

IGBT ECONO3 Module, 100 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 $V_{CE(on)}$ 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
$V_{CE(on)}$ typ. at 100 A	3.52 V
$I_{C(DC)}$ at $T_C = 64\text{ }^\circ\text{C}$	100 A
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 heat sink 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	$T_C = 25\text{ }^\circ\text{C}$	127	A
		$T_C = 80\text{ }^\circ\text{C}$	87	
Pulsed collector current	I_{CM}		260	
Clamped inductive load current	I_{LM}		260	
Diode continuous forward current	I_F	$T_C = 25\text{ }^\circ\text{C}$	71	
		$T_C = 80\text{ }^\circ\text{C}$	49	
Diode maximum forward current	I_{FSM}		370	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ }^\circ\text{C}$	625	W
		$T_C = 80\text{ }^\circ\text{C}$	350	
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	$V_{BR(CE)}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$	-	2.67	-	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	3.52	4.0	
		$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2.88	-	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.9	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	4.1	5.3	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 $125\text{ }^\circ\text{C}$)	-	-12.2	-	mV/ $^\circ\text{C}$
Zero gate voltage collector current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	6.5	80	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	0.85	-	mA
Forward voltage drop	V_{FM}	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$	-	2.59	3.15	V
		$I_F = 100\text{ A}, V_{GE} = 0\text{ V}$	-	3.38	-	
		$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	2.69	-	
		$I_F = 100\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	3.74	-	
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	$I_C = 50\text{ A},$	-	400	-	nC	
Gate-to-emitter charge (turn-on)	Q_{GE}	$V_{CC} = 600\text{ V},$	-	43	-		
Gate-to-collector charge (turn-on)	Q_{GC}	$V_{GE} = 15\text{ V}$	-	187	-		
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}, V_{CC} = 600\text{ V},$	-	2.86	-	mJ	
Turn-off switching loss	E_{off}	$V_{GE} = 15\text{ V}, R_g = 4.7\text{ }\Omega,$	-	3.43	-		
Total switching loss	E_{tot}	$L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	6.29	-		
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}, V_{CC} = 600\text{ V},$	-	4.32	-		
Turn-off switching loss	E_{off}	$V_{GE} = 15\text{ V}, R_g = 4.7\text{ }\Omega,$	-	4.48	-		
Total switching loss	E_{tot}	$L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	8.8	-		
Turn-on delay time	$t_{d(on)}$	$I_C = 100\text{ A}, V_{CC} = 600\text{ V},$ $V_{GE} = 15\text{ V}, R_g = 4.7\text{ }\Omega,$ $L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	275	-		ns
Rise time	t_r		-	71	-		
Turn-off delay time	$t_{d(off)}$		-	305	-		
Fall time	t_f		-	116	-		
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 260\text{ A}, V_{GE} = 15\text{ V to } 0\text{ V},$ $R_g = 4.7\text{ }\Omega, V_{CC} = 600\text{ V}, V_p = 1200\text{ V}$					
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^\circ\text{C}, R_g = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V},$ $V_{CC} = 900\text{ V}, V_p = 1200\text{ V}$	10	-	-	μs	
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s},$ $V_R = 400\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$	-	190	-	ns
			$T_J = 125\text{ }^\circ\text{C}$	-	293	-	
Diode peak reverse current	I_{rr}		$T_J = 25\text{ }^\circ\text{C}$	-	12	-	A
			$T_J = 125\text{ }^\circ\text{C}$	-	18.6	-	
Diode recovery charge	Q_{rr}		$T_J = 25\text{ }^\circ\text{C}$	-	1140	-	nC
			$T_J = 125\text{ }^\circ\text{C}$	-	2725	-	



