

MOSFET – N-Channel, UniFET™

200 V, 39 A, 66 mΩ

FDP39N20, FDPF39N20

Description

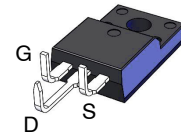
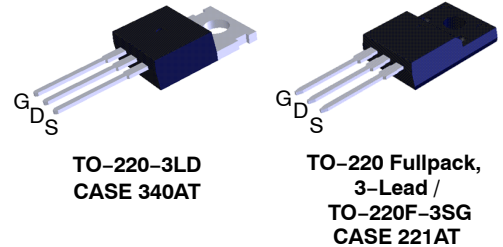
UniFET™ MOSFET is onsemi's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

Features

- $R_{DS(on)} = 66 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 19.5 \text{ A}$
- Low Gate Charge (Typ. 38 nC)
- Low C_{rss} (Typ. 57 pF)
- 100% Avalanche Tested

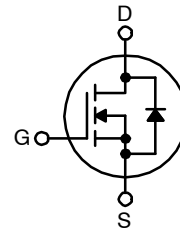
Applications

- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

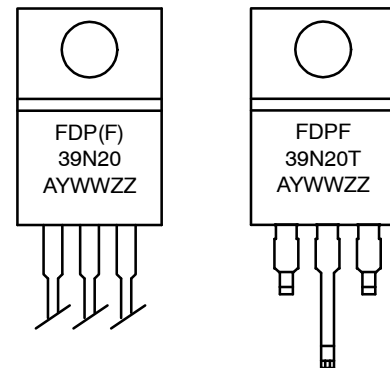


TO-220 FULLPAK 3LD L-FORMED
 CASE 340BM

N-CHANNEL MOSFET



MARKING DIAGRAMS



FDP(F)39N20(T) = Specific Device Code
 A = Assembly Location
 YWW = Date Code (Year and Week)
 ZZ = Assembly Lot

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 9 of this data sheet.

FDP39N20, FDPF39N20

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

Symbol	Parameter	FDP39N20	FDPF39N20 / FDPF39N20TLDTU	Unit	
V _{DSS}	Drain-Source Voltage	200	200	V	
I _D	Drain Current	- Continuous (T _C = 25°C)	39	39*	A
		- Continuous (T _C = 100°C)	23.4	23.4*	A
I _{DM}	Drain Current	- Pulsed (Note 1)	156	156*	A
V _{GSS}	Gate-Source Voltage	±30	±30	V	
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	860	860	mJ	
I _{AR}	Avalanche Current (Note 1)	39	39	A	
E _{AR}	Repetitive Avalanche Energy (Note 1)	25.1	25.1	mJ	
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	4.5	V/ns	
P _D	Power Dissipation	(T _C = 25°C)	251	37	W
		- Derate Above 25°C	2.0	0.29	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	-55 to +150	°C	
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	300	°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	FDP39N20	FDPF39N20 / FDPF39N20TLDTU	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case, Max.	0.5	3.4	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

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

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

OFF CHARACTERISTICS

BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	200	-	-	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	-	0.2	-	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 200 V, V _{GS} = 0 V V _{DS} = 160 V, T _C = 125°C	-	-	1	μA
			-	-	10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	-	-	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0V	-	-	-100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	-	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 19.5 A	-	0.056	0.066	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 19.5 A	-	28.5	-	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	-	1640	2130	pF
C _{oss}	Output Capacitance		-	400	520	pF
C _{rss}	Reverse Transfer Capacitance		-	57	85	pF

FDP39N20, FDPF39N20

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

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

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}$, $I_D = 39\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 25\ \Omega$ (Note 4)	–	30	70	ns
t_r	Turn-On Rise Time		–	160	330	ns
$t_{d(off)}$	Turn-Off Delay Time		–	150	310	ns
t_f	Turn-Off Fall Time		–	150	310	ns
Q_g	Total Gate Charge	$V_{DS} = 160\text{ V}$, $I_D = 39\text{ A}$, $V_{GS} = 10\text{ V}$ (Note 4)	–	38	49	nC
Q_{gs}	Gate-Source Charge		–	11	–	nC
Q_{gd}	Gate-Drain Charge		–	16.5	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I_S	Maximum Continuous Drain-Source Diode Forward Current	–	–	39	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	–	–	156	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = 39\text{ A}$	–	–	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}$, $I_S = 39\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$	–	152	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.1	–	μC

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.

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. $L = 0.85\text{ mH}$, $I_{AS} = 39\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 39\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

