

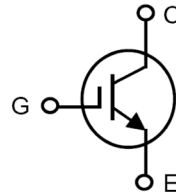


# GenX3™ 600V IGBT

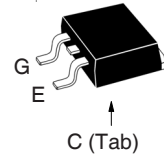
**IXGA36N60A3**  
**IXGP36N60A3**  
**IXGH36N60A3**

**V<sub>CES</sub> = 600V**  
**I<sub>C110</sub> = 36A**  
**V<sub>CE(sat)</sub> ≤ 1.4V**

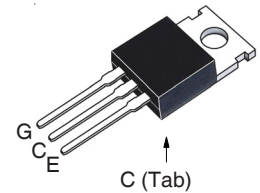
Ultra Low V<sub>sat</sub> PT IGBT for up to 5kHz Switching



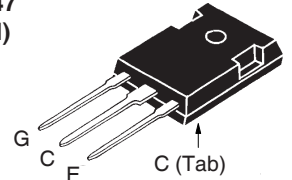
**TO-263 (IXGA)**



**TO-220 (IXGP)**



**TO-247 (IXGH)**



G = Gate      C = Collector  
 E = Emitter    Tab = Collector

Symbol	Test Conditions	Maximum Ratings	
V <sub>CES</sub>	T <sub>C</sub> = 25°C to 150°C	600	V
V <sub>CGR</sub>	T <sub>J</sub> = 25°C to 150°C, R <sub>GE</sub> = 1MΩ	600	V
V <sub>GES</sub>	Continuous	± 20	V
V <sub>GEM</sub>	Transient	± 30	V
I <sub>C25</sub>	T <sub>C</sub> = 25°C	96	A
I <sub>C110</sub>	T <sub>C</sub> = 110°C	36	A
I <sub>CM</sub>	T <sub>C</sub> = 25°C, 1ms	200	A
<b>SSOA</b> <b>(RBSOA)</b>	V <sub>GE</sub> = 15V, T <sub>VJ</sub> = 125°C, R <sub>G</sub> = 5Ω Clamped Inductive Load	I <sub>CM</sub> = 60 V <sub>CE</sub> ≤ V <sub>CES</sub>	A
P <sub>C</sub>	T <sub>C</sub> = 25°C	220	W
T <sub>J</sub>		-55 ... +150	°C
T <sub>JM</sub>		150	°C
T <sub>stg</sub>		-55 ... +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering	300	°C
T <sub>SOLD</sub>	1.6 mm (0.062in.) from Case for 10s	260	°C
F <sub>C</sub> M <sub>d</sub>	Mounting Force (TO-263) Mounting Torque (TO-220 & TO-247)	10..65 / 2.2..14.6 1.13 / 10	N/lb Nm/lb.in
<b>Weight</b>	TO-263 TO-220 TO-247	2.5 3.0 6.0	g g g

### Features

- Optimized for Low Conduction Losses
- Square RBSOA
- International Standard Packages

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- Inrush Current Protection Circuits

Symbol	Test Conditions (T <sub>J</sub> = 25°C, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
BV <sub>CES</sub>	I <sub>C</sub> = 250μA, V <sub>GE</sub> = 0V	600		V
V <sub>GE(th)</sub>	I <sub>C</sub> = 250μA, V <sub>CE</sub> = V <sub>GE</sub>	3.0		V
I <sub>CES</sub>	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V T <sub>J</sub> = 125°C			25 μA 250 μA
I <sub>GES</sub>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V			±100 nA
V <sub>CE(sat)</sub>	I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V, Note 1			1.4 V

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 30\text{A}, V_{CE} = 10\text{V}$ , Note 1	25	42	S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		2380	pF
$C_{oes}$			115	pF
$C_{res}$			30	pF
$Q_g$	$I_C = 30\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		80	nC
$Q_{ge}$			12	nC
$Q_{gc}$			36	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 5\Omega$ Note 2		18	ns
$t_{ri}$			23	ns
$E_{on}$			0.74	mJ
$t_{d(off)}$			330	ns
$t_{fi}$			325	ns
$E_{off}$			3.00	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 5\Omega$ Note 2		18	ns
$t_{ri}$			25	ns
$E_{on}$			1.50	mJ
$t_{d(off)}$			500	ns
$t_{fi}$			500	ns
$E_{off}$			5.30	mJ
$R_{thJC}$			0.56	$^\circ\text{C/W}$
$R_{thCS}$	TO-220	0.50		$^\circ\text{C/W}$
	TO-247	0.21		$^\circ\text{C/W}$

