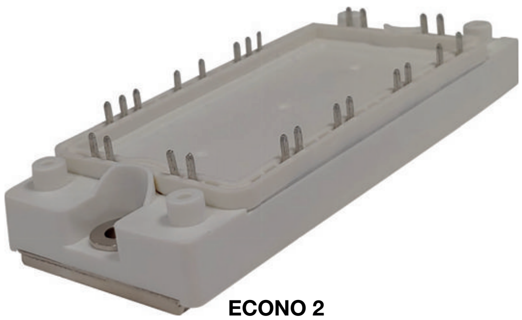
IGBT Fourpack Module, 50 A



ECONO 2
(Package example)

FEATURES

- Trench gate field stop IGBT
- Square RBSOA
- HEXFRED® low Q_{rr}, low switching energy
- Positive $V_{CE(on)}$ temperature coefficient
- Copper baseplate
- Low stray inductance design
- Designed and qualified for industrial market
- UL pending
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS
COMPLIANT

PRIMARY CHARACTERISTICS	
V_{CES}	1200 V
I_C at T_C = 66 °C	50 A
$V_{CE(on)}$ (typical)	2.34 V
Speed	8 kHz to 30 kHz
Package	ECONO 2
Circuit configuration	4 pack

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	64	A
		T_C = 80 °C	44	
Pulsed collector current, see fig. C.T.5	I_{CM}	T_J = 150 °C, t_p = 6 ms, V_{GE} = 15 V	180	
Clamped inductive load current	I_{LM}		150	
Diode continuous forward current	I_F	T_C = 25 °C	40	
		T_C = 80 °C	25	
Diode maximum forward current	I_{FM}		150	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation (IGBT)	P_D	T_C = 25 °C	231	W
		T_C = 80 °C	130	
Isolation voltage	V_{ISOL}		AC 2500 (min)	V

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Collector to emitter breakdown voltage	$BV_{(CES)}$	V_{GE} = 0 V, I_C = 2 mA	1200	-	-	V
Collector to emitter voltage	$V_{CE(ON)}$	I_C = 50 A, V_{GE} = 15 V	-	2.34	2.80	
		I_C = 50 A, V_{GE} = 15 V, T_J = 125 °C	-	2.66	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, I_C = 2 mA	4.6	5.9	7.6	
Threshold voltage temperature coefficient	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, I_C = 2 mA (25 °C to 125 °C)	-	-13	-	mV/°C
Zero gate voltage collector current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	1	50	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	670	-	
Diode forward voltage drop	V_{FM}	I_F = 50 A	-	3.30	4.5	V
		I_F = 50 A, T_J = 125 °C	-	3.60	-	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 200	nA

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNITS**
Total gate charge (turn-on)	Q_G	I_C = 50 A V_{CC} = 960 V V_{GE} = 15 V		-	154	-	nC
Gate to emitter charge (turn-on)	Q_{GE}			-	17	-	
Gate to collector charge (turn-on)	Q_{GC}			-	79	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 V V_{GE} = 15 V, R_G = 4.7 Ω, L = 500 μH T_J = 25 °C (1)		-	1.17	-	mJ
Turn-off switching loss	E_{off}			-	1.50	-	
Total switching loss	E_{tot}			-	2.67	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 V V_{GE} = 15 V, R_G = 4.7 Ω, L = 500 μH T_J = 125 °C (1)		-	1.58	-	
Turn-off switching loss	E_{off}			-	2.52	-	
Total switching loss	E_{tot}			-	4.10	-	
Turn-on delay time	$t_{d(on)}$	I_C = 50 A, V_{CC} = 600 V V_{GE} = 15 V, R_G = 4.7 Ω, L = 500 μH T_J = 125 °C		-	44	-	ns
Rise time	t_r			-	11	-	
Turn-off delay time	$t_{d(off)}$			-	96	-	
Fall time	t_f			-	187	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 150 A, V_{CC} = 800 V, V_P = 1200 V, R_g = 4.7 Ω, V_{GE} = 15 V to 0 V		Fullsquare			
Short circuit safe operating area	SCSOA	T_J = 150 °C V_{CC} = 600 V, V_P = 1200 V R_G = 10 Ω, V_{GE} = 15 V to 0 V		5	-	-	μs
Diode peak reverse recovery current	I_{rr}	T_J = 25 °C	V_{CC} = 600 V I_F = 50 A dI/dt = 7 A/μs	-	1.3	-	A
		T_J = 125 °C		-	2.0	-	
Diode reverse recovery time	t_{rr}	T_J = 25 °C		-	0.453	-	μs
		T_J = 125 °C		-	0.74	-	
Total reverse recovery charge	Q_{rr}	T_J = 25 °C		-	0.12	-	μC
		T_J = 125 °C		-	0.4	-	

