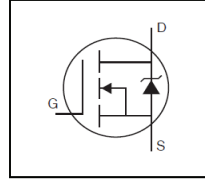# Features

- Advanced Process Technology
- New Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *

HEXFET® Power MOSFET

V_{DSS}		**40V**
$R_{DS(on)}$	**typ.**	**2.4mΩ**
	max.	**3.1mΩ**
I_D (Silicon Limited)		**127A①**
I_D (Package Limited)		**100A**

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 design 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 wide variety of other applications.

D-Pak
AUIRFR8403

I-Pak
AUIRFU8403

Applications

- Electric Power Steering (EPS)
- Battery Switch
- Start/Stop Micro Hybrid
- Heavy Loads
- DC-DC Converter
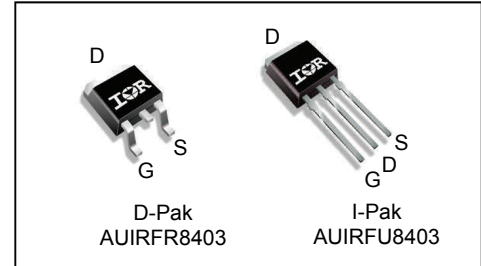
G	**D**	**S**
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	**Quantity**	
AUIRFU8403	I-Pak	Tube	75	AUIRFU8403
AUIRFR8403	D-Pak	Tube	75	AUIRFR8403
		Tape and Reel Left	3000	AUIRFR8403TRL

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 (TA) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	127①	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	90	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Package Limited)	100	
I_{DM}	Pulsed Drain Current ②	520⑩	
P_D @T_C = 25°C	Maximum Power Dissipation	99	W
	Linear Derating Factor	0.66	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Avalanche Characteristics

E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ③	114	mJ
E_{AS} (tested)	Single Pulse Avalanche Energy (Tested Limited) ③	148	
I_{AR}	Avalanche Current ②	See Fig. 14, 15, 24a, 24b	A
E_{AR}	Repetitive Avalanche Energy ②		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{θJC}$	Junction-to-Case ⑨	——	1.52	
$R_{θJA}$	Junction-to-Ambient (PCB Mount) ⑧	——	50	°C/W
$R_{θJA}$	Junction-to-Ambient	——	110	

HEXFET® is a registered trademark of Infineon.
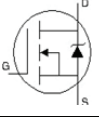
*Qualification standards can be found at www.infineon.com

2017-10-03

Static @ T$_J$ = 25°C (unless otherwise specified)

Parameter		Min.	Typ.	Max.	Units	Conditions
V$_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	——	——	V	V$_{GS}$ = 0V, I$_D$ = 250µA
ΔV$_{(BR)DSS}$/ΔT$_J$	Breakdown Voltage Temp. Coefficient	——	0.03	——	V/°C	Reference to 25°C, I$_D$ = 5mA ③
R$_{DS(on)}$	Static Drain-to-Source On-Resistance	——	2.4	3.1	mΩ	V$_{GS}$ = 10V, I$_D$ = 76A ⑤
V$_{GS(th)}$	Gate Threshold Voltage	2.2	3.0	3.9	V	V$_{DS}$ = V$_{GS}$, I$_D$ = 100µA
I$_{DSS}$	Drain-to-Source Leakage Current	——	——	1.0	µA	V$_{DS}$ = 40V, V$_{GS}$ = 0V
		——	——	150		V$_{DS}$ = 40V,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
R$_G$	Internal Gate Resistance	——	1.5	——	Ω	

Dynamic Electrical Characteristics @ T$_J$ = 25°C (unless otherwise specified)

gfs	Forward Trans conductance	283	——	——	S	V$_{DS}$ = 10V, I$_D$ = 76A
Q$_g$	Total Gate Charge	——	66	99	nC	I$_D$ = 76A
Q$_{gs}$	Gate-to-Source Charge	——	18	——		V$_{DS}$ = 20V
Q$_{gd}$	Gate-to-Drain Charge	——	22	——		V$_{GS}$ = 10V⑤
Q$_{sync}$	Total Gate Charge Sync. (Q$_g$ - Q$_{gd}$)	——	44	——		
t$_{d(on)}$	Turn-On Delay Time	——	10	——	ns	V$_{DD}$ = 26V
t$_r$	Rise Time	——	32	——		I$_D$ = 76A
t$_{d(off)}$	Turn-Off Delay Time	——	31	——		R$_G$ = 2.7Ω
t$_f$	Fall Time	——	23	——		V$_{GS}$ = 10V⑤
C$_{iss}$	Input Capacitance	——	3171	——	pF	V$_{GS}$ = 0V
C$_{oss}$	Output Capacitance	——	477	——		V$_{DS}$ = 25V
C$_{rss}$	Reverse Transfer Capacitance	——	331	——		f = 1.0MHz, See Fig. 5
C$_{oss\ eff.}$ (ER)	Effective Output Capacitance (Energy Related)	——	573	——		V$_{GS}$ = 0V, V$_{DS}$ = 0V to 32V ⑦
C$_{oss\ eff.}$ (TR)	Effective Output Capacitance (Time Related)	——	681	——		V$_{GS}$ = 0V, V$_{DS}$ = 0V to 32V ⑥

Diode Characteristics

Parameter		Min.	Typ.	Max.	Units	Conditions
I$_S$	Continuous Source Current (Body Diode)	——	——	127①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I$_{SM}$	Pulsed Source Current (Body Diode) ①	——	——	520⑩		
V$_{SD}$	Diode Forward Voltage	——	0.9	1.3	V	T$_J$ = 25°C,I$_S$ = 76A,V$_{GS}$ = 0V ⑤
dv/dt	Peak Diode Recovery dv/dt④	——	5.1	——	V/ns	T$_J$ = 175°C,I$_S$ = 76A,V$_{DS}$ = 40V
t$_{rr}$	Reverse Recovery Time	——	25	——	ns	T$_J$ = 25°C
		——	26	——		T$_J$ = 125°C
Q$_{rr}$	Reverse Recovery Charge	——	20	——	nC	T$_J$ = 25°C
		——	21	——		T$_J$ = 125°C
I$_{RRM}$	Reverse Recovery Current	——	1.2	——	A	T$_J$ = 25°C

(Conditions spanning t$_{rr}$ and Q$_{rr}$: V$_R$ = 34V, I$_F$ = 76A, di/dt = 100A/µs ⑤)

Notes:

① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 100A by source bonding technology. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)

② Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)

③ Limited by T$_{Jmax}$, starting T$_J$ = 25°C, L = 0.039mH, R$_G$ = 50Ω, I$_{AS}$ = 76A, V$_{GS}$ =10V. Part not recommended for use above this value.

