

# Digital FET, Dual N & P Channel

## FDG6321C

### General Description

These dual N & P-Channel logic level enhancement mode field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially on low voltage replacement for bipolar digital transistors and small signal MOSFETS. Since bias resistors are not required, this dual digital FET can replace several different digital transistors, with different bias resistor values.

### Features

- N-Ch 0.50 A, 25 V
  - ◆  $R_{DS(ON)} = 0.45 \Omega @ V_{GS} = 4.5 V$
  - ◆  $R_{DS(ON)} = 0.60 \Omega @ V_{GS} = 2.7 V$
- P-Ch -0.41 A, -25 V
  - ◆  $R_{DS(ON)} = 1.1 \Omega @ V_{GS} = -4.5 V$
  - ◆  $R_{DS(ON)} = 1.5 \Omega @ V_{GS} = -2.7 V$
- Very Small Package Outline SC70-6
- Very Low Level Gate Drive Requirements Allowing Direct Operation in 3 V Circuits ( $V_{GS(th)} < 1.5 V$ )
- Gate-Source Zener for ESD Ruggedness (>6 kV Human Body Model)
- These Devices are Pb-Free and are RoHS Compliant

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

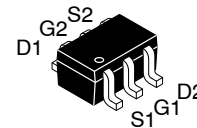
Symbol	Parameter	N-Channel	P-Channel	Units
$V_{DSS}$	Drain-Source Voltage	25	-25	V
$V_{GSS}$	Gate-Source Voltage	8	-8	V
$I_D$	Drain Current	Continuous	0.5	-0.41
		Pulsed	1.5	-1.2
$P_D$	Maximum Power Dissipation (Note 1)	0.3		W
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150		$^\circ C$
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100 pF / 1500 $\Omega$ )	6		kV

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.



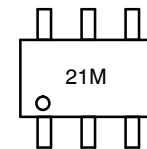
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)



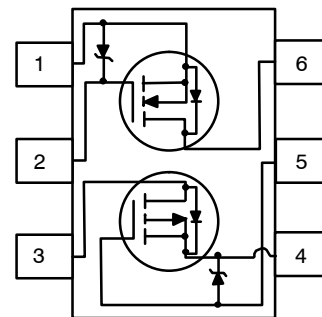
SC-88/SC70-6/SOT-363  
CASE 419B-02

### MARKING DIAGRAM



21 = Specific Device Code  
M = Assembly Operation Month

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

# FDG6321C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	415	$^{\circ}\text{C}/\text{W}$

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.  $R_{\theta JA} = 415^{\circ}\text{C}/\text{W}$  on minimum pad mounting on FR-4 board in still air.

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

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

### OFF CHARACTERISTICS

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	N-Ch	25	-	-	V
		$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	P-Ch	-25	-	-	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	N-Ch	-	26	-	$\text{mV}/^{\circ}\text{C}$
		$I_D = -250\ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	P-Ch	-	-22	-	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$	N-Ch	-	-	1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^{\circ}\text{C}$		-	-	10	
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$	P-Ch	-	-	-1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^{\circ}\text{C}$		-	-	-10	
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$	N-Ch	-	-	100	nA
		$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$	P-Ch	-	-	-100	

### ON CHARACTERISTICS (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	N-Ch	0.65	0.8	1.5	V
		$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	P-Ch	-0.65	-0.82	-1.5	
$\Delta V_{GS(th)} / \Delta T_J$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	N-Ch	-	-2.6	-	$\text{mV}/^{\circ}\text{C}$
		$I_D = -250\ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	P-Ch	-	2.1	-	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}$	N-Ch	-	0.34	0.45	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}, T_J = 125^{\circ}\text{C}$		-	0.55	0.72	
		$V_{GS} = 2.7\text{ V}, I_D = 0.2\text{ A}$		-	0.44	0.6	
		$V_{GS} = -4.5\text{ V}, I_D = -0.41\text{ A}$	P-Ch	-	0.85	1.1	
		$V_{GS} = -4.5\text{ V}, I_D = -0.41\text{ A}, T_J = 125^{\circ}\text{C}$		-	1.2	1.8	
		$V_{GS} = -2.7\text{ V}, I_D = -0.05\text{ A}$		-	1.15	1.5	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$	N-Ch	0.5	-	-	A
		$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	P-Ch	-0.41	-	-	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 0.5\text{ A}$	N-Ch	-	1.45	-	S
		$V_{DS} = -5\text{ V}, I_D = -0.41\text{ A}$	P-Ch	-	0.9	-	

