

MOSFET – Power, N-Channel, SUPERFET® V, FAST

600 V, 185 mΩ, 15 A



ON Semiconductor®

www.onsemi.com

NTP185N60S5H

Description

The SUPERFET V MOSFET is the fifth generation high voltage super-junction (SJ) MOSFET family from ON Semiconductor. SUPERFET V delivers best-in-class FOMs ($R_{DS(ON)} \cdot Q_G$ and $R_{DS(ON)} \cdot E_{OSS}$) to improve not only heavy load but also light load efficiency. The 600 V SUPERET V series provides design benefits through reduced conduction and switching losses, while supporting extreme MOSFET dV_{DS}/dt ratings at 120 V/ns. Consequently, the SUPERFET V MOSFET FAST series helps maximize system efficiency and power density.

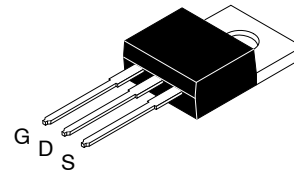
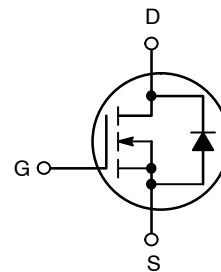
Features

- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 148\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 25\text{ nC}$)
- Low Time Related Output Capacitance (Typ. $C_{oss(tr)} = 372\text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

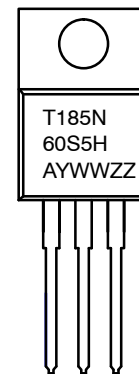
- Telecom / Server Power Supplies
- Industrial Power Supplies
- EV Charger
- UPS / Solar

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



TO-220-3LD
CASE 340AT

MARKING DIAGRAM



T185N60S5H = Specific Device Code
 A = Assembly Plant Code
 YWW = Date Code (Year & Week)
 ZZ = Lot

ORDERING INFORMATION

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

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

Symbol	Parameter	Value	Unit
V _{DSS}	Drain to Source Voltage	600	V
V _{GSS}	Gate to Source Voltage	- DC	±30
		- AC (f > 1 Hz)	±30
I _D	Drain Current	- Continuous (T _C = 25°C)	15
		- Continuous (T _C = 100°C)	9
I _{DM}	Drain Current	- Pulsed (Note 1)	53
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	124	mJ
I _{AS}	Avalanche Current (Note 2)	3.6	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	1.16	mJ
dv/dt	MOSFET dv/dt	120	V/ns
	Peak Diode Recovery dv/dt (Note 3)	20	
P _D	Power Dissipation	(T _C = 25°C)	116
		- Derate Above 25°C	0.93
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	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_{AS} = 3.6 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 7.5 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	1.08	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	62.5	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Shipping
NTP185N60S5H	T185N60S5H	TO-220-3LD (Pb-Free / Halogen Free)	50 Units / Tube

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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

BV _{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 150^\circ\text{C}$	650	-	-	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.63	-	V/ $^\circ\text{C}$
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	-	0.69	-	
I _{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1.4\text{ mA}$	2.7	-	4.3	V
R _{DS(on)}	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$	-	148	185	m Ω
g _{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 7.5\text{ A}$	-	18	-	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$	-	1350	-	pF
C _{oss}	Output Capacitance		-	25	-	pF
C _{oss(tr.)}	Time Related Output Capacitance	$I_D = \text{Constant}, V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	372	-	pF
C _{oss(er.)}	Energy Related Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	-	42	-	pF
Q _{g(tot)}	Total Gate Charge	$V_{DD} = 400\text{ V}, I_D = 7.5\text{ A}, V_{GS} = 10\text{ V}$	-	25	-	nC
Q _{gs}	Gate to Source Charge		-	7	-	nC
Q _{gd}	Gate to Drain Charge		-	8	-	nC
ESR	Equivalent Series Resistance		$f = 1\text{ MHz}$	-	0.9	-

