November 2014

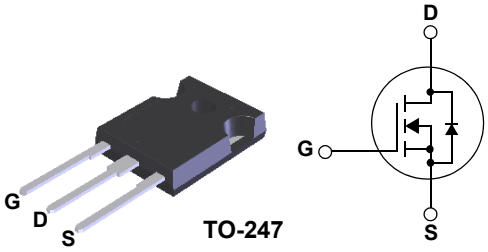
FCH041N65F_F085

N-Channel SuperFET II FRFET MOSFET

650 V, 76 A, 41 mΩ

Features

- Typical $R_{DS(on)}$ = 34 mΩ at V_{GS} = 10 V, I_D = 38 A
- Typical $Q_{g(tot)}$ = 234 nC at V_{GS} = 10V, I_D = 38 A
- UIS Capability
- Qualified to AEC Q101
- RoHS Compliant



Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently SuperFETII is very well suited for the Soft switching and Hard Switching topologies like High Voltage Full Bridge and Half Bridge DC-DC, Interleaved Boost PFC, Boost PFC for HEV-EV automotive.
SuperFET II FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.

For current package drawing, please refer to the Fairchild web-site at https://www.fairchildsemi.com/package-drawings/TO/TO247A03.pdf

Application

- Automotive On Board Charger
- Automotive DC/DC converter for HEV

Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current - Continuous (V_{GS}=10) (Note 1)	T_C = 25°C	76	A
		T_C = 100°C	24	A
	Pulsed Drain Current		See Fig 4	A
E_{AS}	Single Pulse Avalanche Rating	(Note 2)	2025	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt	(Note 3)	50	
P_D	Power Dissipation		595	W
	Derate Above 25°C		4.76	W/°C
T_J, T_{STG}	Operating and Storage Temperature		-55 to + 150	°C
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Case		0.21	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance Junction to Ambient	(Note 4)	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH041N65F	FCH041N65F_F085	TO-247	-	-	30

Notes:
1: Current is limited by bondwire configuration.
2: Starting T_J = 25°C, L = 18mH, I_{AS} = 15A, V_{DD} = 100V during inductor charging and V_{DD} = 0V during time in avalanche.
3: I_{SD} ≤ 38A, di/dt ≤ 200 A/us, V_{DD} ≤ 380V, starting T_J = 25°C.
4: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design, while $R_{\theta JA}$ is determined by the board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	650	-	-	V
I_{DSS}	Drain to Source Leakage Current	V_{DS}=650V, V_{GS} = 0V, T_J = 25°C	-	-	10	μA
		V_{DS}=650V, V_{GS} = 0V, T_J = 150°C(Note 5)	-	-	1	mA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	3.0	-	5.0	V
$r_{DS(on)}$	Drain to Source On Resistance	I_D = 38A, V_{GS} = 10V, T_J = 25°C	-	34	41	mΩ
		I_D = 38A, V_{GS} = 10V, T_J = 150°C(Note 5)	-	80	96	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz	-	10200	13566	pF
C_{oss}	Output Capacitance		-	10529	14004	pF
C_{rss}	Reverse Transfer Capacitance		-	227	-	pF
$C_{oss(eff)}$	Effective Output Capacitance	V_{DS} = 0V to 520V, V_{GS} = 0V	-	843	-	pF
R_g	Gate Resistance	f = 1MHz	-	0.5	-	Ω
$Q_{g(ToT)}$	Total Gate Charge	V_{DD} = 380V, I_D = 38A, V_{GS} = 10V	-	234	304	nC
$Q_{g(th)}$	Threshold Gate Charge		-	17	22	nC
Q_{gs}	Gate to Source Gate Charge		-	50	-	nC
Q_{gd}	Gate to Drain “Miller“ Charge		-	90	-	nC

Switching Characteristics

t_{on}	Turn-On Time	V_{DD} = 380V, I_D = 38A, V_{GS} = 10V, R_G = 4.7Ω	-	94	207	ns
$t_{d(on)}$	Turn-On Delay Time		-	55	-	ns
t_r	Rise Time		-	39	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	183	-	ns
t_f	Fall Time		-	8	-	ns
t_{off}	Turn-Off Time		-	191	402	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	I_{SD} = 38A, V_{GS} = 0V	-	-	1.2	V
T_{rr}	Reverse Recovery Time	I_F = 38A, dI_{SD}/dt = 100A/μs, V_{DD} = 480V	-	235	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.0	-	μC

Notes:

5: The maximum value is specified by design at T_J = 150°C. Product is not tested to this condition in production.

