

AUTOMOTIVE GRADE

AUIRF540Z AUIRF540ZS

HEXFET® Power MOSFET

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching

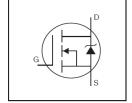
Description

Repetitive Avalanche Allowed up to Tjmax

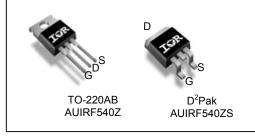
Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved

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.

- Lead-Free, RoHS Compliant
- Automotive Qualified *



V _{DSS}	100V
R _{DS(on)} typ.	21 mΩ
max.	26.5m Ω
I _D	36A



G	D	S
Gate	Drain	Source

Page nort number Dockers Type		Standard Pack	Orderable Part Number	
Base part number	Package Type	Form Quan		Orderable Part Number
AUIRF540Z	TO-220	Tube	50	AUIRF540Z
ALUDE 4070	D ² -Pak	Tube	50	AUIRF540ZS
AUIRF540ZS	D -Pak	Tape and Reel Left	800	AUIRF540ZSTRL

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)	36	
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	25	Α
I _{DM}	Pulsed Drain Current ①	140	
P _D @T _C = 25°C	Maximum Power Dissipation	92	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	83	1
E _{AS} (tested)	Single Pulse Avalanche Energy Tested Value ®	120	mJ
I _{AR}	Avalanche Current ①	See Fig.15,16, 12a, 12b	Α
E _{AR}	Repetitive Avalanche Energy ①		mJ
T _J	Operating Junction and	-55 to + 175	
T _{STG}	Storage Temperature Range		°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw⑦	10 lbf•in (1.1N•m)	

Thermal Resistance

Symbol	Parameter	Тур.	Max.	Units
$R_{ heta JC}$	Junction-to-Case		1.64	
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ⑦	0.50		°C/M
$R_{\theta JA}$	Junction-to-Ambient ⑦		62	°C/W
$R_{ hetaJA}$	Junction-to-Ambient (PCB Mount, steady state) ®		40	

HEXFET® is a registered trademark of Infineon.

^{*}Qualification standards can be found at www.infineon.com



Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Тур.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	100			V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_{J}$	Breakdown Voltage Temp. Coefficient		0.093		V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance		21	26.5	mΩ	V _{GS} = 10V, I _D = 22A ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0		4.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu A$
gfs	Forward Trans conductance	36			S	$V_{DS} = 25V, I_{D} = 22A$
ı	Drain-to-Source Leakage Current			20	μA	$V_{DS} = 100V, V_{GS} = 0V$
IDSS	Drain-to-Source Leakage Current			250	μΑ	$V_{DS} = 100V, V_{GS} = 0V, T_{J} = 125^{\circ}C$
	Gate-to-Source Forward Leakage			200	- Δ	V _{GS} = 20V
I _{GSS}	Gate-to-Source Reverse Leakage			-200	nA	V _{GS} = -20V

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

-	•	_	_		
Q_g	Total Gate Charge	 42	63		I _D = 22A
Q_{gs}	Gate-to-Source Charge	 9.7	l ——	nC	$V_{DS} = 80V$
$\overline{Q_{gd}}$	Gate-to-Drain Charge	 15			V _{GS} = 10V3
$t_{d(on)}$	Turn-On Delay Time	 15			V _{DD} = 50V
t _r	Rise Time	 51		200	$I_D = 22A$
$t_{d(off)}$	Turn-Off Delay Time	43		ns	$R_G = 12\Omega$
t _f	Fall Time	 39			V _{GS} = 10V ③
L _D	Internal Drain Inductance	 4.5			Between lead, 6mm (0.25in.)
Ls	Internal Source Inductance	 7.5			from package and center of die contact
C _{iss}	Input Capacitance	 1770			$V_{GS} = 0V$
C _{oss}	Output Capacitance	 180			$V_{DS} = 25V$
C _{rss}	Reverse Transfer Capacitance	 100		, r	f = 1.0MHz, See Fig. 5
C _{oss}	Output Capacitance	 730		pF	$V_{GS} = 0V, V_{DS} = 1.0V f = 1.0MHz$
C _{oss}	Output Capacitance	 110			$V_{GS} = 0V, V_{DS} = 80V f = 1.0MHz$
Coss eff.	Effective Output Capacitance	 170			$V_{GS} = 0V, V_{DS} = 0V \text{ to } 80V $

