

600V, 40A, Trench FS II Fast IGBT

General Description:

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

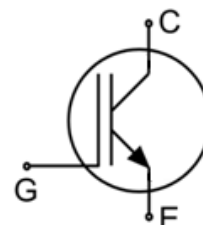
Features

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

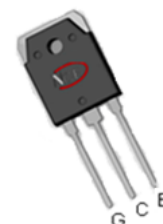
- Air Condition
- Inverters
- Motor drives



Schematic diagram

Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE40T60BP	TO-3PNT	NCE40T60BP



TO-3PNT

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	80	A
	Collector Current @ $T_C = 100^{\circ}\text{C}$	40	A
I_{Cplus}	Pulsed Collector Current, t_p limited by T_{jmax}	120	A
-	turn off safe operating area, $V_{CE}=600\text{V}$, $T_j=150^{\circ}\text{C}$	120	A
P_D	Power Dissipation @ $T_C = 25^{\circ}\text{C}$	286	W
	Power Dissipation @ $T_C = 100^{\circ}\text{C}$	114	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 $V_{GE}=15\text{V}$, $V_{CC}\leq 400\text{V}$, 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

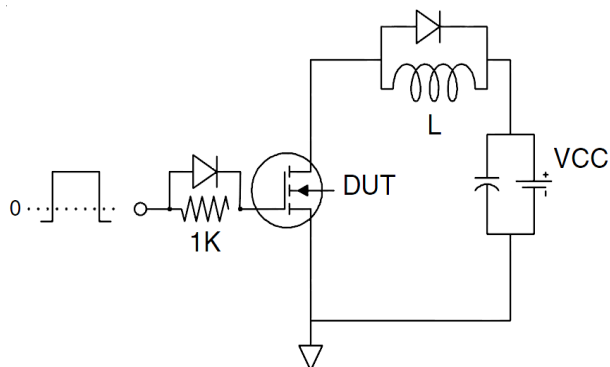
Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	0.43	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^{\circ}\text{C/W}$

Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise noted)

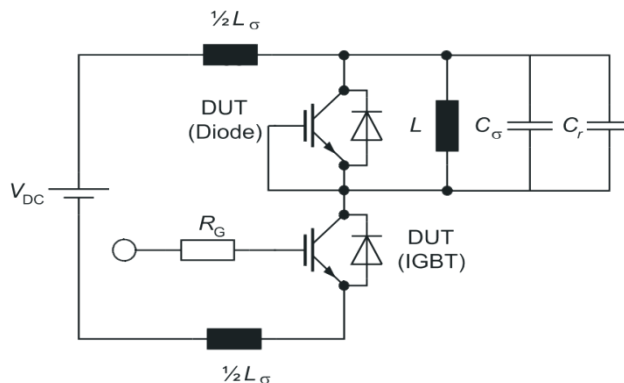
Symbol	Parameter	Test Conditions		Value			Units
				Min.	Typ.	Max.	
Static Characteristics							
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V,I _{CE} =1mA		600	--	--	V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V,V _{CE} =600V		--	--	4	uA
I _{GES(F)}	Gate to Emitter Forward Leakage	V _{GE} =+30V,V _{CE} =0V		--	--	200	nA
I _{GES(R)}	Gate to Source Reverse Leakage	V _{GE} =-30V,V _{CE} =0V		--	--	200	nA
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =40A	T _J =25°C	--	1.7	1.9	V
		V _{GE} =15V	T _J =150°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		--	4894	--	pF
C _{oes}	Output Capacitance			--	136	--	
C _{res}	Reverse Transfer Capacitance			--	94	--	
Q _g	Total Gate Charge	V _{CC} =480V, I _C =40A V _{GE} =15V		--	176	--	nC
Q _{ge}	Gate to Emitter Charge			--	38	--	
Q _{gc}	Gate to Collector Charge			--	73	--	
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		--	250	--	A
Switching Characteristics							
t _{d(ON)}	Turn-on Delay Time	V _{CC} =400V,I _C =40A V _{GE} =0/15V, R _g =5Ω Inductive Load		--	19	--	ns
t _r	Rise Time			--	17	--	
t _{d(OFF)}	Turn-Off Delay Time			--	168	--	
t _f	Fall Time			--	16	--	
E _{on}	Turn-On Switching Loss			--	0.58	--	mJ
E _{off}	Turn-Off Switching Loss			--	0.48	--	
E _{ts}	Total Switching Loss			--	1.06	--	

