

# MOSFET - Power, Single N-Channel, DFN5/DFNW5

## 30 V, 6.0 mΩ, 51 A

### NVMFS4C310N

#### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- AEC-Q101 Qualified and PPAP Capable
- NVMFS4C310NWF – Wettable Flanks Option for Enhanced Optical Inspection
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

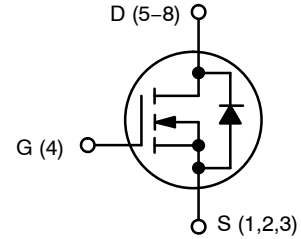
#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DS}$	30	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2 and 4)	$I_D$	$T_A = 25^\circ\text{C}$	17	A
		$T_A = 100^\circ\text{C}$	12	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2 and 4)	$P_D$	$T_A = 25^\circ\text{C}$	3.5	W
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3 and 4)	$I_D$	$T_C = 25^\circ\text{C}$	51	A
		$T_C = 100^\circ\text{C}$	36	
Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3 and 4)	$P_D$	$T_C = 25^\circ\text{C}$	32	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	132	A
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to +175		$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	21		A
Single Pulse Drain-to-Source Avalanche Energy ( $I_L = 25 A_{pk}$ ) (Note 3)	$E_{AS}$	31		mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260		$^\circ\text{C}$

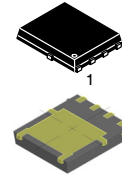
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
3. Assumes heat-sink sufficiently large to maintain constant case temperature independent of device power.
4. Continuous DC current rating. Maximum current for pulses as long as one second is higher but dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$
30 V	6.0 mΩ @ 10 V	51 A
	9.0 mΩ @ 4.5 V	



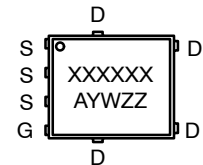
N-CHANNEL MOSFET



DFN5  
CASE 488AA

DFNW5  
CASE 507BA

#### MARKING DIAGRAM



4C10N = Specific Device Code for NVMFS4C310N

4C10WF = Specific Device Code of NVMFS4C310NWF

A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

#### ORDERING INFORMATION

Device	Package	Shipping†
NVMFS4C310NT1G	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS4C310NWF1G	DFNW5 (Pb-Free)	1500 / 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.

# NVMFS4C310N

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	4.7	°C/W
Junction-to-Ambient – Steady State (Note 5)	$R_{\theta JA}$	43	

5. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			14.5		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS (Note 6)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.3		2.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			4.7		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}$	5.0	6.0	m $\Omega$
		$V_{GS} = 4.5\text{ V}$	$I_D = 30\text{ A}$	7.5	9.0	
Forward Transconductance	$g_{FS}$	$V_{DS} = 1.5\text{ V}, I_D = 15\text{ A}$		43		S

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$		1000		pF
Output Capacitance	$C_{OSS}$			580		
Reverse Transfer Capacitance	$C_{RSS}$			160		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		9.7		nC
Threshold Gate Charge	$Q_{G(TH)}$			1.5		
Gate-to-Source Charge	$Q_{GS}$			2.8		
Gate-to-Drain Charge	$Q_{GD}$			4.8		
Gate Plateau Voltage	$V_{GP}$			3.2		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		18.6		nC

### SWITCHING CHARACTERISTICS (Note 7)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		9.0		ns
Rise Time	$t_r$			34		
Turn-Off Delay Time	$t_{d(OFF)}$			14		
Fall Time	$t_f$			7.0		
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		7.0		ns
Rise Time	$t_r$			26		
Turn-Off Delay Time	$t_{d(OFF)}$			18		
Fall Time	$t_f$			4.0		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 10\text{ A}$	$T_J = 25^\circ\text{C}$		0.80	1.1	V
			$T_J = 125^\circ\text{C}$		0.67		

# NVMFS4C310N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$		26.7		ns
Charge Time	$t_a$			14.1		
Discharge Time	$t_b$			12.6		
Reverse Recovery Charge	$Q_{RR}$			13.7		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.

6. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

7. Switching characteristics are independent of operating junction temperatures.

# NVMFS4C310N

## TYPICAL CHARACTERISTICS

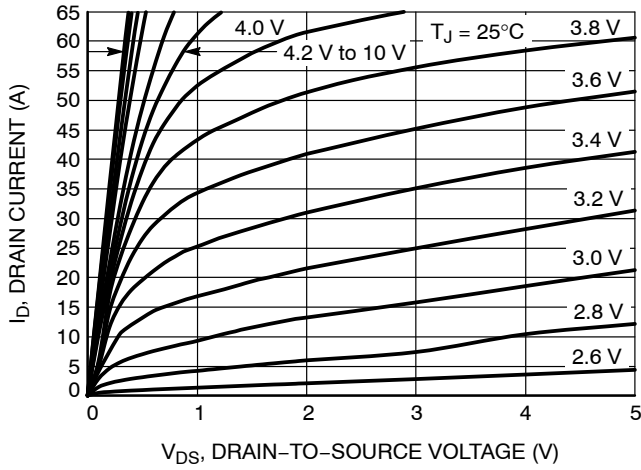


Figure 1. On-Region Characteristics

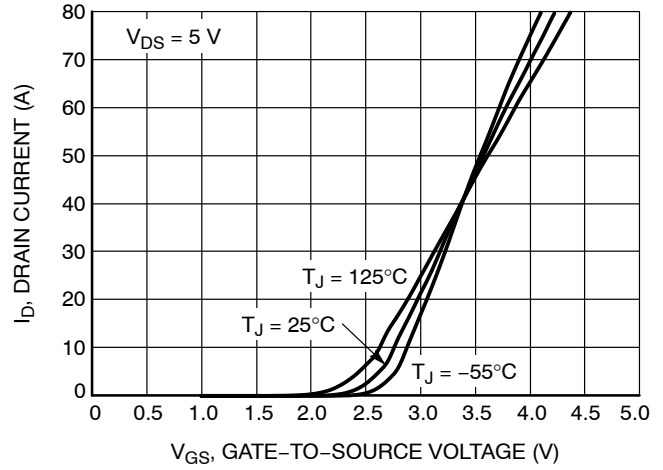


Figure 2. Transfer Characteristics

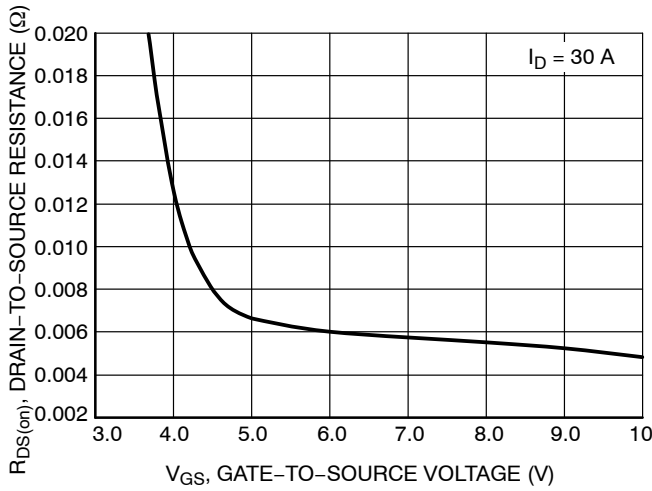


Figure 3. On-Resistance vs.  $V_{GS}$

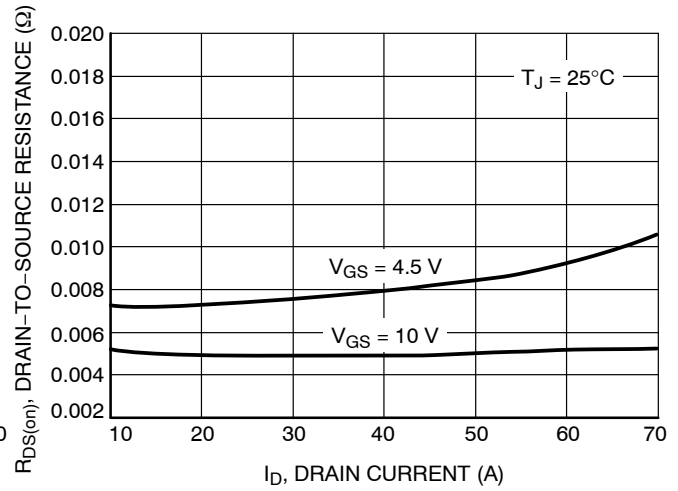


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

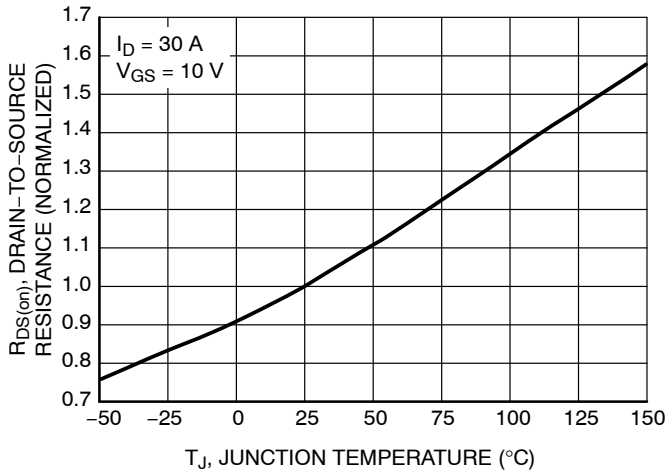


Figure 5. On-Resistance Variation with Temperature

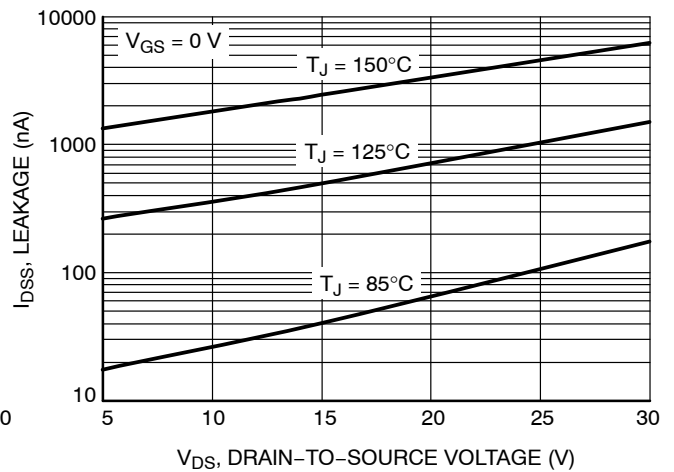


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NVMFS4C310N

