

1200V, 75A, Trench FS II Fast IGBT

General Description

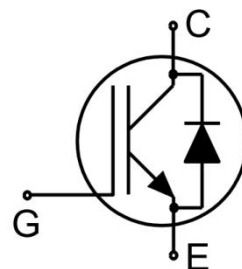
Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 1200V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

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

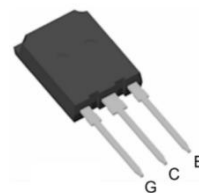
- PV power
- Three-level Solar String Inverter
- UPS



Schematic diagram

Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE75TD120VTP	TO-247P	NCE75TD120VTP



TO-247P

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	± 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	$^{\circ}\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	0.44	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^{\circ}\text{C/W}$

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

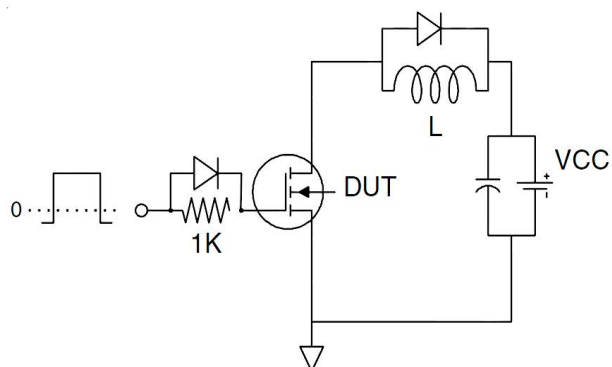
Symbol	Parameter	Conditions		Value			Units
				Min.	Typ.	Max.	
Static Characteristics							
V _{(BR)CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V,I _{CE} =3mA		1200	--	--	V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V,V _{CE} =1200V		--	--	400	uA
I _{GES(F)}	Gate to Emitter Forward 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	T _J =25°C	--	1.70	1.95	V
		V _{GE} =15V	T _J =175°C	--	1.95	--	V
V _{GE(th)}	Gate Threshold Voltage	I _C =3mA,V _{CE} =V _{GE}		4.5	--	6.0	V
Dynamic Characteristics							
C _{ies}	Input Capacitance	V _{CE} =30V,V _{GE} =0V, f=1MHz		--	9747	--	pF
C _{oes}	Output Capacitance			--	327	--	
C _{res}	Reverse Transfer Capacitance			--	271	--	
Q _g	Total Gate Charge	V _{CC} =960V, I _C =75A, V _{GE} =15V		--	572	--	nC
Q _{ge}	Gate to Emitter Charge			--	69	--	
Q _{gc}	Gate to Collector Charge			--	368	--	
Switching Characteristics							
t _{d(ON)}	Turn-on Delay Time	V _{CE} =600V,I _C =75A, V _{GE} =0/15V, R _g =8Ω 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			--	5.6	--	mJ
E _{off}	Turn-Off Switching Loss			--	2.7	--	
E _{ts}	Total Switching Loss			--	8.3	--	
E _{on}	Turn-On Switching Loss	V _{CE} =600V,I _C =75A,		--	7.1	--	mJ
E _{off}	Turn-Off Switching Loss	V _{GE} =0/15V, R _g =8Ω		--	3.6	--	
E _{ts}	Total Switching Loss	T _J =175°C		--	10.7	--	

Electrical Characteristics of the Diode (T_c= 25°C unless otherwise specified)

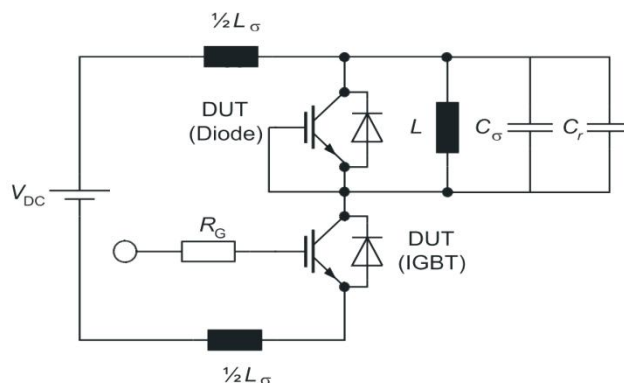
Symbol	Parameter	Conditions		Rating			Units
				Min.	Typ.	Max.	
V _{FM}	Diode Forward Voltage	I _F =75A	T _j =25°C	--	2.2	2.8	V
			T _j =175°C	--	2.0	--	V
T _{rr}	Reverse Recovery Time	I _F =37.5A, di/dt=800A/us		--	180	--	ns
I _{RRM}	Diode Peak Reverse Recovery Current			--	29	--	A
Q _{rr}	Reverse Recovery Charge			--	2.6	--	uC
T _{rr}	Reverse Recovery Time	I _F =37.5A, di/dt=800A/us T _j =175°C		--	320	--	ns
I _{RRM}	Diode Peak Reverse Recovery Current			--	42	--	A
Q _{rr}	Reverse Recovery Charge			--	6.7	--	uC

