1200V, 100A, Trench FS Gen.7 IGBT

General Description

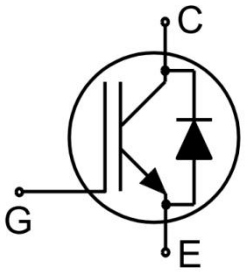
Using NCE's proprietary high density trench gate design and advanced FS (Field Stop) Gen.7 technology, the 1200V Trench Field Stop Gen.7 IGBT offers superior conduction and switching performances, and easy parallel operation;

Features

- Trench Field Stop Gen.7 Technology Offering
- Low saturation voltage: V_{CEsat} = 1.6V(Typ.) @ I_C = 100 A
- High speed switching, Low switching losses
- Maximum junction temperature T_{vjmax} = 175°C
- Tighten parameter distribution
- High ruggedness, temperature stable behavior
- Pb-free lead plating; RoHS compliant

Application

- Air Condition
- Inverters
- Motor drives



Schematic diagram

Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE100ED120BTP	TO-247P-3L	NCE100ED120BTP



TO-247P-3L

Absolute Maximum Ratings (T_C=25°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	200	A
	Collector Current @T_C = 100 °C	100	A
I_{Cpuls}	Pulsed Collector Current，t_p limited by T_{jmax}	300	A
-	Turn off safe operating area，V_{CE}=1200V，T_j=175°C	300	A
I_F	Diode Continuous Forward Current @T_C = 100 °C	100	A
I_{FM}	Diode Maximum Forward Current	300	A
P_D	Power Dissipation @ T_C = 25°C	810	W
	Power Dissipation @T_C = 100 °C	405	W
T_{stg}	Storage Temperature	-55 to +150	°C
T_{vj}	Operating junction temperature	-40 to +175	°C
T_L	Maximum Temperature for Soldering	260	°C
t_{SC}	Short circuit withstand time V_{GE}=15V, V_{CC}=800V Allowed number of short circuits<1000 Time between short circuits:≥1.0s,T_j≤150°C	10	us

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	0.33	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	°C/W

Electrical Characteristics (T_C=25°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		--	--	30	uA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE}=+30V,V_{CE}=0V		--	--	100	nA
$I_{GES(R)}$	Gate to Emitter Reverse Leakage	V_{GE}=-30V,V_{CE} =0V		--	--	100	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=50A	T_j=25°C	--	1.30	--	V
			T_j=150°C	--	1.50	--	
		V_{GE}=15V, I_C=100A	T_j=25°C	--	1.60	2.10	
			T_j=150°C	--	2.10	--	
$V_{GE(th)}$	Gate Threshold Voltage	I_C=3mA,V_{CE}=V_{GE}		5.00	5.75	6.50	V
Dynamic Characteristics							
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V, f=1MHz		6900	8900	9900	pF
C_{oes}	Output Capacitance			--	232	--	
C_{res}	Reverse Transfer Capacitance			--	14	--	
Q_g	Total Gate Charge	V_{CC}=960V, I_C=100A, V_{GE}=15V		--	283	--	nC
Q_{ge}	Gate to Emitter Charge			--	84	--	
Q_{gc}	Gate to Collector Charge			--	122	--	
R_G	Internal Gate Resistance	f=1MHz		--	3.2	--	Ω
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	V_{GE}=15V,V_{CC}=800V, t_{SC}≤10us,T_j≤150°C		--	400	--	A
Switching Characteristics							
$t_{d(ON)}$	Turn-on Delay Time	V_{CE}=600V,I_C=100A, V_{GE}=0/15V, R_g=20Ω Inductive Load T_j=25°C		--	136	--	ns
t_r	Rise Time			--	134	--	
$t_{d(OFF)}$	Turn-Off Delay Time			--	438	--	
t_f	Fall Time			--	82	--	
E_{on}	Turn-On Switching Loss			--	18.5	--	mJ
E_{off}	Turn-Off Switching Loss			--	5.3	--	
E_{ts}	Total Switching Loss			--	23.8	--	
E_{on}	Turn-On Switching Loss	V_{CE}=600V,I_C=100A, V_{GE}=0/15V, R_g=20Ω Inductive Load T_j=150°C		--	25.2	--	mJ
E_{off}	Turn-Off Switching Loss			--	7.0	--	
E_{ts}	Total Switching Loss			--	32.2	--	

