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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

May 2014

FDH50N50 / FDA50N50

N-Channel UniFET^{TM} MOSFET

500 V, 48 A, 105 mΩ

Features

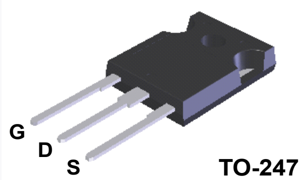
- $R_{DS(on)}$ = 89 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 24 A
- Low Gate Charge (Typ. 105 nC)
- Low C_{rss} (Typ. 45 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability

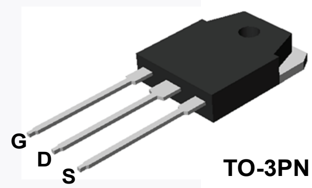
Applications

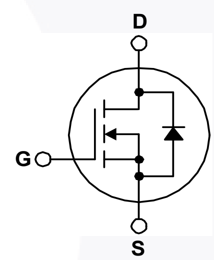
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET^{TM} MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.







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

Symbol	Parameter		FDH50N50_F133 / FDA50N50	Unit
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	48 30.8	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	192	A
V_{GSS}	Gate-Source voltage		±20	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		1868	mJ
I_{AR}	Avalanche Current (Note 1)		48	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		62.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		20	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate Above 25°C	625 5	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FDH50N50_F133 / FDA50N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDH50N50_F133	FDH50N50	TO-247	Tube	N/A	N/A	30 units
FDA50N50	FDA50N50	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	500	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500 V, V_{GS} = 0 V V_{DS} = 400 V, T_C = 125°C	-- --	-- --	25 250	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 20 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -20 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 24 A	--	0.089	0.105	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 48 A	--	20	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	--	4979	6460	pF
C_{oss}	Output Capacitance		--	760	1000	pF
C_{rss}	Reverse Transfer Capacitance		--	50	65	pF
C_{oss}	Output Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	--	161	--	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	--	342	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 250 V, I_D = 48 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	--	105	220	ns
t_r	Turn-On Rise Time		--	360	730	ns
$t_{d(off)}$	Turn-Off Delay Time		--	225	460	ns
t_f	Turn-Off Fall Time		--	230	470	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 48 A V_{GS} = 10 V (Note 4)	--	105	137	nC
Q_{gs}	Gate-Source Charge		--	33	--	nC
Q_{gd}	Gate-Drain Charge		--	45	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	48	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	192	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 48 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 48 A, dI_F/dt =100 A/μs	--	580	--	ns
Q_{rr}	Reverse Recovery Charge		--	10	--	μC

Notes:
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1.46 mH, I_{AS} = 48 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 48 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

