

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

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

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

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		1200	V
Continuous collector current	I_C	$T_C = 25^\circ C$	244	A
		$T_C = 80^\circ C$	166	
Pulsed collector current	I_{CM}		675	
Clamped inductive load current	I_{LM}		280	
Diode continuous forward current	I_F	$T_C = 25^\circ C$	113	
		$T_C = 80^\circ C$	78	
Diode maximum forward current	I_{FSM}		730	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation	IGBT	P_D	$T_C = 25^\circ C$	892
			$T_C = 80^\circ C$	500
MODULE				
Operating junction temperature range	T_J		-40 to +150	$^\circ C$
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	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 150\text{ A}$	-	2.18	2.53	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}$	-	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	R25	$T_C = 25\text{ }^\circ\text{C}$	5000	Ω
	R100	$T_C = 100\text{ }^\circ\text{C}$	$493 \pm 5\%$	
B-value	$B_{25/50}$	$R_2 = R_{25} \text{ exp. } [B_{25/50} (1/T_2 - 1/(298.15\text{ K}))]$	$3375 \pm 5\%$	K
Maximum operating temperature			220	$^\circ\text{C}$
Dissipation constant			2	mW/ $^\circ\text{C}$
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	$^\circ\text{C/W}$
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

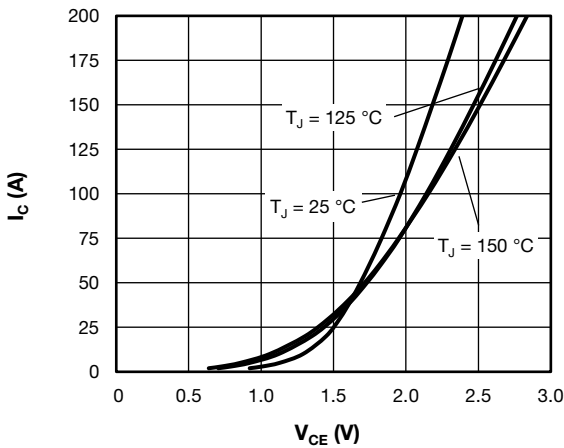


Fig. 1 - Typical Trench IGBT Output Characteristics, $V_{GE} = 15\text{ V}$

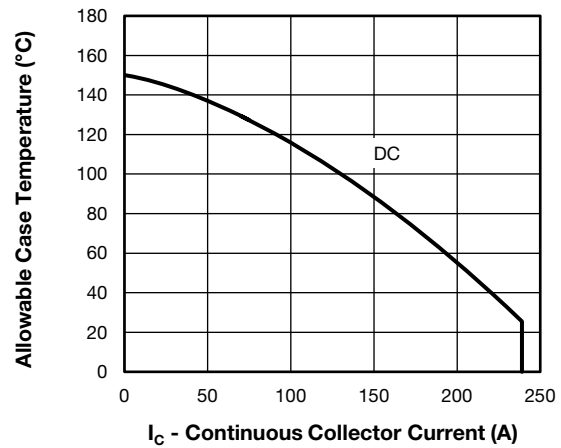


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

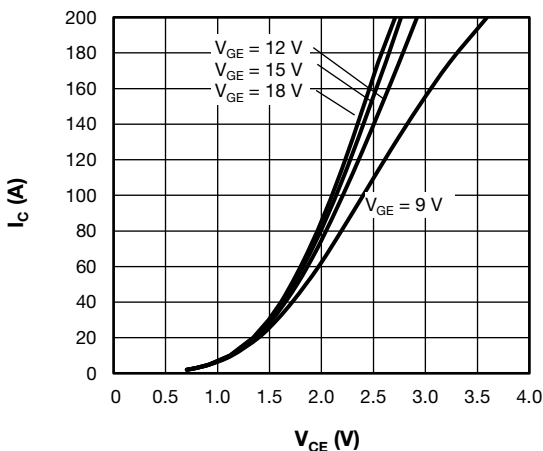


Fig. 2 - Typical Trench IGBT Output Characteristics, $T_J = 125\text{ }^\circ\text{C}$

