MOSFET - Power, Single N-Channel, SUPERFET® V, Easy Drive, TO247-3L

600 V, 99 mΩ, 33 A

NTHL099N60S5

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
600 V	99 mΩ @ 10 V	33 A

Description

SUPERFET V MOSFET Easy Drive series combines excellent switching performance without sacrificing ease of use and EMI issues for both hard and soft switching topologies.

Features

- 650 V @ $T_J = 150°C$
- Typ. $R_{DS(on)} = 79.2$ mΩ
- 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

D
G
S

G D S

TO−247 Long Leads
CASE 340CX

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

Parameter		Symbol	Value	Unit
Drain−to−Source Voltage		V_{DSS}	600	V
Gate−to−Source Voltage	DC	V_{GSS}	±30	V
	AC (f > 1 Hz)		±30	
Continuous Drain Current	$T_C = 25°C$	I_D	33*	A
	$T_C = 100°C$		20*	
Power Dissipation	$T_C = 25°C$	P_D	184	W
Pulsed Drain Current (Note 1)	$T_C = 25°C$	I_{DM}	95*	A
Pulsed Source Current (Body Diode) (Note 1)	$T_C = 25°C$	I_{SM}	95*	A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)		I_S	33*	A
Single Pulse Avalanche Energy	$I_L = 5.1$ A, $R_G = 25$ Ω	E_{AS}	232	mJ
Avalanche Current		I_{AS}	5.1	A
Repetitive Avalanche Energy (Note 1)		E_{AR}	1.84	mJ
MOSFET dv/dt		dv/dt	120	V/ns
Peak Diode Recovery dv/dt (Note 2)			50	
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.
*Drain current limited by maximum junction temperature.
1. Repetitive rating: pulse−width limited by maximum junction temperature.
2. $I_{SD} \leq 13.5$ A, di/dt ≤ 200 A/μs, $V_{DD} \leq 400$ V, starting $T_J = 25°C$.

MARKING DIAGRAM

T099N
60S5
AYWWZZ

T099N60S5	= Specific Device Code
A	= Assembly Location
YWW	= Data Code (Year & Week)
ZZ	= Assembly Lot

ORDERING INFORMATION

Device	Package	Shipping
NTHL099N60S5	TO−247	30 Units / Tube

Publication Order Number:
NTHL099N60S5/D

NTHL099N60S5

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction−to−Case, Max.	$R_{\theta JC}$	0.68	°C/W
Thermal Resistance, Junction−to−Ambient, Max.	$R_{\theta JA}$	40	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 1 mA, T_J = 25°C	600	–	–	V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	I_D = 10 mA, Referenced to 25°C	–	630	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 600 V, T_J = 25°C	–	–	1	μA
Gate−to−Source Leakage Current	I_{GSS}	V_{GS} = ±30 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 13.5 A, T_J = 25°C	–	79.2	99	mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 2.8 mA, T_J = 25°C	2.4	–	4.0	V
Forward Trans−conductance	g_{FS}	V_{DS} = 20 V, I_D = 13.5 A	–	26	–	S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 250 kHz	–	2500	–	pF
Output Capacitance	C_{OSS}		–	41	–	
Time Related Output Capacitance	$C_{OSS(tr.)}$	I_D = Constant, V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	642	–	
Energy Related Output Capacitance	$C_{OSS(er.)}$	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	70	–	
Total Gate Charge	$Q_{G(tot)}$	V_{DD} = 400 V, I_D = 13.5 A, V_{GS} = 10 V	–	48	–	nC
Gate−to−Source Charge	Q_{GS}		–	12	–	
Gate−to−Drain Charge	Q_{GD}		–	14	–	
Gate Resistance	R_G	f = 1 MHz	–	6.9	–	Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(on)}$	V_{GS} = 0/10 V, V_{DD} = 400 V, I_D = 13.5 A, R_G = 4.7 Ω	–	26	–	ns
Rise Time	t_r		–	17	–	
Turn-Off Delay Time	$t_{d(off)}$		–	92	–	
Fall Time	t_f		–	4.2	–	
SOURCE-TO−DRAIN DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_{SD} = 13.5 A, T_J = 25°C	–	–	1.2	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_{SD} = 13.5 A, dI/dt = 100 A/μs, V_{DD} = 400 V	–	310	–	ns
Reverse Recovery Charge	Q_{RR}		–	4627	–	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.

