

IGBT ECONO 3 Module, 150 A



ECONO 3, 4 pack

FEATURES

- Trench gate field stop IGBT
- 5 μ s short circuit capability
- Square RBSOA
- HEXFRED low Q_{rr} , low switching energy
- Positive $V_{CE(on)}$ temperature coefficient
- Copper baseplate
- Low stray inductance design
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

BENEFITS

- Benchmark efficiency for SMPS appreciation in particular HF welding
- Rugged transient performance
- Low EMI, requires less snubbing
- Direct mounting to heatsink space saving
- PCB solderable terminals
- Low junction to case thermal resistance

PRIMARY CHARACTERISTICS

V_{CES}	1200 V
$I_C(DC)$ at $T_C = 90^\circ C$	150 A
$V_{CE(on)}$ typ. at 150 A	2.18 V
Package	ECONO 3
Circuit configuration	4 pack with thermistor

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V _{CES}		1200	V
Continuous collector current	I _C	T _C = 25 °C	244	A
		T _C = 80 °C	166	
Pulsed collector current	I _{CM}		675	
Clamped inductive load current	I _{LM}		280	
Diode continuous forward current	I _F	T _C = 25 °C	113	
		T _C = 80 °C	78	
Diode maximum forward current	I _{FSM}		730	
Gate to emitter voltage	V _{GE}		± 20	V
Maximum power dissipation IGBT	P _D	T _C = 25 °C	892	W
		T _C = 80 °C	500	
MODULE				
Operating junction temperature range	T _J		-40 to +150	°C
Storage temperature range	T _{Stg}		-40 to +150	
RMS isolation voltage	V _{ISOL}	Any terminal to case, t = 1 s	3500	V

**ELECTRICAL SPECIFICATIONS** ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 8\text{ mA}$	1200	-	-	
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 150\text{ A}$	-	2.18	2.53	V
		$V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$	-	2.39	-	
		$V_{GE} = 15\text{ V}$, $I_C = 150\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.47	-	
		$V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.77	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 8\text{ mA}$	4.6	5.8	7.6	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 8\text{ mA}$, ($25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)	-	-12.5	-	mV/ $^{\circ}\text{C}$
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$	-	2.0	100	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.40	-	mA
Diode forward voltage drop	V_{FM}	$I_F = 100\text{ A}$	-	2.73	3.5	V
		$I_F = 150\text{ A}$	-	3.18	-	
		$I_F = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.8	-	
		$I_F = 150\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.4	-	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 1000	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q_g	$I_C = 150\text{ A}$ $V_{CC} = 960\text{ V}$ $V_{GE} = 15\text{ V}$	-	590	-	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	70	-	
Gate to collector charge (turn-on)	Q_{gc}		-	300	-	
Turn-on switching loss	E_{on}	$I_C = 150\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 4.7\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	3.37	-	mJ
Turn-off switching loss	E_{off}		-	5.55	-	
Total switching loss	E_{tot}		-	8.92	-	
Turn-on switching loss	E_{on}	$V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $R_g = 4.7\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	5.26	-	
Turn-off switching loss	E_{off}		-	8.60	-	
Total switching loss	E_{tot}		-	13.86	-	
Turn-on delay time	$t_{d(on)}$	$I_C = 150\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 4.7\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	39	-	ns
Rise time	t_r		-	40	-	
Turn-off delay time	$t_{d(off)}$		-	229	-	
Fall time	t_f		-	126	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 280\text{ A}$, $R_g = 4.7\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0 , $V_{CC} = 600\text{ V}$, $V_P = 1200\text{ V}$	Full square			
Short circuit safe operating area	SCSOA	$V_{CC} = 600\text{ V}$, $V_P = 1200\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	-	5	μs
Diode reverse recovery time	$T_J = 25\text{ }^{\circ}\text{C}$	$V_R = 400\text{ V}$, $I_F = 50\text{ A}$ $di/dt = 200\text{ A}/\mu\text{s}$	-	210	-	ns
	$T_J = 125\text{ }^{\circ}\text{C}$		-	345	-	
Diode peak reverse current	$T_J = 25\text{ }^{\circ}\text{C}$		-	13.8	-	A
	$T_J = 125\text{ }^{\circ}\text{C}$		-	23.2	-	
Diode recovery charge	$T_J = 25\text{ }^{\circ}\text{C}$		-	1448	-	nC
	$T_J = 125\text{ }^{\circ}\text{C}$		-	3990	-	

