

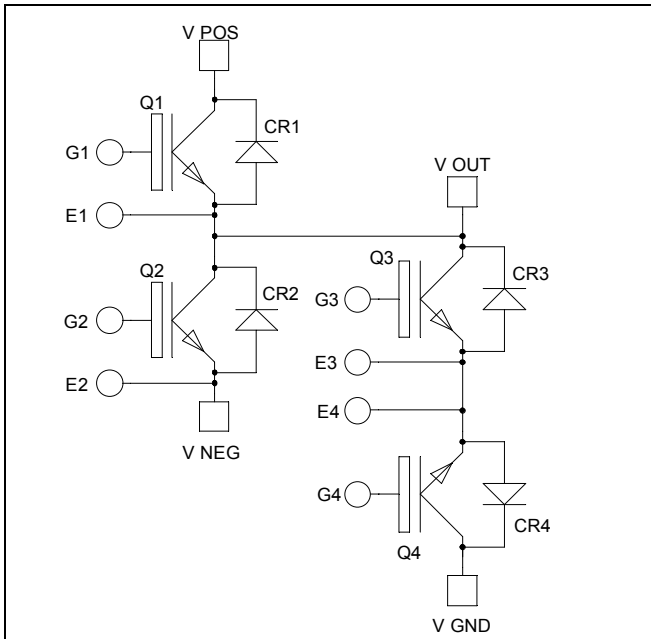
**Phase Leg & Dual Common Emitter
Power Module**

Fast Trench & Field Stop IGBT4 (Q1, Q2):

$V_{CES} = 1200V$; $I_C = 200A$ @ $T_c = 80^\circ C$

Trench & Field Stop IGBT3 (Q3, Q4):

$V_{CES} = 600V$; $I_C = 100A$ @ $T_c = 80^\circ C$



Application

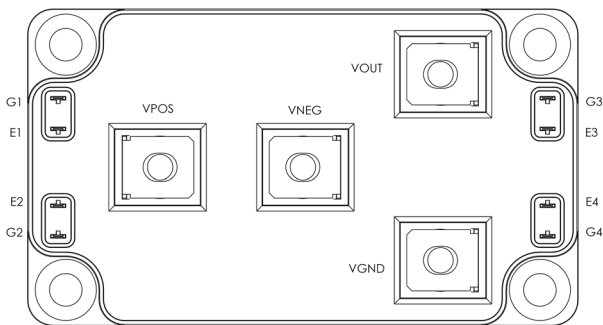
- Uninterruptible Power Supplies

Features

- **Q1, Q2 (High speed Trench & Field Stop IGBT4)**
- **Q3, Q4 (Trench & Field Stop IGBT3)**
 - Low voltage drop
 - Low tail current
 - 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 T_C of V_{CESat}
- Low profile
- RoHS Compliant



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

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

1. High speed Trench & Field Stop IGBT4 Phase Leg Q1&Q2 (per IGBT)
Absolute maximum ratings

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>	<i>Unit</i>
V_{CES}	Collector - Emitter Voltage	1200	V
I_C	Continuous Collector Current	$T_C = 25^\circ\text{C}$	300
		$T_C = 80^\circ\text{C}$	200
I_{CM}	Pulsed Collector Current	$T_C = 25^\circ\text{C}$	640
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	1000	W
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150^\circ\text{C}$	320A @ 1100V

Electrical Characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}, V_{CE} = 1200\text{V}$			200	μA	
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 160\text{A}$	$T_j = 25^\circ\text{C}$	1.7	2.05	2.4	V
			$T_j = 150^\circ\text{C}$		2.6		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 4\text{mA}$	5.0	5.8	6.5	V	
I_{GES}	Gate - Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			480	nA	

Dynamic Characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}$ $V_{CE} = 25\text{V}$ $f = 1\text{MHz}$		9200		pF
C_{oes}	Output Capacitance			600		
C_{res}	Reverse Transfer Capacitance			540		
Q_G	Gate charge	$V_{GE} = 15\text{V}, I_C = 160\text{A}$ $V_{CE} = 960\text{V}$		740		nC
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 160\text{A}$ $R_G = 3\Omega$		30		ns
T_r	Rise Time			57		
$T_{d(off)}$	Turn-off Delay Time			290		
T_f	Fall Time			16		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 160\text{A}$ $R_G = 3\Omega$		30		ns
T_r	Rise Time			49		
$T_{d(off)}$	Turn-off Delay Time			366		
T_f	Fall Time			48		
E_{on}	Turn on Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 160\text{A}$ $R_G = 3\Omega$	$T_j = 25^\circ\text{C}$	12.6		mJ
			$T_j = 150^\circ\text{C}$	15		
E_{off}	Turn off Energy	$R_G = 3\Omega$	$T_j = 25^\circ\text{C}$	4.8		
			$T_j = 150^\circ\text{C}$	9		
I_{sc}	Short Circuit data	$V_{GE} \leq 15\text{V}; V_{Bus} = 600\text{V}$ $t_p \leq 10\mu\text{s}; T_j = 150^\circ\text{C}$		600		A
R_{thJC}	Junction to Case Thermal Resistance				0.15	$^\circ\text{C}/\text{W}$

Diode ratings and characteristics (D1 & D2) (per diode)

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>		<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
V _{RRM}	Peak Repetitive Reverse Voltage					1200	V
I _{RM}	Reverse Leakage Current	V _R =1200V				200	μA
I _F	DC Forward Current		T _c = 50°C		180		A
V _F	Diode Forward Voltage	I _F = 150A	T _j = 25°C		1.7	2.2	V
			T _j = 150°C		1.65		
t _{rr}	Reverse Recovery Time	I _F = 150A	T _j = 25°C		155		ns
			T _j = 150°C		300		
Q _{rr}	Reverse Recovery Charge	V _R = 600V di/dt = 3800A/μs	T _j = 25°C		14.6		μC
			T _j = 150°C		30.4		
E _{rr}	Reverse Recovery Energy	I _F = 150A V _R = 600V di/dt = 3800A/μs	T _j = 25°C		5.2		mJ
			T _j = 150°C		11		
R _{thJC}	Junction to Case Thermal Resistance					0.32	°C/W

2. Trench & Field Stop IGBT3 Dual common emitter Q3&Q4 (per IGBT)

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>		<i>Unit</i>
V _{CES}	Collector - Emitter Voltage		600	V
I _C	Continuous Collector Current	T _C = 25°C	150	A
		T _C = 80°C	100	
I _{CM}	Pulsed Collector Current	T _C = 25°C	200	
V _{GE}	Gate - Emitter Voltage		±20	V
P _D	Maximum Power Dissipation	T _C = 25°C	340	W
RBSOA	Reverse Bias Safe Operating Area	T _j = 150°C	200A @ 550V	

Electrical Characteristics

<i>Symbol</i>	<i>Characteristic</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>	
I _{CES}	Zero Gate Voltage Collector Current	V _{GE} = 0V, V _{CE} = 600V			250	μA	
V _{CE(sat)}	Collector Emitter Saturation Voltage	V _{GE} = 15V I _C = 100A	T _j = 25°C		1.5	1.9	V
			T _j = 150°C		1.7		
V _{GE(th)}	Gate Threshold Voltage	V _{GE} = V _{CE} , I _C = 1.5 mA	5.0	5.8	6.5	V	
I _{GES}	Gate - Emitter Leakage Current	V _{GE} = 20V, V _{CE} = 0V			400	nA	

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{ies}	Input Capacitance	V _{GE} = 0V		6100		pF
C _{oes}	Output Capacitance	V _{CE} = 25V		390		
C _{res}	Reverse Transfer Capacitance	f = 1MHz		190		
Q _G	Gate charge	V _{GE} = ±15V, I _C = 100A V _{CE} = 300V		1.1		μC
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C) V _{GE} = ±15V V _{Bus} = 300V I _C = 100A R _G = 3.3Ω		115		ns
T _r	Rise Time			45		
T _{d(off)}	Turn-off Delay Time			225		
T _f	Fall Time			55		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (150°C) V _{GE} = ±15V V _{Bus} = 300V I _C = 100A R _G = 3.3Ω		130		ns
T _r	Rise Time			50		
T _{d(off)}	Turn-off Delay Time			300		
T _f	Fall Time			70		
E _{on}	Turn on Energy	V _{GE} = ±15V V _{Bus} = 300V I _C = 100A R _G = 3.3Ω	T _j = 25°C	0.4		mJ
			T _j = 150°C	0.875		
E _{off}	Turn off Energy	I _C = 100A R _G = 3.3Ω	T _j = 25°C	2.5		mJ
			T _j = 150°C	3.5		
I _{sc}	Short Circuit data	V _{GE} ≤ 15V ; V _{Bus} = 360V t _p ≤ 10μs ; T _j = 150°C		500		A
R _{thJC}	Junction to Case Thermal Resistance				0.45	°C/W

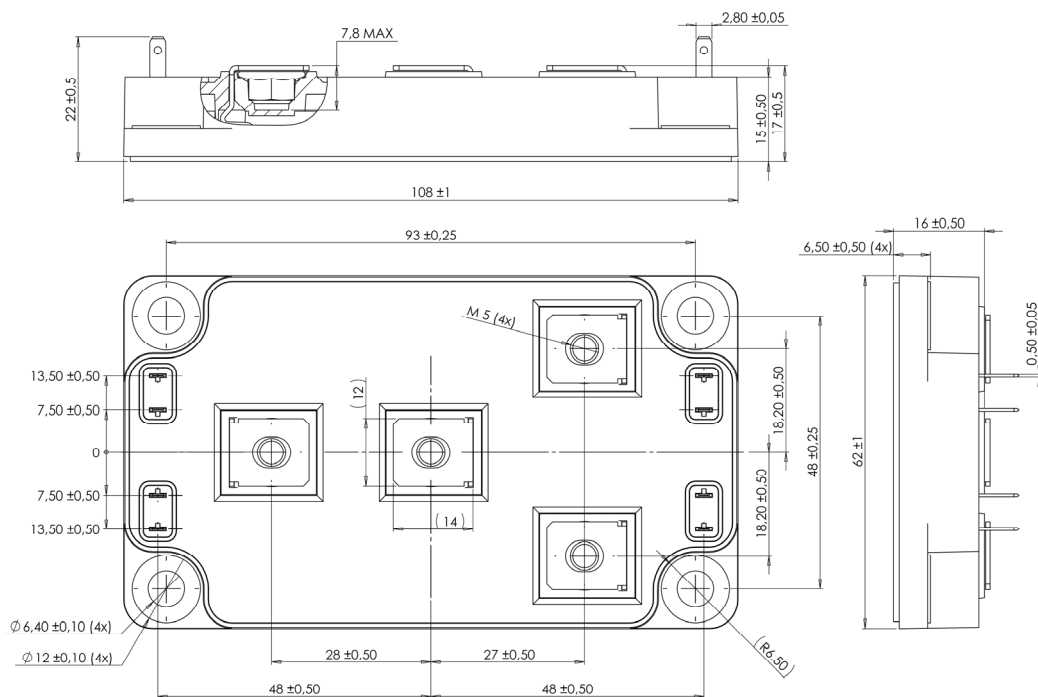
Diode ratings and characteristics (D3 & D4) (per diode)

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Peak Repetitive Reverse Voltage				600	V
I _{RM}	Reverse Leakage Current	V _R = 600V			250	μA
I _F	DC Forward current	T _c = 25°C		150		A
V _F	Diode Forward Voltage	I _F = 150A V _{GE} = 0V	T _j = 25°C	1.6	2	V
			T _j = 150°C	1.5		
t _{rr}	Reverse Recovery Time	I _F = 150A V _R = 300V di/dt = 3000A/μs	T _j = 25°C	130		ns
			T _j = 150°C	225		
Q _{rr}	Reverse Recovery Charge	I _F = 150A V _R = 300V di/dt = 3000A/μs	T _j = 25°C	6.5		μC
			T _j = 150°C	14.5		
E _r	Reverse Recovery Energy	I _F = 150A V _R = 300V di/dt = 3000A/μs	T _j = 25°C	1.6		mJ
			T _j = 150°C	3.5		
R _{thJC}	Junction to Case Thermal Resistance				0.52	°C/W

3. Thermal & Package characteristics

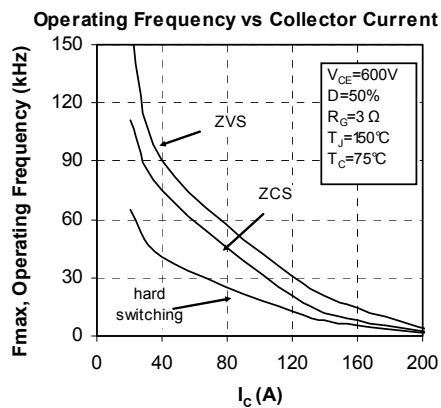
Symbol	Characteristic	Min	Max	Unit	
V_{ISOL}	RMS Isolation Voltage, any terminal to case $t = 1$ min, 50/60Hz	4000		V	
T_J	Operating junction temperature range	-40	175	°C	
T_{JOP}	Recommended junction temperature under switching conditions	-40	$T_{Jmax} - 25$		
T_{STG}	Storage Temperature Range	-40	125		
T_C	Operating Case Temperature	-40	100		
Torque	Mounting torque	To heatsink	M6	3	N.m
		For terminals	M5	2	
Wt	Package Weight		300	g	

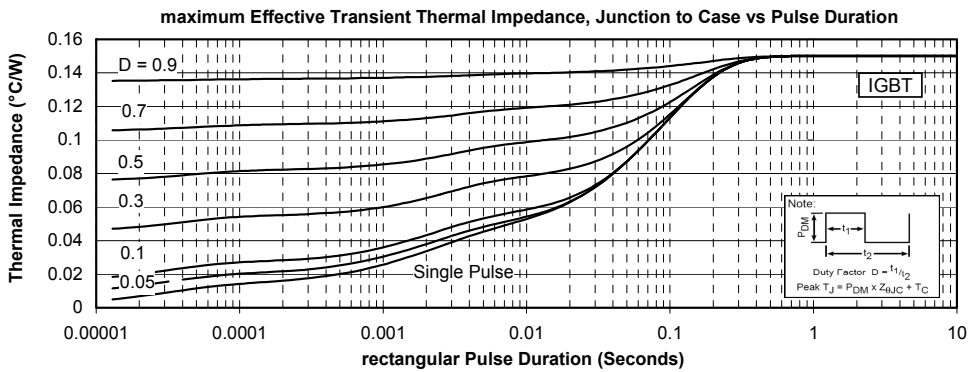
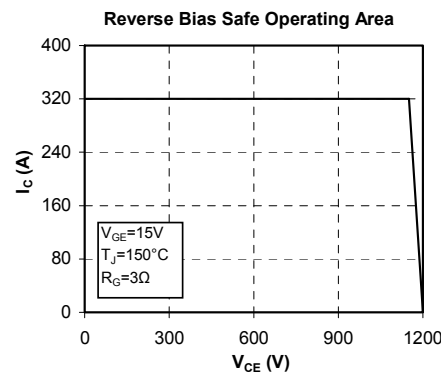
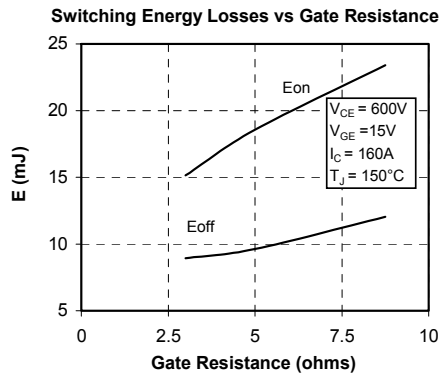
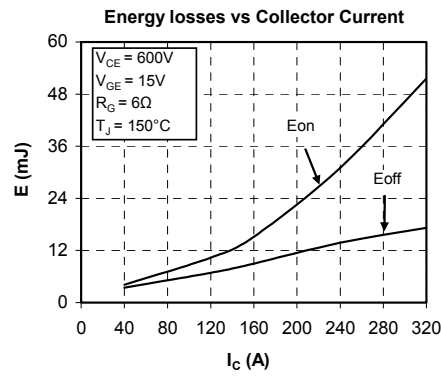
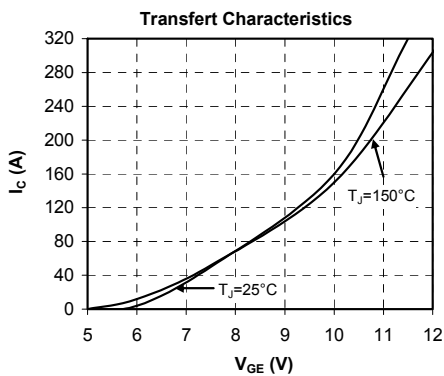
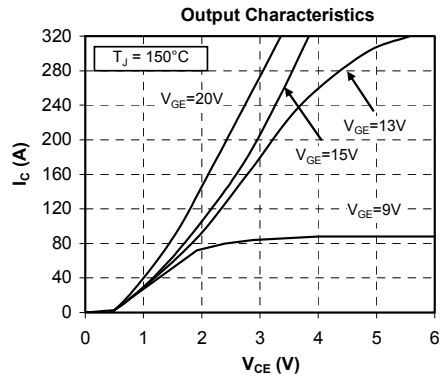
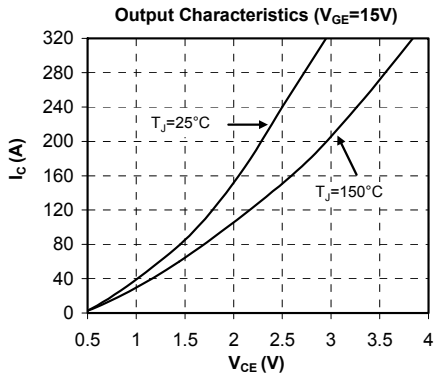
Package outline (dimensions in mm)



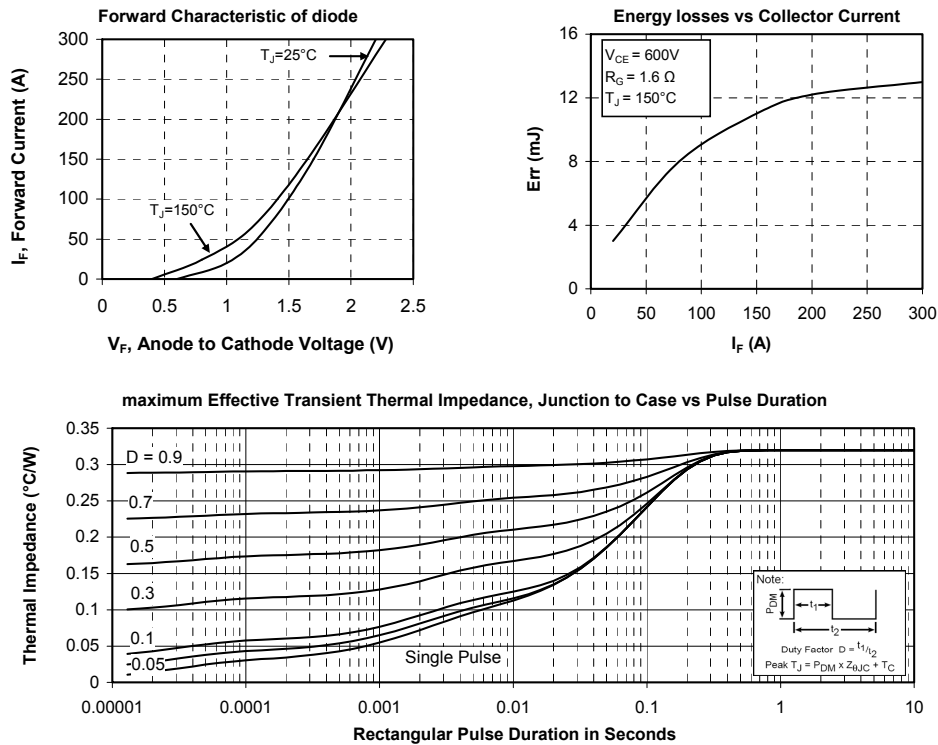
See application note APT0601 - Mounting Instructions for SP6 Power Modules on www.microsemi.com

High speed Trench & Field Stop IGBT4 performance curve (per IGBT)

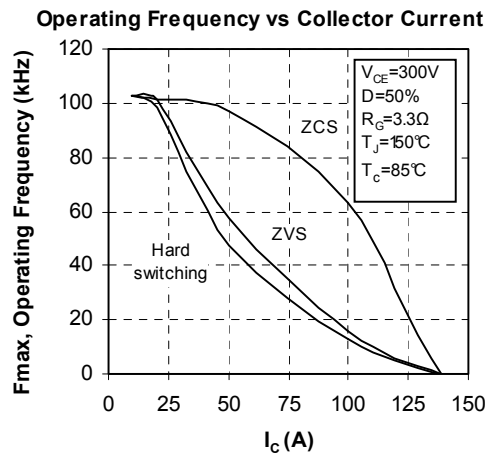


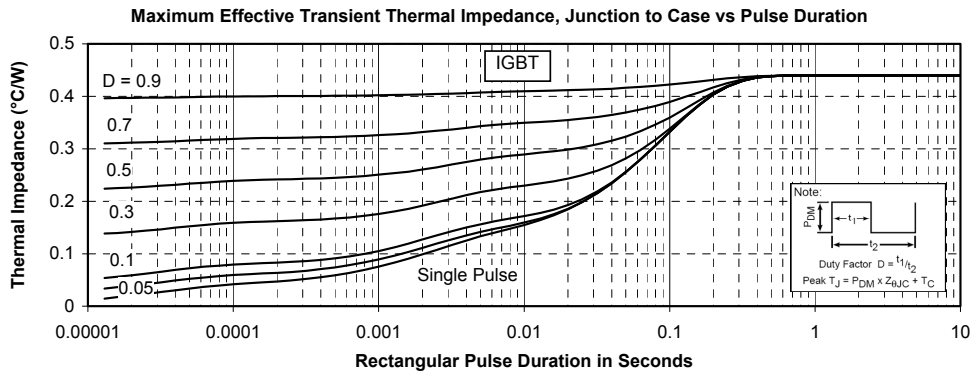
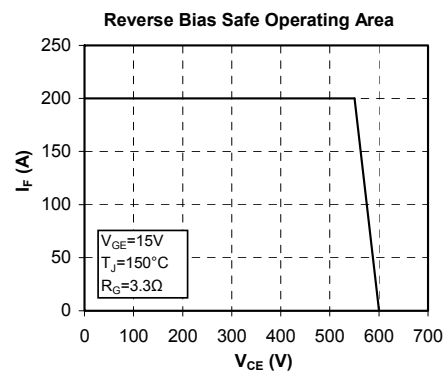
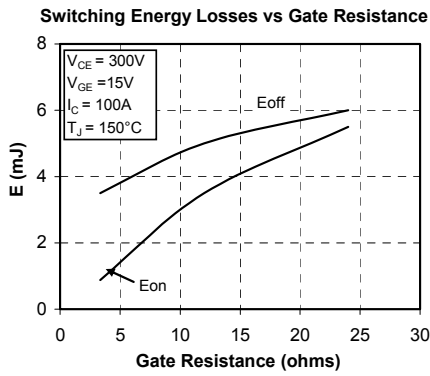
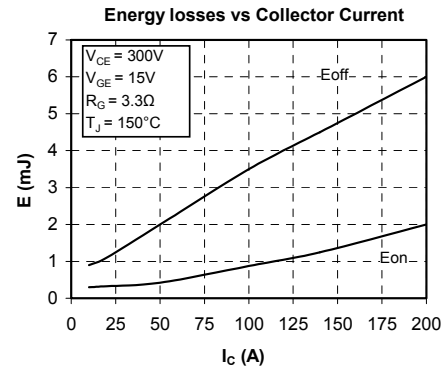
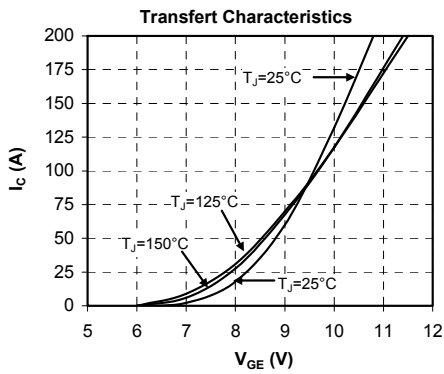
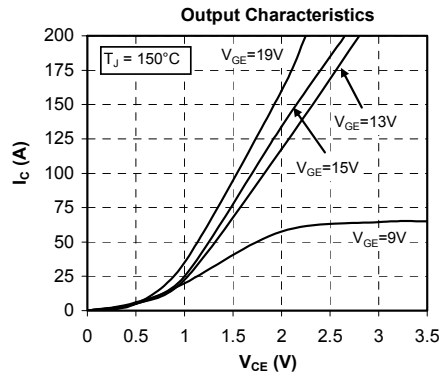
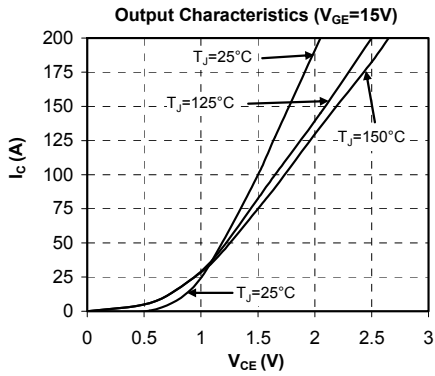


Diode D1 & D2 performance curve (per diode)

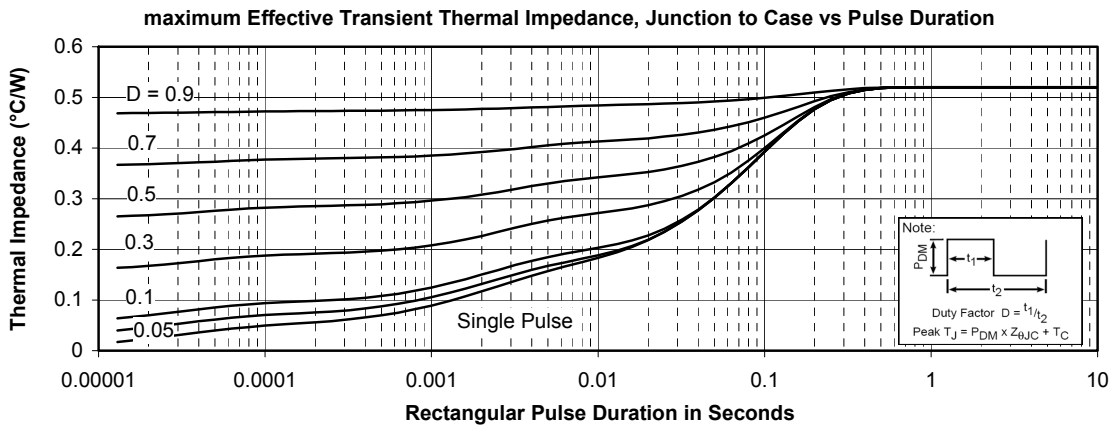
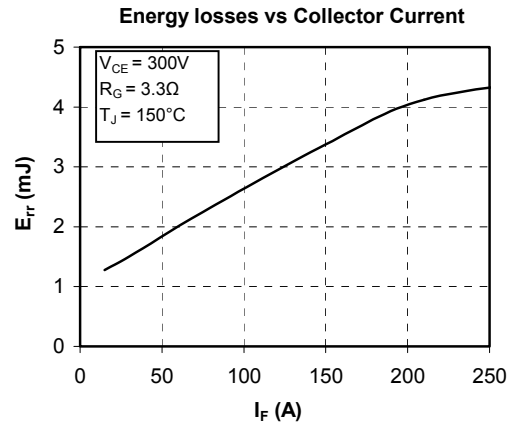
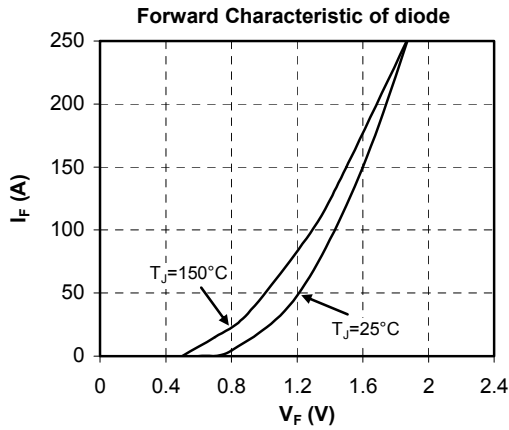


Trench & Field Stop IGBT3 performance curve (per IGBT)





Diode D3 & D4 performance curve (per diode)



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