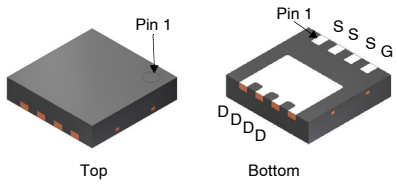
MOSFET – N-Channel, Shielded Gate POWERTRENCH®

60 V, 84 A, 4.3 mΩ

FDMC86570L



WDFN8 3.3x3.3, 0.65P
CASE 483AW

General Description

This N−Channel MOSFET is produced using **onsemi's** advanced POWERTRENCH process that incorporates Shielded Gate technology. This process has been optimized for the on−state resistance and yet maintain superior switching performance.

Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 4.3 mΩ at V_{GS} = 10 V, I_D = 18 A
- Max $r_{DS(on)}$ = 6.5 mΩ at V_{GS} = 4.5 V, I_D = 15 A
- High Performance Technology for Extremely Low $r_{DS(on)}$
- These Devices are Pb−Free and are RoHS Compliant

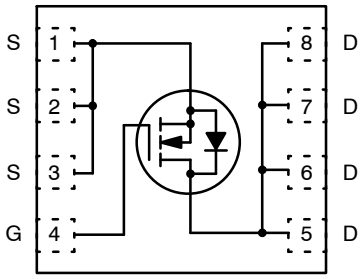
Application

- DC−DC Conversion

MARKING DIAGRAM

Z	= Assembly Plant Code
X	= Year Code
YY	= Week Code
KK	= Lot Code
FDMC	= Specific Device Code
86570L	= Specific Device Code

PIN ASSIGNMENT



N−Channel MOSFET

MOSFET MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current −Continuous T_C = 25°C (Note 5) −Continuous T_C = 100°C (Note 5) −Continuous T_A = 25°C (Note 1a) −Pulsed (Note 4)	 84 53 18 416	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	253	mJ
P_D	Power Dissipation T_C = 25°C	54	W
	Power Dissipation T_A = 25°C (Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	−55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	2.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a)	53	°C/W

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

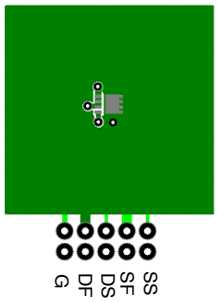
ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	60			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C		30		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	1.0	1.8	3.0	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C		−7		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 18 A		3.1	4.3	mΩ
		V_{GS} = 4.5 V, I_D = 15 A		4.7	6.5	
		V_{GS} = 10 V, I_D = 18 A, T_J = 125°C		5.0	6.9	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 18 A		75		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz		4790	6705	pF
C_{oss}	Output Capacitance			821	1150	pF
C_{rss}	Reverse Transfer Capacitance			19	30	pF
R_g	Gate Resistance		0.1	0.9	2.7	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 30 V, I_D = 18 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		19	34	ns
t_r	Rise Time			6.2	12	ns
$t_{d(off)}$	Turn−Off Delay Time			38	61	ns
t_f	Fall Time			3.9	10	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 10 V; V_{DD} = 30 V, I_D = 18 A		63	88	nC
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 4.5 V; V_{DD} = 30 V, I_D = 18 A		29	41	nC
Q_{gs}	Gate to Source Charge	V_{DD} = 30 V, I_D = 18 A		14		nC
Q_{gd}	Gate to Drain “Miller” Charge	V_{DD} = 30 V, I_D = 18 A		6.3		nC
DRAIN−SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 18 A (Note 2)		0.8	1.3	V
		V_{GS} = 0 V, I_S = 1.9 A (Note 2)		0.7	1.2	
t_{rr}	Reverse Recovery Time	I_F = 18 A, di/dt = 100 A/μs		43	69	ns
Q_{rr}	Reverse Recovery Charge			26	42	nC

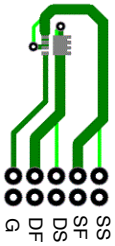
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR−4 material. $R_{\theta CA}$ is determined by the user's board design.



a. 53 °C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 125 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0 %.
3. E_{AS} of 253 mJ is based on starting T_J = 25 °C, L = 3 mH, I_{AS} = 13 A, V_{DD} = 60 V, V_{GS} = 10 V. 100% test at L = 0.1 mH, I_{AS} = 43 A.
4. Pulsed I_D please refer to Figure 11 SOA graph for more details.
5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro−mechanical application board design.

TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

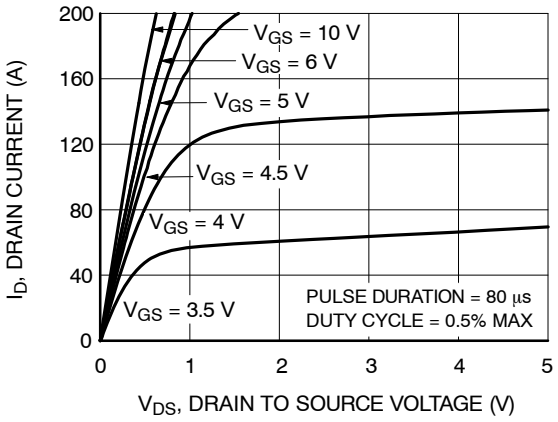


Figure 1. On−Region Characteristics

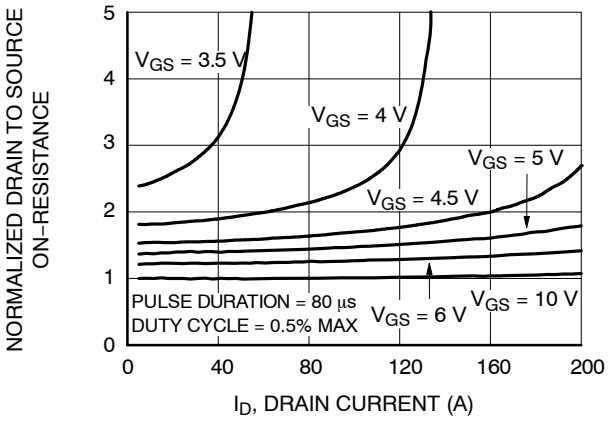


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

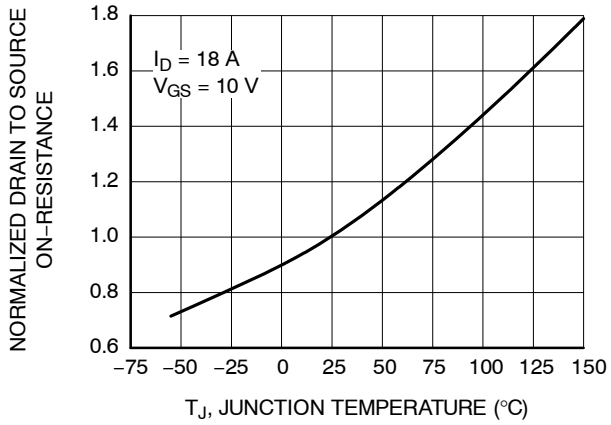


Figure 3. Normalized On−Resistance vs. Junction Temperature

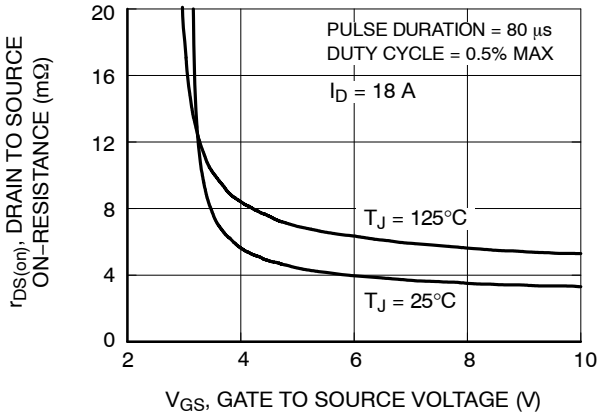


Figure 4. On−Resistance vs. Gate to Source Voltage

