FAIRCHILD
A Schlumberger Company

IRF330-333/IRF730-733 MTM/MTP5N35/5N40 N-Channel Power MOSFETs, 5.5 A, 350 V/400 V

Power And Discrete Division

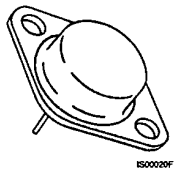
T-39-11

Description

These devices are n-channel, enhancement mode, power MOSFETs designed especially for high voltage, high speed applications, such as off-line switching power supplies, UPS, AC and DC motor controls, relay and solenoid drivers.

- **V_{GS} Rated at ±20 V**
- **Silicon Gate for Fast Switching Speeds**
- **I_{DSS}, $V_{DS(on)}$, SOA and $V_{GS(th)}$ Specified at Elevated Temperature**
- **Rugged**

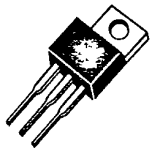
TO-204AA



IS00020F

IRF330
IRF331
IRF332
IRF333
MTM5N35
MTM5N40

TO-220AB



IS00010F

IRF730
IRF731
IRF732
IRF733
MTP5N35
MTP5N40

Maximum Ratings

Symbol	Characteristic	Rating IRF330/332 IRF730/732 MTM/MTP5N40	Rating IRF331/333 IRF731/733 MTM/MTP5N35	Unit
V_{DSS}	Drain to Source Voltage	400	350	V
V_{DGR}	Drain to Gate Voltage R_{GS} = 1.0 MΩ	400	350	V
V_{GS}	Gate to Source Voltage	±20	±20	V
T_J, T_{stg}	Operating Junction and Storage Temperature	−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

		IRF330/331 IRF730/731	IRF332/333 IRF732/733	MTM5N35/40 MTP5N35/40	
$R_{DS\ (on)}$	Static Drain-to-Source On Resistance	1.0	1.5	1.0	Ω
I_D	Drain Current Continuous Pulsed	 5.5 22	 4.5 22	 5.0 22	A

Maximum Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.67	1.67	1.67	°C/W
P_D	Total Power Dissipation at T_C = 25°C	75	75	75	W

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

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
	IRF330/332/730/732	400			
	IRF331/333/731/733	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			nA	V_{GS} = ±20 V, V_{DS} = 0 V
	IRF330-333		±100		
	IRF730-733		±500		
On Characteristics					
$V_{GS(th)}$	Gate Threshold Voltage	2.0	4.0	V	I_D = 250 μA, V_{DS} = V_{GS}
$R_{DS(on)}$	Static Drain-Source On-Resistance[2]			Ω	V_{GS} = 10 V, I_D = 3.0 A
	IRF330/331/730/731		1.0		
	IRF332/333/732/733		1.5		
g_{fs}	Forward Transconductance	3.0		S (℧)	V_{DS} = 10 V, I_D = 3.0 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		900	pF	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz
C_{oss}	Output Capacitance		300	pF	
C_{rss}	Reverse Transfer Capacitance		80	pF	
Switching Characteristics (T_C = 25°C, *Figures 12, 13*)					
$t_{d(on)}$	Turn-On Delay Time		30	ns	V_{DD} = 175 V, I_D = 3.0 A, V_{GS} = 10 V, R_{GEN} = 15 Ω, R_{GS} = 15 Ω
t_r	Rise Time		35	ns	
$t_{d(off)}$	Turn-Off Delay Time		55	ns	
t_f	Fall Time		35	ns	
Q_g	Total Gate Charge		30	nC	V_{GS} = 10 V, I_D = 7.0 A, V_{DD} = 180 V

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
Source-Drain Diode Characteristics					
V_{SD}	Diode Forward Voltage				
	IRF330/331/730/731		1.6	V	I_S = 5.5 A; V_{GS} = 0 V
	IRF332/333/732/733		1.5	V	I_S = 4.5 A; V_{GS} = 0 V
t_{rr}	Reverse Recovery Time	400		ns	I_S = 5.5 A; dI_S/dt = 100 A/μS

