

## 1200V, 25A, Trench FS II Fast IGBT

### General Description:

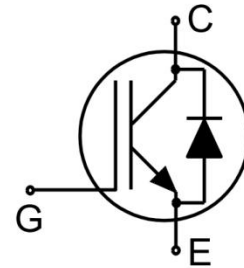
Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 1200V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

### Features

- Trench FSII Technology offering
- Very low  $V_{CE(sat)}$
- Positive temperature coefficient in  $V_{CE(sat)}$
- Very tight parameter distribution
- High ruggedness, temperature stable behavior

### Application

- PV power
- Three-level Solar String Inverter



Schematic diagram

### Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE25TD120VT	TO-247	NCE25TD120VT



TO-247

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

Symbol	Parameter	Value	Units
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate- Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current	50	A
	Collector Current @ $T_C = 100^\circ\text{C}$	25	A
$I_{Cpuls}$	Pulsed Collector Current, $t_p$ limited by $T_{jmax}$	75	A
-	turn off safe operating area, $V_{CE}=1200\text{V}$ , $T_j=150^\circ\text{C}$	75	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	25	A
$I_{FM}$	Diode Maximum Forward Current	75	A
$P_D$	Power Dissipation @ $T_C = 25^\circ\text{C}$	365	W
	Power Dissipation @ $T_C = 100^\circ\text{C}$	183	W
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum Temperature for Soldering	260	$^\circ\text{C}$

**Thermal Characteristic**

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	0.41	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	0.78	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^{\circ}\text{C}/\text{W}$

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

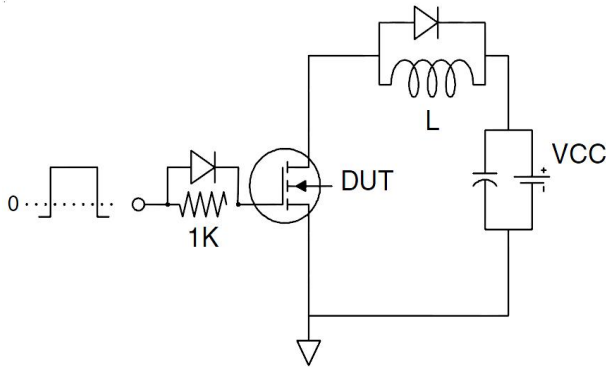
Symbol	Parameter	Test Conditions	Value			Units	
			Min.	Typ.	Max.		
<b>Static Characteristics</b>							
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0\text{V}, I_{CE}=1\text{mA}$	1200	--	--	V	
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}, V_{CE}=1200\text{V}$	--	--	5	$\mu\text{A}$	
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+30\text{V}, V_{CE}=0\text{V}$	--	--	200	nA	
$I_{GES(R)}$	Gate to Source Reverse Leakage	$V_{GE}=-30\text{V}, V_{CE}=0\text{V}$	--	--	200	nA	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V},$ $I_C=25\text{A},$	$T_j=25^{\circ}\text{C}$	--	1.85	2.05	V
			$T_j=150^{\circ}\text{C}$	--	2.05	--	
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=1\text{mA}, V_{CE}=V_{GE}$	4.5	--	6.5	V	
<b>Dynamic Characteristics</b>							
$C_{ies}$	Input Capacitance	$V_{CE}=30\text{V}, V_{GE}=0\text{V},$ $f=1\text{MHz}$	--	2674	--	pF	
$C_{oes}$	Output Capacitance		--	72	--		
$C_{res}$	Reverse Transfer Capacitance		--	59	--		
$Q_g$	Total Gate Charge	$V_{CC}=960\text{V}, I_C=25\text{A}$ $V_{GE}=15\text{V}$	--	146	--	nC	
$Q_{ge}$	Gate to Emitter Charge		--	28	--	nC	
$Q_{gc}$	Gate to Collector Charge		--	84	--	nC	
<b>Switching Characteristics</b>							
$t_{d(ON)}$	Turn-on Delay Time	$V_{CE}=600\text{V}, I_C=25\text{A}$ $V_{GE}=0/15\text{V}, R_g=5\Omega$ Inductive Load	--	19	--	ns	
$t_r$	Rise Time		--	17	--		
$t_{d(OFF)}$	Turn-Off Delay Time		--	170	--		
$t_f$	Fall Time		--	18	--		
$E_{on}$	Turn-On Switching Loss		--	1.3	--	mJ	
$E_{off}$	Turn-Off Switching Loss		--	0.7	--		
$E_{ts}$	Total Switching Loss	--	2.0	--			

