

MOSFET – Power, Single N-Channel

40 V, 0.67 mΩ, 370 A

NVMFS5C404NL

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
- NVMFS5C404NLWF – Wettable Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR 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	370	A
		$T_C = 100^{\circ}\text{C}$		260	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^{\circ}\text{C}$	P_D	200	W
		$T_C = 100^{\circ}\text{C}$		100	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	52	A
		$T_A = 100^{\circ}\text{C}$		37	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)	Steady State	$T_A = 25^{\circ}\text{C}$	P_D	3.9	W
		$T_A = 100^{\circ}\text{C}$		1.9	
Pulsed Drain Current	$T_A = 25^{\circ}\text{C}$, $t_p = 10\text{ }\mu\text{s}$		I_{DM}	900	A
Operating Junction and Storage Temperature			T_J , T_{stg}	-55 to + 175	$^{\circ}\text{C}$
Source Current (Body Diode)			I_S	191	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 38\text{ A}$)			E_{AS}	907	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^{\circ}\text{C}$

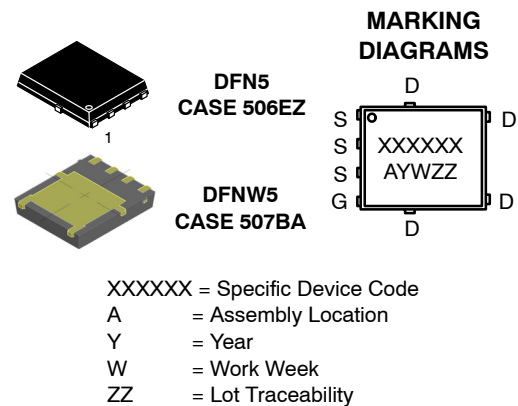
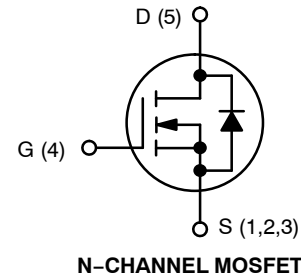
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

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

$V_{(BR)DS}$	$R_{DS(ON)}$ MAX	I_D MAX
40 V	0.67 mΩ @ 10 V	370 A
	1.0 mΩ @ 4.5 V	



ORDERING INFORMATION

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

NVMFS5C404NL

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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			21.6		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$		10	μA
			$T_J = 125^\circ\text{C}$		250	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-6.2		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		0.52	0.67	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$		0.75	1.0	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		270		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		12168		pF
Output Capacitance	C_{OSS}			4538		
Reverse Transfer Capacitance	C_{RSS}			79.8		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$		81		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$		181		
Threshold Gate Charge	$Q_{G(TH)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$		8.5		
Gate-to-Source Charge	Q_{GS}			27.8		
Gate-to-Drain Charge	Q_{GD}			23.8		
Plateau Voltage	V_{GP}			2.7		V

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}, I_D = 50\text{ A}, R_G = 1.0\text{ }\Omega$		24		ns
Rise Time	t_r			135		
Turn-Off Delay Time	$t_{d(OFF)}$			87		
Fall Time	t_f			157		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$	$T_J = 25^\circ\text{C}$		0.7	1.2	V
			$T_J = 125^\circ\text{C}$		0.61		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$			97.4		ns
Charge Time	t_a				46.5		
Discharge Time	t_b				50.9		
Reverse Recovery Charge	Q_{RR}				190		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

