

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;

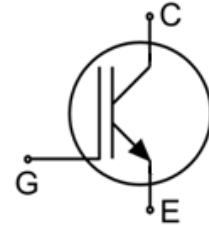
Features

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

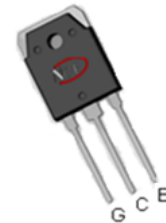
- Air Condition
- Inverters
- Motor drives



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

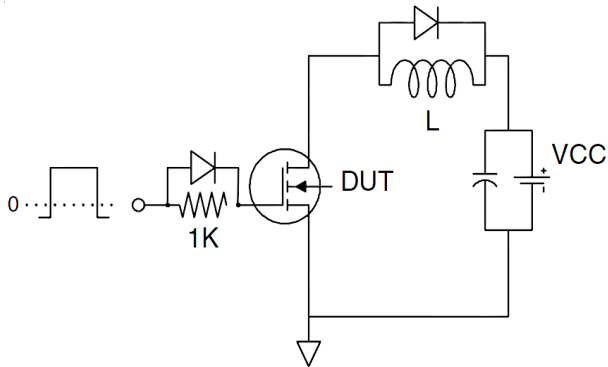
Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	0.43	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	°C/W

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

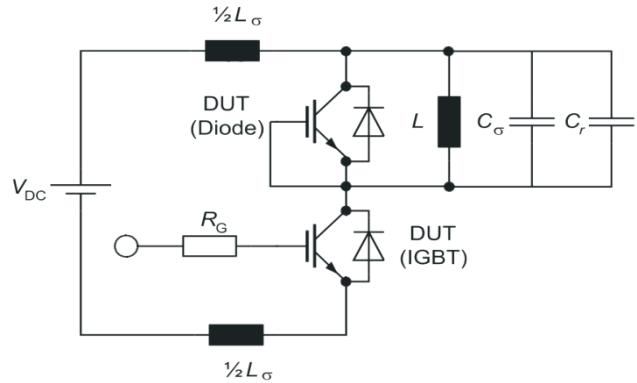
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
Static Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_{CE}=1mA$	600	--	--	V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0V, V_{CE}=600V$	--	--	4	μA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+30V, V_{CE}=0V$	--	--	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	$I_C=40A$ $T_j=25^\circ\text{C}$	--	1.7	1.9	V
		$V_{GE}=15V$ $T_j=150^\circ\text{C}$	--	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	--	μF
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: $\geq 1.0s$	$V_{GE}=15V, V_{CC} \leq 400V,$ $t_{SC} \leq 3\mu s, T_j \leq 150^\circ\text{C}$	--	250	--	A
Switching Characteristics						
$t_{d(ON)}$	Turn-on Delay Time	$V_{CC}=400V, I_C=40A$ $V_{GE}=0/15V, R_g=5\Omega$ 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

