IGBT ECONO 3 Module, 100 A

ECONO 3, 4 pack

PRIMARY CHARACTERISTICS	
V_{CES}	1200 V
$I_{C(DC)}$ at T_C = 93 °C	100 A
$V_{CE(on)}$ typ. at 100 A	2.12 V
Package	ECONO 3
Circuit configuration	4 pack with thermistor

FEATURES

- Trench gate field stop IGBT
- 5 μs 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

Pb-free
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

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	170	A
		T_C = 80 °C	115	
Pulsed collector current	I_{CM}		500	
Clamped inductive load current	I_{LM}		250	
Diode continuous forward current	I_F	T_C = 25 °C	71	
		T_C = 80 °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 °C	595	W
		T_C = 80 °C	333	
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 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 6 mA	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 50 A	-	1.8	-	
		V_{GE} = 15 V, I_C = 100 A	-	2.12	2.43	
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C	-	1.88	-	
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C	-	2.35	-	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 6 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 = 6 mA (25 °C to 125 °C)	-	-12.3	-	mV/°C
Collector to emitter leaking current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	1.1	75	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	0.72	-	mA
Diode forward voltage drop	V_{FM}	I_F = 50 A, V_{GE} = 0 V	-	2.59	3.15	V
		I_F = 100 A, V_{GE} = 0 V	-	3.38	-	
		I_F = 50 A, V_{GE} = 0 V, T_J = 125 °C	-	2.69	-	
		I_F = 100 A, V_{GE} = 0 V, T_J = 125 °C	-	3.74	-	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 750	nA

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q_g	I_C = 100 A, V_{CC} = 960 v, V_{GE} = 15 V		-	455	-	nC
Gate to emitter charge (turn-on)	Q_{ge}			-	51	-	
Gate to collector charge (turn-on)	Q_{gc}			-	211	-	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 4.7 Ω, L = 500 μH, T_J = 25 °C		-	2.82	-	mJ
Turn-off switching loss	E_{off}			-	3.47	-	
Total switching loss	E_{tot}			-	6.29	-	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 4.7 Ω, L = 500 μH, T_J = 125 °C		-	4.09	-	
Turn-off switching loss	E_{off}			-	5.67	-	
Total switching loss	E_{tot}			-	9.76	-	
Turn-on delay time	$t_{d(on)}$	I_C = 100 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 4.7 Ω, L = 500 μH, T_J = 125 °C		-	63	-	ns
Rise time	t_r			-	28	-	
Turn-off delay time	$t_{d(off)}$			-	222	-	
Fall time	t_f			-	150	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 250 A, V_{GE} = 15 V to 0 V, R_g = 4.7 Ω, V_{CC} = 700 V, V_p = 1200 V		Full square			
Short circuit safe operating area	SCSOA	V_{CC} = 600 V, V_{GE} = 15 V, T_J = 150 °C		-	-	5	μs
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_R = 400 V	T_J = 25 °C	-	190	-	ns
			T_J = 125 °C	-	293	-	
Diode peak reverse current	I_{rr}		T_J = 25 °C	-	12	-	A
			T_J = 125 °C	-	18.6	-	
Diode recovery charge	Q_{rr}		T_J = 25 °C	-	1140	-	nC
			T_J = 125 °C	-	2725	-	

INTERNAL NTC - THERMISTOR SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS
Resistance	R25	T_C = 25 °C	5000	Ω
	R100	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}	-	-	0.21	°C/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

