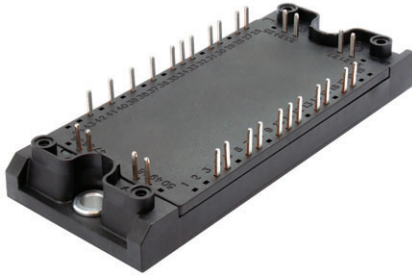


## IGBT Fourpack Module, 50 A



ECONO 2

### FEATURES

- 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 approved file E78996
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS  
COMPLIANT**

### PRIMARY CHARACTERISTICS

$V_{CES}$	1200 V
$I_C$ at $T_C = 66\text{ °C}$	50 A
$V_{CE(on)}$ (typical)	3.49 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	$I_C$	$T_C = 25\text{ °C}$	66	A
		$T_C = 80\text{ °C}$	44	
Pulsed collector current See fig. C.T.5	$I_{CM}$		150	
Clamped inductive load current	$I_{LM}$		150	
Diode continuous forward current	$I_F$	$T_C = 25\text{ °C}$	40	
		$T_C = 80\text{ °C}$	25	
Diode maximum forward current	$I_{FM}$		150	
Gate to emitter voltage	$V_{GE}$		$\pm 20$	V
Maximum power dissipation (IGBT)	$P_D$	$T_C = 25\text{ °C}$	330	W
		$T_C = 80\text{ °C}$	180	
Maximum operating junction temperature	$T_J$		150	°C
Storage temperature range	$T_{Stg}$		-40 to +125	
Isolation voltage	$V_{ISOL}$		AC 2500 (min)	V



<b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$BV_{(CES)}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(ON)}$	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	-	3.49	3.9	
		$I_C = 75\text{ A}, V_{GE} = 15\text{ V}$	-	4.15	4.5	
		$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	4.16	4.5	
		$I_C = 75\text{ A}, V_{GE} = 15\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	4.97	5.4	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	4.0	4.9	6.0	
Threshold voltage temperature coefficient	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$ (25 °C to 125 °C)	-	-10	-	mV/°C
Zero gate voltage collector current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	11	250	$\mu\text{A}$
		$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	600	1000	
Diode forward voltage drop	$V_{FM}$	$I_F = 50\text{ A}$	-	3.30	4.5	V
		$I_F = 75\text{ A}$	-	3.90	5.0	
		$I_F = 50\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.6	4.8	
		$I_F = 75\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	4.37	5.5	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	$\pm 200$	nA

<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_G$	$I_C = 50\text{ A}$ $V_{CC} = 600\text{ V}$ $V_{GE} = 15\text{ V}$	-	400	-	nC
Gate to emitter charge (turn-on)	$Q_{GE}$		-	43	-	
Gate to collector charge (turn-on)	$Q_{GC}$		-	187	-	
Turn-on switching loss	$E_{on}$	$I_C = 50\text{ A}, V_{CC} = 600\text{ V}$ $V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$ $T_J = 25\text{ }^\circ\text{C}$ (1)	-	0.93	-	mJ
Turn-off switching loss	$E_{off}$		-	1.20	-	
Total switching loss	$E_{tot}$		-	2.13	-	
Turn-on switching loss	$E_{on}$	$I_C = 50\text{ A}, V_{CC} = 600\text{ V}$ $V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$ $T_J = 125\text{ }^\circ\text{C}$ (1)	-	1.68	-	mJ
Turn-off switching loss	$E_{off}$		-	1.77	-	
Total switching loss	$E_{tot}$		-	3.46	-	
Turn-on delay time	$t_{d(on)}$	$I_C = 50\text{ A}, V_{CC} = 600\text{ V}$ $V_{GE} = 15\text{ V}, R_G = 4.7\text{ }\Omega, L = 500\text{ }\mu\text{H}$ $T_J = 125\text{ }^\circ\text{C}$	-	128	-	ns
Rise time	$t_r$		-	56	-	
Turn-off delay time	$t_{d(off)}$		-	292	-	
Fall time	$t_f$		-	134	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 150\text{ A}$ $R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}$	Fullsquare			
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^\circ\text{C}$ $V_{CC} = 900\text{ V}, V_P = 1200\text{ V}$ $R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}$	10	-	-	$\mu\text{s}$
Diode peak reverse recovery current	$I_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	1.3	2.3	A
		$T_J = 125\text{ }^\circ\text{C}$	-	2.0	3	
Diode reverse recovery time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	0.453	0.49	$\mu\text{s}$
		$T_J = 125\text{ }^\circ\text{C}$	-	0.74	0.82	
Total reverse recovery charge	$Q_{rr}$	$T_J = 25\text{ }^\circ\text{C}$	-	0.12	0.3	$\mu\text{C}$
		$T_J = 125\text{ }^\circ\text{C}$	-	0.4	1.5	

