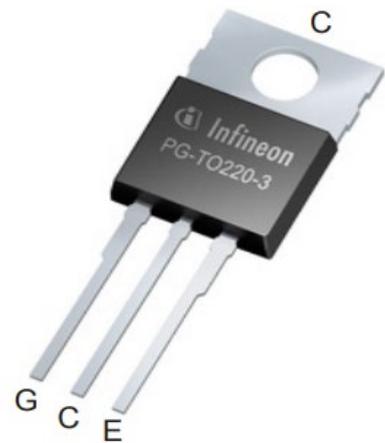
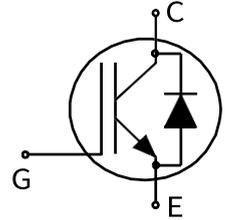


英飞凌TRENCHSTOP™ 系列

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器控制二极管

特性：

- 符合汽车级 AEC Q101 标准
- 专为汽车应用设计的DC/AC转换器
- 极低 $V_{CE(sat)}$ 1.5V (典型值)
- 最高结温 150°C
- 经过动态压力测试
- 短路耐受时间 5 μ s
- $V_{CE(sat)}$ 正温度系数
- 低电磁干扰
- 低栅极电荷
- 绿色封装
- 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
AIKP20N60CT	600V	20A	1.5V	150°C	AK20DCT	PG-TO220-3

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。

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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} $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	I_C	40.0 20.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	60.0	A
Turn off safe operating area $V_{CE} \leq 600\text{V}$, $T_{vj} \leq 150^{\circ}\text{C}^{1)}$	-	60.0	A
Diode forward current, limited by T_{vjmax} $T_C = 25^{\circ}\text{C}$ $T_C = 100^{\circ}\text{C}$	I_F	40.0 20.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	60.0	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}	156.0	W
Operating junction temperature	T_{vj}	-40...+150	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-40...+150	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

热阻抗

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

 R_{th} 特性

IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.90	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	-	1.50	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	62	K/W

¹⁾ $t_p \leq 1\mu\text{s}$

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除非另有规定，特性均为 $T_{vj} = 25^{\circ}\text{C}$ 。

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
静态特性						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}, I_C = 0.20\text{mA}$	600	-	-	V
Collector-emitter saturation voltage	V_{CESat}	$V_{GE} = 15.0\text{V}, I_C = 20.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	- -	1.50 1.85	2.05 -	V
Diode forward voltage	V_F	$V_{GE} = 0\text{V}, I_F = 20.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	- -	1.65 1.65	2.05 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.29\text{mA}, V_{CE} = V_{GE}$	4.1	4.9	5.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 600\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	- -	- 550	40 -	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20\text{V}, I_C = 20.0\text{A}$	-	11.0	-	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}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	1100	-	pF
Output capacitance	C_{oes}		-	71	-	
Reverse transfer capacitance	C_{res}		-	32	-	
Gate charge	Q_G	$V_{CC} = 480\text{V}, I_C = 20.0\text{A},$ $V_{GE} = 15\text{V}$	-	120.0	-	nC
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0\text{s}$	$I_{C(SC)}$	$V_{GE} = 15.0\text{V}, V_{CC} \leq 400\text{V},$ $t_{SC} \leq 5\mu\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	-	183	-	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	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 20.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 12.0\Omega, R_{G(off)} = 12.0\Omega,$ $L\sigma = 131\text{nH}, C\sigma = 31\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	18	-	ns
Rise time	t_r		-	14	-	ns
Turn-off delay time	$t_{d(off)}$		-	199	-	ns
Fall time	t_f		-	42	-	ns
Turn-on energy	E_{on}		-	0.31	-	mJ
Turn-off energy	E_{off}		-	0.46	-	mJ
Total switching energy	E_{ts}		-	0.77	-	mJ

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二极管特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下

Diode reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}\text{C}$, $V_R = 400\text{V}$, I_F $= 20.0\text{A}$, $di_F/dt = 880\text{A}/\mu\text{s}$	-	41	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.31	-	μC
Diode peak reverse recovery current	I_{rrm}		-	13.3	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	711	-	$\text{A}/\mu\text{s}$

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT 特性， $T_{vj} = 150^{\circ}\text{C}$

Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 20.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L\sigma = 131\text{nH}$, $C\sigma = 31\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	18	-	ns
Rise time	t_r		-	17	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	217	-	ns
Fall time	t_f		-	70	-	ns
Turn-on energy	E_{on}		-	0.47	-	mJ
Turn-off energy	E_{off}		-	0.60	-	mJ
Total switching energy	E_{ts}		-	1.07	-	mJ

二极管特性， $T_{vj} = 150^{\circ}\text{C}$

Diode reverse recovery time	t_{rr}	$T_{vj} = 150^{\circ}\text{C}$, V_R $= 400\text{V}$, $I_F =$ 20.0A , $di_F/dt = 800\text{A}/\mu\text{s}$	-	201	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.28	-	μC
Diode peak reverse recovery current	I_{rrm}		-	16.6	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	481	-	$\text{A}/\mu\text{s}$

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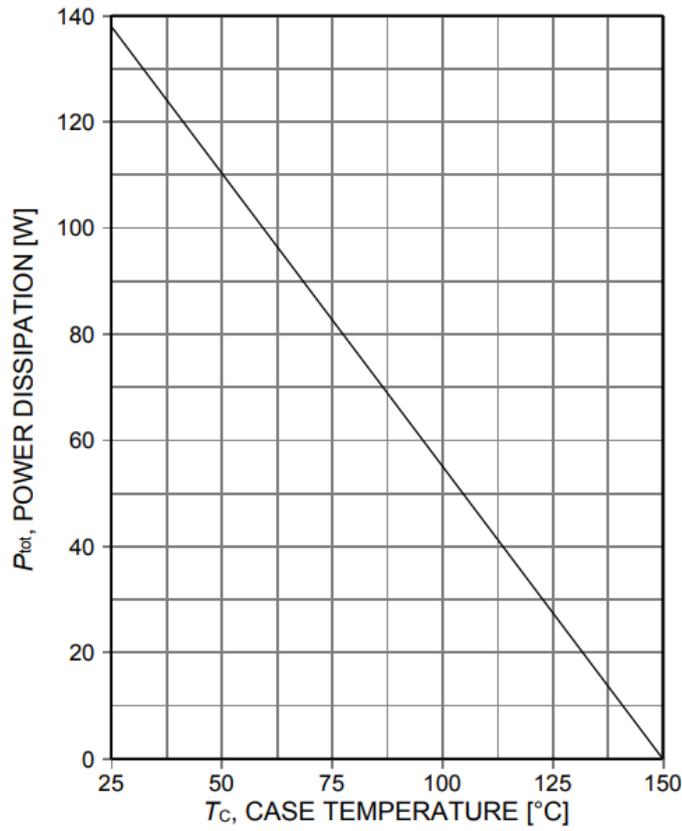


Figure 1. Power dissipation as a function of case temperature ($T_j \leq 150^\circ\text{C}$)

