MOSFET – N-Channel, SUPERFET® II

600 V, 47 A, 70 mΩ

FCH47N60

Description

SuperFET II MOSFET is ON Semiconductor's first generation of high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low onresistance 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 MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.

Features

- Typ. $R_{DS(on)}$ = 58 mΩ
- 650 V @ T_J = 150°C
- Ultra Low Gate Charge (Typ. Q_g = 210 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 420 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

Applications

- Telecom / Sever Power Supplies
- Industrial Power Supplies

ON Semiconductor®

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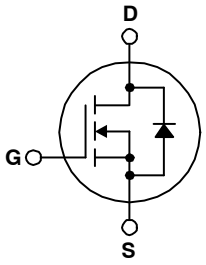
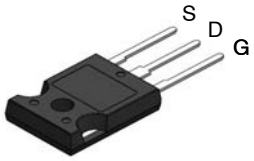
V_{DS}	$R_{DS(ON)}$ MAX	I_D MAX
600 V	70 mΩ @ 10 V	47 A

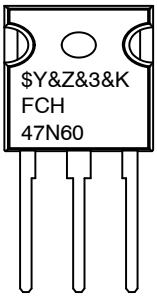


N-CHANNEL MOSFET



TO−247−3LD
CASE 340CK

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FCH47N60	= Specific Device Code

ORDERING INFORMATION

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

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter		FCH47N60	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage		±30	
I_D	Drain Current:	– Continuous (T_C = 25°C)	47	A
		– Continuous (T_C = 100°C)	29.7	
I_{DM}	Drain Current:	– Pulsed (Note 1)	141	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		1800	mJ
I_{AR}	Avalanche Current (Note 1)		47	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		41.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)	417	W
		– Derate Above 25°C	3.33	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		–55 to + 150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8″ from Case for 5 seconds		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_{AS} = 18 A, V_{DD} = 50 V, R_G = 25 Ω, Starting T_J = 25 °C.
3. I_{SD} ≤ 48 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25 °C.

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH47N60_F133	FCH47N60	TO−247	Tube	N/A	N/A	30 Units

THERMAL CHARACTERISTICS

Symbol	Parameter	FCH47N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Case−to−Sink, Typ.	0.24	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	41.7	°C/W

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_C = 25°C	600	–	–	V
		V_{GS} = 0 V,I_D = 250 μA, T_C = 150°C	–	650	–	
ΔBV_{DSS} /ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	0.6	–	V/°C
BV_{DS}	Drain to Source Avalanche Breadown Voltage	V_{GS} = 0 V, I_D = 47 A	–	700	–	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 480 V, T_C = 125 °C	–	–	10	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3	–	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 23.5 A	–	0.058	0.070	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 23.5 A	–	40	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	–	5900	8000	pF
C_{oss}	Output Capacitance		–	3200	4200	pF
C_{rss}	Reverse Transfer Capacitance		–	250	–	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	–	160	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	420	–	pF
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 47 A, V_{GS} = 10 V, R_g = 25 Ω (Note 4)	–	185	430	ns
t_r	Turn−On Rise Time		–	210	450	ns
$t_{d(off)}$	Turn-Off Delay Time		–	520	1100	ns
t_f	Turn−Off Fall Time		–	75	160	ns
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 480 V, I_D = 47 A, V_{GS} = 10 V (Note 4)	–	210	270	nC
Q_{gs}	Gate to Source Gate Charge		–	38	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	110	–	nC
DRAIN-SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source to Drain Diode Forward Current		–	–	47	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		–	–	141	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 47 A	–	–	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 47 A, dI_F/dt = 100 A/μs	–	590	–	ns
Q_{rr}	Reverse Recovery Charge		–	25	–	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

