

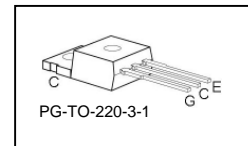
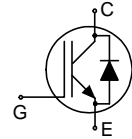


**THE DATASHEET OF
IKP01N120H2XKSA1**



HighSpeed 2-Technology with soft, fast recovery anti-parallel Emitter Controlled HE diode

- Designed for:**
 - SMPS
 - Lamp Ballast
 - ZVS-Converter
 - optimised for soft-switching / resonant topologies
- 2nd generation HighSpeed-Technology for 1200V applications offers:**
 - loss reduction in resonant circuits
 - temperature stable behavior
 - parallel switching capability
 - tight parameter distribution
 - E_{off} optimized for $I_C = 1A$
- Pb-free lead plating; RoHS compliant
- Qualified according to JEDEC² for target applications
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>



Type	V_{CE}	I_C	E_{off}	T_j	Marking	Package
IKP01N120H2	1200V	1A	0.09mJ	150°C	K01H1202	PG-TO-220-3-1

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
Triangular collector current	I_C		A
$T_C = 25^\circ\text{C}$, $f = 140\text{kHz}$		3.2	
$T_C = 100^\circ\text{C}$, $f = 140\text{kHz}$		1.3	
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	3.5	
Turn off safe operating area	-	3.5	
$V_{CE} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$			
Diode forward current	I_F		
$T_C = 25^\circ\text{C}$		3.2	
$T_C = 100^\circ\text{C}$		1.3	
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation	P_{tot}	28	W
$T_C = 25^\circ\text{C}$			
Operating junction and storage temperature	T_j, T_{stg}	-40...+150	°C
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

² J-STD-020 and JESD-022

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		4.5	K/W
Diode thermal resistance, Junction - case	R_{thJCD}		11	
Thermal resistance, junction – ambient	R_{thJA}	PG-TO-220-3-1	62	

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=300\mu A$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C=1A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	-	2.2	2.8	
			$V_{GE} = 10V, I_C=1A,$ $T_j=25^\circ\text{C}$	-	2.5	
				-	2.4	-
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C=30\mu A, V_{CE}=V_{GE}$	2.1	3	3.9	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	-	-	20	μA
			-	-	80	
Diode forward voltage	V_F	$V_{GE} = 0, I_F=0.5A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	-	2.0	2.5	V
			-	1.75	-	
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	40	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=1A$	-	0.75	-	S
Dynamic Characteristic						
Input capacitance	C_{iss}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1\text{MHz}$	-	91.6	-	pF
Output capacitance	C_{oss}		-	9.8	-	
Reverse transfer capacitance	C_{riss}		-	3.4	-	
Gate charge	Q_{Gate}	$V_{CC}=960V, I_C=1A$ $V_{GE}=15V$	-	8.6	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	7	-	nH

Switching Characteristic, Inductive Load, at $T_j=25^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=25^\circ\text{C}$,	-	13	-	ns
Rise time	t_r	$V_{CC}=800\text{V}$,	-	6.3	-	
Turn-off delay time	$t_{d(off)}$	$I_C=1\text{A}$,	-	370	-	
Fall time	t_f	$V_{GE}=15\text{V}/0\text{V}$,	-	28	-	
Turn-on energy	E_{on}	$R_G=241\Omega$,	-	0.08	-	mJ
Turn-off energy	E_{off}	$L_\sigma^{(2)}=180\text{nH}$,	-	0.06	-	
Total switching energy	E_{ts}	$C_\sigma^{(2)}=40\text{pF}$ Energy losses include "tail" and diode ³⁾ reverse recovery.	-	0.14	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	$T_j=25^\circ\text{C}$,	-	83	-	ns
Diode reverse recovery charge	Q_{rr}	$V_R=800\text{V}$, $I_F=1\text{A}$,	-	89	-	μC
Diode peak reverse recovery current	I_{rrm}	$R_G=241\Omega$	-	2.5	-	A
Diode current slope	di_F/dt		-	289	-	$\text{A}/\mu\text{s}$
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	178	-	

Switching Characteristic, Inductive Load, at $T_j=150^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	max.	
IGBT Characteristic						
Turn-on delay time	$t_{d(on)}$	$T_j=150^\circ\text{C}$	-	12	-	ns
Rise time	t_r	$V_{CC}=800\text{V}$,	-	8.9	-	
Turn-off delay time	$t_{d(off)}$	$I_C=1\text{A}$,	-	450	-	
Fall time	t_f	$V_{GE}=15\text{V}/0\text{V}$,	-	43	-	
Turn-on energy	E_{on}	$R_G=241\Omega$,	-	0.11	-	mJ
Turn-off energy	E_{off}	$L_\sigma^{(2)}=180\text{nH}$,	-	0.09	-	
Total switching energy	E_{ts}	$C_\sigma^{(2)}=40\text{pF}$ Energy losses include "tail" and diode ³⁾ reverse recovery.	-	0.2	-	
Anti-Parallel Diode Characteristic						
Diode reverse recovery time	t_{rr}	$T_j=150^\circ\text{C}$	-	213	-	ns
Diode reverse recovery charge	Q_{rr}	$V_R=800\text{V}$, $I_F=1\text{A}$,	-	180	-	μC
Diode peak reverse recovery current	I_{rrm}	$R_G=241\Omega$	-	2.7	-	A
Diode current slope	di_F/dt		-	240	-	$\text{A}/\mu\text{s}$
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	135	-	

²⁾ Leakage inductance L_σ and stray capacity C_σ due to dynamic test circuit in figure E

³⁾ Commutation diode from device IKP01N120H2

Switching Energy ZVT, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
Turn-off energy	E_{off}	$V_{CC}=800V,$ $I_C=1A,$ $V_{GE}=15V/0V,$ $R_G=241\Omega,$ $C_r^{2)}=1nF$ $T_j=25^\circ C$ $T_j=150^\circ C$	-	0.02	-	mJ
			-	0.044	-	

