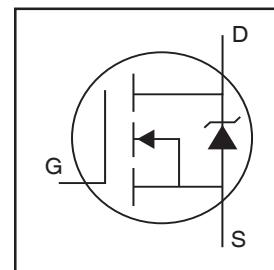
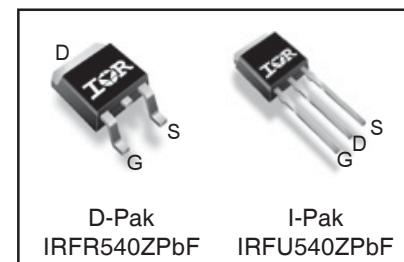


V_{DSS}	100V
R_{DS(on)} typ.	22.5mΩ
	28.5mΩ
I_D	35A



HEXFET® Power MOSFET



Applications

- Automatic Voltage Regulator (AVR)
- Solenoid Injection
- Body Control
- Low Power Automotive Applications

G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRFR540Z	Dpak	Tube	75	AUIRFR540Z
		Tape and Reel	2000	AUIRFR540ZTR
		Tape and Reel Left	3000	AUIRFR540ZTRL
		Tape and Reel Right	3000	AUIRFR540ZTRR
AUIRFU540Z	IPak	Tube	75	AUIRFU540Z

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
I _D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	35	A
I _D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	25	
I _{DM}	Pulsed Drain Current ①	140	
P _D @ $T_C = 25^\circ\text{C}$	Power Dissipation	91	W
	Linear Derating Factor	0.61	W/°C
V _{GS}	Gate-to-Source Voltage	± 20	V
E _{AS}	Single Pulse Avalanche Energy (Thermally Limited) ②	39	mJ
E _{AS} (tested)	Single Pulse Avalanche Energy Tested Value ⑥	75	
I _{AR}	Avalanche Current ①	See Fig.12a, 12b, 15, 16	A
E _{AR}	Repetitive Avalanche Energy ⑤		mJ
T _J	Operating Junction and	-55 to + 175	°C
T _{STG}	Storage Temperature Range		
	Reflow Soldering Temperature, for 10 seconds	300	

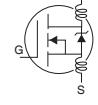
Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case ⑧	—	1.64	°C/W
R _{θJA}	Junction-to-Ambient (PCB mount) ⑦⑧	—	40	
R _{θJA}	Junction-to-Ambient ⑧	—	110	

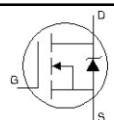
HEXFET® is a registered trademark of International Rectifier.

*Qualification standards can be found at <http://www.irf.com/>

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{\text{GS}} = 0\text{V}$, $I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}/\Delta T_J}$	Breakdown Voltage Temp. Coefficient	—	0.092	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$
$R_{\text{DS}(\text{on})}$	Static Drain-to-Source On-Resistance	—	22.5	28.5	$\text{m}\Omega$	$V_{\text{GS}} = 10\text{V}$, $I_D = 21\text{A}$ ③
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 50\mu\text{A}$
g_{fs}	Forward Transconductance	28	—	—	S	$V_{\text{DS}} = 25\text{V}$, $I_D = 21\text{A}$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{\text{DS}} = 100\text{V}$, $V_{\text{GS}} = 0\text{V}$
		—	—	250		$V_{\text{DS}} = 100\text{V}$, $V_{\text{GS}} = 0\text{V}$, $T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{\text{GS}} = 20\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{\text{GS}} = -20\text{V}$
Q_g	Total Gate Charge	—	39	59	nC	$I_D = 21\text{A}$
Q_{gs}	Gate-to-Source Charge	—	11	—		$V_{\text{DS}} = 50\text{V}$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	12	—		$V_{\text{GS}} = 10\text{V}$ ③
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	14	—	ns	$V_{\text{DD}} = 50\text{V}$
t_r	Rise Time	—	42	—		$I_D = 21\text{A}$
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	43	—		$R_G = 13\Omega$
t_f	Fall Time	—	34	—		$V_{\text{GS}} = 10\text{V}$ ③
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_s	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	1690	—	pF	$V_{\text{GS}} = 0\text{V}$
C_{oss}	Output Capacitance	—	180	—		$V_{\text{DS}} = 25\text{V}$
C_{rss}	Reverse Transfer Capacitance	—	100	—		$f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	720	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 1.0\text{V}$, $f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	110	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 80\text{V}$, $f = 1.0\text{MHz}$
$C_{\text{oss eff.}}$	Effective Output Capacitance	—	190	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 0\text{V}$ to 80V ④

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	35	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	140		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}$, $I_S = 21\text{A}$, $V_{\text{GS}} = 0\text{V}$ ③
t_{rr}	Reverse Recovery Time	—	32	48	ns	$T_J = 25^\circ\text{C}$, $I_F = 21\text{A}$, $V_{\text{DD}} = 50\text{V}$
Q_{rr}	Reverse Recovery Charge	—	40	60	nC	$dI/dt = 100\text{A}/\mu\text{s}$ ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.17\text{mH}$ $R_G = 25\Omega$, $I_{\text{AS}} = 21\text{A}$, $V_{\text{GS}} = 10\text{V}$. Part not recommended for use above this value.
- ③ Pulse width $\leq 1.0\text{ms}$; duty cycle $\leq 2\%$.

