FAIRCHILD SEMICONDUCTOR®

May 2013

FCH104N60F

N-Channel SuperFET® II FRFET® MOSFET

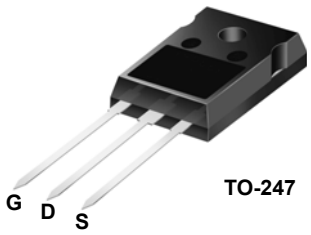
600 V, 37 A, 104 mΩ

Features

- $R_{DS(on)}$ = 104 mΩ (Max)
- Ultra Low Gate Charge (Typ. Q_g = 107 nC)
- Low Effective Output Capacitance
- 100% AvalancheTested
- RoHS Compliant

Description

SuperFET®II MOSFET is Fairchild Semiconductor®'s first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance.This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFETII MOSFET is suitable for various AC/DC power conversion for system miniaturization and higher efficiency.



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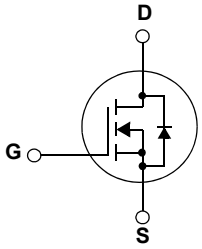


MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage	-DC	±20	V
		-AC	±30	
I_D	Drain Current	-Continuous (T_C = 25°C)	37	A
		-Continuous (T_C = 100°C)	24	
I_{DM}	Drain Current	- Pulsed (Note 1)	111	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		809	mJ
I_{AR}	Avalanche Current		6.8	A
E_{AR}	Repetitive Avalanche Energy		3.57	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		50	
P_D	Power Dissipation	(T_C = 25°C)	357	W
		- Derate above 25°C	2.85	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

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.35	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH104N60F	FCH104N60F	TO-247	-	-	30

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 = 10 mA, V_{GS} = 0 V, $T_C = 25^oC$	600	-	-	V
		I_D = 10 mA, V_{GS} = 0 V, $T_C = 150^oC$	650	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25^oC	-	0.67	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480 V, V_{GS} = 0 V	-	-	10	µA
		V_{DS} = 480 V, V_{GS} = 0 V, $T_C = 125^oC$	-	-	100	
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	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 18.5 A	-	98	104	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 18.5 A	-	47	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	-	4475	5950	pF
C_{oss}	Output Capacitance		-	135	180	pF
C_{rss}	Reverse Transfer Capacitance		-	1.5	2.5	pF
C_{oss}	Output Capacitance	V_{DS} = 380 V, V_{GS} = 0V, f = 1 MHz	-	75	-	pF
C_{oss}eff.	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	109	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380 V, I_D = 18.5 A, V_{GS} = 10 V (Note 4)	-	107	139	nC
Q_{gs}	Gate to Source Gate Charge		-	25	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	44	-	nC
ESR	Equivalent Series Resistance	f=1MHz	-	0.87	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380 V, I_D = 18.5 A, R_{GEN} = 4.7 Ω (Note 4)	-	34	78	ns
t_r	Turn-On Rise Time		-	24	58	ns
$t_{d(off)}$	Turn-Off Delay Time		-	98	206	ns
t_f	Turn-Off Fall Time		-	5	20	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	37	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	111	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} =18.5 A	-		1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 18.5 A, dI_F/dt = 100 A/µs	-	144	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.89	-	µC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 6.8 A, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \le$ 18.5 A, di/dt ≤ 200 A/µs, $V_{DD} \le$ 380 V, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

