

MOSFET – P-Channel, POWER TRENCH®

-20 V, -75 A, 4.9 mΩ

FDMC6696P

General Description

This P-Channel MOSFET is produced using onsemi's advanced POWER TRENCH process that has been optimized for $R_{DS(on)}$, switching performance and ruggedness.

Features

- Max $R_{DS(on)}$ = 4.9 mΩ at $V_{GS} = -4.5$ V, $I_D = -18$ A
- Max $R_{DS(on)}$ = 16.4 mΩ at $V_{GS} = -1.8$ V, $I_D = -9$ A
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

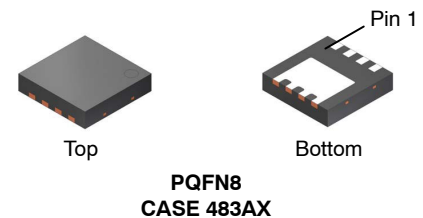
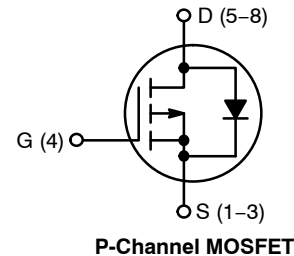
- Load Switch
- Battery Management
- Power Management
- Reverse Polarity Protection

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

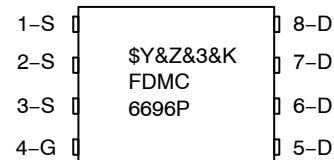
Symbol	Parameter	Value	Unit
V_{DS}	Drain to Source Voltage	-20	V
V_{GS}	Gate to Source Voltage	±12	V
I_D	Drain Current: Continuous, $T_C = 25^\circ\text{C}$ (Note 5) Continuous, $T_C = 100^\circ\text{C}$ (Note 5) Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) Pulsed (Note 4)	-75 -47 -18 -335	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	54	mJ
P_D	Power Dissipation: $T_C = 25^\circ\text{C}$ $T_A = 25^\circ\text{C}$ (Note 1a)	40 2.4	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

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.

V_{DS}	$R_{DS(on)}$ MAX	I_D MAX
-20 V	4.9 mΩ @ -4.5 V	-75 A
	6.5 mΩ @ -2.5 V	
	16.4 mΩ @ -1.8 V	



MARKING DIAGRAM



\$Y = onsemi Logo
 &Z = Assembly Plant Code
 &3 = Data Code (Year & Week)
 &K = Lot
 FDMC6696P = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

FDMC6696P

THERMAL CHARACTERISTICS

Symbol	Parameter	FDMC6696P	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.1	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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OFF CHARACTERISTICS

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	-20			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$, Referenced to 25°C		-15		$\text{mV}/^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\ \text{V}$, $V_{GS} = 0\ \text{V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 12\ \text{V}$, $V_{DS} = 0\ \text{V}$			± 100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\ \mu\text{A}$	-0.4	-0.7	-1.6	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$, referenced to 25°C		4		$\text{mV}/^{\circ}\text{C}$
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\ \text{V}$, $I_D = -18\ \text{A}$		3.3	4.9	$\text{m}\Omega$
		$V_{GS} = -2.5\ \text{V}$, $I_D = -11\ \text{A}$		4.1	6.5	
		$V_{GS} = -1.8\ \text{V}$, $I_D = -9\ \text{A}$		6.2	16.4	
		$V_{GS} = -4.5\ \text{V}$, $I_D = -18\ \text{A}$, $T_J = 125^{\circ}\text{C}$		4.5	6.8	
g_{FS}	Forward Transconductance	$V_{DS} = -5\ \text{V}$, $I_D = -18\ \text{A}$		113		S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = -10\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$		7535	10550	pF
C_{oss}	Output Capacitance			1100	1540	pF
C_{rss}	Reverse Transfer Capacitance			1040	1455	pF
R_g	Gate Resistance		0.1	4.5	10	Ω

