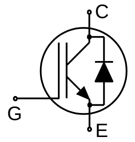
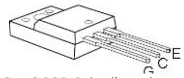
Low Loss DuoPack : IGBT in TRENCHSTOP™ and Fieldstop technology with soft, fast recovery anti-parallel Emitter Controlled HE diode

Features

- Very low $V_{CE(sat)}$ 1.5V (typ.)
- Maximum Junction Temperature 175°C
- Short circuit withstand time 5µs
- TRENCHSTOP™ and Fieldstop technology for 600V applications offers :
  - very tight parameter distribution
  - high ruggedness, temperature stable behavior
  - very high switching speed
- Low EMI
- Very soft, fast recovery anti-parallel Emitter Controlled HE diode
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : http://www.infineon.com/igbt/





PG-TO220-3 (FullPAK)

Applications

- Washing Machine
- Inverter and Variable Speed Drive

Type	V_{CE}	I_C	$V_{CE(sat),Tj=25°C}$	$T_{j,max}$	Marking Code	Package
IKA06N60T	600V	6A	1.5V	175°C	K06T60	PG-TO220-3 (FullPAK)

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_j \geq 25°C$	V_{CE}	600	V
DC collector current, limited by T_{jmax}			
$T_C = 25°C$	I_C	10	A
$T_C = 100°C$		6.2	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	18	
Turn off safe operating area, $V_{CE} = 600V$, $T_j = 175°C$, $t_p = 1µs$	-	18	
Diode forward current, limited by T_{jmax}			
$T_C = 25°C$	I_F	10.2	
$T_C = 100°C$		6.5	
Diode pulsed current, t_p limited by T_{jmax}	I_{Fpuls}	18	
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time[2] $V_{GE} = 15V$, $V_{CC} \leq 400V$, $T_j \leq 150°C$	t_{SC}	5	µs
Power dissipation $T_C = 25°C$	P_{tot}	28	W
Operating junction temperature	T_j	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Isolation voltage	V_{isol}	2500	V_{rms}

[1] J-STD-020 and JESD-022

[2] Allowed number of short circuits: <1000; time between short circuits: >1s.

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		5.3	K/W
Diode thermal resistance, junction – case	R_{thJCD}		6.5	
Thermal resistance, junction – ambient	R_{thJA}		80	

Electrical Characteristic, at T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.25mA	600	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE} = 15V, I_C=6A T_j=25°C T_j=175°C	 - -	 1.5 1.8	 2.05	
Diode forward voltage	V_F	V_{GE}=0V, I_F=6A T_j=25°C T_j=175°C	 - -	 1.6 1.6	 2.05 -	
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C=0.18mA, V_{CE}=V_{GE}	4.1	4.6	5.7	
Zero gate voltage collector current	I_{CES}	V_{CE}=600V, V_{GE}=0V T_j=25°C T_j=175°C	 - -	 - -	 40 700	µA
Gate-emitter leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=6A	-	3.6	-	S
Integrated gate resistor	R_{Gint}			none		Ω

Dynamic Characteristic

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Input capacitance	C_{iss}	V_{CE}=25V,	-	368	-	pF
Output capacitance	C_{oss}	V_{GE}=0V,	-	28	-	
Reverse transfer capacitance	C_{rss}	f=1MHz	-	11	-	
Gate charge	Q_{Gate}	V_{CC}=480V, I_C=6A V_{GE}=15V	-	42	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH
Short circuit collector current[1)]	$I_{C(SC)}$	V_{GE}=15V, t_{SC}≤5µs V_{CC} = 400V, T_j = 25°C	-	55	-	A

[1)] Allowed number of short circuits: <1000; time between short circuits: >1s.

Switching Characteristic, Inductive Load, at T_j=25 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=25°C, V_{CC}=400V, I_C=6A, V_{GE}=0/15V, r_G=23Ω, L_σ=60nH, C_σ=40pF L_σ, C_σ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	9.4	-	ns
Rise time	t_r		-	5.6	-	
Turn-off delay time	$t_{d(off)}$		-	130	-	
Fall time	t_f		-	58	-	
Turn-on energy	E_{on}		-	0.09	-	mJ
Turn-off energy	E_{off}		-	0.11	-	
Total switching energy	E_{ts}		-	0.2	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	T_j=25°C, V_R=400V, I_F=6A, di_F/dt=550A/µs	-	123	-	ns
Diode reverse recovery charge	Q_{rr}		-	190	-	nC
Diode peak reverse recovery current	I_{rrm}		-	5.3	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	450	-	A/µs

Switching Characteristic, Inductive Load, at T_j=175 °C

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	T_j=175°C, V_{CC}=400V, I_C=6A, V_{GE}=0/15V, r_G=23Ω, L_σ=60nH, C_σ=40pF L_σ, C_σ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	8.8	-	ns
Rise time	t_r		-	8.2	-	
Turn-off delay time	$t_{d(off)}$		-	165	-	
Fall time	t_f		-	84	-	
Turn-on energy	E_{on}		-	0.14	-	mJ
Turn-off energy	E_{off}		-	0.18	-	
Total switching energy	E_{ts}		-	0.335	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	T_j=175°C V_R=400V, I_F=6A, di_F/dt=550A/µs	-	180	-	ns
Diode reverse recovery charge	Q_{rr}		-	500	-	nC
Diode peak reverse recovery current	I_{rrm}		-	7.6	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	285	-	A/µs

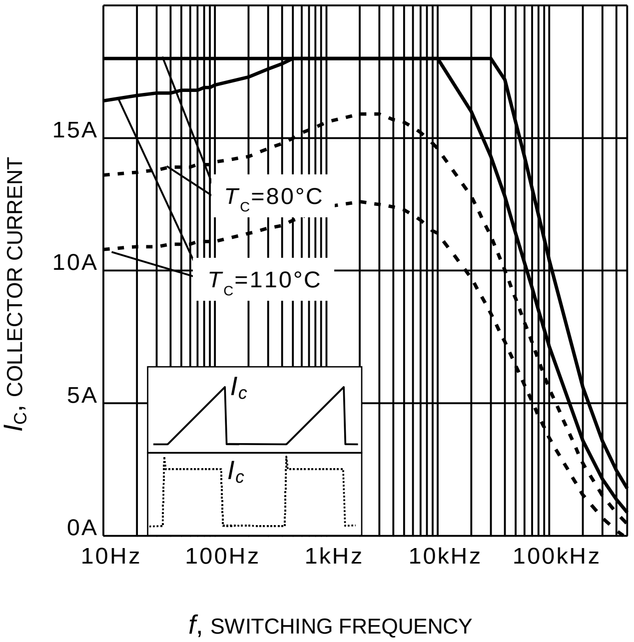


Figure 1. Collector current as a function of switching frequency
($T_j \leq 175°C$, $D = 0.5$, $V_{CE} = 400V$, $V_{GE} = 0/15V$, $r_G = 23\Omega$)

