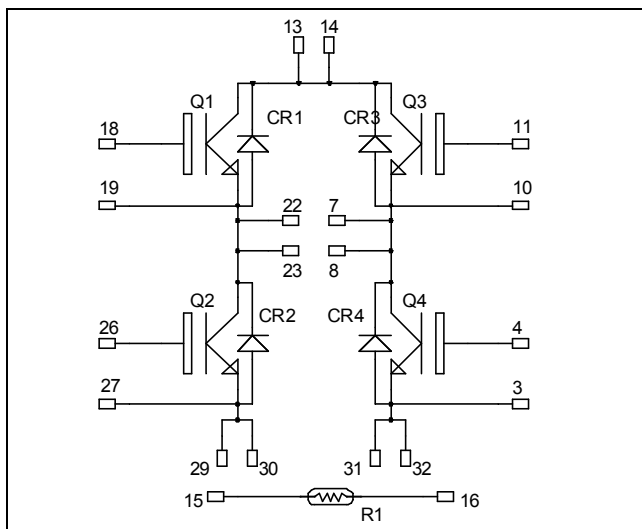


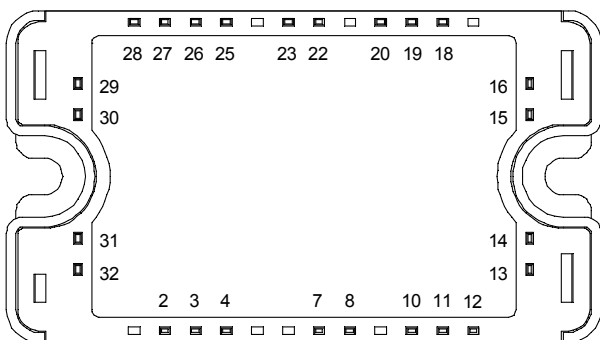
**Full - Bridge
NPT & Trench + Field Stop® IGBT
Power module**

Trench & Field Stop® IGBT Q1, Q3:
 $V_{CES} = 1200V$; $I_C = 15A$ @ $T_c = 80^\circ C$

Fast NPT IGBT Q2, Q4:
 $V_{CES} = 1200V$; $I_C = 15A$ @ $T_c = 80^\circ C$



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	$T_C = 25^\circ\text{C}$	25
		$T_C = 80^\circ\text{C}$	15
I_{CM}	Pulsed Collector Current	$T_C = 25^\circ\text{C}$	30
V_{GE}	Gate - Emitter Voltage	± 20	V
P_D	Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	115
RBSOA	Reverse Bias Safe Operation Area	$T_j = 125^\circ\text{C}$	30A @ 1150V

Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0\text{V}, V_{CE} = 1200\text{V}$			250	μA
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15\text{V}$		1.7	2.1	V
		$I_C = 15\text{A}$		2.0		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 0.6\text{mA}$	5.0	5.8	6.5	V
I_{GES}	Gate - Emitter Leakage Current	$V_{GE} = 20\text{V}, V_{CE} = 0\text{V}$			400	nA

Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{ies}	Input Capacitance	$V_{GE} = 0\text{V}, V_{CE} = 25\text{V}$		1100		pF
C_{res}	Reverse Transfer Capacitance	$f = 1\text{MHz}$		90		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 15\text{A}$ $R_G = 62\Omega$		90		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			420		
T_f	Fall Time			80		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) $V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 15\text{A}$ $R_G = 62\Omega$		90		ns
T_r	Rise Time			30		
$T_{d(off)}$	Turn-off Delay Time			520		
T_f	Fall Time			120		
E_{on}	Turn-on Switching Energy	$V_{GE} = \pm 15\text{V}$ $V_{Bus} = 600\text{V}$ $I_C = 15\text{A}$ $R_G = 62\Omega$	$T_i = 25^\circ\text{C}$	1.15		mJ
E_{off}	Turn-off Switching Energy		$T_i = 125^\circ\text{C}$	1.5		
			$T_i = 25^\circ\text{C}$	1.15		
			$T_i = 125^\circ\text{C}$	1.8		
R_{thJC}	Junction to Case Thermal resistance				1.3	$^\circ\text{C/W}$

