

600V, 7A, Trench FS II Fast IGBT
General Description:

Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 600V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

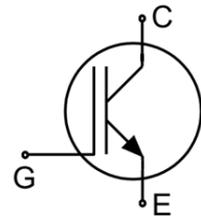
Features

Trench FSII Technology offering

- Very low $V_{CE(sat)}$
- High speed switching
- Positive temperature coefficient in $V_{CE(sat)}$
- Very tight parameter distribution
- High ruggedness, temperature stable behavior

Application

- Air Condition
- Inverters
- Motor drives


Schematic diagram
Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE07T60BI	TO-251	NCE07T60BI


TO-251
Absolute Maximum Ratings ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate- Emitter Voltage	± 30	V
I_C	Collector Current	14	A
	Collector Current @ $T_C = 100^{\circ}\text{C}$	7	A
I_{Cplus}	Pulsed Collector Current, t_p limited by T_{jmax}	21	A
-	turn off safe operating area, $V_{CE}=600\text{V}$, $T_j=150^{\circ}\text{C}$	21	A
P_D	Power Dissipation @ $T_C = 25^{\circ}\text{C}$	73	W
	Power Dissipation @ $T_C = 100^{\circ}\text{C}$	29.2	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +150	$^{\circ}\text{C}$
T_L	Maximum Temperature for Soldering	260	$^{\circ}\text{C}$
t_{sc}	Short circuit withstand time $V_{GE}=15.0\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits<1000Time between short circuits: $\geq 1.0\text{s}$, $T_j\leq 150^{\circ}\text{C}$	3	us

Thermal Characteristic

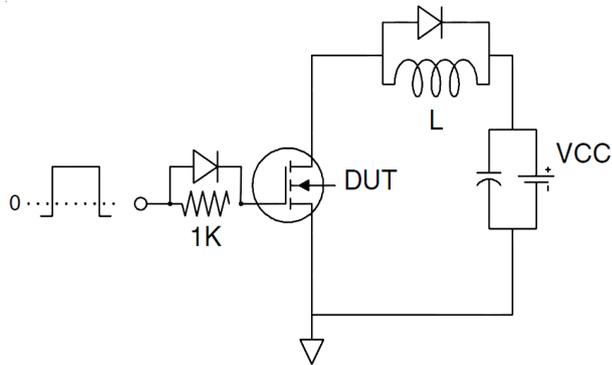
Symbol	Parameter	Value	Units
R _{θJC}	Thermal Resistance, Junction to case for IGBT	1.71	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient	62	°C/W

Electrical Characteristics (T_C=25°C unless otherwise noted)

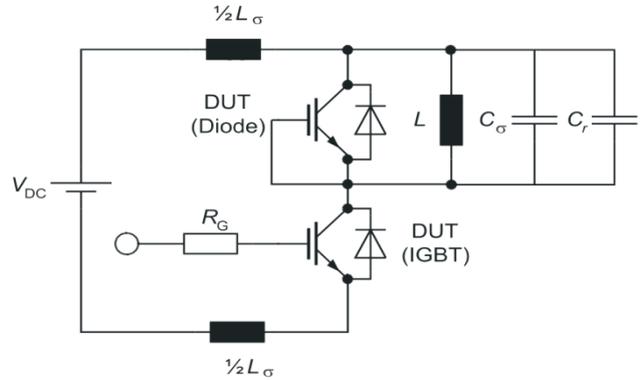
Symbol	Parameter	Test Conditions	Value			Units	
			Min.	Typ.	Max.		
Static Characteristics							
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V, I _{CE} =1mA	600	--	--	V	
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =600V	--	--	4	uA	
I _{GES(F)}	Gate to Emitter Forward Leakage	V _{GE} =+30V, V _{CE} =0V	--	--	100	nA	
I _{GES(R)}	Gate to Source Reverse Leakage	V _{GE} =-30V, V _{CE} =0V	--	--	100	nA	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =4A, V _{GE} =15V	--	1.5	--	V	
		I _C =5A V _{GE} =15V	T _J =25°C	--	1.7	1.9	V
			T _J =100°C	--	1.9	--	V
V _{GE(th)}	Gate Threshold Voltage	I _C =1mA, V _{CE} =V _{GE}	4.0	5.0	6.0	V	
Dynamic Characteristics							
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz	--	675	--	pF	
C _{oes}	Output Capacitance		--	22	--		
C _{res}	Reverse Transfer Capacitance		--	13	--		
Q _g	Total Gate Charge	V _{CC} =480V, I _C =7A V _{GE} =15V	--	28	--	nC	
Q _{ge}	Gate to Emitter Charge		--	8	--	nC	
Q _{gc}	Gate to Collector Charge		--	13	--	nC	
I _{C(SC)}	Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	V _{GE} =15V, V _{CC} ≤400V, t _{sc} ≤3us, T _J ≤150°C	--	34	--	A	
Switching Characteristics							
t _{d(ON)}	Turn-on Delay Time	V _{CE} =400V, I _C =7A V _{GE} =0/15V, R _g =5Ω Inductive Load	--	20	--	ns	
t _r	Rise Time		--	15	--		
t _{d(OFF)}	Turn-Off Delay Time		--	73	--		
t _f	Fall Time		--	18	--		
E _{on}	Turn-On Switching Loss		--	0.21	--	mJ	
E _{off}	Turn-Off Switching Loss		--	0.10	--		
E _{ts}	Total Switching Loss		--	0.31	--		