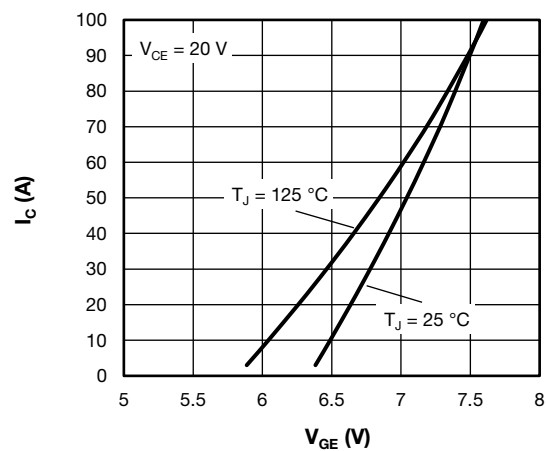


Fig. 4 - Typical Trench IGBT Transfer Characteristics

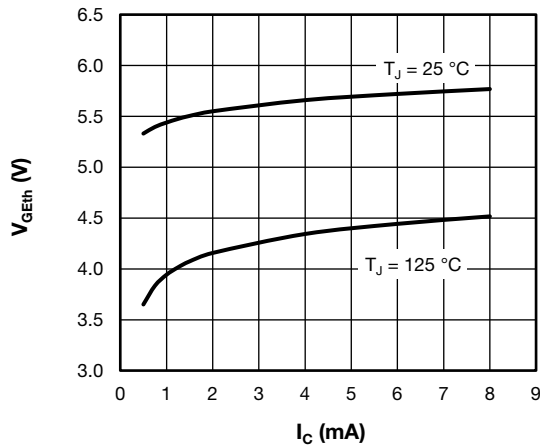


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

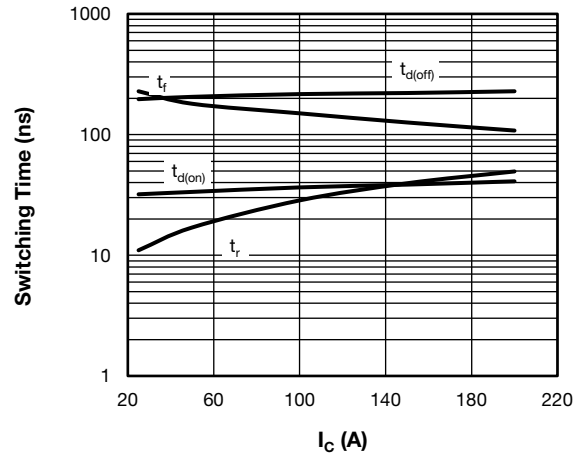


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C with (Antiparallel Diode)
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\ \mu\text{H}$