**INTERNAL NTC - THERMISTOR SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS
Resistance	R ₂₅	T _C = 25 °C	5000	Ω
	R ₁₀₀	T _C = 100 °C	493 ± 5 %	
B-value	B _{25/50}	R ₂ = R ₂₅ exp. [B _{25/50} (1/T ₂ - 1/(298.15 K))]	3375 ± 5 %	K
Maximum operating temperature			220	°C
Dissipation constant			2	mW/°C
Thermal time constant			8	s

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
IGBT - junction-to-case (per switch)	R _{thJC}	-	-	0.14	°C/W
DIODE - junction-to-case (per diode)	R _{thJC}	-	-	0.3	
Case to sink, flat, greased surface (per module)	R _{thJS}	-	0.015	-	
Mounting torque (M5)		3.0	-	6.0	Nm
Weight		-	290	-	g

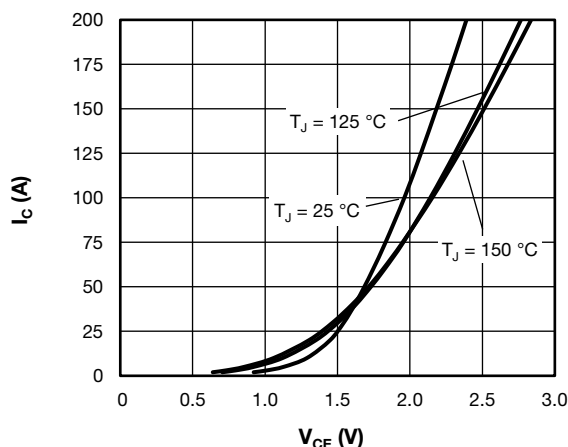
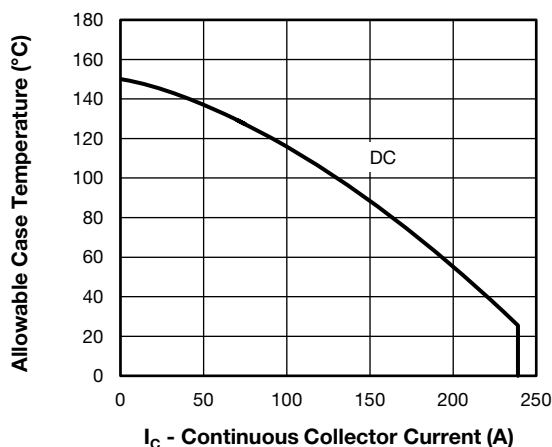
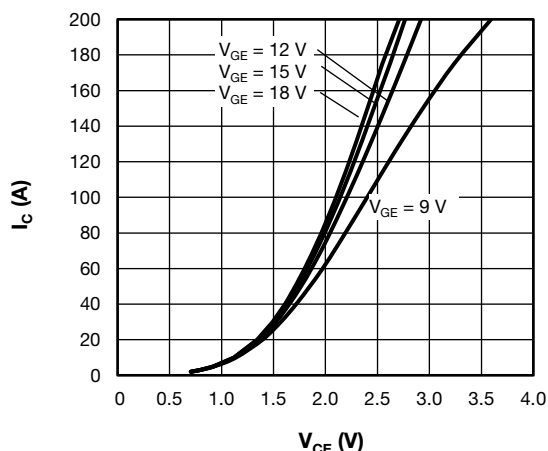
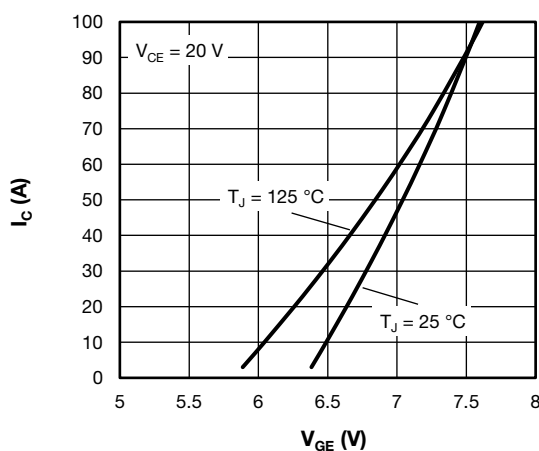
Fig. 1 - Typical Trench IGBT Output Characteristics,
V_{GE} = 15 VFig. 3 - Maximum Trench IGBT Continuous Collector Current vs.
Case TemperatureFig. 2 - Typical Trench IGBT Output Characteristics,
T_J = 125 °C

