1200V, 40A, Trench FS II Fast IGBT

General Description:

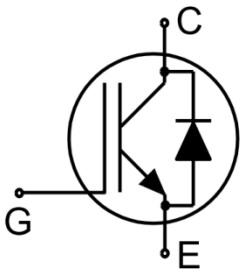
Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 1200V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

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

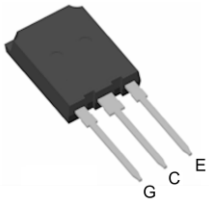
- PV power
- Three-level Solar String Inverter



Schematic diagram

Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE40TD120VTP	TO-247P	NCE40TD120VTP



TO-247P

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	±20	V
I_C	Collector Current	80	A
	Collector Current @T_C = 100 °C	40	A
I_{Cpuls}	Pulsed Collector Current，t_p limited by T_{jmax}	160	A
-	turn off safe operating area，V_{CE}=1200V，Tj=150°C	160	A
I_F	Diode Continuous Forward Current @T_C = 100 °C	40	A
I_{FM}	Diode Maximum Forward Current	160	A
P_D	Power Dissipation @ T_C = 25°C	468	W
	Power Dissipation @T_C = 100 °C	234	W
T_J,T_{stg}	Operating Junction and Storage Temperature Range	-55 to +175	°C
T_L	Maximum Temperature for Soldering	260	°C

Thermal Characteristic

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	0.32	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	0.61	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	°C/W

Electrical Characteristics (T_C=25°C unless otherwise noted)

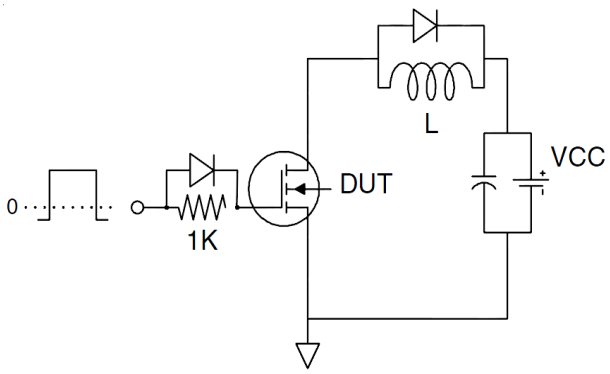
Symbol	Parameter	Conditions		Value			Units
				Min.	Typ.	Max.	
Static Characteristics							
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=1mA		1200	--	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE} =0V,V_{CE}=1200V		--	--	5	uA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	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=40A	Tj=25°C	--	1.85	2.05	V
		V_{GE}=15V	Tj=150°C	--	2.05	--	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA,V_{CE}=V_{GE}		4.5	--	6.5	V
Dynamic Characteristics							
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V, f=1MHz		--	5590	--	pF
C_{oes}	Output Capacitance			--	177	--	
C_{res}	Reverse Transfer Capacitance			--	134	--	
Q_g	Total Gate Charge	V_{CC}=960V, I_C=40A, V_{GE}=15V		--	298	--	nC
Q_{ge}	Gate to Emitter Charge			--	52	--	
Q_{gc}	Gate to Collector Charge			--	169	--	
Switching Characteristics							
$t_{d(ON)}$	Turn-on Delay Time	V_{CE}=600V,I_C=40A, 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			--	2.2	--	mJ
E_{off}	Turn-Off Switching Loss			--	1.3	--	
E_{ts}	Total Switching Loss			--	3.5	--	

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

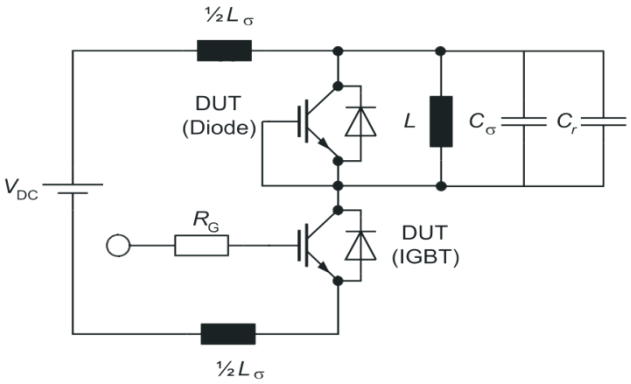
Symbol	Parameter	Conditions	Value			Units
			Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	I_F=40A	--	2.2	3.0	V
T_{rr}	Reverse Recovery Time	I_F=20A, di/dt=500A/us	--	180	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current		--	10	--	A
Q_{rr}	Reverse Recovery Charge		--	2.4	--	uC
Pulse width t_{tp}≤380μs,δ≤2%						

