PD - 96204

International
IOR Rectifier

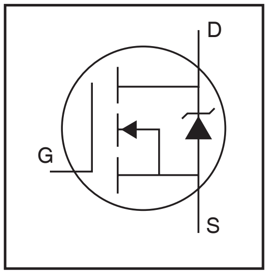
DIGITAL AUDIO MOSFET

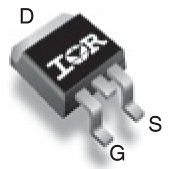
IRFS5615PbF
IRFSL5615PbF

Features

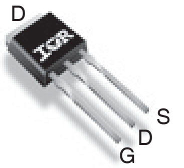
- Key Parameters Optimized for Class-D Audio Amplifier Applications
- Low R_{DSON} for Improved Efficiency
- Low Q_G and Q_{SW} for Better THD and Improved Efficiency
- Low Q_{RR} for Better THD and Lower EMI
- 175°C Operating Junction Temperature for Ruggedness
- Can Deliver up to 300W per Channel into 4Ω Load in Half-Bridge Configuration Amplifier

Key Parameters		
V_{DS}	150	V
$R_{DS(ON)}$ typ. @ 10V	34.5	mΩ
Q_g typ.	26	nC
Q_{sw} typ.	11	nC
$R_{G(int)}$ typ.	2.7	Ω
T_J max	175	°C





D^2Pak
IRFS5615PbF



TO-262
IRFSL5615PbF

G	D	S
Gate	Drain	Source

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

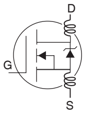
	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	150	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	33	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	24	
I_{DM}	Pulsed Drain Current ①	140	
P_D @T_C = 25°C	Power Dissipation ④	144	W
P_D @T_C = 100°C	Power Dissipation ④	72	
	Linear Derating Factor	0.96	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	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	1.045	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑥	—	40	

Notes ① through ⑥ are on page 2

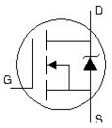
Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	150	–––	–––	V	V_{GS} = 0V, I_D = 250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.18	–––	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	34.5	42	mΩ	V_{GS} = 10V, I_D = 21A ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	–––	5.0	V	V_{DS} = V_{GS}, I_D = 100µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	–––	-13	–––	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	–––	–––	20	µA	V_{DS} = 150V, V_{GS} = 0V
		–––	–––	250		V_{DS} = 150V, 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
g_{fs}	Forward Transconductance	35	–––	–––	S	V_{DS} = 50V, I_D = 21A
Q_g	Total Gate Charge	–––	26	40	nC	
Q_{gs1}	Pre-Vth Gate-to-Source Charge	–––	6.4	–––		V_{DS} =75V
Q_{gs2}	Post-Vth Gate-to-Source Charge	–––	2.2	–––		V_{GS} = 10V
Q_{gd}	Gate-to-Drain Charge	–––	9.0	–––		I_D = 21A
Q_{godr}	Gate Charge Overdrive	–––	8.9	–––		See Fig. 6 and 19
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})	–––	11	–––		
$R_{G(int)}$	Internal Gate Resistance	–––	2.7	5.0	Ω	
$t_{d(on)}$	Turn-On Delay Time	–––	8.9	–––	ns	V_{DD} = 75V, V_{GS} = 10V ③
t_r	Rise Time	–––	23.1	–––		I_D = 21A
$t_{d(off)}$	Turn-Off Delay Time	–––	17.2	–––		R_G = 2.4Ω
t_f	Fall Time	–––	13.1	–––		
C_{iss}	Input Capacitance	–––	1750	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	155	–––		V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance	–––	40	–––		ƒ = 1.0MHz, See Fig.5
C_{oss}	Effective Output Capacitance	–––	175	–––		V_{GS} = 0V, V_{DS} = 0V to 120V
L_D	Internal Drain Inductance	–––	4.5	–––	nH	Between lead, 6mm (0.25in.) from package and center of die contact  D G S
L_S	Internal Source Inductance	–––	7.5	–––		

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	–––	109	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 (Body Diode)	–––	–––	33	A	MOSFET symbol showing the integral reverse p-n junction diode.  D G S
I_{SM}	Pulsed Source Current (Body Diode) ①	–––	–––	140		
V_{SD}	Diode Forward Voltage	–––	–––	1.3	V	T_J = 25°C, I_S = 21A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	–––	80	120	ns	T_J = 25°C, I_F = 21A, V_R =120V
Q_{rr}	Reverse Recovery Charge	–––	312	468	nC	di/dt = 100A/µs ③

Notes:

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

② Starting T_J = 25°C, L = 0.51mH, R_G = 25Ω, I_{AS} = 21A.

