

IGBT ECONO3 Module, 150 A


ECONO 3 4 pack

FEATURES

- Gen 5 non punch through (NPT) technology
- 10 μ s short circuit capability
- Square RBSOA
- HEXFRED low Q_{rr} , low switching energy
- Positive temperature coefficient
- Copper baseplate
- Operating frequencies 8 kHz to 60 kHz
- 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 $T_C = 57\text{ }^\circ\text{C}$	150 A
$V_{CE(on)}$ typ. at 150 A	3.45 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	$T_C = 25\text{ }^\circ\text{C}$	182	A
		$T_C = 80\text{ }^\circ\text{C}$	124	
Pulsed collector current	I_{CM}		370	
Clamped inductive load current	I_{LM}		370	
Diode continuous forward current	I_F	$T_C = 25\text{ }^\circ\text{C}$	113	
		$T_C = 80\text{ }^\circ\text{C}$	78	
Diode maximum forward current	I_{FSM}		730	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation IGBT	P_D	$T_C = 25\text{ }^\circ\text{C}$	892	W
		$T_C = 80\text{ }^\circ\text{C}$	500	
MODULE				
Operating junction temperature range	T_J		-55 to +150	$^\circ\text{C}$
Storage temperature range	T_{Stg}		-40 to +125	
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ s}$	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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 150\text{ A}$	-	3.45	4.0	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}$	-	3.9	-	
		$V_{GE} = 15\text{ V}, I_C = 150\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.87	-	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	4.42	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 1.5\text{ mA}$	4.1	4.9	6.5	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 1\text{ mA}, (25\text{ }^\circ\text{C to } 125\text{ }^\circ\text{C})$	-	-12.3	-	mV/ $^\circ\text{C}$
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	21	120	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	1.57	-	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}	$V_{GE} = \pm 20\text{ V}$	-	-	± 440	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	$I_C = 150\text{ A}$ $V_{CC} = 600\text{ V}$ $V_{GE} = 15\text{ V}$	-	1260	-	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	130	-	
Gate to collector charge (turn-on)	Q_{gc}		-	500	-	
Turn-on switching loss	E_{on}	$I_C = 150\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V},$ $R_g = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	5.86	-	mJ
Turn-off switching loss	E_{off}		-	4.7	-	
Total switching loss	E_{tot}		-	10.56	-	
Turn-on switching loss	E_{on}	$V_{CC} = 600\text{ V}, I_C = 150\text{ A}, V_{GE} = 15\text{ V},$ $R_g = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	7.74	-	
Turn-off switching loss	E_{off}		-	7.2	-	
Total switching loss	E_{tot}		-	14.94	-	
Turn-on delay time	$t_{d(on)}$	$I_C = 150\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V},$ $R_g = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	474	-	ns
Rise time	t_r		-	89	-	
Turn-off delay time	$t_{d(off)}$		-	520	-	
Fall time	t_f		-	101	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 370\text{ A}, R_g = 4.7\text{ }\Omega,$ $V_{GE} = 15\text{ V to } 0, V_{CC} = 600\text{ V}, V_P = 1200\text{ V}$				
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^\circ\text{C}, V_{CC} = 900\text{ V}, V_P = 1200\text{ V},$ $R_g = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0$	10	-	-	μs
Diode reverse recovery time	$T_J = 25\text{ }^\circ\text{C}$	t_{rr}	-	210	-	ns
	$T_J = 125\text{ }^\circ\text{C}$			345	-	
Diode peak reverse current	$T_J = 25\text{ }^\circ\text{C}$	I_{rr}	-	13.8	-	A
	$T_J = 125\text{ }^\circ\text{C}$			23.2	-	
Diode recovery charge	$T_J = 25\text{ }^\circ\text{C}$	Q_{rr}	-	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

