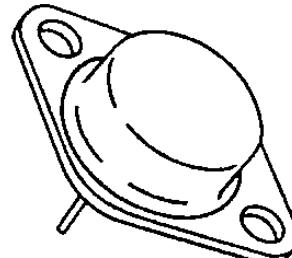


### Description

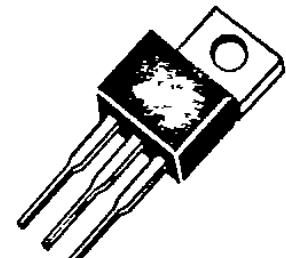
These devices are n-channel, enhancement mode, power MOSFETs designed especially for high power, high speed applications, such as switching power supplies, UPS, AC and DC motor controls, relay and solenoid drivers and high energy pulse circuits.

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

TO-204AA



TO-220AB



IS00020F

IS00010F

IRF230  
IRF231  
IRF232  
IRF233

IRF630  
IRF631  
IRF632  
IRF633  
MTP12N18  
MTP12N20

### Product Summary

Part Number	$V_{DSS}$	$R_{DS(on)}$	$I_D$ at $T_c=25$	$I_D$ at $T_c=100$	Case Style
IRF230	200V	0.40 $\Omega$	9.0A	6.0A	TO-204AA
IRF231	150V	0.40 $\Omega$	9.0A	6.0A	
IRF232	200V	0.50 $\Omega$	8.0A	5.0A	
IRF233	150V	0.50 $\Omega$	8.0A	5.0A	
IRF630	200V	0.40 $\Omega$	9.0A	6.0A	TO-220AB
IRF631	150V	0.40 $\Omega$	9.0A	6.0A	
IRF632	200V	0.50 $\Omega$	8.0A	5.0A	
IRF633	150V	0.50 $\Omega$	8.0A	5.0A	
MTP12N18	180V	0.35 $\Omega$	12A	8.5A	
MTP12N20	200V	0.35 $\Omega$	12A	8.5A	

### Notes

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

## Maximum Ratings

Symbol	Characteristic	Rating IRF220/222 IRF620/622 MTP7N20	Rating MTP7N18	Rating IRF222/223 IRF622/623	Unit
$V_{DSS}$	Drain to Source Voltage 1	200	180	150	V
$V_{DGR}$	Drain to Gate Voltage1 $R_{GS}=20\text{k }\Omega$	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 Temperature	-55 to +150	-55 to +150	-50 to +150	
$T_L$	Maximum Lead Temperatures for Soldering Purposes, 1/8" From Case for 5S	275	275	275	

## Maximum Thermal Characteristics

		IRF220-233 IRF630-633	MTP12N18/20	
$R_{eJC}$	Thermal Resistance Junction to Case	1.67	1.25	/W
$P_D$	Total Power Dissipation At $T_c=25$	75	100	W
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	40	40	A

**Electrical Characteristics** ( $T_c=25$  unless otherwise noted)

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>Off Characteristics</b>					
$V_{(BR)DSS}$	Drain Source Breakdown Voltage IRF230/232/630/632 MTP12N20 MTP12N18 IRF231/233/631/633			V	$V_{GS}=0V, I_D=250\mu A$
		200			
		180			
		150			
$I_{DSS}$	Zero Gate Voltage Drain Current		250	$\mu A$	$V_{DS}=\text{Rated } V_{DSS}, V_{GS}=0V$
			1000	$\mu A$	$V_{DS}=0.8 \times \text{Rated } V_{DSS}, V_{GS}=0V, T_c=125$
$I_{GSS}$	Gate-Body Leakage Current IRF230-233 IRF630-633/ MTP12N18/12N20			nA	$V_{GS}=\pm 20V, V_{DS}=0V$
			$\pm 100$		
			$\pm 500$		