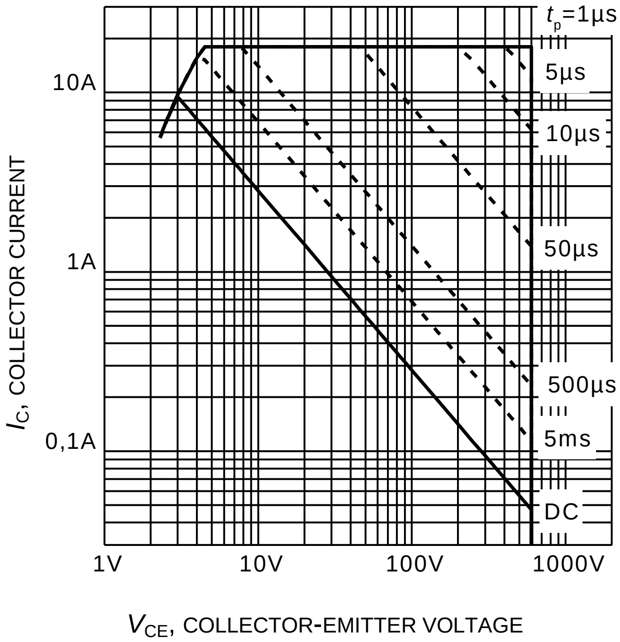


Figure 2. Safe operating area
($D = 0$, $T_C = 25°C$, $T_j \leq 175°C$; V_{GE}=0/15V)

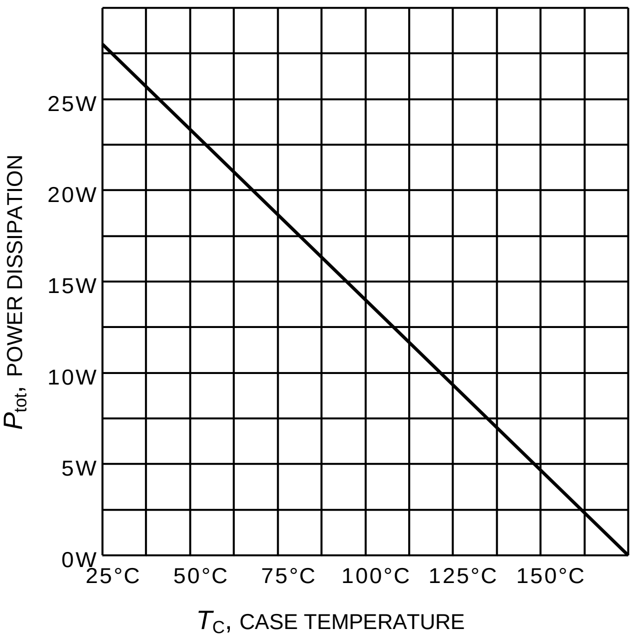


Figure 3. Power dissipation as a function of case temperature
($T_j \leq 175°C$)

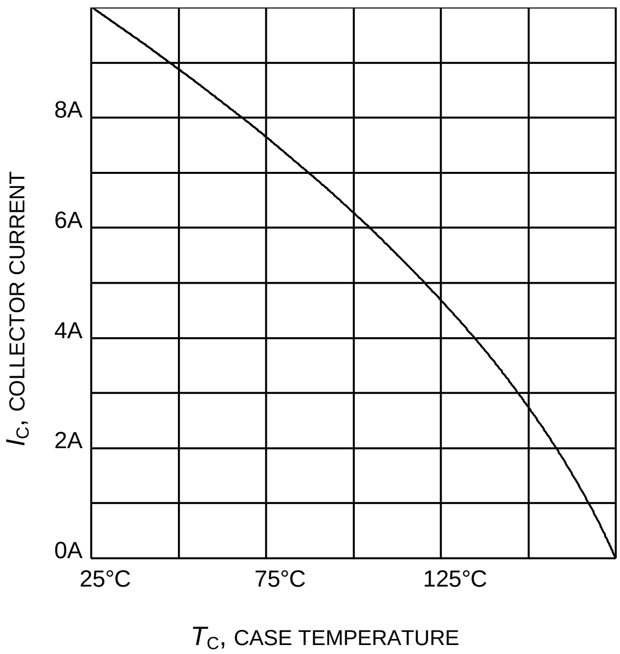


Figure 4. Collector current as a function of case temperature
($V_{GE} \geq 15V$, $T_j \leq 175°C$)

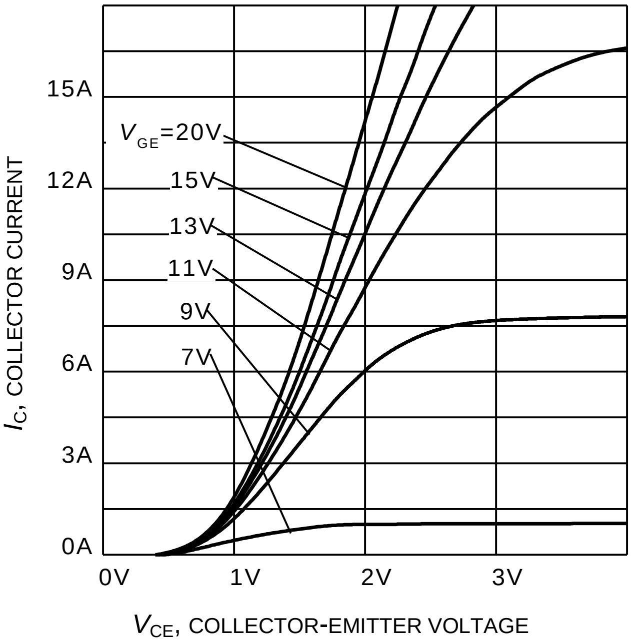


Figure 5. Typical output characteristic
(T_j = 25°C)

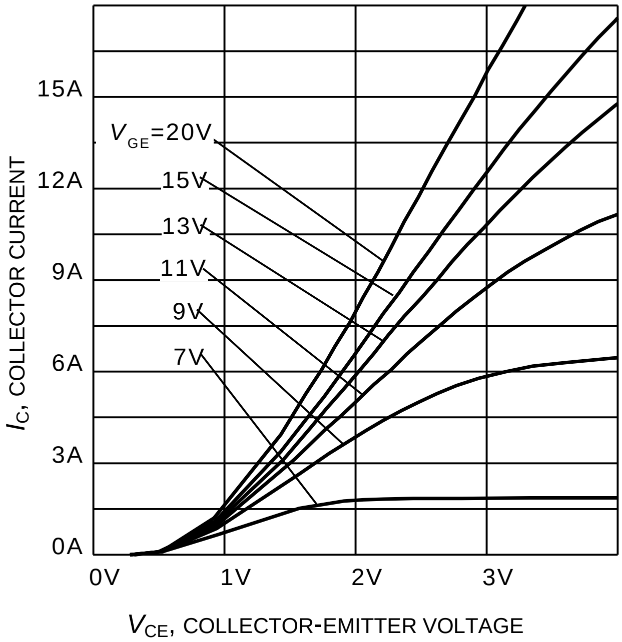


Figure 6. Typical output characteristic
(T_j = 175°C)

