

FDB9506L-F085

Power MOSFET

-40 V, 3.6 mΩ, -110 A, Single P-Channel

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G 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}	± 16	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	I_D -110	A
		$T_C = 100^\circ\text{C}$	-110	
Power Dissipation $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	P_D 176	W
		$T_C = 100^\circ\text{C}$	88	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	I_D -24.5	A
		$T_A = 100^\circ\text{C}$	-17.3	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	P_D 3.5	W
		$T_A = 100^\circ\text{C}$	1.7	
Pulsed Drain Current	$T_C = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	I_{DM} -1260	A	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode) (Note 1)	I_S	-110	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = -86 \text{ A}$)	E_{AS}	370	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	$R_{\theta JC}$	0.85	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	43	

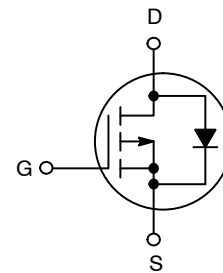
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted. Maximum current is limited by package configuration.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for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



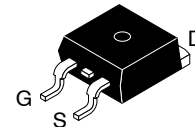
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$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
-40 V	3.6 mΩ @ -10 V	-80 A
	5.0 mΩ @ -4.5 V	

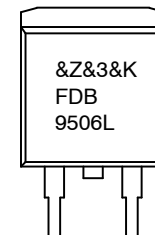


P-CHANNEL MOSFET



D²PAK-3
TO-263
CASE 418AJ

MARKING DIAGRAM



- &Z = Assembly Plant Code
- &3 = Numeric Date Code
- &K = Lot Code
- FDB9506L = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

FDB9506L-F085

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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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	$V_{(BR)DSS}/T_J$		-	-22	-	mV/ $^\circ\text{C}$
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
		$V_{GS} = 0\text{ V}, V_{DS} = -40\text{ V}, T_J = 175^\circ\text{C}$	-	-	-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	$V_{GS(th)}/T_J$		-	-6.4	-	mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -80\text{ A}$	-	2.8	3.6	m Ω
		$V_{GS} = -4.5\text{ V}, I_D = -40\text{ A}$	-	3.9	5.0	

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 100\text{ KHz}, V_{DS} = -20\text{ V}$	-	9100	-	pF
Output Capacitance	C_{oss}		-	3300	-	pF
Reverse Transfer Capacitance	C_{rss}		-	140	-	pF
Gate Resistance	R_g	$V_{GS} = 0.5\text{ V}, f = 100\text{ KHz}$	-	19	-	Ω
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -10\text{ V}, V_{DS} = -32\text{ V}, I_D = -80\text{ A}$	-	126	-	nC
		$V_{GS} = -4.5\text{ V}, V_{DS} = -32\text{ V}, I_D = -80\text{ A}$	-	58	-	
Threshold Gate Charge	$Q_{g(th)}$	$V_{GS} = 0\text{ to }-1\text{ V}$	-	8	-	
Gate-to-Source Gate Charge	Q_{gs}	$V_{DD} = -32\text{ V}, I_D = -80\text{ A}$	-	27	-	
Gate-to-Drain "Miller" Charge	Q_{gd}		-	16	-	
Plateau Voltage	V_{GP}		-	-3.2	-	V

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -20\text{ V}, I_D = -80\text{ A}, V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$	-	12	-	ns
Turn-On Rise Time	t_r		-	9	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	474	-	ns
Turn-Off Fall Time	t_f		-	140	-	ns

DRAIN-SOURCE DIODE CHARACTERISTICS

Source-to-Drain Diode Voltage	V_{SD}	$I_{SD} = -80\text{ A}, V_{GS} = 0\text{ V}$	-	-0.91	-1.25	V
		$I_{SD} = -40\text{ A}, V_{GS} = 0\text{ V}$	-	-0.84	-1.2	V
Reverse Recovery Time	T_{RR}	$V_{GS} = 0\text{ V}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = -80\text{ A}$	-	87	-	ns
Charge Time	t_a		-	42	-	
Discharge Time	t_b		-	45	-	
Reverse Recovery Charge	Q_{RR}		-	101	-	

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 $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

