

FCH041N60F

600V N-Channel MOSFET, FRFET

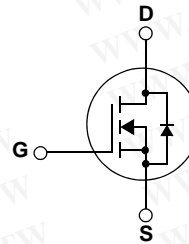
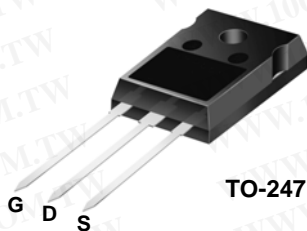
Features

- $R_{DS(on)} = 36m\Omega$ (Typ)
- Ultra low gate charge (Typ. $Q_g = 277nC$)
- Low effective output capacitance
- 100% avalanche tested
- RoHS Compliant

Description

SuperFET®II 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®II is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted*

Symbol	Parameter	FCH041N60F	Units
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate to Source Voltage	-DC	± 20
		-AC ($f > 1Hz$)	30
I_D	Drain Current	-Continuous ($T_C = 25^\circ C$)	76
		-Continuous ($T_C = 100^\circ C$)	48.1
I_{DM}	Drain Current - Pulsed (Note 1)	228	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	2025	mJ
I_{AR}	Avalanche Current (Note 1)	15	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.95	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	50	
P_D	Power Dissipation	($T_C = 25^\circ C$)	595
		- Derate above $25^\circ C$	4.76
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ C$

Thermal Characteristics

Symbol	Parameter	FCH041N60F	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.21	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCH041N60F	FCH041N60F	TO-247	-	-	30

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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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
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.67	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}$	-	-	1	μA
		$V_{DS} = 480\text{V}, T_C = 125^\circ\text{C}$	-	-	10	μA
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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 38\text{A}$	-	36	41	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{V}, I_D = 38\text{A}$ (Note 4)	-	64.5	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 100\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	10800	14365	pF
C_{oss}	Output Capacitance		-	324	430	pF
C_{riss}	Reverse Transfer Capacitance		-	4.5	-	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$	-	185	-	pF
$C_{oss \text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{V to } 480\text{V}, V_{GS} = 0\text{V}$	-	748	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{V}, I_D = 38\text{A}$ $V_{GS} = 10\text{V}$	-	277	360	nC
Q_{gs}	Gate to Source Gate Charge		-	65.3	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	116	-
ESR	Equivalent Series Resistance	$f = 1\text{MHz}$	-	1	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{V}, I_D = 38\text{A}$ $R_{GEN} = 4.7\Omega$	-	63	136	ns
t_r	Turn-On Rise Time		-	66	142	ns
$t_{d(off)}$	Turn-Off Delay Time		-	244	498	ns
t_f	Turn-Off Fall Time		(Note 4)	-	53	116

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	77	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	231	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 38\text{A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 38\text{A}$	-	190	-	ns
Q_{rr}	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	1490	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 15\text{A}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 38\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq 380\text{V}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

