FAIRCHILD
A Schlumberger Company

IRF710-713 MTP2N35/2N40 N-Channel Power MOSFETs, 2.25 A, 350-400 V

T-39-09

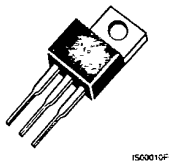
Power And Discrete Division

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 driver and high energy 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



IRF710
IRF711
IRF712
IRF713
MTP2N35
MTP2N40

Maximum Ratings

Symbol	Characteristic	Rating IRF710/712 MTP2N40	Rating IRF711/713 MTP2N35	Unit
V_{DSS}	Drain to Source Voltage[1]	400	350	V
V_{DGR}	Drain to Gate Voltage[1] 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 On-State Characteristics

		IRF710-711	IRF712-713	MTP2N35/40	Unit
$R_{DS(on)}$	Static Drain-to-Source On Resistance	3.6	5.0	5.0	Ω
I_D	Drain Current				A
	Continuous at T_C = 25°C	1.5	1.4	1.3	
	Continuous at T_C = 100°C	1.0	0.9	0.8	
	Pulsed	6.0	5.0	5.0	

Maximum Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	6.4	6.4	2.5	°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	20	50	W

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

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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
	IRF710/712/MTP2N40	400			
	IRF711/713/MTP2N35	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		±500	nA	V_{GS} = ±20 V, V_{DS} = 0 V
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage			V	
	IRF710-713	2.0	4.0		I_D = 250 μA, V_{DS} = V_{GS}
	MTP2N35/2N40	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 = 0.8 A
	IRF710/711		3.6		
	IRF712/713/MTP2N35/40		5.0		
$V_{DS(on)}$	Drain-Source On-Voltage[2]		13	V	V_{GS} = 10 V, I_D = 2.0 A
	MTP2N35/2N40		10	V	V_{GS} = 10 V, I_D = 1.0 A, T_C = 100°C
g_{fs}	Forward Transconductance	0.5		S (℧)	V_{DS} = 10 V, I_D = 0.8 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		50	pF	
C_{rss}	Reverse Transfer Capacitance		15	pF	
Switching Characteristics (T_C = 25°C, *Figures 11, 12*)[3]					
$t_{d(on)}$	Turn-On Delay Time		10	ns	V_{DD} = 200 V, I_D = 0.8 A V_{GS} = 10 V, R_{GEN} = 50 Ω R_{GS} = 50 Ω
t_r	Rise Time		20	ns	
$t_{d(off)}$	Turn-Off Delay Time		10	ns	
t_f	Fall Time		15	ns	
Q_g	Total Gate Charge		7.5	nC	V_{GS} = 10 V, I_D = 2.0 A V_{DD} = 200 V

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				
	IRF710/711		1.6	V	$I_S = 1.5$ A; $V_{GS} = 0$ V
	IRF712/713		1.5	V	$I_S = 1.3$ A; $V_{GS} = 0$ V
t_{rr}	Reverse Recovery Time	380		ns	$I_S = 1.5$ 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

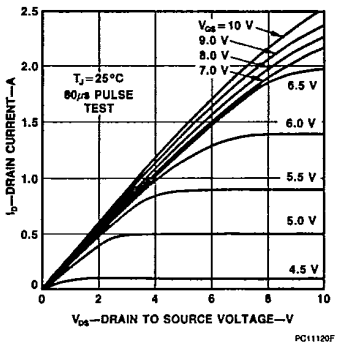


Figure 2 Static Drain to Source Resistance vs Drain Current

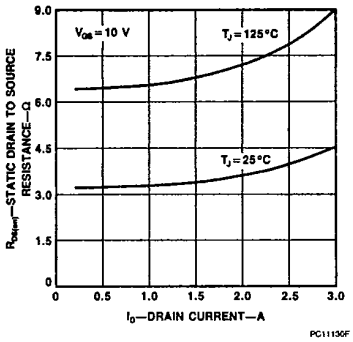


Figure 3 Transfer Characteristics

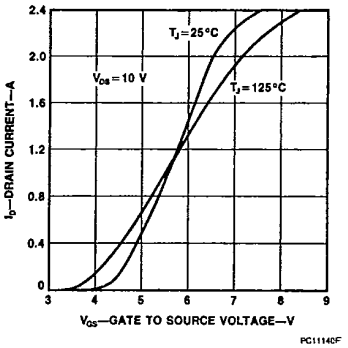
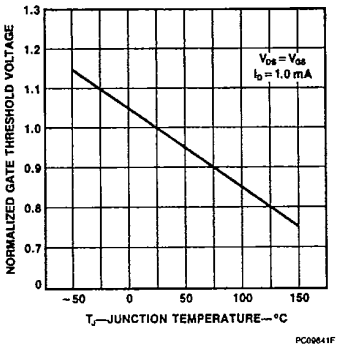


Figure 4 Temperature Variation of Gate to Source Threshold Voltage



Typical Performance Curves (Cont.)

