

MOSFET - Power, Single N-Channel, SUPERFET® V, FRFET®, TO247-3L 600 V, 19 mΩ, 75 A

NTHL019N60S5F

Description

The SUPERFET V MOSFET FRFET series, optimized reverse recovery performance of body diode, can remove additional component and improve system reliability for soft switching applications such as PSFB and LLC.

Features

- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 15.2 \text{ m}\Omega$
- 100% Avalanche Tested
- Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Telecom / Server Power Supplies
- EV Charger / UPS / Solar / Industrial Power Supplies

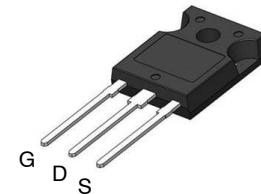
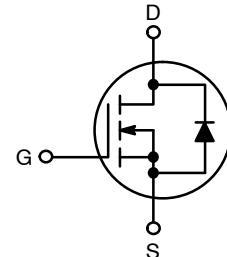
ABSOLUTE MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$, Unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	600	V
Gate-to-Source Voltage	V_{GSS} DC	± 30	V
	V_{GSS} AC ($f > 1 \text{ Hz}$)	± 30	
Continuous Drain Current	I_D $T_C = 25^\circ\text{C}$	75	A
	I_D $T_C = 100^\circ\text{C}$	70	
Power Dissipation	P_D $T_C = 25^\circ\text{C}$	568	W
Pulsed Drain Current (Note 1)	I_{DM} $T_C = 25^\circ\text{C}$	393	A
Pulsed Source Current (Body Diode) (Note 1)	I_{SM} $T_C = 25^\circ\text{C}$	393	A
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C
Source Current (Body Diode)	I_S	75	A
Single Pulse Avalanche Energy	E_{AS} $I_L = 12.4 \text{ A}, R_G = 25 \Omega$	1208	mJ
Avalanche Current	I_{AS}	12.4	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	5.68	mJ
MOSFET dv/dt	dv/dt	120	V/ns
Peak Diode Recovery dv/dt (Note 2)		70	
Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds)	T_L	260	°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. $I_{SD} \leq 37.5 \text{ A}$, $di/dt \leq 200 \text{ A}/\mu\text{s}$, $V_{DD} \leq 400 \text{ V}$, starting $T_J = 25^\circ\text{C}$.

V_{DSS}	$R_{DS(\text{ON}) \text{ MAX}}$	$I_D \text{ MAX}$
600 V	19 mΩ @ 10 V	75 A



TO-247 Long Leads
CASE 340CX

MARKING DIAGRAM



T019N60S5F = Specific Device Code
 A = Assembly Location
 YWW = Data Code (Year & Week)
 ZZ = Assembly Lot

ORDERING INFORMATION

Device	Package	Shipping
NTHL019N60S5F	TO-247	30 Units / Tube

NTHL019N60S5F

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case, Max.	$R_{\theta JC}$	0.22	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient, Max.	$R_{\theta JA}$	40	

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}, I_D = 1 \text{ mA}, T_J = 25^{\circ}\text{C}$	600	–	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	$I_D = 10 \text{ mA}$, Referenced to 25°C	–	630	–	$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{\text{GS}} = 0 \text{ V}, V_{\text{DS}} = 600 \text{ V}, T_J = 25^{\circ}\text{C}$	–	–	10	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{\text{GS}} = \pm 30 \text{ V}, V_{\text{DS}} = 0 \text{ V}$	–	–	± 100	nA

ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, I_D = 37.5 \text{ A}, T_J = 25^{\circ}\text{C}$	–	15.2	19	$\text{m}\Omega$
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{GS}} = V_{\text{DS}}, I_D = 15.7 \text{ mA}, T_J = 25^{\circ}\text{C}$	3.2	–	4.8	V
Forward Trans-conductance	g_{FS}	$V_{\text{DS}} = 20 \text{ V}, I_D = 37.5 \text{ A}$	–	96	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{iss}	$V_{\text{DS}} = 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 250 \text{ kHz}$	–	13400	–	pF
Output Capacitance	C_{oss}		–	203	–	
Time Related Output Capacitance	$C_{\text{OSS}(\text{tr.})}$	$I_D = \text{Constant}, V_{\text{DS}} = 0 \text{ V to } 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}$	–	3174	–	
Energy Related Output Capacitance	$C_{\text{OSS}(\text{er.})}$	$V_{\text{DS}} = 0 \text{ V to } 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}$	–	343	–	
Total Gate Charge	$Q_{\text{G}(\text{tot})}$	$V_{\text{DD}} = 400 \text{ V}, I_D = 37.5 \text{ A}, V_{\text{GS}} = 10 \text{ V}$	–	252	–	nC
Gate-to-Source Charge	Q_{GS}		–	75	–	
Gate-to-Drain Charge	Q_{GD}		–	71	–	
Gate Resistance	R_{G}		$f = 1 \text{ MHz}$	3.5	–	Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{GS}} = 0/10 \text{ V}, V_{\text{DD}} = 400 \text{ V}, I_D = 37.5 \text{ A}, R_{\text{G}} = 2.2 \Omega$	–	73	–	ns
Rise Time	t_r		–	45	–	
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$		–	204	–	
Fall Time	t_f		–	4	–	

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{\text{GS}} = 0 \text{ V}, I_{\text{SD}} = 37.5 \text{ A}, T_J = 25^{\circ}\text{C}$	–	–	1.2	V
Reverse Recovery Time	t_{RR}	$V_{\text{GS}} = 0 \text{ V}, I_{\text{SD}} = 37.5 \text{ A},$ $dl/dt = 100 \text{ A}/\mu\text{s}, V_{\text{DD}} = 400 \text{ V}$	–	204	–	ns
Reverse Recovery Charge	Q_{RR}		–	1686	–	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.

