

MOSFET – Power, Single N-Channel

40 V, 0.82 mΩ, 330 A

NVMFS5C410NL

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
- NVMFS5C410NLWF – 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)

Symbol	Parameter	Value	Unit
V_{DS}	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)	Steady State $T_C = 25^\circ\text{C}$: 330 $T_C = 100^\circ\text{C}$: 230	A
P_D	Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State $T_C = 25^\circ\text{C}$: 167 $T_C = 100^\circ\text{C}$: 83	W
I_D	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State $T_A = 25^\circ\text{C}$: 50 $T_A = 100^\circ\text{C}$: 35	A
P_D	Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State $T_A = 25^\circ\text{C}$: 3.8 $T_A = 100^\circ\text{C}$: 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)	169	A
E_{AS}	Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 29 \text{ A}$)	706	mJ
T_L	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	260	$^\circ\text{C}$

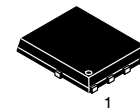
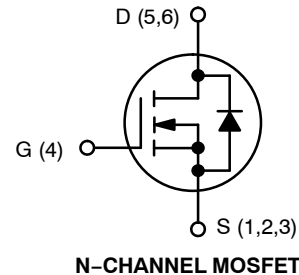
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State	0.9	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	39	

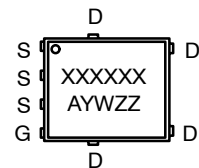
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	0.82 mΩ @ 10 V	330 A
	1.2 mΩ @ 4.5 V	



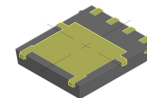
DFN5
(SO-8FL)
CASE 488AA
STYLE 1

MARKING DIAGRAMS

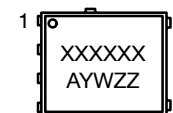


XXXXXX = 5C410L
(NVMFS5C410NL) or
410LWF
(NVMFS5C410NLWF)

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



DFNW5
(SO-8FL WF)
CASE 507BE



XXXXXX = Specific Device Code
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.

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

NVMFS5C410NL

ELECTRICAL CHARACTERISTICS (T_J = 25°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 V, I _D = 250 μA	40			V
V _{(BR)DSS} /T _J	Drain-to-Source Breakdown Voltage Temperature Coefficient			21.2		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} = 0 V, V _{DS} = 40 V	T _J = 25°C T _J = 125°C		10 250	μA
I _{GSS}	Gate-to-Source Leakage Current	V _{DS} = 0 V, V _{GS} = 20 V			100	nA

ON CHARACTERISTICS (Note 4)

V _{GS(TH)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 250 μA	1.2		2.0	V
V _{GS(TH)} /T _J	Threshold Temperature Coefficient			-5.75		mV/°C
R _{DS(on)}	Drain-to-Source On Resistance	V _{GS} = 10 V V _{GS} = 4.5 V	I _D = 50 A I _D = 50 A	0.65 0.95	0.82 1.2	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 15 V, I _D = 50 A		190		S

CHARGES, CAPACITANCES & GATE RESISTANCE

C _{ISS}	Input Capacitance	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 25 V		8862		pF
C _{OSS}	Output Capacitance			4156		
C _{RSS}	Reverse Transfer Capacitance			116		
Q _{G(TOT)}	Total Gate Charge	V _{GS} = 4.5 V, V _{DS} = 20 V; I _D = 50 A		66		nC
Q _{G(TOT)}	Total Gate Charge	V _{GS} = 10 V, V _{DS} = 20 V; I _D = 50 A		143		
Q _{G(TH)}	Threshold Gate Charge	V _{GS} = 4.5 V, V _{DS} = 20 V; I _D = 50 A		6.75		
Q _{GS}	Gate-to-Source Charge			21.4		
Q _{GD}	Gate-to-Drain Charge			22		
V _{GP}	Plateau Voltage			2.7		V

SWITCHING CHARACTERISTICS (Note 5)

t _{d(ON)}	Turn-On Delay Time	V _{GS} = 4.5 V, V _{DS} = 20 V, I _D = 50 A, R _G = 1.0 Ω		20		ns
t _r	Rise Time			130		
t _{d(OFF)}	Turn-Off Delay Time			66		
t _f	Fall Time			177		