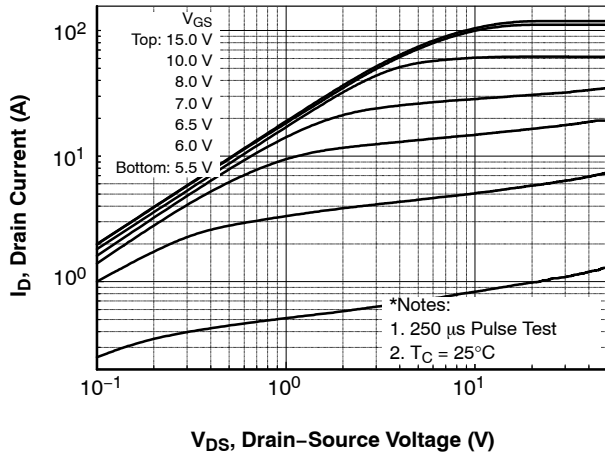


Figure 1. On-Region Characteristics

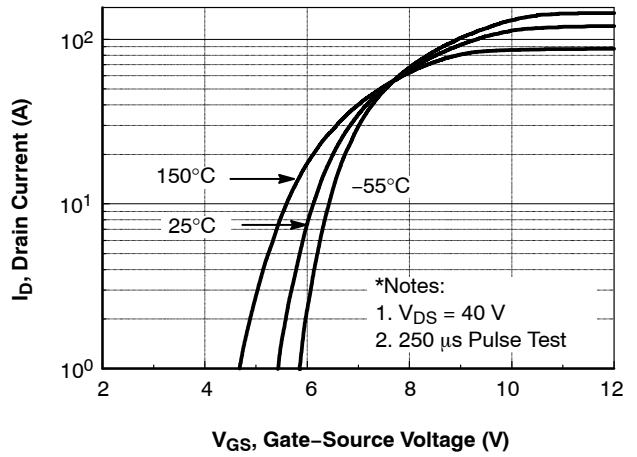


Figure 2. Transfer Characteristics

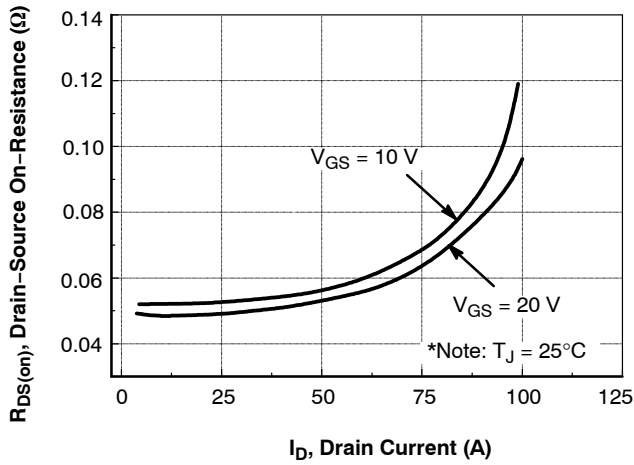


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

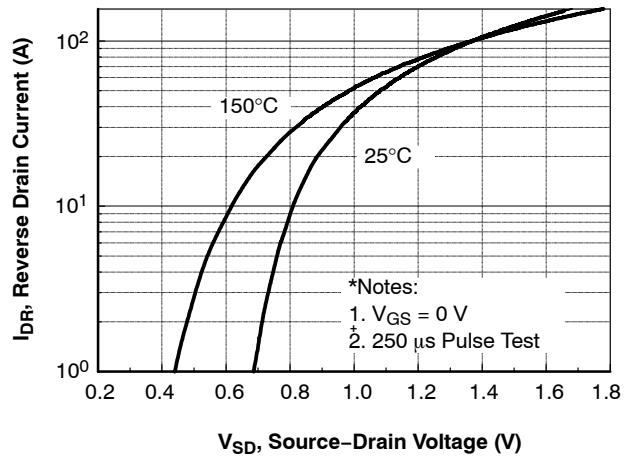


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

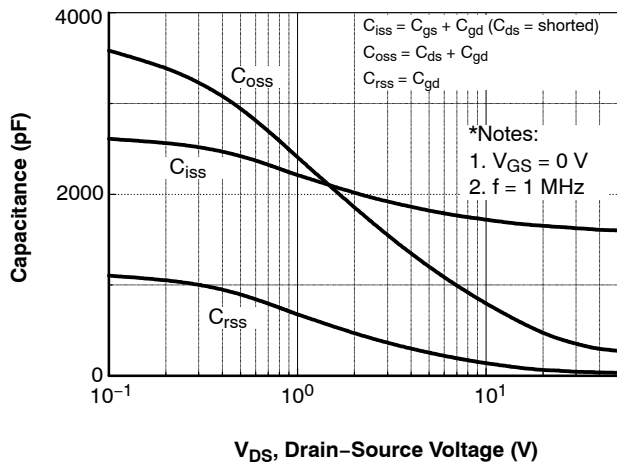


Figure 5. Capacitance Characteristics

