

# MOSFET – Power, N-Channel, SUPERFET III, Easy Drive

## 650 V, 17 A, 180 mΩ

### FCMT180N65S3

#### Description

SUPERFET III MOSFET is ON 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.

Consequently, SUPERFET III MOSFET Easy-drive series helps manage EMI issues and allows for easier design implementation.

The Power88 package is an ultra-slim surface-mount package (1 mm high) with a low profile and small footprint (8x8 mm<sup>2</sup>). SUPERFET III MOSFET in a Power88 package offers excellent switching performance due to lower parasitic source inductance and separated power and drive sources. Power88 offers Moisture Sensitivity Level 1 (MSL 1).

#### Features

- 700 V @ T<sub>J</sub> = 150 °C
- Typ R<sub>DS(on)</sub> = 152 mΩ
- Ultra Low Gate Charge (Typ. Q<sub>g</sub> = 33 nC)
- Low Effective Output Capacitance (Typ. C<sub>oss(eff.)</sub> = 305 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

#### Applications

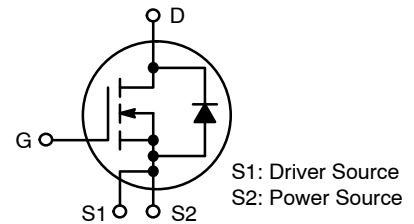
- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar
- Lighting / Charger / Adapter



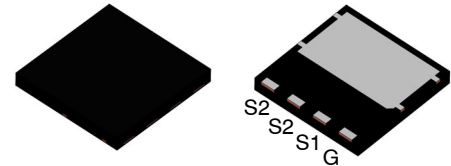
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

V <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
650 V	180 mΩ @ 10 V	17 A

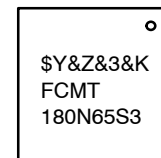


POWER MOSFET



PQFN4 8X8 2P  
CASE 483AP

#### MARKING DIAGRAM



- \$Y = ON Semiconductor Logo
- &Z = Assembly Plant Code
- &3 = Data Code (Year & Week)
- &K = Lot Code
- FCMT180N65S3 = Specific Device Code

#### ORDERING INFORMATION

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

# FCMT180N65S3

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, Unless otherwise specified)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain to Source Voltage	650	V
V <sub>GSS</sub>	Gate to Source Voltage	DC	±30
		AC (f > 1 Hz)	±30
I <sub>D</sub>	Drain Current	Continuous (T <sub>C</sub> = 25°C)	17
		Continuous (T <sub>C</sub> = 100°C)	11
I <sub>DM</sub>	Drain Current	Pulsed (Note 1)	42.5
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	80	mJ
I <sub>AS</sub>	Avalanche Current (Note 2)	2.4	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	1.39	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	20	
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	139
		Derate Above 25°C	1.11
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, 1/8" from Case for 5 s	300	°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<sub>AS</sub> = 2.4 A, R<sub>G</sub> = 25 Ω starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 9 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ 400 V, starting T<sub>J</sub> = 25°C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	0.9	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max. (Note 4)	45	

4. Device on 1 in<sup>2</sup> pad 2 oz copper pad on 1.5 x 1.5 in. board of FR-4 material.

## ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping†
FCMT180N65S3	FCMT180N65S3	PQFN8	13"	13.3 mm	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# FCMT180N65S3

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
--------	-----------	----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 25°C	650			V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 150°C	700			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 1mA, referenced to 25°C		0.64		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V			10	μA
		V <sub>DS</sub> = 520 V, T <sub>C</sub> = 125 °C		1.18		
I <sub>GSS</sub>	Gate to Source 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> = 0.39 mA	2.5		4.5	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 8.5 A		152	180	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 8.5 A		11		S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1350		pF
C <sub>oss</sub>	Output Capacitance			30		pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		305		pF
C <sub>oss(er.)</sub>	Energy Related Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		42		pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 8.5 A, V <sub>GS</sub> = 10 V (Note 5)		33		nC
Q <sub>gs</sub>	Gate to Source Gate Charge			8		nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge			14		nC
ESR	Equivalent Series Resistance	f = 1 MHz		0.5		Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 8.5 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 4.7 Ω (Note 5)		17		ns
t <sub>r</sub>	Rise Time			16		ns
t <sub>d(off)</sub>	Turn-Off Delay Time			43		ns
t <sub>f</sub>	Fall Time			6		ns

