

DIAP Trench IGBT Power Module - 1200 V, 300 A

Current Fed Inverter Topology



Dual INT-A-PAK

PRIMARY CHARACTERISTICS	
IGBT	
V_{CES}	1200 V
$V_{CE(on)}$ (typical) at 300 A, 25 °C	2.17 V
$I_{D(DC)}$ at $T_C = 48$ °C	300 A
HEXFRED® SERIES DIODE	
V_R	1200 V
V_F (typical) at 300 A, 25 °C	1.99 V
$I_{F(DC)}$ at 49 °C	300 A
IGBT AND HEXFRED® SERIES DIODE	
$V_{CE(on)} + V_F$ typical at 300 A	4.12 V
HEXFRED® Antiparallel DIODE	
V_F (typical) at 10 A, 25 °C	1.6 V
$I_{F(DC)}$ at 63 °C	40 A
Speed	8 kHz to 30 kHz
Package	Dual INT-A-PAK
Circuit configuration	Current fed inverter topology

FEATURES

- Trench IGBT technology with positive temperature coefficient
- Low switching losses
- Maximum junction temperature 150 °C
- 10 μ s short circuit capability
- Low inductance case
- HEXFRED® antiparallel and series diodes with soft reverse recovery
- Isolated copper baseplate using DCB (direct copper bonding) technology
- Direct mounting to heatsink
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



BENEFITS

- Short circuit ruggedness

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C unless otherwise noted)				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
IGBT				
Collector to emitter voltage	V _{CES}		1200	V
Collector current	I _C	T _C = 80 °C	234	A
		T _C = 25 °C	341	
Clamped inductive load current	I _{LM}		700	
Gate to emitter voltage	V _{GE}		± 30	V
Maximum power dissipation	P _D	T _C = 80 °C	583	W
		T _C = 25 °C	1042	
SERIES DIODE				
Cathode to anode breakdown voltage	V _{RRM}		1200	
Continuous forward current	I _F	T _C = 80 °C	232	A
		T _C = 25 °C	348	
Peak repetitive forward current	I _{FSM}	T _C = 25 °C	2200	A
Maximum power dissipation	P _D	T _C = 80 °C	438	W
		T _C = 25 °C	781	
ANTIPARALLEL DIODE				
Continuous forward current	I _F ⁽¹⁾	T _C = 80 °C	36	A
		T _C = 25 °C	51	
Peak repetitive forward current	I _{FSM}		n/a	A
Maximum power dissipation	P _D	T _C = 80 °C	77	W
		T _C = 25 °C	137	

**ABSOLUTE MAXIMUM RATINGS** ($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MODULE				
RMS isolation voltage	V_{ISOL}	$f = 50\text{ Hz}$, $t = 1\text{ minute}$	4000	V
Junction temperature range	T_J		-40 to +150	$^{\circ}\text{C}$
Storage temperature range	T_{STG}		-40 to +150	

Note

(1) Max. RMS current admitted for the terminals 10 A

ELECTRICAL SPECIFICATIONS ($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
IGBT						
Collector to emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 0.5\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$	1200	-	-	V
Collector to emitter saturation voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 300\text{ A}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	2.17	-	
		$V_{GE} = 15\text{ V}$, $I_C = 300\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.4	-	
Gate to emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 14\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$	4.7	5.6	7.8	mA
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$	-	0.003	0.3	
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.03	-	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 30\text{ V}$	-	-	400	nA
SERIES DIODE						
Cathode to anode breakdown voltage	V_R	$I_C = 1.0\text{ mA}$, $T_J = 125\text{ }^{\circ}\text{C}$	1200	-	-	mA
Cathode to anode leakage current	I_R	$V_R = 1200\text{ V}$	-	0.003	0.2	
		$V_R = 1200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.5	-	
Forward voltage	V_F	$I_F = 300\text{ A}$	-	1.99	-	V
		$I_F = 300\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.02	-	
ANTIPARALLEL DIODE						
Forward voltage	V_F	$I_F = 10\text{ A}$	-	1.6	-	V
		$I_F = 10\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.4	-	
IGBT AND HEXFRED® SERIES DIODE						
Collector to emitter saturation voltage + Forward voltage	$V_{CE(on)} + V_F$	$I_C = 300\text{ A}$	-	4.12	4.65	V

