MOSFET - Power, N-Channel, SUPERFET® III, FRFET®

650 V, 110 mΩ, 30 A

NVHL110N65S3HF

Description

SUPERFET III 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 advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate.

Consequently, SUPERFET III MOSFET is very suitable for the various power system for miniaturization and higher efficiency.

SUPERFET III HF version provides fast recovery for improved efficiency in high speed switching applications.

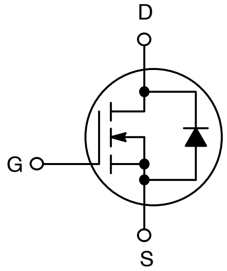
Features

- 700 V @ $T_J = 150°C$
- Typ. $R_{DS(on)} = 89\ m\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 58\ nC$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 510\ pF$)
- 100% Avalanche Tested
- NVHL Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

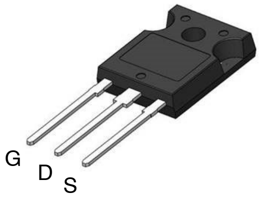
Applications

- Automotive On Board Charger HEV−EV
- Automotive DC/DC Converter for HEV−EV

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
650 V	110 mΩ @ 10 V	30 A

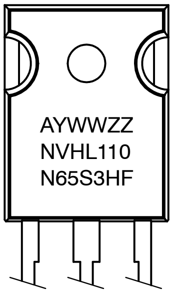


N−Channel MOSFET



TO−247 Long Leads
CASE 340CX

MARKING DIAGRAM



A	= Assembly Plant Code
YWW	= Data Code (Year & Week)
ZZ	= Assembly Lot Code
NVHL110N65S3HF	= Specific Device Code

ORDERING INFORMATION

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

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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain−to−Source Voltage		650	V
V_{GSS}	Gate−to−Source Voltage	DC	±30	V
		AC (f > 1 Hz)	±30	V
I_D	Drain Current	Continuous (T_C = 25°C)	30	A
		Continuous (T_C = 100°C)	19.5	
I_{DM}	Drain Current	Pulsed (Note 1)	69	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		380	mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)		2.4	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		50	
P_D	Power Dissipation	(T_C = 25°C)	240	W
		Derate Above 25°C	1.92	W/°C
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 s		300	°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} = 3.5 A, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \le 15$ A, di/dt ≤ 200 A/μs, $V_{DD} \le 400$ V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Max.	0.52	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Max.	40	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NVHL110N65S3HF	NVHL110N65S3HF	TO−247	Tube	N/A	N/A	30 Units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain–to–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA, T_J = 25°C	650	–	–	V
		V_{GS} = 0 V, I_D = 10 mA, T_J = 150°C	700	–	–	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 20 mA, Referenced to 25°C	–	0.61	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	–	–	10	μA
		V_{DS} = 520 V, T_C = 125°C	–	9	–	
I_{GSS}	Gate–to–Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 0.74 mA	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain–to–Source On Resistance	V_{GS} = 10 V, I_D = 15 A	–	89	110	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 15 A	–	16	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	–	2753	–	pF
C_{oss}	Output Capacitance		–	52	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	510	–	pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	94	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 400 V, I_D = 15 A, V_{GS} = 10 V (Note 4)	–	58	–	nC
Q_{gs}	Gate–to–Source Gate Charge		–	18	–	nC
Q_{gd}	Gate–to–Drain “Miller” Charge		–	23	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	1.6	–	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 15 A, V_{GS} = 10 V, R_g = 4.7 Ω (Note 4)	–	27.1	–	ns
t_r	Turn-On Rise Time		–	16.9	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	66	–	ns
t_f	Turn-Off Fall Time		–	2.9	–	ns
SOURCE-DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source–to–Drain Diode Forward Current		–	–	30	A
I_{SM}	Maximum Pulsed Source–to–Drain Diode Forward Current		–	–	69	A
V_{SD}	Source–to–Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 15 A	–	–	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 15 A, dI_F/dt = 100 A/μs	–	90	–	ns
Q_{rr}	Reverse Recovery Charge		–	128	–	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.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL CHARACTERISTICS