Test Circuit

1) Gate Charge Test Circuit

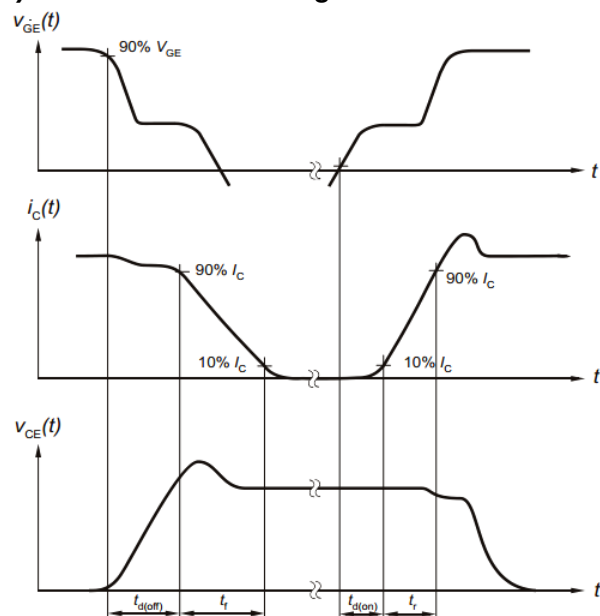


2) Switch Time Test Circuit

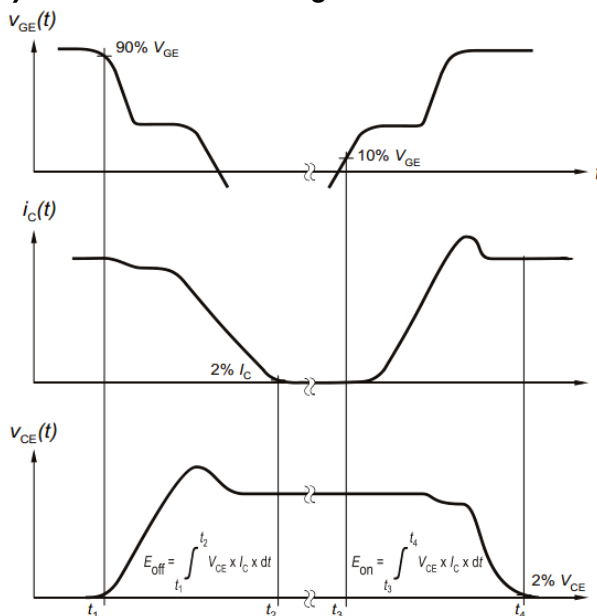


Switching characteristics

1) definition of switching times



2) definition of switching losses



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

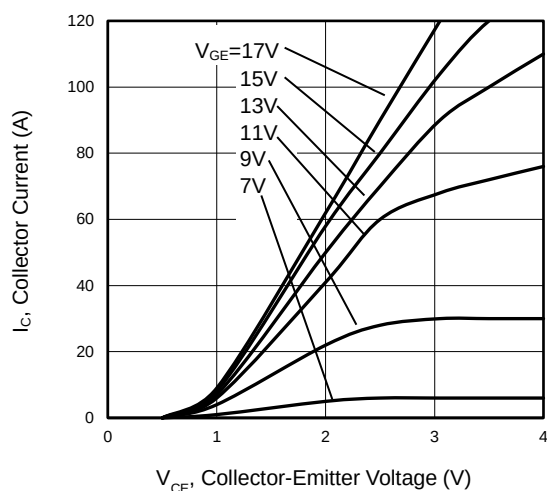


