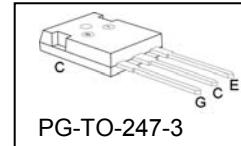
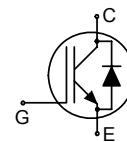


Reverse Conducting IGBT with monolithic body diode

Features:

- Powerful monolithic Body Diode with very low forward voltage
- Body diode clamps negative voltages
- TrenchStop® and Fieldstop technology for 1200 V applications offers :
 - very tight parameter distribution
 - high ruggedness, temperature stable behavior
- NPT technology offers easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Qualified according to JEDEC¹ for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt/>


Applications:

- Inductive Cooking
- Soft Switching Applications

Type	V_{CE}	I_C	$V_{CE(sat), T_j=25^\circ C}$	$T_{j,max}$	Marking	Package
IHW20N120R2	1200V	20A	1.55V	175°C	H20R1202	PG-T0-247-3

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage $T_C = 25^\circ C$ $T_C = 100^\circ C$	V_{CE}	1200	V
DC collector current $T_C = 25^\circ C$ $T_C = 100^\circ C$	I_C	40 20	A
Pulsed collector current, t_p limited by $T_{j,max}$	I_{Cpuls}	60	
Turn off safe operating area ($V_{CE} \leq 1200V$, $T_j \leq 175^\circ C$)	-	60	
Diode forward current $T_C = 25^\circ C$ $T_C = 100^\circ C$	I_F	40 20	
Diode pulsed current, t_p limited by $T_{j,max}$	I_{Fpuls}	30	
Diode surge non repetitive current, t_p limited by $T_{j,max}$ $T_C = 25^\circ C$, $t_p = 10ms$, sine halfwave $T_C = 25^\circ C$, $t_p \leq 2.5\mu s$, sine halfwave $T_C = 100^\circ C$, $t_p \leq 2.5\mu s$, sine halfwave	I_{FSM}	50 130 120	
Gate-emitter voltage Transient Gate-emitter voltage ($t_p < 5 ms$)	V_{GE}	± 20 ± 25	V
Power dissipation $T_C = 25^\circ C$	P_{tot}	330	W
Operating junction temperature	T_j	-40...+175	$^\circ C$
Storage temperature	T_{stg}	-55...+175	
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

¹ J-STD-020 and JESD-022

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.45	K/W
Diode thermal resistance, junction – case	R_{thJCD}		0.45	
Thermal resistance, junction – ambient	R_{thJA}		40	

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	$V_{(BR)CES}$	$V_{GE}=0\text{V}, I_C=500\mu\text{A}$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(\text{sat})}$	$V_{GE} = 15\text{V}, I_C=20\text{A}$	-	1.55	1.75	
		$T_j=25^\circ\text{C}$	-	1.75	-	
		$T_j=125^\circ\text{C}$	-	1.85	-	
Diode forward voltage	V_F	$V_{GE}=0\text{V}, I_F=20\text{A}$	-	1.45	1.7	
		$T_j=25^\circ\text{C}$	-	1.6	-	
		$T_j=125^\circ\text{C}$	-	1.65	-	
		$T_j=175^\circ\text{C}$	-			
Gate-emitter threshold voltage	$V_{GE(\text{th})}$	$I_C=0.5\text{mA}, V_{CE}=V_{GE}$	5.1	5.8	6.4	
Zero gate voltage collector current	I_{CES}	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$	-	-	5	μA
		$T_j=25^\circ\text{C}$	-	-	2500	
		$T_j=175^\circ\text{C}$	-			
Gate-emitter leakage current	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE}=20\text{V}, I_C=20\text{A}$	-	14.5	-	S
Integrated gate resistor	R_{Gint}			none		Ω

Dynamic Characteristic

Input capacitance	C_{iss}	$V_{CE}=25V$, $V_{GE}=0V$, $f=1MHz$	-	1887	-	pF
Output capacitance	C_{oss}		-	59	-	
Reverse transfer capacitance	C_{rss}		-	47	-	
Gate charge	Q_{Gate}	$V_{CC}=960V$, $I_C=20A$ $V_{GE}=15V$	-	143	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	Max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_j=25^\circ C$, $V_{CC}=600V$, $I_C=20A$ $V_{GE}=0 / 15V$, $R_G=15\Omega$, $L_\sigma^{(2)}=180nH$, $C_\sigma^{(2)}=39pF$	-	359	-	ns
Fall time	t_f		-	53	-	
Turn-on energy	E_{on}		-	-	-	
Turn-off energy	E_{off}		-	1.2	-	
Total switching energy	E_{ts}		-	1.2	-	mJ

Switching Characteristic, Inductive Load, at $T_j=175^\circ C$

Parameter	Symbol	Conditions	Value			Unit
			min.	Typ.	Max.	
IGBT Characteristic						
Turn-off delay time	$t_{d(off)}$	$T_j=175^\circ C$, $V_{CC}=600V$, $I_C=20A$, $V_{GE}= 0 / 15V$, $R_G= 15\Omega$, $L_\sigma=180nH^{(2)}$, $C_\sigma=39pF^{(2)}$	-	427	-	ns
Fall time	t_f		-	99	-	
Turn-on energy	E_{on}		-	-	-	
Turn-off energy	E_{off}		-	2.0	-	
Total switching energy	E_{ts}		-	2.0	-	mJ

²⁾ Leakage inductance L_σ and Stray capacity C_σ due to dynamic test circuit in Figure E.

