

# FCB11N60F

## 600V N-Channel MOSFET

### Features

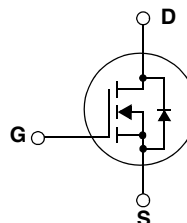
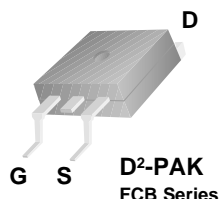
- 650V @T<sub>J</sub> = 150°C
- Typ. R<sub>DS(on)</sub> = 0.32Ω
- Fast Recovery Type ( t<sub>rr</sub> = 120ns )
- Ultra low gate charge (typ. Q<sub>g</sub> = 40nC)
- Low effective output capacitance (typ. C<sub>oss-eff</sub> = 95pF)
- 100% avalanche tested
- RoHS Compliant



### Description

SuperFET™ is, Fairchild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

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



### Absolute Maximum Ratings

Symbol	Parameter	FCB11N60F	Unit
V <sub>DSS</sub>	Drain-Source Voltage	600	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C) - Continuous (T <sub>C</sub> = 100°C)	11 7	A A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	33	A
V <sub>GSS</sub>	Gate-Source voltage	± 30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	340	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	11	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	12.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	50	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C) - Derate above 25°C	125 1.0	W W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

### Thermal Characteristics

Symbol	Parameter	FCB11N60F	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	1.0	°C/W
R <sub>θJA</sub> *	Thermal Resistance, Junction-to-Ambient*	40	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

\* When mounted on the minimum pad size recommended (PCB Mount)

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCB11N60F	FCB11N60FTM	D <sup>2</sup> -PAK	330mm	24m	800

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 25°C	600	--	--	V
		V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 150°C	--	650	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.6	--	V/°C
BV <sub>DS</sub>	Drain-Source Avalanche Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 11A	--	700	--	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V	--	--	10	μA
		V <sub>DS</sub> = 480V, T <sub>C</sub> = 125°C	--	--	100	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.5A	--	0.32	0.38	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 5.5A (Note 4)	--	9.7	--	S
Dynamic Characteristics						
C <sub>iSS</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	1148	1490	pF
C <sub>oSS</sub>	Output Capacitance		--	671	870	pF
C <sub>rSS</sub>	Reverse Transfer Capacitance		--	63	--	pF
C <sub>oSS</sub>	Output Capacitance	V <sub>DS</sub> = 480V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	35	--	pF
C <sub>oSS</sub> eff.	Effective Output Capacitance	V <sub>DS</sub> = 0V to 400V, V <sub>GS</sub> = 0V	--	95	--	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 300V, I <sub>D</sub> = 11A R <sub>G</sub> = 25Ω  (Note 4, 5)	--	34	80	ns
t <sub>r</sub>	Turn-On Rise Time		--	98	205	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	119	250	ns
t <sub>f</sub>	Turn-Off Fall Time		--	56	120	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 480V, I <sub>D</sub> = 11A V <sub>GS</sub> = 10V  (Note 4, 5)	--	40	52	nC
Q <sub>gs</sub>	Gate-Source Charge		--	7.2	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	21	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	11	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	33	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 11A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 11A	--	120	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt = 100A/μs (Note 4)	--	0.8	--	μC

### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 5.5A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 11A, di<sub>F</sub>/dt ≤ 1200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

