

# Isolated Compact IGBT Gate Driver with Current Sense



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## NCD57085, NCV57085

NCx57085 is a high current single channel IGBT gate driver with 2.5 kVrms internal galvanic isolation designed for high system efficiency and reliability in high power applications. The driver includes Current Sense function with soft turn off and fault reporting in a narrow body SOIC – 8 package. NCx57085 accommodates wide range of input bias voltage and signal levels from 3.3 V to 20 V, and wide range of output bias voltage up to 30 V.

### Features

- High Peak Output Current (+7A/-7 A)
- Low Output Impedance for Enhanced IGBT Driving
- Short Propagation Delays with Accurate Matching
- IGBT Over Current Protection
- Negative Voltage (Down to -9 V) Capability for CS Pin
- IGBT Gate Clamping during Short Circuit
- IGBT Gate Active Pull Down
- Soft Turn Off During IGBT Over Current
- Tight UVLO Thresholds for Bias Flexibility
- Output Partial Pulse Avoidance During UVLO/CS (Restart)
- 3.3 V, 5 V, and 15 V Logic Input
- 2.5 kVrms Galvanic Isolation
- High Transient Immunity
- High Electromagnetic Immunity
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant

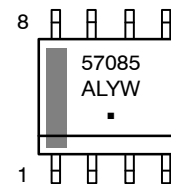
### Typical Applications

- Motor Control
- Automotive Applications
- Uninterruptible Power Supplies (UPS)
- Industrial Power Supplies
- HVAC
- Industrial Pumps and Fans
- PTC Heater



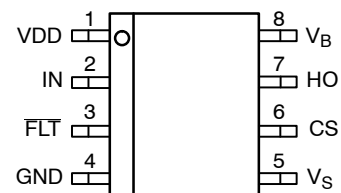
SOIC-8 NB  
CASE 751-07

### MARKING DIAGRAM



57085	= Specific Device Code
A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
▪	= Pb-Free Package

### PIN CONNECTIONS



NCx57085  
x = D or V

### ORDERING INFORMATION

See detailed ordering and shipping information on page 12 of this data sheet.

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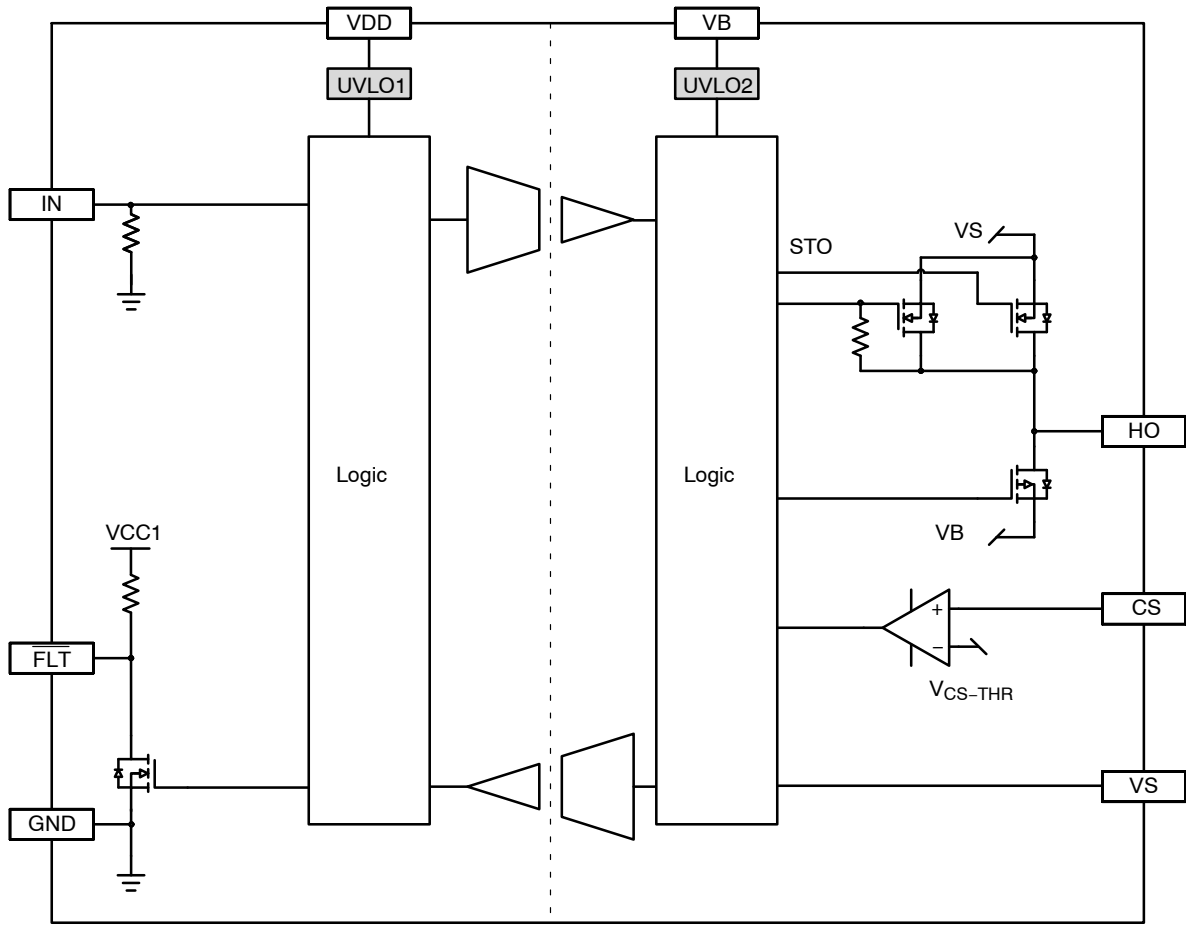


Figure 1. Simplified Block Diagram

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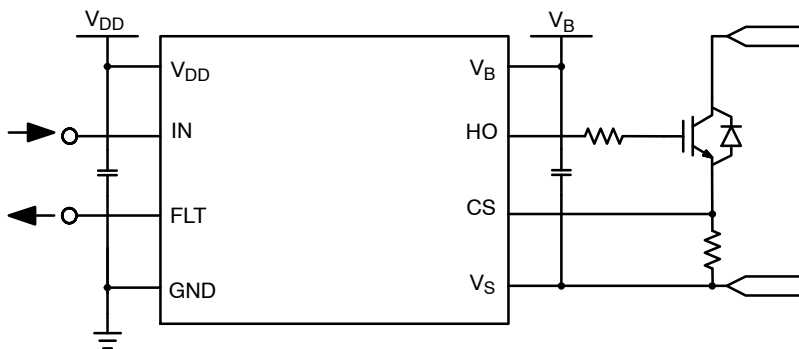


Figure 2. Simplified Application Schematics, Current Sense Using Shunt Resistor

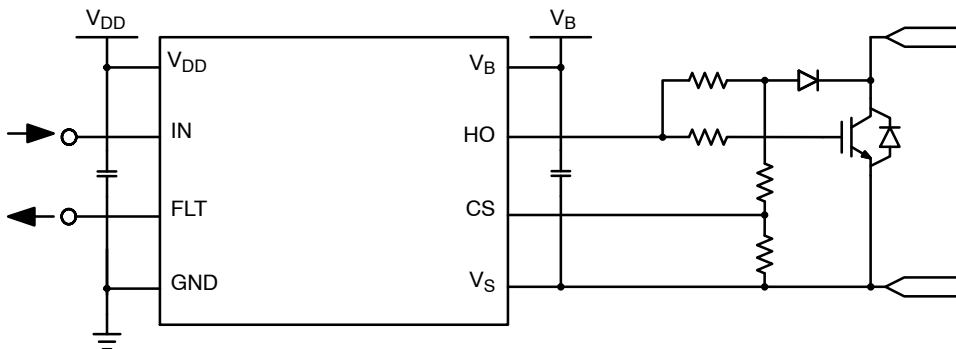


Figure 3. Simplified Application Schematics, Current Sense Using IGBT Vce

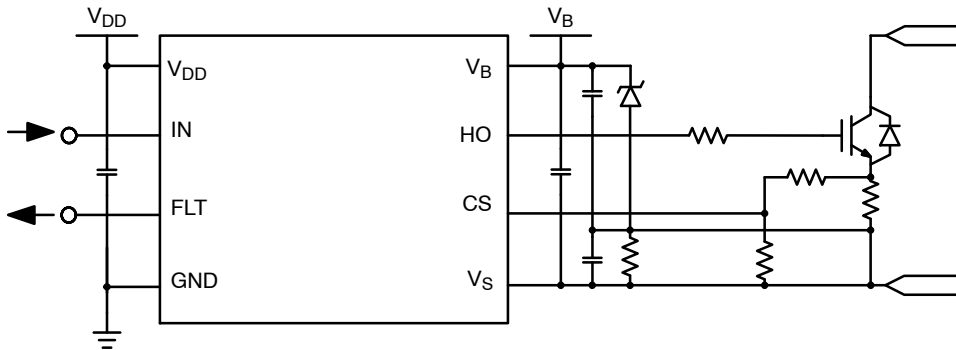


Figure 4. Simplified Application Schematics, Current Sense Using Shunt Resistor and Negative Gate Drive

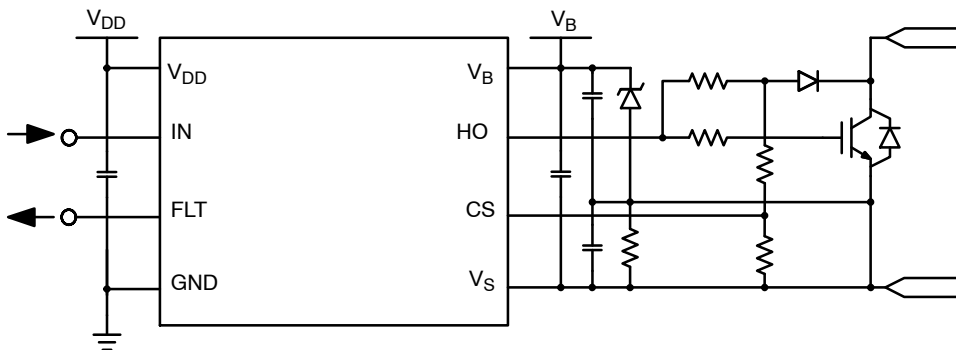


Figure 5. Simplified Application Schematics, Current Sense Using IGBT Vce and Negative Gate Drive

## NCD57085, NCV57085

### FUNCTION DESCRIPTION

Pin Name	No.	I/O	Description
V <sub>DD</sub>	1	Power	Input side power supply. A good quality bypassing capacitor is required from this pin to GND and should be placed close to the pins for best results. The under voltage lockout (UVLO) circuit enables the device to operate at power on when a typical supply voltage higher than V <sub>UVLO1-OUT-ON</sub> is present. Please see Figure 7 for more details.
IN	2	I	Non-inverted gate driver input. The equivalent input pull down resistance is about 100 kΩ when the input voltage is below 5.5 V. The input adapter circuitry will work once the input voltage is higher than 5.5 V, and will keep the input current at the level when the input voltage is 5.5 V even though it is higher than that. A minimum pulse width is required at IN before HO responds.
FLT	3	O	Fault output (active low) that allows communication to the main controller that the driver has encountered a Over Current, or UVLO1, or UVLO2 condition and has deactivated the output. There is an internal 50 kΩ pull-up resistor connected to this pin. Multiple of them from different drivers can be "OR"ed together. /FLT and HO will go high automatically after t <sub>MUTE</sub> expires along with a rising edge of IN to avoid partial output pulse on HO. This is a feature called "Re-start".
GND	4	Power	Input side ground reference.
V <sub>S</sub>	5	Power	Output side ground reference.
CS	6	I/O	Input for detecting over current of IGBT. The current sense threshold has to be met uninterruptedly for a fixed period of t <sub>FILTER</sub> before HO and /FLT are set low. Please refer to Figure 9 and Figure 10. FLT and HO will be kept low (including soft turn off time) at least for a period defined by t <sub>MUTE</sub> .
HO	7	O	Driver output that provides the appropriate drive voltage and source/sink current to the IGBT/FET gate. HO is actively pulled low during start-up.
V <sub>B</sub>	8	Power	Output side positive power supply. The operating range for this pin is from UVLO2 to its maximum allowed value. A good quality bypassing capacitor is required from this pin to V <sub>S</sub> and should be placed close to the pins for best results. The under voltage lockout (UVLO) circuit enables the device to operate at power on when a typical supply voltage higher than V <sub>UVLO2-OUT-ON</sub> is present. Please see Figure 8 for more details.