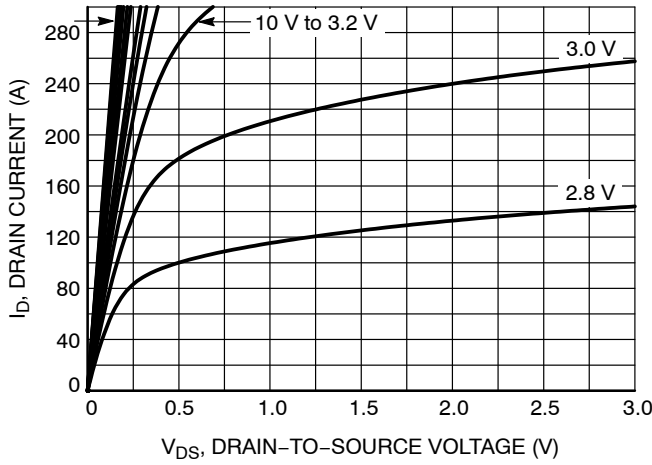


Figure 1. On-Region Characteristics

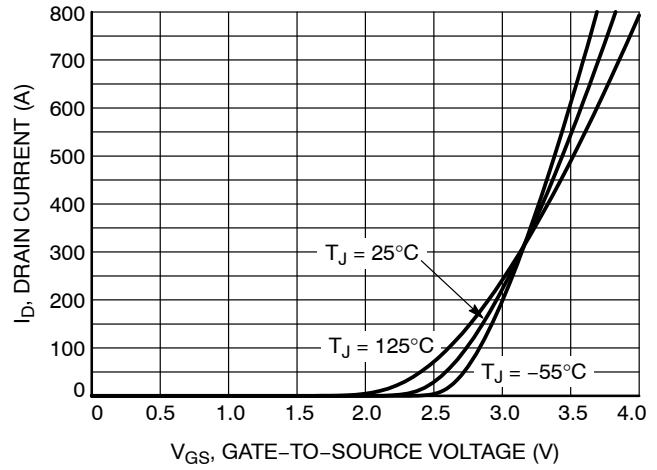


Figure 2. Transfer Characteristics

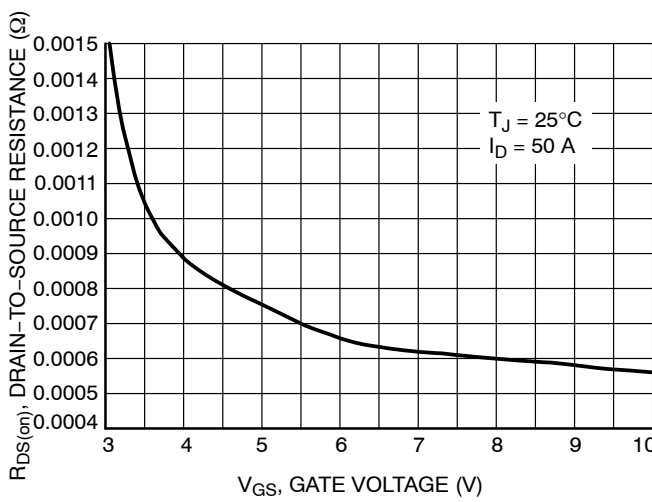


Figure 3. On-Resistance vs. Gate-to-Source Voltage

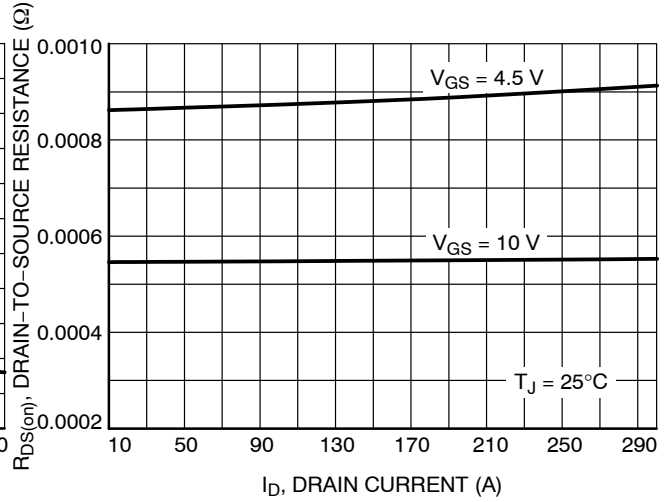


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

