

# MOSFET – N-Channel DUAL COOL™ 33 POWERTRENCH®

30 V, 40 A, 6.25 mΩ

## FDMC3020DC

### Description

This N-Channel MOSFET is produced using onsemi's advanced POWERTRENCH® process. Advancements in both silicon and DUAL COOL package technologies have been combined to offer the lowest  $R_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

### Features

- DUAL COOL™ Top Side Cooling PQFN Package
- Max  $R_{DS(on)}$  = 6.25 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 12\text{ A}$
- Max  $R_{DS(on)}$  = 9.0 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 10\text{ A}$
- High Performance Technology for Extremely Low  $R_{DS(on)}$
- These Device is Pb-Free, Halide Free, and is RoHS Compliant

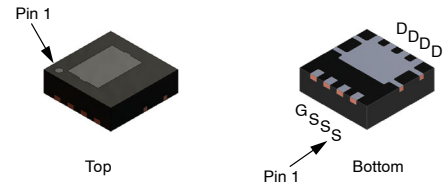
### Typical Applications

- Synchronous Rectifier for DC-DC Converters
- Telecom Secondary Side Rectification
- High End Server/Workstation

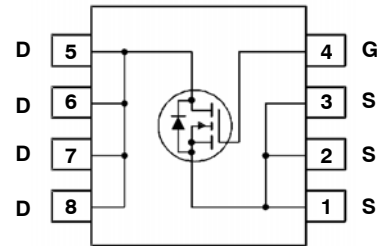
### MOSFET MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current		A
	– Continuous (Package limited) $T_C = 25^\circ\text{C}$	40	
	– Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	70	
	– Continuous $T_A = 25^\circ\text{C}$ (Note 1 a)	17	
	– Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	60	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 4)	1.6	V/ns
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	50	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1 a)	3.0	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	–55 to +150	°C

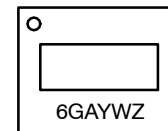
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



PQFN8 3.3X3.3, 0.65P  
CASE 483AL



### MARKING DIAGRAM



- 6G = Specific Device Code
- A = Assembly Plant Code
- YW = 3-Date Code (Year & Week)
- Z = Lot Code

### ORDERING INFORMATION

Device	Package	Shipping†
FDMC3020DC	PQFN8 (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](#).

# FDMC3020DC

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$	30	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	17	–	$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24 \text{ V}$ , $V_{GS} = 0 \text{ V}$	–	–	1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$	–	–	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$	1.0	1.9	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	–6	–	$\text{mV}/^\circ\text{C}$
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 12 \text{ A}$ $V_{GS} = 4.5 \text{ V}$ , $I_D = 10 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $I_D = 12 \text{ A}$ , $T_J = 125^\circ\text{C}$	–	5.0 7.2 7.5	6.25 9.0 9.1	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 5 \text{ V}$ , $I_D = 12 \text{ A}$	–	44	–	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	–	1038	1385	pF
$C_{oss}$	Output Capacitance		–	513	685	pF
$C_{rss}$	Reverse Transfer Capacitance		–	87	135	pF
$R_g$	Gate Resistance		0.1	0.9	2.0	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15 \text{ V}$ , $I_D = 12 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_{GEN} = 6 \Omega$	–	9	18	ns
$t_r$	Rise Time		–	3	10	ns
$t_{d(off)}$	Turn-Off Delay Time		–	19	35	ns
$t_f$	Fall Time		–	2	10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0 \text{ V}$ , to $10 \text{ V}$ , $V_{DD} = 15 \text{ V}$ , $I_D = 12 \text{ A}$	–	15.5	23	nC
	Total Gate Charge	$V_{GS} = 0 \text{ V}$ , to $4.5 \text{ V}$ , $V_{DD} = 15 \text{ V}$ , $I_D = 12 \text{ A}$	–	7.1	10.6	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DD} = 15 \text{ V}$ , $I_D = 12 \text{ A}$	–	3	–	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	$V_{DD} = 15 \text{ V}$ , $I_D = 12 \text{ A}$	–	2.5	–	nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_S = 12 \text{ A}$ (Note 2)	–	0.82	1.3	V
		$V_{GS} = 0 \text{ V}$ , $I_S = 1.9 \text{ A}$ (Note 2)	–	0.73	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 12 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$	–	25	45	ns
$Q_{rr}$	Reverse Recovery Charge	$I_F = 12 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$	–	9	18	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.