④ $C_{\text{oss eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

⑤ Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.

⑥ This value determined from sample failure population. 100% tested to this value in production.

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material).

⑧ R_{θ} is measured at T_J approximately 90°C

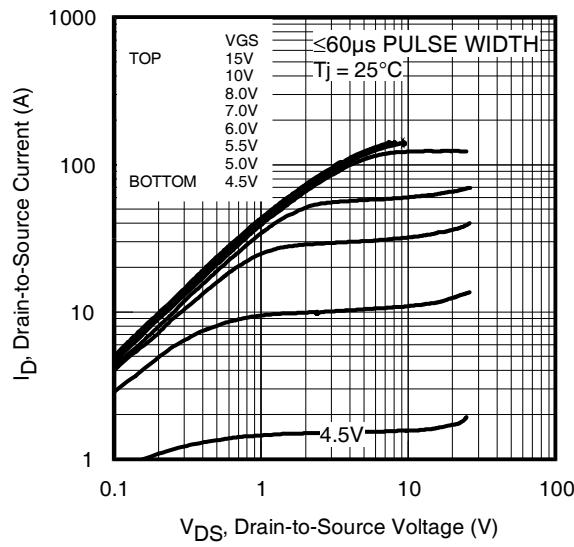


Fig 1. Typical Output Characteristics

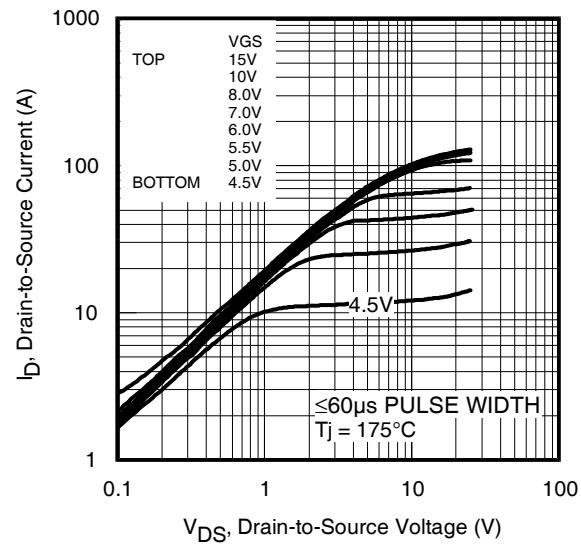


Fig 2. Typical Output Characteristics

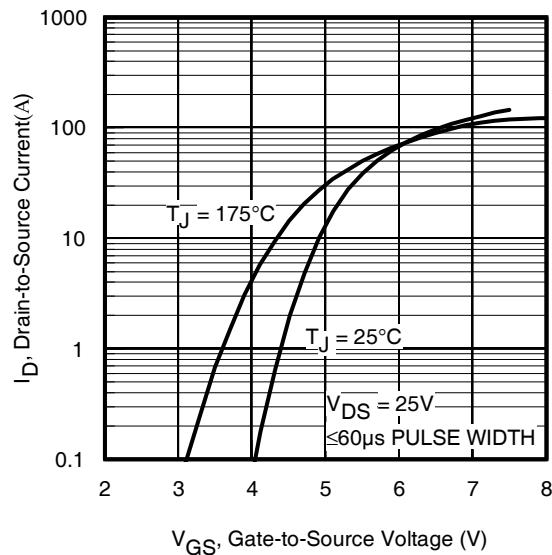


Fig 3. Typical Transfer Characteristics