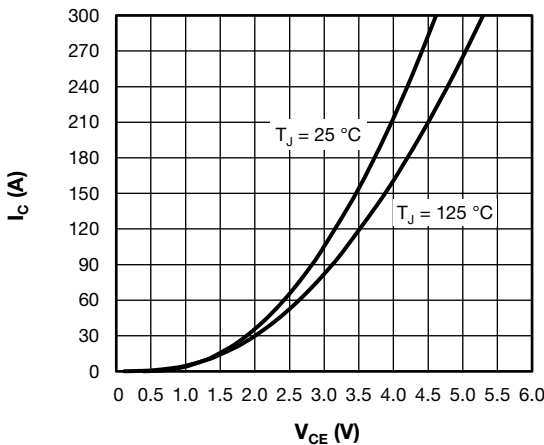


Fig. 1 - Typical IGBT Output Characteristics, V_{GE} = 15 V

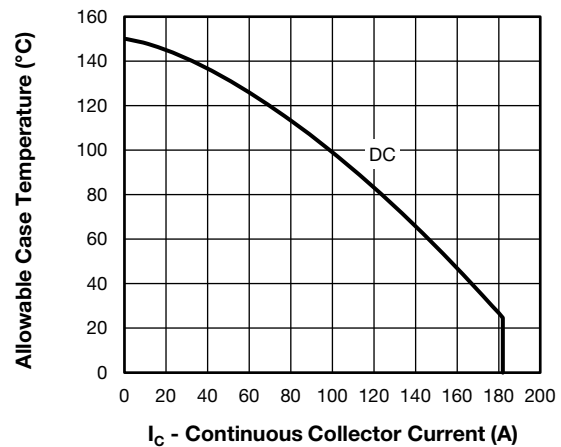


Fig. 3 - Maximum IGBT Continuous Collector Current vs. Case Temperature

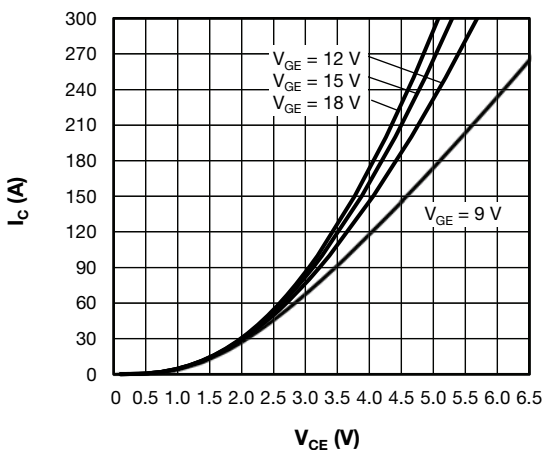


Fig. 2 - Typical IGBT Output Characteristics, T_J = 125 °C

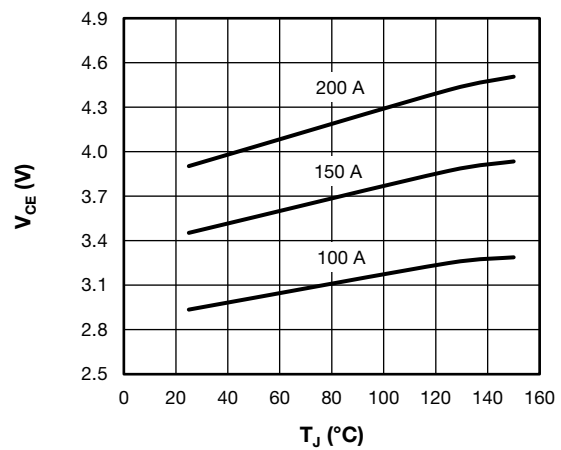


Fig. 4 - Collector to Emitter Voltage vs. Junction Temperature

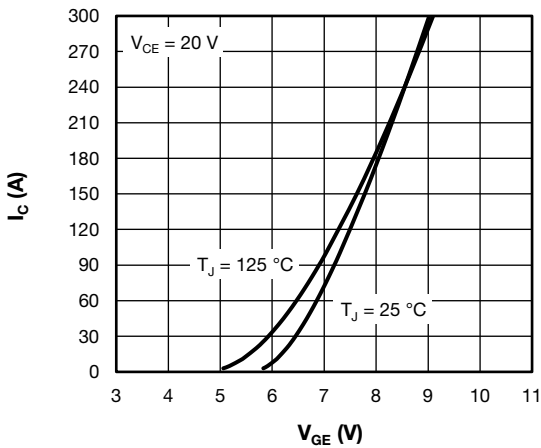


