

# MOSFET - Power, Single N-Channel, SUPERFET® V, FAST, TO220

## 600 V, 185 mΩ, 15 A

### NTP185N60S5H

#### Description

The SUPERFET V MOSFET FAST series helps maximize system efficiency by the extremely low switching losses in hard switching application.

#### Features

- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(\text{on})} = 148 \text{ m}\Omega$
- 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

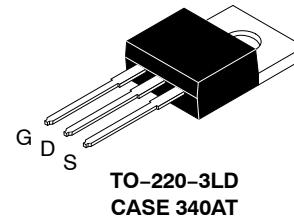
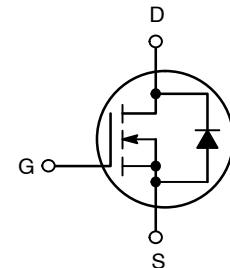
#### ABSOLUTE MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ , Unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	600	V
Gate-to-Source Voltage	$V_{GSS}$	$\pm 30$	V
		$\pm 30$	
Continuous Drain Current	$I_D$	15	A
		9	
Power Dissipation	$P_D$	116	W
Pulsed Drain Current (Note 1)	$I_{DM}$	53	A
Pulsed Source Current (Body Diode) (Note 1)	$I_{SM}$	53	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C
Source Current (Body Diode)	$I_S$	15	A
Single Pulse Avalanche Energy	$E_{AS}$	124	mJ
Avalanche Current	$I_{AS}$	3.6	A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	1.16	mJ
MOSFET dv/dt	dv/dt	120	V/ns
Peak Diode Recovery dv/dt (Note 2)		20	
Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds)	$T_L$	260	°C

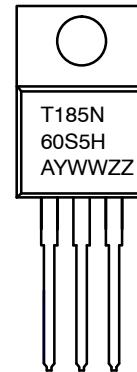
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{SD} \leq 7.5 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 400 \text{ V}$ , starting  $T_J = 25^\circ\text{C}$ .

$V_{DSS}$	$R_{DS(\text{ON})} \text{ MAX}$	$I_D \text{ MAX}$
600 V	185 mΩ @ 10 V	15 A



#### MARKING DIAGRAM



T185N60S5H = Specific Device Code

A = Assembly Plant Code

YWW = Date Code (Year & Week)

ZZ = Lot

#### ORDERING INFORMATION

Device	Package	Shipping
NTP185N60S5H	TO220	50 Units / Tube

# NTP185N60S5H

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case, Max.	$R_{\theta JC}$	1.08	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient, Max.	$R_{\theta JA}$	62.5	

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

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

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

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 7.5 \text{ A}$ , $T_J = 25^{\circ}\text{C}$	$R_{DS(on)}$	–	148	185	$\text{m}\Omega$
Gate Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 1.4 \text{ mA}$ , $T_J = 25^{\circ}\text{C}$	$V_{GS(\text{th})}$	2.7	–	4.3	V
Forward Transconductance	$V_{DS} = 20 \text{ V}$ , $I_D = 7.5 \text{ A}$	$g_{FS}$	–	18	–	S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$V_{DS} = 400 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 250 \text{ kHz}$	$C_{ISS}$	–	1350	–	pF
Output Capacitance		$C_{OSS}$	–	25	–	
Time Related Output Capacitance	$I_D = \text{Constant}$ , $V_{DS} = 0 \text{ V}$ to $400 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$C_{OSS(\text{tr.})}$	–	372	–	
Energy Related Output Capacitance	$V_{DS} = 0 \text{ V}$ to $400 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$C_{OSS(\text{er.})}$	–	42	–	
Total Gate Charge	$V_{DD} = 400 \text{ V}$ , $I_D = 7.5 \text{ A}$ , $V_{GS} = 10 \text{ V}$	$Q_{G(\text{tot})}$	–	25	–	nC
Gate-to-Source Charge		$Q_{GS}$	–	7	–	
Gate-to-Drain Charge		$Q_{GD}$	–	8	–	
Gate Resistance		$R_G$	–	0.9	–	$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{GS} = 0/10 \text{ V}$ , $V_{DD} = 400 \text{ V}$ , $I_D = 7.5 \text{ A}$ , $R_G = 10 \Omega$	$t_{d(\text{on})}$	–	18	–	ns
Rise Time		$t_r$	–	9	–	
Turn-Off Delay Time		$t_{d(\text{off})}$	–	53	–	
Fall Time		$t_f$	–	4	–	

