

## 1200V, 75A, Trench FS II Fast IGBT

### General Description

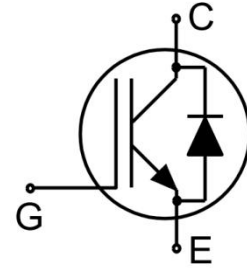
Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 1200V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

### Features

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

### Application

- Welding



Schematic diagram

### Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE75TD120WT	TO-247	NCE75TD120WT



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	150	A
	Collector Current @ $T_C = 100^\circ\text{C}$	75	A
$I_{Cpuls}$	Pulsed Collector Current, $t_p$ limited by $T_{jmax}$	300	A
-	turn off safe operating area, $V_{CE}=1200\text{V}$ , $T_j=175^\circ\text{C}$	300	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	75	A
$I_{FM}$	Diode Maximum Forward Current	300	A
$P_D$	Power Dissipation @ $T_C = 25^\circ\text{C}$	833	W
	Power Dissipation @ $T_C = 100^\circ\text{C}$	417	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	0.18	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	0.44	°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.	
<b>Static Characteristics</b>						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_{CE}=3mA$	1200	--	--	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0V, V_{CE}=1200V$	--	--	400	$\mu A$
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+30V, V_{CE}=0V$	--	--	200	nA
$I_{GES(R)}$	Gate to Emitter Reverse Leakage	$V_{GE}=-30V, V_{CE}=0V$	--	--	200	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=75A$	--	1.9	2.4	V
		$V_{GE}=15V$	--	2.2	--	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=3mA, V_{CE}=V_{GE}$	4.5	--	6.5	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE}=30V, V_{GE}=0V,$ $f=1MHz$	--	13830	--	pF
$C_{oes}$	Output Capacitance		--	320	--	
$C_{res}$	Reverse Transfer Capacitance		--	280	--	
$Q_g$	Total Gate Charge	$V_{CC}=960V, I_C=75A,$ $V_{GE}=15V$	--	450	--	nC
$Q_{ge}$	Gate to Emitter Charge		--	87	--	
$Q_{gc}$	Gate to Collector Charge		--	204	--	
<b>Switching Characteristics</b>						
$t_{d(ON)}$	Turn-on Delay Time	$V_{CE}=600V, I_C=75A,$ $V_{GE}=0/15V, R_g=8\Omega$ 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		--	5.5	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	2.5	--	
$E_{ts}$	Total Switching Loss		--	8.0	--	

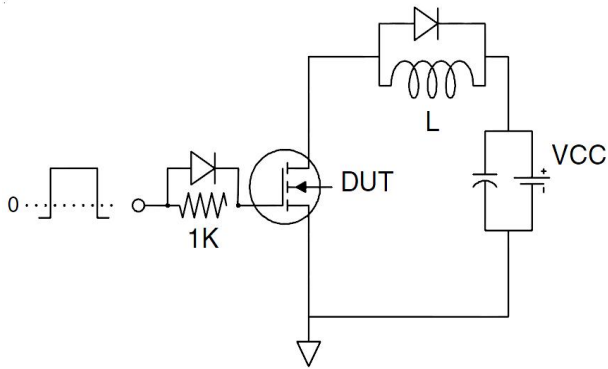
**Electrical Characteristics of the Diode( $T_c=25^\circ\text{C}$  unless otherwise specified):**

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{FM}$	Diode Forward Voltage	$I_F=37.5A$	--	2.1	2.8	V
$T_{rr}$	Reverse Recovery Time	$I_F=37.5A,$ $di/dt=700A/us$	--	150	--	ns
$I_{RRM}$	Diode Peak Reverse Recovery Current		--	10	--	A
$Q_{rr}$	Reverse Recovery Charge		--	0.75	--	$\mu C$

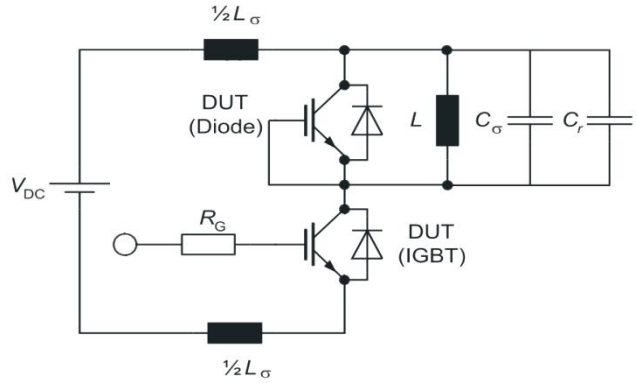
Pulse width  $t_p \leq 380\mu s, \delta \leq 2\%$