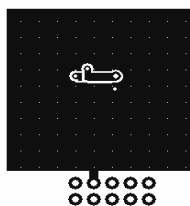
# FDMC3020DC

## THERMAL CHARACTERISTICS

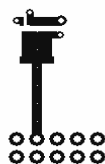
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	7.9	°C/W
	Thermal Resistance, Junction to Case (Bottom Drain)	2.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	42	
	Thermal Resistance, Junction to Ambient (Note 1b)	105	
	Thermal Resistance, Junction to Ambient (Note 1c)	29	
	Thermal Resistance, Junction to Ambient (Note 1d)	40	
	Thermal Resistance, Junction to Ambient (Note 1e)	19	
	Thermal Resistance, Junction to Ambient (Note 1f)	23	
	Thermal Resistance, Junction to Ambient (Note 1g)	30	
	Thermal Resistance, Junction to Ambient (Note 1h)	79	
	Thermal Resistance, Junction to Ambient (Note 1i)	17	
	Thermal Resistance, Junction to Ambient (Note 1j)	26	
	Thermal Resistance, Junction to Ambient (Note 1k)	12	
	Thermal Resistance, Junction to Ambient (Note 1l)	16	

### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 42 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b) 105 °C/W when mounted on a minimum pad of 2 oz copper.

- Still air, 20.9 x 10.4 x 12.7 mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - Still air, 20.9 x 10.4 x 12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - Still air, 45.2 x 41.4 x 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - Still air, 45.2 x 41.4 x 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, 20.9 x 10.4 x 12.7 mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - 200FPM Airflow, 20.9 x 10.4 x 12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
  - 200FPM Airflow, 45.2 x 41.4 x 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
  - 200FPM Airflow, 45.2 x 41.4 x 11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
  - $E_{AS}$  of 60 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 1$  mH,  $I_{AS} = 11$  A,  $V_{DD} = 27$  V,  $V_{GS} = 10$  V.
  - $I_{SD} \leq 12$  A,  $di/dt \leq 100$  A/μs,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .

# FDMC3020DC

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED

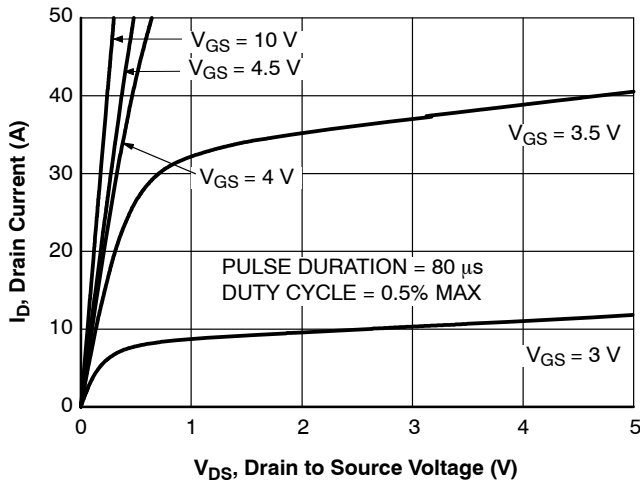


Figure 1. On-Region Characteristics

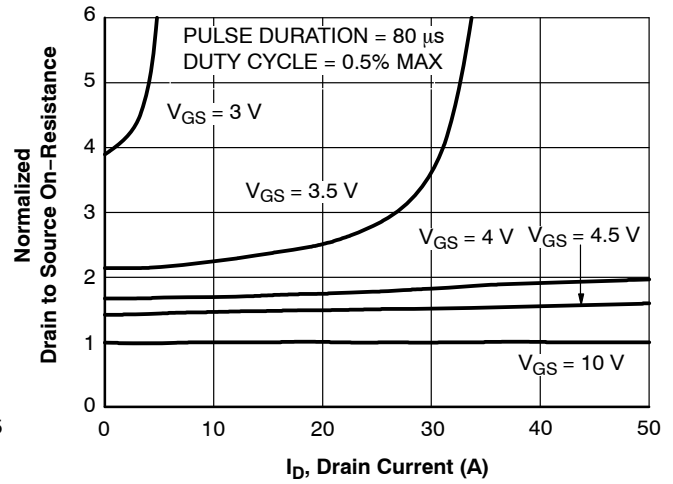


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

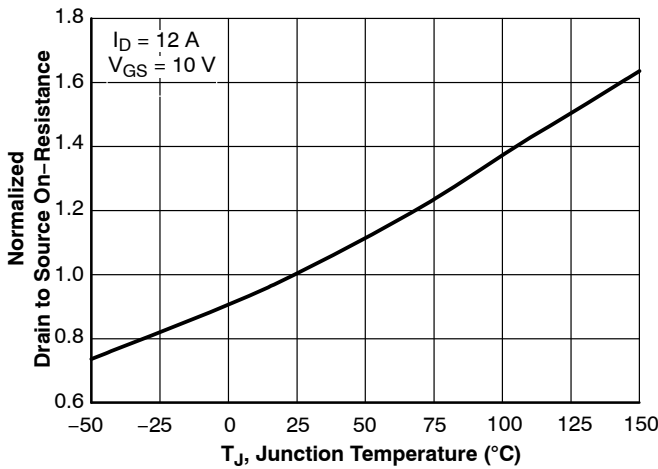


Figure 3. Normalized On Resistance vs. Junction Temperature

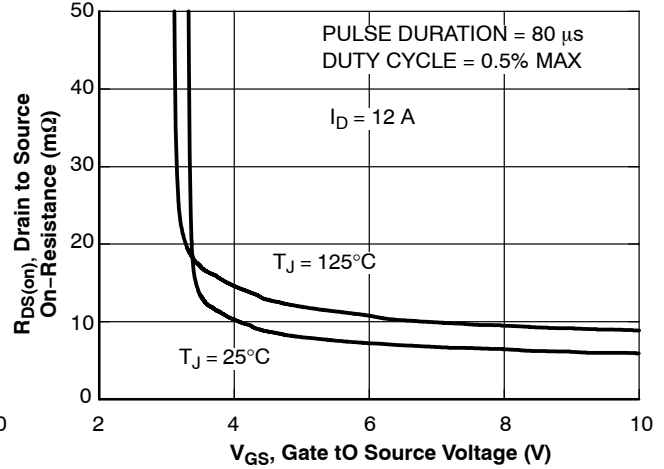


Figure 4. On Resistance vs. Gate to Source Voltage

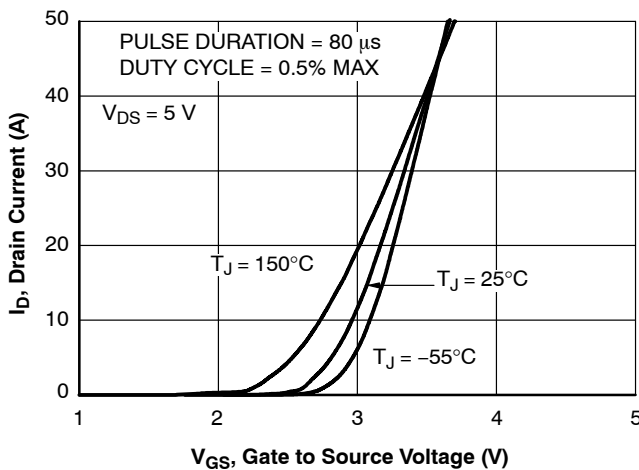


Figure 5. Transfer Characteristics

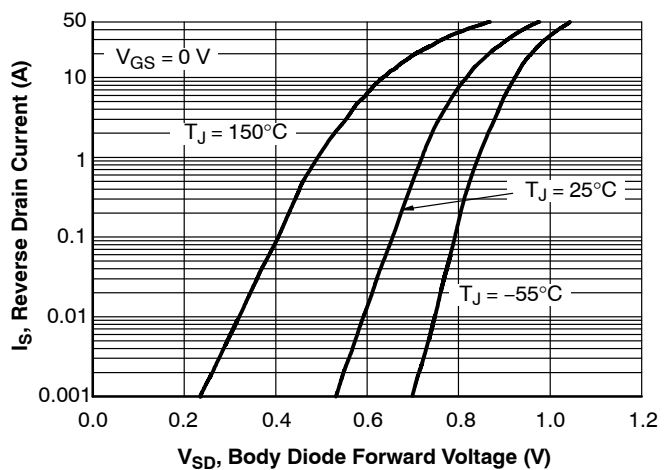