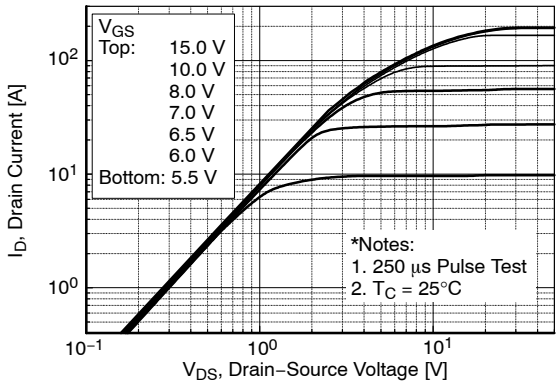


Figure 1. On−Region Characteristics

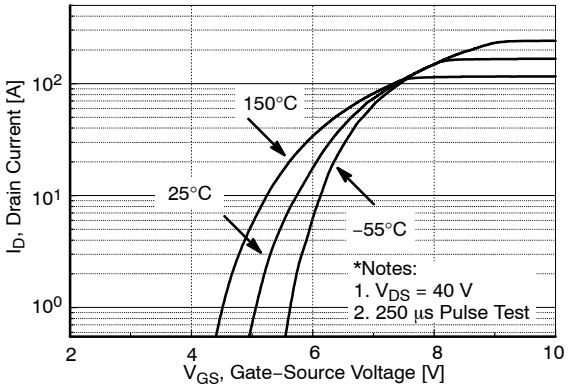


Figure 2. Transfer Characteristics

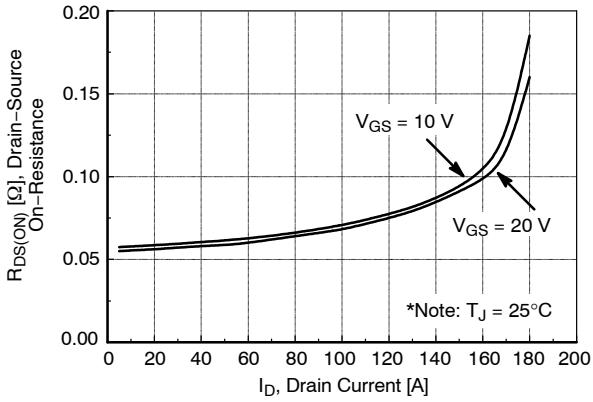


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

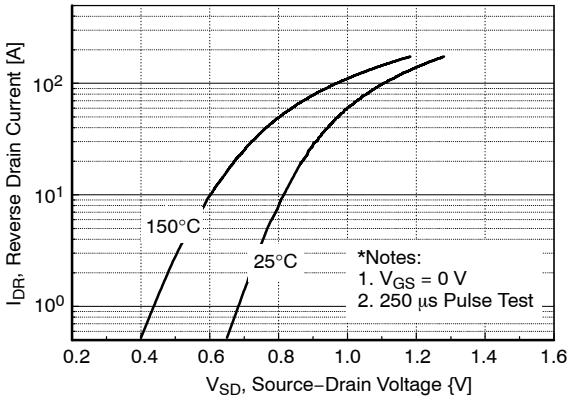


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

