MOSFET – Power, Dual P-Channel

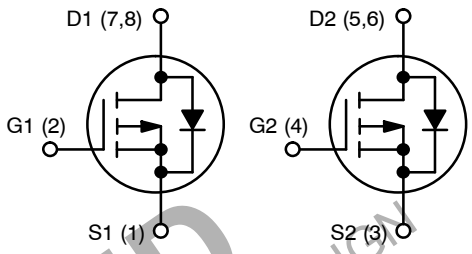
-40 V, -20 A, 12.5 mΩ

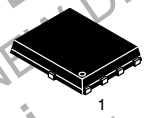
FDWS9520L-F085

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
−40 V	12.5 mΩ @ −10 V	−20 A
	19.5 mΩ @ −4.5 V	

Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low QG and Capacitance to Minimize Driver Losses
- Wettable Flanks for Enhanced Optical Inspection
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant





PQFN8 5x6, 1.27P
CASE 483BL

ORDERING INFORMATION

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

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−40	V
Gate−to−Source Voltage			V_{GS}	±16	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	T_C = 25°C	I_D	−60.8	A
		T_C = 100°C		−43.0	
Power Dissipation $R_{\theta JC}$ (Note 1)		T_C = 25°C	P_D	75	W
		T_C = 100°C		37.5	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	T_C = 25°C	I_D	−12.2	A
		T_C = 100°C		−8.6	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)		T_C = 25°C	P_D	3.0	W
		T_C = 100°C		1.5	
Pulsed Drain Current	T_C = 25°C, t_p = 10 μs		I_{DM}	−281	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)			I_S	−20	A
Single Pulse Drain−to−Source Avalanche Energy (IL(pk) = −19)			E_{AS}	90	mJ
Lead Temperature for Soldering Purposes (1/83 from case for 10 s)			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.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case − Steady State	$R_{\theta JC}$	2	°C/W
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	50	°C/W

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface−mounted on FR4 board using a 650 mm^2, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

© Semiconductor Components Industries, LLC, 2018

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Off Characteristics							
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = −250 μA		−40			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}$/ T_J				21		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −40 V	T_J = 25°C			−1	μA
			T_J = 175°C			−1	mA
Zero Gate Voltage Drain Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±16 V				±100	nA
On Characteristics (Note 4)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−1	−1.8	−3	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				−5.5		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V	I_D = −20 A		10.4	12.5	mΩ
		V_{GS} = −4.5 V	I_D = −10 A		14.6	19.5	
Charges, Capacitances & Gate Resistance							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = −20 V			2370		pF
Output Capacitance	C_{oss}				940		pF
Reverse Transfer Capacitance	C_{rss}				40		pF
Gate Resistance	R_g	V_{GS} = 0.5 V, f = 1 MHz			17		Ω
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DS} = −32 V; I_D = −20 A			33		nC
		V_{GS} = −4.5V, V_{DS} = −32 V; I_D = −20 A			13		
Threshold Gate Charge	$Q_{g(th)}$	V_{GS} = 0 to −1 V			2		
Gate to Source Gate Charge	Q_{gs}	V_{DD} = −20 V, I_D = −20 A			7		
Gate to Drain "Miller" Charge	Q_{gd}				4		
Plateau Voltage	V_{GP}				−4		V
Switching Characteristics							
Turn−On Delay Time	$t_{d(ON)}$	V_{DD} = −20 V, I_D = −20 A, V_{GS} = −10 V, R_{GEN} = 6 Ω			8		ns
Turn−On Rise Time	t_r				21		ns
Turn−Off Delay Time	$t_{d(OFF)}$				120		ns
Turn−Off Fall Time	t_f				34		ns
Drain−Source Diode Characteristics							
Source to Drain Diode Voltage	V_{SD}	I_{SD} = −20 A, V_{GS} = 0 V			−0.9	−1.25	V
		I_{SD} = −10 A, V_{GS} = 0 V			−0.83	−1.2	V
Reverse Recovery Time	T_{RR}	V_{GS} = 0 V, dI_{SD}/dt = 100 A/us, I_S = −20 A			46		ns
Charge Time	t_a				22		
Discharge Time	t_b				24		
Reverse Recovery Charge	Q_{RR}				37		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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%
5. Switching characteristics are independent of operating junction temperatures.