INTERNAL NTC - THERMISTOR SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	TYP.	UNITS
Resistance	R_{25}	$T_C = 25\text{ }^\circ\text{C}$	5000	Ω
	R_{100}	$T_C = 100\text{ }^\circ\text{C}$	$493 \pm 5\%$	
B-value	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50} (1/T_2 - 1/(298.15K))]$	$3375 \pm 5\%$	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}	-	-	0.2	$^\circ\text{C}/\text{W}$
DIODE - junction-to-case (per diode)	R_{thJC}	-	-	0.46	
Case to sink, flat, greased surface (per module)	R_{thJS}	-	0.015	-	
Mounting torque (M5)		3.0	-	6.0	Nm
Weight		-	285	-	g

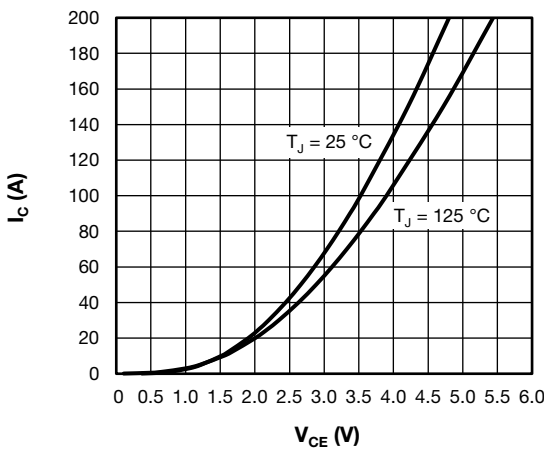


Fig. 1 - Typical IGBT Output Characteristics, $V_{GE} = 15\text{ V}$

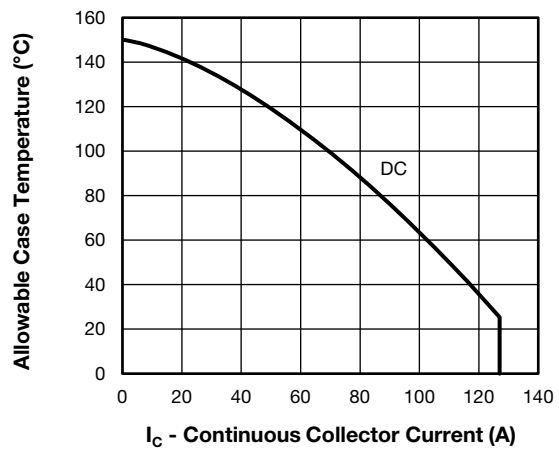


Fig. 3 - Maximum IGBT Continuous Collector Current vs. Case Temperature

