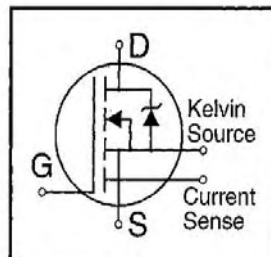


IRC640PbF

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Current Sense
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free

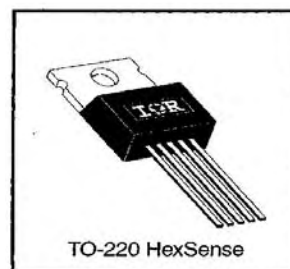


$V_{DSS} = 200V$
$R_{DS(on)} = 0.18\Omega$
$I_D = 18A$

Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The HEXSense device provides an accurate fraction of the drain current through the additional two leads to be used for control or protection of the device. These devices exhibit similar electrical and thermal characteristics as their IRF-series equivalent part numbers. The provision of a kelvin source connection effectively eliminates problems of common source inductance when the HEXSense is used as a fast, high-current switch in non current-sensing applications.



Absolute Maximum Ratings

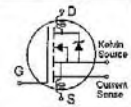
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	18	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10 V$	11	
I_{DM}	Pulsed Drain Current ①	72	
$P_D @ T_C = 25^\circ C$	Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	430	mJ
I_{AR}	Avalanche Current ①	18	A
E_{AR}	Repetitive Avalanche Energy ①	13	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.0	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{GS}=0V$, $I_D=250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.29	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D=1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.18	Ω	$V_{GS}=10V$, $I_D=11A$ 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	6.5	—	—	S	$V_{DS}=50V$, $I_D=11A$ ④
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS}=200V$, $V_{GS}=0V$
		—	—	250		$V_{DS}=160V$, $V_{GS}=0V$, $T_J=125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS}=20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS}=-20V$
Q_{g1}	Total Gate Charge	—	—	70	nC	$I_D=18A$
Q_{gs}	Gate-to-Source Charge	—	—	13		$V_{DS}=160V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	39		$V_{GS}=10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD}=100V$
t_r	Rise Time	—	51	—		$I_D=18A$
$t_{d(off)}$	Turn-Off Delay Time	—	45	—		$R_G=9.1\Omega$
t_f	Fall Time	—	36	—		$R_D=3.2\Omega$ ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	1300	—	pF	$V_{GS}=0V$
C_{oss}	Output Capacitance	—	430	—		$V_{DS}=25V$
C_{rss}	Reverse Transfer Capacitance	—	130	—		$f=1.0MHz$
r	Current Sensing Ratio	2600	—	2880	—	$I_D=18A$, $V_{GS}=10V$
C_{oss}	Output Capacitance of Sensing Cells	—	9.0	—	pF	$V_{GS}=0V$, $V_{DS}=25V$, $f=1.0MHz$



Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	18	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	72		
V_{SD}	Diode Forward Voltage	—	—	2.0	V	$T_J=25^\circ\text{C}$, $I_S=18A$, $V_{GS}=0V$ ④
t_{rr}	Reverse Recovery Time	—	300	610	ns	$T_J=25^\circ\text{C}$, $I_F=18A$
Q_{rr}	Reverse Recovery Charge	—	3.4	7.1	μC	$di/dt=100A/\mu s$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

