

FDWS9511L-F085

Power MOSFET

-40 V, 20.5 mΩ, -30 A, Single P-Channel

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 Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		V_{DSS}	-40	V	
Gate-to-Source Voltage		V_{GS}	± 20	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	I_D	-30	A
		$T_C = 100^\circ\text{C}$		-30	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	P_D	68.2	W
		$T_C = 100^\circ\text{C}$		34.1	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_C = 25^\circ\text{C}$	I_D	-9.1	A
		$T_C = 100^\circ\text{C}$		-6.5	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_C = 25^\circ\text{C}$	P_D	3.0	W
		$T_C = 100^\circ\text{C}$		1.5	
Pulsed Drain Current	$T_C = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	I_{DM}	-298	A	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	-100	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = -25$)		E_{AS}	25	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$	

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.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State	$R_{\theta JC}$	2.2	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	50	

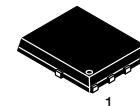
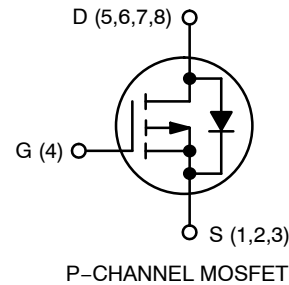
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted. Current is limited by wirebond configuration
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



ON Semiconductor®

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$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
-40 V	20.5 mΩ @ -10 V	-30 A
	32.0 mΩ @ -4.5 V	



DFN8
Power 56
CASE 506DW

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 2 of this data sheet.

FDWS9511L-F085

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			20		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = -40\text{ V}$	$T_J = 25^\circ\text{C}$		-1	μA
			$T_J = 175^\circ\text{C}$		-1	mA
Zero Gate Voltage Drain Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 16\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-1	-1.8	-3	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-5.1		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -30\text{ A}$		17	20.5	m Ω
		$V_{GS} = -4.5\text{ V}, I_D = -15\text{ A}$		26	34	

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 100\text{ KHz}, V_{DS} = -20\text{ V}$		1200		pF
Output Capacitance	C_{OSS}			470		
Reverse Transfer Capacitance	C_{RSS}			26		
Gate Resistance	R_G	$V_{GS} = 0.5\text{ V}, f = 1\text{ MHz}$		37		Ω
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -20\text{ V}, I_D = -30\text{ A}$		8		nC
		$V_{GS} = -10\text{ V}, V_{DS} = -20\text{ V}, I_D = -30\text{ A}$		18		
Threshold Gate Charge	$Q_{G(TH)}$	$V_{GS} = 0\text{ to }-1\text{ V}$		1		
Gate-to-Source Gate Charge	Q_{GS}	$V_{DD} = -20\text{ V}, I_D = -30\text{ A}$		4		
Gate-to-Drain "Miller" Charge	Q_{GD}			3		
Plateau Voltage	V_{GP}			-3.8		V

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{DD} = -20\text{ V}, I_D = -30\text{ A}, V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$		8		ns
Turn-On Rise Time	t_r			28		
Turn-Off Delay Time	$t_{d(OFF)}$			112		
Turn-Off Fall Time	t_f			40		

DRAIN-SOURCE DIODE CHARACTERISTICS

Source-to-Drain Diode Voltage	V_{SD}	$I_{SD} = -30\text{ A}, V_{GS} = 0\text{ V}$		-0.9	-1.3	V
		$I_{SD} = -15\text{ A}, V_{GS} = 0\text{ V}$		-0.85	-1.2	
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, di_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = -30\text{ A}$		36		ns
Charge Time	t_a			18		
Discharge Time	t_b			18		
Reverse Recovery Charge	Q_{RR}			24		

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 $\leq 2\%$.
- Switching characteristics are independent of operating junction temperatures.

