FAIRCHILD SEMICONDUCTOR®

May 2013

FDD1600N10ALZD

BoostPak (N-Channel PowerTrench® MOSFET + Diode)

100 V, 6.8 A, 160 mΩ

Features

- $R_{DS(on)}$ = 124 mΩ (Typ.)@ V_{GS} = 10 V, I_D = 3.4 A
- $R_{DS(on)}$ = 175 mΩ (Typ.)@ V_{GS} = 5.0 V, I_D = 2.1 A
- Low Gate Charge (Typ.2.78 nC)
- Low C_{rss} (Typ. 2.04 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

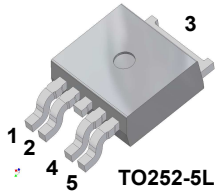
Description

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

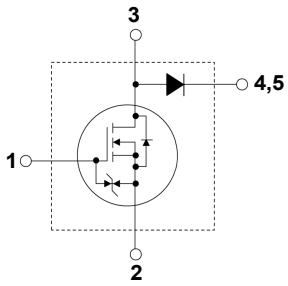
The NP diode is hyperfast rectifier with low forward voltage drop and excellent switching performance.

Applications

- LED Monitor Backlight
- LED TV Backlight
- LED Lighting
- Consumer Appliances,
  DC-DC converter (Step up & Step down)



1. Gate
2. Source
3. Drain / Anode
4. Cathode
5. Cathode



Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FDD1600N10ALZD	Unit
V_{DSS}	Drain to Source Voltage			100	V
V_{GSS}	Gate to Source Voltage			±20	V
I_D	Drain Current	- Continuous (T_C = 25°C)		6.8	A
		- Continuous (T_C = 100°C)		4.3	
I_{DM}	Drain Current	- Pulsed	(Note 1)	13.6	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	5.08	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	6.0	V/ns
I_F	Diode Continuous Forward Current (T_C = 124°C)			4	A
I_{FM}	Diode Maximum Forward Current			40	A
P_D	Power Dissipation	(T_C = 25°C)		14.9	W
		- Derate above 25°C		0.12	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FDD1600N10ALZD	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for MOSFET, Max	8.4	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case for Diode, Max	3.3	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	87	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
1600N10ALZD	FDD1600N10ALZD	TO252-5L	13”	12mm	2500

Electrical Characteristics of the MOSFET T_C = 25°C 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	100	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.1	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 80 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 80 V, V_{GS} = 0 V, T_C = 125°C	-	-	500	
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V	-	-	±10	μA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	1.4	2.1	2.8	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 3.4 A	-	124	160	mΩ
		V_{GS} = 5 V, I_D = 2.1 A	-	175	375	
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 6.8 A	-	19.6	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 50 V, V_{GS} = 0 V, f = 1 MHz	-	169	225	pF
C_{oss}	Output Capacitance		-	43	55	pF
C_{rss}	Reverse Transfer Capacitance		-	2.04	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	V_{DS} = 50 V, V_{GS} = 0 V		85	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{GS} = 10 V; V_{DD} = 50 V, I_D = 6.8 A	-	2.78	3.61	nC
$Q_{g(tot)}$	Total Gate Charge at 5V	V_{GS} = 5 V; V_{DD} = 50 V, I_D = 6.8 A		1.5	1.95	nC
Q_{gs}	Gate to Source Gate Charge	V_{DD} = 50 V, I_D = 6.8 A (Note 4)	-	0.72	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	0.56	-	nC
$V_{plateau}$	Gate Plateau Volatge		-	4.02	-	V
Q_{sync}	Total Gate Charge Sync.	V_{DS} = 0 V, I_D = 3.4 A (Note 5)	-	2.5	-	nC
Q_{oss}	Output Charge	V_{DS} = 50 V, V_{GS} = 0 V	-	5.2	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 50 V, I_D = 6.8 A, V_{GS} = 10 V, R_{GEN} = 4.7 Ω (Note 4)	-	7	24	ns
t_r	Turn-On Rise Time		-	2	14	ns
$t_{d(off)}$	Turn-Off Delay Time		-	13	36	ns
t_f	Turn-Off Fall Time		-	2	14	ns
ESR	Equivalent Series Resistance (G-S)	f = 1 MHz	-	2.1	-	Ω
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	6.8	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	13.6	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 6.8 A	-	-	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 6.8 A, V_{DS} = 50 V, dI_F/dt = 100 A/μs	-	37	-	ns
Q_{rr}	Reverse Recovery Charge		-	42	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 1mH, I_{AS} = 3.18A, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 6.8A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics
5. See the test circuit in page 10

