Silicon Carbide (SiC) MOSFET - EliteSiC, 16 mohm 650 V, M3S, TO247-4L

NVH4L016N065M3S

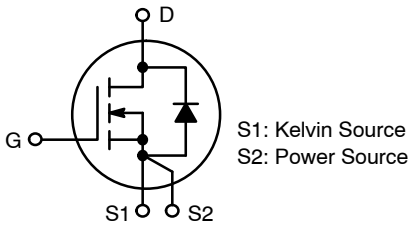
$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX
650 V	16 mΩ @ V_{GS} = 18 V	71 A

Features

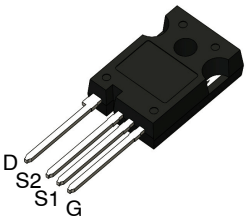
- Typical $R_{DS(on)}$ = 16 mΩ @ V_{GS} = 18 V
- Low Effective Output Capacitance
- Ultra Low Gate Charge
- 100% UIS Tested
- Qualified According to AECQ101
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb-Free 2LI (on second level interconnection)

Applications

- Automotive On and Off Board Charger
- Automotive DC-DC Converter for EV-HEV



N−CHANNEL MOSFET



TO-247-4LD
CASE 340CJ

MARKING DIAGRAM

H4L016065M3S = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V_{DSS}	650	V
Gate-to-Source Voltage		V_{GS}	−10/+22.6	V
Continuous Drain Current	T_C = 25 °C	I_D	71	A
Power Dissipation		P_D	300	W
Continuous Drain Current	T_C = 100 °C	I_D	50	A
Power Dissipation		P_D	150	W
Pulsed Drain Current (Note 1)	T_C = 25 °C, t_p = 100 μs	I_{DM}	243	A
Continuous Source-Drain Current (Body Diode)	T_C = 25 °C, V_{GS} = −3 V	I_S	48	A
	T_C = 100 °C, V_{GS} = −3 V		28	
Pulsed Source-Drain Current (Body Diode) (Note 1)	T_C = 25 °C, V_{GS} = −3 V, t_p = 100 μs	I_{SM}	226	
Single Pulse Avalanche Energy (Note 2)	I_{LPK} = 60 A, L = 0.1 mH	E_{AS}	180	mJ
Operating Junction and Storage Temperature Range		T_J, T_{stg}	−55 to +175	°C
Lead Temperature for Soldering Purposes (1/8″ from case for 10 seconds)		T_L	270	°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. Single pulse, limited by max junction temperature.
2. E_{AS} of 180 mJ is based on starting T_J = 25 °C, L = 0.1 mH, I_{AS} = 60 A, V_{DD} = 100 V, V_{GS} = 18 V.

ORDERING INFORMATION

Device	Package	Shipping
NVH4L016N065M3S	TO-247-4L	30 Units / Tube

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{\theta JC}$	0.50	°C/W

3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Operation Values of Gate to Source Voltage	V_{GSop}	−3/+18	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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

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	650			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650 V, T_J = 25 °C			10	μA
		V_{DS} = 650 V, T_J = 175 °C (Note 5)			500	μA
Gate-to-Source Leakage Current	I_{GSS}	V_{GS} = −10 V, V_{DS} = 0 V	−1			μA
		V_{GS} = +22.6 V, V_{DS} = 0 V			1	
ON CHARACTERISTICS						
Drain-to-Source On Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 30 A, T_J = 25 °C		16	23.5	mΩ
		V_{GS} = 18 V, I_D = 30 A, T_J = 175 °C (Note 5)		25		
		V_{GS} = 15 V, I_D = 30 A, T_J = 25 °C		21		
		V_{GS} = 15 V, I_D = 30 A, T_J = 175 °C (Note 5)		27		
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 15 mA, T_J = 25 °C	2.0	2.7	4.0	V
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 30 A (Note 5)		27		S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz (Note 5)		2735		pF
Output Capacitance	C_{OSS}			208		
Reverse Transfer Capacitance	C_{RSS}			18		
Total Gate Charge	$Q_{G(TOT)}$	V_{DD} = 400 V, I_D = 30 A, V_{GS} = −3/18 V (Note 5)		100		nC
Gate-to-Source Charge	Q_{GS}			33		
Gate-to-Drain Charge	Q_{GD}			25		
Gate Resistance	R_G	f = 1 MHz		3.0		Ω
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 30 A, R_G = 4.7 Ω, T_J = 25 °C (Notes 4, 5)		6.5		ns
Turn-Off Delay Time	$t_{d(OFF)}$			45		
Rise Time	t_r			20		
Fall Time	t_f			45		
Turn-On Switching Loss	E_{ON}			103		μJ
Turn-Off Switching Loss	E_{OFF}			100		
Total Switching Loss	E_{TOT}			203		

