

MOSFET – Power, Single N-Channel

40 V, 378 A, 0.7 mΩ

NVMFS5C404N

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
- NVMFS5C404NWF – 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)

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-to-Source Voltage	40	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D	Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	$T_C = 25^\circ\text{C}$ 378 $T_C = 100^\circ\text{C}$ 267	A
P_D	Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$ 200 $T_C = 100^\circ\text{C}$ 100	W
I_D	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	$T_A = 25^\circ\text{C}$ 53 $T_A = 100^\circ\text{C}$ 37	A
P_D	Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	$T_A = 25^\circ\text{C}$ 3.9 $T_A = 100^\circ\text{C}$ 1.9	W
I_{DM}	Pulsed Drain Current $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	900	A
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to $+175$	$^\circ\text{C}$
I_S	Source Current (Body Diode)	191	A
E_{AS}	Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 38 \text{ A}$)	907	mJ
T_L	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	260	$^\circ\text{C}$

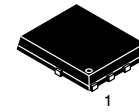
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

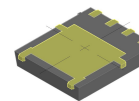
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State	0.75	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	39	

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.

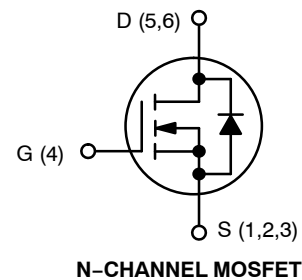
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	0.7 mΩ @ 10 V	378 A



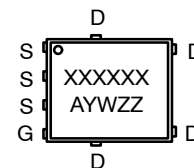
DFN5
CASE 506EZ



DFNW5
CASE 507BA



MARKING DIAGRAMS



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

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

NVMFS5C404N

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
$V_{(BR)DSS}/T_J$	Drain-to-Source Breakdown Voltage Temperature Coefficient			19.7		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		10	μA
			$T_J = 125^\circ\text{C}$		250	
I_{GSS}	Gate-to-Source Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

ON CHARACTERISTICS (Note 4)

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.0		4.0	V
$V_{GS(TH)}/T_J$	Threshold Temperature Coefficient			-6.2		mV/°C
$R_{DS(on)}$	Drain-to-Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		0.57	0.7	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		210		S

CHARGES, CAPACITANCES & GATE RESISTANCE

C_{ISS}	Input Capacitance	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		8400		pF
C_{OSS}	Output Capacitance			4600		
C_{RSS}	Reverse Transfer Capacitance			120		
$Q_{G(TOT)}$	Total Gate Charge	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$		128		nC
$Q_{G(TH)}$	Threshold Gate Charge	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$		22		
Q_{GS}	Gate-to-Source Charge			35		
Q_{GD}	Gate-to-Drain Charge			26		
V_{GP}	Plateau Voltage			4.3		V

SWITCHING CHARACTERISTICS (Note 5)

$t_{d(ON)}$	Turn-On Delay Time	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}, I_D = 50\text{ A}, R_G = 2.5\text{ }\Omega$		16		ns
t_r	Rise Time			113		
$t_{d(OFF)}$	Turn-Off Delay Time			77		
t_f	Fall Time			109		

DRAIN-SOURCE DIODE CHARACTERISTICS

V _{SD}	Forward Diode Voltage	V _{GS} = 0 V, I _S = 50 A	T _J = 25°C		0.76	1.2	V
			T _J = 125°C		0.63		
t _{RR}	Reverse Recovery Time	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 A			96		ns
t _a	Charge Time				49		
t _b	Discharge Time				47		
Q _{RR}	Reverse Recovery Charge				189		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.

