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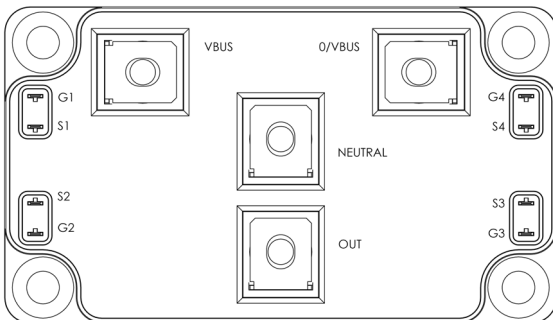
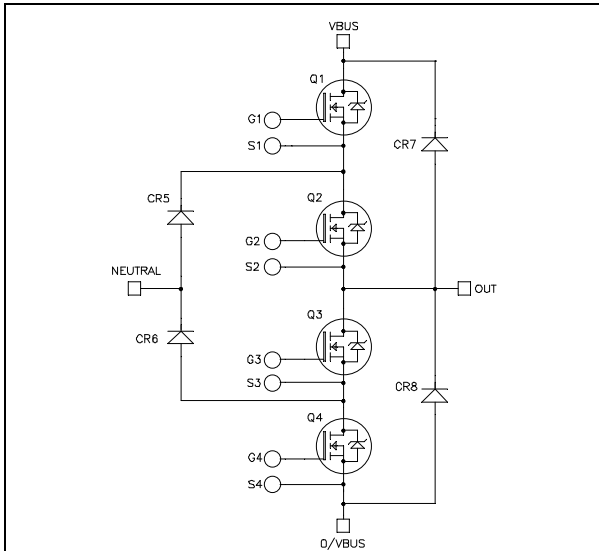
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Three level inverter SiC MOSFET Power Module

SiC Power MOSFET :

$V_{DSS} = 1200V$; $R_{DS(on)} = 12m\Omega$ @ $T_j = 25^\circ C$



Application

- Uninterruptible Power Supplies

Features

- **SiC Power MOSFET**
 - Low $R_{DS(on)}$
 - High temperature performance
- **SiC Schottky Diode**
 - Zero reverse recovery
 - Zero forward recovery
 - Temperature Independent switching behavior
 - Positive temperature coefficient on VF
- Kelvin emitter for easy drive
- Very low stray inductance
- M5 power connectors
- High level of integration
- AlN substrate for improved thermal performance

Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- Low profile
- RoHS Compliant

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

Q1 to Q4 Absolute maximum ratings (per SiC MOSFET)

Symbol	Parameter	Max ratings	Unit
V_{DSS}	Drain - Source Voltage	1200	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	219
		$T_c = 80^\circ C$	164
I_{DM}	Pulsed Drain current	440	
V_{GS}	Gate - Source Voltage	-10/+25	V
$R_{DS(on)}$	Drain - Source ON Resistance	12	$m\Omega$
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	925
			W

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.
See application note APT0502 on www.microsemi.com

Q1 to Q4 Electrical Characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V$; $V_{DS} = 1200V$			300	μA
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 20V$ $I_D = 150A$	$T_j = 25^\circ C$	8	12	m Ω
			$T_j = 150^\circ C$	14	21	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$; $I_D = 30mA$	2.1	2.4		V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = 20V$, $V_{DS} = 0V$			1.8	μA