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	N-Channel $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$  P-Channel $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	N-Ch	-	50	-	$\text{pF}$
			P-Ch	-	62	-	
$C_{oss}$	Output Capacitance		N-Ch	-	28	-	
			P-Ch	-	34	-	
$C_{rss}$	Reverse Transfer Capacitance		N-Ch	-	9	-	
			P-Ch	-	10	-	

# FDG6321C

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

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

### SWITCHING CHARACTERISTICS (Note 2)

$t_{D(on)}$	Turn-On Delay Time	N-Channel $V_{DD} = 5\text{ V}$ , $I_D = 0.5\text{ A}$ , $V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 50\ \Omega$	N-Ch	-	3	6	ns
			P-Ch	-	7	15	
$t_r$	Turn-On Rise Time	P-Channel $V_{DD} = -5\text{ V}$ , $I_D = -0.5\text{ A}$ , $V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 50\ \Omega$	N-Ch	-	8.5	18	ns
			P-Ch	-	8	16	
$t_{D(off)}$	Turn-Off Delay Time		N-Ch	-	17	30	ns
			P-Ch	-	55	80	
$t_f$	Turn-Off Fall Time		N-Ch	-	13	25	ns
			P-Ch	-	35	60	
$Q_g$	Total Gate Charge	N-Channel $V_{DS} = 5\text{ V}$ , $I_D = 0.5\text{ A}$ , $V_{GS} = 4.5\text{ V}$	N-Ch	-	1.64	2.3	nC
			P-Ch	-	1.1	1.5	
$Q_{gs}$	Gate-Source Charge	P-Channel $V_{DS} = -5\text{ V}$ , $I_D = -0.41\text{ A}$ , $V_{GS} = -4.5\text{ V}$	N-Ch	-	0.38	-	nC
			P-Ch	-	0.31	-	
$Q_{gd}$	Gate-Drain Charge		N-Ch	-	0.45	-	nC
			P-Ch	-	0.29	-	

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current		N-Ch	-	-	0.25	A
			P-Ch	-	-	-0.25	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 0.5\text{ A}$ (Note 2)	N-Ch	-	0.8	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = -0.5\text{ A}$ (Note 2)	P-Ch	-	-0.8	-1.2	

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. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

