

# MOSFET – N-Channel, SUPREMOS, FRFET

600 V, 48.5 A, 65 mΩ

## FCH47N60NF

### Description

The SUPREMOS<sup>®</sup> MOSFET is ON Semiconductor's next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest R<sub>sp</sub> on-resistance, superior switching performance and ruggedness. SUPREMOS MOSFET is suitable for high frequency switching power converter applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SUPREMOS FRFET<sup>®</sup> MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.

### Features

- 650 V @ T<sub>J</sub> = 150°C
- Typ. R<sub>DS(on)</sub> = 57.5 mΩ
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 240 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 420 pF)
- 100% Avalanche Tested
- This Device is Pb-Free and is RoHS Compliant

### Applications

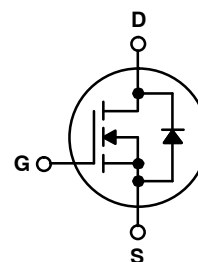
- Solar Inverter
- AC-DC Power Supply



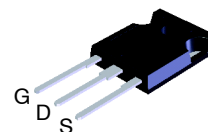
ON Semiconductor<sup>®</sup>

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V <sub>DS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
600 V	65 mΩ @ 10 V	48.5 A

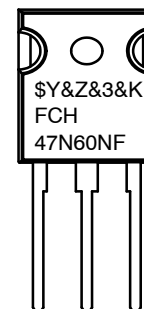


N-CHANNEL MOSFET



TO-247-3LD  
CASE 340CK

### MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FCH47N60NF	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FCH47N60NF

## MOSFET MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	FCH47N60NF	Unit
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	45.8
		- Continuous ( $T_C = 100^\circ\text{C}$ )	28.9
$I_{DM}$	Drain Current	- Pulsed (Note 1)	137.4
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	2926	mJ
$I_{AR}$	Avalanche Current (Note 1)	15.3	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	3.7	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	50	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	368
		- Derate above $25^\circ\text{C}$	2.94
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to + 150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Second	300	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2.  $I_{AS} = 15.3\text{ A}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25\ ^\circ\text{C}$

3.  $I_{SD} \leq 45.8\text{ A}$ ,  $di/dt \leq 1200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 380\text{ V}$ , starting  $T_J = 25\ ^\circ\text{C}$

## THERMAL CHARACTERISTICS

Symbol	Parameter	FCH47N60NF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.34	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Package Method	Reel Size	Tape Width	Quantity
FCH47N60NF	FCH47N60NF	TO-247-3LD	Tube	N/A	N/A	30 Units

# FCH47N60NF

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
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### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 25°C	600	–	–	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 1 mA, Referenced to 25°C	–	0.78	–	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 480 V, V <sub>GS</sub> = 0 V	–	–	10	μA
		V <sub>DS</sub> = 480 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 125°C	–	–	100	
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V	–	–	±100	nA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	3	–	5	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23.5 A	–	57.5	65.0	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 23.5 A	–	52	100	S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	4600	6120	pF
C <sub>oss</sub>	Output Capacitance		–	195	260	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	3.0	5.0	pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> = 380 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	108	–	pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	V <sub>DS</sub> = 0 V to 380 V, V <sub>GS</sub> = 0 V	–	492	–	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DS</sub> = 380 V, I <sub>D</sub> = 23.5 A, V <sub>GS</sub> = 10 V (Note 4)	–	121	157	nC
Q <sub>gs</sub>	Gate to Source Gate Charge		–	23	–	nC
Q <sub>gd</sub>	Gate to Drain “Miller” Charge		–	47	–	nC
ESR	Equivalent Series Resistance (G–S)	f = 1 MHz	–	0.9	–	Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 380 V, I <sub>D</sub> = 23.5 A, R <sub>G</sub> = 4.7 Ω (Note 4)	–	34	78	ns
t <sub>r</sub>	Turn-On Rise Time		–	22	54	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		–	117	244	ns
t <sub>f</sub>	Turn-Off Fall Time		–	4	18	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

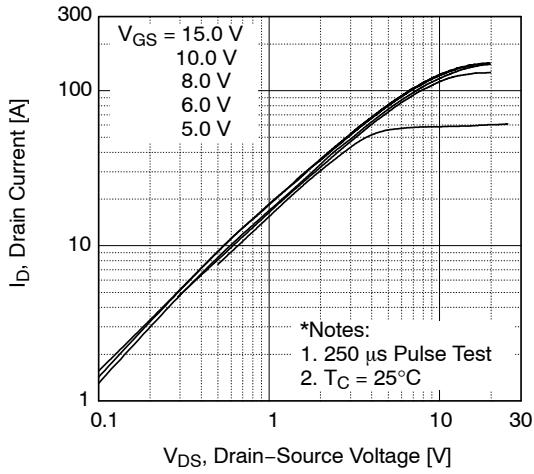
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current	–	–	47	A	
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current	–	–	141	A	
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 23.5 A	–	–	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 23.5 A, dI <sub>F</sub> /dt = 100 A/μs	–	169	–	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	1.3	–	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

