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June 2014

FDB016N04AL7

N-Channel PowerTrench® MOSFET

40 V, 306 A, 1.6 mΩ

Features

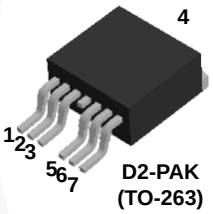
- $R_{DS(on)}$ = 1.16 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 80 A
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advance PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

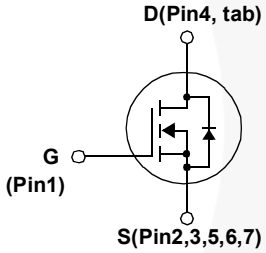
Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor drives and Uninterruptible Power Supplies



D2-PAK
(TO-263)

1. Gate
2. Source
3. Source
4. Drain
5. Source
6. Source
7. Source



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

Symbol	Parameter		FDB016N04AL7	Unit
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, 1/8" from Case for 5 Seconds		300	°C

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

Thermal Characteristics

Symbol	Parameter	FDB016N04AL7	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.53	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

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Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDB016N04AL7	FDB016N04A	D2PAK-7L	Tape and Reel	330 mm	24 mm	800 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V, $T_C = 25^oC$	40	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25^oC	-	0.03	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 32 V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 32 V, $T_C = 150^oC$	-	-	500	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, I_D = 250 μA	1.0	-	3.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 80 A	-	1.16	1.6	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 80 A	-	381	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	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} = 32 V, I_D = 80 A, V_{GS} = 10 V (Note 4)	-	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} = 20 V, I_D = 80 A, R_G = 4.7 Ω, V_{GS} = 10 V (Note 4)	-	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)	f = 1 MHz	-	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} = 0 V, I_{SD} = 80 A	-	-	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 80 A, dI_F/dt = 100 A/μs	-	68	-	ns
Q_{rr}	Reverse Recovery Charge		-	84	-	nC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 3 mH, I_{AS} = 30 A, V_{DD} = 25 V, R_G = 25 Ω, starting $T_J = 25°C$.
3. $I_{SD} \le 80$ A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting $T_J = 25°C$.
4. Essentially independent of operating temperature typical characteristics.

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Typical Performance Characteristics

