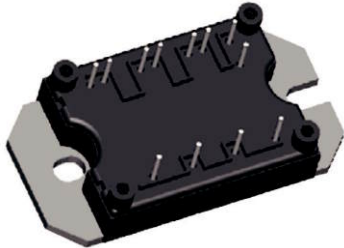



"Half Bridge" IGBT MTP (Ultrafast NPT IGBT), 80 A



MTP

FEATURES

- Ultrafast Non Punch Through (NPT) technology
- Positive $V_{CE(on)}$ temperature coefficient
- 10 μ s short circuit capability
- Square RBSOA
- HEXFRED[®] antiparallel diodes with ultrasoft reverse recovery and low V_F
- Al_2O_3 DBC
- Optional SMD thermistor (NTC)
- Very low stray inductance design for high speed operation
- UL approved file E78996 
- Speed 8 kHz to 60 kHz
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



RoHS*
COMPLIANT

PRODUCT SUMMARY

V_{CES}	1200 V
$V_{CE(on)}$ typical at $V_{GE} = 15$ V	3.36 V
I_C at $T_C = 25$ °C	80 A

BENEFITS

- Optimized for welding, UPS and SMPS applications
- Rugged with ultrafast performance
- Benchmark efficiency above 20 kHz
- Outstanding ZVS and hard switching operation
- Low EMI, requires less snubbing
- Excellent current sharing in parallel operation
- Direct mounting to heatsink
- PCB solderable terminals
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V_{CES}		1200	V
Continuous collector current	I_C	$T_C = 25$ °C	80	A
		$T_C = 104$ °C	40	
Pulsed collector current	I_{CM}		160	
Clamped inductive load current	I_{LM}		160	
Diode continuous forward current	I_F	$T_C = 105$ °C	21	
Diode maximum forward current	I_{FM}		160	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	
Maximum power dissipation (only IGBT)	P_D	$T_C = 25$ °C	463	W
		$T_C = 100$ °C	185	

* Pb containing terminations are not RoHS compliant, exemptions may apply

40MT120UHAPbF, 40MT120UHTAPbF



Vishay High Power Products "Half Bridge" IGBT MTP
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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 = 250 μA	1200	-	-	V
Temperature coefficient of breakdown voltage	ΔV _{(BR)CES} /ΔT _J	V _{GE} = 0 V, I _C = 3 mA (25 °C to 125 °C)	-	+ 1.1	-	V/°C
Collector to emitter saturation voltage	V _{CE(on)}	V _{GE} = 15 V, I _C = 40 A	-	3.36	3.59	V
		V _{GE} = 15 V, I _C = 80 A	-	4.53	4.91	
		V _{GE} = 15 V, I _C = 40 A, T _J = 150 °C	-	3.88	4.10	
		V _{GE} = 15 V, I _C = 80 A, T _J = 150 °C	-	5.35	5.68	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 500 μA	4	-	6	
Temperature coefficient of threshold voltage	V _{GE(th)} /ΔT _J	V _{CE} = V _{GE} , I _C = 1 mA (25 °C to 125 °C)	-	- 12	-	mV/°C
Transconductance	g _{fe}	V _{CE} = 50 V, I _C = 40 A, PW = 80 μs	-	35	-	S
Zero gate voltage collector current	I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 25 °C	-	-	250	μA
		V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 125 °C	-	0.4	1.0	mA
		V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 150 °C	-	0.2	10	
Gate to emitter leakage current	I _{GES}	V _{GE} = ± 20 V	-	-	± 250	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 = 40 A V _{CC} = 600 V V _{GE} = 15 V	-	399	599	nC	
Gate to emitter charge (turn-on)	Q _{ge}		-	43	65		
Gate to collector charge (turn-on)	Q _{gc}		-	187	281		
Turn-on switching loss	E _{on}	V _{CC} = 600 V, I _C = 40 A, V _{GE} = 15 V, R _g = 5 Ω, L = 200 μH, T _J = 25 °C, energy losses include tail and diode reverse recovery	-	1.14	1.71	mJ	
Turn-off switching loss	E _{off}		-	1.35	2.02		
Total switching loss	E _{tot}		-	2.49	3.73		
Turn-on switching loss	E _{on}		V _{CC} = 600 V, I _C = 40 A, V _{GE} = 15 V, R _g = 5 Ω, L = 200 μH, T _J = 125 °C, energy losses include tail and diode reverse recovery	-	1.60		2.40
Turn-off switching loss	E _{off}			-	1.62		2.43
Total switching loss	E _{tot}			-	3.22		4.82
Input capacitance	C _{ies}	V _{GE} = 0 V V _{CC} = 30 V f = 1.0 MHz	-	5521	8282	pF	
Output capacitance	C _{oes}		-	380	570		
Reverse transfer capacitance	C _{res}		-	171	257		
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 160 A V _{CC} = 1000 V, V _p = 1200 V R _g = 5 Ω, V _{GE} = + 15 V to 0 V	Fullsquare				
Short circuit safe operating area	SCSOA	T _J = 150 °C, V _{CC} = 900 V, V _p = 1200 V R _g = 5 Ω, V _{GE} = + 15 V to 0 V	10	-	-	μs	