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	V_{GS} = −3/18 V, V_{DD} = 400 V, I_D = 30 A, R_G = 4.7 Ω, T_J = 175 °C (Notes 4, 5)		4.7		ns
Turn-Off Delay Time	$t_{d(OFF)}$			55		
Rise Time	t_r			20		
Fall Time	t_f			13		
Turn-On Switching Loss	E_{ON}			104		μJ
Turn-Off Switching Loss	E_{OFF}			108		
Total Switching Loss	E_{TOT}			212		
SOURCE-TO-DRAIN DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	I_{SD} = 30 A, V_{GS} = −3 V, T_J = 25 °C		4.6	6.0	V
		I_{SD} = 30 A, V_{GS} = −3 V, T_J = 175 °C (Note 5)		4.3		
Reverse Recovery Time	t_{RR}	V_{GS} = −3 V, I_S = 30 A, dI/dt = 1000 A/μs, V_{DS} = 400 V, T_J = 25 °C (Note 5)		23		ns
Charge Time	t_a			13		
Discharge Time	t_b			10		
Reverse Recovery Charge	Q_{RR}			146		nC
Reverse Recovery Energy	E_{REC}			12		μJ
Peak Reverse Recovery Current	I_{RRM}			11		A

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. E_{ON}/E_{OFF} result is with body diode.
5. Defined by design, not subject to production test.

