

Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A



SOT-227

FEATURES

- Ultrafast: Optimized for minimum saturation voltage and speed up to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package (2500 V_{AC}/RMS)
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS
COMPLIANT**

PRODUCT SUMMARY	
V _{CES}	600 V
V _{CE(on)} (typical)	1.92 V
V _{GE}	15 V
I _C	100 A

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Lower overall losses available at frequencies = 20 kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- Plug-in compatible with other SOT-227 packages

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V _{CES}		600	V
Continuous collector current	I _C	T _C = 25 °C	200	A
		T _C = 100 °C	100	
Pulsed collector current	I _{CM}		400	
Clamped inductive load current	I _{LM}	V _{CC} = 80 % (V _{CES}), V _{GE} = 20 V, L = 10 μH, R _G = 2.0 Ω, See fig. 13a	400	
Gate to emitter voltage	V _{GE}		± 20	V
Reverse voltage avalanche energy	E _{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V _{ISOL}	Any terminal to case, t = 1 minute	2500	V
Maximum power dissipation	P _D	T _C = 25 °C	500	W
		T _C = 100 °C	200	
Operating junction and storage temperature range	T _J , T _{Stg}		- 55 to + 150	°C
Mounting torque		6-32 or M3 screw	1.3 (12)	N · m (lbf · in)

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case	R _{thJC}	-	0.25	°C/W
Case to sink, flat, greased surface	R _{thCS}	0.05	-	
Weight of module		30	-	g



ELECTRICAL SPECIFICATIONS (T _J = 25 °C unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Collector to emitter breakdown voltage	V _{(BR)CES}	V _{GE} = 0 V, I _C = 250 μA	600	-	-	V	
Emitter to collector breakdown voltage	V _{(BR)ECS}	V _{GE} = 0 V, I _C = 1.0 A Pulse width ≤ 80 μs; duty factor ≤ 0.1	18	-	-		
Temperature coeff. of breakdown	ΔV _{(BR)CES} /ΔT _J	V _{GE} = 0 V, I _C = 10 mA	-	0.38	-	V/°C	
Collector to emitter saturation voltage	V _{CE(on)}	I _C = 100 A	V _{GE} = 15 V See fig. 2, 5	-	1.60	1.9	V
		I _C = 200 A		-	1.92	-	
		I _C = 100 A, T _J = 150 °C		-	1.54	-	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 250 μA	3.0	-	6.0		
Temperature coeff. of threshold voltage	ΔV _{GE(th)} /ΔT _J	V _{CE} = V _{GE} , I _C = 2.0 mA	-	- 11	-	mV/°C	
Forward transconductance	g _{fe}	V _{CE} = 100 V, I _C = 100 A Pulse width 5.0 μs, single shot	79	-	-	S	
Zero gate voltage collector current	I _{CES}	V _{GE} = 0 V, V _{CE} = 600 V	-	-	1.0	mA	
		V _{GE} = 0 V, V _{CE} = 600 V, T _J = 150 °C	-	-	10		
Gate to emitter leakage current	I _{GES}	V _{GE} = ± 20 V	-	-	± 250	nA	

SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q _g	I _C = 100 A V _{CC} = 400 V V _{GE} = 15 V; See fig. 8	-	770	1200	nC
Gate-emitter charge (turn-on)	Q _{ge}		-	100	150	
Gate-collector charge (turn-on)	Q _{gc}		-	260	380	
Turn-on delay time	t _{d(on)}	T _J = 25 °C I _C = 100 A V _{CC} = 480 V V _{GE} = 15 V R _g = 2.0 Ω Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	t _r		-	79	-	
Turn-off delay time	t _{d(off)}		-	130	200	
Fall time	t _f		-	300	450	
Turn-on switching loss	E _{on}		-	0.98	-	
Turn-off switching loss	E _{off}	-	3.48	-		
Total switching loss	E _{ts}	-	4.46	7.6		
Turn-on delay time	t _{d(on)}	T _J = 150 °C I _C = 100 A, V _{CC} = 480 V V _{GE} = 15 V, R _g = 2.0 Ω Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	t _r		-	75	-	
Turn-off delay time	t _{d(off)}		-	160	-	
Fall time	t _f		-	460	-	
Total switching loss	E _{ts}		-	7.24	-	
Internal emitter inductance	L _E	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	C _{ies}	V _{GE} = 0 V V _{CC} = 30 V f = 1.0 MHz; See fig. 7	-	16 500	-	pF
Output capacitance	C _{oes}		-	1000	-	
Reverse transfer capacitance	C _{res}		-	200	-	