Test Circuit

1) Gate Charge Test Circuit

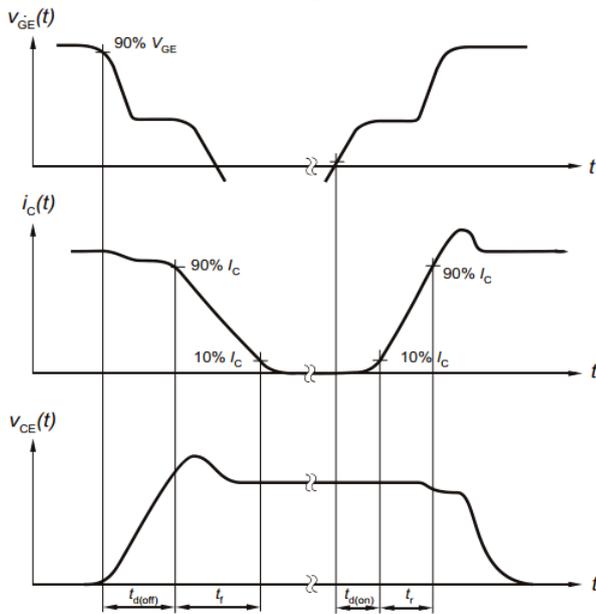


2) Switch Time Test Circuit

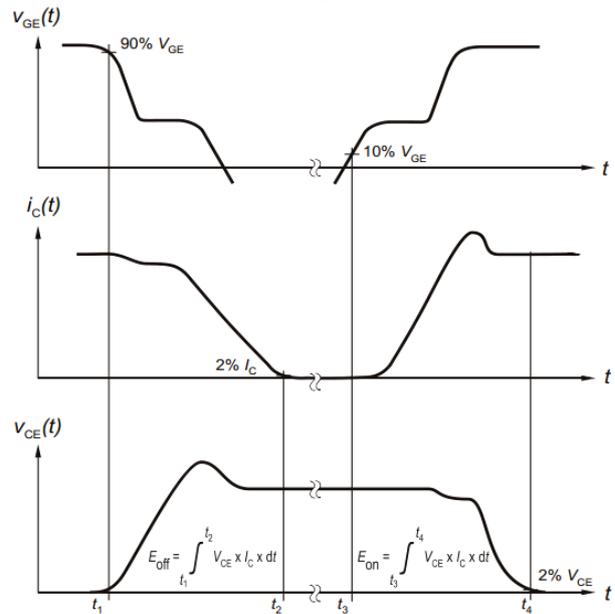


Switching characteristics

1) definition of switching times



2) definition of switching losses



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

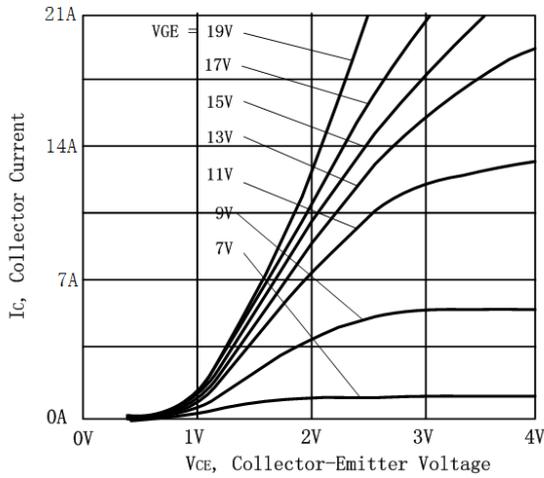