④ I$_{SD}$ ≤ 76A, di/dt ≤ 1255A/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.

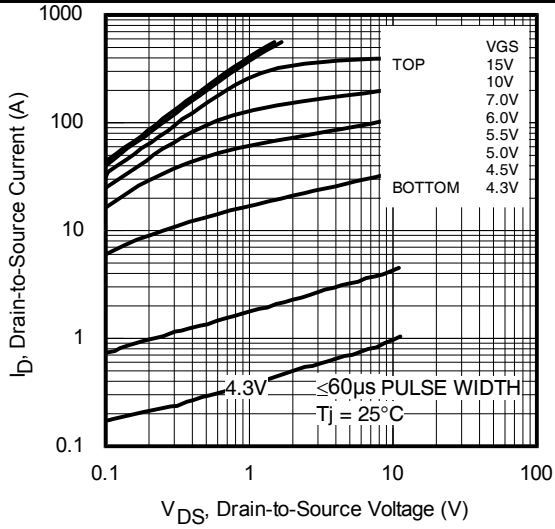⑩ Pulse drain current is limited by source bonding technology.

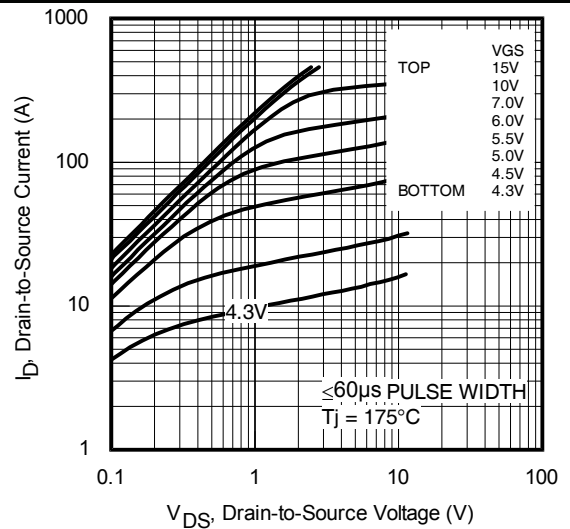Fig. 1 Typical Output Characteristics

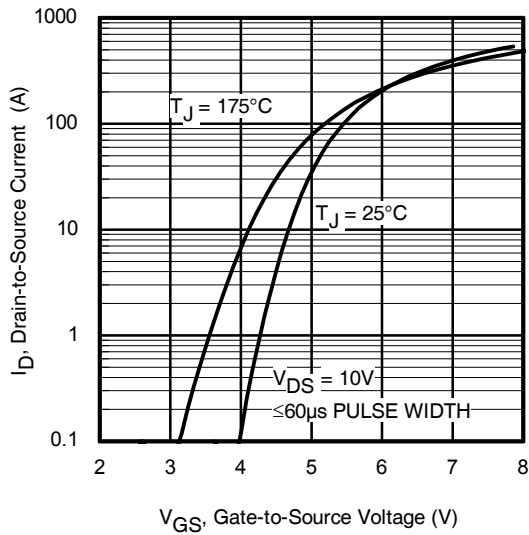Fig. 2 Typical Output Characteristics
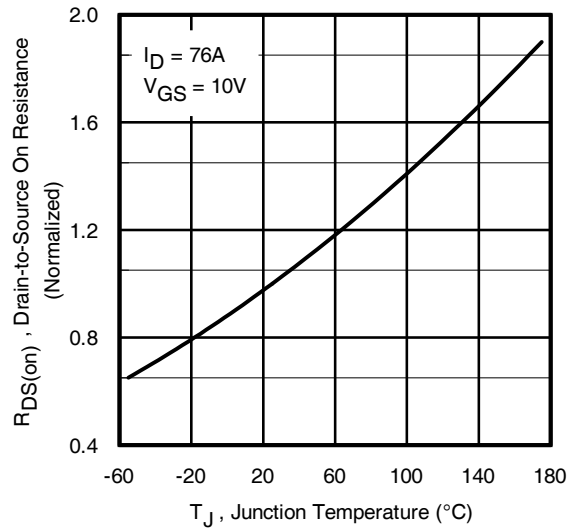

