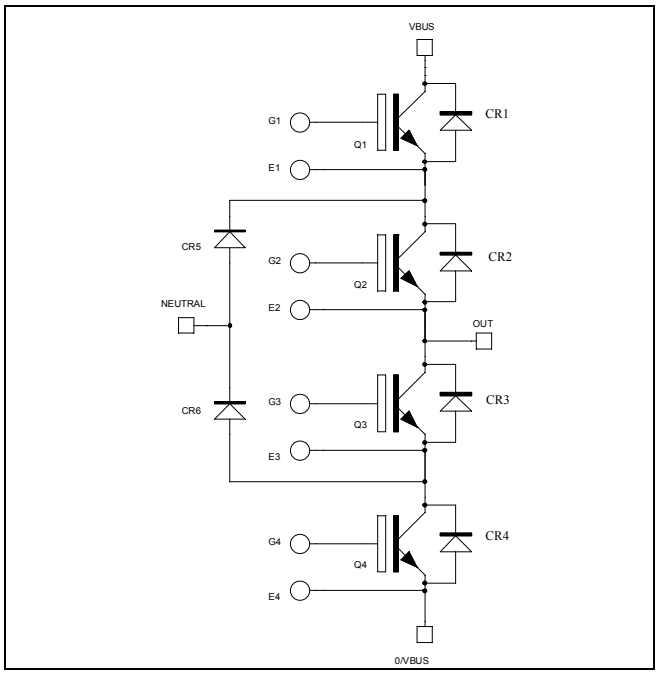
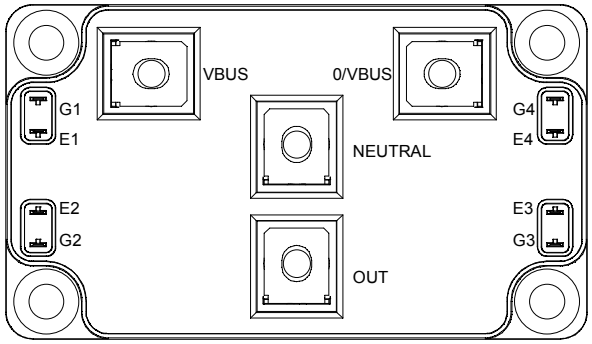
Three level inverter Trench + Field Stop IGBT4 Power Module

V_{CES} = 1200V
I_C = 240A @ Tc = 80°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°C	305	A
		T_c = 80°C	240	
I_{CM}	Pulsed Collector Current	T_c = 25°C	400	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_c = 25°C	1000	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°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

All ratings @ T_j = 25°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°C		1.8	2.2	V
			T_j = 150°C		2.2		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 5 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 V_{CE} = 25V f = 1MHz			12.3		nF
C_{oes}	Output Capacitance				0.8		
C_{res}	Reverse Transfer Capacitance				0.69		
Q_G	Gate charge	V_{GE}=±15V			1.7		µC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = ±15V V_{CE} = 600V I_C = 200A R_G = 3.6Ω			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°C) V_{GE} = ±15V V_{CE} = 600V I_C = 200A R_G = 3.6Ω			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} = ±15V V_{CE} = 600V I_C = 200A R_G = 3.6Ω	T_J = 25°C		10.4		mJ
			T_J = 150°C		21		
E_{off}	Turn-off Switching Energy		T_J = 25°C		11		mJ
			T_J = 150°C		18.6		
I_{SC}	Short circuit current	V_{GE}≤15V ; V_{CC}=900V t_p≤10µs ; T_j=150°C			1000		A
R_{thJC}	Junction to Case Thermal Resistance					0.15	°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	T_j = 25°C			150	µA
			T_j = 150°C			400	
I_F	DC Forward Current		Tc = 80°C		180		A
V_F	Diode Forward Voltage	I_F = 150A V_{GE} = 0V	T_j = 25°C		1.7	2.2	V
			T_j = 150°C		1.65		
t_{rr}	Reverse Recovery Time	I_F = 150A V_R = 600V di/dt =3800A/µs	T_j = 25°C		155		ns
			T_j = 150°C		300		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		14.6		µC
			T_j = 150°C		30.4		
E_{rr}	Reverse Recovery Energy		T_j = 25°C		5.2		mJ
			T_j = 150°C		11		
R_{thJC}	Junction to Case Thermal Resistance					0.32	°C/W

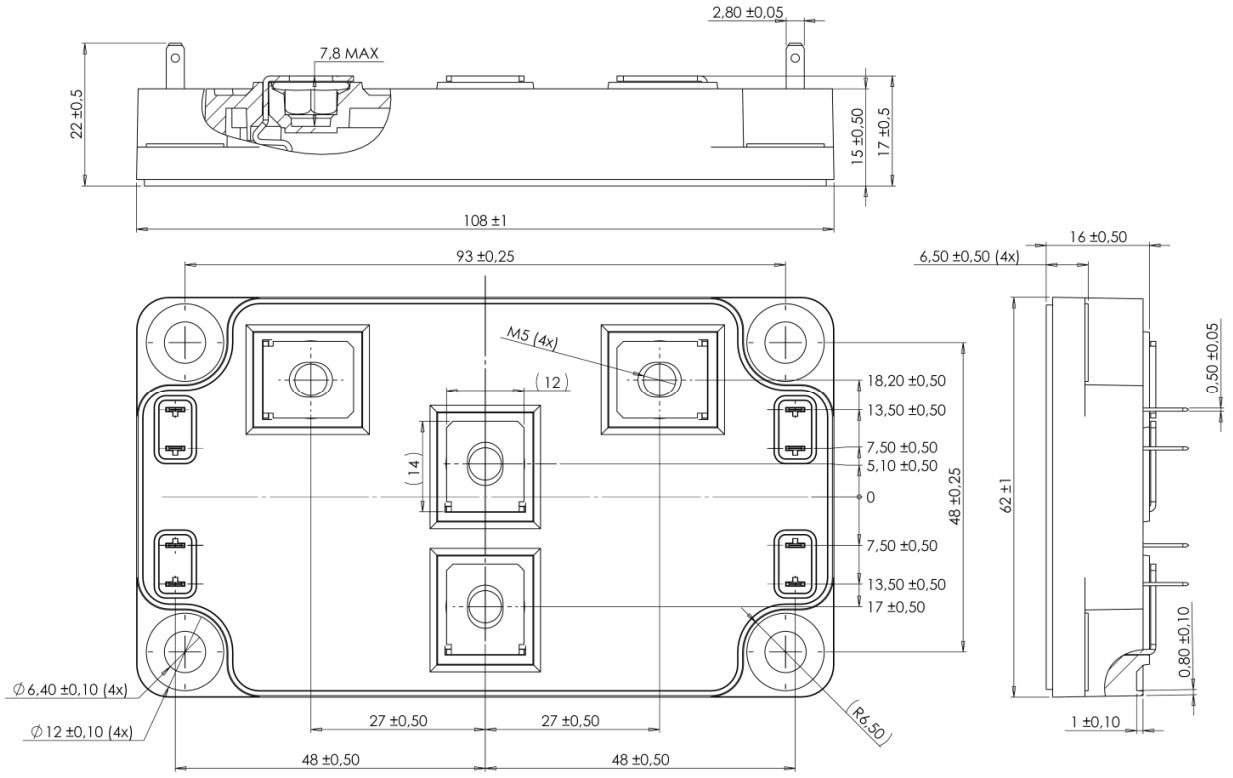
CR5 & CR6 diode ratings and characteristics

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	T_j = 25°C			150	µA
			T_j = 150°C			400	
I_F	DC Forward Current		Tc = 80°C		240		A
V_F	Diode Forward Voltage	I_F = 200A V_{GE} = 0V	T_j = 25°C		1.9	2.4	V
			T_j = 150°C		1.85		
t_{rr}	Reverse Recovery Time	I_F = 200A V_R = 600V di/dt =4000A/µs	T_j = 25°C		155		ns
			T_j = 150°C		300		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		18.6		µC
			T_j = 150°C		39		
E_{rr}	Reverse Recovery Energy		T_j = 25°C		8.2		mJ
			T_j = 150°C		16		
R_{thJC}	Junction to Case Thermal Resistance					0.25	°C/W

