

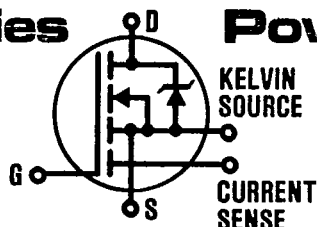
INTERNATIONAL RECTIFIER **IR**



REPETITIVE AVALANCHE AND dv/dt RATED*

LOWER ON STATE RESISTANCE, 175°C OPERATING TEMPERATURE

HEXSense™ — Current Sense **IRC530**
C Series **Power MOSFET** **IRC531**



N-CHANNEL

IRC530
IRC531

**100 Volt, 0.16 Ohm Current Sense
Plastic Package Similar to TO-220**

The HEXSense™ "C" Power MOSFETs incorporate a current sensing feature, obtained by isolating a few cells in its structure. In addition to the well established characteristics of the HEXFETs, they provide an accurate fraction of the drain current as feedback parameters for control and/or protection.

Fields of applications include: current mode motor control ; power supplies using flyback or push pull topology; uninterruptible power systems; instrumentation; solid state relays; CRT deflection, solenoid and lamp drive circuits.

The HEXFET technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry and unique processing of the HEXFET design achieve very low on-state resistance combined with high transconductance and great device ruggedness.

Product Summary

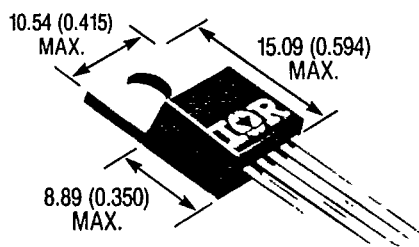
Part Number	BV _{DSS}	R _{DS(on)}	I _D
IRC530	100V	0.16Ω	14A
IRC531	80V	0.16Ω	14A

Features:

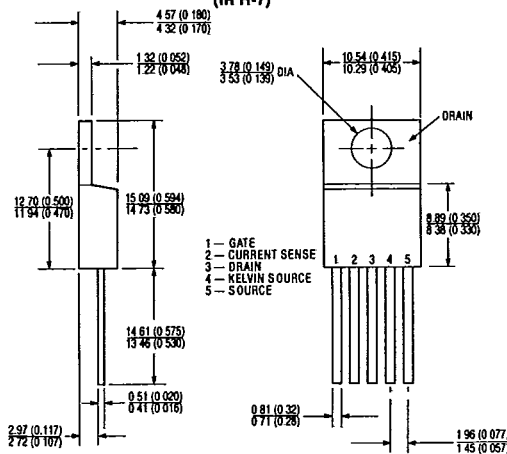
- **±2.5% Sensing Accuracy**
- **Repetitive Avalanche Ratings**
- **Dynamic dv/dt Rating**
- **Simple Drive Requirements**

CURRENT SENSING DEVICES

CASE STYLE AND DIMENSIONS



**Conforms to Outline TO-220
(IR H-7)***



***For Additional Outlines
See Page E-12**

Dimensions in Millimeters and (Inches)

*This data sheet applies to product with batch codes that begin with a digit, ie. 2A3B

IRC530, IRC531 Devices

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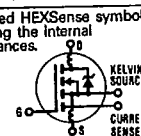
T-39-11

Absolute Maximum Ratings

Parameter	IRC530, IRC531	Units
I_D @ $T_C = 25^\circ\text{C}$ Continuous Drain Current	14	A
I_D @ $T_C = 100^\circ\text{C}$ Continuous Drain Current	10	A
I_{DM} Pulsed Drain Current ①	56	A
P_D @ $T_C = 25^\circ\text{C}$ Max. Power Dissipation	79	W
Linear Derating Factor	0.53	W/K ②
V_{GS} Gate-to-Source Voltage	± 20	V
E_{AS} Single Pulse Avalanche Energy ②	69 (See Fig. 14)	mJ
I_{AR} Avalanche Current ① (Repetitive or Non-Repetitive)	14 (See E_{AR})	A
E_{AR} Repetitive Avalanche Energy ①	7.9 (See I_{AR})	mJ
dv/dt Peak Diode Recovery dv/dt ③	5.6 (See Fig. 17)	V/ns
T_J Operating Junction	-55 to 175	$^\circ\text{C}$
T_{STG} Storage Temperature Range		$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)	$^\circ\text{C}$