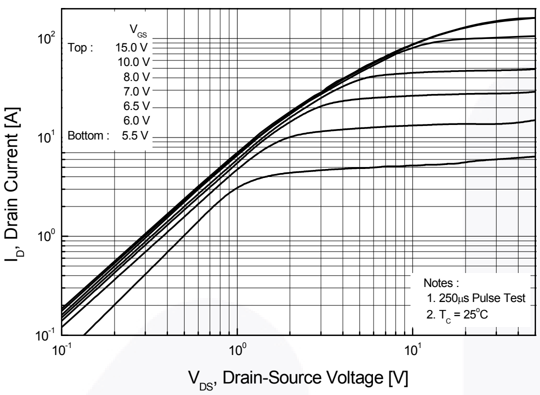


Figure 2. Transfer Characteristics

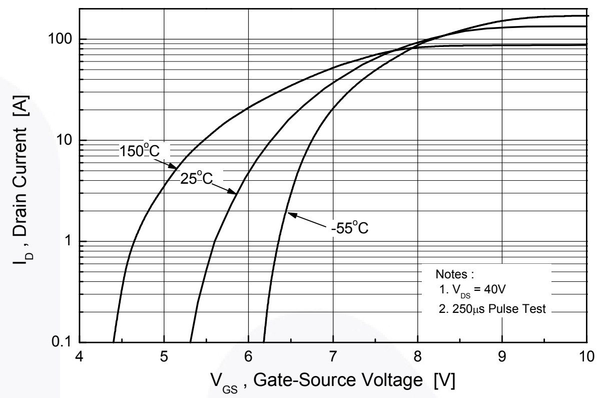


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

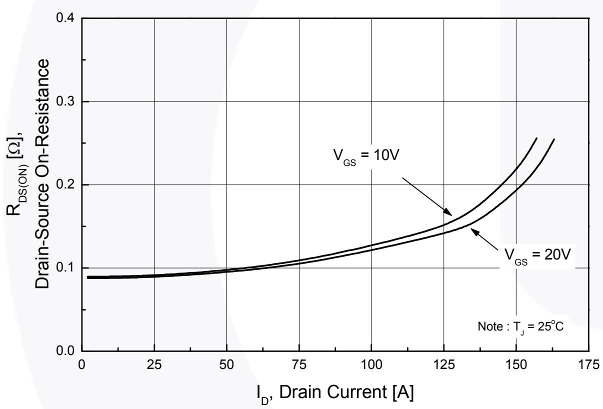


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

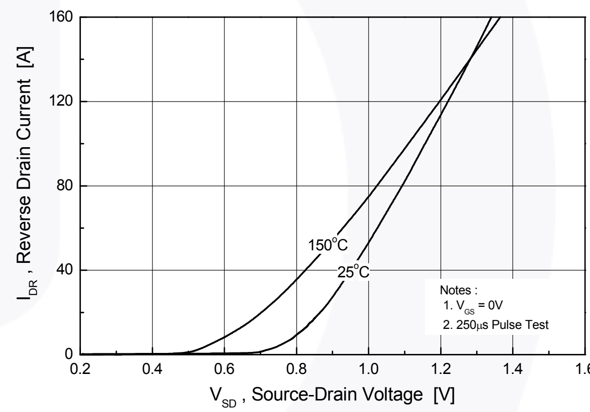


Figure 5. Capacitance Characteristics

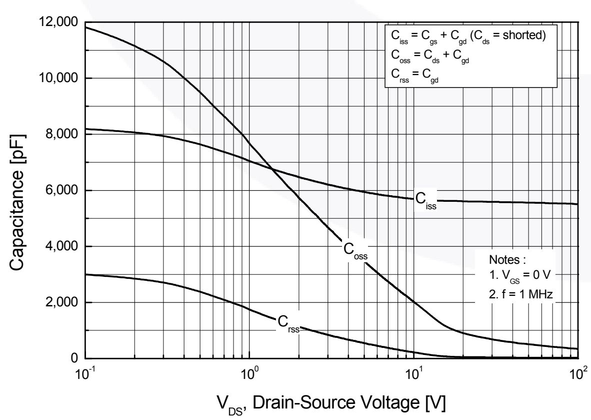
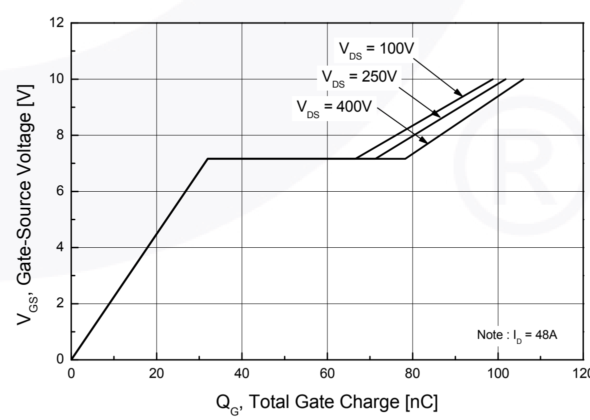


