FAIRCHILD SEMICONDUCTOR®

December 2010

FDB016N04AL7

N-Channel PowerTrench® MOSFET

40V, 306A, 1.6mΩ

Features

- $R_{DS(on)}$ = 1.16mΩ (Typ.)@ V_{GS} = 10V, I_D = 80A
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

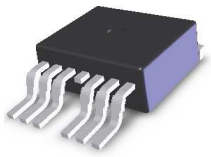
Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's adcanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

Application

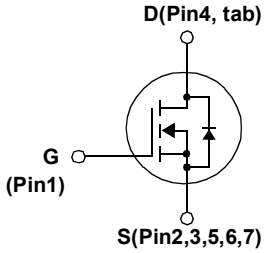
- DC to DC Convertors / Synchronous Rectification

100% LEAD-FREE IMPLEMENTATION



D^2-PAK-7L

FDB Series with suffix - L7



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted*

Symbol	Parameter		FDB016N04AL7	Units
V_{DSS}	Drain to Source Voltage		40	V
V_{GSS}	Gate to Source Voltage		±20	V
I_D	Drain Current	- Continuous (T_C = 25°C, Silicon Limited)	306*	A
		- Continuous (T_C = 100°C, Silicon Limited)	216*	
		- Continuous (T_C = 25°C, Package Limited)	160	
I_{DM}	Drain Current	- Pulsed (Note 1)	1224	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	1350	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	6.0	V/ns
P_D	Power Dissipation	(T_C = 25°C)	283	W
		- Derate above 25°C	1.89	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 160A.

Thermal Characteristics

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.53	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDB016N04A	FDB016N04AL7	D2-PAK-7L	330mm	24mm	800

Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V, T_C = 25°C	40	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	-	0.03	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 32V, V_{GS} = 0V	-	-	10	μA
		V_{DS} = 32V, T_C = 150°C	-	-	500	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20V, V_{DS} = 0V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	1.0	-	3.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 80A	-	1.16	1.6	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10V, I_D = 80A (Note 4)	-	381	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	8715	11600	pF
C_{oss}	Output Capacitance		-	2035	2710	pF
C_{rss}	Reverse Transfer Capacitance		-	230	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 32V, I_D = 80A, V_{GS} = 10V (Note 4, 5)	-	129	167	nC
Q_{gs}	Gate to Source Gate Charge		-	28	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau		-	12	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	17	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 20V, I_D = 80A, R_{GEN} = 4.7Ω, V_{GS} = 10V (Note 4, 5)	-	21	52	ns
t_r	Turn-On Rise Time		-	14	38	ns
$t_{d(off)}$	Turn-Off Delay Time		-	118	246	ns
t_f	Turn-Off Fall Time		-	33	76	ns
ESR	Equivalent Series Resistance (G-S)		-	1.25	-	Ω
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	306	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	1224	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 80A	-	-	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 80A, dI_F/dt = 100A/μs (Note 4)	-	68	-	ns
Q_{rr}	Reverse Recovery Charge		-	84	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 3mH, I_{AS} = 30A, V_{DD} = 25V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 80A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