**Note**

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



THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Junction to case IGBT	$R_{thJC}$ (IGBT)	-	-	0.38	°C/W
Junction to case DIODE	$R_{thJC}$ (DIODE)	-	-	1.00	
Case to sink, flat, greased surface	$R_{thCS}$ (MODULE)	-	0.05	-	
Mounting torque (M5)		2.7	-	3.3	Nm
Weight		-	170	-	g

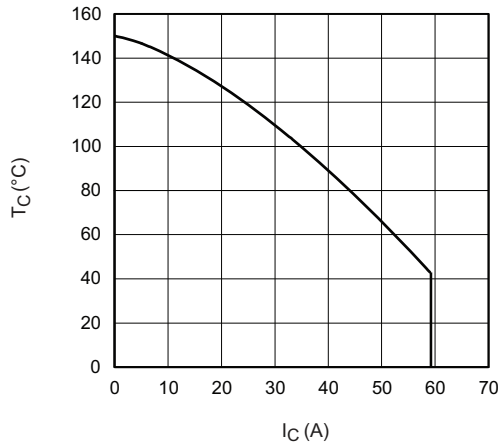


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

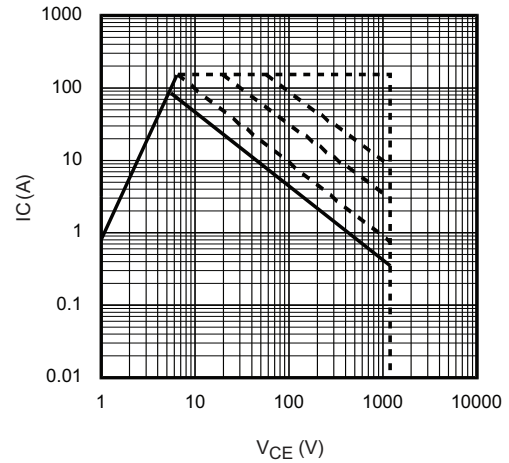


Fig. 3 - Forward SOA  
 $T_C = 25\text{ }^\circ\text{C}$ ;  $T_J \leq 150\text{ }^\circ\text{C}$