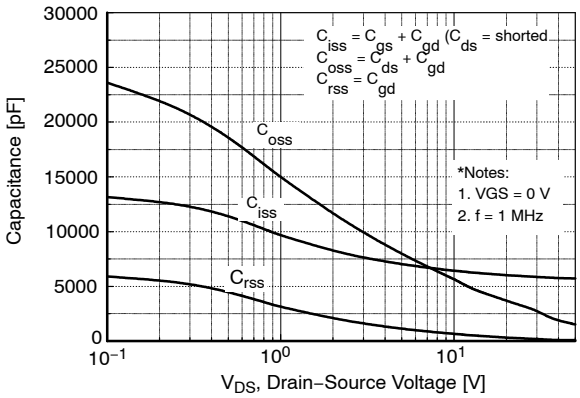


Figure 5. Capacitance Characteristics

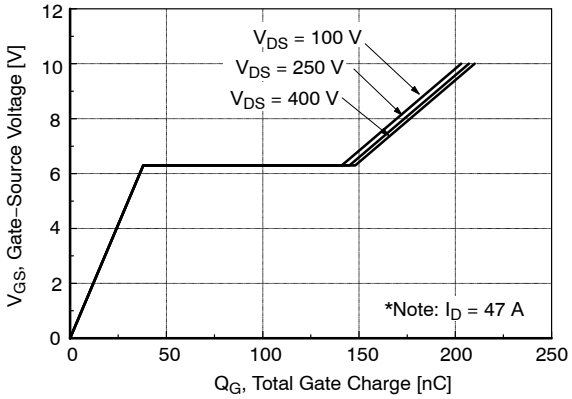


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

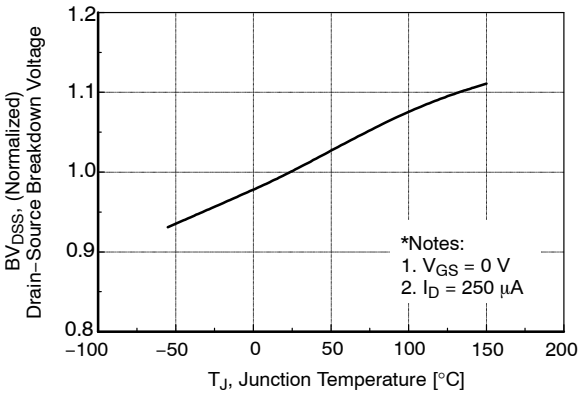


Figure 7. Breakdown Voltage Variation vs. Temperature

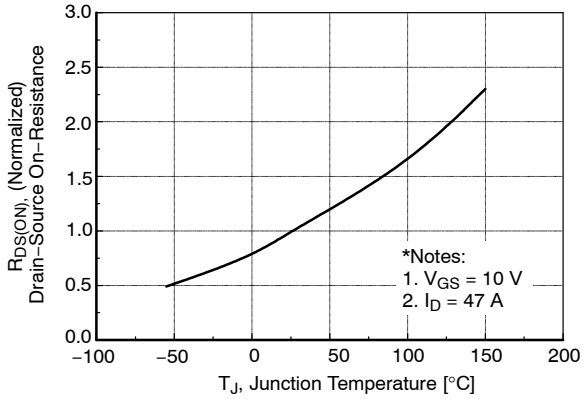


