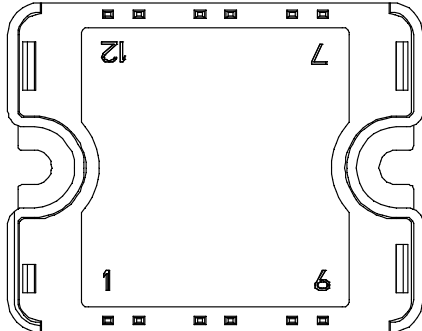
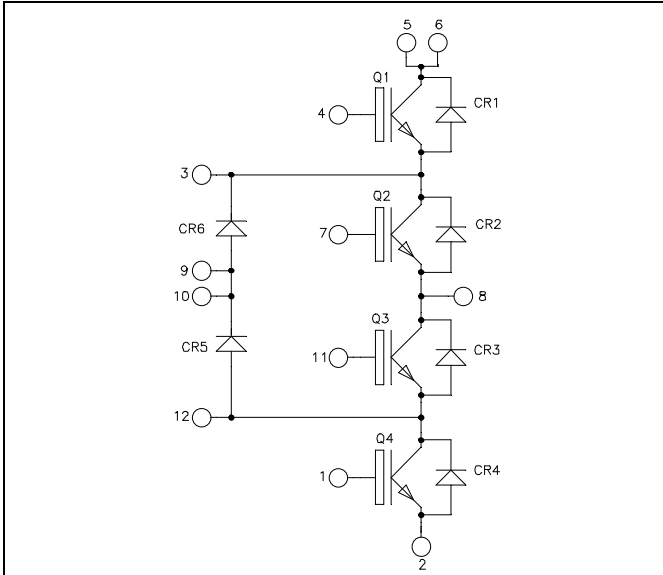


**Three level inverter  
Trench + Field Stop IGBT  
Power Module**

**$V_{CES} = 600V$   
 $I_C = 30A @ T_c = 80^\circ C$**



All multiple inputs and outputs must be shorted together  
5/6 ; 9/10

### Application

- Solar converter
- Uninterruptible Power Supplies

### Features

- Trench + Field Stop IGBT Technology
  - Low voltage drop
  - Low tail current
  - Switching frequency up to 20 kHz
  - Soft recovery parallel diodes
  - Low diode VF
  - Low leakage current
  - RBSOA and SCSOA rated
- Very low stray inductance
- High level of integration

### 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 Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
$V_{CES}$	Collector - Emitter Breakdown Voltage	600	V
$I_C$	Continuous Collector Current	$T_c = 25^\circ C$	50
		$T_c = 80^\circ C$	30
$I_{CM}$	Pulsed Collector Current	$T_c = 25^\circ C$	60
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	90
RBSOA	Reverse Bias Safe Operating Area	$T_J = 150^\circ C$	60A @ 550V

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.  
See application note APT0502 on [www.microsemi.com](http://www.microsemi.com)

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

**Q1 to Q4 Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$I_{CES}$	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}, V_{CE} = 600\text{V}$			250	$\mu\text{A}$
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 30\text{A}$	$T_j = 25^\circ\text{C}$	1.5	1.9	V
			$T_j = 150^\circ\text{C}$	1.7		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 400\mu\text{A}$	5.0	5.8	6.5	V
$I_{GES}$	Gate – Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			300	nA