**Electrical Characteristics of the Diode ( $T_c=25^{\circ}\text{C}$  unless otherwise specified):**

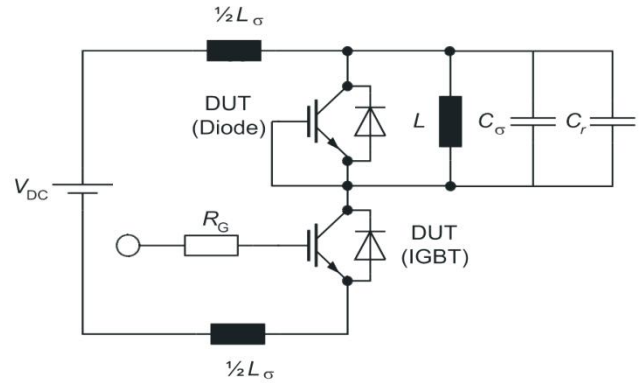
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{FM}$	Diode Forward Voltage	$I_F=25\text{A}$	--	2.2	3.0	V
$T_{rr}$	Reverse Recovery Time	$I_F=25\text{A},$ $di/dt=500\text{A}/\mu\text{s}$	--	190	--	ns
$I_{RRM}$	Diode Peak Reverse Recovery Current		--	12	--	A
$Q_{rr}$	Reverse Recovery Charge		--	2.5	--	$\mu\text{C}$
Pulse width $t_p \leq 380\mu\text{s}, \delta \leq 2\%$						