Fig. 3 Typical Transfer Characteristics
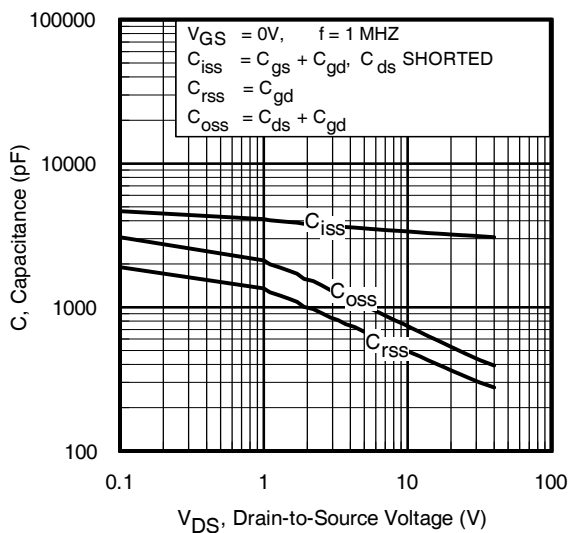

Fig. 4 Normalized On-Resistance vs. Temperature

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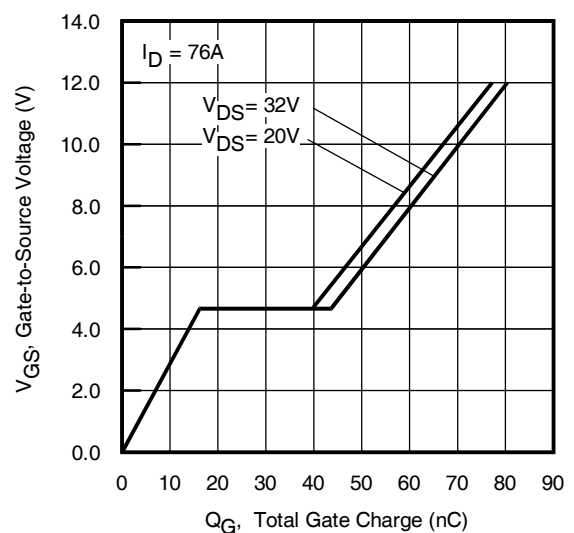

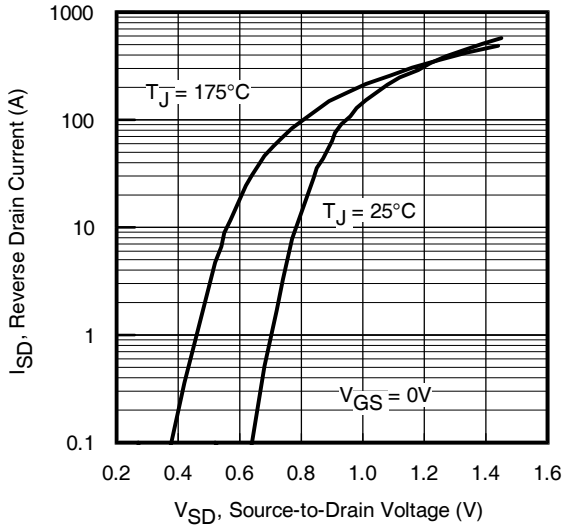Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage
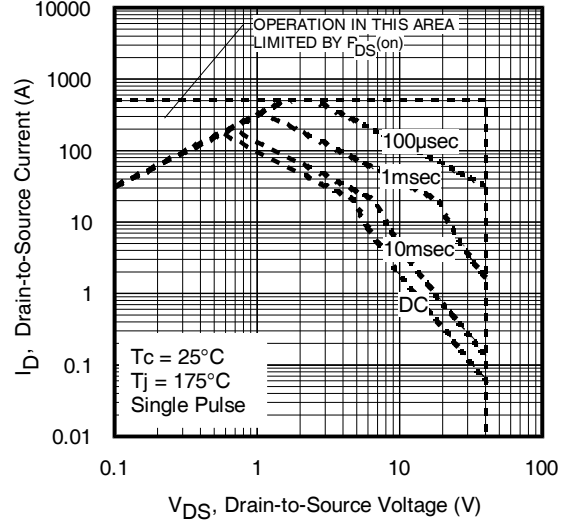
2017-10-03

Fig. 7 Typical Source-to-Drain Diode Forward Voltage
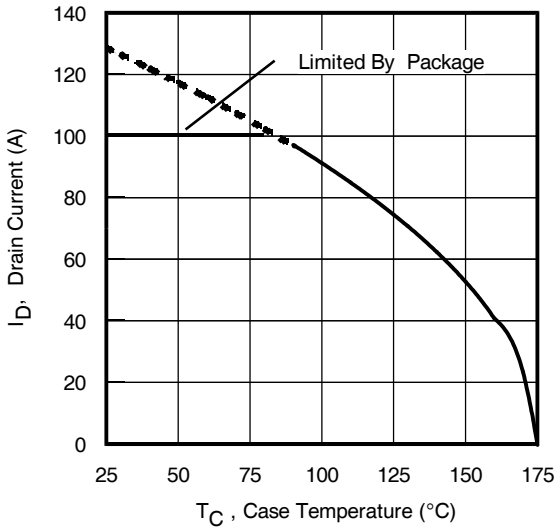

