MOSFET – N-Channel, SUPERFET II, FRFET

600 V, 76 A, 41 mΩ

FCH041N60F-F085

ON Semiconductor®

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V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
600 V	41 mΩ	76 A

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Description

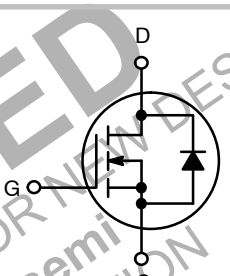
SUPERFET® II MOSFET is ON Semiconductor's brand−new high voltage super−junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on−resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, 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

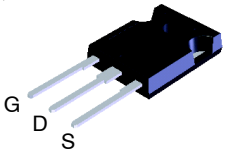
- Typical $R_{DS(on)}$ = 36 mΩ at V_{GS} = 10 V, I_D = 38 A
- Typical $Q_{g(tot)}$ = 267 nC at V_{GS} = 10 V, I_D = 38 A
- Low Effective Output Capacitance (Typical $C_{oss(eff.)}$ = 720 nF)
- 100% Avalanche Tested
- Qualified to AEC Q101 and PPAP Capable
- This Device is Pb−Free and is RoHS Compliant

Applications

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

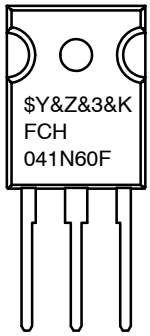


N-Channel MOSFET



TO−247
CASE 340CK

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot Code
FCH041N60F	= Specific Device Code

ORDERING INFORMATION

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

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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)	T_C = 25°C	76	A
	Pulsed Drain Current		See Fig. 4	
E_{AS}	Single Pulsed Avalanche Rating (Note 1)		2025	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 2)		50	
P_D	Power Dissipation		595	W
	Derate Above 25°C		4.76	W/°C
T_J, T_{STG}	Operating and Storage Temperature (Note 3)		−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. Starting T_J = 25°C, L = 18 mH, I_{AS} = 15 A, V_{DD} = 100 V during inductor charging and V_{DD} = 0 V during time in avalanche.
2. I_{SD} ≤ 38 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 380 V, starting T_J = 25°C.
3. $R_{\theta JA}$ 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
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.21	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Quantity
FCH041N60F−F085	FCH041N60F	TO−247	−	−	30

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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 4)	–	–	1	mA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3	4	5	V
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 38 A, T_J = 25°C	–	36	41	mΩ
		V_{GS} = 10 V, I_D = 38 A, T_J = 150°C (Note 4)	–	89	98	mΩ
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1 MHz	–	10900	–	pF
C_{oss}	Output Capacitance		–	360	–	pF
C_{rss}	Reverse Transfer Capacitance		–	4.4	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	–	720	–	pF
R_g	Gate Resistance	f = 1 MHz	–	0.7	–	Ω
$Q_{g(TOT)}$	Total Gate Charge	V_{DD} = 380 V, I_D = 38 A, V_{GS} = 10 V	–	267	347	nC
$Q_{g(th)}$	Threshold Gate Charge		–	20	26	nC
Q_{gs}	Gate to Source Gate Charge		–	59	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	106	–	nC
SWITCHING CHARACTERISTICS						
t_{on}	Turn-On Time	V_{DD} = 380 V, I_D = 38 A, V_{GS} = 10 V, R_G = 4.7 Ω	–	–	242	ns
$t_{d(on)}$	Turn-On Delay Time		–	63	–	ns
t_r	Rise Time		–	48	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	214	–	ns
t_f	Fall Time		–	33	–	ns
t_{off}	Turn-Off Time		–	–	514	ns
DRAIN−SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 38 A, V_{GS} = 0 V	–	–	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 38 A, dI_{SD}/dt = 100 A/μs, V_{DD} = 480 V	–	219	–	ns
Q_{rr}	Reverse Recovery Charge		–	1.9	–	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.