Figure 2 Transfer Characteristics

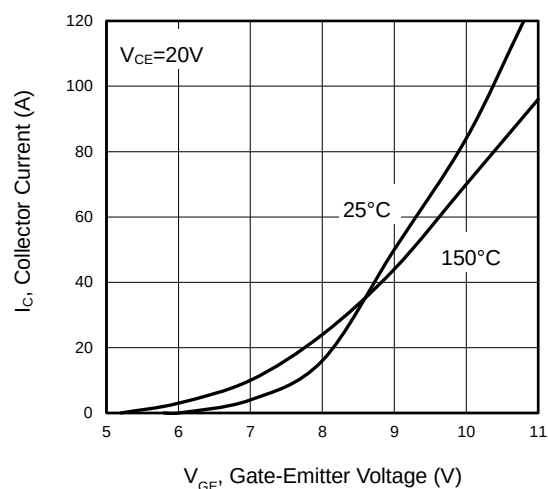


Figure 3 V_{CEsat} vs. Case Temperature

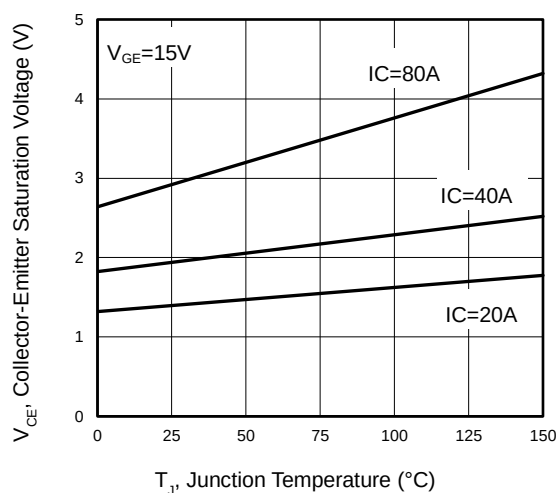


Figure 4 Saturation Voltage vs. V_{GE}

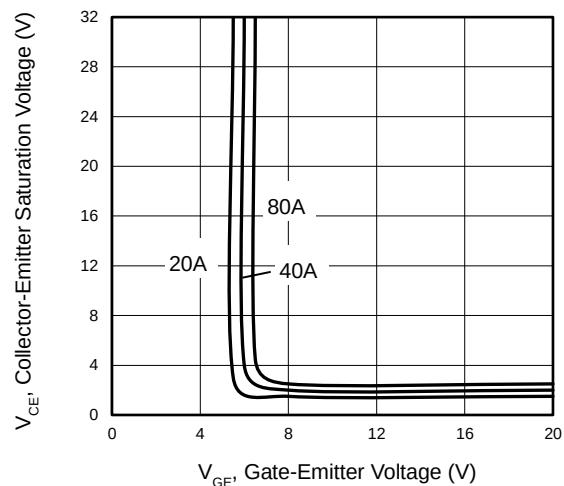


Figure 5 Capacitance Characteristics

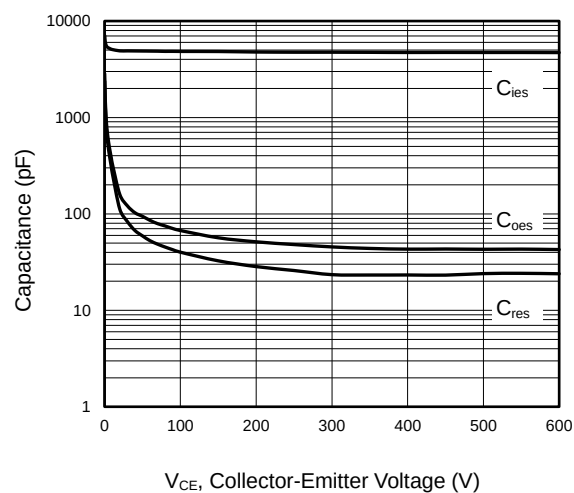
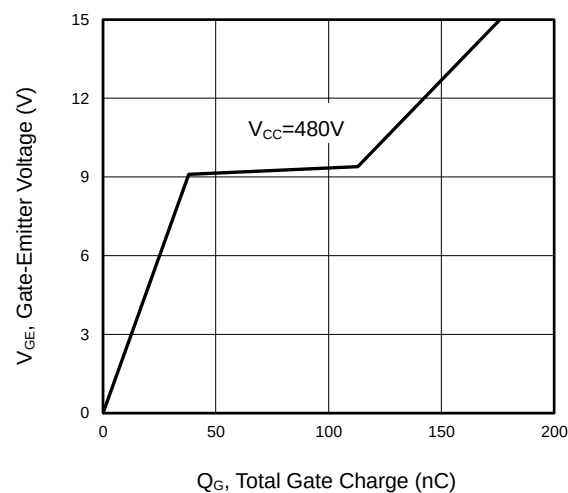


