

# MOSFET – N-Channel, SUPERFET® II

**800 V, 58 A, 60 mΩ**

## FCH060N80

### Description

SUPERFET II MOSFET is onsemi'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 MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.

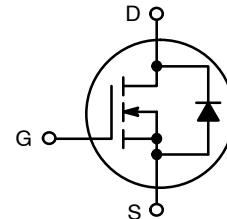
### Features

- Typ.  $R_{DS(on)} = 54 \text{ m}\Omega$
- 850 V @  $T_J = 150^\circ\text{C}$
- Ultra Low Gate Charge (Typ.  $Q_g = 270 \text{ nC}$ )
- Low Eoss (Typ. 23  $\mu\text{J}$  @ 400 V)
- Low Effective Output Capacitance (Typ.  $C_{oss(\text{eff.})} = 981 \text{ pF}$ )
- 100% Avalanche Tested
- This Device is RoHS Compliant

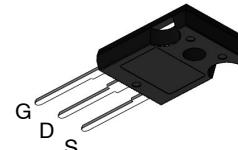
### Applications

- AC–DC Power Supply
- LED Lighting

$V_{DSS}$	$R_{DS(\text{ON}) \text{ MAX}}$	$I_D \text{ MAX}$
800 V	60 mΩ @ 10 V	58 A

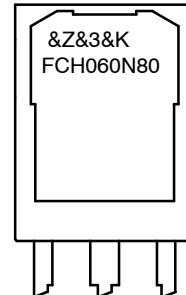


POWER MOSFET



TO-247-3LD  
CASE 340CH

### MARKING DIAGRAM



&Z                          = Assembly Plant Code  
&3                          = Numeric Date Code  
&K                          = Lot Code  
FCH060N80                = Specific Device Code

### ORDERING INFORMATION

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

# FCH060N80

## ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , Unless otherwise noted)

Symbol	Parameter		Value	Unit
$V_{DSS}$	Drain to Source Voltage		800	V
$V_{GSS}$	Gate to Source Voltage	DC	$\pm 20$	V
		AC ( $f > 1 \text{ Hz}$ )	$\pm 30$	
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ\text{C}$ )	58	A
		Continuous ( $T_C = 100^\circ\text{C}$ )	36.8	
$I_{DM}$	Drain Current	Pulsed (Note 1)	174	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		2317	mJ
$I_{AS}$	Avalanche Current (Note 1)		11.6	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		50	mJ
$dv/dt$	MOSFET $dv/dt$		100	V/ns
	Peak Diode Recovery $dv/dt$ (Note 3)		20	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	500	W
		Derate Above $25^\circ\text{C}$	4	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose 1/8" from Case for 5 seconds		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.  $I_{AS} = 11.6 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 58 \text{ A}$ ,  $dI/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCH060N80-F155	FCH060N80	TO-247-3LD	Tube	N/A	N/A	30 Units



# FCH060N80

**ELECTRICAL CHARACTERISTICS** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

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

$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}, I_D = 1 \text{ mA}, T_J = 25^\circ\text{C}$	800			V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 1 \text{ mA}$ , Referenced to $25^\circ\text{C}$		0.8		$^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 800 \text{ V}, V_{\text{GS}} = 0 \text{ V}$		25	$\mu\text{A}$	
		$V_{\text{DS}} = 640 \text{ V}, T_C = 125^\circ\text{C}$		250		
$I_{\text{GSS}}$	Gate to Body Leakage Current	$V_{\text{GS}} = \pm 20 \text{ V}, V_{\text{DS}} = 0 \text{ V}$		$\pm 100$	nA	

## ON CHARACTERISTICS

$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{GS}} = V_{\text{DS}}, I_D = 5.8 \text{ mA}$	2.5		4.5	V
$R_{\text{DS(on)}}$	Static Drain to Source On Resistance	$V_{\text{GS}} = 10 \text{ V}, I_D = 29 \text{ A}$		54	60	$\text{m}\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}} = 20 \text{ V}, I_D = 29 \text{ A}$		68		S