SWITCHING CHARACTERISTICS ($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
IGBT						
Turn-on switching loss	E_{on}	$V_{CC} = 600\text{ V}$, $I_C = 300\text{ A}$, $R_g = 4.7\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$	-	35.2	-	mJ
Turn-off switching loss	E_{off}		-	26.3	-	
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600\text{ V}$, $I_C = 300\text{ A}$, $R_g = 4.7\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	776	-	ns
Rise time	t_r		-	263	-	
Turn-off delay time	$t_{d(off)}$		-	816	-	
Fall time	t_f		-	131	-	
Turn-on switching loss	E_{on}		-	36.1	-	mJ
Turn-off switching loss	E_{off}	$V_{CE} = 30\text{ V}$, $f = 1.0\text{ MHz}$	-	32.1	-	
Input capacitance	C_{ies}		-	36	-	nF
Output capacitance	C_{oes}		-	1.4	-	
Reverse transfer capacitance	C_{res}		-	1.0	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $R_g = 22\text{ }\Omega$, $V_{GE} = 15\text{ V to }0\text{ V}$, $V_{CC} = 600\text{ V}$, $V_P = 1200\text{ V}$, $I_C = 700\text{ A}$	-	-	-	
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $R_g = 22\text{ }\Omega$, $V_{GE} = 15\text{ V to }0\text{ V}$, $V_{CC} = 600\text{ V}$, $V_P = 1200\text{ V}$	-	-	10	μs



SWITCHING CHARACTERISTICS (T _C = 25 °C unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
SERIES DIODE							
Diode reverse recovery charge	Q _{rr}	I _F = 50 A, V _R = 400 V, dI/dt = -500 A/μs	T _J = 25 °C	-	3.0	-	μC
			T _J = 125 °C	-	8.0	-	
Reverse recovery time	t _{rr}		T _J = 25 °C	-	230	-	nS
			T _J = 125 °C	-	370	-	
Reverse recovery current	I _{rr}		T _J = 25 °C	-	26	-	A
			T _J = 125 °C	-	43	-	
ANTIPARALLEL DIODE							
Diode reverse recovery charge	Q _{rr}	I _F = 10 A, V _R = 400 V, dI/dt = 500 A/μs	T _J = 25 °C	-	2.1	-	μC
			T _J = 125 °C	-	3.4	-	
Reverse recovery time	t _{rr}		T _J = 25 °C	-	175	-	ns
			T _J = 125 °C	-	241	-	

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Junction to case per $\frac{1}{2}$ module	R_{thJC}	IGBT	-	-	0.12	$^{\circ}\text{C}/\text{W}$	
Series diode			-	-	0.16		
Antiparallel diode			-	-	0.91		
Case to sink	R_{thCS}	Conductive grease applied	-	0.035	-		
Mounting torque		Power terminal screw: M6	2.5 to 5.0			Nm	
		Mounting screw: M6	3.0 to 5.0				
Weight			300				g

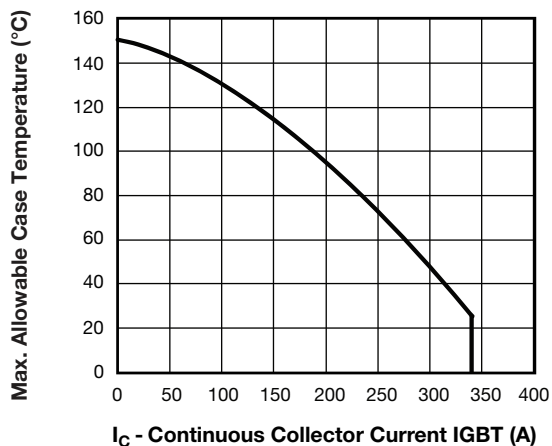
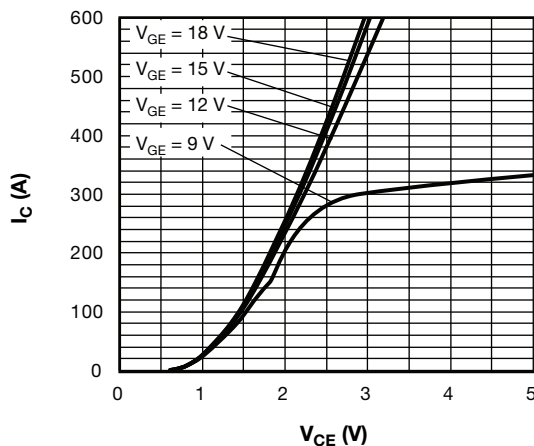