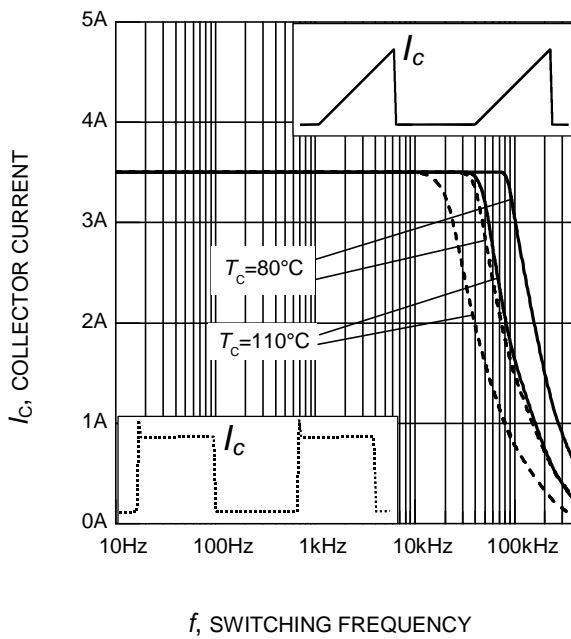


Figure 1. Collector current as a function of switching frequency
 ($T_j \leq 150^\circ\text{C}$, $D = 0.5$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 241\Omega$)

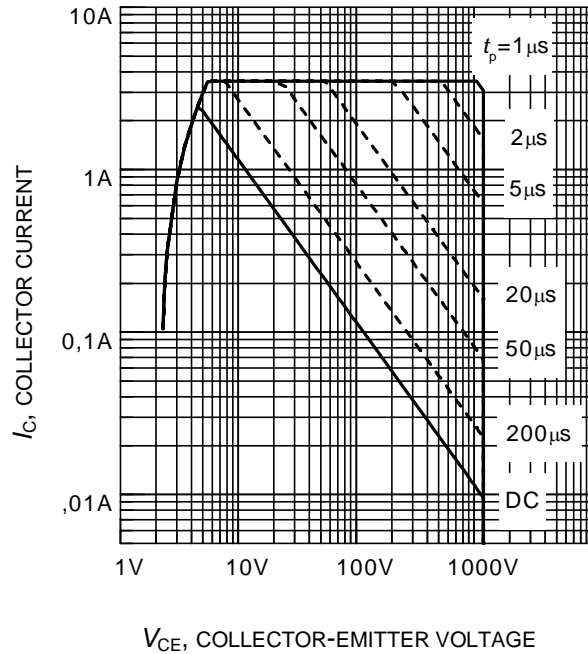


Figure 2. Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$)

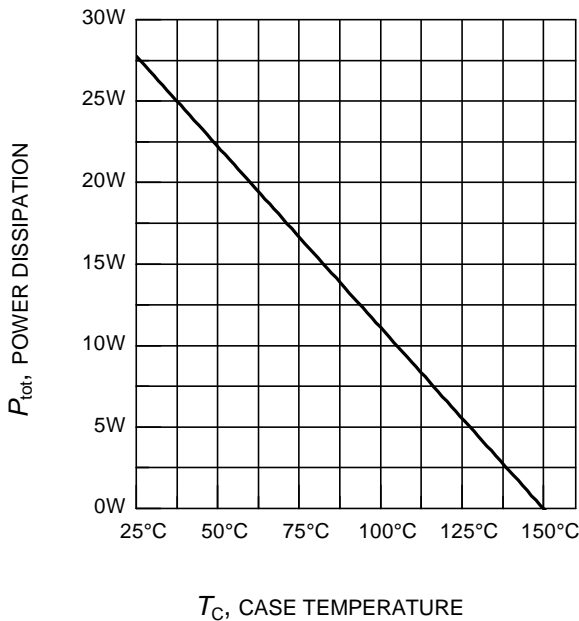


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 150^\circ\text{C}$)

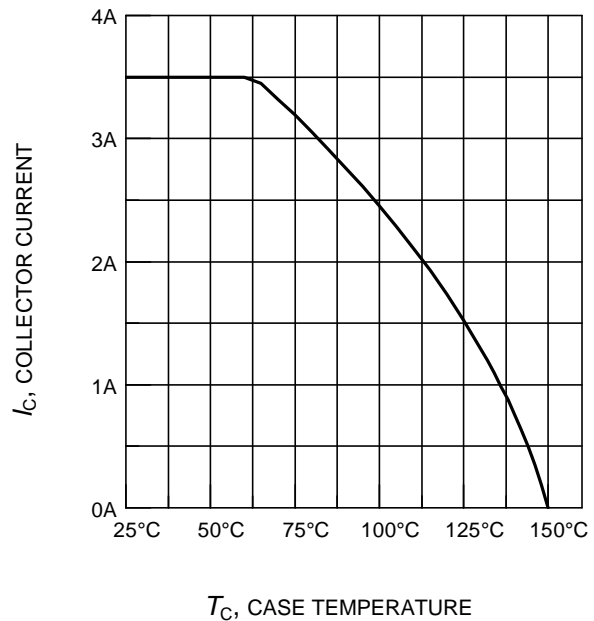
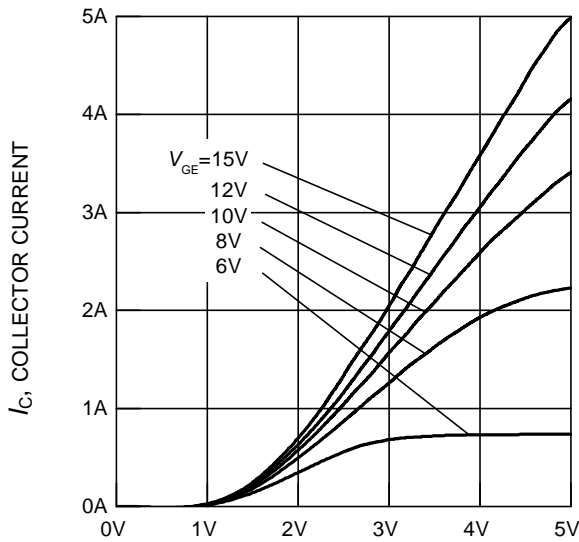
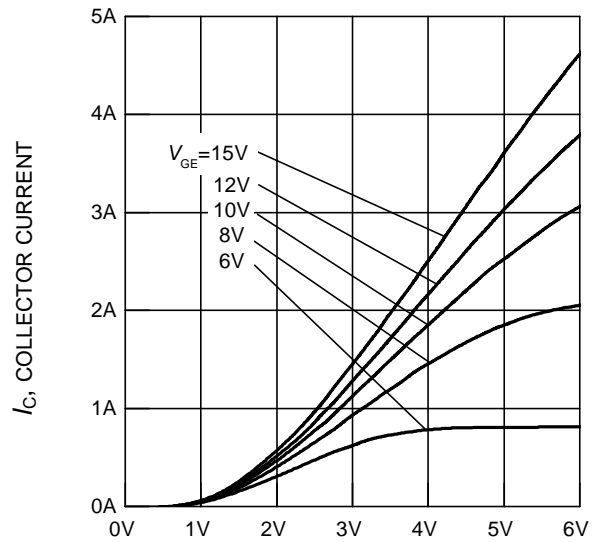