### SOURCE-DRAIN DIODE CHARACTERISTICS

I <sub>S</sub>	Maximum Continuous Source to Drain Diode Forward Current			17		A
I <sub>SM</sub>	Maximum Pulsed Source to Drain Diode Forward Current			42.5		A
V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 8.5 A			1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>DD</sub> = 400 V, I <sub>SD</sub> = 8.5 A, di <sub>F</sub> /dt = 100 A/μs		290		ns
Q <sub>rr</sub>	Reverse Recovery Charge			3.9		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.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

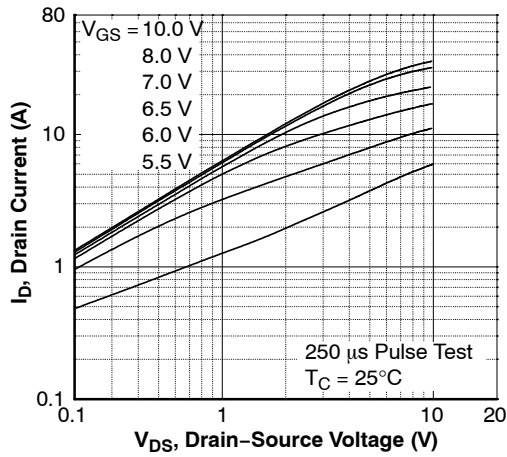


Figure 1. On-Region Characteristics

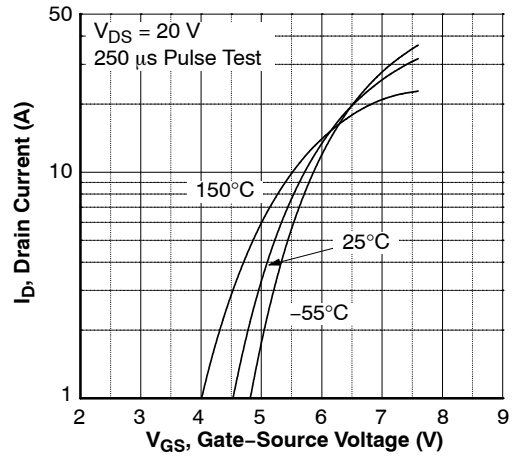


Figure 2. Transfer Characteristics

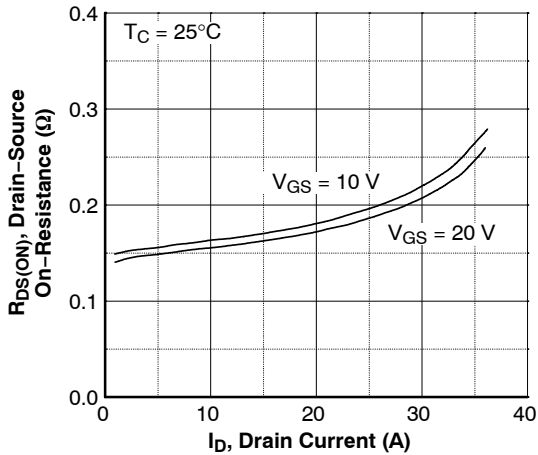


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

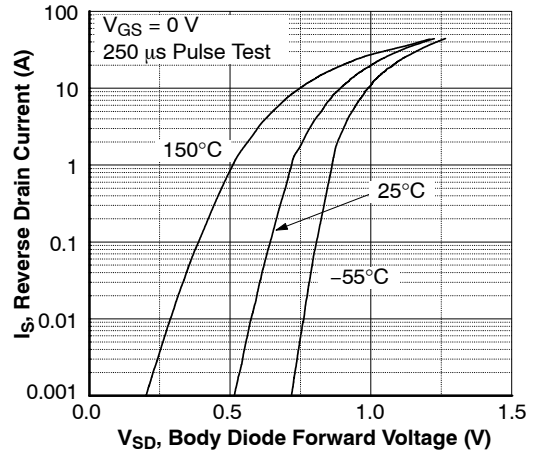


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

