

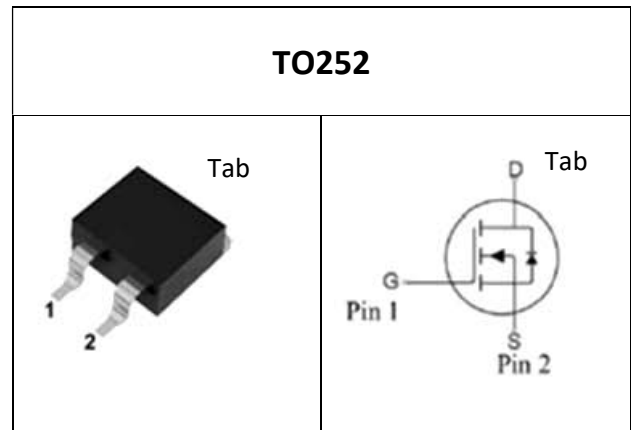
NW6532CX1

650V Silicon Carbide Mosfet

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}(V_{GS}=15V)$	316	$m\Omega$
$R_{DS(on)}(V_{GS}=18V)$	240	$m\Omega$
$I_D (T_C = 25^\circ C)$	13	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



Applications

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

Description

The NW6532CX1 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
NW6532CX1	TO252	NW6532CX1

Absolute Maximum Ratings

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

Gate-source transient voltage, $t_p < 1\ \mu\text{s}$, $t \leq 10$ hours over lifetime, $-10/+22\text{V}$

Parameter	Symbol	Value	Unit	Test conditions
Drain-Source Voltage	V_{DSmax}	650	V	$V_{GS} = 0\text{ V}$, $I_D = 100\ \mu\text{A}$
Continuous Drain Current, limited by $T_{j(max)}$	I_D	13	A	$V_{GS}=15\text{V}, T_C=25^\circ\text{C}$
		9		$V_{GS}=15\text{V}, T_C=100^\circ\text{C}$
Pulse Drain Current, Pulse width t_p limited by T_{jmax}	$I_{D(pulse)}$	18	A	$V_{GS} = 15\text{ V}$, $T_C = 25^\circ\text{C}$
Avalanche energy, single pulse	E_{AS}	16.5	mJ	$I_D = 8.1\text{A}$, $V_{DS} = 50\text{V}$, $L = 0.5\text{mH}$, $V_{GS} = 15\text{ V}$
Power Dissipation	P_D	57	W	$T_C=25^\circ\text{C}$
		28		$T_C=100^\circ\text{C}$
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 ($f > 1\text{ Hz}$)
Operating Junction and Storage Temperature Range	T_{VJ} , T_{stg}	-55/+175	$^\circ\text{C}$	
Soldering Temperature	T_L	260	$^\circ\text{C}$	

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance from Junction to Case	$R_{TH(J-C)}$		2.6		$^\circ\text{C/W}$

Electrical Characteristics

at $T_C = 25^\circ\text{C}$, unless otherwise specified

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	650	--	--	V	$I_D=100\mu\text{A}$, $V_{GS}=0\text{V}$