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \leq 15\text{V}$, $T_j \leq 150^\circ\text{C}$)



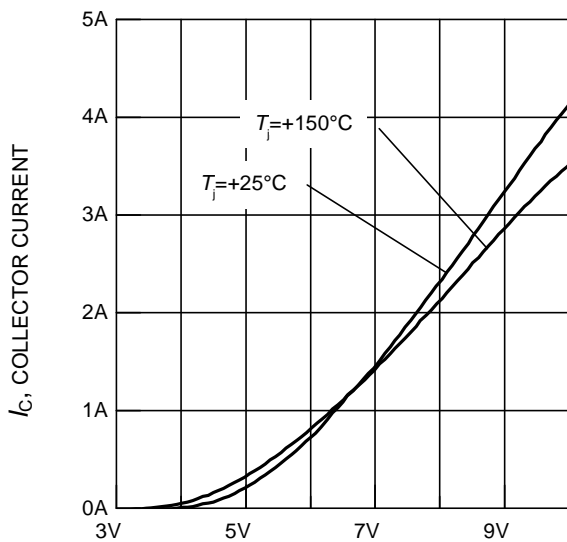
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 5. Typical output characteristics
($T_j = 25^\circ\text{C}$)



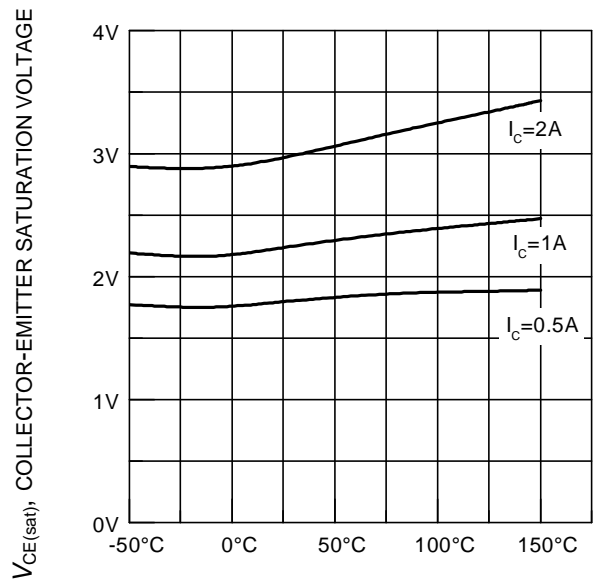
V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 6. Typical output characteristics
($T_j = 150^\circ\text{C}$)



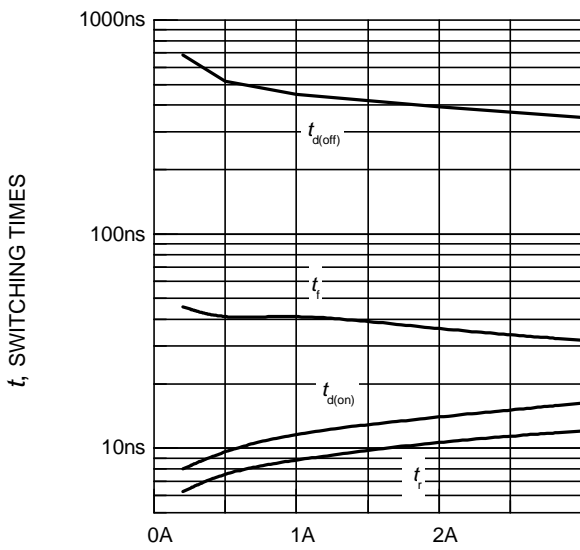
V_{GE} , GATE-EMITTER VOLTAGE

Figure 7. Typical transfer characteristics
($V_{CE} = 20\text{V}$)



T_j , JUNCTION TEMPERATURE

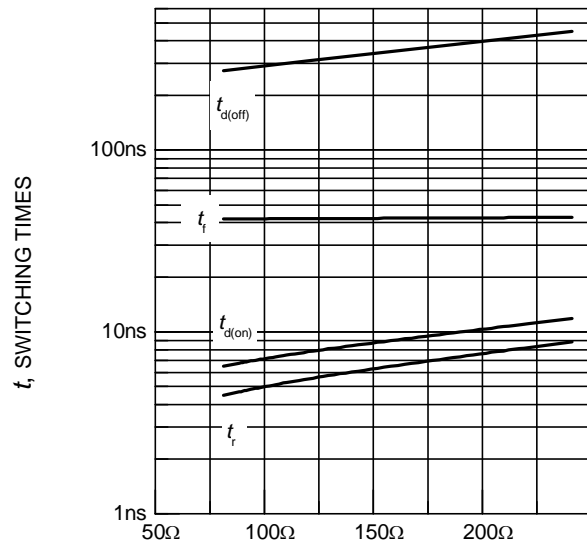
Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)



I_C , COLLECTOR CURRENT

Figure 9. Typical switching times as a function of collector current

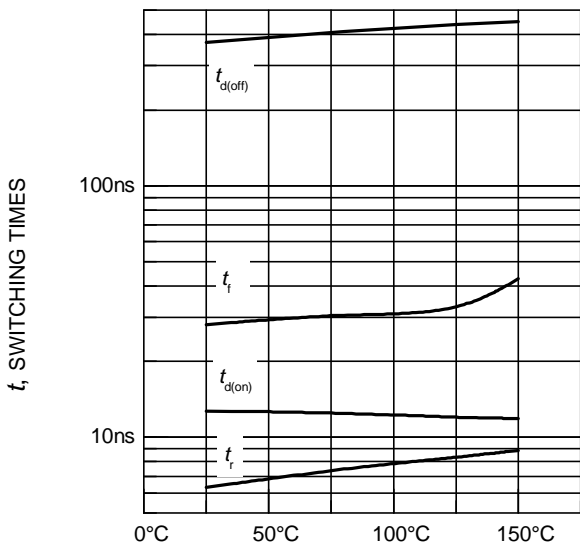
(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 241\Omega$,
dynamic test circuit in Fig.E)



