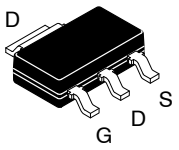
Transistor, N-Channel, Field Effect, Enhancement Mode, 2.5 V Specified

FDT439N

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
30 V	0.045 Ω @ 4.5 V	6.3 A
	0.058 Ω @ 2.5 V	



SOT−223
CASE 318H

General Description

This N−Channel enhancement mode power field effect transistor is produced using **onsemi**'s proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on−state resistance and provide superior switching performance. These products are well suited to low voltage, low current applications such as notebook computer power management, battery powered circuits, and DC motor control.

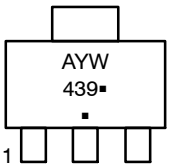
Features

- 6.3 A, 30 V
  $R_{DS(on)}$ = 0.045 Ω @ V_{GS} = 4.5 V
  $R_{DS(on)}$ = 0.058 Ω @ V_{GS} = 2.5 V
- Fast switching speed.
- High power and current handling capability in a widely used surface mount package.
- This Device is Pb−Free

Applications

- DC/DC Converter
- Load Switch
- Motor Driving

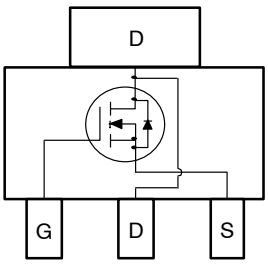
MARKING DIAGRAM



A = Specific Device Code
Y = Date Code
W = Work Week
439 = Specific Device Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

PINOUT



ORDERING INFORMATION

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

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain−Source Voltage		30	V
V_{GSS}	Gate−Source Voltage		±8	V
I_D	Drain Current	− Continuous (Note 1a)	6.3	A
		− Pulsed	20	
P_D	Power Dissipation for Single Operation	(Note 1a)	3	W
		(Note 1b)	1.3	
		(Note 1c)	1.1	
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

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a)	42	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	12	°C/W

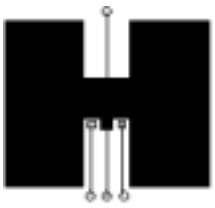
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA,Referenced to 25°C	–	40	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V	–	–	1	μA
I_{GSSF}	Gate–Body Leakage Current, Forward	V_{GS} = 8 V, V_{DS} = 0 V	–	–	100	nA
I_{GSSR}	Gate–Body Leakage Current, Reverse	V_{GS} = –8 V, V_{DS} = 0 V	–	–	–100	nA
ON CHARACTERISTICS (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	0.4	0.67	1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	–2.2	–	mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 4.5 V, I_D = 6.3 A V_{GS} = 4.5 V, I_D = 6.3 A, T_J = 125°C V_{GS} = 2.5 V, I_D = 5.5 A	– – –	0.038 0.055 0.048	0.045 0.072 0.058	Ω
$I_{D(on)}$	On–State Drain Current	V_{GS} = 4.5 V, V_{DS} = 5 V	10	–	–	A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 6.3 A	–	17	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz	–	500	–	pF
C_{oss}	Output Capacitance		–	185	–	pF
C_{rss}	Reverse Transfer Capacitance		–	43	–	pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω	–	6	12	ns
t_r	Turn–On Rise Time		–	10	18	ns
$t_{d(off)}$	Turn–Off Delay Time		–	30	48	ns
t_f	Turn–Off Fall Time		–	10	18	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 6.3 A, V_{GS} = 4.5 V	–	10.7	15	nC
Q_{gs}	Gate–Source Charge		–	0.9	–	nC
Q_{gd}	Gate–Drain Charge		–	3.7	–	nC
DRAIN–SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATIINGS						
I_S	Maximum Continuous Drain–Source Diode Forward Current		–	–	2.5	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.5 A (Note 2)	–	0.8	1.2	V

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.

NOTES:

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. 42°C/W when mounted on a 1 in^2 pad of 2 oz copper.

b. 95°C/W when mounted on a 0.066 in^2 pad of 2 oz copper.

c. 110°C/W when mounted on a minimum mounting pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width ≤ 300 μs, Duty cycle ≤ 2.0 %.

