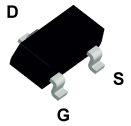
MOSFET – N-Channel, POWERTRENCH®

20 V, 6.1 A, 28 mΩ

FDN028N20

V_{DS}	$r_{DS(on)}$ MAX	I_D MAX
20 V	28 mΩ @ 4.5 V	6.1 A
	45 mΩ @ 2.5 V	



SOT−23/SUPERSOT™−23, 3 LEAD, 1.4x2.9
CASE 527AG

General Description

This N−Channel POWERTRENCH MOSFET is produced using **onsemi**'s advanced POWERTRENCH process that has been especially tailored to minimize on−state resistance and yet maintain low gate charge for superior switching performance.

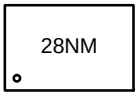
Features

- Max $r_{DS(on)}$ = 28 mΩ at V_{GS} = 4.5 V, I_D = 5.2 A
- Max $r_{DS(on)}$ = 45 mΩ at V_{GS} = 2.5 V, I_D = 4.4 A
- High Performance Trench Technology for Extremely Low $r_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- Fast Switching Speed
- 100% UIL Tested
- This Device is Pb−Free, Halide Free and is RoHS Compliant

Applications

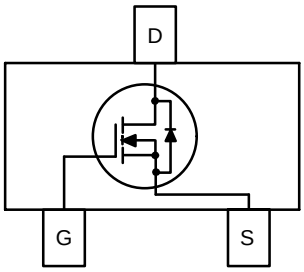
- Primary DC−DC Switch
- Load Switch

MARKING DIAGRAM



28N = Specific Device Code
M = Date Code

PIN ASSIGNMENT



ORDERING INFORMATION

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

MOSFET MAXIMUM RATINGS (T_C = 25°C, unless otherwise noted)

Symbol	Parameter		Ratings	Unit
V_{DS}	Drain to Source Voltage		20	V
V_{GS}	Gate to Source Voltage (Note 3)		±12	V
I_D	Continuous	T_A = 25°C (Note 1a)	6.1	A
	Pulsed	(Note 5)	52	
E_{AS}	Single Pulse Avalanche Energy (Note 4)		6	mJ
P_D	Power Dissipation	(Note 1a)	1.5	W
		(Note 1b)	0.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		−55 to 150	°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 CHARACTERISTICS (T_C = 25°C, unless otherwise noted)

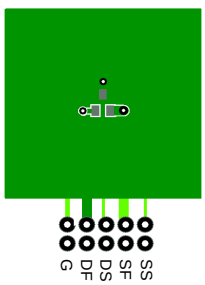
Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	75	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a)	80	°C/W

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

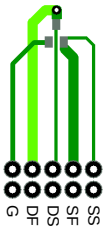
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	20	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C	–	15	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16 V, V_{GS} = 0 V	–	–	1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = 12 V, V_{DS} = 0 V	–	–	100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	0.5	0.9	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25°C	–	−3	–	mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 4.5 V, I_D = 5.2 A	–	23	28	mΩ
		V_{GS} = 2.5 V, I_D = 4.4 A	–	32	45	
		V_{GS} = 4.5 V, I_D = 5.2 A, T_J = 125°C	–	30	41	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 5.2 A	–	28	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	–	399	600	pF
C_{oss}	Output Capacitance		–	91	140	pF
C_{rss}	Reverse Transfer Capacitance		–	87	130	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 10 V, I_D = 5.2 A, V_{GS} = 10 V, R_{GEN} = 6 Ω	–	5	10	ns
t_r	Rise Time		–	2	10	ns
$t_{d(off)}$	Turn−Off Delay Time		–	15	29	ns
t_f	Fall Time		–	2	10	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 4.5 V V_{DD} = 10 V, I_D = 5.2 A	–	4.3	6.0	nC
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 2.5 V V_{DD} = 10 V, I_D = 5.2 A	–	2.8	3.9	nC
Q_{gs}	Gate to Source Charge	V_{DD} = 10 V, I_D = 5.2 A	–	0.7	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	1.6	–	nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 5.2 A (Note 2)	–	0.85	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 5.2 A, di/dt = 100 A/μs	–	13	27	ns
Q_{rr}	Reverse Recovery Charge		–	3	10	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.