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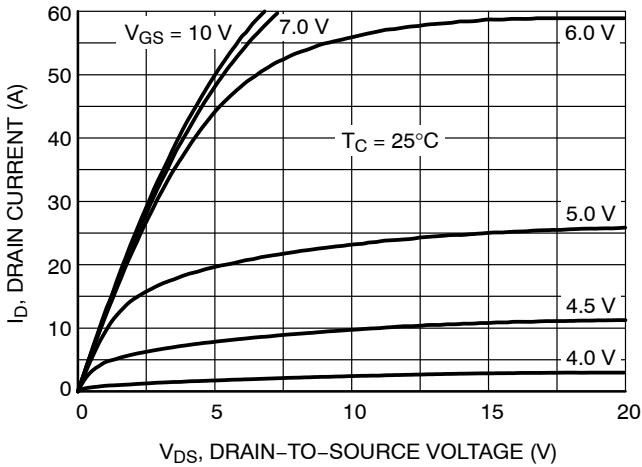## TYPICAL CHARACTERISTICS

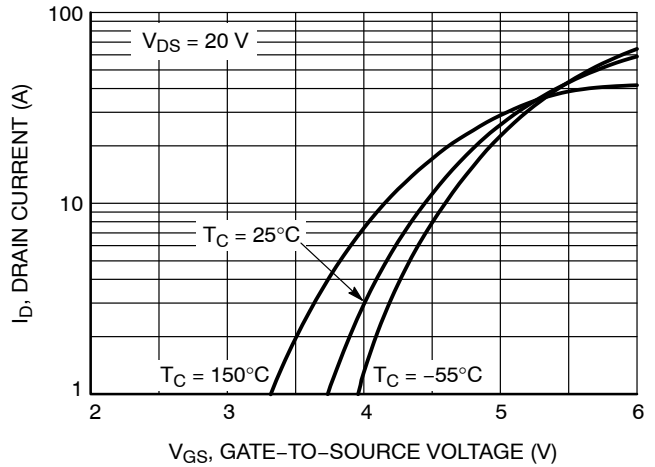Figure 1. On−Region Characteristics
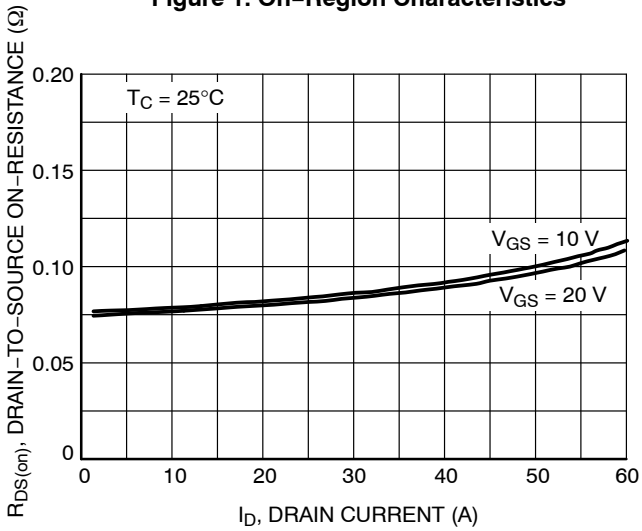

Figure 2. Transfer Characteristics

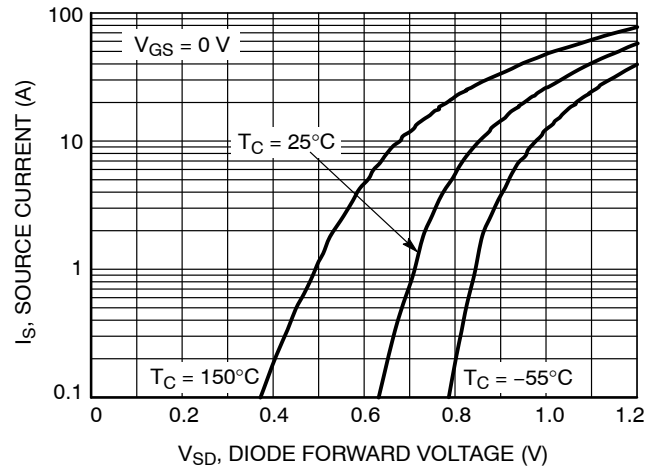Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