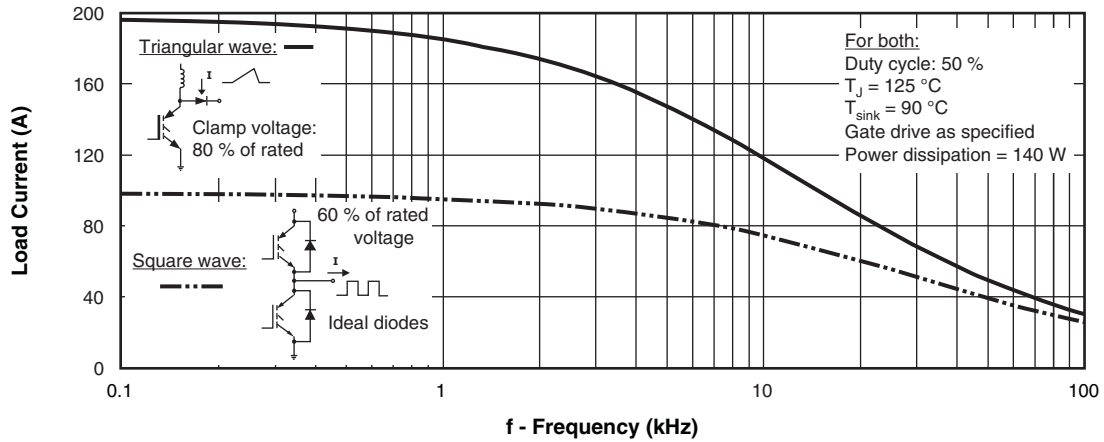


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of Fundamental)