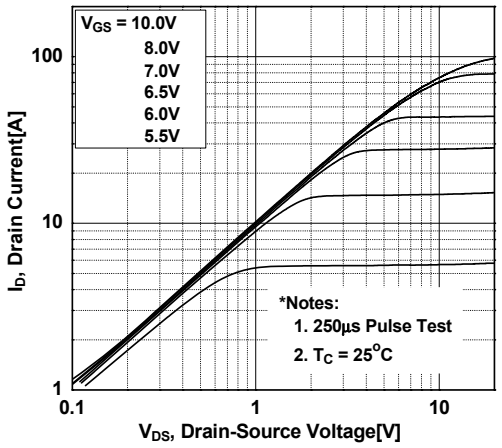


Figure 2. Transfer Characteristics

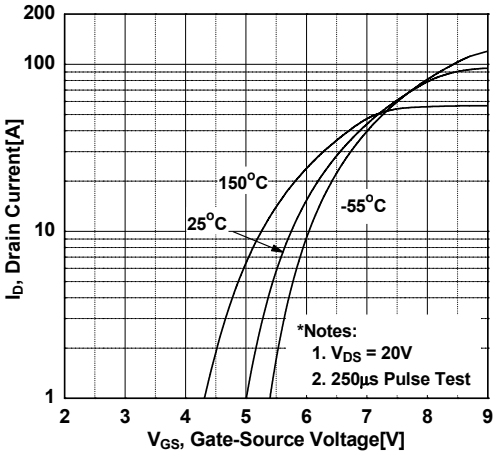


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

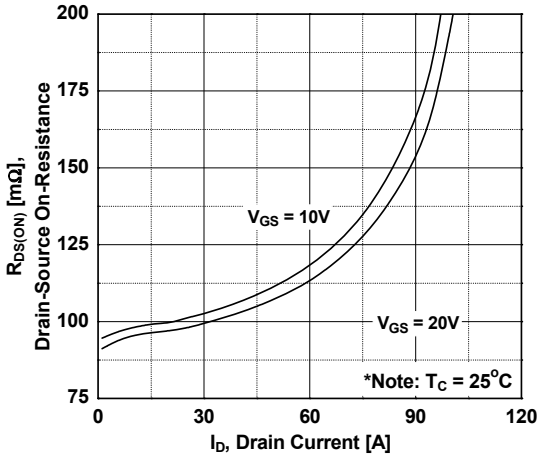


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

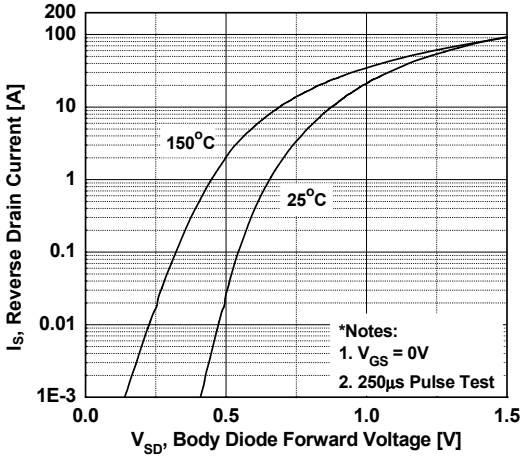


Figure 5. Capacitance Characteristics

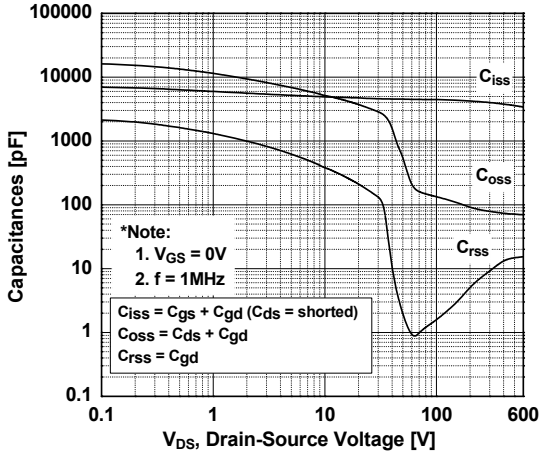
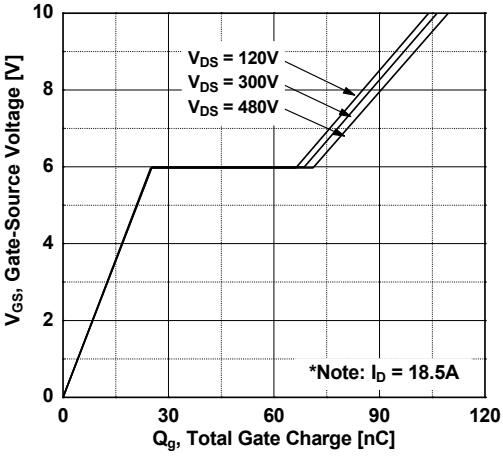