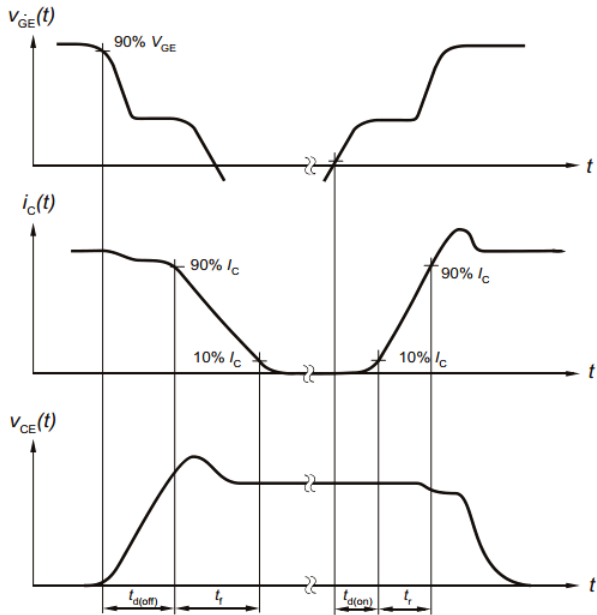


2) Switch Time Test Circuit

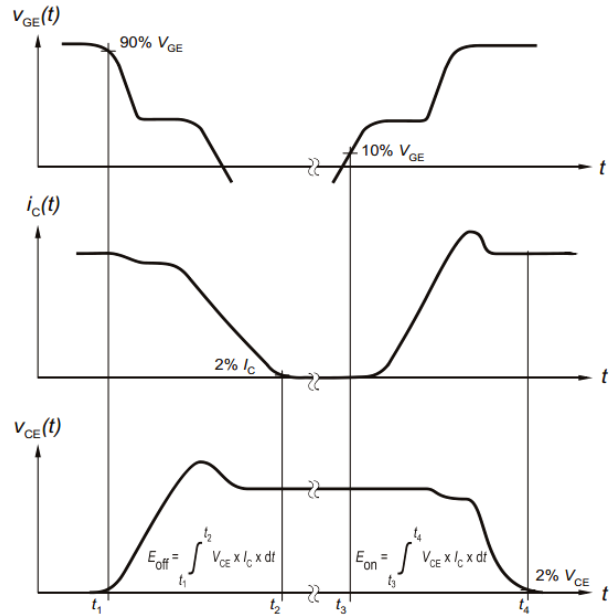


Switching characteristics

1) definition of switching times



2) definition of switching losses



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

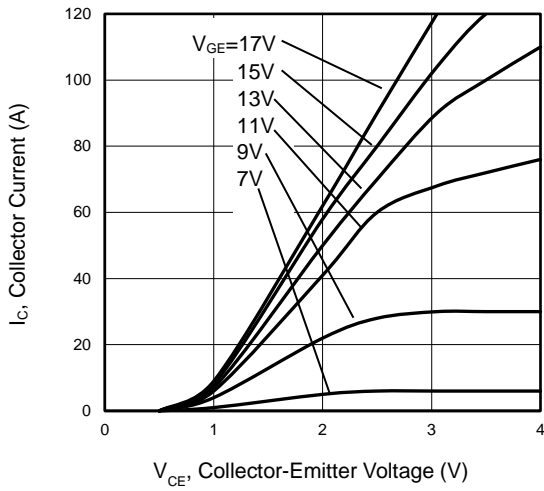


Figure 2 Transfer Characteristics

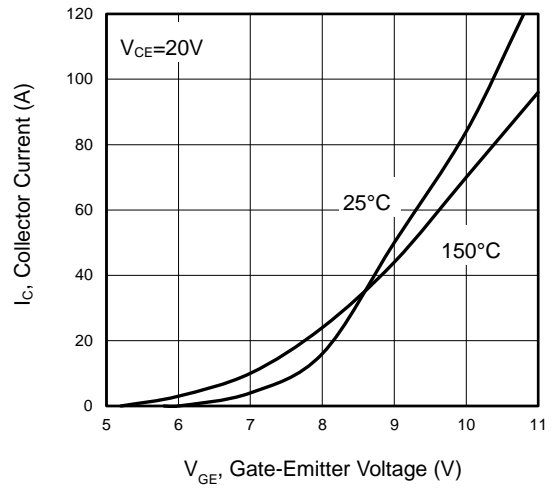


Figure 3 V_{CEsat} vs. Case Temperature

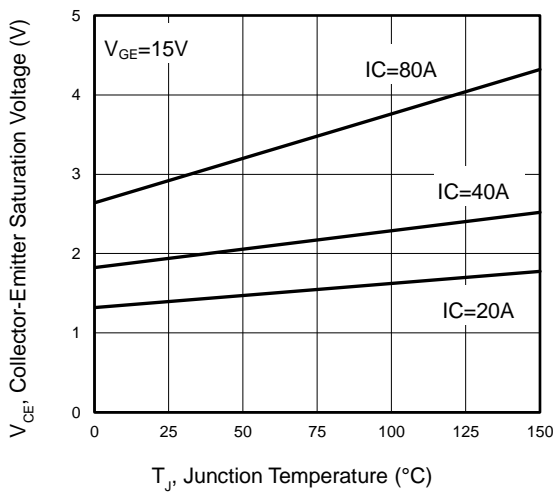


Figure 4 Saturation Voltage vs. V_{GE}

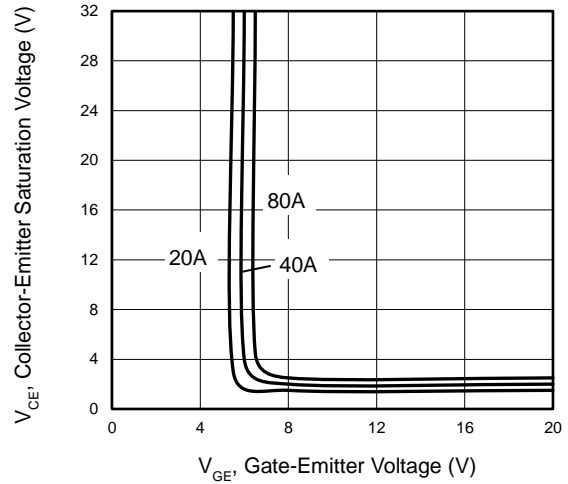


Figure 5 Capacitance Characteristics