TYPICAL CHARACTERISTICS

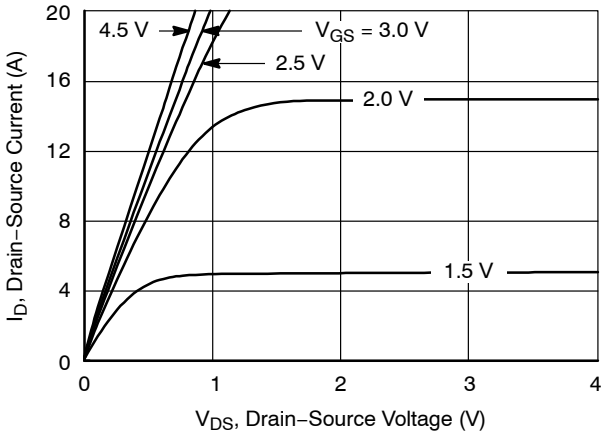


Figure 1. On−Region Characteristics

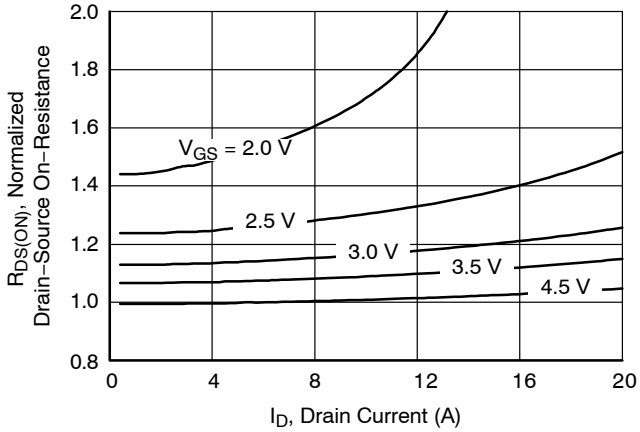


Figure 2. On−Resistance Variation with Drain Current and Gate Voltage

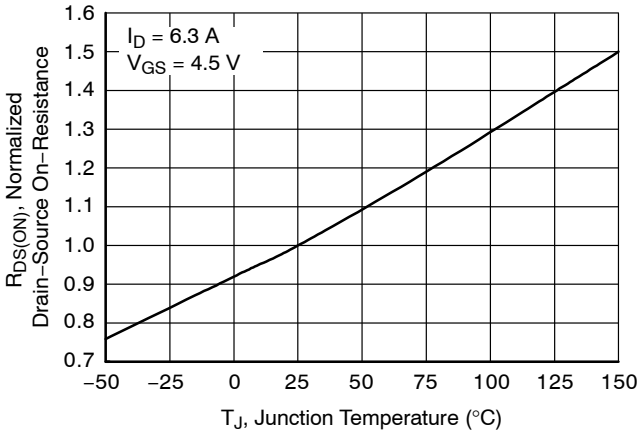


Figure 3. On−Resistance Variation with Temperature

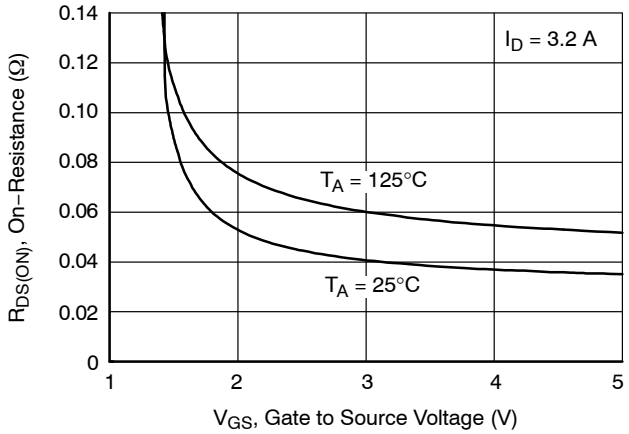


Figure 4. On−Resistance Variation with Gate−to−Source Voltage

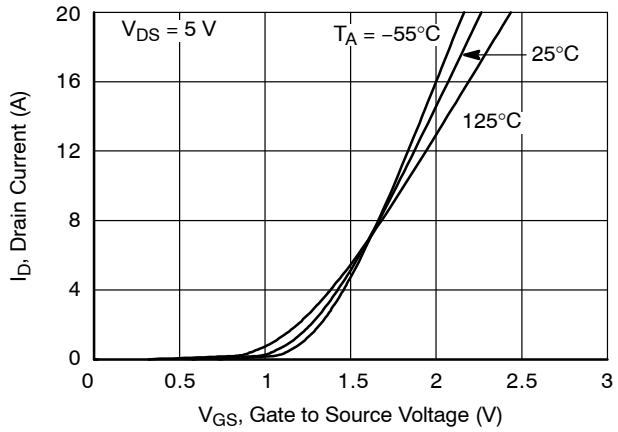


Figure 5. Transfer Characteristics

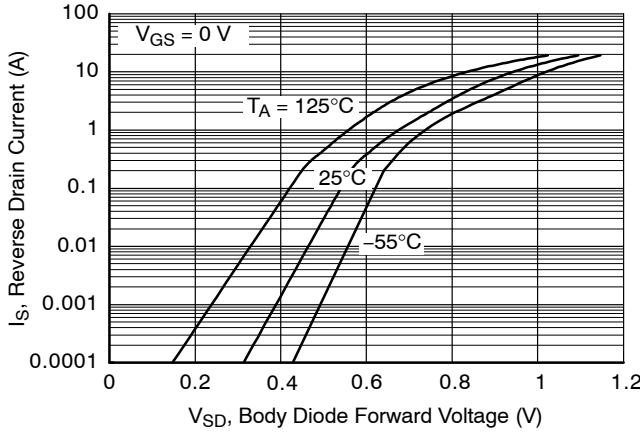


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL ELECTRICAL CHARACTERISTICS (continued)