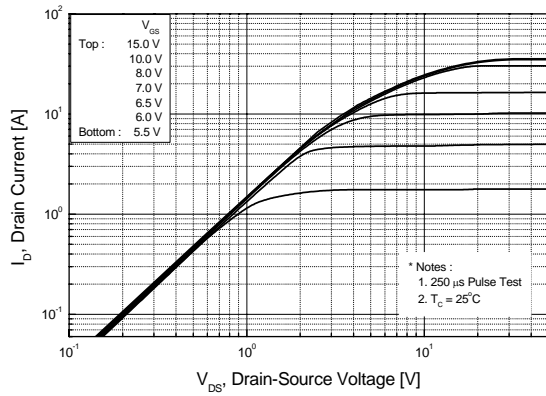


Figure 2. Transfer Characteristics

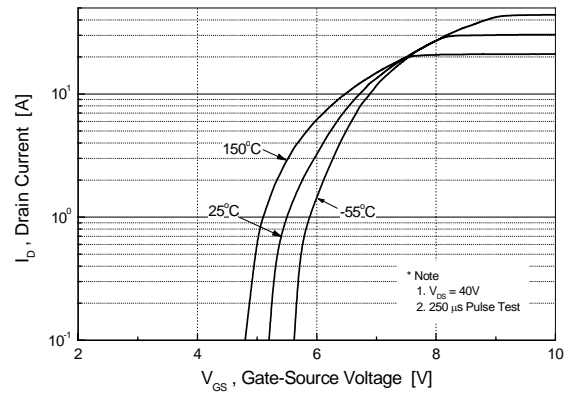


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

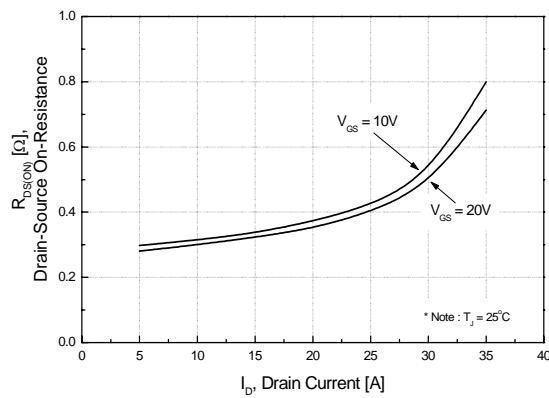


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

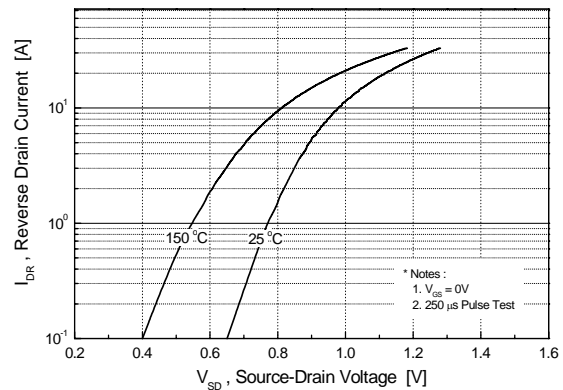


Figure 5. Capacitance Characteristics

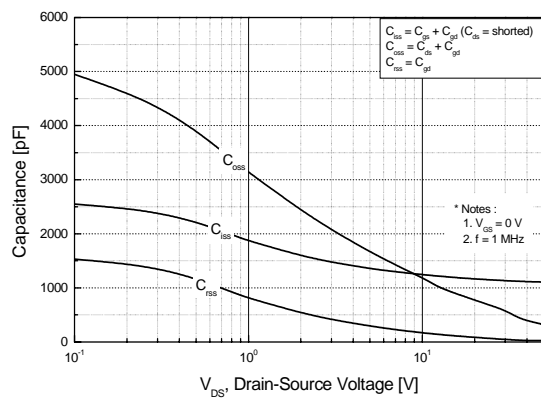
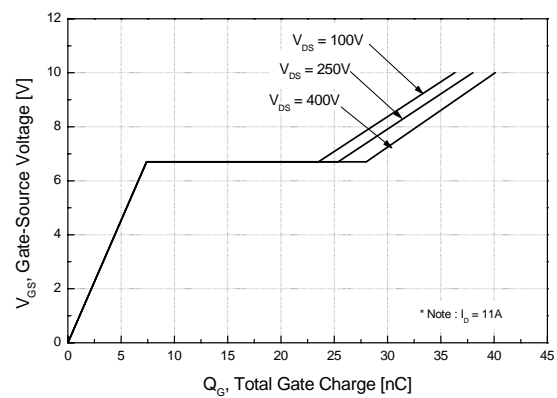
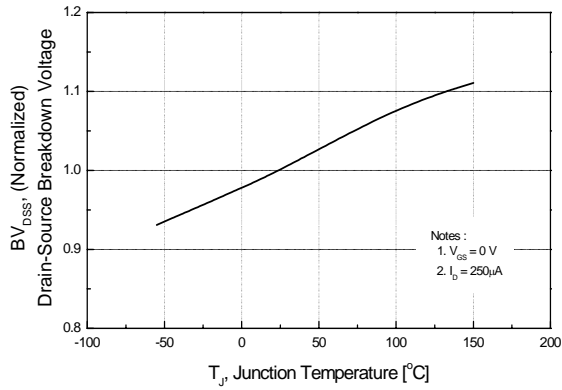