Note

(1) Energy losses include "tail" and diode reverse recovery

INTERNAL NTC - THERMISTOR SPECIFICATIONS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**TYP.**	**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/(298.15K))]	3375 ± 5 %	K
Maximum operating temperature			220	°C
Dissipation constant			2	mW/°C
Thermal time constant			8	s

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	T_J, T_{Stg}		-40	-	150	°C
Junction to case IGBT	R_{thJC}		-	-	0.54	°C/W
Junction to case DIODE	R_{thJC}		-	-	1	
Case to sink per module	R_{thCS}		-	0.05	-	
Mounting torque (M5)			2.7	-	3.3	Nm
Weight			-	170	-	g

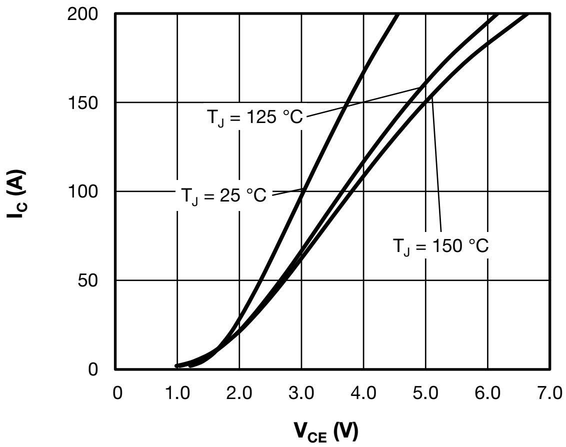


Fig. 1 - Typical Trench IGBT Output Characteristics, V_{GE} = 15 V

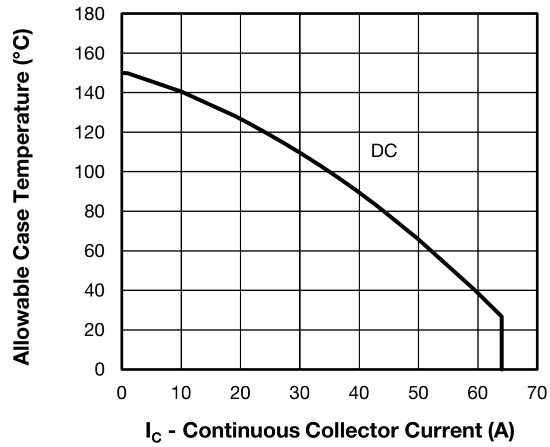


Fig. 3 - Maximum Trench IGBT Continuous Collector Current vs. Case Temperature

