

Thank you for your interest in **onsemi** products.  
Your technical document begins on the following pages.



## Your Feedback is Important to Us!

Please take a moment to participate in our short survey.  
At **onsemi**, we are dedicated to delivering technical content that best  
meets your needs.

### Help Us Improve – Take the Survey

This survey is intended to collect your feedback, capture any issues you may encounter, and to provide improvements you would like to suggest.

**We look forward to your feedback.**

To learn more about **onsemi**, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

# Field Effect Transistor - N-Channel, Enhancement Mode

## 2N7002DW

### Features

- Dual N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

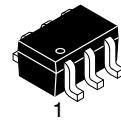
Symbol	Parameter		Ratings	Unit
$V_{DSS}$	Drain-Source Voltage		60	V
$V_{DGR}$	Drain-Gate Voltage ( $R_{GS} \leq 1.0 \text{ M}\Omega$ )		60	V
$V_{GSS}$	Gate-Source Voltage	Continuous	$\pm 20$	V
		Pulsed	$\pm 40$	
$I_D$	Drain Current	Continuous	115	mA
		Continuous at $100^\circ\text{C}$	73	
		Pulsed	800	
$T_J, T_{STG}$	Junction and Storage 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 ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

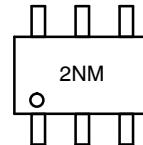
Symbol	Parameter		Ratings	Unit
$P_D$	Total Device Dissipation		200	mW
	Derate Above $T_A = 25^\circ\text{C}$		1.6	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)		415	°C/W

1. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch. Minimum land pad size.



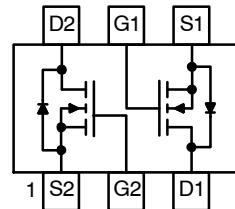
SC-88/SC70-6/SOT-363  
CASE 419B-02

### MARKING DIAGRAM



2N = Specific Device Code  
M = Assembly Operation Month

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

## ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping <sup>†</sup>
2N7002DW	2N	SC70-6 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>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](#).

ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
--------	-----------	-----------------	-----	-----	-----	------

## OFF CHARACTERISTICS (Note 2)

$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$\text{V}_{\text{GS}} = 0 \text{ V}$ , $\text{I}_D = 10 \mu\text{A}$	60	78	–	V
$\text{I}_{\text{DSS}}$	Zero Gate Voltage Drain Current	$\text{V}_{\text{DS}} = 60 \text{ V}$ , $\text{V}_{\text{GS}} = 0 \text{ V}$	–	0.001	1.0	$\mu\text{A}$
		$\text{V}_{\text{DS}} = 60 \text{ V}$ , $\text{V}_{\text{GS}} = 0 \text{ V}$ , $\text{T}_J = 125^\circ\text{C}$	–	7	500	
$\text{I}_{\text{GSS}}$	Gate-Body Leakage	$\text{V}_{\text{GS}} = \pm 20 \text{ V}$ , $\text{V}_{\text{DS}} = 0 \text{ V}$	–	0.2	$\pm 10$	nA

## ON CHARACTERISTICS (Note 2)

$\text{V}_{\text{GS(th)}}$	Gate Threshold Voltage	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}$ , $\text{I}_D = 250 \mu\text{A}$	1.00	1.76	2.0	V
$\text{R}_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$\text{V}_{\text{GS}} = 5 \text{ V}$ , $\text{I}_D = 0.05 \text{ A}$	–	1.6	7.5	$\Omega$
		$\text{V}_{\text{GS}} = 10 \text{ V}$ , $\text{I}_D = 0.5 \text{ A}$	–	–	2.0	
		$\text{V}_{\text{GS}} = 10 \text{ V}$ , $\text{I}_D = 0.5 \text{ A}$ , $\text{T}_J = 125^\circ\text{C}$	–	2.53	13.5	
$\text{I}_{\text{D(on)}}$	On-State Drain Current	$\text{V}_{\text{GS}} = 10 \text{ V}$ , $\text{V}_{\text{DS}} = 7.5 \text{ V}$	0.50	1.43	–	A
$\text{g}_{\text{FS}}$	Forward Transconductance	$\text{V}_{\text{DS}} = 10 \text{ V}$ , $\text{I}_D = 0.2 \text{ A}$	80.0	356.5	–	mS

