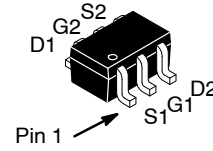


# MOSFET – Dual N-Channel, POWERTRENCH®

20 V, 1.2 A, 175 mΩ

## FDG1024NZ



SC-88/SC-70 6 Lead, 1.25 x 2  
CASE 419AD

### Description

This dual N-Channel logic level enhancement mode field effect transistors are produced using onsemi'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 for low voltage applications as a 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

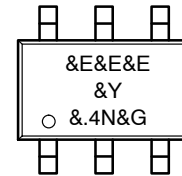
- Max  $r_{DS(on)}$  = 175 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 1.2$  A
- Max  $r_{DS(on)}$  = 215 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 1.0$  A
- Max  $r_{DS(on)}$  = 270 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 0.9$  A
- Max  $r_{DS(on)}$  = 389 mΩ at  $V_{GS} = 1.5$  V,  $I_D = 0.8$  A
- HBM ESD Protection Level > 2 kV (Note 3)
- Very Low Level Gate Drive Requirements Allowing Operation in 1.5 V Circuits ( $V_{GS(th)} < 1$  V)
- Very Small Package Outline SC-88/SC-70 6 Lead
- RoHS Compliant
- These Device is Halogen Free

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

Symbol	Parameter	Ratings	Unit	
$V_{DS}$	Drain to Source Voltage	20	V	
$V_{GS}$	Gate to Source Voltage	±8	V	
$I_D$	Drain Current	Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	1.2	A
		Pulsed	6	
$P_D$	Power Dissipation	$T_A = 25^\circ\text{C}$ (Note 1a)	0.36	W
		$T_A = 25^\circ\text{C}$ (Note 1b)	0.30	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$	

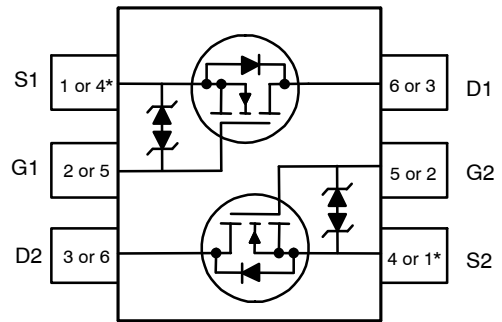
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### MARKING DIAGRAM



- &E = Designates Space
- &Y = Binary Calendar Year
- &.4N = Specific Device Code
- &G = 1-Digit Weekly Date Code

### ELECTRICAL CONNECTION



### N-Channel MOSFET

\* The pinouts are symmetrical; pin 1 and 4 are interchangeable. Units inside the carrier can be of either orientation and will not affect the functionality of the device.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

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## THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	350	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	415	

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{V}$	20	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	–	14	–	mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 16 \text{V}, V_{GS} = 0 \text{V}$	–	–	1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8 \text{V}, V_{DS} = 0 \text{V}$	–	–	$\pm 10$	$\mu\text{A}$

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	0.4	0.8	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$	–	–3	–	mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 4.5 \text{V}, I_D = 1.2 \text{A}$	–	160	175	m $\Omega$
		$V_{GS} = 2.5 \text{V}, I_D = 1.0 \text{A}$	–	185	215	
		$V_{GS} = 1.8 \text{V}, I_D = 0.9 \text{A}$	–	232	270	
		$V_{GS} = 1.5 \text{V}, I_D = 0.8 \text{A}$	–	321	389	
		$V_{GS} = 4.5 \text{V}, I_D = 1.2 \text{A}, T_J = 125^\circ\text{C}$	–	220	259	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5 \text{V}, I_D = 1.2 \text{A}$	–	4	–	S

### DYNAMIC CHARACTERISTICS

$C_{ISS}$	Input Capacitance	$V_{DS} = 10 \text{V}, V_{GS} = 0 \text{V},$ $f = 1 \text{MHz}$	–	115	150	pF
$C_{OSS}$	Output Capacitance		–	25	35	pF
$C_{rss}$	Reverse Transfer Capacitance		–	20	25	pF
$R_g$	Gate Resistance		–	4.6	–	$\Omega$

