

# IGBT with Diode

## IXGR 50N60A2U1

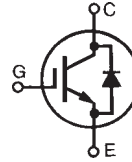
$$V_{CES} = 600 \text{ V}$$

$$I_{C25} = 75 \text{ A}$$

$$V_{CE(sat)} = 1.7 \text{ V}$$

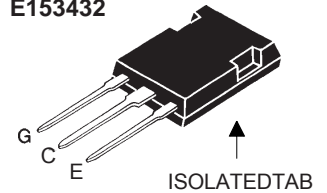
Low Saturation Voltage IGBT with  
Low Forward Drop Diode  
Electrically Isolated Mounting Tab

### Preliminary Data Sheet



Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$	600	V
$V_{CGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1 \text{ M}\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$ (limited by leads)	75	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	50	A
$I_{F110}$	$T_C = 110^\circ\text{C}$ (50N60A2U1 Diode)	25	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	200	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10 \Omega$ Clamped inductive load @ $V_{CE} \leq 600 \text{ V}$	$I_{CM} = 80$	A
$P_C$	$T_C = 25^\circ\text{C}$	200	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$
$F_C$	Mounting Force	22..130/5..29	N/lb
$V_{ISOL}$	50/60 Hz, RMS, t = 1 minute $I_{SOL} = 1 \text{ mA}$ , t = 1 s	2500 3000	V~ V~
<b>Weight</b>		4	g
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$

**ISOPLUS247(IXGR)**

**E153432**


G = Gate      C = Collector  
E = Emitter

### Features

- Low on-state voltage IGBT and anti-parallel diode in one package
- High current handling capability
- MOS Gate turn-on for drive simplicity

### Applications

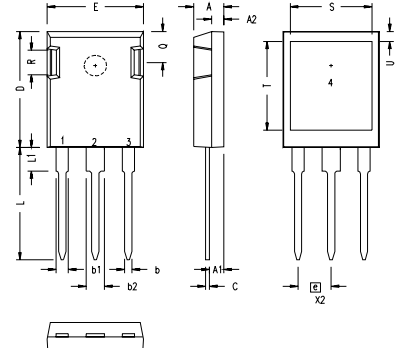
- Lighting controls
- Heating controls
- AC/DC relays

### Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw or spring clip

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$ , $V_{CE} = V_{GE}$	3.0		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$		$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	650 $\mu\text{A}$ 5 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 50 \text{ A}$ , $V_{GE} = 15 \text{ V}$ Note 1		$T_J = 125^\circ\text{C}$	1.7 V 1.3 V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 50\text{ A}; V_{CE} = 10\text{ V}$ , Note 1	40	55	S
$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		3500	pF
$C_{oes}$			400	pF
$C_{res}$			50	pF
$Q_g$	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		140	nC
$Q_{ge}$			23	nC
$Q_{gc}$			44	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 480\text{ V}, R_G = R_{off} = 5.0\ \Omega$		20	ns
$t_{ri}$			25	ns
$t_{d(off)}$			410	ns
$t_{fi}$			260	ns
$E_{off}$			3.5	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 480\text{ V}, R_G = R_{off} = 5.0\ \Omega$		20	ns
$t_{ri}$			25	ns
$E_{on}$			1.0	mJ
$t_{d(off)}$			720	ns
$t_{fi}$			510	ns
$E_{off}$		7.7	mJ	
$R_{thJC}$			0.15	0.62 K/W
$R_{thCK}$				K/W

**ISOPLUS247 Outline**


SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b1	.075	.084	1.91	2.13
b2	.115	.123	2.92	3.12
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
E	.620	.635	15.75	16.13
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1	.150	.170	3.81	4.32
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.520	.540	13.21	13.72
T	.620	.640	15.75	16.26
U	.065	.080	1.65	2.03

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

**Reverse Diode (FRED)**

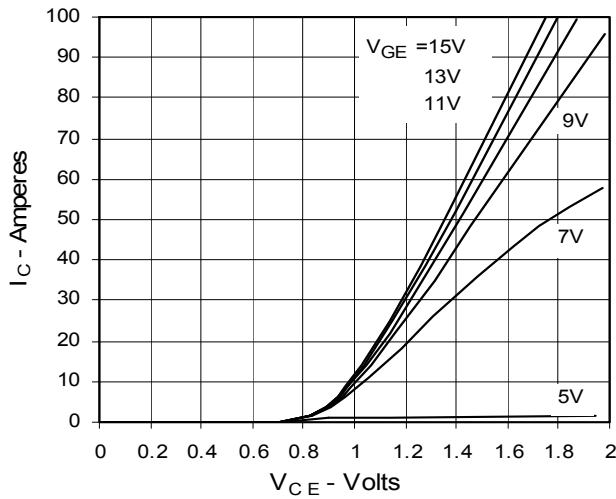
Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$ , Note 1			1.6 V
$R_{thJC}$				0.95 K/W