DRAIN-SOURCE DIODE CHARACTERISTICS

V _{SD}	Forward Diode Voltage	V _{GS} = 0 V, I _S = 50 A	T _J = 25°C T _J = 125°C		0.73 0.6	1.2	V
t _{RR}	Reverse Recovery Time	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 50 A			79.5		ns
t _a	Charge Time				39		
t _b	Discharge Time				40.5		
Q _{RR}	Reverse Recovery Charge				126		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 ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

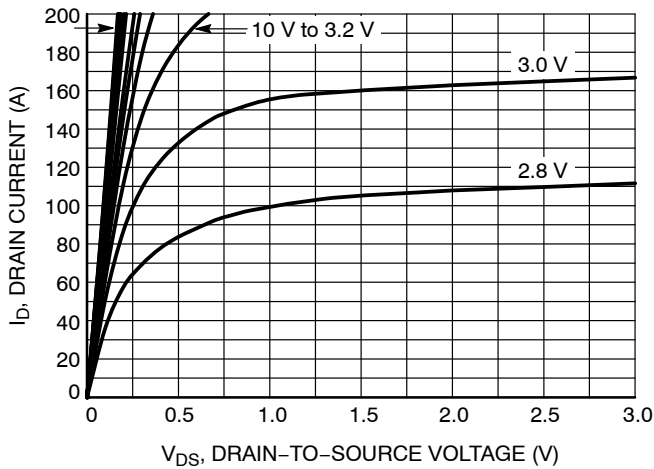


Figure 1. On-Region Characteristics

