



1200V SiC ED3 Power Module

ADPR30B12CSNF_I01

DATASHEET

V1.0, 2025/05



Applications

- Motor Drives
- Servo Drives
- UPS Drives
- Energy Storage Systems
- Solar applications
- Commercial, Agriculture Vehicles and Construction
- All-Terrain Vehicles

Features

Electrical Features

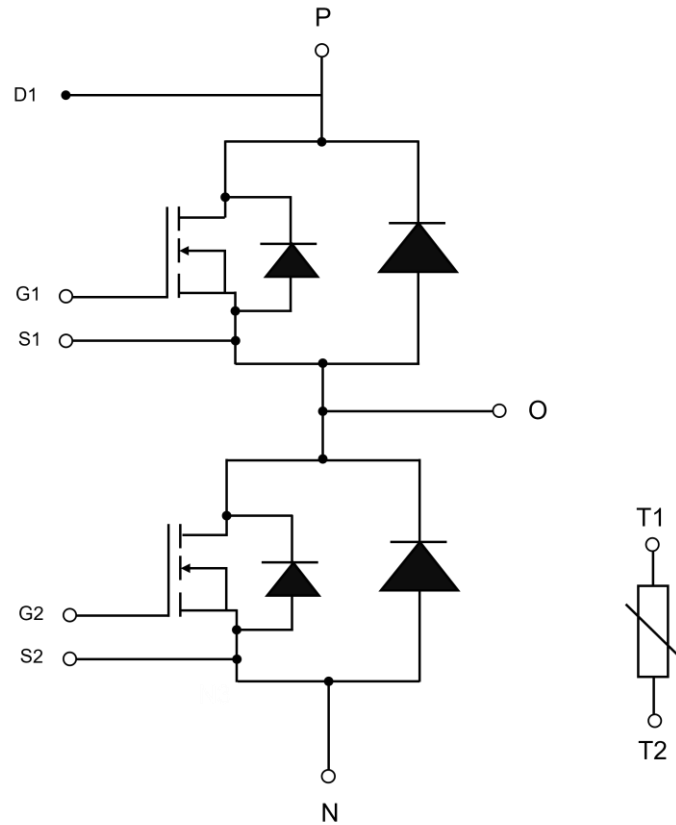
- $T_{j,op} = 150^{\circ}\text{C}$
- Low $R_{DS(on)}$
- Blocking Voltage 1200V
- Low Switching Losses
- Low Inductance Design
- SiC High Performance Chip

Mechanical Features

- UL 94 Module Frame
- Temperature Sensor Included
- Pb-free Device and RoHS Compliant
- Guiding Elements for PCB and Cooler Assembly



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}	-10/+23	V
DC drain current	$V_{GS} = 18\text{V}$, $T_C = 25^{\circ}\text{C}$, $T_{J\text{max}} = 175^{\circ}\text{C}$	$I_{D\text{nom}}$	600	A
Pulsed drain current	Verified by design, t_p limited by $T_{J\text{max}}$	$I_{D\text{pulse}}$	1200	A
Max junction temperature		$T_{J\text{max}}$	175	$^{\circ}\text{C}$

Characteristics Values

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Drain-source on resistance	$I_D = 600\text{ A}$, $V_{GS} = 18\text{ V}$	$R_{DS(on)}$		3.0	4.1	m Ω
	$I_D = 600\text{ A}$, $V_{GS} = 18\text{ V}$			4.5		
	$I_D = 600\text{ A}$, $V_{GS} = 18\text{ V}$			5.2		
Gate threshold voltage	$I_D = 175\text{ mA}$, $V_{GS} = V_{DS}$	$V_{GS,th}$	2.0	2.6	3.2	V
	$I_D = 175\text{ mA}$, $V_{GS} = V_{DS}$			1.9		
	$I_D = 175\text{ mA}$, $V_{GS} = V_{DS}$			1.8		
Internal gate resistance	$f = 1\text{MHz}$	$R_{G,int}$		1.6		Ω
Drain-source leakage current	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}			100	μA
	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$				1	mA
	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$				5	mA
Gate-source leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = 20\text{ V}$	I_{GSS}			400	nA
Gate charge	$I_D = 600\text{ A}$	Q_g		1.6		μC
	$V_{GS} = -5\text{ V} / +18\text{ V}$					
	$V_{DS} = 600\text{V}$					
Input capacitance	$f = 100\text{ kHz}$, $V_{DS} = 600\text{ V}$ $V_{GS} = 0\text{V}$	C_{iss}		36.1		nF
Output capacitance	$f = 100\text{ kHz}$, $V_{DS} = 600\text{ V}$ $V_{GS} = 0\text{V}$	C_{oss}		3.9		nF
Reverse transfer capacitance	$f = 100\text{ kHz}$, $V_{DS} = 600\text{ V}$ $V_{GS} = 0\text{V}$	C_{rss}		0.1		nF
Turn-on delay time, inductive load	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$	$t_{d(on)}$		124		ns
	$V_{GS} = -5\text{ V} / +18\text{ V}$			95		
	$R_{G,on} = 5.1\ \Omega$					