Note 1: Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

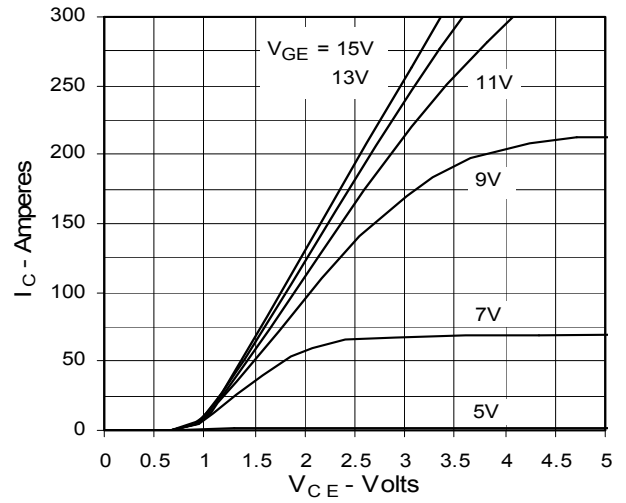
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:	4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065B1	6,683,344	6,727,585
	4,850,072	5,017,508	5,063,307	5,381,025	6,259,123B1	6,534,343	6,710,405B2	6,759,692
	4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	6,771,478B2

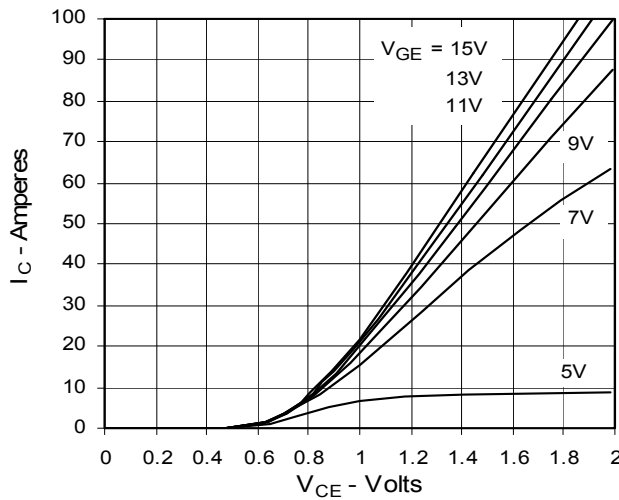
**Fig. 1. Output Characteristics @ 25 °C**



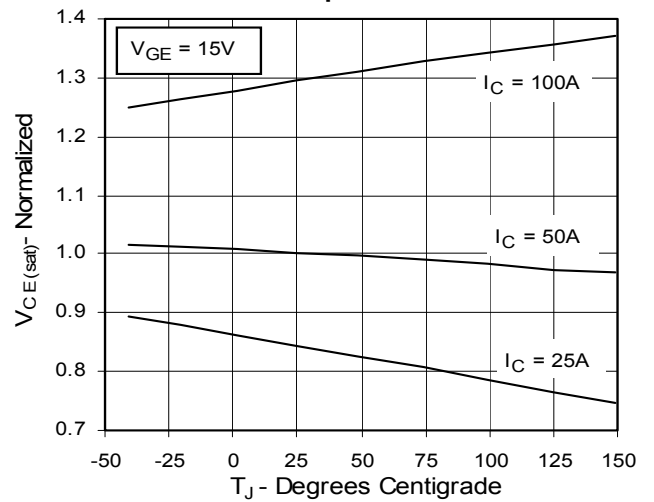
**Fig. 2. Extended Output Characteristics @ 25 °C**



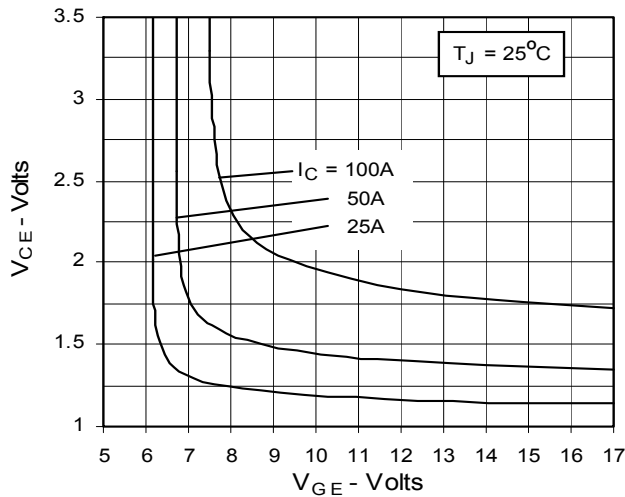
**Fig. 3. Output Characteristics @ 125 °C**