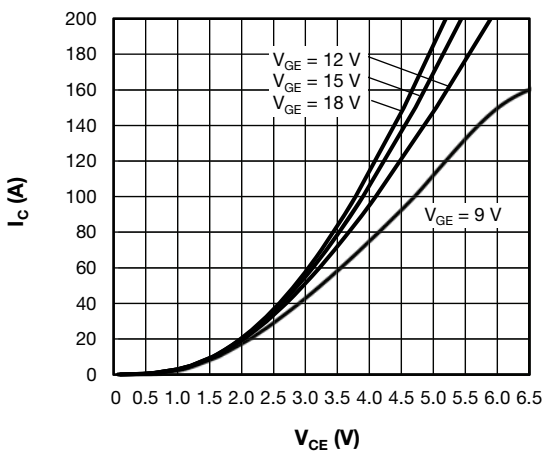


Fig. 2 - Typical IGBT Output Characteristics, $T_J = 125\text{ }^\circ\text{C}$

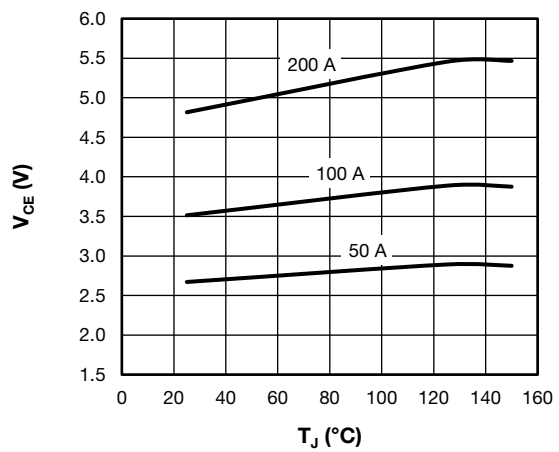


Fig. 4 - Collector to Emitter Voltage vs. Junction Temperature

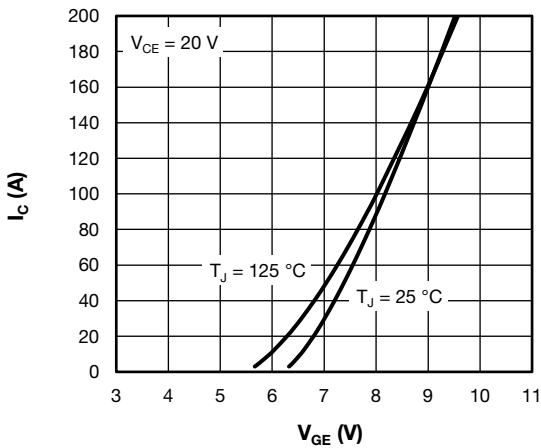


Fig. 5 - Typical IGBT Transfer Characteristics

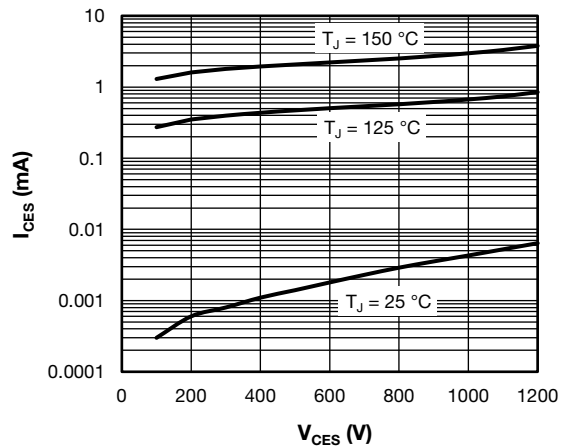


Fig. 8 - Typical IGBT Zero Gate Voltage Collector Current

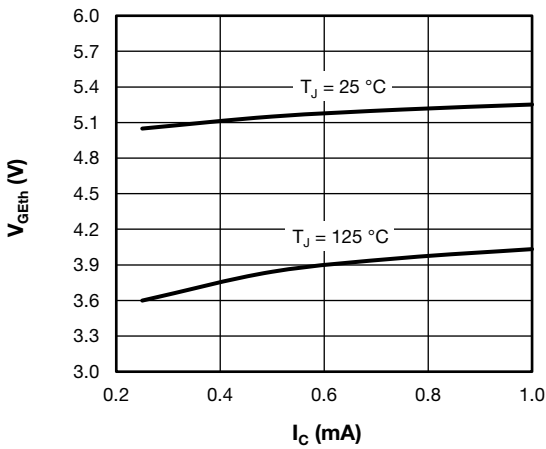


Fig. 6 - Typical IGBT Gate Threshold Voltage

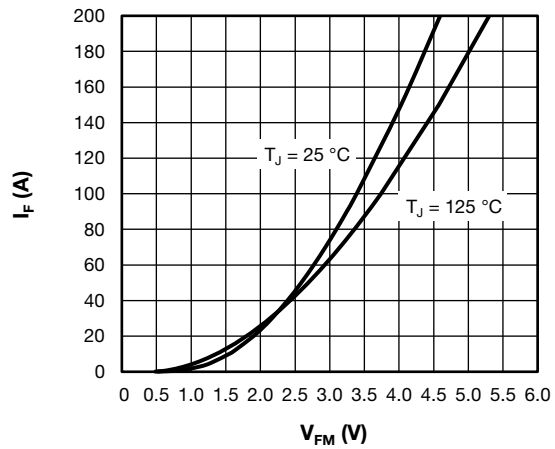


Fig. 9 - Typical Diode Forward Characteristics

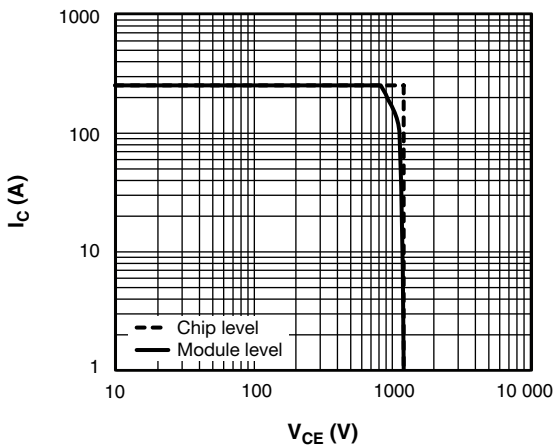


Fig. 7 - IGBT Reverse BIAS SOA $T_J = 150\text{ }^\circ\text{C}$, $V_{GE} = 15\text{ V}$