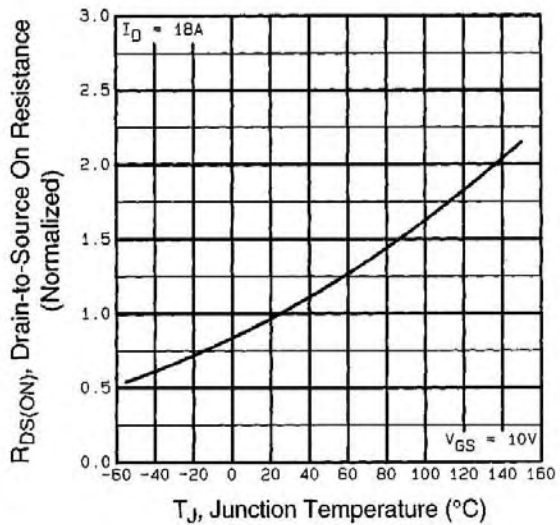
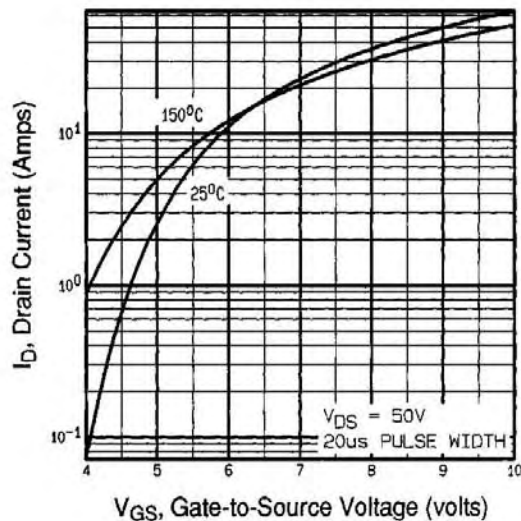
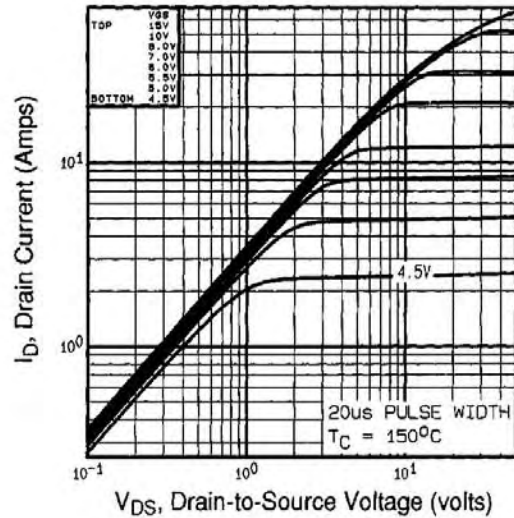
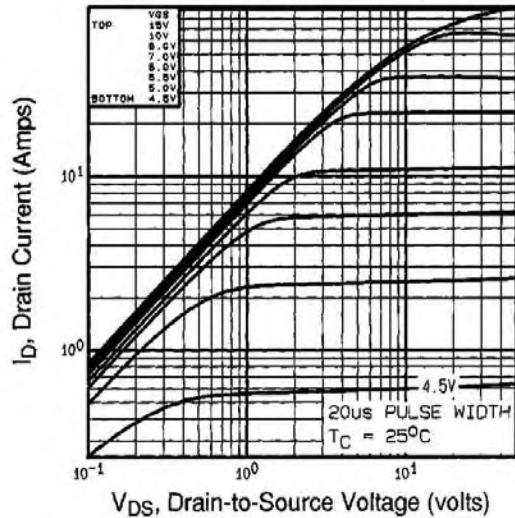
Notes:

① Repetitive rating; pulse width limited by max. junction temperature

② $V_{DD}=50V$, starting $T_J=25^\circ\text{C}$, $L=2.0mH$
 $R_G=25\Omega$, $I_{AS}=18A$

③ $I_{SD}\leq 18A$, $di/dt\leq 150A/\mu s$, $V_{DD}\leq V_{(BR)DSS}$,
 $T_J\leq 150^\circ\text{C}$

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.