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	$V_{DD} = 400\text{ V}, I_D = 7.5\text{ A}, V_{GS} = 10\text{ V}, R_g = 10\ \Omega$	-	18	-	ns
t _r	Turn-On Rise Time		-	9	-	ns
t _{d(off)}	Turn-Off Delay Time		-	53	-	ns
t _f	Turn-Off Fall Time		-	4	-	ns

SOURCE-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source to Drain Diode Forward Current	-	-	15	A	
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current	-	-	53	A	
V _{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 7.5\text{ A}$	-	-	1.2	V
t _{rr}	Reverse Recovery Time	$V_{DD} = 400\text{ V}, I_{SD} = 7.5\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}$	-	251	-	ns
Q _{rr}	Reverse Recovery Charge		-	3	-	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.

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TYPICAL CHARACTERISTICS

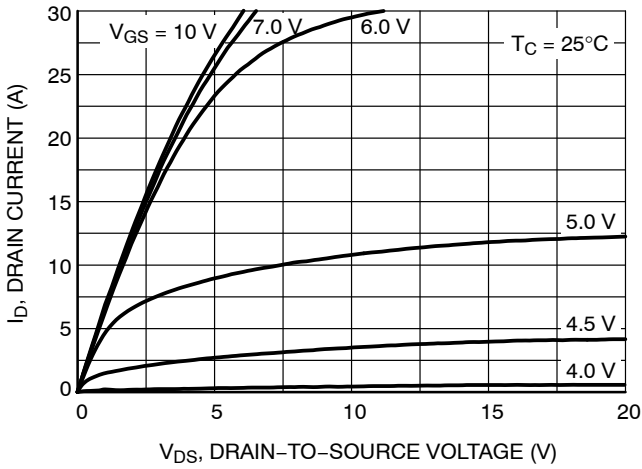


Figure 1. On-Region Characteristics

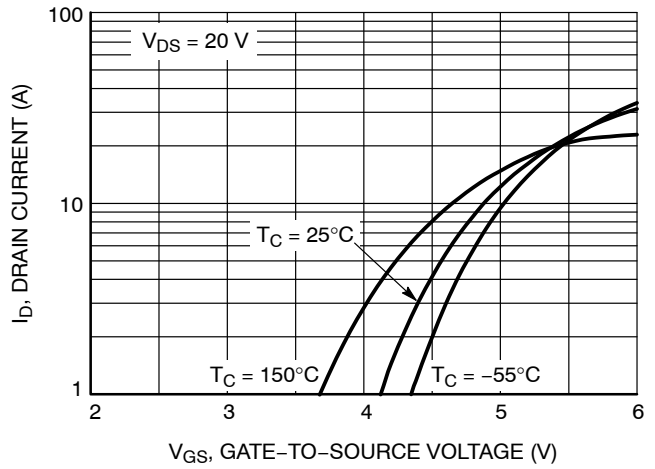


Figure 2. Transfer Characteristics

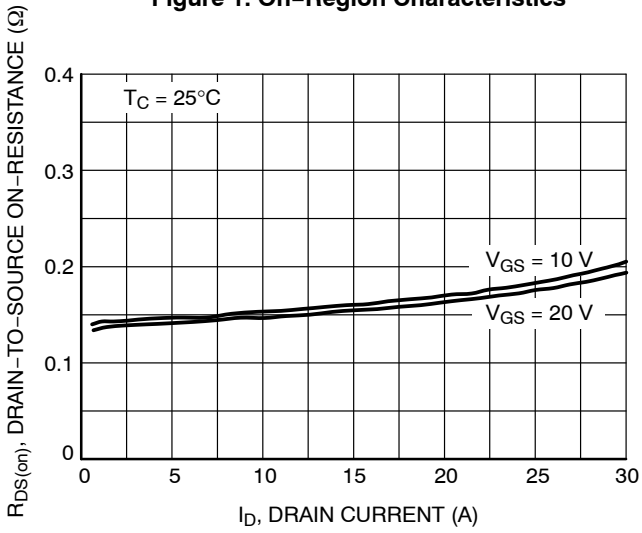


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

