

General Description

- Bottom Source Technology
- Very Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

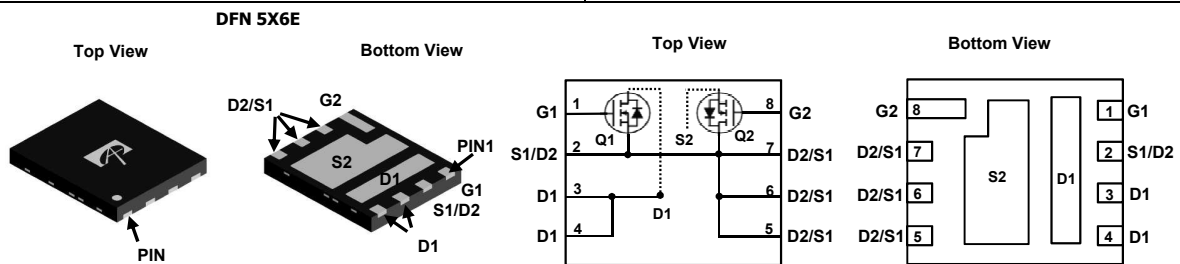
Applications

- DC/DC Converters in Computing, Servers, and POL
- Non-Isolated DC/DC Converters in Telecom and Industrial

Product Summary

	Q1	Q2
V_{DS}	30V	30V
I_D (at $V_{GS}=10V$)	22A	85A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 4.3m Ω < 0.83m Ω	
$R_{DS(ON)}$ (at $V_{GS}=4.5V$)	< 7.0m Ω < 1.05m Ω	

100% UIS Tested
100% Rg Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOE6930	DFN 5x6E	Tape & Reel	3000

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Max Q1	Max Q2	Units
Drain-Source Voltage	V_{DS}	30	30	V
Gate-Source Voltage	V_{GS}	± 20	± 12	V
Continuous Drain Current ^G	$T_C=25^\circ\text{C}$	22	85	A
	$T_C=100^\circ\text{C}$	22	85	
Pulsed Drain Current ^C	I_{DM}	88	340	
Continuous Drain Current	$T_A=25^\circ\text{C}$	22 ^G	60	A
	$T_A=70^\circ\text{C}$	19	48	
Avalanche Current ^C	I_{AS}	50	80	A
Avalanche energy $L=0.01\text{mH}$ ^C	E_{AS}	13	32	mJ
V_{DS} Spike	V_{SPIKE}	36	36	V
Power Dissipation ^B	$T_C=25^\circ\text{C}$	24	75	W
	$T_C=100^\circ\text{C}$	9.6	30	
Power Dissipation ^A	$T_A=25^\circ\text{C}$	4.1	5	W
	$T_A=70^\circ\text{C}$	2.6	3.2	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ Q1	Typ Q2	Max Q1	Max Q2	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	23	20	30	25	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A,D}		45	40	60	50	$^\circ\text{C/W}$
Maximum Junction-to-Case (Note)	$R_{\theta JC}$	4	1.25	5.2	1.65	$^\circ\text{C/W}$

Note: Bottom S2, D1.

Q1 Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	ID=250μA, VGS=0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.3	1.7	2.1	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A T _J =125°C		3.5 5.0	4.3 6.2	mΩ
		V _{GS} =4.5V, I _D =20A		5.2	7.0	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		85		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.7	1	V
I _S	Maximum Body-Diode Continuous Current ^G				22	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		1075		pF
C _{oss}	Output Capacitance			480		pF
C _{rss}	Reverse Transfer Capacitance			55		pF
R _g	Gate resistance	f=1MHz	0.2	1.0	2.0	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A		15	25	nC
Q _g (4.5V)	Total Gate Charge			7	15	nC
Q _{gs}	Gate Source Charge			2.5		nC
Q _{gd}	Gate Drain Charge			2.5		nC
Q _{gs}	Gate Source Charge	V _{GS} =4.5V, V _{DS} =15V, I _D =20A		2.5		nC
Q _{gd}	Gate Drain Charge			2.5		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		4.5		ns
t _r	Turn-On Rise Time			4		ns
t _{D(off)}	Turn-Off DelayTime			19		ns
t _f	Turn-Off Fall Time			3		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=500A/μs		12.5		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs		21.5		nC

A. The value of R_{θJA} is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} ≤ 10s and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature T_{J(MAX)}=150° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

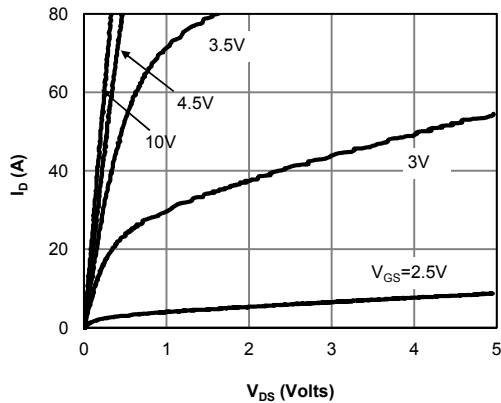


Figure 1: On-Region Characteristics (Note E)

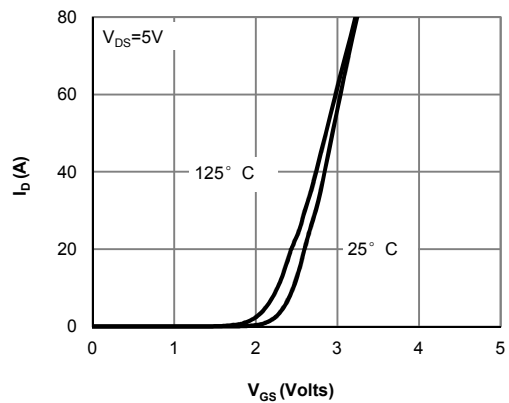


Figure 2: Transfer Characteristics (Note E)

