



Features

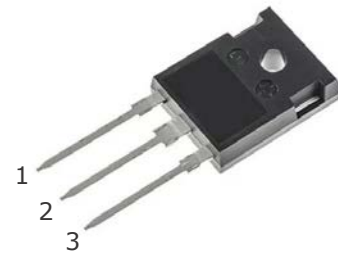
- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

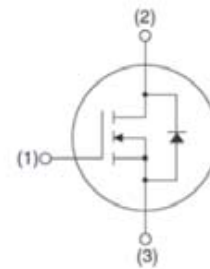
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



TO-247
Package



Ordering Part Number	Package	Qty(PCS)
NVHL040N65S3F	TO-247	30



Maximum Ratings ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	650	V
Continuous drain current $T_c = 25^\circ\text{C}$ $T_c = 100^\circ\text{C}$	I_D	49 35	A
Pulsed drain current ($T_c = 25^\circ\text{C}$, t_p limited by T_{jmax})	$I_{D \text{ pulse}}$	123	A
Avalanche energy, single pulse ($L=10\text{mH}$)	E_{AS}	1000	mJ
Gate-Source voltage	V_{GS}	-5/+20	V
Gate-Source voltage (dynamic, Absolute maximum values)	V_{GSmax}	-10/+25	V
Power dissipation ($T_c = 25^\circ\text{C}$)	P_{tot}	242	W
Operating junction and storage temperature	T_j, T_{stg}	-55...+175	$^\circ\text{C}$

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal resistance, junction – case. Max	R_{thJC}	0.62	$^\circ\text{C/W}$
Thermal resistance, junction – ambient. Max	R_{thJA}	40	



Electrical Characteristic (at $T_j = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Static Characteristic						
Drain-source breakdown voltage	BV _{DSS}	650	-	-	V	V _{GS} =0V, I _D =250uA
Gate threshold voltage	V _{GS(th)}	2	-	4	V	V _{DS} =V _{GS} ,I _D =7mA
Zero gate voltage drain current	I _{DSS}	- -	1 10	100 -	μA	V _{DS} =650V,V _{GS} =0V T _j =25°C T _j =175°C
Gate-source leakage current	I _{GSS}	-		250	nA	V _{GS} =20V,V _{DS} =0V
Drain-source on-state resistance	R _{DS(on)}	-	45	-	mΩ	V _{GS} =18V, I _D =17.6A,
		-	33	49		V _{GS} =20V, I _D =17.6A, T _j =25°C
		-	50	-		T _j =175°C
Transconductance	g _{fs}	-	5.6	-	S	V _{DS} =20V,I _D =17.6A
Dynamic Characteristic						
Input Capacitance	C _{iss}	-	1823	-	pF	V _{DS} = 650V V _{GS} = 0V T _J = 25°C V _{AC} = 25mV f = 1MHz
Output Capacitance	C _{Oss}	-	190	-		
Reverse Transfer Capacitance	C _{rss}	-	19	-		
Gate Total Charge	Q _G	-	96	-	nC	V _{DS} = 400V V _{GS} = -5/20V I _D = 17.6A
Gate-Source charge	Q _{gs}	-	25	-		
Gate-Drain charge	Q _{gd}	-	26	-		
Turn-On Switching Energy	E _{ON}	-	188	-	μJ	V _{DD} = 400V V _{GS} = -5/+20V I _D = 17.6A R _G = 10Ω L = 100uH
Turn-Off Switching Energy-	E _{OFF}	-	19			
Turn-on delay time	t _{d(on)}	-	20	-	ns	
Rise time	t _r	-	26	-		
Turn-off delay time	t _{d(off)}	-	48	-		
Fall time	t _f	-	15	-		
Gate resistance	R _G	-	1.7	-	Ω	



Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	V_{SD}		3.2		V	$V_{GS}=0V, I_{SD}=8.8A,$ $T_J=25^{\circ}C$
			2.6			$V_{GS}=0V, I_{SD}=8.8A,$ $T_J=175^{\circ}C$
Body Diode Reverse Recovery Time	t_{rr}	-	40	-	ns	$V_R = 400V,$ $I_D = 17.6A$ $di/dt = 1000A/\mu S$
Body Diode Reverse Recovery Charge	Q_{rr}	-	156	-	nC	



Typical Performance Characteristics

Fig 1. Output Characteristic ($T_J = -55^\circ\text{C}$)