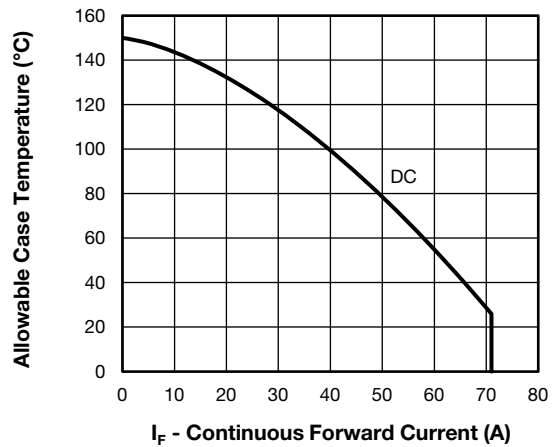


Fig. 10 - Maximum Diode Continuous Forward Current vs. Case Temperature

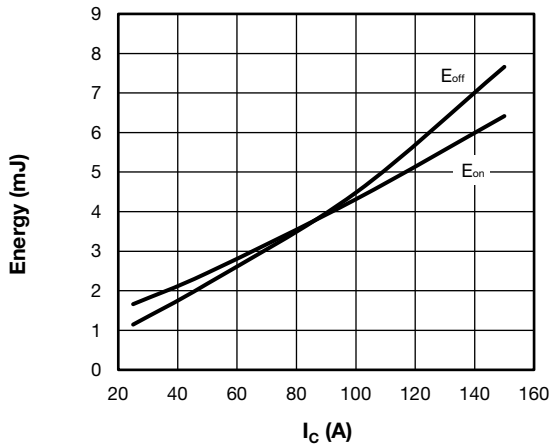


Fig. 11 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

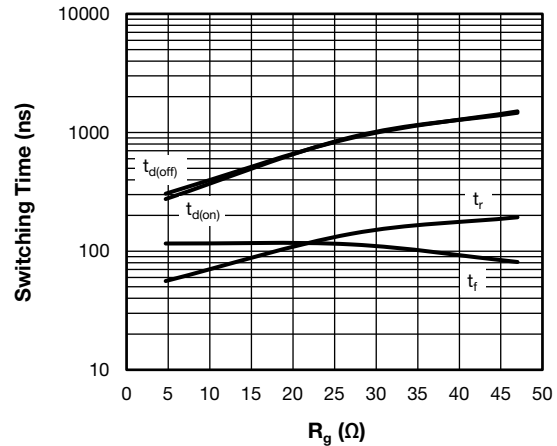


Fig. 14 - Typical IGBT Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

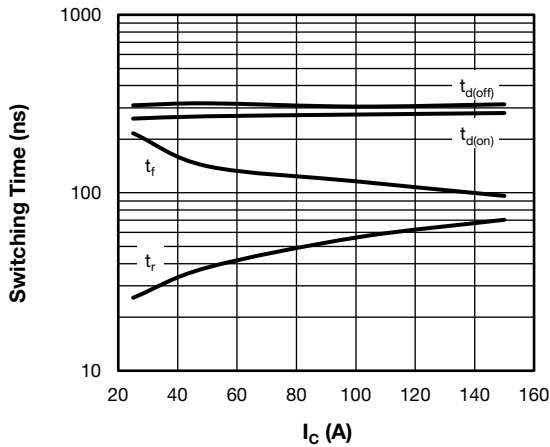


Fig. 12 - Typical IGBT Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

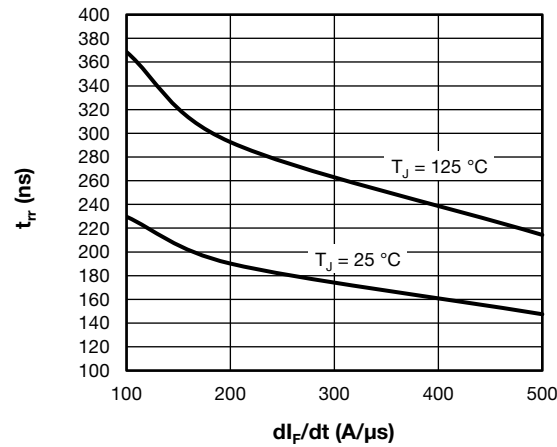


