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June 2014

FDB016N04AL7

N-Channel PowerTrench® MOSFET

40 V, 306 A, 1.6 mΩ

Features

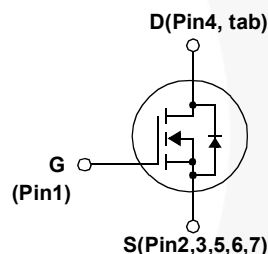
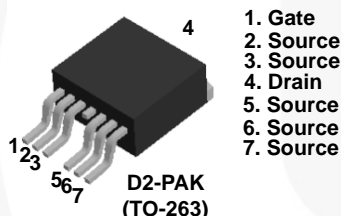
- $R_{DS(on)} = 1.16 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 80 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

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



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ 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 ($T_C = 25^\circ\text{C}$, Silicon Limited)	A
		- Continuous ($T_C = 100^\circ\text{C}$, Silicon Limited)	
		- Continuous ($T_C = 25^\circ\text{C}$, Package Limited)	
I_{DM}	Drain Current	- Pulsed (Note 1)	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	W
		- Derate Above 25°C	$W/^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

*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	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

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 $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$, $T_C = 25^\circ\text{C}$	40	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	-	0.03	-	$V/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32\ \text{V}$, $V_{GS} = 0\ \text{V}$	-	-	10	μA
		$V_{DS} = 32\ \text{V}$, $T_C = 150^\circ\text{C}$	-	-	500	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	1.0	-	3.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 80\ \text{A}$	-	1.16	1.6	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 10\ \text{V}$, $I_D = 80\ \text{A}$	-	381	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	-	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	$V_{DS} = 32\ \text{V}$, $I_D = 80\ \text{A}$, $V_{GS} = 10\ \text{V}$ (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	$V_{DD} = 20\ \text{V}$, $I_D = 80\ \text{A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\ \text{V}$ (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)	$f = 1\ \text{MHz}$	-	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,	-	68	-	ns
Q _{rr}	Reverse Recovery Charge	di _F /dt = 100 A/μs	-	84	-	nC

Notes:

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

Typical Performance Characteristics

Figure 1. On-Region Characteristics

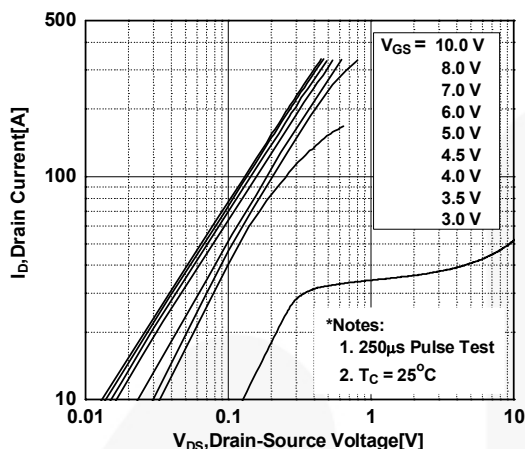


Figure 2. Transfer Characteristics

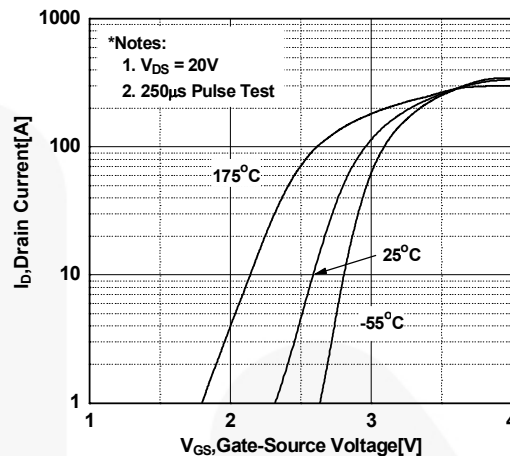


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

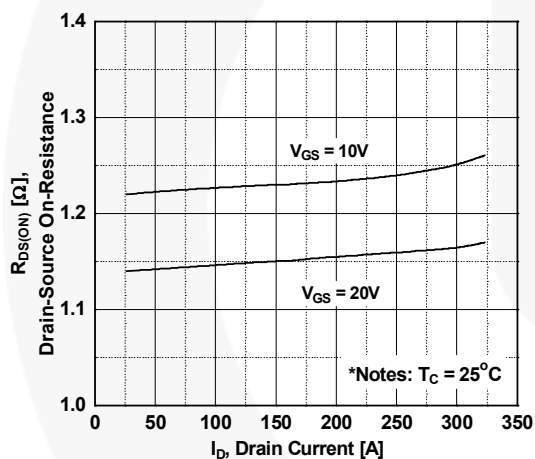


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

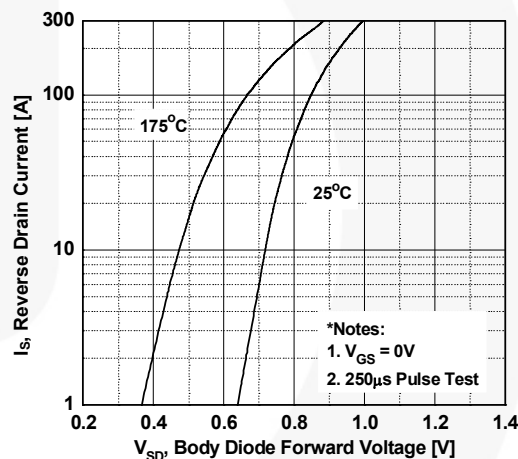


Figure 5. Capacitance Characteristics

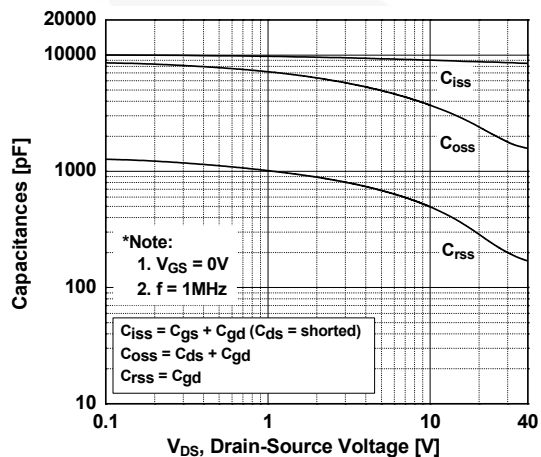
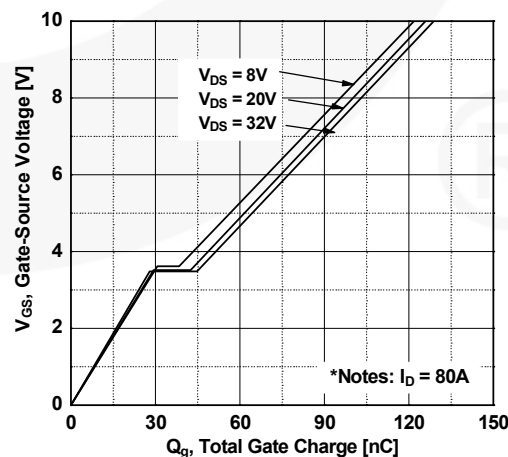