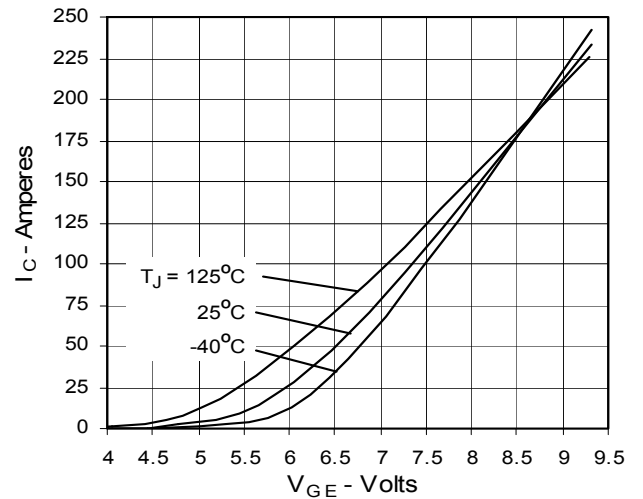
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Temperature**

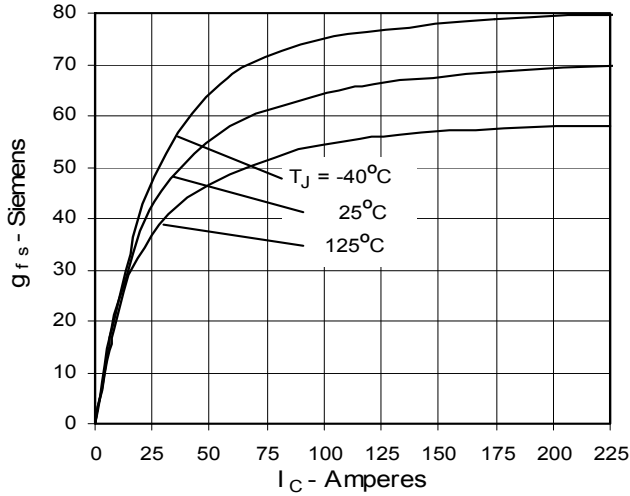
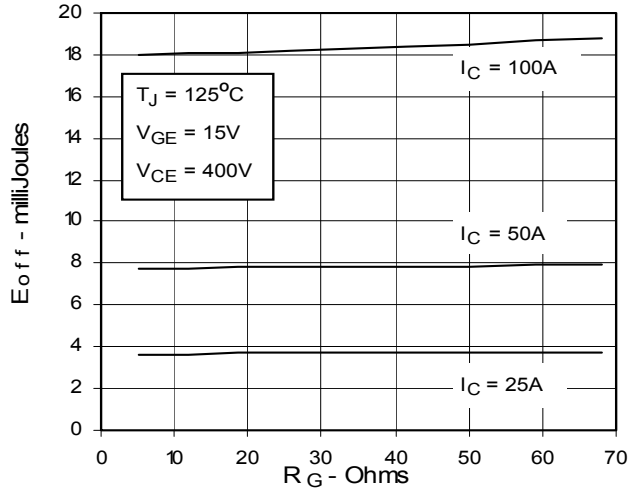