1.2 Top fast 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	$V_R = 1200V$	$T_j = 25^\circ C$			100	μA
			$T_j = 125^\circ C$			500	
I_F	DC Forward Current		$T_c = 80^\circ C$		15		A
V_F	Diode Forward Voltage	$I_F = 15A$			2.8	3.3	V
		$I_F = 30A$			3.4		
		$I_F = 15A$	$T_j = 125^\circ C$		2.4		
t_{rr}	Reverse Recovery Time	$I_F = 15A$ $V_R = 800V$ $di/dt = 200A/\mu s$	$T_j = 25^\circ C$		240		ns
			$T_j = 125^\circ C$		290		
Q_{rr}	Reverse Recovery Charge	$I_F = 15A$ $V_R = 800V$ $di/dt = 200A/\mu s$	$T_j = 25^\circ C$		260		nC
			$T_j = 125^\circ C$		960		
R_{thJC}	Junction to Case Thermal resistance					2	$^\circ C/W$

2. Bottom switches

2.1 Bottom Fast NPT IGBT characteristics

Absolute maximum ratings

Symbol	Parameter	Max ratings		Unit
V_{CES}	Collector - Emitter Breakdown Voltage		1200	V
I_C	Continuous Collector Current	$T_C = 25^\circ C$	25	A
		$T_C = 80^\circ C$	15	
I_{CM}	Pulsed Collector Current	$T_C = 25^\circ C$	60	
V_{GE}	Gate – Emitter Voltage		± 20	V
P_D	Maximum Power Dissipation	$T_C = 25^\circ C$	140	W
RBSOA	Reverse Bias Safe Operating Area	$T_j = 125^\circ C$	30A@1150V	

Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero Gate Voltage Collector Current	$V_{GE} = 0V$ $V_{CE} = 1200V$	$T_j = 25^\circ C$			250	μA
			$T_j = 125^\circ C$			500	
$V_{CE(sat)}$	Collector Emitter Saturation Voltage	$V_{GE} = 15V$ $I_C = 15A$	$T_j = 25^\circ C$	2.5	3.2	3.7	V
			$T_j = 125^\circ C$		4.0		
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CEs}$, $I_C = 1mA$		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		1000		pF
C _{oes}	Output Capacitance	V _{CE} = 25V		150		
C _{res}	Reverse Transfer Capacitance	f = 1MHz		70		
Q _g	Total gate Charge	V _{GE} = 15V		99		nC
Q _{ge}	Gate – Emitter Charge	V _{Bus} = 300V		10		
Q _{gc}	Gate – Collector Charge	I _C = 15A		70		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (25°C)		60		ns
T _r	Rise Time	V _{GE} = 15V		50		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 400V		315		
T _f	Fall Time	I _C = 15A R _G = 33Ω		30		
T _{d(on)}	Turn-on Delay Time	Inductive Switching (125°C)		60		ns
T _r	Rise Time	V _{GE} = 15V		50		
T _{d(off)}	Turn-off Delay Time	V _{Bus} = 400V		356		
T _f	Fall Time	I _C = 15A R _G = 33Ω		40		
E _{on}	Turn-on Switching Energy	V _{GE} = 15V V _{Bus} = 400V T _j = 125°C		2		mJ
E _{off}	Turn-off Switching Energy	I _C = 15A R _G = 33Ω T _j = 125°C		1		
R _{thJC}	Junction to Case Thermal resistance				0.9	°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			100	μA
		T _j = 25°C				
		T _j = 125°C			500	
I _F	DC Forward Current	T _c = 80°C		15		A
V _F	Diode Forward Voltage	I _F = 15A		2.8	3.3	V
		I _F = 30A		3.4		
		I _F = 15A T _j = 125°C		2.4		
t _{rr}	Reverse Recovery Time	I _F = 15A V _R = 800V		240		ns
		di/dt = 200A/μs		290		
Q _{rr}	Reverse Recovery Charge	T _j = 25°C		260		nC
		T _j = 125°C		960		
R _{thJC}	Junction to Case Thermal resistance				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