Fig. 4 - Typical Trench IGBT Transfer Characteristics

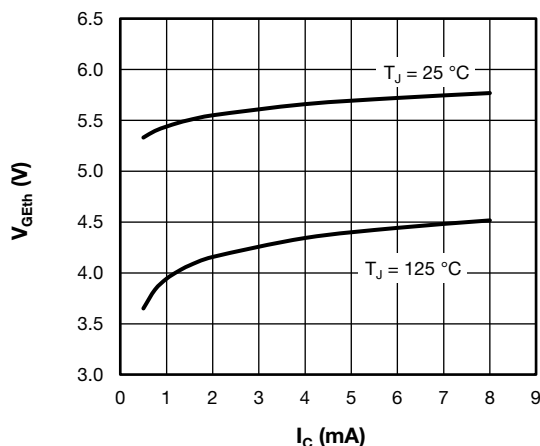
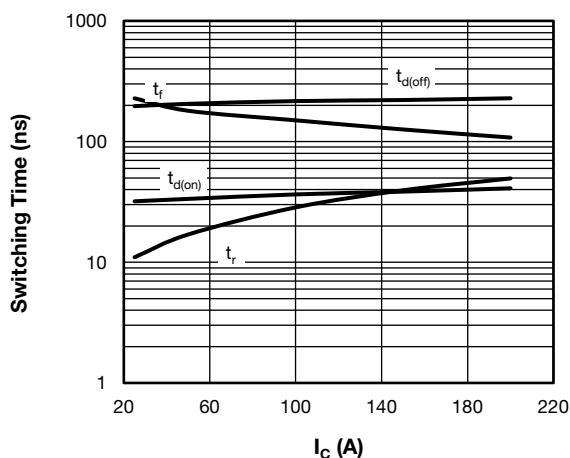


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C with (Antiparallel Diode)

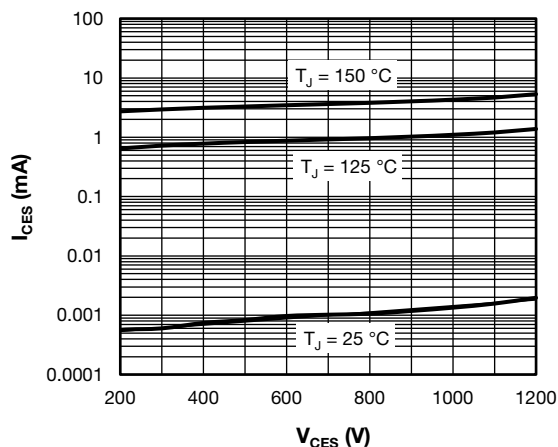
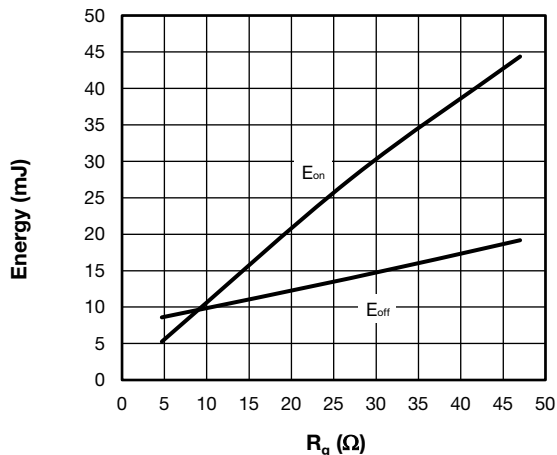
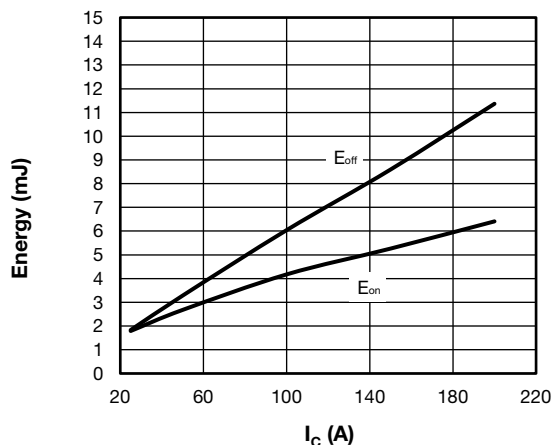
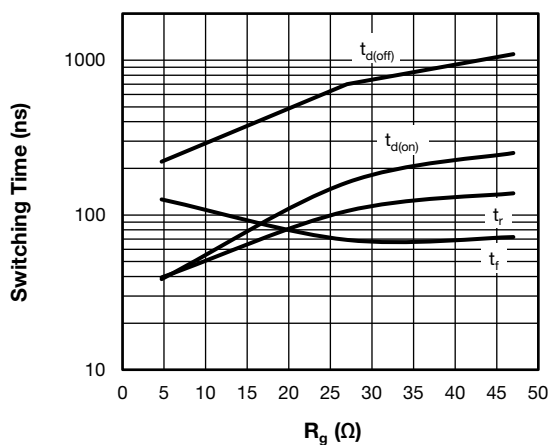
 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\ \mu\text{H}$


