

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

40 V, 2.5 mΩ, 130 A

NVMFS5C442NL

Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- NVMFS5C442NLWF – Wettable Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	V_{DSS}	40	V	
Gate-to-Source Voltage	V_{GS}	± 20	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	I_D 130	A
		$T_C = 100^\circ\text{C}$	95	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	P_D 83	W
		$T_C = 100^\circ\text{C}$	42	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	I_D 28	A
		$T_A = 100^\circ\text{C}$	20	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	P_D 3.7	W
		$T_A = 100^\circ\text{C}$	1.8	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	I_{DM} 900	A	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)	I_S	81	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 10 \text{ A}$)	E_{AS}	265	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260	$^\circ\text{C}$	

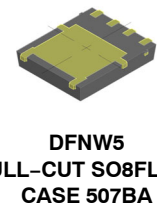
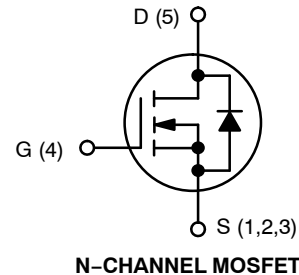
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

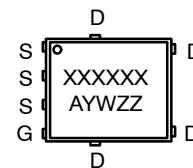
Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	1.8	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	41	

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 a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	2.5 mΩ @ 10 V	130 A
	3.7 mΩ @ 4.5 V	



MARKING DIAGRAM



XXXXXX = 5C442L
(NVMFS5C442NL) or
442LWF
(NVMFS5C442NLWF)

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

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

NVMFS5C442NL

ELECTRICAL CHARACTERISTICS (T_J = 25°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 V, I _D = 250 μA	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J			24.8		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 40 V	T _J = 25 °C		10	μA
			T _J = 125°C		250	
		V _{GS} = 0 V, V _{DS} = 20 V, T _J = 125°C			20	
Gate-to-Source Leakage Current	I _{GSS}	V _{DS} = 0 V, V _{GS} = 20 V			100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 90 μA	1.2		2.0	V	
Threshold Temperature Coefficient	V _{GS(TH)} /T _J			-5.4		mV/°C	
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 50 A		2.0	2.5	mΩ
		V _{GS} = 4.5 V	I _D = 50 A		2.9	3.7	
Forward Transconductance	g _{FS}	V _{DS} = 15 V, I _D = 50 A		116		S	

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 25 V		3100		pF
Output Capacitance	C _{OSS}			1100		
Reverse Transfer Capacitance	C _{RSS}			37		
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 4.5 V, V _{DS} = 32 V; I _D = 50 A		23		nC
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 10 V, V _{DS} = 32 V; I _D = 50 A		50		
Threshold Gate Charge	Q _{G(TH)}	V _{GS} = 4.5 V, V _{DS} = 32 V; I _D = 50 A		5.0		
Gate-to-Source Charge	Q _{GS}			9.8		
Gate-to-Drain Charge	Q _{GD}			6.7		
Plateau Voltage	V _{GP}			3.1		

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.5 V, V _{DS} = 32 V, I _D = 50 A, R _G = 1.0 Ω		12		ns
Rise Time	t _r			8.3		
Turn-Off Delay Time	t _{d(OFF)}			28		
Fall Time	t _f			9.4		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 50 A	T _J = 25°C		0.85	1.2	V
			T _J = 125°C		0.73		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 A			46		ns
Charge Time	t _a				23		
Discharge Time	t _b				23		
Reverse Recovery Charge	Q _{RR}				40		

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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