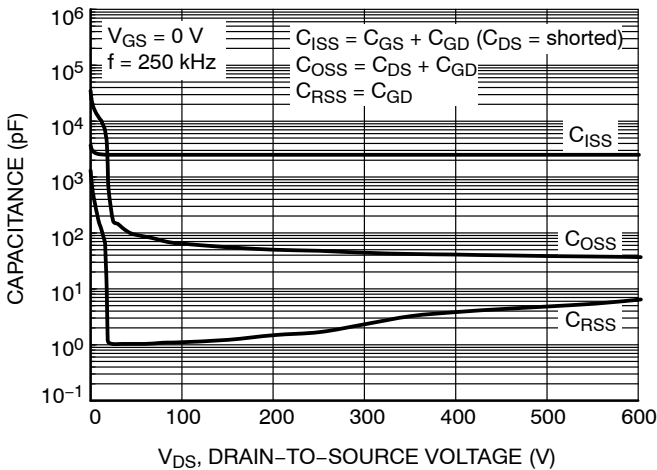Figure 4. Diode Forward Voltage vs. Source Current

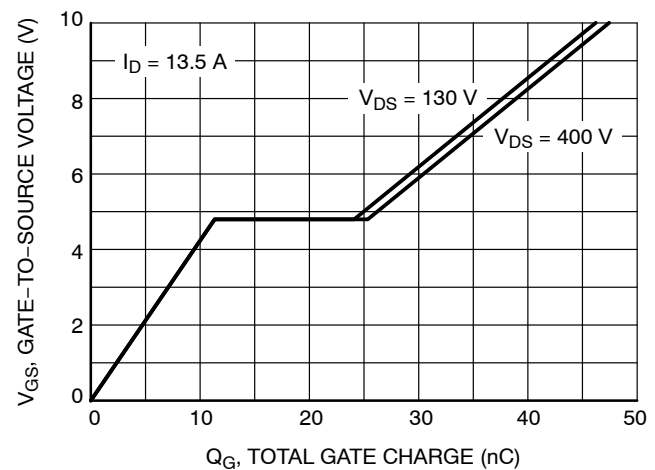Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

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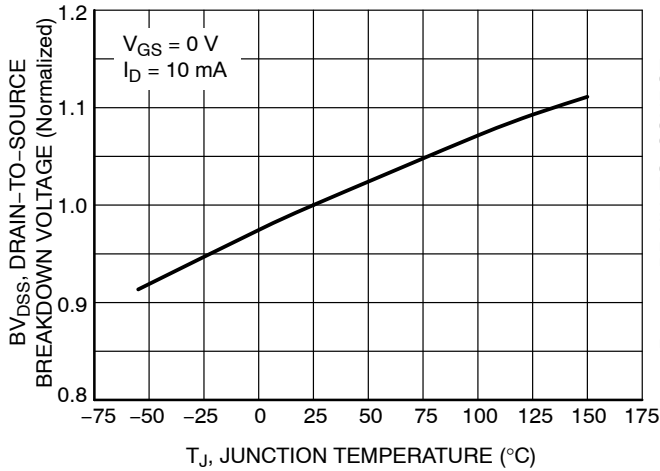## TYPICAL CHARACTERISTICS

