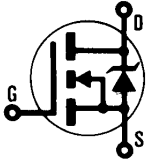


# International IOR Rectifier

**AVALANCHE ENERGY RATED AND dv/dt RATED**

**HEXFET® TRANSISTOR**

**IRFM054**



**N-CHANNEL**

**60 Volt, 0.027 Ohm HEXFET**

The HEXFET® technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry design achieves very low on-state resistance combined with high transconductance.

The HEXFET transistors also feature all of the well established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

They are well suited for applications such as switching power supplies and virtually any application where military and/or high reliability is required.

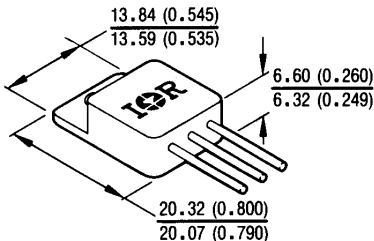
**Product Summary**

Part Number	$V_{DSS}$	$R_{DS(on)}$	$I_D$
IRFM054	60V	0.027Ω	35A*

**FEATURES:**

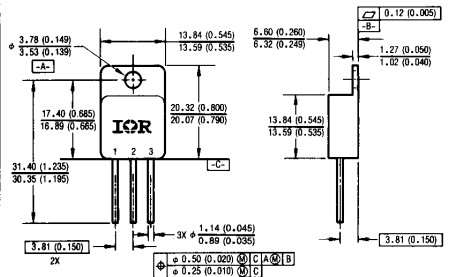
- Avalanche Energy Rating
- Isolated and Hermetically Sealed
- Alternative to TO-3 Package
- Simple Drive Requirements
- Ease of Paralleling
- Ceramic Eyelets

**CASE STYLE AND DIMENSIONS**



**CAUTION**

BERYLLIA WARNING PER MIL-PRF-19500



**LEGEND**

- 1 DRAIN
- 2 SOURCE
- 3 GATE

**NOTES:**

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M - 1982.
- 2 ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES)

Conforms to JEDEC Outline TO-254AA\*  
Dimensions in Millimeters and (Inches)

\* $I_D$  current limited by pin diameter

**Absolute Maximum Ratings**

Parameter	IRFM054	Units
$I_D$ @ $V_{GS} = 10V, T_C = 25^\circ C$ Continuous Drain Current	35*	A
$I_D$ @ $V_{GS} = 10V, T_C = 100^\circ C$ Continuous Drain Current	35	
$I_{DM}$ Pulsed Drain Current ①	220	
$P_D$ @ $T_C = 25^\circ C$ Max. Power Dissipation	150	W
Linear Derating Factor	1.2	W/K ②
$V_{GS}$ Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$ Single Pulse Avalanche Energy ②	480	mJ
$dv/dt$ Peak Diode Recovery $dv/dt$ ③	4.5	V/ns
$T_J$ Operating Junction	-55 to 150	°C
$T_{STG}$ Storage Temperature Range		
Lead Temperature		
Weight	300 (0.063 in. (1.6 mm) from case for 10s) 9.3 (typical)	g