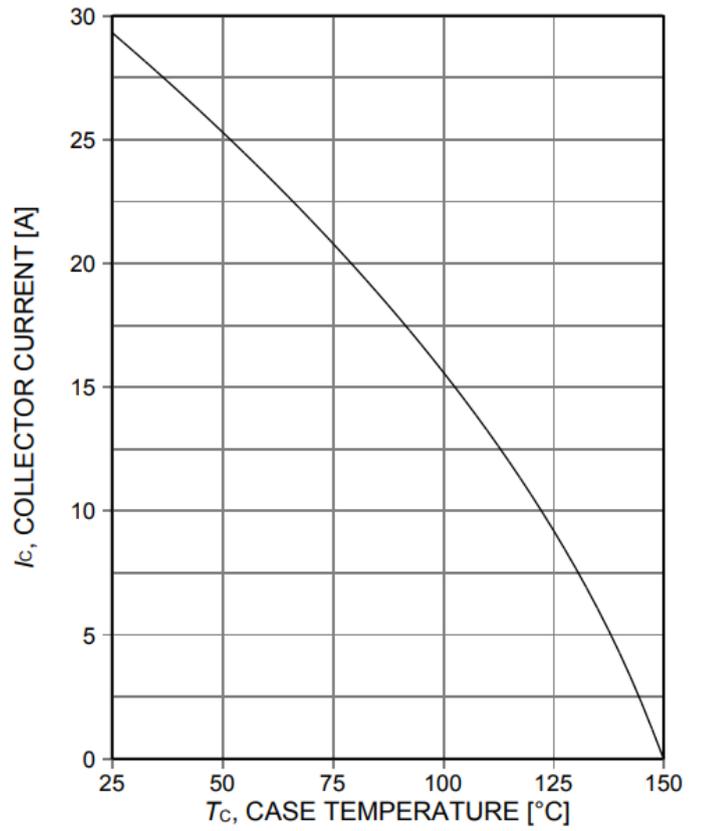


Figure 2. Collector current as a function of case temperature ($V_{GE} \geq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)

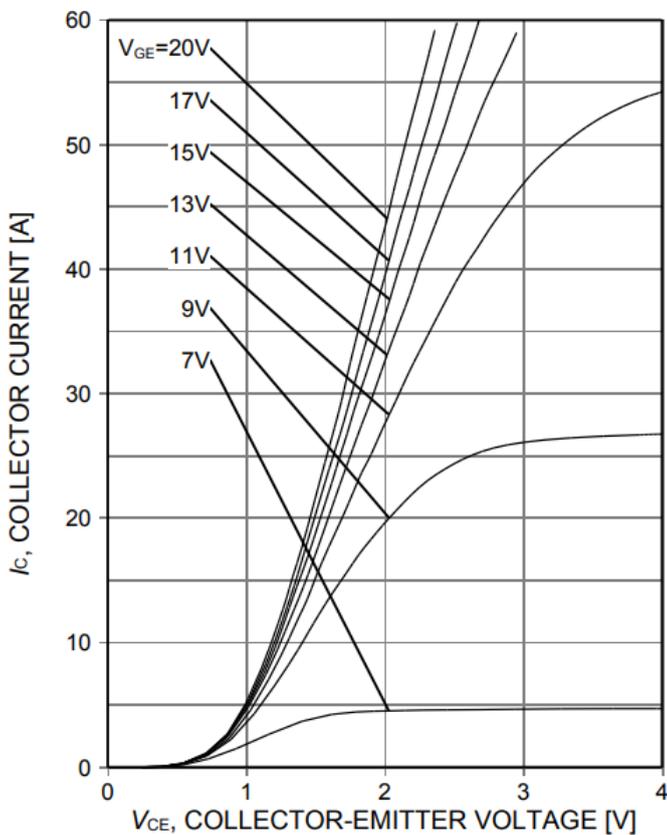


Figure 3. Typical output characteristic ($T_j = 25^\circ\text{C}$)

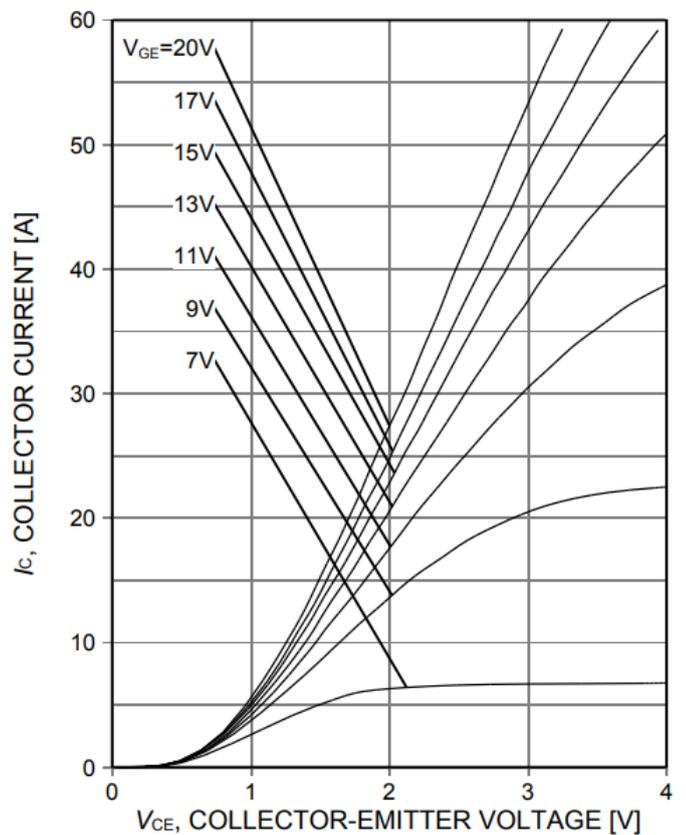


Figure 4. Typical output characteristic ($T_j = 150^\circ\text{C}$)

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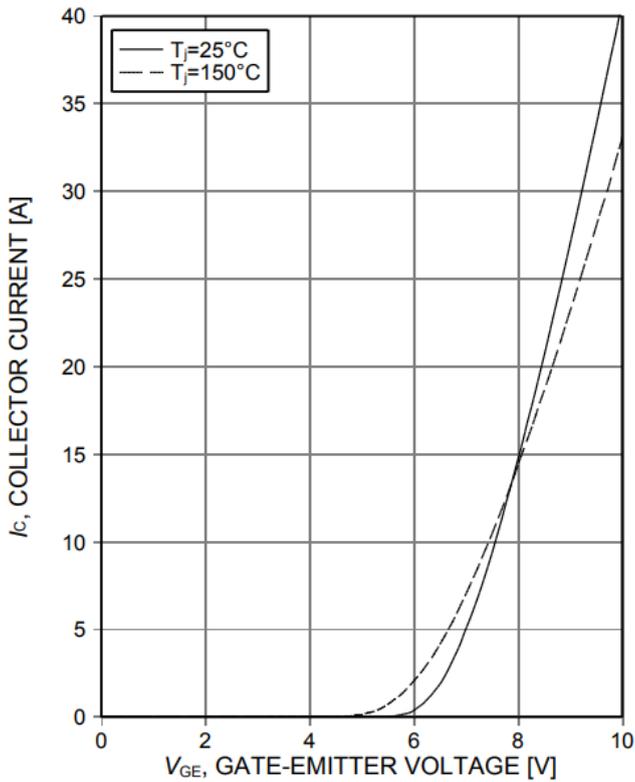


Figure 5. Typical transfer characteristic ($V_{CE}=10V$)

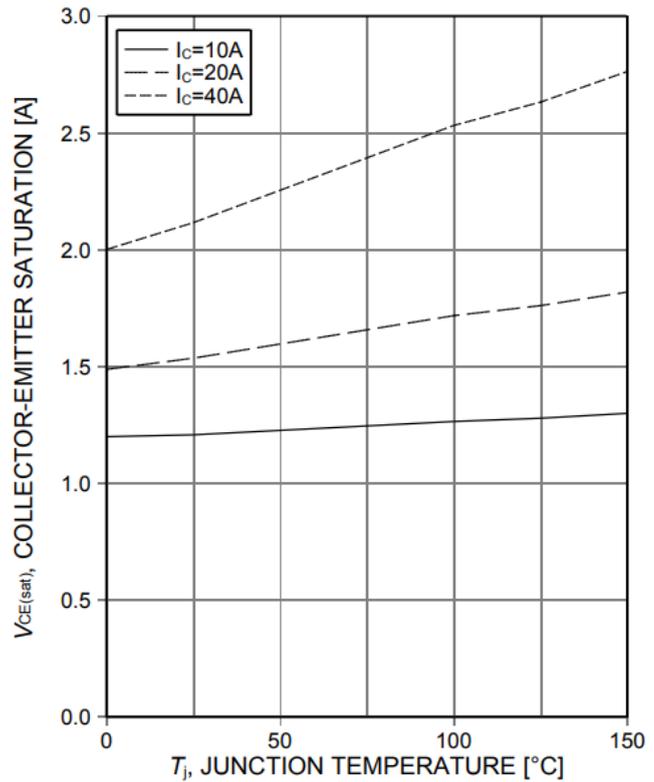


Figure 6. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15V$)