Figure 1. On-Region Characteristics

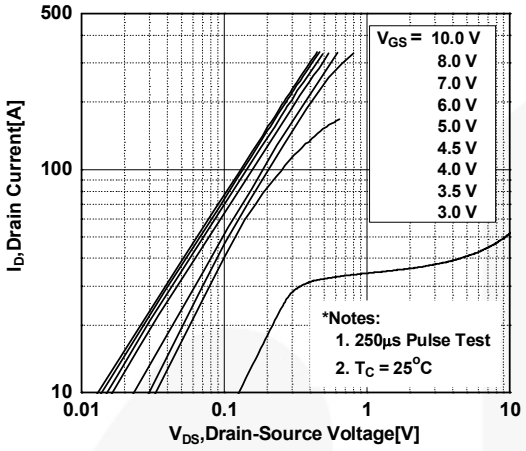


Figure 2. Transfer Characteristics

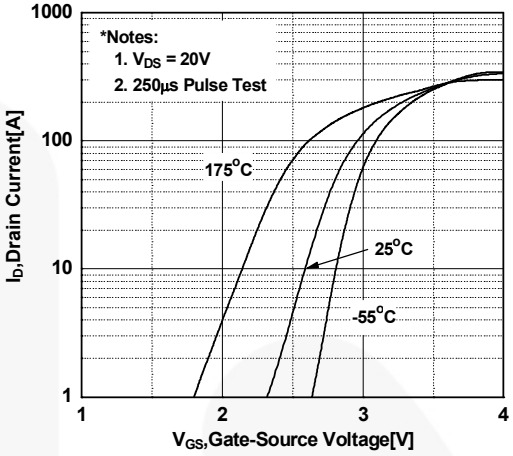


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

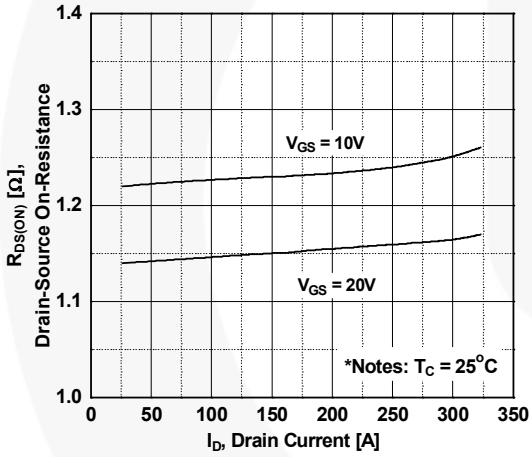


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

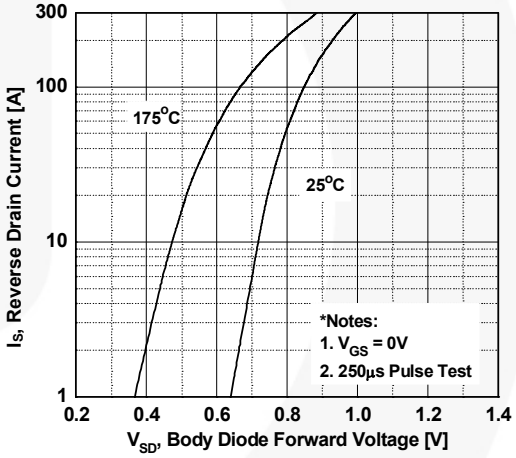


Figure 5. Capacitance Characteristics

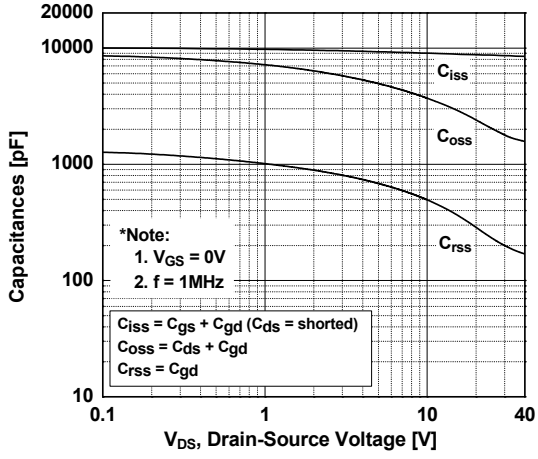
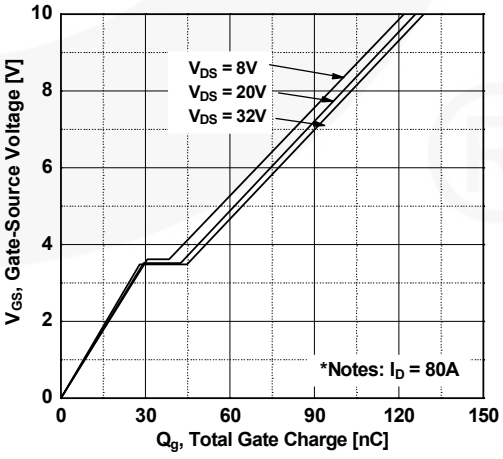


