NW6520CW1-3

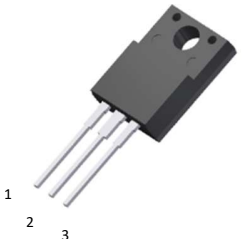
650V Silicon Carbide Mosfet

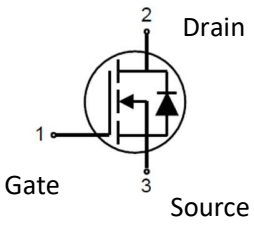
Parameter	Value	Unit
V_{RRM}	650	V
$R_{DS(on)}$(V_{GS}= 15V)	200	mΩ
$R_{DS(on)}$(V_{GS}= 18V)	154	mΩ
I_F (T_C = 25℃)	15	A

Features

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

TO220F-3





Applications

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

Description

The NW6520CW1-3 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
Pin3-Source

Part Description

Part Number	Package	Marking
NW6520CW1-3	TO220F-3	NW6520CW1-3

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	15 11	A	T_C = 25 °C V_{GS} =18V T_C = 100 °C
Peak Drain Current	I_{DM}	30	A	Pulse width t_p limited by T_{jmax}
Power Dissipation	P_{tot}	48 24	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	$R_{TH,\ J\text{-}C}$	3.147	°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	2.8 2.0	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		14		nC	V_{DS}=400V, I_D=4.5A, V_{GS}=-4V/18V
Gate to Source Charge	Q_{gs}		2.8		nC	
Gate to Drain Charge	Q_{gd}		6.4		nC	
Turn-On Delay Time	$t_{d(on)}$		6		ns	V_{DD}=400V, I_D=4.5A, V_{GS}=-4V/18V, $R_{G(ext)}$=2.5Ω, L=200μH, T_j=25°C
Rise Time	t_r		9		ns	
Turn-Off Delay Time	$t_{d(off)}$		8		ns	
Fall Time	t_f		11		ns	
Turn-On Energy	E_{on}		27		μJ	
Turn-Off Energy	E_{off}		6		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		15 8		A	V_{GS}=-4V,T_c=25°C, T_c=100°C
Reverse Recovery Time	t_{rr}		12		ns	V_{GS}=-4V,I_{SD}=5A, V_R=400V, di/dt=1400A/µs, T_j=25°C
Reverse Recovery Charge	Q_{rr}		62		nC	
Peak Reverse Recovery Current	I_{rrm}		5		A	