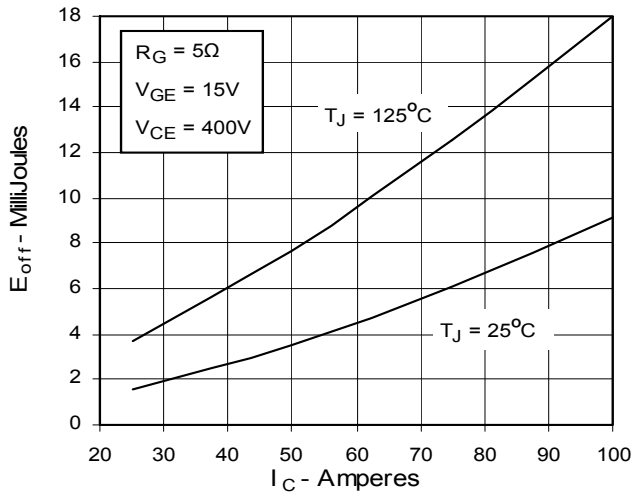
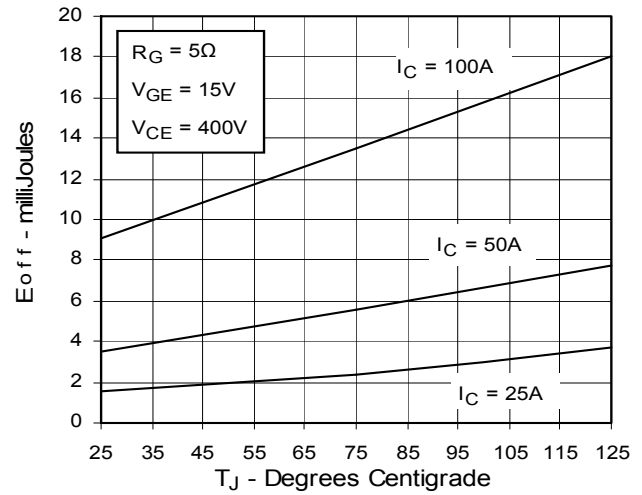
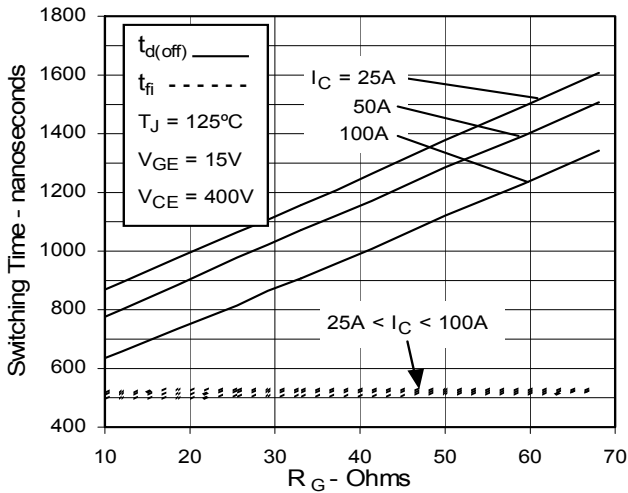
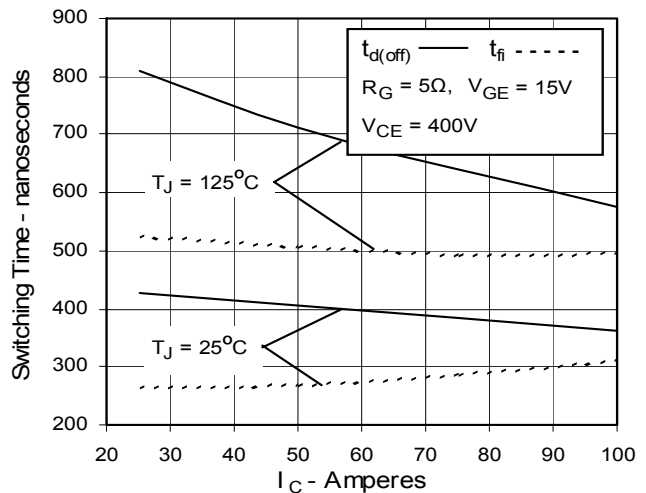