**Notes:**

1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

**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	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
4,860,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	6,771,478 B2	7,071,537	

Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$

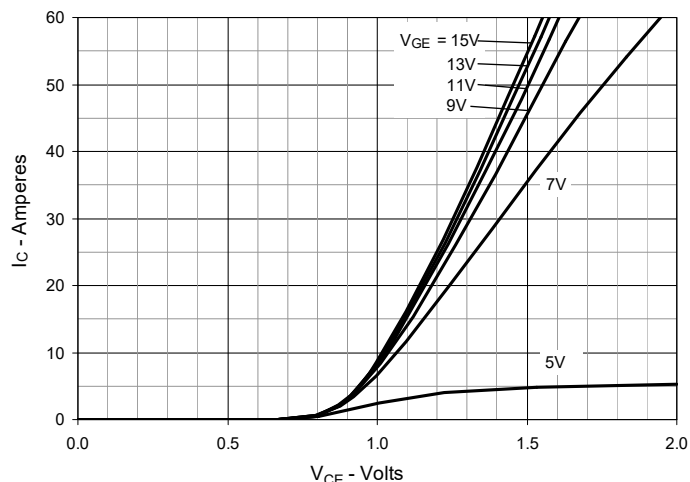


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

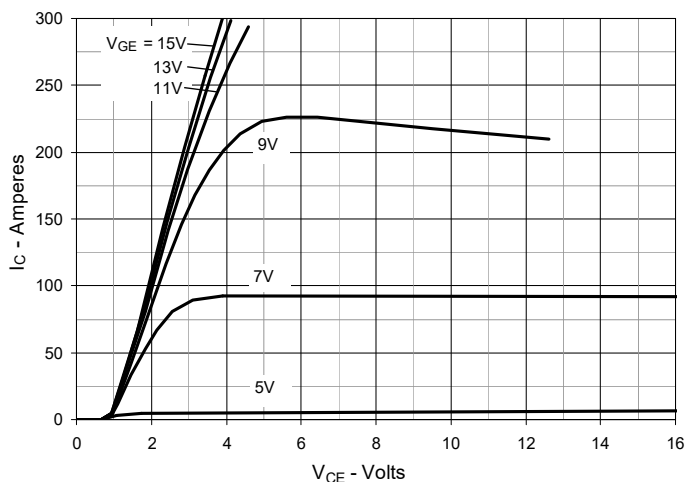


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

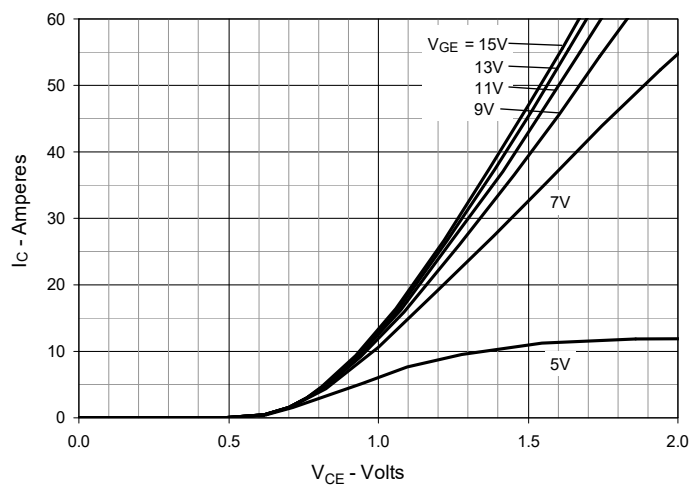


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

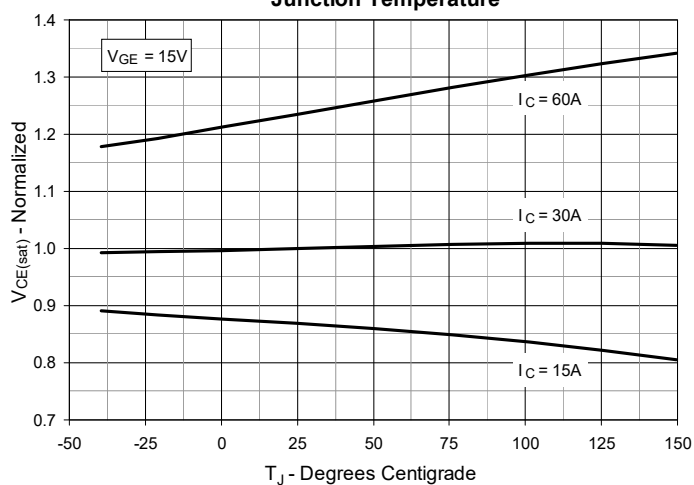


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