40MT120UHAPbF, 40MT120UHTAPbF

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DIODE SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Diode forward voltage drop	V_{FM}	$I_C = 40\text{ A}$	-	2.98	3.38	V
		$I_C = 80\text{ A}$	-	3.90	4.41	
		$I_C = 40\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.08	3.39	
		$I_C = 80\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	4.29	4.72	
		$I_C = 40\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	3.12	3.42	
Reverse recovery energy of the diode	E_{rec}	$V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 200\text{ }\mu\text{H}$	-	574	861	μJ
Diode reverse recovery time	t_{rr}	$V_{CC} = 600\text{ V}, I_C = 40\text{ A}$	-	120	180	ns
Peak reverse recovery current	I_{rr}	$T_J = 125\text{ }^\circ\text{C}$	-	43	65	A

THERMISTOR SPECIFICATIONS (40MT120UHTAPbF only)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	$R_0^{(1)}$	$T_0 = 25\text{ }^\circ\text{C}$	-	30	-	$\text{k}\Omega$
Sensitivity index of the thermistor material	$\beta^{(1)(2)}$	$T_0 = 25\text{ }^\circ\text{C}$ $T_1 = 85\text{ }^\circ\text{C}$	-	4000	-	K

Notes

(1) T_0, T_1 are thermistor's temperatures

(2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, temperature in Kelvin

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J		- 40	-	150	$^\circ\text{C}$
Storage temperature range	T_{Stg}		- 40	-	125	
Junction to case	R_{thJC}	IGBT	-	-	0.29	$^\circ\text{C}/\text{W}$
		Diode	-	-	0.61	
Case to sink per module	R_{thCS}	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Clearance ⁽¹⁾		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage ⁽²⁾		Shortest distance along external surface of the insulating material between 2 terminals	8	-	-	
Mounting torque to heatsink		A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads.	3 ± 10 %			Nm
Weight			66			g

40MT120UHAPbF, 40MT120UHTAPbF



Vishay High Power Products "Half Bridge" IGBT MTP
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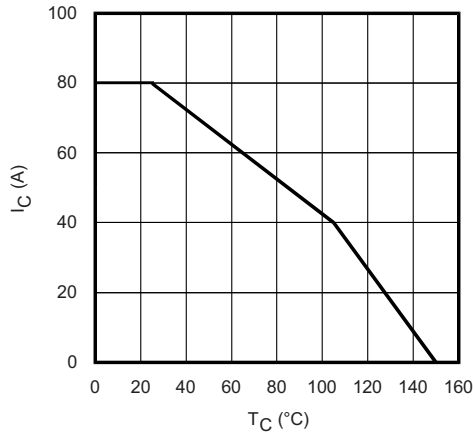


