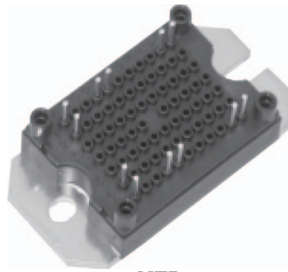


MTP IGBT Power Module Primary Dual Forward



MTP
(Package example)

FEATURES

- Buck PFC stage with warp 3 IGBT and FRED Pt® hyperfast diode
- Integrated thermistor
- Isolated baseplate
- Very low stray inductance design for high speed operation
- Ultrafast switching IGBT
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

PRODUCT SUMMARY	
IGBT, T_J = 150 °C	
V _{CES}	600 V
V _{CE(ON)} at 25 °C at 80 A	2.11 V
I _C at 80 °C	96 A
FRED Pt® AP DIODE, T_J = 150 °C	
V _{RRM}	600 V
I _{F(DC)} at 80 °C	11 A
V _F at 25 °C at 5 A	1.1 V
FRED Pt® CHOPPER DIODE, T_J = 150 °C	
V _R	600 V
I _{F(DC)} at 80 °C	22 A
V _F at 25 °C at 60 A	2.07 V
Speed	30 kHz to 150 kHz
Package	MTP
Circuit	Dual forward

BENEFITS

- Lower conduction losses and switching losses
- Optimized for welding, UPS, and SMPS applications
- PCB solderable terminals
- Direct mounting to heatsink

ABSOLUTE MAXIMUM RATINGS					
	PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
IGBT	Collector to emitter voltage	V _{CES}		600	V
	Gate to emitter voltage	V _{GE}		± 20	V
	Maximum continuous collector current at V _{GE} = 15 V, T _J = 150 °C maximum	I _C	T _C = 25 °C	138	A
			T _C = 80 °C	96	
	Pulse collector current	I _{CM} ⁽¹⁾		330	
	Clamped inductive load current	I _{LM}		330	
Maximum power dissipation	P _D	T _C = 25 °C	543	W	
Antiparallel Diode	Repetitive peak reverse voltage	V _{RRM}		600	V
	Maximum continuous forward current T _J = 150 °C maximum	I _{F(DC)}	T _C = 25 °C	17	A
			T _C = 80 °C	11	
	Maximum non-repetitive peak current	I _{FSM}	10 ms sine or 6 ms rectangular pulse, T _J = 25 °C	60	
Maximum power dissipation	P _D	T _C = 25 °C	24	W	



ABSOLUTE MAXIMUM RATINGS					
	PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Chopper Diode	Repetitive peak reverse voltage	V_{RRM}		600	V
	Maximum continuous forward current $T_J = 150\text{ }^\circ\text{C}$ maximum	I_F	$T_C = 25\text{ }^\circ\text{C}$	33	A
			$T_C = 80\text{ }^\circ\text{C}$	22	
	Maximum non-repetitive peak current	I_{FSM}	10 ms sine or 6 ms rectangular pulse, $T_J = 25\text{ }^\circ\text{C}$	135	
Maximum power dissipation	P_D	$T_C = 25\text{ }^\circ\text{C}$	57	W	
	Maximum operating junction temperature	T_J		150	$^\circ\text{C}$
	Storage temperature range	T_{Stg}		-40 to +150	
	Isolation voltage	V_{ISOL}	$T_J = 25\text{ }^\circ\text{C}$, all terminals shorted, $f = 50\text{ Hz}$, $t = 1\text{ s}$	3500	V

Notes

- Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur.
- (1) $V_{CC} = 300\text{ V}$, $V_{GE} = 15\text{ V}$, $L = 500\text{ }\mu\text{H}$, $R_g = 4.7\text{ }\Omega$, $T_J = 150\text{ }^\circ\text{C}$

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)							
	PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
IGBT	Collector to emitter breakdown voltage	BV_{CES}	$V_{GE} = 0\text{ V}$, $I_C = 1.5\text{ mA}$	600	-	-	V
	Temperature coefficient of breakdown voltage	$\Delta V_{BR(CES)}/\Delta T_J$	$I_C = 1.0\text{ mA}$ ($25\text{ }^\circ\text{C}$ to $125\text{ }^\circ\text{C}$)	-	0.6	-	$\text{V}/^\circ\text{C}$
	Collector to emitter voltage	$V_{CE(ON)}$	$V_{GE} = 15\text{ V}$, $I_C = 80\text{ A}$	-	2.11	2.48	V
			$V_{GE} = 15\text{ V}$, $I_C = 80\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	2.43	-	
	Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 750\text{ }\mu\text{A}$	3.2	4.4	6.2	V
	Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 1.0\text{ mA}$ ($25\text{ }^\circ\text{C}$ to $125\text{ }^\circ\text{C}$)	-	-12	-	$\text{mV}/^\circ\text{C}$
	Forward transconductance	g_{fe}	$V_{CE} = 20\text{ V}$, $I_C = 80\text{ A}$	-	97	-	S
	Transfer characteristics	V_{GE}	$V_{CE} = 20\text{ V}$, $I_C = 80\text{ A}$	-	6.6	-	V
	Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	8	100	μA
$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$			-	0.1	-	mA	
Gate to emitter leakage	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 250	nA	
AP Diode	Blocking voltage	BV_{RRM}	$I_R = 100\text{ }\mu\text{A}$	600	-	-	V
	Forward voltage drop	V_{FM}	$I_F = 5\text{ A}$	-	1.1	1.27	V
$I_F = 5\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$			-	0.96	-		
Chopper Diode	Forward voltage drop	V_{FM}	$I_F = 60\text{ A}$	-	2.07	2.53	V
			$I_F = 60\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	1.87	-	
	Blocking voltage	BV_{RM}	$I_R = 100\text{ }\mu\text{A}$	600	-	-	
	Reverse leakage current	I_{RM}	$V_{RRM} = 600\text{ V}$	-	2	70	μA
$V_{RRM} = 600\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$			-	12	-		



SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise noted)							
	PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
PFC IGBT	Total gate charge (turn-on)	Q _g	I _C = 60 A V _{CC} = 400 V V _{GE} = 15 V	-	540	-	nC
	Gate to emitter charge (turn-on)	Q _{ge}		-	84	-	
	Gate to collector charge (turn-on)	Q _{gc}		-	192	-	
	Turn-on switching loss	E _{on}	I _C = 150 A, V _{CC} = 300 V, V _{GE} = 15 V, R _g = 4.7 Ω, L = 500 μH, T _J = 25 °C ⁽¹⁾	-	0.51	-	mJ
	Turn-off switching loss	E _{off}		-	2.66	-	
	Total switching loss	E _{tot}		-	3.17	-	
	Turn-on delay time	t _{d(on)}		-	173	-	ns
	Rise time	t _r		-	79	-	
	Turn-off delay time	t _{d(off)}		-	374	-	
	Fall time	t _f	-	66	-		
	Turn-on switching loss	E _{on}	I _C = 150 A, V _{CC} = 300 V, V _{GE} = 15 V, R _g = 4.7 Ω, L = 500 μH, T _J = 125 °C ⁽¹⁾	-	0.66	-	mJ
	Turn-off switching loss	E _{off}		-	2.75	-	
	Total switching loss	E _{tot}		-	3.41	-	
	Turn-on delay time	t _{d(on)}		-	167	-	ns
	Rise time	t _r		-	80	-	
	Turn-off delay time	t _{d(off)}		-	389	-	
	Fall time	t _f	-	69	-		
	Input capacitance	C _{ies}	V _{GE} = 0 V V _{CC} = 30 V f = 1 MHz	-	14 020	-	pF
	Output capacitance	C _{oes}		-	1010	-	
	Reverse transfer capacitance	C _{res}		-	174	-	
Reverse bias safe operating area	RBSOA	I _C = 330 A, V _{CC} = 300 V, V _P = 600 V, R _g = 4.7 Ω, V _{GE} = 15 V, L = 500 μH, T _J = 150 °C	Full square				

Note

⁽¹⁾ Energy losses include “tail” and diode reverse recovery.

RECOVERY PARAMETER (T _J = 25 °C unless otherwise noted)							
	PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
AP Diode	Peak reverse recovery current	I _{rr}	I _F = 10 A di/dt = 200 A/μs V _{rr} = 200 V	-	10	-	A
	Reverse recovery time	t _{rr}		-	104	-	ns
	Reverse recovery charge	Q _{rr}		-	537	-	nC
Chopper Diode	Peak reverse recovery current	I _{rr}	I _F = 50 A di/dt = 200 A/μs V _{rr} = 200 V	-	4.7	-	A
	Reverse recovery time	t _{rr}		-	73	-	ns
	Reverse recovery charge	Q _{rr}		-	171	-	nC
	Peak reverse recovery current	I _{rr}	I _F = 50 A di/dt = 200 A/μs V _{rr} = 200 V, T _J = 125 °C	-	10.3	-	A
	Reverse recovery time	t _{rr}		-	140	-	ns
	Reverse recovery charge	Q _{rr}		-	716	-	nC

THERMISTOR ELECTRICAL CHARACTERISTICS (T _J = 25 °C unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	R	T _J = 25 °C	-	30 000	-	Ω
B value	B	T _J = 25 °C/T _J = 85 °C	-	4000	-	K



THERMAL AND MECHANICAL SPECIFICATIONS						
	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
IGBT	Junction to case IGBT thermal resistance		-	-	0.23	
AP FRED Pt	Junction to case diode thermal resistance	R _{thJC}	-	-	5.1	°C/W
FRED Pt	Junction to case diode thermal resistance		-	-	2.2	
	Case to sink, flat, greased surface per module	R _{thCS}	-	0.06	-	°C/W
	Mounting torque ± 10 % to heatsink ⁽¹⁾		-	-	4	Nm
	Approximate weight		-	65	-	g

Note

⁽¹⁾ A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound.

