

"Half-Bridge" IGBT INT-A-PAK (Ultrafast Speed IGBT), 200 A



INT-A-PAK

FEATURES

- Generation 4 IGBT technology
- Ultrafast: Optimized for high speed 8 kHz to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- HEXFRED® antiparallel diodes with ultrasoft recovery
- Industry standard package
- UL approved file E78996
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS
COMPLIANT**

PRODUCT SUMMARY

V_{CES}	600 V
I_C DC	265 A
$V_{CE(on)}$ at 200 A, 25 °C	1.74 V

BENEFITS

- Increased operating efficiency
- Direct mounting to heatsink
- Performance optimized for power conversion: UPS, SMPS, welding
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	265	A
		$T_C = 67\text{ °C}$	200	
Pulsed collector current	I_{CM}		400	
Peak switching current	I_{LM}		400	
Peak diode forward current	I_{FM}		400	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	625	W
		$T_C = 85\text{ °C}$	325	

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 200\text{ A}$	-	1.74	2.2	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}, T_J = 125\text{ °C}$	-	1.79	2.25	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 0.25\text{ mA}$	3	4.4	6	
Temperature coeff. of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 0.25\text{ mA}$	-	- 11	-	mV/°C
Forward transconductance	g_{fe}	$V_{CE} = 20\text{ V}, I_C = 200\text{ A}$	-	220	-	S
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	0.014	1	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ °C}$	-	-	10	
Diode forward voltage drop	V_{FM}	$I_C = 200\text{ A}, V_{GE} = 0\text{ V}$	-	4.2	6.0	V
		$I_C = 200\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ °C}$	-	4.4	6.2	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 250	nA



GA200TS60UPbF



Vishay High Power Products "Half-Bridge" IGBT INT-A-PAK
(Ultrafast Speed IGBT), 200 A

SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge	Q _g	I _C = 200 A	-	900	-	nC
Gate to emitter charge	Q _{ge}	I _C = 270 A	-	125	-	
Gate to collector charge	Q _{gc}	V _{GE} = 15 V	-	306	-	
Turn-on delay time	t _{d(on)}	I _C = 200 A V _{CC} = 360 V V _{GE} = ± 15 V T _J = 25 °C	-	220	-	ns
Rise time	t _r		-	154	-	
Turn-off delay time	t _{d(off)}		-	300	-	
Fall time	t _f		-	180	-	
Turn-on switching energy	E _{on}	R _{g1} = 15 Ω R _{g2} = 0 Ω	-	2.2	-	mJ
Turn-off switching energy	E _{off}		-	6.6	-	
Total switching energy	E _{ts}		-	8.8	-	
Turn-on delay time	t _{d(on)}	I _C = 200 A V _{CC} = 360 V V _{GE} = ± 15 V T _J = 125 °C	-	342	-	ns
Rise time	t _r		-	194	-	
Turn-off delay time	t _{d(off)}		-	366	-	
Fall time	t _f		-	213	-	
Turn-on switching energy	E _{on}	R _{g1} = 15 Ω R _{g2} = 0 Ω	-	5	-	mJ
Turn-off switching energy	E _{off}		-	16	-	
Total switching energy	E _{ts}		-	21	-	
Input capacitance	C _{ies}	V _{GE} = 0 V	-	20 068	-	pF
Output capacitance	C _{oes}	V _{CC} = 30 V	-	1254	-	
Reverse transfer capacitance	C _{res}	f = 1.0 MHz	-	261	-	
Diode reverse recovery time	t _{rr}	I _C = 200 A V _{CC} = 360 V di/dt = 1300 A/μs	-	179	-	ns
Diode peak reverse current	I _{rr}		-	120	-	A
Diode recovery charge	Q _{rr}		-	10 714	-	μC
Diode peak rate of fall of recovery during t _b	dl _{(rec)M} /dt		-	1922	-	A/μs

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T _J	- 40	-	150	°C
Storage temperature range	T _{Stg}	- 40	-	125	
Junction to case	IGBT	-	-	0.2	°C/W
	Diode	-	-	0.4	
Case to sink per module	R _{thCS}	-	0.1	-	
Mounting torque	case to heatsink	-	-	4	Nm
	case to terminal 1, 2, 3	-	-	3	
Weight		-	200	-	g

