

## 600V, 75A, Trench FS II 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;

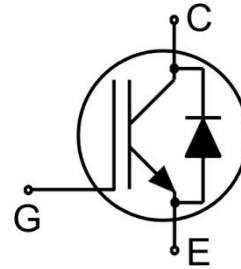
### Features

Trench FSII Technology offering

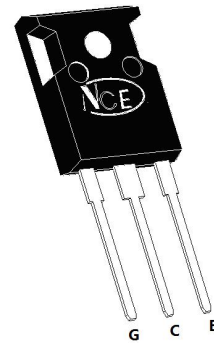
- Very low  $V_{CE(sat)}$
- High speed switching
- Positive temperature coefficient in  $V_{CE(sat)}$
- Very tight parameter distribution
- High ruggedness, temperature stable behavior

### Application

- Uninterruptible Power Supplies ( UPS )
- Welding Converters
- Inverters



Schematic diagram



TO-247-3L top view

### Package Marking and Ordering Information

Device	$V_{CE}$	$I_C$	Device Marking	Device Package
NCE75TD60T	600V	75A	NCE75TD60T	TO-247-3L

### Absolute Maximum Ratings (TC=25°C unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate- Emitter Voltage	±30	V
$I_C$	Collector Current	150	A
	Collector Current @ $T_C = 100\text{ }^\circ\text{C}$	75	A
$I_{Cplus}$	Pulsed Collector Current, $t_p$ limited by $T_{jmax}$	225	A
-	turn off safe operating area, $V_{CE}=600V$ , $T_j=150^\circ\text{C}$	225	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100\text{ }^\circ\text{C}$	75	A
$I_{FM}$	Diode Maximum Forward Current	225	A
$P_D$	Power Dissipation @ $T_C = 25\text{ }^\circ\text{C}$	428	W
	Power Dissipation @ $T_C = 100\text{ }^\circ\text{C}$	172	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 $V_{GE}=15.0V$ , $V_{CC}\leq 400V$ , Allowed number of short circuits<1000Time between short circuits: $\geq 1.0s, T_{vj}\leq 150^\circ\text{C}$	10	us

**Thermal Characteristic**

Symbol	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Thermal Resistance, Junction to case for IGBT	--	0.29	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction to case for Diode	--	0.78	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	--	40	°C/W

**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)**

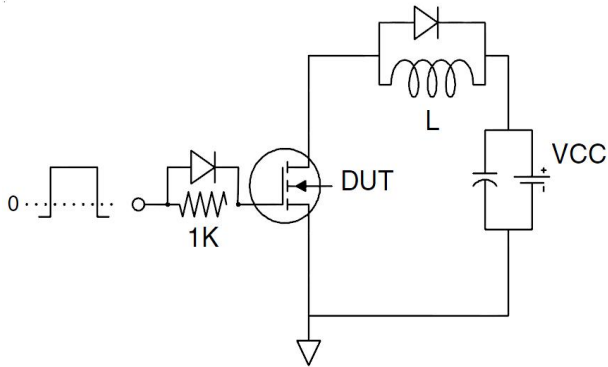
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
<b>OFF Characteristics</b>						
V <sub>(BR)CES</sub>	Collector-Emitter Breakdown Voltage	V <sub>GE</sub> =0V, I <sub>CE</sub> =1mA	600	--	--	V
I <sub>CES</sub>	Collector-Emitter Leakage Current	V <sub>GE</sub> =0V, V <sub>CE</sub> =600V	--	--	4	μA
I <sub>GES(F)</sub>	Gate to Emitter Forward Leakage	V <sub>GE</sub> =+30V, V <sub>CE</sub> =0V	--	--	100	nA
I <sub>GES(R)</sub>	Gate to Source Reverse Leakage	V <sub>GE</sub> =-30V, V <sub>CE</sub> =0V	--	--	100	nA
<b>ON Characteristics</b>						
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	I <sub>C</sub> =75A, V <sub>GE</sub> =15V	--	1.65	1.9	V
V <sub>GE(th)</sub>	Gate Threshold Voltage	I <sub>C</sub> =1.8mA, V <sub>CE</sub> =V <sub>GE</sub>	4.0	5.0	6.0	V
<b>Dynamic Characteristics</b>						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz	--	3800	--	pF
C <sub>oes</sub>	Output Capacitance		--	260	--	
C <sub>res</sub>	Reverse Transfer Capacitance		--	180	--	
Q <sub>Gate</sub>	Gate charge	V <sub>CC</sub> =480V, I <sub>C</sub> =75A V <sub>GE</sub> =15V	--	360	--	nC
I <sub>C(SC)</sub>	Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	V <sub>GE</sub> =15V, V <sub>CC</sub> ≤400V, t <sub>SC</sub> ≤10us, T <sub>J</sub> ≤150°C	--	330	--	A
<b>Switching Characteristics</b>						
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>CE</sub> =400V, I <sub>C</sub> =75A V <sub>GE</sub> =-5/15V, R <sub>g</sub> =5Ω Inductive Load	--	24	--	ns
t <sub>r</sub>	Rise Time		--	38	--	
t <sub>d(OFF)</sub>	Turn-Off Delay Time		--	248	--	
t <sub>f</sub>	Fall Time		--	32	--	
E <sub>on</sub>	Turn-On Switching Loss		--	2.5	--	mJ
E <sub>off</sub>	Turn-Off Switching Loss		--	1.9	--	
E <sub>ts</sub>	Total Switching Loss		--	3.4	--	