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 7.5 \text{ A}$ , $T_J = 25^{\circ}\text{C}$	$V_{SD}$	–	–	1.2	V
Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 7.5 \text{ A}$ , $dl/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 400 \text{ V}$	$t_{RR}$	–	251	–	ns
Reverse Recovery Charge		$Q_{RR}$	–	3028	–	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

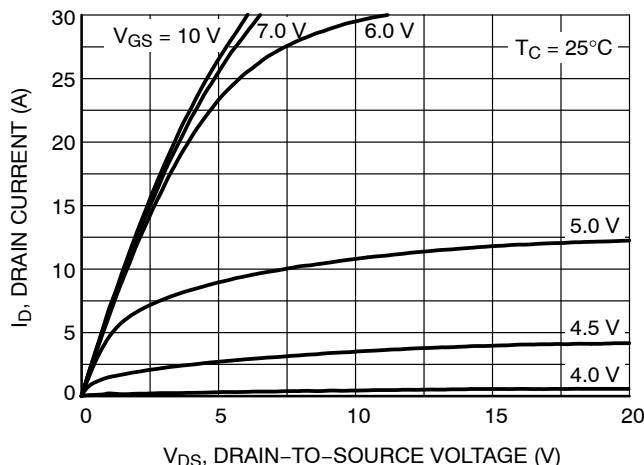


Figure 1. On-Region Characteristics