Figure 6. Gate Charge Characteristics

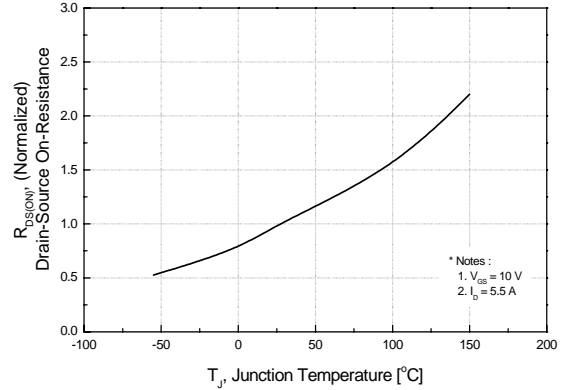


## Typical Performance Characteristics (Continued)

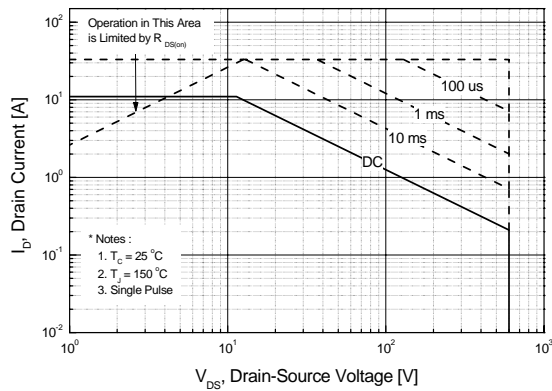
**Figure 7. Breakdown Voltage Variation vs. Temperature**



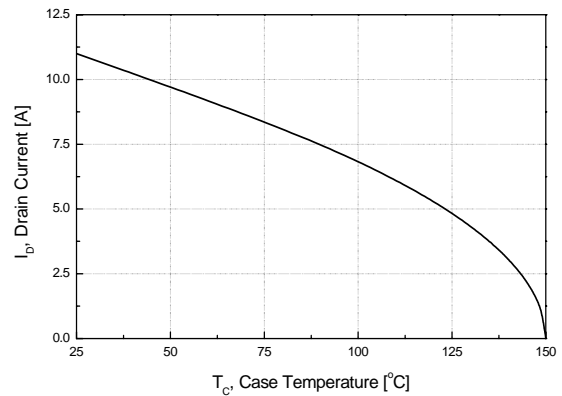
**Figure 8. On-Resistance Variation vs. Temperature**



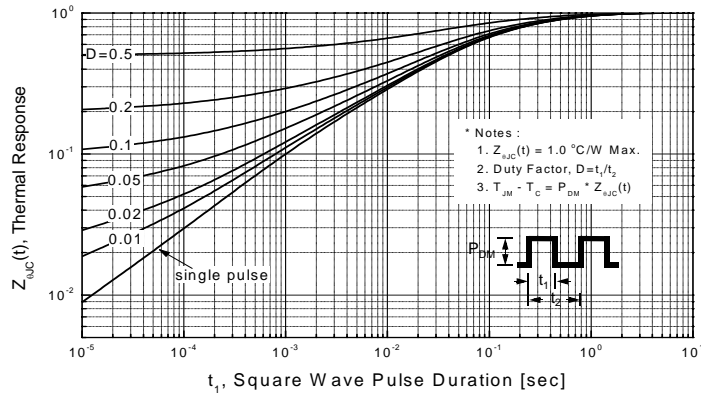
**Figure 9. Maximum Safe Operating Area**