R_G , GATE RESISTOR

Figure 10. Typical switching times as a function of gate resistor

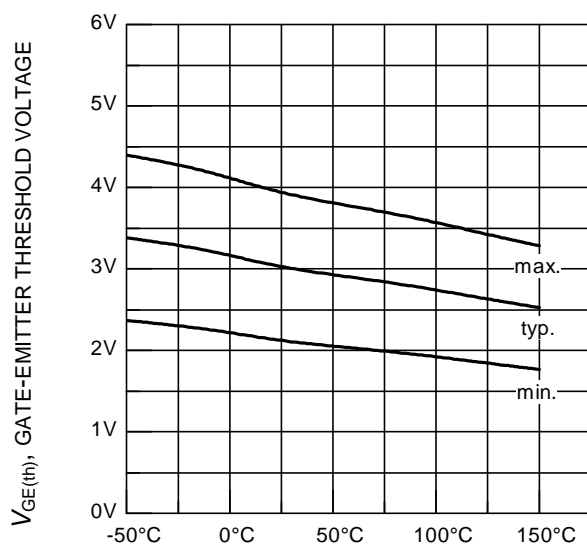
(inductive load, $T_j = 150^\circ\text{C}$,
 $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 1\text{A}$,
dynamic test circuit in Fig.E)



T_j , JUNCTION TEMPERATURE

Figure 11. Typical switching times as a function of junction temperature

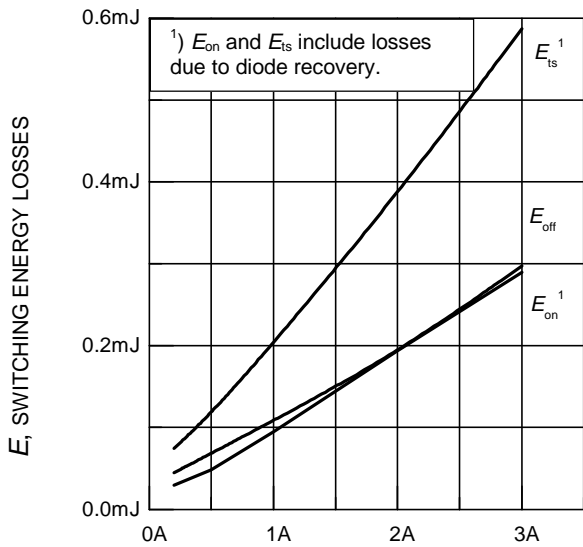
(inductive load, $V_{CE} = 800\text{V}$,
 $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 1\text{A}$, $R_G = 241\Omega$,
dynamic test circuit in Fig.E)



T_j , JUNCTION TEMPERATURE

Figure 12. Gate-emitter threshold voltage as a function of junction temperature

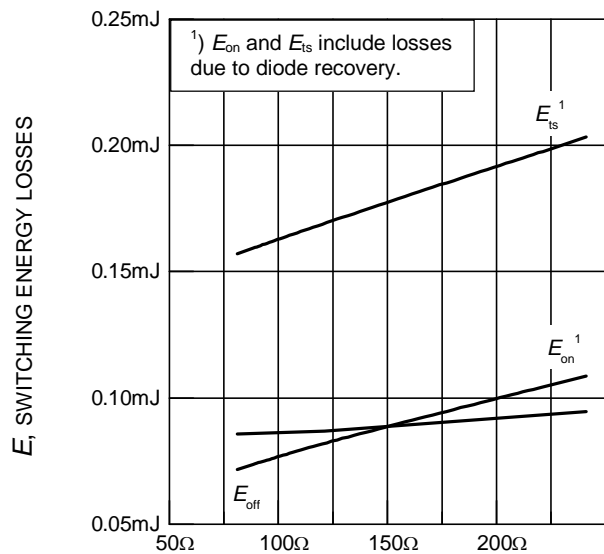
($I_C = 0.03\text{mA}$)



I_C , COLLECTOR CURRENT

Figure 13. Typical switching energy losses as a function of collector current

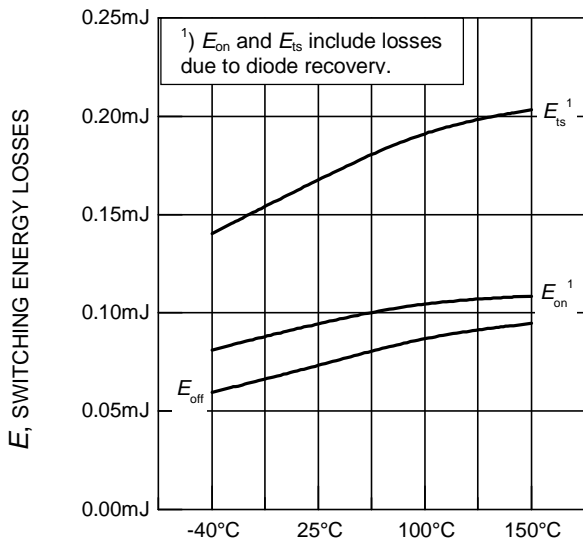
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 241\Omega$, dynamic test circuit in Fig.E)



R_G , GATE RESISTOR

Figure 14. Typical switching energy losses as a function of gate resistor

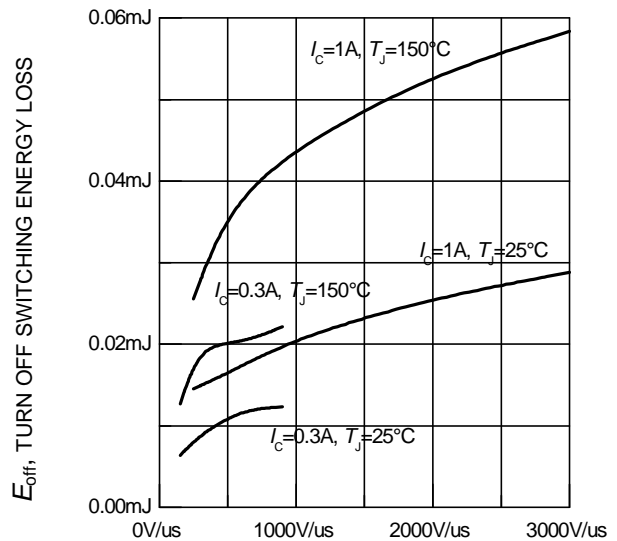
(inductive load, $T_j = 150^\circ\text{C}$, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 1\text{A}$, dynamic test circuit in Fig.E)