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

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TYPICAL CHARACTERISTICS

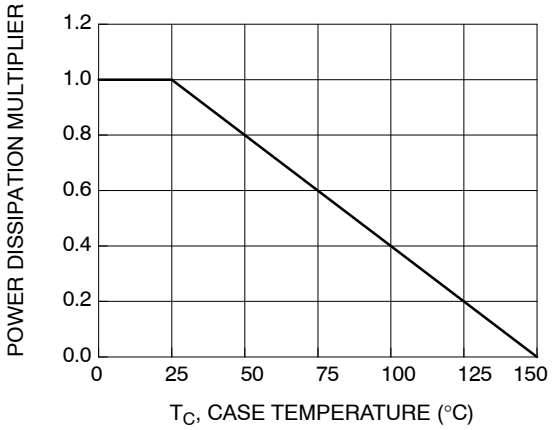

Figure 1. Normalized Power Dissipation vs. Case Temperature

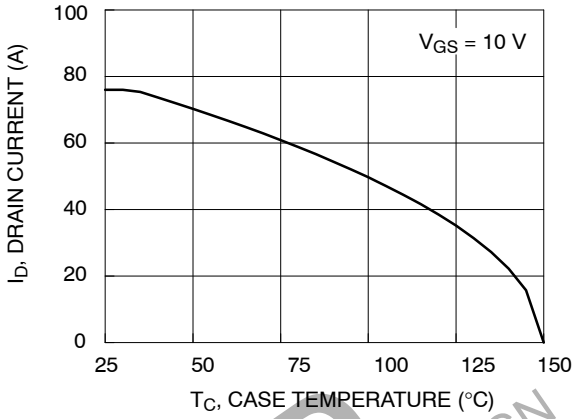

Figure 2. Maximum Continuous Drain Current vs. Case Temperature

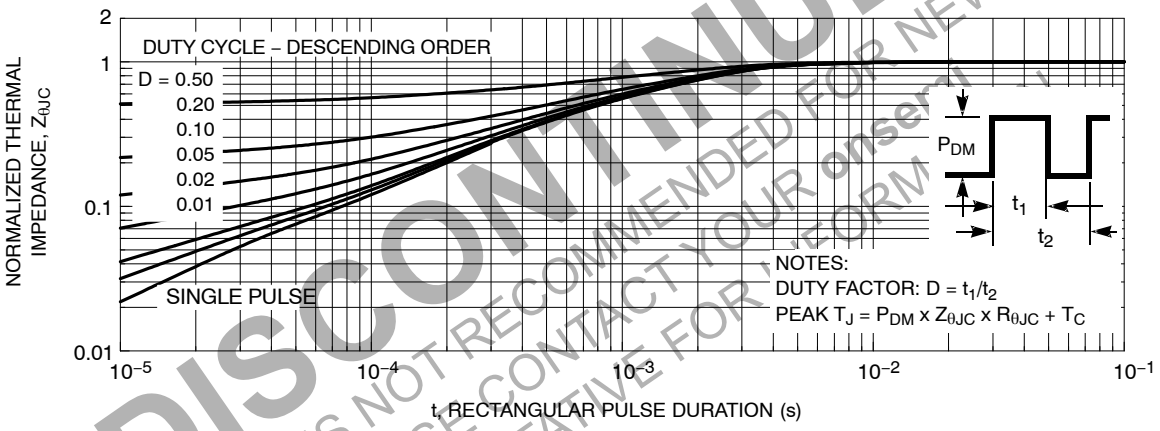

Figure 3. Normalized Maximum Transient Thermal Impedance

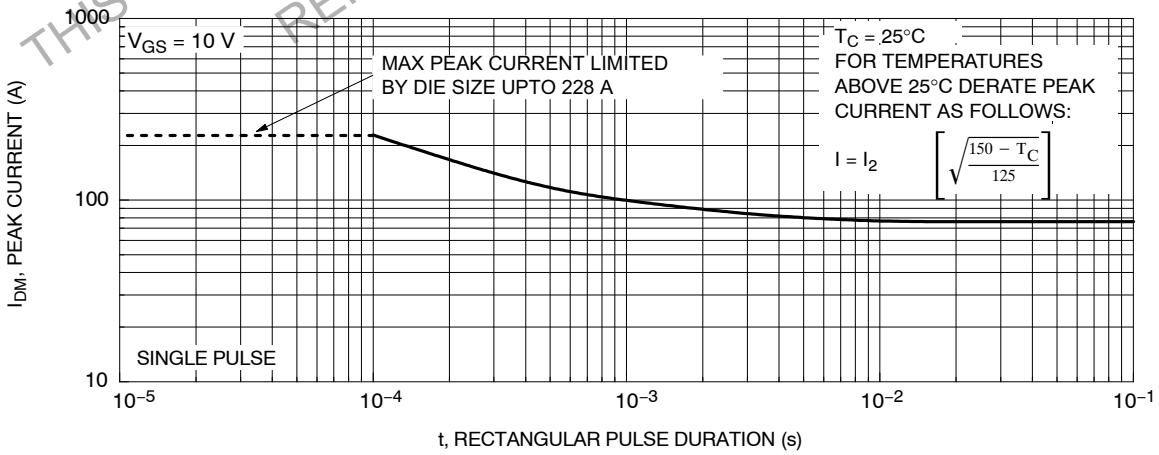

Figure 4. Peak Current Capability

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TYPICAL CHARACTERISTICS (continued)