**SAFETY AND INSULATION RATINGS**

Symbol	Parameter	Value	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1 Rated Mains Voltage	< 150 V <sub>RMS</sub>	I-IV
		< 300 V <sub>RMS</sub>	I-IV
		< 450 V <sub>RMS</sub>	I-IV
		< 600 V <sub>RMS</sub>	I-IV
		< 1000 V <sub>RMS</sub>	I-III
		Climatic Classification	40/100/21
	Pollution Degree (DIN VDE 0110/1.89)	2	
CTI	Comparative Tracking Index (DIN IEC 112/VDE 0303 Part 1)	600	
V <sub>PR</sub>	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	2250	V <sub>PK</sub>
V <sub>IORM</sub>	Maximum Repetitive Peak Voltage	1200	V <sub>PK</sub>
V <sub>IOWM</sub>	Maximum Working Insulation Voltage	870	V <sub>RMS</sub>
V <sub>IOTM</sub>	Highest Allowable Over Voltage	4200	V <sub>PK</sub>
E <sub>CR</sub>	External Creepage	4.0	mm
E <sub>CL</sub>	External Clearance	4.0	mm
DTI	Insulation Thickness	8.65	μm
T <sub>Case</sub>	Safety Limit Values – Maximum Values in Failure; Case Temperature	150	°C
P <sub>S,INPUT</sub>	Safety Limit Values – Maximum Values in Failure; Input Power	132	mW
P <sub>S,OUTPUT</sub>	Safety Limit Values – Maximum Values in Failure; Output Power	1128	mW
R <sub>IO</sub>	Insulation Resistance at TS, V <sub>IO</sub> = 500 V	10 <sup>9</sup>	Ω

**ISOLATION CHARACTERISTICS**

Symbol	Parameter	Conditions	Value	Unit
V <sub>ISO</sub> , INPUT- OUTPUT	Input-Output Isolation Voltage	T <sub>A</sub> = 25°C, Relative Humidity < 50%, t = 1.0 minute, I <sub>I-O</sub> < 30 μA, 50 Hz (Notes 1, 2, 3)	2500	V <sub>RMS</sub>
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = 500 V (Note 1)	10 <sup>11</sup>	Ω

1. Device is considered a two-terminal device: pins 1 to 4 are shorted together and pins 5 to 8 are shorted together.
2. 2,500 VRMS for 1-minute duration is equivalent to 3,000 VRMS for 1-second duration.
3. The input-output isolation voltage is a dielectric voltage rating per UL1577. It should not be regarded as an input-output continuous voltage rating. For the continuous working voltage rating, refer to equipment-level safety specification or DIN VDE V 0884-11 Safety and Insulation Ratings Table.

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**ABSOLUTE MAXIMUM RATINGS** (Note 4) Over operating free-air temperature range unless otherwise noted.

Symbol	Parameter	Minimum	Maximum	Unit
$V_{DD} - GND$	Supply Voltage, Input Side	-0.3	22	V
$V_B - V_S$	Supply Voltage, Output Side	-0.3	32	V
$V_{HO} - V_S$	Gate-driver Output Voltage	-0.3	$V_{BS} + 0.3$	V
$I_{PK-SRC}$	Gate-driver Output Sourcing Current (maximum pulse width = 10 $\mu$ s, maximum duty cycle = 0.2%, $V_D - V_S = 15$ V)	-	7	A
$I_{PK-SNK}$	Gate-driver Output Sinking Current (maximum pulse width = 10 $\mu$ s, maximum duty cycle = 0.2%, $V_D - V_S = 15$ V)	-	7.5	A
$V_{IN} - GND$	Voltage at IN, FLT	-0.3	$V_{DD} + 0.3$	V
$I_{FLT}$	Output current of FLT	-	10	mA
$V_{CS} - V_S$	Voltage at CS (Note 5)	-9	$V_{BS} + 0.3$	V
PD	Power Dissipation (Note 6)	-	1123	mW
ESD <sub>HBM</sub>	ESD Capability, Human Body Model (Note 7)	-	$\pm 2$	kV
ESD <sub>CDM</sub>	ESD Capability, Charged Device Model (Note 7)	-	$\pm 2$	kV
MSL	Moisture Sensitivity Level	-	1	-
$T_{J(max)}$	Maximum Junction Temperature	-40	150	$^{\circ}$ C
$T_{STG}$	Storage Temperature Range	-65	150	$^{\circ}$ C
$T_{SLD}$	Lead Temperature Soldering Reflow, Pb-Free (Note 8)	-	260	$^{\circ}$ C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

4. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

5. The minimum value is verified by characterization with a single pulse of 1.5 mA for 300  $\mu$ s.

6. The value is estimated for ambient temperature 25 $^{\circ}$ C and junction temperature 150 $^{\circ}$ C, 650 mm<sup>2</sup>, 1 oz copper, 2 surface layers and 2 internal power plane layers. Power dissipation is affected by the PCB design and ambient temperature.

7. This device series incorporates ESD protection and is tested by the following methods:

ESD Human Body Model tested per AEC-Q100-002 (EIA/JESD22-A114).

ESD Charged Device Model tested per AEC-Q100-011 (EIA/JESD22-C101).

Latchup Current Maximum Rating:  $\leq 100$  mA per JEDEC standard: JESD78, 125 $^{\circ}$ C.

8. For information, please refer to our Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

## Thermal Characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Air	100 mm <sup>2</sup> , 1 oz Copper, 1 Surface Layer	179	$^{\circ}$ C/W
		100 mm <sup>2</sup> , 1 oz Copper, 2 Surface Layers and 2 Internal Power Plane Layers	110	

9. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

10. Values based on copper area of 100 mm<sup>2</sup> (or 0.16 in<sup>2</sup>) of 1 oz copper thickness and FR4 PCB substrate.

## Operating Ranges

Symbol	Parameter	Min	Max	Unit
$V_{DD-GND}$	Supply Voltage, Input Side	UVLO1	20	V
$V_B - V_S$	Supply Voltage, Output Side	UVLO2	30	V
$V_{IN}$	Logic Input Voltage at IN	GND	$V_{DD}$	V
$ dV_{ISO}/dt $	Common Mode Transient Immunity	100	-	kV/ $\mu$ s
$T_A$	Ambient Temperature	-40	125	$^{\circ}$ C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

11. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

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## ELECTRICAL CHARACTERISTICS $V_{DD} = 5\text{ V}$ , $V_{BS} = 15\text{ V}$ .

For typical values  $T_A = 25^\circ\text{C}$ , for min/max values,  $T_A$  is the operating ambient temperature range that applies, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### VOLTAGE SUPPLY

$V_{UVLO1-OUT-ON}$	UVLO1 Output Enabled		-	-	3.1	V
$V_{UVLO1-OUT-OFF}$	UVLO1 Output Disabled		2.4	-	-	V
$V_{UVLO1-HYST}$	UVLO1 Hysteresis		0.1	-	-	V
$V_{UVLO2-OUT-ON}$	UVLO2 Output Enabled		12.4	12.9	13.4	V
$V_{UVLO2-OUT-OFF}$	UVLO2 Output Disabled		11.5	12	12.5	V
$V_{UVLO2-HYST}$	UVLO2 Hysteresis		0.7	1	-	V
$I_{DD-0-3.3}$	Input Supply Quiescent Current	IN = Low, $V_{DD} = 3.3\text{ V}$ , $\overline{FLT} = \text{High}$	-	-	2	mA
$I_{DD-0-5}$		IN = Low, $V_{DD} = 5\text{ V}$ , $\overline{FLT} = \text{High}$	-	-	2	mA
$I_{DD-0-15}$		IN = Low, $V_{DD} = 15\text{ V}$ , $\overline{FLT} = \text{High}$	-	-	2	mA
$I_{DD-100-5}$		IN = High, $V_{DD} = 5\text{ V}$ , $\overline{FLT} = \text{High}$	-	-	6	mA
$I_{BS-0}$	Output Supply Quiescent Current	IN = Low, no load	-	-	4	mA
$I_{BS-100}$		IN = High, no load	-	-	6	mA

### LOGIC INPUT AND OUTPUT

$V_{IL}$	Low Input Voltage (Note 12)				1.65	V
$V_{IH}$	High Input Voltage (Note 12)		$0.7 \times V_{DD}$		2.1	V
$V_{IN-HYST}$	Input Hysteresis Voltage (Note 12)			$0.15 \times V_{DD}$		V
$I_{IN}$	Input Current	$V_{IN} = V_{DD}$		50		$\mu\text{A}$
$I_{FLT-L}$	FLT Pull-up Current (50 k $\Omega$ pull-up resistor)	$V_{FLT} = \text{Low}$	-	100	-	$\mu\text{A}$
$V_{FLT-L}$	$\overline{FLT}$ Low Level Output Voltage	$I_{FLT} = 5\text{ mA}$	-	-	0.3	V
$t_{MIN1}$	Input Pulse Width of IN for No Response at Output		-	-	10	ns
$t_{MIN2}$	Input Pulse Width of IN for Guaranteed Response at Output		40	-	-	ns

### DRIVER OUTPUT

$V_{HOL1}$	Output Low State ( $V_{HO} - V_S$ )	$I_{SNK} = 200\text{ mA}$	-	0.1	0.22	V
$V_{HOL2}$		$I_{SNK} = 1.0\text{ A}$ , $T_A = 25^\circ\text{C}$	-	0.4	1	
$V_{HOH1}$	Output High State ( $V_B - V_{HO}$ )	$I_{SRC} = 200\text{ mA}$	-	0.2	0.35	V
$V_{HOH2}$		$I_{SRC} = 1.0\text{ A}$ , $T_A = 25^\circ\text{C}$	-	0.6	1.7	
$I_{PK-SNK1}$	Peak Driver Current, Sink (Note 13)		-	7.5	-	A
$I_{PK-SNK2}$	Peak Driver Current, Sink (Note 13)	$V_{HO} = 9\text{ V}$ (near IGBT Miller Plateau)	-	7	-	A
$I_{PK-SRC1}$	Peak Driver Current, Source (Note 13)		-	7	-	A
$I_{PK-SRC2}$	Peak Driver Current, Source (Note 13)	$V_{HO} = 9\text{ V}$ (near IGBT Miller Plateau)	-	5	-	A

### OVER CURRENT PROTECTION

$V_{CS-THR}$	CS Threshold Voltage		0.2	0.25	0.3	V
$V_{CS-NEG}$	CS Negative Voltage	$I_{CS} = 1.5\text{ mA}$	-	-8	-	V

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## ELECTRICAL CHARACTERISTICS $V_{DD} = 5\text{ V}$ , $V_{BS} = 15\text{ V}$ .