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Zero Gate Voltage Drain Current	I_{DSS}	--	0.1	20	μA	$V_{DS}=650V, V_{GS}=0V, T_{VJ} = 25^{\circ}C$
		--	1	--		$V_{DS}=650V, V_{GS}=0V, T_{VJ} = 175^{\circ}C$
Gate-Source Leakage Current	I_{GSS}	--	--	250	nA	$V_{GS}=22V$
Gate Threshold Voltage	$V_{GS(th)}$	--	3.6	--	V	$V_{DS}=V_{GS}, I_D=10mA, T_J=25^{\circ}C$
		--	2.5	--		$V_{DS}=V_{GS}, I_D=10mA, T_J=175^{\circ}C$
Drain-Source On-State Resistance	$R_{DS(on)}$	--	316 334	--	m Ω	$V_{GS}=15V, I_D=4A, T_J=25^{\circ}C$ $T_J=175^{\circ}C$
		--	240 310	--	m Ω	$V_{GS}=18V, I_D=4A, T_J=25^{\circ}C$ $T_J=175^{\circ}C$
Forward Transconductance	g_{fs}	--	2.9	--	S	$V_{DS}=20V, I_D=4A$
Input Capacitance	C_{iss}	--	220	--	pF	$V_{DS}=650V, f=1MHz,$ $V_{GS}=0V, V_{AC}=25mV$
Output Capacitance	C_{oss}	--	20	--		
Reverse Transfer Capacitance	C_{rss}	--	3.5	--		
Internal Gate Resistance	$R_{G(int)}$	--	25	--	Ω	$f=1MHz, V_{AC}=25mV$
Total Gate Charge	Q_g	--	8.7	--	nC	$V_{DS}=400V, I_D=4A, V_{GS}=0/+15V$
Gate to Source Charge	Q_{gs}	--	3.5	--		
Gate to Drain Charge	Q_{gd}	--	1.0	--		

Turn-On Delay Time	$t_{d(on)}$	--	6.1	--	ns	$V_{DD}=400V$, $I_D=4A$, $V_{GS}=0V/+15V$, $R_{G(on)}=4.3\Omega$, $R_{G(off)}=4.3\Omega$ $L=600\mu H$, $T_{VJ}=25^{\circ}C$ FWD = Body Diode
Rise Time	t_r	--	17.1	--		
Turn-Off Delay Time	$t_{d(off)}$	--	14.2	--		
Fall Time	t_f	--	14.6	--		
Turn-On Energy	E_{on}	--	35.0	--	μJ	
Turn-Off Energy	E_{off}	--	3.0	--		
Total switching Energy	E_{Total}	--	38.0	--		
Turn-On Delay Time	$t_{d(on)}$	--	5.9	--	ns	$V_{DD}=400V$, $I_D=4A$, $V_{GS}=0V/+15V$, $R_{G(on)}=4.3\Omega$, $R_{G(off)}=4.3\Omega$ $L=600\mu H$, $T_{VJ}=175^{\circ}C$ FWD = Body Diode
Rise Time	t_r	--	13.0	--		
Turn-Off Delay Time	$t_{d(off)}$	--	17.2	--		
Fall Time	t_f	--	14.6	--		
Turn-On Energy	E_{on}	--	33.0	--	μJ	
Turn-Off Energy	E_{off}	--	3.0	--		
Total switching Energy	E_{Total}	--	36.0	--		

Reverse Diode Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Diode Forward Voltage	V_{SD}		3.3 2.8		V	$V_{GS}=0V, I_S=2A, T_{VJ}=25^{\circ}C$ $T_{VJ}=175^{\circ}C$
Continuous Diode Forward Current	I_S	--	13	--	A	$V_{GS}=-4V$
Diode pulse Current	$I_{S(pulse)}$	--	18	--	A	Pulse width t_p , limited by T_{jmax}
Reverse Recovery Time	t_{rr}		9.0		ns	$V_{GS}=0V, I_S=4A,$ $V_{DS}=400V,$ $di/dt=1.2A/ns,$ $T_{VJ}=25^{\circ}C$
Reverse Recovery Charge	Q_{rr}		24		nC	
Peak Reverse Recovery Current	I_{rrm}		4.4		A	
Reverse Recovery Time	t_{rr}		8.4		ns	$V_{GS}=0V, I_S=4A,$ $V_{DS}=400V,$ $di/dt=1.2A/ns,$ $T_{VJ}=175^{\circ}C$
Reverse Recovery Charge	Q_{rr}		27		nC	
Peak Reverse Recovery Current	I_{rrm}		5.3		A	