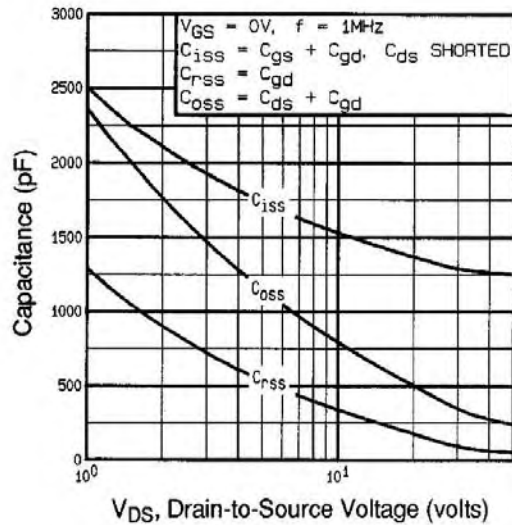


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

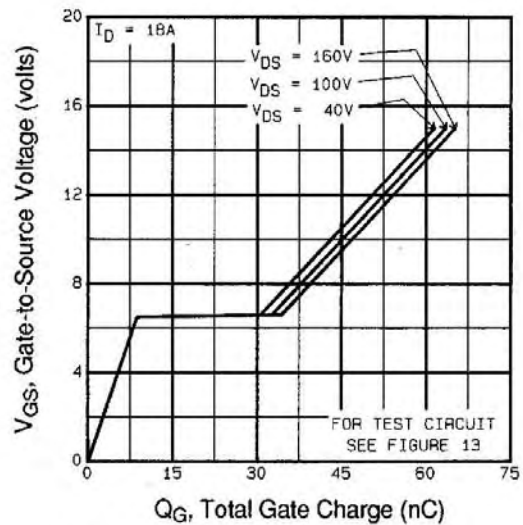


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

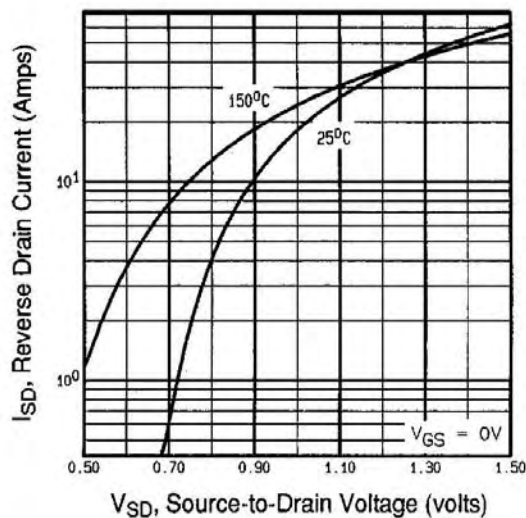


Fig 7. Typical Source-Drain Diode Forward Voltage

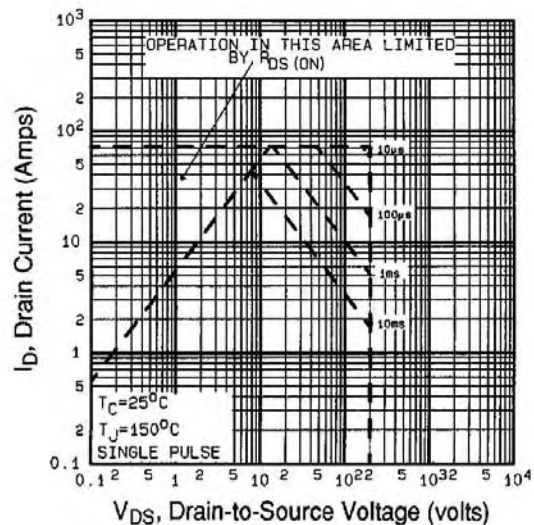


Fig 8. Maximum Safe Operating Area