For typical values  $T_A = 25^\circ\text{C}$ , for min/max values,  $T_A$  is the operating ambient temperature range that applies, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### IGBT SHORT CIRCUIT CLAMPING

$V_{CLP-HO}$	IGBT Short Circuit Clamping ( $V_{HO} - V_B$ )	IN = High, $I_{HO} = 500\text{ mA}$ , $t_{CLP} = 10\text{ }\mu\text{s}$	-	0.7	1.5	V
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### DYNAMIC CHARACTERISTICS

$t_{PD-ON}$	IN to HO High Propagation Delay	$C_{LOAD} = 10\text{ nF}$ $V_{IH}$ to 10% of HO Change for $PW > 150\text{ ns}$	40	60	90	ns
$t_{PD-OFF}$	IN to HO Low Propagation Delay	$C_{LOAD} = 10\text{ nF}$ $V_{IL}$ to 90% of HO Change for $PW > 150\text{ ns}$	40	60	90	ns
$t_{DISTORT}$	Propagation Delay Distortion (= $t_{PD-ON} - t_{PD-OFF}$ )	$T_A = 25^\circ\text{C}$ , $PW > 150\text{ ns}$	-	0	-	ns
		$T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$ , $PW > 150\text{ ns}$	-25	-	25	
$t_{DISTORT\_TOT}$	Prop Delay Distortion between Parts	$PW > 150\text{ ns}$	-30	0	30	ns
$t_{RISE}$	Rise Time (see Figure 6) (Note 13)	$C_{LOAD} = 1\text{ nF}$ , 10% to 90% of HO Change	-	10	-	ns
$t_{FALL}$	Fall Time (see Figure 6) (Note 13)	$C_{LOAD} = 1\text{ nF}$ , 90% to 10% of HO Change	-	15	-	ns
$t_{LEB}$	CS Leading Edge Blanking Time (See Figure 9 and Figure 10)		200	450	700	ns
$t_{FILTER}$	CS Threshold Filtering Time (see Figure 9 and Figure 10)		-	600	700	ns
$t_{STO}$	Soft Turn Off Time (see Figure 9 and Figure 10)	$C_{LOAD} = 10\text{ nF}$ , $R_G = 10\text{ }\Omega$	1.2	1.8	3	$\mu\text{s}$
$t_{FLT}$	Delay after $t_{FILTER}$ to $\overline{FLT}$ Low		100	450	700	ns
$t_{FLT1}$	Delay from $V_{UVLO1-OUT-OFF}$ Triggered to $\overline{FLT}$ Low		-	1.5	-	ns
$t_{FLT2}$	Delay from $t_{UV2F}$ to $\overline{FLT}$ Low		-	2.4	-	$\mu\text{s}$
$t_{MUTE}$	IN Mute Time after $t_{FILTER}$ , or UVLO1, UVLO2 Triggered		20	-	-	$\mu\text{s}$
$t_{UVR1}$	Delay from $V_{UVLO1-OUT-ON}$ Triggered to HO High (see Figure 7)	(Note 13)	-	770	-	ns
$t_{UVF1}$	Delay from $V_{UVLO1-OUT-OFF}$ Triggered to HO Low (see Figure 7)	(Note 13)	-	1500	-	ns
$t_{UVR2}$	Delay from $V_{UVLO2-OUT-ON}$ Triggered to HO High (see Figure 8)	(Note 13)	-	1000	-	ns
$t_{UVF2}$	Delay from $V_{UVLO2-OUT-OFF}$ Triggered to HO Low (see Figure 8)	(Note 13)	-	1000	-	ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

12. Table values are valid for 3.3 V and 5 V  $V_{DD}$ , for higher  $V_{DD}$  voltages, the threshold values are maintained at the 5 V  $V_{DD}$  levels.

13. Values based on design and/or characterization.



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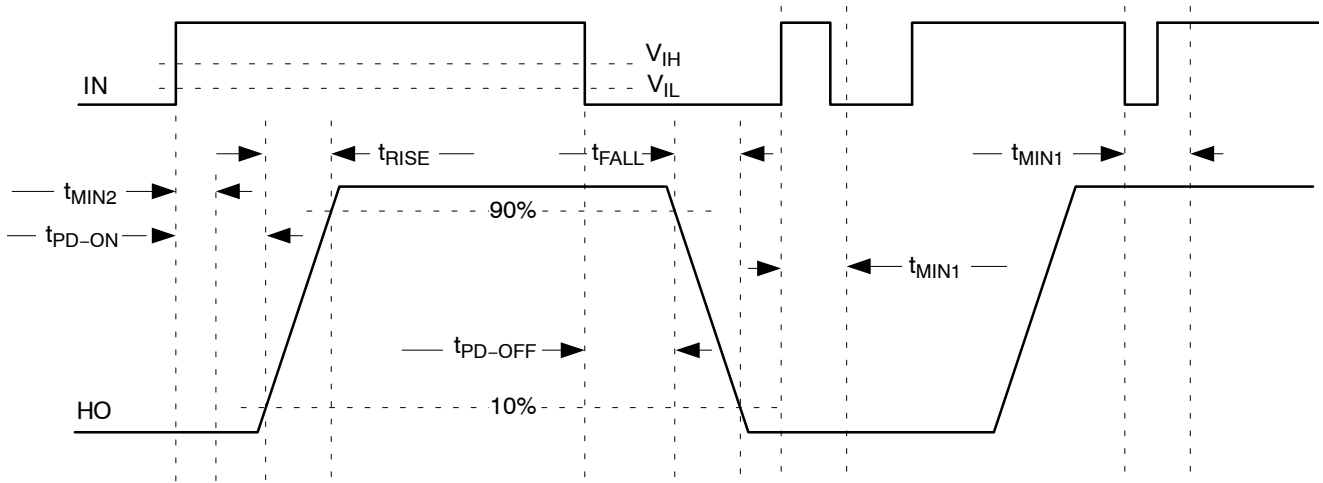


Figure 6. Propagation Delay, Rise and Fall Time

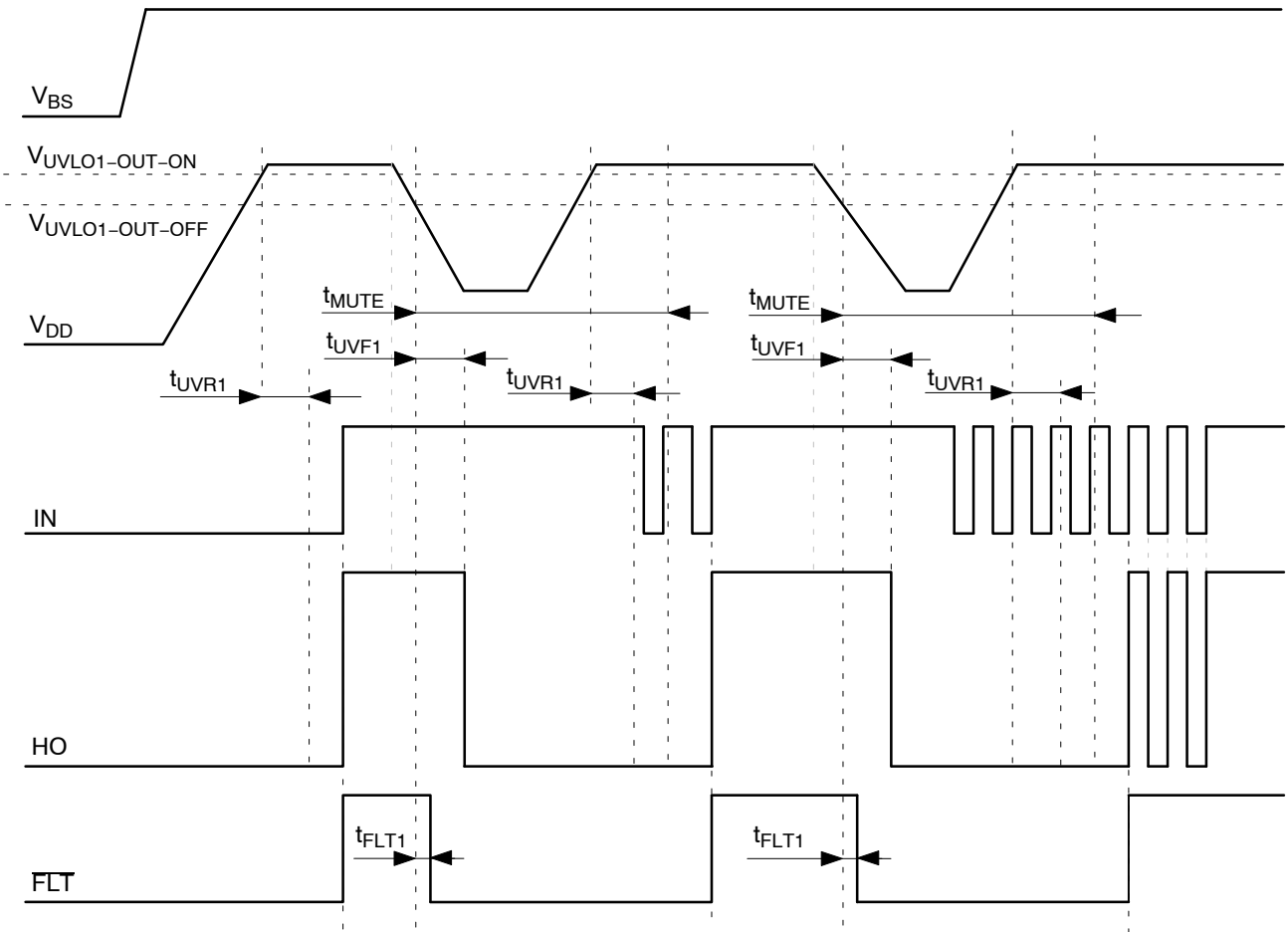


Figure 7. UVLO1 Waveform

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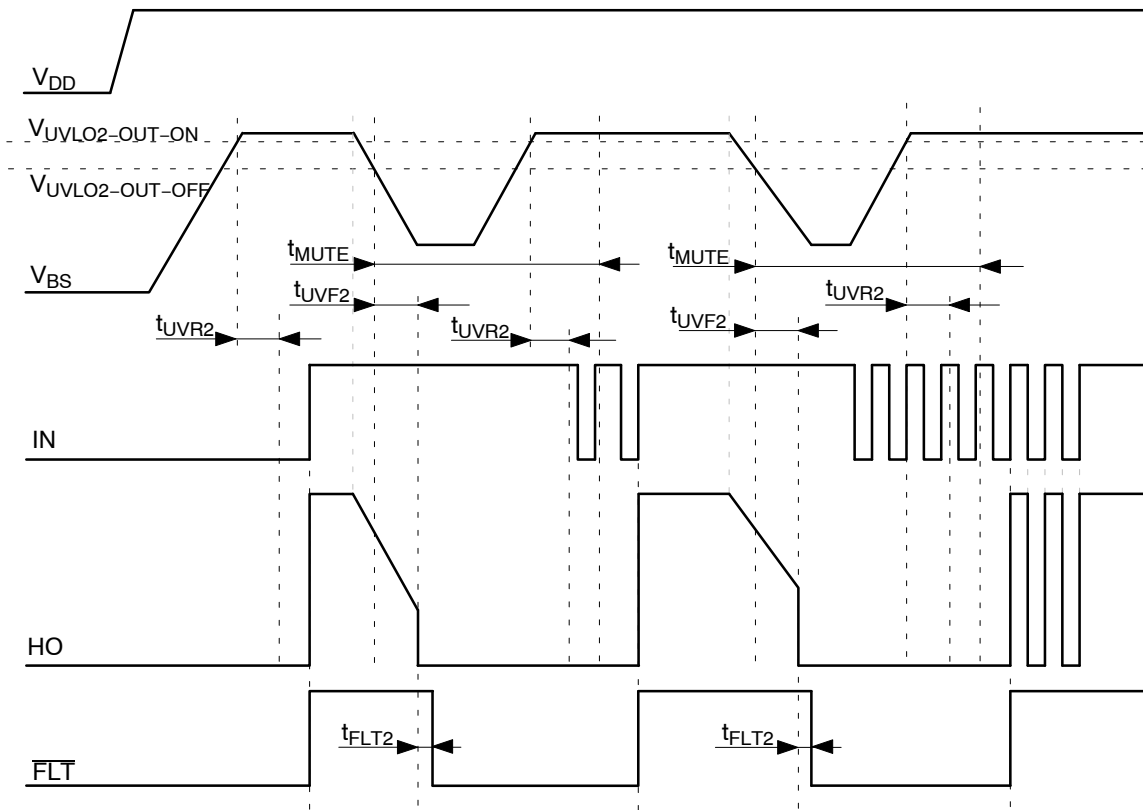