Fig 8. Maximum Safe Operating Area
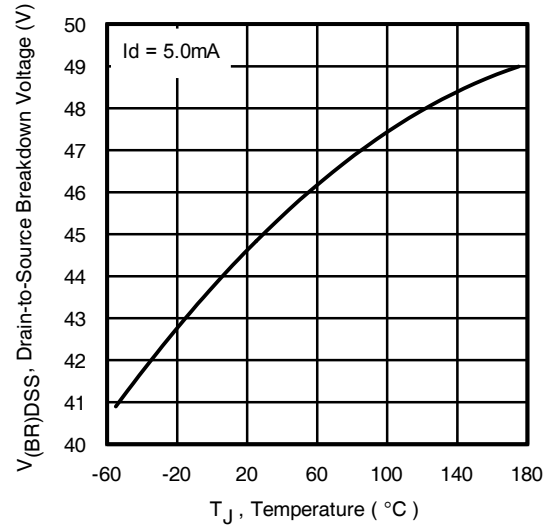

Fig. 9 Maximum Drain Current vs. Case Temperature

Fig 10. Drain-to-Source Breakdown Voltage
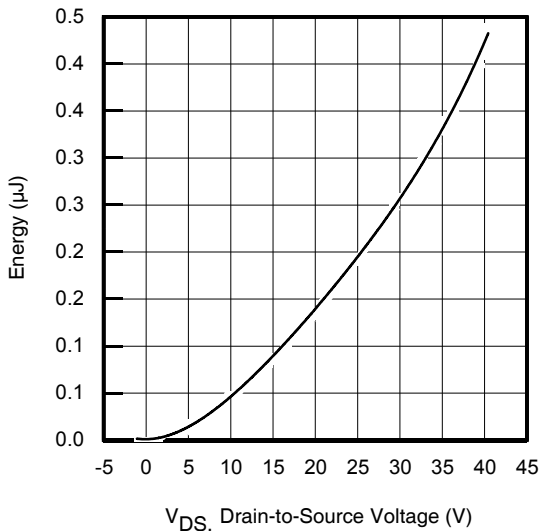
Fig. 11 Typical C_{oss} Stored Energy
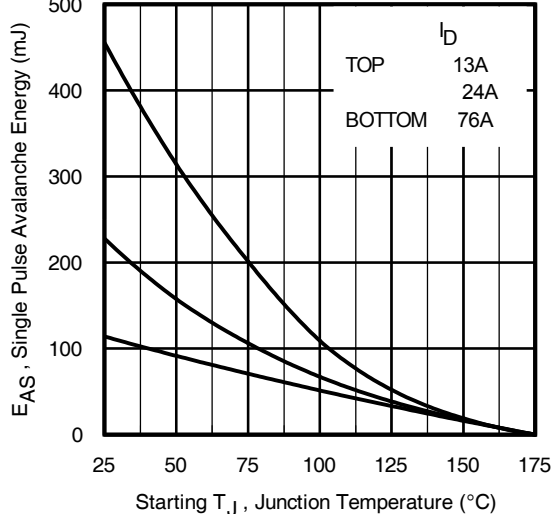
Fig 12. Maximum Avalanche Energy vs. Drain Current

2017-10-03
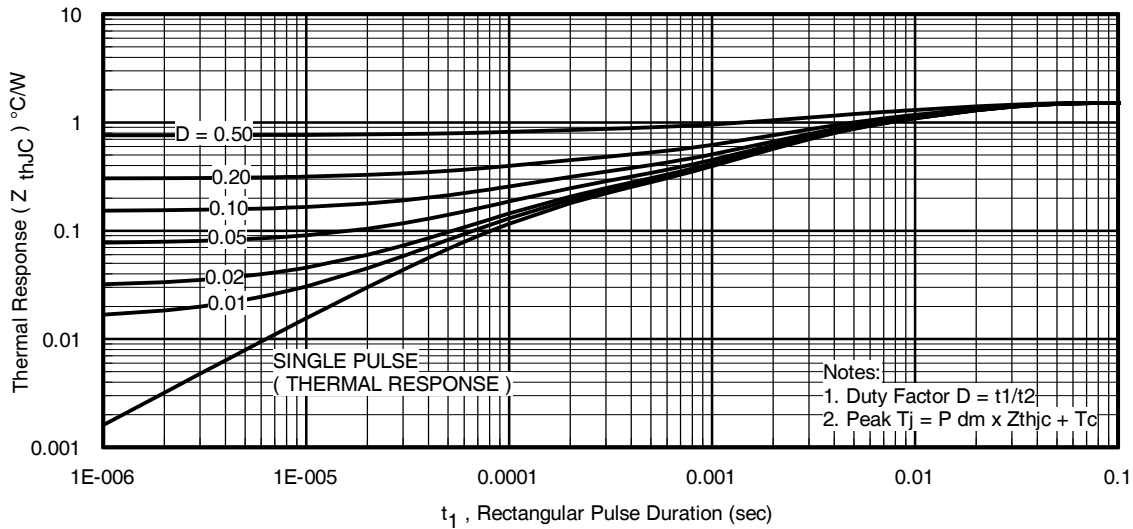
Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case
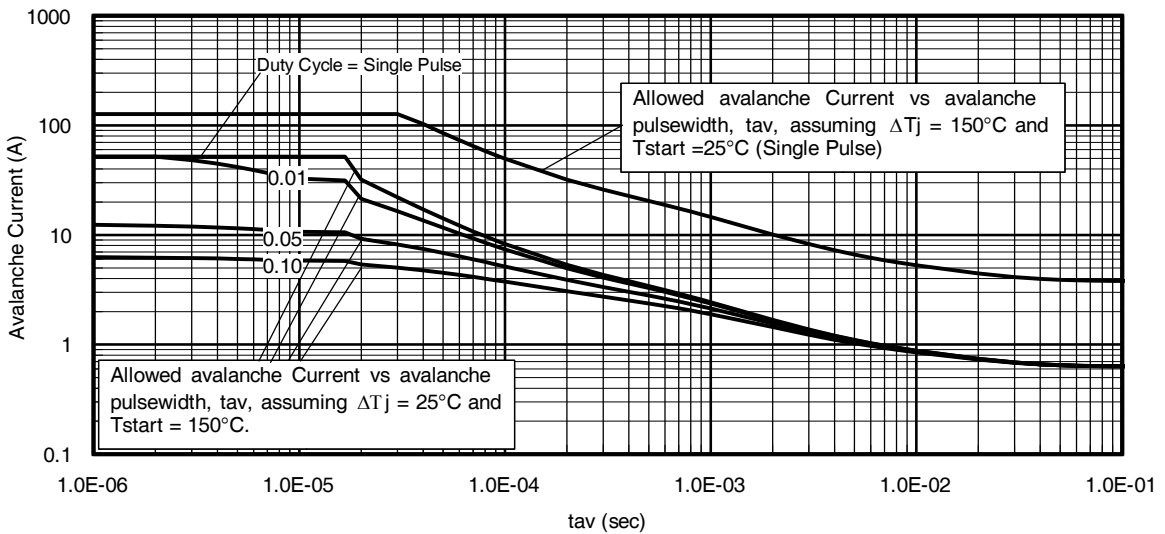
Fig 14. Typical Avalanche Current Vs. Pulse width
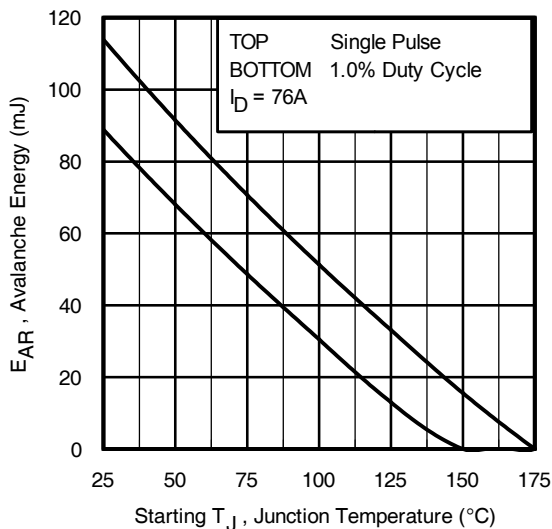
Fig 15. Maximum Avalanche Energy Vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 14, 15:
(For further info, see AN-1005 at www.infineon.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 24a, 24b.
4. $P_{D (ave)}$ = 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 13, 14).
   t_{av} = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 13)