Fig. 1 - Maximum IGBT Continuous Collector Current vs. Case Temperature

Fig. 2 - Typical IGBT Output Characteristics, $T_J = 25\text{ }^{\circ}\text{C}$

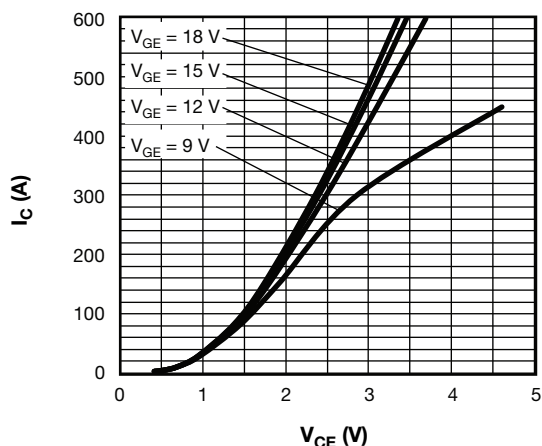
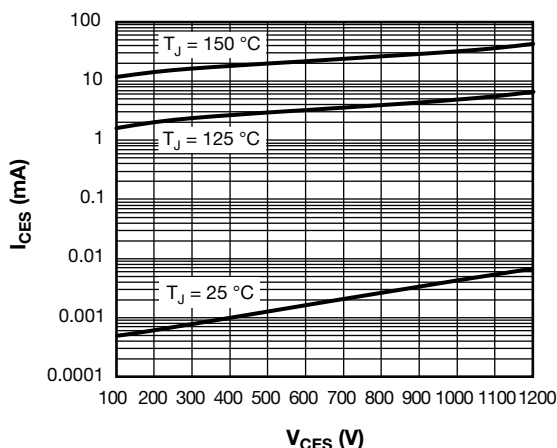

Fig. 3 - Typical IGBT Output Characteristics, $T_J = 125\text{ }^{\circ}\text{C}$


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

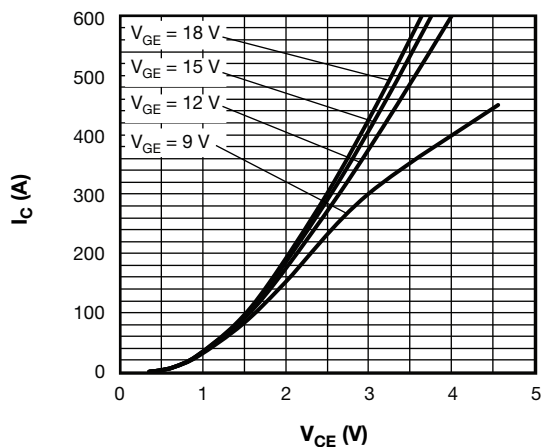
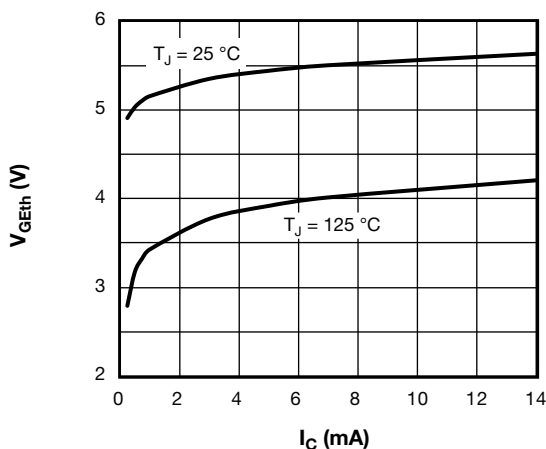

Fig. 4 - Typical IGBT Output Characteristics, $T_J = 150\text{ }^{\circ}\text{C}$