TYPICAL PERFORMANCE CHARACTERISTICS: N-CHANNEL

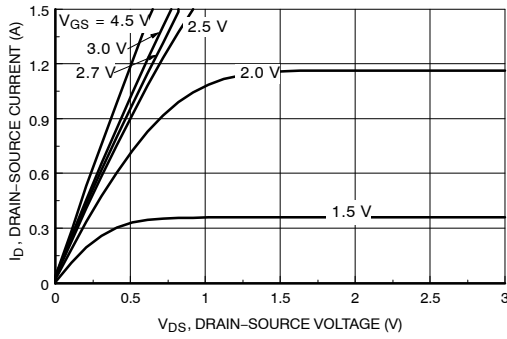


Figure 1. On-Region Characteristics

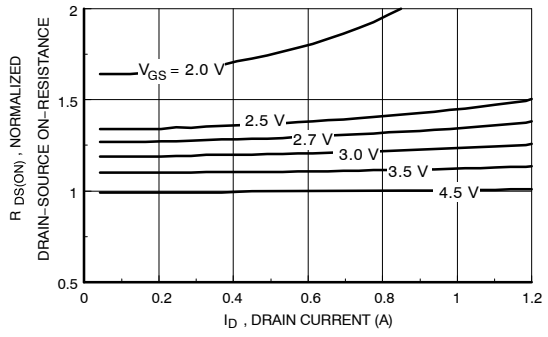


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

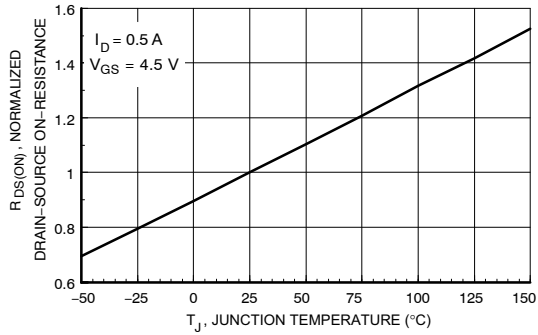


Figure 3. On-Resistance Variation with Temperature

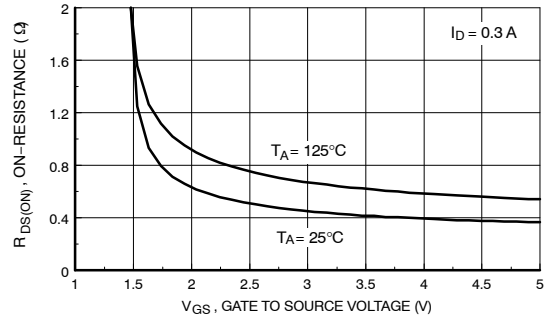


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

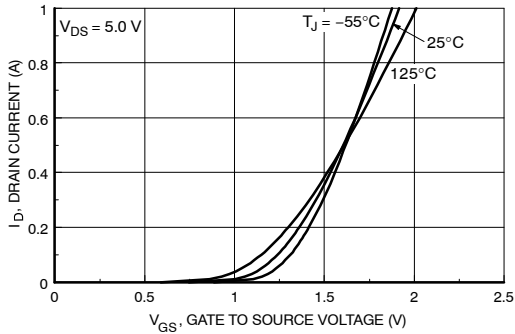


Figure 5. Transfer Characteristics

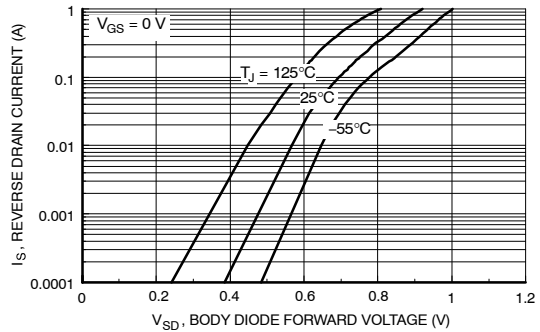


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL PERFORMANCE CHARACTERISTICS: N-CHANNEL (continued)