Test Circuit

1) Gate Charge Test Circuit

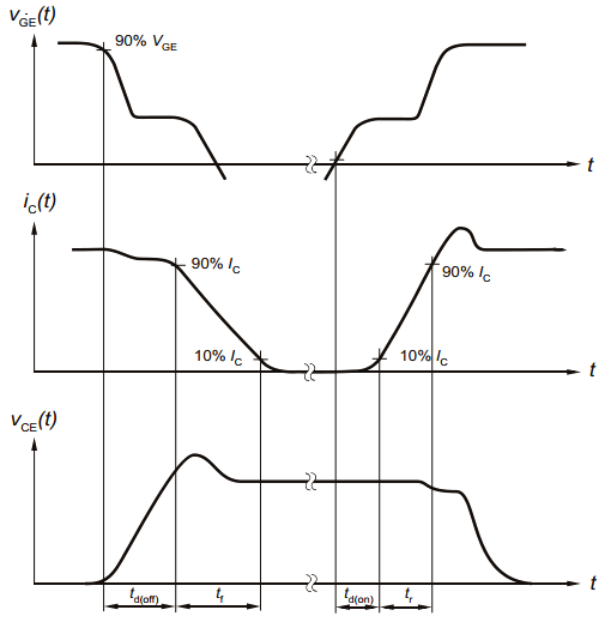


2) Switch Time Test Circuit

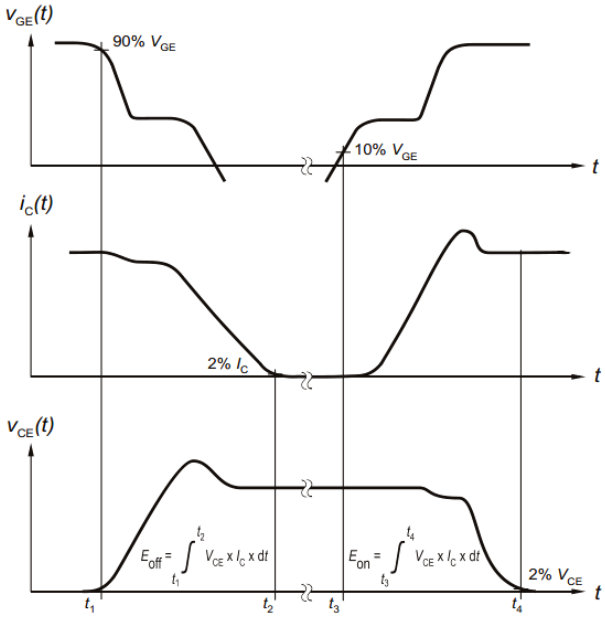


Switching characteristics

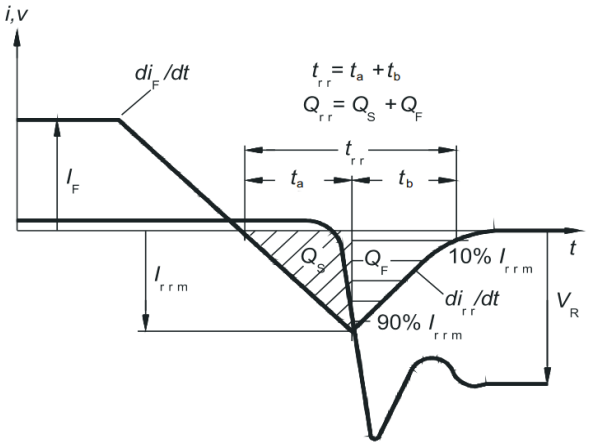
1) Definition of switching times