Electrical Performance Graphs

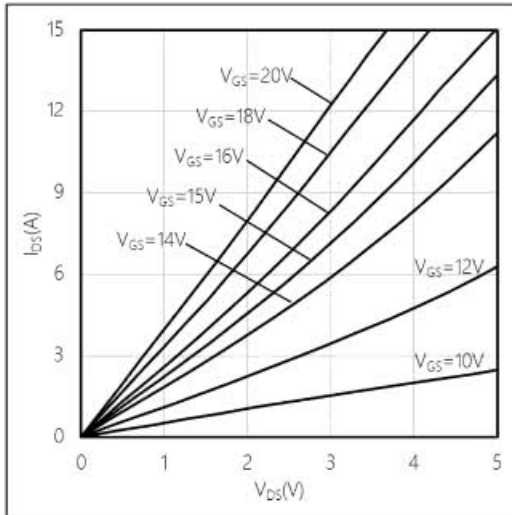


Figure 1. Typical Output Characteristics
 $T_j = -55^{\circ}\text{C}$

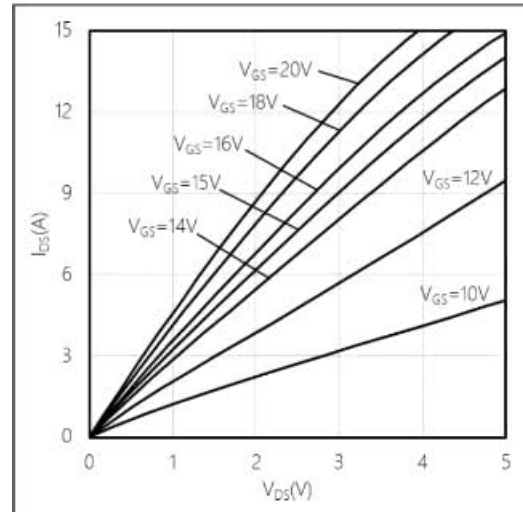


Figure 2. Typical Output Characteristics
 $T_j = 25^{\circ}\text{C}$

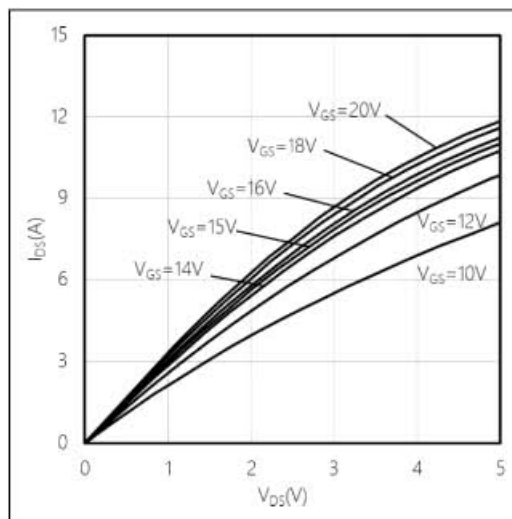


Figure 3. Typical Output Characteristics
 $T_j = 175^{\circ}\text{C}$

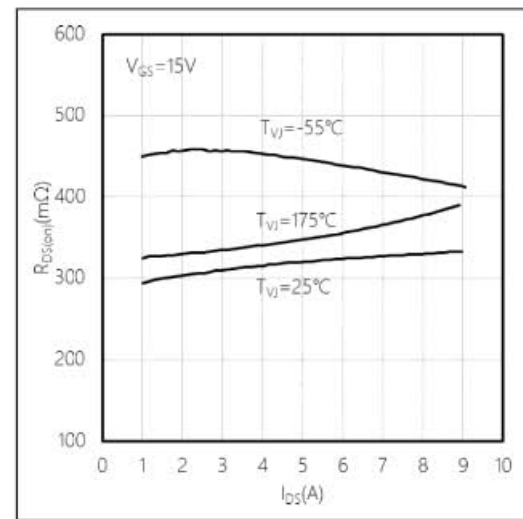


Figure 4. On-Resistance vs. Drain Current for