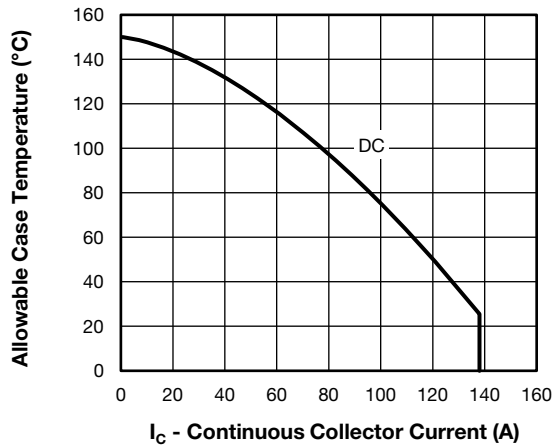


Fig. 1 - Allowable Case Temperature vs. Continuous Collector Current (Maximum IGBT Continuous Collector Current vs. Case Temperature)

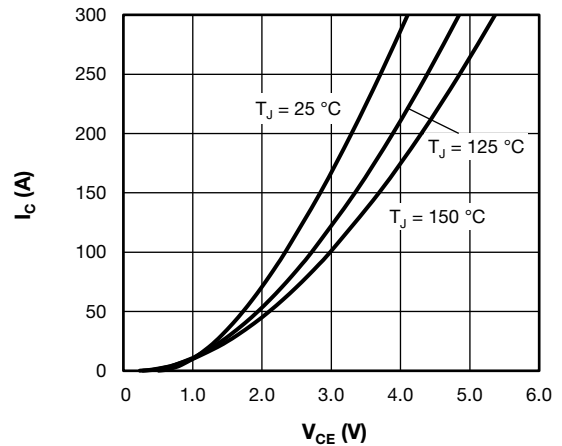


Fig. 3 - I_c vs. V_{CE} (Typical IGBT Output Characteristics, V_{GE} = 15 V)

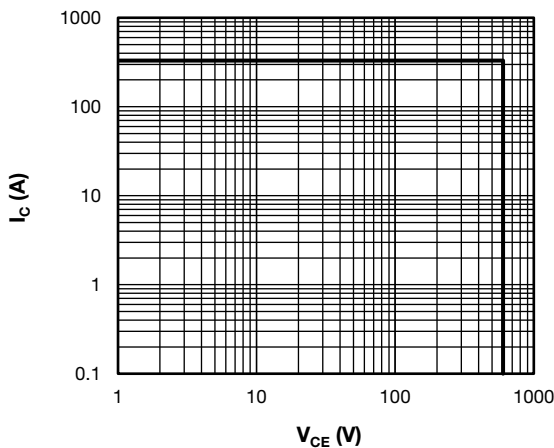


Fig. 2 - I_c vs. V_{CE} (IGBT Reverse BIAS SOA, T_J = 150 °C, V_{GE} = 15 V)

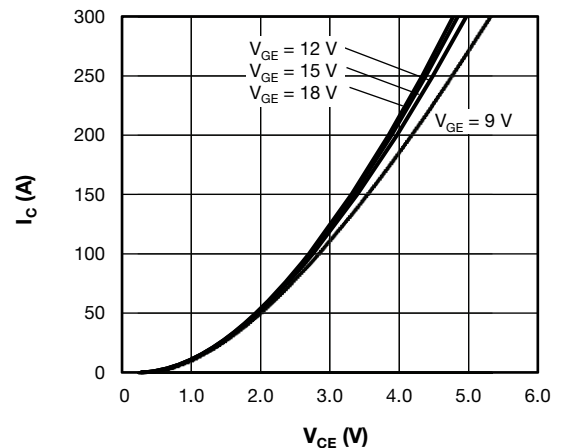


Fig. 4 - I_c vs. V_{CE} (Typical IGBT Output Characteristics, T_J = 125 °C)

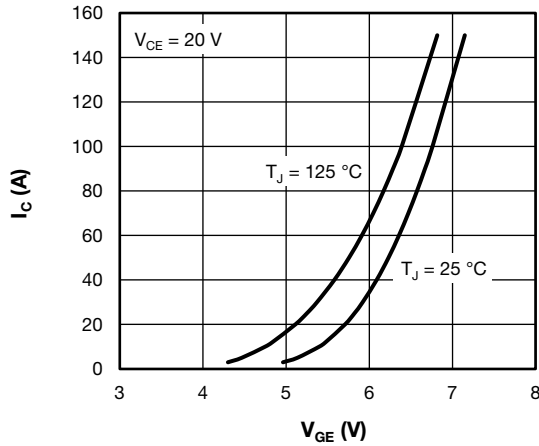


Fig. 5 - I_C vs. V_{GE}
(Typical IGBT Transfer Characteristics)

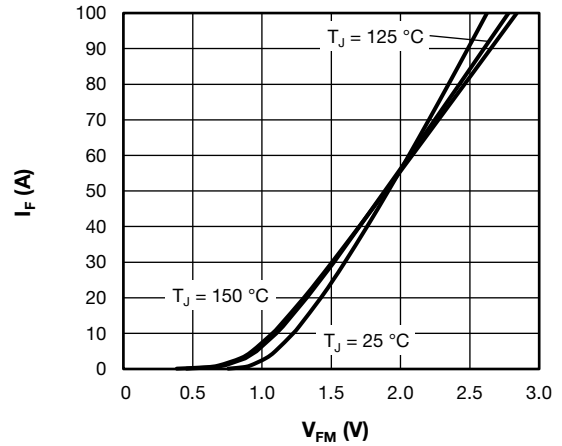


Fig. 8 - I_F vs. V_{FM}
(Typical Antiparallel Diode Forward Characteristics)

