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## Insulated Gate Bipolar Transistor (Ultrafast IGBT), 75 A



SOT-227

### FEATURES

- NPT Generation V IGBT technology
- Square RBSOA
- Positive  $V_{CE(on)}$  temperature coefficient
- Fully isolated package
- Speed 8 kHz to 60 kHz
- Very low internal inductance ( $\leq 5$  nH typical)
- Industry standard outline
- Material categorization: For definitions of compliance please see [www.vishay.com/doc/99912](http://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 on heatsink
- Plug-in compatible with other SOT-227 packages
- Low EMI, requires less snubbing

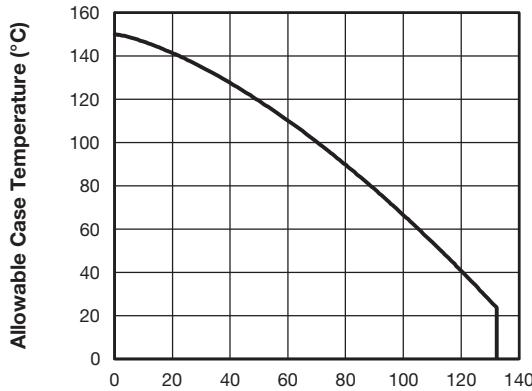
PRODUCT SUMMARY	
$V_{CES}$	1200 V
$I_C$ DC	75 A at 95 °C
$V_{CE(on)}$ typical at 75 A, 25 °C	3.3 V
Package	SOT-227

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	$V_{CES}$		1200	V
Continuous collector current	$I_C$	$T_C = 25$ °C	131	A
		$T_C = 80$ °C	89	
Pulsed collector current	$I_{CM}$		200	
Clamped inductive load current	$I_{LM}$		200	
Gate to emitter voltage	$V_{GE}$		$\pm 20$	V
Power dissipation	$P_D$	$T_C = 25$ °C	658	W
		$T_C = 80$ °C	369	
Isolation voltage	$V_{ISOL}$	Any terminal to case, $t = 1$ min	2500	V

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, $I_C = 250$ $\mu$ A	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15$ V, $I_C = 75$ A	-	3.3	3.8	
		$V_{GE} = 15$ V, $I_C = 75$ A, $T_J = 125$ °C	-	3.6	3.9	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$ , $I_C = 250$ $\mu$ A	4	5	6	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$ , $I_C = 1$ mA (25 °C to 125 °C)	-	-12	-	mV/°C
Collector to emitter leakage current	$I_{CES}$	$V_{GE} = 0$ V, $V_{CE} = 1200$ V	-	3	250	$\mu$ A
		$V_{GE} = 0$ V, $V_{CE} = 1200$ V, $T_J = 150$ °C	-	4	20	mA
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20$ V	-	-	$\pm 200$	nA

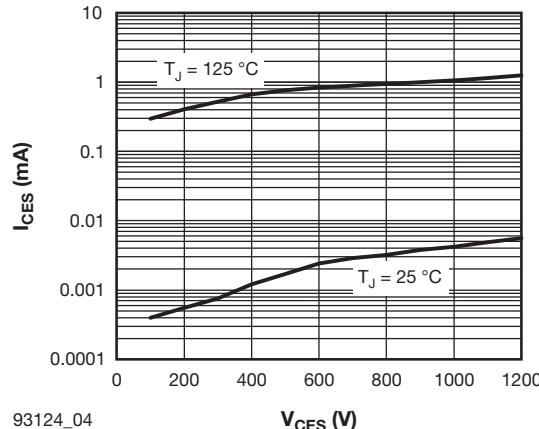
<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$I_C = 50 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}$		-	690	-	nC
Gate to emitter charge (turn-on)	$Q_{ge}$			-	65	-	
Gate to collector charge (turn-on)	$Q_{gc}$			-	250	-	
Turn-on switching loss	$E_{on}$	$I_C = 75 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, R_g = 5 \Omega, L = 500 \mu\text{H}$	Energy losses include tail and diode recovery (see fig. 18)	-	1.53	-	mJ
Turn-off switching loss	$E_{off}$			-	1.76	-	
Total switching loss	$E_{tot}$			-	3.29	-	
Turn-on switching loss	$E_{on}$			-	2.49	-	
Turn-off switching loss	$E_{off}$			-	3.45	-	
Total switching loss	$E_{tot}$			-	5.94	-	
Turn-on delay time	$t_{d(on)}$			-	281	-	ns
Rise time	$t_r$			-	45	-	
Turn-off delay time	$t_{d(off)}$			-	300	-	
Fall time	$t_f$			-	126	-	
Reverse bias safe operating area	RBSOA	$T_J = 150^\circ\text{C}, I_C = 200 \text{ A}, R_g = 22 \Omega, V_{GE} = 15 \text{ V to } 0 \text{ V}, V_{CC} = 900 \text{ V}, V_P = 1200 \text{ V}, L = 500 \mu\text{H}$		Fullsquare			

