

Absolute Maximum Ratings

Parameter	IRFM440, JANTXV-, JANTX-, 2N7222	Units
I_D @ $V_{GS} = 10V$, $T_C = 25^\circ C$	Continuous Drain Current	8.0
I_D @ $V_{GS} = 10V$, $T_C = 100^\circ C$	Continuous Drain Current	5.0
I_{DM}	Pulsed Drain Current ①	32
P_D @ $T_C = 25^\circ C$	Max. Power Dissipation	125
	Linear Derating Factor	1.0
V_{GS}	Gate-to-Source Voltage	± 20
E_{AS}	Single Pulse Avalanche Energy ②	700 (See Fig. 12)
I_{AR}	Avalanche Current ①	8.0 (See E_{AR})
E_{AR}	Repetitive Avalanche Energy ①	12.5 (See Fig. 13)
dv/dt	Peak Diode Recovery dv/dt ③	3.5 (See Fig. 13)
T_J	Operating Junction Temperature	-55 to 150
T_{STG}	Storage Temperature Range	
	Lead Temperature	300 (0.083 in. (1.6 mm) from case for 10s)
	Weight	9.3 (typical)

Electrical Characteristics @ $T_J = 25^\circ C$ (Unless Otherwise Specified)

Parameter	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	500	—	V	$V_{GS} = 0V$, $I_D = 1.0$ mA
$\Delta BV_{DSS}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	—	0.78	V/ $^\circ C$	Reference to $25^\circ C$, $I_D = 1.0$ mA
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	0.85	Ω	$V_{GS} = 10V$, $I_D = 5.0A$ ④
		—	0.95		$V_{GS} = 10V$, $I_D = 8.0A$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	V	$V_{DS} = V_{GS}$, $I_D = 250$ μA
g_{fs}	Forward Transconductance	4.7	—	S (d)	$V_{DS} \geq 15V$, $I_{DS} = 5.0A$ ④
I_{DSS}	Zero Gate Voltage Drain Current	—	25	μA	$V_{DS} = 0.8 \times \text{Max. Rating}$, $V_{GS} = 0V$
		—	250		$V_{DS} = 0.8 \times \text{Max. Rating}$, $V_{GS} = 0V$, $T_J = 125^\circ C$
I_{GSS}	Gate-to-Source Leakage Forward	—	100	nA	$V_{GS} = 20V$
I_{GSS}	Gate-to-Source Leakage Reverse	—	-100		$V_{GS} = -20V$
Q_g	Total Gate Charge	27.3	—	68.5	$V_{GS} = 10V$, $I_D = 8.0A$
Q_{gs}	Gate-to-Source Charge	2.0	—	12.5	$V_{DS} = 0.5 \times \text{Max. Rating}$
Q_{gd}	Gate-to-Drain ("Miller") Charge	11.1	—	42.4	See Fig. 6 and 14
$t_{d(on)}$	Turn-On Delay Time	—	21	ns	$V_{DD} = 250V$, $I_D = 5.0A$, $R_G = 9.1\Omega$
t_r	Rise Time	—	73		
$t_{d(off)}$	Turn-Off Delay Time	—	72		See Fig. 11
t_f	Fall Time	—	51		
L_D	Internal Drain Inductance	—	8.7	nH	Measured from the drain lead, 6 mm (0.25 in.) from package to center of die.
L_S	Internal Source Inductance	—	8.7		Measured from the source lead, 6 mm (0.25 in.) from package to source bonding pad.
C_{iss}	Input Capacitance	—	1300	pF	$V_{GS} = 0V$, $V_{DS} = 25V$
C_{oss}	Output Capacitance	—	310		$f = 1.0$ MHz
C_{rss}	Reverse Transfer Capacitance	—	120		See Fig. 5
C_{DC}	Drain-to-Case Capacitance	—	12		



Source-Drain Diode Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S Continuous Source Current (Body Diode)	—	—	8.0	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 
I_{SM} Pulsed Source Current (Body Diode) ①	—	—	32		
V_{SD} Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$, $I_S = 8.0\text{A}$, $V_{GS} = 0\text{V}$ ④
t_{rr} Reverse Recovery Time	—	—	700	nS	$T_J = 25^\circ\text{C}$, $I_F = 8.0\text{A}$, $dI/dt \leq 100\text{ A}/\mu\text{s}$ ④
Q_{RR} Reverse Recovery Charge	—	—	8.9	μC	$V_{DD} \leq 50\text{V}$
t_{on} Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
R_{thJC} Junction-to-Case	—	—	1.0	K/W ⑤	
R_{thCS} Case-to-Sink	—	0.21	—		Mounting surface flat, smooth, and greased
R_{thJA} Junction-to-Ambient	—	—	48		Typical socket mount

① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 9) Refer to current HEXFET reliability report

② @ $V_{DD} = 50\text{V}$, Starting $T_J = 25^\circ\text{C}$, $L \geq 20\text{ mH}$, $R_G = 25\Omega$, Peak $I_L = 8.0\text{A}$

③ $I_{SD} \leq 8.0\text{A}$, $dI/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J \leq 150^\circ\text{C}$
Suggested $R_G = 9.1\Omega$

④ Pulse width $\leq 300\text{ }\mu\text{s}$; Duty Cycle $\leq 2\%$

⑤ $K/W = ^\circ\text{C}/W$
 $W/K = W/^\circ\text{C}$

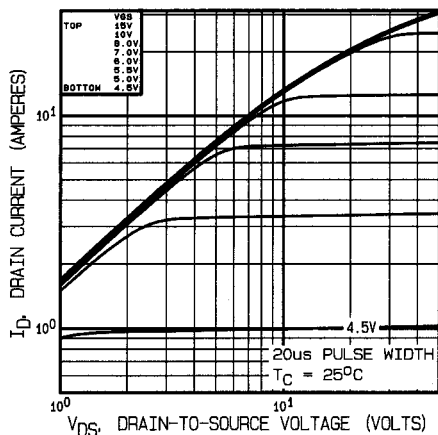
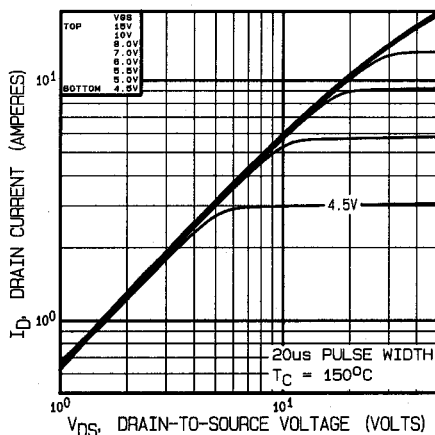
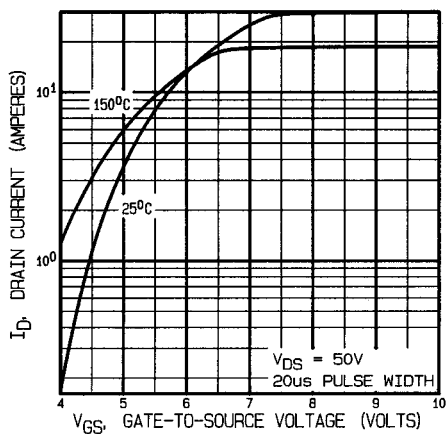
Fig. 1 — Typical Output Characteristics, $T_C = 25^\circ\text{C}$ Fig. 2 — Typical Output Characteristics, $T_C = 150^\circ\text{C}$ 