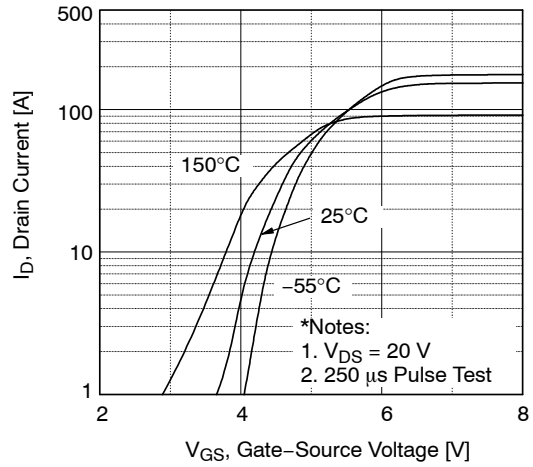
4. Essentially Independent of Operating Temperature Typical Characteristics.

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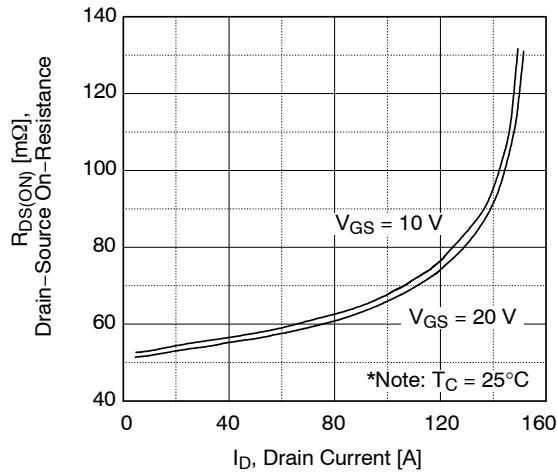
## TYPICAL CHARACTERISTICS



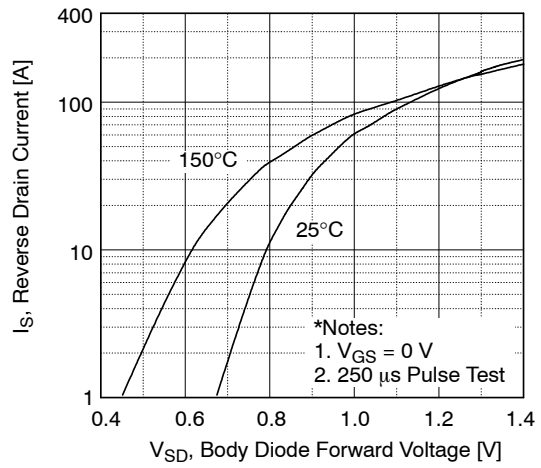
**Figure 1. On-Region Characteristics**



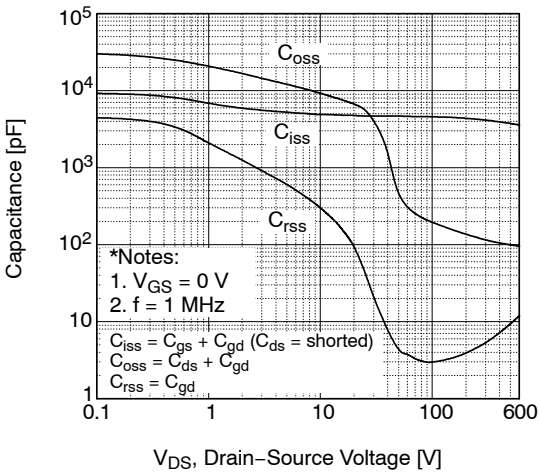
**Figure 2. Transfer Characteristics**



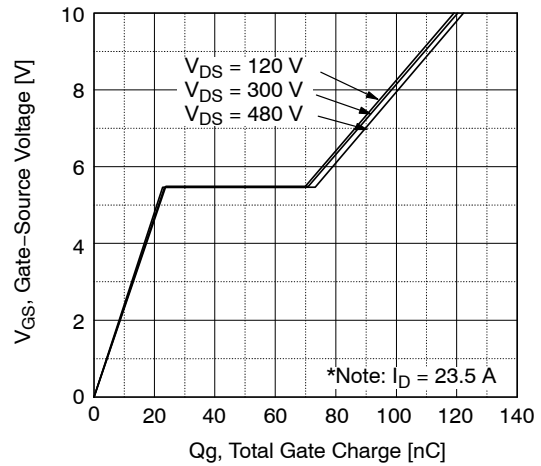
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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