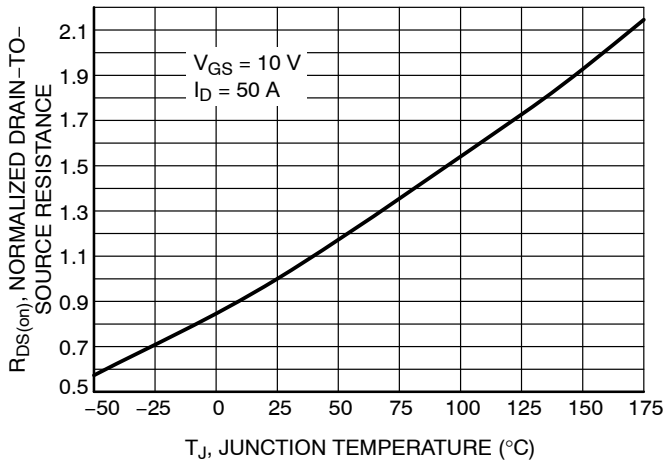


Figure 5. On-Resistance Variation with Temperature

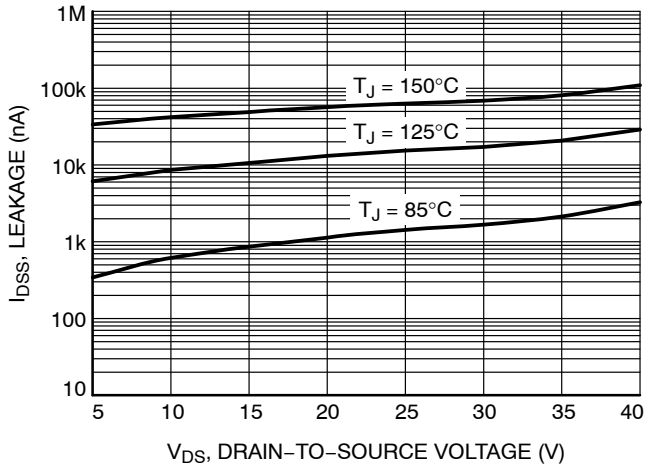


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

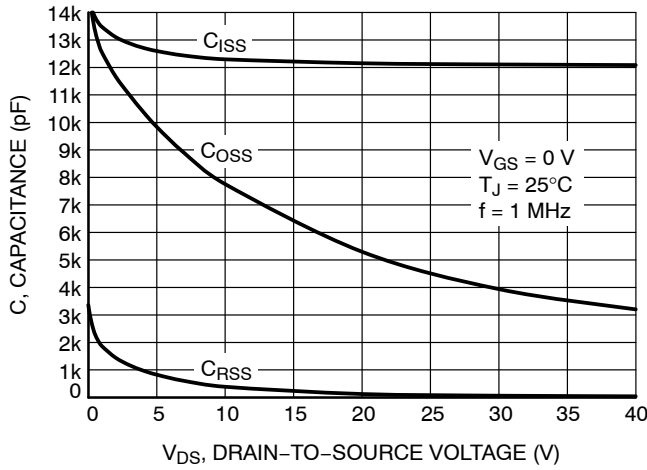


Figure 7. Capacitance Variation

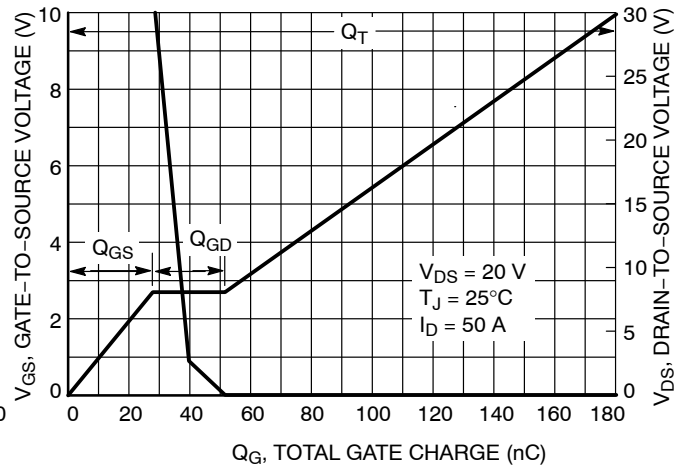


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