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics

Figure 7 Typical Switching Times as a Function of Gate Resistor

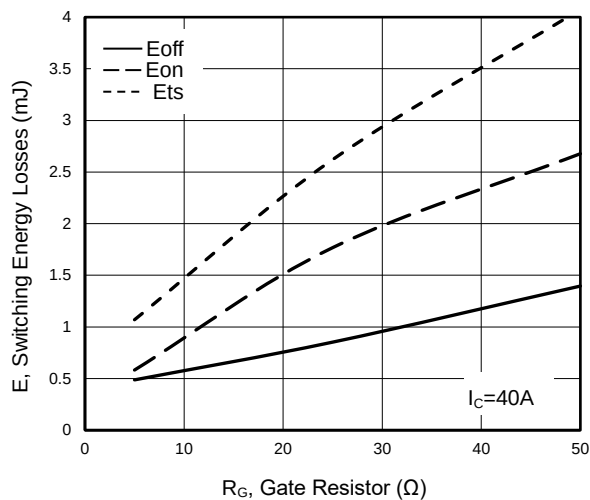


Figure 8 Typical Switching Times as a Function of Junction Temperature

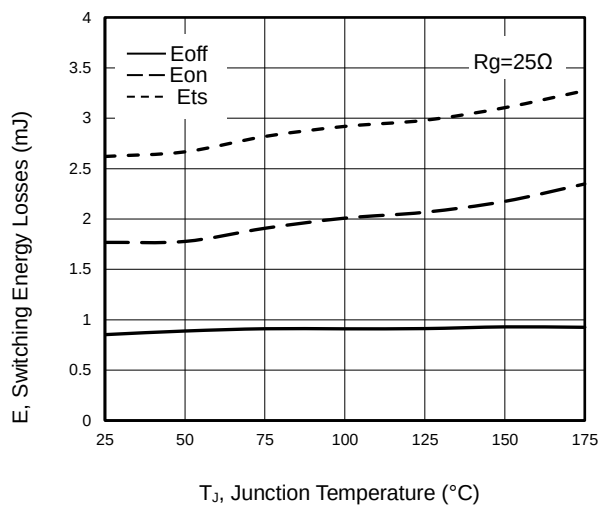


Figure 9 Gate-emitter Threshold Voltage as a Function of Junction Temperature

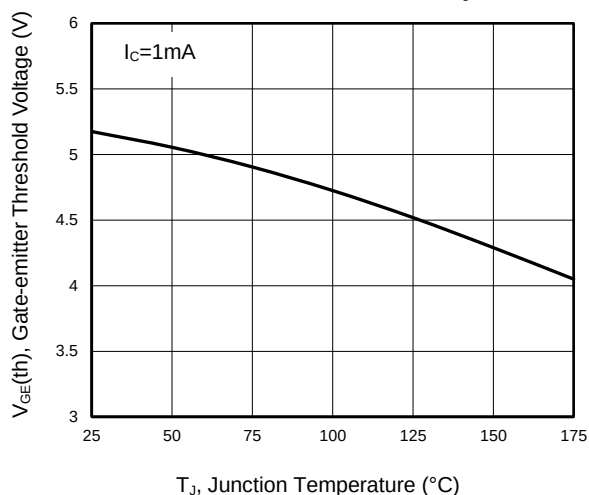


Figure 10 Typical Collector-emitter Saturation Voltage as a function of Collector Current