**Q1 to Q4 Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	$V_{GE} = 0\text{V}$		1600		pF
$C_{oes}$	Output Capacitance	$V_{CE} = 25\text{V}$		110		
$C_{res}$	Reverse Transfer Capacitance	$f = 1\text{MHz}$		50		
$Q_G$	Gate charge	$V_{GE} = \pm 15\text{V}, I_C = 30\text{A}$ $V_{CE} = 300\text{V}$		0.3		$\mu\text{C}$
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $25^\circ\text{C}$ )		110		ns
$T_r$	Rise Time	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$		45		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 30\text{A}$		200		
$T_f$	Fall Time	$R_G = 10\Omega$		40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $150^\circ\text{C}$ )		120		ns
$T_r$	Rise Time	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$		50		
$T_{d(off)}$	Turn-off Delay Time	$I_C = 30\text{A}$		250		
$T_f$	Fall Time	$R_G = 10\Omega$		60		
$E_{on}$	Turn-on Switching Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$	$T_j = 25^\circ\text{C}$	0.16		mJ
			$T_j = 150^\circ\text{C}$	0.3		
$E_{off}$	Turn-off Switching Energy	$I_C = 30\text{A}$ $R_G = 10\Omega$	$T_j = 25^\circ\text{C}$	0.7		mJ
			$T_j = 150^\circ\text{C}$	1.05		
$I_{sc}$	Short Circuit data	$V_{GE} \leq 15\text{V}; V_{Bus} = 360\text{V}$ $t_p \leq 6\mu\text{s}; T_j = 150^\circ\text{C}$		150		A
$R_{thJC}$	Junction to Case Thermal Resistance				1.6	$^\circ\text{C/W}$

**CR1 to CR4 diode ratings and characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage			600			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =600V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C			150 350	μA
I <sub>F</sub>	DC Forward Current		T <sub>c</sub> = 80°C		20		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.6 1.5	2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 20A V <sub>R</sub> = 300V di/dt = 1600A/μs	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		100 150		ns
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.1 2.3		μC
E <sub>rr</sub>	Reverse Recovery Energy		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		0.23 0.50		mJ
R <sub>thJC</sub>	Junction to Case Thermal Resistance					3.25	°C/W

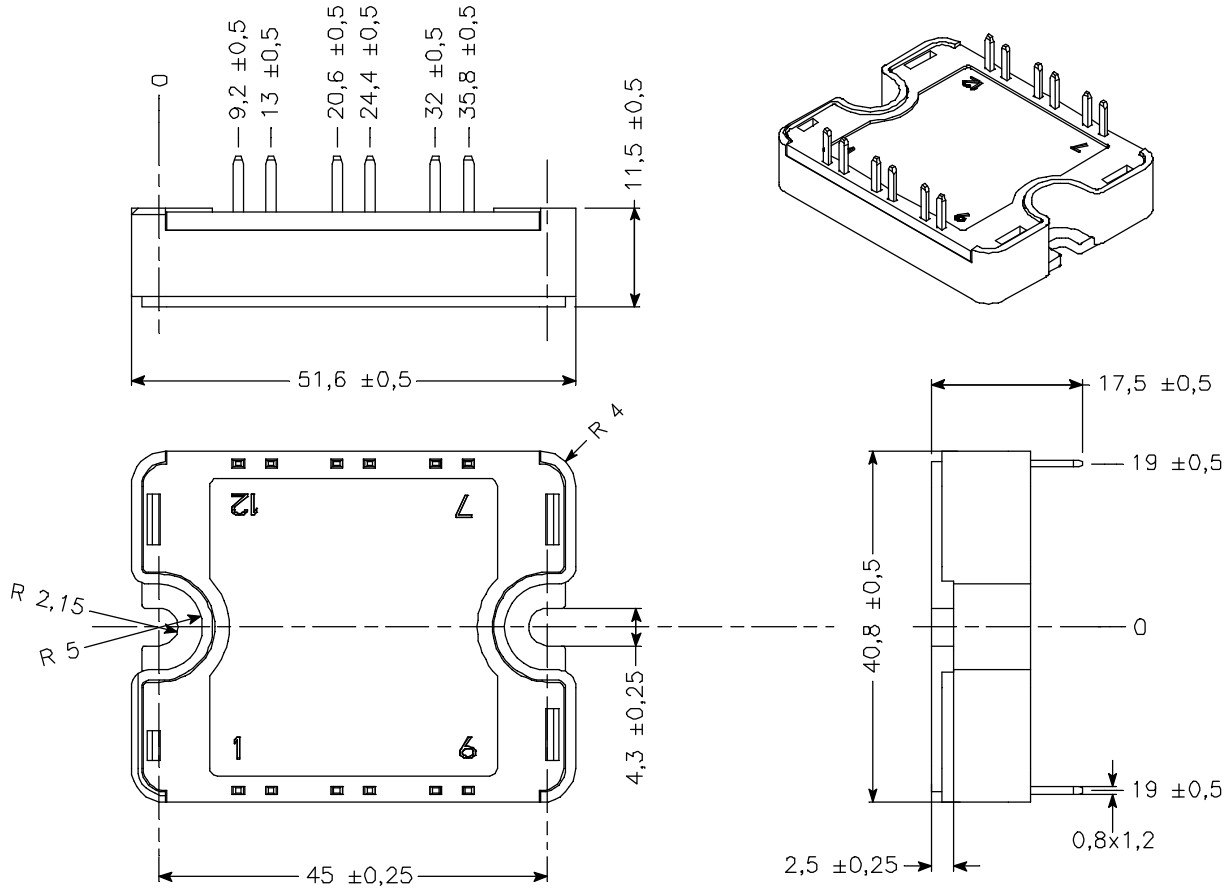
**CR5 & CR6 diode ratings and characteristics**

