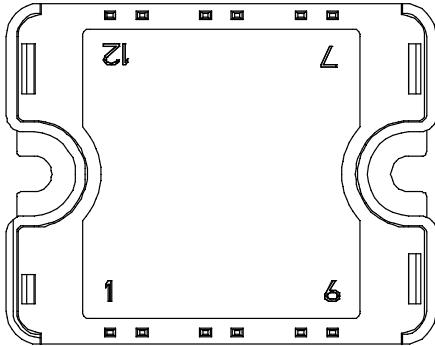
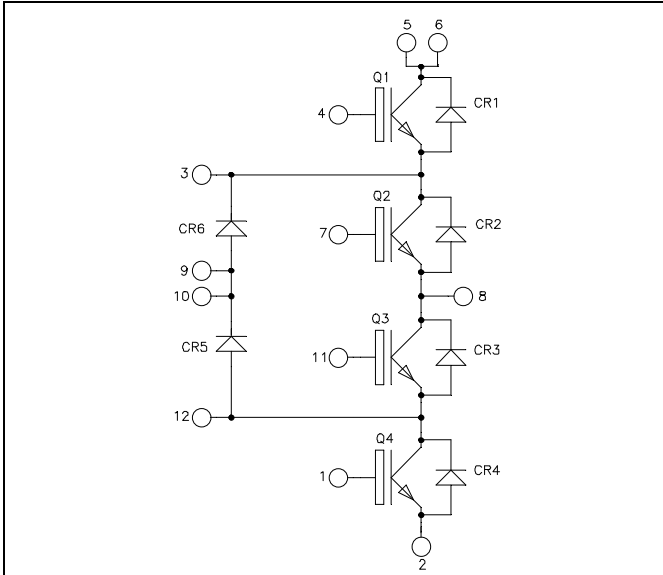


**Three level inverter
NPT IGBT Power Module**

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



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

Application

- Solar converter
- Uninterruptible Power Supplies

Features

- Non Punch Through (NPT) Fast IGBT
 - Low voltage drop
 - Low tail current
 - Switching frequency up to 100 kHz
 - Soft recovery parallel diodes
 - Low diode VF
 - Low leakage current
 - RBSOA and SCSOA rated
- Kelvin emitter for easy drive
- 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	$T_c = 25^\circ C$	42
		$T_c = 80^\circ C$	30
I_{CM}	Pulsed Collector Current	$T_c = 25^\circ C$	100
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	140
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125^\circ C$	60A@500V

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.
See application note APT0502 on 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	$V_{GE} = 0V$ $V_{CE} = 600V$	$T_j = 25^\circ\text{C}$			250	μA
			$T_j = 125^\circ\text{C}$			500	
$V_{CE(on)}$	Collector Emitter on Voltage	$V_{GE} = 15V$ $I_C = 30A$	$T_j = 25^\circ\text{C}$	1.7	2.0	2.45	V
			$T_j = 125^\circ\text{C}$		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE2}, I_C = 1mA$	4		6	V	
I_{GES}	Gate – Emitter Leakage Current	$V_{GE} = 20V, V_{CE} = 0V$			400	nA	

Q1 to Q4 Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1MHz$		1350		pF
C_{oes}	Output Capacitance			193		
C_{res}	Reverse Transfer Capacitance			120		
Q_g	Total gate Charge	$V_{GE} = 15V$ $V_{Bus} = 300V$ $I_C = 30A$		99		nC
Q_{ge}	Gate – Emitter Charge			10		
Q_{gc}	Gate – Collector Charge			60		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = 15V$ $V_{Bus} = 400V$ $I_C = 30A$ $R_G = 6.8\Omega$		30		ns
T_r	Rise Time			12		
$T_{d(off)}$	Turn-off Delay Time			80		
T_f	Fall Time			15		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) $V_{GE} = 15V$ $V_{Bus} = 400V$ $I_C = 30A$ $R_G = 6.8\Omega$		32		ns
T_r	Rise Time			12		
$T_{d(off)}$	Turn-off Delay Time			90		
T_f	Fall Time			21		
E_{on}	Turn-on Switching Energy	$V_{GE} = 15V$ $V_{Bus} = 400V$ $I_C = 30A$ $R_G = 6.8\Omega$	$T_j = 125^\circ\text{C}$		0.3	mJ
E_{off}	Turn-off Switching Energy			$T_j = 125^\circ\text{C}$	0.8	
I_{sc}	Short Circuit data	$V_{GE} \leq 15V ; V_{Bus} = 360V$ $t_p \leq 10\mu\text{s} ; T_j = 125^\circ\text{C}$			135	A
R_{thJC}	Junction to Case Thermal Resistance				0.9	$^\circ\text{C/W}$