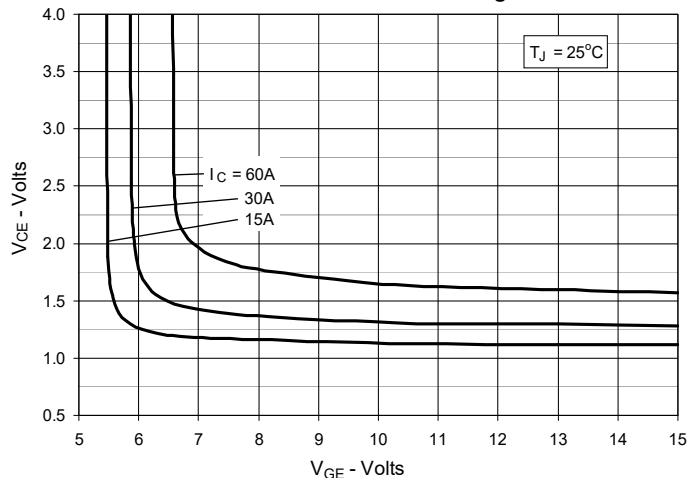


Fig. 6. Input Admittance

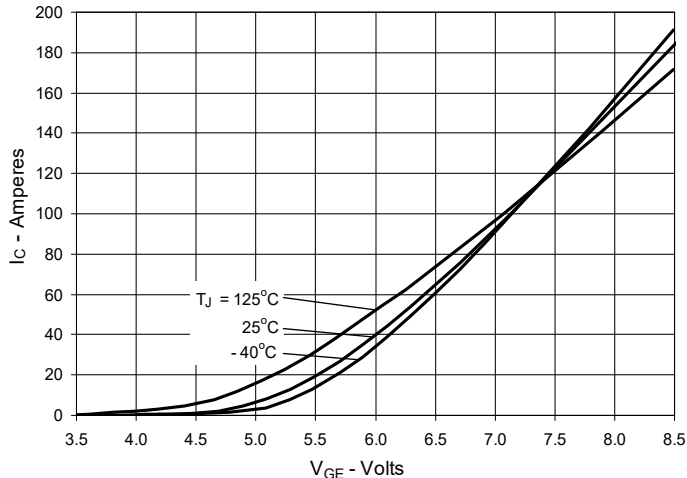


Fig. 7. Transconductance

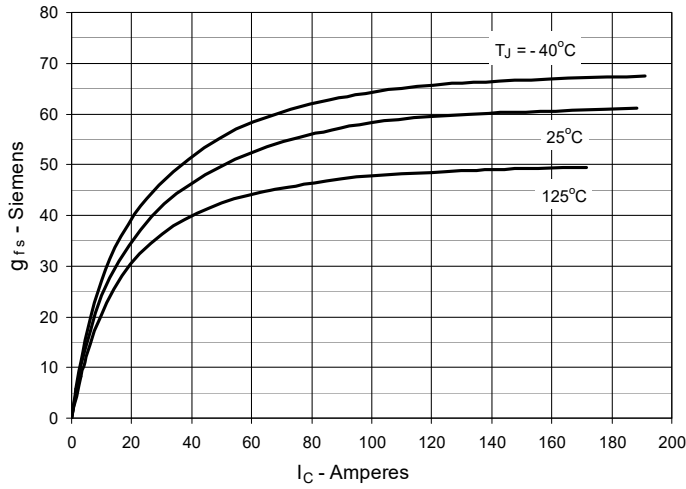


Fig. 8. Gate Charge

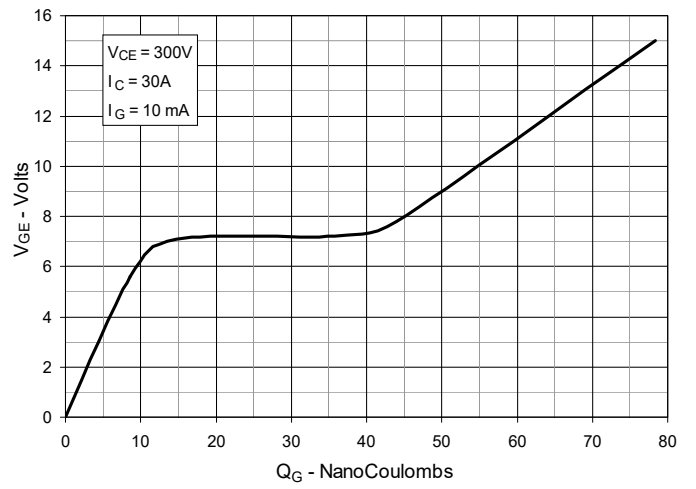


Fig. 9. Reverse-Bias Safe Operating Area

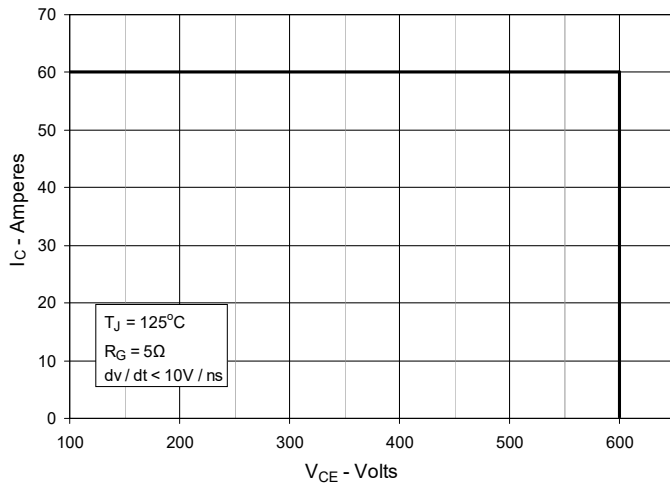


