FAIRCHILD SEMICONDUCTOR®

January 2011

SupreMOS™

FCH47N60NF

N-Channel MOSFET, FRFET

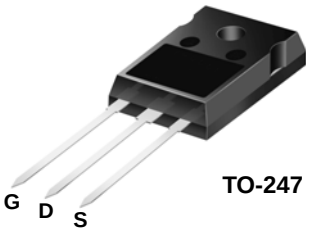
600V, 47A, 65mΩ

Features

- $R_{DS(on)}$ = 57.5mΩ (Typ.) @ V_{GS} = 10V, I_D = 23.5A
- Ultra Low Gate Charge (Typ. Q_g = 121nC)
- Low Effective Output Capacitance
- 100% Avalanche Tested
- RoHS Compliant

Description

The SupreMOS MOSFET, Fairchild's next generation of high voltage super-junction MOSFETs, employs a deep trench filling process that differentiates it from preceding multi-epi based technologies. By utilizing this advanced technology and precise process control, SupreMOS provides world class Rsp, superior switching performance and ruggedness.
This SupreMOS MOSFET fits the industry's AC-DC SMPS requirements for PFC, server/telecom power, FPD TV power, ATX power, and industrial power applications.



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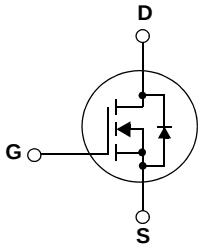


MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage		±30	V
I_D	Drain Current	-Continuous (T_C = 25°C)	45.8	A
		-Continuous (T_C = 100°C)	28.9	
I_{DM}	Drain Current	- Pulsed (Note 1)	137.4	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	2926	mJ
I_{AR}	Avalanche Current		15.3	A
E_{AR}	Repetitive Avalanche Energy		3.7	mJ
dv/dt	MOSFET dv/dt Ruggedness		100	V/ns
	Peak Diode Recovery dv/dt	(Note 3)	50	V/ns
P_D	Power Dissipation	(T_C = 25°C)	368	W
		- Derate above 25°C	2.94	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	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.34	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH47N60NF	FCH47N60NF	TO-247	-	-	30

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1mA, V_{GS} = 0V, $T_C = 25^oC$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 1mA, Referenced to 25^oC	-	0.78	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 480V, V_{GS} = 0V	-	-	10	μA
		V_{DS} = 480V, V_{GS} = 0V, $T_C = 125^oC$	-	-	100	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30V, V_{DS} = 0V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 23.5A	-	57.5	65.0	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 23.5A	-	52	100	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 100V, V_{GS} = 0V, f = 1MHz	-	4600	6120	pF
C_{oss}	Output Capacitance		-	195	260	pF
C_{rss}	Reverse Transfer Capacitance		-	3.0	5.0	pF
C_{oss}	Output Capacitance	V_{DS} = 380V, V_{GS} = 0V, f = 1MHz	-	108	-	pF
C_{oss}eff.	Effective Output Capacitance	V_{DS} = 0V to 380V, V_{GS} = 0V	-	492	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 380V, I_D = 23.5A, V_{GS} = 10V (Note 4)	-	121	157	nC
Q_{gs}	Gate to Source Gate Charge		-	23	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	47	-	nC
ESR	Equivalent Series Resistance(G-S)	Drain Open	-	0.9	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 380V, I_D = 23.5A, R_{GEN} = 4.7Ω (Note 4)	-	34	78	ns
t_r	Turn-On Rise Time		-	22	54	ns
$t_{d(off)}$	Turn-Off Delay Time		-	117	244	ns
t_f	Turn-Off Fall Time		-	4	18	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	47	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	141	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_{SD} = 23.5A	-	-	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_{SD} = 23.5A, dI_F/dt = 100A/μs	-	169	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.3	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 15.3A, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \le$ 45.8 A, di/dt ≤ 1200A/μs, $V_{DD} \le$ 380V, Starting T_J = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