## Electrical Characteristics(Cont.)(Tc=25 unless otherwise noted)

Symbol	Characteristic	Min	Max	Unit	Test Conditions
<b>On Characteristics</b>					
V <sub>GS(th)</sub>	Gate Threshold Voltage IRF230/233/630/633 MTP12N18/12N20			V	I <sub>D</sub> =250µA, V <sub>DS</sub> =V <sub>GS</sub>
		2.0	4.0		I <sub>D</sub> =1mA, V <sub>DS</sub> =V <sub>GS</sub>
		2.0	4.5		
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance 2 IRF230/231/630/631 IRF232/233/632/633 MTP12N18/12N20			Ω	V <sub>GS</sub> =10V , I <sub>D</sub> =5.0A
			0.40		
			0.50		
			0.35		I <sub>D</sub> =6.0A
V <sub>DS(on)</sub>	Drain-Source On-Voltage <sup>2</sup> MTP12N18/12N20		2.1	V	V <sub>GS</sub> =10V; I <sub>D</sub> =6.0A
			5.0	V	V <sub>GS</sub> =10V; I <sub>D</sub> =12.0A;
			4.2	V	V <sub>GS</sub> =10V; I <sub>D</sub> =6.0A Tc=100
gfs	Forward Transconductance	3.0		S(Ω)	V <sub>DS</sub> =10V; I <sub>D</sub> =6.0A Tc=100
<b>Dynamic Characteristics</b>					
Ciss	Input Capacitance		800	pF	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V f=1.0MHz
Coss	Output Capacitance		450	pF	
Crss	Reverse Transfer Capacitance		150	pF	
<b>Switching Characteristics (Tc=25 , Figure 1,2)<sup>1</sup></b>					
t <sub>d(on)</sub>	Turn-On Delay Time		30	ns	V <sub>DD</sub> =90V, I <sub>D</sub> =5.0A V <sub>GS</sub> =10V, R <sub>GEN</sub> =15 Ω R <sub>GS</sub> =15 Ω
t <sub>r</sub>	Rise Time		50	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		50	ns	
t <sub>f</sub>	Fall Time		40	ns	
t <sub>d(on)</sub>	Turn-On Delay Time		50	ns	V <sub>DD</sub> =25V; I <sub>D</sub> =6.0A V <sub>GS</sub> =10V, R <sub>GEN</sub> =50 Ω R <sub>GS</sub> =50 Ω
t <sub>r</sub>	Rise Time		250	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		100	ns	
t <sub>f</sub>	Fall Time		120	ns	
Qg	Total Gate Charge		30	ns	V <sub>GS</sub> =10V, I <sub>D</sub> =12A V <sub>DD</sub> =120V

## Electrical Characteristics (Cont.)(Tc=25 unless otherwise noted)

Symbol	Characteristic	Typ	Max	Unit	Test Conditions
<b>Source-Drain Diode Characteristics</b>					
V <sub>SD</sub>	Diode Forward Voltage IRF230/231/630/831 IRF232/233/632/633	1.25	2.0	V	I <sub>S</sub> =9.0A; V <sub>GS</sub> =0V
		1.25	1.8	V	I <sub>S</sub> =8.0A; V <sub>GS</sub> =0V
		450		ns	I <sub>S</sub> =4.0A; I <sub>s/dt</sub> =25A/µs

### Notes

1. T<sub>J</sub>=+25 to +160
2. Pulse width limited by T<sub>J</sub>.
3. Switching time measurements performed on LEM TR-58 equipment.

### Typical Electrical Characteristics

Figure 1 Switching Test Circuit

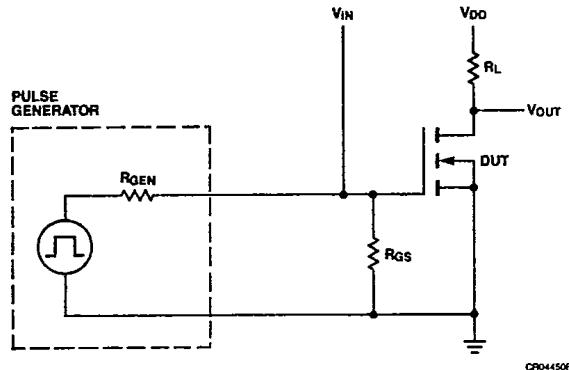
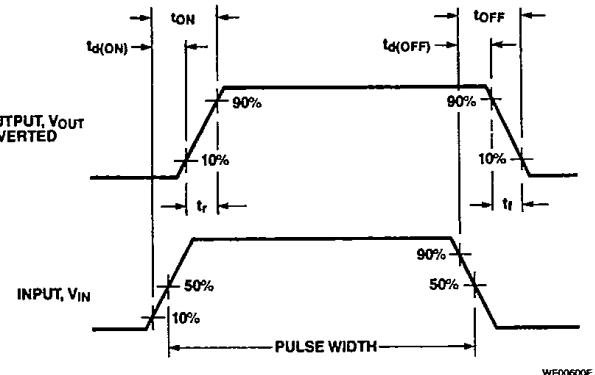


