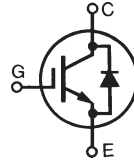


# GenX3™ 600V IGBT with Diode

## IXGR48N60C3D1

(Electrically Isolated Back Surface)

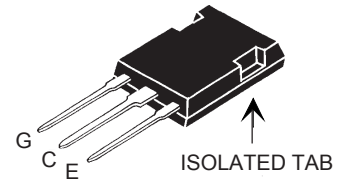
High Speed PT IGBTs for  
40-100kHz Switching



$V_{CES} = 600V$   
 $I_{C25} = 56A$   
 $V_{CE(sat)} \leq 2.7V$   
 $t_{fi(typ)} = 38ns$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ C$ to $150^\circ C$	600	V
$V_{CGR}$	$T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$	56	A
$I_{C110}$	$T_C = 110^\circ C$	26	A
$I_{D110}$	$T_C = 110^\circ C$	27	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	230	A
$I_A$	$T_C = 25^\circ C$	30	A
$E_{AS}$	$T_C = 25^\circ C$	300	mJ
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 3\Omega$ Clamped Inductive Load	$I_{CM} = 100$ @ $V_{CE} \leq 600$	A V
$P_C$	$T_C = 25^\circ C$	125	W
$T_J$		-55 ... +150	$^\circ C$
$T_{JM}$		150	$^\circ C$
$T_{stg}$		-55 ... +150	$^\circ C$
$T_L$	1.6mm (0.062 in.) from Case for 10s	300	$^\circ C$
$T_{SOLD}$	Plastic Body for 10 Seconds	260	$^\circ C$
$V_{ISOL}$	50/60 Hz RMS, $t = 1min$	2500	V~
$F_C$	Mounting Force	20..120 / 4.5..27	N/lb.
<b>Weight</b>		5	g

### ISOPLUS 247™



G = Gate      C = Collector  
E = Emitter

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
  - UL Recognized Package
  - Isolated Mounting Surface
  - 2500V Electrical Isolation
- Avalanche Rated
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- Fast Switching
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

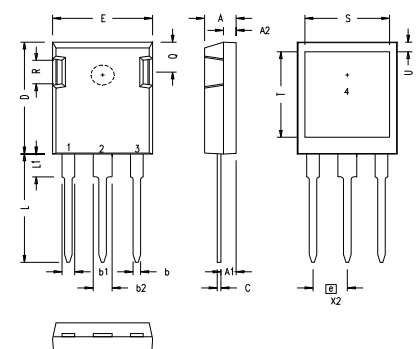
### Applications

- High Frequency Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ C$ , Unless Otherwise Specified)		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.0		5.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0V$ $T_J = 125^\circ C$			300 $\mu A$ 1.75 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 30A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$		2.3 1.8	2.7 V V

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, Unless Otherwise Specified)		
		Min.	Typ.	Max.
<b>g<sub>fs</sub></b>	I <sub>C</sub> = 30A V <sub>CE</sub> = 10V, Note 1	20	30	S
<b>C<sub>ies</sub></b>	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		1960	pF
<b>C<sub>oes</sub></b>			220	pF
<b>C<sub>res</sub></b>			66	pF
<b>Q<sub>g</sub></b>	I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V, V <sub>CE</sub> = 0.5 • V <sub>CES</sub>		77	nC
<b>Q<sub>ge</sub></b>			16	nC
<b>Q<sub>gc</sub></b>			32	nC
<b>t<sub>d(on)</sub></b>	Inductive Load, T <sub>J</sub> = 25°C I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 400V, R <sub>G</sub> = 3Ω		19	ns
<b>t<sub>ri</sub></b>			26	ns
<b>E<sub>on</sub></b>			0.41	mJ
<b>t<sub>d(off)</sub></b>			60	ns
<b>t<sub>fi</sub></b>			38	ns
<b>E<sub>off</sub></b>			0.23	0.55 mJ
<b>t<sub>d(on)</sub></b>	Inductive Load, T <sub>J</sub> = 125°C I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 400V, R <sub>G</sub> = 3Ω		19	ns
<b>t<sub>ri</sub></b>			26	ns
<b>E<sub>on</sub></b>			0.65	mJ
<b>t<sub>d(off)</sub></b>			92	ns
<b>t<sub>fi</sub></b>			95	ns
<b>E<sub>off</sub></b>			0.57	mJ
<b>R<sub>thJC</sub></b>			1.0	°C/W
<b>R<sub>thCS</sub></b>		0.15		°C/W

