MOSFET – N-Channel, SUPERFET II, FRFET

600 V, 37 A, 104 mΩ

FCH104N60F-F085

ON Semiconductor®

www.onsemi.com

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
600 V	104 mΩ	37 A

Description

SUPERFET® II 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 technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently SUPERFET II is very well suited for the Soft switching and Hard Switching topologies like High Voltage Full Bridge and Half Bridge DC−DC, Interleaved Boost PFC, Boost PFC for HEV−EV automotive.

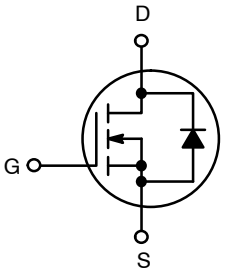
SUPERFET II FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.

Features

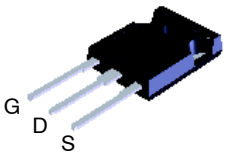
- Typical $R_{DS(on)}$ = 91 mΩ at V_{GS} = 10 V, I_D = 18.5 A
- Typical $Q_{g(tot)}$ = 109 nC at V_{GS} = 10 V, I_D = 18.5 A
- UIS Capability
- Qualified to AEC Q101 and PPAP Capable
- This Device is Pb−Free and is RoHS Compliant

Applications

- Automotive On Board Charger
- Automotive DC/DC Converter for HEV

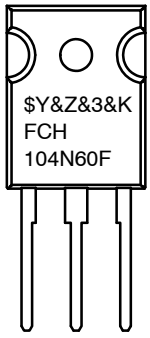


N-Channel MOSFET



TO−247
CASE 340CK

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot Code
FCH104N60F	= Specific Device Code

ORDERING INFORMATION

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

MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current − Continuous (V_{GS} = 10) (Note 1)	T_C = 25°C T_C = 100°C	37 24	A
	Pulsed Drain Current		See Fig. 4	
E_{AS}	Single Pulsed Avalanche Rating (Note 2)		809	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		50	
P_D	Power Dissipation		357	W
	Derate Above 25°C		2.85	W/°C
T_J, T_{STG}	Operating and Storage Temperature		−55 to +150	°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. Current is limited by bondwire configuration.
2. Starting T_J = 25°C, L = 35 mH, I_{AS} = 6.8 A, V_{DD} = 100 V during inductor charging and V_{DD} = 0 V during time in avalanche.
3. $I_{SD} \le$ 18.5 A, di/dt ≤ 200 A/μs, $V_{DD} \le$ 380 V, starting T_J = 25°C.
4. $R_{\theta JA}$ is the sum of the junction−to−case and case−to−ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design, while $R_{\theta JA}$ is determined by the board design. The maximum rating presented here is based on mounting on a 1 in^2 pad of 2oz copper.

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	0.35	°C/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	40	

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Quantity
FCH104N60F−F085	FCH104N60F	TO−247	−	−	30

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	600	–	–	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 600 V, V_{GS} = 0 V, T_J = 25°C	–	–	10	μA
		V_{DS} = 600 V, V_{GS} = 0 V, T_J = 150°C (Note 5)	–	–	1	mA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3	4	5	V
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10 V, I_D = 18.5 A, T_J = 25°C	–	91	104	mΩ
		V_{GS} = 10 V, I_D = 18.5 A, T_J = 150°C (Note 5)	–	217	275	mΩ
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	–	4302	–	pF
C_{oss}	Output Capacitance		–	134	–	pF
C_{rss}	Reverse Transfer Capacitance		–	1.7	–	pF
R_g	Gate Resistance	f = 1 MHz	–	0.49	–	Ω
$Q_{g(TOT)}$	Total Gate Charge	V_{DD} = 380 V, I_D = 18.5 A, V_{GS} = 10 V	–	109	139	nC
$Q_{g(th)}$	Threshold Gate Charge		–	8	11	nC
Q_{gs}	Gate to Source Gate Charge		–	23	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	46	–	nC
SWITCHING CHARACTERISTICS						
t_{on}	Turn-On Time	V_{DD} = 380 V, I_D = 18.5 A, V_{GS} = 10 V, R_G = 4.7 Ω	–	58	78	ns
$t_{d(on)}$	Turn-On Delay Time		–	35	–	ns
t_r	Rise Time		–	23	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	94	–	ns
t_f	Fall Time		–	5	–	ns
t_{off}	Turn-Off Time		–	98	131	ns
DRAIN−SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 18.5 A, V_{GS} = 0 V	–	–	1.2	V
T_{rr}	Reverse Recovery Time	I_F = 18.5 A, dI_{SD}/dt = 100 A/μs V_{DD} = 480 V	–	162	–	ns
Q_{rr}	Reverse Recovery Charge		–	1223	–	nC