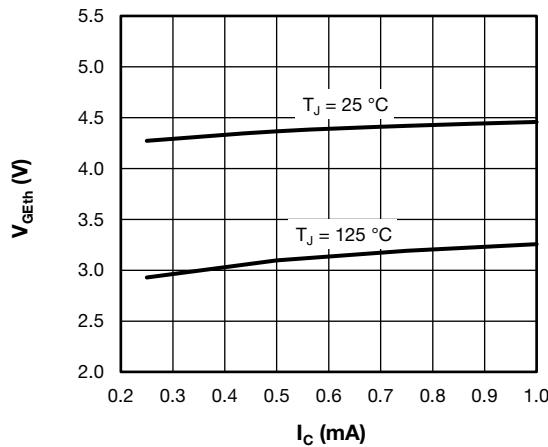


Fig. 6 - V_{GEth} vs. I_C
(Typical IGBT Gate Threshold Voltage)

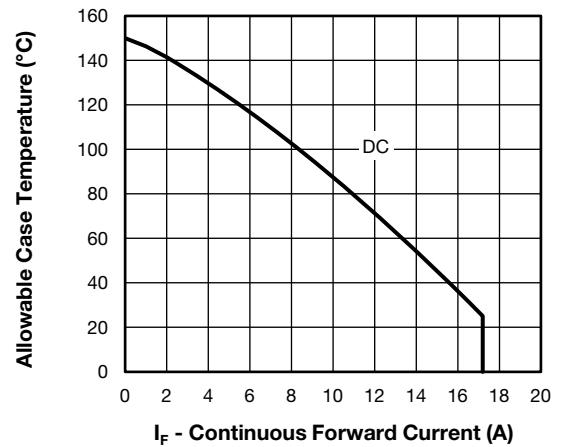


Fig. 9 - Allowable Case Temperature vs. Continuous Forward Current (Maximum Antiparallel Diode Continuous Forward Current vs. Case Temperature)

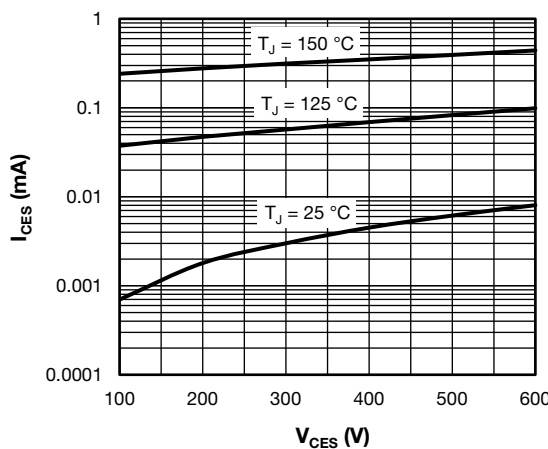


Fig. 7 - I_{CES} vs. V_{CES}
(Typical IGBT Zero Gate Voltage Collector Current)

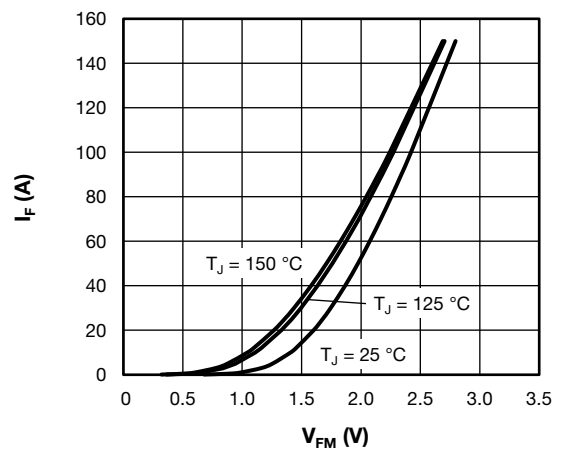


Fig. 10 - I_F vs. V_{FM}
(Typical Chopper Diode Forward Characteristics)

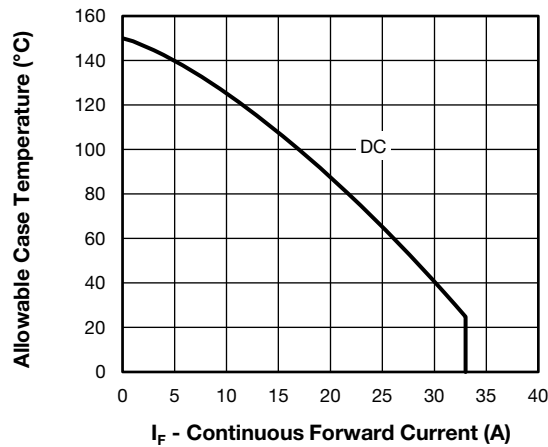


Fig. 11 - Allowable Case Temperature vs. Continuous Forward Current (Maximum Chopper Diode Continuous Forward Current vs. Case Temperature)