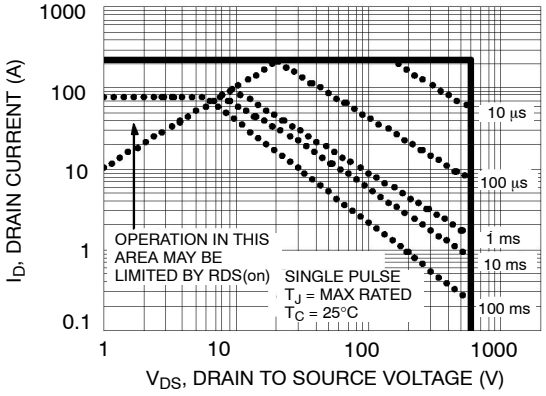

Figure 5. Forward Bias Safe Operating Area

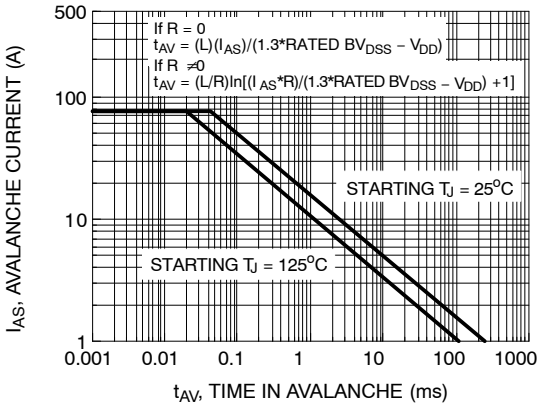

Figure 6. Unclamped Inductive Switching Capability

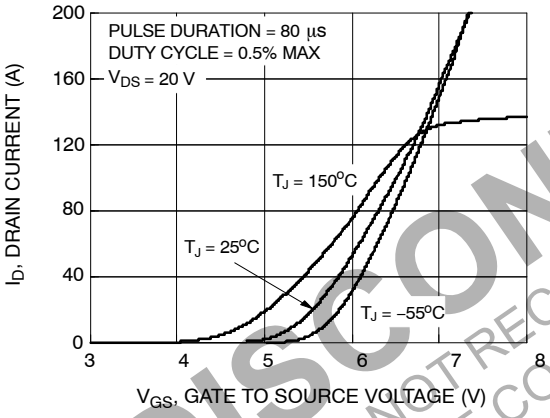

Figure 7. Transfer Characteristics

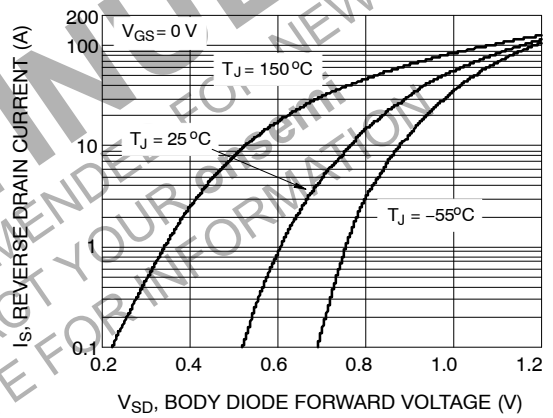

Figure 8. Forward Diode Characteristics

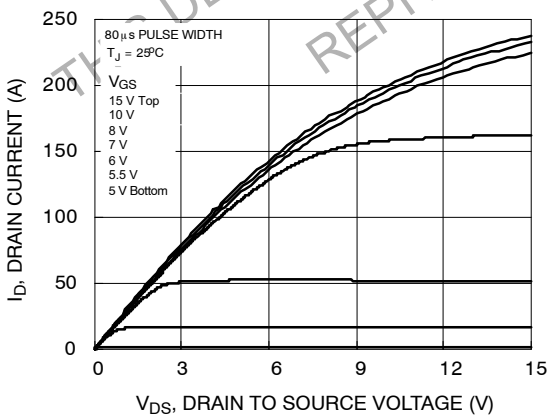

Figure 9. Saturation Characteristics

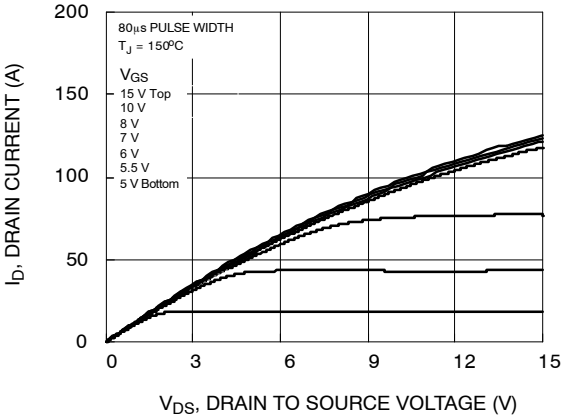

Figure 10. Saturation Characteristics

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TYPICAL CHARACTERISTICS (continued)