### Test Circuit

#### 1) Gate Charge Test Circuit

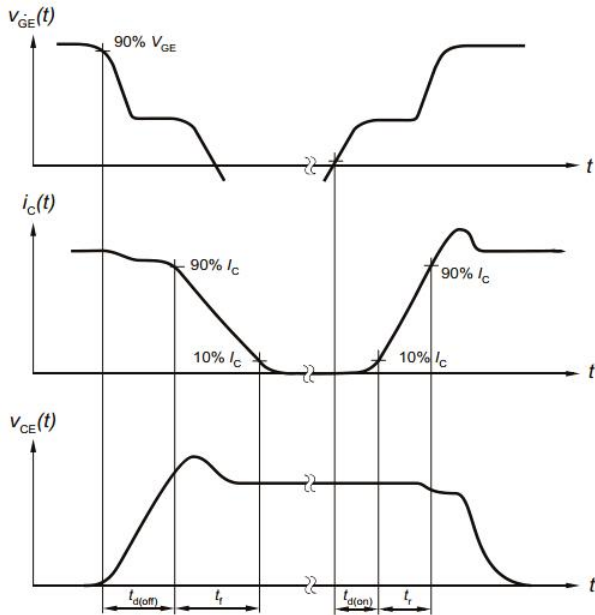


#### 2) Switch Time Test Circuit

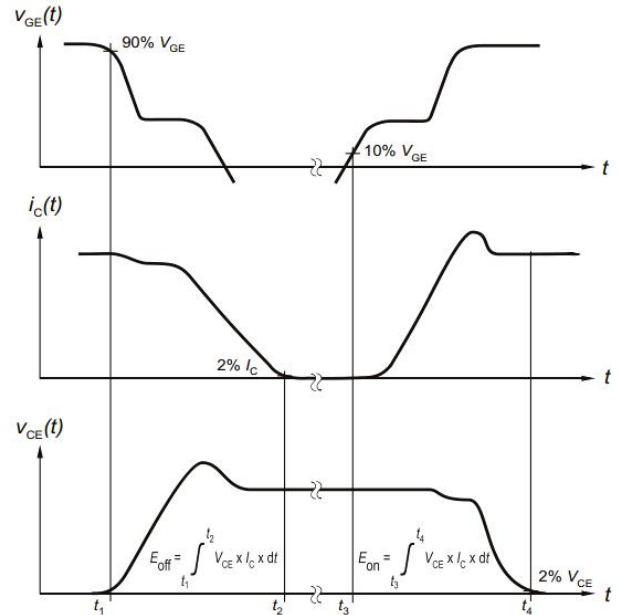


### Switching characteristics

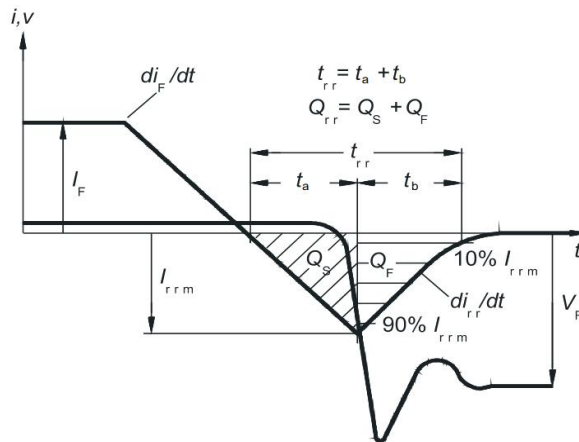
#### 1) definition of switching times



#### 2) definition of switching losses



#### 3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

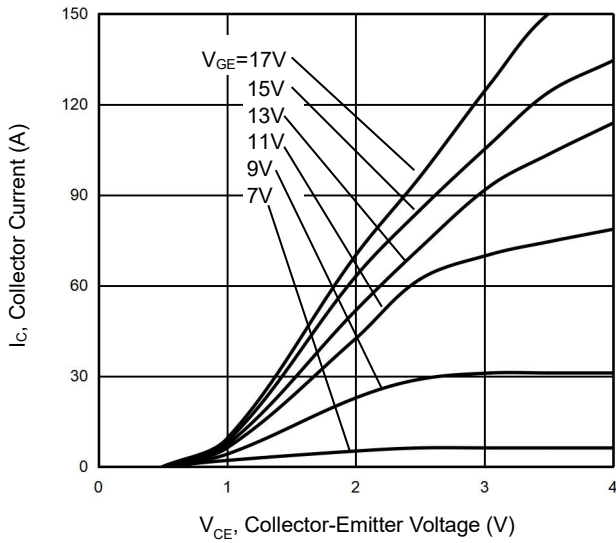


Figure 2 Transfer Characteristics

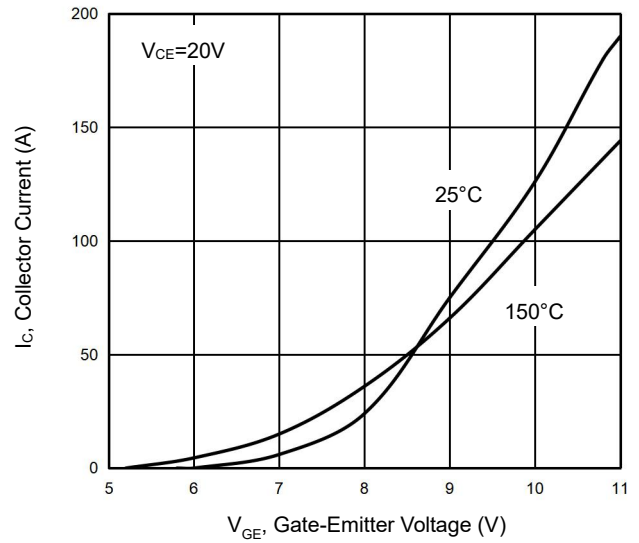


Figure 3  $V_{CE(sat)}$  vs. Case Temperature

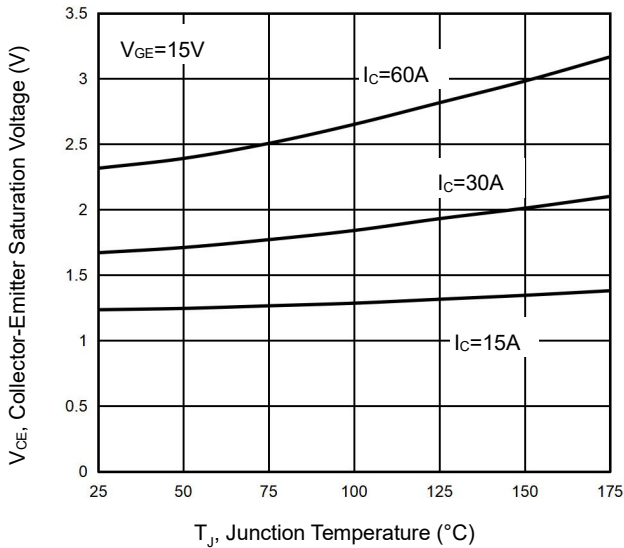


Figure 4 Saturation Voltage vs.  $V_{GE}$

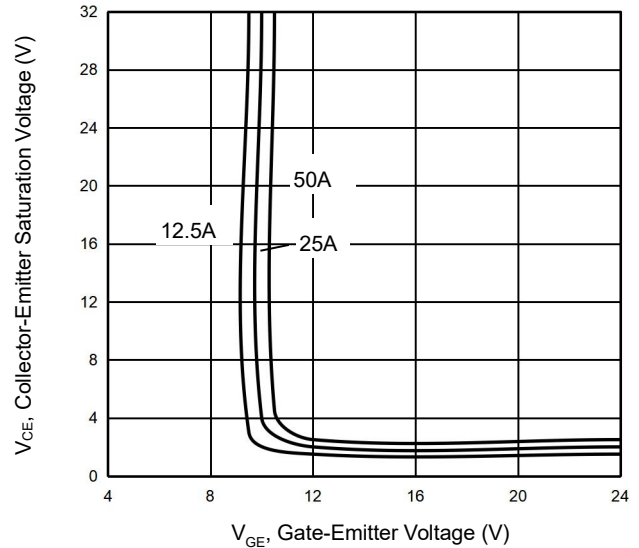