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

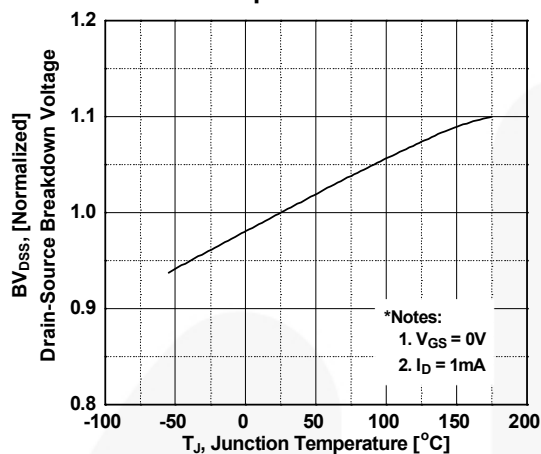


Figure 8. On-Resistance Variation vs. Temperature

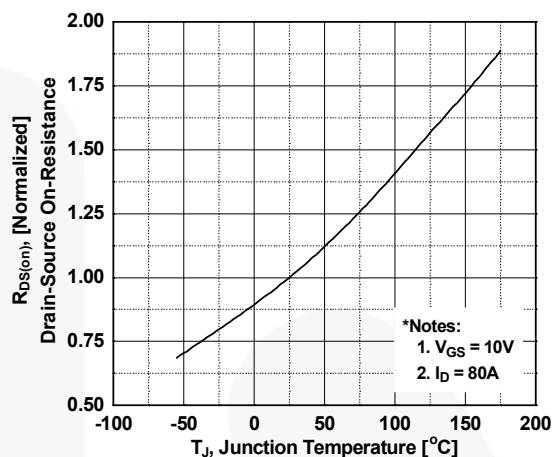


Figure 9. Maximum Safe Operating Area

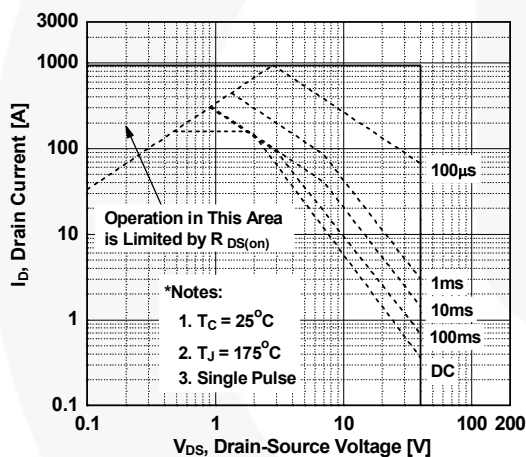


Figure 10. Maximum Drain Current vs. Case Temperature

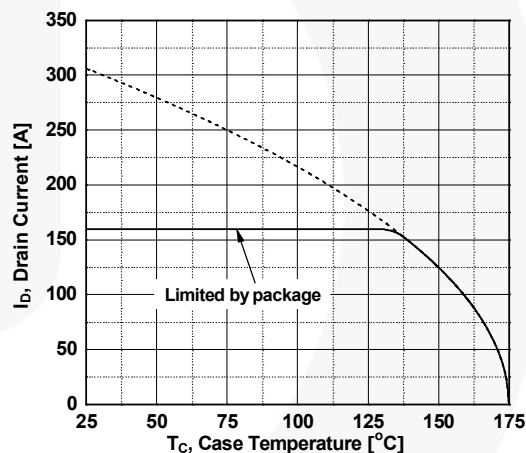
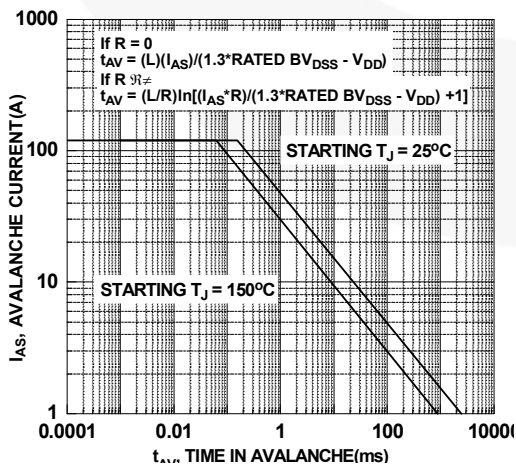


