

INT-A-PAK™ “Half-Bridge” (Ultrafast Speed IGBT), 100 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 
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	182 A
$V_{CE(on)}$ at 100 A, 25 °C	2.25 V

BENEFITS

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

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		1200	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	182	A
		$T_C = 93\text{ °C}$	100	
Pulsed collector current	I_{CM}	Repetitive rating; $V_{GE} = 20\text{ V}$, pulse width limited by maximum junction temperature	200	
Peak switching current See fig. 17	I_{LM}		200	
Peak diode forward current	I_{FM}		200	
Gate to emitter voltage	V_{GE}		± 20	
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ minute}$	2500	
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	520	W
		$T_C = 85\text{ °C}$	270	
Operating junction temperature range	T_J		- 40 to + 150	°C
Storage temperature range	T_{Stg}		- 40 to + 125	



ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	2.25	3	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2	2.4	
Gate threshold voltage	$V_{GE(th)}$	$I_C = 1.25\text{ mA}$	3.0	4.4	6.0	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 1.25\text{ mA}$	-	-12	-	mV/°C
Forward transconductance	g_{fe}	$V_{CE} = 25\text{ V}, I_C = 100\text{ A}$ Pulse width 50 μs , single shot	-	136	-	S
Collector to emitter leaking current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	0.03	1.0	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	4.2	10	
Maximum diode forward voltage	V_{FM}	$V_{GE} = 0\text{ V}, I_F = 100\text{ A}$	-	3.3	4.0	V
		$V_{GE} = 0\text{ V}, I_F = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.2	3.8	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	250	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Total gate charge (turn-on)	Q_g	$V_{CC} = 400\text{ V}$ $I_C = 124\text{ A}$	-	830	1245	nC	
Gate to emitter charge (turn-on)	Q_{ge}		-	140	210		
Gate to collector charge (turn-on)	Q_{gc}		-	275	412		
Turn-on delay time	$t_{d(on)}$	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$ $I_C = 100\text{ A}$ $V_{CC} = 720\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $T_J = 25\text{ }^\circ\text{C}$	-	570	-	ns	
Rise time	t_r		-	85	-		
Turn-off delay time	$t_{d(off)}$		-	581	-		
Fall time	t_f		-	276	-		
Turn-on switching energy	E_{on}		$T_J = 25\text{ }^\circ\text{C}$	-	7.6	-	mJ
Turn-off switching energy	$E_{off}^{(1)}$			-	6.8	-	
Total switching energy	$E_{ts}^{(1)}$			-	14.4	-	
Turn-on delay time	$t_{d(on)}$	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$ $I_C = 100\text{ A}$ $V_{CC} = 720\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $T_J = 125\text{ }^\circ\text{C}$	-	571	-	ns	
Rise time	t_r		-	89	-		
Turn-off delay time	$t_{d(off)}$		-	606	-		
Fall time	t_f		-	649	-		
Turn-on switching energy	E_{on}		$T_J = 125\text{ }^\circ\text{C}$	-	10	-	mJ
Turn-off switching energy	$E_{off}^{(1)}$			-	16	-	
Total switching energy	$E_{ts}^{(1)}$			-	26	45	
Input capacitance	C_{ies}	$V_{GE} = 0\text{ V}$	-	18 672	-	pF	
Output capacitance	C_{oes}	$V_{CC} = 30\text{ V}$	-	830	-		
Reverse transfer capacitance	C_{res}	$f = 1\text{ MHz}$	-	161	-		
Diode reverse recovery time	t_{rr}	$I_C = 100\text{ A}$	-	149	-	ns	
Diode peak reverse current	I_{rr}	$R_{g1} = 15\text{ }\Omega$ $R_{g2} = 0\text{ }\Omega$	-	104	-	A	
Diode recovery charge	Q_{rr}	$V_{CC} = 720\text{ V}$	-	7664	-	nC	
Diode peak rate of fall of recovery during t_b	$dl_{(rec)M}/dt$	$dl/dt = 1300\text{ A}/\mu\text{s}$	-	1916	-	A/ μs	

Note

(1) Repetitive rating; $V_{GE} = 20\text{ V}$, pulse width limited by maximum junction temperature