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

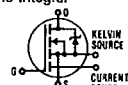
Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain-to-Source Breakdown Voltage	IRC530 IRF531	100 80	—	—	V	$V_{GS} = 0V, I_D = 250 \mu A$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance ④	ALL	—	0.12	0.16	Ω	$V_{GS} = 10V, I_D = 8.3A$
$I_{D(on)}$ On-State Drain Current ④	ALL	14	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max. $V_{GS} = 10V$
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250 \mu A$
g_{fs} Forward Transconductance ④	ALL	4.7	7.1	—	S (⑤)	$V_{DS} \geq 50V, I_{DS} = 8.3A$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250 1000	μA	$V_{DS} = \text{Max. Rating}, V_{GS} = 0V$ $V_{DS} = 0.8 \times \text{Max. Rating}$ $V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS} Gate-to-Source Leakage Forward	ALL	—	—	500	nA	$V_{GS} = 20V$
I_{GSS} Gate-to-Source Leakage Reverse	ALL	—	—	-500	nA	$V_{GS} = -20V$
Q_g Total Gate Charge	ALL	—	17	26	nC	$V_{GS} = 10V, I_D = 14A$ $V_{DS} = 0.8 \times \text{Max. Rating}$ See Fig. 16
Q_{gs} Gate-to-Source Charge	ALL	—	3.7	5.5	nC	(Independent of operating temperature)
Q_{gd} Gate-to-Drain ("Miller") Charge	ALL	—	7.0	11	nC	
$t_{d(on)}$ Turn-On Delay Time	ALL	—	9.5	14	ns	$V_{DD} = 50V, I_D = 14A, R_G = 12\Omega$
t_r Rise Time	ALL	—	42	63	ns	$R_D = 3.5\Omega$
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	22	33	ns	See Fig. 15
t_f Fall Time	ALL	—	25	38	ns	(Independent of operating temperature)
L_D Internal Drain Inductance	ALL	—	4.5	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L_S Internal Source Inductance	ALL	—	7.5	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.
C_{iss} Input Capacitance	ALL	—	650	—	pF	$V_{GS} = 0V, V_{DS} = 25V$
C_{oss} Output Capacitance	ALL	—	240	—	pF	$f = 1.0 \text{ MHz}$
C_{rss} Reverse Transfer Capacitance	ALL	—	44	—	pF	See Fig. 10



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T-39-11

Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	—	—	14	A	Modified HEXSense symbol showing the integral Reverse p-n junction rectifier. 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	—	—	56	A	
V_{SD}	Diode Forward Voltage ④	ALL	—	—	2.5	V	$T_J = 25^{\circ}\text{C}$, $I_S = 14\text{A}$, $V_{GS} = 0\text{V}$
t_{rr}	Reverse Recovery Time	ALL	66	140	310	ns	$T_J = 25^{\circ}\text{C}$, $I_F = 14\text{A}$, $dI/dt = 100\text{ A}/\mu\text{s}$
Q_{RR}	Reverse Recovery Charge	ALL	0.22	0.49	1.2	μC	
t_{on}	Forward Turn-On Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				

Current Sense Characteristics @ $T_J = 25^\circ\text{C}$ (Unless Otherwise Noted)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
r Current Sensing Ratio	ALL	1430	1465	1500	—	$V_{GS} = 10$, $I_D = 14\text{A}$ See Figure 21 for test circuit, See Figure 18, 19, and 20 for typ. behavior.
C_{oss} Output Capacitance of Sensing Cells	ALL	—	9.0	—	pF	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{ MHz}$ See Figure 22 for test circuit.

Thermal Resistance

R_{thJC} Junction-to-Case	ALL	—	—	1.9	K/W ⑤	
R_{thCS} Case-to-Sink	ALL	—	0.50	—	K/W ⑤	Mounting surface flat, smooth, and greased
R_{thJA} Junction-to-Ambient	ALL	—	—	80	K/W ⑤	Typical socket mount

① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 5) Refer to current HEXFET reliability report

③ $I_{SD} \leq 14\text{A}$, $dI/dt \leq 140\text{A}/\mu\text{s}$,
 $V_{DD} \leq BV_{DSS}$, $T_J \leq 175^\circ\text{C}$
Suggested $R_G = 12\Omega$

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

② @ $V_{DD} = 25\text{V}$, Starting $T_J = 25^\circ\text{C}$,
 $L = 530\text{ }\mu\text{H}$, $R_G = 25\Omega$,
Peak $I_L = 14\text{A}$.