Figure 2. Transfer Characteristics

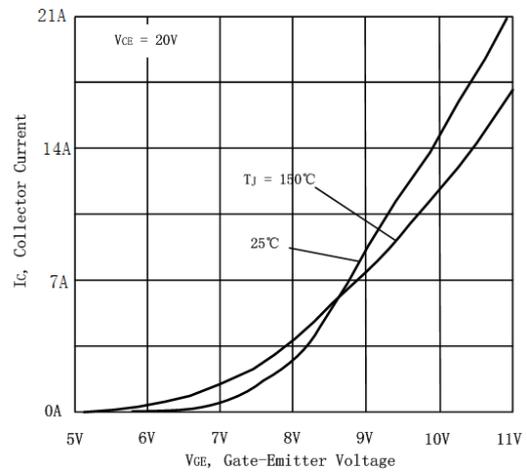


Figure 3 V_{CEsat} vs. Case Temperature

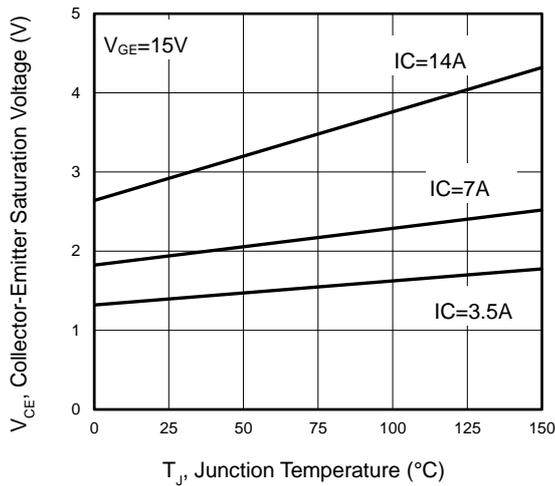


Figure 4 Saturation Voltage vs. VGE

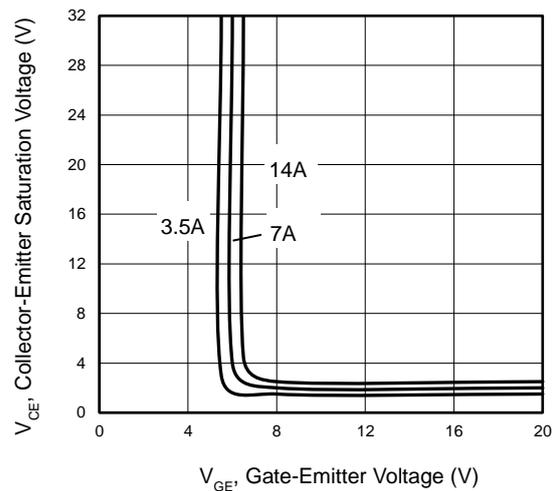


Figure 5 Capacitance Characteristics

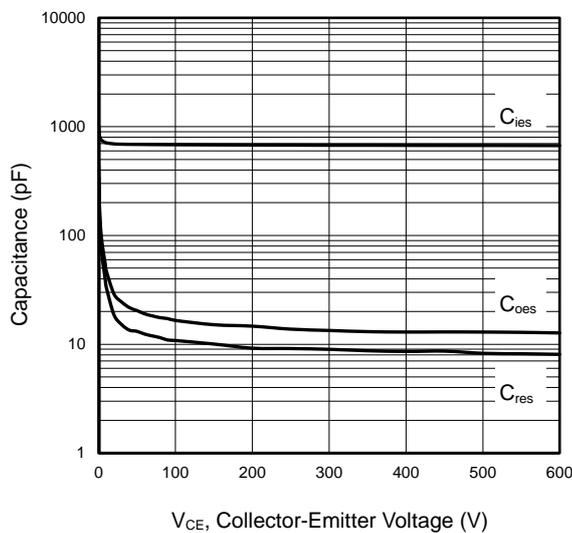
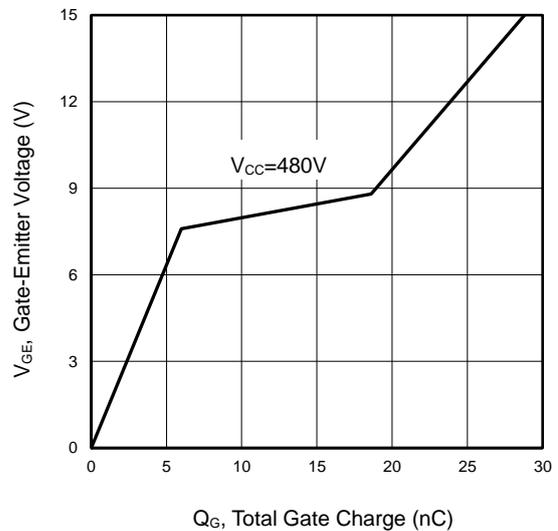


