

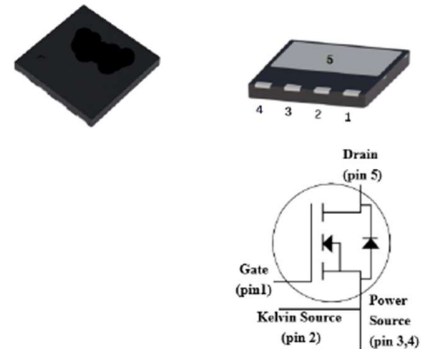
NW6506CD1

650V N-Channel Silicon Carbide Power MOSFET

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}$	60	mΩ
I_D	67	A

Features

- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- Low on-resistance with high junction temperature
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Easy to parallel
- RoHS compliant



Applications

- Switch Mode Power Supplies
- DC/DC Converters
- Solar Inverters
- EV charging infrastructure
- Energy storage & battery
- Battery control unit

Description

The NW6506CD1 is a 650V, 60mohm SiC MOSFET designed for improved system efficiency and large power density. It reduces cooling requirements and gate ringing while simplifying system complexity. This results in a significant cost reduction, making it an ideal solution for enhancing performance in a wide range of applications.

Part Description

Part No.	Package	Marking
NW6506CD1	DFN 8*8	NW6506CD1

Absolute Maximum Ratings

$T_J = 25\text{ }^{\circ}\text{C}$ except as noted. Exceeding the maximum ratings may damage the device.

Parameter	Symbol	Value	Unit	Test conditions
Drain-Source Breakdown Voltage	V_{DSmax}	650	V	$V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$
Recommend Gate Source Voltage	$V_{GS,op}$	-5/+20	V	
Maximum Gate Source Voltage	V_{GSmax}	-10/+25	V	AC ($f > 1\text{ Hz}$)
Continuous Drain Current	I_D	56	A	$V_{GS} = 20\text{ V}$, $T_C = 25\text{ }^{\circ}\text{C}$
Pulsed Drain Current	$I_{D(pulse)}$	112	A	Pulse width t_p limited by T_{jmax}
Power Dissipation	P_D	259	W	$T_C = 25\text{ }^{\circ}\text{C}$
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$	-
Soldering Temperature	T_L	260	$^{\circ}\text{C}$	

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{TH,J-C}$	0.59	$^{\circ}\text{C/W}$

Electrical Characteristics

Static Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	650	-	-	V	$V_{GS}=0\text{ V}$, $I_D=100\text{ }\mu\text{A}$
Zero Gate Voltage Drain Current	I_{DSS}	-	10	100	μA	$V_{DS}=650\text{ V}$, $V_{GS}=0\text{ V}$
Gate-Source Leakage	I_{GSS}	-	5	250	nA	$V_{GS}=20\text{ V}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	2	-	4	V	$I_D=5\text{ mA}$, $V_{GS}=V_{DS}$
Drain-Source On-Resistance	$R_{DS(on)}$	-	60	80	mΩ	$V_{GS}=20\text{ V}$, $I_D=13.2\text{ A}$
		-	80	-		$V_{GS}=18\text{ V}$, $I_D=13.2\text{ A}$
		-	89	-		$V_{GS}=15\text{ V}$, $I_D=13.2\text{ A}$

Dynamic Characteristics

Input Capacitance	C_{iss}	-	1129	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=600\text{ V}$ $f=1.0\text{ MHz}$, $V_{AC}=25\text{ mV}$
Output Capacitance	C_{oss}	-	114	-		
Reverse Transfer Capacitance	C_{rss}	-	6.5	-		
C_{OSS} Stored Energy	E_{OSS}	-	25	-	μJ	
Total Gate Charge	Q_g	-	62	-	nC	$V_{DS}=400\text{ V}$ $I_D=13.2\text{ A}$ $V_{GS}=-5/+20\text{ V}$
Gate-Source Charge	Q_{gs}	-	18	-		
Gate-Drain Charge	Q_{gd}	-	33	-		
Turn-on Delay Time	$t_{d(on)}$	-	21.3	-	ns	$V_{DS}=400\text{ V}$ $V_{GS}=-5/+20\text{ V}$ $I_D=13.2\text{ A}$
Turn-on Rise Time	t_r	-	14.5	-		