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

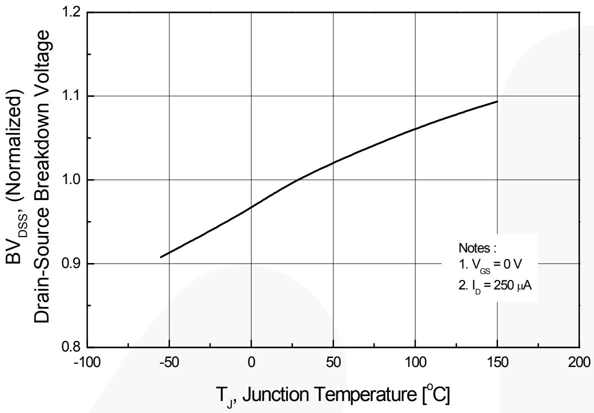


Figure 8. On-Resistance Variation vs. Temperature

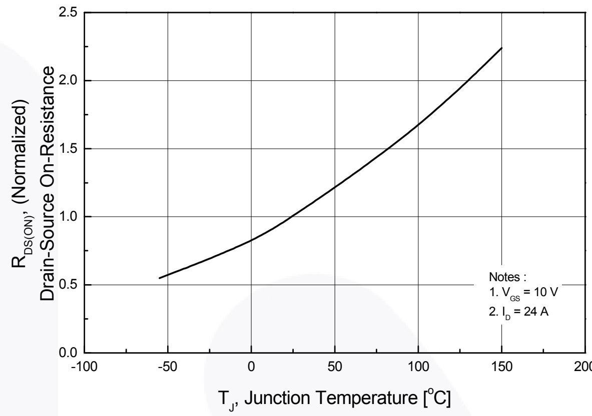


Figure 9. Maximum Safe Operating Area

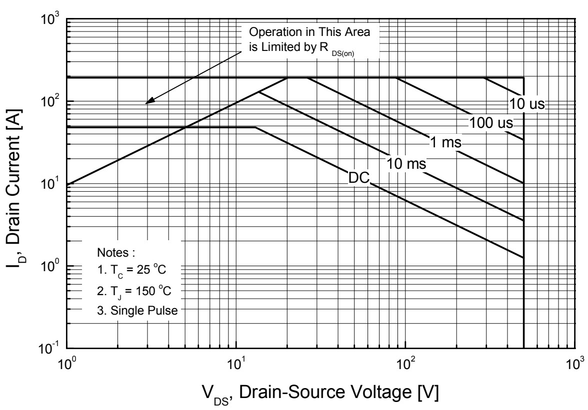


Figure 10. Maximum Drain Current vs. Case Temperature

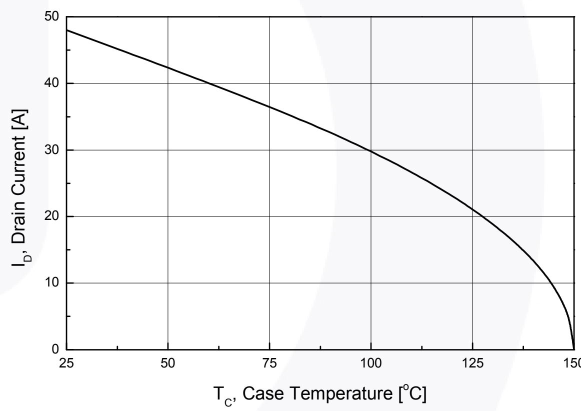


Figure 11. Typical Drain Current Slope vs. Gate Resistance