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10 \text{V}, I_D = 1.2 \text{A},$ $V_{GS} = 4.5 \text{V}, R_{GEN} = 6 \Omega$	–	3.7	10	ns
$t_r$	Rise Time		–	1.7	10	ns
$t_{d(off)}$	Turn-Off Delay Time		–	11	19	ns
$t_f$	Fall Time		–	1.5	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 4.5 \text{V}, V_{DD} = 10 \text{V}, I_D = 1.2 \text{A}$	–	1.8	2.6	nC
$Q_{gs}$	Gate to Source Charge		–	0.3	–	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		–	0.4	–	nC

### DRAIN-SOURCE DIODE CHARACTERISTICS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	–	–	0.3	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{V}, I_S = 0.3 \text{A}$ (Note 2)	–	0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 1.2 \text{A}, di/dt = 100 \text{A}/\mu\text{s}$	–	10	20	ns
$Q_{rr}$	Reverse Recovery Charge		–	1.9	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.

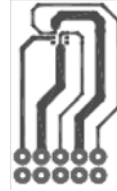
# FDG1024NZ

## NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a. 350°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 415°C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300  $\mu$ s, Duty cycle < 2.0%.
3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

## PACKAGE MARKING AND ORDERING INFORMATION

### ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Shipping <sup>†</sup>
.4N	FDG1024NZ	SC-88/SC-70 6 Lead (Halogen Free)	7"	8 mm	3000 / Tape and Reel

<sup>†</sup>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.