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics

Figure 7 Typical Switching Times as a Function of Gate Resistor

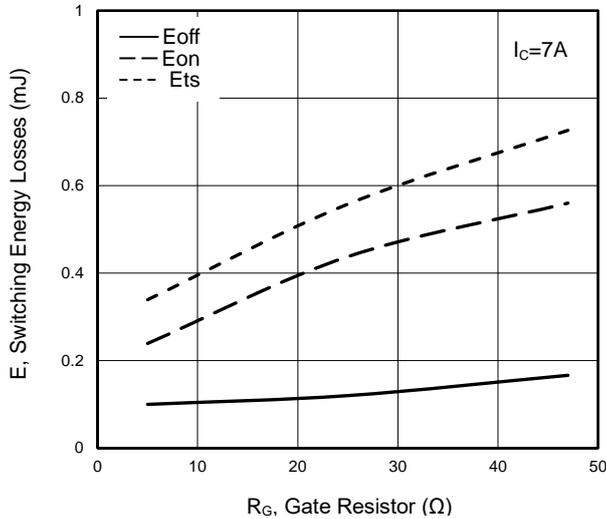


Figure 8 Typical Switching Times as a Function of Junction Temperature

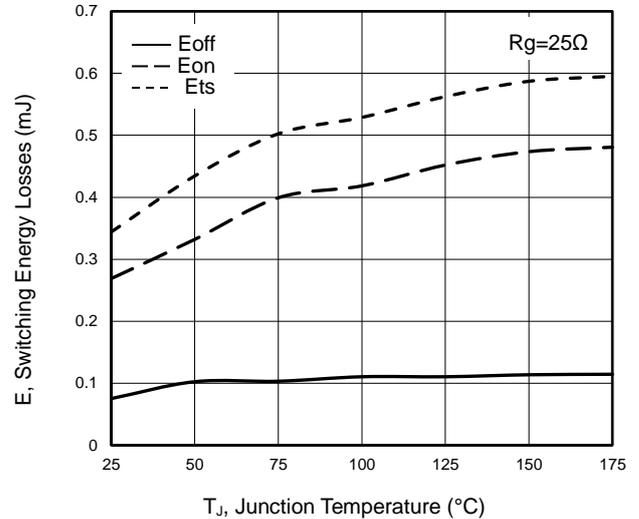


Figure 9 Gate-emitter Threshold Voltage as a Function of Junction Temperature

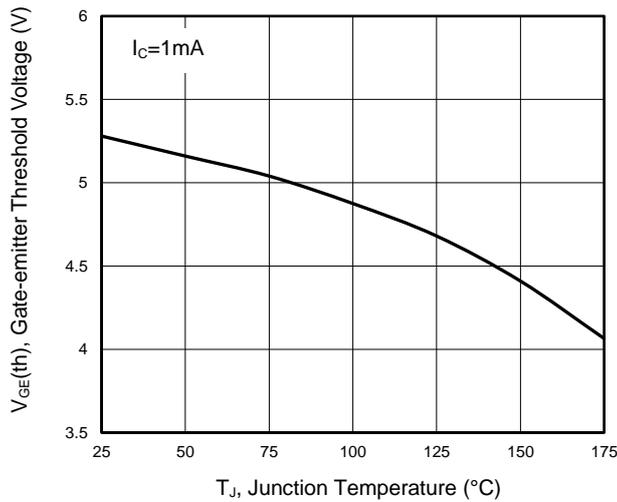


Figure 10 Typical Collector-emitter Saturation Voltage as a function of Collector Current

