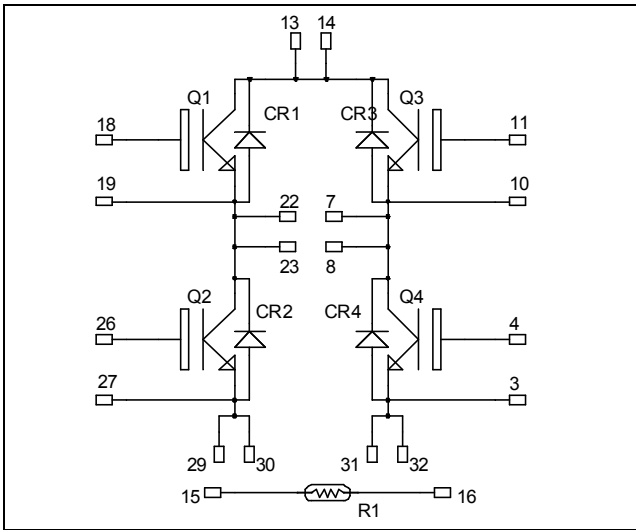


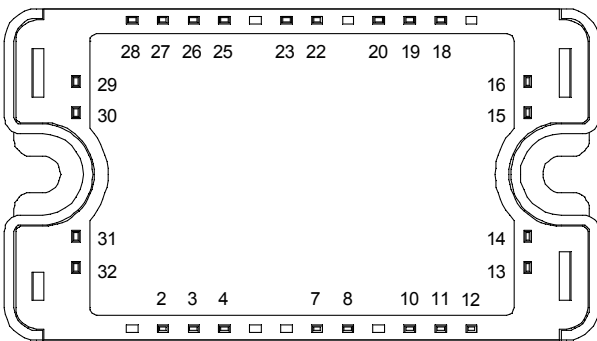
**Full - Bridge
NPT & Trench + Field Stop® IGBT
Power module**

Trench & Field Stop® IGBT Q1, Q3:
 $V_{CES} = 1200V$; $I_C = 50A$ @ $T_c = 80^\circ C$

Fast NPT IGBT Q2, Q4:
 $V_{CES} = 1200V$; $I_C = 50A$ @ $T_c = 80^\circ C$



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 50 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	1200	V
I_C	Continuous Collector Current	$T_C = 25^\circ\text{C}$	75
		$T_C = 80^\circ\text{C}$	50
I_{CM}	Pulsed Collector Current	$T_C = 25^\circ\text{C}$	100
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	270
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125^\circ\text{C}$	100A @ 1150V

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	$T_j = 25^\circ\text{C}$			250
			$T_j = 125^\circ\text{C}$			500
$V_{CE(sat)}$	Collector Emitter saturation Voltage	$V_{GE} = 15\text{V}$ $I_C = 50\text{A}$	$T_j = 25^\circ\text{C}$	1.4	1.7	2.1
			$T_j = 125^\circ\text{C}$		2.0	
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 2\text{mA}$	5.0	5.8	6.5	
I_{GES}	Gate - Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			400	

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}, V_{CE} = 25\text{V}$		3600		pF
C_{rss}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		160		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 50\text{A}$ $R_G = 18\Omega$		90		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			420		
T_f	Fall Time			70		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 50\text{A}$ $R_G = 18\Omega$		90		ns
T_r	Rise Time			50		
$T_{d(off)}$	Turn-off Delay Time			520		
T_f	Fall Time			90		
E_{on}	Turn-on Switching Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 50\text{A}$ $R_G = 18\Omega$	$T_j = 125^\circ\text{C}$	5		mJ
E_{off}	Turn-off Switching Energy		$T_j = 125^\circ\text{C}$	5.5		
R_{thJC}	Junction to Case Thermal resistance				0.45	$^\circ\text{C/W}$