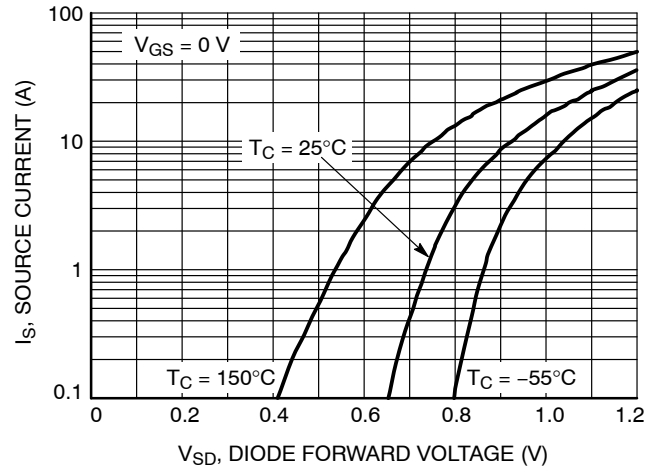


Figure 4. Diode Forward Voltage vs. Source Current

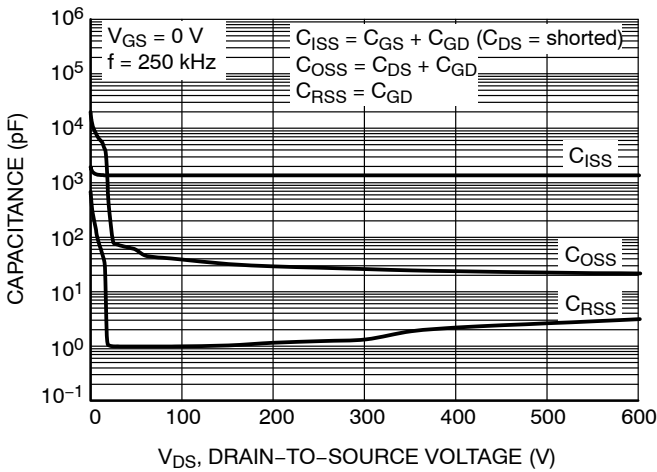


Figure 5. Capacitance Characteristics

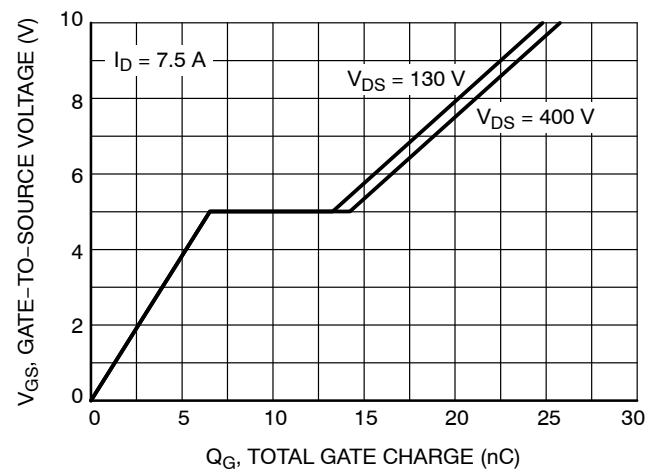


Figure 6. Gate Charge Characteristics

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TYPICAL CHARACTERISTICS

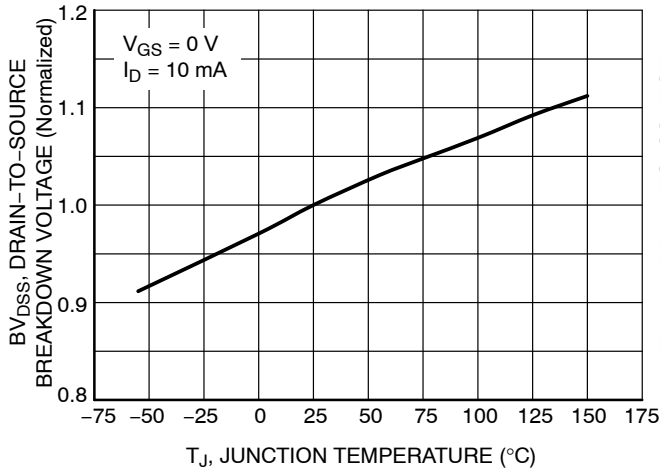


Figure 7. Breakdown Voltage Variation vs. Temperature

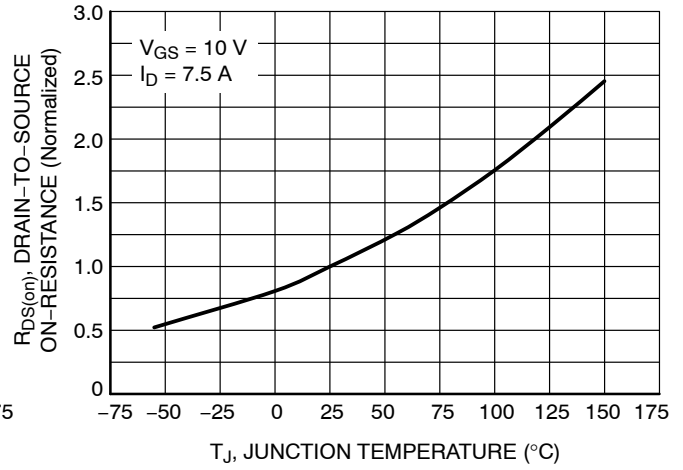


Figure 8. On-Resistance Variation vs. Temperature