2) Definition of switching losses



3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

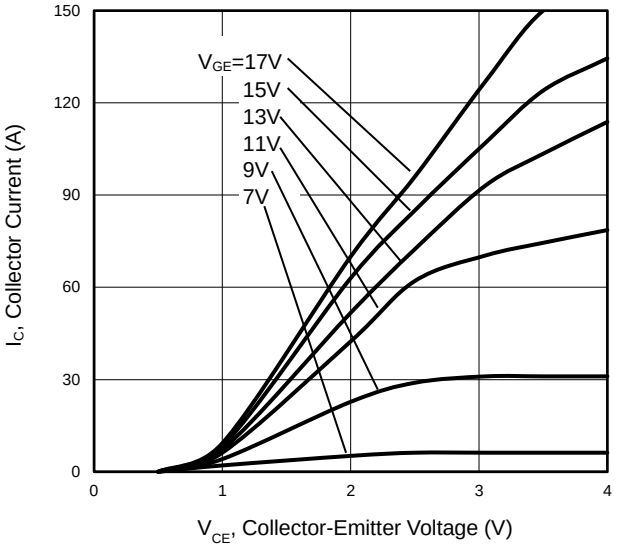


Figure 2 Transfer Characteristics

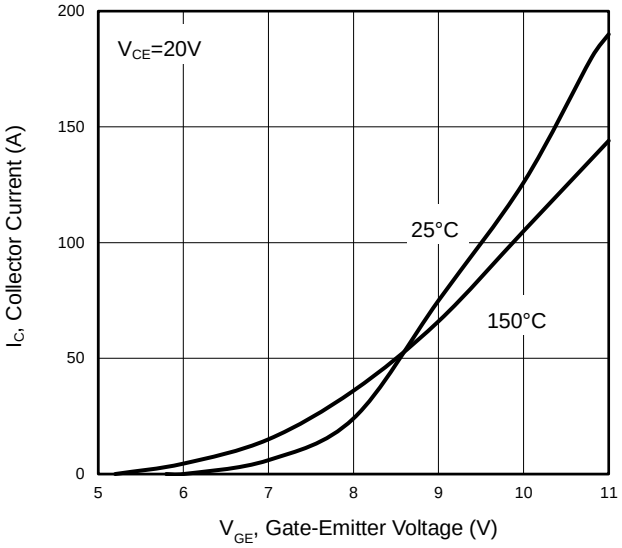


Figure 3 $V_{CE(sat)}$ vs. Case Temperature