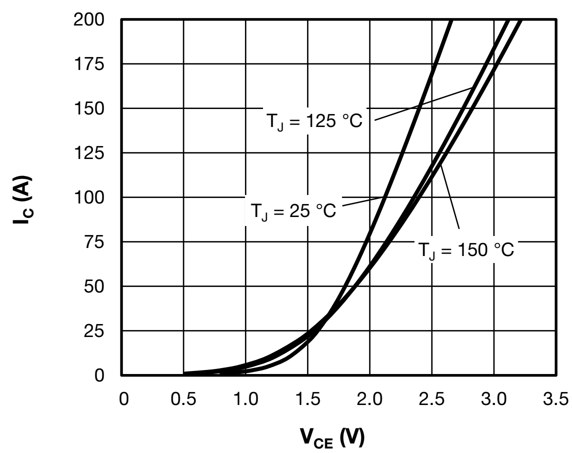


Fig. 1 - Typical Trench IGBT Output Characteristics, V_{GE} = 15 V

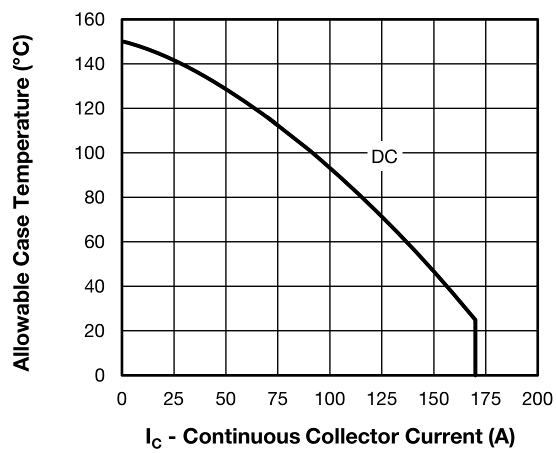


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

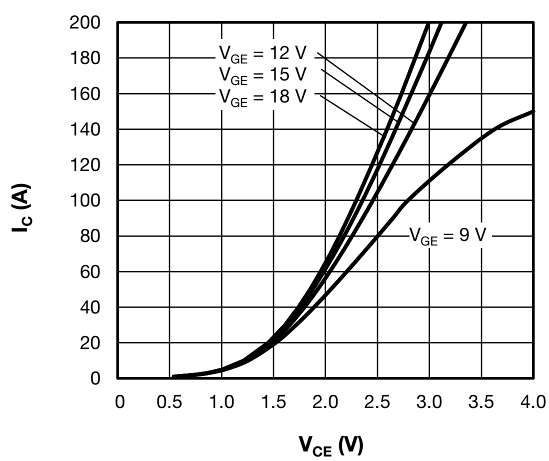


Fig. 2 - Typical Trench IGBT Output Characteristics, T_J = 125 °C

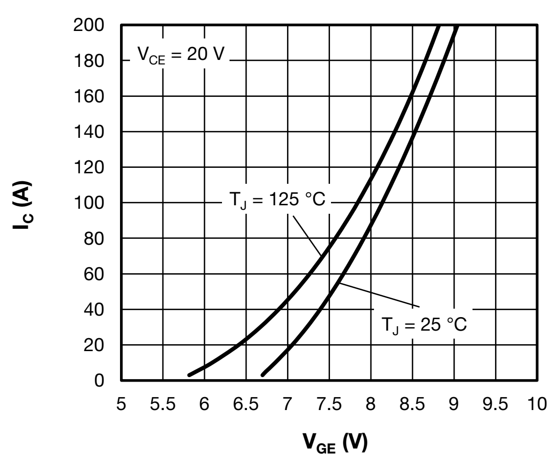


Fig. 4 - Typical Trench IGBT Transfer Characteristics

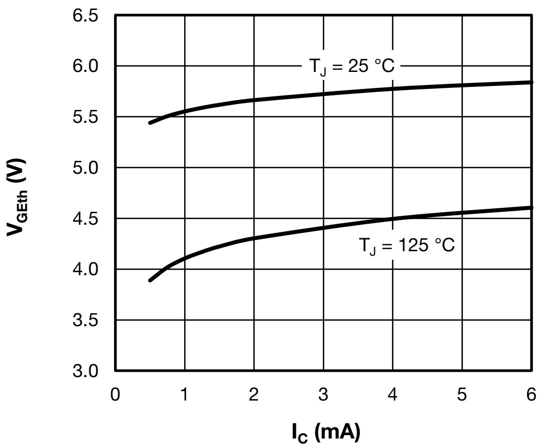


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

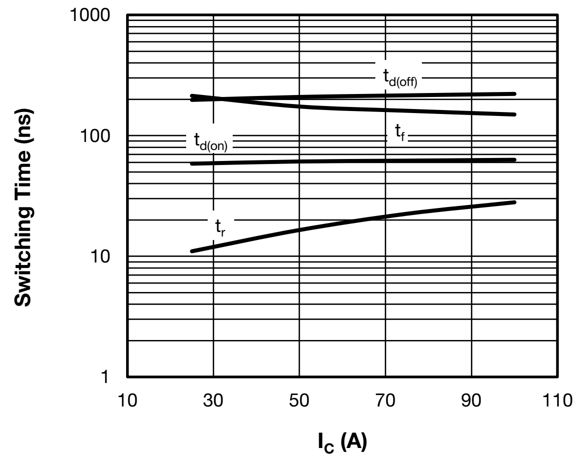