Figure 5 Capacitance Characteristics

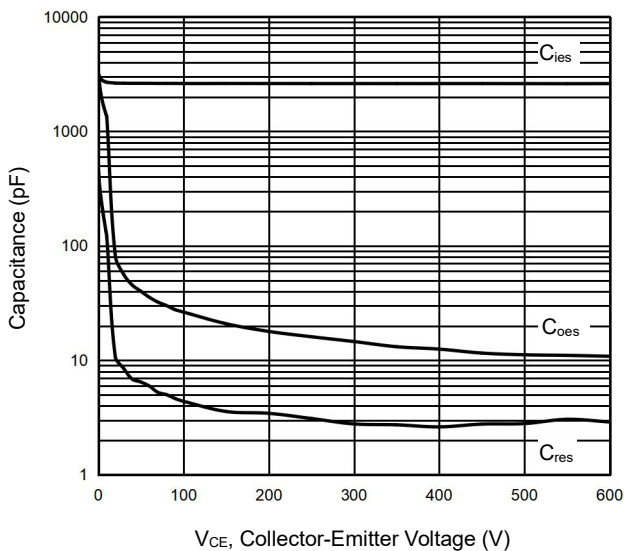
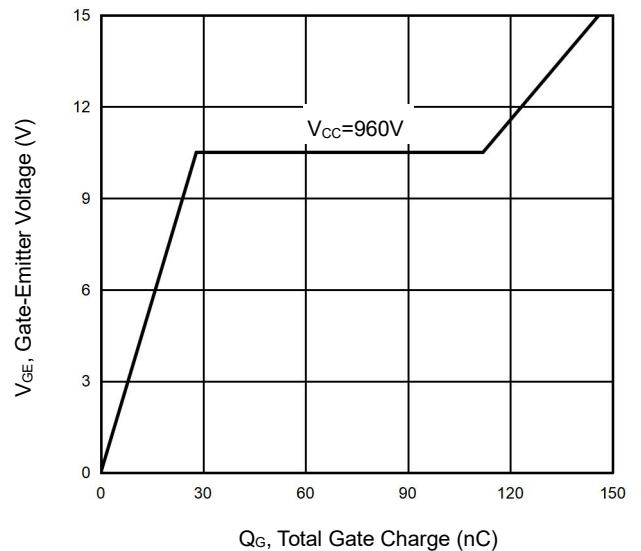
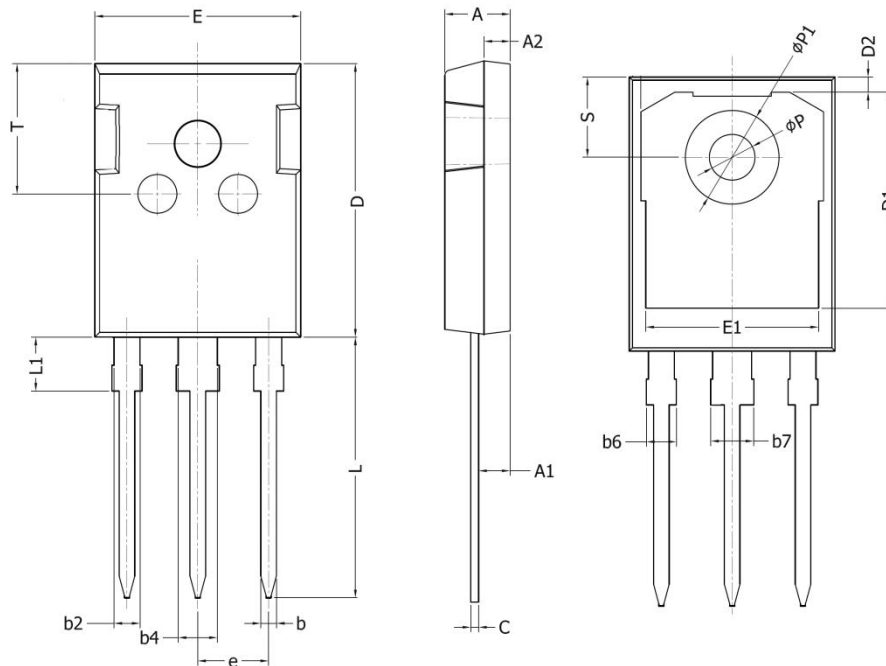


Figure 6 Gate Charge Wave Form



## TO-247-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.9	2.1	0.075	0.083
b	1.16	1.26	0.046	0.050
b2	1.96	2.06	0.077	0.081
b4	2.96	3.06	0.117	0.120
b6	-	2.25	-	0.089
b7	-	3.25	-	0.128
C	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
e	5.436 BSC		0.214 BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
P	3.40	3.60	0.134	0.142
P1	7.00	7.40	0.276	0.291
S	6.05	6.25	0.238	0.246
T	9.80	10.20	0.386	0.402

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