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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rise time, inductive load	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / +18\text{ V}$ $R_{G,on} = 5.1\ \Omega$	$T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$ t_r		307 218		ns
Turn-on energy loss per pulse	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$ $L_S = 30\text{ nH}$ $V_{GS} = -5\text{ V} / +18\text{ V}$ $R_{G,on} = 5.1\ \Omega$ $di/dt = 4.1\text{ A/ns}$ (25°C) $di/dt = 4.7\text{ A/ns}$ (175°C)	$T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$ E_{on}		28.4 22.6		mJ
Turn-off delay time, inductive load	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / +18\text{ V}$ $R_{G,off} = 5.1\ \Omega$	$T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$ $t_{d(off)}$		400 497		ns
Fall time, inductive load	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / +18\text{ V}$ $R_{G,off} = 5.1\ \Omega$	$T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$ t_f		91 95		ns
Turn-off energy loss per pulse	$I_D = 600\text{ A}$, $V_{DS} = 600\text{ V}$ $L_S = 30\text{ nH}$ $V_{GS} = -5\text{ V} / +18\text{ V}$ $R_{G,off} = 5.1\ \Omega$ $dV/dt = 6.6\text{ V/ns}$ (25°C) $dV/dt = 5.5\text{ V/ns}$ (175°C)	$T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$ E_{off}		21.4 24.1		mJ
Short circuit current	$V_{GS} = -5\text{ V} / +18\text{ V}$ $V_{DD} = 800\text{ V}$ $R_{G,on} = 5.1\ \Omega$ $R_{G,off} = 5.1\ \Omega$ $t_{sc} = 3\ \mu\text{s}$	$T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$ I_{sc}		4900 4700		A
Thermal resistance, junction to case	Per MOSFET	$R_{th,jc}$		0.070		K/W
Operated temperature condition		$T_{j,op}$	-40		150	°C



Diode

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
DC diode forward current	$V_{GS} = -5V$, $T_C = 25^{\circ}C$, $T_{j,max}=175^{\circ}C$	I_F	600	A
Pulsed diode current	Verified by design, t_p limited by $T_{j,max}$	$I_{F, pulse}$	1200	A

Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit
Forward voltage	$I_F = 600 A$, $V_{GS} = -5 V$ $T_j = 25^{\circ}C$ $T_j = 175^{\circ}C$	V_F	1.45 2.25	2.00	V
Peak reverse recovery current	$I_F = 600 A$, $V_R = 600 V$ $V_{GS} = -5 V$ $-di_F/dt = 4.2 A/ns (25^{\circ}C)$ $-di_F/dt = 4.7 A/ns (175^{\circ}C)$ $T_j = 25^{\circ}C$ $T_j = 175^{\circ}C$	I_{RM}	67 86		A
Recovered charge	$I_F = 600 A$, $V_R = 600 V$ $V_{GS} = -5 V$ $-di_F/dt = 4.2 A/ns (25^{\circ}C)$ $-di_F/dt = 4.7 A/ns (175^{\circ}C)$ $T_j = 25^{\circ}C$ $T_j = 175^{\circ}C$	Q_{rr}	2.2 2.8		μC
Reverse recovery energy	$I_F = 600 A$, $V_R = 600 V$ $V_{GS} = -5 V$ $-di_F/dt = 4.2 A/ns (25^{\circ}C)$ $-di_F/dt = 4.7 A/ns (175^{\circ}C)$ $T_j = 25^{\circ}C$ $T_j = 175^{\circ}C$	E_{rec}	0.6 0.9		mJ
Thermal resistance, junction to case	Per Diode	$R_{th,JC}$	0.075		K/W

NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_C = 25^{\circ}C$	R_{25}		5.0		k Ω
Resistance tolerance	$T_C = 100^{\circ}C$	$\Delta R/R$	- 5		5	%
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 K))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298 K))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298 K))]$	$B_{25/100}$		3433		K



Module

Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 0 Hz, t = 1 min	V_{ISOL}	2.5	kV
Module baseplate material			Cu + Ni	
Module internal isolation material	Basic isolation (class 1, IEC 61140)		Si_3N_4	
Creepage distance	Terminal to heatsink	$d_{Creep,TH}$	14.5	mm
Creepage distance	Terminal to terminal	$d_{Creep,TT}$	13.0	mm
Clearance distance	Terminal to heatsink	$d_{Clear,TH}$	12.5	mm
Clearance distance	Terminal to terminal	$d_{Clear,TT}$	10.0	mm
Comparative tracking index ¹⁾		CTI	> 200	

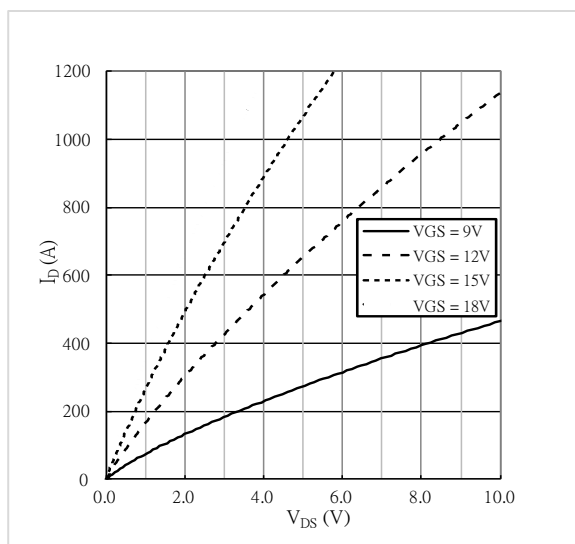
Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance		L_s		18		nH
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for module mounting	Screw M5 - Mounting according to valid application note	M	3		6	Nm
Terminal connection torque	Screw M6 - Mounting according to valid application note	M	3		6	Nm
Weight		G		340		g

