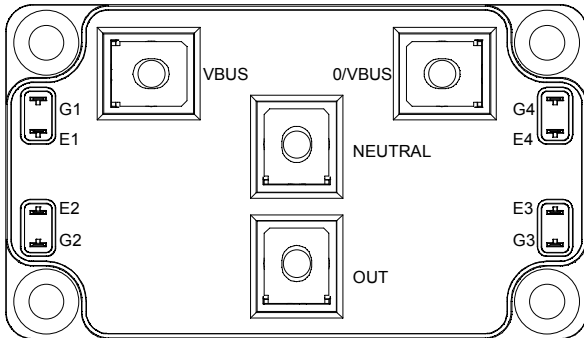
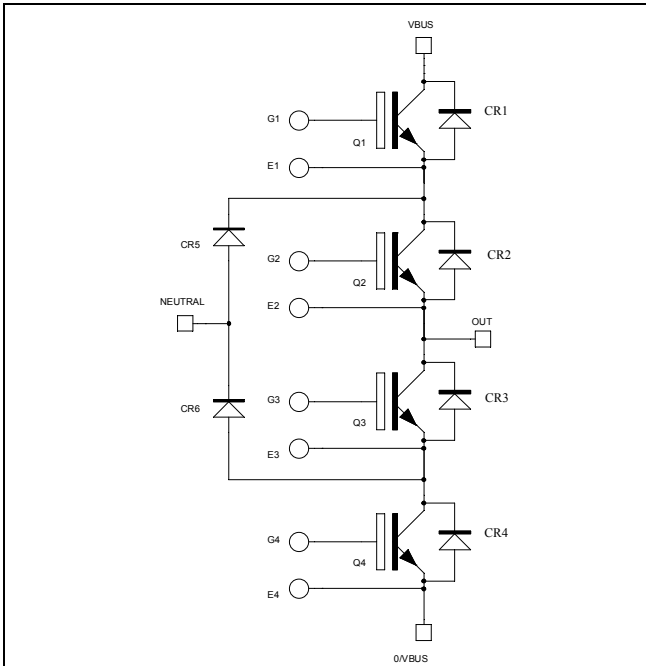


**Three level inverter  
Trench + Field Stop IGBT4  
Power Module**

**$V_{CES} = 1200V$   
 $I_C = 240A @ T_c = 80^\circ C$**



### Application

- Solar converter
- Uninterruptible Power Supplies

### Features

- Trench + Field Stop IGBT 4 Technology
  - Low voltage drop
  - Low leakage current
  - Low switching losses
  - Soft recovery parallel diodes
  - Low diode VF
  - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- Very low stray inductance
  - Symmetrical design
  - M5 power connectors
- 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	1200	V
$I_C$	Continuous Collector Current	$T_c = 25^\circ C$	305
		$T_c = 80^\circ C$	240
$I_{CM}$	Pulsed Collector Current	$T_c = 25^\circ C$	400
$V_{GE}$	Gate - Emitter Voltage	$\pm 20$	V
$P_D$	Maximum Power Dissipation	$T_c = 25^\circ C$	1000
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150^\circ C$	400A @ 1150V

**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	$V_{GE} = 0V$ ; $V_{CE} = 1200V$			2	mA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15V$ $I_C = 200A$	$T_j = 25^\circ\text{C}$	1.8	2.2	V
			$T_j = 150^\circ\text{C}$	2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}$ , $I_C = 5\text{ mA}$	5	5.8	6.5	V