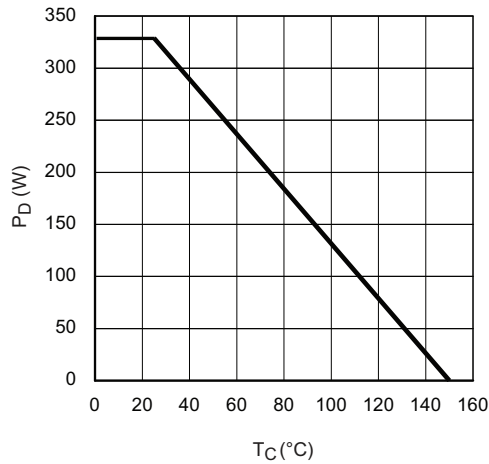


Fig. 2 - Power Dissipation vs. Case Temperature

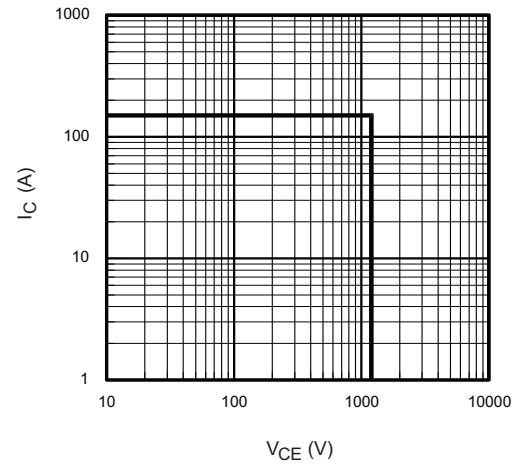
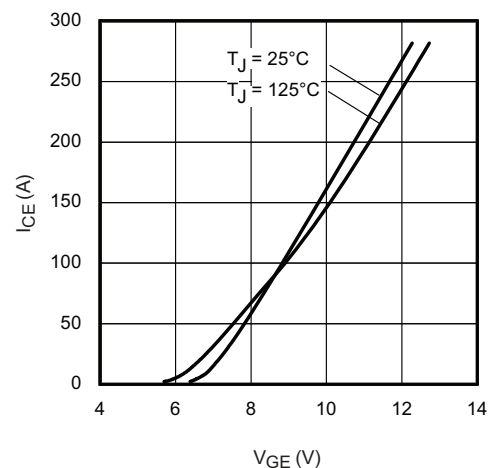
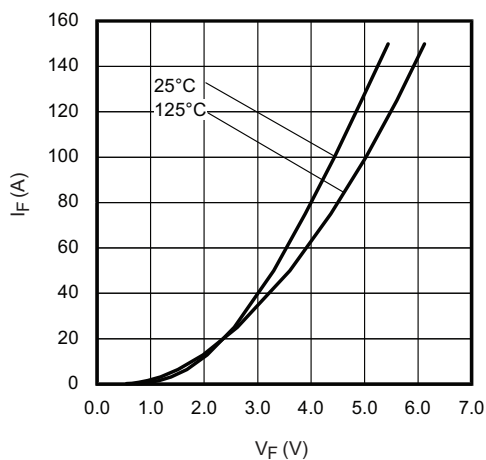
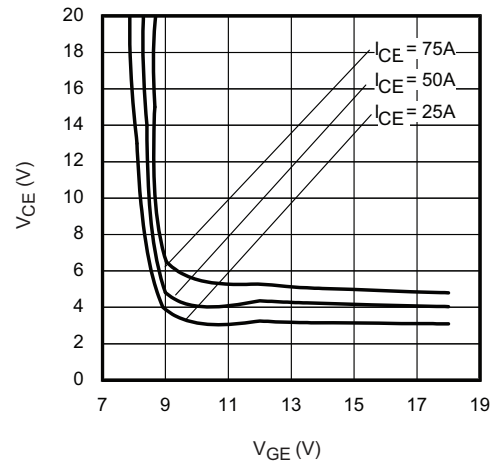
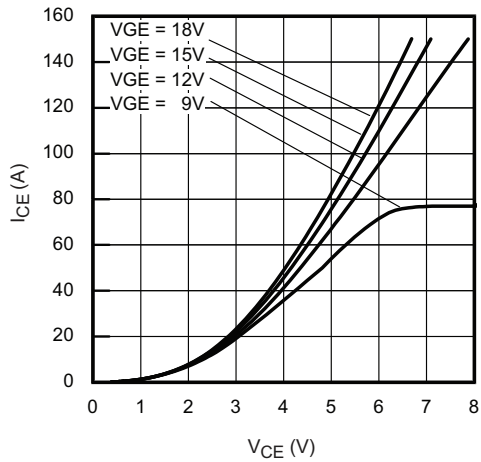
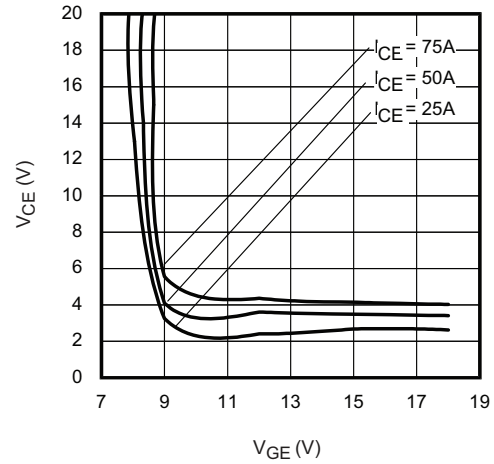
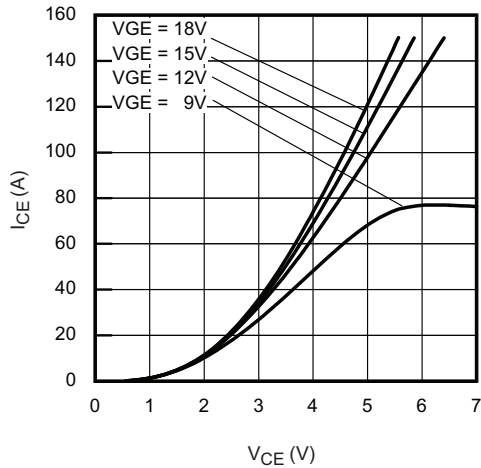