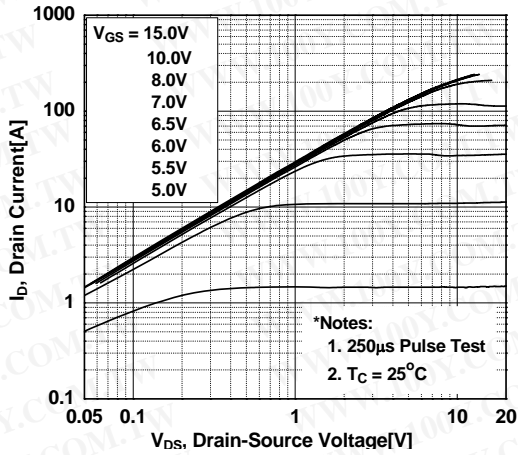


Figure 2. Transfer Characteristics

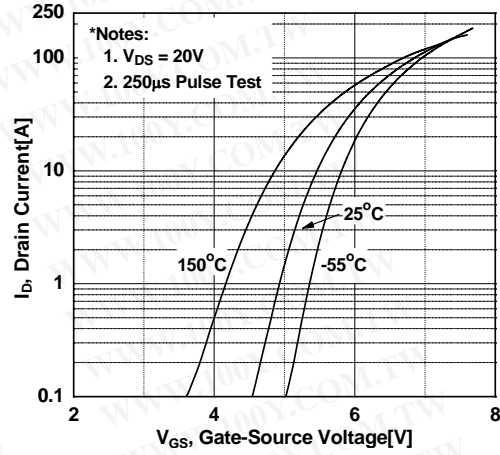


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

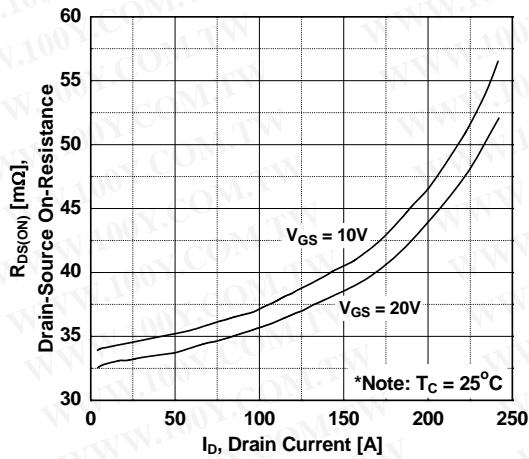


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

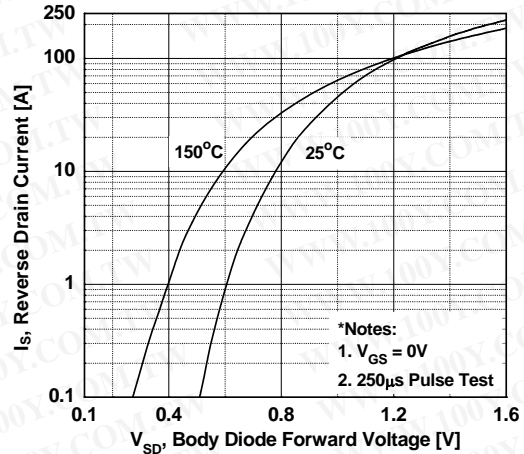


Figure 5. Capacitance Characteristics

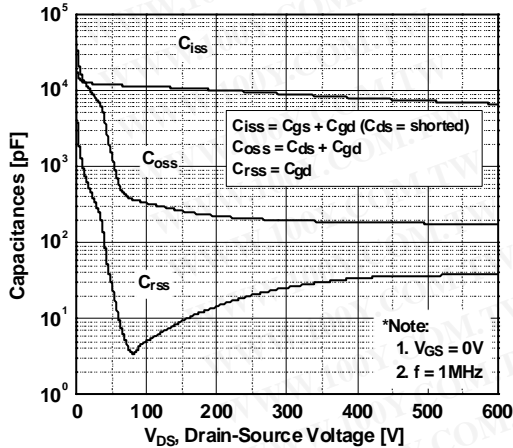
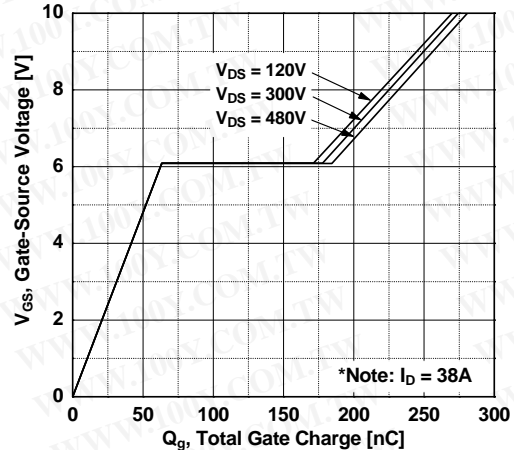