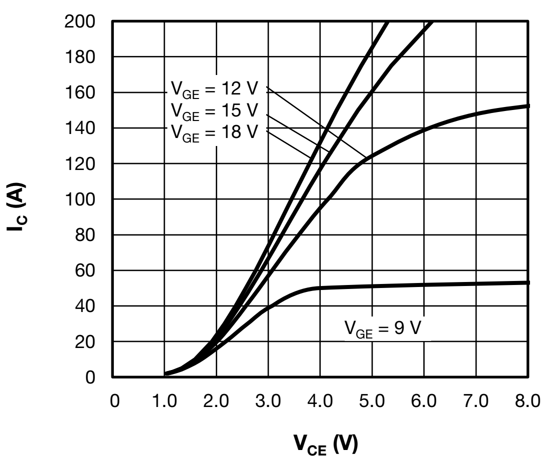


Fig. 2 - Typical Trench IGBT Output Characteristics, T_J = 125 °C

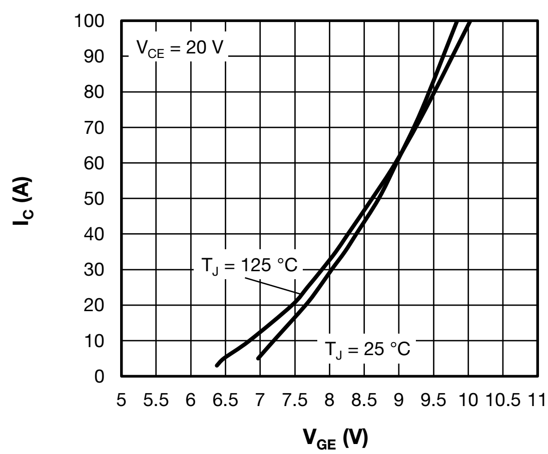


Fig. 4 - Typical Trench IGBT Transfer Characteristics

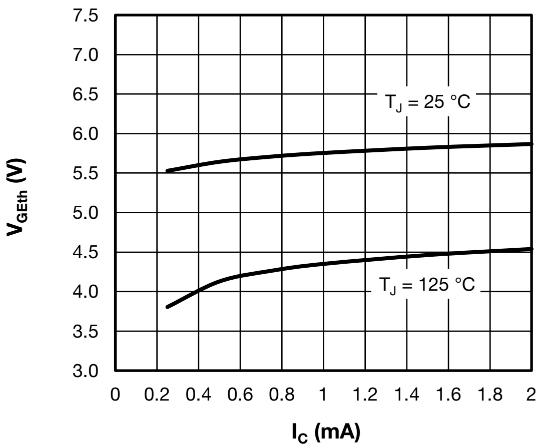


Fig. 5 - Typical Trench IGBT Gate Threshold Voltage

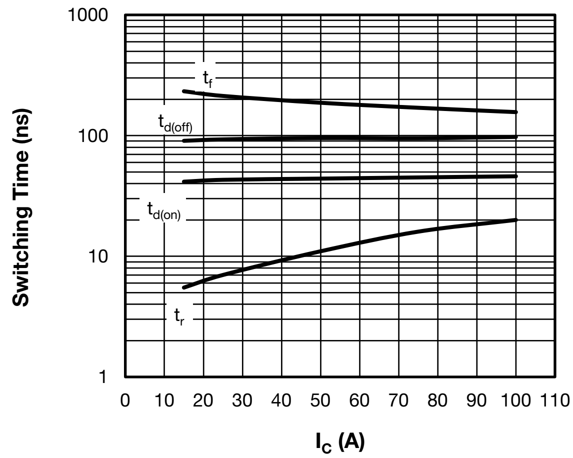


Fig. 8 - Typical Trench IGBT Switching Time vs. I_C (with Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, R_g = 4.7 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

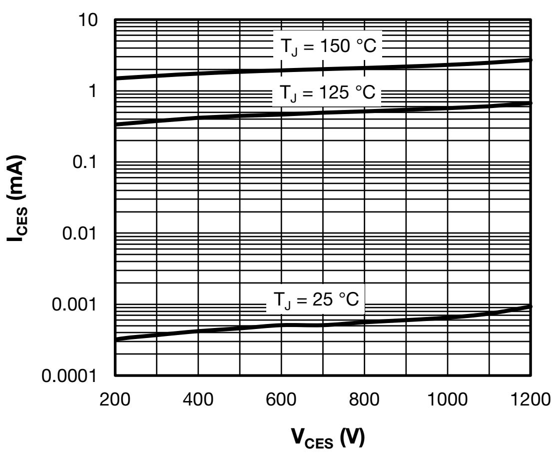


Fig. 6 - Typical Trench IGBT Zero Gate Voltage Collector Current

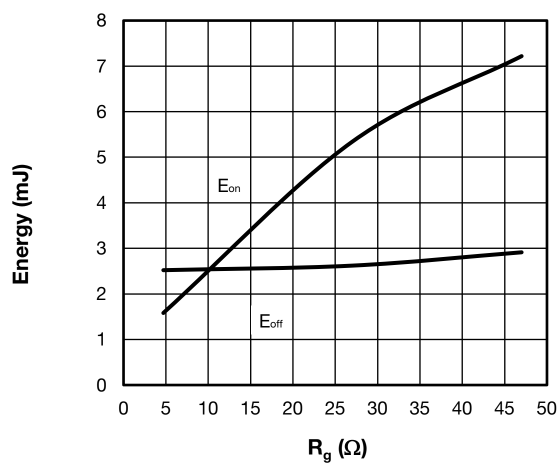


Fig. 9 - Typical Trench IGBT Energy Loss vs. R_g (with Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, I_C = 40 A, V_{GE} = +15 V/-15 V, L = 500 μH

