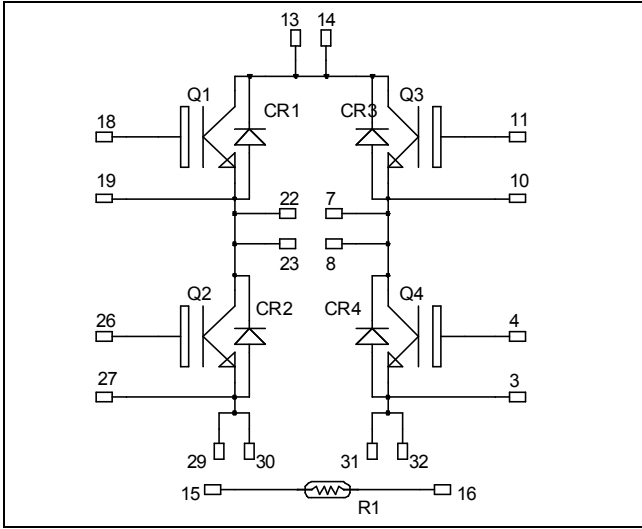


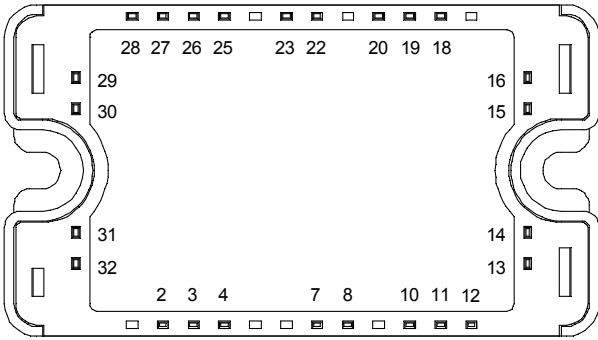
**Full - Bridge
NPT & Trench + Field Stop[®] IGBT
Power module**

Trench & Field Stop[®] IGBT Q1, Q3:
 $V_{CES} = 600V$; $I_C = 75A$ @ $T_c = 80^\circ C$

Fast NPT IGBT Q2, Q4:
 $V_{CES} = 600V$; $I_C = 60A$ @ $T_c = 80^\circ C$



Top switches : Trench + Field Stop IGBT[®]
 Bottom switches : FAST NPT IGBT



All multiple inputs and outputs must be shorted together
 13/14 ; 15/16 ; 26/27 ; 31/32

Application

- Solar converter

Features

- **Q2, Q4 FAST Non Punch Through (NPT) IGBT**
 - Switching frequency up to 100 kHz
 - RBSOA & SCSOA rated
 - Low tail current
- **Q1, Q3 Trench & Field Stop IGBT[®]**
 - Low voltage drop
 - Switching frequency up to 20 kHz
 - RBSOA & SCSOA rated
 - Low tail current

- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring

Benefits

- Optimized conduction & switching losses
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- Easy paralleling due to positive T_C of V_{CEsat}
- RoHS Compliant

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

1. Top switches

1.1 Top Trench + Field Stop IGBT[®] characteristics

Absolute maximum ratings

Symbol	Parameter	Max ratings	Unit
V_{CES}	Collector - Emitter Breakdown Voltage	600	V
I_C	Continuous Collector Current	$T_C = 25^\circ\text{C}$	100
		$T_C = 80^\circ\text{C}$	75
I_{CM}	Pulsed Collector Current	$T_C = 25^\circ\text{C}$	140
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	250
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150^\circ\text{C}$	150A @ 550V

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	μA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$		1.5	1.9	V
		$I_C = 75\text{A}$	$T_j = 25^\circ\text{C}$			
				1.7		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 600\mu\text{A}$	5.0	5.8	6.5	V
I_{GES}	Gate - Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			600	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}$		4620		pF
C_{oes}	Output Capacitance	$V_{CE} = 25\text{V}$		300		
C_{res}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		140		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 75\text{A}$ $R_G = 4.7\Omega$		110		ns
T_r	Rise Time			45		
$T_{d(off)}$	Turn-off Delay Time			200		
T_f	Fall Time			40		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (150°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 75\text{A}$ $R_G = 4.7\Omega$		120		ns
T_r	Rise Time			50		
$T_{d(off)}$	Turn-off Delay Time			250		
T_f	Fall Time			60		
E_{on}	Turn-on Switching Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 300\text{V}$ $I_C = 75\text{A}$	$T_j = 25^\circ\text{C}$	0.35		mJ
			$T_j = 150^\circ\text{C}$	0.6		
E_{off}	Turn-off Switching Energy	$R_G = 4.7\Omega$	$T_j = 25^\circ\text{C}$	2.2		mJ
			$T_j = 150^\circ\text{C}$	2.6		
R_{thJC}	Junction to Case Thermal resistance				0.6	$^\circ\text{C}/\text{W}$

1.2 Top fast diode 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°C			25	μA
			T _j = 125°C			500	
I _F	DC Forward Current	T _c = 80°C			60		A
V _F	Diode Forward Voltage	I _F = 60A			1.7	2.3	V
		I _F = 120A			2		
		I _F = 60A	T _j = 125°C		1.4		
t _{rr}	Reverse Recovery Time	I _F = 60A V _R = 400V di/dt = 200A/μs	T _j = 25°C		70		ns
			T _j = 125°C		140		
Q _{rr}	Reverse Recovery Charge	I _F = 60A V _R = 400V di/dt = 200A/μs	T _j = 25°C		100		nC
			T _j = 125°C		690		
R _{thJC}	Junction to Case Thermal resistance					0.85	°C/W

2. Bottom switches

2.1 Bottom Fast NPT IGBT characteristics

Absolute maximum ratings

<i>Symbol</i>	<i>Parameter</i>	<i>Max ratings</i>		<i>Unit</i>
V _{CES}	Collector - Emitter Breakdown Voltage	600		V
I _C	Continuous Collector Current	T _C = 25°C	84	A
		T _C = 80°C	60	
I _{CM}	Pulsed Collector Current	T _C = 25°C	300	
V _{GE}	Gate - Emitter Voltage	±20		V
P _D	Maximum Power Dissipation	T _C = 25°C	275	W
RBSOA	Reverse Bias Safe Operating Area	T _j = 125°C	120A@500V	

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	T _j = 25°C			250	μA
			T _j = 125°C			500	
V _{CE(sat)}	Collector Emitter saturation Voltage	V _{GE} = 15V I _C = 60A	T _j = 25°C	1.7	2.0	2.45	V
			T _j = 125°C		2.2		
V _{GE(th)}	Gate Threshold Voltage	V _{GE} = V _{CE} , I _C = 2mA		4		6	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		2700		pF
C _{oes}	Output Capacitance	V _{CE} = 25V		386		
C _{res}	Reverse Transfer Capacitance	f = 1MHz		240		
Q _g	Total gate Charge	V _{GE} = 15V		198		nC
Q _{ge}	Gate – Emitter Charge	V _{Bus} = 300V		20		
Q _{gc}	Gate – Collector Charge	I _C = 60A		120		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C)		30		ns
T _r	Rise Time	V _{GE} = 15V		12		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 400V		80		
T _f	Fall Time	I _C = 60A R _G = 3.3Ω		15		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (125°C)		32		ns
T _r	Rise Time	V _{GE} = 15V		12		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 400V		90		
T _f	Fall Time	I _C = 60A R _G = 3.3Ω		21		
E _{on}	Turn-on Switching Energy	V _{GE} = 15V V _{Bus} = 400V I _C = 60A R _G = 3.3Ω	T _j = 125°C	0.6		mJ
E _{off}	Turn-off Switching Energy		T _j = 125°C	1.6		
R _{thJC}	Junction to Case Thermal resistance				0.45	°C/W

2.2 Bottom diode characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V _{RRM}	Maximum Peak Repetitive Reverse Voltage		600			V
I _{RM}	Maximum Reverse Leakage Current	V _R = 600V			250	μA
					500	
I _F	DC Forward Current			30		A
V _F	Diode Forward Voltage	I _F = 30A		1.6	1.8	V
		I _F = 60A		1.9		
		I _F = 30A T _j = 125°C		1.4		
t _{rr}	Reverse Recovery Time	I _F = 30A V _R = 400V	T _j = 25°C	85		ns
			T _j = 125°C	160		
Q _{rr}	Reverse Recovery Charge	di/dt = 200A/μs	T _j = 25°C	130		nC
			T _j = 125°C	700		
R _{thJC}	Junction to Case Thermal resistance				1.2	°C/W

3. Temperature sensor

NTC (see application note APT0406 on www.microsemi.com for more information).

Symbol	Characteristic	Min	Typ	Max	Unit
R ₂₅	Resistance @ 25°C		50		kΩ
B _{25/85}	T ₂₅ = 298.15 K		3952		K

$$R_T = \frac{R_{25}}{\exp \left[B_{25/85} \left(\frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

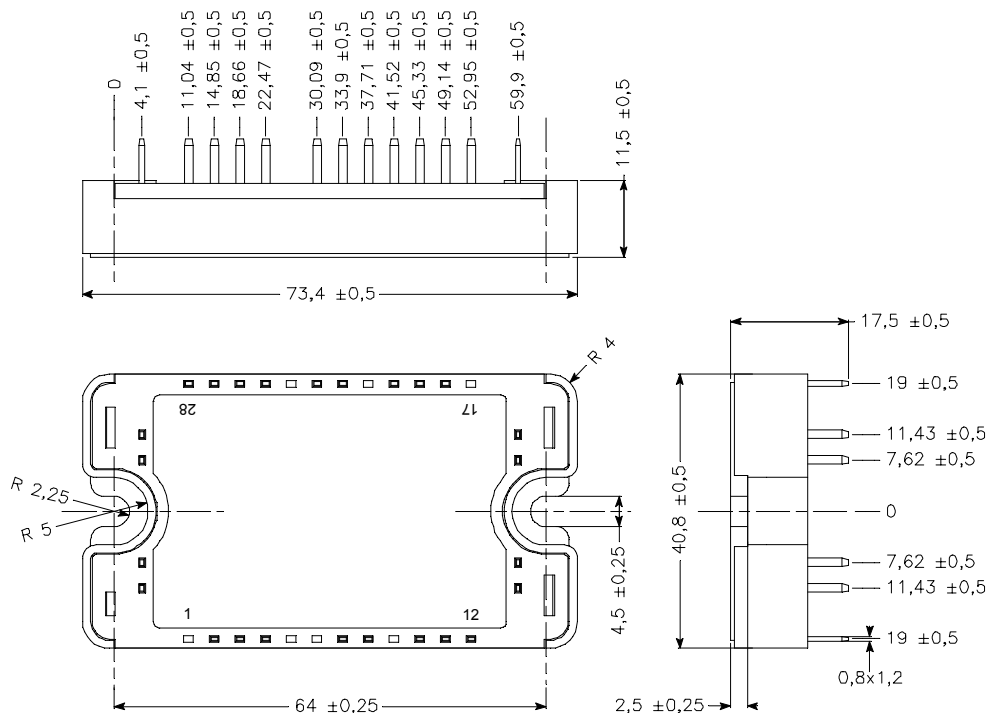
T: Thermistor temperature
 R_T: Thermistor value at T

4. Package characteristics

Symbol	Characteristic	Min	Typ	Max	Unit	
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*	°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				110	g

T_j=175°C for Trench & Field Stop IGBT

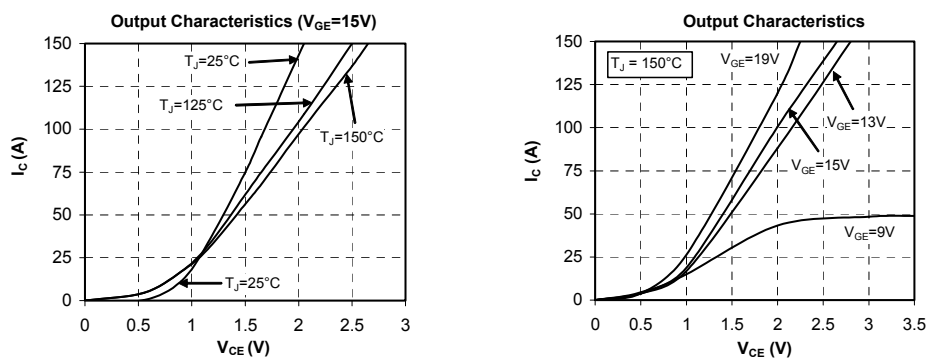
5. SP3 Package outline (dimensions in mm)

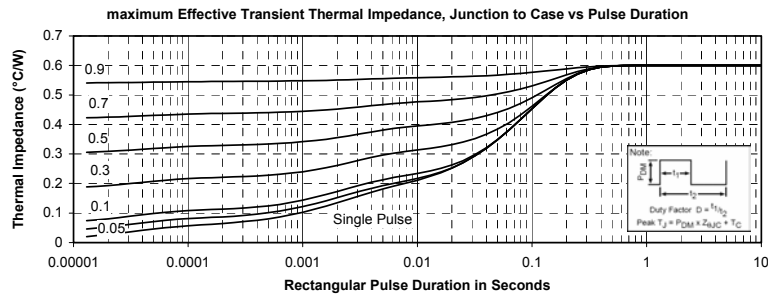
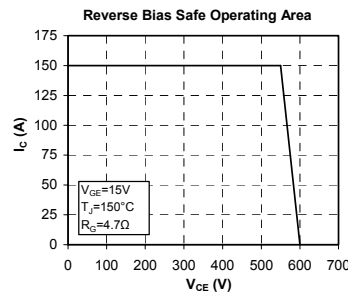
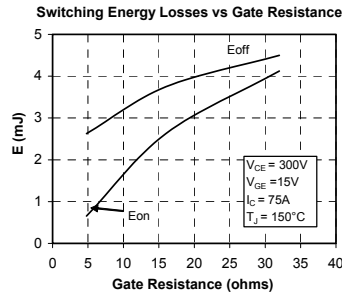
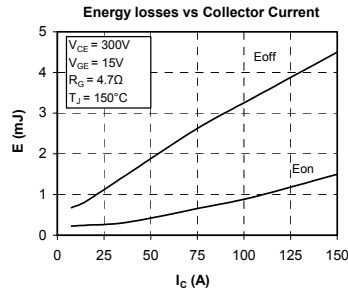
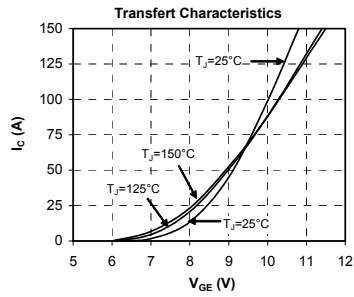


See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

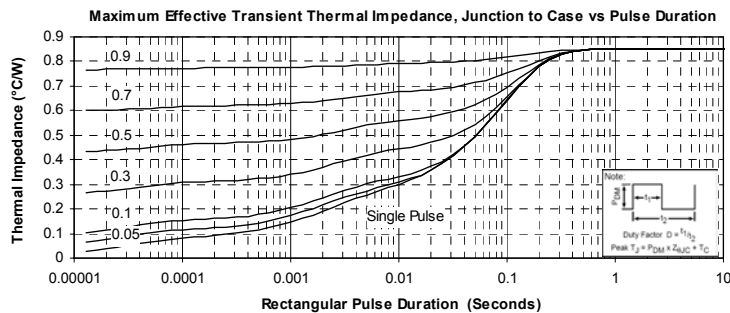
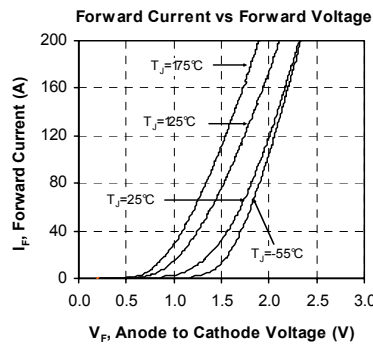
6. Top switches curves

6.1 Top Trench + Field Stop IGBT® typical performance curves



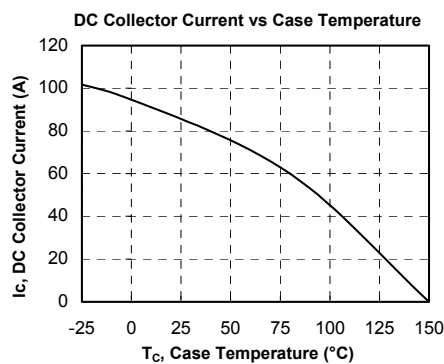
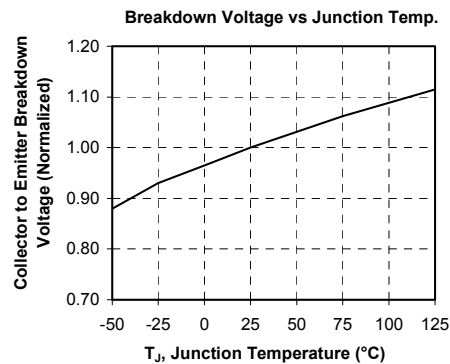
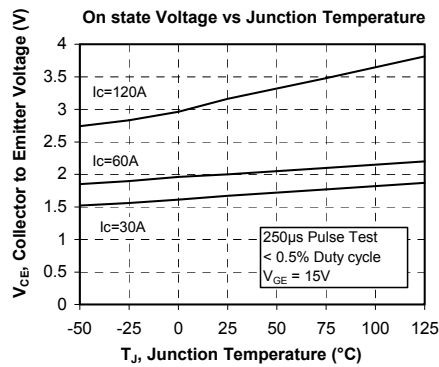
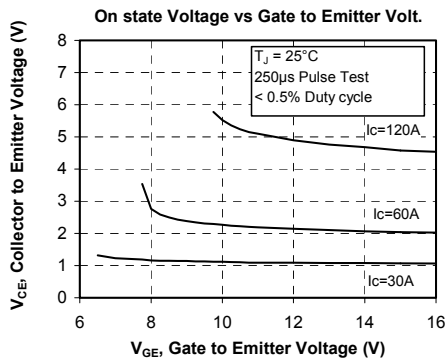
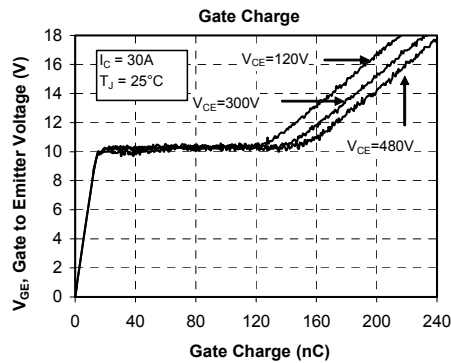
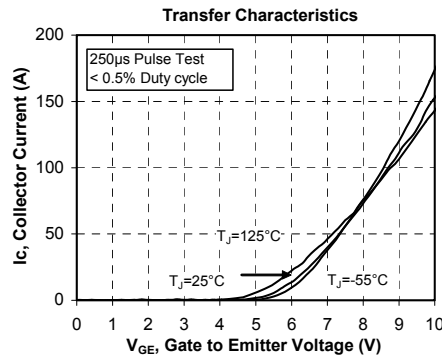
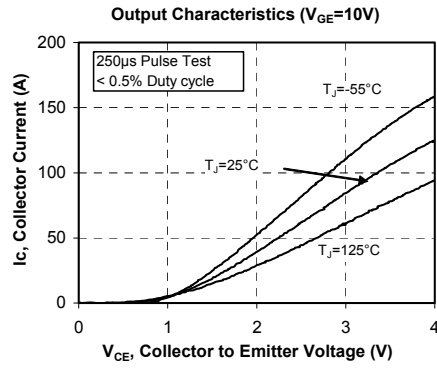
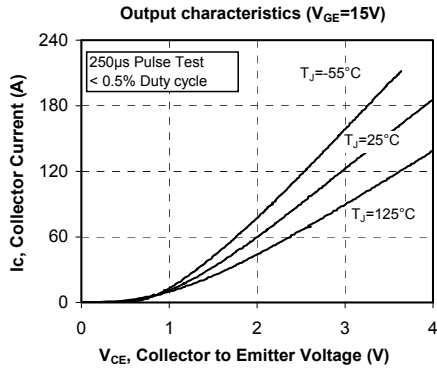


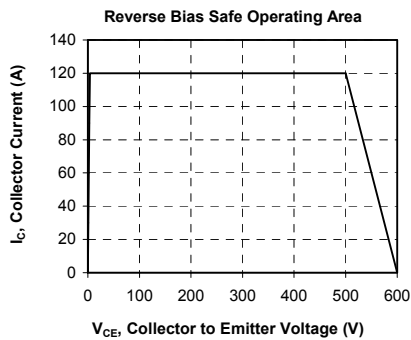
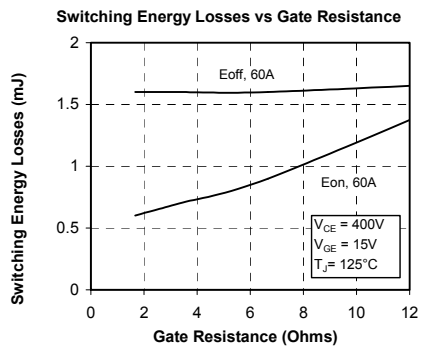
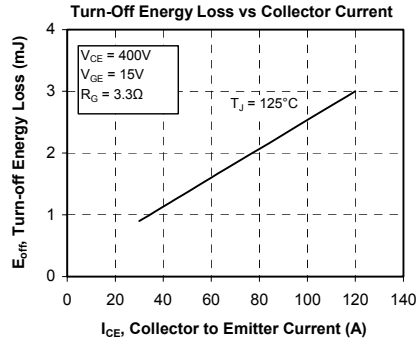
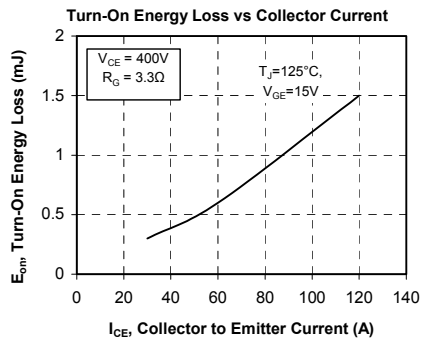
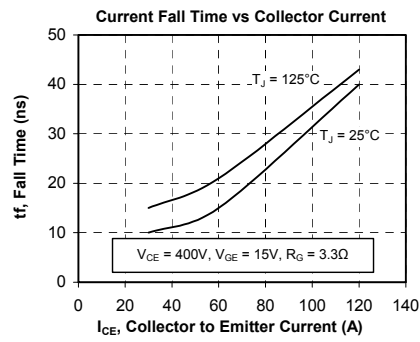
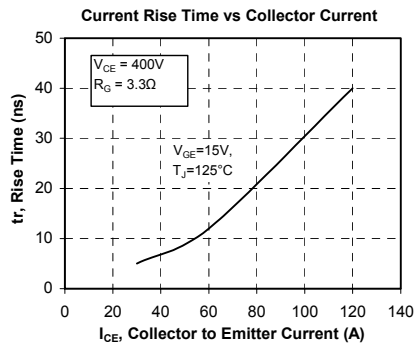
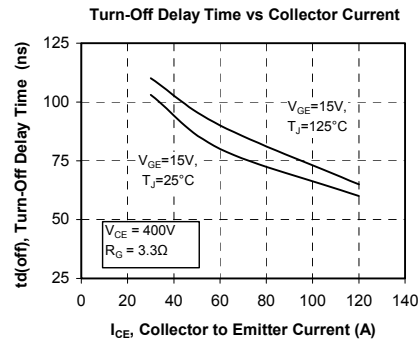
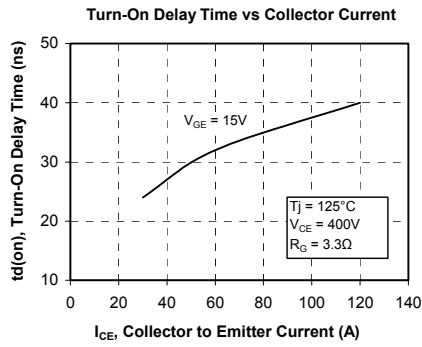
6.2 Top Fast diode typical performance curves

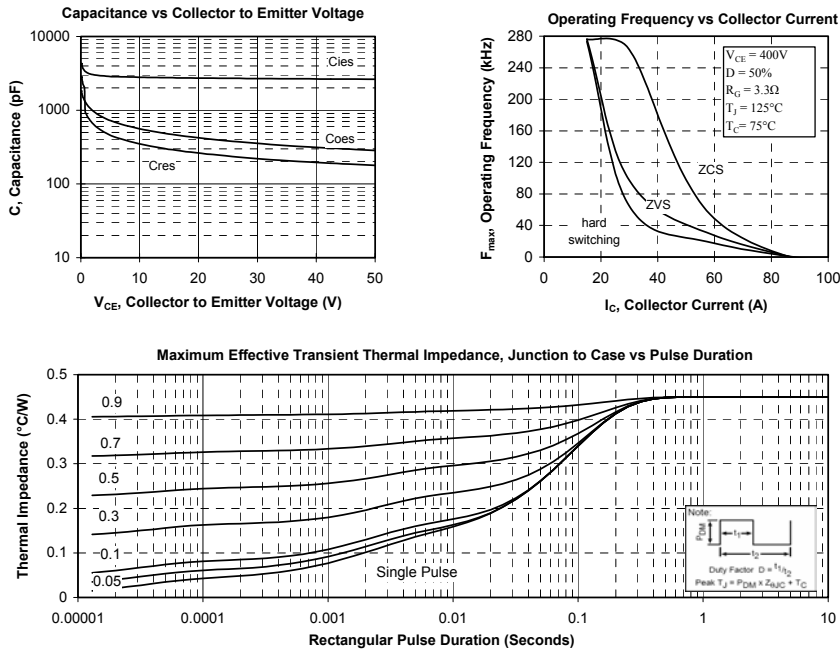


7. Bottom switches curves

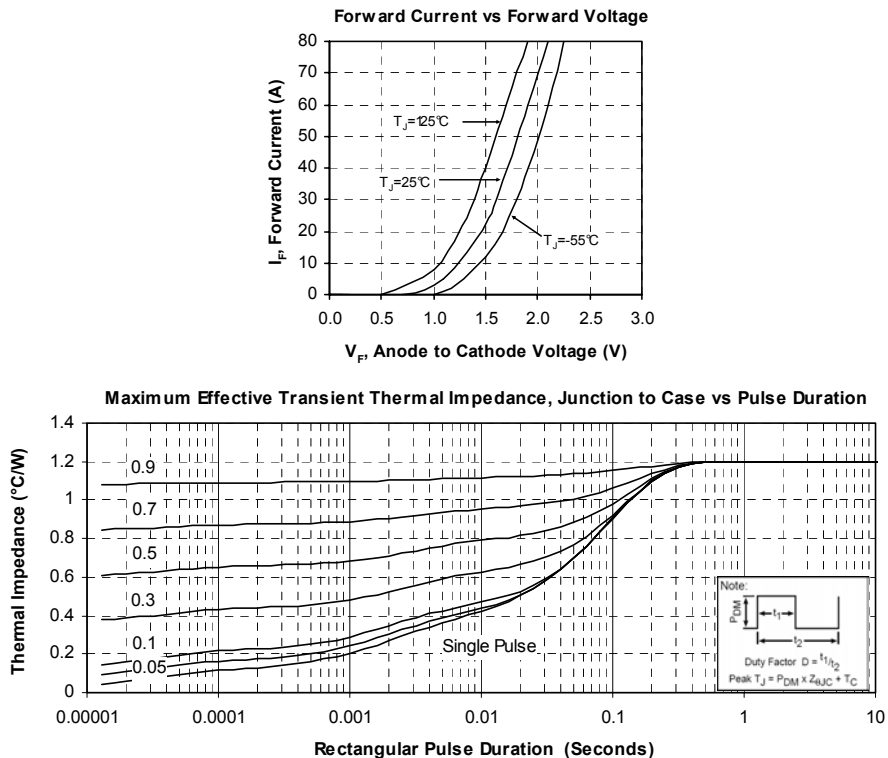
7.1 Bottom fast NPT IGBT typical performance curves







7.2 Bottom diode typical performance curves



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