

**FAIRCHILD**

A Schlumberger Company

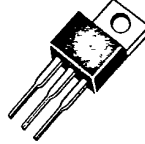
IRF610-613  
MTP2N18/2N20  
N-Channel Power MOSFETs,  
3.5 A, 150-200 V  
Power And Discrete Division

J-39-09

**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-220AB**

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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 <sup>1</sup>	200	180	150	V
$V_{DGR}$	Drain to Gate Voltage <sup>1</sup> $R_{GS} = 20 \text{ k}\Omega$	200	180	150	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	$\pm 20$	$\pm 20$	V
$T_J$ , $T_{stg}$	Operating Junction and Storage Temperatures	-55 to +150	-55 to +150	-55 to +150	$^{\circ}\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5 s	275	275	275	$^{\circ}\text{C}$

**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	$\Omega$
$I_D$	Drain Current				A
	Continuous at $T_C = 25^{\circ}\text{C}$	2.5	3.25	2.0	
	Continuous at $T_C = 100^{\circ}\text{C}$	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	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	80	80	80	$^{\circ}\text{C}/\text{W}$
$P_D$	Total Power Dissipation at $T_C = 25^{\circ}\text{C}$	20	50	20	W

**Notes**

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

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

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>Off Characteristics</b>					
$V_{(BR)DSS}$	Drain Source Breakdown Voltage <sup>1</sup>			V	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$
	IRF610/612/MTP2N20	200			
	MTP2N18	180			
	IRF611/613	150			
$I_{DSS}$	Zero Gate Voltage Drain Current		250	$\mu\text{A}$	$V_{DS} = \text{Rated } V_{DSS}, V_{GS} = 0\text{ V}$
			1000	$\mu\text{A}$	$V_{DS} = 0.8 \times \text{Rated } V_{DSS}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$
$I_{GSS}$	Gate-Body Leakage Current		$\pm 500$	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
<b>On Characteristics</b>					
$V_{GS(th)}$	Gate Threshold Voltage			V	$I_D = 250\ \mu\text{A}, V_{DS} = V_{GS}$ $I_D = 1\text{ mA}, V_{DS} = V_{GS}$
	IRF610-613	2.0	4.0		
	MTP2N18/20	2.0	4.5		
$R_{DS(on)}$	Static Drain-Source On-Resistance <sup>2</sup>			$\Omega$	$V_{GS} = 10\text{ V}, I_D = 1.25\text{ A}$  $I_D = 1.0\text{ A}$
	IRF610/611		1.5		
	IRF612/613		2.4		
	MTP2N18/20		1.8		
$V_{DS(on)}$	Drain-Source On-Voltage <sup>2</sup>		4.4	V	$V_{GS} = 10\text{ V}; I_D = 2.0\text{ A}$
	MTP2N18/2N20		3.6	V	$V_{GS} = 10\text{ V}; I_D = 1.0\text{ A}; T_C = 100^\circ\text{C}$
$g_{fs}$	Forward Transconductance	0.8		S ( $\Omega$ )	$V_{DS} = 10\text{ V}, I_D = 1.25\text{ A}$
<b>Dynamic Characteristics</b>					
$C_{iss}$	Input Capacitance		200	pF	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ $f = 1.0\text{ MHz}$
$C_{oss}$	Output Capacitance		80	pF	
$C_{rss}$	Reverse Transfer Capacitance		25	pF	
<b>Switching Characteristics</b> ( $T_C = 25^\circ\text{C}$ , Figures 11, 12) <sup>3</sup>					
$t_{d(on)}$	Turn-On Delay Time		15	ns	$V_{DD} = 50\text{ V}, I_D = 1.25\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 50\ \Omega$ $R_{GS} = 50\ \Omega$
$t_r$	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	$V_{GS} = 10\text{ V}, I_D = 3.0\text{ A}$ $V_{DD} = 45\text{ V}$

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

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
<b>Source-Drain Diode Characteristics</b>					
$V_{SD}$	Diode Forward Voltage IRF610/611		2.0	V	$I_S = 2.5 \text{ A}; V_{GS} = 0 \text{ V}$
	IRF612/613		1.8	V	$I_S = 2.0 \text{ A}; V_{GS} = 0 \text{ V}$
$t_{rr}$	Reverse Recovery Time	290		ns	$I_S = 2.5 \text{ A}; di_S/dt = 25 \text{ A}/\mu\text{S}$

Notes

- $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$
- Pulse test: Pulse width  $\leq 80 \mu\text{s}$ , Duty cycle  $\leq 1\%$
- Switching time measurements performed on LEM TR-58 test equipment.