**Q1 to Q4 Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{ies}$	Input Capacitance	$V_{GE} = 0V$		12.3		nF
$C_{oes}$	Output Capacitance	$V_{CE} = 25V$		0.8		
$C_{res}$	Reverse Transfer Capacitance	$f = 1\text{MHz}$		0.69		
$Q_G$	Gate charge	$V_{GE} = \pm 15V$		1.7		$\mu\text{C}$
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $25^\circ\text{C}$ ) $V_{GE} = \pm 15V$ $V_{CE} = 600V$ $I_C = 200A$ $R_G = 3.6\Omega$		160		ns
$T_r$	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			340		
$T_f$	Fall Time			80		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching ( $150^\circ\text{C}$ ) $V_{GE} = \pm 15V$ $V_{CE} = 600V$ $I_C = 200A$ $R_G = 3.6\Omega$		170		ns
$T_r$	Rise Time			40		
$T_{d(off)}$	Turn-off Delay Time			450		
$T_f$	Fall Time			170		
$E_{on}$	Turn-on Switching Energy	$V_{GE} = \pm 15V$ $V_{CE} = 600V$ $I_C = 200A$ $R_G = 3.6\Omega$	$T_j = 25^\circ\text{C}$	10.4		mJ
			$T_j = 150^\circ\text{C}$	21		
$E_{off}$	Turn-off Switching Energy	$I_C = 200A$ $R_G = 3.6\Omega$	$T_j = 25^\circ\text{C}$	11		mJ
			$T_j = 150^\circ\text{C}$	18.6		
$I_{SC}$	Short circuit current	$V_{GE} \leq 15V$ ; $V_{CC} = 900V$ $t_p \leq 10\mu\text{s}$ ; $T_j = 150^\circ\text{C}$		1000		A
$R_{thJC}$	Junction to Case Thermal Resistance				0.15	$^\circ\text{C/W}$

**CR1 to CR4 diode ratings and characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{RRM}$	Maximum Peak Repetitive Reverse Voltage		1200			V
$I_{RM}$	Maximum Reverse Leakage Current	$V_R = 1200V$			150	$\mu\text{A}$
					400	
$I_F$	DC Forward Current			180		A
$V_F$	Diode Forward Voltage	$I_F = 150A$ $V_{GE} = 0V$	$T_j = 25^\circ\text{C}$	1.7	2.2	V
			$T_j = 150^\circ\text{C}$	1.65		
$t_{rr}$	Reverse Recovery Time	$I_F = 150A$ $V_R = 600V$ $di/dt = 3800A/\mu\text{s}$	$T_j = 25^\circ\text{C}$	155		ns
			$T_j = 150^\circ\text{C}$	300		
$Q_{rr}$	Reverse Recovery Charge		$T_j = 25^\circ\text{C}$	14.6		$\mu\text{C}$
			$T_j = 150^\circ\text{C}$	30.4		
$E_{rr}$	Reverse Recovery Energy		$T_j = 25^\circ\text{C}$	5.2		mJ
			$T_j = 150^\circ\text{C}$	11		
$R_{thJC}$	Junction to Case Thermal Resistance				0.32	$^\circ\text{C/W}$