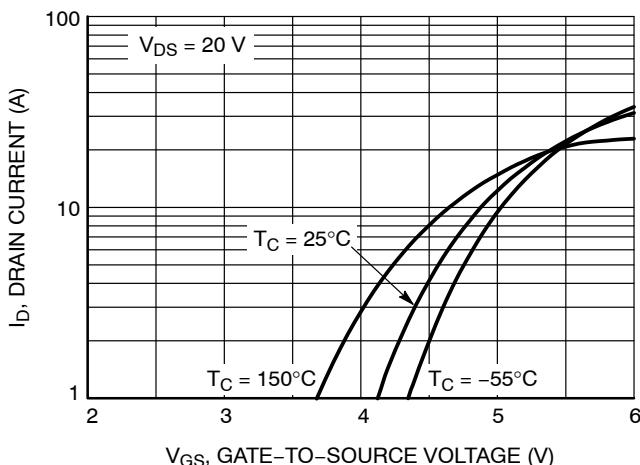


Figure 2. Transfer Characteristics

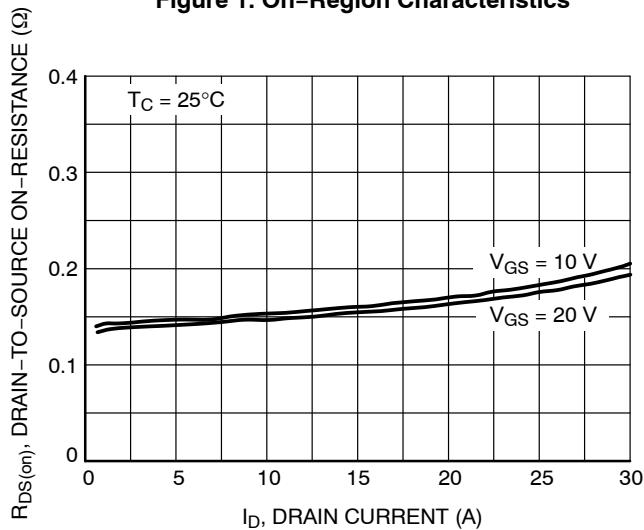


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

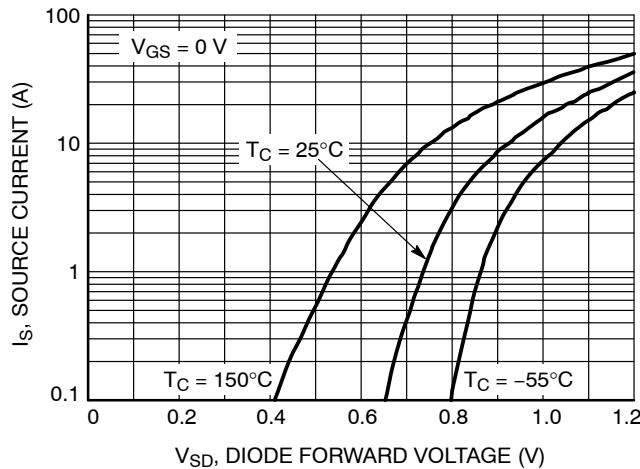


Figure 4. Diode Forward Voltage vs. Source Current

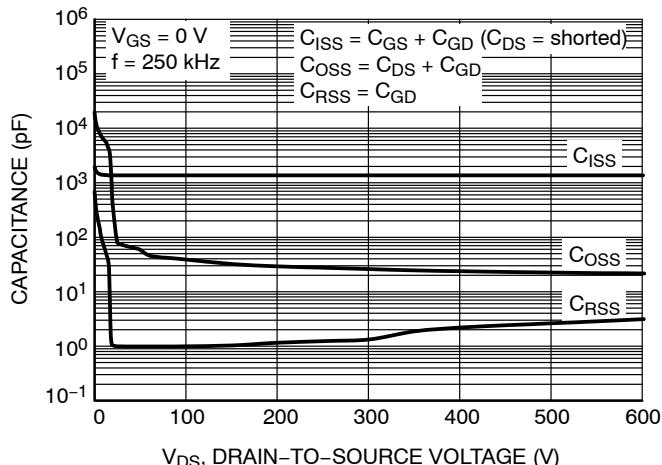


Figure 5. Capacitance Characteristics

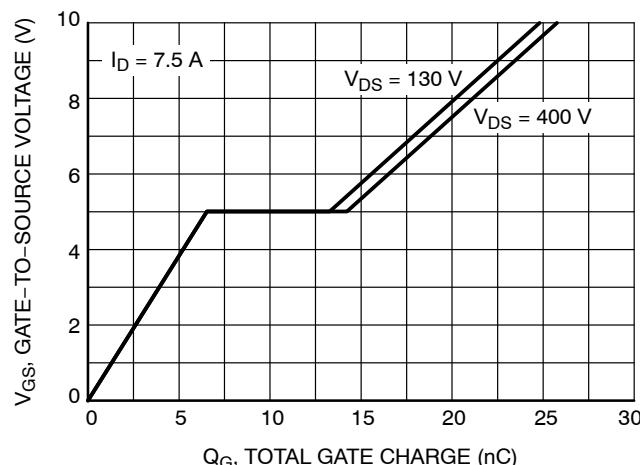
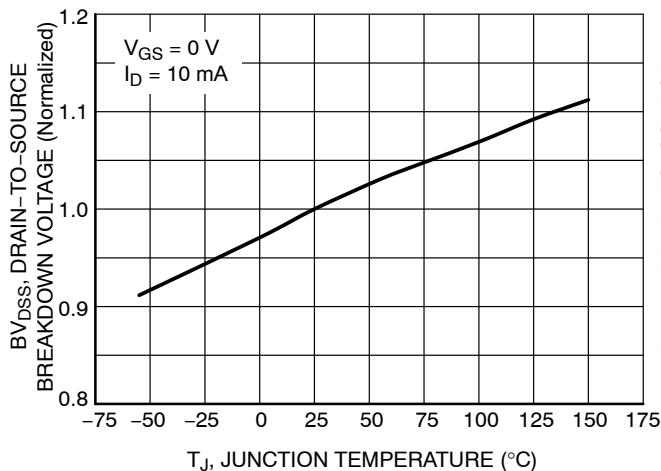
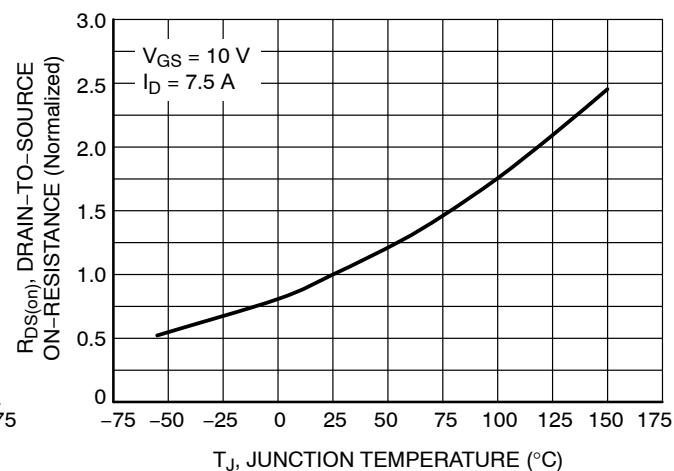