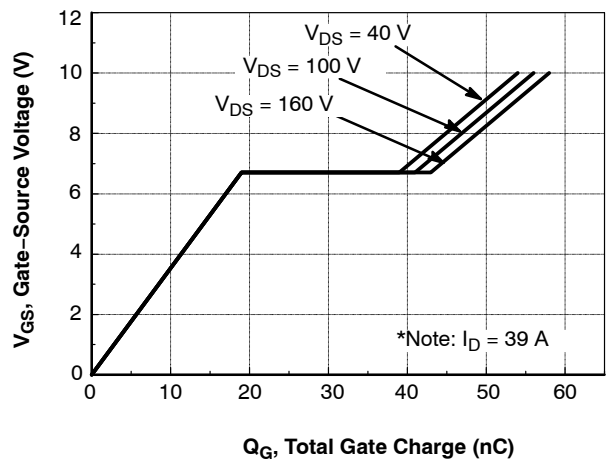


Figure 6. Gate Charge Characteristics

FDP39N20, FDPF39N20

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

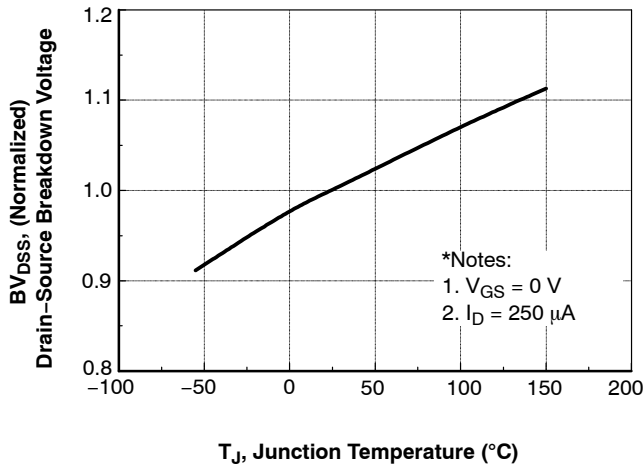


Figure 7. Breakdown Voltage Variation vs. Temperature

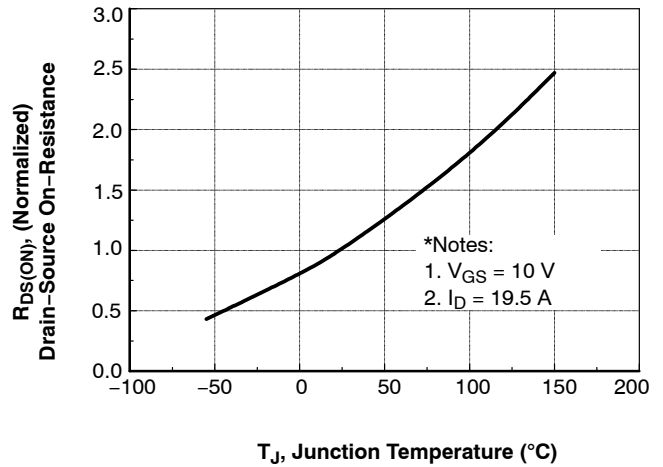


Figure 8. On-Resistance Variation vs. Temperature

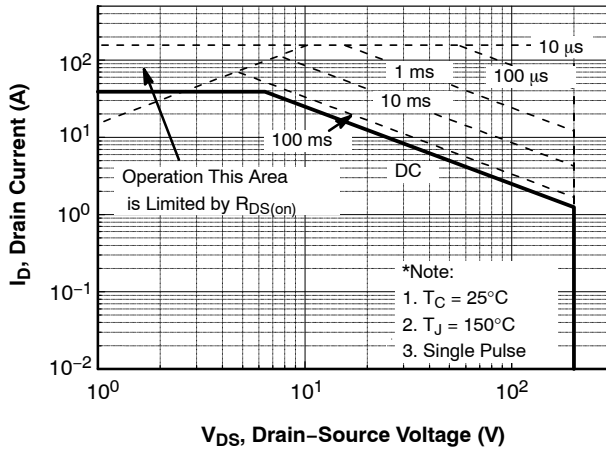


Figure 9. Maximum Safe Operating Area - FDP39N20

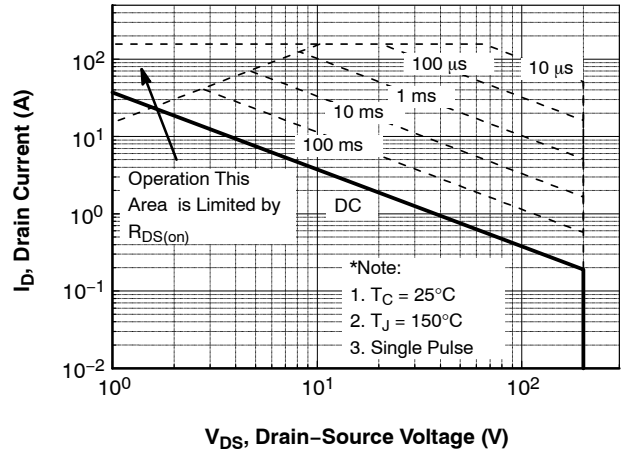