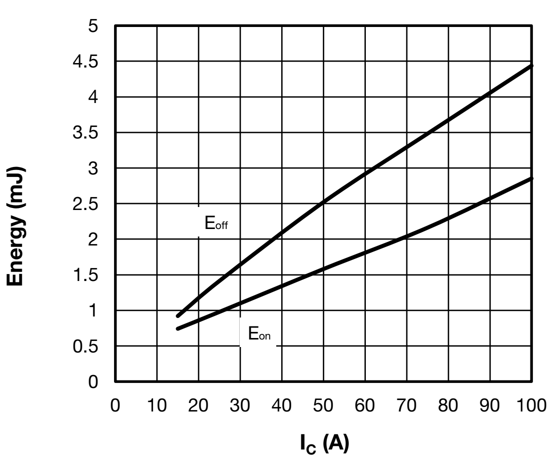


Fig. 7 - Typical Trench IGBT Energy Loss vs. I_C (with Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, R_g = 4.7 Ω, V_{GE} = +15 V/-15 V, L = 500 μH

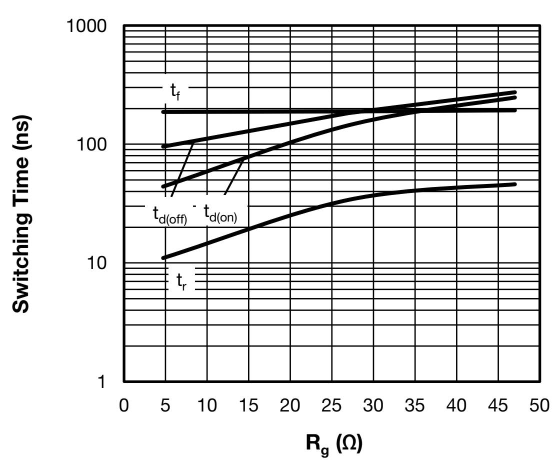


Fig. 10 - Typical Trench IGBT Switching Time vs. R_g (with Antiparallel Diode)
T_J = 125 °C, V_{CC} = 600 V, I_C = 50 A, V_{GE} = +15 V/-15 V, L = 500 μH

