristics



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Figure 6 Temperature Variation of Gate to Source Threshold Voltage



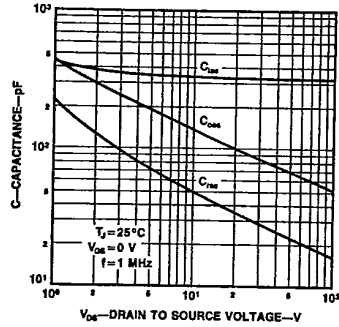
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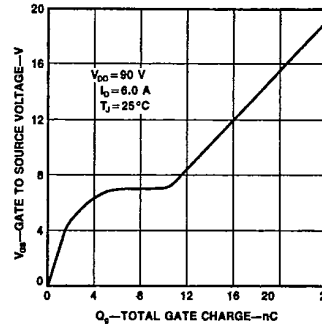
**Typical Performance Curves (Cont)**

**Figure 7 Capacitance vs Drain to Source Voltage**



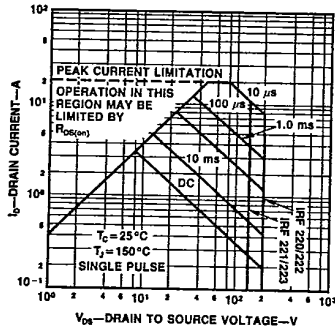
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**Figure 8 Gate to Source Voltage vs Total Gate Charge**



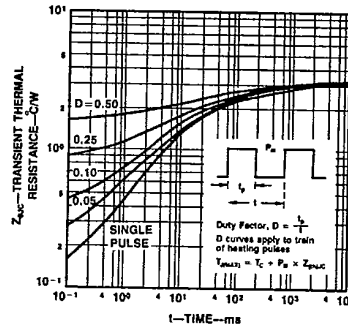
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**Figure 9 Forward Biased Safe Operating Area for IRF220-223 and IRF620-623**



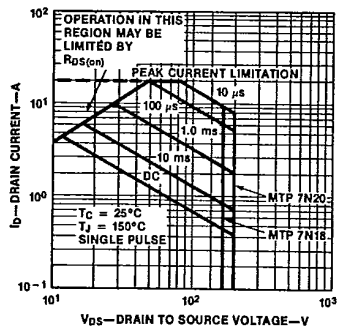
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**Figure 10 Transient Thermal Resistance vs Time for IRF220-223 and IRF620-623**



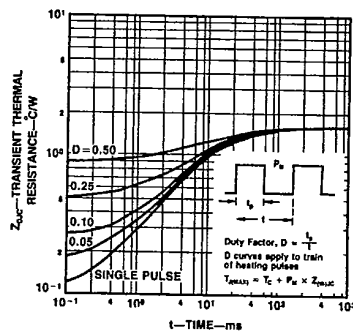
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**Figure 11 Forward Biased Safe Operating Area for MTP7N18/7N20**



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**Figure 12 Transient Thermal Resistance vs Time for MTP7N18/7N20**



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