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Quantity
FDWS9511L-F085	FDWS9511L	Power 56	13"	12 mm	3000 units

TYPICAL CHARACTERISTICS

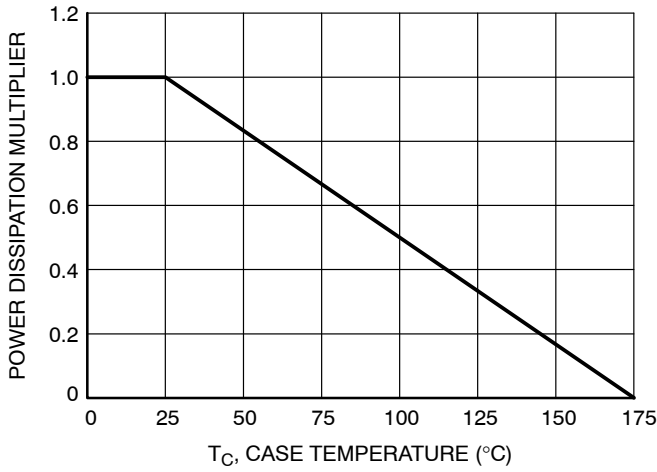


Figure 1. Normalized Power Dissipation vs. Case Temperature

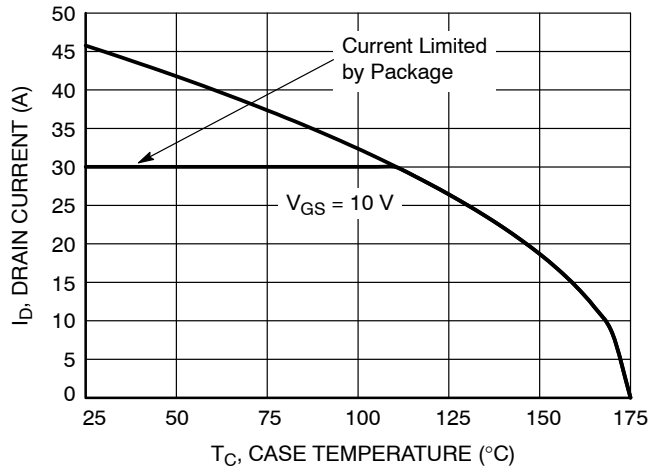


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