Fig. 10. Capacitance

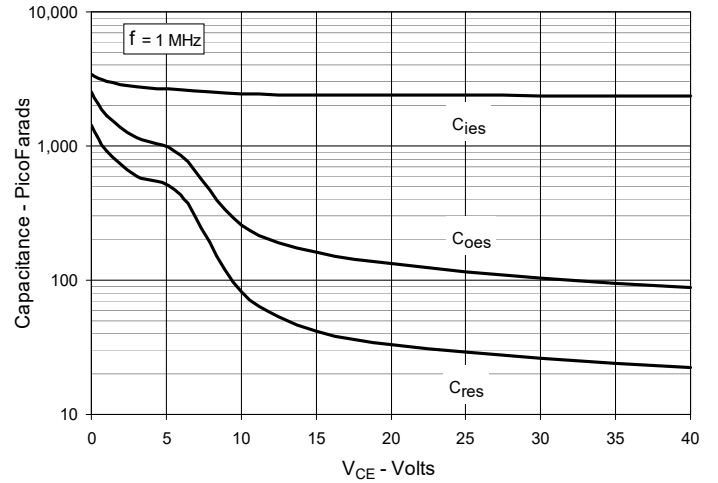
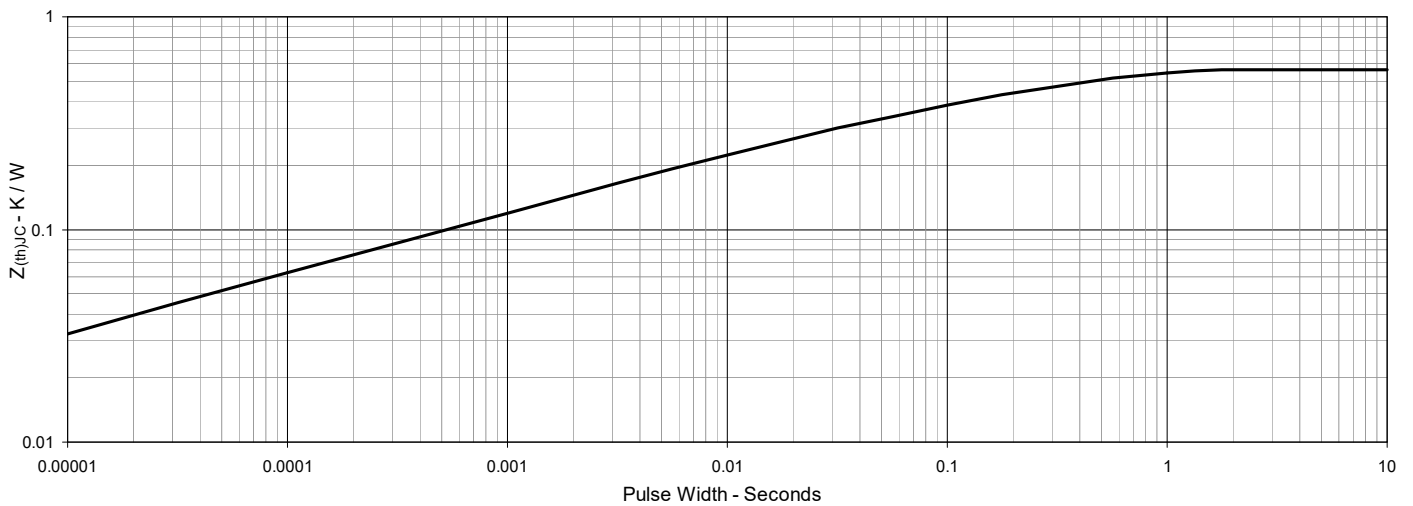
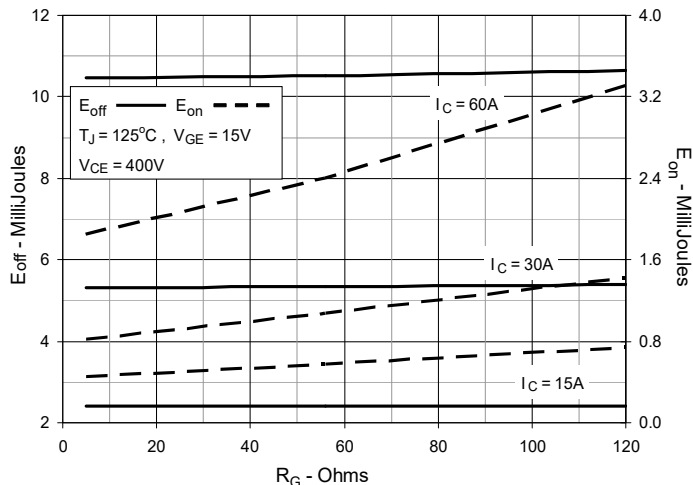


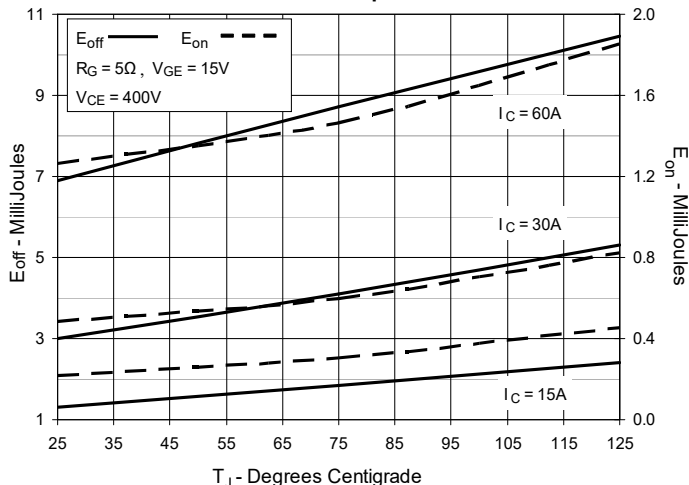
Fig. 11. Maximum Transient Thermal Impedance



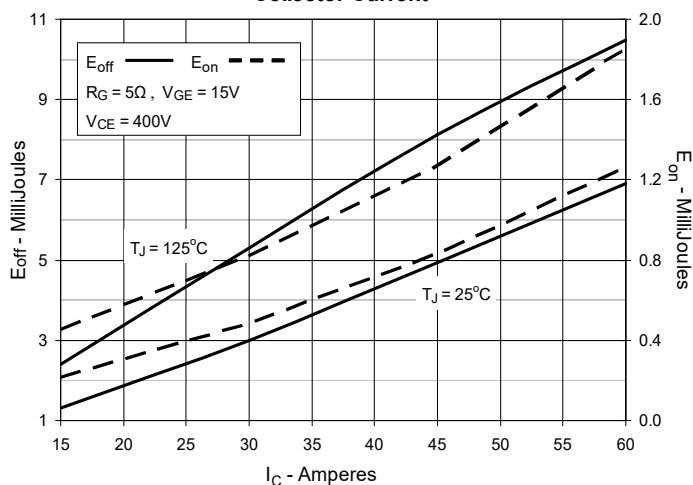
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



