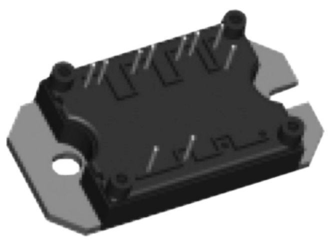
"Low Side Chopper" IGBT MTP (Ultrafast Speed IGBT), 100 A



MTP

FEATURES

- Generation 4 ultrafast speed IGBT technology
- HEXFRED® diode with ultrasoft reverse recovery
- Very low conduction and switching losses
- Optional SMD thermistor (NTC)
- Al_2O_3 DBC
- Very low stray inductance design for high speed operation
- UL approved file E78996
- Speed 8 kHz to 60 kHz > 20 kHz hard switching, > 200 kHz resonant mode
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level

Pb-free
RoHS
COMPLIANT

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	100 A
$V_{CE(on)}$	1.68 V

BENEFITS

- Optimized for welding, UPS and SMPS applications
- Low EMI, requires less snubbing
- Direct mounting to heatsink
- PCB solderable terminals
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage		V_{CES}		600	V
Continuous collector current		I_C	T_C = 25 °C	100	A
			T_C = 122 °C	50	
Pulsed collector current		I_{CM}		200	
Peak switching current		I_{LM}		200	
Diode continuous forward current		I_F	T_C = 100 °C	48	
Peak diode forward current		I_{FM}		200	
Gate to emitter voltage		V_{GE}		± 20	V
RMS isolation voltage		V_{ISOL}	Any terminal to case, t = 1 minute	2500	
Maximum power dissipation	IGBT	P_D	T_C = 25 °C	445	W
			T_C = 100 °C	175	
	Diode		T_C = 25 °C	205	
			T_C = 100 °C	83	

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
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 50 A	-	1.69	2.31	
		V_{GE} = 15 V, I_C = 100 A	-	1.96	2.55	
		V_{GE} = 15 V, I_C = 100 A, T_J = 150 °C	-	1.88	2.24	
Gate threshold voltage	$V_{GE(th)}$	I_C = 0.5 mA	3	-	6	
Diode reverse breakdown voltage	V_{BR}	I_R = 200 µA	600	-	-	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, I_C = 500 µA	-	- 13	-	mV/°C
Forward transconductance	g_{fe}	V_{CE} = 50 V, I_C = 100 A	22	29	-	S
Collector to emitter leaking current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	-	0.25	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C	-	-	6	
Diode forward voltage drop	V_{FM}	I_F = 100 A, V_{GE} = 0 V	-	1.64	1.82	V
		I_F = 100 A, V_{GE} = 0 V, T_J = 150 °C	-	1.56	1.74	
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} = 480 V V_{GE} = 15 V	-	370	555	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	64	96	
Gate to collector charge (turn-on)	Q_{gc}		-	163	245	
Turn-on switching loss	E_{on}	V_{CC} = 480 V, I_C = 50 A, V_{GE} = 15 V, R_g = 5 Ω, T_J = 25 °C, energy losses include tail and diode reverse recovery	-	0.7	1.2	mJ
Turn-off switching loss	E_{off}		-	1.7	2.6	
Total switching loss	E_{ts}		-	2.4	3.8	
Turn-on switching loss	E_{on}	V_{CC} = 480 V, I_C = 50 A, V_{GE} = 15 V, R_g = 5 Ω, T_J = 125 °C, energy losses include tail and diode reverse recovery	-	1.1	1.7	
Turn-off switching loss	E_{off}		-	2.5	3.8	
Total switching loss	E_{ts}		-	3.6	5.5	
Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1.0 MHz	-	9800	14 700	pF
Output capacitance	C_{oes}		-	602	903	
Reverse transfer capacitance	C_{res}		-	121	182	
Diode junction capacitance	C_t	V_R = 600 V, f = 1.0 MHz	-	118	177	
Diode reverse recovery time	t_{rr}	V_{CC} = 480 V, I_C = 50 A dI/dt = 200 A/µs R_g = 5 Ω	-	99	150	ns
Diode peak reverse current	I_{rr}		-	6.5	9.8	A
Diode recovery charge	Q_{rr}		-	320	735	nC
Diode peak rate of fall of recovery during t_b	$dI_{(rec)M}/dt$		-	236	-	A/µs

THERMISTOR SPECIFICATIONS						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Resistance	R_0 (1)	T_0 = 25 °C	-	30	-	kΩ
Sensitivity index of the thermistor material	β (1)(2)	T_0 = 25 °C T_1 = 85 °C	-	4000	-	K