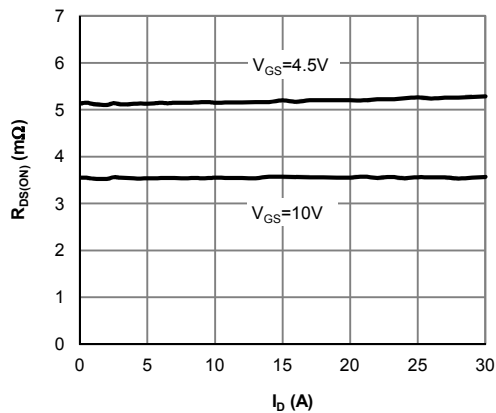


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

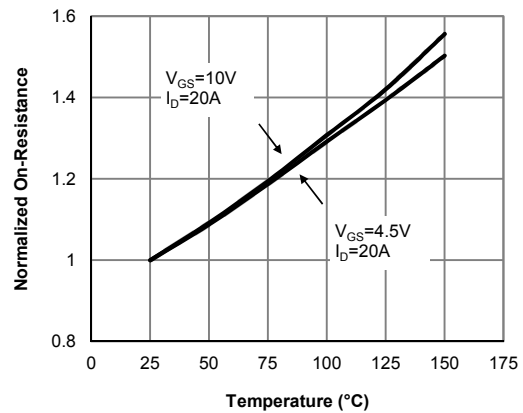


Figure 4: On-Resistance vs. Junction Temperature (Note E)