## DYNAMIC CHARACTERISTICS

$\text{C}_{\text{iss}}$	Input Capacitance	$\text{V}_{\text{DS}} = 25 \text{ V}$ , $\text{V}_{\text{GS}} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	–	37.8	50	pF
$\text{C}_{\text{oss}}$	Output Capacitance		–	12.4	25	pF
$\text{C}_{\text{rss}}$	Reverse Transfer Capacitance		–	6.5	7	pF

## SWITCHING CHARACTERISTICS (Note 2)

$t_{\text{D(ON)}}$	Turn-On Delay Time	$\text{V}_{\text{DD}} = 30 \text{ V}$ , $\text{I}_D = 0.2 \text{ A}$ , $\text{V}_{\text{GEN}} = 10 \text{ V}$ , $\text{R}_L = 150 \Omega$ , $\text{R}_{\text{GEN}} = 25 \Omega$	–	5.85	20	ns
$t_{\text{D(OFF)}}$	Turn-Off Delay Time		–	12.5	20	ns

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.

2. Short duration test pulse used to minimize self-heating effect.

## TYPICAL PERFORMANCE CHARACTERISTICS

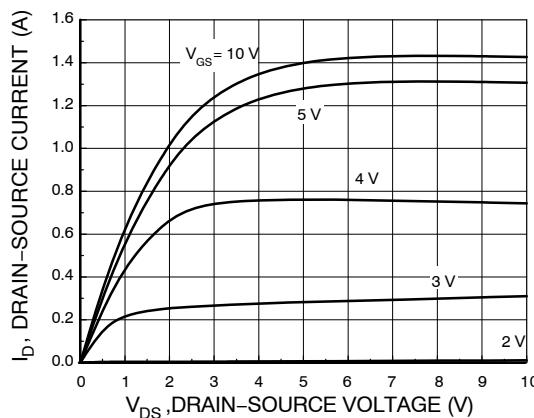


Figure 1. On-Region Characteristics

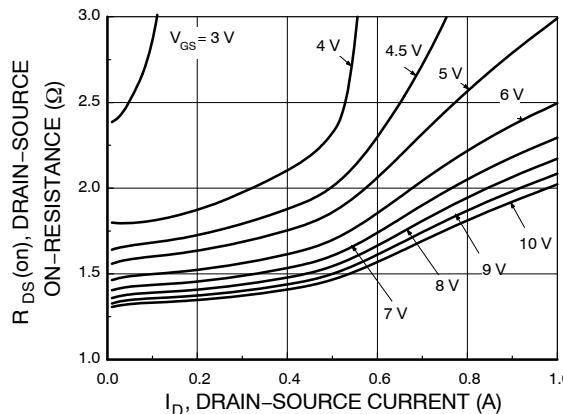
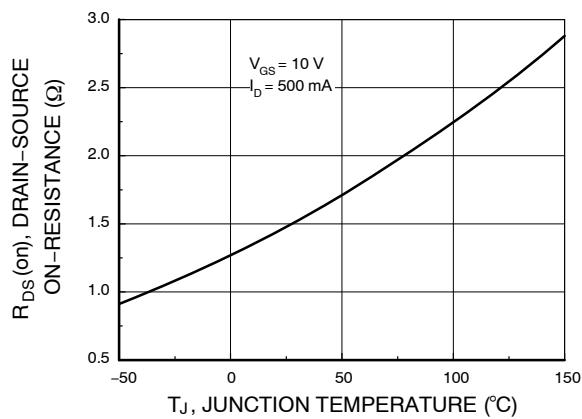
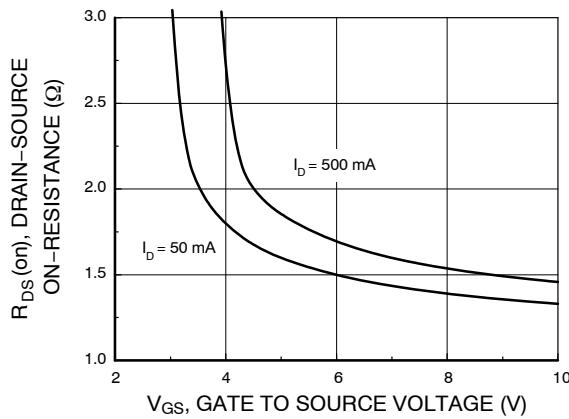