TYPICAL CHARACTERISTICS

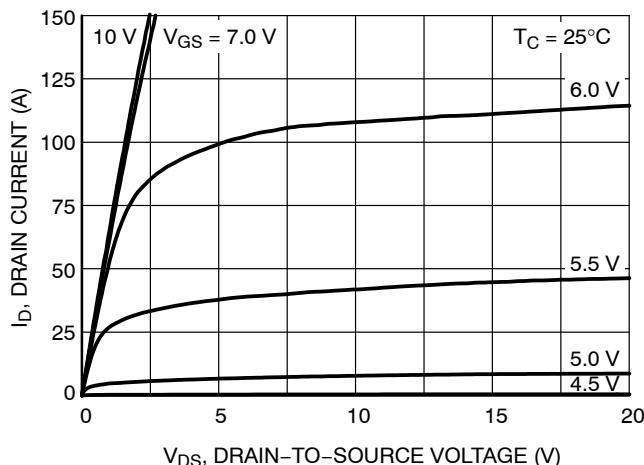


Figure 1. On-Region Characteristics

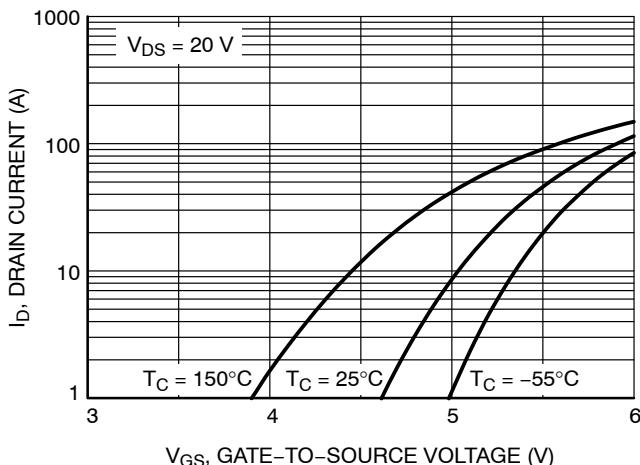


Figure 2. Transfer Characteristics

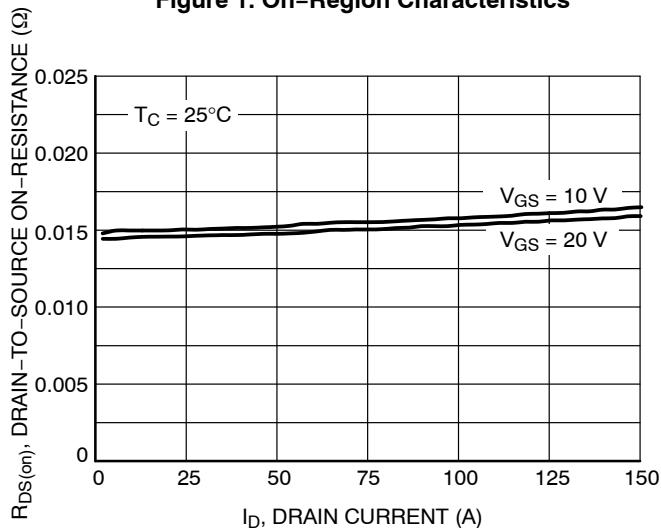


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

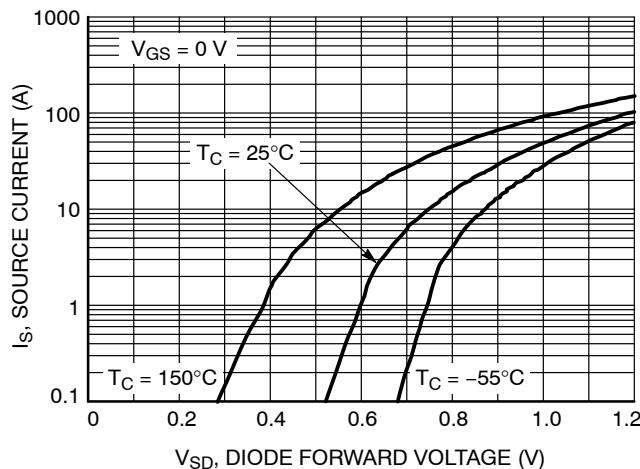


