International
IOR Rectifier

PD-90930A

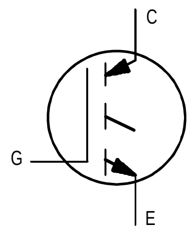
IRGIH50F

INSULATED GATE BIPOLAR TRANSISTOR

Fast Speed IGBT

Features

- Eletrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- Fast Speed operation 3 kHz ~ 8 kHz
- High operating frequency
- Switching-loss rating includes all "tail" losses
- Ceramic eyelets



n-channel

V_{CES} = 1200V

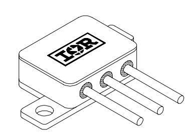
$V_{CE(sat)} \leq 2.9V$

@V_{GE} = 15V, I_C = 25A

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.

The performance of various IGBTs varies greatly with frequency. Note that IR now provides the designer with a speed benchmark ($f_{Ic/2}$, or the "haft-current frequency "), as well as an indication of the current handling capability of the device.



TO-259AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
I_C @ T_C = 100°C	Continuous Collector Current	45	
I_C @ T_C = 25°C	Continuous Collector Current	25	A
I_{CM}	Pulsed Collector Current ①	180	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
I_{LM}	Clamped Inductive Load Current ②	90	A
P_D @ T_C = 25°C	Maximum Power Dissipation	200	
P_D @ T_C = 100°C	Maximum Power Dissipation	80	W
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Lead Temperature, for 10 seconds	300 (0.063 in.(1.6mm) from case)	
	Weight	10.5 (typical)	g

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	–––	0.625	
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.21	–––	°C/W
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	–––	30	

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V_{GE} = 0V, I_C = 100µA	
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	22	—	—		V_{GE} = 0V, I_C = 1.0A	
$\Delta V_{(BR)DSS}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.1	—	V/°C	V_{GE} = 0V, I_C = 1.0mA	
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.1	2.9	V	V_{GE} = 15V, I_C = 25A	See Fig. 2, 5
		—	2.5	—		V_{GE} = 15V, I_C = 45A	
		—	2.4	—		V_{CE} = 15V, I_C = 25A , T_J = 125°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		V_{CE} = V_{GE}, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-14	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA	
g_{fe}	Forward Transconductance ⑤	7.5	—	—	S	V_{CE} = 100V, I_C = 25A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	100	µA	V_{GE} = 0V, V_{CE} = 960V	
		—	—	1200		V_{GE} = 0V, V_{CE} = 960V, T_J = 125°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V_{GE} = ±20V	

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	—	100	nC	I_C = 25A ⑥
Q_{ge}	Gate - Emitter Charge (turn-on)	—	—	21		V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	—	43		V_{GE} = 15V See Fig. 8
$t_{d(on)}$	Turn-On Delay Time	—	—	68	ns	
t_r	Rise Time	—	—	26		T_J = 25°C ⑥
$t_{d(off)}$	Turn-Off Delay Time	—	—	480		I_C = 25A, V_{CC} = 400V
t_f	Fall Time	—	—	330		V_{GE} = 15V, R_G = 2.35Ω
E_{on}	Turn-On Switching Loss	—	1.4	—	mJ	Energy losses include "tail"
E_{off}	Turn-Off Switching Loss	—	4.5	—		See Fig. 9, 10, 14
E_{ts}	Total Switching Loss	—	5.9	8.2		
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	T_J = 125° ⑥
t_r	Rise Time	—	15	—		I_C = 25A, V_{CC} = 400V
$t_{d(off)}$	Turn-Off Delay Time	—	590	—		V_{GE} = 15V, R_G = 2.35Ω
t_f	Fall Time	—	500	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	13	—	mJ	See Fig. 11, 14
L_S	Internal Source Inductance	—	8.7	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	2400	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	140	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	28	—		f = 1.0MHz See Fig. 7

Notes:

① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature. (See fig. 13b)

② V_{CC} = 80%(V_{CES}), V_{GE} = 20V, L ≥ 10µH, R_G = 5.0Ω, (See fig. 13a)

③ Repetitive rating; pulse width limited by maximum junction temperature.

④ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

⑤ Pulse width ≤ 5.0µs, single shot.