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	TYP.	MAX.	UNITS
Thermal resistance, junction to case	IGBT		-	0.24	°C/W
	Diode		-	0.35	
Thermal resistance, case to sink per module	R_{thCS}		0.1	-	
Mounting torque	case to heatsink	For screws M5 x 0.8	-	4.0	Nm
	case to terminal 1, 2 and 3		-	3.0	
Weight of module			200	-	g

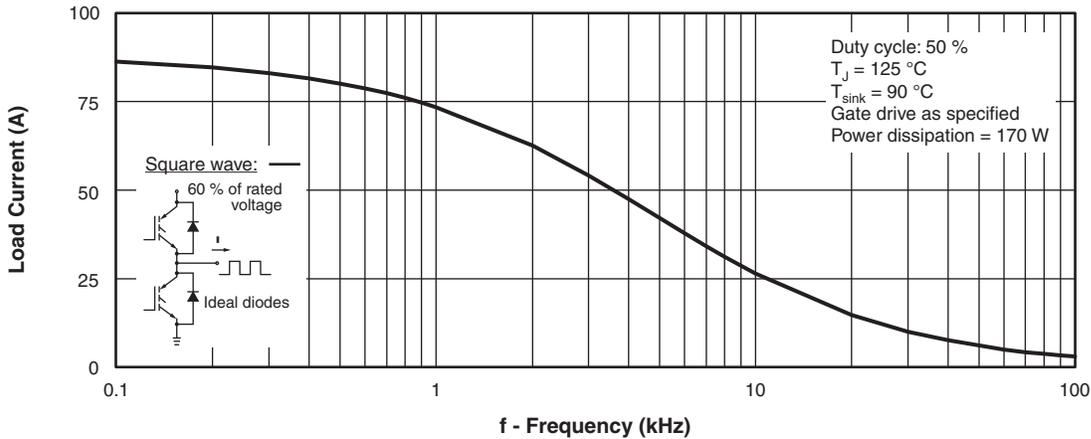


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of Fundamental)