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

ORDERING INFORMATION

Device	Device Marking	Package	Shipping†
FDWS9520L−F085	FDWS9520L	PQFN8 5x6, 12.7P (Pb−Free, Halogen Free)	3,000 / 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

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

TYPICAL CHARACTERISTICS

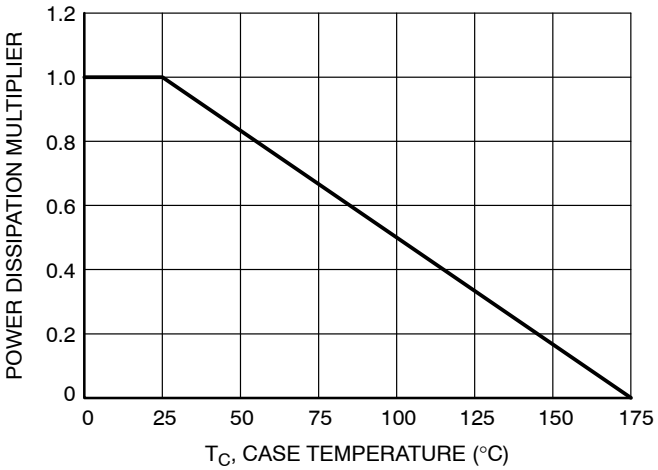


Figure 1. Normalized Power Dissipation vs. Case Temperature

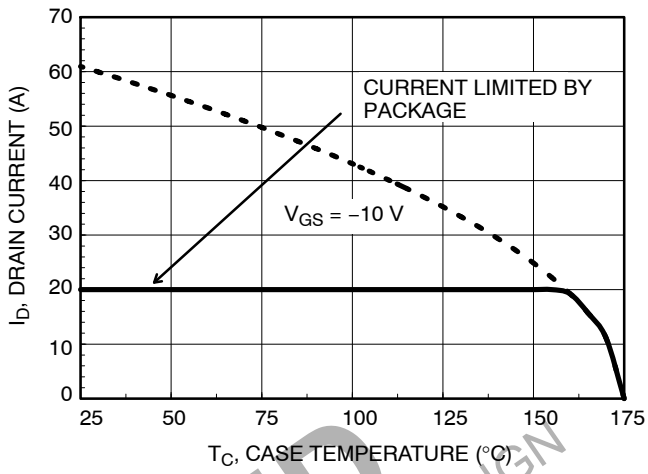


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