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

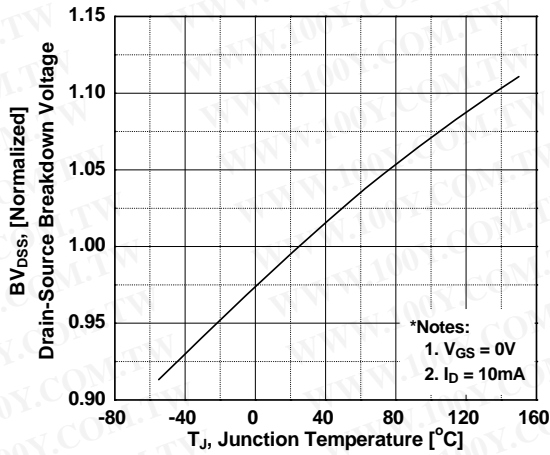


Figure 8. On-Resistance Variation vs. Temperature

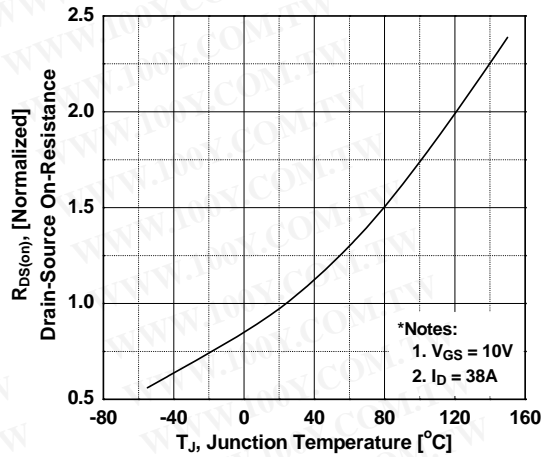


Figure 9. Maximum Safe Operating Area vs. Case Temperature

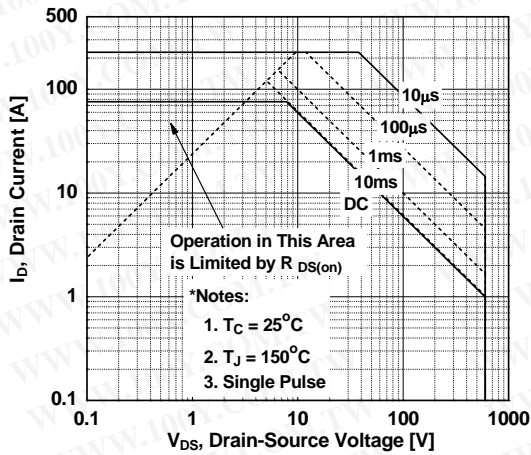


Figure 10. Maximum Drain Current

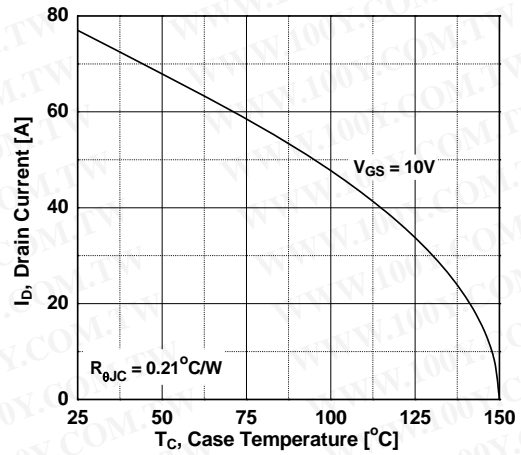
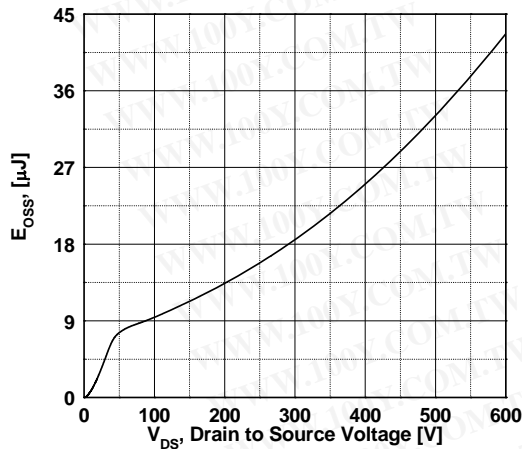
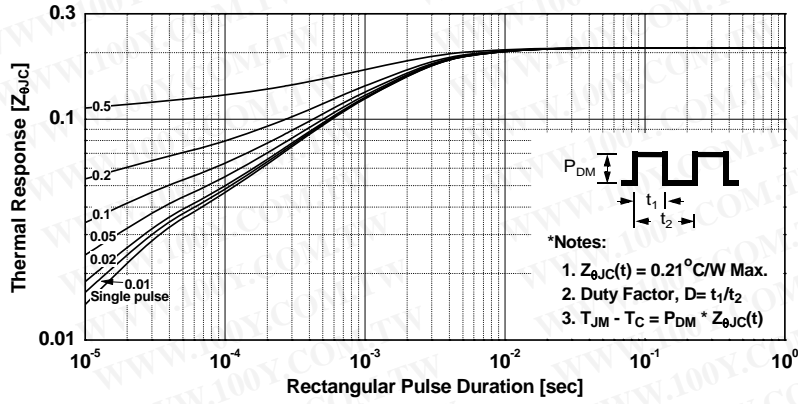