T_j , JUNCTION TEMPERATURE

Figure 15. Typical switching energy losses as a function of junction temperature

(inductive load, $V_{CE} = 800\text{V}$, $V_{GE} = +15\text{V}/0\text{V}$, $I_C = 1\text{A}$, $R_G = 241\Omega$, dynamic test circuit in Fig.E)



dv/dt , VOLTAGE SLOPE

Figure 16. Typical turn off switching energy loss for soft switching

(dynamic test circuit in Fig. E)

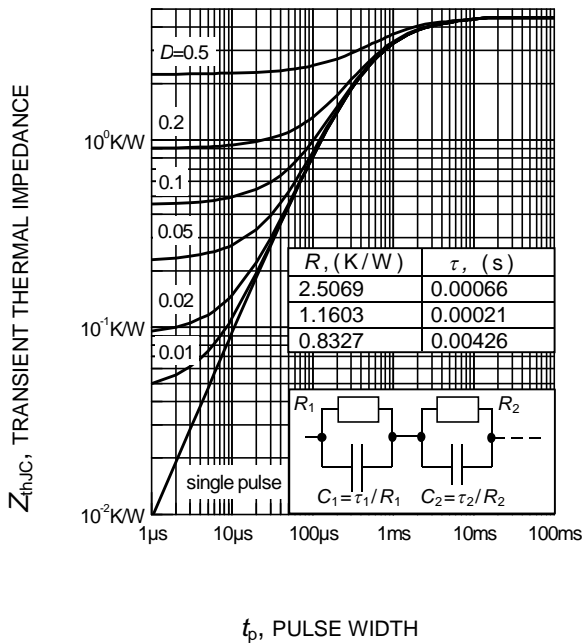


Figure 17. IGBT transient thermal impedance as a function of pulse width
 $(D = t_p / T)$

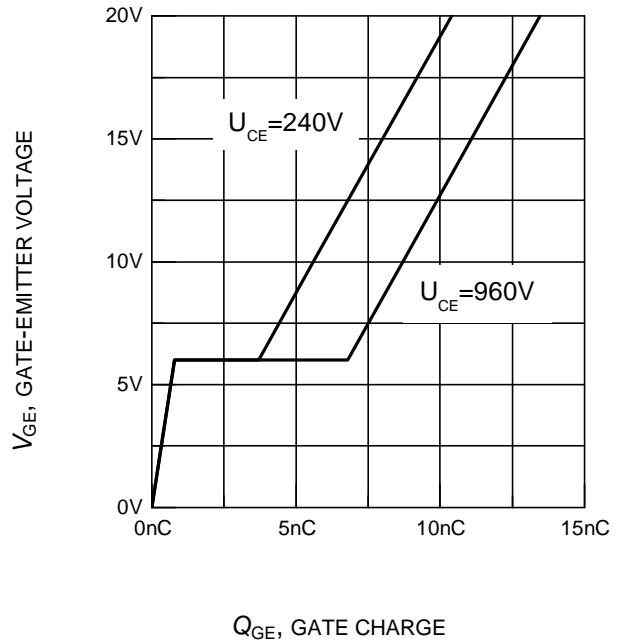


Figure 18. Typical gate charge
 $(I_C = 1A)$

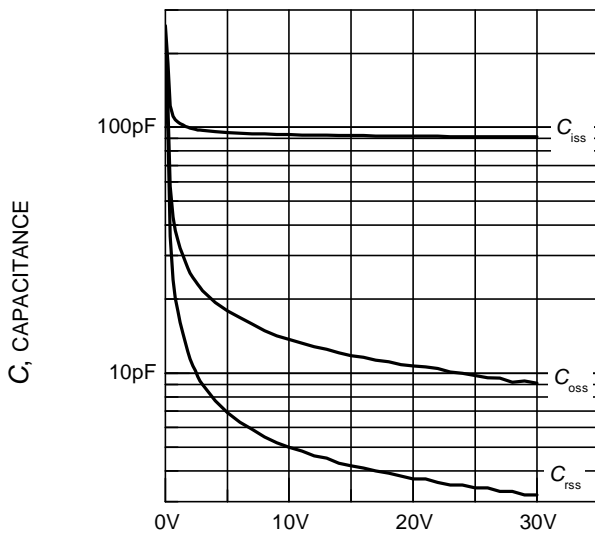


Figure 19. Typical capacitance as a function of collector-emitter voltage
 $(V_{GE} = 0V, f = 1MHz)$

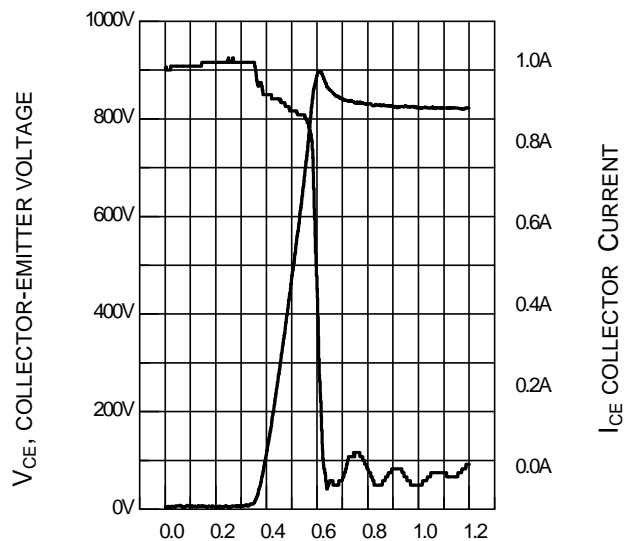


Figure 20. Typical turn off behavior, hard switching
 $(V_{GE} = 15/0V, R_G = 220\Omega, T_j = 150^\circ C,$
 Dynamic test circuit in Figure E)

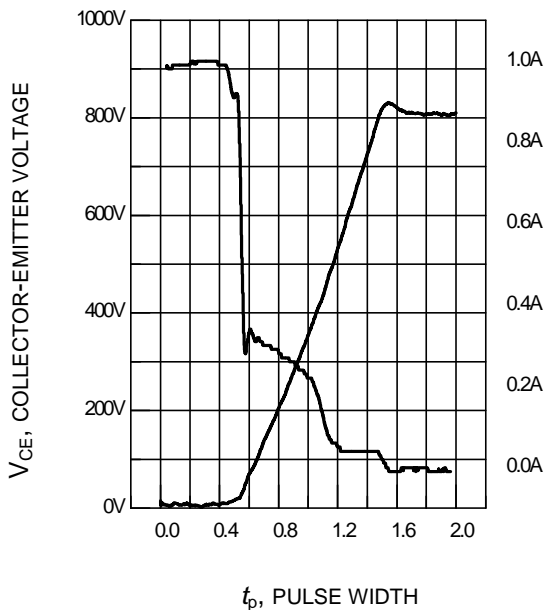


Figure 21. Typical turn off behavior, soft switching
 ($V_{GE}=15/0V$, $R_G=220\Omega$, $T_j = 150^\circ C$,
 Dynamic test circuit in Figure E)