Figure 8. On−Resistance Variation vs. Temperature

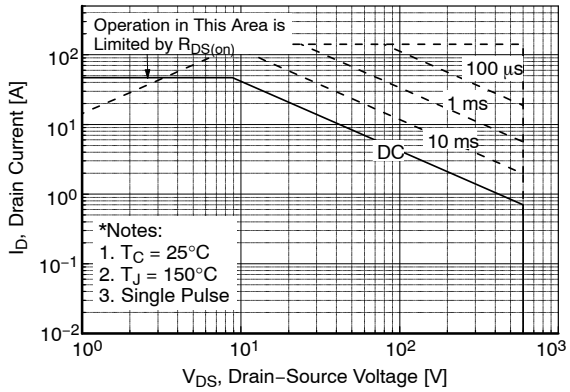


Figure 9. Safe Operating Area

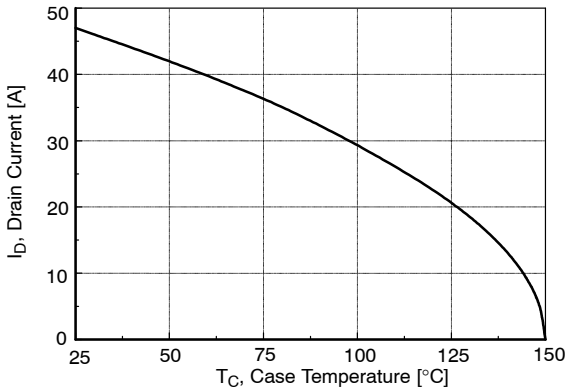


Figure 10. Maximum Drain Current vs. Case Temperature

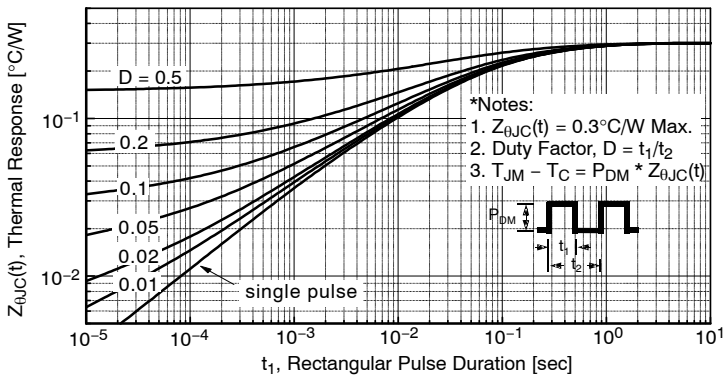


Figure 11. Transient Thermal Response Curve