1) Extracted by following UL 746A

Characteristics Diagrams

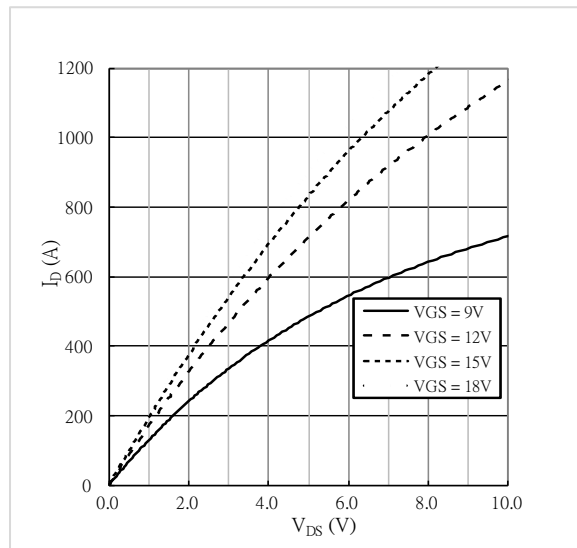
MOSFET, Output Characteristics

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



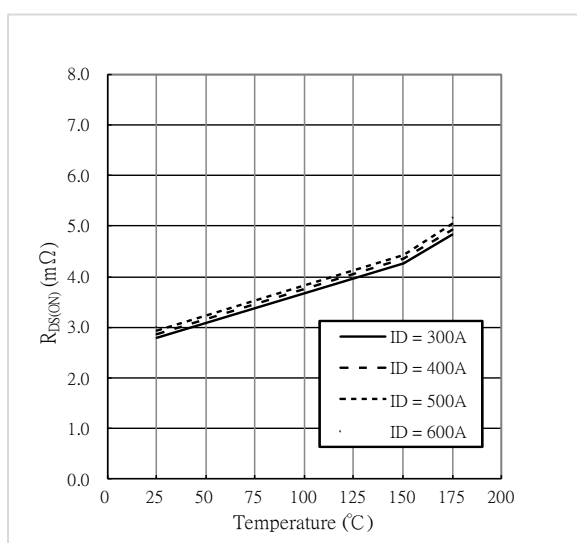
MOSFET, Output Characteristics

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



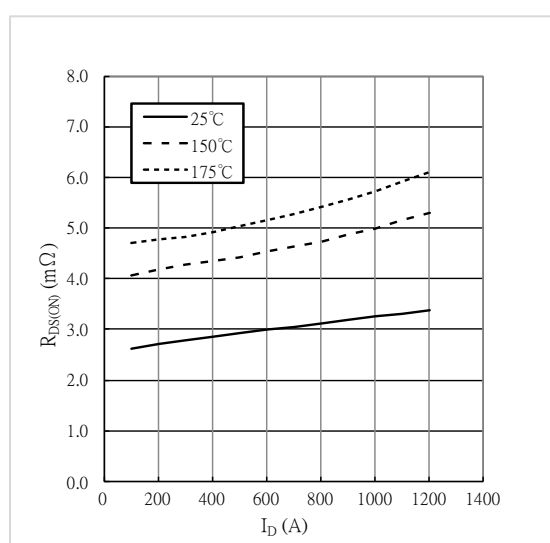
Typical temperature dependence of $R_{DS(on)}$,

