NTMFS4120N

Power MOSFET

30 V, 31 A, Single N−Channel, SO−8 Flat Lead

Features

- Low $R_{DS(on)}$
- Optimized Gate Charge
- Low Inductance SO−8 Package
- These are Pb−Free Devices

Applications

- Notebooks, Graphics Cards
- DC−DC Converters
- Synchronous Rectification

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	I_D Max (Note 1)
30 V	3.5 mΩ @ 10 V	31 A
	4.2 mΩ @ 4.5 V	

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	18	A
		T_A = 85°C		13	
	t ≤ 10 s	T_A = 25°C		31	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	2.2	W
	t ≤ 10 s			6.9	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	11	A
		T_A = 85°C		8.0	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.9	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	94	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 150	°C
Source Current (Body Diode)			I_S	7.0	A
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 30 V, V_{GS} = 10 V, I_{PK} = 30 A, L = 1 mH, R_G = 25 Ω)			E_{AS}	450	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case – Steady State	$R_{θJC}$	1.7	°C/W
Junction−to−Ambient – Steady State (Note 1)	$R_{θJA}$	55.8	
Junction−to−Ambient – t ≤ 10 s (Note 1)	$R_{θJA}$	18	
Junction−to−Ambient – Steady State (Note 2)	$R_{θJA}$	139.1	

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
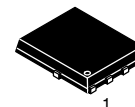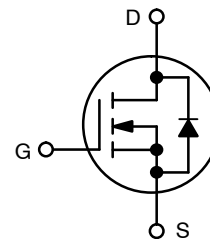1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
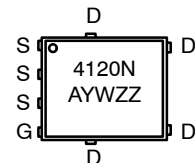2. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 1.0 in sq).