Figure 10. Maximum Safe Operating Area - FDPF39N20

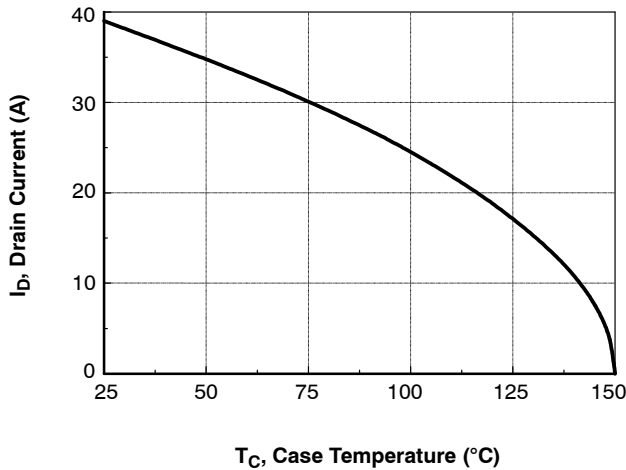


Figure 11. Maximum Drain Current vs. Case Temperature

FDP39N20, FDPF39N20

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

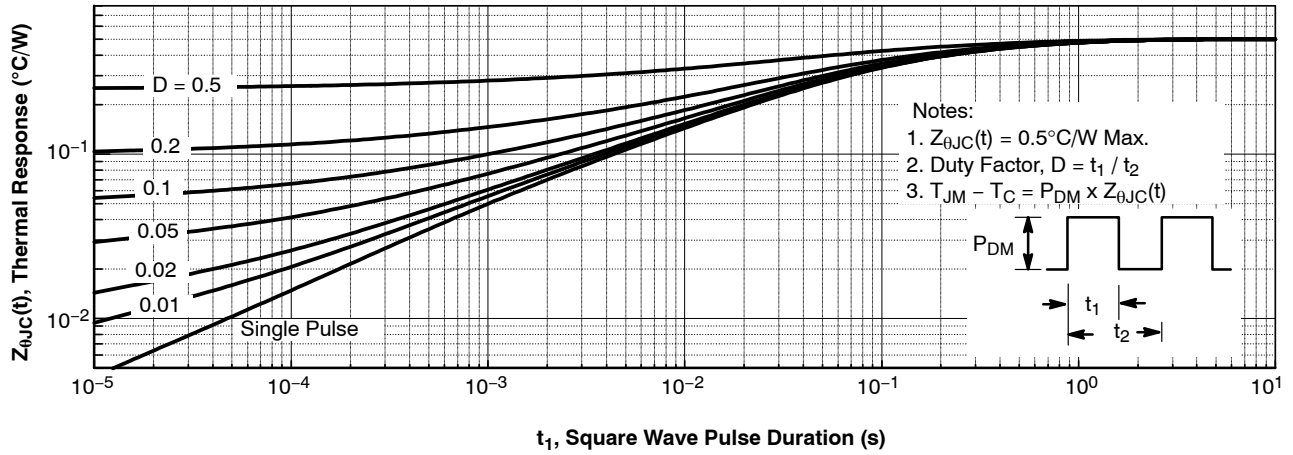


Figure 12. Transient Thermal Response Curve – FDP39N20

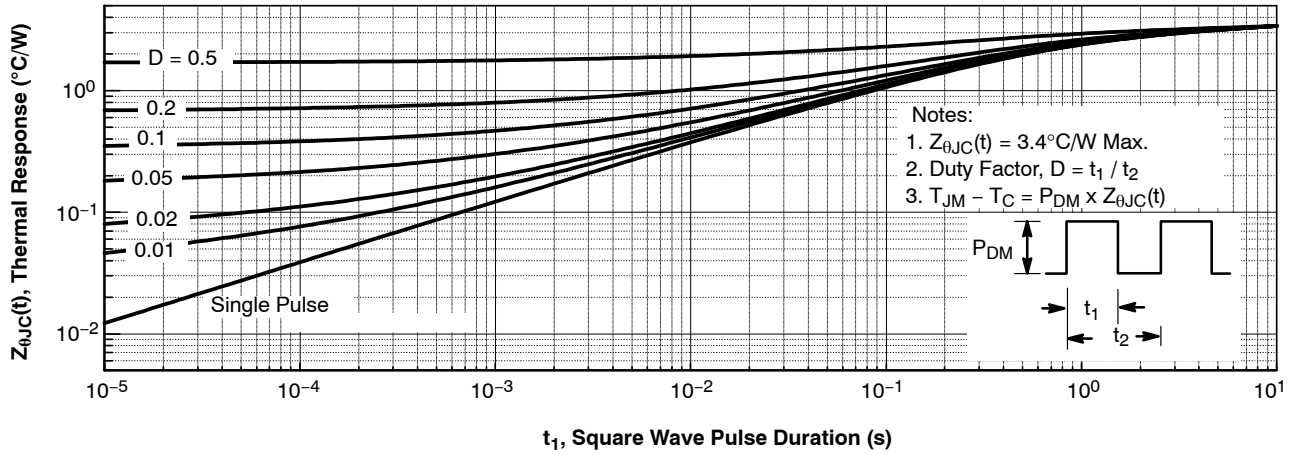


Figure 13. Transient Thermal Response Curve – FDPF39N20

FDP39N20, FDPF39N20