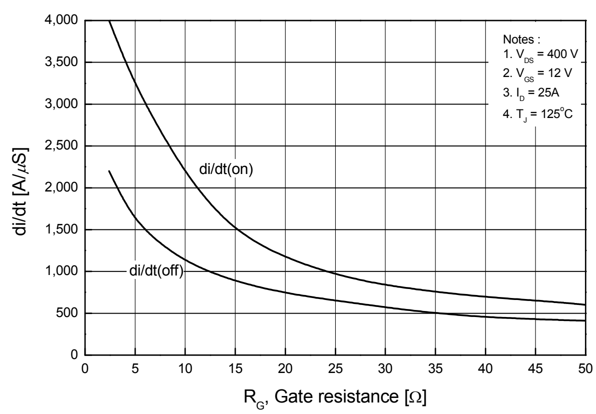
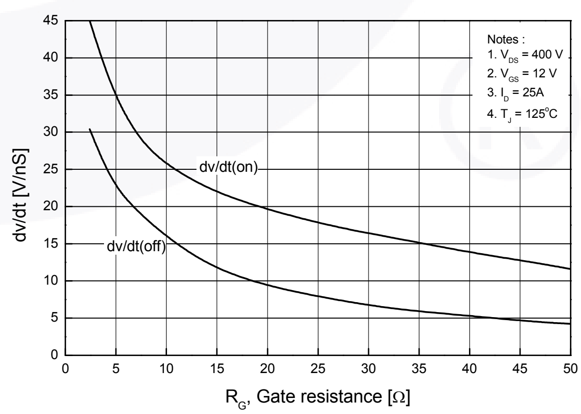


Figure 12. Typical Drain-Source Voltage Slope vs. Gate Resistance



Typical Performance Characteristics (Continued)

Figure 13. Typical Switching Losses vs. Gate Resistance

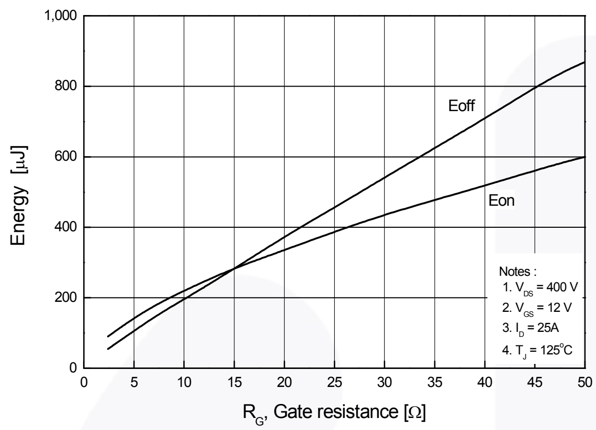


Figure 14. Unclamped Inductive Switching Capability

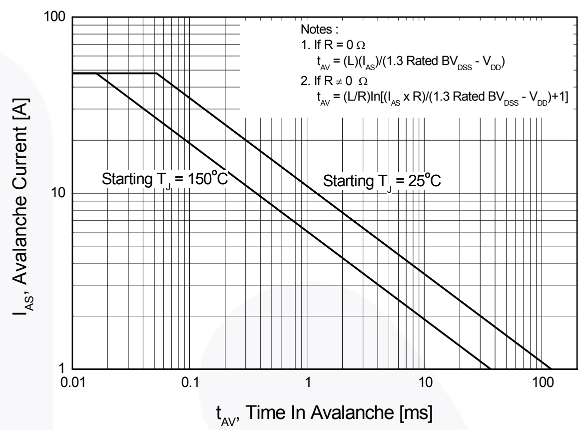
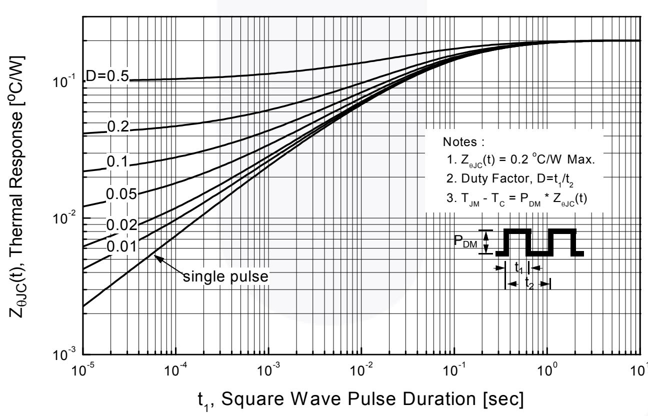