Notes
(1) T_0, T_1 are thermistor´s temperatures
(2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0} - \frac{1}{T_1}\right)\right]$, temperature in Kelvin

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER		**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Operating junction temperature range		T_J		- 40	-	150	°C
Storage temperature range		T_{Stg}		- 40	-	125	°C
Junction to case	IGBT	R_{thJC}		-	-	0.28	°C/W
	Diode			-	-	0.6	°C/W
Case to sink per module		R_{thCS}	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	°C/W
Mounting torque to heatsink ± 10 %			A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads.		3		Nm
Weight					66		g

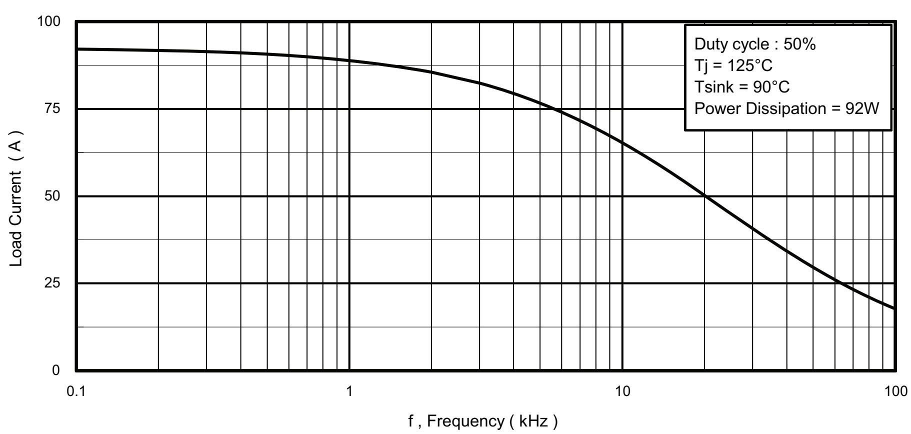


Fig. 1 - Typical Load Current vs. Frequency (Load Current = I_{RMS} of Fundamental)

