

# **MOSFET** – Dual N-Channel, **POWERTRENCH®**

20 V, 4 A, Q1: 68 mΩ, Q2: 100 mΩ

# FDMC6890NZ

#### **General Description**

FDMC6890NZ is a compact single package solution for DC to DC converters with excellent thermal and switching characteristics. Inside the Power 33 package features two N-channel MOSFETs with low on-state resistance and low gate charge to maximize the power conversion and switching efficiency. The Q1 switch also integrates gate protection from unclamped voltage input.

#### **Features**

- Q1: N-Channel
  - Max  $R_{DS(on)} = 68 \text{ m}\Omega$  at  $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 4 \text{ A}$
  - Max  $R_{DS(on)} = 100 \text{ m}\Omega$  at  $V_{GS} = 2.5 \text{ V}$ ,  $I_D = 3 \text{ A}$
- Q2: N-Channel
  - Max  $R_{DS(on)} = 100 \text{ m}\Omega$  at  $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 4 \text{ A}$
  - Max  $R_{DS(on)} = 150 \text{ m}\Omega$  at  $V_{GS} = 2.5 \text{ V}$ ,  $I_D = 2 \text{ A}$
  - ◆ Low Gate Charge
- Low Gate Charge
   These Device is Pb–Free, Halide Free and is RoHS Compliant

  Applications
   DC–DC Conversion

  D1/





WDFN6 3x3, 0.95P (Power 33)

CASE 511DT

#### **MARKING DIAGRAM**

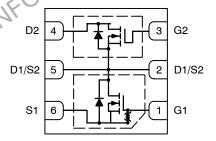


= Specific Device Code 6890N Assembly Location

= 2-Digit Date Code

2-Digit Lot Run Traceability Code

## PIN CONNECTIONS



#### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 9 of this data sheet.

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

Symbol	Parameter			Q2	Unit
$V_{DS}$	Drain to Source Voltage		20	20	٧
$V_{GS}$	Gate to Source Voltage		±12	±12	٧
I <sub>D</sub>	Drain Current	- Continuous	4		Α
		- Pulsed	1	0	
P <sub>D</sub>	Power Dissipation (Steady State) Q1 (Note 1a)		1.92		W
	Power Dissipation (Steady State) Q2 1.78		78		
T <sub>J</sub> , T <sub>STG</sub>	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	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Q1 (Note 1a)	65	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Q2	70	

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

Symbol	Parameter Test Condition		Туре	Min	Тур	Max	Unit	
OFF CHARACTERISTICS								
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250 \ \mu A, V_{GS} = 0$	Q1 Q2	20 20	0	- -	V	
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 μA, Referenced to 25°C	Q1 Q2	W	13 12	- -	mV/°C	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	$V_{DS} = 16 \text{ V}, V_{GS} = 0.\text{ V}$	Q1 Q2	- -	-	1	μΑ	
I <sub>GSS</sub>	Gate to Source Leakage Current	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0. \text{ V}$	Q1 Q2	-	-	±10 ±100	μA nA	
ON CHARA	ON CHARACTERISTICS							
V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu A$	Q1 Q2	0.6 0.6	0.9 1.0	2 2	V	
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	Q1 Q2	-	-3 -3	-	mV/°C	
R <sub>DS(on)</sub>	Drain to Source On Resistance	$V_{GS} = 4.5 \text{ V}, I_D = 4 \text{ A}$ $V_{GS} = 2.5 \text{ V}, I_D = 3 \text{ A}$	Q1	1 1	58 77	68 100	mΩ	
		$V_{GS} = 4.5 \text{ V}, I_D = 4 \text{ A}$ $V_{GS} = 2.5 \text{ V}, I_D = 2 \text{ A}$	Q2	1 1	67 102	100 150		
g <sub>FS</sub>	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 4 \text{ A}$	Q1 Q2	-	10 7		S	
DYNAMIC	CHARACTERISTICS							
C <sub>iss</sub>	Input Capacitance	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	Q1 Q2	- -	205 190	270 250	pF	
C <sub>oss</sub>	Output Capacitance		Q1 Q2	- -	60 60	80 80	pF	
C <sub>rss</sub>	Reverse Transfer Capacitance		Q1 Q2	- -	40 35	60 55	pF	
$R_g$	Gate Resistance	f = 1 MHz	Q1 Q2	- -	3.3 2.8	- -	Ω	