Thermal and package characteristics

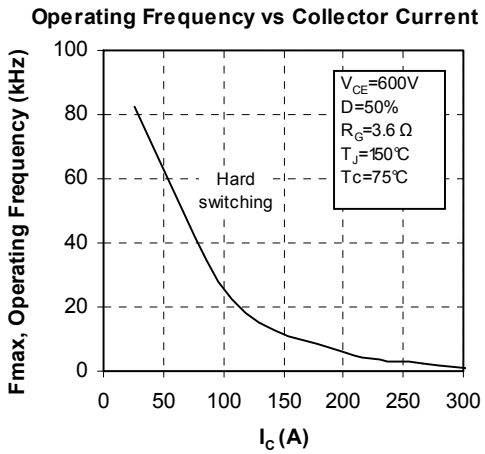
Symbol	Characteristic			Min	Typ	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		175	°C
T_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink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

SP6 Package outline (dimensions in mm)

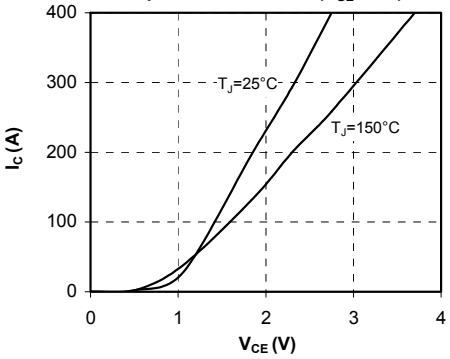


See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

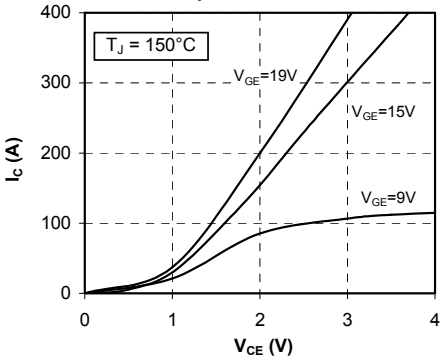
Q1 to Q4 Typical performance curve



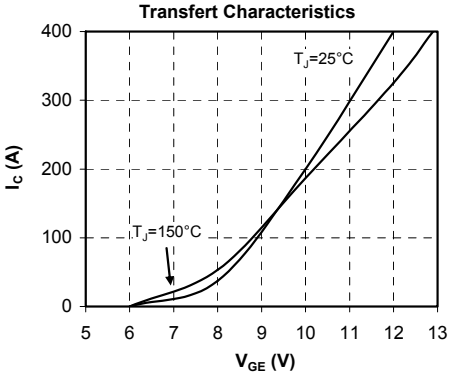
Output Characteristics (V_{GE}=15V)



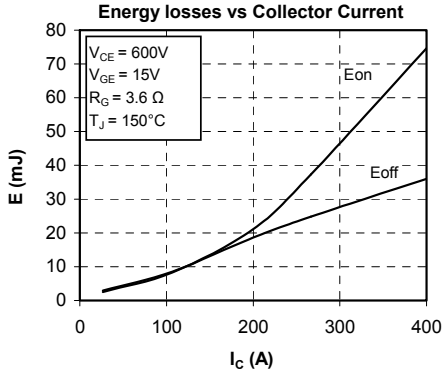
Output Characteristics



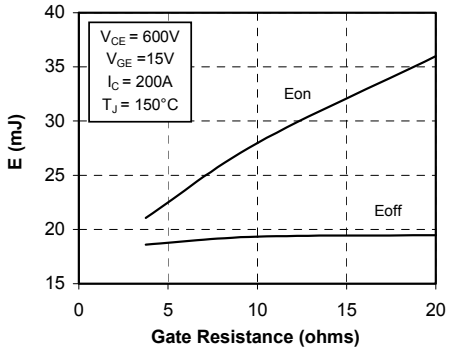
Transfert Characteristics



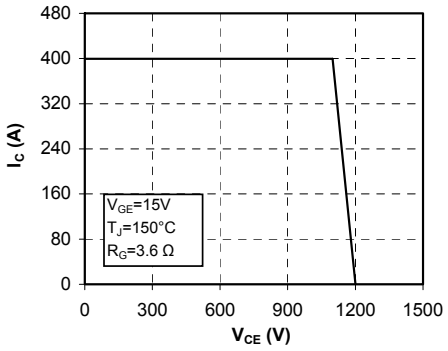
Energy losses vs Collector Current



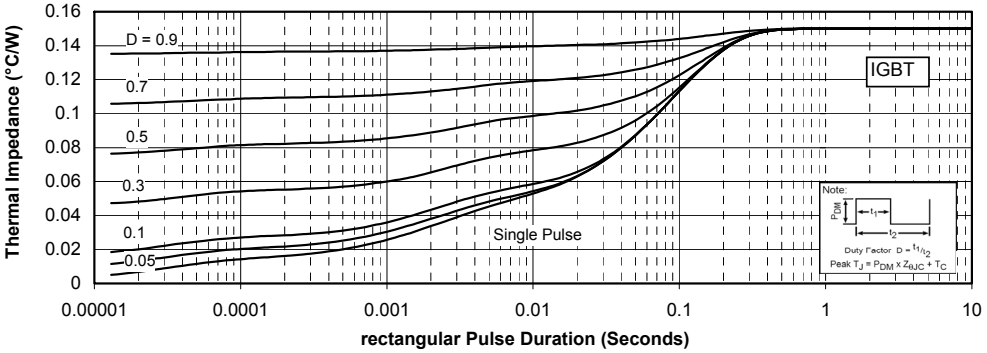
Switching Energy Losses vs Gate Resistance



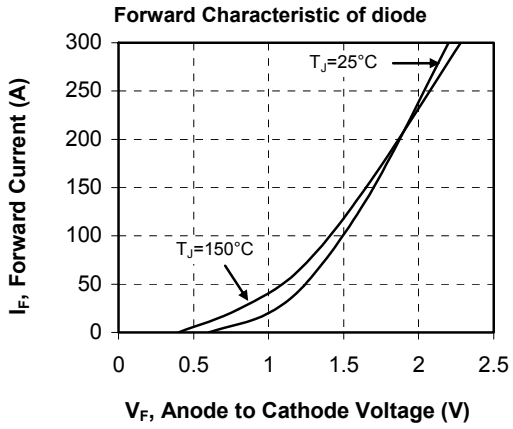
Reverse Bias Safe Operating Area

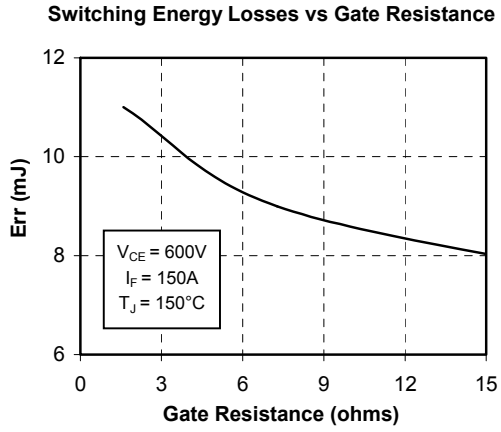


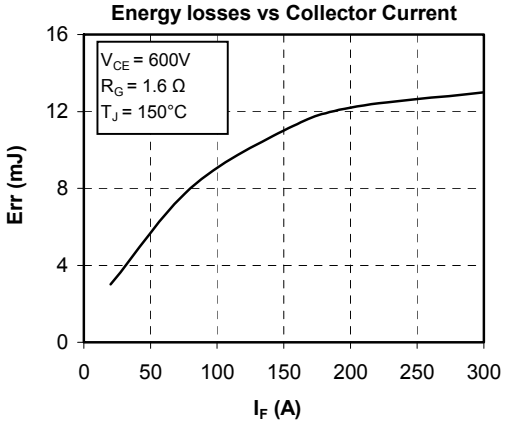
maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

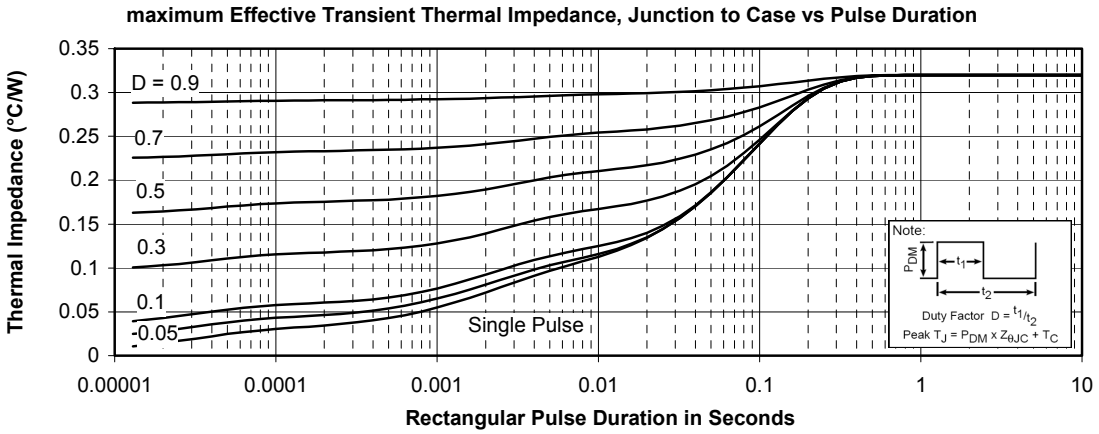


CR1 to CR4 Typical performance curve

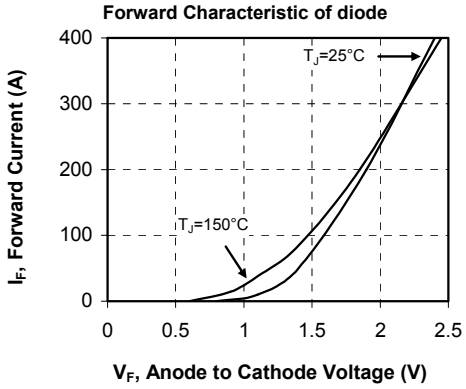


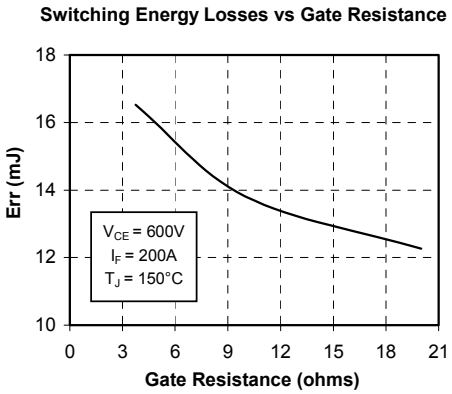


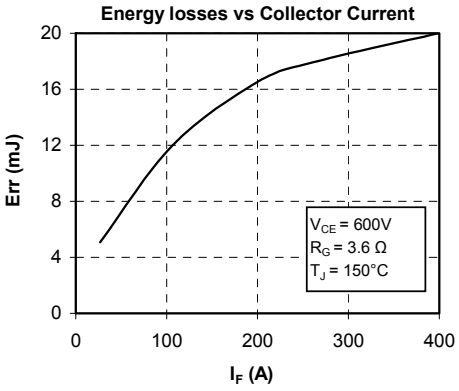


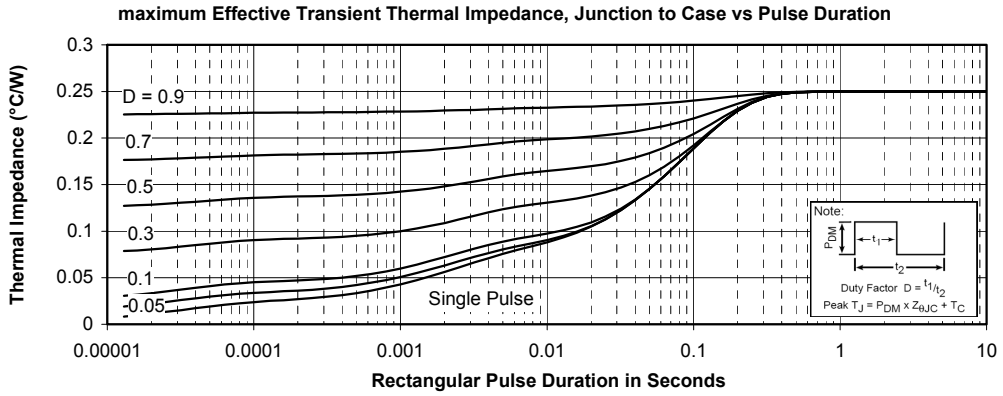


CR5 & CR6 Typical performance curve









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