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

# FDMC3020DC

## TYPICAL CHARACTERISTICS (CONTINUED) $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

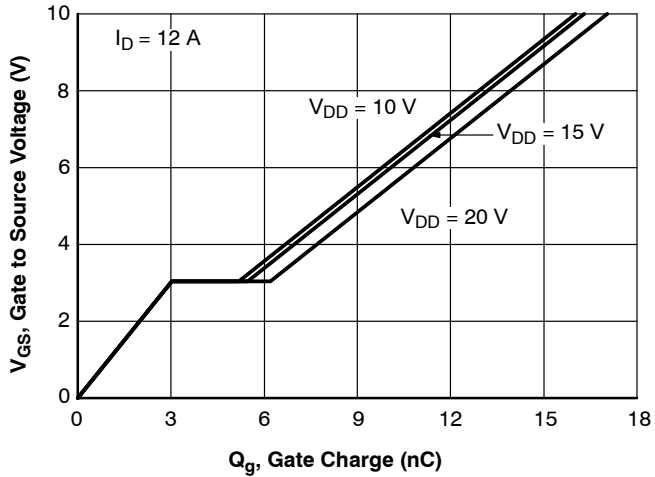


Figure 7. Gate Charge Characteristics

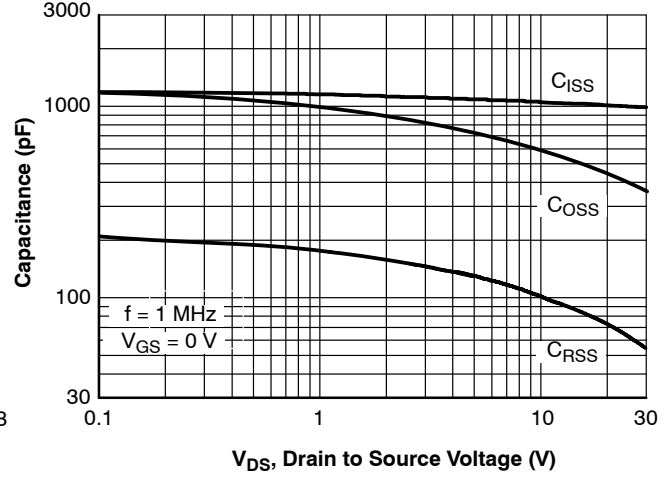


Figure 8. Capacitance vs. Drain to Source Voltage

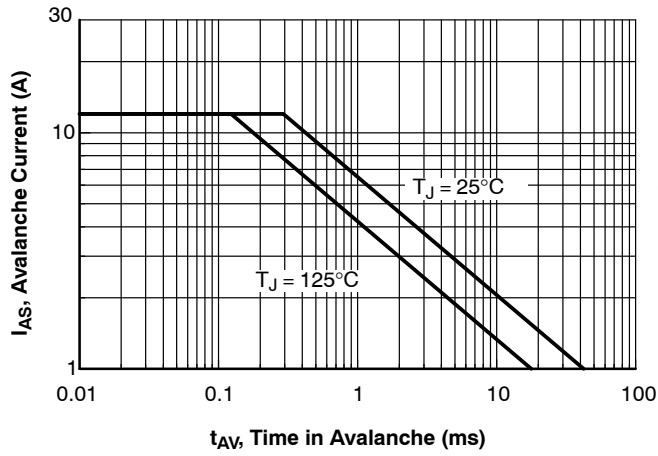


Figure 9. Unclamped Inductive Switching Capability

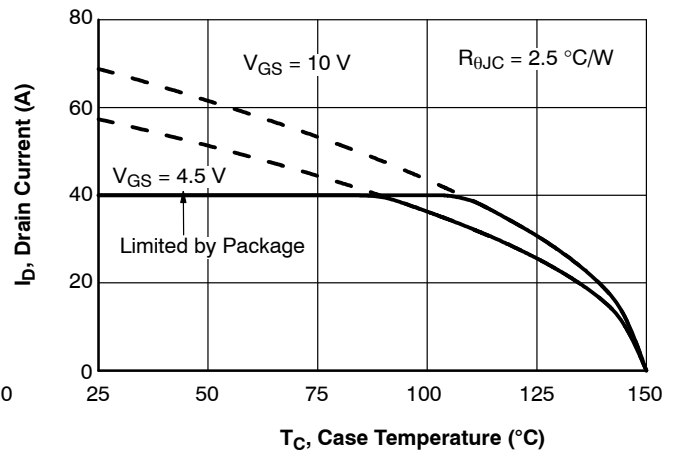


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

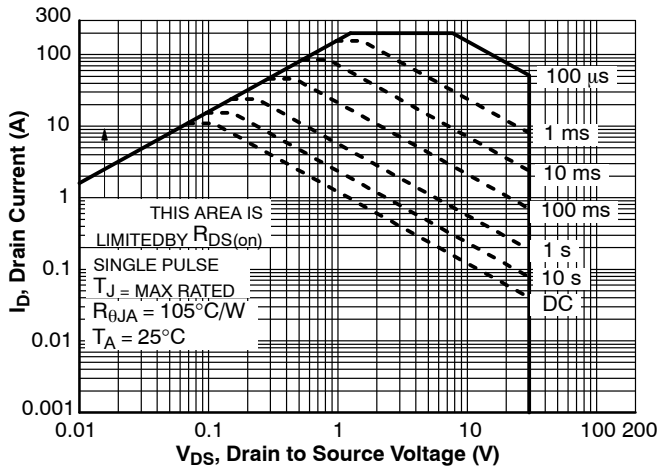