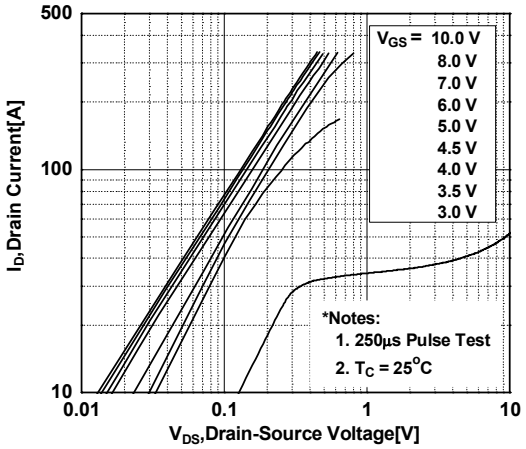


Figure 2. Transfer Characteristics

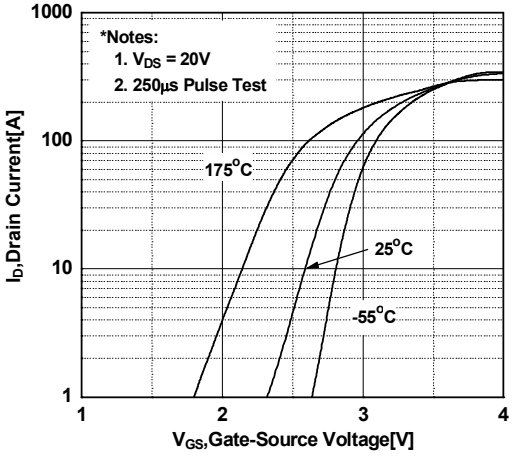


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

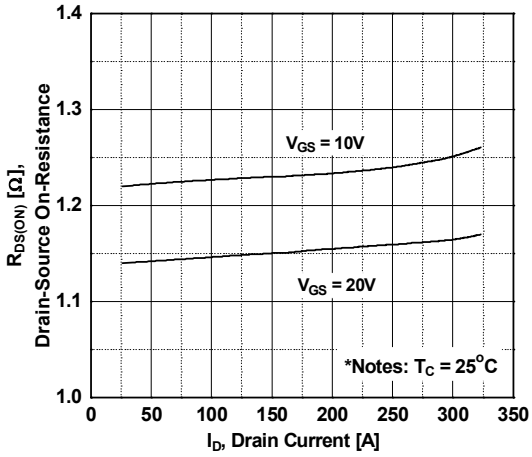


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

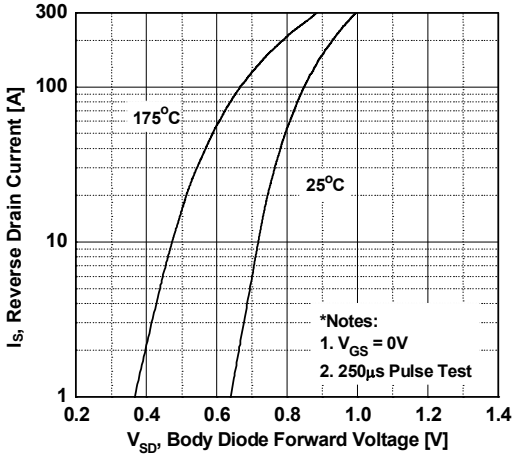


Figure 5. Capacitance Characteristics

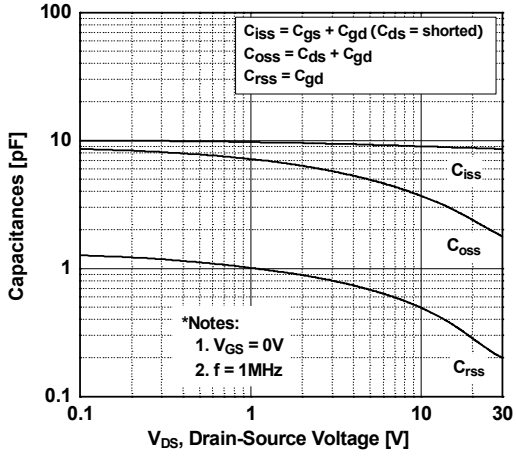
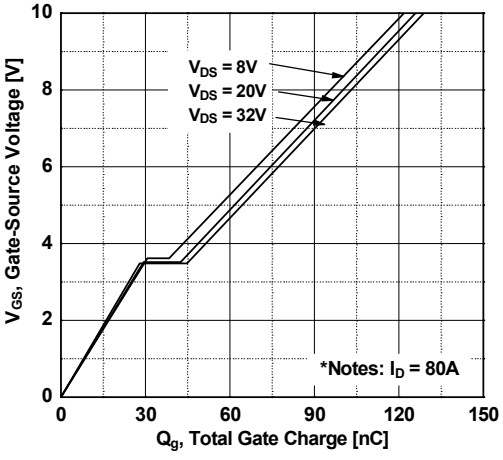