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\ \text{V}$, $I_D = -18\ \text{A}$, $V_{GS} = -4.5\ \text{V}$, $R_G = 6\ \Omega$		13	23	ns
t_r	Rise Time			17	31	ns
$t_{d(off)}$	Turn-Off Delay Time			312	499	ns
t_f	Fall Time			176	282	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $-4.5\ \text{V}$, $V_{DD} = -10\ \text{V}$, $I_D = -18\ \text{A}$		78	109	nC
		$V_{GS} = 0\ \text{V}$ to $-2.5\ \text{V}$, $V_{DD} = -10\ \text{V}$, $I_D = -18\ \text{A}$		50	70	nC
Q_{gs}	Gate to Source Charge	$V_{DD} = -10\ \text{V}$, $I_D = -18\ \text{A}$		12		nC
Q_{gd}	Gate to Drain "Miller" Charge	$V_{DD} = -10\ \text{V}$, $I_D = -18\ \text{A}$		24		nC

DRAIN-SOURCE DIODE CHARACTERISTICS

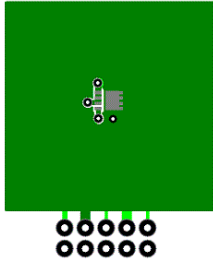
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$, $I_S = -18\ \text{A}$ (Note 2)		-0.7	-1.2	V
		$V_{GS} = 0\ \text{V}$, $I_S = -2\ \text{A}$ (Note 2)		-0.6	-1.2	
t_{rr}	Reverse Recovery Time	$I_S = -18\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$		41	66	ns
Q_{rr}	Reverse Recovery Charge			22	35	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.

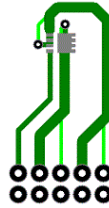
FDMC6696P

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



- a) 53 °C/W when mounted on a 1 in² 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 μ s, Duty cycle < 2.0 %
3. E_{AS} of 54 mJ is based on starting $T_J = 25$ °C, $L = 3$ mH, $I_{AS} = -6$ A, $V_{DD} = -20$ V, $V_{GS} = -10$ V.
4. Pulsed Id please refer to Fig 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.

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC6696P	FDMC6696P	PQFN8 (Pb Free)	13"	12 mm	3000 Units