$V_{GS} = 18\text{V}$, $R_{DS(on)} = f(T_j)$



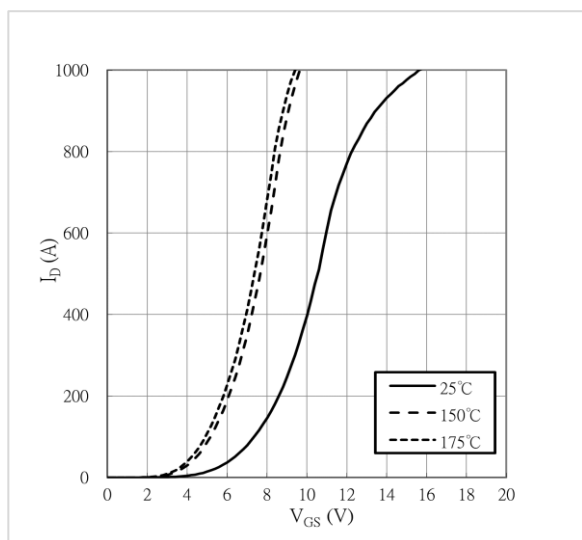
Typical I_D dependence of $R_{DS(on)}$,

$V_{GS} = 18\text{V}$, $R_{DS(on)} = f(I_D)$

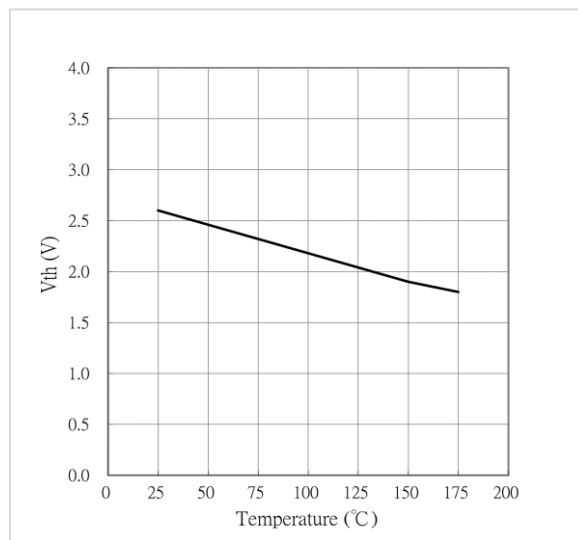


MOSFET, Transfer Characteristics

$$I_D = f(V_{GS})$$

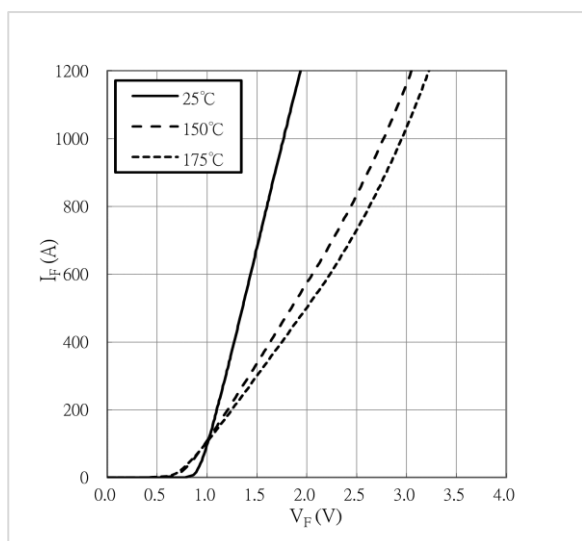


Typical temperature dependence of threshold voltage, $V_{GS,th} = f(T_j)$



Diode, Forward characteristics

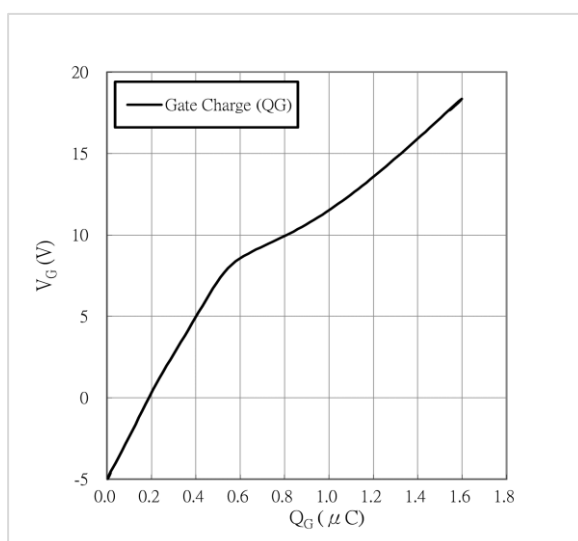
$$V_{GS} = -5V, I_F = f(V_F)$$



MOSFET, Total Gate charge characteristics

$$V_{DS} = 600V, I_D = 600A, T_j = 25^\circ C$$

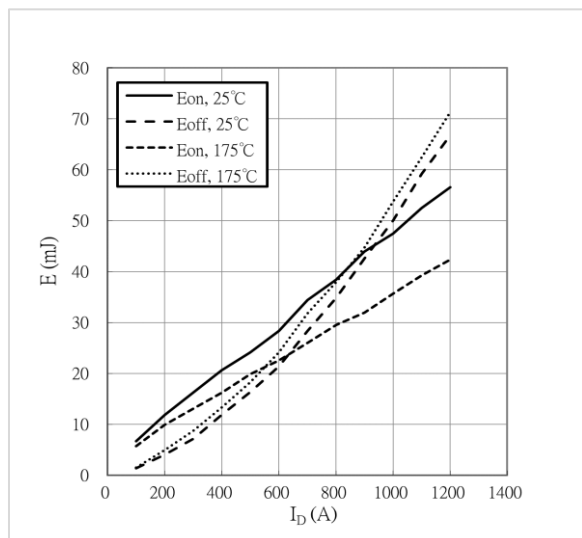
$$V_{GS} = f(Q_G)$$



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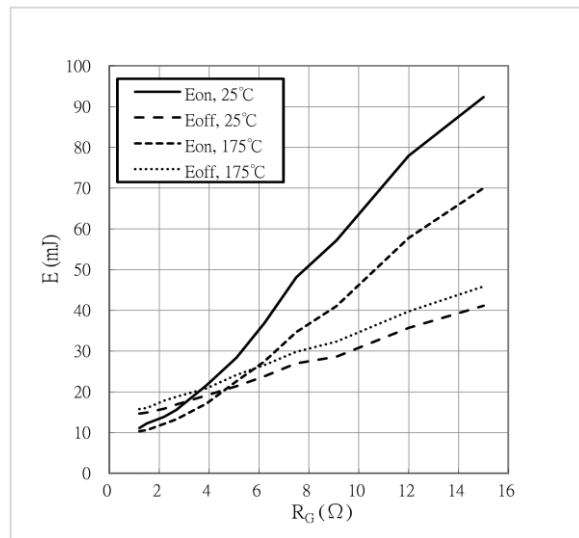
MOSFET, Switching losses vs. I_D

$V_{GS} = -5V / +18V$, $R_{G,on} = 5.1\Omega$, $R_{G,off} = 5.1\Omega$,
 $V_{DS} = 600V$, E_{on} & $E_{off} = f(I_D)$



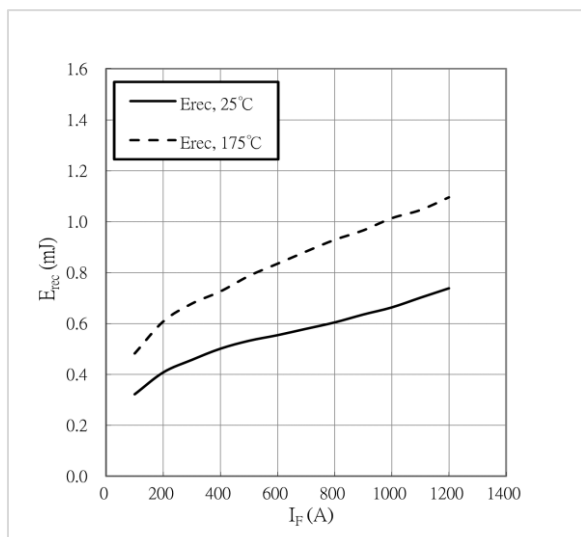
MOSFET, Switching losses vs. R_G

$V_{GS} = -5V / +18V$, $V_{DS} = 600V$, $I_D = 600A$,
 E_{on} & $E_{off} = f(R_G)$



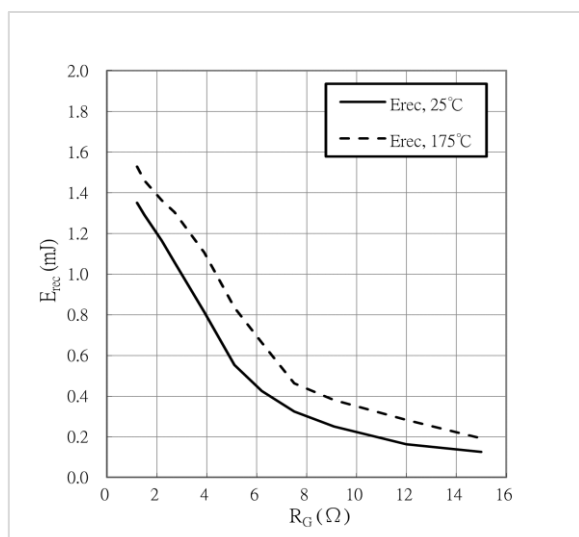
Diode, Switching losses vs. I_F

$V_{GS} = -5V / +18V$, $R_{G,on} = 5.1\Omega$, $R_{G,off} = 5.1\Omega$,
 $V_{DS} = 600V$, $E_{rec} = f(I_F)$

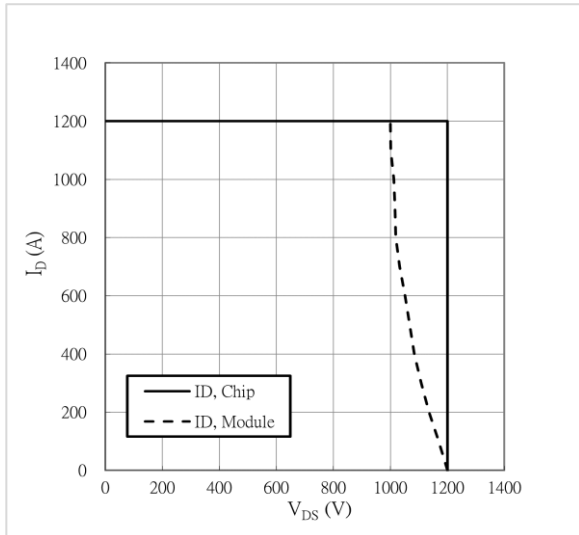


Diode, Switching losses vs. R_G

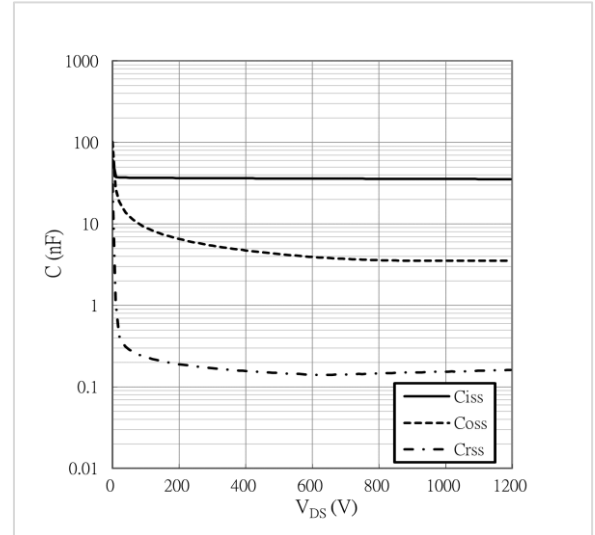
$V_{GS} = -5V / +18V$, $V_{DS} = 600V$, $I_F = 600A$,
 $E_{rec} = f(R_G)$



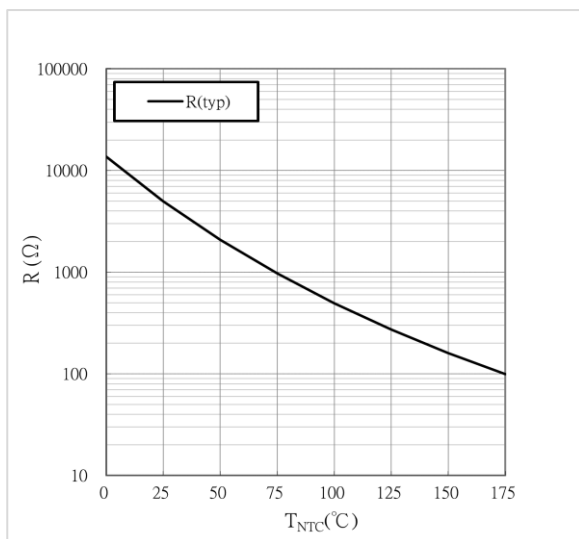
MOSFET, Reverse bias safe operating area (RBSOA) , $V_{GS} = -5V / +18V$, $R_{G,on} = 5.1\Omega$
 $R_{G,off} = 5.1\Omega$, $T_j = 175^\circ C$, $I_D = f(V_D)$



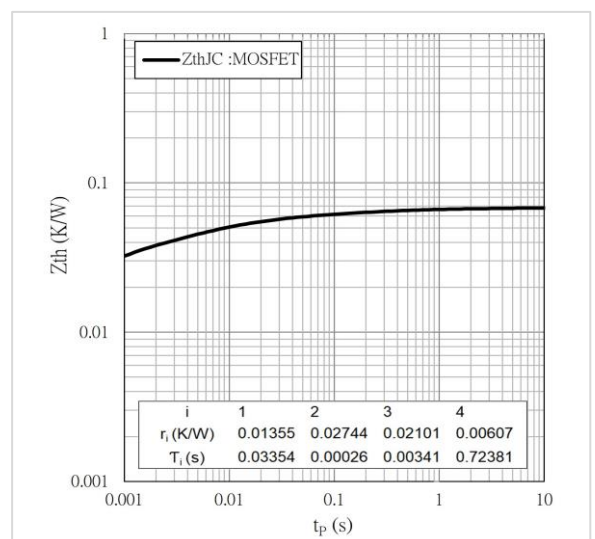
MOSFET, Capacitance characteristics
 $V_{GS} = 0V$, $T_j = 25^\circ C$, $f = 100kHz$, $C = f(V_{DS})$



NTC-Thermistor-temperature characteristics
 $R = f(T_{NTC})$



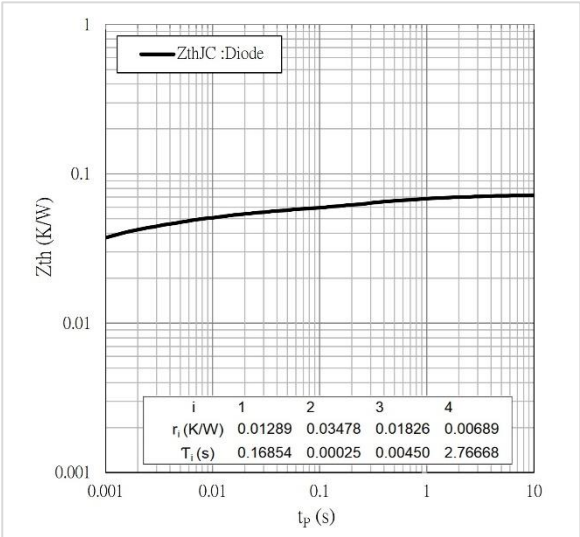
MOSFET, Transient thermal impedance
 $Z_{thJC} = f(t_p)$