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. The maximum value is specified by design at T_J = 150°C. Product is not tested to this condition in production.

TYPICAL CHARACTERISTICS

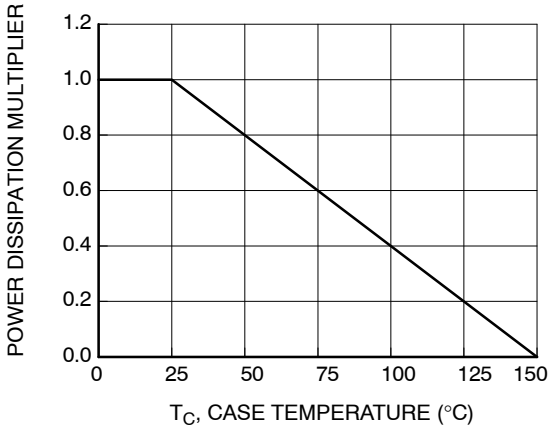


Figure 1. Normalized Power Dissipation vs. Case Temperature

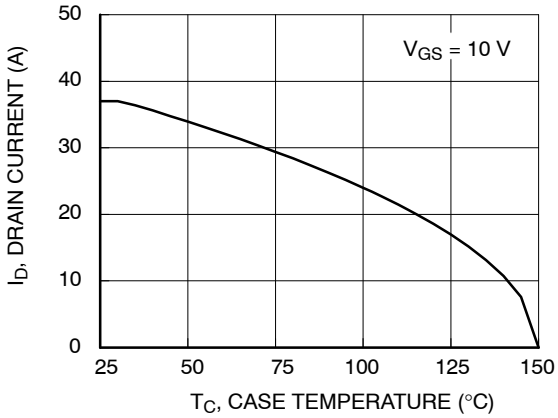


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

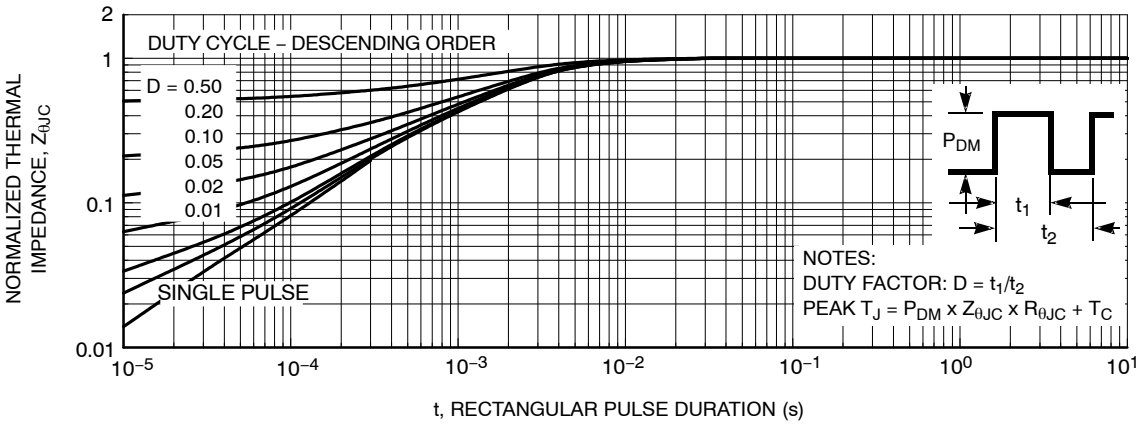


Figure 3. Normalized Maximum Transient Thermal Impedance

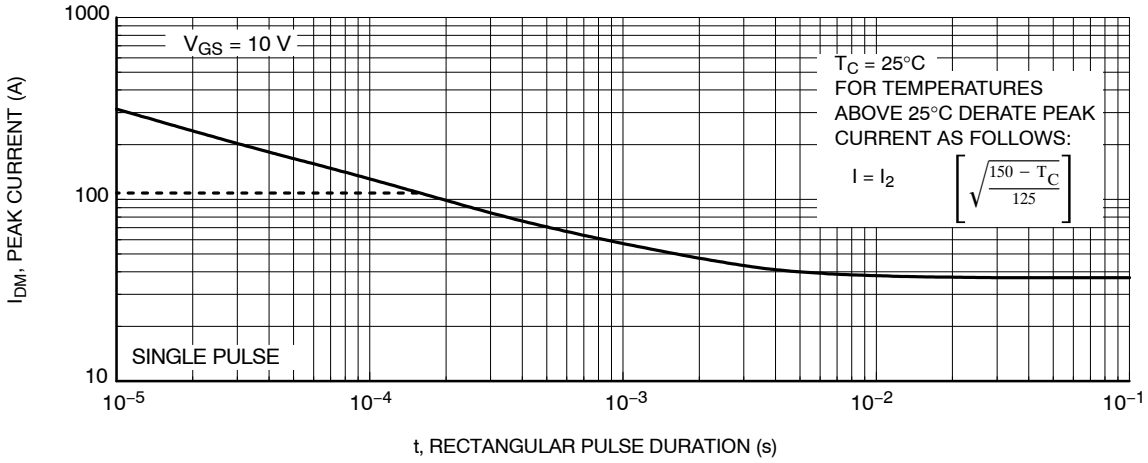


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS (continued)