Typical Characteristics

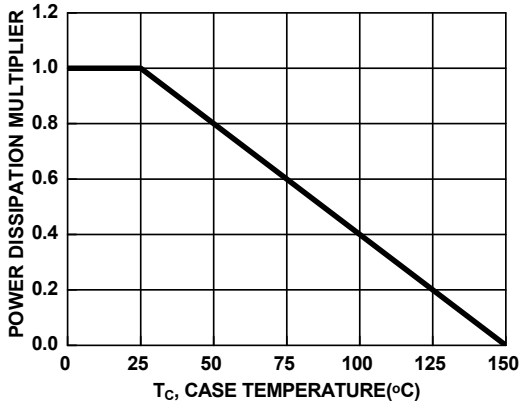


Figure 1. Normalized Power Dissipation vs. Case Temperature

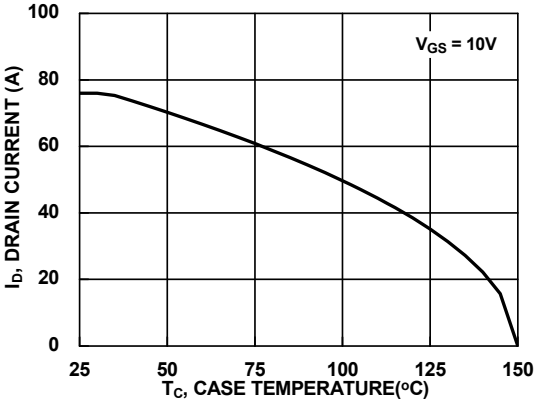


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

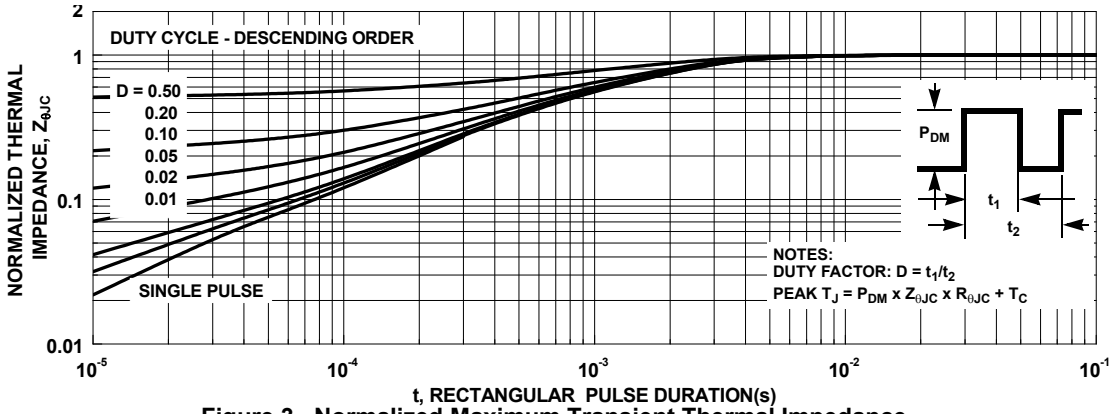


Figure 3. Normalized Maximum Transient Thermal Impedance