1. $R_{\theta JA}$ is the sum of the junction−to−case and case−to−ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user’s board design.



a. 80°C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 180°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.
3. As an N−ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.
4. E_{AS} of 6 mJ is based on starting T_J = 25°C, L = 3 mH, I_{AS} = 2 A, V_{DD} = 20 V, V_{GS} = 10 V. 100% test at L = 0.1 mH, I_{AS} = 7 A.
5. Pulsed Id please refer to Figure 10 SOA graph for more details.

TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted)

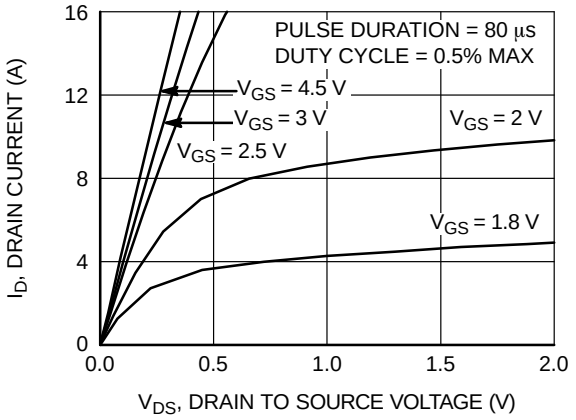


Figure 1. On Region Characteristics

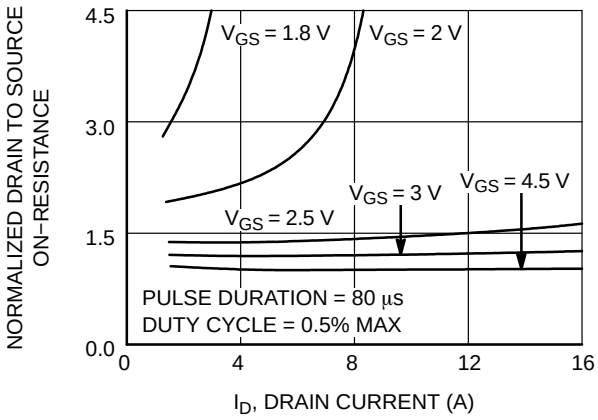


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

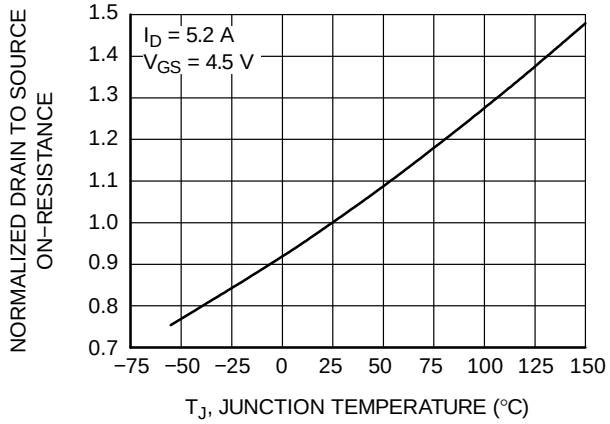


Figure 3. Normalized On−Resistance vs. Junction Temperature

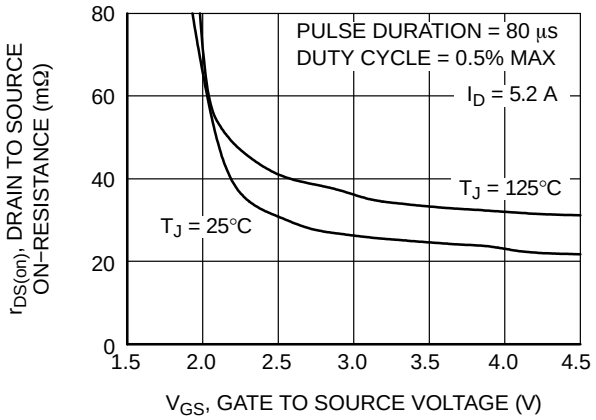


Figure 4. On−Resistance vs. Gate to Source Voltage

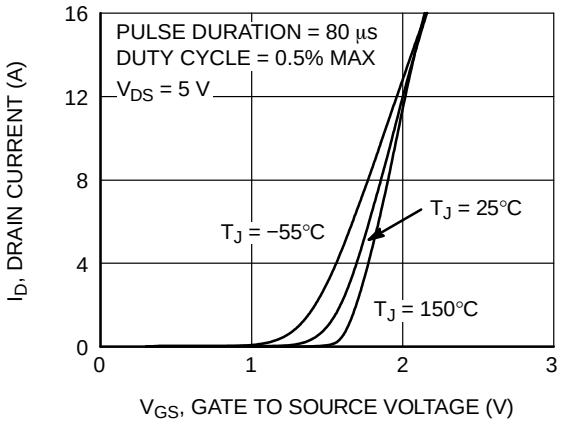


Figure 5. Transfer Characteristics

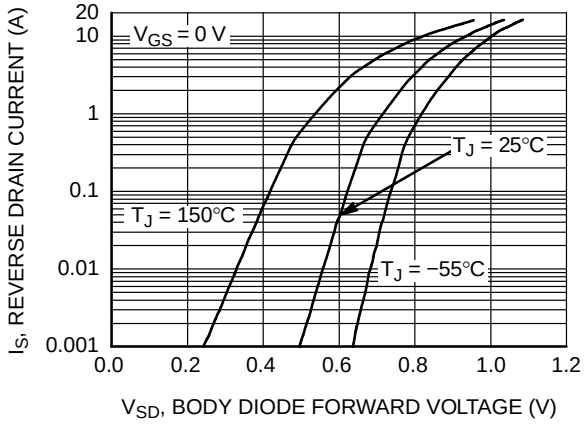


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted) (continued)