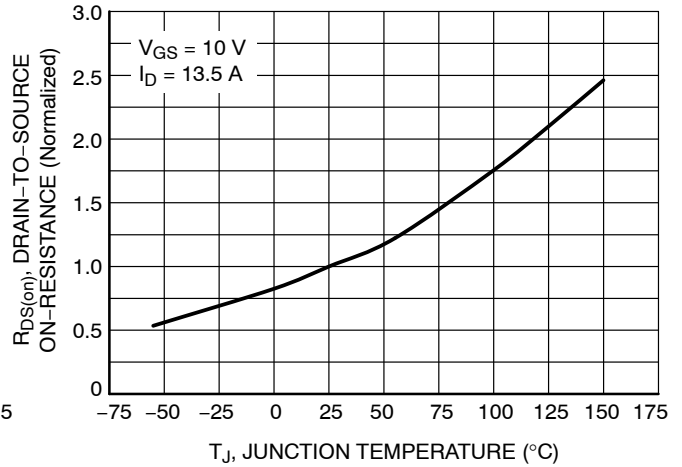Figure 7. Breakdown Voltage Variation vs. Temperature
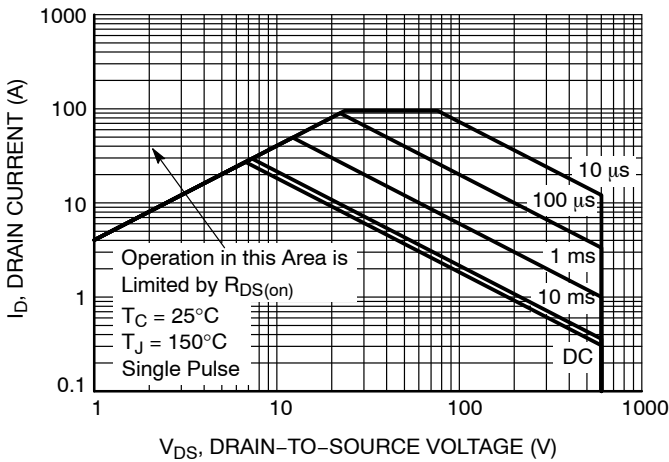

Figure 8. On−Resistance Variation vs. Temperature

Figure 9. Maximum Safe Operating Area
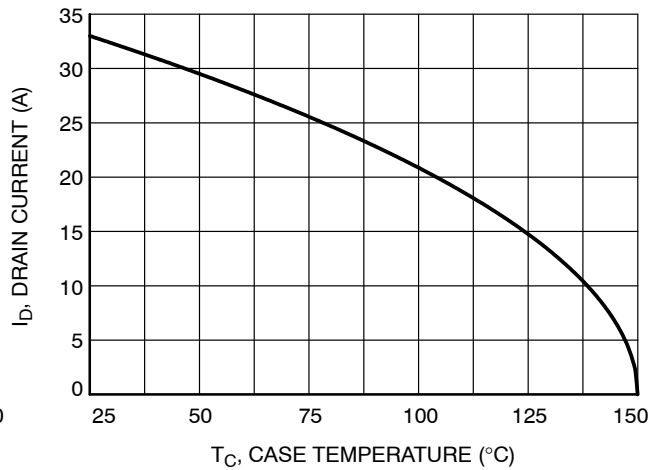
Figure 10. Maximum Drain Current vs. Case Temperature
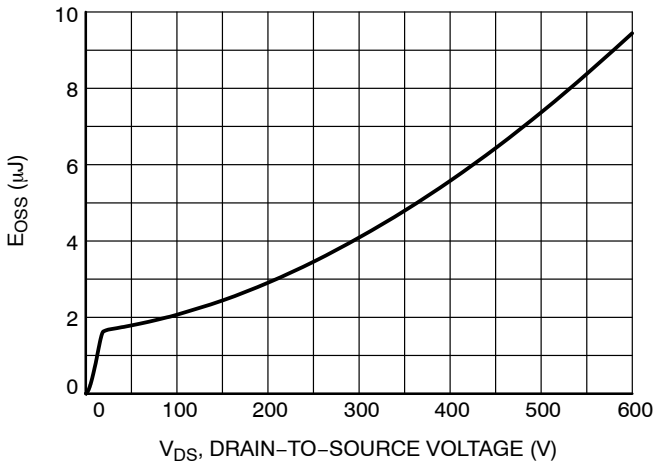
Figure 11. E_{OSS} vs. Drain−to−Source Voltage