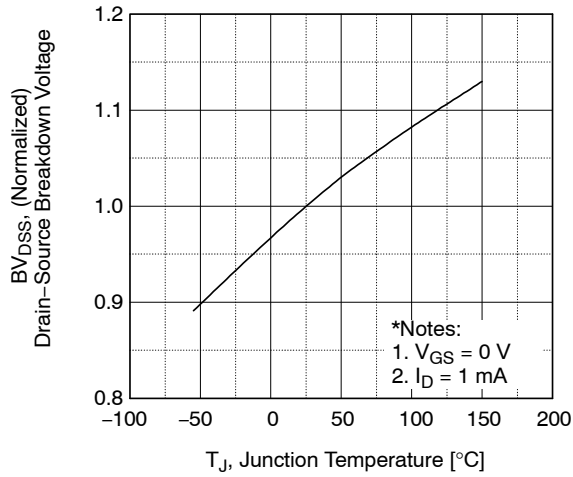
**Figure 5. Capacitance Characteristics**



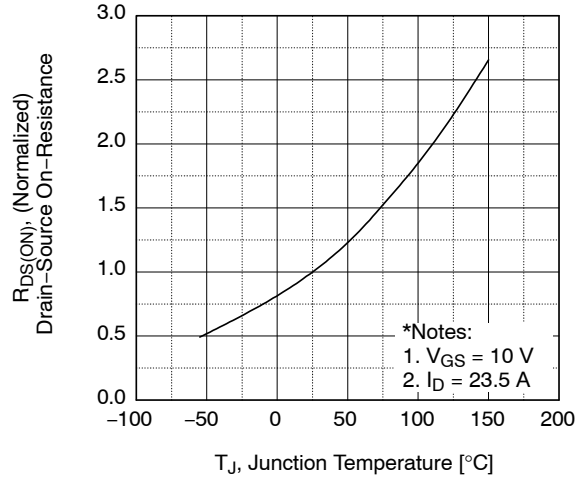
**Figure 6. Gate Charge Characteristics**

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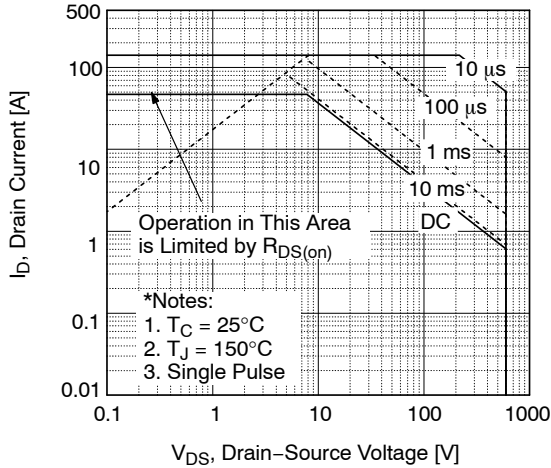
## TYPICAL CHARACTERISTICS (continued)



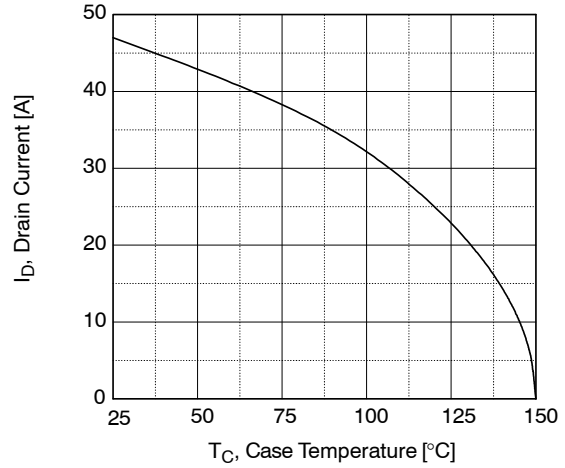
**Figure 7. Breakdown Voltage Variation vs. Temperature**



