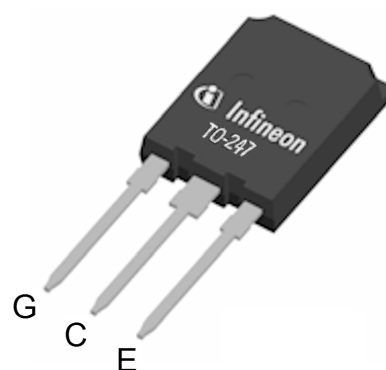
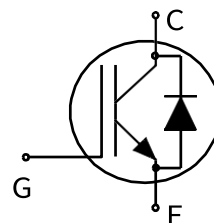


英飞凌TRENCHSTOP™ 系列

低损耗 DuoPack：采用 TRENCHSTOP™ 和 Fieldstop 技术的 IGBT，搭配软、快速恢复反并联发射极控制二极管

特性：

- 符合汽车级 AEC-Q101 标准
- 专为汽车应用的直流/交流转换器而设计
- 极低 $V_{CE(sat)}$ 1.5V (典型值)
- 最高结温 175°C
- 经过动态压力测试
- 短路耐受时间 5 μ s
- 100% 短路测试
- 100% 的器件都经过动态测试
- $V_{CE(sat)}$ 正温度系数
- 低电磁干扰
- 低栅极电荷 Q_g
- 绿色封装
- 非常软、快速恢复的反并联发射极控制 HE 二极管
- 适用于 600V 应用的 TRENCHSTOP™ 和 Fieldstop 技术提供：
 - 参数分布紧密
 - 高稳健性、温度稳定性
 - 非常高的开关速度



应用：

- 主逆变器
- 空调压缩机
- PTC 加热器
- 电机驱动



关键性能和封装参数

Type	V_{CE}	I_C	$V_{CE(sat)}$ $T_{vj}=25^\circ\text{C}$	T_{vjmax}	Marking	Package
AIKQ120N60CT	600V	120A	1.5V	175°C	AK120DCT	PG-TO247-3-46

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最大额定值

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	600	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 135^{\circ}\text{C}$	I_C	160.0 120.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	480.0	A
Turn off safe operating area $V_{CE} \leq 600\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$	-	480.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 124^{\circ}\text{C}$	I_F	160.0 120.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	480.0	A
Gate-emitter voltage	V_{GE}	± 20	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 400\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	t_{SC}	5	μs
Power dissipation $T_c = 25^{\circ}\text{C}$	P_{tot}	833.0	W
Operating junction temperature	T_{vj}	$-40 \dots +175$	$^{\circ}\text{C}$
Storage temperature	T_{stg}	$-55 \dots +150$	$^{\circ}\text{C}$
Soldering temperature, ¹⁾ wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$

热阻抗

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

 R_{th} 特性

IGBT thermal resistance, ²⁾ junction - case	$R_{th(j-c)}$		-	-	0.18	K/W
Diode thermal resistance, ²⁾ junction - case	$R_{th(j-c)}$		-	-	0.30	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

¹⁾封装不推荐用于表面贴装应用²⁾热阻抗 $R_{th(c-s)}$ (外壳到散热器) 大于0.1K/W的导热硅脂不包括在内。

TRENCHSTOP™ 系列

除非另有规定，电气特性均测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下。

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
静态特性						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.20mA$	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE}=15.0V, I_C=120.0A$ $T_{vj}=25^{\circ}C$ $T_{vj}=175^{\circ}C$	- -	1.50 1.90	2.00 -	V
Diode forward voltage	V_F	$V_{GE}=0V, I_F=120.0A$ $T_{vj}=25^{\circ}C$ $T_{vj}=175^{\circ}C$	- -	1.65 1.60	2.05 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=1.90mA, V_{CE}=V_{GE}$	4.1	4.9	5.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE}=600V, V_{GE}=0V$ $T_{vj}=25^{\circ}C$ $T_{vj}=175^{\circ}C$	- -	- 3000	40 -	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=120.0A$	-	75.0	-	S
Integrated gate resistor	r_G			none		Ω

电气特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下，除非另有说明

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
动态特性						
Input capacitance	C_{ies}	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	-	7530	-	pF
Output capacitance	C_{oes}		-	446	-	
Reverse transfer capacitance	C_{res}		-	206	-	
Gate charge	Q_G	$V_{CC} = 480V, I_C = 120.0A,$ $V_{GE} = 15V$	-	772.0	-	nC
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0s$	$I_{C(SC)}$	$V_{GE} = 15.0V, V_{CC} \leq 400V,$ $t_{sc} \leq 5\mu s$ $T_{vj} = 150^{\circ}C$	-	846	-	A

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT 特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 120.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 3.0\Omega, R_{G(off)} = 3.0\Omega,$ $L\sigma = 63\text{nH}, C\sigma = 31\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	33	-	ns
Rise time	t_r		-	43	-	ns
Turn-off delay time	$t_{d(off)}$		-	310	-	ns
Fall time	t_f		-	33	-	ns
Turn-on energy	E_{on}		-	4.10	-	mJ
Turn-off energy	E_{off}		-	2.80	-	mJ
Total switching energy	E_{ts}		-	6.90	-	mJ

TRENCHSTOP™ 系列

二极管特性, $T_{vj} = 25^{\circ}\text{C}$

Diode reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}\text{C}, V_R = 400\text{V}, I_F = 120.0\text{A}, di_F/dt = 1100\text{A}/\mu\text{s}$	-	280	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.50	-	μC
Diode peak reverse recovery current	I_{rrm}		-	25.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-500	-	$\text{A}/\mu\text{s}$

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT 特性, 测于 $T_{vj} = 175^{\circ}\text{C}$ 的条件

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C}, V_{CC} = 400\text{V}, I_C = 120.0\text{A}, V_{GE} = 0.0/15.0\text{V}, R_{G(on)} = 3.0\Omega, R_{G(off)} = 3.0\Omega, L\sigma = 63\text{nH}, C\sigma = 31\text{pF}, L\sigma, C\sigma \text{ from Fig. E}$ Energy losses include "tail" and diode reverse recovery.	-	33	-	ns
Rise time	t_r		-	51	-	ns
Turn-off delay time	$t_{d(off)}$		-	355	-	ns
Fall time	t_f		-	43	-	ns
Turn-on energy	E_{on}		-	6.70	-	mJ
Turn-off energy	E_{off}		-	4.10	-	mJ
Total switching energy	E_{ts}		-	10.80	-	mJ

二极管特性, 测于 $T_{vj} = 175^{\circ}\text{C}$ 的条件下

Diode reverse recovery time	t_{rr}	$T_{vj} = 175^{\circ}\text{C}, V_R = 400\text{V}, I_F = 120.0\text{A}, di_F/dt = 1000\text{A}/\mu\text{s}$	-	410	-	ns
Diode reverse recovery charge	Q_{rr}		-	10.80	-	μC
Diode peak reverse recovery current	I_{rrm}		-	45.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-520	-	$\text{A}/\mu\text{s}$

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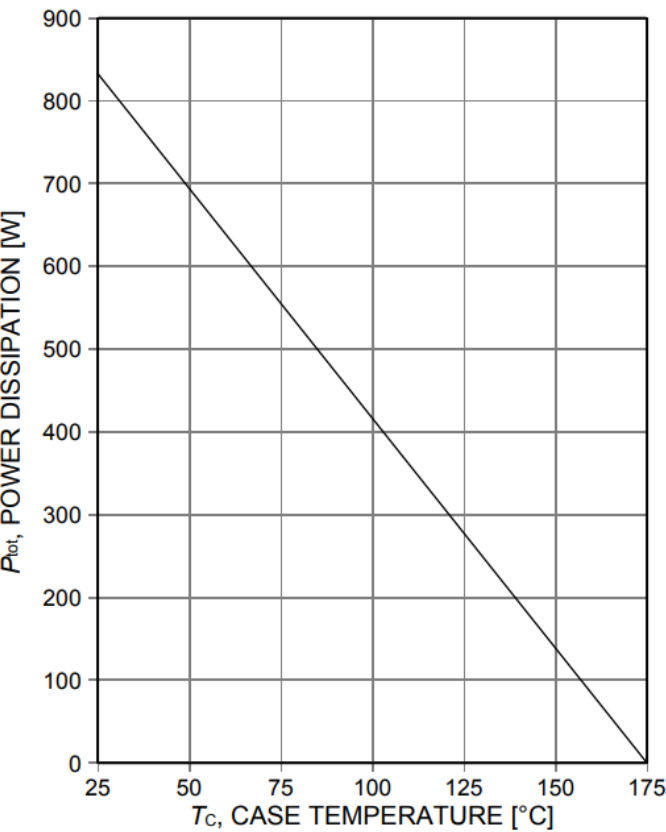