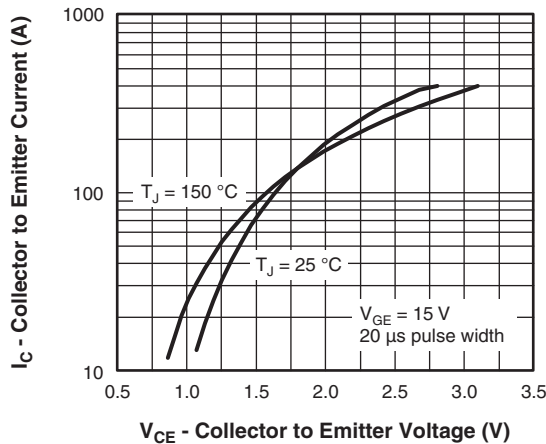


Fig. 2 - Typical Output Characteristics

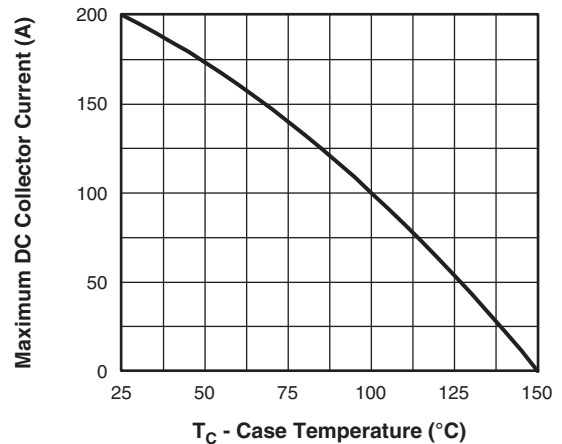


Fig. 4 - Maximum Collector Current vs. Case Temperature

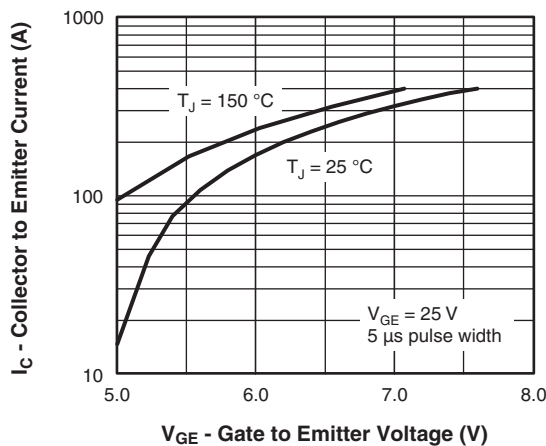


Fig. 3 - Typical Transfer Characteristics

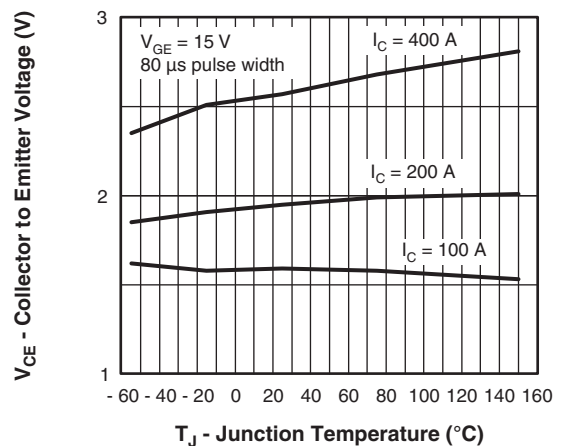


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

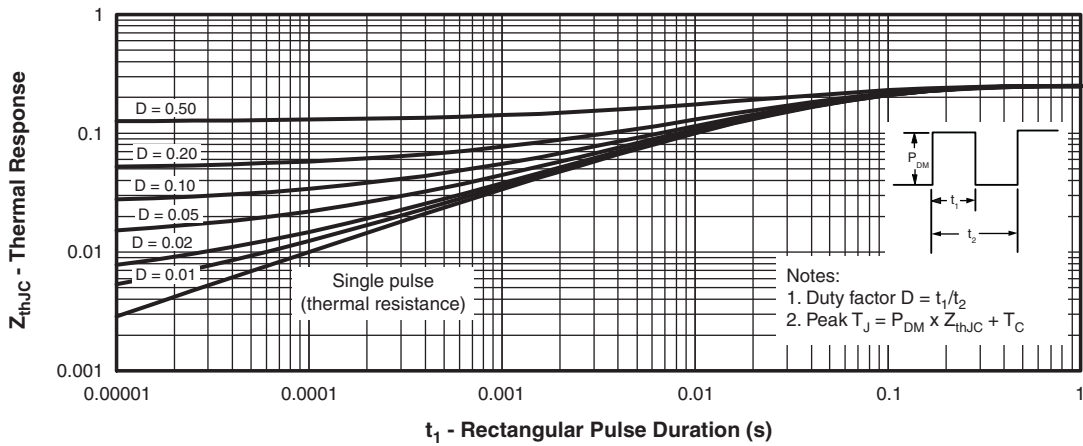


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

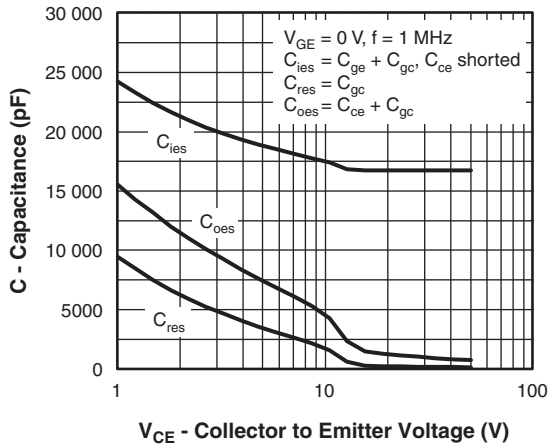


