

FAIRCHILD

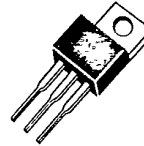
A Schlumberger Company

IRF710-713
MTP2N35/2N40 T-39.09
N-Channel Power MOSFETs,
2.25 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 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



15C0010F

 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 $R_{GS} = 20 \text{ k}\Omega$	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	$^{\circ}\text{C}$
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" From Case for 5 s	275	275	$^{\circ}\text{C}$

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 $T_C = 25^{\circ}\text{C}$	1.5	1.4	1.3	
	Continuous at $T_C = 100^{\circ}\text{C}$	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	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	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	20	50	W

Notes

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

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

Symbol	Characteristic	Min	Max	Unit	Test Conditions
Off Characteristics					
$V_{(BR)DSS}$	Drain Source Breakdown Voltage ¹			V	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$
	IRF710/712/MTP2N40	400			
	IRF711/713/MTP2N35	350			
I_{DSS}	Zero Gate Voltage Drain Current		250	μA	$V_{DS} = \text{Rated } V_{DSS}, V_{GS} = 0\text{ V}$
			1000	μA	$V_{DS} = 0.8 \times \text{Rated } V_{DSS}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$
I_{GSS}	Gate-Body Leakage Current		± 500	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage			V	$I_D = 250\text{ }\mu\text{A}, V_{DS} = V_{GS}$ $I_D = 1\text{ mA}, V_{DS} = V_{GS}$
	IRF710-713	2.0	4.0		
	MTP2N35/2N40	2.0	4.5		
$R_{DS(on)}$	Static Drain-Source On-Resistance ²			Ω	$V_{GS} = 10\text{ V}, I_D = 0.8\text{ A}$
	IRF710/711		3.6		
	IRF712/713/MTP2N35/40		5.0		
$V_{DS(on)}$	Drain-Source On-Voltage ²		13	V	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$
	MTP2N35/2N40		10	V	$V_{GS} = 10\text{ V}, I_D = 1.0\text{ A}, T_C = 100^\circ\text{C}$
g_{fs}	Forward Transconductance	0.5		S (Ω)	$V_{DS} = 10\text{ V}, I_D = 0.8\text{ A}$
Dynamic Characteristics					
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		50	pF	
C_{rss}	Reverse Transfer Capacitance		15	pF	
Switching Characteristics ($T_C = 25^\circ\text{C}$, Figures 11, 12) ³					
$t_{d(on)}$	Turn-On Delay Time		10	ns	$V_{DD} = 200\text{ V}, I_D = 0.8\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 50\text{ }\Omega$ $R_{GS} = 50\text{ }\Omega$
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	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$ $V_{DD} = 200\text{ V}$

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

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
V_{SD}	Diode Forward Voltage				
	IRF710/711		1.6	V	$I_S = 1.5 \text{ A}; V_{GS} = 0 \text{ V}$
	IRF712/713		1.5	V	$I_S = 1.3 \text{ A}; V_{GS} = 0 \text{ V}$
t_{rr}	Reverse Recovery Time	380		ns	$I_S = 1.5 \text{ A}; di_S/dt = 25 \text{ A}/\mu\text{S}$