Figure 4. Diode Forward Voltage vs. Source Current

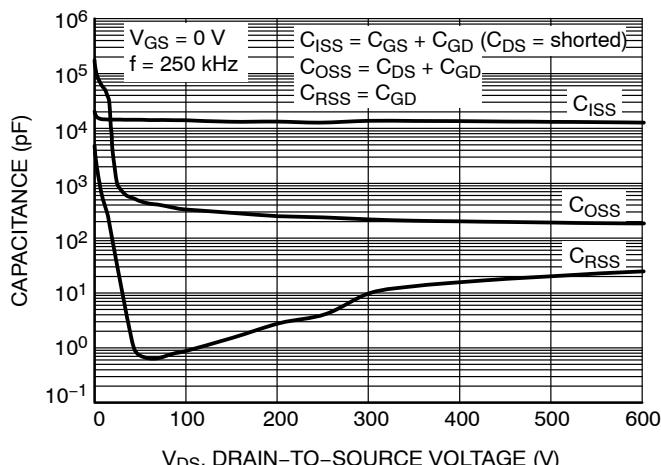


Figure 5. Capacitance Characteristics

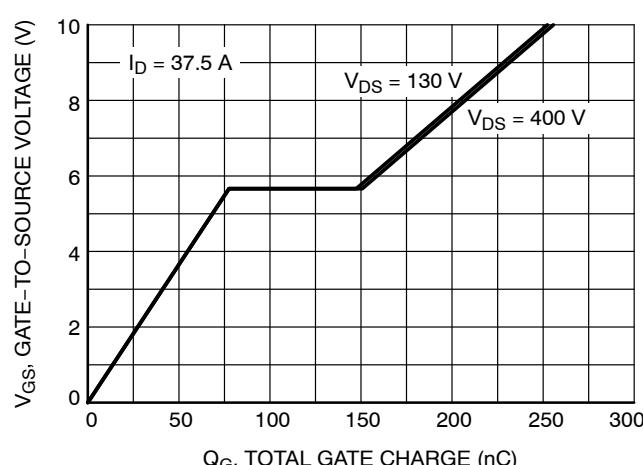


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

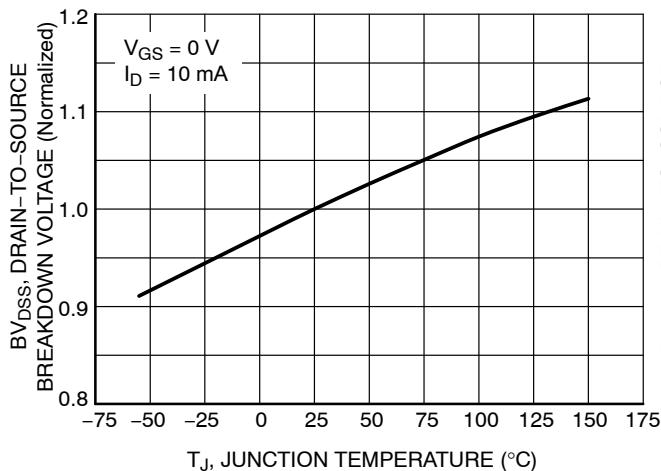