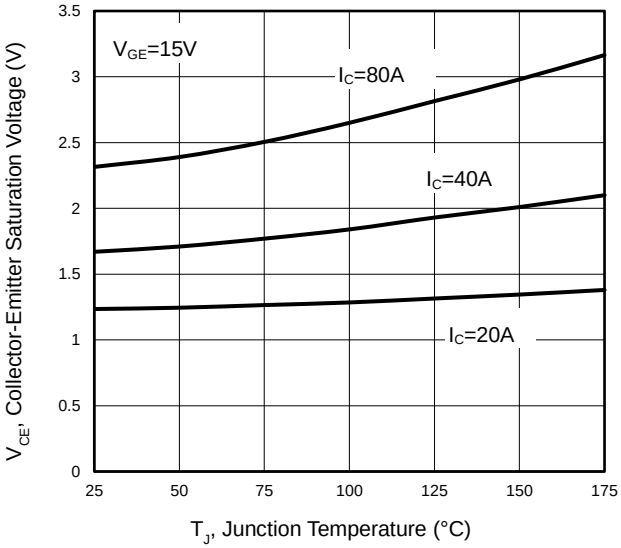


Figure 4 Saturation Voltage vs. V_{GE}

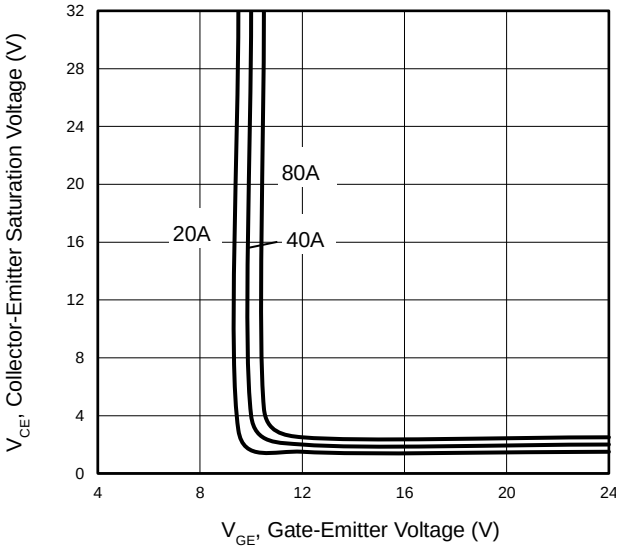


Figure 5 Capacitance Characteristics

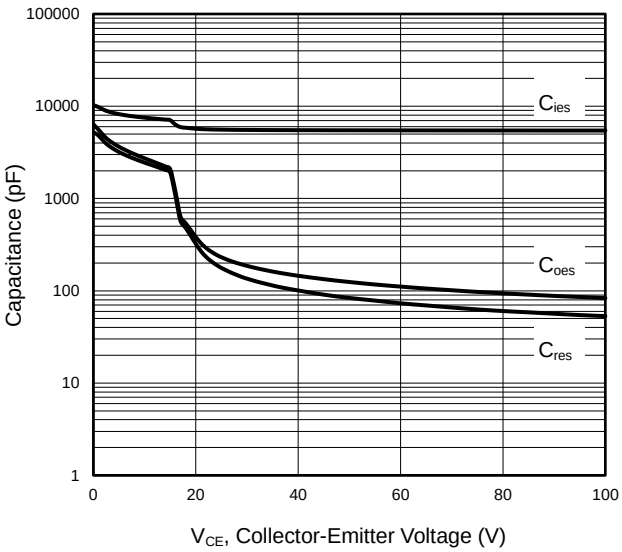
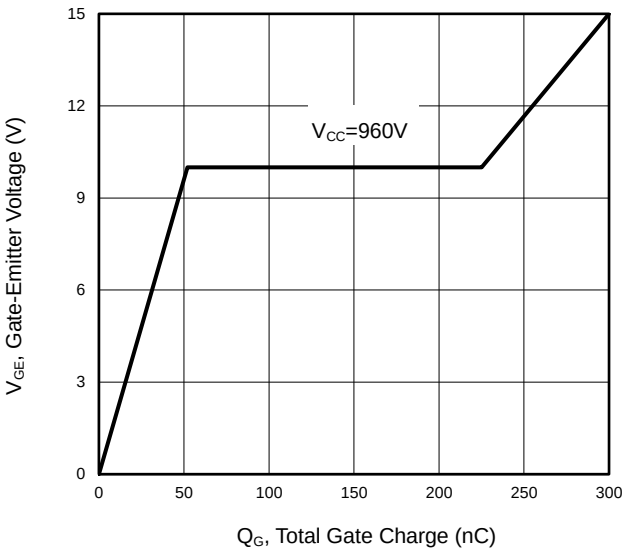