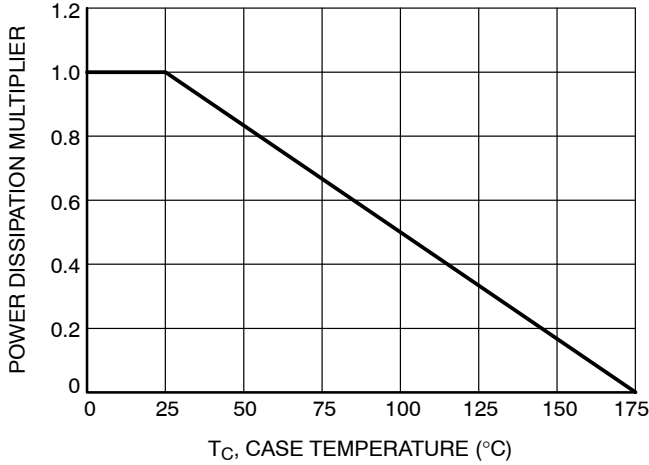


Figure 1. Normalized Power Dissipation vs. Case Temperature

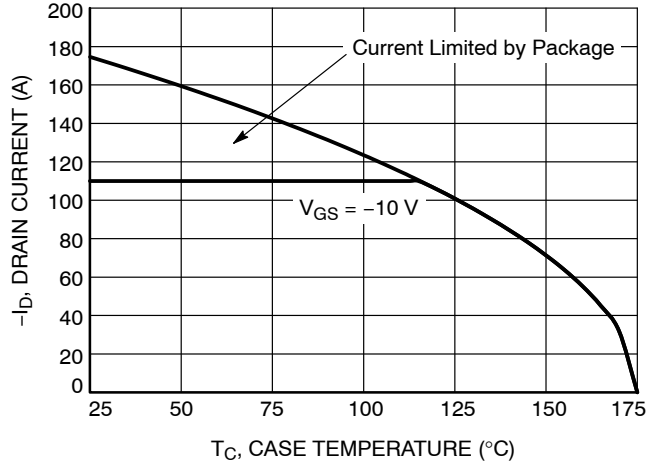


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

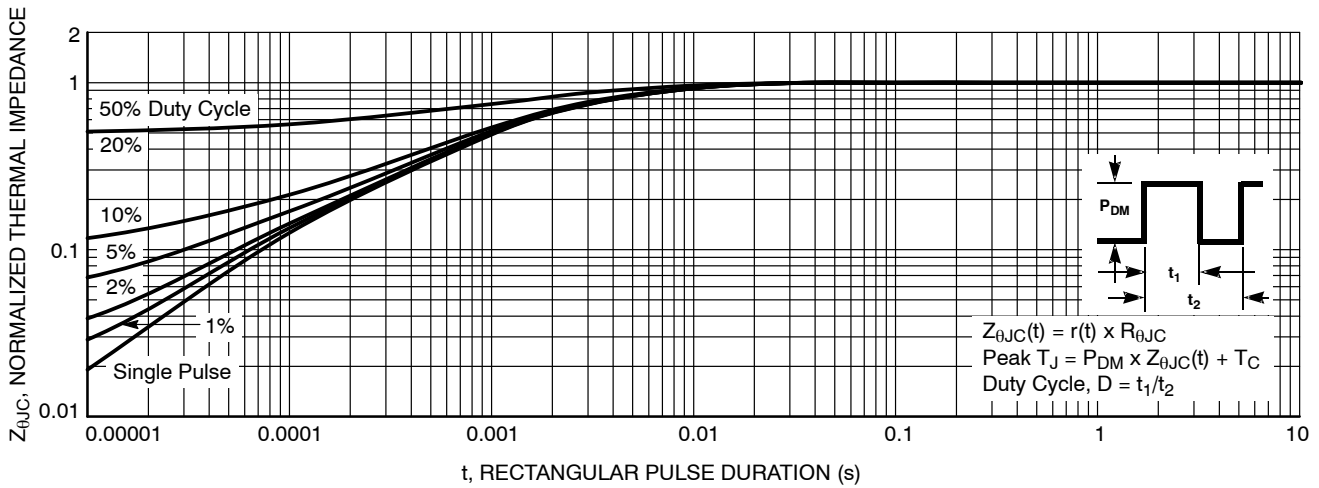


Figure 3. Normalized Maximum Transient Thermal Impedance

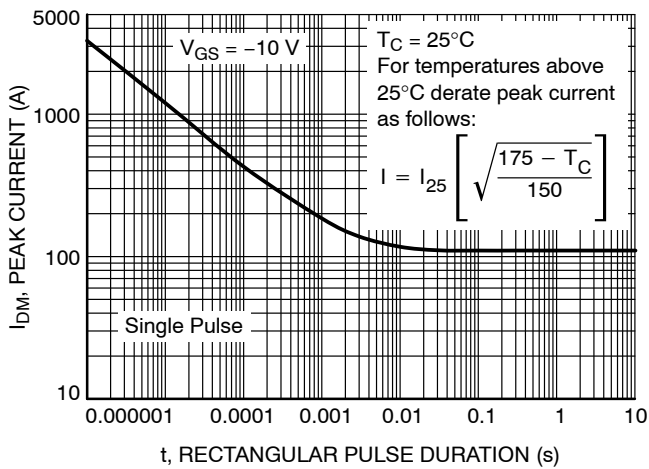


Figure 4. Peak Current Capability

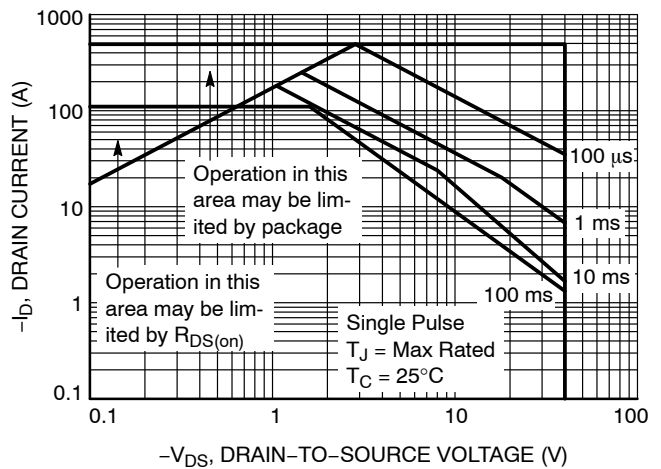


Figure 5. Forward Bias Safe Operating Area

TYPICAL CHARACTERISTICS

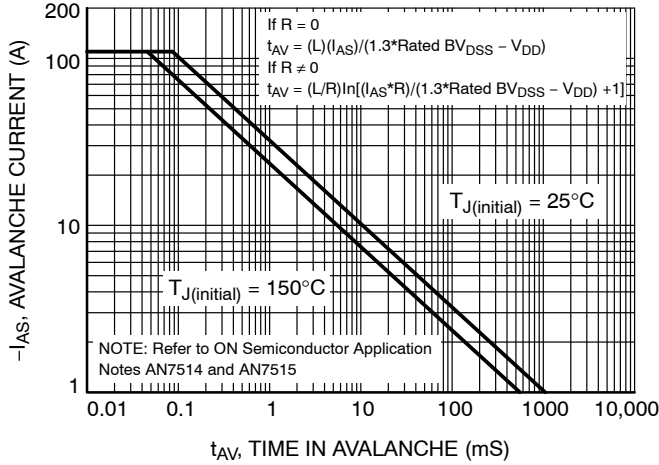


Figure 6. Unclamped Inductive Switching Capability