Various Temperature

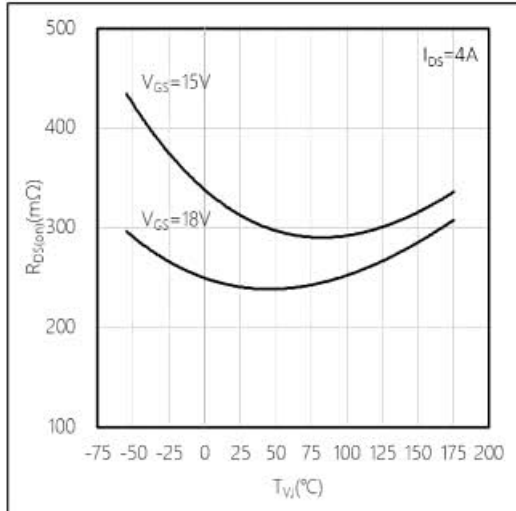


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

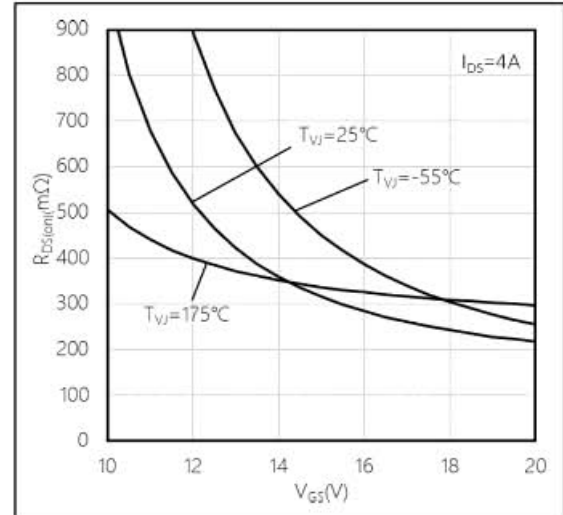


Figure 6. On-Resistance vs. Gate Voltage for Various Junction Temperature

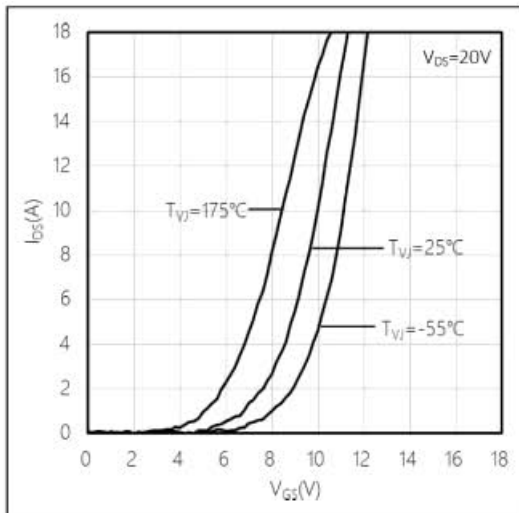


Figure 7. Typical Transfer Characteristic for Various Temperatures

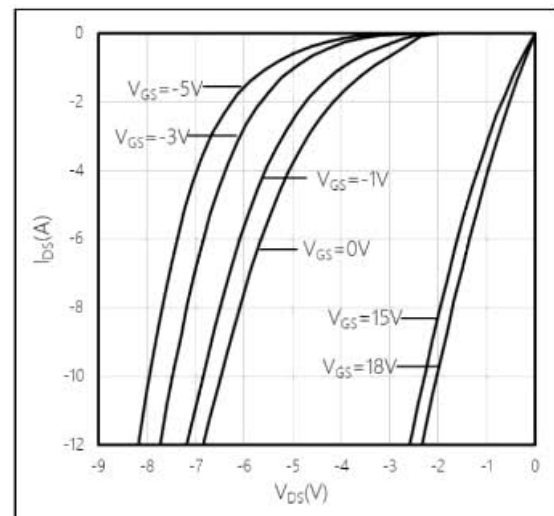


Figure 8. Typical 3rd Quadrant Characteristics at $T_J = -55\text{ }^{\circ}\text{C}$