Fig. 3 — Typical Transfer Characteristics

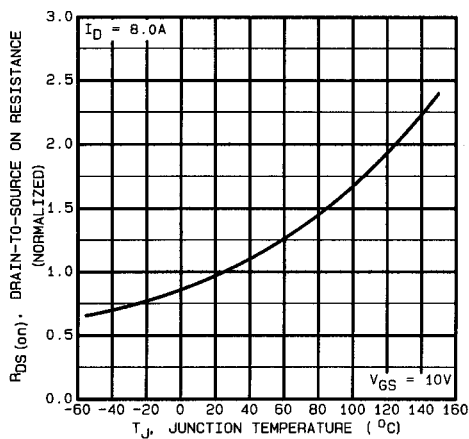


Fig. 4 — Normalized On-Resistance Vs. Temperature

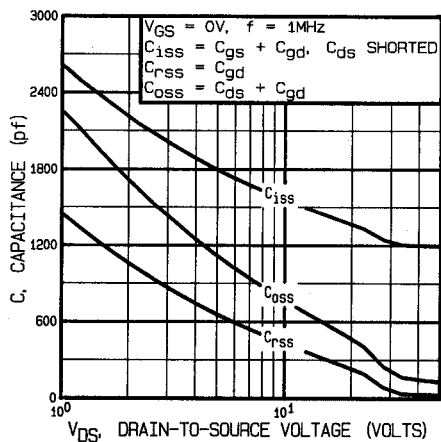


Fig. 5 — Typical Capacitance Vs. Drain-to-Source Voltage

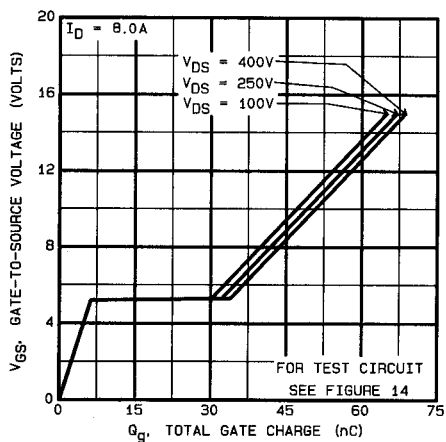


Fig. 6 — Typical Gate Charge Vs. Gate-to-Source Voltage

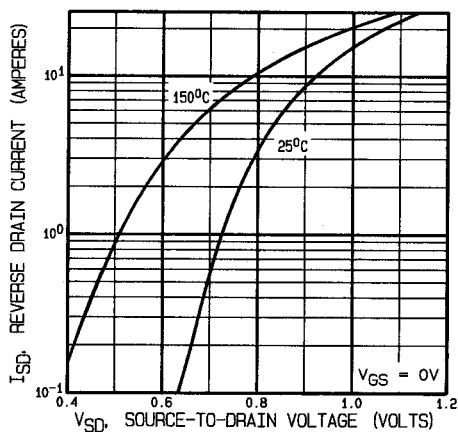


Fig. 7 — Typical Source-Drain Diode Forward Voltage

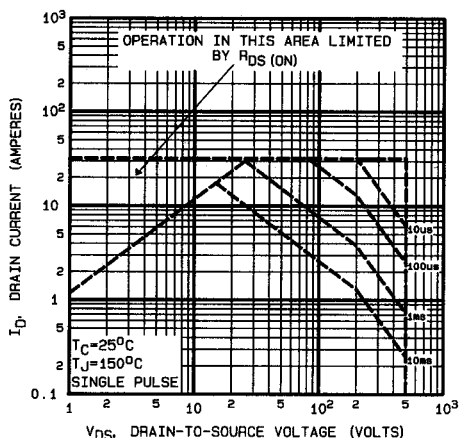


Fig. 8 — Maximum Safe Operating Area

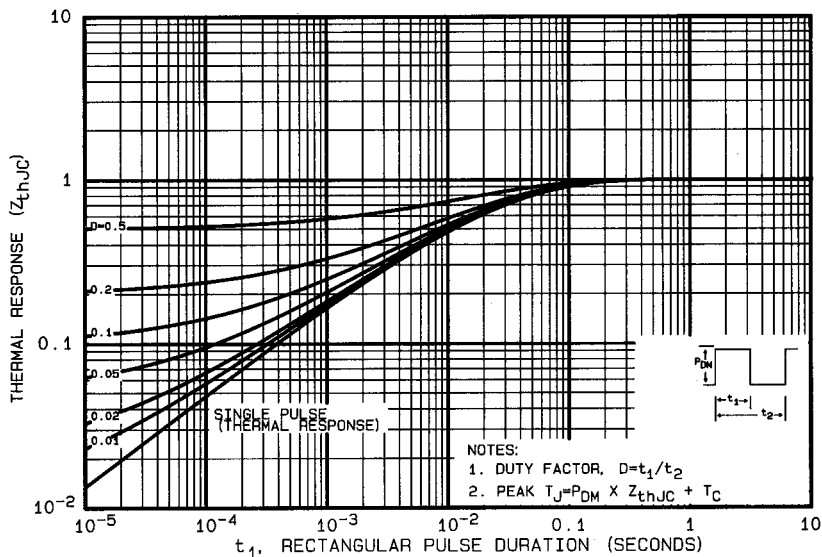


Fig. 9 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

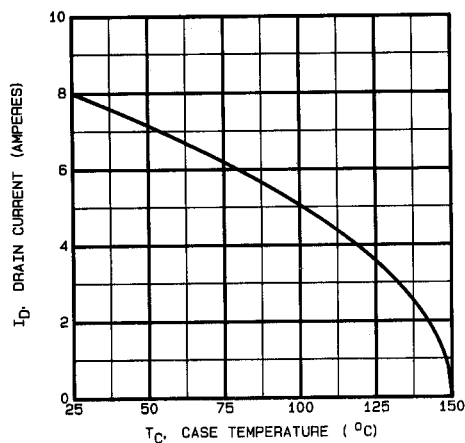


Fig. 10 — Maximum Drain Current Vs. Case Temperature

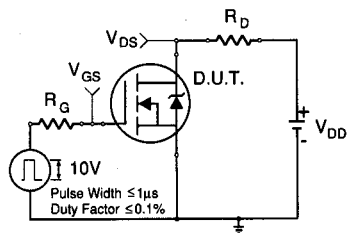


Fig. 11a — Switching Time Test Circuit

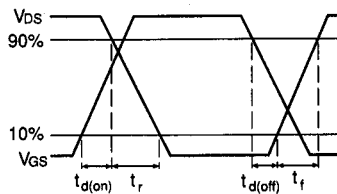
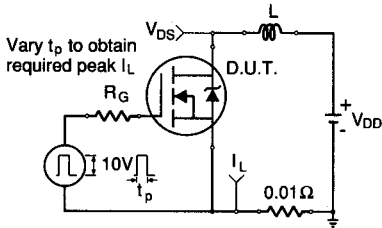
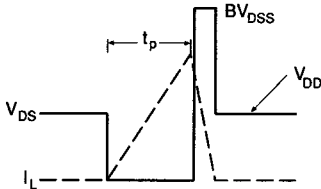
