

## Static @ T<sub>J</sub> = 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		0.053		V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance		19	24.5	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 18A ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0		4.0	٧	$V_{DS} = V_{GS}$ , $I_D = 250\mu A$
gfs	Forward Trans conductance	16			S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 18A ③
I <sub>DSS</sub>		$V_{DS} = 55V$ , $V_{GS} = 0V$				
				250	μΑ	$V_{DS} = 55V, V_{GS} = 0V, T_{J} = 125^{\circ}C$
	Gate-to-Source Forward Leakage			200	- Λ	V <sub>GS</sub> = 20V
I <sub>GSS</sub>	Gate-to-Source Reverse Leakage			-200	nA	$V_{GS} = -20V$

### Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

$Q_g$	Total Gate Charge	 18	27		I <sub>D</sub> = 18A
$Q_gs$	Gate-to-Source Charge	 5.3		nC	$V_{DS} = 44V$
$\overline{Q_{gd}}$	Gate-to-Drain Charge	 7.0			V <sub>GS</sub> = 10V③
$t_{d(on)}$	Turn-On Delay Time	 10			$V_{DD} = 28V$
t <sub>r</sub>	Rise Time	 40			I <sub>D</sub> = 18A
$t_{d(off)}$	Turn-Off Delay Time	 26		ns	$R_G = 24.5\Omega$
t <sub>f</sub>	Fall Time	 24			V <sub>GS</sub> = 10V③
L <sub>D</sub>	Internal Drain Inductance	 4.5			Between lead, 6mm (0.25in.)
L <sub>S</sub>	Internal Source Inductance	 7.5			from package and center of die contact
$C_{iss}$	Input Capacitance	 740			$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	 140			$V_{DS} = 25V$
C <sub>rss</sub>	Reverse Transfer Capacitance	 74		ne	f = 1.0MHz
$C_{oss}$	Output Capacitance	 450		pF	$V_{GS} = 0V$ , $V_{DS} = 1.0V$ $f = 1.0MHz$
C <sub>oss</sub>	Output Capacitance	 110			$V_{GS} = 0V$ , $V_{DS} = 44V$ $f = 1.0MHz$
Coss eff.	Effective Output Capacitance	 180			$V_{GS} = 0V, V_{DS} = 0V \text{ to } 44V  $

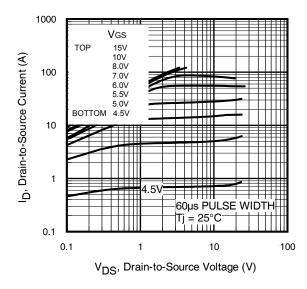
#### **Diode Characteristics**

	Sidd Thailactoricae						
	Parameter	Min.	Тур.	Max.	Units	Conditions	
ı	Continuous Source Current			30		MOSFET symbol	
I <sub>S</sub>	(Body Diode)		30	_	showing the		
ı	Pulsed Source Current			120		integral reverse	
I <sub>SM</sub>	(Body Diode) ①			120		p-n junction diode.	
$V_{SD}$	Diode Forward Voltage			1.3	٧	$T_J = 25^{\circ}C, I_S = 18A, V_{GS} = 0V$ ③	
t <sub>rr</sub>	Reverse Recovery Time		19	29	ns	$T_J = 25^{\circ}C$ , $I_F = 18A$ , $V_{DD} = 28V$	
Q <sub>rr</sub>	Reverse Recovery Charge		14	21	nC	di/dt = 100A/µs③	
t <sub>on</sub>	Forward Turn-On Time	Intrinsio	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				

#### 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 = 0.18mH,  $R_G = 25\Omega$ ,  $I_{AS} = 18$ A,  $V_{GS} = 10$ V. Part not recommended for use above this value.
- $\oplus$  C<sub>oss</sub> eff. is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>
- © Limited by T<sub>Jmax</sub>, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population, starting  $T_J = 25^{\circ}C$ , L = 0.18mH, R<sub>G</sub> = 25 $\Omega$ , I<sub>AS</sub> = 18A, V<sub>GS</sub> =10V.
- When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994
- ® R<sub>θ</sub> is measured at T<sub>J</sub> approximately 90°C.