Fig. 7 - Typical IGBT Gate Threshold Voltage

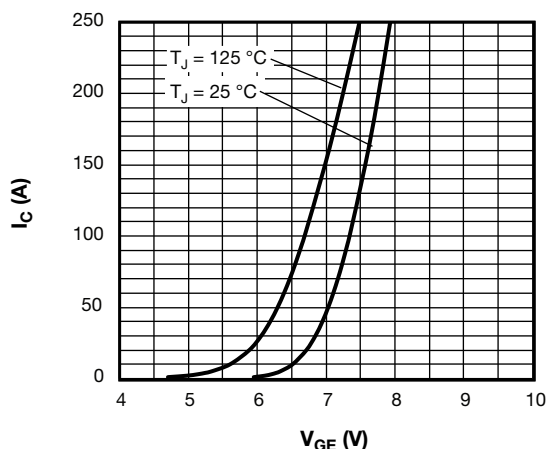


Fig. 5 - Typical IGBT Transfer Characteristics

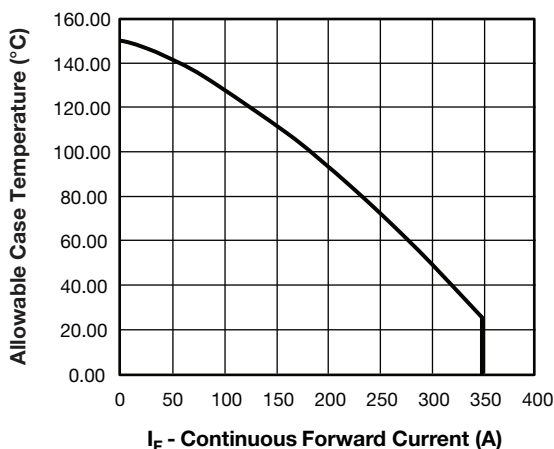


Fig. 8 - Maximum Continuous Forward Current vs. Case Temperature Series Diode

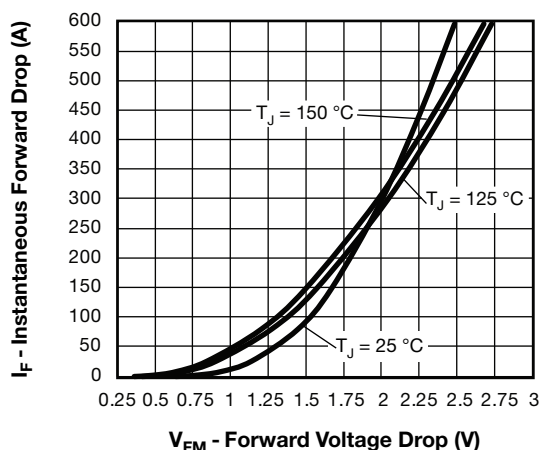


Fig. 9 - Typical Series Diode Forward Voltage

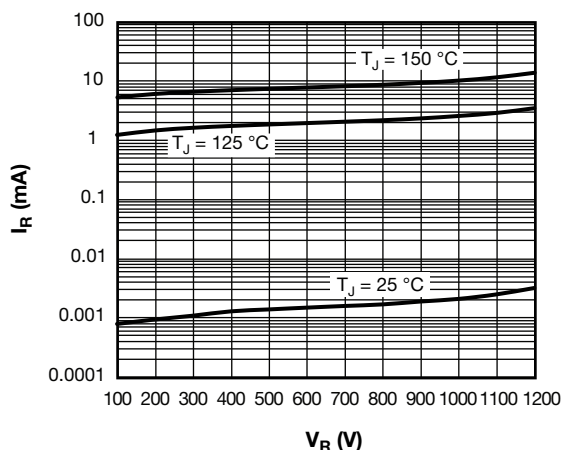


Fig. 12 - Typical Series Diode Leakage Current vs. Reverse Voltage

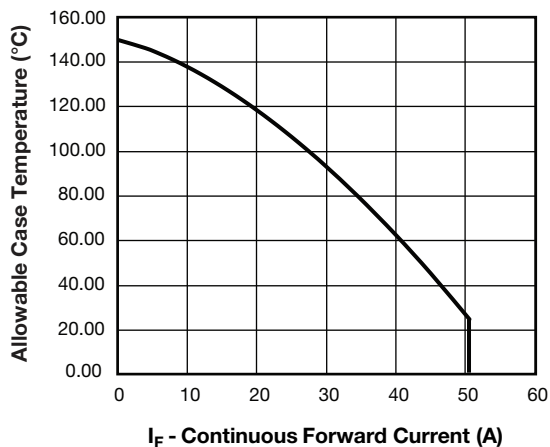
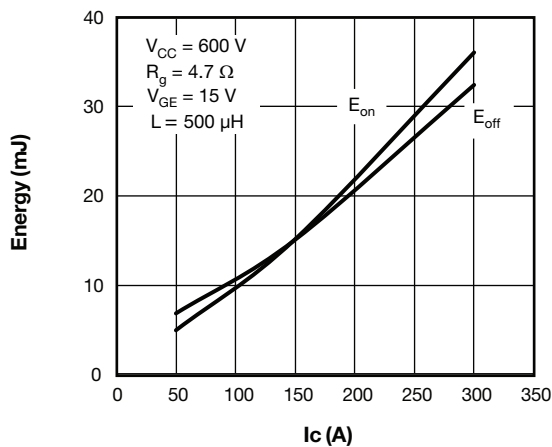
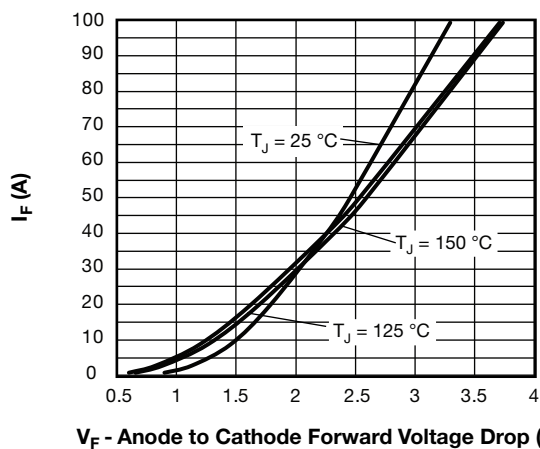
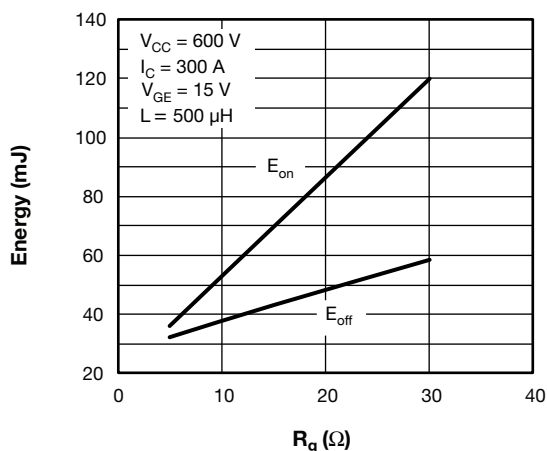