Electrical Performance Graphs

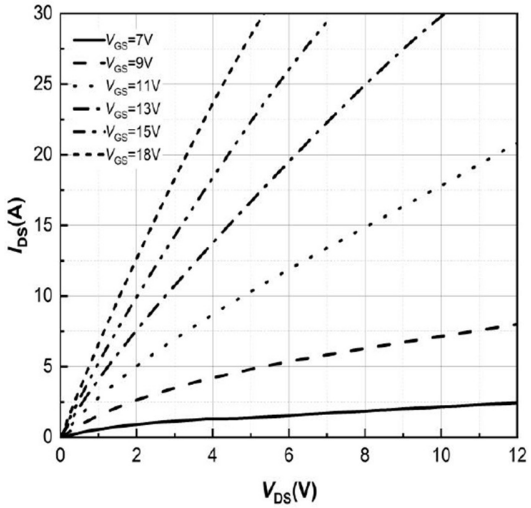


Figure 1: Output Characteristics
Tj=25°C

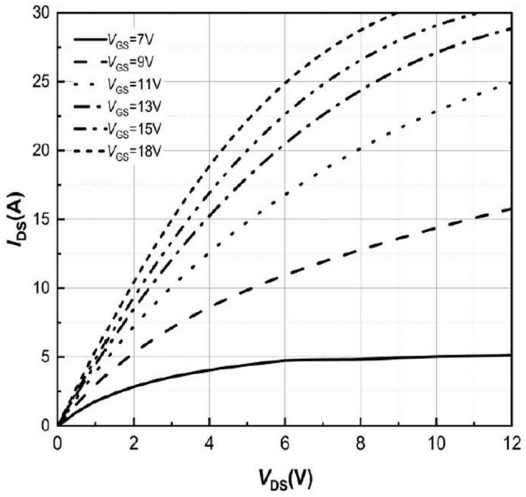


Figure 2: Output Characteristics
Tj=175°C

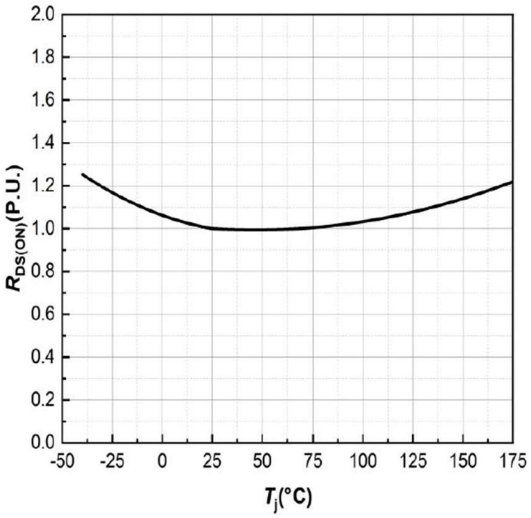


Figure 3: Normalized On-Resistance vs. Temperature

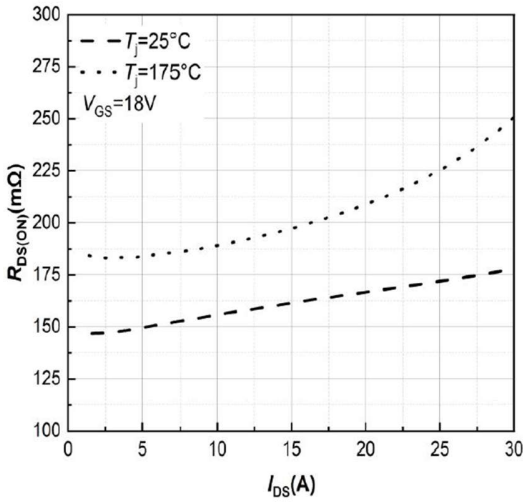


Figure 4: On-Resistance vs. Drain Current For Various Temperatures

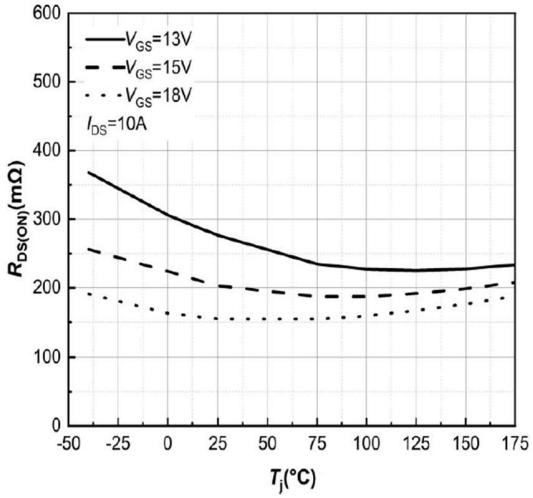


Figure 5: On-Resistance vs. Temperature For Various Gate Voltage