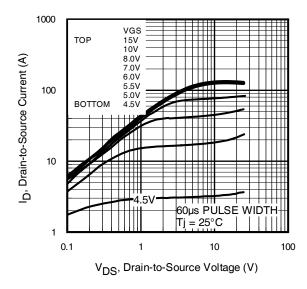
Diode Characteristics

	Parameter	Min.	Тур.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)			36		MOSFET symbol showing the
I _{SM}	Pulsed Source Current (Body Diode) ①			140		integral reverse p-n junction diode.
V_{SD}	Diode Forward Voltage			1.3	V	$T_J = 25^{\circ}C, I_S = 22A, V_{GS} = 0V$ ③
t _{rr}	Reverse Recovery Time		33	50	ns	$T_J = 25^{\circ}C$, $I_F = 22A$, $V_{DD} = 50V$
Q_{rr}	Reverse Recovery Charge		41	62	nC	di/dt = 100A/µs ③
ton	Forward Turn-On Time	Intrinsio	Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D)			

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 = 0.46mH, R_G = 25 Ω , I_{AS} = 20A, V_{GS} =10V. Part not recommended for use above this value.
- \P 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, T_J = 25°C, L = 0.46mH, R_G = 25 Ω , I_{AS} = 20A, V_{GS} =10V.
- This is only applied to TO-220AB package.
- This is applied to D²Pak When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994





TOP 15V
8.0V
7.0V
8.0V
7.0V
6.0V
5.5V
5.5V
6.0V
6.0P
10
60µs PULSE WIDTH
Tj = 175°C
1
0.1 1 10 100
VDS, Drain-to-Source Voltage (V)

1000

Fig. 1 Typical Output Characteristics

Fig. 2 Typical Output Characteristics

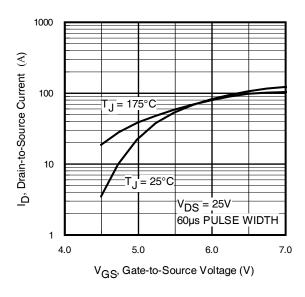


Fig. 3 Typical Transfer Characteristics

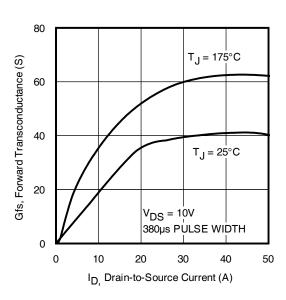


Fig. 4 Typical Forward Transconductance vs. Drain Current



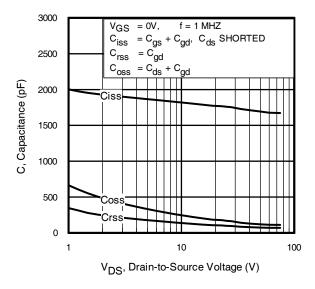


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

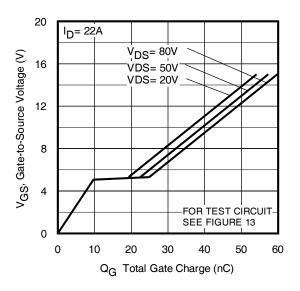


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

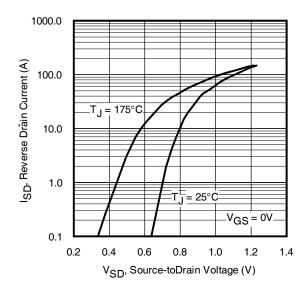


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

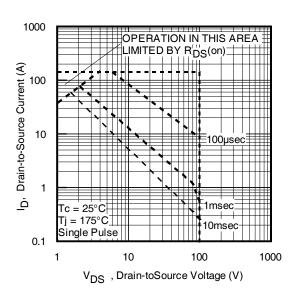
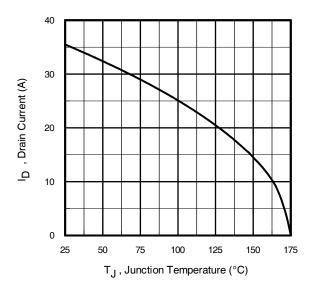