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C with (Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, R_g = 4.7 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

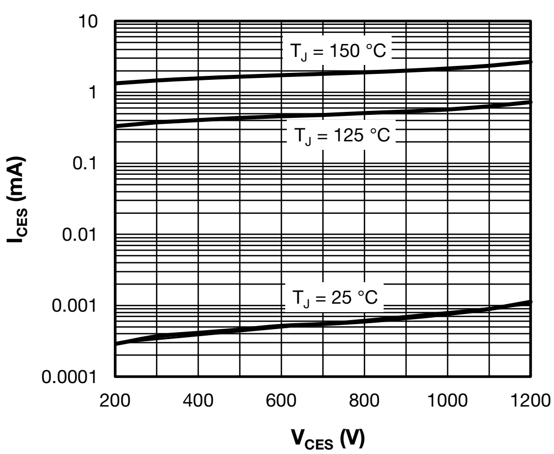


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current

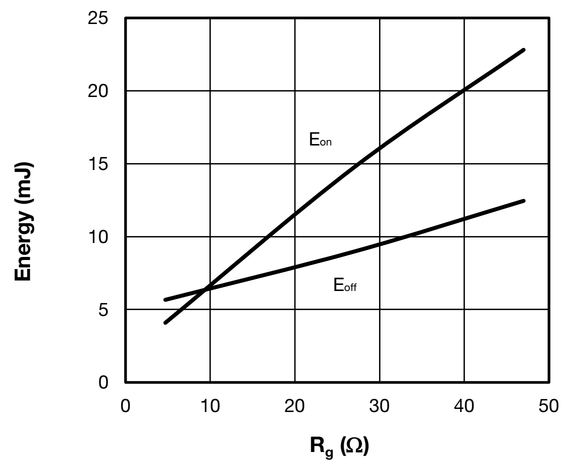


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g with (Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, I_C = 100 A, V_{GE} = 15 V, L = 500 μH

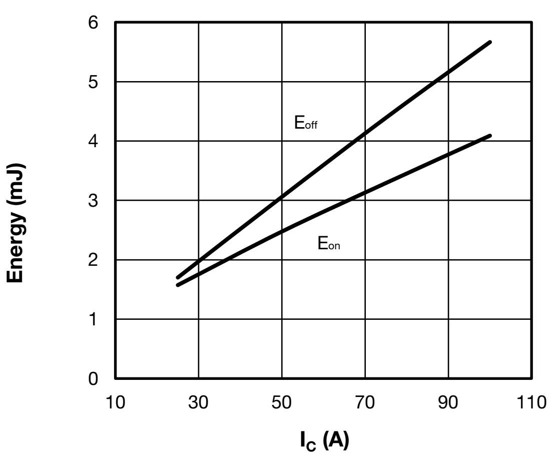


Fig. 7 - Typical IGBT Energy Loss vs. I_C with (Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, R_g = 4.7 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