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

⑥ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

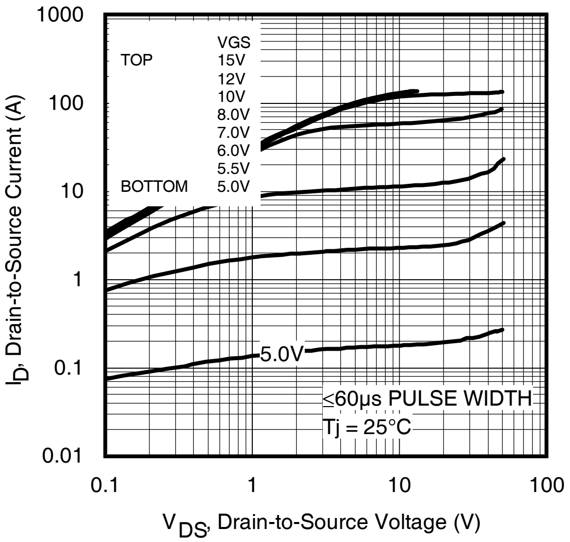


Fig 1. Typical Output Characteristics

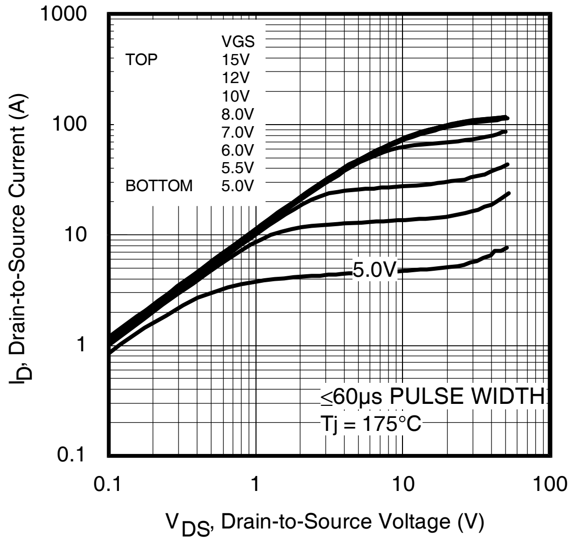


Fig 2. Typical Output Characteristics

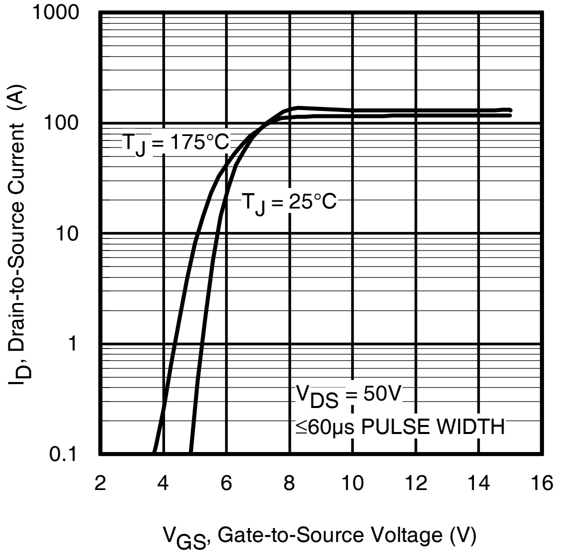


Fig 3. Typical Transfer Characteristics