Figure 15. Transient Thermal Resistance Curve



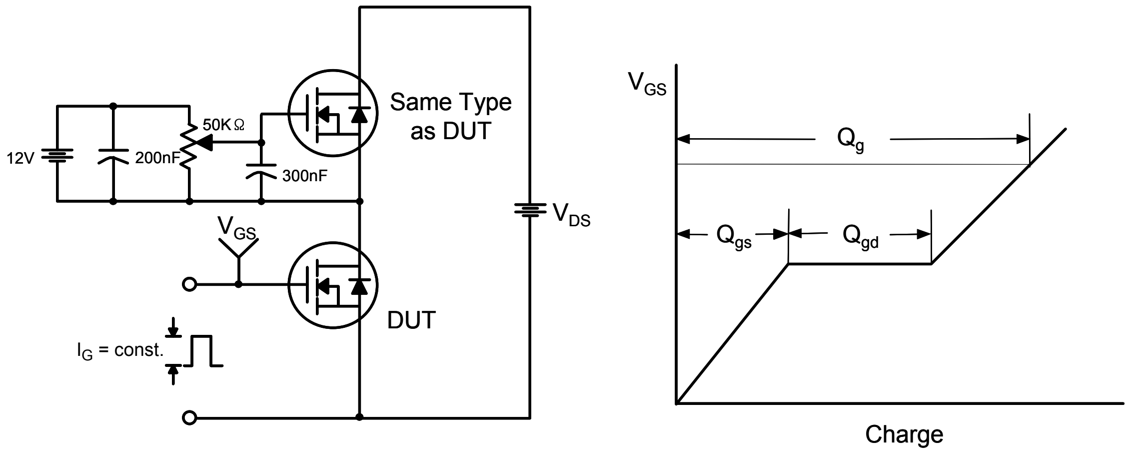


Figure 16. Gate Charge Test Circuit & Waveform

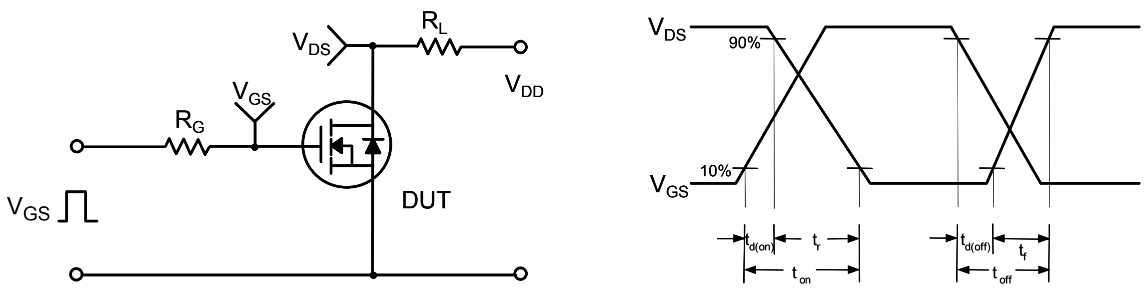