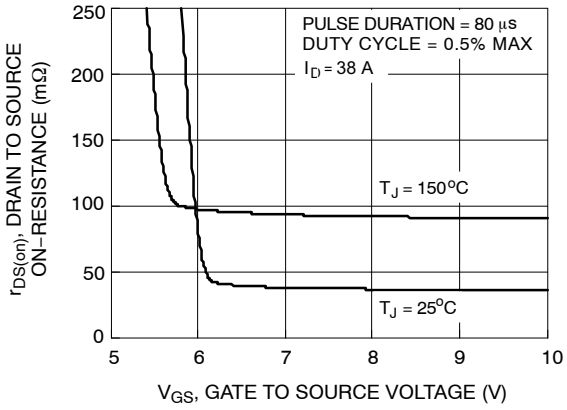

Figure 11. R_{DSON} vs. Gate Voltage

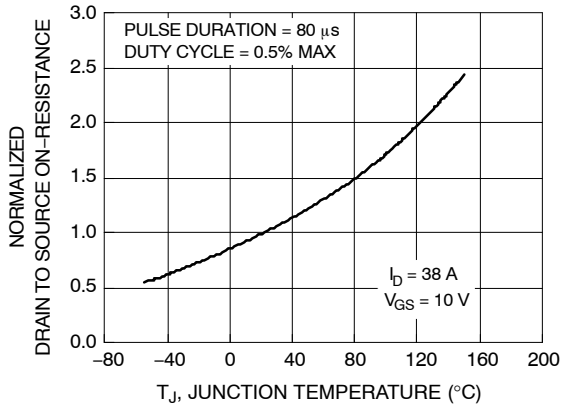

Figure 12. Normalized R_{DSON} vs. Junction Temperature

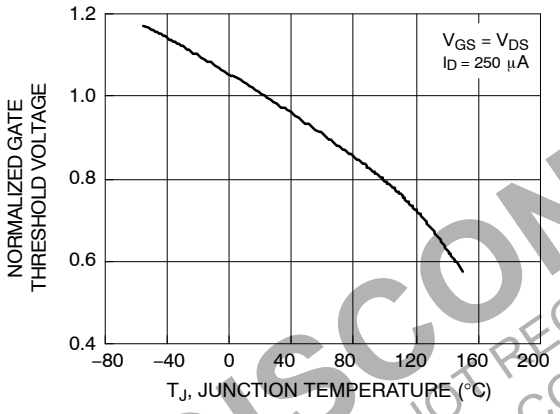

Figure 13. Normalized Gate Threshold Voltage vs. Temperature

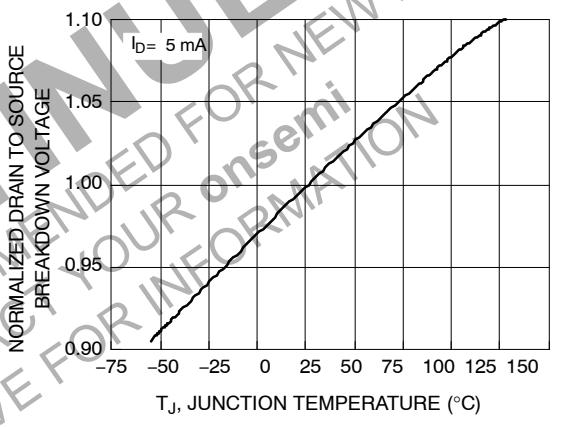

Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

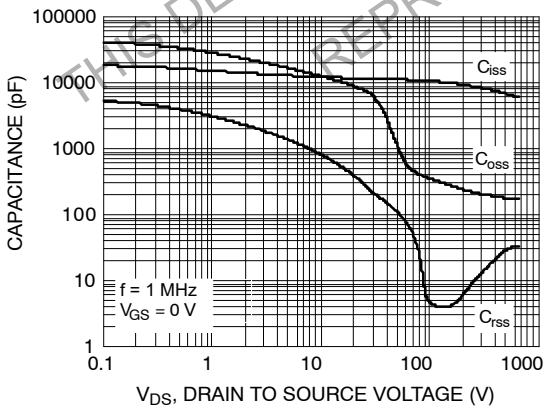

Figure 15. Capacitance vs. Drain to Source Voltage

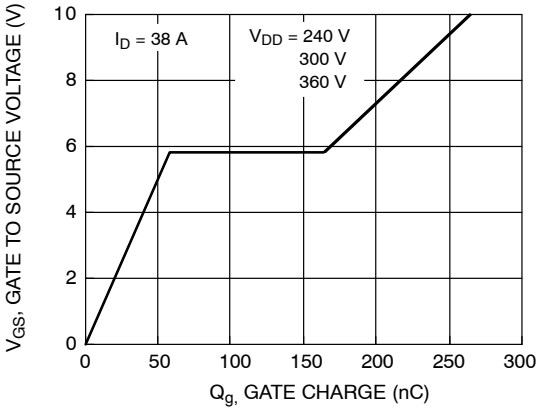

Figure 16. Gate Charge vs. Gate to Source Voltage

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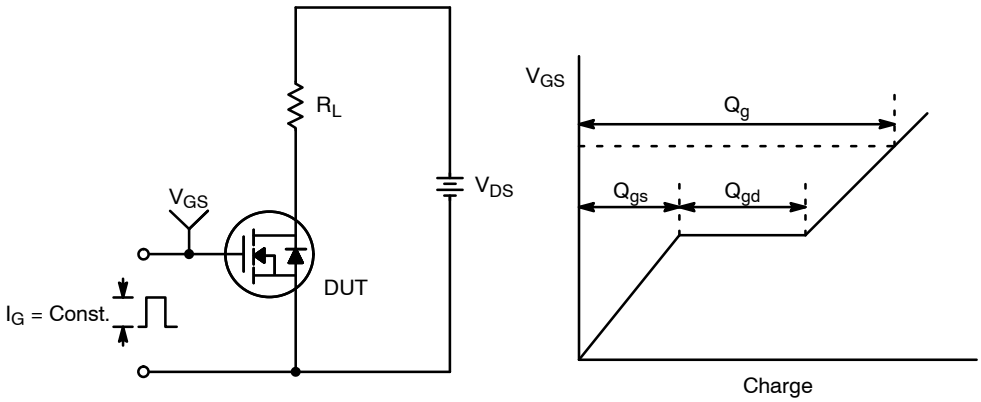

