

NTF5P03, NVF5P03

Power MOSFET -5.2 A, -30 V

P-Channel SOT-223

Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature SOT-223 Surface Mount Package
- Avalanche Energy Specified
- AEC-Q101 Qualified and PPAP Capable – NVF5P03T3G
- These Devices are Pb-Free and are RoHS Compliant

Applications

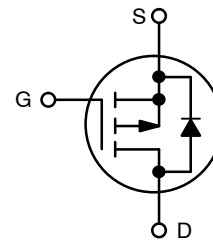
- DC-DC Converters
- Power Management
- Motor Controls
- Inductive Loads
- Replaces MMFT5P03HD



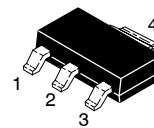
ON Semiconductor®

<http://onsemi.com>

-5.2 AMPERES, -30 VOLTS
 $R_{DS(on)} = 100 \text{ m}\Omega$

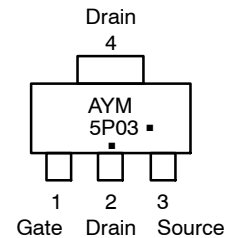


P-Channel MOSFET



**SOT-223
CASE 318E
STYLE 3**

MARKING DIAGRAM & PIN ASSIGNMENT



- A = Assembly Location
- Y = Year
- M = Date Code
- 5P03 = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTF5P03T3G	SOT-223 (Pb-Free)	4000 / Tape & Reel
NVF5P03T3G	SOT-223 (Pb-Free)	4000 / 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.

NTF5P03, NVF5P03

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

Negative sign for P-Channel devices omitted for clarity

Rating		Symbol	Max	Unit
Drain-to-Source Voltage		V_{DSS}	-30	V
Drain-to-Gate Voltage ($R_{GS} = 1.0\text{ M}\Omega$)		V_{DGR}	-30	V
Gate-to-Source Voltage - Continuous		V_{GS}	± 20	V
1 sq in FR-4 or G-10 PCB 10 seconds	Thermal Resistance - Junction to Ambient	R_{THJA}	40	$^\circ\text{C}/\text{W}$
	Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	3.13	Watts
	Linear Derating Factor		25	$\text{mW}/^\circ\text{C}$
	Drain Current - Continuous @ $T_A = 25^\circ\text{C}$	I_D	-5.2	A
Minimum FR-4 or G-10 PCB 10 seconds	Continuous @ $T_A = 70^\circ\text{C}$	I_D	-4.1	A
	Pulsed Drain Current (Note 1)	I_{DM}	-26	A
	Thermal Resistance - Junction to Ambient	R_{THJA}	80	$^\circ\text{C}/\text{W}$
	Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	1.56	Watts
	Linear Derating Factor		12.5	$\text{mW}/^\circ\text{C}$
	Drain Current - Continuous @ $T_A = 25^\circ\text{C}$	I_D	-3.7	A
	Continuous @ $T_A = 70^\circ\text{C}$	I_D	-2.9	A
	Pulsed Drain Current (Note 1)	I_{DM}	-19	A
Operating and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = -30\text{ Vdc}$, $V_{GS} = -10\text{ Vdc}$, Peak $I_L = -12\text{ Apk}$, $L = 3.5\text{ mH}$, $R_G = 25\ \Omega$)		E_{AS}	250	mJ

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. Repetitive rating; pulse width limited by maximum junction temperature.

NTF5P03, NVF5P03

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-to-Source Breakdown Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V _{GS} = 0 Vdc, I _D = -250 μAdc) Temperature Coefficient (Positive)	V _{(BR)DSS}	-30	-	-	Vdc
		-	-28	-	mV/°C
Zero Gate Voltage Drain Current (V _{DS} = -24 Vdc, V _{GS} = 0 Vdc) (V _{DS} = -24 Vdc, V _{GS} = 0 Vdc, T _J = 125°C)	I _{DSS}	-	-	-1.0	μAdc
		-	-	-25	
Gate-Body Leakage Current (V _{GS} = ± 20 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	-	-	± 100	nAdc

