

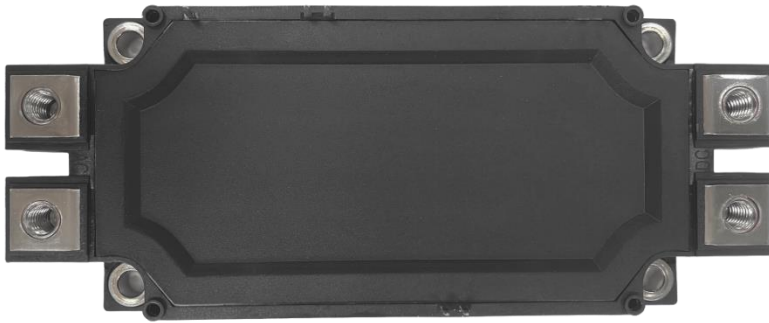


# **1200V SIC ED3 Power Module**

## **ADPR30B12CSNT**

**PRELIMINARY  
DATASHEET**

V0.1, 2022/12



## Applications

- Automotive Applications
- Electrical Vehicles (xEV)
- Commercial Agriculture Vehicles
- All-Terrain Vehicles
- Motor Drives
- Servo Drives
- UPS Drives

## Electrical Features

- Low  $R_{DS(on)}$
- $T_{j,op} = 150^{\circ}C$
- Blocking voltage 1200V
- Low Switching Losses
- Low Inductive Design
- SiC High Performance Chip

## Mechanical Features

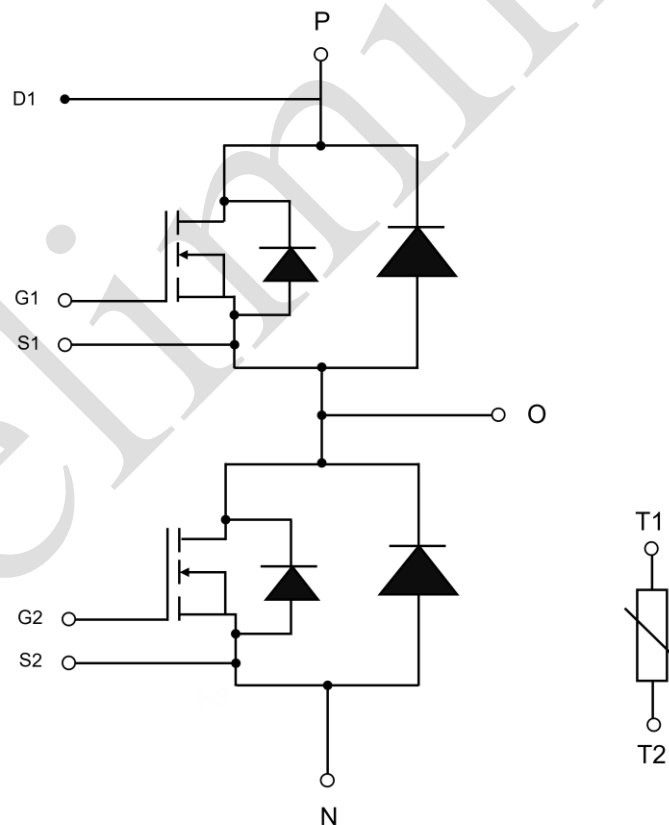
- Compact design
- UL 94 Module frame
- Temperature sensor included
- Pb-free device and RoHS compliant
- Guiding elements for PCB and cooler assembly
- Sintered Ag Die attachment



## FEATURES

- High speed, low loss SiC module
- High reliability, high durability module

## Inner Circuit Diagram





## MOSEFT

### Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Drain-source voltage	$T_j = 25^\circ\text{C}$	$V_{DS}$	1200	V
Gate-source voltage		$V_{GS}$	-5/+20	V
DC drain current	$V_{GS} = 15\text{ V}, T_C = 70^\circ\text{C}, T_j = 175^\circ\text{C}$	$I_{D\text{ nom}}$	600	A
Pulsed drain current	Verified by design, $t_p$ limited by $T_{j, \text{max}}$	$I_{D\text{ pulse}}$	1200	A