Figure 1. Power dissipation as a function of case temperature ($T_J \leq 175^\circ\text{C}$)

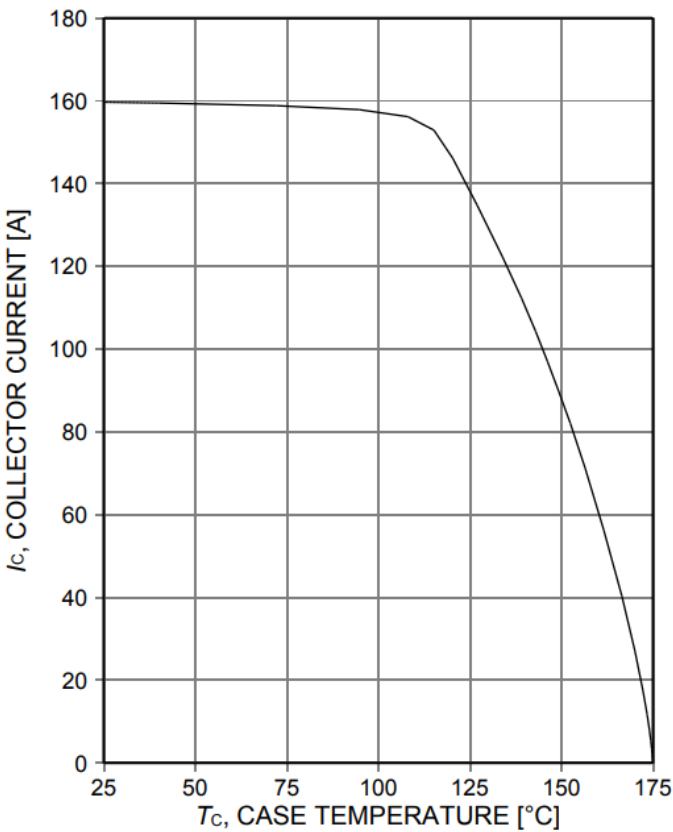


Figure 2. Collector current as a function of case temperature ($V_{GE} \geq 15\text{V}$, $T_J \leq 175^\circ\text{C}$)

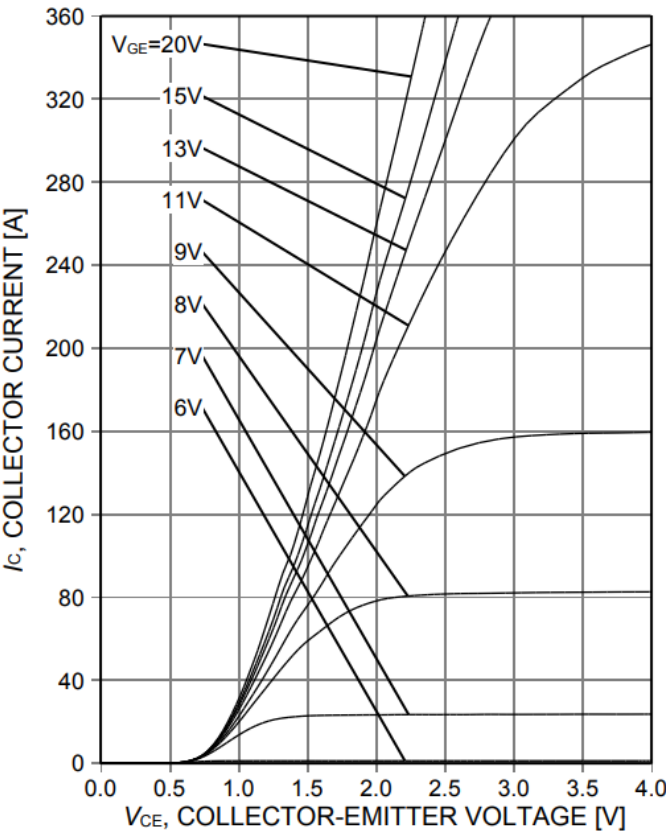


Figure 3. Typical output characteristic ($T_J = 25^\circ\text{C}$)

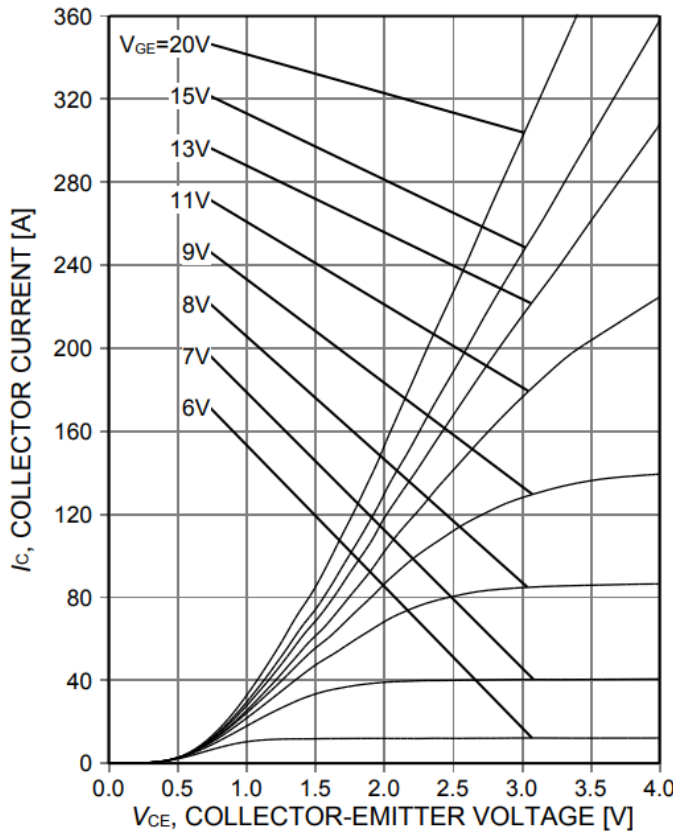


Figure 4. Typical output characteristic ($T_J = 175^\circ\text{C}$)

TRENCHSTOP™ 系列

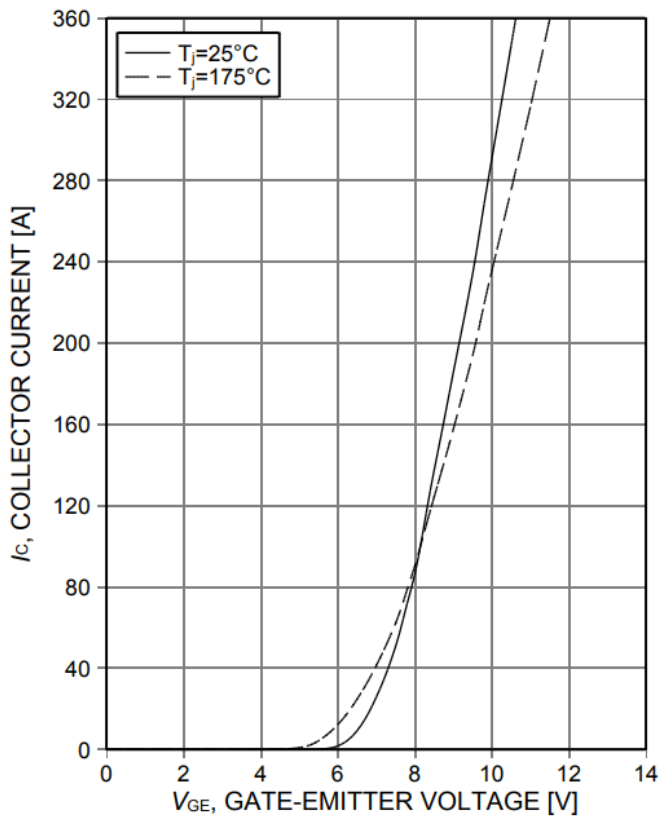


Figure 5. **Typical transfer characteristic**
($V_{CE}=20V$)

