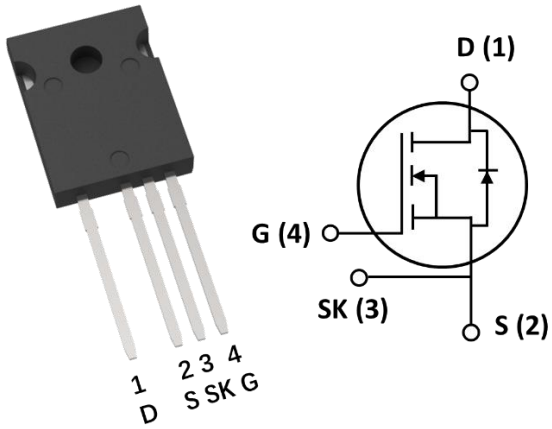
NW6506CJ1

650V N-Channel Silicon Carbide Power MOSFET

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}$	60	mΩ
I_D	56	A



Features

- 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 (Qrr)
- Easy to parallel.
- RoHS compliant

Applications

- Switch Mode Power Supplies
- DC/DC converters
- Solar inverters
- Battery Chargers
- Motor Drives

Description

The NW6506CJ1 is a 650V, 60mohm SiC MOSFET designed for improved system efficiency, large power density, and high operating frequency. 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.

Pin Description

Pin No.	Pin Name	Description
1	D	Drain
2	S	Source
3	SK	Kelvin Source
4	G	Gate

Absolute Maximum Ratings

T_J = 25 ˚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 V, I_D=100 µA
Continuous Drain Current	I_D	56	A	V_{GS}=20 V, T_C=25 ℃
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 °C
Recommend Gate Source Voltage	$V_{GS,op}$	-5/+20	V	
Maximum Gate Source Voltage	V_{Gsmax}	-10/+25	V	AC （f > 1Hz)
Operating Junction Temperature	T_J	-55 to +175	˚C	-
Storage Temperature	T_S	-55 to +175	˚C	-
Soldering Temperature	T_L	260	˚C	

Thermal Characteristics

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

Electrical Characteristics

Static Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	BV_{DS}	650	-	-	V	V_{GS}=0 V, I_D=100 µA

Zero Gate Voltage Drain Current	I_{Dss}	-	10	100	µA	V_{DS}=650 V, V_{GS}=0 V
Gate-Source Leakage	I_{Gss}	-	5	250	nA	V_{GS}=20 V
Gate-Source Threshold Voltage	$V_{GS(th)}$	2	-	4	V	I_D=5 mA, V_{GS}=V_{DS}
Drain-Source On-Resistance	$R_{DS(on)}$	-	60	80	mΩ	V_{GS}=20 V, I_D=13.2 A
			80			V_{GS}=18 V, I_D=13.2 A
			89			V_{GS}=15 V, I_D=13.2 A

Dynamic Characteristics

Input Capacitance	C_{iss}	-	1129	-	pF	V_{GS}=0 V, V_{DS}=600 V f=1.0 MHz, V_{AC}=25 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 V I_D=13.2 A V_{GS}=-5/+20 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 V V_{GS}=-5/+20 V I_D=13.2 A $R_{G(ext)}$=2.5 Ω
Turn-on Rise Time	t_r	-	14.5	-		
Turn-off Delay Time	$t_{d(off)}$	-	132.6	-		
Turn-off Fall Time	t_f	-	42.7	-		
Internal Gate Resistance	$R_{G(int)}$	-	2.8	-	Ω	f=1.0 MHz, V_{AC}=25 mV

Body Diode Characteristics

Continuous Diode Froward Current	I_S	-	-	56	A	
Diode Froward Voltage	V_{SD}	-	3.0	-	V	V_{GS}=0 V, I_S=6.6 A
Reverse Recovery Time	t_{rr}	-	23	-	ns	I_S=13.2 A, V_{DS}=400 V V_{GS}=-5 V di/dt=2100 A/µs
Reverse Recovery Charge	Q_{rr}	-	132	-	nC	
Peak Reverse Recovery Current	I_{rrm}	-	13	-	A	