$$P_{D (ave)} = 1/2 \ (\ 1.3 \cdot BV \cdot I_{av}) = \Delta T / \ Z_{thJC}$$
$$I_{av} = 2\Delta T / \ [1.3 \cdot BV \cdot Z_{th}]$$
$$E_{AS (AR)} = P_{D (ave)} \cdot t_{av}$$
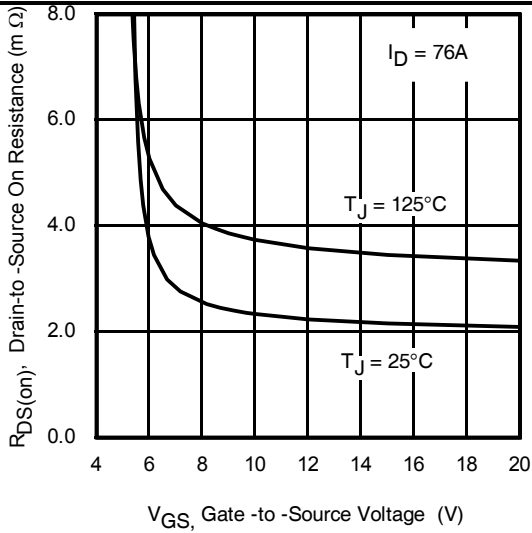
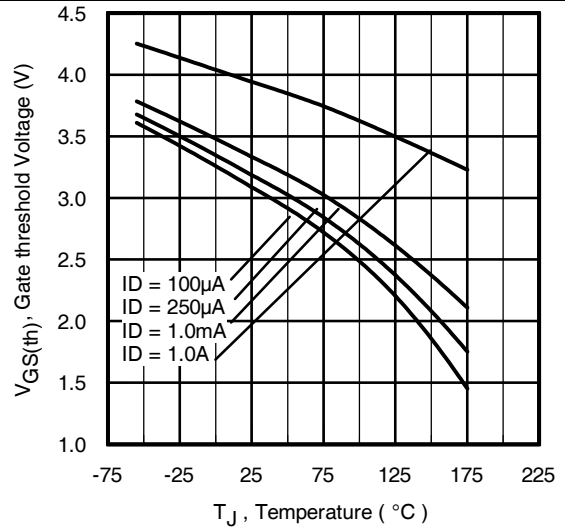**Fig 16.** On-Resistance vs. Gate Voltage
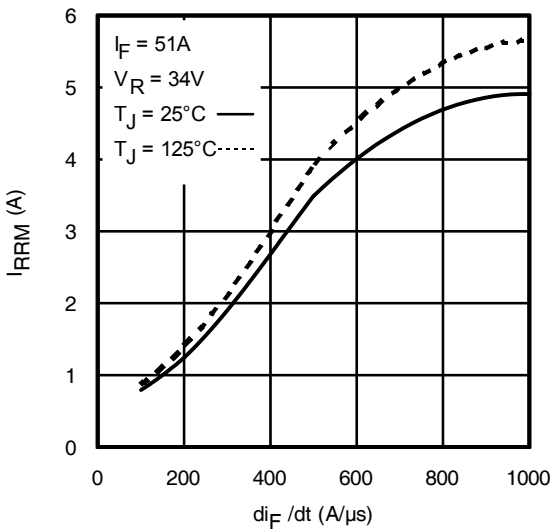

Fig. 17 - Threshold Voltage vs. Temperature

Fig. 18 - Typical Recovery Current vs. di$_f$/dt
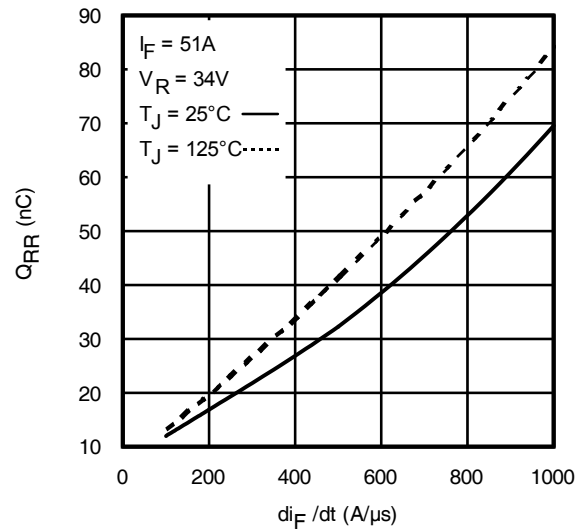

Fig. 19 - Typical Stored Charge vs. di$_f$/dt
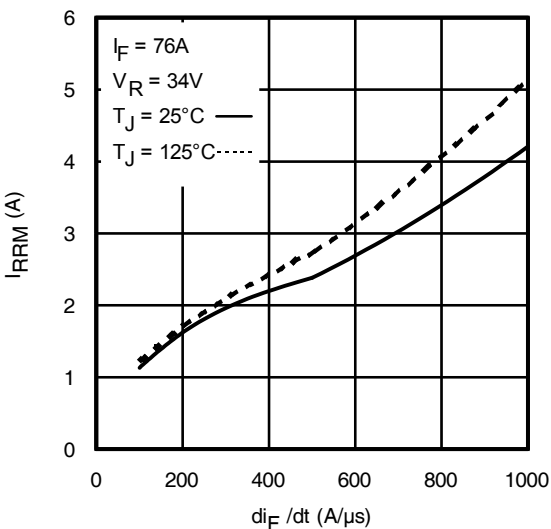