Turn-off Delay Time	$t_{d(off)}$	-	132.6	-		$R_{G(ext)}=2.5\ \Omega$
Turn-off Fall Time	t_f	-	42.7	-		
Internal Gate Resistance	$R_{G(int)}$	-	2.8	-	Ω	$f=1.0\ \text{MHz}, V_{AC}=25\ \text{mV}$

Body Diode Characteristics (at T_j of 25°C)

Continuous Diode Forward Current	I_S	-	-	56	A	
Diode pulse Current	$I_{S(pulse)}$		112		A	
Diode Forward Voltage	V_{SD}	-	3.0	-	V	$V_{GS}=0\ \text{V}, I_S=6.6\ \text{A}$
Reverse Recovery Time	t_{rr}	-	23	-	ns	$I_S=13.2\ \text{A}, V_{DS}=400\ \text{V}$ $V_{GS}=-5\ \text{V}$ $di/dt=2100\ \text{A}/\mu\text{s}$
Reverse Recovery Charge	Q_{rr}	-	132	-	nC	
Peak Reverse Recovery Current	I_{rrm}	-	13	-	A	

Typical Performance

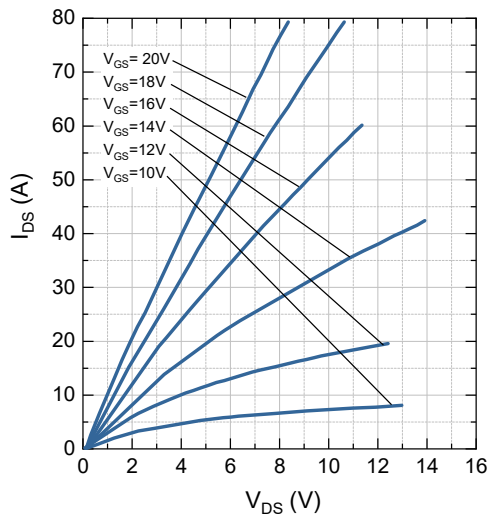


Figure 1: Typical Output Characteristics
at $T_J = -55\text{ }^{\circ}\text{C}$