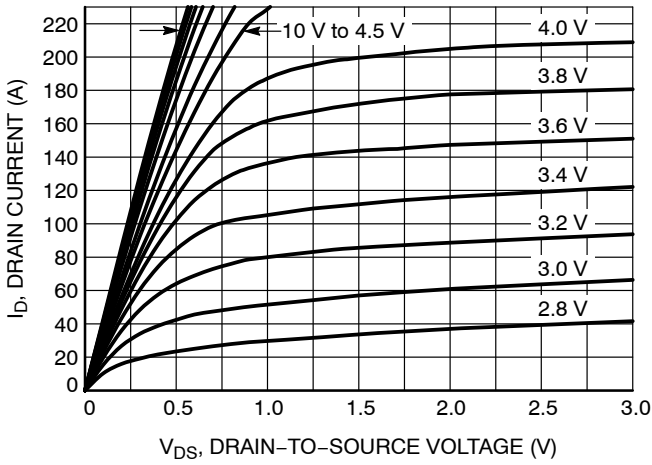


Figure 1. On-Region Characteristics

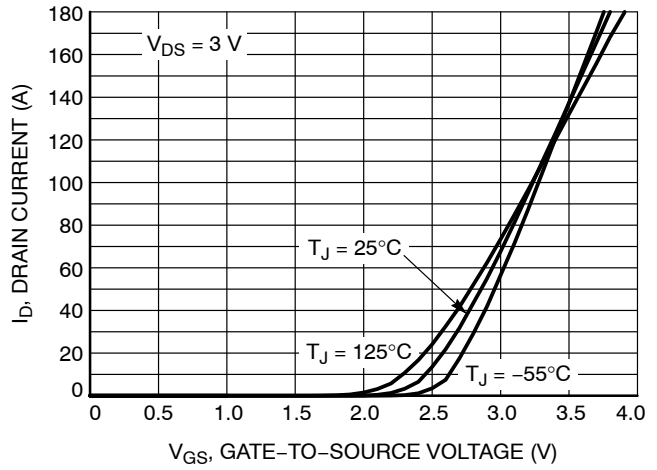


Figure 2. Transfer Characteristics

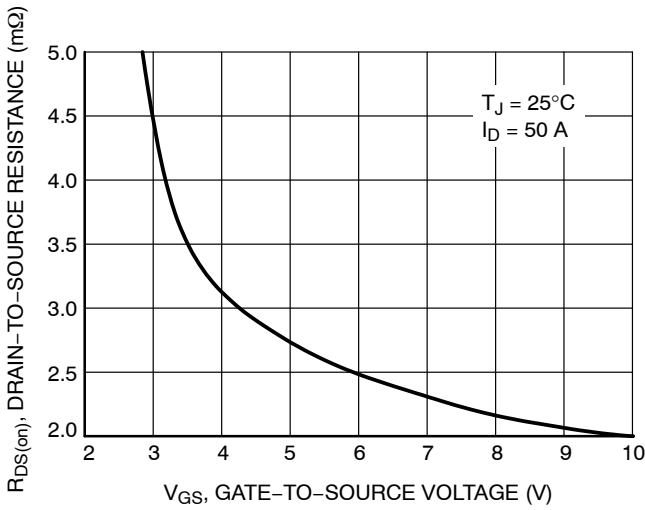


Figure 3. On-Resistance vs. Gate-to-Source Voltage

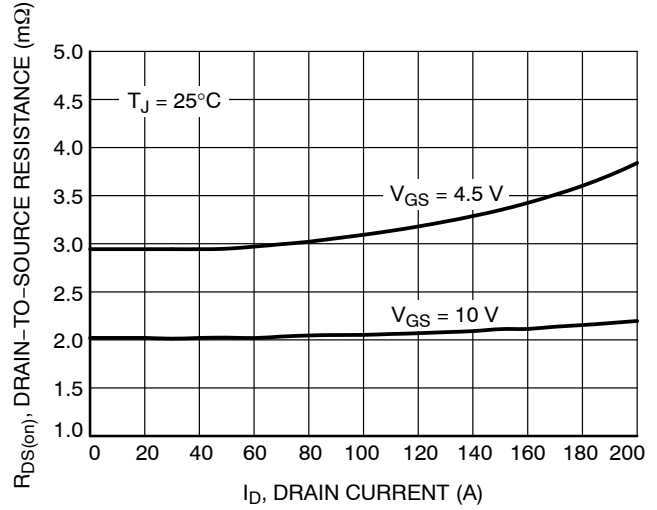


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

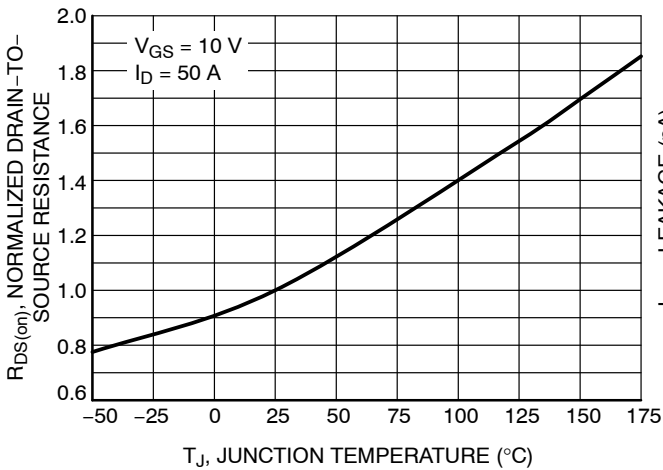


Figure 5. On-Resistance Variation with Temperature

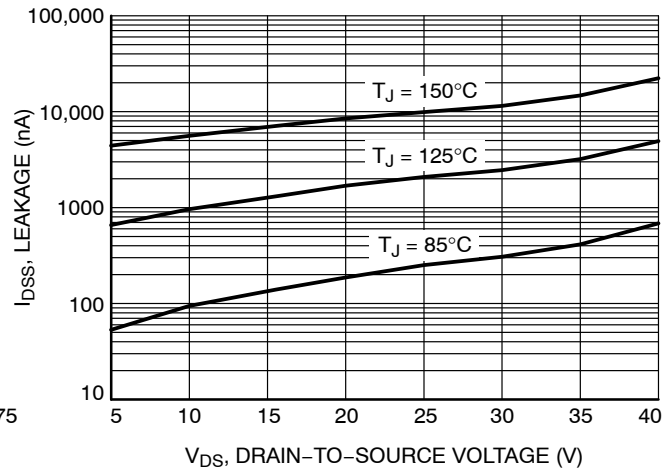


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

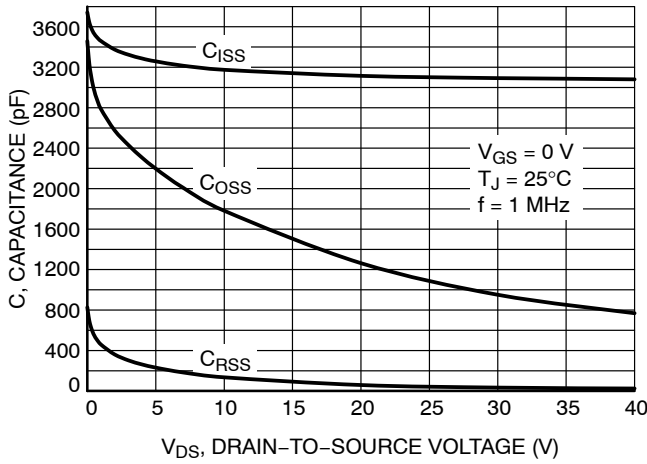


Figure 7. Capacitance Variation

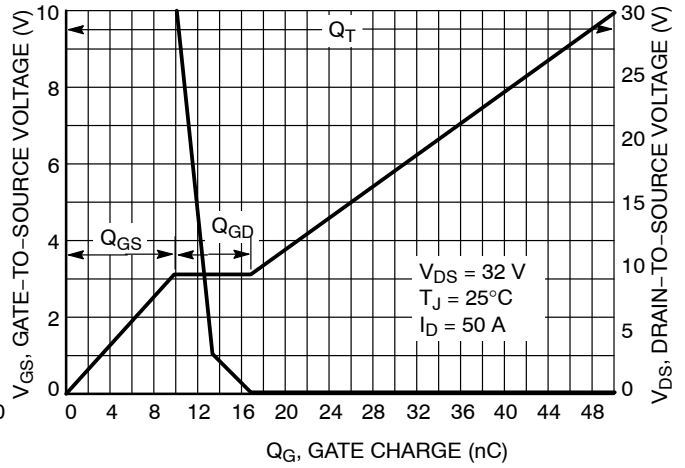


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

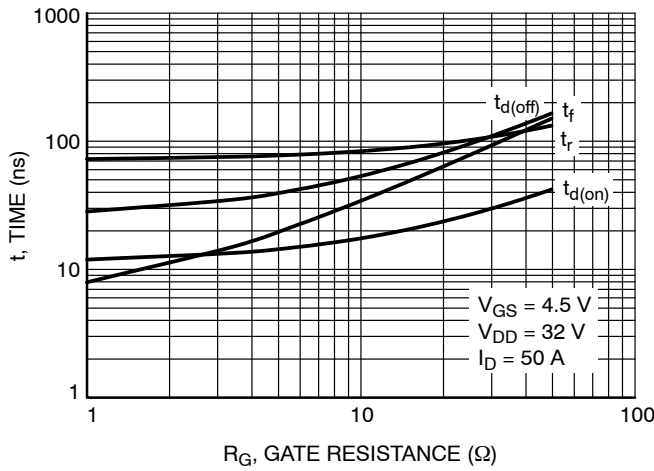