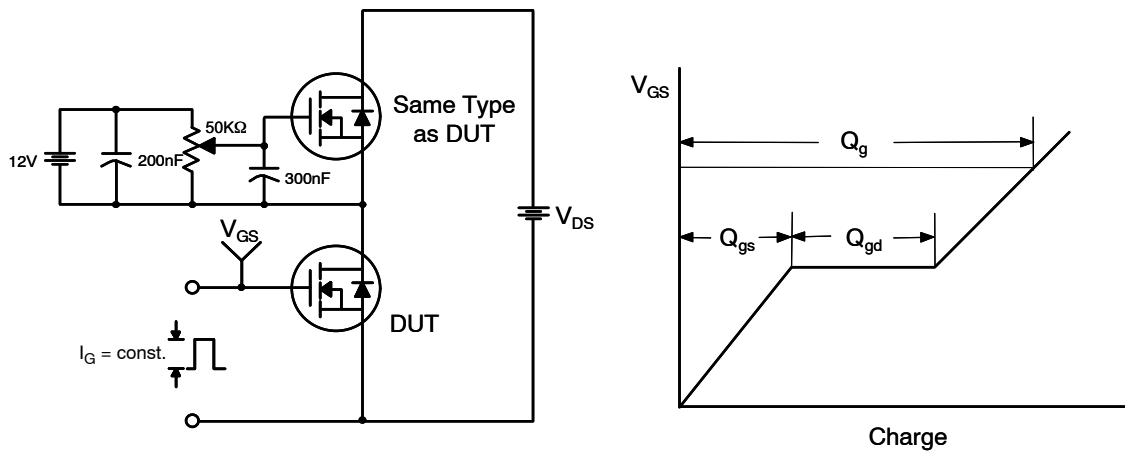


Figure 14. Gate Charge Test Circuit & Waveform

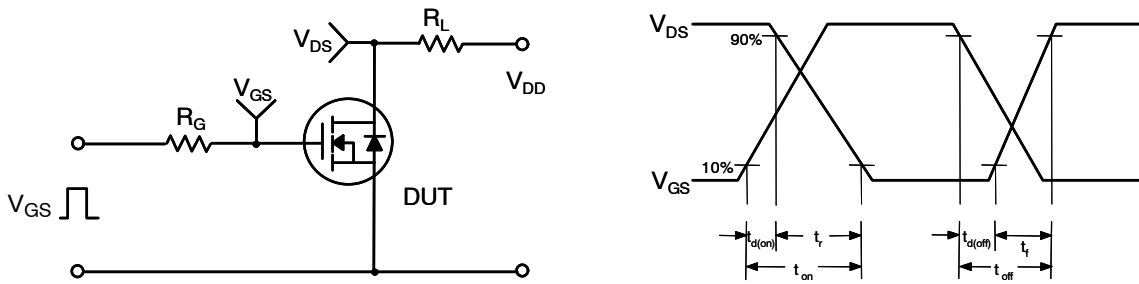


Figure 15. Resistive Switching Test Circuit & Waveforms

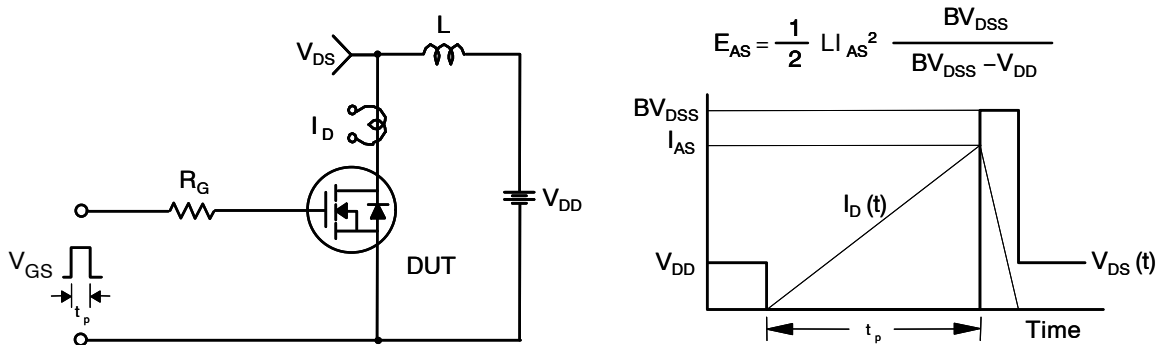


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

FDP39N20, FDPF39N20

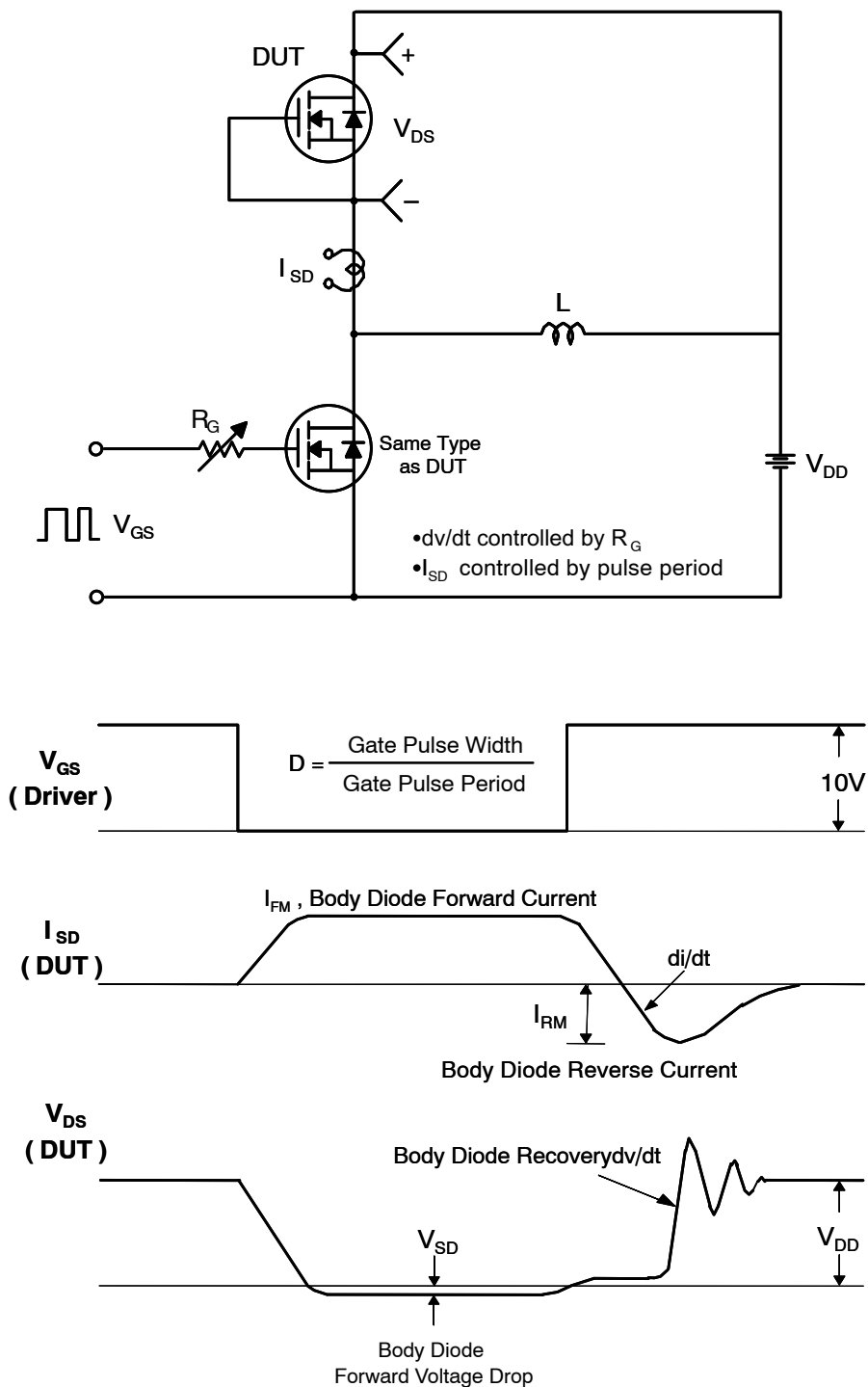


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

FDP39N20, FDPF39N20

ORDERING INFORMATION