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

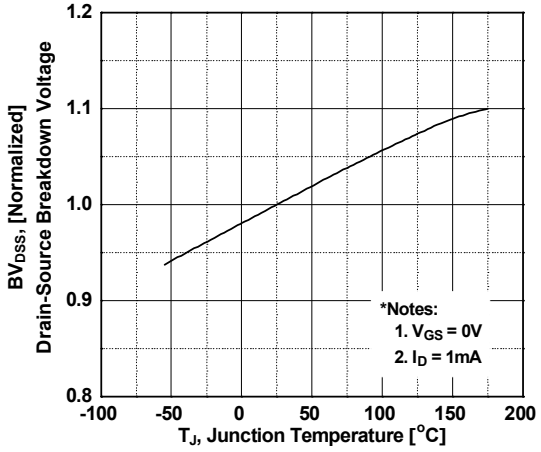


Figure 8. On-Resistance Variation vs. Temperature

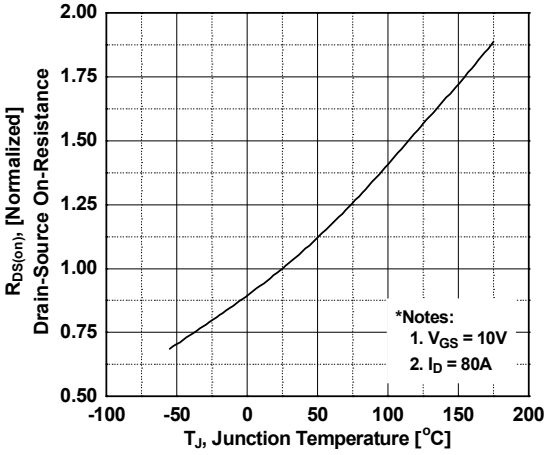


Figure 9. Maximum Safe Operating Area

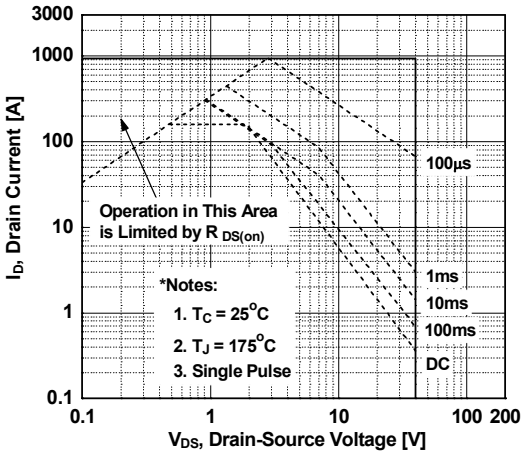


Figure 10. Maximum Drain Current vs. Case Temperature