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

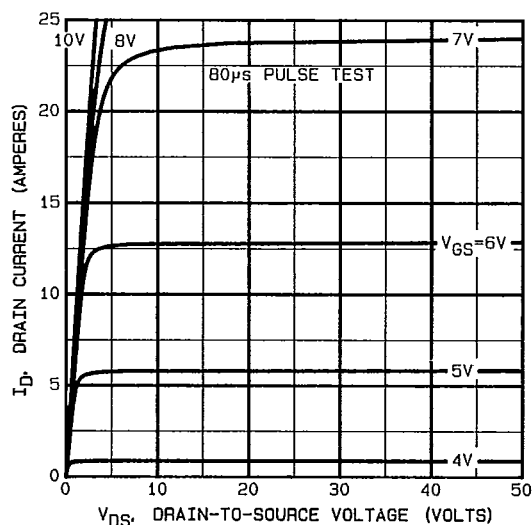


Fig. 1 — Typical Output Characteristics

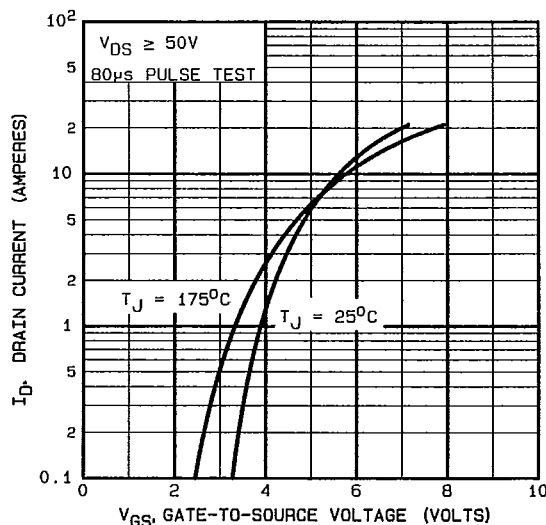


Fig. 2 — Typical Transfer Characteristics

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T-39-11

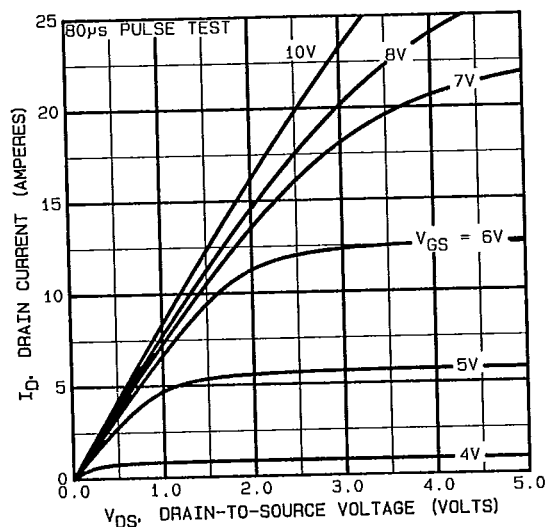


Fig. 3 — Typical Saturation Characteristics

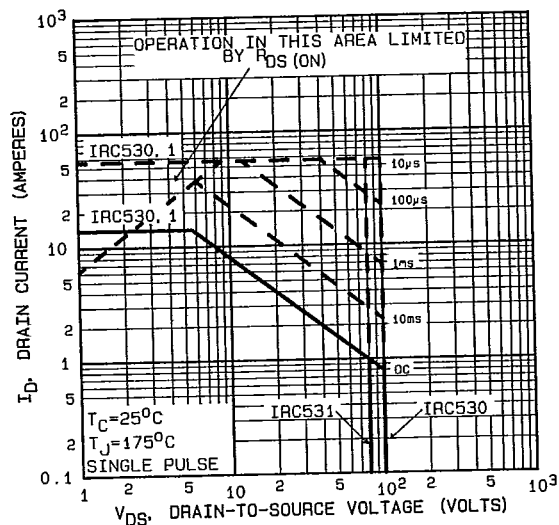


Fig. 4 — Maximum Safe Operating Area

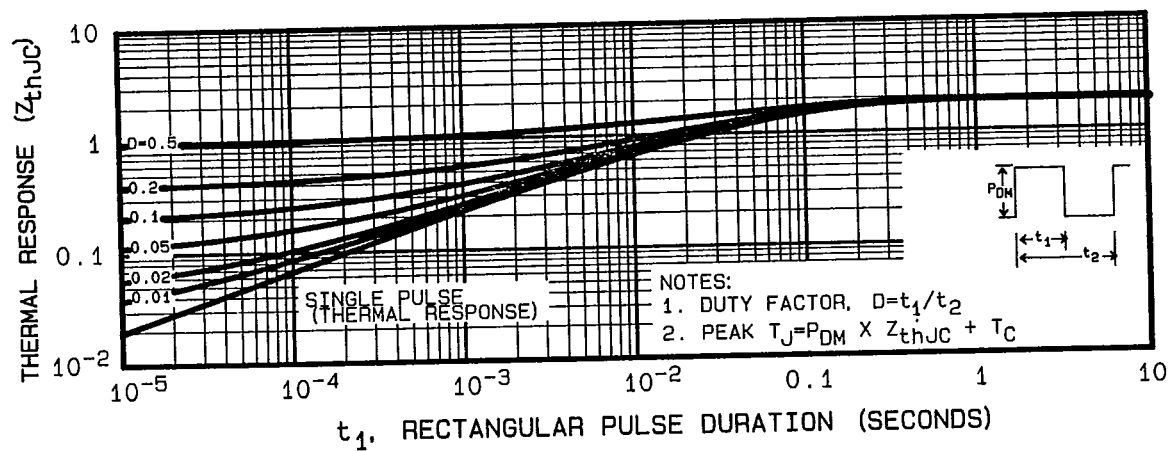


