FAIRCHILD
A Schlumberger Company

IRF610-613 MTP2N18/2N20 N-Channel Power MOSFETs, 3.5 A, 150-200 V

T-39-09

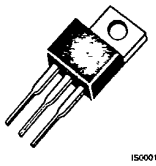
Power And Discrete Division

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-220AB



IS00010F

IRF610
IRF611
IRF612
IRF613
MTP2N18
MTP2N20

Maximum Ratings

Symbol	Characteristic	Rating IRF610/612 MTP2N20	Rating MTP2N18	Rating IRF611/613	Unit
V_{DSS}	Drain to Source Voltage[1]	200	180	150	V
V_{DGR}	Drain to Gate Voltage[1] R_{GS} = 20 kΩ	200	180	150	V
V_{GS}	Gate to Source Voltage	±20	±20	±20	V
T_J, T_{stg}	Operating Junction and Storage Temperatures	−55 to +150	−55 to +150	−55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5 s	275	275	275	°C

Maximum On-State Characteristics

		IRF610/611	MTP2N18/20	IRF612/613	
$R_{DS(on)}$	Static Drain-to-Source On Resistance	1.5	1.8	2.4	Ω
I_D	Drain Current				A
	Continuous at T_C = 25°C	2.5	3.25	2.0	
	Continuous at T_C = 100°C	1.5	2.25	1.25	
	Pulsed	10	9.0	8.0	

Maximum Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	6.4	2.5	6.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	80	80	80	°C/W
P_D	Total Power Dissipation at T_C = 25°C	20	50	20	W

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

IRF610-613
MTP2N18/2N20

T-39-09

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
	IRF610/612/MTP2N20	200			
	MTP2N18	180			
	IRF611/613	150			
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		±500	nA	V_{GS} = ±20 V, V_{DS} = 0 V
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage			V	
	IRF610-613	2.0	4.0		I_D = 250 μA, V_{DS} = V_{GS}
	MTP2N18/20	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 = 1.25 A
	IRF610/611		1.5		
	IRF612/613		2.4		I_D = 1.0 A
	MTP2N18/20		1.8		
$V_{DS(on)}$	Drain-Source On-Voltage[2]		4.4	V	V_{GS} = 10 V; I_D = 2.0 A
	MTP2N18/2N20		3.6	V	V_{GS} = 10 V; I_D = 1.0 A; T_C = 100°C
g_{fs}	Forward Transconductance	0.8		S (℧)	V_{DS} = 10 V, I_D = 1.25 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		200	pF	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz
C_{oss}	Output Capacitance		80	pF	
C_{rss}	Reverse Transfer Capacitance		25	pF	
Switching Characteristics (T_C = 25°C, *Figures 11, 12*)[3]					
$t_{d(on)}$	Turn-On Delay Time		15	ns	V_{DD} = 50 V, I_D = 1.25 A V_{GS} = 10 V, R_{GEN} = 50 Ω R_{GS} = 50 Ω
t_r	Rise Time		25	ns	
$t_{d(off)}$	Turn-Off Delay Time		15	ns	
t_f	Fall Time		15	ns	
Q_g	Total Gate Charge		7.5	nC	V_{GS} = 10 V, I_D = 3.0 A V_{DD} = 45 V

IRF610-613
MTP2N18/2N20

T-39-09

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

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
Source-Drain Diode Characteristics					
V_{SD}	Diode Forward Voltage IRF610/611		2.0	V	I_S = 2.5 A; V_{GS} = 0 V
	IRF612/613		1.8	V	I_S = 2.0 A; V_{GS} = 0 V
t_{rr}	Reverse Recovery Time	290		ns	I_S = 2.5 A; dI_S/dt = 25 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 Performance Curves