Figure 17. Resistive Switching Test Circuit & Waveforms

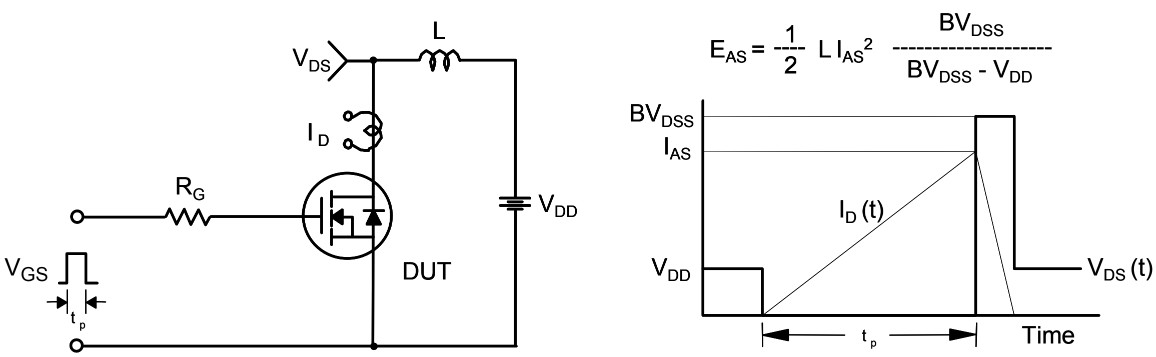


Figure 18. Unclamped Inductive Switching Test Circuit & Waveforms

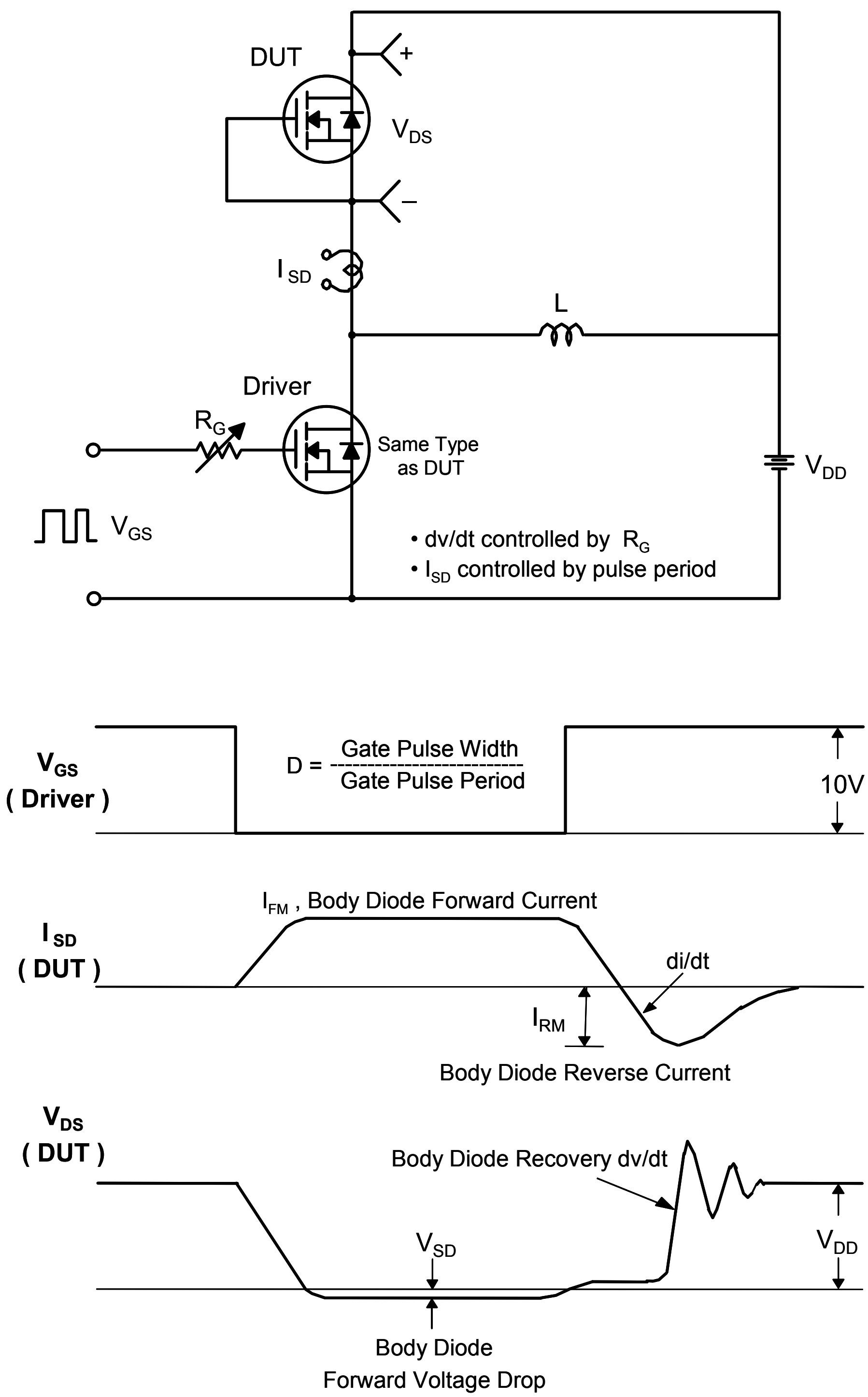