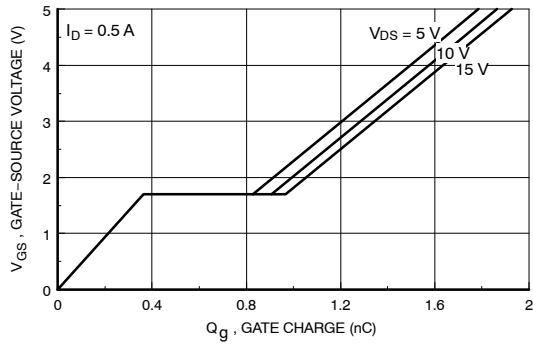


Figure 7. Gate Charge Characteristics

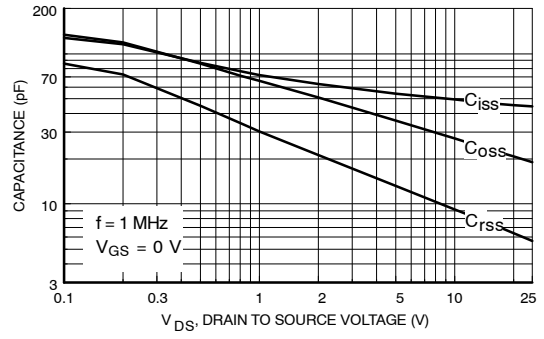


Figure 8. Capacitance Characteristics

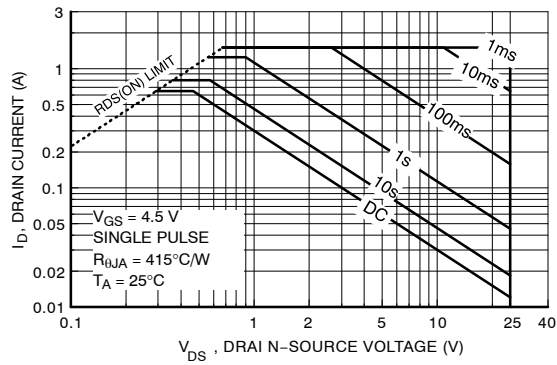


Figure 9. Maximum Safe Operating Area

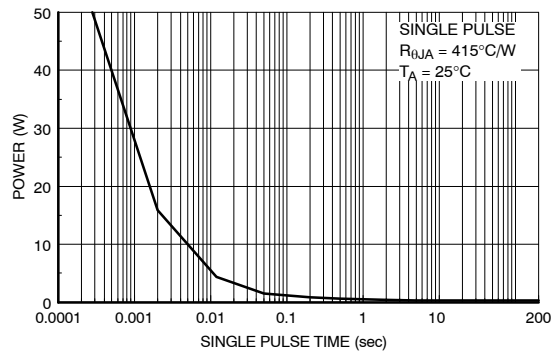


Figure 10. Single Pulse Maximum Power Dissipation

TYPICAL PERFORMANCE CHARACTERISTICS: P-CHANNEL

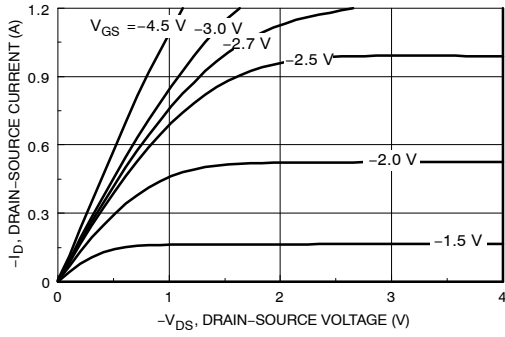


Figure 11. On-Region Characteristics

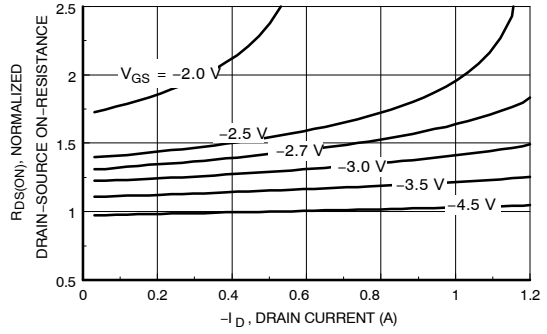