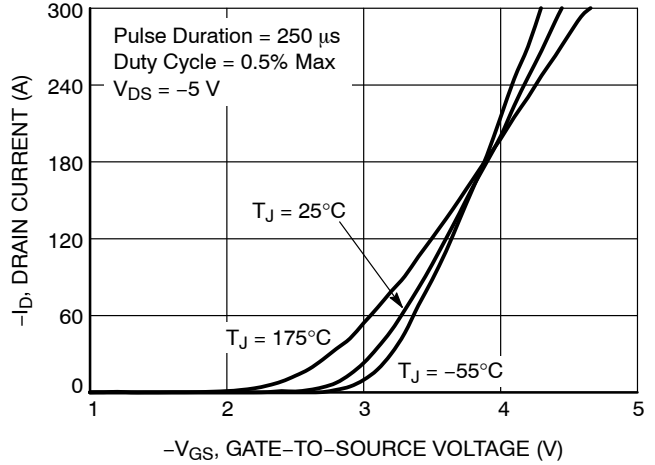


Figure 7. Transfer Characteristics

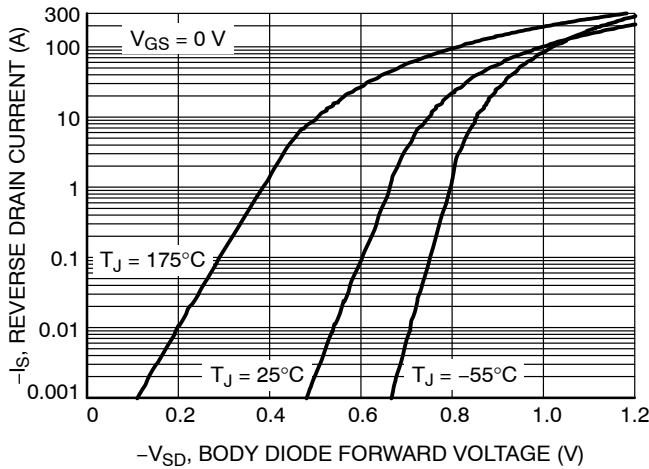


Figure 8. Forward Diode Characteristics

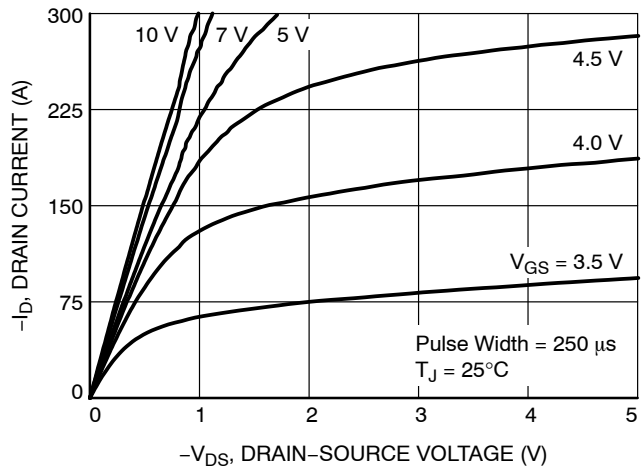


Figure 9. Saturation Characteristics

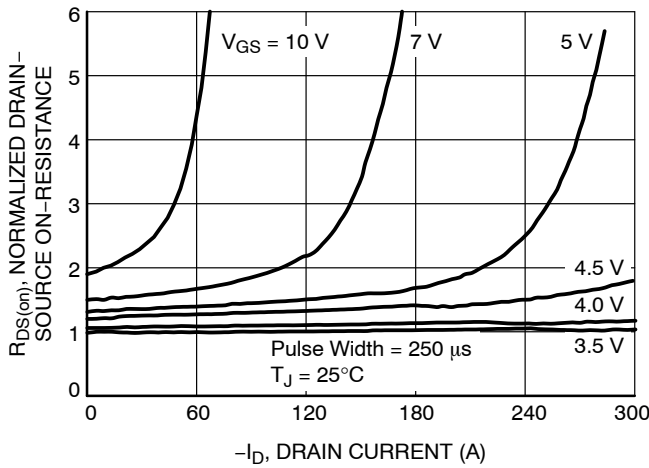


Figure 10. Normalized $R_{DS(on)}$ vs. Drain Current

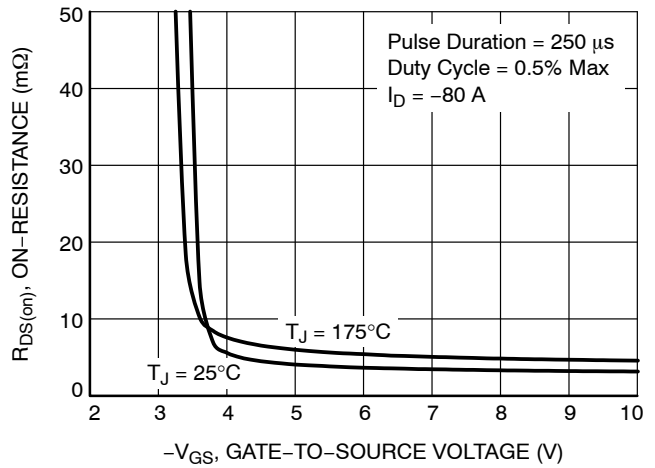


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

TYPICAL CHARACTERISTICS

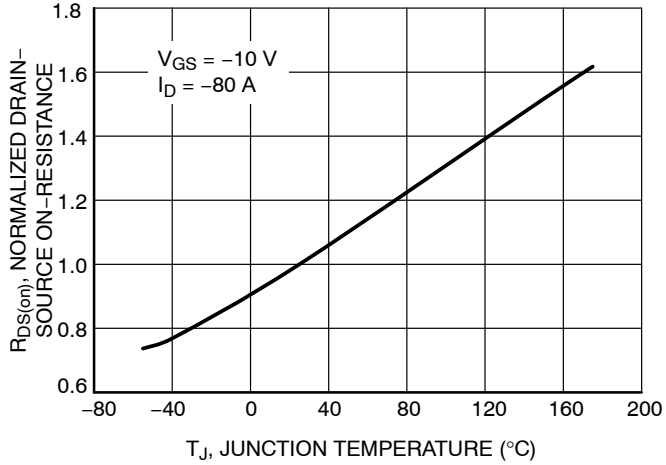


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