## DYNAMIC CHARACTERISTICS

$C_{\text{iss}}$	Input Capacitance	$V_{\text{DS}} = 100 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}$		11040	14685	pF
$C_{\text{oss}}$	Output Capacitance			298	395	pF
$C_{\text{rss}}$	Reverse Transfer Capacitance			10		pF
$C_{\text{oss}}$	Output Capacitance	$V_{\text{DS}} = 480 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}$		147		pF
$C_{\text{oss(eff.)}}$	Effective Output Capacitance	$V_{\text{DS}} = 0 \text{ V} \text{ to } 480 \text{ V}, V_{\text{GS}} = 0 \text{ V}$		981		pF
$Q_{\text{g(tot)}}$	Total Gate Charge at $10 \text{ V}$	$V_{\text{DS}} = 640 \text{ V}, I_D = 58 \text{ A}, V_{\text{GS}} = 10 \text{ V}$ (Note 4)		270	350	nC
$Q_{\text{gs}}$	Gate to Source Gate Charge			54		nC
$Q_{\text{gd}}$	Gate to Drain "Miller" Charge			100		nC
$\text{ESR}$	Equivalent Series Resistance	$f = 1 \text{ MHz}$		0.78		$\Omega$

## SWITCHING CHARACTERISTICS

$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 400 \text{ V}, I_D = 58 \text{ A}, V_{\text{GS}} = 10 \text{ V}$ $R_g = 4.7 \Omega$ (Note 4)		55	120	ns
$t_r$	Turn-On Rise Time			73	156	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time			213	436	ns
$t_f$	Turn-Off Fall Time			72	154	ns

## SOURCE-DRAIN DIODE CHARACTERISTICS

$I_S$	Maximum Continuous Drain to Source Diode Forward Current			58		A
$I_{\text{SM}}$	Maximum Pulsed Drain to Source Diode Forward Current			174		A
$V_{\text{SD}}$	Drain to Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}, I_{\text{SD}} = 58 \text{ A}$		1.2		V
$t_{\text{rr}}$	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}, I_{\text{SD}} = 58 \text{ A},$ $dI_F/dt = 100 \text{ A}/\mu\text{s}$		850		ns
$Q_{\text{rr}}$	Reverse Recovery Charge			35		$\mu\text{C}$

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.