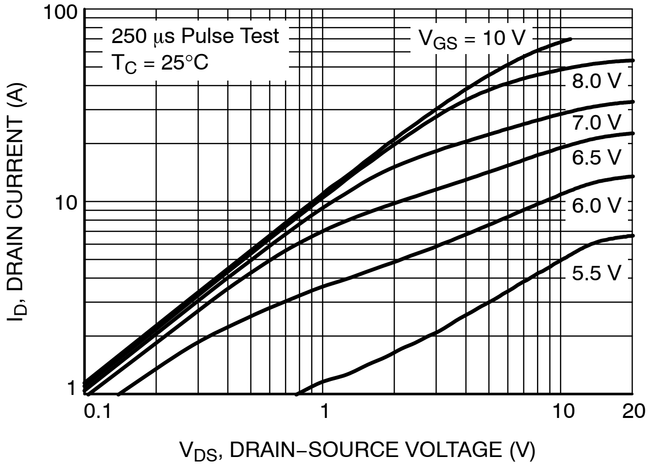


Figure 1. On−Region Characteristics 25°C

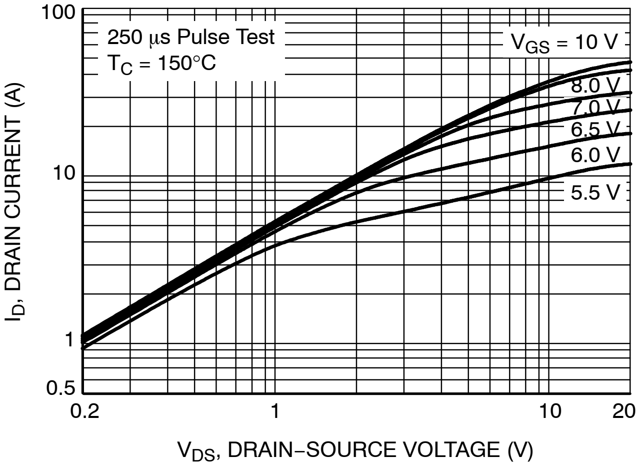


Figure 2. On−Region Characteristics 150°C

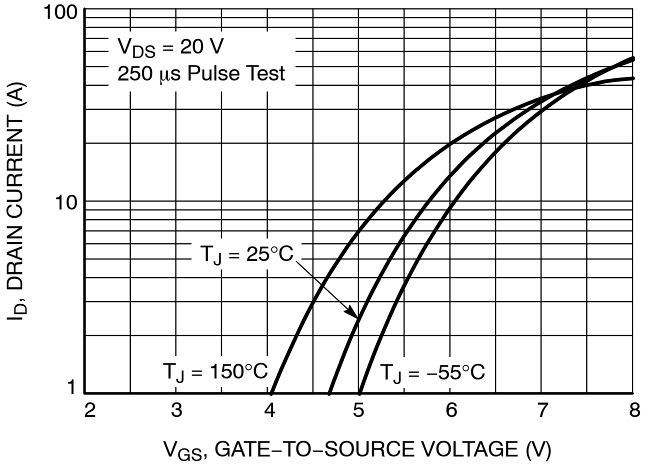


Figure 3. Transfer Characteristics

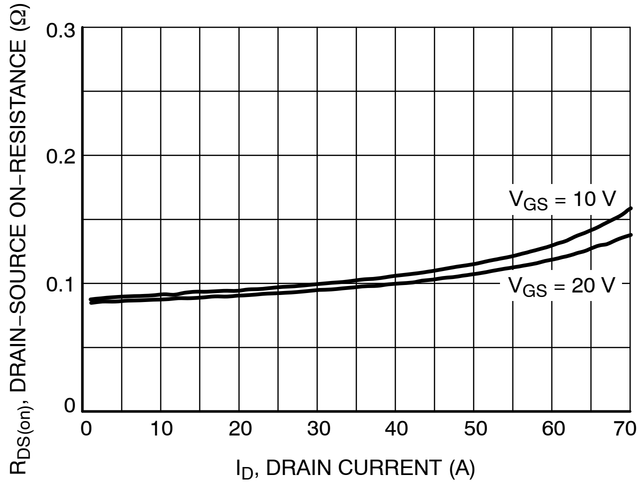