\* $I_D$  current limited by pin diameter

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

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 1.0 mA$
$\Delta BV_{DSS}/\Delta T_J$ Temperature Coefficient of Breakdown Voltage	—	0.68	—	V/°C	Reference to 25°C, $I_D = 1.0 mA$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.027	$\Omega$	$V_{GS} = 10V, I_D = 35A$ ④
$V_{GS(th)}$ Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250 \mu A$
$g_{fs}$ Forward Transconductance	20	—	—	S (ft)	$V_{DS} \geq 15V, I_{DS} = 35A$ ④
$I_{DSS}$ Zero Gate Voltage Drain Current	—	—	25	$\mu A$	$V_{DS} = 0.8 \text{ Max. Rating}, V_{GS} = 0V$
	—	—	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	80	—	180	nC	$V_{GS} = 10V, I_D = 35A$
$Q_{gs}$ Gate-to-Source Charge	20	—	45		$V_{DS} = 0.5 \times \text{Max. Rating}$
$Q_{gd}$ Gate-to-Drain ("Miller") Charge	34	—	105		See Fig. 6 and 14
$t_{d(on)}$ Turn-On Delay Time	—	—	33		ns
$t_r$ Rise Time	—	—	180	See Fig. 11	
$t_{d(off)}$ Turn-Off Delay Time	—	—	100		
$t_f$ Fall Time	—	—	100		
$L_D$ Internal Drain Inductance	—	8.7	—	nH	Measured from the drain lead, 6 mm (0.25 in.) from package to center of die. Modified MOSFET symbol showing the internal inductances.
$L_S$ Internal Source Inductance	—	8.7	—		
$C_{iss}$ Input Capacitance	—	4600	—	pF	$V_{GS} = 0V, V_{DS} = 25V$ $f = 1.0 MHz$ See Fig. 5
$C_{oss}$ Output Capacitance	—	2000	—		
$C_{rss}$ Reverse Transfer Capacitance	—	340	—		
$C_{DC}$ 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)	—	—	35*	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	220		
$V_{SD}$	Diode Forward Voltage	—	—	2.5	V	$T_J = 25^\circ\text{C}$ , $I_S = 35\text{A}$ , $V_{GS} = 0\text{V}$ ④
$t_{rr}$	Reverse Recovery Time	—	—	280	nS	$T_J = 25^\circ\text{C}$ , $I_F = 35\text{A}$ , $dI/dt \leq 100 \text{ A}/\mu\text{s}$ ④
$Q_{RR}$	Reverse Recovery Charge	—	—	2.2	$\mu\text{C}$	$V_{DD} \leq 50\text{V}$
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$ .				

\* $I_S$  current limited by pin diameter

**Thermal Resistance**

Parameter		Min.	Typ.	Max.	Units	Test Conditions
$R_{thJC}$	Junction-to-Case	—	—	0.83	K/W ⑤	Mounting surface flat, smooth, and greased Typical socket mount
$R_{thCS}$	Case-to-Sink	—	0.21	—		
$R_{thJA}$	Junction-to-Ambient	—	—	48		

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

② @  $V_{DD} = 25\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  
 $L \geq 450 \mu\text{H}$ ,  $R_G = 25\Omega$ ,  
Peak  $I_L = 35\text{A}$

③  $I_{SD} \leq 35\text{A}$ ,  $dI/dt \leq 200 \text{ A}/\mu\text{s}$ ,  
 $V_{DD} \leq BV_{DSS}$ ,  $T_J \leq 125^\circ\text{C}$   
Suggested  $R_G = 2.35\Omega$