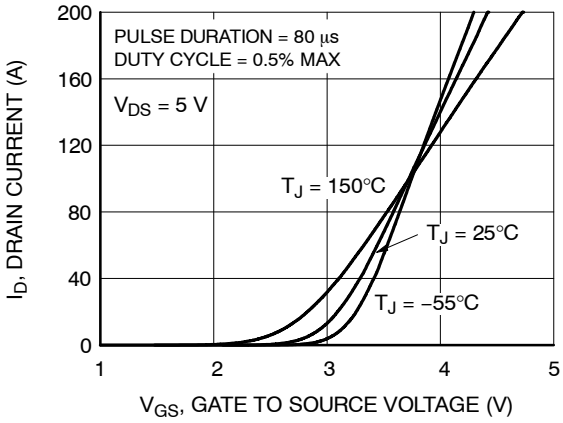


Figure 5. Transfer Characteristics

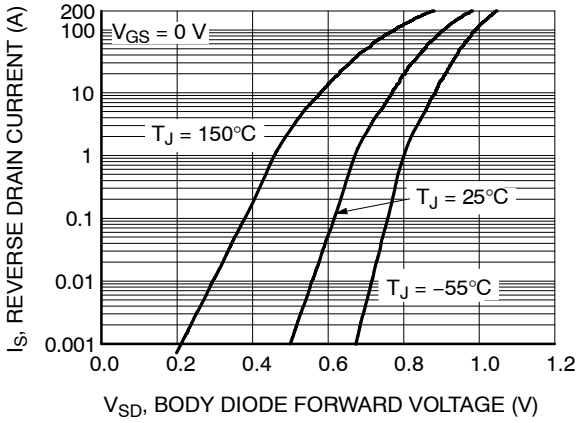


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

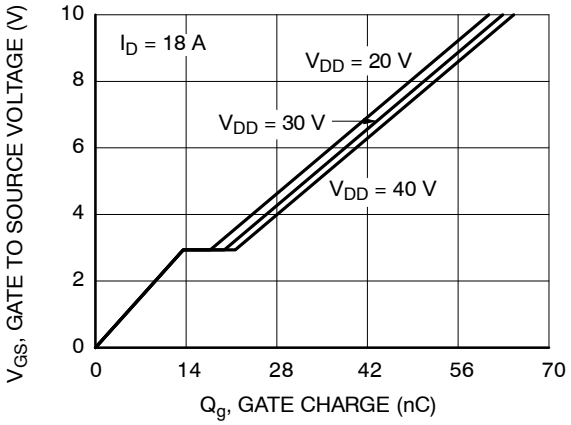


Figure 7. Gate Charge Characteristics

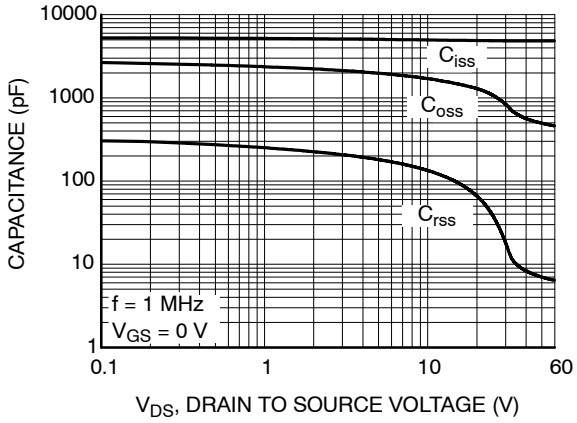


Figure 8. Capacitance vs. Drain to Source Voltage

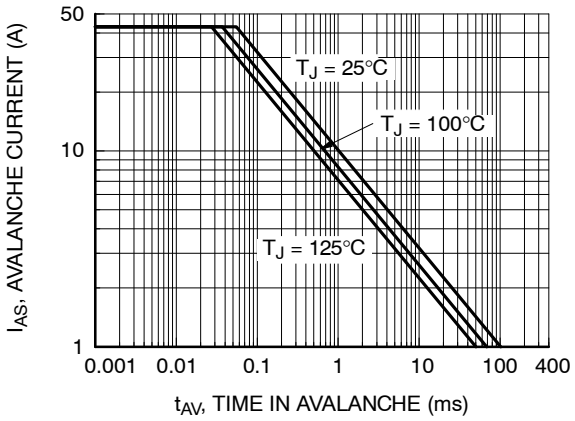