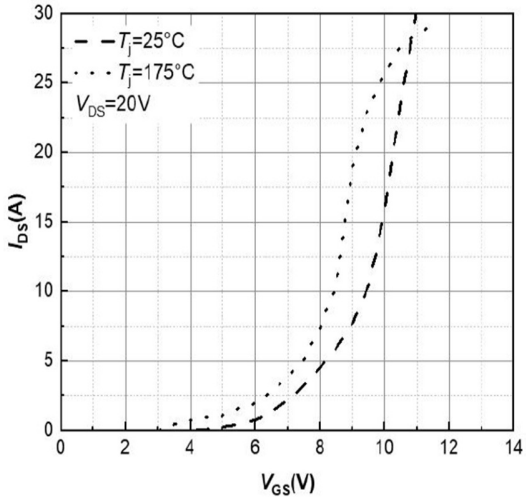


Figure 6: Transfer Characteristic for Various Junction Temperatures

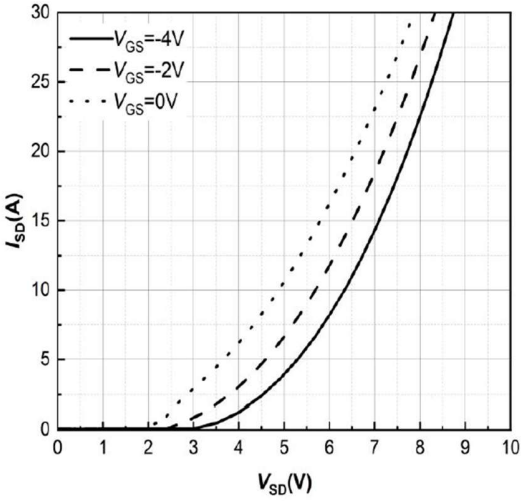


Figure 7: Body Diode Characteristic
T_j=25°C

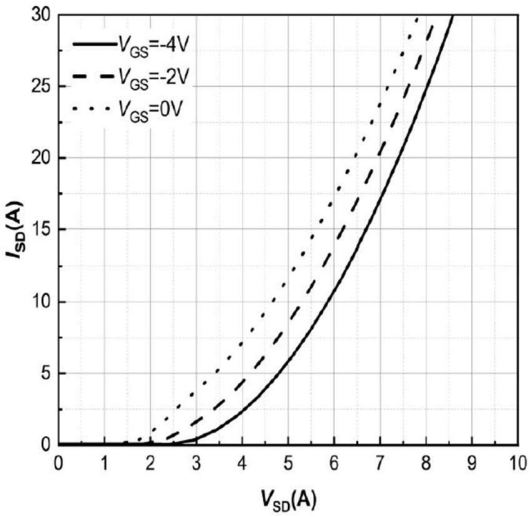


Figure 8: Body Diode Characteristic
T_j=175°C

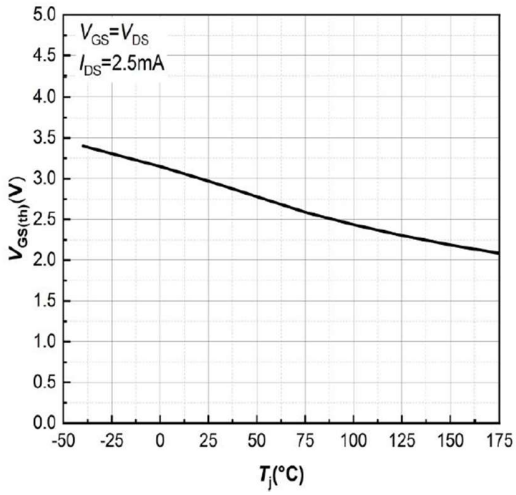


Figure 9. Threshold Voltage vs. Temperature

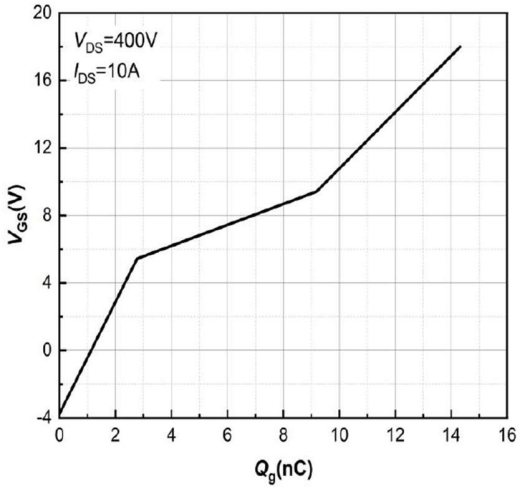


Figure 10. Gate Charge Characteristics