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

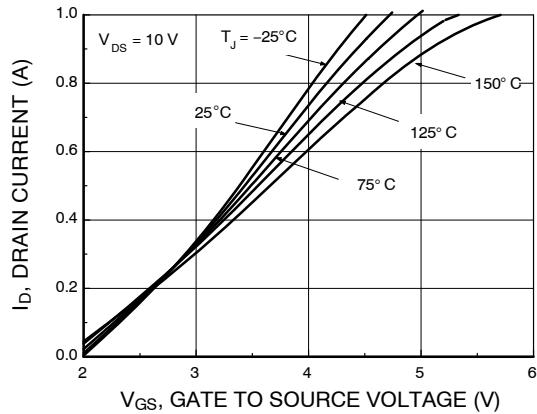
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



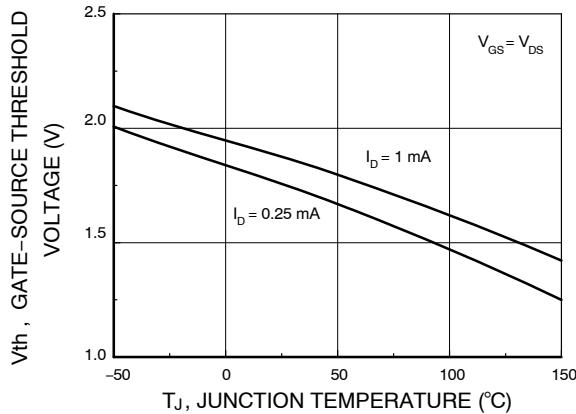
**Figure 3. On-Resistance Variation with Temperature**



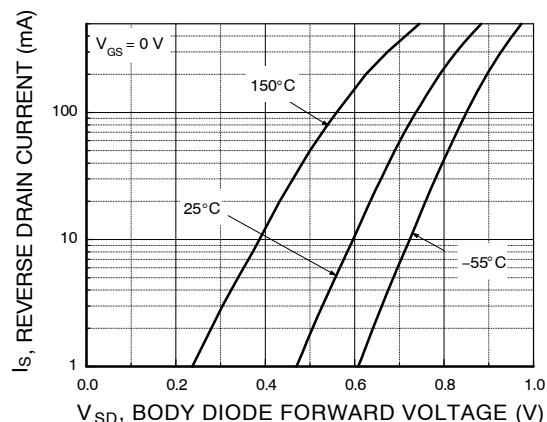
**Figure 4. On-Resistance Variation with Gate-Source Voltage**