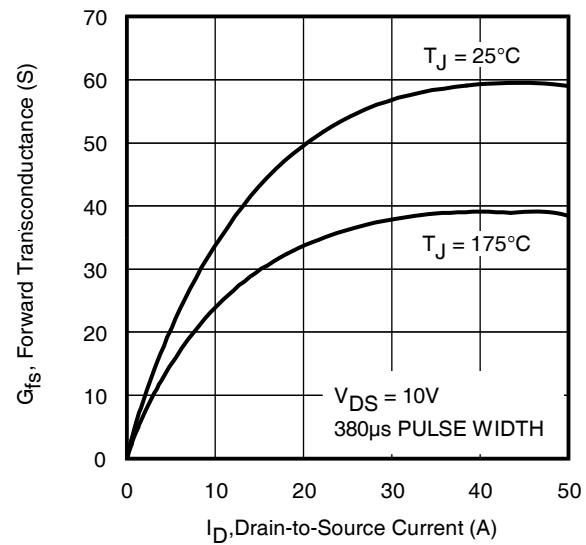


Fig 4. Typical Forward Transconductance vs. Drain Current

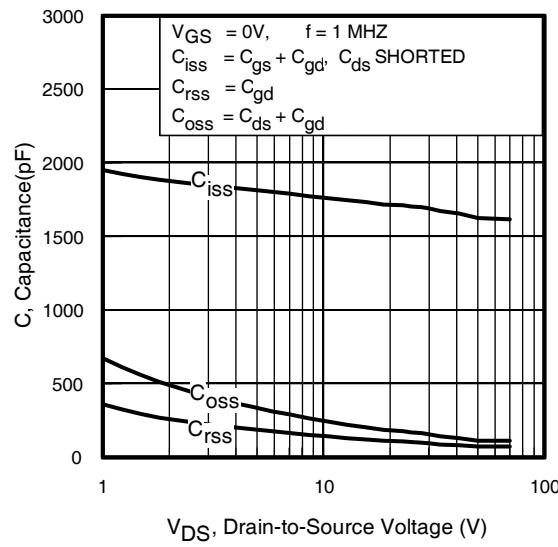


Fig 5. Typical Capacitance vs.
Drain-to-Source Voltage

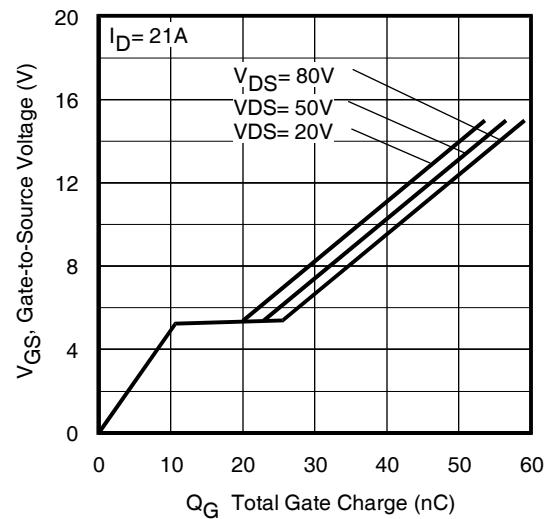


Fig 6. Typical Gate Charge vs.
Gate-to-Source Voltage

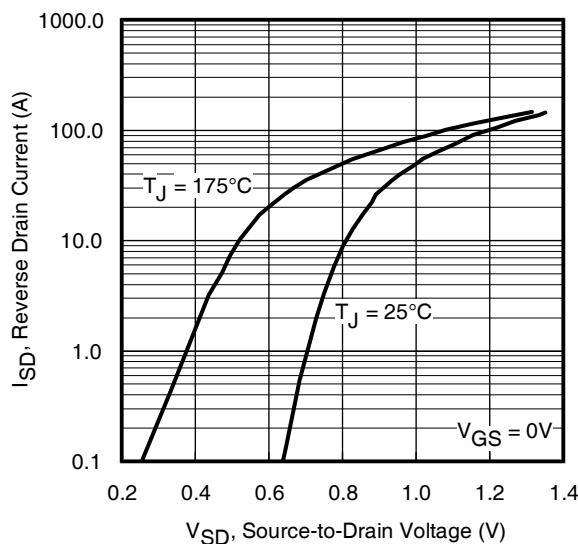


Fig 7. Typical Source-Drain Diode
Forward Voltage

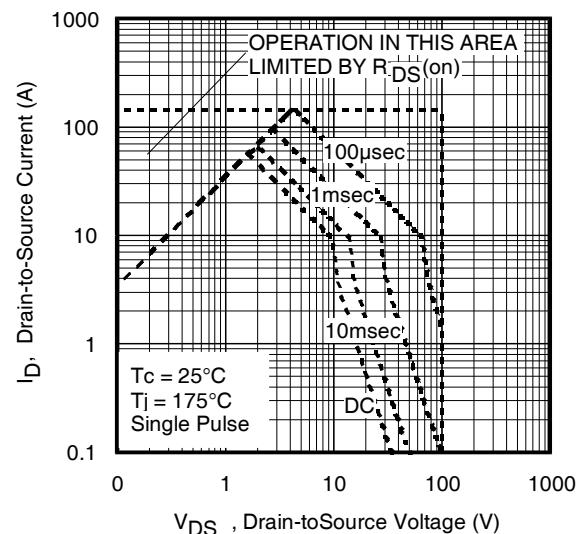


Fig 8. Maximum Safe Operating Area

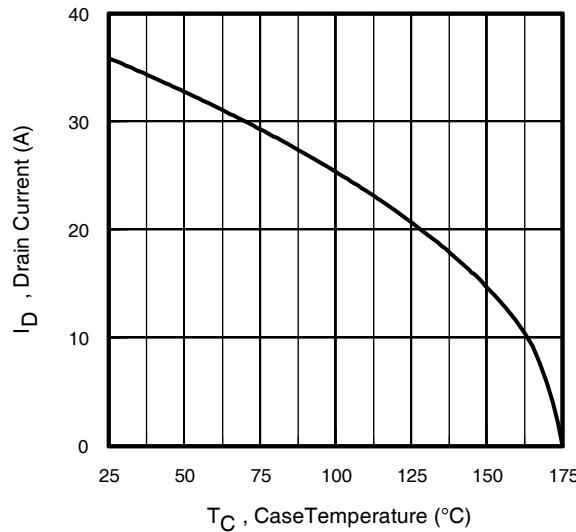


Fig 9. Maximum Drain Current vs. Case Temperature

