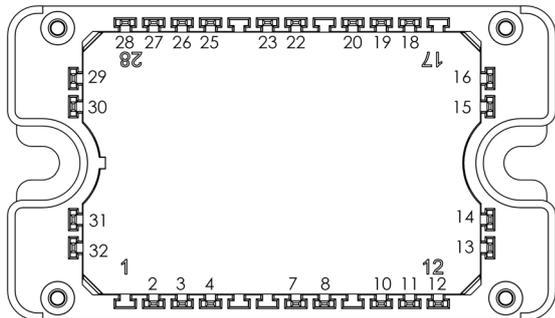
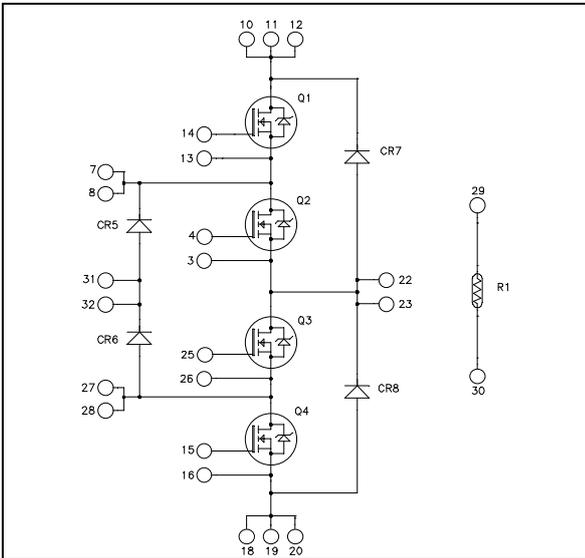


Three level inverter
SiC MOSFET Power Module

SiC Power MOSFET :
 $V_{DSS} = 1200V$; $R_{DS(on)} = 98m\Omega$ @ $T_j = 25^\circ C$



All multiple inputs and outputs must be shorted together
 10/11/12 ; 7/8 ; 27/28 ; ...

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 Breakdown Voltage	1200	V
I_D	Continuous Drain Current	$T_c = 25^\circ C$	28
		$T_c = 80^\circ C$	21
I_{DM}	Pulsed Drain current	55	A
V_{GS}	Gate - Source Voltage	-10/+25	V
$R_{DS(on)}$	Drain - Source ON Resistance	98	m Ω
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	125
			W

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

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
- High level of integration
- Internal thermistor for temperature monitoring
- 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

Q1 to Q4 Electrical Characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 1200V$		12	100	μA
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 20V$ $I_D = 20A$	$T_j = 25^\circ C$	80	98	m Ω
			$T_j = 150^\circ C$	150	208	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}; I_D = 1mA$	1.7	2.2		V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = 20V, V_{DS} = 0V$			250	nA

Q1 to Q4 Dynamic Characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS} = 0V$		950		pF
C_{oss}	Output Capacitance	$V_{DS} = 1000V$		80		
C_{rss}	Reverse Transfer Capacitance	$f = 1MHz$		6.5		
Q_g	Total gate Charge	$V_{GS} = 20V$		49		nC
Q_{gs}	Gate – Source Charge	$V_{Bus} = 800V$		11		
Q_{gd}	Gate – Drain Charge	$I_D = 20A$		18		
$T_{d(on)}$	Turn-on Delay Time	$V_{GS} = -2/+20V$ $V_{Bus} = 800V$ $I_D = 20A$ $R_L = 40\Omega; R_G = 50\Omega$		12		ns
T_r	Rise Time			14		
$T_{d(off)}$	Turn-off Delay Time			23		
T_f	Fall Time			18		
E_{on}	Turn on Energy	Inductive Switching $V_{GS} = -5/+20V$ $V_{Bus} = 600V$ $I_D = 20A$ $R_G = 50\Omega$	$T_j = 150^\circ C$	0.45		mJ
E_{off}	Turn off Energy		$T_j = 150^\circ C$	0.25		
R_{thJC}	Junction to Case Thermal Resistance				1	$^\circ C/W$

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

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		600			V
I_{RM}	Maximum Reverse Leakage Current	$V_R = 600V$	$T_j = 25^\circ C$	10	60	μA
			$T_j = 175^\circ C$	20	300	
I_F	DC Forward Current		$T_c = 125^\circ C$	10		A
V_F	Diode Forward Voltage	$I_F = 10A$	$T_j = 25^\circ C$	1.6	1.8	V
			$T_j = 175^\circ C$	2	2.4	
Q_C	Total Capacitive Charge	$I_F = 10A, V_R = 600V$ $di/dt = 500A/\mu s$		28		nC
C	Total Capacitance	$f = 1MHz, V_R = 200V$		65		pF
		$f = 1MHz, V_R = 400V$		50		
R_{thJC}	Junction to Case Thermal Resistance				2.2	$^\circ C/W$