TYPICAL CHARACTERISTICS

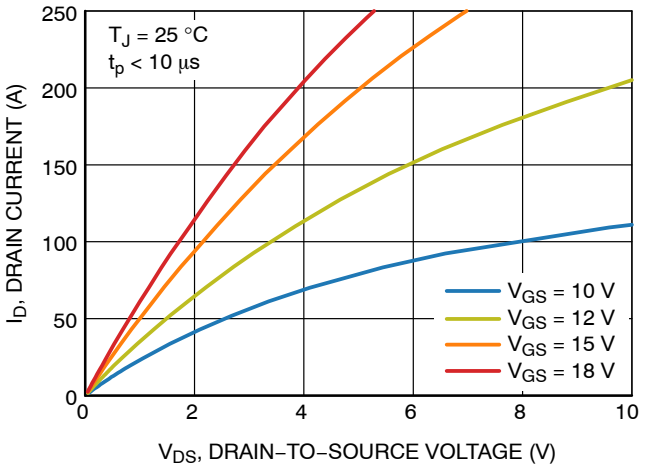


Figure 1. Output Characteristics

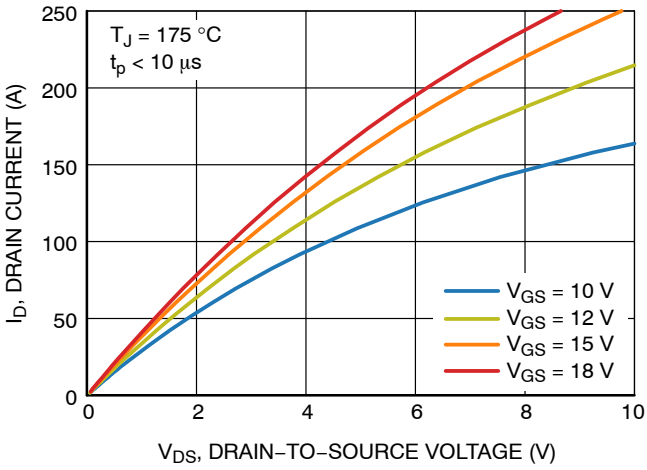


Figure 2. Output Characteristics

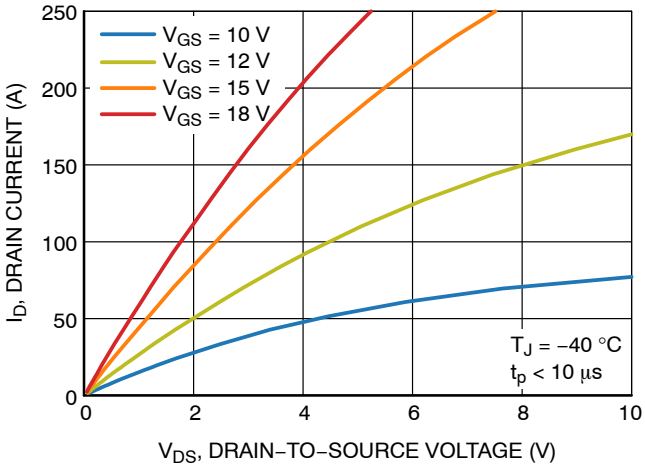


Figure 3. Output Characteristics

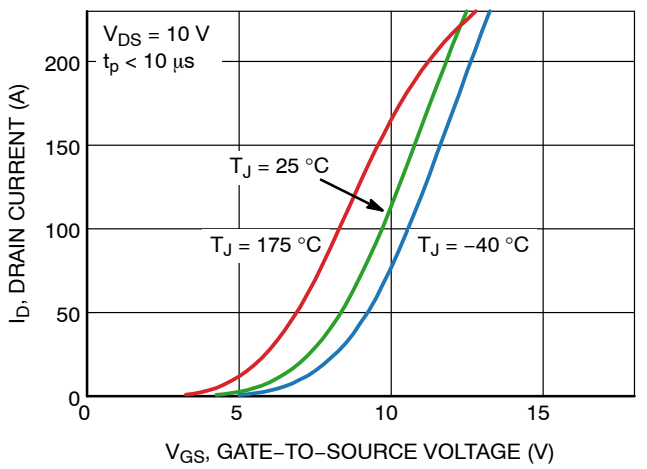


Figure 4. I_D vs. V_{GS}

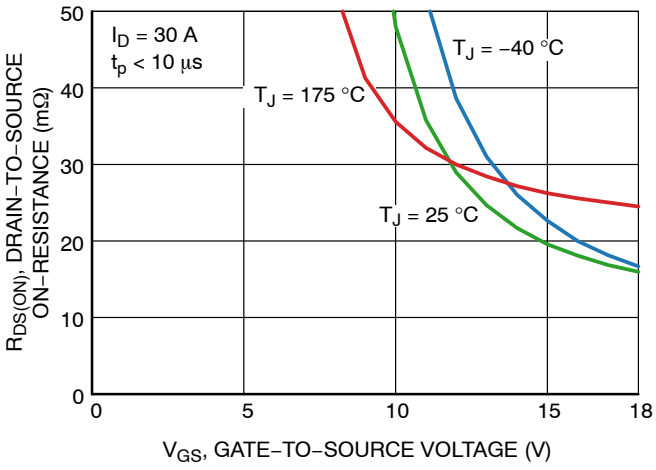


Figure 5. $R_{DS(ON)}$ vs. V_{GS}

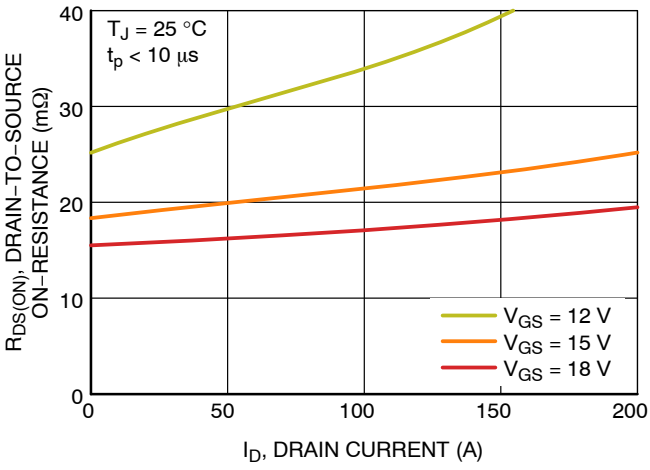


Figure 6. $R_{DS(ON)}$ vs. I_D

TYPICAL CHARACTERISTICS

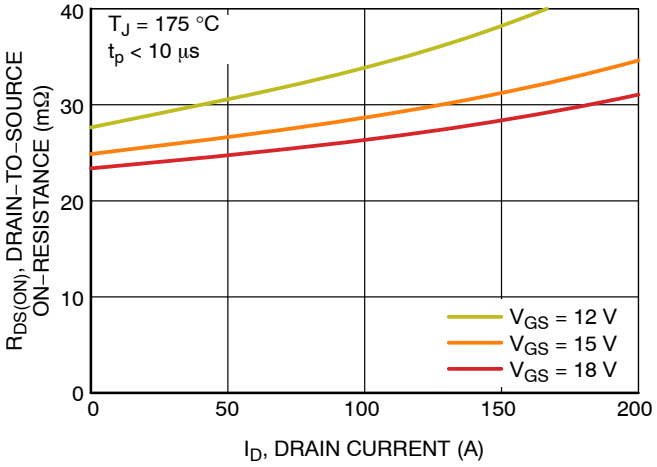


Figure 7. $R_{DS(ON)}$ vs. I_D

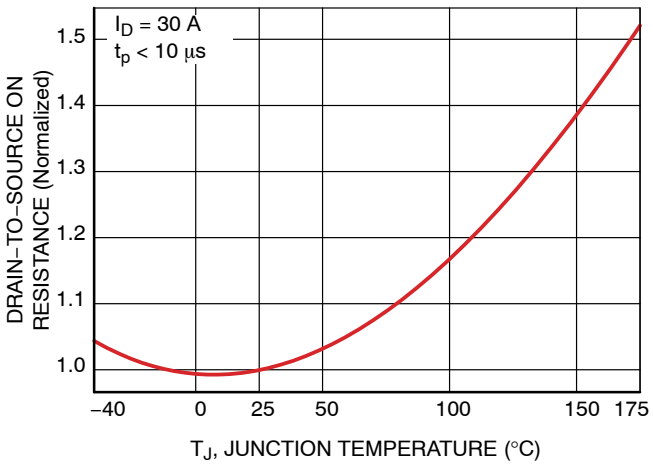


Figure 8. $R_{DS(ON)}$ vs. T_J

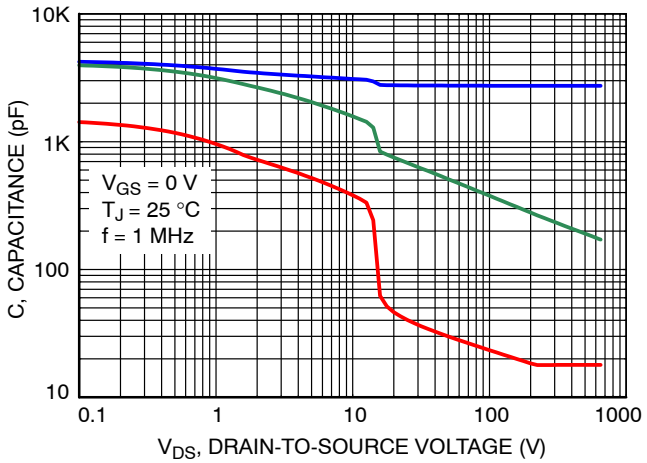


Figure 9. Capacitance Characteristics

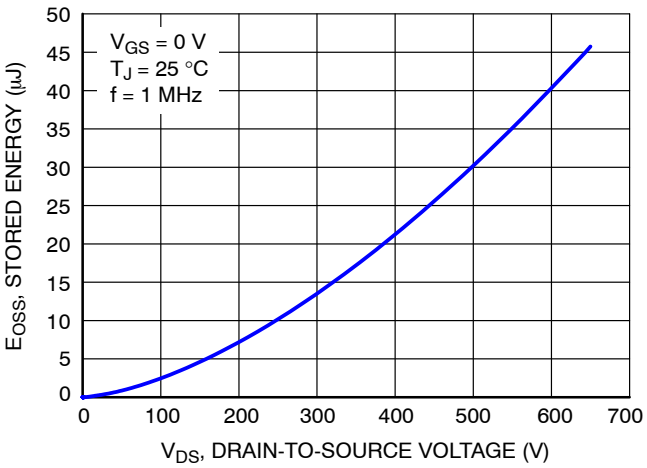


Figure 10. Stored Energy vs. Drain-to-Source Voltage

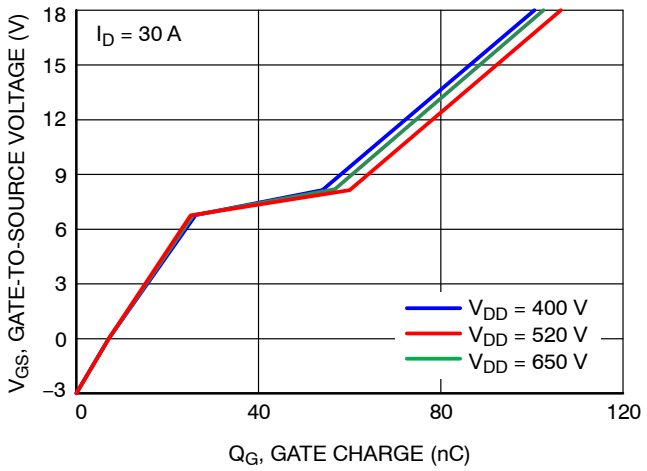


Figure 11. Gate Charge Characteristics

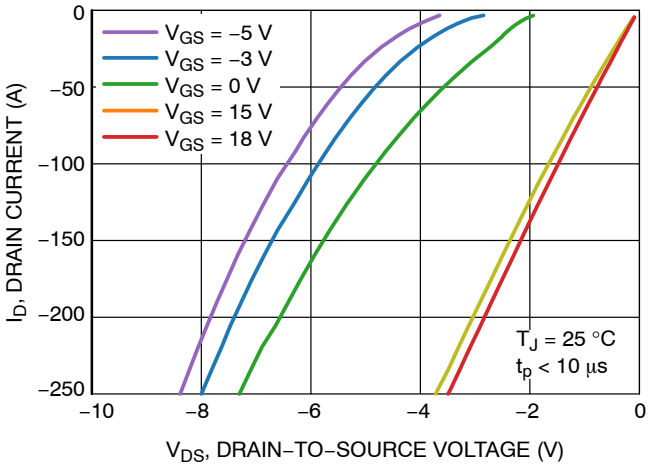


Figure 12. Reverse Conduction Characteristics

TYPICAL CHARACTERISTICS

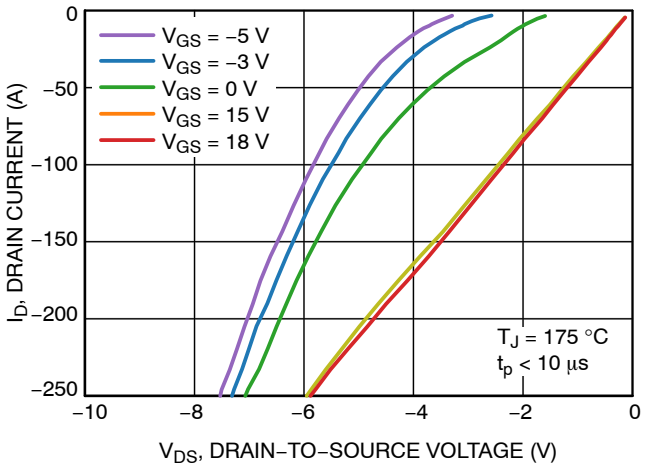


Figure 13. Reverse Conduction Characteristics

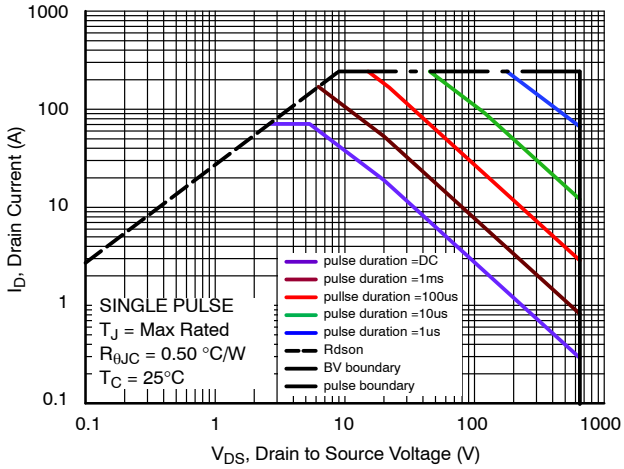


Figure 14. Safe Operating Area

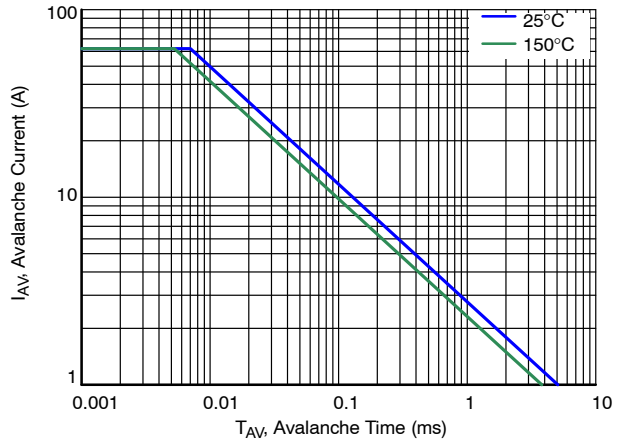


Figure 15. Avalanche Current vs Pulse Time (UIS)

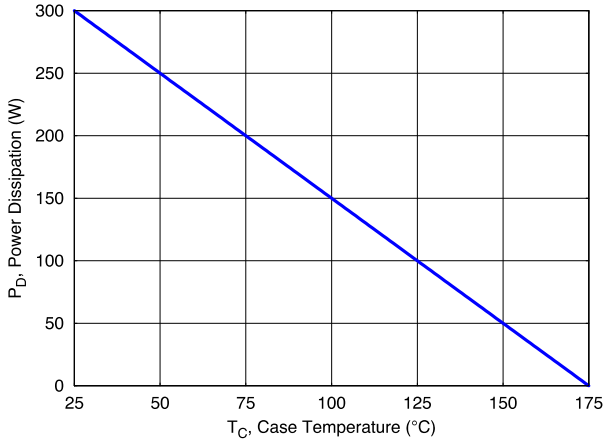


Figure 16. Maximum Power Dissipation vs Case Temperature

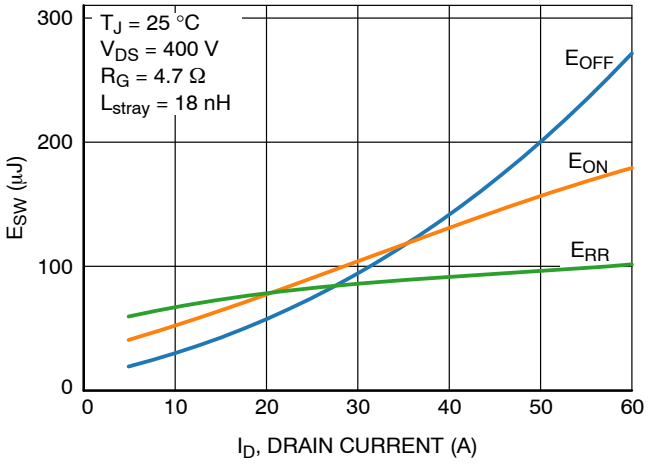


Figure 17. E_{SW} vs. I_D

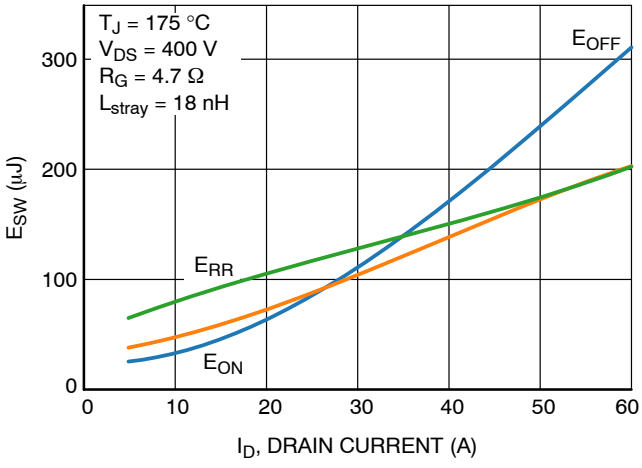


Figure 18. E_{SW} vs. I_D

TYPICAL CHARACTERISTICS

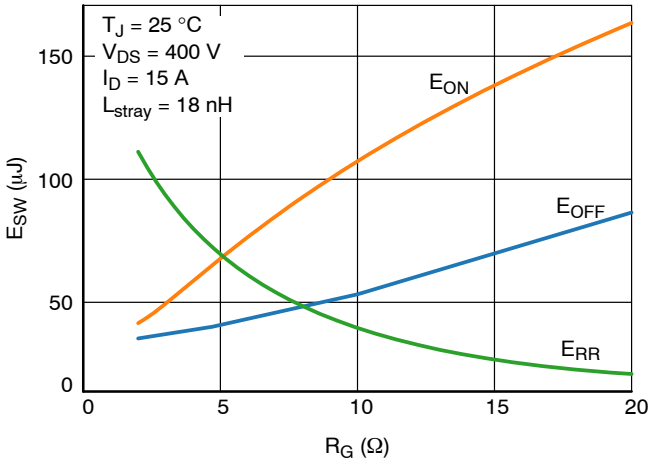


Figure 19. E_{SW} vs. R_G

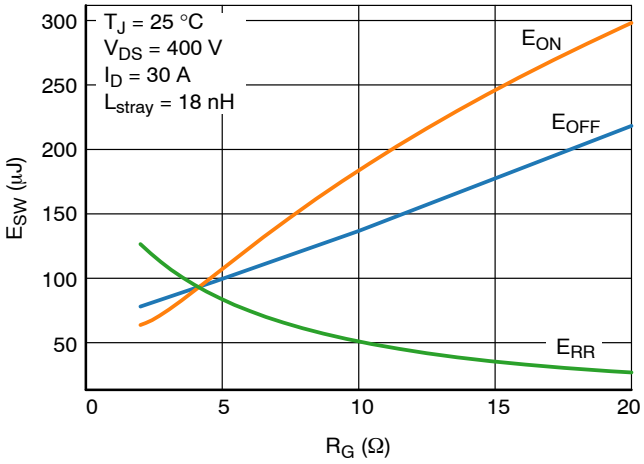


Figure 20. E_{SW} vs. R_G

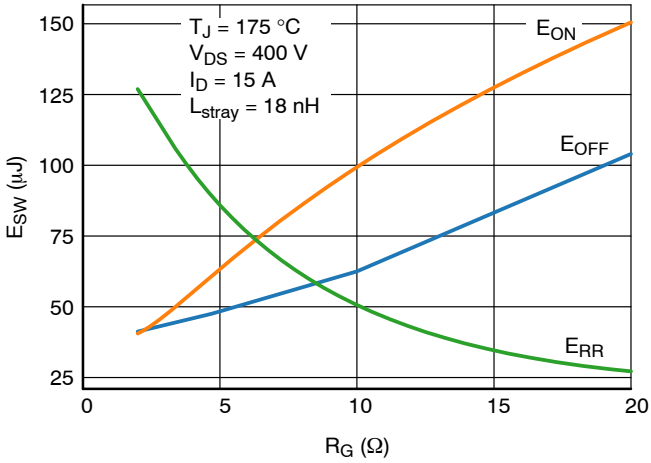


Figure 21. E_{SW} vs. R_G

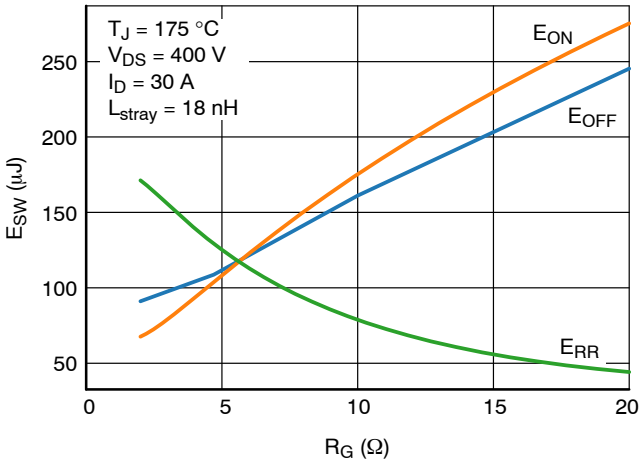


Figure 22. E_{SW} vs. R_G

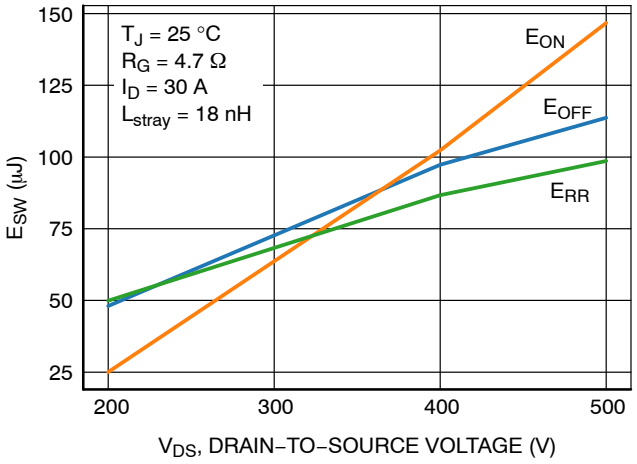


Figure 23. E_{SW} vs. V_{DS}

TYPICAL CHARACTERISTICS

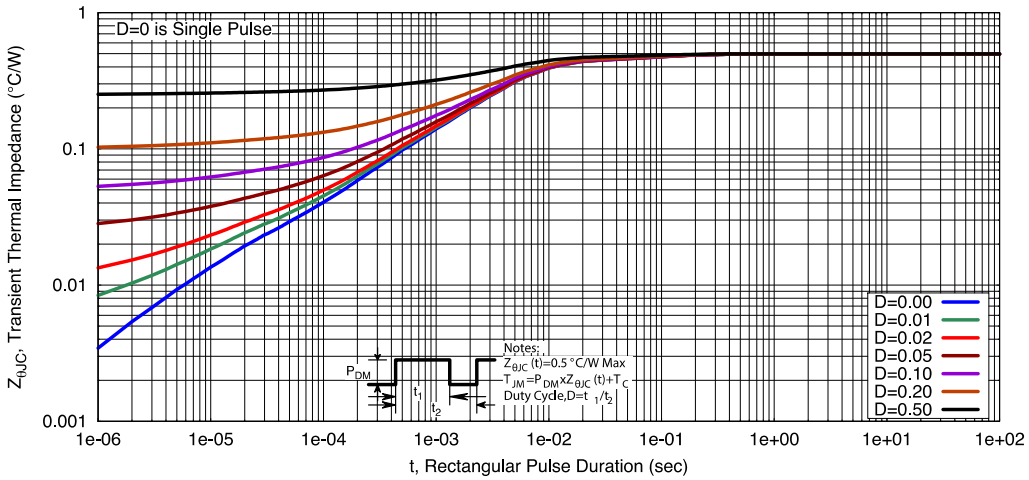


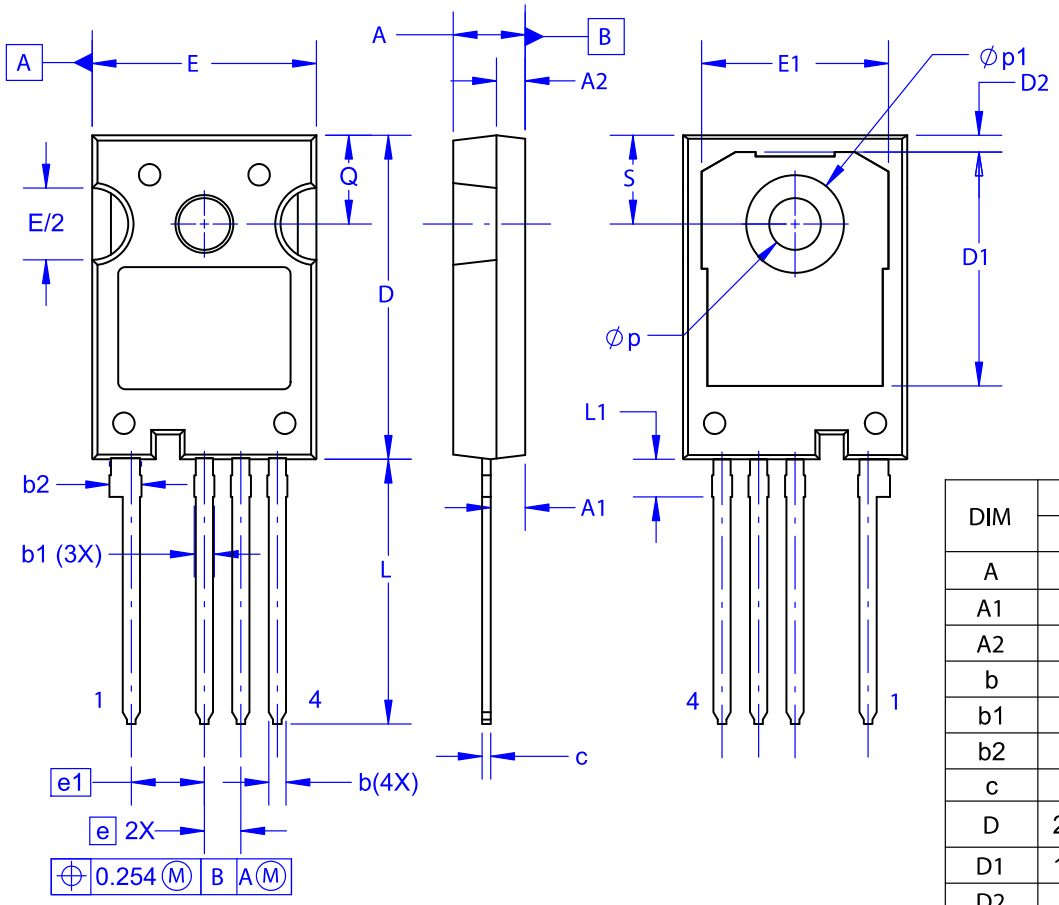
Figure 24. Thermal Response Characteristics

REVISION HISTORY

Revision	Description of Changes	Date
0	Initial datasheet release	11/4/2025

PACKAGE DIMENSIONS

TO−247−4LD
CASE 340CJ
ISSUE A



NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS,MOLD FLASH,AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.10	2.40	2.70
A2	1.80	2.00	2.20
b	1.07	1.20	1.33
b1	1.20	1.40	1.60
b2	2.02	2.22	2.42
c	0.50	0.60	0.70
D	22.34	22.54	22.74
D1	16.00	16.25	16.50
D2	0.97	1.17	1.37
e	2.54 BSC		
e1	5.08 BSC		
E	15.40	15.60	15.80
E1	12.80	13.00	13.20
E/2	4.80	5.00	5.20
L	18.22	18.42	18.62
L1	2.42	2.62	2.82
p	3.40	3.60	3.80
p1	6.60	6.80	7.00
Q	5.97	6.17	6.37
S	5.97	6.17	6.37

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
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onsemi Website: www.onsemi.com

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