Fig. 4 - Reverse Bias SOA  
 $T_J = 150\text{ }^\circ\text{C}$ ;  $V_{GE} = 15\text{ V}$



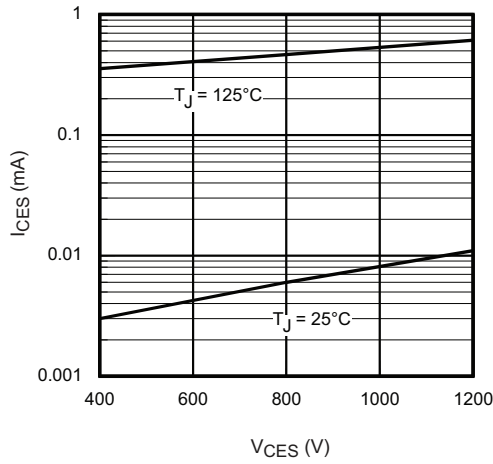


Fig. 11 - Typical Zero Gate Voltage Collector Current

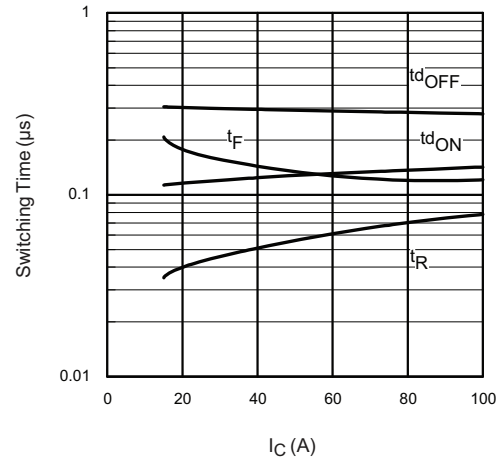


Fig. 14 - Typical Switching Time vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 200\ \mu\text{H}$ ;  $V_{CE} = 600\ \text{V}$ ;  $R_G = 5\ \Omega$ ;  $V_{GE} = 15\ \text{V}$