SO−8 FLAT LEAD CASE 488AA STYLE 1

MARKING DIAGRAM

```
S  o  D
S     D
S  4120N
G  AYWZZ  D
      D
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4120N = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping[†]
NTMFS4120NT1G	SO−8 FL (Pb−Free)	1500 Tape & Reel
NTMFS4120NT3G	SO−8 FL (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 Specification Brochure, BRD8011/D.

Publication Order Number:
NTMFS4120N/D

NTMFS4120N

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		30			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				21		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 24 V	T_J = 25°C			1.0	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = 20 V				100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				7.4		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 26 A			3.5	4.5	mΩ
		V_{GS} = 4.5 V, I_D = 24 A			4.2	5.5	
Forward Transconductance	g_{FS}	V_{DS} = 15 V, I_D = 26 A			35		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 24 V			3600		pF
Output Capacitance	C_{OSS}				640		
Reverse Transfer Capacitance	C_{RSS}				380		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 24 A			33	50	nC
Threshold Gate Charge	$Q_{G(TH)}$				4.4		
Gate−to−Source Charge	Q_{GS}				13		
Gate−to−Drain Charge	Q_{GD}				14		
Gate Resistance	R_G				1.0		Ω
SWITCHING CHARACTERISTICS (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 1.0 A, R_G = 3.0 Ω			24		ns
Rise Time	t_r				32		
Turn−Off Delay Time	$t_{d(OFF)}$				27		
Fall Time	t_f				31		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 6.0 A	T_J = 25°C		0.74	1.0	V
			T_J = 125°C		0.6		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = 6.0 A			36		ns