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

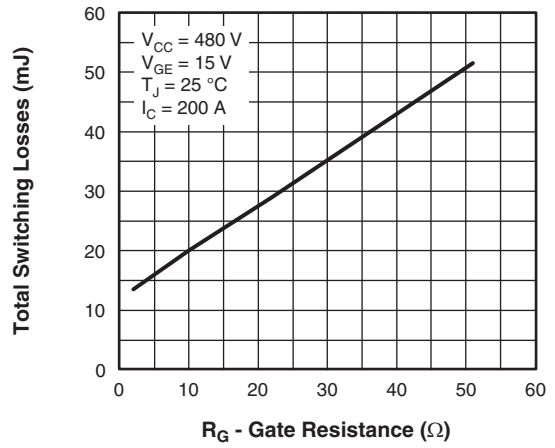


Fig. 9 - Typical Switching Losses vs. Gate Resistance

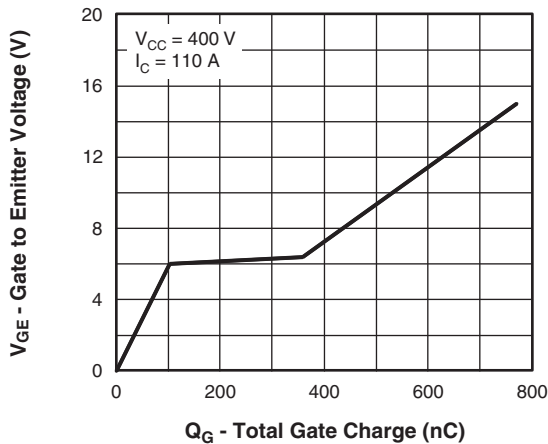


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

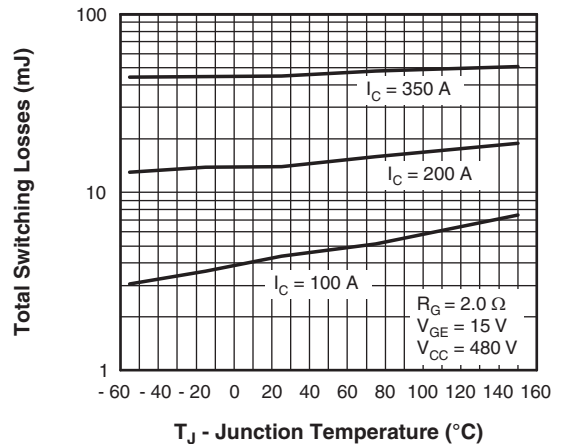


Fig. 10 - Typical Switching Losses vs. Junction Temperature

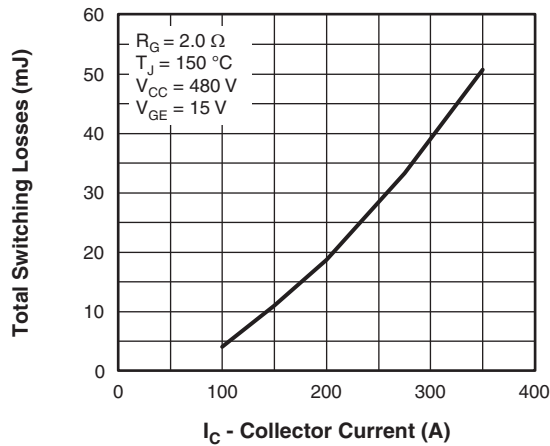


Fig. 11 - Typical Switching Losses vs. Collector Current

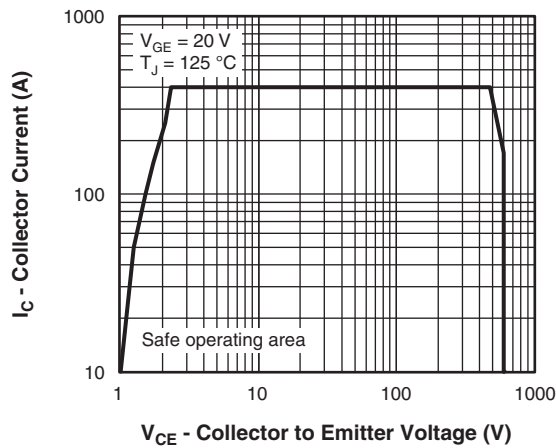
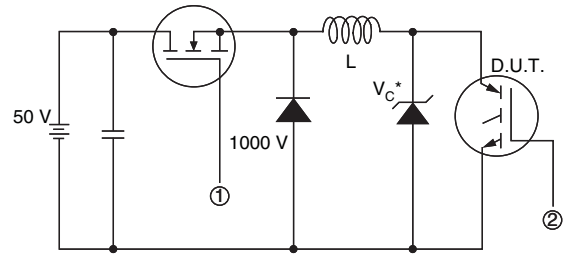