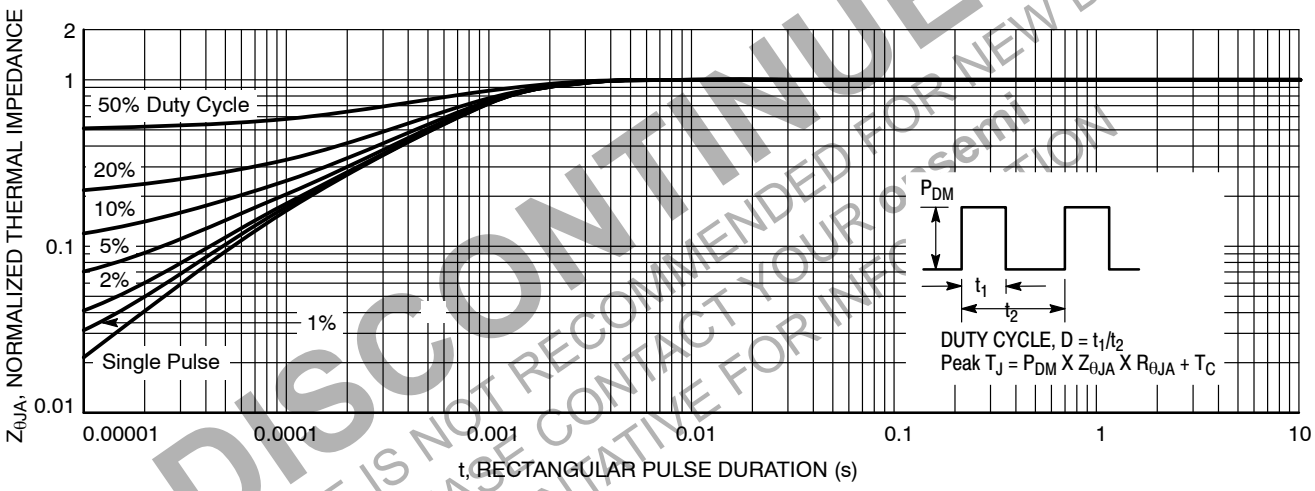


Figure 3. Normalized Maximum Transient Thermal Impedance

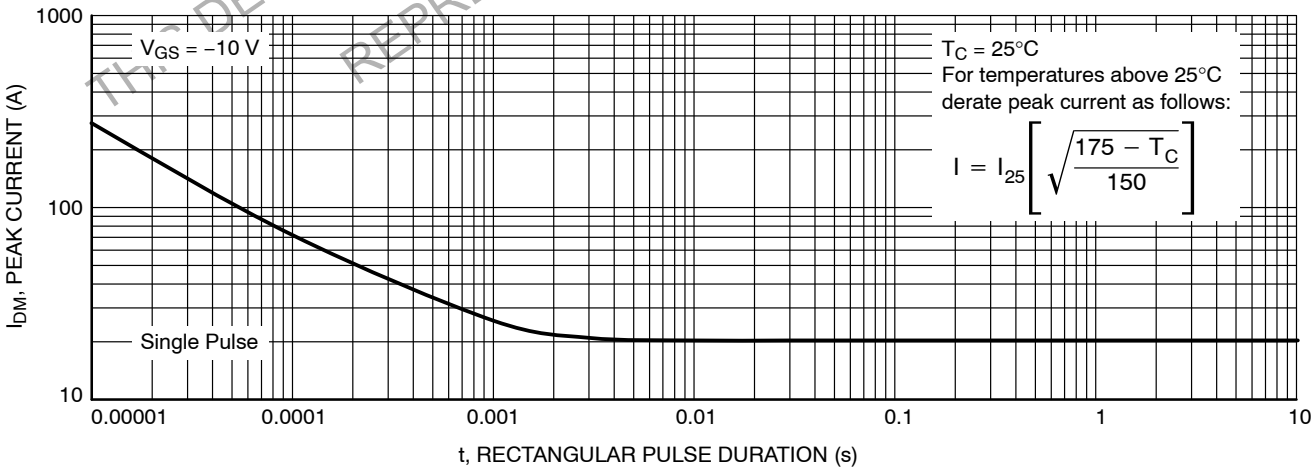


Figure 4. Peak Current Capability

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

TYPICAL CHARACTERISTICS

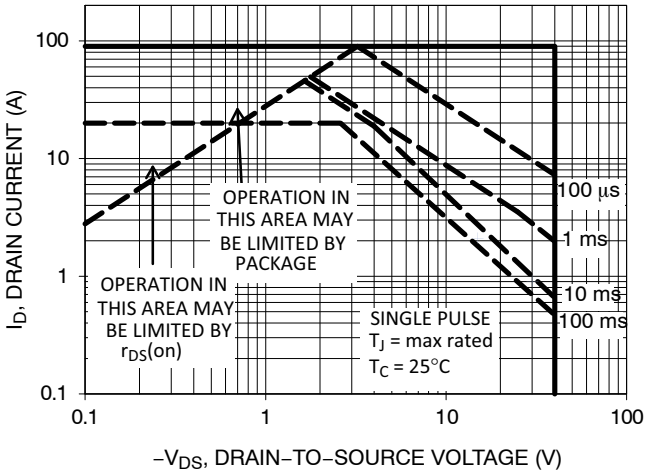


Figure 5. Forward Bias Safe Operating Area

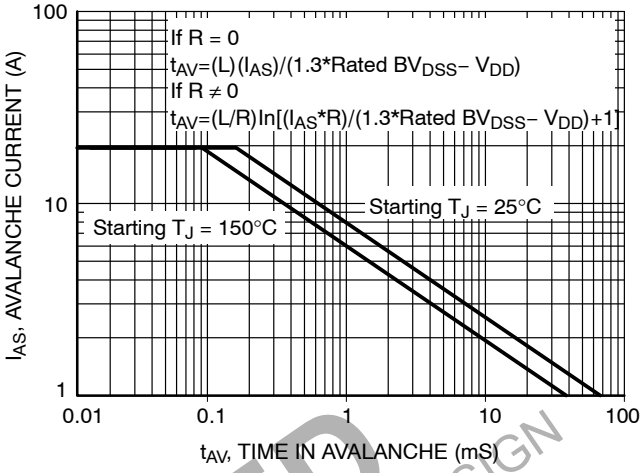


Figure 6. Unclamped Inductive Switching Capability

(Note: Refer to **onsemi** Applications Notes AN7514 and AN7515)