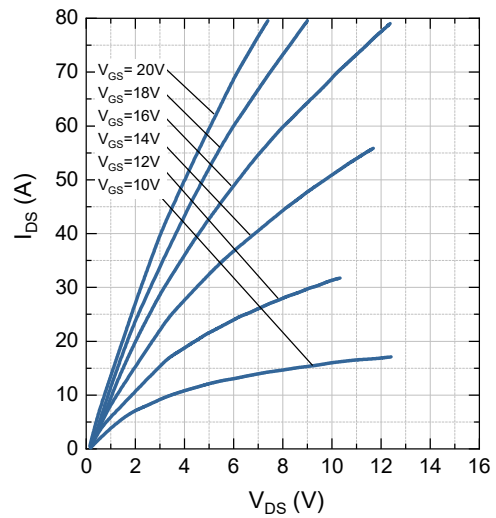


Figure 2: Typical Output Characteristics
at $T_J = 25\text{ }^{\circ}\text{C}$

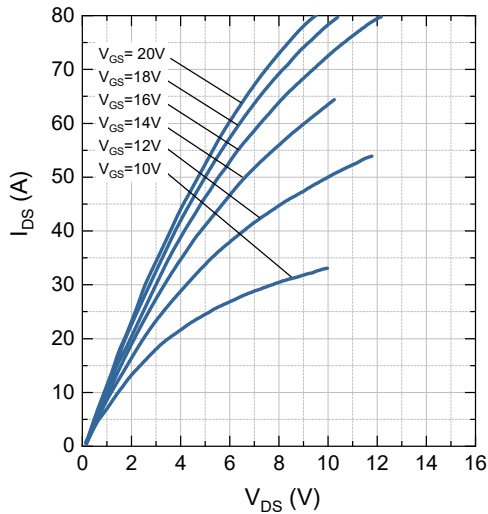


Figure 3: Typical Output Characteristics
at $T_J = 175\text{ }^{\circ}\text{C}$

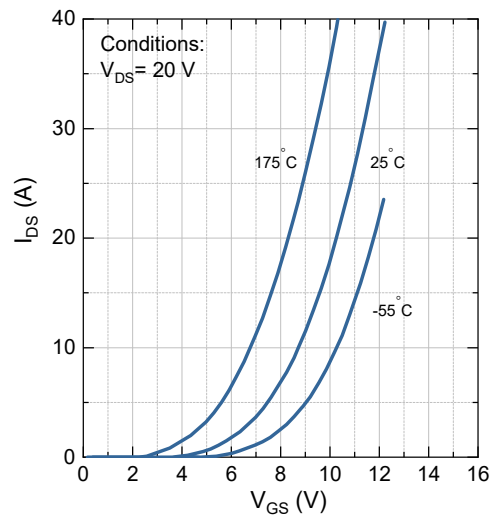


Figure 4: Typical Transfer Characteristics for
Various Temperature

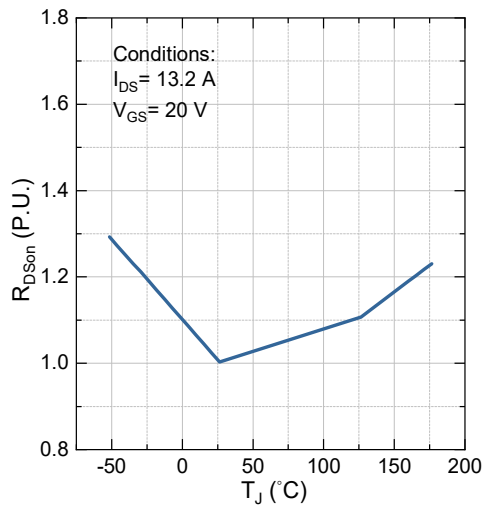


Figure 5: Normalized On-Resistance vs Temperature

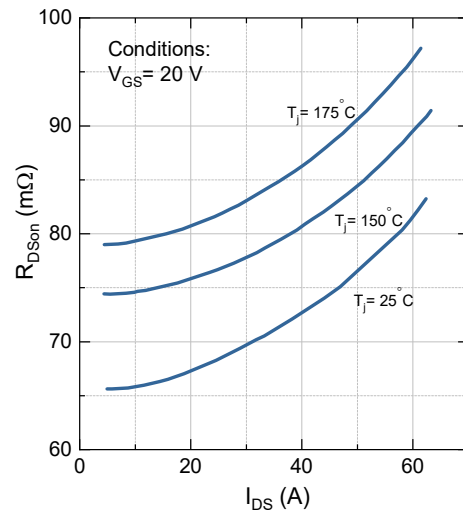


Figure 6: On-Resistance vs. Drain Current for Gate Various Temperatures

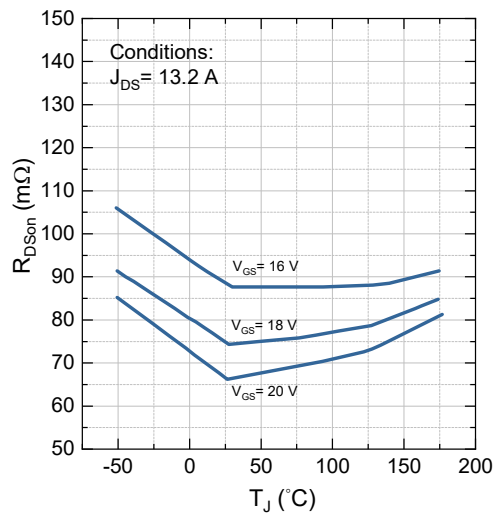


Figure 7: On-Resistance vs. Temperature for Various Voltage

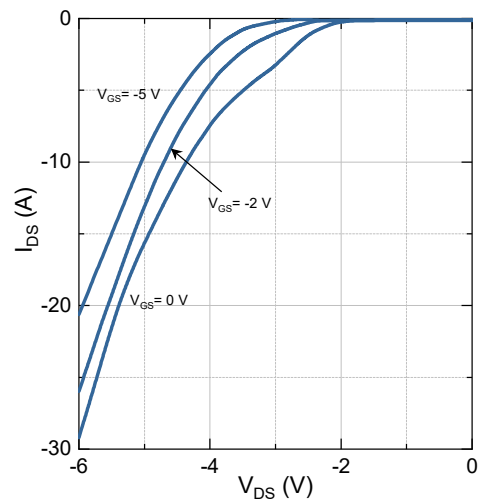


Figure 8: Typical Body Diode Characteristics at $T_J = -55 \text{ }^{\circ}\text{C}$