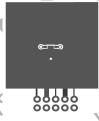
ELECTRICAL CHARACTERISTICS (T, = 25°C unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Type	Min	Тур	Max	Unit	
SWITCHIN	G CHARACTERISTICS							
t <sub>d(on)</sub>	Turn-On Delay Time	$V_{DD} = 10 \text{ V}, I_{D} = 4 \text{ A}, R_{GEN} = 6 \Omega$	Q1 Q2	_ _	4 4	10 10	ns	
t <sub>r</sub>	Rise Time		Q1 Q2	_ _	13 12	22 21	ns	
t <sub>d(off)</sub>	Turn-Off Delay Time		Q1 Q2	_ _	10 7	19 14	ns	
t <sub>f</sub>	Fall Time		Q1 Q2	_ _	6 6	12 12	ns	
Q <sub>g(TOT)</sub>	Total Gate Charge at 4.5 V	V <sub>GS</sub> = 0 V to 4.5 V, V <sub>DD</sub> = 10 V, I <sub>D</sub> = 4 A	Q1 Q2	_ _	2.4 1.8	3.4 2.6	nC	
Q <sub>g(2)</sub>	Total Gate Charge at 2 V	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 4 A	Q1 Q2	_ _	1.4 0.6	1.9 0.8	nC	
$Q_{gs}$	Gate to Source Gate Charge	7	Q1 Q2	(-)	0.4 0.5	JGN	nC	
$Q_{gd}$	Gate to Drain "Miller" Charge		Q1 Q2		0.9 0.8	) - -	nC	
DRAIN-SOURCE DIODE CHARACTERISTICS								
V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4 A	Q1 Q2	/Jr	0.94 0.92	1.25 1.25	V	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 4 A, di/dt = 100 A/μs	Q1 Q2	S.L.	018 17	27 26	ns	
$Q_{rr}$	Reverse Recovery Charge	MOE	Q1 Q2	NA,	9 10	14 15	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<sup>2</sup> 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.



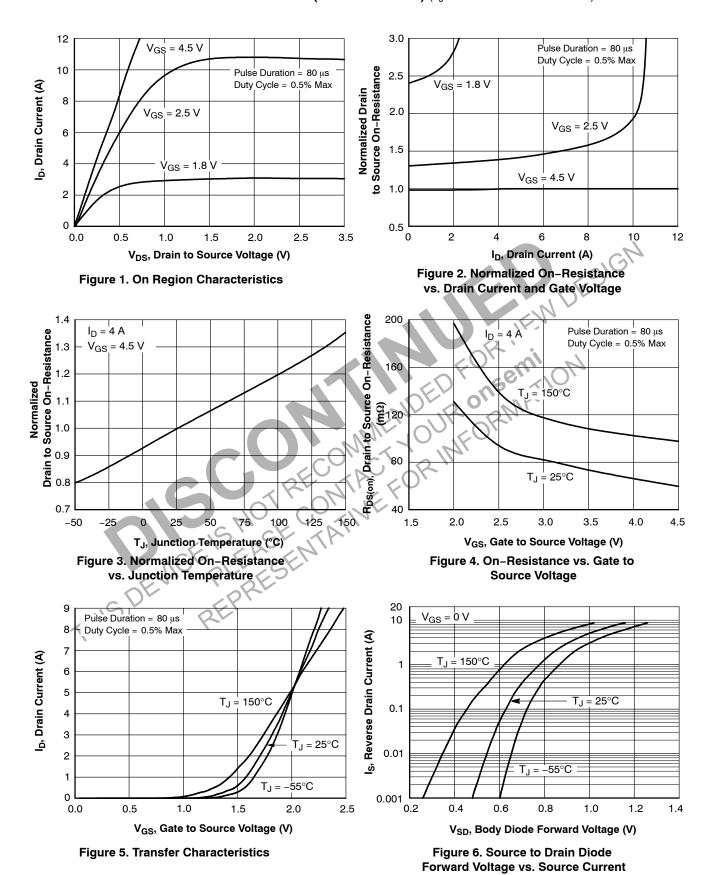
a. 65°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 150°C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300  $\mu$ s, Duty Cycle < 2.0%