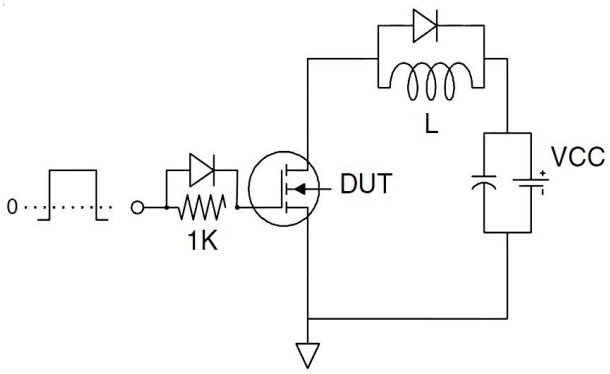
Electrical Characteristics of the Diode (T_C= 25°C unless otherwise specified)

Symbol	Parameter	Conditions		Rating			Units
				Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	I_F=100A	T_j=25°C	--	1.75	2.75	V
			T_j=150°C	--	1.65	--	
T_{rr}	Reverse Recovery Time	I_F=100A,R_g=20Ω T_j=25°C		--	554	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current			--	21	--	A
Q_{rr}	Reverse Recovery Charge			--	5.96	--	uC
E_{rec}	Reverse Recovery Energy			--	1.56	--	mJ
T_{rr}	Reverse Recovery Time	I_F=100A,R_g=20Ω T_j=150°C		--	806	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current			--	27	--	A
Q_{rr}	Reverse Recovery Charge			--	13.76	--	uC
E_{rec}	Reverse Recovery Energy			--	4.07	--	mJ

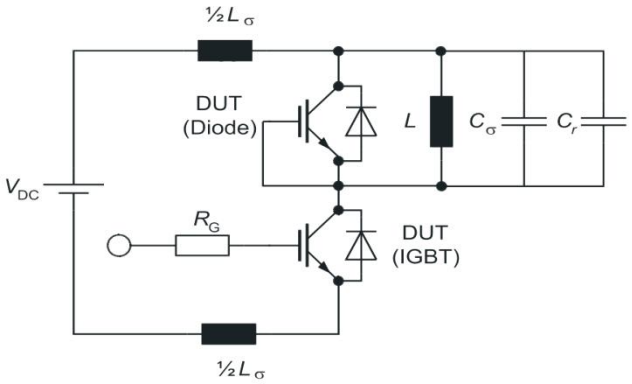
Note: For optimum lifetime and reliability, NCE recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Test Circuit