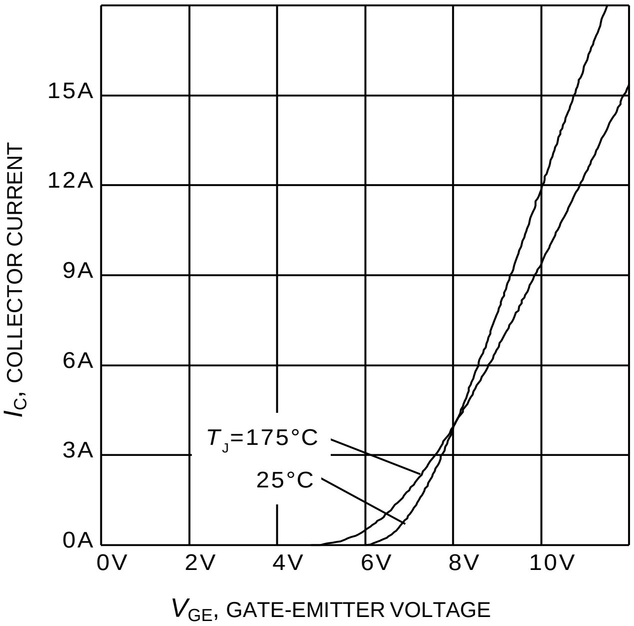


Figure 7. Typical transfer characteristic
(V_{CE}=20V)

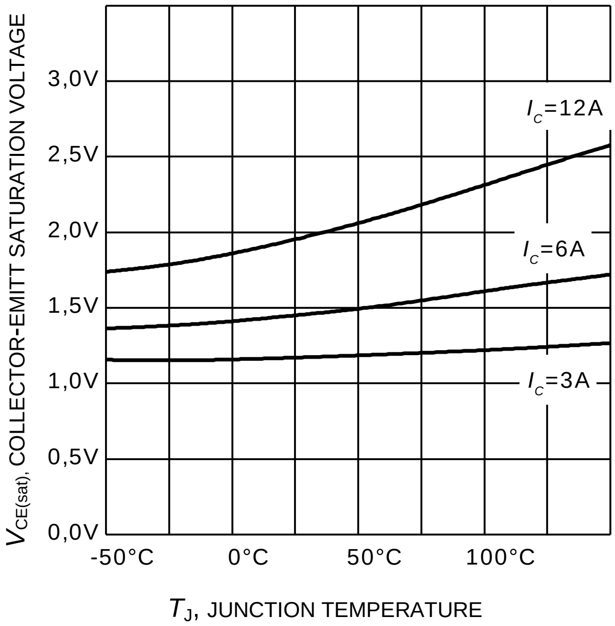


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE} = 15V)

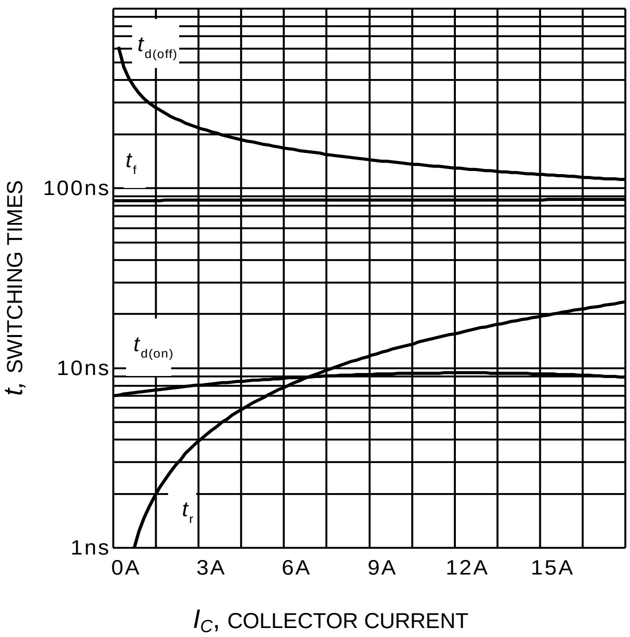


Figure 9. Typical switching times as a function of collector current
(inductive load, T_J=175°C, V_{CE} = 400V, V_{GE} = 0/15V, r_G = 23Ω, Dynamic test circuit in Figure E)

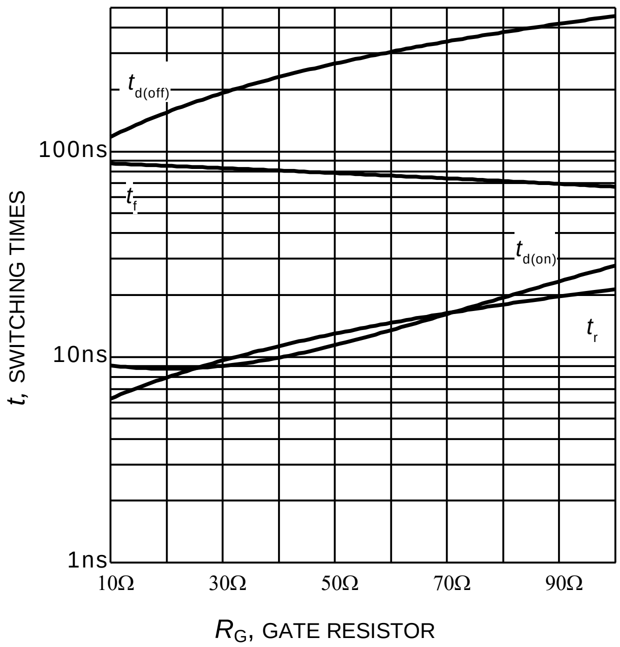


Figure 10. Typical switching times as a function of gate resistor
(inductive load, T_J=175°C, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 6A, Dynamic test circuit in Figure E)

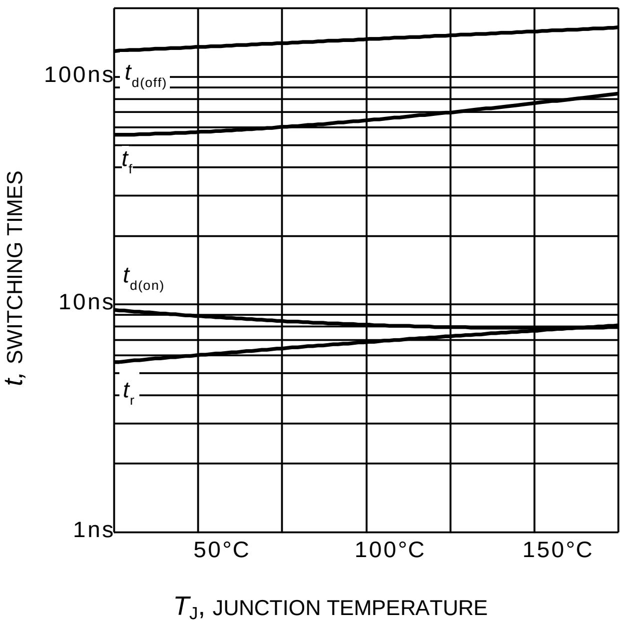


Figure 11. Typical switching times as a function of junction temperature
(inductive load, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 6A, r_G = 23Ω, Dynamic test circuit in Figure E)