Figure 6. Gate Charge Characteristics

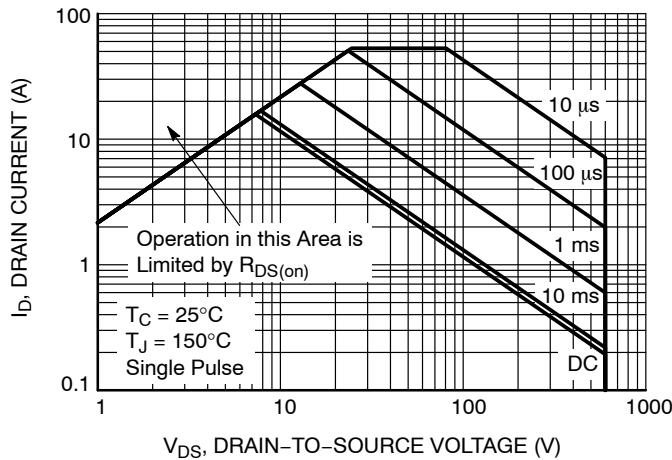
## TYPICAL CHARACTERISTICS



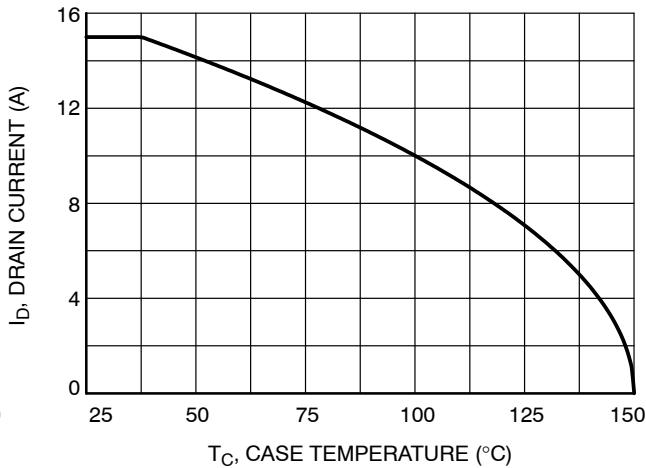
**Figure 7. Breakdown Voltage Variation vs. Temperature**



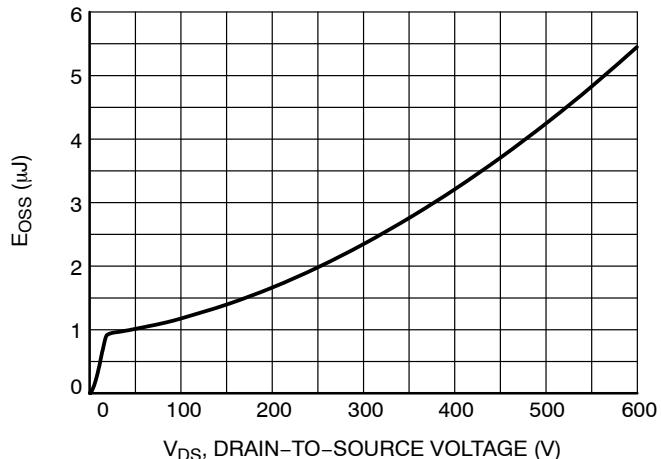
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. E<sub>oss</sub> vs. Drain-to-Source Voltage**