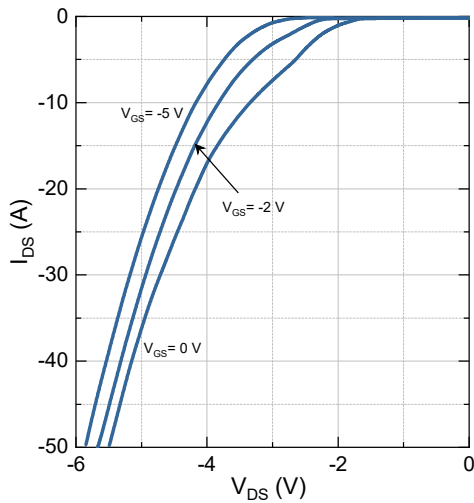


Figure 9: Typical Body Diode Characteristics at $T_J=25\text{ }^{\circ}\text{C}$

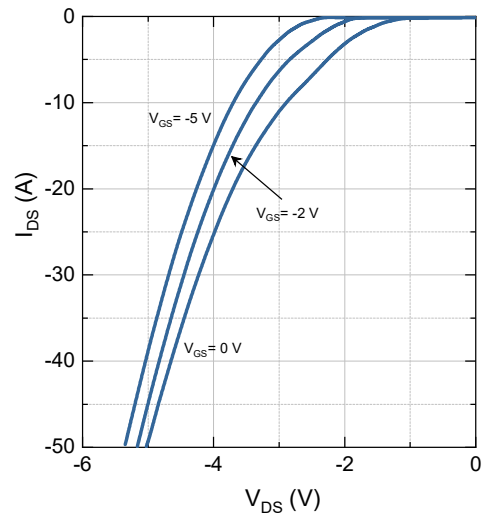


Figure 10: Typical Body Diode Characteristics at $T_J=175\text{ }^{\circ}\text{C}$

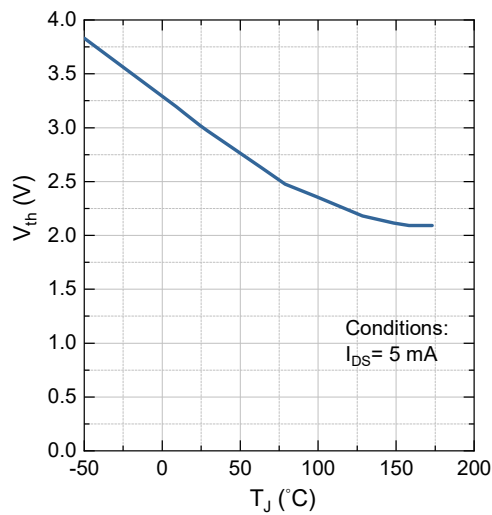


Figure 11: Typical Threshold Voltage vs. Temperature

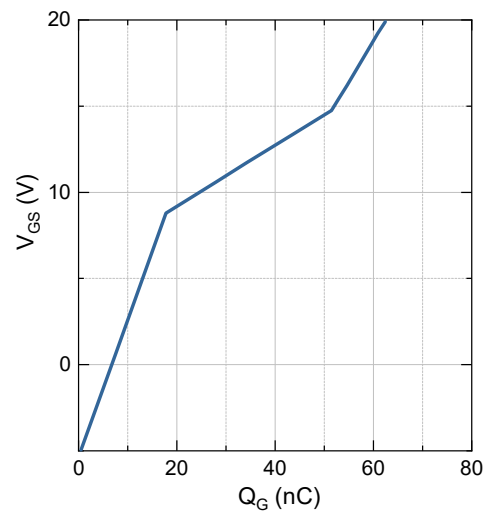


Figure 12: Typical Gate Charge Characteristics at $T_J=25\text{ }^{\circ}\text{C}$

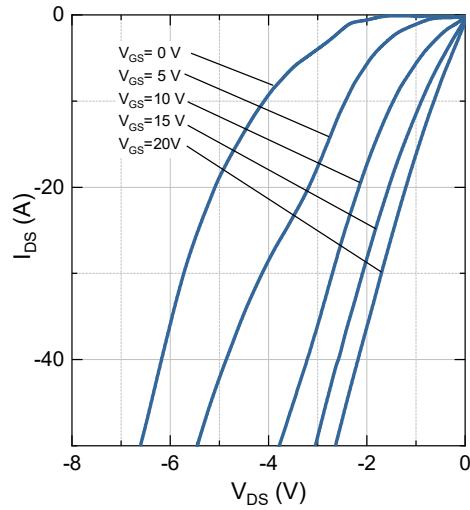


Figure 13: Typical 3rd Quadrant Characteristics
 $T_J = -55\text{ }^{\circ}\text{C}$

