FDB9509L-F085

Power MOSFET, Single P-Channel

–40 V, –83 A, 8.0 mΩ

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low QG and Capacitance to Minimize Driver Losses
- AEC–Q101 Qualified and PPAP Capable
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

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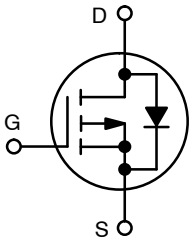
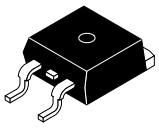
$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
–40 V	8.0 mΩ @ –10 V	–83 A
	12.5 mΩ @ –4.5 V	





D²PAK–3 (TO–163AB)
CASE 418AJ

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	–83	A
		T_C = 100°C		–59	
Power Dissipation $R_{\theta JC}$ (Note 1)		T_C = 25°C	P_D	93.8	W
		T_C = 100°C		46.9	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	T_C = 25°C	I_D	–16.1	A
		T_C = 100°C		–11.4	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)		T_C = 25°C	P_D	3.5	W
		T_C = 100°C		1.7	
Pulsed Drain Current	T_C = 25°C, t_p = 10 μs		I_{DM}	–669	A
Operating Junction and Storage Temperature			T_J, T_{stg}	–55 to +175	°C
Source Current (Body Diode)			I_S	–80	A
Single Pulse Drain–to–Source Avalanche Energy (IL(pk) = –64)			E_{AS}	82	mJ
Lead Temperature for Soldering Purposes (1/83 from case for 10 s)			T_L	260	°C

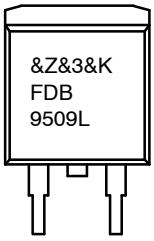
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction–to–Case – Steady State	$R_{\theta JC}$	1.6	°C/W
Junction–to–Ambient – Steady State (Note 2)	$R_{\theta JA}$	43	°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.

MARKING DIAGRAM



&Z = Assembly Plant Code
&3 = Numeric Date Code
&K = Lot Code
FDB9509L = Specific Device Code

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

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				20		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	−1.7	−3	V
Threshold Temperature Coefficient	$V_{GS(TH)}$/T_J				−5		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V	I_D = −80 A		6.4	8.0	mΩ
		V_{GS} = −4.5 V	I_D = −40 A		9.6	12.5	
Charges, Capacitances & Gate Resistance							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = −20 V			3400		pF
Output Capacitance	C_{oss}				1250		pF
Reverse Transfer Capacitance	C_{rss}				39		pF
Gate Resistance	R_g	V_{GS} = 0.5 V, f = 100 kHz			21		Ω
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DS} = −32 V; I_D = −80 A			48		nC
		V_{GS} = −4.5V, V_{DS} = −32 V; I_D = −80 A			22		
Threshold Gate Charge	$Q_{g(th)}$	V_{GS} = 0 to −1 V			6		
Gate to Source Gate Charge	Q_{gs}	V_{DD} = −32 V, I_D = −80 A			12		
Gate to Drain “Miller” Charge	Q_{gd}				5		
Plateau Voltage	V_{GP}				−3.5		V
Switching Characteristics							
Turn−On Delay Time	$t_{d(ON)}$	V_{DD} = −20 V, I_D = −80 A, V_{GS} = −10 V, R_{GEN} = 6 Ω			9		ns
Turn−On Rise Time	t_r				4		ns
Turn−Off Delay Time	$t_{d(OFF)}$				200		ns
Turn−Off Fall Time	t_f				57		ns
Drain−Source Diode Characteristics							
Source to Drain Diode Voltage	V_{SD}	I_{SD} = −80 A, V_{GS} = 0 V			−0.98	−1.25	V
		I_{SD} = −40 A, V_{GS} = 0 V			−0.9	−1.2	V
Reverse Recovery Time	T_{RR}	V_{GS} = 0 V, dI_{SD}/dt = 100 A/us, I_S = −80 A			78		ns
Charge Time	t_a				33		
Discharge Time	t_b				46		
Reverse Recovery Charge	Q_{RR}				95		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.