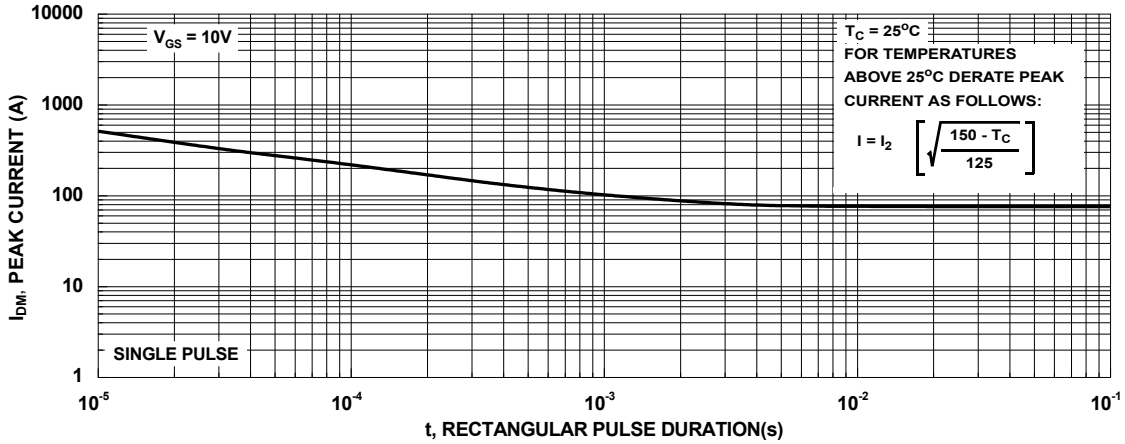


Figure 4. Peak Current Capability

Typical Characteristics

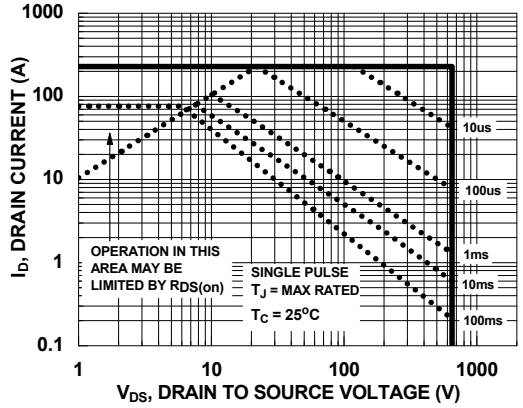


Figure 5. Forward Bias Safe Operating Area

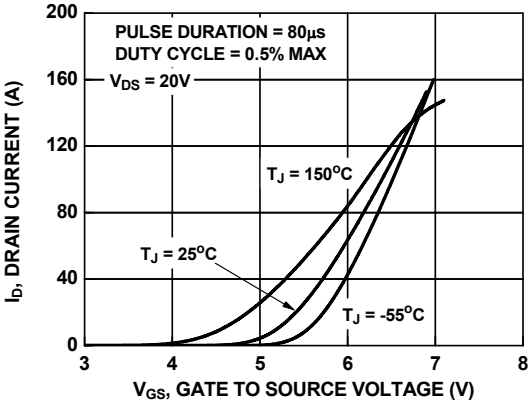


Figure 6. Transfer Characteristics

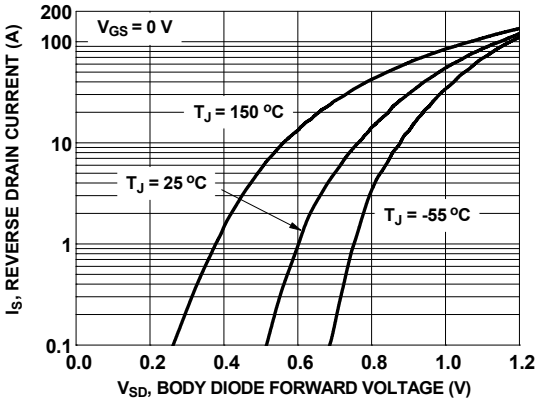