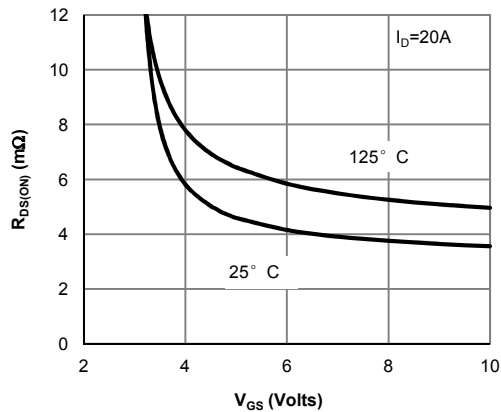


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

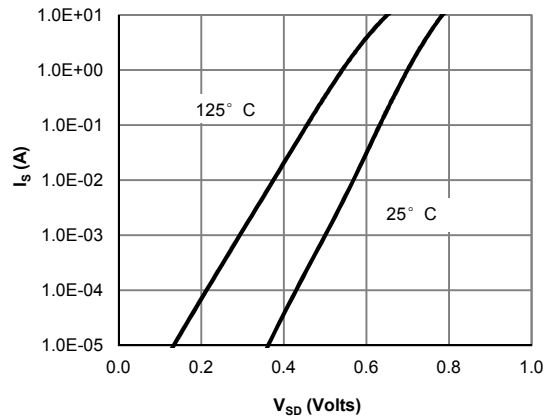
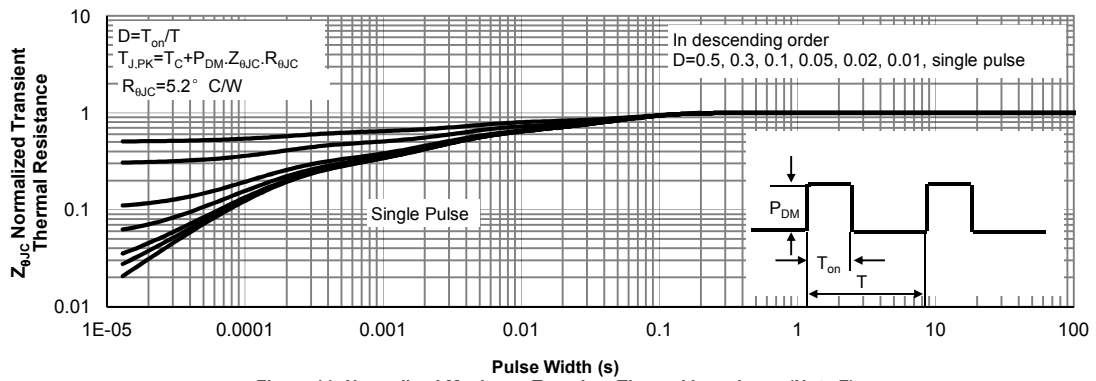
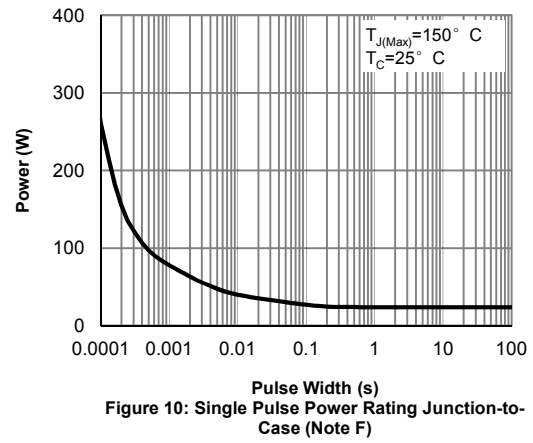
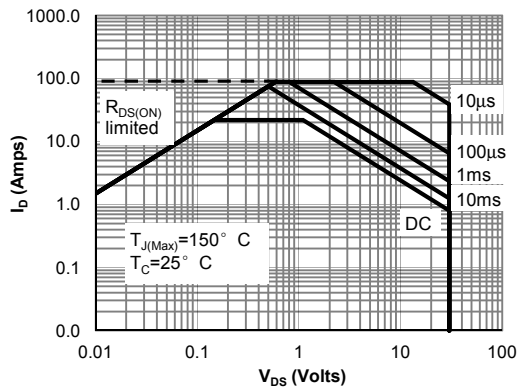
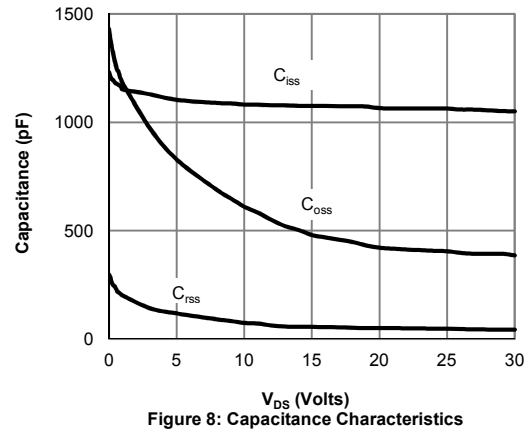
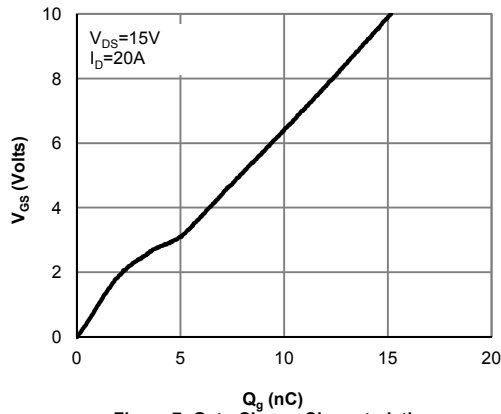
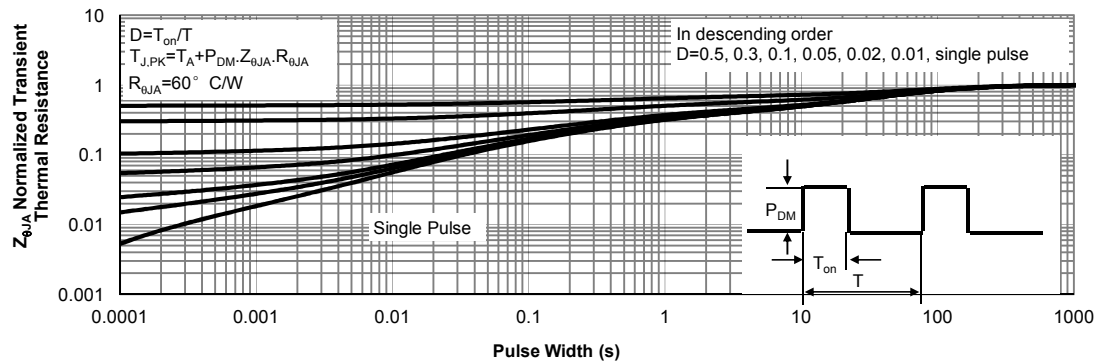
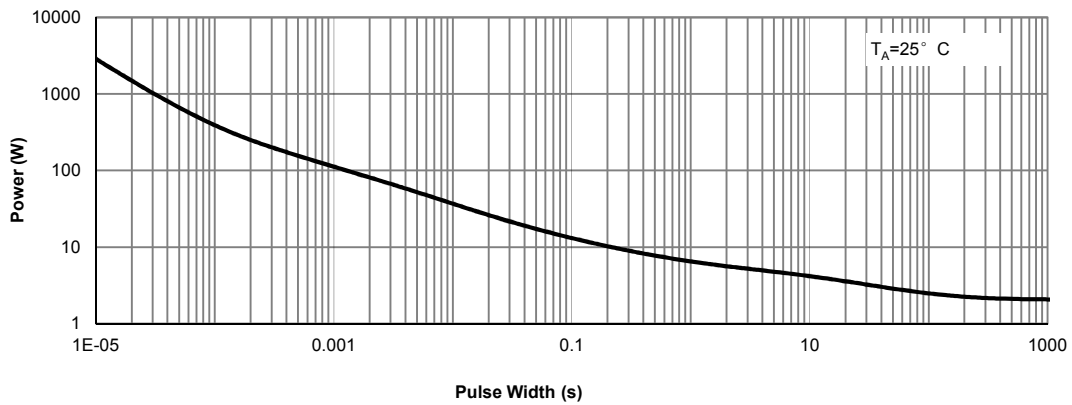
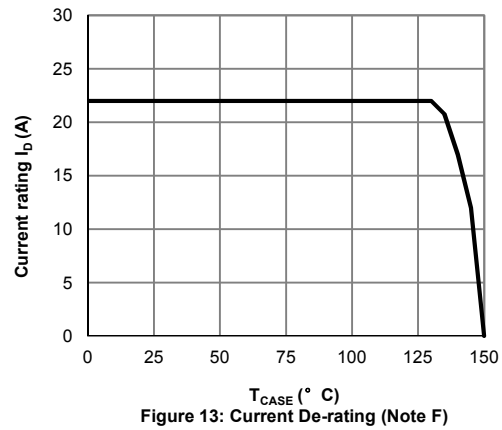
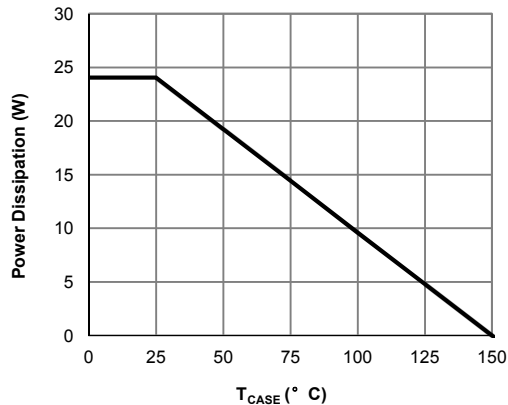


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



Q2 Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	ID=250μA, VGS=0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±12V			±100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.2	1.5	1.9	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =30A T _J =125°C		0.65 0.95	0.83 1.2	mΩ
		V _{GS} =4.5V, I _D =30A		0.8	1.05	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		278		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.65	1	V
I _S	Maximum Body-Diode Continuous Current ^G				85	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		5560		pF
C _{oss}	Output Capacitance			1670		pF
C _{rss}	Reverse Transfer Capacitance			200		pF
R _g	Gate resistance	f=1MHz	0.2	1.0	2.0	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A		95	150	nC
Q _g (4.5V)	Total Gate Charge			42	65	nC
Q _{gs}	Gate Source Charge			11.5		nC
Q _{gd}	Gate Drain Charge			12		nC
Q _{gs}	Gate Source Charge	V _{GS} =4.5V, V _{DS} =15V, I _D =20A		11.5		nC
Q _{gd}	Gate Drain Charge			12		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		12.5		ns
t _r	Turn-On Rise Time			27		ns
t _{D(off)}	Turn-Off DelayTime			66.5		ns
t _f	Turn-Off Fall Time			13		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=500A/μs		23		ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs		72.5		nC

A. The value of R_{θJA} is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C. The Power dissipation P_{DSM} is based on R_{θJA} ≤ 10s and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Single pulse width limited by junction temperature T_{J(MAX)}=150° C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° C.