TYPICAL CHARACTERISTICS

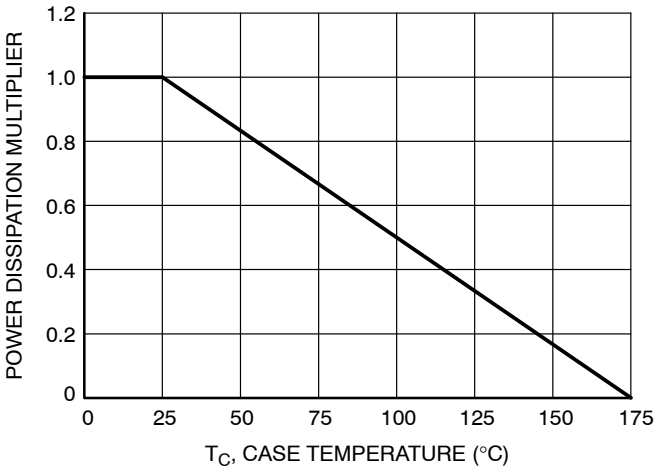


Figure 1. Normalized Power Dissipation vs. Case Temperature

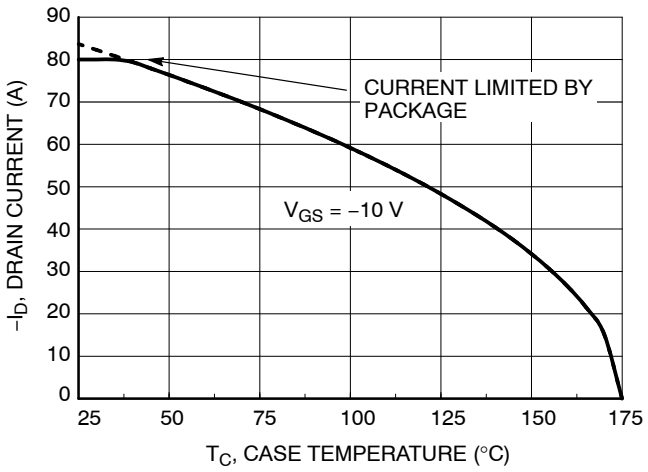


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

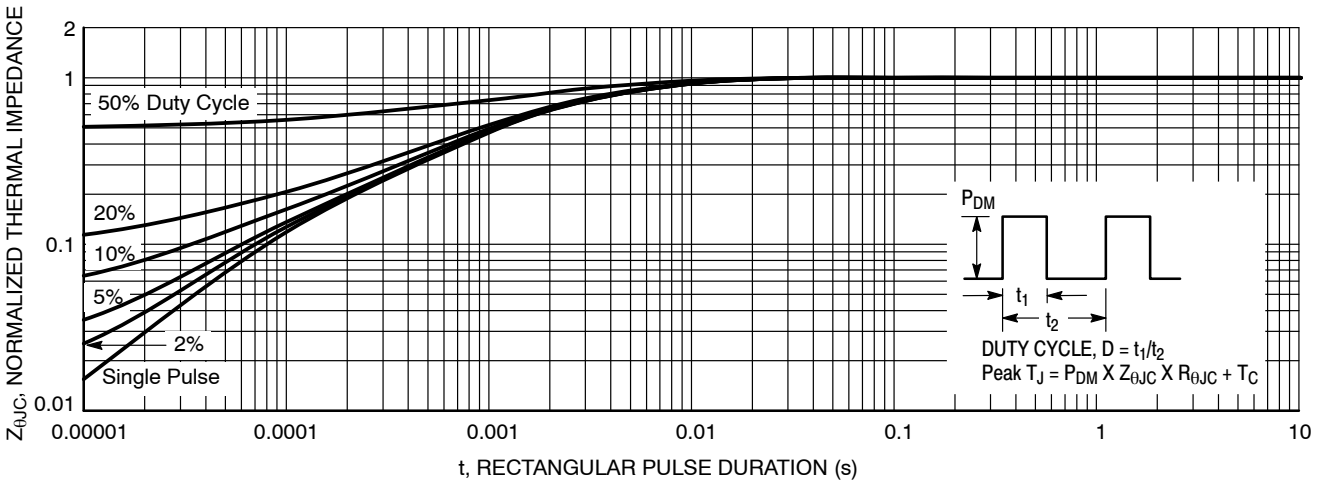