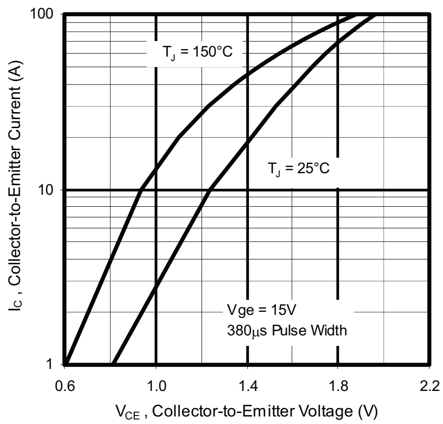


Fig. 2 - Typical Output Characteristics

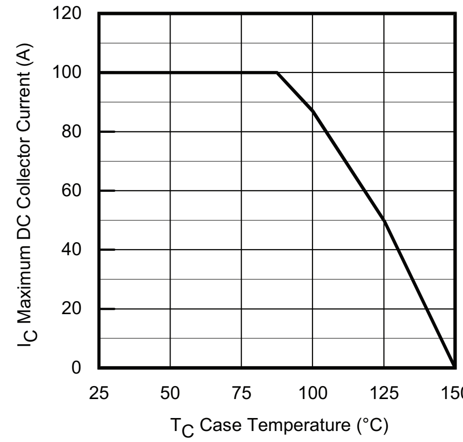


Fig. 4 - Maximum Collector Current vs. Case Temperature

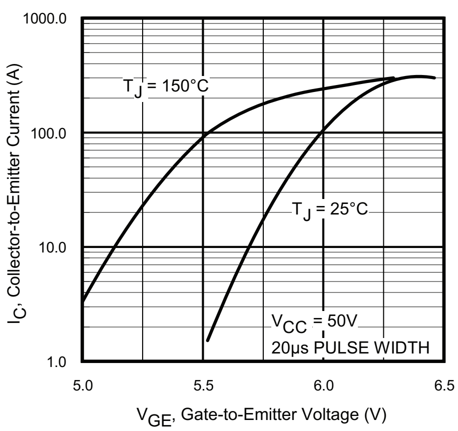


Fig. 3 - Typical Transfer Characteristics

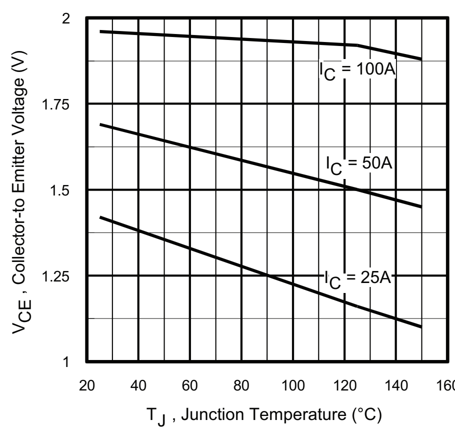


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

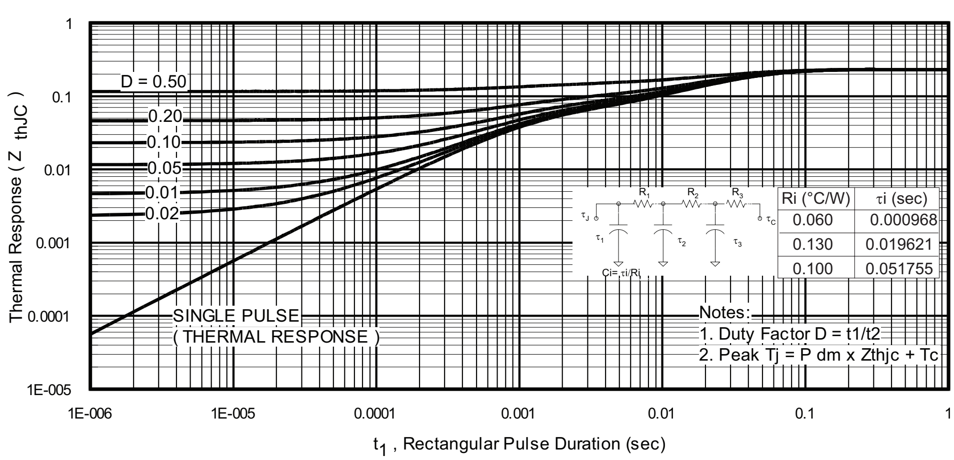


Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

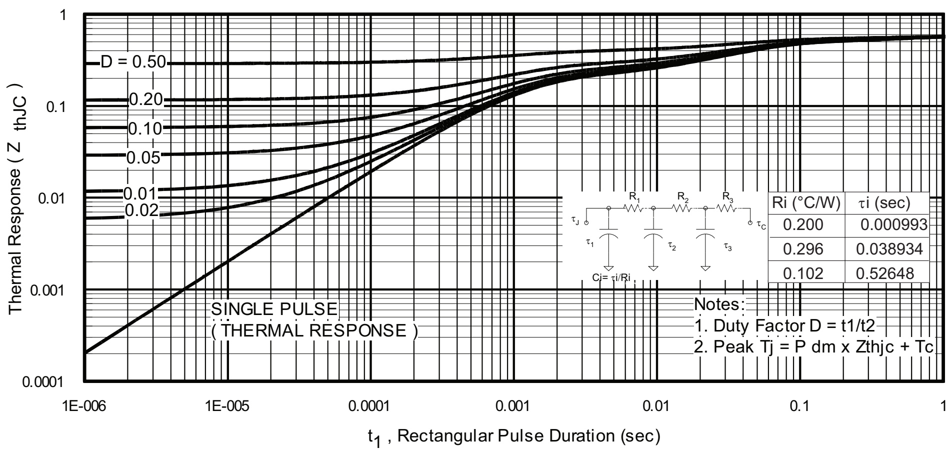


Fig. 7 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

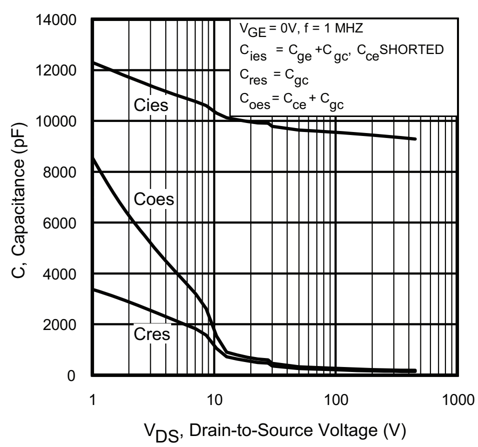


Fig. 8 - Typical Capacitance vs. Collector to Emitter Voltage

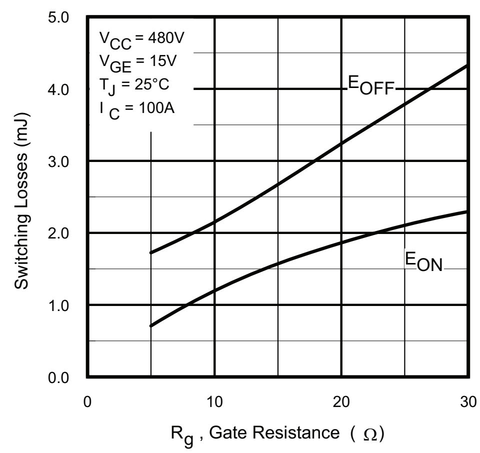