Figure 17. Gate Charge Test Circuit & Waveform

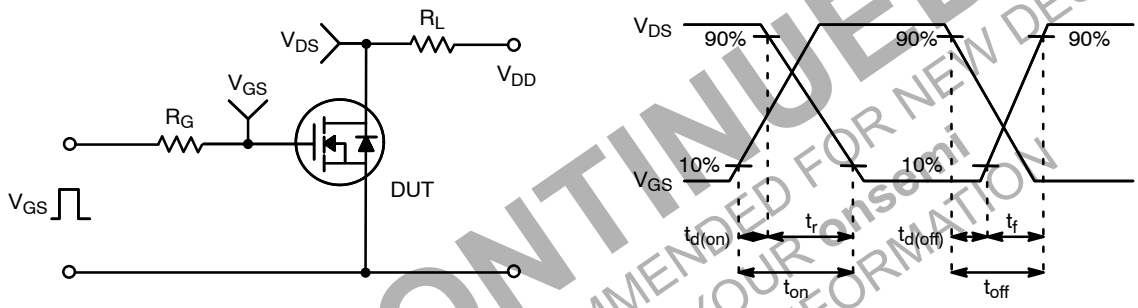

Figure 18. Resistive Switching Test Circuit & Waveforms

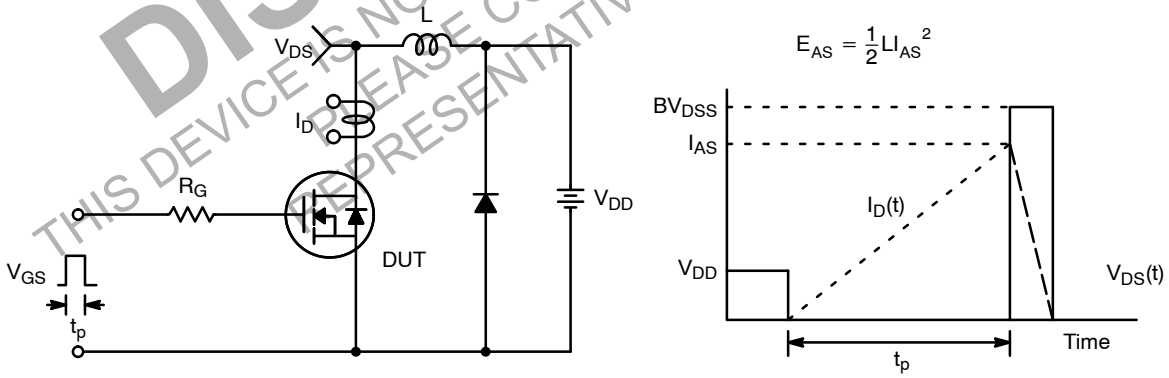