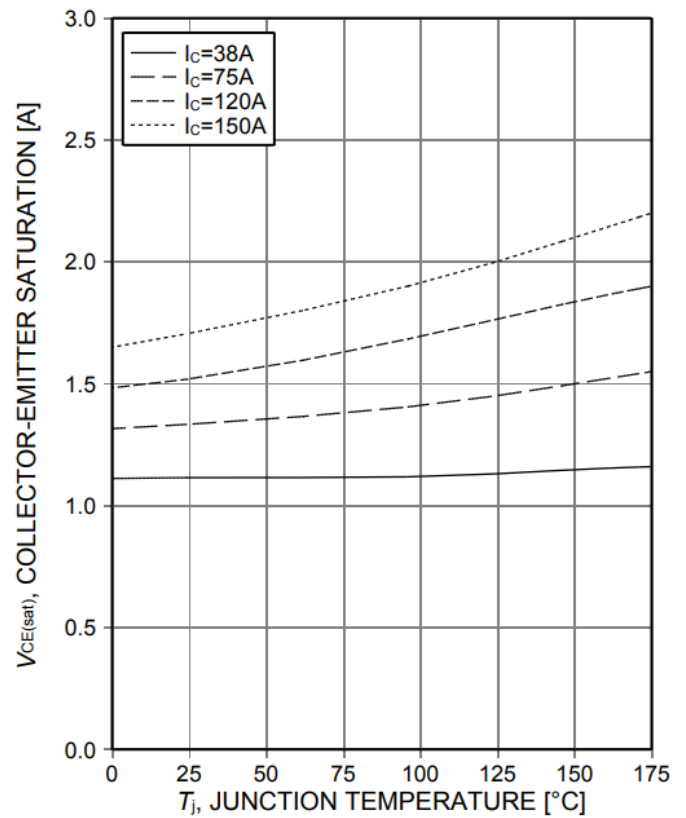


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15V$)

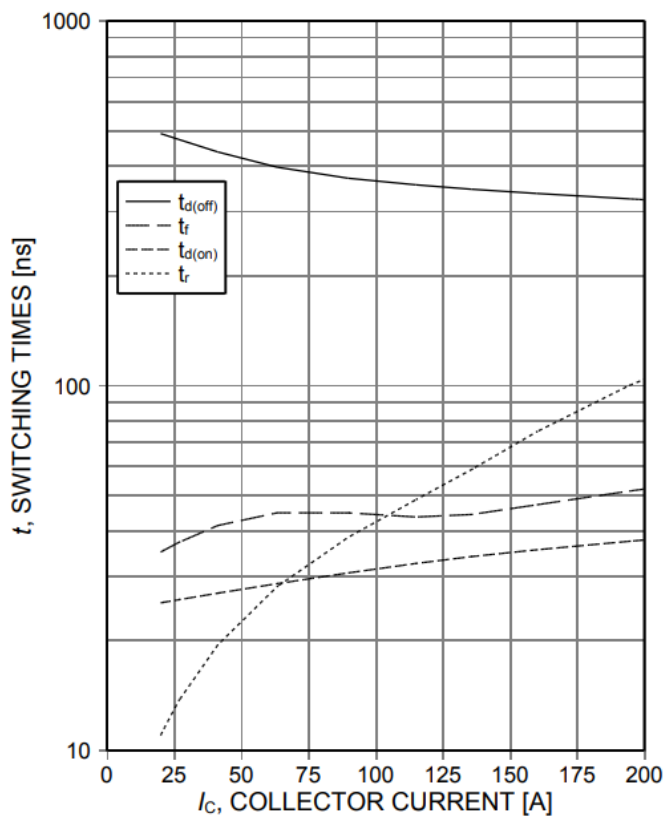


Figure 7. **Typical switching times as a function of collector current**
(inductive load, $T_J=175^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $r_G=3\Omega$, Dynamic test circuit in Figure E)

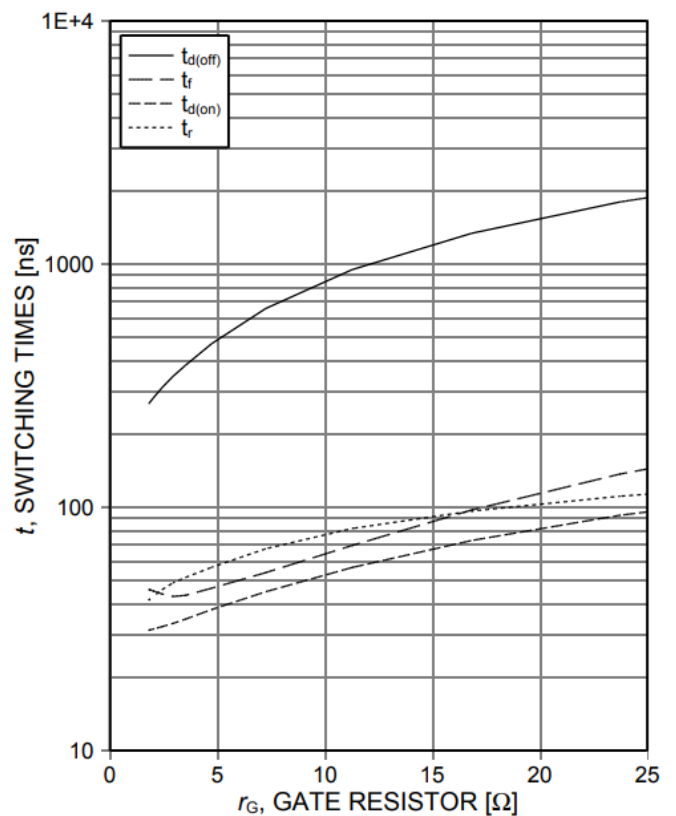


Figure 8. **Typical switching times as a function of gate resistor**
(inductive load, $T_J=175^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=120A$, Dynamic test circuit in Figure E)

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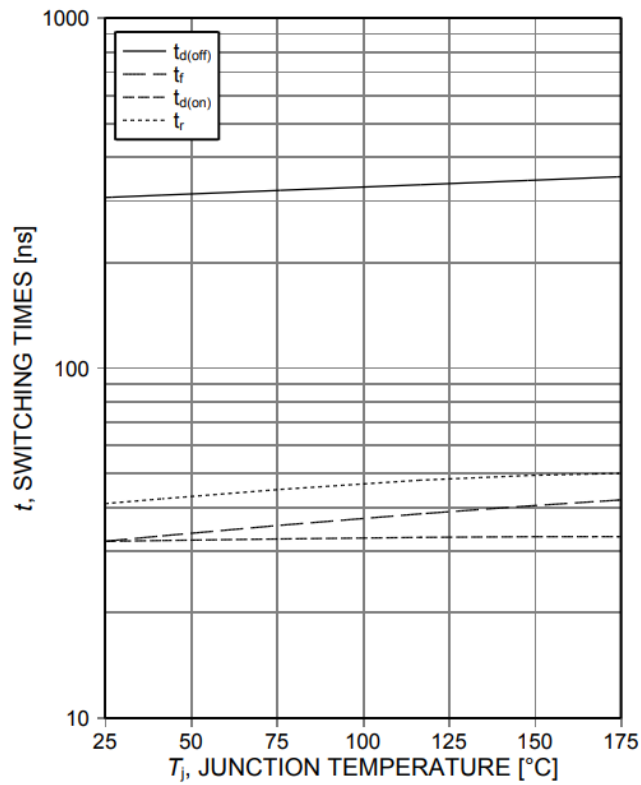


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=120A$, $r_G=3\Omega$, Dynamic test circuit in Figure E)

