

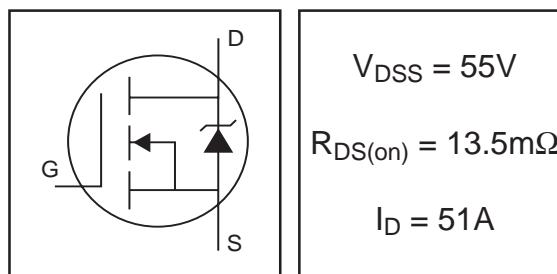
## Features

- Logic Level
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to  $T_{jmax}$

## Description

Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications.

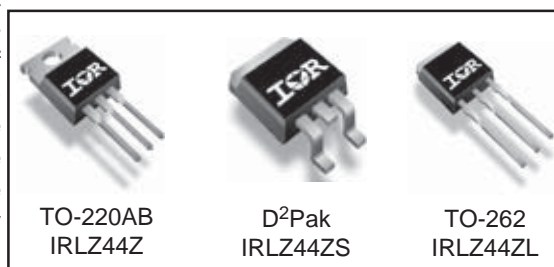
## HEXFET® Power MOSFET



$$V_{DS} = 55V$$

$$R_{DS(on)} = 13.5m\Omega$$

$$I_D = 51A$$



TO-220AB  
IRLZ44Z

D²Pak  
IRLZ44ZS

TO-262  
IRLZ44ZL

## Absolute Maximum Ratings

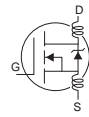
	Parameter	Max.	Units
$I_D$ @ $T_C = 25^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V (Silicon Limited)	51	A
$I_D$ @ $T_C = 100^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	36	
$I_{DM}$	Pulsed Drain Current ①	204	
$P_D$ @ $T_C = 25^\circ C$	Power Dissipation	80	W
	Linear Derating Factor	0.53	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 16$	V
$E_{AS}$ (Thermally limited)	Single Pulse Avalanche Energy ②	78	mJ
$E_{AS}$ (Tested)	Single Pulse Avalanche Energy Tested Value ③	110	
$I_{AR}$	Avalanche Current ④	See Fig.12a, 12b, 15, 16	A
$E_{AR}$	Repetitive Avalanche Energy ⑤		mJ
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting Torque, 6-32 or M3 screw ⑦	300 (1.6mm from case ) 10 lbf•in (1.1N•m)	

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧	—	1.87	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface ⑦ ⑧	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ⑦ ⑧	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑧ ⑨	—	40	

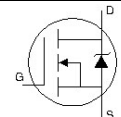
Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.05	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	11	13.5	$m\Omega$	$V_{GS} = 10V, I_D = 31A$ ③
		—	—	20	$m\Omega$	$V_{GS} = 5.0V, I_D = 30A$ ③
		—	—	22.5	$m\Omega$	$V_{GS} = 4.5V, I_D = 15A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	3.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	27	—	—	V	$V_{DS} = 25V, I_D = 31A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu A$	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 55V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 16V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -16V$
$Q_g$	Total Gate Charge	—	24	36		$I_D = 31A$
$Q_{gs}$	Gate-to-Source Charge	—	7.5	—	nC	$V_{DS} = 44V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	12	—		$V_{GS} = 5.0V$ ③
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = 50V$
$t_r$	Rise Time	—	160	—		$I_D = 31A$
$t_{d(off)}$	Turn-Off Delay Time	—	25	—		$R_G = 7.5\Omega$
$t_f$	Fall Time	—	42	—		$V_{GS} = 5.0V$ ③
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	1620	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	230	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	130	—		$f = 1.0MHz$
$C_{oss}$	Output Capacitance	—	860	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
$C_{oss}$	Output Capacitance	—	180	—		$V_{GS} = 0V, V_{DS} = 44V, f = 1.0MHz$
$C_{oss\ eff.}$	Effective Output Capacitance	—	280	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 44V$ ④



## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	51	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	204		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	21	32	ns	$T_J = 25^\circ\text{C}, I_F = 31A, V_{DD} = 28V$
$Q_{rr}$	Reverse Recovery Charge	—	16	24	nC	$di/dt = 100A/\mu s$ ③
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				