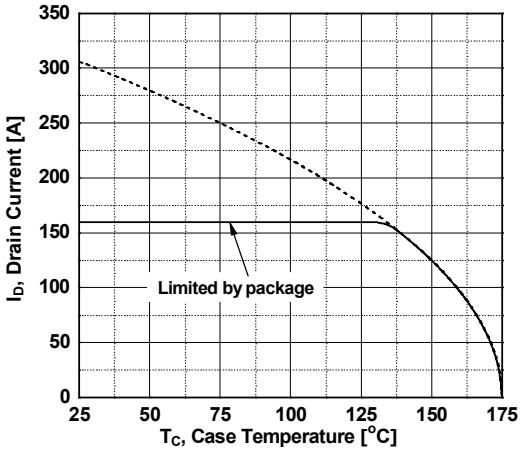


Figure 11. Unclamped Inductive Switching Capability

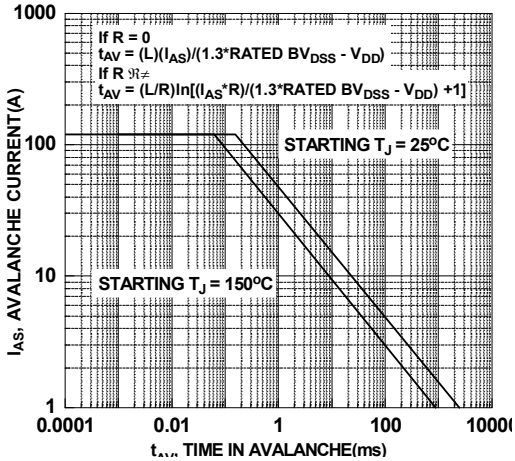
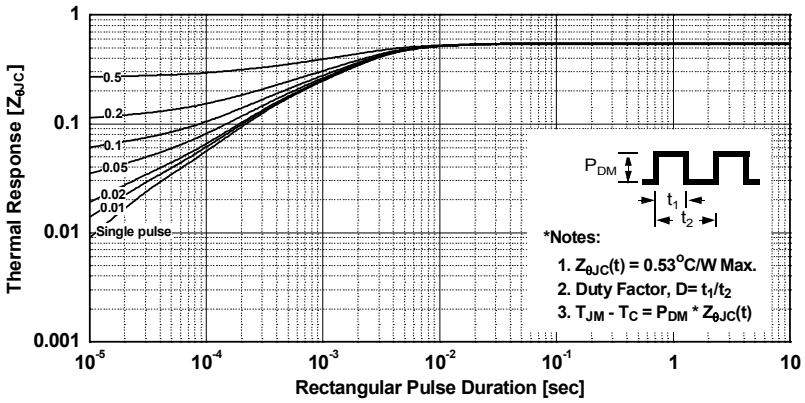
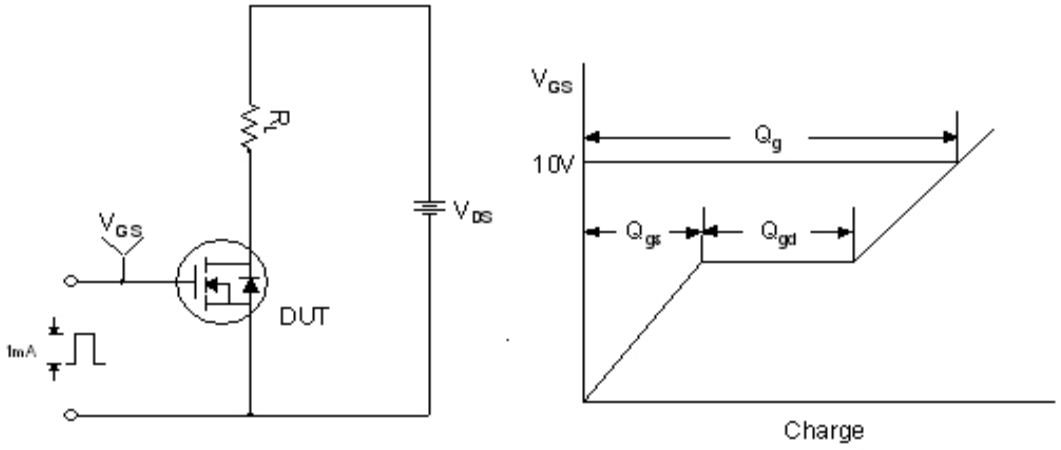


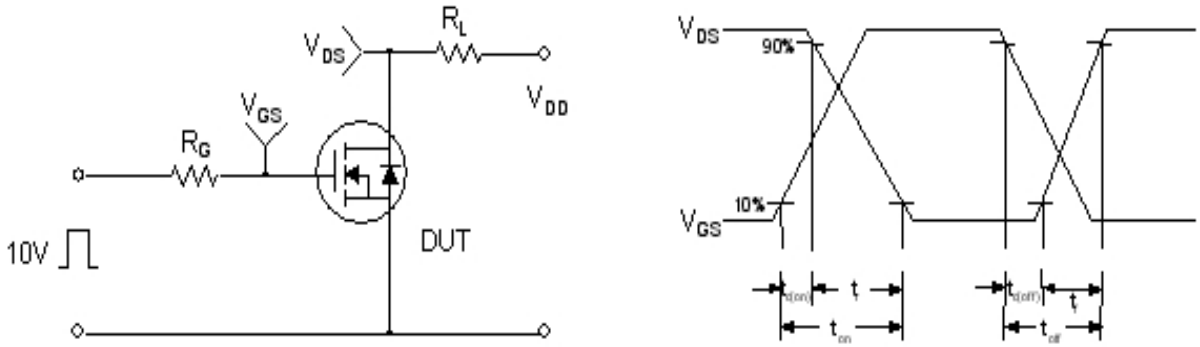
Figure 12. Transient Thermal Response Curve