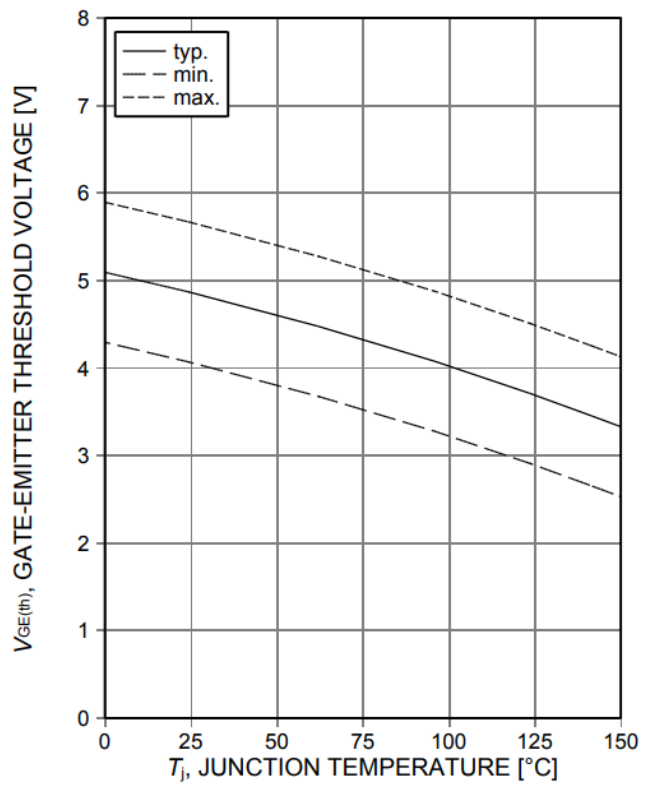


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=1,9mA$)

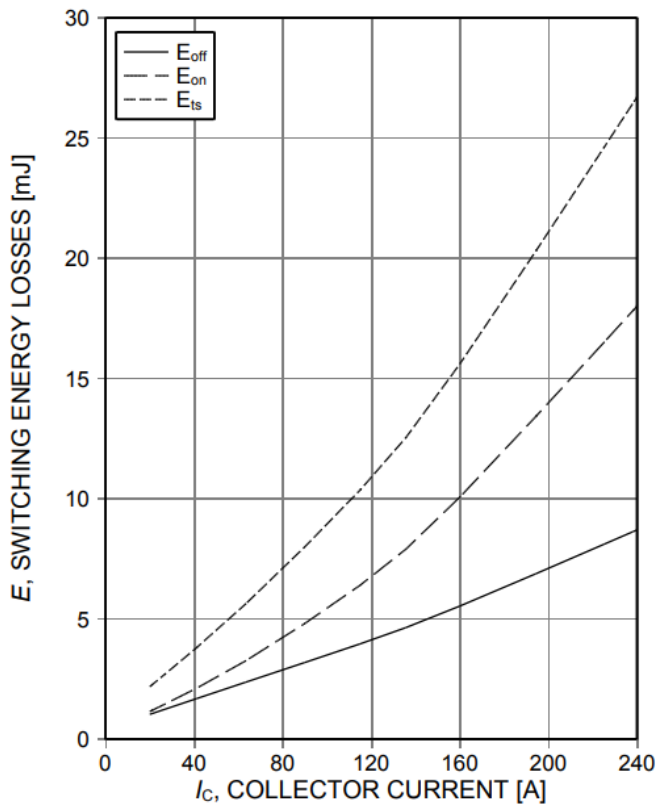


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, $T_j=175^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $r_G=3\Omega$, Dynamic test circuit in Figure E)

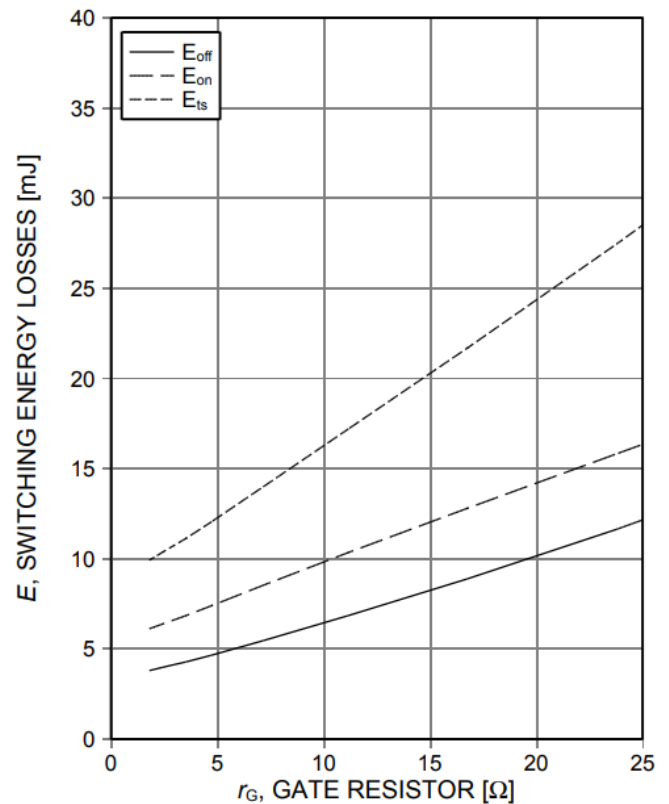


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, $T_j=175^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=120A$, Dynamic test circuit in Figure E)

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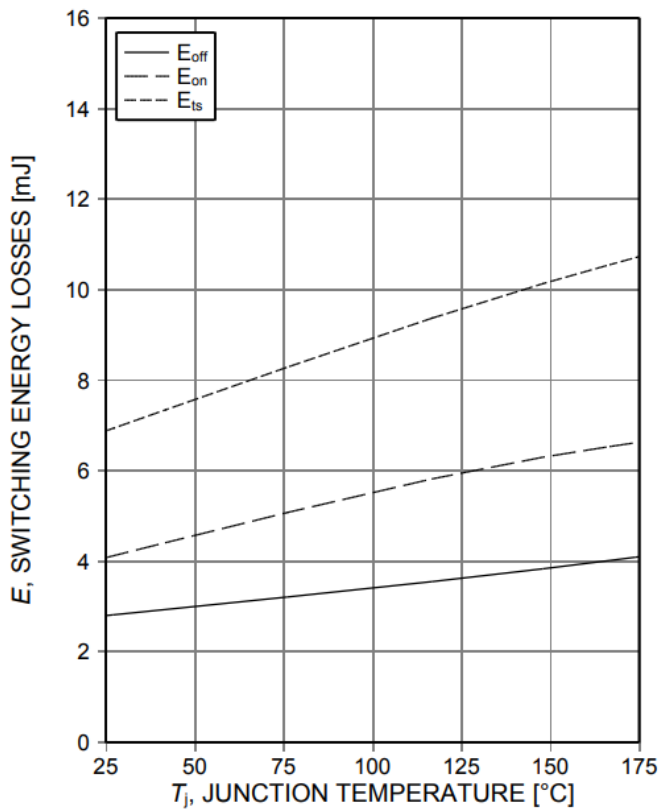


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=120A$, $r_G=3\Omega$, Dynamic test circuit in Figure E)

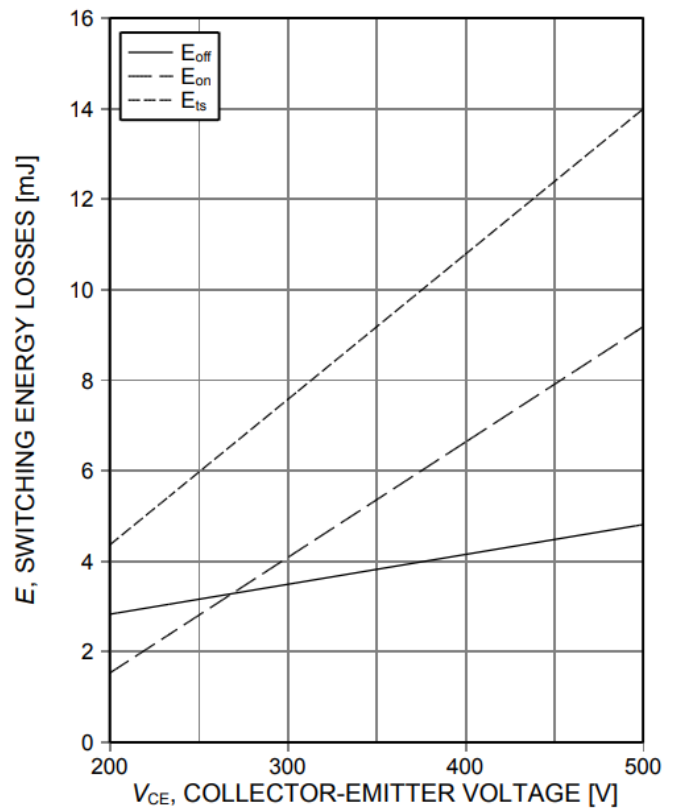


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_j=175^\circ C$, $V_{GE}=15/0V$, $I_C=120A$, $R_G=3\Omega$, Dynamic test circuit in Figure E)