1) Gate Charge Test Circuit

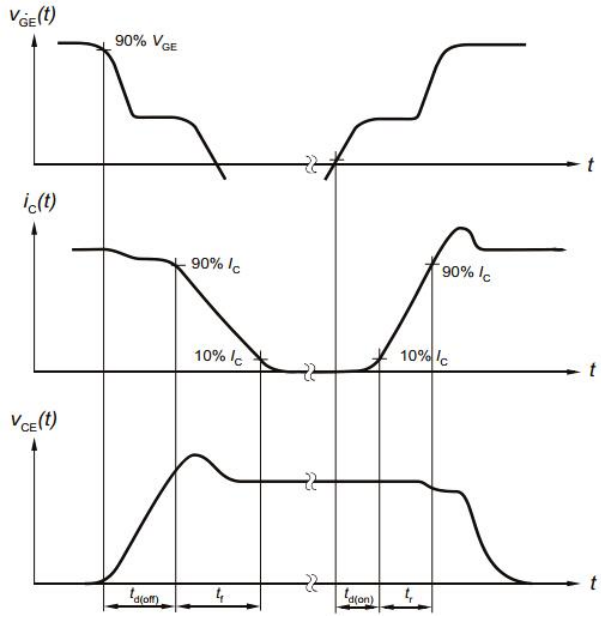


2) Switch Time Test Circuit

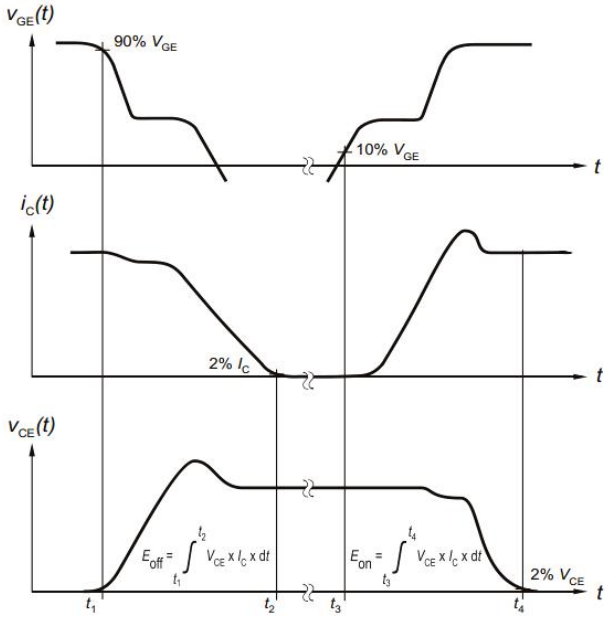


Switching characteristics

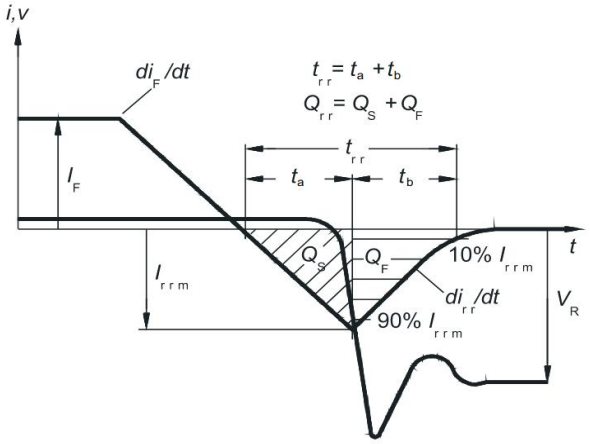
1) Definition of switching times



2) Definition of switching losses



3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

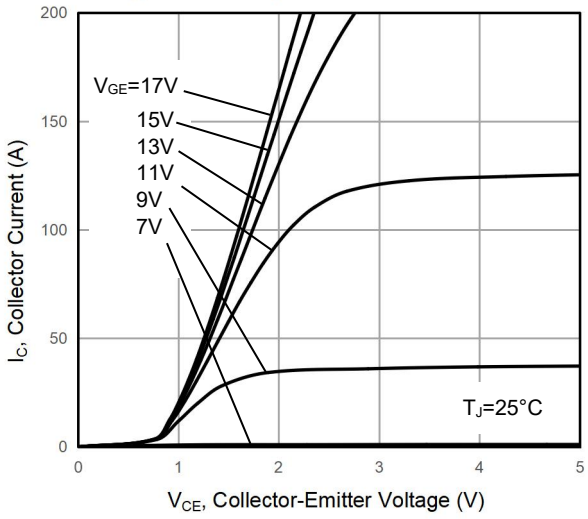