Figure 8. UVLO2 Waveform

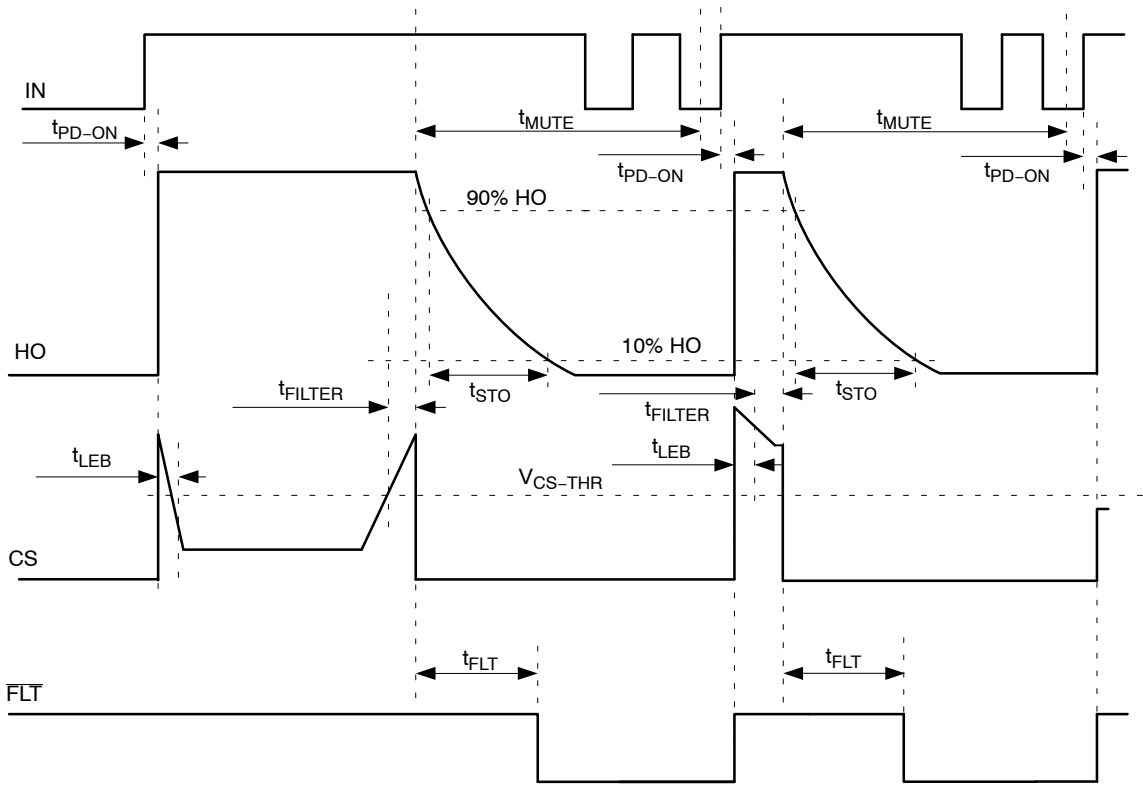


Figure 9. CS Response Waveform Using IGBT V<sub>ce</sub>

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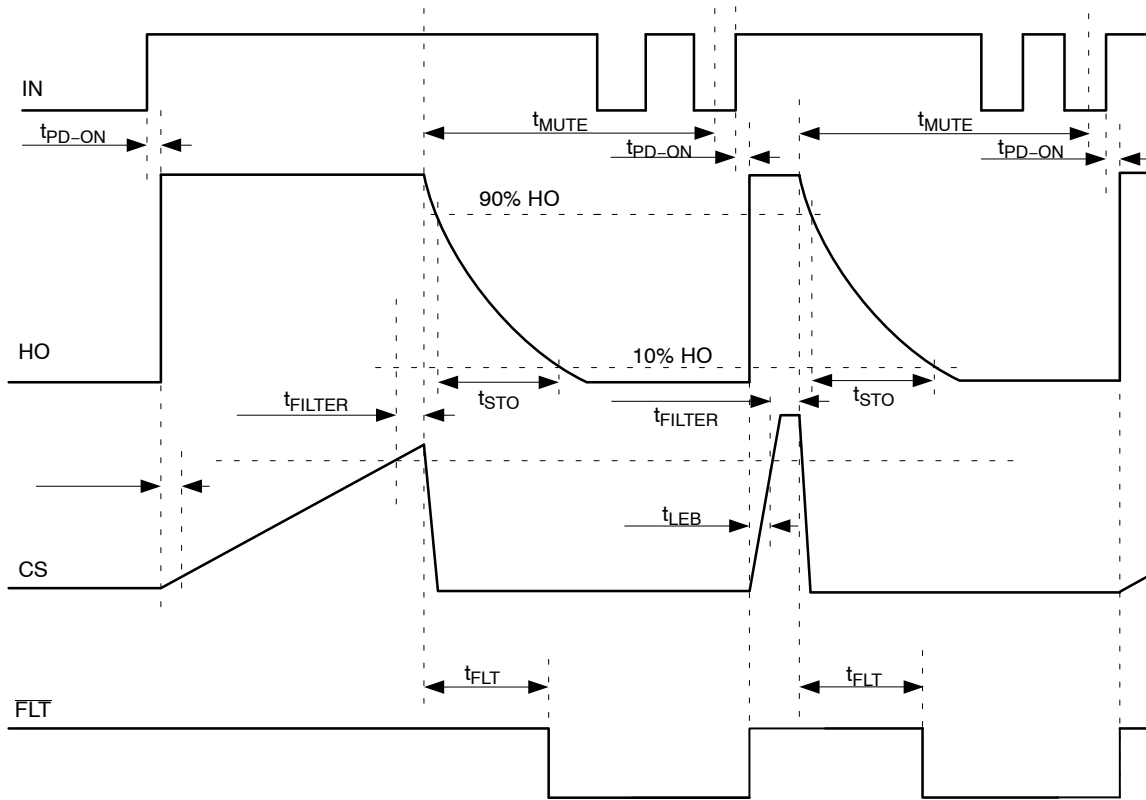


Figure 10. CS Response Waveform Using Shunt Resistor

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## TRUTH TABLE

IN	UVLO1	UVLO2	CS	HO	FLT	Notes
H	Inactive	Inactive	L	L	L	Initial condition after power up $V_{DD}$ and $V_{BS}$
$\nearrow$	Inactive	Inactive	L	$\nearrow$	$\nearrow$	Initial condition – IN First Rising edge
H	Inactive	Inactive	L	H	H	Normal Operation – Output High
$\searrow$	Inactive	Inactive	L	$\searrow$	H	Normal Operation – Turn off Output
L	Inactive	Inactive	L	L	H	Normal Operation – Output Low
X	Active	Inactive	X	L	L	UVLO1 Activated – FLT Low ( $t_{FLT1}$ ), Output Low
$\nearrow$	Inactive	Inactive	L	$\nearrow$	$\nearrow$	FLT reset, UVLO1 conditions disappear
X	Inactive	Active	X	L	L	UVLO2 Activated – FLT Low ( $t_{FLT1}$ ), Output Low
$\nearrow$	Inactive	Inactive	L	$\nearrow$	$\nearrow$	FLT reset, UVLO2 conditions disappear
H	Inactive	Inactive	H ( $>t_{FILTER}$ )	L	L	CS Activated – FLT Low ( $t_{FLT}$ ), Output Low
$\nearrow$	Inactive	Inactive	L	$\nearrow$	$\nearrow$	FLT reset, CS conditions disappear

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NCD57085DR2G	SOIC–8 Narrow Body, (Pb–Free)	2500 / Tape & Reel
NCV57085DR2G	SOIC–8 Narrow Body, (Pb–Free)	2500 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