**Electrical Characteristics of the Diode (T<sub>c</sub>= 25°C unless otherwise specified) :**

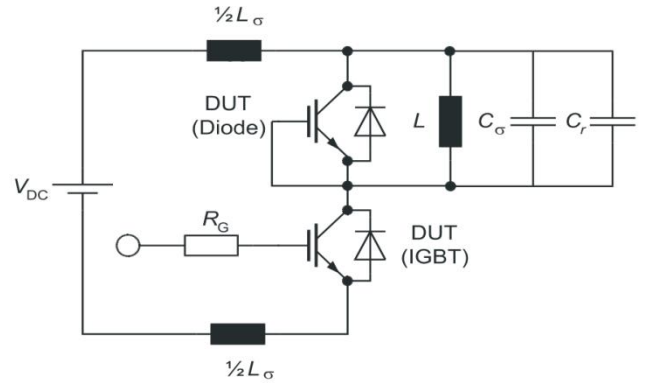
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> =75A	--	1.6	2.0	V
T <sub>rr</sub>	Reverse Recovery Time	V <sub>ce</sub> =400V, I <sub>F</sub> =75A, di/dt=2000A/μS	--	64	--	ns
I <sub>RRM</sub>	Diode Peak Reverse Recovery Current		--	45	--	A
Q <sub>rr</sub>	Reverse Recovery Charge		--	1.44	--	μC
Pulse width t <sub>p</sub> ≤380μs, δ≤2%						

