SKIS40N120-T7

Trench Field stop Fast IGBT Co-packed half rated with Thin SiC Schottky Diode

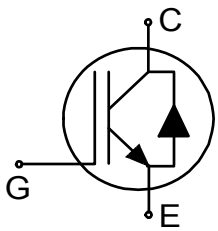
Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Package
SKIS40N120-T7	1200V	40A	1.8V	150°C	TO-247

Features and Benefits

- Low switching losses due to the combination of trench field stop fast IGBT and thin SiC Schottky Diode
- Better efficiency and cost balance than SiC MOSFET solution
- High ruggedness

Applications

- Charger
- Solar inverter
- Energy storage
- Industrial UPS



	Parameter		**Unit**
V_{CE}	Max Collector-Emitter Voltage	1200	V
$I_{C(Nominal)}$	Max DC Collector Current	40	A
V_f	SiC Schottky Diode Typical Forward Voltage at 20A	1.7	V
Q_c	SiC Schottky Diode Total Capacitance	60	nC

Maximum Ratings

	Parameter	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	——	——	V
I_C	DC collector current limited by T_{jmax} T_c = 25°C T_c = 100°C	 —— ——	 —— ——	 80 40	 A A
I_F	Diode Forward current, limited by T_{jmax} T_c = 25°C T_c = 100°C	 —— ——	 —— ——	 80 40	 A A
V_{GE}	Continuous Gate-emitter voltage	-20	——	20	V
V_{GE}	Transient Gate-emitter voltage	-30	——	30	V
I_{Fpuls}	Diode Pulsed Current, t_p limited by T_{jmax} t_P = 10 ms, Half Sine Wave	——	——	80	A
T_{vj}	Operating junction temperature	-40	——	150	°C
T_{stg}	Storage temperature -	-55	——	150	°C

Thermal Resistance

Parameter	Symbol	Max. Value	Unit
IGBT thermal resistance junction - case	$R_{\theta(j-c)}$	0.5	K/W
Diode thermal resistance, junction - case	$R_{\theta(j-c)}$	1.4	K/W
Thermal resistance, junction - ambient	$R_{\theta(j-a)}$	38	K/W

Static Characteristics. T_J=25°C

	Parameter	Min.	Typ.	Max.	Unit	Conditions
$V_{CE(sat)}$	Collector-to-Emitter Saturated Voltage	 —— ——	 1.8 2.4	 2.0 ——	V	V_{GE} = 15V, I_C =40A T_J=25°C T_J=150°C
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	5.0	5.8	6.5	V	I_C =250uA , V_{GE} = V_{CE}
I_{CES}	Zero Gate Voltage Collector Current	 —— ——	 —— ——	 1 5	mA	V_{CE} = 1200V, V_{GE} = 0V, T_j=25°C T_j=150°C
I_{GES}	Gate Emitter Leakage Current	——	——	200	nA	V_{CE} = 0V, V_{GE} =20V
C_{ies}	Input Capacitance	——	4742	——	pF	V_{GE} = 0V, V_{CE}=25V, f=1MHz
C_{oes}	Output Capacitance	——	277	——		
C_{res}	Reverse Transfer Capacitance	——	81	——		
Q_g	Gate charge	——	237	——	nC	V_{CC}=960V,I_C=40A,V_{GE}=15V

Switching Characteristic, Inductive Load (T_J=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	$t_{d(on)}$	—	50	—	ns	V_{CC} = 600V, I_C = 40A, V_{GE} = 0/15V, R_g=10Ω
Rise time	t_r	—	28	—	ns	
Turn-off delay time	$t_{d(off)}$	—	355	—	ns	
Fall time	t_f	—	25	—	ns	
Turn-on energy Eon	E_{on}	—	1.43	—	mJ	
Turn-off energy	E_{off}	—	1.47	—	mJ	
Total switching energy	E_{ts}	—	2.9	—	mJ	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	$t_{d(on)}$	—	46	—	ns	V_{CC} = 600V, I_C = 20A, V_{GE} = 0/15V, R_g=10Ω
Rise time	t_r	—	18	—	ns	
Turn-off delay time	$t_{d(off)}$	—	370	—	ns	
Fall time	t_f	—	19	—	ns	
Turn-on energy Eon	E_{on}	—	0.34	—	mJ	
Turn-off energy	E_{off}	—	0.63	—	mJ	
Total switching energy	E_{ts}	—	0.97	—	mJ	