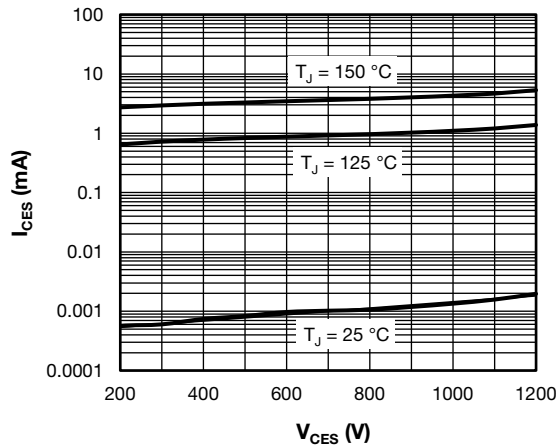


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current

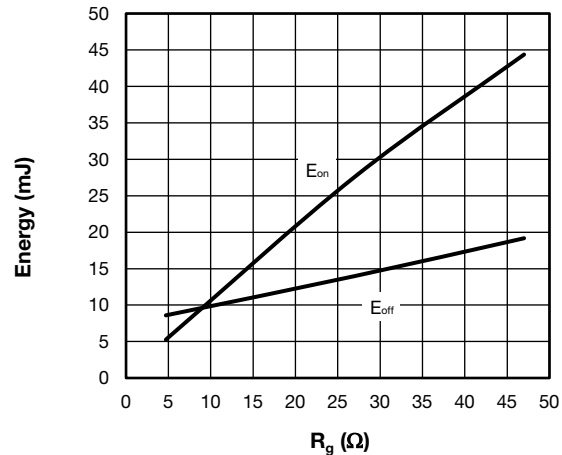


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

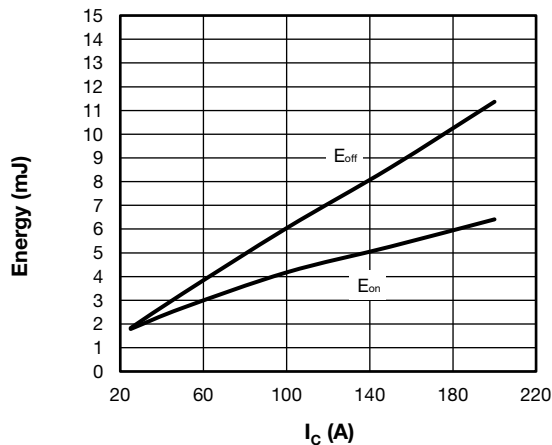


Fig. 7 - Typical IGBT Energy Loss vs. I_C with (Antiparallel Diode)
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = +15\text{ V}/-15\text{ V}$, $L = 500\ \mu\text{H}$

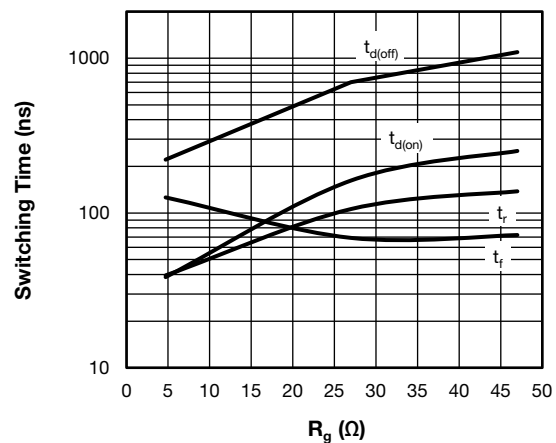


Fig. 10 - Typical Trench IGBT Switching Time vs. R_g with (Antiparallel Diode)
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

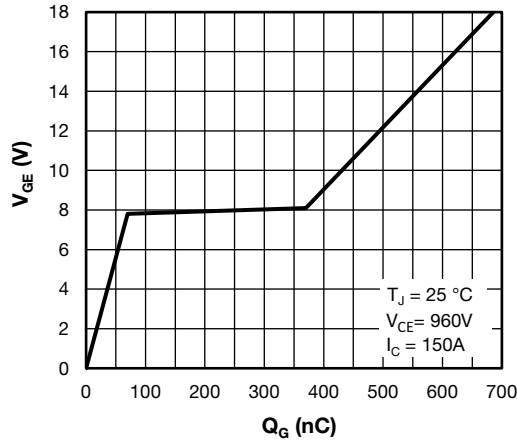


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

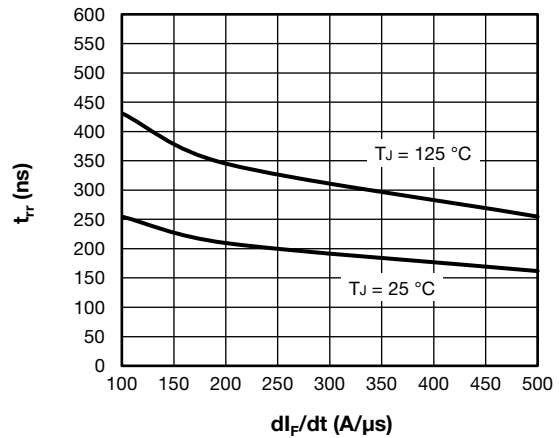


Fig. 14 - Typical Diode Reverse Recovery Time vs. di_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

