FAIRCHILD
A Schlumberger Company

IRF320-323/IRF720-723 MTP3N35/3N40 N-Channel Power MOSFETs, 3.0 A, 350-400 V

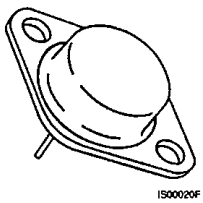
Power And Discrete Division

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.

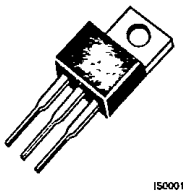
- **Low $R_{DS(on)}$**
- **V_{GS} Rated at ±20 V**
- **Silicon Gate for Fast Switching Speeds**
- **I_{DSS}, $V_{DS(on)}$, Specified at Elevated Temperature**
- **Rugged**
- **Low Drive Requirements**
- **Ease of Paralleling**

TO-204AA



IRF320
IRF321
IRF322
IRF323

TO-220AB



IRF720
IRF721
IRF722
IRF723
MTP3N35
MTP3N40

Product Summary

Part Number	V_{DSS}	$R_{DS\ (on)}$	I_D at $T_C = 25°C$	I_D at $T_C = 100°C$	Case Style
IRF320	400 V	1.8 Ω	3.0 A	2.0 A	TO-204AA
IRF321	350 V	1.8 Ω	3.0 A	2.0 A	
IRF322	400 V	2.5 Ω	2.5 A	1.5 A	
IRF323	350 V	2.5 Ω	2.5 A	1.5 A	
IRF720	400 V	1.8 Ω	3.0 A	2.0 A	TO-220AB
IRF721	350 V	1.8 Ω	3.0 A	2.0 A	
IRF722	400 V	2.5 Ω	2.5 A	1.5 A	
IRF723	350 V	2.5 Ω	2.5 A	1.5 A	
MTP3N35	350 V	3.3 Ω	3.0 A	2.0 A	
MTP3N40	400 V	3.3 Ω	3.0 A	2.0 A	

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

Maximum Ratings

Symbol	Characteristic	Rating IRF320/322 IRF720/722 MTP3N40	Rating IRF321/323 IRF721/723 MTP3N35	Unit
V_{DSS}	Drain to Source Voltage[2]	400	350	V
V_{DGR}	Drain to Gate Voltage[2] R_{GS} = 20 kΩ	400	350	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

		IRF320-323/ IRF720-723	MTP3N35/3N40	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.12	1.67	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	30/80	80	°C/W
P_D	Total Power Dissipation at T_C = 25°C	40	75	W
I_{DM}	Pulsed Drain Current[2]	12	12	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]			V	V_{GS} = 0 V, I_D = 250 μA
	IRF320/322/720/722/ MTP3N40	400			
	IRF321/323/721/723/ MTP3N35	350			
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 IRF320-323 IRF720-723/MTP3N35/3N40		±100 ±500	nA	V_{GS} = ±20 V, V_{DS} = 0 V

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

Symbol	Characteristic	Min	Max	Unit	Test Conditions
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage			V	
	IRF320-323/IRF720-723	2.0	4.0		I_D = 250 μA, V_{DS} = V_{GS}
	MTP3N35/40	2.0	4.5		I_D = 1 mA, V_{DS} = V_{GS}
$R_{DS(on)}$	Static Drain-Source On-Resistance[2]			Ω	V_{GS} = 10 V, I_D = 1.5 A
	IRF320/321/720/721		1.8		
	IRF322/323/722/723		2.5		
	MTP3N35/40		3.3		
$V_{DS(on)}$	Drain-Source On-Voltage[2] MTP3N35/40		12	V	V_{GS} = 10 V; I_D = 3.0 A;
			10	V	V_{GS} = 10 V; I_D = 1.5 A; T_C = 100°C
g_{fs}	Forward Transconductance	1.0		S (℧)	V_{DS} = 10 V, I_D = 1.5 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		500	pF	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz
C_{oss}	Output Capacitance		100	pF	
C_{rss}	Reverse Transfer Capacitance		40	pF	
Switching Characteristics (T_C = 200°C, *Figures 1, 2*)[3]					
$t_{d(on)}$	Turn-On Delay Time		40	ns	V_{DD} = 200 V, I_D = 1.5 A V_{GS} = 10 V, R_{GEN} = 50 Ω R_{GS} = 50 Ω
t_r	Rise Time		50	ns	
$t_{d(off)}$	Turn-Off Delay Time		100	ns	
t_f	Fall Time		50	ns	
Q_g	Total Gate Charge		15	nC	V_{GS} = 10 V, I_D = 4.0 A V_{DD} = 200 V