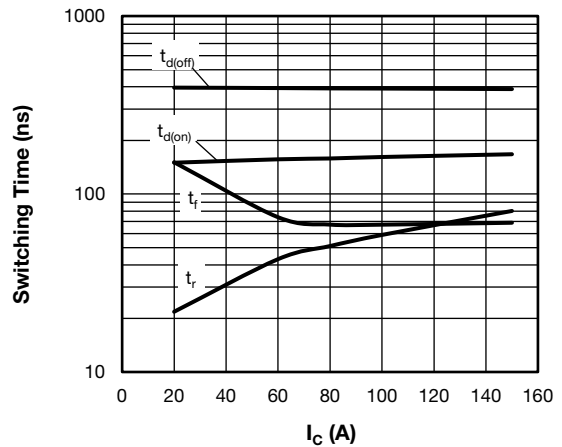


Fig. 14 - Switching Time vs. I_c
(Typical IGBT Switching Time vs. I_c)
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

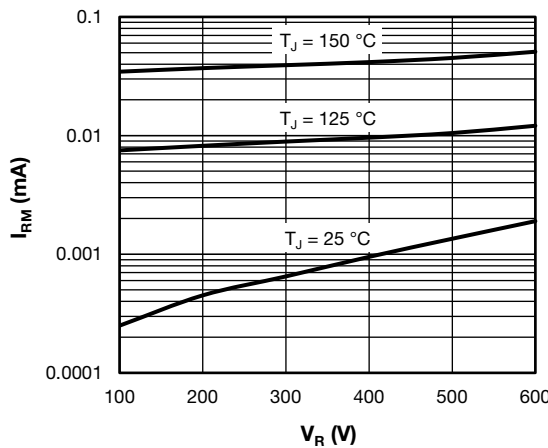


Fig. 12 - I_{RM} vs. V_R
(Typical Chopper Diode Reverse Leakage Current)

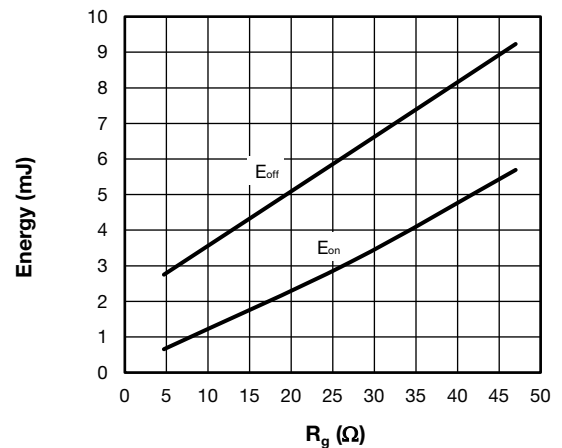


Fig. 15 - Energy Loss vs. R_g
(Typical IGBT Energy Loss vs. R_g)
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_c = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

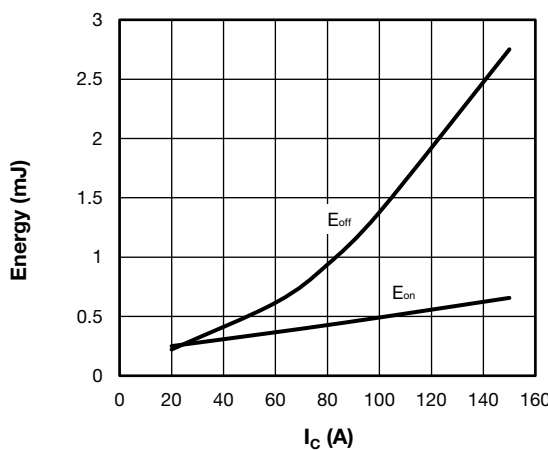


Fig. 13 - Energy Loss vs. I_c
(Typical IGBT Energy Loss vs. I_c)
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $R_g = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

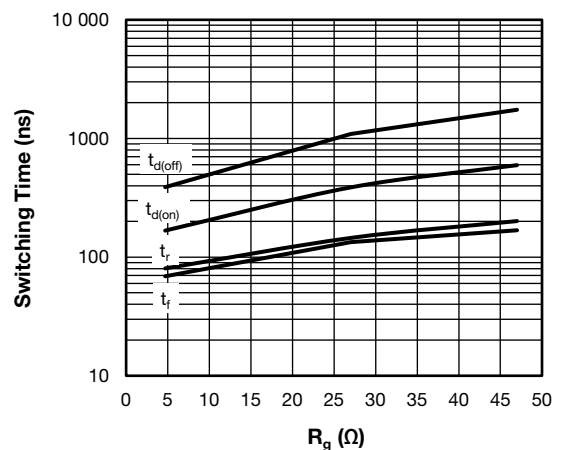


Fig. 16 - Switching Time vs. R_g
(Typical IGBT Switching Time vs. R_g)
 $T_J = 125^\circ\text{C}$, $V_{CC} = 300\text{ V}$, $I_c = 150\text{ A}$, $V_{GE} = 15\text{ V}$, $L = 500\ \mu\text{H}$