Figure 7. Breakdown Voltage Variation vs. Temperature

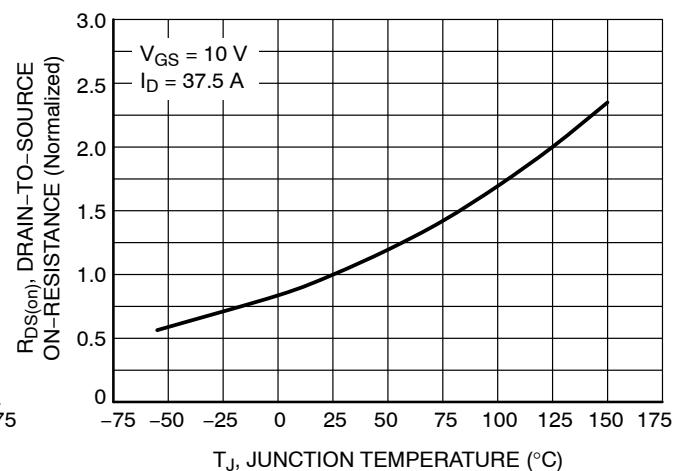


Figure 8. On-Resistance Variation vs. Temperature

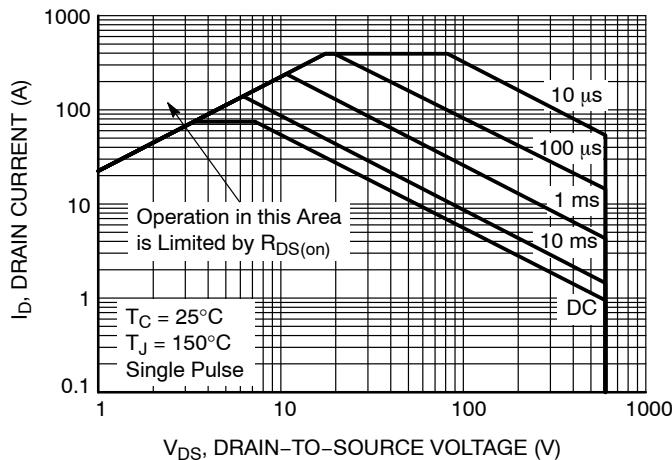


Figure 9. Maximum Safe Operating Area

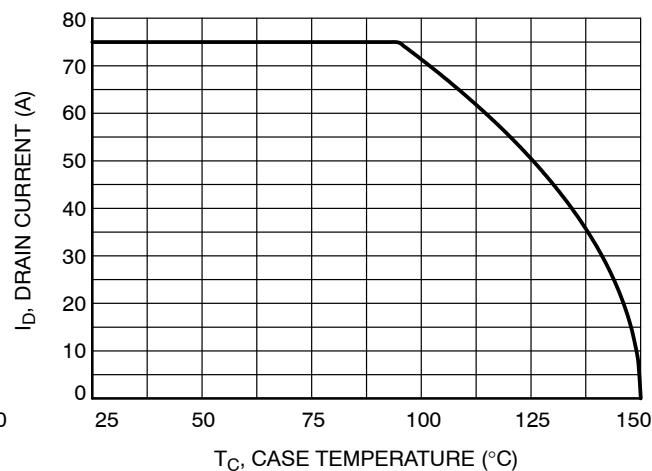


Figure 10. Maximum Drain Current vs. Case Temperature

