NW6520CX1

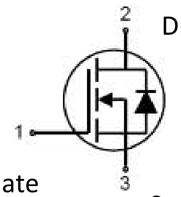
650V Silicon Carbide Mosfet

Parameter	Value	Unit
V_{RRM}	650	V
$R_{DS(on)}(V_{GS}=15V)$	200	mΩ
$R_{DS(on)}(V_{GS}=18V)$	154	mΩ
I_D (T_C = 25℃)	19	A

Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to Parallel
- Simple to Drive
- RoHS Compliant

TO252



Drain
Gate
Source

Applications

- Power Factor Correction Modules
- Switch Mode Power Supplies
- DC-AC Inverters
- High Voltage DC/DC Converters

Description

The NW6520CX1 is a 650 V, SiC mosfet based on NovaWave's advanced SiC technology resulting in high performance and long-term reliability. It supports high-temperature operation while showing minimal losses , zero reverse recovery, and low leakage current.
Pin1-Gate
Pin2-Drain and Backside
Pin3-Source

Part Description

Part Number	Package	Marking
NW6520CX1	TO252	NW6520CX1

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 Voltage	V_{DS}	650	V	
Continuous Drain Current	I_D	19 13	A	T_C = 25 °C V_{GS} =18V T_C = 100 °C
Peak Drain Current	I_{DM}	35	A	Pulse width t_p limited by T_{jmax}
Power Dissipation	P_{tot}	72 36	W	T_C = 25 °C T_C = 100 °C
Operating Junction Range	T_J	-40 to +175	°C	
Storage Temperature Range	T_{Stg}	-40 to +150	°C	
Soldering Temperature	T_{sold}	260	°C	1.6mm (0.063”) from case for 10s
Gate-Source Voltage, max. Transient Voltage	V_{GSmax}	-8 to +22	V	$t_p \leqslant 0.5\mu s$, D<0.001
Gate-Source Voltage	V_{GSmax}	-8 to +22	V	
Recommend Gate-Source Voltage	V_{GSop}	-4 to +18	V	

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction to Case	$R_{TH(J-C)}$	2.06	°C/W

Electrical Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	650			V	I_D=100µA, V_{GS}=0V
Zero Gate Voltage Drain Current	I_{DSS}		1	10	µA	V_{DS}=650V, V_{GS}=0V
Gate-Source Leakage Current	I_{GSS}			250	nA	V_{DS}=0V, V_{GS}=18V

Gate Threshold Voltage	$V_{GS(th)}$	2	2.9 2.1	4	V	$V_{DS}=V_{GS}$,I_D=2.5mA ,T_j=25°C T_j=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$		200 208	290	mΩ	V_{GS}=15V,I_D=10A,T_j=25°C T_j=175°C
			154 188	208	mΩ	V_{GS}=18V,I_D=10A,T_j=25°C T_j=175°C
Forward Transconductance	g_{fs}		7.2		S	VDS=20V, ID=10A
Input Capacitance	C_{iss}		308		pF	V_{DS}=600V, f=1MHz, V_{GS}=0V
Output Capacitance	C_{oss}		32		pF	
Reverse Transfer Capacitance	C_{rss}		4.2		pF	
C_{oss} Stored Energy	E_{oss}		5.3		pF	
Internal Gate Resistance	$R_{G(int)}$		3.9		Ω	f=1MHz
Total Gate Charge	Q_g		15		nC	V_{DS}=400V, I_D=10A, V_{GS}=-4V/18V
Gate to Source Charge	Q_{gs}		3		nC	
Gate to Drain Charge	Q_{gd}		4.4		nC	
Turn-On Delay Time	$t_{d(on)}$		4		ns	V_{DD}=400V, I_D=10A, V_{GS}=-4V/18V, $R_{G(ext)}$=2.5Ω, L=200µH, T_j=25°C
Rise Time	t_r		12		ns	
Turn-Off Delay Time	$t_{d(off)}$		7		ns	
Fall Time	t_f		5		ns	
Turn-On Energy	E_{on}		43		µJ	
Turn-Off Energy	E_{off}		8		µJ	

Turn-On Delay Time	$t_{d(on)}$		4		ns	V_{DD}=400V, I_D=10A, V_{GS}=-4V/18V, $R_{G(ext)}$=2.5Ω, L=200μH, T_j=175°C
Rise Time	t_r		12		ns	
Turn-Off Delay Time	$t_{d(off)}$		8		ns	
Fall Time	t_f		5		ns	
Turn-On Energy	E_{on}		43		μJ	
Turn-Off Energy	E_{off}		9		μJ	

Reverse Diode Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Diode Forward Voltage	V_{SD}		4.0 3.7		V	V_{GS}=-4V,I_{SD}=5A,T_j=25°C T_j=175°C
Continuous Diode Forward Current	I_S		17 9		A	V_{GS}=-4V,T_c=25°C, T_c=100°C
Reverse Recovery Time	t_{rr}		9		ns	V_{GS}=-4V,I_{SD}=5A, V_R=400V, di/dt=2000A/μs, T_j=25°C
Reverse Recovery Charge	Q_{rr}		33		nC	
Peak Reverse Recovery Current	I_{rrm}		6.4		A	
Reverse Recovery Time	t_{rr}		28		ns	V_{GS}=-4V,I_{SD}=5A, V_R=400V, di/dt=2000A/μs, T_j=175°C
Reverse Recovery Charge	Q_{rr}		81		nC	
Peak Reverse Recovery Current	I_{rrm}		6.1		A	

Electrical Performance Graphs

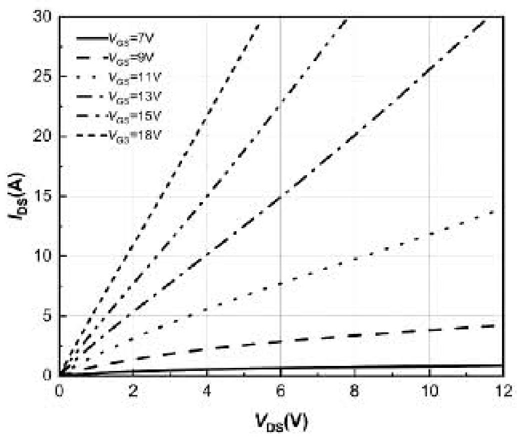


Figure 1. Output Characteristics
Tj = -40°C

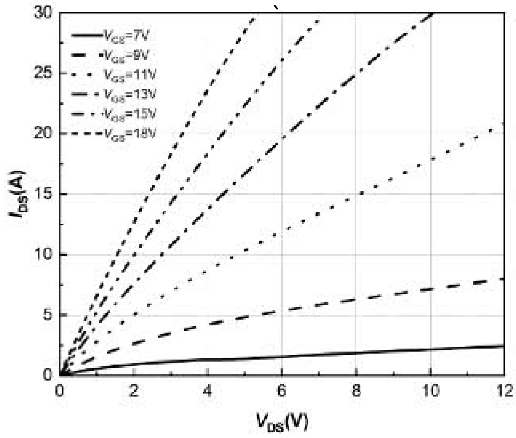


Figure 2. Output Characteristics
Tj = 25°C

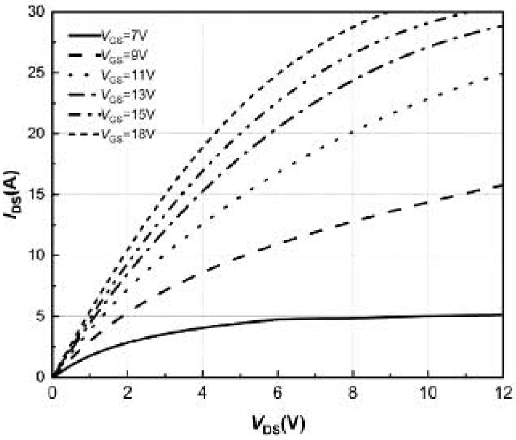


Figure 3. Output Characteristics
Tj = 125°C

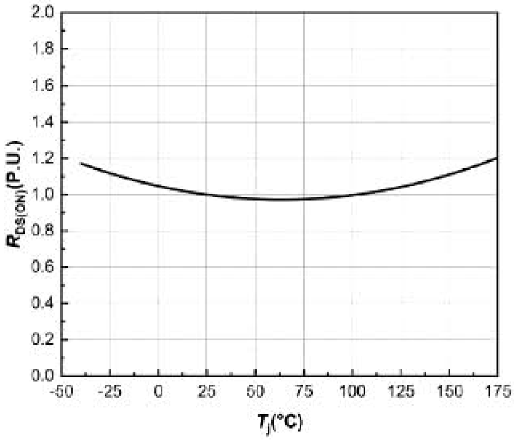


Figure 4. Normalized On-Resistance
vs. Temperature

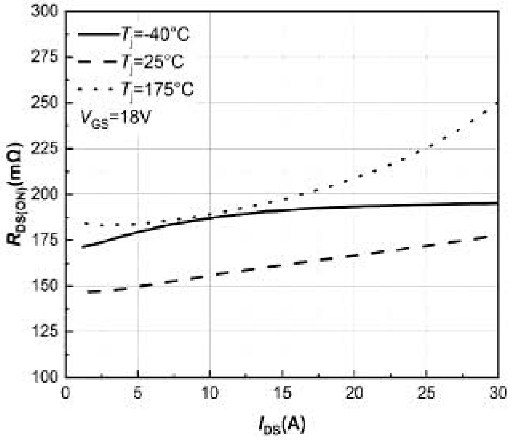


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

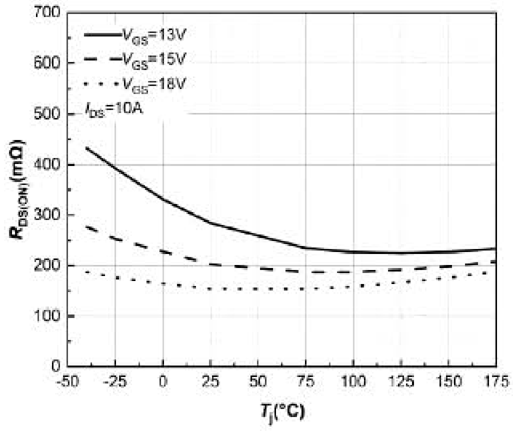


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

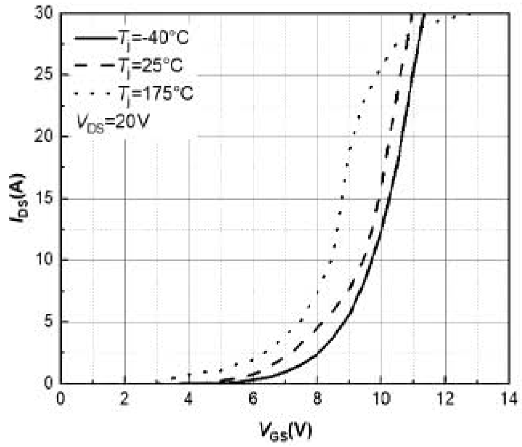


Figure 7. Transfer Characteristic for
Various Junction Temperatures

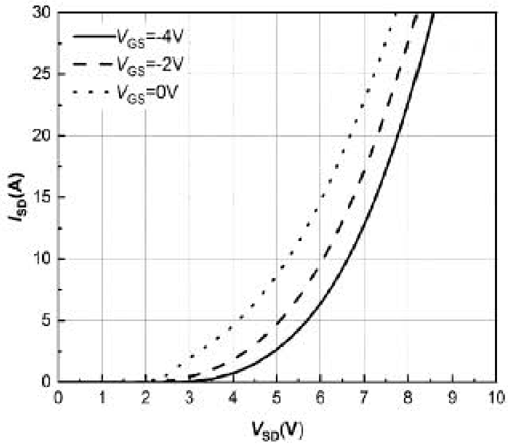


Figure 8. Body Diode Characteristic
T_j = -40°C

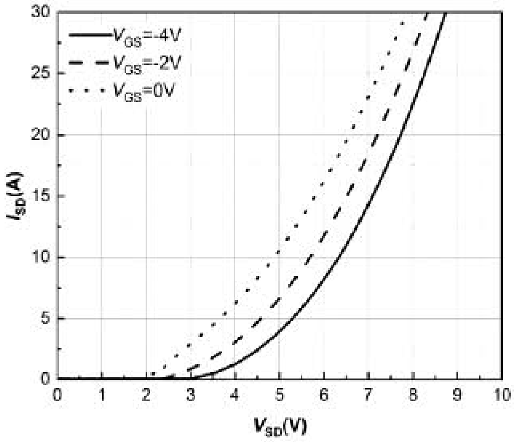


Figure 9. Body Diode Characteristic
Tj = 25°C

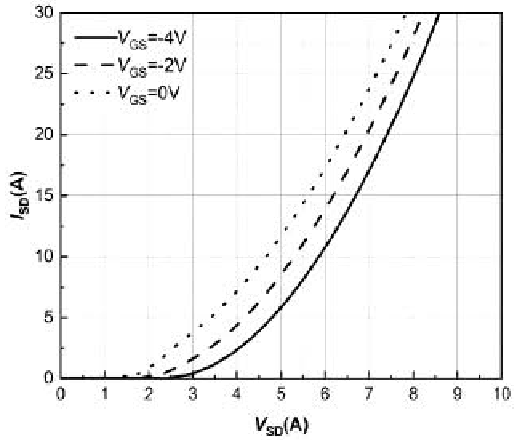


Figure 10. Body Diode Characteristic
Tj = 125°C

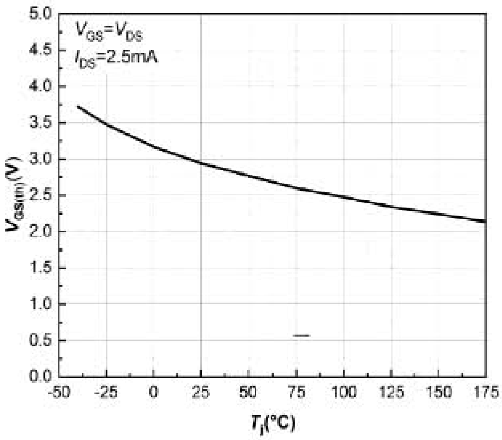


Figure 11. Threshold Voltage vs. Temperature

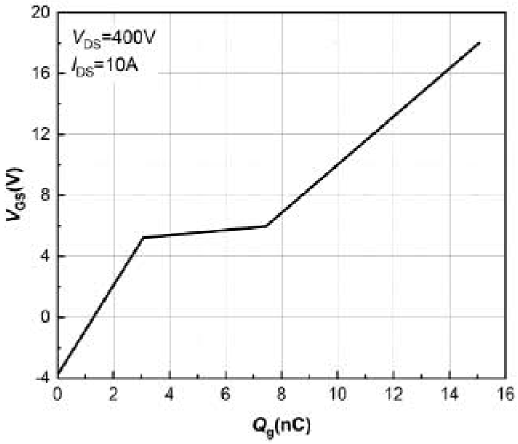


Figure 12. Gate Charge Characteristics

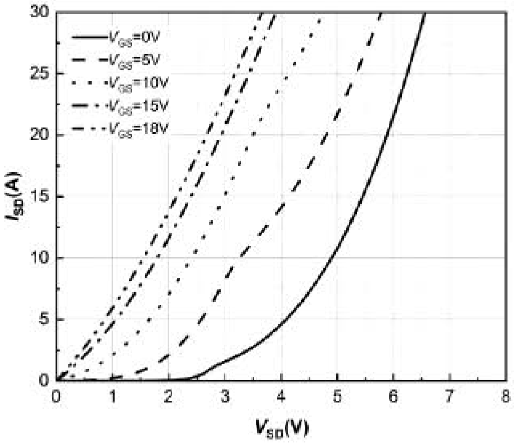


Figure 13. 3rd Quadrant Characteristic
Tj = -40°C

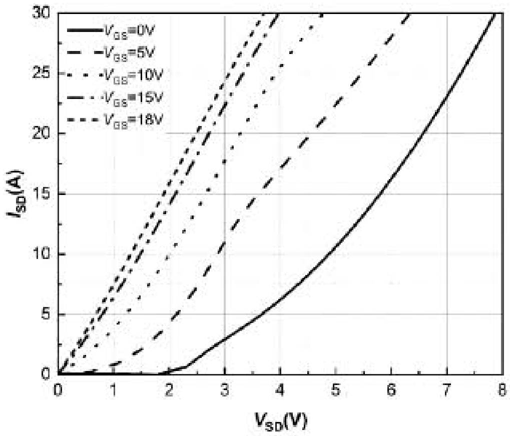


Figure 14. 3rd Quadrant Characteristic
Tj=25°C

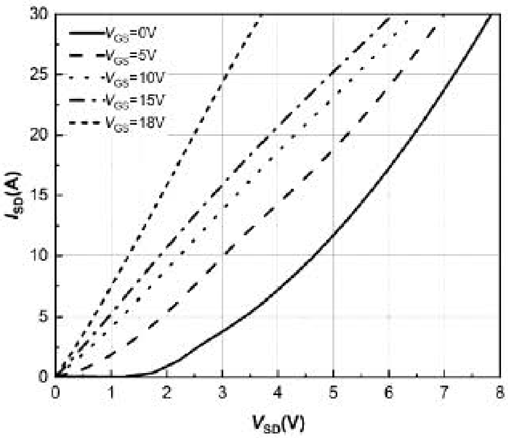


Figure 15. 3rd Quadrant Characteristic
Tj=175°C

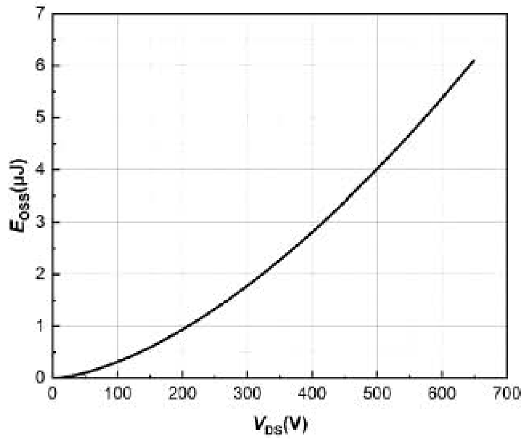


Figure 16. Output Capacitor Stored Energy

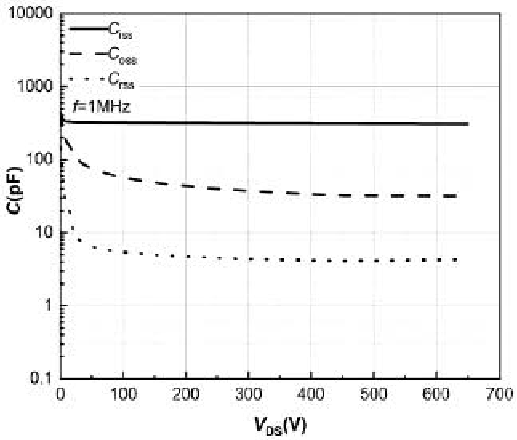


Figure 17. Capacitances vs. Drain-Source

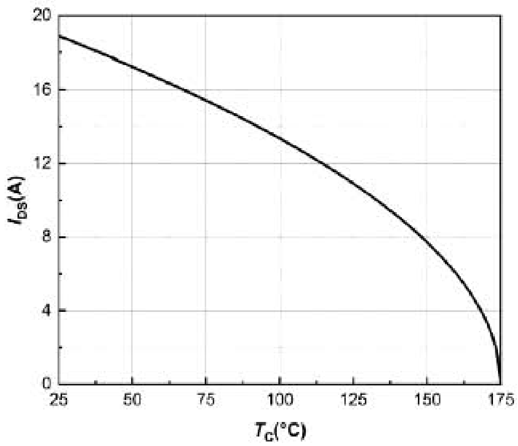


Figure 18. Continuous Drain Current Derating vs. Case Temperature

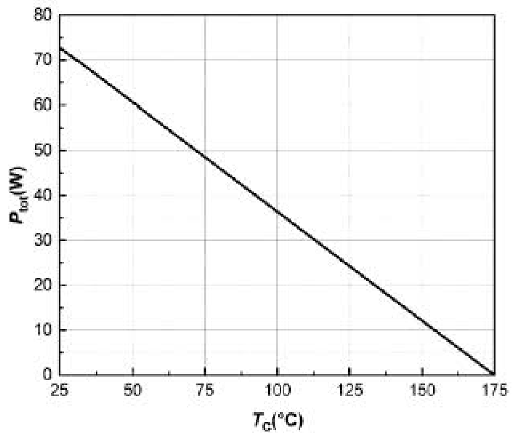


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

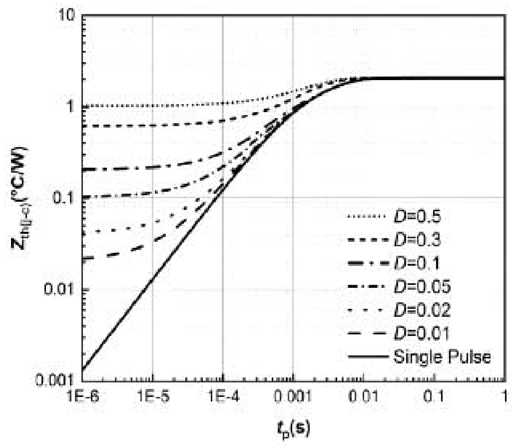


Figure 20. Transient Thermal Impedance

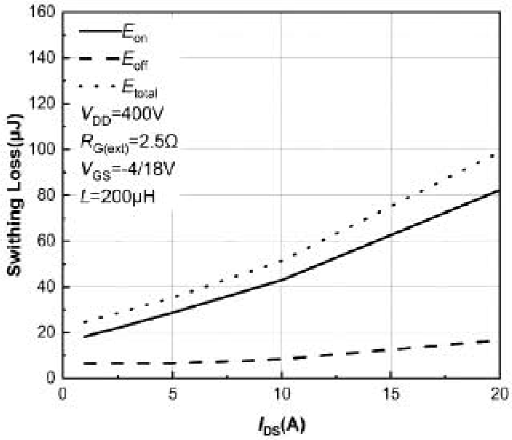


Figure 21. Clamped Inductive Switching Energy vs. Drain Current Tj = 25°C

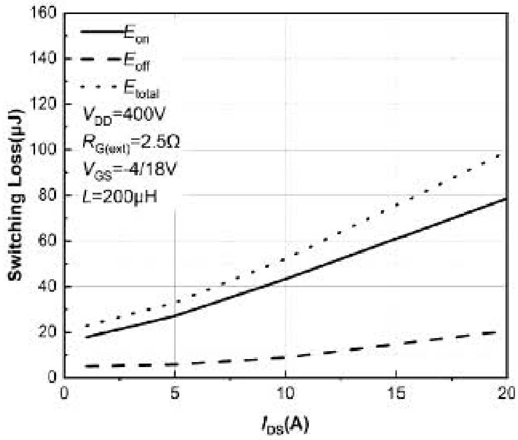


Figure 22. Clamped Inductive Switching Energy vs. Drain Current Tj = 175°C

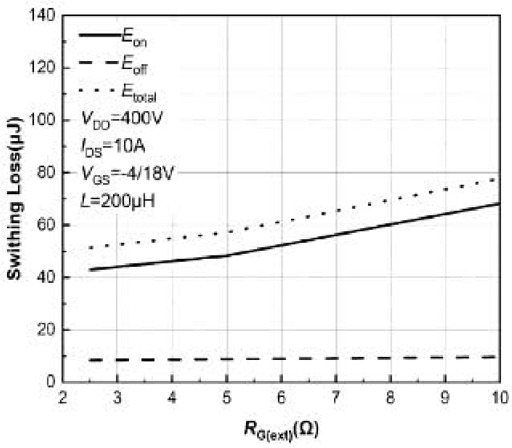


Figure 23. Clamped Inductive Switching Energy vs. RG(ext) Tj = 25°C

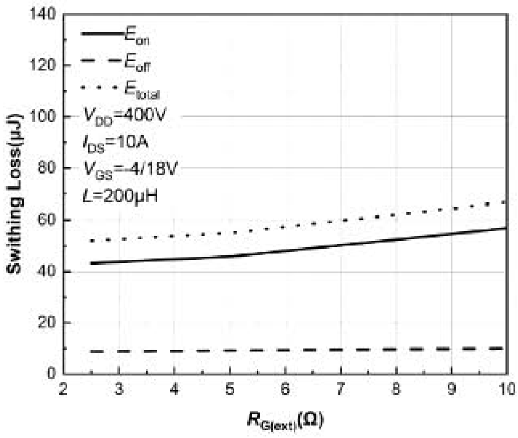


Figure 24. Clamped Inductive Switching Energy vs. RG(ext) Tj = 175°C

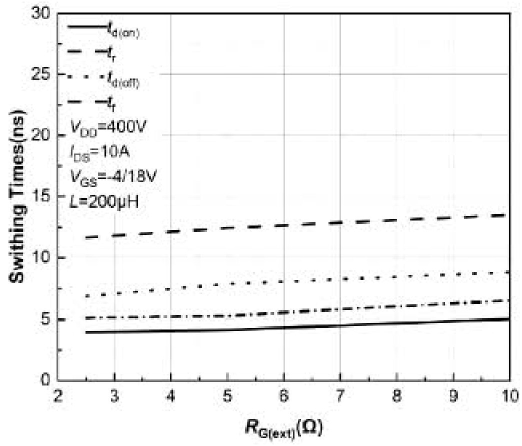


Figure 25. Switching Times vs. RG(ext)
Tj=25°C

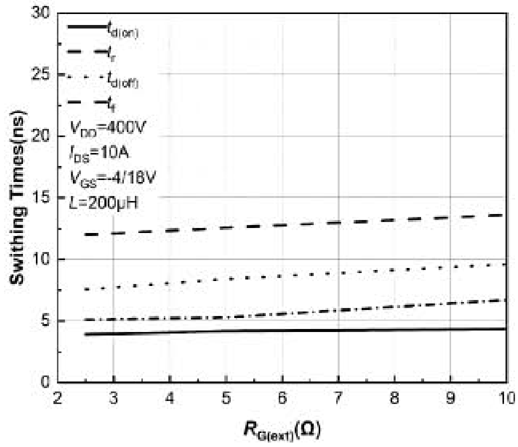


Figure 26. Switching Times vs. RG(ext)
Tj=175°C

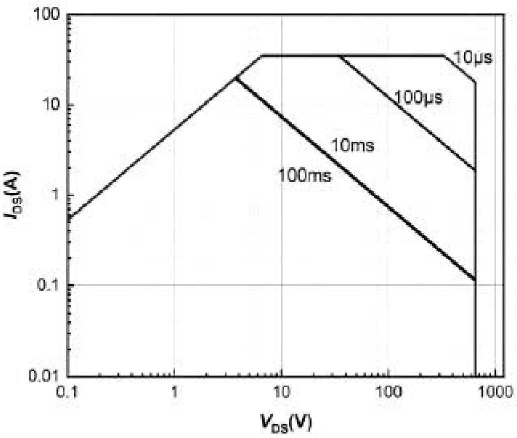
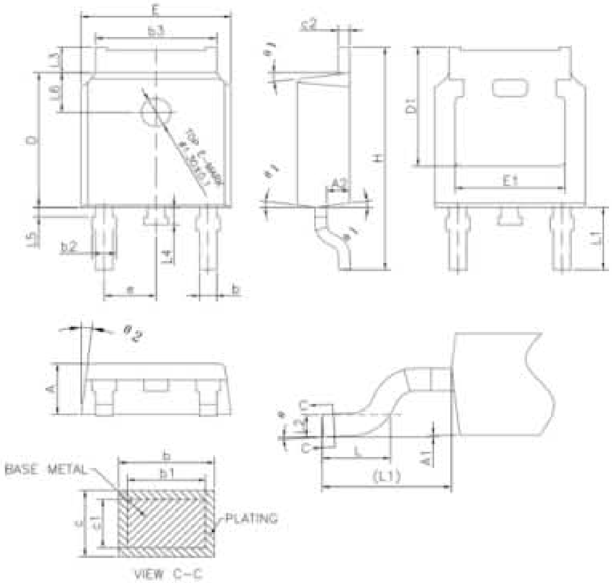


Figure 27. Safe Operating Area

Package Dimensions



SYMBOL	Unit(mm)			SYMBOL	Unit(mm)		
	MIN	NOM	MAX		MIN	NOM	MAX
A	2.20	2.30	2.38	E1	4.70	-	-
A1	0.00	-	0.10	e	2.186	2.286	2.386
A2	0.90	1.01	1.10	H	9.80	10.10	10.40
b	0.72	-	0.85	L	1.40	1.50	1.70
b1	0.71	0.76	0.81	L1	2.90 REF		
b2	0.72	-	0.90	L2	0.50 BSC		
b3	5.13	5.33	5.46	L3	0.90	-	1.25
c	0.47	-	0.60	L4	0.60	0.80	1.00
c1	0.46	0.51	0.56	L5	0.15	-	0.75
c2	0.47	-	0.60	L6	1.80 REF		
D	6.00	6.10	6.20	θ	0°	-	8°
D1	5.25	-	-	θ1	5°	7°	9°
E	6.50	6.60	6.70	θ2	5°	7°	9°

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