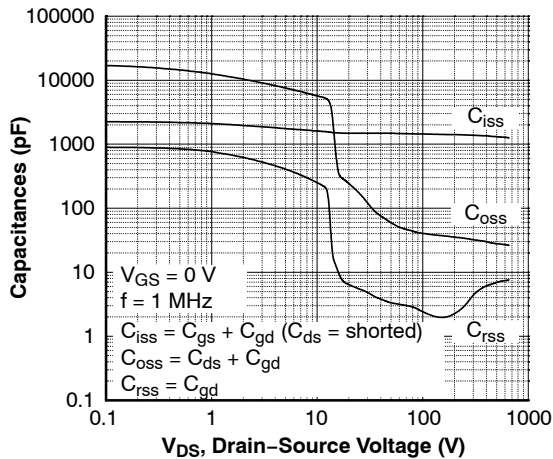


Figure 5. Capacitance Characteristics

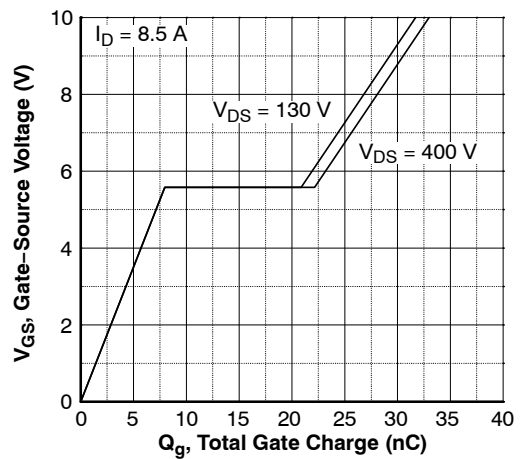


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

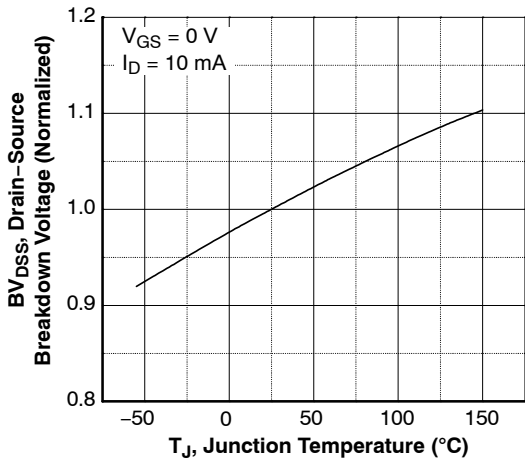


Figure 7. Breakdown Voltage Variation vs. Temperature

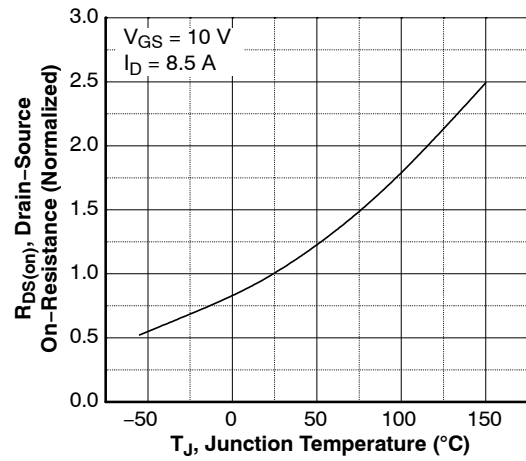


Figure 8. On-Resistance Variation vs. Temperature

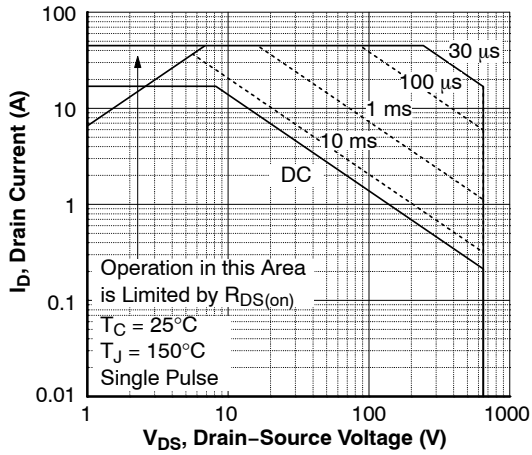


Figure 9. Maximum Safe Operating Area