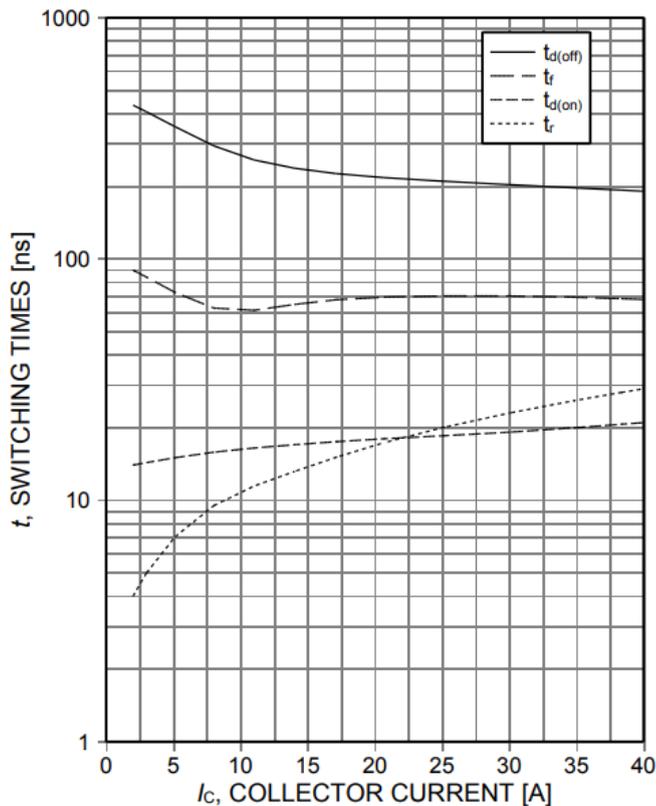


Figure 7. Typical switching times as a function of collector current (inductive load, $T_j=150^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

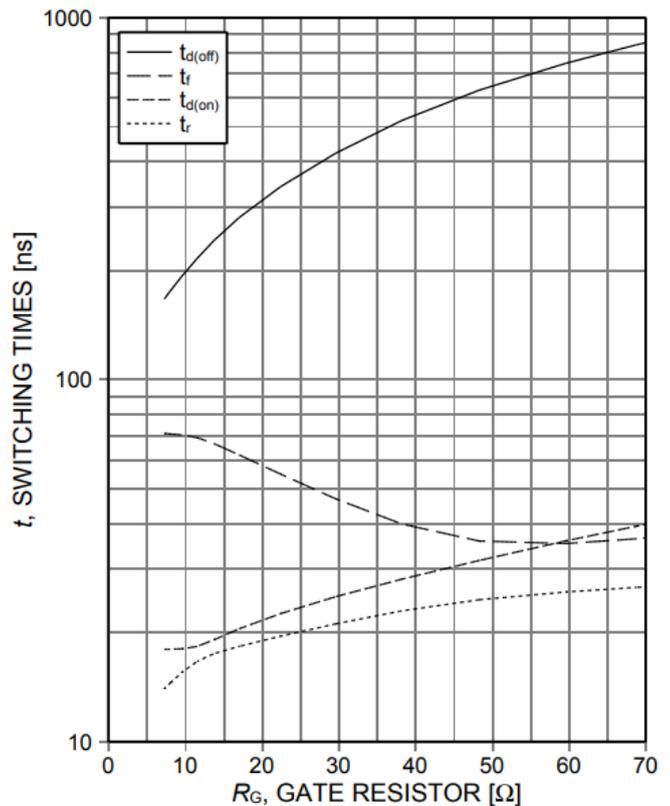


Figure 8. Typical switching times as a function of gate resistor (inductive load, $T_j=150^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=20A$, Dynamic test circuit in Figure E)

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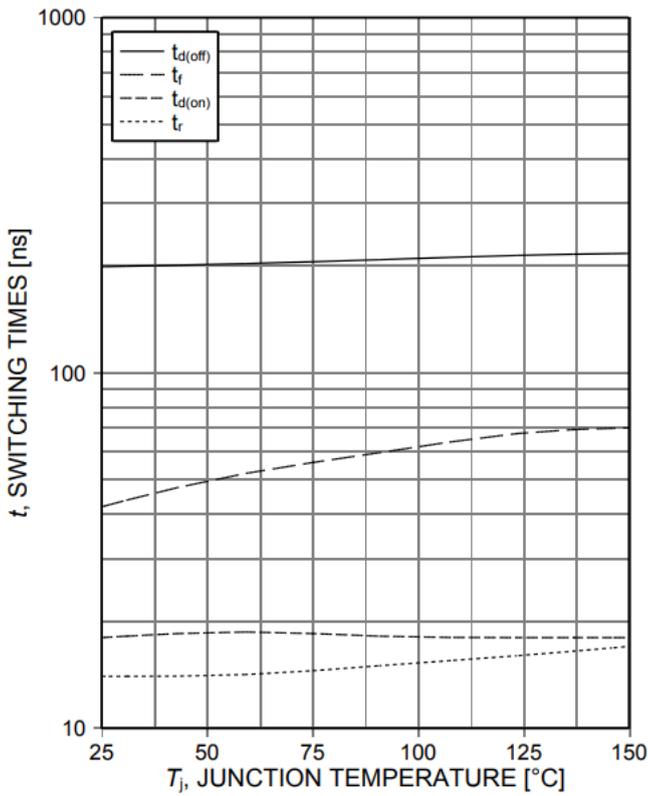


Figure 9. Typical switching times as a function of junction temperature (inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=20A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

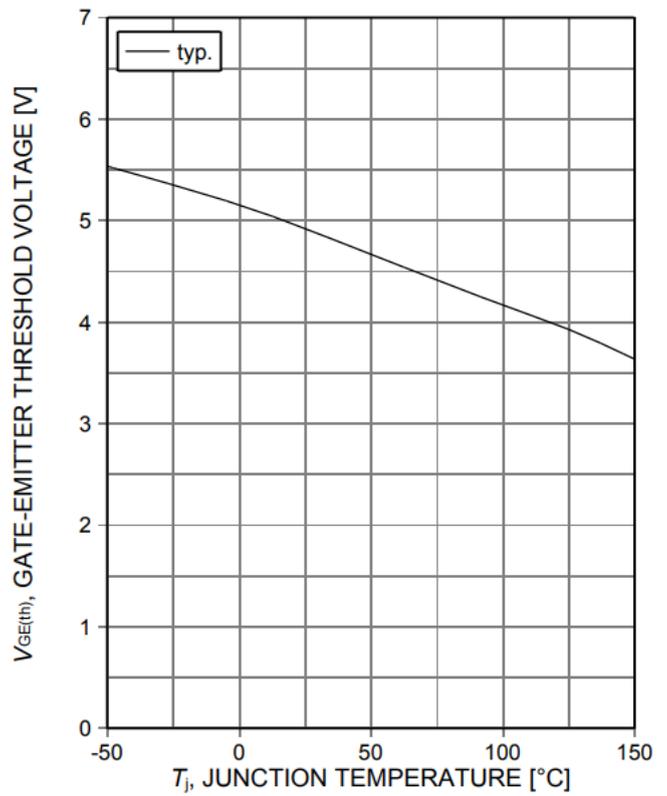


Figure 10. Gate-emitter threshold voltage as a function of junction temperature ($I_C=0.29mA$)