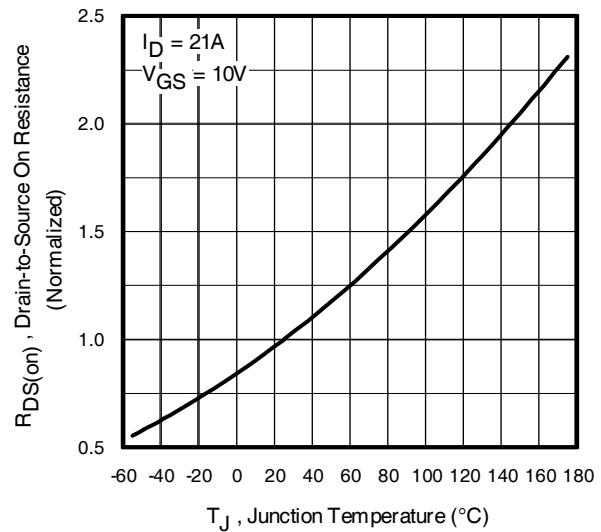


Fig 10. Normalized On-Resistance vs. Temperature

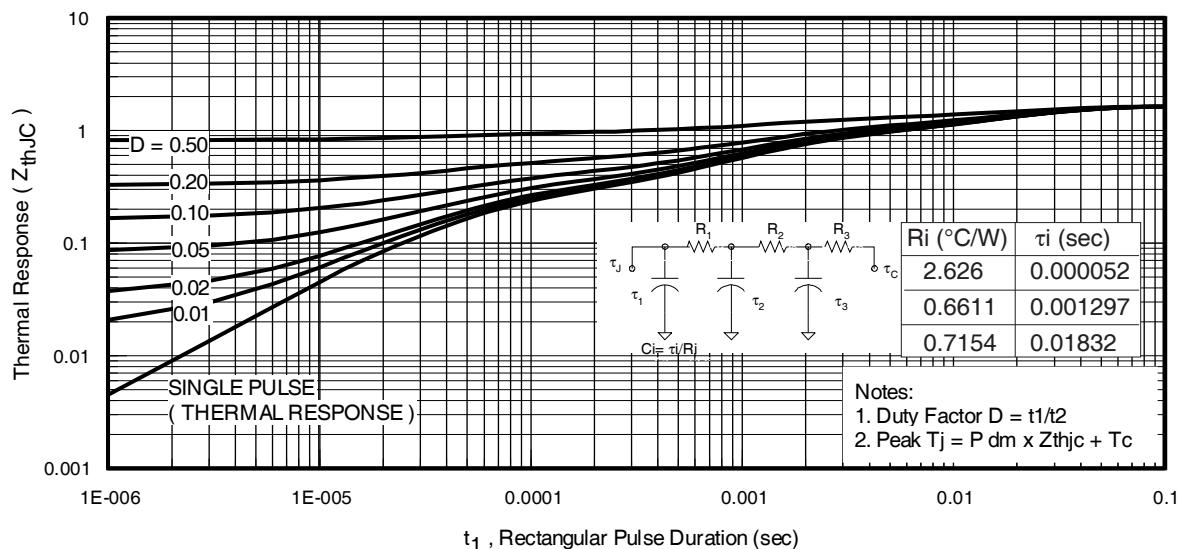


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

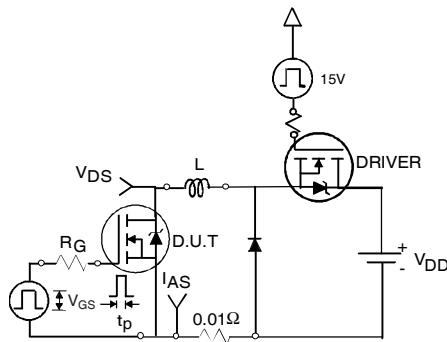


Fig 12a. Unclamped Inductive Test Circuit

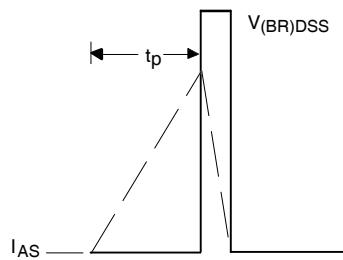


Fig 12b. Unclamped Inductive Waveforms

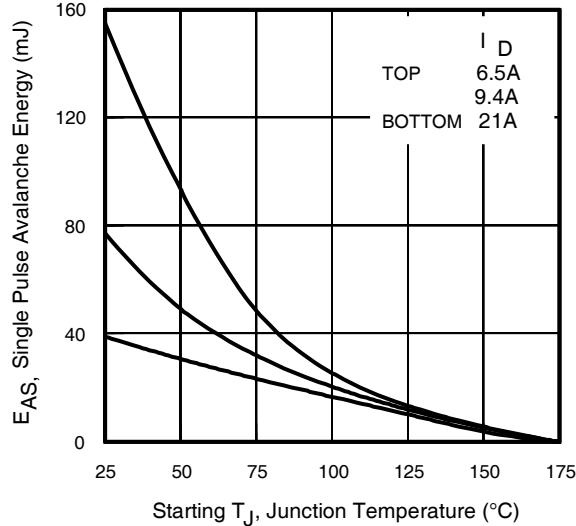


Fig 12c. Maximum Avalanche Energy vs. Drain Current

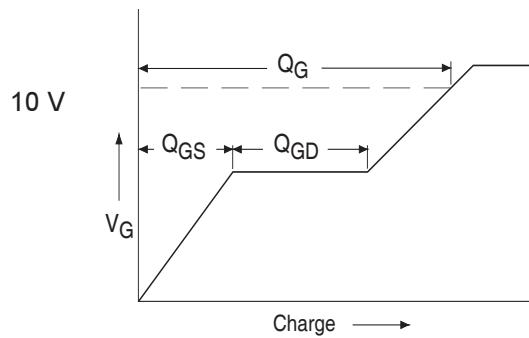


Fig 13a. Basic Gate Charge Waveform

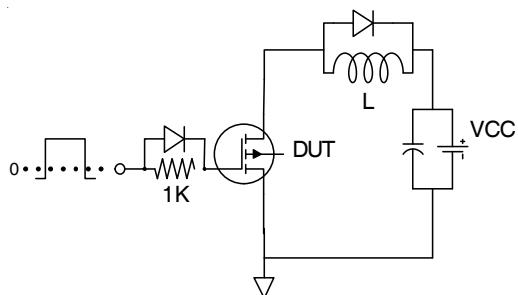