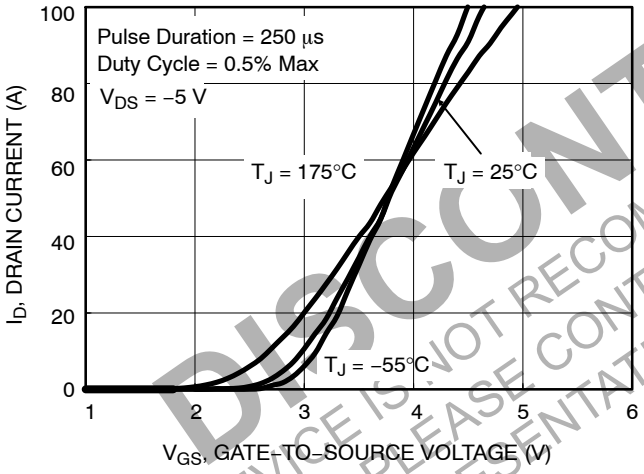


Figure 7. Transfer Characteristics

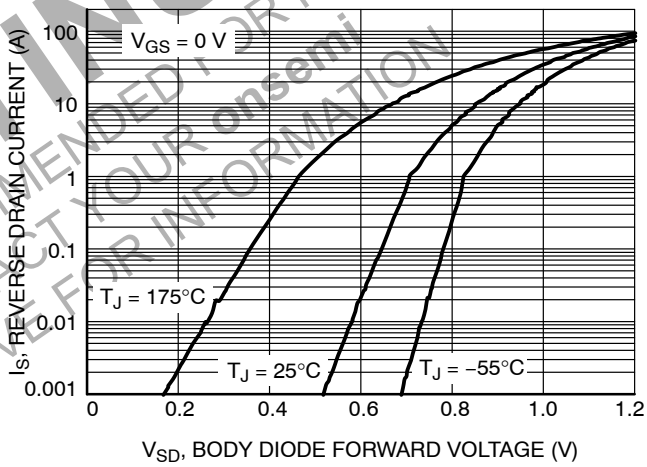


Figure 8. Forward Diode Characteristics

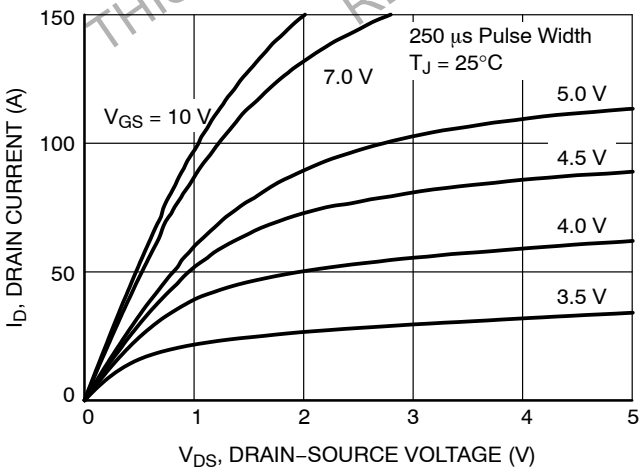


Figure 9. Saturation Characteristics

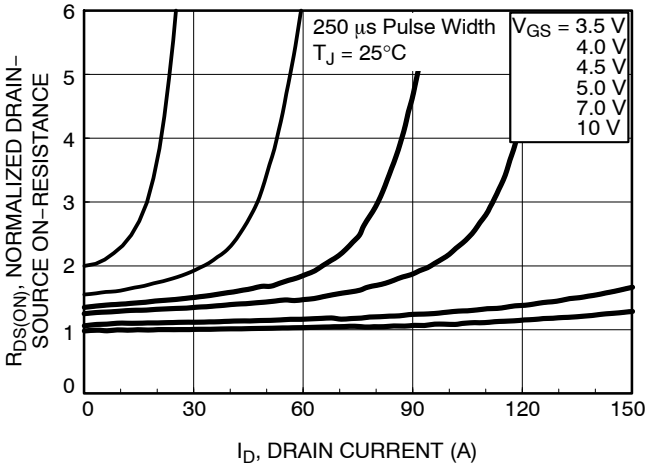


Figure 10. Normalized $R_{DS(ON)}$ vs. Drain Current

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