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			1200			V	
I_{RM}	Maximum Reverse Leakage Current	$V_R=1200V$	$T_j = 25^\circ C$			100	μA	
			$T_j = 125^\circ C$			500		
I_F	DC Forward Current	$T_c = 80^\circ C$			60		A	
V_F	Diode Forward Voltage	$I_F = 60A$			2.5	3	V	
		$I_F = 120A$			3			
		$I_F = 60A$	$T_j = 125^\circ C$		1.8			
t_{rr}	Reverse Recovery Time	$I_F = 60A$	$V_R = 800V$	$di/dt = 200A/\mu s$	$T_j = 25^\circ C$		265	ns
					$T_j = 125^\circ C$			
Q_{rr}	Reverse Recovery Charge	$I_F = 60A$	$V_R = 800V$	$di/dt = 200A/\mu s$	$T_j = 25^\circ C$		560	nC
					$T_j = 125^\circ C$			
R_{thJC}	Junction to Case Thermal resistance					0.9	$^\circ C/W$	

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	1200		V
I_C	Continuous Collector Current	$T_c = 25^\circ C$	70	A
		$T_c = 80^\circ C$	50	
I_{CM}	Pulsed Collector Current	$T_c = 25^\circ C$	150	
V_{GE}	Gate - Emitter Voltage	± 20		V
P_D	Maximum Power Dissipation	$T_c = 25^\circ C$	312	W
RBSOA	Reverse Bias Safe Operating Area	$T_j = 150^\circ C$	100A @ 1200V	

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	$V_{GE} = 0V$	$V_{CE} = 1200V$	$T_j = 25^\circ C$		250	μA
				$T_j = 125^\circ C$			
$V_{CE(sat)}$	Collector Emitter saturation Voltage	$V_{GE} = 15V$	$I_C = 50A$	$T_j = 25^\circ C$		3.2	V
				$T_j = 125^\circ C$			
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 1 mA$		4.5		6.5	V
I_{GES}	Gate - Emitter Leakage Current	$V_{GE} = 20 V, V_{CE} = 0V$				100	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C _{ies}	Input Capacitance	V _{GE} = 0V		3450		pF
C _{oes}	Output Capacitance	V _{CE} = 25V		330		
C _{res}	Reverse Transfer Capacitance	f = 1MHz		220		
Q _g	Total gate Charge	V _{GS} = 15V		330		nC
Q _{ge}	Gate – Emitter Charge	V _{Bus} = 600V		35		
Q _{gc}	Gate – Collector Charge	I _C = 50A		200		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C)		35		ns
T _r	Rise Time	V _{GE} = 15V		65		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 600V		320		
T _f	Fall Time	I _C = 50A		30		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (125°C)		35		ns
T _r	Rise Time	V _{GE} = ±15V		65		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 600V		360		
T _f	Fall Time	I _C = 50A		40		
E _{on}	Turn-on Switching Energy	V _{GE} = ±15V V _{Bus} = 600V	T _j = 125°C	6.9		mJ
E _{off}	Turn-off Switching Energy	I _C = 50A R _G = 5 Ω	T _j = 125°C	3.05		
R _{thJC}	Junction to Case Thermal resistance				0.4	°C/W

2.2 Bottom diode 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			250	μA
		T _j = 25°C			500	
I _F	DC Forward Current			30		A
V _F	Diode Forward Voltage	I _F = 30A		2	2.5	V
		I _F = 60A		2.3		
		I _F = 30A	T _j = 125°C	1.8		
t _{rr}	Reverse Recovery Time	I _F = 30A V _R = 800V	T _j = 25°C	370		ns
			T _j = 125°C	500		
Q _{rr}	Reverse Recovery Charge	di/dt = 200A/μs	T _j = 25°C	660		nC
			T _j = 125°C	3450		
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

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

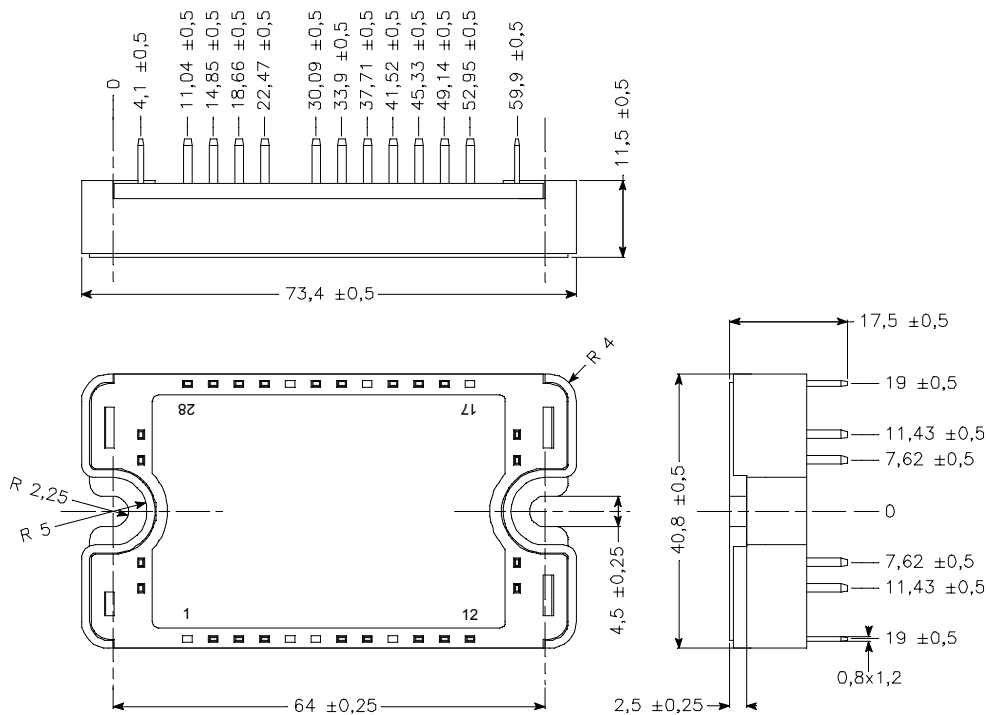
T: Thermistor temperature
 R_T: Thermistor value at T

4. Package characteristics

Symbol	Characteristic	Min	Typ	Max	Unit	
V_{ISOL}	RMS Isolation Voltage, any terminal to case $t=1$ min, $I_{isol}<1$ mA, 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				160	g

$T_J=175^{\circ}\text{C}$ for Trench & Field Stop IGBT

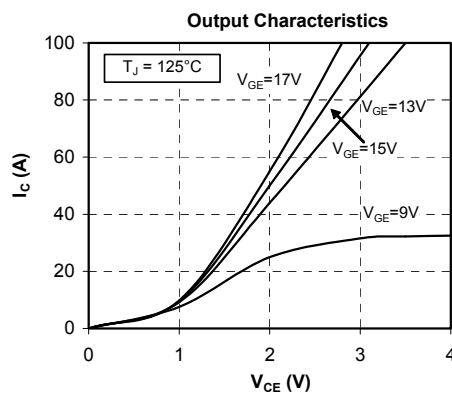
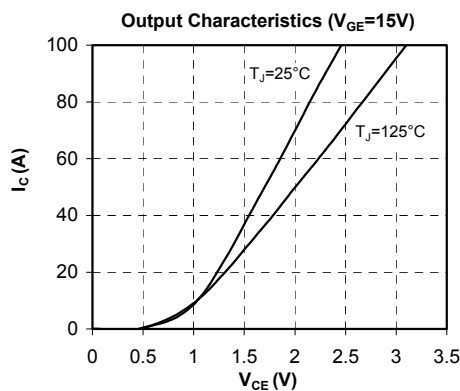
5. SP3 Package outline (dimensions in mm)

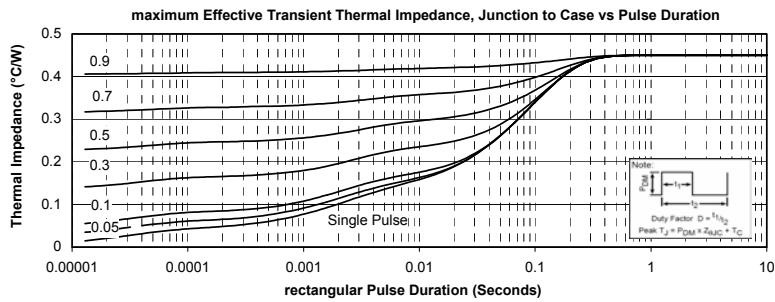
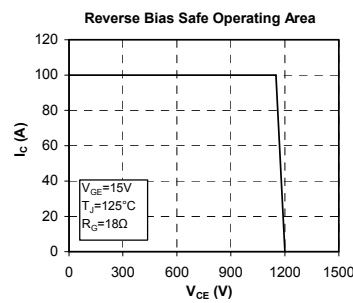
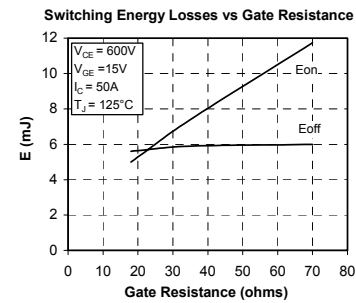
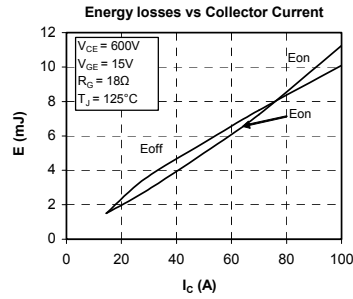
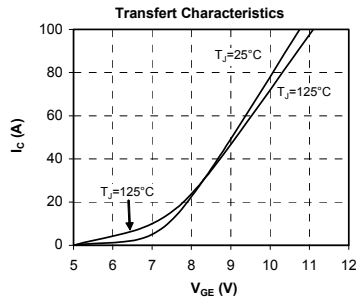


See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

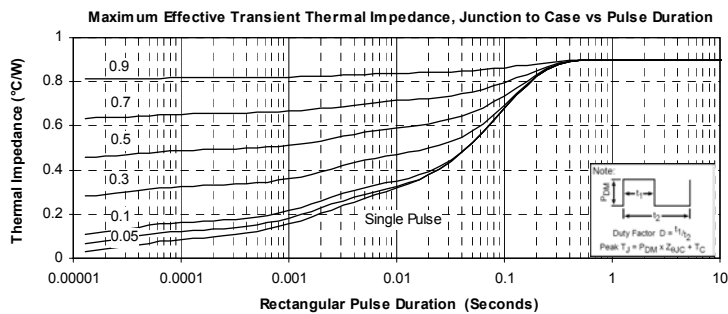
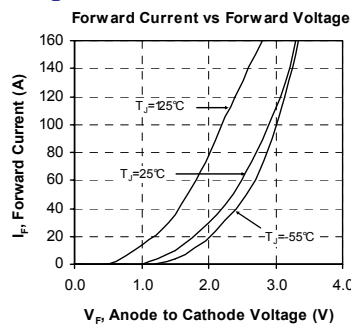
6. Top switches curves

