International Rectifier

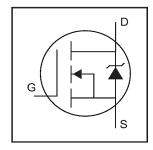
AUTOMOTIVE MOSFET

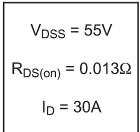
IRFR3505PbF IRFU3505PbF

HEXFET® Power MOSFET

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Timax
- Lead-Free





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 product 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.

The D-Pak is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 watts are possible in typical surface mount applications.



Absolute Maximum Ratings

	Parameter	Max.	Units		
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Silicon limited)	71			
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V (See Fig.9) 49				
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Package limited)	30			
I _{DM}	Pulsed Drain Current ①	280			
P _D @T _C = 25°C	Power Dissipation	140	W		
	Linear Derating Factor	0.92	W/°C		
V_{GS}	Gate-to-Source Voltage	± 20	V		
E _{AS}	Single Pulse Avalanche Energy®	210	mJ		
E _{AS} (tested)	Single Pulse Avalanche Energy Tested Value	410	1		
I _{AR}	Avalanche Current①	See Fig.12a, 12b, 15, 16	Α		
E _{AR}	Repetitive Avalanche Energy®		mJ		
dv/dt	Peak Diode Recovery dv/dt ③	4.0	V/ns		
TJ	Operating Junction and	-55 to + 175			
T _{STG}	Storage Temperature Range		°C		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	1		

Thermal Resistance

	Parameter	Тур.	Max.	Units
$R_{\theta JC}$	Junction-to-Case		1.09	
$R_{\theta JA}$	Junction-to-Ambient (PCB mount)®		40	°C/W
$R_{\theta JA}$	Junction-to-Ambient		110	

IRFR/U3505PbF



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

	Parameter	Min.	Тур.	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		0.057		V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance		0.011	0.013	Ω	V _{GS} = 10V, I _D = 30A ④
V _{GS(th)}	Gate Threshold Voltage	2.0		4.0	V	$V_{DS} = 10V, I_D = 250\mu A$
g _{fs}	Forward Transconductance	41			S	$V_{DS} = 25V, I_D = 30A$
I _{DSS}	Drain-to-Source Leakage Current	urrent		20	μΑ	$V_{DS} = 55V$, $V_{GS} = 0V$
				250	· ·	$V_{DS} = 55V, V_{GS} = 0V, T_{J} = 125^{\circ}C$
I _{GSS}	Gate-to-Source Forward Leakage			200	nA .	$V_{GS} = 20V$
1688	Gate-to-Source Reverse Leakage			-200	11/	$V_{GS} = -20V$
Q _g	Total Gate Charge		62	93		$I_D = 30A$
Q _{gs}	Gate-to-Source Charge		17	26	nC	$V_{DS} = 44V$
Q _{gd}	Gate-to-Drain ("Miller") Charge		22	33		V _{GS} = 10V4
t _{d(on)}	Turn-On Delay Time		13			$V_{DD} = 28V$
t _r	Rise Time		74		20	$I_D = 30A$
t _{d(off)}	Turn-Off Delay Time	43			ns	$R_G = 6.8\Omega$
t _f	Fall Time		54			V _{GS} = 10V ④
L _D	Internal Drain Inductance		4.5			Between lead, 6mm (0.25in.)
L _S	Internal Source Inductance		7.5	nH		from package and center of die contact
C _{iss}	Input Capacitance		2030			$V_{GS} = 0V$
Coss	Output Capacitance	 470			pF	$V_{DS} = 25V$
C _{rss}	Reverse Transfer Capacitance		91			f = 1.0MHz, See Fig. 5
Coss	Output Capacitance		2600			$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
Coss	Output Capacitance		330			$V_{GS} = 0V, V_{DS} = 44V, f = 1.0MHz$
Coss eff.	Effective Output Capacitance ®		630			$V_{GS} = 0V$, $V_{DS} = 0V$ to 44V

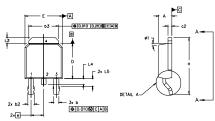
Source-Drain Ratings and Characteristics