Fig. 10 - Maximum Continuous Forward Current vs. Case Temperature Antiparallel Diode


Fig. 13 - Typical IGBT Energy Loss vs. I_C , $T_J = 125\text{ °C}$ - Freewheeling Diode VS-H3195D12A6B in TO-247 Package

Fig. 11 - Typical Diode Forward Voltage Characteristics of Antiparallel Diode $t_p = 500\text{ μs}$

Fig. 14 - Typical IGBT Energy Loss vs. R_g , $T_J = 125\text{ °C}$ - Freewheeling Diode VS-H3195D12A6B in TO-247 Package

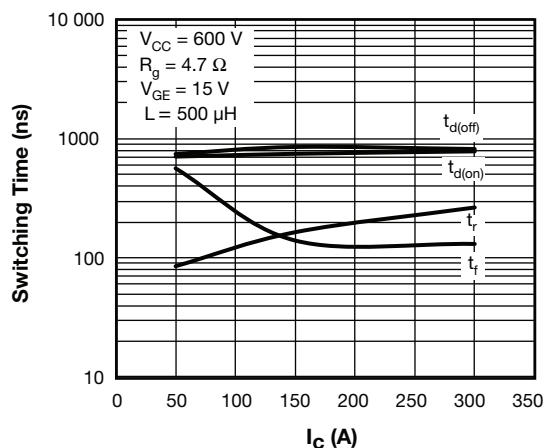


Fig. 15 - Typical IGBT Switching Time vs. I_C , $T_J = 125$ °C - Freewheeling Diode VS-H3195D12A6B in TO-247 Package

