

Vienna Rectifier MOSFET Power Module

Super junction MOSFET:

$V_{DSS} = 600V$

$R_{DSon} = 45m\Omega \text{ Max @ } T_j = 25^\circ C$

Application

- Power supply

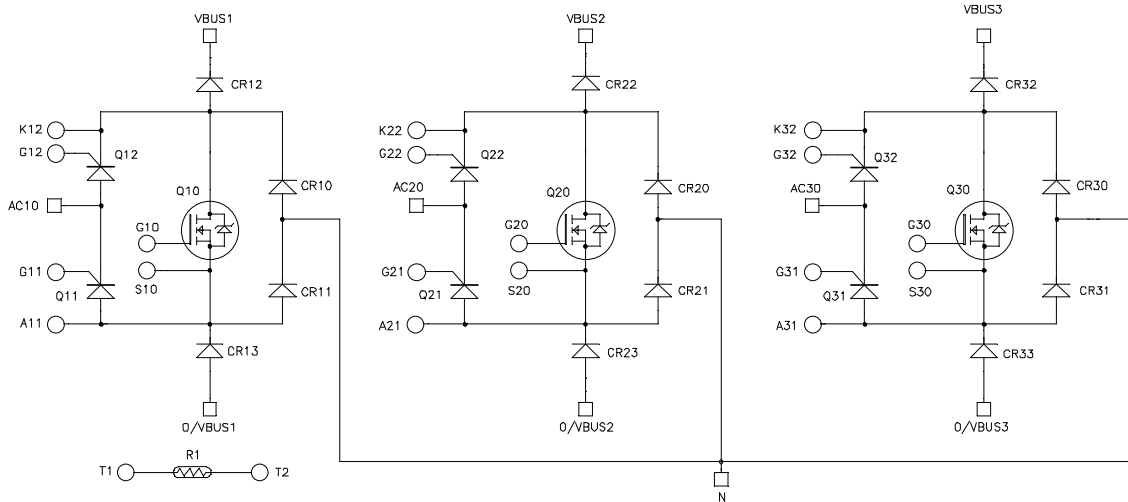
Features

- **Super junction MOSFET**
 - Ultra low R_{DSon}
 - Low Miller capacitance
 - Ultra low gate charge
 - Avalanche energy rated
 - Very rugged
- Kelvin emitter for easy drive
- Very low stray inductance
 - Symmetrical design
 - Lead frames for power connections
- Internal thermistor for temperature monitoring
- High level of integration

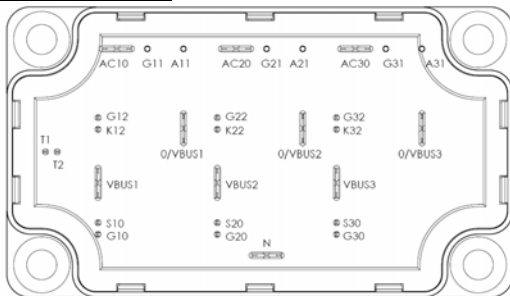
Benefits


- AlN substrate for improved thermal performance
- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS Compliant

Electrical scheme:



Pin out Location:



 **CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

All ratings @ $T_j = 25^\circ C$ unless otherwise specified

1. Absolute maximum ratings

Thyristor Absolute maximum ratings (per thyristor)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>	
V _{DRM}	Repetitive Peak Reverse Voltage	1600	V	
I _{DRM}	Repetitive Peak Reverse Current	3	mA	
I _{TRMS}	RMS on – state current	T _J = 100°C	60	A
I _{TSM}	Surge on – state current	t = 10ms T _C = 45°C	520	A
V _{RGM}	Peak Reverse Gate Voltage	10	V	
P _D	Power Dissipation	T _C = 25°C	310	W

Super junction MOSFET Absolute maximum ratings (per MOSFET)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>	
V _{DSS}	Drain - Source Voltage	600	V	
I _D	Continuous Drain Current	T _c = 25°C	55	A
		T _c = 80°C	41	
I _{DM}	Pulsed Drain current	130		
V _{GS}	Gate - Source Voltage	±20	V	
R _{DSon}	Drain - Source ON Resistance	45	mΩ	
P _D	Power Dissipation	T _c = 25°C	357	W
I _{AR}	Avalanche current (repetitive and non repetitive)	15	A	
E _{AR}	Repetitive Avalanche Energy	3	mJ	
E _{AS}	Single Pulse Avalanche Energy	1900		

FRED Diodes CR12, CR13, CR22, CR23, CR32, CR33 Absolute maximum ratings (per diode)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>	
V _R	DC reverse Voltage	600	V	
V _{RSM}	Peak Repetitive Reverse Voltage			
I _F	DC Forward Current	T _C = 60°C	60	A
I _{FSM}	Non-Repetitive Forward Surge Current	t = 8.3ms T _J = 45°C	600	
P _D	Power Dissipation	T _C = 25°C	160	W

Rectifier diode CR10, CR11, CR20, CR21, CR30, CR31 Absolute maximum ratings (per diode)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>	
V _R	DC reverse Voltage	1600	V	
V _{RSM}	Peak Repetitive Reverse Voltage			
I _F	DC Forward Current	T _C = 100°C	90	A
I _{FSM}	Non-Repetitive Forward Surge Current	t=10ms T _J = 45°C	850	

2. Electrical Characteristics

Thyristor Electrical Characteristics (per thyristor)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_T	On – state Voltage	$I_T = 60A$	$T_J = 25^\circ C$		1.41		V
V_{TO}	Direct On state threshold Voltage		$T_J = 125^\circ C$		0.85		
r_T	On – state Slope resistance		$T_J = 125^\circ C$		10		m Ω
V_{GT}	Gate Trigger Voltage		$T_J = 25^\circ C$		1.5		V
I_{GT}	Gate Trigger Current				50		mA
R_{thJC}	Junction to Case Thermal Resistance					0.40	$^\circ C/W$

Super junction MOSFET Electrical Characteristics (per MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V ; V_{DS} = 600V$				50	μA
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 24.5A$			40	45	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 3mA$		2.1	3	3.9	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$				140	nA
C_{iss}	Input Capacitance	$V_{GS} = 0V ; V_{DS} = 25V$			7.2		nF
C_{oss}	Output Capacitance	$f = 1MHz$			8.5		
Q_g	Total gate Charge	$V_{GS} = 10V$			150		nC
Q_{gs}	Gate – Source Charge	$V_{Bus} = 300V$			34		
Q_{gd}	Gate – Drain Charge	$I_D = 49A$			51		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125$^\circ C$)			21		ns
T_r	Rise Time	$V_{GS} = 10V$ $V_{Bus} = 400V$			30		
$T_{d(off)}$	Turn-off Delay Time	$I_D = 49A$			100		
T_f	Fall Time	$R_G = 5\Omega$			45		
E_{on}	Turn-on Switching Energy	Inductive switching @ 125$^\circ C$ $V_{GS} = 10V ; V_{Bus} = 400V$			1100		μJ
E_{off}	Turn-off Switching Energy	$I_D = 49A ; R_G = 5\Omega$			635		
R_{thJC}	Junction to Case Thermal Resistance					0.36	$^\circ C/W$

FRED Diodes Electrical Characteristics CR12, CR13, CR22, CR23, CR32, CR33 (per diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Peak Repetitive Reverse Voltage			600			V
I_{RM}	Reverse Leakage Current	$V_R = 600V$				25	μA
V_F	Diode Forward Voltage	$I_F = 60A$			1.7	2.5	V
		$I_F = 120A$			2		
		$I_F = 60A$	$T_J = 125^\circ C$		1.4		
t_{rr}	Reverse Recovery Time	$I_F = 60A$ $V_R = 400V$	$T_J = 25^\circ C$		70		ns
			$T_J = 125^\circ C$		140		
Q_{rr}	Reverse Recovery Charge	$di/dt = 200A/\mu s$	$T_J = 25^\circ C$		100		nC
			$T_J = 125^\circ C$		690		
R_{thJC}	Junction to Case Thermal Resistance					0.58	$^\circ C/W$

Rectifier diodes Electrical Characteristics CR10, CR11, CR20, CR21, CR30, CR31 (per diode)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I _R	Reverse Current	V _R = 1600V			50	μA
V _F	Forward Voltage	I _F = 33A		1		V
				0.9		
V _T	On – state Voltage				0.83	V
r _T	On – state Slope resistance				4.89	mΩ
R _{thJC}	Junction to Case Thermal Resistance				0.66	°C/W

3. Thermal and package characteristics

Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
ΔR ₂₅ /R ₂₅			5		%
B _{25/85}	T ₂₅ = 298.15 K		3952		K
ΔB/B	T _C = 100°C		4		%

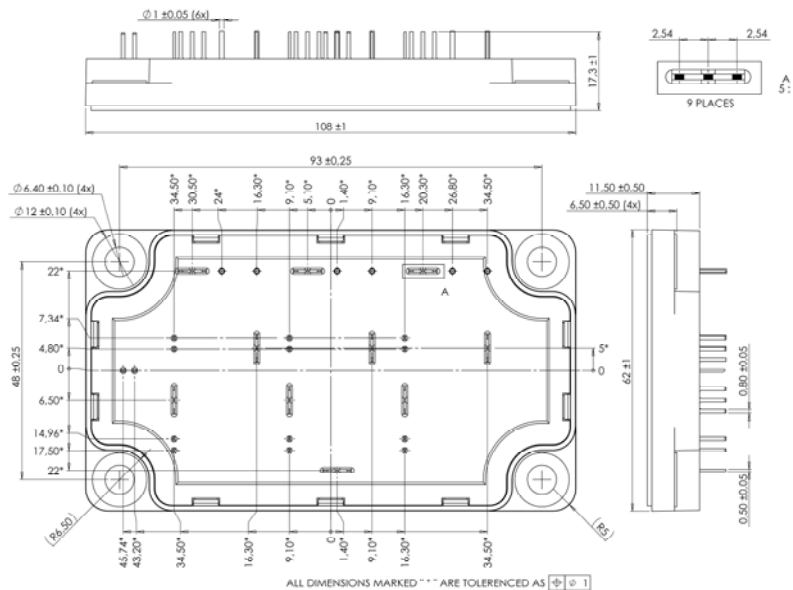
$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Package characteristics