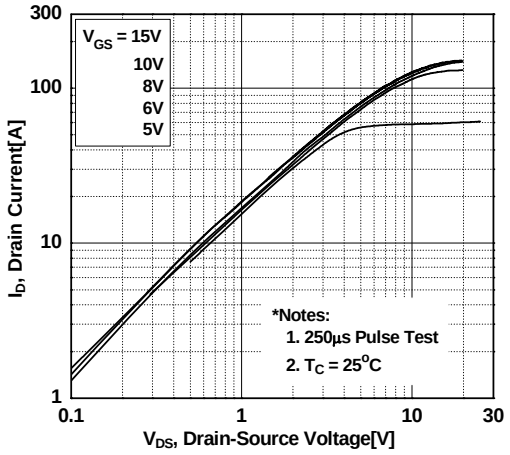


Figure 2. Transfer Characteristics

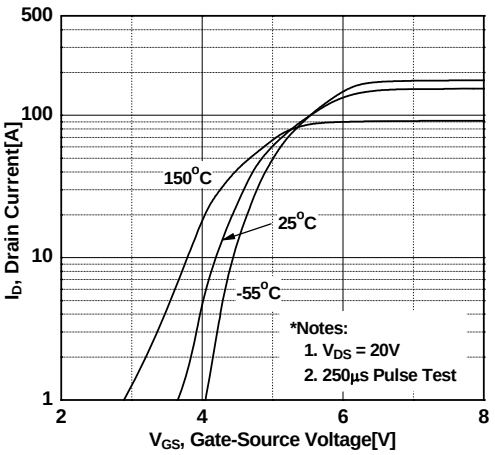


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

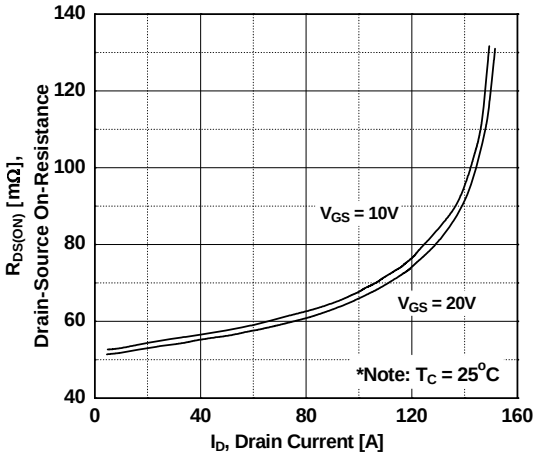


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

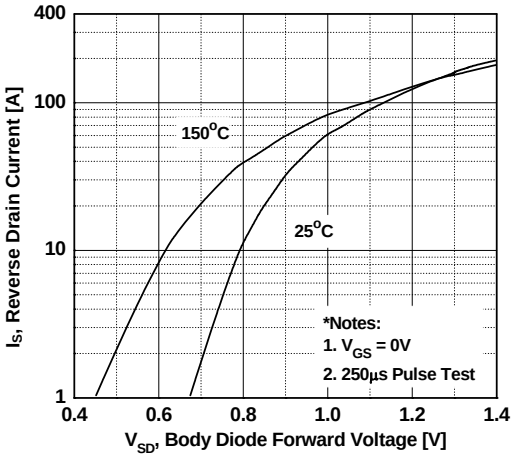


Figure 5. Capacitance Characteristics

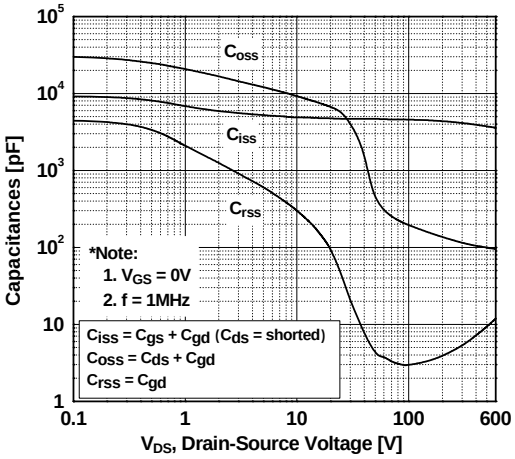
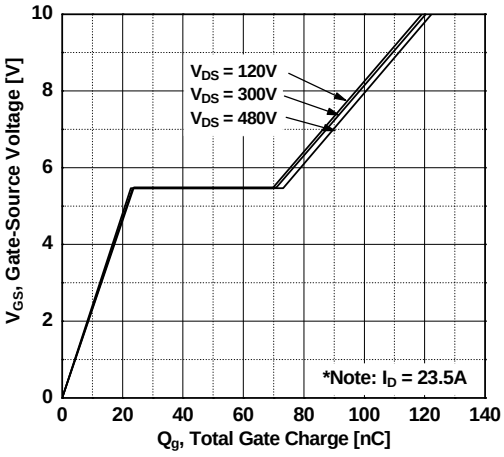