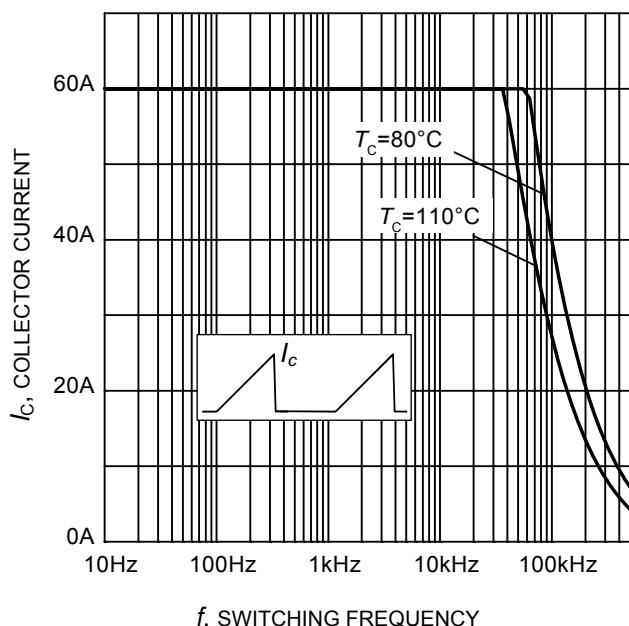


Figure 1. Collector current as a function of switching frequency for hard switching (turn-off)
 $(T_j \leq 175^\circ\text{C}, D = 0.5, V_{CE} = 600\text{V}, V_{GE} = 0/+15\text{V}, R_G = 15\Omega)$

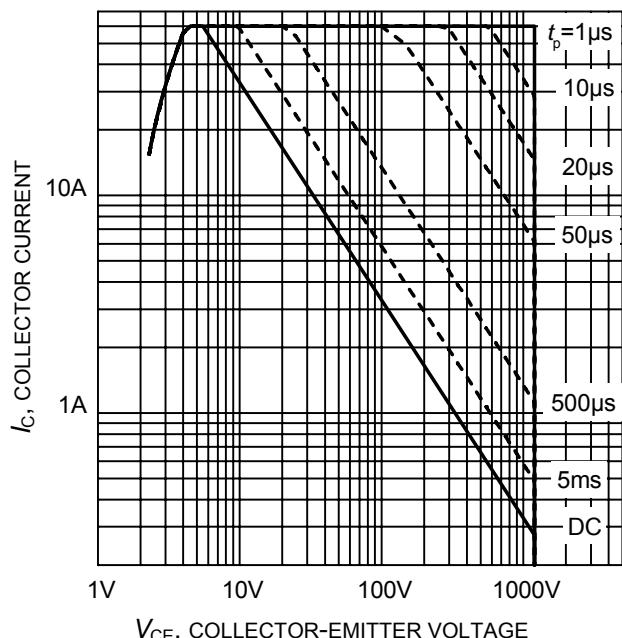


Figure 2. IGBT Safe operating area
 $(D = 0, T_c = 25^\circ\text{C}, T_j \leq 175^\circ\text{C}; V_{GE} = 15\text{V})$

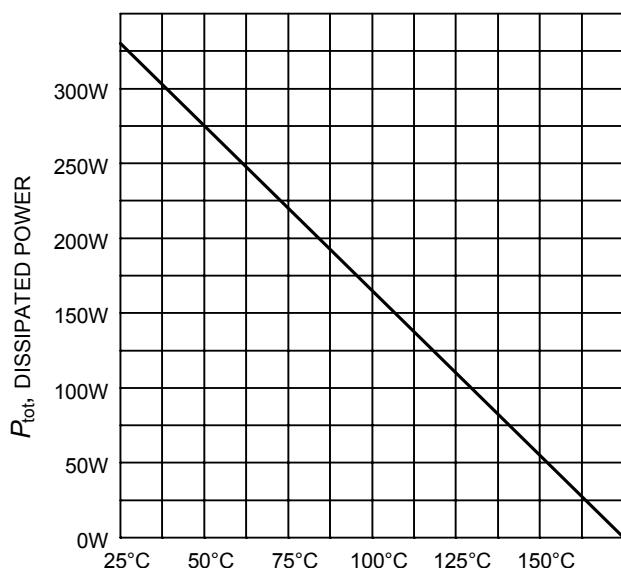


Figure 3. Power dissipation as a function of case temperature
 $(T_j \leq 175^\circ\text{C})$

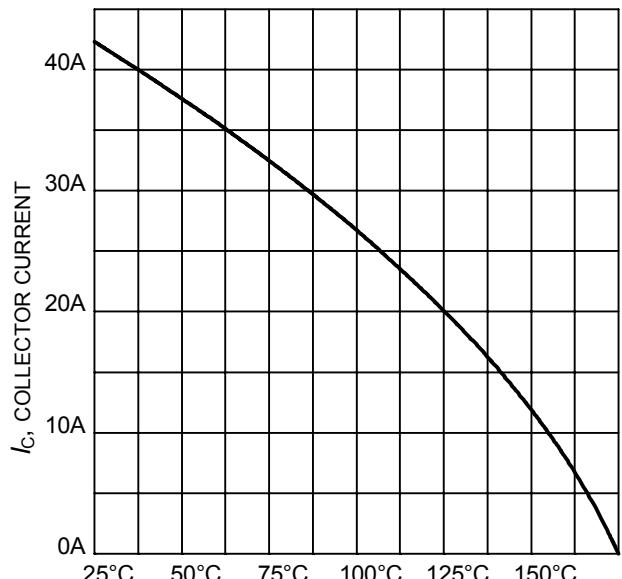


Figure 4. DC Collector current as a function of case temperature
 $(V_{GE} \geq 15\text{V}, T_j \leq 175^\circ\text{C})$