Test Circuit

1) Gate Charge Test Circuit

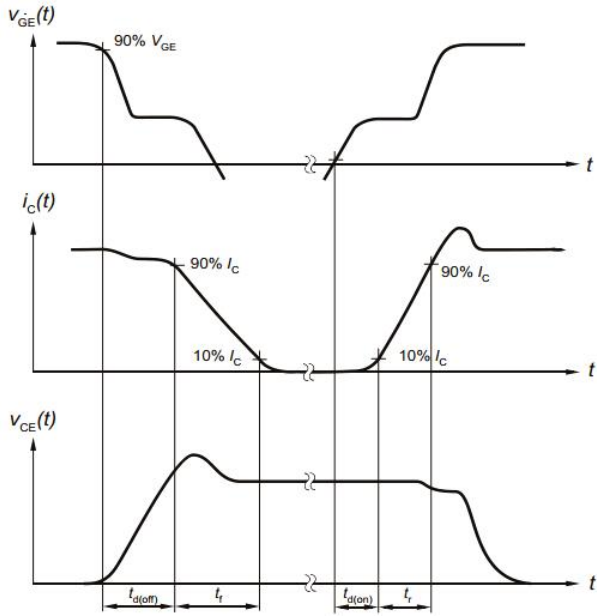


2) Switch Time Test Circuit

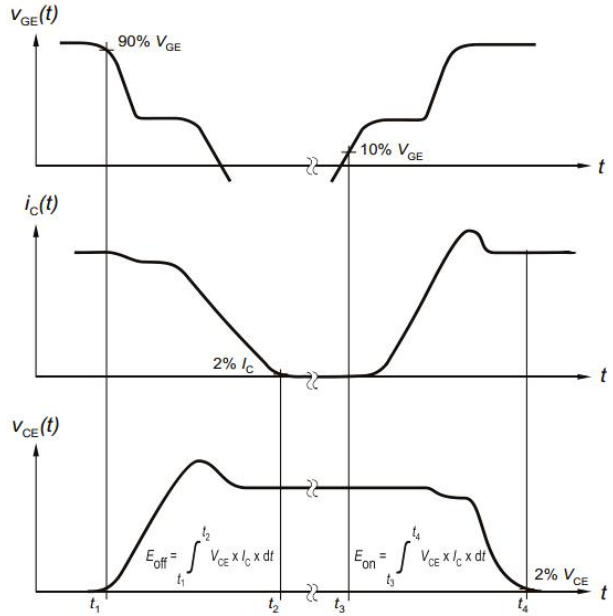


Switching characteristics

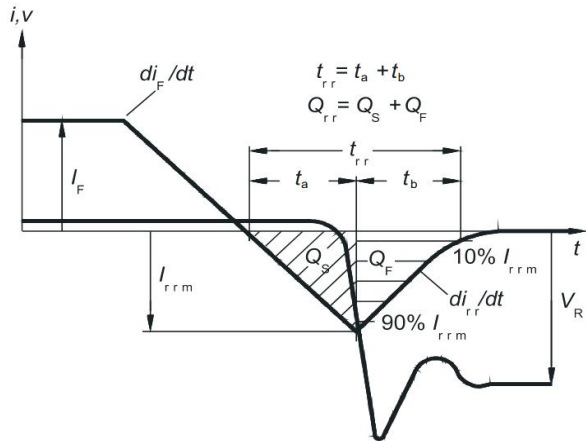
1) Definition of switching times



2) Definition of switching losses

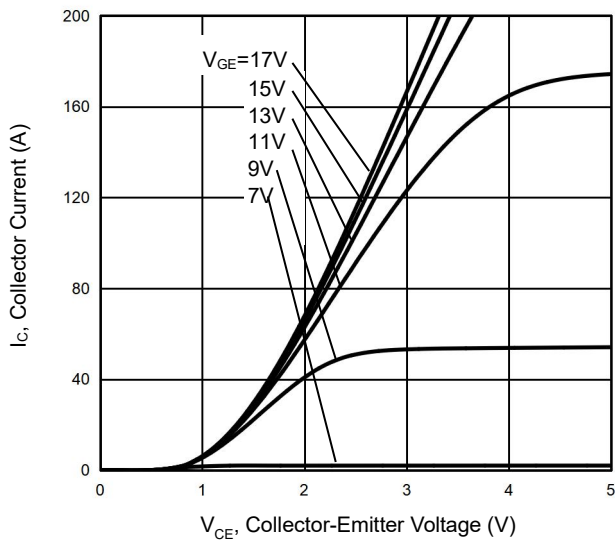


3) Definition of diode switching characteristics

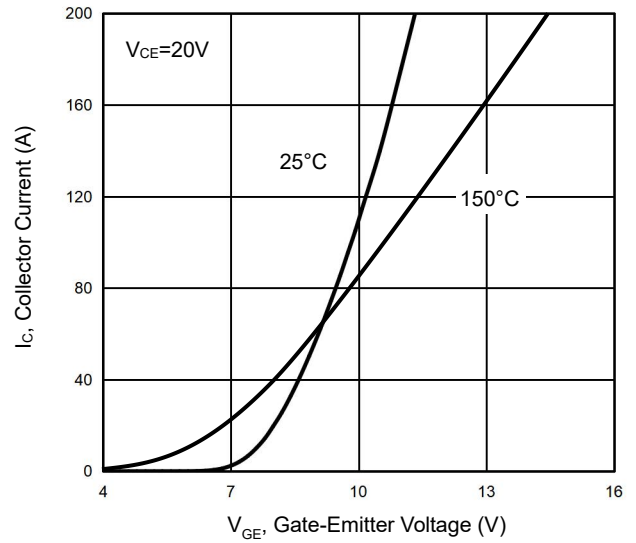