#### TYPICAL CHARACTERISTICS (Q1 N-CHANNEL) (T, = 25°C unless otherwise noted)



# TYPICAL CHARACTERISTICS (Q1 N-CHANNEL) (T<sub>J</sub> = 25°C unless otherwise noted) (continued)

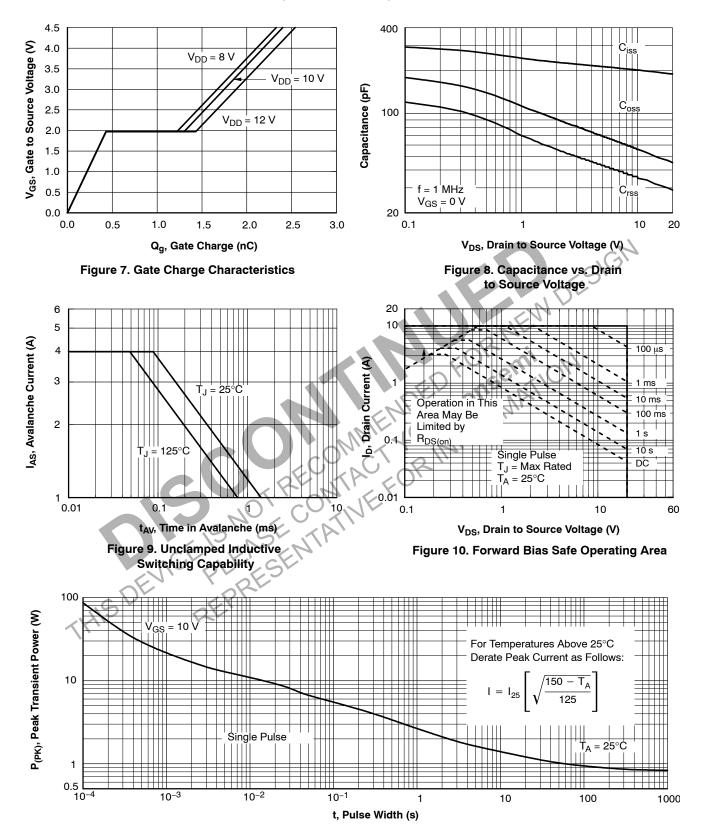
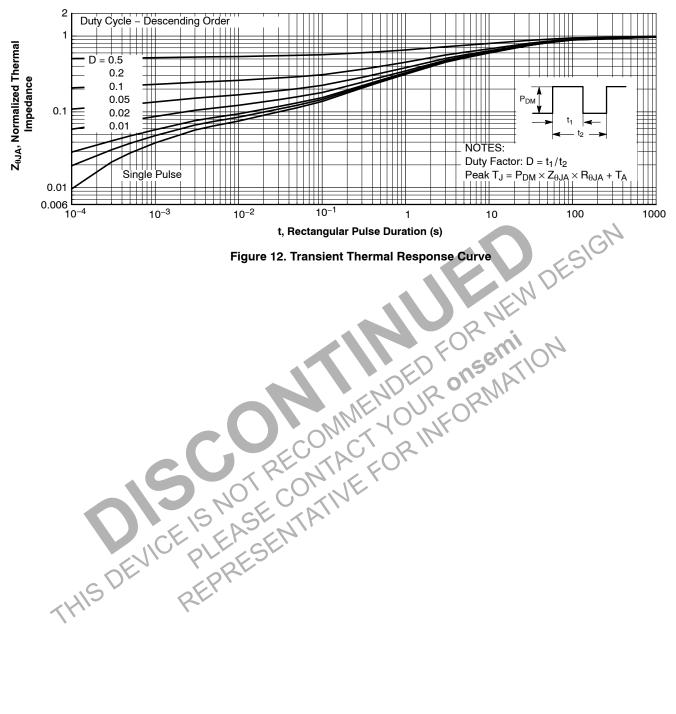
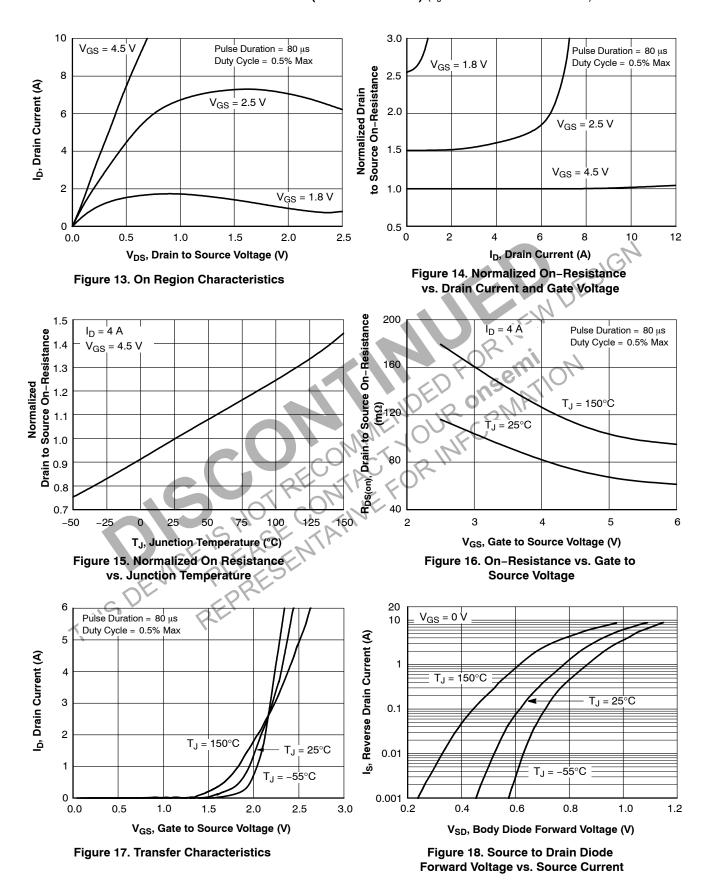