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

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

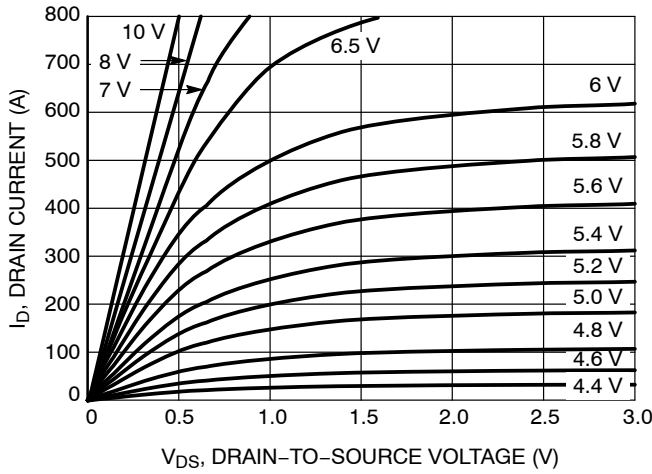


Figure 1. On-Region Characteristics

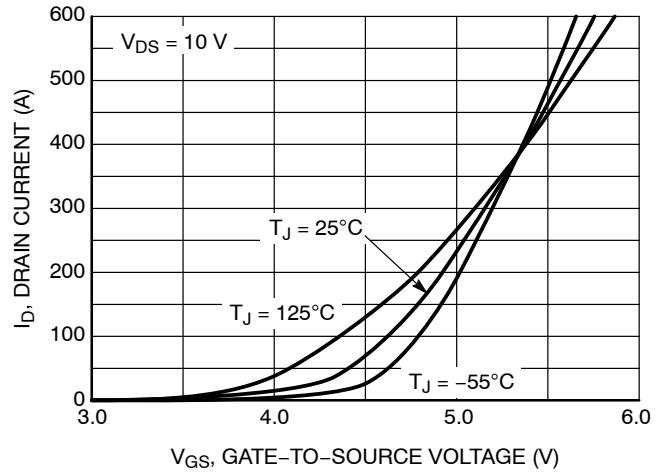


Figure 2. Transfer Characteristics

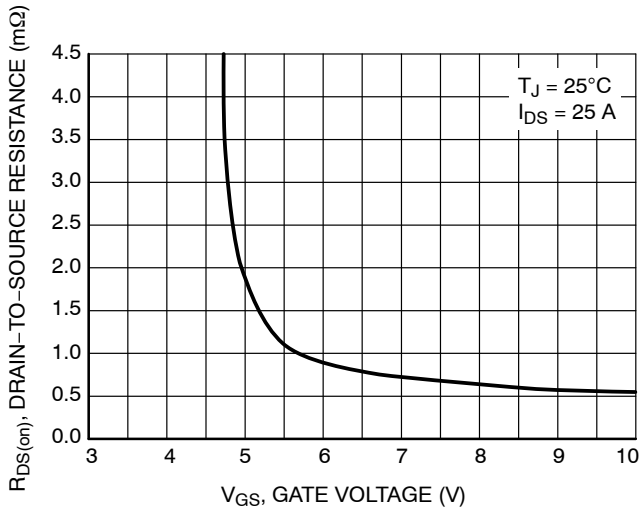


Figure 3. On-Resistance vs. Gate-to-Source Voltage

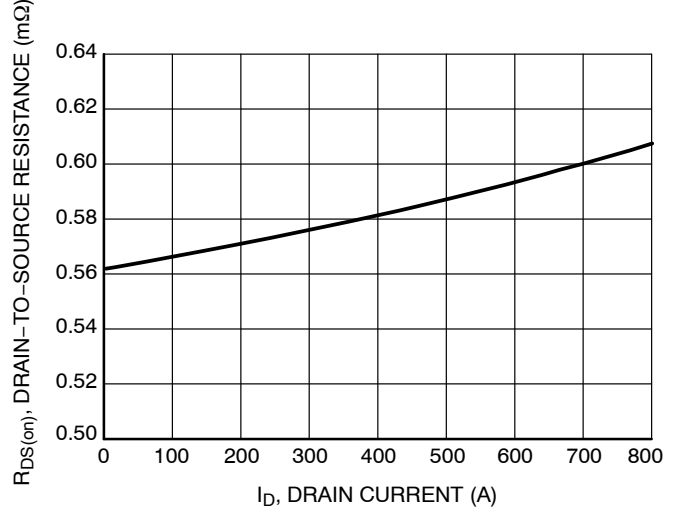


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

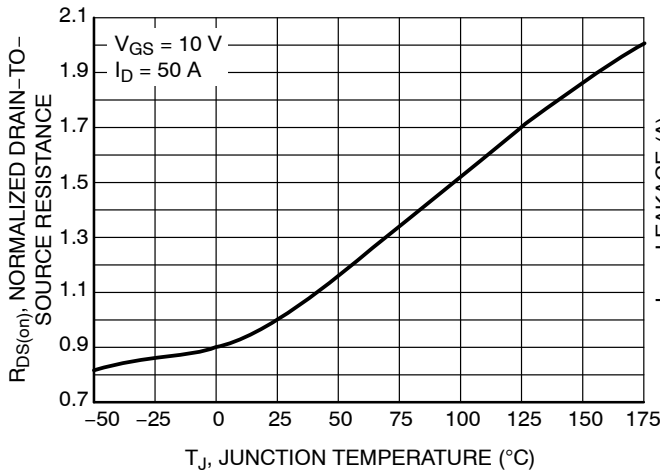


Figure 5. On-Resistance Variation with Temperature

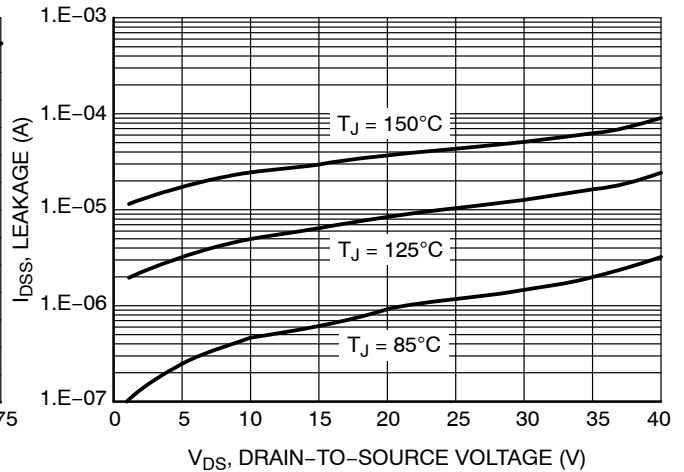


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

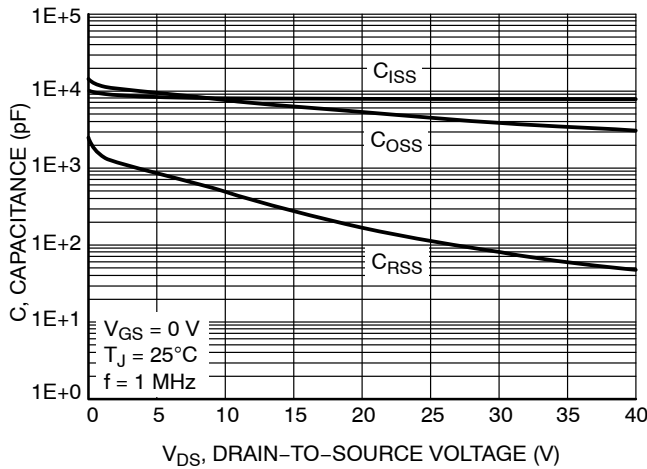


Figure 7. Capacitance Variation

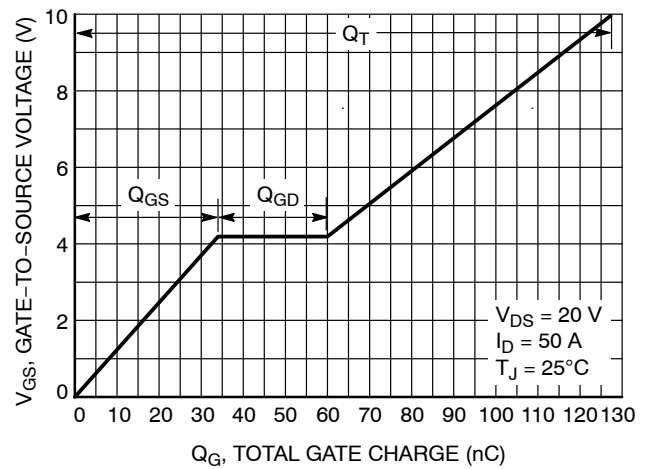


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