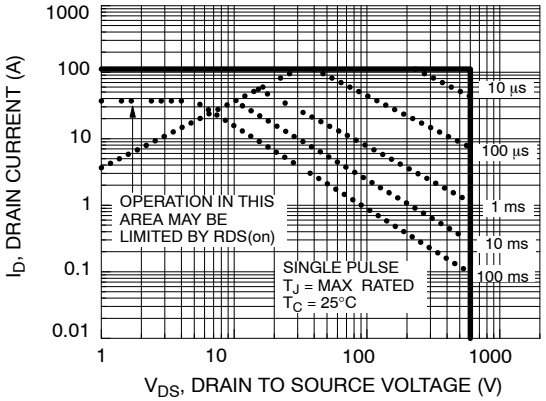


Figure 5. Forward Bias Safe Operating Area

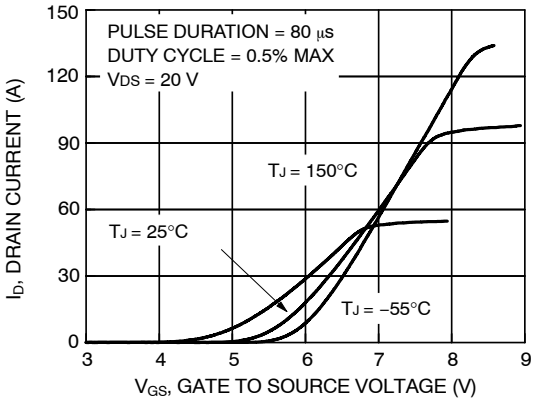


Figure 6. Transfer Characteristics

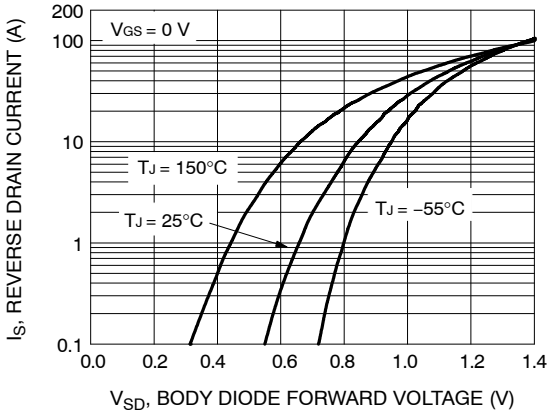


Figure 7. Forward Diode Characteristics

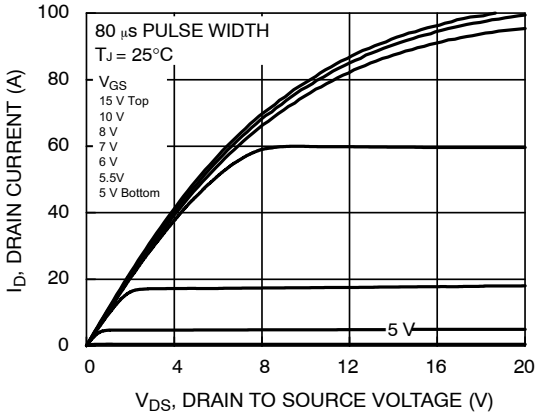


Figure 8. Forward Diode Characteristics

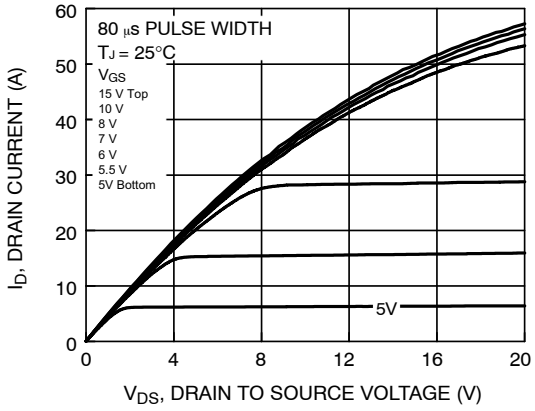


Figure 9. Saturation Characteristics

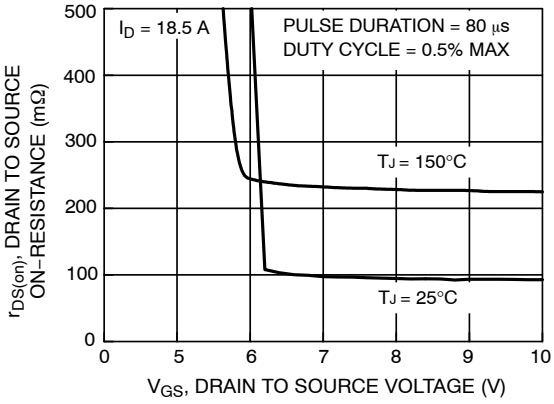


Figure 10. R_{DSON} vs. Gate Voltage

TYPICAL CHARACTERISTICS (continued)

