

IRFB4310ZPbF
IRFS4310ZPbF
IRFSL4310ZPbF

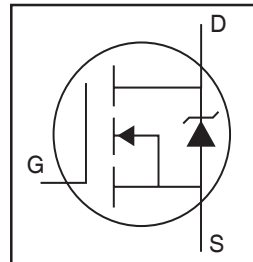
HEXFET® Power MOSFET

Applications

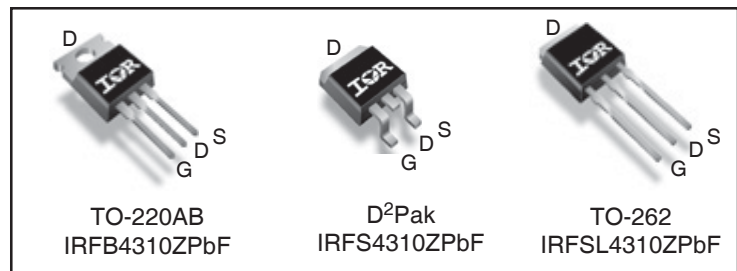
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

Benefits

- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dV/dt and dI/dt Capability
- Lead-Free



V_{DSS}	100V
$R_{DS(on)}$ typ.	4.8mΩ
max.	6.0mΩ
I_D (Silicon Limited)	127A ①
I_D (Package Limited)	120A



G	D	S
Gate	Drain	Source

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	127①	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	90①	
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Wire Bond Limited)	120	
I_{DM}	Pulsed Drain Current ②	560	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation	250	W
	Linear Derating Factor	1.7	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ④	18	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

Avalanche Characteristics

E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ③	130	mJ
I_{AR}	Avalanche Current ①	See Fig. 14, 15, 22a, 22b,	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑥	—	0.6	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface, TO-220	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, TO-220 ⑥	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount), D²Pak ⑦⑧	—	40	

Static @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	100	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/°C	Reference to 25°C, I _D = 5mA ^②
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	4.8	6.0	mΩ	V _{GS} = 10V, I _D = 75A ^③
V _{GS(th)}	Gate Threshold Voltage	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 150μA
I _{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	V _{DS} = 100V, V _{GS} = 0V
		—	—	250		V _{DS} = 80V, V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V _{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V _{GS} = -20V
R _G	Internal Gate Resistance	—	0.7	—	Ω	

Dynamic @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	150	—	—	S	V _{DS} = 50V, I _D = 75A
Q _g	Total Gate Charge	—	120	170	nC	I _D = 75A
Q _{gs}	Gate-to-Source Charge	—	29	—		V _{DS} = 50V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	35	—		V _{GS} = 10V ^⑤
Q _{sync}	Total Gate Charge Sync. (Q _g - Q _{gd})	—	85	—		I _D = 75A, V _{DS} = 0V, V _{GS} = 10V
t _{d(on)}	Turn-On Delay Time	—	20	—	ns	V _{DD} = 65V
t _r	Rise Time	—	60	—		I _D = 75A
t _{d(off)}	Turn-Off Delay Time	—	55	—		R _G = 2.7Ω
t _f	Fall Time	—	57	—		V _{GS} = 10V ^⑤
C _{iss}	Input Capacitance	—	6860	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	490	—		V _{DS} = 50V
C _{rss}	Reverse Transfer Capacitance	—	220	—		f = 1.0MHz, See Fig. 5
C _{oss} eff. (ER)	Effective Output Capacitance (Energy Related)	—	570	—		V _{GS} = 0V, V _{DS} = 0V to 80V ^⑦ , See Fig. 11
C _{oss} eff. (TR)	Effective Output Capacitance (Time Related) ^⑧	—	920	—		V _{GS} = 0V, V _{DS} = 0V to 80V ^⑥