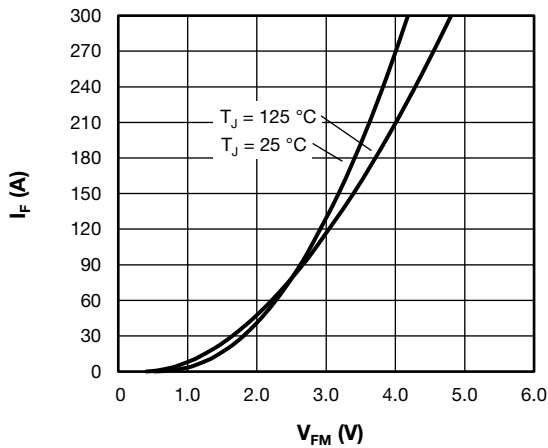


Fig. 12 - Typical Diode Forward Characteristics

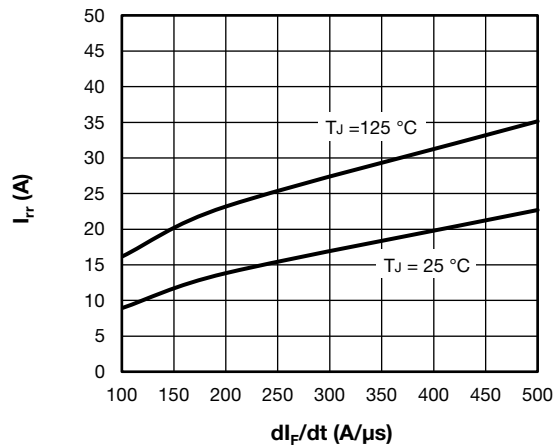


Fig. 15 - Typical Diode Reverse Recovery Current vs. di_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

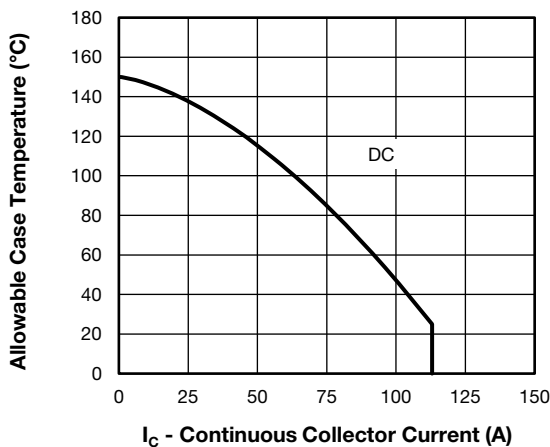


Fig. 13 - Maximum Diode Continuous Forward Current vs. Case Temperature

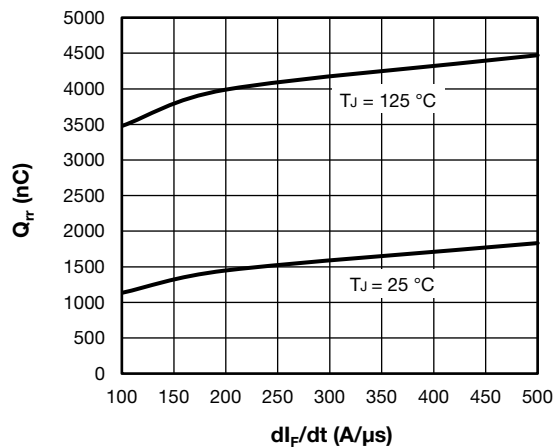


Fig. 16 - Typical Diode Reverse Recovery Cuharge vs. di_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

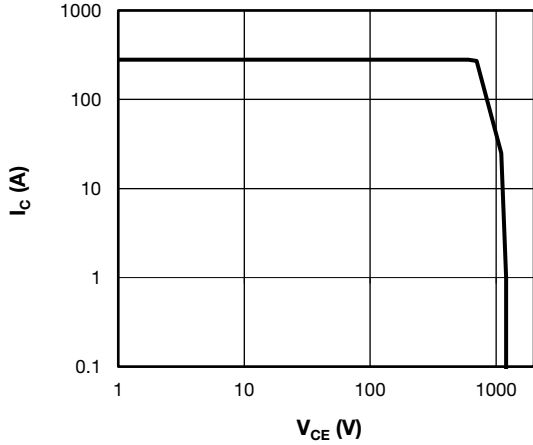


Fig. 17 - Trench IGBT Reverse BIAS SOA
 $T_J = 150\text{ }^\circ\text{C}$, $I_C = 280\text{ A}$, $R_{\theta} = 4.7\ \Omega$, $V_{GE} = +15\text{ V} / 0\text{ V}$
 $V_{CC} = 600\text{ V}$, $V_p = 1200\text{ V}$