Figure 19. Unclamped Inductive Switching Test Circuit & Waveforms

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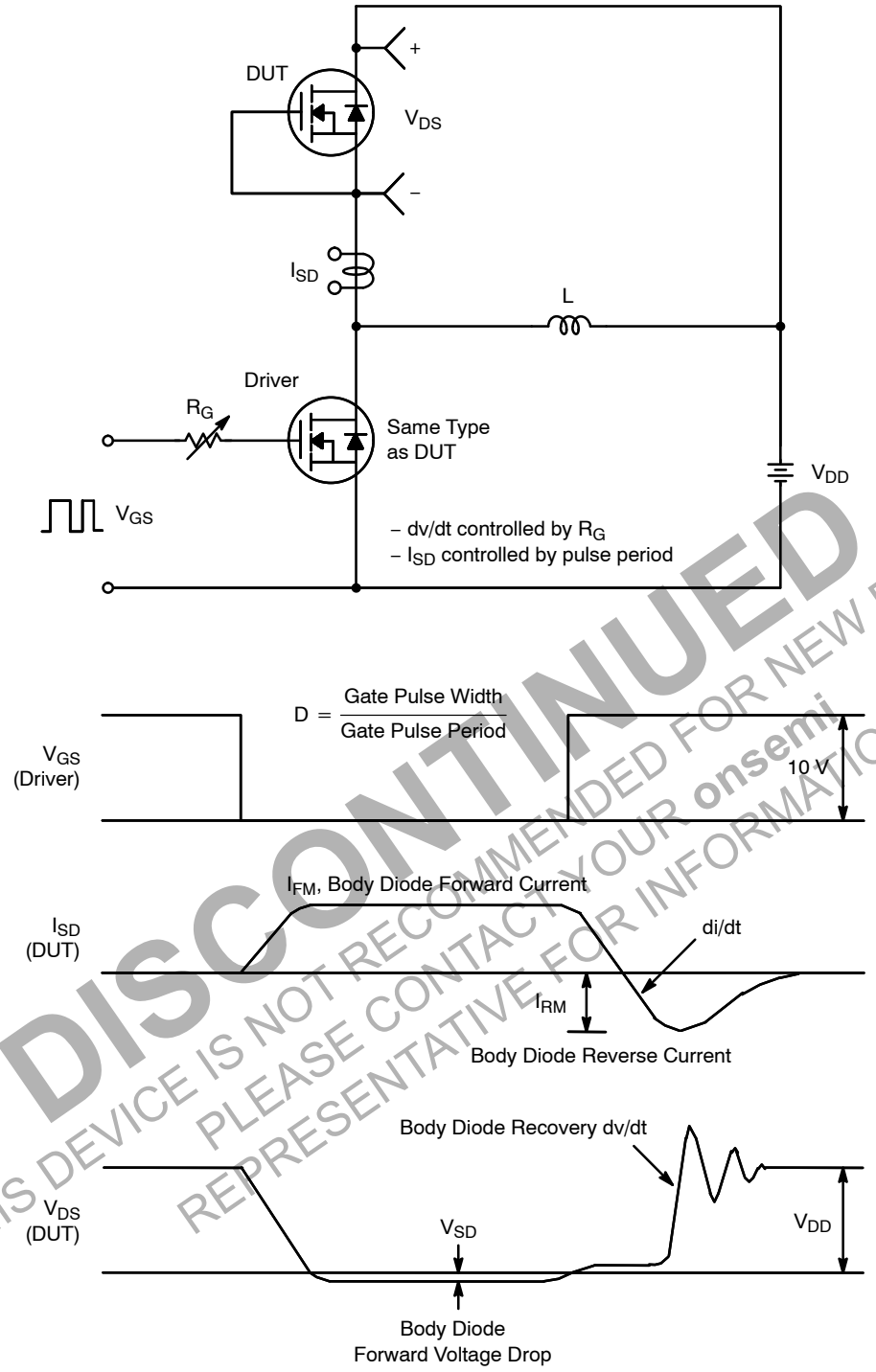