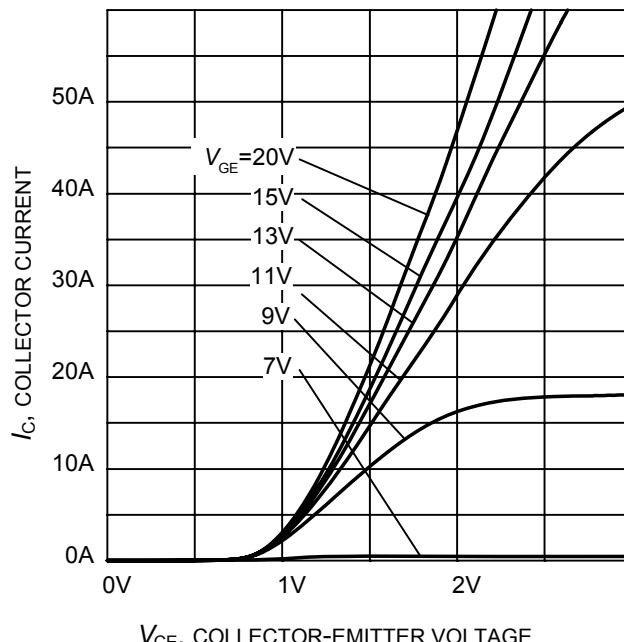


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

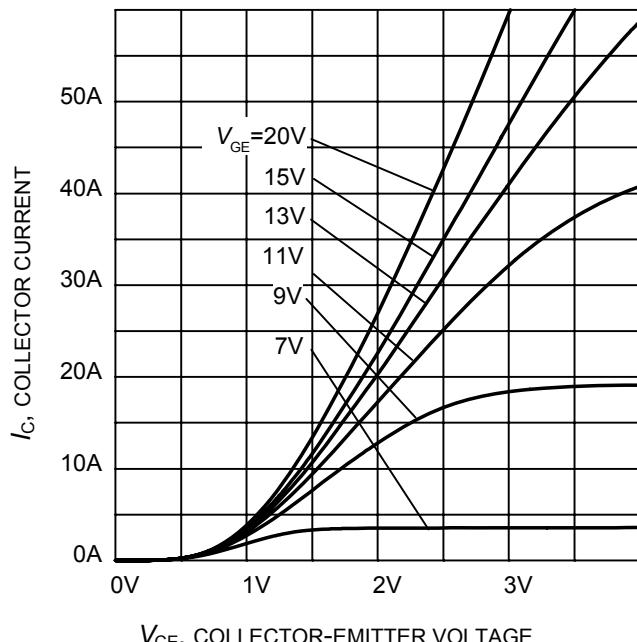


Figure 6. Typical output characteristic
($T_j = 175^\circ\text{C}$)

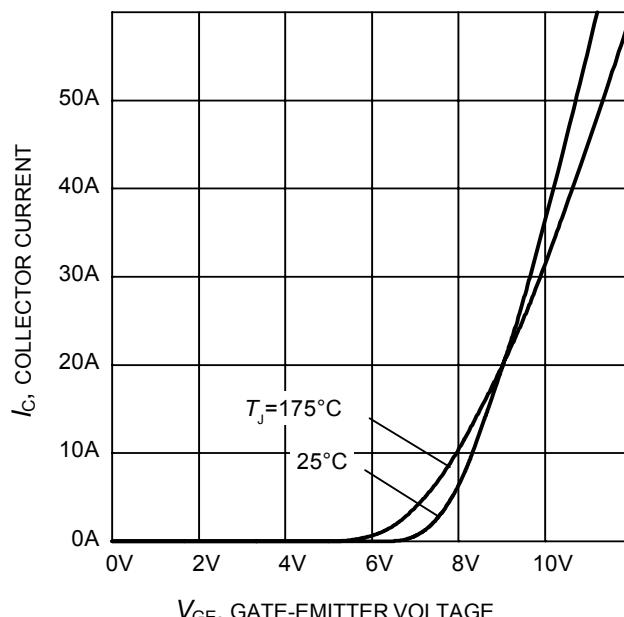


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

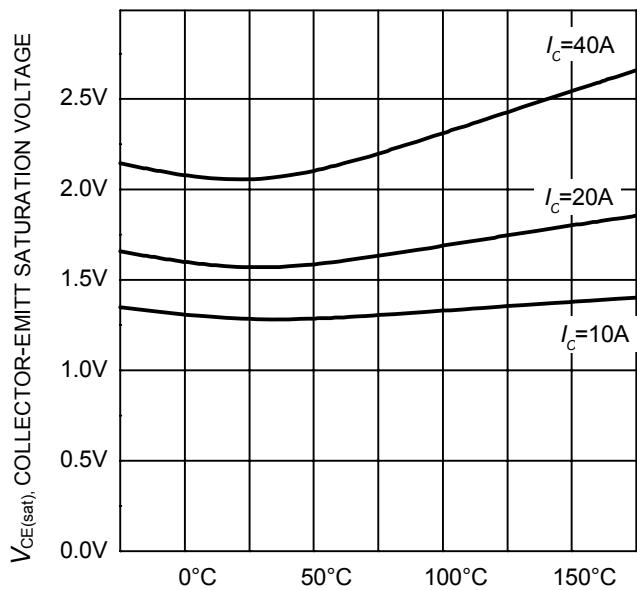


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

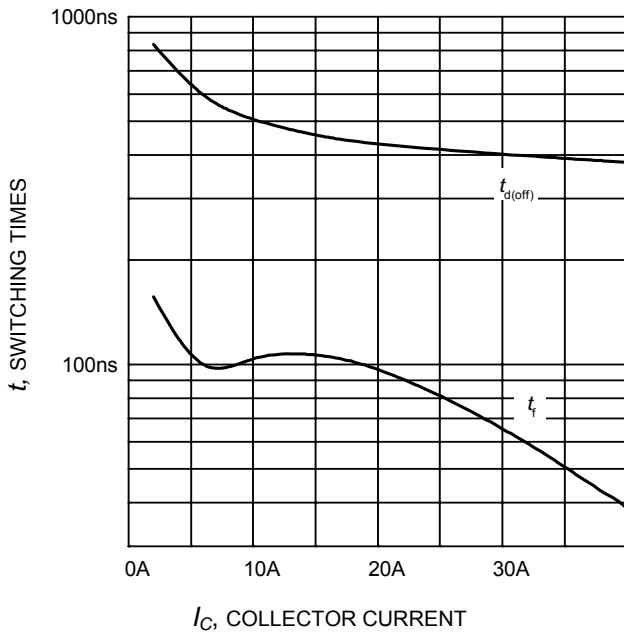


Figure 9. Typical switching times as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$,
Dynamic test circuit in Figure E)