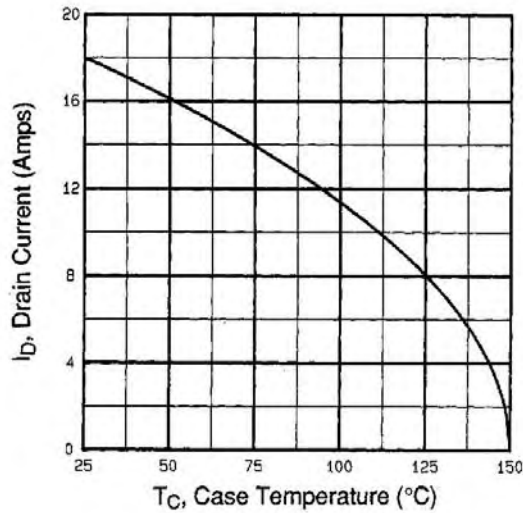


Fig 9. Maximum Drain Current Vs. Case Temperature

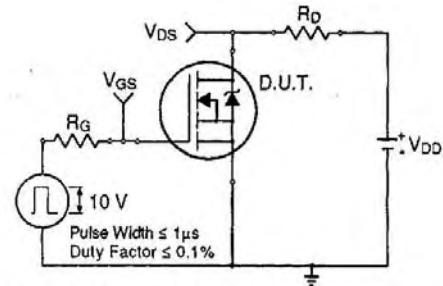


Fig 10a. Switching Time Test Circuit

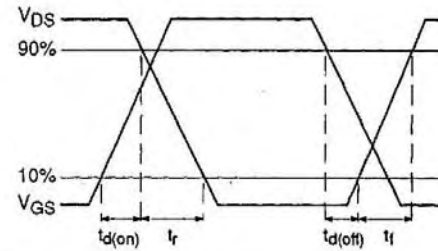


Fig 10b. Switching Time Waveforms

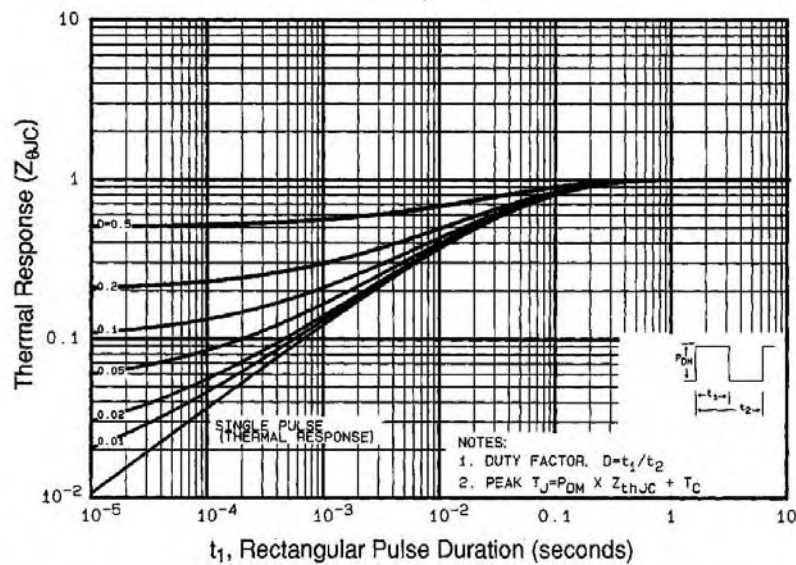


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

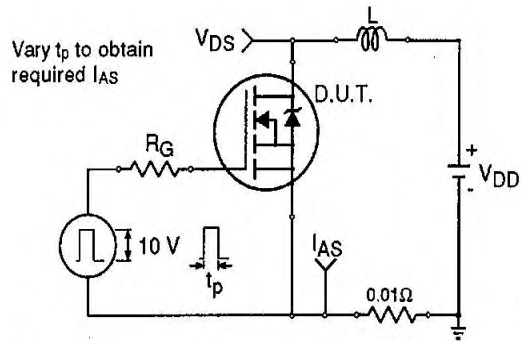