Figure 7. Forward Diode Characteristics

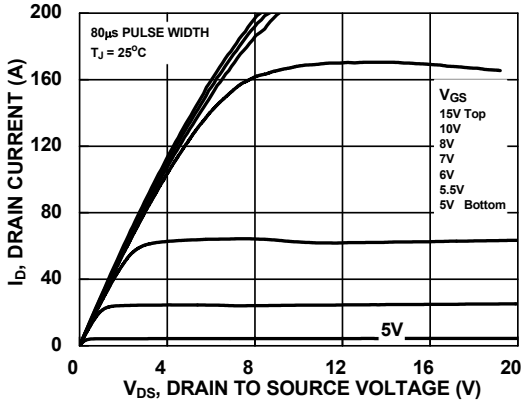


Figure 8. Saturation Characteristics

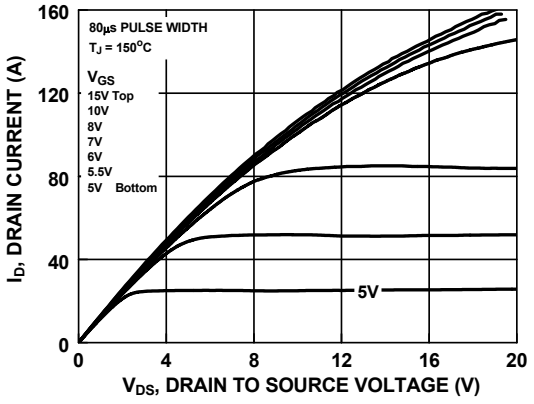


Figure 9. Saturation Characteristics

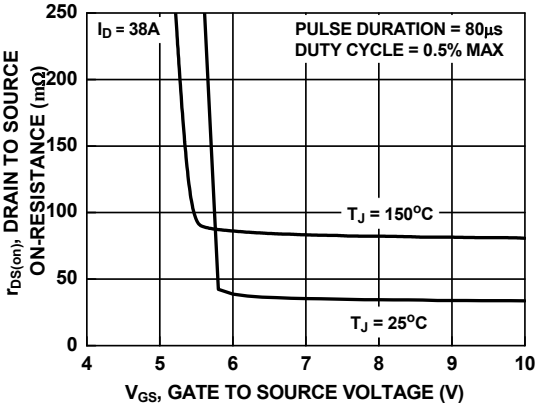


Figure 10. R_{DSON} vs. Gate Voltage

Typical Characteristics

