

# **IRF840**

# N - CHANNEL 500V - $0.75\Omega$ - 8A - TO-220 PowerMESHTM MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRF840	500 V	< 0.85 Ω	8 A

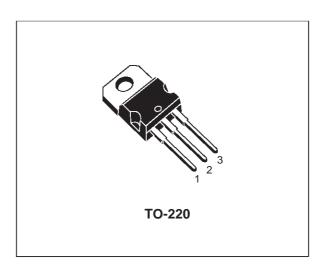
- TYPICAL  $R_{DS(on)} = 0.75 \Omega$
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

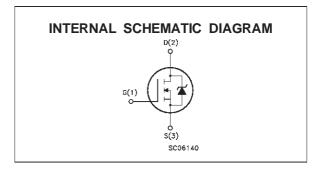
#### **DESCRIPTION**

This power MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY<sup>TM</sup> process. This technology matches and improves the performances compared with standard parts from various sources.

#### **APPLICATIONS**

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVER





#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	V
$V_{DGR}$	Drain- gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	500	V
$V_{GS}$	Gate-source Voltage	± 20	V
$I_D$	Drain Current (continuous) at T <sub>c</sub> = 25 °C	8.0	Α
ID	Drain Current (continuous) at T <sub>c</sub> = 100 °C	5.1	Α
I <sub>DM</sub> (●)	Drain Current (pulsed)	32	А
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	125	W
	Derating Factor	1.0	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	3.5	V/ns
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
Tj	Max. Operating Junction Temperature	150	°C

<sup>(•)</sup> Pulse width limited by safe operating area

(1)  $I_{SD} \le 8A$ ,  $di/dt \le 100 \text{ A/}\mu\text{s}$ ,  $V_{DD} \le V_{(BR)DSS}$ ,  $Tj \le T_{JMAX}$ 

First Digit of the Datecode Being Z or K Identifies Silicon Characterized in this Datasheet

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# THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.0	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	oC/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Тур	0.5	°C/W
Tı	Maximum Lead Temperature For Soldering F	Purpose	300	°C

# **AVALANCHE CHARACTERISTICS**

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	8.0	А
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting $T_j = 25$ °C, $I_D = I_{AR}$ , $V_{DD} = 50$ V)	520	mJ

# **ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

U	Г	Г

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	$I_D = 250 \ \mu A$ $V_{GS} = 0$	500			<b>V</b>
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	$V_{DS} = Max Rating$ $V_{DS} = Max Rating$ $T_c = 125  ^{\circ}C$			1 50	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20 V			± 100	nA

# ON (\*)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	$V_{GS} = 10V I_D = 4.8 A$		0.75	0.85	Ω
I <sub>D(on)</sub>	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 \text{ V}$	8.0			Α

# DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
gfs (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_{D} = 4.8 \text{ A}$	4.9			S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25 \text{ V}$ f = 1 MHz $V_{GS} = 0$		1300 200 18		pF pF pF

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# **ELECTRICAL CHARACTERISTICS** (continued)

# **SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Turn-on Time Rise Time	$V_{DD} = 250 \text{ V}$ $I_D = 4.3 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 3)		19 11		ns ns
$egin{array}{c} Q_g \ Q_{gs} \ Q_{qd} \end{array}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400 \text{ V}$ $I_{D} = 8.0 \text{ A}$ $V_{GS} = 10 \text{ V}$		39 10.6 13.7	50	nC nC nC

# **SWITCHING OFF**

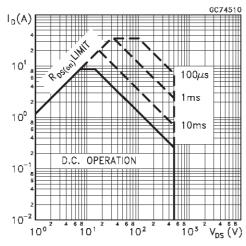
Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>r(Voff)</sub>	Off-voltage Rise Time	$V_{DD} = 400 \text{ V}  I_{D} = 8 \text{ A}$		11.5		ns
t <sub>f</sub>	Fall Time	$R_G = 4.7 \Omega$ $V_{GS} = 10 V$		11		ns
tc	Cross-over Time	(see test circuit, figure 5)		20		ns

### SOURCE DRAIN DIODE

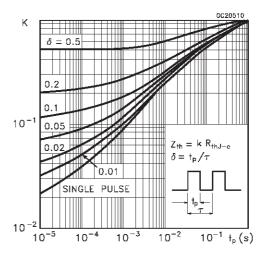
Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
I <sub>SD</sub> I <sub>SDM</sub> (•)	Source-drain Current Source-drain Current (pulsed)				8.0 32	A A
V <sub>SD</sub> (*)	Forward On Voltage	$I_{SD} = 8.0 \text{ A}$ $V_{GS} = 0$			1.6	V
t <sub>rr</sub>	Reverse Recovery Time	$I_{SD} = 8.0 \text{ A}$ di/dt = 100 A/ $\mu$ s $V_{DD} = 100 \text{ V}$ $T_i = 150 \text{ °C}$		420		ns
Qrr	Reverse Recovery Charge	(see test circuit, figure 5)		3.5		μС
I <sub>RRM</sub>	Reverse Recovery Current			16.5		A

<sup>(\*)</sup> Pulsed: Pulse duration = 300 μs, duty cycle 1.5 % (•) Pulse width limited by safe operating area