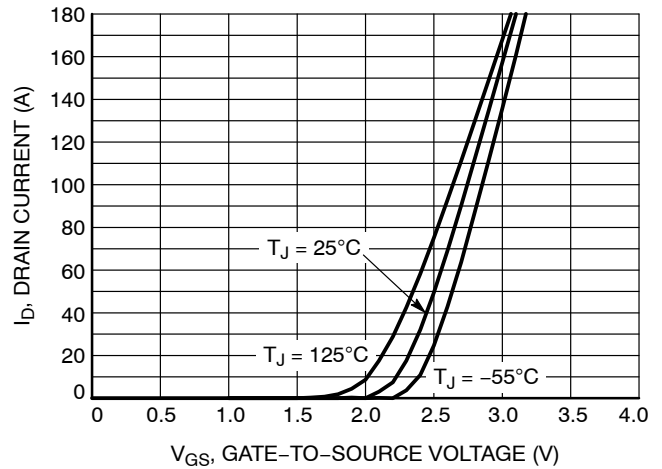


Figure 2. Transfer Characteristics

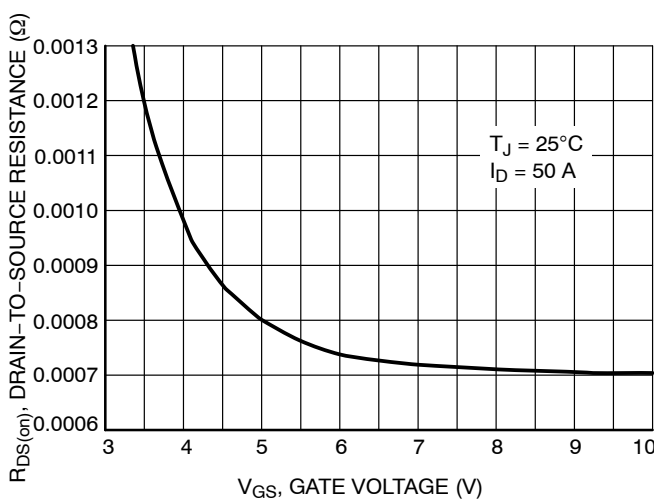


Figure 3. On-Resistance vs. Gate-to-Source Voltage

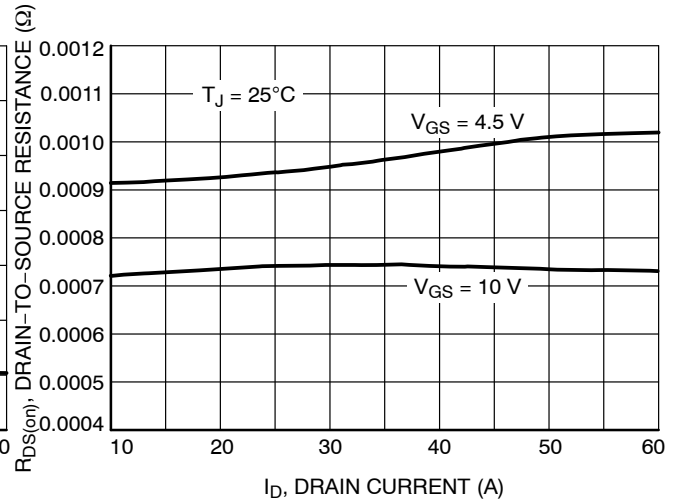


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

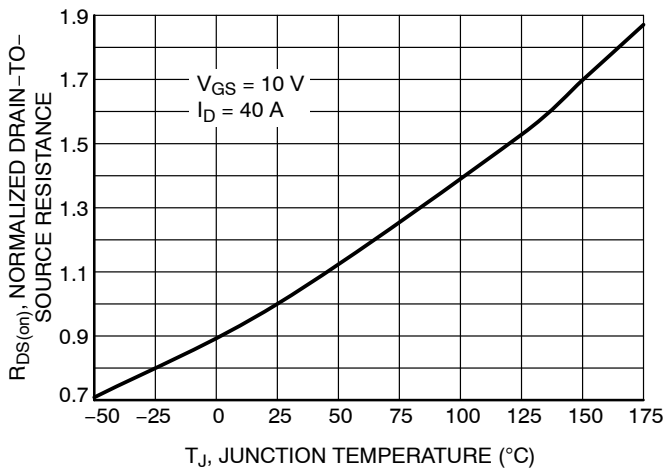


Figure 5. On-Resistance Variation with Temperature

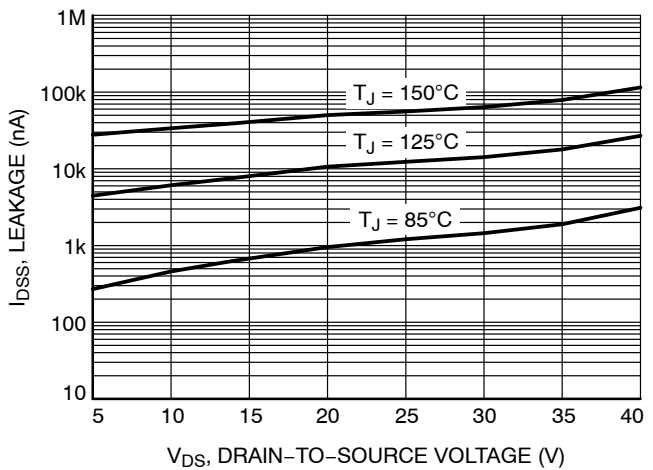


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NVMFS5C410NL

TYPICAL CHARACTERISTICS (continued)