### ISOPLUS247 (IXGR) Outline



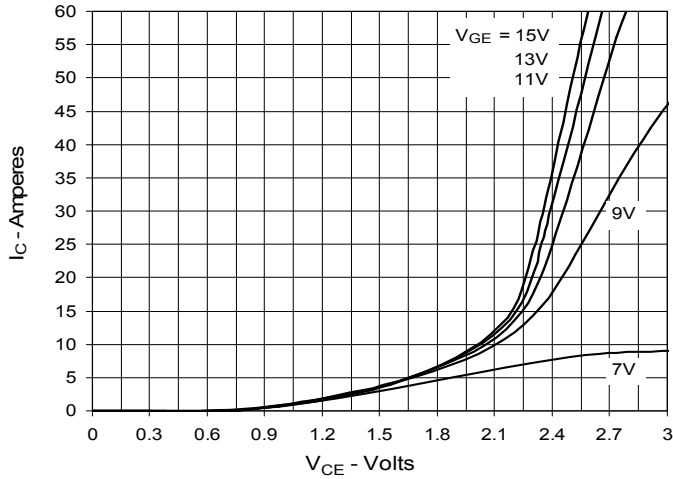
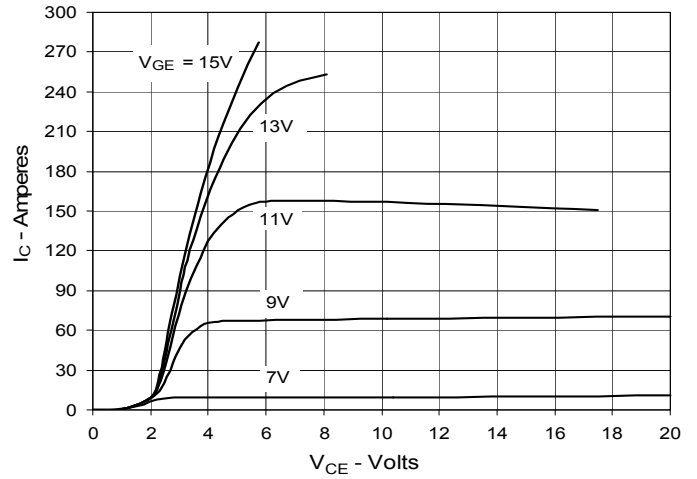
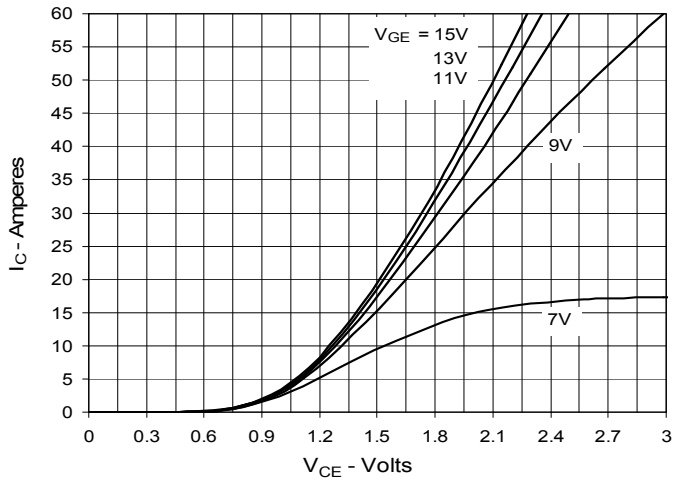
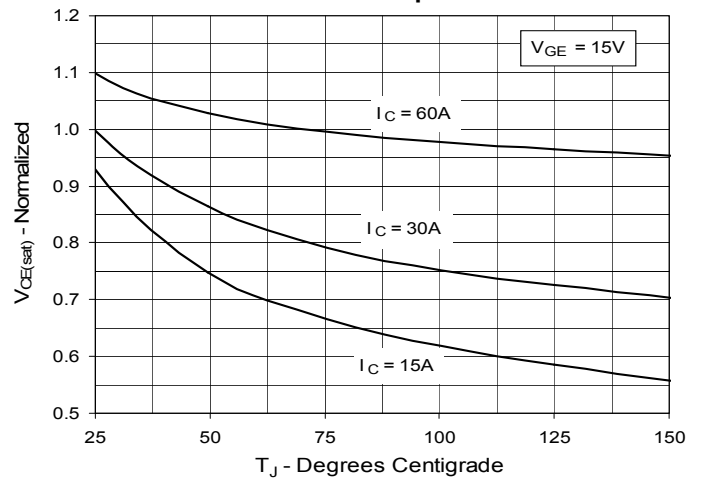
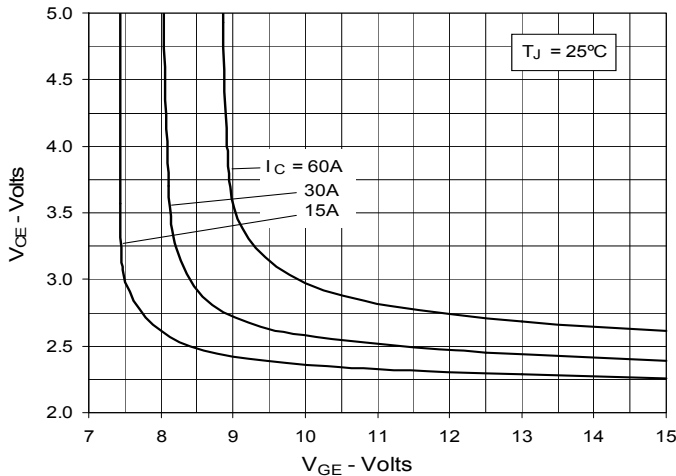
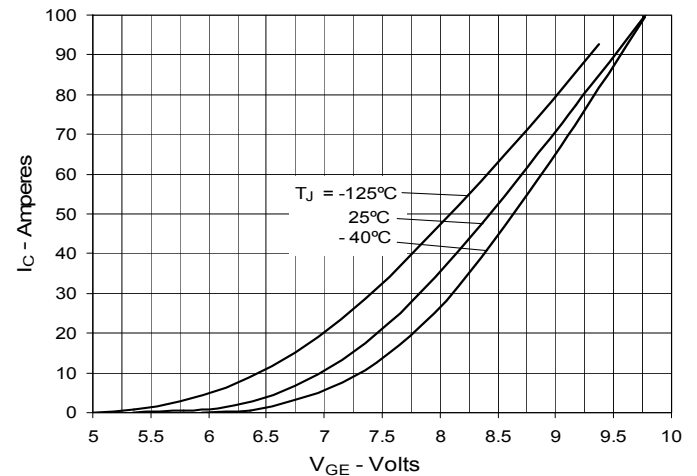
SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b1	.075	.084	1.91	2.13
b2	.115	.123	2.92	3.12
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
E	.620	.635	15.75	16.13
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1	.150	.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