Fig 8. Maximum Safe Operating Area

4





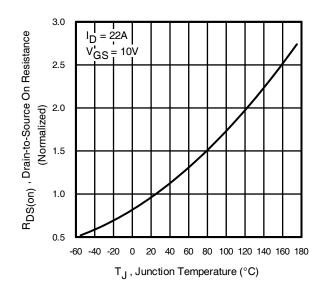


Fig 9. Maximum Drain Current vs. Case Temperature

Fig 10. Normalized On-Resistance vs. Temperature

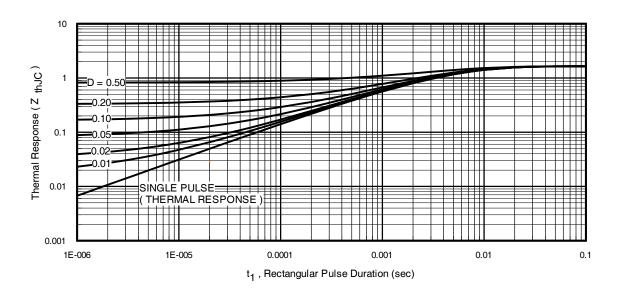


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case



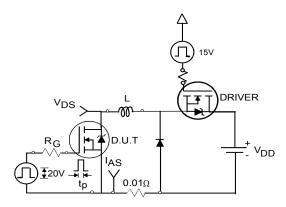


Fig 12a. Unclamped Inductive Test Circuit

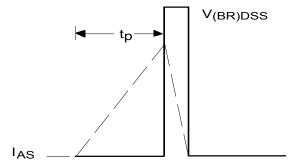


Fig 12b. Unclamped Inductive Waveforms

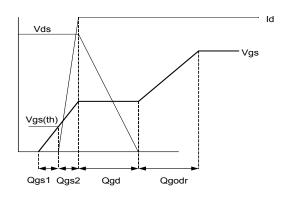


Fig 13a. Gate Charge Waveform

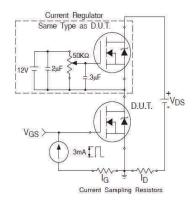


Fig 13b. Gate Charge Test Circuit

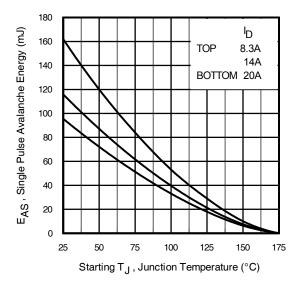


Fig 12c. Maximum Avalanche Energy vs. Drain Current

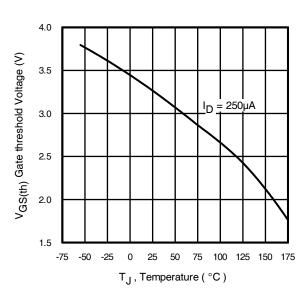


Fig 14. Threshold Voltage vs. Temperature



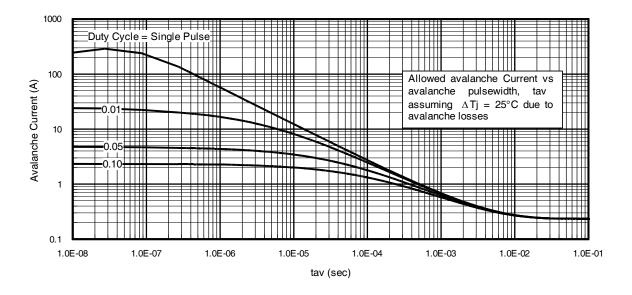


Fig 15. Typical Avalanche Current vs. Pulse width

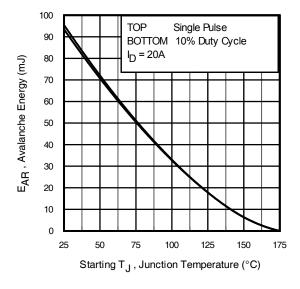


Fig 16. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16: (For further info, see AN-1005 at www.infineon.com)