Test Circuit

1) Gate Charge Test Circuit

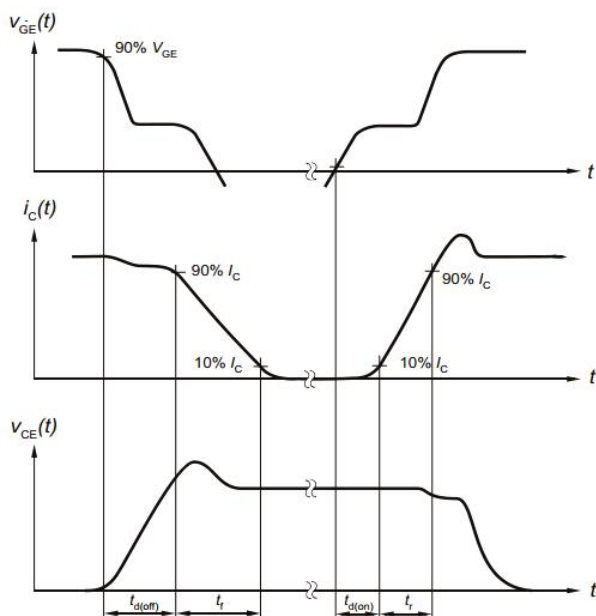


2) Switch Time Test Circuit

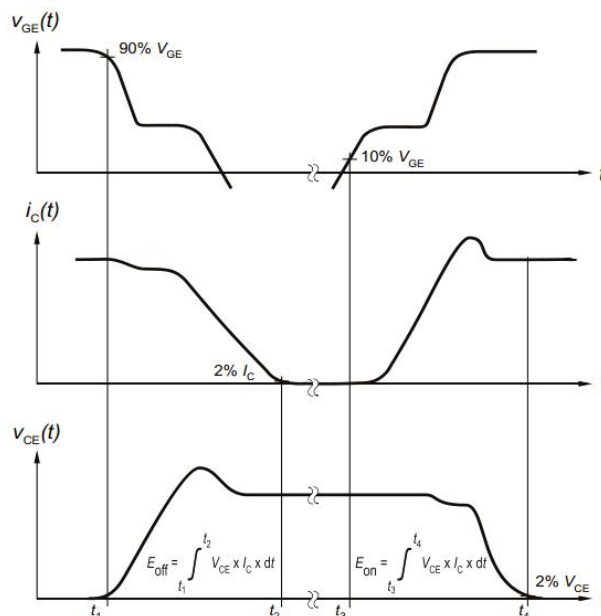


Switching characteristics

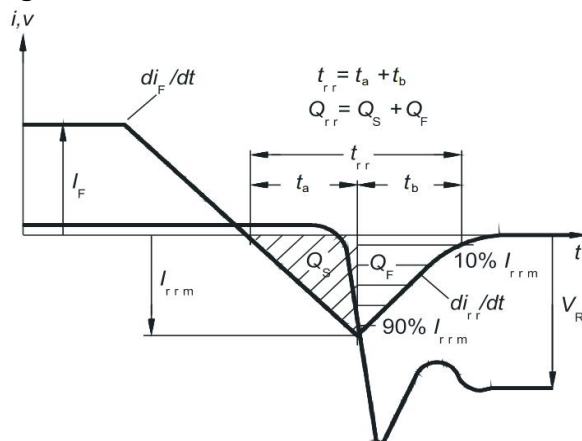
1) Definition of switching times



2) Definition of switching losses



3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

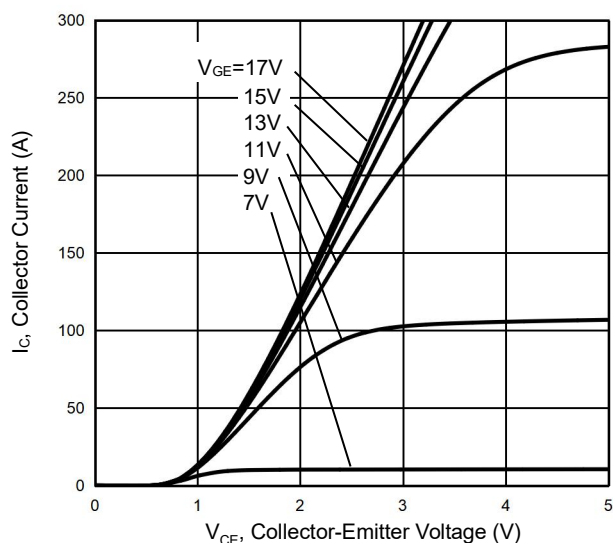