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

T-39-11

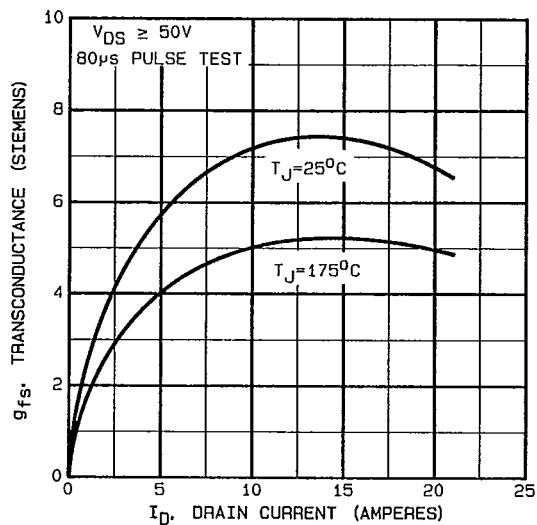


Fig. 6 — Typical Transconductance Vs. Drain Current

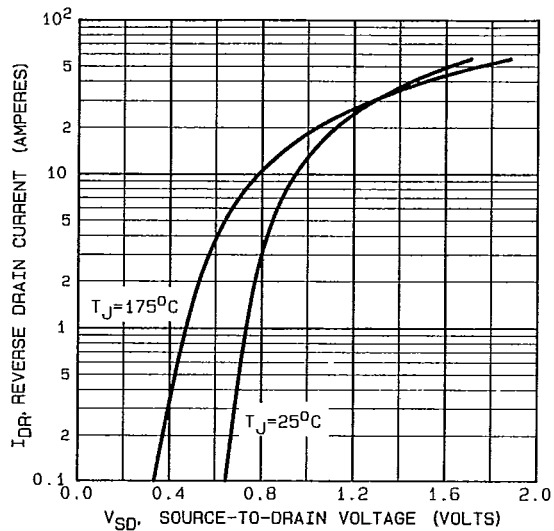


Fig. 7 — Typical Source-Drain Diode Forward Voltage

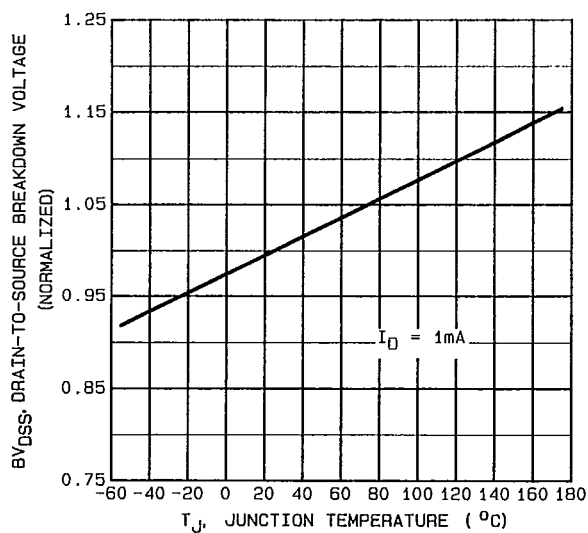


Fig. 8 — Breakdown Voltage Vs. Temperature

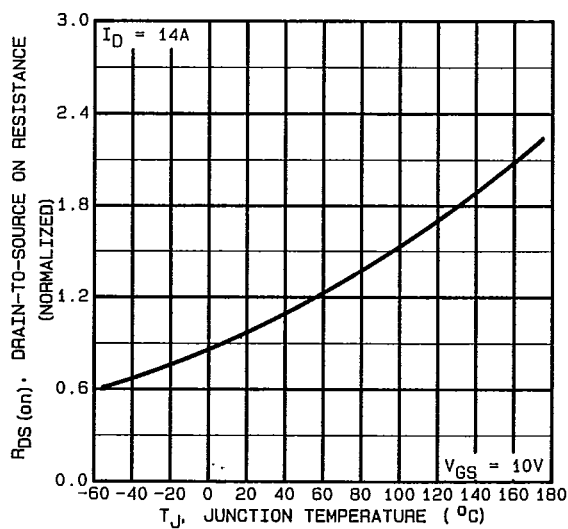


Fig. 9 — Normalized On-Resistance Vs. Temperature

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DEVICES