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

Fig. 7 - Typical IGBT Energy Loss vs. I_C with (Antiparallel Diode)

 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\ \mu\text{H}$

Fig. 10 - Typical Trench IGBT Switching Time vs. R_g with (Antiparallel Diode)

 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

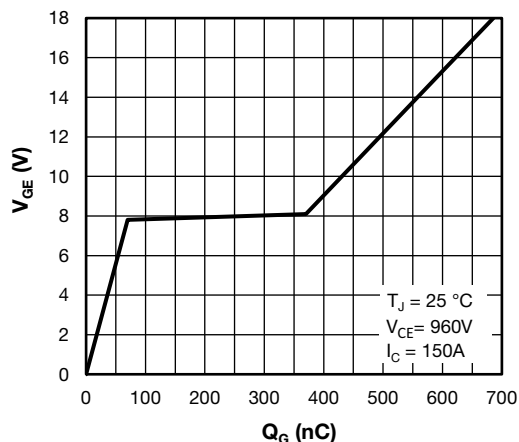


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

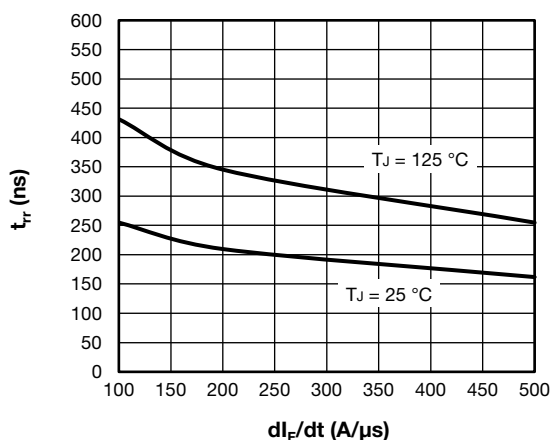


Fig. 14 - Typical Diode Reverse Recovery Time vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