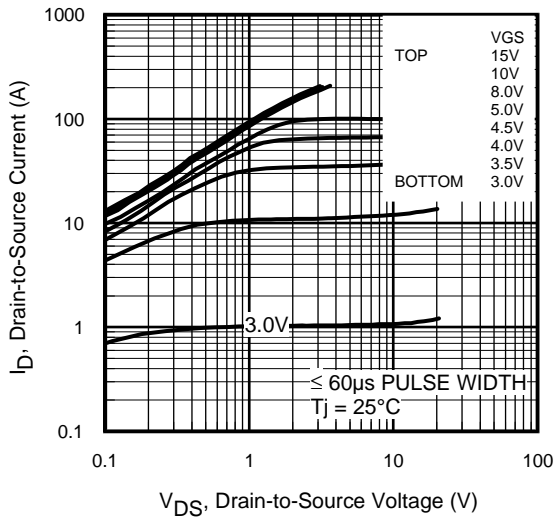


Fig 1. Typical Output Characteristics

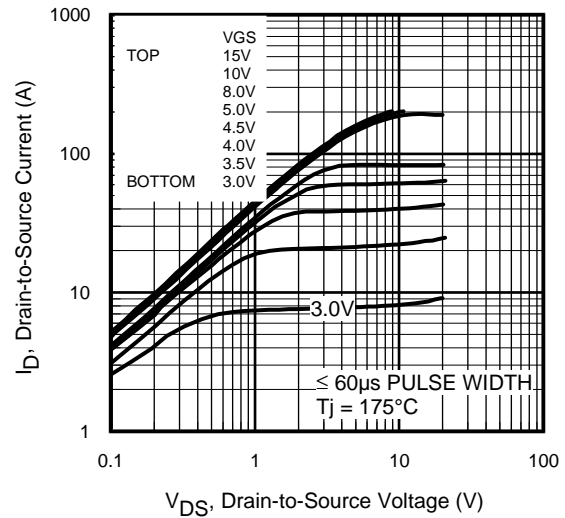


Fig 2. Typical Output Characteristics

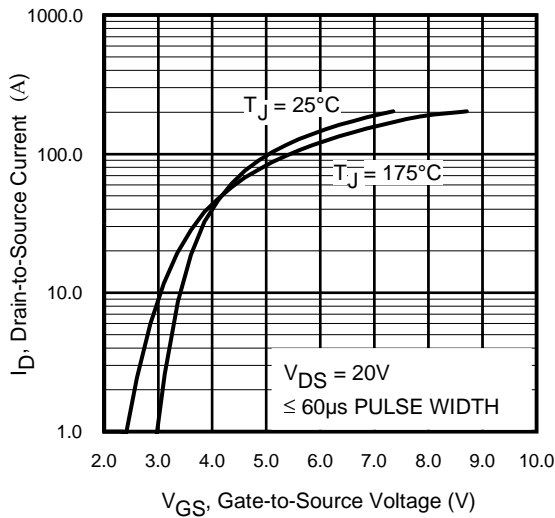


Fig 3. Typical Transfer Characteristics

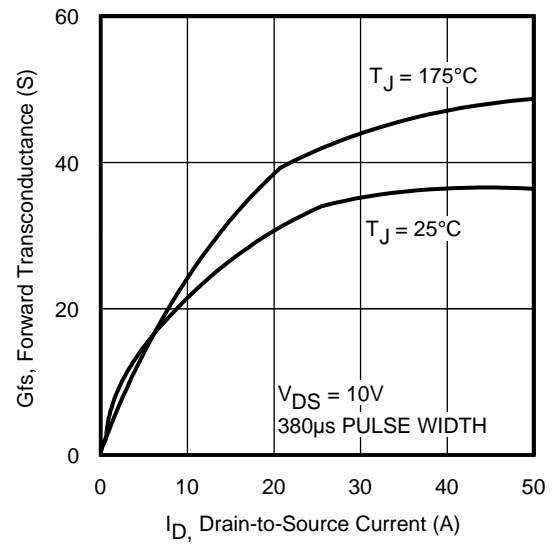
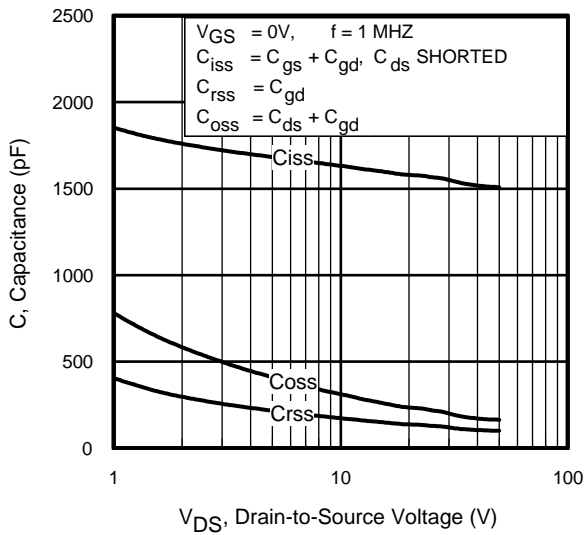
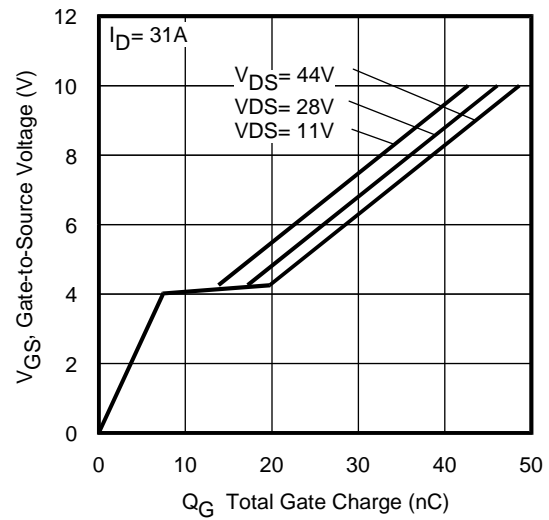