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage

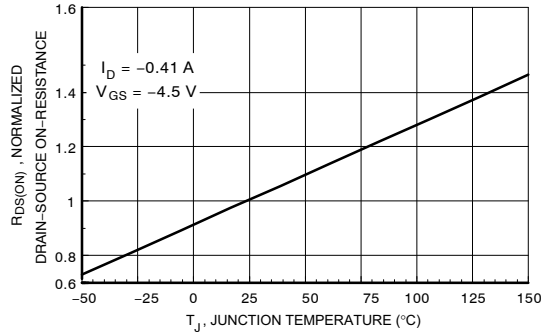


Figure 13. On-Resistance Variation with Temperature

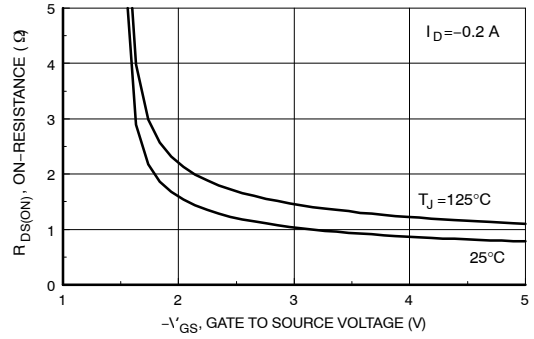


Figure 14. On-Resistance Variation with Gate-to-Source Voltage

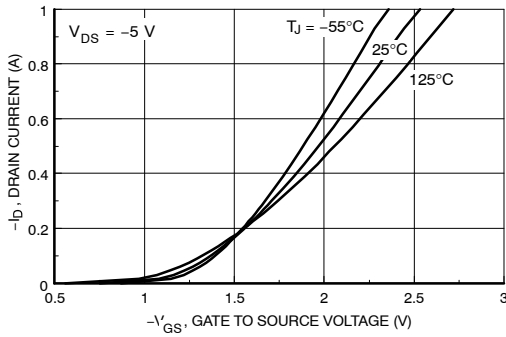


Figure 15. Transfer Characteristics

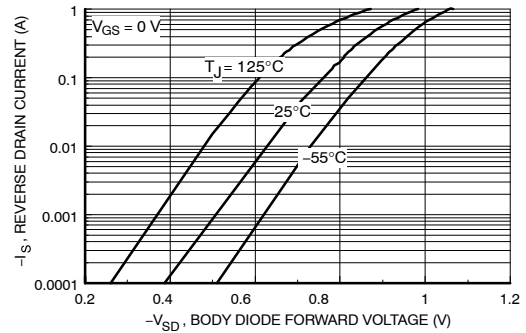


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL PERFORMANCE CHARACTERISTICS: P-CHANNEL (continued)