MTM/MTP5N35/5N40

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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 = 5.0 mA
	MTM/MTP5N40	400			
	MTM/MTP5N35	350			
I_{DSS}	Zero Gate Voltage Drain Current		0.25	mA	V_{DS} = 0.85 x Rated V_{DSS}, V_{GS} = 0 V
			2.5	mA	V_{DS} = 0.85 x Rated V_{DSS}, V_{GS} = 0 V, T_C = 100°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	2.0	4.5	V	I_D = 1.0 mA, V_{DS} = V_{GS}
		1.5	4.0	V	I_D = 1.0 mA, V_{DS} = V_{GS} T_C = 100°C
$R_{DS(on)}$	Static Drain-Source On-Resistance[2]		1.0	Ω	V_{GS} = 10 V, I_D = 2.5 A
$V_{DS(on)}$	Drain-Source On-Voltage[2]		2.5 6.2	V V	V_{GS} = 10 V; I_D = 2.5 A V_{GS} = 10 V, I_D = 5.0 A
			5.0	V	V_{GS} = 10 V, I_D = 2.5 A T_C = 100°C
g_{fs}	Forward Transconductance	2.0		S (℧)	V_{DS} = 10 V, I_D = 2.5 A
Dynamic Characteristics					
C_{iss}	Input Capacitance		1200	pF	V_{DS} = 25 V, V_{GS} = 0 V f = 1.0 MHz
C_{oss}	Output Capacitance		300	pF	
C_{rss}	Reverse Transfer Capacitance		80	pF	
Switching Characteristics (T_C = 25°C, *Figures 12, 13*)[3]					
$t_{d(on)}$	Turn-On Delay Time		50	ns	V_{DD} = 25 V, I_D = 2.5 A V_{GS} = 10 V, R_{GEN} = 50 Ω R_{GS} = 50 Ω
t_r	Rise Time		100	ns	
$t_{d(off)}$	Turn-Off Delay Time		200	ns	
t_f	Fall Time		100	ns	
Q_g	Total Gate Charge		30	nC	V_{GS} = 10 V, I_D = 7.0 A V_{DD} = 180 V

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

Figures 4-6 for IRF332/333/732/733 only.

Figure 1 Output Characteristics

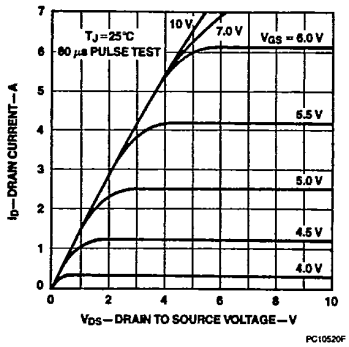


Figure 2 Static Drain to Source Resistance vs Drain Current

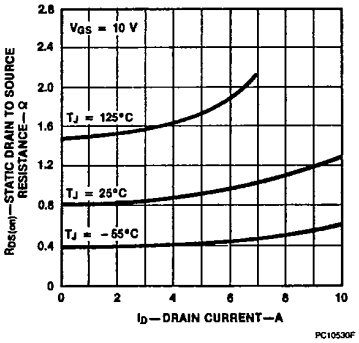


Figure 3 Transfer Characteristics

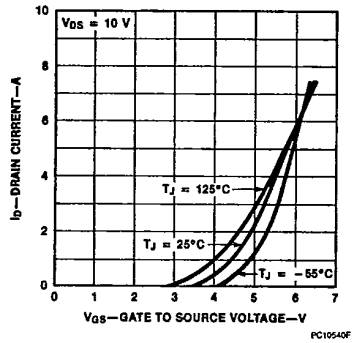


Figure 4 Output Characteristics

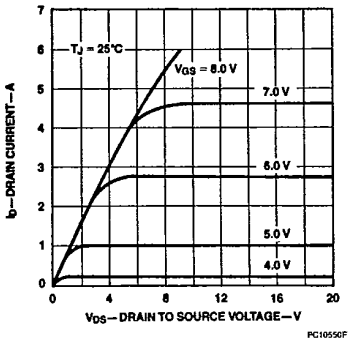


Figure 5 Static Drain to Source On-Resistance vs Drain Current

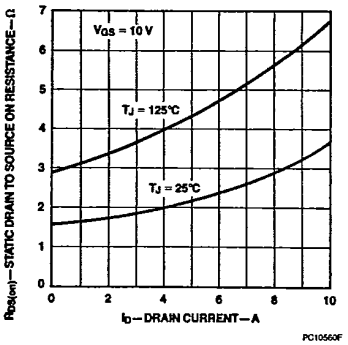
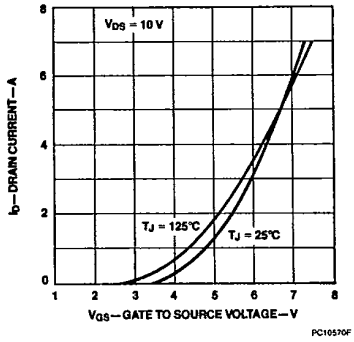


Figure 6 Transfer Characteristics



Typical Performance Curves (Cont.)