TYPICAL CHARACTERISTICS

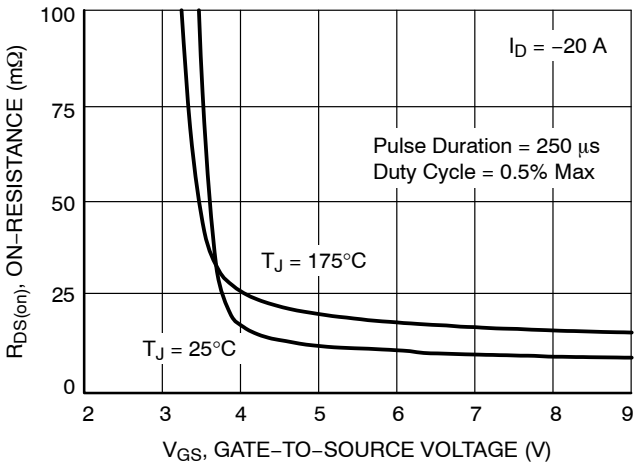


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

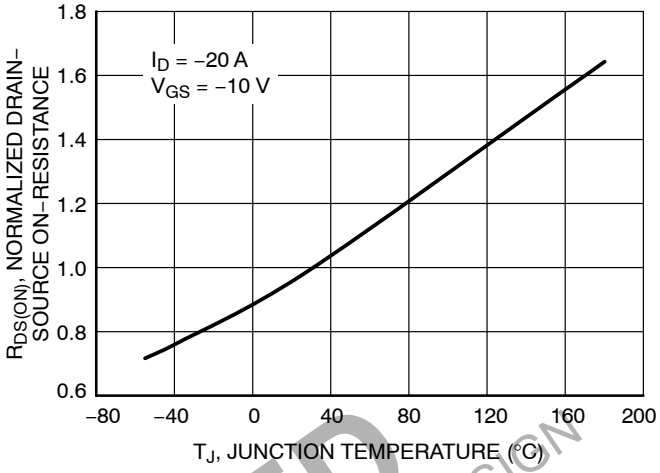


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

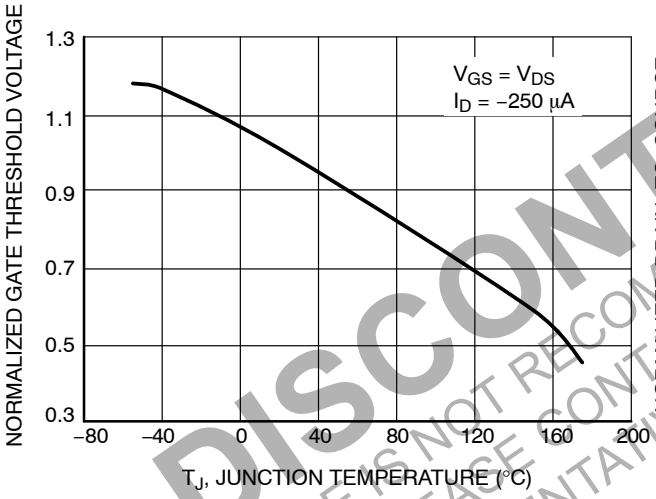


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

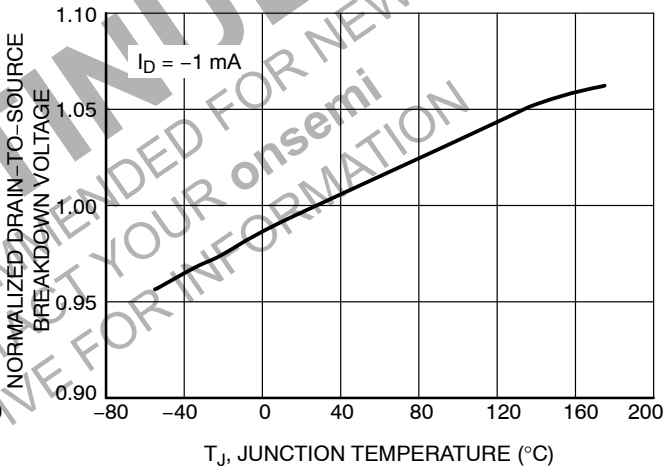