### Characteristics Values

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit		
Drain-source on resistance	$I_D = 600\text{ A}, V_{GS} = 15\text{ V}$	$R_{DS(on)}$		$T_j = 25^\circ\text{C}$	3.0	5.9	m $\Omega$	
	$I_D = 600\text{ A}, V_{GS} = 15\text{ V}$			$T_j = 150^\circ\text{C}$	9.0			
	$I_D = 600\text{ A}, V_{GS} = 15\text{ V}$			$T_j = 175^\circ\text{C}$	10.5			
Gate threshold voltage	$I_D = 175\text{ mA}, V_{GS} = V_{DS}$	$V_{GSth}$		$T_j = 25^\circ\text{C}$	2.2	3.2	4.2	V
	$I_D = 175\text{ mA}, V_{GS} = V_{DS}$			$T_j = 150^\circ\text{C}$	2.7			
	$I_D = 175\text{ mA}, V_{GS} = V_{DS}$			$T_j = 175^\circ\text{C}$	2.6			
Drain-source leakage current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	$I_{DSS}$		$T_j = 25^\circ\text{C}$		100	$\mu\text{A}$	
	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$			$T_j = 150^\circ\text{C}$	1			mA
	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$			$T_j = 175^\circ\text{C}$	5			
Gate-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$	$I_{GSS}$				400	nA	
Input capacitance	$f = 100\text{ kHz}, V_{DS} = 100\text{ V}$ $V_{GS} = 0\text{ V}$	$C_{iss}$				37	nF	
Output capacitance	$f = 100\text{ kHz}, V_{DS} = 100\text{ V}$ $V_{GS} = 0\text{ V}$	$C_{oss}$				7.9	nF	
Reverse transfer capacitance	$f = 100\text{ kHz}, V_{DS} = 100\text{ V}$ $V_{GS} = 0\text{ V}$	$C_{rss}$				34	pF	
Turn-on delay time, inductive load	$I_D = 600\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / +15\text{ V}$ $R_G = 5.0\ \Omega$	$t_{d(on)}$		$T_j = 25^\circ\text{C}$		44	ns	
				$T_j = 175^\circ\text{C}$		50		
Rise time, inductive load	$I_D = 600\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / +15\text{ V}$ $R_G = 5.0\ \Omega$	$t_r$		$T_j = 25^\circ\text{C}$		124	ns	
				$T_j = 175^\circ\text{C}$		91		



# ADPR30B12CSNT Power Module

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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Turn-on energy loss per pulse	$I_D = 600 \text{ A}$ , $V_{DS} = 600 \text{ V}$ $L_S = 30 \text{ nH}$ $V_{GS} = -5 \text{ V} / +15 \text{ V}$ $R_G = 5.0 \Omega$ , $di/dt = 4250 \text{ A}/\mu\text{s}$ (25°C) $di/dt = 6000 \text{ A}/\mu\text{s}$ (175°C)	$T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$		28.9 21.4		mJ
Turn-off delay time, inductive load	$I_D = 600 \text{ A}$ , $V_{DS} = 600 \text{ V}$ $V_{GS} = -5 \text{ V} / +15 \text{ V}$ $R_G = 5.0 \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$		207 250		ns
Fall time, inductive load	$I_D = 600 \text{ A}$ , $V_{DS} = 600 \text{ V}$ $V_{GS} = -5 \text{ V} / +15 \text{ V}$ $R_G = 5.0 \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$		68 72		ns
Turn-off energy loss per pulse	$I_D = 0 \text{ A}$ , $V_{DS} = 600 \text{ V}$ $L_S = 30 \text{ nH}$ $V_{GS} = -5 \text{ V} / +15 \text{ V}$ $R_G = 5.0 \Omega$ , $dV/dt = 11.5 \text{ kV}/\mu\text{s}$ (25°C) $dV/dt = 12.0 \text{ kV}/\mu\text{s}$ (175°C)	$T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$		12.7 14.6		mJ
Thermal resistance, junction to cooling fluid	Per MOSFET; $\Delta V/\Delta T = 10 \text{ dm}^3/\text{min}$ , $T_F = 60^\circ\text{C}$			TBD		K/W
Thermal resistance, junction to cooling fluid	Per Diode; $\Delta V/\Delta T = 10 \text{ dm}^3/\text{min}$ , $T_F = 60^\circ\text{C}$			0.13		K/W



## Diode

### Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
DC body diode forward current	$V_{GS} = -5\text{ V}$ , $T_j = 175^\circ\text{C}$	$I_{SD}$	600	A
Pulsed body diode current	Verified by design, $t_p$ limited by $T_{j, max}$	$I_{SD, pulse}$	1200	A

### Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit
Forward voltage	$I_{SD} = 600\text{ A}$ , $V_{GS} = -5\text{ V}$ $T_j = 25^\circ\text{C}$	$V_{SD}$	1.9	2.5	V
Peak reverse recovery current	$I_F = 600\text{ A}$ , $V_R = 600\text{ V}$ , $V_{GE} = -5\text{ V}$ , $-di_F/dt = 5700\text{ A}/\mu\text{s}$ ( $25^\circ\text{C}$ ) $-di_F/dt = 6400\text{ A}/\mu\text{s}$ ( $150^\circ\text{C}$ )	$I_{RM}$	115 140		A
Recovered charge	$I_F = 600\text{ A}$ , $V_R = 600\text{ V}$ , $V_{GE} = -5\text{ V}$ , $-di_F/dt = 5700\text{ A}/\mu\text{s}$ ( $25^\circ\text{C}$ ) $-di_F/dt = 6400\text{ A}/\mu\text{s}$ ( $150^\circ\text{C}$ )	$Q_{rr}$	3.5 4.3		$\mu\text{C}$
Reverse recovery energy	$I_F = 600\text{ A}$ , $V_R = 600\text{ V}$ , $V_{GE} = -5\text{ V}$ , $-di_F/dt = 5700\text{ A}/\mu\text{s}$ ( $25^\circ\text{C}$ ) $-di_F/dt = 6400\text{ A}/\mu\text{s}$ ( $150^\circ\text{C}$ )	$E_{rec}$	0.45 0.68		mJ

## NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_c = 25^\circ\text{C}$	$R_{25}$		5.0		k $\Omega$
Resistance tolerance	$T_c = 100^\circ\text{C}$	$\Delta R/R$	5		5	%
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\text{ K}))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15\text{ K}))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\text{ K}))]$	$B_{25/100}$		3433		K



## Module

Parameter	Conditions	Symbol	Value	Unit
Module baseplate material			Cu + Ni	
Module internal isolation material			Si <sub>3</sub> N <sub>4</sub>	
Comparative tracking index <sup>1)</sup>		CTI	200	

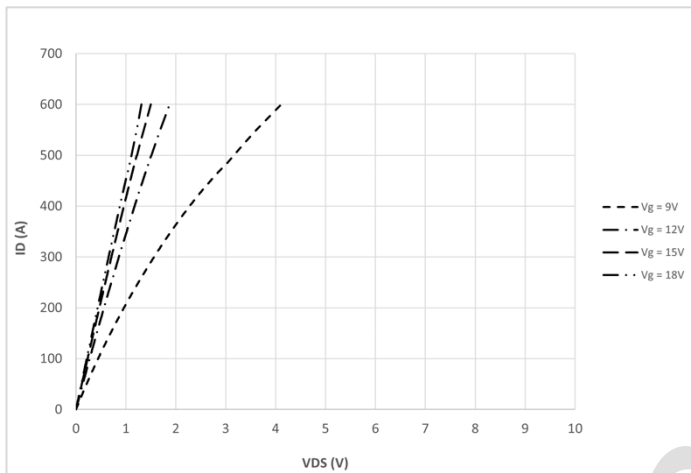
Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance		L <sub>s</sub>		TBD		nH
Storage temperature		T <sub>stg</sub>	-40		125	°C
Weight		G		350		g