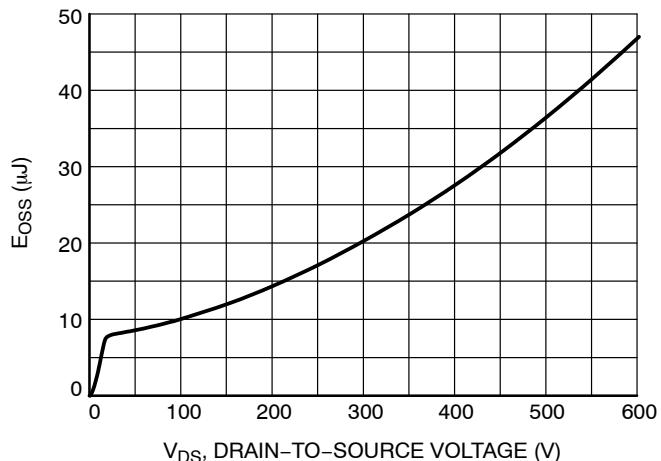


Figure 11. E_{oss} vs. Drain-to-Source Voltage

TYPICAL CHARACTERISTICS

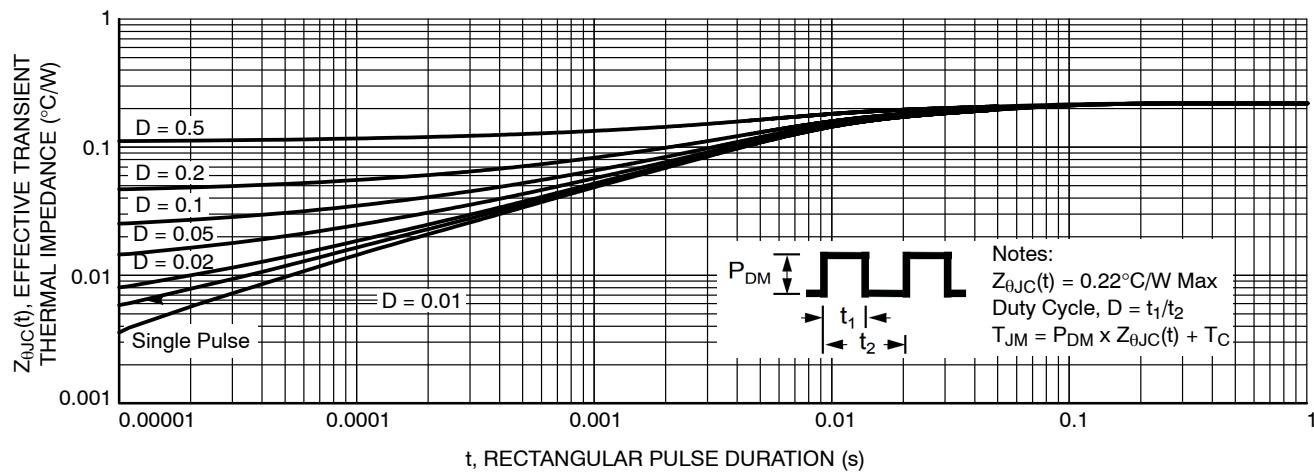


Figure 12. Transient Thermal Impedance

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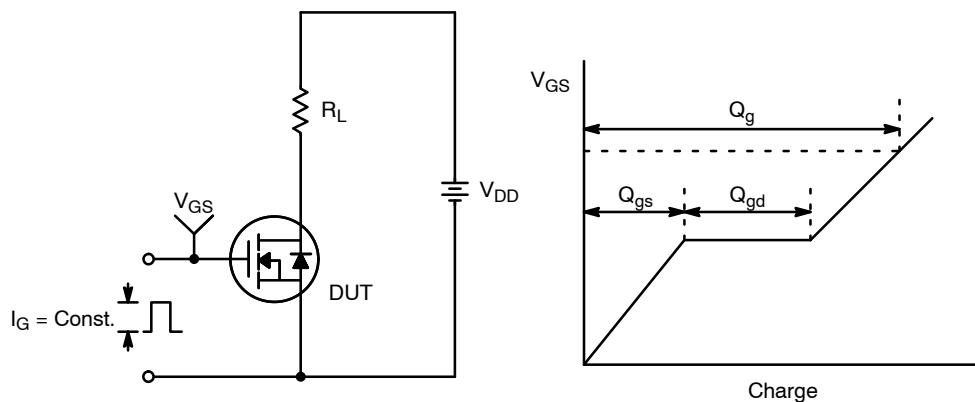