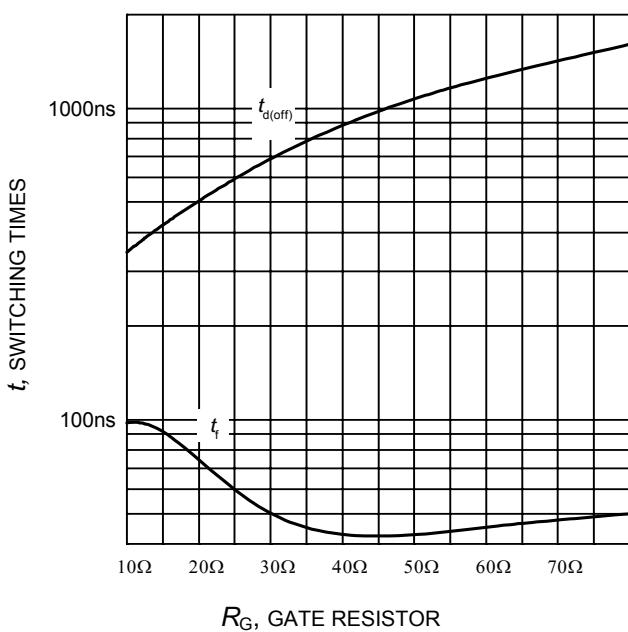


Figure 10. Typical switching times as a function of gate resistor
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_c=20\text{A}$,
Dynamic test circuit in Figure E)

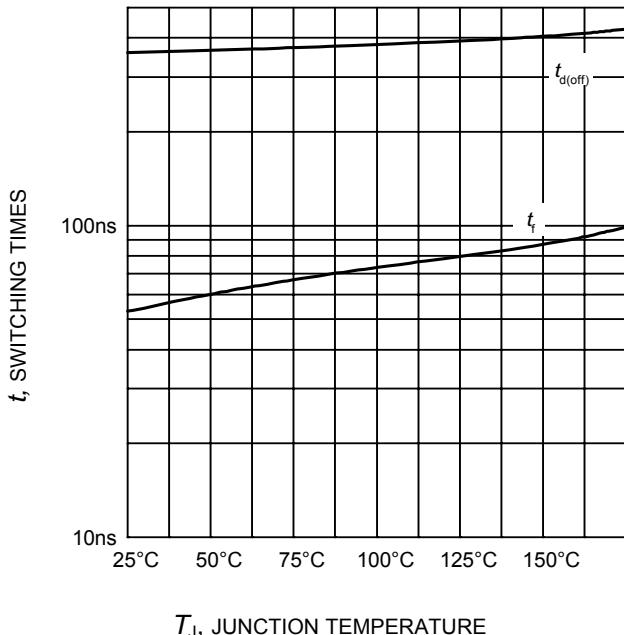


Figure 11. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_c=20\text{A}$, $R_G=29\Omega$,
Dynamic test circuit in Figure E)

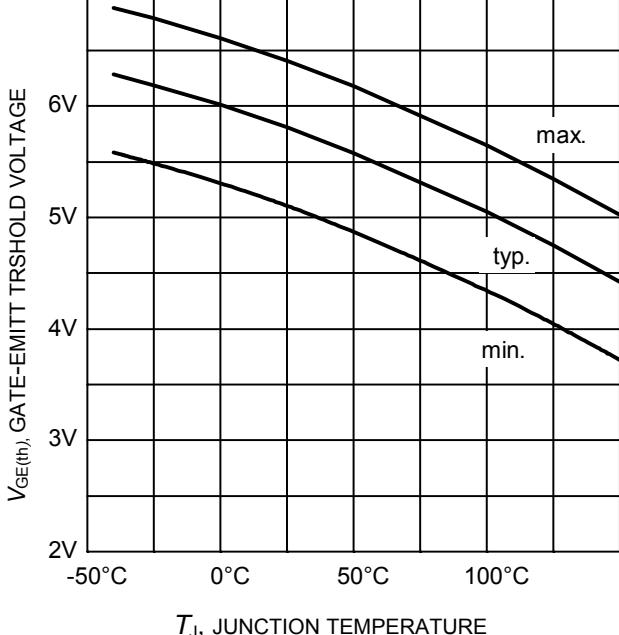


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
($I_c = 0.5\text{mA}$)

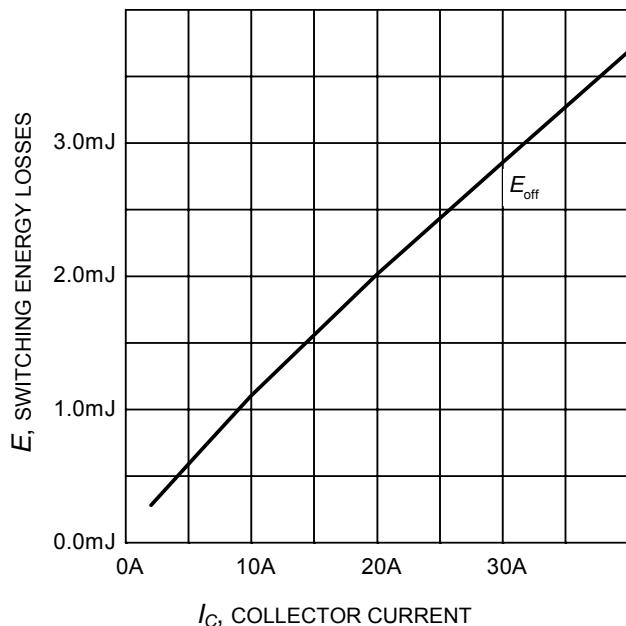

 I_C , COLLECTOR CURRENT

Figure 13. Typical turn-off energy as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$,
Dynamic test circuit in Figure E)