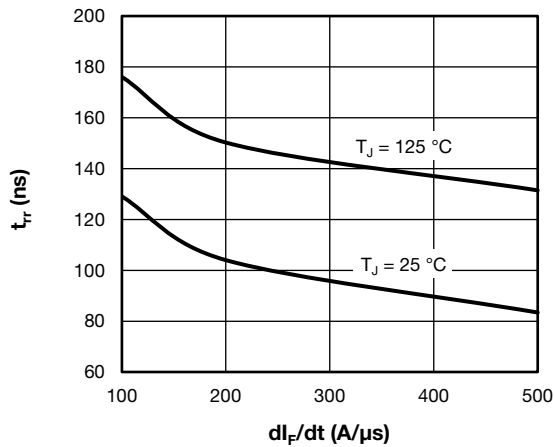


Fig. 17 - t_{rr} vs. di_F/dt
(Typical Antiparallel Diode Reverse Recovery Time vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 10\text{ A}$

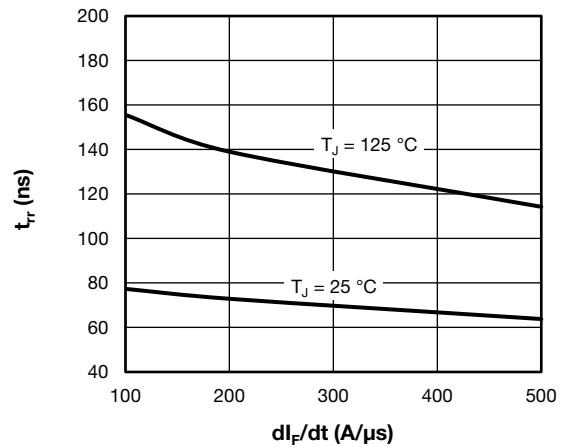


Fig. 20 - t_{rr} vs. di_F/dt
(Typical Chopper Diode Reverse Recovery Time vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$

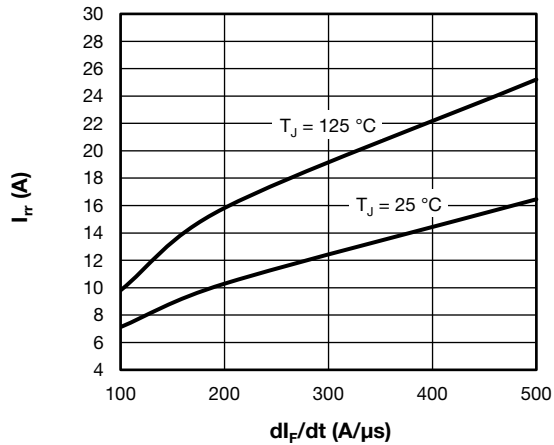


Fig. 18 - I_{rr} vs. di_F/dt
(Typical Antiparallel Diode Reverse Recovery Current vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 10\text{ A}$

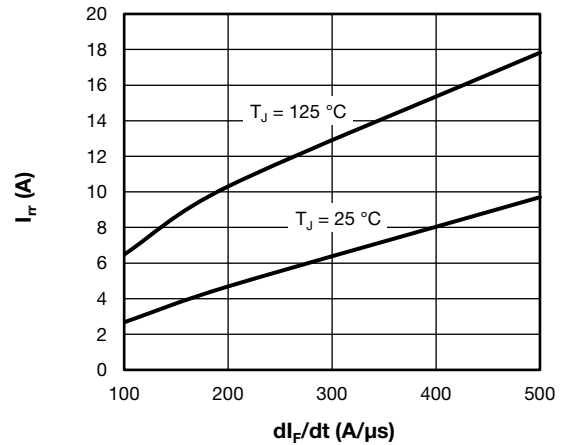


Fig. 21 - I_{rr} vs. di_F/dt
(Typical Chopper Diode Reverse Recovery Current vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$

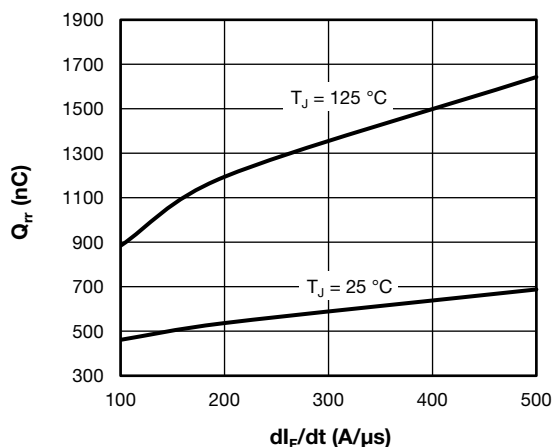


Fig. 19 - Q_{rr} vs. di_F/dt
(Typical Antiparallel Diode Reverse Recovery Charge vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 10\text{ A}$