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

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage		1200			V
I _{RM}	Maximum Reverse Leakage Current	V _R =1200V	T _j = 25°C	64	400	μA
			T _j = 175°C	112	2000	
I _F	DC Forward Current			20		A
V _F	Diode Forward Voltage	I _F = 20A	T _j = 25°C	1.6	1.8	V
			T _j = 175°C	2.3	3	
Q _C	Total Capacitive Charge	I _F = 20A, V _R = 1200V di/dt = 1000A/μs		160		nC
C	Total Capacitance	f = 1MHz, V _R = 200V		192		pF
		f = 1MHz, V _R = 400V		138		
R _{thJC}	Junction to Case Thermal Resistance				0.8	°C/W

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

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		%

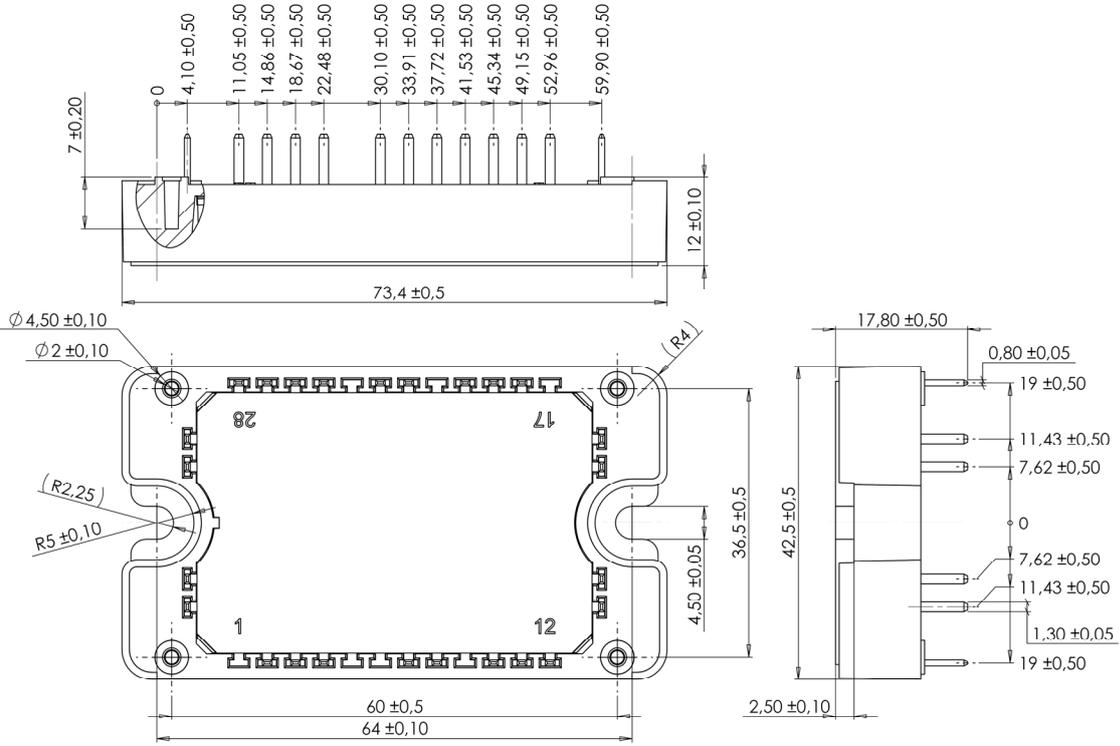
$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