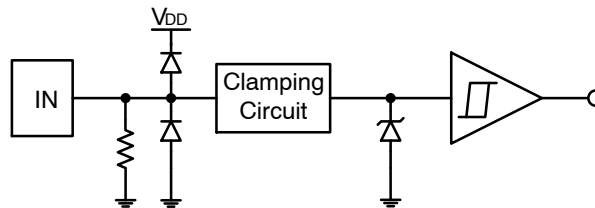


Figure 11. Input Pin Structure

TYPICAL CHARACTERISTICS

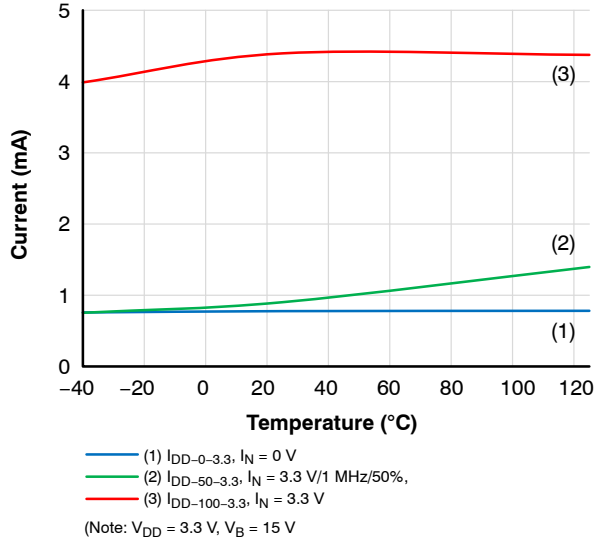


Figure 12.  $I_{DD}$  Supply Current,  $V_{DD} = 3.3$  V

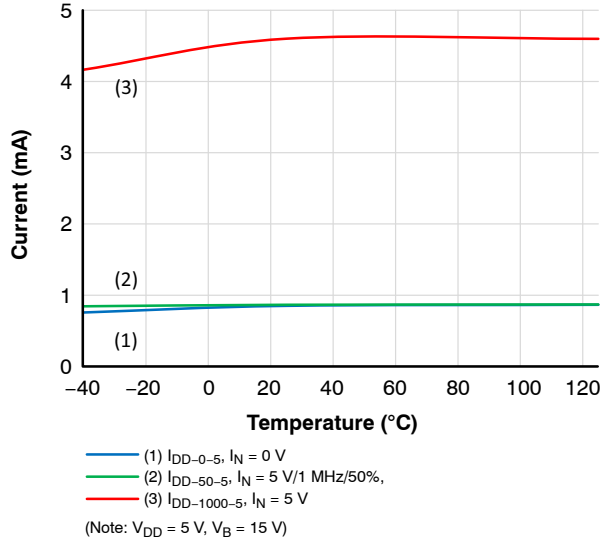


Figure 13.  $I_{DD}$  Supply Current,  $V_{BS} = 5$  V

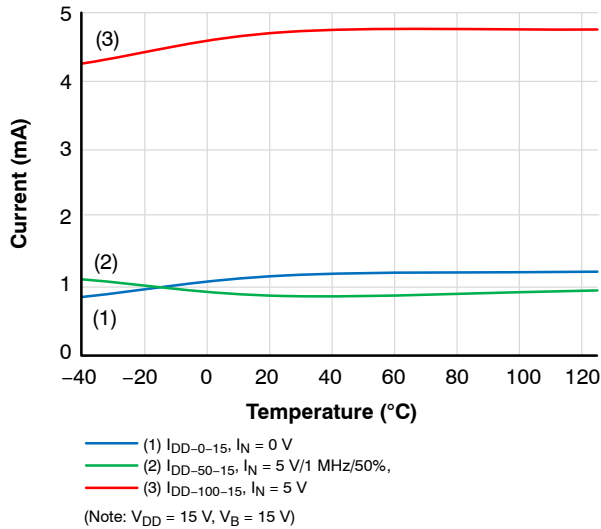


Figure 14.  $I_{DD}$  Supply Current,  $V_{DD} = 15$  V

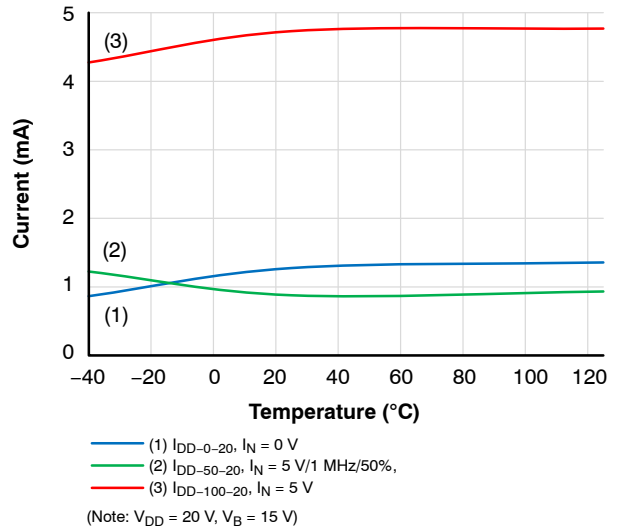


Figure 15.  $I_{DD}$  Supply Current,  $V_{DD} = 20$  V

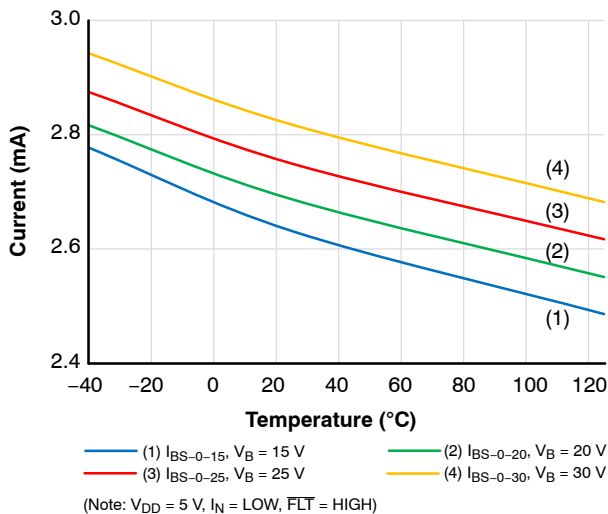


Figure 16.  $I_{BS}$  Supply Current,  $V_{DD} = 5$  V

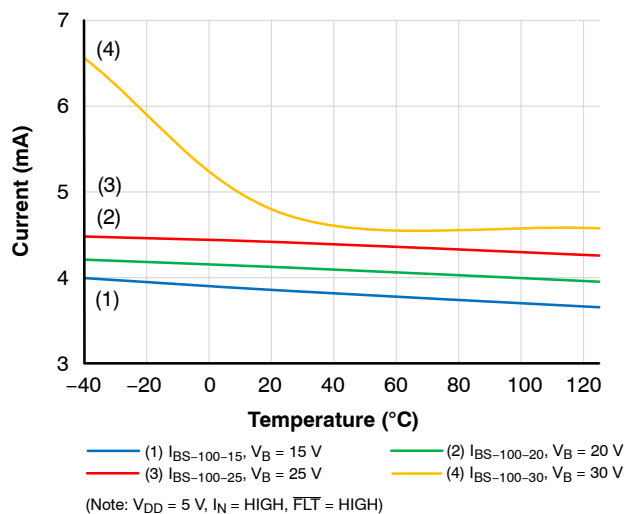


Figure 17.  $I_{BS}$  Supply Current,  $V_{DD} = 5$  V

TYPICAL CHARACTERISTICS (continued)

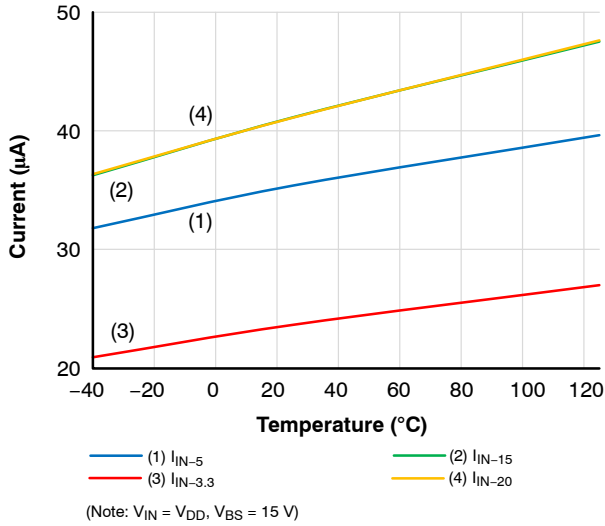


Figure 18. Input Current - Logic "1"

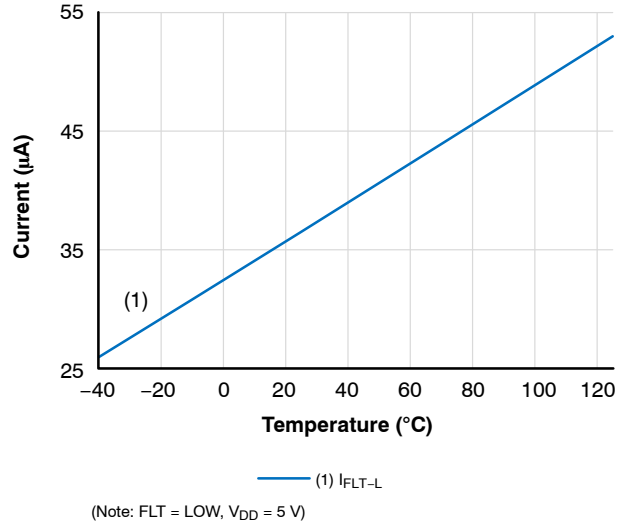


Figure 19. FLT = Pull-up Current

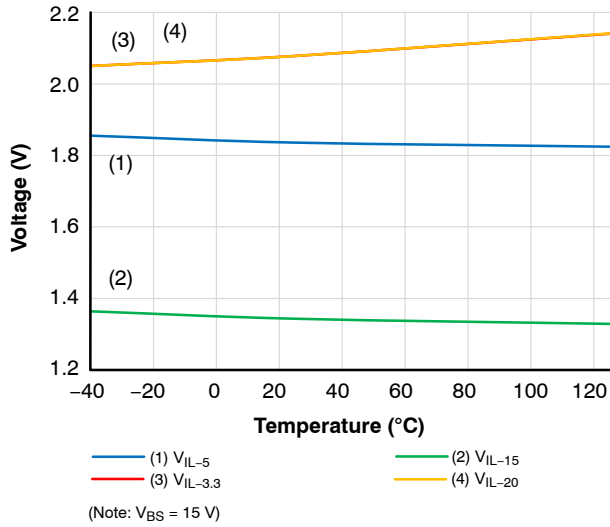


Figure 20. Low Input Voltage

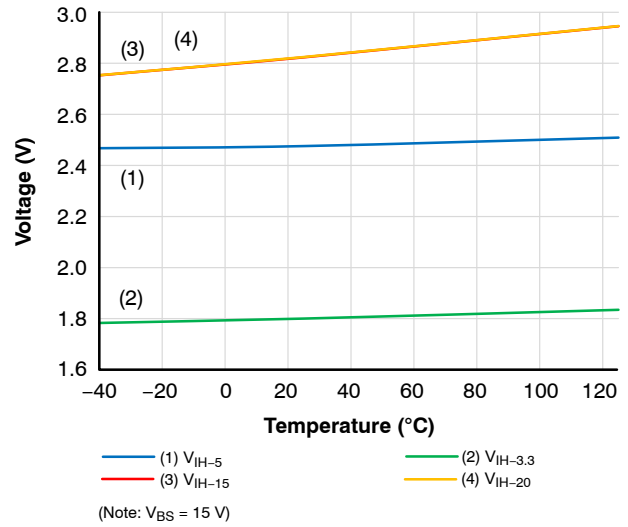


Figure 21. High Input Voltage

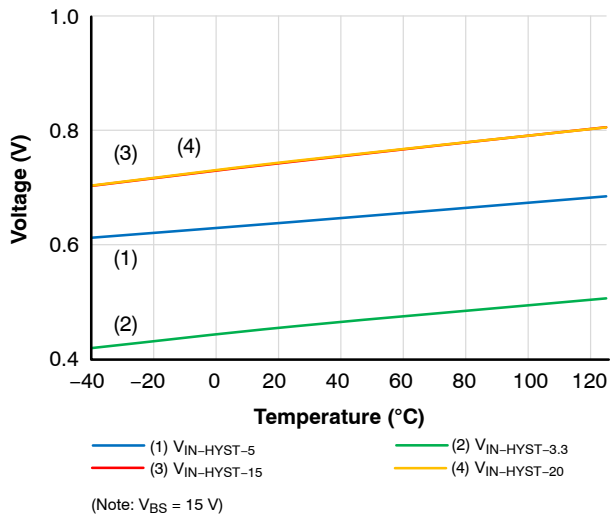


Figure 22. Input Hysteresis Voltage

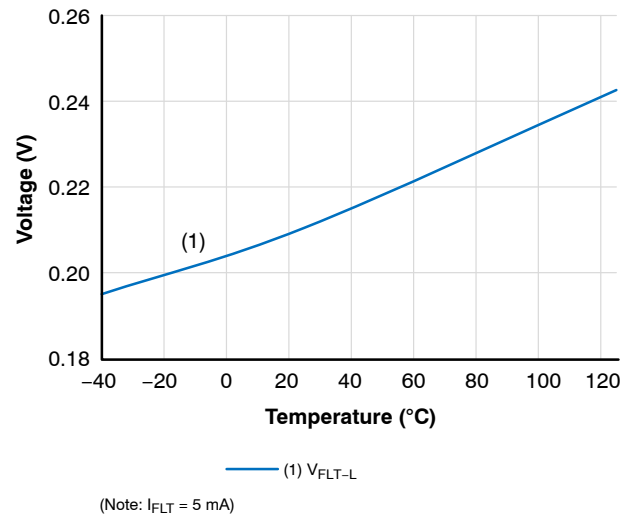


Figure 23. FLT Low Level Output Voltage

TYPICAL CHARACTERISTICS (continued)