Figure 13. Gate Charge Test Circuit & Waveform

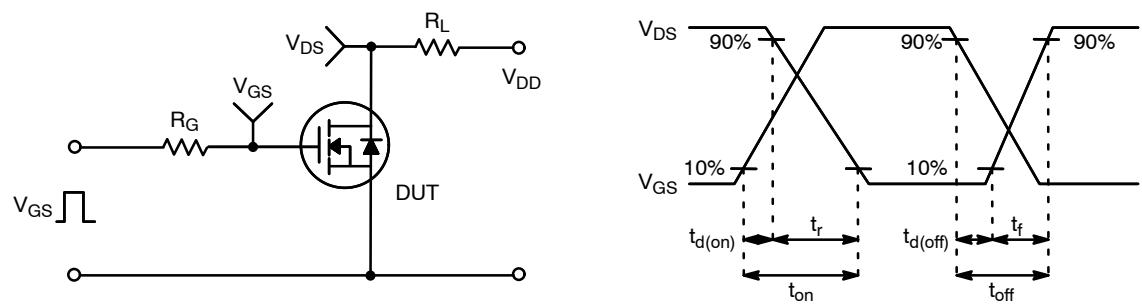


Figure 14. Resistive Switching Test Circuit & Waveforms

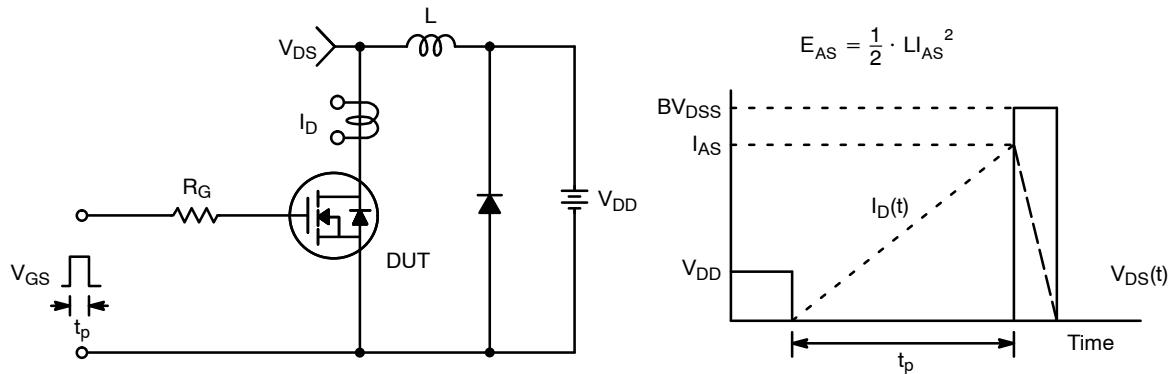


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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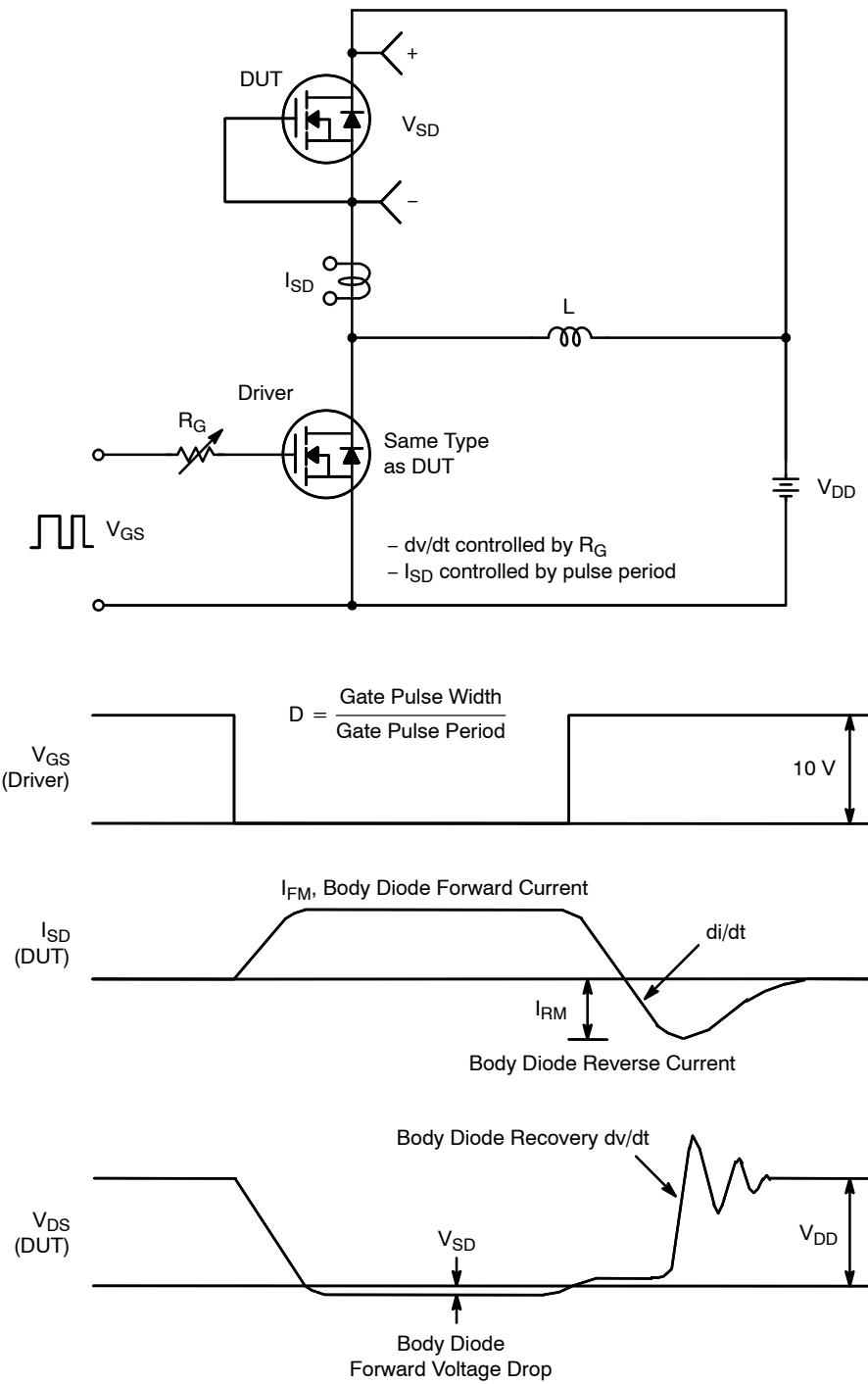
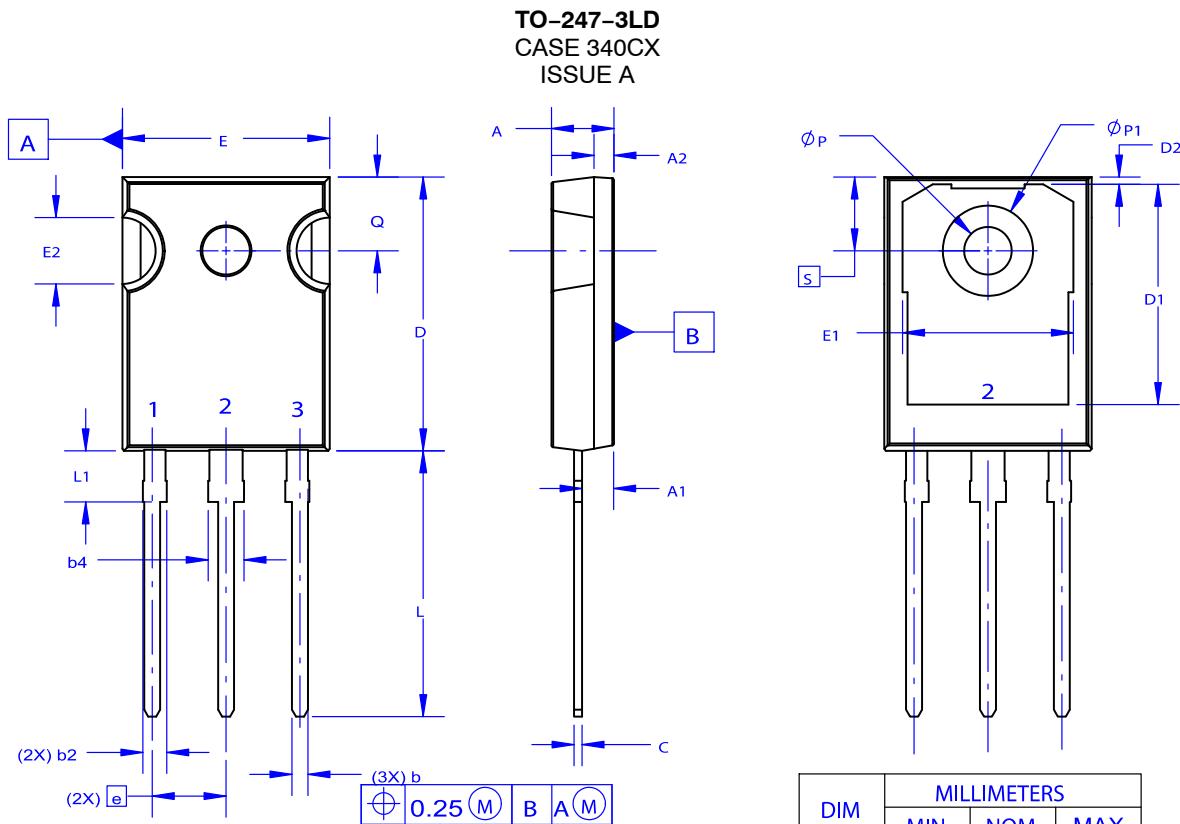


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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PACKAGE DIMENSIONS



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
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
ϕP	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	~	~
$\phi P1$	6.60	6.80	7.00

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