6.1 Top Trench + Field Stop IGBT® typical performance curves



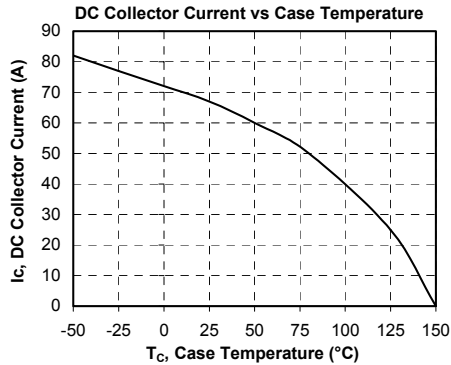
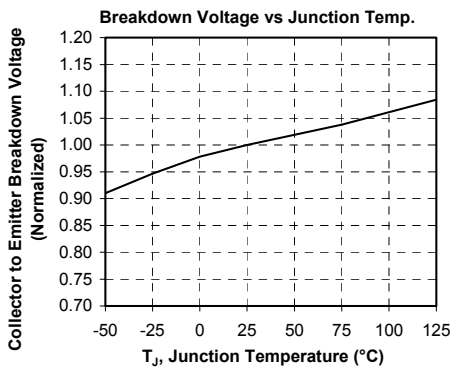
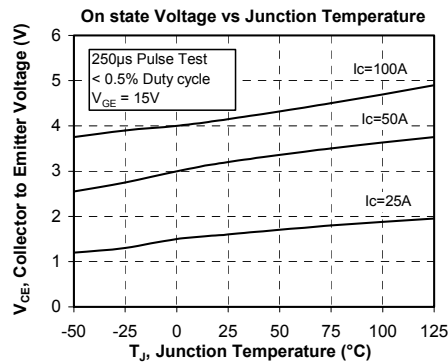
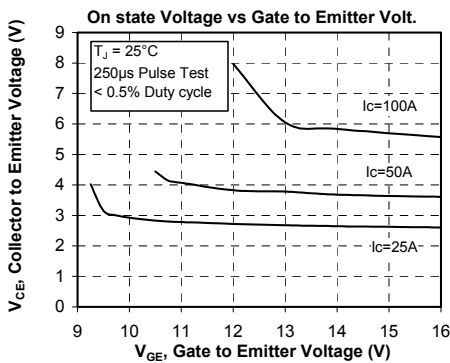
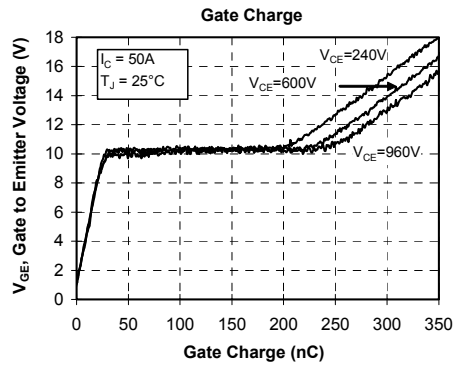
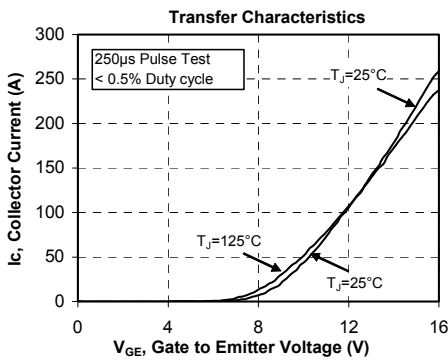
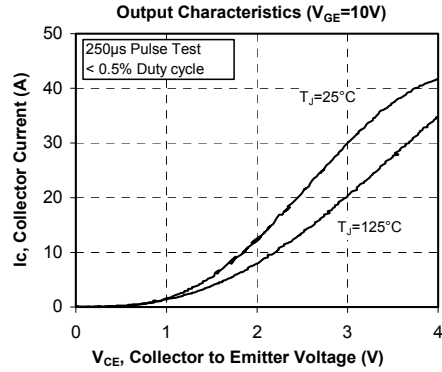
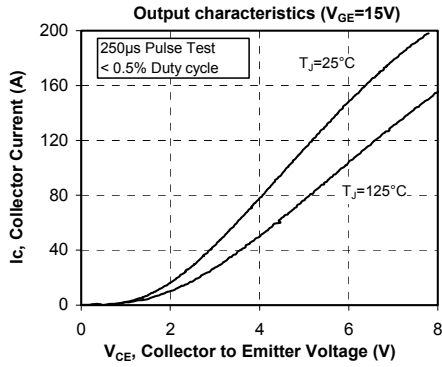


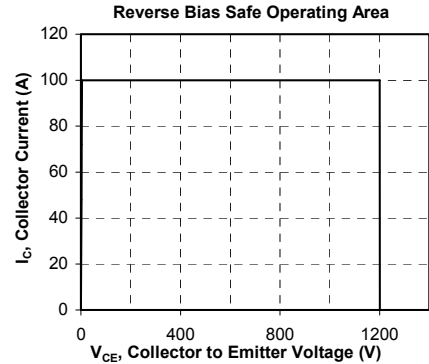
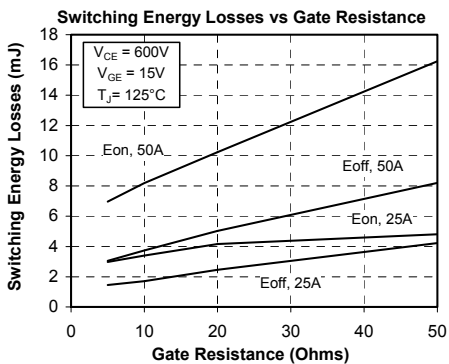
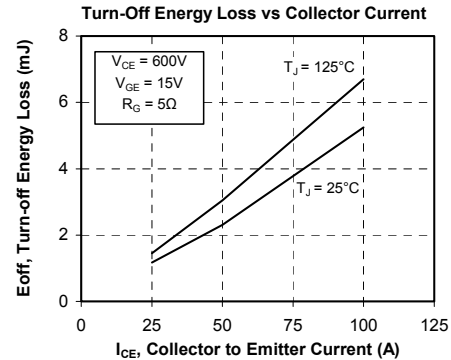
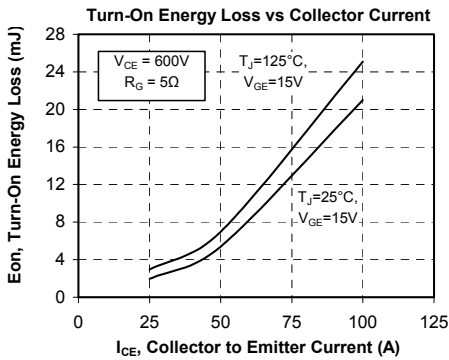
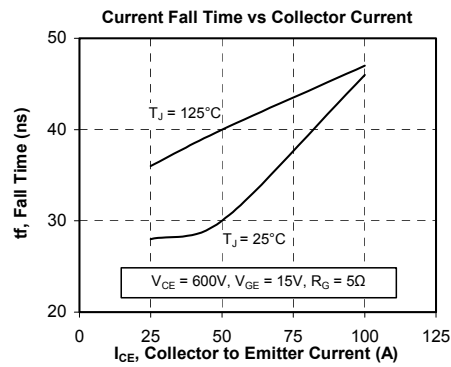
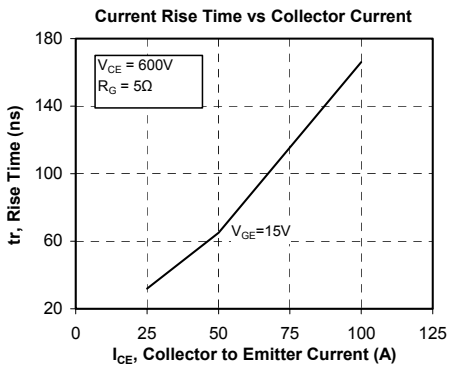
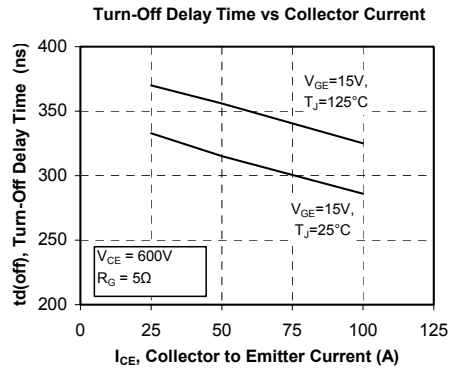
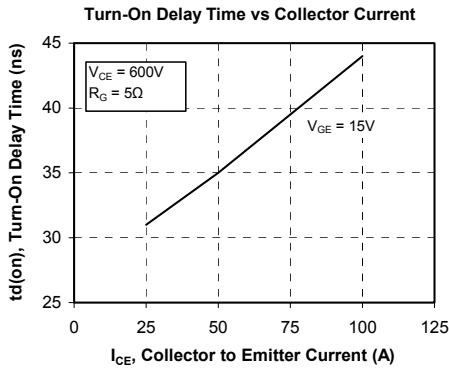
6.2 Top Fast diode typical performance curves

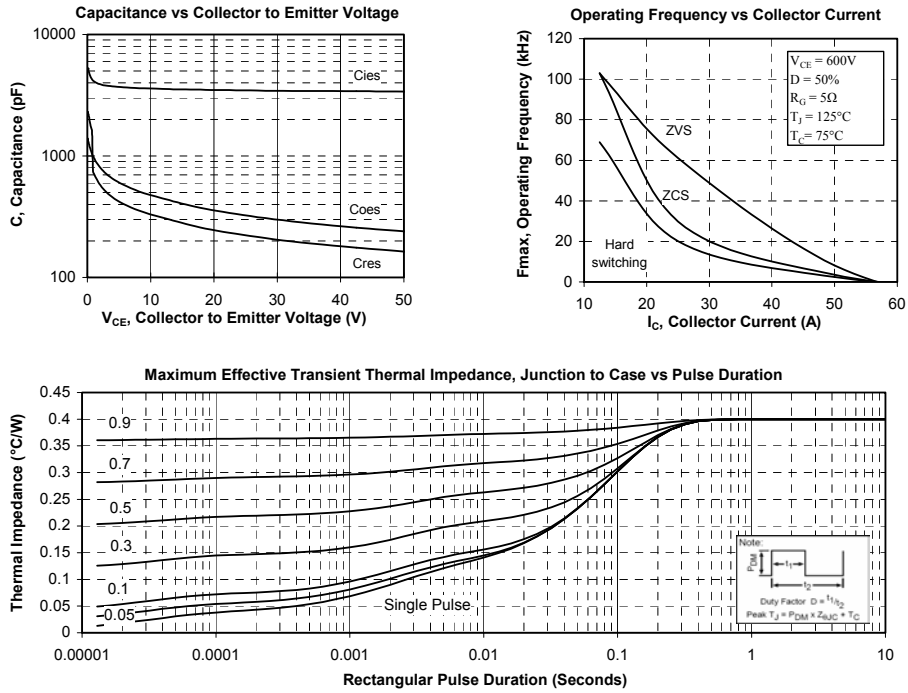


7. Bottom switches curves

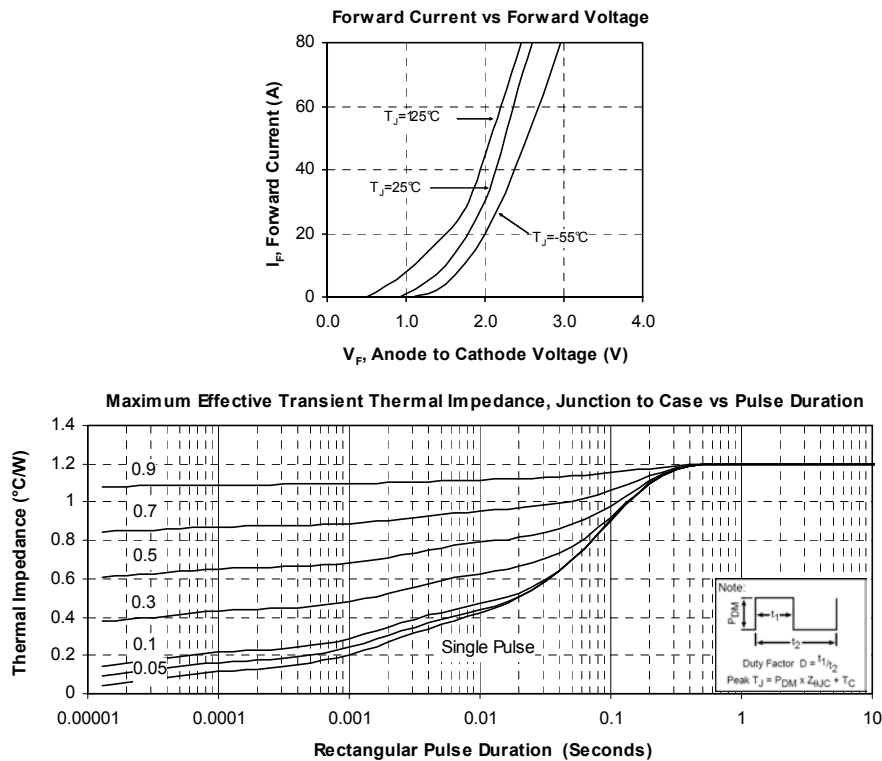
7.1 Bottom fast NPT IGBT typical performance curves







7.2 Bottom diode typical performance curves



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