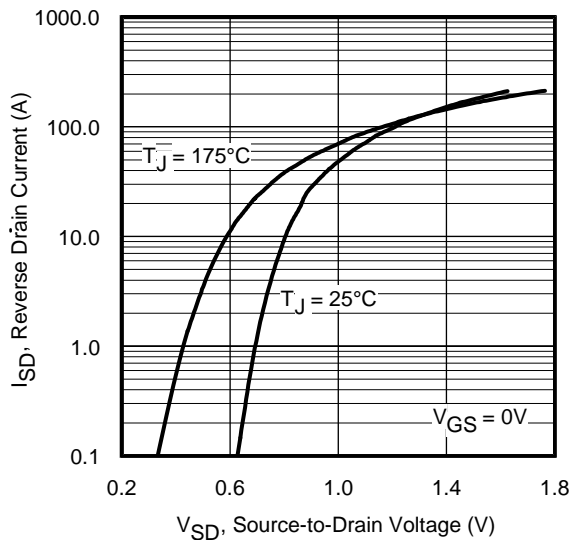
Fig 4. Typical Forward Transconductance Vs. Drain Current



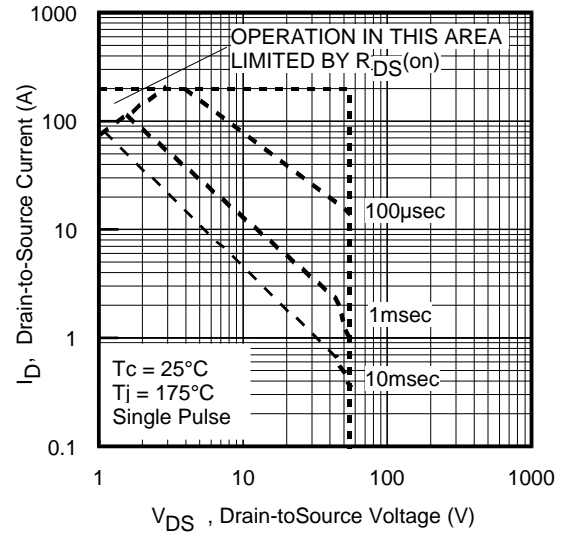
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