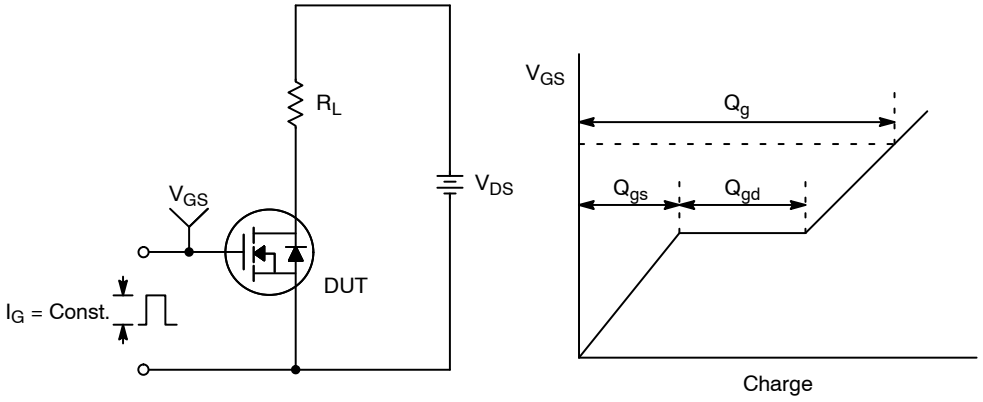


Figure 12. Gate Charge Test Circuit & Waveform

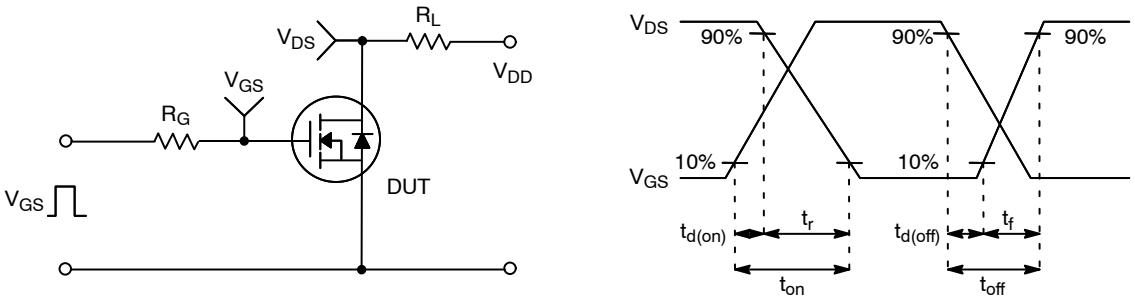


Figure 13. Resistive Switching Test Circuit & Waveforms

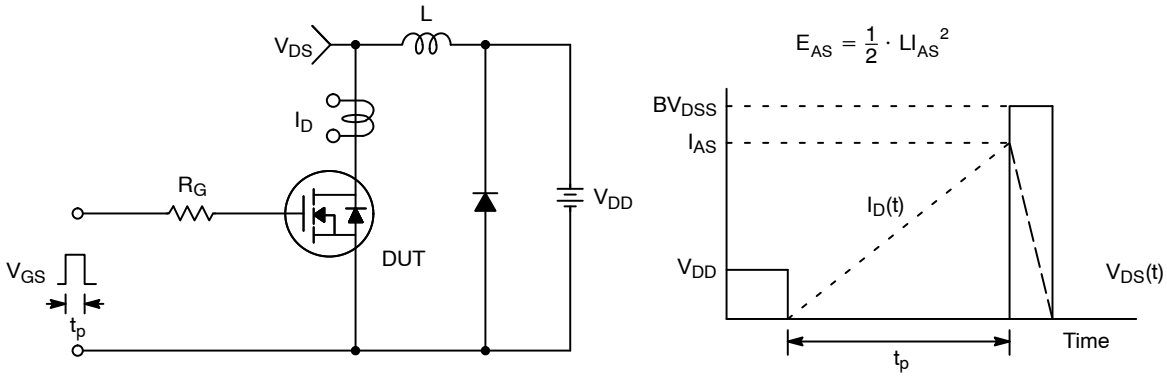


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

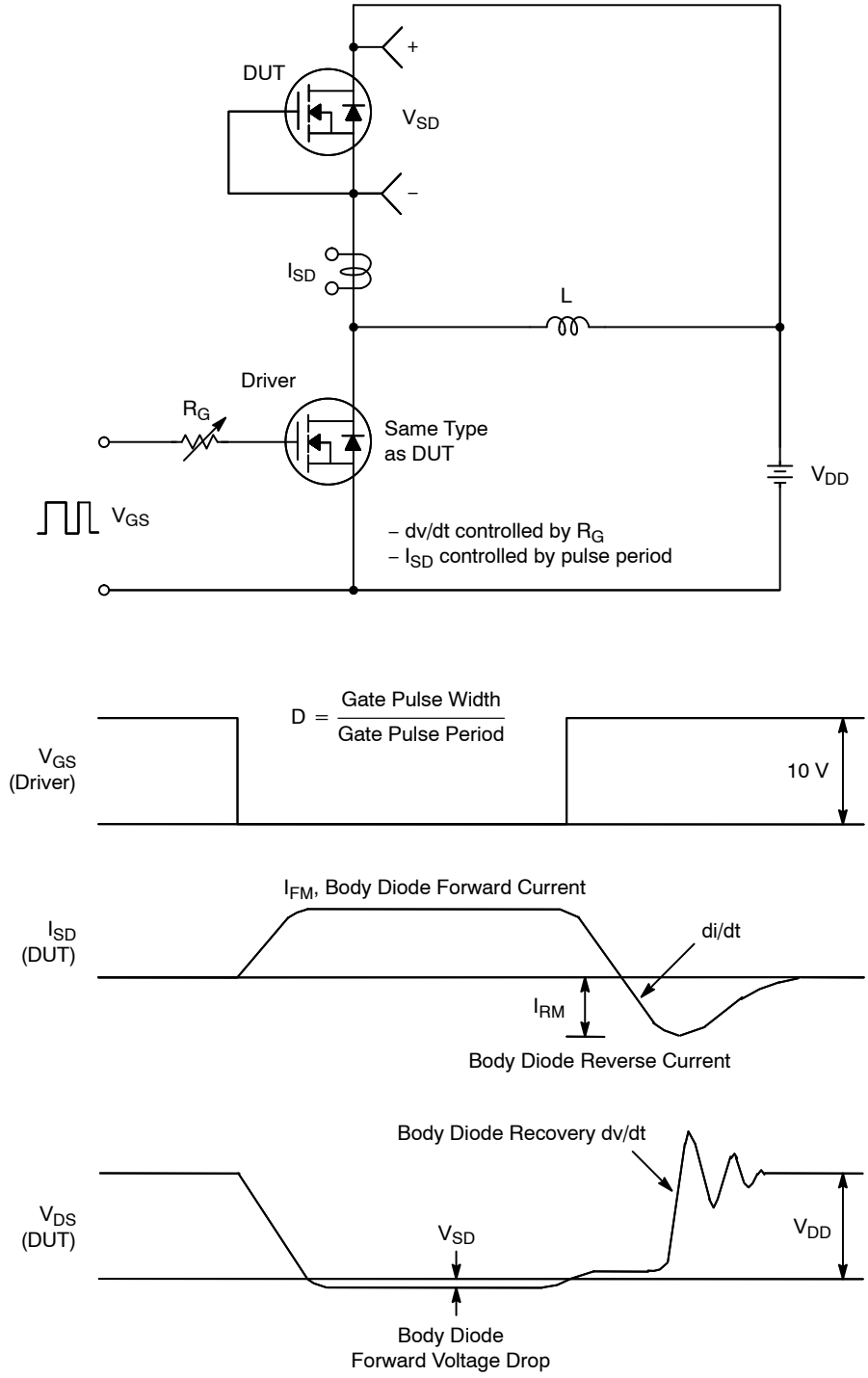