Figure 11. E_oss vs. Drain to Source Voltage

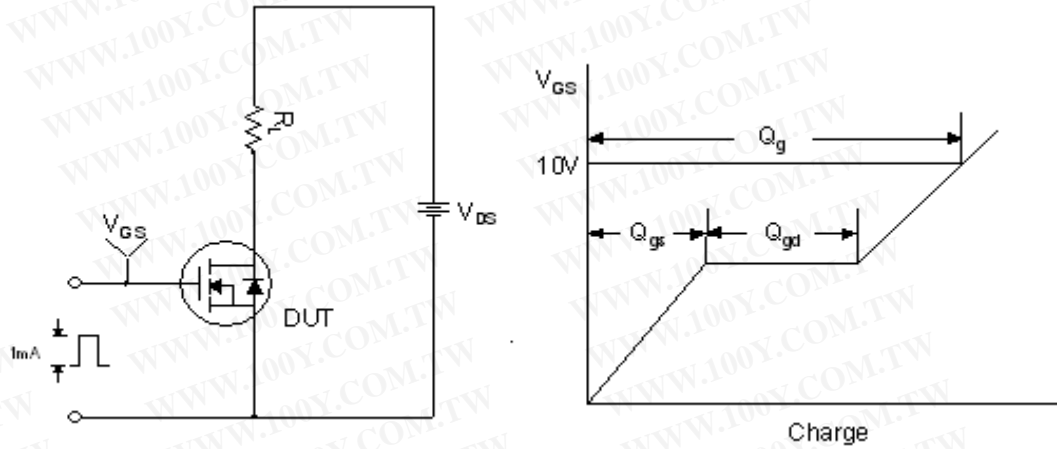


Typical Performance Characteristics (Continued)

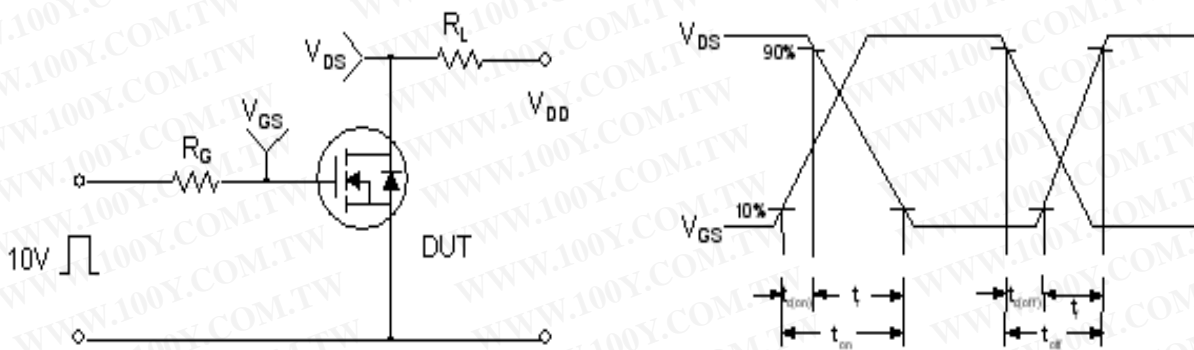
Figure 12. Transient Thermal Response Curve