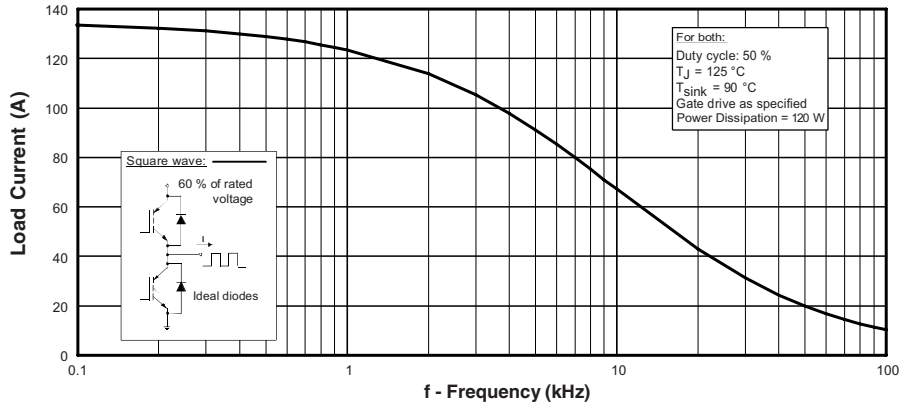


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of Fundamental)

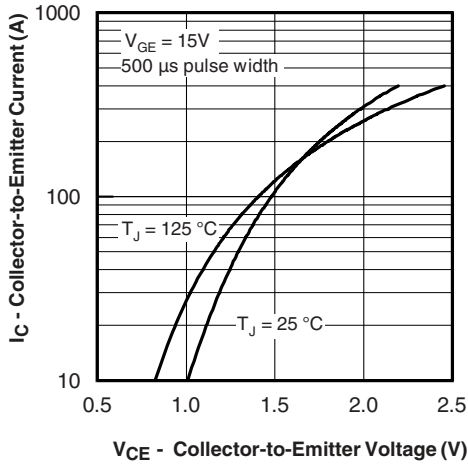


Fig. 2 - Typical Output Characteristics

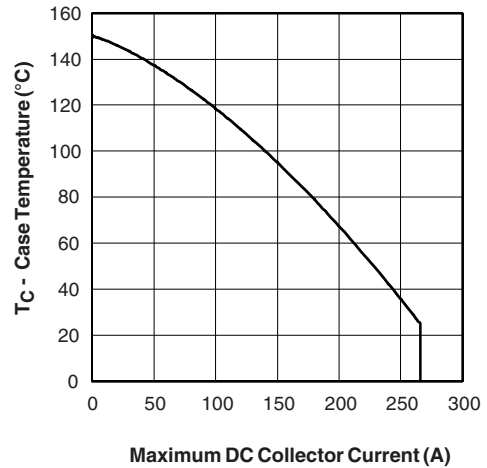


Fig. 4 - Case Temperature vs. Maximum Collector Current

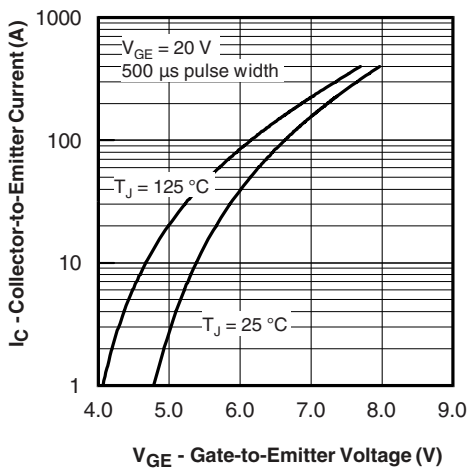


Fig. 3 - Typical Transfer Characteristics

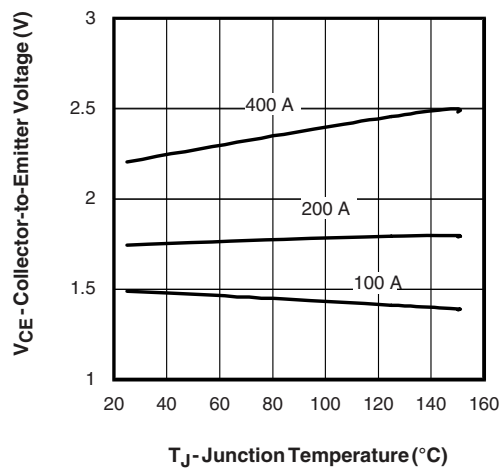


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

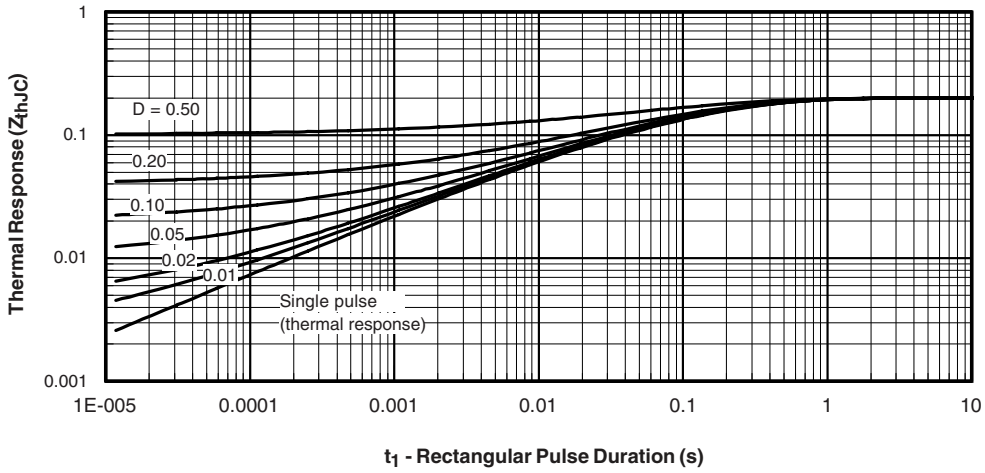


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

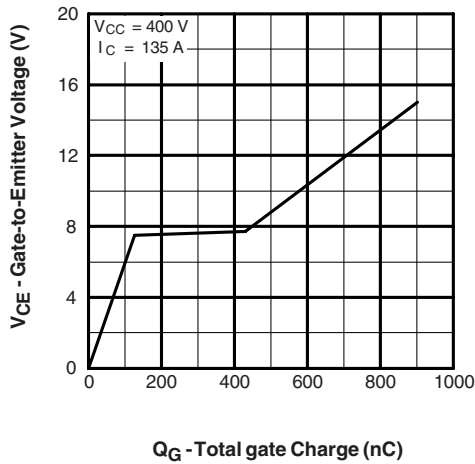