**Test Circuit**

**1) Gate Charge Test Circuit**

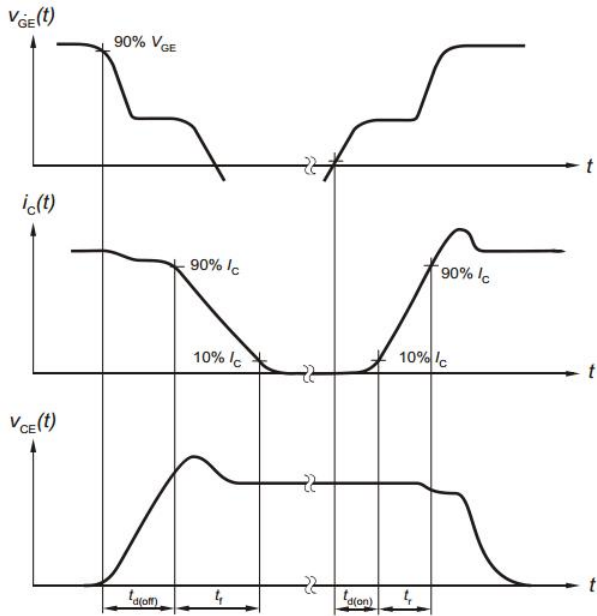


**2) Switch Time Test Circuit**

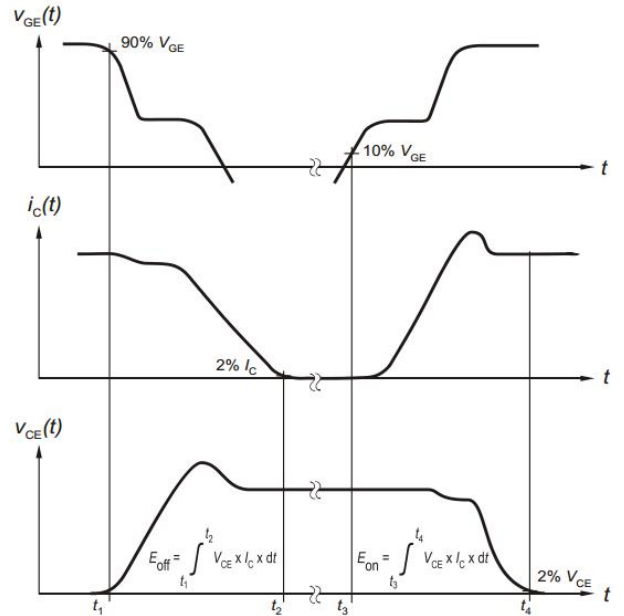


**Switching characteristics**

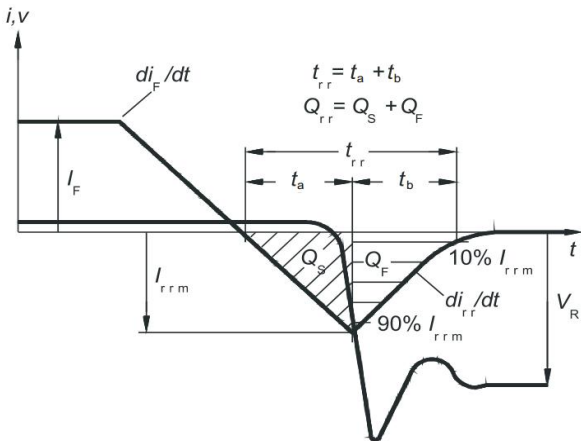
**1) definition of switching times**



**2) definition of switching losses**



**3) Definition of diode switching characteristics**



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