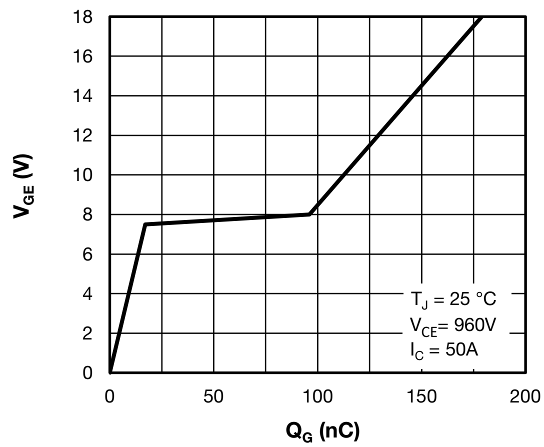


Fig. 11 - Typical Trench IGBT Gate Charge vs. Gate to Emitter Voltage

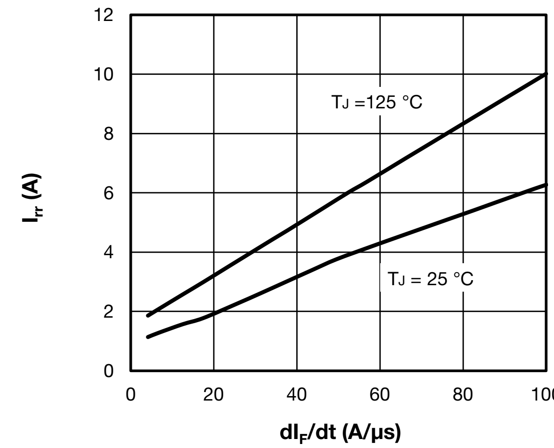


Fig. 14 - Typical Diode Reverse Recovery Current vs. dI_F/dt

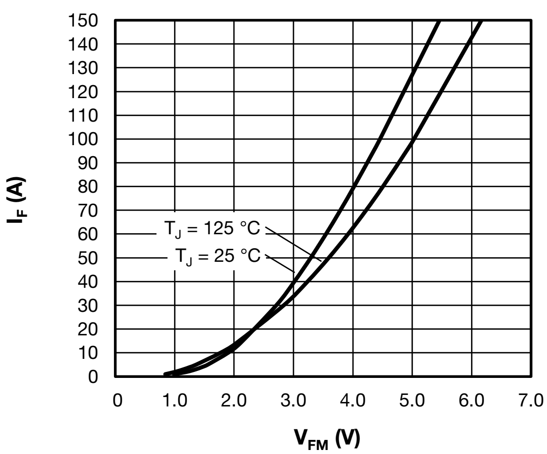


Fig. 12 - Typical Diode Forward Characteristics

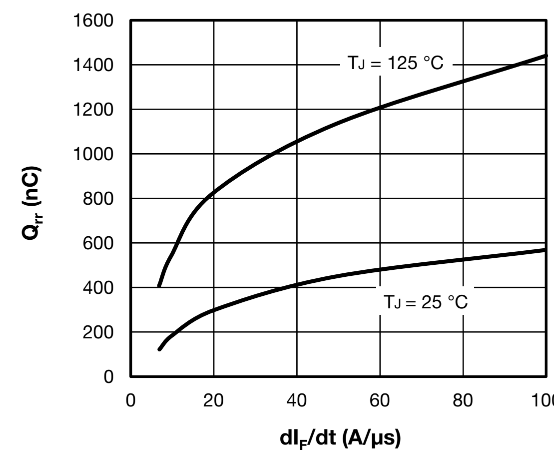


Fig. 15 - Typical Diode Reverse Recovery Charge vs. dI_F/dt

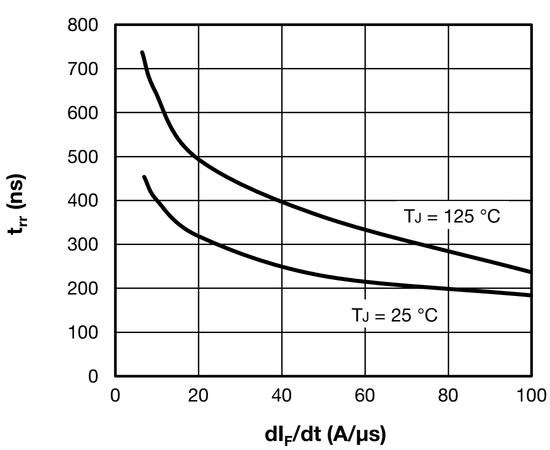


Fig. 13 - Typical Diode Reverse Recovery Time vs. dI_F/dt

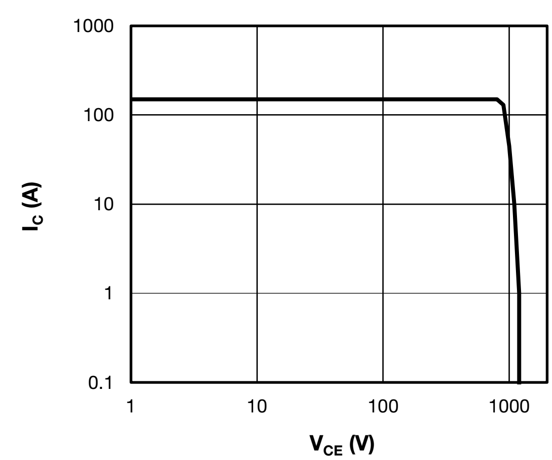


Fig. 16 - Trench IGBT Reverse BIAS SOA
T_J = 150 °C, I_C = 150 A, R_g = 4.7 Ω, V_{GE} = +15 V / 0 V, V_{CC} = 800 V, V_p = 1200 V