Figure 1 Output Characteristics

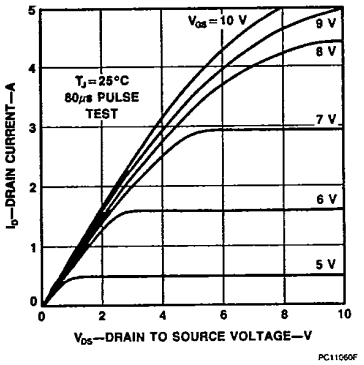


Figure 2 Static Drain to Source Resistance vs Drain Current

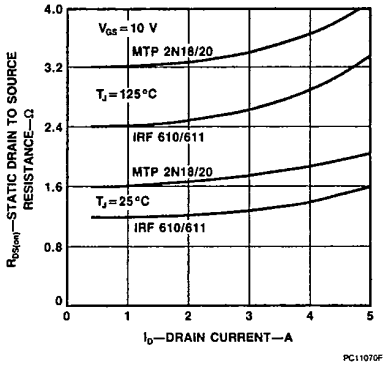


Figure 3 Transfer Characteristics

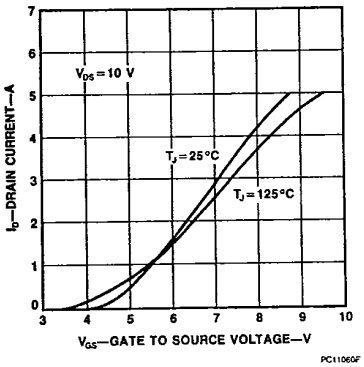
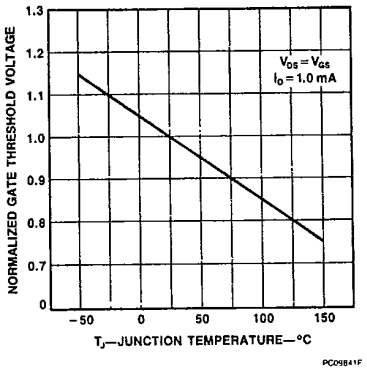


Figure 4 Temperature Variation of Gate to Source Threshold Voltage



Typical Performance Curves (Cont.)

Figure 5 Capacitance vs Drain to Source Voltage

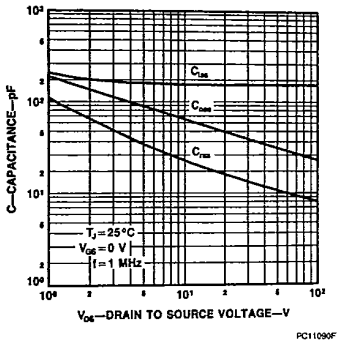


Figure 6 Gate to Source Voltage vs Total Gate Charge

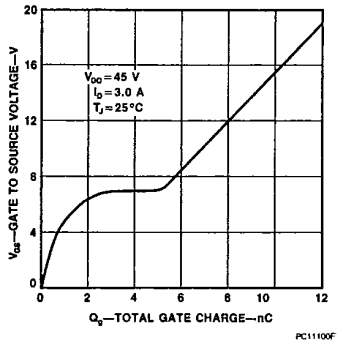


Figure 7 Forward Biased Safe Operating Area for MTP2N18/2N20

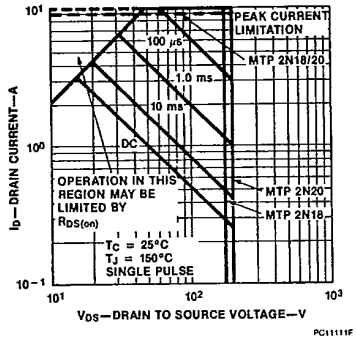


Figure 8 Transient Thermal Resistance vs Time for MTP2N18/2N20

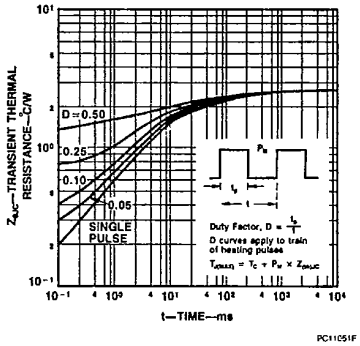


Figure 9 Forward Biased Safe Operating Area for IRF610-613

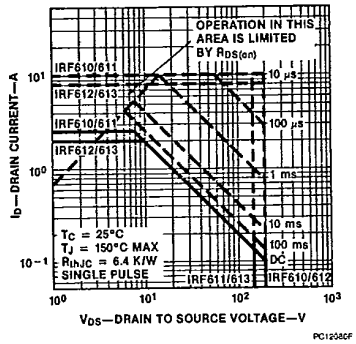
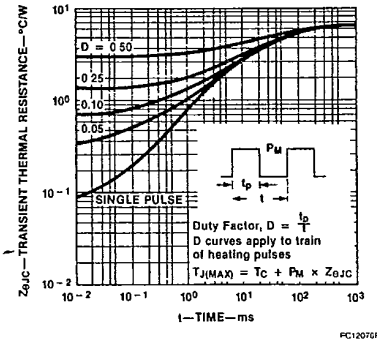


Figure 10 Transient Thermal Resistance for IRF610-613



Typical Electrical Characteristics

Figure 11 Switching Test Circuit

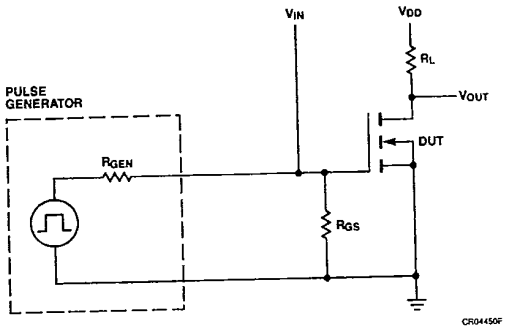


Figure 12 Switching Waveforms