Fig. 7 - Typical Gate Charge vs. Gate to Emitter Voltage

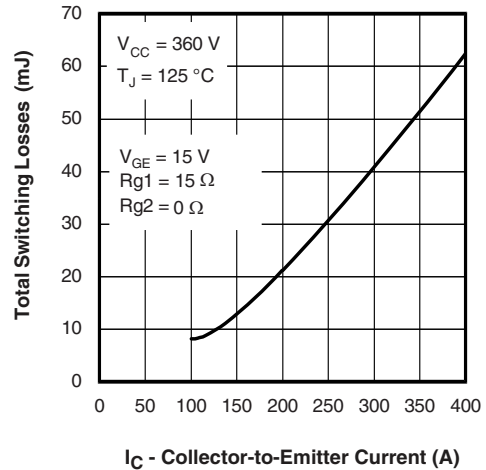


Fig. 9 - Typical Switching Losses vs. Collector to Emitter Current

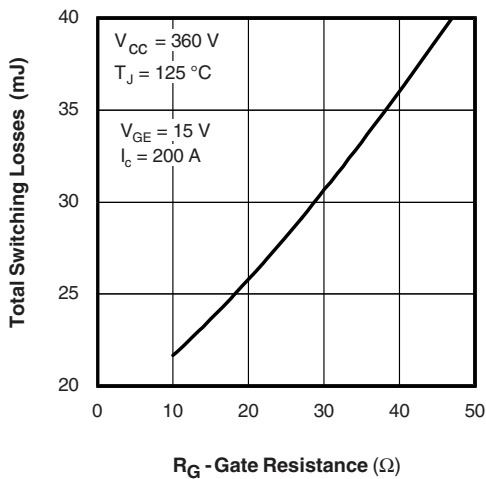


Fig. 8 - Typical Switching Losses vs. Gate Resistance

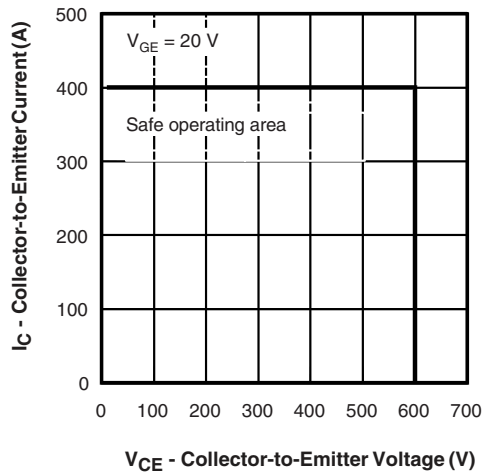


Fig. 10 - Reverse Bias SOA

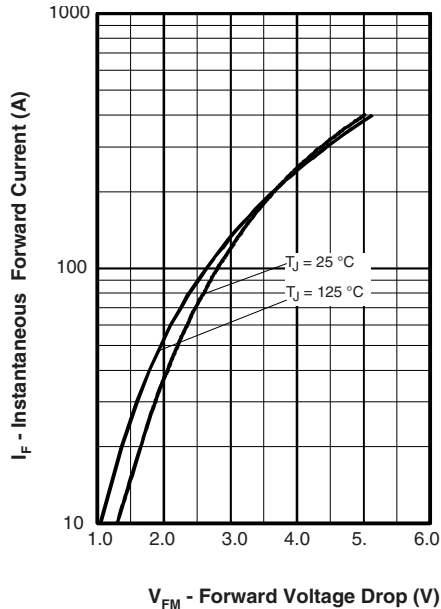


Fig. 11 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

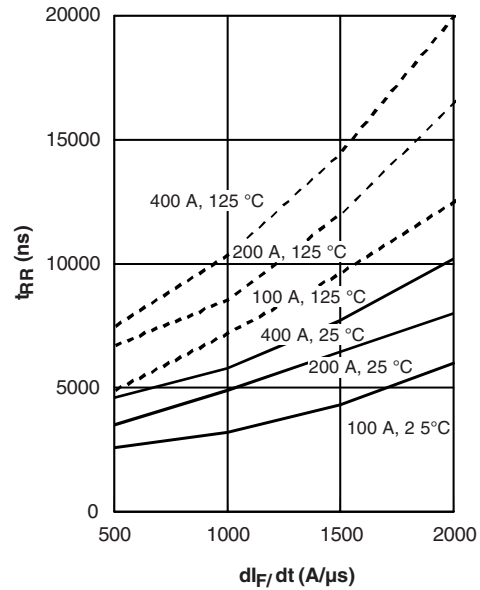


Fig. 13 - Typical Reverse Recovery Time vs. di_F/dt

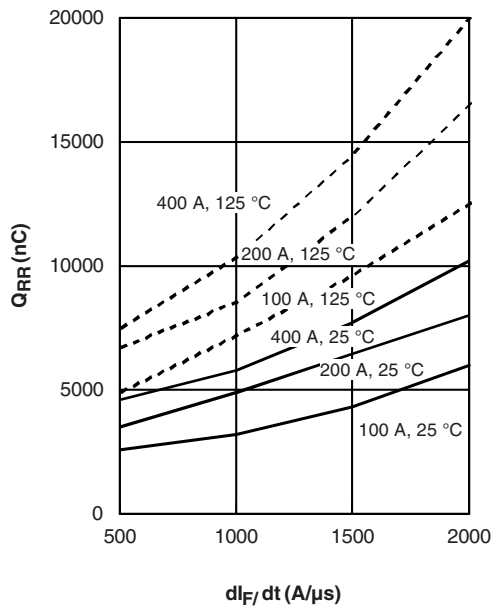


Fig. 12 - Typical Stored Charge vs. di_F/dt