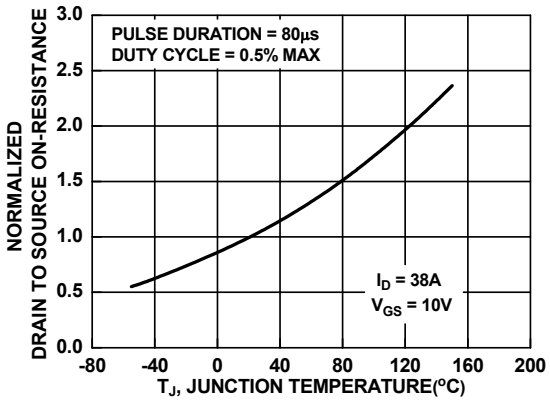


Figure 11. Normalized R_{DSON} vs. Junction Temperature

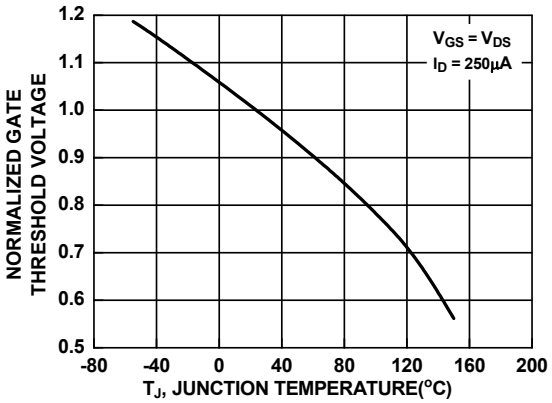


Figure 12. Normalized Gate Threshold Voltage vs. Temperature

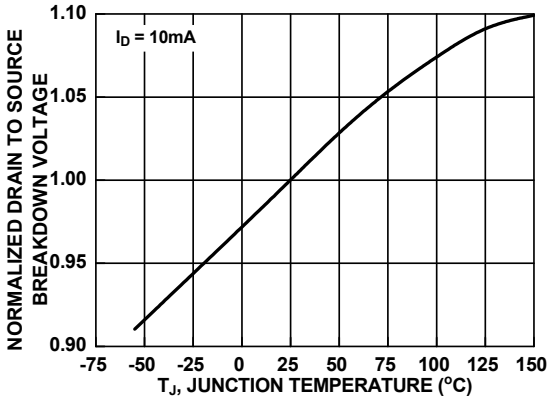


Figure 13. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