Figure 2 Switching Waveforms



### Typical Performance Curves

Figure 3 Output Characteristics

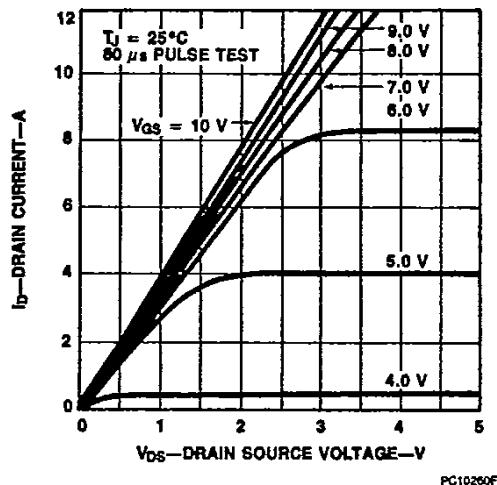
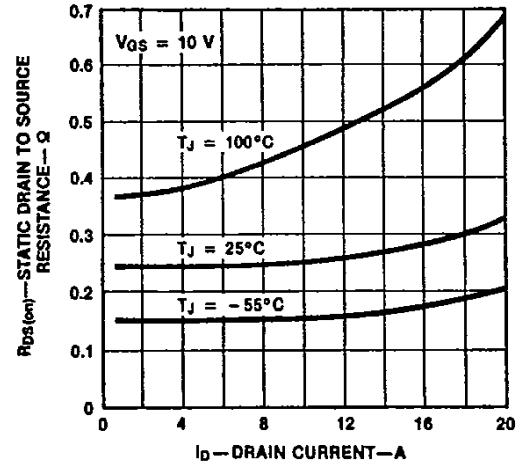


Figure 4 Static Drain to Source Resistance vs Drain Current



Typical Performance Curves (Cont.)