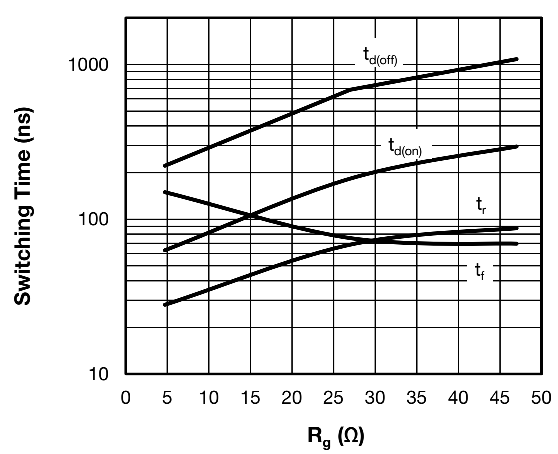


Fig. 10 - Typical Trench IGBT Switching Time vs. R_g with (Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, I_C = 100 A, V_{GE} = 15 V, L = 500 μH

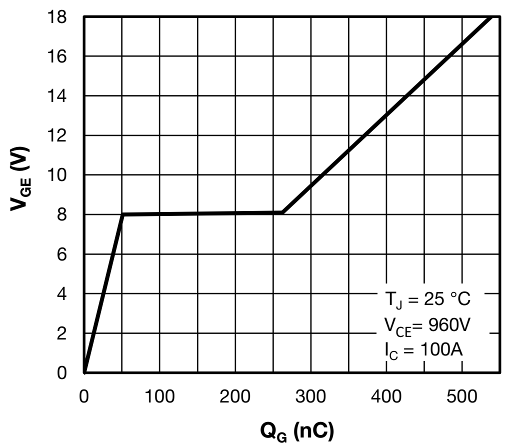


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

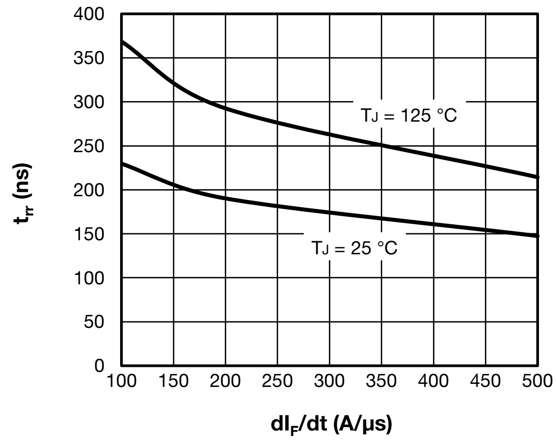


Fig. 14 - Typical Diode Reverse Recovery Time vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

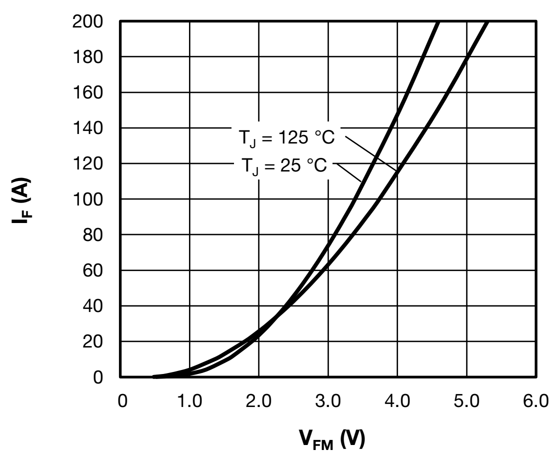


Fig. 12 - Typical Diode Forward Characteristics

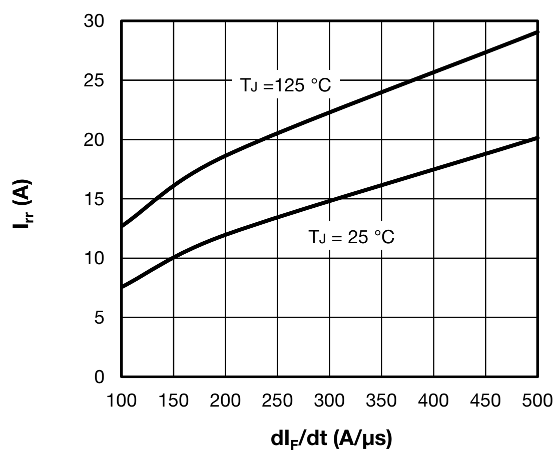


Fig. 15 - Typical Diode Reverse Recovery Current vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