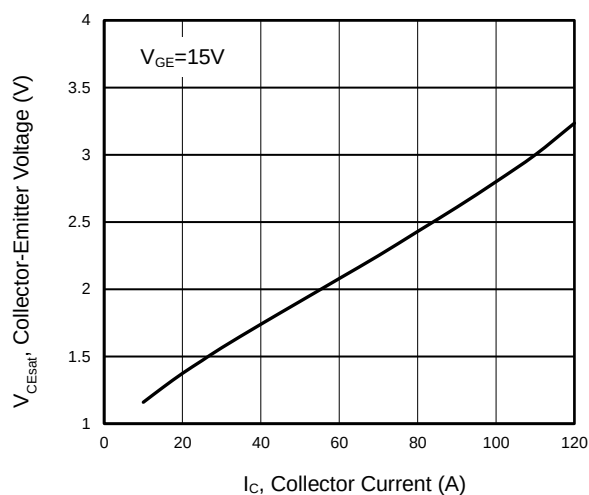
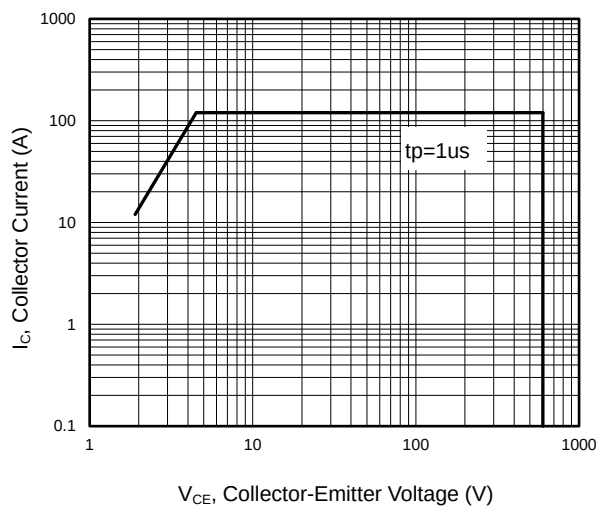
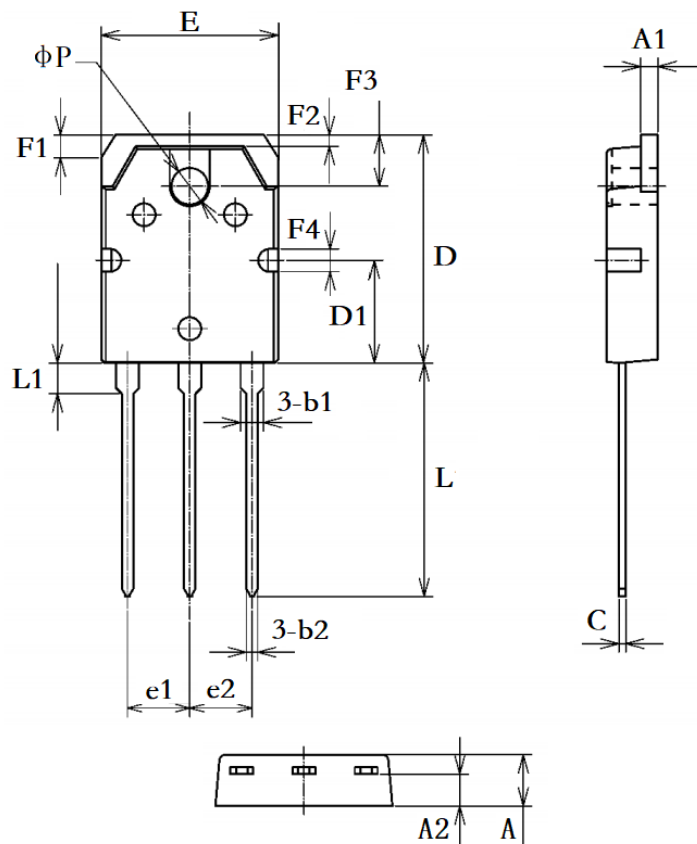


Figure 11 Forward Bias Safe Operating Area



TO-3PNT Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.35	4.65	0.17	0.18
A1	1.40	1.60	0.06	0.06
A2	2.60	3.00	0.10	0.12
b1	1.90	2.30	0.07	0.09
b2	0.90	1.10	0.04	0.04
C	0.50	0.70	0.02	0.03
D	19.70	20.30	0.78	0.80
D1	7.30	7.90	0.29	0.31
E	15.20	15.80	0.60	0.62
e1/e2	5.35	5.55	0.21	0.22
F1	1.50	2.50	0.06	0.10
F2	0.70	1.30	0.03	0.05
F3	4.60	4.90	0.18	0.19
F4	2.10	2.50	0.08	0.10
L	19.50	21.5	0.77	0.85
L1	2.10	3.30	0.08	0.13
ΦP	3.00	3.40	0.12	0.13

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