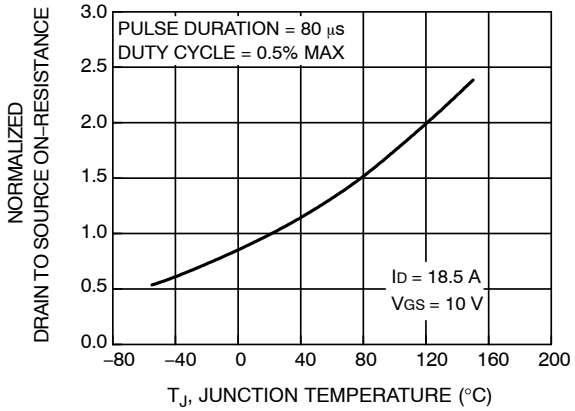


Figure 11. Normalized R_{DSON} vs. Junction Temperature

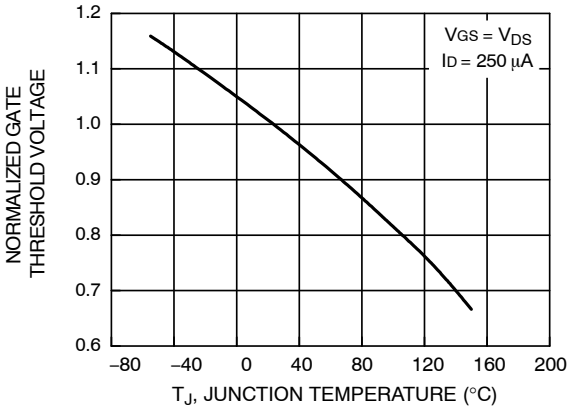


Figure 12. Normalized Gate Threshold Voltage vs. Temperature

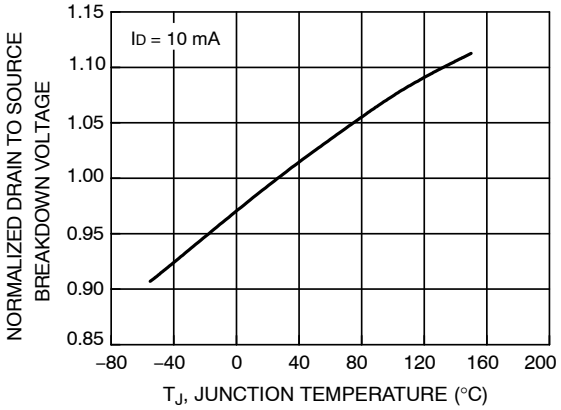


Figure 13. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

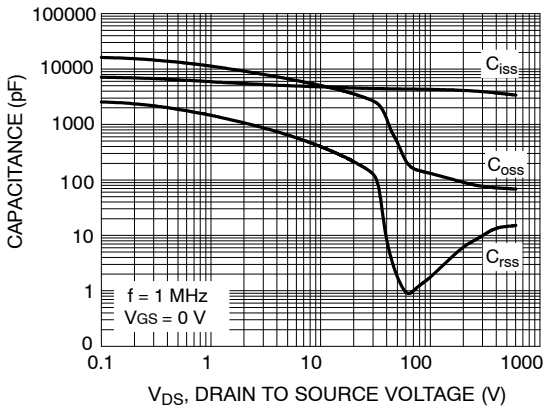