<b>THERMAL AND MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL		MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	$T_J, T_{STG}$		-40	-	150	°C/W
Thermal resistance, junction to case	$R_{thJC}$		-	-	0.19	
Thermal resistance case to heatsink	$R_{thCS}$		Flat, greased surface	0.05	-	
Weight			-	30	-	g
Mounting torque			-	-	1.3	Nm
Case style			SOT-227			



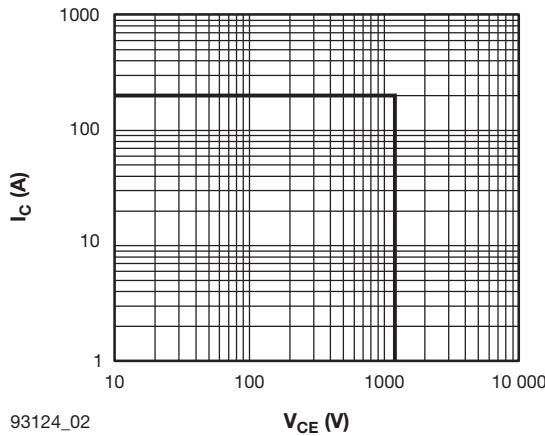
93124\_01 **I<sub>C</sub> - Continuous Collector Current (A)**

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



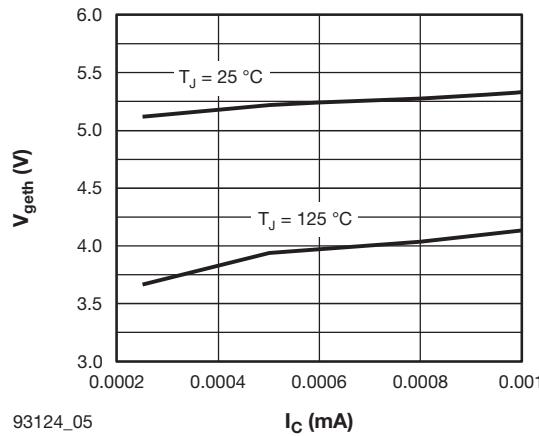
93124\_04 **V<sub>CE</sub> (V)**

Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current



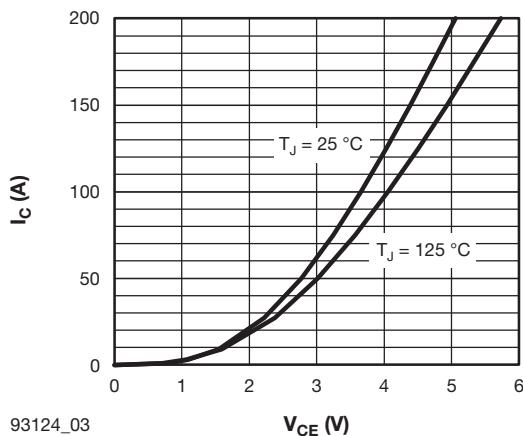
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Fig. 2 - IGBT Reverse Bias SOA  
T<sub>J</sub> = 150 °C, V<sub>GE</sub> = 15 V



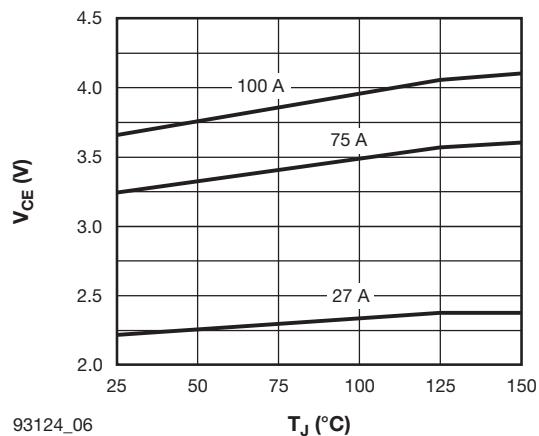
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Fig. 5 - Typical IGBT Threshold Voltage



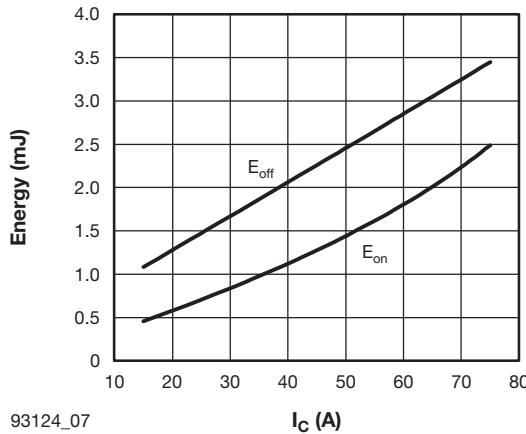
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Fig. 3 - Typical IGBT Collector Current Characteristics