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_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RM}	Maximum Reverse Leakage Current	$V_R=600V$	$T_j = 25^\circ C$			25	μA
			$T_j = 150^\circ C$			500	
I_F	DC Forward Current		$T_c = 80^\circ C$		15		A
V_F	Diode Forward Voltage	$I_F = 15A$			2	2.4	V
		$I_F = 30A$			2.5		
		$I_F = 15A$	$T_j = 125^\circ C$		1.6		
t_{rr}	Reverse Recovery Time	$I_F = 15A$ $V_R = 400V$	$T_j = 25^\circ C$		20		ns
			$T_j = 125^\circ C$		105		
Q_{rr}	Reverse Recovery Charge	$di/dt = 200A/\mu s$	$T_j = 25^\circ C$		21		nC
			$T_j = 125^\circ C$		250		
E_{rr}	Reverse Recovery Energy	$I_F = 15A$ $V_R = 400V$ $di/dt = 1000A/\mu s$	$T_j = 125^\circ C$		0.24		mJ
R_{thJC}	Junction to Case Thermal Resistance					2	$^\circ C/W$

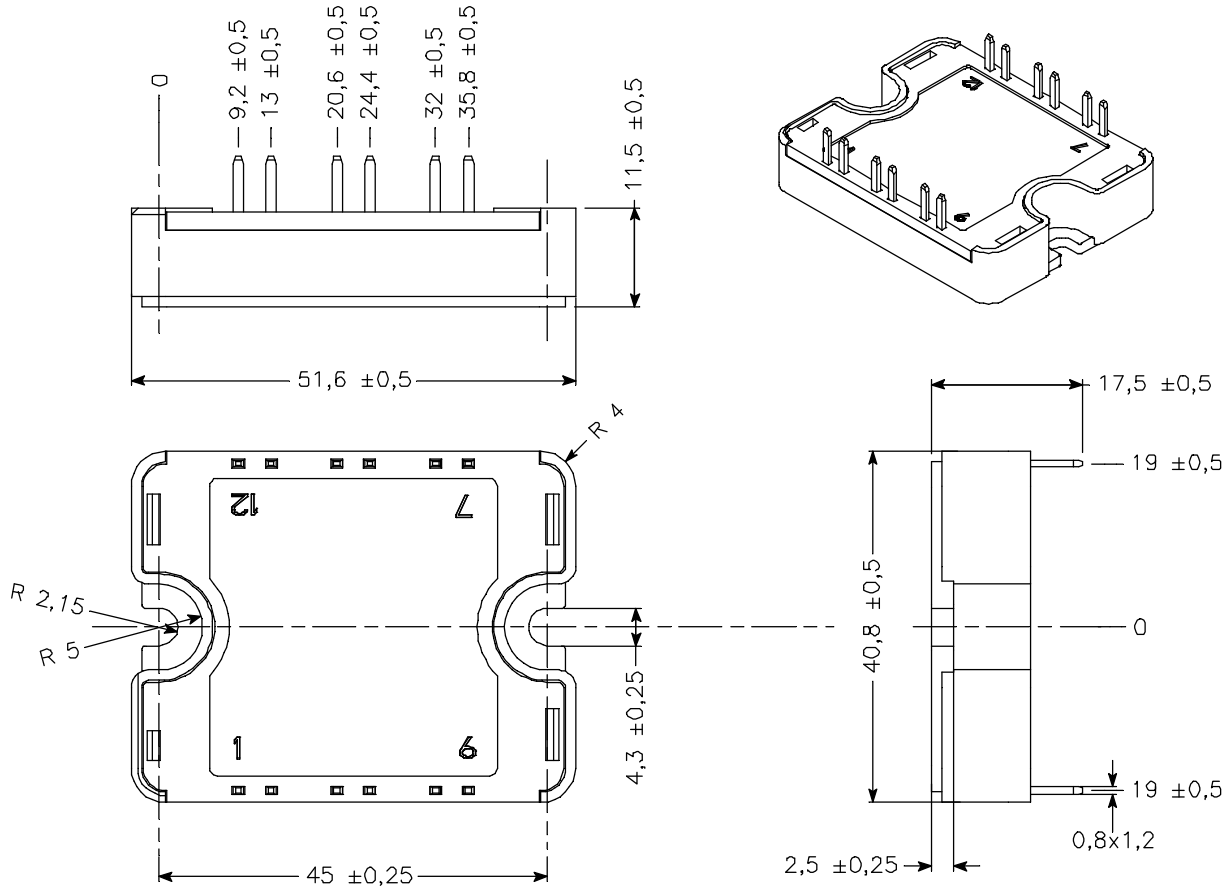
CR5 & CR6 diode ratings and characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RM}	Maximum Reverse Leakage Current	$V_R=600V$	$T_j = 25^\circ C$			25	μA
			$T_j = 150^\circ C$			500	
I_F	DC Forward Current		$T_c = 80^\circ C$		30		A
V_F	Diode Forward Voltage	$I_F = 30A$			1.8	2.2	V
		$I_F = 60A$			2.2		
		$I_F = 30A$	$T_j = 125^\circ C$		1.5		
t_{rr}	Reverse Recovery Time	$I_F = 30A$ $V_R = 400V$	$T_j = 25^\circ C$		25		ns
			$T_j = 125^\circ C$		160		
Q_{rr}	Reverse Recovery Charge	$di/dt = 200A/\mu s$	$T_j = 25^\circ C$		35		nC
			$T_j = 125^\circ C$		480		
E_{rr}	Reverse Recovery Energy	$I_F = 30A$ $V_R = 400V$ $di/dt = 1000A/\mu s$	$T_j = 125^\circ C$		0.6		mJ
R_{thJC}	Junction to Case Thermal Resistance					1.2	$^\circ C/W$