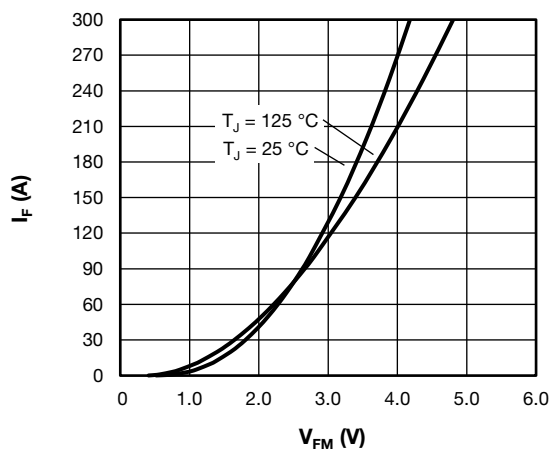


Fig. 12 - Typical Diode Forward Characteristics

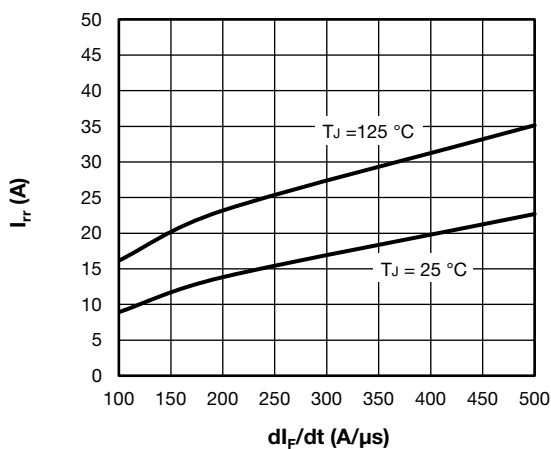


Fig. 15 - Typical Diode Reverse Recovery Current vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

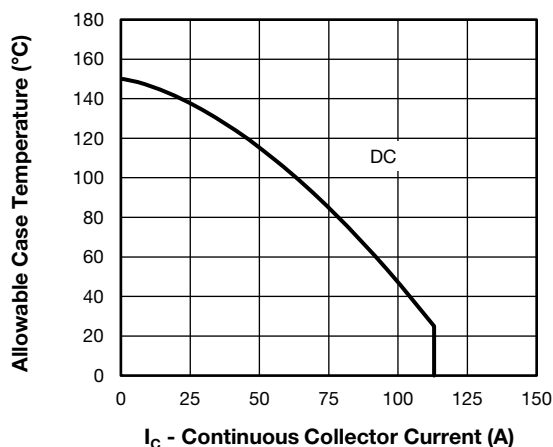


Fig. 13 - Maximum Diode Continuous Forward Current vs. Case Temperature

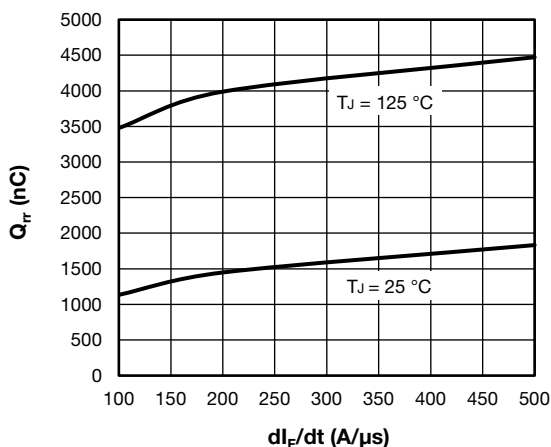


Fig. 16 - Typical Diode Reverse Recovery Cuharge vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

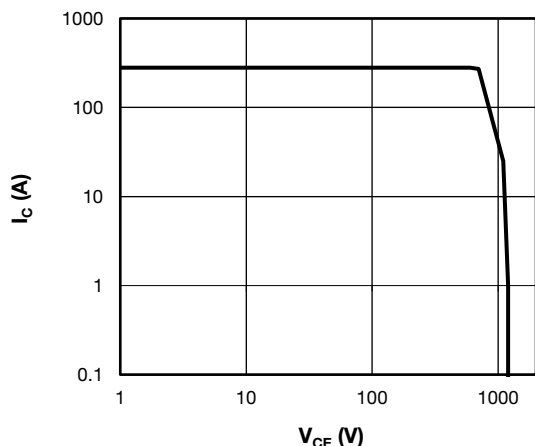


Fig. 17 - Trench IGBT Reverse BIAS SOA
 $T_J = 150^\circ\text{C}$, $I_C = 280\text{ A}$, $R_g = 4.7\ \Omega$, $V_{GE} = +15\text{ V} / 0\text{ V}$
 $V_{CC} = 600\text{ V}$, $V_p = 1200\text{ V}$