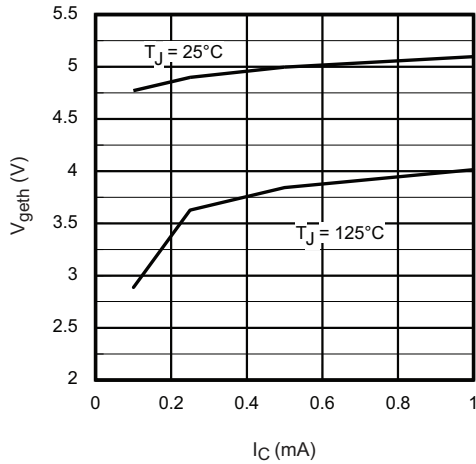


Fig. 12 - Typical Threshold Voltage

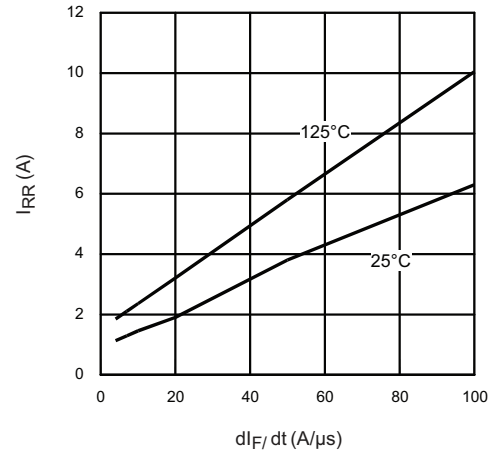


Fig. 15 - Typical Diode  $I_{RR}$  vs.  $dI_F/dt$   
 $V_{CC} = 600\ \text{V}$ ;  $I_F = 50\ \text{A}$

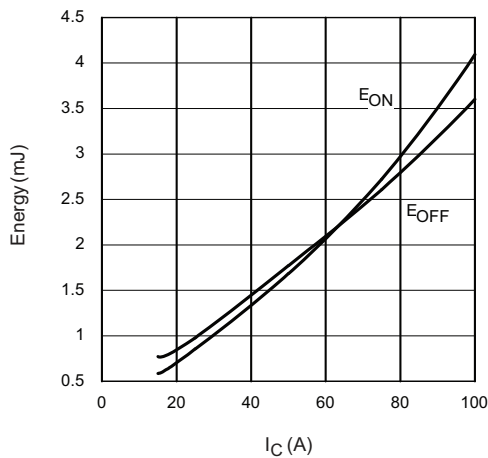


Fig. 13 - Typical Energy Loss vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 200\ \mu\text{H}$ ;  $V_{CE} = 600\ \text{V}$ ;  $R_G = 5\ \Omega$ ;  $V_{GE} = 15\ \text{V}$

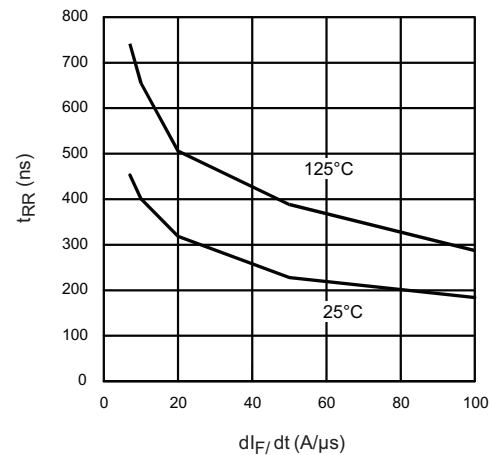


Fig. 16 - Typical Diode  $t_{rr}$  vs.  $dI_F/dt$   
 $V_{CC} = 600\ \text{V}$ ;  $I_F = 50\ \text{A}$

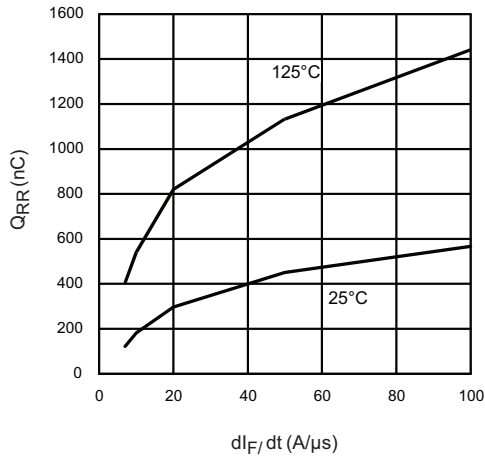


Fig. 17 - Typical Diode  $Q_{rr}$  vs.  $dI_F/dt$   
 $V_{CC} = 600\text{ V}$ ;  $I_F = 50\text{ A}$

