



July 2014

FCH170N60

N-Channel SuperFET[®] II MOSFET

600 V, 22 A, 170 mΩ

Features

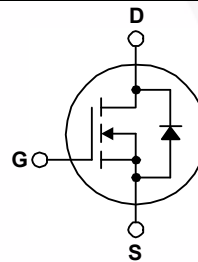
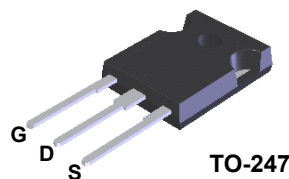
- 650 V @T_J = 150°C
- Typ. R_{DS(on)} = 150 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 42 nC)
- Low Effective Output Capacitance (Typ. C_{oss(eff.)} = 190 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies
- AC-DC Power Supply

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 advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET II MOSFET is suitable for various AC/DC power conversion for system miniaturization and higher efficiency.



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

Symbol	Parameter		FCH170N60	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)	22	A
		- Continuous (T _C = 100°C)	14	
I _{DM}	Drain Current	- Pulsed (Note 1)	66	A
E _{AS}	Single Pulsed Avalanche Energy	(Note 2)	525	mJ
I _{AR}	Avalanche Current	(Note 1)	5	A
E _{AR}	Repetitive Avalanche Energy	(Note 1)	2.27	mJ
dv/dt	MOSFET dv/dt	(Note 3)	100	V/ns
	Peak Diode Recovery dv/dt		20	
P _D	Power Dissipation	(T _C = 25°C)	227	W
		- Derate above 25°C	1.82	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	FCH170N60	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.55	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH170N60	FCH170N60	TO-247	-	-	30

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	600	-	-	V
		$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}, T_J = 150^\circ\text{C}$	650	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.67	-	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$	-	1.2	-	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.5	-	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 11\text{ A}$	-	150	170	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 11\text{ A}$	-	17	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	-	2150	2860	pF
C_{oss}	Output Capacitance		-	60	80	pF
C_{rss}	Reverse Transfer Capacitance		-	2.65	-	pF
$C_{oss (eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	-	190	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 11\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4)	-	42	55	nC
Q_{gs}	Gate to Source Gate Charge		-	9	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	11	-	nC
ESR	Equivalent Series Resistance		-	0.95	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 11\text{ A},$ $V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$ (Note 4)	-	21	50	ns
t_r	Turn-On Rise Time		-	12	35	ns
$t_{d(off)}$	Turn-Off Delay Time		-	55	120	ns
t_f	Turn-Off Fall Time		-	3.8	18	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	22	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	66	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 11 A	-	-	1.2	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 11 A, dI _F /dt = 100 A/μs	-	346	-	ns
Q _{rr}	Reverse Recovery Charge		-	6.2	-	μC

Notes:

1. Repetitive rating: pulse width limited by maximum junction temperature
2. $I_{AS} = 5\text{ A}, R_g = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 11\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature typical characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