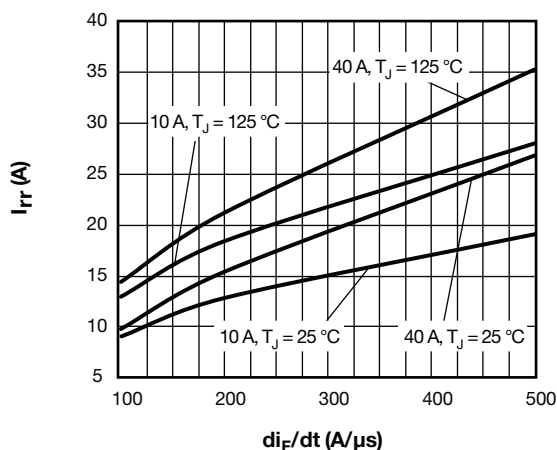


Fig. 18 - Typical I_{rr} Antiparallel Diode vs. di_F/dt , $V_{rr} = 400$ V

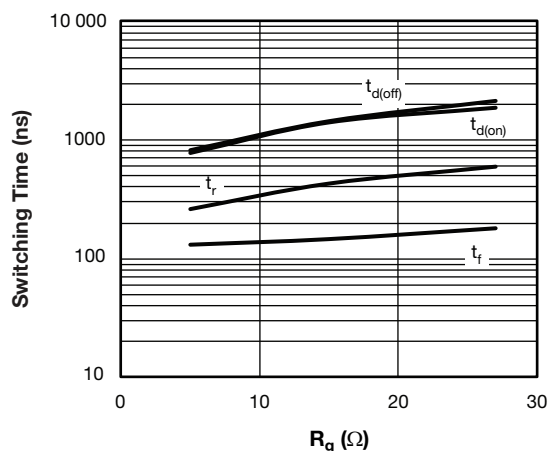


Fig. 16 - Typical IGBT Switching Time vs. R_g , $T_J = 125$ °C, $I_C = 100$ A, $V_{CE} = 360$ V, $V_{GE} = 15$ V, $L = 500$ μ H