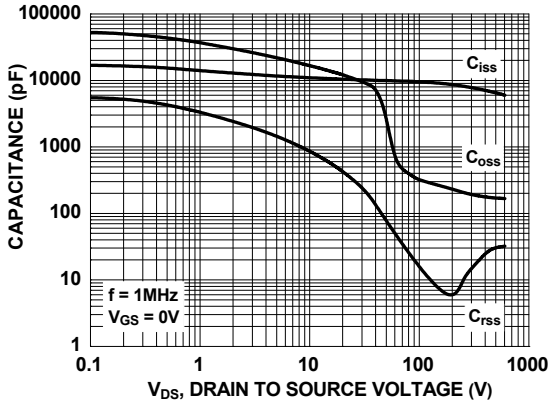


Figure 14. Capacitance vs. Drain to Source Voltage

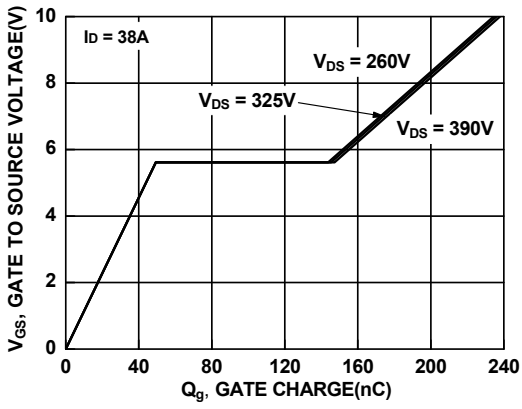


Figure 15. Gate Charge vs. Gate to Source Voltage

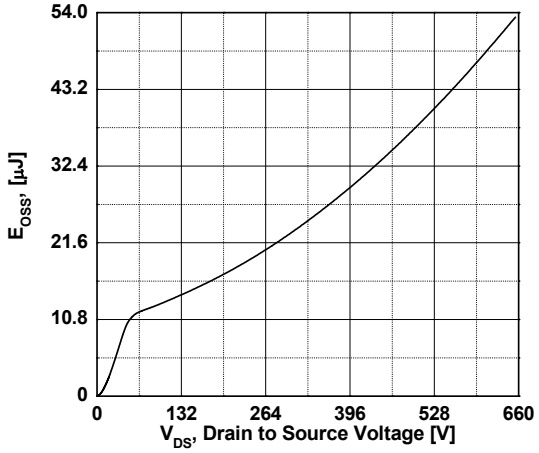


Figure 16. Eoss vs. Drain to Source Voltage

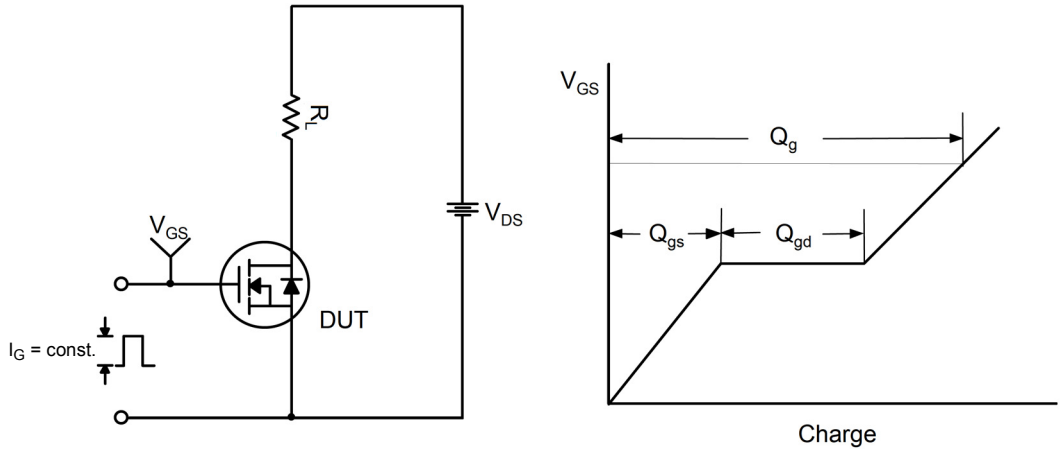