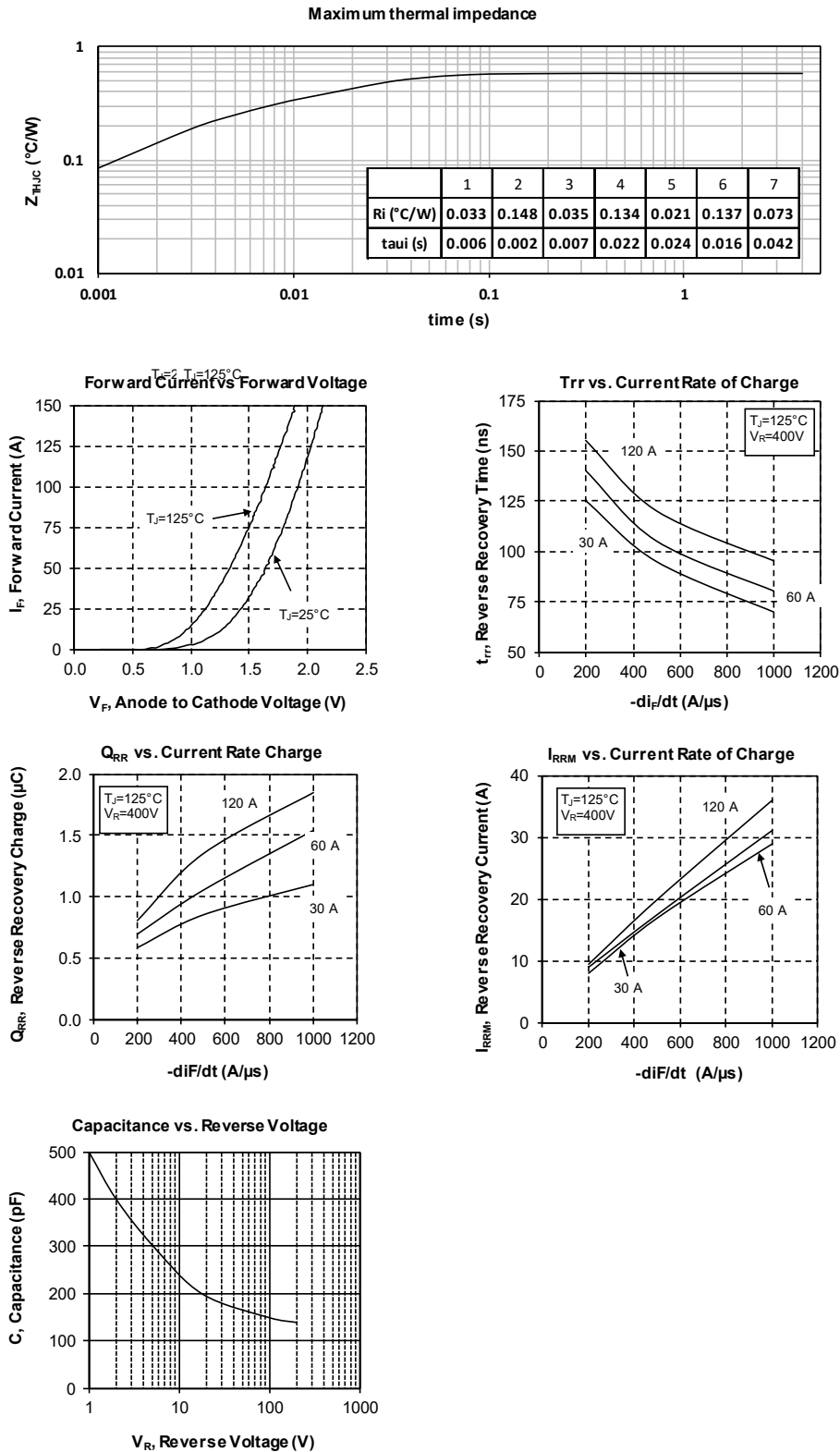
Symbol	Characteristic	Min	Typ	Max	Unit	
V _{ISOL}	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz	4000			V	
T _J	Operating junction temperature range	-40		150	°C	
T _{STG}	Storage Temperature Range	-40		125		
T _C	Operating Case Temperature	-40		125		
Torque	Mounting torque	To Heatsink	M6	3	5	N.m
Wt	Package Weight				250	g

Package outline (dimensions in mm)



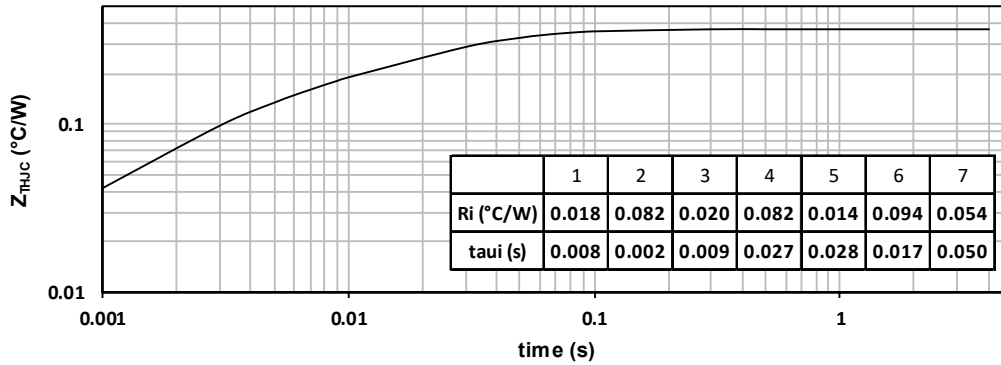
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical FRED Performance Curve (per diode)

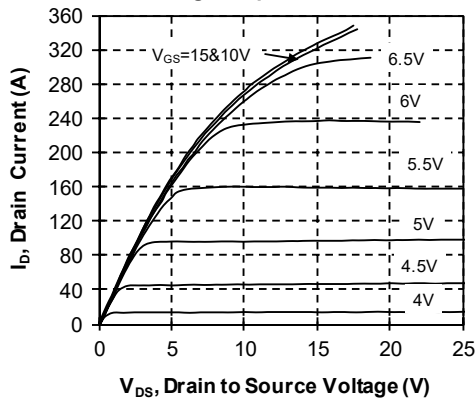


Typical Super junction MOSFET Performance Curve (per MOSFET)

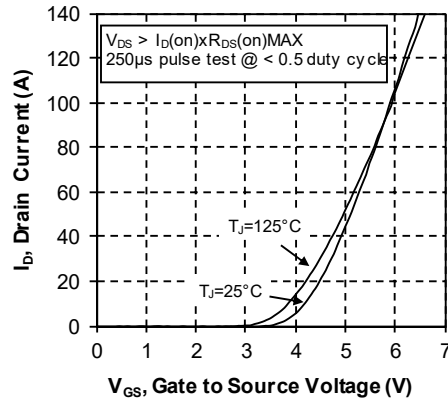
Maximum thermal impedance



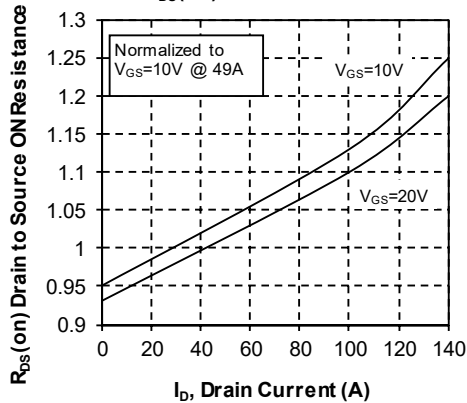
Low Voltage Output Characteristics



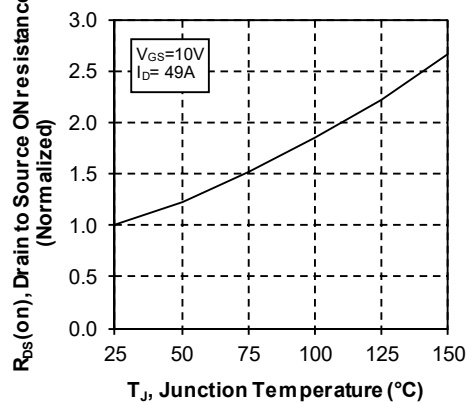
Transfer Characteristics

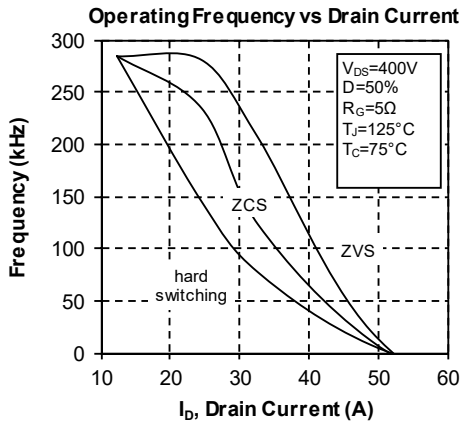
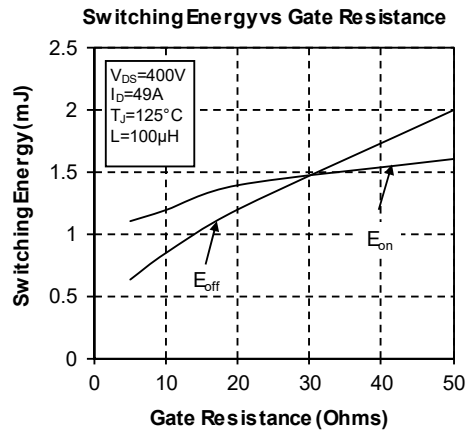
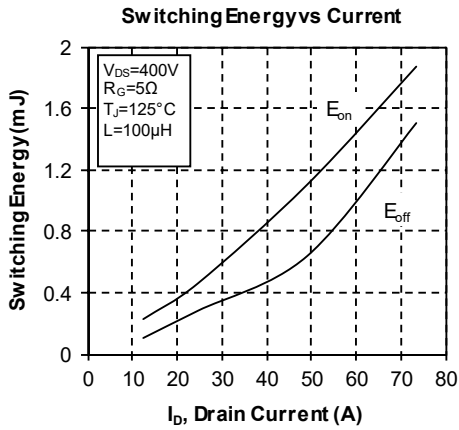
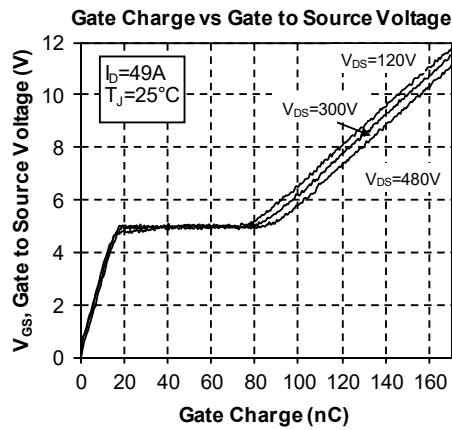
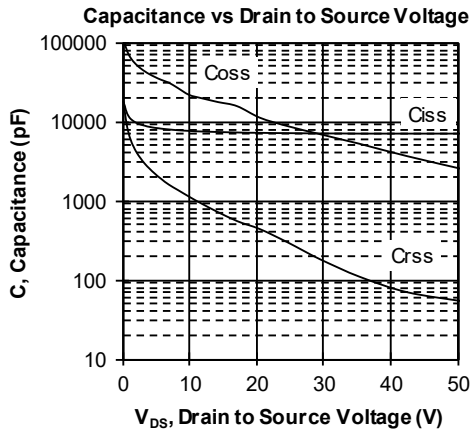


R_DS(on) vs Drain Current

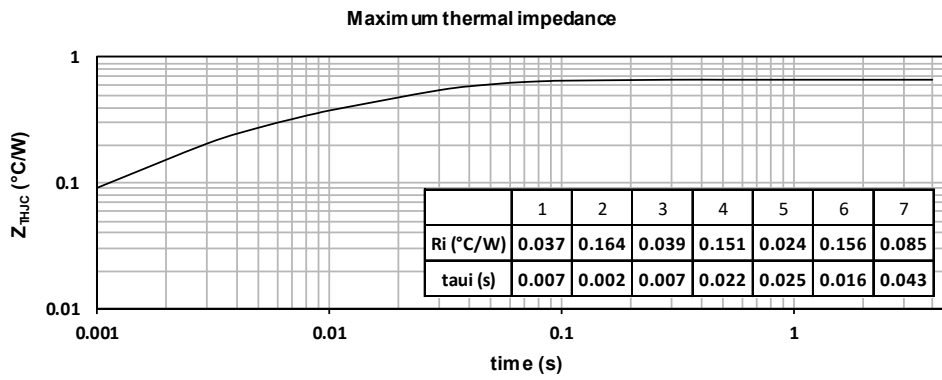
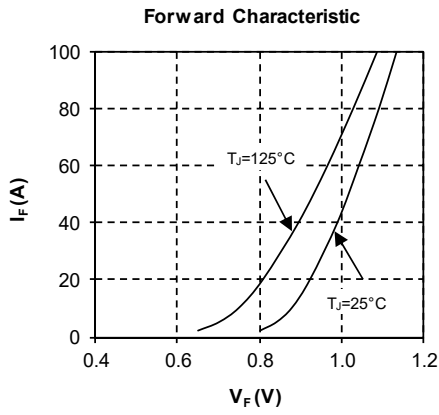


ON resistance vs Temperature





Typical Rectifier Performance Curve (per diode)



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