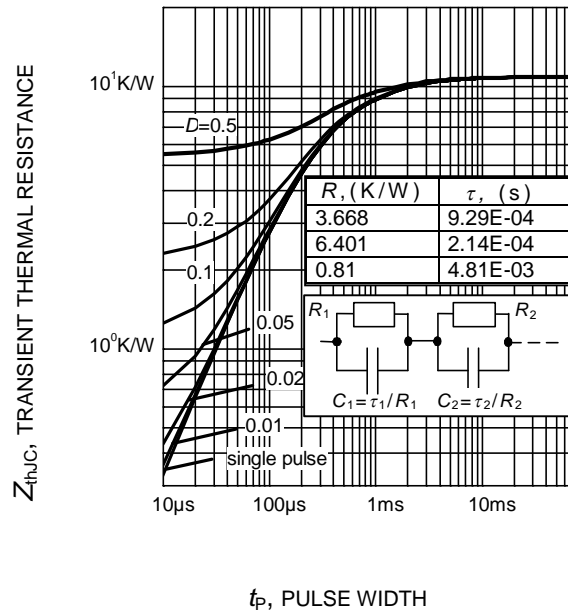


Figure 22. Diode transient thermal impedance as a function of pulse width
 ($D=t_p/T$)

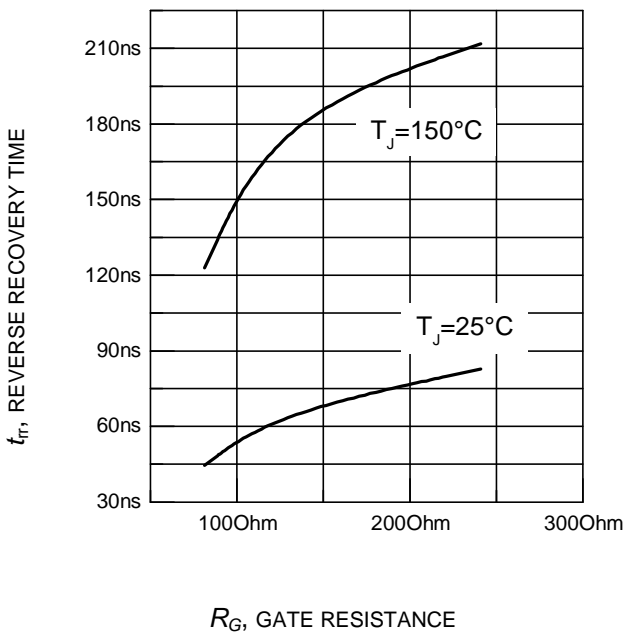


Figure 23. Typical reverse recovery time as a function of diode current slope
 ($V_R=800V$, $I_F=3A$,
 Dynamic test circuit in Figure E)

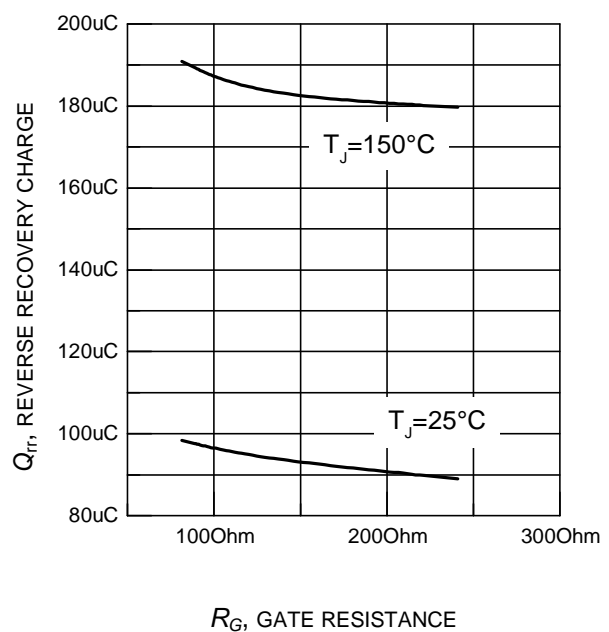
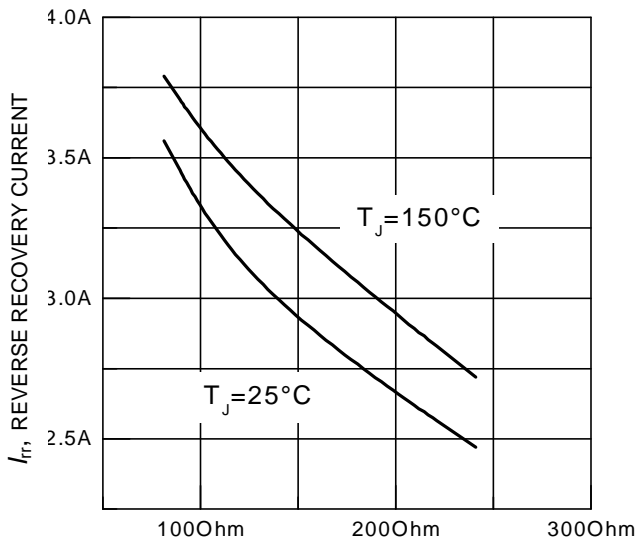
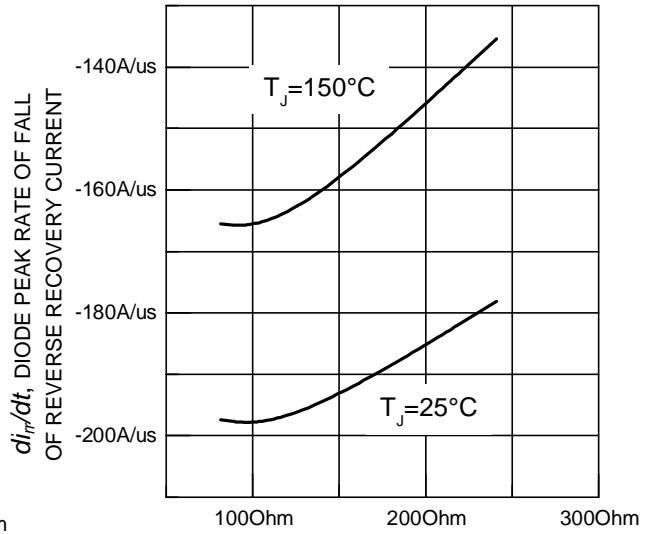