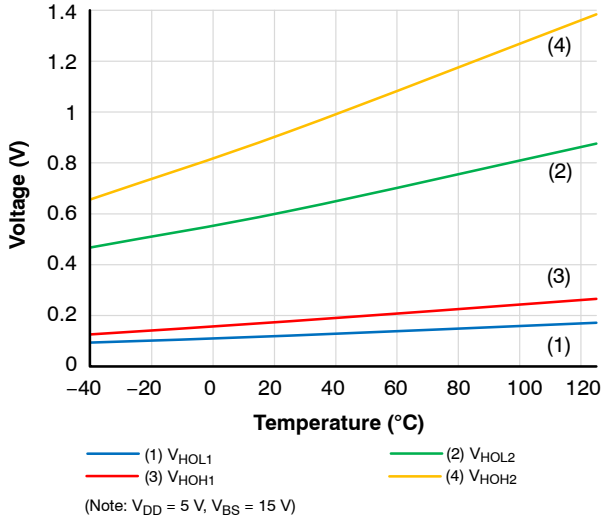


Figure 24. Output Voltage

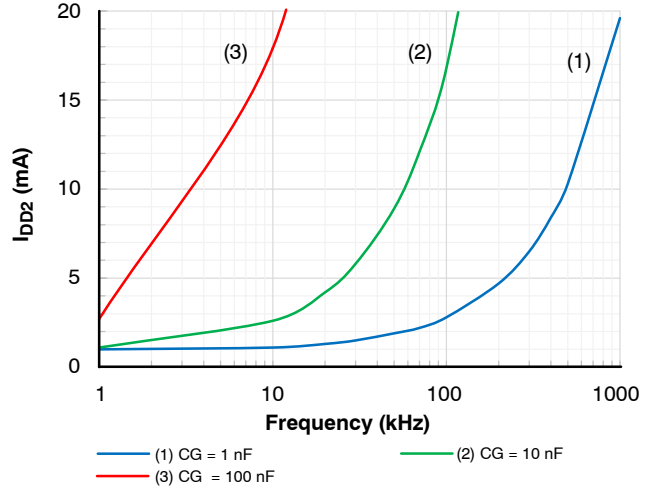


Figure 25.  $I_{DS}$  vs Switching Frequency

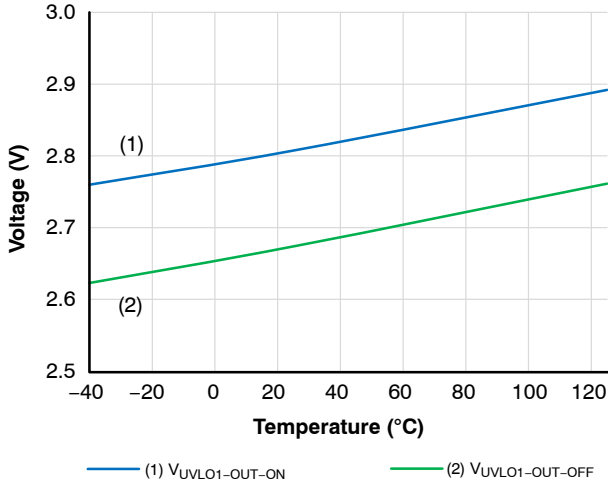


Figure 26. UVLO1 Threshold Voltage

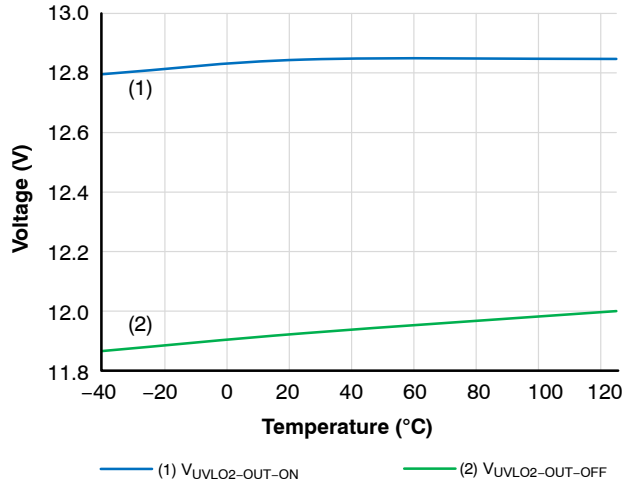


Figure 27. UVLO2 Threshold Voltage

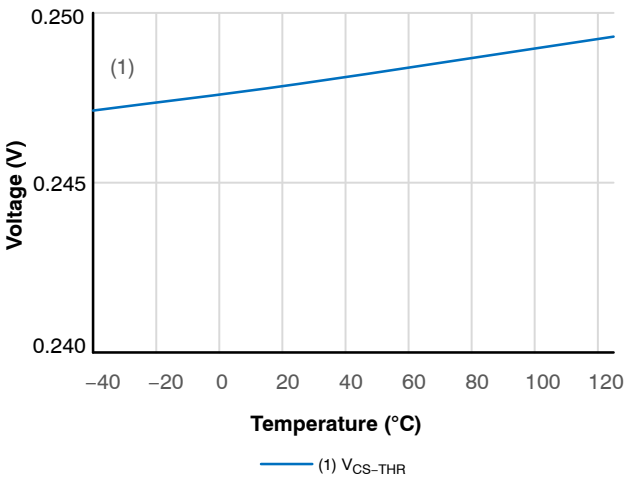


Figure 28. CS Threshold Voltage

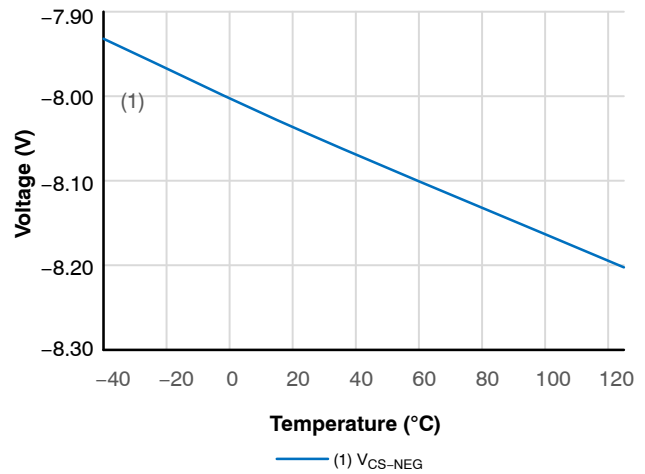


Figure 29. CS Negative Voltage

TYPICAL CHARACTERISTICS (continued)

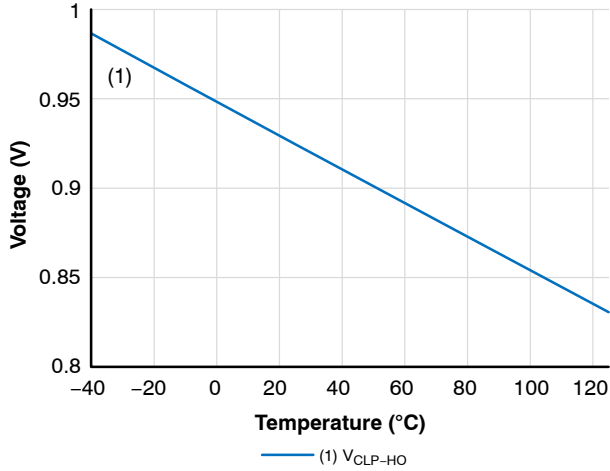


Figure 30. IGBT Short Circuit Clamping Voltage

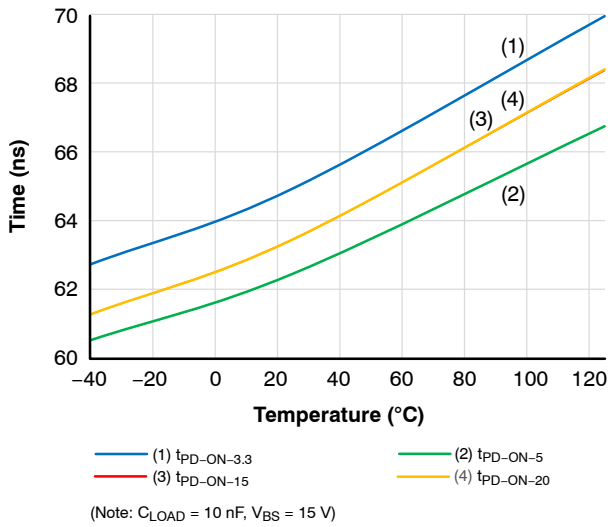


Figure 31. High Propagation Delay

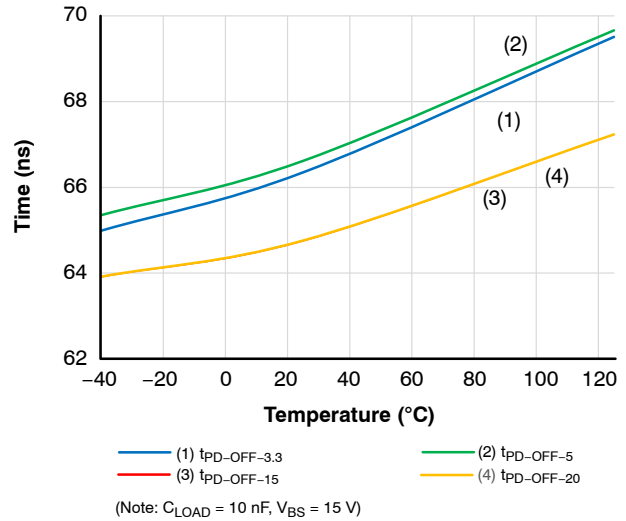


Figure 32. Low Propagation Delay

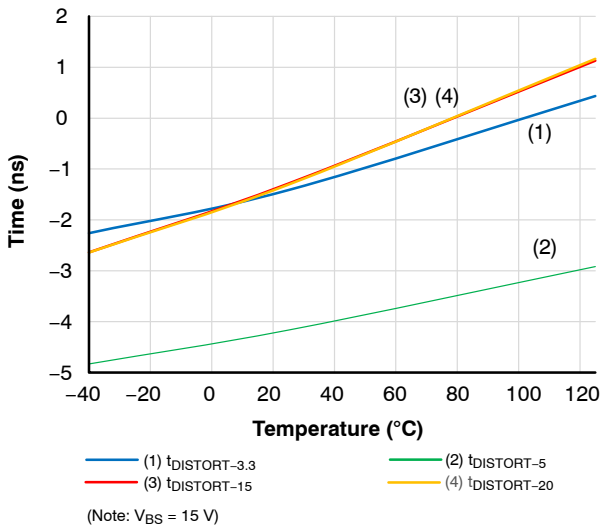


Figure 33. Propagation Delay Distortion

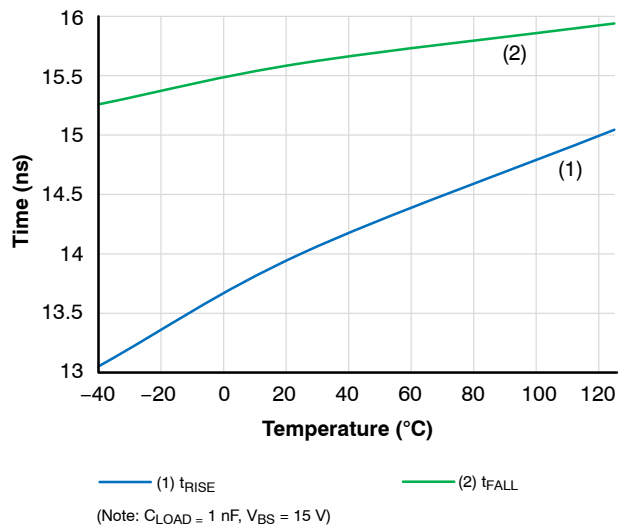


Figure 34. Rise / Fall Time



TYPICAL CHARACTERISTICS (continued)