Fig. 5 - Typical IGBT Transfer Characteristics

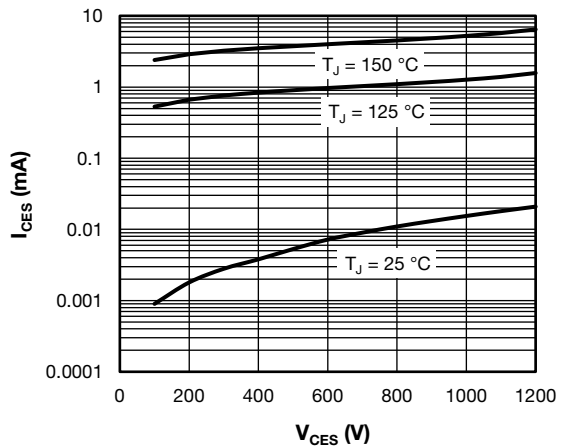


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

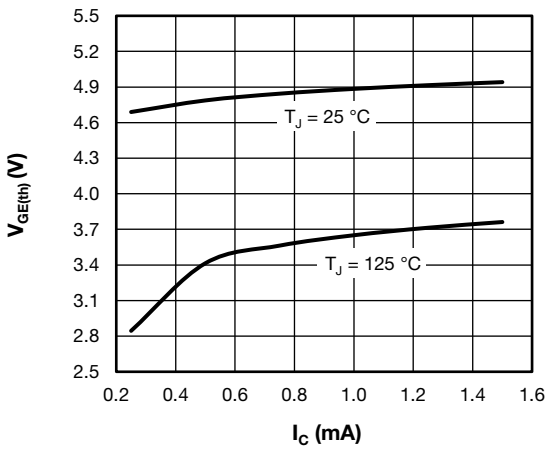


Fig. 6 - Typical IGBT Gate Threshold Voltage

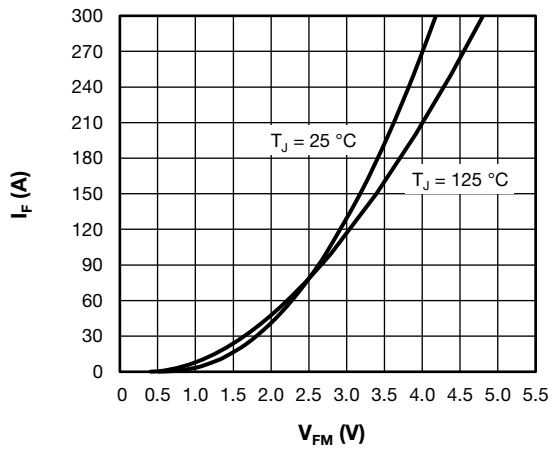


Fig. 9 - Typical Diode Forward Characteristics

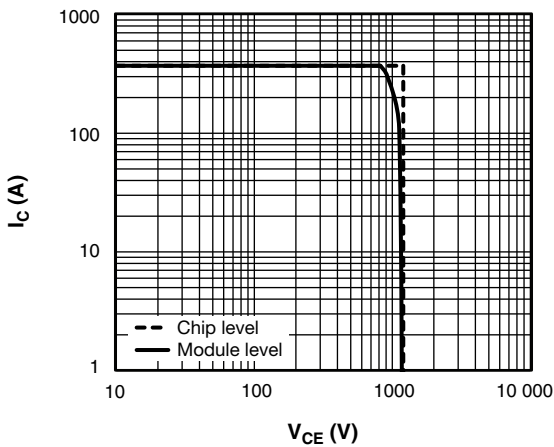


Fig. 7 - IGBT Reverse BIAS SOA $T_J = 150\text{ }^\circ\text{C}$, $V_{GE} = 15\text{ V}$