1000

VGS

TOP 15V
10V
8.0V
7.0V
6.0V
5.5V
5.5V
5.0V
BOTTOM 4.5V

0.1 1 10 100

VDS, Drain-to-Source Voltage (V)

Fig. 1 Typical Output Characteristics

Fig. 2 Typical Output Characteristics

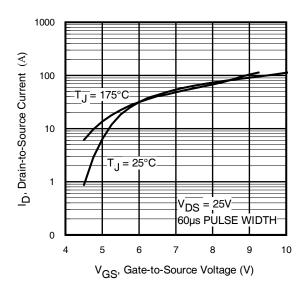
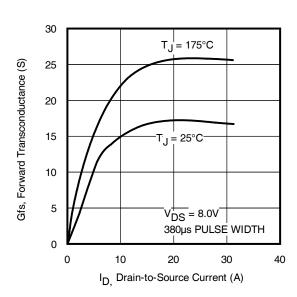
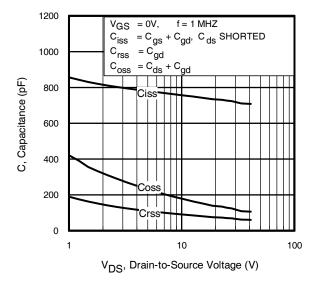


Fig. 3 Typical Transfer Characteristics

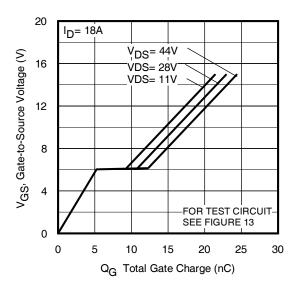


**Fig. 4** Typical Forward Trans conductance Vs. Drain Current





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



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

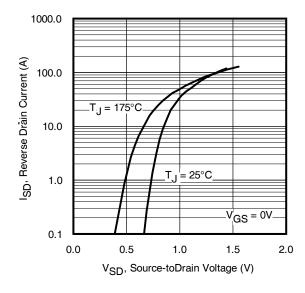


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

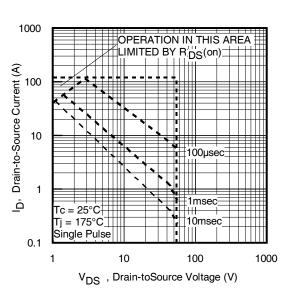
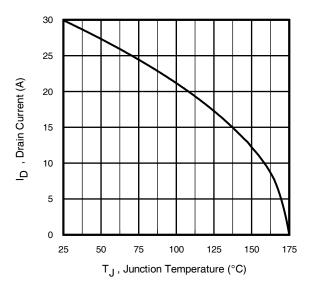
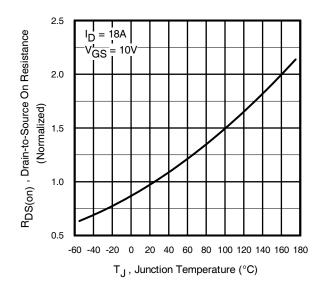


Fig 8. Maximum Safe Operating Area







**Fig 9.** Maximum Drain Current Vs. Case Temperature

**Fig 10.** Normalized On-Resistance Vs. Temperature

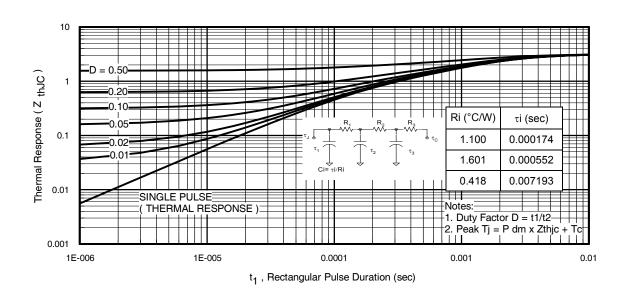


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



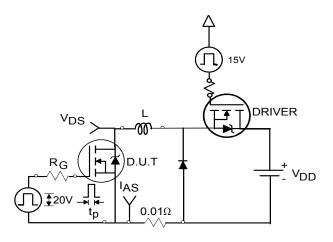


Fig 12a. Unclamped Inductive Test Circuit

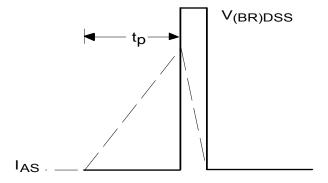


Fig 12b. Unclamped Inductive Waveforms

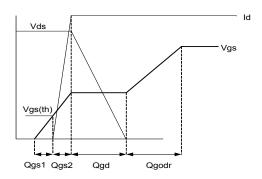


Fig 13a. Gate Charge Waveform

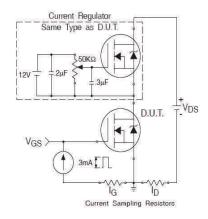
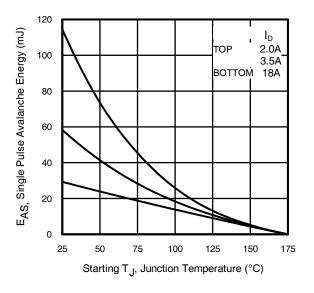