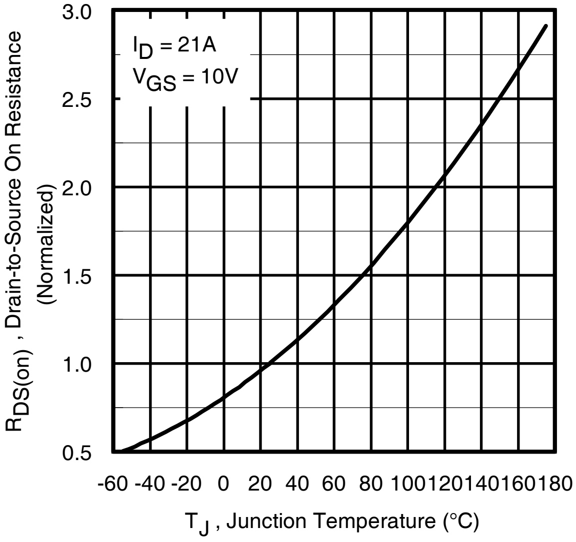


Fig 4. Normalized On-Resistance vs. Temperature

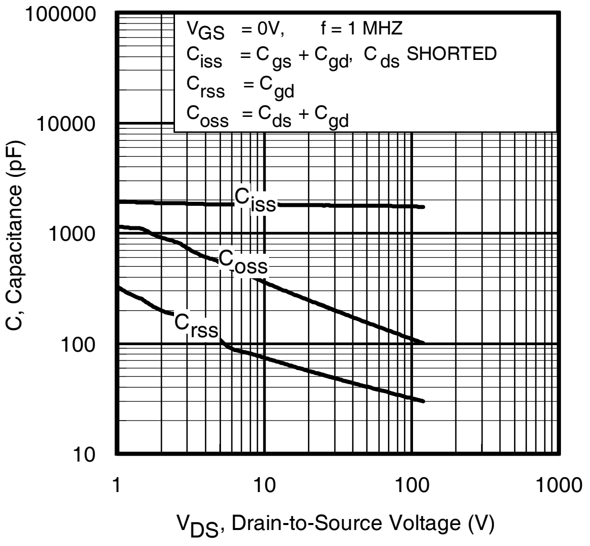


Fig 5. Typical Capacitance vs.Drain-to-Source Voltage

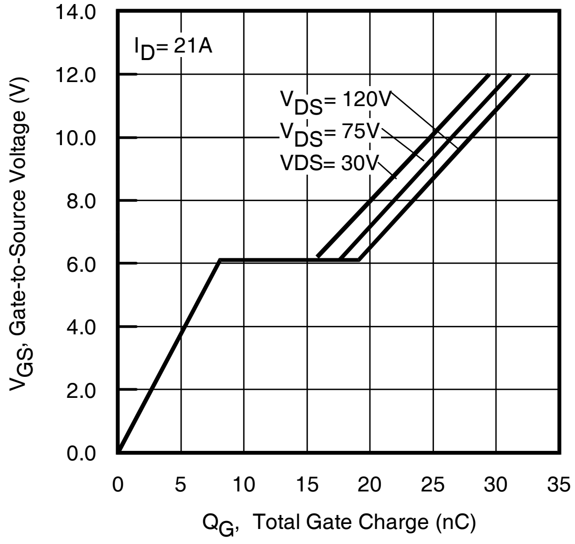


Fig 6. Typical Gate Charge vs.Gate-to-Source Voltage

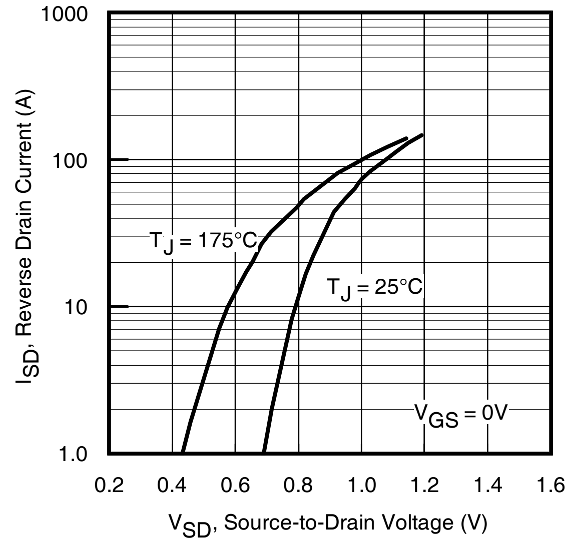


Fig 7. Typical Source-Drain Diode Forward Voltage