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage (Cpk ≥ 2.0) (Notes 2 and 4) (V _{DS} = V _{GS} , I _D = -250 μAdc) Threshold Temperature Coefficient (Negative)	V _{GS(th)}	-1.0	-1.75	-3.0	Vdc
		-	3.5	-	mV/°C
Static Drain-to-Source On-Resistance (Cpk ≥ 2.0) (Notes 2 and 4) (V _{GS} = -10 Vdc, I _D = -5.2 Adc) (V _{GS} = -4.5 Vdc, I _D = -2.6 Adc)	R _{DS(on)}	-	76	100	mΩ
			107	150	
Forward Transconductance (Note 2) (V _{DS} = -15 Vdc, I _D = -2.0 Adc)	g _{fs}	2.0	3.9	-	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	(V _{DS} = -25 Vdc, V _{GS} = 0 V, f = 1.0 MHz)	C _{iss}	-	500	950	pF
Output Capacitance		C _{oss}	-	153	440	
Transfer Capacitance		C _{rss}	-	58	140	

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	(V _{DD} = -15 Vdc, I _D = -4.0 Adc, V _{GS} = -10 Vdc, R _G = 6.0 Ω) (Note 2)	t _{d(on)}	-	10	24	ns
Rise Time		t _r	-	33	48	
Turn-Off Delay Time		t _{d(off)}	-	38	94	
Fall Time		t _f	-	20	92	
Turn-On Delay Time	(V _{DD} = -15 Vdc, I _D = -2.0 Adc, V _{GS} = -10 Vdc, R _G = 6.0 Ω) (Note 2)	t _{d(on)}	-	16	38	ns
Rise Time		t _r	-	45	110	
Turn-Off Delay Time		t _{d(off)}	-	23	60	
Fall Time		t _f	-	24	80	
Gate Charge	(V _{DS} = -24 Vdc, I _D = -4.0 Adc, V _{GS} = -10 Vdc) (Note 2)	Q _T	-	15	38	nC
		Q ₁	-	1.6	-	
		Q ₂	-	3.5	-	
		Q ₃	-	2.6	-	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I _S = -4.0 Adc, V _{GS} = 0 Vdc) (I _S = -4.0 Adc, V _{GS} = 0 Vdc, T _J = 125°C) (Note 2)	V _{SD}	-	-1.1	-1.5	Vdc
			-	-0.89	-	
Reverse Recovery Time	(I _S = -4.0 Adc, V _{GS} = 0 Vdc, di _S /dt = 100 A/μs) (Note 2)	t _{rr}	-	34	-	ns
		t _a	-	20	-	
		t _b	-	14	-	
Reverse Recovery Stored Charge		Q _{RR}	-	0.036	-	μC

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
3. Switching characteristics are independent of operating junction temperatures.
4. Reflects typical values.

$$Cpk = \left| \frac{\text{Max limit} - \text{Typ}}{3 \times \text{SIGMA}} \right|$$