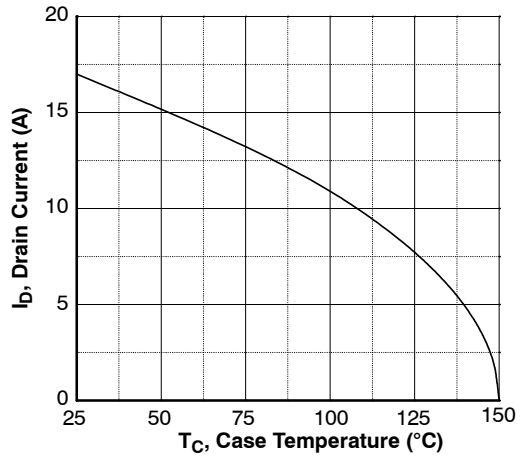


Figure 10. Maximum Drain Current vs. Case Temperature

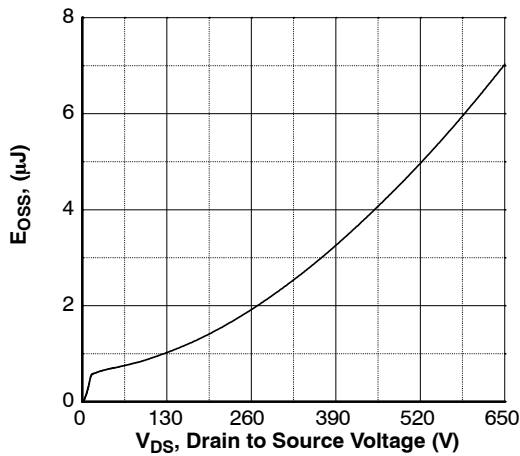


Figure 11.  $E_{OSS}$  vs. Drain to Source Voltage

# FCMT180N65S3

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

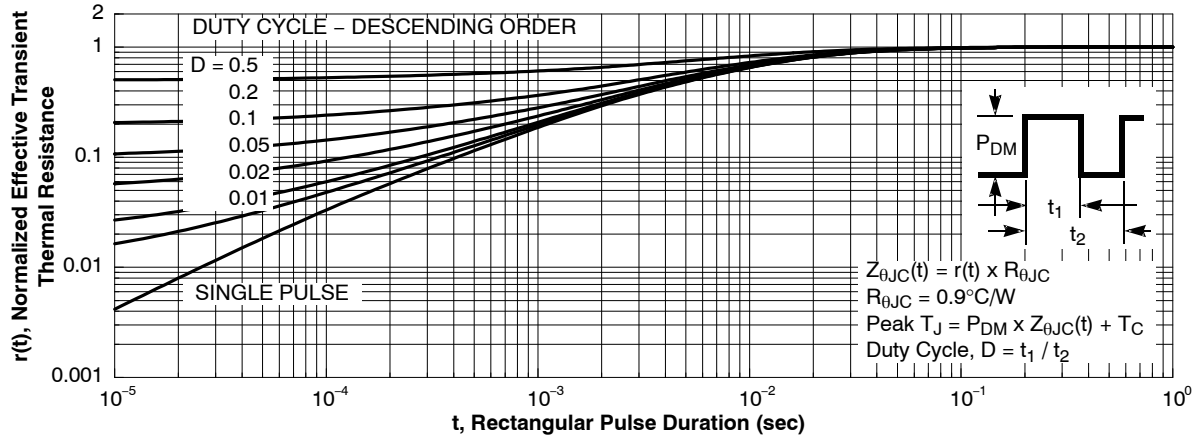


Figure 12. Transient Thermal Response Curve

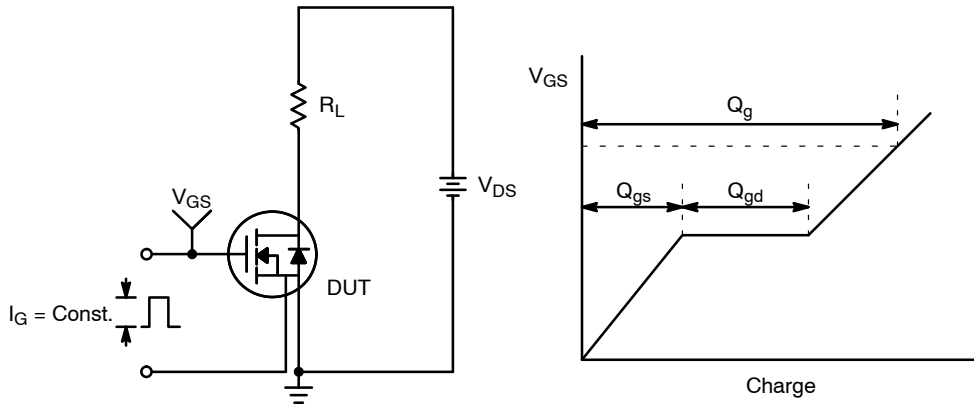


Figure 13. Gate Charge Test Circuit & Waveform