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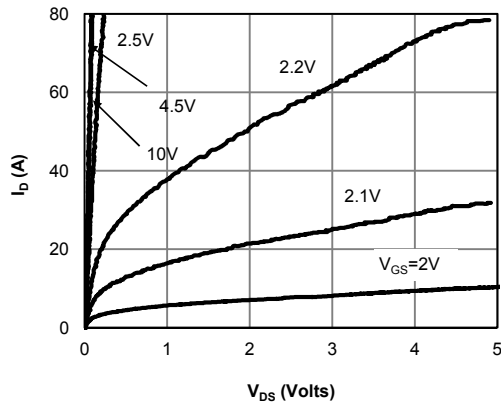


Figure 1: On-Region Characteristics (Note E)

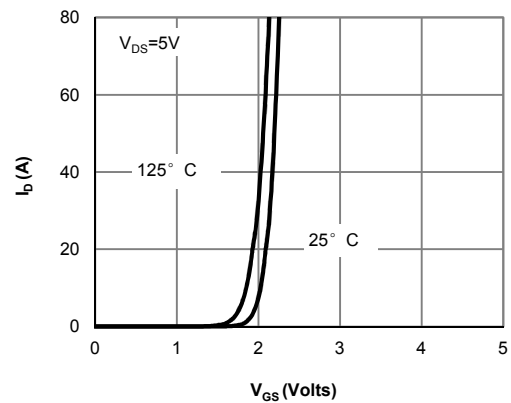


Figure 2: Transfer Characteristics (Note E)

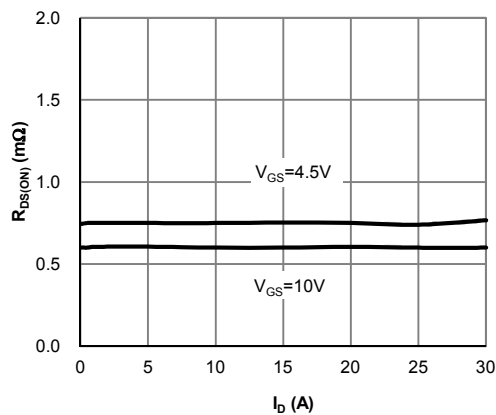


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

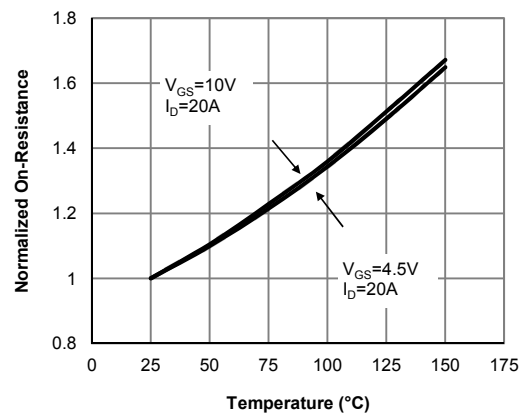


Figure 4: On-Resistance vs. Junction Temperature (Note E)