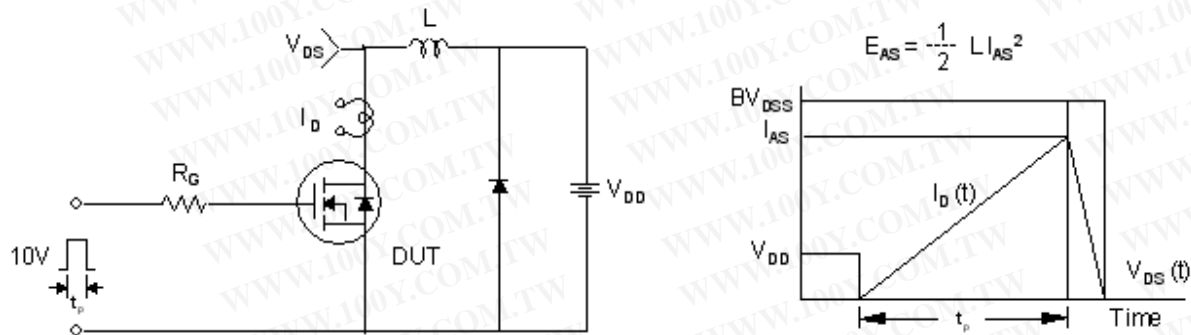
Gate Charge Test Circuit & Waveform



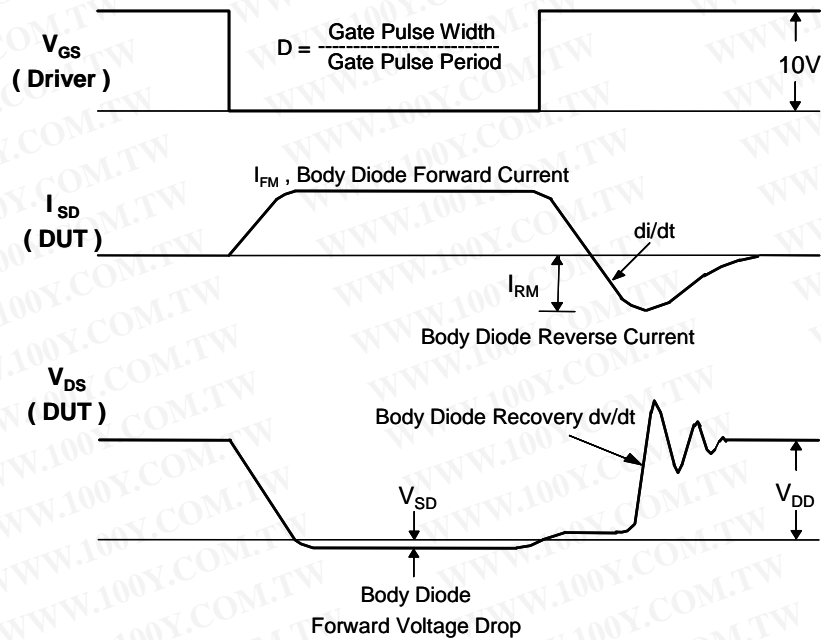
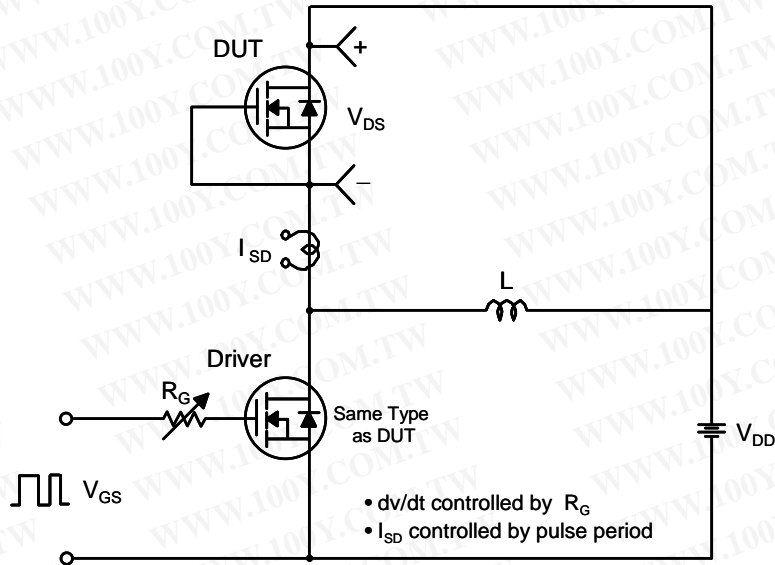
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