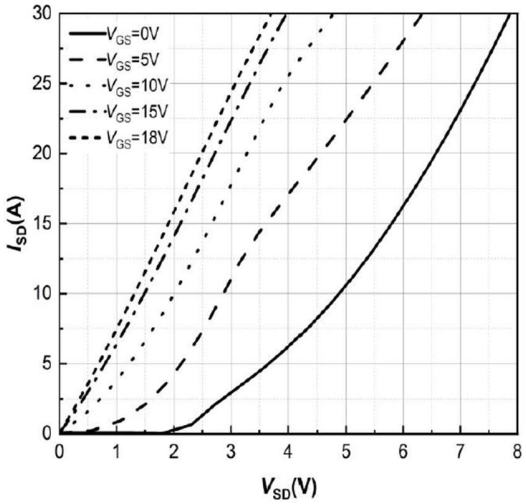


Figure 11. 3rd Quadrant Characteristic
T_j=25°C

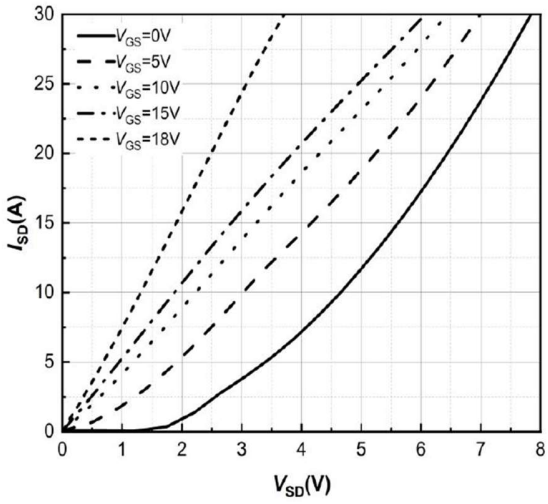


Figure 12. 3rd Quadrant Characteristic
T_j=175°C

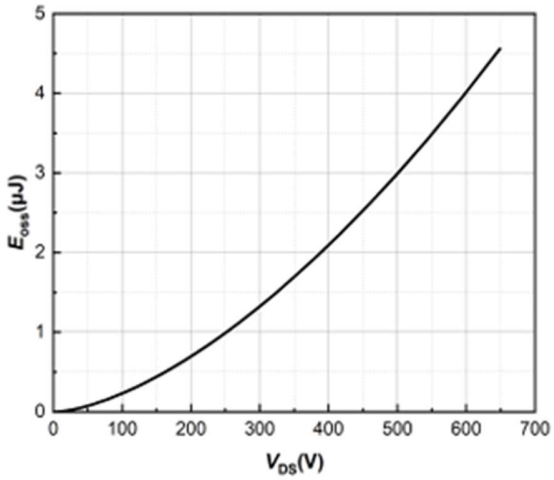


Figure 13: Output Capacitor Stored Energy

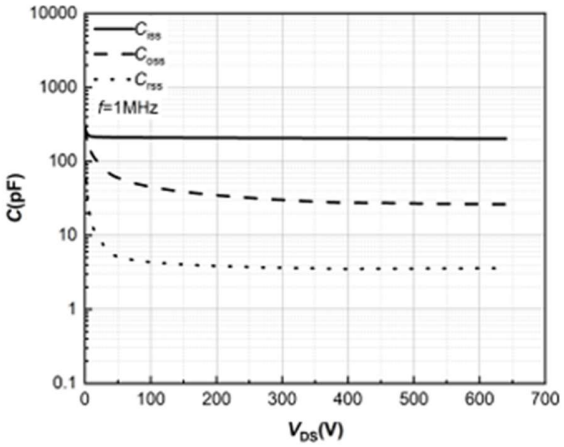


Figure 14: Capacitances vs. Drain-Source

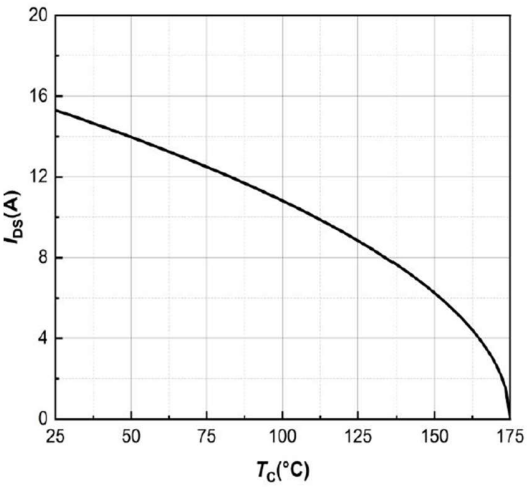


Figure 15: Continuous Drain Current Derating vs. Case Temperature

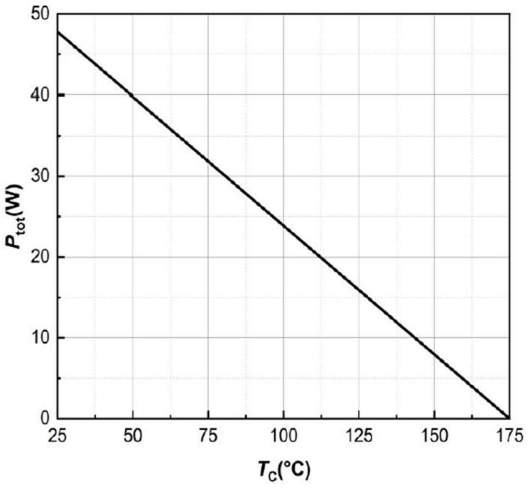