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>RRM</sub>	Maximum Peak Repetitive Reverse Voltage			600			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =600V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C			150 350	μA
I <sub>F</sub>	DC Forward Current		T <sub>c</sub> = 80°C		30		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 30A V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.6 1.5	2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 30A V <sub>R</sub> = 300V di/dt = 1800A/μs	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		100 150		ns
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.5 3.1		μC
E <sub>rr</sub>	Reverse Recovery Energy		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		0.34 0.75		mJ
R <sub>thJC</sub>	Junction to Case Thermal Resistance					2.45	°C/W

**Thermal and package characteristics**

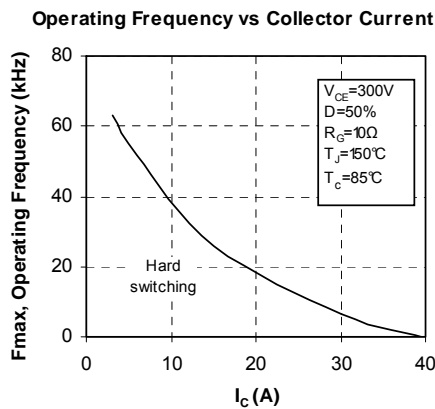
<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, I <sub>isol</sub> < 1mA, 50/60Hz	2500			V	
T <sub>J</sub>	Operating junction temperature range	-40		175	°C	
T <sub>STG</sub>	Storage Temperature Range	-40		125		
T <sub>C</sub>	Operating Case Temperature	-40		100		
Torque	Mounting torque	To heatsink	M4	2.5	4.7	N.m
Wt	Package Weight				80	g

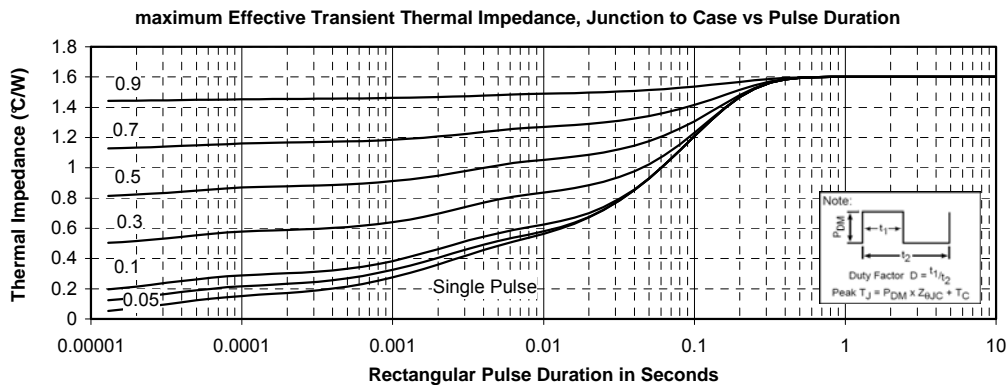
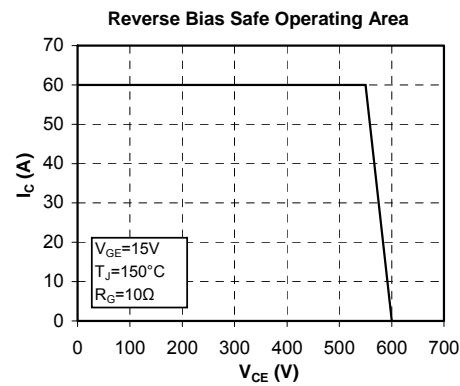
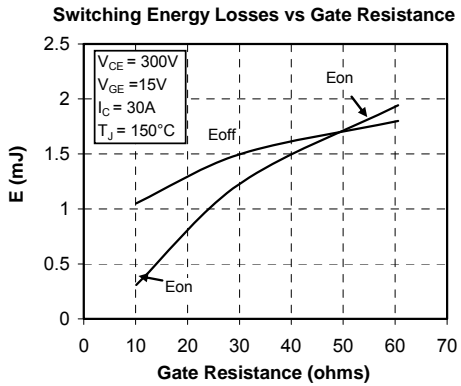
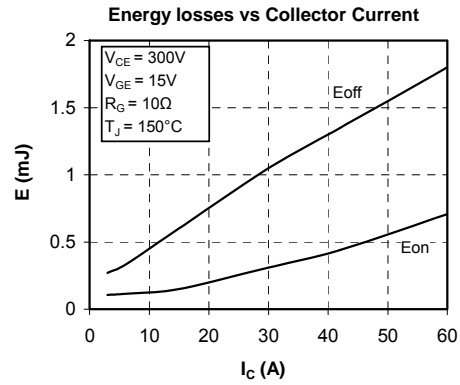
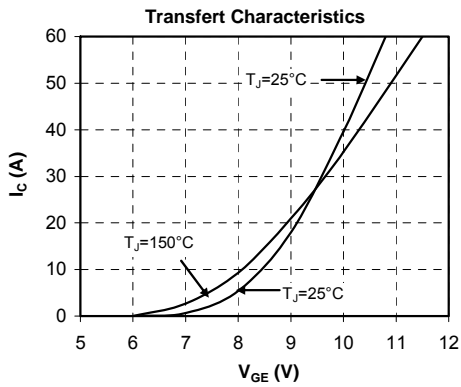
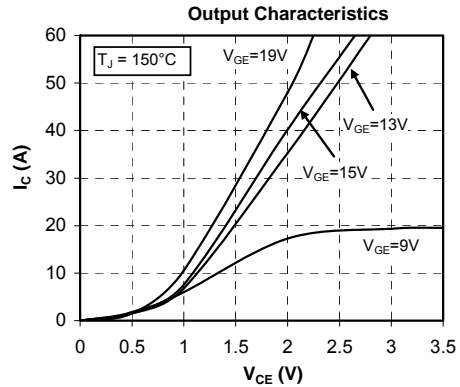
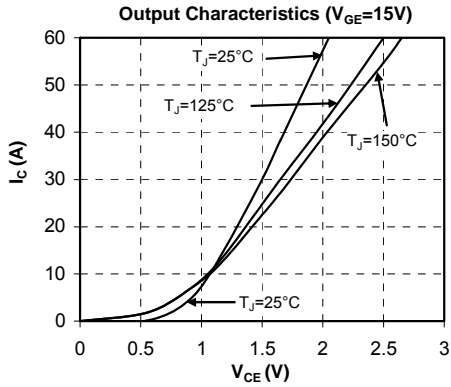
**SP1 Package outline** (dimensions in mm)