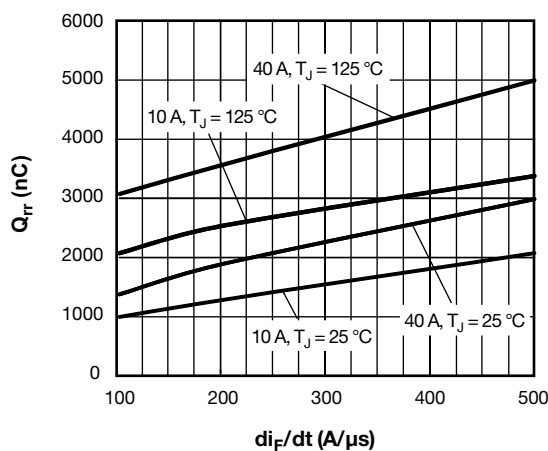


Fig. 19 - Typical Q_{rr} Antiparallel Diode vs. di_F/dt , $V_{rr} = 400$ V

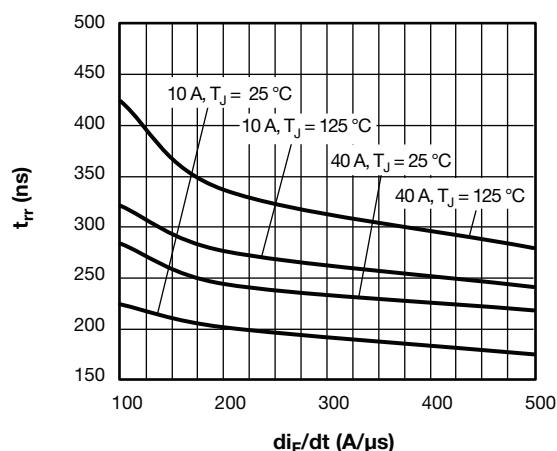


Fig. 17 - Typical t_{rr} Antiparallel Diode vs. di_F/dt , $V_{rr} = 400$ V

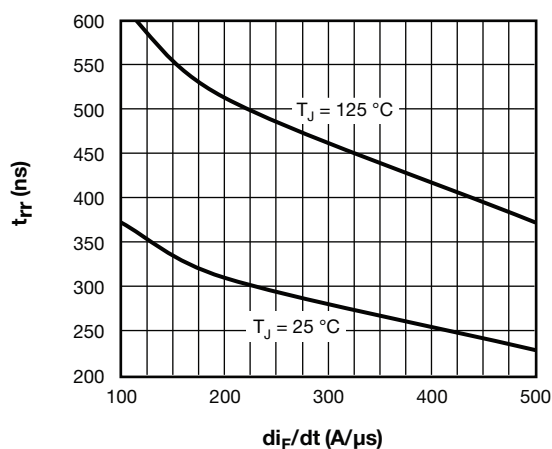
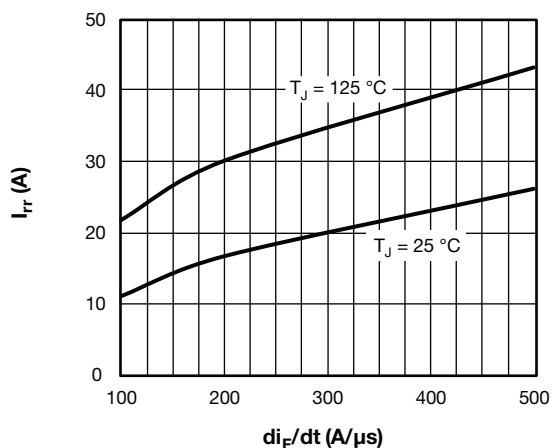
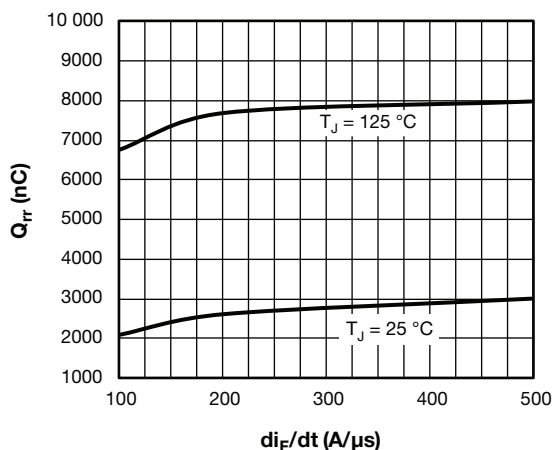
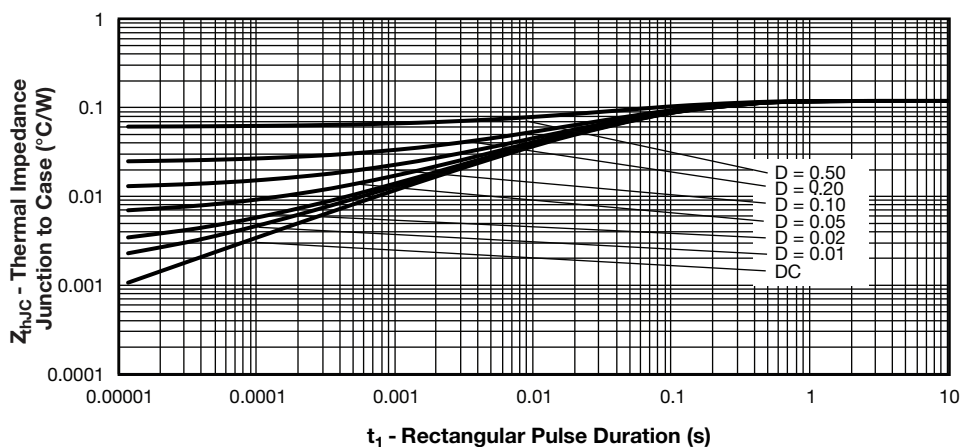
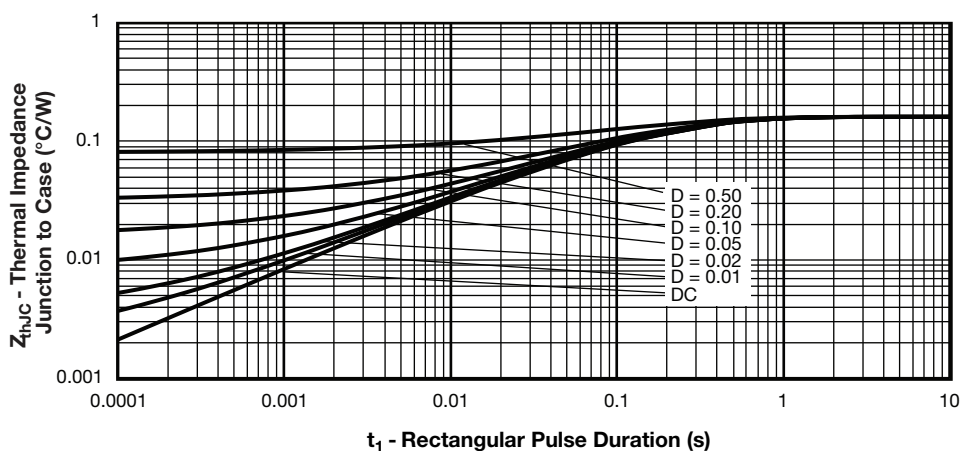
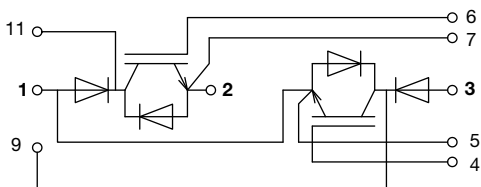


Fig. 20 - Typical t_{rr} Series Diode vs. di_F/dt , $V_{rr} = 400$ V, $I_F = 50$ A


Fig. 21 - Typical I_{rr} Chopper Diode vs. di_F/dt , $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$

Fig. 22 - Typical Q_{rr} Chopper Diode vs. di_F/dt , $V_{rr} = 400\text{ V}$, $I_F = 40\text{ A}$