**Fig 7.** Typical Source-Drain Diode Forward Voltage



**Fig 8.** Maximum Safe Operating Area

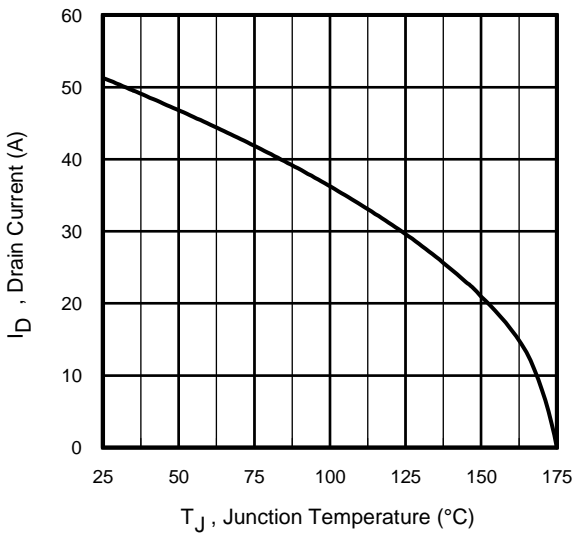


Fig 9. Maximum Drain Current Vs. Case Temperature

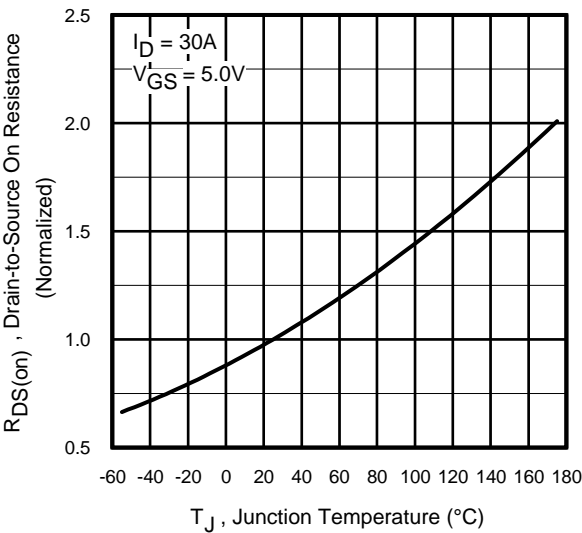


Fig 10. Normalized On-Resistance Vs. Temperature

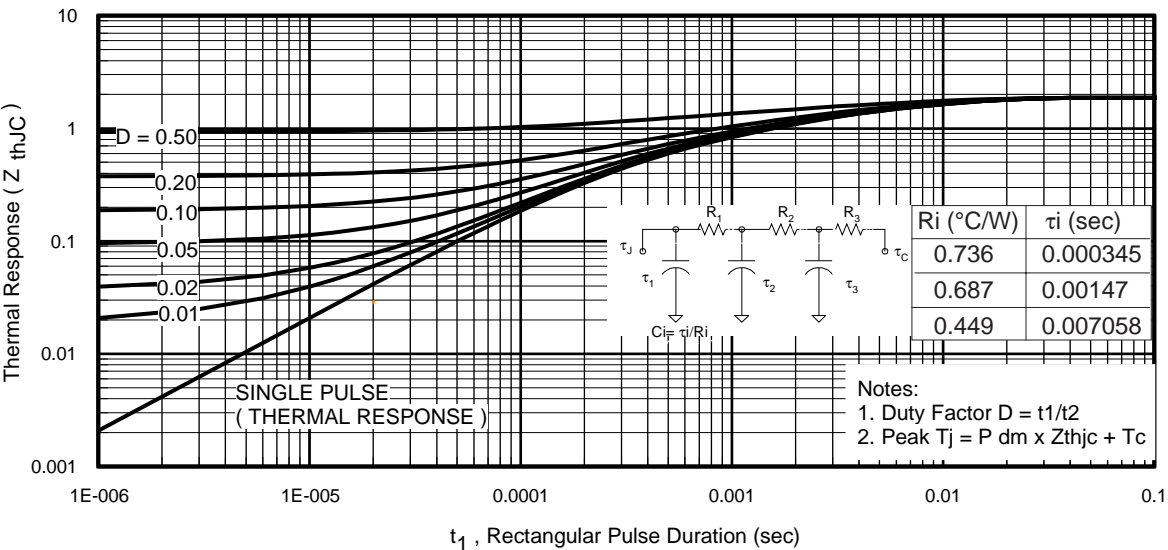
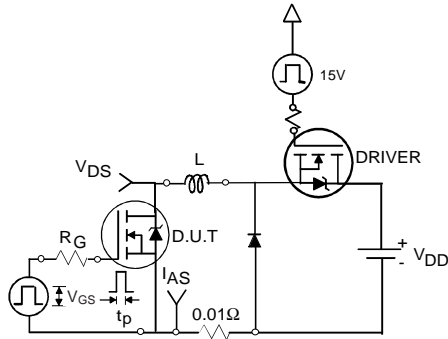
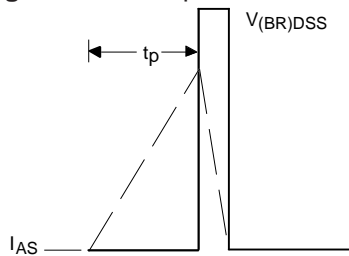


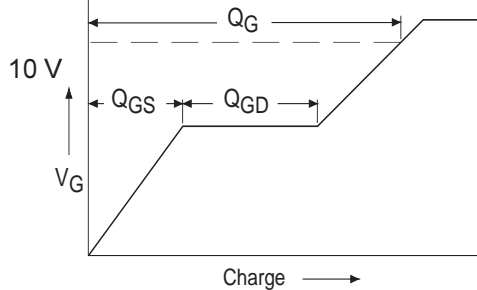
Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