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TYPICAL CHARACTERISTICS
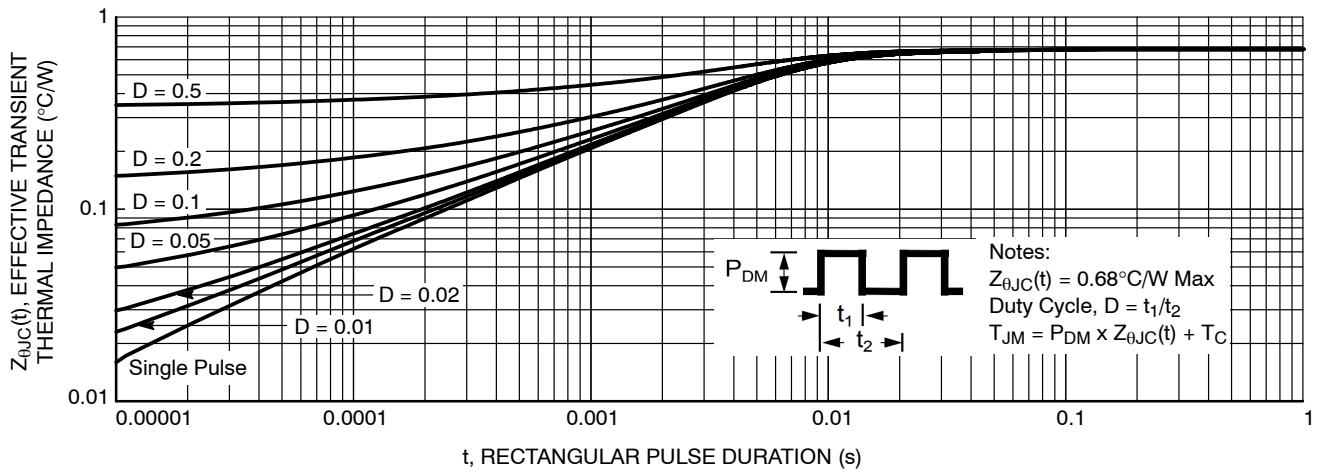
Figure 12. Transient Thermal Impedance
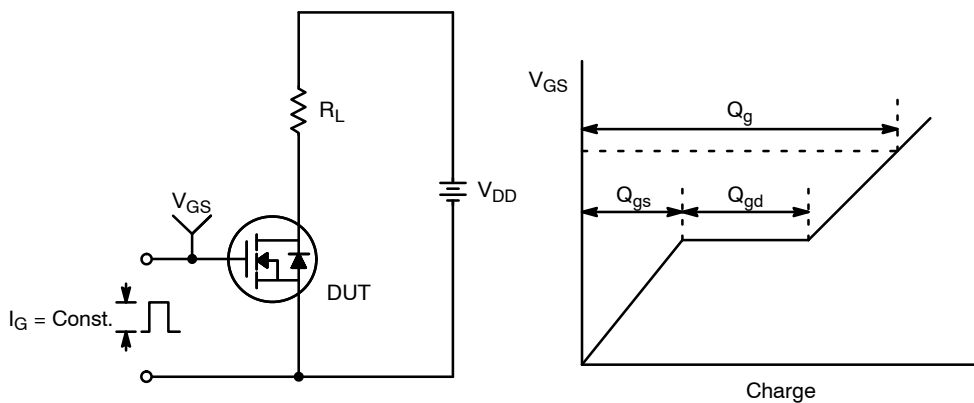
Figure 13. Gate Charge Test Circuit & Waveform
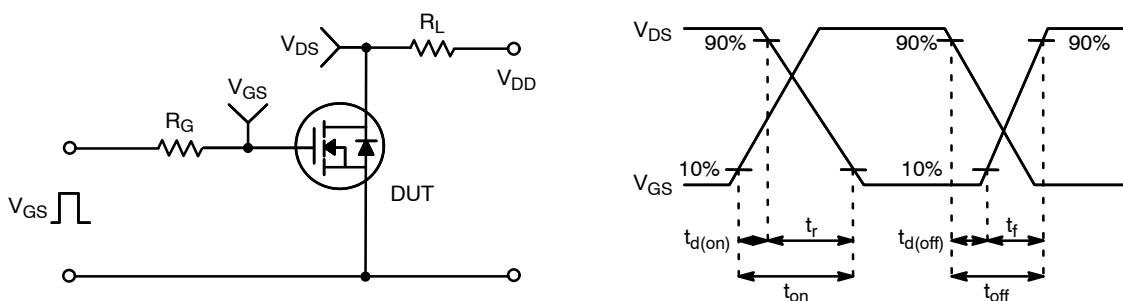