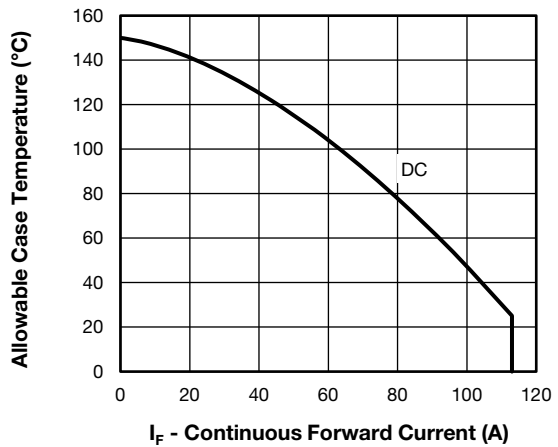


Fig. 10 - Maximum Diode Continuous Forward Current vs. Case Temperature

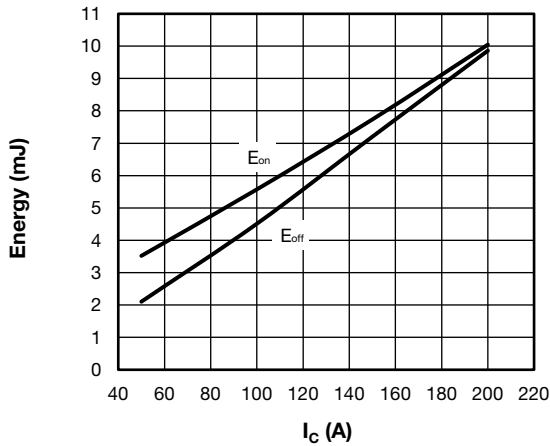


Fig. 11 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

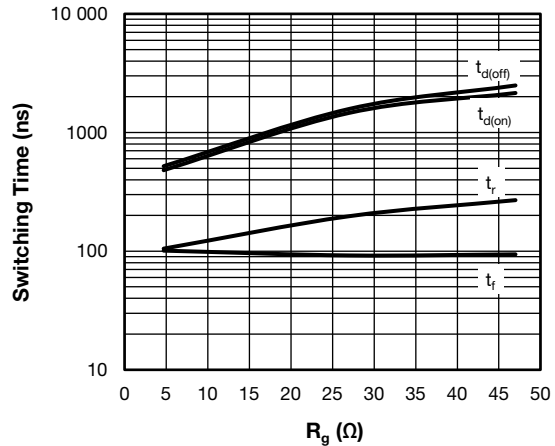


Fig. 14 - Typical IGBT Switching Time vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

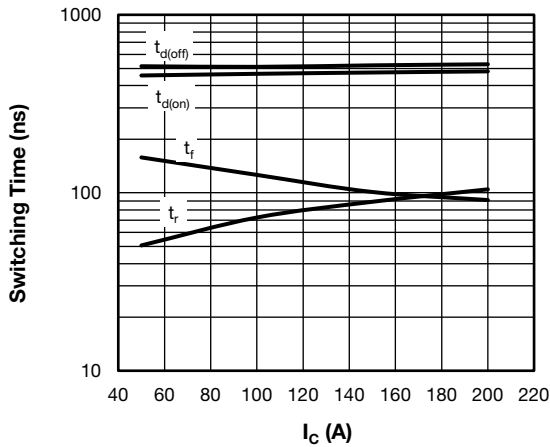


Fig. 12 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

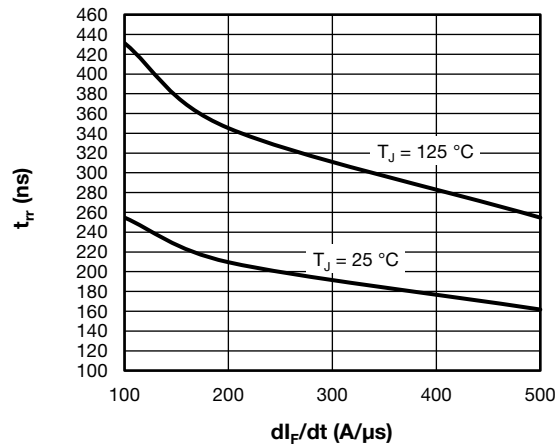


Fig. 15 - Typical Diode Reverse Recovery Time vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

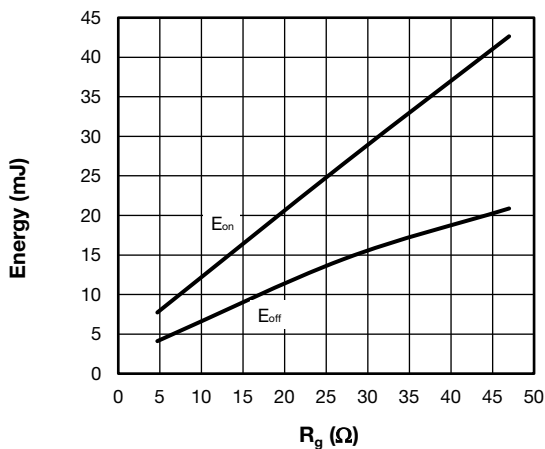


Fig. 13 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

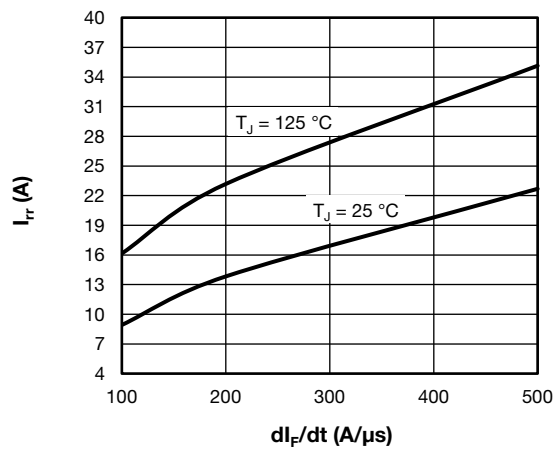


Fig. 16 - Typical Diode Reverse Recovery Current vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