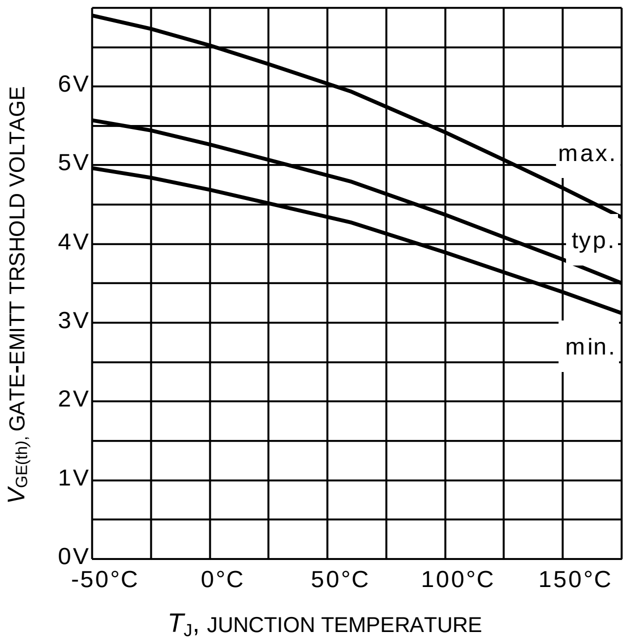


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
(I_C = 0.18mA)

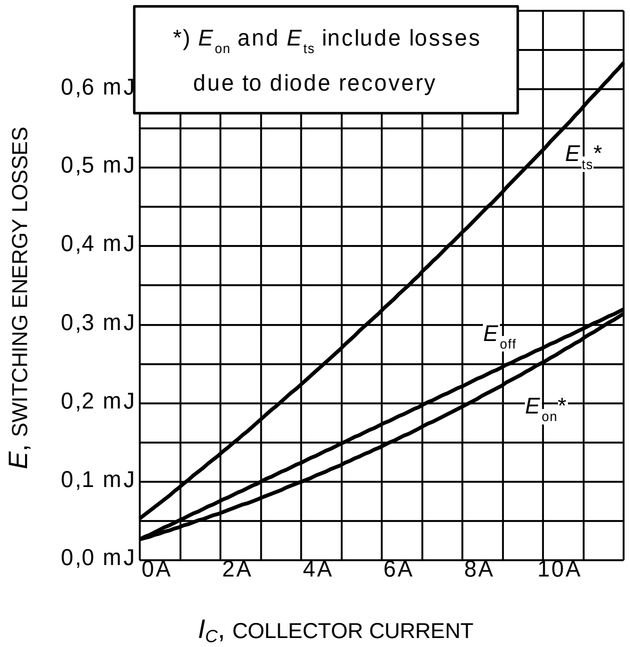


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, T_J=175°C, V_{CE}=400V, V_{GE}=0/15V, r_G=23Ω, Dynamic test circuit in Figure E)

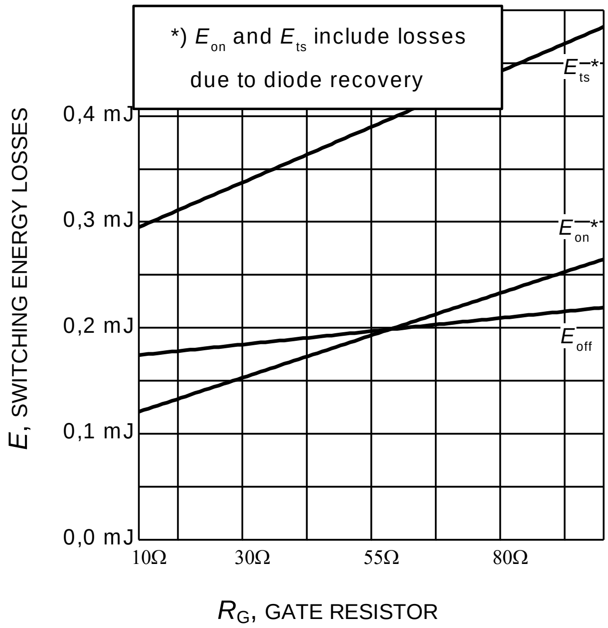


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, T_J=175°C, V_{CE} = 400V, V_{GE} = 0/15V, I_C = 6A, Dynamic test circuit in Figure E)

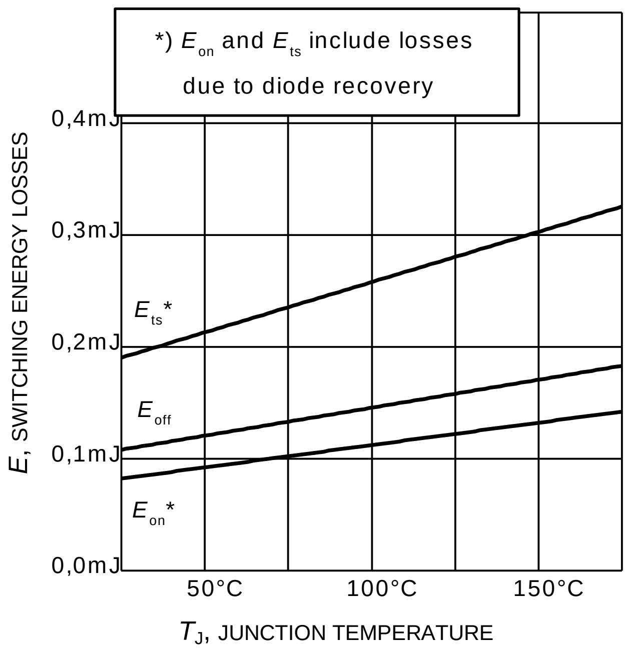


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=400V, V_{GE} = 0/15V, I_C = 6A, r_G = 23Ω, Dynamic test circuit in Figure E)

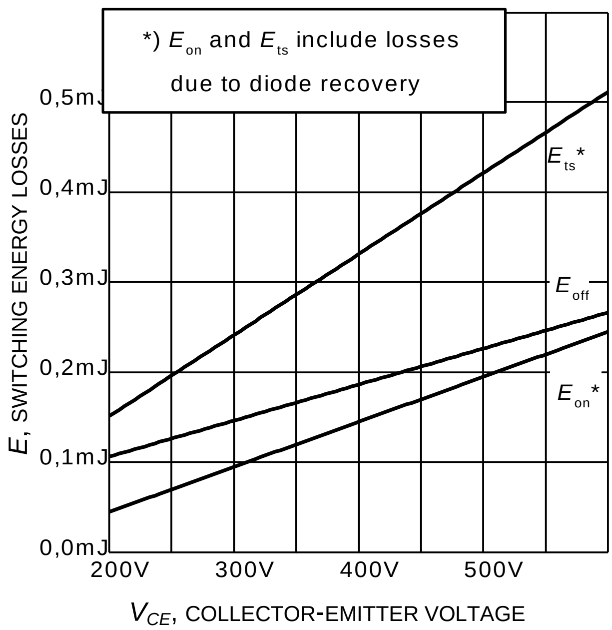


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_J = 175°C, V_{GE} = 0/15V, I_C = 6A, r_G = 23Ω, Dynamic test circuit in Figure E)