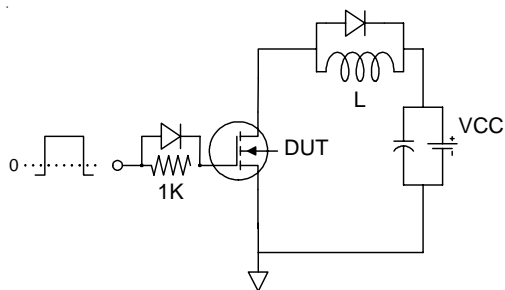
**Fig 12a.** Unclamped Inductive Test Circuit



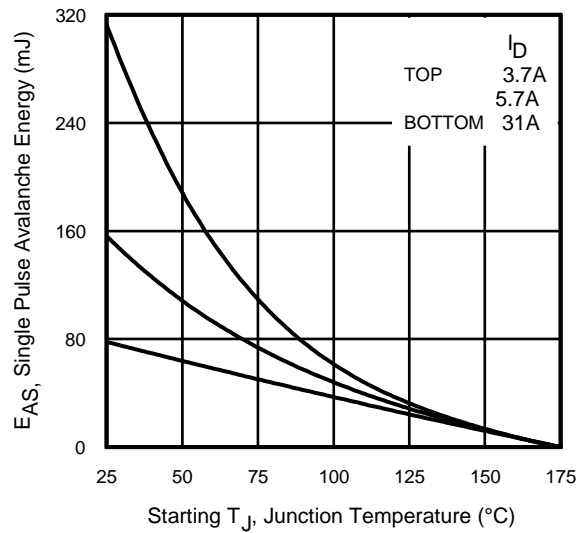
**Fig 12b.** Unclamped Inductive Waveforms



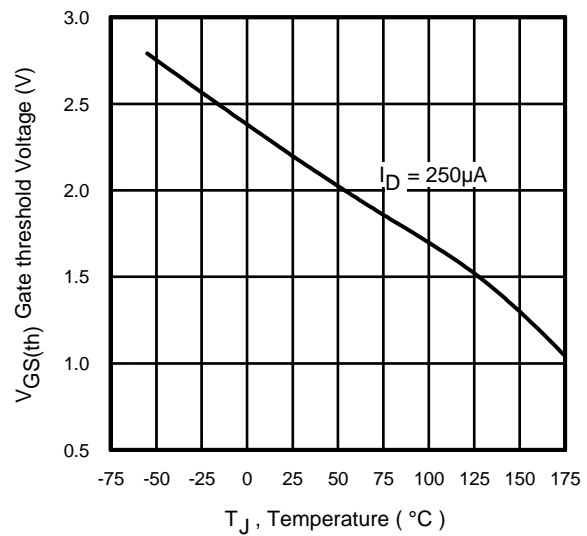
**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 14.** Threshold Voltage Vs. Temperature