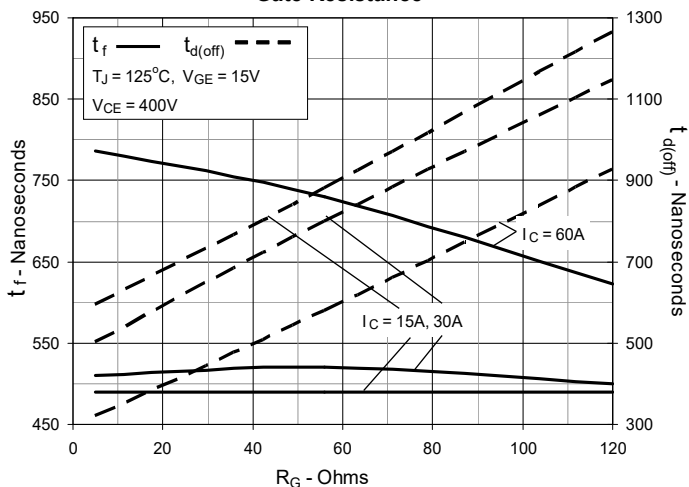
**Fig. 13. Inductive Switching Energy Loss vs. Junction Temperature**



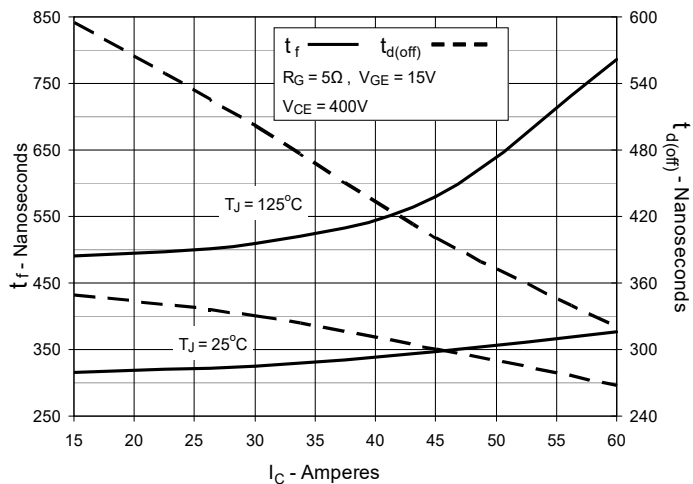
**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**



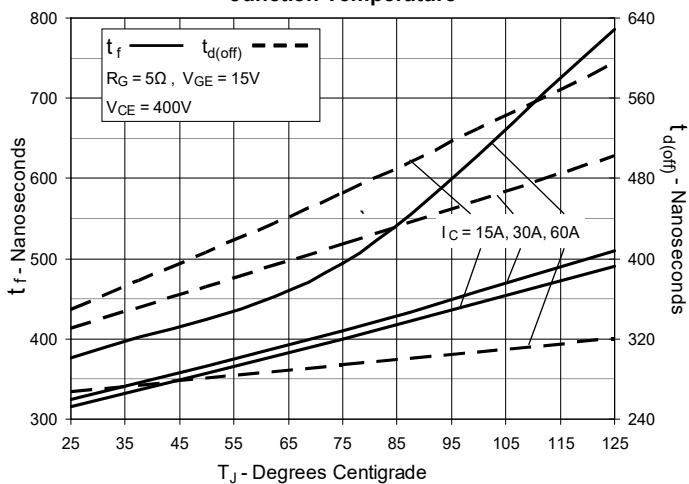
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