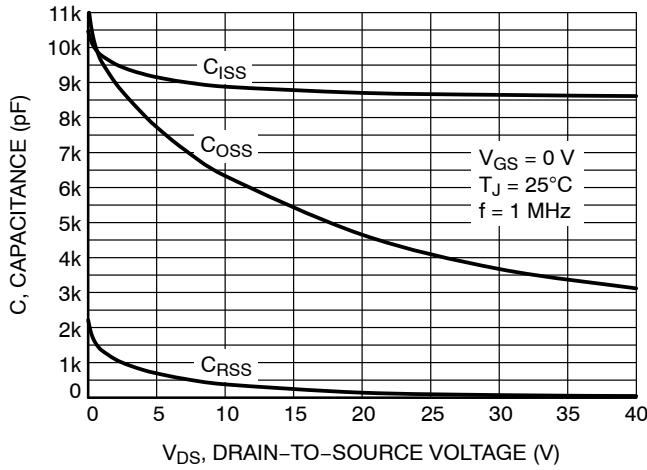


Figure 7. Capacitance Variation

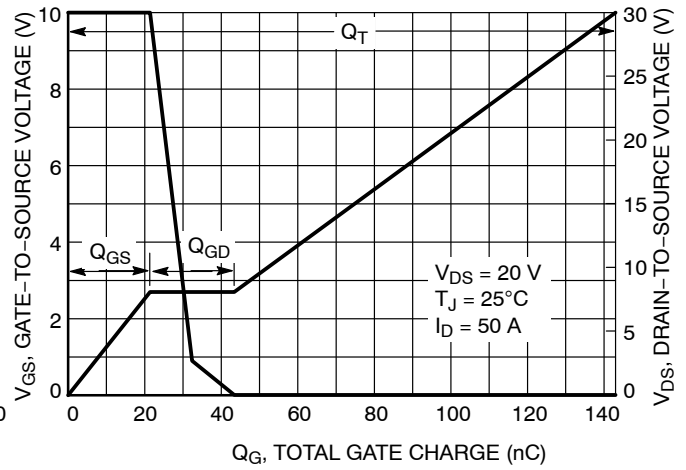


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

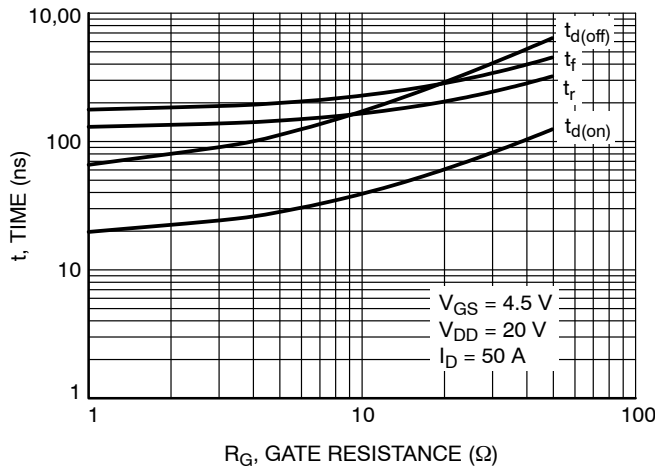


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

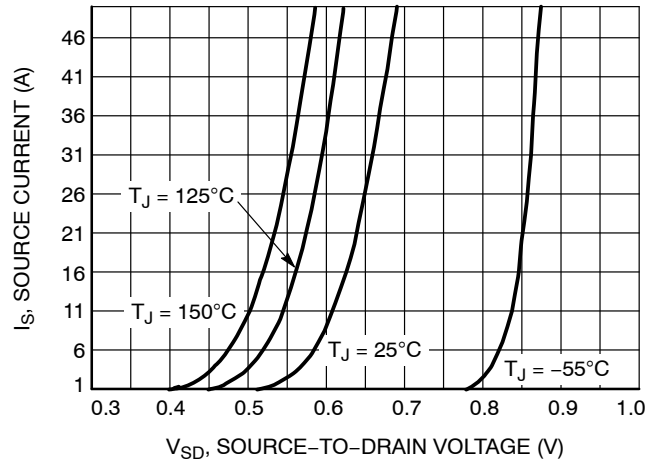


Figure 10. Diode Forward Voltage vs. Current

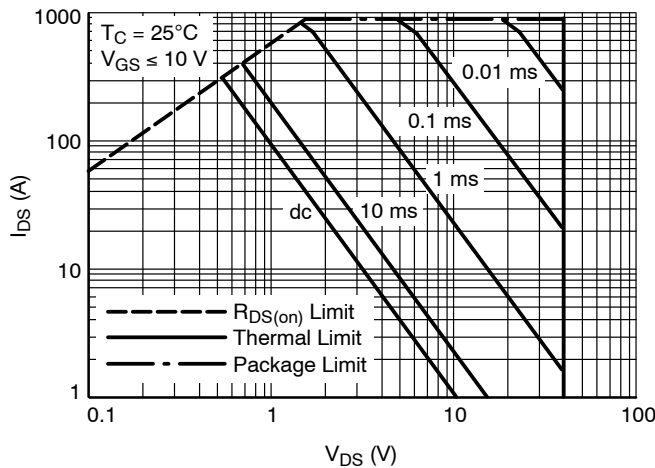


Figure 11. Safe Operating Area

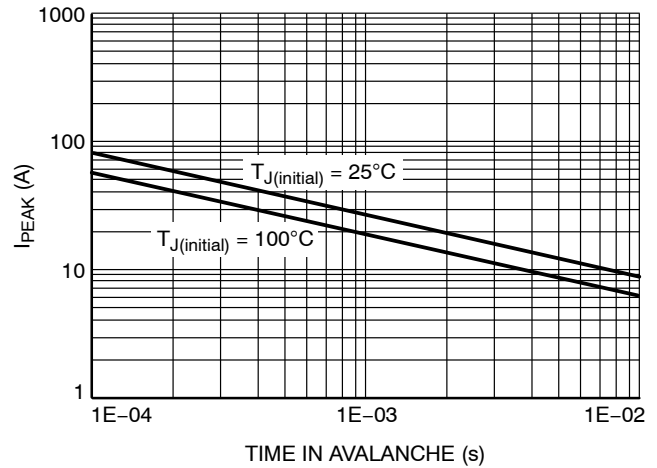


Figure 12. I_{PEAK} vs. Time in Avalanche

NVMFS5C410NL

TYPICAL CHARACTERISTICS (continued)

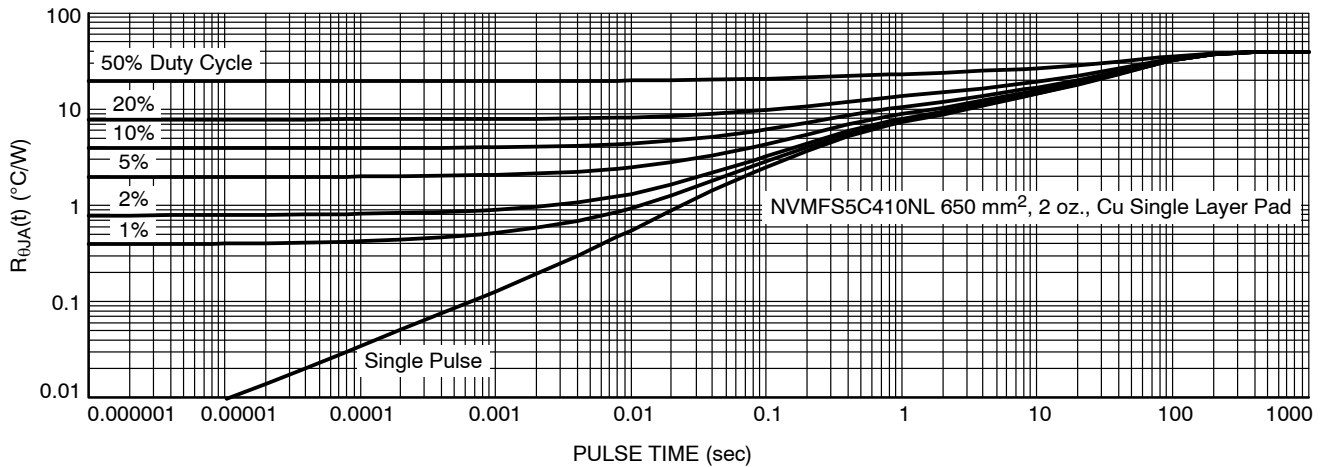


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

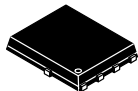
Device	Marking	Package	Shipping [†]
NVMFS5C410NLT1G	5C410L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C410NLWFT1G	410LWF	DFNW5 (Pb-Free, Wettable Flanks, Full-cut SO-8FL WF)	1500 / Tape & Reel
NVMFS5C410NLWFT3G	410LWF	DFNW5 (Pb-Free, Wettable Flanks, Full-cut SO-8FL WF)	5000 / Tape & Reel
NVMFS5C410NLAFT1G	5C410L	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C410NLWFAFT1G	410LWF	DFNW5 (Pb-Free, Wettable Flanks, Full-cut SO-8FL WF)	1500 / Tape & Reel
NVMFS5C410NLWFET1G	410LWF	DFNW5 (Full-cut SO-8FL WF)	1500 / Tape & Reel
NVMFS5C410NLWFET3G	410LWF	DFNW5 (Full-cut SO-8FL WF)	5000 / Tape & Reel

DISCONTINUED (Note 6)

NVMFS5C410NLT3G	5C410L	DFN5 (Pb-Free)	5000 / Tape & Reel
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[†]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](#).