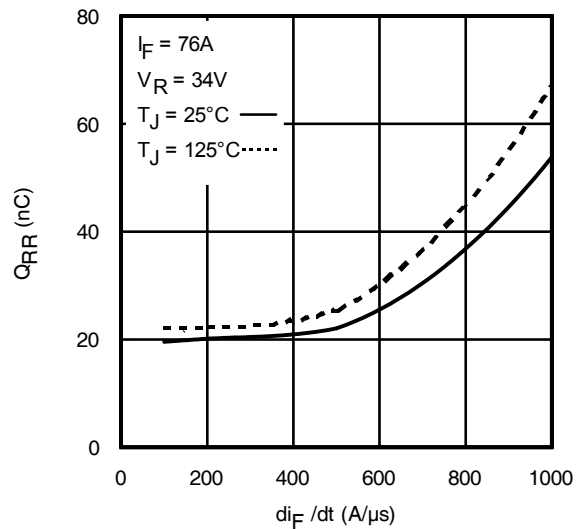**Fig. 20** - Typical Recovery Current vs. di$_f$/dt

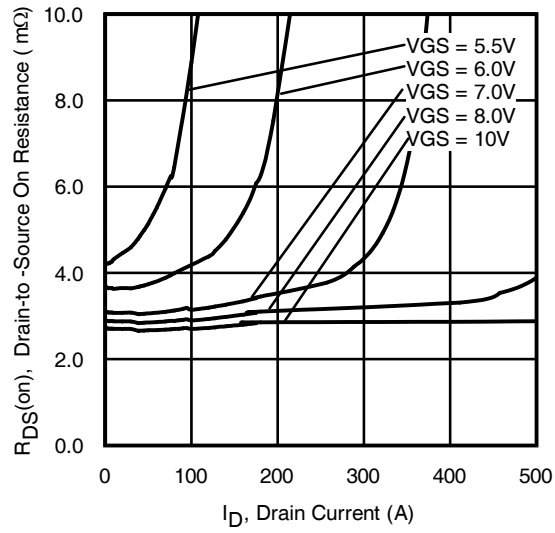**Fig. 21** - Typical Stored Charge vs. di$_f$/dt

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Fig 22. Typical On-Resistance vs. Drain Current
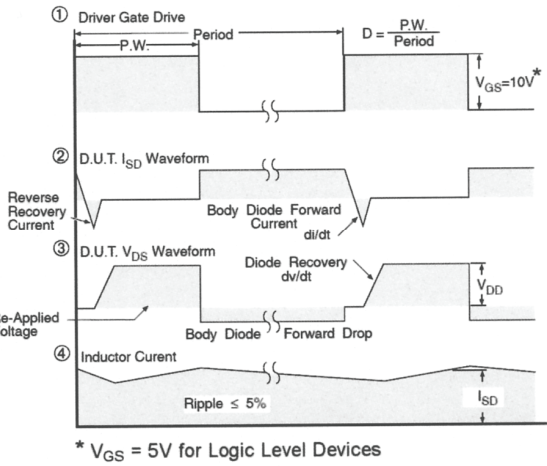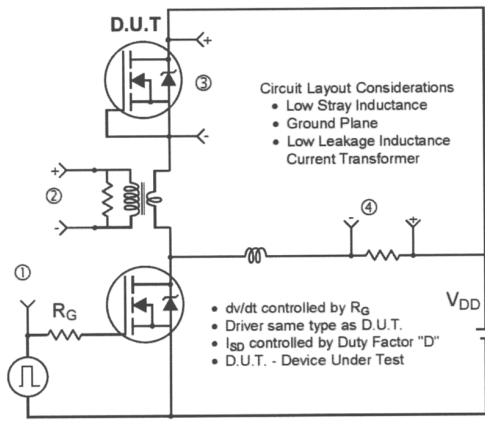
Fig 23. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs
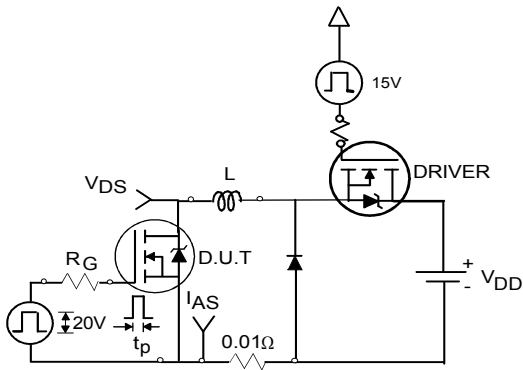

Fig 24a. Unclamped Inductive Test Circuit
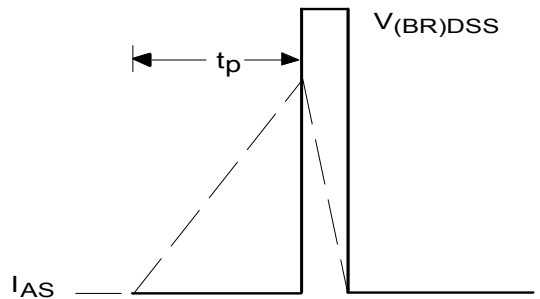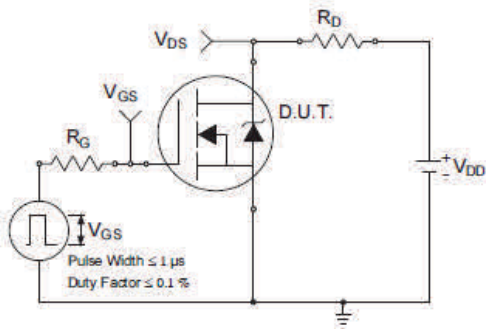