Q1 to Q4 Dynamic Characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
C_{iss}	Input Capacitance	$V_{GS} = 0V$ $V_{DS} = 1000V$ $f = 1MHz$		8.4		nF
C_{oss}	Output Capacitance		0.66			
C_{riss}	Reverse Transfer Capacitance		0.045			
Q_g	Total gate Charge	$V_{GS} = -5/+20V$ $V_{Bus} = 800V$ $I_D = 150A$		483		nC
Q_{gs}	Gate – Source Charge		138			
Q_{gd}	Gate – Drain Charge		150			
$T_{d(on)}$	Turn-on Delay Time	$V_{GS} = -5/+20V$ $V_{Bus} = 800V$ $I_D = 150A$, $T_j = 150^\circ C$ $R_L = 5.3\Omega$; $R_{Gext} = 6.7\Omega$		35		ns
T_r	Rise Time		40			
$T_{d(off)}$	Turn-off Delay Time		150			
T_f	Fall Time		70			
E_{on}	Turn on Energy	Inductive Switching $V_{GS} = -5/+20V$ $V_{Bus} = 600V$ $I_D = 150A$ $R_{Gext} = 6.7\Omega$	$T_j = 150^\circ C$	3.3		mJ
E_{off}	Turn off Energy			$T_j = 150^\circ C$	1.8	
R_{thJC}	Junction to Case Thermal Resistance				0.135	$^\circ C/W$

Body diode ratings and characteristics (per SiC MOSFET)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V_{SD}	Diode Forward Voltage	$V_{GS} = -5V$, $I_{SD} = 75A$		3.3		V
		$V_{GS} = -2V$, $I_{SD} = 75A$		3.1		
t_{rr}	Reverse Recovery Time	$I_{SD} = 150A$; $V_{GS} = -5V$ $V_R = 800V$; $di_F/dt = 3000A/\mu s$		45		ns
Q_{rr}	Reverse Recovery Charge		1.2		μC	
I_{rr}	Reverse Recovery Current		40		A	

CR5 & CR6 SiC diode ratings and characteristics (Per SiC diode)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{RRM}	Peak Repetitive Reverse Voltage					600	V
I _{RM}	Reverse Leakage Current	V _R =600V	T _j = 25°C		220	1320	μA
			T _j = 175°C		440	6600	
I _F	DC Forward Current		T _c = 125°C		220		A
V _F	Diode Forward Voltage	I _F = 220A	T _j = 25°C		1.6	1.8	V
			T _j = 175°C		2	2.4	
Q _C	Total Capacitive Charge	I _F = 220A, V _R = 600V di/dt = 5000A/μs			616		nC
C	Total Capacitance	f = 1MHz, V _R = 200V			1430		pF
		f = 1MHz, V _R = 400V			1100		
R _{thJC}	Junction to Case Thermal Resistance					0.1	°C/W

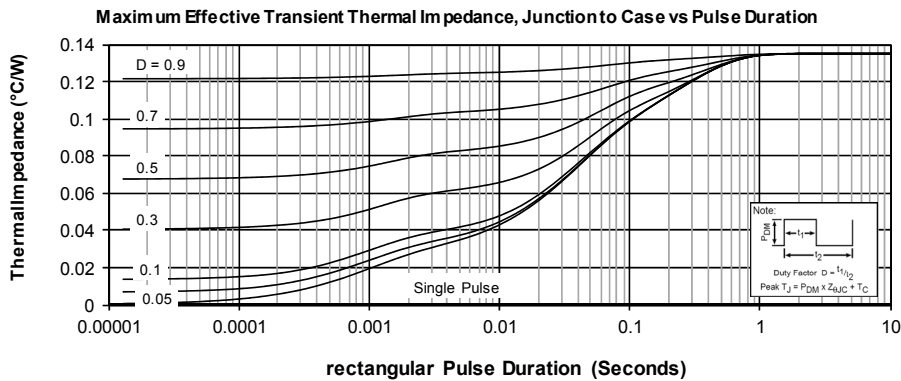
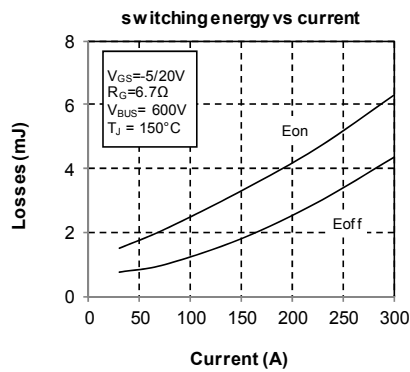
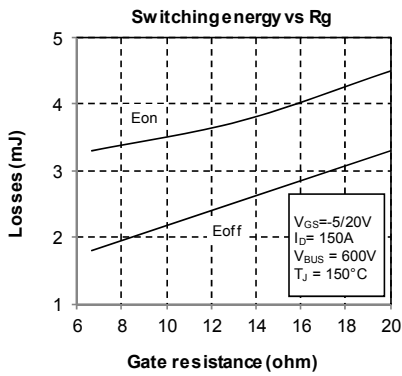
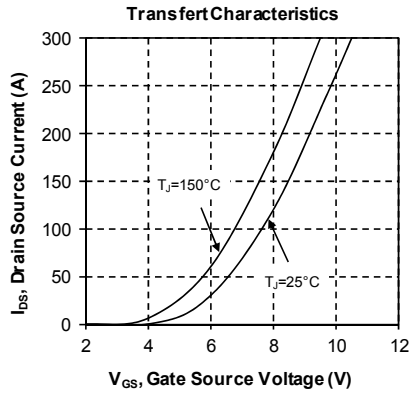
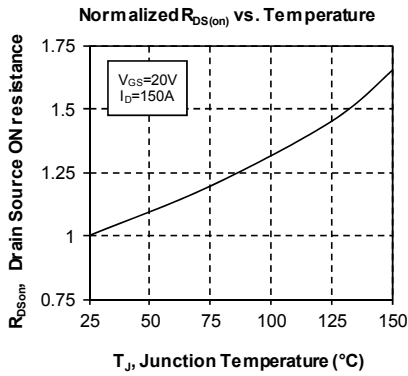
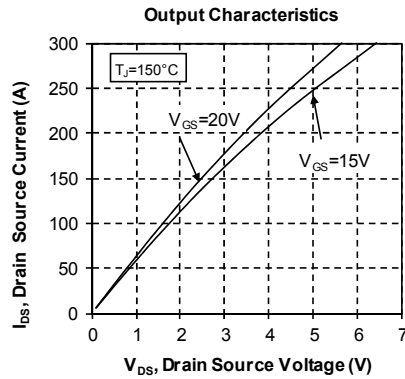
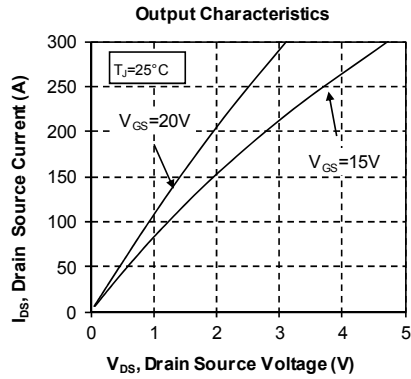
CR7 & CR8 diode ratings and characteristics (Per SiC diode)