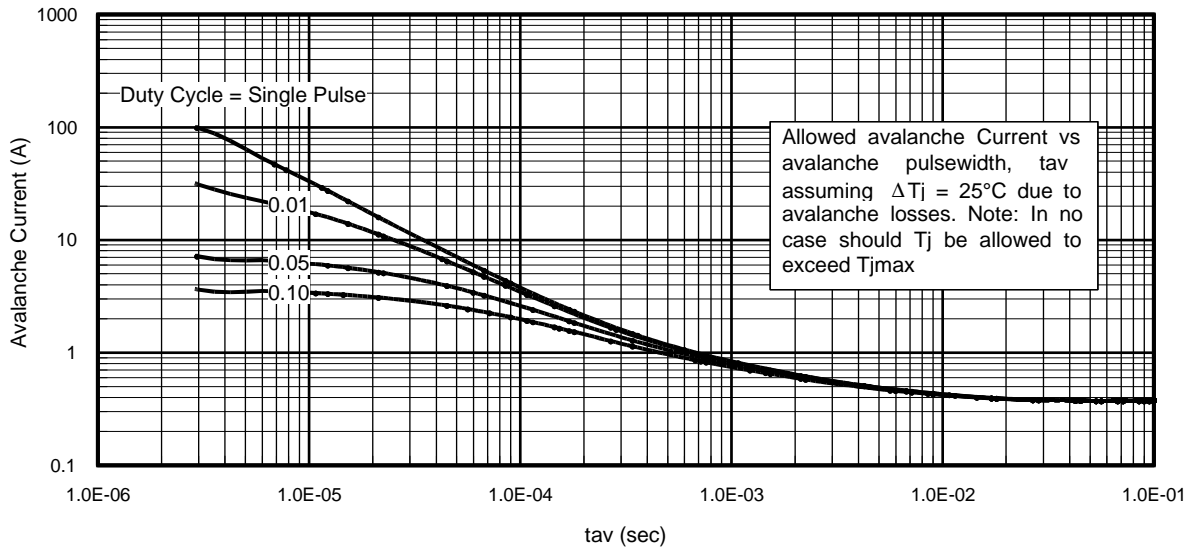


Fig 15. Typical Avalanche Current Vs. Pulsewidth

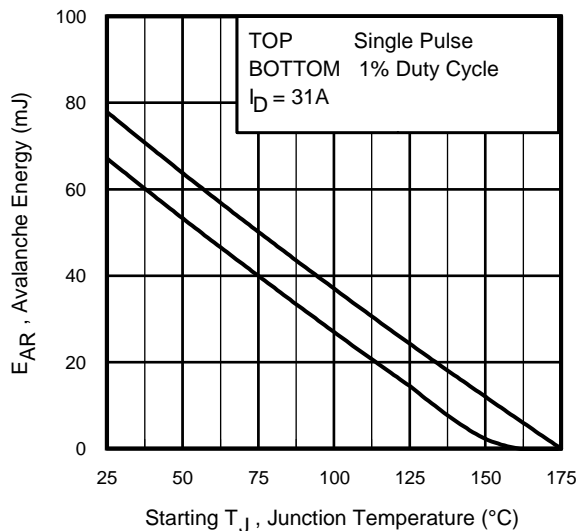


Fig 16. Maximum Avalanche Energy Vs. Temperature

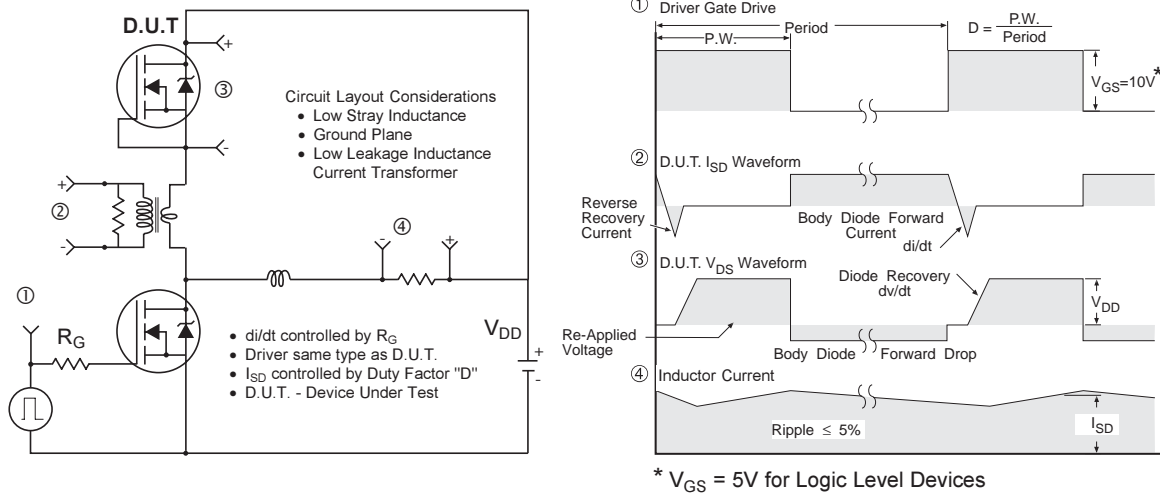
**Notes on Repetitive Avalanche Curves , Figures 15, 16:**  
(For further info, see AN-1005 at [www.irf.com](http://www.irf.com))

1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 15, 16).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see figure 11)

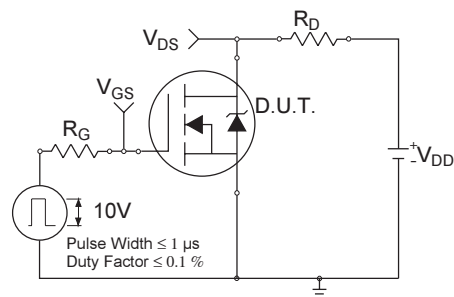
$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

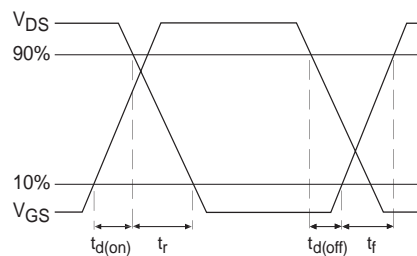
$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$