Thermal and package characteristics

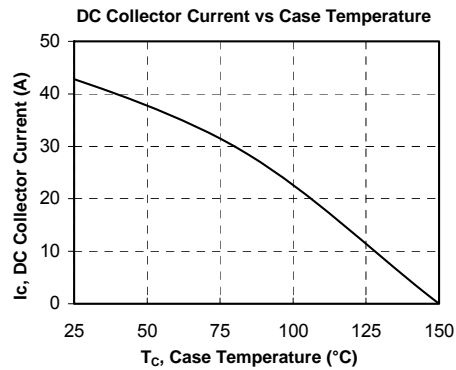
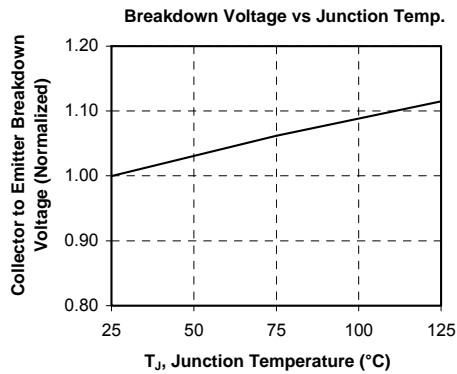
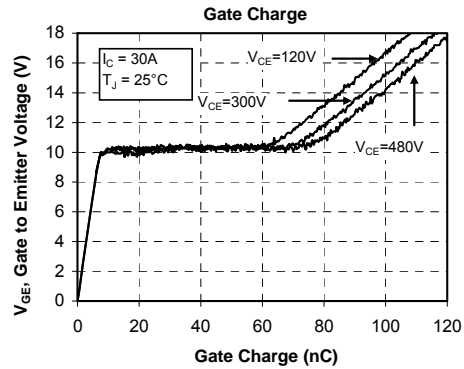
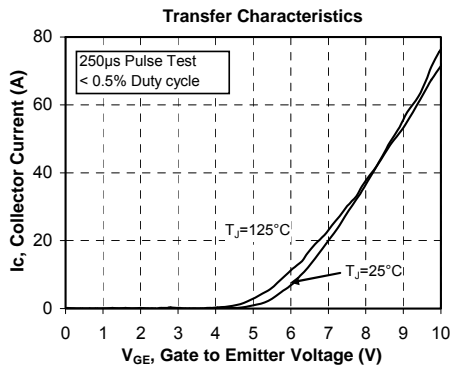
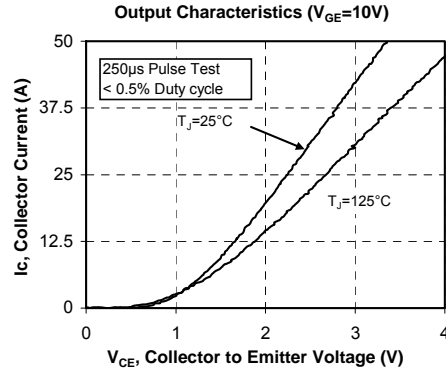
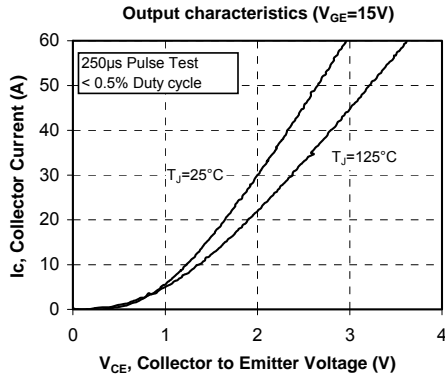
<i>Symbol</i>	<i>Characteristic</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
V_{ISOL}	RMS Isolation Voltage, any terminal to case $t=1$ min, $I_{isol} < 1mA$, 50/60Hz	2500			V	
T_j	Operating junction temperature range	-40		150	$^\circ C$	
T_{STG}	Storage Temperature Range	-40		125		
T_c	Operating 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)

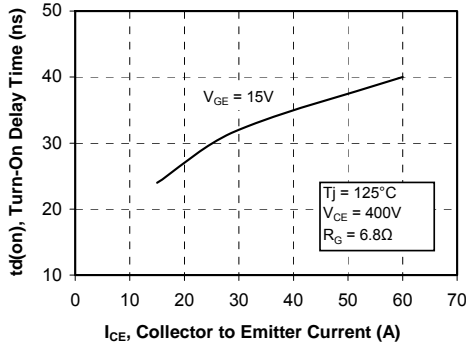


See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

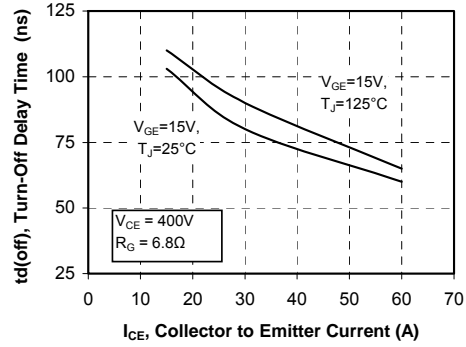
Q1 to Q4 Typical performance curve



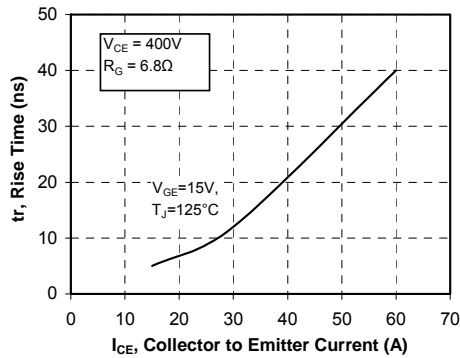
Turn-On Delay Time vs Collector Current



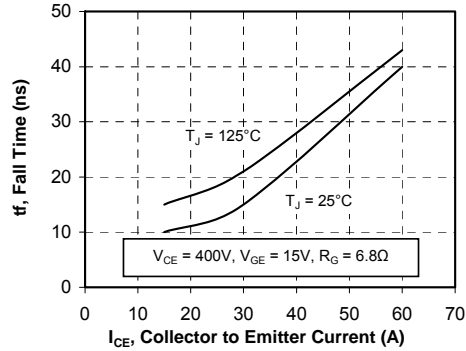
Turn-Off Delay Time vs Collector Current



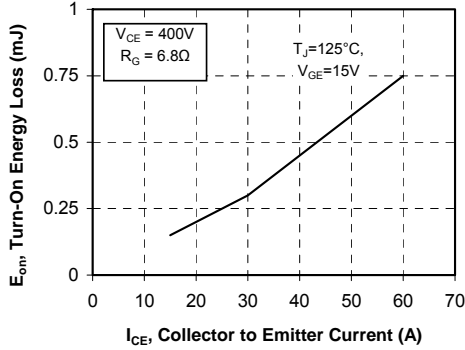
Current Rise Time vs Collector Current



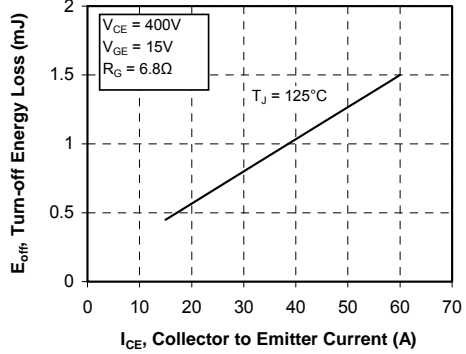
Current Fall Time vs Collector Current



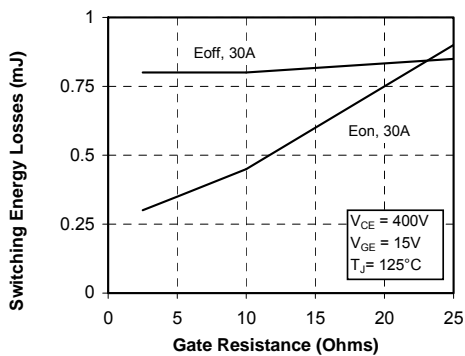
Turn-On Energy Loss vs Collector Current



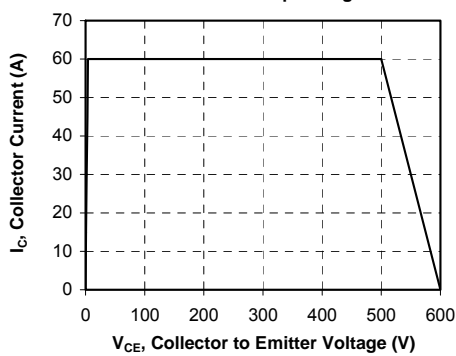
Turn-Off Energy Loss vs Collector Current

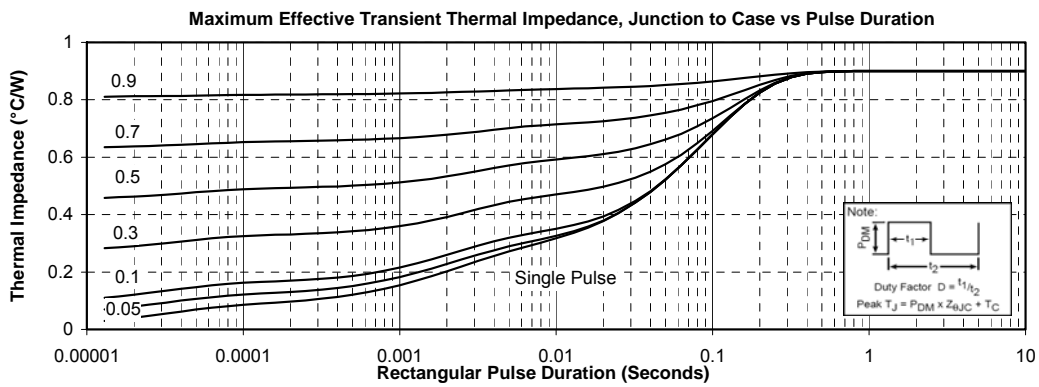
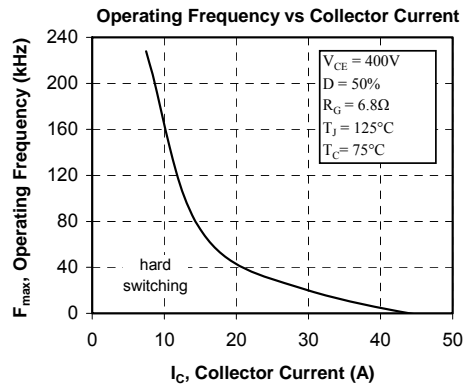
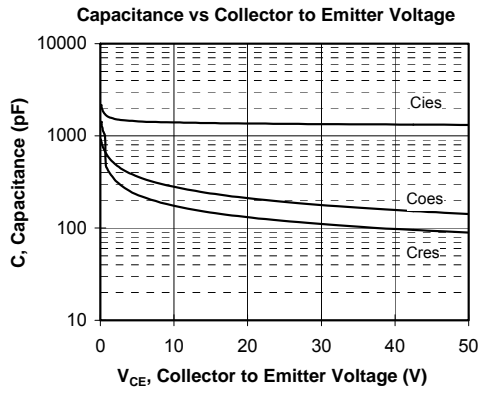