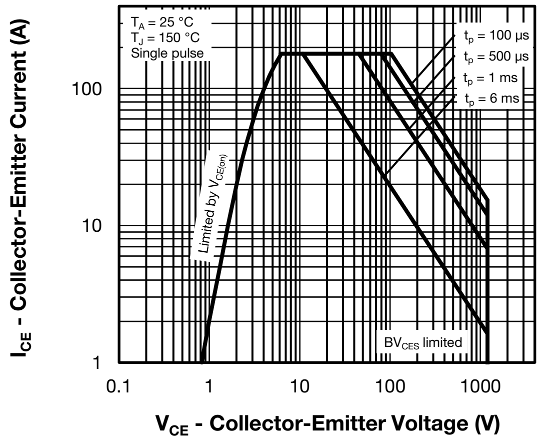


Fig. 17 - Trench IGBT Safe Operating Area

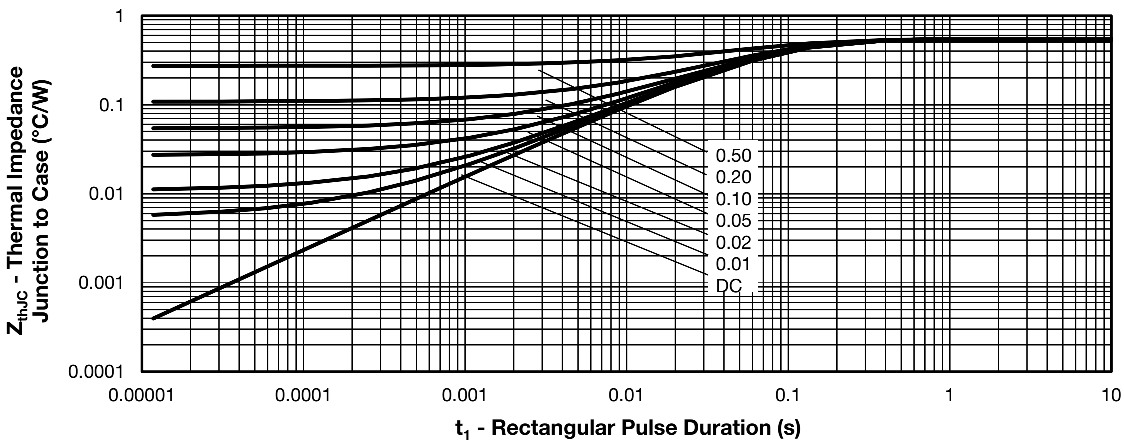


Fig. 18 - Maximum Trench IGBT Thermal Impedance Z_{thJC} Characteristics

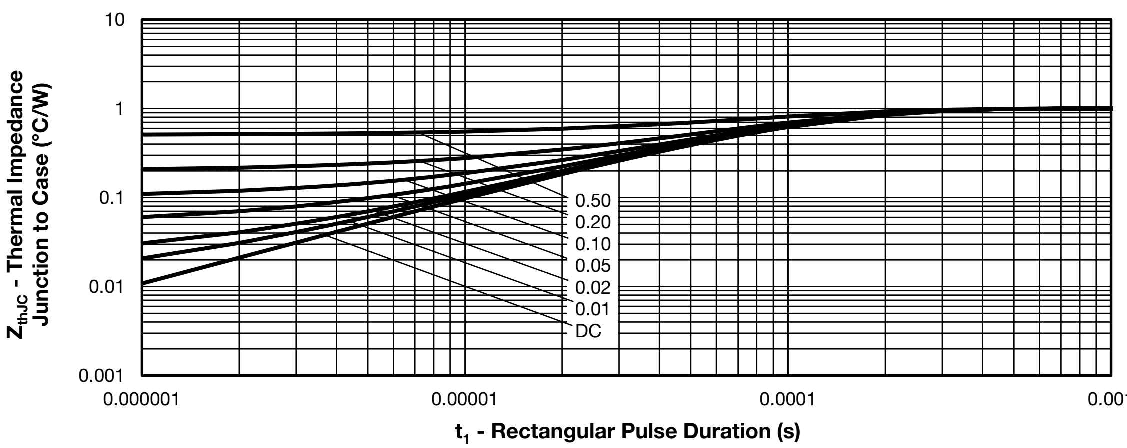


Fig. 19 - Maximum Diode Thermal Impedance Z_{thJC} Characteristics

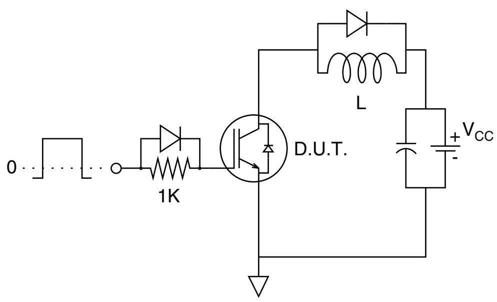


Fig. 20 - Gate Charge Circuit (Turn-Off)

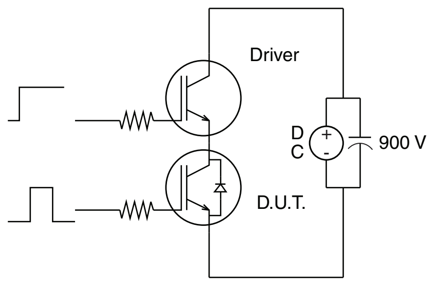


Fig. 22 - S.C. SOA Circuit