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

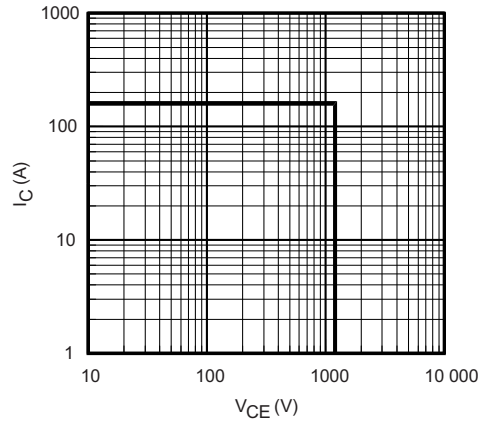


Fig. 4 - Reverse BIAS SOA
 $T_J = 150$ °C; $V_{GE} = 15$ V

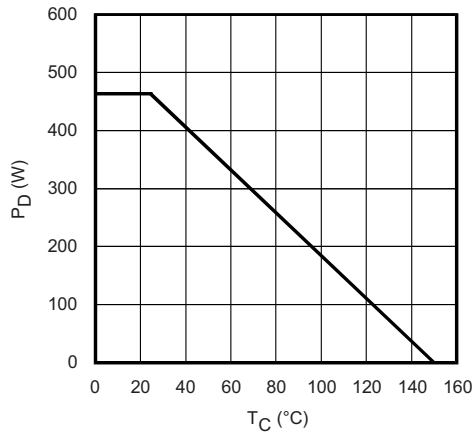


Fig. 2 - Power Dissipation vs. Case Temperature

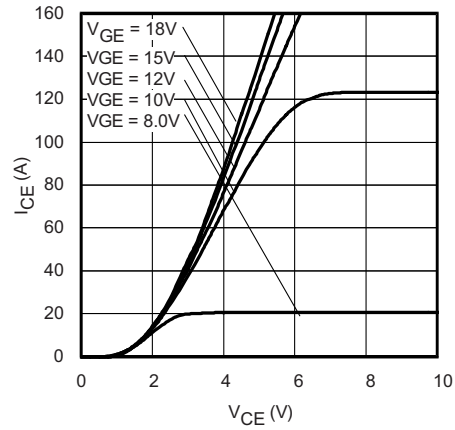


Fig. 5 - Typical IGBT Output Characteristics
 $T_J = -40$ °C; $t_p = 80$ μ s