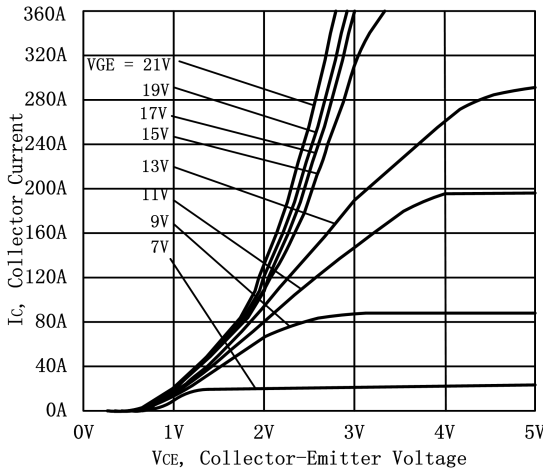


Figure 2. Transfer Characteristics

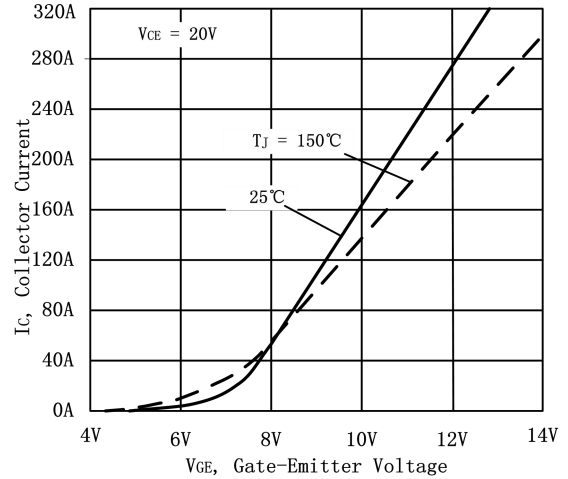


Figure 3 VCEsat vs. Case Temperature

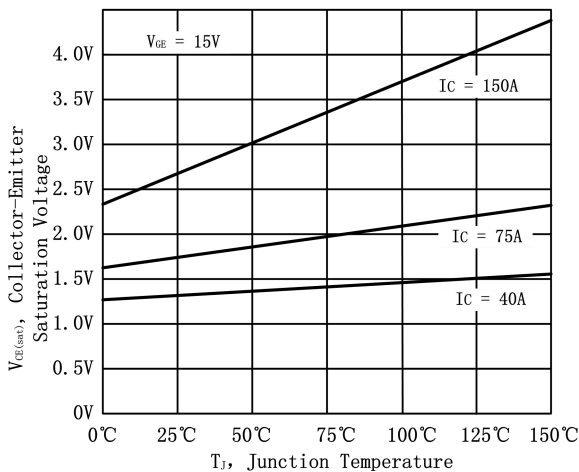


Figure 4 Saturation Voltage vs. VGE

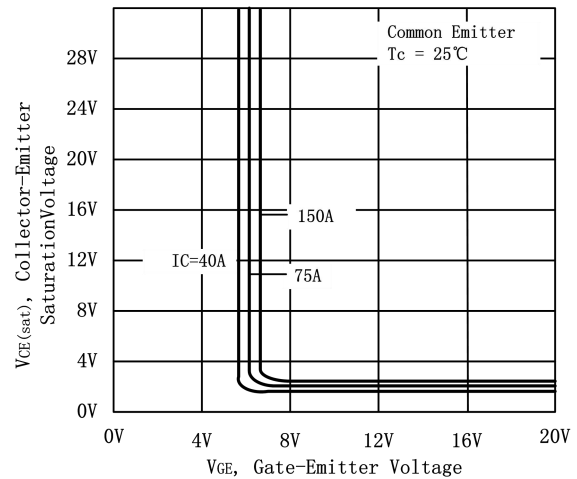


Figure 5 Capacitance Characteristics

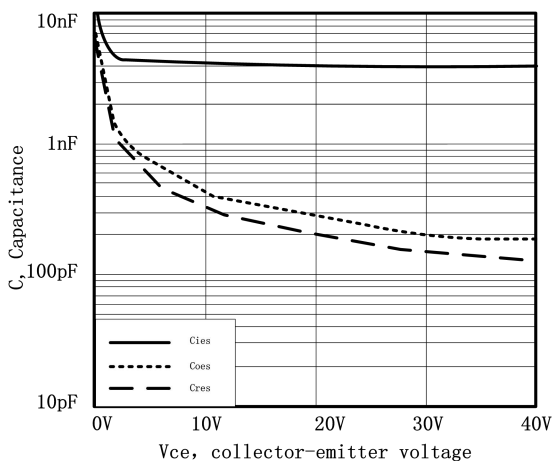
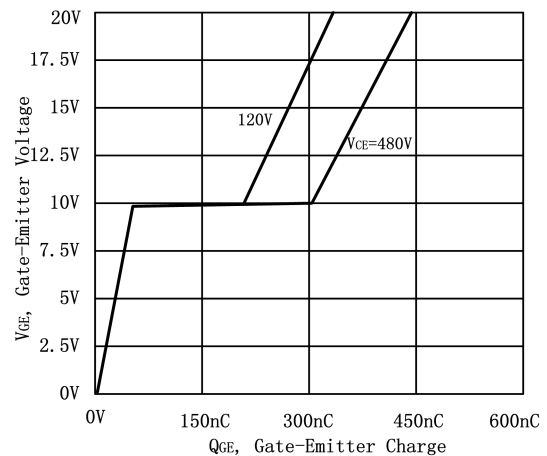