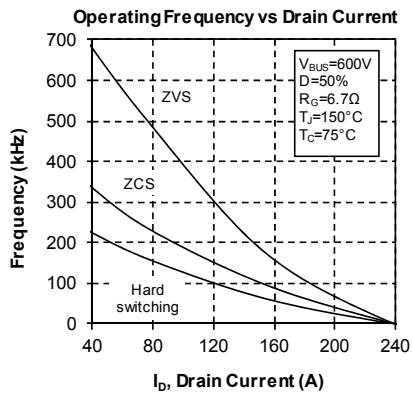
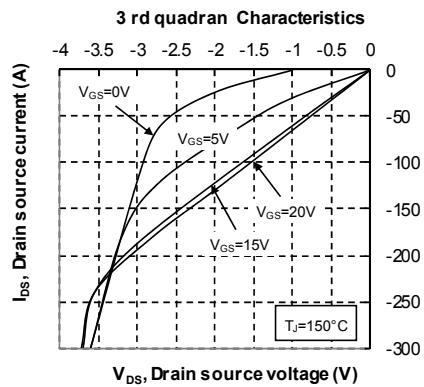
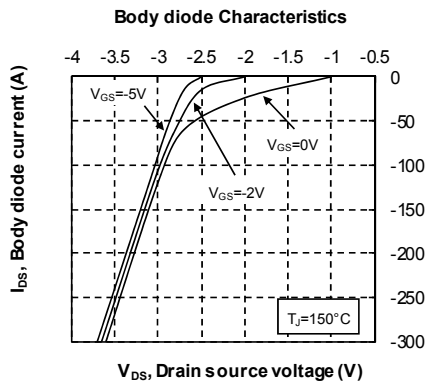
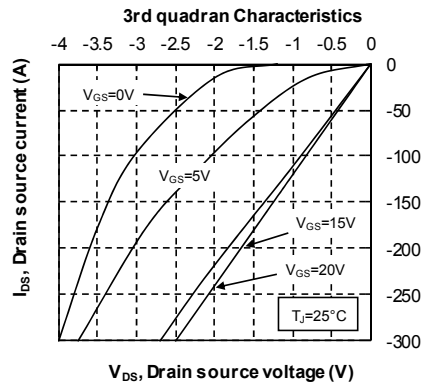
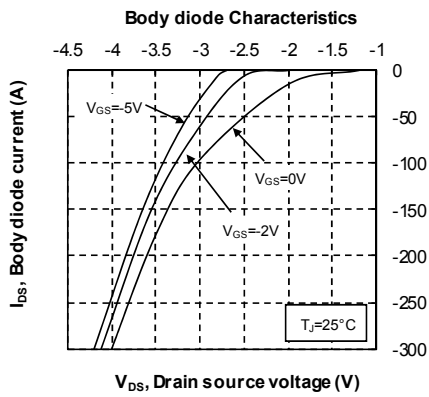
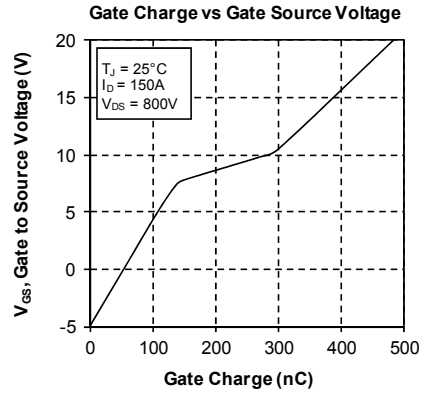
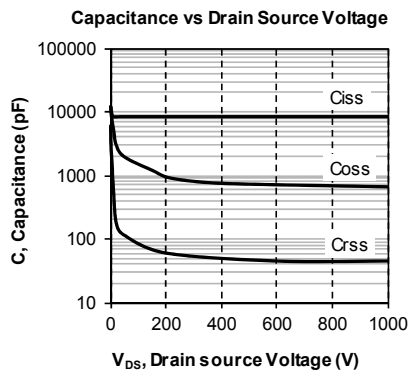
<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{RRM}	Peak Repetitive Reverse Voltage					1200	V
I _{RM}	Reverse Leakage Current	V _R =1200V	T _j = 25°C		280	1600	μA
			T _j = 175°C		520	3200	
I _F	DC Forward Current		T _c = 125°C		160		A
V _F	Diode Forward Voltage	I _F = 160A	T _j = 25°C		1.5	1.8	V
			T _j = 175°C		2.2	3	
Q _C	Total Capacitive Charge	I _F = 160A, V _R = 1200V di/dt = 4000A/μs			1040		nC
C	Total Capacitance	f = 1MHz, V _R = 400V			744		pF
		f = 1MHz, V _R = 800V			536		
R _{thJC}	Junction to Case Thermal Resistance					0.14	°C/W

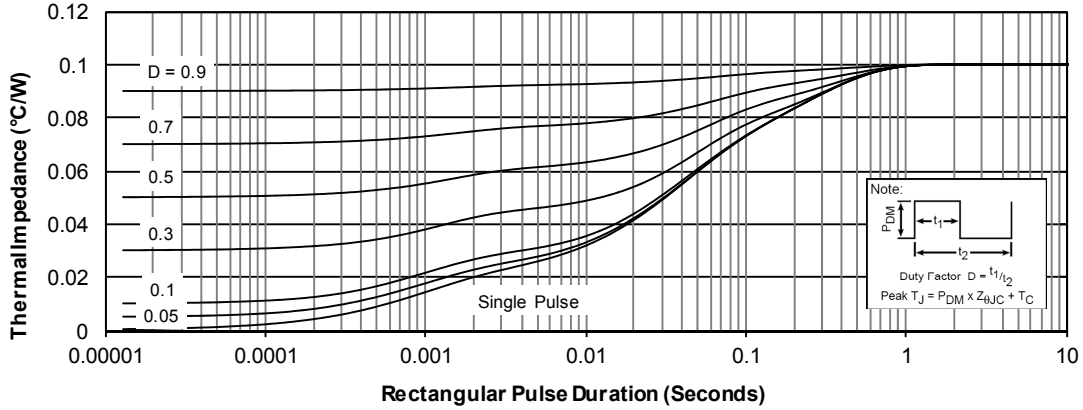
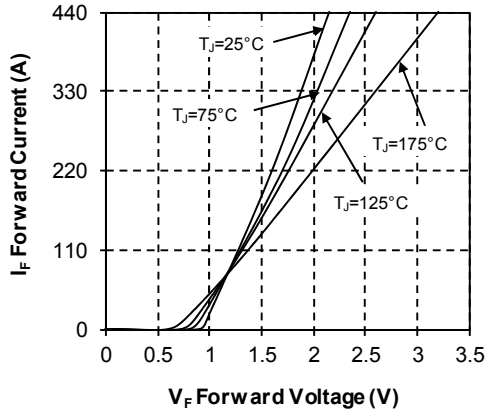
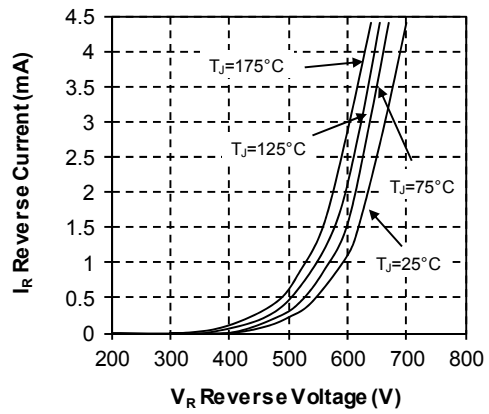
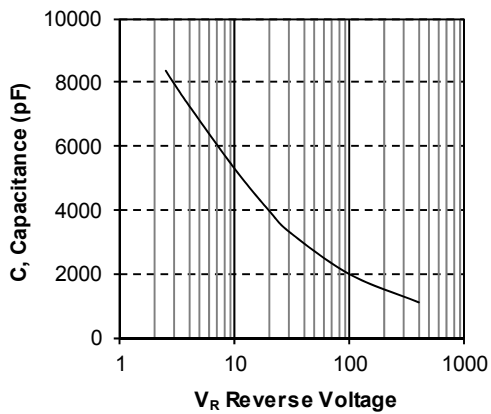
Thermal and package characteristics

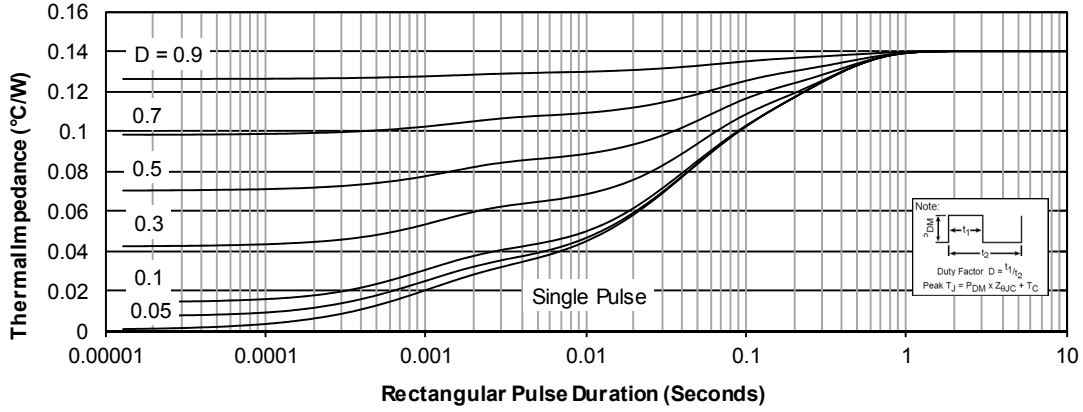
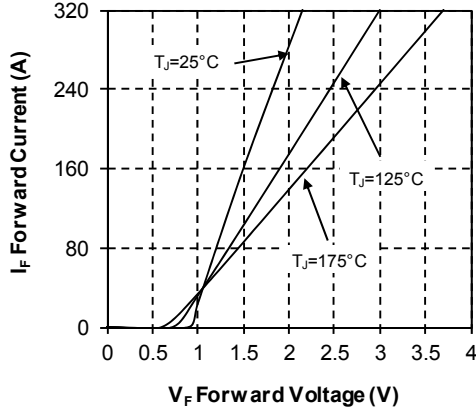
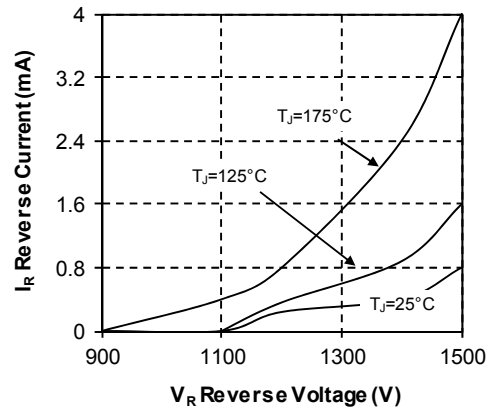
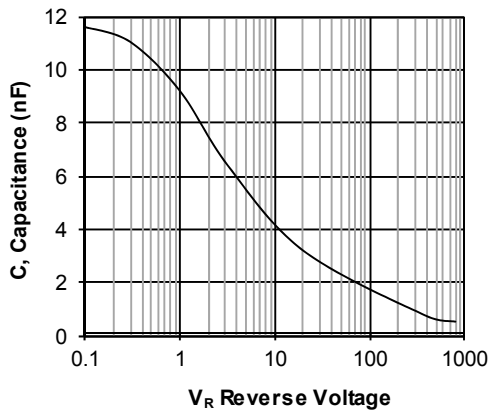
<i>Symbol</i>	<i>Characteristic</i>			<i>Min</i>	<i>Max</i>	<i>Unit</i>
V _{ISOL}	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz			4000		V
T _j	Operating junction temperature range	SiC MOSFET		-40	150	°C
		SiC diode		-40	175	
T _{JOP}	Recommended junction temperature under switching conditions			-40	T _{jmax} -25	°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
		For terminals	M5	2	3.5	
Wt	Package Weight				300	g

Q1 to Q4 Typical performance curve





CR5 & CR6 Typical performance curve
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

Forward Characteristics

Reverse Characteristics

Capacitance vs. Reverse Voltage


CR7 & CR8 Typical performance curve
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

Forward Characteristics

Reverse Characteristics

Capacitance vs. Reverse Voltage


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