International
IOR Rectifier

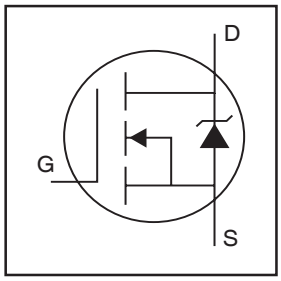
DIGITAL AUDIO MOSFET

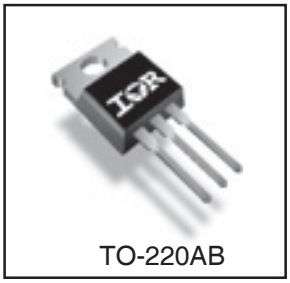
IRFB4212PbF

Features

- Key parameters optimized for Class-D audio amplifier applications
- Low R_{DSON} for improved efficiency
- Low Q_G and Q_{SW} for better THD and improved efficiency
- Low Q_{RR} for better THD and lower EMI
- 175°C operating junction temperature for ruggedness
- Can deliver up to 150W per channel into 4Ω load in half-bridge topology

Key Parameters		
V_{DS}	100	V
$R_{DS(ON)}$ typ. @ 10V	72.5	mΩ
Q_g typ.	15	nC
Q_{sw} typ.	8.3	nC
$R_{G(int)}$ typ.	2.2	Ω
T_J max	175	°C





TO-220AB

Description

This Digital Audio MOSFET is specifically designed for Class-D audio amplifier applications. This MOSFET utilizes the latest processing techniques to achieve low on-resistance per silicon area. Furthermore, Gate charge, body-diode reverse recovery and internal Gate resistance are optimized to improve key Class-D audio amplifier performance factors such as efficiency, THD and EMI. Additional features of this MOSFET are 175°C operating junction temperature and repetitive avalanche capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for ClassD audio amplifier applications.

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	100	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	18	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	13	
I_{DM}	Pulsed Drain Current ①	57	
P_D @T_C = 25°C	Power Dissipation ④	60	W
P_D @T_C = 100°C	Power Dissipation ④	30	
	Linear Derating Factor	0.4	W/°C
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)	

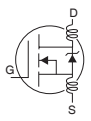
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	2.5	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ④	—	62	

Notes ① through ⑤ are on page 2

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	100	–––	–––	V	V_{GS} = 0V, I_D = 250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.09	–––	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	58	72.5	mΩ	V_{GS} = 10V, I_D = 13A ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	–––	5.0	V	V_{DS} = V_{GS}, I_D = 250µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	–––	-13	–––	mV/°C	
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
g_{fs}	Forward Transconductance	11	–––	–––	S	V_{DS} = 50V, I_D = 13A
Q_g	Total Gate Charge	–––	15	23		
Q_{gs1}	Pre-Vth Gate-to-Source Charge	–––	3.3	–––		V_{DS} = 80V
Q_{gs2}	Post-Vth Gate-to-Source Charge	–––	1.4	–––	nC	V_{GS} = 10V
Q_{gd}	Gate-to-Drain Charge	–––	6.9	–––		I_D = 13A
Q_{godr}	Gate Charge Overdrive	–––	3.4	–––		See Fig. 6 and 19
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})	–––	8.3	–––		
$R_{G(int)}$	Internal Gate Resistance	–––	2.2	–––	Ω	
$t_{d(on)}$	Turn-On Delay Time	–––	7.7	–––		V_{DD} = 50V, V_{GS} = 10V ③
t_r	Rise Time	–––	28	–––		I_D = 13A
$t_{d(off)}$	Turn-Off Delay Time	–––	14	–––	ns	R_G = 2.5Ω
t_f	Fall Time	–––	3.9	–––		
C_{iss}	Input Capacitance	–––	550	–––		V_{GS} = 0V
C_{oss}	Output Capacitance	–––	66	–––	pF	V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance	–––	35	–––		ƒ = 1.0MHz, See Fig.5
C_{oss}	Effective Output Capacitance	–––	350	–––		V_{GS} = 0V, V_{DS} = 0V to 80V
L_D	Internal Drain Inductance	–––	4.5	–––		Between lead,
					nH	6mm (0.25in.)
L_S	Internal Source Inductance	–––	7.5	–––		from package
						and center of die contact

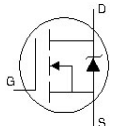


Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	–––	25	mJ
I_{AR}	Avalanche Current ⑤	See Fig. 14, 15, 17a, 17b		A
E_{AR}	Repetitive Avalanche Energy ⑤			mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S @ T_C = 25°C	Continuous Source Current	–––	–––	18		MOSFET symbol
	(Body Diode)				A	showing the
I_{SM}	Pulsed Source Current	–––	–––	57		integral reverse
	(Body Diode) ①					p-n junction diode.
V_{SD}	Diode Forward Voltage	–––	–––	1.3	V	T_J = 25°C, I_S = 13A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	–––	41	62	ns	T_J = 25°C, I_F = 13A
Q_{rr}	Reverse Recovery Charge	–––	69	100	nC	di/dt = 100A/µs ③



Notes:

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

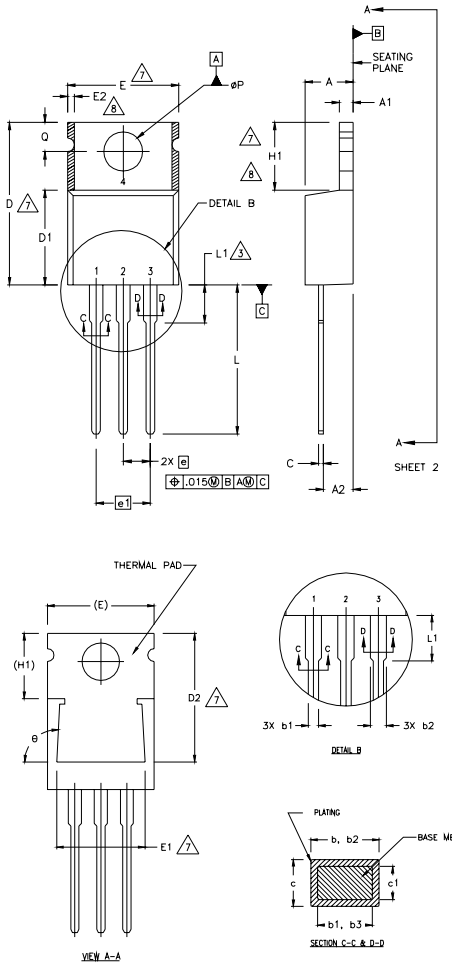
② Starting T_J = 25°C, L = 0.32mH, R_G = 25Ω, I_{AS} = 13A.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

④ R_θ is measured at T_J of approximately 90°C.

⑤ Limited by Tjmax. See Figs. 14, 15, 17a, 17b for repetitive avalanche information

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

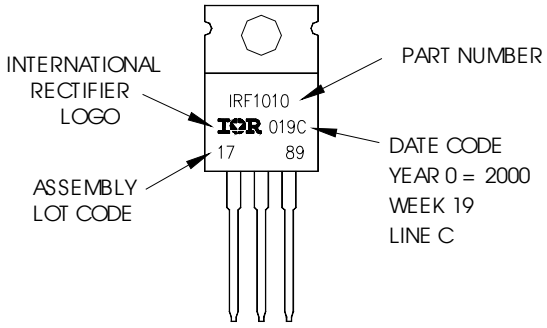
DIODES
1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

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.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.

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