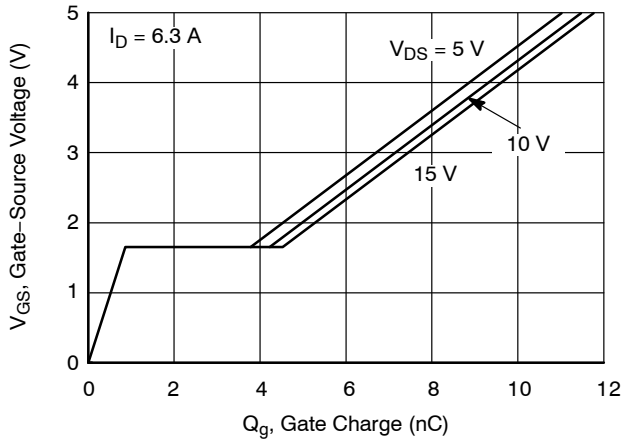


Figure 7. Gate Charge Characteristics

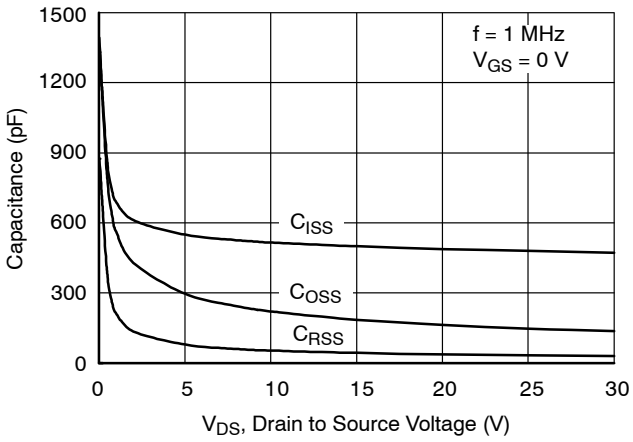


Figure 8. Capacitance Characteristics

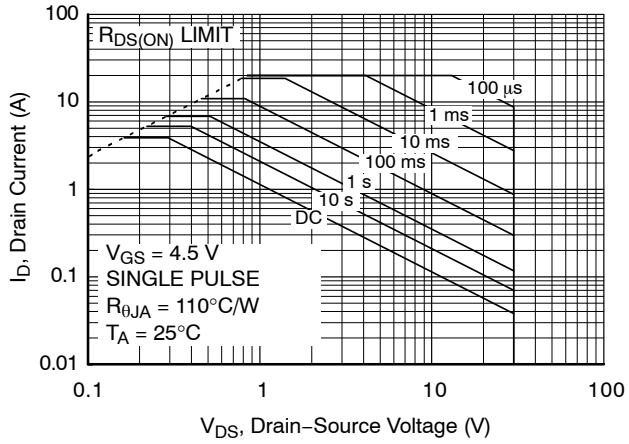


Figure 9. Maximum Safe Operating Area