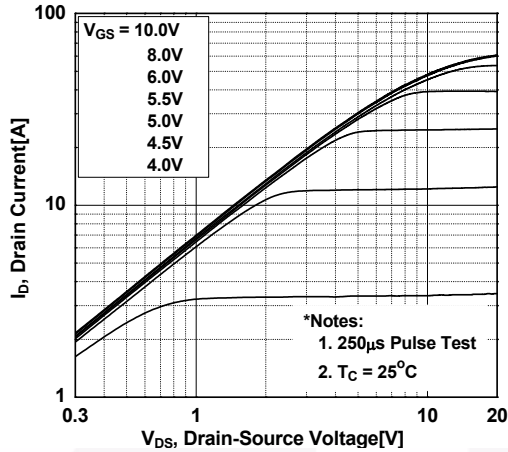


Figure 2. Transfer Characteristics

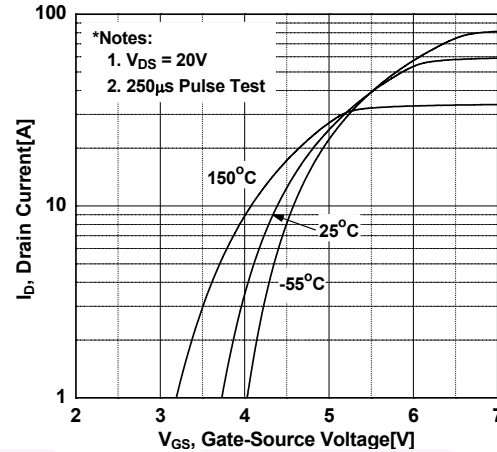


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

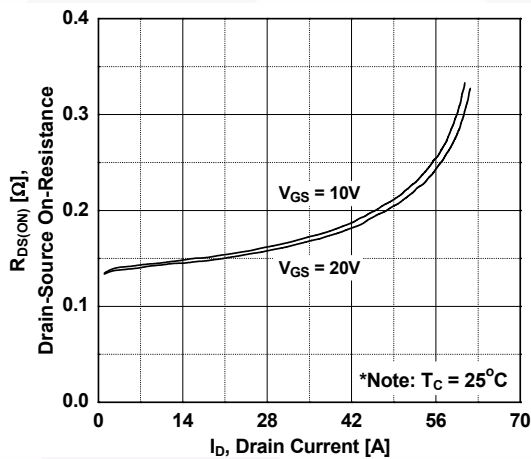


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

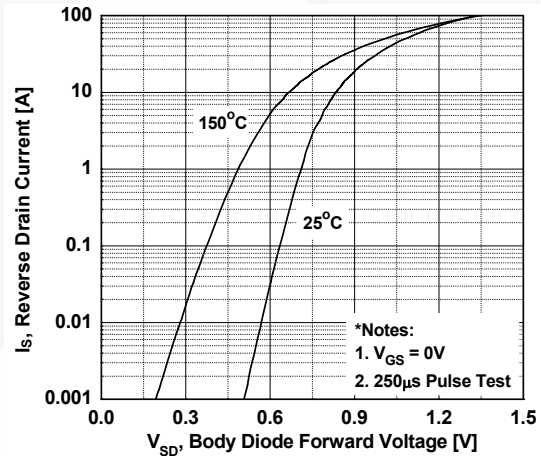


Figure 5. Capacitance Characteristics

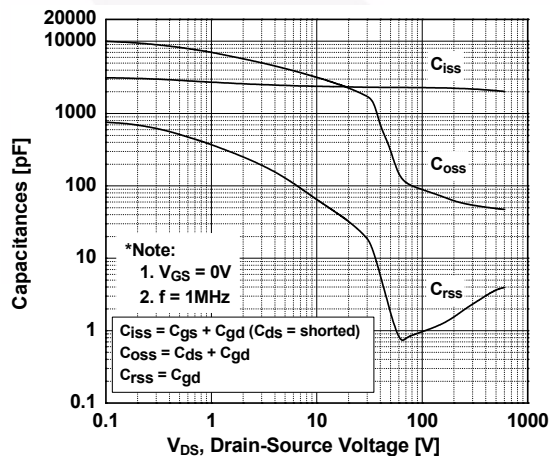
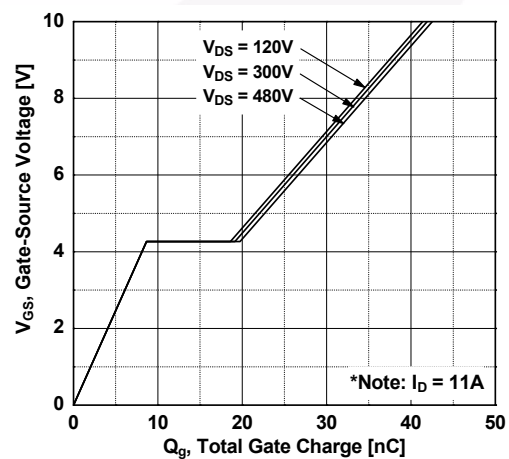