Figure 16: . Maximum Power Dissipation Derating vs. Case Temperature

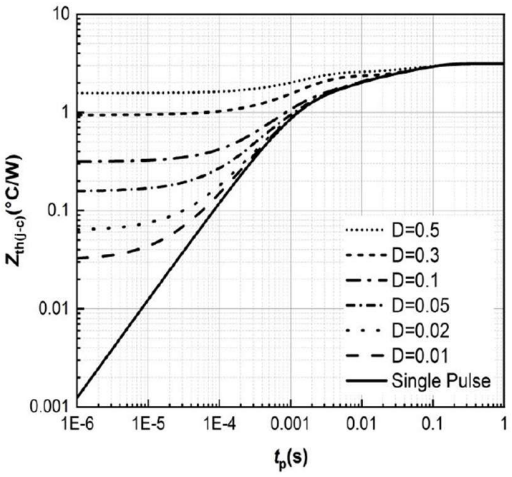


Figure 17: Transient Thermal Impedance

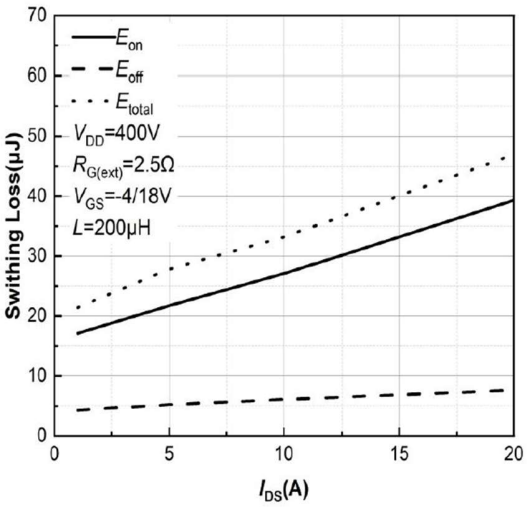


Figure 18: Clamped Inductive Switching Energy vs. Drain Current T_j=25°C

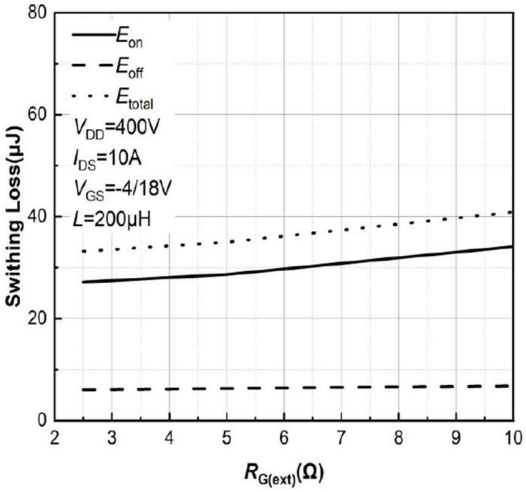


Figure 19: Clamped Inductive Switching Energy vs. RG(ext) T_j=25°C

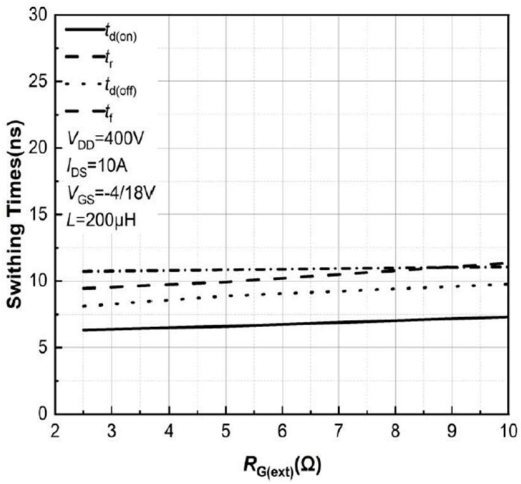


Figure 20: Switching Times vs. RG(ext) T_j=25°

