

NTF2955

Power MOSFET

–60 V, 2.4 A, Single P–Channel SOT–223

Features

- TMOS7 Design for low $R_{DS(on)}$
- Withstands High Energy in Avalanche and Commutation Modes

Applications

- Power Supplies
- PWM Motor Control
- Converters
- Power Management

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	–60	V
Gate-to-Source Voltage			V_{GS}	± 20	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	–2.4	A
		$T_A = 85^{\circ}\text{C}$		–1.7	
Power Dissipation (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	P_D	1.92	W
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^{\circ}\text{C}$	I_D	–1.6	A
		$T_A = 85^{\circ}\text{C}$		–1.1	
Power Dissipation (Note 2)		$T_A = 25^{\circ}\text{C}$	P_D	0.83	W
Pulsed Drain Current	$t_p = 10\ \mu\text{s}$		I_{DM}	9.2	A
Operating Junction and Storage Temperature			T_J , T_{STG}	–55 to 150	$^{\circ}\text{C}$
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 25\ \text{V}$, $V_G = 10\ \text{V}$, $I_{PK} = 6.7\ \text{A}$, $L = 10\ \text{mH}$, $R_G = 25\ \Omega$)			EAS	225	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^{\circ}\text{C}$

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Tab (Drain) – Steady State (Note 2)	$R_{\theta JC}$	14	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	65	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	150	

1. When surface mounted to an FR4 board using 1 in. pad size (Cu. area = 1.127 in² [1 oz] including traces)
2. When surface mounted to an FR4 board using the minimum recommended pad size (Cu. area = 0.341 in²)

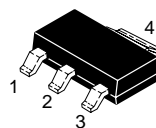
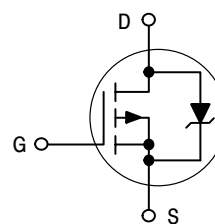


ON Semiconductor®

<http://onsemi.com>

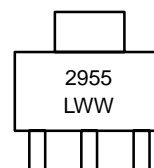
$V_{(BR)DS}$	$R_{DS(on)}$ TYP	I_D MAX
–60 V	145 m Ω @ –10 V	–2.4 A

P-Channel



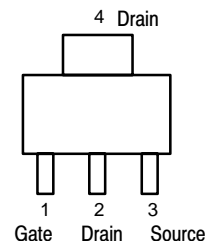
**SOT-223
CASE 318E
STYLE 3**

MARKING DIAGRAM



2955 = Device Code
L = Location Code
WW = Work Week

PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping†
NTF2955T1	SOT-223	1000/Tape & Reel
NTF2955T3	SOT-223	4000/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.

NTF2955

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

Parameter	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	-60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V _{(BR)DSS} /T _J			66.4		mV/°C
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V, V _{DS} = -60 V	T _J = 25°C		-1.0	μA
			T _J = 125°C		-50	
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 = -1.0 mA	-2.0		-4.0	V
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = -10 V, I _D = -0.75 A		145	170	mΩ
		V _{GS} = -10 V, I _D = -1.5 A		150	180	
		V _{GS} = -10 V, I _D = -2.4 A		154	185	
Forward Transconductance	g _{FS}	V _{GS} = -15 V, I _D = -0.75 A		1.77		S

CHARGES AND CAPACITANCES

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 25 V		492		pF
Output Capacitance	C _{OSS}			165		
Reverse Transfer Capacitance	C _{RSS}			50		
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 10 V, V _{DS} = 30 V, I _D = 1.5 A		14.3		nC
Threshold Gate Charge	Q _{G(TH)}			1.2		
Gate-to-Source Charge	Q _{GS}			2.3		
Gate-to-Drain Charge	Q _{GD}			5.2		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 10 V, V _{DD} = 25 V, I _D = 1.5 A, R _G = 9.1 Ω R _L = 25 Ω		11		ns
Rise Time	t _r			7.6		
Turn-Off Delay Time	t _{d(OFF)}			65		
Fall Time	t _f			38		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 1.5 A	T _J = 25°C		-1.10	-1.30	V
			T _J = 125°C		-0.9		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 1.5 A			36		ns
Charge Time	t _a				20		
Discharge Time	t _b				16		
Reverse Recovery Charge	Q _{RR}				0.139		nC

- Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

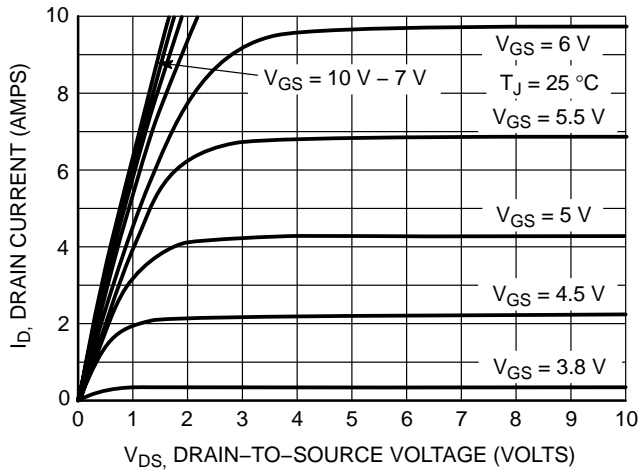


Figure 1. On-Region Characteristics

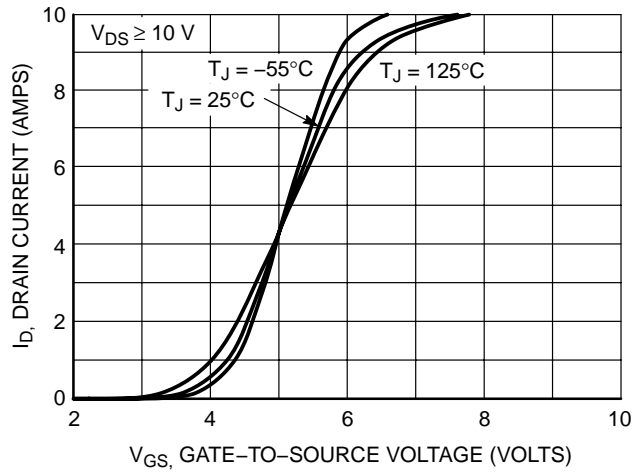


Figure 2. Transfer Characteristics

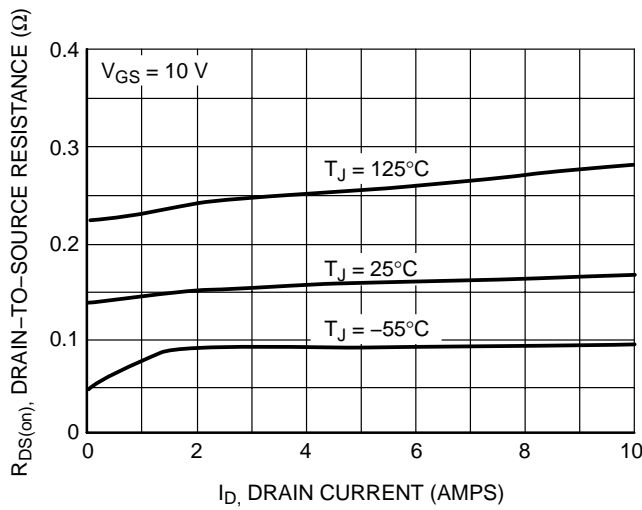


Figure 3. On-Resistance versus Drain Current and Temperature

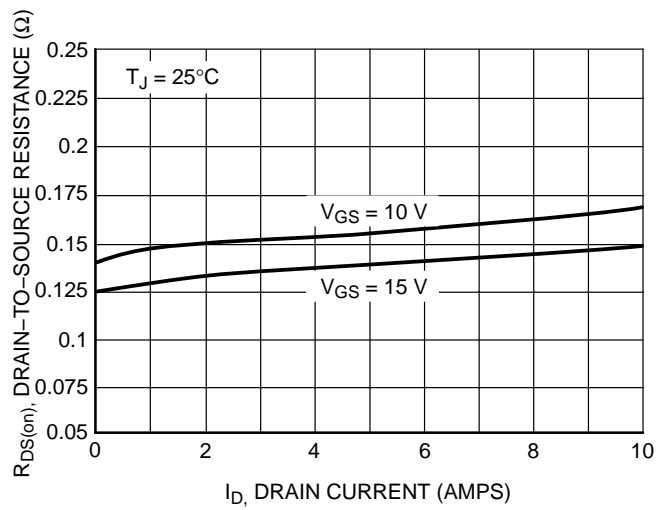


Figure 4. On-Resistance versus Drain Current and Gate Voltage

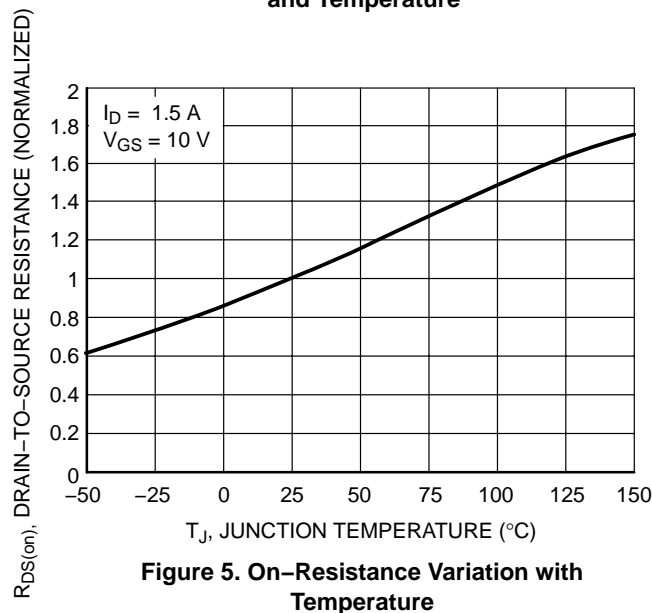


Figure 5. On-Resistance Variation with Temperature

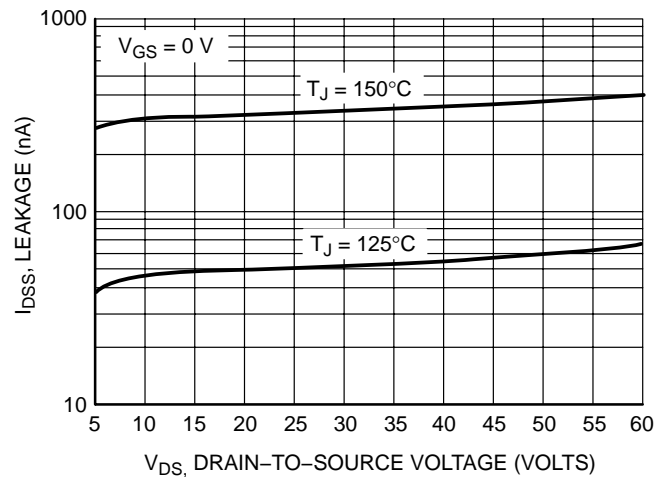


Figure 6. Drain-to-Source Leakage Current versus Voltage

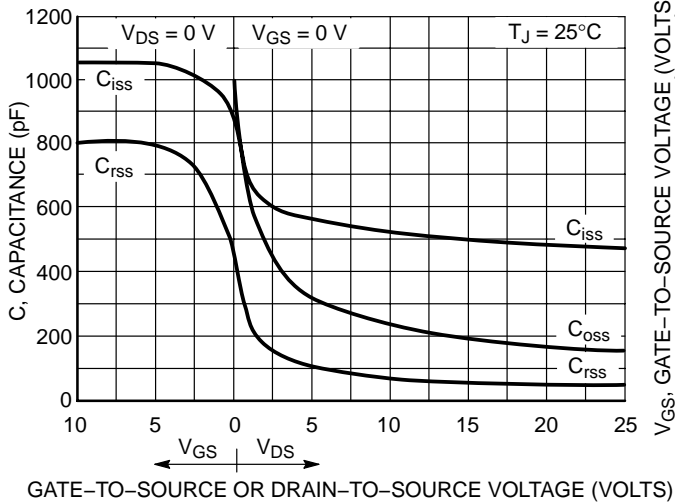


Figure 7. Capacitance Variation

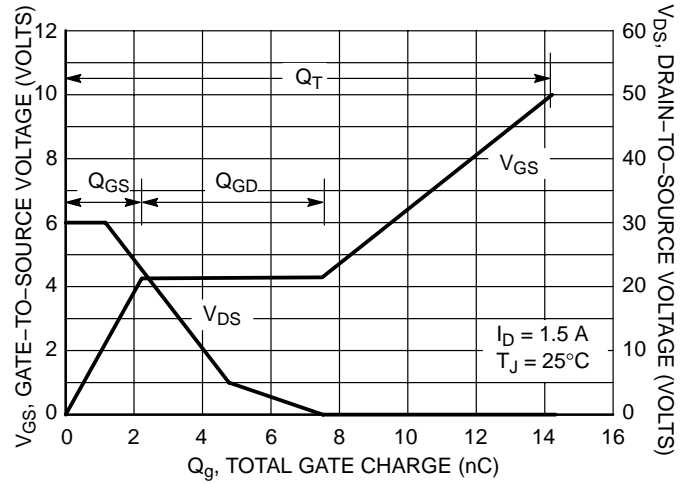