Figure 14. Normalized Drain−to−Source Breakdown Voltage vs. Junction Temperature

DISCONTINUED
THIS DEVICE IS NOT RECOMMENDED FOR NEW DESIGN
PLEASE CONTACT YOUR onsemi
REPRESENTATIVE FOR INFORMATION

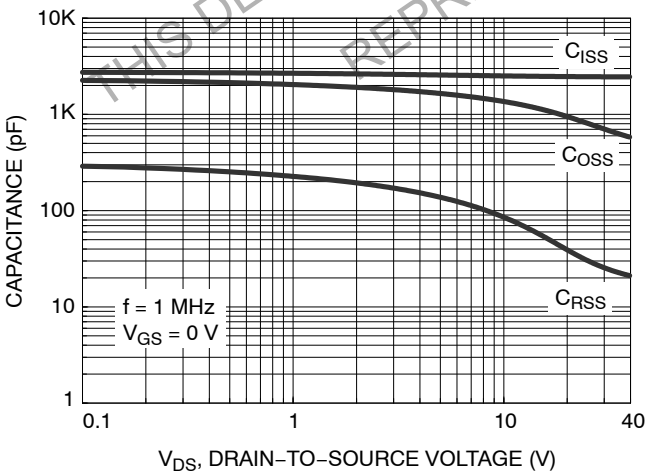


Figure 15. Capacitance vs. Drain−to−Source Voltage

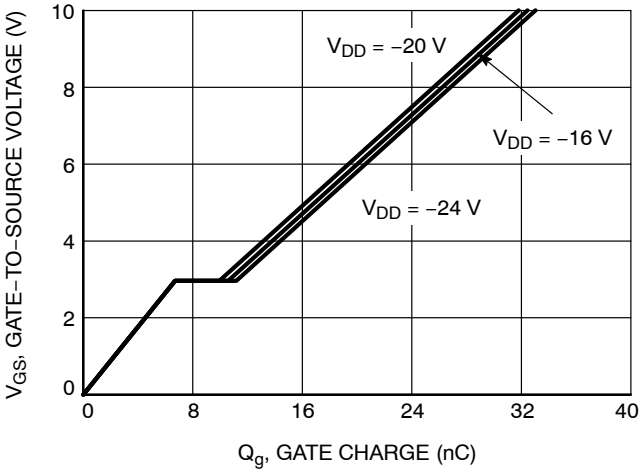
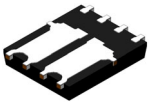
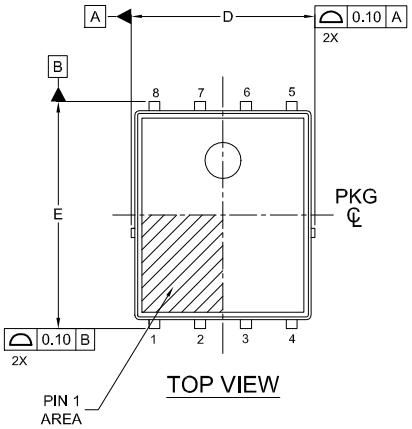