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

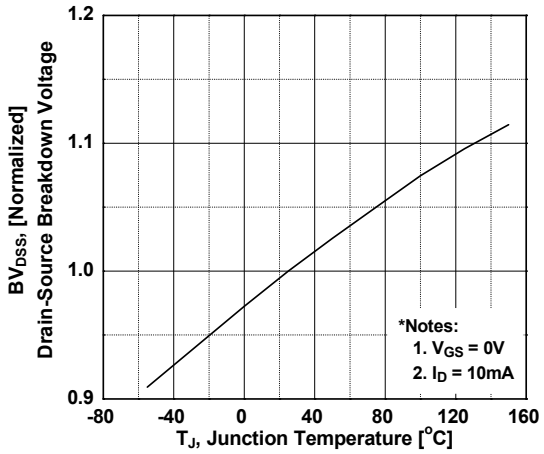


Figure 8. On-Resistance Variation vs. Temperature

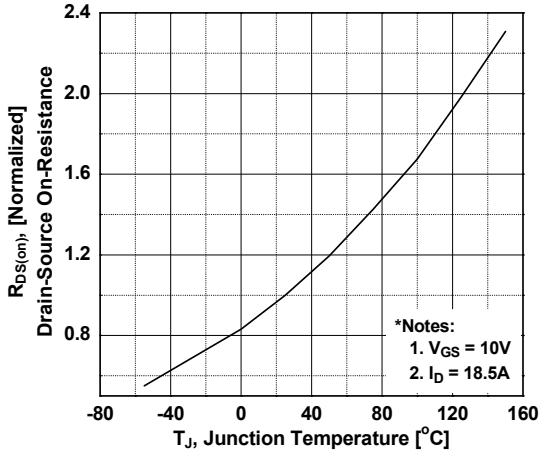


Figure 9. Maximum Safe Operating Area

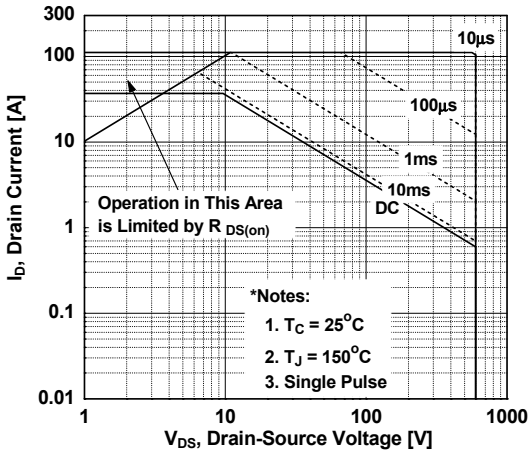


Figure 10. Maximum Drain Current vs. Case Temperature

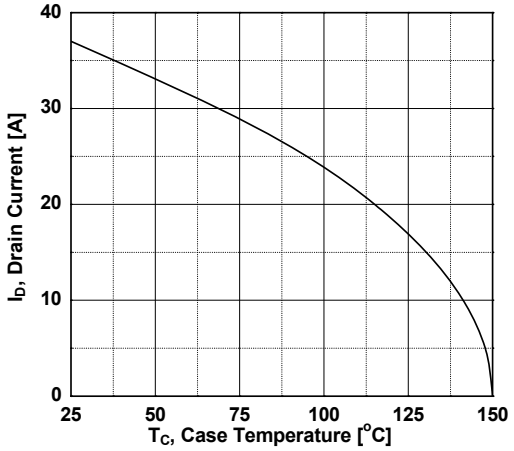
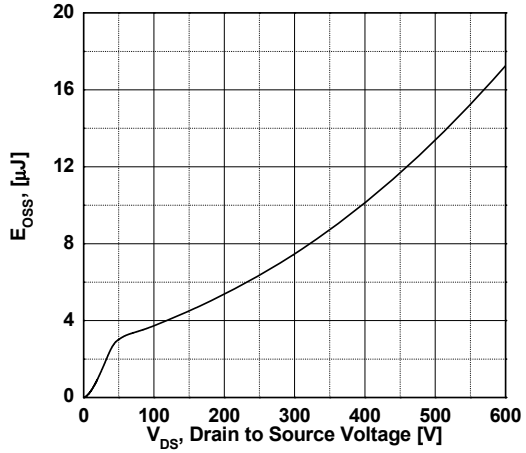
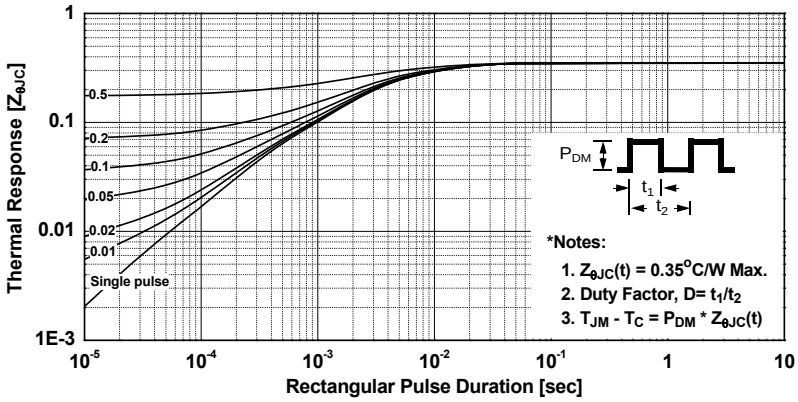