- Avalanche failures assumption:

 Purely a thormal phonomenon and failure
 - 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. PD (ave) = Average power dissipation per single avalanche pulse.
- 5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
- 6. lav = Allowable avalanche current.
- ΔT = 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 = tav ·f

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

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



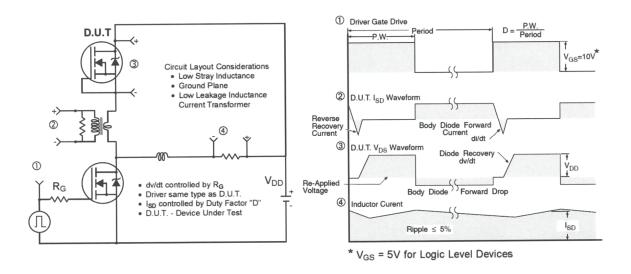


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

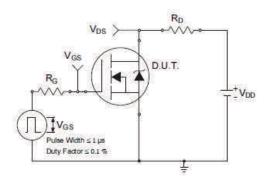


Fig 18a. Switching Time Test Circuit

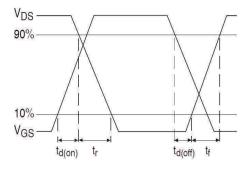
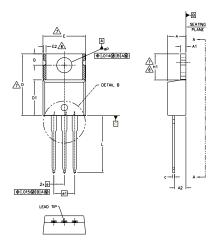
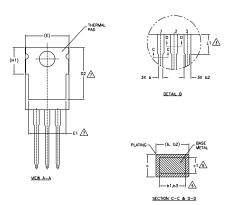


Fig 18b. Switching Time Waveforms



TO-220AB Package Outline (Dimensions are shown in millimeters (inches))





NOTES:

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

- DIMENSIONING AND TOLERANGING AS PER ASME 114.5 M = 1994.

 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].

 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.

 DIMENSION D, D1 & 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.

DIMENSION 61, 63 & c1 APPLY TO BASE METAL ONLY.

- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	MILLIM	ETERS	INC	HES	
	MIN.	MAX.	MIN.	MAX.	NOTES
Α	3.56	4.83	.140	.190	
A1	1.14	1.40	.045	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1,14	1.78	.045	.070	
b3	1,14	1.73	.045	.068	5
С	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
e	2.54 5.08	BSC	.100 .200	BSC	
e1	5.08	BSC	.200	BSC	
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
ØΡ	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

LEAD ASSIGNMENTS

HEXFET

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

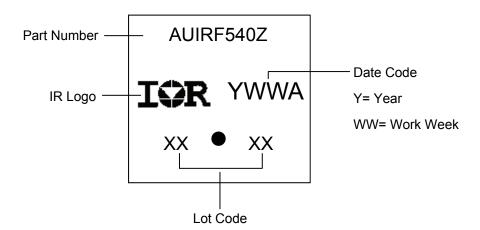
IGBTs, CoPACK

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

DIODES

- 1.- ANODE 2.- CATHODE 3.- ANODE

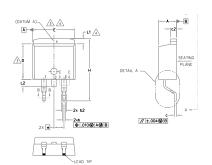
TO-220AB Part Marking Information

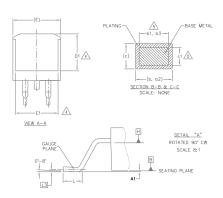


TO-220AB package is not recommended for Surface Mount Application.



D²Pak (TO-263AB) Package Outline (Dimensions are shown in millimeters (inches))





- 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.

4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.