Fig 13b. Gate Charge Test Circuit

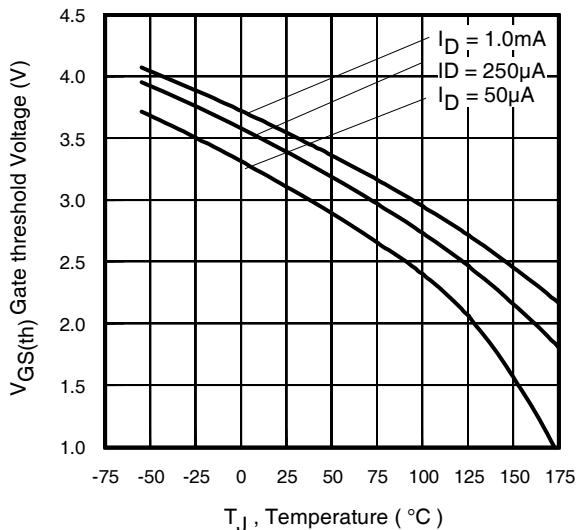


Fig 14. Threshold Voltage vs. Temperature

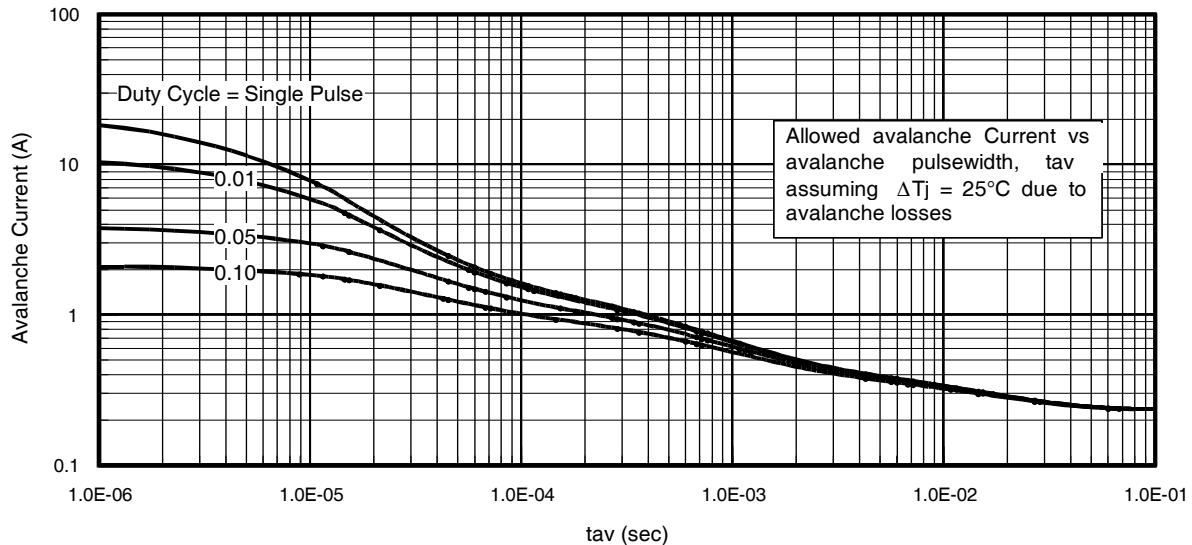


Fig 15. Typical Avalanche Current vs.Pulsewidth

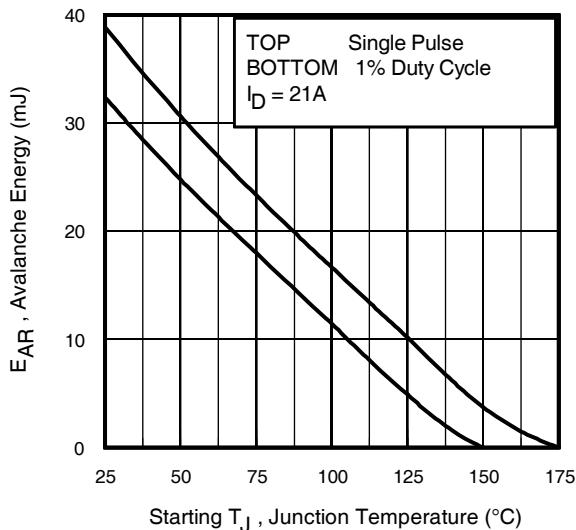


Fig 16. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16: (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 T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_D(\text{ave})$ = Average power dissipation per single avalanche pulse.
5. BV = 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 15, 16).