Figure 2 Output Characteristics

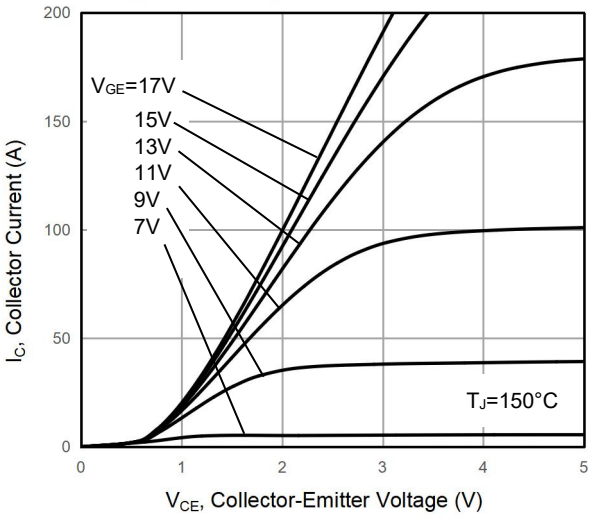


Figure 3 $V_{CE(sat)}$ vs. Case Temperature

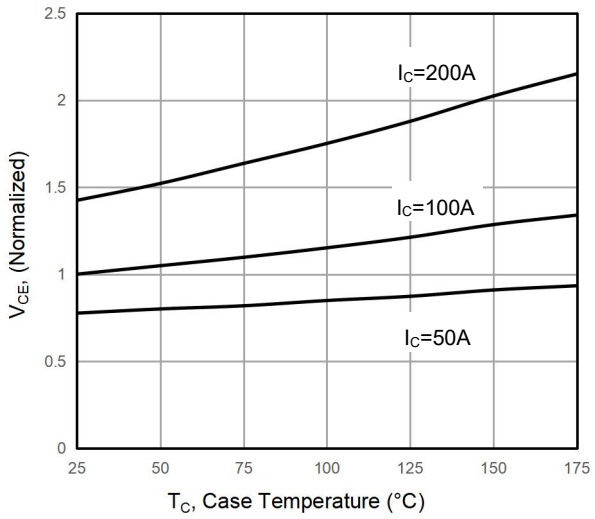


Figure 4 Transfer Characteristics

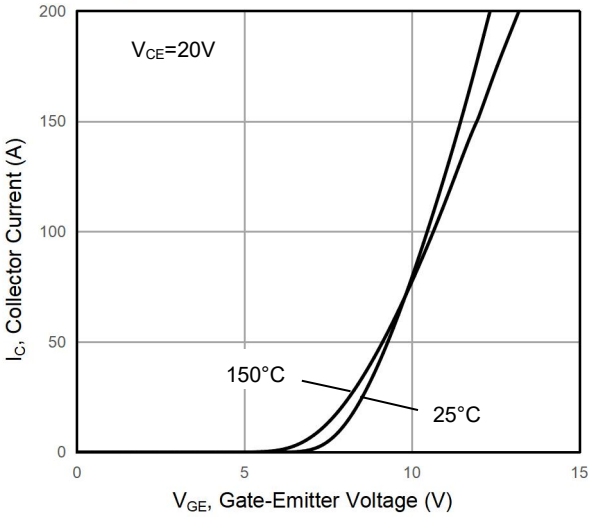


Figure 5 Capacitance Characteristics

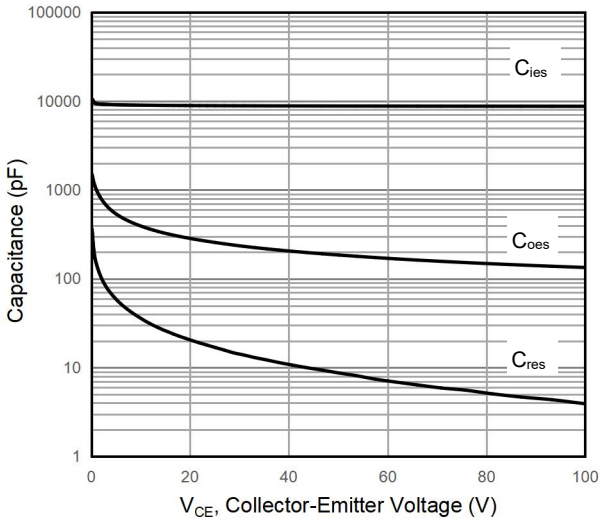
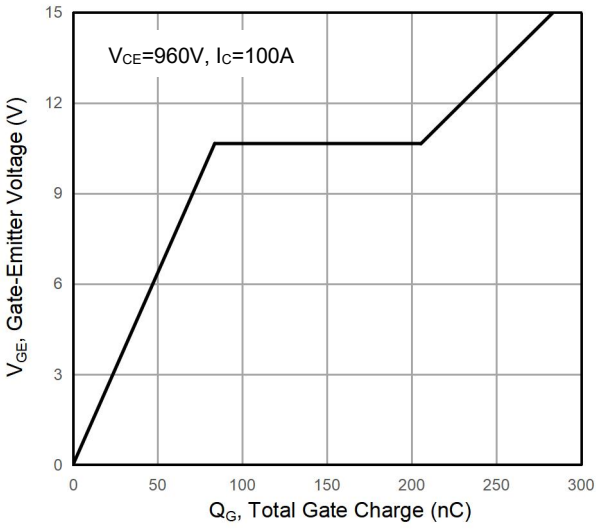