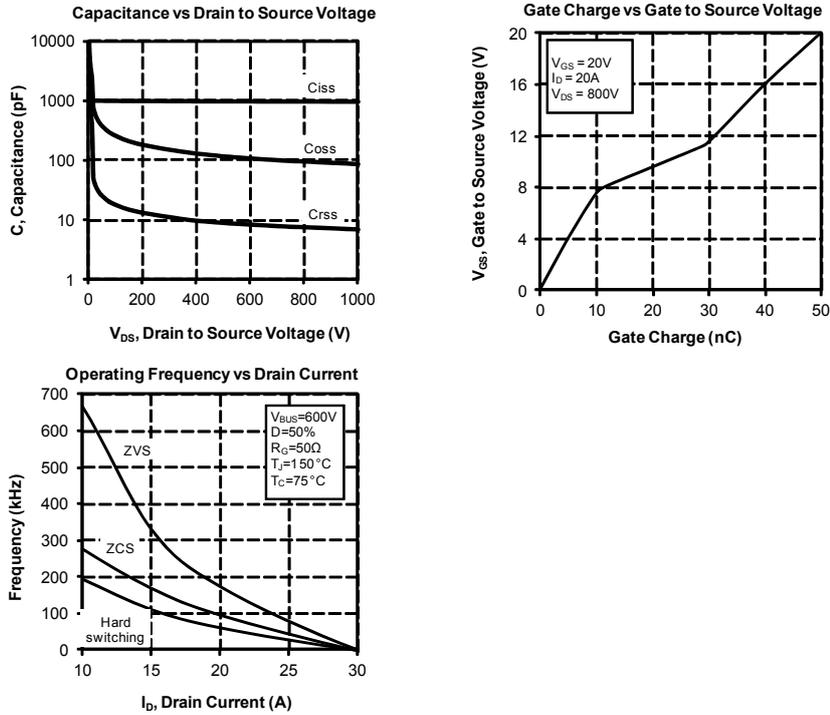
Symbol	Characteristic	Min	Typ	Max	Unit	
V _{ISOL}	RMS Isolation Voltage, any terminal to case t=1 min, 50/60Hz		4000		V	
T _J	Operating junction temperature range	SiC MOSFET	-40	150	°C	
		SiC Diode	-40	175		
T _{JOP}	Recommended junction temperature under switching conditions		-40	T _{Jmax} -25	°C	
T _{STG}	Storage Temperature Range		-40	125		
T _C	Operating Case Temperature		-40	125		
Torque	Mounting torque	To heatsink	M4	2	3	N.m
Wt	Package Weight				110	g

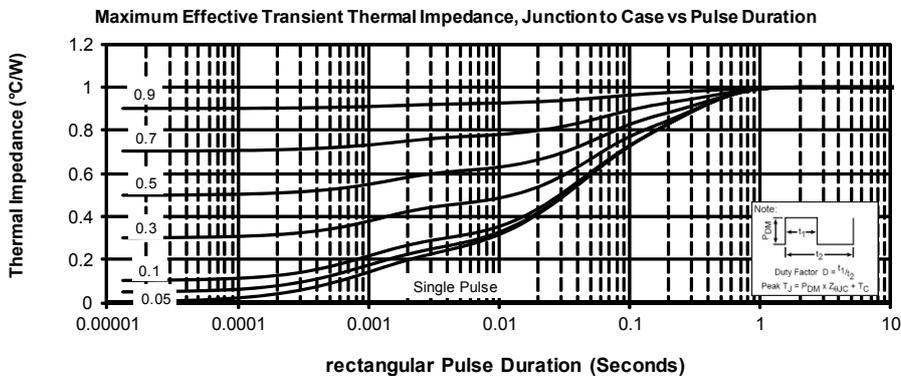
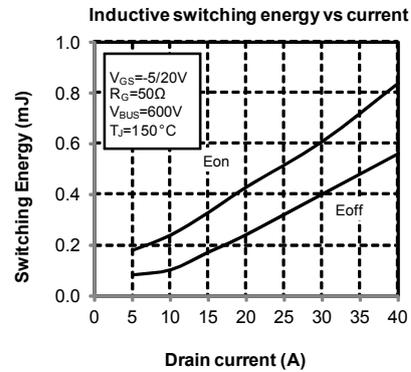
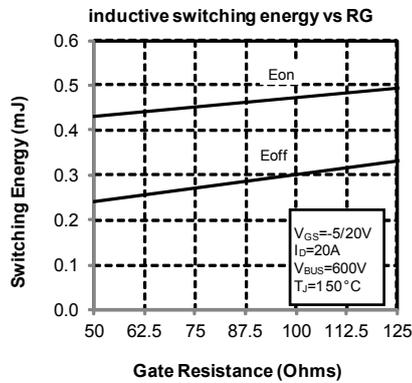
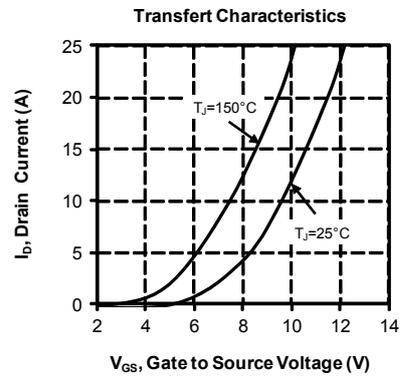
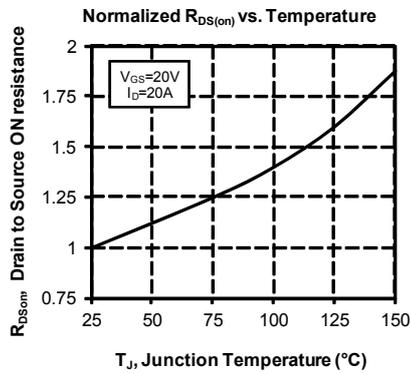
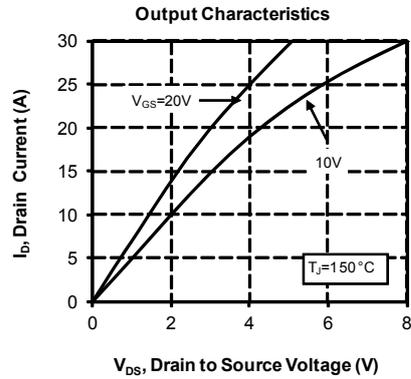
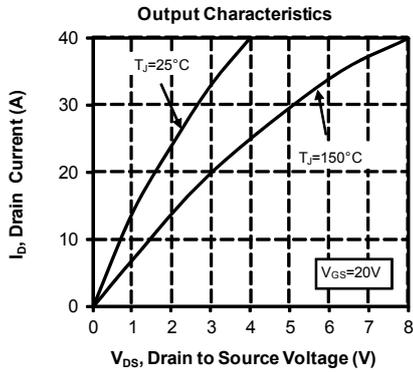
SP3 Package outline (dimensions in mm)



See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

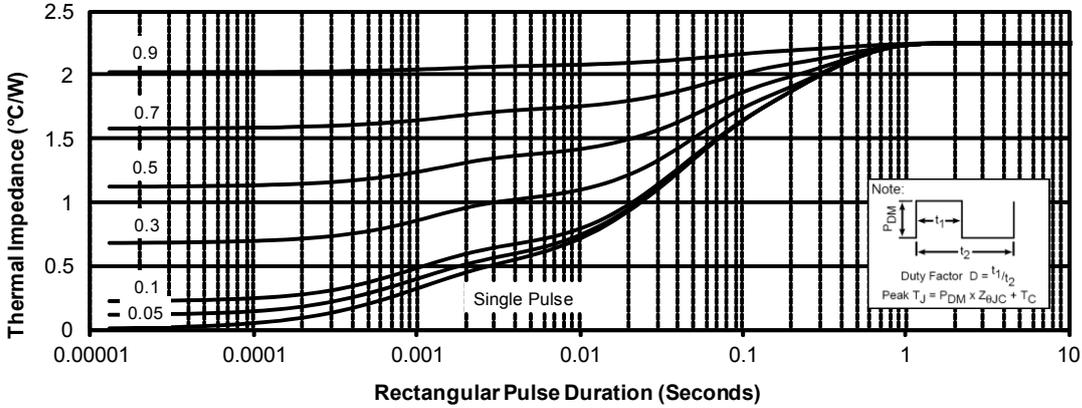
Q1 to Q4 Typical performance curve



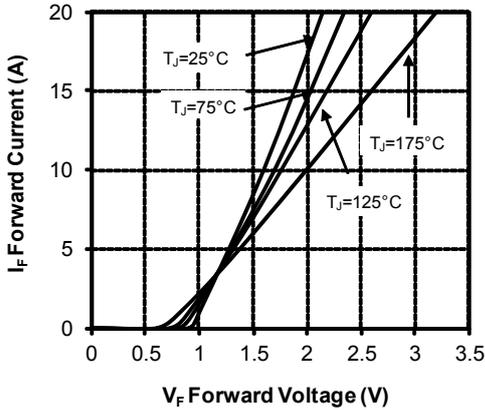


CR5 & CR6 Typical performance curve

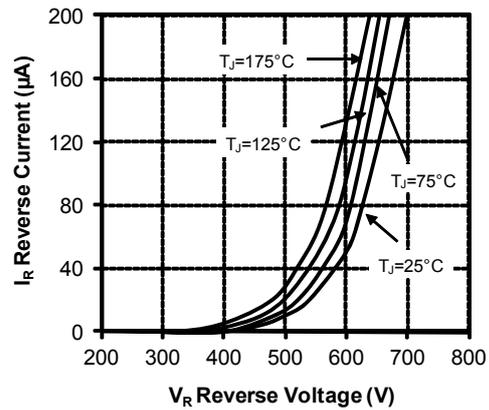
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