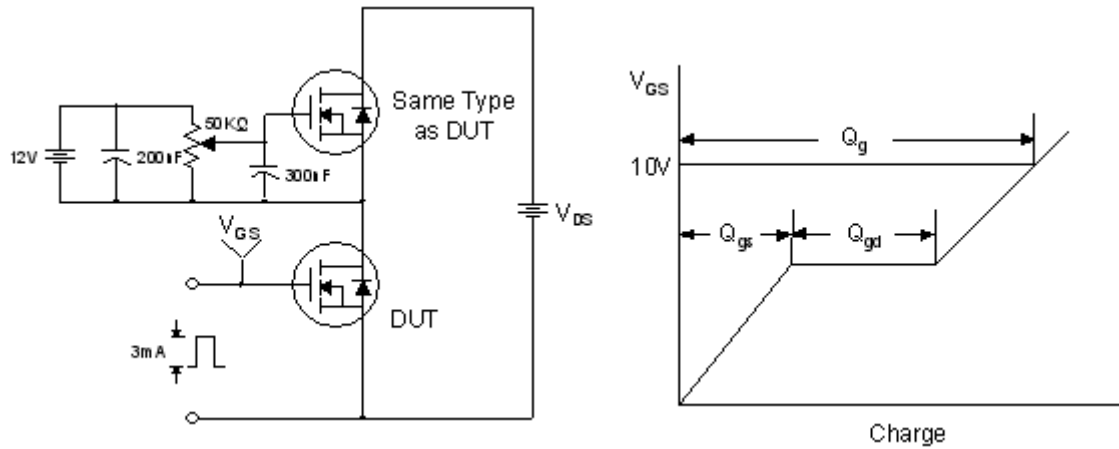
**Figure 10. Maximum Drain Current vs. Case Temperature**



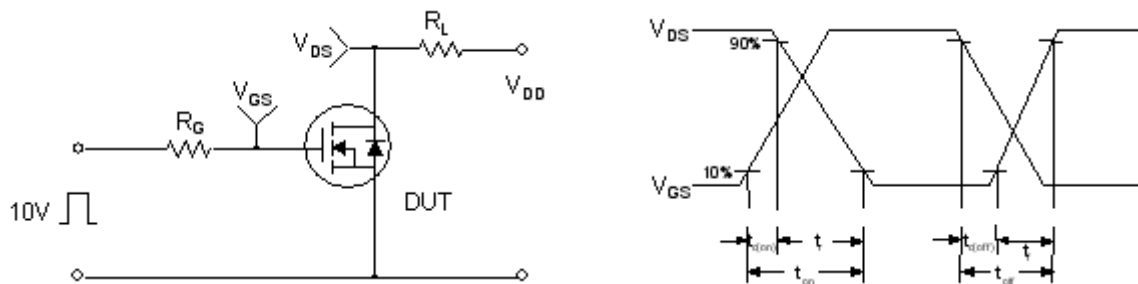
**Figure 11. Transient Thermal Response Curve**