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
Source-Drain Diode Characteristics					
V_{SD}	Diode Forward Voltage IRF320/321/720/721		1.6	V	I_S = 3.0 A; V_{GS} = 0 V
	IRF322/323/722/723		1.5	V	I_S = 2.5 A; V_{GS} = 0 V
t_{rr}	Reverse Recovery Time	450		ns	I_F = 3.0 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%
3. Switching time measurements performed on LEM TR-58 test equipment.

Typical Electrical Characteristics

Figure 1 Switching Test Circuit

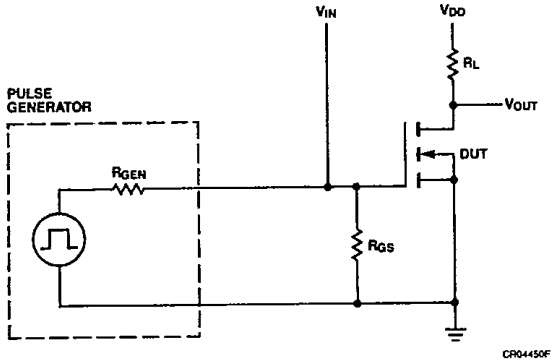
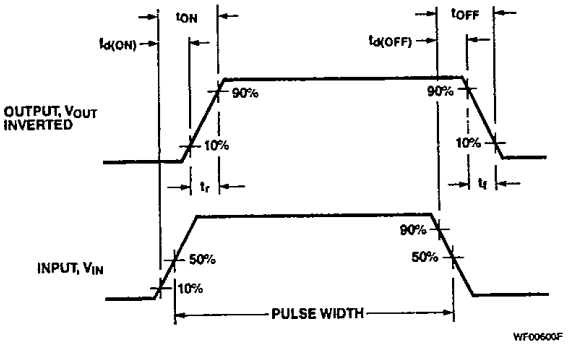