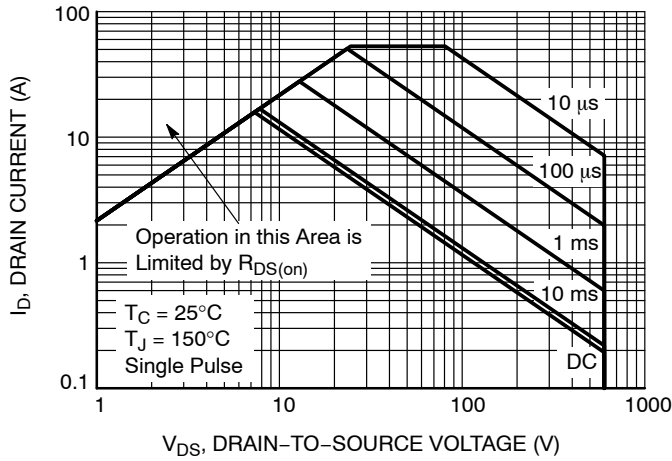


Figure 9. Maximum Safe Operating Area

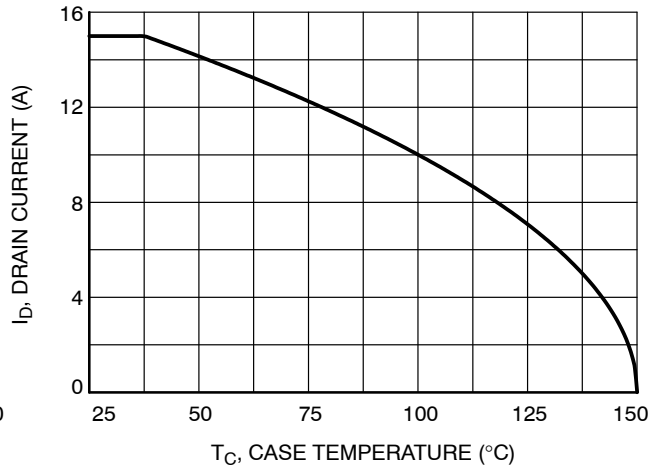


Figure 10. Maximum Drain Current vs. Case Temperature

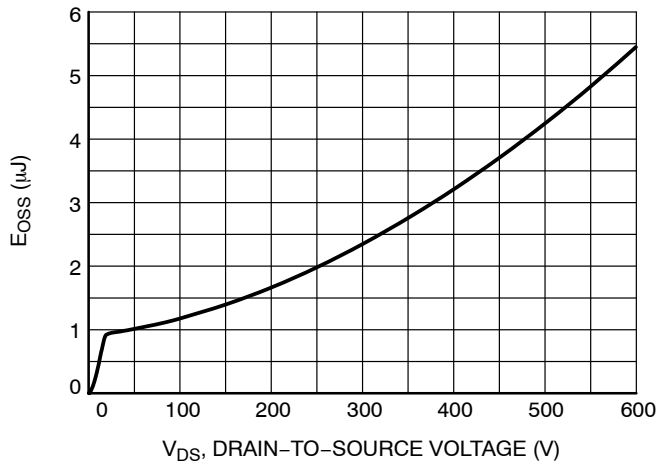


Figure 11. E_{OSS} vs. Drain-to-Source Voltage

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TYPICAL CHARACTERISTICS

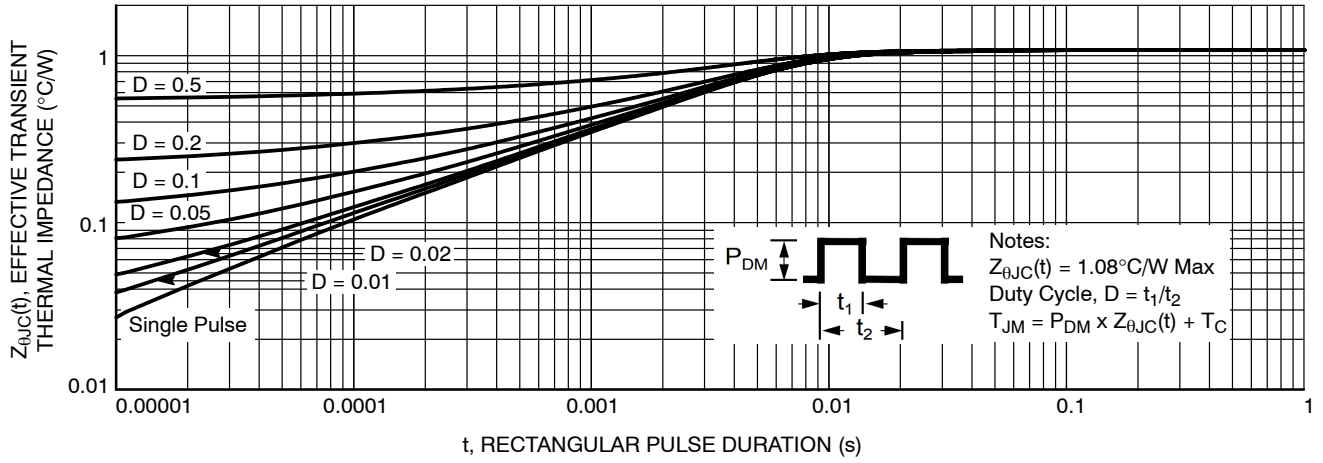


Figure 12. Transient Thermal Impedance

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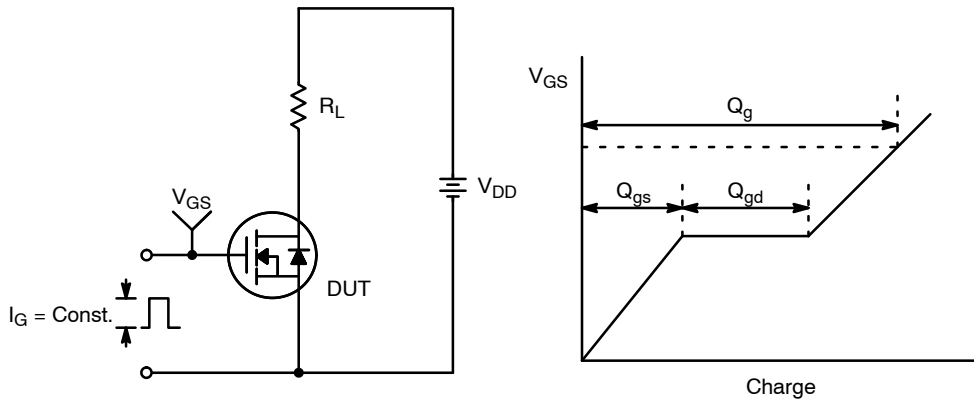