Figure 6 Gate Charge Wave Form



Typical Electrical and Thermal Characteristics

Figure 7 Forward Characteristics

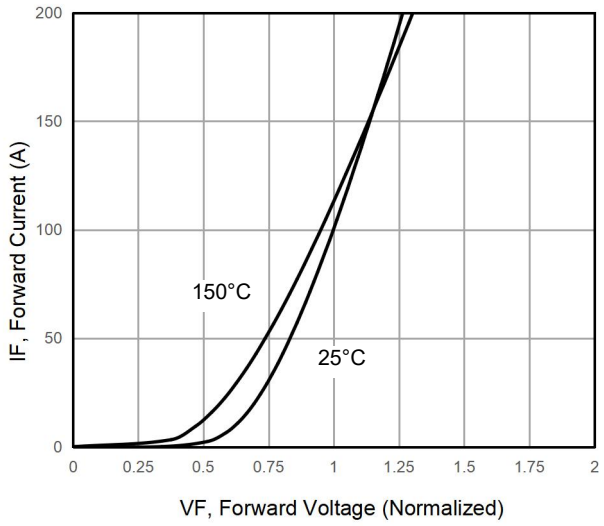


Figure 8 V_F vs. Temperature

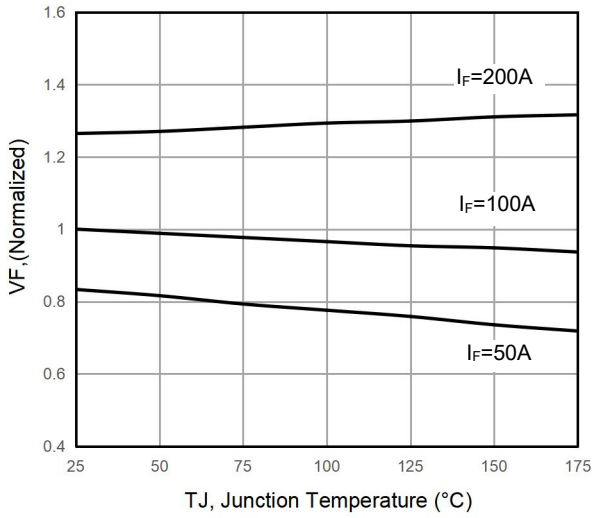


Figure 9 Saturation Voltage vs. V_{GE}