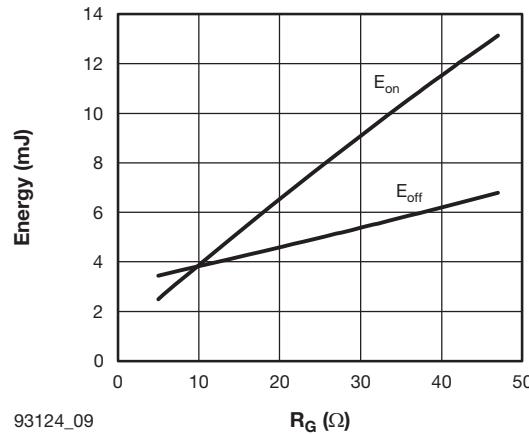
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Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V<sub>GE</sub> = 15 V



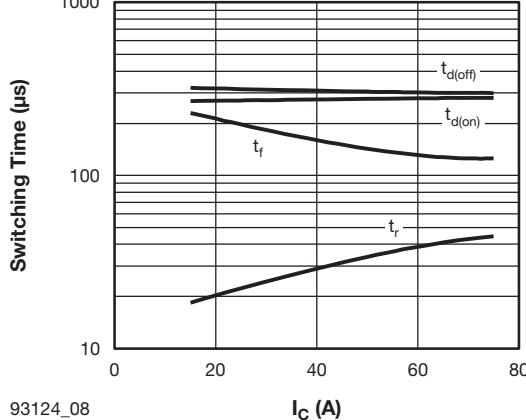
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Fig. 7 - Typical IGBT Energy Loss vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ,  $L = 500 \mu\text{H}$ ,  $V_{CC} = 600 \text{ V}$ ,  
 $R_g = 5 \Omega$ ,  $V_{GE} = 15 \text{ V}$



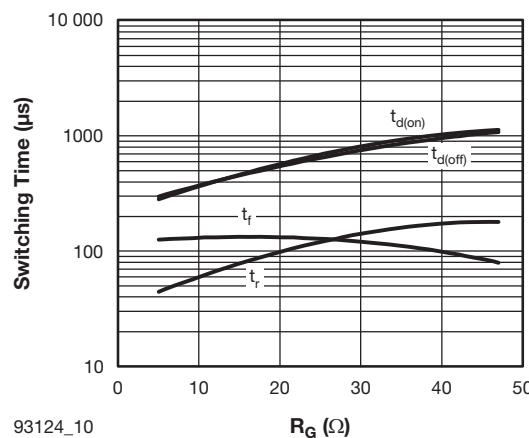
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Fig. 9 - Typical IGBT Energy Loss vs.  $R_G$   
 $T_J = 125^\circ\text{C}$ ,  $I_C = 75 \text{ A}$ ,  $L = 500 \mu\text{H}$ ,  
 $V_{CC} = 600 \text{ V}$ ,  $V_{GE} = 15 \text{ V}$



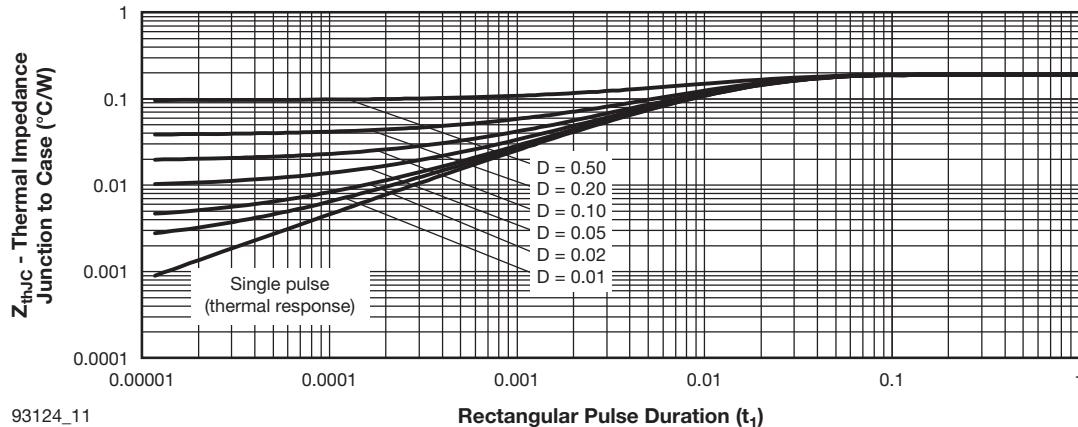
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Fig. 8 - Typical IGBT Switching Time vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ,  $L = 500 \mu\text{H}$ ,  $V_{CC} = 600 \text{ V}$ ,  
 $R_g = 5 \Omega$ ,  $V_{GE} = 15 \text{ V}$