## Typical Electrical and Thermal Characteristics

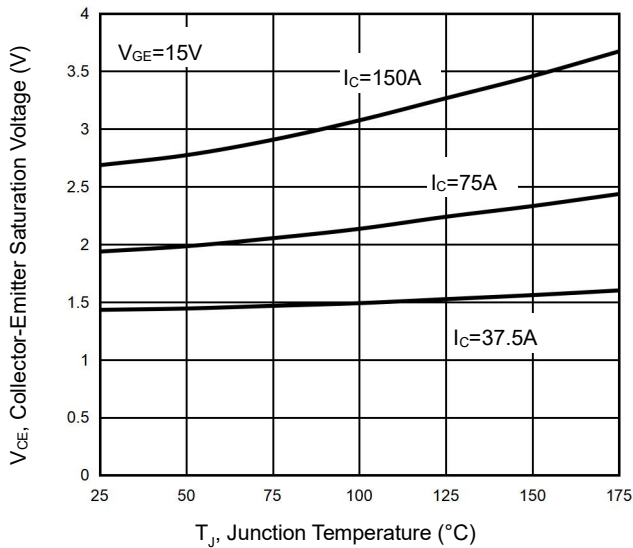
**Figure 1 Output Characteristics**



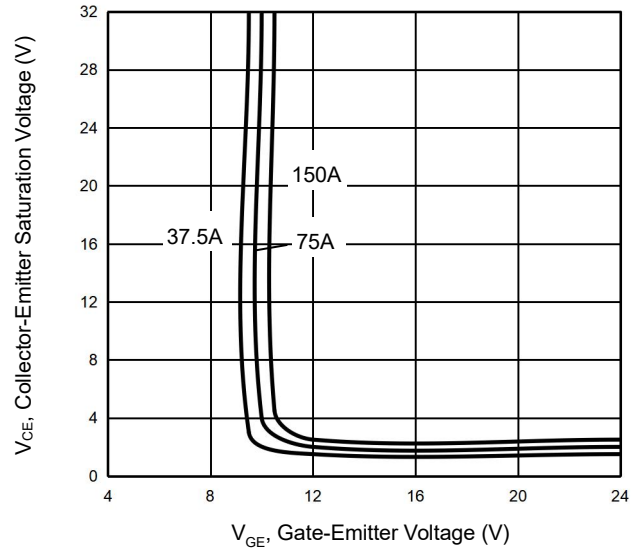
**Figure 2 Transfer Characteristics**



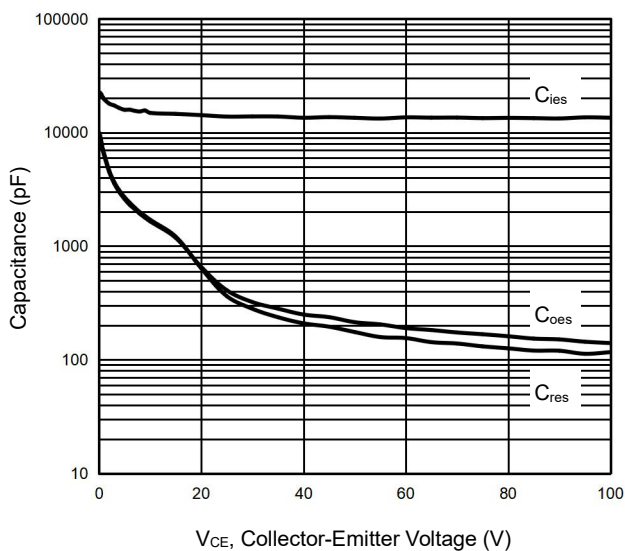
**Figure 3  $V_{CE(sat)}$  vs. Case Temperature**



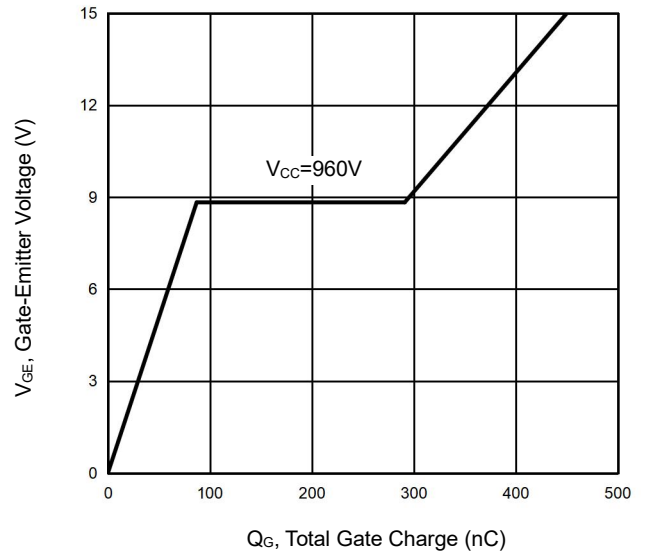
**Figure 4 Saturation Voltage vs.  $V_{GE}$**