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

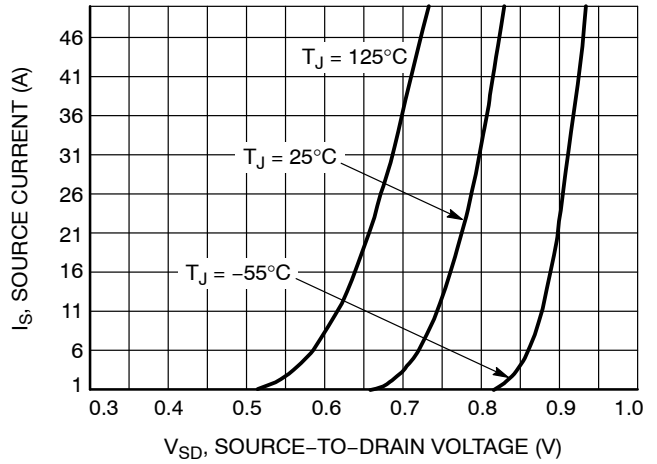


Figure 10. Diode Forward Voltage vs. Current

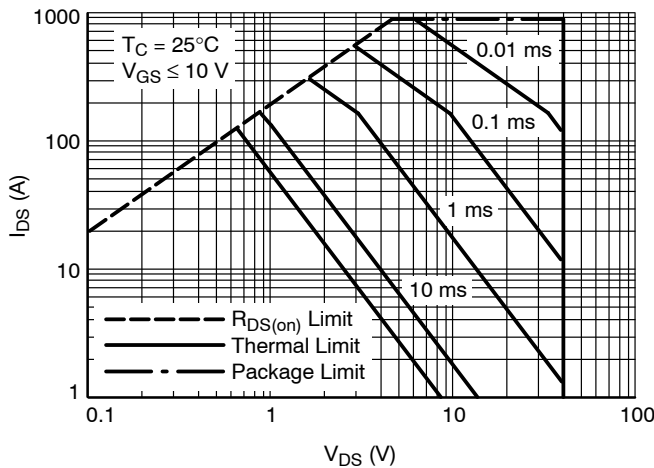


Figure 11. Safe Operating Area

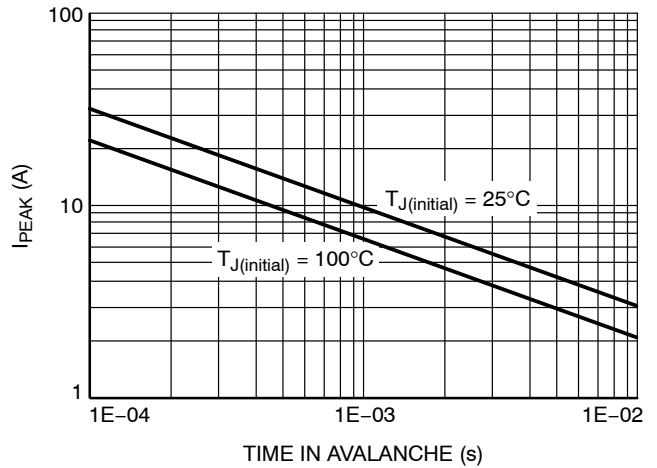


Figure 12. I_{PEAK} vs. Time in Avalanche

NVMFS5C442NL

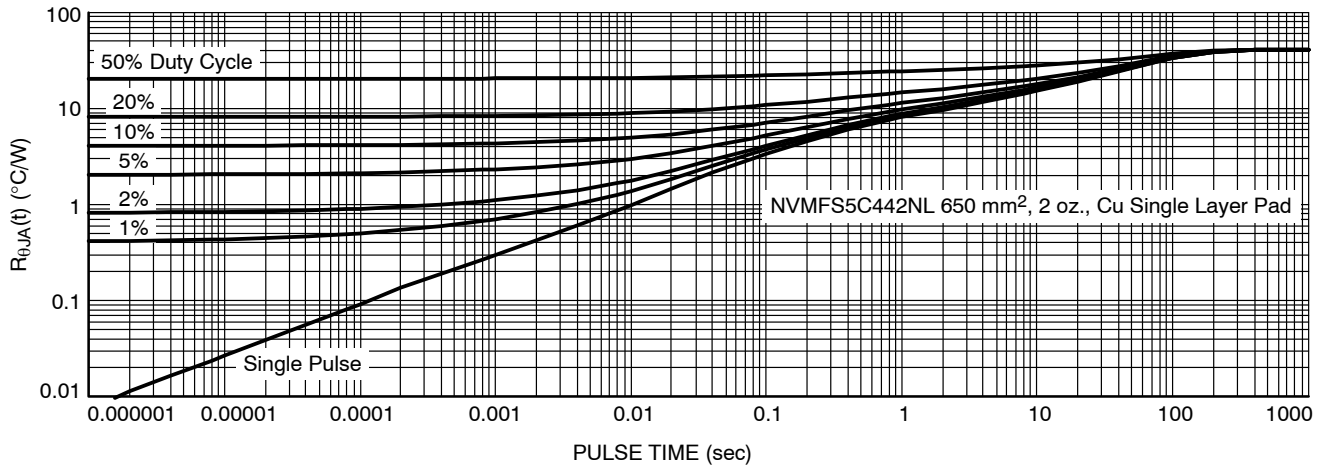


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
NVMFS5C442NLT1G	5C442L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C442NLWFT1G	442LWF	DFNW5 (Pb-Free, Wettable Flanks)	1500 / Tape & Reel
NVMFS5C442NLT3G	5C442L	DFN5 (Pb-Free)	5000 / Tape & Reel
NVMFS5C442NLWFT3G	442LWF	DFNW5 (Pb-Free, Wettable Flanks)	5000 / Tape & Reel
