IRF710-713 / MTP2N35 / 2N40

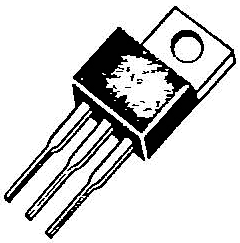
N-Channel Power MOSFETs, 2.25 A, 350-400V

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

TO-220AB



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}=20k Ω	400	350	V
V_{GS}	Gate to Source Voltage	±20	±20	V
T_J,T_{sgt}	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	NTP2N35/40	Unit
$R_{DS(on)}$	Static Drain-to-Source On Resistance	3.6	5.0	5.0	Ω
I_D	Drain Current				A
	Continuous at Tc=25°C	1.5	1.4	1.3	
	Continuous at Tc=100°C	1.0	0.9	0.8	
	Pulsed	6.0	5.0	5.0	

Maximum On-State 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 Tc=25°C	20	20	50	W

Notes

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

Electrical Characteristics (Tc=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}=0V, I_D=250μA
	IRF710/712/MTP2N40	400			
	IRF711/713/MTP2N35	350			
I_{DSS}	Zero Gate Voltage Drain Current		250	μA	V_{DS}=Rated V_{DSS}, V_{GS}=0V
			1000	μA	V_{DS}=0.8 x Rated V_{DSS}, V_{GS}=0V, Tc=125°C
I_{GSS}	Gate-Body Leakage Current		±500	μA	V_{GS}=±20V, V_{DS}=0V
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage			V	
	IRF710-713	2.0	4.0		I_D=250μA, V_{DS}=V_{GS}
	MTP2N35/2N40	2.0	4.5		I_D=1mA, V_{DS}=V_{GS}
$R_{DS(on)}$	Static Drain-Source On-Resistance[2]			Ω	V_{GS}=10V, I_D=0.8A
	IRF710/711		3.6		
	IRF712/713/MTP2N35/40		5.0		
$V_{DS(on)}$	Drain-Source On-Voltage2		13	V	V_{GS}=10V, I_D=2.0A
	MTP2N35/2N40		10	V	V_{GS}=10V, I_D=1.0A, T_C=100°C
g_{fs}	Forward Transconductance	0.5		S(℧)	V_{DS}=10V, I_D=0.8A
Dynamic Characteristics					
Ciss	Input Capacitance		200	pF	V_{DS}=25V, V_{GS}=0V f=1.0MHz
Coss	Output Capacitance		50	pF	
Crss	Reverse Transfer Capacitance		15	pF	
Switching Characteristics (Tc=25°C, Figure 11,12)[3]					
$t_{d(on)}$	Turn-On Delay Time		10	ns	V_{DD}=200V, I_D=0.8A V_{GS}=10V, 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	
Qg	Total Gate Charge		7.5	nC	V_{GS}=10V, I_D=2.0A V_{DD}=200V

Electrical Characteristics (Cont.) (Tc=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	IS=1.5A; V_{GS}=0V
	IRF712/713		1.5	V	IS=1.3A; V_{GS}=0V
trr	Reverse Recovery Time	380		ns	Is=1.5A; dI_s/dt=25A/μS

Notes

1. TJ=+25°C to +150°C
2. Pulse test: Pulse width ≤ 80μs, Duty cycle ≤1%
3. Switching time measurements performed on LEM TR-58 test equipment.