TYPICAL ELECTRICAL CHARACTERISTICS

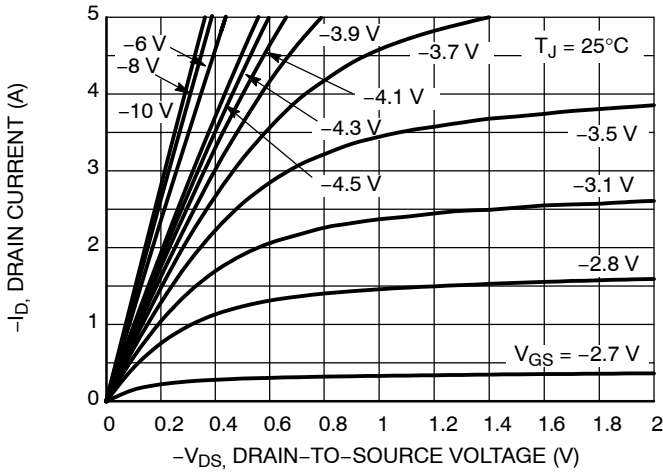


Figure 1. On-Region Characteristics

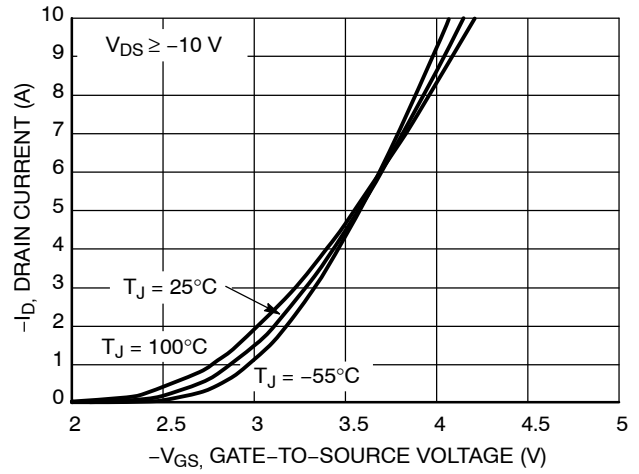


Figure 2. Transfer Characteristics

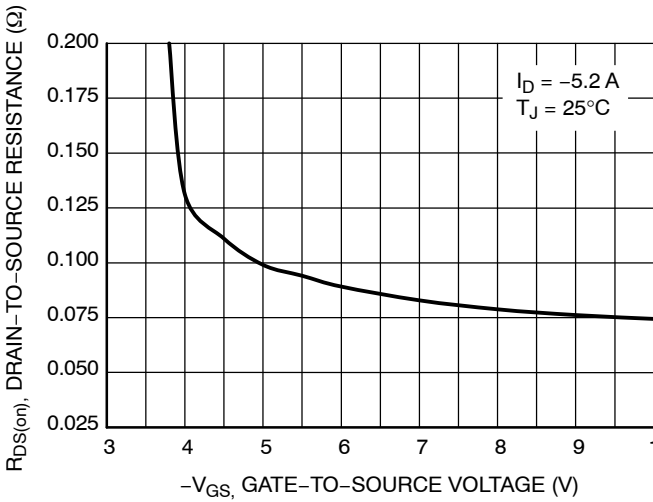


Figure 3. On-Resistance versus Gate-to-Source Voltage

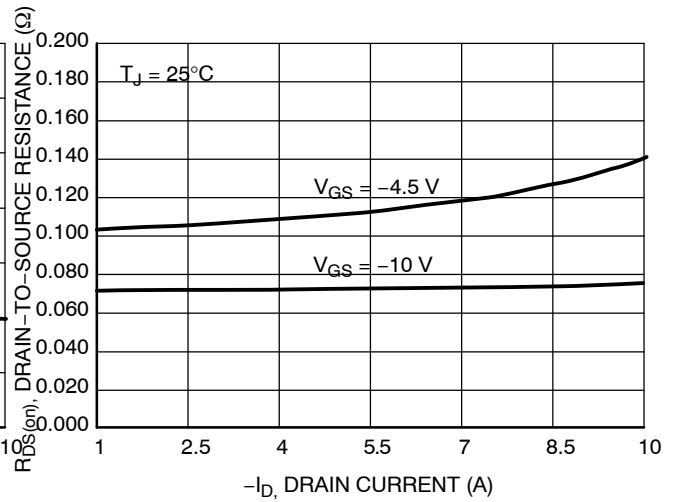


Figure 4. On-Resistance versus Drain Current and Gate Voltage