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

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

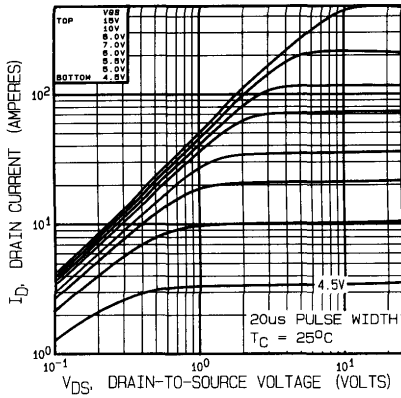


Fig. 1 — Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

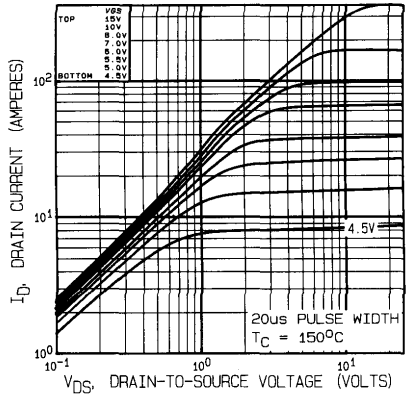


Fig. 2 — Typical Output Characteristics,  $T_C = 150^\circ\text{C}$

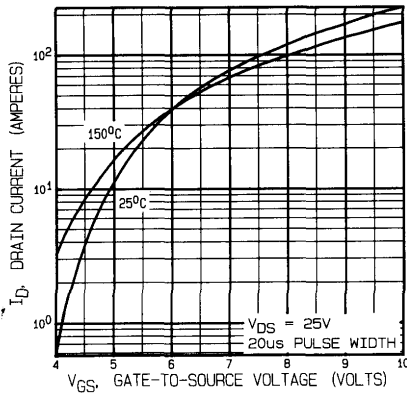


Fig. 3 — Typical Transfer Characteristics

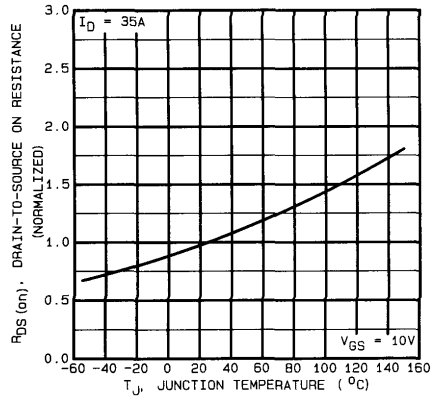


Fig. 4 — Normalized On-Resistance vs. Temperature

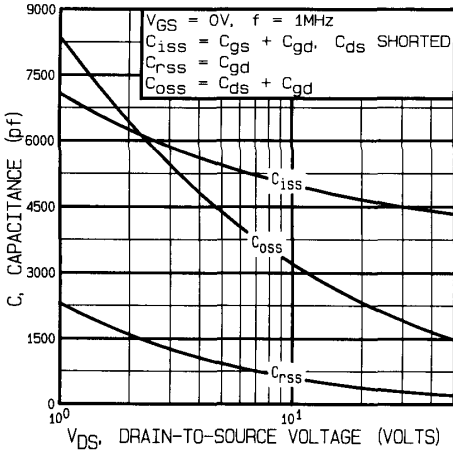


Fig. 5 — Typical Capacitance Vs. Drain-to-Source Voltage

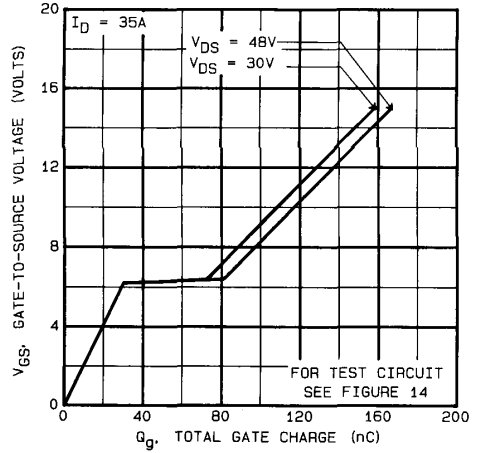


Fig. 6 — Typical Gate Charge Vs. Gate-to-Source Voltage