**Figure 5 Capacitance Characteristics**



**Figure 6 Gate Charge Wave Form**



Typical Electrical and Thermal Characteristics

Figure 7 Forward Characteristics

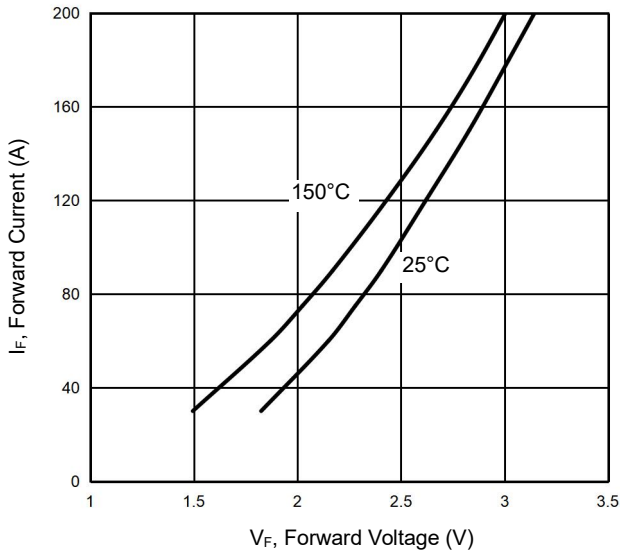


Figure 8  $V_F$  vs. Temperature

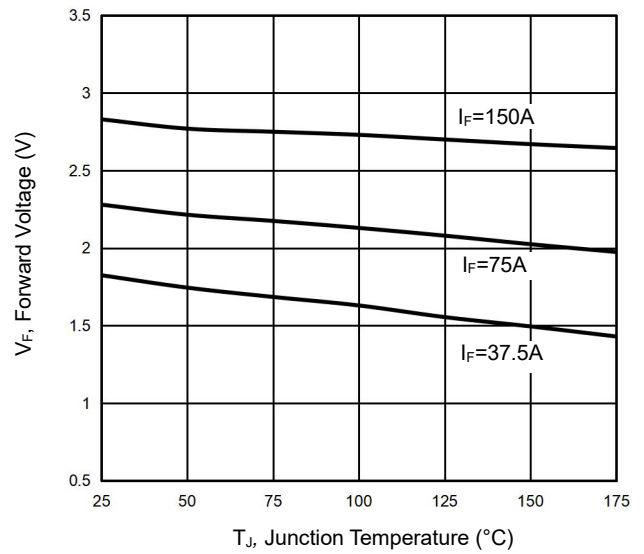


Figure 9 Switching Energy vs. Temperature