Figure 24. Typical reverse recovery charge as a function of diode current slope
 ($V_R=800V$, $I_F=3A$,
 Dynamic test circuit in Figure E)



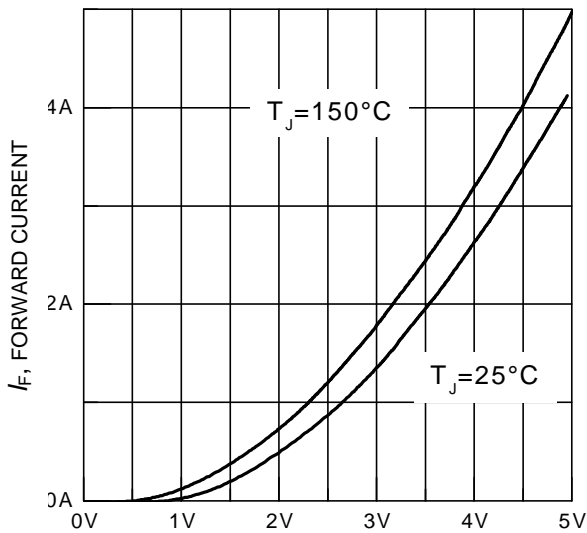
R_G , GATE RESISTANCE

Figure 25. Typical reverse recovery current as a function of diode current slope
 ($V_R=800V$, $I_F=3A$,
 Dynamic test circuit in Figure E)



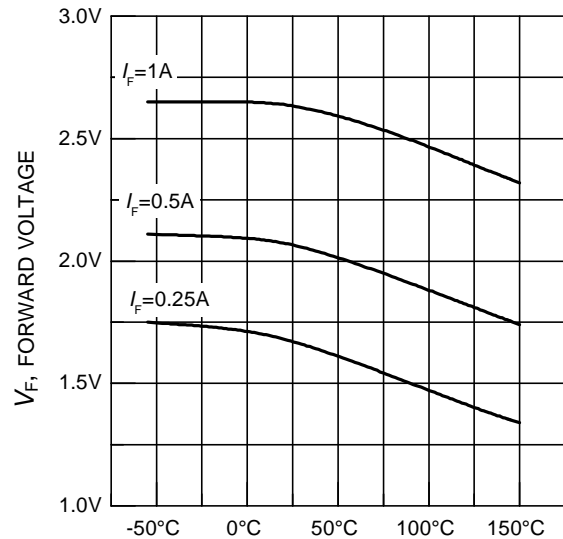
R_G , GATE RESISTANCE

Figure 26. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope
 ($V_R=800V$, $I_F=3A$,
 Dynamic test circuit in Figure E)



V_F , FORWARD VOLTAGE

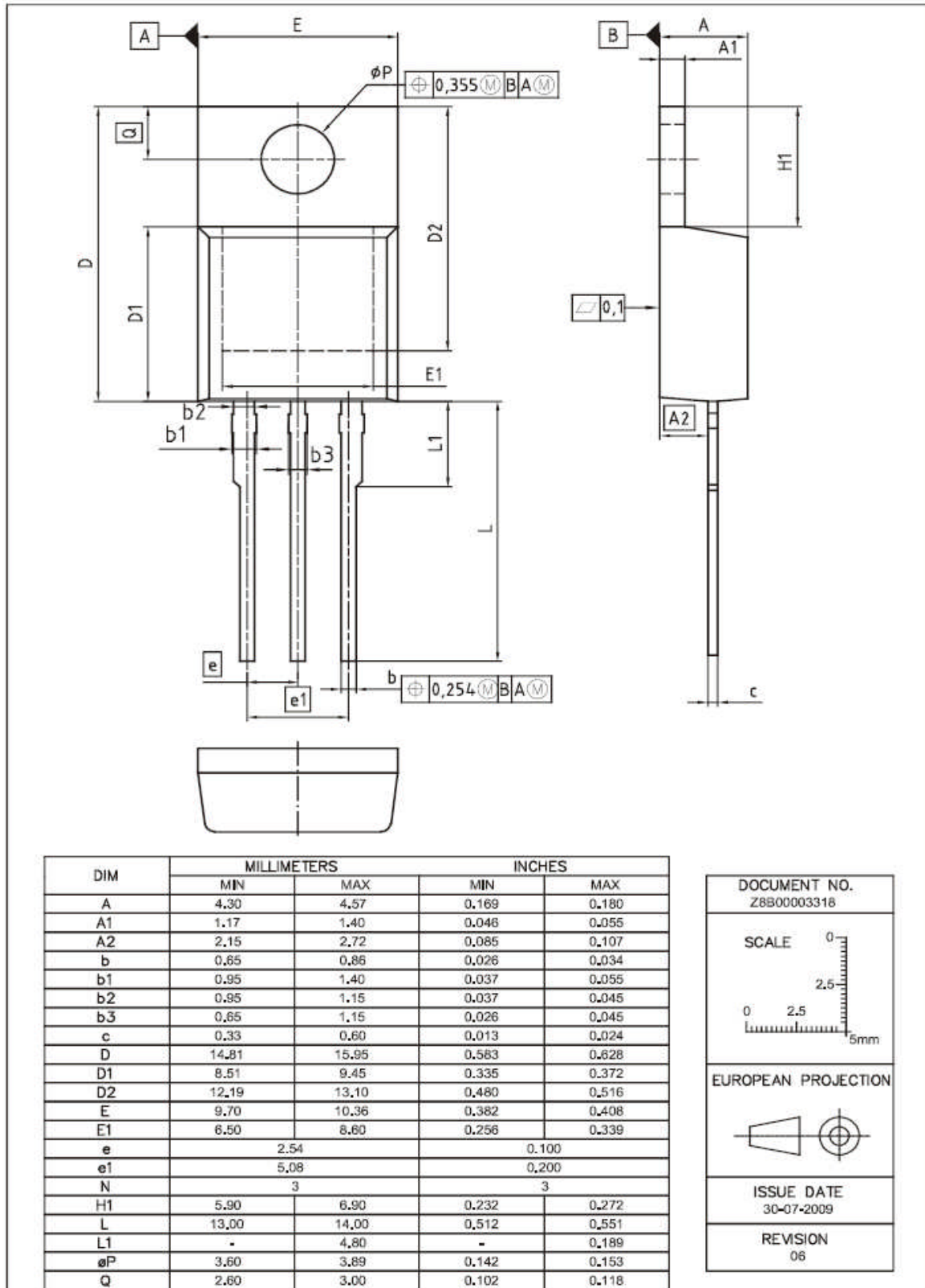
Figure 27. Typical diode forward current as a function of forward voltage