Figure 3. Normalized Maximum Transient Thermal Impedance

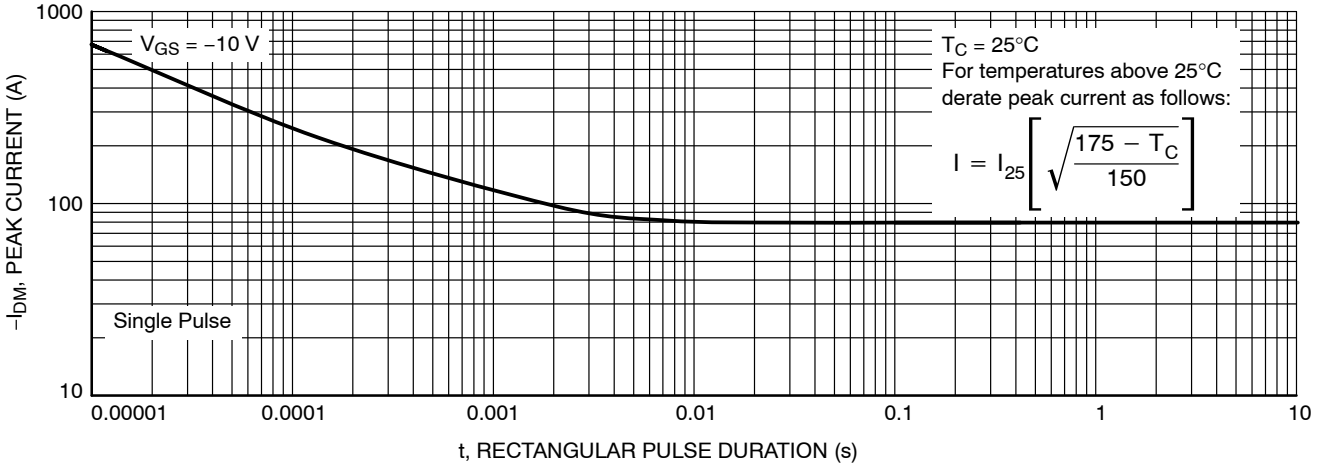


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS

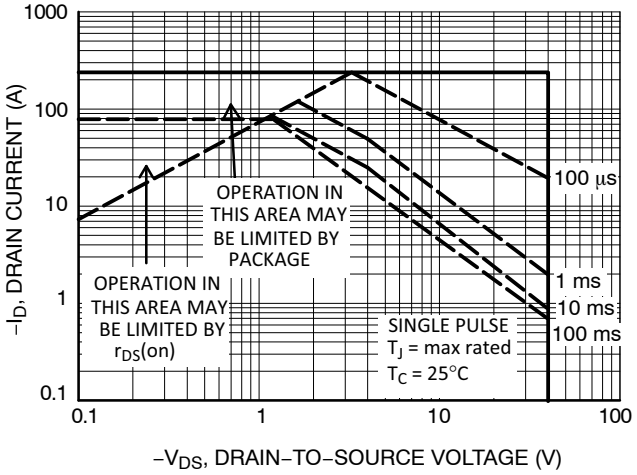
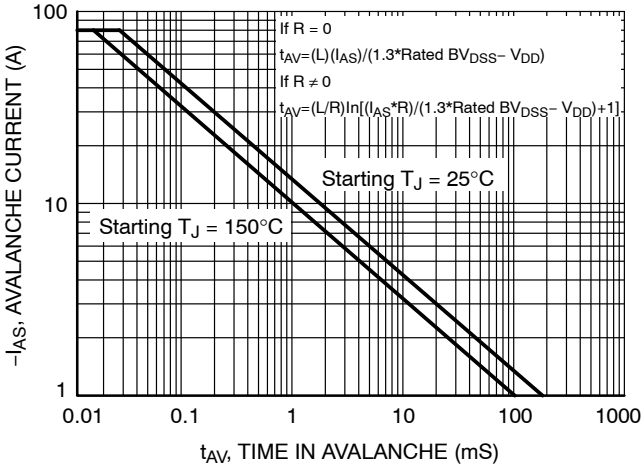