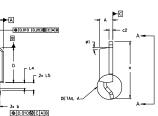
	Parameter	Min.	Тур.	Max.	Units	Conditions		
Is	Continuous Source Current					- 71		MOSFET symbol
	(Body Diode)			/ 1	A	showing the		
I _{SM}	Pulsed Source Current						integral reverse	
	(Body Diode) ①			280		p-n junction diode.		
V_{SD}	Diode Forward Voltage			1.3	V	$T_J = 25^{\circ}C$, $I_S = 30A$, $V_{GS} = 0V$ ④		
t _{rr}	Reverse Recovery Time		70	105	ns	$T_J = 25$ °C, $I_F = 30$ A, $V_{DD} = 28$ V		
Q _{rr}	Reverse RecoveryCharge		180	270	nC	di/dt = 100A/µs ④		
t _{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D)						

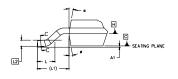
International IOR Rectifier

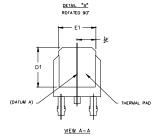
IRFR/U3505PbF

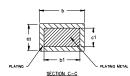
D-Pak (TO-252AA) Package Outline











NO	TEC.

- DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2.0 3.0 4.0 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
 LEAD DIMENSION UNCONTROLLED IN L5

- DIMENSION DI AND EI ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.

 SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 [0.127] AND
 .016 [0.2540 FROM THE LEAD TP.

 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.
- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

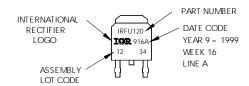
					1	1
	DIMENSIONS			ASIONS		
SYMBOL	MILLIM	ETERS	INC	HES		
	Min.	MAX	MIN.	MAX.	NOTES	
A	2.18	2.39	.086	.094		
A1		0.13		.005		
ь	0.64	0.89	.025	.035	5	LEAD ASSIGNMENTS
ь1	0.64	0.79	.025	0.031	5	
b2	0,76	1,14	.030	.045		<u>HEXFET</u>
b3	4.95	5.46	.195	.215		
С	0.46	0,61	.018	.024	5	1 GATE
c1	0,41	0,56	.016	.022	5	2 DRAIN 3 SOURCE
c2	.046	0.89	.018	.035	5	4 DRAIN
D	5.97	6.22	.235	.245	6	4 DRAIN
D1	5,21	-	,205	-	4	
E	6.35	6.73	.250	.265	6	IGBTs, CoPACK
E1	4.32	-	.170		4	
e	2.	29	.090	BSC		1 GATE
Н	9.40	10.41	.370	.410		2 COLLECTOR
L	1,40	1,78	,055	.070		3 EMITTER
L1		REF.		REF,		4 COLLECTOR
L2	0.05	BSC	.020	BSC		
L3	0.89	1.27	.035	.050		
L4		1.02		.040		
L5	1,14	1.52	.045	.060	3	
ø	0.	10*	o.	10*		
ø1	0.	15*	σ	15*		

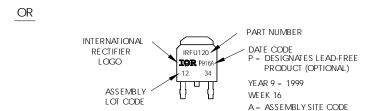
D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120 WITH ASSEMBLY

LOT CODE 1234 ASSEMBLED ON WW 16, 1999 IN THE ASSEMBLY LINE "A"

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

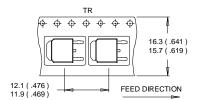


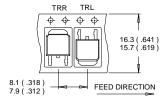


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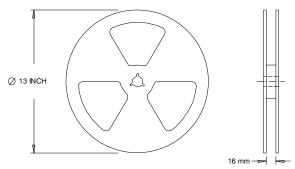
D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)





- 1. CONTROLLING DIMENSION: MILLIMETER.
 2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
 3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



1. OUTLINE CONFORMS TO EIA-481.

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Limited by T_{Jmax} , starting $T_{J} = 25$ °C, L = 0.47mH ⑥ $R_G = 25\Omega$, $I_{AS} = 30A$, $V_{GS} = 10V$. Part not recommended for use above this value.
- T_J≤ 175°C
- ④ Pulse width \leq 1.0ms; duty cycle \leq 2%.
- ⑤ Coss 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} .
- Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- This value determined from sample failure population. 100% tested to this value in production.
- When mounted on 1" square PCB (FR-4 or G-10 Material) . For recommended footprint and soldering techniques refer to application note #AN-994

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.