Device	Device Marking	Package	Shipping
FDP39N20	FDP39N20	TO-220	1000 Units / Tube
FDPF39N20	FDPF39N20	TO-220F	1000 Units / Tube
FDPF39N20TLDTU	FDPF39N20T	TO-220F (L-formed)	800 Units / Tube

UniFET is trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.

MECHANICAL CASE OUTLINE

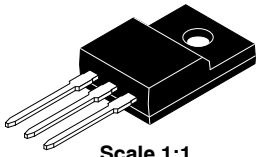
PACKAGE DIMENSIONS

ON Semiconductor®

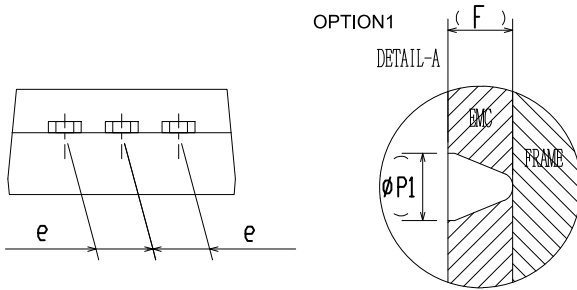
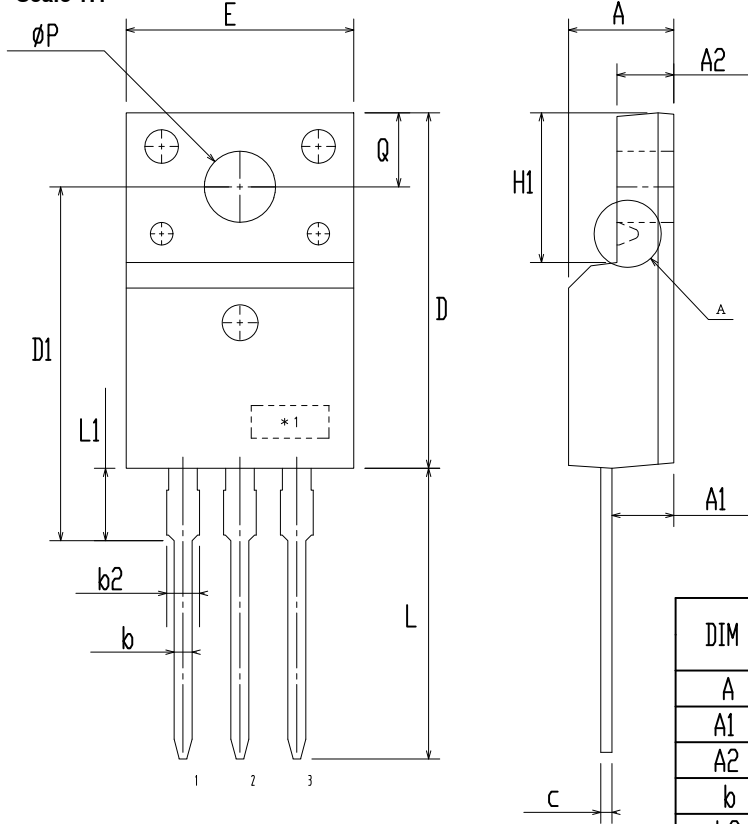