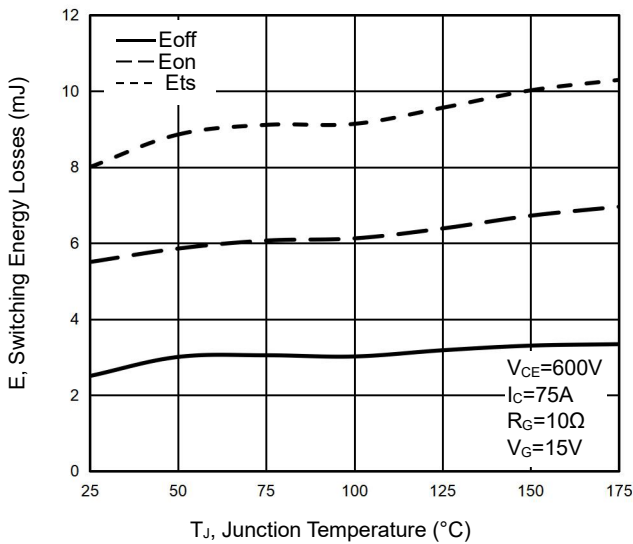


Figure 10 Forward Bias Safe Operating Area

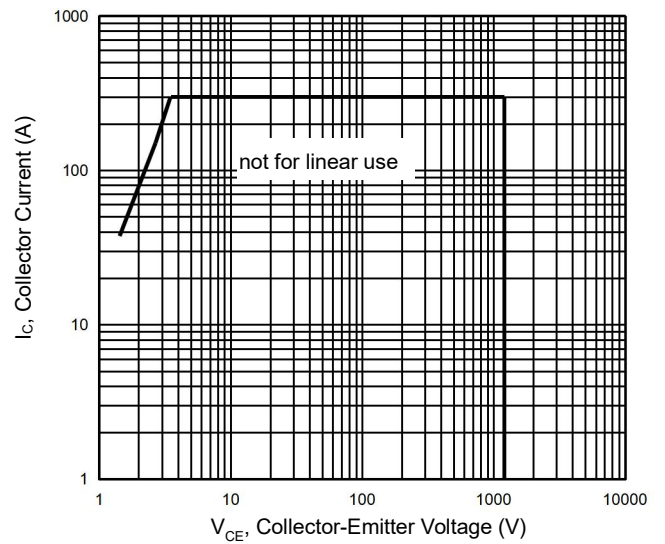


Figure 11 Gate-Emitter Threshold Voltage as a Function of Junction Temperature

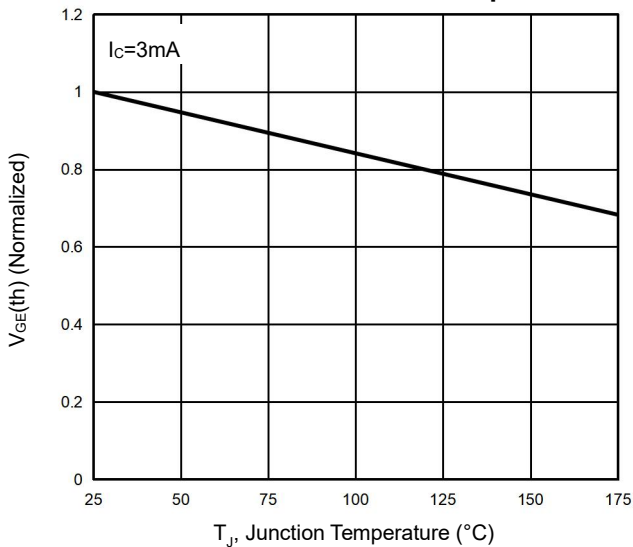
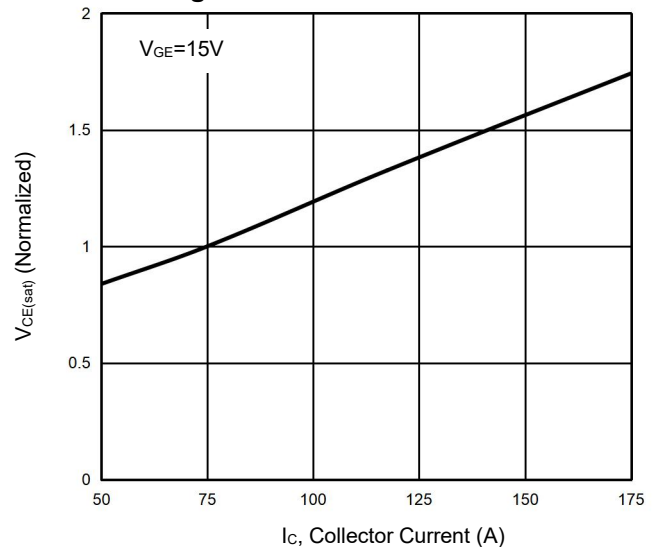