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## TYPICAL CHARACTERISTICS

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

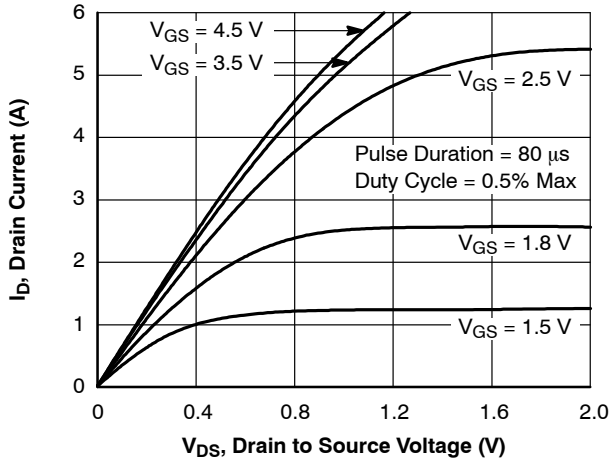


Figure 1. On-Region Characteristics

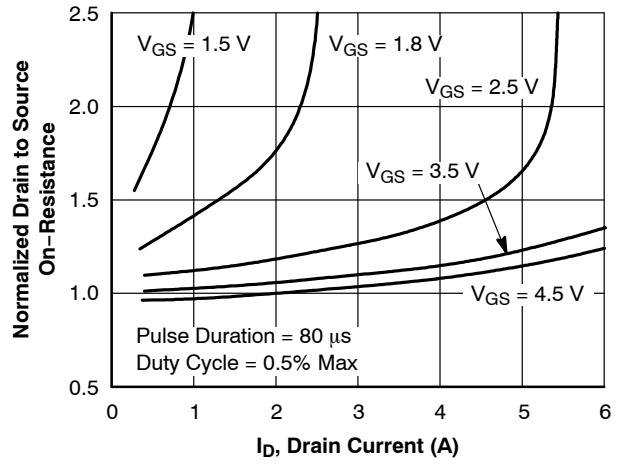


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

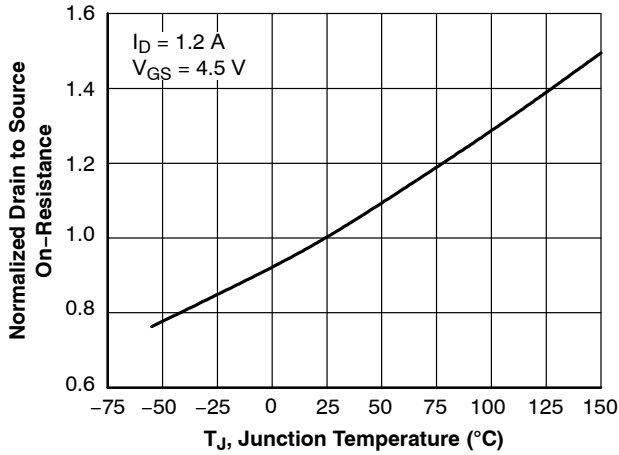


Figure 3. Normalized On-Resistance vs. Junction Temperature

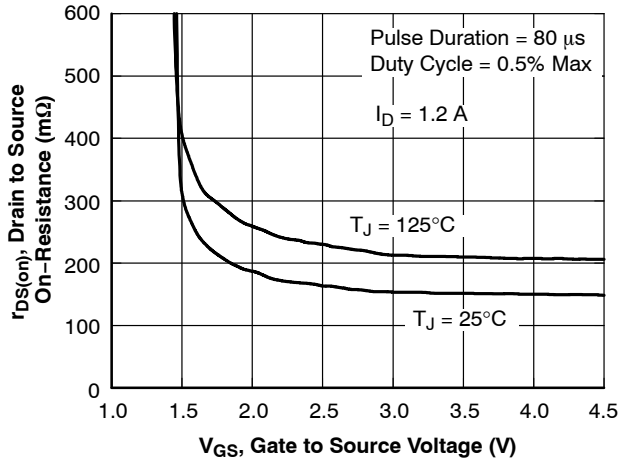


Figure 4. On-Resistance vs. Gate to Source Voltage

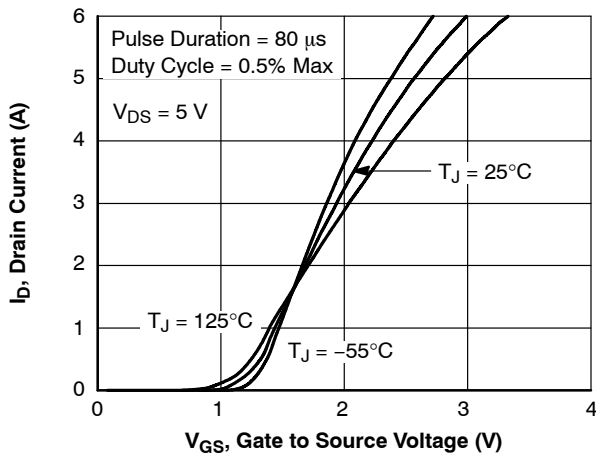


Figure 5. Transfer Characteristics

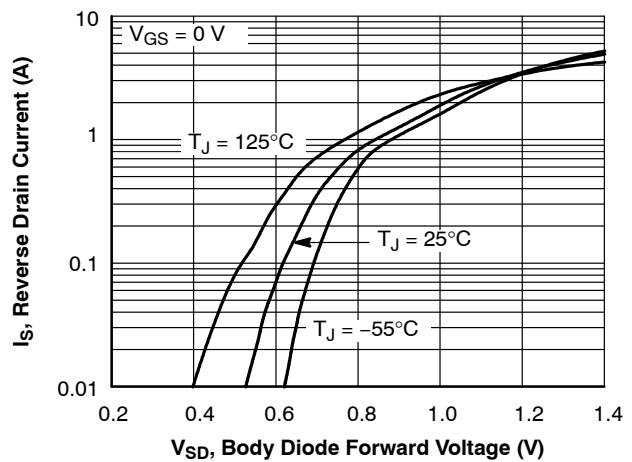


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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## TYPICAL CHARACTERISTICS (continued)