Fig 24b. Unclamped Inductive Waveforms

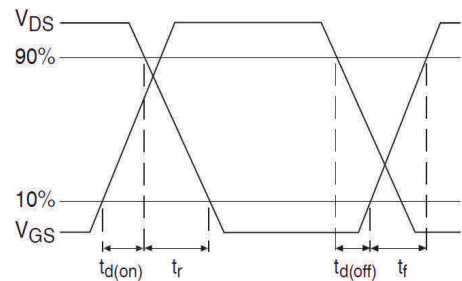**Fig 25a.** Switching Time Test Circuit

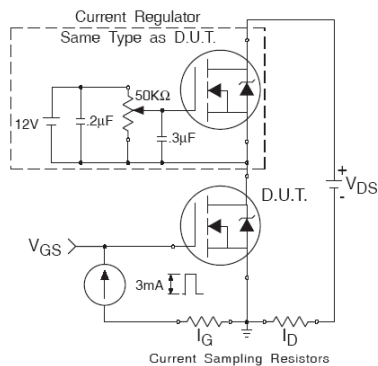**Fig 25b.** Switching Time Waveforms

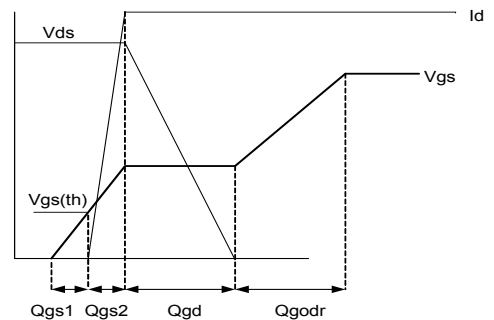**Fig 26a.** Gate Charge Test Circuit

Fig 26b. Gate Charge Waveform

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.

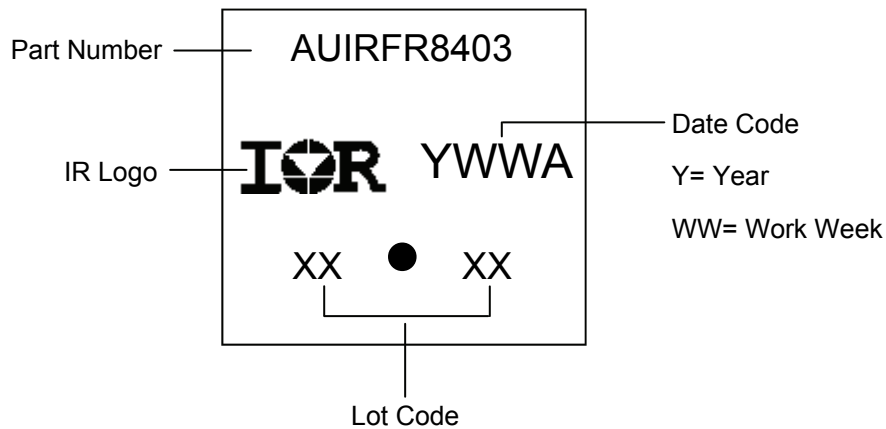| SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	–	0.13	–	.005	
b	0.64	0.89	.025	.035	
b1	0.65	0.79	.025	.031	7
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	7
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	6
D1	5.21	–	.205	–	4
E	6.35	6.73	.250	.265	6
E1	4.32	–	.170	–	4
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	4
L4	–	1.02	–	.040	
L5	1.14	1.52	.045	.060	3
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 (TO-252AA) Part Marking Information