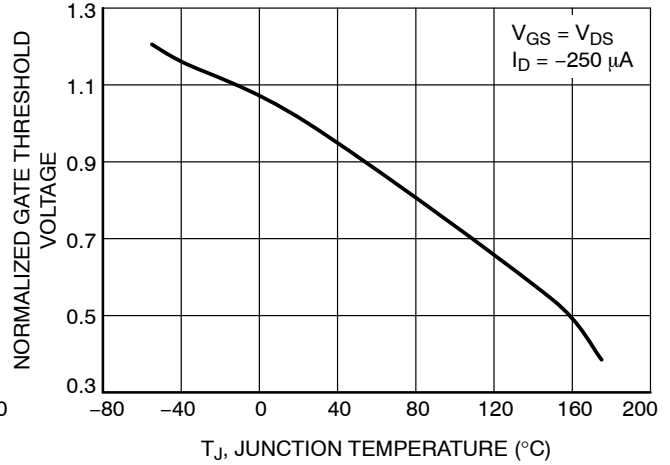


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

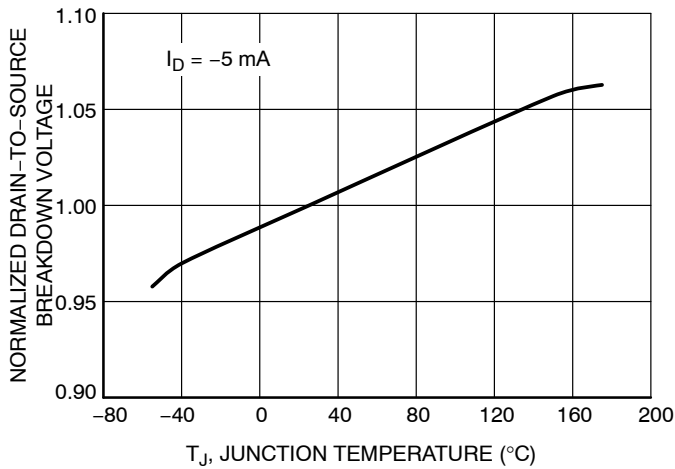


Figure 14. Normalized Drain-to-Source Breakdown Voltage vs. Junction Temperature

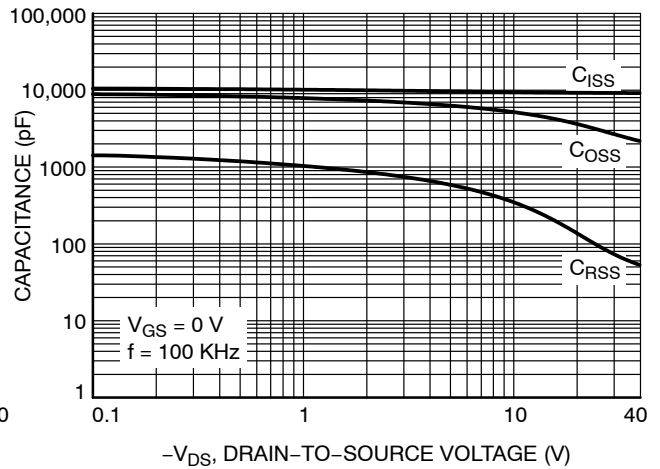


Figure 15. Capacitance vs. Drain-to-Source Voltage

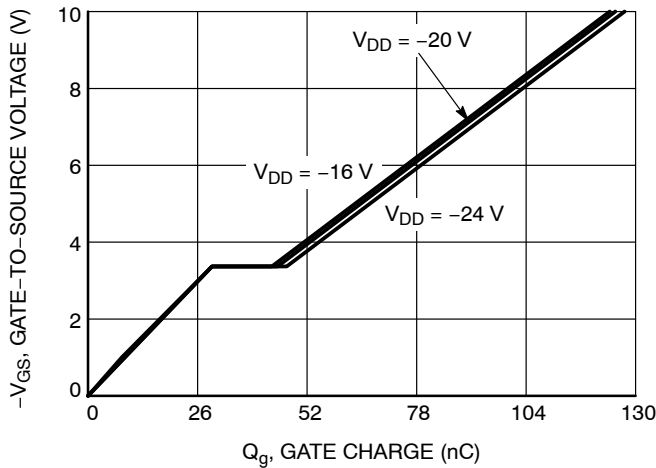
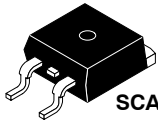


Figure 16. Gate Charge vs. Gate-to-Source Voltage

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