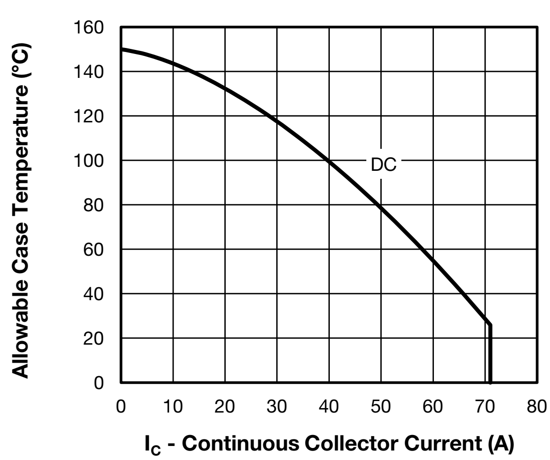


Fig. 13 - Maximum Diode Continuous Forward Current vs. Case Temperature

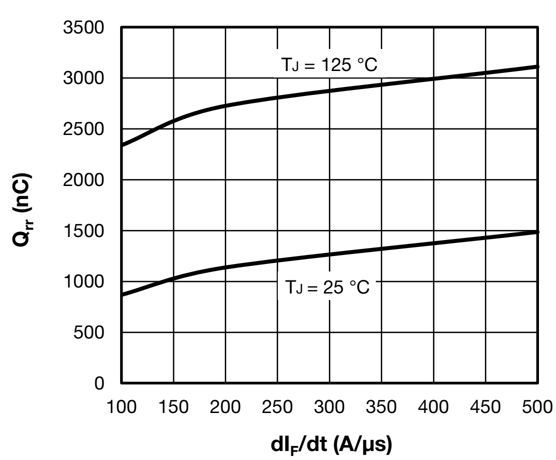


Fig. 16 - Typical Diode Reverse Recovery Charge vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

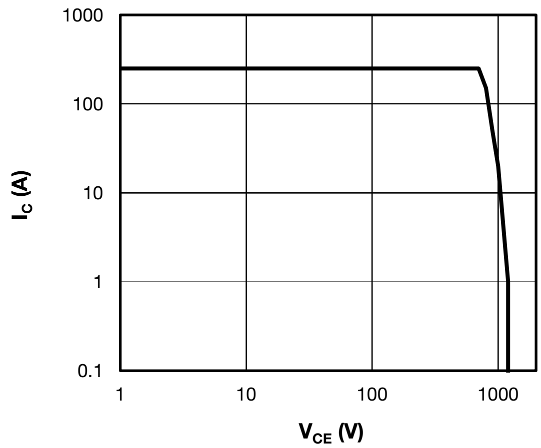


Fig. 17 - Trench IGBT Reverse BIAS SOA
T_J = 150 °C, I_C = 200 A, R_g = 10 Ω, V_{GE} = +15 V/0 V,
V_{CC} = 600 V, V_p = 1200 V