Fig. 10 - Typical Switching Losses vs. Gate Resistance

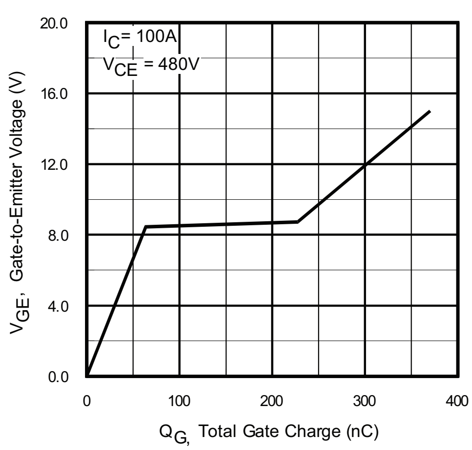


Fig. 9 - Typical Gate Charge vs. Gate to Emitter Voltage

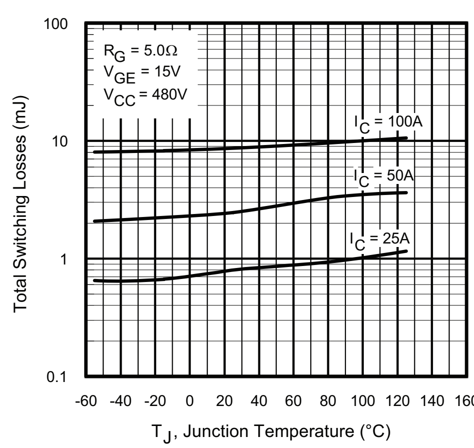


Fig. 11 - Typical Switching Losses vs. Junction Temperature

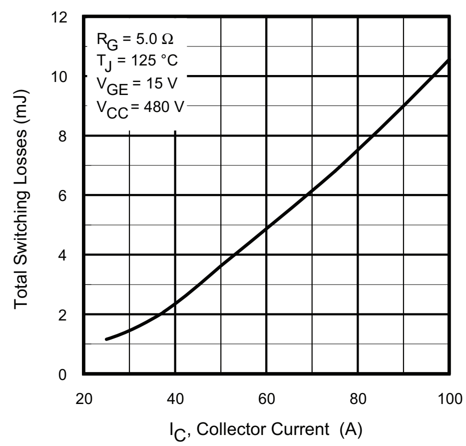


Fig. 12 - Typical Switching Losses vs. Collector to Emitter Current

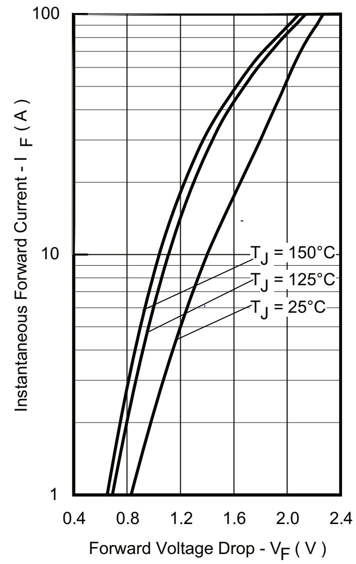


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

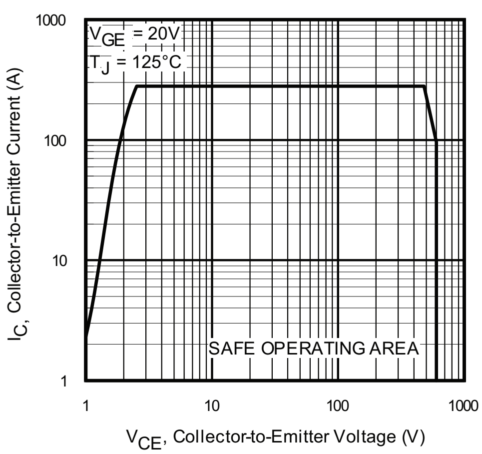


Fig. 1 Turn-Off SOA

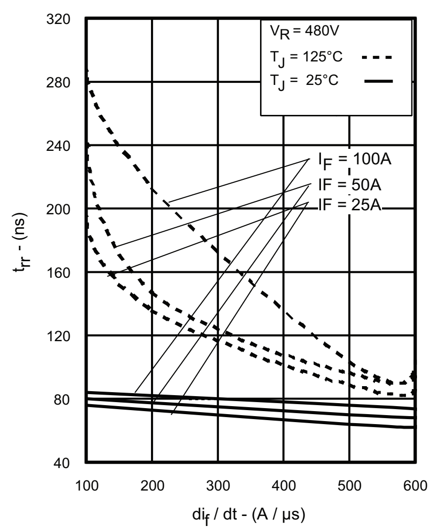


Fig. 14 - Typical Reverse Recovery Time vs. dI_F/dt

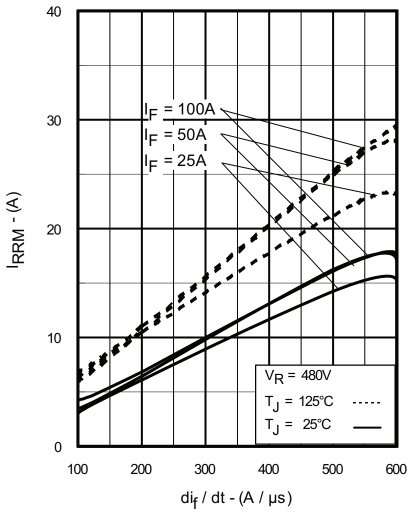


Fig. 15 - Typical Recovery Current vs. dI_F/dt

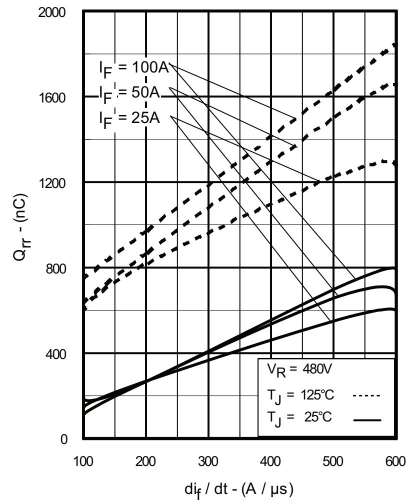