Figure 11. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

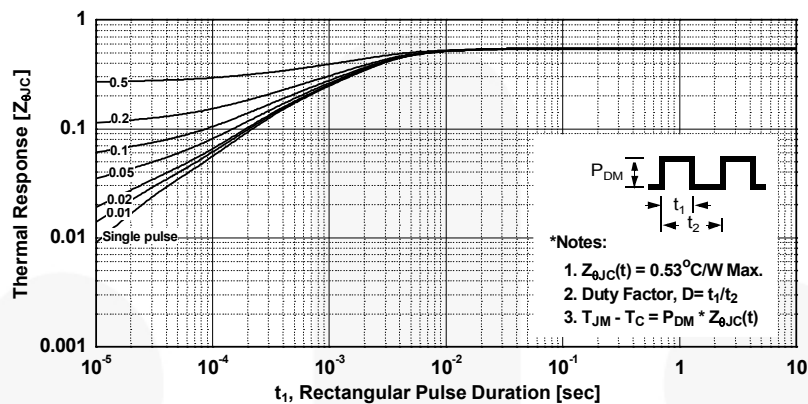


Figure 13. Gate Charge Test Circuit & Waveform

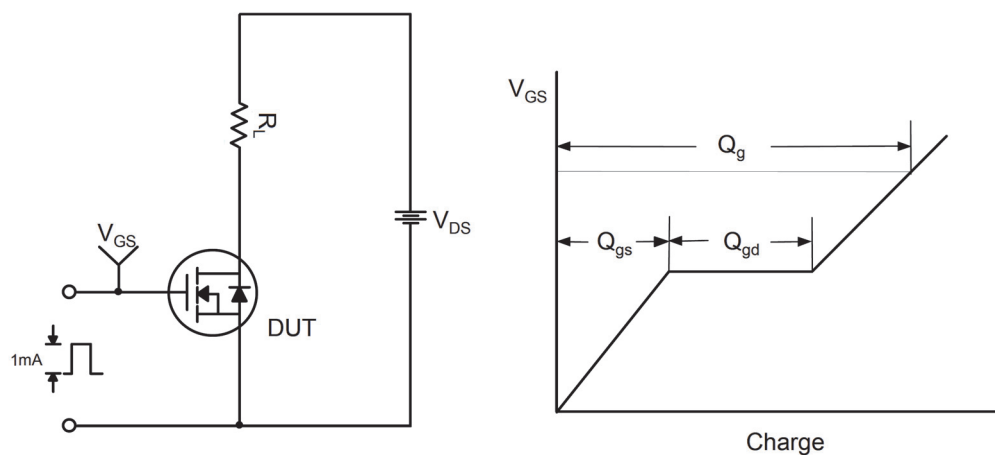


Figure 14. Resistive Switching Test Circuit & Waveforms

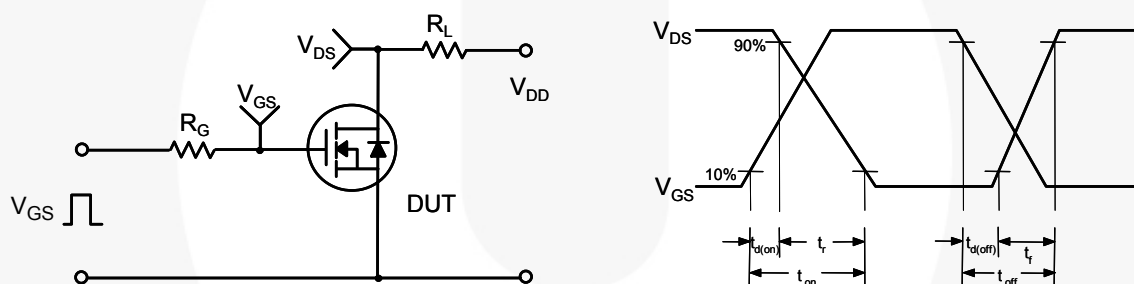
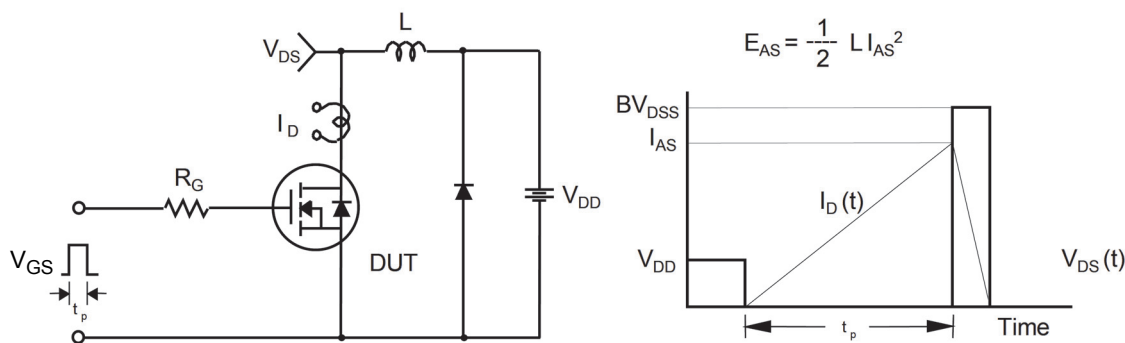