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

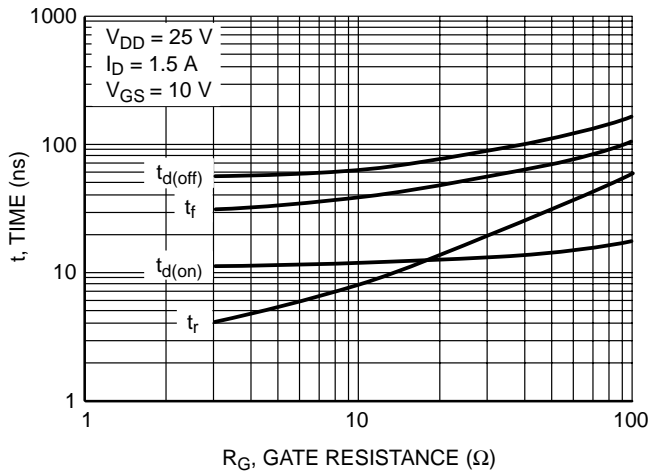


Figure 9. Resistive Switching Time Variation versus Gate Resistance

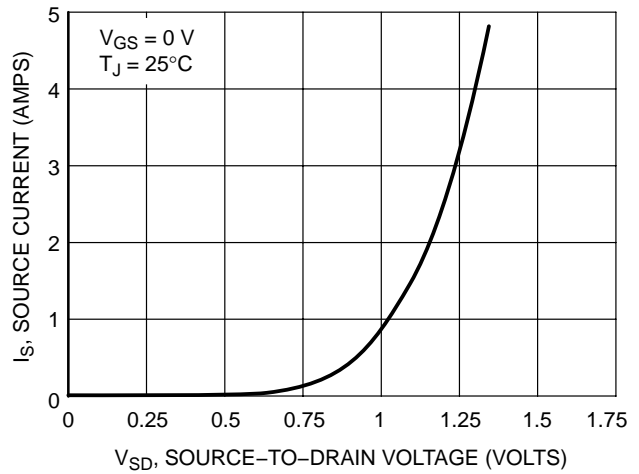


Figure 10. Diode Forward Voltage versus Current

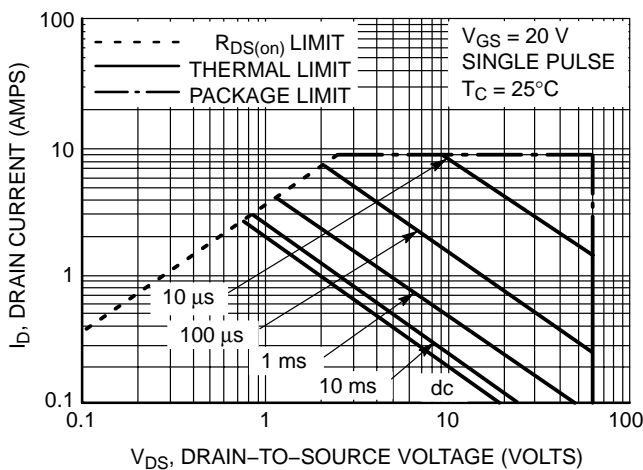


Figure 11. Maximum Rated Forward Biased Safe Operating Area

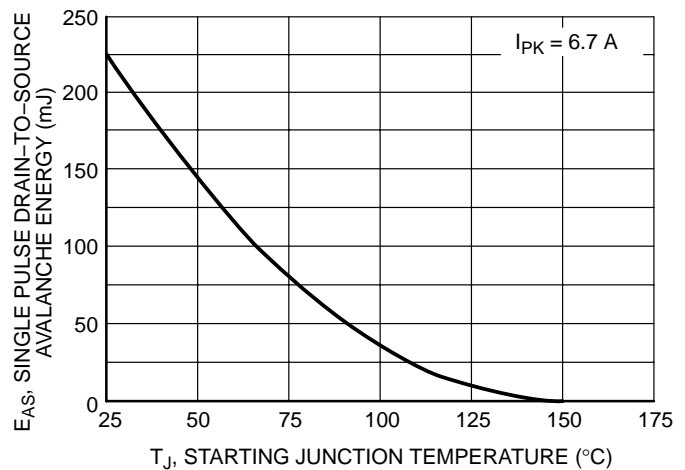


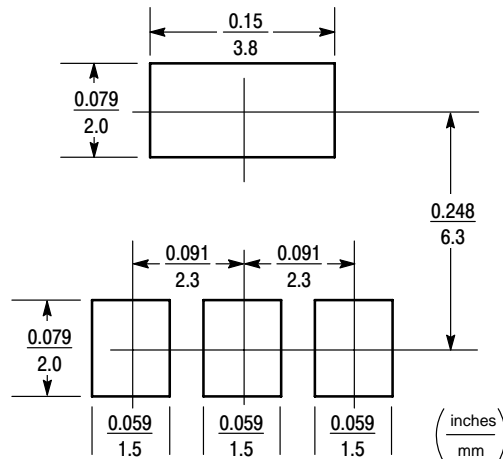
Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

INFORMATION FOR USING THE SOT-223 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



SOT-223 POWER DISSIPATION

The power dissipation of the SOT-223 is a function of the drain pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A . Using the values provided on the data sheet for the SOT-223 package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 833 milliwatts.