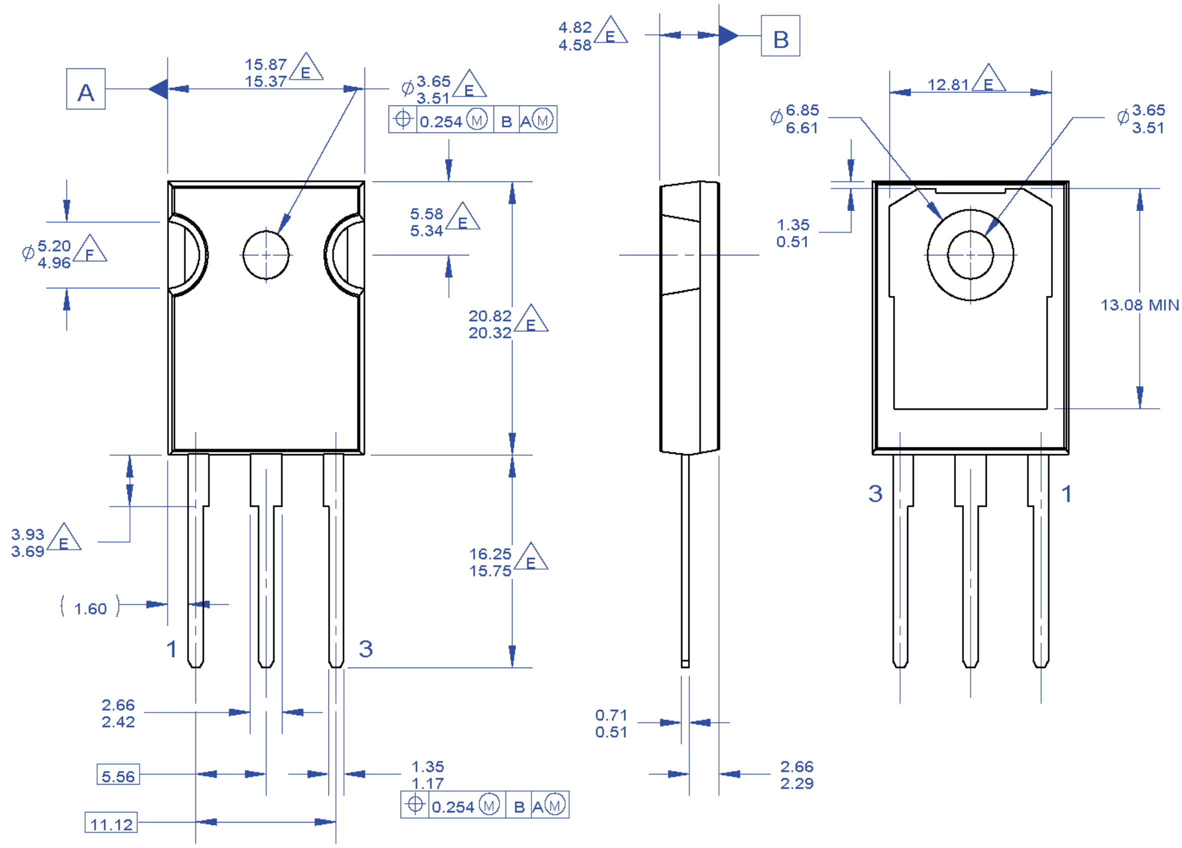


Figure 19. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



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C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5 - 1994