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
V_R	DC Blocking Voltage	I_R = 1 mA		150	-	-	V
V_{FM}	Maximum Instantaneous Forward Voltage	I_F = 4 A	$T_C = 25^oC$	-	-	2.5	V
			$T_C = 125^oC$	-	1.01	-	
I_{RM}	Maximum Instantaneous Reverse Current @ rated V_R		$T_C = 25^oC$	-	-	50	uA
			$T_C = 125^oC$	-	-	1000	
t_{rr}	Diode Reverse Recovery Time	I_F = 4 A dI/dt = 200 A/μs	$T_C = 25^oC$	-	12.7	26	ns
			$T_C = 125^oC$	-	17.1	-	
I_{rr}	Diode Peak Reverse Recovery Current		$T_C = 25^oC$	-	2.6	6	A
			$T_C = 125^oC$	-	3.8	-	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^oC$	-	18.3	-	nC
			$T_C = 125^oC$	-	35.7	-	
W_{AVL}	Avalanche Energy (L=40mH)			10	-	-	mJ

Typical Performance Characteristics - MOSFET

Figure 1. On-Region Characteristics

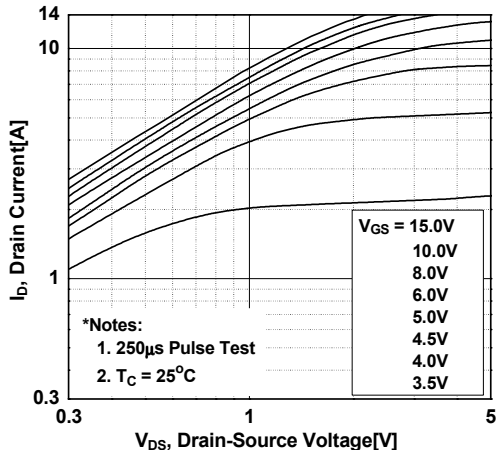


Figure 2. Transfer Characteristics

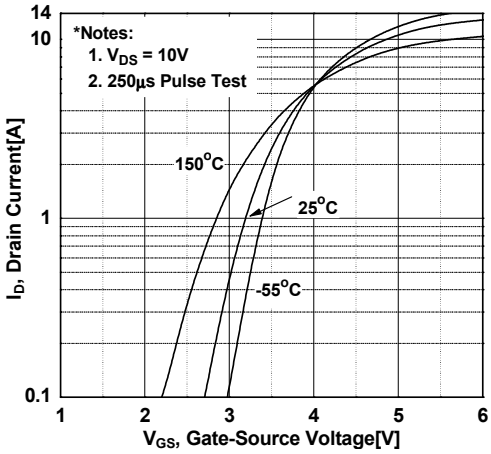


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

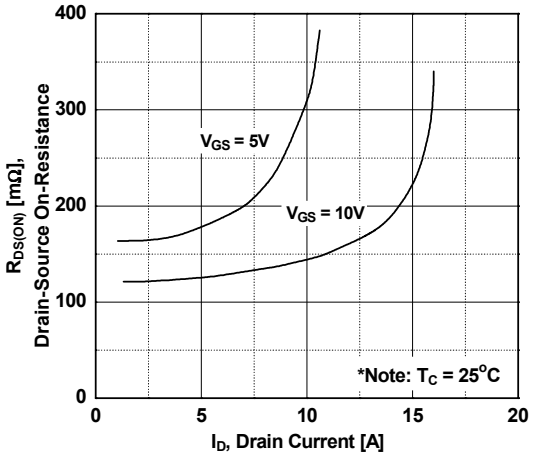


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

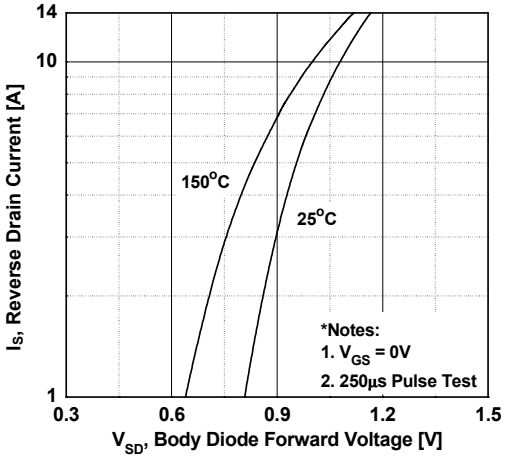


Figure 5. Capacitance Characteristics

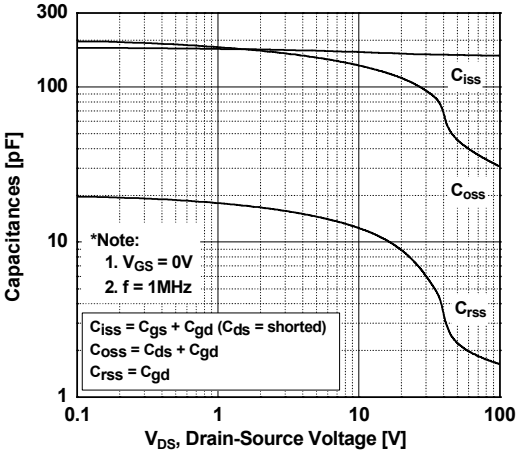
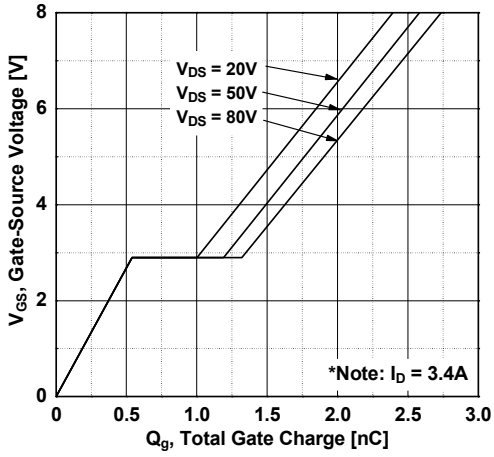


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics - MOSFET (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