Figure 16. Gate Charge vs. Gate−to−Source Voltage

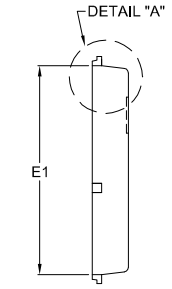


PQFN8 5X6, 1.27P
CASE 483BL
ISSUE A

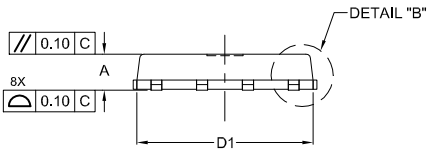
DATE 23 APR 2021



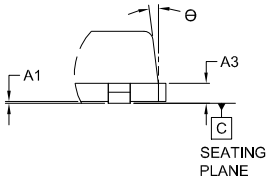
TOP VIEW



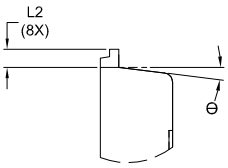
SIDE VIEW



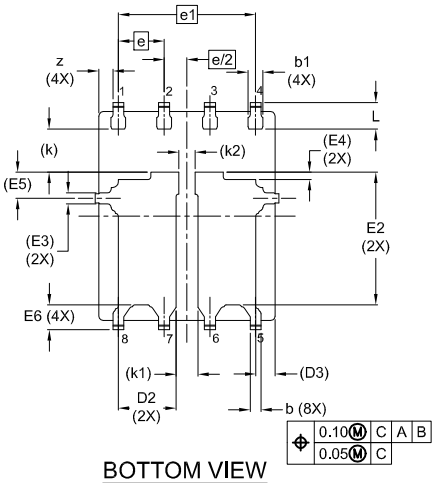
FRONT VIEW



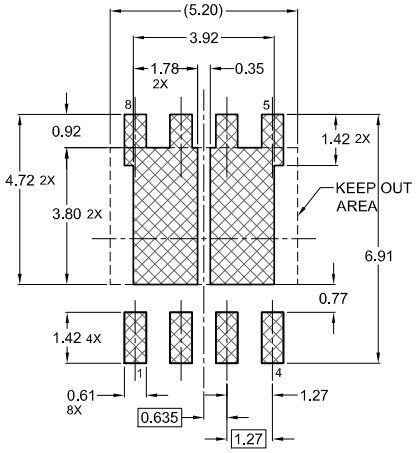
DETAIL "B"



DETAIL "A"



BOTTOM VIEW



LAND PATTERN
RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
A3	0.23	0.28	0.33
b	0.26	0.31	0.36
b1	0.36	0.41	0.46
D	5.00	5.10	5.20
D1	4.80	4.90	5.00
D2	1.51	1.61	1.71
D3	0.54 REF		
E	6.20	6.30	6.40
E1	5.70	5.80	5.90
E2	3.58	3.68	3.78
E3	0.30 REF		
E4	0.10	0.20	0.30
E5	0.72 REF		
E6	0.59	0.69	0.79
e	1.27 BSC		
e1	3.81 BSC		
e/2	0.635 BSC		
k	1.19 REF		
k1	0.60 REF		
k2	0.45 REF		
L	0.64	0.74	0.84
L2	0.15	0.25	0.35
z	0.39 REF		
θ	0°	-	7°

DOCUMENT NUMBER:	**98AON13690G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**PQFN8 5X6, 1.27P**	**PAGE 1 OF 1**

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