Figure 2 Output Characteristics

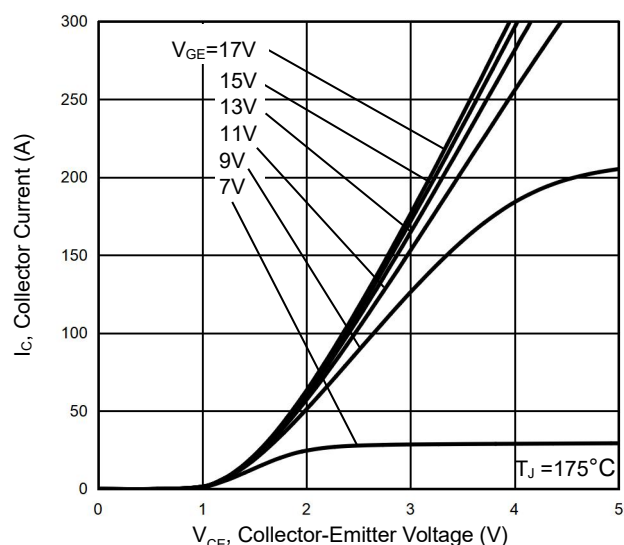


Figure 3 Transfer Characteristics

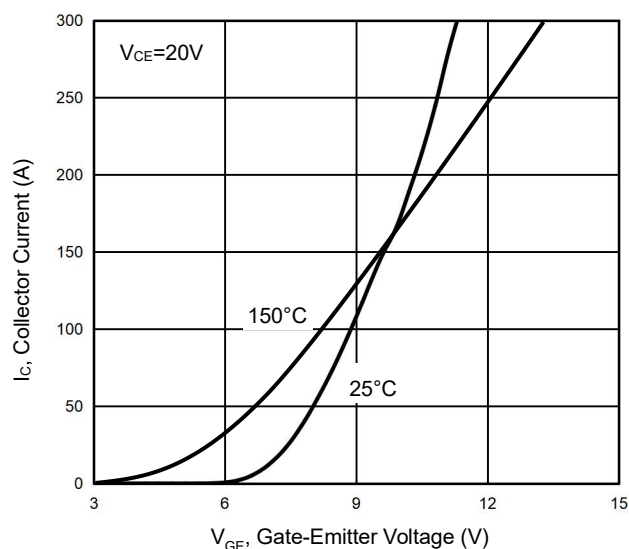


Figure 4 VCE(sat) vs. Case Temperature

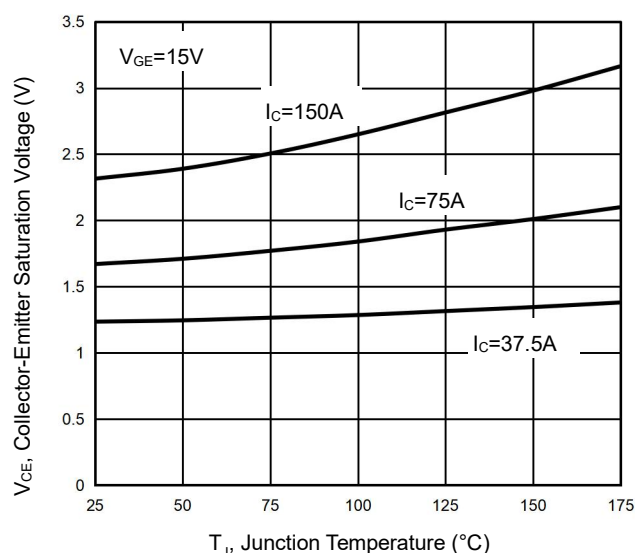


Figure 5 Saturation Voltage vs. VGE

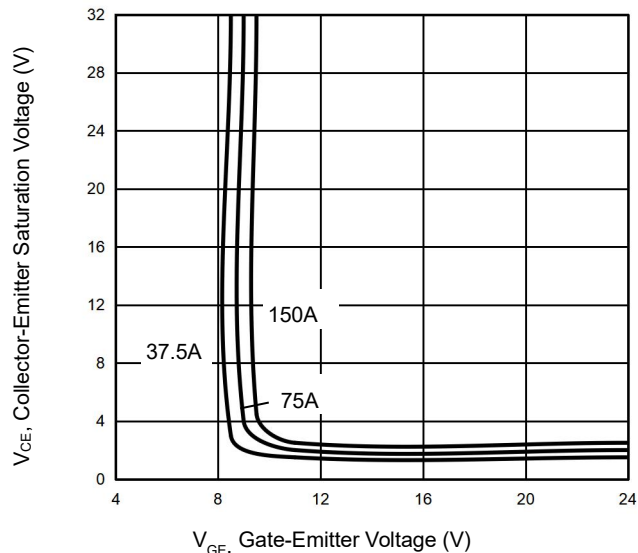
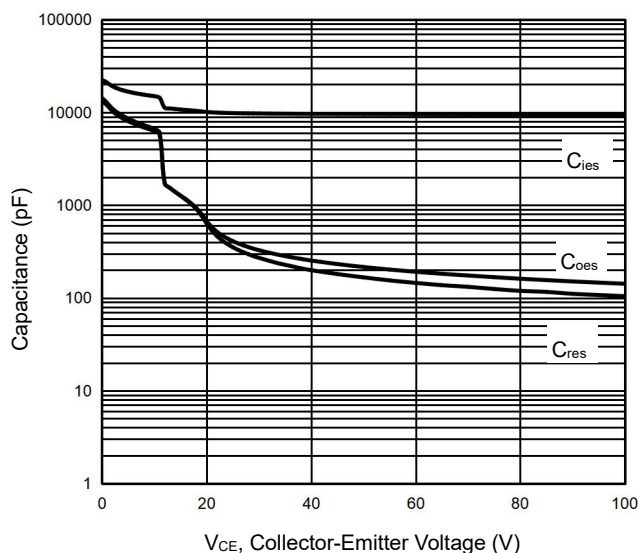