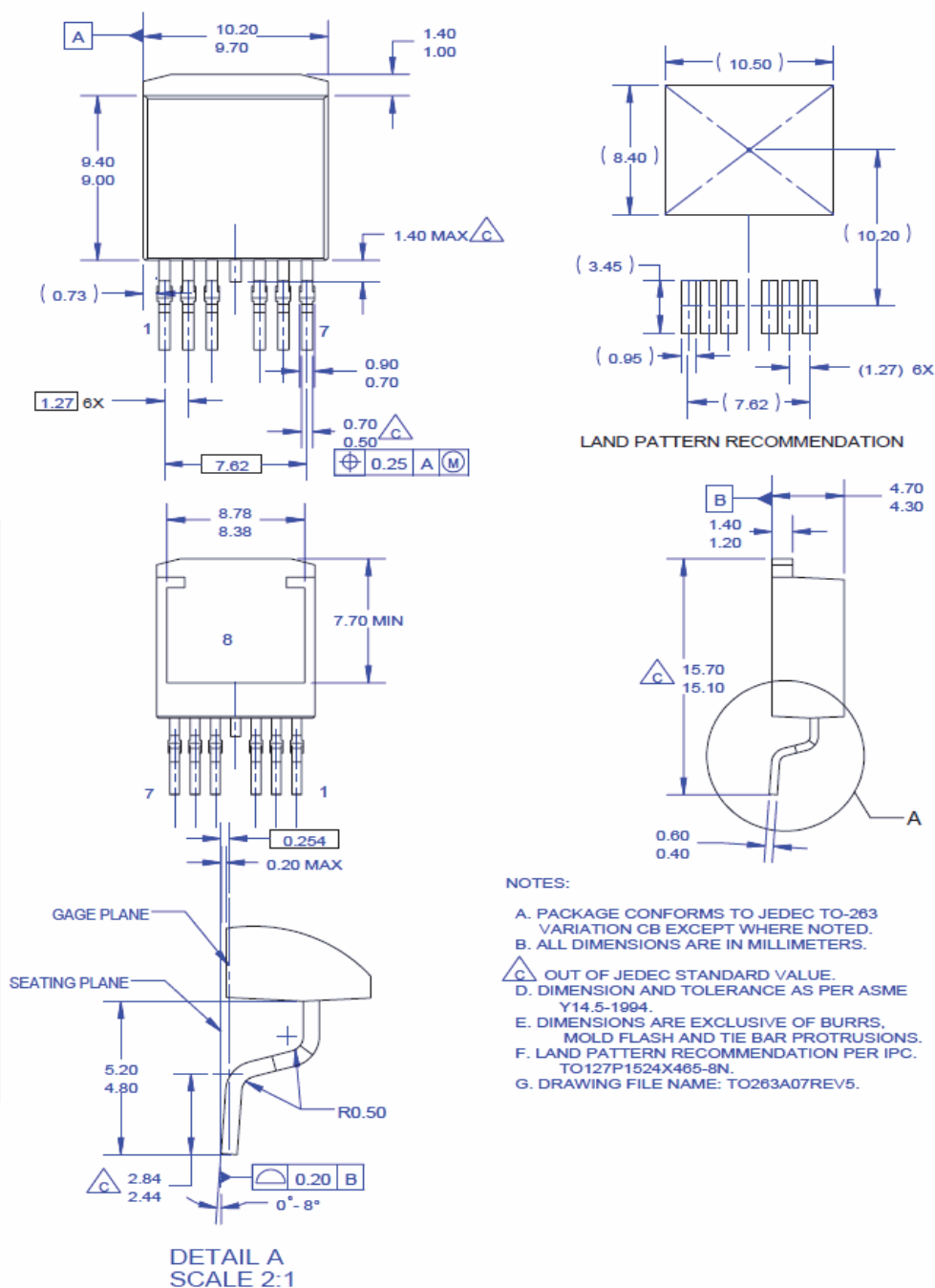
Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms



The diagram shows a switching circuit. A MOSFET labeled 'DUT' has its gate connected to a driver MOSFET. The driver MOSFET's gate is connected to a pulse source V_{GS} through a resistor R_G . The driver MOSFET is labeled 'Same Type as DUT'. The drain of the DUT is connected to a positive supply V_{DD} through an inductor L . The source of the DUT is connected to ground through a current source I_{SD} . The voltage across the DUT is labeled V_{DS} . The current through the inductor is labeled I_{SD} .

- dv/dt controlled by R_G
- I_{SD} controlled by pulse period

Mechanical Dimensions

Figure 17. TO263 (D²PAK), Molded, 7-Lead, Surface Mount


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