**Fig 17. Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs**



**Fig 18a. Switching Time Test Circuit**

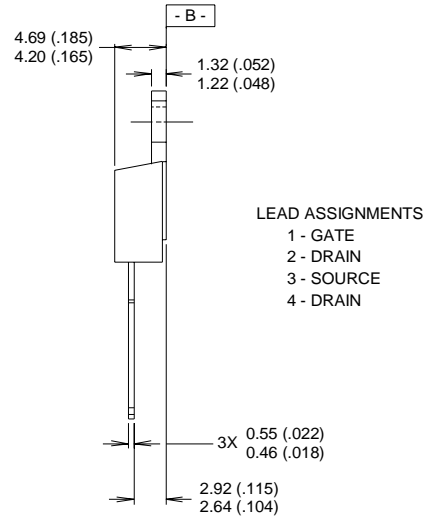
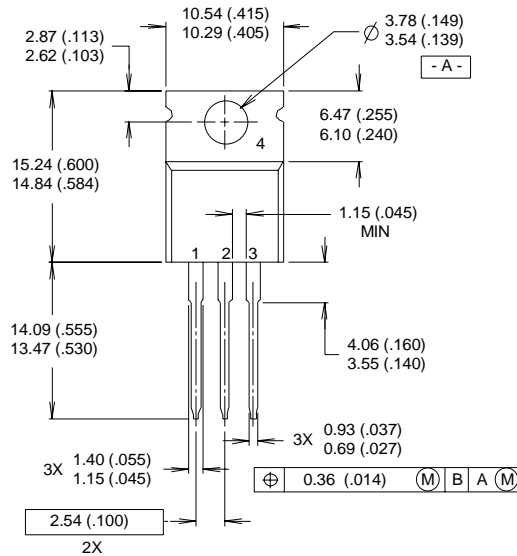


**Fig 18b. Switching Time Waveforms**



## TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



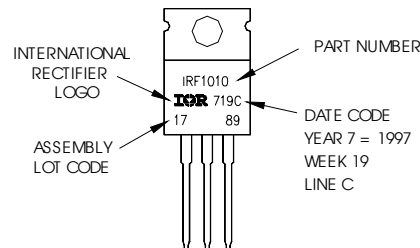
### NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

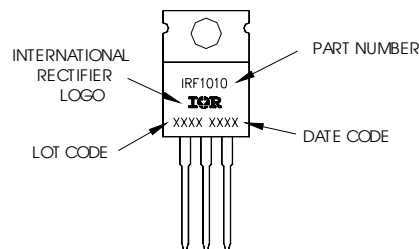
## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"



### For GB Production

EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"

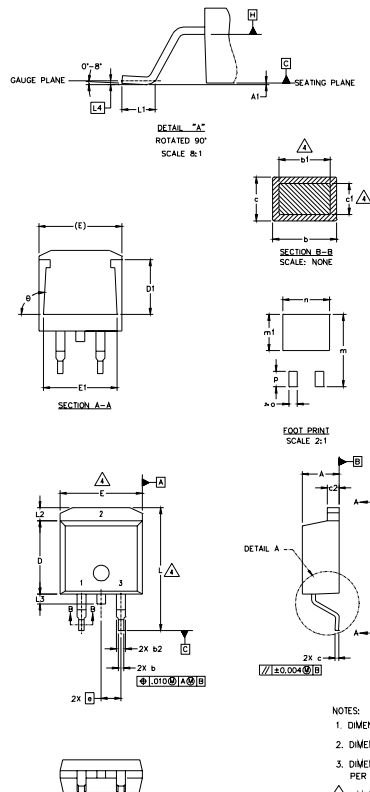


# IRLZ44Z/S/L

## D<sup>2</sup>Pak Package Outline

Dimensions are shown in millimeters (inches)

International  
**IR** Rectifier



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		3
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

### LEAD ASSIGNMENTS

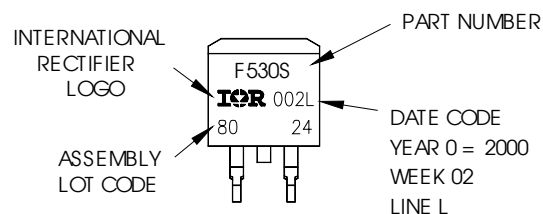
HEXFET	IGBTs, CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE *
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

\* PART DEPENDENT.

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
  3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
  4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
  5. CONTROLLING DIMENSION: INCH.