Figure 6 Capacitance Characteristics



Typical Electrical and Thermal Characteristics

Figure 7 Gate Charge Wave Form

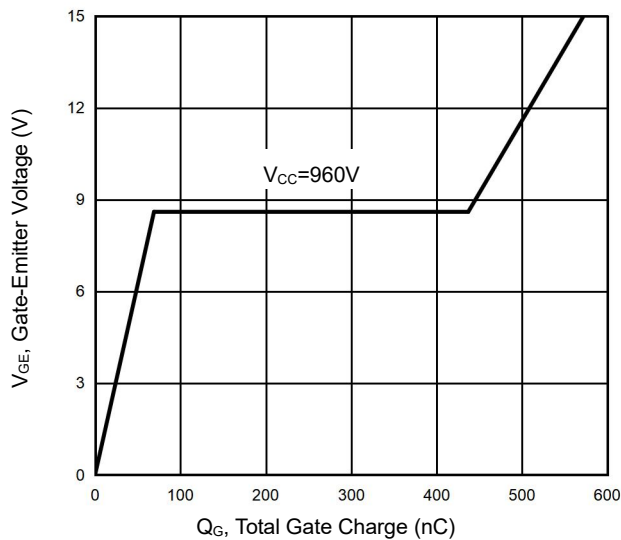


Figure 9 V_F vs. Temperature

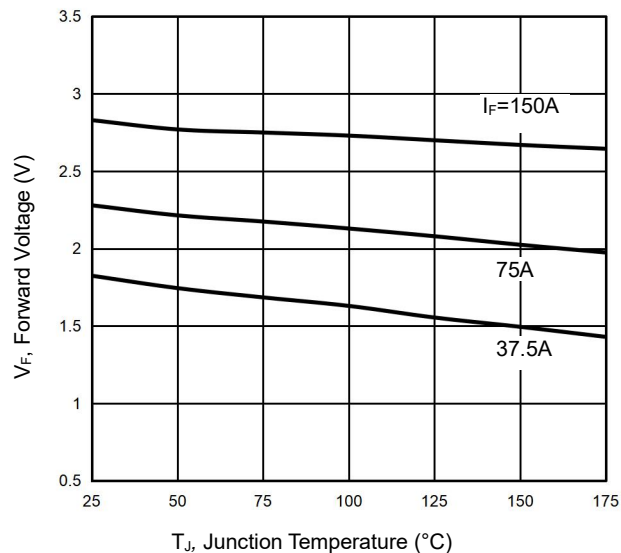


Figure 11 Forward Bias Safe Operating Area

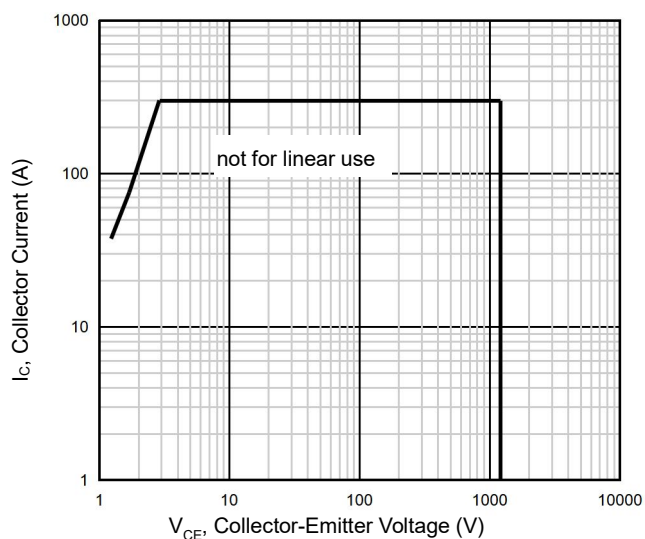


Figure 8 Forward Characteristics

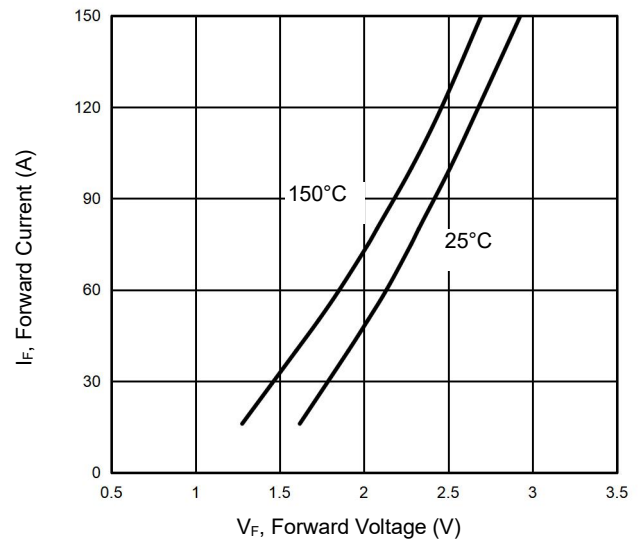


Figure 10 Switching Energy vs. Temperature

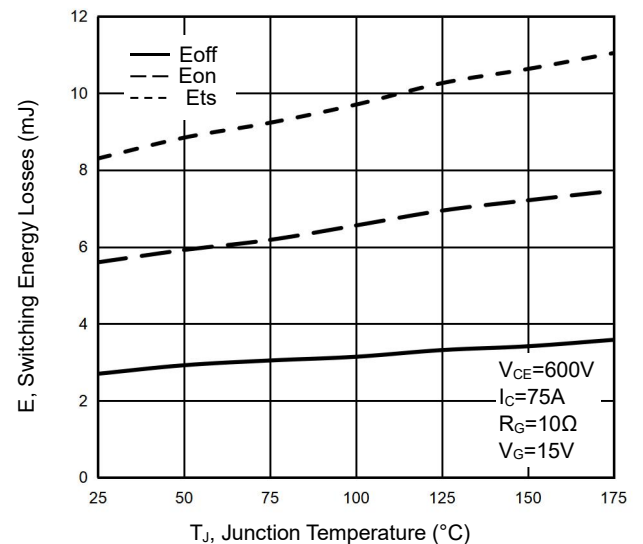
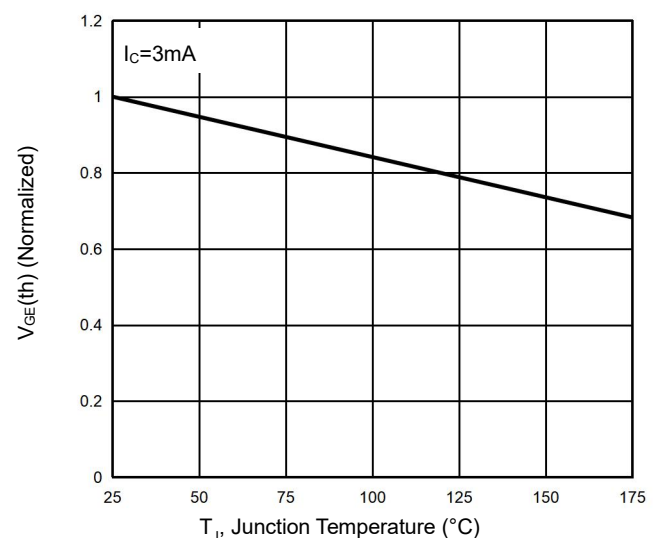