Electrical Performance Graphs

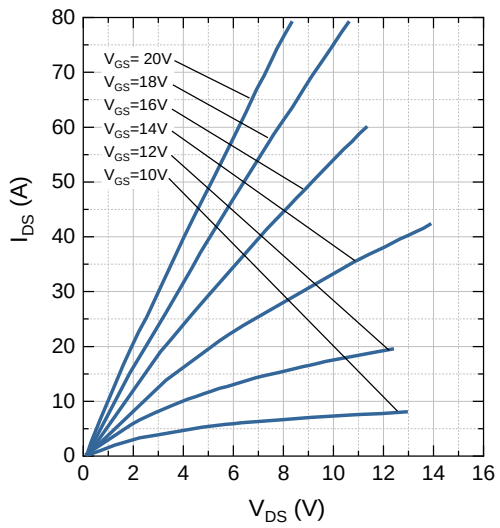


Figure 1: Typical Output Characteristics at T_J=-55 ℃

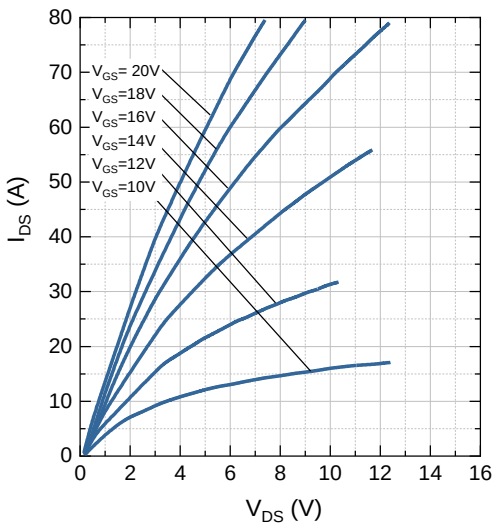


Figure 2: Typical Output Characteristics at T_J=25 ℃

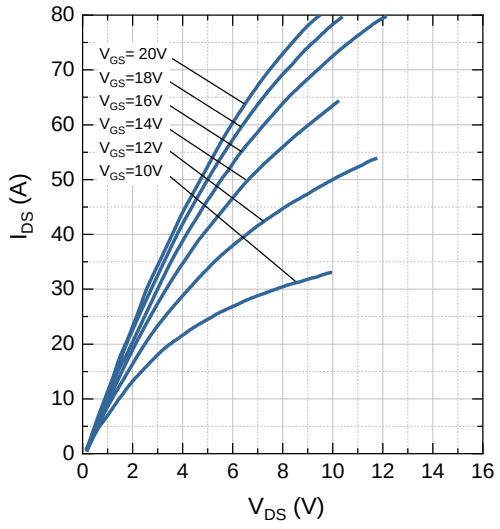


Figure 3: Typical Output Characteristics at T_J=175 ℃

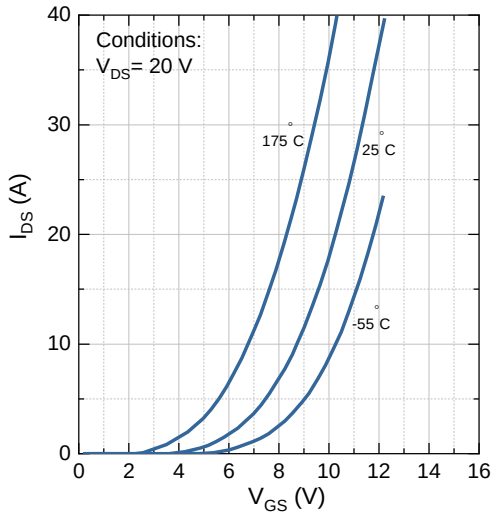


Figure 4: Typical Transfer Characteristics for Various Temperature

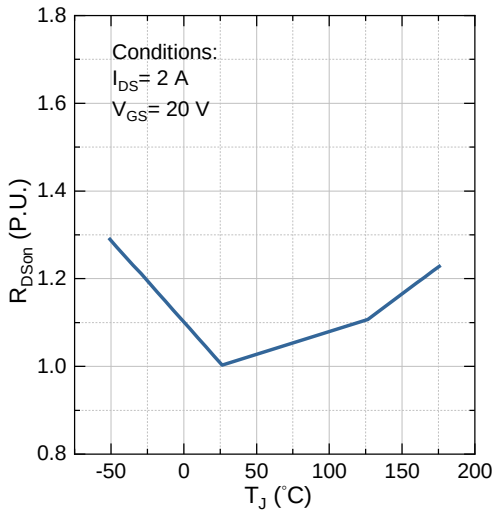


Figure 5: Normalized On-Resistance vs Temperature