Figure 11. Eoss vs. Drain to Source Voltage

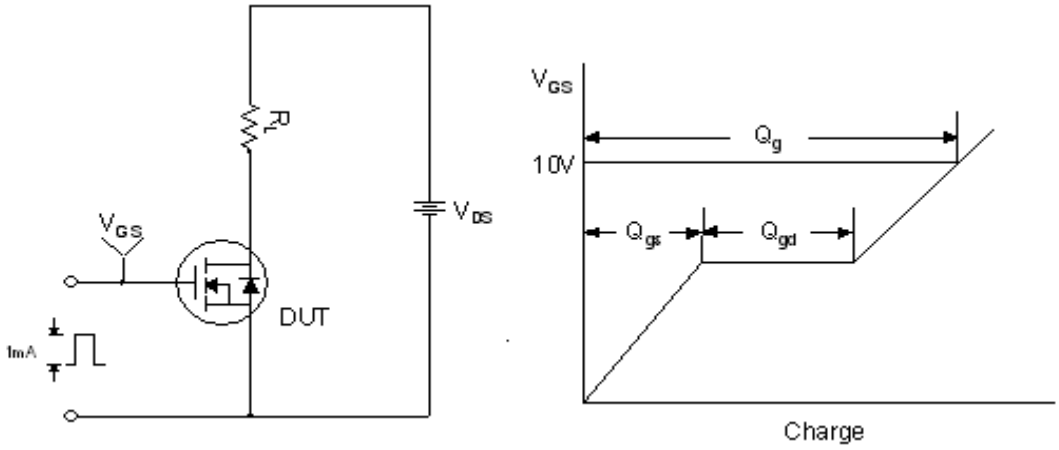


Typical Performance Characteristics (Continued)

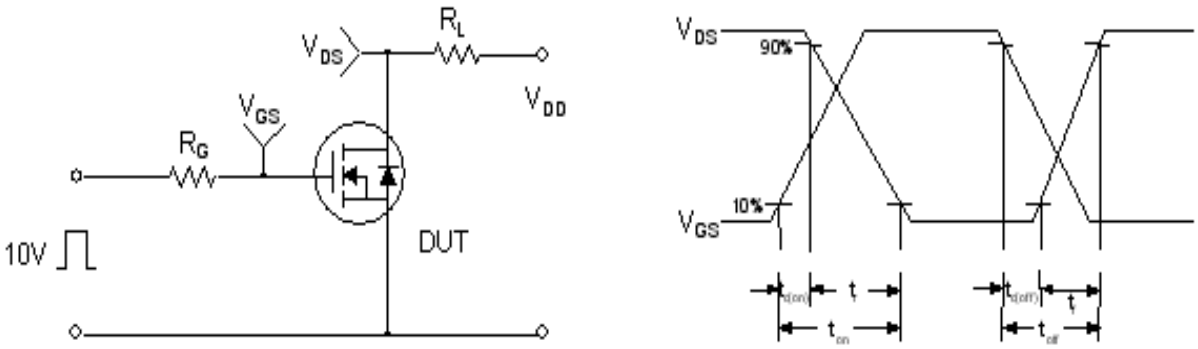
Figure 12. Transient Thermal Response Curve