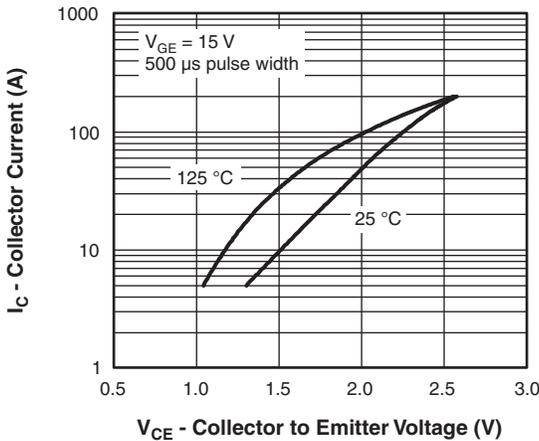


Fig. 2 - Typical Output Characteristics

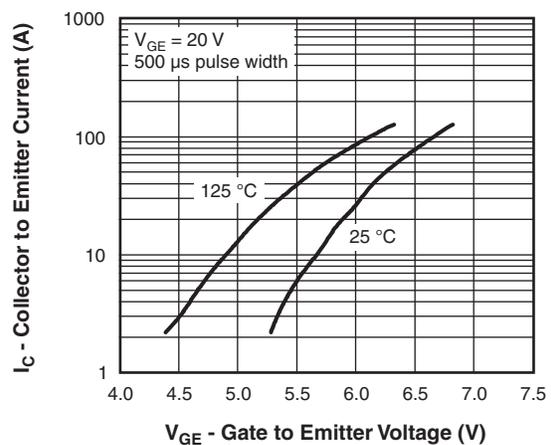


Fig. 3 - Typical Transfer Characteristics

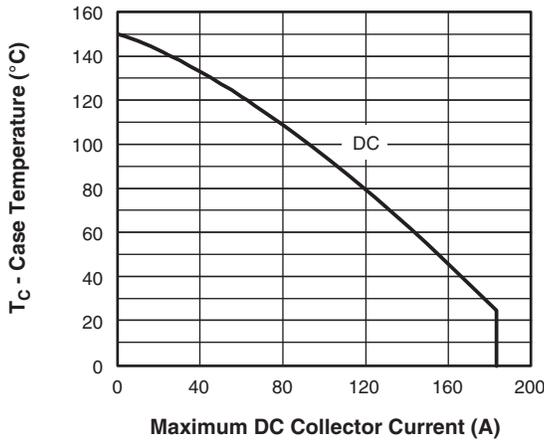


Fig. 4 - Case Temperature vs. Maximum Collector Current

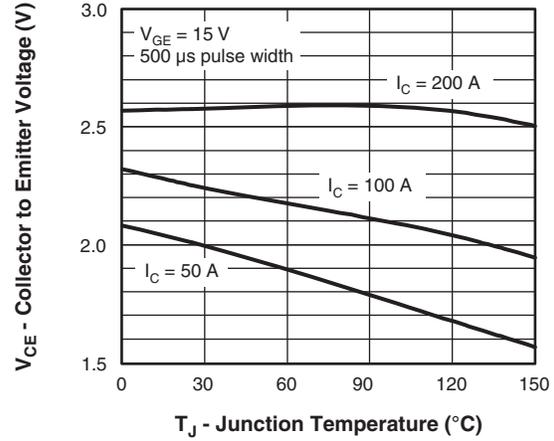


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

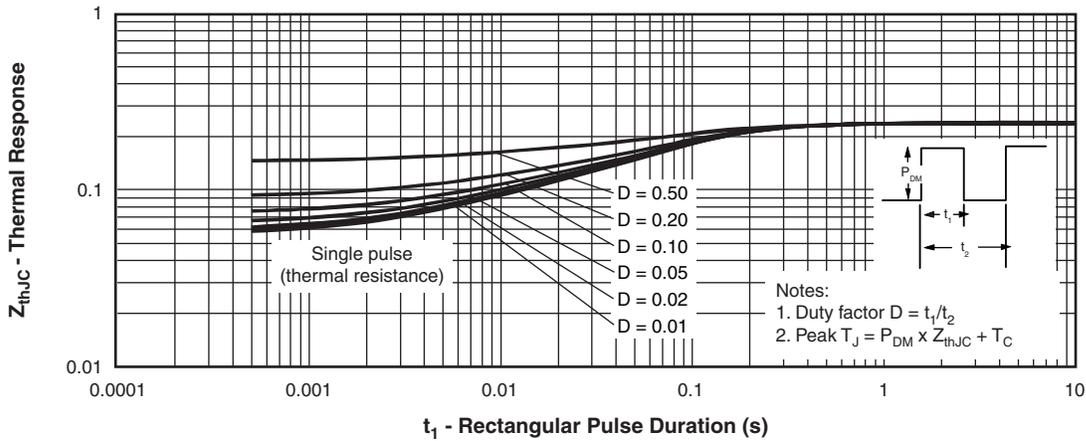


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

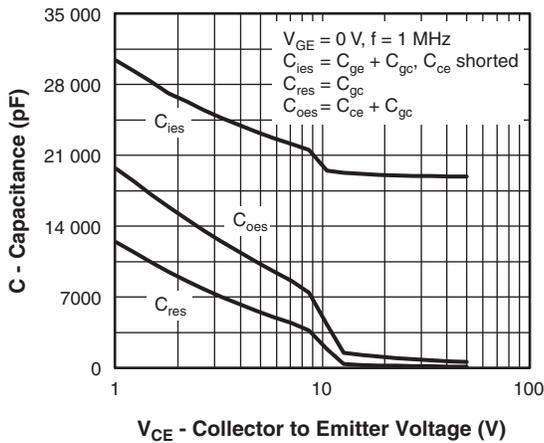


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