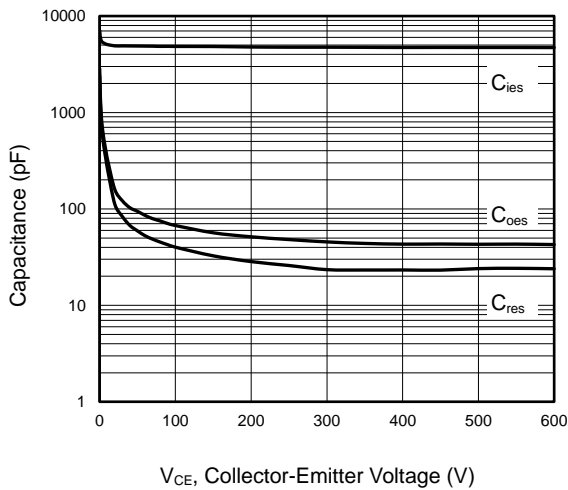
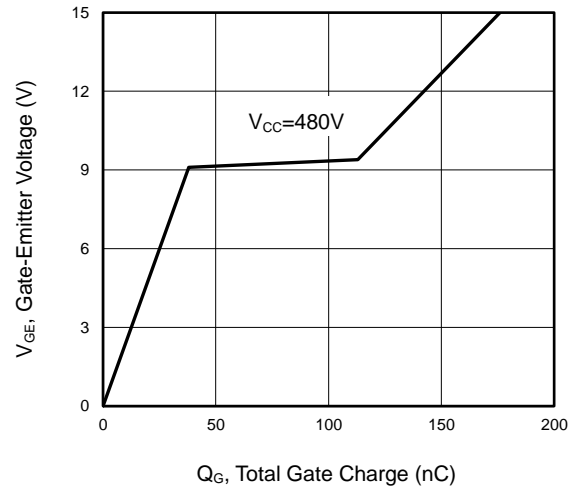


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics

Figure 7 Typical Switching Times as a Function of Gate Resistor

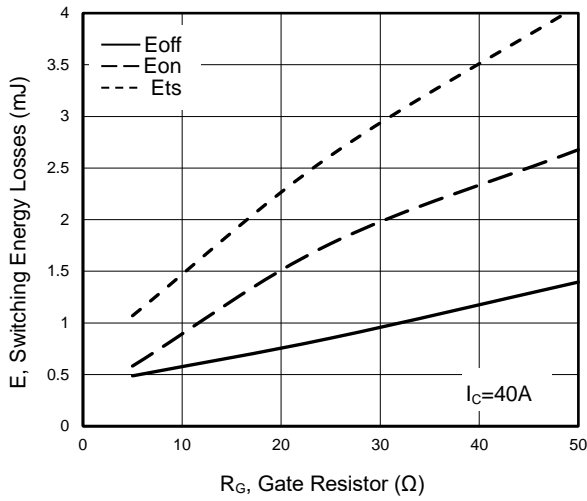


Figure 8 Typical Switching Times as a Function of Junction Temperature

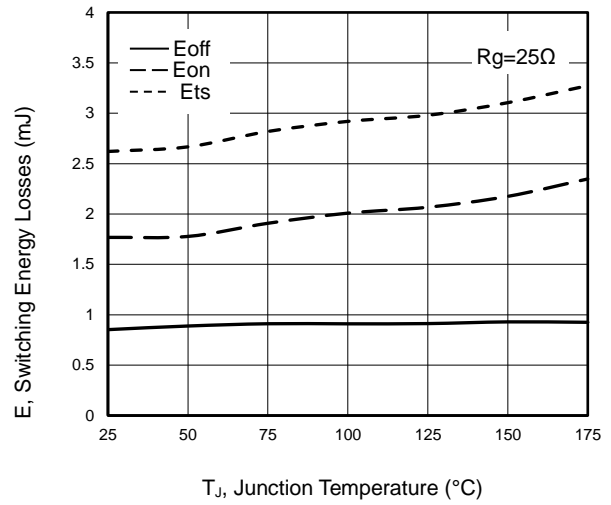


Figure 9 Gate-emitter Threshold Voltage as a Function of Junction Temperature

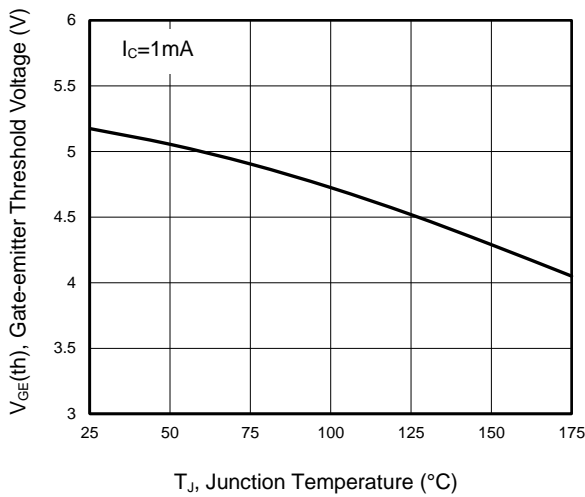


Figure 10 Typical Collector-emitter Saturation Voltage as a function of Collector Current