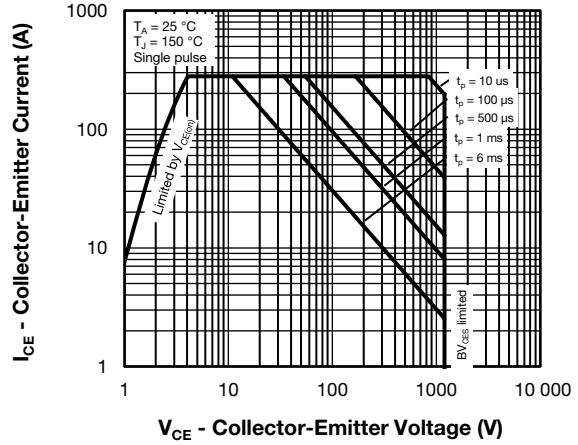


Fig. 18 - Trench IGBT Safe Operating Area

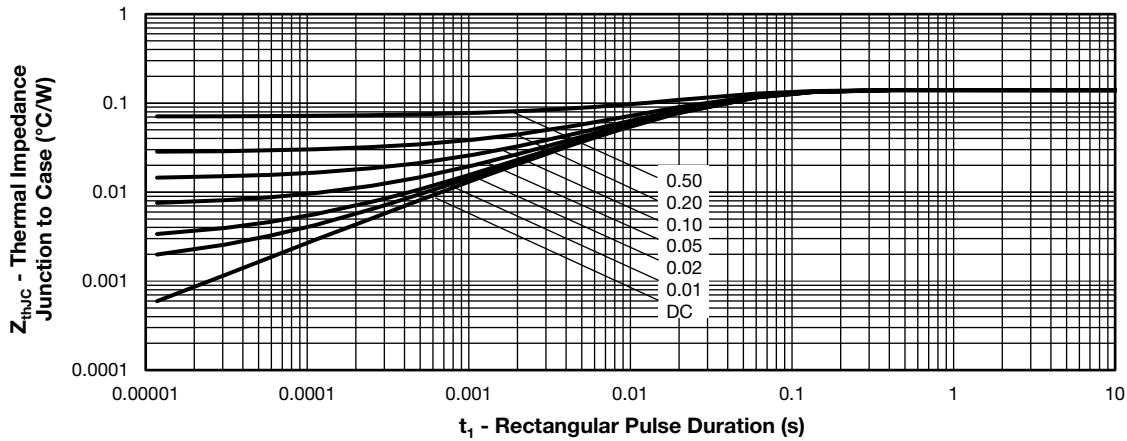


Fig. 19 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

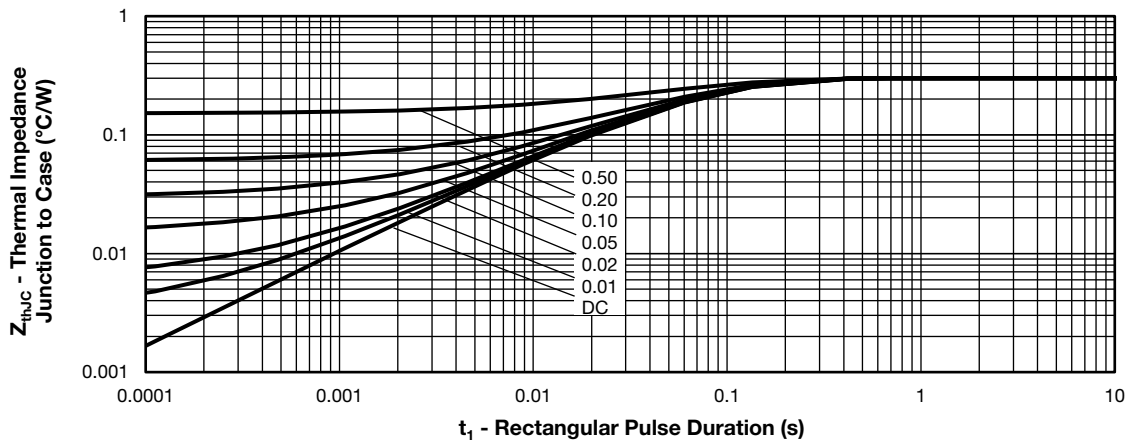


Fig. 20 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	G	T	150	Y	G	120	N	T
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