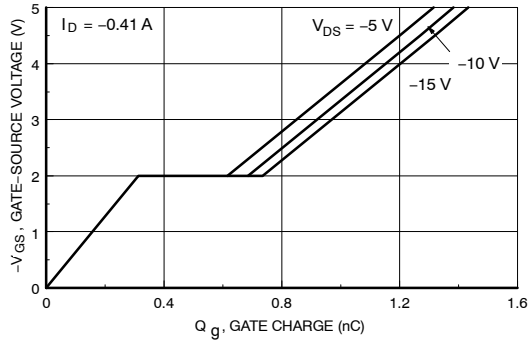


Figure 17. Gate Charge Characteristics

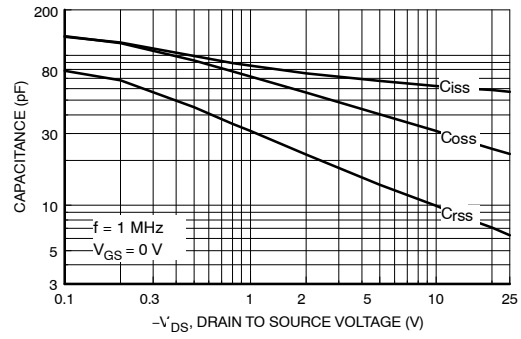


Figure 18. Capacitance Characteristics

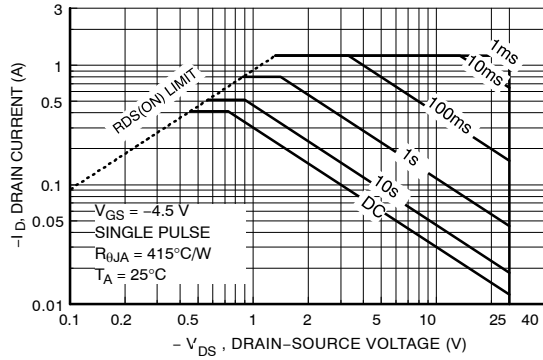


Figure 19. Maximum Safe Operating Area

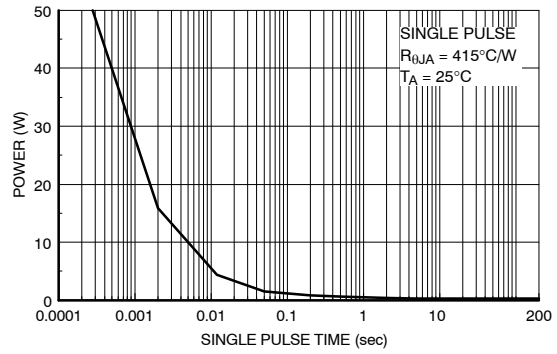
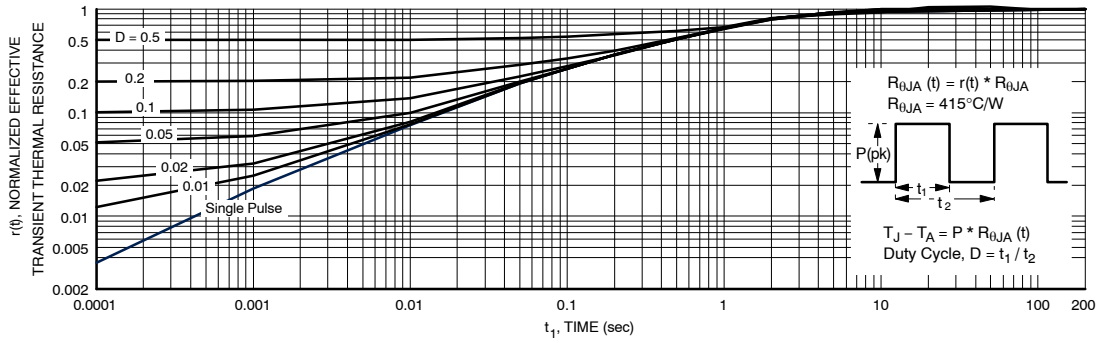


Figure 20. Single Pulse Maximum Power Dissipation

# FDG6321C

## TYPICAL PERFORMANCE CHARACTERISTICS: N & P-CHANNEL



Thermal characterization performed using the conditions described in Note 1.  
 Transient thermal response will change depending on the circuit board design.

**Figure 21. Transient Thermal Response Curve**

### ORDERING INFORMATION

Device Order Number	Device Marking	Package Type	Shipping†
FDG6321C	21	SC-88/SC70-6/SOT-363 (Pb-Free)	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

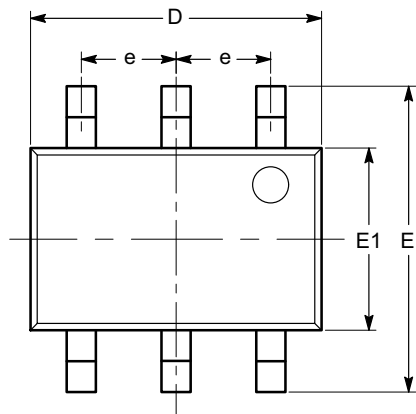
## PACKAGE DIMENSIONS

ON Semiconductor®



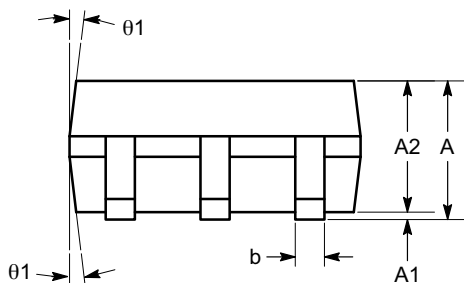
SC-88 (SC-70 6 Lead), 1.25x2  
CASE 419AD-01  
ISSUE A

DATE 07 JUL 2010

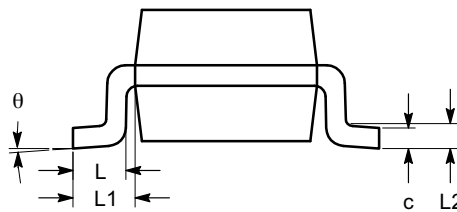


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
$\theta$	0°		8°
$\theta_1$	4°		10°



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

<b>DOCUMENT NUMBER:</b>	<b>98AON34266E</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 (SC-70 6 LEAD), 1.25X2</b>	<b>PAGE 1 OF 1</b>

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor 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.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**onsemi Website:** [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[onsemi:](#)

[FDG6321C](#)