## TYPICAL PERFORMANCE CHARACTERISTICS

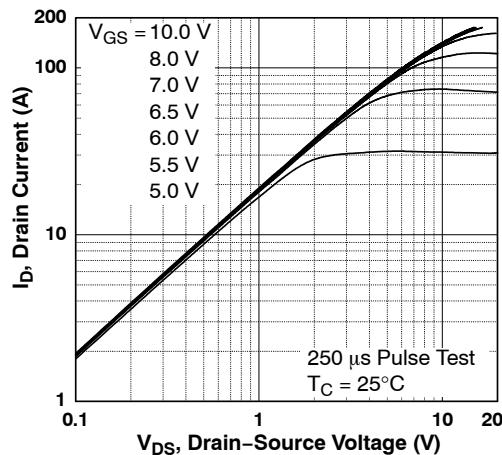


Figure 1. On-Region Characteristics

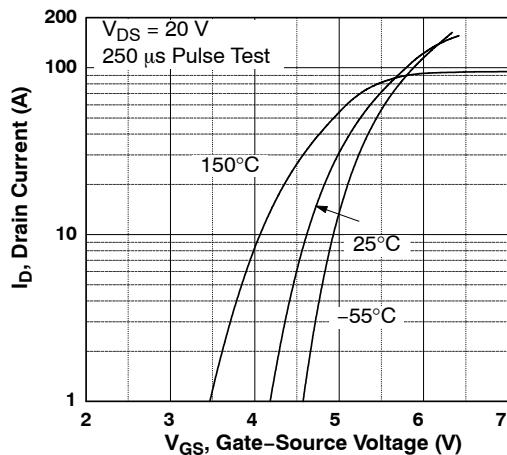


Figure 2. Transfer Characteristics

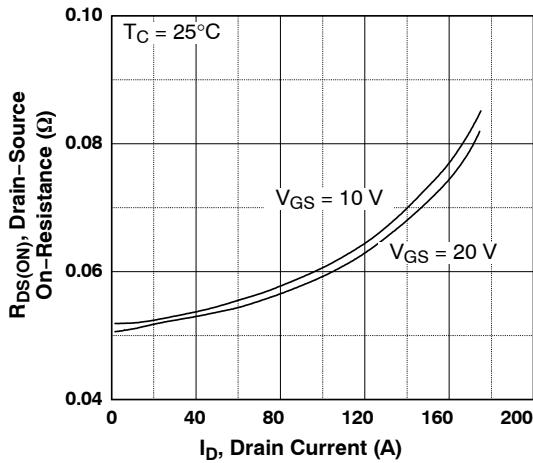


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

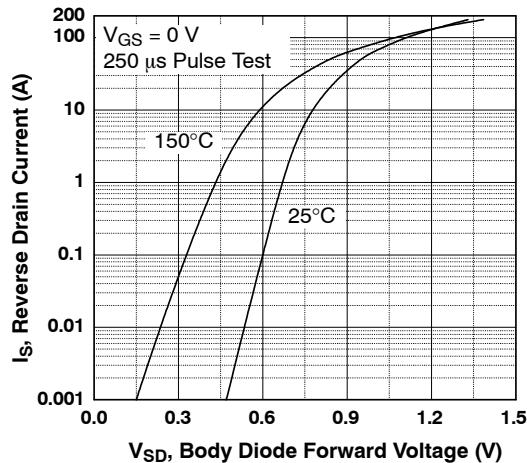


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

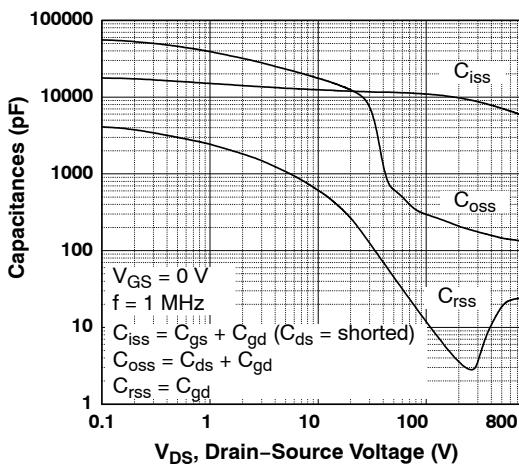


Figure 5. Capacitance Characteristics

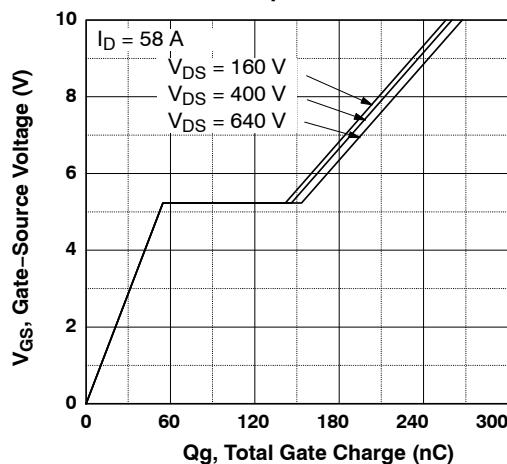