⑥ Equipment limitation

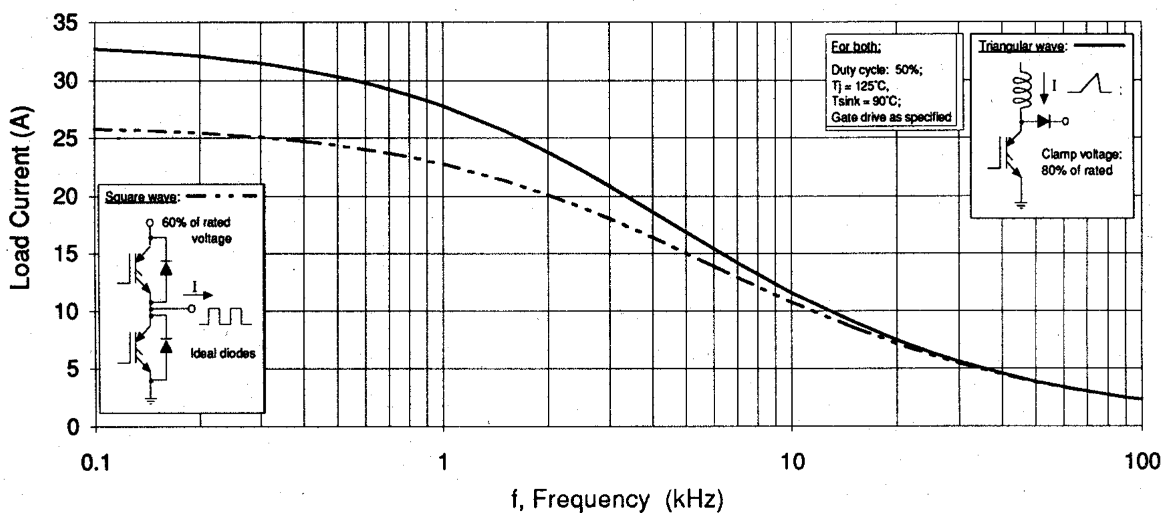


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

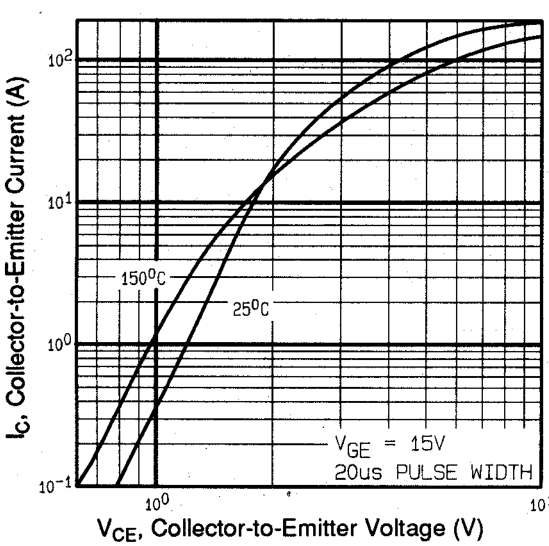


Fig. 2 - Typical Output Characteristics

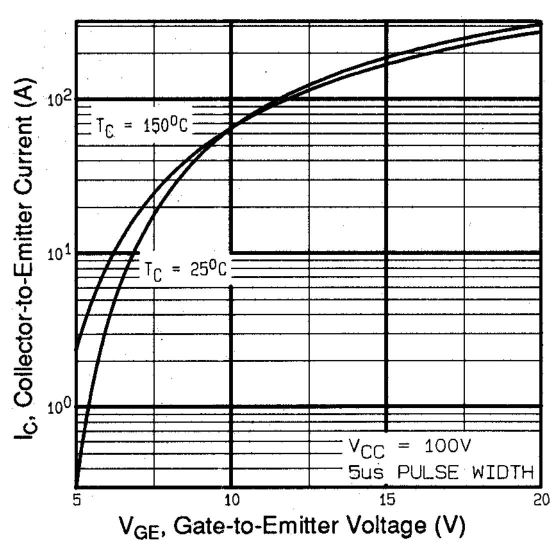


Fig. 3 - Typical Transfer Characteristics

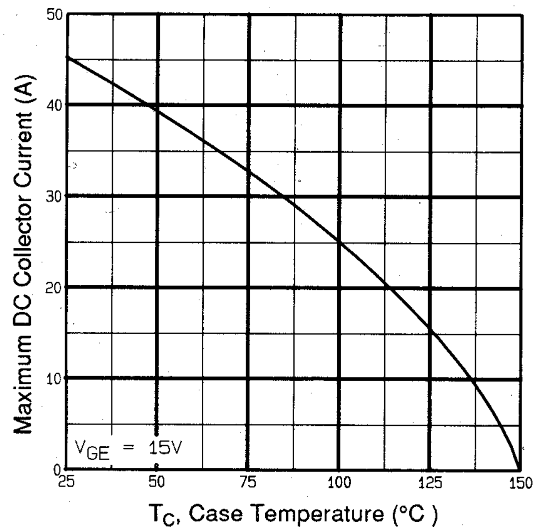


Fig. 4 - Maximum Collector Current vs. Case Temperature

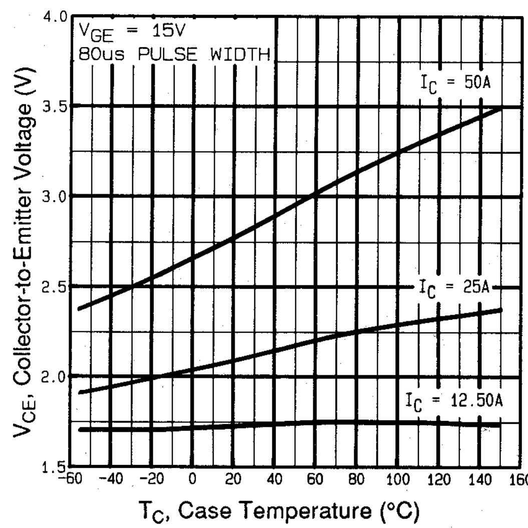


Fig. 5 - Collector-to-Emitter Saturation Voltage vs. Case Temperature