Figure 11. Forward Bias Safe Operating Area

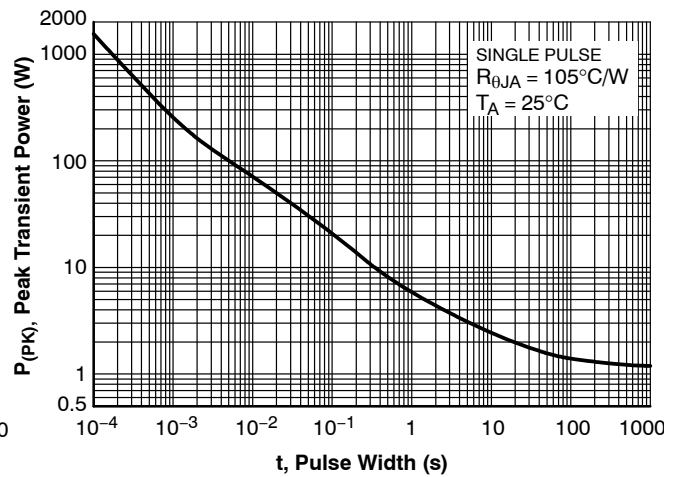


Figure 12. Single Pulse Maximum Power Dissipation

# FDMC3020DC

## TYPICAL CHARACTERISTICS (CONTINUED) $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

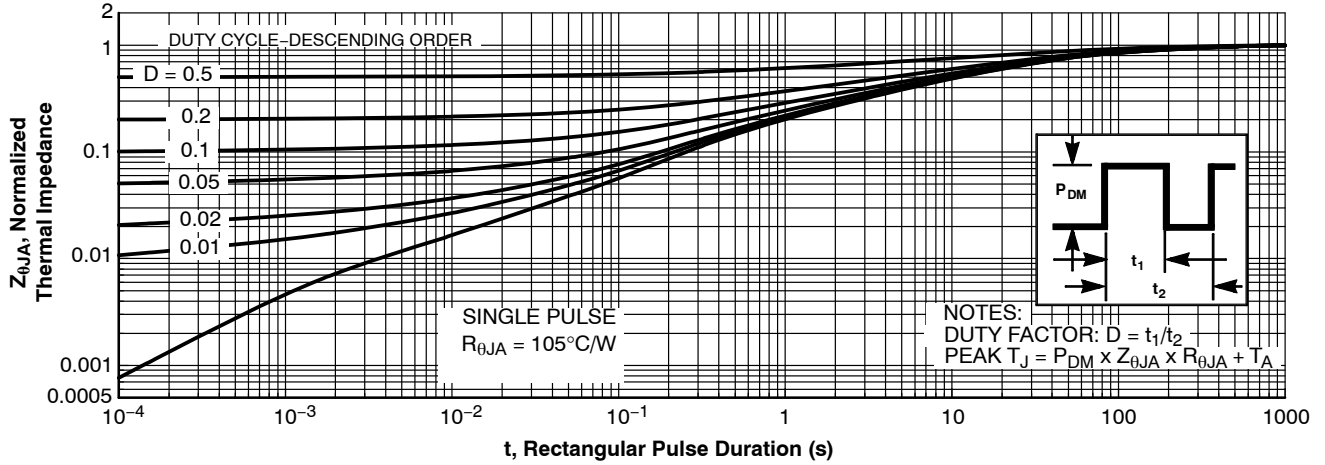
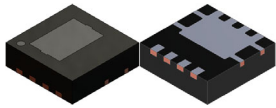
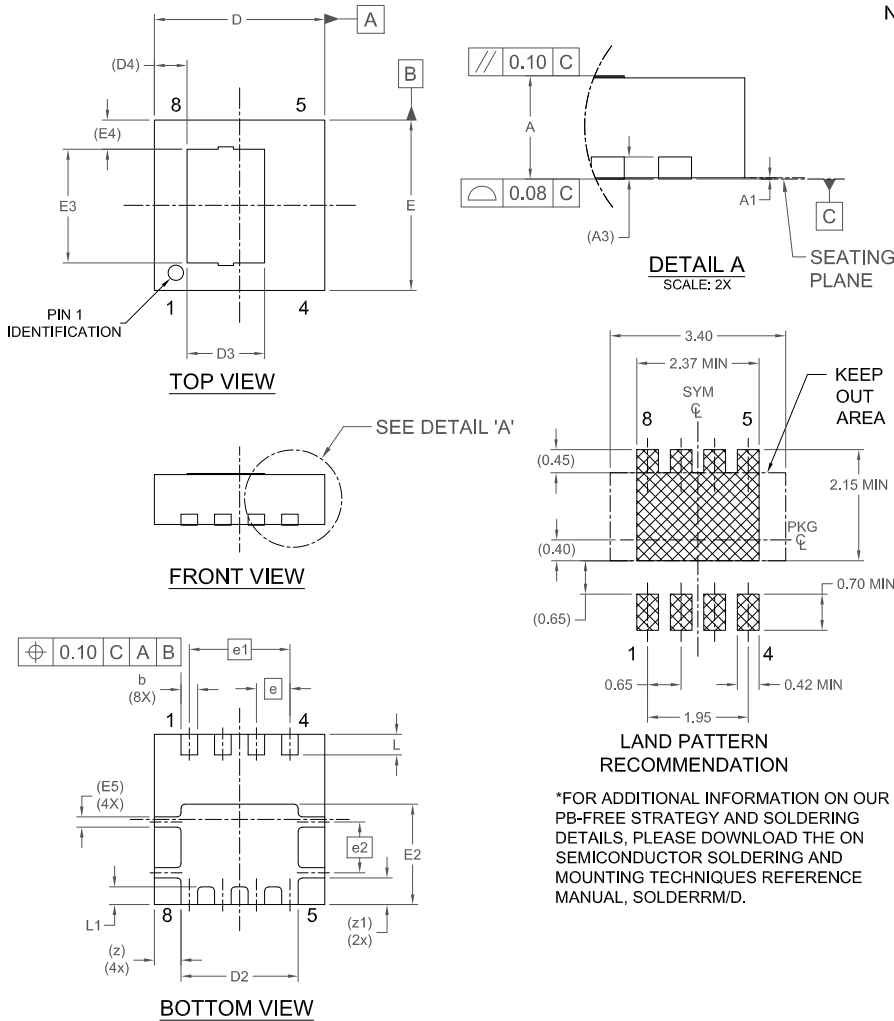


Figure 13. Junction-to-Ambient Transient Thermal Response Curve



**PQFN8 3.30x3.30x1.00, 0.65P  
CASE 483AL  
ISSUE B**

DATE 20 DEC 2023



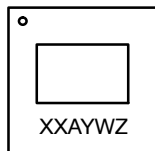
NOTES:

- A. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.27	0.32	0.37
A3	0.20 REF		
D	3.20	3.30	3.40
D2	2.17	2.27	2.37
D3	1.40	1.55	1.70
D4	0.63 REF		
E	3.20	3.30	3.40
E2	1.90	2.00	2.10
E3	2.10	2.25	2.40
E4	0.56 REF		
E5	0.20 REF		
e	0.65 BSC		
e1	1.95 BSC		
e2	0.98 BSC		
L	0.30	0.40	0.50
L4	0.29	0.39	0.49
z	0.52 REF		
z1	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, SOLDERRM/D.

**GENERIC MARKING DIAGRAM\***



- XX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- Z = Assembly Lot Code

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

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