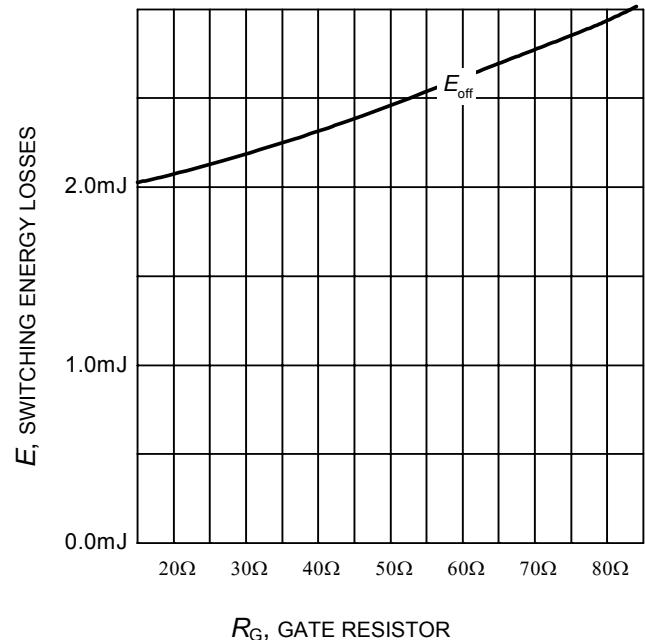

 R_G , GATE RESISTOR

Figure 14. Typical turn-off energy as a function of gate resistor
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=20\text{A}$,
Dynamic test circuit in Figure E)

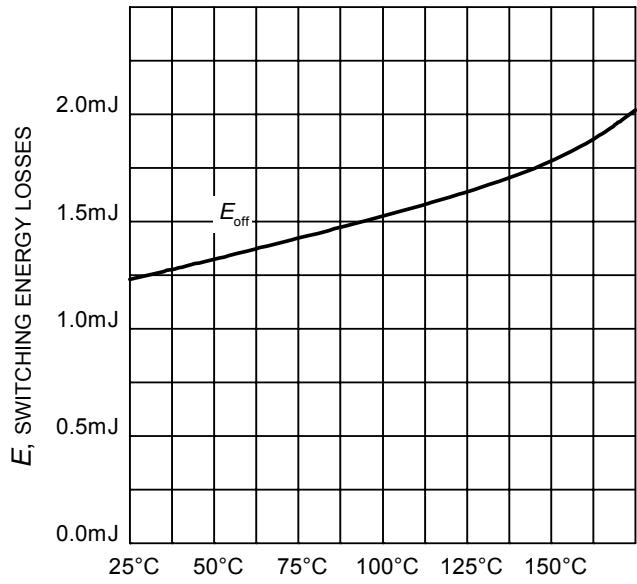

 T_J , JUNCTION TEMPERATURE

Figure 15. Typical turn-off energy as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=20\text{A}$, $R_G=15\Omega$,
Dynamic test circuit in Figure E)

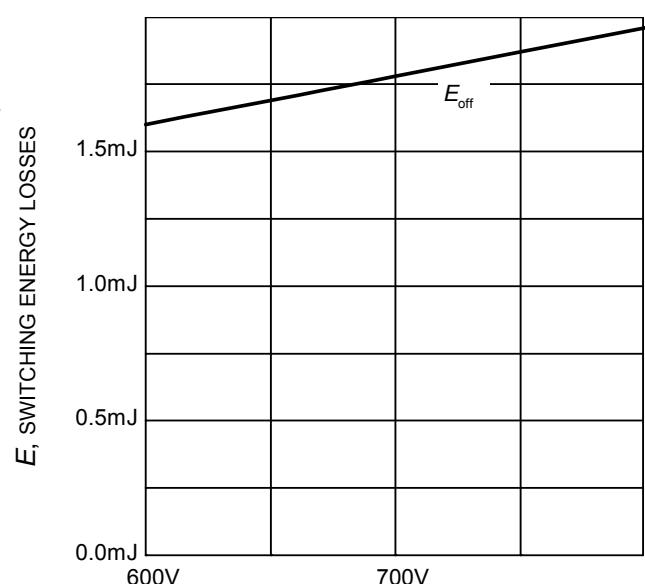

 V_{CE} , COLLECTOR-EMITTER VOLTAGE

Figure 16. Typical turn-off energy as a function of collector-emitter voltage
(inductive load, $T_J=175^\circ\text{C}$,
 $V_{GE}=0/15\text{V}$, $I_C=20\text{A}$, $R_G=15\Omega$,
Dynamic test circuit in Figure E)

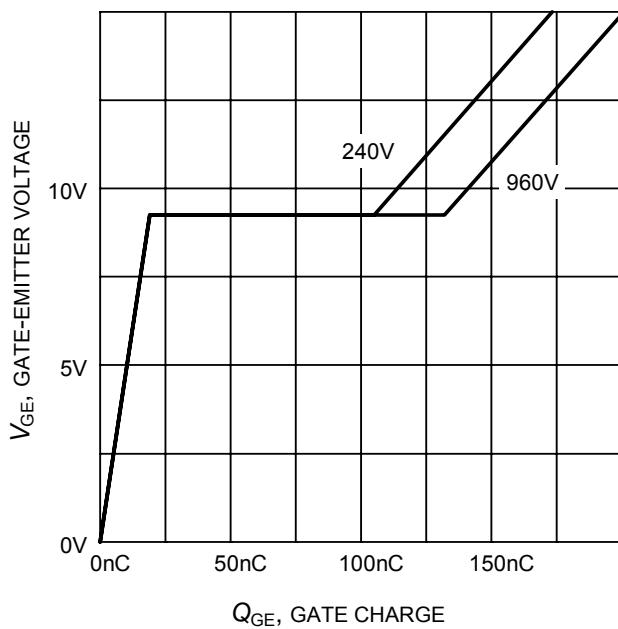


Figure 17. Typical gate charge
($I_C=20$ A)