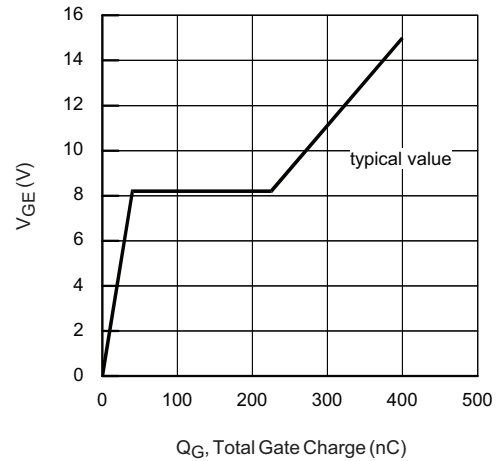


Fig. 18 - Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 5.0\text{ A}$ ;  $L = 600\text{ μH}$

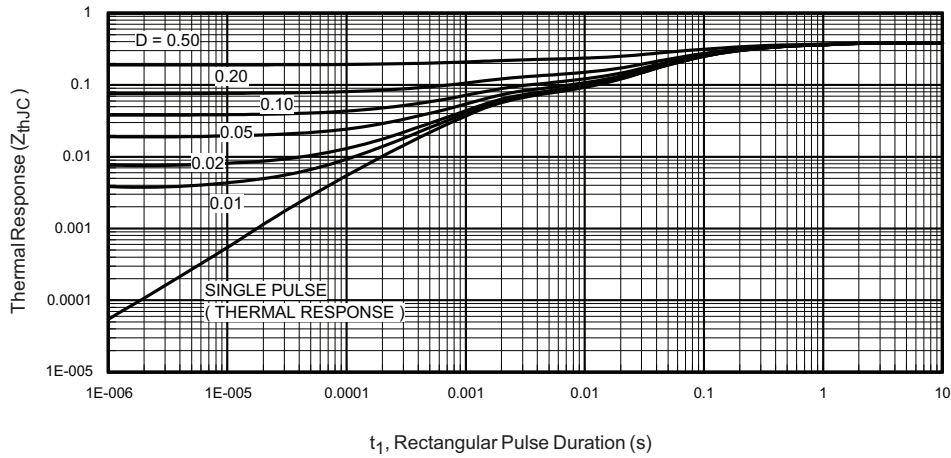


Fig. 19 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

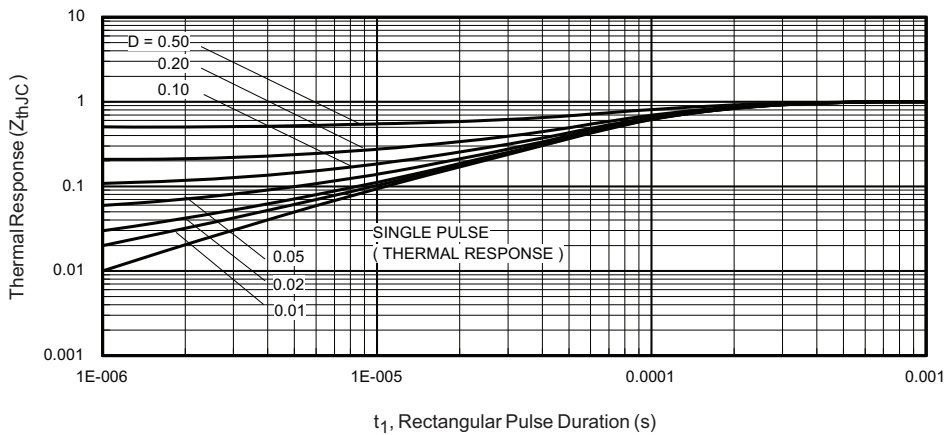


Fig. 20 - Maximum Transient Thermal Impedance, Junction to Case (DIODE)