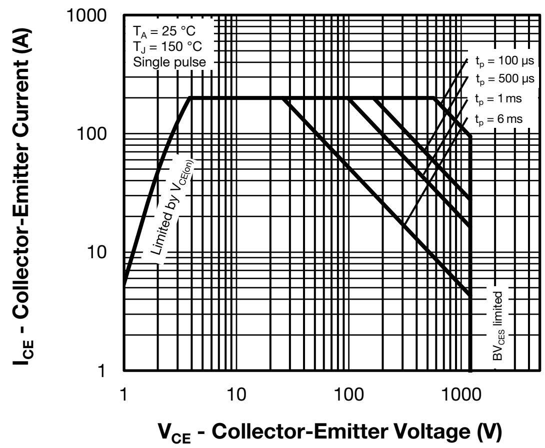


Fig. 18 - Trench IGBT Safe Operating Area

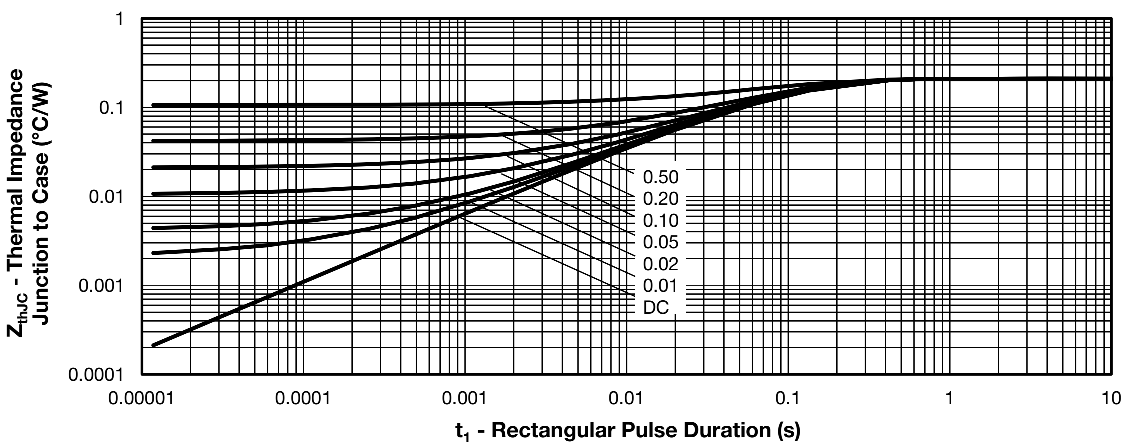


Fig. 19 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

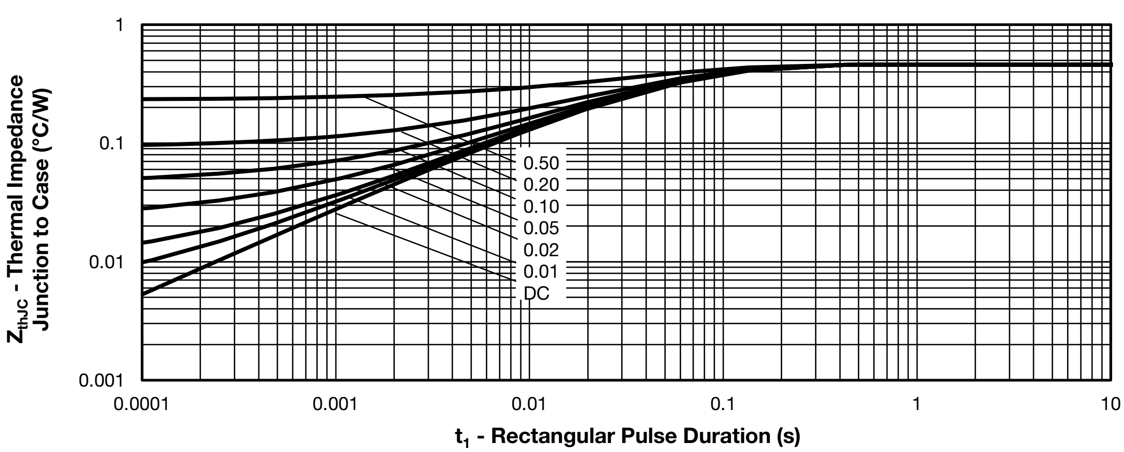
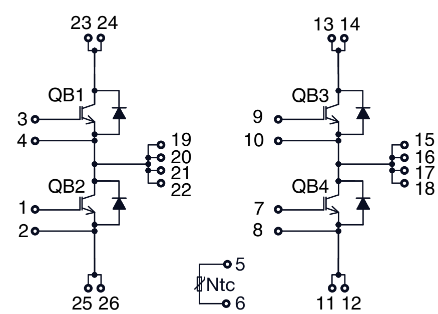


Fig. 20 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	G	T	100	Y	G	120	U	T
	1	2	3	4	5	6	7	8	9