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

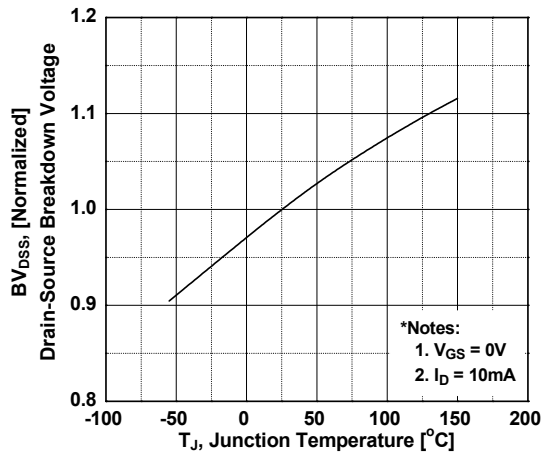


Figure 8. On-Resistance Variation vs. Temperature

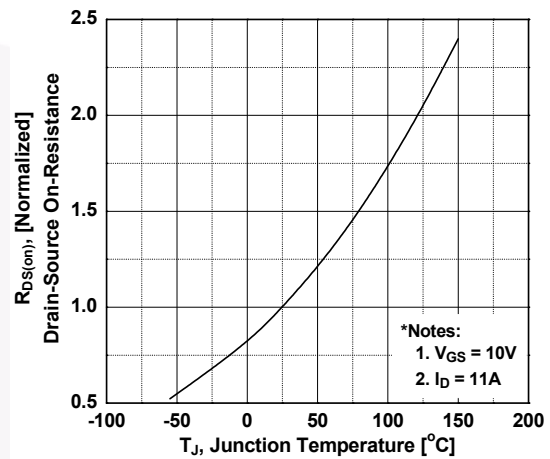


Figure 9. Maximum Safe Operating Area

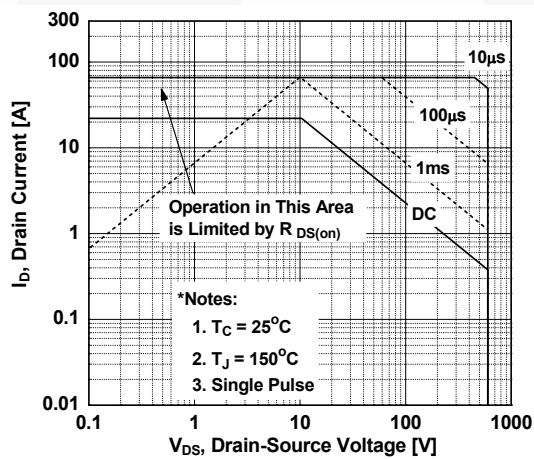


Figure 10. Maximum Drain Current vs. Case Temperature

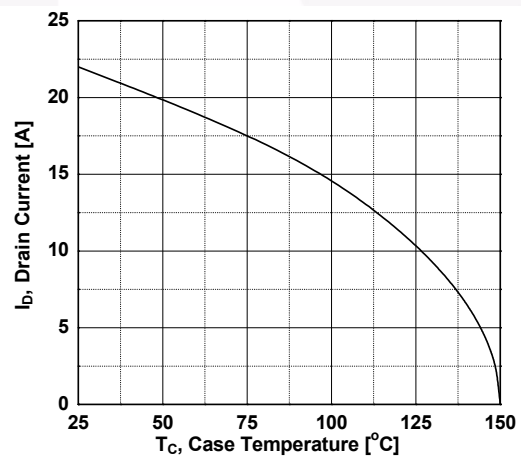
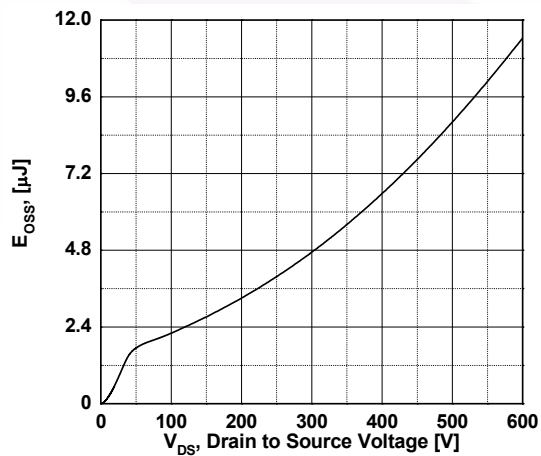
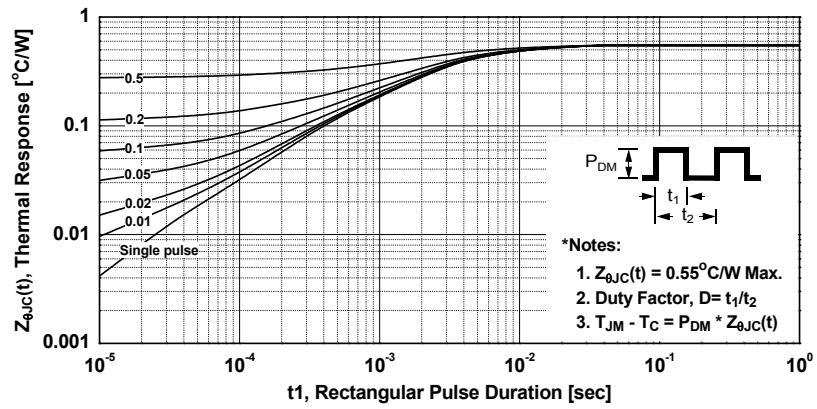