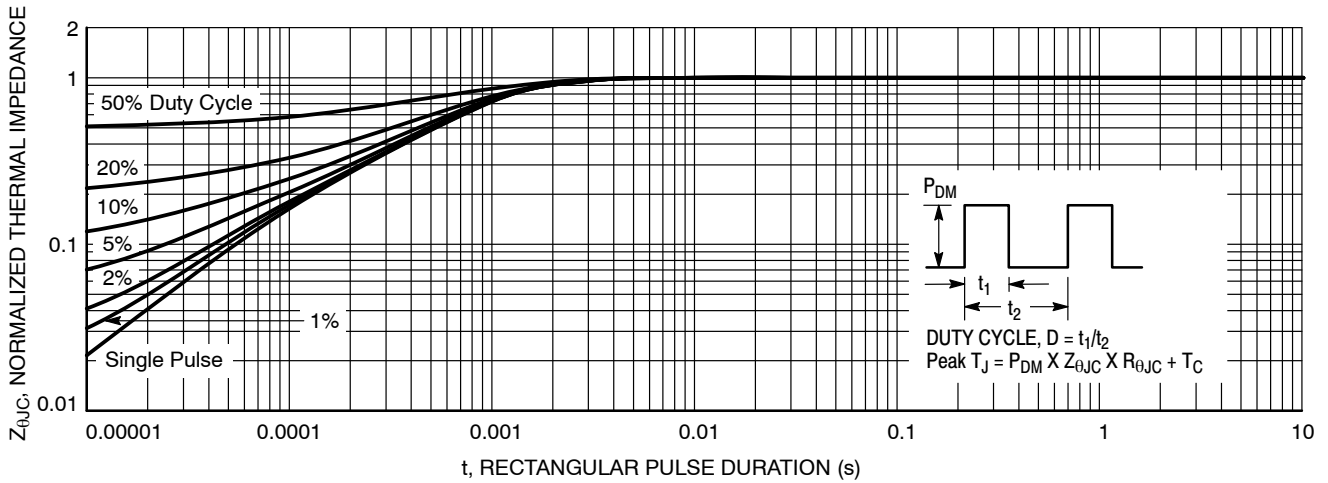


Figure 3. Normalized Maximum Transient Thermal Impedance

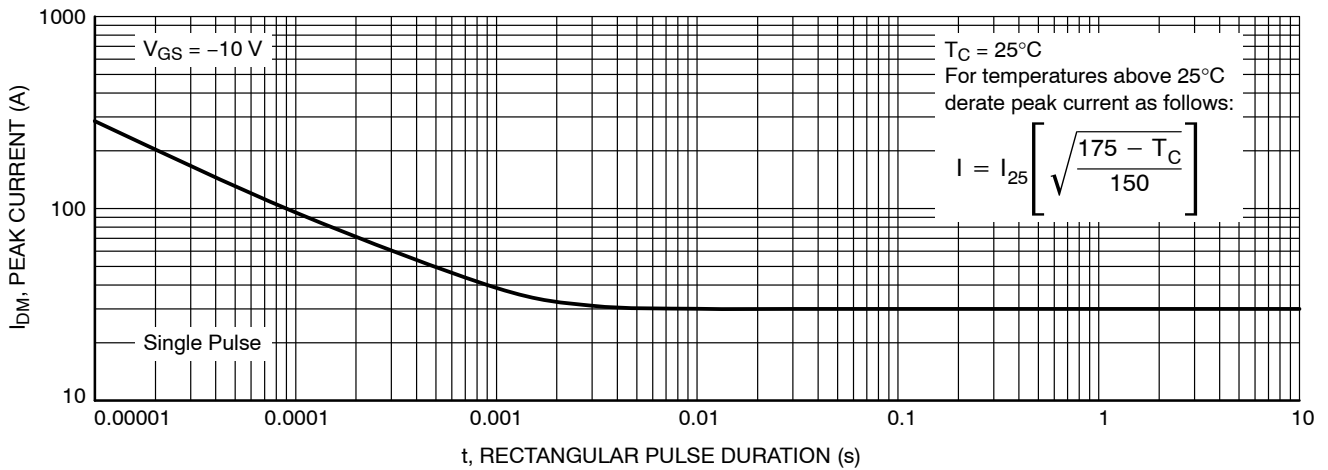


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS

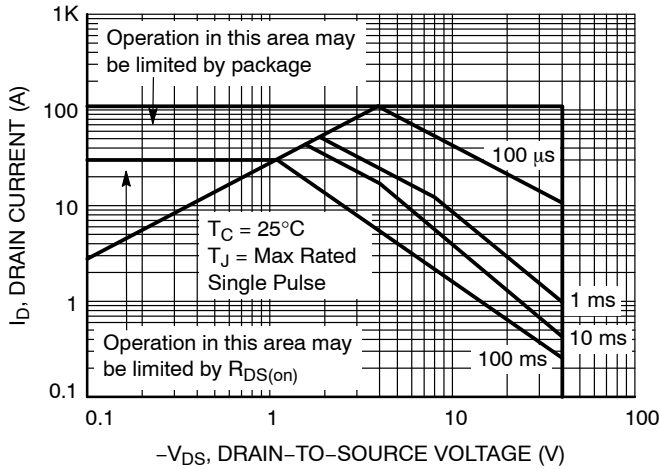


Figure 5. Forward Bias Safe Operating Area

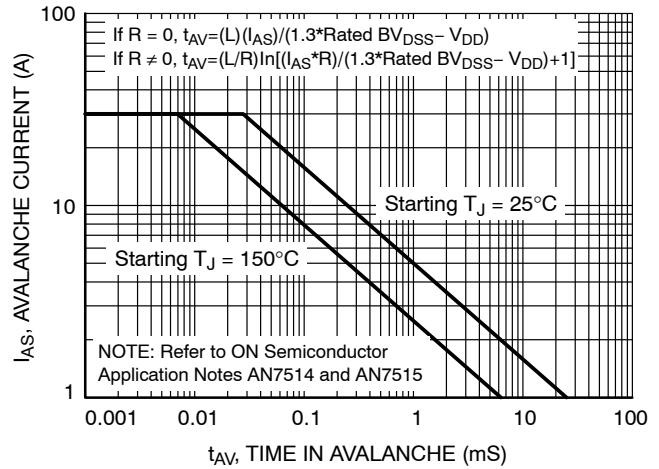


Figure 6. Unclamped Inductive Switching Capability