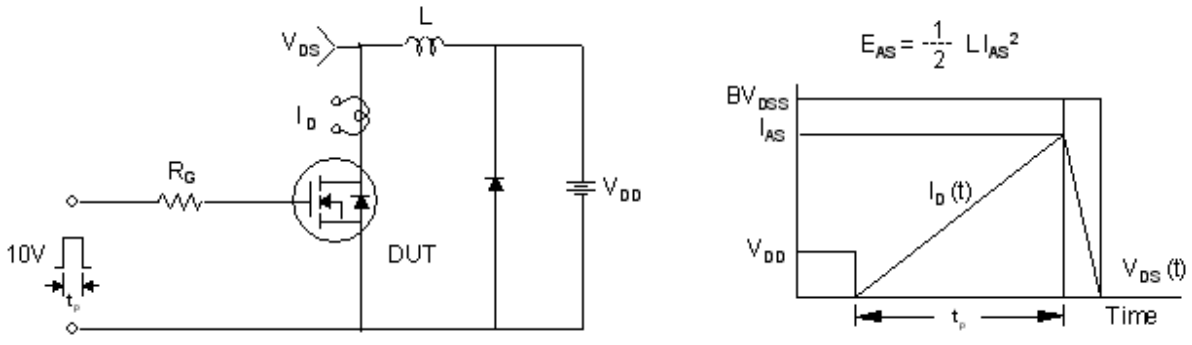
Gate Charge Test Circuit & Waveform



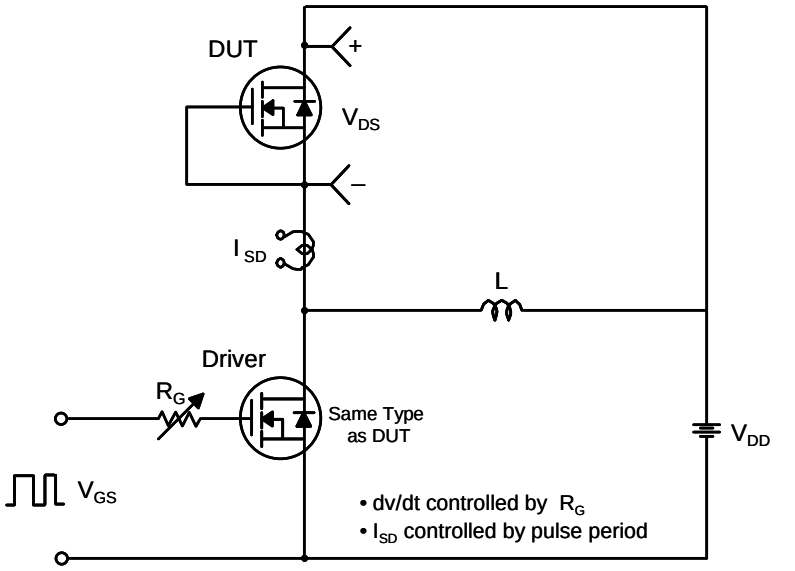
Resistive Switching Test Circuit & Waveforms