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)

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

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

$$E_{AS(AR)} = P_D(\text{ave}) \cdot t_{av}$$

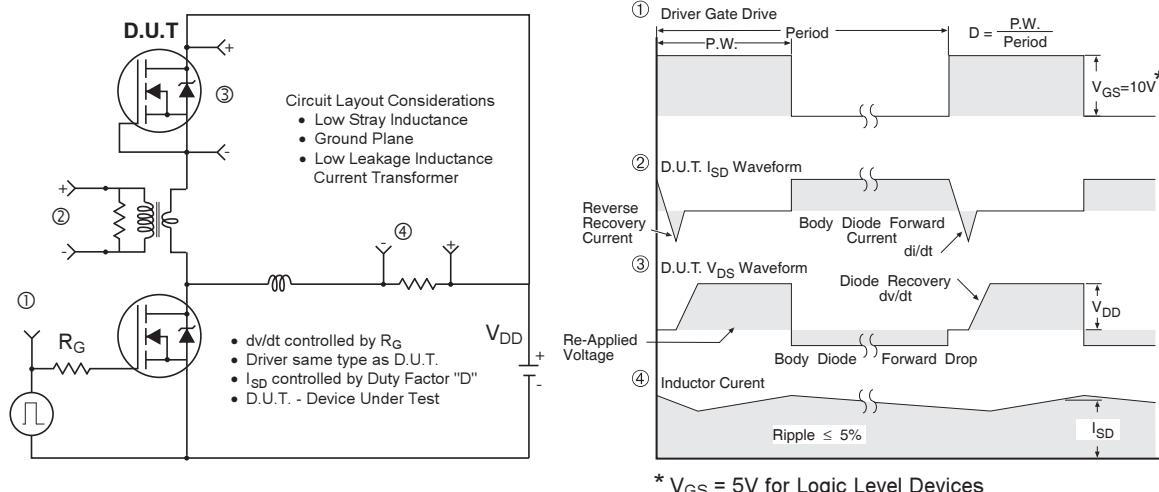


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

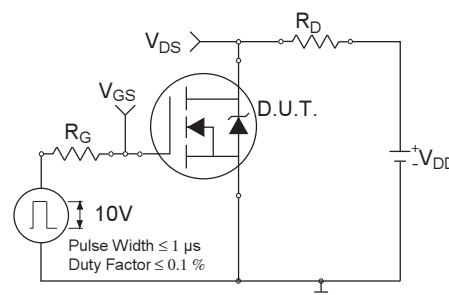


Fig 18a. Switching Time Test Circuit

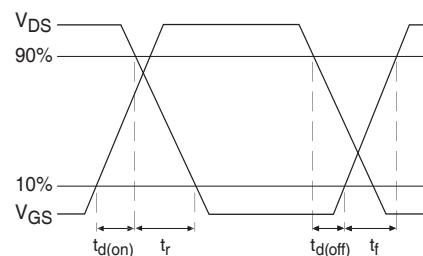
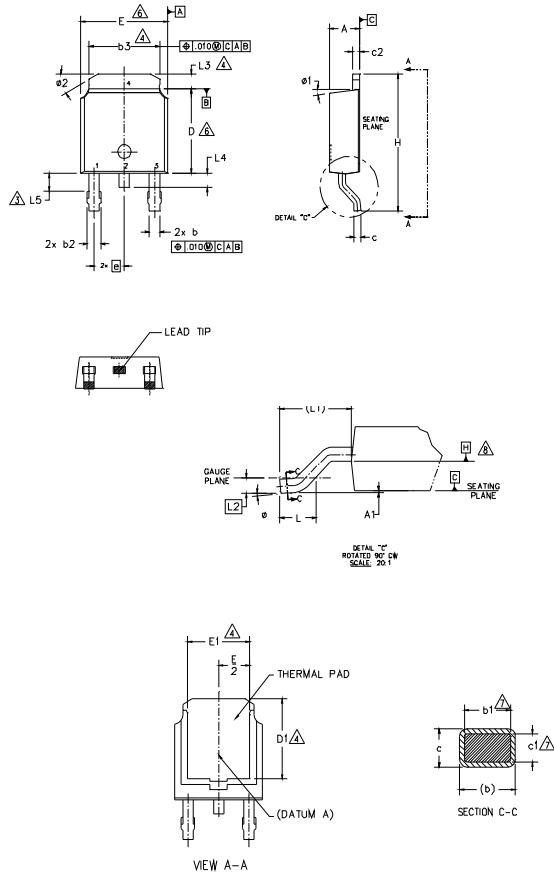


Fig 18b. Switching Time Waveforms

D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSION ARE SHOWN IN INCHES [MILLIMETERS]
3. LEAD DIMENSION UNCONTROLLED IN L5.
4. DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
5. SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
6. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
7. DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
8. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
9. OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

S Y M O L	DIMENSIONS		N O T E S
	MILLIMETERS	INCHES	
	MIN.	MAX.	
A	2.18	.239	.086 .094
A1	—	.13	— .005
b	0.64	.89	.025 .035
b1	0.65	.79	.025 .031
b2	0.76	1.14	.030 .045
b3	4.95	5.46	.195 .215
c	0.46	0.61	.018 .024
c1	0.41	0.56	.016 .022
c2	0.46	0.89	.018 .035
D	5.97	6.22	.235 .245
D1	5.21	—	.205 —
E	6.35	6.73	.250 .265
E1	4.32	—	.170 —
e	2.29 BSC	.090 BSC	
H	9.40	10.41	.370 .410
L	1.40	1.78	.055 .070
L1	2.74 BSC	.108 REF.	
L2	0.51 BSC	.020 BSC	
L3	0.89	1.27	.035 .050
L4	—	1.02	— .040
L5	1.14	1.52	.045 .060
ø	0°	10°	0° 10°
ø1	0°	15°	0° 15°
ø2	25°	35°	25° 35°