Fig. 15 - Typical Diode Reverse Recovery Time vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

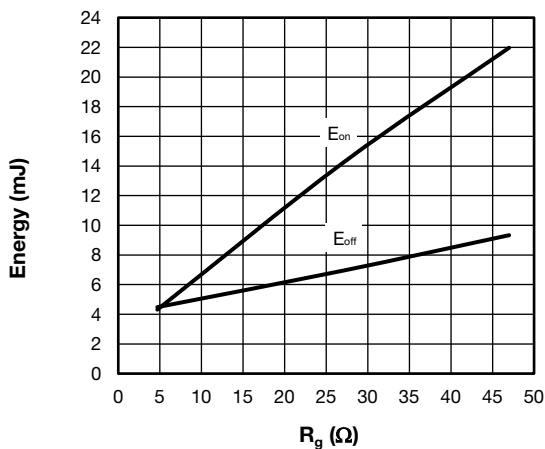


Fig. 13 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

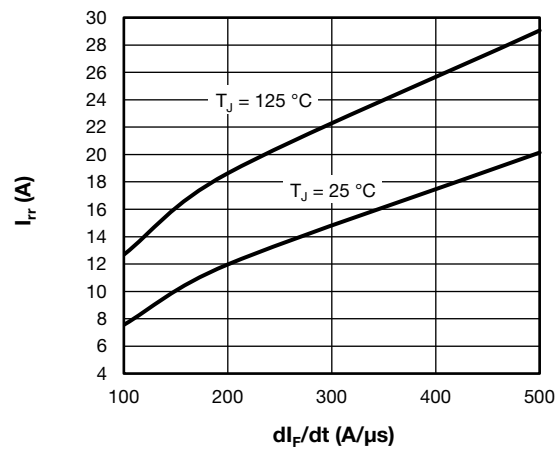


Fig. 16 - Typical Diode Reverse Recovery Current vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

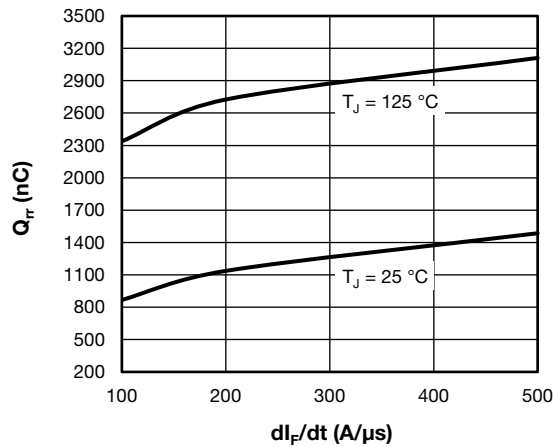


Fig. 17 - Typical Diode Reverse Recovery Charge vs. di_F/dt , $V_{rr} = 400$ V, $I_F = 50$ A