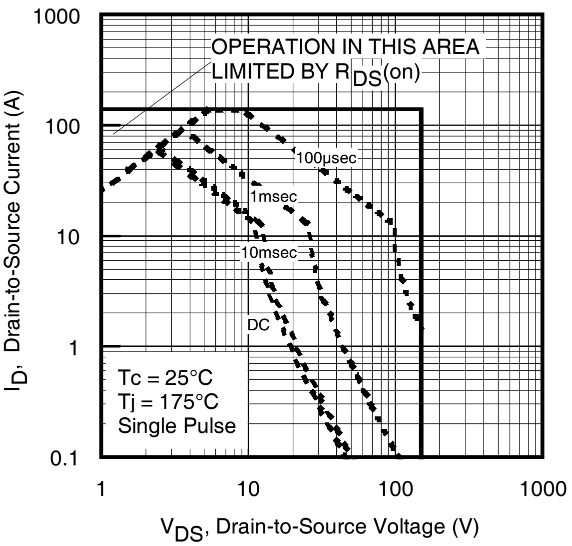


Fig 8. Maximum Safe Operating Area

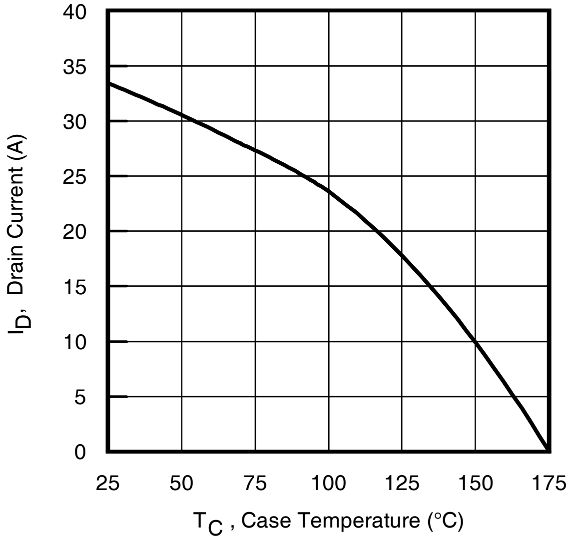


Fig 9. Maximum Drain Current vs. Case Temperature

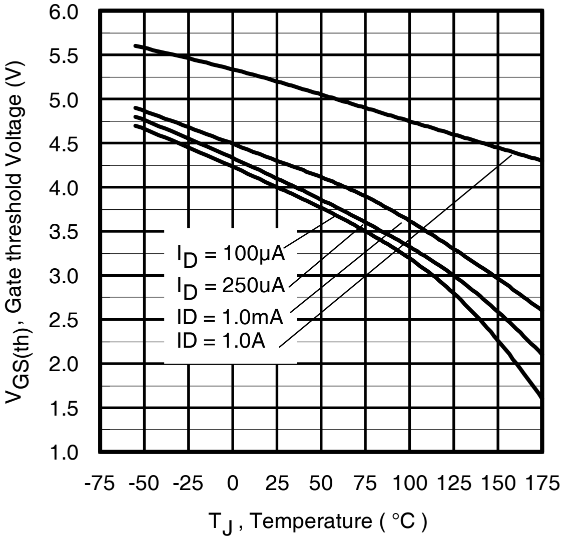
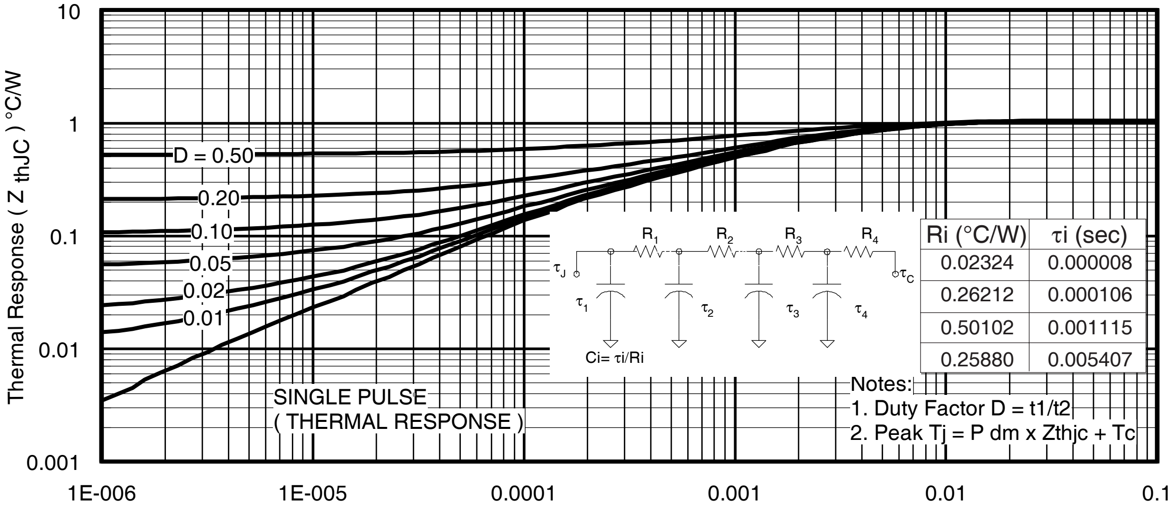


Fig 10. Threshold Voltage vs. Temperature



Ri (°C/W)	τi (sec)
0.02324	0.000008
0.26212	0.000106
0.50102	0.001115
0.25880	0.005407