Figure 6. Gate Charge Characteristics



## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

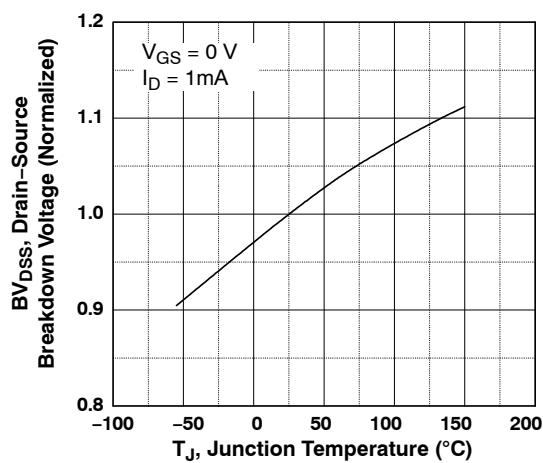


Figure 7. Breakdown Voltage Variation vs. Temperature

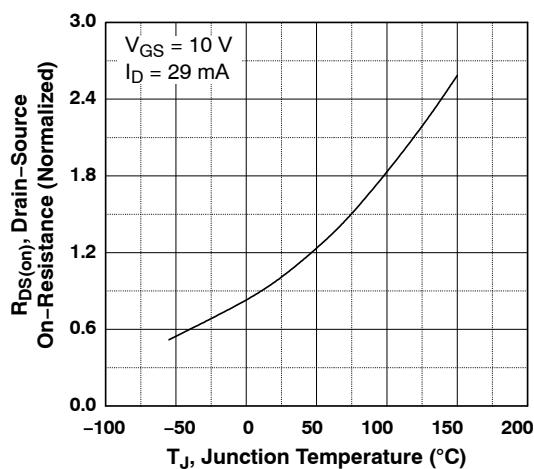


Figure 8. On-Resistance Variation vs. Temperature

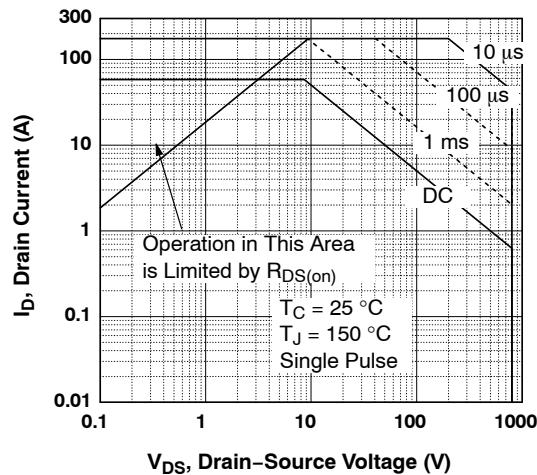


Figure 9. Maximum Safe Operating Area

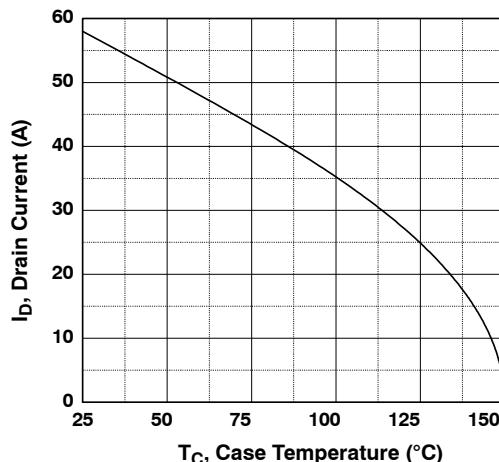
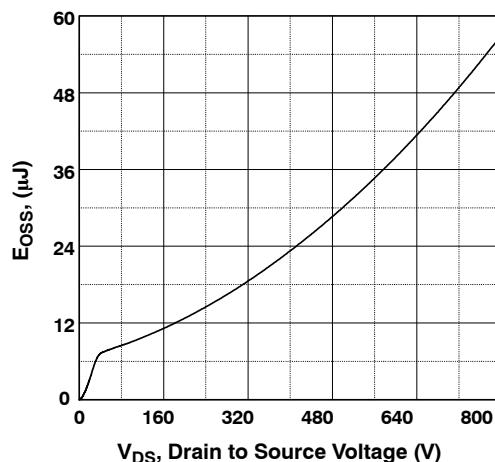
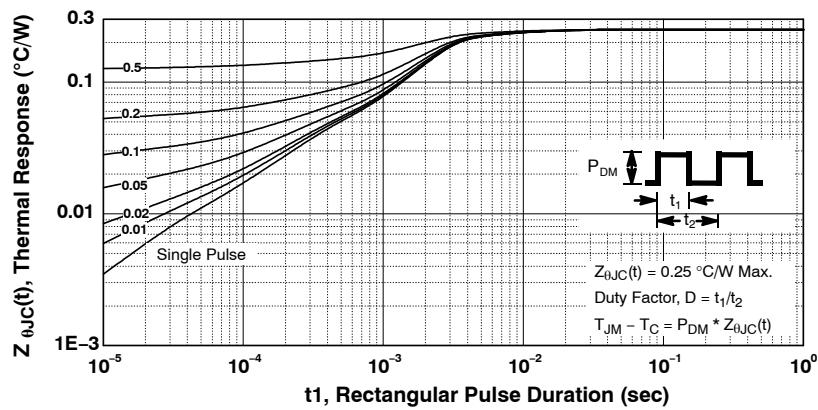