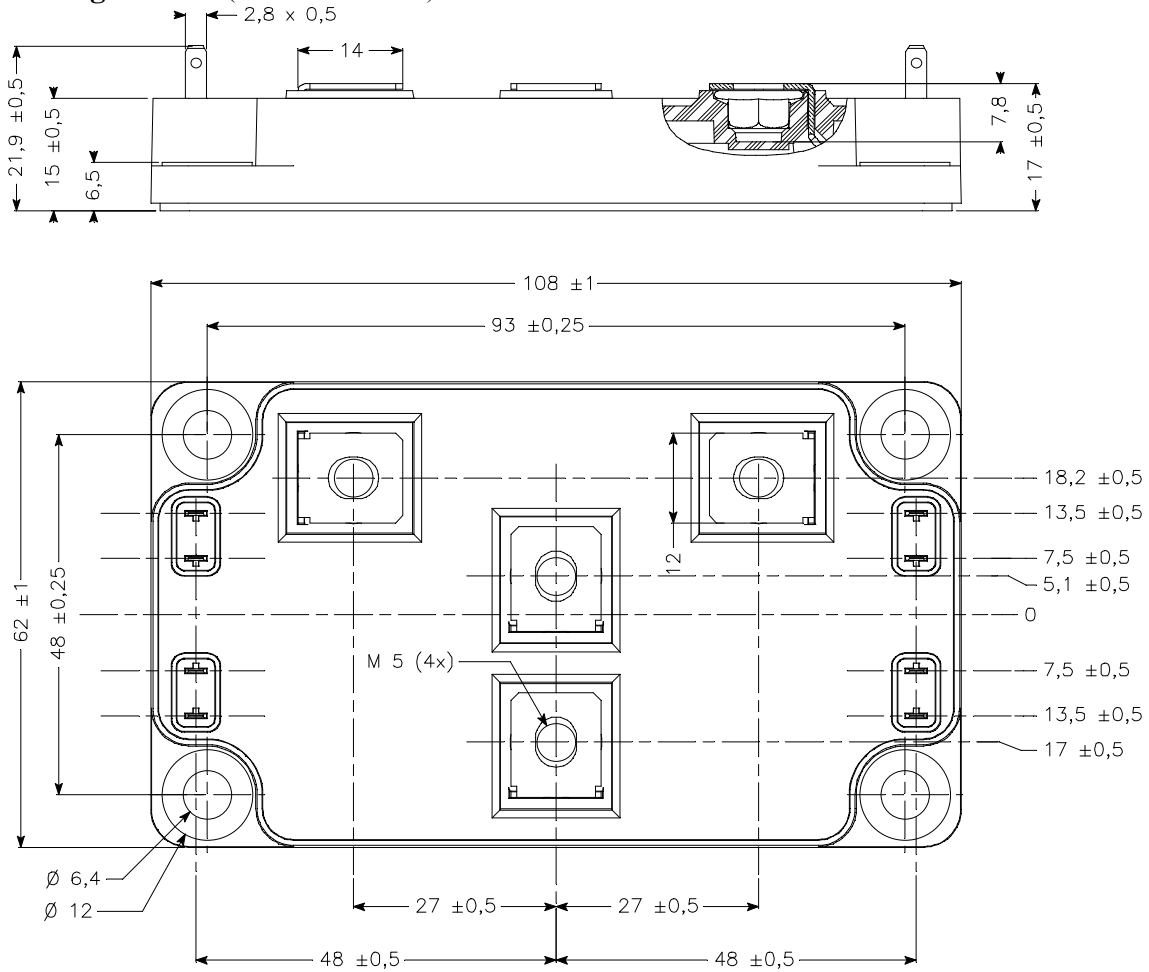
**CR5 & CR6 diode ratings and characteristics**

<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			1200			V
I <sub>RM</sub>	Maximum Reverse Leakage Current	V <sub>R</sub> =1200V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C			150 400	μA
I <sub>F</sub>	DC Forward Current		T <sub>c</sub> = 80°C		240		A
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 200A V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		1.9 1.85	2.4	V
t <sub>rr</sub>	Reverse Recovery Time		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		155 300		ns
Q <sub>rr</sub>	Reverse Recovery Charge	I <sub>F</sub> = 200A V <sub>R</sub> = 600V di/dt = 4000A/μs	T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		18.6 39		μC
E <sub>rr</sub>	Reverse Recovery Energy		T <sub>j</sub> = 25°C T <sub>j</sub> = 150°C		8.2 16		mJ
R <sub>thJC</sub>	Junction to Case Thermal Resistance					0.25	°C/W

**Thermal and package characteristics**

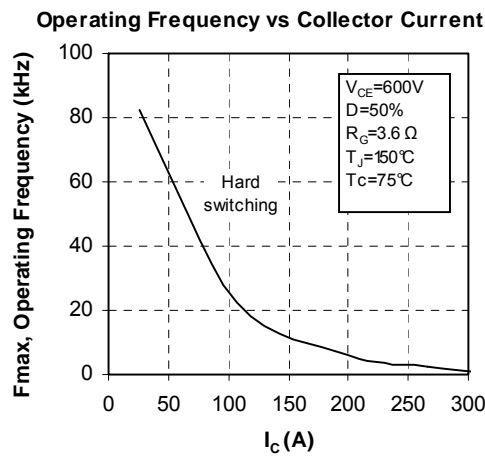
<i>Symbol</i>	<i>Characteristic</i>			<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V <sub>ISOL</sub>	RMS Isolation Voltage, any terminal to case t = 1 min, I <sub>isol</sub> < 1mA, 50/60Hz			4000			V
T <sub>J</sub>	Operating junction temperature range			-40		175	°C
T <sub>STG</sub>	Storage Temperature Range			-40		125	
T <sub>C</sub>	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
		For terminals	M5	2		3.5	
Wt	Package Weight					300	g

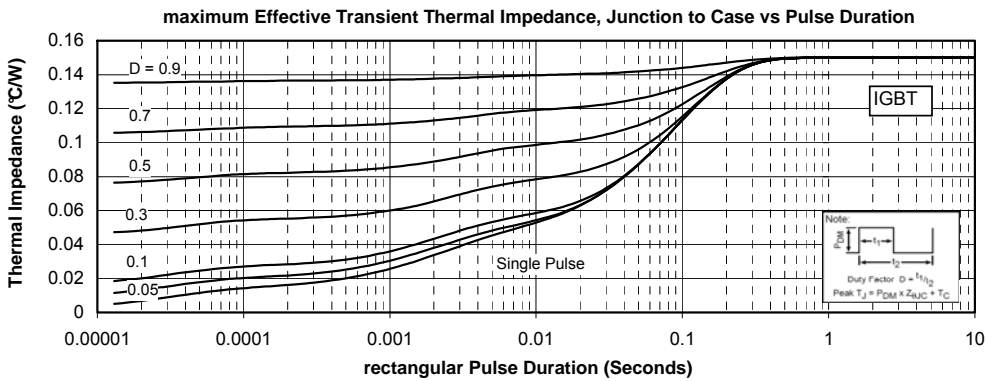
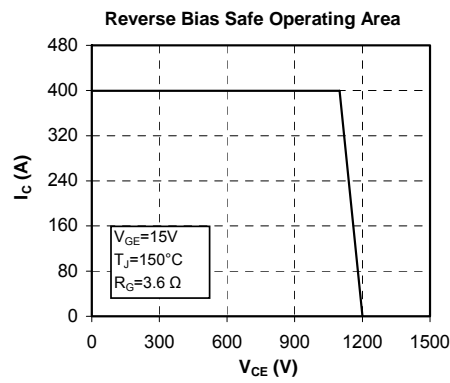
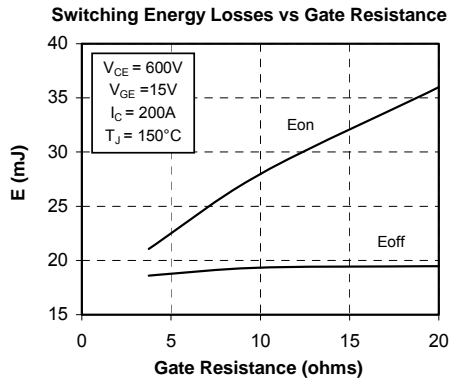
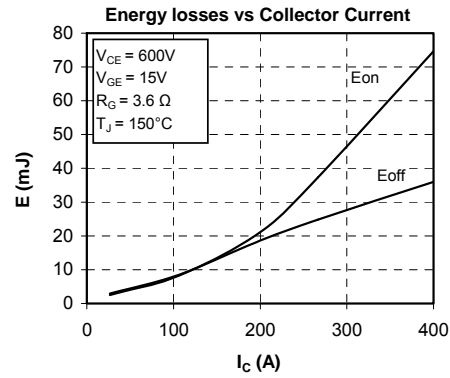
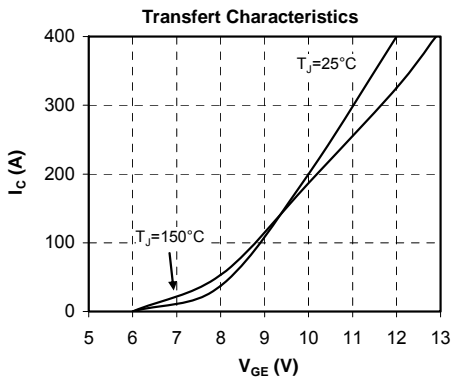
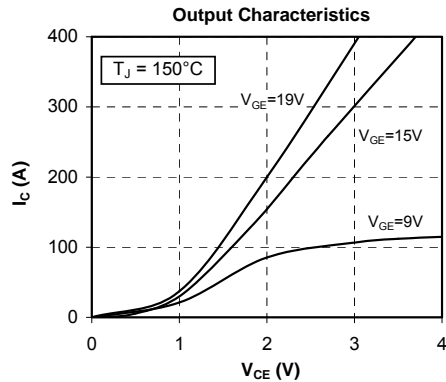
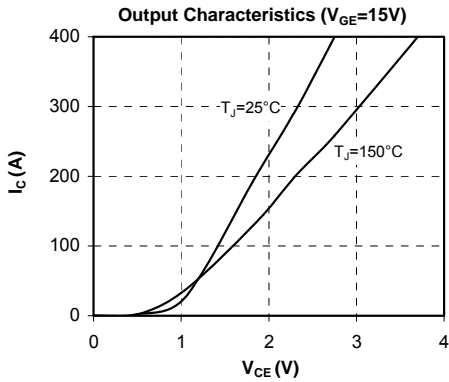
**SP6 Package outline** (dimensions in mm)