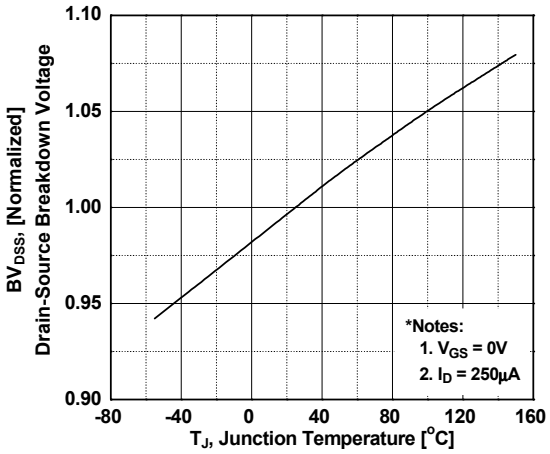


Figure 8. On-Resistance Variation vs. Temperature

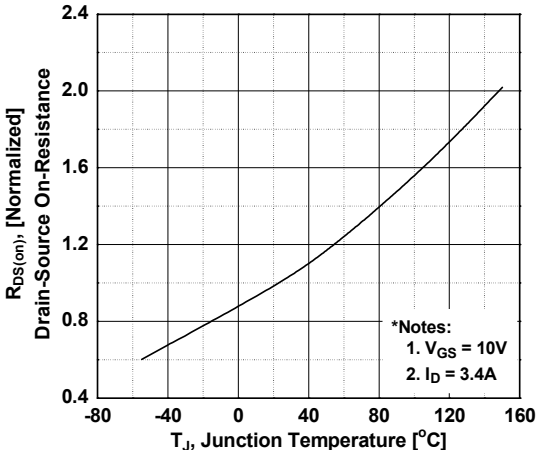


Figure 9. Maximum Safe Operating Area vs. Case Temperature

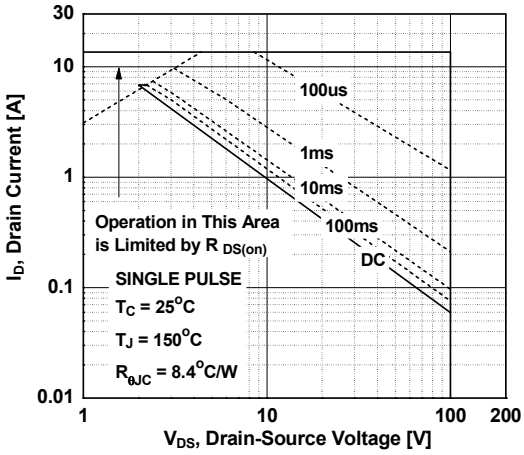


Figure 10. Maximum Drain Current

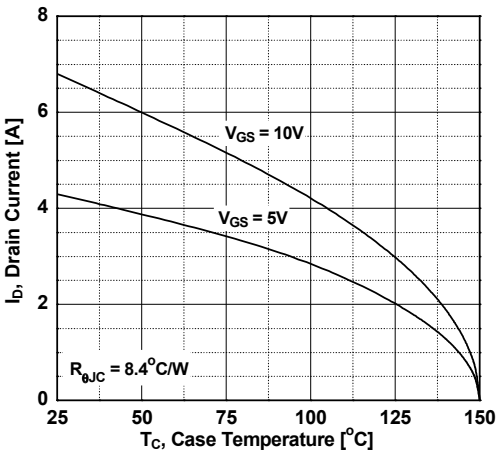


Figure 11. Eoss vs. Drain to Source Voltage

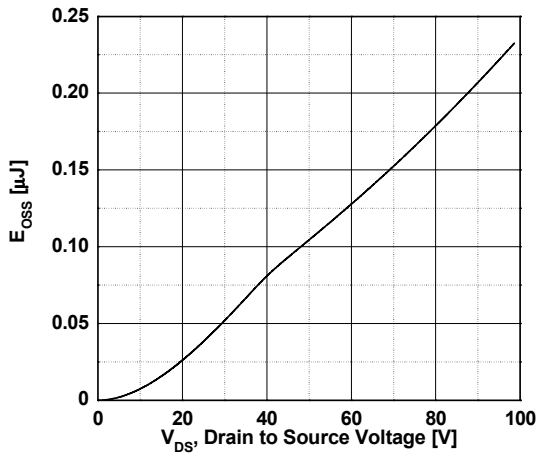
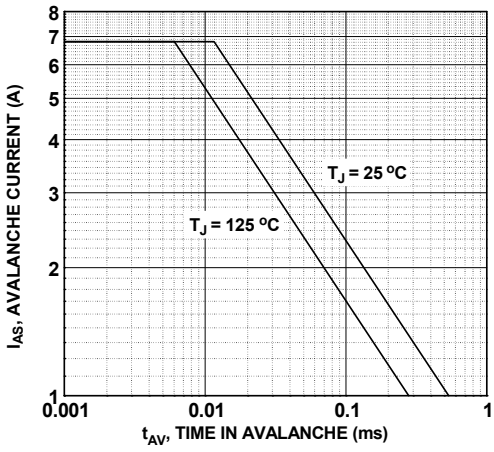


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics - Diode (Continued)