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthjc + Tc

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

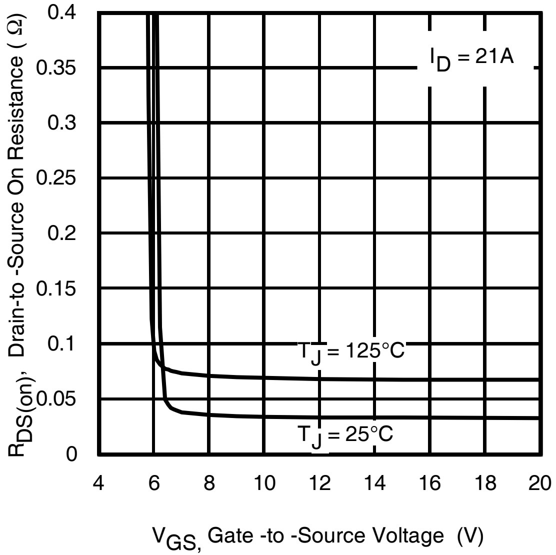


Fig 12. On-Resistance Vs. Gate Voltage

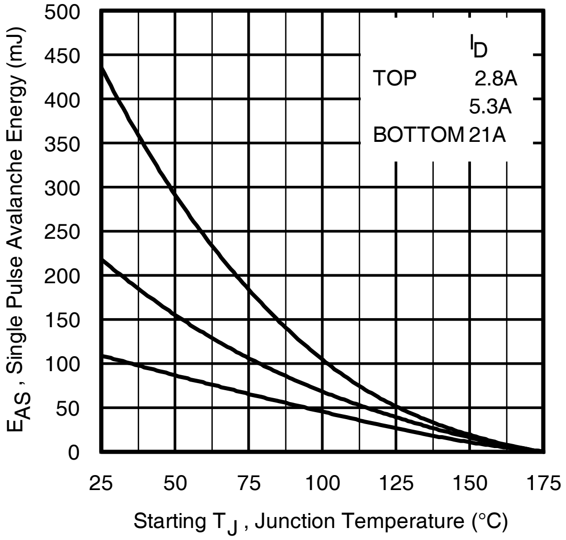


Fig 13. Maximum Avalanche Energy Vs. Drain Current

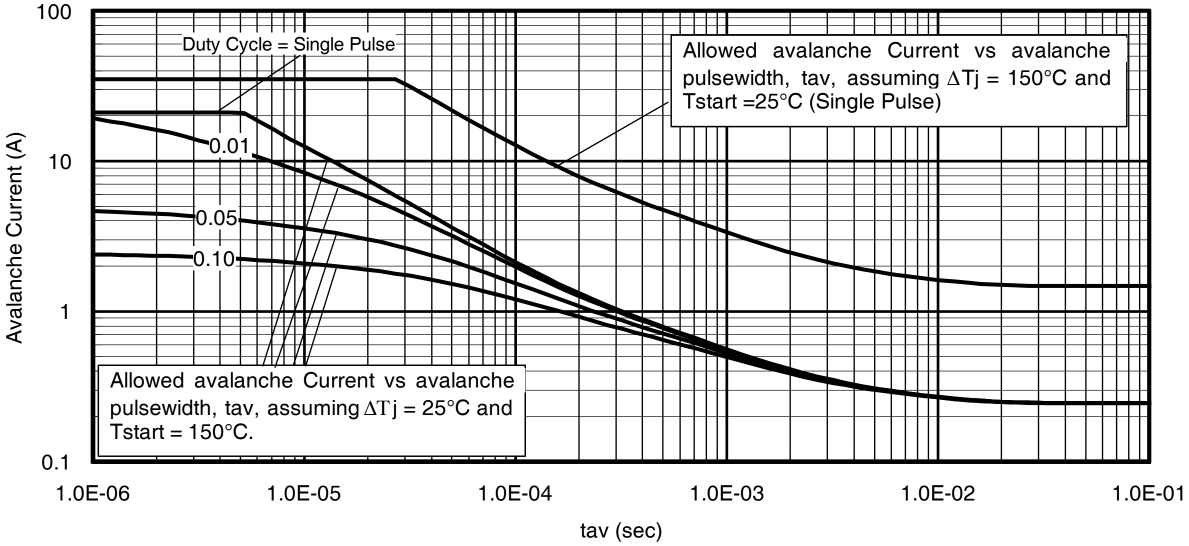


Fig 14. Typical Avalanche Current Vs.Pulsewidth

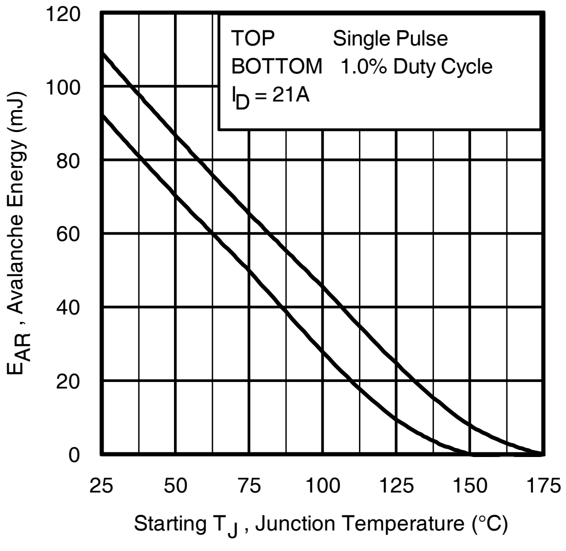


Fig 15. Maximum Avalanche Energy Vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 14, 15:
(For further info, see AN-1005 at 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 neither Tjmax nor Iav (max) is exceeded
3. Equation below based on circuit and waveforms shown in Figures 17a, 17b.
4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.
5. B_V = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 14, 15).
   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)