Figure 11. Eoss vs. Drain to Source Voltage



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve



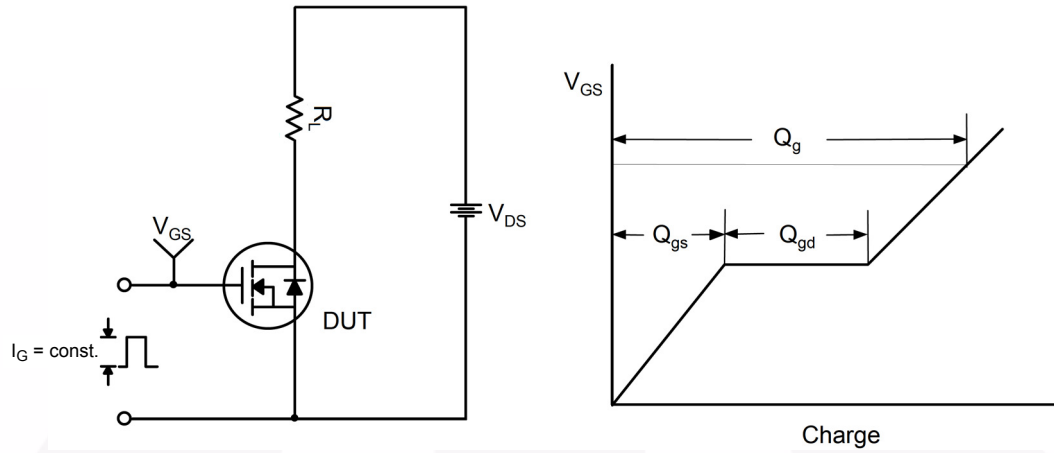


Figure 13. Gate Charge Test Circuit & Waveform

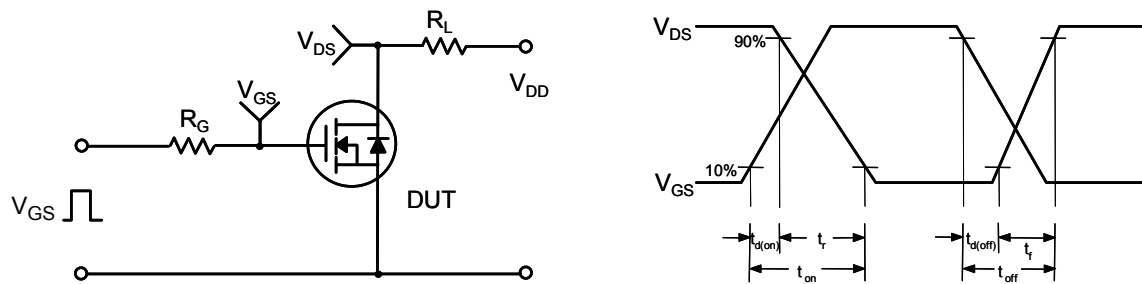


Figure 14. Resistive Switching Test Circuit & Waveforms

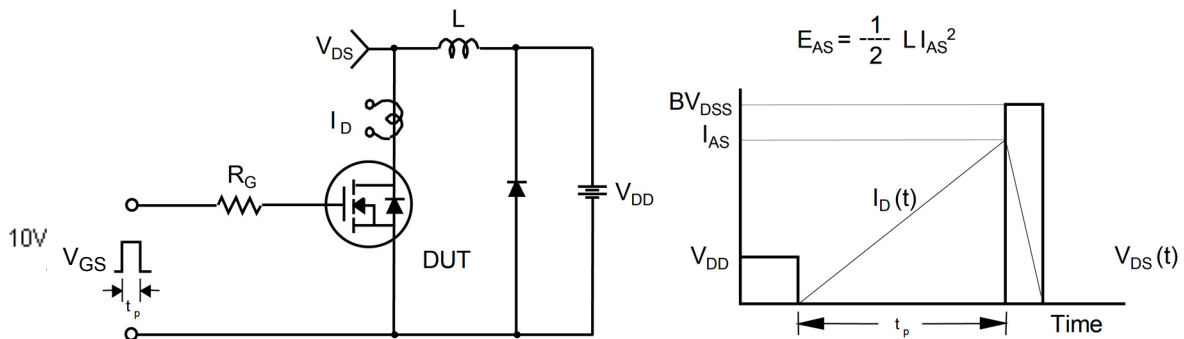