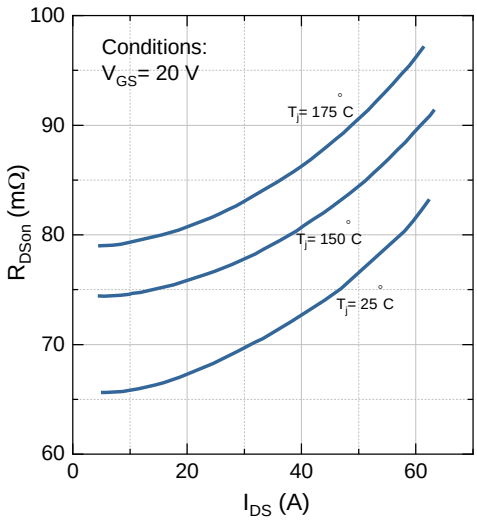


Figure 6: On-Resistance vs. Drain Current for Gate Various Temperatures

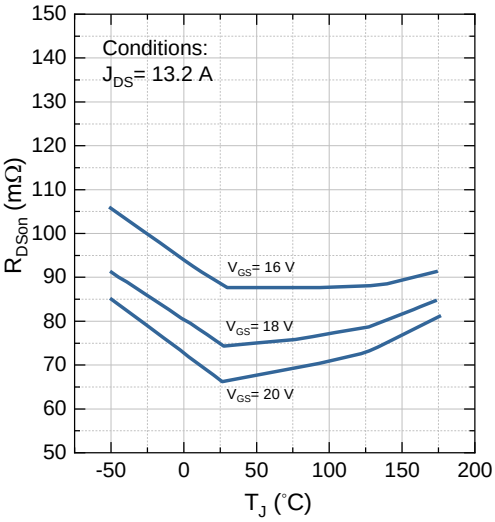


Figure 7: On-Resistance vs. Temperature for Various Voltage

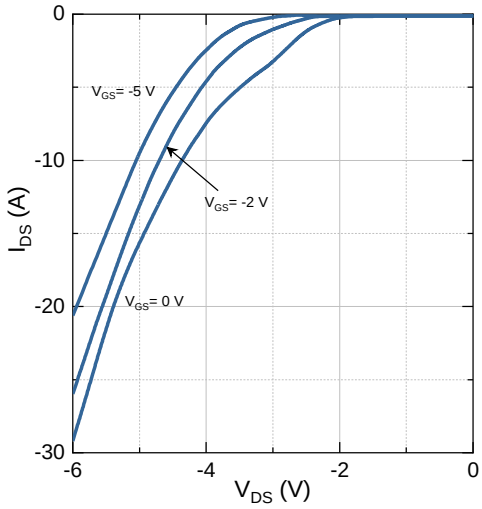


Figure 8: Typical Body Diode Characteristics at T_J=-55 ℃

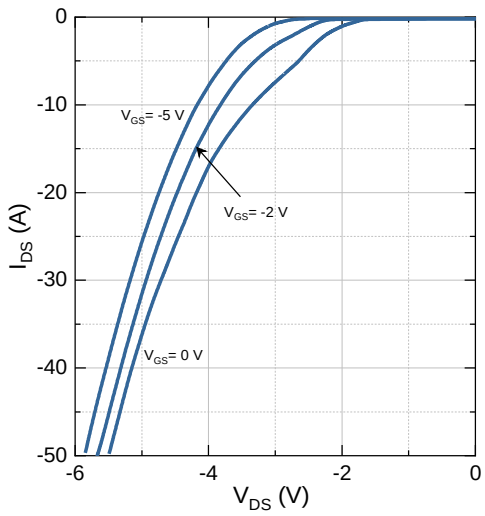


Figure 9: Typical Body Diode Characteristics at T_J=25 ℃

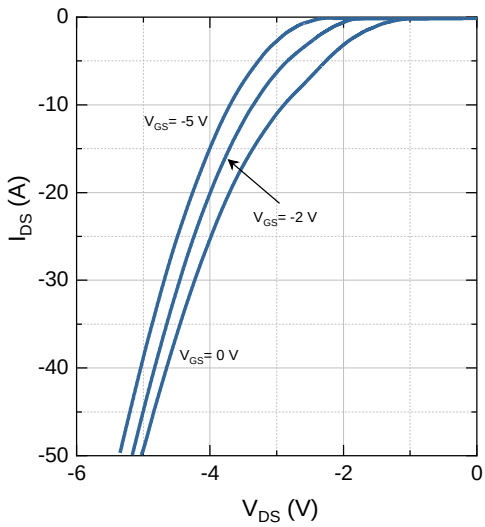


Figure 10: Typical Body Diode Characteristics at T_J=175 ℃

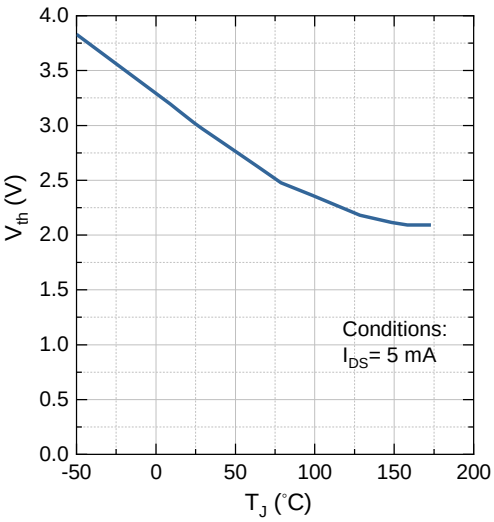


Figure 11: Typical Threshold Voltage vs. Temperature

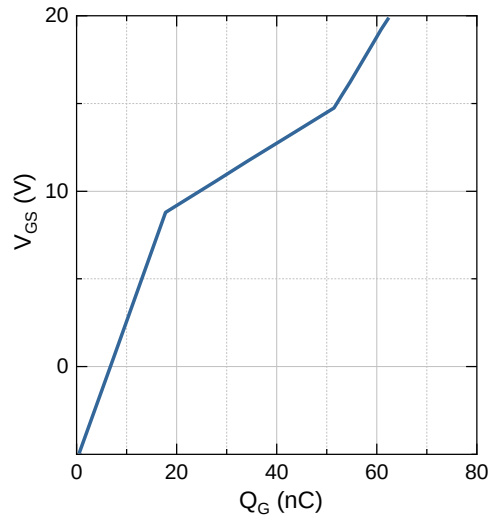


Figure 12: Typical Gate Charge Characteristics at T_J=25 ℃

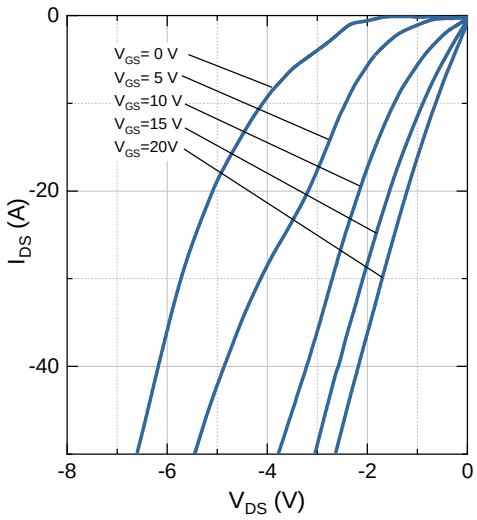


Figure 13: Typical 3rd Quadrant Characteristics T_J=-55 ℃

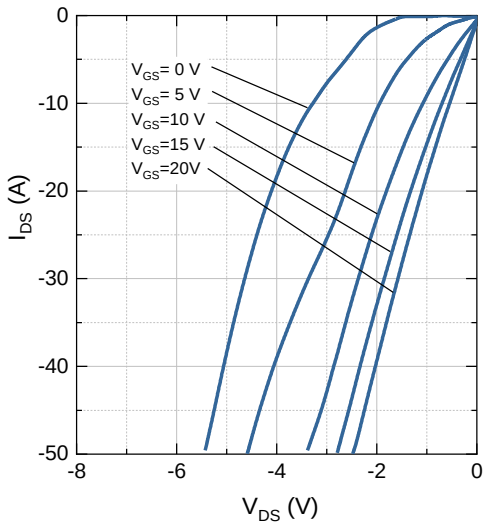


Figure 14: Typical 3rd Quadrant Characteristics at T_J=25 ℃

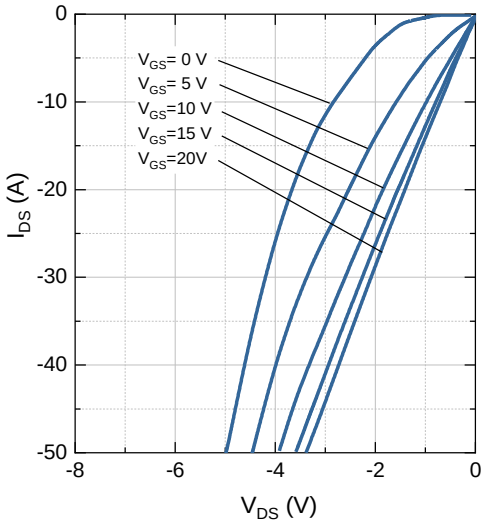


Figure 15: Typical 3rd Quadrant Characteristics at T_J=175 ℃

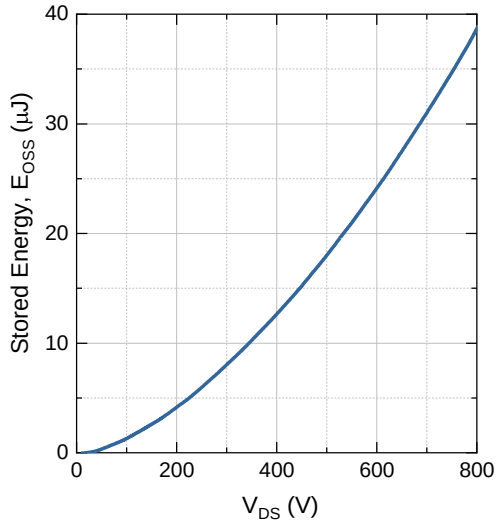


Figure 16: Typical Output Capacitor Stored Energy

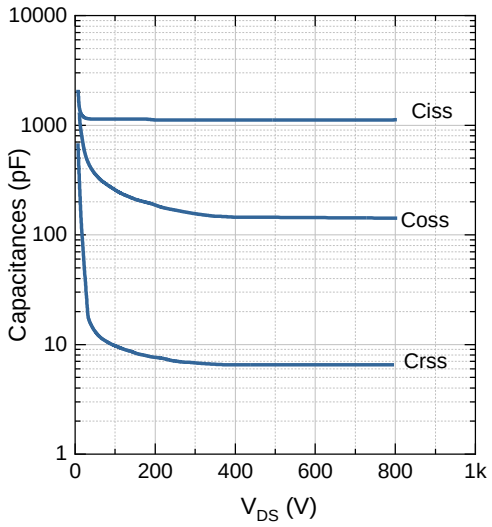


Figure 17: Typical Capacitances vs. Drain-Source Voltage

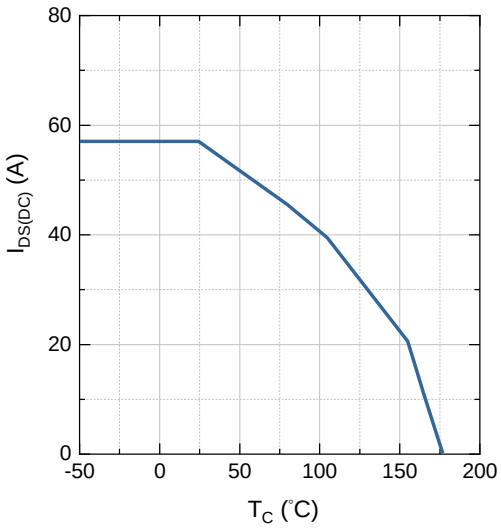


Figure 18: Continuous I_{DS} Current Derating Curve

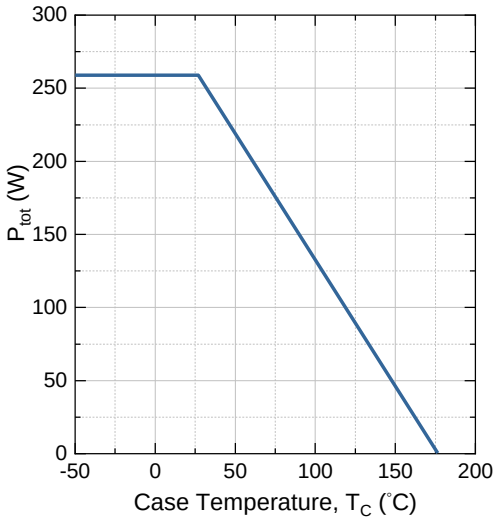


Figure 19: Power Dissipation Derating Curve

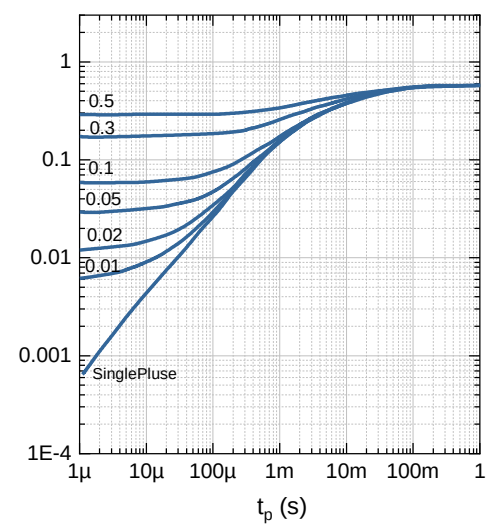


Figure 20: Typical Transient Thermal Impedance (Junction- Case) with Duty Cycle