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

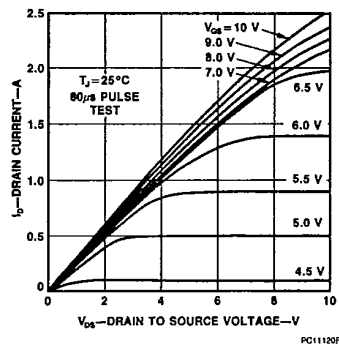


Figure 2 Static Drain to Source Resistance vs Drain Current

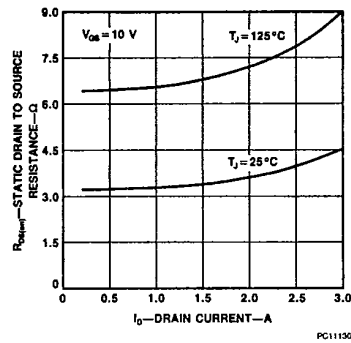


Figure 3 Transfer Characteristics

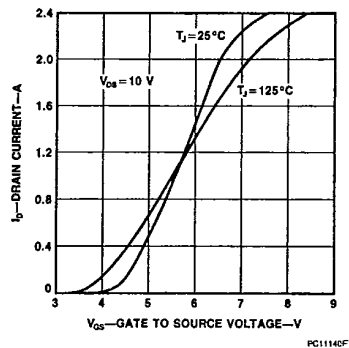
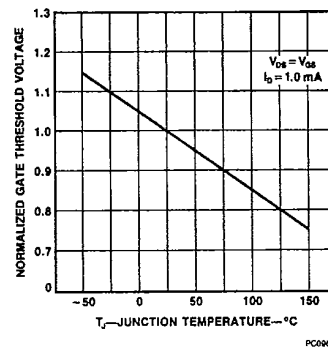
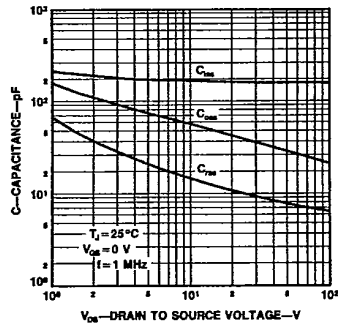


Figure 4 Temperature Variation of Gate to Source Threshold Voltage

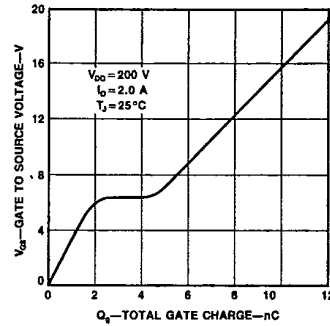


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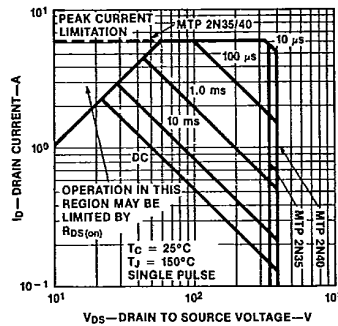
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Typical Performance Curves (Cont.)
Figure 5 Capacitance vs Drain to Source Voltage


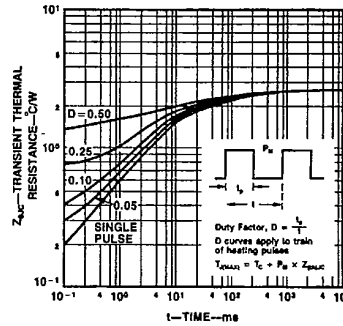
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Figure 6 Gate to Source Voltage vs Total Gate Charge


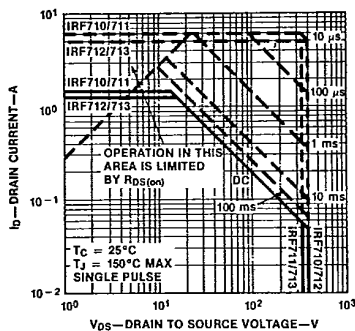
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Figure 7 Forward Biased Safe Operating Area for MTP2N35/2N40


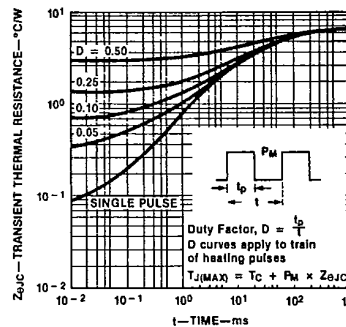
PC11171F

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


PC11051F

Figure 9 Forward Biased Safe Operating Area for IRF710-713


PC1209CF

Figure 10 Transient Thermal Resistance for IRF710-713


PC12070F

Typical Electrical Characteristics

Figure 11 Switching Test Circuit

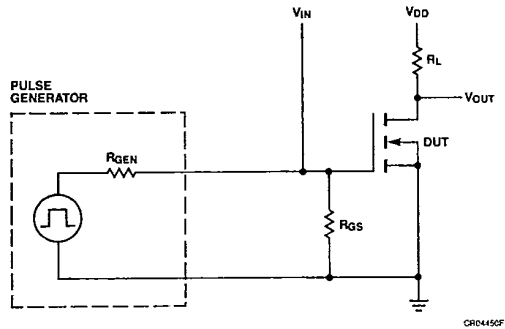


Figure 12 Switching Waveforms