LEAD ASSIGNMENTS

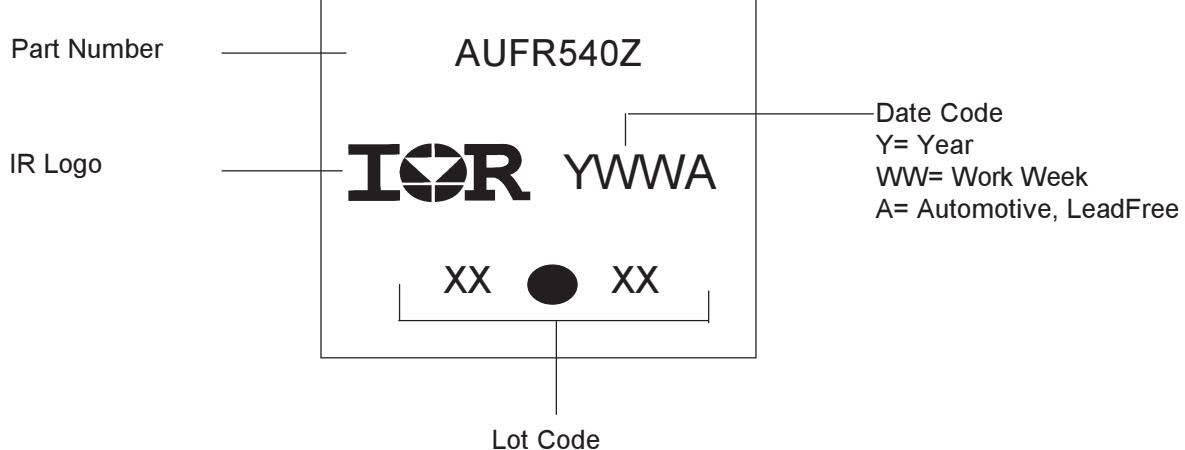
HEXFET

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

IGBT & CoPAK

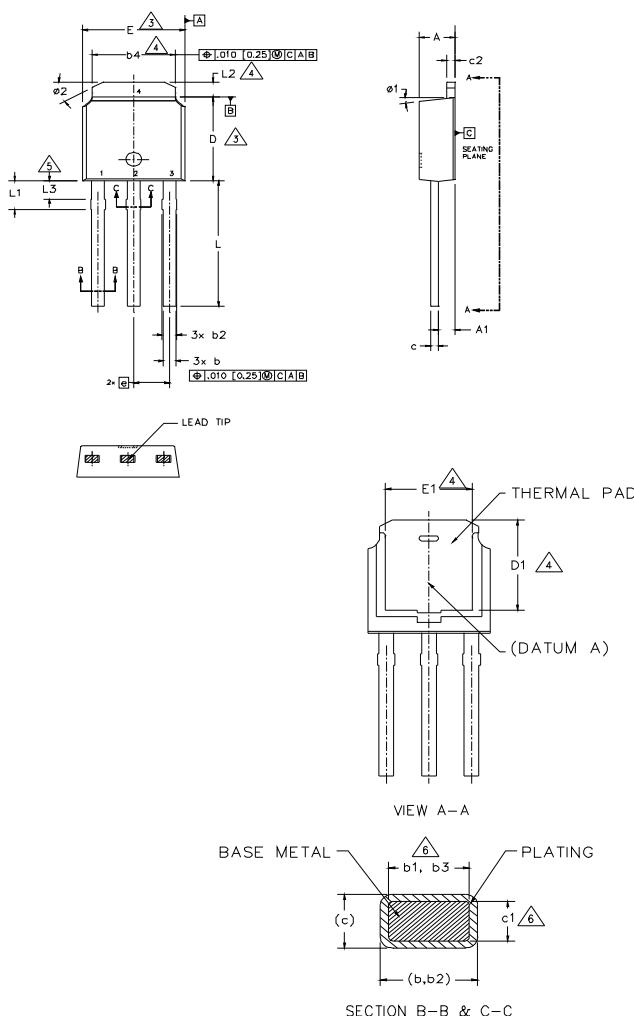
1. GATE
2. COLLECTOR
3. Emitter
4. COLLECTOR

D-Pak Part Marking Information

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

I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994

2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS].

3.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.

4.- THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.

5.- LEAD DIMENSION UNCONTROLLED IN L3.

6.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.

7.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA (Date 06/02).

8.- CONTROLLING DIMENSION : INCHES.