Diode Characteristics

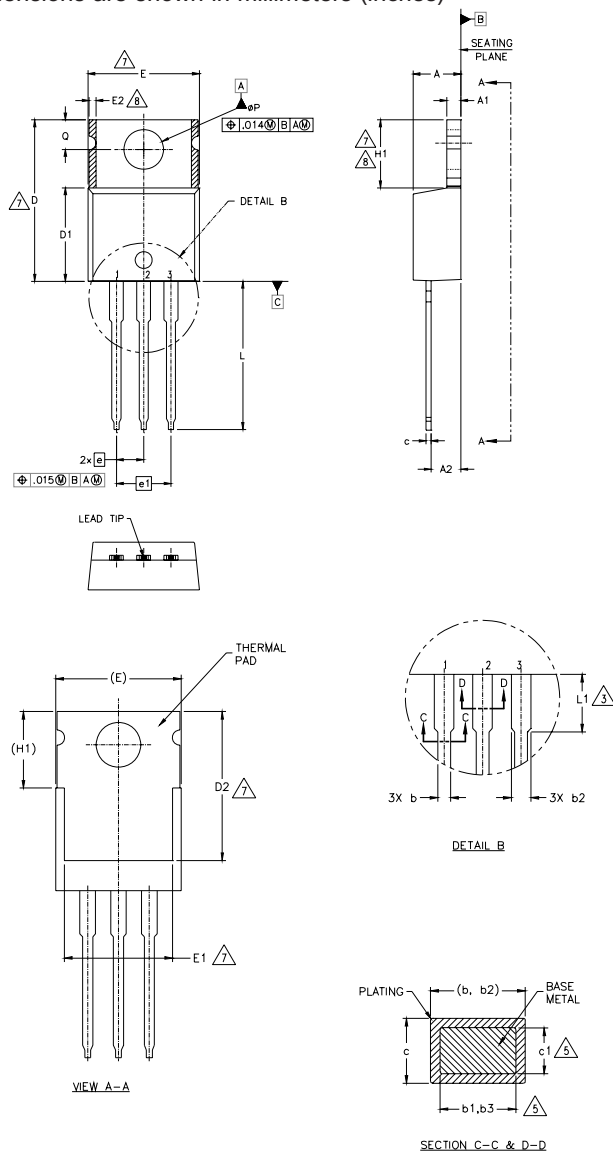
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	127 ^①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ^②	—	—	560	A	
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 75A, V _{GS} = 0V ^⑤
t _{rr}	Reverse Recovery Time	—	40	—	ns	T _J = 25°C
		—	49	—		T _J = 125°C
Q _{rr}	Reverse Recovery Charge	—	58	—	nC	T _J = 25°C
		—	89	—		T _J = 125°C
I _{RRM}	Reverse Recovery Current	—	2.5	—	A	T _J = 25°C
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 120A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.047mH
R_G = 25Ω, I_{AS} = 75A, V_{GS} = 10V. Part not recommended for use above the Eas value and test conditions.
- ④ I_{SD} ≤ 75A, di/dt ≤ 600A/μs, V_{DD} ≤ V_{(BR)DSS}, T_J ≤ 175°C.
- ⑤ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑥ C_{oss} eff. (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- ⑦ C_{oss} eff. (ER) is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- ⑧ 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_θ is measured at T_J approximately 90°C

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.- DIMENSION D, D1 & 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, b3 & 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.
- 9.- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

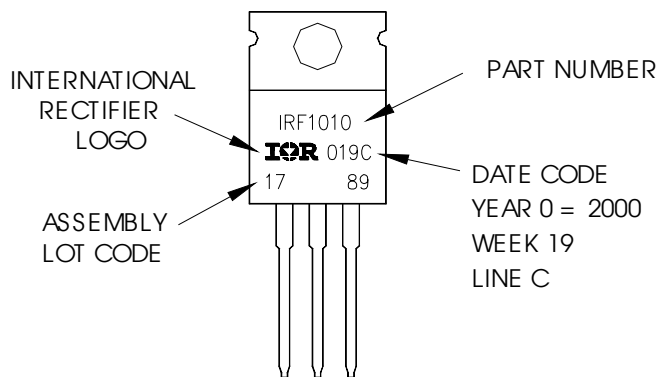
DIODES

- 1.- ANODE
- 2.- CATHODE
- 3.- ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 2000
 IN THE ASSEMBLY LINE "C"

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



TO-220AB packages are not recommended for Surface Mount Application.