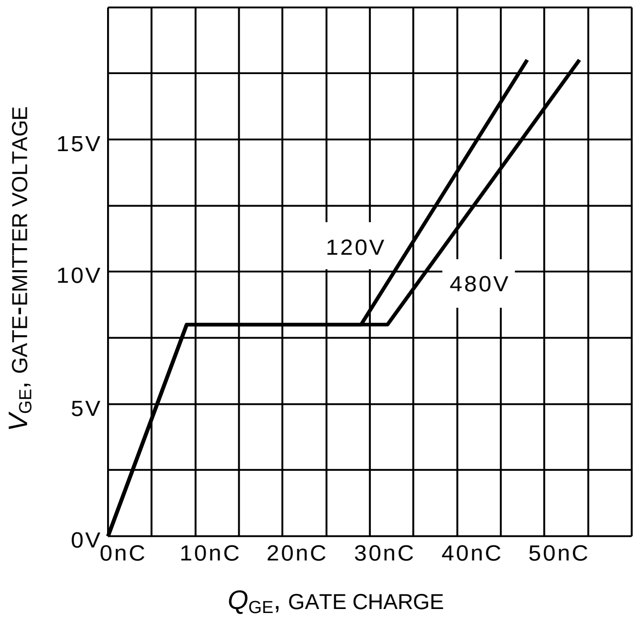


Figure 17. Typical gate charge
(I_C=6 A)

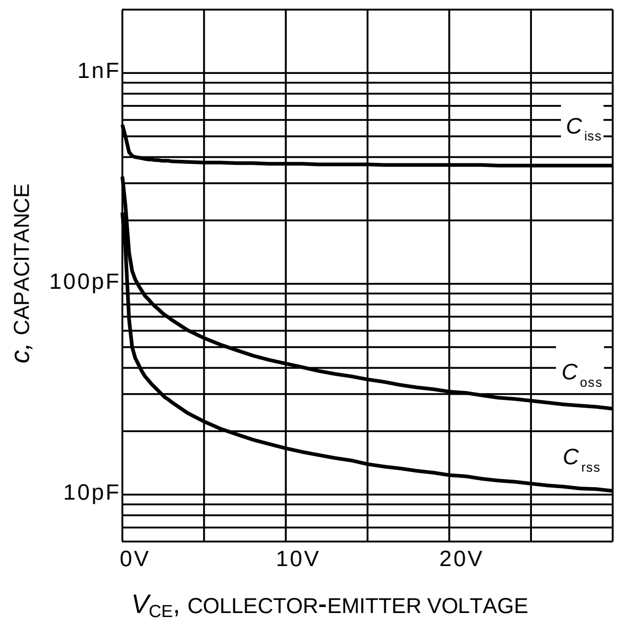


Figure 18. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

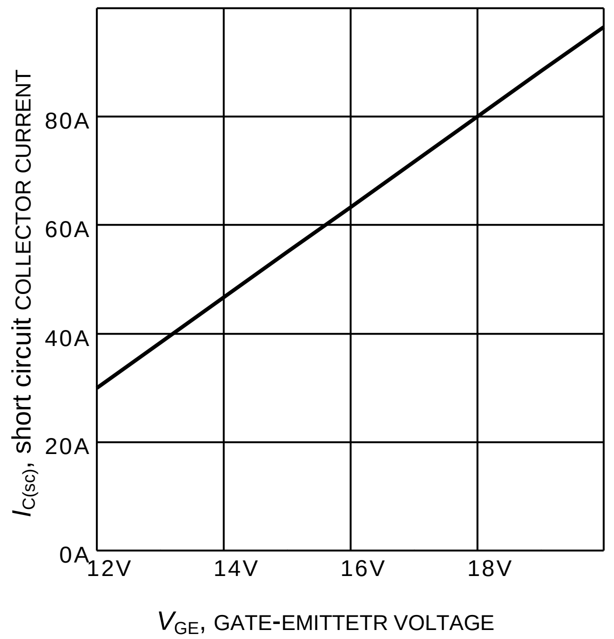


Figure 19. Typical short circuit collector current as a function of gate-emitter voltage
($V_{CE} \leq$ 400V, $T_j \leq$ 150°C)

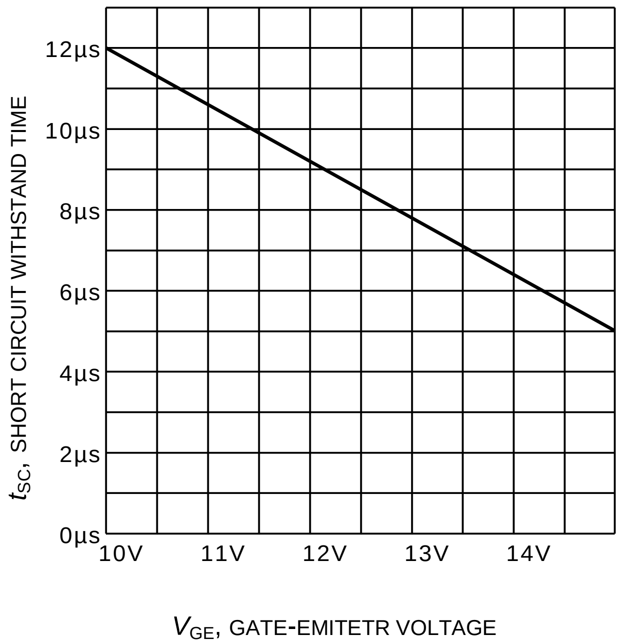


Figure 20. Short circuit withstand time as a function of gate-emitter voltage
(V_{CE}=400V, start at T_J=25°C, T_{Jmax}<150°C)

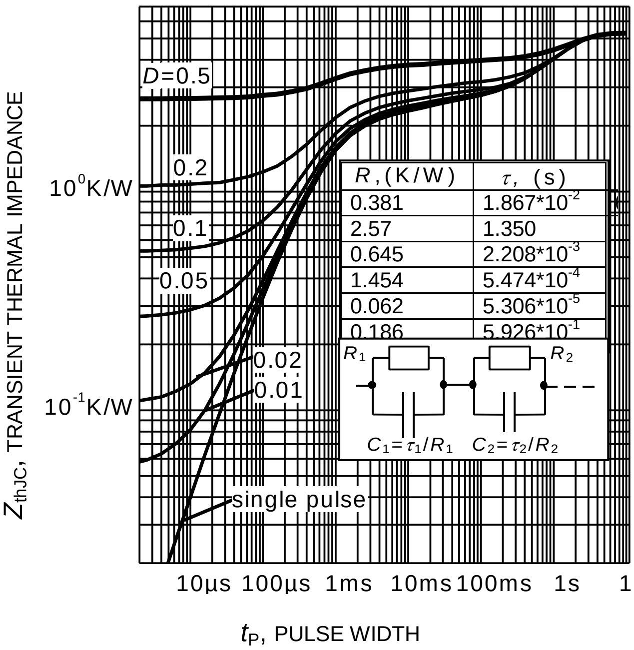


Figure 21. IGBT transient thermal impedance
($D = t_p / T$)