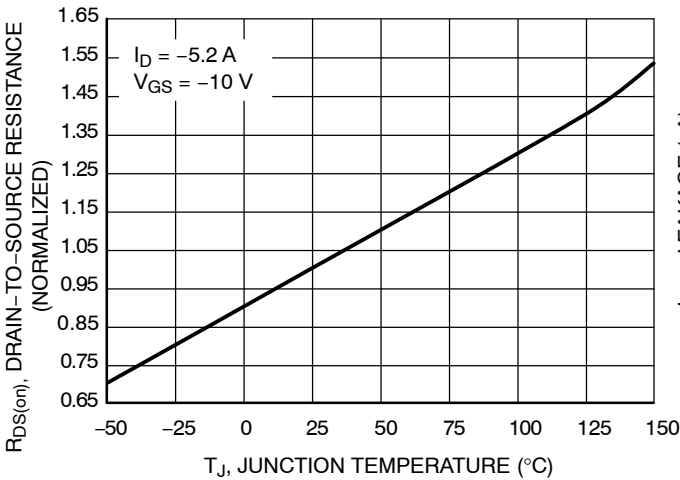


Figure 5. On-Resistance Variation with Temperature

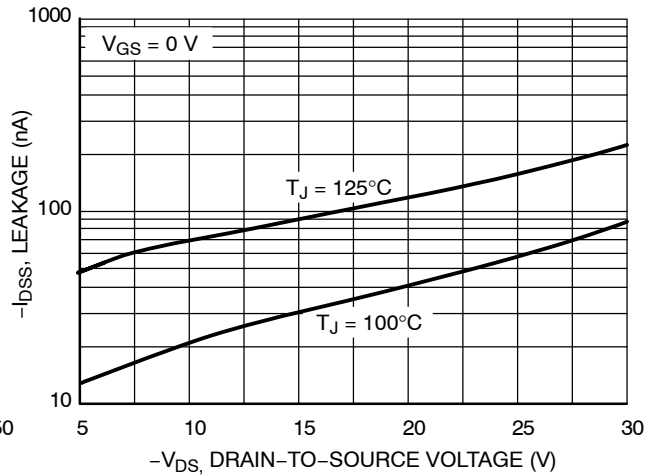


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTF5P03, NVF5P03

TYPICAL ELECTRICAL CHARACTERISTICS

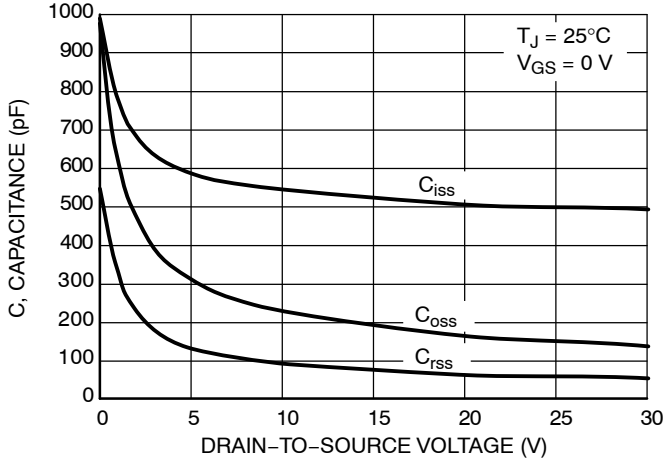


Figure 7. Capacitance Variation

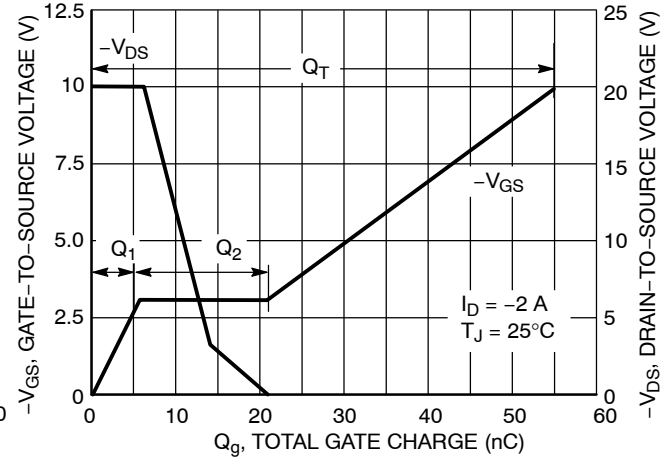