Charge Time	t_a				18		
Discharge Time	t_b				18		
Reverse Recovery Charge	Q_{RR}				34		nC

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.
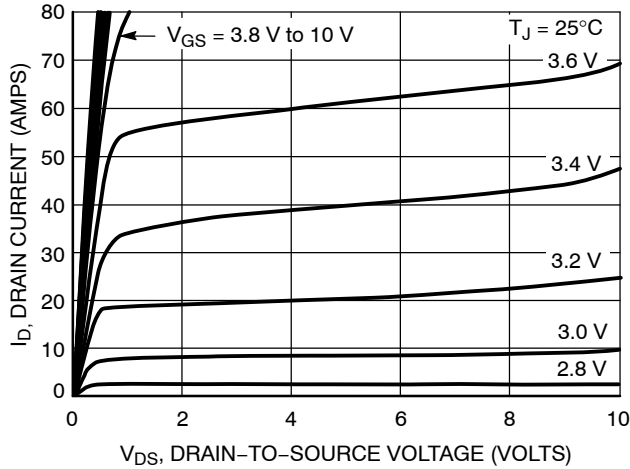
NTMFS4120N

TYPICAL PERFORMANCE CURVES

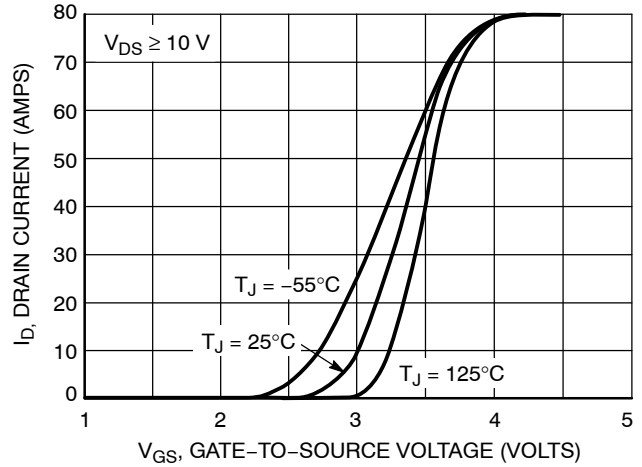Figure 1. On−Region Characteristics

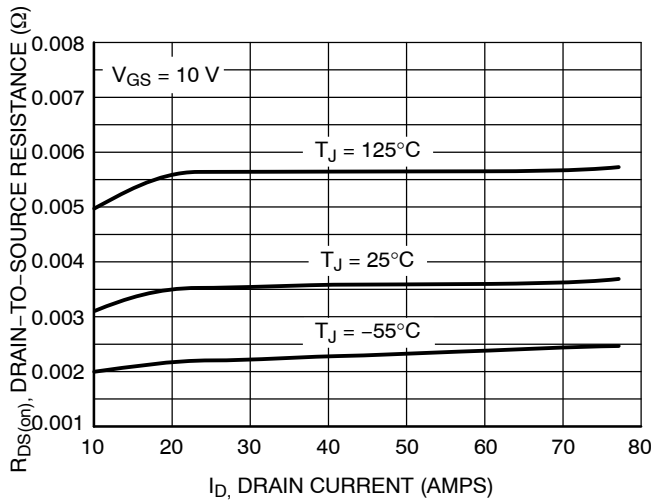Figure 2. Transfer Characteristics

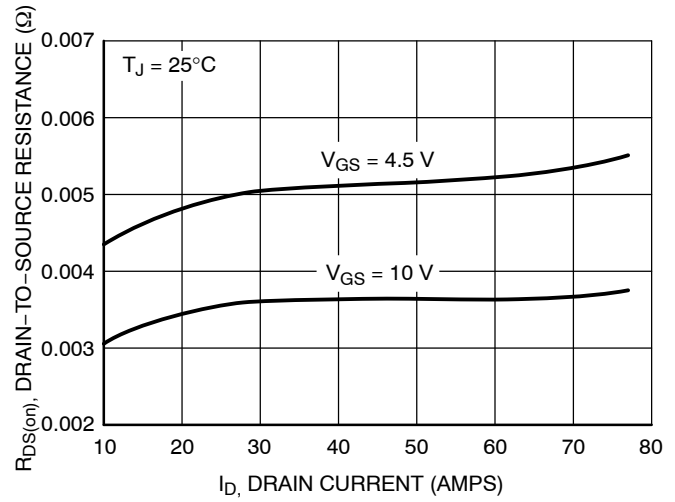Figure 3. On−Resistance vs. Drain Current and Temperature

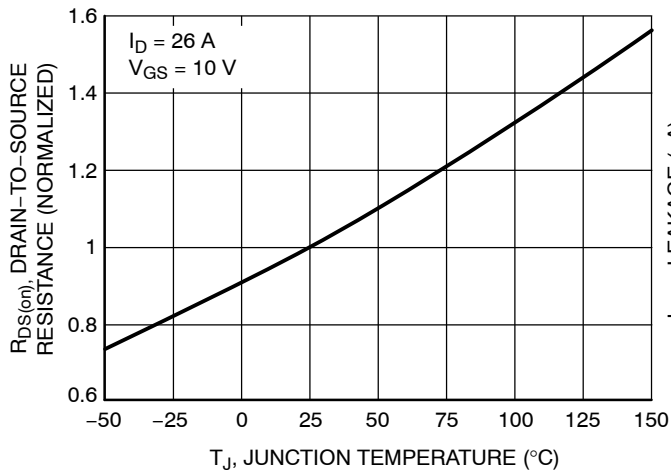Figure 4. On−Resistance vs. Drain Current and Gate Voltage

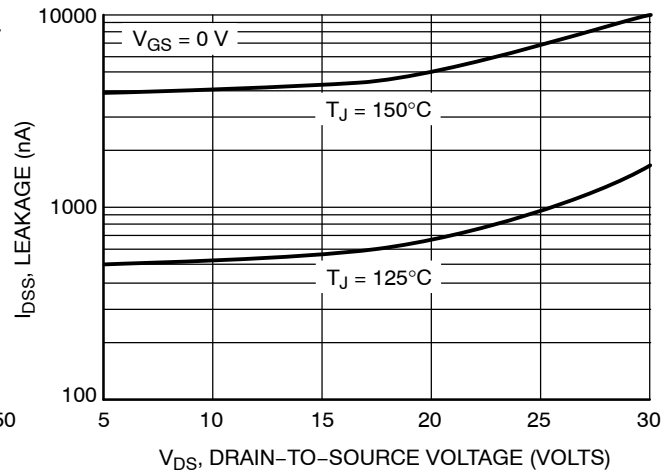Figure 5. On−Resistance Variation with Temperature

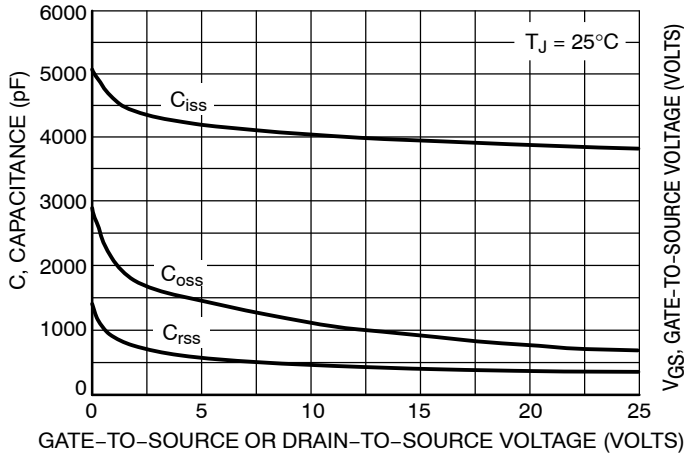Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

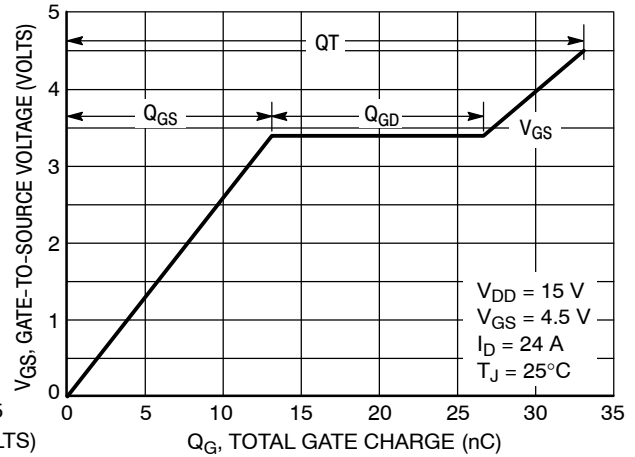

Figure 7. Capacitance Variation