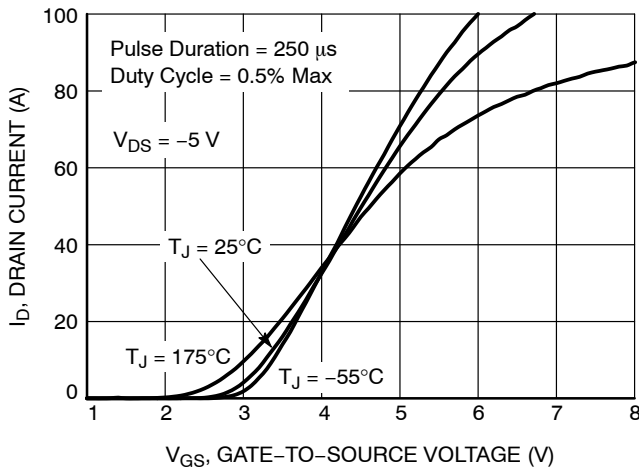


Figure 7. Transfer Characteristics

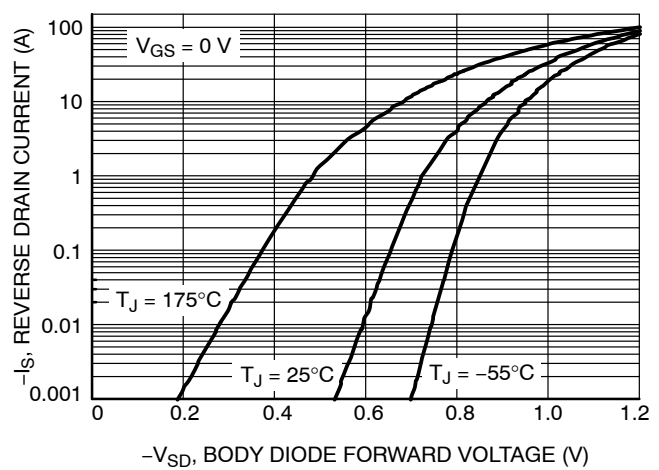


Figure 8. Forward Diode Characteristics

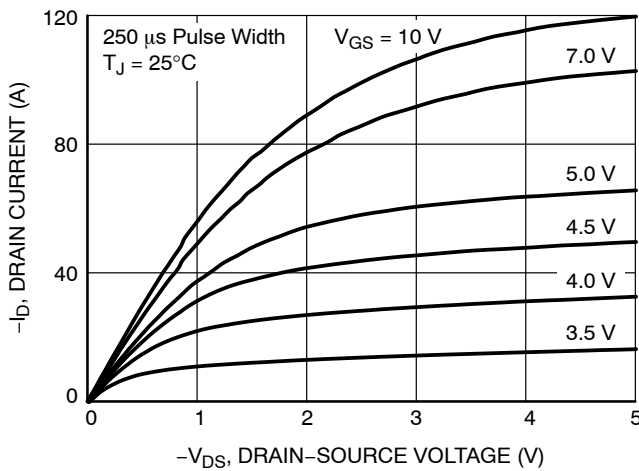


Figure 9. Saturation Characteristics

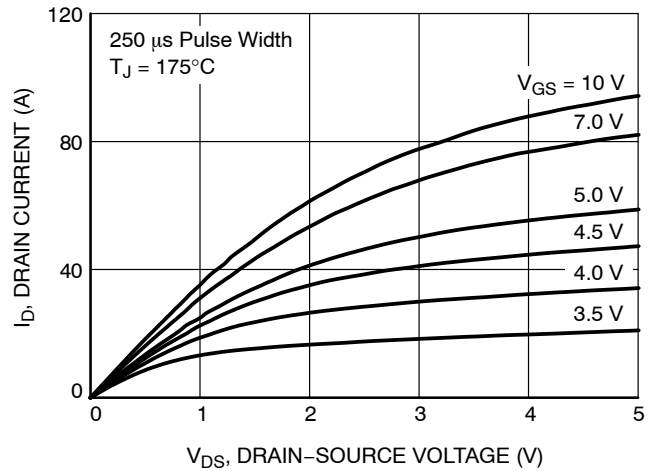


Figure 10. Saturation Characteristics

TYPICAL CHARACTERISTICS