Figure 7 Temperature Variation of Gate to Source Threshold Voltage

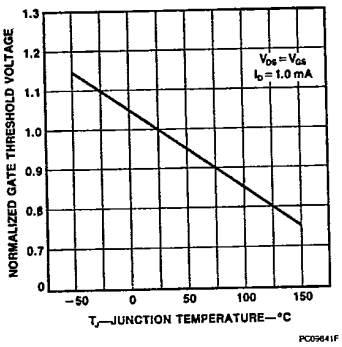


Figure 8 Capacitance vs Drain to Source Voltage

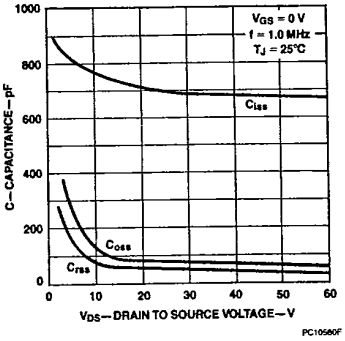


Figure 9 Gate to Source Voltage vs Total Gate Charge

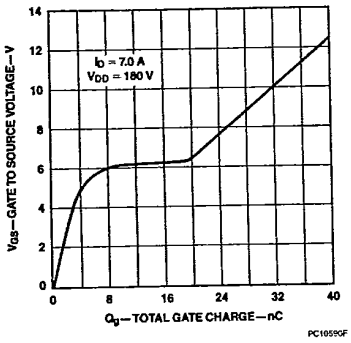


Figure 10 Forward Biased Safe Operating Area

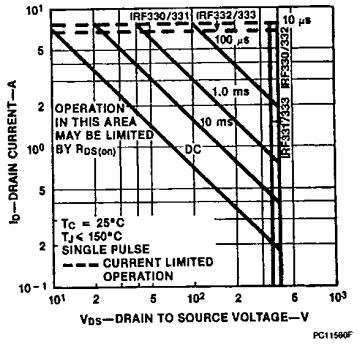
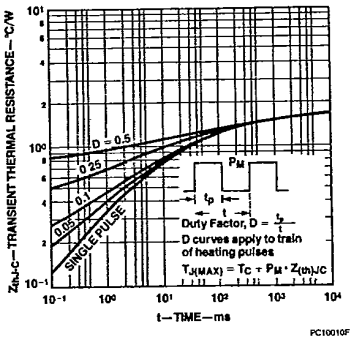


Figure 11 Transient Thermal Resistance



Typical Electrical Characteristics

Figure 12 Switching Test Circuit

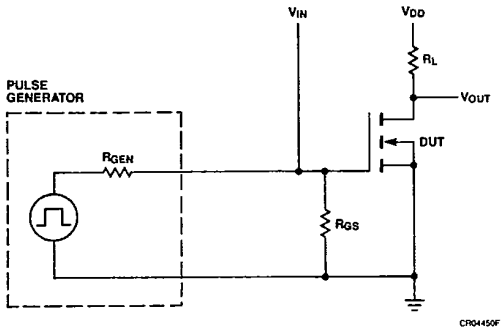
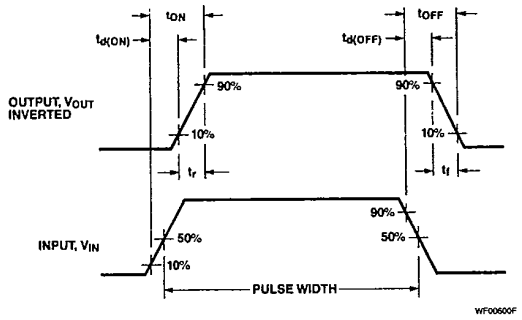


Figure 13 Switching Waveforms



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