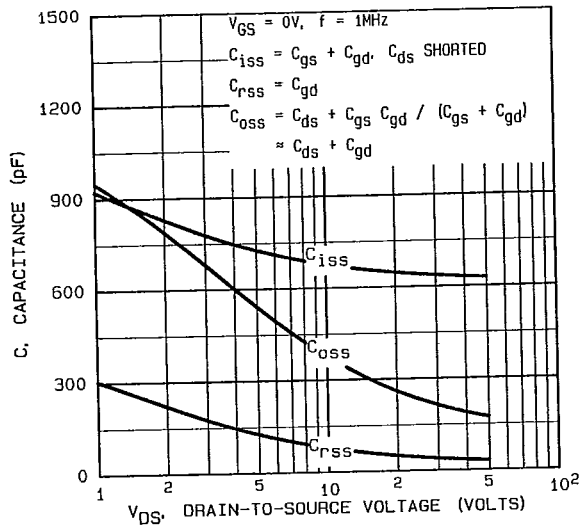


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

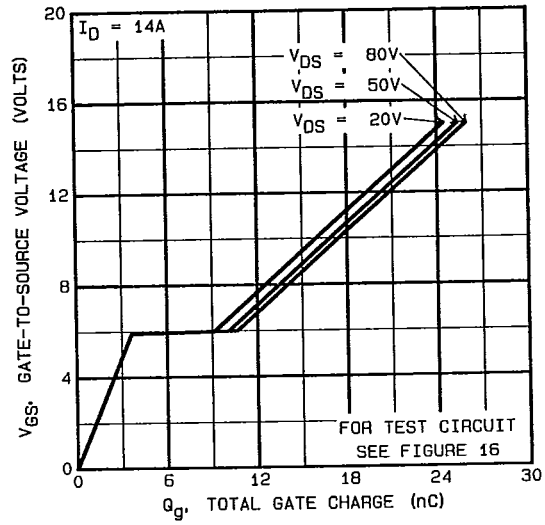


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

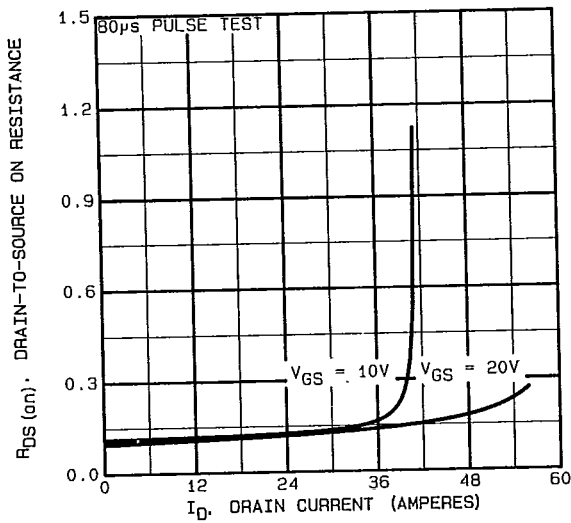


Fig. 12 — Typical On-Resistance Vs. Drain Current

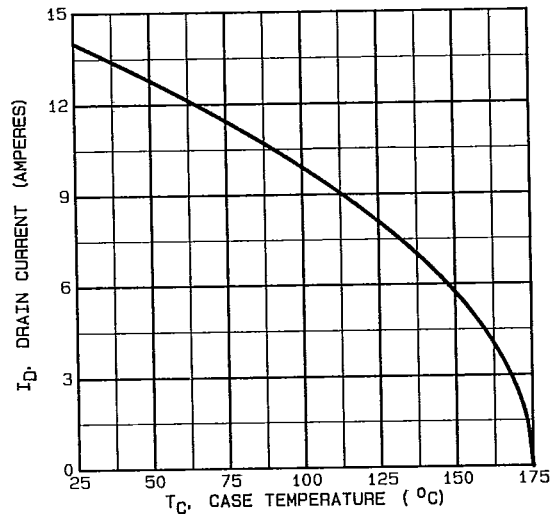


Fig. 13 — Maximum Drain Current Vs. Case Temperature

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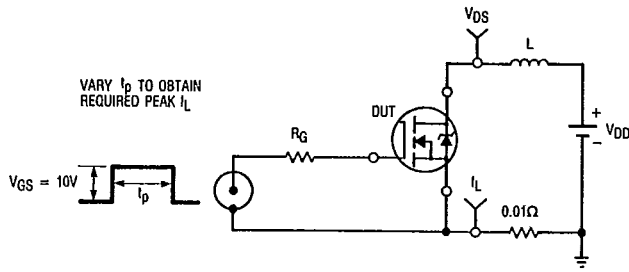