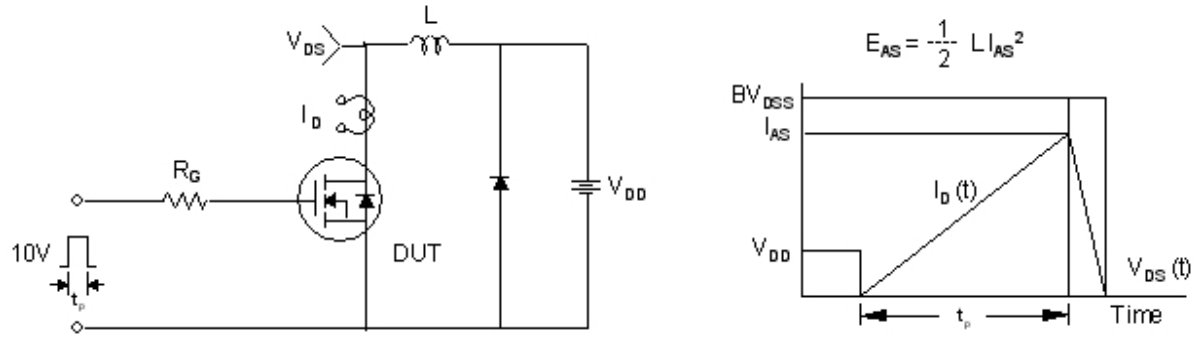
Gate Charge Test Circuit & Waveform



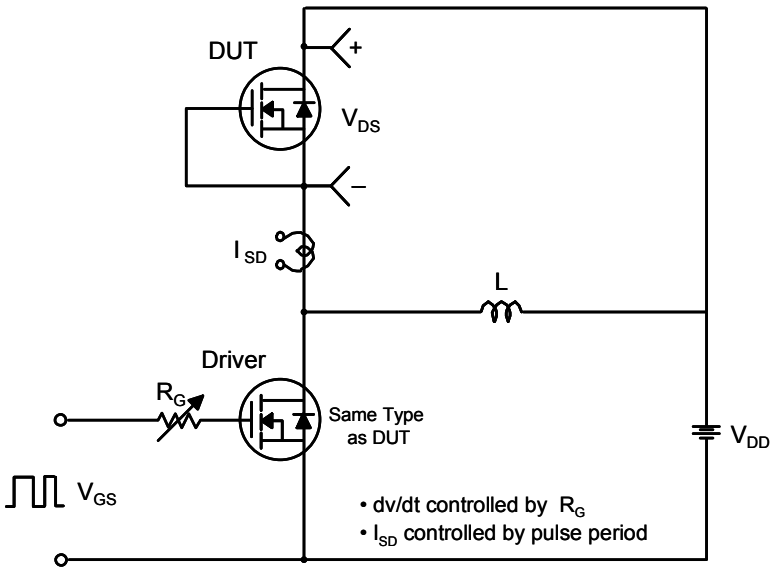
Resistive Switching Test Circuit & Waveforms