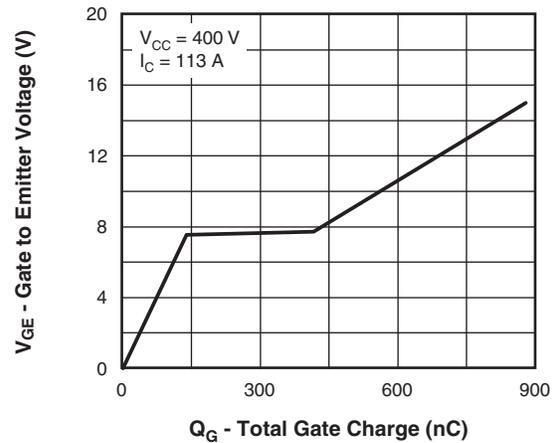


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

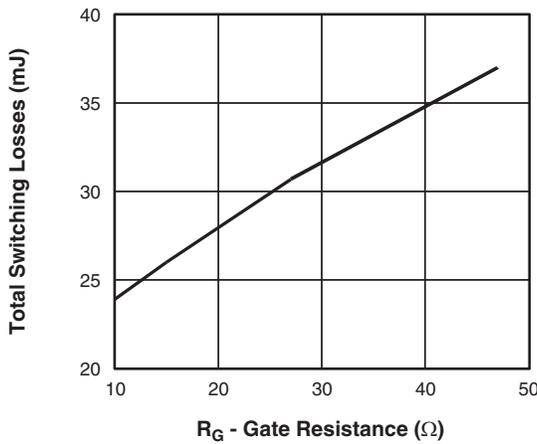


Fig. 9 - Typical Switching Losses vs. Gate Resistance

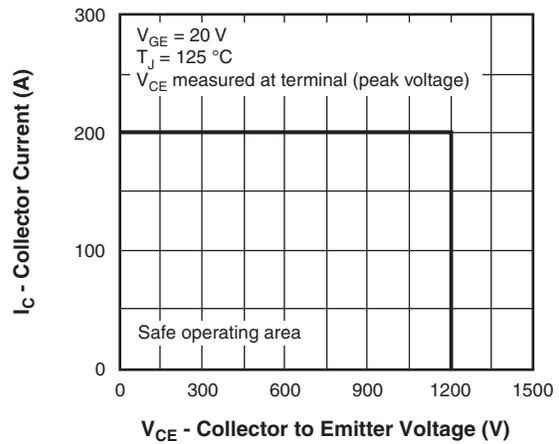


Fig. 12 - Reverse Bias SOA

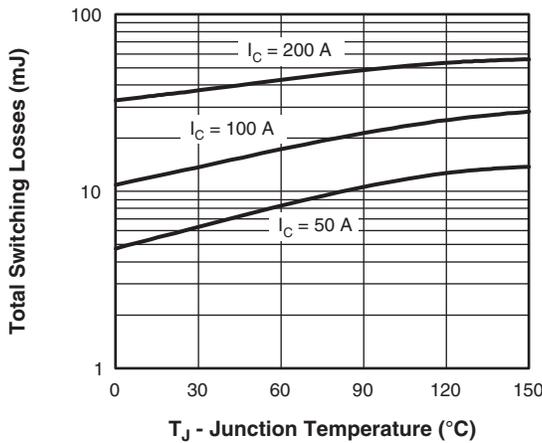


Fig. 10 - Typical Switching Losses vs. Junction Temperature

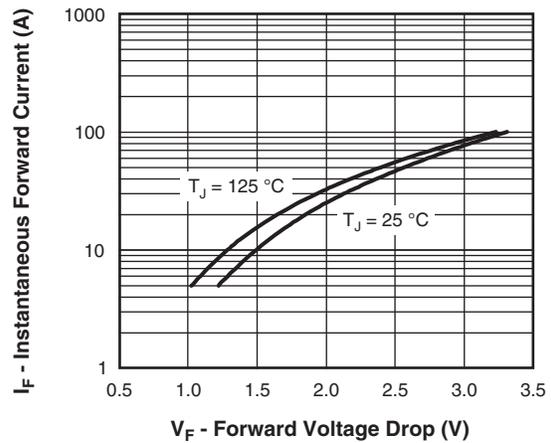


Fig. 13 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

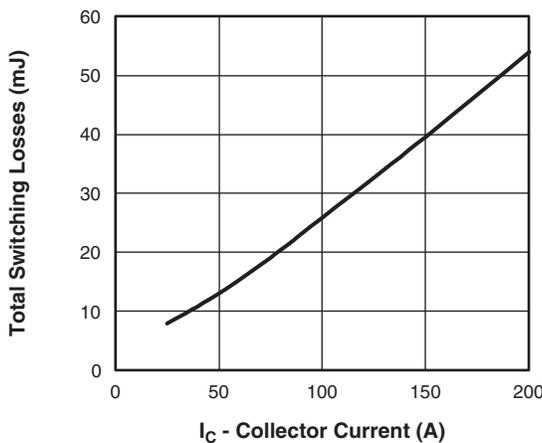