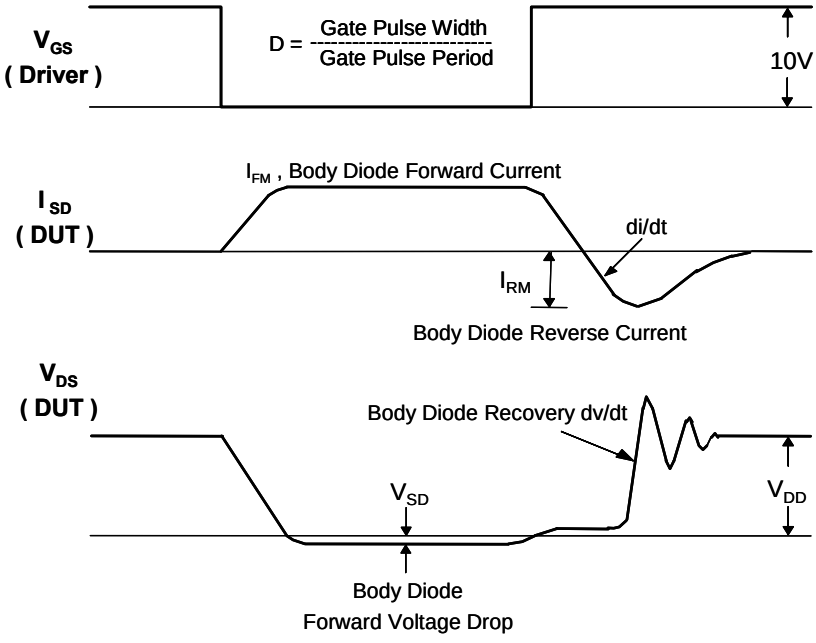


Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

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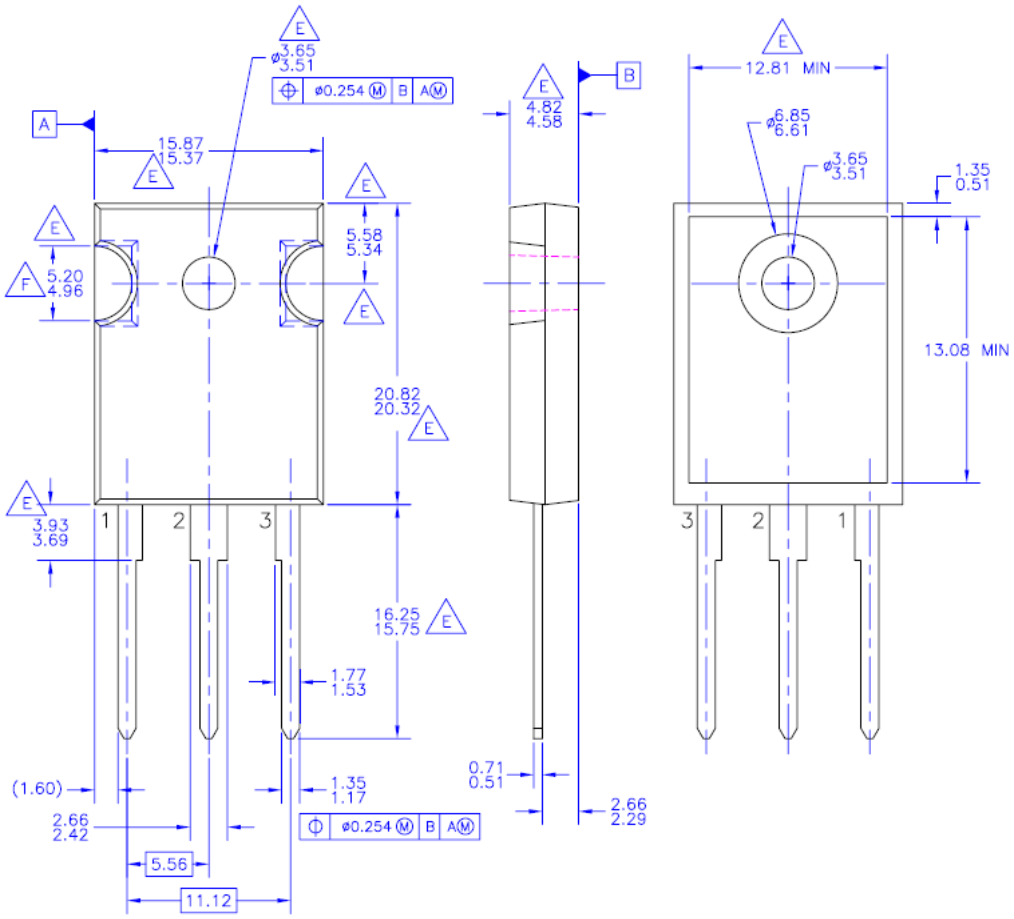

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E. DOES NOT COMPLY JEDEC STANDARD VALUE

F. NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03_REV02

Dimensions in Millimeters

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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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