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

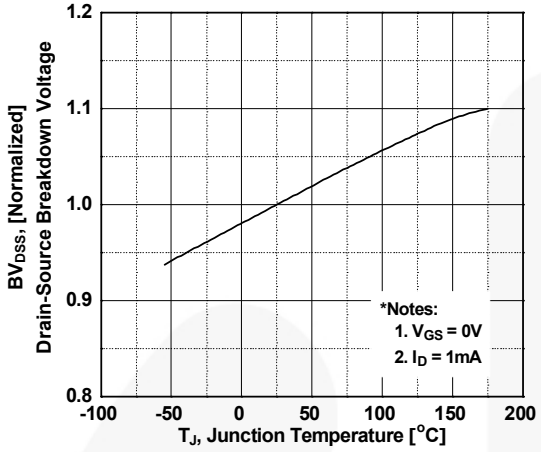


Figure 8. On-Resistance Variation vs. Temperature

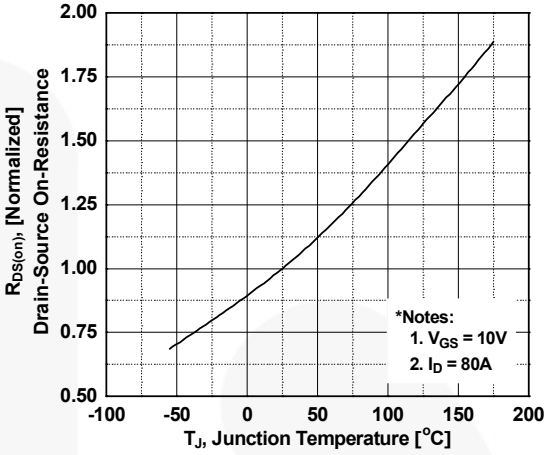


Figure 9. Maximum Safe Operating Area

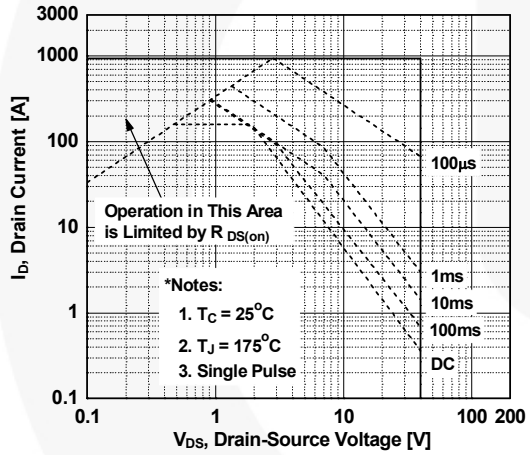


Figure 10. Maximum Drain Current vs. Case Temperature

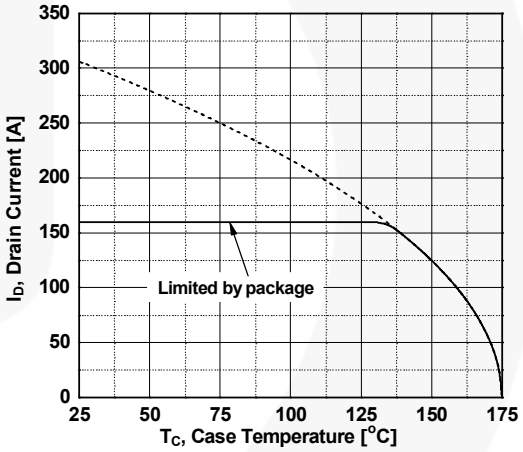
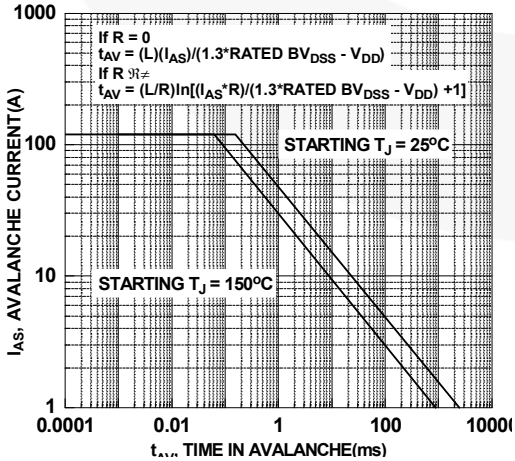