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

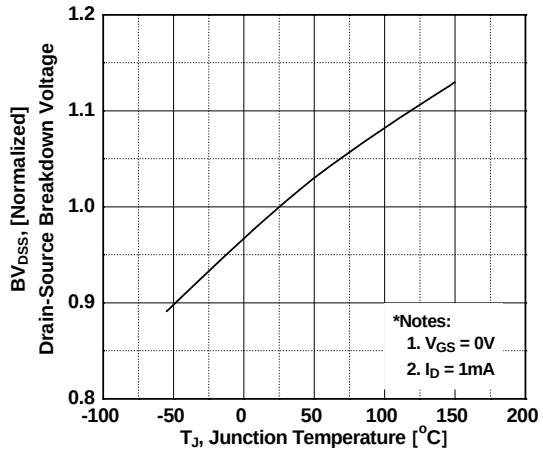


Figure 8. On-Resistance Variation vs. Temperature

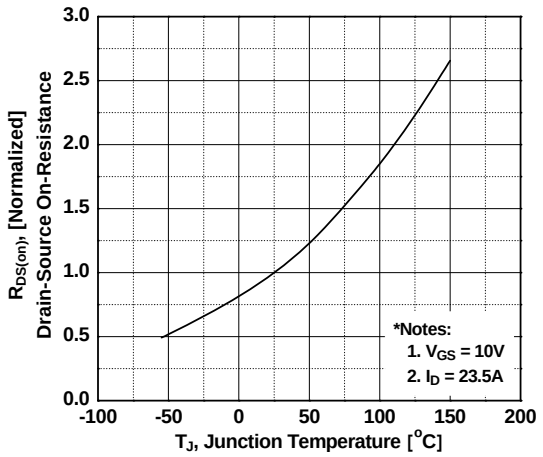


Figure 9. Maximum Safe Operating Area

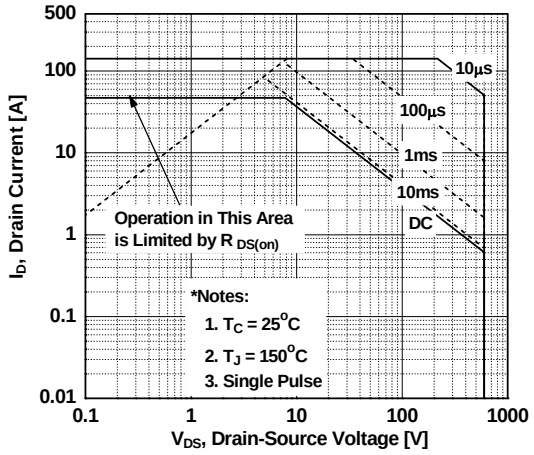