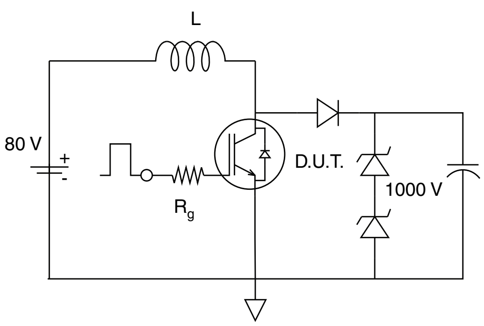


Fig. 21 - RBSOA Circuit

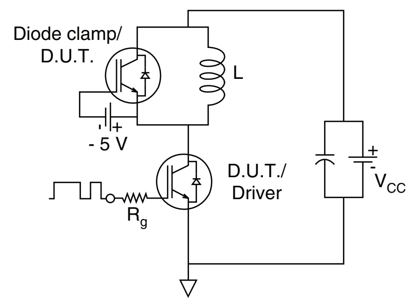


Fig. 23 - Switching Loss Circuit

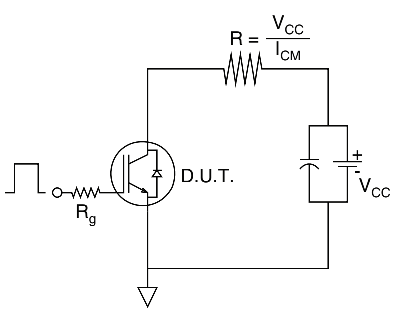


Fig. 24 - Resistive Load Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	T	51	Y	F	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 (51 = 50 A)

5 - Circuit configuration (Y = 4 pack)

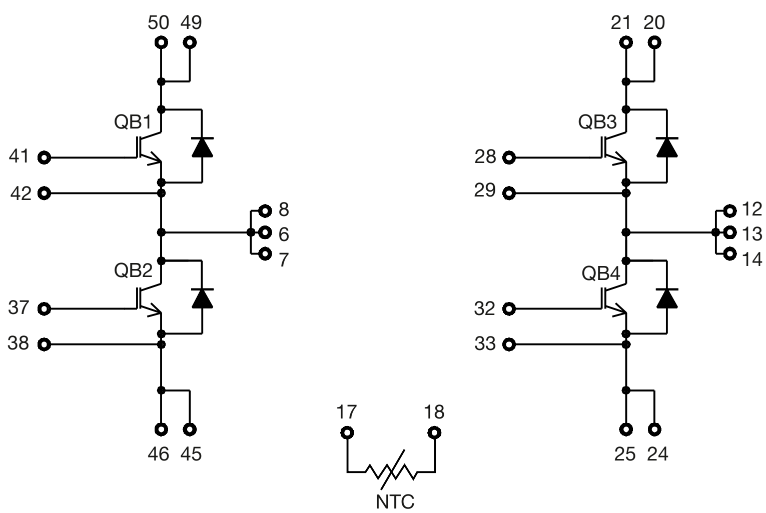
6 - Package indicator (F = ECONO 2)

