


Insulated Gate Bipolar Transistor (Warp 2 Speed IGBT), 90 A



SOT-227

PRIMARY CHARACTERISTICS	
V_{CES}	600 V
I_C DC	90 A at 90 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	2.40 V
I_F DC	108 A at 90 °C
Speed	8 kHz to 30 kHz
Package	SOT-227
Circuit configuration	Single switch with AP diode

FEATURES

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- Square RBSOA
- HEXFRED® anti-parallel diodes with ultrasoft reverse recovery
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**
BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting to heatsink
- Plug-in compatible with other SOT-227 packages
- Lower conduction losses and switching losses
- 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	$T_C = 25\text{ °C}$	147	A
		$T_C = 90\text{ °C}$	90	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	180	
		$T_C = 90\text{ °C}$	108	
Gate-to-emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	625	W
		$T_C = 90\text{ °C}$	300	
Power dissipation, diode	P_D	$T_C = 25\text{ °C}$	379	
		$T_C = 90\text{ °C}$	182	
Isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V



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	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	2.4	2.8	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3	3.4	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	3.3	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3	3.9	5.0	
		$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}, T_J = 125\text{ }^\circ\text{C}$	-	2.5	-	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$ ($25\text{ }^\circ\text{C}$ to $125\text{ }^\circ\text{C}$)	-	-10	-	mV/ $^\circ\text{C}$
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	7	100	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	1.5	6.0	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	6	10	
Forward voltage drop, diode	V_{FM}	$I_C = 100\text{ A}, V_{GE} = 0\text{ V}$	-	1.6	2.1	V
		$I_C = 100\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	1.56	2.0	
		$I_C = 100\text{ A}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	1.53	-	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 200	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)								
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS		
Total gate charge (turn-on)	Q_g	$I_C = 100\text{ A}, V_{CC} = 480\text{ V}, V_{GE} = 15\text{ V}$	-	460	690	nC		
Gate to emitter charge (turn-on)	Q_{ge}		-	160	250			
Gate to collector charge (turn-on)	Q_{gc}		-	70	130			
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	0.39	-	mJ		
Turn-off switching loss	E_{off}		-	1.10	-			
Total switching loss	E_{tot}		-	1.49	-			
Turn-on delay time	$t_{d(on)}$		Energy losses include tail and diode recovery. Diode used 60APH06	-	245	-	ns	
Rise time	t_r			-	53	-		
Turn-off delay time	$t_{d(off)}$			-	240	-		
Fall time	t_f			-	63	-		
Turn-on switching loss	E_{on}			-	0.52	-		mJ
Turn-off switching loss	E_{off}			-	1.24	-		
Total switching loss	E_{tot}			-	1.76	-		
Turn-on delay time	$t_{d(on)}$	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	240	-	ns		
Rise time	t_r		-	54	-			
Turn-off delay time	$t_{d(off)}$		-	250	-			
Fall time	t_f		-	80	-			
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 300\text{ A}, R_g = 22\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}, V_{CC} = 400\text{ V}, V_P = 600\text{ V}, L = 500\text{ }\mu\text{H}$	Fullsquare					
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 200\text{ V}$	-	95	-	ns		
Diode peak reverse current	I_{rr}		-	10	-	A		
Diode recovery charge	Q_{rr}		-	480	-	nC		
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	144	-	ns		
Diode peak reverse current	I_{rr}		-	16	-	A		
Diode recovery charge	Q_{rr}		-	1136	-	nC		