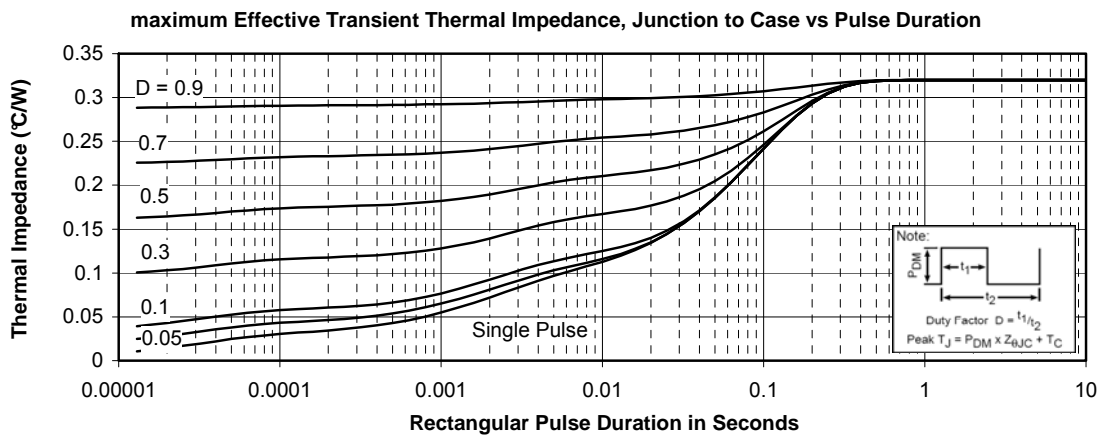
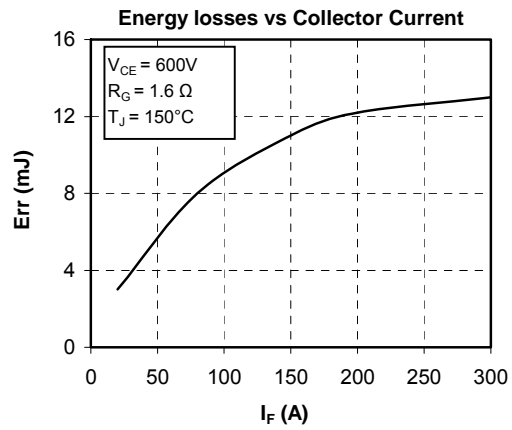
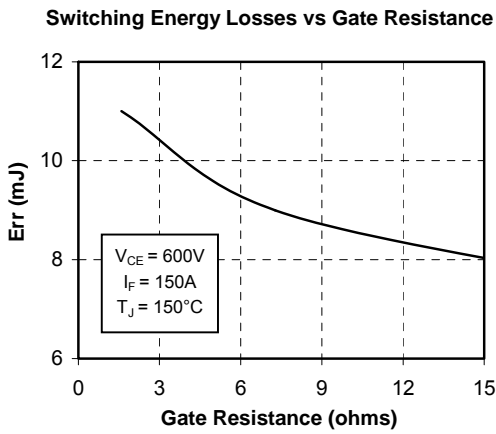
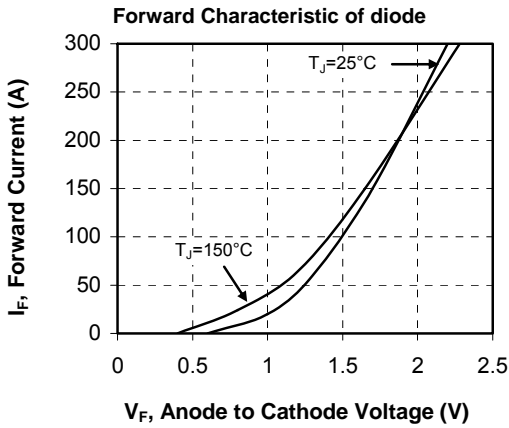


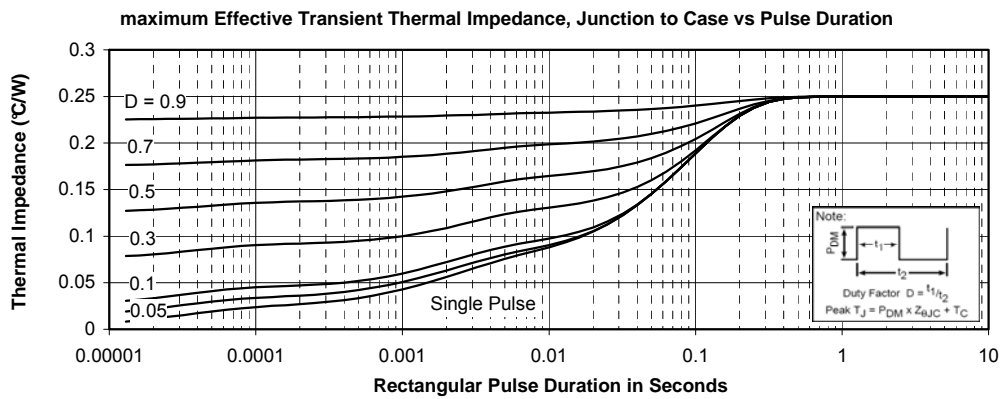
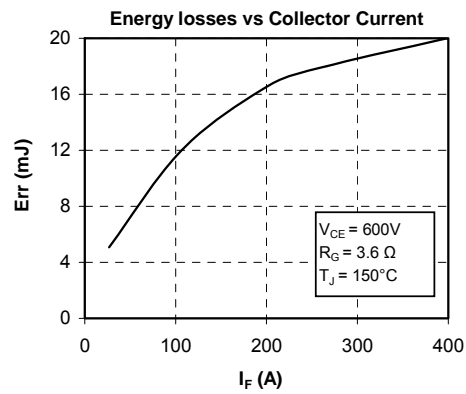
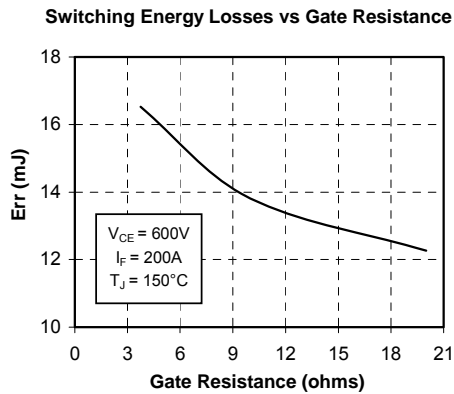
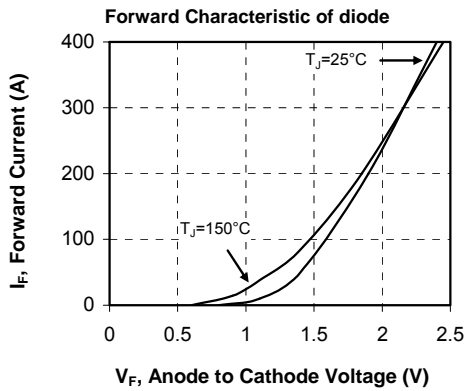
See application note APT0601 - Mounting Instructions for SP6 Power Modules on [www.microsemi.com](http://www.microsemi.com)

**Q1 to Q4 Typical performance curve**





**CR1 to CR4 Typical performance curve**


**CR5 & CR6 Typical performance curve**


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