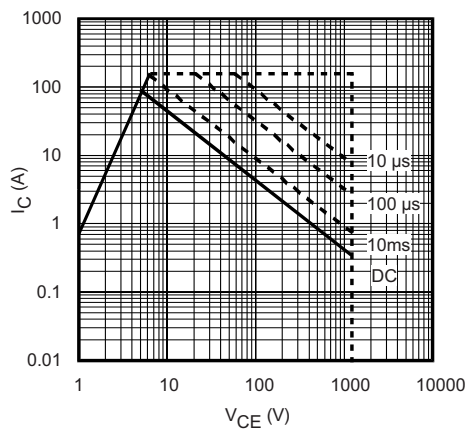


Fig. 3 - Forward SOA
 $T_C = 25$ °C; $T_J \leq 150$ °C

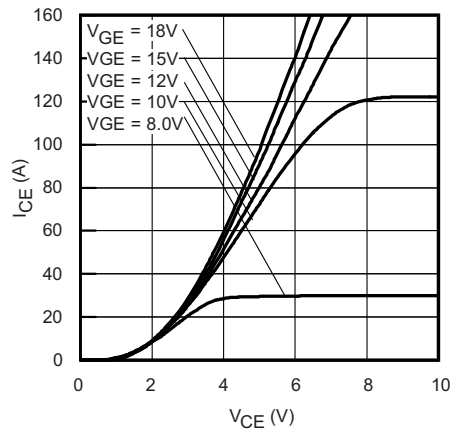
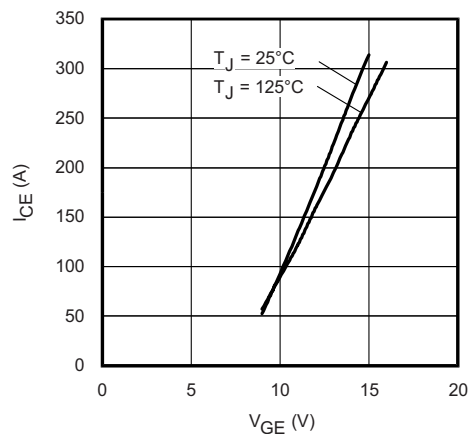
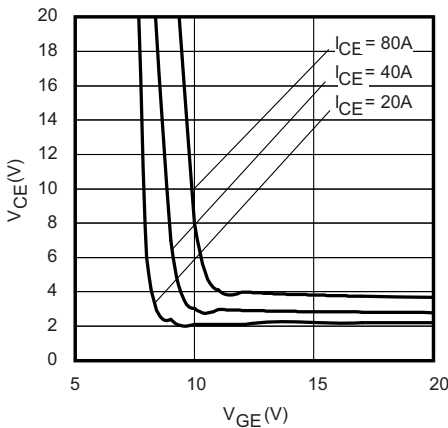
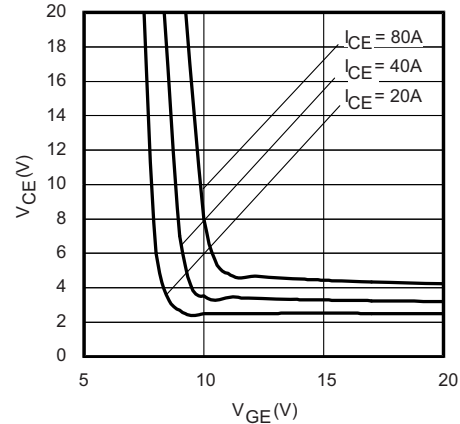
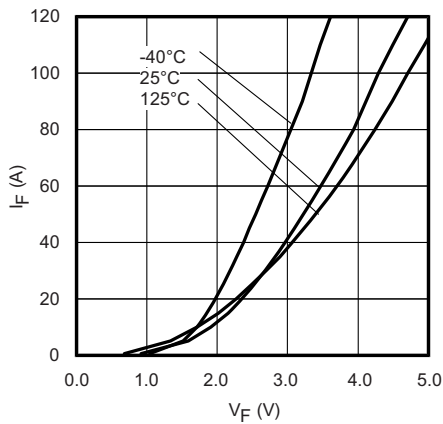
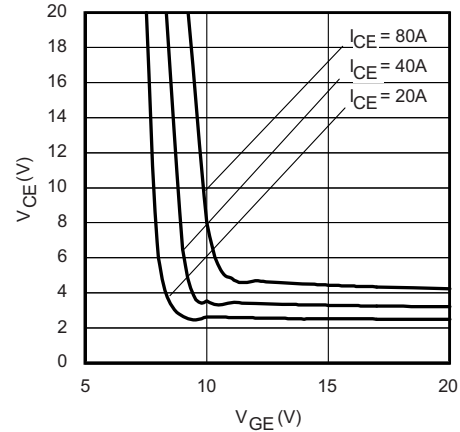
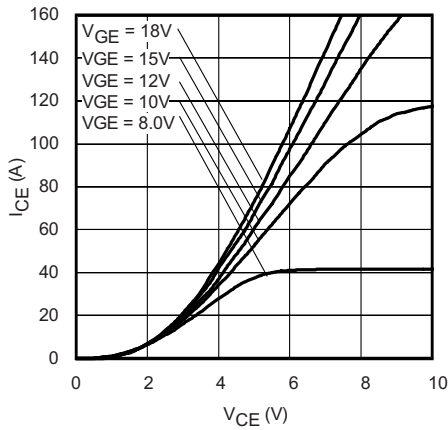