Figure 5 Transfer Characteristics

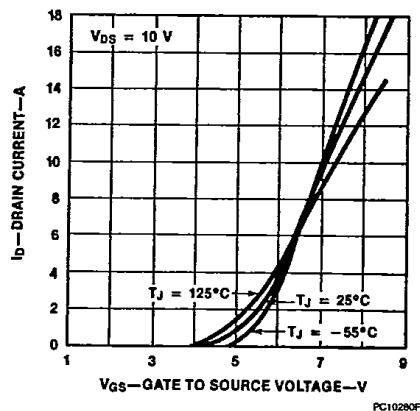


Figure 7 Capacitance vs Drain to Source Voltage

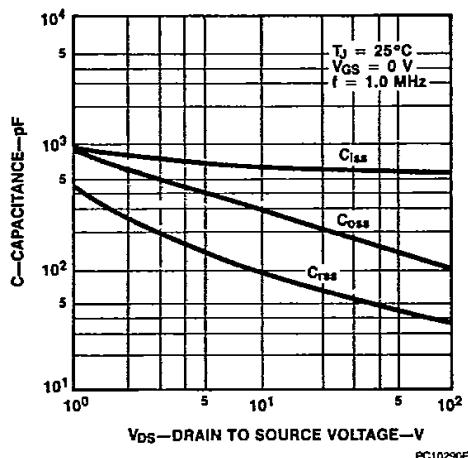


Figure 9 Forward Biased Safe Operating Area  
For IRF230-233 and IRF630-633

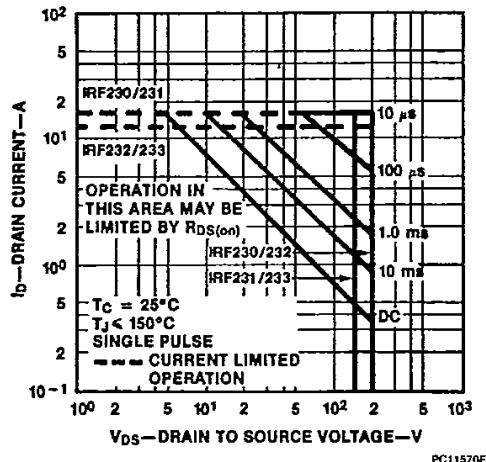


Figure 6 Temperature Variation of Gate to Source Threshold Voltage

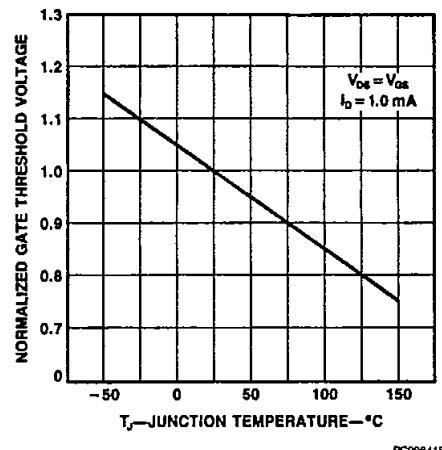


Figure 8 Gate to Source Voltage vs Total Gate Charge

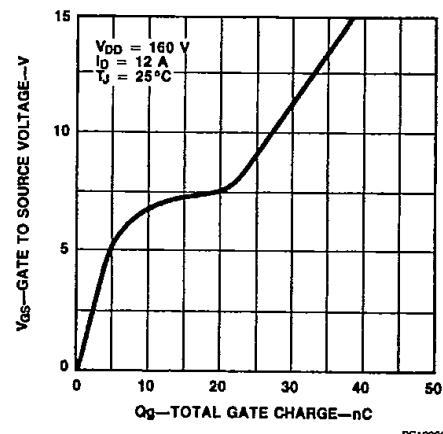
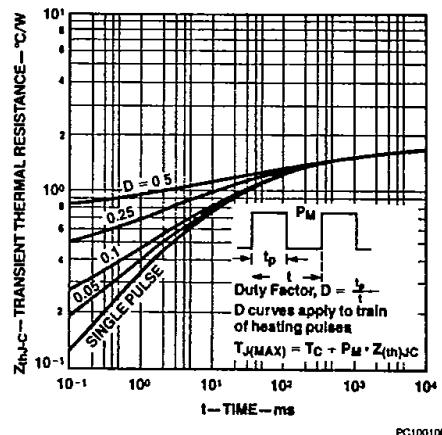
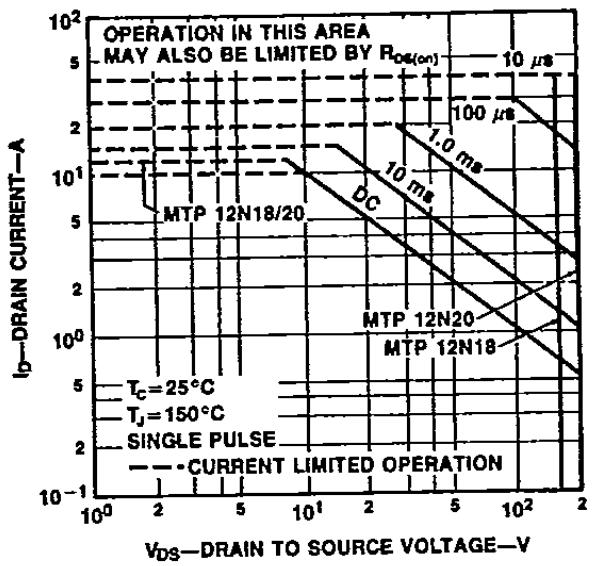


Figure 10 Transient Thermal Resistance vs Time  
For IRF230-233 and IRF630-633



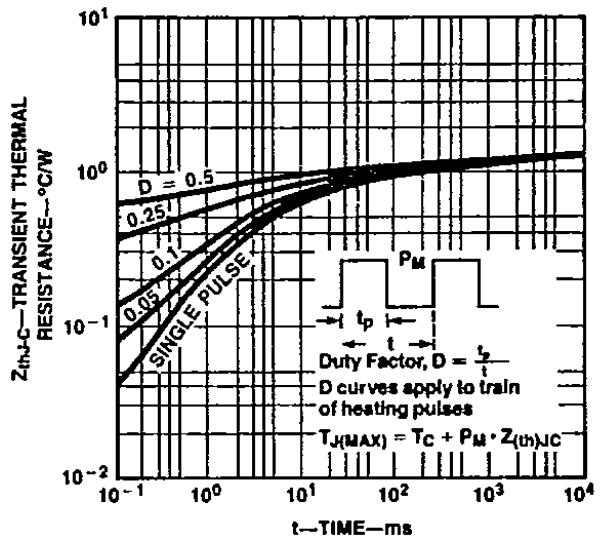
### Typcial Performance Curves (Cont.)

Figure 11 Forward Biased Safe Operating Area  
 For MTP12N18/12N20



PC10311F

Figure 12 Transient Thermal Resistance vs Time  
 For MTP12N18/12N20



PC10030F