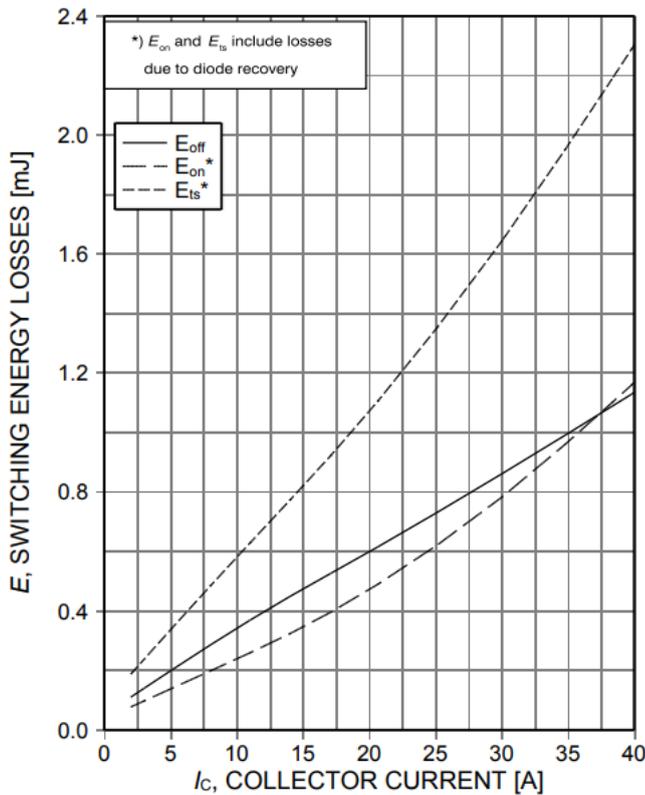


Figure 11. Typical switching energy losses as a function of collector current (inductive load, $T_J=150^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

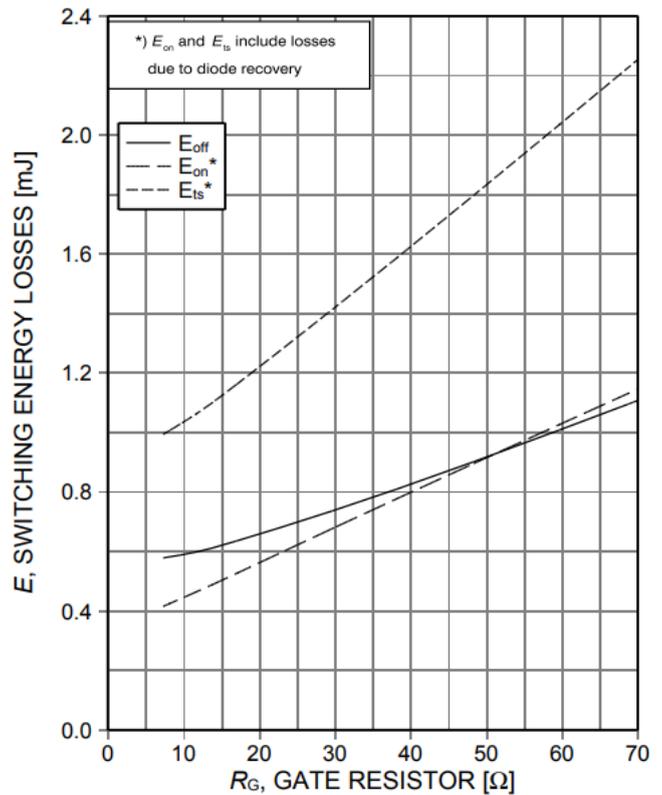


Figure 12. Typical switching energy losses as a function of gate resistor (inductive load, $T_J=150^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=20A$, Dynamic test circuit in Figure E)

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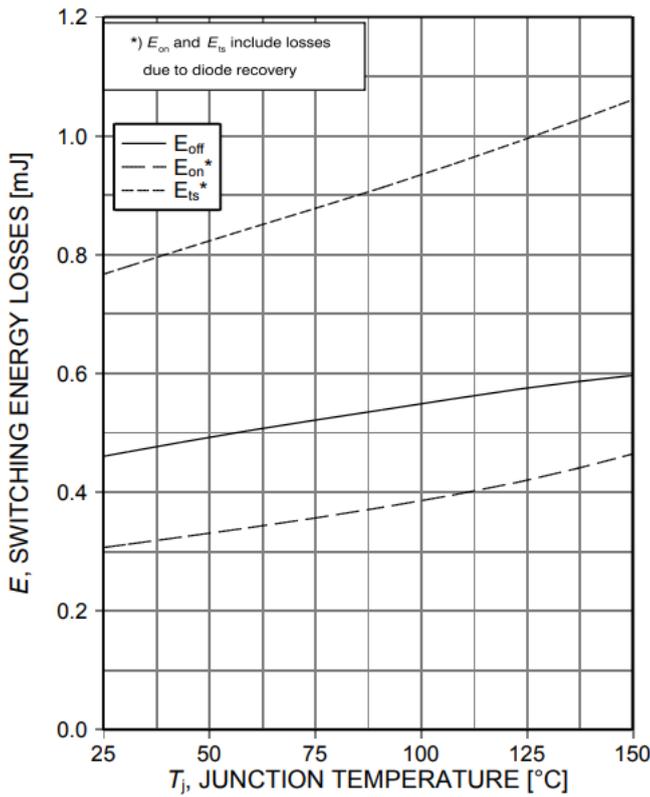


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=20A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

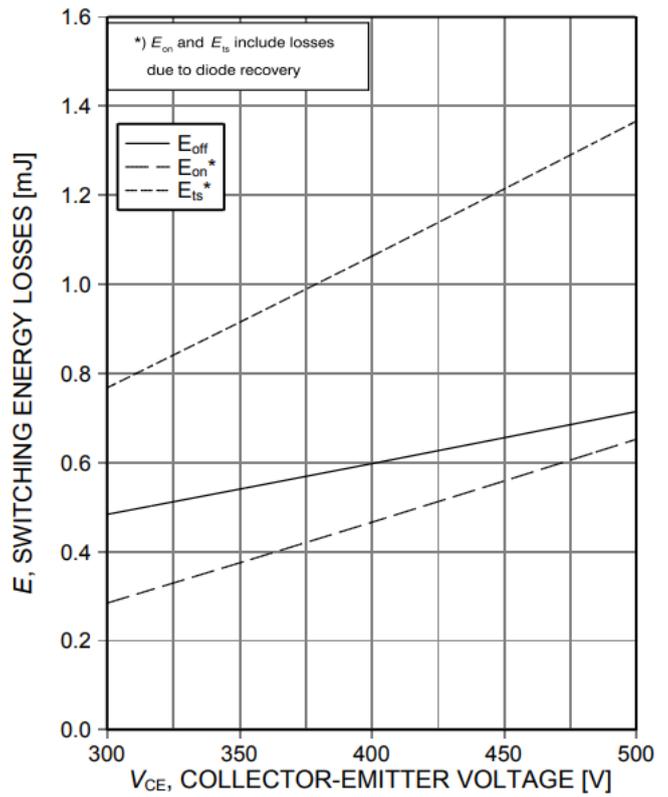


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_j=150^\circ C$, $V_{GE}=15/0V$, $I_C=20A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