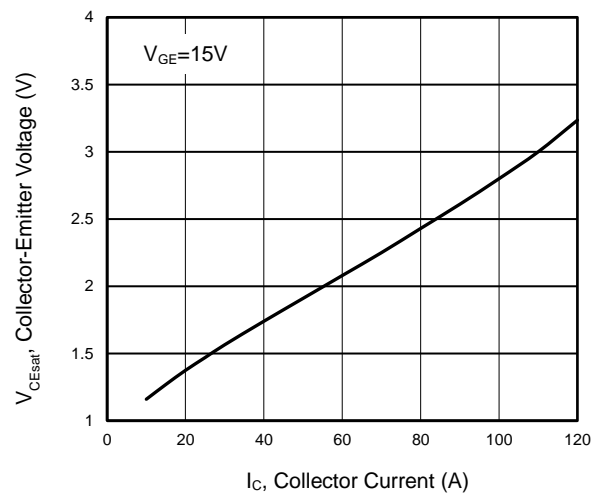
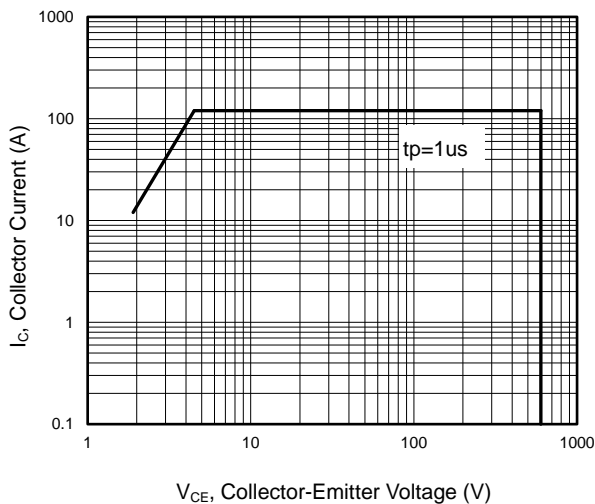
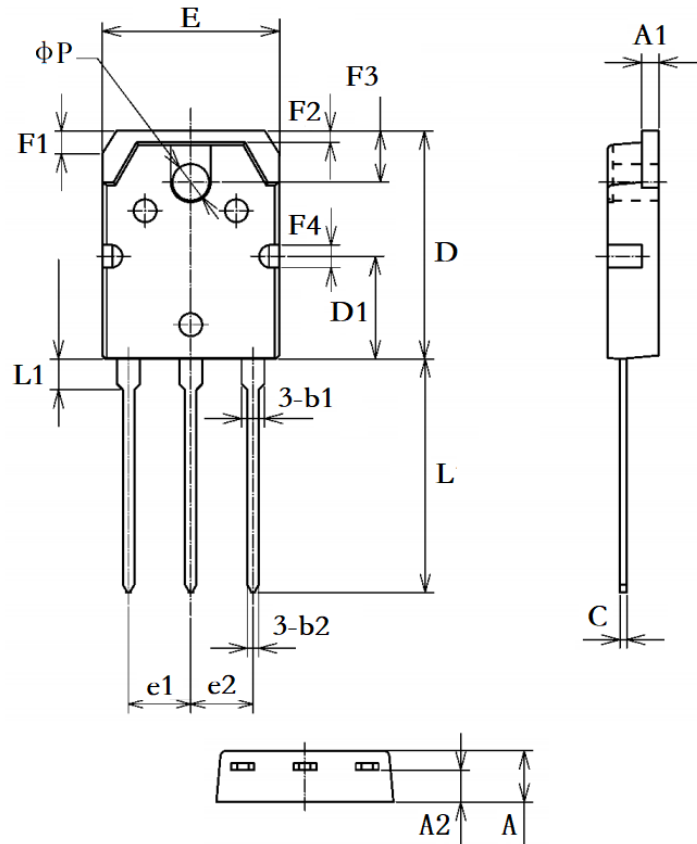


Figure 11 Forward Bias Safe Operating Area



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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