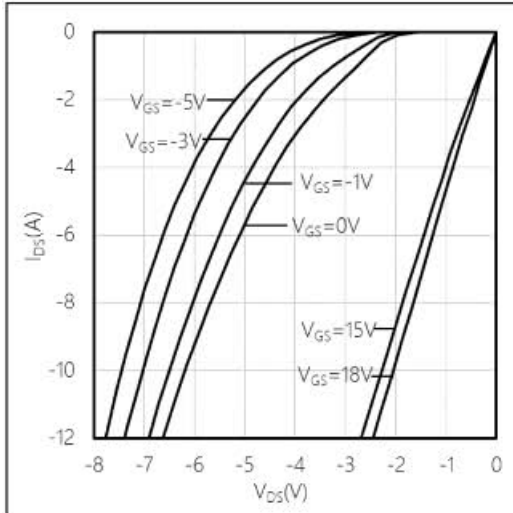


Figure 9. Typical 3rd Quadrant Characteristics at $T_j = 25^\circ\text{C}$

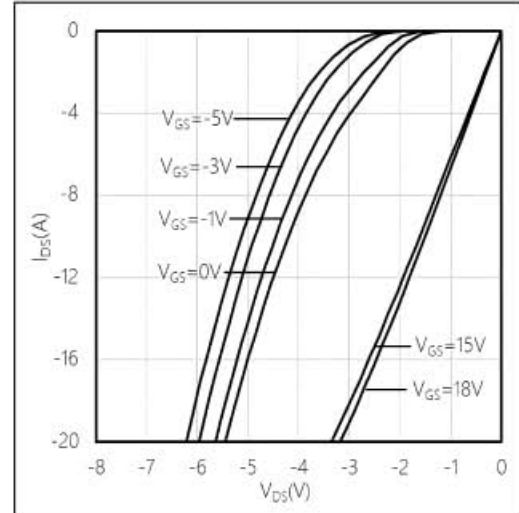


Figure 10. Typical 3rd Quadrant Characteristics at $T_j = 125^\circ\text{C}$

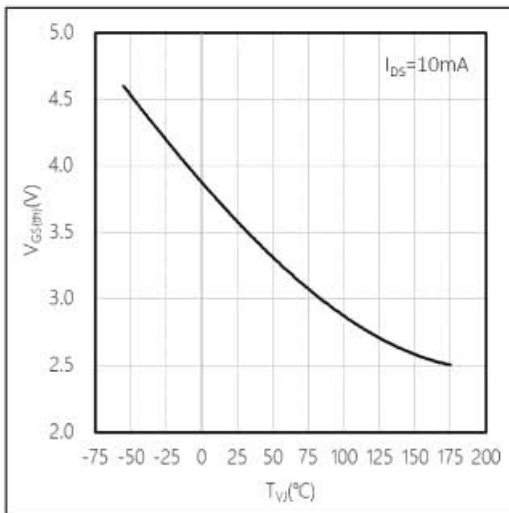


Figure 11. Threshold Voltage vs. Temperature

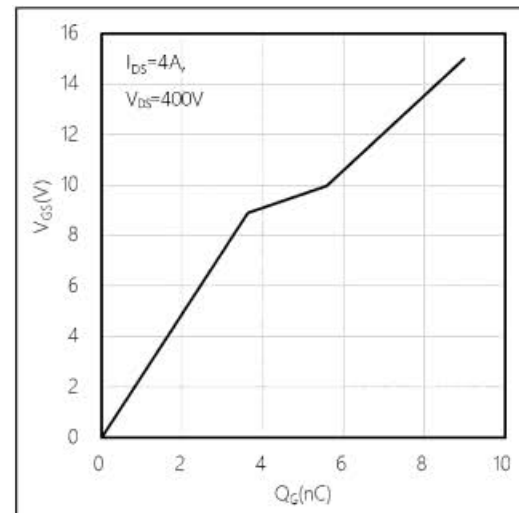


Figure 12. Gate Charge Characteristics

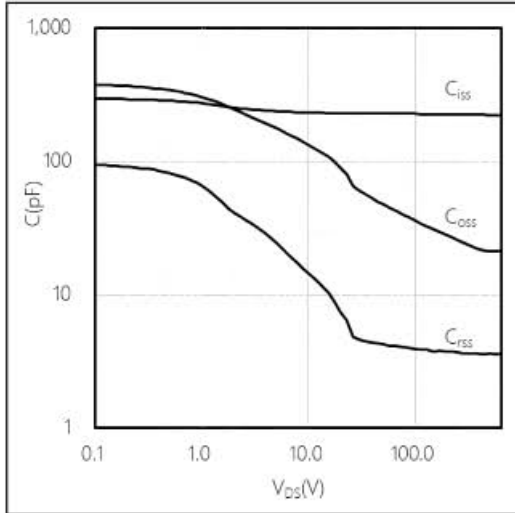


Figure 13. Typical Capacitances vs. Drain-Source Voltage (0 – 650V)