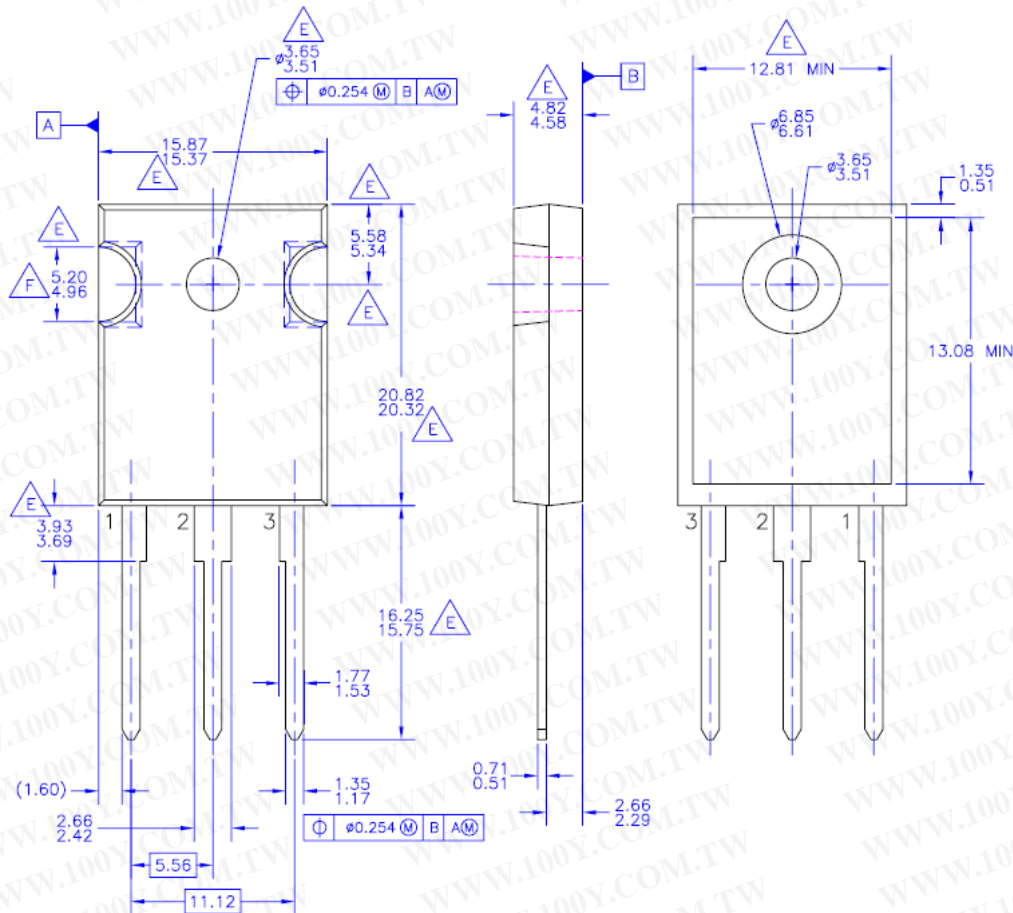
Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-247

FCH041N60F 600V N-Channel MOSFET, FRFET



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