## TYPICAL CHARACTERISTICS

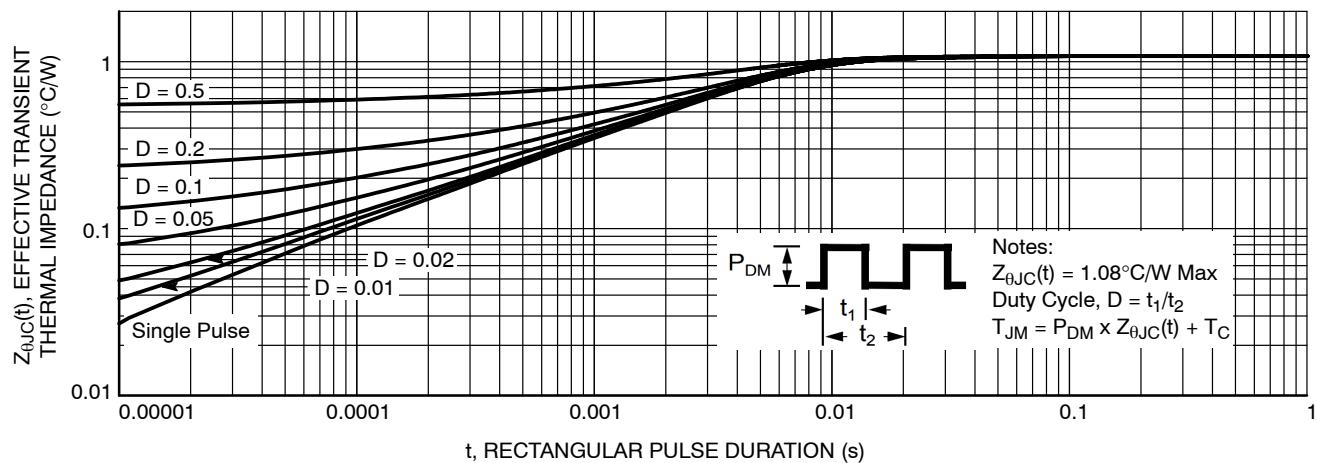


Figure 12. Transient Thermal Impedance

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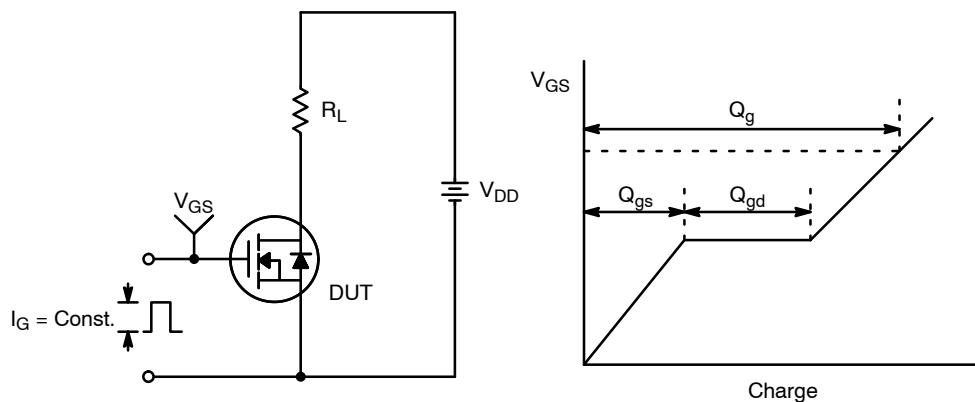