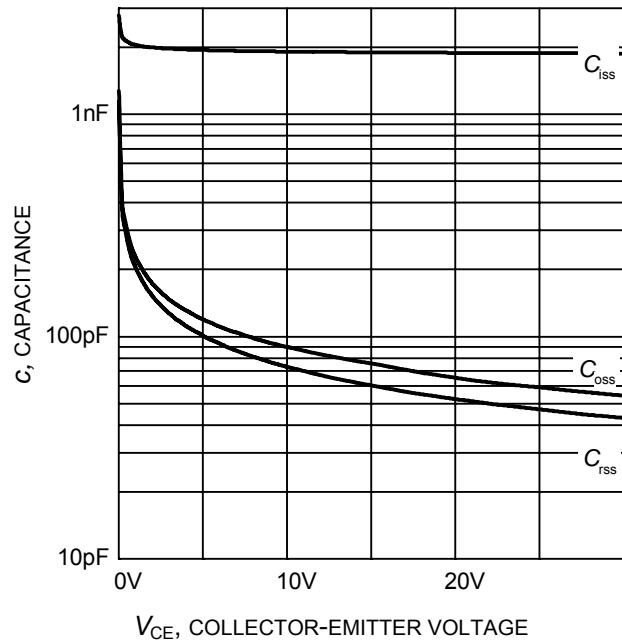


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0$ V, $f = 1$ MHz)

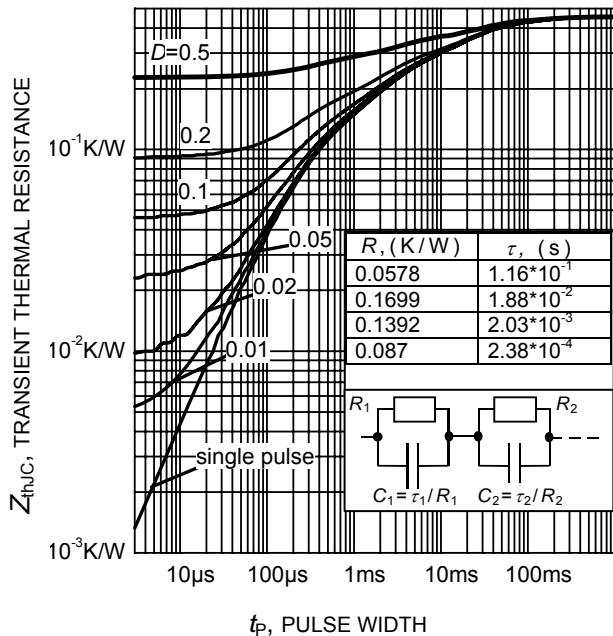


Figure 19. IGBT transient thermal resistance
($D = t_p / T$)

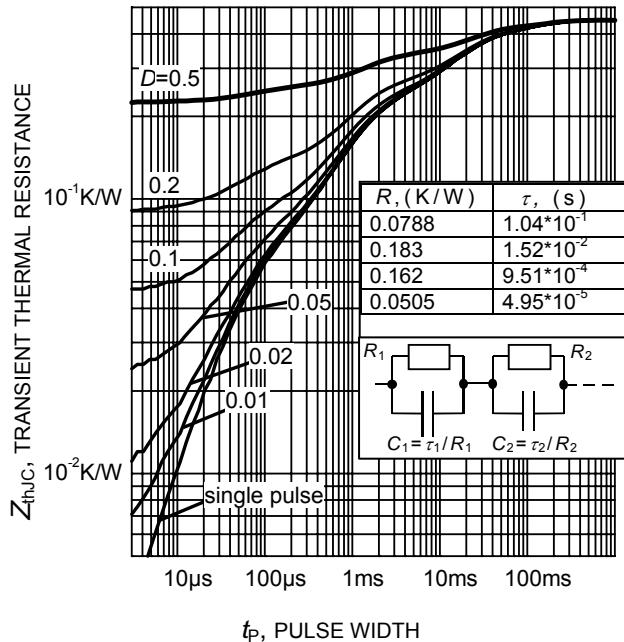


Figure 20. Diode transient thermal impedance as a function of pulse width
($D=t_p/T$)