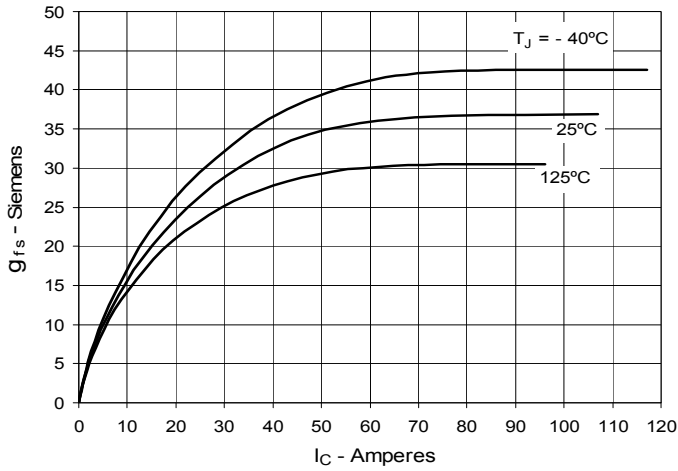
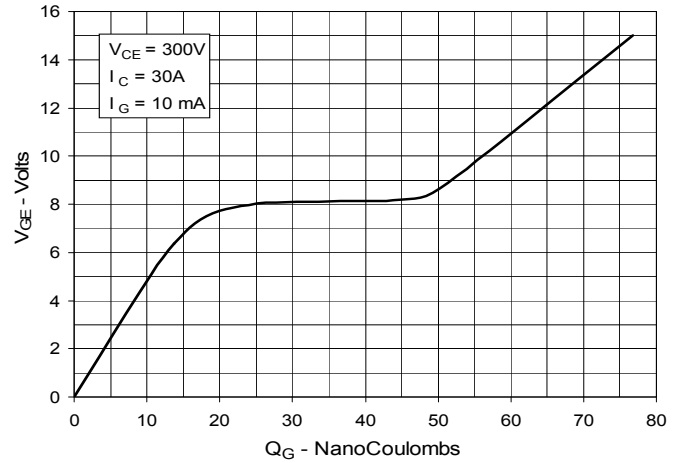
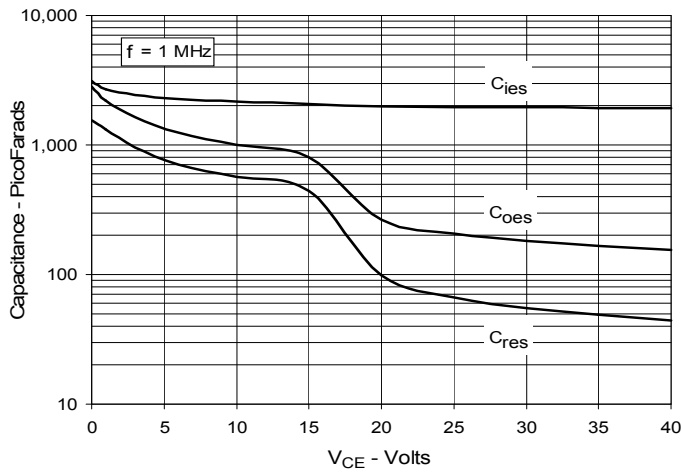
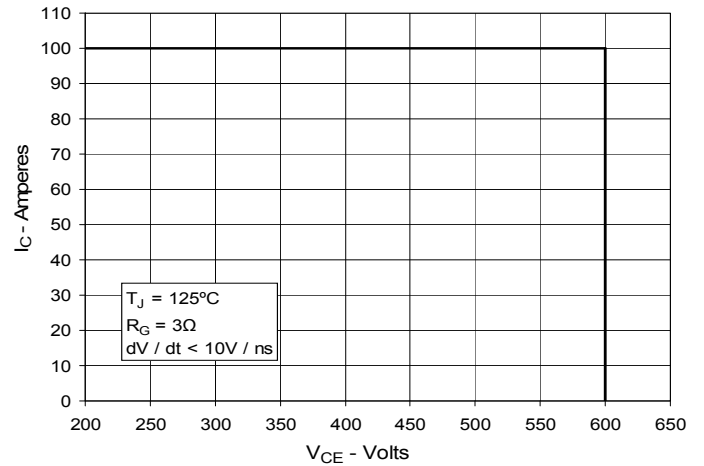
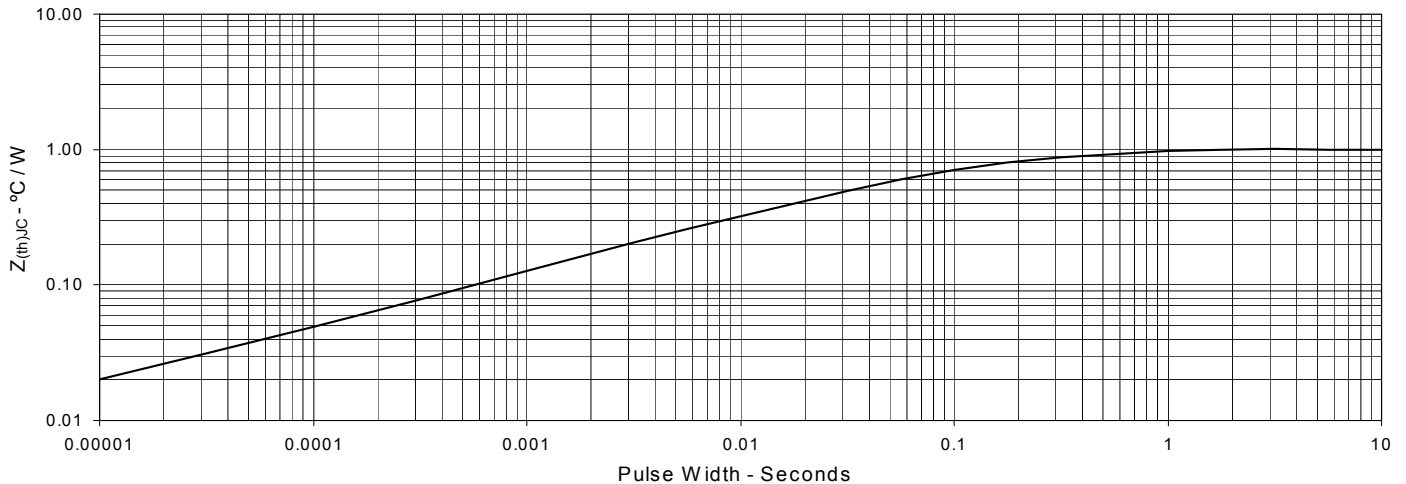
- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