Fig. 14a — Unclamped Inductive Test Circuit

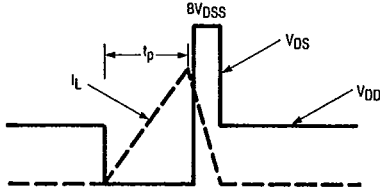


Fig. 14b — Unclamped Inductive Waveforms

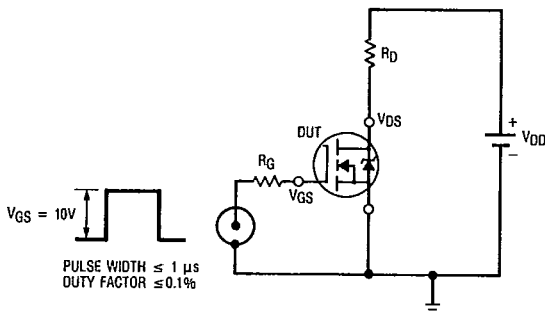


Fig. 15a — Switching Time Test Circuit

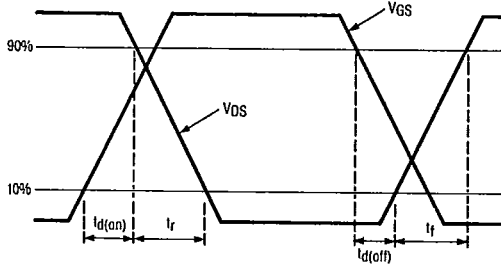


Fig. 15b — Switching Time Waveforms

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T-39-11