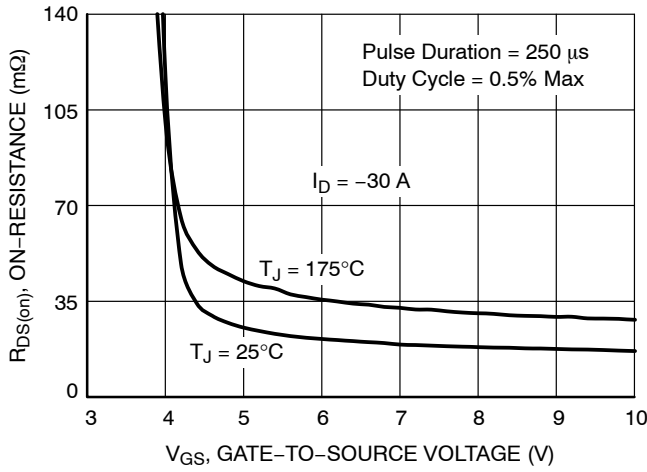


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

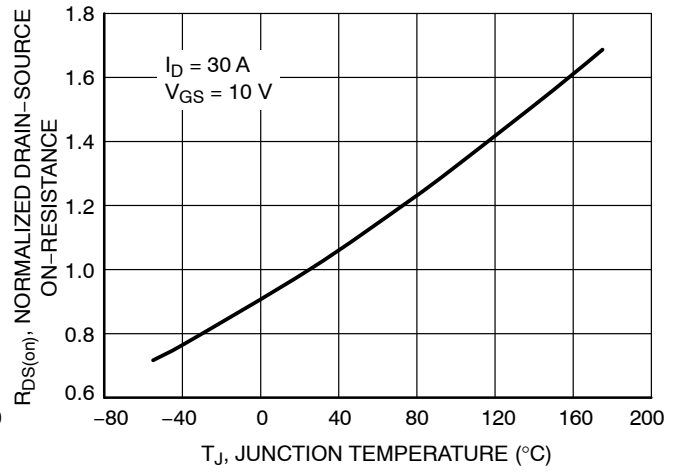


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

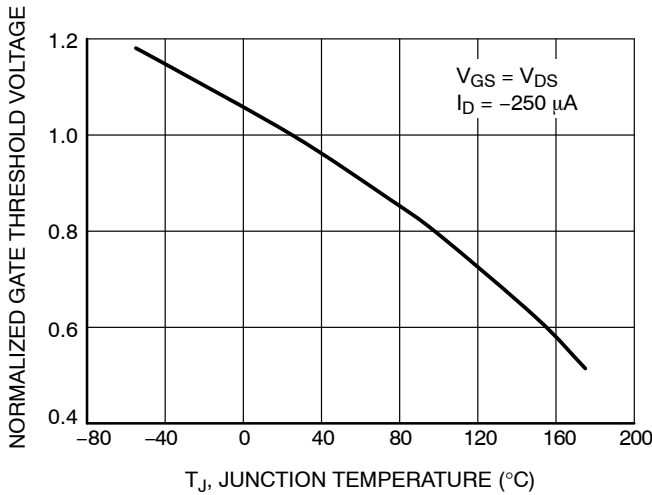


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

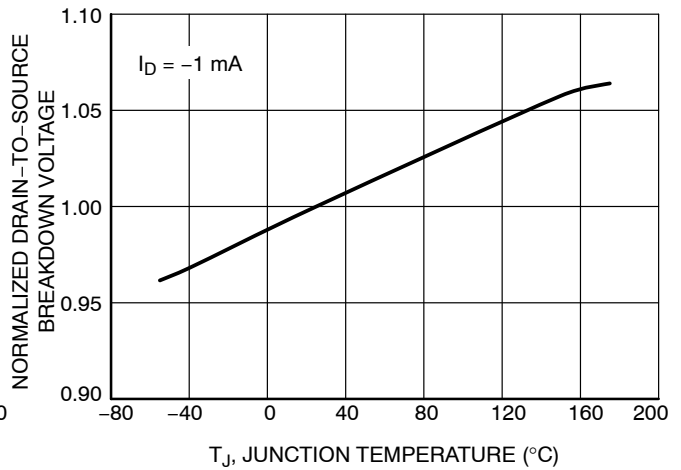


