MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

Power Field Effect Transistor
N-Channel Enhancement-Mode Silicon Gate TMOS

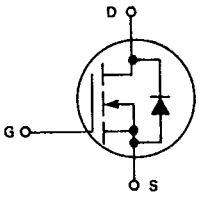
IRF820
IRF821
IRF823

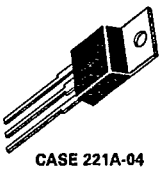
These TMOS Power FETs are designed for high voltage, high speed power switching applications such as switching regulators, converters, solenoid and relay drivers.

- Silicon Gate for Fast Switching Speeds
- Low $r_{DS(on)}$ to Minimize On-Losses. Specified at Elevated Temperature
- Rugged — SOA is Power Dissipation Limited
- Source-to-Drain Diode Characterized for Use With Inductive Loads

TMOS™

TMOS POWER FETs
2 and 2.5 AMPERES
$r_{DS(on)}$ = 3 OHM
450 and 500 VOLTS
$r_{DS(on)}$ = 4 OHM
450 VOLTS





CASE 221A-04
TO-220AB

MAXIMUM RATINGS

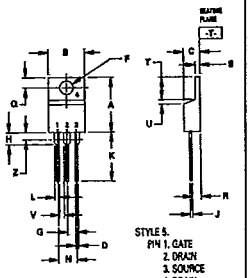
Rating	Symbol	IRF 820	IRF 821	IRF 823	Unit
Drain-Source Voltage	V_{DSS}	500	450	450	Vdc
Drain-Gate Voltage (R_{GS} = 1 MΩ)	V_{DGR}	500	450	450	Vdc
Gate-Source Voltage	V_{GS}	±20			Vdc
Drain Current Continuous Pulsed	I_D I_{DM}	2.5 10		2 8	Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	40 0.32			Adc
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to 150			°C

THERMAL CHARACTERISTICS

Thermal Resistance Junction to Case Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	3.12 62.5	°C/W
Maximum Lead Temp. for Soldering Purposes, 1/8" from Case for 5 Seconds	T_L	300	°C

See the MTP3N45 Designer's Data Sheet for a complete set of design curves for the product on this data sheet.

OUTLINE DIMENSIONS



STYLE 5.
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.48	15.75	0.570	0.620
B	9.66	10.28	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.64	0.88	0.025	0.035
F	3.61	3.73	0.142	0.147
G	2.47	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
J	0.36	0.55	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.15	1.39	0.045	0.055
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage (V_{GS} = 0, I_D = 0.25 mA)	IRF821, IRF823 IRF820	$V_{(BR)DSS}$	450 500	— —	Vdc
Zero Gate Voltage Drain Current (V_{DS} = Rated V_{DSS}, V_{GS} = 0) (V_{DS} = 0.8 Rated V_{DSS}, V_{GS} = 0, T_J = 125°C)		I_{DSS}	— —	0.25 1	mAdc
Gate-Body Leakage Current, Forward (V_{GSF} = 20 Vdc, V_{DS} = 0)		I_{GSSF}	—	500	nAdc
Gate-Body Leakage Current, Reverse (V_{GSR} = 20 Vdc, V_{DS} = 0)		I_{GSSR}	—	500	nAdc
ON CHARACTERISTICS*					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 0.25 mA)		$V_{GS(th)}$	2	4	Vdc
Static Drain-Source On-Resistance (V_{GS} = 10 Vdc, I_D = 1 Adc)	IRF820, IRF821 IRF823	$r_{DS(on)}$	— —	3 4	Ohm
On-State Drain Current (V_{GS} = 10 V) (V_{DS} ≥ 7.5 Vdc) (V_{DS} ≥ 8 Vdc)	IRF820, IRF821 IRF823	$I_{D(on)}$	2.5 2	— —	Adc
Forward Transconductance (V_{DS} ≥ 7.5 V, I_D = 1 A) (V_{DS} ≥ 8 V, I_D = 1 A)	IRF820, IRF821 IRF823	g_{FS}	1 1	— —	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	(V_{DS} = 25 V, V_{GS} = 0, f = 1 MHz)	C_{iss}	—	400	pF
Output Capacitance		C_{oss}	—	150	
Reverse Transfer Capacitance		C_{rss}	—	40	
SWITCHING CHARACTERISTICS*					
Turn-On Delay Time	V_{DD} ≈ 200 V, I_D = 1 Apk, R_{gen} = 50 Ohms)	$t_{d(on)}$	—	60	ns
Rise Time		t_r	—	50	
Turn-Off Delay Time		$t_{d(off)}$	—	60	
Fall Time		t_f	—	30	
Total Gate Charge	(V_{GS} = 10 V, V_{DS} = 0.8 x Rated V_{DSS}, I_D = Rated I_D)	Q_g	12 (Typ)	15	nC
Gate-Source Charge		Q_{gs}	6 (Typ)	—	
Gate-Drain Charge		Q_{gd}	6 (Typ)	—	
SOURCE-DRAIN DIODE CHARACTERISTICS*					
Forward On-Voltage	(I_S = Rated I_D, V_{GS} = 0)	V_{SD}	—	1.5(1)	Vdc
Forward Turn-On Time		t_{on}	Limited by stray inductance		
Reverse Recovery Time		t_{rr}	500 (Typ)	—	ns
INTERNAL PACKAGE INDUCTANCE					
Internal Drain Inductance (Measured from the contact screw on tab to center of die) (Measured from the drain lead 0.25" from package to center of die)		L_d	3.5 (Typ) 4.5 (Typ)	— —	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)		L_s	7.5 (Typ)	—	

*Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
(1) Add 0.1 V for IRF820 and IRF821.