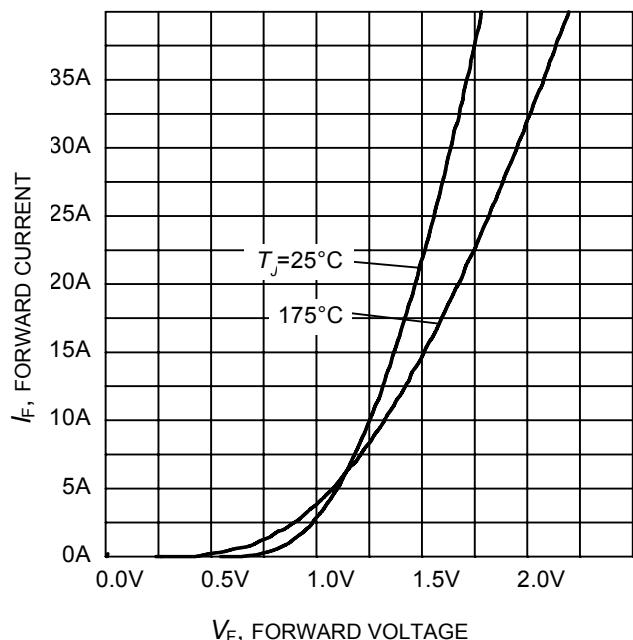


Figure 21. Typical diode forward current as a function of forward voltage

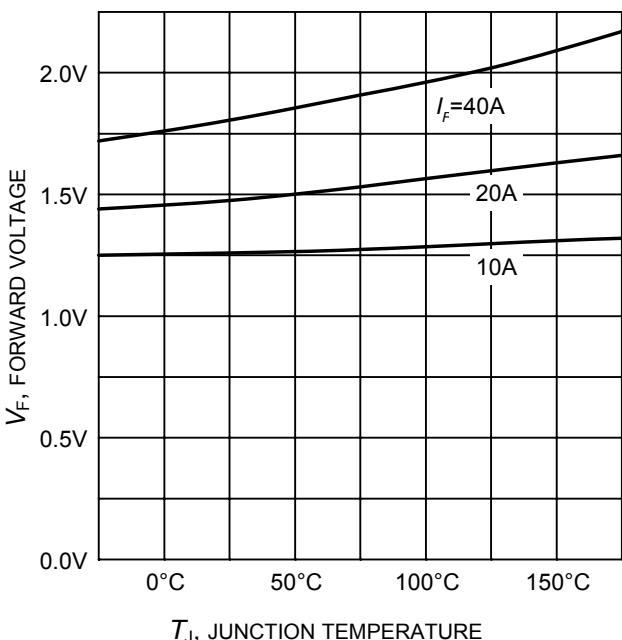
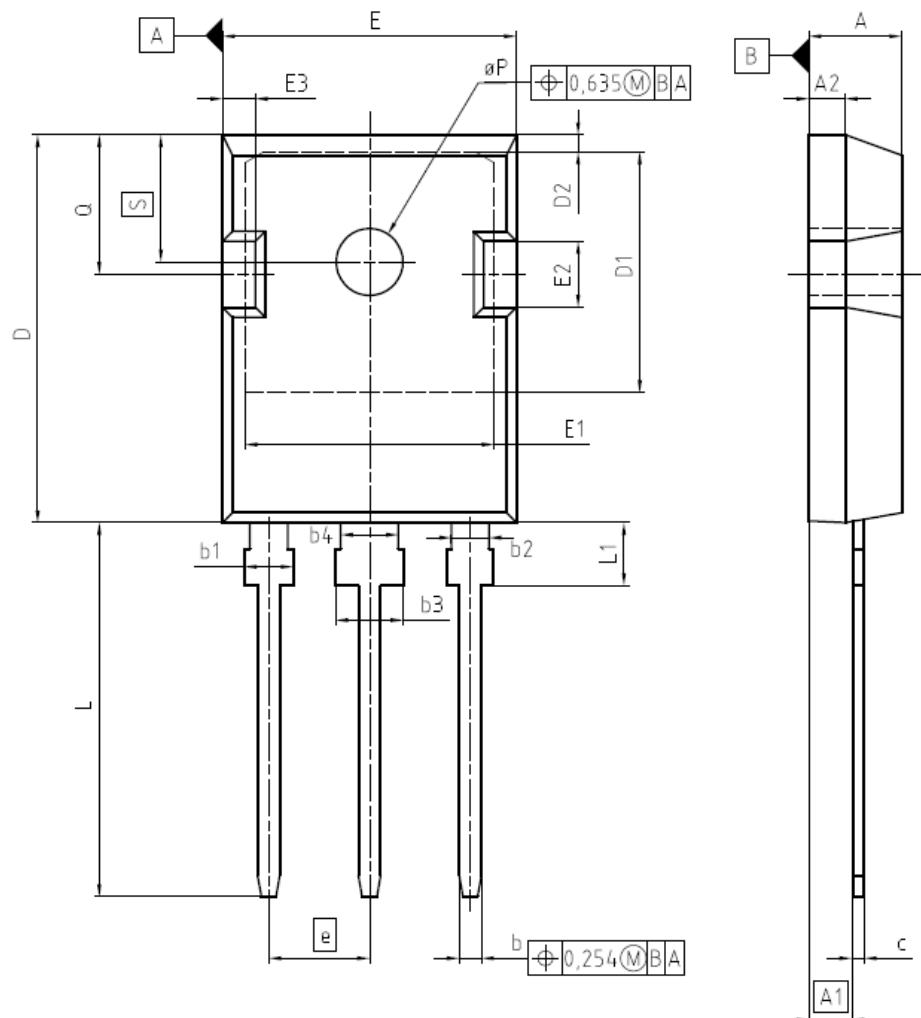


Figure 22. Typical diode forward voltage as a function of junction temperature

PG-T0247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4,90	5,16	0,193	0,203
A1	2,27	2,53	0,089	0,099
A2	1,85	2,11	0,073	0,083
b	1,07	1,33	0,042	0,052
b1	1,90	2,41	0,075	0,095
b2	1,90	2,16	0,075	0,085
b3	2,87	3,38	0,113	0,133
b4	2,87	3,13	0,113	0,123
c	0,55	0,68	0,022	0,027
D	20,82	21,10	0,820	0,831
D1	16,25	17,65	0,640	0,695
D2	1,05	1,35	0,041	0,053
E	15,70	16,03	0,618	0,631
E1	13,10	14,15	0,516	0,557
E2	3,68	5,10	0,145	0,201
E3	1,68	2,60	0,066	0,102
e	5,44		0,214	
N	3		3	
L	19,80	20,31	0,780	0,799
L1	4,17	4,47	0,164	0,176
ØP	3,50	3,70	0,138	0,146
Q	5,49	6,00	0,216	0,236
S	6,04	6,30	0,238	0,248