Figure 10. Maximum Drain Current vs. Case Temperature

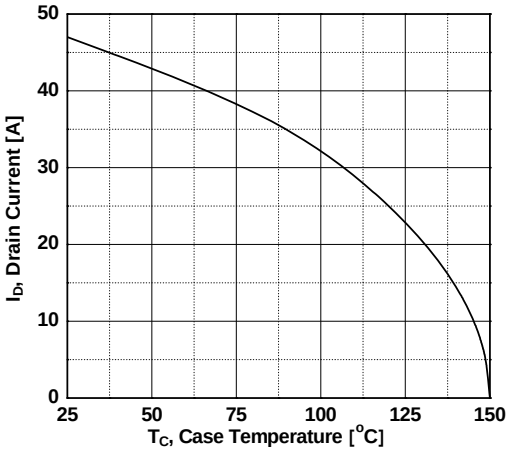
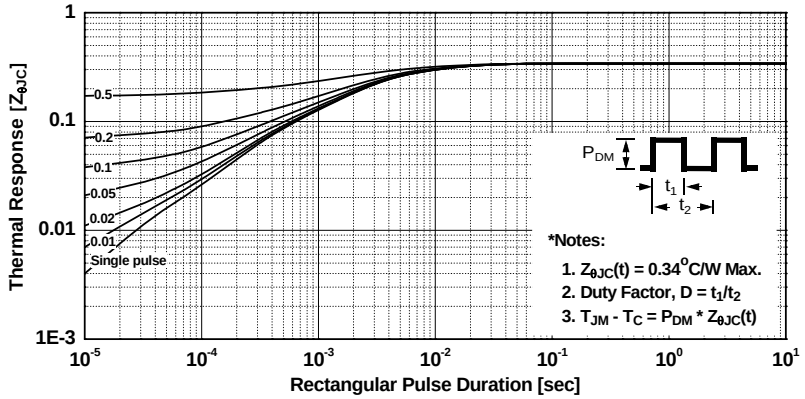
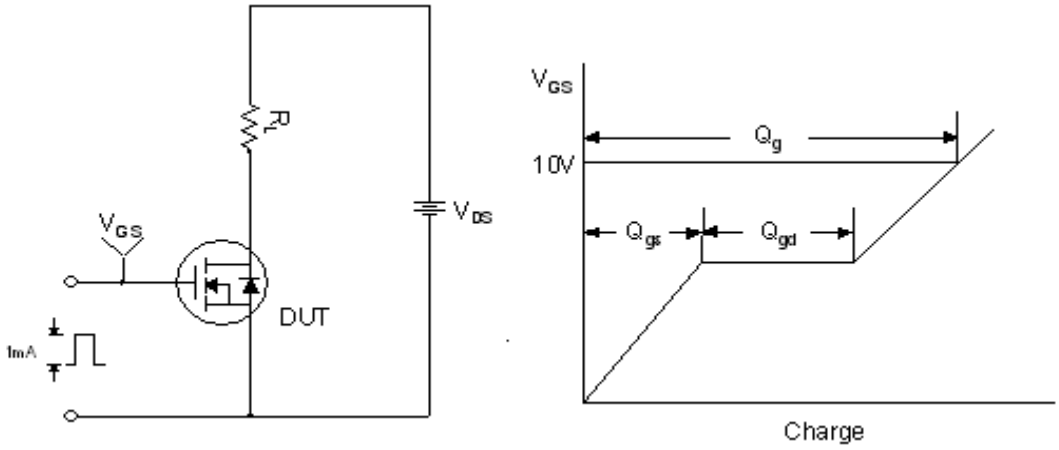


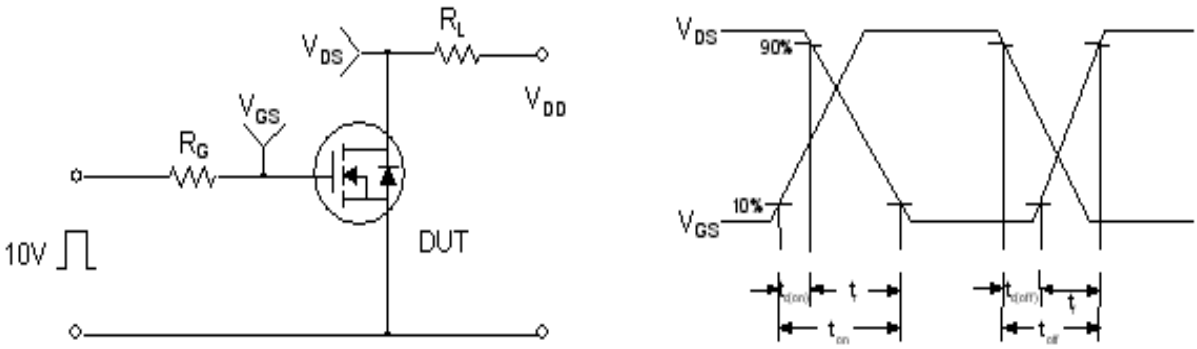
Figure 11. Transient Thermal Response Curve