Fig. 6 - Typical IGBT Output Characteristics
 $T_J = 25$ °C; $t_p = 80$ μ s



40MT120UHAPbF, 40MT120UHTAPbF

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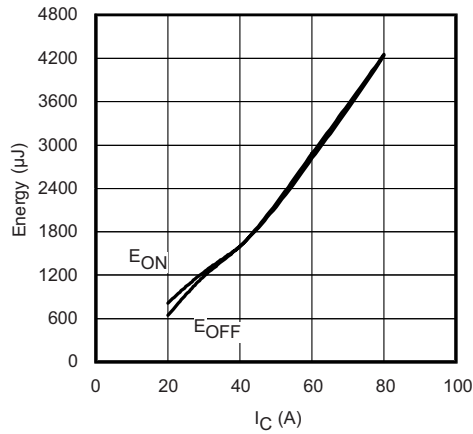


Fig. 13 - Typical Energy Loss vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$; $L = 250\text{ }\mu\text{H}$; $V_{CE} = 400\text{ V}$
 $R_g = 5\text{ }\Omega$; $V_{GE} = 15\text{ V}$

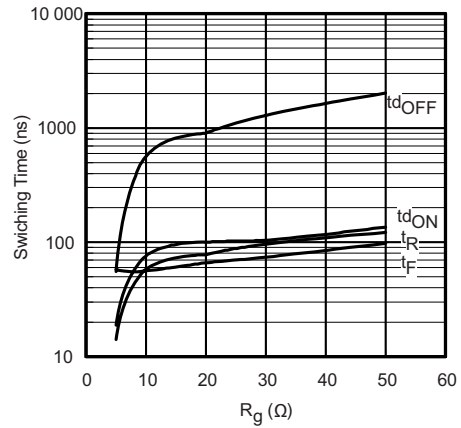


Fig. 16 - Typical Switching Time vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $L = 250\text{ }\mu\text{H}$; $V_{CE} = 600\text{ V}$
 $I_{CE} = 40\text{ A}$; $V_{GE} = 15\text{ V}$

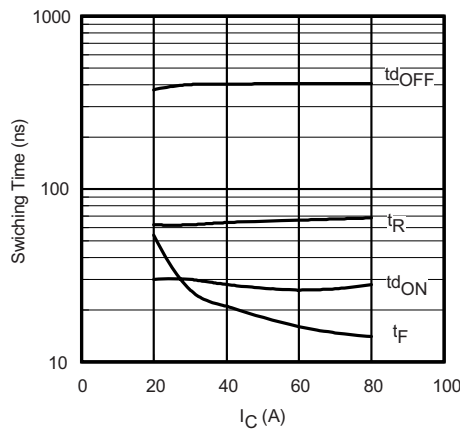


Fig. 14 - Typical Switching Time vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$; $L = 250\text{ }\mu\text{H}$; $V_{CE} = 400\text{ V}$
 $R_g = 5\text{ }\Omega$; $V_{GE} = 15\text{ V}$

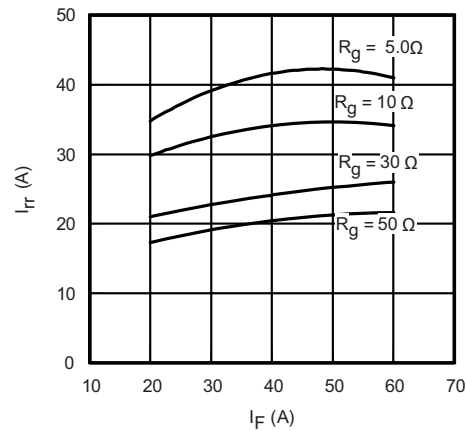


Fig. 17 - Typical Diode I_{rr} vs. I_F
 $T_J = 125\text{ }^\circ\text{C}$

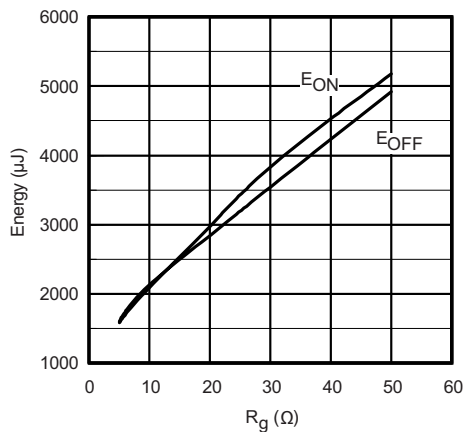


Fig. 15 - Typical Energy Loss vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $L = 250\text{ }\mu\text{H}$; $V_{CE} = 600\text{ V}$
 $I_{CE} = 40\text{ A}$; $V_{GE} = 15\text{ V}$