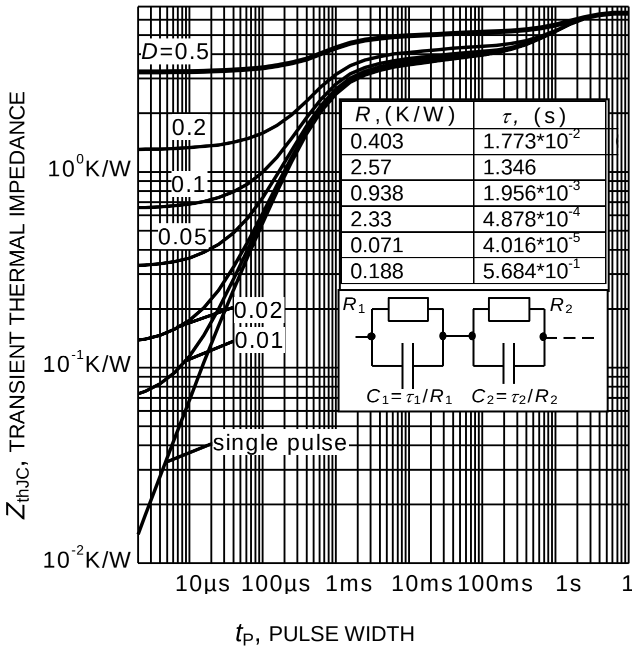


Figure 22. Diode transient thermal impedance as a function of pulse width
($D=t_P/T$)

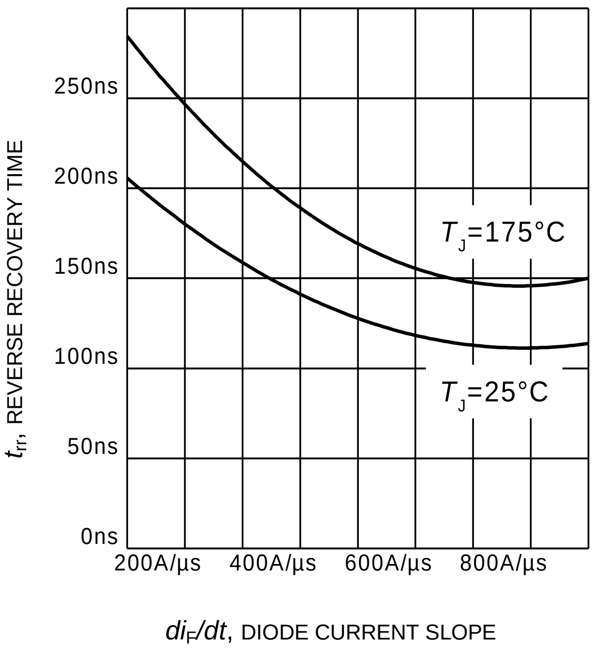


Figure 23. Typical reverse recovery time as a function of diode current slope
(V_R = 400V, I_F = 6A,
Dynamic test circuit in Figure E)

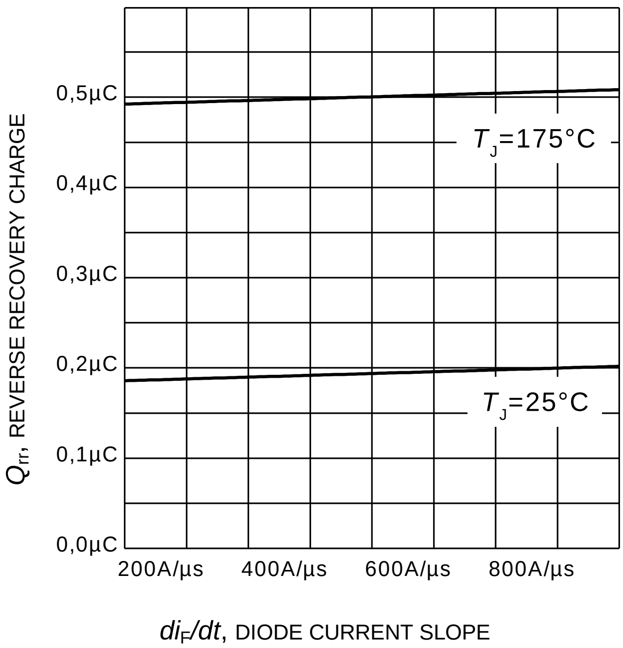


Figure 24. Typical reverse recovery charge as a function of diode current slope
(V_R = 400V, I_F = 6A,
Dynamic test circuit in Figure E)

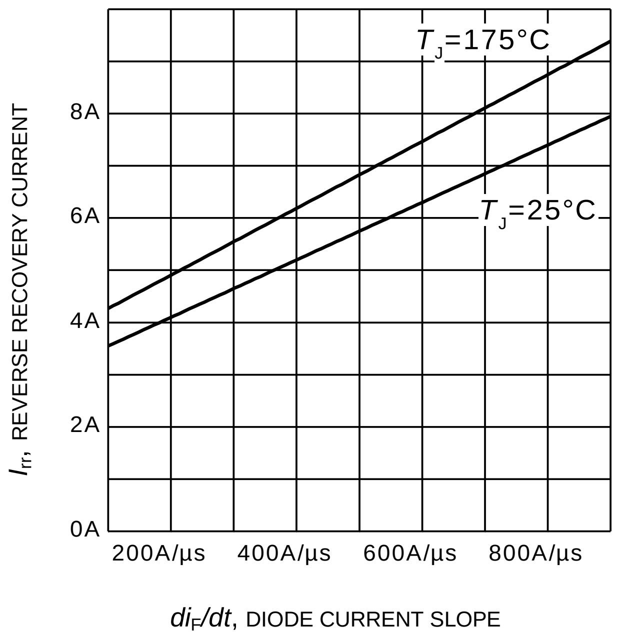


Figure 25. Typical reverse recovery current as a function of diode current slope
(V_R = 400V, I_F = 6A,
Dynamic test circuit in Figure E)