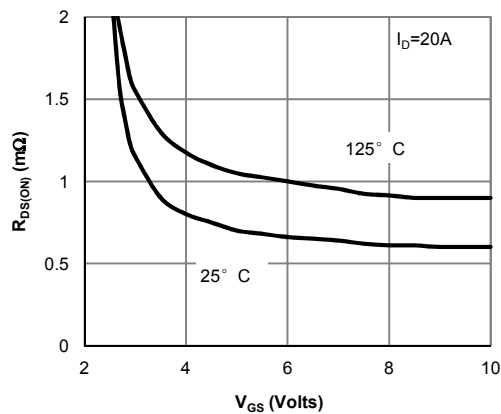


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

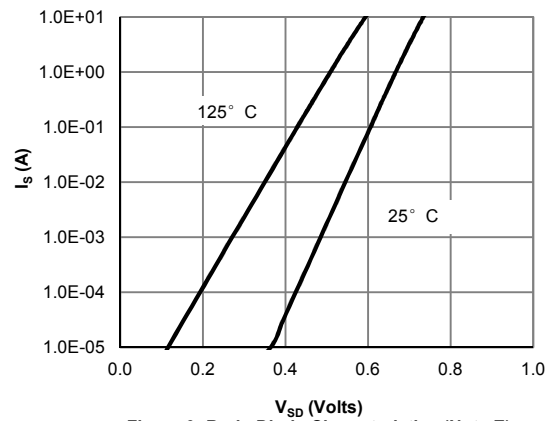


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

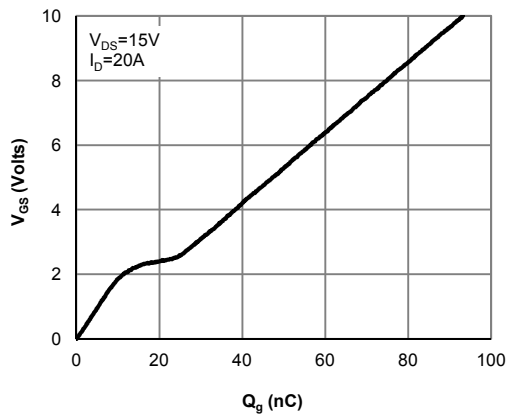


Figure 7: Gate-Charge Characteristics

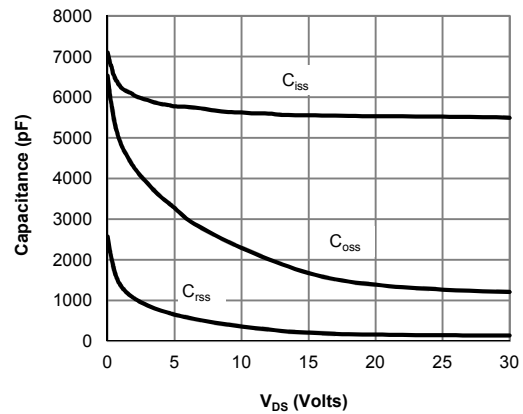


Figure 8: Capacitance Characteristics

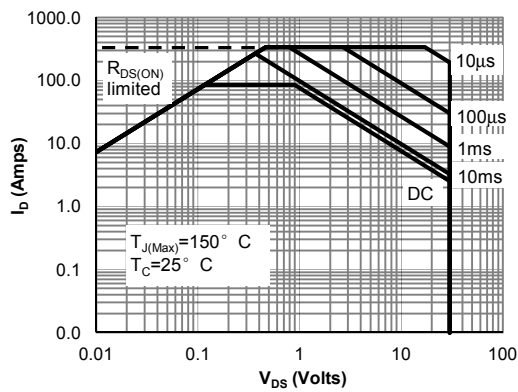


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

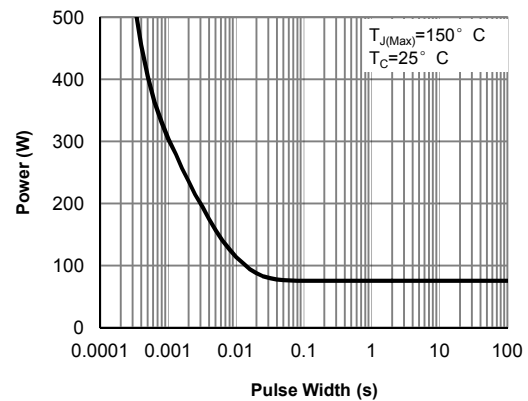


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

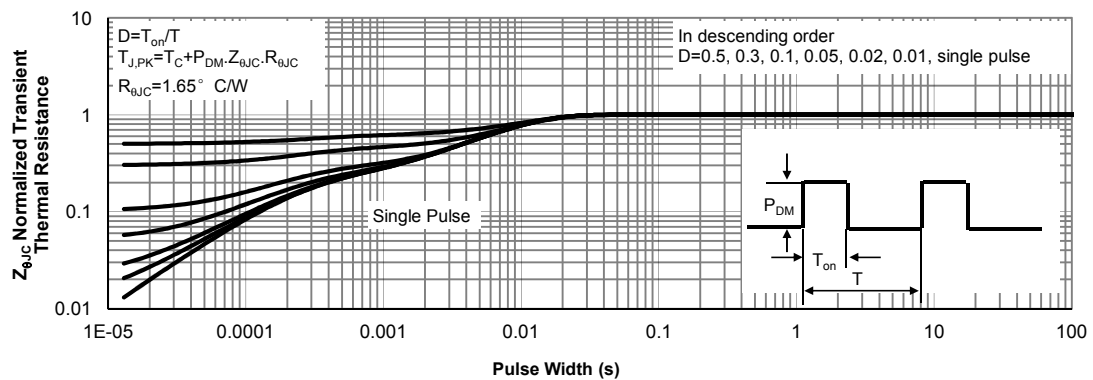


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

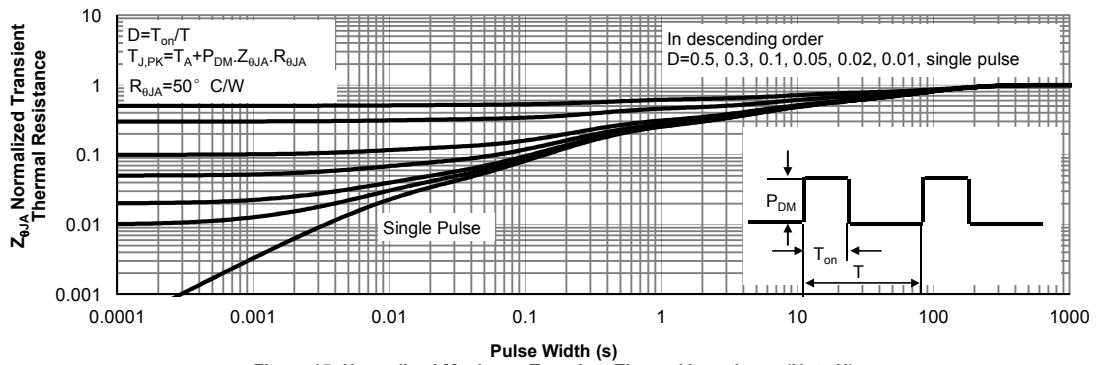
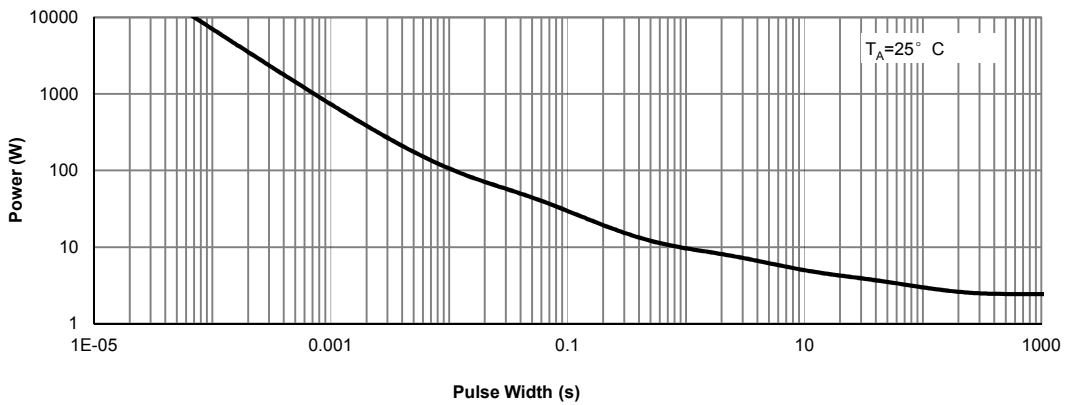
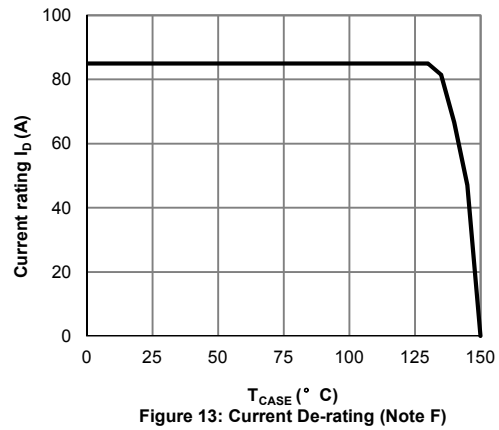
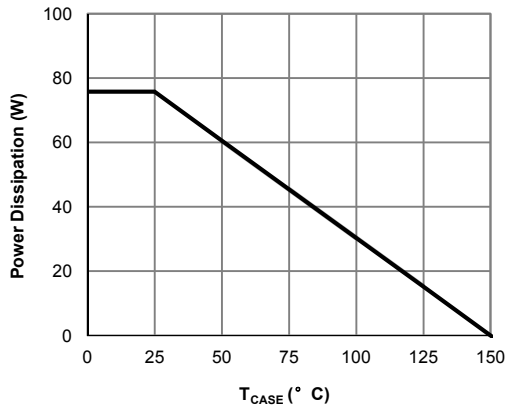