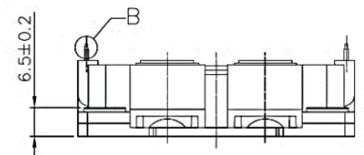
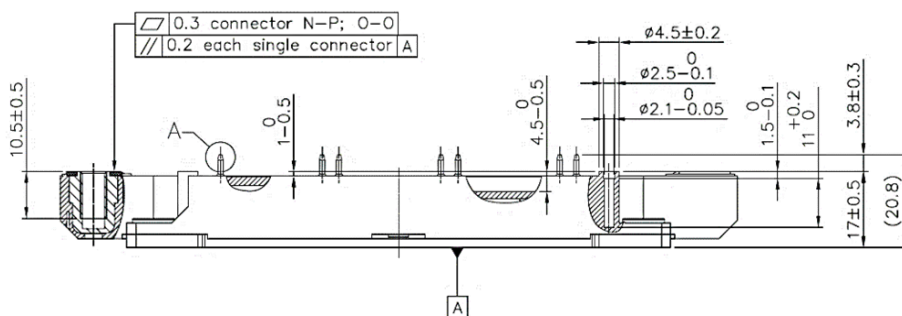
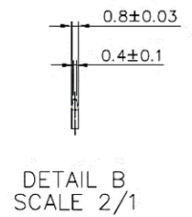
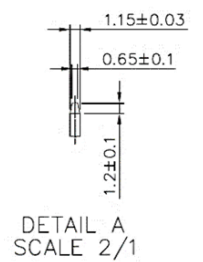
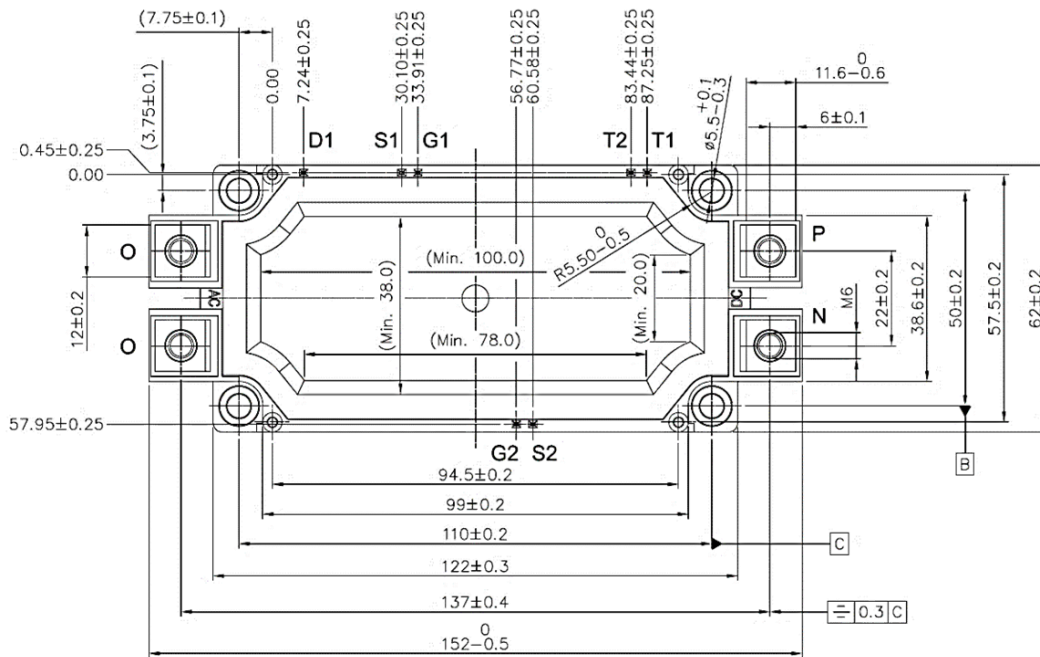
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Diode, Transient thermal impedance
 $Z_{thJC} = f(t_p)$





Package Outlines



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