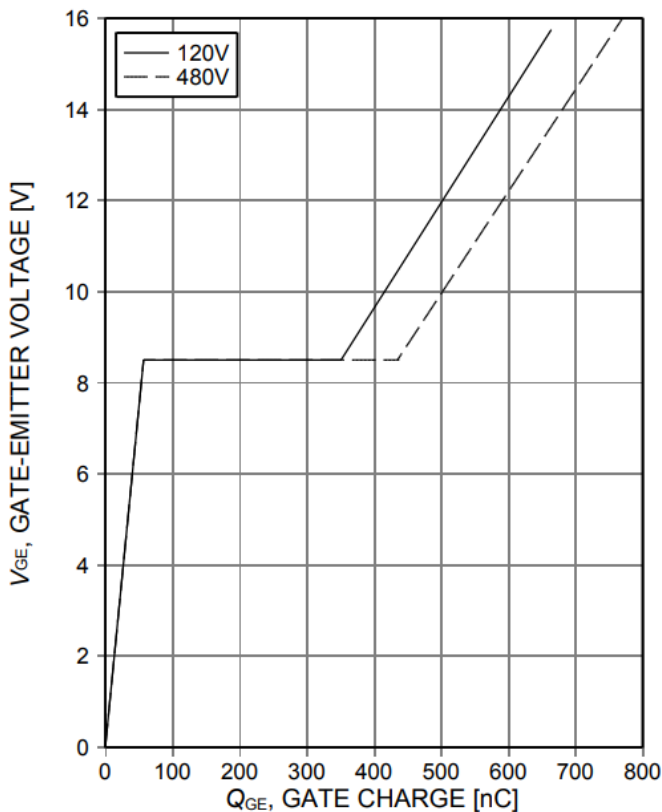


Figure 15. **Typical gate charge**
($I_C=120A$)

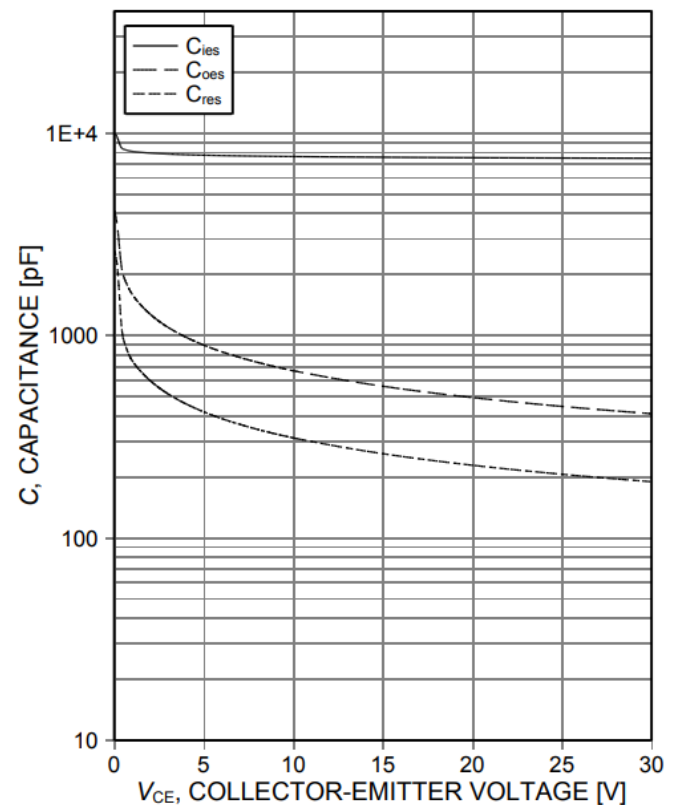


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

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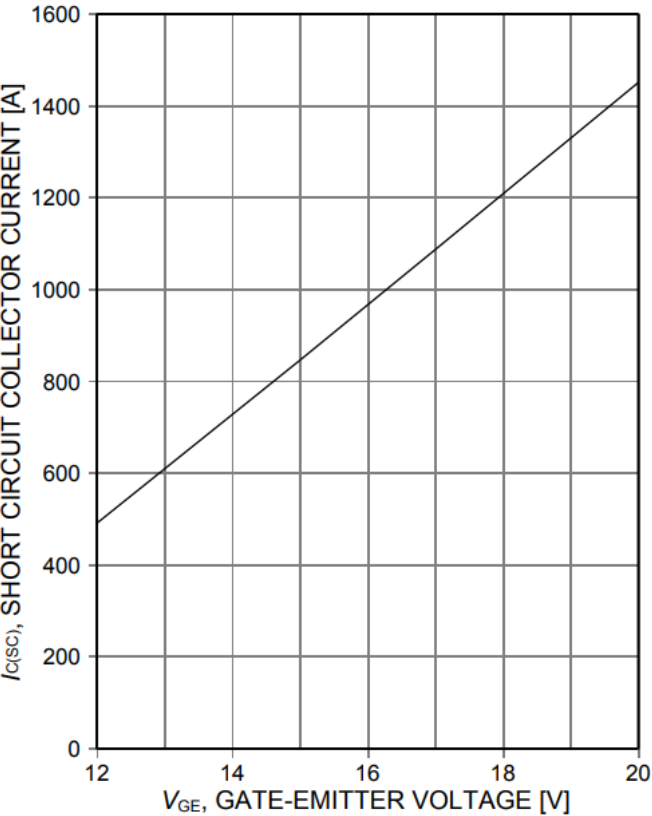


Figure 17. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq 400V$, start at $T_J \leq 150^{\circ}C$)

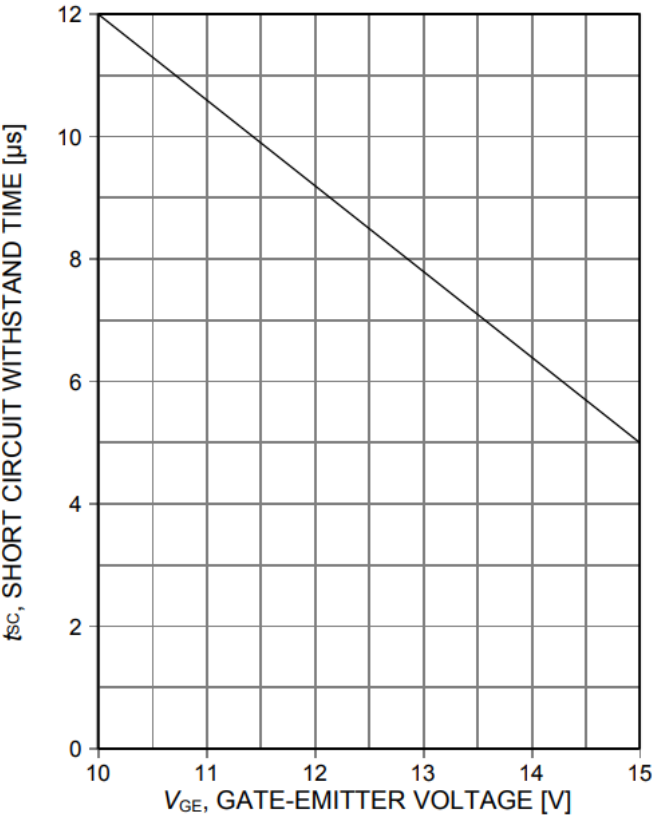


Figure 18. Short circuit withstand time as a function of gate-emitter voltage
($V_{CE} = 400V$, start at $T_J = 25^{\circ}C$, $T_{J,max} \leq 150^{\circ}C$)