Figure 4. On−Resistance Variation vs. Drain Current and Gate Voltage

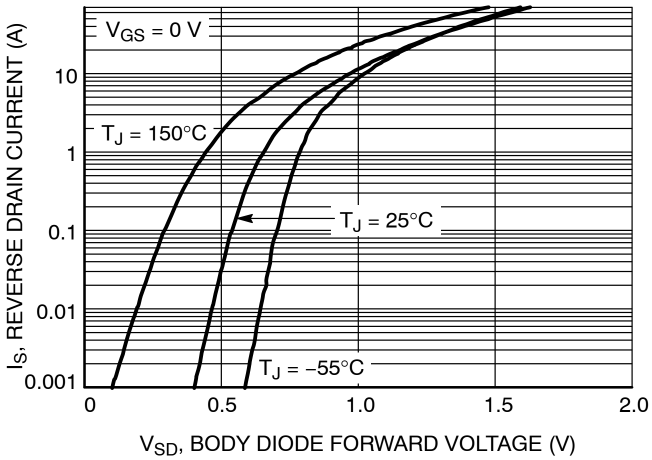


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

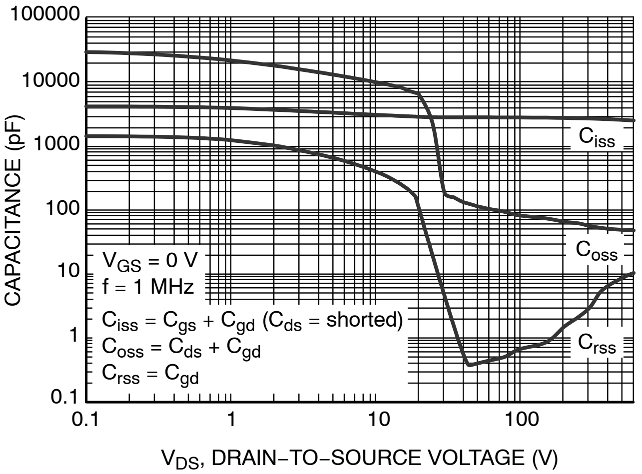


Figure 6. Capacitance Characteristics

TYPICAL CHARACTERISTICS

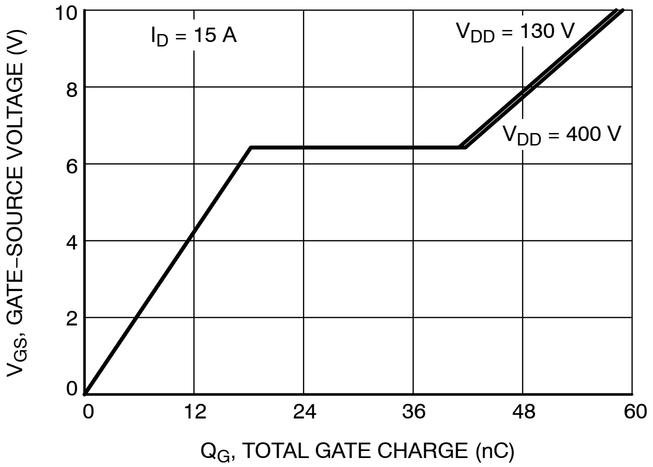


Figure 7. Gate Charge Characteristics