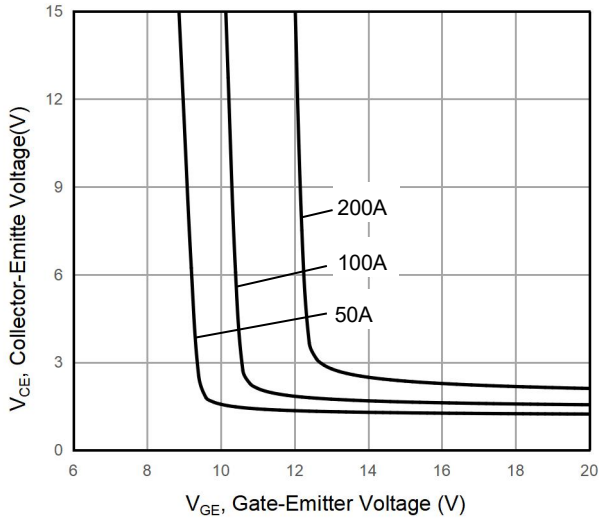


Figure 10 $V_{(BR)CES}$ vs. Temperature

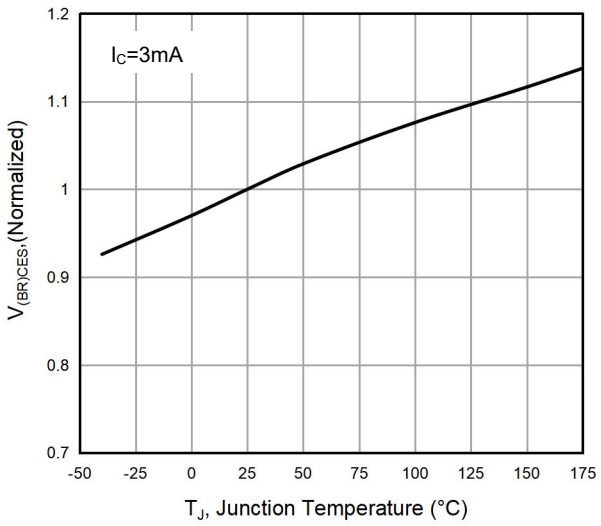


Figure 11 $V_{GE(th)}$ vs. Temperature

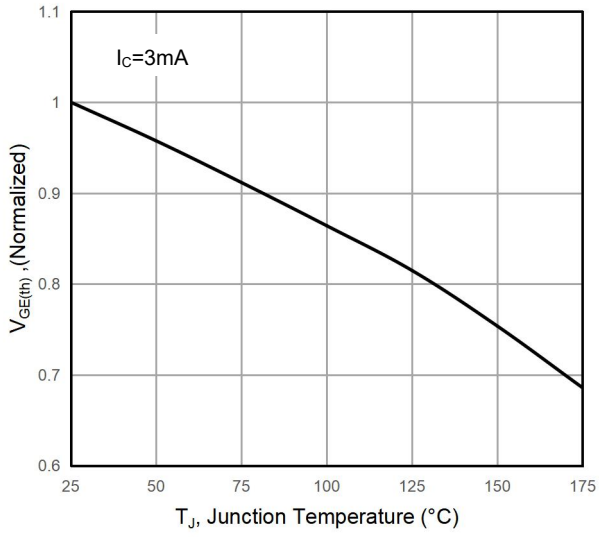
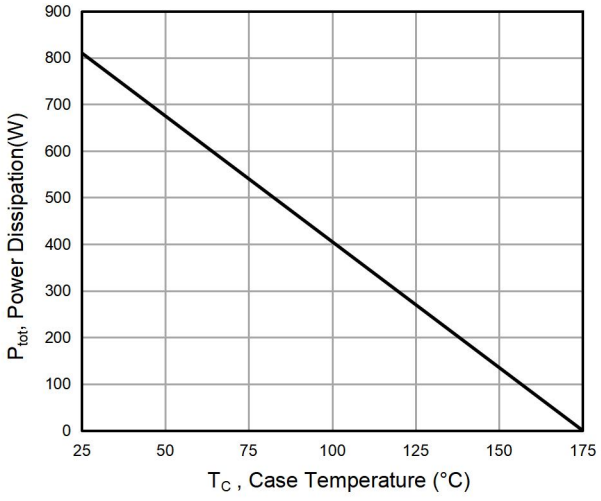