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

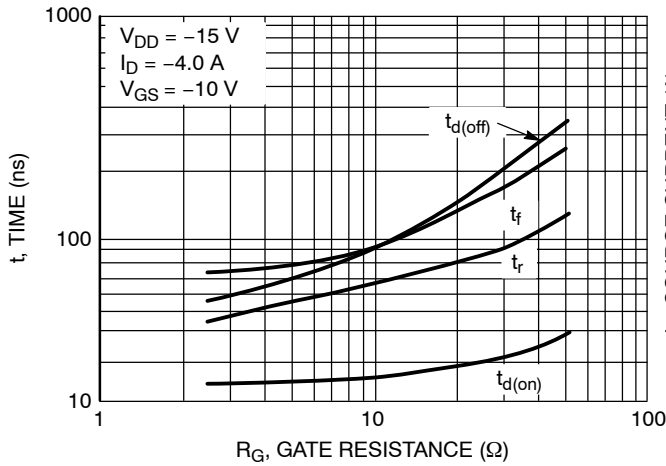


Figure 9. Resistive Switching Time Variation versus Gate Resistance

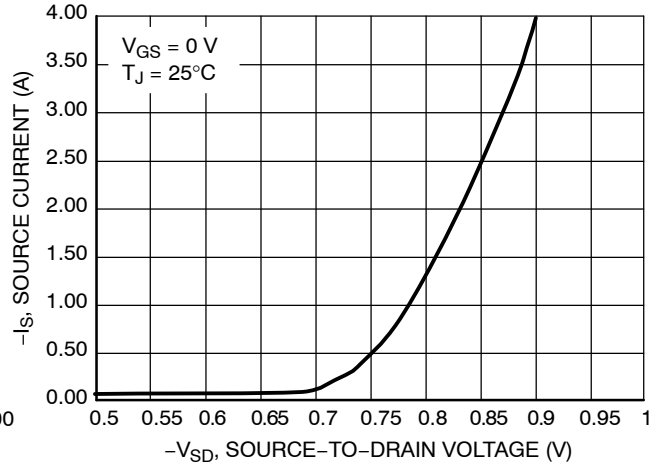
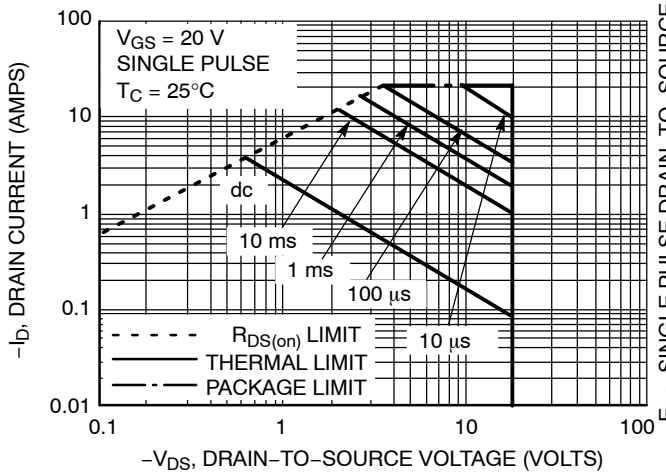


Figure 10. Diode Forward Voltage versus Current



Mounted on 2"sq. FR4 board (1"sq. 2 oz. Cu 0.06" thick single sided) with on die operating, 10 s max.