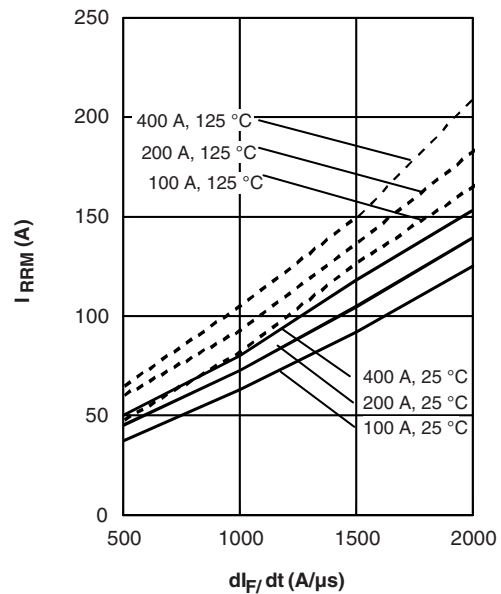


Fig. 14 - Typical Reverse Recovery vs. di_F/dt

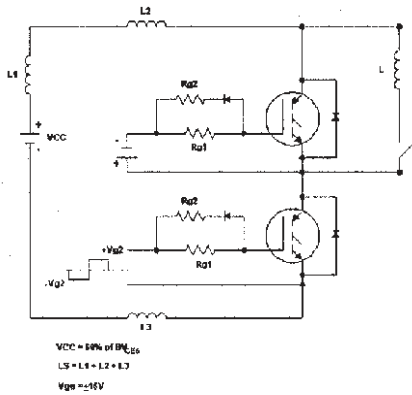


Fig. 15a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

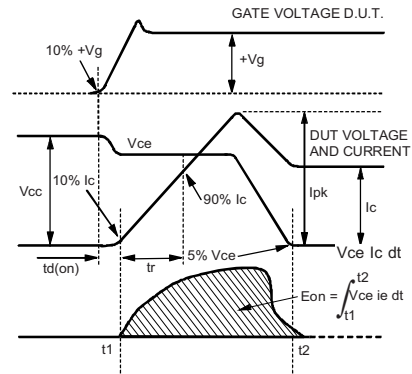


Fig. 15c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

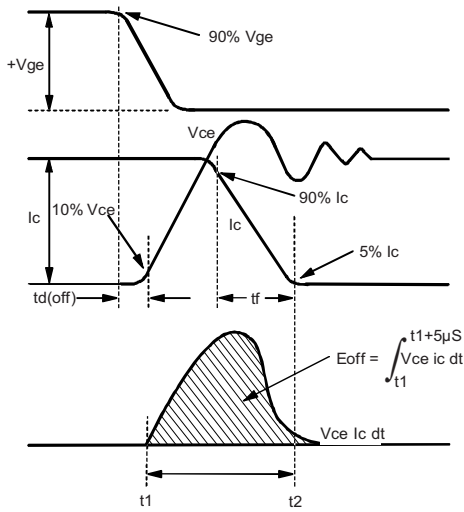


Fig. 15b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

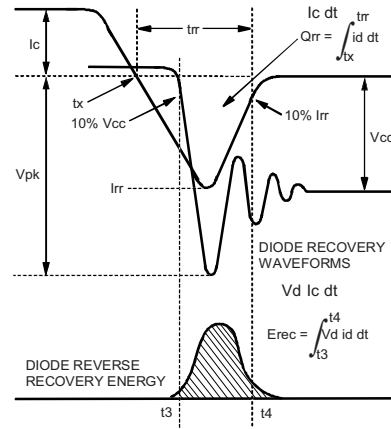


Fig. 15d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

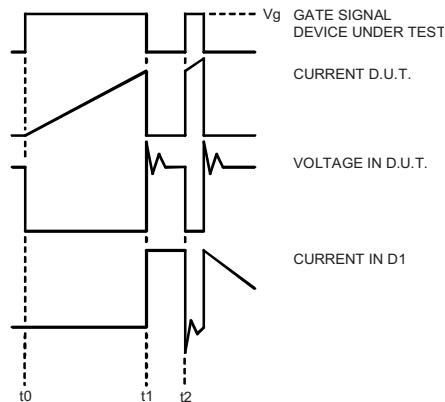


Fig. 15e - Macro Waveforms for Figure 18a's Test Circuit

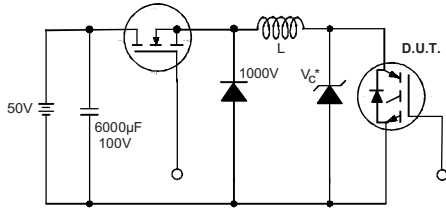