Figure 14. Capacitance vs. Drain to Source Voltage

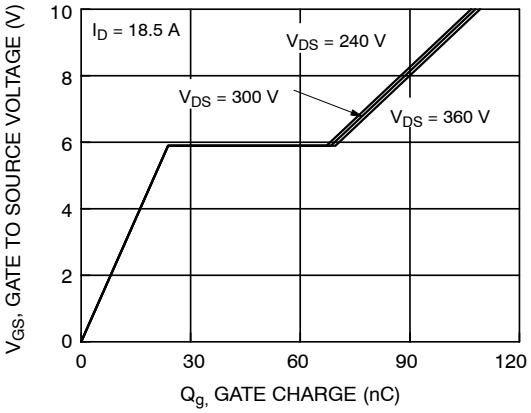


Figure 15. Gate Charge vs. Gate to Source Voltage

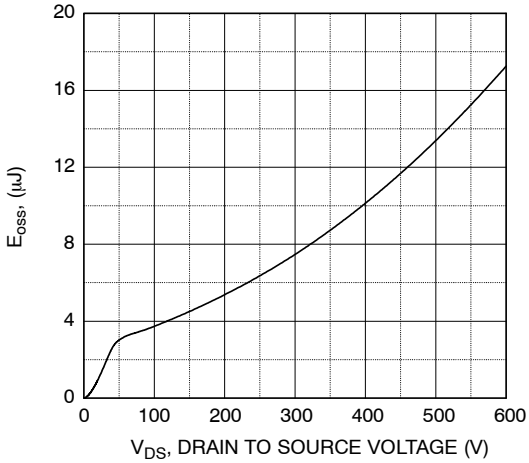


Figure 16. Eoss vs. Drain to Source Voltage

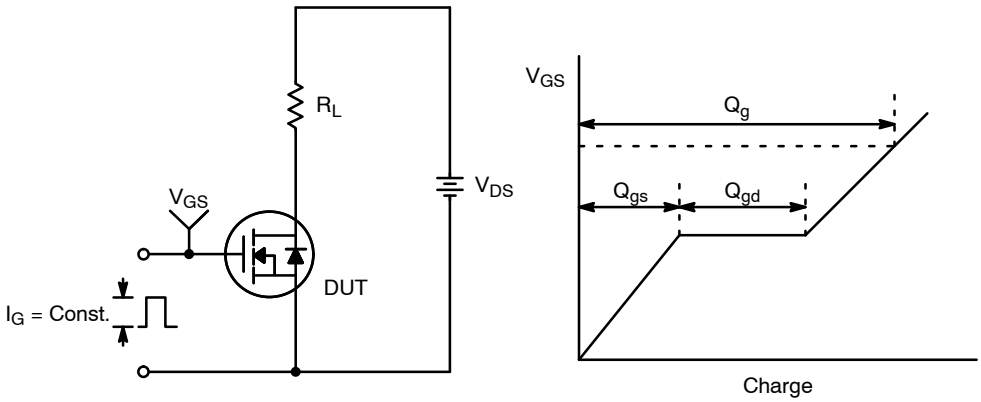


Figure 17. Gate Charge Test Circuit & Waveform

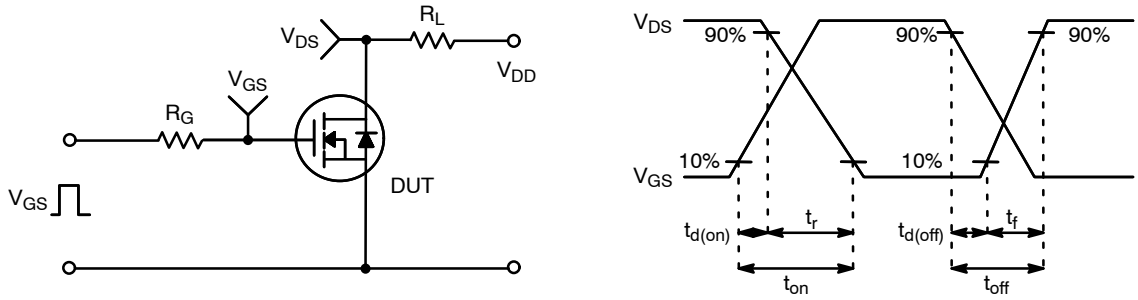