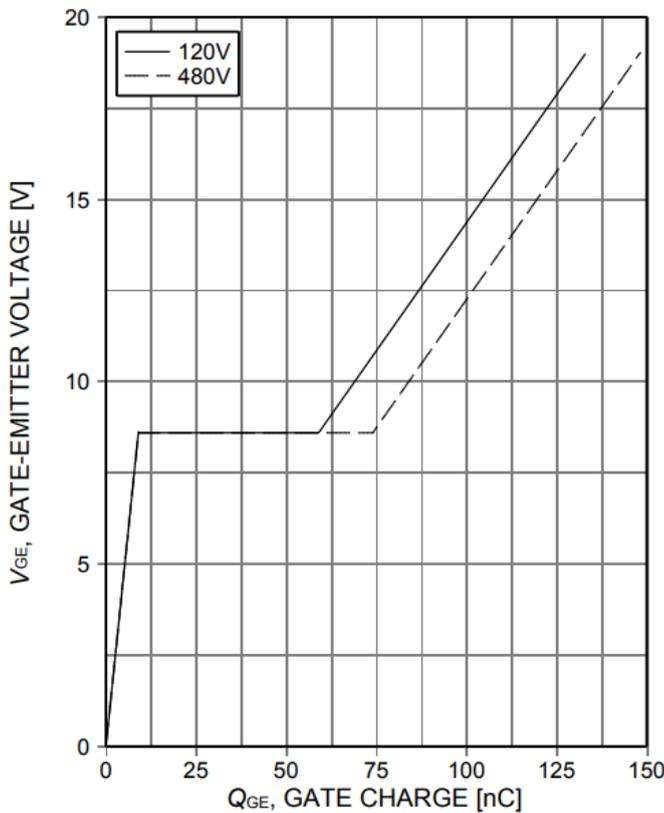


Figure 15. **Typical gate charge**
($I_C=20A$)

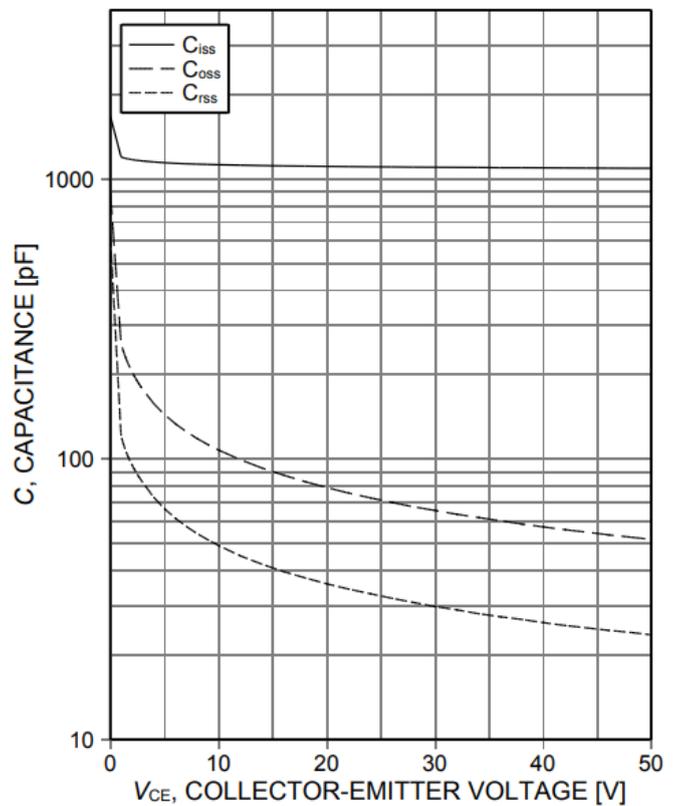


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

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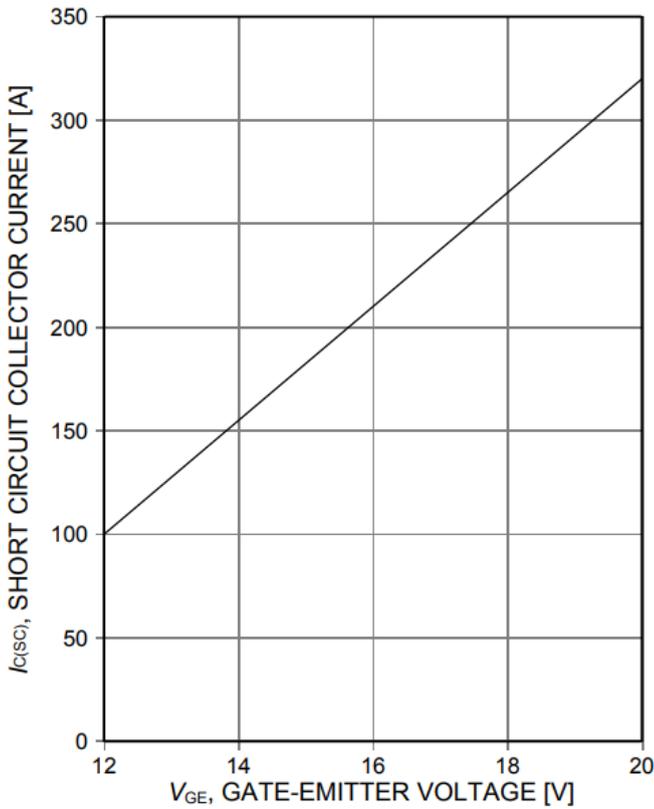


Figure 17. Typical short circuit collector current as a function of gate-emitter voltage ($V_{CE} \leq 400V$, $T_j \leq 150^\circ C$)

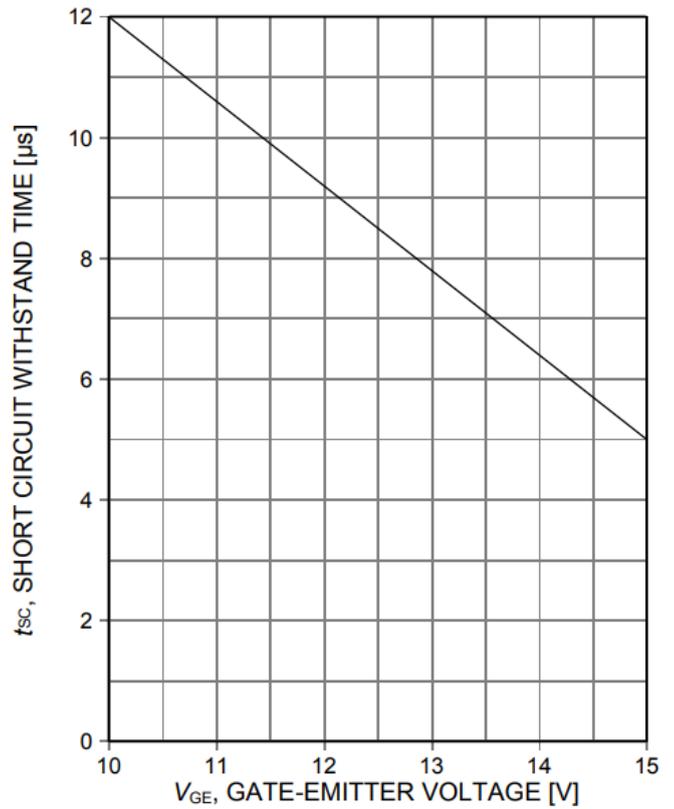


Figure 18. Short circuit withstand time as a function of gate-emitter voltage ($V_{CE} = 400V$, start at $T_j = 25^\circ C$, $T_{jmax} \leq 150^\circ C$)

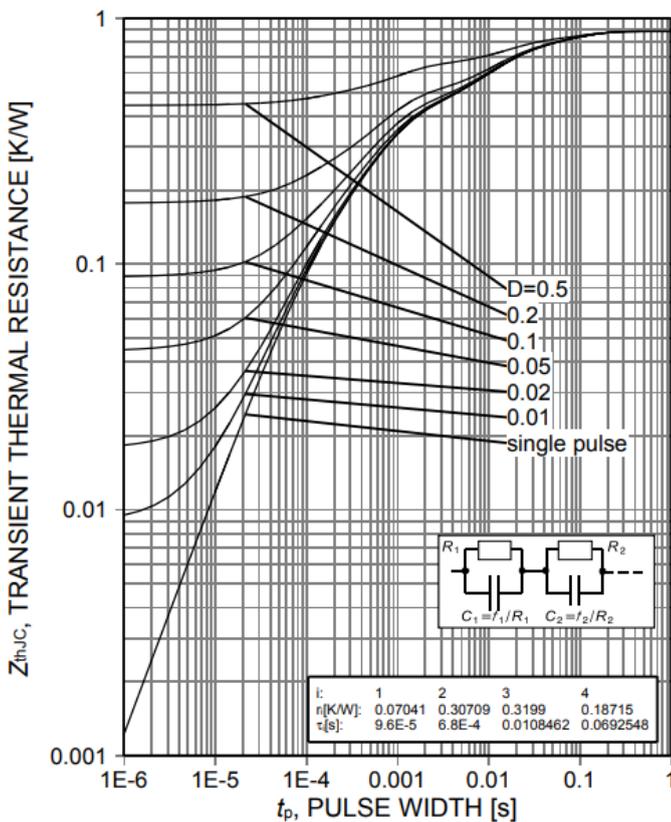


Figure 19. IGBT transient thermal resistance as a function of pulse width for different duty cycles D ($D = t_p/T$)