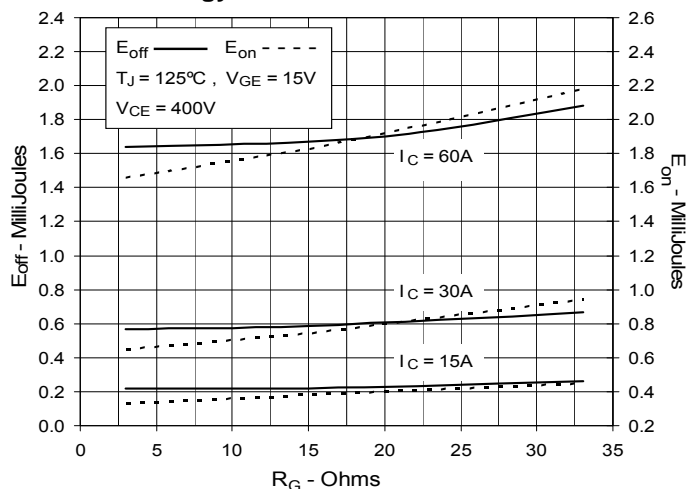
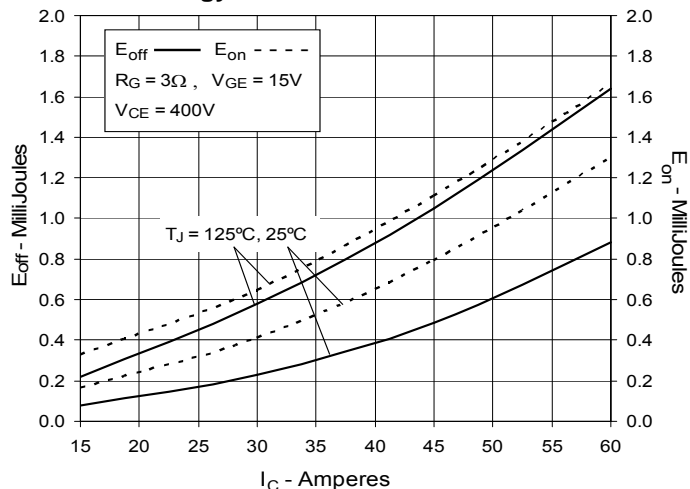
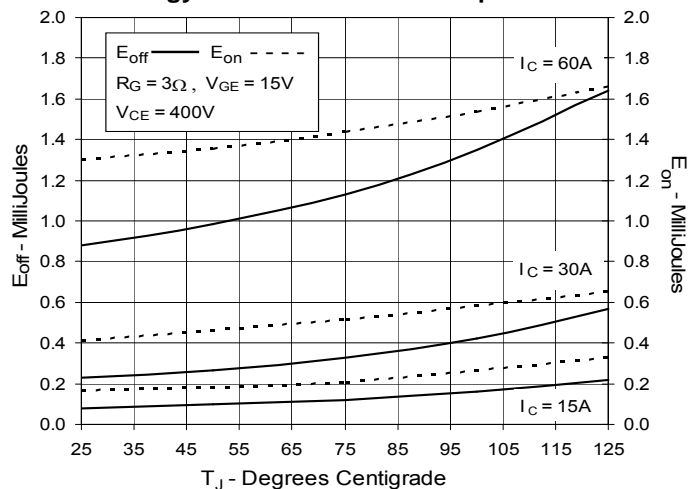
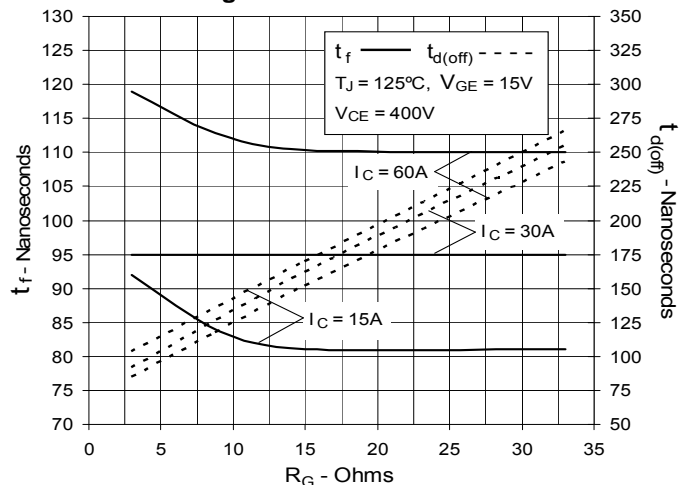
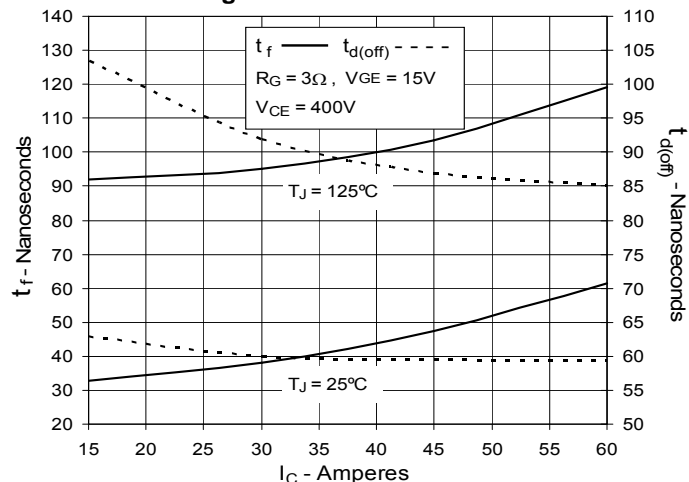
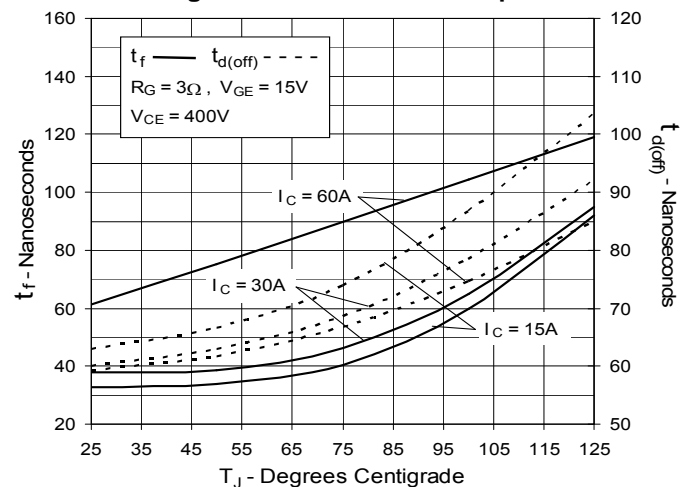
NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, Unless Otherwise Specified)		
		Min.	Typ.	Max.
<b>V<sub>F</sub></b>	I <sub>F</sub> = 30A, V <sub>GE</sub> = 0V, Note 1	T <sub>J</sub> = 25°C		2.7 V
<b>I<sub>RM</sub></b>	I <sub>F</sub> = 30A, V <sub>GE</sub> = 0V, -di <sub>F</sub> /dt = 100A/μs, V <sub>R</sub> = 100V	T <sub>J</sub> = 100°C		4 A
<b>t<sub>rr</sub></b>		T <sub>J</sub> = 100°C	100	
	I <sub>F</sub> = 1A, -di/dt = 100A/μs; V <sub>R</sub> = 30V		25	ns
<b>R<sub>thJC</sub></b>				1.5 °C/W