Figure 11. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

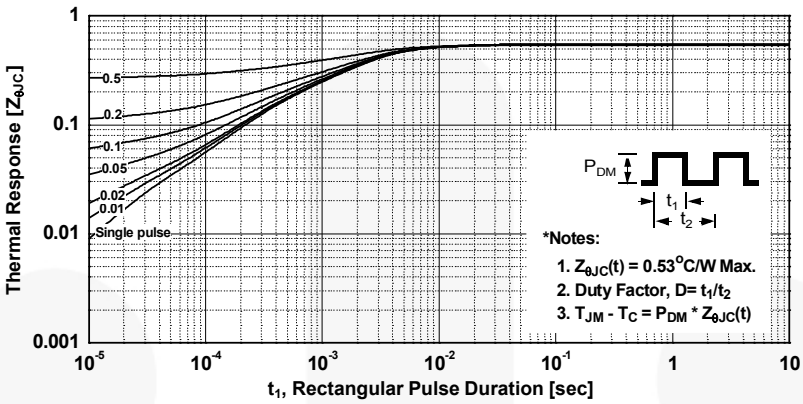


Figure 13. Gate Charge Test Circuit & Waveform

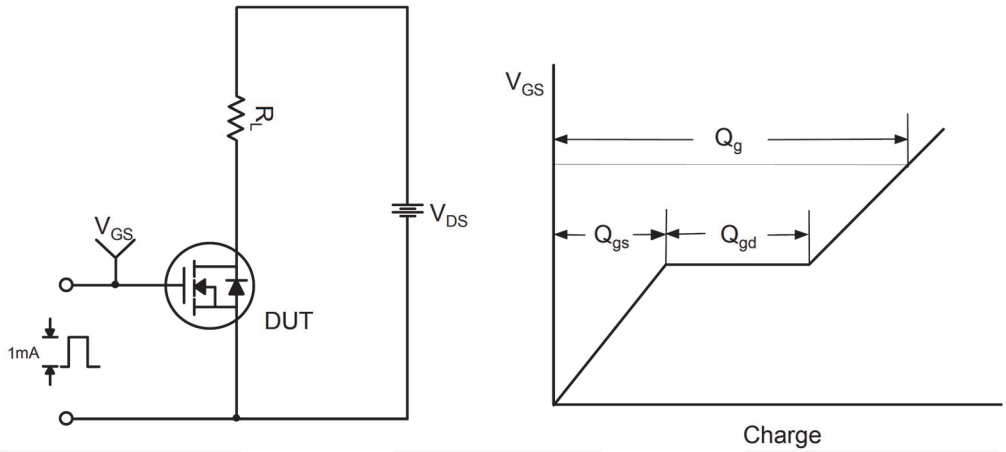