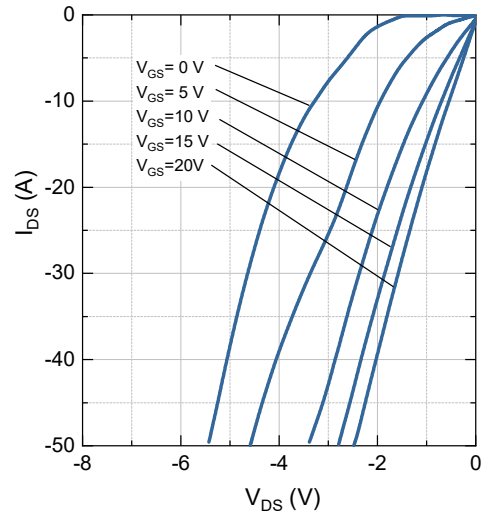


Figure 14: Typical 3rd Quadrant Characteristics at
 $T_J = 25\text{ }^{\circ}\text{C}$

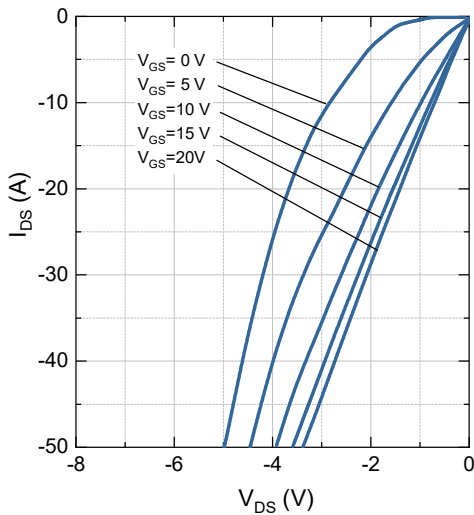


Figure 15: Typical 3rd Quadrant Characteristics at
 $T_J = 175\text{ }^{\circ}\text{C}$