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

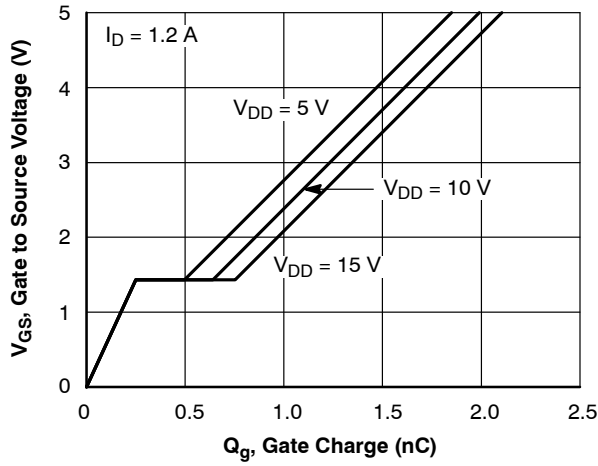


Figure 7. Gate Charge Characteristics

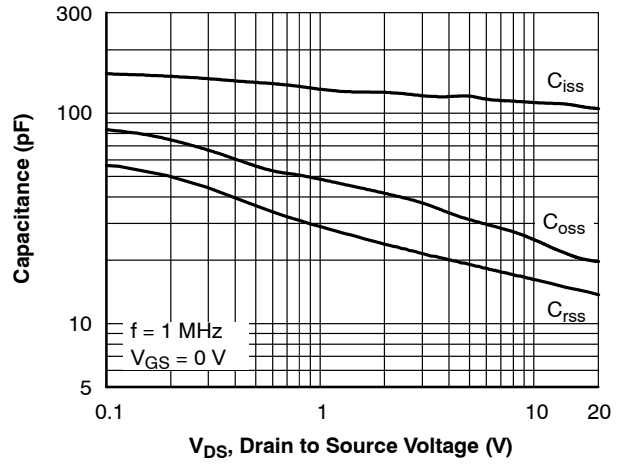


Figure 8. Capacitance vs. Drain to Source Voltage

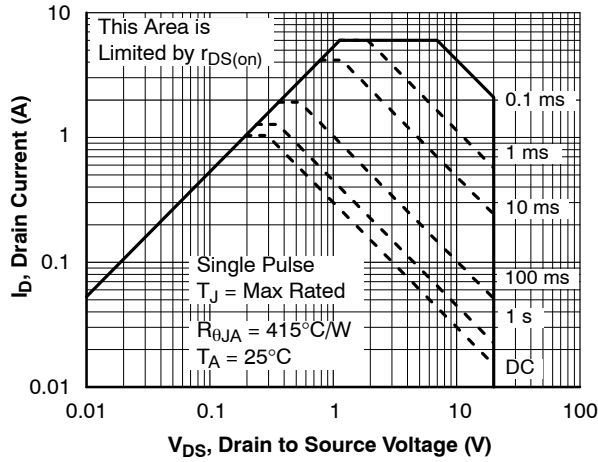


Figure 9. Forward Bias Safe Operating Area

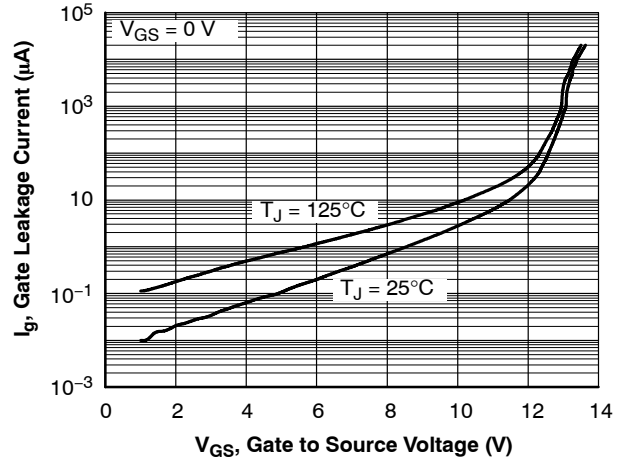


Figure 10. Gate Leakage Current vs. Gate to Source Voltage

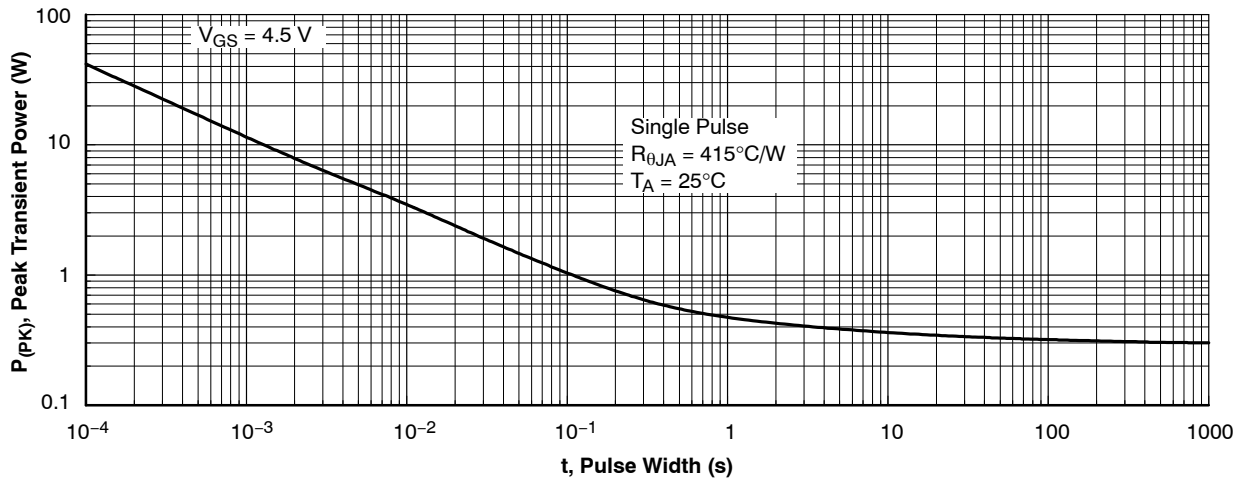


Figure 11. Single Pulse Maximum Power Dissipation

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## TYPICAL CHARACTERISTICS (continued)