Fig. 16 - Clamped Inductive Load Test Circuit

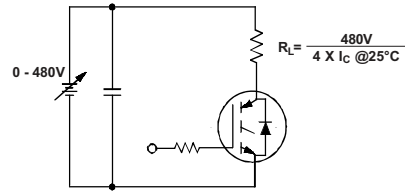


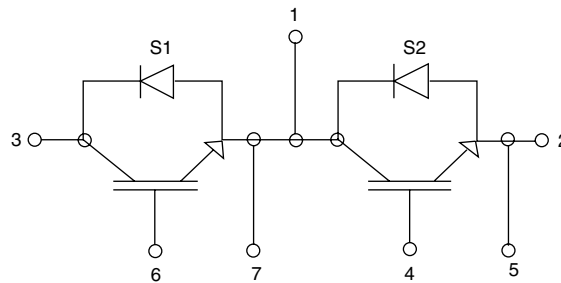
Fig. 17 - Pulsed Collector Current Test Circuit

ORDERING INFORMATION TABLE

Device code	GA	200	T	S	60	U	PbF
	①	②	③	④	⑤	⑥	⑦

- 1** - Essential part number IGBT modules
- 2** - Current rating (200 = 200 A)
- 3** - Circuit configuration (T = Half bridge)
- 4** - INT-A-PAK
- 5** - Voltage code (60 = 600 V)
- 6** - Speed/type (U = Ultrafast IGBT)
- 7** - PbF = Lead (Pb)-free

CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95173

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