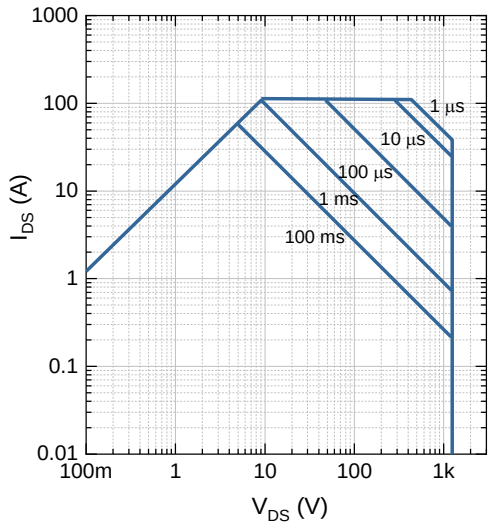


Figure 21: Safe Operate Area

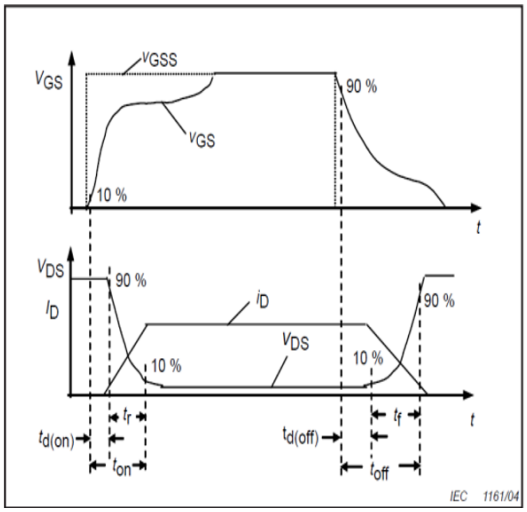


Figure 22: Resistive Switching Time Description

Test Circuit Schematic

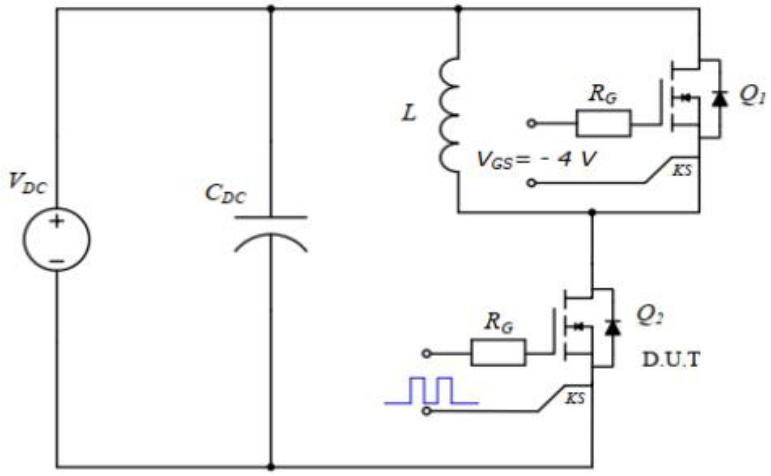
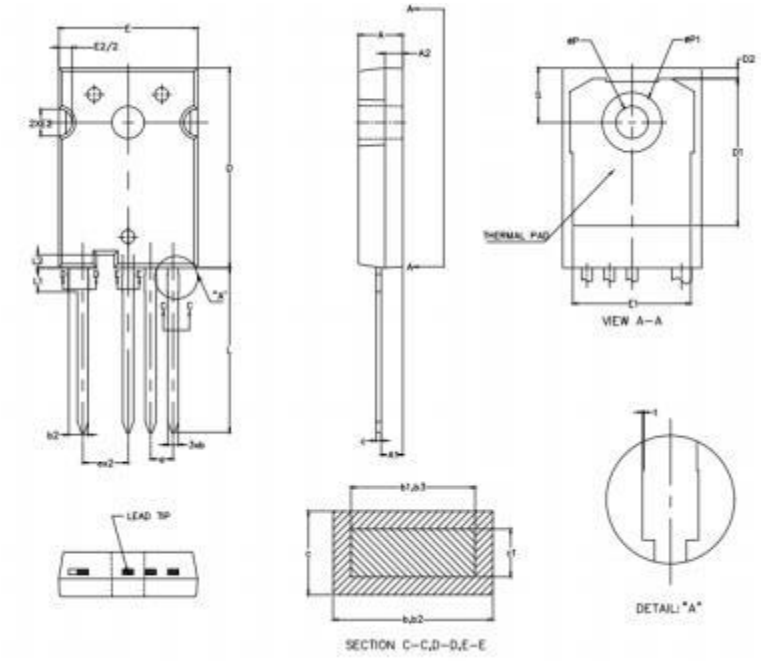


Figure 23: Clamped Inductive Switching Waveform Test Circuit

Package Dimensions

Package： TO-247-4



SYMBOLS	DIMENSIONS			
	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	2.16	2.26	0.085	0.089
b3	2.15	2.22	0.085	0.087
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	22.40	22.60	0.882	0.890
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.75	15.90	0.620	0.626
E1	13.26	—	0.552	—
E2	2.90	3.10	0.114	0.122
e	2.54BSC		0.1BSC	
L	18.30	18.60	0.720	0.732
L1	—	2.80	—	0.110
L2	—	1.50	—	0.059
øP	3.50	3.70	0.138	0.146
øP1	—	7.40	—	0.291
S	6.05	6.25	0.238	0.246
t	0.00	0.15	0.000	0.006

Disclaimer

The information given in this document is intended as a refence 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.