



**ON Semiconductor<sup>®</sup>**  
**Xenon Flash Light**  
**IGBT Application Note**

**Hyper Device Division**

March. 2014

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# Agenda

- 1. Operating Precautions**
- 2. Recommended Circuit Example**
- 3. Evaluation Board Data**



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## Operating Precautions

**Please note the followings when you use the devices because flash IGBTs handle high current.**

**Please evaluate the following points when designing.**

- a. ICP precautions
- b.  $dv/dt$  precautions
- c.  $dv/dt$  adjustments
- d. Wiring precautions

## a. ICP precautions

The ICP, collector current peak is restricted by  $V_{GE}$ , gate-emitter voltage.

Please use the device within the ICP- $V_{GE}$  safe operation area described in each product's specification.

Please note that the ICP is also restricted by the main condenser capacity.

Operating waveform

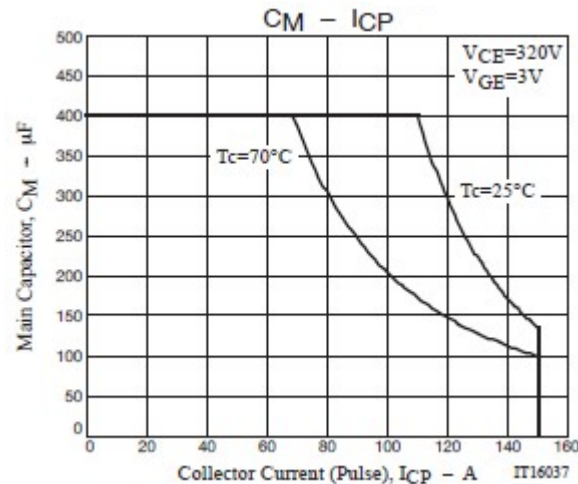
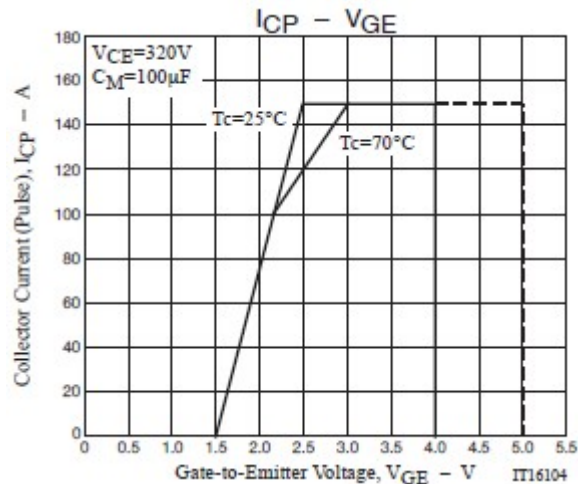
Collector Current Peak ICP

Gate Signal

Collector-Emitter Voltage VCE

Collector Current IC

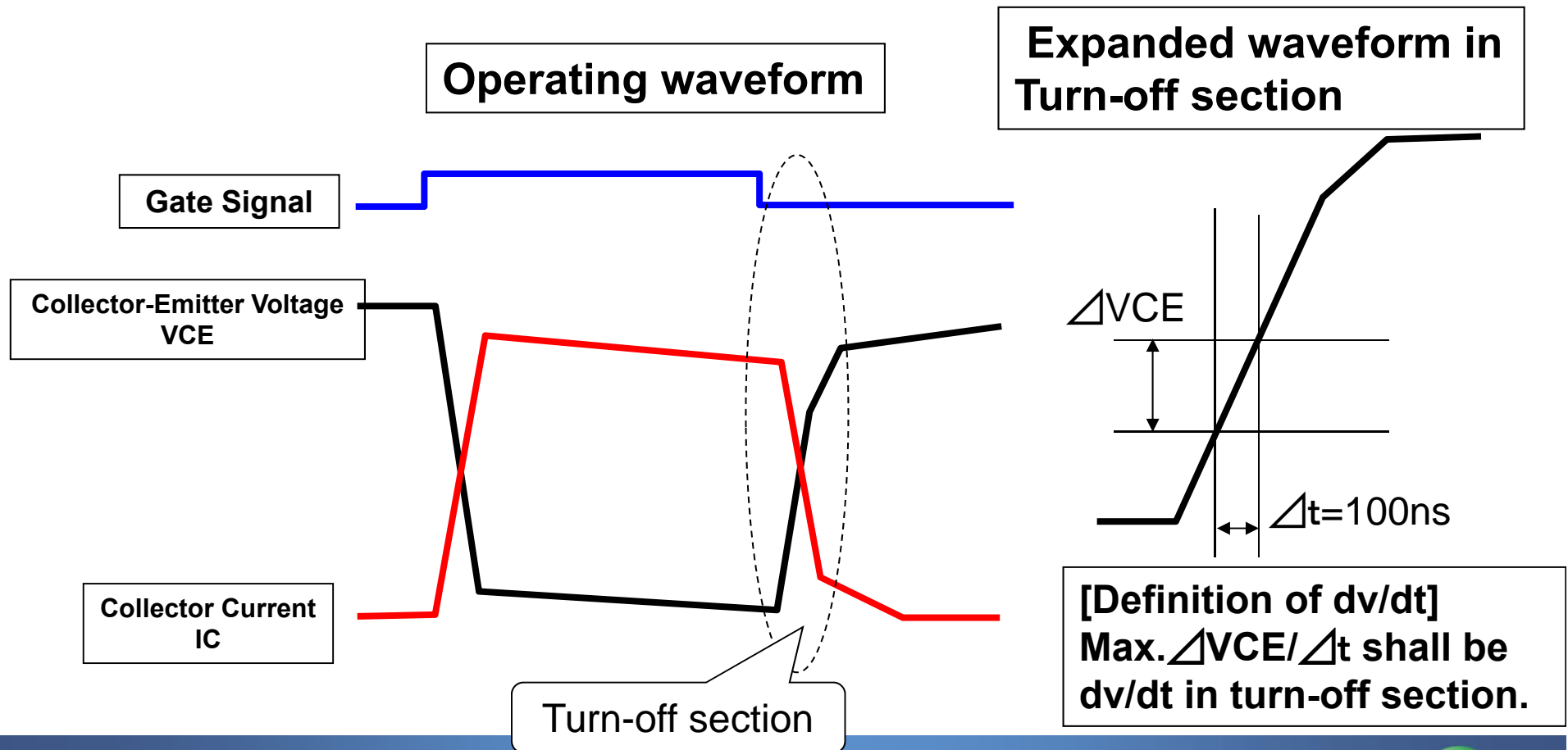
Example: TIG065E8's ASO



✘Left chart shows the ASO for single-shot pulse. Considering heat generation, please use the device with channel temperature  $T_{ch} \leq 150^\circ C$  in continuous operating

## b. dv/dt precautions

Please use the device with **400V/ $\mu$ s or less** of dv/dt , inclination of collector-emitter voltage in turn-off section. Using with dv/dt > 400V/ $\mu$ s is not guaranteed.



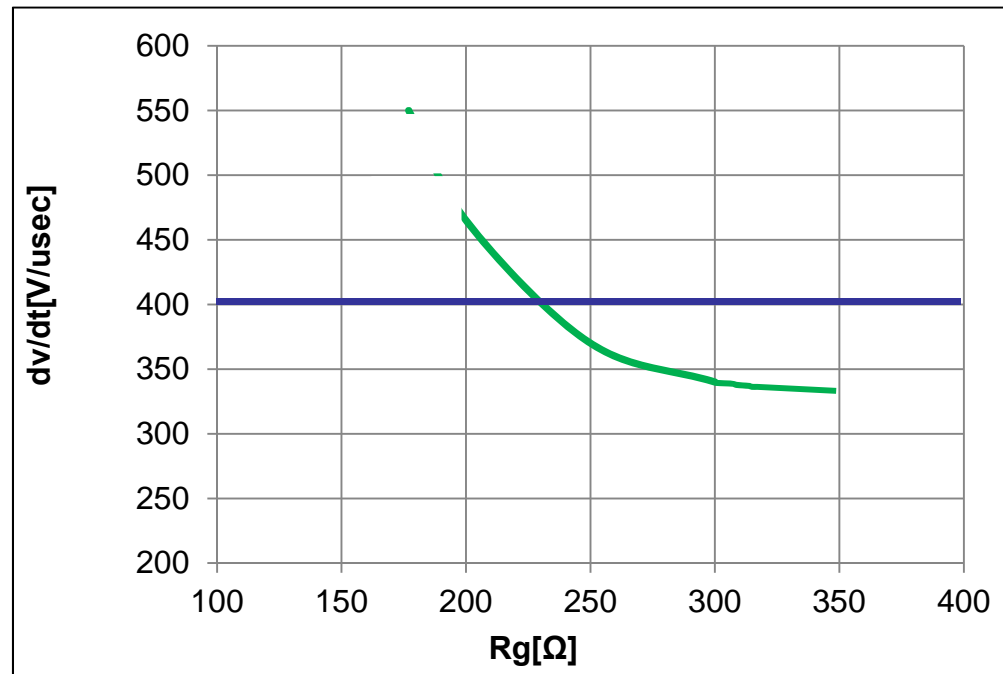
## c. dv/dt adjustments

Please adjust the gate series resistance  $R_G$  to keep dv/dt to 400V/ $\mu$ s or less. There is no restriction for  $R_G$ .

Though the dv/dt- $R_G$  dependency differs according to the mount conditions, for your reference, we provide the dv/dt- $R_G$  dependency graphs in each product's specification.

### Example: TIG065E8's dv/dt- $R_G$ dependency graph

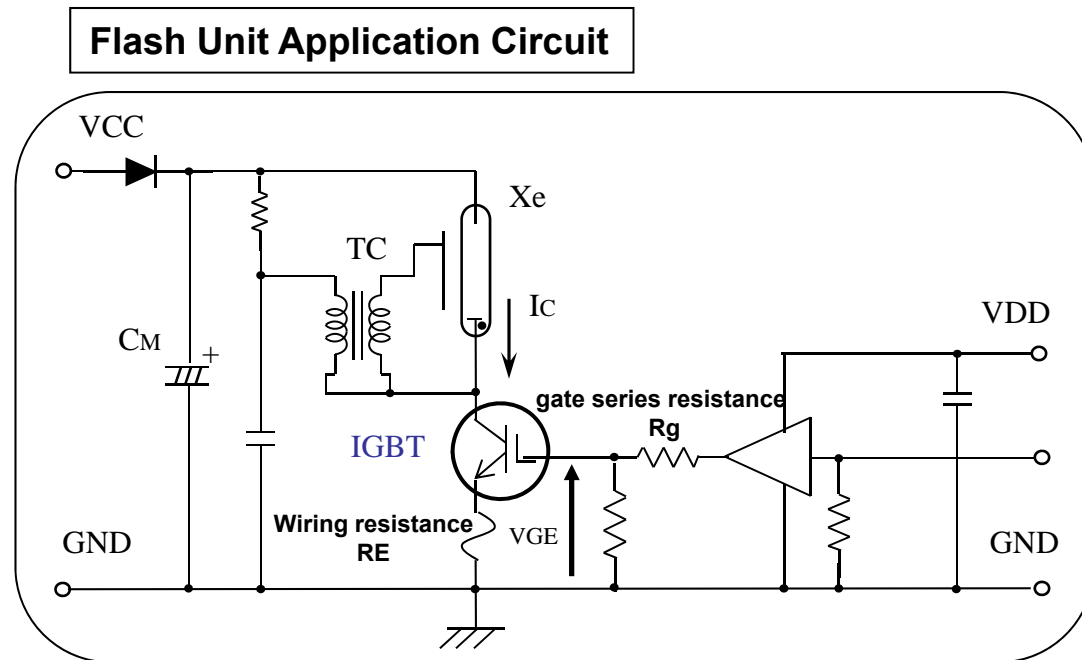
Measurement condition  $V_{CC}=320V, I_c=100A$



## d. Wiring precautions

If the wiring resistance between IGBT's emitter terminal and GND is high, there will be rise in emitter terminal potential and lack in actual gate voltage during high current operation.

This may cause the breakdown of IGBT.



Gate Voltage during high current operation will be:  
 $V_{GE} - I_C \times R_E$



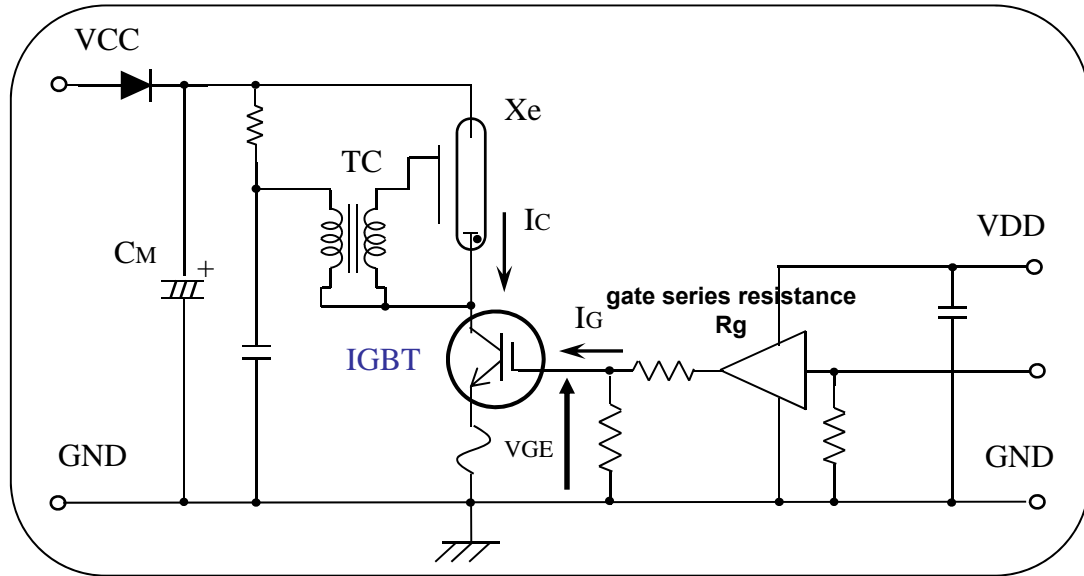
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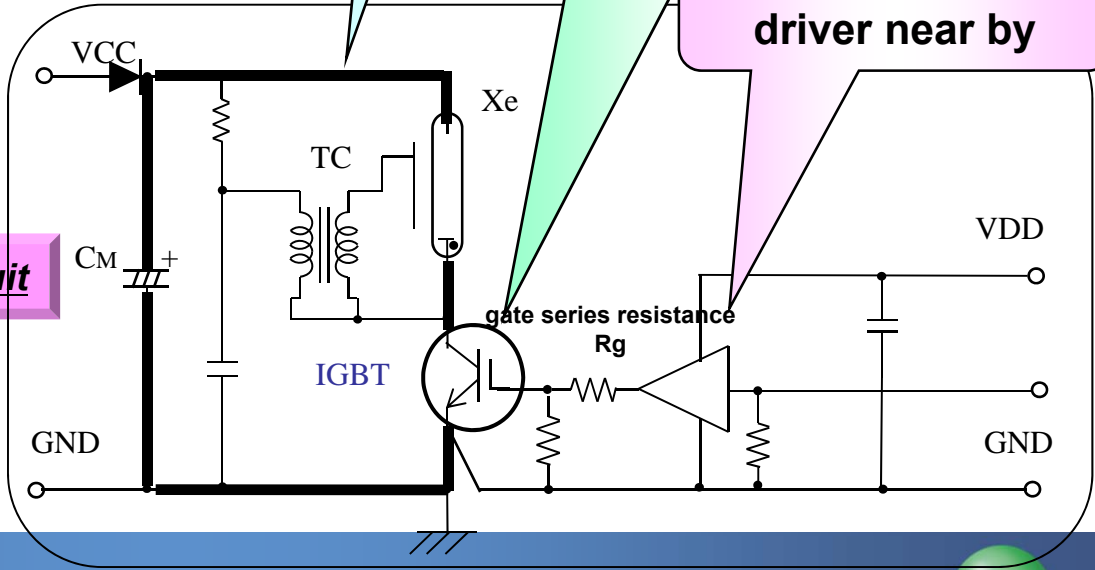
# Recommended Circuit Example



① High current path should be thick and short

② Keep low impedance between IGBT-GND (3mΩ or less is recommended)

③ Place IGBT & driver near by



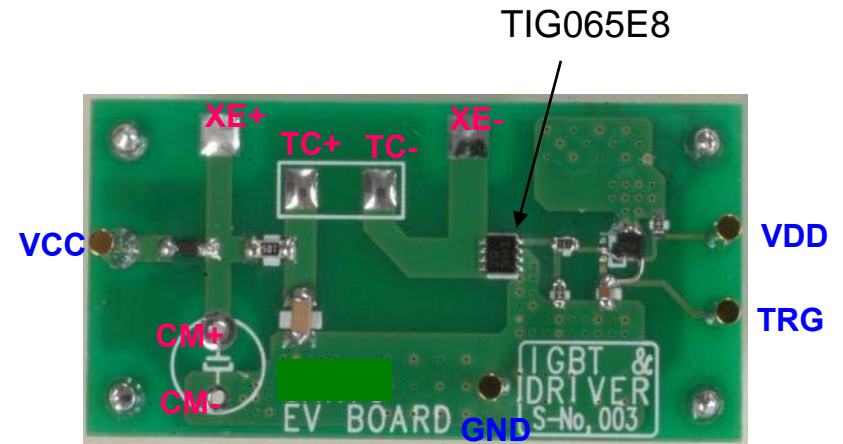
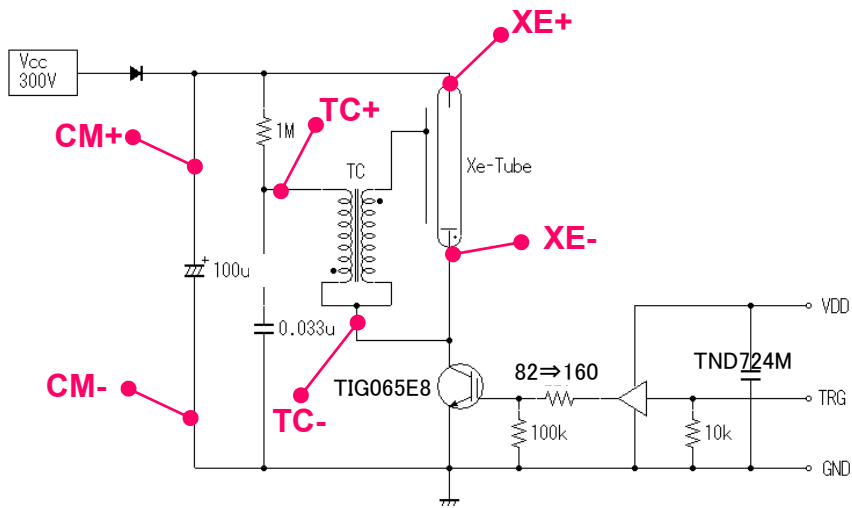
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# Evaluation Board



## [Conditions]

**VCC=300V(MAX320V)**  
**VDD=2.5~4.0V**  
**TRG=VDD**



# TIG065E8 Measured Data

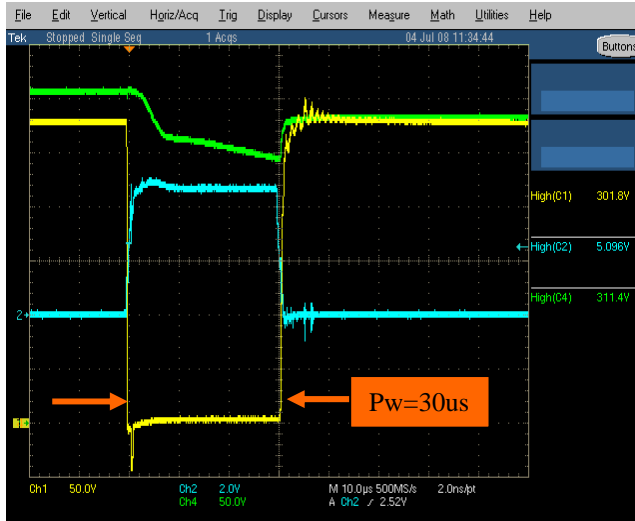
## Pulse width in 30us operation

10us/div

VCM:50V/div

VCE:50V/div

VGE:2V/div



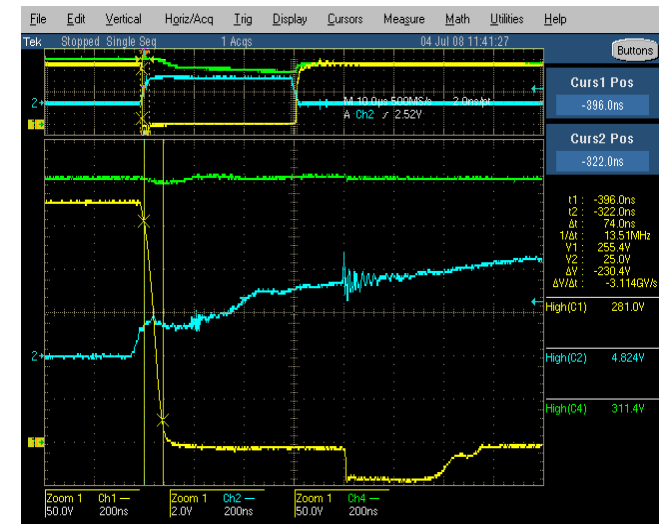
## Turn-on expanded waveform

200ns/div

VCM:50V/div

VCE:50V/div

VGE:2V/div

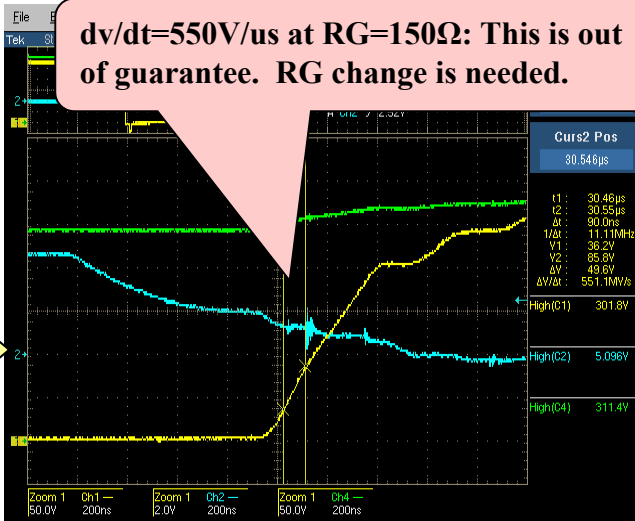


## Turn-off expanded waveform

200ns/div

**dv/dt=550V/us at RG=150Ω: This is out of guarantee. RG change is needed.**

VCE toff  
dv/dt=550V/ns

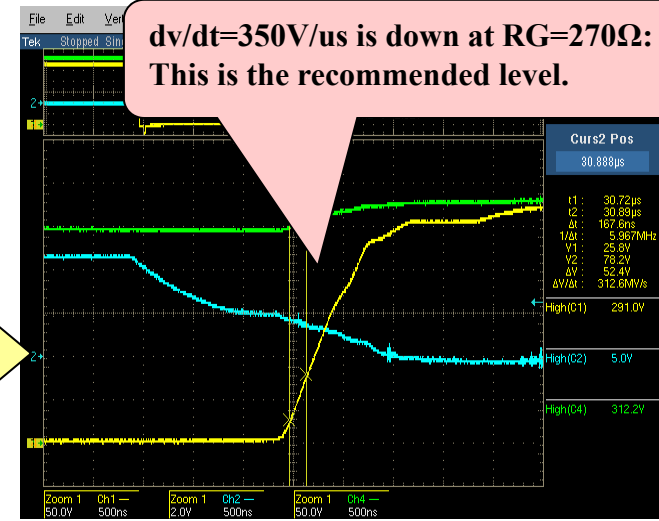


## Turn-off expanded waveform

200ns/div

**dv/dt=350V/us is down at RG=270Ω: This is the recommended level.**

VCE toff  
dv/dt=310V/ns



**RG=270Ω(Recommended Condition)**