Figure 12 Gate-Emitter Threshold Voltage as a Function of Junction Temperature



Typical Electrical and Thermal Characteristics

Figure 13 Typical Collector-Emitter Saturation Voltage as a function of Collector Current

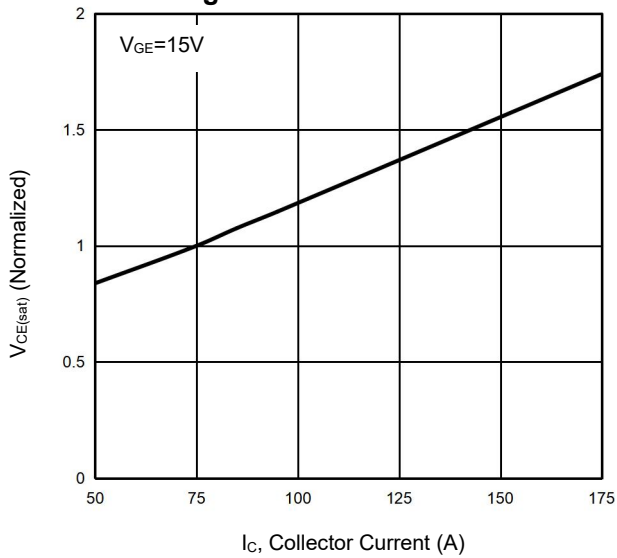


Figure 14 Switching Loss vs. R_G

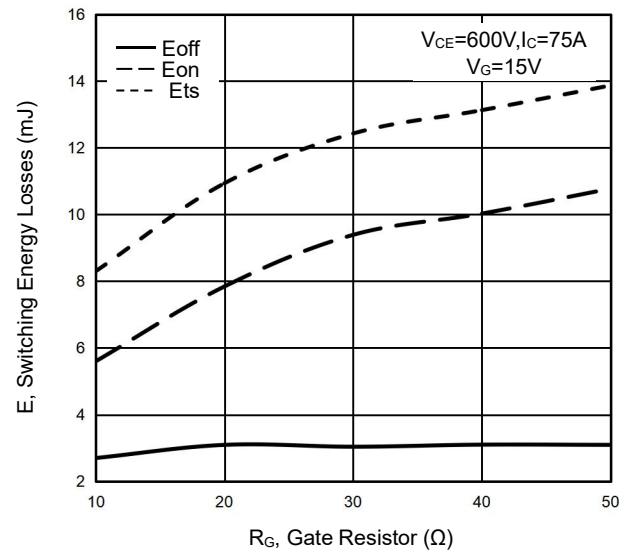


Figure 15 Switching Loss vs. Collector Current

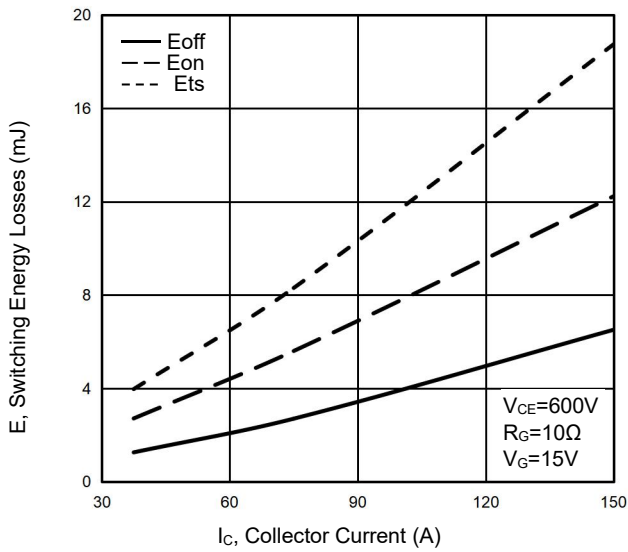


Figure 16 Switching Loss vs. Collector Current

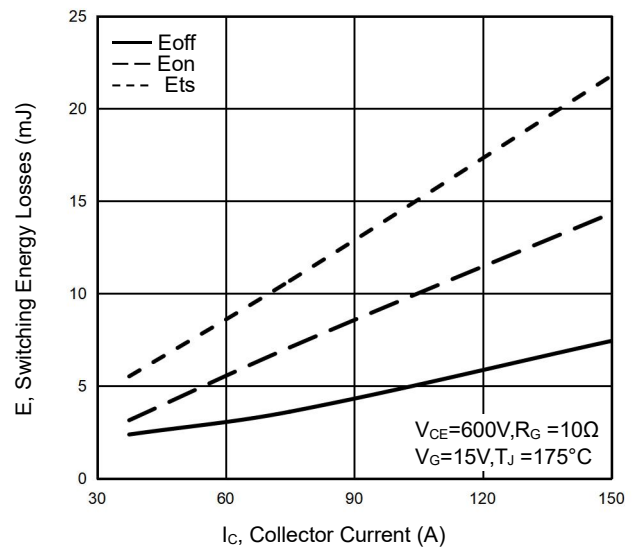


Figure 17 P_tot vs. Case Temperature

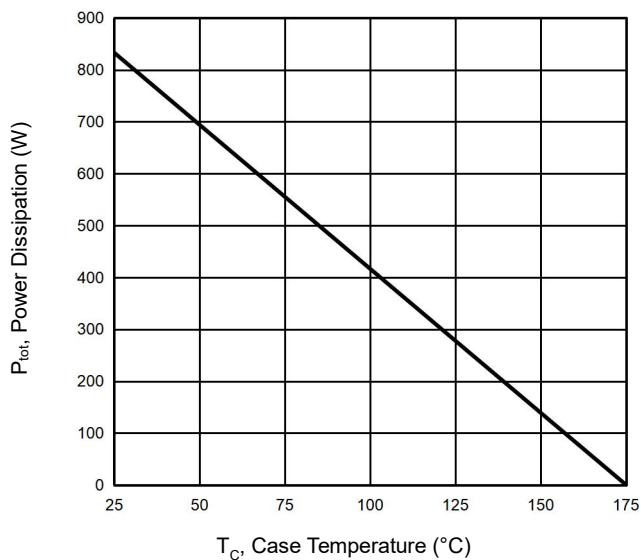
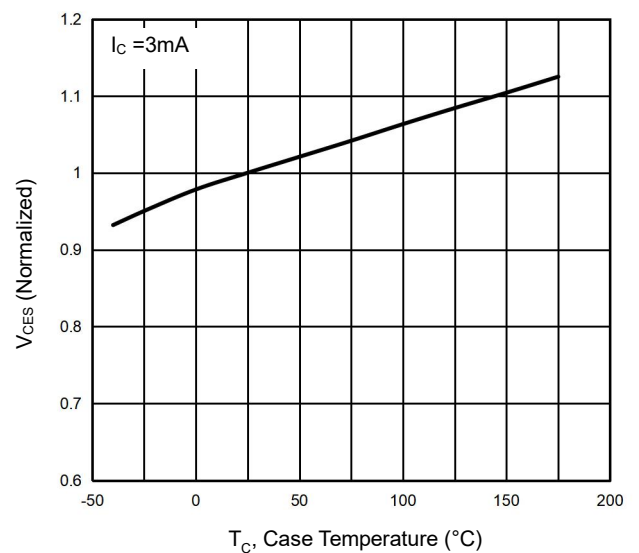