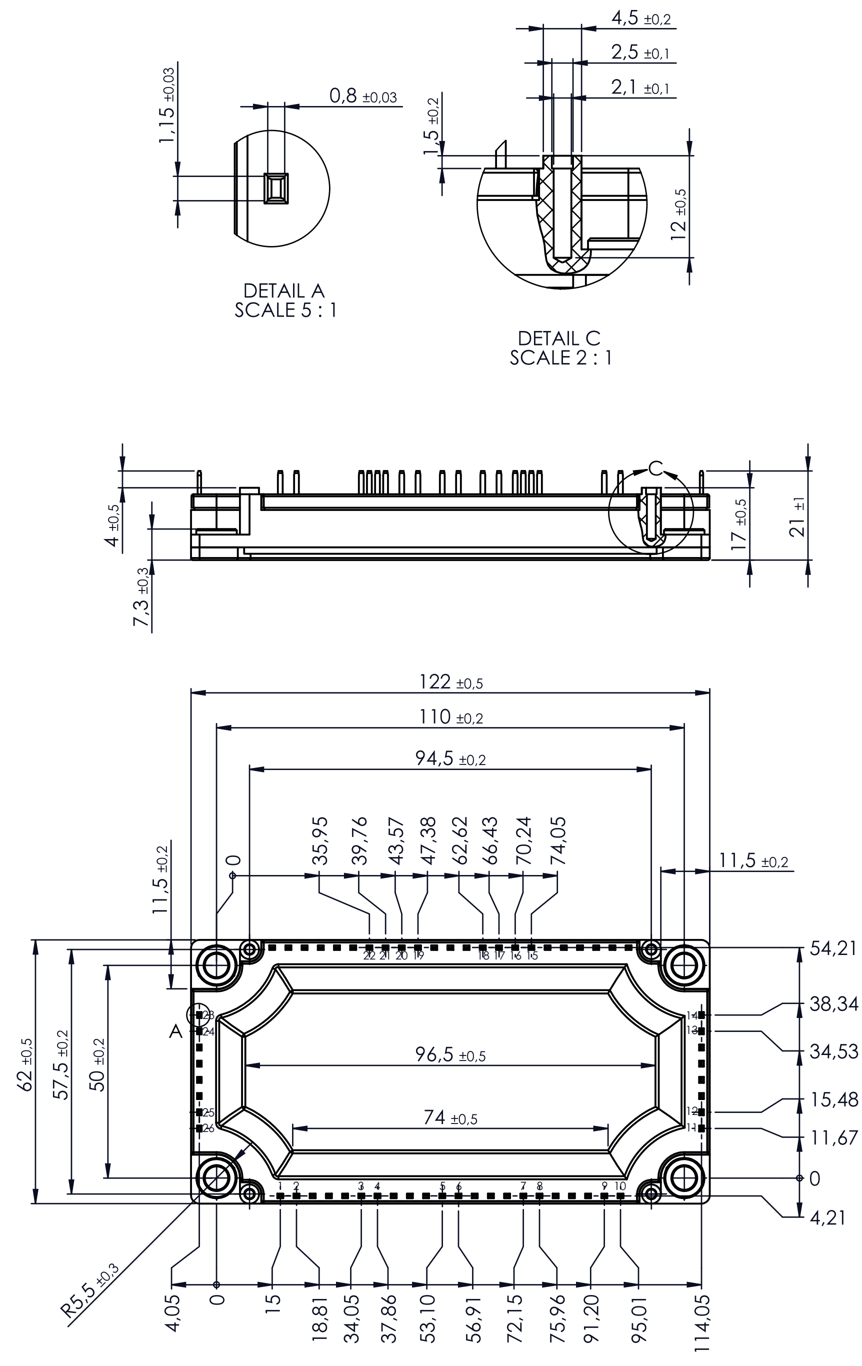
1 - Vishay Semiconductors product
2 - Insulated gate bipolar transistor (IGBT)
3 - T = Trench IGBT technology
4 - Current rating (100 = 100 A)
5 - Circuit configuration (Y = 4 pack)
6 - Package indicator (G = ECONO 3)
7 - Voltage rating (120 = 1200 V)
8 - Speed / type (U = Ultrafast IGBT)
9 - NTC thermistor

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



All pins position with tolerance of ⌖ ∅ 0.5

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