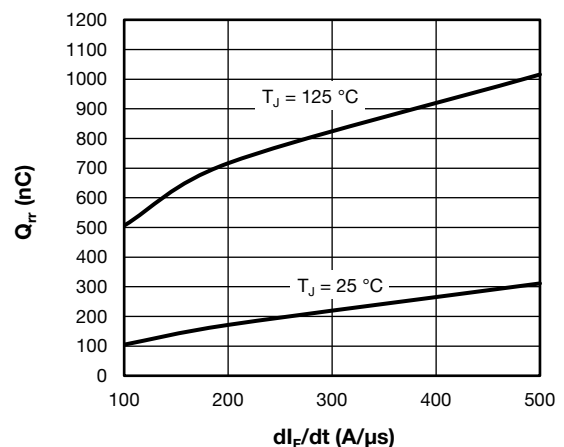


Fig. 22 - Q_{rr} vs. di_F/dt
(Typical Chopper Diode Reverse Recovery Charge vs. di_F/dt)
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$

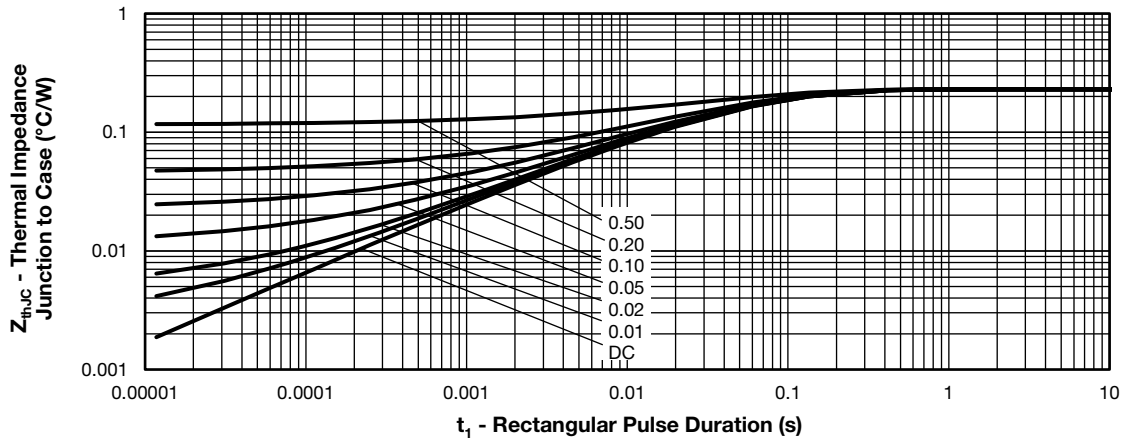


Fig. 23 - Z_{thJC} vs. t_1 Rectangular Pulse Duration
(Maximum Thermal Impedance Z_{thJC} Characteristics - (IGBT))

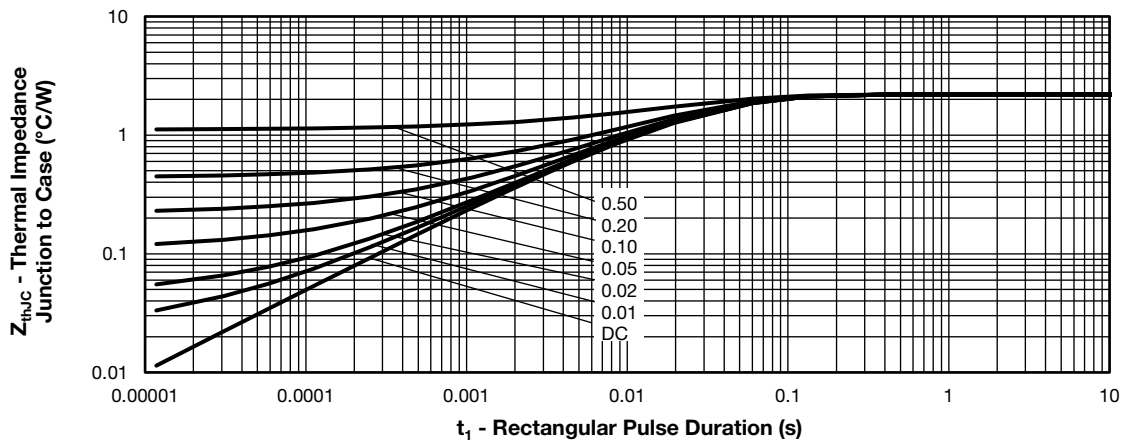
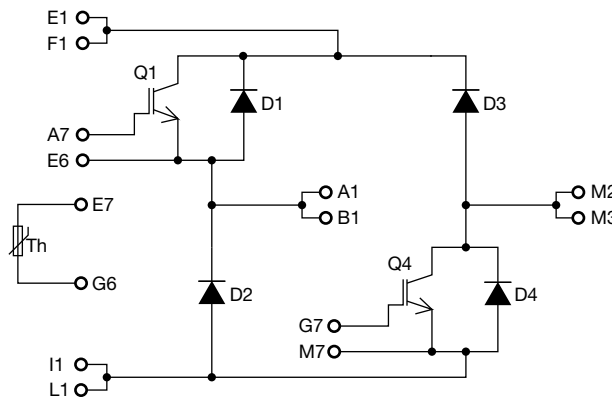