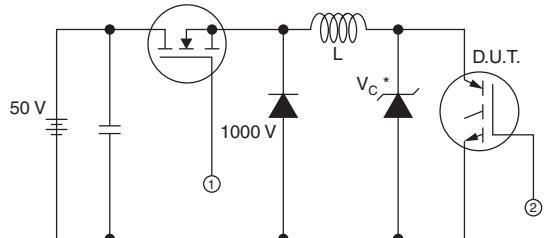
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Fig. 10 - Typical IGBT Switching Time vs.  $R_G$   
 $T_J = 125^\circ\text{C}$ ,  $L = 500 \mu\text{H}$ ,  $V_{CC} = 600 \text{ V}$ ,  
 $R_g = 5 \Omega$ ,  $V_{GE} = 15 \text{ V}$



93124\_11

Fig. 11 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics



\* Driver same type as D.U.T.;  $V_C = 80\%$  of  $V_{ce(\max)}$   
\* Note: Due to the 50 V power supply, pulse width and inductor will increase to obtain  $I_d$

Fig. 12 - Clamped Inductive Load Test Circuit

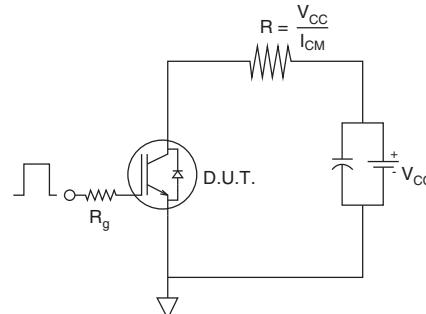


Fig. 13 - Pulsed Collector Current Test Circuit

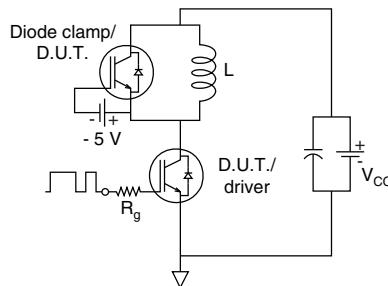


Fig. 14 - Switching Loss Test Circuit

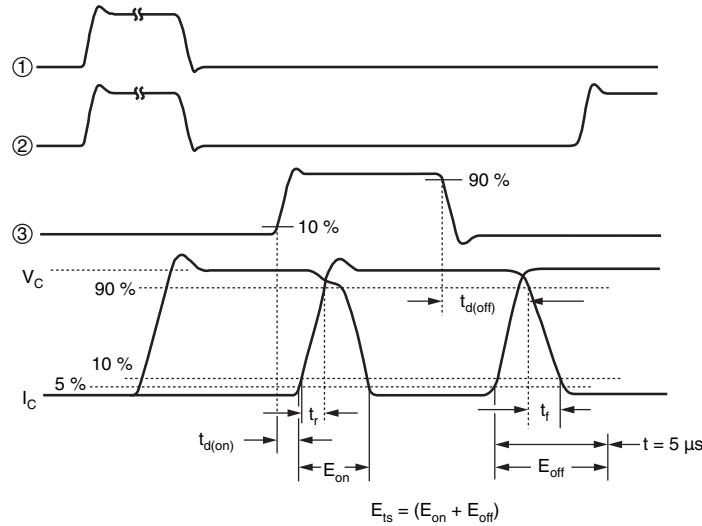


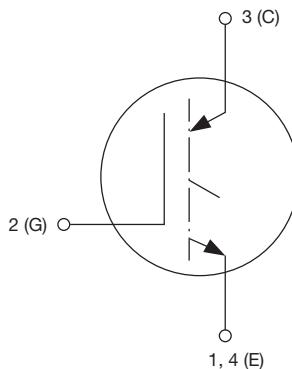
Fig. 15 - Switching Loss Waveforms Test Circuit

**ORDERING INFORMATION TABLE**

Device code	VS-	G	B	75	S	A	120	U	P
	1	2	3	4	5	6	7	8	9

1	- Vishay Semiconductors product
2	- Insulated Gate Bipolar Transistor (IGBT)
3	- B = IGBT Generation 5
4	- Current rating (75 = 75 A)
5	- Circuit configuration (S = Single switch without antiparallel diode)
6	- Package indicator (A = SOT-227)
7	- Voltage rating (120 = 1200 V)
8	- Speed/type (U = Ultrafast IGBT)
9	- Totally lead (Pb)-free

**CIRCUIT CONFIGURATION**



<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95036">www.vishay.com/doc?95036</a>
Packaging information	<a href="http://www.vishay.com/doc?95037">www.vishay.com/doc?95037</a>



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