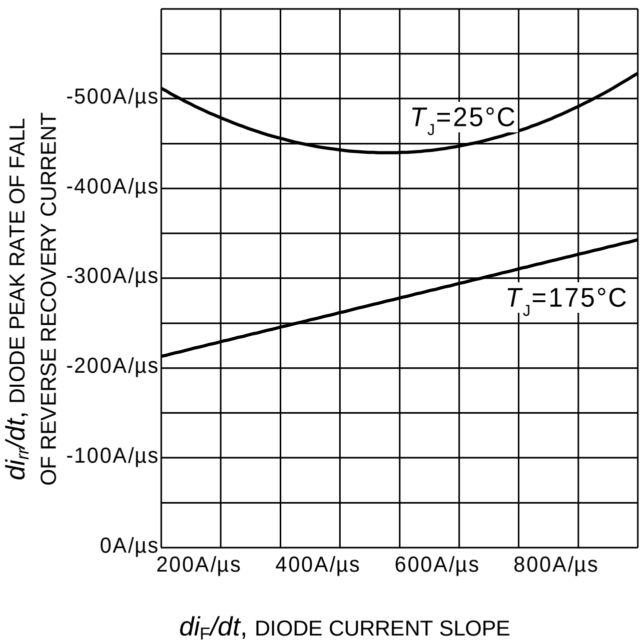


Figure 26. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope
(V_R = 400V, I_F = 6A,
Dynamic test circuit in Figure E)

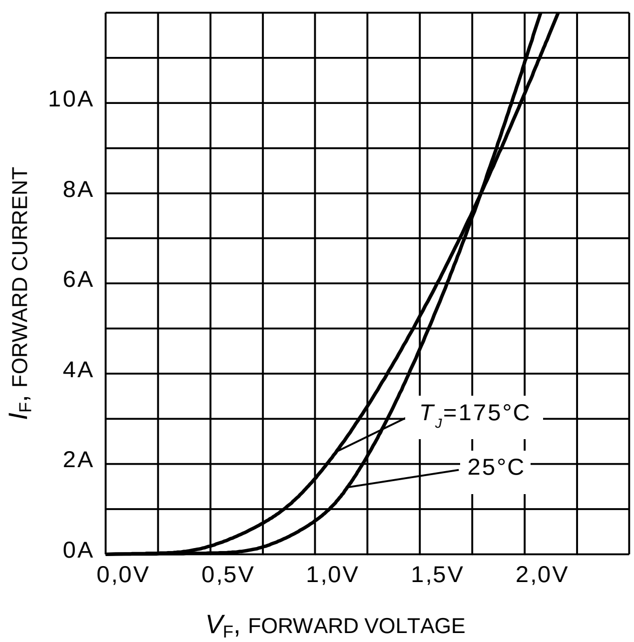


Figure 27. Typical diode forward current as a function of forward voltage

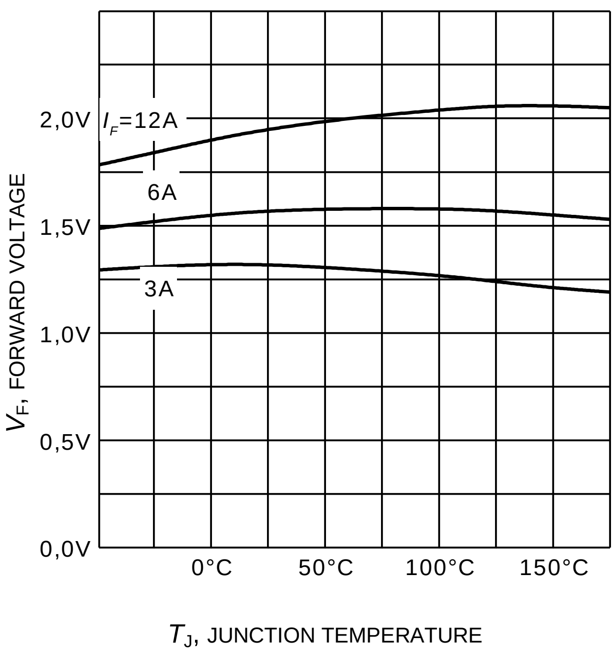
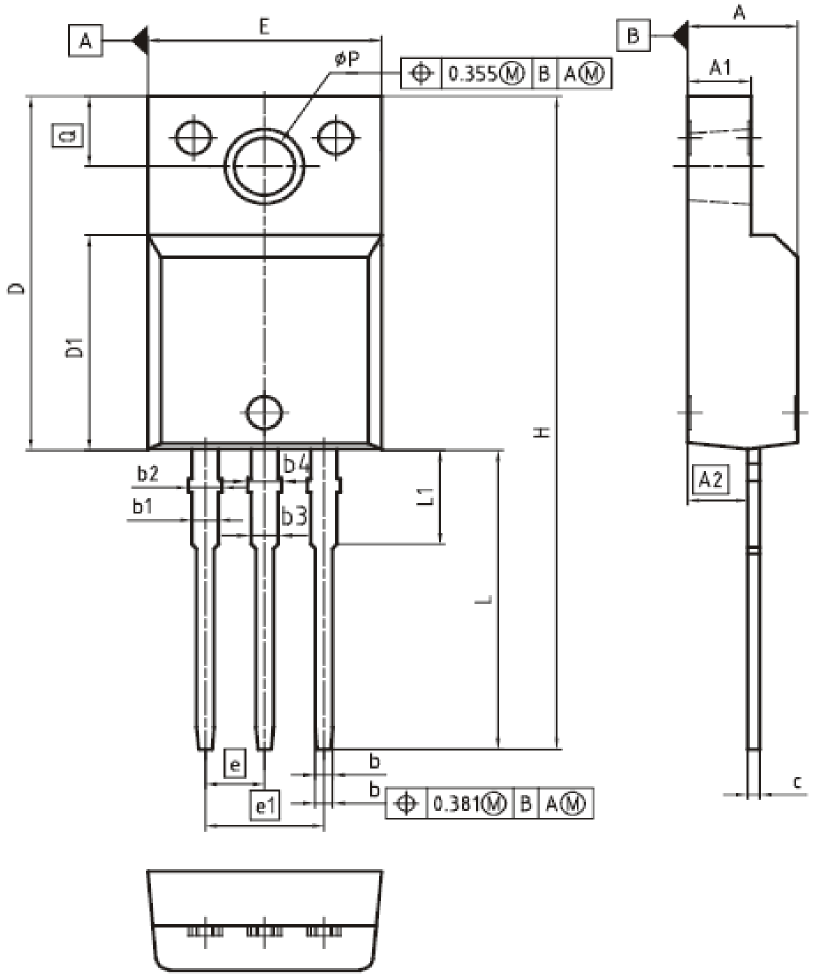


Figure 28. Typical diode forward voltage as a function of junction temperature

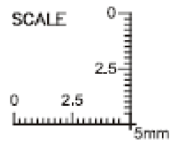
PG-TO220-3 (FullPAK)



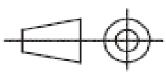
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.55	4.85	0.179	0.191
A1	2.55	2.85	0.100	0.112
A2	2.42	2.72	0.095	0.107
b	0.65	0.85	0.026	0.033
b1	0.95	1.33	0.037	0.052
b2	0.95	1.51	0.037	0.059
b3	0.65	1.33	0.026	0.052
b4	0.65	1.51	0.026	0.059
c	0.40	0.63	0.016	0.025
D	15.85	16.15	0.624	0.636
D1	9.53	9.83	0.375	0.387
E	10.35	10.65	0.407	0.419
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H	29.45	29.75	1.159	1.171
L	13.45	13.75	0.530	0.541
L1	3.15	3.45	0.124	0.136
øP	2.95	3.20	0.116	0.126
Q	3.15	3.50	0.124	0.138