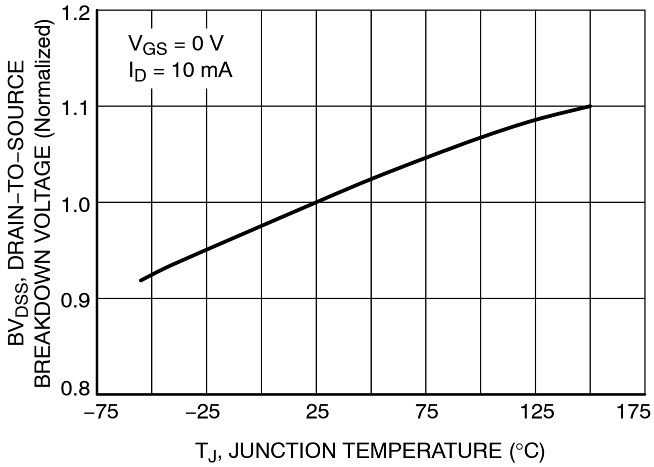


Figure 8. Breakdown Voltage Variation vs. Temperature

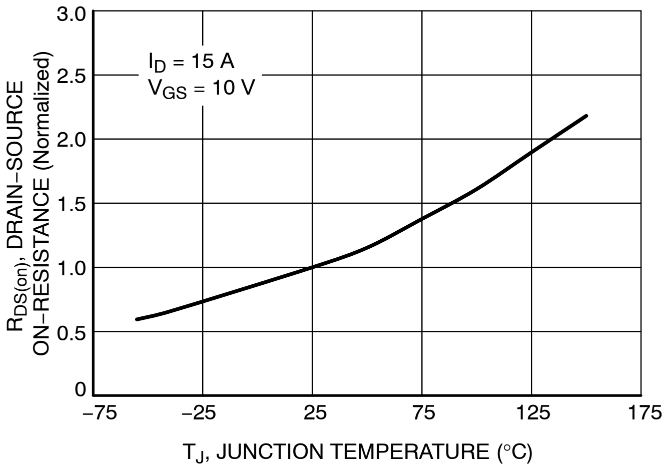


Figure 9. On−Resistance Variation vs. Temperature

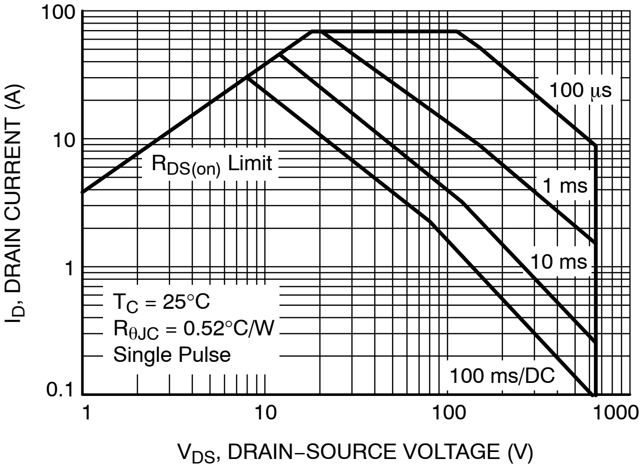


Figure 10. Maximum Safe Operating Area

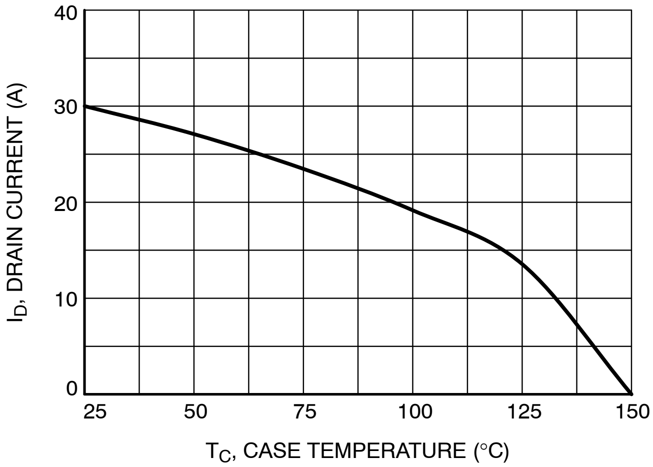


Figure 11. Maximum Drain Current vs. Case Temperature

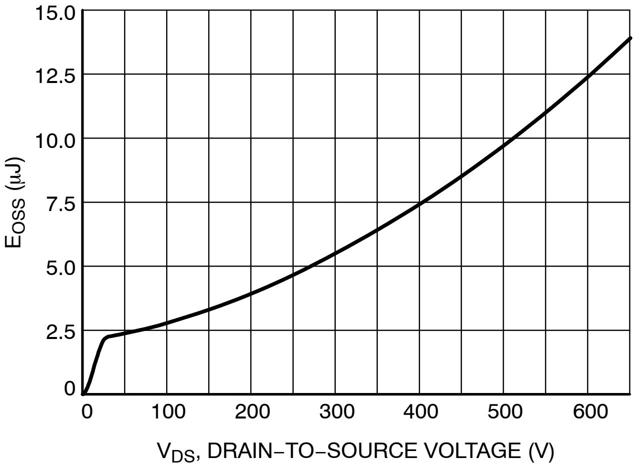


Figure 12. E_{OSS} vs. Drain−to−Source Voltage

TYPICAL CHARACTERISTICS

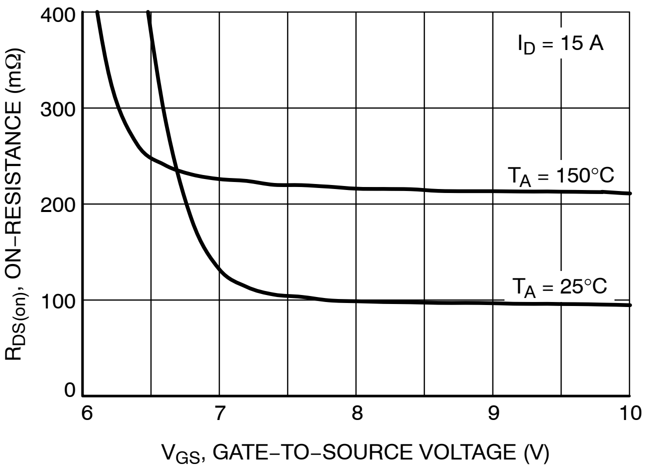


Figure 13. $R_{DS(on)}$ vs. Gate Voltage

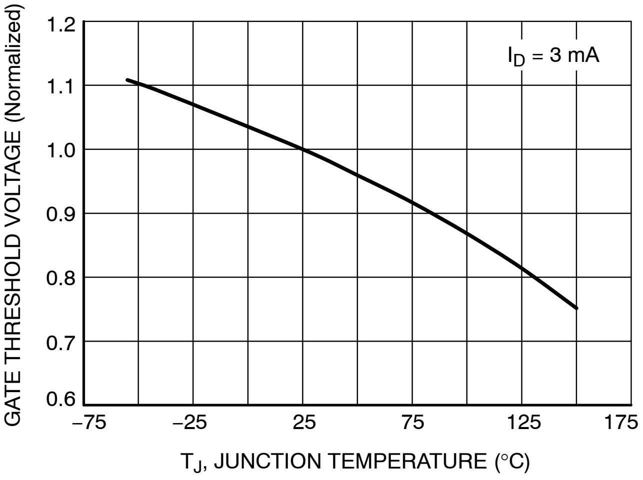
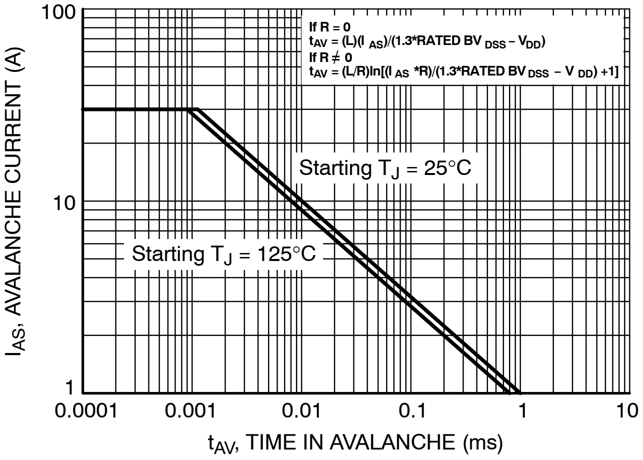


Figure 14. Normalized Gate Threshold Voltage vs. Temperature



NOTE: Refer to Application Notes AN7514 and AN7515

Figure 15. Unclamped Inductive Switching Capability

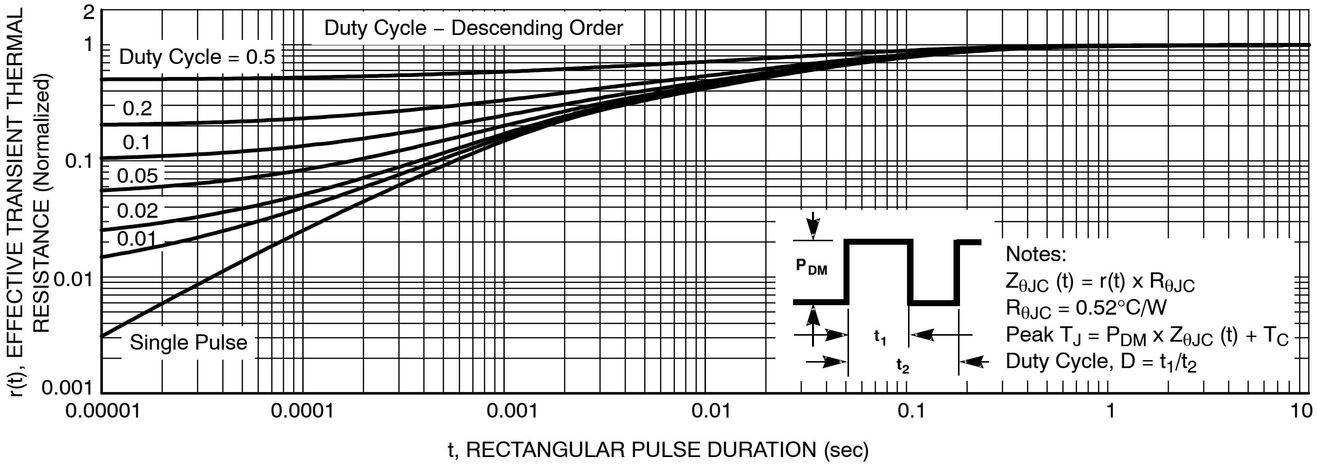


Figure 16. Transient Thermal Response

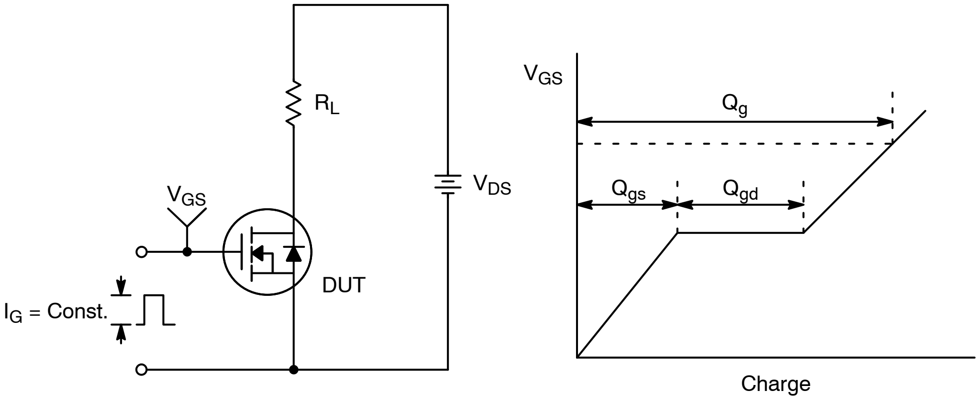


Figure 17. Gate Charge Test Circuit & Waveform

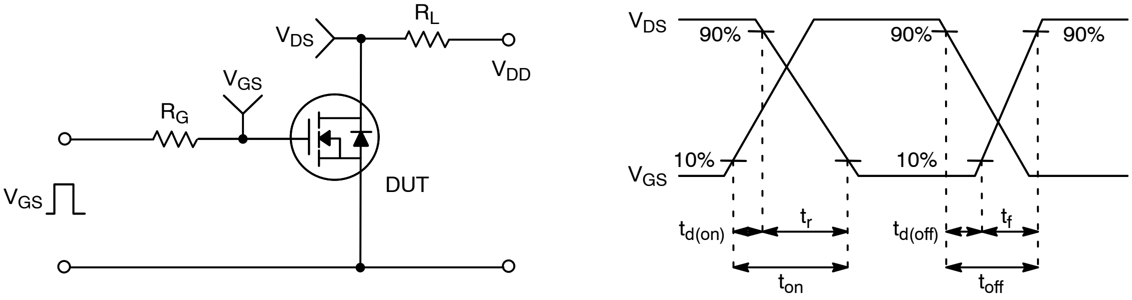


Figure 18. Resistive Switching Test Circuit & Waveforms

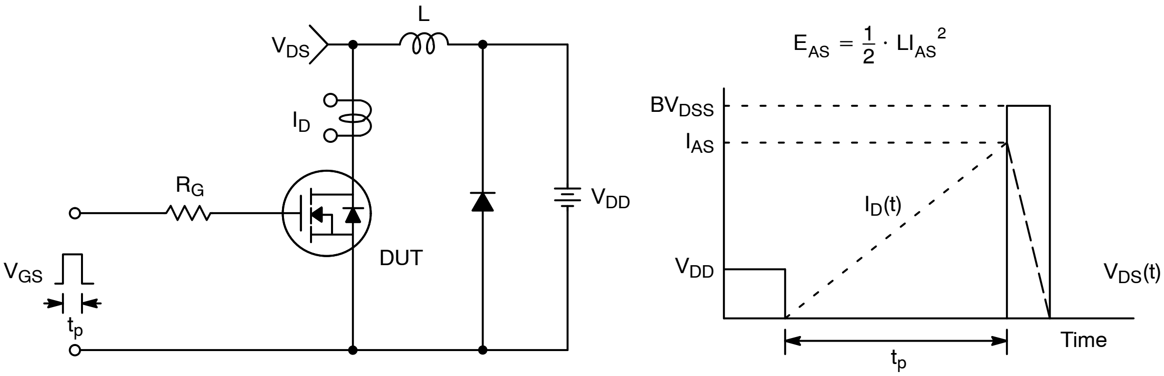


Figure 19. Unclamped Inductive Switching Test Circuit & Waveforms

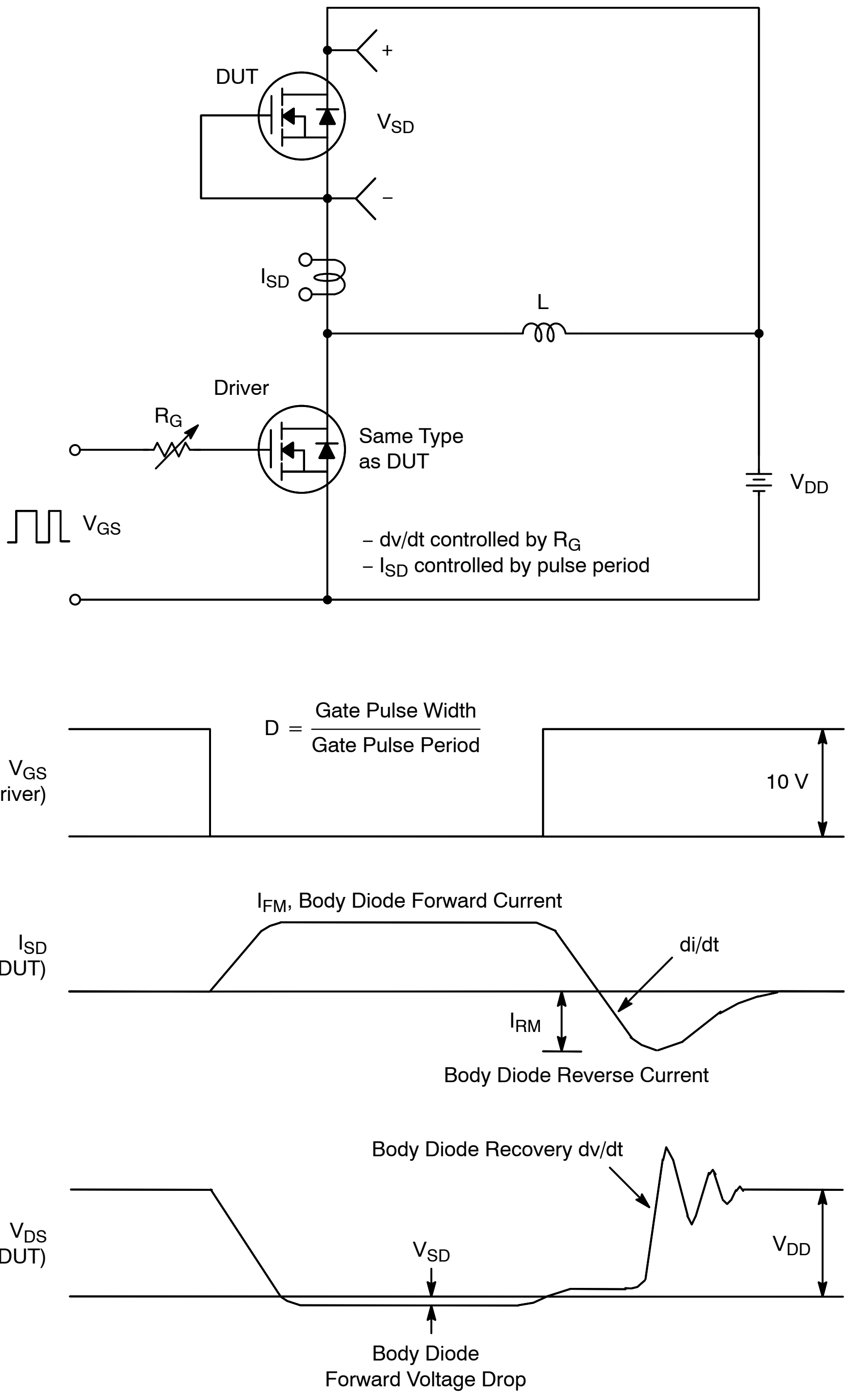


Figure 20. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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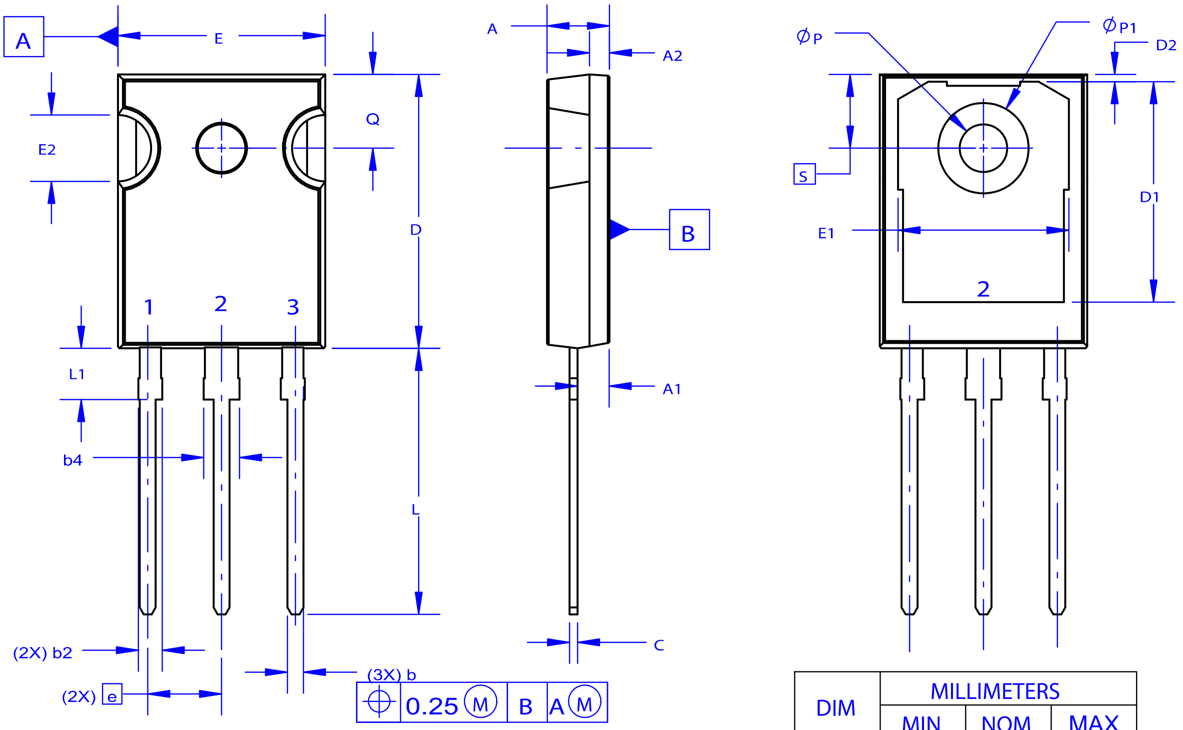
PACKAGE DIMENSIONS

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
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	6.60	6.80	7.00

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