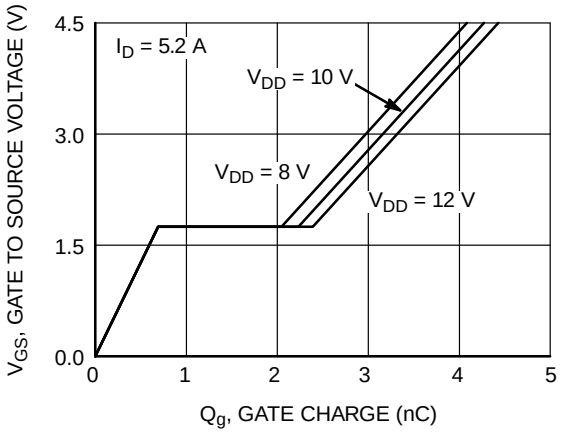


Figure 7. Gate Charge Characteristics

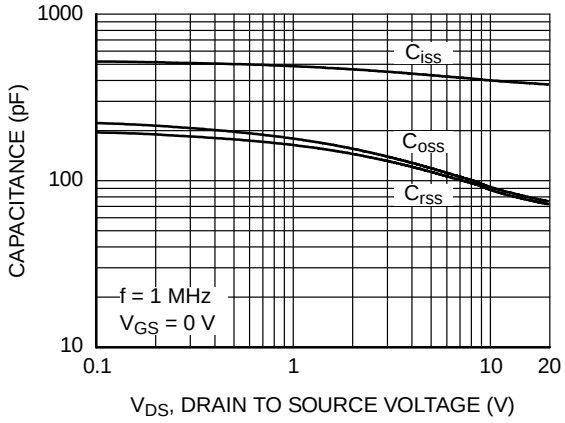


Figure 8. Capacitance vs. Drain to Source Voltage

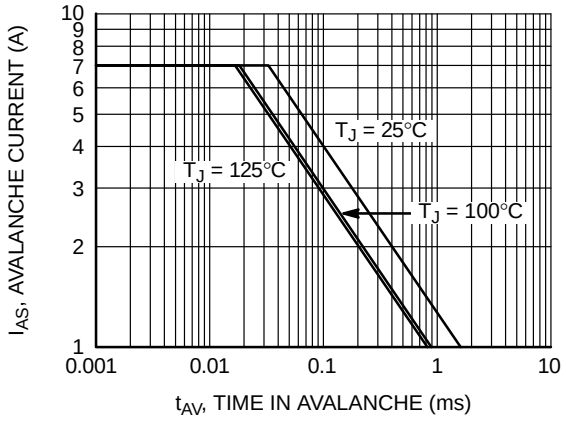


Figure 9. Unclamped Inductive Switching Capability

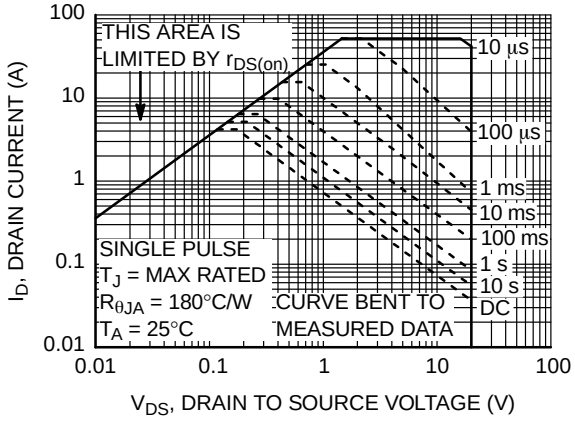


Figure 10. Forward Bias Safe Operating Area

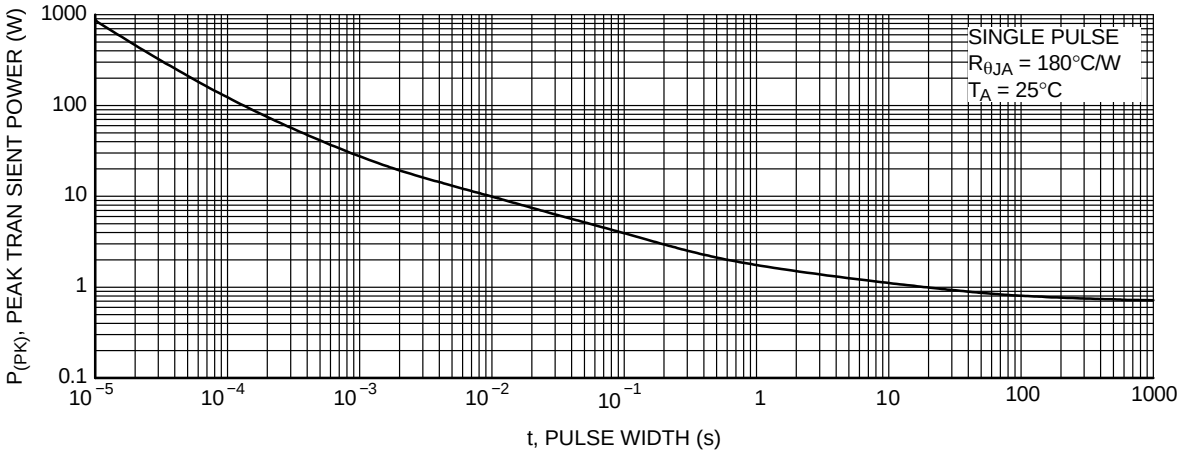


Figure 11. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted) (continued)