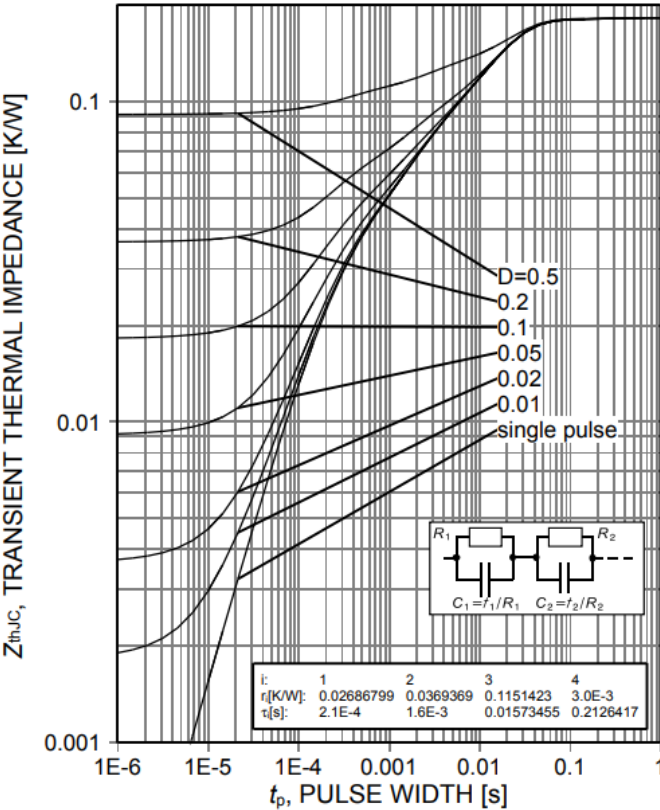


Figure 19. IGBT transient thermal impedance as a function of pulse width for different duty cycles D
($D = t_p/T$)

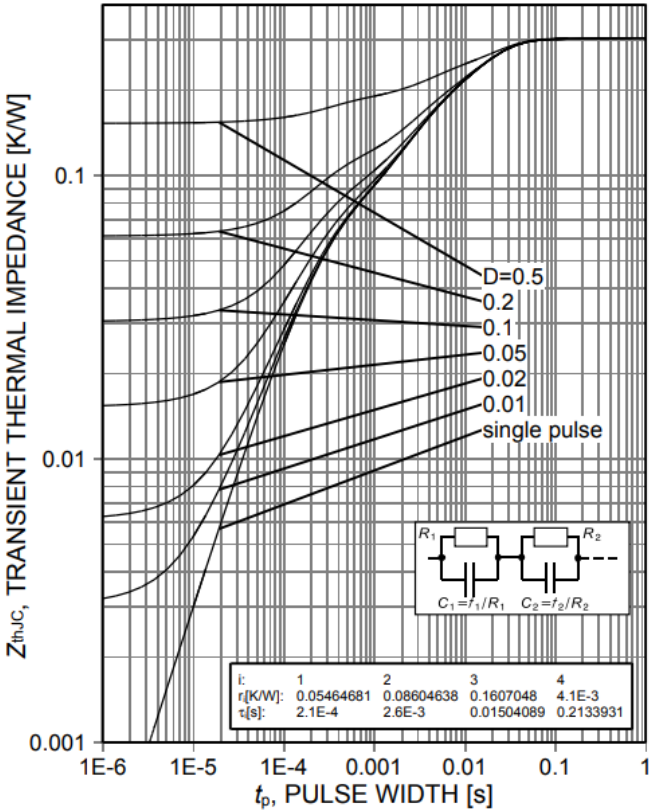


Figure 20. Diode transient thermal impedance as a function of pulse width for different duty cycles D
($D = t_p/T$)

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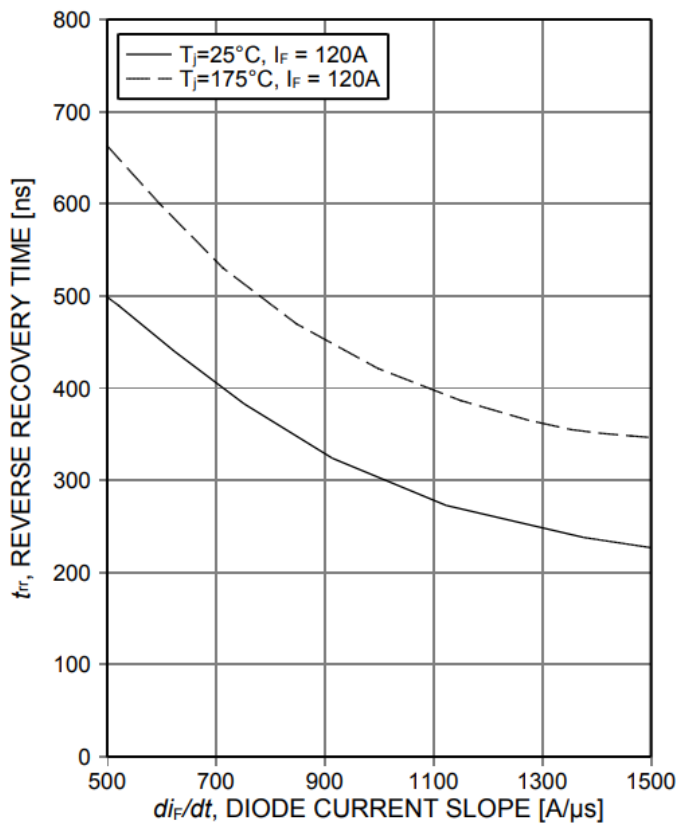


Figure 21. **Typical reverse recovery time as a function of diode current slope**
($V_R=400\text{V}$, Dynamic test circuit in Figure E)

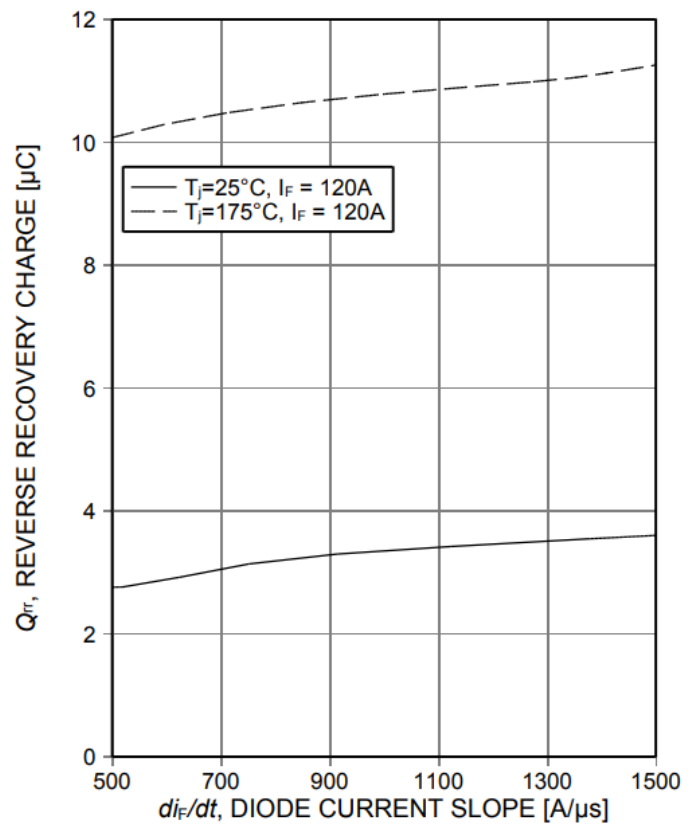


Figure 22. **Typical reverse recovery charge as a function of diode current slope**
($V_R=400\text{V}$, Dynamic test circuit in Figure E)

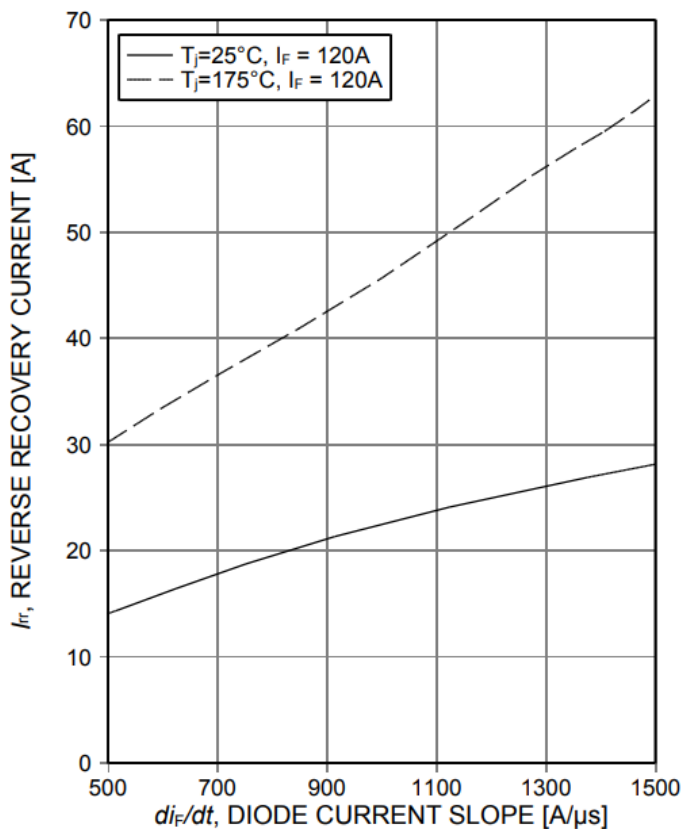


Figure 23. **Typical reverse recovery current as a function of diode current slope**
($V_R=400\text{V}$, Dynamic test circuit in Figure E)