Fig 12a. Unclamped Inductive Test Circuit

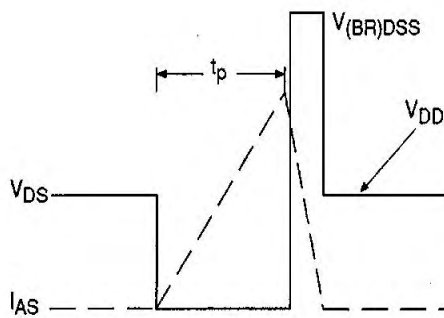


Fig 12b. Unclamped Inductive Waveforms

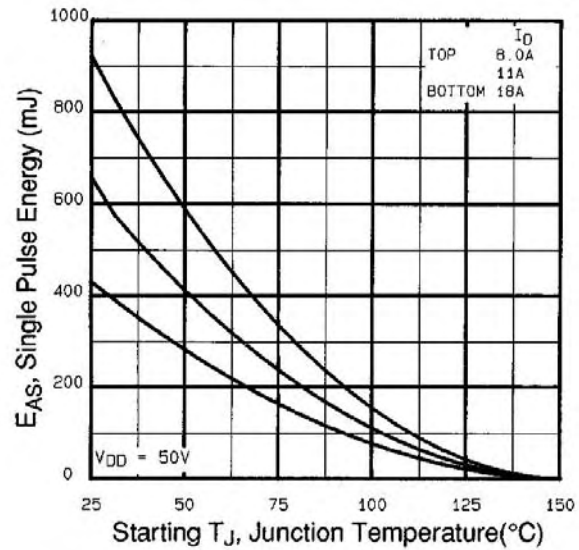


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

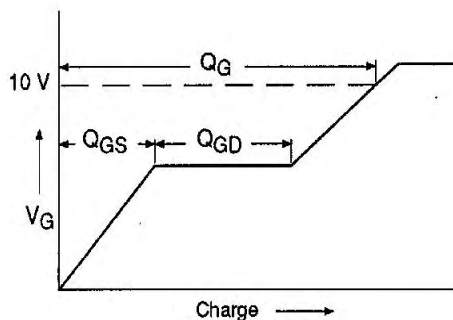


Fig 13a. Basic Gate Charge Waveform

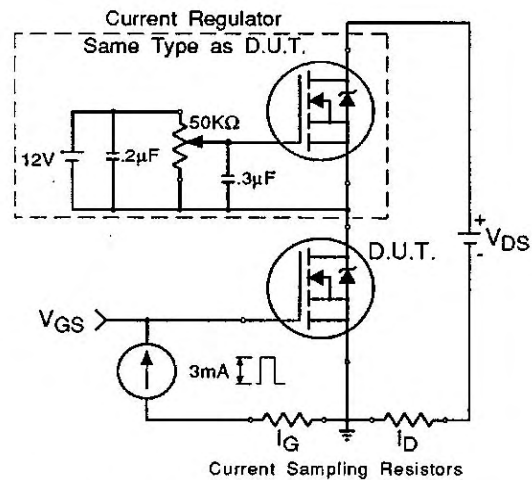


Fig 13b. Gate Charge Test Circuit