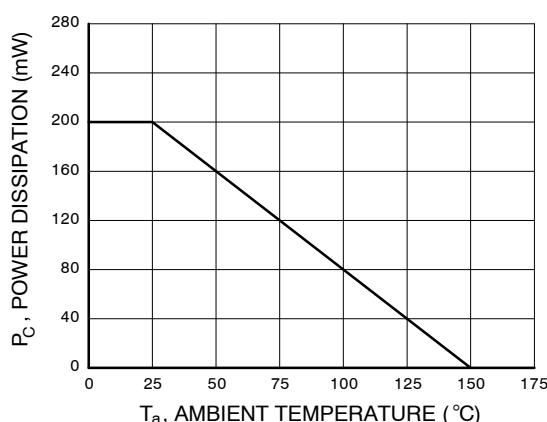
**Figure 5. Transfer Characteristics**



**Figure 6. Gate Threshold Variation with Temperature**

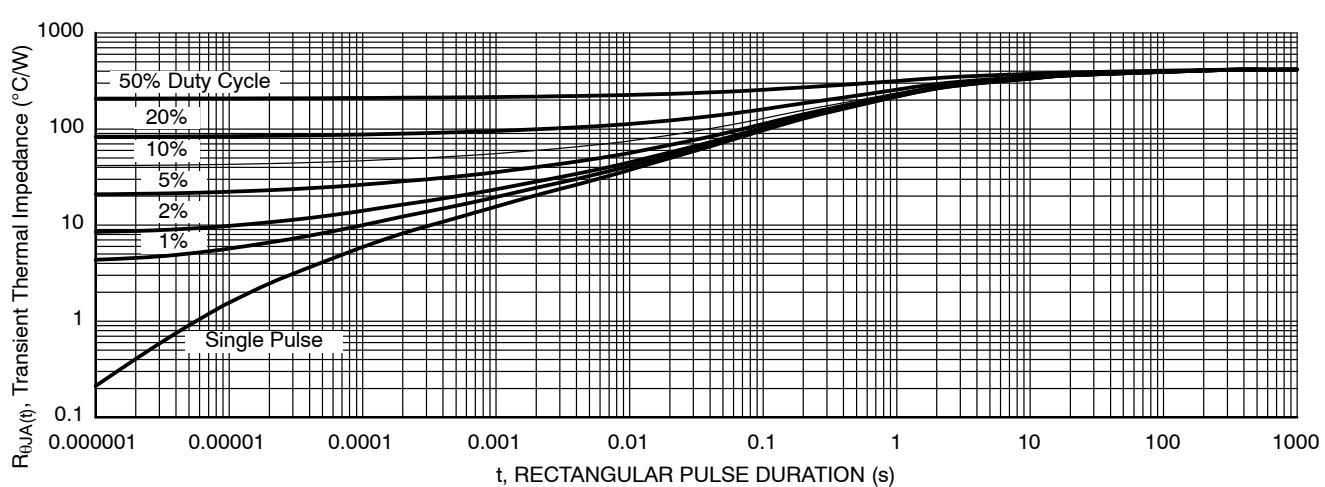
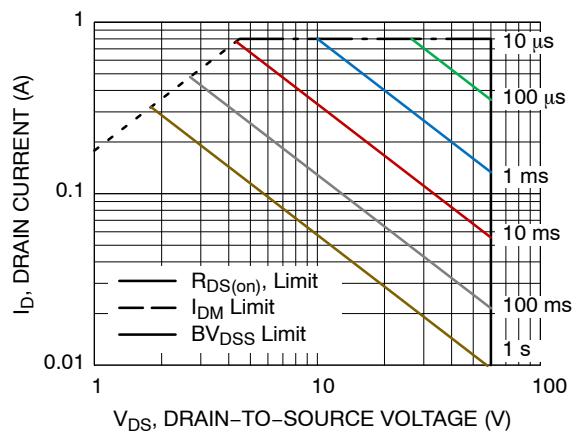


**Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature**



**Figure 8. Power Derating**

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



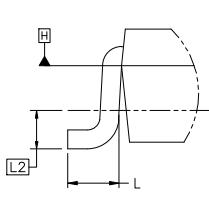
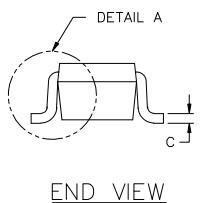
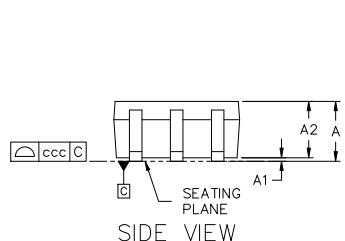
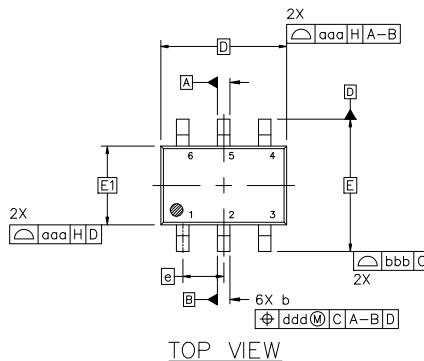


**SC-88 2.00x1.25x0.90, 0.65P**  
**CASE 419B-02**  
**ISSUE Z**

DATE 18 APR 2024

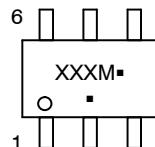
## NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUM A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.10
A1	0.00	---	0.10
A2	0.70	0.90	1.00
b	0.15	0.20	0.25
c	0.08	0.15	0.22
D	2.00	BSC	
E	2.10	BSC	
E1	1.25	BSC	
e	0.65	BSC	
L	0.26	0.36	0.46
L2	0.15	BSC	
aaa	0.15		
bbb	0.30		
ccc	0.10		
ddd	0.10		

## GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code

XXX = Specific Dev.

■ = Ph-Free Package

**RECOMMENDED MOUNTING FOOTPRINT\***

\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL. SOI DFRM1D.

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing 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.

#### STYLES ON PAGE 2

<b>DOCUMENT NUMBER:</b>	<b>98ASB42985B</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>SC-88 2.00x1.25x0.90, 0.65P</b>	<b>PAGE 1 OF 2</b>

**onsemi** and **ONSEMI** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** 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. **onsemi** does not convey any license under its patent rights nor the rights of others.