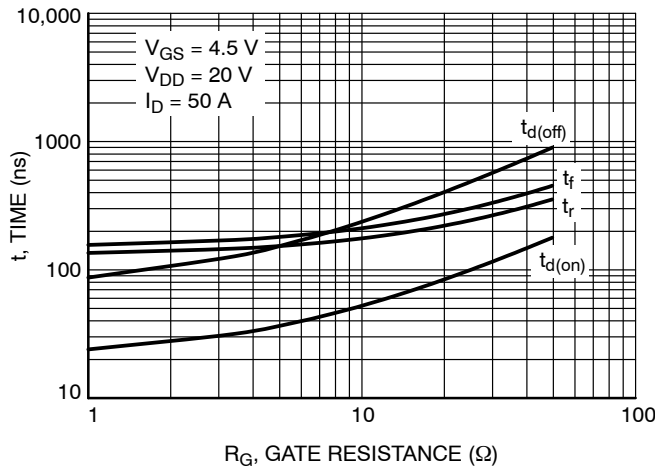


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

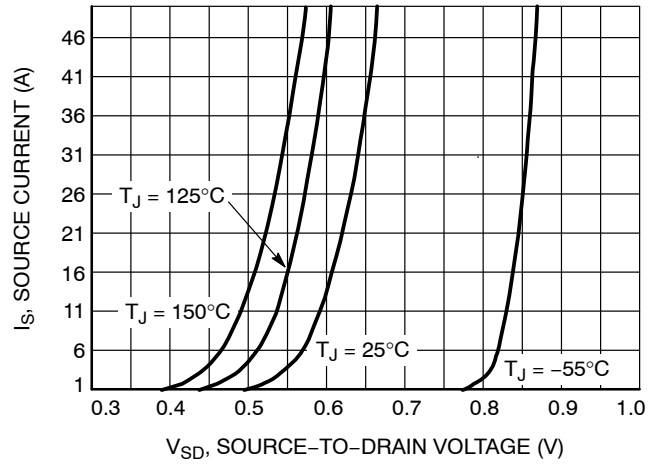


Figure 10. Diode Forward Voltage vs. Current

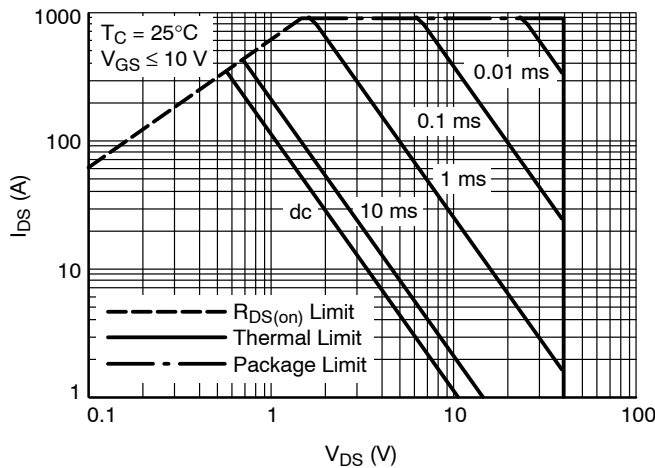


Figure 11. Safe Operating Area

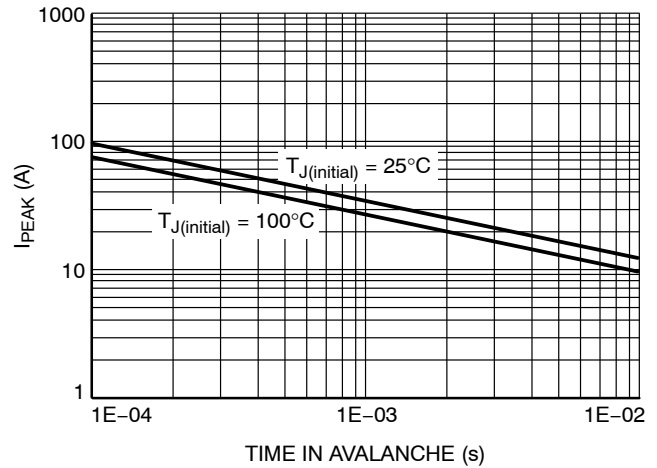
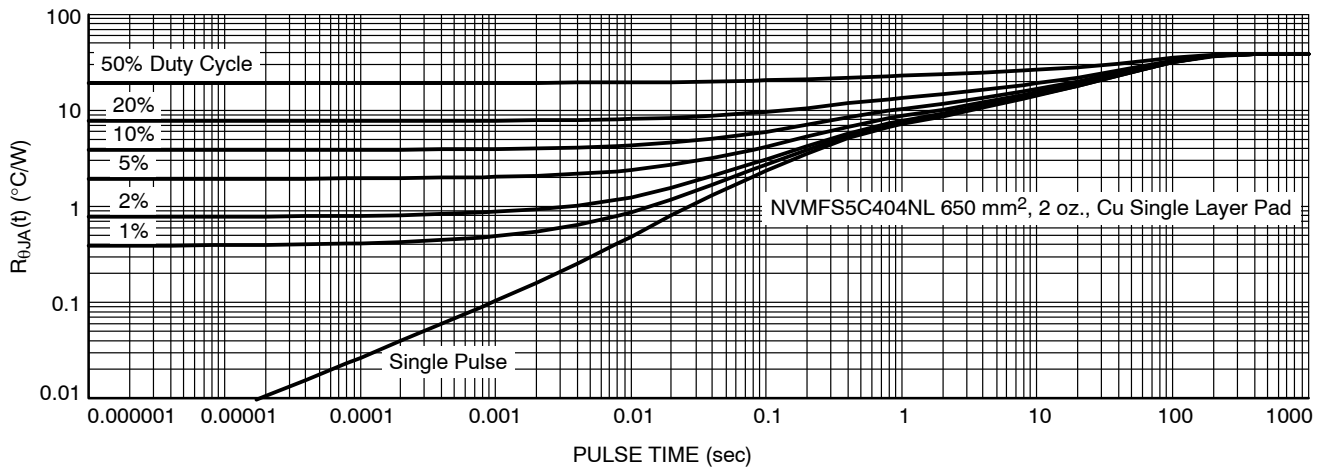