TYPICAL CHARACTERISTICS

($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

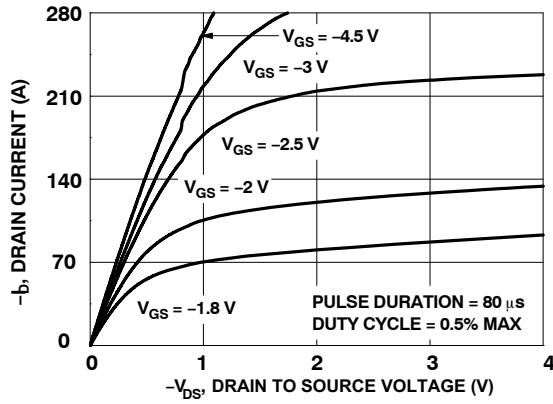


Figure 1. On-Region Characteristics

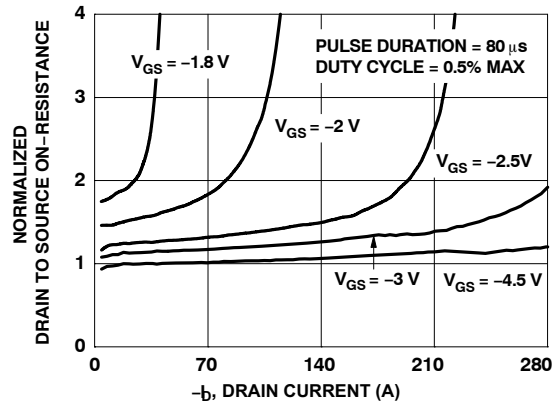


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

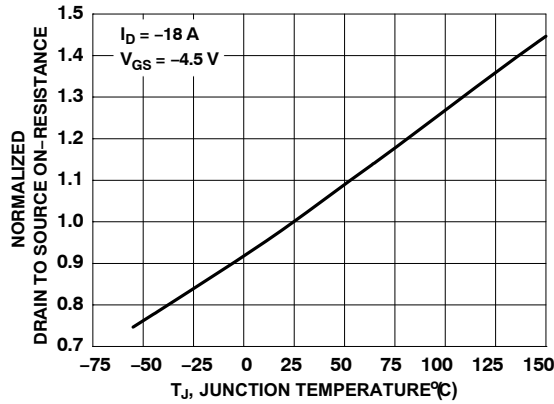


Figure 3. Normalized On-Resistance vs. Junction Temperature

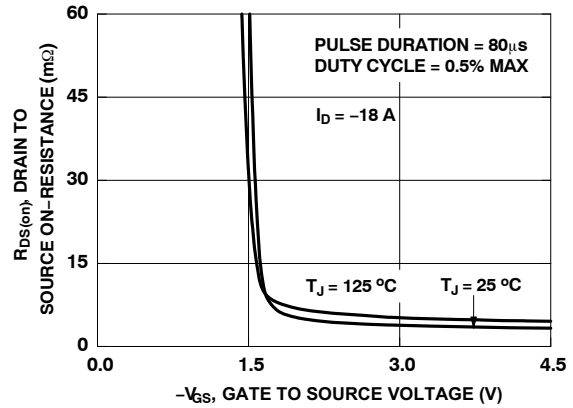


Figure 4. On-Resistance vs. Gate to Source Voltage

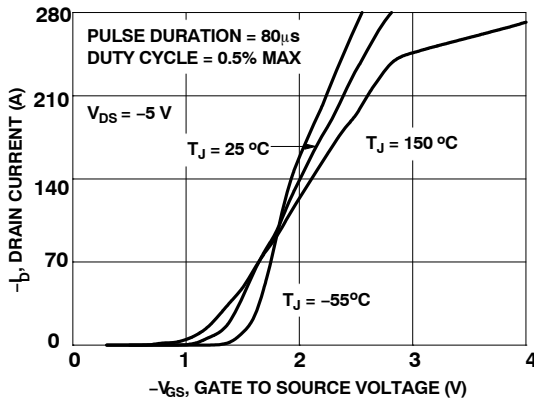


Figure 5. Transfer Characteristics

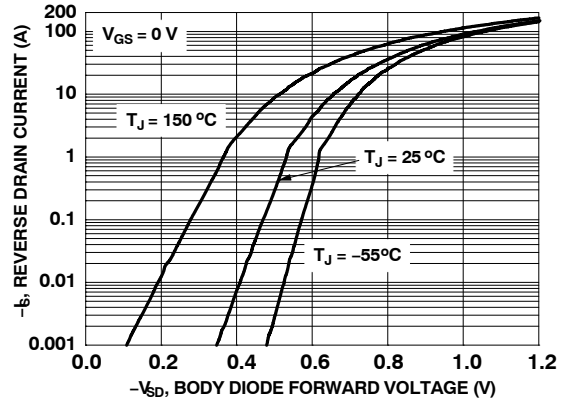


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS

($T_J = 25^\circ\text{C}$ unless otherwise noted)