Figure 14. Resistive Switching Test Circuit & Waveforms

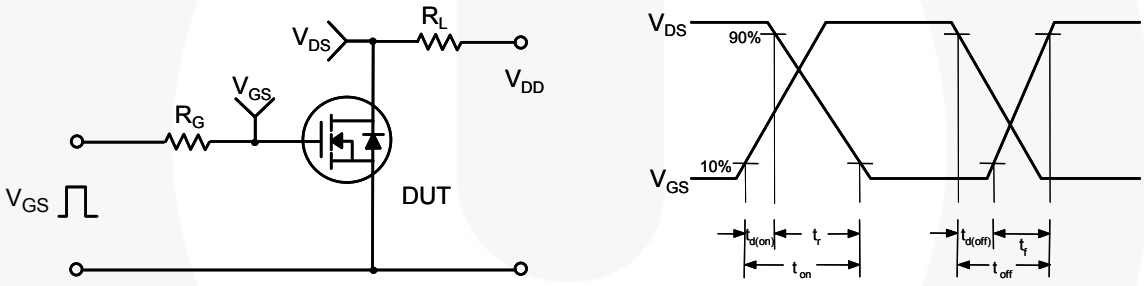


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

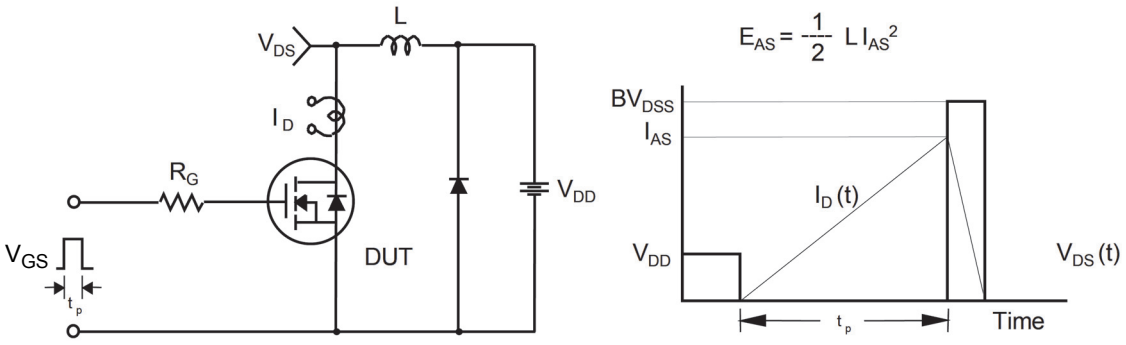
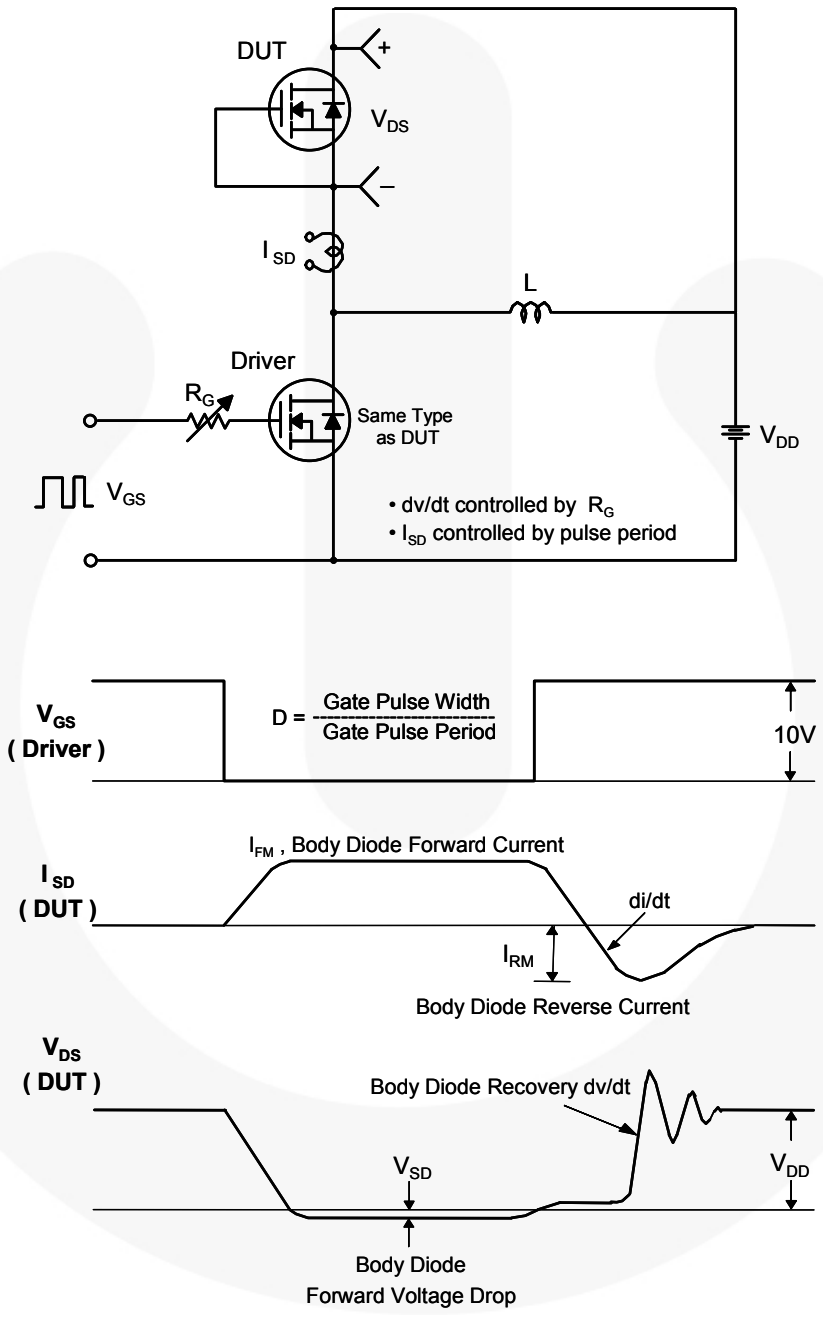