Figure 12. I_{PEAK} vs. Time in Avalanche

NVMFS5C404NL



DEVICE ORDERING INFORMATION

Device	Case	Marking	Package	Shipping [†]
NVMFS5C404NLT1G	506EZ	5C404L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NLWFT1G	507BA	404LWF	DFN5 (Pb-Free, Wettable Flanks)	1500 / Tape & Reel
NVMFS5C404NLT3G	506EZ	5C404L	DFN5 (Pb-Free)	5000 / Tape & Reel
NVMFS5C404NLWFT3G	507BA	404LWF	DFN5 (Pb-Free, Wettable Flanks)	5000 / Tape & Reel
NVMFS5C404NLAFT1G	506EZ	5C404L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NLWFAFT1G	507BA	404LWF	DFN5 (Pb-Free, Wettable Flanks)	1500 / Tape & Reel
NVMFS5C404NLAFT3G	506EZ	5C404L	DFN5 (Pb-Free)	5000 / Tape & Reel
NVMFS5C404NLWFAFT3G	507BA	404LWF	DFN5 (Pb-Free, Wettable Flanks)	5000 / Tape & Reel
NVMFS5C404NLWFET3G	507BA	404LWF	DFN5 (Pb-Free, Wettable Flanks)	5000 / Tape & Reel

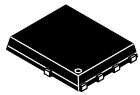
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®

ON



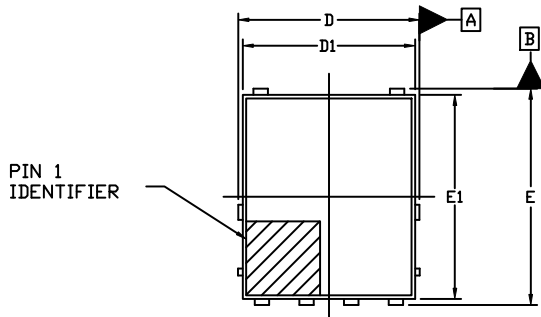
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DFN5 5x6, 1.27P (SO-8FL)

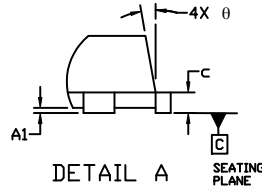
CASE 506EZ

ISSUE A

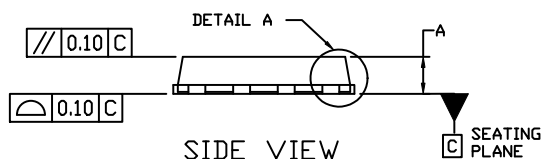
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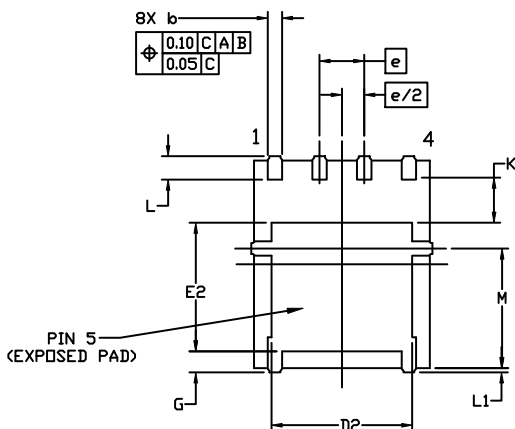
TOP VIEW