Fig. 11 - Typical Switching Losses vs. Collector Current

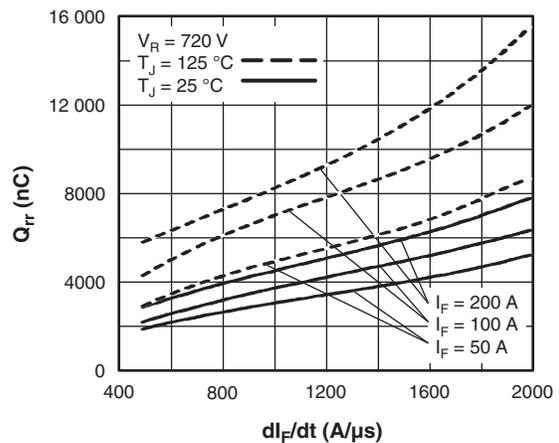


Fig. 14 - Typical Stored Charge vs. dI_F/dt

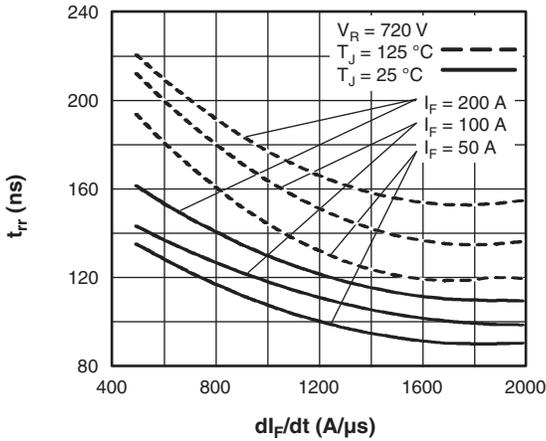


Fig. 15 - Typical Reverse Recovery Time vs. di/dt

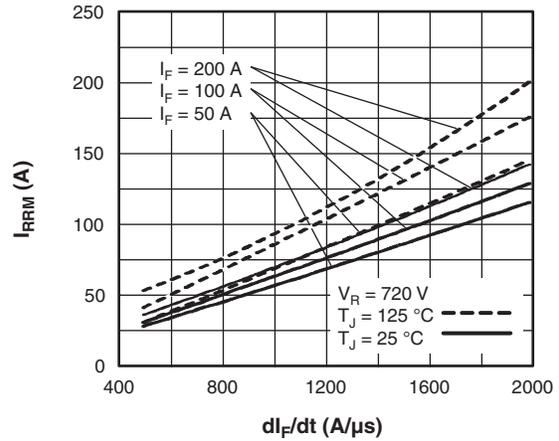


Fig. 16 - Typical Recovery Current vs. di/dt

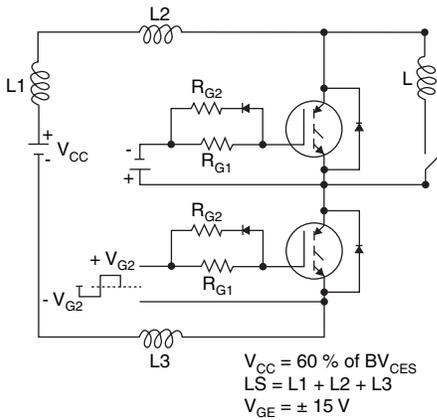


Fig. 17a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

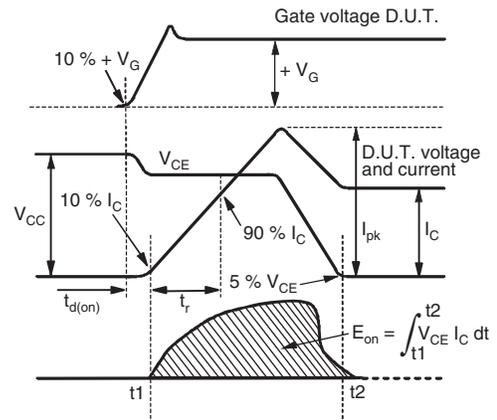


Fig. 17c - Test Waveforms for Circuit of Fig. 17a, Defining E_{on} , $t_{d(on)}$, t_r