NVMFS5C442NLAFT1G	5C442L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C442NLAFT1G-YE	5C442L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C442NLWFAFT1G	442LWF	DFNW5 (Pb-Free, Wettable Flanks)	1500 / Tape & Reel
NVMFS5C442NLWFET1G	442LWF	DFNW5 (Pb-Free, Wettable Flanks)	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.

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.



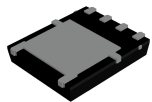
- STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
- STYLE 2:
PIN 1. ANODE
2. ANODE
3. ANODE
4. NO CONNECT
5. CATHODE

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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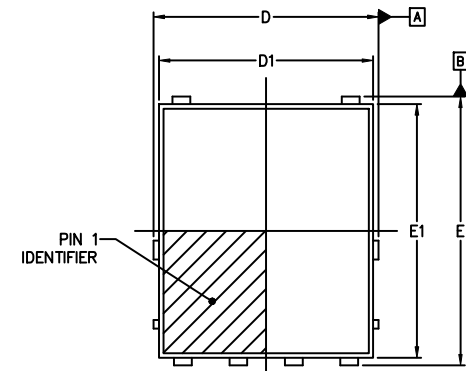


DFNW5 4.90x5.90x1.00, 1.27P
CASE 507BE
ISSUE A

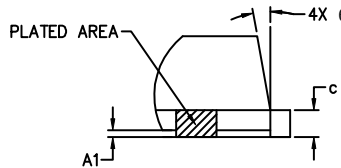
DATE 15 JUL 2024

NOTES:

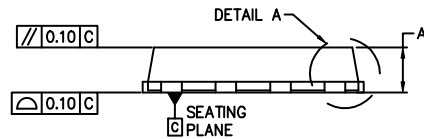