Figure 12 Power Dissipation as a Function of Case Temperature



Typical Electrical and Thermal Characteristics

Figure 13 Switching Energy Losses vs. I_C

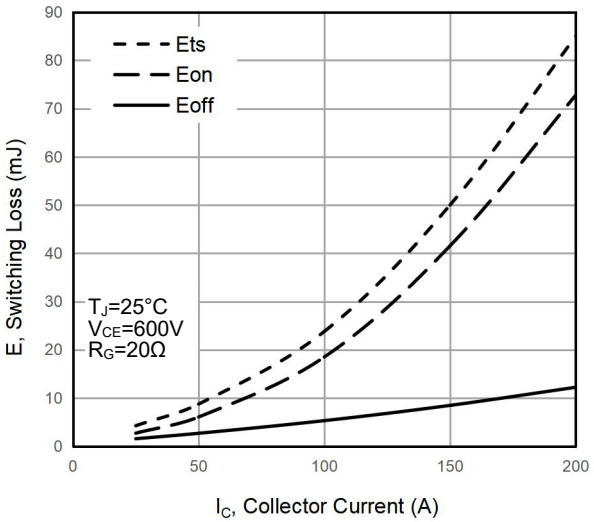


Figure 14 Switching Energy Losses vs. R_G

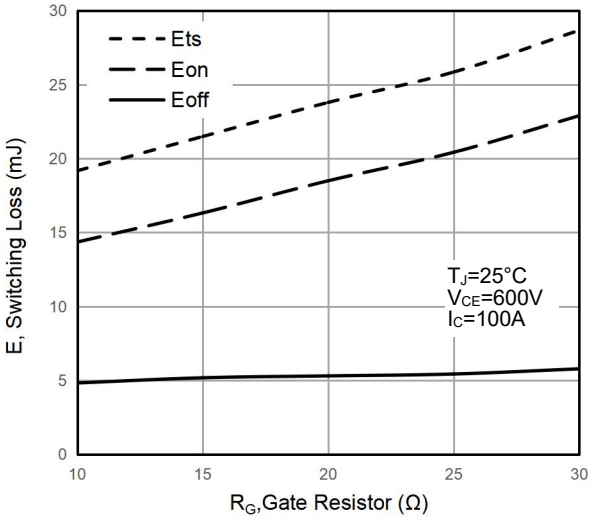


Figure 15 Switching Energy Losses vs. V_{CE}

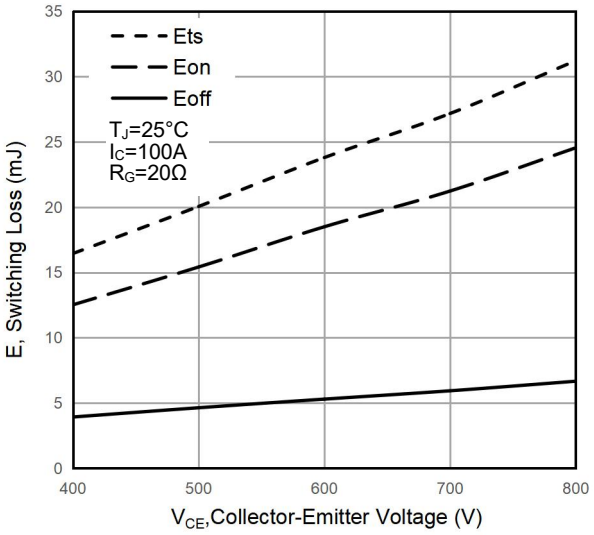
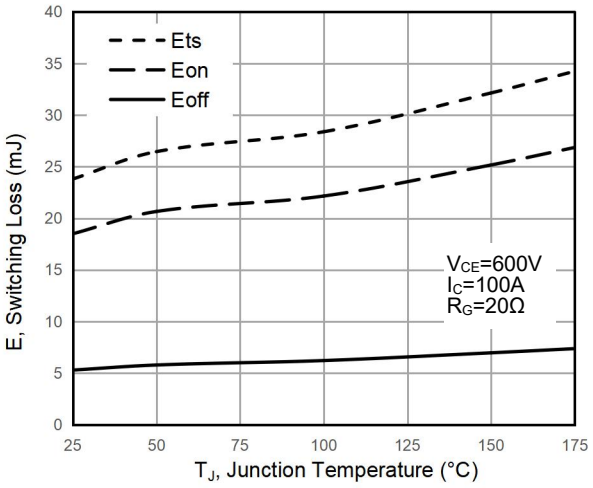
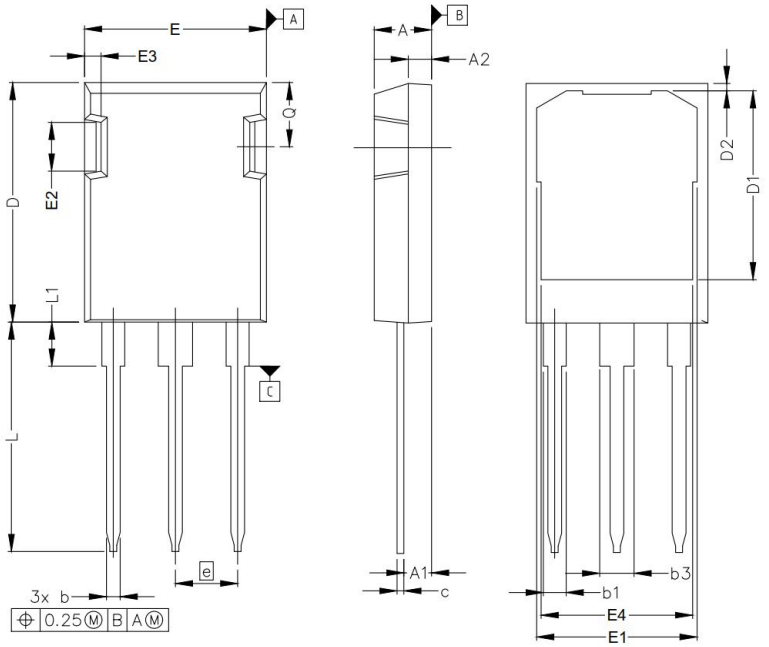


Figure 16 Switching Energy Losses vs. Temperature



TO-247P-3L(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

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