5. DIMENSION 61, 63 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.

S	DIMENSIONS					
M B	MILLIM	MILLIMETERS INCHES				
0 L	MIN.	MAX.	MIN.	MAX.	O T E S	
А	4.06	4.83	.160	.190		
A1	0.00	0.254	.000	.010		
Ь	0.51	0.99	.020	.039		
ь1	0.51	0.89	.020	.035	5	
b2	1.14	1.78	.045	.070		
ь3	1.14	1.73	.045	.068	5	
С	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	
е	2.54	BSC	.100	BSC		
Н	14.61	15.88	.575	.625		
L	1.78	2.79	.070	.110		
L1	_	1.68	_	.066	4	
L2	_	1.78	_	.070		
L3	0.25	BSC	.010	BSC		

LEAD ASSIGNMENTS

DIODES

1.- ANODE (TWO DIE) / OPEN (ONE DIE)
2, 4.- CATHODE
3.- ANODE

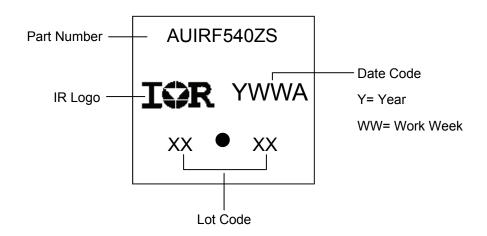
HEXFET

IGBTs, CoPACK

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

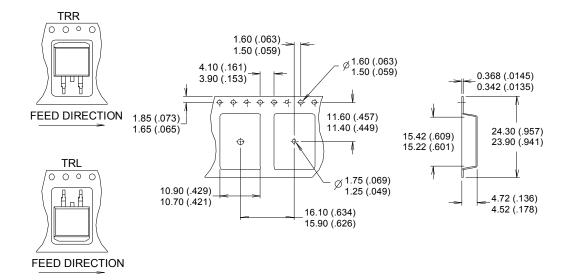
2, 4.- COLLECTOR 3.- EMITTER

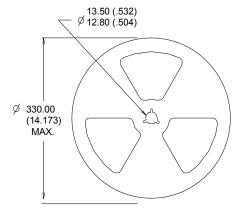
D²Pak (TO-263AB) Part Marking Information





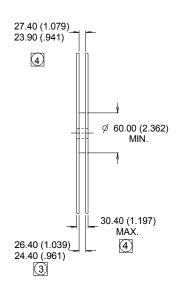
D²Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))







- COMFORMS TO EIA-418.
- CONTROLLING DIMENSION: MILLIMETER.
- 3
- DIMENSION MEASURED @ HUB.
 INCLUDES FLANGE DISTORTION @ OUTER EDGE.





Qualification Information

		Automotive					
		(per AEC-Q101)					
Qualification Level Comments: This part number(s) passed Automotive qualification level is granted by extendation level.							
Moisture Sensitivity Level		TO-220AB	N/A				
		D ² -Pak	MSL1				
	Machine Model	Class M4 (400V) [†]					
	Machine Model	AEC-Q101-002					
50 0	Liver on Dady Madel	Class H1B (1000V) [†]					
ESD	Human Body Model		AEC-Q101-001				
Charged Device Model		Class C3 (750V) [†]					
		AEC-Q101-005					
RoHS Compliant Yes			Yes				

[†] Highest passing voltage.

Revision History

Date	Comments			
9/30/2015	 Updated datasheet with corporate template Corrected ordering table on page 1. 			
09/22/2017	Corrected typo error on part marking on pages 9,10.			

Published by Infineon Technologies AG 81726 München, Germany © Infineon Technologies AG 2015 All Rights Reserved.

IMPORTANT NOTICE

The information given in this document shall in <u>no event</u> be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may <u>not</u> be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET category:

Click to view products by Infineon manufacturer:

Other Similar products are found below:

614233C 648584F IRFD120 JANTX2N5237 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E GROUP A 5962-8877003PA NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE222 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE6400A NTE2910 NTE2916 NTE2956 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B DMN1006UCA6-7