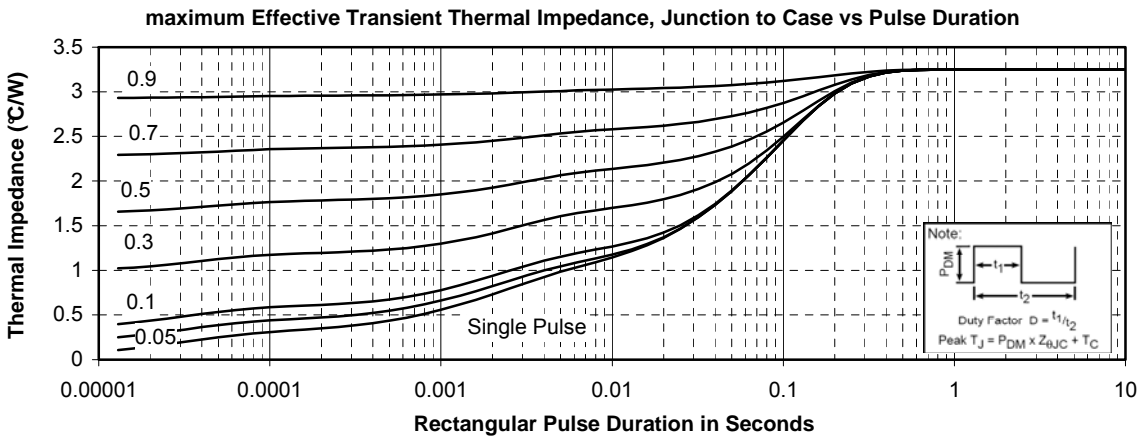
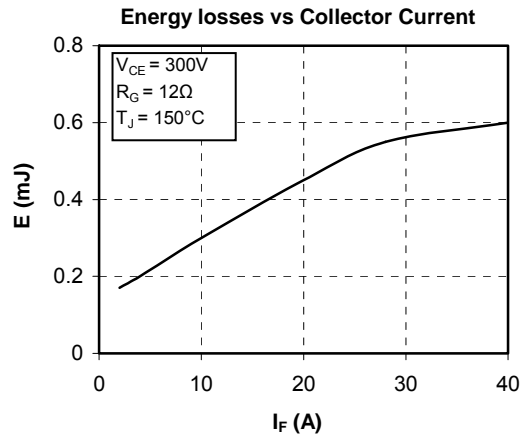
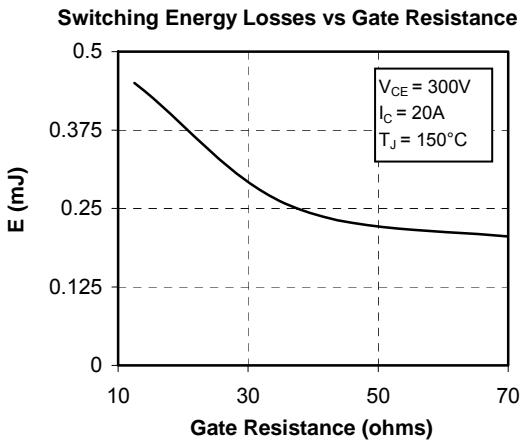
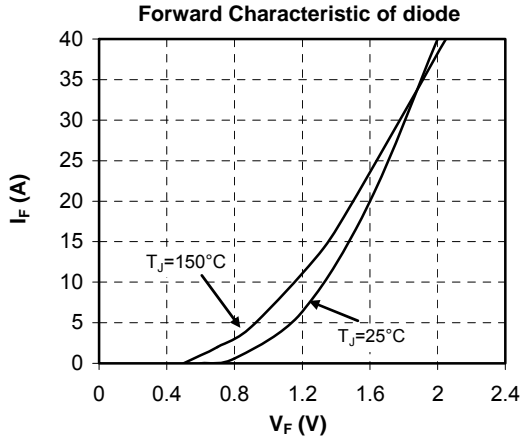


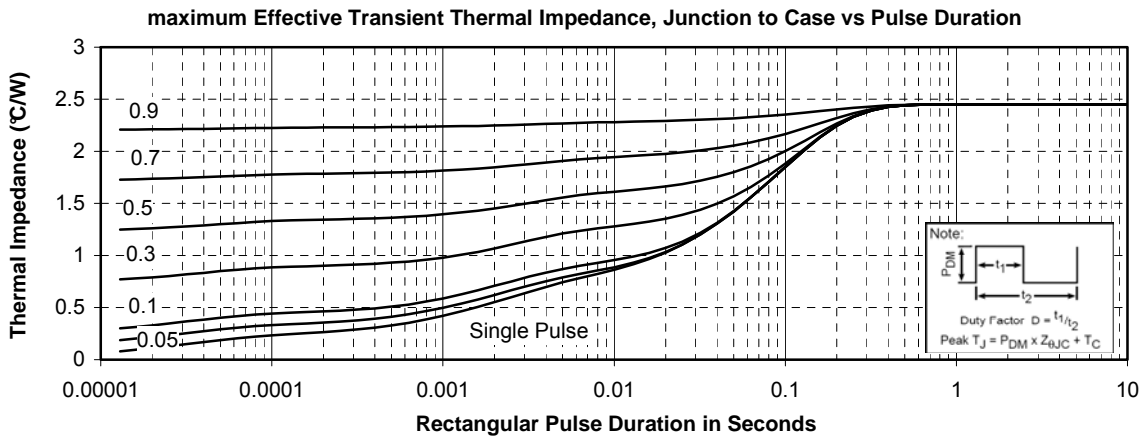
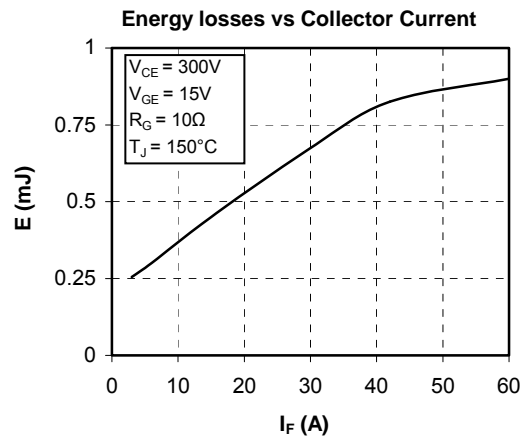
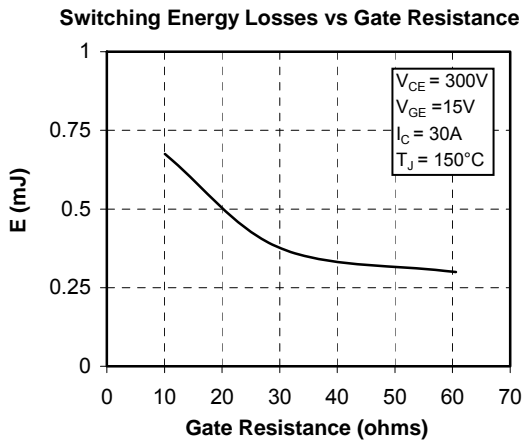
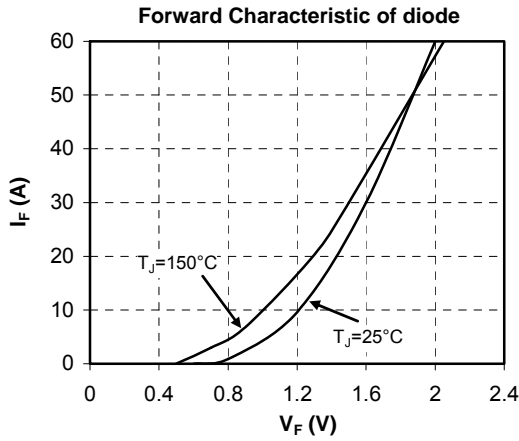
See application note 1904 - Mounting Instructions for SP1 Power Modules on [www.microsemi.com](http://www.microsemi.com)

**Q1 to Q4 Typical performance curve**





**CR1 to CR4 Typical performance curve**


**CR5 & CR6 Typical performance curve**


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