7 - Voltage rating (120 = 1200 V)

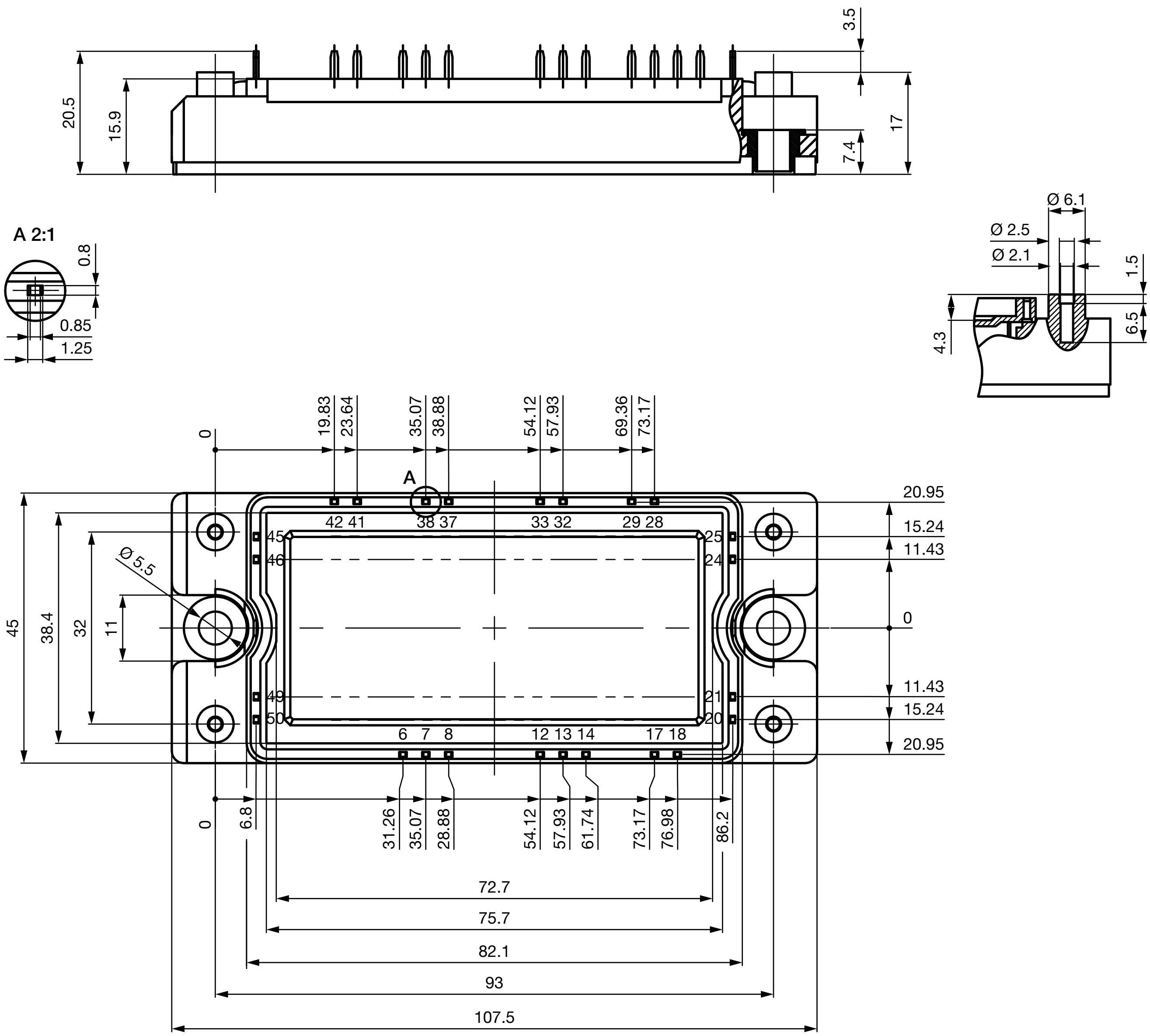
8 - Speed / type (N = ultrafast with reduced diode, speed 8 kHz to 60 kHz)

9 - NTC thermistor

CIRCUIT CONFIGURATION



DIMENSIONS in millimeters



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