E DOES NOT COMPLY JEDEC STANDARD VALUE

F NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03_REV03

Figure 20. TO-247, Molded, 3-Lead, Jedec Variation AB

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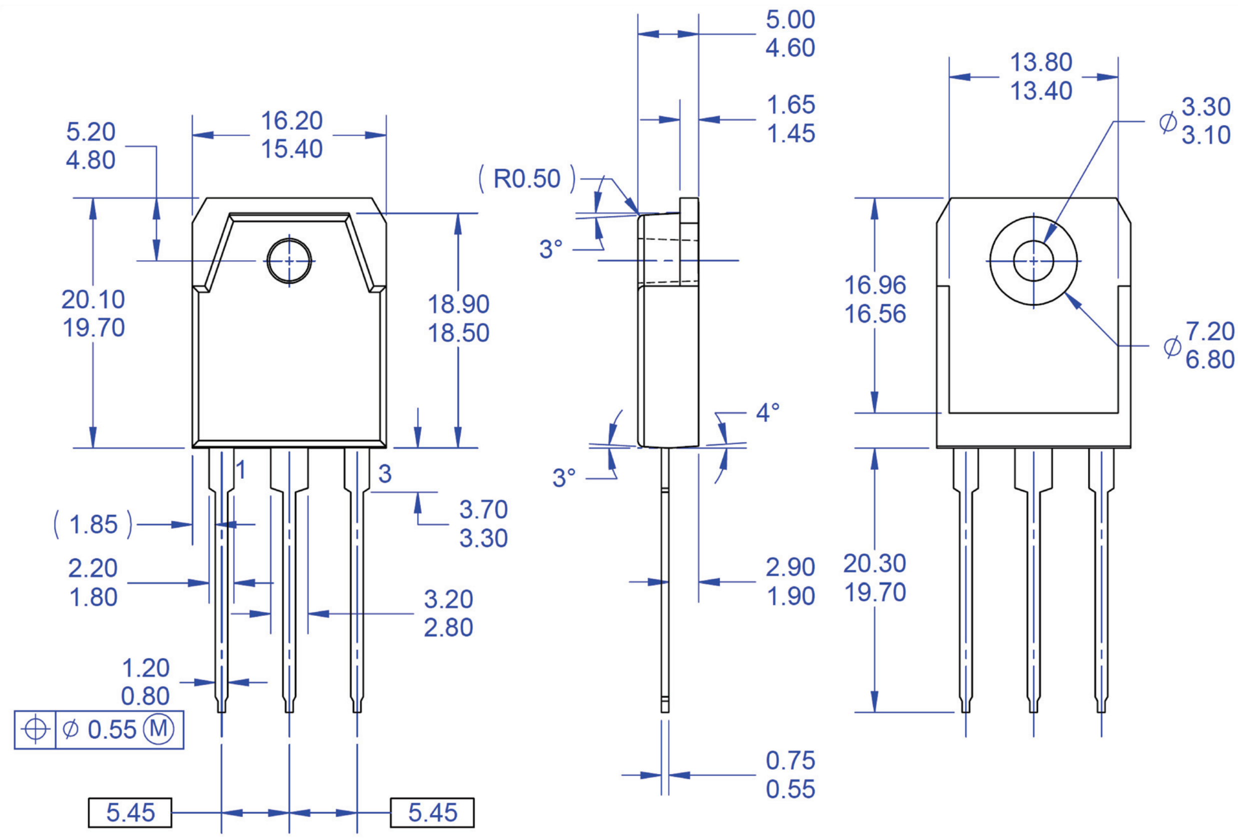
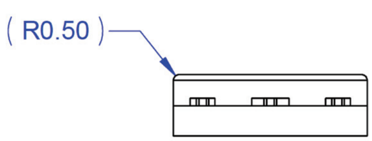
Mechanical Dimensions





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E) DRAWING FILE NAME: TO3PN03AREV1.
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Figure 21. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I68

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