**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage**

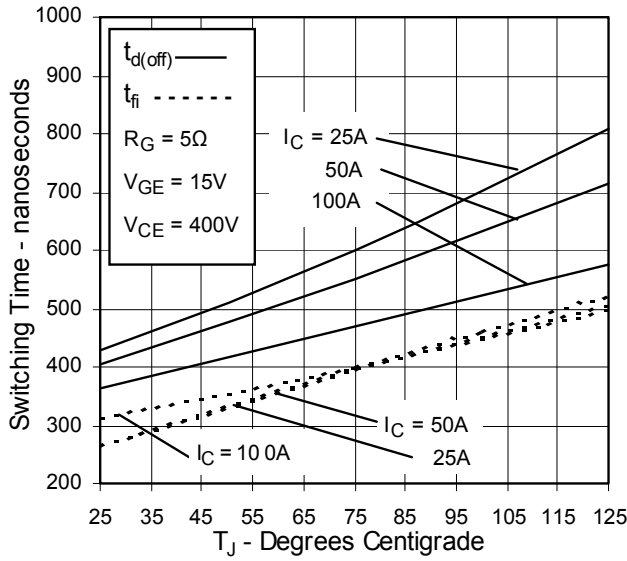


**Fig. 6. Input Admittance**

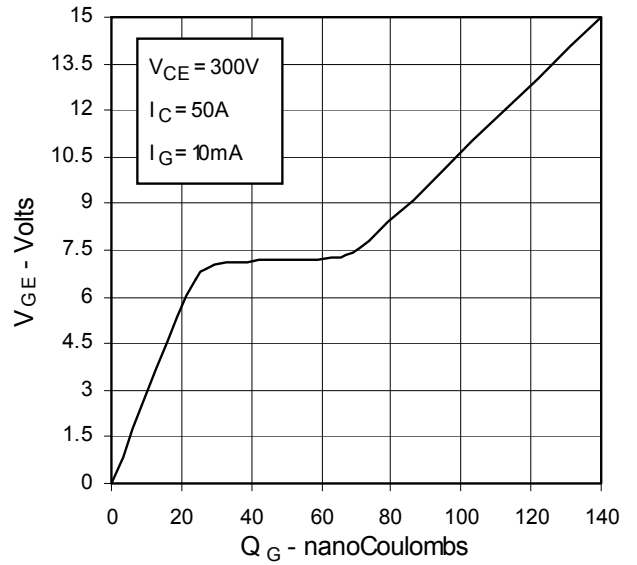


**Fig. 7. Transconductance**

**Fig. 8. Dependence of Turn-off Energy Loss on  $R_G$** 

**Fig. 9. Dependence of Turn-Off Energy Loss on  $I_C$** 

**Fig. 10. Dependence of Turn-off Energy Loss on Temperature**

**Fig. 11. Dependence of Turn-off Switching Time on  $R_G$** 

**Fig. 12. Dependence of Turn-off Switching Time on  $I_C$** 


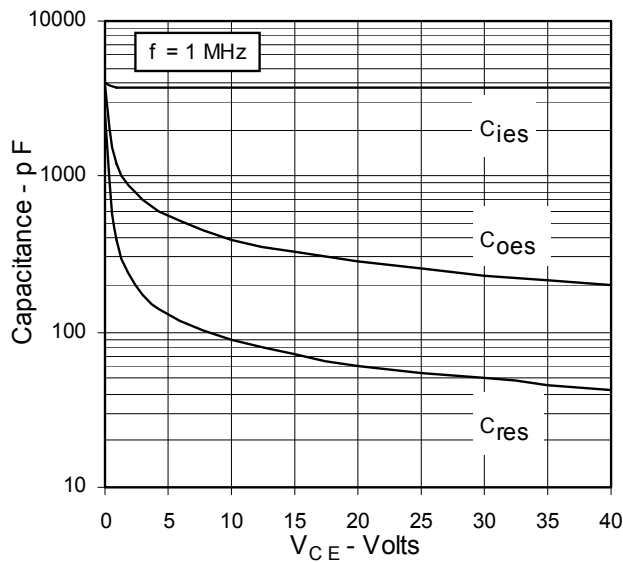
**Fig. 13. Dependence of Turn-off Switching Time on Temperature**



**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



**Fig. 16. Reverse-Bias Safe Operating Area**

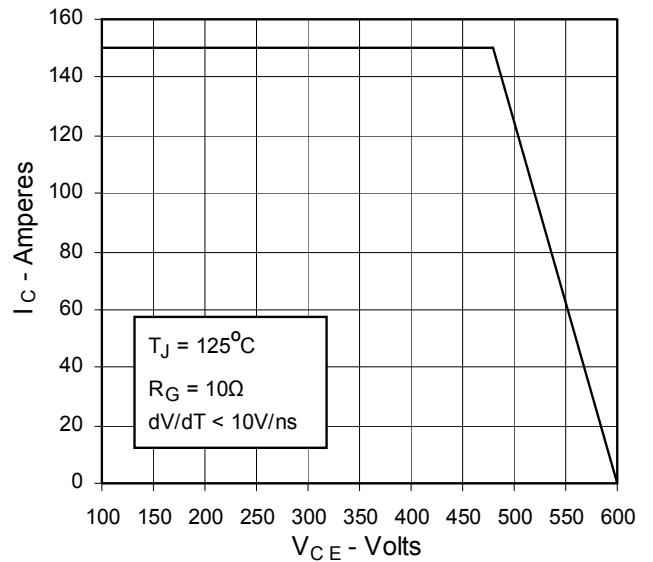


Fig. 17. Maximum Transient Thermal Resistance