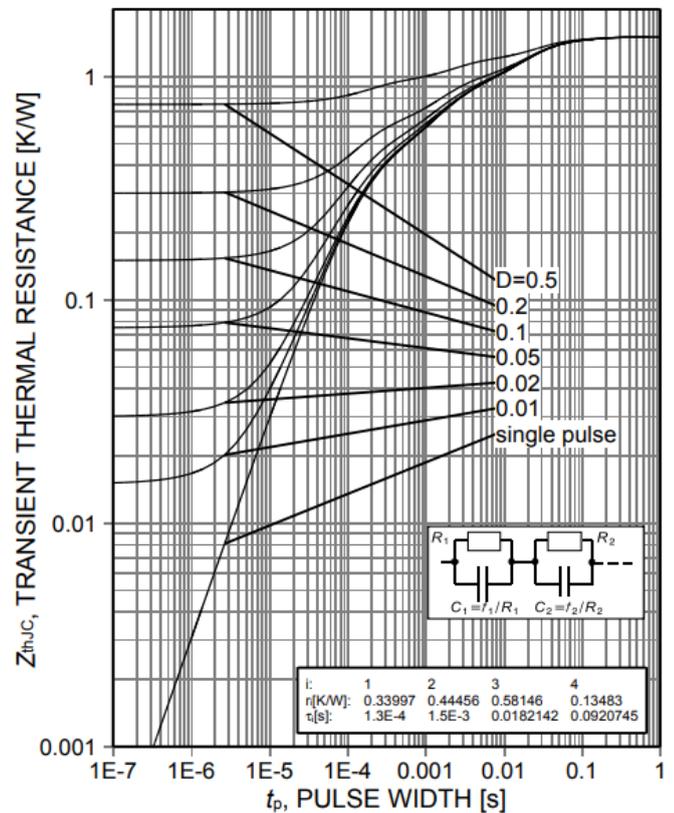


Figure 20. Diode transient thermal impedance as a function of pulse width for different duty cycles D ($D = t_p/T$)

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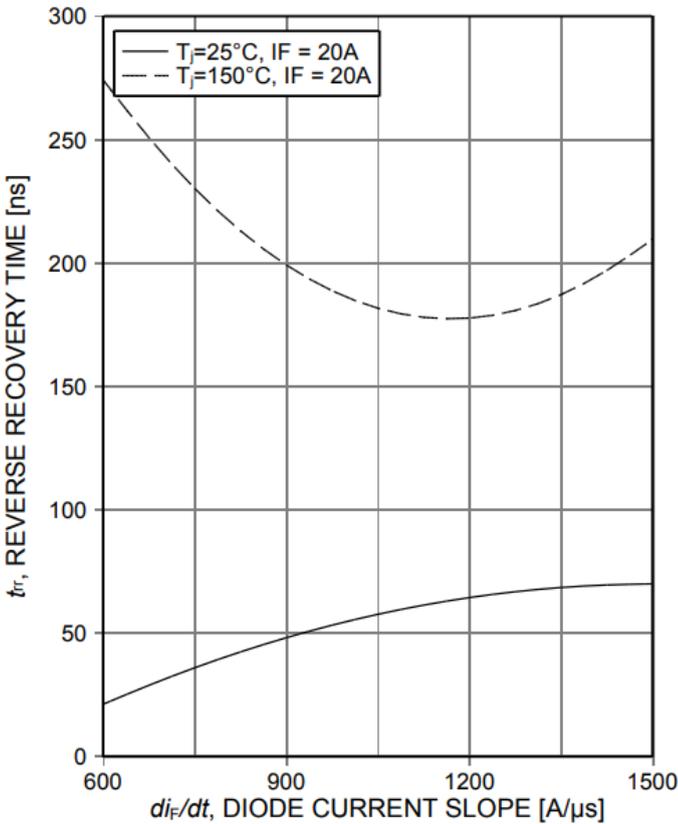


Figure 21. Typical reverse recovery time as a function of diode current slope ($V_R=400V$, Dynamic test circuit in Figure E)

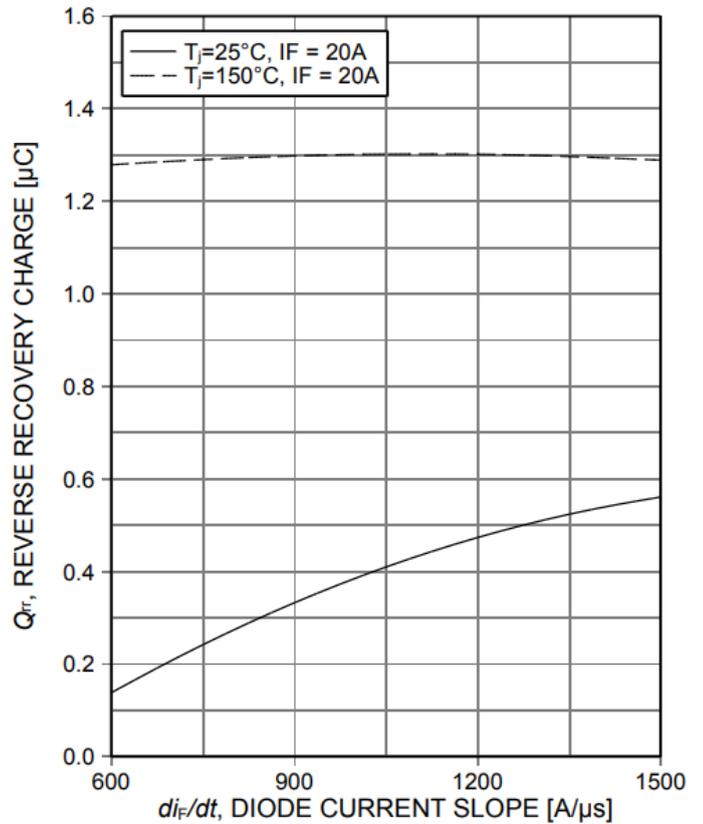


Figure 22. Typical reverse recovery charge as a function of diode current slope ($V_R=400V$, Dynamic test circuit in Figure E)