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. THIS PACKAGE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.



TOP VIEW



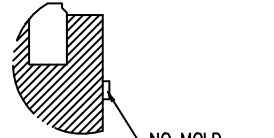
DETAIL "A"
SCALE 2:1



SIDE VIEW



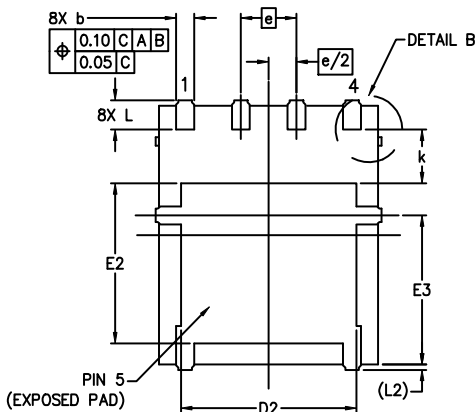
ALTERNATE CONSTRUCTION



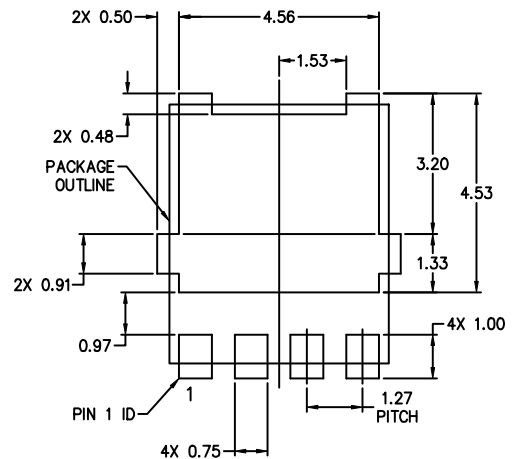
DETAIL "B"
SCALE 2:1

NO MOLD COMPOUND ON THE BOTTOM OF THE BAR.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	0.25	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
E3	3.00	3.40	3.80
e	1.27 BSC		
k	1.20	1.35	1.50
L	0.51	0.57	0.71
L2	0.15 REF.		
theta	0°	6°	12°



BOTTOM VIEW



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

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.

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