Figure 5. Forward Bias Safe Operating Area



Note: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

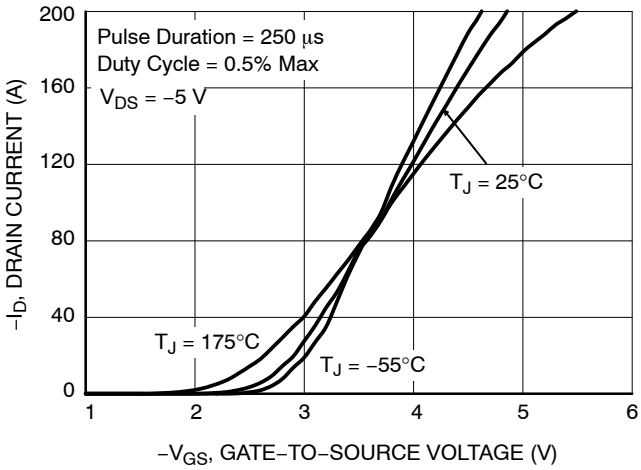


Figure 7. Transfer Characteristics

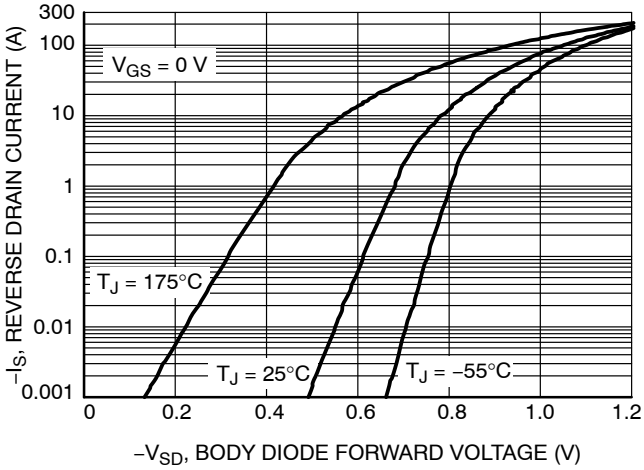


Figure 8. Forward Diode Characteristics

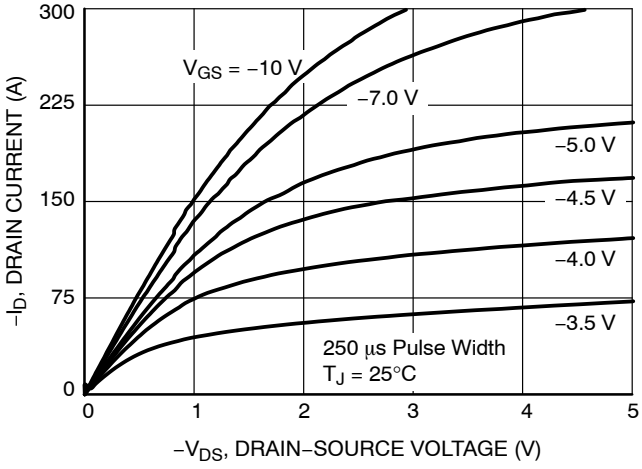


Figure 9. Saturation Characteristics

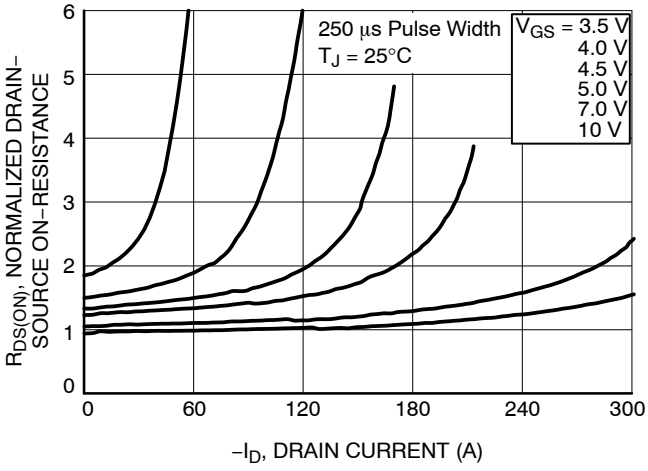


Figure 10. Normalized $R_{DS(ON)}$ vs. Drain Current

TYPICAL CHARACTERISTICS

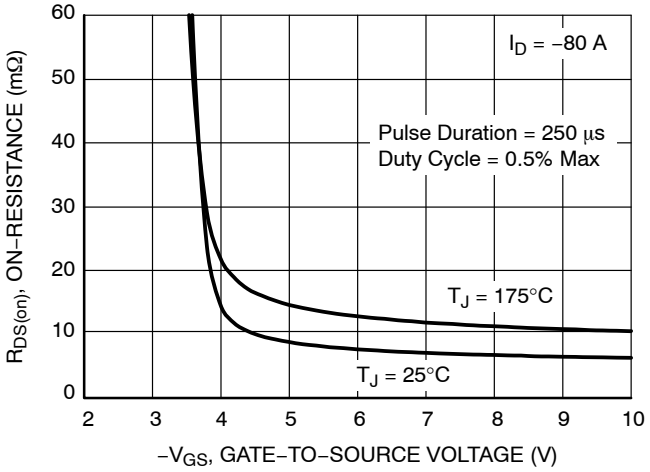


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

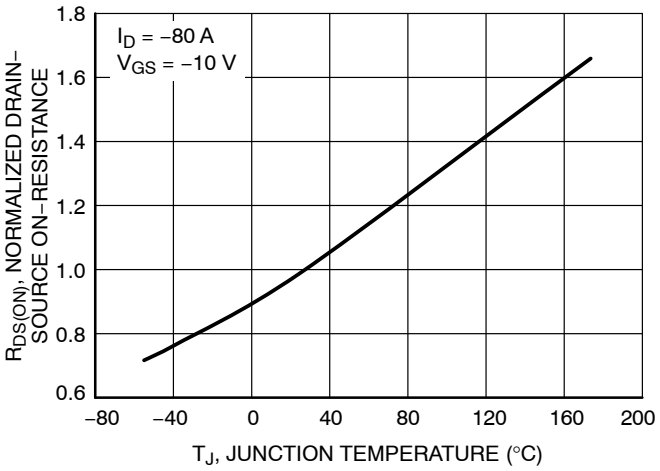


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

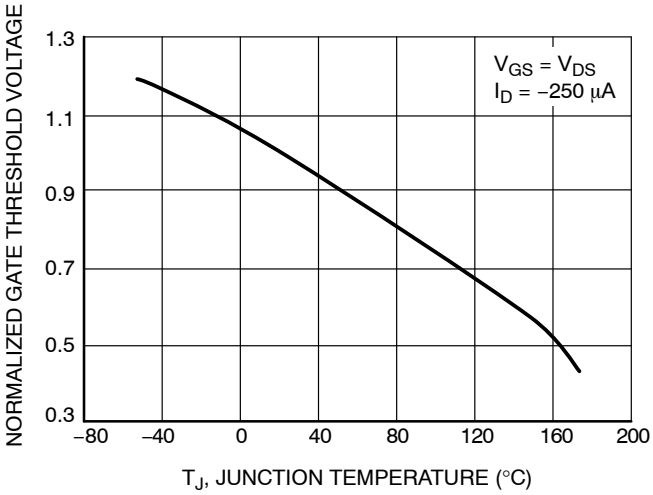