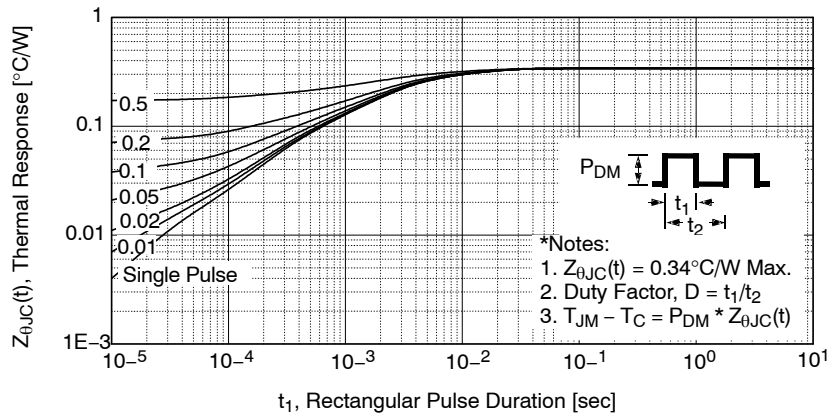
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**

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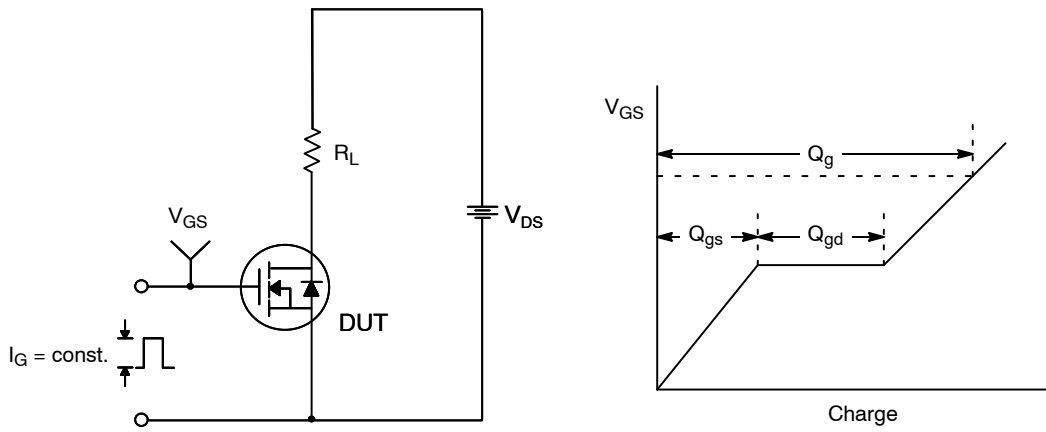