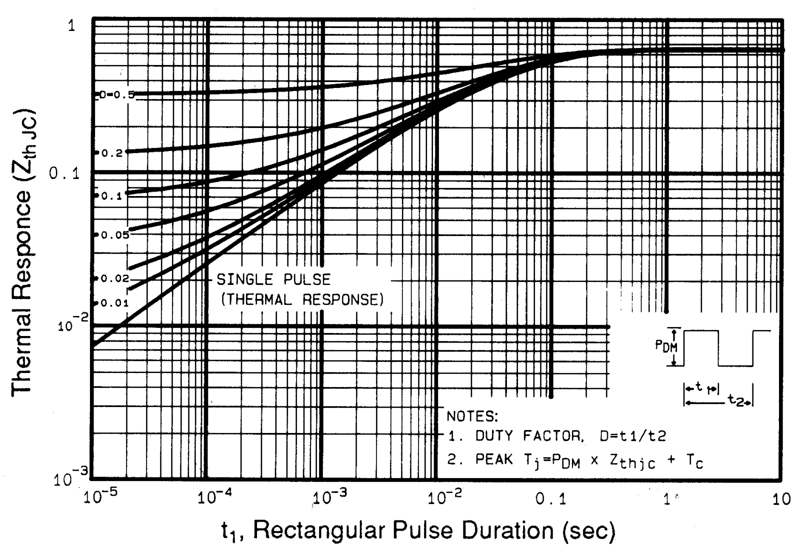


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

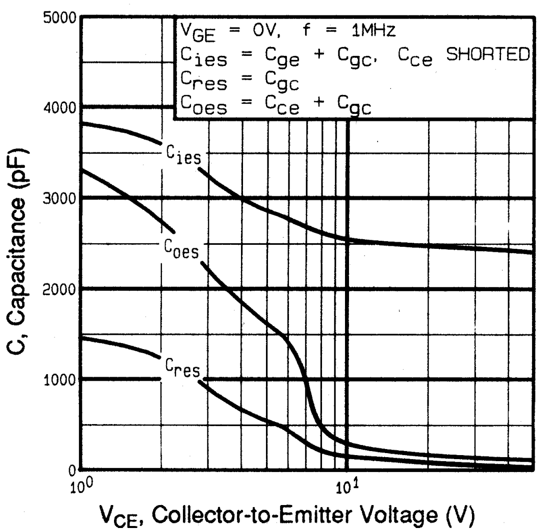


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

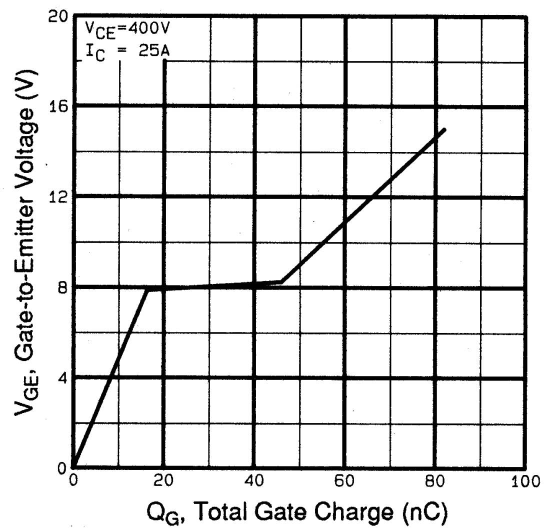


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

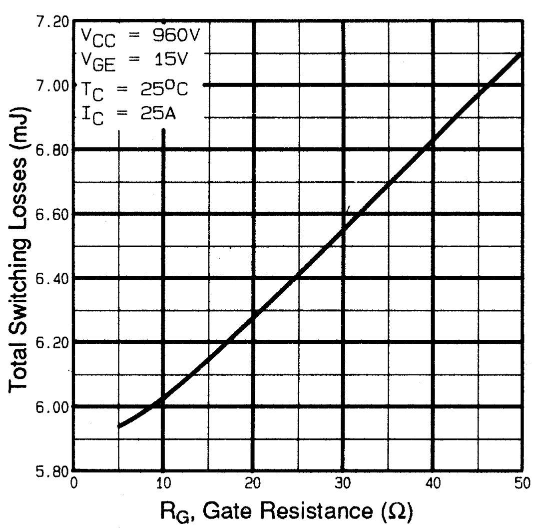


Fig. 9 - Typical Switching Losses vs. Gate Resistance

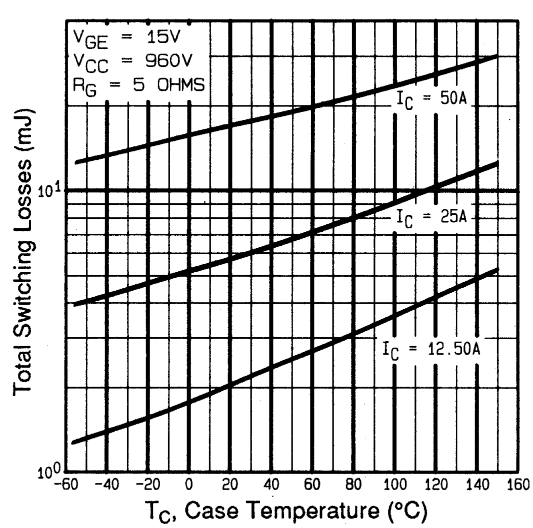


Fig. 10 - Typical Switching Losses vs. Case Temperature

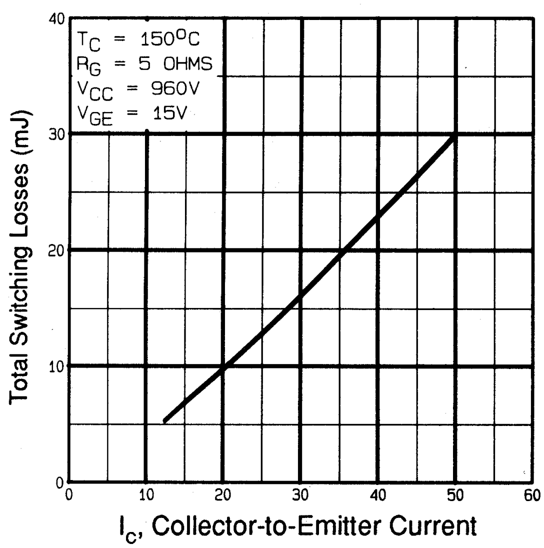


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

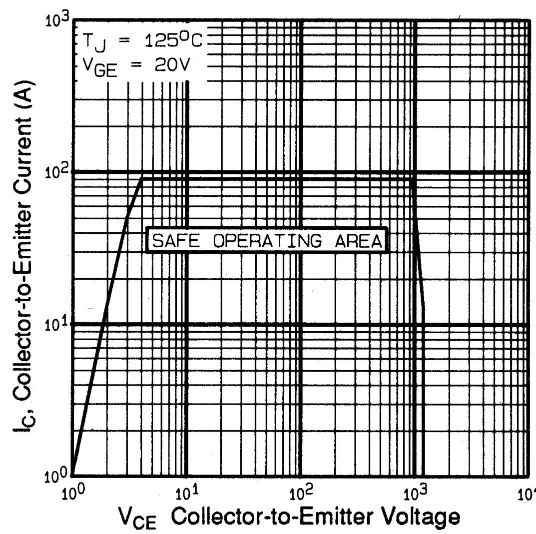


Fig. 12 - Turn-Off SOA

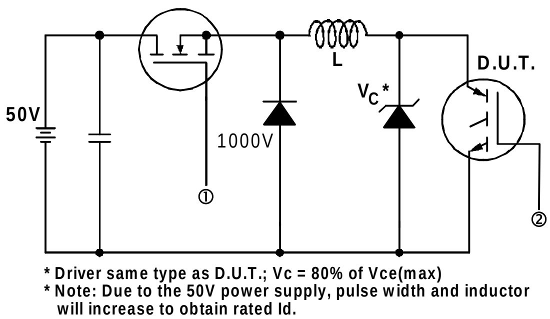


Fig. 13a - Clamped Inductive Load Test Circuit

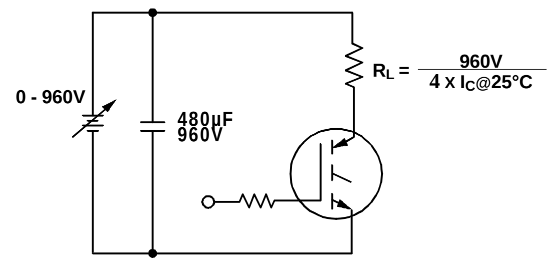


Fig. 13b - Pulsed Collector Current Test Circuit

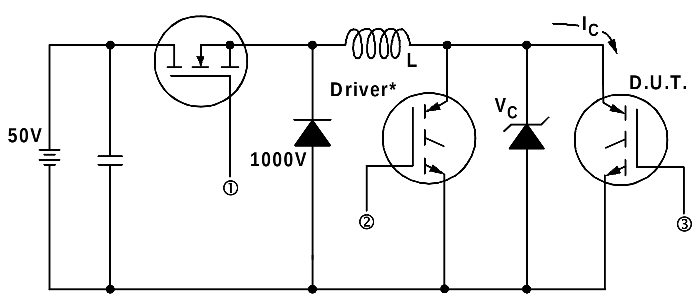


Fig. 14a - Switching Loss Test Circuit

*** Driver same type as D.U.T., VC = 960V**

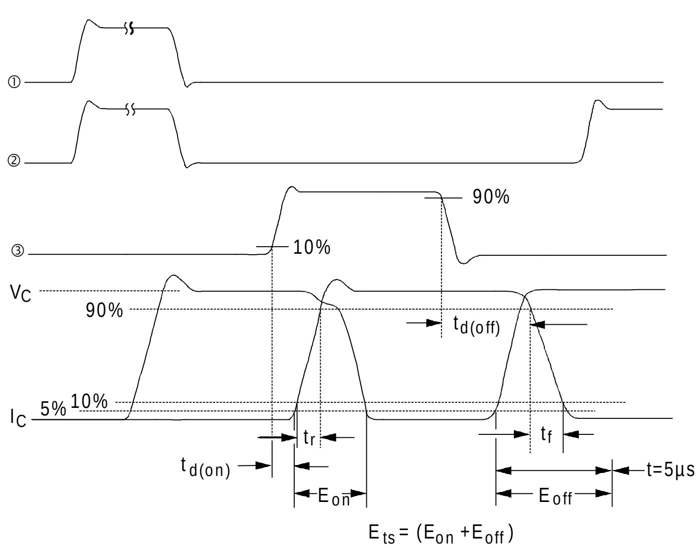
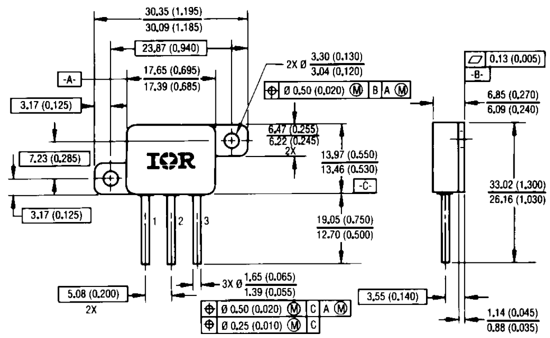


Fig. 14b - Switching Loss Waveforms

Case Outline and Dimensions — TO-259AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982
2. ALL DIMENSIONS ARE SHOW IN MILLIMETERS (INCHES).

LEGEND
1- ANODE
2- COMMON CATHODE
3- ANODE

Conforms to JEDEC Outline TO-259AA
Dimensions in millimeters and (inches)

CAUTION
BERYLLIA WARNING PER MIL- PRF-19500

Package containing beryllia shall not be ground, sandblasted,machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

International
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