Fig. 16 - Typical Stored Charge vs.dI_F/dt

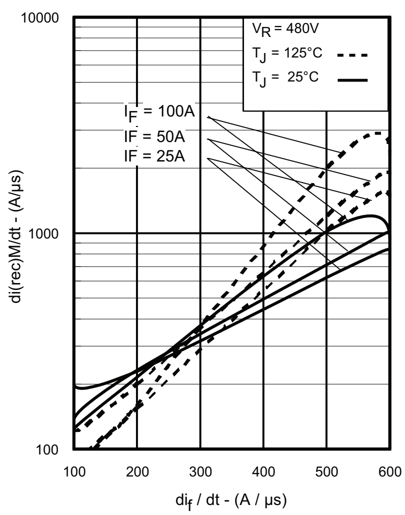


Fig. 17 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

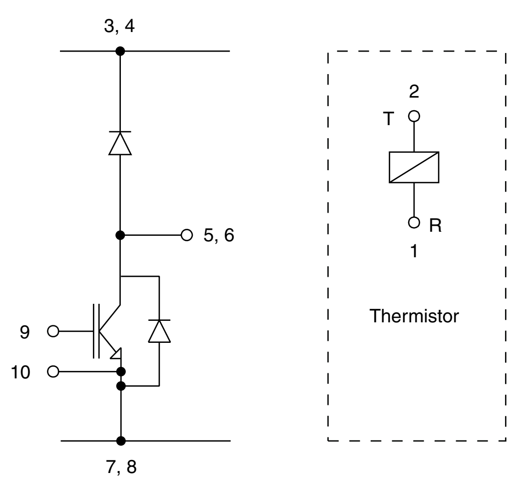


Fig. 18 - Electrical diagram

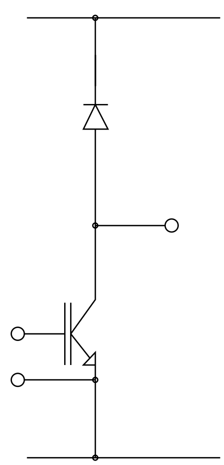
ORDERING INFORMATION TABLE

Device code	50	MT	060	U	LS	T	A	PbF
	1	2	3	4	5	6	7	8

1 - Current rating (50 = 50 A)
2 - Essential part number
3 - Voltage rating (060 = 600 V)
4 - Speed/type (U = Ultrafast IGBT)
5 - Circuit configuration (LS = Low side chopper)
6 - Special option:
- None = No special option
- T = Thermistor

7 - A = Al_2O_3 DBC substrate
8 - PbF = Lead (Pb)-free

CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95175

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