Figure 13. Gate Charge Test Circuit & Waveform

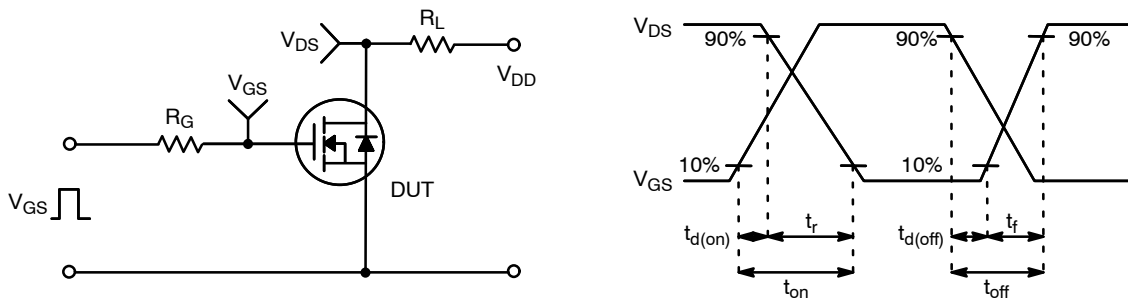


Figure 14. Resistive Switching Test Circuit & Waveforms

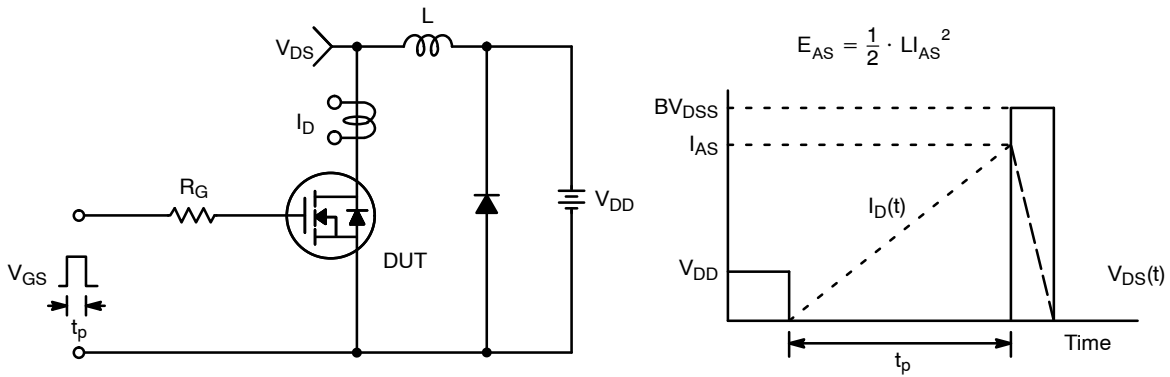