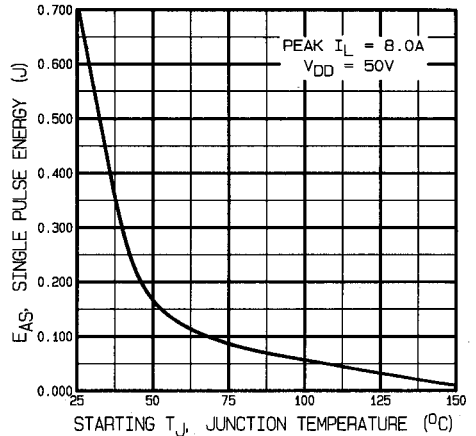
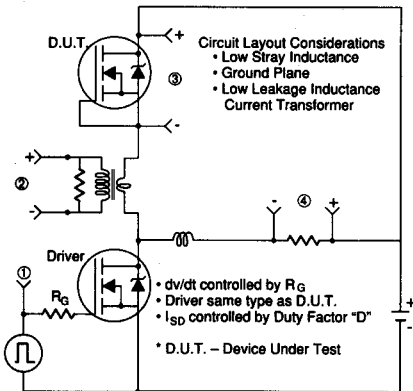
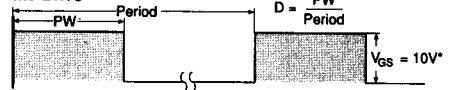
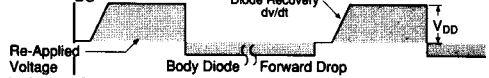


Fig. 11b — Switching Time Waveforms


Fig. 12a — Unclamped Inductive Test Circuit

Fig. 12b — Unclamped Inductive Waveforms

Fig. 12c — Maximum Avalanche Energy Vs. Starting Junction Temperature

① Driver Gate Drive

② D.U.T. I_{SD} Waveform

③ D.U.T. V_{DS} Waveform

④ Inductor Current


* $V_{GS} = 5V$ for Logic Level Devices

Fig. 13 — Peak Diode Recovery dv/dt Test Circuit

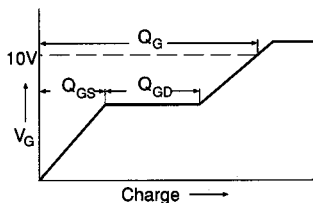


Fig. 14a — Basic Gate Charge Waveform

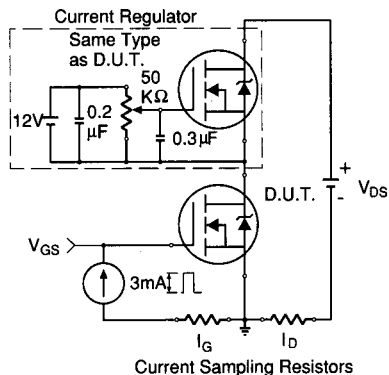


Fig. 14b — Gate Charge Test Circuit

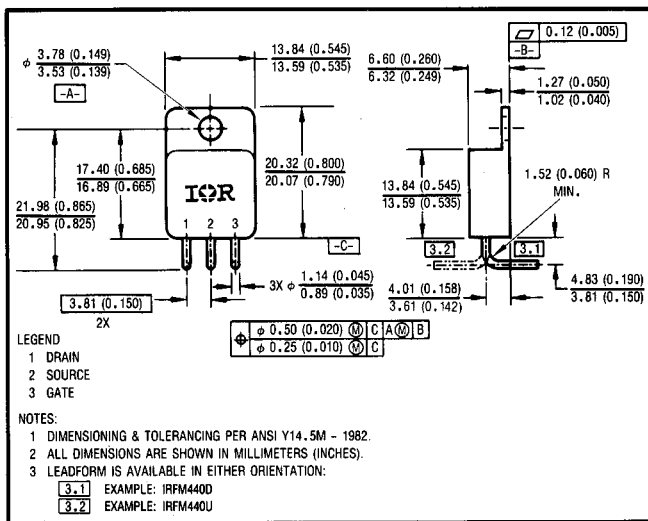


Fig. 15 — Optional Leadforms for Outline TO-254

BERYLLIA WARNING PER MIL-S-19500

Packages containing beryllia shall not be ground, sandblasted, machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.