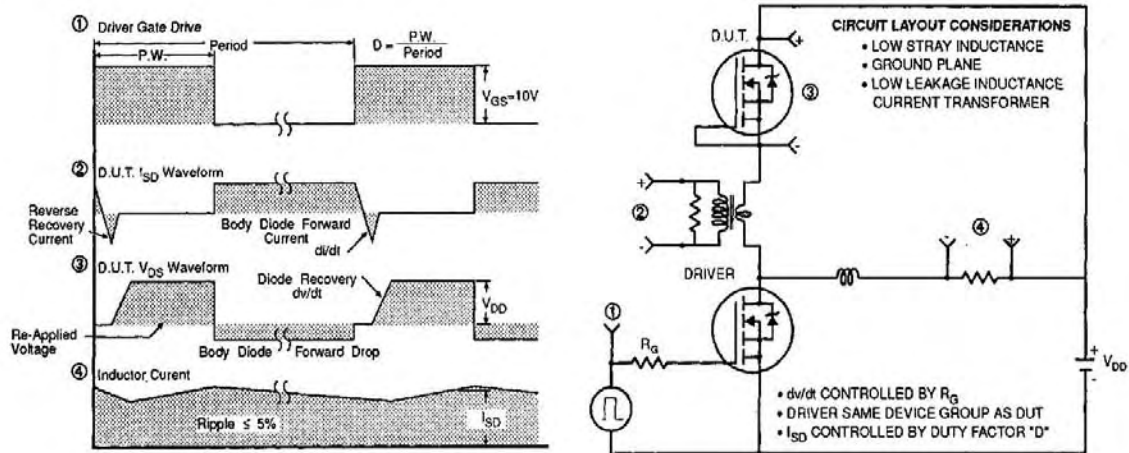


Fig 14. Peak Diode Recovery dv/dt Test Circuit

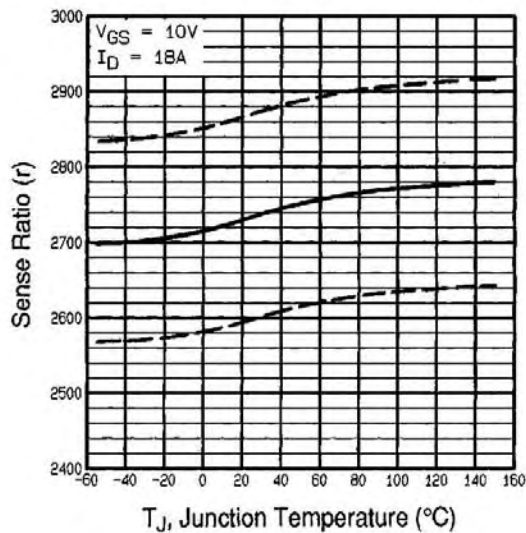


Fig 15. Typical HEXSense Ratio Vs. Junction Temperature

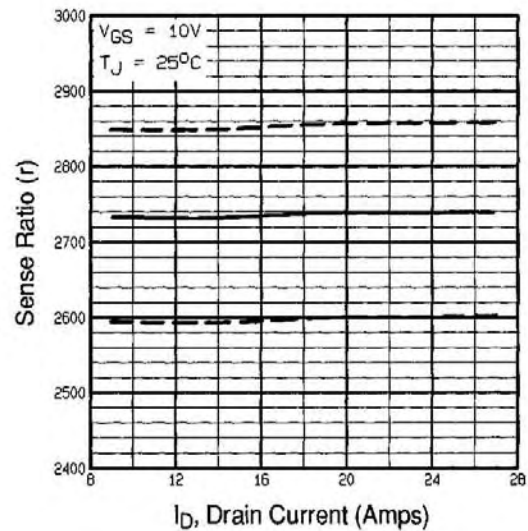


Fig 16. Typical HEXSense Ratio Vs. Drain Current

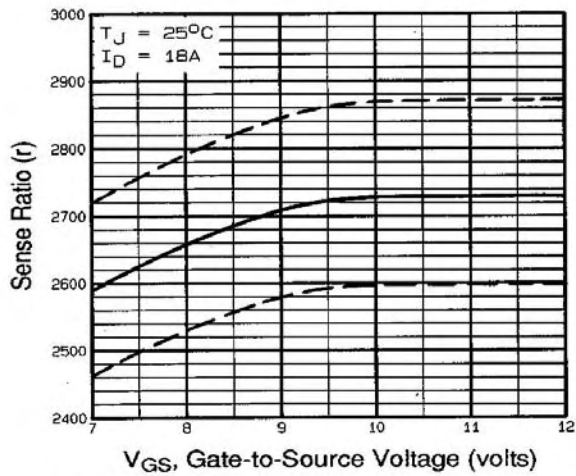
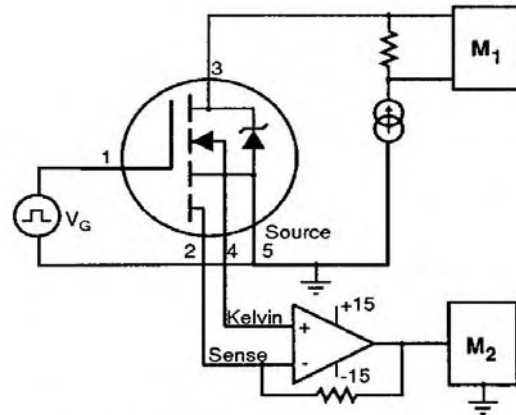