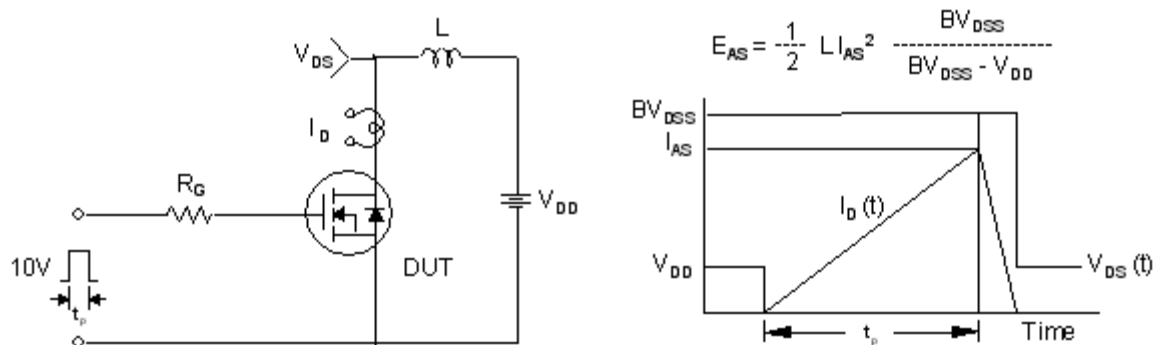
### Gate Charge Test Circuit & Waveform

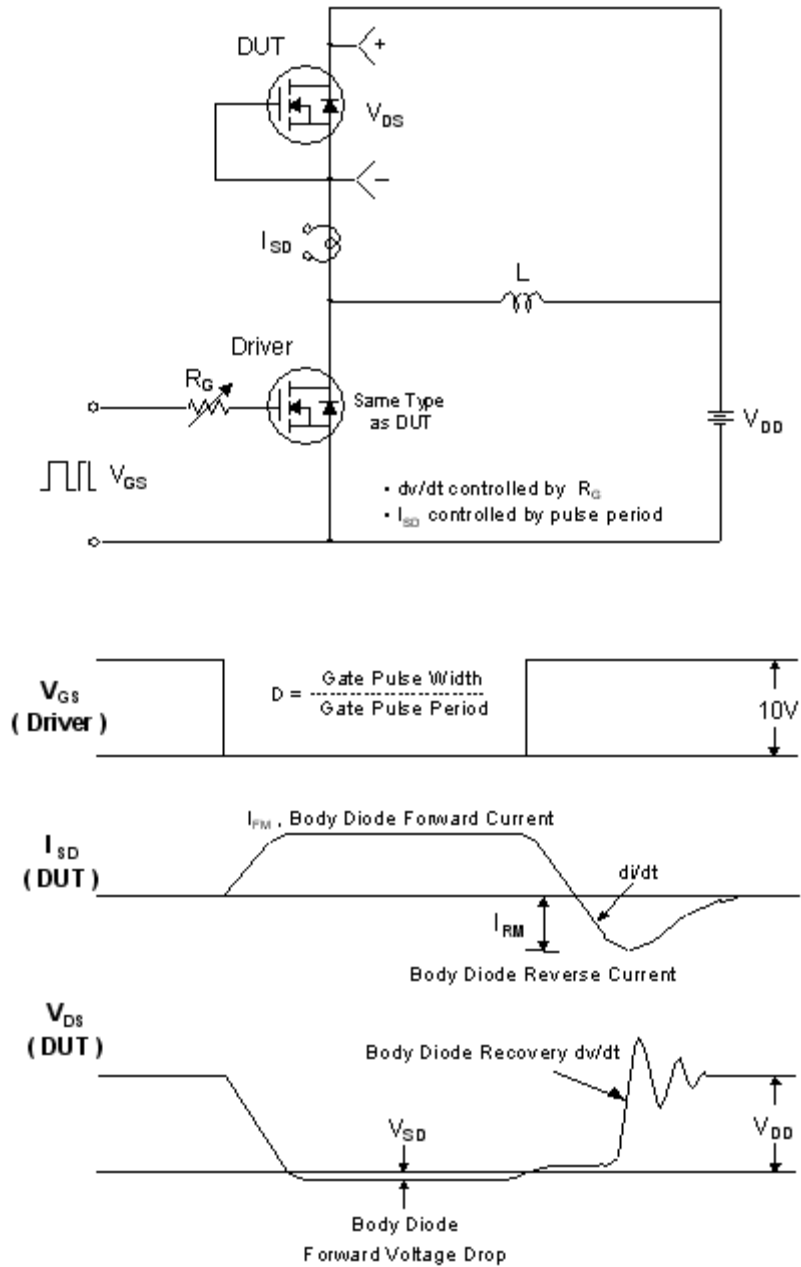


### Resistive Switching Test Circuit & Waveforms

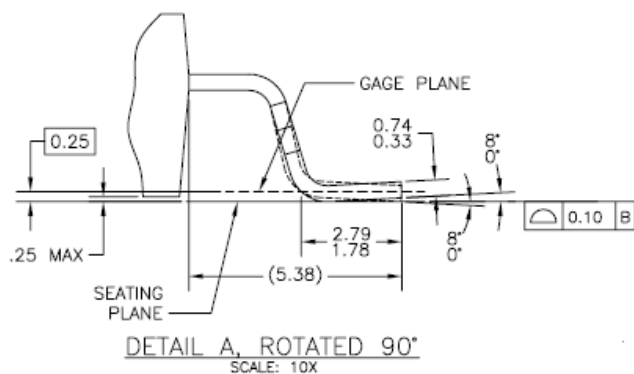
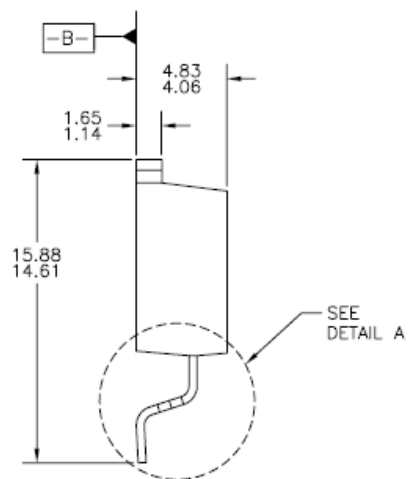