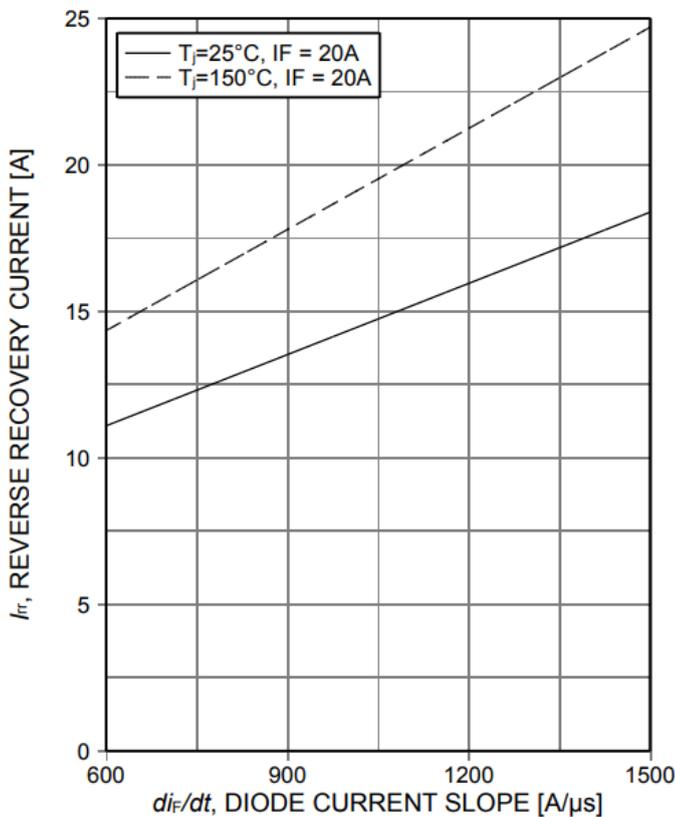


Figure 23. Typical reverse recovery current as a function of diode current slope ($V_R=400V$, Dynamic test circuit in Figure E)

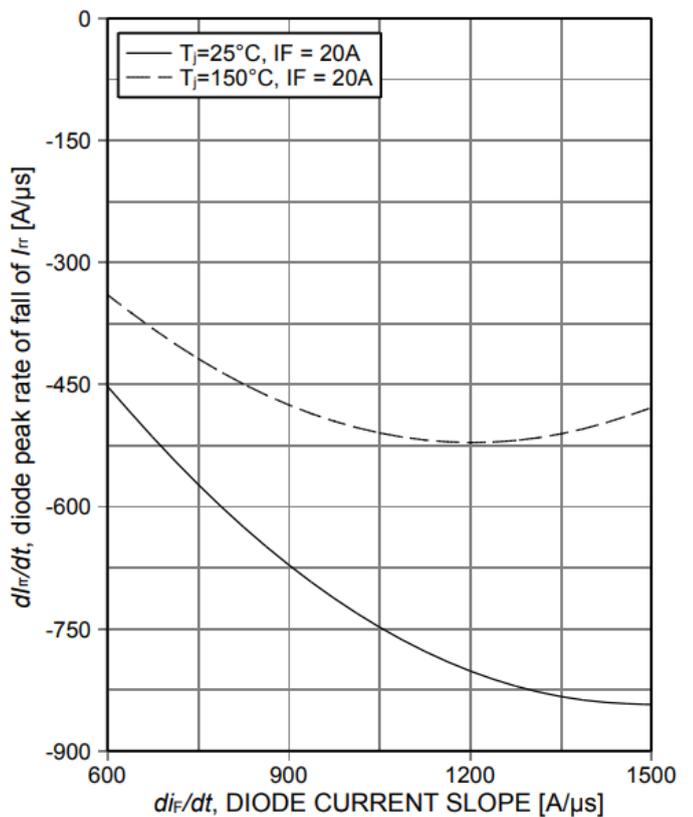


Figure 24. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ($V_R=400V$, Dynamic test circuit in Figure E)

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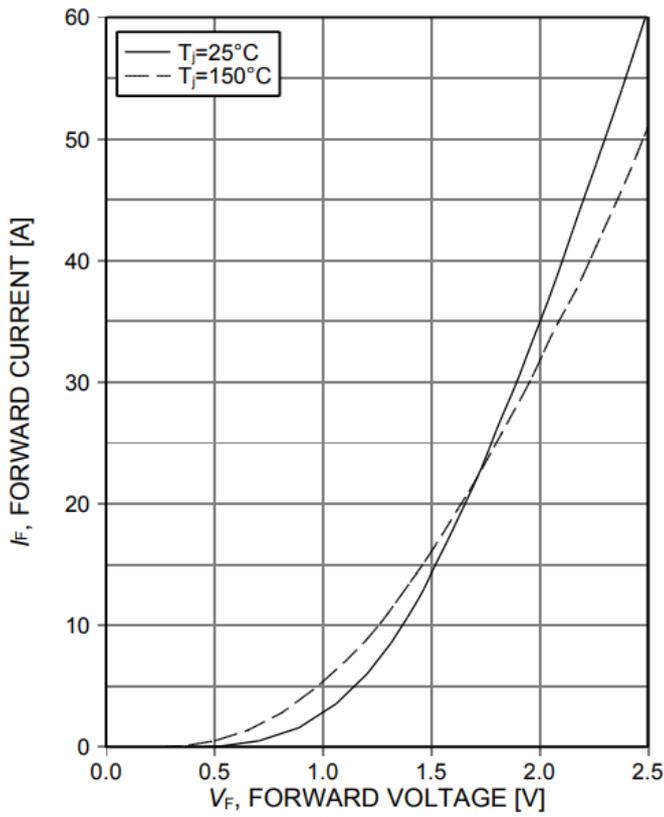


Figure 25. Typical diode forward current as a function of forward voltage

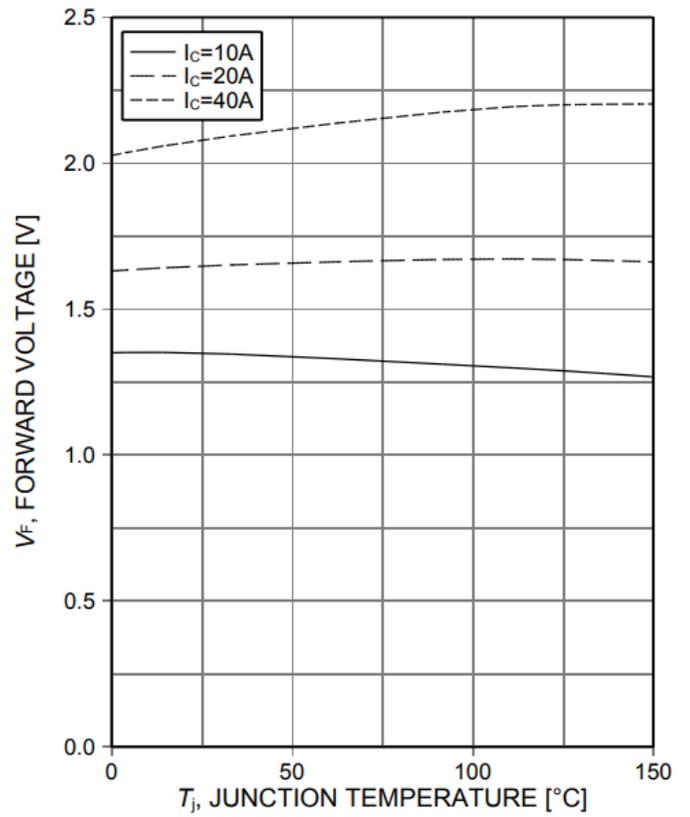
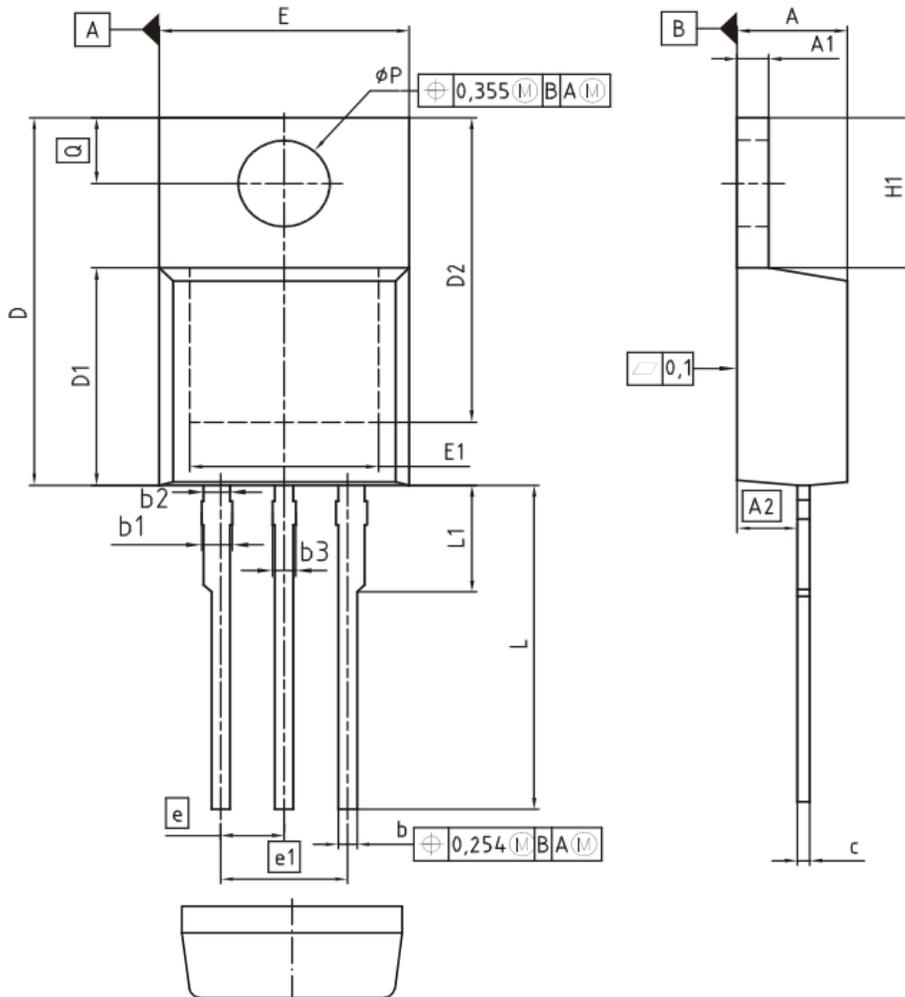