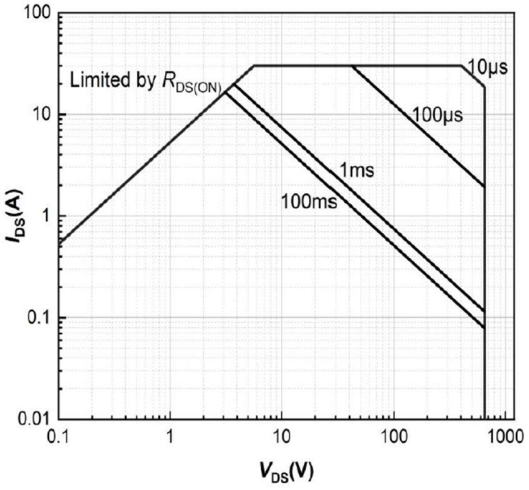
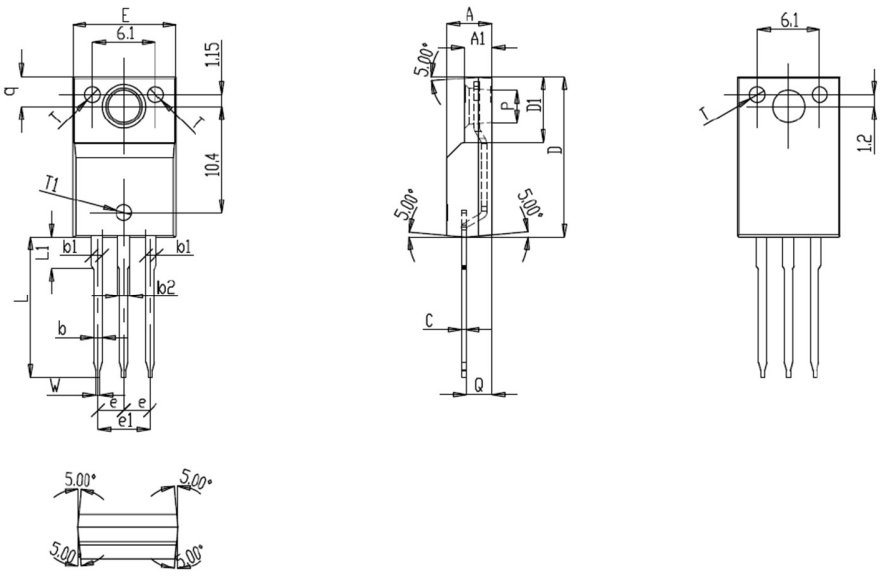


Figure 21: Safe Operating Area

Package Dimensions



SYMBOL	Unit(mm)		
	MIN	NOM	MAX
A	4.2	4.4	4.6
A1	2.5	2.7	2.9
b	0.7	0.8	0.9
b1	0.9	1.07	1.3
b2	1	1.17	1.4
C	0.4	0.5	0.6
D	15.4	15.63	15.8
D1	6	6.22	6.4
E	9.7	10.06	10.3
e	2.5	2.54	2.58
e1	5	5.08	5.12
L	13.5	13.9	14.4
L1	2.8	3.12	3.3
P	3	3.14	3.2
Q	2.3	2.44	2.6
q	2.6	2.86	3
W	0.3	0.37	0.5
T	1.3	1.52	1.7
T1	1.1	1.2	1.3

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