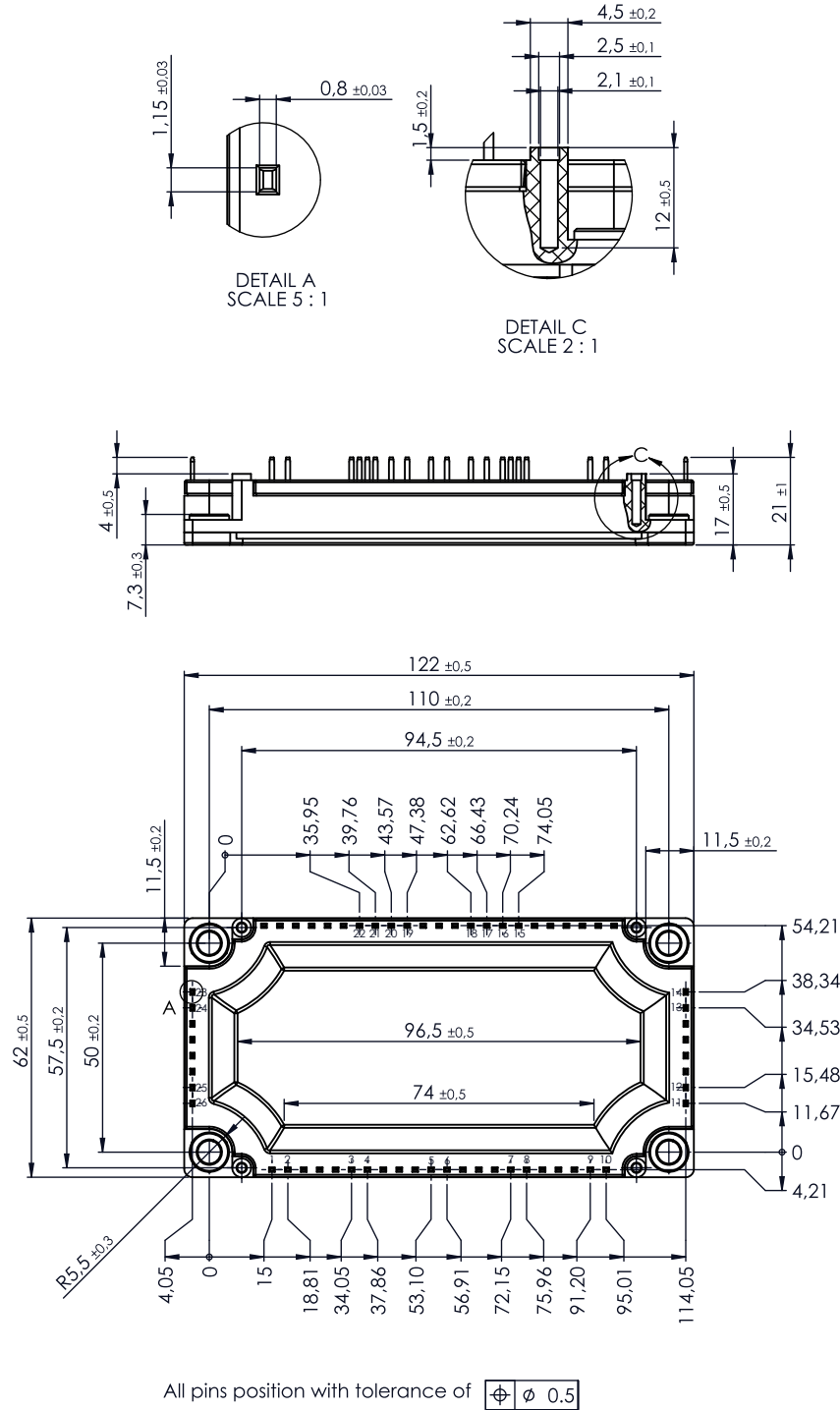
- 1** - Vishay Semiconductors product
- 2** - Insulated gate bipolar transistor (IGBT)
- 3** - T = Trench gate field stop IGBT
- 4** - Current rating (150 = 150 A)
- 5** - Circuit configuration (Y = 4 pack)
- 6** - Package indicator (G = ECONO 3)
- 7** - Voltage rating (120 = 1200 V)
- 8** - Speed / 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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