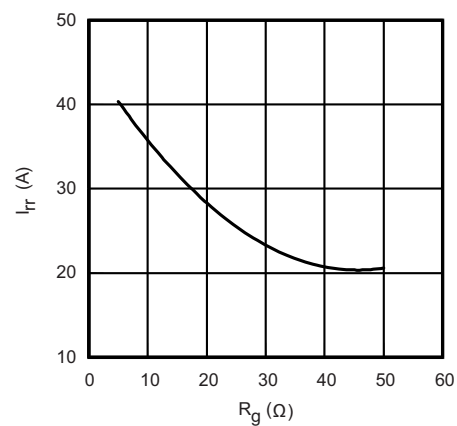


Fig. 18 - Typical Diode I_{rr} vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$; $I_F = 40\text{ A}$



40MT120UHAPbF, 40MT120UHTAPbF

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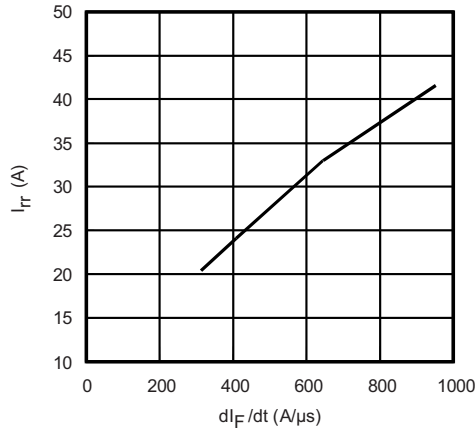


Fig. 19 - Typical Diode I_{rr} vs. dl_F/dt
 $V_{CC} = 600\text{ V}$; $V_{GE} = 15\text{ V}$; $I_{CE} = 40\text{ A}$; $T_J = 125\text{ }^\circ\text{C}$

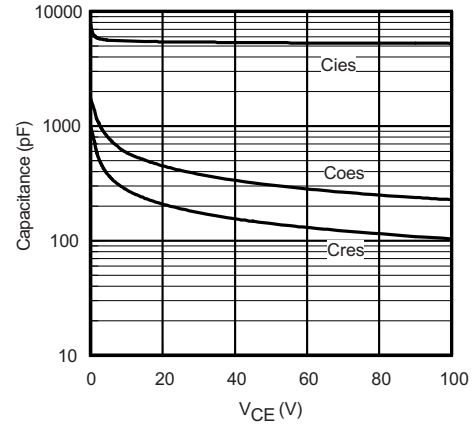


Fig. 21 - Typical Capacitance vs. V_{CE}
 $V_{GE} = 0\text{ V}$; $f = 1\text{ MHz}$

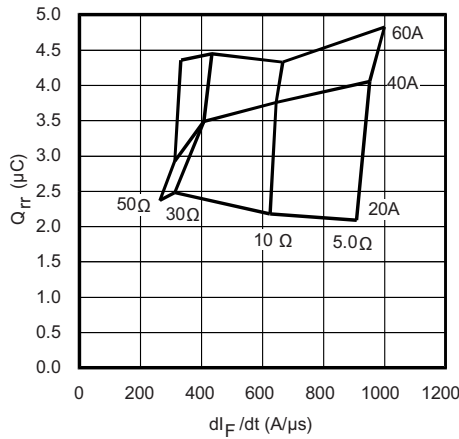


Fig. 20 - Typical Diode Q_{rr} vs. dl_F/dt
 $V_{CC} = 600\text{ V}$; $V_{GE} = 15\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$