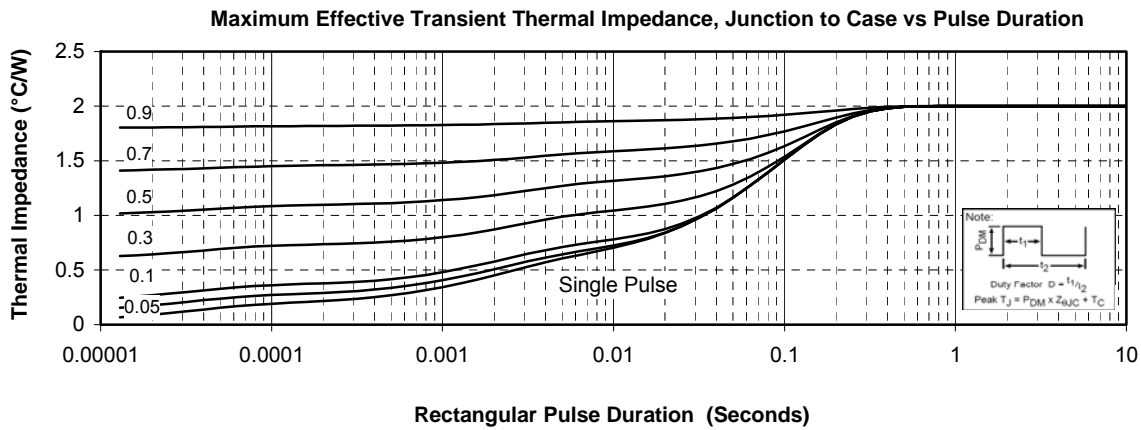
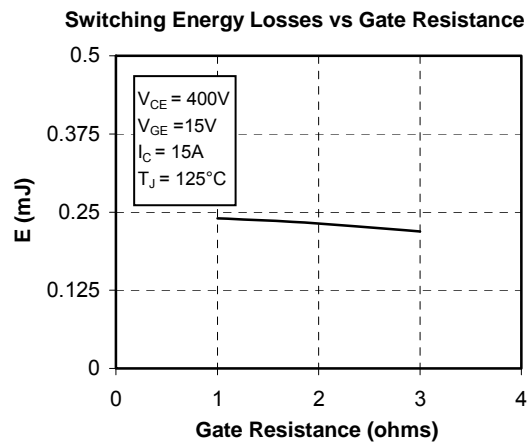
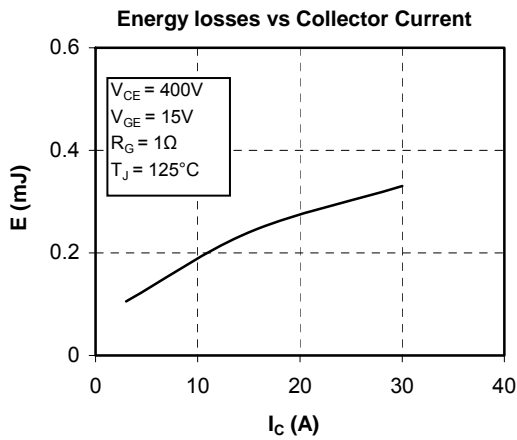
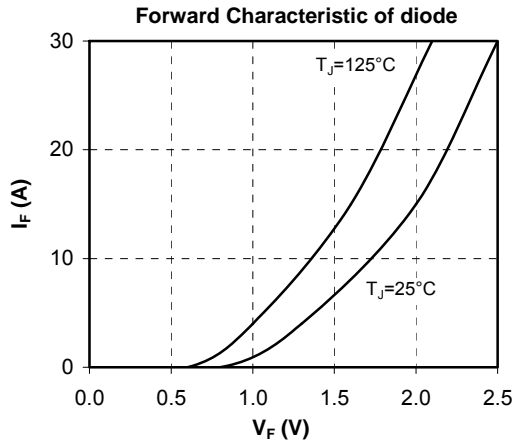
Switching Energy Losses vs Gate Resistance



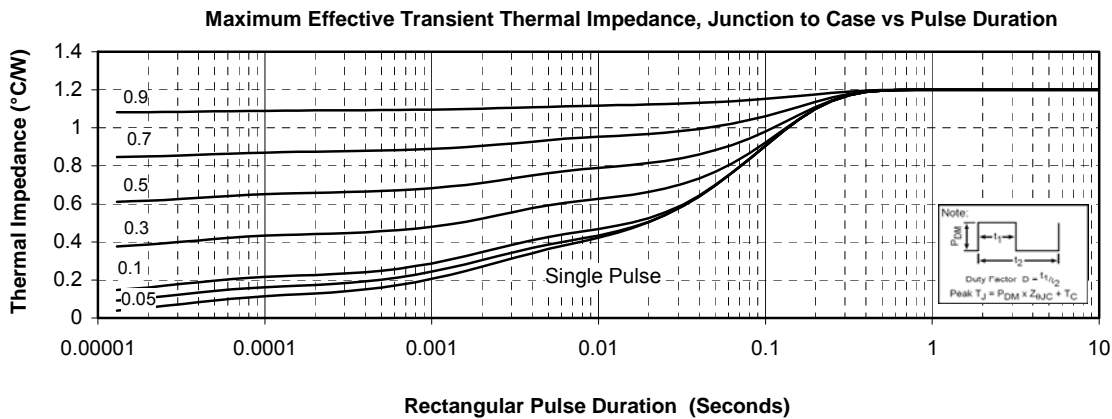
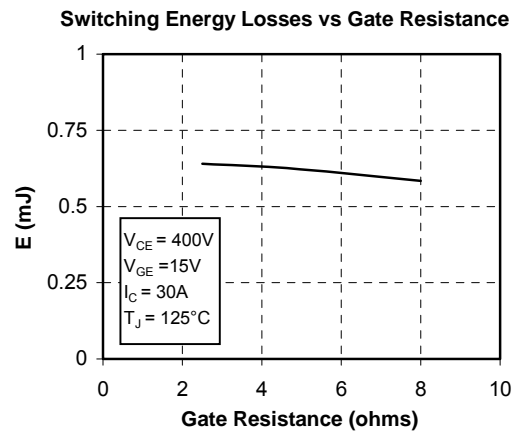
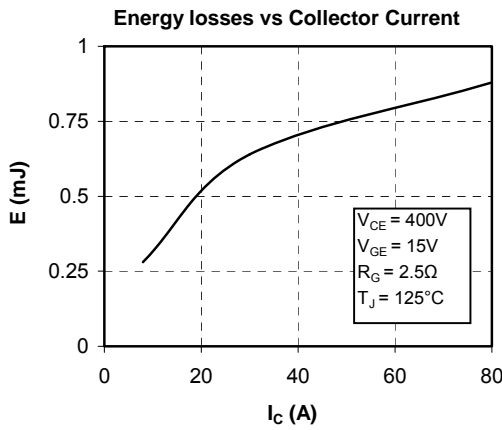
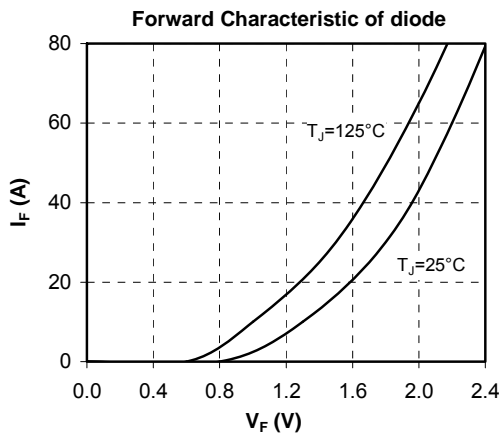
Reverse Bias Safe Operating Area





CR1 to CR4 Typical performance curve


CR5 & CR6 Typical performance curve



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