Part Number — AUIRFR8403

IR Logo — IOR   YWWA

XX ● XX

Date Code
Y= Year
WW= Work Week

Lot Code

I-Pak (TO-251AA) Package Outline (Dimensions are shown in millimeters (inches)
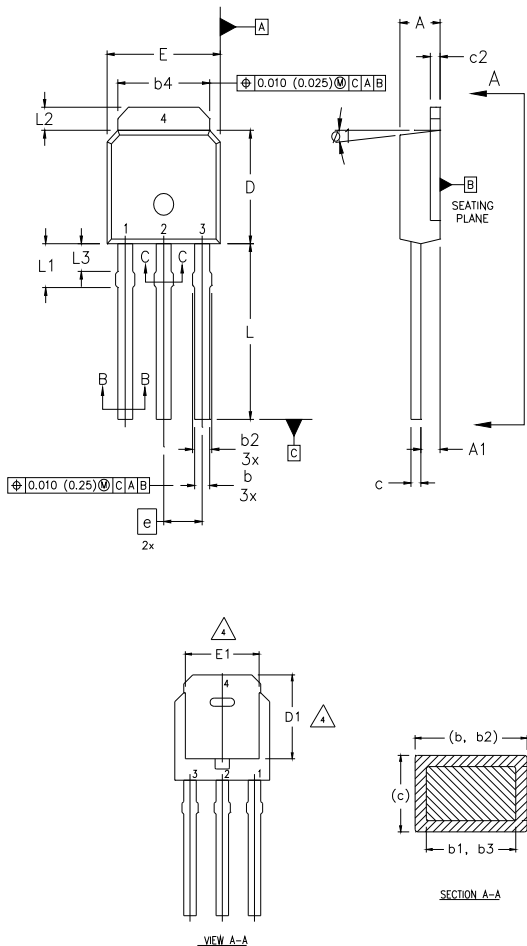
NOTES:
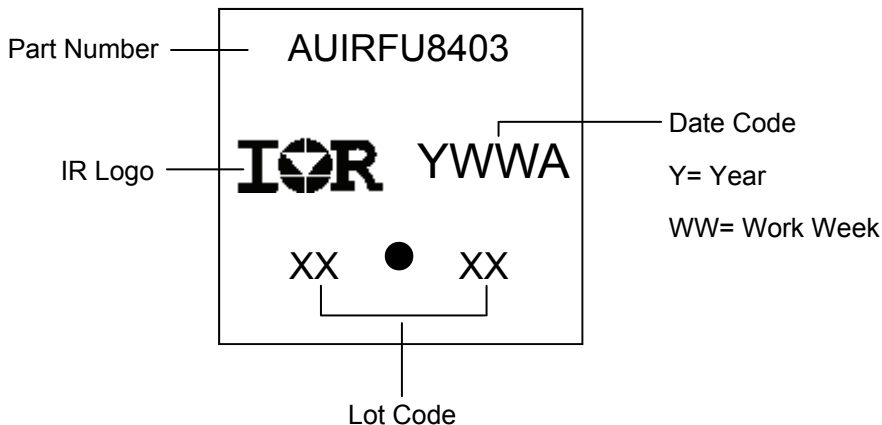
1.   DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2.   DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3.   DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
4.   THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
5.   LEAD DIMENSION UNCONTROLLED IN L3.
6.   DIMENSION b1, b3 APPLY TO BASE METAL ONLY.
7.   OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
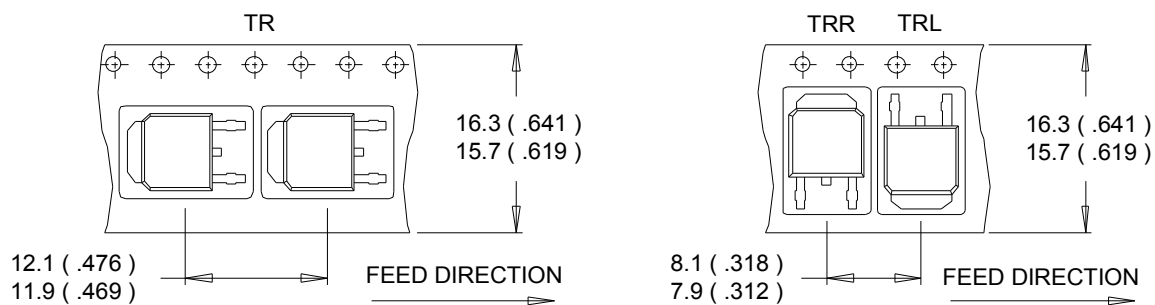8.   CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	.094	
A1	0.89	1.14	0.035	0.045	
b	0.64	0.89	0.025	0.035	
b1	0.64	0.79	0.025	0.031	4
b2	0.76	1.14	0.030	0.045	
b3	0.76	1.04	0.030	0.041	
b4	5.00	5.46	0.195	0.215	4
c	0.46	0.61	0.018	0.024	
c1	0.41	0.56	0.016	0.022	
c2	.046	0.86	0.018	0.035	
D	5.97	6.22	0.235	0.245	3, 4
D1	5.21	–	0.205	–	4
E	6.35	6.73	0.250	0.265	3, 4
E1	4.32	–	0.170	–	4
e	2.29		0.090 BSC		
L	8.89	9.60	0.350	0.380	
L1	1.91	2.29	0.075	0.090	
L2	0.89	1.27	0.035	0.050	4
L3	1.14	1.52	0.045	0.060	5
ø1	0°	15°	0°	15°	

LEAD ASSIGNMENTS

HEXFET

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

I-Pak (TO-251AA) Part Marking Information

Part Number — AUIRFU8403

IR Logo — I☢R YWWA

Date Code
Y= Year
WW= Work Week

XX ● XX

Lot Code

D-Pak (TO-252AA) Tape & Reel Information (Dimensions are shown in millimeters (inches))

TR

16.3 (.641)
15.7 (.619)

12.1 (.476)
11.9 (.469)

FEED DIRECTION

TRR   TRL

16.3 (.641)
15.7 (.619)

8.1 (.318)
7.9 (.312)

FEED DIRECTION

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

$\varnothing$ 13 INCH

16 mm
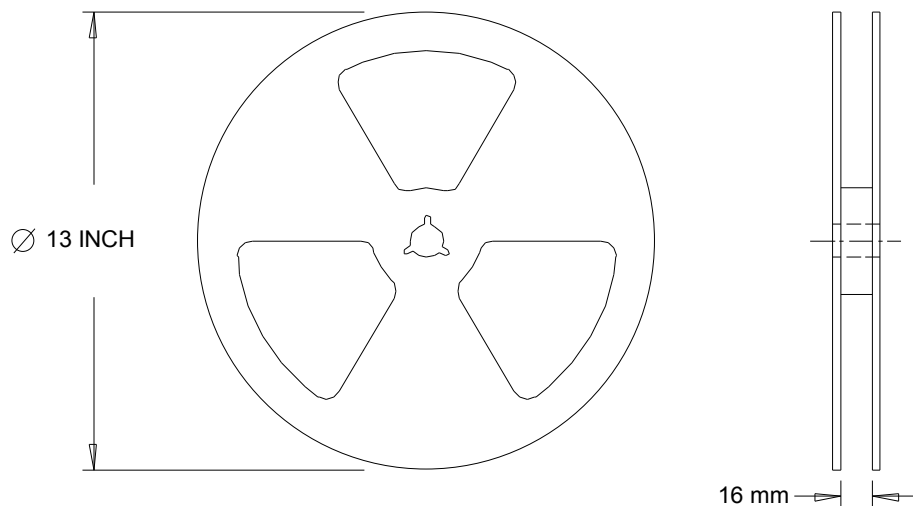
NOTES :
1. OUTLINE CONFORMS TO EIA-481.

Qualification Information

Qualification Level	Automotive (per AEC-Q101)
	Comments: This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.

Moisture Sensitivity Level	D-Pak	MSL1
	I-Pak	

ESD	Machine Model	Class M2 (+/- 200V)† AEC-Q101-002
	Human Body Model	Class H1C (+/- 2000V)† AEC-Q101-001
	Charged Device Model	Class C5 (+/- 2000V)† AEC-Q101-005

RoHS Compliant	Yes

† Highest passing voltage.

Revision History

Date	Comments
10/12/2015	• Updated datasheet with corporate template • Corrected ordering table on page 1.
10/03/2017	• Corrected typo error on part marking on page 9 and 10.

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