**SC-88 2.00x1.25x0.90, 0.65P**  
CASE 419B-02  
ISSUE Z

DATE 18 APR 2024

STYLE 1: PIN 1. Emitter 2 2. Base 2 3. Collector 1 4. Emitter 1 5. Base 1 6. Collector 2	STYLE 2: Cancelled	STYLE 3: Cancelled	STYLE 4: PIN 1. Cathode 2. Cathode 3. Collector 4. Emitter 5. Base 6. Anode	STYLE 5: PIN 1. Anode 2. Anode 3. Collector 4. Emitter 5. Base 6. Cathode	STYLE 6: PIN 1. Anode 2 2. N/C 3. Cathode 1 4. Anode 1 5. N/C 6. Cathode 2
STYLE 7: PIN 1. Source 2 2. Drain 2 3. Gate 1 4. Source 1 5. Drain 1 6. Gate 2	STYLE 8: Cancelled	STYLE 9: PIN 1. Emitter 2 2. Emitter 1 3. Collector 1 4. Base 1 5. Base 2 6. Collector 2	STYLE 10: PIN 1. Source 2 2. Source 1 3. Collector 1 4. Drain 1 5. Drain 2 6. Gate 2	STYLE 11: PIN 1. Cathode 2 2. Cathode 2 3. Anode 1 4. Cathode 1 5. Cathode 1 6. Anode 2	STYLE 12: PIN 1. Anode 2 2. Anode 2 3. Cathode 1 4. Anode 1 5. Anode 1 6. Cathode 2
STYLE 13: PIN 1. Anode 2. N/C 3. Collector 4. Emitter 5. Base 6. Cathode	STYLE 14: PIN 1. Vref 2. GND 3. GND 4. Iout 5. Ven 6. Vcc	STYLE 15: PIN 1. Anode 1 2. Anode 2 3. Anode 3 4. Cathode 3 5. Cathode 2 6. Cathode 1	STYLE 16: PIN 1. Base 1 2. Emitter 2 3. Collector 2 4. Base 2 5. Emitter 1 6. Collector 1	STYLE 17: PIN 1. Base 1 2. Emitter 1 3. Collector 2 4. Base 2 5. Emitter 2 6. Collector 1	STYLE 18: PIN 1. Vin1 2. Vcc 3. Vout2 4. Vin2 5. Gnd 6. Vout1
STYLE 19: PIN 1. Iout 2. Gnd 3. Gnd 4. Vcc 5. Ven 6. Vref	STYLE 20: PIN 1. Collector 2. Collector 3. Base 4. Emitter 5. Collector 6. Collector	STYLE 21: PIN 1. Anode 1 2. N/C 3. Anode 2 4. Cathode 2 5. N/C 6. Cathode 1	STYLE 22: PIN 1. D1 (l) 2. Gnd 3. D2 (l) 4. D2 (c) 5. Vbus 6. D1 (c)	STYLE 23: PIN 1. Vn 2. Ch1 3. Vp 4. N/C 5. Ch2 6. N/C	STYLE 24: PIN 1. Cathode 2. Anode 3. Cathode 4. Cathode 5. Cathode 6. Cathode
STYLE 25: PIN 1. Base 1 2. Cathode 3. Collector 2 4. Base 2 5. Emitter 6. Collector 1	STYLE 26: PIN 1. Source 1 2. Gate 1 3. Drain 2 4. Source 2 5. Gate 2 6. Drain 1	STYLE 27: PIN 1. Base 2 2. Base 1 3. Collector 1 4. Emitter 1 5. Emitter 2 6. Collector 2	STYLE 28: PIN 1. Drain 2. Drain 3. Gate 4. Source 5. Drain 6. Drain	STYLE 29: PIN 1. Anode 2. Anode 3. Collector 4. Emitter 5. Base/Anode 6. Cathode	STYLE 30: PIN 1. Source 1 2. Drain 2 3. Drain 2 4. Source 2 5. Gate 1 6. Drain 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

DOCUMENT NUMBER:	98ASB42985B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SC-88 2.00x1.25x0.90, 0.65P	PAGE 2 OF 2

**onsemi** and **Onsemi** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** 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. **onsemi** does not convey any license under its patent rights nor the rights of others.

**onsemi**, **ONSEMI**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)