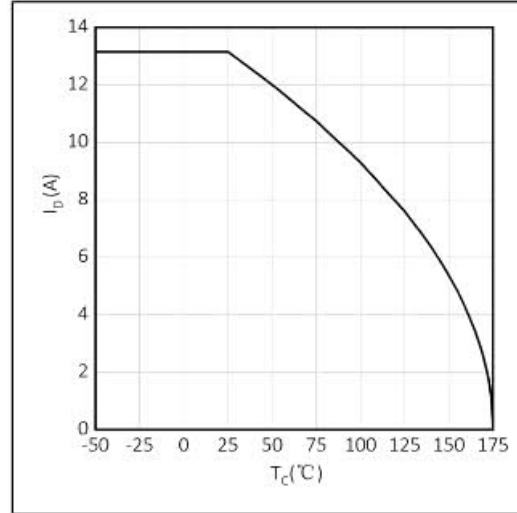


Figure 14. Continuous Drain Current Derating vs. Case Temperature

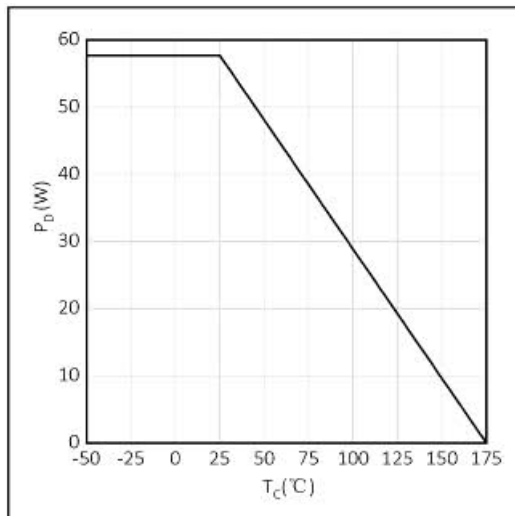


Figure 15. Maximum Power Dissipation Derating vs. Case Temperature

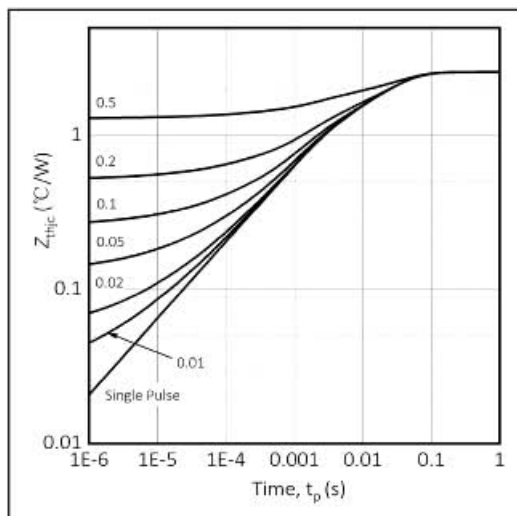


Figure 16. Transient Thermal Impedance (Junction-Case) with different duty cycle

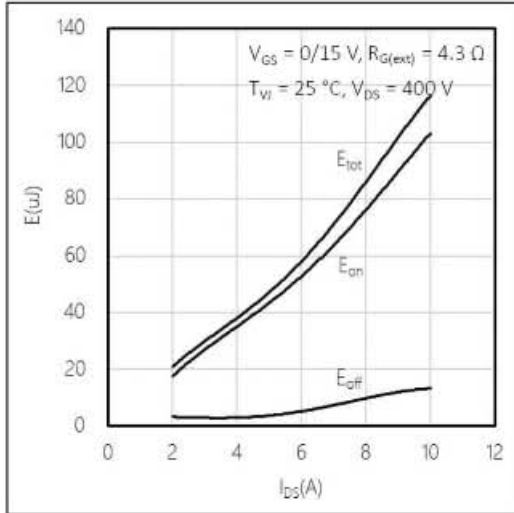