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

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

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

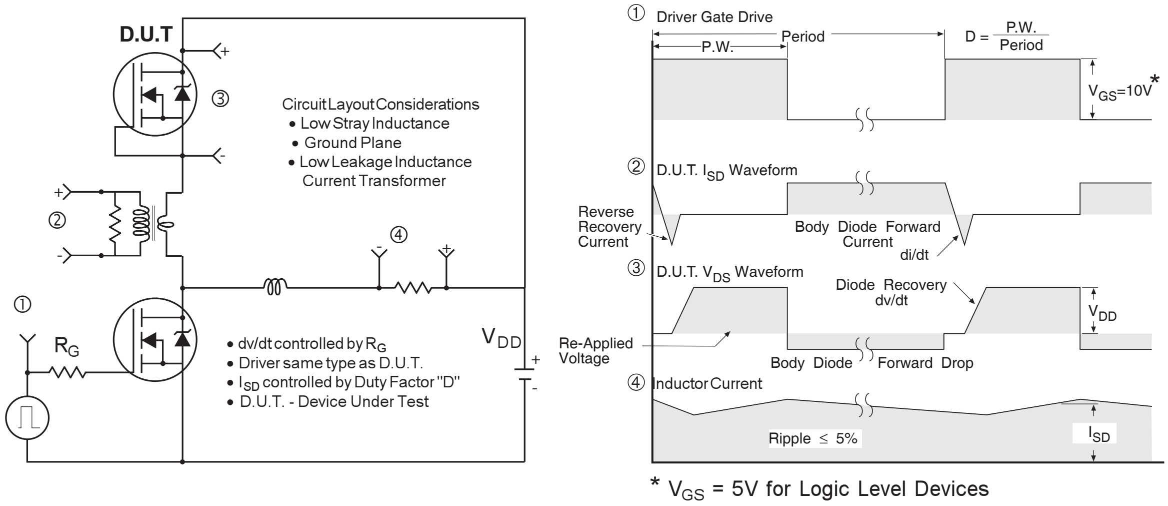


Fig 16. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

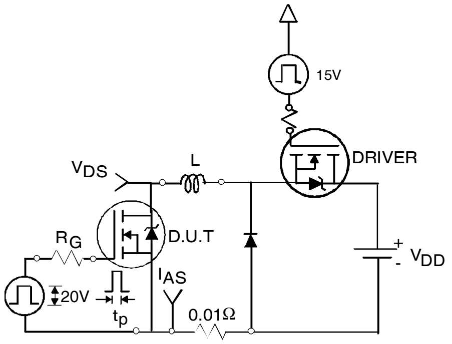


Fig 17a. Unclamped Inductive Test Circuit

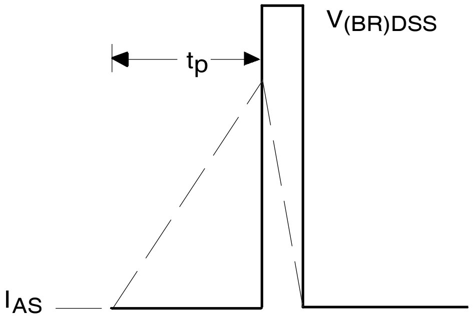


Fig 17b. Unclamped Inductive Waveforms

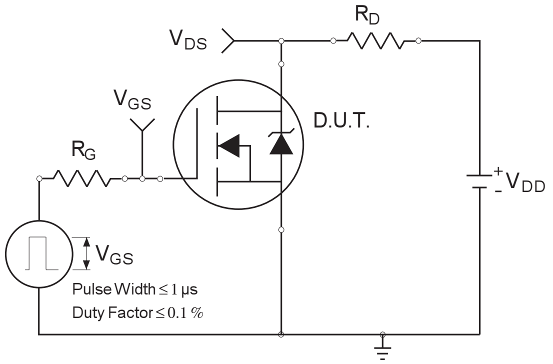


Fig 18a. Switching Time Test Circuit

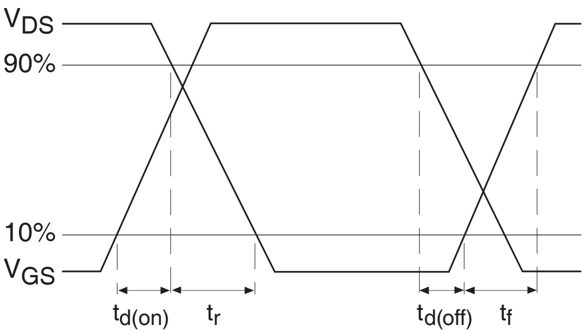


Fig 18b. Switching Time Waveforms

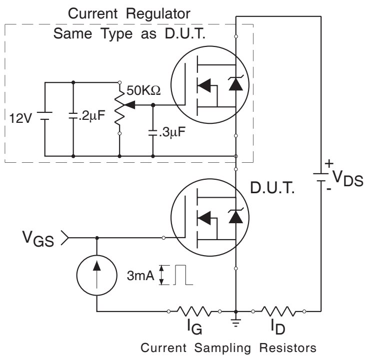


Fig 19a. Gate Charge Test Circuit

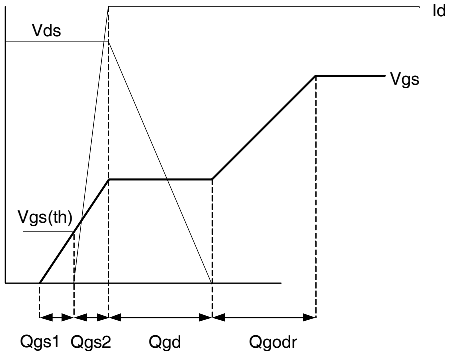
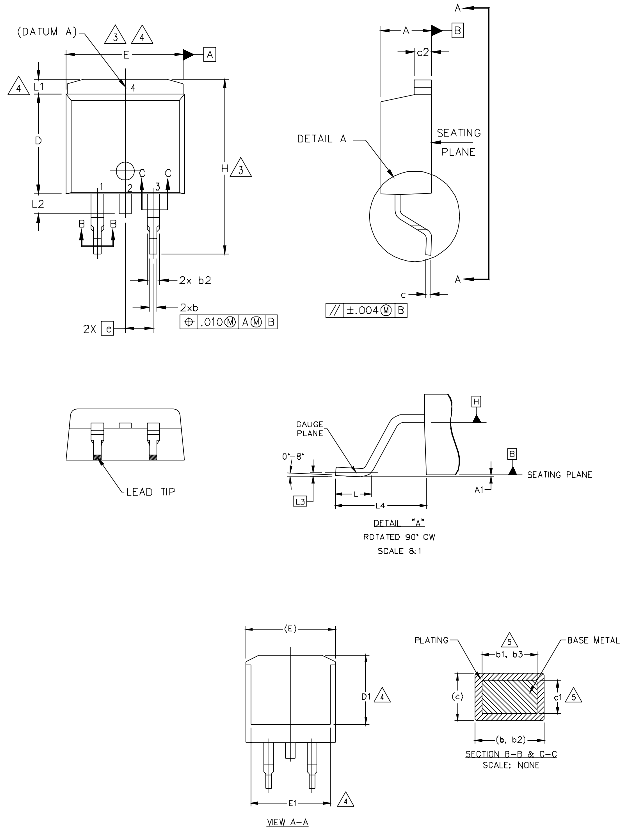