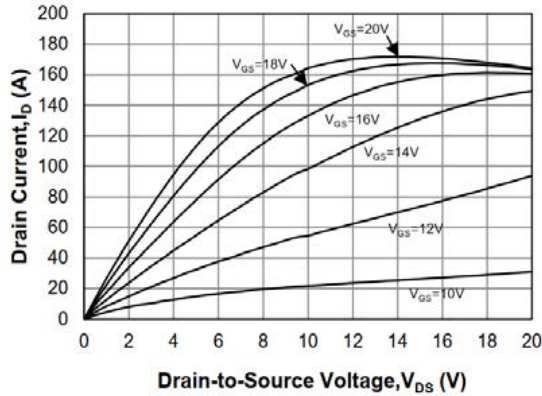


Fig 2. Output Characteristic ($T_J = 25^\circ\text{C}$)

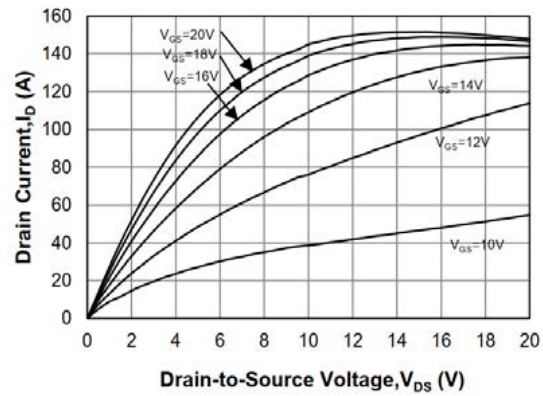


Fig 3. Output Characteristic ($T_J = 175^\circ\text{C}$)

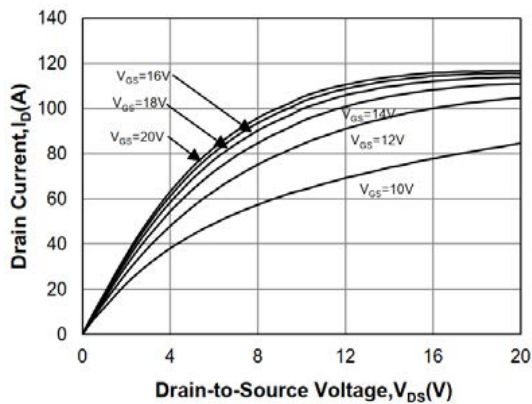


Fig 4: $R_{DS(on)}$ Vs I_{DS} Characteristic

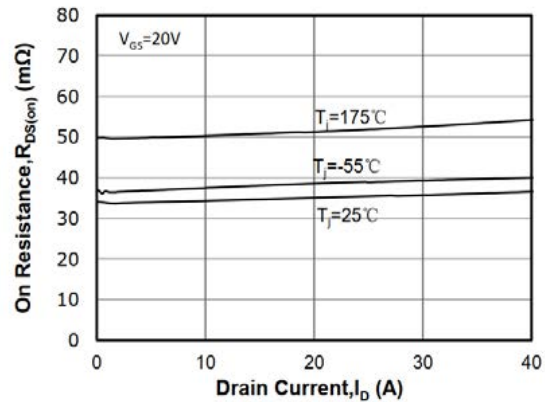


Fig 5: $R_{DS(on)}$ vs. Temperature

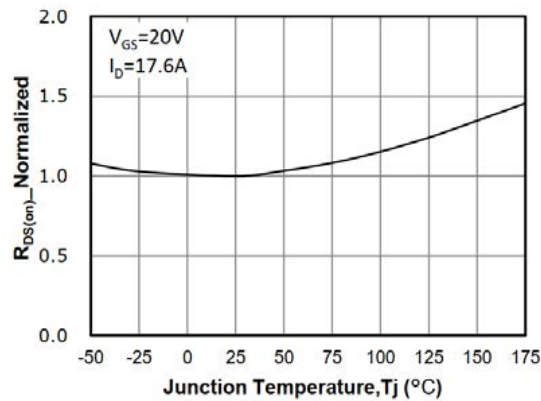


Fig 6: Transfer Characteristic

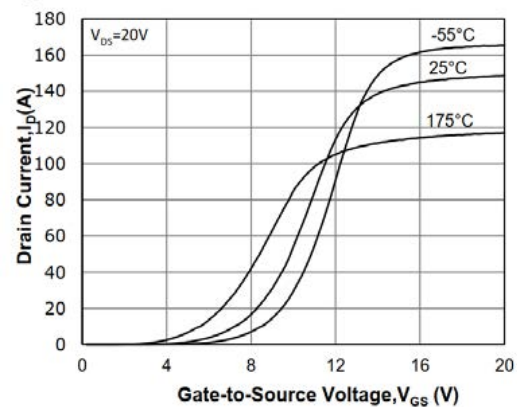




Fig 7: Body-diode Characteristic

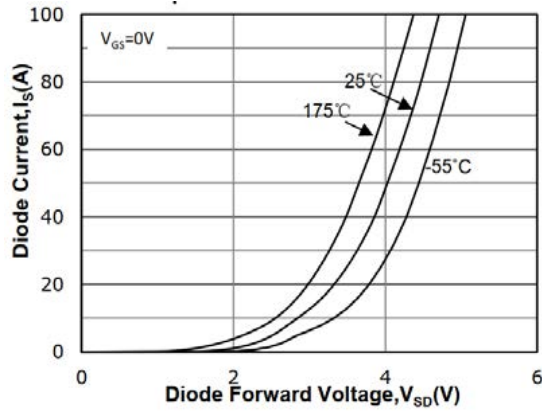


Fig 8: V_{th} Vs T_j Temperature Characteristic

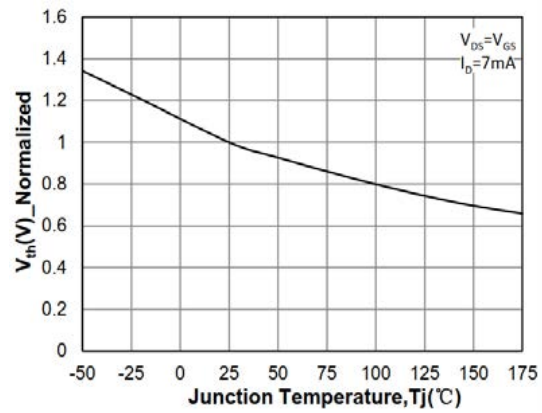


Fig 9: Gate Charge Characteristics

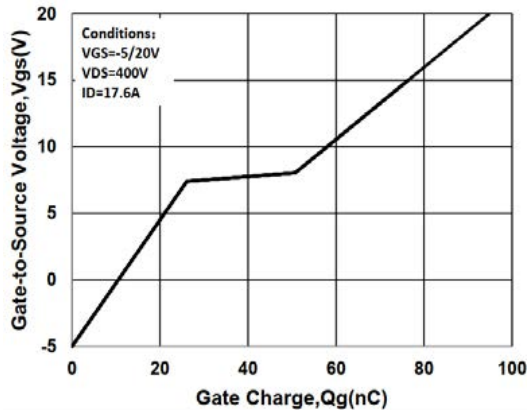


Fig 10: Continuous Drain Current vs. Case Temperature

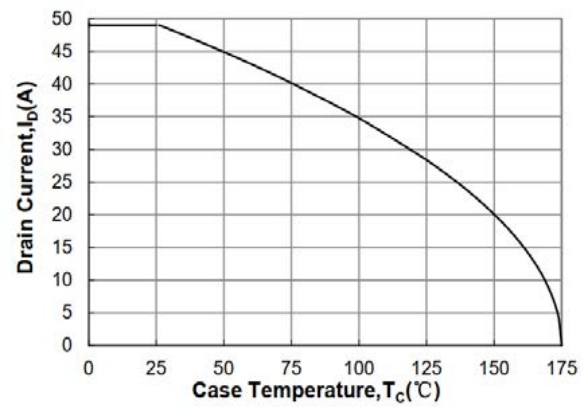


Fig 11: Safe Operating Area

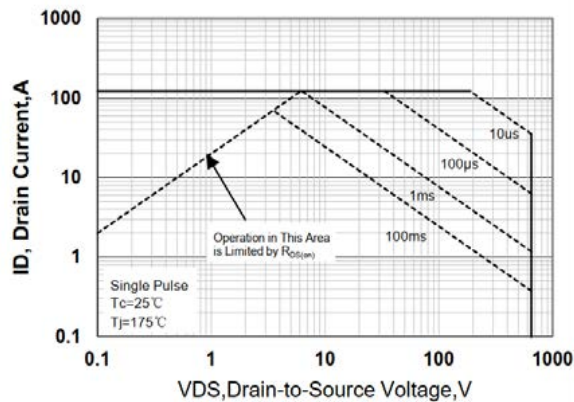


Fig 12: Capacitance Characteristics

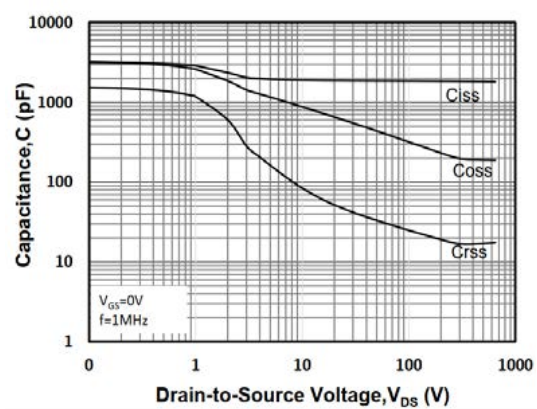
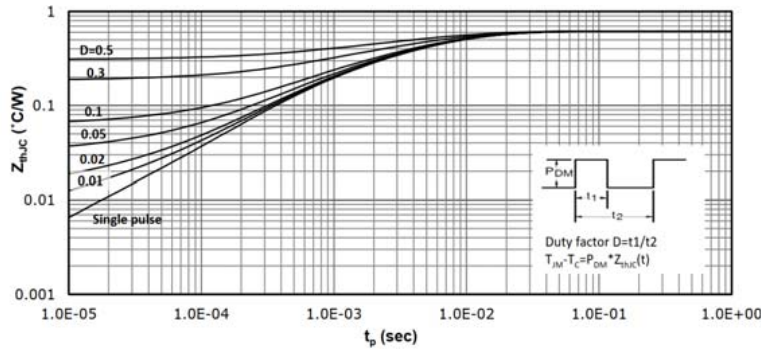




Fig 13: Transient Thermal Impedance



Test Circuit & Waveform

Figure A. Definition of switching times

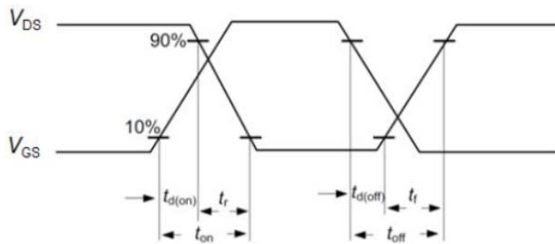


Figure B. Dynamic test circuit

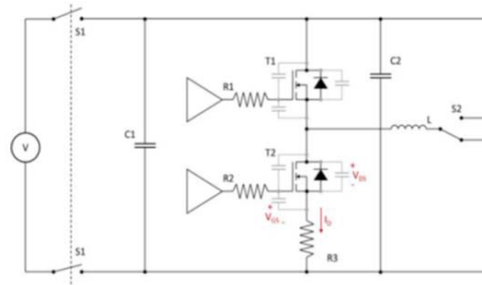
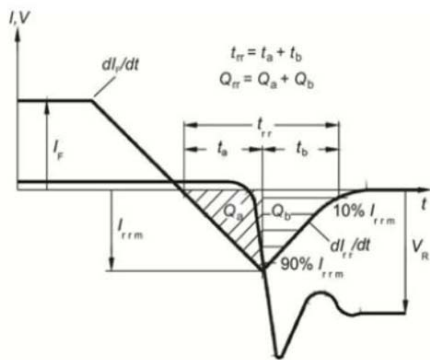


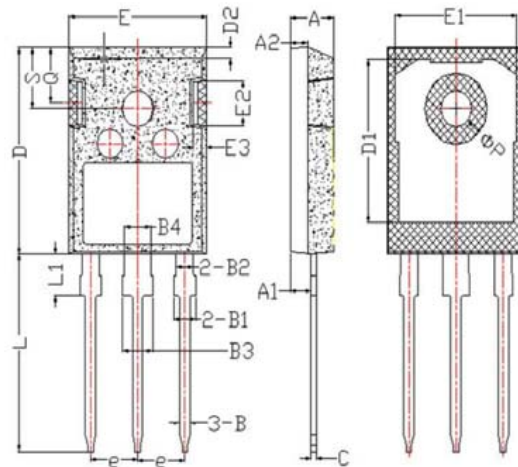
Figure C. Definition of body diodeswitching characteristics





Package Dimensions

Package TO-247



Items	Values(mm)	
	MIN	MAX
A	4.6	5.2
A1	2.2	2.6
B	0.9	1.4
B1	1.75	2.35
B2	1.75	2.15
B3	2.8	3.35
B4	2.8	3.15
C	0.5	0.7
D	20.6	21.3
D1	16	18
E	15.5	16.1
E1	13	14.7
E2	3.8	5.3
E3	0.8	2.6
e	5.2	5.2
L	19	20.5
L1	3.9	4.6
Φp	3.3	3.7
Q	5.2	6
S	5.8	6.6



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