Figure 13. Forward Voltage Drop vs. Forward Current

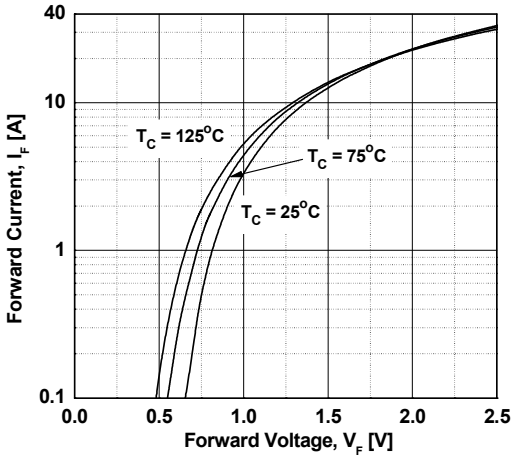


Figure 14. Reverse Current vs. Reverse Voltage

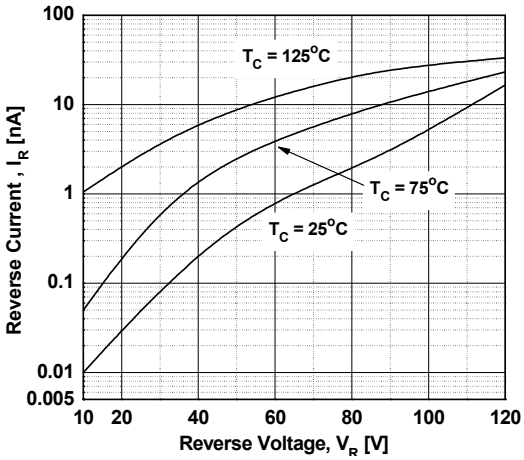


Figure 15. Junction Capacitance

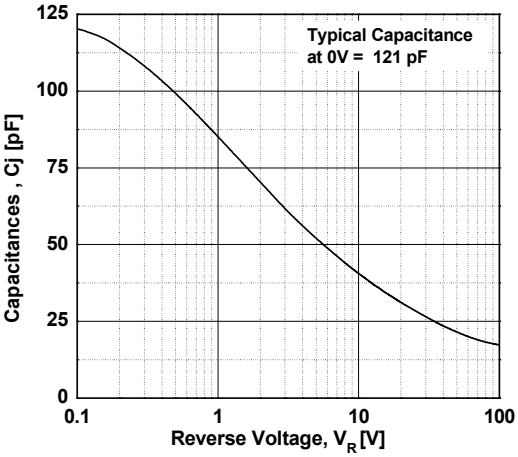


Figure 16. Reverse Recovery Time vs. di/dt

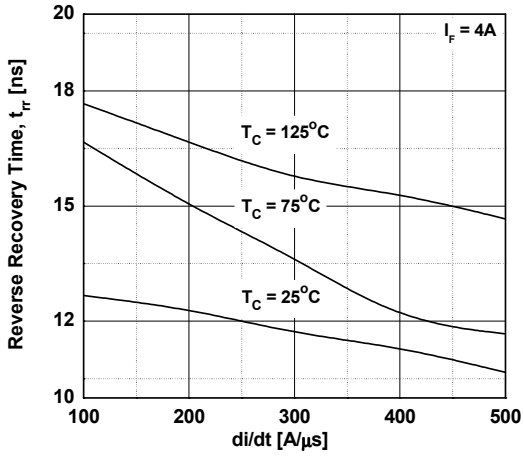


Figure 17. Reverse Recovery Current vs. di/dt

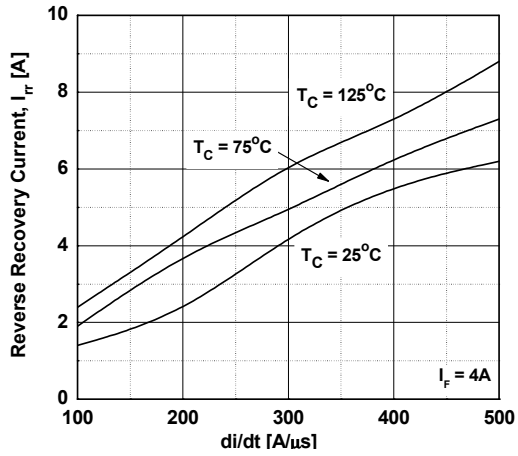
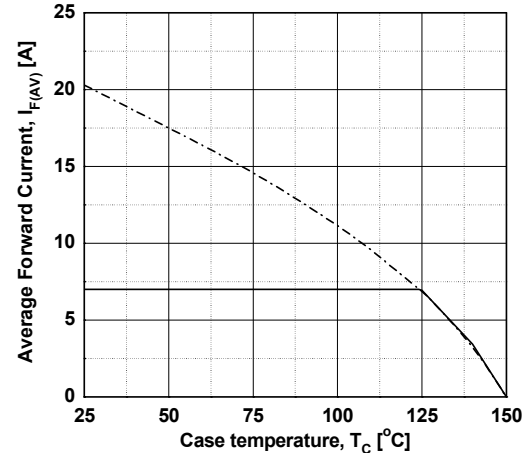


Figure 18. Forward Current Derating Curve



Typical Performance Characteristics (Continued)