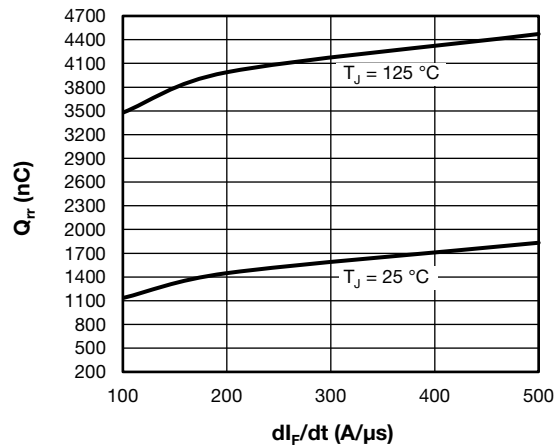


Fig. 17 - Typical Diode Reverse Recovery Charge vs. di_F/dt , $V_{rr} = 400$ V, $I_F = 50$ A

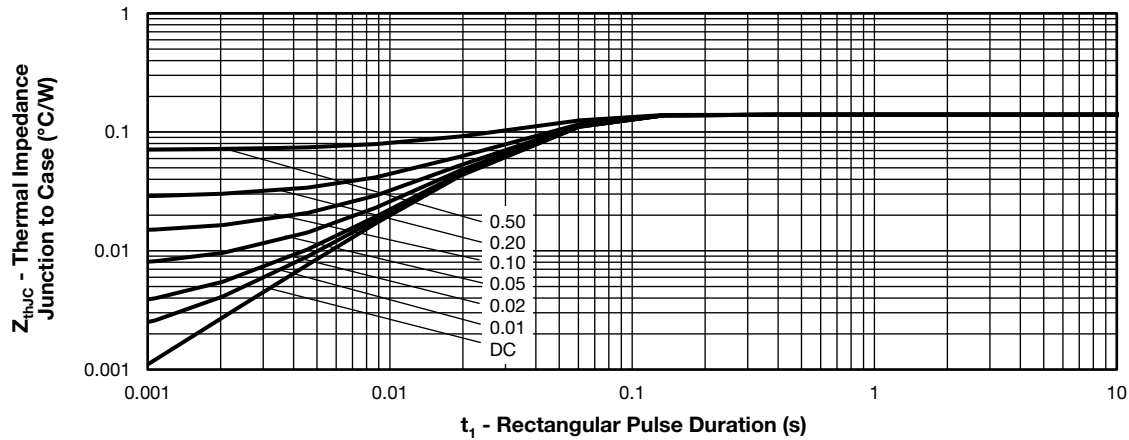


Fig. 18 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

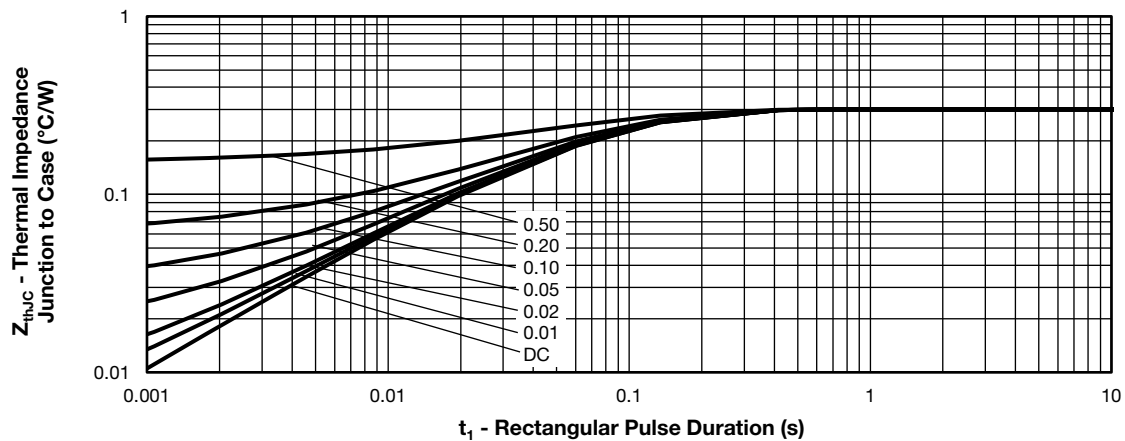


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

ORDERING INFORMATION TABLE

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

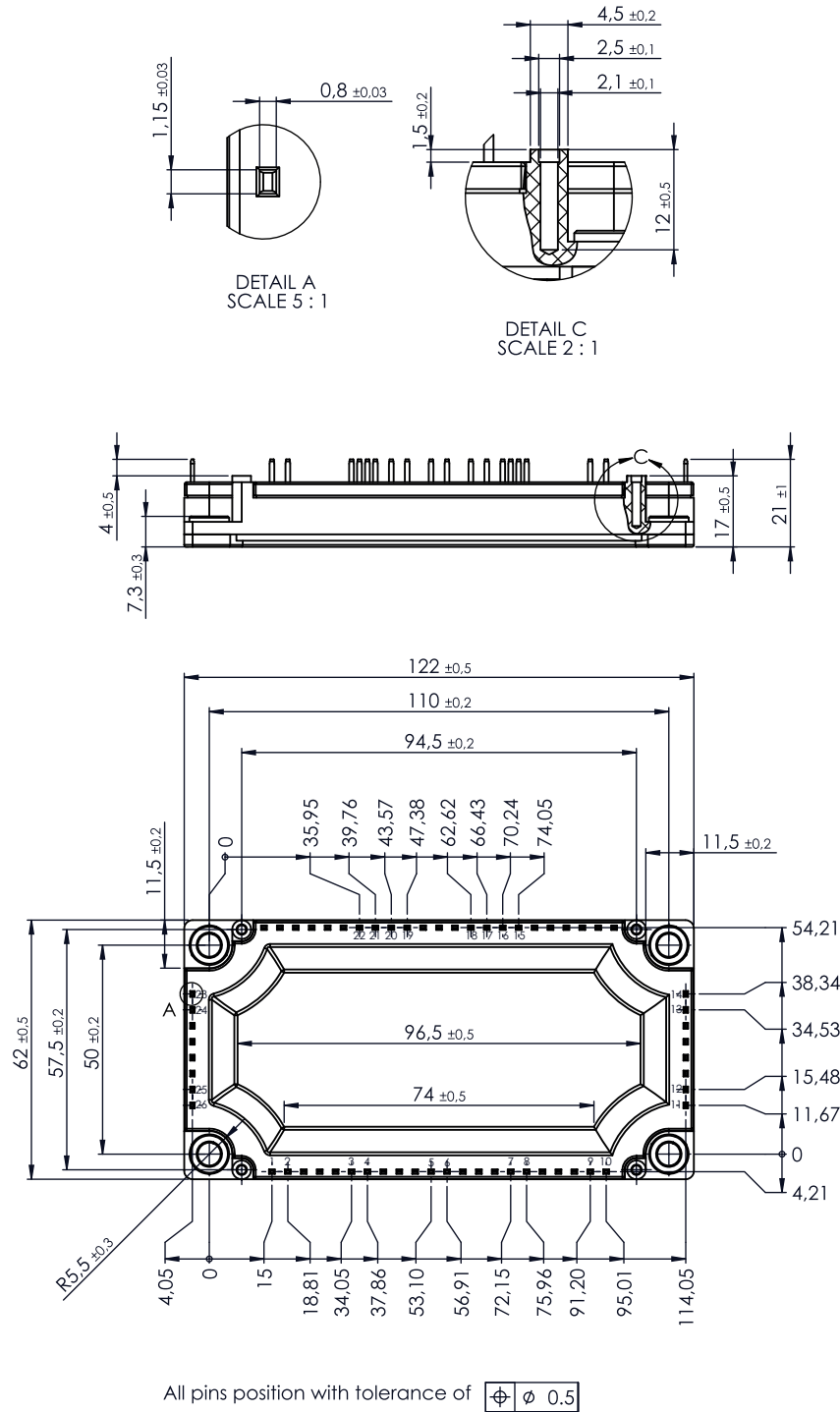
- 1** - Vishay Semiconductors product
- 2** - Insulated gate bipolar transistor (IGBT)
- 3** - B = IGBT Gen 5 NPT
- 4** - Current rating (150 = 150 A)
- 5** - Circuit configuration (Y = 4 pack)
- 6** - Package indicator (G = ECONO 3)
- 7** - Voltage rating (120 = 1200 V)
- 8** - Speed / type (N = ultrafast 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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