Figure 6 Gate Charge Wave Form



Typical Electrical and Thermal Characteristics

Figure 7 Forward Characteristics

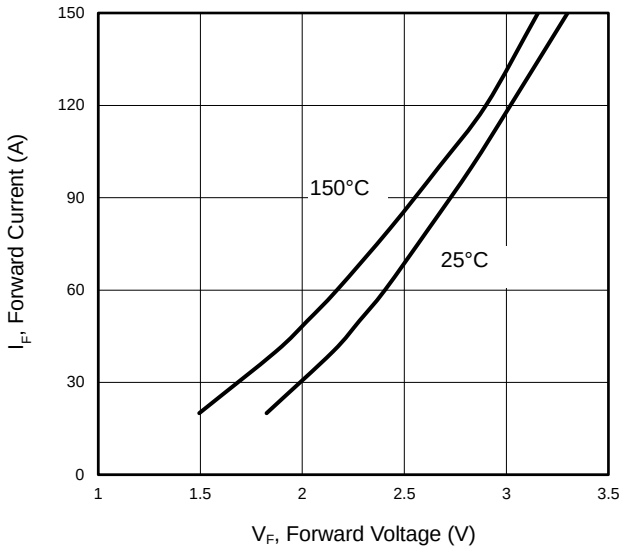


Figure 8 Transfer Characteristics

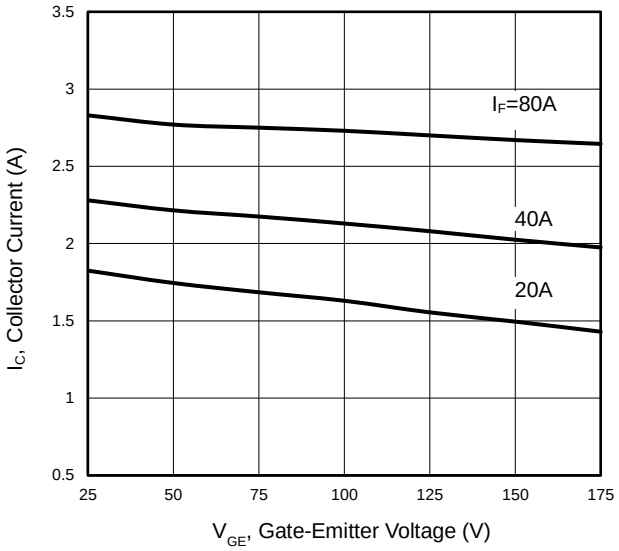


Figure 9 Typical Transfer Characteristic

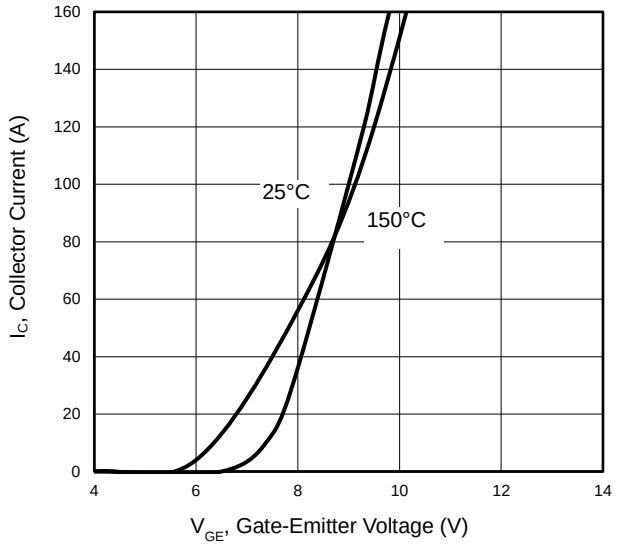


Figure 10 Forward Bias Safe Operating Area