Typical Performance Curves

Figure 1 Output Characteristic

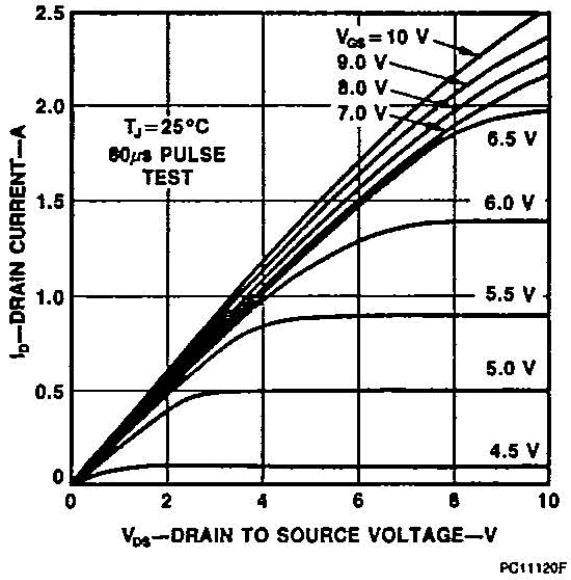


Figure 2 Static Drain to Source Resistance Vs Drain Current

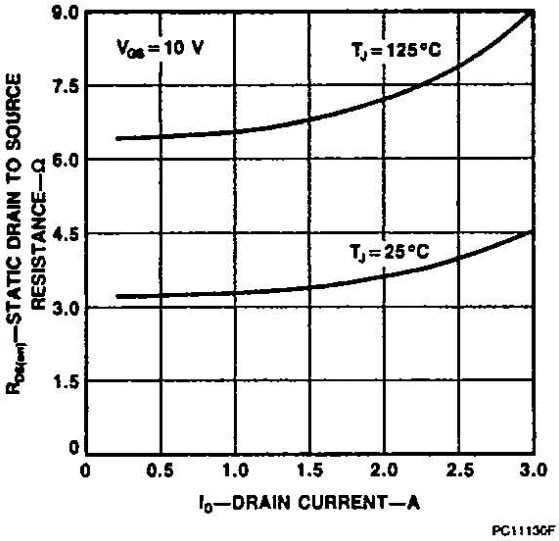


Figure 3 Transfer Characteristics

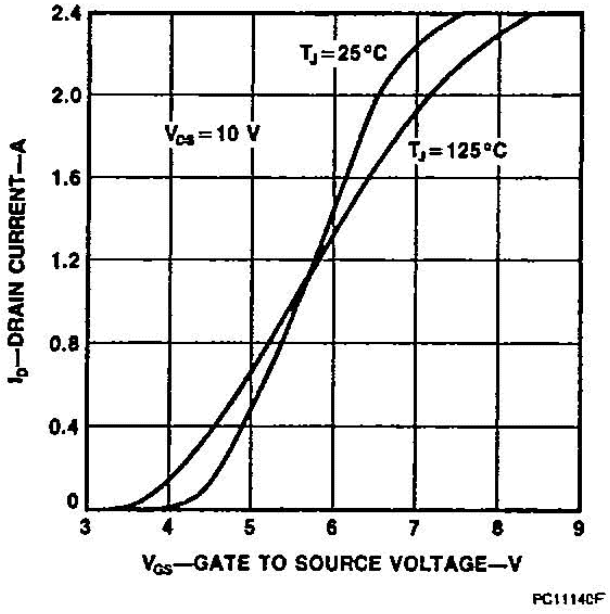
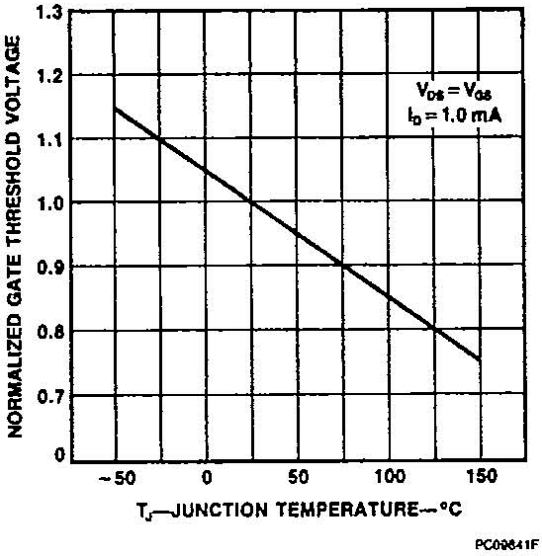


Figure 4 Temperature Variation of Gate to Source Threshold Voltage



Typical Performance Curves (Cont.)