1) Extracted by following UL 746A

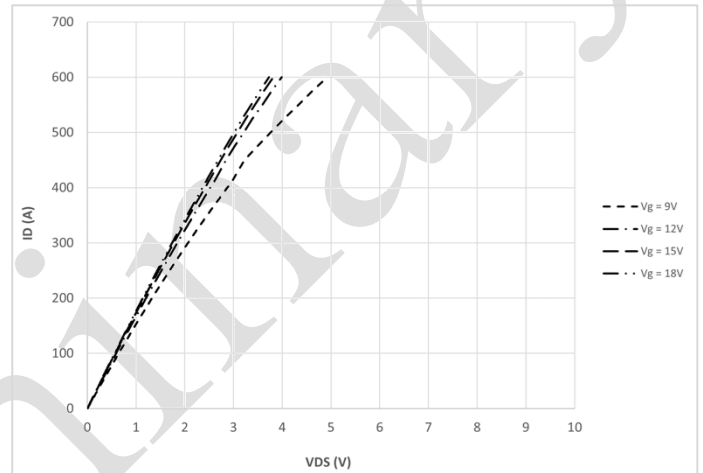


## Characteristics Diagrams

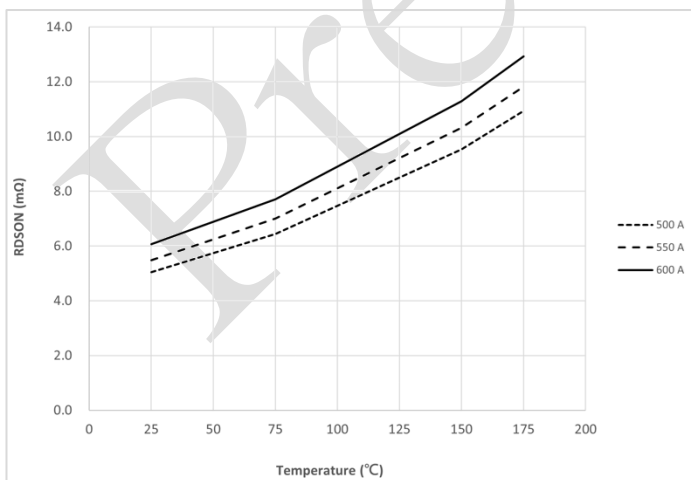
Typical Output Characteristics,  
 $T_j = 25^\circ\text{C}$ ,  $I_D = f(V_{DS})$



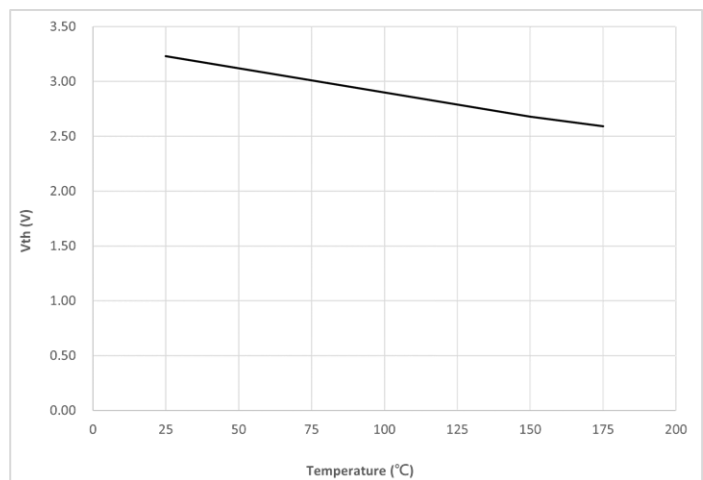
Typical Output Characteristics,  
 $T_j = 175^\circ\text{C}$ ,  $I_D = f(V_{DS})$



Typical temperature dependence of  $R_{DS(on)}$ ,  
 $V_{GS} = 15\text{V}$ ,  $R_{DS(on)} = f(T_j)$



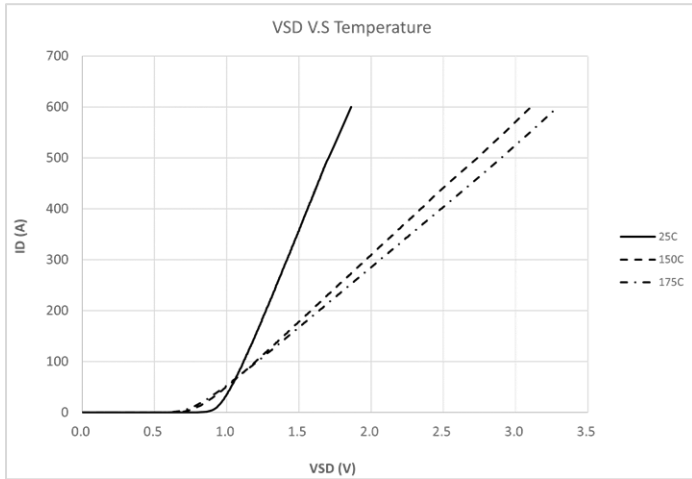
Typical temperature dependence of  
threshold voltage,  $T_j = 25^\circ\text{C}$ ,  $V_{th} = f(T_j)$



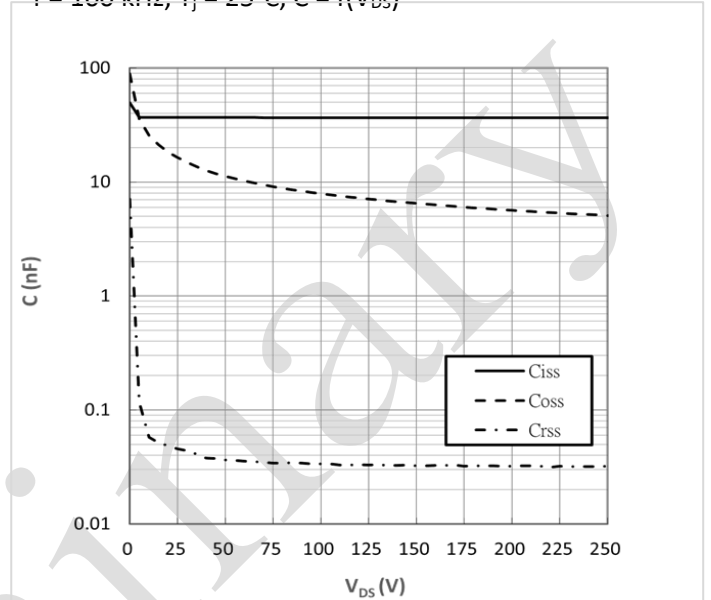




Typical diode Characteristics,  
 $V_{GS} = -5V, I_{SD} = f(V_{SD})$

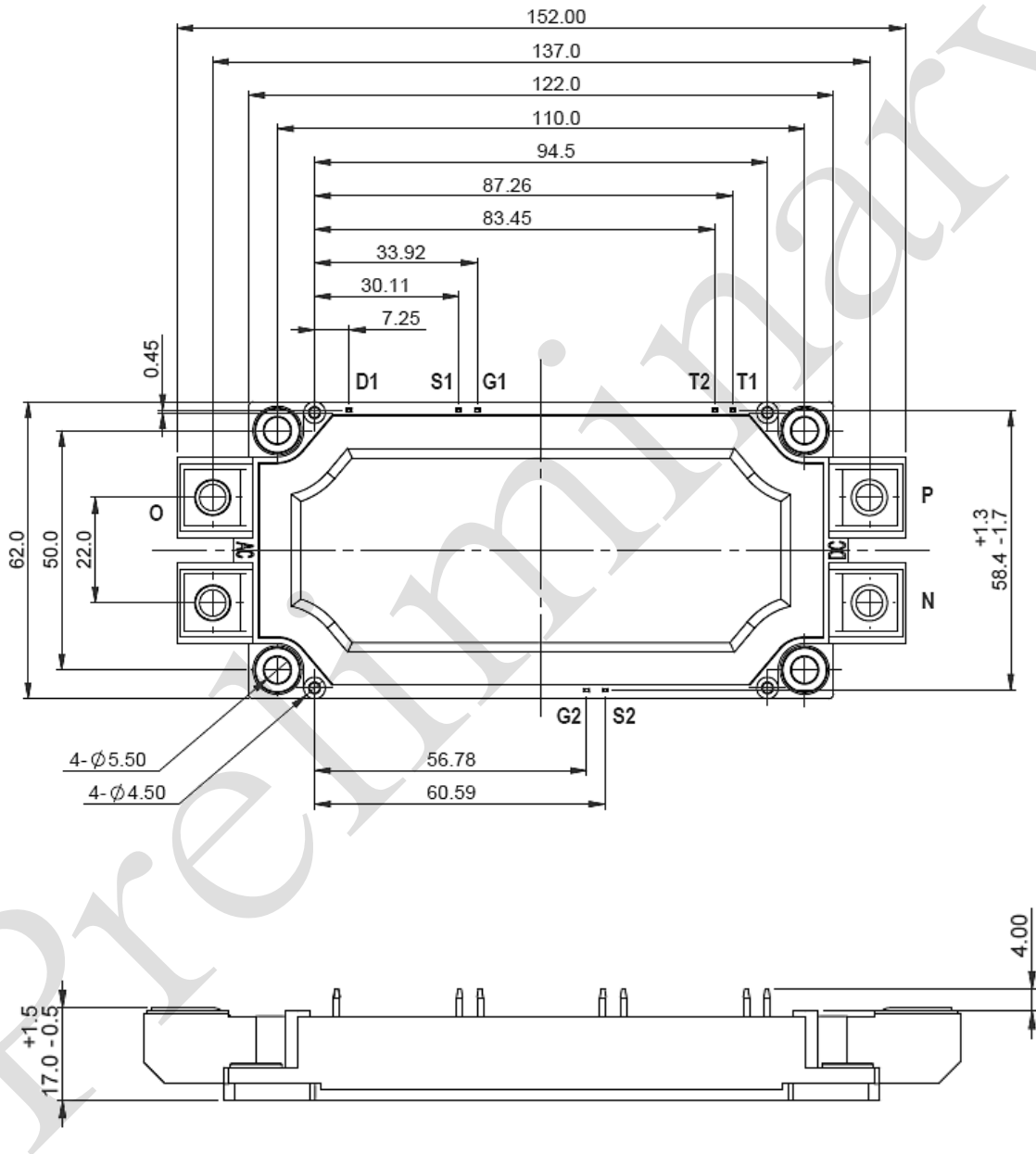


Typical capacitance Characteristics,  
 $f = 100\text{ kHz}, T_j = 25^\circ\text{C}, C = f(V_{DS})$





## Package Outlines



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