Figure 11. Single Pulse Maximum Power Dissipation

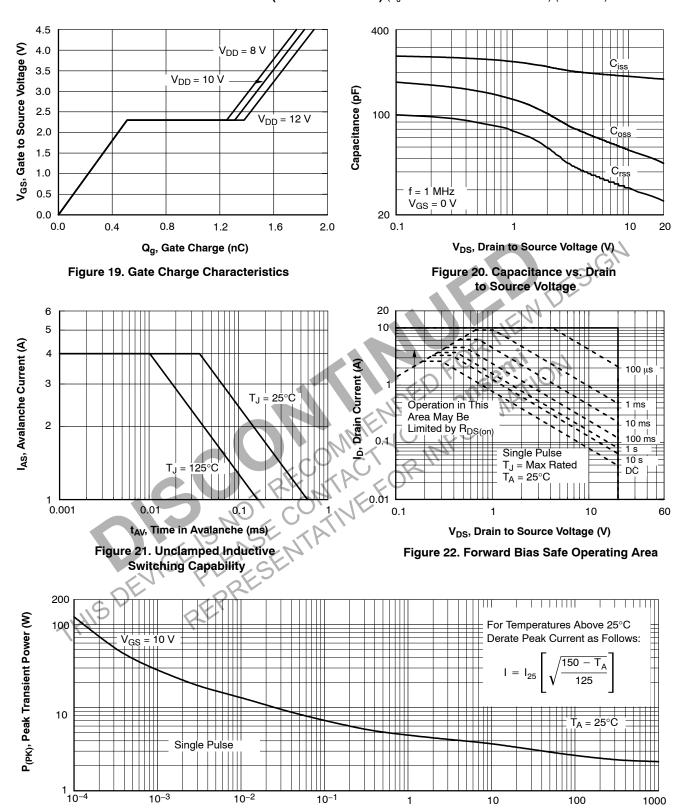
# TYPICAL CHARACTERISTICS (Q1 N-CHANNEL) (T<sub>J</sub> = 25°C unless otherwise noted) (continued)