TO-220 Fullpack, 3-Lead / TO-220F-3SG CASE 221AT ISSUE B

DATE 19 JAN 2021



Scale 1:1



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.56	2.76	2.96
A2	2.34	2.54	2.74
b	0.70	0.80	0.90
b2	~	~	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.60	15.80	16.00
E	9.96	10.16	10.36
e	2.34	2.54	2.74
F	~	0.84	~
H1	6.48	6.68	6.88
L	12.78	12.98	13.18
L1	3.03	3.23	3.43
phi P	2.98	3.18	3.38
phi P1	~	1.00	~
Q	3.20	3.30	3.40

NOTES:

- A. DIMENSION AND TOLERANCE AS ASME Y14.5-2009
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUCTIONS.
- C. OPTION 1 - WITH SUPPORT PIN HOLE
OPTION 2 - NO SUPPORT PIN HOLE

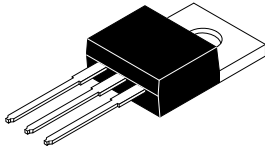
DOCUMENT NUMBER:	98AON67439E	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-220 FULLPACK, 3-LEAD / TO-220F-3SG	PAGE 1 OF 1

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.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

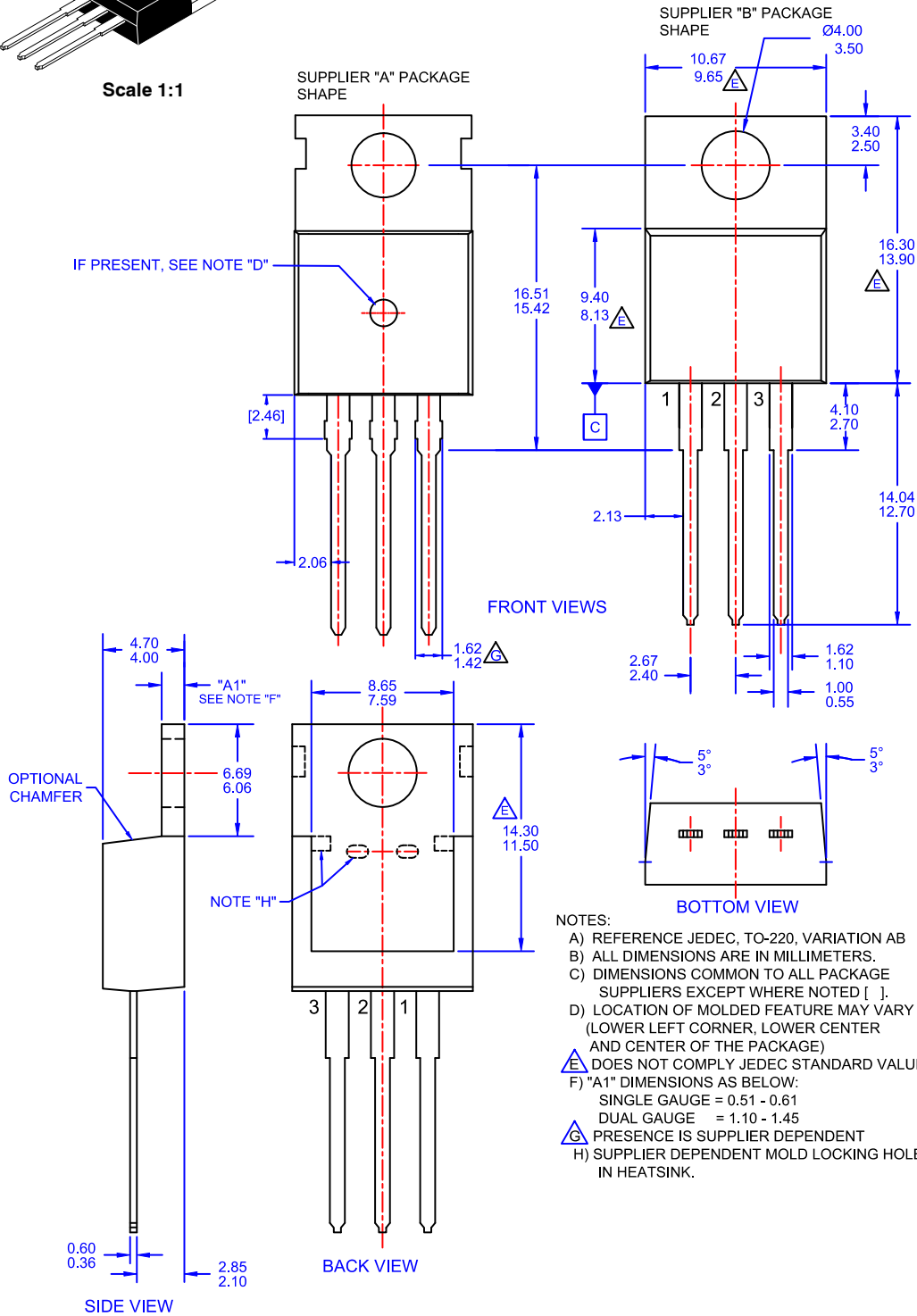
ON Semiconductor®



Scale 1:1

TO-220-3LD CASE 340AT ISSUE A

