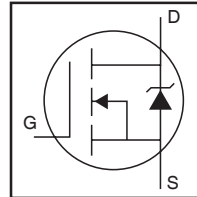


IRFB4410PbF
IRFS4410PbF
IRFSL4410PbF

Applications

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

HEXFET® Power MOSFET



V_{DSS}		100V
R_{DS(on)}	typ.	8.0mΩ
	max.	10mΩ
I_D		88A

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



Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V	88①②	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V	63①②	
I _{DM}	Pulsed Drain Current ②	380	
P _D @ T _C = 25°C	Maximum Power Dissipation	200③	W
	Linear Derating Factor	1.3③	W/°C
V _{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ④	19	V/ns
T _J	Operating Junction and Storage Temperature Range	-55 to + 175	°C
T _{STG}			
	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	220	mJ
I _{AR}	Avalanche Current ①	See Fig. 14, 15, 16a, 16b	A
E _{AR}	Repetitive Avalanche Energy ⑤		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case ⑥	—	0.61⑦	°C/W
R _{θCS}	Case-to-Sink, Flat Greased Surface , TO-220	0.50	—	
R _{θJA}	Junction-to-Ambient, TO-220 ⑧	—	62	
R _{θJA}	Junction-to-Ambient (PCB Mount) , D²Pak ⑧ ⑨	—	40	

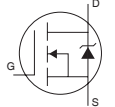
Static @ T_J = 25°C (unless otherwise specified)

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	—	0.094	—	V/°C	Reference to 25°C, I _D = 1mA②
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	8.0	10	mΩ	V _{GS} = 10V, I _D = 58A ⑤
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} = 100V, V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	V _{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-200		V _{GS} = -20V
R _G	Gate Input Resistance	—	1.5	—	Ω	f = 1MHz, open drain

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	120	—	—	S	V _{DS} = 50V, I _D = 58A
Q _g	Total Gate Charge	—	120	180	nC	I _D = 58A
Q _{gs}	Gate-to-Source Charge	—	31	—		V _{DS} = 80V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	44	—		V _{GS} = 10V ⑤
t _{d(on)}	Turn-On Delay Time	—	24	—	ns	V _{DD} = 65V
t _r	Rise Time	—	80	—		I _D = 58A
t _{d(off)}	Turn-Off Delay Time	—	55	—		R _G = 4.1Ω
t _f	Fall Time	—	50	—		V _{GS} = 10V ⑤
C _{iss}	Input Capacitance	—	5150	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	360	—		V _{DS} = 50V
C _{rss}	Reverse Transfer Capacitance	—	190	—		f = 1.0MHz
C _{oss eff. (ER)}	Effective Output Capacitance (Energy Related)	—	420	—		V _{GS} = 0V, V _{DS} = 0V to 80V ⑦, See Fig.11
C _{oss eff. (TR)}	Effective Output Capacitance (Time Related)⑧	—	500	—		V _{GS} = 0V, V _{DS} = 0V to 80V ⑧, See Fig. 5

Diode Characteristics

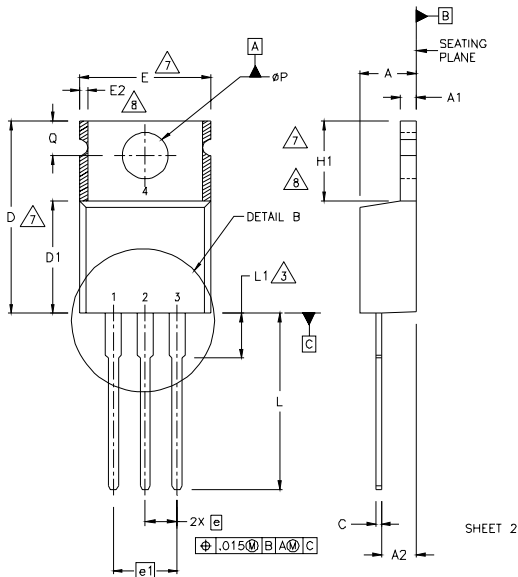
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	88①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I _{SM}	Pulsed Source Current (Body Diode) ②	—	—	380	A	
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 58A, V _{GS} = 0V ③
t _{rr}	Reverse Recovery Time	—	38	56	ns	T _J = 25°C V _R = 85V, T _J = 125°C I _F = 58A
Q _{rr}	Reverse Recovery Charge	—	61	92	nC	T _J = 25°C di/dt = 100A/μs ⑤ T _J = 125°C
I _{RRM}	Reverse Recovery Current	—	2.8	—	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. Package limitation current is 75A.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.14mH R_G = 25Ω, I_{AS} = 58A, V_{GS} = 10V. Part not recommended for use above this value.
- ④ I_{SD} ≤ 58A, di/dt ≤ 650A/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.
- ⑩ R_{θJC} (end of life) for D²Pak and TO-262 = 0.75°C/W. Note: This is the maximum measured value after 1000 temperature cycles from -55 to 150°C and is accounted for by the physical wearout of the die attach medium.

TO-220AB 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.

LEAD ASSIGNMENTS

HEXFET

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

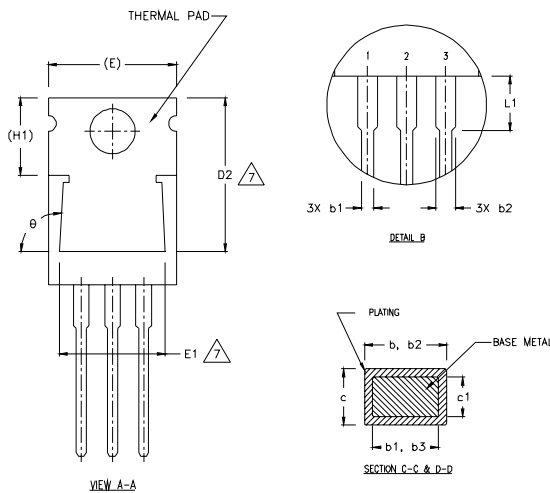
IGBTs, CoPACK

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

DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

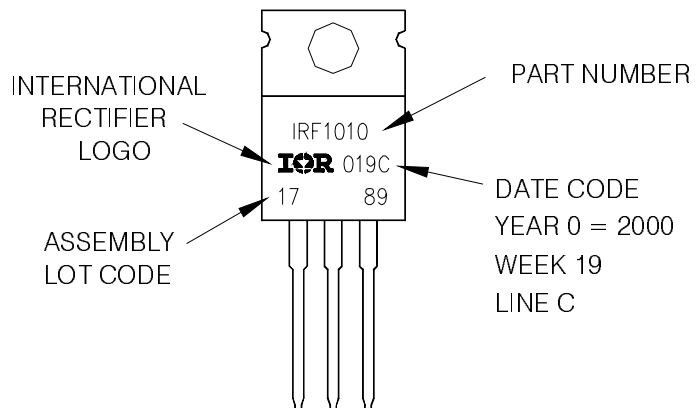
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	5
b2	1.15	1.77	.045	.070	
b3	1.15	1.73	.045	.068	
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	-	6.35	-	.250	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
ø	90°-93°		90°-93°		



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.