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

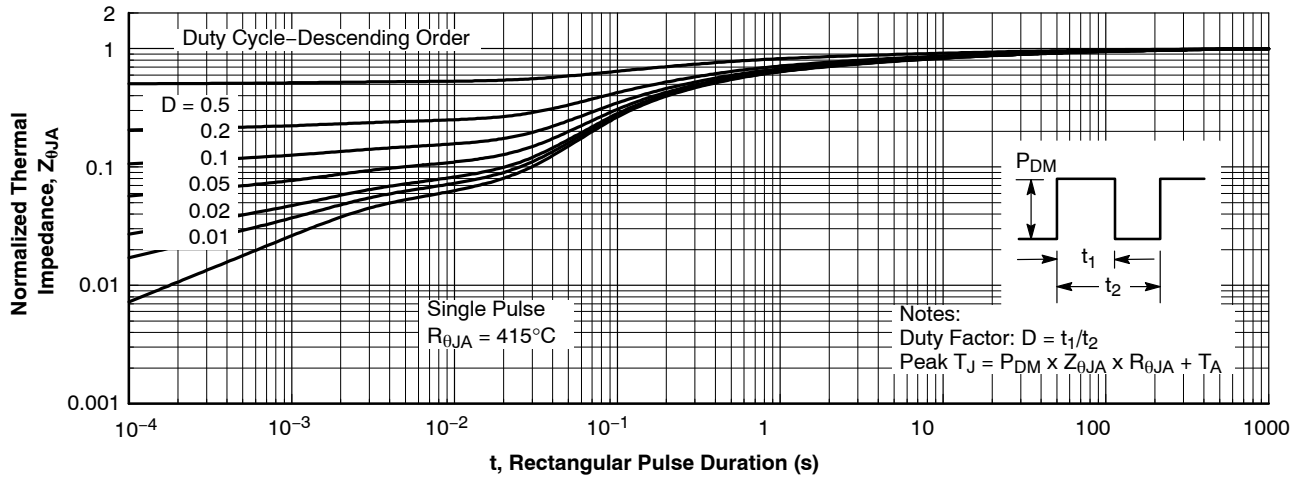


Figure 12. Transient Thermal Response Curve

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# MECHANICAL CASE OUTLINE

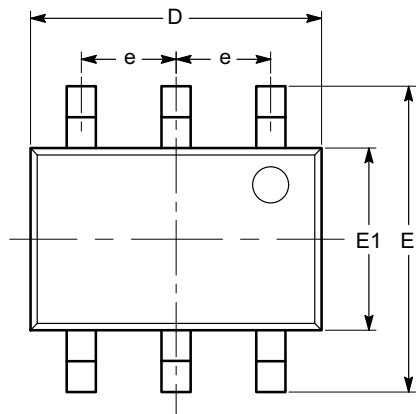
## PACKAGE DIMENSIONS

ON Semiconductor®



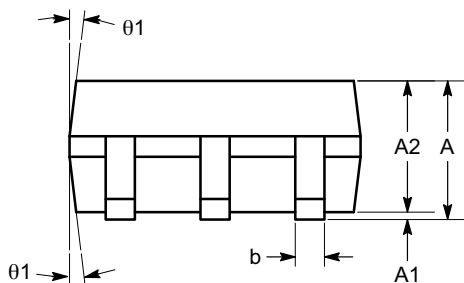
SC-88 (SC-70 6 Lead), 1.25x2  
CASE 419AD-01  
ISSUE A

DATE 07 JUL 2010

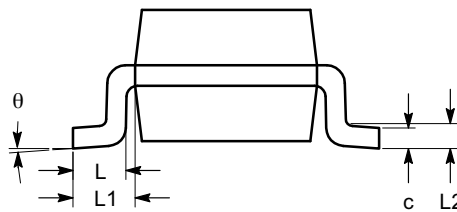


TOP VIEW

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.

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