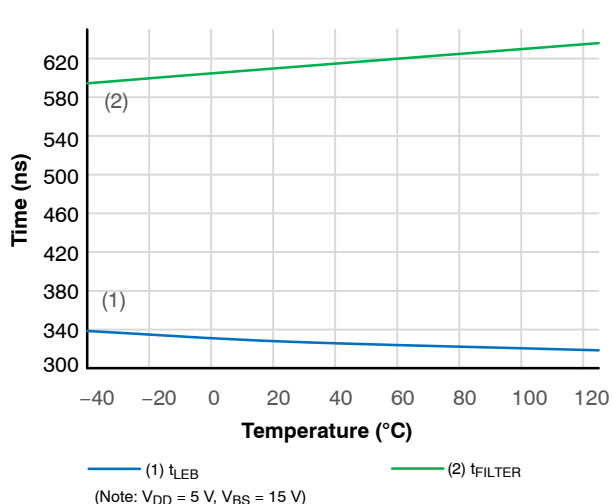


Figure 35. CS Threshold Filtering Time, CS Leading Edge Blanking Time

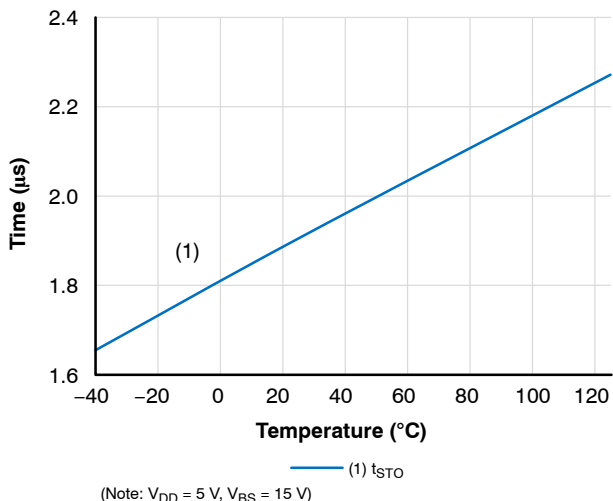


Figure 36. Soft Turn Off Time

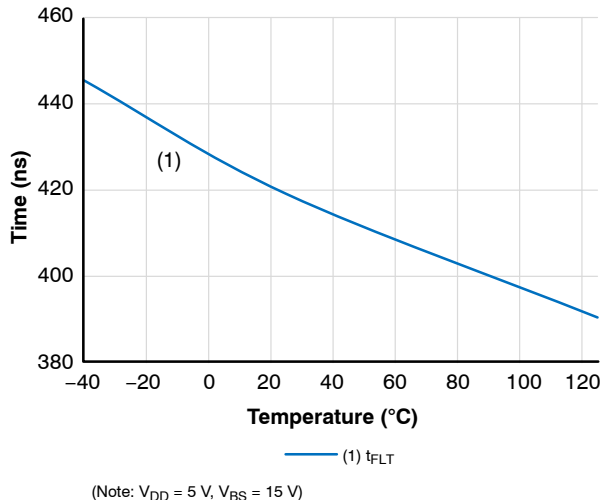


Figure 37. FLT Delay Time

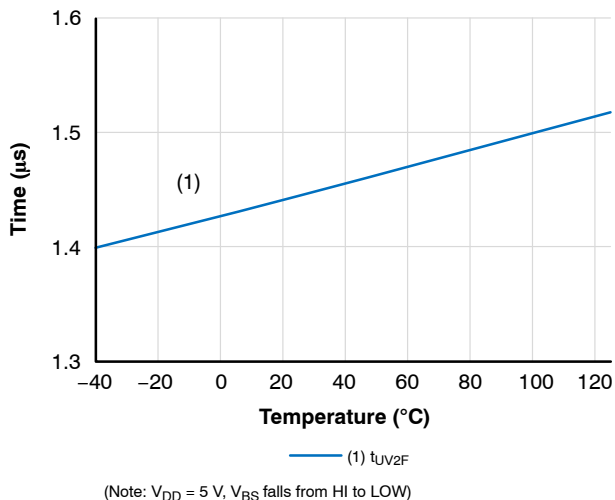


Figure 38. UVLO2 Fall Delay

**Under Voltage Lockout (UVLO)**

UVLO ensures correct switching of IGBT connected to the driver output.

- The IGBT is turned-off and the output is disabled, if the supply  $V_{DD}$  drops below  $V_{UVLO1-OUT-OFF}$  or  $V_{BS}$  drops below  $V_{UVLO2-OUT-OFF}$ .
- The driver output does not follow the input signal on  $V_{IN}$  until the  $V_{DD} / V_{BS}$  rises above the  $V_{UVLOX-OUT-ON}$  and the input signal rising edge is applied to the  $V_{IN}$ .

With high loading gate capacitances over 10 nF it is important to follow the decoupling capacitor routing guidelines as shown on Figure 41. The decoupling capacitor value should be at least 10  $\mu$ F. Also gate resistor of minimal value of 2  $\Omega$  has to be used in order to avoid interference of the high di/dt with internal circuitry (e.g. UVLO2).

After the power-on of the driver there has to be a rising edge applied to the IN in order for the output to start following the inputs. This serves as a protection against producing partial pulses at the output if the  $V_{DD}$  or  $V_B$  is applied in the middle of the input PWM pulse.

**Power Supply ( $V_{DD}$ ,  $V_{BS}$ )**

NCx57085 is designed to support unipolar power supply.

For reliable high output current the suitable external power capacitors required. Parallel combination of 100 nF + 4,7  $\mu$ F ceramic capacitors is optimal for a wide range of applications using IGBT. For reliable driving IGBT modules (containing several parallel IGBT's) a higher capacity required (typically 100 nF + 10  $\mu$ F). Capacitors should be as close as possible to the driver's power pins.

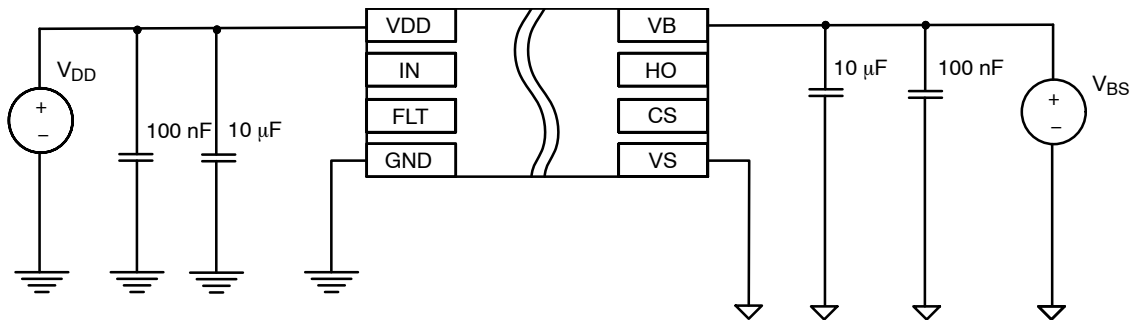
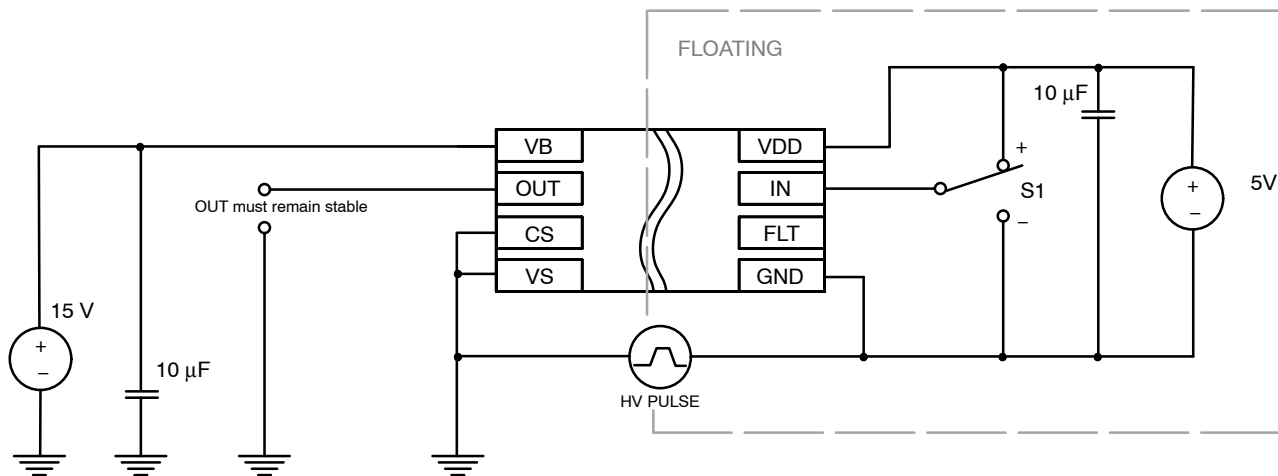


Figure 39. Power Supply

**Current Sense (CS)**

Current sense protection ensures the protection of IGBT at over current. When the  $V_{CESAT}$  or  $V_{SHUTN}$  voltage goes up and reaches the set limit, the output is driven low and FLT output is activated. To avoid false CS triggering, all CS circuit parts should be placed as close as possible to CS pin and wires from detecting circuit ( $V_{CESAT}$  or  $R_{SHUNT}$ ) should be routed directly and without approaching the power paths.