Figure 12 Typical Collector-Emitter Saturation Voltage as a function of Collector Current



Typical Electrical and Thermal Characteristics

Figure 13 Switching Loss vs.  $R_G$

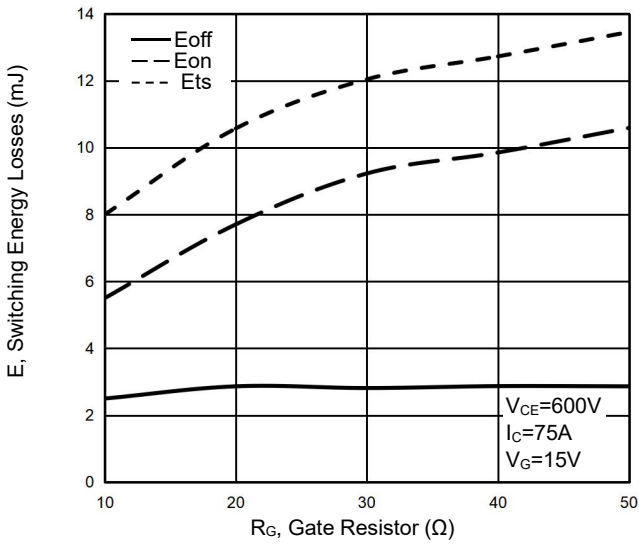


Figure 14 Switching Loss vs. Collector Current

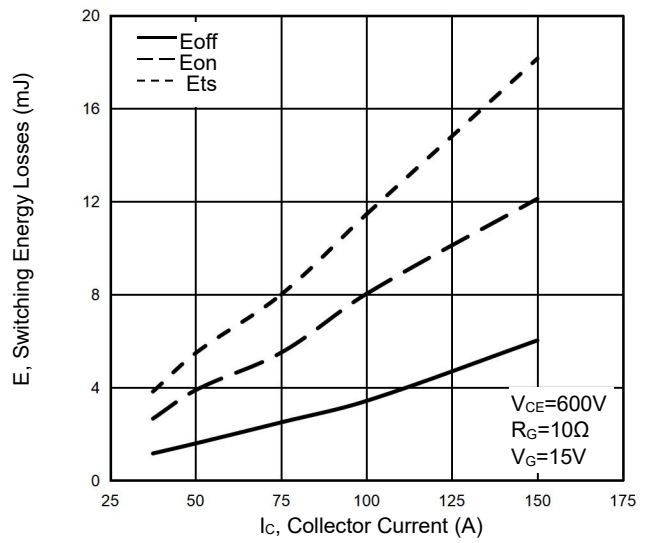