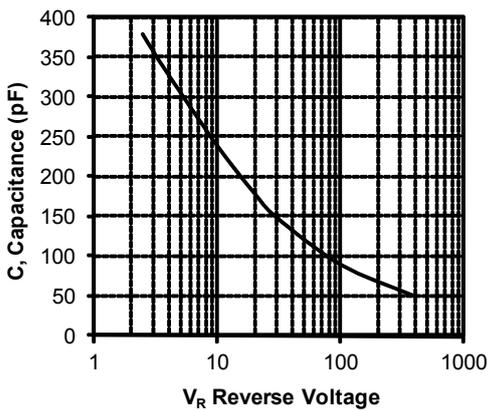
Forward Characteristics

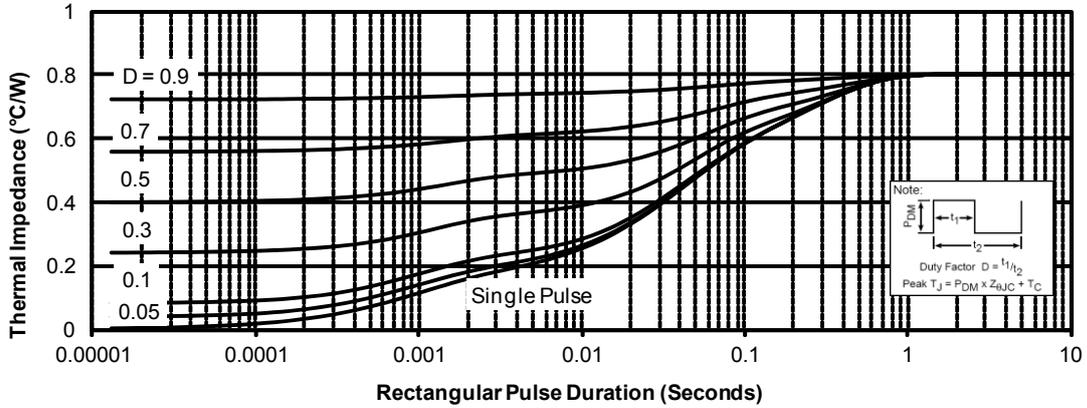
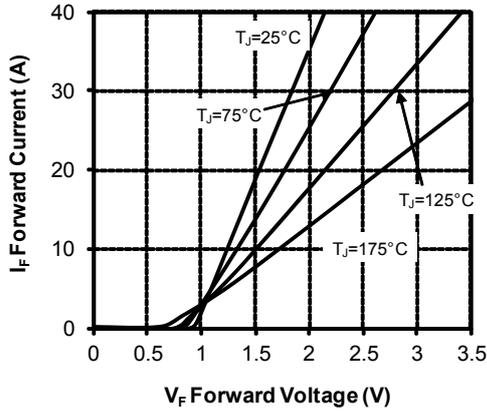
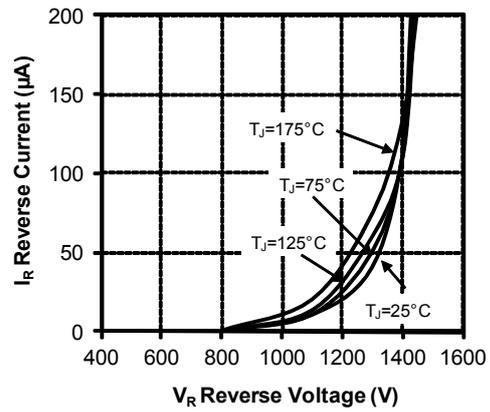
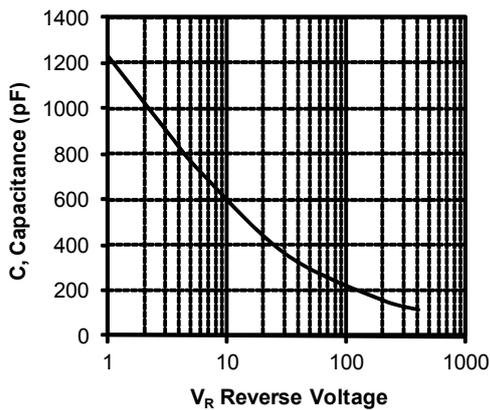


Reverse Characteristics



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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