Figure 13. Gate Charge Test Circuit & Waveform

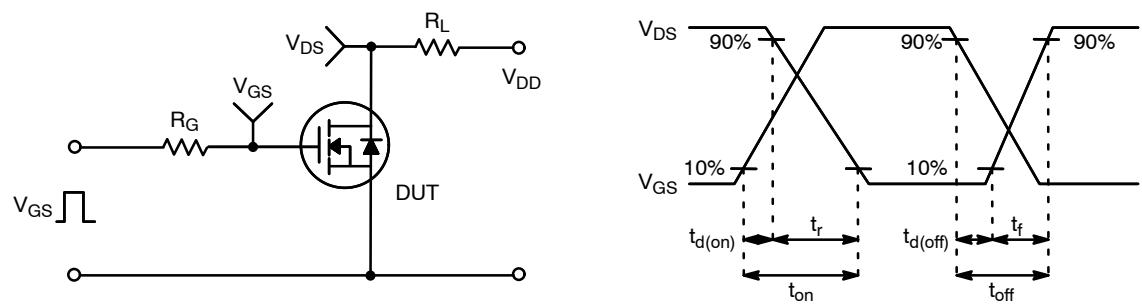


Figure 14. Resistive Switching Test Circuit & Waveforms

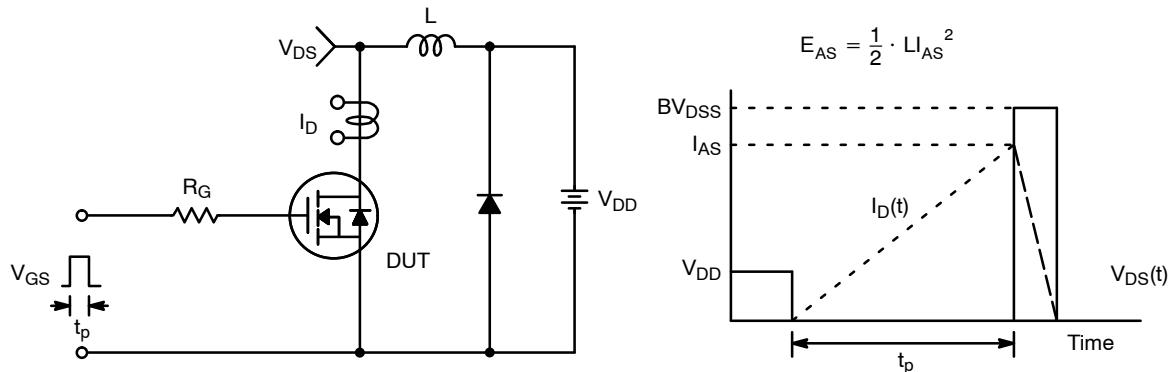


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