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

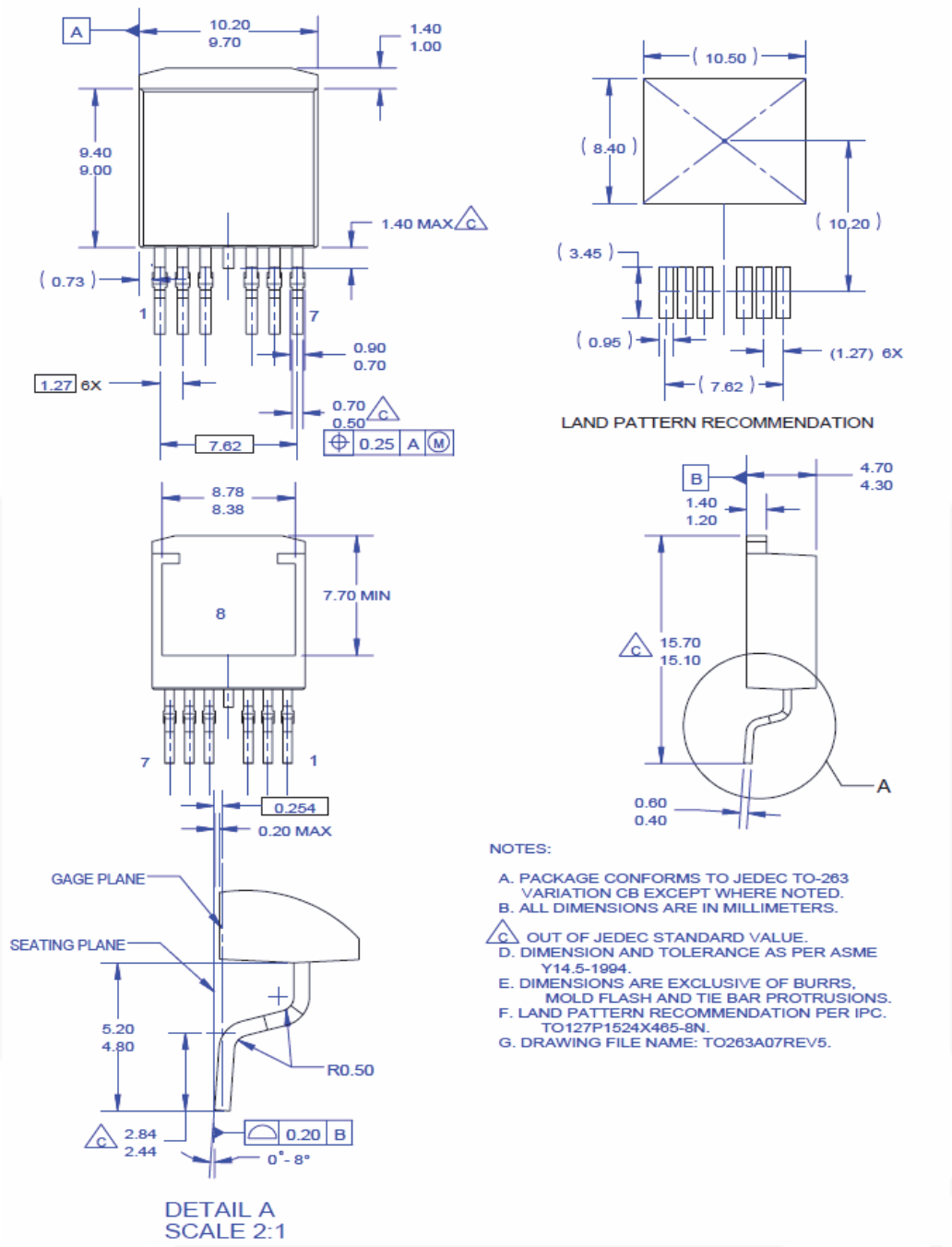


Figure 17. TO263 (D^2PAK), Molded, 7-Lead, Surface Mount

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