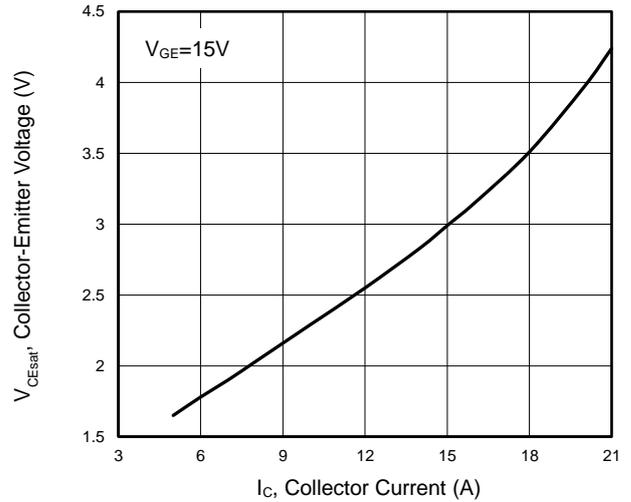
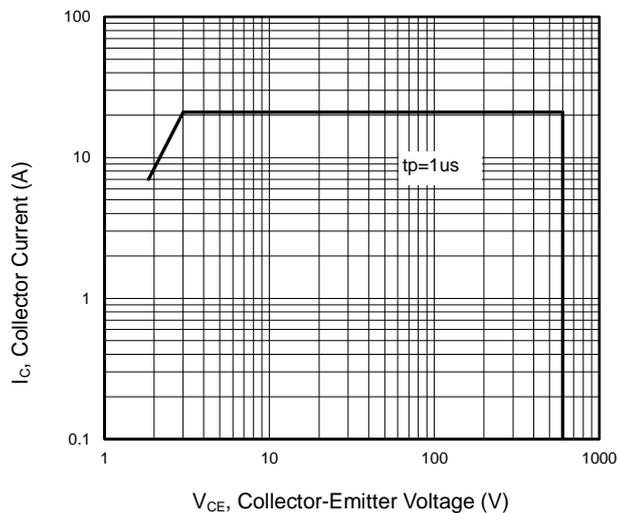
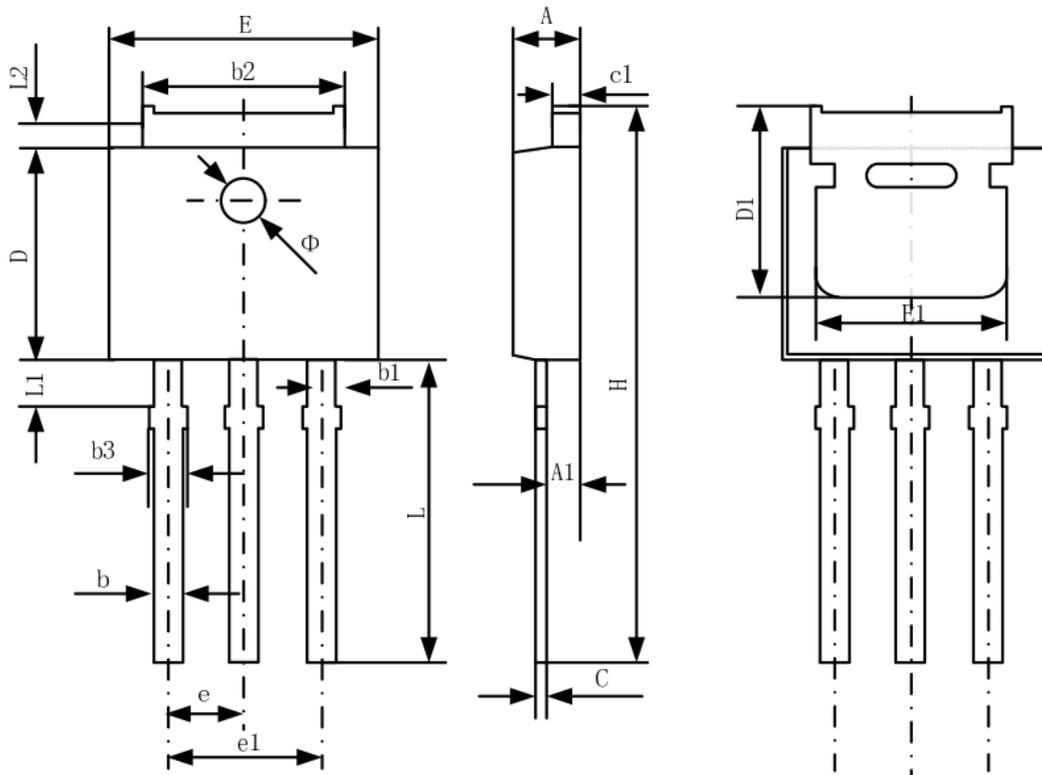


Figure 11 Forward Bias Safe Operating Area



TO-251 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.35	0.087	0.093
A1	0.90	1.10	0.035	0.043
b	0.56	0.69	0.022	0.027
b1	0.77	0.90	0.030	0.035
b2	5.23	5.43	0.206	0.214
b3		1.05		0.041
C	0.46	0.59	0.018	0.023
c1	0.46	0.59	0.018	0.023
D	6.00	6.20	0.236	0.244
D1	5.20		0.205	
E	6.50	6.70	0.256	0.264
E1	4.60	5.00	0.181	0.197
e	2.24	2.34	0.088	0.092
e1	4.47	4.67	0.176	0.184
H	16.18	16.78	0.637	0.661
L	9.00	9.60	0.354	0.378
L1	0.95	1.35	0.037	0.053
L2	0.90	1.25	0.035	0.049

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