Figure 15 Switching Loss vs. Collector Current

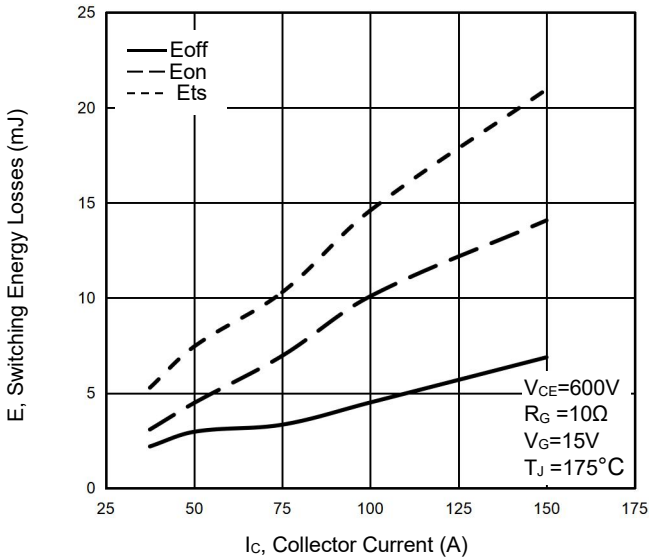


Figure 16  $P_{tot}$  vs. Case Temperature

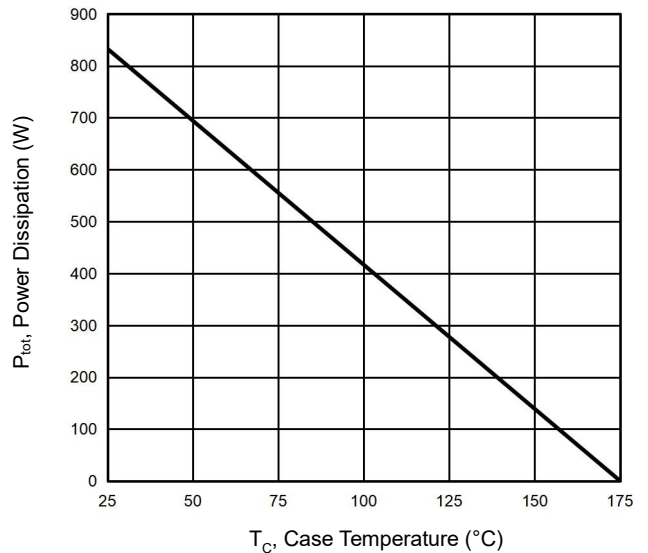


Figure 17  $V_{CES}$  vs. Case Temperature

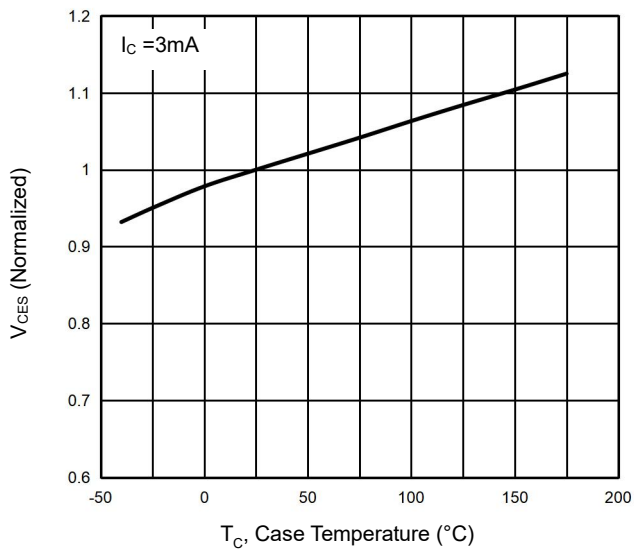
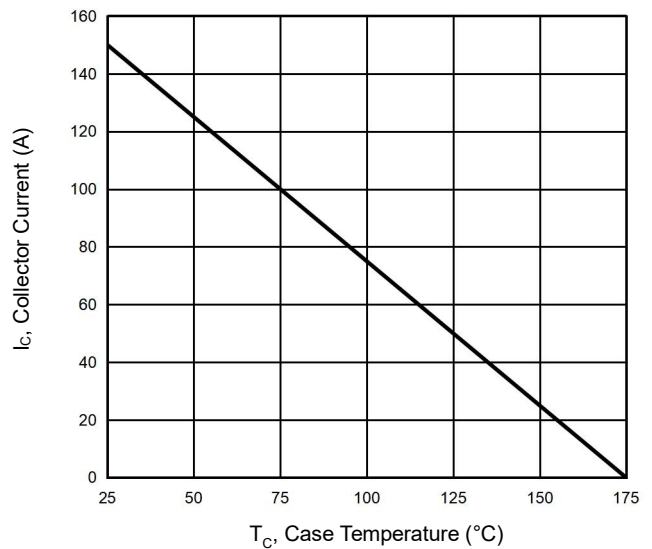
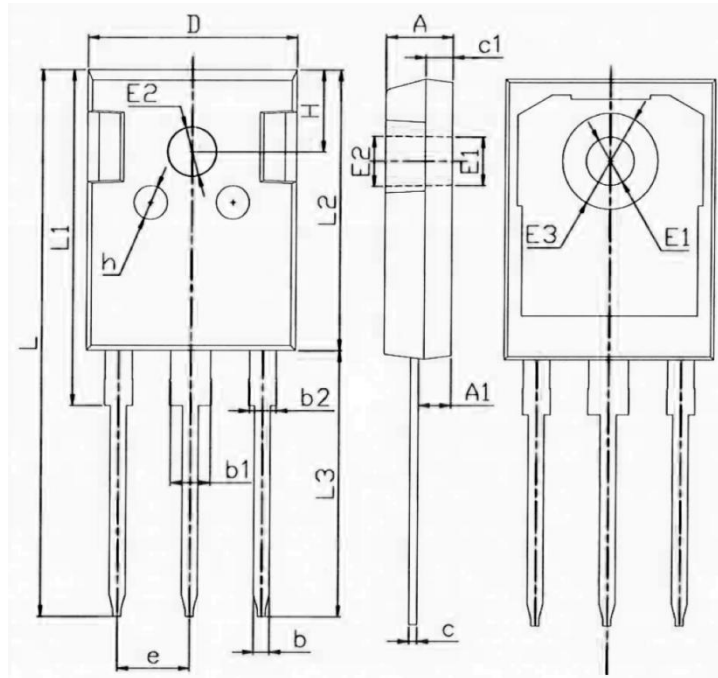