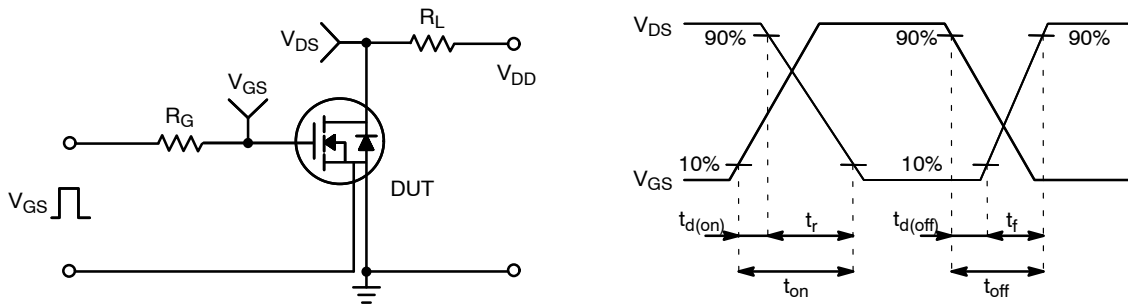


Figure 14. Resistive Switching Test Circuit & Waveforms

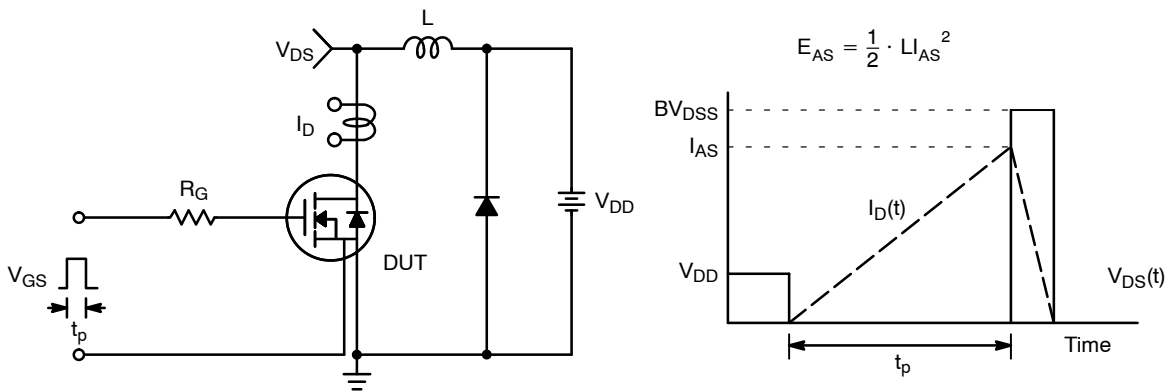
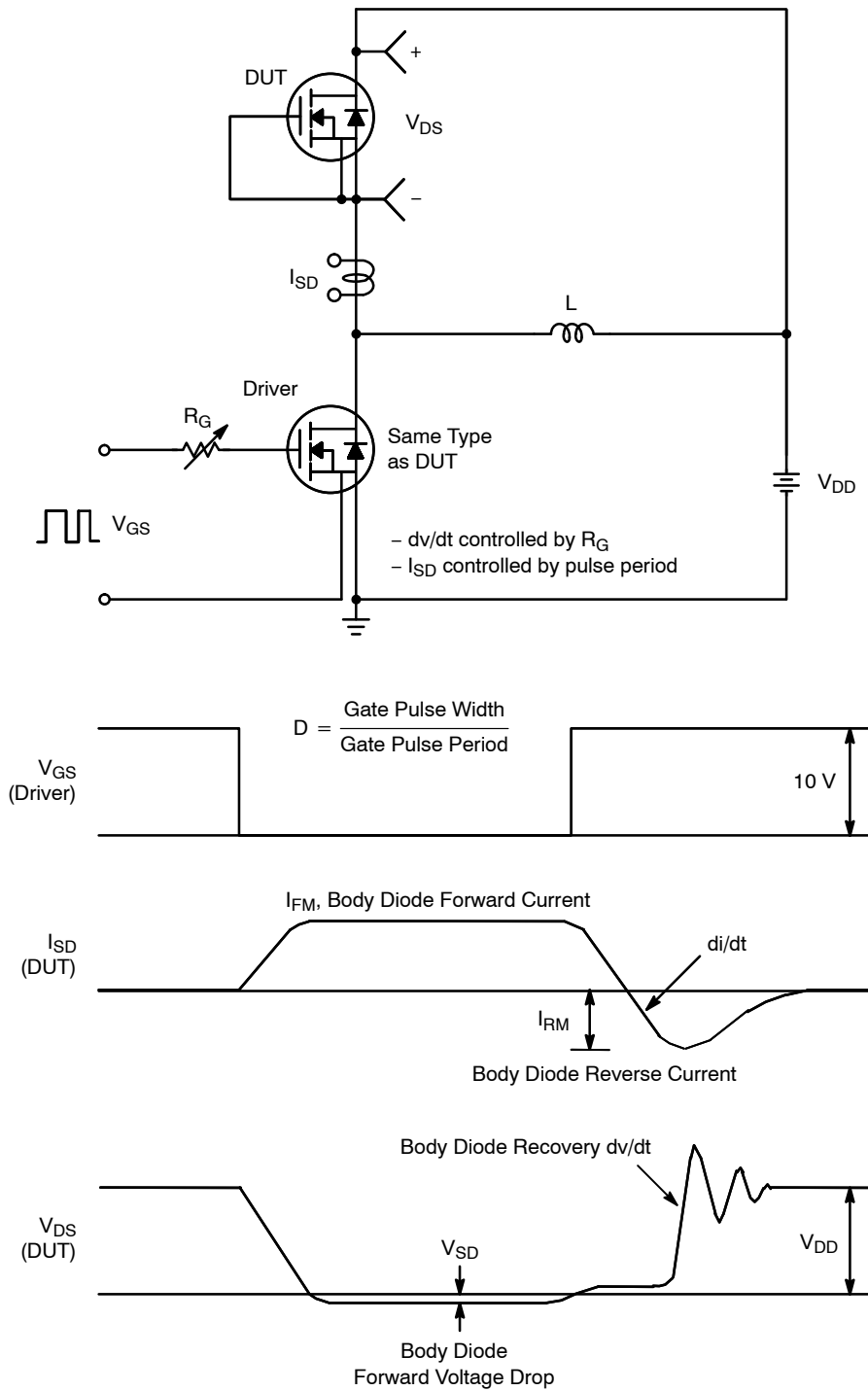


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

# FCMT180N65S3



**Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms**





ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

North American Technical Support:  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative