NW6550CX1

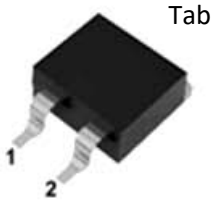
650V Silicon Carbide Mosfet

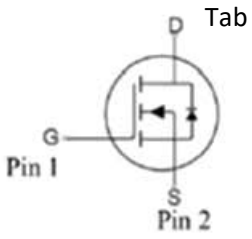
Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}$(V_{GS}= 15V)	500	mΩ
$R_{DS(on)}$(V_{GS}= 18V)	370	mΩ
I_D (T_C = 25℃,$R_{thjc,typ,}$)	8.8	A

Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with low on-resistance
- Low on-resistance with high junction temperaturel
- Fast intrinsic diode with low reverse recovery (Qrr)
- RoHS Compliant

TO252





Applications

- PC Power
- EV Charging
- LED Lighting
- Solar PV inverters / UPS
- Server Power / Telecom Power

Description

The NW6550CX1 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.

Part Description

Part Number	Package	Marking
NW6550CX1	TO252	NW6550CX1

Absolute Maximum Ratings

T_J = 25 °C except as noted. Exceeding the maximum ratings may damage the device.

Gate-source transient voltage, tp < 1 µs, t ≤ 10 hours over lifetime，-10/+22V

Parameter	Symbol	Value	Unit	Test conditions
Drain-Source Voltage	V_{DSmax}	650	V	V_{GS} = 0 V, I_D = 100 µA
Continuous Drain Current for $R_{thjc, typ}$,limited by $T_{j(max)}$	I_D	8.8	A	V_{GS}=15V,T_C=25°C
		6.2		V_{GS}=15V,T_C=100°C
		9.3		V_{GS}=18V,T_C=25°C
		6.6		V_{GS}=18V,T_C=100°C
Pulse Drain Current, Pulse width tp limited by T_{jmax}	$I_{D(pulse)}$	16	A	T_C = 25 °C
Avalanche energy, single pulse	E_{AS}	10.2	mJ	I_D = 6.4A, V_{DS} = 50V, L = 0.5mH,V_{GS} = 15 V
Power Dissipation for $R_{thjc, typ}$	P_D	39	W	T_C=25°C
		19		T_C=100°C
Recommended turn-on Gate Source Voltage	$V_{GS(on)}$	+15/+18	V	
Recommended turn-off Gate Source Voltage	$V_{GS(off)}$	-4/0	V	
Maximum Gate Source Voltage, transient voltage	V_{GSmax}	-10/+22	V	AC （f > 1 Hz)
Operating Junction and Storage Temperature Range	T_{stg}	-55/+175	°C	
Soldering Temperature	T_L	260	°C	
Virtual junction temperature	T_{VJ}	-55/+175	°C	

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance from Junction to Case	$R_{TH(J-C)}$		3.8	4.6	°C/W

Electrical Characteristics

at T_C = 25°C, unless otherwise specified

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}	--	0.1	20	μA	V_{DS}=650V, V_{GS}=0V, T_{VJ} = 25°C
		--	1	--		V_{DS}=650V, V_{GS}=0V, T_{VJ} = 175°C
Gate-Source Leakage Current	I_{GSS}	--	--	250	nA	V_{GS}=22V
Gate Threshold Voltage	$V_{GS(th)}$	--	3.8	--	V	V_{DS}=V_{GS},I_D=3.5mA ,T_j=25°C
		--	2.7	--		V_{DS}=V_{GS},I_D=3.5mA ,T_j=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$	--	500 510	--	mΩ	V_{GS}=15V,I_D=4A,T_j=25°C T_j=175°C
		--	370 450	--	mΩ	V_{GS}=18V,I_D=4A,T_j=25°C T_j=175°C
Forward Transconductance	g_{fs}	--	2.7	--	S	V_{DS}=20V, I_D=4A
Input Capacitance	C_{iss}	--	150	--	pF	V_{DS}=400V, f =1MHz, V_{GS}=0V
Output Capacitance	C_{oss}	--	13	--		
Reverse Transfer Capacitance	C_{rss}	--	2.3	--		
Internal Gate Resistance	$R_{G(int)}$	--	36	--	Ω	f =1MHz, V_{AC}=25mV
Total Gate Charge	Q_g	--	6.7	--	nC	V_{DS}=400V, I_D=4A, V_{GS}=0/+15V
Gate to Source Charge	Q_{gs}	--	2.5	--		
Gate to Drain Charge	Q_{gd}	--	1.0	--		

Turn-On Delay Time	$t_{d(on)}$	--	16.0	--	ns	V_{DD}=400V, I_D=4A, V_{GS}=0V/+15V, $R_{G(ext)}$ = 10 Ω L=600µH, T_{VJ}=25°C FWD = Body Diode
Rise Time	t_r	--	13.8	--		
Turn-Off Delay Time	$t_{d(off)}$	--	13.1	--		
Fall Time	t_f	--	13.5	--		
Turn-On Energy	E_{on}	--	41.0	--	µJ	
Turn-Off Energy	E_{off}	--	3.0	--		
Total switching Energy	E_{Total}	--	44.0	--		
Turn-On Delay Time	$t_{d(on)}$	--	15.2	--	ns	V_{DD}=400V, I_D=4A, V_{GS}=0V/+15V, $R_{G(ext)}$ = 10 Ω L=600µH, T_{VJ}=175°C FWD = Body Diode
Rise Time	t_r	--	18.1	--		
Turn-Off Delay Time	$t_{d(off)}$	--	15.4	--		
Fall Time	t_f	--	13.4	--		
Turn-On Energy	E_{on}	--	39.6	--	µJ	
Turn-Off Energy	E_{off}	--	2.9	--		
Total switching Energy	E_{Total}	--	42.5	--		

Reverse Diode Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Diode Forward Voltage	V_{SD}		3.8 3.3		V	V_{GS}=0V,I_S=2A,T_{VJ}=25°C T_{VJ}=175°C
Continuous Diode Forward Current	I_S	--	8	--	A	V_{GS}=-4V
Diode pulse Current	$I_{S(pulse)}$	--	--	16	A	Pulse width t_p, limited by T_{jmax}
Reverse Recovery Time	t_{rr}		7.8		ns	V_{GS}=0V,I_S=4A, V_{DS}=400V, di/dt=1.1A/ns, T_{VJ}=25°C
Reverse Recovery Charge	Q_{rr}		19.9		nC	
Peak Reverse Recovery Current	I_{rrm}		4.1		A	
Reverse Recovery Time	t_{rr}		8.9		ns	V_{GS}=0V,I_S=4A, V_{DS}=400V, di/dt=1.1A/ns, T_{VJ}=175°C
Reverse Recovery Charge	Q_{rr}		22.9		nC	
Peak Reverse Recovery Current	I_{rrm}		4.4		A	

Electrical Performance Graphs

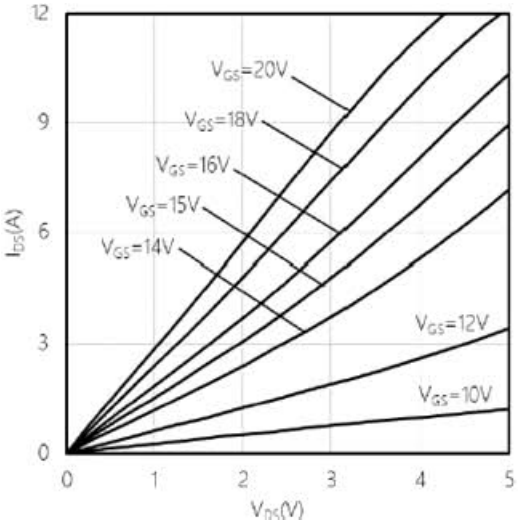


Figure 1.Typical Output Characteristics
T_{VJ} = -55°C

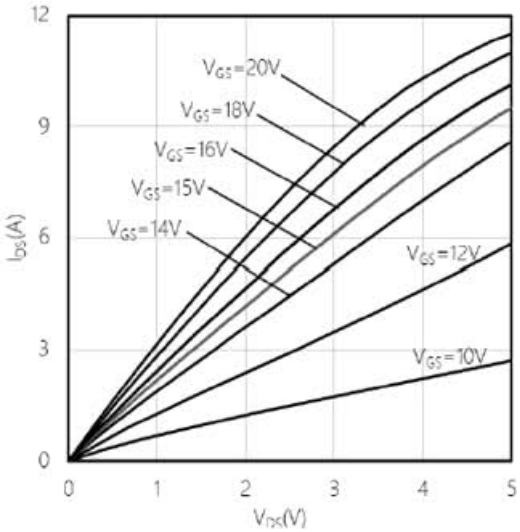


Figure 2.Typical Output Characteristics
T_{VJ} = 25°C

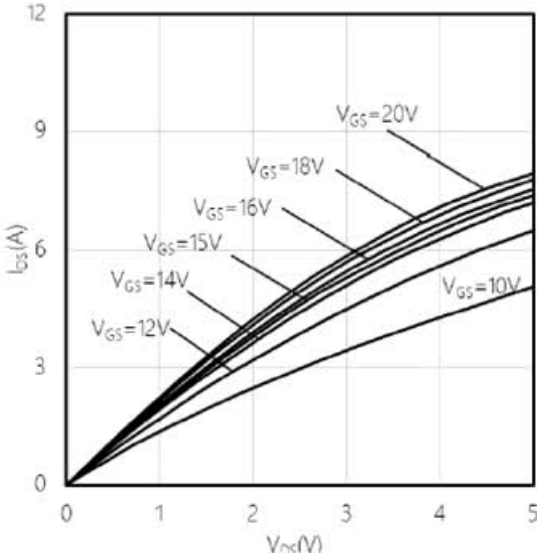


Figure 3.Typical Output Characteristics
T_{VJ} = 175°C

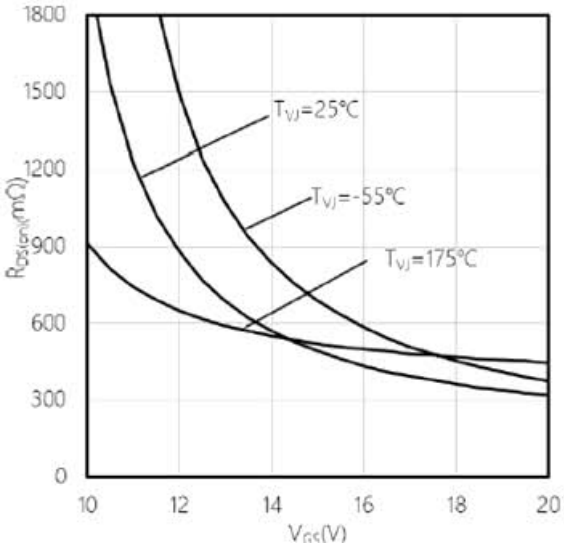


Figure 4. On-Resistance vs. Gate Voltage for Various Temperature I_D=4A

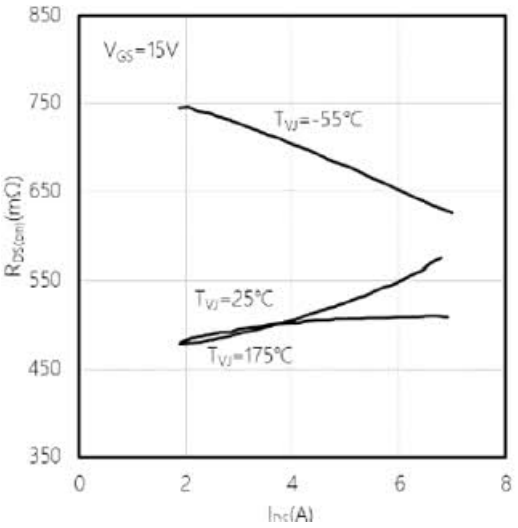


Figure 5. On-Resistance vs. Drain Current for Various Temperature V_{GS}=15V

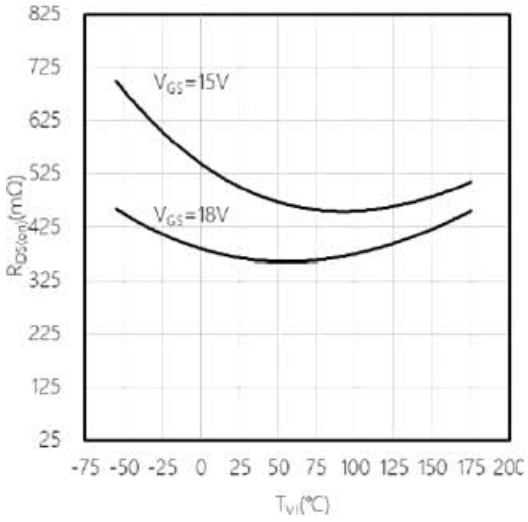


Figure 6. On-Resistance vs. Junction Temperature for Various Gate Voltage I_D=4A

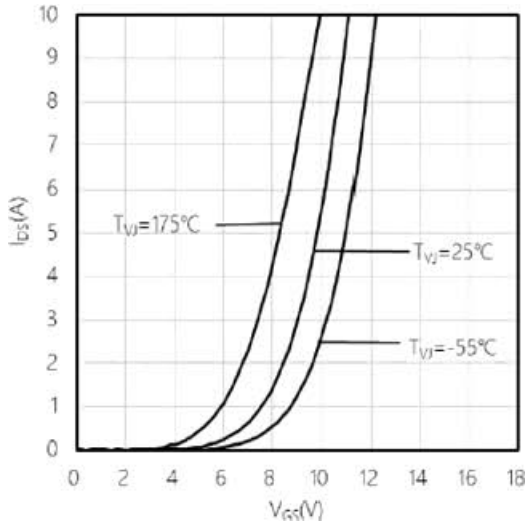


Figure 7. Transfer Characteristic for Various Temperature V_{DS}=20V

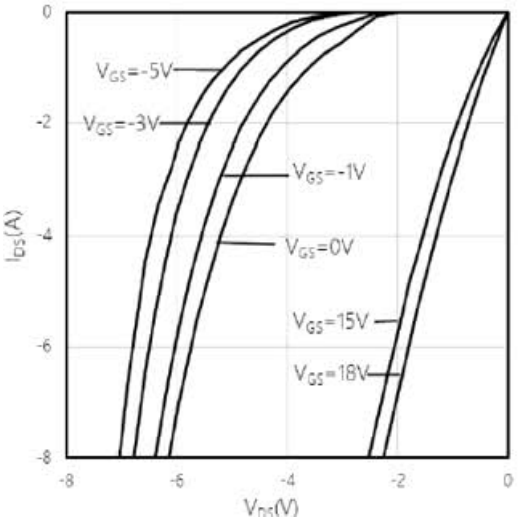


Figure 8. Typical 3rd Quadrant Characteristics T_{VJ} = -55 °C

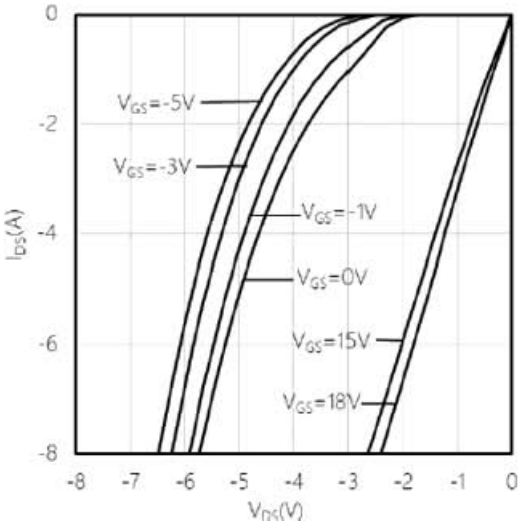


Figure 9. Typical 3rd Quadrant Characteristics at T_{VJ} = 25°C

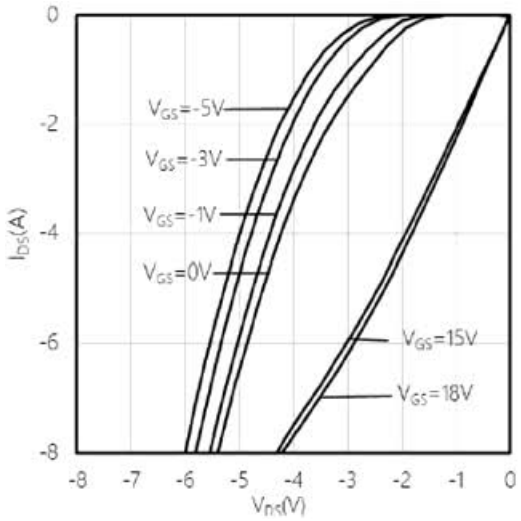


Figure 10. Typical 3rd Quadrant Characteristics at T_{VJ} = 125°C

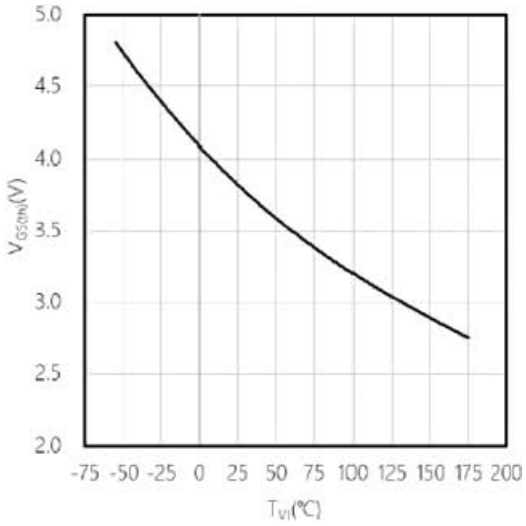


Figure 11. Threshold Voltage vs. Temperature V_{GS}=V_{DS},I_D=10mA

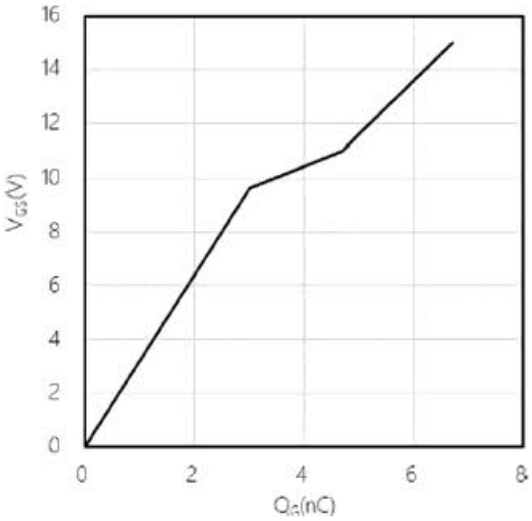


Figure 12. Gate Charge Characteristics V_{DS}=400V,T_{VJ}=25°C

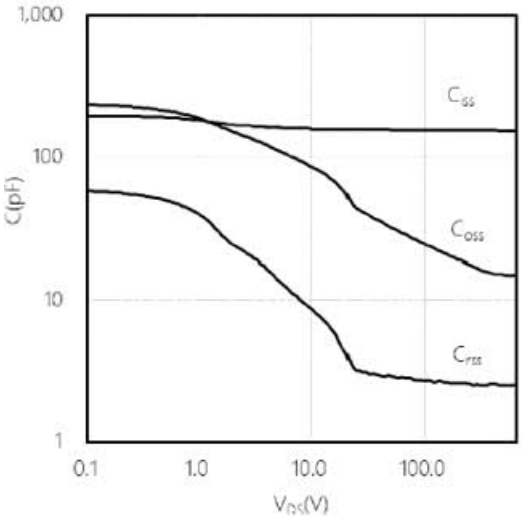


Figure 13. Typical Capacitances vs. Drain-Source Voltage (0 – 650V) T_{VJ} = 25 °C, V_{AC} = 25 mV, f = 100 KHz

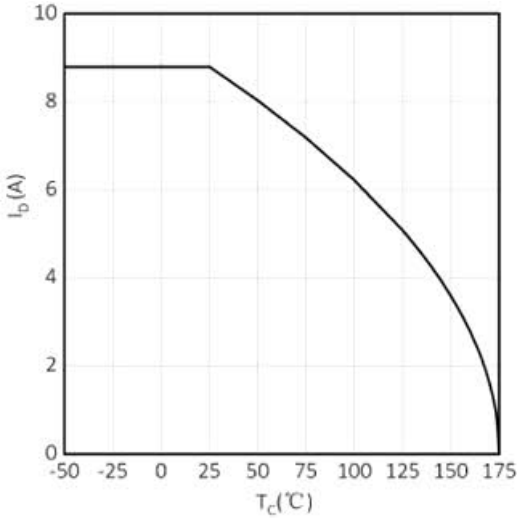


Figure 14. Continuous Drain Current Derating vs. Case Temperature V_{GS} = 15 V, T_{VJ} ≤ 175°C

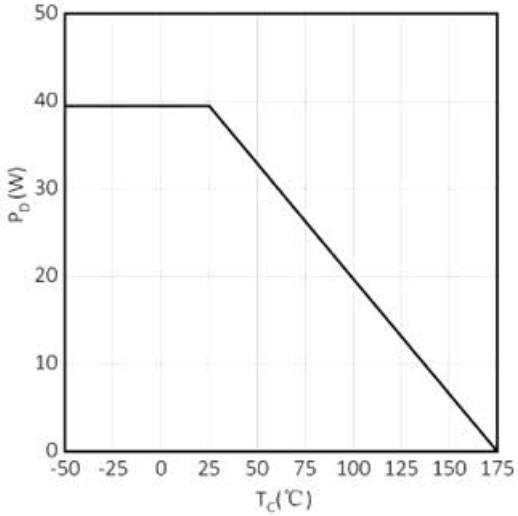


Figure 15. Maximum Power Dissipation Derating vs. Case Temperature T_{VJ} ≤ 175°C

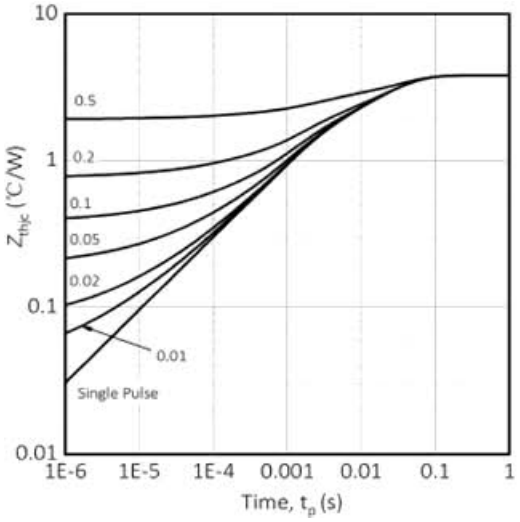


Figure 16. Transient Thermal Impedance (Junction-Case) with different duty cycle for $R_{thjc,typ}$

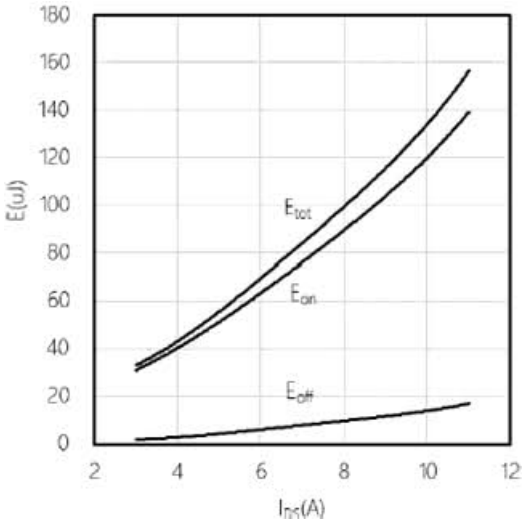


Figure 17. Clamped Inductive Switching Energy vs. Drain Current T_{VJ} = 25 °C

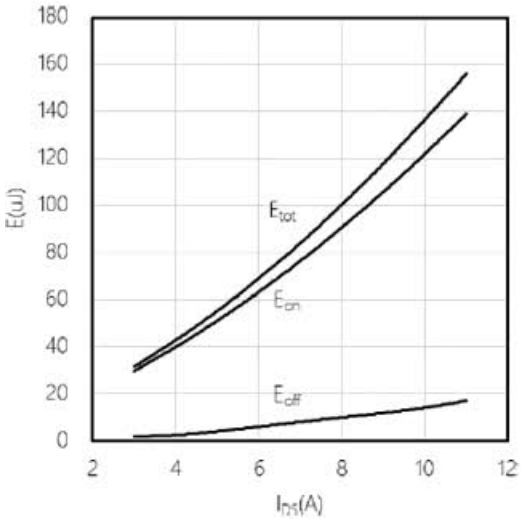


Figure 18. Clamped Inductive Switching Energy vs.Drain Current T_{VJ} = 175 °C

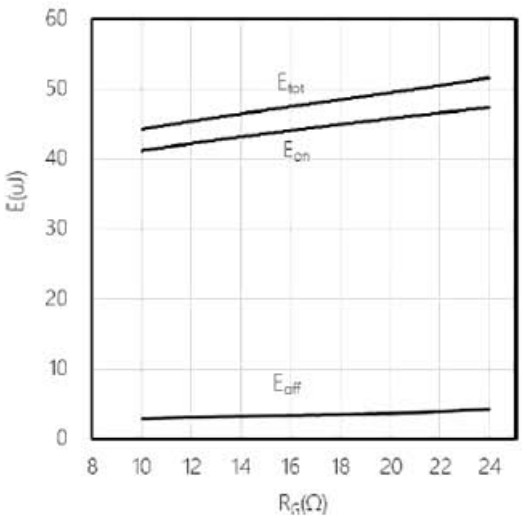


Figure 19. Clamped Inductive Switching Energy vs.$R_{G(ext)}$ T_{VJ} = 25 °C

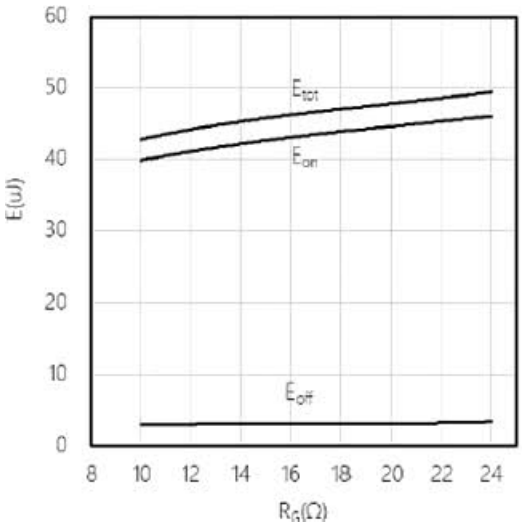


Figure 20. Clamped Inductive Switching Energy vs.$R_{G(ext)}$ T_{VJ} = 175 °C

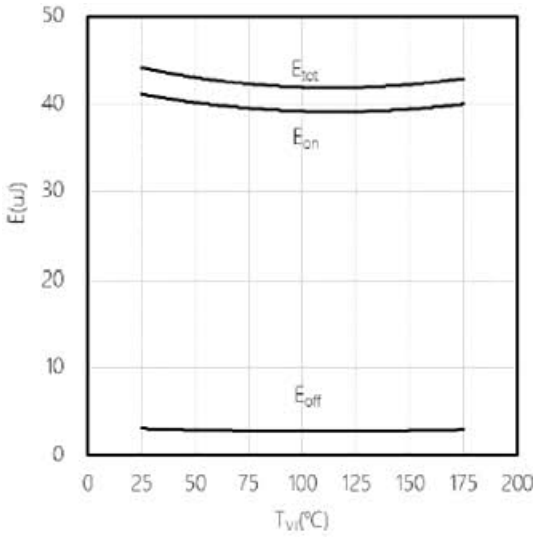


Figure 21. Clamped Inductive Switching Energy vs. Temperature T_{VJ} = 25 °C