Fig 13b. Gate Charge Test Circuit



**Fig 12c.** Maximum Avalanche Energy vs. Drain Current

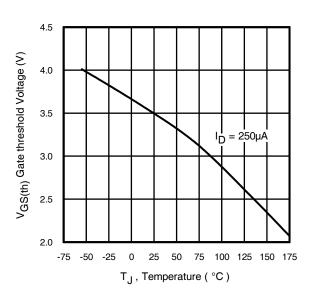


Fig 14. Threshold Voltage Vs. Temperature



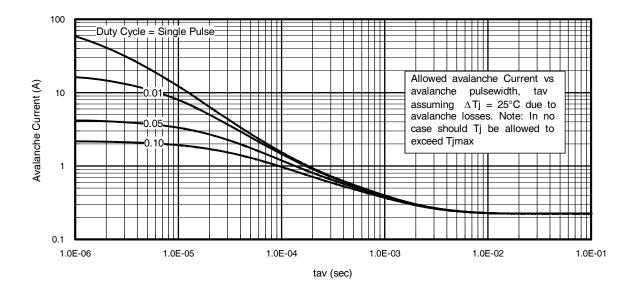
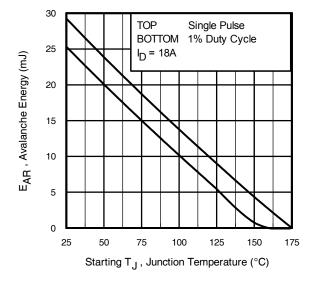


Fig 15. Typical Avalanche Current Vs. Pulse width



**Fig 16.** Maximum Avalanche Energy Vs. Temperature

### Notes on Repetitive Avalanche Curves , Figures 15, 16:

# (For further info, see AN-1005 at www.infineon.com)

- Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of T<sub>imax</sub>. 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. PD (ave) = Average power dissipation per single avalanche pulse.
- 5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
- 6. Iav = Allowable avalanche current.
- 7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 15, 16).

tav = Average time in avalanche.

D = Duty cycle in avalanche =  $t_{av} \cdot f$ 

ZthJC(D, tav) = Transient thermal resistance, see Figures 13)

$$\begin{split} P_{D \; (ave)} &= 1/2 \; (\; 1.3 \cdot BV \cdot I_{av}) = \Delta T / \; Z_{thJC} \\ I_{av} &= 2\Delta T / \; [1.3 \cdot BV \cdot Z_{th}] \\ E_{AS \; (AR)} &= P_{D \; (ave)} \cdot t_{av} \end{split}$$

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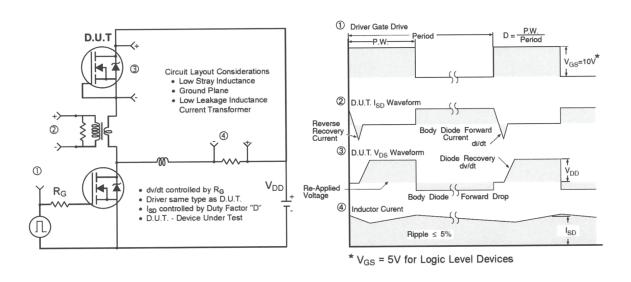


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

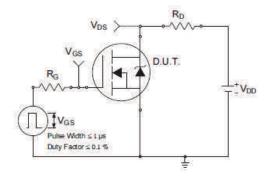


Fig 18a. Switching Time Test Circuit

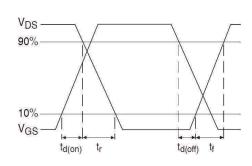
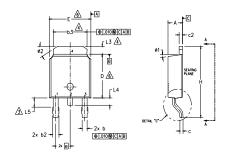


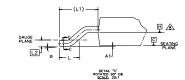
Fig 18b. Switching Time Waveforms

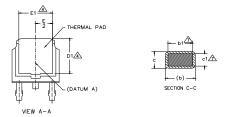


# D-Pak (TO-252AA) Package Outline (Dimensions are shown in millimeters (inches))









#### NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS].
- A- LEAD DIMENSION UNCONTROLLED IN L5.
- A- 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.
- A- DIMENSION 61 & c1 APPLIED TO BASE METAL ONLY.
- ♠ DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