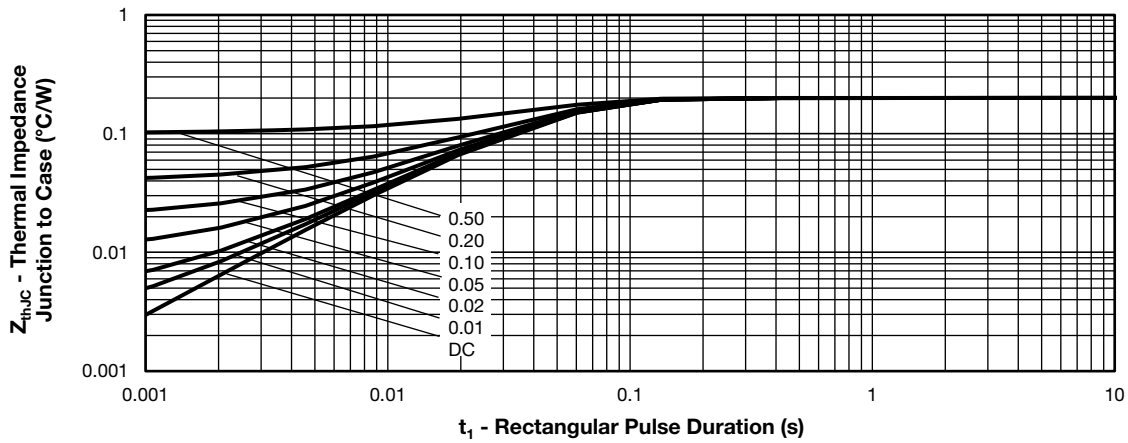


Fig. 18 - Maximum Thermal Impedance Z_{thJC} Characteristics - (IGBT)

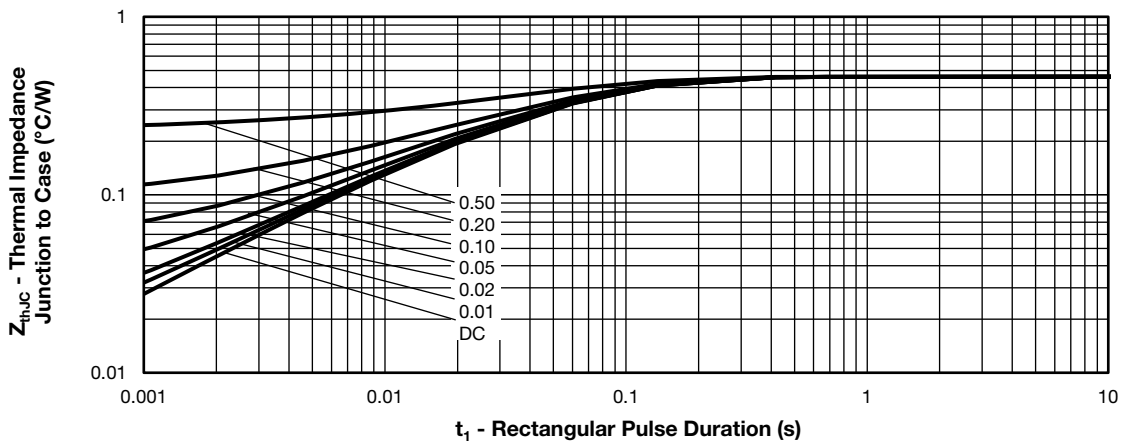


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (Diode)



ORDERING INFORMATION TABLE

Device code	VS-	G	B	100	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 (100 = 100 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