Figure 12. Gate Charge Test Circuit & Waveform

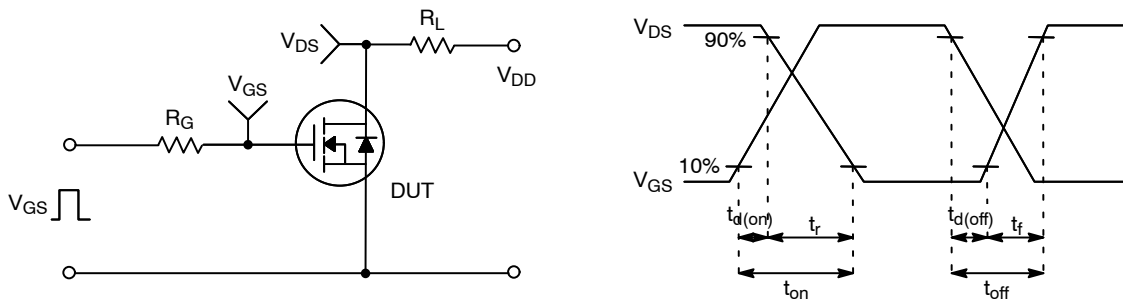


Figure 13. Resistive Switching Test Circuit & Waveforms

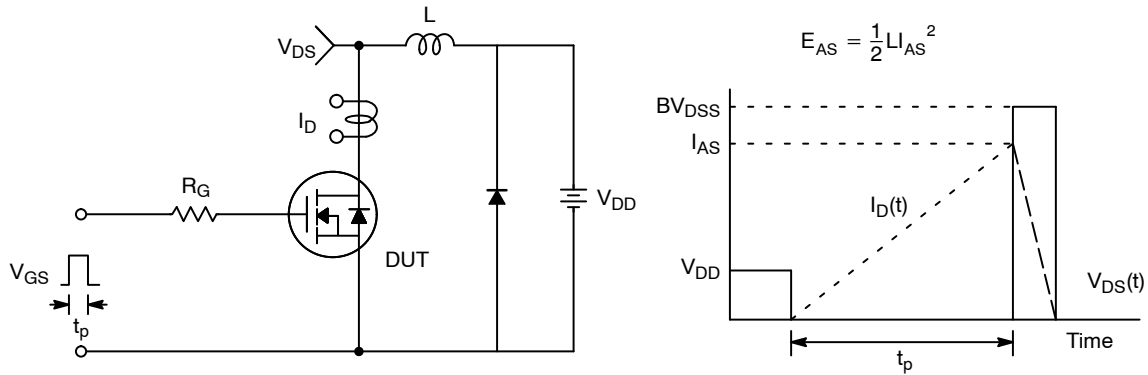
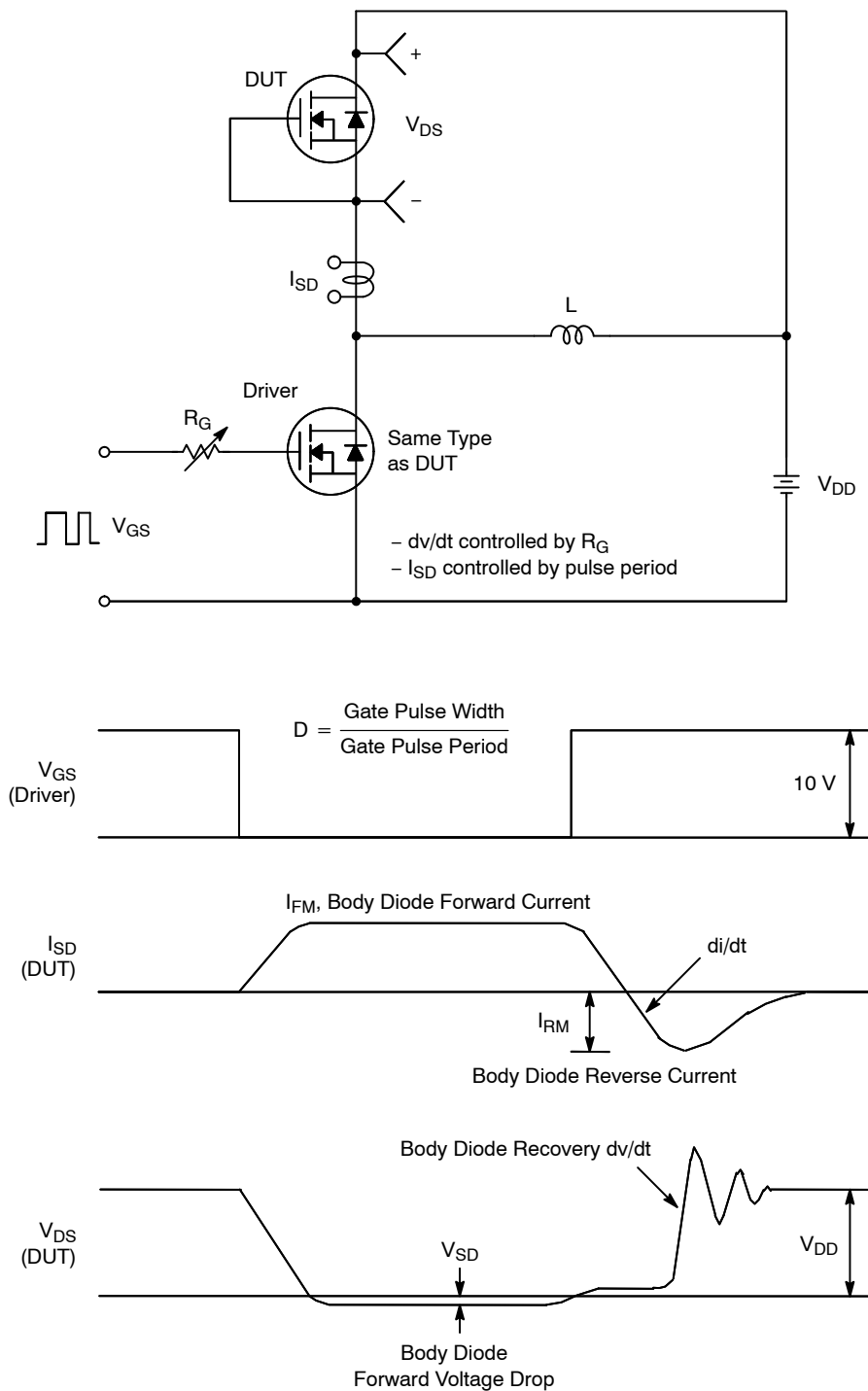


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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**Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms**

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**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

**GENERIC MARKING DIAGRAM\***



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
∅P	3.51	3.58	3.65
∅P1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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