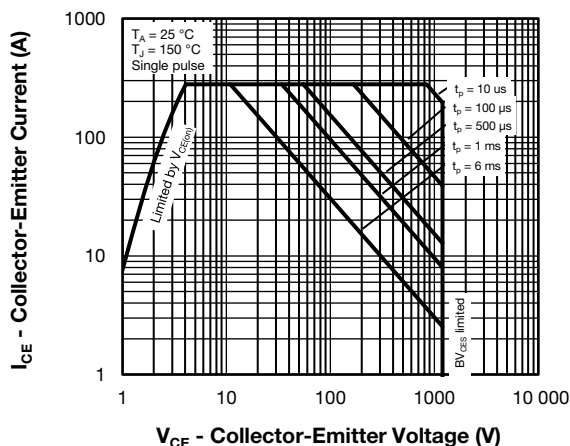


Fig. 18 - Trench IGBT Safe Operating Area

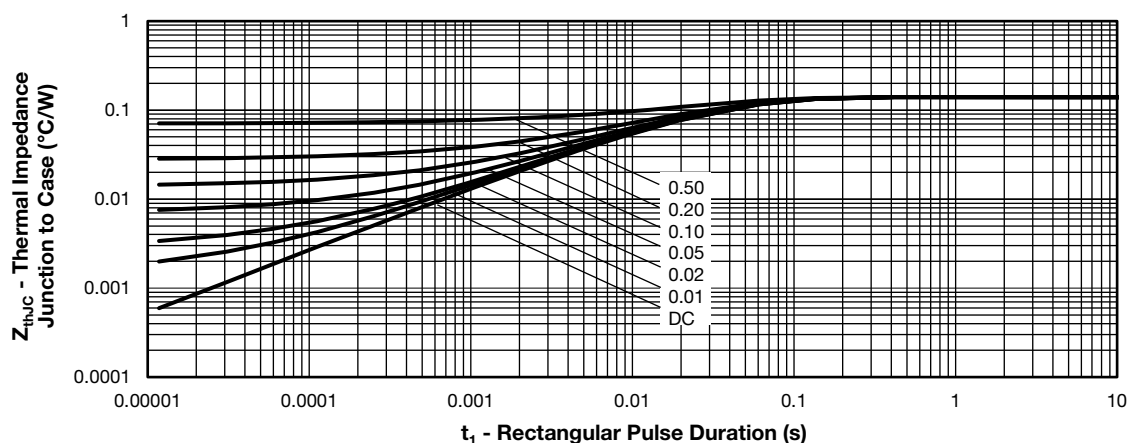


Fig. 19 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

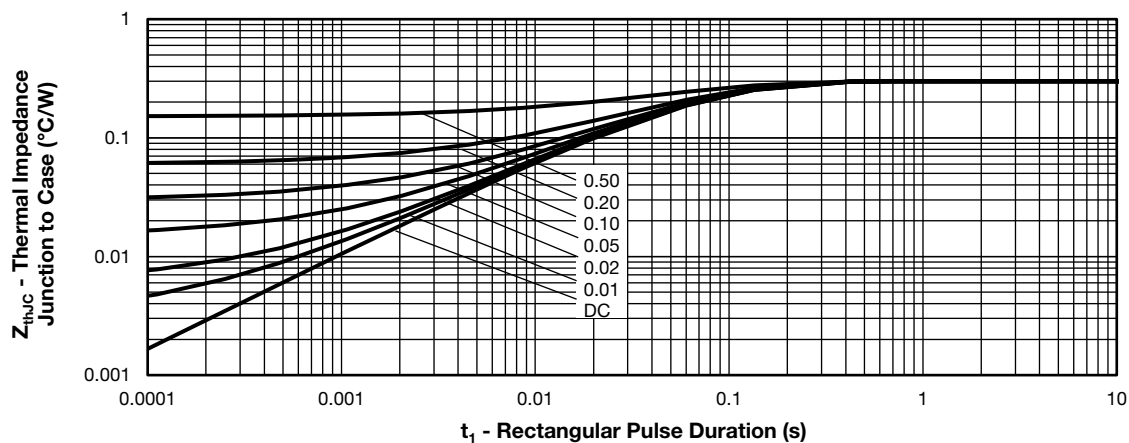


Fig. 20 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics



ORDERING INFORMATION TABLE

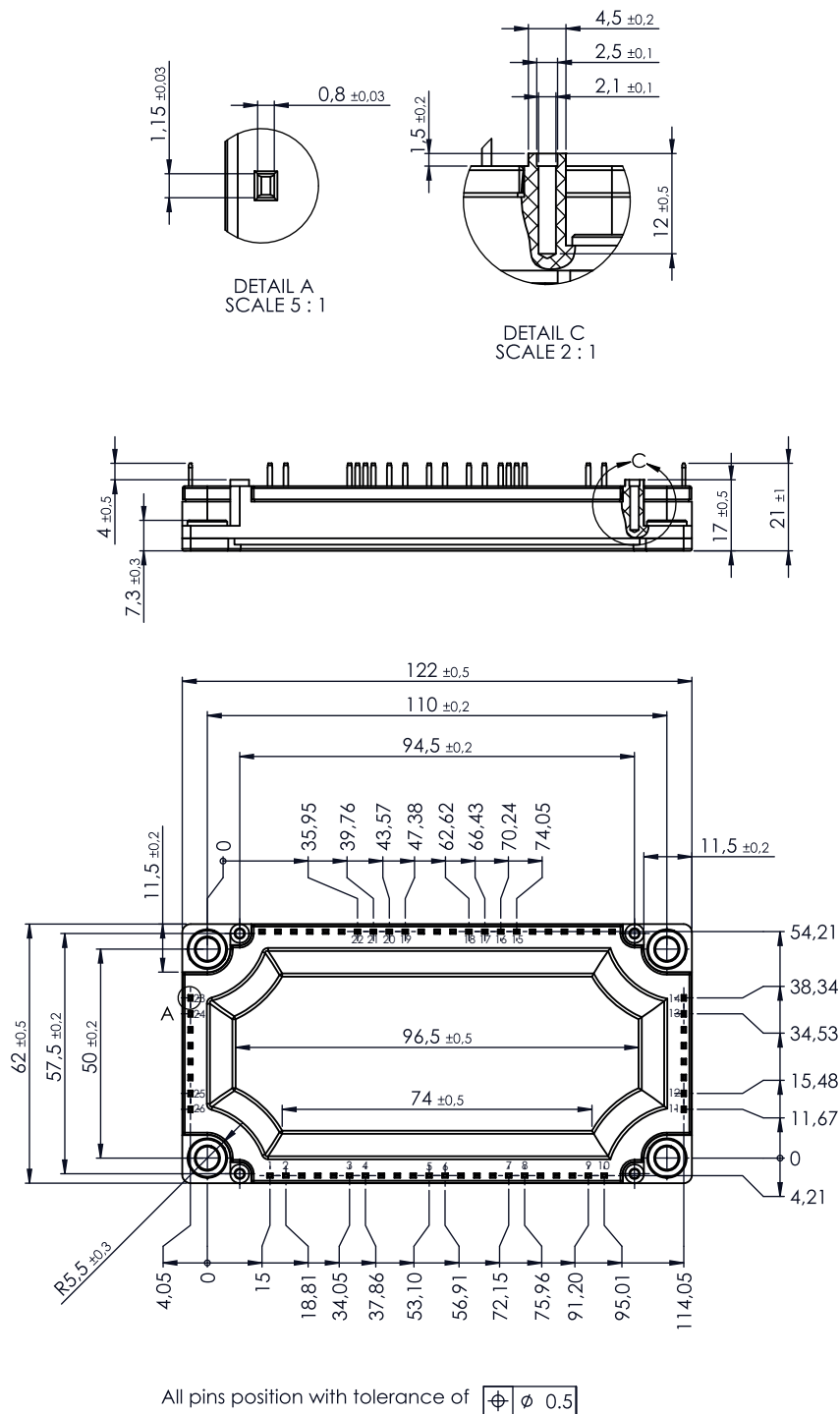
Device code	VS-	G	T	150	Y	G	120	N	T
	1	2	3	4	5	6	7	8	9
1	- Vishay Semiconductors product								
2	- Insulated gate bipolar transistor (IGBT)								
3	- T = Trench gate field stop IGBT								
4	- Current rating (150 = 150 A)								
5	- Circuit configuration (Y = 4 pack)								
6	- Package indicator (G = ECONO 3)								
7	- Voltage rating (120 = 1200 V)								
8	- Speed / type (N = ultrafast with reduced diode, speed 8 kHz to 60 kHz)								
9	- NTC thermistor								

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
4 pack with thermistor	Y	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95686

ECONO3 4 Pack

DIMENSIONS in millimeters and inches





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