T_J , JUNCTION TEMPERATURE

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

PG-TO220-3-1



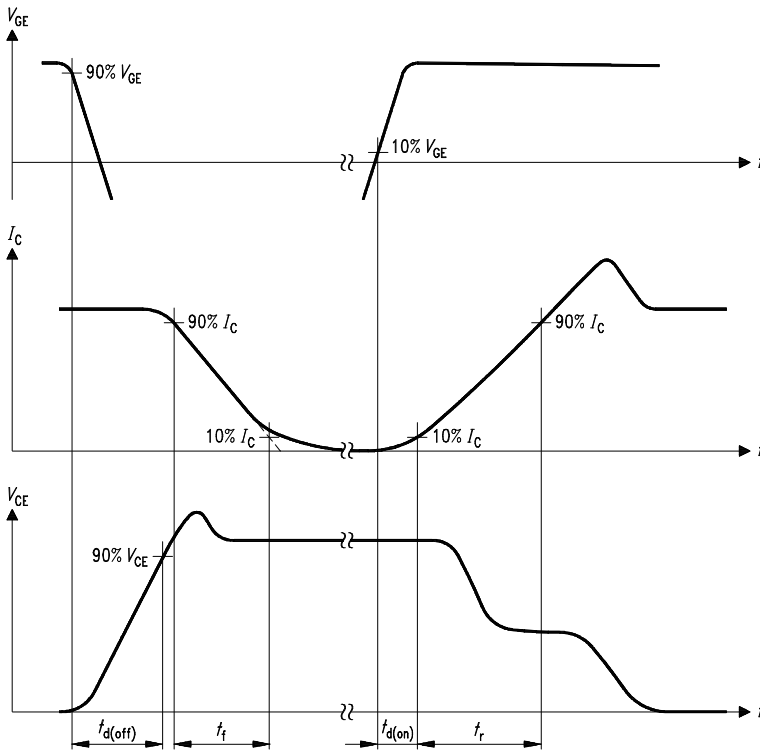


Figure A. Definition of switching times

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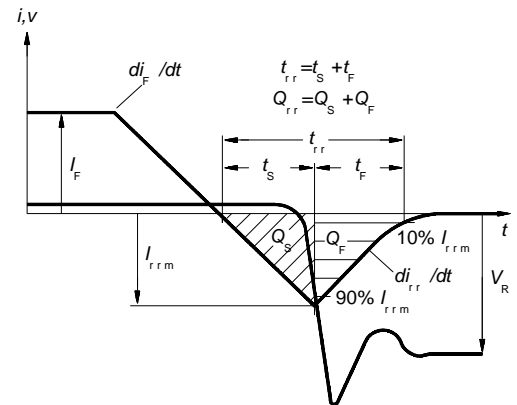


Figure C. Definition of diodes switching characteristics

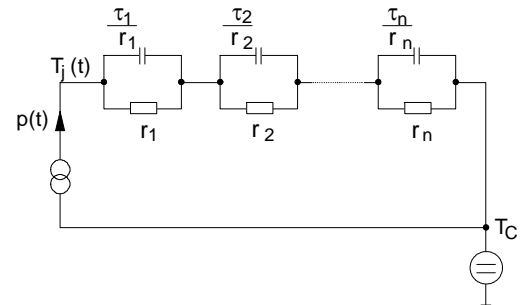


Figure D. Thermal equivalent circuit

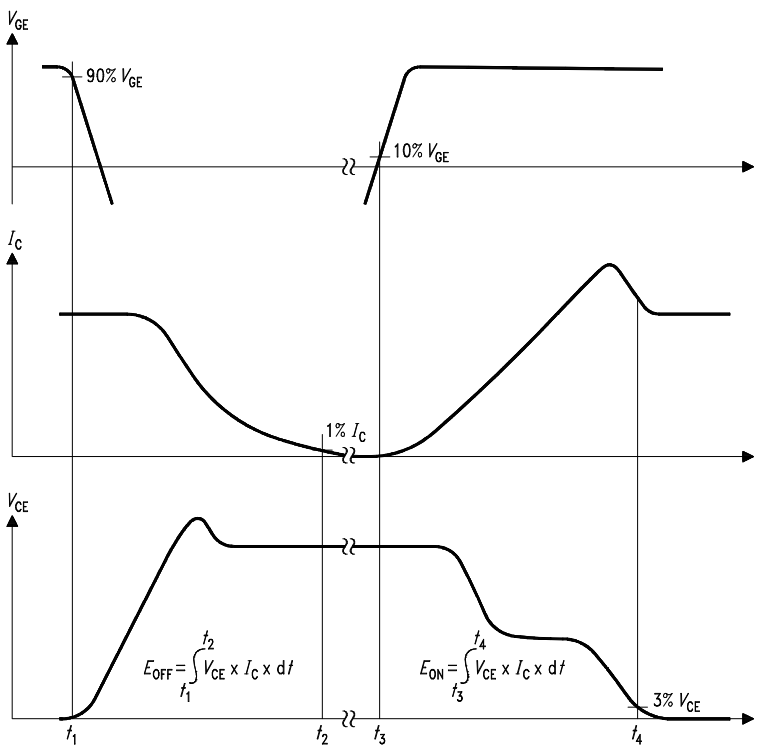


Figure B. Definition of switching losses

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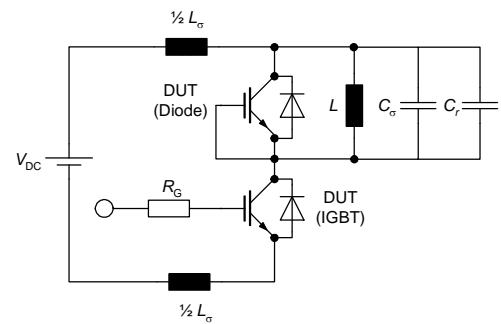


Figure E. Dynamic test circuit
 Leakage inductance $L_{\sigma} = 180\text{nH}$,
 Stray capacitor $C_{\sigma} = 40\text{pF}$,
 Relief capacitor $C_r = 1\text{nF}$ (only for ZVT switching)

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