Fig 19b. Gate Charge Waveform

D^{2}Pak (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



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 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	–	.270		4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245		4
e	2.54 BSC		.100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	–	1.65	–	.066	4
L2	1.27	1.78	–	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

IGBTs, CoPACK

1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

DIODES

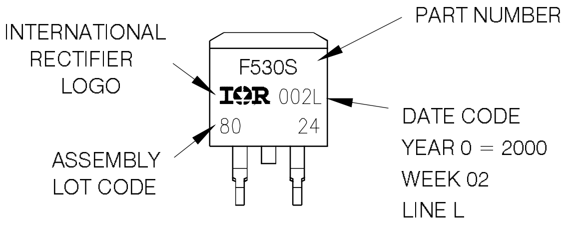
1.– ANODE *
2, 4.– CATHODE
3.– ANODE

* PART DEPENDENT.

D^{2}Pak (TO-263AB) Part Marking Information

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

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



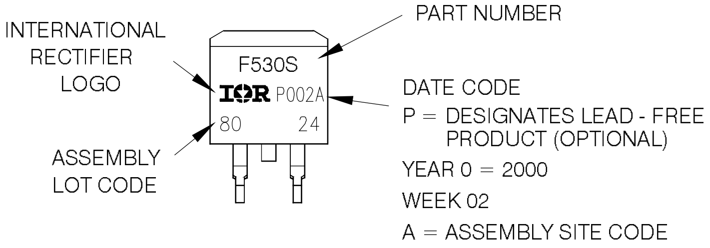
PART NUMBER

INTERNATIONAL
RECTIFIER
LOGO

DATE CODE
YEAR 0 = 2000
WEEK 02
LINE L

ASSEMBLY
LOT CODE

OR



PART NUMBER

INTERNATIONAL
RECTIFIER
LOGO

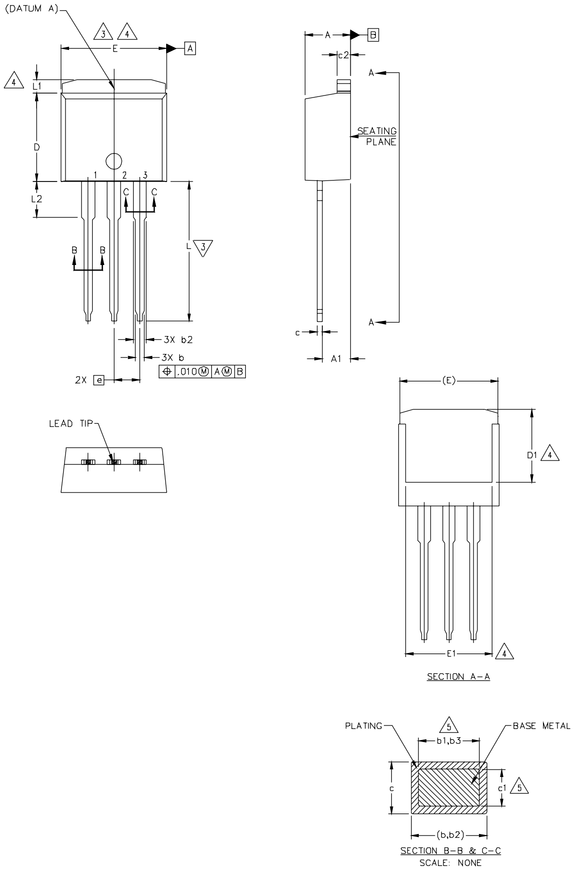
DATE CODE
P = DESIGNATES LEAD - FREE
PRODUCT (OPTIONAL)
YEAR 0 = 2000
WEEK 02
A = ASSEMBLY SITE CODE

ASSEMBLY
LOT CODE

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

TO-262 Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

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2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7.- OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	–	.270	–	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245		4
e	2.54 BSC		.100 BSC		
L	13.46	14.10	.530	.555	
L1	–	1.65	–	.065	4
L2	3.56	3.71	.140	.146	