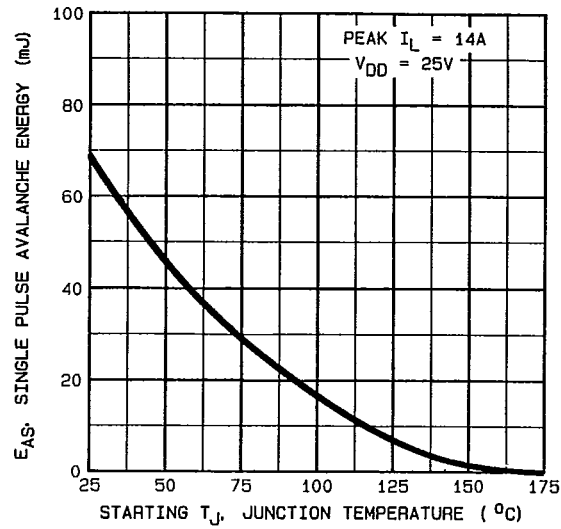


Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

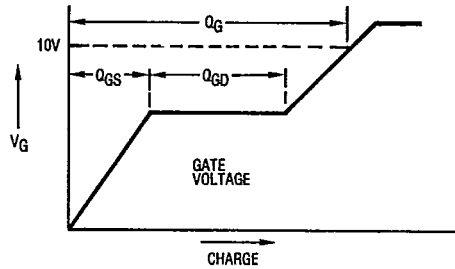


Fig. 16a — Basic Gate Charge Waveform

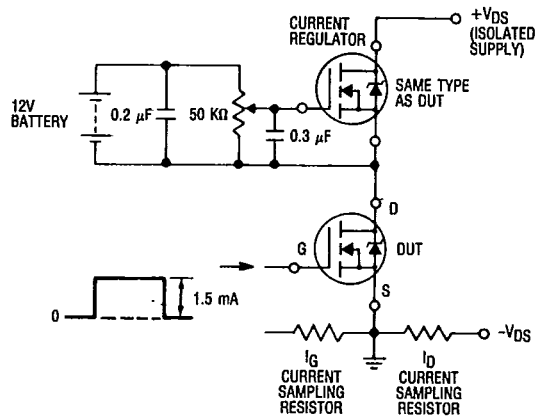


Fig. 16b — Gate Charge Test Circuit

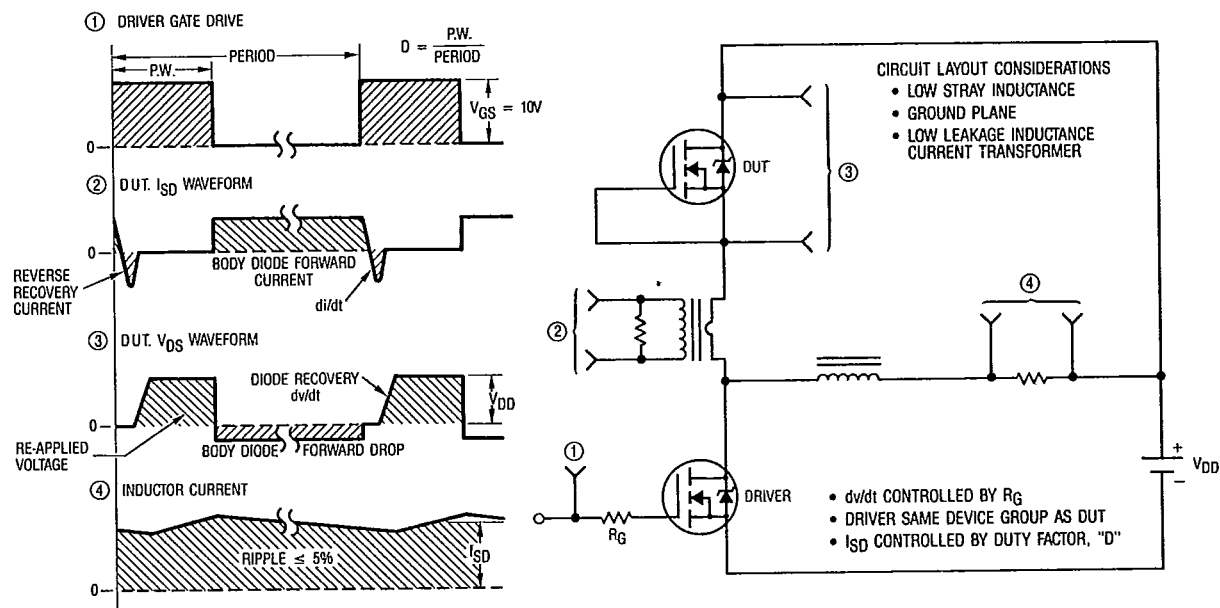
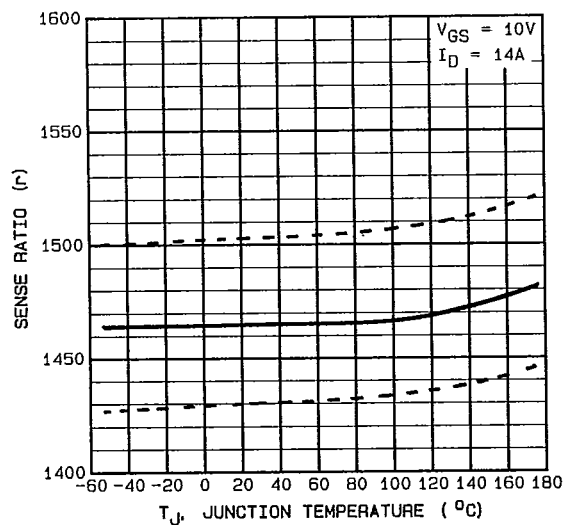
Fig. 17 — Peak Diode Recovery dv/dt Test Circuit