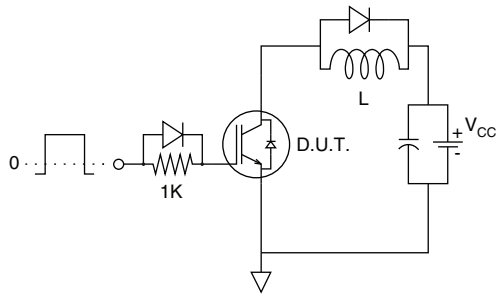


Fig. 21 - Gate Charge Circuit (Turn-Off)

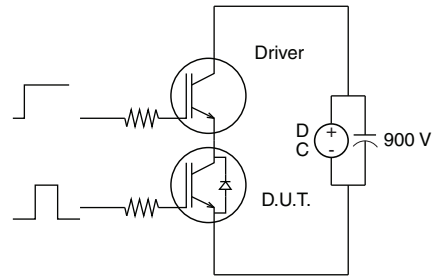


Fig. 23 - S.C. SOA Circuit

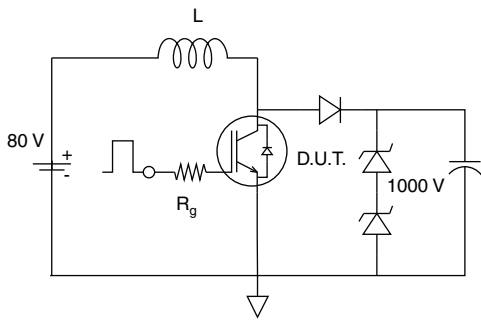


Fig. 22 - RBSOA Circuit

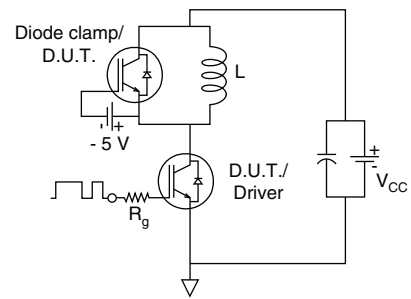


Fig. 24 - Switching Loss Circuit

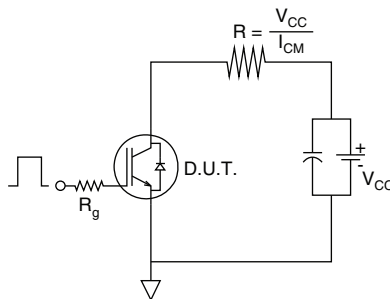


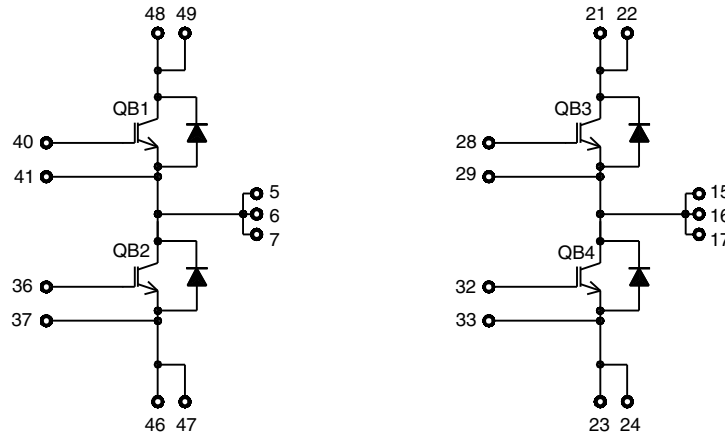
Fig. 25 - Resistive Load Circuit

## ORDERING INFORMATION TABLE

Device code	<b>VS-</b>	<b>G</b>	<b>B</b>	<b>50</b>	<b>Y</b>	<b>F</b>	<b>120</b>	<b>N</b>
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Vishay Semiconductors product
- 2** - Insulated gate bipolar transistor (IGBT)
- 3** - B = IGBT Gen 5 NPT
- 4** - Current rating (50 = 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)