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics (continued)

Figure 7. Forward Characteristics

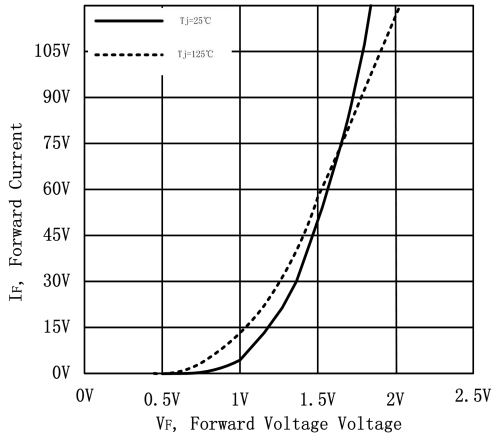


Figure 8  $V_F$  vs. Temperature

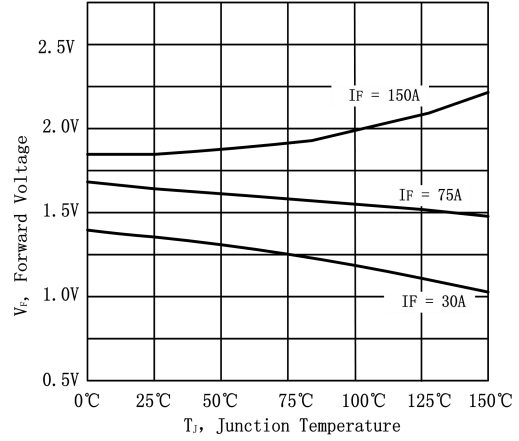
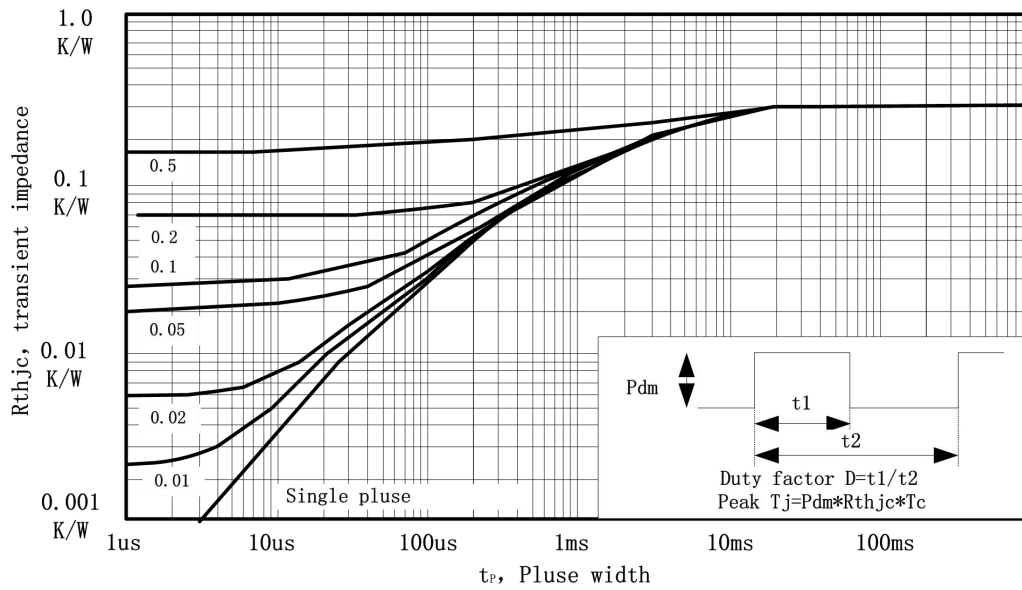
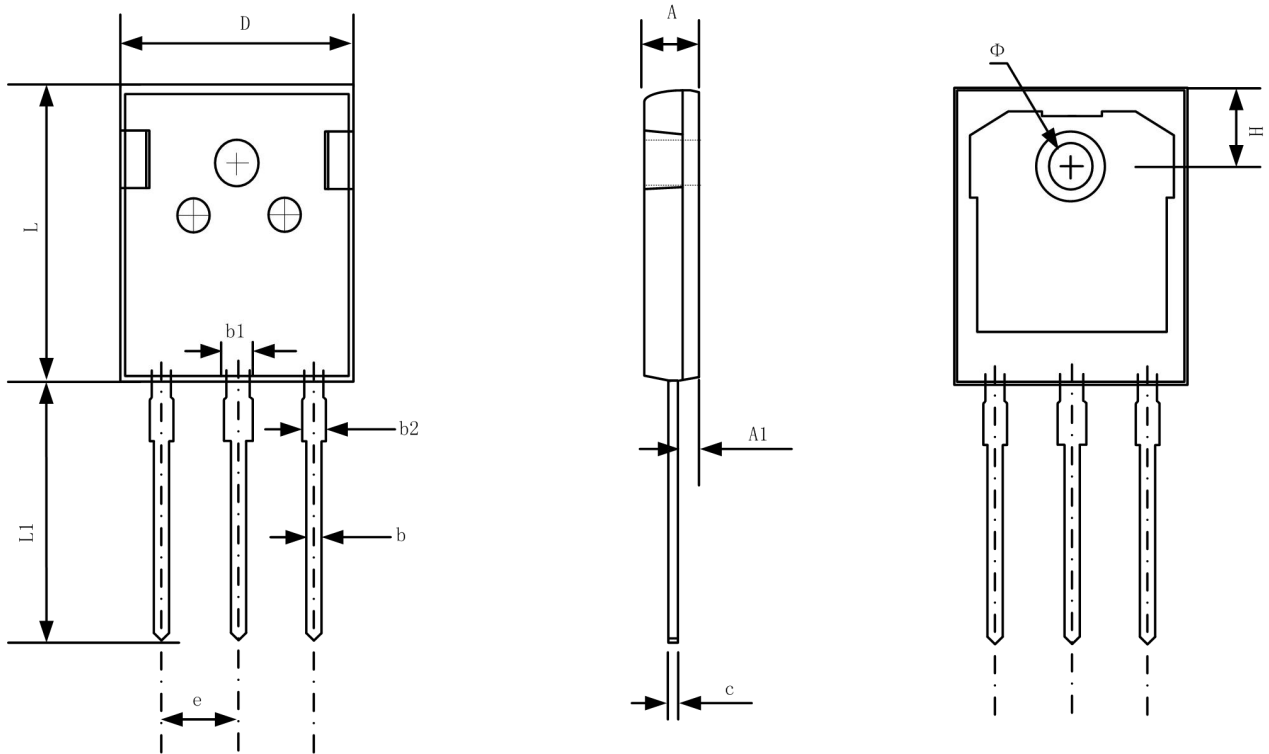


Figure 9. Transient Thermal Impedance of IGBT



## TO-247-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.800	5.200	0.189	0.205
A1	2.210	2.610	0.087	0.103
b	1.700	1.900	0.067	0.075
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
D	15.600	16.000	0.614	0.630
L	20.800	21.200	0.819	0.835
L1	19.620	20.220	0.772	0.796
$\Phi$	3.450	3.750	0.136	0.148
e	5.440 TYP		0.214 TYP	
H	6.150 REF		0.242 REF	

## Revision History

NCE75TD60T

### Revision:2018-1-15 Rev.1.1

Previous Revision

Revision	Date	Subjects(major changes since last revision)
1.0	2017-12-28	Preliminary data sheet
1.1	2018-1-15	Add switching Characteristics

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