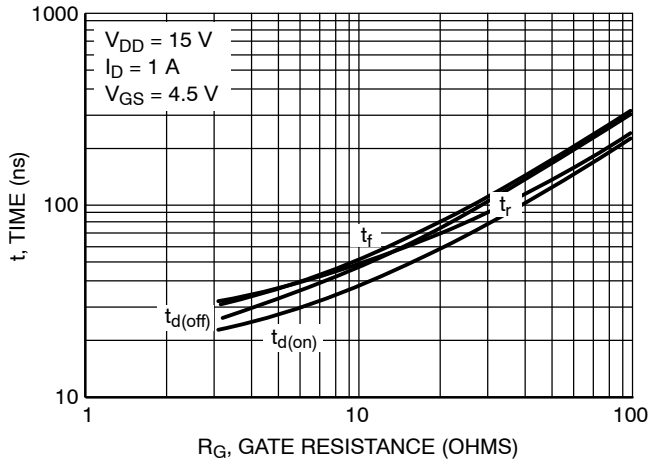

**Figure 8. Gate−To−Source and
Drain−To−Source Voltage vs. Total Charge**

**Figure 9. Resistive Switching Time
Variation vs. Gate Resistance**
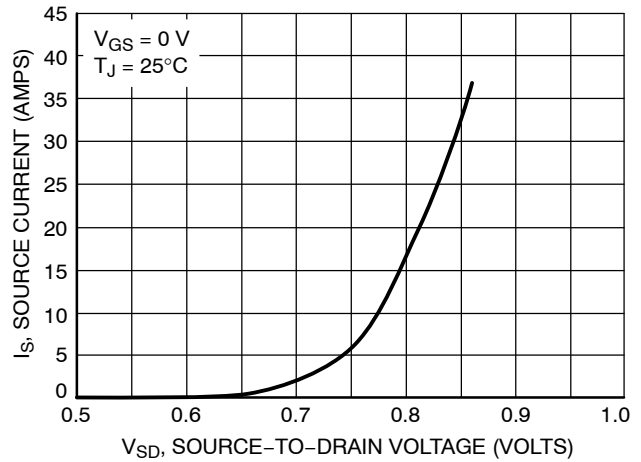
Figure 10. Diode Forward Voltage vs. Current
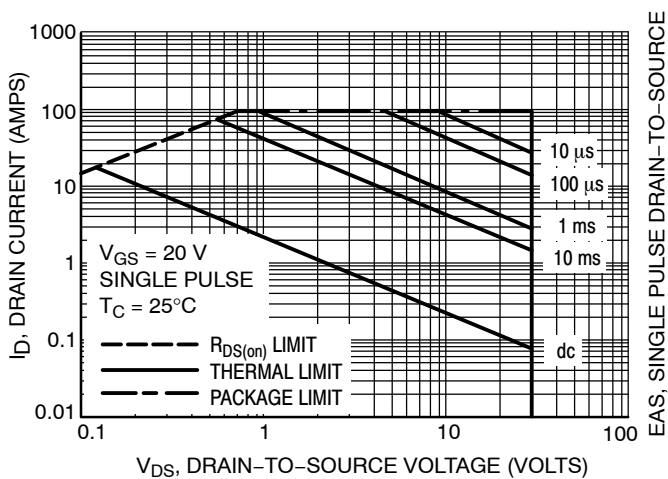
**Figure 11. Maximum Rated Forward Biased
Safe Operating Area**
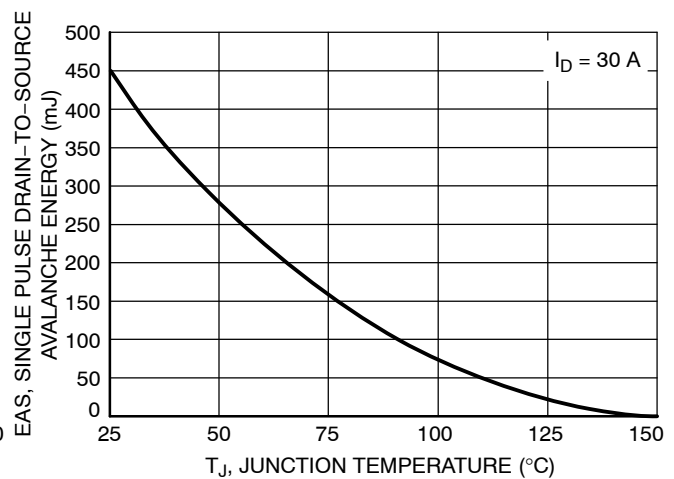
**Figure 12. Maximum Avalanche Energy vs
Starting Junction Temperature**

NTMFS4120N
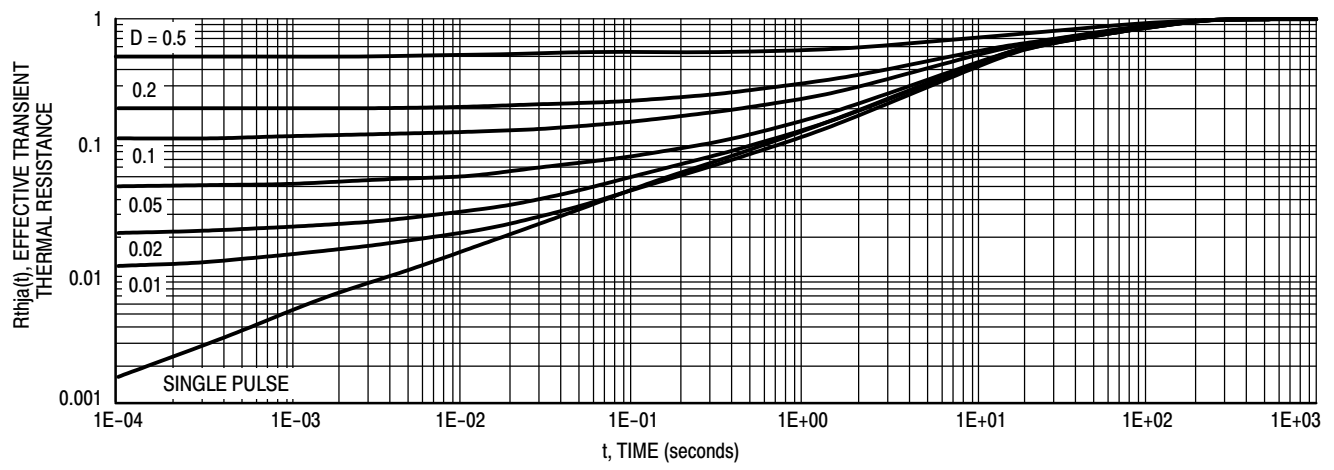
Figure 13. Thermal Response

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

SCALE 2:1

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.

2 X

| | 0.20 | C |

D

| | A |

B 2 X

| | 0.20 | C |

E1

E

4 X
θ

c

A1

DETAIL A

SEATING PLANE

| | C |

TOP VIEW

| | 0.10 | C |