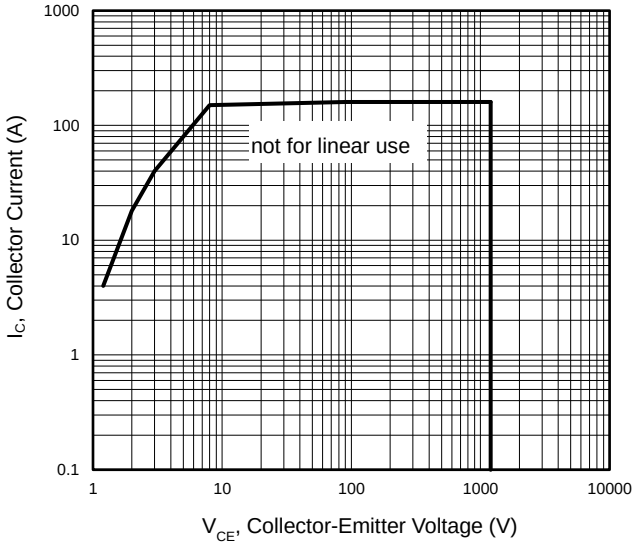


Figure 11 Gate-Emitter Threshold Voltage as a Function of Junction Temperature

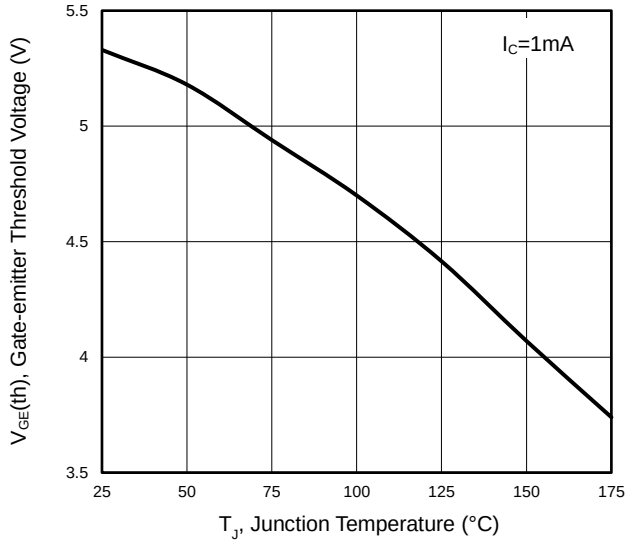
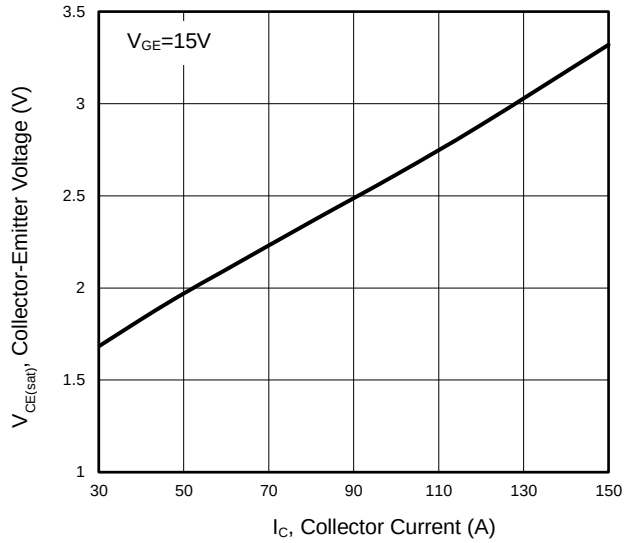
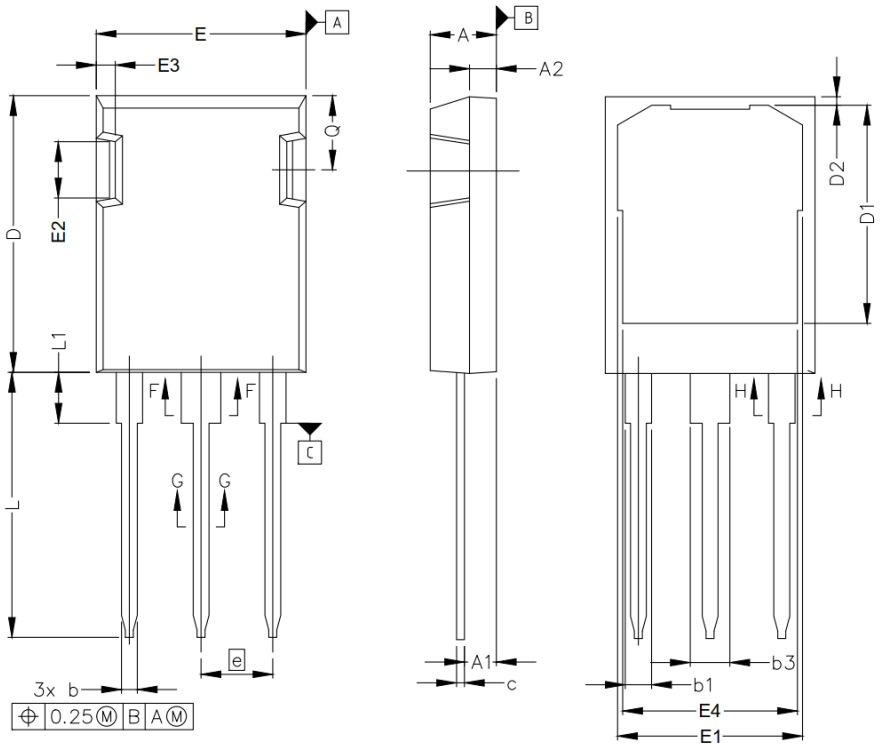


Figure 12 Typical Collector-emitter Saturation Voltage as a function of Collector Current