Figure 17. Gate Charge Test Circuit & Waveform

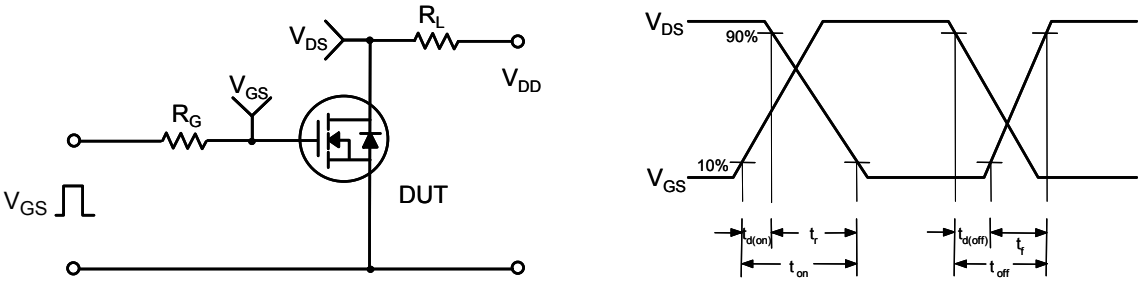


Figure 18. Resistive Switching Test Circuit & Waveforms

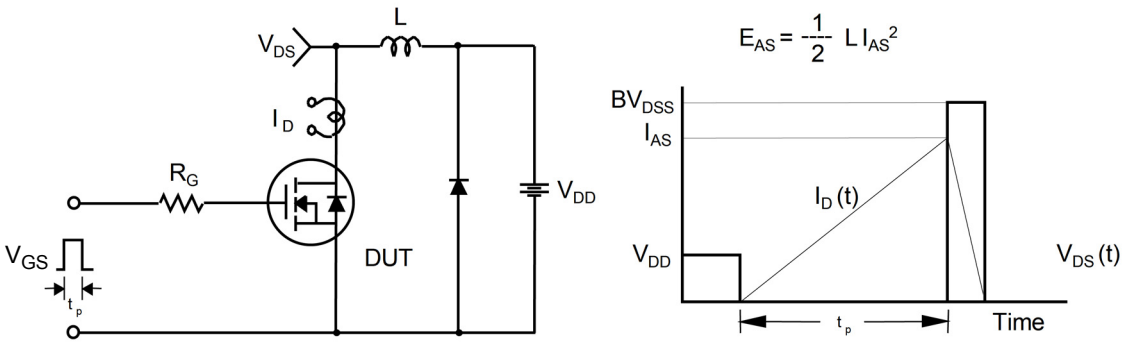


Figure 19. Unclamped Inductive Switching Test Circuit & Waveforms

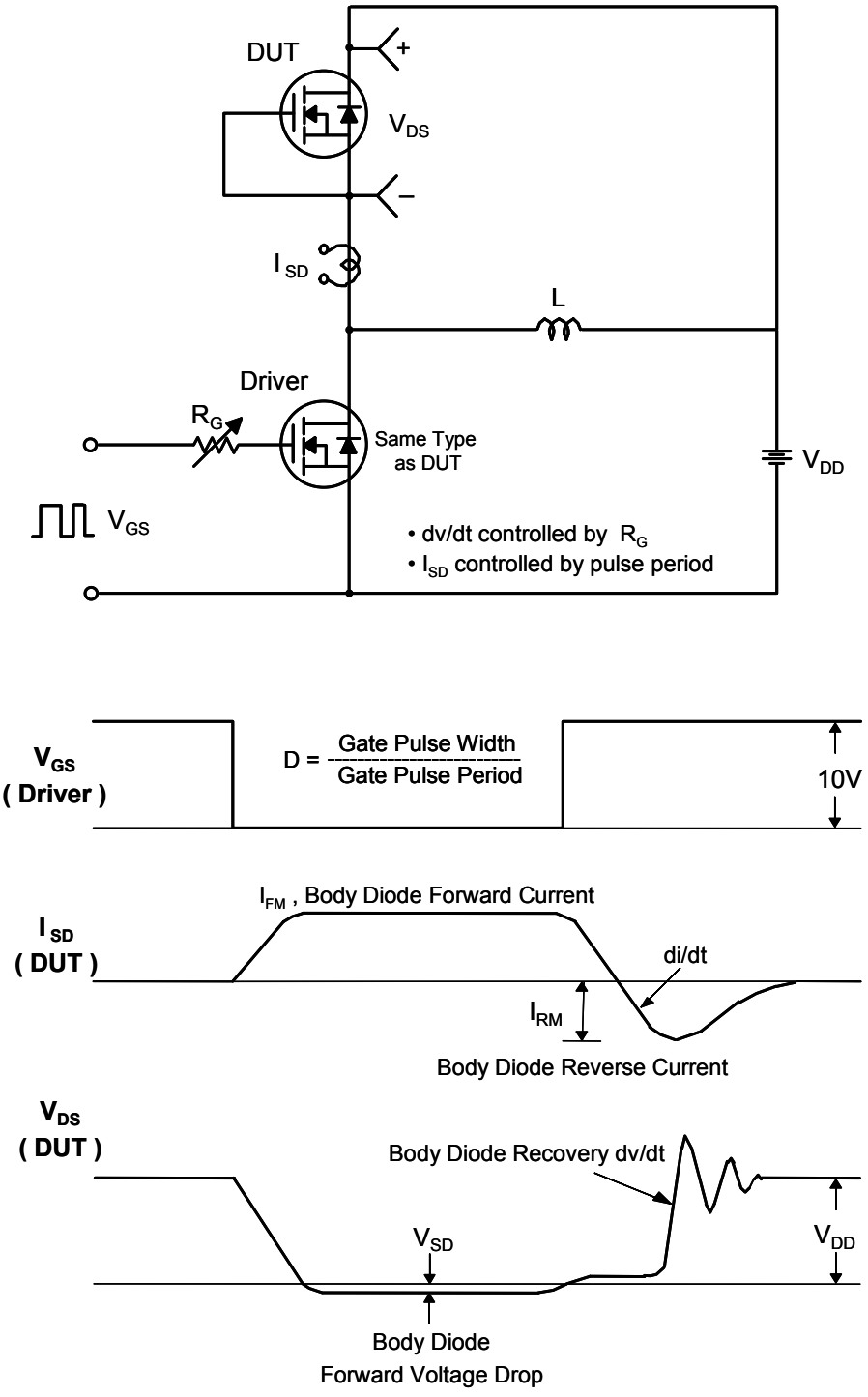
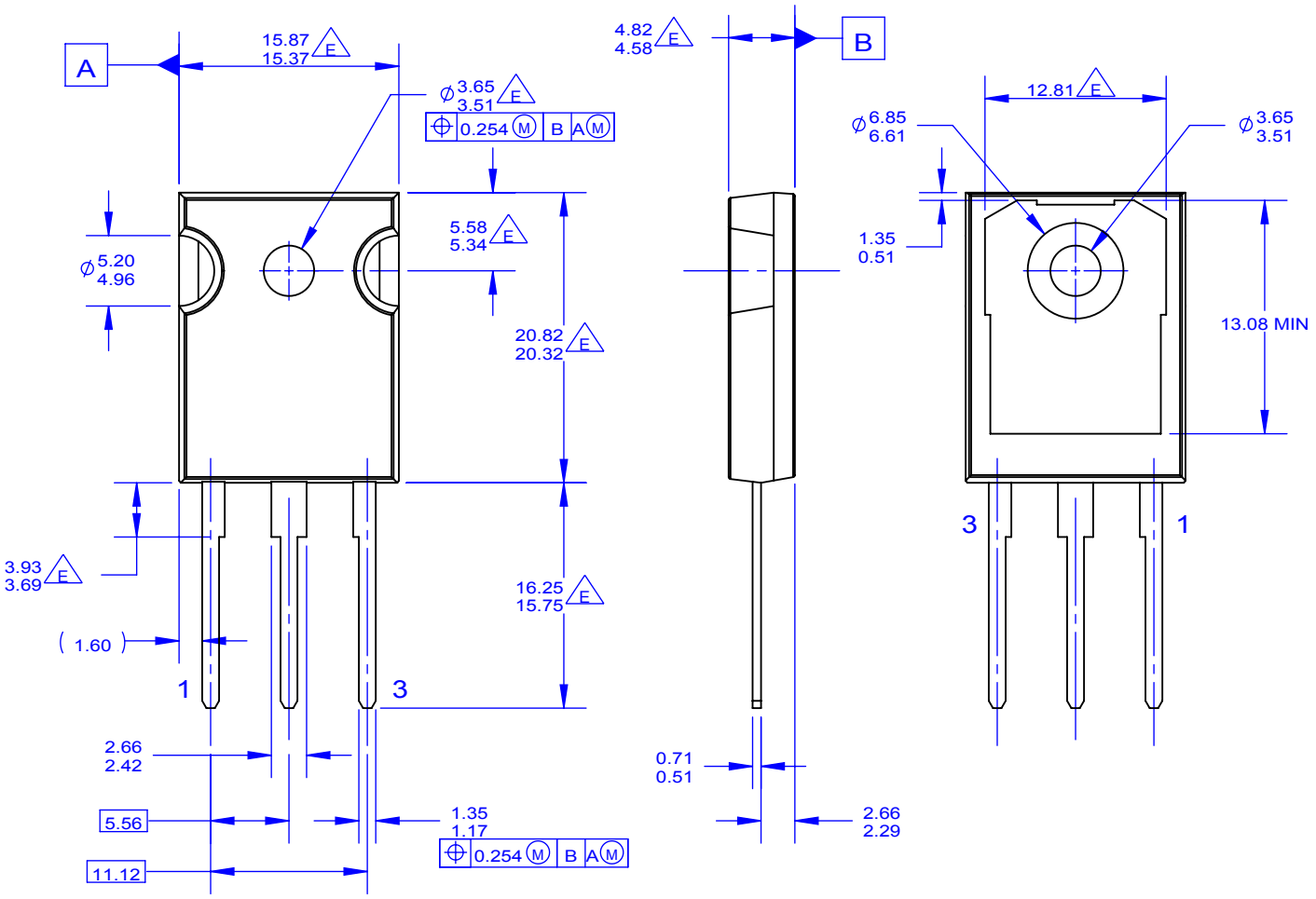