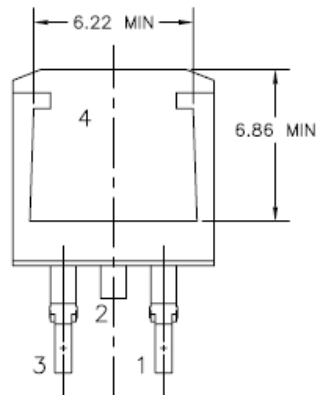
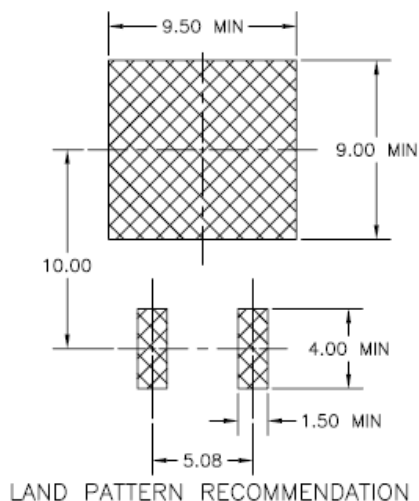
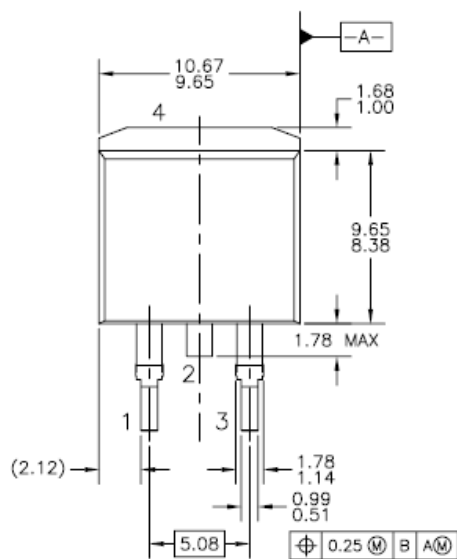


### Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions

D<sup>2</sup> - PAK

Dimensions in Millimeters



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