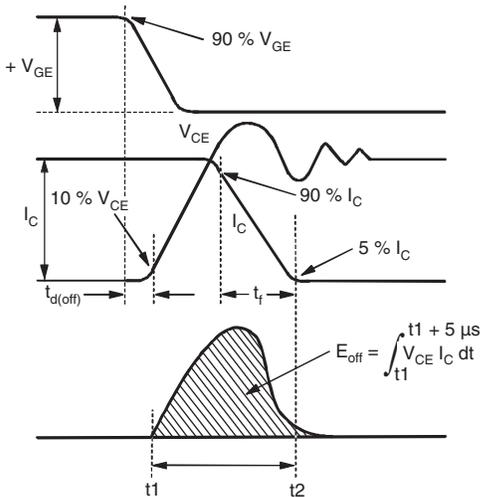


Fig. 17b - Test Waveforms for Circuit of Fig. 17a, Defining E_{off} , $t_{d(off)}$, t_f

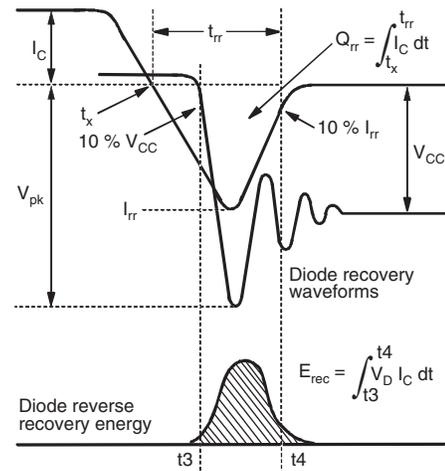


Fig. 17d - Test Waveforms for Circuit of Fig. 17a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

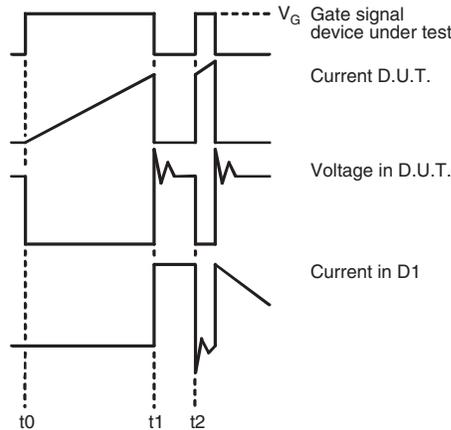


Fig. 17e - Macro Waveforms for Figure 18a's Test Circuit

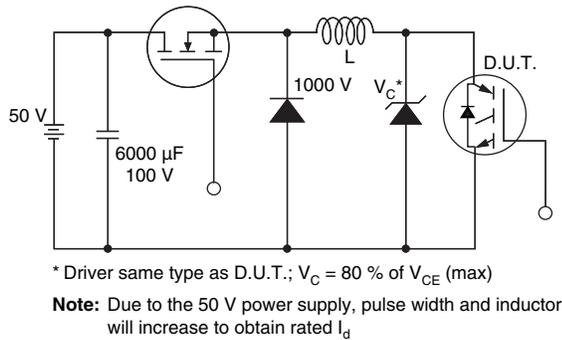


Fig. 18 - Clamped Inductive Load Test Circuit

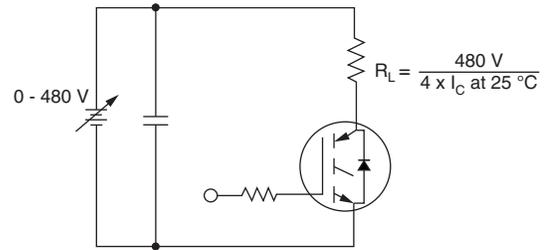


Fig. 19 - Pulsed Collector Current Test Circuit

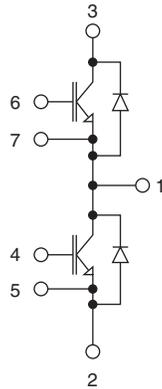
ORDERING INFORMATION TABLE

Device code	VS-	G	A	100	T	S	120	U	PbF
	1	2	3	4	5	6	7	8	9

- 1** - Vishay Semiconductors product
- 2** - Insulated gate bipolar transistor (IGBT)
- 3** - Generation 4, IGBT silicon, DBC construction
- 4** - Current rating (100 = 100 A)
- 5** - Circuit configuration (T = Half-bridge)
- 6** - Package indicator (INT-A-PAK)
- 7** - Voltage rating (120 = 1200 V)
- 8** - Speed/type (U = Ultrafast)
- 9** - PbF = Lead (Pb)-free



CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS

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



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