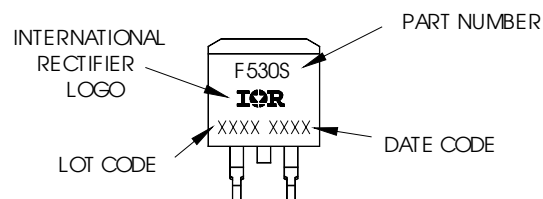
## D<sup>2</sup>Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH  
LOT CODE 8024  
ASSEMBLED ON WW 02, 2000  
IN THE ASSEMBLY LINE "L"



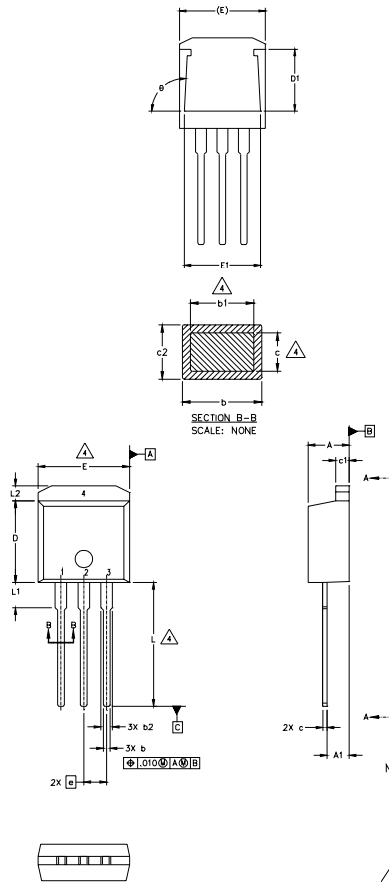
For GB Production

EXAMPLE: THIS IS AN IRF530S WITH  
LOT CODE 8024  
ASSEMBLED ON WW 02, 2000  
IN THE ASSEMBLY LINE "L"



## TO-262 Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

### LEAD ASSIGNMENTS

#### HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

#### IGBT

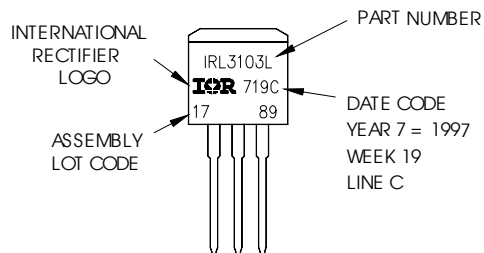
- 1- GATE
- 2- COLLECTOR

#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
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4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

## TO-262 Part Marking Information

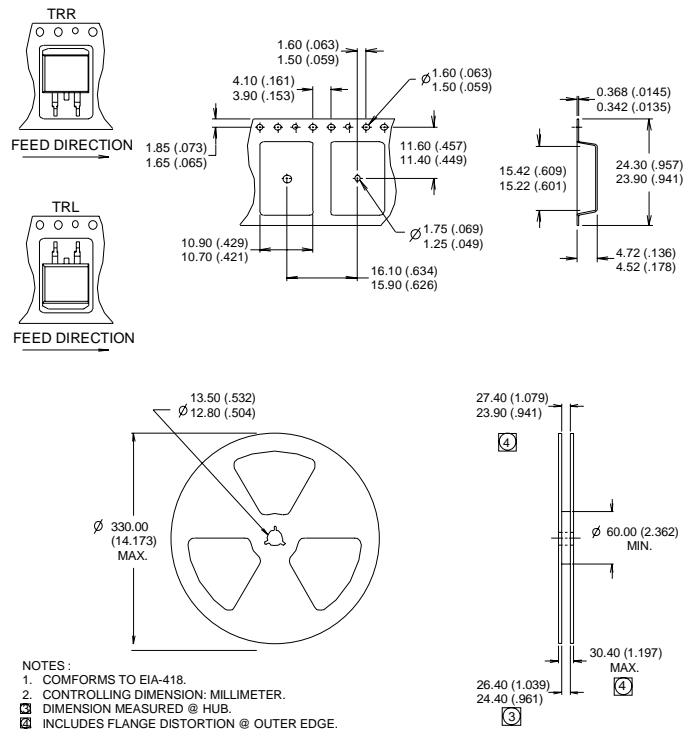
EXAMPLE: THIS IS AN IRL3103L  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"



# IRLZ44Z/S/L

## D<sup>2</sup>Pak Tape & Reel Information

International  
**IR** Rectifier



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Limited by  $T_{Jmax}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.166\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 31\text{A}$ ,  $V_{GS} = 10\text{V}$ . Part not recommended for use above this value.
- ③ Pulse width  $\leq 1.0\text{ms}$ ; duty cycle  $\leq 2\%$ .
- ④  $C_{OSS}$  eff. is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑤ Limited by  $T_{Jmax}$ , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population. 100% tested to this value in production.
- ⑦ This is only applied to TO-220AB package.
- ⑧ This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑨  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$ .

**TO-220AB package is not recommended for Surface Mount Application.**

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Automotive [Q101]market.  
Qualification Standards can be found on IR's Web site.

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
TAC Fax: (310) 252-7903

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Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>