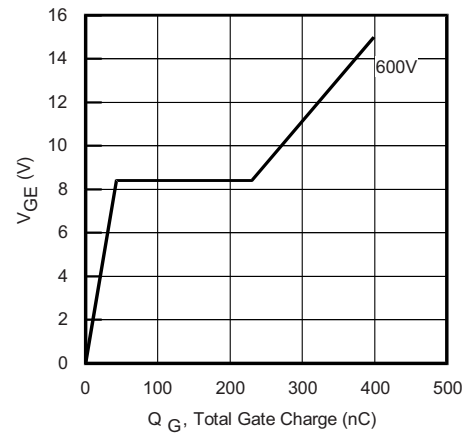


Fig. 22 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 5.0\text{ A}$; $L = 600\text{ }\mu\text{H}$

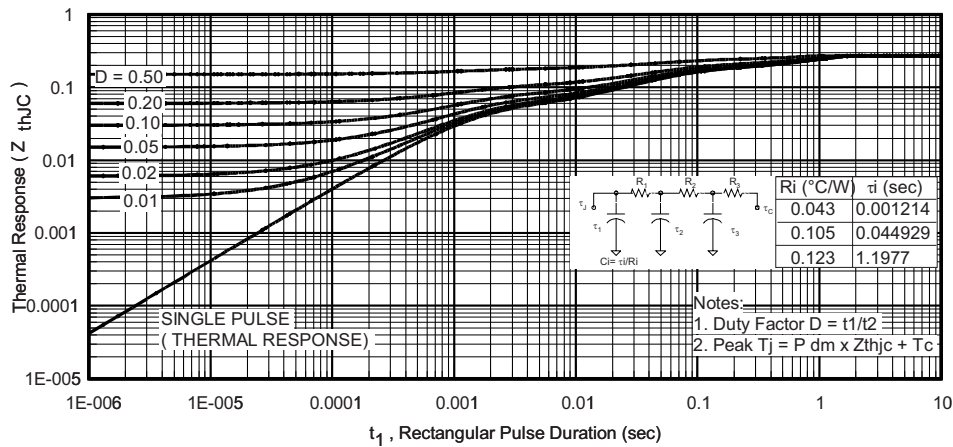


Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

40MT120UHAPbF, 40MT120UHTAPbF



Vishay High Power Products "Half Bridge" IGBT MTP
(Ultrafast NPT IGBT), 80 A

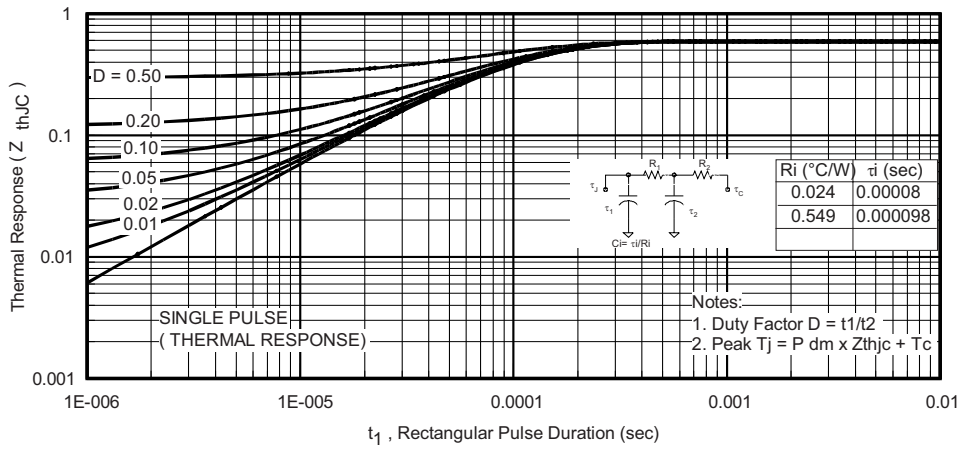


Fig. 24 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

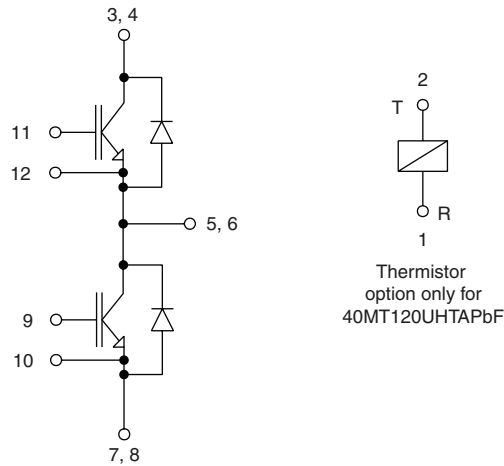


Fig. 25 - Electrical diagram

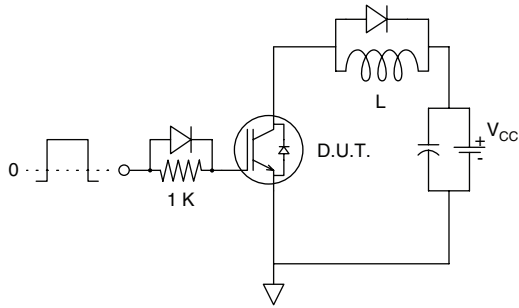


Fig. CT.1 - Gate Charge Circuit (Turn-Off)

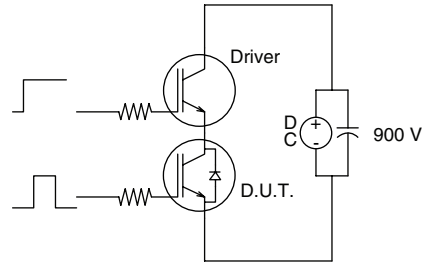


Fig. CT.3 - S.C. SOA Circuit

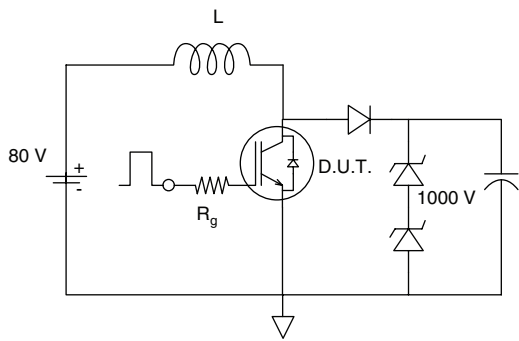


Fig. CT.2 - RBSOA Circuit