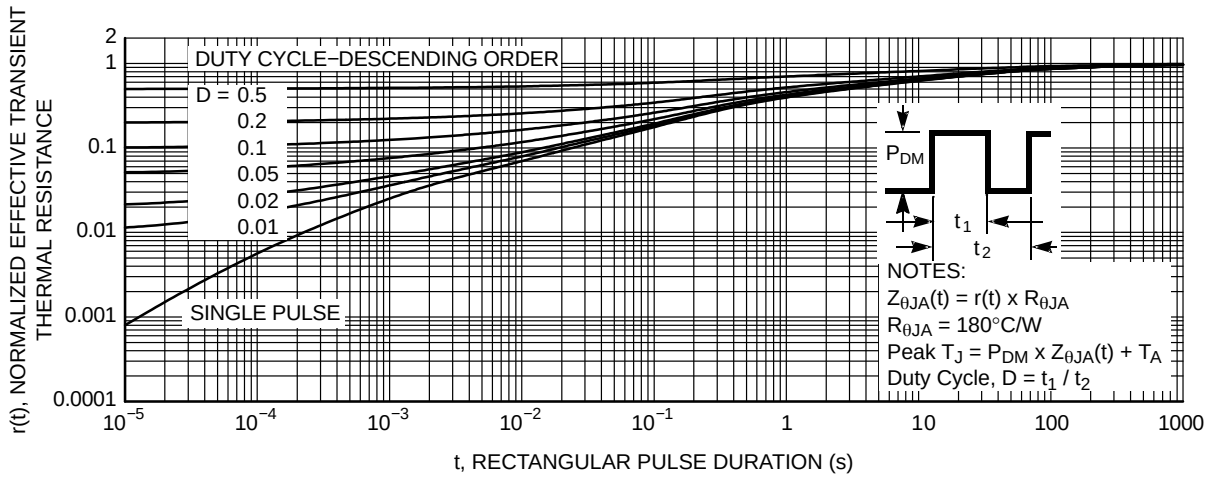


Figure 12. Junction−to−Ambient Transient Thermal Response Curve

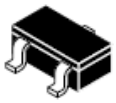
PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Shipping†
FDN028N20	28N	SOT−23/SUPERSOT−23, 3 LEAD, 1.4x2.9 (Pb−Free, Halide Free)	7”	8 mm	3000 / 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.

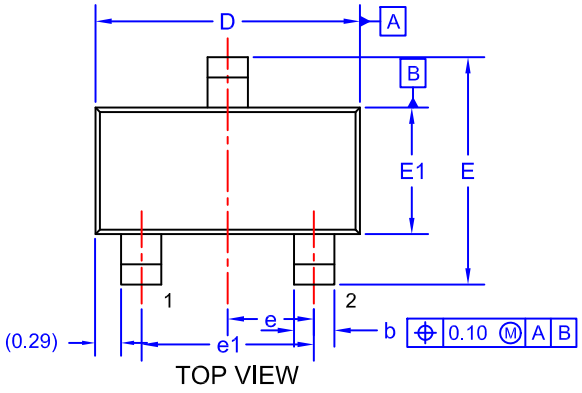
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®



SOT−23/SUPERSOT™ −23, 3 LEAD, 1.4x2.9
CASE 527AG
ISSUE A

DATE 09 DEC 2019

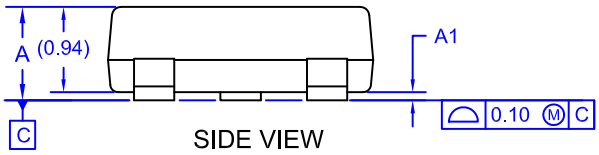


TOP VIEW

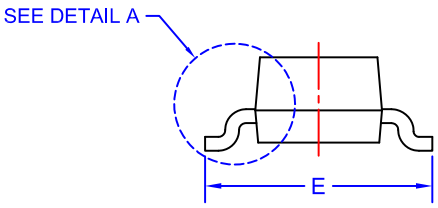
NOTES: UNLESS OTHERWISE SPECIFIED

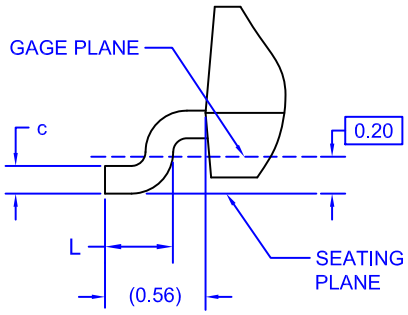