# NCD57085, NCV57085



(Test Conditions: HV Pulse  $\pm 1500$  V,  $dV/dt = 1-100$  V/ns,  $V_{DD} = 5$  V,  $V_{BS} = 15$  V)

Figure 40. CMTI Test Setup

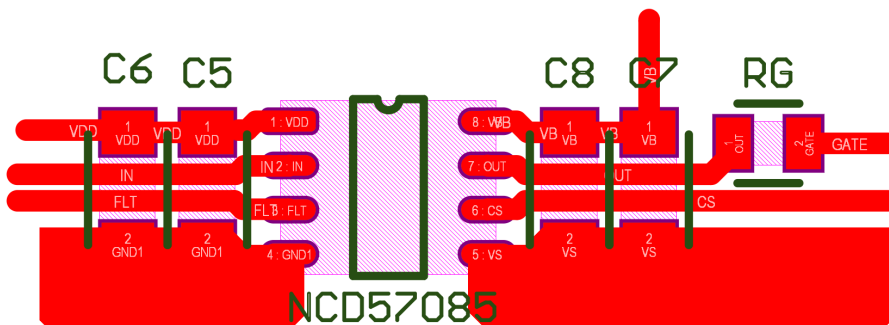


Figure 41. Recommended Layout

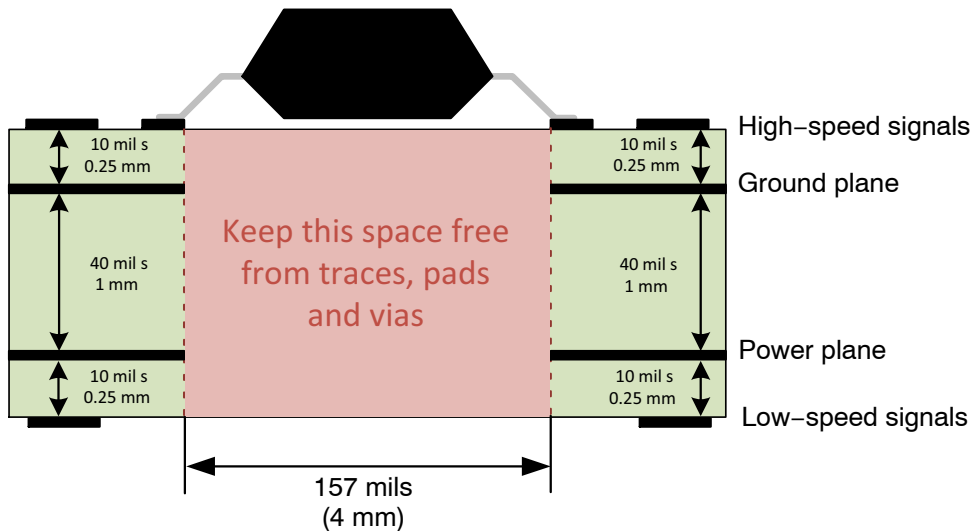
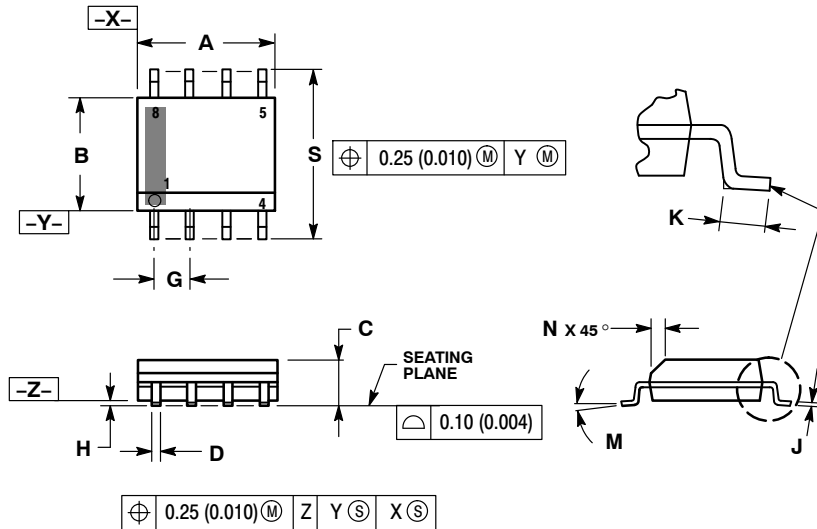


Figure 42. Recommended Layer Stack

# NCD57085, NCV57085

## PACKAGE DIMENSIONS

SOIC-8 NB  
CASE 751-07  
ISSUE AK



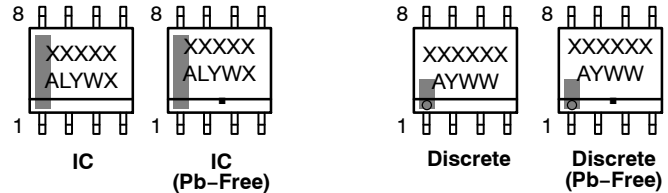
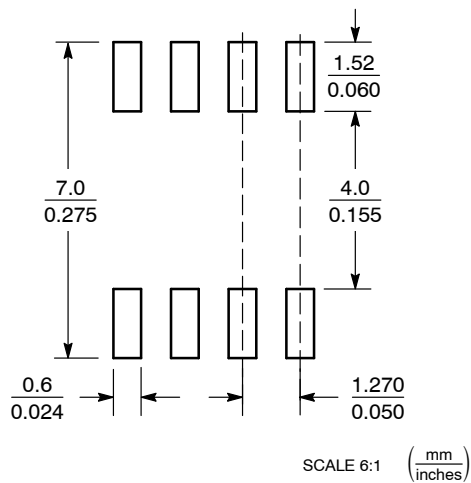
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0° - 8°		0° - 8°	
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

### GENERIC MARKING DIAGRAM\*

#### SOLDERING FOOTPRINT\*



XXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

# NCD57085, NCV57085

SOIC-8 NB  
CASE 751-07  
ISSUE AK

DATE 16 FEB 2011

## STYLE 1:

PIN 1. EMITTER  
2. COLLECTOR  
3. COLLECTOR  
4. EMITTER  
5. EMITTER  
6. BASE  
7. BASE  
8. EMITTER

## STYLE 5:

PIN 1. DRAIN  
2. DRAIN  
3. DRAIN  
4. DRAIN  
5. GATE  
6. GATE  
7. SOURCE  
8. SOURCE

## STYLE 9:

PIN 1. EMITTER, COMMON  
2. COLLECTOR, DIE #1  
3. COLLECTOR, DIE #2  
4. EMITTER, COMMON  
5. EMITTER, COMMON  
6. BASE, DIE #2  
7. BASE, DIE #1  
8. EMITTER, COMMON

## STYLE 13:

PIN 1. N.C.  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN  
6. DRAIN  
7. DRAIN  
8. DRAIN

## STYLE 17:

PIN 1. VCC  
2. V2OUT  
3. V1OUT  
4. TXE  
5. RXE  
6. VEE  
7. GND  
8. ACC

## STYLE 21:

PIN 1. CATHODE 1  
2. CATHODE 2  
3. CATHODE 3  
4. CATHODE 4  
5. CATHODE 5  
6. COMMON ANODE  
7. COMMON ANODE  
8. CATHODE 6

## STYLE 25:

PIN 1. VIN  
2. N/C  
3. REXT  
4. GND  
5. IOUT  
6. IOUT  
7. IOUT  
8. IOUT

## STYLE 29:

PIN 1. BASE, DIE #1  
2. EMITTER, #1  
3. BASE, #2  
4. EMITTER, #2  
5. COLLECTOR, #2  
6. COLLECTOR, #2  
7. COLLECTOR, #1  
8. COLLECTOR, #1

## STYLE 2:

PIN 1. COLLECTOR, DIE, #1  
2. COLLECTOR, #1  
3. COLLECTOR, #2  
4. COLLECTOR, #2  
5. BASE, #2  
6. EMITTER, #2  
7. BASE, #1  
8. EMITTER, #1

## STYLE 6:

PIN 1. SOURCE  
2. DRAIN  
3. DRAIN  
4. SOURCE  
5. SOURCE  
6. GATE  
7. GATE  
8. SOURCE

## STYLE 10:

PIN 1. GROUND  
2. BIAS 1  
3. OUTPUT  
4. GROUND  
5. GROUND  
6. BIAS 2  
7. INPUT  
8. GROUND

## STYLE 14:

PIN 1. N-SOURCE  
2. N-GATE  
3. P-SOURCE  
4. P-GATE  
5. P-DRAIN  
6. P-DRAIN  
7. N-DRAIN  
8. N-DRAIN

## STYLE 18:

PIN 1. ANODE  
2. ANODE  
3. SOURCE  
4. GATE  
5. DRAIN  
6. DRAIN  
7. CATHODE  
8. CATHODE

## STYLE 22:

PIN 1. I/O LINE 1  
2. COMMON CATHODE/VCC  
3. COMMON CATHODE/VCC  
4. I/O LINE 3  
5. COMMON ANODE/GND  
6. I/O LINE 4  
7. I/O LINE 5  
8. COMMON ANODE/GND

## STYLE 26:

PIN 1. GND  
2. dv/dt  
3. ENABLE  
4. ILIMIT  
5. SOURCE  
6. SOURCE  
7. SOURCE  
8. VCC

## STYLE 30:

PIN 1. DRAIN 1  
2. DRAIN 1  
3. GATE 2  
4. SOURCE 2  
5. SOURCE 1/DRAIN 2  
6. SOURCE 1/DRAIN 2  
7. SOURCE 1/DRAIN 2  
8. GATE 1

## STYLE 3:

PIN 1. DRAIN, DIE #1  
2. DRAIN, #1  
3. DRAIN, #2  
4. DRAIN, #2  
5. GATE, #2  
6. SOURCE, #2  
7. GATE, #1  
8. SOURCE, #1

## STYLE 7:

PIN 1. INPUT  
2. EXTERNAL BYPASS  
3. THIRD STAGE SOURCE  
4. GROUND  
5. DRAIN  
6. GATE 3  
7. SECOND STAGE Vd  
8. FIRST STAGE Vd

## STYLE 11:

PIN 1. SOURCE 1  
2. GATE 1  
3. SOURCE 2  
4. GATE 2  
5. DRAIN 2  
6. DRAIN 2  
7. DRAIN 1  
8. DRAIN 1

## STYLE 15:

PIN 1. ANODE 1  
2. ANODE 1  
3. ANODE 1  
4. ANODE 1  
5. CATHODE, COMMON  
6. CATHODE, COMMON  
7. CATHODE, COMMON  
8. CATHODE, COMMON

## STYLE 19:

PIN 1. SOURCE 1  
2. GATE 1  
3. SOURCE 2  
4. GATE 2  
5. DRAIN 2  
6. MIRROR 2  
7. DRAIN 1  
8. MIRROR 1

## STYLE 23:

PIN 1. LINE 1 IN  
2. COMMON ANODE/GND  
3. COMMON ANODE/GND  
4. LINE 2 IN  
5. LINE 2 OUT  
6. COMMON ANODE/GND  
7. COMMON ANODE/GND  
8. LINE 1 OUT

## STYLE 27:

PIN 1. ILIMIT  
2. OVLO  
3. UVLO  
4. INPUT+  
5. SOURCE  
6. SOURCE  
7. SOURCE  
8. DRAIN

## STYLE 4:

PIN 1. ANODE  
2. ANODE  
3. ANODE  
4. ANODE  
5. ANODE  
6. ANODE  
7. ANODE  
8. COMMON CATHODE

## STYLE 8:

PIN 1. COLLECTOR, DIE #1  
2. BASE, #1  
3. BASE, #2  
4. COLLECTOR, #2  
5. COLLECTOR, #2  
6. EMITTER, #2  
7. EMITTER, #1  
8. COLLECTOR, #1

## STYLE 12:

PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN  
6. DRAIN  
7. DRAIN  
8. DRAIN

## STYLE 16:

PIN 1. EMITTER, DIE #1  
2. BASE, DIE #1  
3. EMITTER, DIE #2  
4. BASE, DIE #2  
5. COLLECTOR, DIE #2  
6. COLLECTOR, DIE #2  
7. COLLECTOR, DIE #1  
8. COLLECTOR, DIE #1

## STYLE 20:


PIN 1. SOURCE (N)  
2. GATE (N)  
3. SOURCE (P)  
4. GATE (P)  
5. DRAIN  
6. DRAIN  
7. DRAIN  
8. DRAIN

## STYLE 24:

PIN 1. BASE  
2. EMITTER  
3. COLLECTOR/ANODE  
4. COLLECTOR/ANODE  
5. CATHODE  
6. CATHODE  
7. COLLECTOR/ANODE  
8. COLLECTOR/ANODE

## STYLE 28:

PIN 1. SW\_TO\_GND  
2. DASIC\_OFF  
3. DASIC\_SW\_DET  
4. GND  
5. V\_MON  
6. VBULK  
7. VBULK  
8. VIN

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