DOCUMENT NO.
Z8B00003319

SCALE



EUROPEAN PROJECTION



ISSUE DATE
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REVISION
03

Please refer to mounting instructions

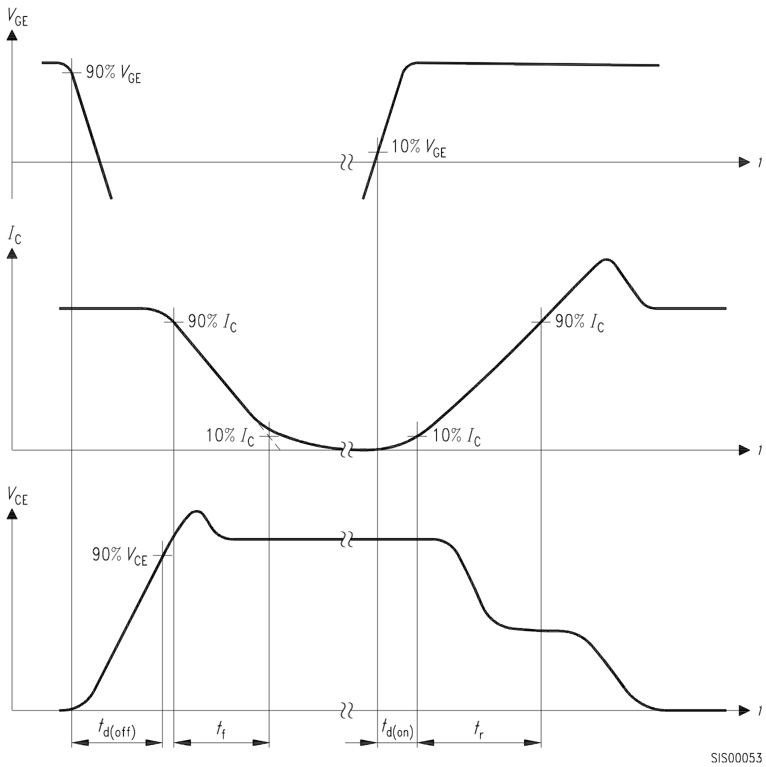

Figure A. Definition of switching times

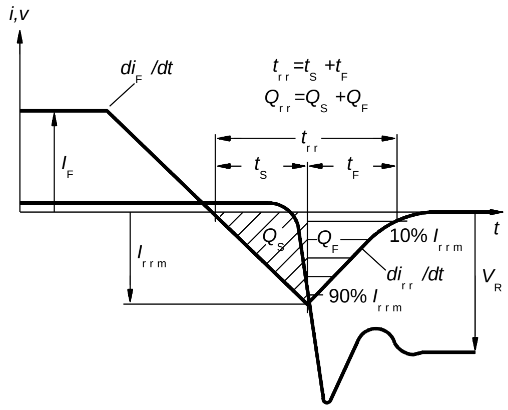

Figure C. Definition of diodes switching characteristics

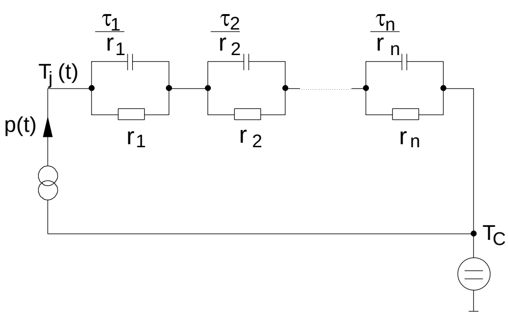

Figure D. Thermal equivalent circuit

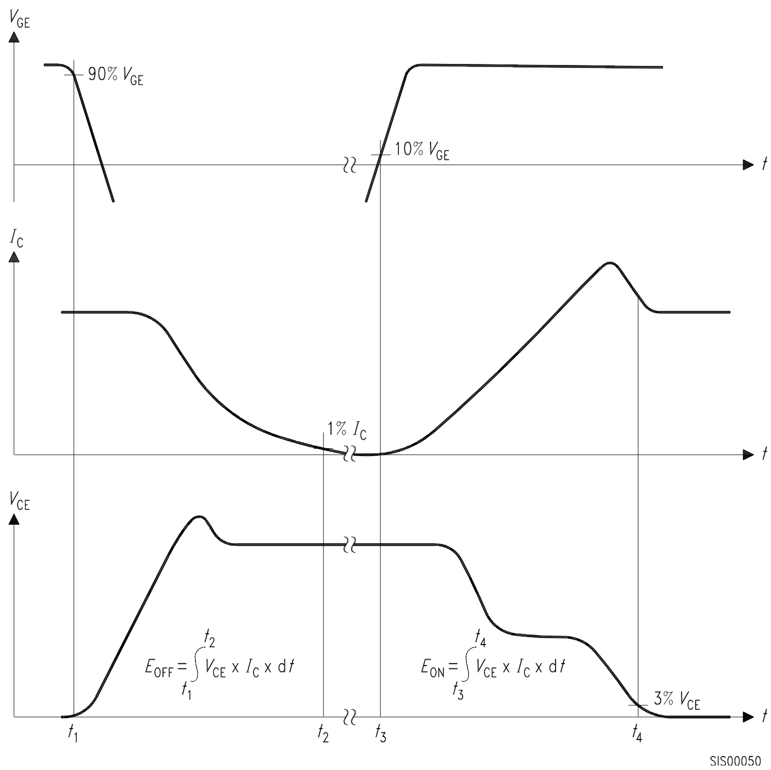

Figure B. Definition of switching losses

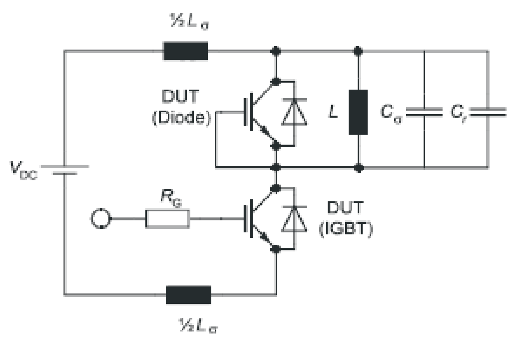

Figure E. Dynamic test circuit
Parasitic inductance L_σ,
Parasitic capacitor C_σ,
Relief capacitor C_r,
(only for ZVT switching)

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Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.
The Infineon Technologies component described in this Data Sheet may be used in life-support devices or systems and/or automotive, aviation and aerospace applications or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support, automotive, aviation and aerospace device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

LifeElectronics
Живое партнерство

ООО «ЛайфЭлектроникс» "LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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