Figure 20. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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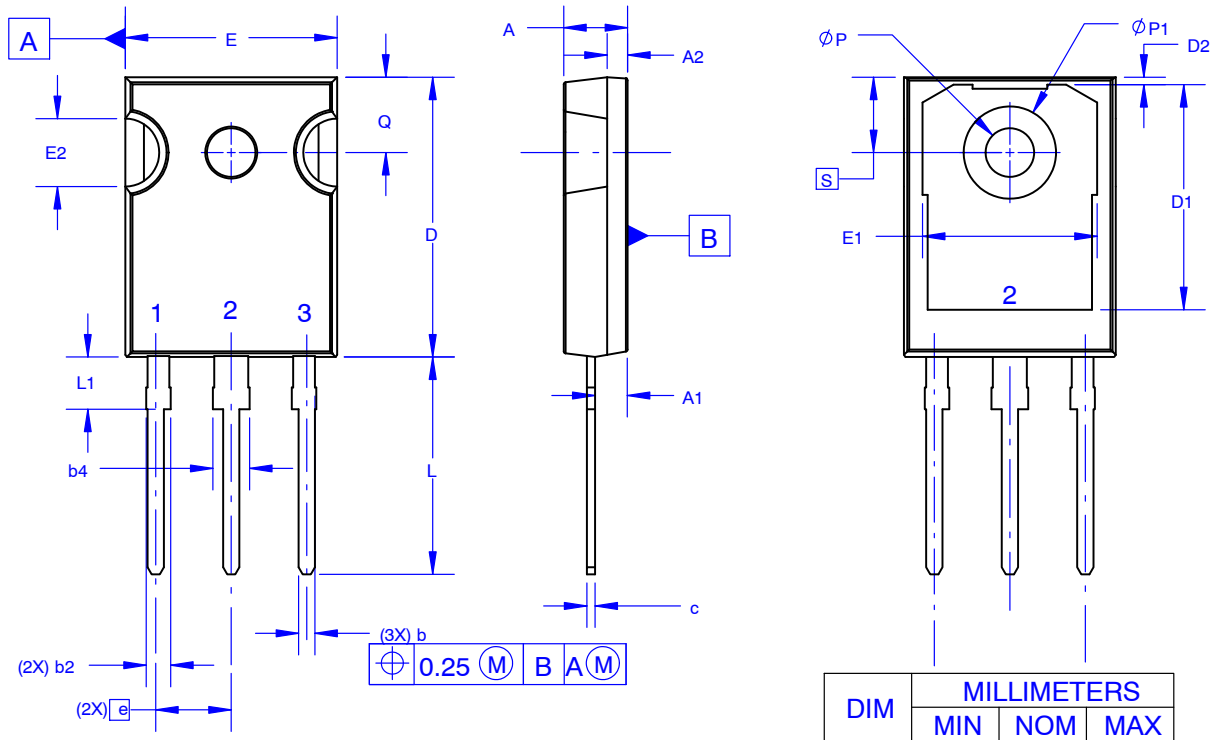
CASE 340CK
ISSUE A

DATE 31 JAN 2019

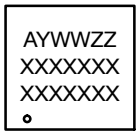


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93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