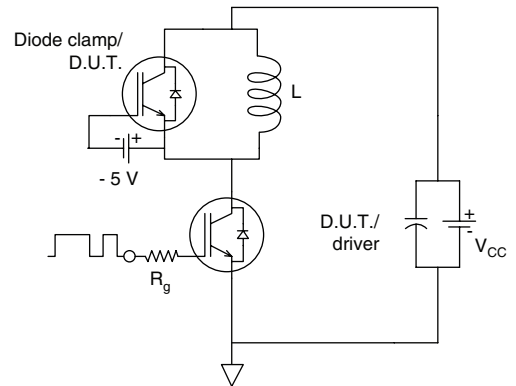


Fig. CT.4 - Switching Loss Circuit

40MT120UHAPbF, 40MT120UHTAPbF



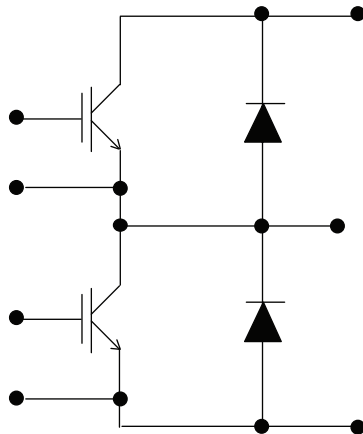
Vishay High Power Products "Half Bridge" IGBT MTP
(Ultrafast NPT IGBT), 80 A

ORDERING INFORMATION TABLE

Device code	40	MT	120	U	H	T	A	PbF
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Current rating (40 = 40 A)
- 2** - Essential part number
- 3** - Voltage code (120 = 1200 V)
- 4** - Speed/type (U = Ultrafast IGBT)
- 5** - Circuit configuration (H = Half bridge)
- 6** - Special option:
 - None = No special option
 - T = Thermistor
- 7** - A = Al₂O₃ DBC substrate
- 8** - PbF = Lead (Pb)-free

CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95175



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