#### TYPICAL CHARACTERISTICS (Q2 N-CHANNEL) (T, = 25°C unless otherwise noted)



# TYPICAL CHARACTERISTICS (Q2 N-CHANNEL) (T<sub>J</sub> = 25°C unless otherwise noted) (continued)



t, Pulse Width (s) Figure 23. Single Pulse Maximum Power Dissipation

10

100

1000

 $10^{-1}$ 

10<sup>-3</sup>

10-2

# TYPICAL CHARACTERISTICS (Q2 N-CHANNEL) (T<sub>J</sub> = 25°C unless otherwise noted) (continued)

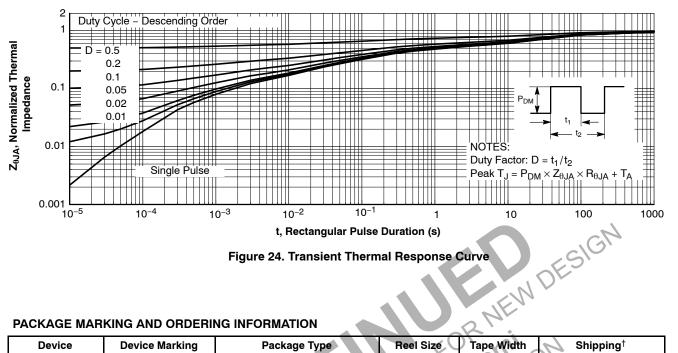


Figure 24. Transient Thermal Response Curve

#### PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	<b>Shipping</b> <sup>†</sup>
FDMC6890NZ	6890N	WDFN6 3 x 3, 0.95P (Power 33) (Pb-Free/Halide Free)	DET)	<b>5</b> 8 mm	3000 / Tape & Reel
†For information on Specifications Broo	chure, <u>BRD8011/D</u> .	tions, including part orientation are	10 16	ase refer to our Ta	pe and Reel Packaging

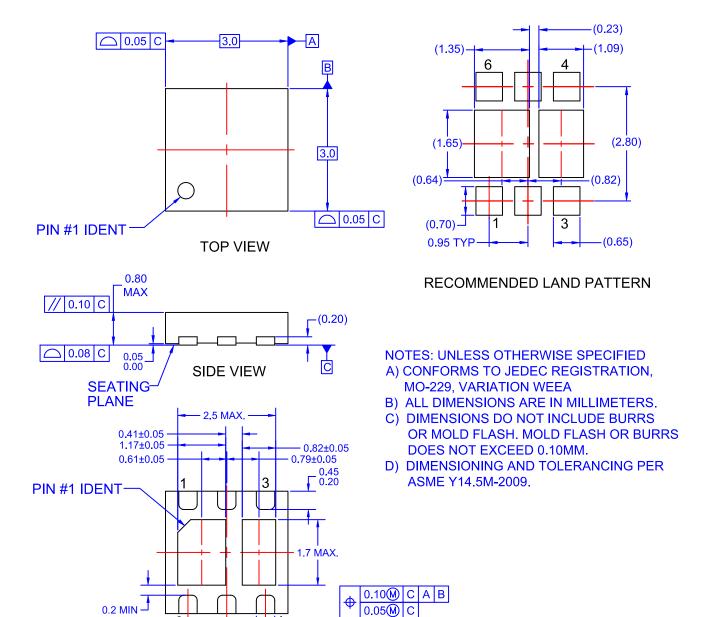
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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#### WDFN6 3x3, 0.95P CASE 511DT ISSUE O

**DATE 31 DEC 2016** 



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**BOTTOM VIEW** 

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