S Y M B O L	DIMENSIONS				N O T E S	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	2.18	2.39	.086	.094		
A1	0.89	1.14	.035	.045	6	
b	0.64	0.89	.025	.035		
b1	0.65	0.79	.025	.031		
b2	0.76	1.14	.030	.045		
b3	0.76	1.04	.030	.041	6	
b4	4.95	5.46	.195	.215	4	
c	0.46	0.61	.018	.024		
c1	0.41	0.56	.016	.022	6	
c2	0.46	0.89	.018	.035		
D	5.97	6.22	.235	.245	3	
D1	5.21	—	.205	—	4	
E	6.35	6.73	.250	.265	3	
E1	4.32	—	.170	—	4	
e	2.29	BSC	.090	BSC		
L	8.89	9.65	.350	.380		
L1	1.91	2.29	.045	.090	4	
L2	0.89	1.27	.035	.050		
L3	1.14	1.52	.045	.060	5	
ø1	0°	15°	0°	15°		
ø2	25°	35°	25°	35°		

LEAD ASSIGNMENTS

HEXFET

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

I-Pak Part Marking Information

Part Number

AUFU540Z

IR Logo

IOR YWWA

Date Code

Y= Year

WW= Work Week

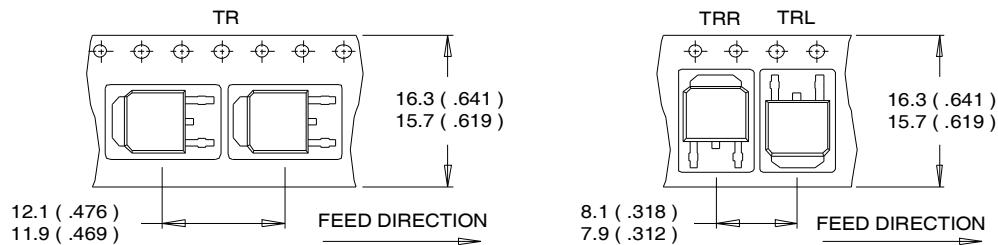
A= Automotive, LeadFree

Lot Code

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

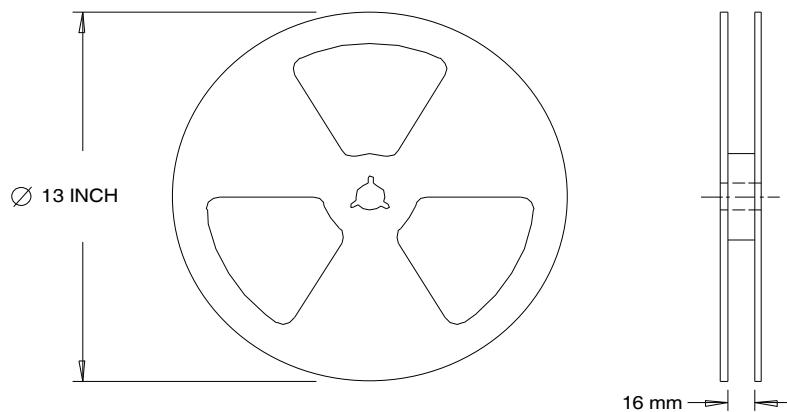
D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

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



NOTES :

1. OUTLINE CONFORMS TO EIA-481.

Qualification Information[†]

		Automotive (per AEC-Q101) [†]	
Qualification Level		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level	D-PAK	MSL1	
	I-PAK	MSL1	
ESD	Machine Model	Class M2 (+/- 200V) ^{††} AEC-Q101-002	
	Human Body Model	Class H1B (+/- 1000V) ^{††} AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) ^{††} AEC-Q101-005	
RoHS Compliant		Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

^{††} Highest passing voltage.

IMPORTANT NOTICE

Unless specifically designated for the automotive market, International Rectifier Corporation and its subsidiaries (IR) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. Part numbers designated with the "AU" prefix follow automotive industry and / or customer specific requirements with regards to product discontinuance and process change notification. All products are sold subject to IR's terms and conditions of sale supplied at the time of order acknowledgment.

IR warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with IR's standard warranty. Testing and other quality control techniques are used to the extent IR deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

IR assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using IR components. To minimize the risks with customer products and applications, customers should provide adequate design and operating safeguards.

Reproduction of IR information in IR data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alterations is an unfair and deceptive business practice. IR is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of IR products or serviced with statements different from or beyond the parameters stated by IR for that product or service voids all express and any implied warranties for the associated IR product or service and is an unfair and deceptive business practice. IR is not responsible or liable for any such statements.

IR products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or in other applications intended to support or sustain life, or in any other application in which the failure of the IR product could create a situation where personal injury or death may occur. Should Buyer purchase or use IR products for any such unintended or unauthorized application, Buyer shall indemnify and hold International Rectifier and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that IR was negligent regarding the design or manufacture of the product.

Only products certified as military grade by the Defense Logistics Agency (DLA) of the US Department of Defense, are designed and manufactured to meet DLA military specifications required by certain military, aerospace or other applications. Buyers acknowledge and agree that any use of IR products not certified by DLA as military-grade, in applications requiring military grade products, is solely at the Buyer's own risk and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

IR products are neither designed nor intended for use in automotive applications or environments unless the specific IR products are designated by IR as compliant with ISO/TS 16949 requirements and bear a part number including the designation "AU". Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, IR will not be responsible for any failure to meet such requirements.

For technical support, please contact IR's Technical Assistance Center

<http://www.irf.com/technical-info/>

WORLD HEADQUARTERS:

101 N. Sepulveda Blvd., El Segundo, California 90245

Tel: (310) 252-7105