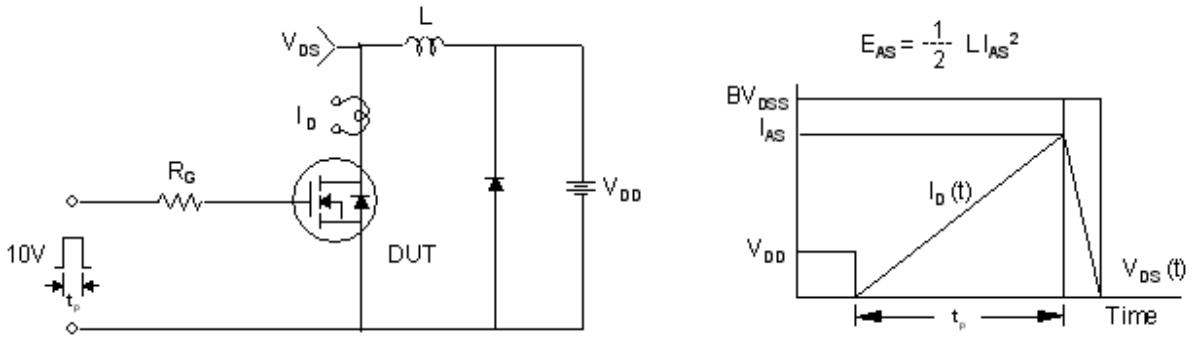
Gate Charge Test Circuit & Waveform



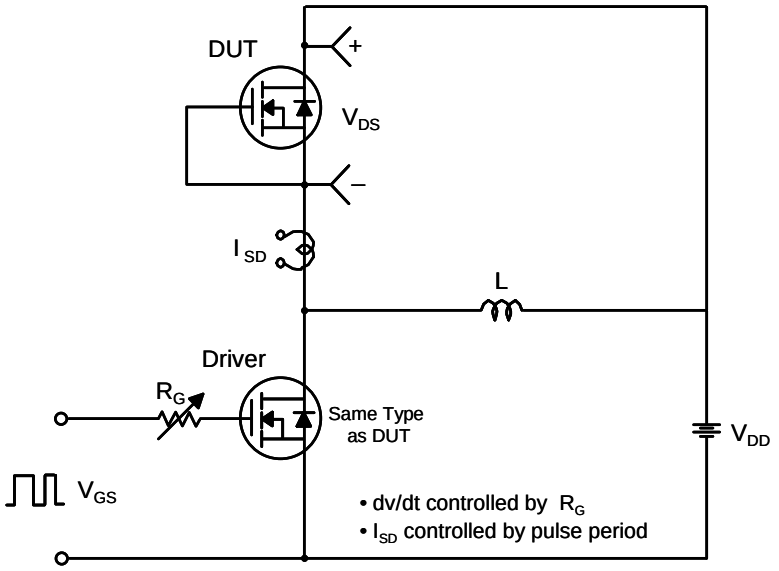
Resistive Switching Test Circuit & Waveforms