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

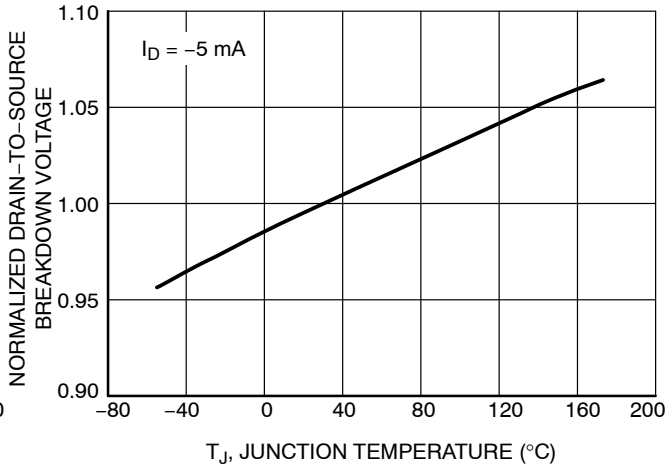


Figure 14. Normalized Drain−to−Source Breakdown Voltage vs. Junction Temperature

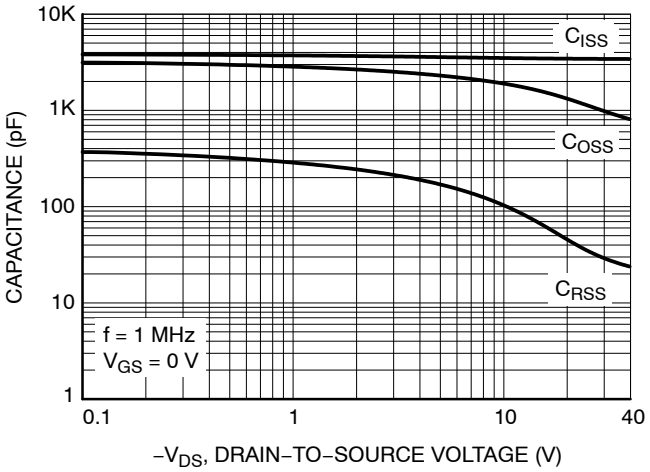


Figure 15. Capacitance vs. Drain−to−Source Voltage

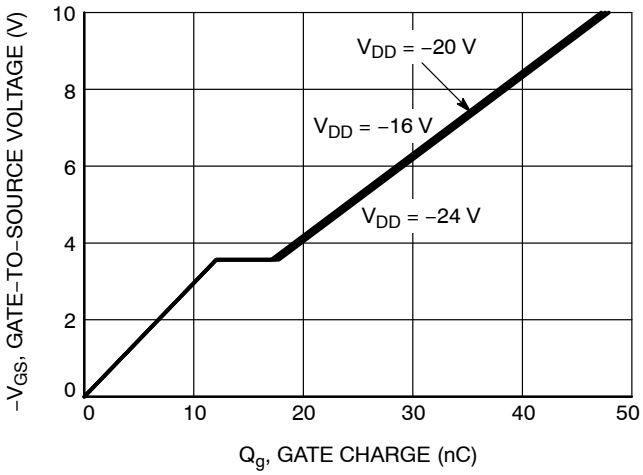


Figure 16. Gate Charge vs. Gate−to−Source Voltage

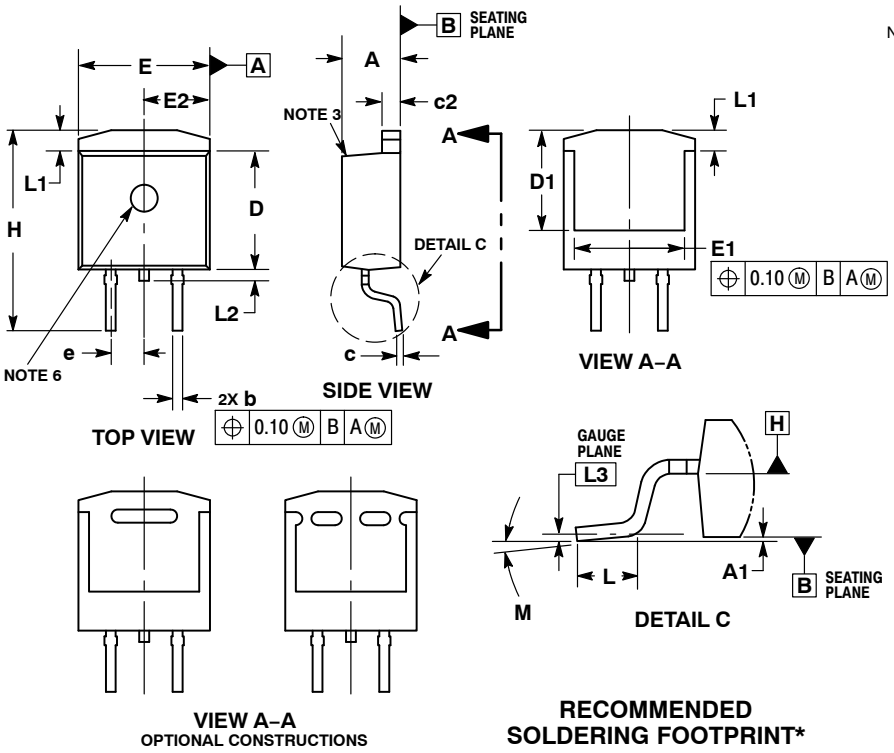
ORDERING INFORMATION

Device	Device Marking	Package	Shipping†
FDB9509L−F085	FDB9509L	D^2PAK−3 (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

PACKAGE DIMENSIONS

D²PAK−3 (TO−263, 3−LEAD)
CASE 418AJ
ISSUE B

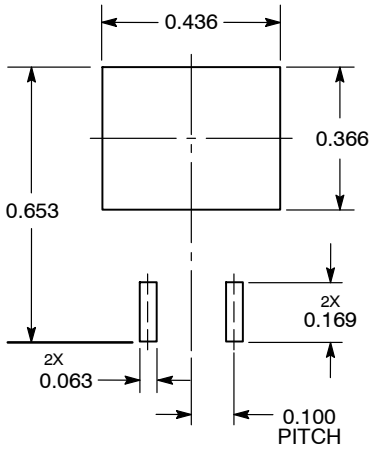


VIEW A−A
OPTIONAL CONSTRUCTIONS

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. CHAMFER OPTIONAL
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1 AND E1.
6. OPTIONAL MOLD FEATURE

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	----	6.60	----
E	0.380	0.420	9.65	10.67
E1	0.245	----	6.22	----
e	0.100 BSC		2.54 BSC	
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	----	0.066	----	1.68
L2	----	0.070	----	1.78
L3	0.010 BSC		0.25 BSC	
M	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: INCHES

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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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
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