# Safe Operating Area

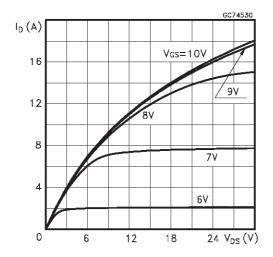


# Thermal Impedance

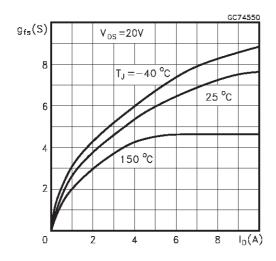


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# **Output Characteristics**

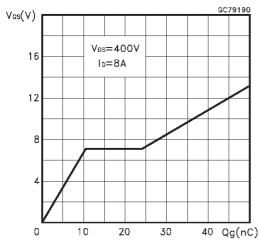


# Transconductance

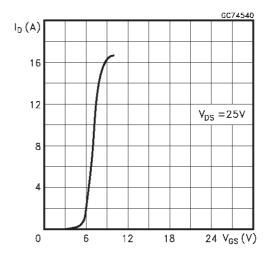


# Gate Charge vs Gate-source Voltage

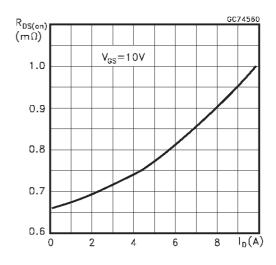
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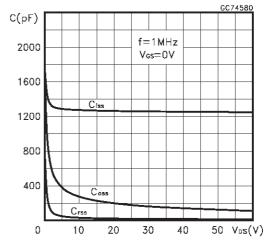
# **Transfer Characteristics**



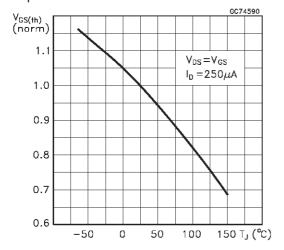
### Static Drain-source On Resistance



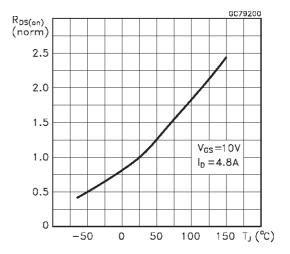
# Capacitance Variations



# Normalized Gate Threshold Voltage vs Temperature



# Normalized On Resistance vs Temperature



# Source-drain Diode Forward Characteristics

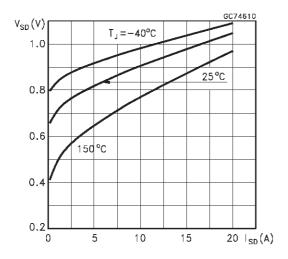
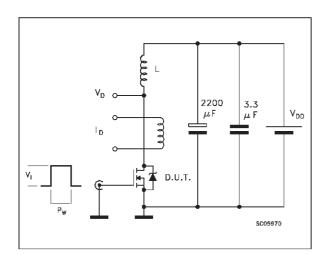
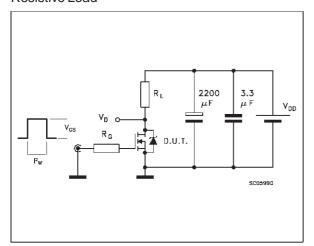


Fig. 1: Unclamped Inductive Load Test Circuit



**Fig. 3:** Switching Times Test Circuits For Resistive Load



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times

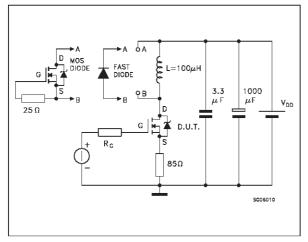


Fig. 1: Unclamped Inductive Waveform

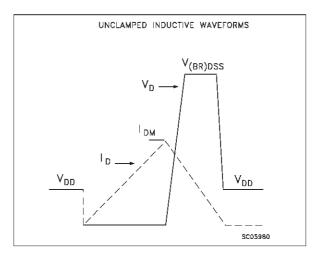
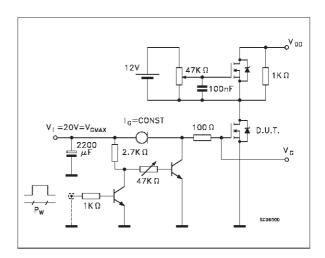


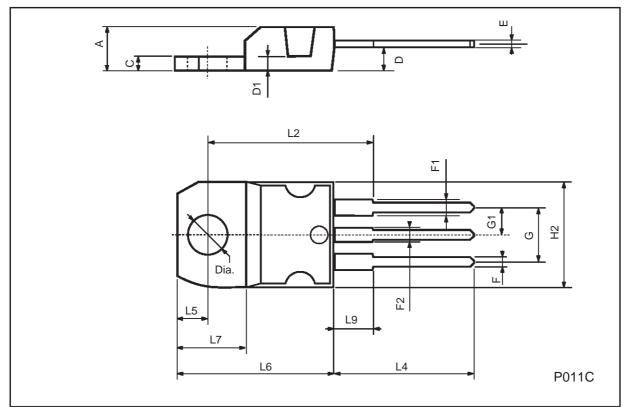
Fig. 4: Gate Charge test Circuit



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# **TO-220 MECHANICAL DATA**

DIM		mm			inch	
DIM.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
А	4.40		4.60	0.173		0.181
С	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
Е	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



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