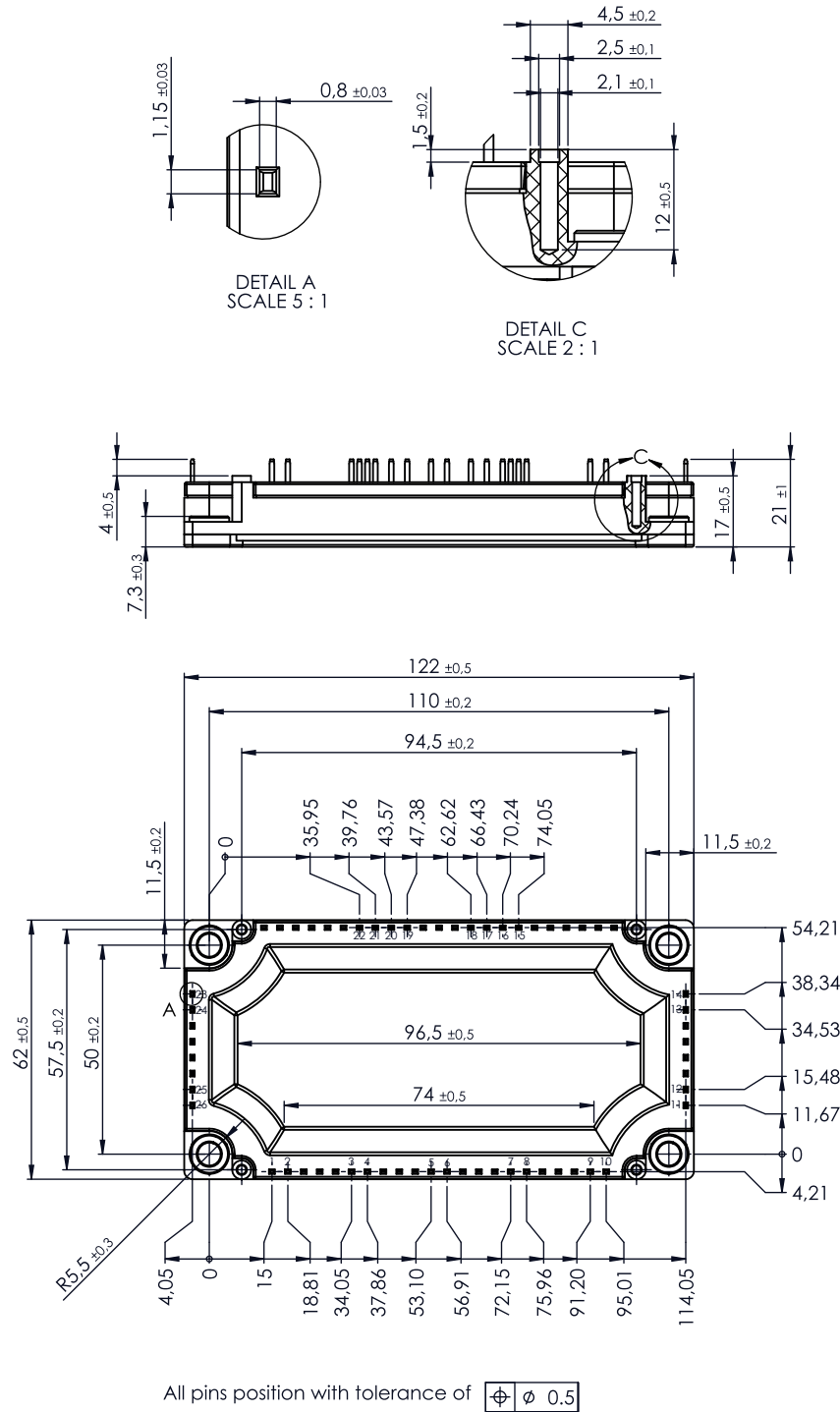
CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
4 pack with thermistor	Y	

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



ECONO3 4 Pack

DIMENSIONS in millimeters and inches





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