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

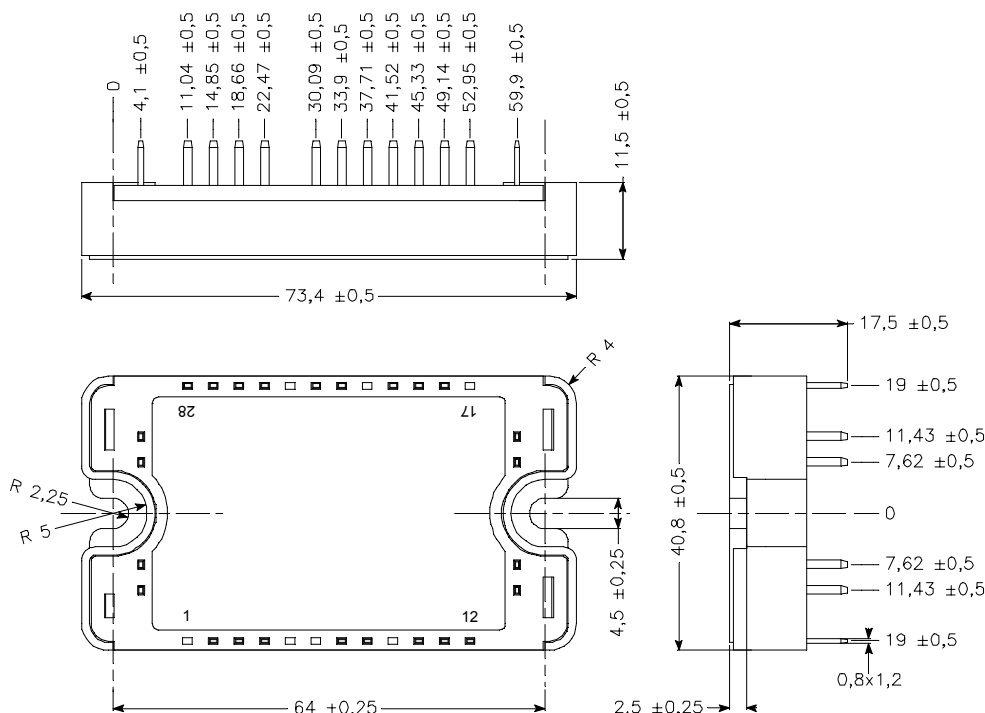
T: Thermistor temperature
 R_T: Thermistor value at T

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

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

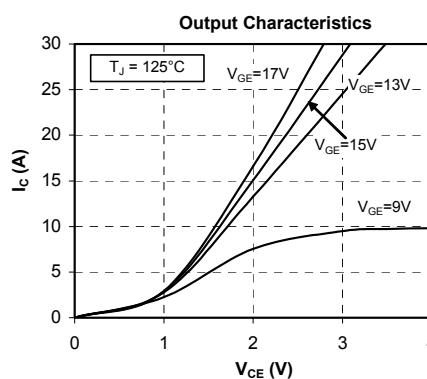
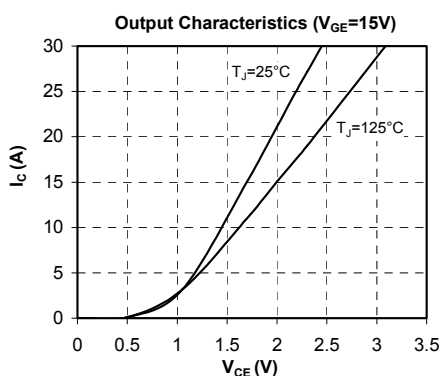
5. SP3 Package outline (dimensions in mm)

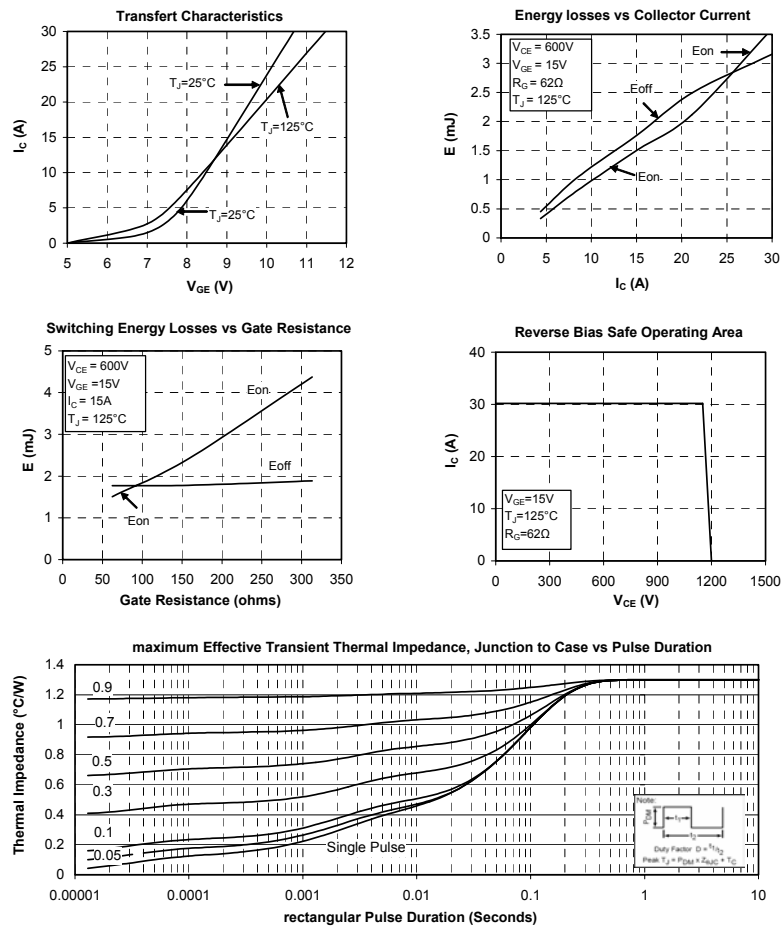


See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

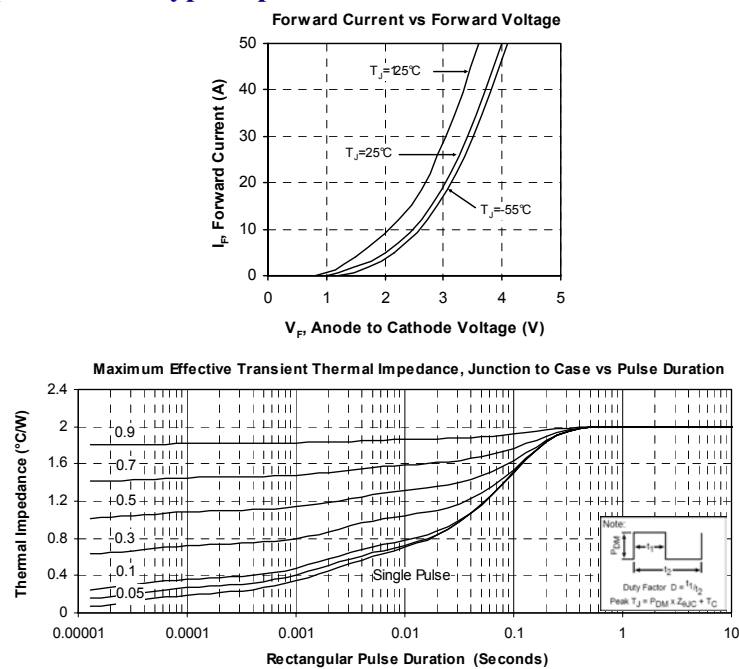
6. Top switches curves

6.1 Top Trench + Field Stop IGBT® typical performance curves



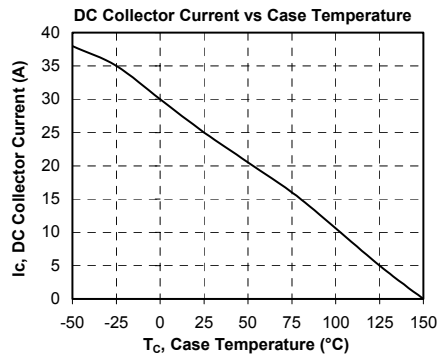
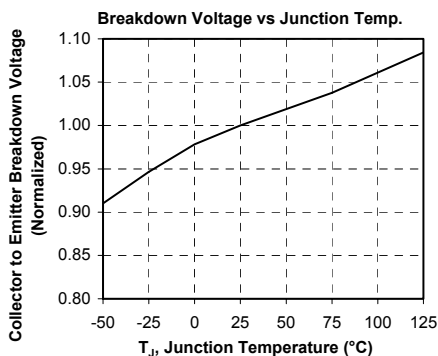
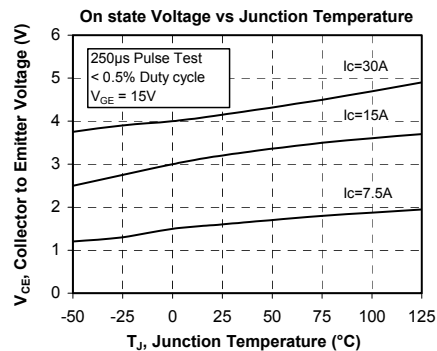
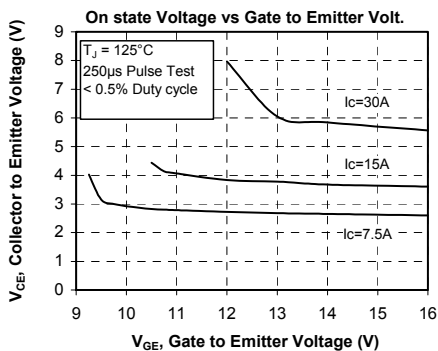
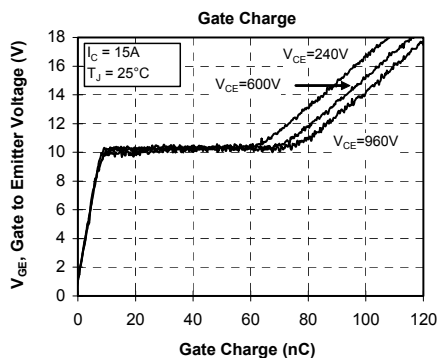
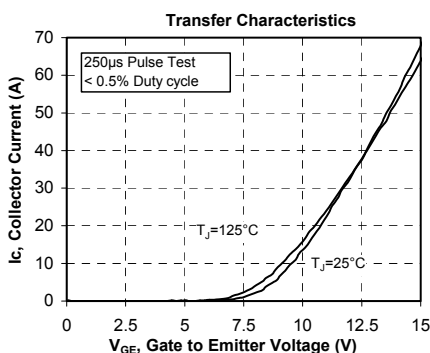
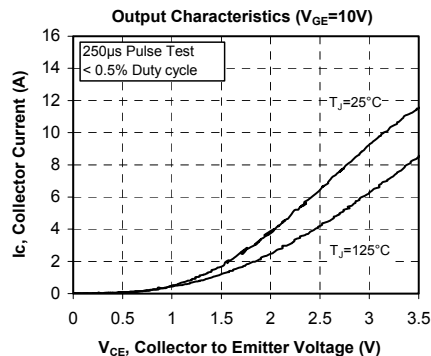
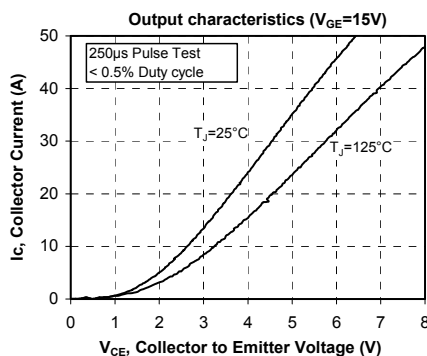


6.2 Top Fast diode typical performance curves

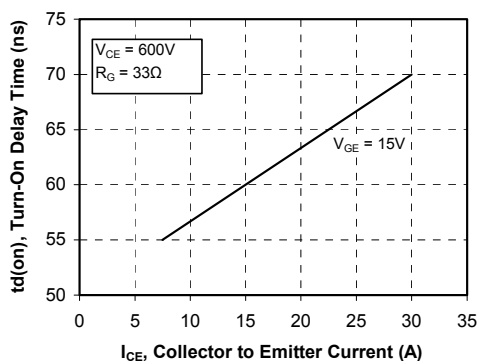


7. Bottom switches curves

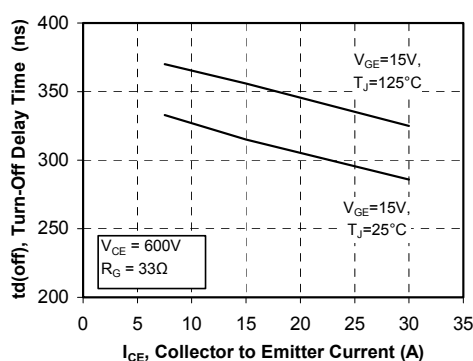
7.1 Bottom fast NPT IGBT typical performance curves