Figure 9. Unclamped Inductive Switching Capability

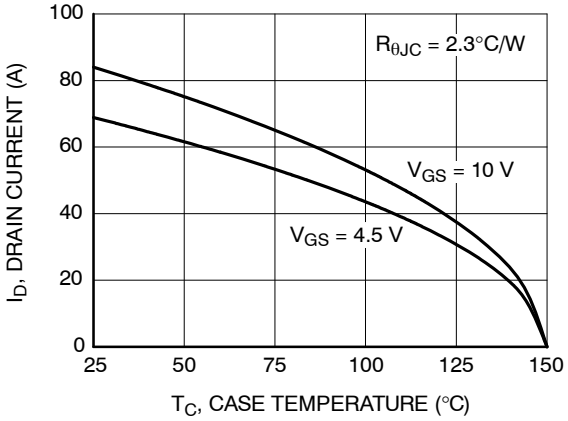


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

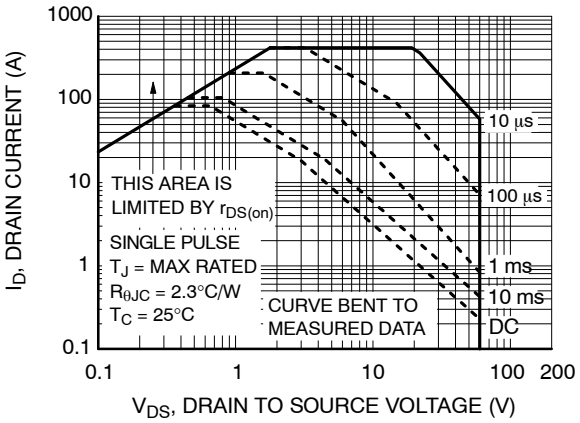


Figure 11. Forward Bias Safe Operating Area

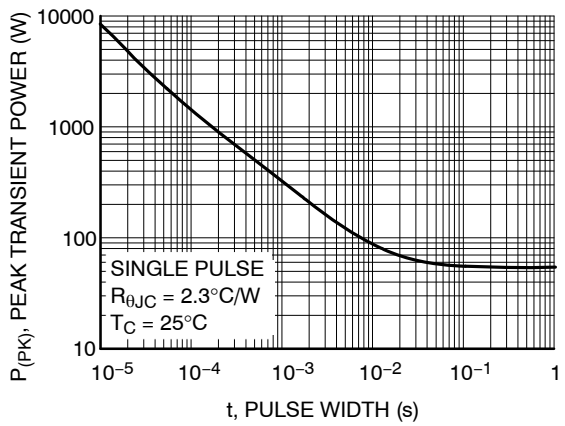


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (continued)

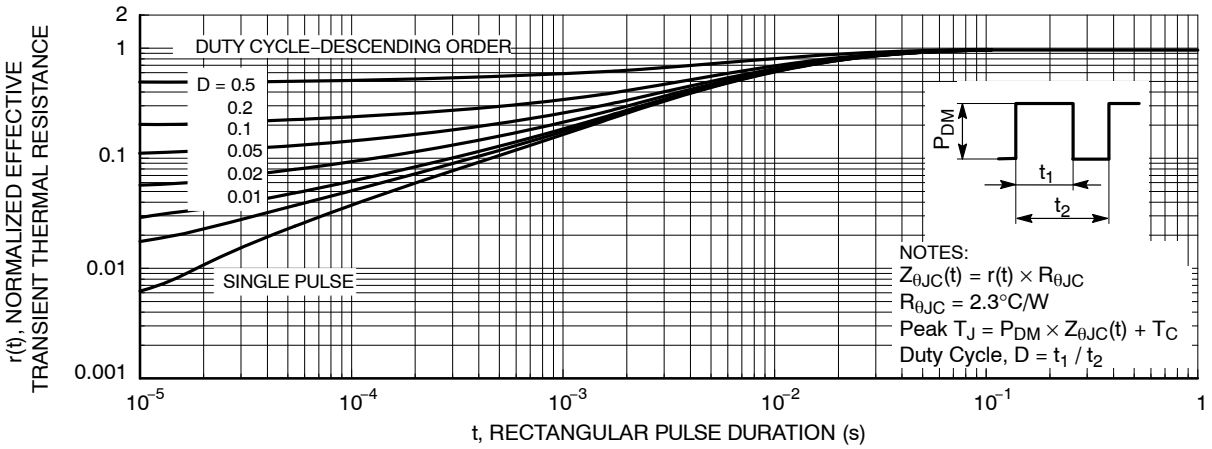
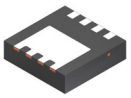