Figure 14. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \cdot L I_{AS}^2$$
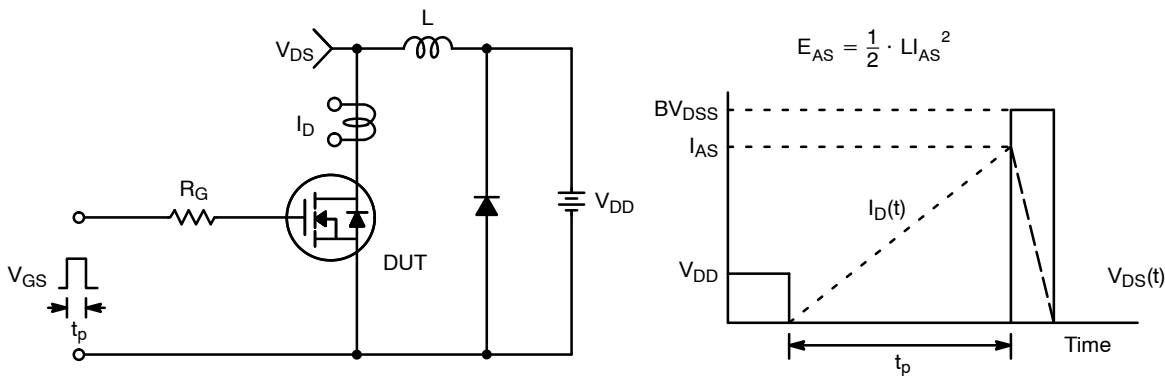
Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$
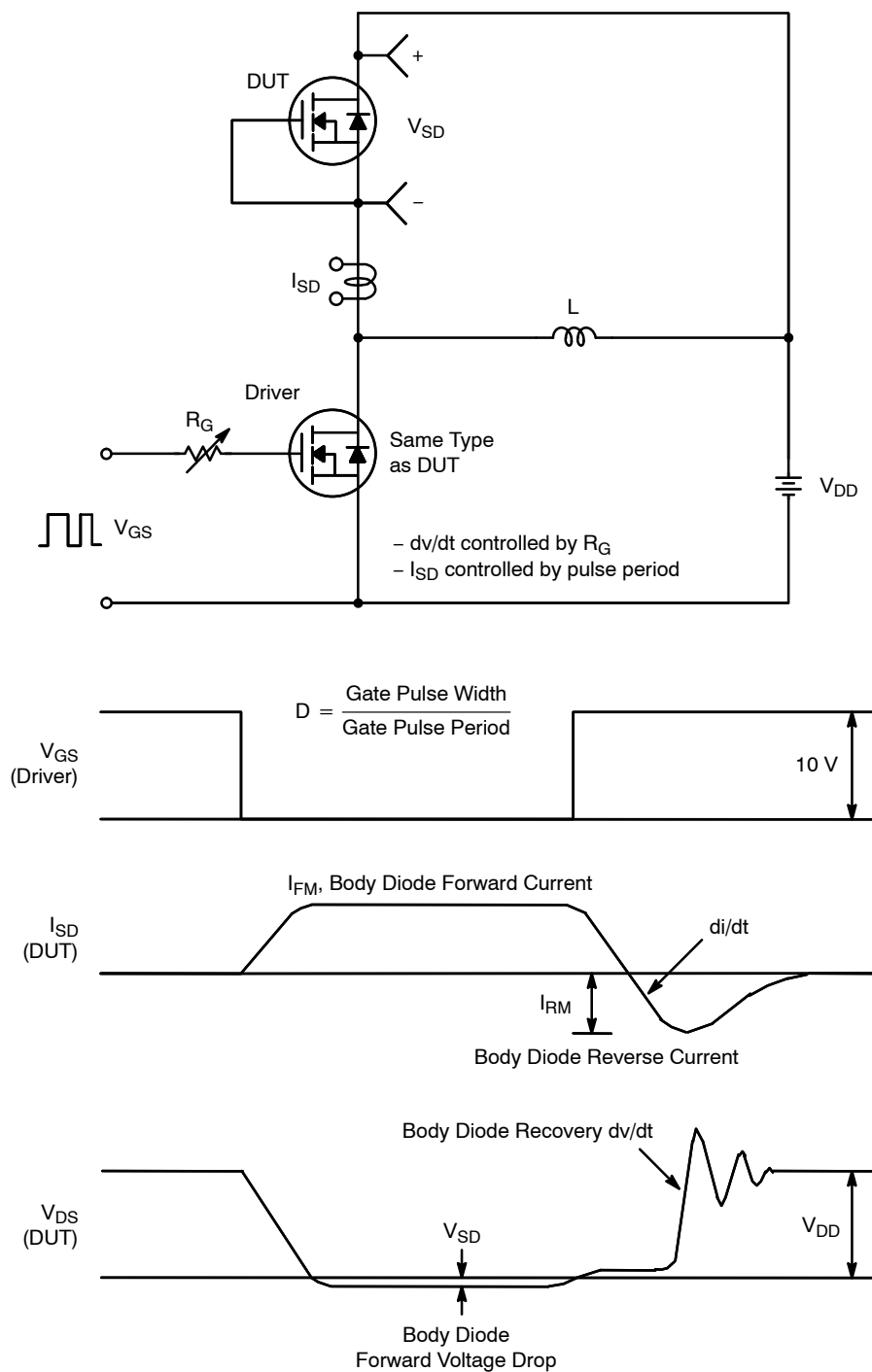
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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PACKAGE DIMENSIONS