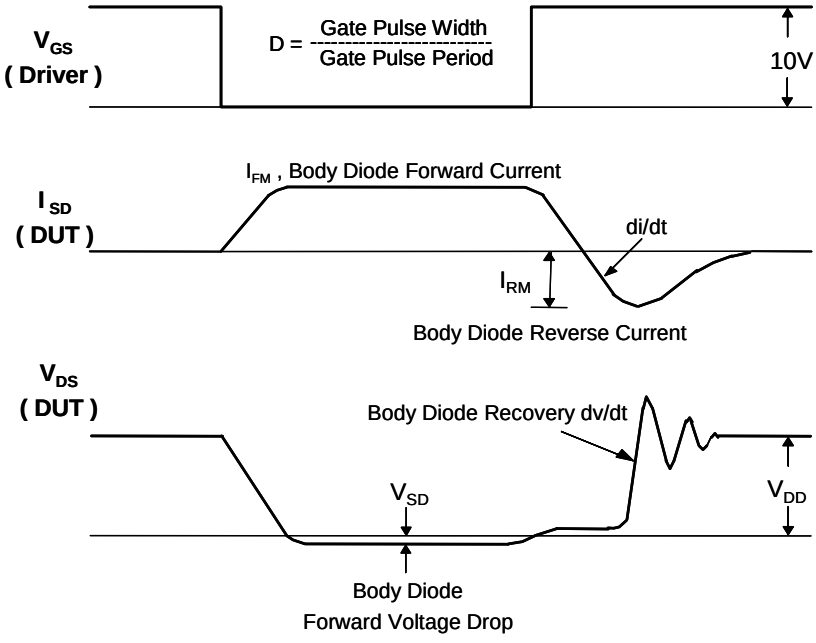


Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

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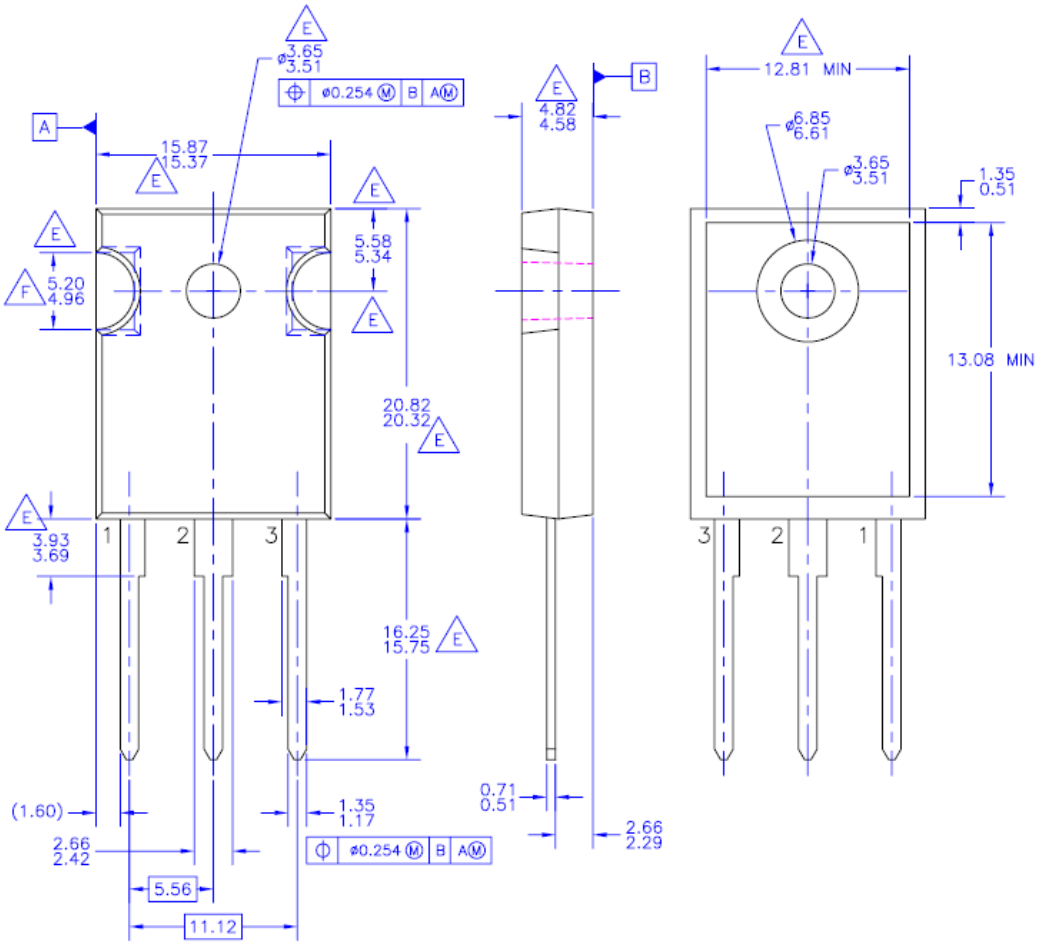

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Dimensions in Millimeters

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