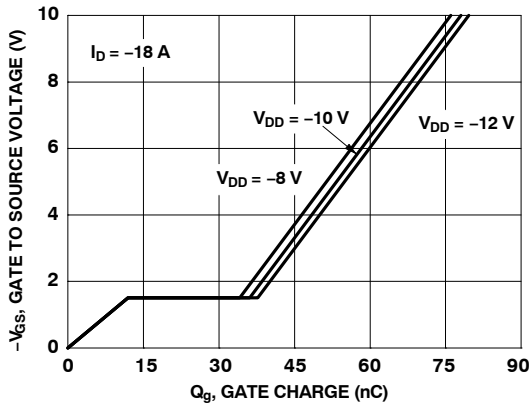


Figure 7. Gate Charge Characteristics

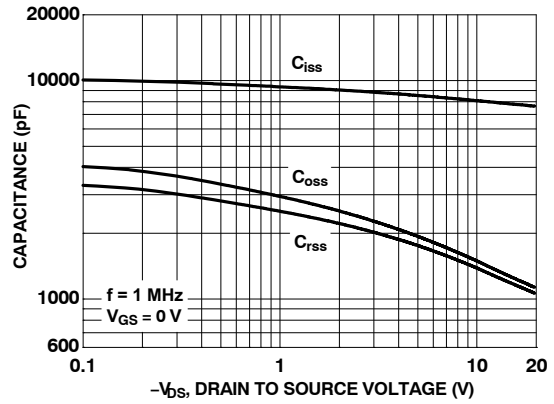


Figure 8. Capacitance vs Drain to Source Voltage

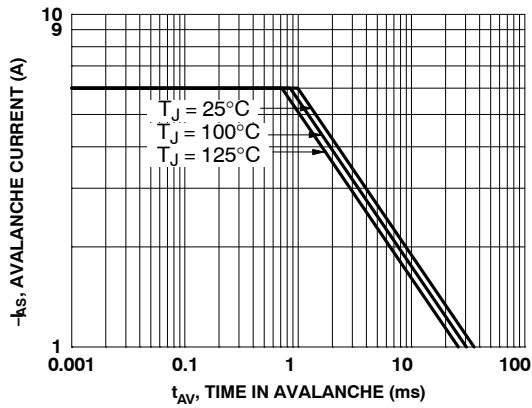


Figure 9. Unclamped Inductive Switching Capability

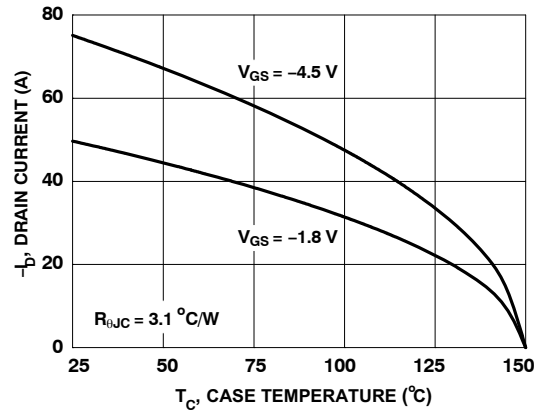


Figure 10. Maximum Continuous Drain Current vs Case Temperature

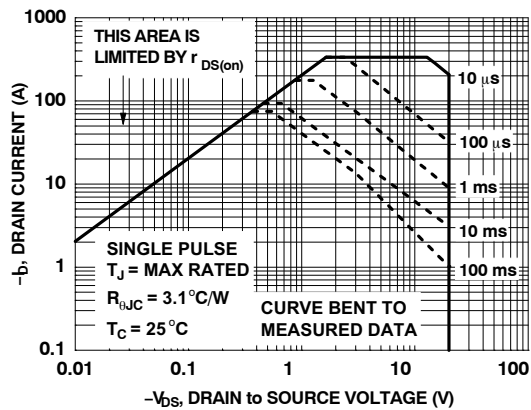


Figure 11. Forward Bias Safe Operating Area

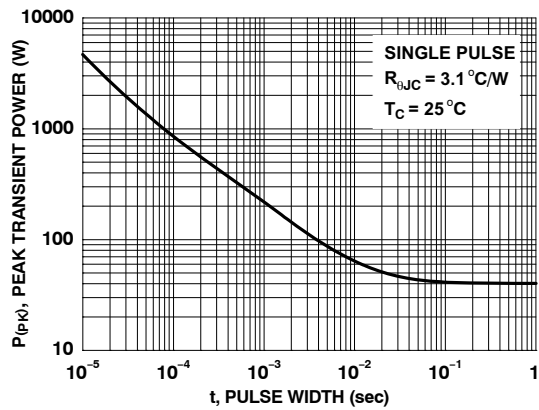
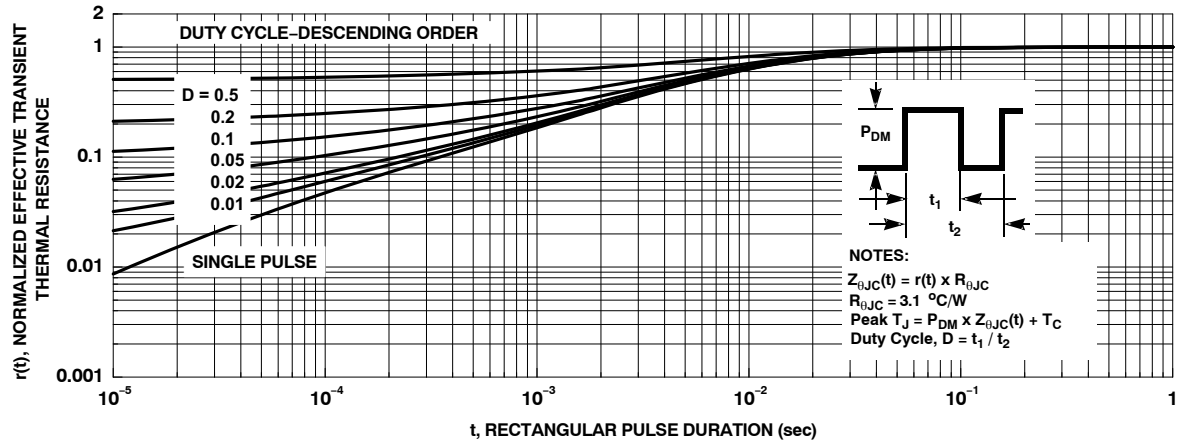