Figure A: Gate Charge Test Circuit & Waveforms

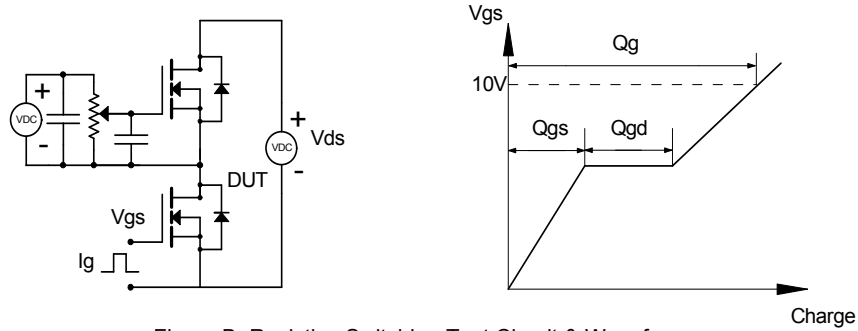


Figure B: Resistive Switching Test Circuit & Waveforms

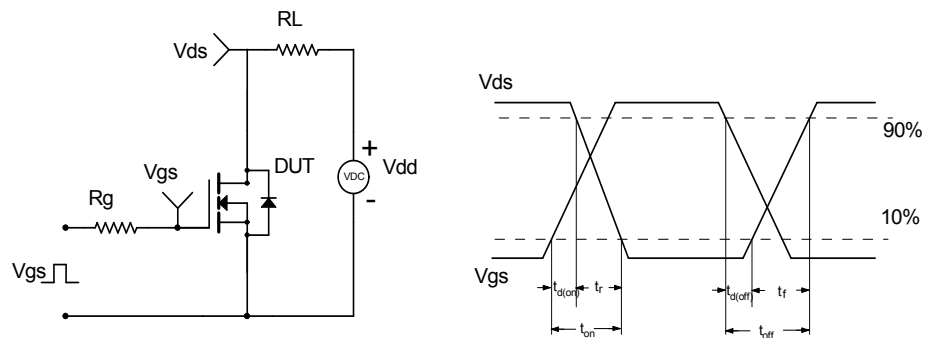


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

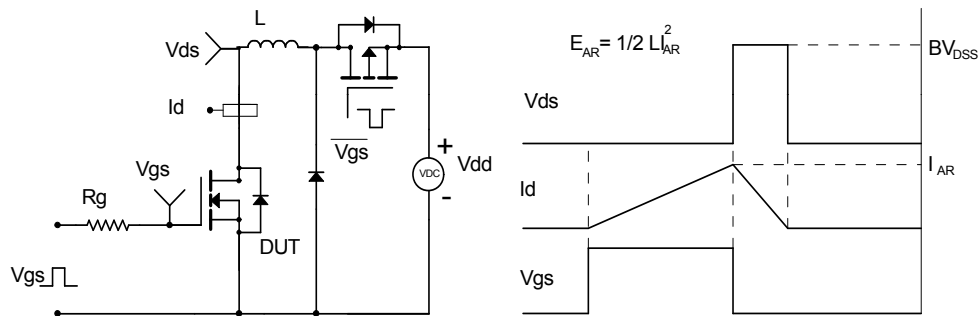
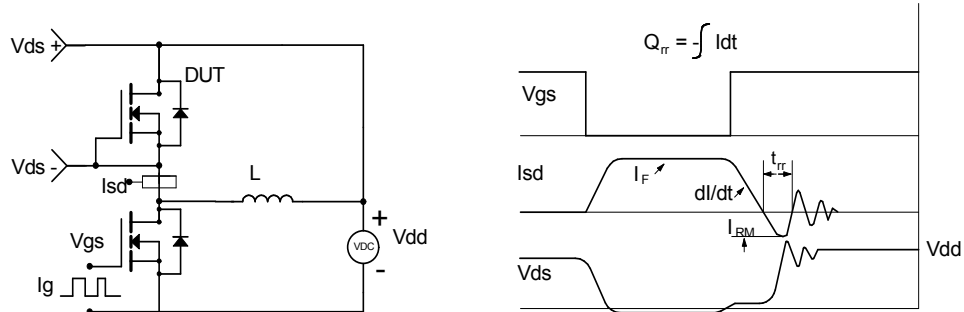


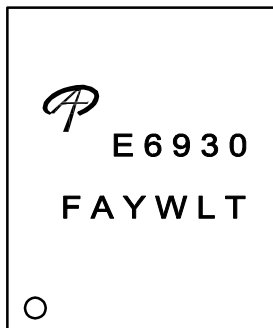
Figure D: Diode Recovery Test Circuit & Waveforms