Figure 18 V_CES vs. Case Temperature



Typical Electrical and Thermal Characteristics

Figure 19 I_C vs. Temperature

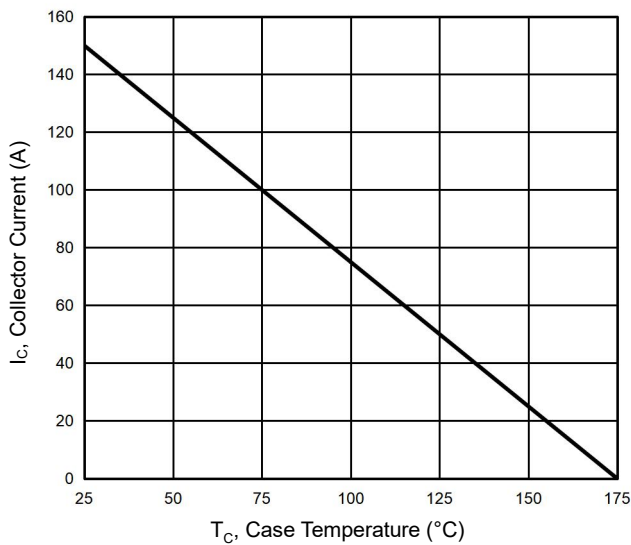


Figure 20 Switching Time vs. R_G

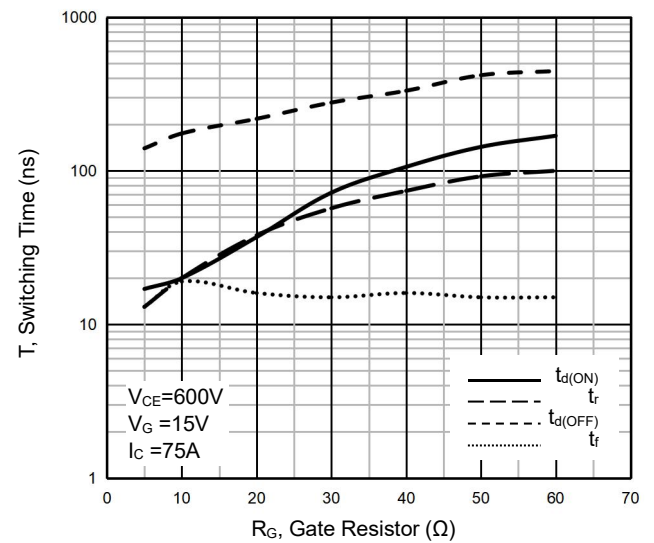