Figure 5 Capacitance vs Drain to Source Voltage

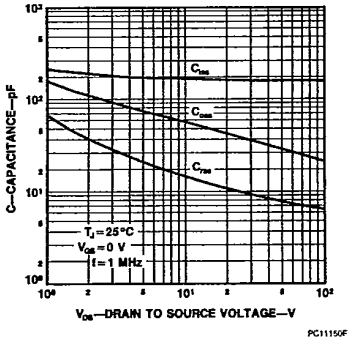


Figure 6 Gate to Source Voltage vs Total Gate Charge

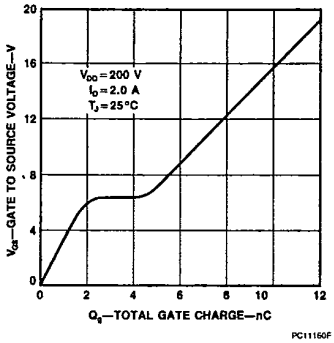


Figure 7 Forward Biased Safe Operating Area for MTP2N35/2N40

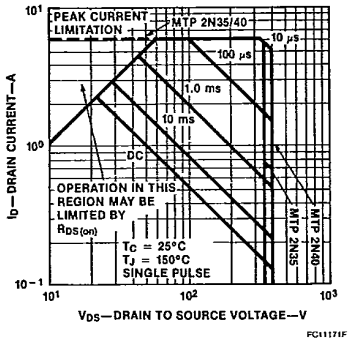


Figure 8 Transient Thermal Resistance vs Time for MTP2N35/2N40

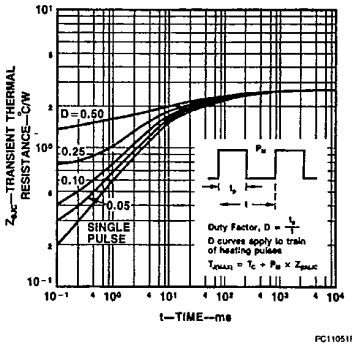


Figure 9 Forward Biased Safe Operating Area for IRF710-713

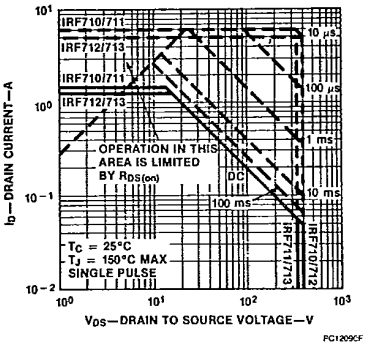
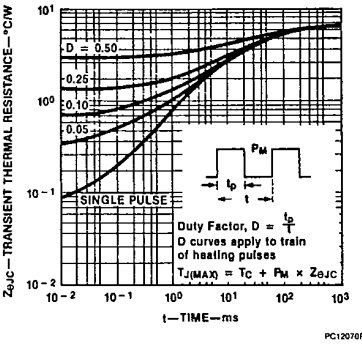


Figure 10 Transient Thermal Resistance for IRF710-713



Typical Electrical Characteristics

Figure 11 Switching Test Circuit

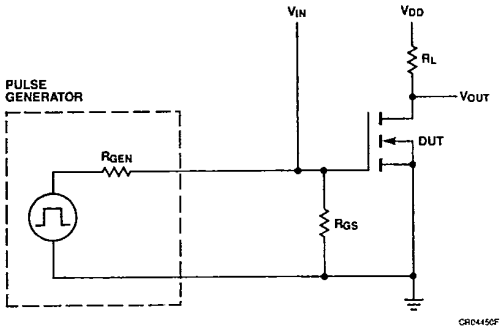
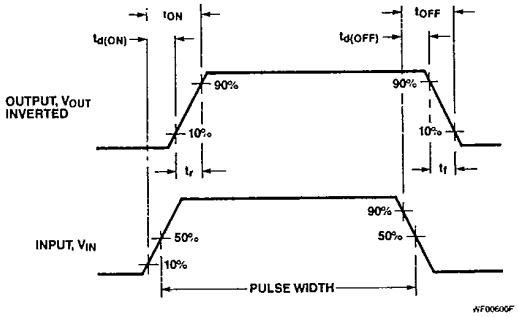


Figure 12 Switching Waveforms



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