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; $V_C = 80\%$ of $V_{CE}(\text{max})$

Note: Due to the 50 V power supply, pulse width and inductor will increase to obtain rated I_d

Fig. 13a - Clamped Inductive Load Test Circuit

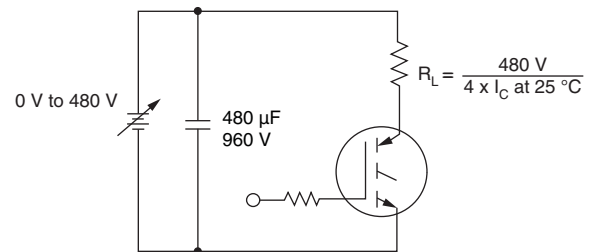
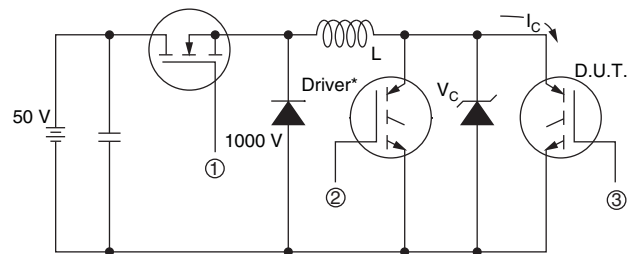


Fig. 13b - Pulsed Collector Current Test Circuit



* Driver same type as D.U.T., $V_C = 480 \text{ V}$

Fig. 14a - Switching Loss Test Circuit

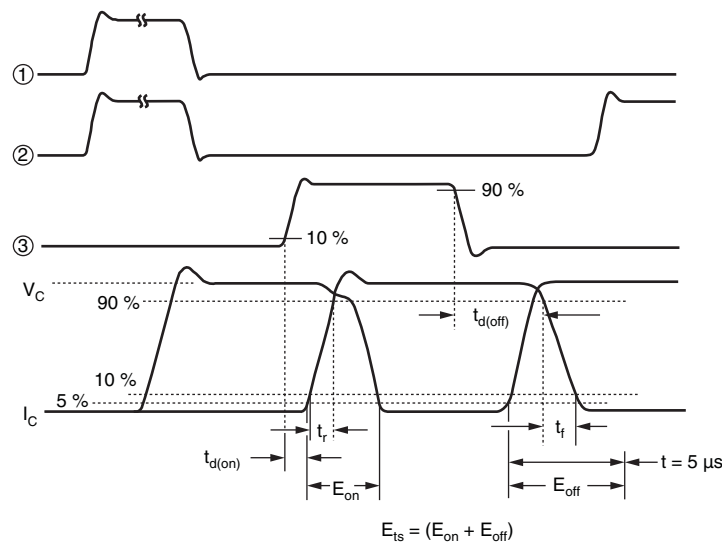
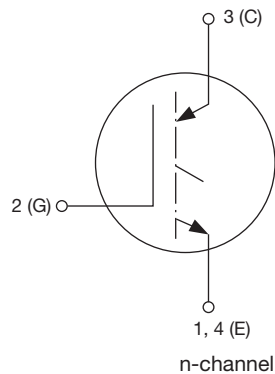