Figure 26. Typical diode forward voltage as a function of junction temperature

封装图 PG-TO220-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
phi P	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.
Z8B00003318

SCALE

EUROPEAN PROJECTION

ISSUE DATE
30-07-2009

REVISION
06

测试条件

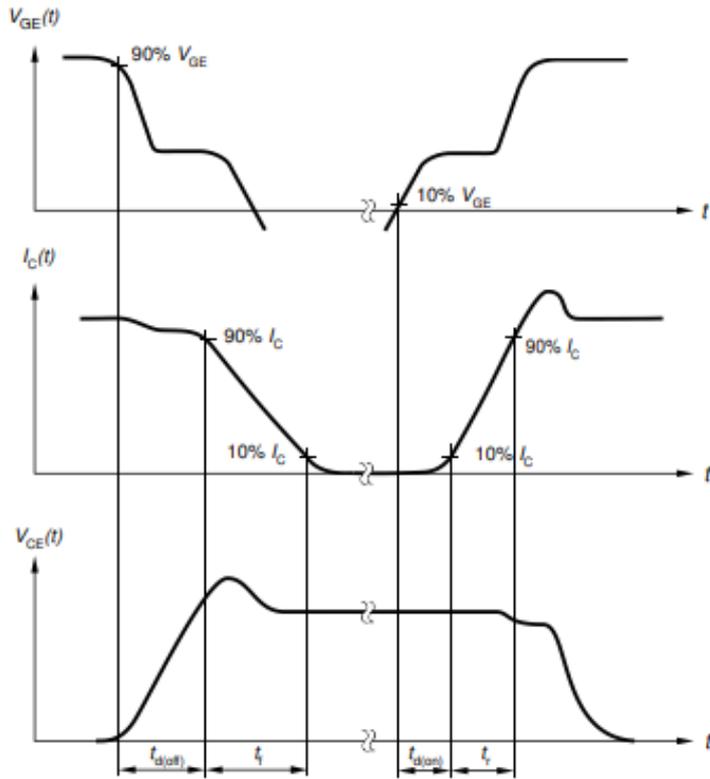


Figure A. Definition of switching times

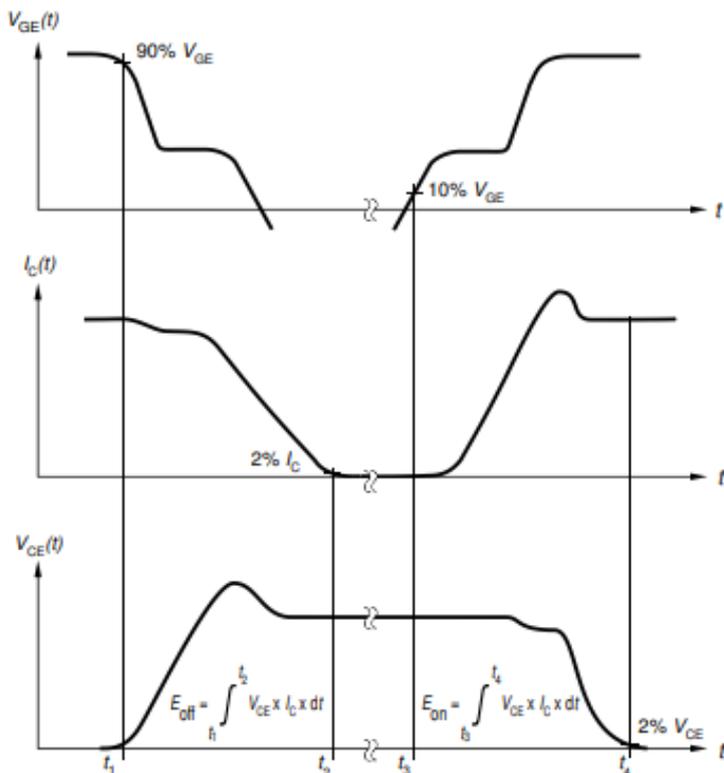


Figure B. Definition of switching losses

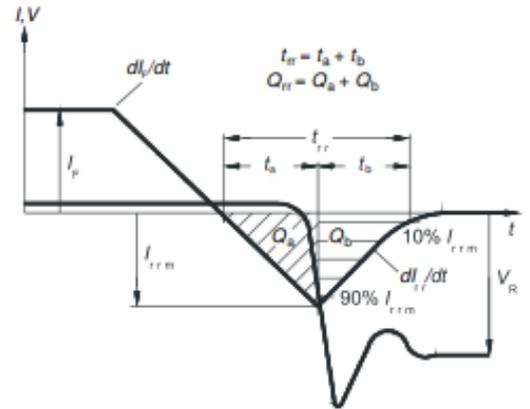


Figure C. Definition of diode switching characteristics

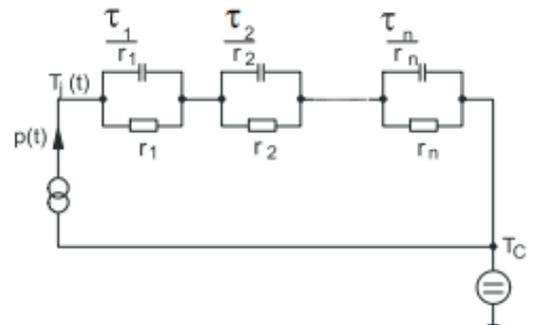


Figure D. Thermal equivalent circuit

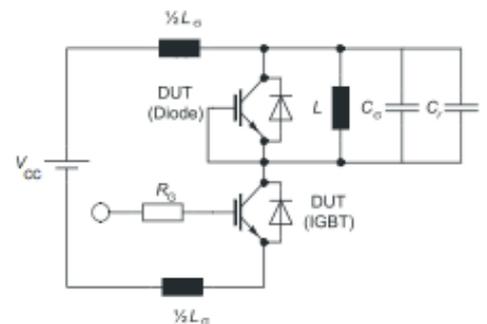


Figure E. Dynamic test circuit
Parasitic inductance L_{σ} ,
parasitic capacitor C_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

TRENCHSTOP™ 系列

修订记录

AIKP20N60CT

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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