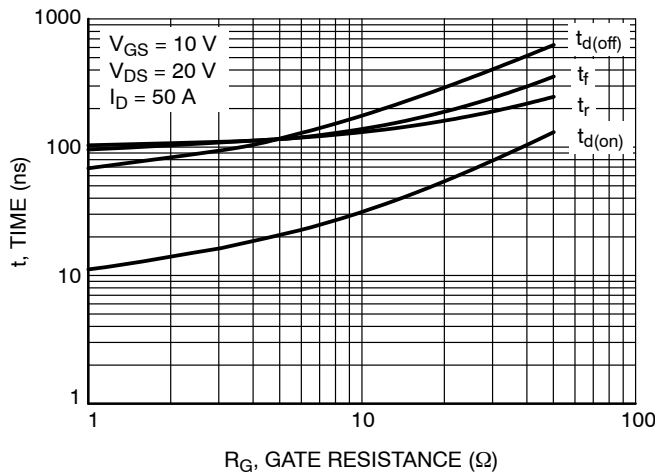


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

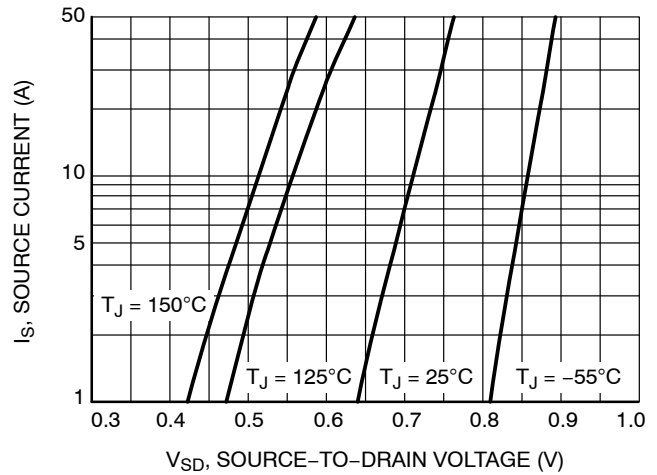


Figure 10. Diode Forward Voltage vs. Current

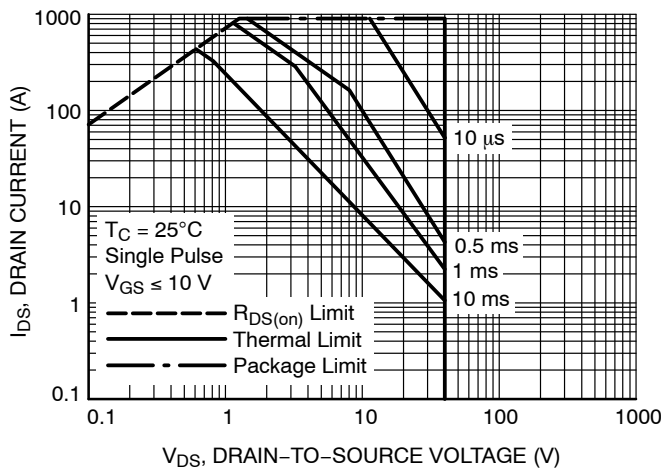


Figure 11. Maximum Rated Forward Biased Safe Operating Area

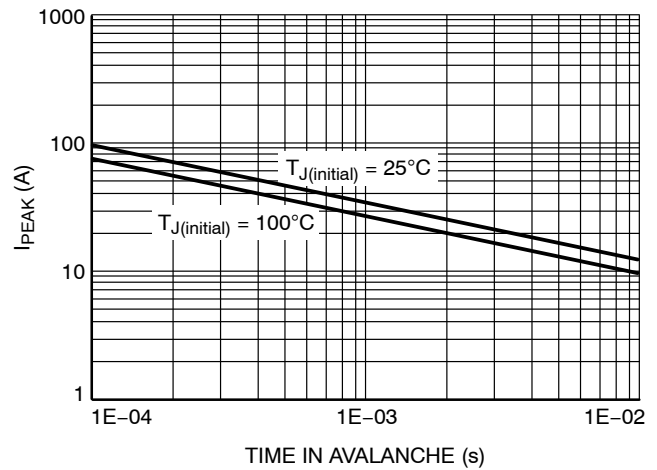


Figure 12. I_{PEAK} vs. Time in Avalanche

NVMFS5C404N

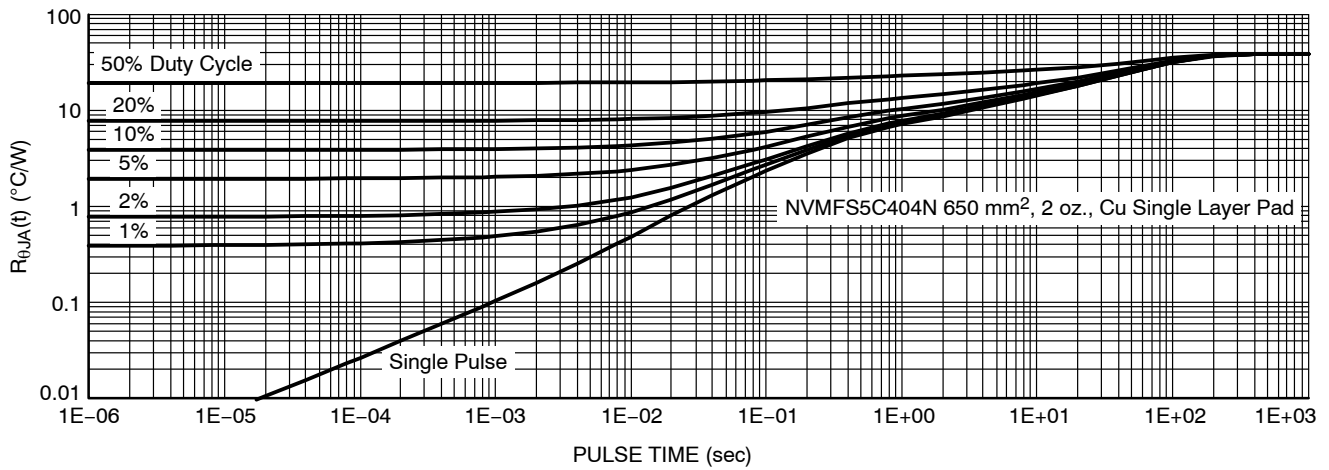


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

Device	Case	Marking	Package	Shipping†
NVMFS5C404NT1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NET1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NAFT1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFAT1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFET1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFET3G	507BA	404NWF	DFNW5 (Pb-Free)	5000 / Tape & Reel