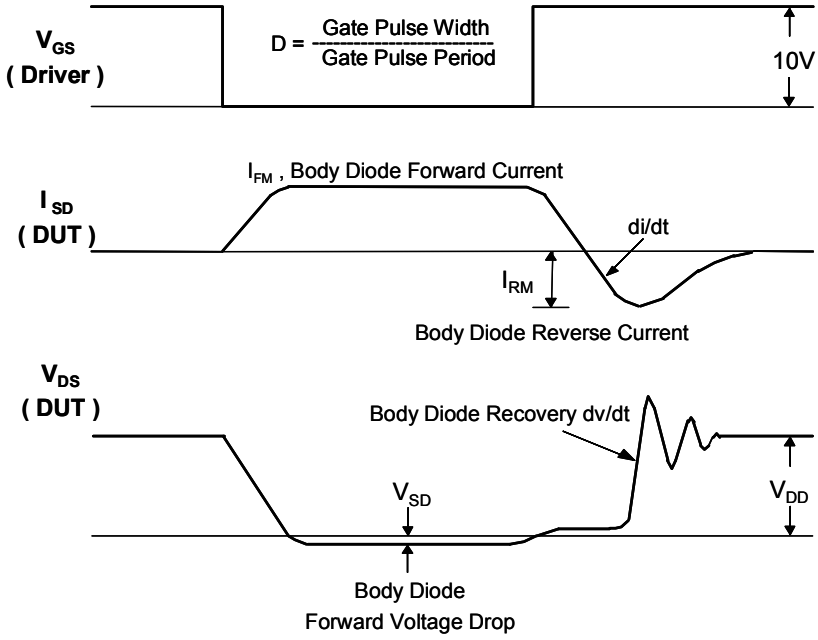


Unclamped Inductive Switching Test Circuit & Waveforms



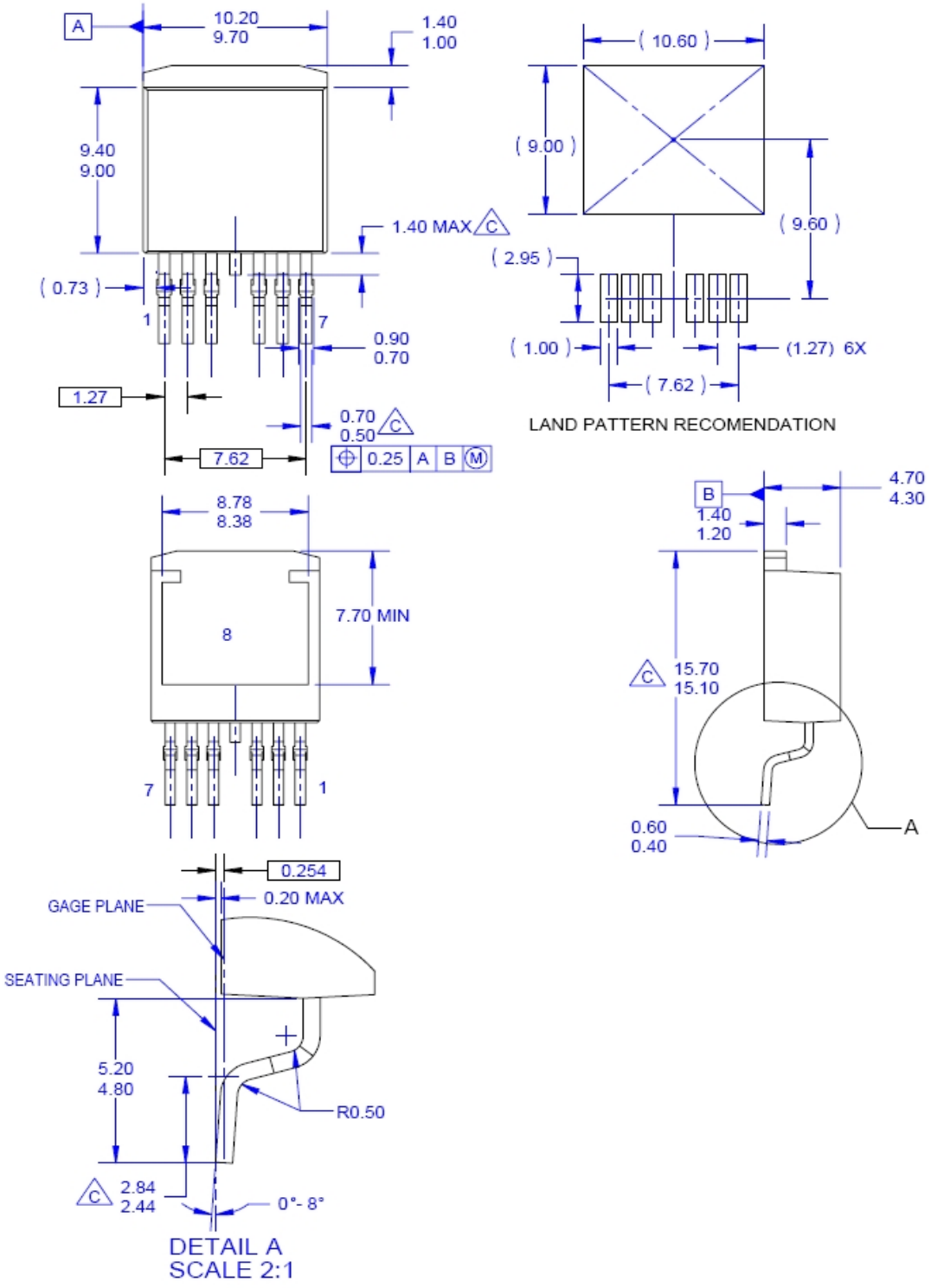
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

D^2PAK-7L



Dimensions in Millimeters

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Rev. I51