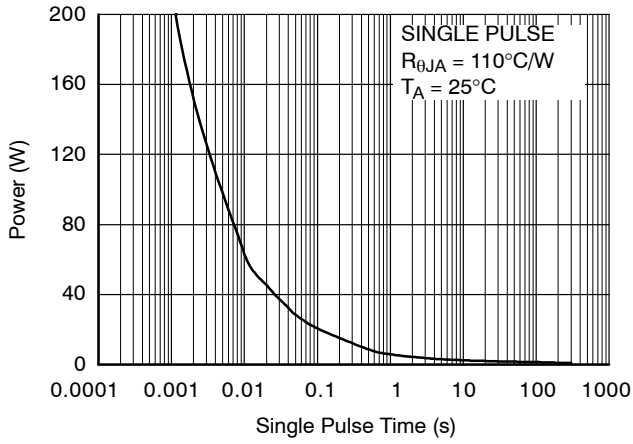


Figure 10. Single Pulse Maximum Power Dissipation

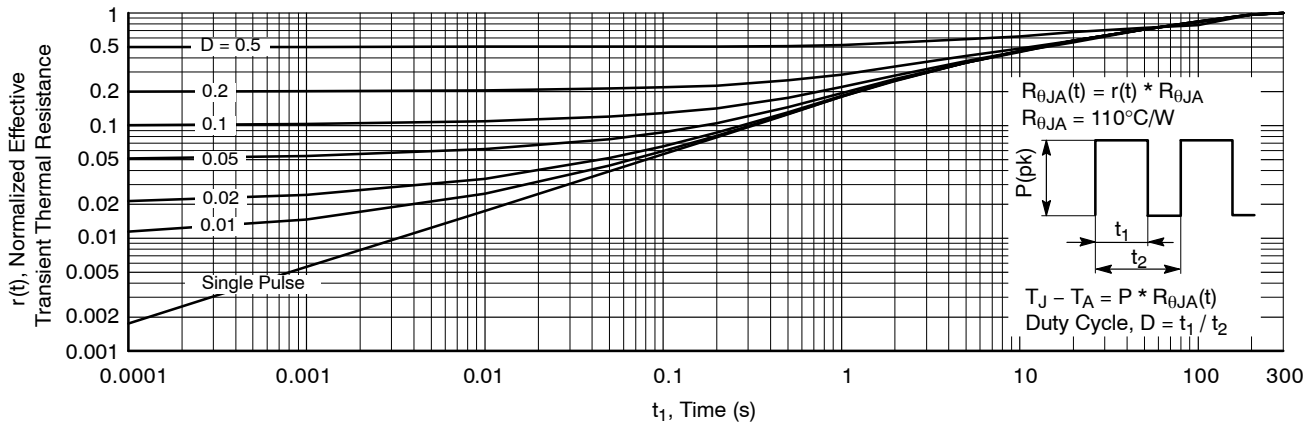


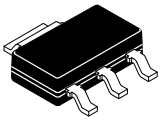
Figure 11. Transient Thermal Response Curve

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

ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Shipping†
FDT439N	439	SOT−223 (Pb−free)	13”	12 mm	4000 / Tape & Reel

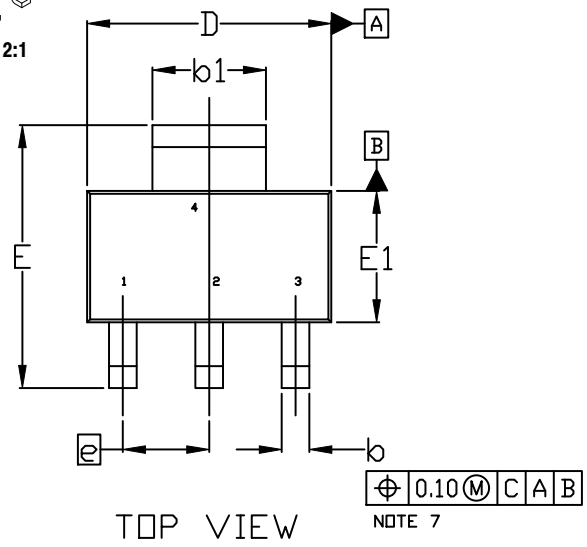
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

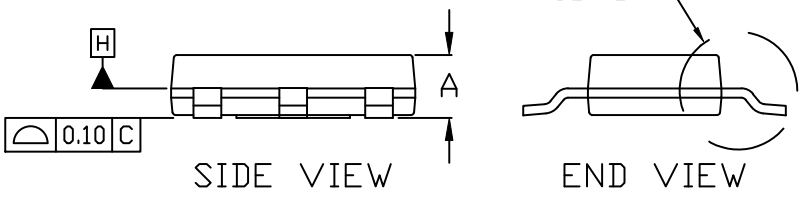


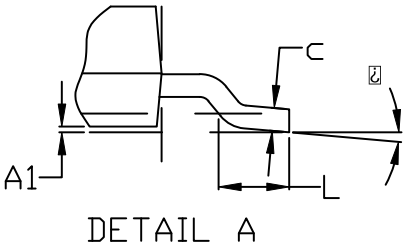
SCALE 2:1

SOT−223
CASE 318H
ISSUE B

DATE 13 MAY 2020

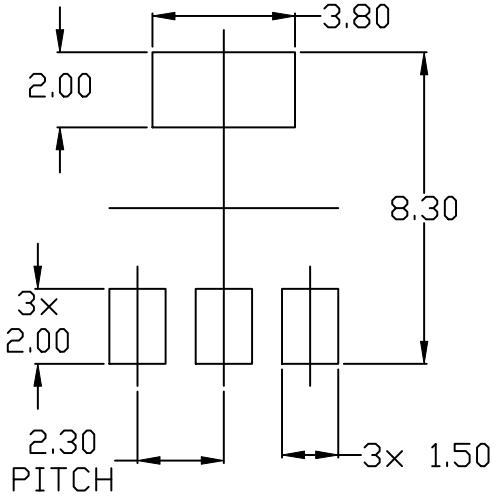






NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E1 ARE DETERMINED AT DATUM H. DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. SHALL NOT EXCEED 0.23mm PER SIDE.
4. LEAD DIMENSIONS b AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBBAR PROTRUSION IS 0.08mm PER SIDE.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
7. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

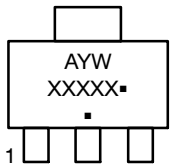
	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	---	---	1.80
A1	0.02	0.06	0.11
b	0.60	0.74	0.88
b1	2.90	3.00	3.10
c	0.24	---	0.35
D	6.30	6.50	6.70
E	6.70	7.00	7.30
E1	3.30	3.50	3.70
e	2.30 BSC		
L	0.25	---	---
θ	0°	---	10°



RECOMMENDED MOUNTING FOOTPRINT

* 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*



A = Assembly Location
Y = Year
W = Work Week
XXXXX = Specific Device 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.

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DESCRIPTION:	**SOT−223**	**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

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