LEAD ASSIGNMENTS

HEXFET

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

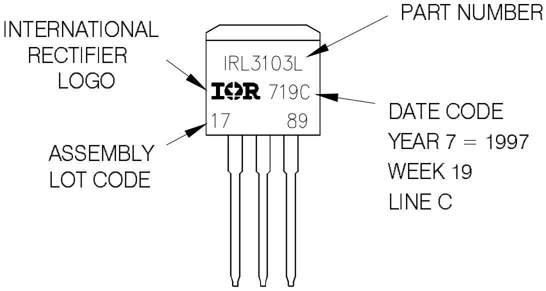
IGBTs, CoPACK

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

TO-262 Part Marking Information

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

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



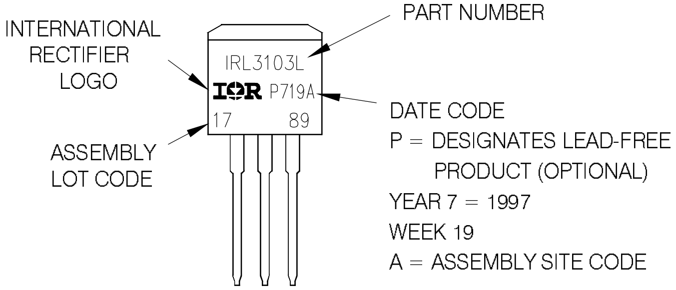
INTERNATIONAL RECTIFIER LOGO

ASSEMBLY LOT CODE

PART NUMBER

DATE CODE
YEAR 7 = 1997
WEEK 19
LINE C

OR



INTERNATIONAL RECTIFIER LOGO

ASSEMBLY LOT CODE

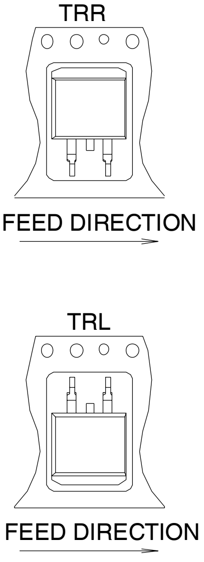
PART NUMBER

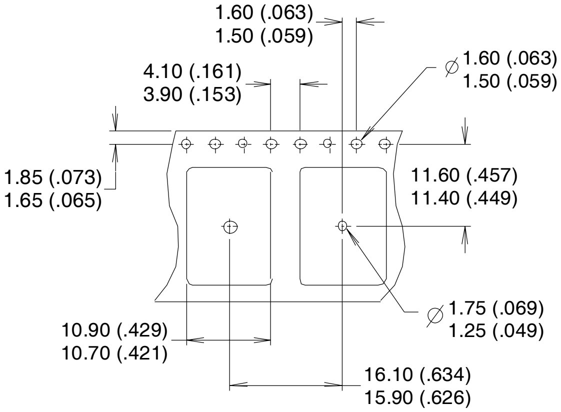
DATE CODE
P = DESIGNATES LEAD-FREE
PRODUCT (OPTIONAL)
YEAR 7 = 1997
WEEK 19
A = ASSEMBLY SITE CODE

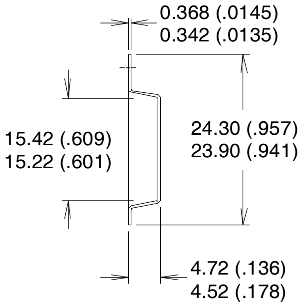
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

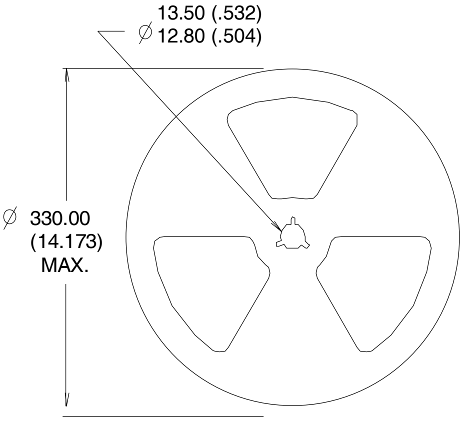
D^2Pak (TO-263AB) Tape & Reel Information

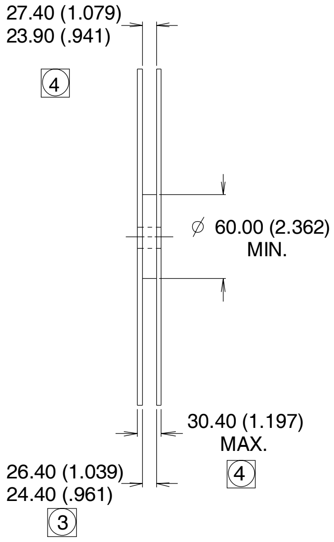
Dimensions are shown in millimeters (inches)











NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
$\boxed{3}$ DIMENSION MEASURED @ HUB.
$\boxed{4}$ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

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

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

International Rectifier

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Visit us at www.irf.com for sales contact information. 12/2008

Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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