DISCONTINUED (Note 6)

NVMFS5C404NT3G	506EZ	5C404N	DFN5 (Pb-Free)	5000 / Tape & Reel
NVMFS5C404NWF1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWF3G	507BA	404NWF	DFNW5 (Pb-Free)	5000 / 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](#).

6. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.



DFN5, 4.90 x 5.90 x 1.00, 1.27P
CASE 506EZ
ISSUE B

DATE 16 SEP 2024

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.



TOP VIEW



SIDE VIEW



DETAIL "A"
SCALED 2:1



BOTTOM VIEW

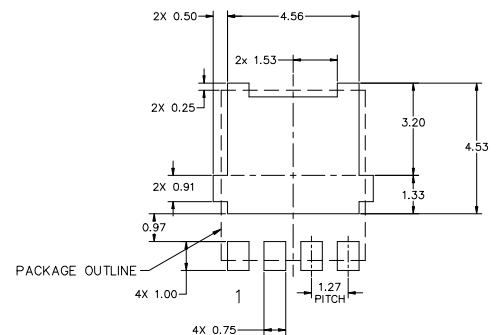
**GENERIC
MARKING DIAGRAM***



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.

MILLIMETERS			
DIM	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	3.80	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
k	1.10	1.20	1.40
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
Ø	0*	---	12*



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.

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DESCRIPTION:	DFN5, 4.90 x 5.90 x 1.00, 1.27P	PAGE 1 OF 1

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DFNW5 4.90x5.90x1.00, 1.27P
CASE 507BA
ISSUE C

DATE 19 SEP 2024



TOP VIEW



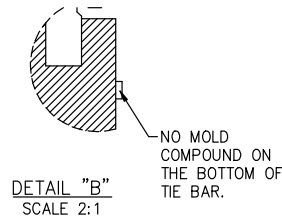
SIDE VIEW



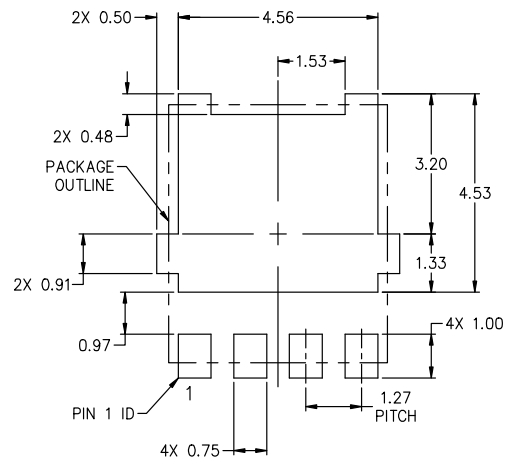
BOTTOM VIEW

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.


DETAIL "A"
SCALE 2:1

DETAIL "B"
SCALE 2:1

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
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.		
θ	0°	6°	12°



RECOMMENDED MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/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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