Fig. 23 - Maximum Thermal Impedance Z_{thJC} Characteristics IGBT

Fig. 24 - Maximum Thermal Impedance Z_{thJC} Characteristics Series Diode



CIRCUIT CONFIGURATION

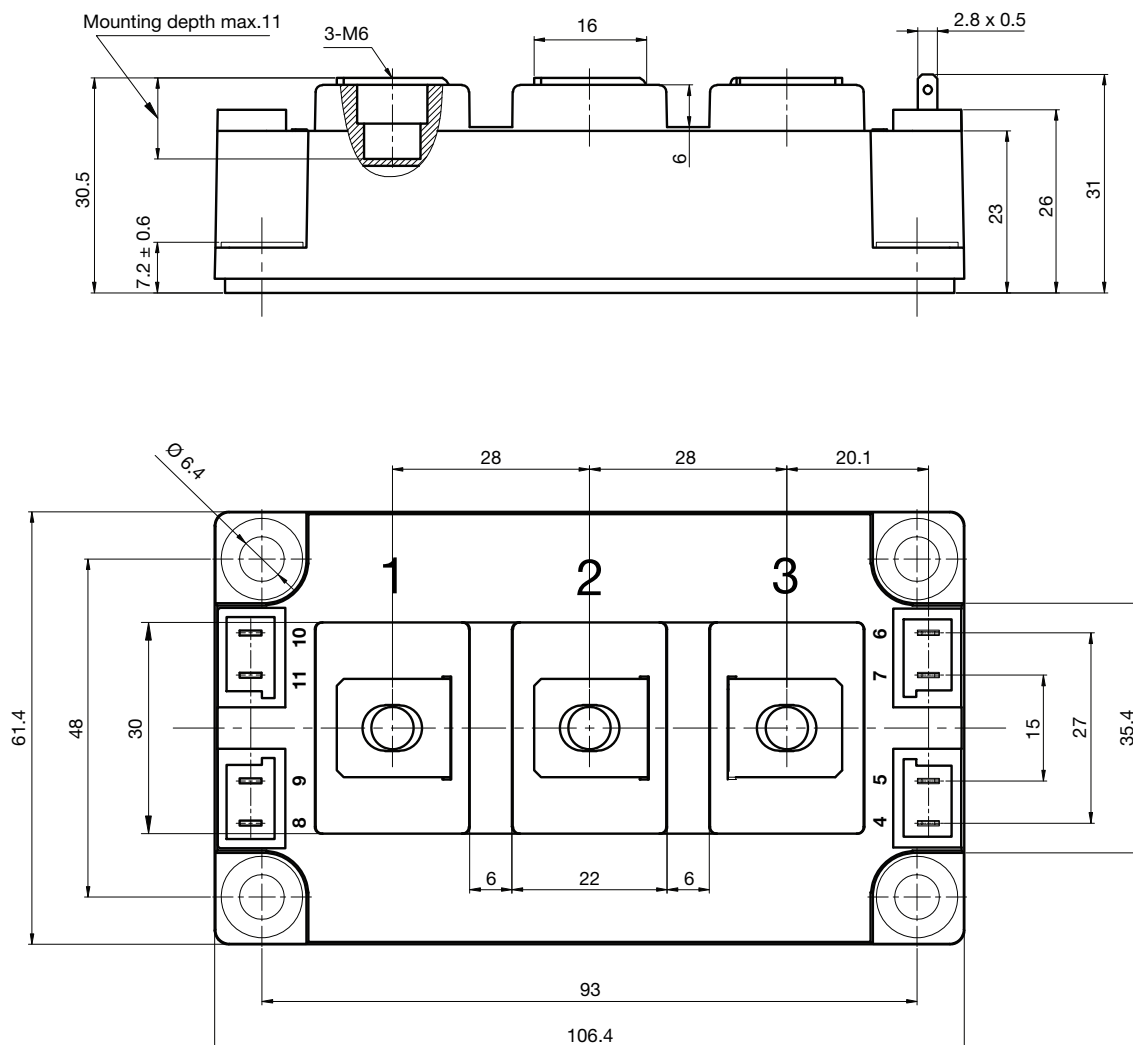


ORDERING INFORMATION TABLE

Device code	VS-	G	T	300	Y	H	120	N
	1	2	3	4	5	6	7	8
1	-	Vishay Semiconductors product						
2	-	Insulated Gate Bipolar Transistor (IGBT)						
3	-	T = trench IGBT technology						
4	-	Current rating (300 = 300 A)						
5	-	Y = current fed inverter						
6	-	Package indicator (dual INT-A-PAK)						
7	-	Voltage rating (120 = 1200 V)						
8	-	N = ultrafast						



DIMENSIONS in millimeters





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