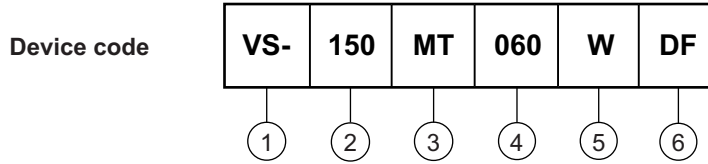
Fig. 24 - Z_{thJC} vs. t_1 Rectangular Pulse Duration
(Maximum Thermal Impedance Z_{thJC} Characteristics - (Chopper Diode))

CIRCUIT CONFIGURATION





ORDERING INFORMATION TABLE



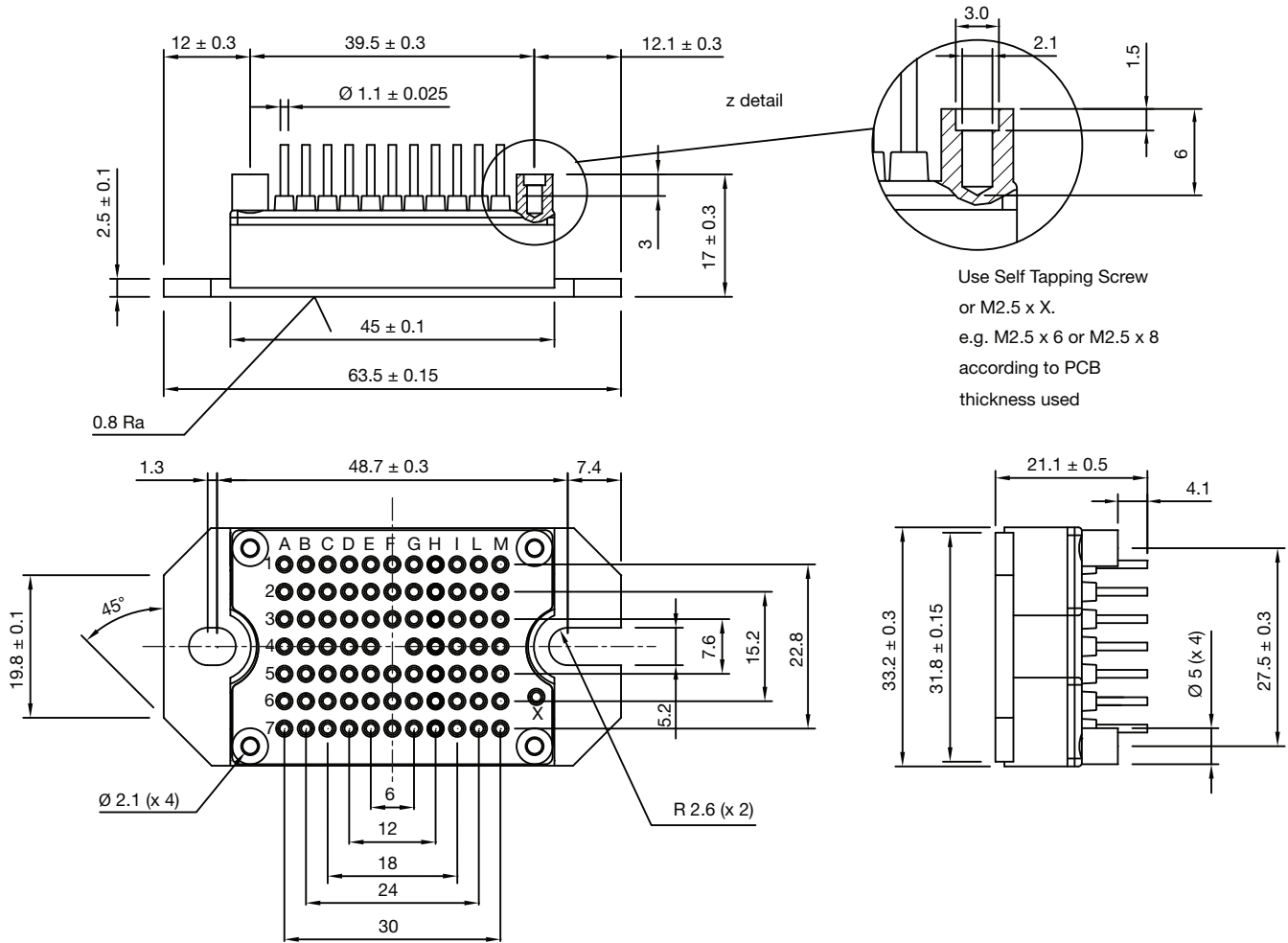
- 1** - Vishay Semiconductors product
- 2** - Current rating (150 = 150 A)
- 3** - Essential part number (MT = MTP package)
- 4** - Voltage code x 10 = Voltage rating (example: 060 = 600 V)
- 5** - Die IGBT technology (W = Warp Speed IGBT)
- 6** - Circuit configuration (DF = Dual forward)

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95383



MTP - Full Pin

DIMENSIONS in millimeters



Use Self Tapping Screw
or M2.5 x X.
e.g. M2.5 x 6 or M2.5 x 8
according to PCB
thickness used

PINS POSITION
WITH TOLERANCE $\varnothing 0.6$



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