Figure 17. Clamped Inductive Switching Energy vs. Drain Current

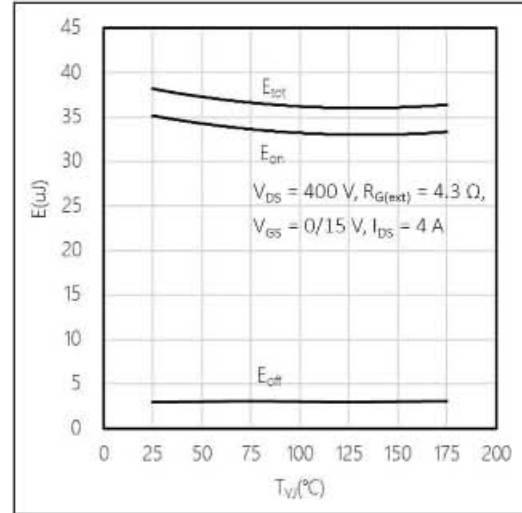


Figure 18. Clamped Inductive Switching Energy vs. Junction Temperature

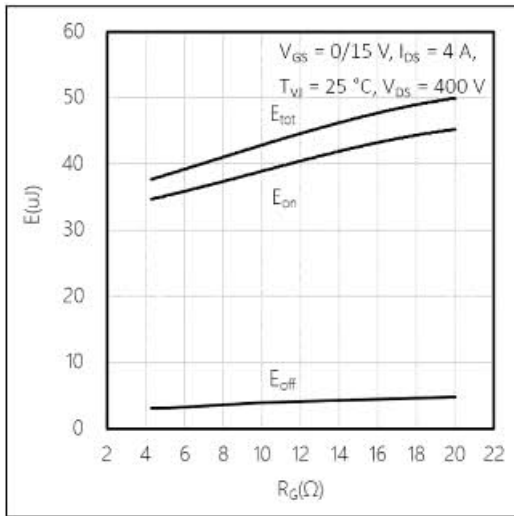


Figure 19. Clamped Inductive Switching Energy vs. R_g

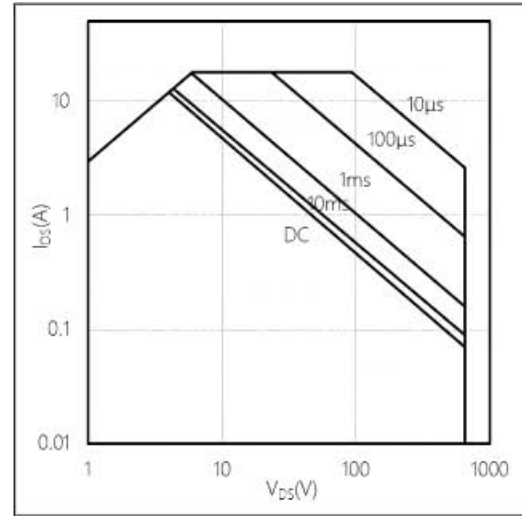


Figure 20. Safe Operating Area

Testing conditions

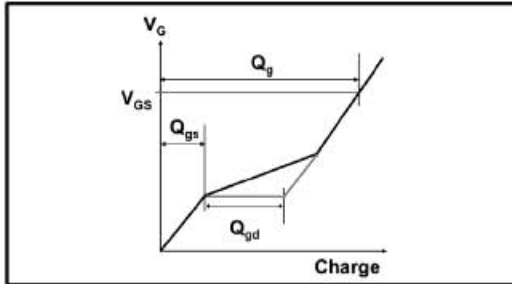


Figure A: Definition of Q_{gd}