Figure 10. Maximum Drain Current vs. Case Temperature

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

**TYPICAL PERFORMANCE CHARACTERISTICS** (Continued)**Figure 12. Transient Thermal Response Curve**

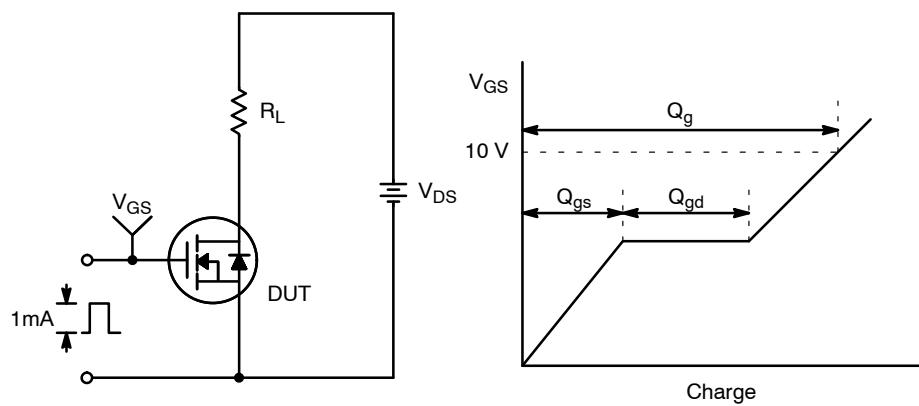


Figure 13. Gate Charge Test Circuit & Waveform

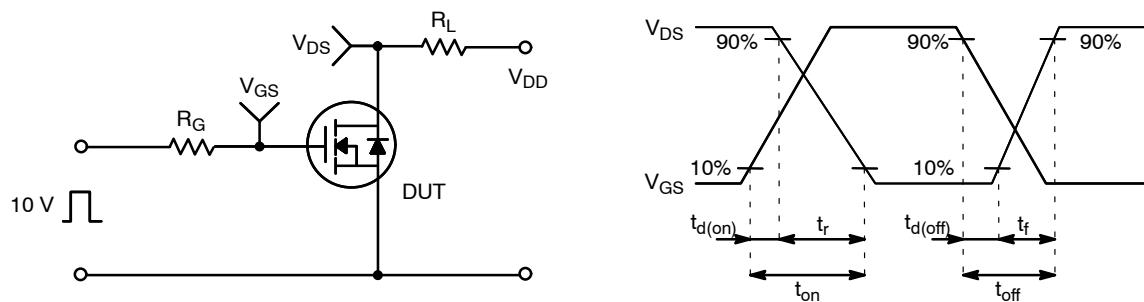


Figure 14. Resistive Switching Test Circuit & Waveforms

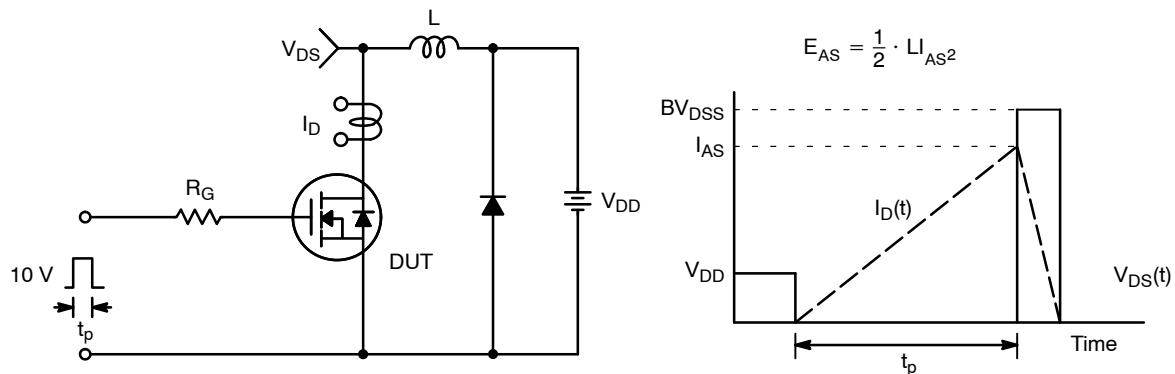