Figure 21 Switching Loss vs. V_{CE}

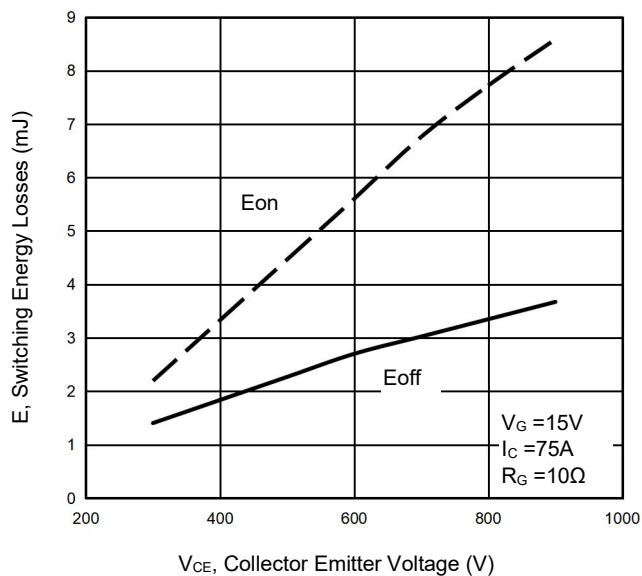


Figure 22 Switching Loss vs. R_G

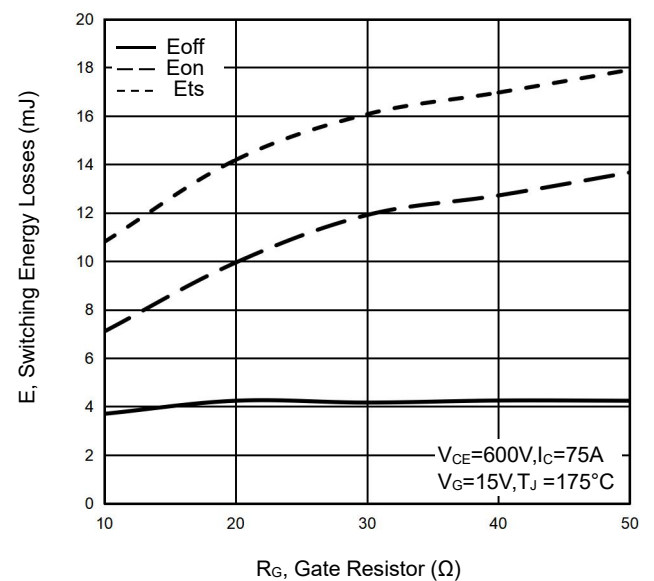
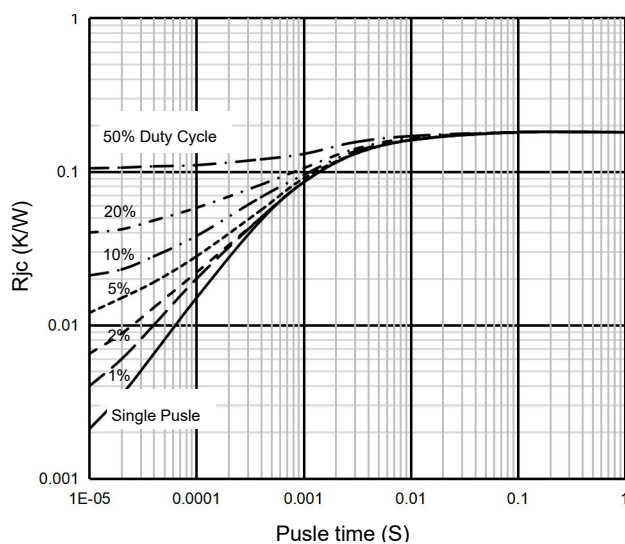
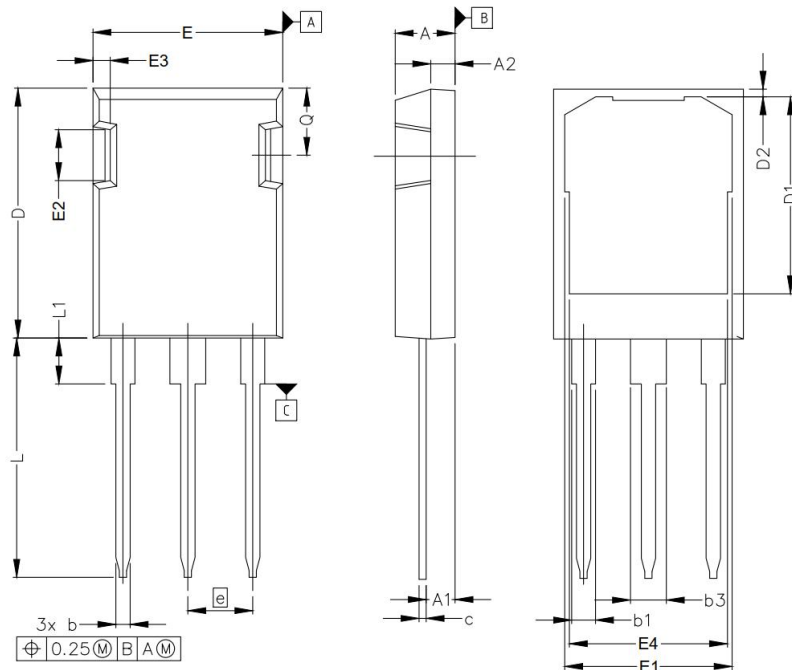