Figure 12. Single Pulse Maximum Power Dissipation

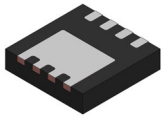
TYPICAL CHARACTERISTICS

(T_J = 25 °C unless otherwise noted)

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®

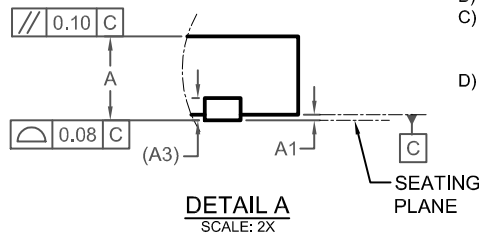
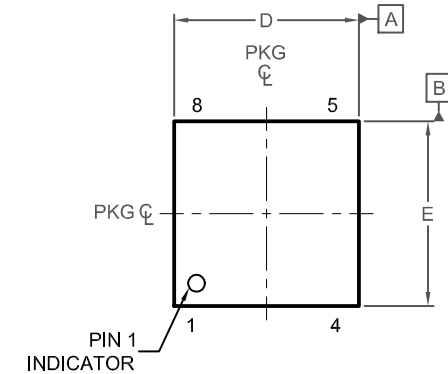


PQFN8 3.3X3.3, 0.65P

CASE 483AX

ISSUE B

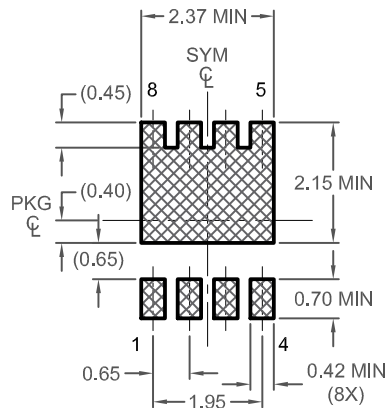
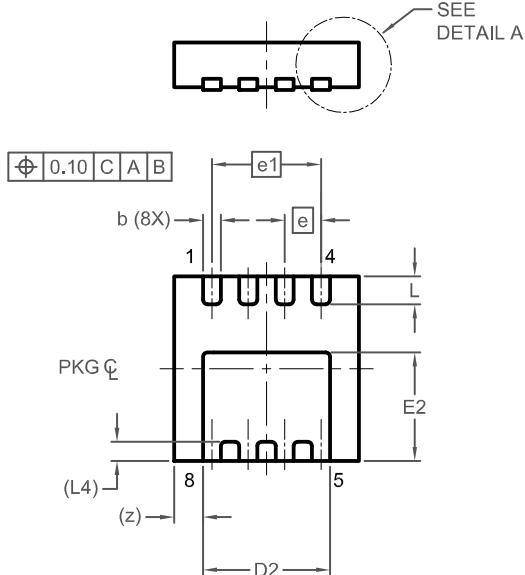
DATE 24 JUN 2022



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	-	0.05
A3	0.20 REF		
b	0.27	0.32	0.37
D	3.20	3.30	3.40
D2	2.17	2.27	2.37
E	3.20	3.30	3.40
E2	1.84	1.94	2.04
e	0.65 BSC		
e1	1.95 BSC		
L	0.40	0.50	0.60
L4	0.34 REF		
z	0.52 REF		



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

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DESCRIPTION:	PQFN8 3.3X3.3, 0.65P	PAGE 1 OF 1

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