Figure 11. Maximum Rated Forward Biased Safe Operating Area

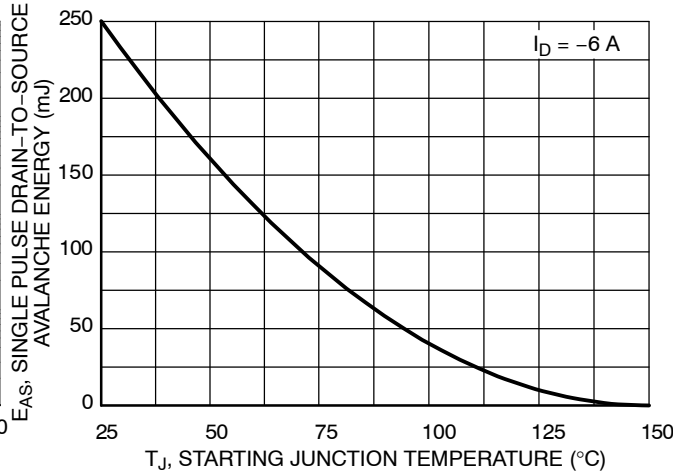


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

NTF5P03, NVF5P03

TYPICAL ELECTRICAL CHARACTERISTICS

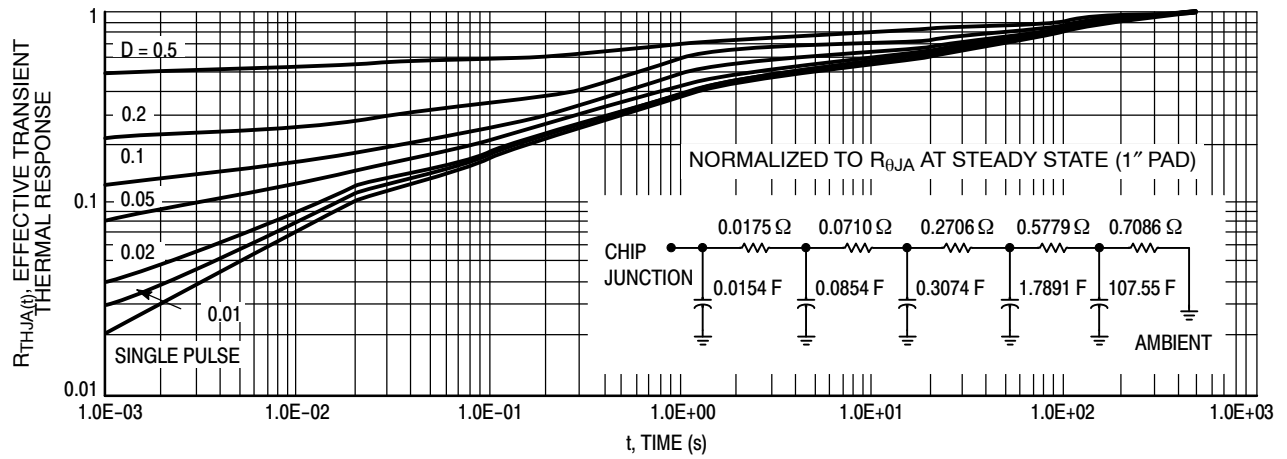


Figure 13. FET Thermal Response

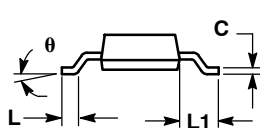
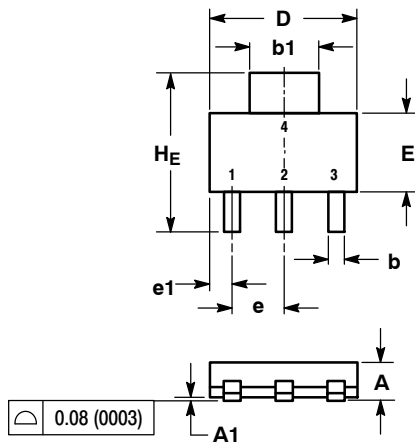
NTF5P03, NVF5P03

PACKAGE DIMENSIONS

SOT-223 (TO-261)

CASE 318E-04

ISSUE N



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

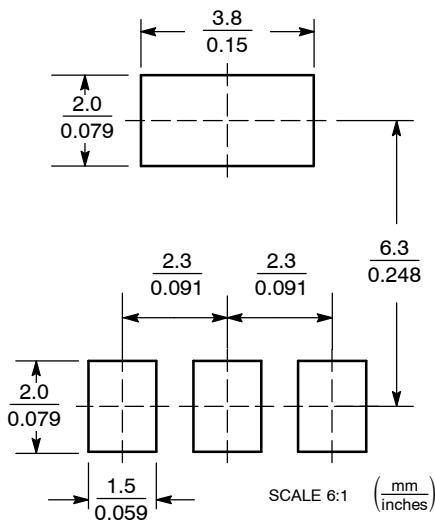
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.50	1.63	1.75	0.060	0.064	0.068
A1	0.02	0.06	0.10	0.001	0.002	0.004
b	0.60	0.75	0.89	0.024	0.030	0.035
b1	2.90	3.06	3.20	0.115	0.121	0.126
c	0.24	0.29	0.35	0.009	0.012	0.014
D	6.30	6.50	6.70	0.249	0.256	0.263
E	3.30	3.50	3.70	0.130	0.138	0.145
e	2.20	2.30	2.40	0.087	0.091	0.094
e1	0.85	0.94	1.05	0.033	0.037	0.041
L	0.20	---	---	0.008	---	---
L1	1.50	1.75	2.00	0.060	0.069	0.078
HE	6.70	7.00	7.30	0.264	0.276	0.287
θ	0°	-	10°	0°	-	10°

STYLE 3:

- PIN 1. GATE
- 2. DRAIN
- 3. SOURCE
- 4. DRAIN

SOLDERING FOOTPRINT



ON Semiconductor and ON are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
 Literature Distribution Center for ON Semiconductor
 P.O. Box 5163, Denver, Colorado 80217 USA
 Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
 Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
 Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
 USA/Canada
 Europe, Middle East and Africa Technical Support:
 Phone: 421 33 790 2910
 Japan Customer Focus Center
 Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative