

NCV8440, NCV8440A

Protected Power MOSFET

2.6 A, 52 V, N-Channel, Logic Level,
Clamped MOSFET w/ ESD Protection

Features

- Diode Clamp Between Gate and Source
- ESD Protection – Human Body Model 5000 V
- Active Over-Voltage Gate to Drain Clamp
- Scalable to Lower or Higher $R_{DS(on)}$
- Internal Series Gate Resistance
- These are Pb-Free Devices

Benefits

- High Energy Capability for Inductive Loads
- Low Switching Noise Generation

Applications

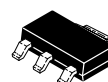
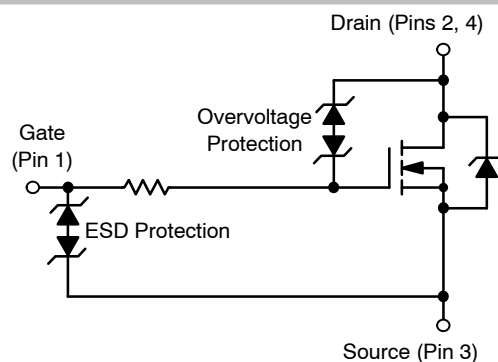
- Automotive and Industrial Markets:
Solenoid Drivers, Lamp Drivers, Small Motor Drivers
- NCV Prefix for Automotive and Other Applications Requiring
Unique Site and Control Change Requirements; AEC-Q100
Qualified and PPAP Capable



ON Semiconductor®

www.onsemi.com

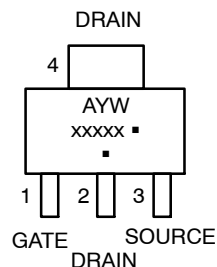
V_{DSS} (Clamped)	$R_{DS(on)}$ TYP	I_D MAX
52 V	95 mΩ @ 10 V	2.6 A



SOT-223
CASE 318E
STYLE 3

1 = Gate
2 = Drain
3 = Source

MARKING DIAGRAM



A = Assembly Location
Y = Year
W = Work Week
xxxxx = V8440 or 8440A
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

NCV8440, NCV8440A

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage Internally Clamped	V _{DSS}	52-59	V
Gate-to-Source Voltage – Continuous	V _{GS}	±15	V
Drain Current – Continuous @ T _A = 25°C – Single Pulse (t _p = 10 μs) (Note 1)	I _D I _{DM}	2.6 10	A
Total Power Dissipation @ T _A = 25°C (Note 1)	P _D	1.69	W
Operating and Storage Temperature Range	T _J , T _{stg}	–55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy (V _{DD} = 50 V, I _{D(pk)} = 1.17 A, V _{GS} = 10 V, L = 160 mH, R _G = 25 Ω)	E _{AS}	110	mJ
Load Dump Voltage (V _{GS} = 0 and 10 V, R _I = 2.0 Ω, R _L = 9.0 Ω, t _d = 400 ms)	V _{LD}	60	V
Thermal Resistance, Junction-to-Ambient (Note 1) Junction-to-Ambient (Note 2)	R _{θJA} R _{θJA}	74 169	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from Case for 10 Seconds	T _L	260	°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.

1. When surface mounted to a FR4 board using 1" pad size, (Cu area 1.127 in²).
2. When surface mounted to a FR4 board using minimum recommended pad size, (Cu area 0.412 in²).

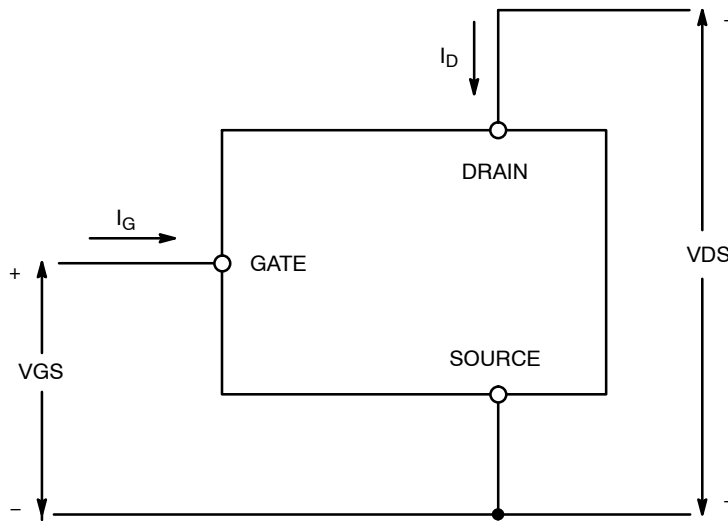


Figure 1. Voltage and Current Convention

NCV8440, NCV8440A

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 3) (V _{GS} = 0 V, I _D = 1.0 mA, T _J = 25°C) (V _{GS} = 0 V, I _D = 1.0 mA, T _J = -40°C to 125°C) (Note 4) Temperature Coefficient (Negative)	V _{(BR)DSS}	52 50.8	55 54 -9.3	59 59.5	V V mV/°C
Zero Gate Voltage Drain Current (V _{DS} = 40 V, V _{GS} = 0 V) (V _{DS} = 40 V, V _{GS} = 0 V, T _J = 125°C) (Note 4)	I _{DSS}			10 25	μA
Gate-Body Leakage Current (V _{GS} = ±8 V, V _{DS} = 0 V) (V _{GS} = ±14 V, V _{DS} = 0 V)	I _{GSS}		±35	±10	μA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage (Note 3) (V _{DS} = V _{GS} , I _D = 100 μA) Threshold Temperature Coefficient (Negative)	V _{GS(th)}	1.1	1.5 -4.1	1.9	V mV/°C
Static Drain-to-Source On-Resistance (Note 3) (V _{GS} = 3.5 V, I _D = 0.6 A) (V _{GS} = 4.0 V, I _D = 1.5 A) (V _{GS} = 10 V, I _D = 2.6 A)	R _{DS(on)}		150 135 95	180 160 110	mΩ
Forward Transconductance (Note 3) (V _{DS} = 15 V, I _D = 2.6 A)	g _{FS}		3.8		Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	V _{DS} = 35 V, V _{GS} = 0 V, f = 10 kHz	C _{iss}		155		pF
Output Capacitance		C _{oss}		60		
Transfer Capacitance		C _{rss}		25		
Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 10 kHz	C _{iss}		170		pF
Output Capacitance		C _{oss}		70		
Transfer Capacitance		C _{rss}		30		

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.

- Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
- Not subject to production testing.
- Switching characteristics are independent of operating junction temperatures.

NCV8440, NCV8440A

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 5)					
Turn-On Delay Time	$V_{GS} = 4.5\text{ V}, V_{DD} = 40\text{ V},$ $I_D = 2.6\text{ A}, R_D = 15.4\ \Omega$	$t_{d(on)}$	375		ns
Rise Time		t_r	1525		
Turn-Off Delay Time		$t_{d(off)}$	1530		
Fall Time		t_f	1160		
Turn-On Delay Time	$V_{GS} = 4.5\text{ V}, V_{DD} = 40\text{ V},$ $I_D = 1.0\text{ A}, R_D = 40\ \Omega$	$t_{d(on)}$	325		ns
Rise Time		t_r	1275		
Turn-Off Delay Time		$t_{d(off)}$	1860		
Fall Time		t_f	1150		
Turn-On Delay Time	$V_{GS} = 10\text{ V}, V_{DD} = 15\text{ V},$ $I_D = 2.6\text{ A}, R_D = 5.8\ \Omega$	$t_{d(on)}$	190		ns
Rise Time		t_r	710		
Turn-Off Delay Time		$t_{d(off)}$	2220		
Fall Time		t_f	1180		
Gate Charge	$V_{GS} = 4.5\text{ V}, V_{DS} = 40\text{ V},$ $I_D = 2.6\text{ A}$ (Note 3)	Q_T	4.5		nC
		Q_1	0.9		
		Q_2	2.6		
Gate Charge	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 1.5\text{ A}$ (Note 3)	Q_T	3.9		nC
		Q_1	1.0		
		Q_2	1.7		

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	$I_S = 2.6\text{ A}, V_{GS} = 0\text{ V}$ (Note 3) $I_S = 2.6\text{ A}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$	V_{SD}	0.81 0.66	1.5	V
Reverse Recovery Time	$I_S = 1.5\text{ A}, V_{GS} = 0\text{ V},$ $di_S/dt = 100\text{ A}/\mu\text{s}$ (Note 3)	t_{rr}	730		ns
		t_a	200		
		t_b	530		
Reverse Recovery Stored Charge		Q_{RR}	6.3		μC

ESD CHARACTERISTICS

 (Note 4)

Electro-Static Discharge Capability	Human Body Model (HBM)	ESD	5000		V
	Machine Model (MM)		500		

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.

- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
- Not subject to production testing.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

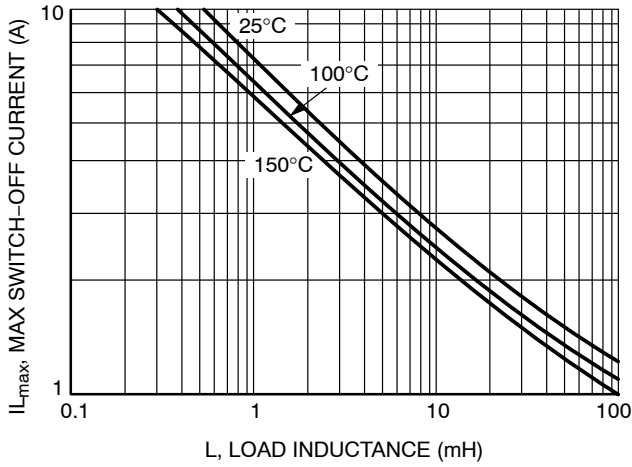


Figure 1. Single Pulse Maximum Switch-off Current vs. Load Inductance

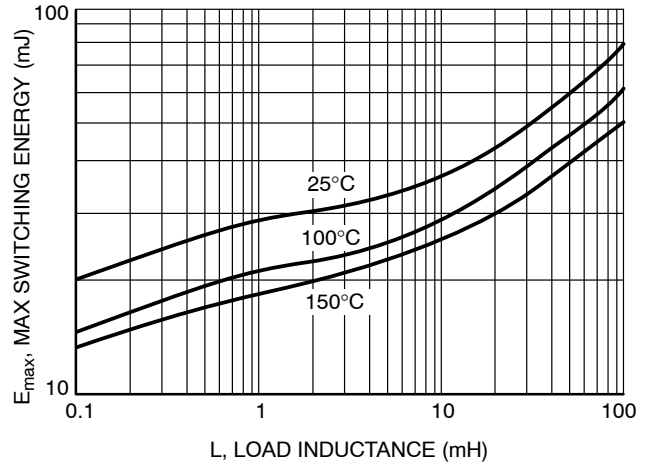


Figure 2. Single Pulse Maximum Switching Energy vs. Load Inductance

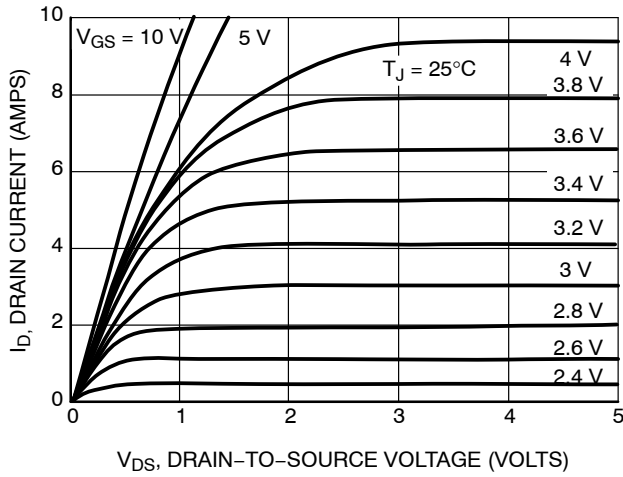


Figure 3. On-State Output Characteristics

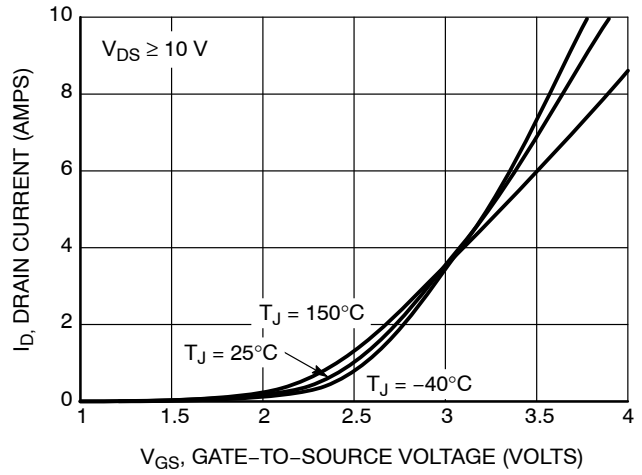


Figure 4. Transfer Characteristics

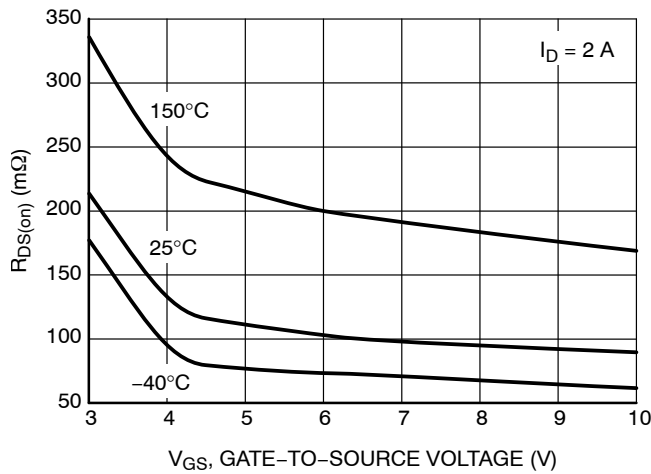


Figure 5. $R_{DS(on)}$ vs. Gate-Source Voltage

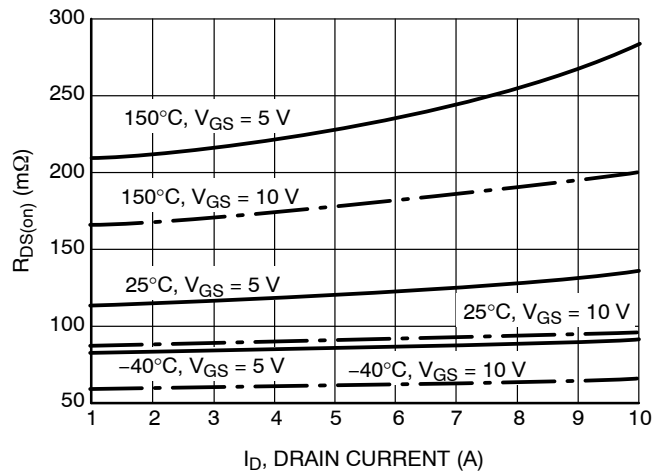


Figure 6. $R_{DS(on)}$ vs. Drain Current

TYPICAL PERFORMANCE CURVES

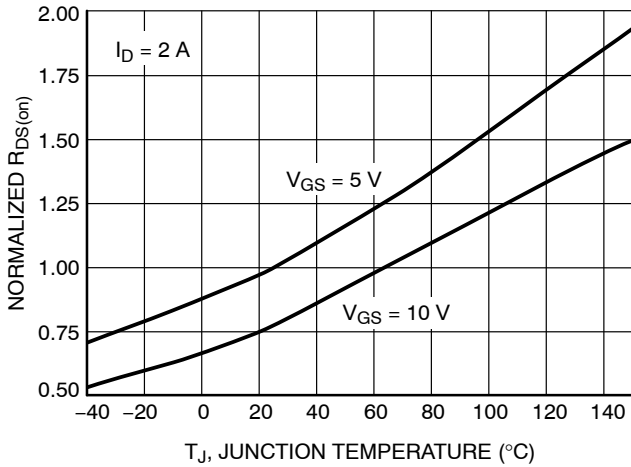


Figure 7. Normalized $R_{DS(on)}$ vs. Temperature

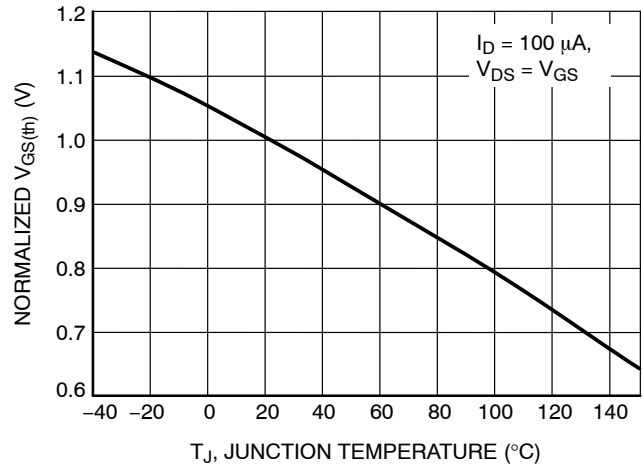


Figure 8. Normalized Threshold Voltage vs. Temperature

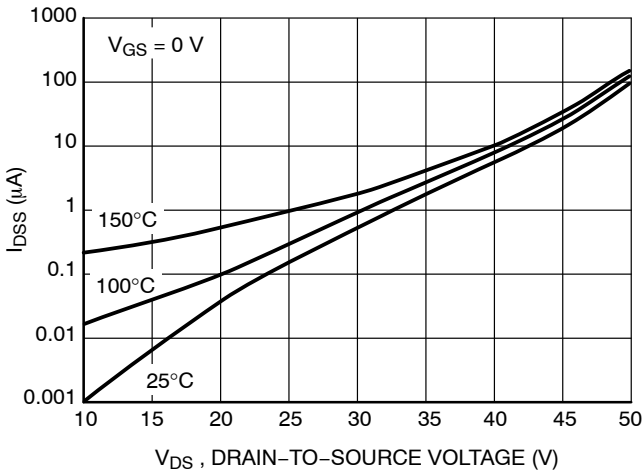


Figure 9. Drain-to-Source Leakage Current

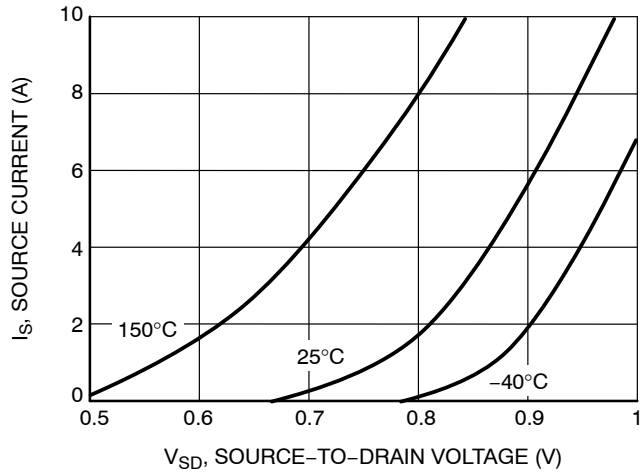


Figure 10. Source-Drain Diode Forward Characteristics

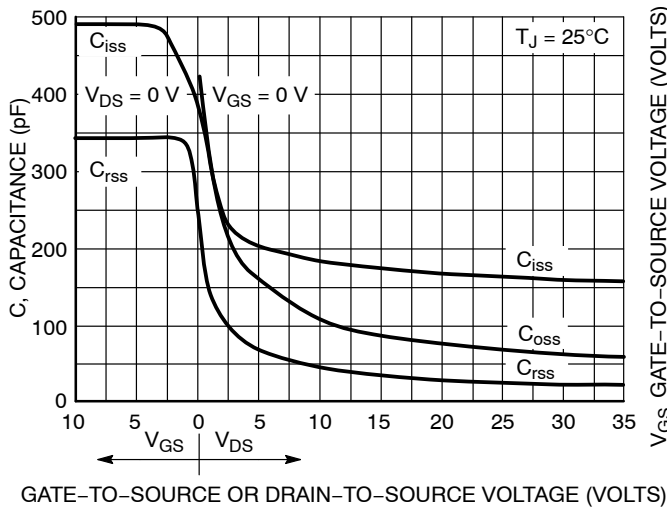


Figure 11. Capacitance Variation

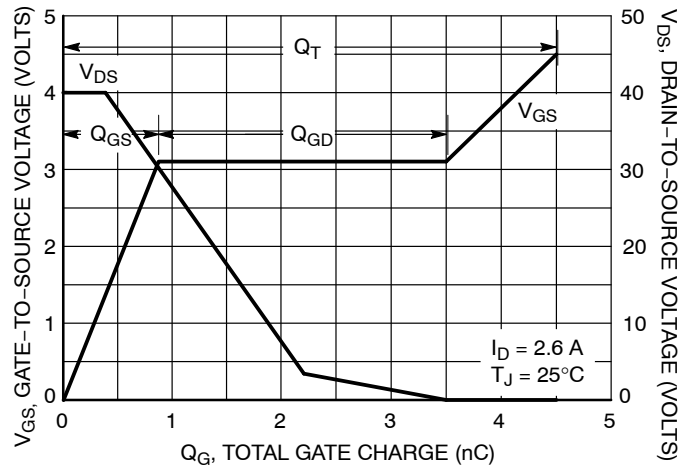


Figure 12. Gate-to-Source Voltage vs. Total Gate Charge

TYPICAL PERFORMANCE CURVES

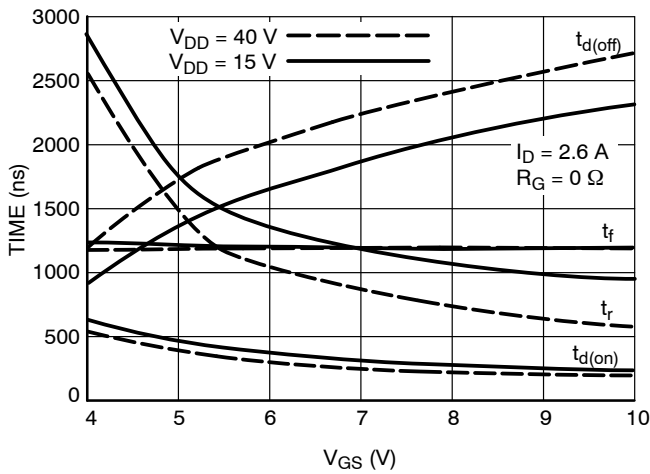


Figure 13. Resistive Load Switching Time vs. Gate-Source Voltage

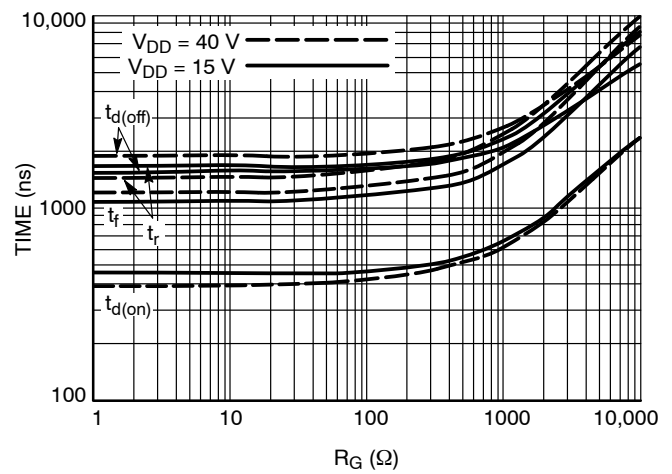


Figure 14. Resistive Load Switching Time vs. Gate Resistance ($V_{GS} = 5\text{ V}$, $I_D = 2.6\text{ A}$)

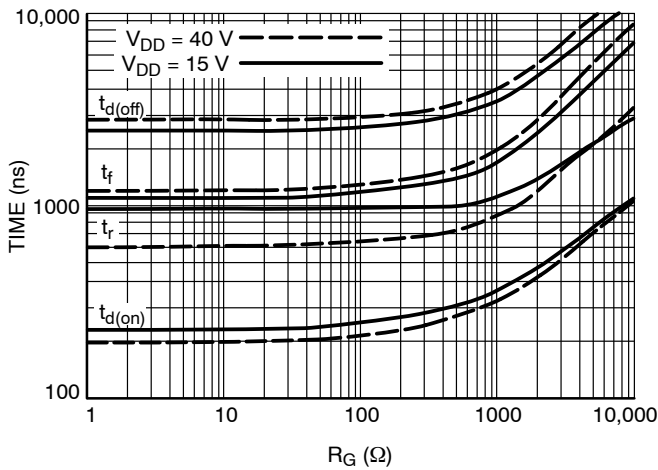


Figure 15. Resistive Load Switching Time vs. Gate Resistance ($V_{GS} = 10\text{ V}$, $I_D = 2.6\text{ A}$)

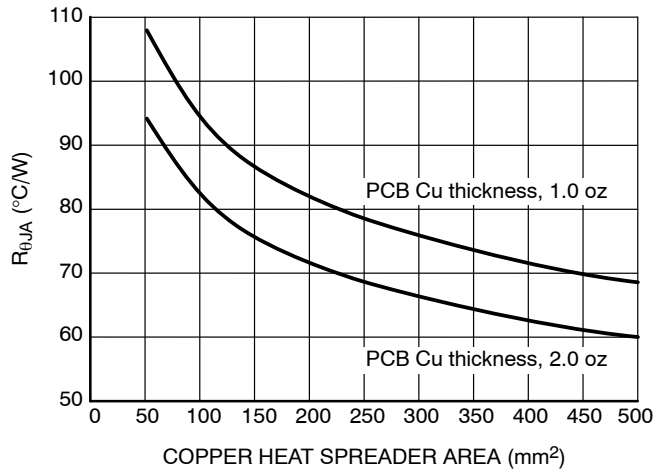


Figure 16. $R_{\theta JA}$ vs. Copper Area

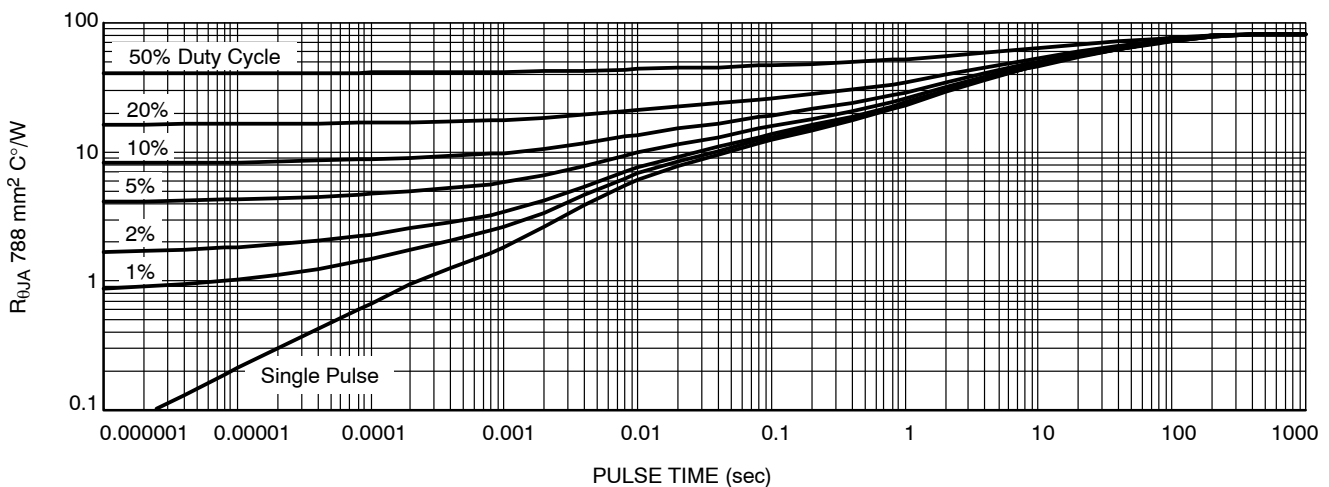


Figure 17. Transient Thermal Resistance

NCV8440, NCV8440A

ORDERING INFORMATION

Device	Package	Shipping†
NCV8440STT1G	SOT-223 (Pb-Free)	1000 / Tape & Reel
NCV8440ASTT1G	SOT-223 (Pb-Free)	1000 / Tape & Reel
NCV8440STT3G	SOT-223 (Pb-Free)	4000 / Tape & Reel
NCV8440ASTT3G	SOT-223 (Pb-Free)	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.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

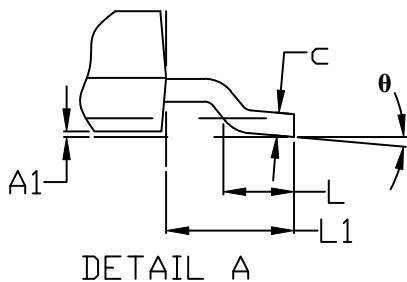
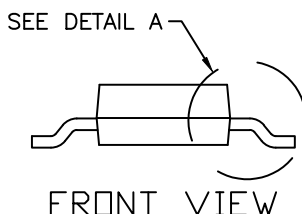
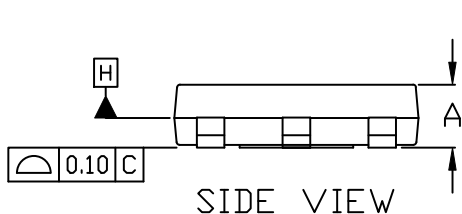
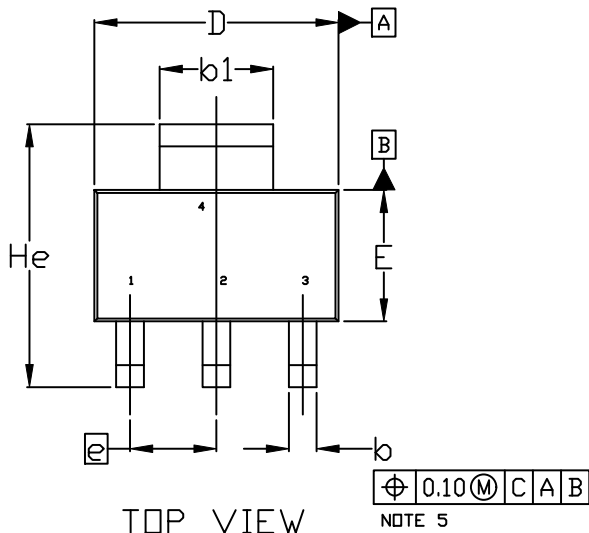
ON Semiconductor®



SCALE 1:1

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

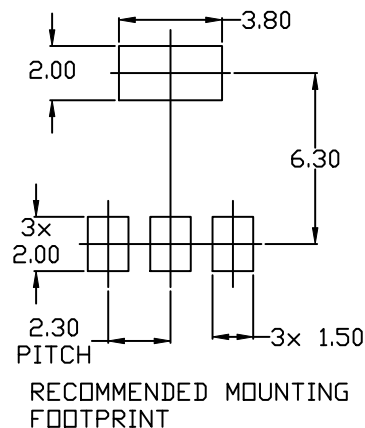
DATE 02 OCT 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

MILLIMETERS			
DIM	MIN.	NOM.	MAX.
A	1.50	1.63	1.75
A1	0.02	0.06	0.10
b	0.60	0.75	0.89
b1	2.90	3.06	3.20
c	0.24	0.29	0.35
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.30 BSC		
L	0.20	---	---
L1	1.50	1.75	2.00
He	6.70	7.00	7.30
θ	0°	---	10°



DOCUMENT NUMBER:	98ASB42680B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-223 (TO-261)	PAGE 1 OF 2

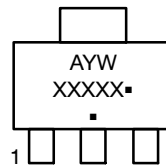
ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, 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.

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

DATE 02 OCT 2018

STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR	STYLE 2: PIN 1. ANODE 2. CATHODE 3. NC 4. CATHODE	STYLE 3: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN	STYLE 4: PIN 1. SOURCE 2. DRAIN 3. GATE 4. DRAIN	STYLE 5: PIN 1. DRAIN 2. GATE 3. SOURCE 4. GATE
STYLE 6: PIN 1. RETURN 2. INPUT 3. OUTPUT 4. INPUT	STYLE 7: PIN 1. ANODE 1 2. CATHODE 3. ANODE 2 4. CATHODE	STYLE 8: CANCELLED	STYLE 9: PIN 1. INPUT 2. GROUND 3. LOGIC 4. GROUND	STYLE 10: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE
STYLE 11: PIN 1. MT 1 2. MT 2 3. GATE 4. MT 2	STYLE 12: PIN 1. INPUT 2. OUTPUT 3. NC 4. OUTPUT	STYLE 13: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR		


**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.

DOCUMENT NUMBER:	98ASB42680B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-223 (TO-261)	PAGE 2 OF 2

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.

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 owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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
19521 E. 32nd Pkwy, Aurora, Colorado 80011 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
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

ON Semiconductor Website: www.onsemi.com

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

For additional information, please contact your local Sales Representative