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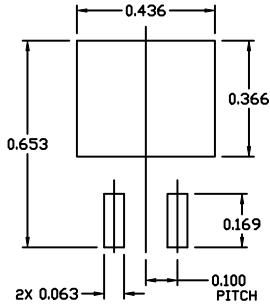
SCALE 1:1

D²PAK-3 (TO-263, 3-LEAD)

CASE 418AJ

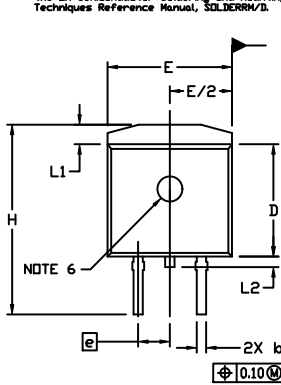
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RECOMMENDED MOUNTING FOOTPRINT

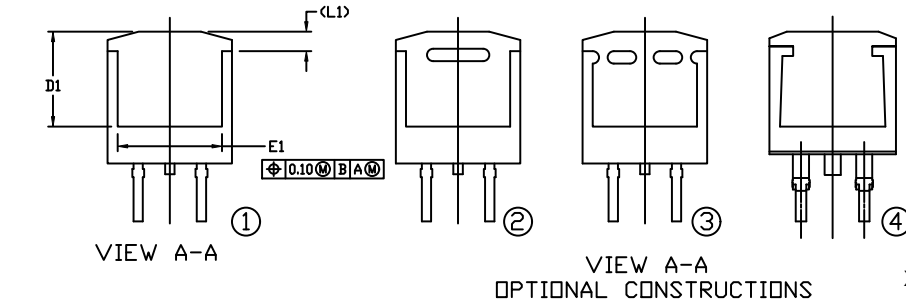
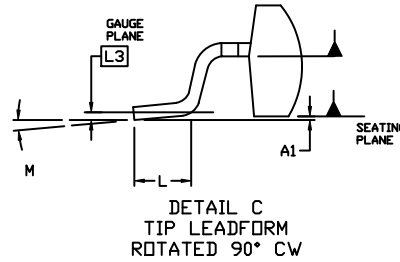
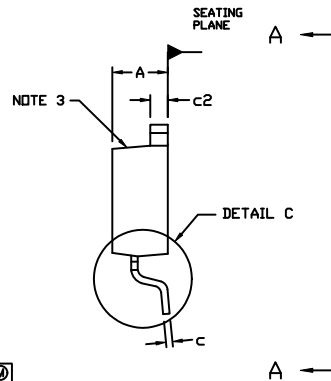
For additional information on our Pb-free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.



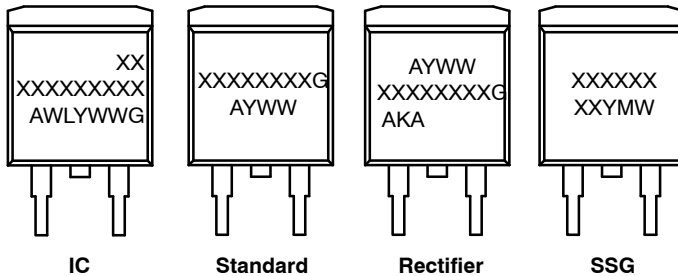
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: INCHES
- CHAMFER OPTIONAL.
- 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.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- OPTIONAL MOLD FEATURE.
- ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES		MILLIMETERS	
	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*



GENERIC MARKING DIAGRAMS*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- W = Week Code (SSG)
- M = Month Code (SSG)
- G = Pb-Free Package
- AKA = Polarity Indicator

*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.

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