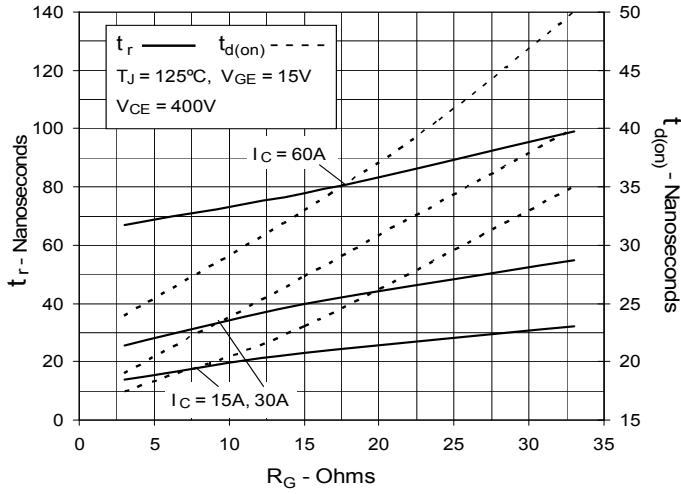
Note 1: Pulse test, t ≤ 300μs, Duty cycle, d ≤ 2 %.

**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  
Junction Temperature**

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

**Fig. 6. Input Admittance**


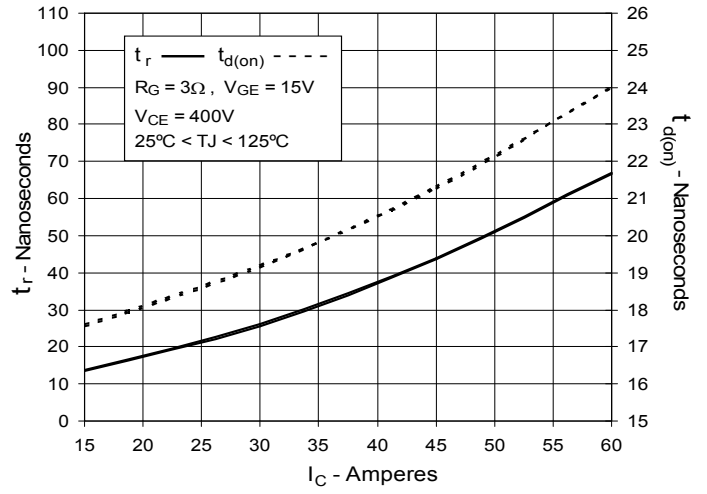
**Fig. 7. Transconductance**

**Fig. 8. Gate Charge**

**Fig. 9. Capacitance**

**Fig. 10. Reverse-Bias Safe Operating Area**

**Fig. 11. Maximum Transient Thermal Impedance**


**Fig. 12. Inductive Switching  
Energy Loss vs. Gate Resistance**

**Fig. 13. Inductive Switching  
Energy Loss vs. Collector Current**

**Fig. 14. Inductive Switching  
Energy Loss vs. Junction Temperature**

**Fig. 15. Inductive Turn-off  
Switching Times vs. Gate Resistance**

**Fig. 16. Inductive Turn-off  
Switching Times vs. Collector Current**

**Fig. 17. Inductive Turn-off  
Switching Times vs. Junction Temperature**


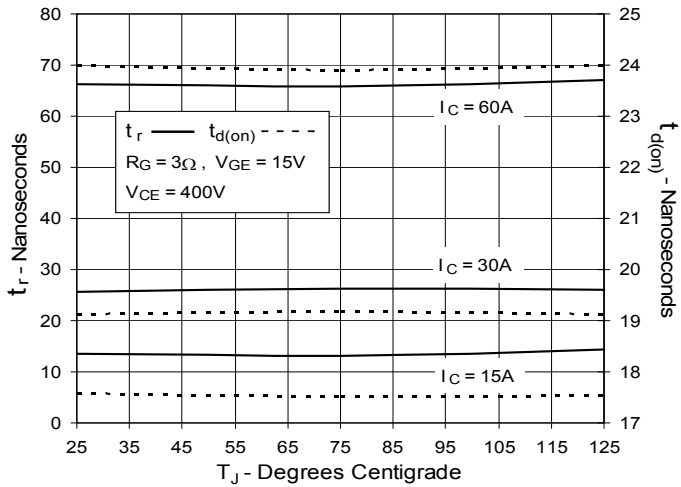
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**