Document No.	PD-02322
Version	A
Title	AOE6930 Marking Description

DFN5X6 PACKAGE MARKING DESCRIPTION



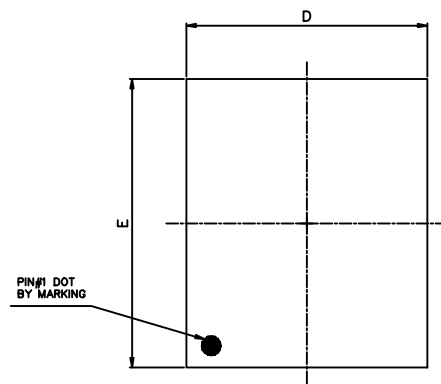
Green product

NOTE:
LOGO - AOS Logo
E6930 - Part number code
F - Fab code
A - Assembly location code
Y - Year code
W - Week code
L&T - Assembly lot code

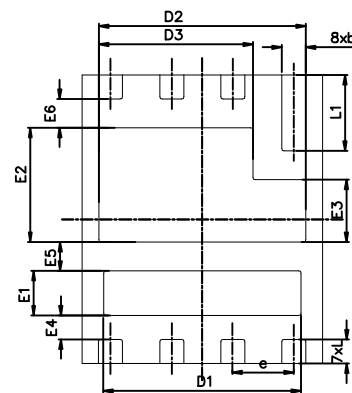
PART NO.	DESCRIPTION	CODE
AOE6930	Green product	E6930



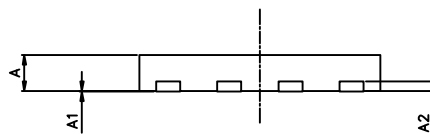
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TOP VIEW

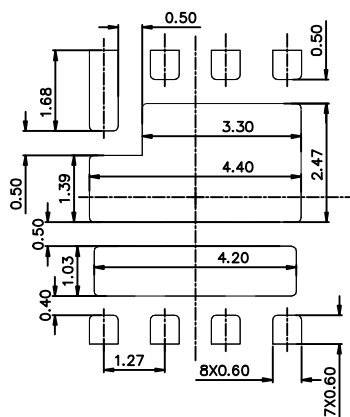


BOTTOM VIEW



SIDE VIEW

RECOMMENDED LAND PATTERN



UNIT: mm

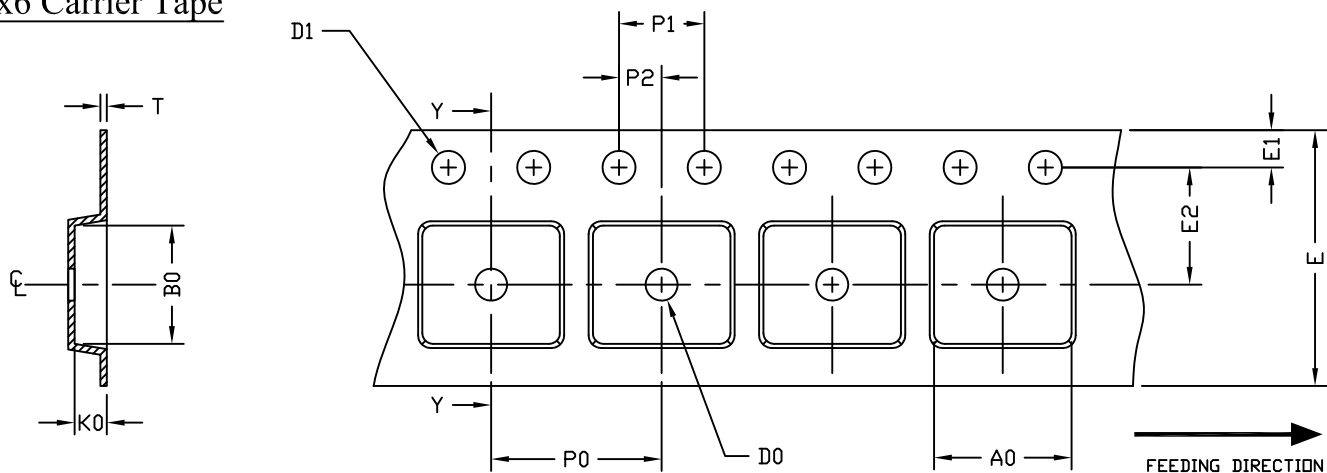
SYMBOL	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.700	0.750	0.850	0.028	0.030	0.034
A1	0.000	0.020	0.050	0.000	0.001	0.002
A2	0.150	0.200	0.250	0.006	0.008	0.010
D	4.900	5.000	5.100	0.193	0.197	0.201
E	5.900	6.000	6.100	0.232	0.236	0.240
D1	4.000	4.100	4.200	0.157	0.161	0.165
D2	4.200	4.300	4.400	0.165	0.169	0.173
D3	3.105	3.205	3.305	0.122	0.126	0.130
E1	0.830	0.930	1.030	0.033	0.037	0.041
E2	2.270	2.370	2.470	0.089	0.093	0.097
E3	1.195	1.295	1.395	0.047	0.051	0.055
E4	0.400	0.500	0.600	0.016	0.020	0.024
E5	0.500	0.600	0.700	0.020	0.024	0.028
E6	0.500	0.600	0.700	0.020	0.024	0.028
L	0.4	0.5	0.6	0.016	0.020	0.024
L1	1.475	1.575	1.675	0.058	0.062	0.066
e	1.27BSC			0.05BSC		
b	0.4	0.5	0.6	0.016	0.020	0.024

Note:

- 1. CONTROLLING DIMENSION IS MILLIMETER.
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.**