Figure 20. Peak Diode Recovery dv/dt Test Circuit & Waveforms



NOTES: UNLESS OTHERWISE SPECIFIED.

A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5 - 1994

E DOES NOT COMPLY JEDEC STANDARD VALUE
F. DRAWING FILENAME: MKT-TO247A03_REV03

TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
AttitudeEngine™
Awinda®
AX-CAP®*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FastvCore™
FETBench™
FPS™
F-PFS™
FRFET®
Global Power Resource SM
GreenBridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
MotionGrid®
MTi®
MTx®
MVN®
mWSaver®
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
®
Power Supply WebDesigner™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
Solutions for Your Success™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
TinyBoost®
TinyBuck®
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TranSiC™
TriFault Detect™
TRUECURRENT®*
µSerDes™
SerDes™
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
VoltagePlus™
XS™
Xsens™
仙童®

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT HTTP://WWW.FAIRCHILDSEMI.COM. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

AUTHORIZED USE

Unless otherwise specified in this data sheet, this product is a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability. This product may not be used in the following applications, unless specifically approved in writing by a Fairchild officer: (1) automotive or other transportation, (2) military/aerospace, (3) any safety critical application – including life critical medical equipment – where the failure of the Fairchild product reasonably would be expected to result in personal injury, death or property damage. Customer's use of this product is subject to agreement of this Authorized Use policy. In the event of an unauthorized use of Fairchild's product, Fairchild accepts no liability in the event of product failure. In other respects, this product shall be subject to Fairchild's Worldwide Terms and Conditions of Sale, unless a separate agreement has been signed by both Parties.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Terms of Use

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

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. I77