S Y M	DIMENSIONS					
В	MILLIM	ETERS	INC	INCHES		
0 L	MIN.	MAX.	MIN.	MAX.	E S	
Α	2.18	2.39	.086	.094		
A1	-	0.13	-	.005		
b	0.64	0.89	.025	.035		
ь1	0.65	0.79	.025	.031	7	
b2	0.76	1.14	.030	.045		
b3	4.95	5.46	.195	.215	4	
С	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	
Ε	6.35	6.73	.250	.265	6	
E1	4.32	-	.170	-	4	
е	2.29	BSC	.090	BSC		
Н	9.40	10.41	.370	.410		
L	1.40	1.78	.055	.070		
L1	2.74	BSC	.108	REF.		
L2	0.51	BSC	.020	.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

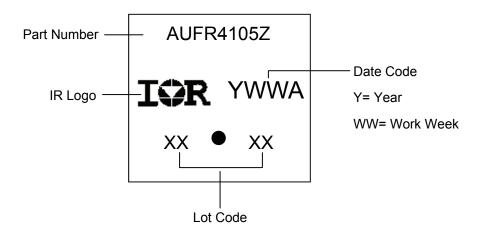
#### **HEXFET**

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

# IGBT & CoPAK

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

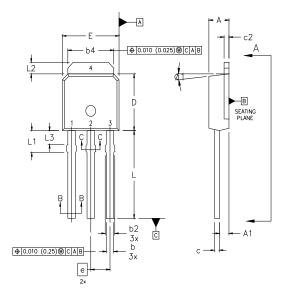
### D-Pak (TO-252AA) Part Marking Information

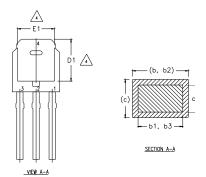


Note: For the most current drawing please refer to IR website at http://www.irf.com/package/



## I-Pak (TO-251AA) Package Outline (Dimensions are shown in millimeters (inches)





#### NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- JIMENSION 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.
- THERMAL PAD CONTOUR OPTION WITHIN DIMENSION 64, L2, E1 & D1.
- LEAD DIMENSION UNCONTROLLED IN L3.
- 6 7 DIMENSION 61, 63 APPLY TO BASE METAL ONLY. OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
- B CONTROLLING DIMENSION : INCHES.

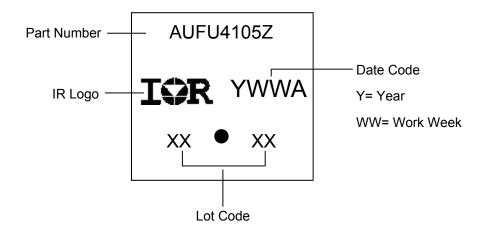
#### LEAD ASSIGNMENTS

Н	ΕX	Ηŧ	
_			

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

DIMENSIONS					
SYMBOL	MILLIM	ETERS	INC	HES	
	MIN.	MAX.	MIN.	MAX.	NOTES
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	
ь1	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
С	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*	

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

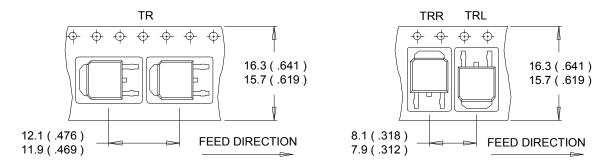


Note: For the most current drawing please refer to IR website at <a href="http://www.irf.com/package/">http://www.irf.com/package/</a>

10

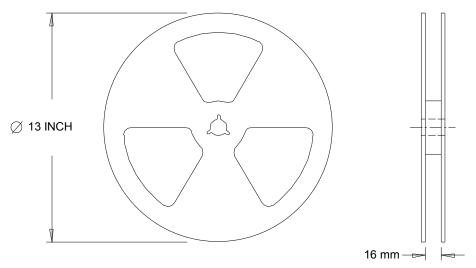


## D-Pak (TO-252AA) Tape & Reel Information (Dimensions are shown in millimeters (inches))



#### 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.

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



#### **Qualification Information**

<b>Q</b> uu	don miorination					
		Automotive (per AEC-Q101)				
		Moisture Sensitivity Level		D-Pak	MOL 4	
I-Pak	MSL1					
			Class M2 (+/-200V) <sup>†</sup>			
	Machine Model	AEC-Q101-002				
FOD	Liverage Dayle Mandal	Class H1A (+/-500V) <sup>†</sup>				
ESD	Human Body Model	AEC-Q101-001				
	Observed Davis a Madal	Class C5 (+/-1125V) <sup>†</sup>				
Charged Device Mod		AEC-Q101-005				
RoHS Compliant		Yes				

<sup>†</sup> Highest passing voltage.

### **Revision History**

Date	Comments		
12/1/2015	Updated datasheet with corporate template		
12/1/2015	Corrected ordering table on page 1.		

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