Figure 19. Transient Thermal Response Curve of MOSFET

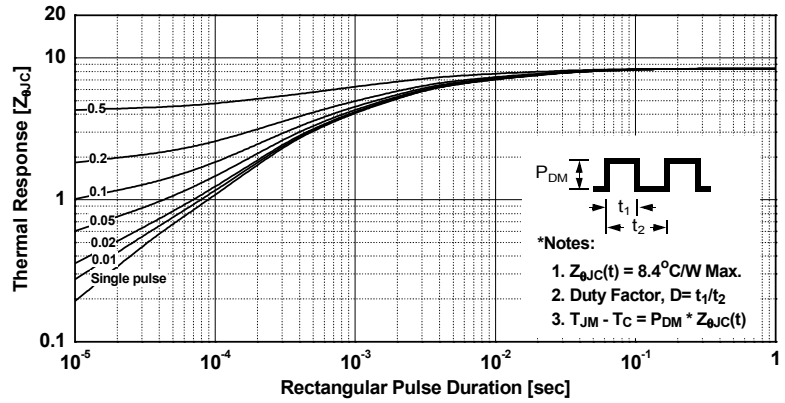
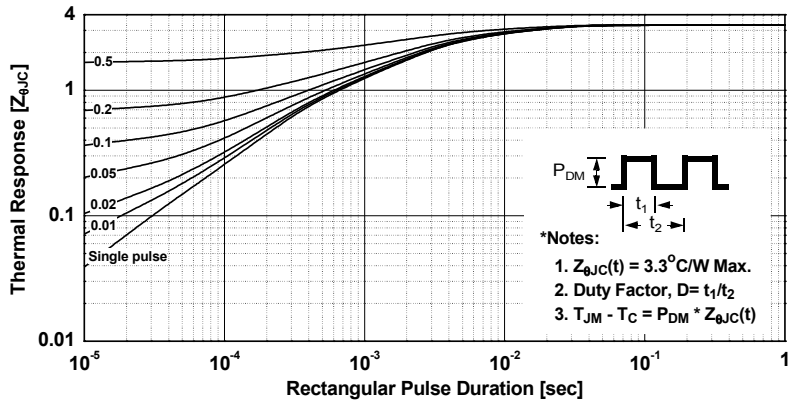
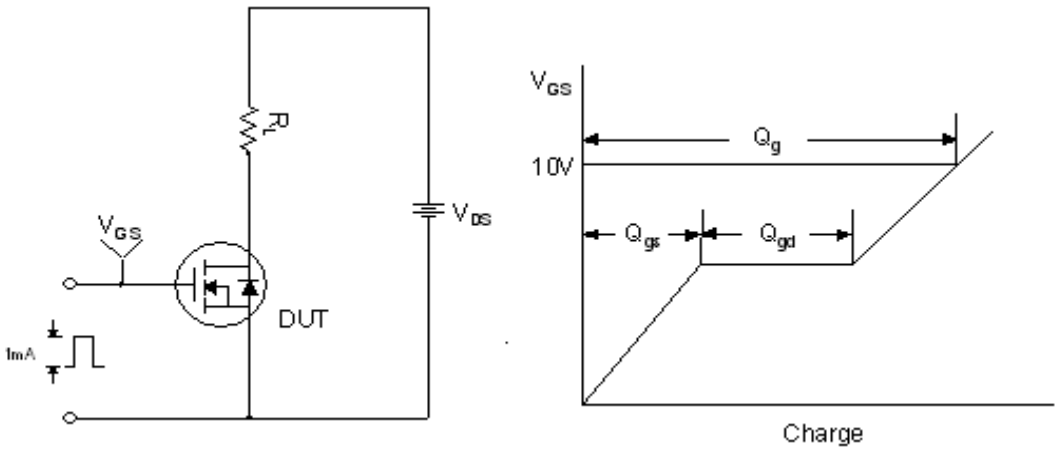


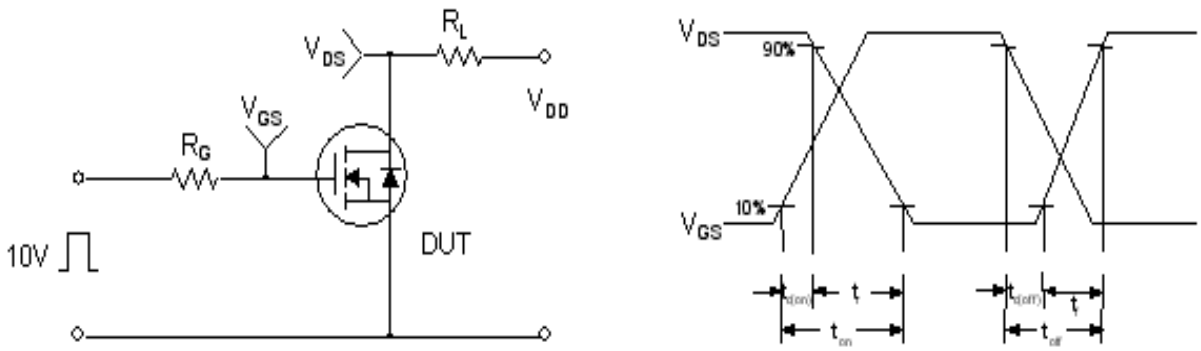
Figure 20. Transient Thermal Response Curve of Diode