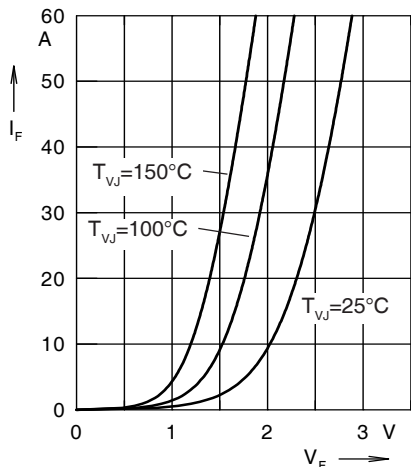


Fig. 21. Forward current  $I_F$  versus  $V_F$

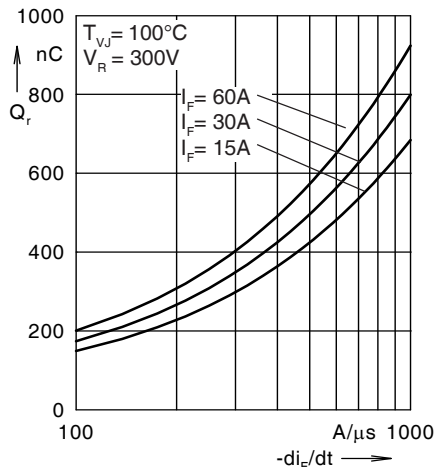


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

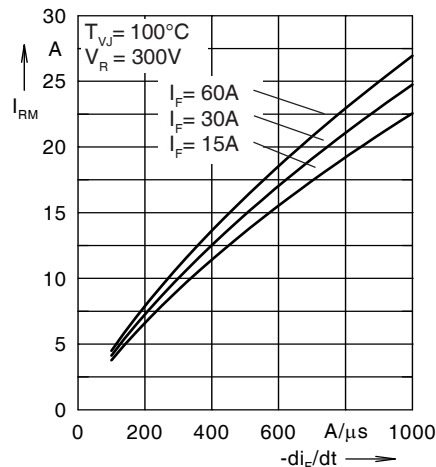


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

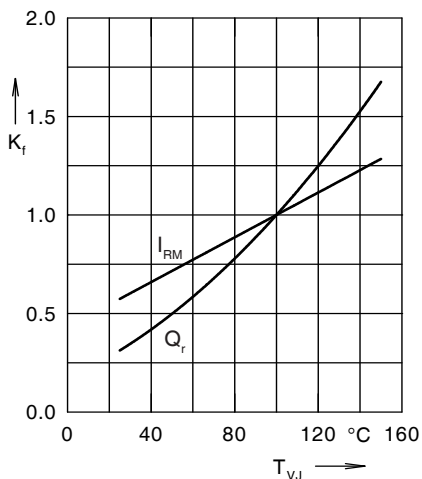


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

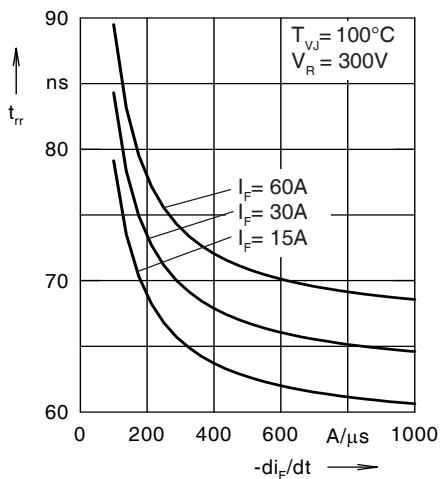


Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$

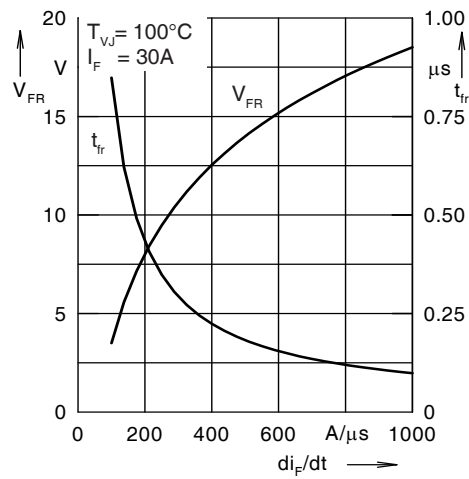


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{fr}$  versus  $di_F/dt$

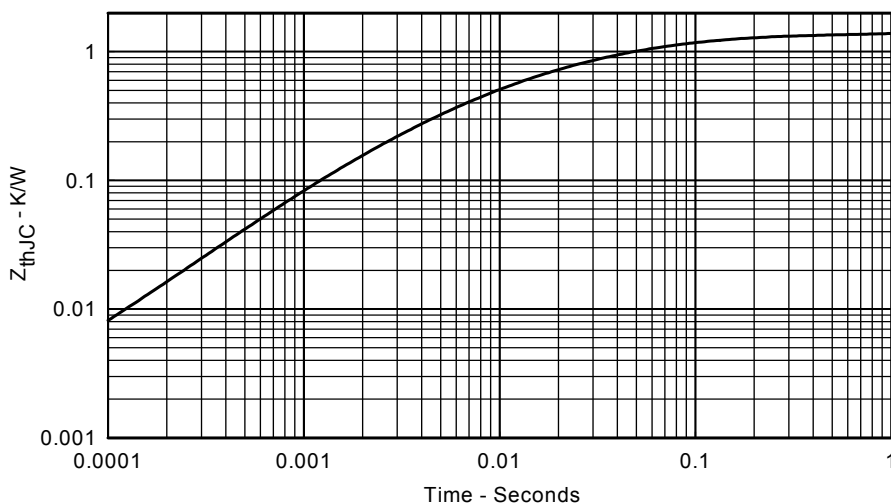


Fig. 27. Transient thermal resistance junction to case