Figure 5 Capacitance vs Drain to Source Voltage

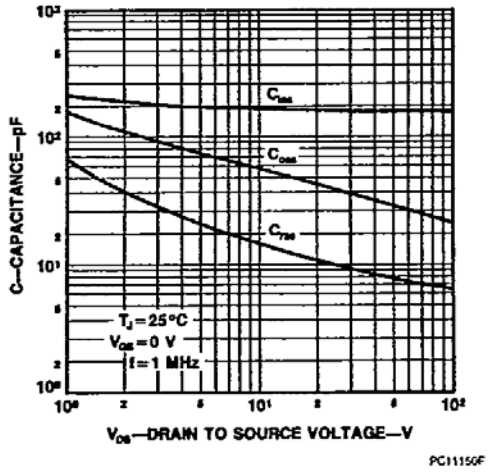


Figure 6 Gate to Source Voltage vs Total Gate Charge

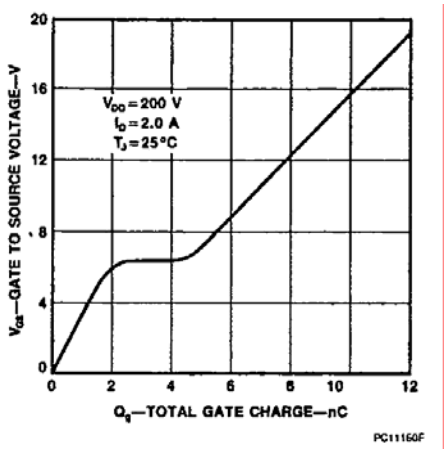


Figure 7 Forward Biased Safe Operating Area for MTP2N35/2N40

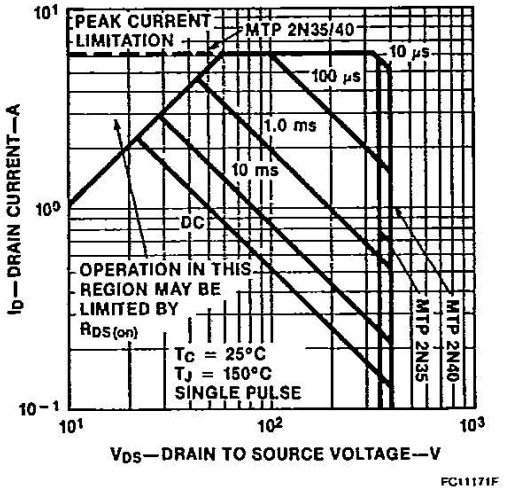


Figure 8 Transient Thermal Resistance vs Time for MTP2N35/2N40

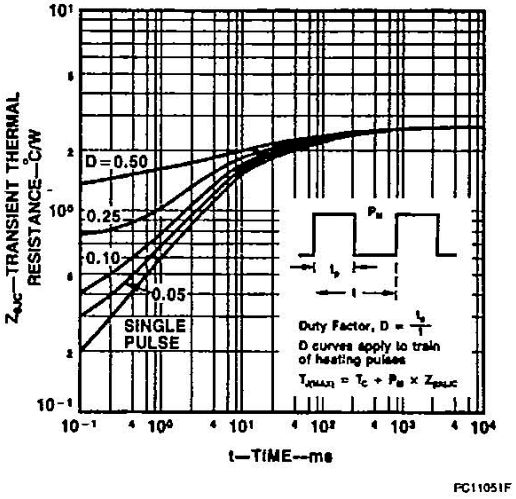


Figure 9 Forward Biased Safe Operating Area for IRF710-713

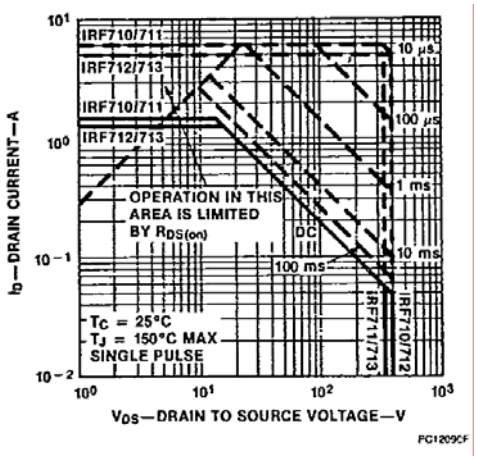
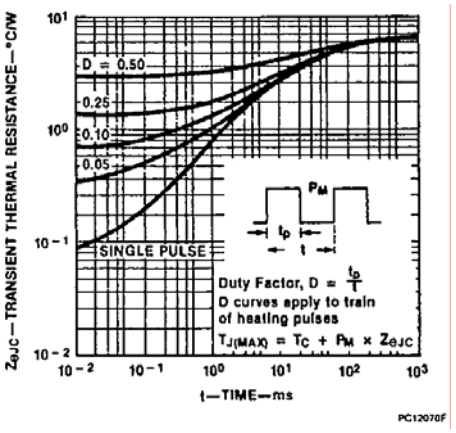


Figure 10 Transient Thermal Resistance for IRF710-713



Typical Electrical Characteristics

Figure 11 Switching Test Circuit

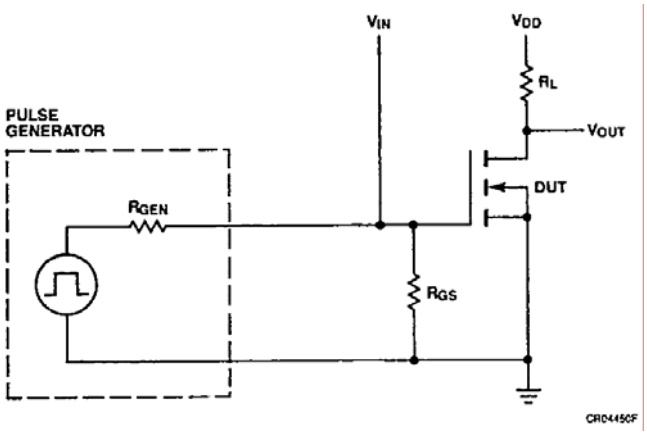


Figure 12 Switching Waveforms