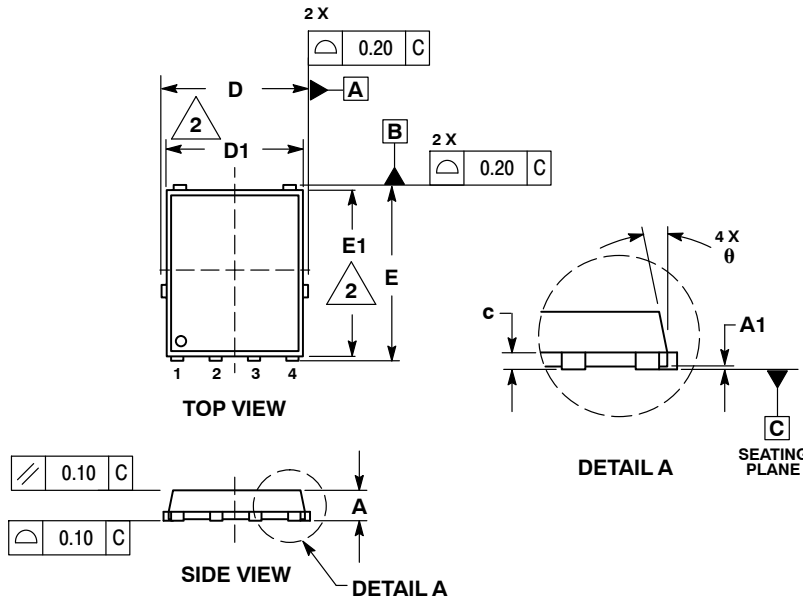
6. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.



SCALE 2:1

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

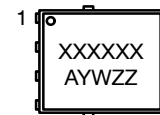
DATE 25 JUN 2018



NOTES:

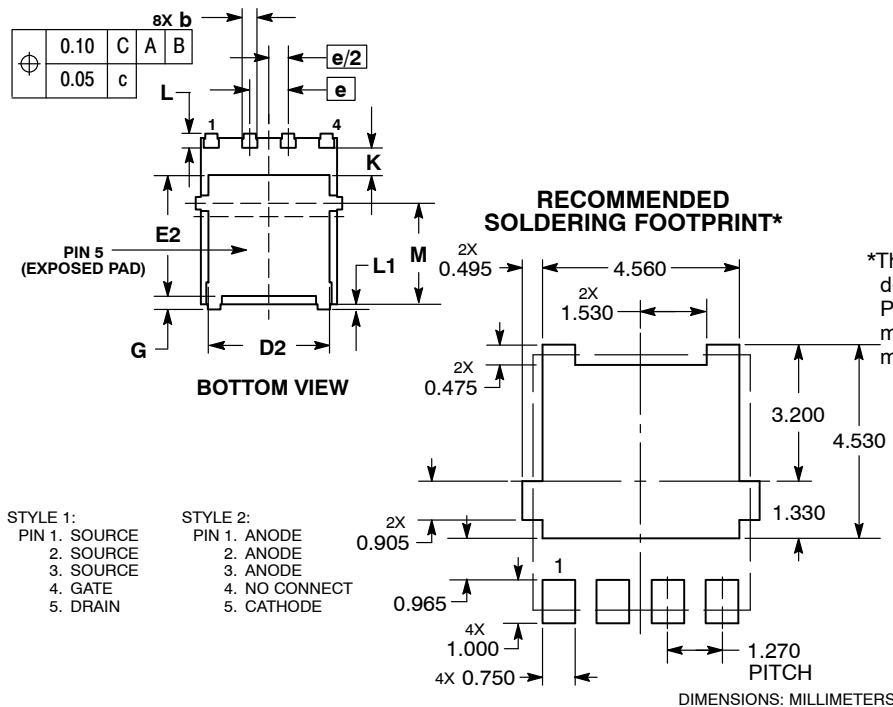
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

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.



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

DOCUMENT NUMBER:	98AON14036D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	DFN5 5x6, 1.27P (SO-8FL)	PAGE 1 OF 1

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