DOCUMENT NO.	Z8B00003327
SCALE	0
EUROPEAN PROJECTION	
ISSUE DATE	17-12-2007
REVISION	03

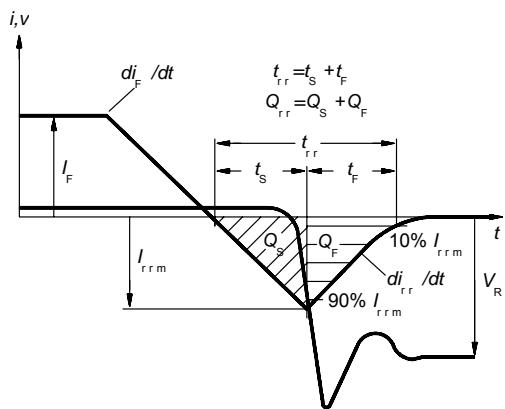
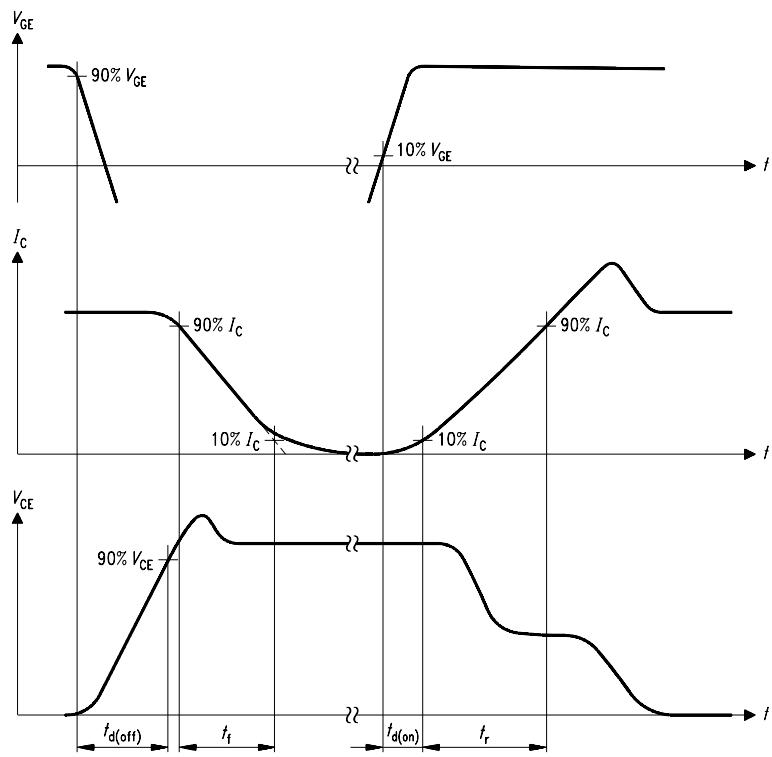


Figure C. Definition of diodes switching characteristics

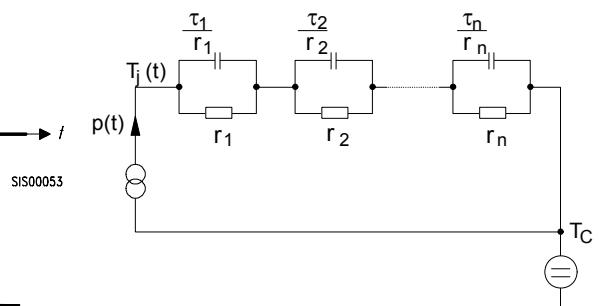


Figure D. Thermal equivalent circuit

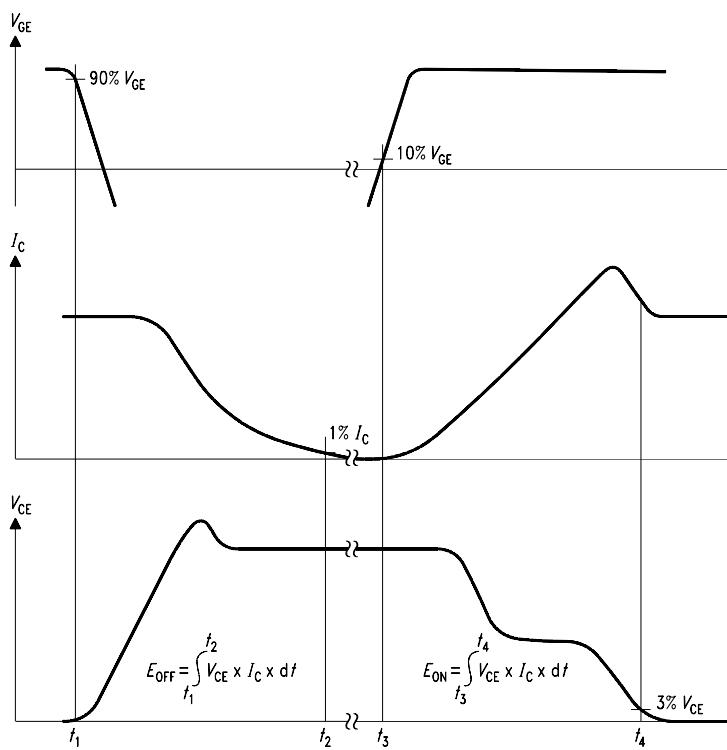


Figure B. Definition of switching losses

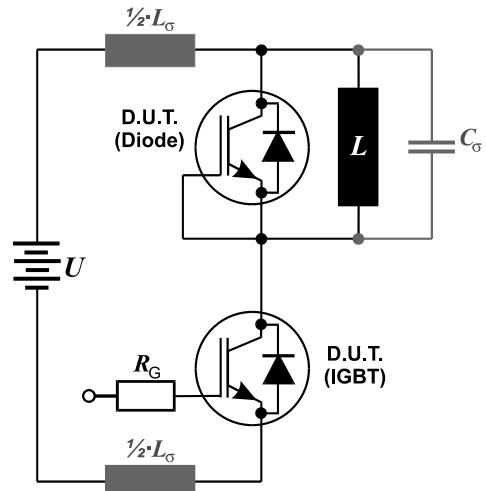


Figure E. Dynamic test circuit
Leakage inductance L_σ and Stray capacity C_σ



IHW20N120R2

Soft Switching Series

Edition 2006-01

Published by

**Infineon Technologies AG
81726 München, Germany**

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