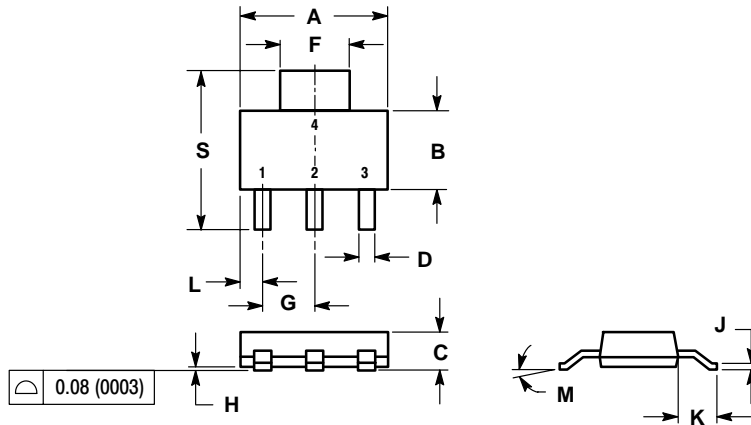
$$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{150^\circ\text{C/W}} = 833 \text{ milliwatts}$$

The 150°C/W for the SOT-223 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 833 milliwatts. There are other alternatives to achieving higher power dissipation from the SOT-223 package. One is to increase the area of the drain pad. By increasing the area of the drain pad, the power dissipation can be increased. Although one can almost double the power dissipation with this method, one will be giving up area on the printed circuit board which can defeat the purpose of using surface mount technology.

NTF2955

PACKAGE DIMENSIONS

SOT-223 (TO-261)
CASE 318E-04
ISSUE K




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.249	0.263	6.30	6.70
B	0.130	0.145	3.30	3.70
C	0.060	0.068	1.50	1.75
D	0.024	0.035	0.60	0.89
F	0.115	0.126	2.90	3.20
G	0.087	0.094	2.20	2.40
H	0.0008	0.0040	0.020	0.100
J	0.009	0.014	0.24	0.35
K	0.060	0.078	1.50	2.00
L	0.033	0.041	0.85	1.05
M	0°	10°	0°	10°
S	0.264	0.287	6.70	7.30

STYLE 3:

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

ON Semiconductor and  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

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

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

For additional information, please contact your
local Sales Representative.

NTF2955/D