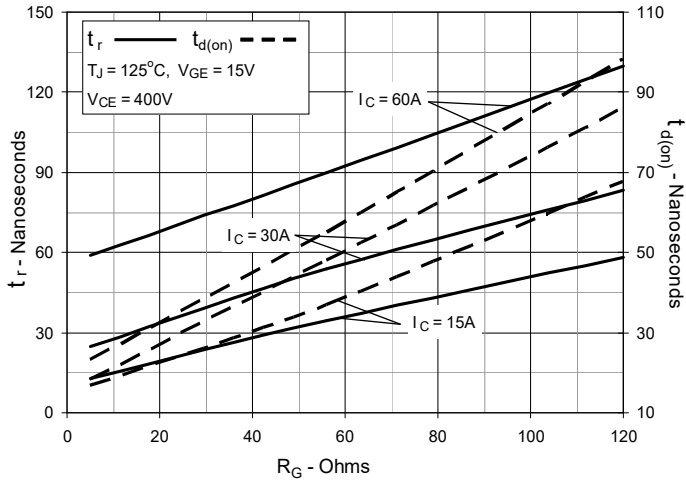
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



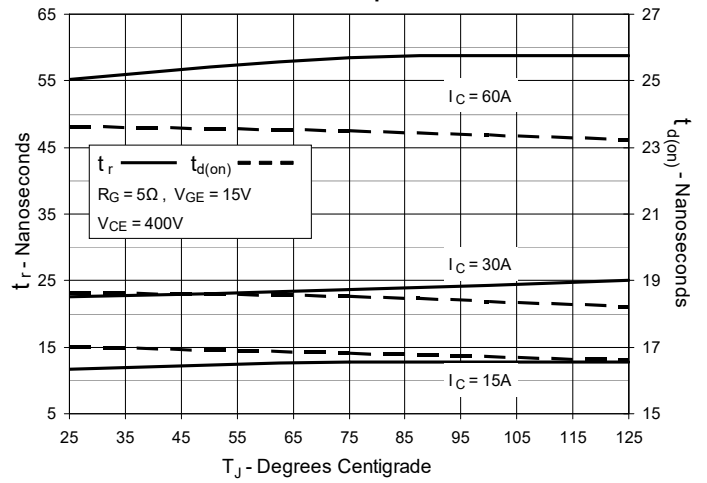
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



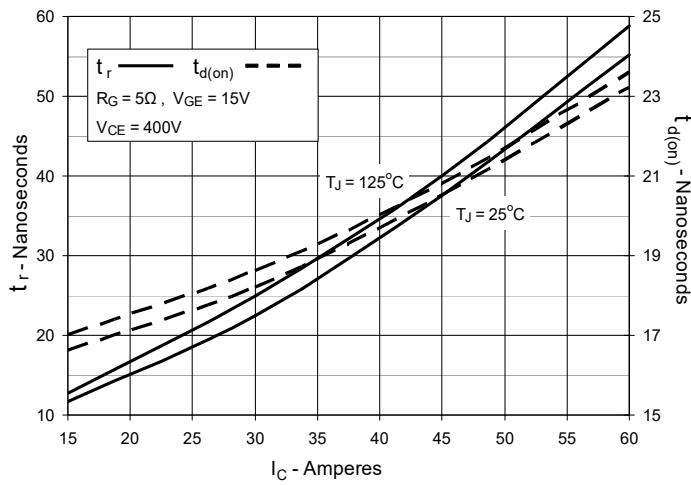
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



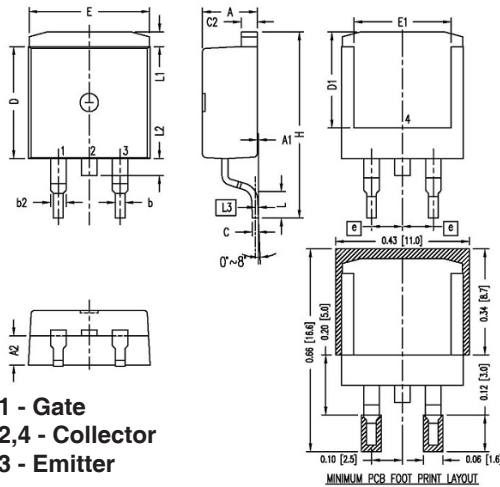
**Fig. 19. Inductive Turn-on Switching Times vs. Junction Temperature**