Typical Performance Curves

Figure 1 Output Characteristics

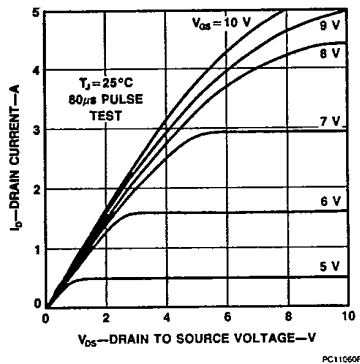


Figure 2 Static Drain to Source Resistance vs Drain Current

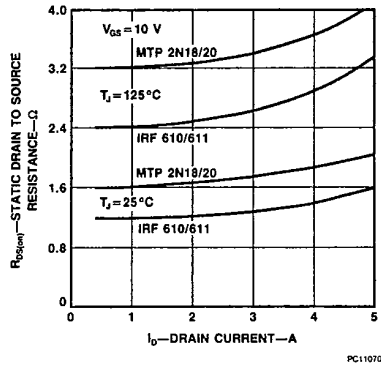


Figure 3 Transfer Characteristics

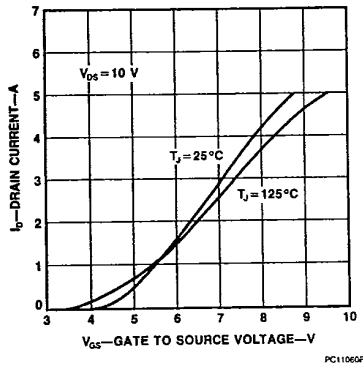
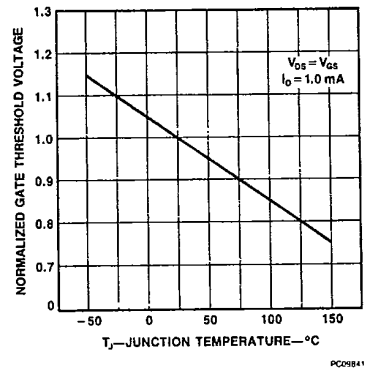


Figure 4 Temperature Variation of Gate to Source Threshold Voltage



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Typical Performance Curves (Cont.)

Figure 5 Capacitance vs Drain to Source Voltage

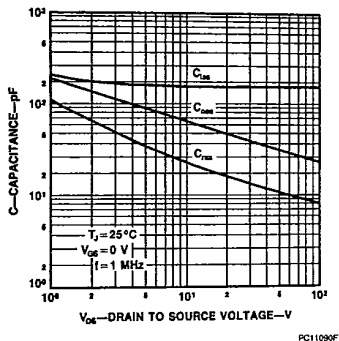


Figure 6 Gate to Source Voltage vs Total Gate Charge

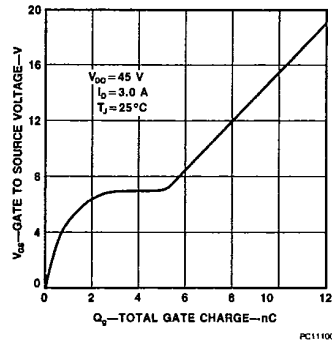


Figure 7 Forward Biased Safe Operating Area for MTP2N18/2N20

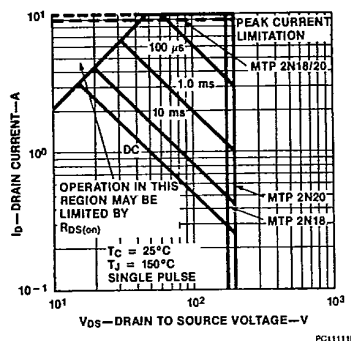


Figure 8 Transient Thermal Resistance vs Time for MTP2N18/2N20

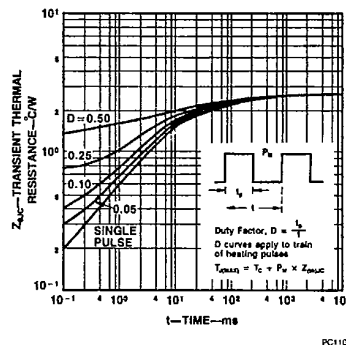


Figure 9 Forward Biased Safe Operating Area for IRF610-613

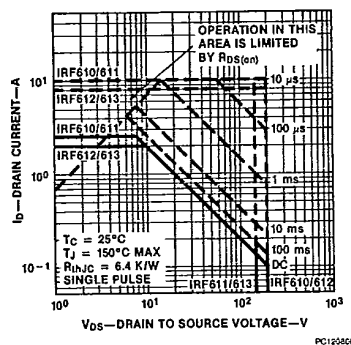
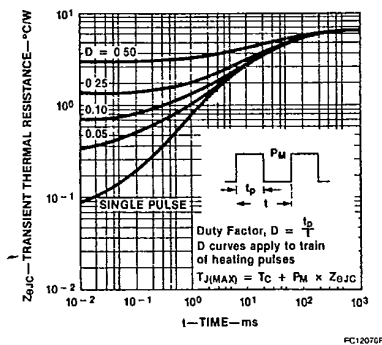


Figure 10 Transient Thermal Resistance for IRF610-613



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Typical Electrical Characteristics  
Figure 11 Switching Test Circuit

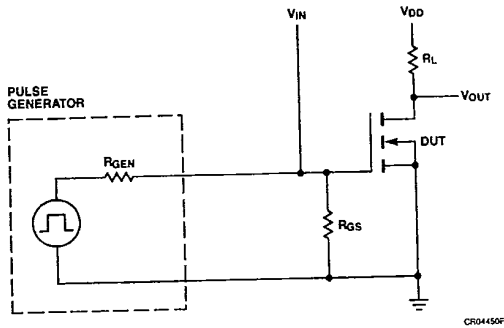
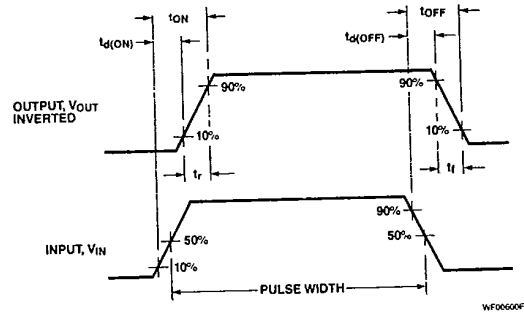


Figure 12 Switching Waveforms



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