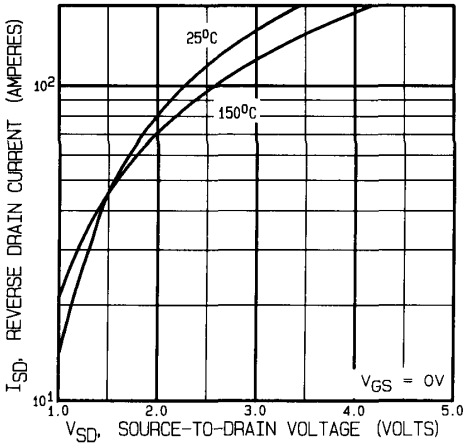


Fig. 7 — Typical Source-Drain Diode Forward Voltage

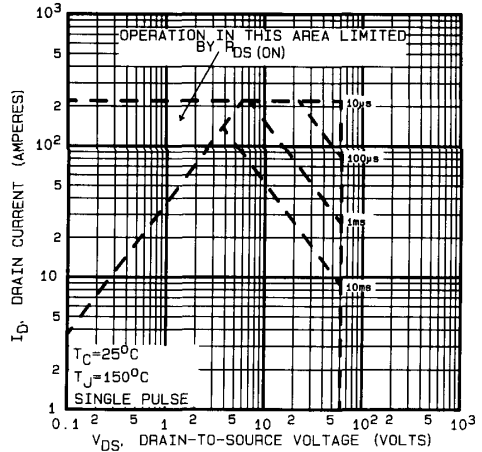


Fig. 8 — Maximum Safe Operating Area

IRFM054 Device

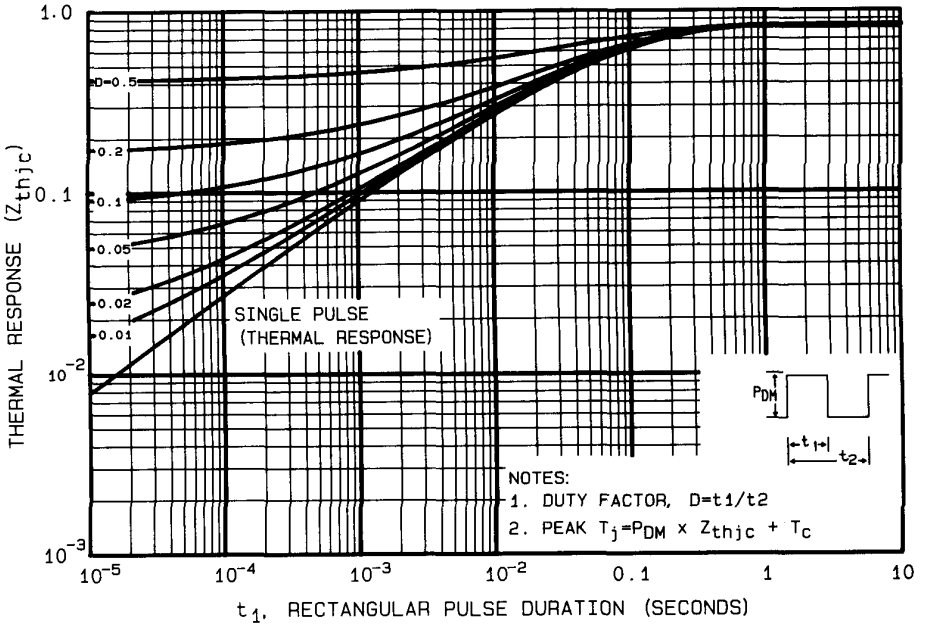


Fig. 9 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

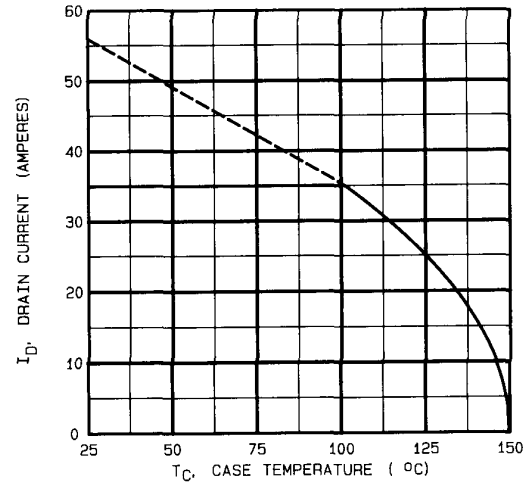


Fig. 10 — Maximum Drain Current Vs. Case Temperature

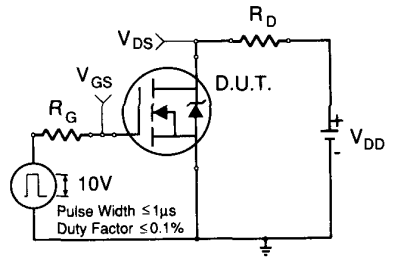


Fig. 11a — Switching Time Test Circuit

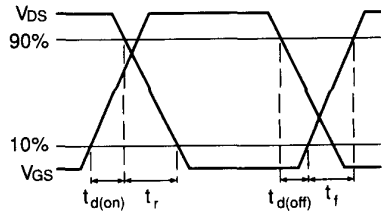


Fig. 11b — Switching Time Waveforms

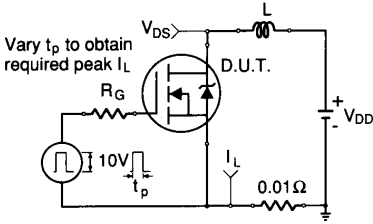


Fig. 12a — Unclamped Inductive Test Circuit