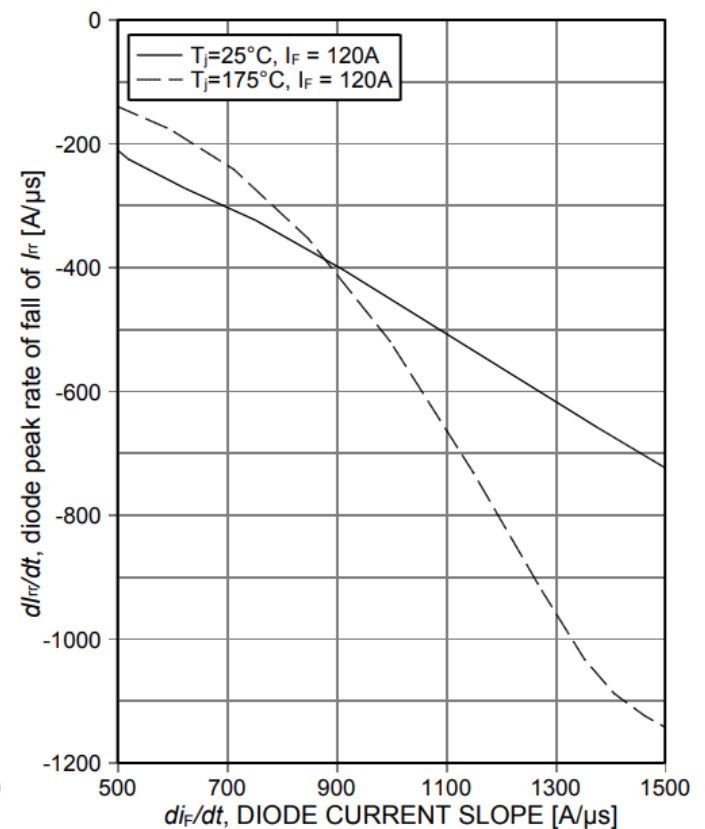


Figure 24. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
($V_R=400\text{V}$, Dynamic test circuit in Figure E)

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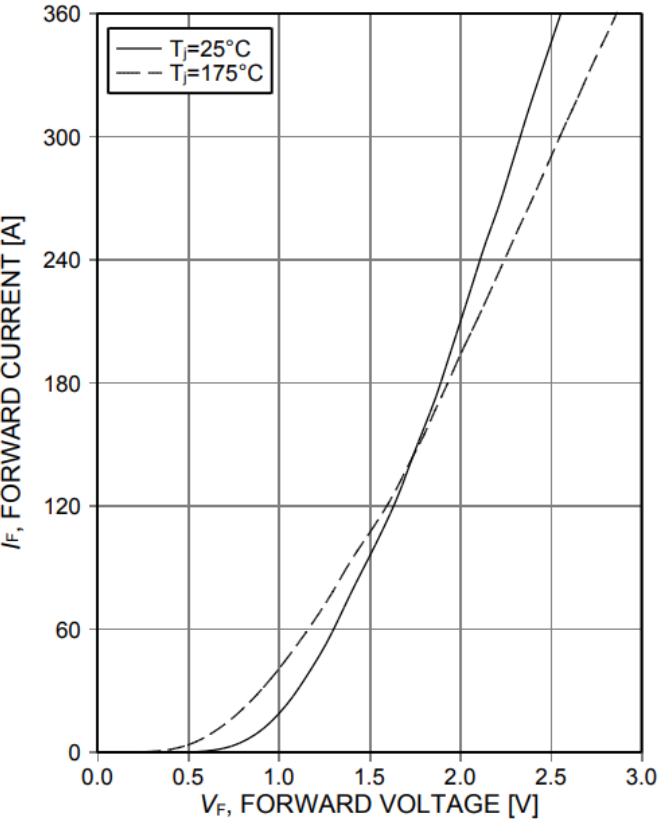


Figure 25. Typical diode forward current as a function of forward voltage

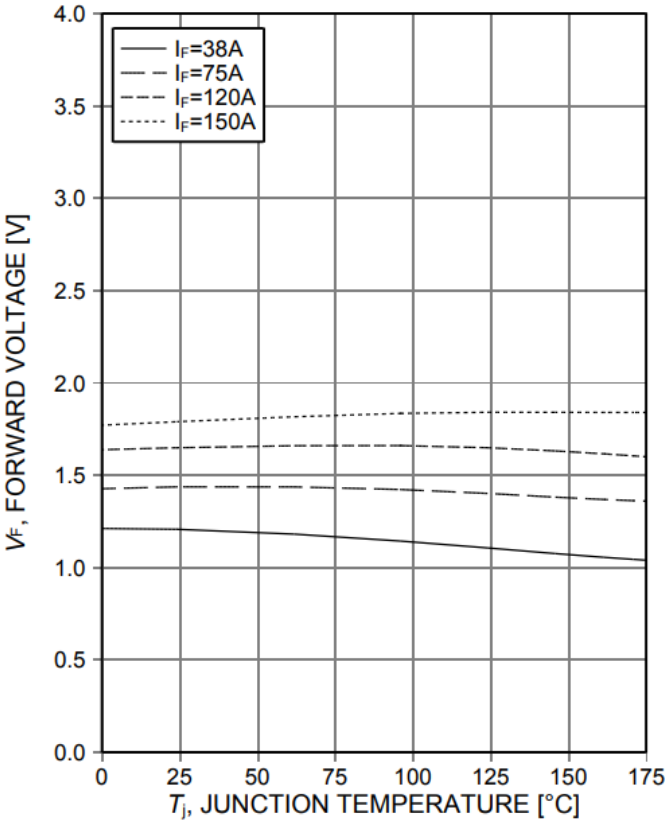
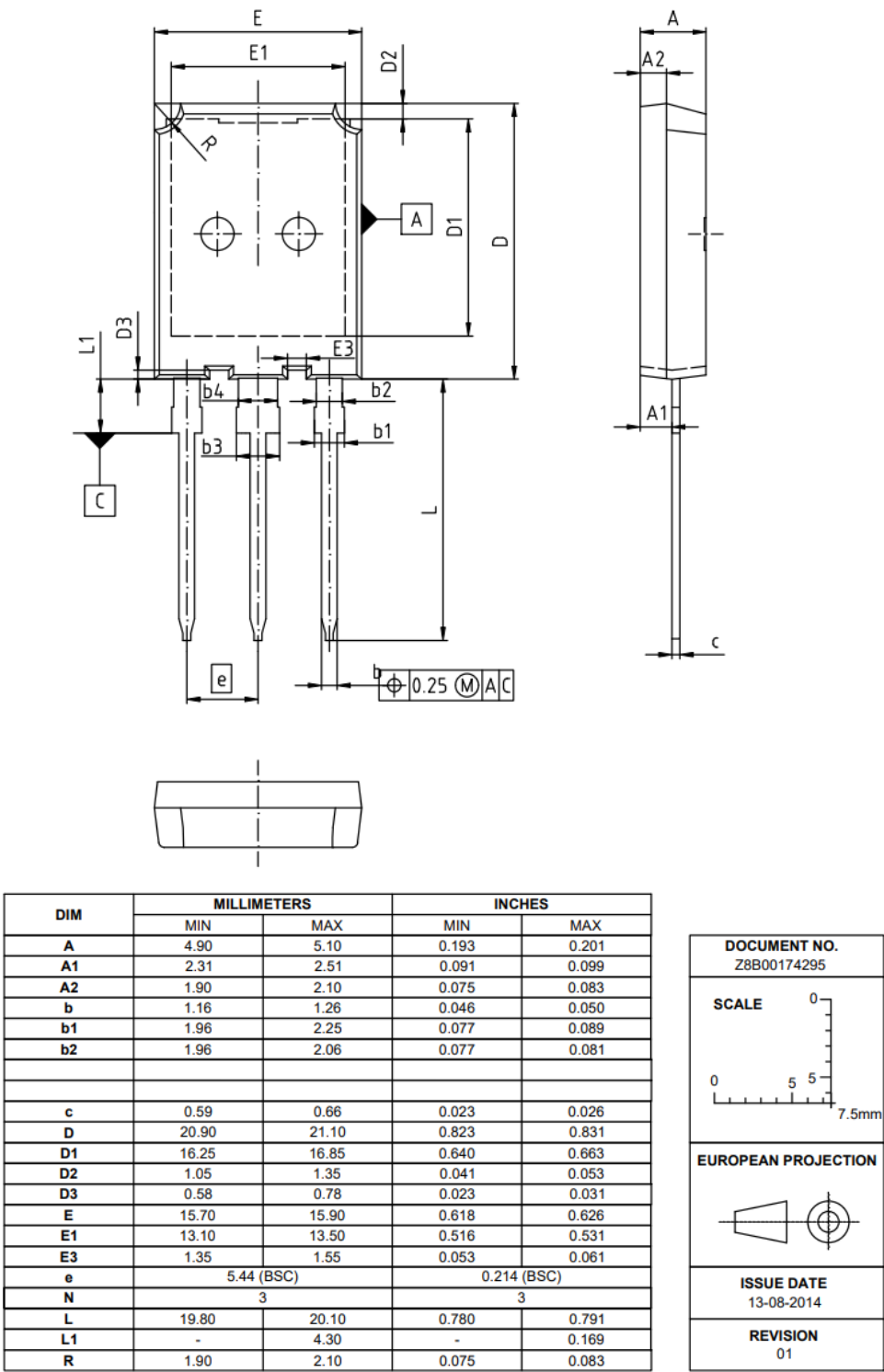