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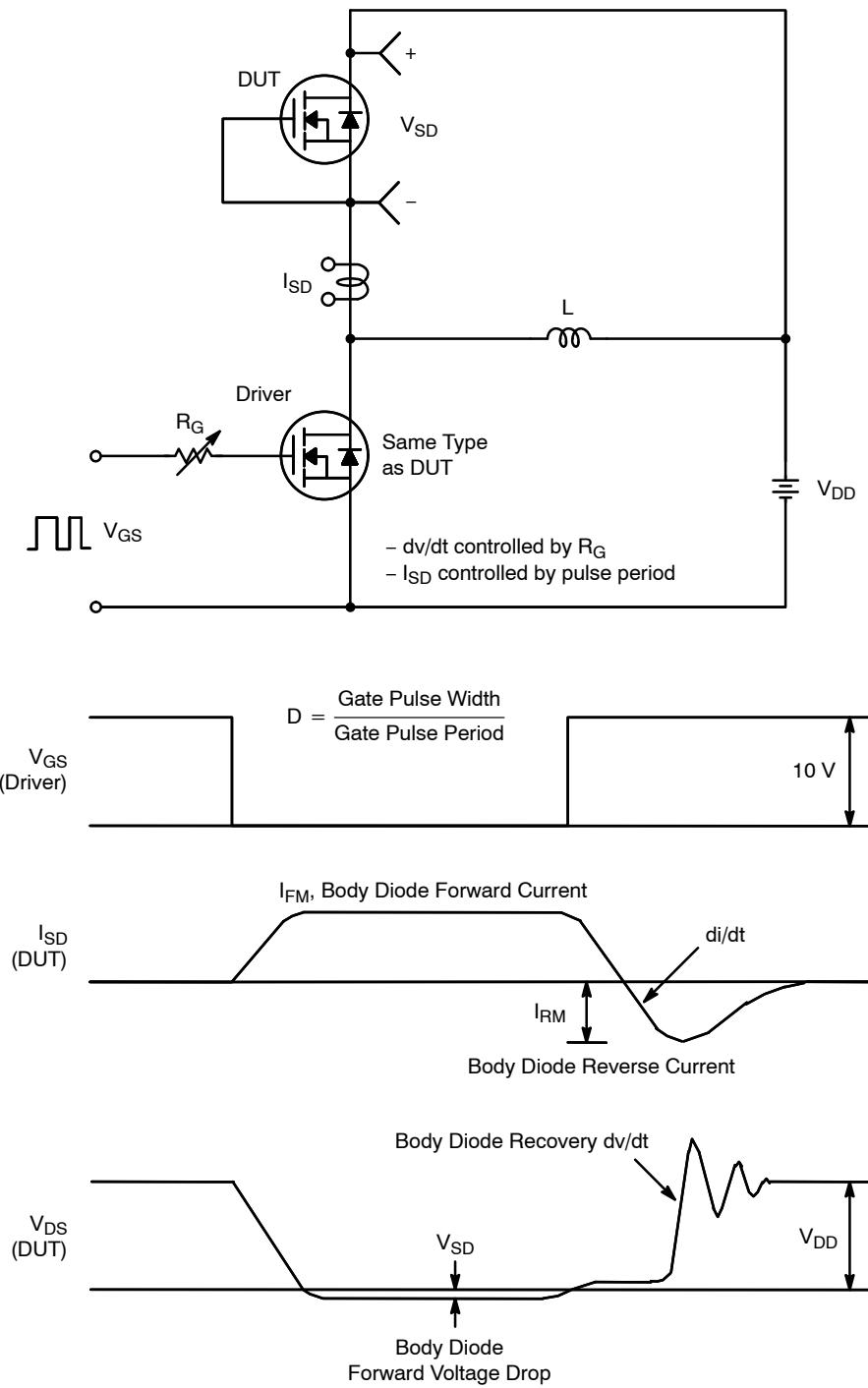
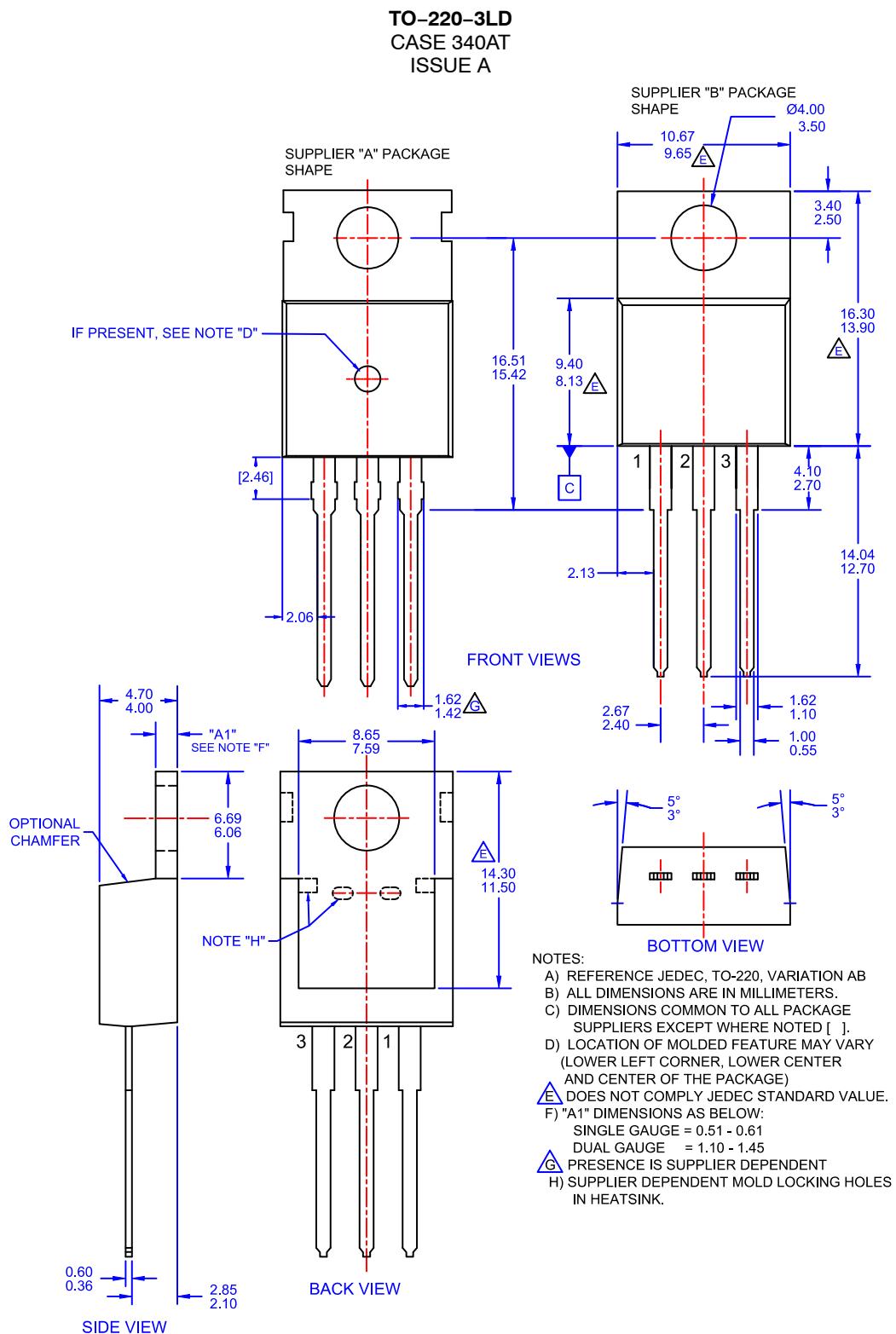


Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

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