Fig 17. Typical HEXSense Ratio Vs. Gate Voltage



M1, M2 = HIGH SPEED DIGITAL VOLTMETERS

Fig 18. HEXSense Ratio Test Circuit

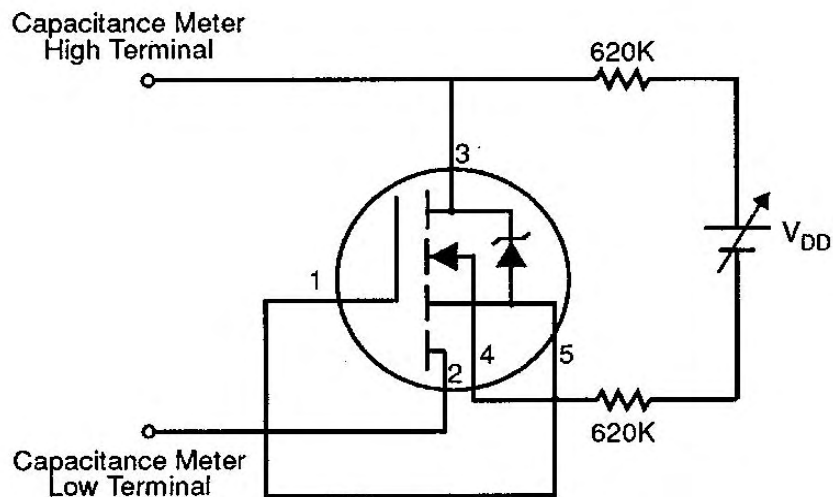
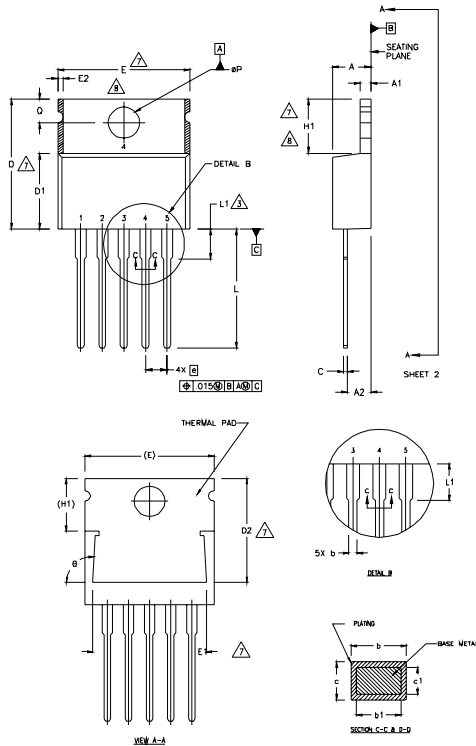


Fig 19. HEXSense Sensing Cell Output Capacitance Test Circuit

HexsenseTO-220 5L Package Outline

(Dimensions are shown in millimeters (inches))



NOTES:

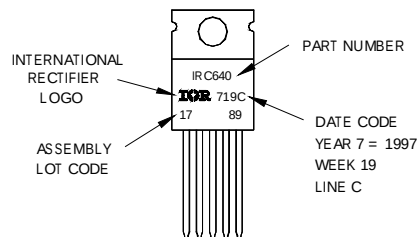
- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 5 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY.
- 6 CONTROLLING DIMENSION : INCHES.
- 7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- 8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	5
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.64	0.88	.025	.035	
b1	0.64	0.84	.025	.033	
c	0.36	0.61	.014	.024	5
c1	0.36	0.56	.014	.022	
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	7
D2	12.19	12.88	.480	.507	
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	1.70 BSC		.067 BSC		7,8
H1	5.85	6.55	.230	.270	
L	13.47	14.09	.530	.555	
L1	—	6.35	—	.250	3
ØP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
ø	90°—93°		90°—93°		

Hexsense TO-220 5L Part Marking Information

EXAMPLE: THIS IS AN IRC640
WITH ASSEMBLY
LOT CODE 1789
ASSEMBLED ON WW19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position
indicates "Lead-Free"



Data and specifications subject to change without notice.