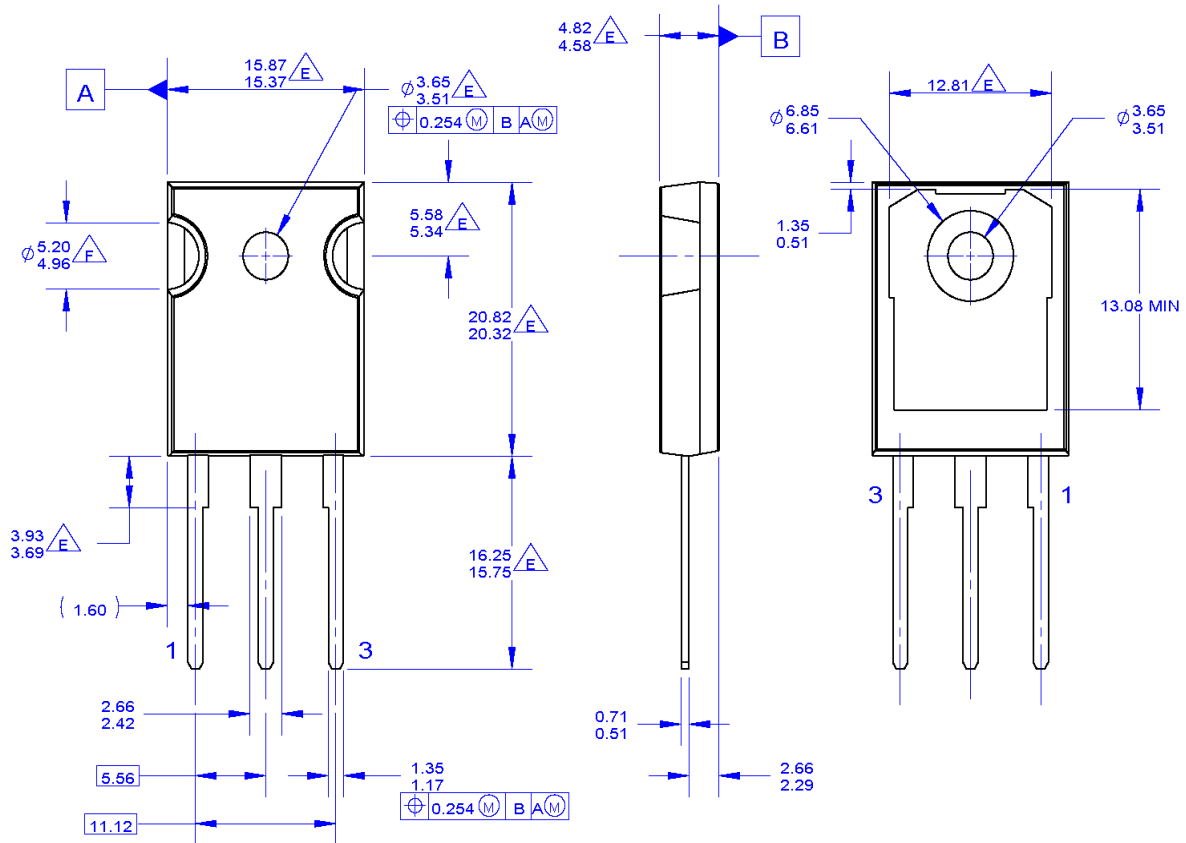


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

Mechanical Dimensions

TO-247 3L



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) NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03_REV03

Figure 17. TO-247, Molded, 3 Lead, Jedec Variation AB

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