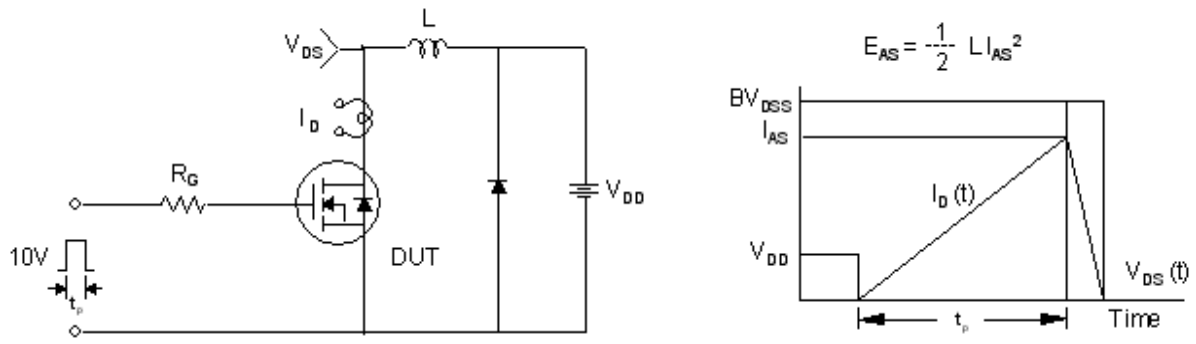
Gate Charge Test Circuit & Waveform



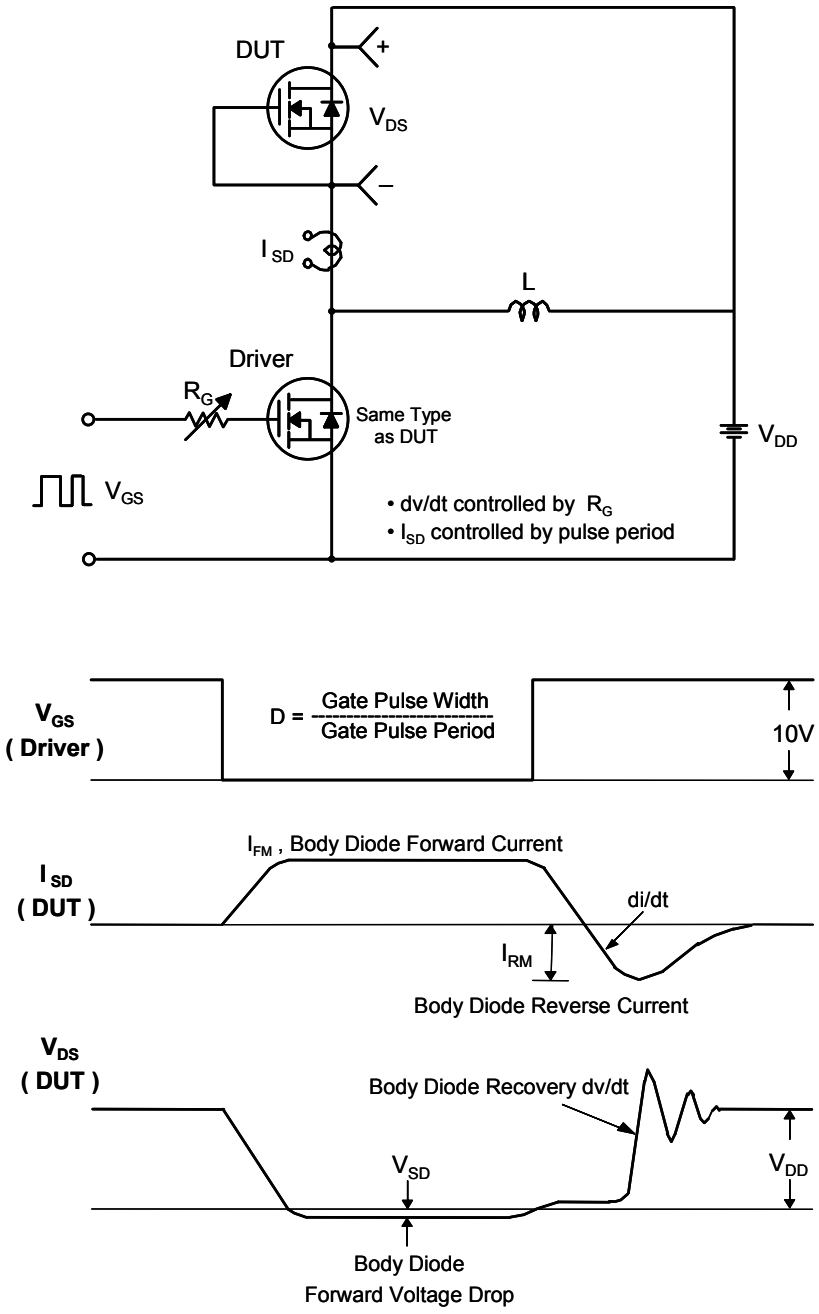
Resistive Switching Test Circuit & Waveforms