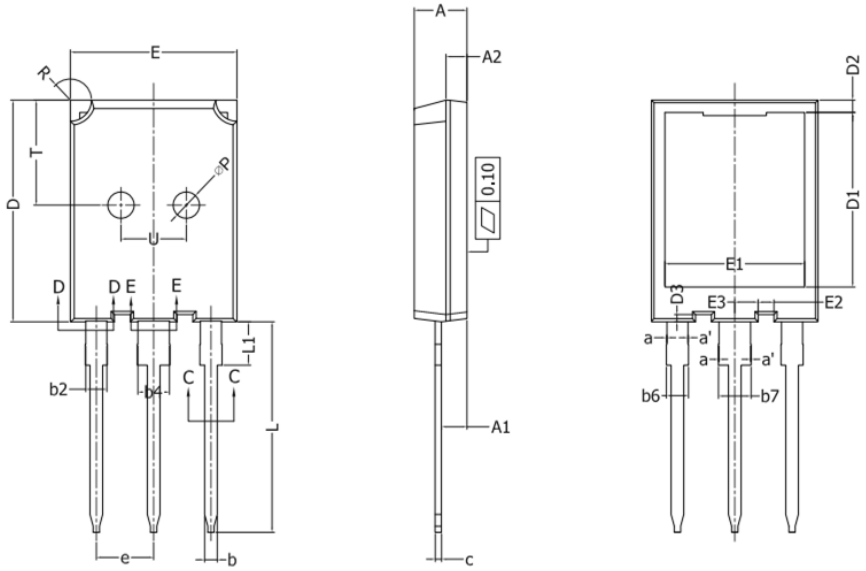


TO-247P-B Package Information



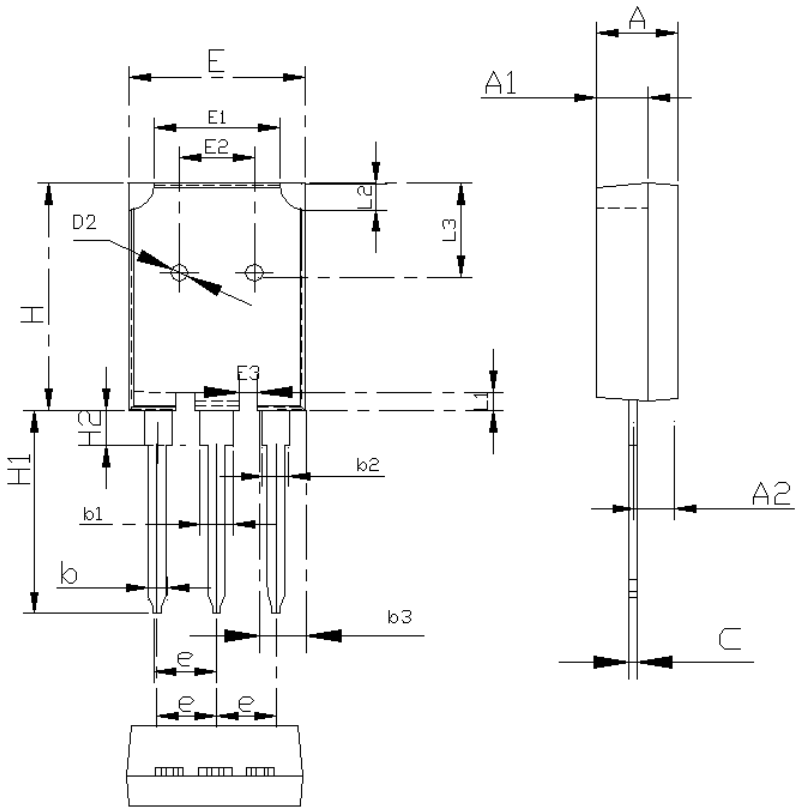
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.19	0.21
A1	2.29	2.54	0.09	0.10
A2	1.91	2.16	0.08	0.09
b	1.07	1.33	0.04	0.05
b1	1.91	2.41	0.08	0.09
b3	2.87	3.38	0.11	0.13
c	0.55	0.68	0.02	0.03
D	20.80	21.10	0.82	0.83
D1	16.25	17.65	0.64	0.69
D2	0.50	0.80	0.02	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	5.44BSC		0.21	
N	3.00		0.12	
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-P 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	1.90	2.10	0.075	0.083
a、a'	0.00	0.15	0.000	0.006
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
D3	0.58	0.78	0.023	0.031
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E2	1.40	1.60	0.055	0.063
E3	2.12	2.32	0.083	0.091
e	5.436 BSC		0.214 BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
P	2.40	2.60	0.094	0.102
R	1.90	2.10	0.075	0.083
T	9.80	10.20	0.386	0.402
U	6.00	6.40	0.236	0.252

TO-247P-d Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.80	5.20	0.189	0.205
A1	2.80	3.20	0.110	0.126
A2	1.80	2.20	0.071	0.087
b	1.00	1.40	0.039	0.055
b1	2.90	3.30	0.114	0.130
b2	1.90	2.30	0.075	0.091
b3	3.90	4.30	0.154	0.169
c	0.45	0.75	0.018	0.030
e	5.25	5.65	0.207	0.222
E	15.60	16.00	0.614	0.630
E1	10.20	11.00	0.402	0.433
E2	6.30	6.90	0.248	0.272
E3	1.60	2.00	0.063	0.079
L1	0.35	0.65	0.014	0.026
L2	1.80	2.20	0.071	0.087
L3	9.50	10.50	0.374	0.413
H	20.50	21.50	0.807	0.846
H1	19.50	20.50	0.768	0.807
H2	3.50	4.50	0.138	0.177

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