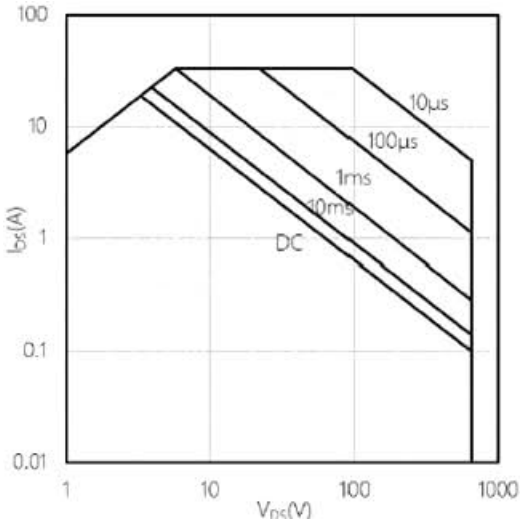


Figure 22. Safe Operating Area $R_{thjc,max}$ = 4.6 °C /W

Testing conditions

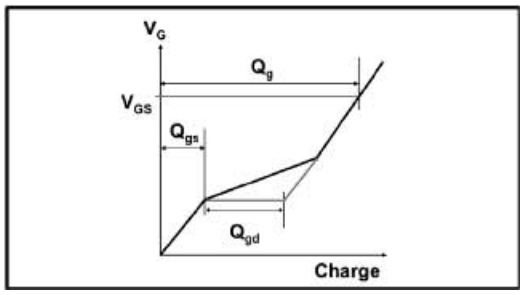


Figure A:Definition of Q_{gd}

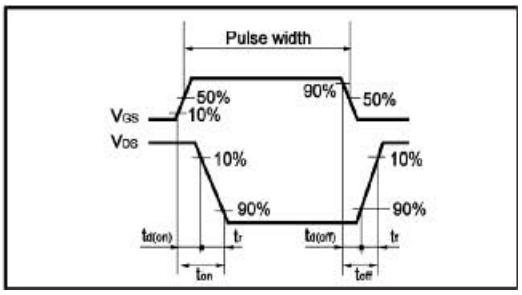


Figure B: Definition of switching times

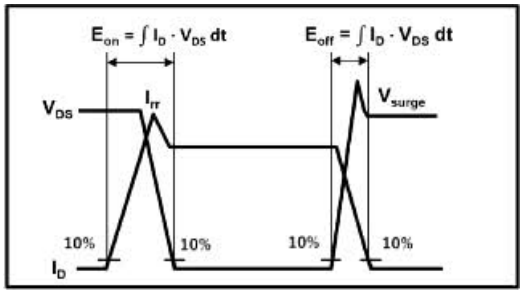


Figure C: Definition of switching losses

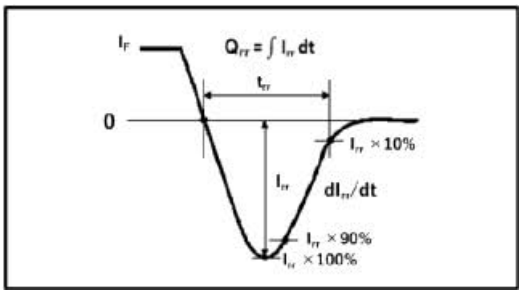
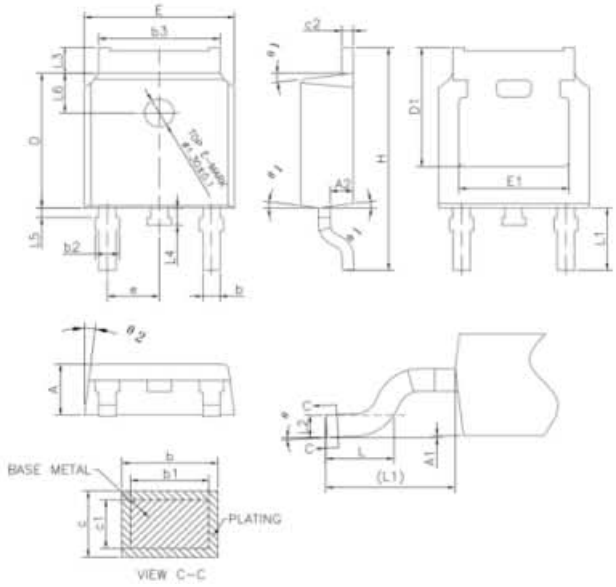


Figure D: Definition of reverse recovery

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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