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.

DIM	MIN.	NOM.	MAX.
A	0.85	0.95	1.12
A1	0.00	0.05	0.10
b	0.370	0.435	0.508
c	0.085	0.150	0.180
D	2.80	2.92	3.04
E	2.31	2.51	2.71
E1	1.20	1.40	1.52
e		0.95 BSC	
e1		1.90 BSC	
L	0.33	0.38	0.43

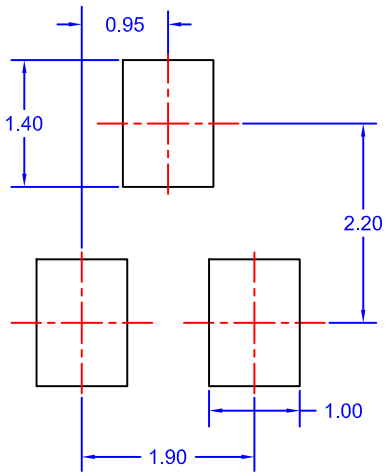


SIDE VIEW





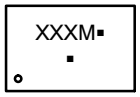
DETAIL A



LAND PATTERN RECOMMENDATION*

*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Month Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*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.

DOCUMENT NUMBER:	**98AON34319E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**SOT−23/SUPERSOT−23, 3 LEAD, 1.4X2.9**	**PAGE 1 OF 1**

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales