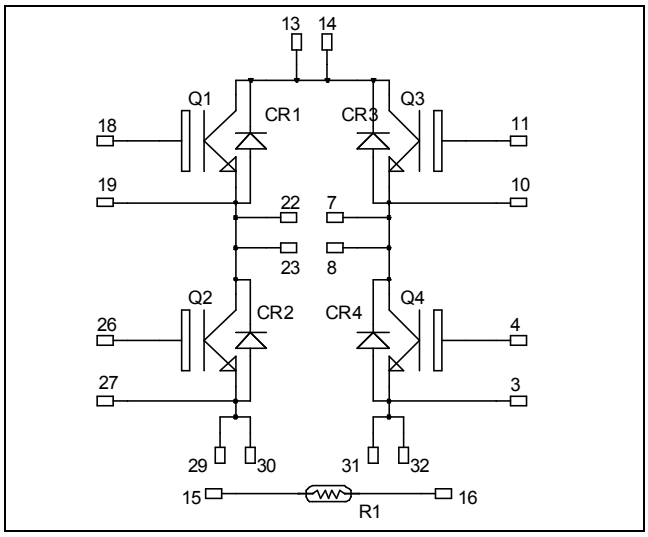
APTGV50H120T3G

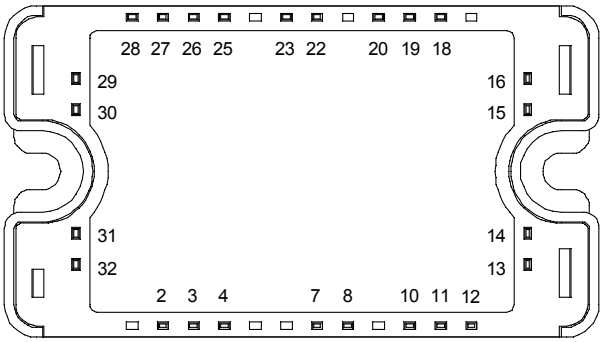
Full - Bridge
NPT & Trench + Field Stop® IGBT
Power module

Trench & Field Stop® IGBT Q1, Q3:
V_{CES} = 1200V ; I_C = 50A @ Tc = 80°C

Fast NPT IGBT Q2, Q4:
V_{CES} = 1200V ; I_C = 50A @ Tc = 80°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 Handing Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ T_j = 25°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°C	75	A
		T_C = 80°C	50	
I_{CM}	Pulsed Collector Current	T_C = 25°C	100	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_C = 25°C	270	W
RBSOA	Reverse Bias Safe Operating Area	T_J = 125°C	100A @ 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°C			250	µA
			T_j = 125°C			500	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V, I_C = 50A	T_j = 25°C	1.4	1.7	2.1	V
			T_j = 125°C		2.0		
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE} = V_{CE}, I_C = 2mA		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, V_{CE} = 25V, f = 1MHz			3600		pF
C_{rss}	Reverse Transfer Capacitance				160		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C), V_{GE} = ±15V, V_{Bus} = 600V, I_C = 50A, R_G = 18Ω			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} = ±15V, V_{Bus} = 600V, I_C = 50A, R_G = 18Ω			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} = ±15V, V_{Bus} = 600V, I_C = 50A, R_G = 18Ω	T_j = 125°C		5		mJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		5.5		
R_{thJC}	Junction to Case Thermal resistance					0.45	°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°C			100	µA
			T_j = 125°C			500	
I_F	DC Forward Current		Tc = 80°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°C		1.8		
t_{rr}	Reverse Recovery Time	I_F = 60A V_R = 800V di/dt =200A/µs	T_j = 25°C		265		ns
			T_j = 125°C		350		
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		560		nC
			T_j = 125°C		2890		
R_{thJC}	Junction to Case Thermal resistance					0.9	°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°C	70	A
		T_c = 80°C	50	
I_{CM}	Pulsed Collector Current	T_c = 25°C	150	
V_{GE}	Gate – Emitter Voltage		±20	V
P_D	Maximum Power Dissipation	T_c = 25°C	312	W
RBSOA	Reverse Bias Safe Operating Area	T_j = 150°C	100A @ 1200V	

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°C			250	µA
			T_j = 125°C			500	
$V_{CE(sat)}$	Collector Emitter saturation Voltage	V_{GE} =15V I_C = 50A	T_j = 25°C		3.2	3.7	V
			T_j = 125°C		4.0		
$V_{GE(th)}$	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 V_{CE} = 25V f = 1MHz			3450		pF
C_{oes}	Output Capacitance				330		
C_{res}	Reverse Transfer Capacitance				220		
Q_g	Total gate Charge	V_{GS} = 15V V_{Bus} = 600V I_C = 50A			330		nC
Q_{ge}	Gate – Emitter Charge				35		
Q_{gc}	Gate – Collector Charge				200		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (25°C) V_{GE} = 15V V_{Bus} = 600V I_C = 50A R_G = 5 Ω			35		ns
T_r	Rise Time				65		
$T_{d(off)}$	Turn-off Delay Time				320		
T_f	Fall Time				30		
$T_{d(on)}$	Turn-on Delay Time	Inductive Switching (125°C) V_{GE} = ±15V V_{Bus} = 600V I_C = 50A R_G = 5 Ω			35		ns
T_r	Rise Time				65		
$T_{d(off)}$	Turn-off Delay Time				360		
T_f	Fall Time				40		
E_{on}	Turn-on Switching Energy	V_{GE} = ±15V V_{Bus} = 600V I_C = 50A R_G = 5 Ω	T_j = 125°C		6.9		mJ
E_{off}	Turn-off Switching Energy		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	T_j = 25°C			250	µA
			T_j = 125°C			500	
I_F	DC Forward Current		Tc = 80°C		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 di/dt =200A/µs	T_j = 25°C		370		ns
			T_j = 125°C		500		
Q_{rr}	Reverse Recovery Charge		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

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

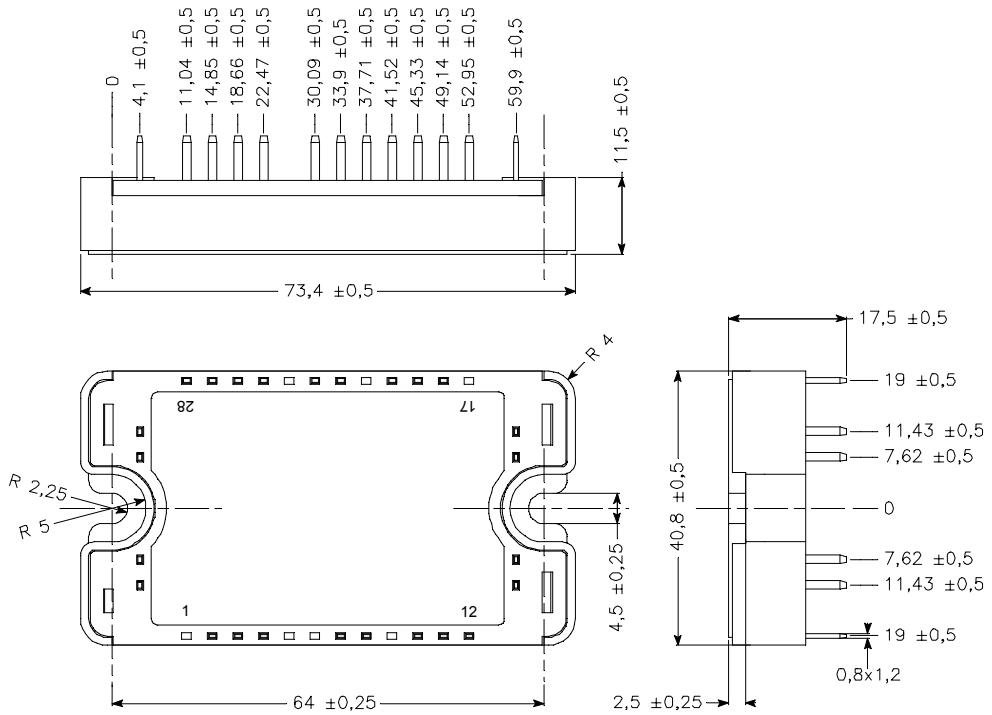
T: Thermistor temperature
R_T: Thermistor value at T

4. Package characteristics

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

Tj=175°C for Trench & Field Stop IGBT

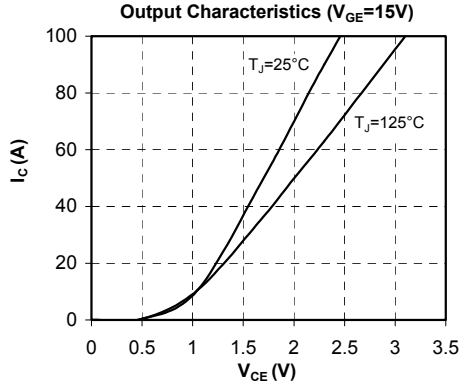
5. SP3 Package outline (dimensions in mm)

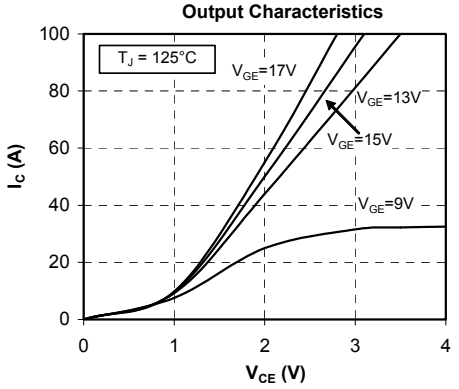


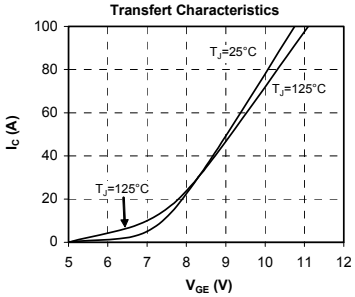
See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com

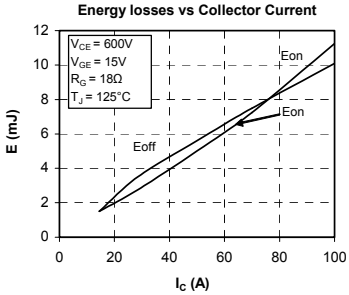
6. Top switches curves

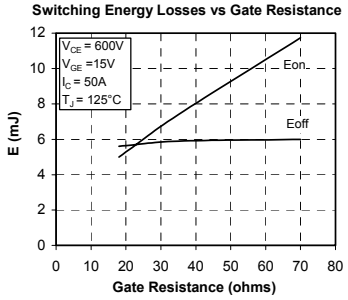
6.1 Top Trench + Field Stop IGBT® typical performance curves

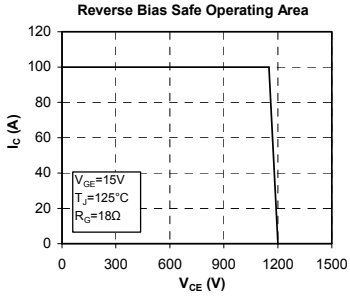


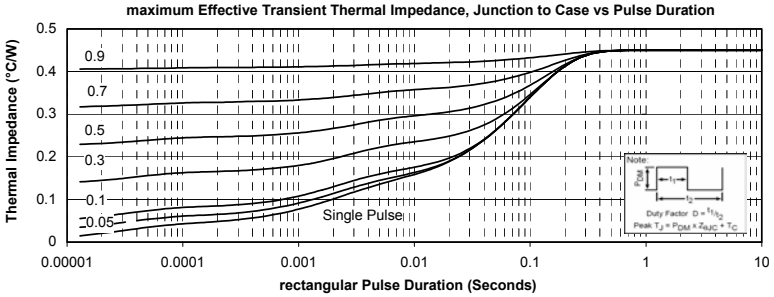




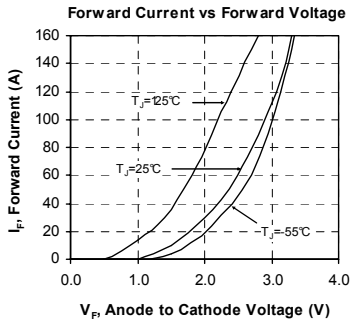


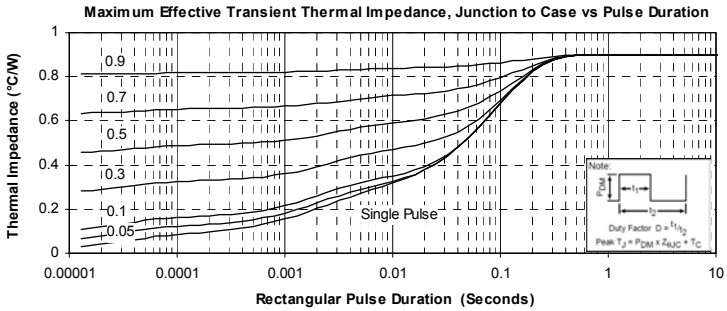






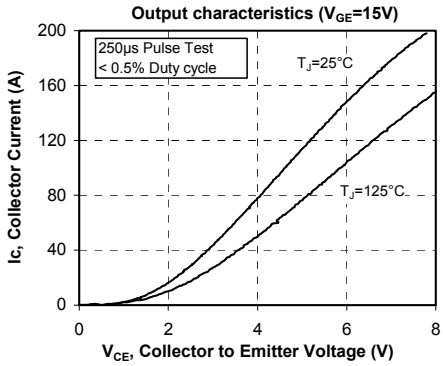
6.2 Top Fast diode typical performance curves

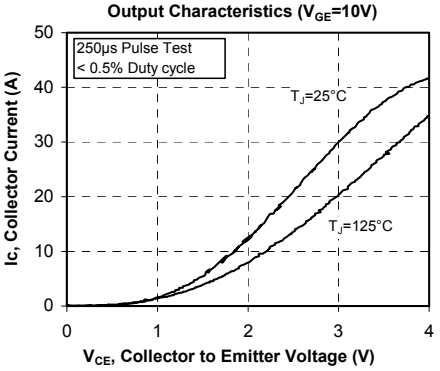


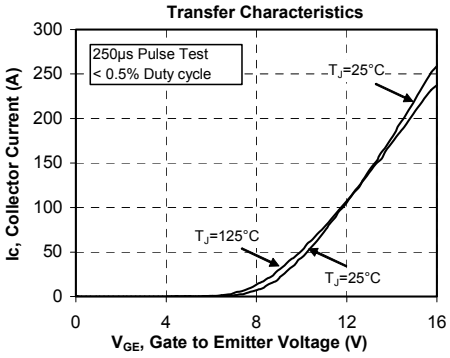


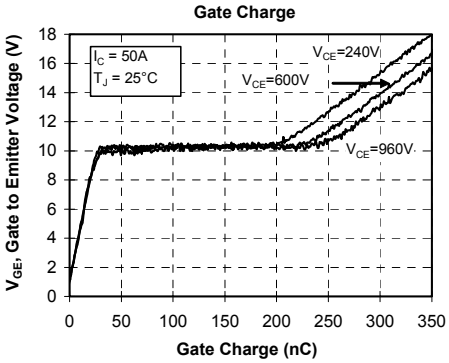
7. Bottom switches curves

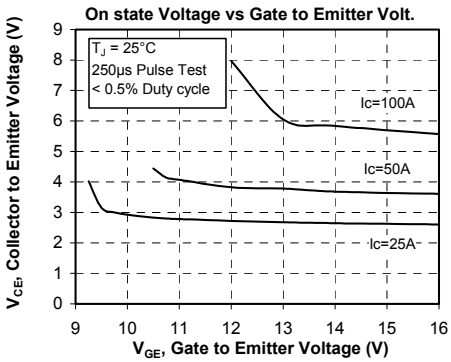
7.1 Bottom fast NPT IGBT typical performance curves

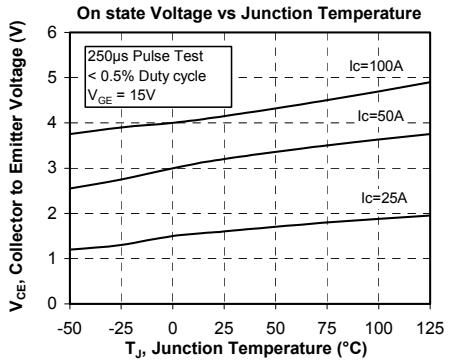


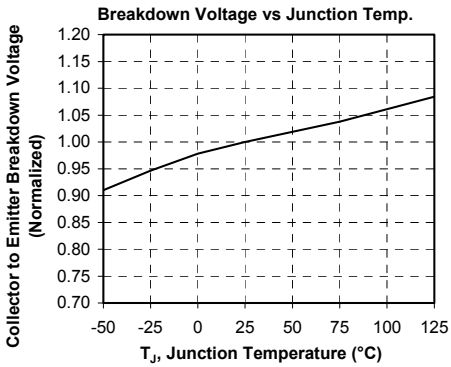


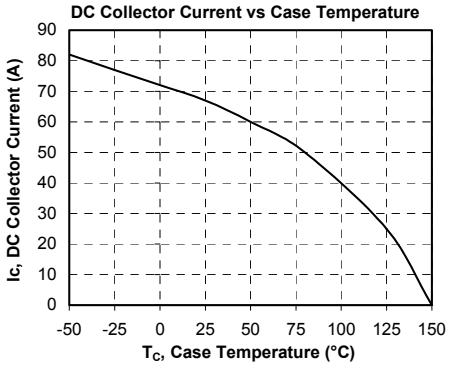




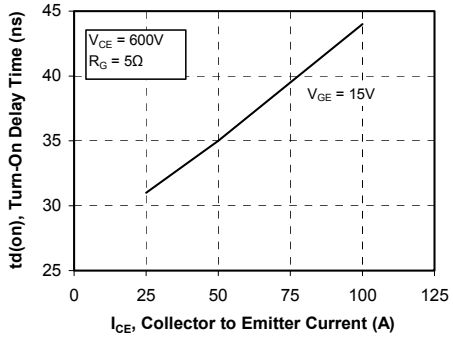




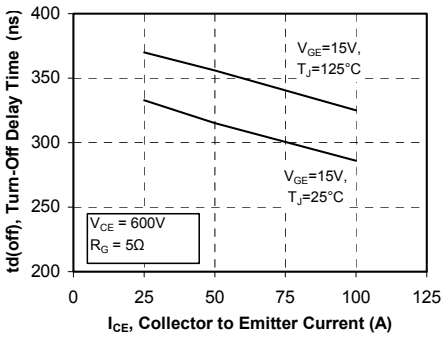




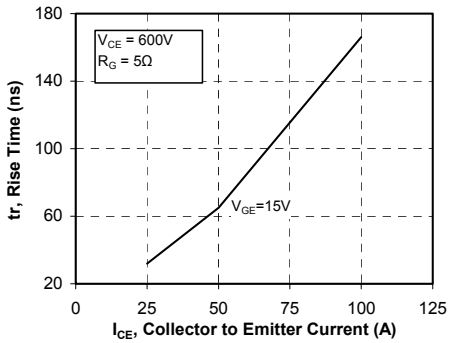
Turn-On Delay Time vs Collector Current



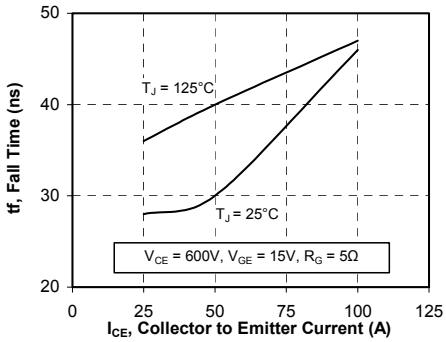
Turn-Off Delay Time vs Collector Current



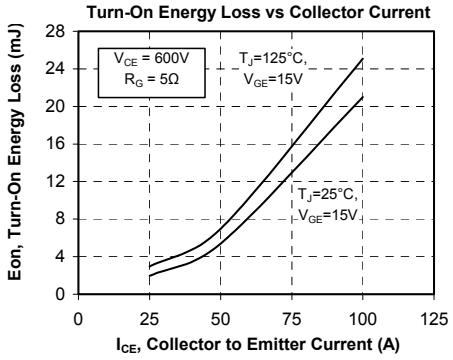
Current Rise Time vs Collector Current



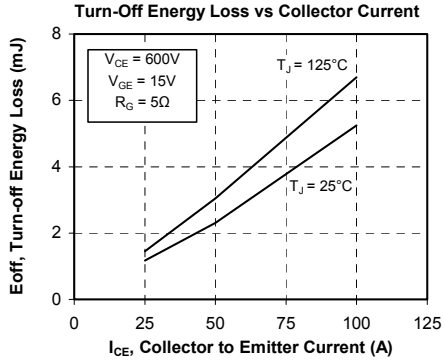
Current Fall Time vs Collector Current



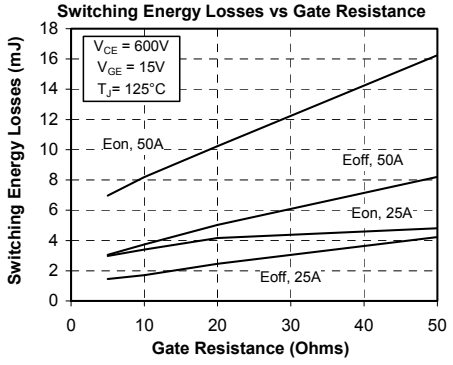
Turn-On Energy Loss vs Collector Current



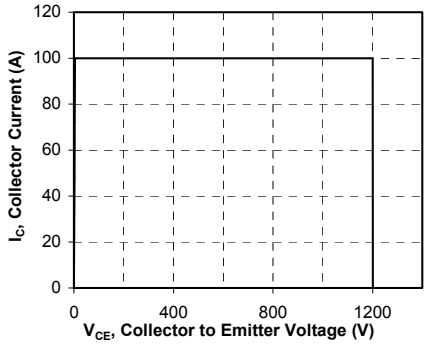
Turn-Off Energy Loss vs Collector Current

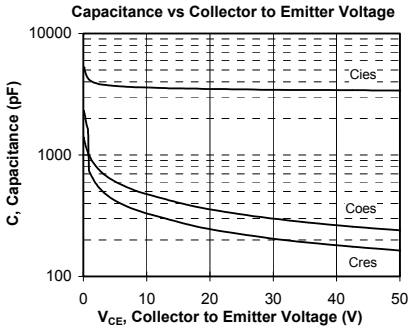


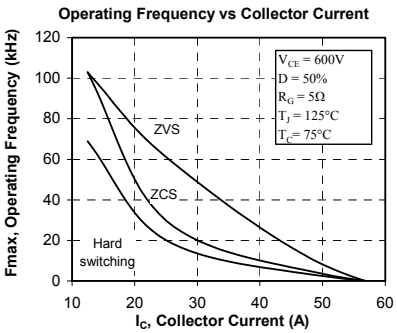
Switching Energy Losses vs Gate Resistance

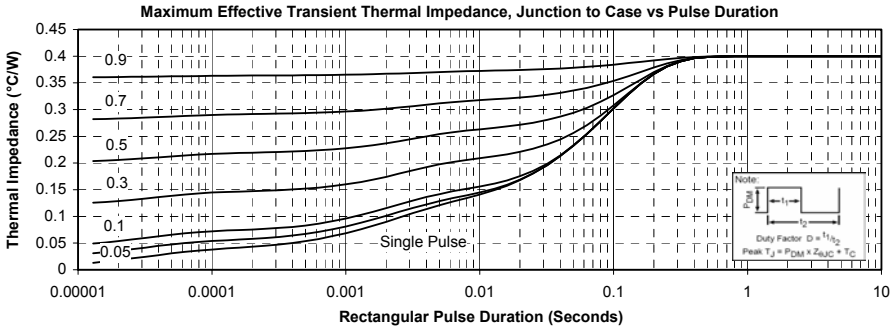


Reverse Bias Safe Operating Area









7.2 Bottom diode typical performance curves