DATE 03 OCT 2017



- NOTES:
- A) REFERENCE JEDEC, TO-220, VARIATION AB
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [].
 - D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
 - E) DOES NOT COMPLY JEDEC STANDARD VALUE.
 - F) "A1" DIMENSIONS AS BELOW:
 SINGLE GAUGE = 0.51 - 0.61
 DUAL GAUGE = 1.10 - 1.45
 - G) PRESENCE IS SUPPLIER DEPENDENT
 - H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

DOCUMENT NUMBER:	98AON13818G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-220-3LD	PAGE 1 OF 1

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.

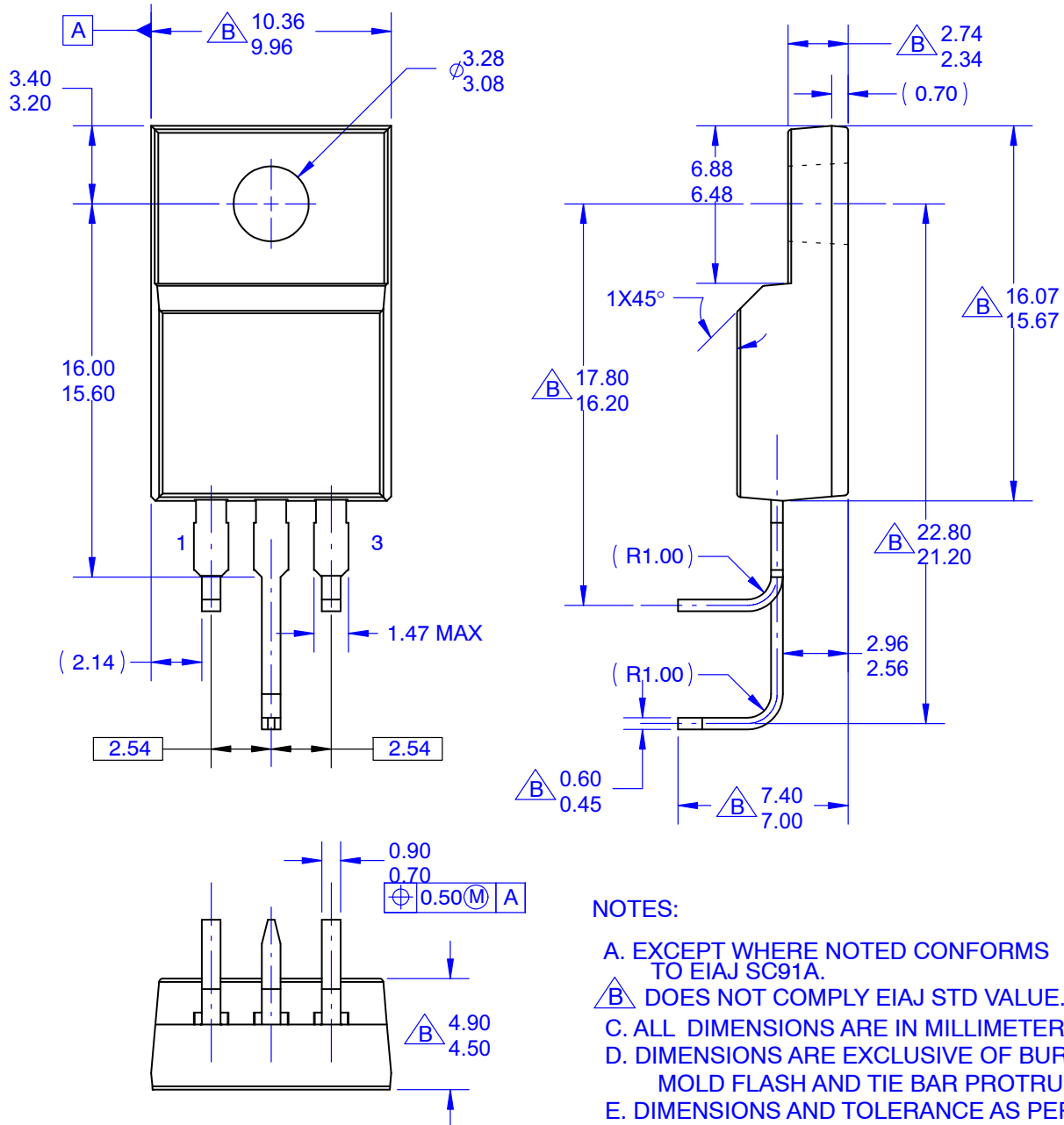
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®



TO-220 FULLPAK 3LD LF
CASE 340BM
ISSUE O

DATE 31 AUG 2016



DOCUMENT NUMBER:	98AON13846G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-220 FULLPAK 3LD LF	PAGE 1 OF 1

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. **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.

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