Figure 14. Normalized Drain-to-Source Breakdown Voltage vs. Junction Temperature

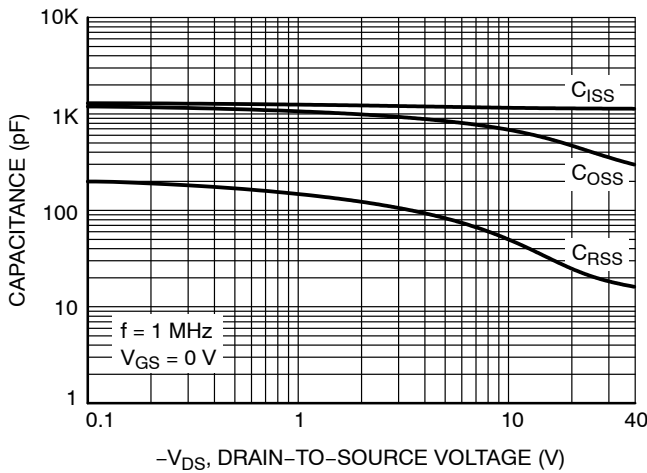


Figure 15. Capacitance vs. Drain-to-Source Voltage

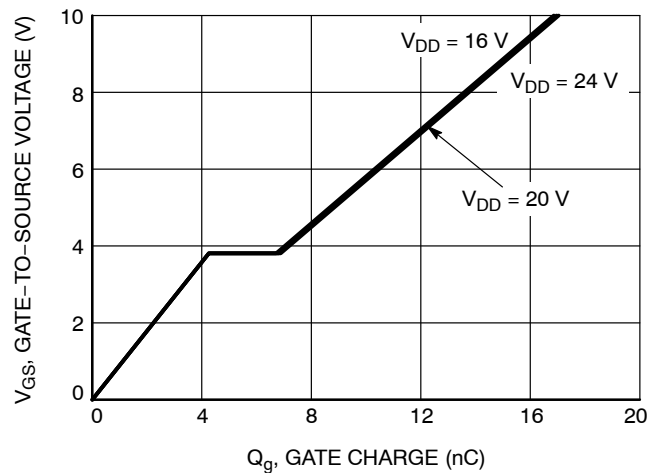
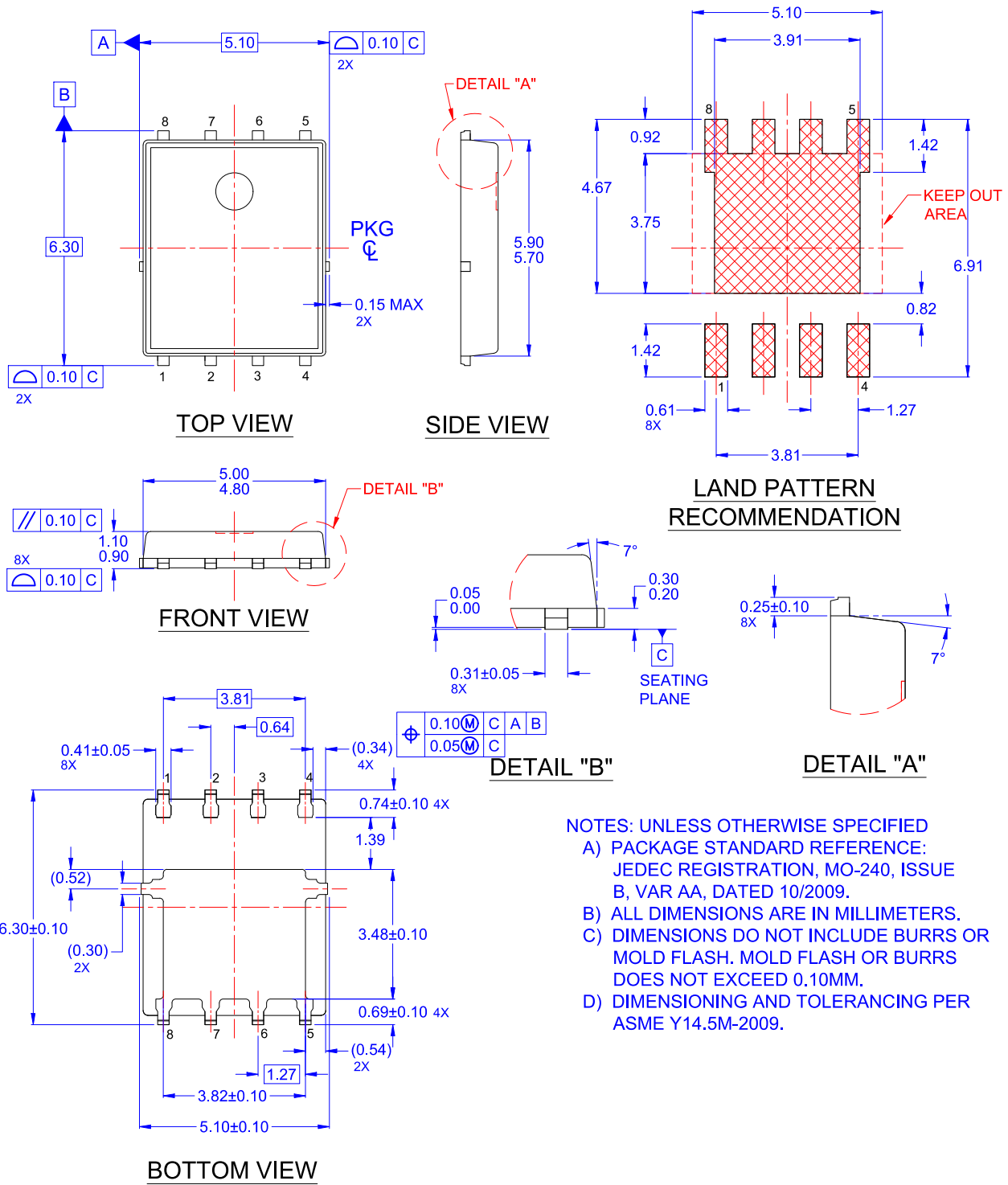


Figure 16. Gate Charge vs. Gate-to-Source Voltage

FDWS9511L-F085


PACKAGE DIMENSIONS

DFN8 5.1x6.3, 1.27P
CASE 506DW
ISSUE O



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) PACKAGE STANDARD REFERENCE: JEDEC REGISTRATION, MO-240, ISSUE B, VAR AA, DATED 10/2009.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.
 - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
 - D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

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