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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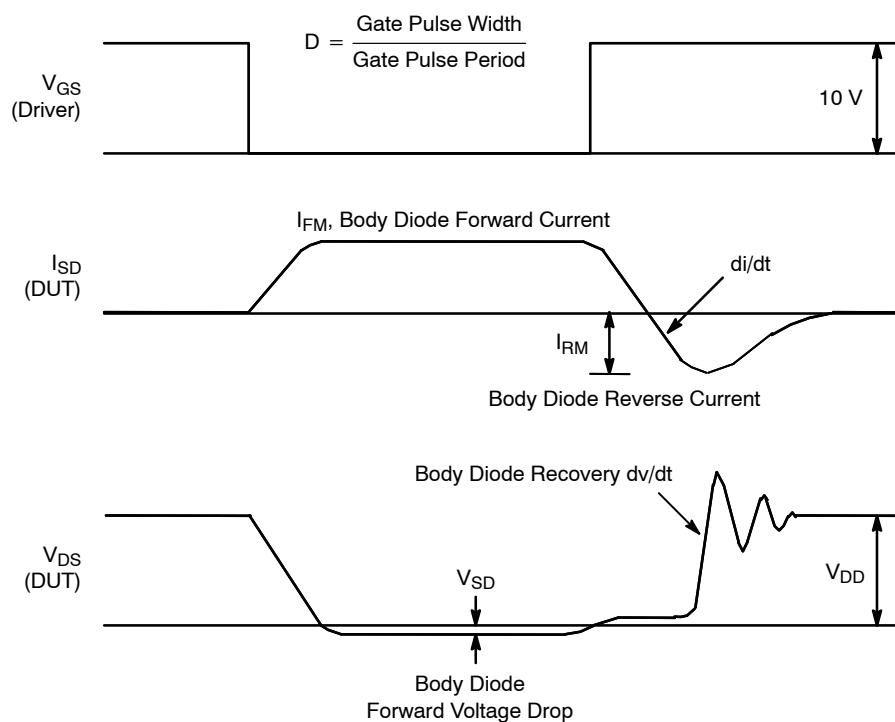
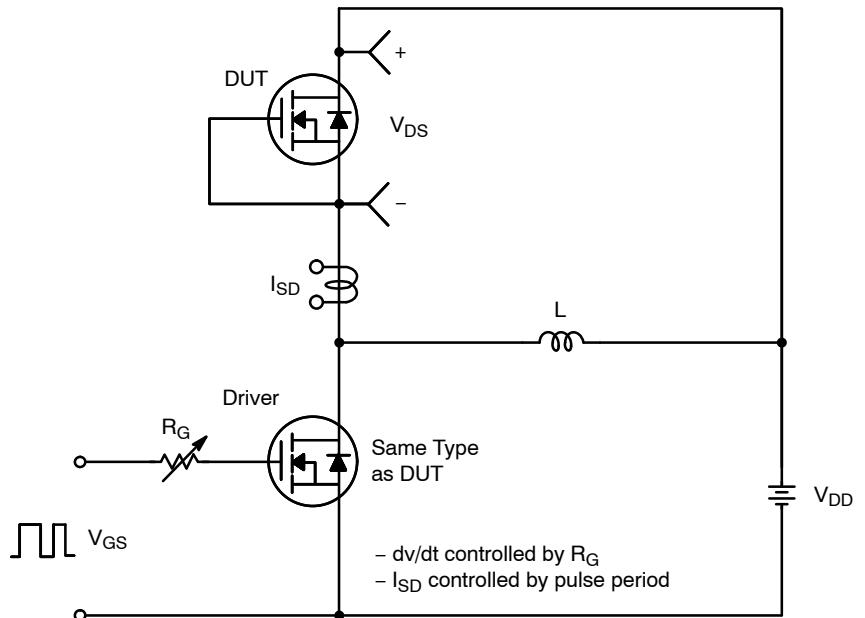
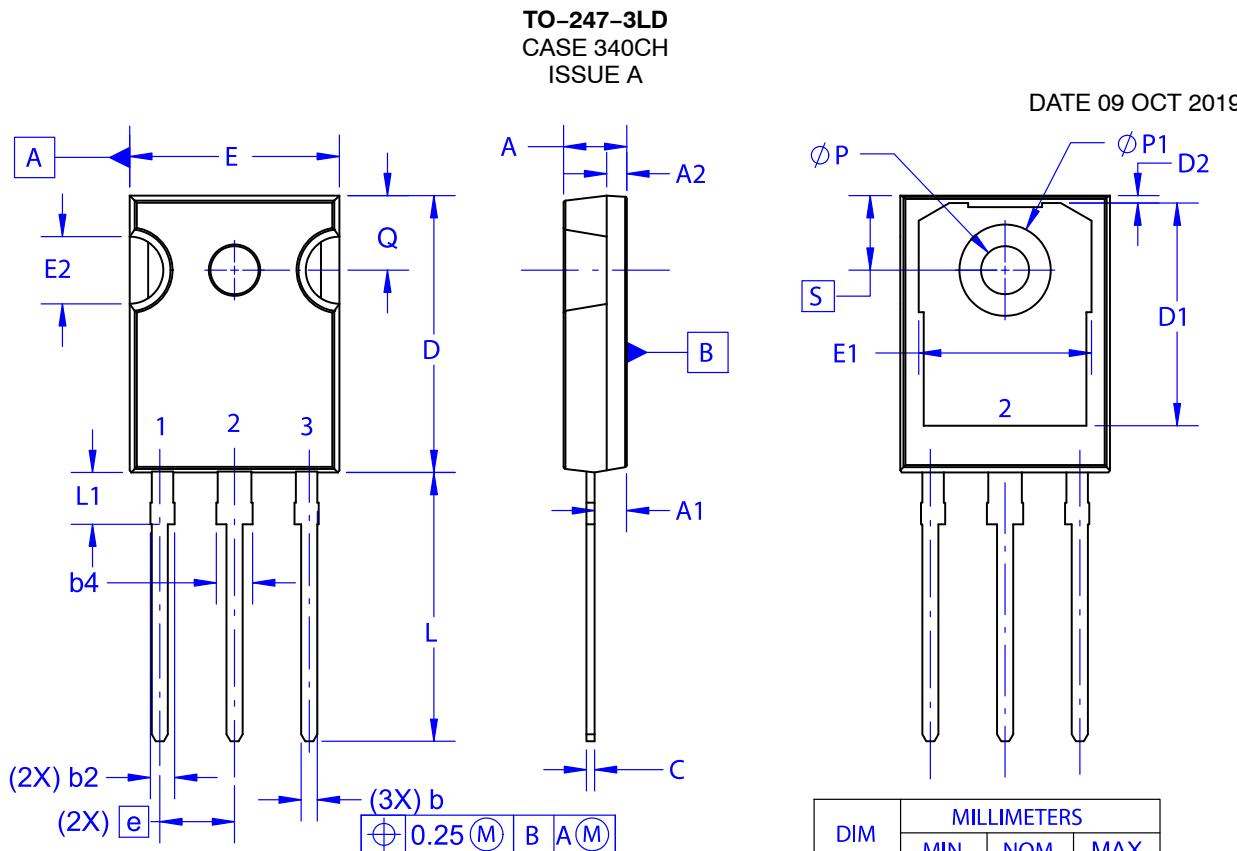


Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

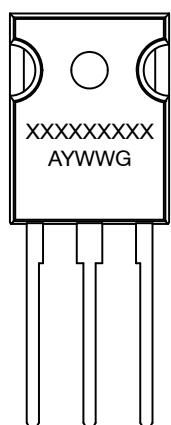
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- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED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

**GENERIC  
MARKING DIAGRAM\***



XXXX = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

G = Pb-Free Package

\*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	2.29	2.475	2.66
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
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
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.61	6.73	6.85

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