Figure 18  $I_C$  vs. Temperature

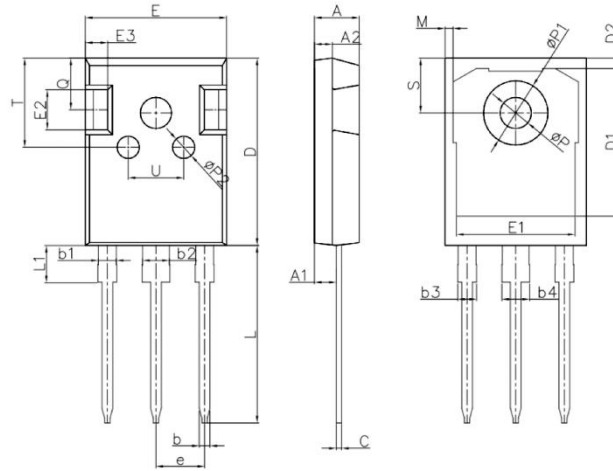


## TO-247-L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.80	5.20	0.19	0.20
A1	2.26	2.56	0.09	0.10
b	1.10	1.30	0.04	0.05
b1	2.85	3.15	0.11	0.12
b2	1.85	2.15	0.07	0.08
c	0.50	0.70	0.02	0.03
c1	1.85	2.15	0.07	0.08
D	15.60	16.00	0.61	0.63
E1	3.45	3.75	0.14	0.15
E2	3.55	3.85	0.14	0.15
E3	7.04	7.34	0.28	0.29
L	40.67	41.17	1.60	1.62
L1	24.80	25.10	0.98	0.99
L2	20.80	21.20	0.82	0.83
L3	19.72	20.12	0.78	0.79
e	5.29	5.59	0.21	0.22
H	6.00	6.30	0.24	0.25
h	2.35	2.65	0.09	0.10

## TO-247-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.19	0.20
A1	2.31	2.51	0.09	0.10
A2	1.90	2.10	0.07	0.08
b	1.16	1.26	0.05	0.06
b1	1.96	2.06	0.08	0.09
b2	2.96	3.06	0.12	0.13
b3	--	2.25	--	0.09
b4	--	3.25	--	0.13
c	0.59	0.66	0.02	0.03
D	20.90	21.10	0.82	0.83
D1	16.25	16.85	0.64	0.66
D2	1.05	1.35	0.04	0.05
E	15.70	15.90	0.62	0.63
E1	13.10	13.50	0.52	0.53
E2	4.40	4.60	0.17	0.18
E3	2.40	2.60	0.09	0.10
e	5.436 BSC		0.214 BSC	
L	19.80	20.10	0.78	0.79
L1	--	4.30	--	0.17
M	0.35	0.95	0.01	0.04
P	3.40	3.60	0.13	0.14
P1	7.00	7.40	0.28	0.29
P2	2.40	2.60	0.09	0.10
Q	5.60	6.00	0.22	0.24
S	6.05	6.25	0.24	0.25
T	9.80	10.20	0.39	0.40
U	6.00	6.40	0.24	0.25



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