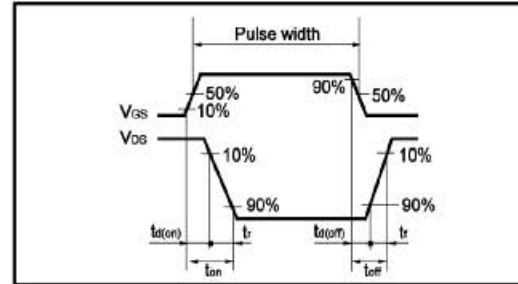


Figure B: Definition of switching times

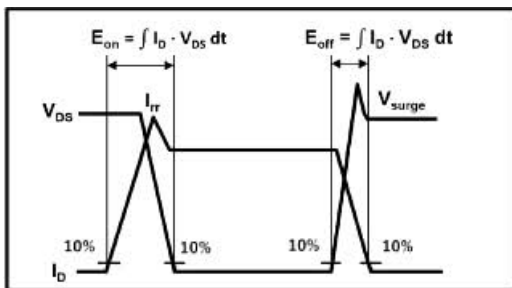


Figure C: Definition of switching losses

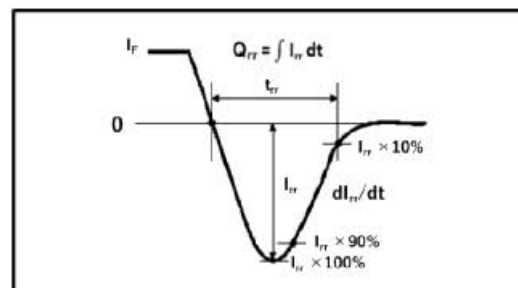
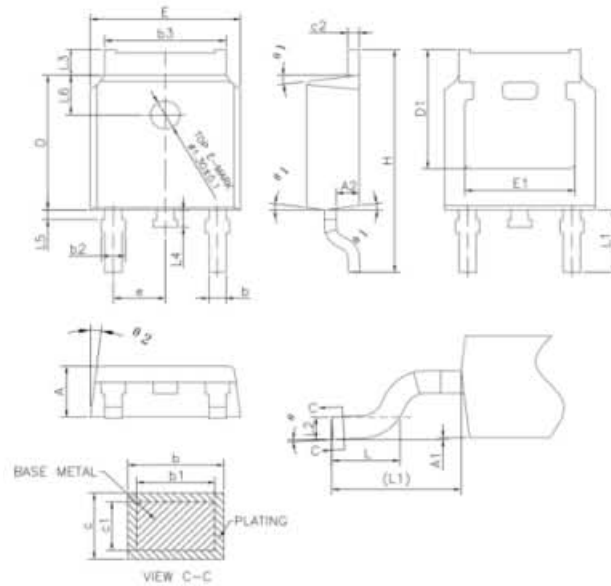


Figure D: Definition of reverse recovery

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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