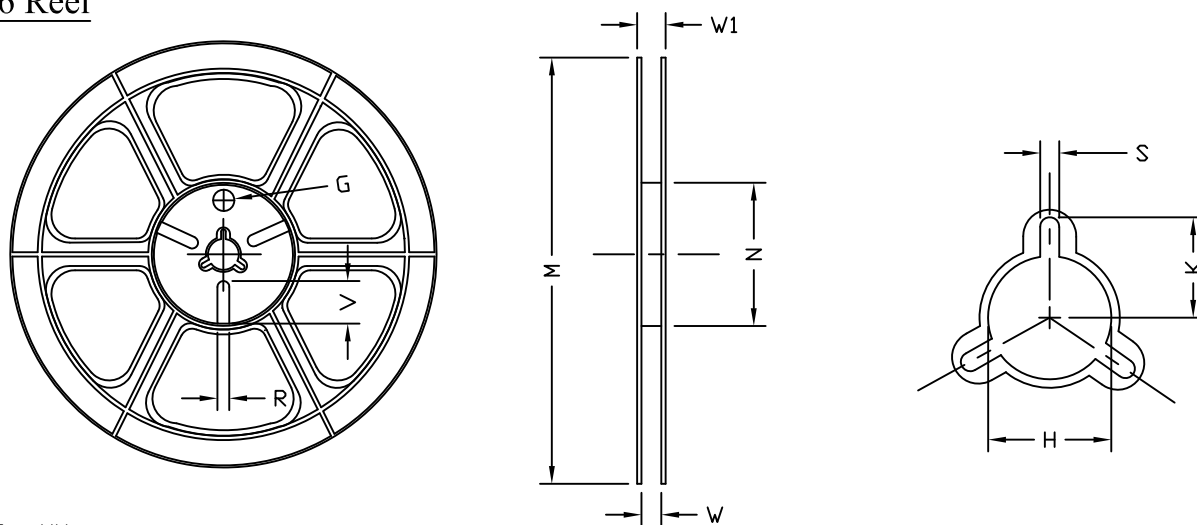
DFN5x6 Carrier Tape



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DFN5x6 (12 mm)	6.30 ±0.10	5.45 ±0.10	1.30 ±0.10	1.50 MIN.	1.55 ±0.05	12.00 ±0.30	1.75 ±0.10	5.50 ±0.10	8.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.05

DFN5x6 Reel



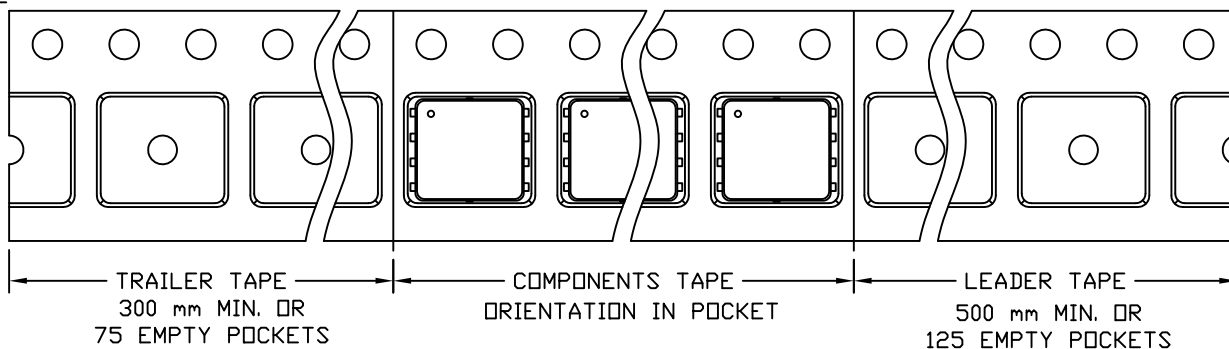
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
12 mm	ø330	ø330.00 ±0.50	ø97.00 ±0.10	13.00 ±0.30	17.40 ±1.00	ø13.00 +0.50 -0.20	10.60	2.00 ±0.50	---	---	---

DFN5x6 Tape

Leader / Trailer
& Orientation

Unit Per Reel:
3000pcs





AOS Semiconductor Product Reliability Report

AOE6930, rev A

Plastic Encapsulated Device

ALPHA & OMEGA Semiconductor, Inc

www.aosmd.com

This AOS product reliability report summarizes the qualification result for AOE6930. Accelerated environmental tests are performed on a specific sample size, and then followed by electrical test at end point. Review of final electrical test result confirms that AOE6930 passes AOS quality and reliability requirements. The released product will be categorized by the process family and be routine monitored for continuously improving the product quality.

I. Reliability Stress Test Summary and Results

Test Item	Test Condition	Time Point	Total Sample Size	Number of Failures	Reference Standard
HTGB	Temp = 150°C , Vgs=100% of Vgsmax	168 / 500 / 1000 hours	385 pcs	0	JESD22-A108
HTRB	Temp = 150°C , Vds=100% of Vdsmax	168 / 500 / 1000 hours	385 pcs	0	JESD22-A108
Precondition (Note A)	168hr 85°C / 85%RH + 3 cycle reflow@260°C	-	924 pcs	0	JESD22-A113
HAST	130°C , 85%RH, 33.3 psia, Vds = 80% of Vdsmax	96 hours	231 pcs	0	JESD22-A110
Autoclave	121°C , 100%RH 29.7psia	96 hours	231 pcs	0	JESD22-A102
Temperature Cycle	-65°C to 150°C , air to air,	1000 cycles	231 pcs	0	JESD22-A104
HTSL	Temp = 150°C	1000 hours	231 pcs	0	JESD22-A103

Note: The reliability data presents total of available generic data up to the published date.

Note A: MSL (Moisture Sensitivity Level) 1 based on J-STD-020

II. Reliability Evaluation

FIT rate (per billion): 5.72

MTTF = 19946 years

The presentation of FIT rate for the individual product reliability is restricted by the actual burn-in sample size. Failure Rate Determination is based on JEDEC Standard JESD 85. FIT means one failure per billion hours.

Failure Rate = $\text{Chi}^2 \times 10^9 / [2 (N) (H) (Af)] = 5.72$

MTTF = $10^9 / \text{FIT} = 19946$ years

Chi² = Chi Squared Distribution, determined by the number of failures and confidence interval

N = Total Number of units from burn-in tests

H = Duration of burn-in testing

Af = Acceleration Factor from Test to Use Conditions (Ea = 0.7eV and Tuse = 55°C)

Acceleration Factor **[Af]** = $\text{Exp} [Ea / k (1/Tj u - 1/Tj s)]$

Acceleration Factor ratio list:

	55 deg C	70 deg C	85 deg C	100 deg C	115 deg C	130 deg C	150 deg C
Af	259	87	32	13	5.64	2.59	1

Tj s = Stressed junction temperature in degree (Kelvin), K = C+273.16

Tj u = The use junction temperature in degree (Kelvin), K = C+273.16

k = Boltzmann's constant, 8.617164 X 10⁻⁵eV / K