Figure 26. Typical diode forward voltage as a function of junction temperature

封装图 PG-TO247-3-46



测试条件

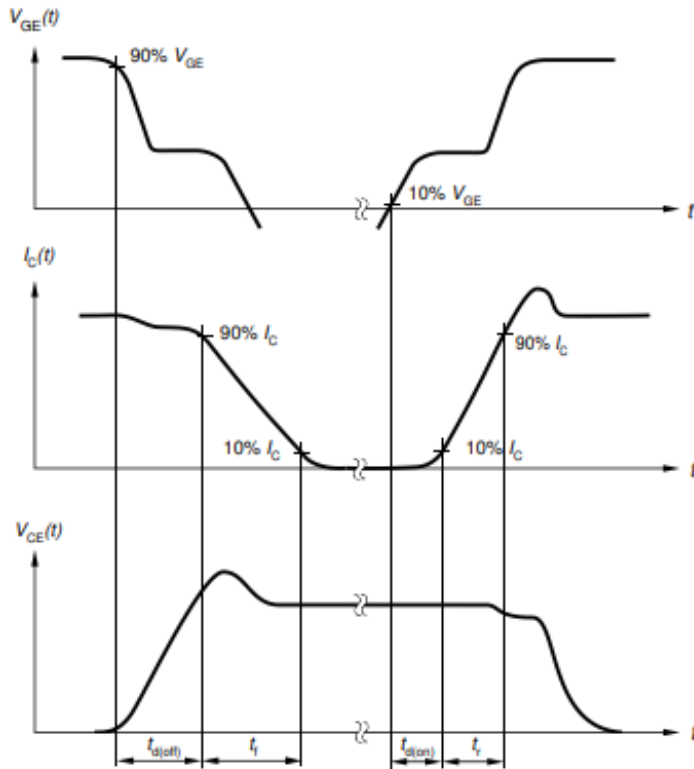


Figure A. Definition of switching times

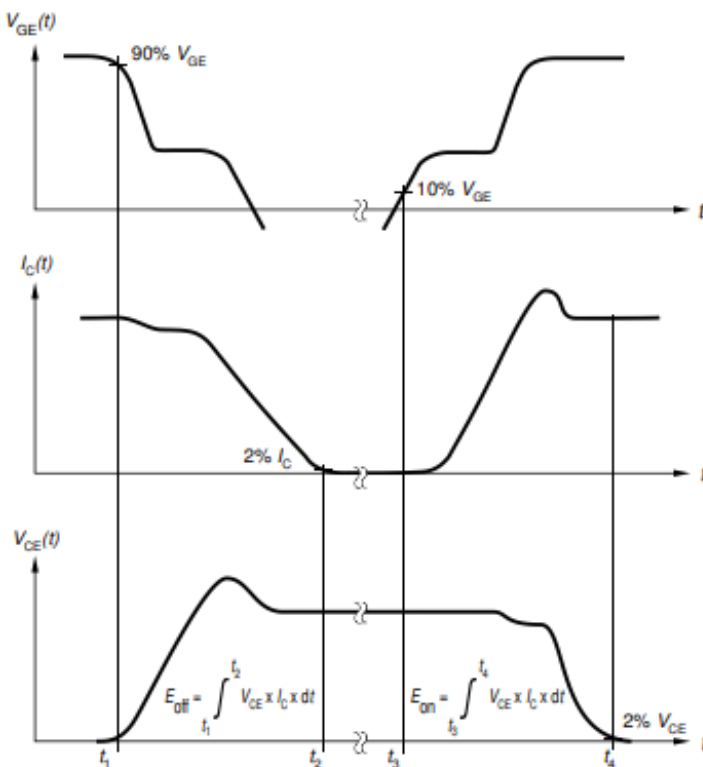


Figure B. Definition of switching losses

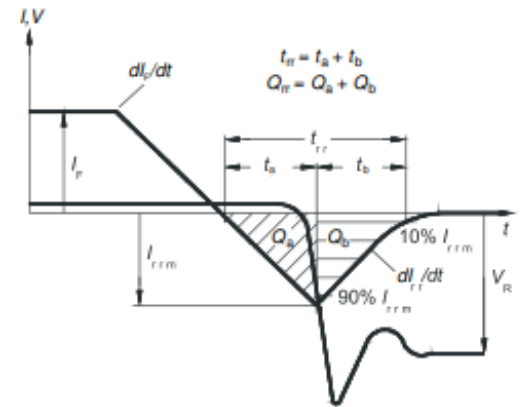


Figure C. Definition of diode switching characteristics

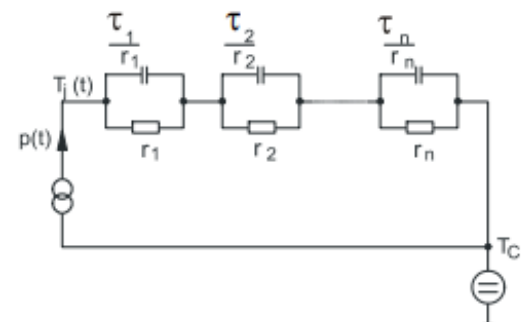


Figure D. Thermal equivalent circuit

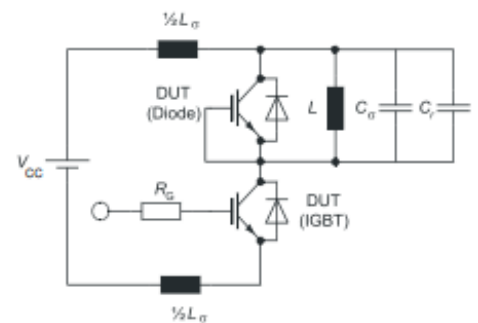


Figure E. **Dynamic test circuit**
 Parasitic inductance L_{σ} ,
 parasitic capacitor C_{σ} ,
 relief capacitor C_r ,
 (only for ZVT switching)

TRENCHSTOP™ 系列

修订记录

AIKQ120N60CT

Revision: 2017-02-09, Rev. 2.1

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.1	2017-02-09	Data sheet created

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