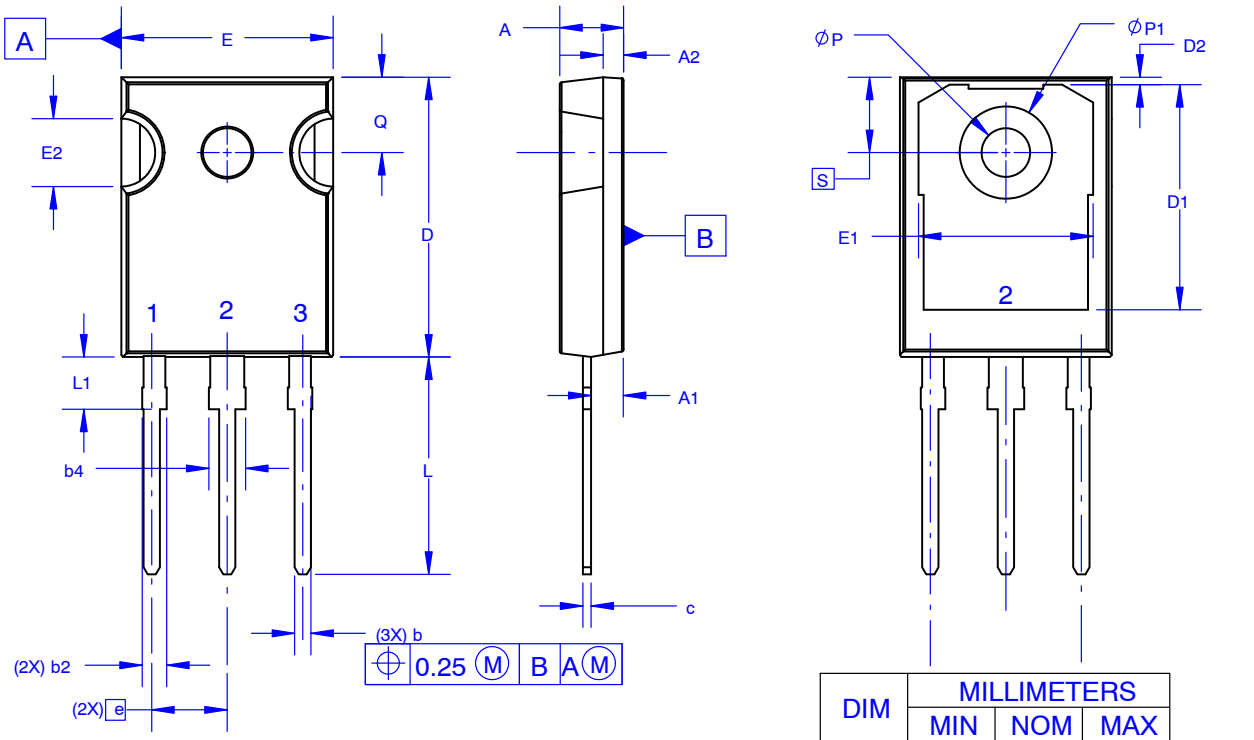
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

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

DATE 31 JAN 2019

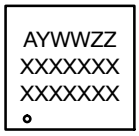


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93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