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



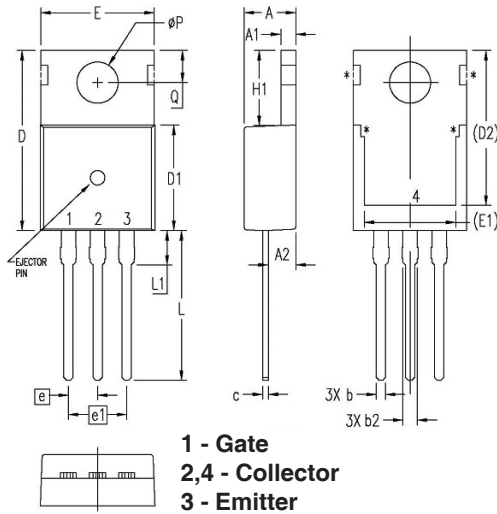
### TO-263 Outline



SYM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	.170	.185	4.30	4.70
A1	.000	.008	0.00	0.20
A2	.091	.098	2.30	2.50
b	.028	.035	0.70	0.90
b2	.046	.060	1.18	1.52
C	.018	.024	0.45	0.60
C2	.049	.060	1.25	1.52
D	.340	.370	8.63	9.40
D1	.300	.327	7.62	8.30
E	.380	.410	9.65	10.41
E1	.270	.330	6.86	8.38
e	.100 BSC		2.54 BSC	
H	.580	.620	14.73	15.75
L	.075	.105	1.91	2.67
L1	.039	.060	1.00	1.52
L2	—	.070	—	1.77
L3	.010 BSC		0.254 BSC	

- NOTE:
- This drawing meets all dimensions requirement of JEDEC outlines TO-263AB.
  - All metal surface are matte pure tin plated except trimmed area.
  - L3 is Gauge plane to measure L.
  - These dimension do not include mold flash and they will not exceed 0.005[0.13] per side.

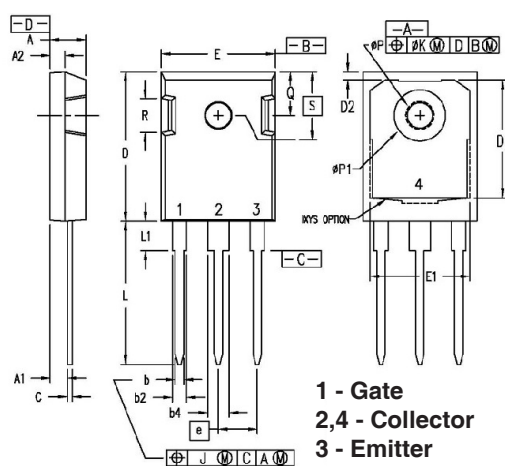
### TO-220 Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.169	.185	4.30	4.70
A1	.047	.055	1.20	1.40
A2	.079	.106	2.00	2.70
b	.024	.039	0.60	1.00
b2	.045	.057	1.15	1.45
c	.014	.026	0.35	0.65
D	.587	.626	14.90	15.90
D1	.335	.370	8.50	9.40
(D2)	.500	.531	12.70	13.50
E	.382	.406	9.70	10.30
(E1)	.283	.323	7.20	8.20
e	.100 BSC		2.54 BSC	
e1	.200 BSC		5.08 BSC	
H1	.244	.268	6.20	6.80
L	.492	.547	12.50	13.90
L1	.110	.154	2.80	3.90
L1	.134	.150	3.40	3.80
Q	.106	.126	2.70	3.20

- NOTE:
- These dimensions do not include mold protrusion.
  - Metal finish - Matte pure tin plating except trim area.
  - Pin call out: 1 - GATE 2 - DRAIN (COLLECTOR for IGBT) 3 - SOURCE (EMITTER for IGBT) 4 - DRAIN (Connected with #2 internally)
  - Ejector pin location & diameter will vary depending on packaging suppliers.
  - \* marked area will vary depending on packaging suppliers.

### TO-247 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
b2	.075	.087	1.91	2.20
b4	.115	.126	2.92	3.20
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
D1	.650	.690	16.51	17.53
D2	.035	.050	0.89	1.27
E	.620	.635	15.75	16.13
E1	.545	.565	13.84	14.35
e	.215 BSC		5.45 BSC	
J	—	.010	—	0.25
K	—	.025	—	0.64
L	.780	.810	19.81	20.57
L1	.150	.170	3.81	4.32
ØP	.140	.144	3.55	3.65
ØP1	.275	.290	6.99	7.37
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.242 BSC		6.15 BSC	

- NOTE: This drawing will meet all dimensions requirement of JEDEC outlines TO-247 AD (R-PSIP-F3)



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