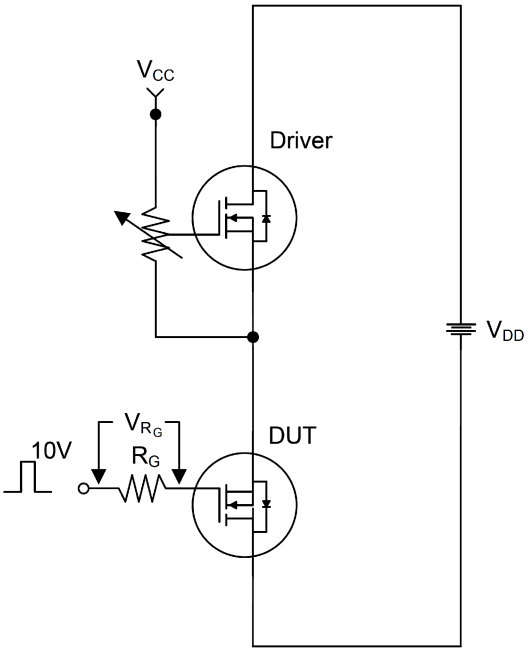
Unclamped Inductive Switching Test Circuit & Waveforms

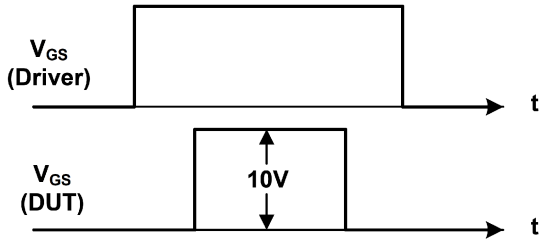


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Total Gate Charge Qsync. Test Circuit & Waveforms

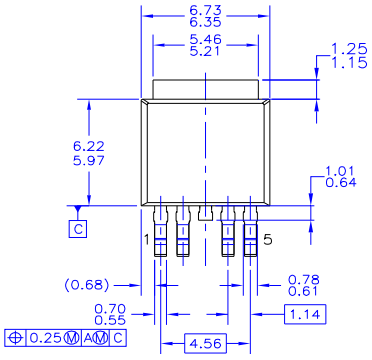


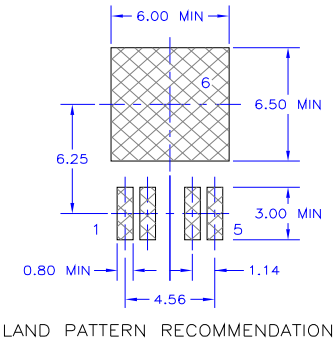


$$Qsync = \frac{1}{R_G} \cdot \int V_{R_G}(t)\ dt$$

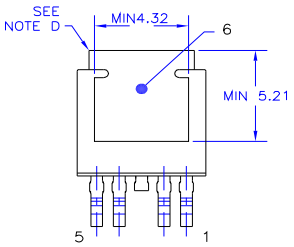
Mechanical Dimensions

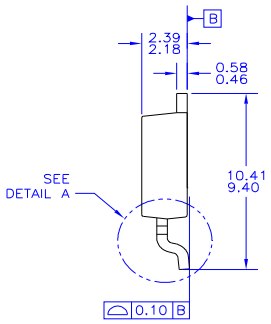
TO252-5L

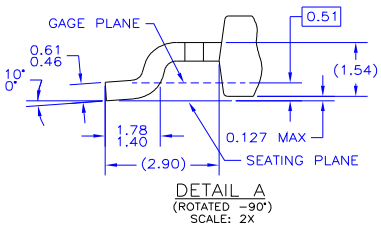




LAND PATTERN RECOMMENDATION







DETAIL A
(ROTATED −90°)
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO JEDEC, TO-252 ISSUE E, VARIATION AD, DATED JUNE. 2004.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
D) HEAT SINK TOP EDGE COULD BE IN CHAMFERD CORNERS OR EDGE PROTRUSION.
E) DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994

FAIRCHILD SEMICONDUCTOR®

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CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficentMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FPS™
F-PFS™
FRFET®
Global Power Resource^{SM}
Green Bridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
mWSaver™
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
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™
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VoltagePlus™
XS™

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Definition of Terms

Datasheet Identification	Product Status	Definition
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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.
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