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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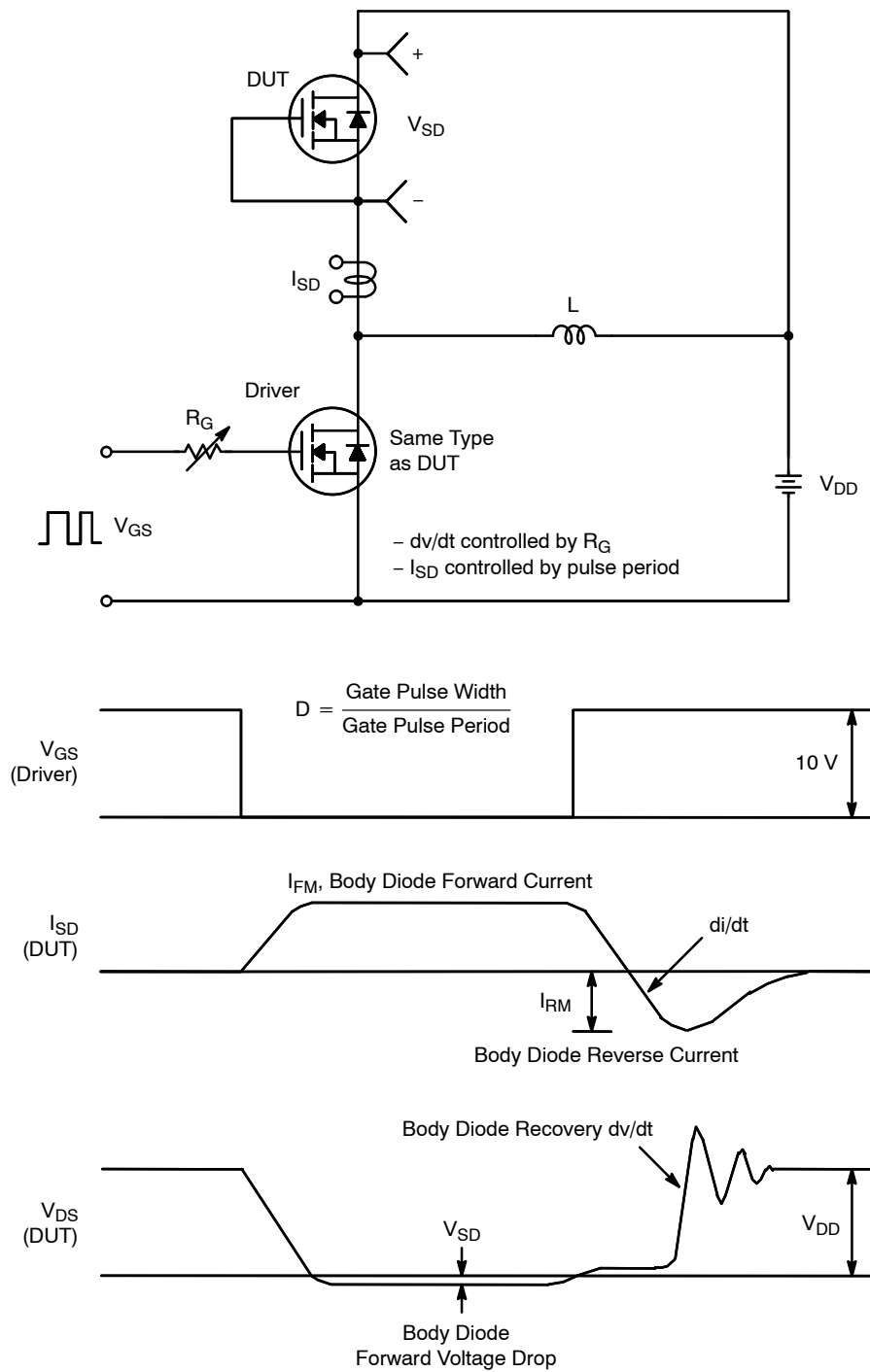
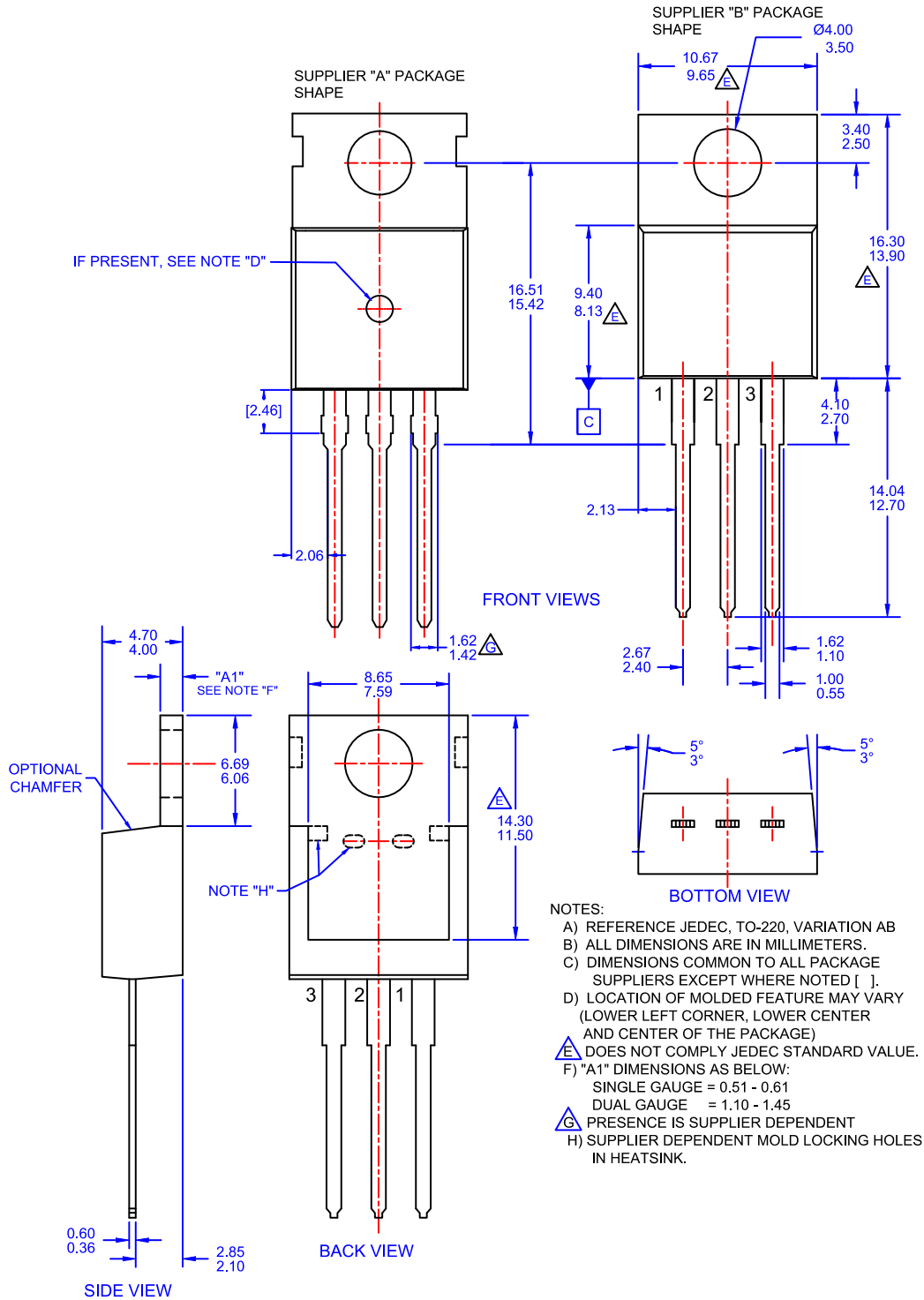



Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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PACKAGE DIMENSIONS

TO-220-3LD
CASE 340AT
ISSUE A



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