## TYPICAL CHARACTERISTICS

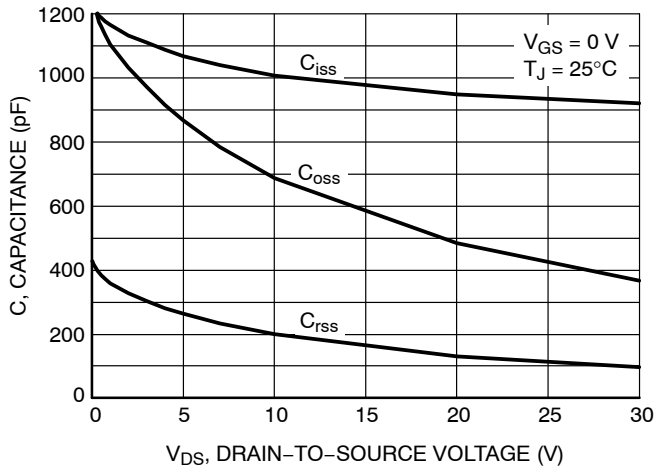


Figure 7. Capacitance Variation

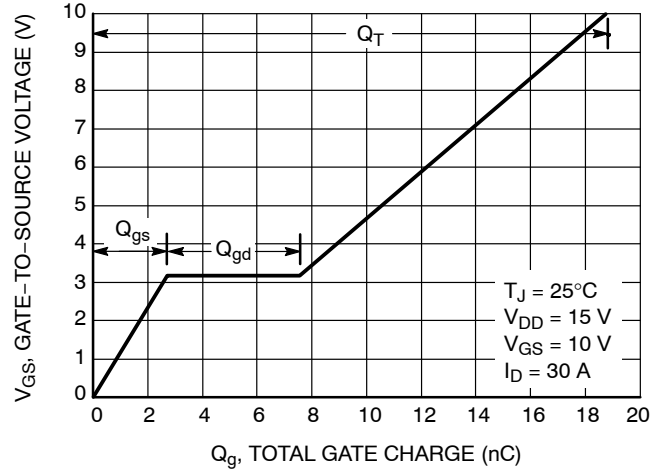


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

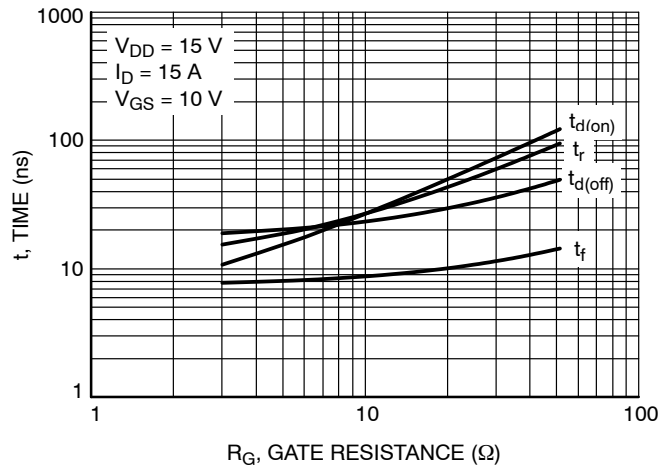


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

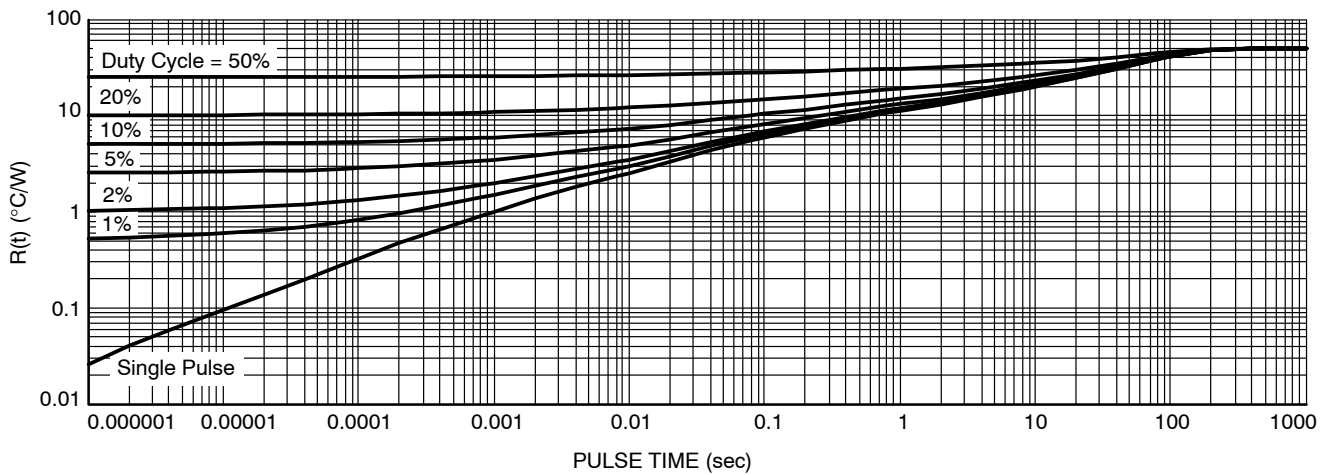


Figure 10. Thermal Response

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS



1  
SCALE 2:1

DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE N

DATE 25 JUN 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

### GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Lot Traceability

\*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.



- STYLE 1:  
PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN
- STYLE 2:  
PIN 1. ANODE  
2. ANODE  
3. ANODE  
4. NO CONNECT  
5. CATHODE

DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	DFN5 5x6, 1.27P (SO-8FL)	PAGE 1 OF 1

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



## DFNW5 5x6 (FULL-CUT SO8FL WF) CASE 507BA ISSUE A

DATE 03 FEB 2021



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. THIS PACKAGE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.150 REF		
M	3.00	3.40	3.80
θ	0°	---	12°



### GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Lot Traceability
- \*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.

**RECOMMENDED MOUNTING FOOTPRINT**

\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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