Figure 18. Resistive Switching Test Circuit & Waveforms

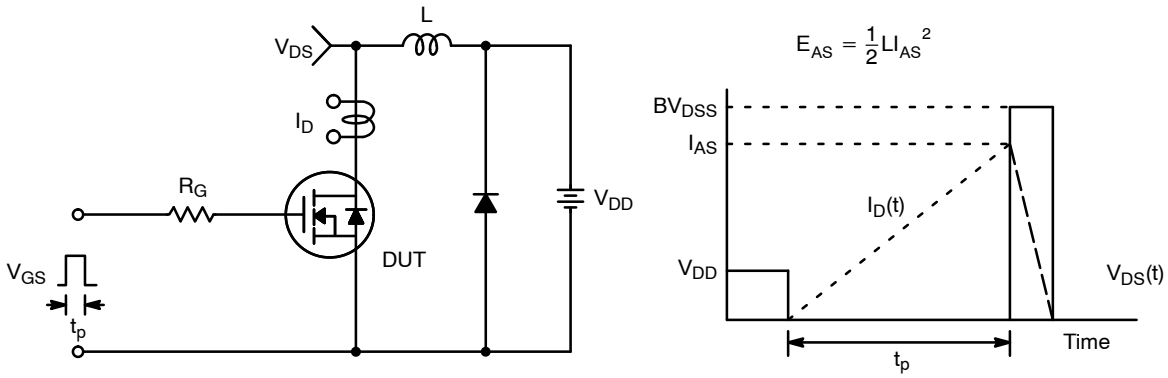


Figure 19. Unclamped Inductive Switching Test Circuit & Waveforms

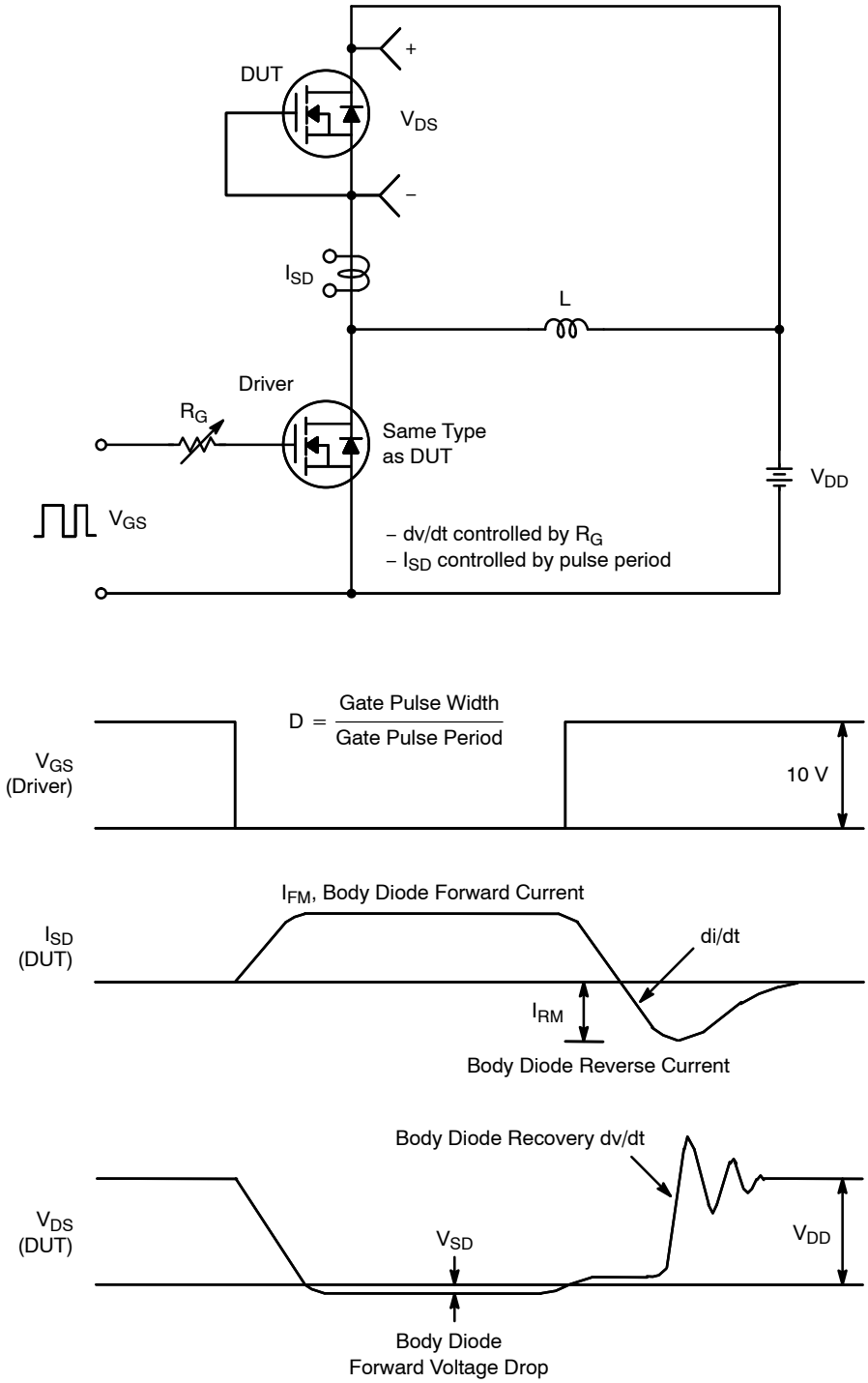


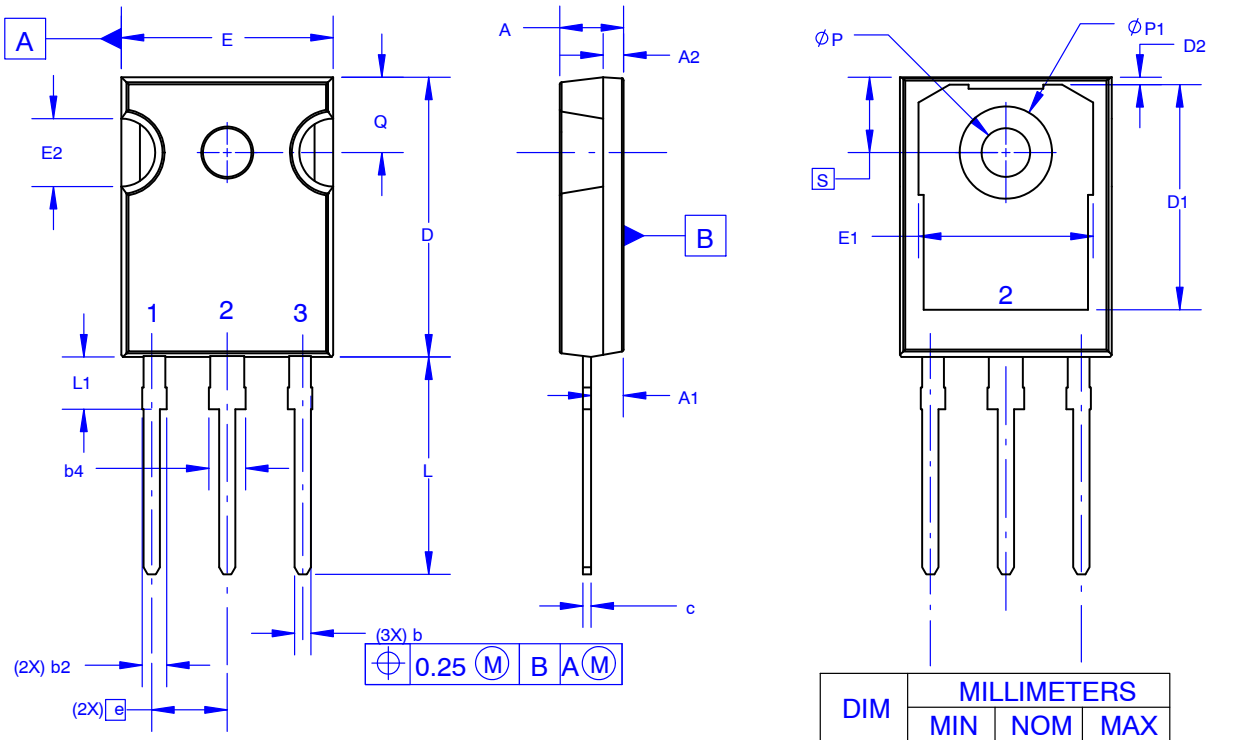
Figure 20. Peak Diode Recovery dv/dt Test Circuit & Waveforms

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

TO−247−3LD SHORT LEAD
CASE 340CK
ISSUE A

DATE 31 JAN 2019

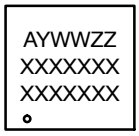


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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.

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DESCRIPTION:	**TO−247−3LD SHORT LEAD**	**PAGE 1 OF 1**

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