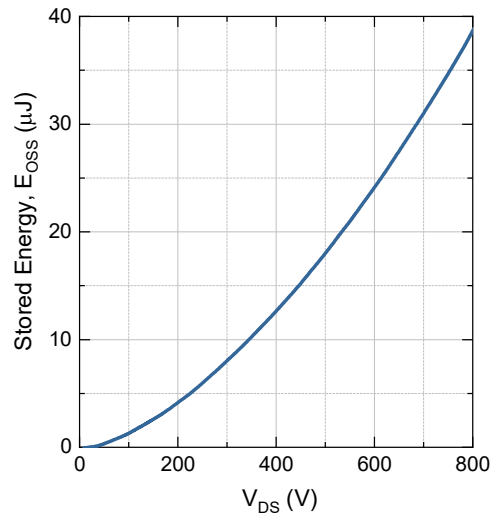


Figure 16: Typical Output Capacitor Stored Energy

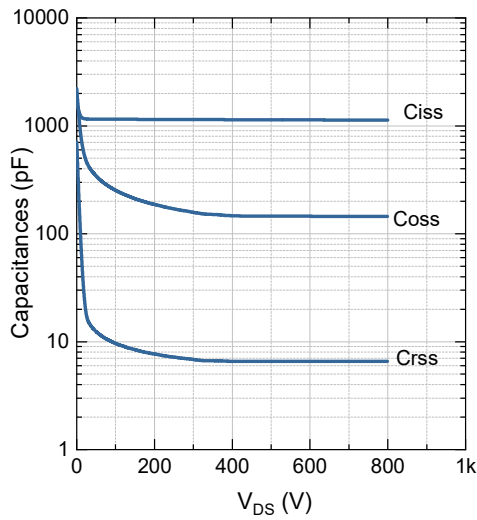


Figure 17: Typical Capacitances vs. Drain-Source Voltage

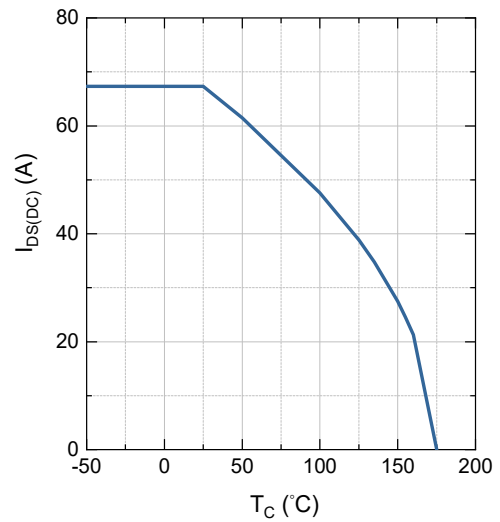


Figure 18: Continuous I_{DS} Current Derating Curve

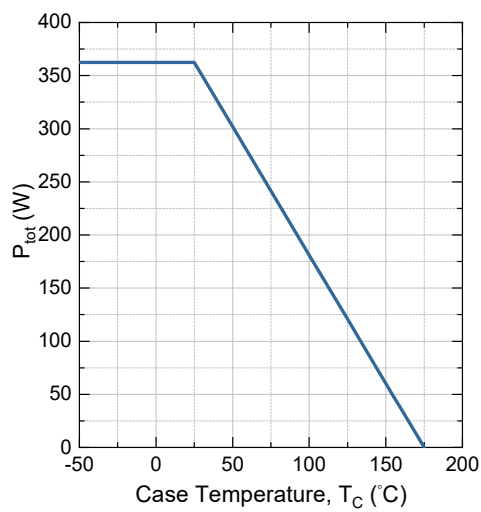


Figure 19: Power Dissipation Derating Curve

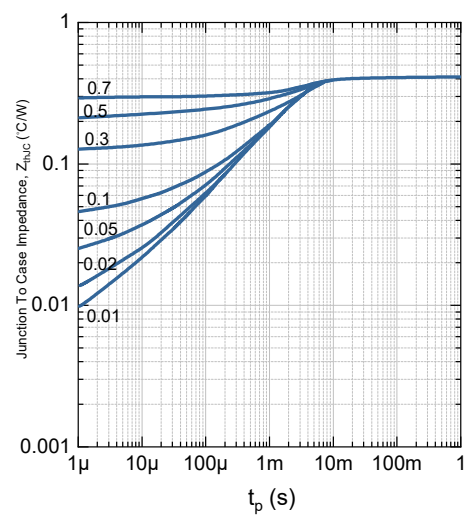


Figure 20: Typical Transient Thermal Impedance (Junction- Case) with Duty Cycle

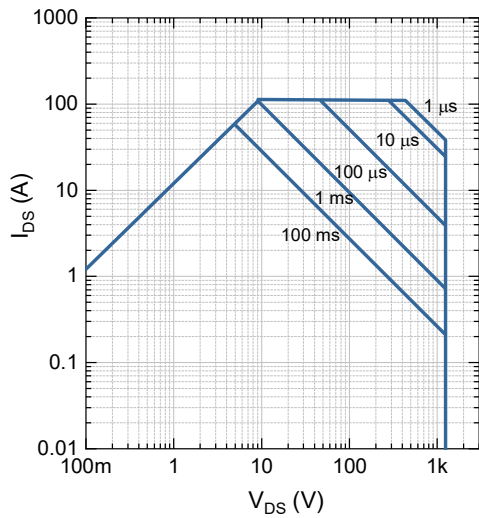


Figure 21: Safe Operate Area

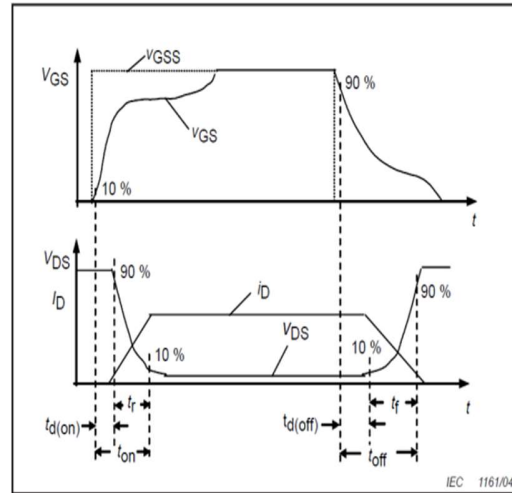


Figure 22: Resistive Switching Time Description

Test Circuit Schematic

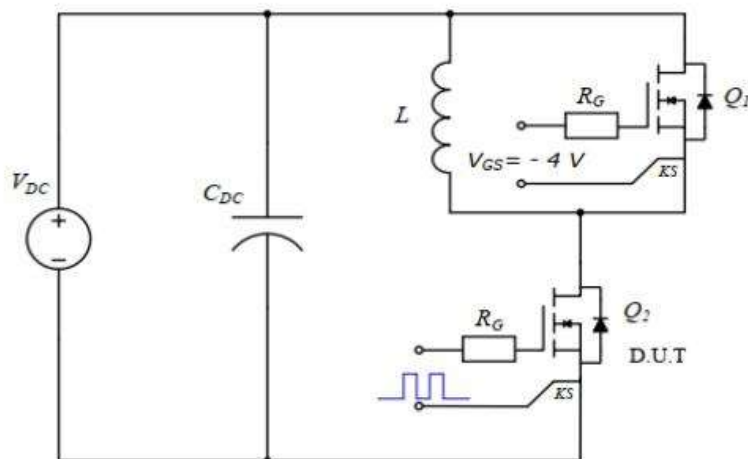
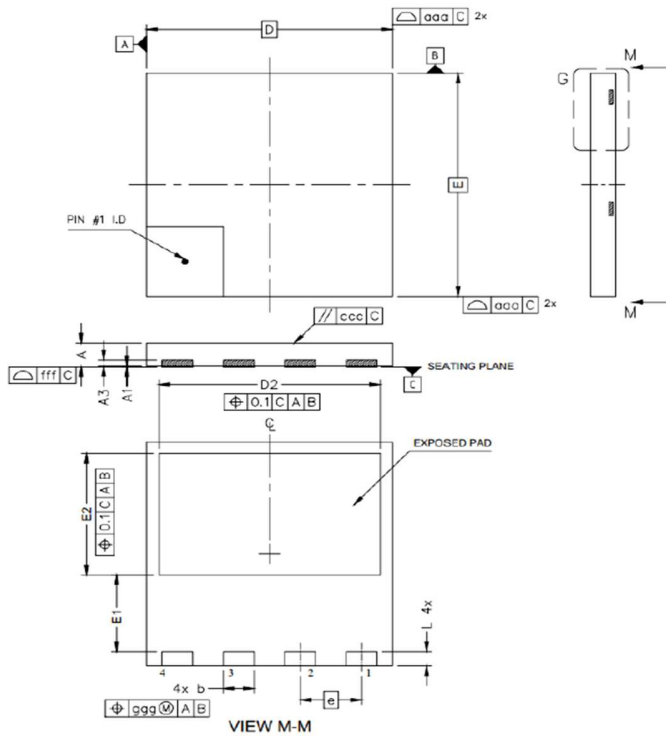


Figure 23: Clamped Inductive Switching Waveform Test Circuit

Package Dimensions

Package: DFN 8*8



SYMBOL	MIN	MAX	NOTES
A	0.75	0.95	1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994
A1	0.00	0.05	
A3	0.10	0.30	
b	0.90	1.10	2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
D	7.90	8.10	
E	7.90	8.10	3.0 DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.90mm AND 1.10mm FROM TERMINAL TIP.
D2	7.10	7.30	
E1	2.65	2.85	4.0 DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
E2	4.25	4.45	
e	2.00 BSC		5.0 COPLANARITY APPLIES TO THE EXPOSED HEAT SLUG AS WELL AS THE TERMINAL.
L	0.40	0.60	
aaa	0.10		6.0 RADIUS ON TERMINAL IS OPTIONAL.
ggg	0.05		
ccc	0.05		
fff	0.05		

Disclaimer

The information given in this document is intended as a reference only and shall not in any event be regarded as a guarantee of performance. Novawave does not assume any liability arising out of the use of any product described herein, including but not limited to any personal injury, death, or property or environmental damage. The products shown herein are not designed for use as critical components in medical, life-saving, or life-sustaining applications, whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness. No licenses, patent rights, or any other intellectual property rights is granted or conveyed. Novawave reserves the right to make changes without further notice to any products herein to improve reliability, function, or design. Novawave standard terms and conditions apply. All rights reserved.