Fig. 14b - Switching Loss Waveforms

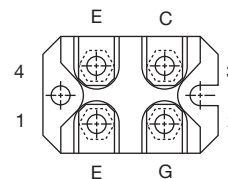
ORDERING INFORMATION TABLE

Device code	G	A	200	S	A	60	U	P
	1	2	3	4	5	6	7	8

- | | |
|----------|----------------------------------------------------------------------------------------------------------------|
| 1 | - Insulated Gate Bipolar Transistor (IGBT) |
| 2 | - Generation 4, IGBT silicon, DBC construction |
| 3 | - Current rating (200 = 200 A) |
| 4 | - Single switch, no diode |
| 5 | - SOT-227 |
| 6 | - Voltage rating (60 = 600 V) |
| 7 | - Speed/type (U = Ultrafast) |
| 8 | - <ul style="list-style-type: none"> • None = Standard production • P = Lead (Pb)-free |

CIRCUIT CONFIGURATION


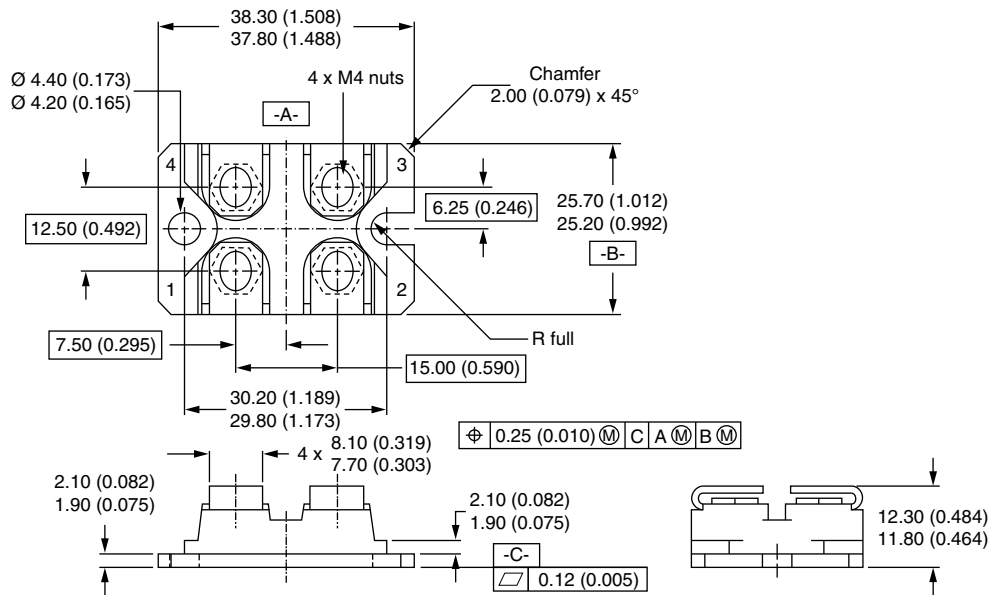
Lead assignment


LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95036
Packaging information	www.vishay.com/doc?95037

SOT-227

DIMENSIONS in millimeters (inches)



Notes

- Dimensioning and tolerancing per ANSI Y14.5M-1982
- Controlling dimension: millimeter



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