Figure 13. Junction−to−Case Transient Thermal Response Curve

ORDERING INFORMATION

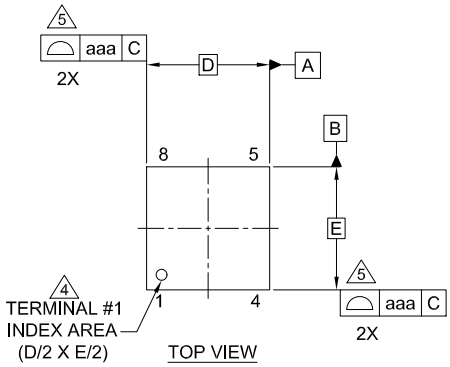
Device	Device Marking	Package Type	Shipping†
FDMC86570L	FDMC86570L	WDFN8 3.3x3.3, 0.65P (Pb−Free)	3000 / Tape & Reel

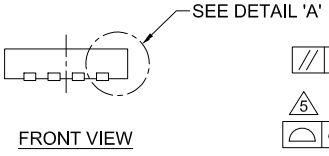
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

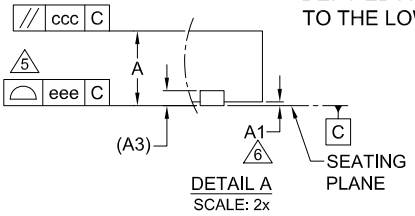


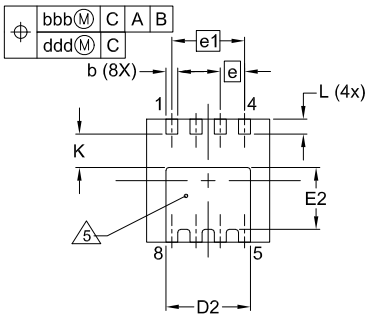
WDFN8 3.30x3.30x0.75, 0.65P
CASE 483AW
ISSUE B

DATE 22 MAR 2024







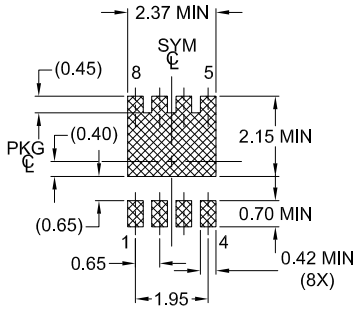


NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEP95 SEC. 3 SPP-12. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD, EMBEDDED METAL OR MARKED FEATURE.
5. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
6. SEATING PLANE IS DEFINED BY THE TERMINALS. 'A1' IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	--	--	0.05
A3		0.20 REF	
b	0.27	0.32	0.37
D		3.30 BSC	
D2	2.17	2.27	2.37
E		3.30 BSC	
E2	1.56	1.66	1.76
e		0.65 BSC	
e1		1.95 BSC	
K	0.90	--	--
L	0.30	0.40	0.50
aaa		0.10	
bbb		0.10	
ccc		0.10	
ddd		0.05	
eee		0.05	

LAND PATTERN RECOMMENDATION



*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*

XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98AON13672G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**WDFN8 3.30x3.30x0.75, 0.65P**	**PAGE 1 OF 1**

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

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