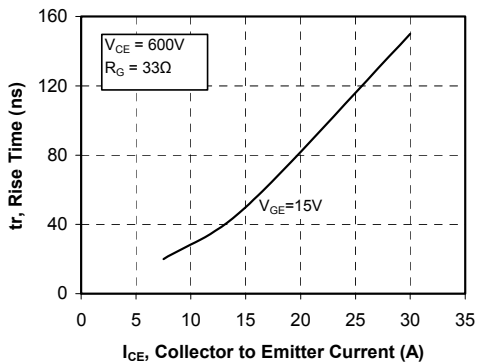
Turn-On Delay Time vs Collector Current



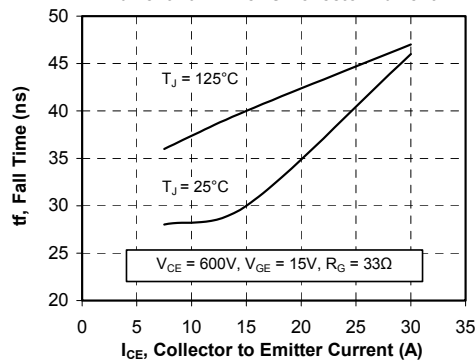
Turn-Off Delay Time vs Collector Current



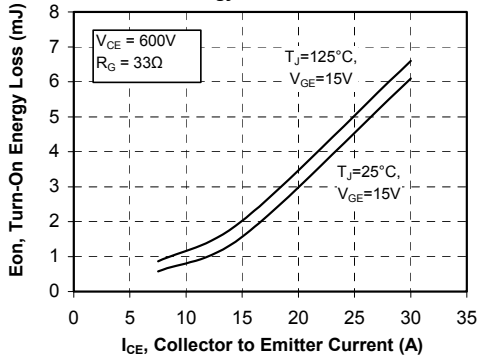
Current Rise Time vs Collector Current



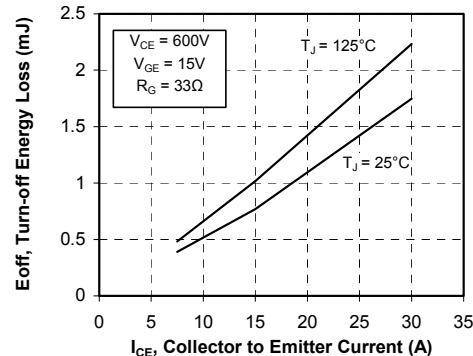
Current Fall Time vs Collector Current



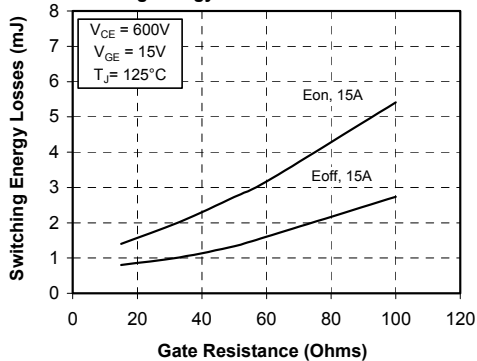
Turn-On Energy Loss vs Collector Current



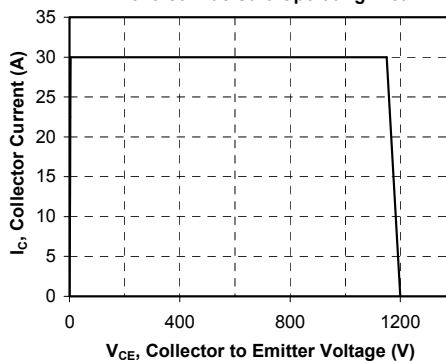
Turn-Off Energy Loss vs Collector Current

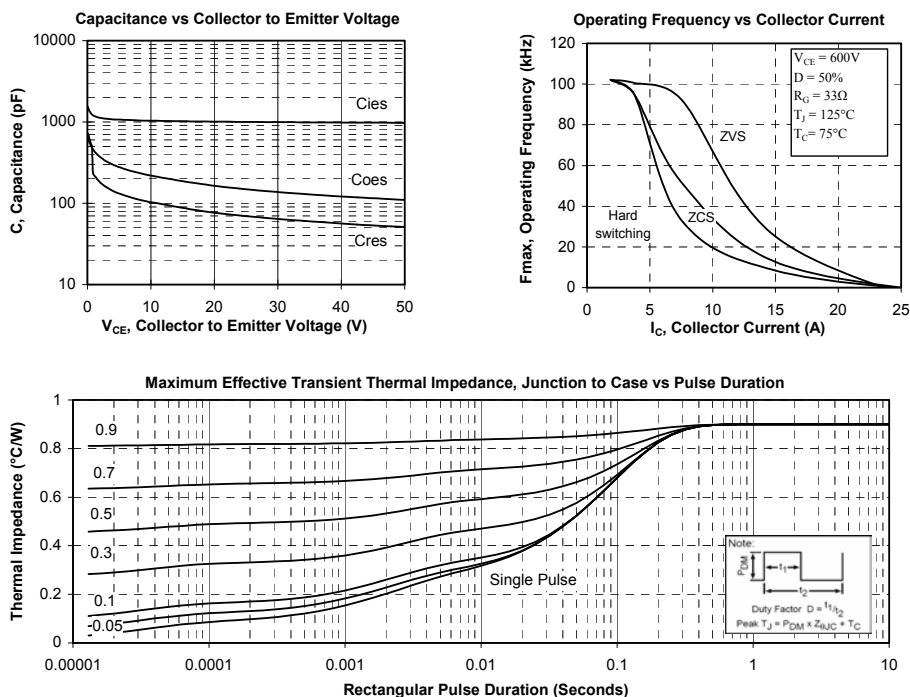


Switching Energy Losses vs Gate Resistance

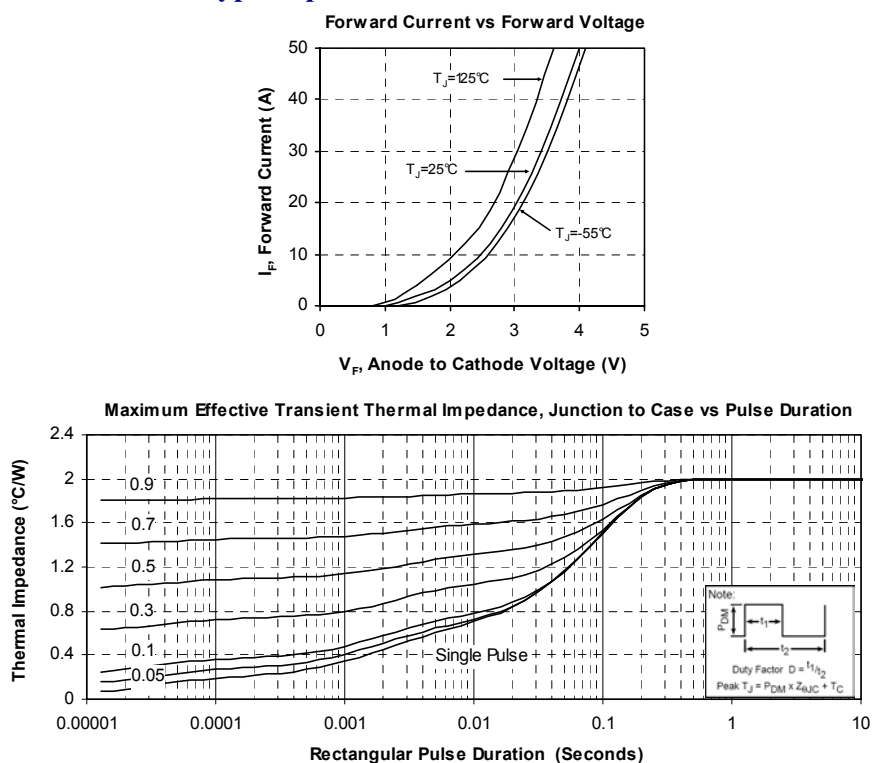


Reverse Bias Safe Operating Area





7.2 Bottom diode typical performance curves



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