TO−247−3LD
CASE 340CX
ISSUE A
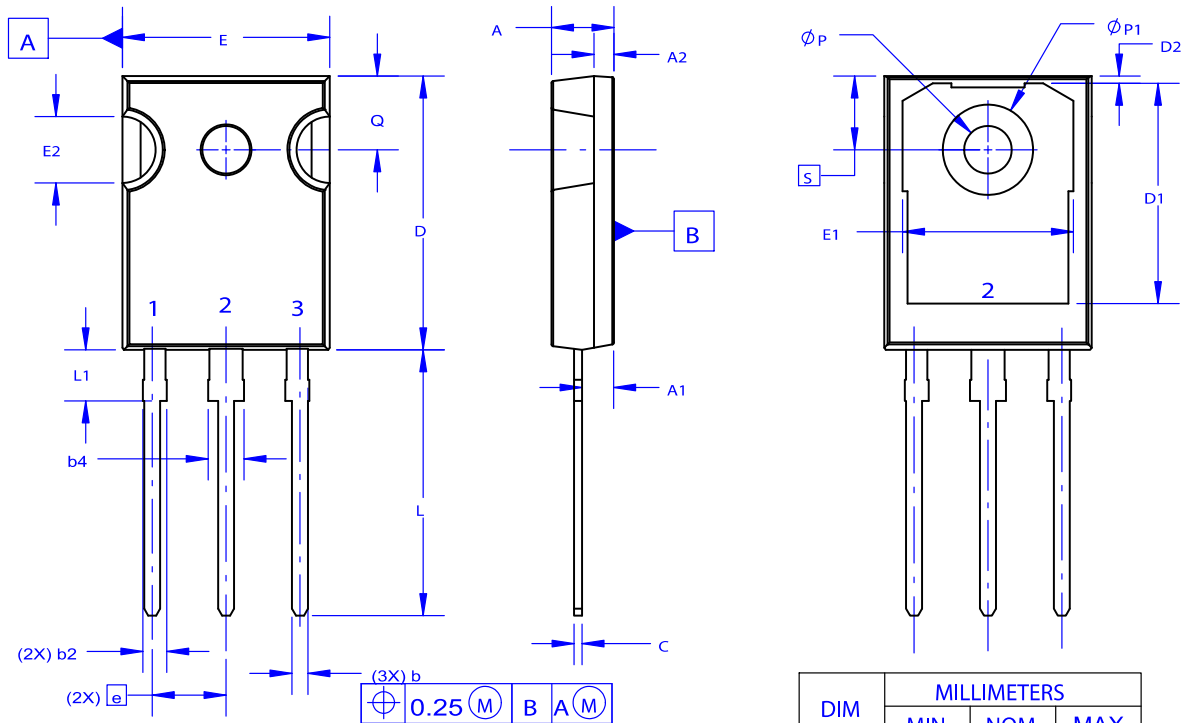
NOTES: UNLESS OTHERWISE SPECIFIED.

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.

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
⌀P	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	~	~
⌀P1	6.60	6.80	7.00

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PUBLICATION ORDERING INFORMATION

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