DETAIL A

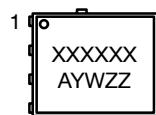


SIDE VIEW



BOTTOM VIEW

GENERIC MARKING DIAGRAM*

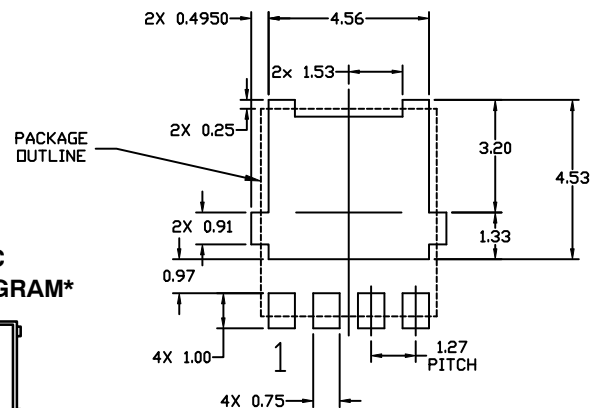


XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*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.

- 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.

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
θ	0°	---	12°



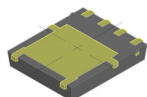
RECOMMENDED MOUNTING FOOTPRINT

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

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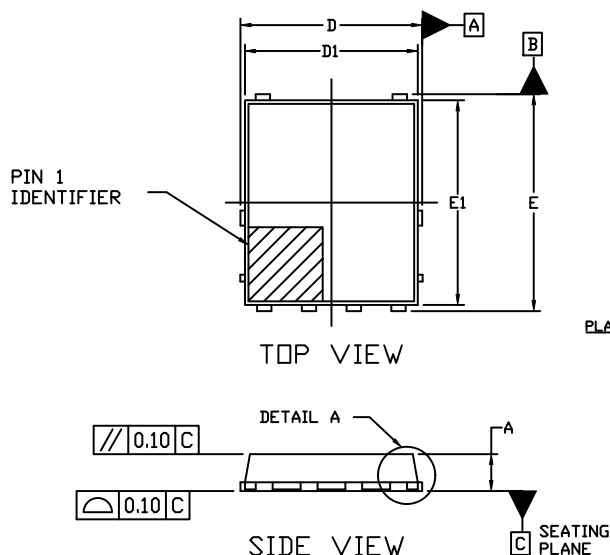
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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



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

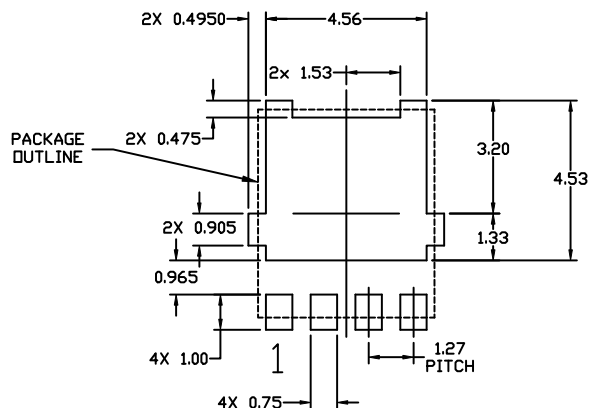
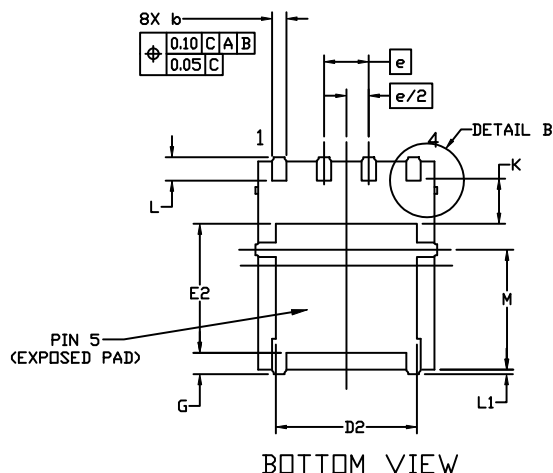
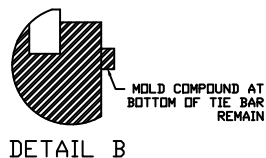
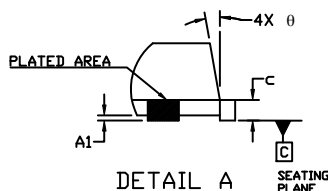
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3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. THIS PACKAGE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.

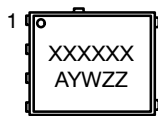
MILLIMETERS			
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E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
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M	3.00	3.40	3.80
θ	0°	---	12°



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