Fig. 18 — HEXSense Ratio Vs. Junction Temperature

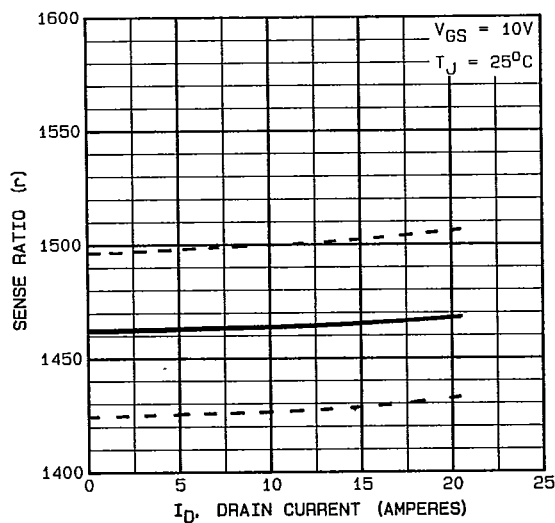


Fig. 19 — HEXSense Ratio Vs. Drain Current

IRC530, IRC531 Devices

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T-39-11

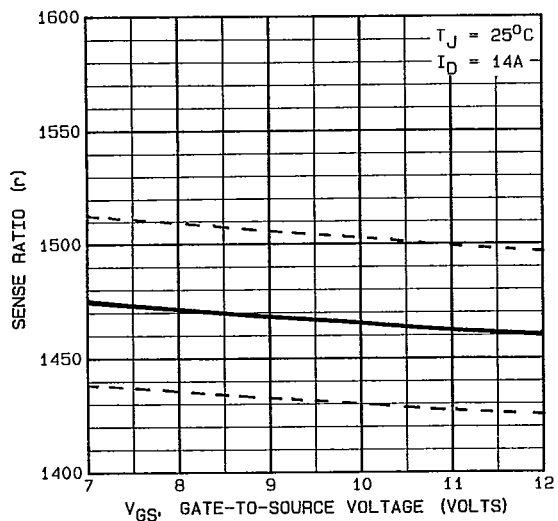
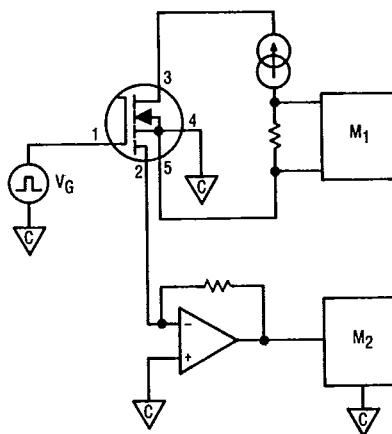


Fig. 20 — HEXSense Ratio Vs. Gate Voltage



M₁, M₂ = HIGH SPEED DIGITAL VOLTMETER

Fig. 21 — HEXSense Ratio Test Circuit

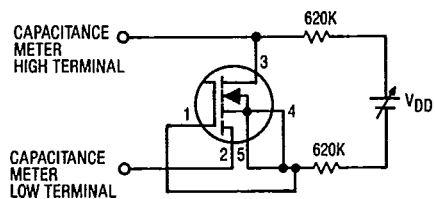


Fig. 22 — Output Capacitance Test Circuit for HEXSense Only

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IRC530, IRC531 Devices

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T-39-11

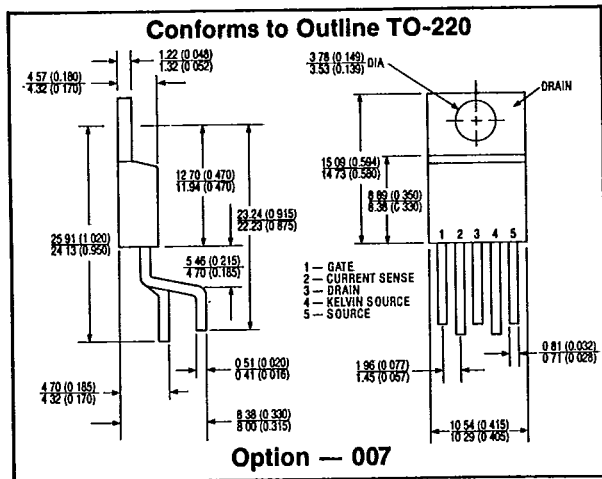


Fig. 23 — HEXSense Case Style (H-8)

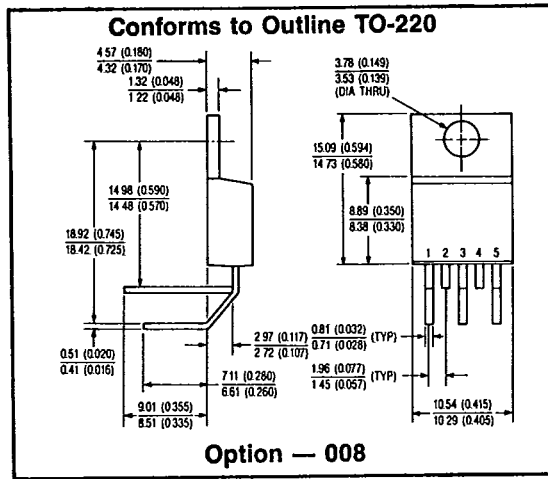


Fig. 24 — HEXSense Case Style (H-9)

Dimensions in Millimeters and (Inches)

ORDERING INFORMATION

Part Number	Case Style	
IRC530	IR H-7	
IRC531		
IRC530-007	IR H-8	
IRC531-007		
IRC530-008	IR H-9	
IRC531-008		

Other lead formings are available upon request.