Figure 23 IGBT Transient Thermal Impedance

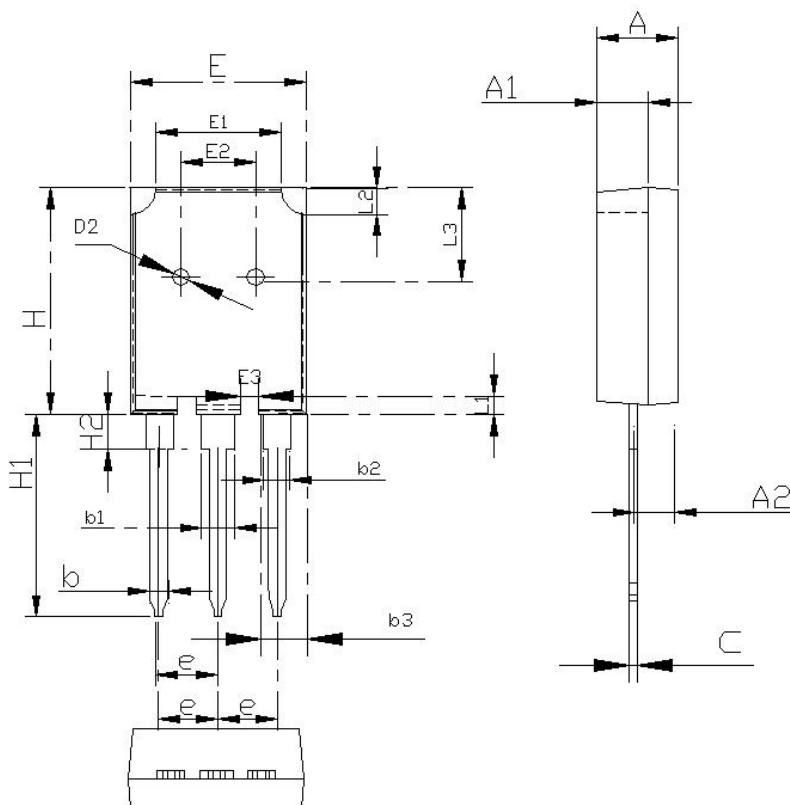


TO-247P-B Package Information



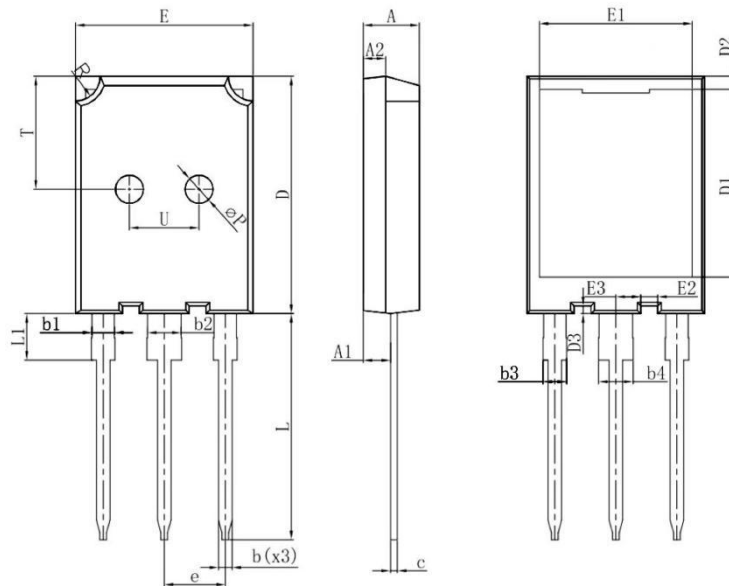
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.19	0.21
A1	2.29	2.54	0.09	0.10
A2	1.91	2.16	0.08	0.09
b	1.07	1.33	0.04	0.05
b1	1.91	2.41	0.08	0.09
b3	2.87	3.38	0.11	0.13
c	0.55	0.68	0.02	0.03
D	20.80	21.10	0.82	0.83
D1	16.25	17.65	0.64	0.69
D2	0.50	0.80	0.02	0.03
E	15.75	16.13	0.62	0.64
E1	13.10	14.15	0.52	0.56
E2	3.68	5.10	0.14	0.20
E3	1.00	1.90	0.04	0.07
E4	12.38	13.43	0.49	0.53
e	5.44 BSC		0.21 BSC	
L	19.81	20.32	0.78	0.80
L1	3.70	4.00	0.15	0.16
Q	5.49	6.00	0.22	0.24

TO-247P-d Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.80	5.20	0.18	0.20
A1	2.80	3.20	0.11	0.12
A2	1.80	2.20	0.07	0.08
b	1.00	1.40	0.03	0.05
b1	2.90	3.30	0.11	0.13
b2	1.90	2.30	0.07	0.09
b3	3.90	4.30	0.15	0.16
c	0.45	0.75	0.01	0.03
e	5.25	5.65	0.20	0.22
E	15.60	16.00	0.61	0.63
E1	10.20	11.00	0.40	0.43
E2	6.30	6.90	0.24	0.27
E3	1.60	2.00	0.06	0.07
L1	0.35	0.65	0.01	0.02
L2	1.80	2.20	0.07	0.08
L3	9.50	10.50	0.37	0.41
H	20.50	21.50	0.80	0.84
H1	19.50	20.50	0.76	0.80
H2	3.50	4.50	0.13	0.17

TO-247P-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	1.10	1.30	0.04	0.05
b1	1.90	2.10	0.07	0.08
b2	2.90	3.10	0.11	0.12
b3	--	2.25	--	0.09
b4	--	3.25	--	0.13
c	0.55	0.65	0.02	0.03
D	20.90	21.10	0.82	0.83
D1	16.55	17.15	0.65	0.68
D2	1.05	1.35	0.04	0.05
D3	0.58	0.78	0.02	0.03
E	15.70	15.90	0.62	0.63
E1	13.40	13.80	0.53	0.54
E2	1.40	1.60	0.06	0.07
E3	2.12	2.32	0.08	0.09
e	5.436 BSC		0.21 BSC	
L	19.90	20.10	0.78	0.79
L1	3.94	4.30	0.16	0.17
∅ P	2.40	2.60	0.09	0.10
R	2.10	2.30	0.08	0.09
T	9.80	10.20	0.39	0.40
U	6.00	6.40	0.24	0.25

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