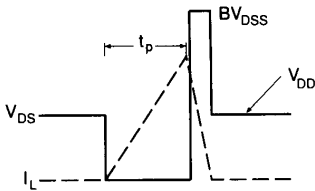


Fig. 12b — Unclamped Inductive Waveforms

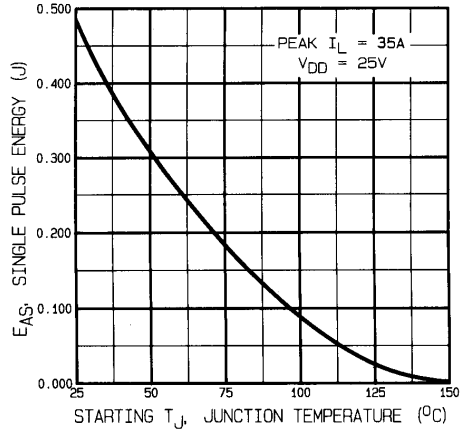


Fig. 12c — Maximum Avalanche Energy Vs. Starting Junction Temperature

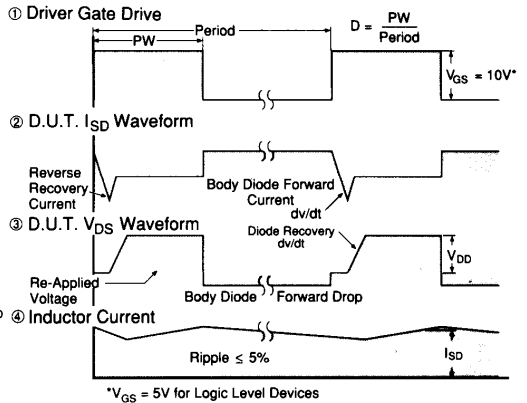
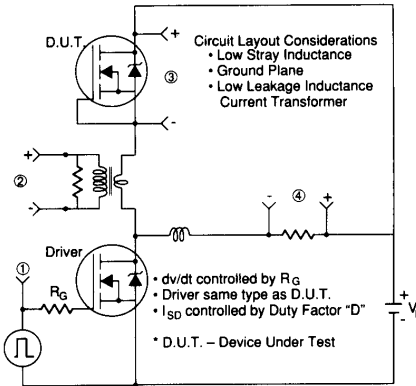


Fig. 13 — Peak Diode Recovery  $dv/dt$  Test Circuit

IRFM054 Device

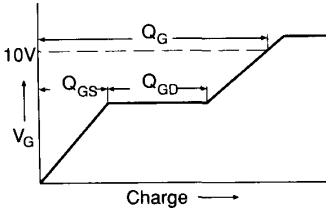


Fig. 14a — Basic Gate Charge Waveform

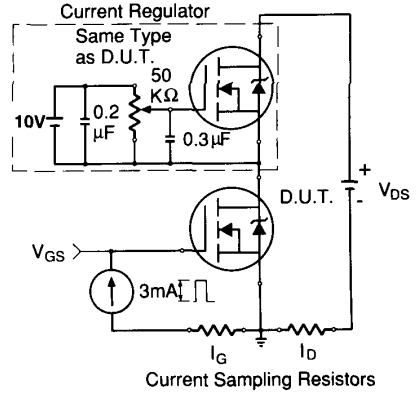


Fig. 14b — Gate Charge Test Circuit

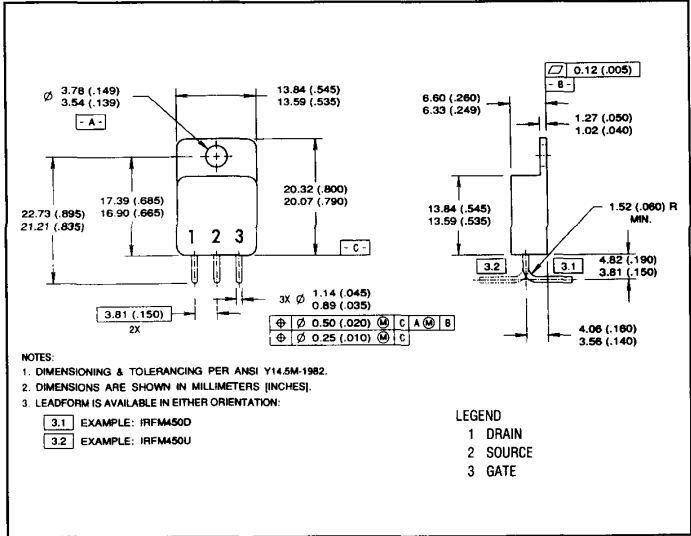


Fig. 15 — Optional Leadforms for Outline TO-254

BERYLLIA WARNING PER MIL-PRF-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.