Figure 2 Switching Waveforms



Typical Performance Curves

Figure 3 Output Characteristics

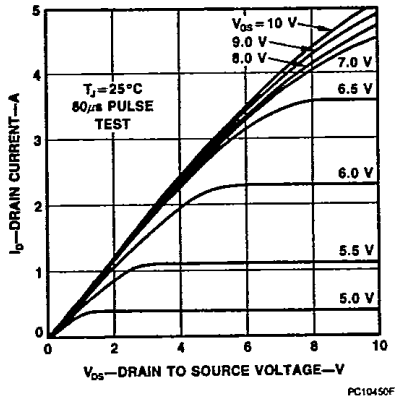


Figure 4 Static Drain to Source Resistance vs Drain Current

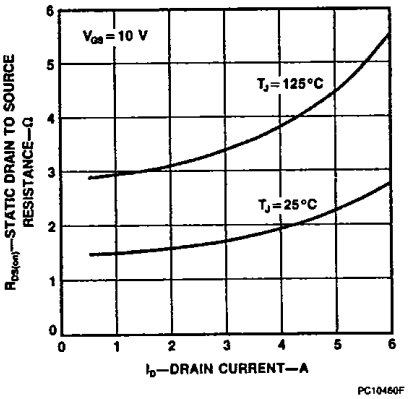


Figure 5 Transfer Characteristics

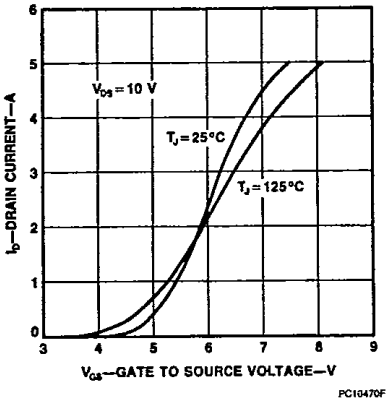
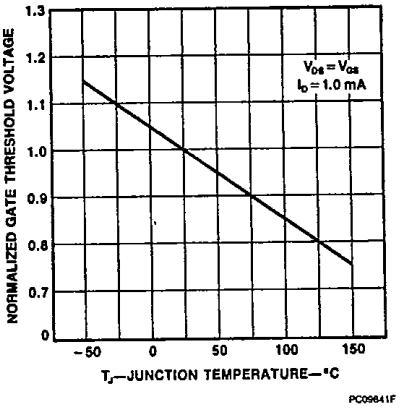


Figure 6 Temperature Variation of Gate to Source Threshold Voltage



Typical Performance Curves (Cont.)

Figure 7 Capacitance vs Drain to Source Voltage

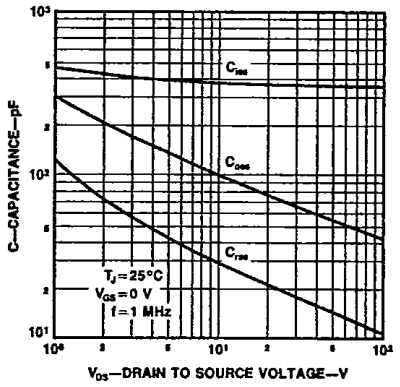


Figure 8 Gate to Source Voltage vs Total Gate Charge

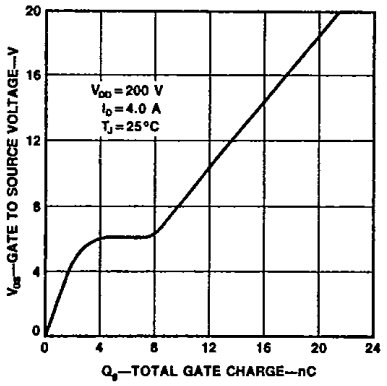


Figure 9 Forward Biased Safe Operating Area for IRF320-323 and IRF720-723

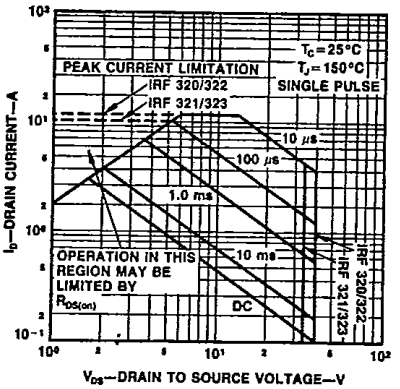


Figure 10 Transient Thermal Resistance vs Time for IRF320-323 and IRF720-723

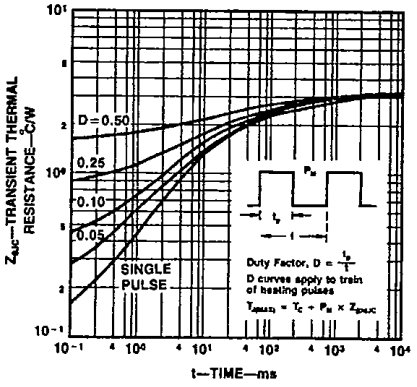


Figure 11 Forward Biased Safe Operating Area for MTP3N35/3N40

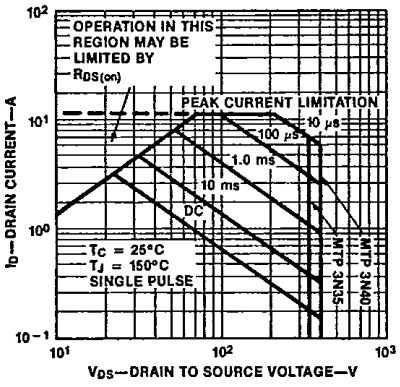


Figure 12 Transient Thermal Resistance vs Time for MTP3N35/3N40