## CIRCUIT CONFIGURATION



### LINKS TO RELATED DOCUMENTS

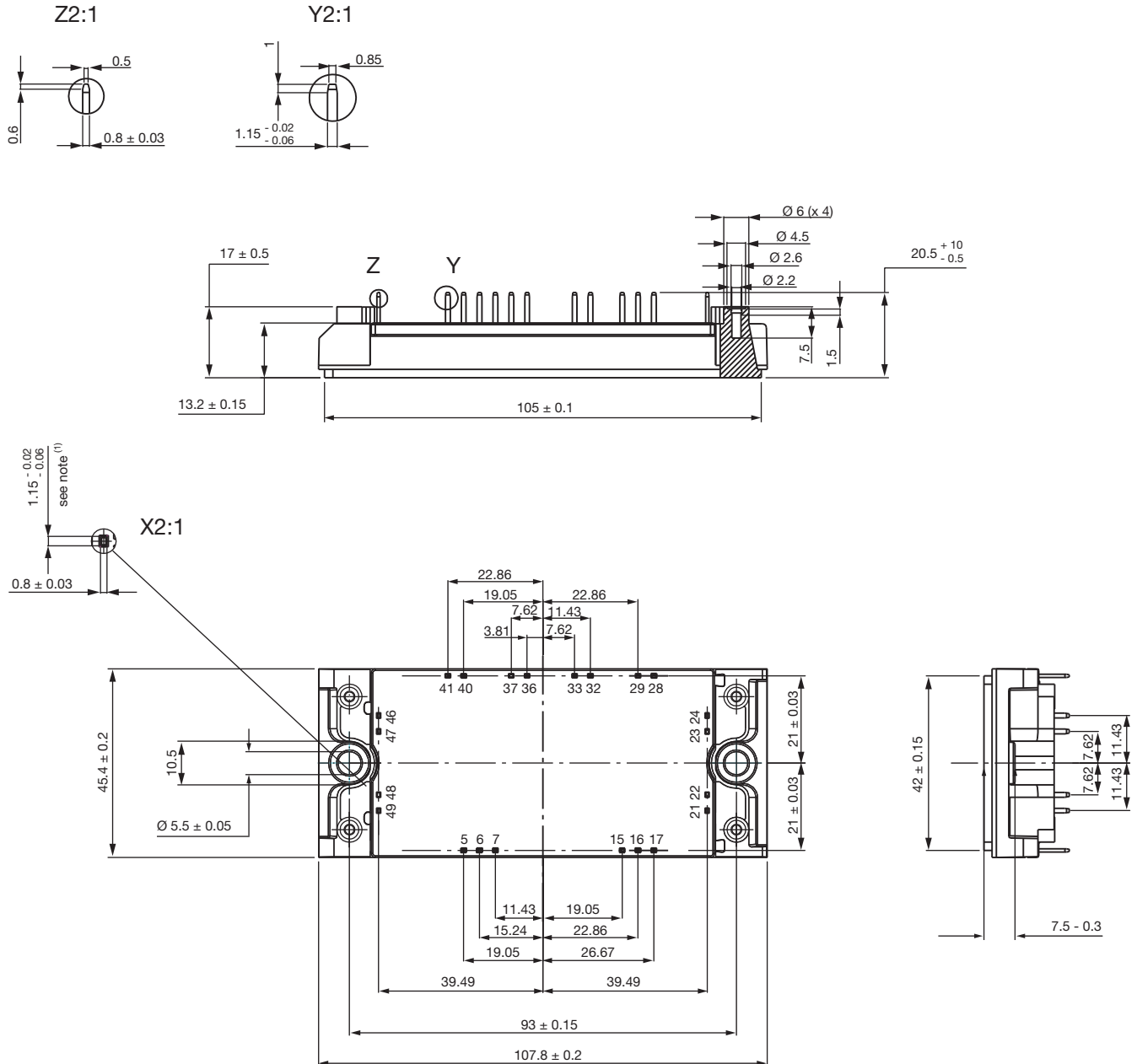
Dimensions	<a href="http://www.vishay.com/doc?95539">www.vishay.com/doc?95539</a>
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## ECONO2 4PACK N Series

**DIMENSIONS** in millimeters





## **Disclaimer**

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