A

| | 0.10 | C |

SIDE VIEW

DETAIL A

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
AYWZZ

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.

8X b

| | 0.10 | C | A | B |
| | 0.05 | c | | |

e/2

e

L

K

1

4

E2

PIN 5
(EXPOSED PAD)

L1 M

G

D2

BOTTOM VIEW

RECOMMENDED SOLDERING FOOTPRINT*

2X
0.495

4.560

2X
1.530

2X
0.475

3.200

4.530

2X
0.905

1.330

1

0.965

4X
1.000

4X 0.750

1.270
PITCH

DIMENSIONS: MILLIMETERS
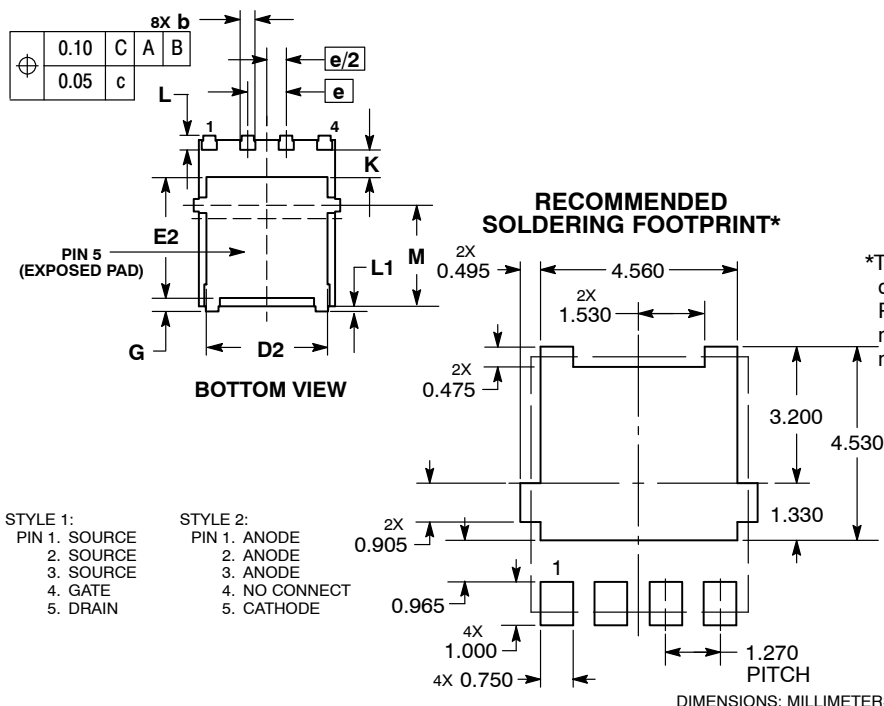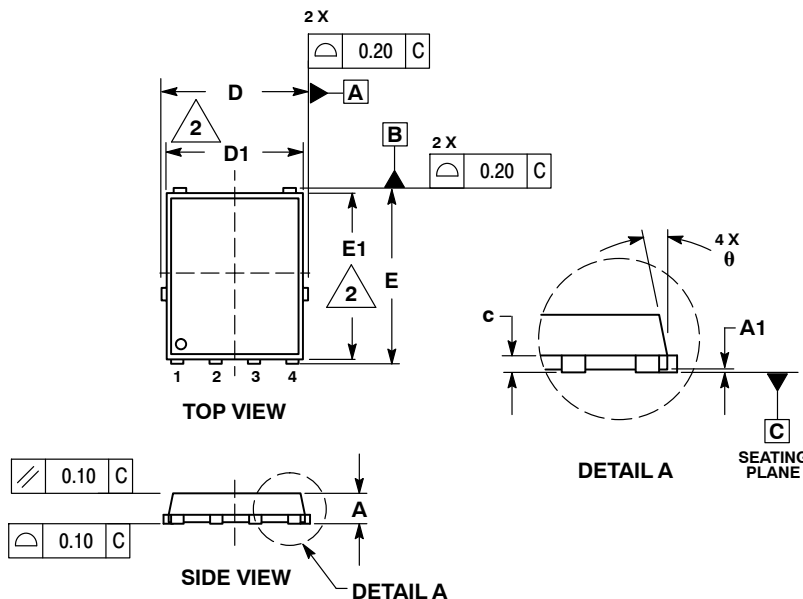
STYLE 1:
PIN 1. SOURCE
    2. SOURCE
    3. SOURCE
    4. GATE
    5. DRAIN

STYLE 2:
PIN 1. ANODE
    2. ANODE
    3. ANODE
    4. NO CONNECT
    5. CATHODE

*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 5x6, 1.27P (SO−8FL)**		**PAGE 1 OF 1**

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