Switching Characteristic, Inductive Load (T_J=150°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	$t_{d(on)}$	—	45	—	ns	V_{CC} = 600V, I_C = 40A, V_{GE} = 0/15V, R_g=10Ω
Rise time	t_r	—	30	—	ns	
Turn-off delay time	$t_{d(off)}$	—	400	—	ns	
Fall time	t_f	—	29	—	ns	
Turn-on energy Eon	E_{on}	—	1.66	—	mJ	
Turn-off energy	E_{off}	—	1.84	—	mJ	
Total switching energy	E_{ts}	—	3.5	—	mJ	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	$t_{d(on)}$	—	43	—	ns	V_{CC} = 600V, I_C = 20A, V_{GE} = 0/15V, R_g=10Ω
Rise time	t_r	—	19.4	—	ns	
Turn-off delay time	$t_{d(off)}$	—	428	—	ns	
Fall time	t_f	—	33	—	ns	
Turn-on energy Eon	E_{on}	—	0.37	—	mJ	
Turn-off energy	E_{off}	—	0.83	—	mJ	
Total switching energy	E_{ts}	—	1.2	—	mJ	

Diode Characteristic

	Parameter	Min.	Typ.	Max.	Unit	Conditions
V_f	Forward Voltage	—	1.7	—	V	I_c=20A, T_J = 25°C
		—	2.5	—		I_c=20A, T_J = 150°C
Q_c	Total Capacitive Charge	—	60	—	nC	V_R=800V
C	Total Capacitance	—	883	—	pF	V_R=0V, T_J=25°C, f=1MHz
		—	59	—		V_R=400V, T_J=25°C, f=1MHz
		—	37	—		V_R=800V, T_J=25°C, f=1MHz

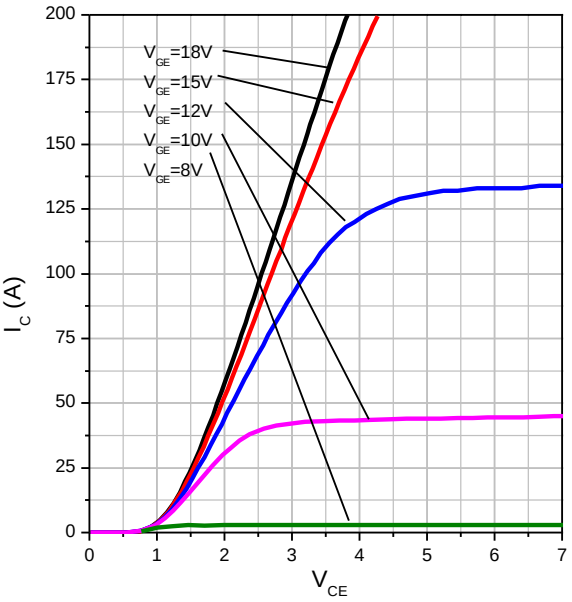


Figure 1. Typical output characteristic (Tvj=25°C)

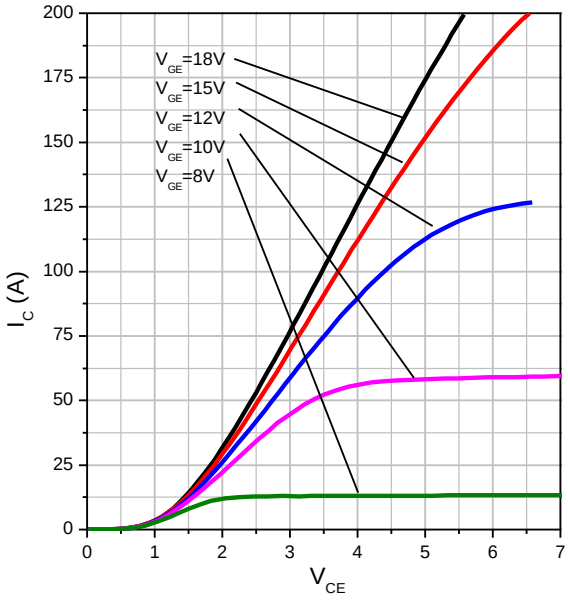


Figure 2. Typical output characteristic (Tvj=150°C)

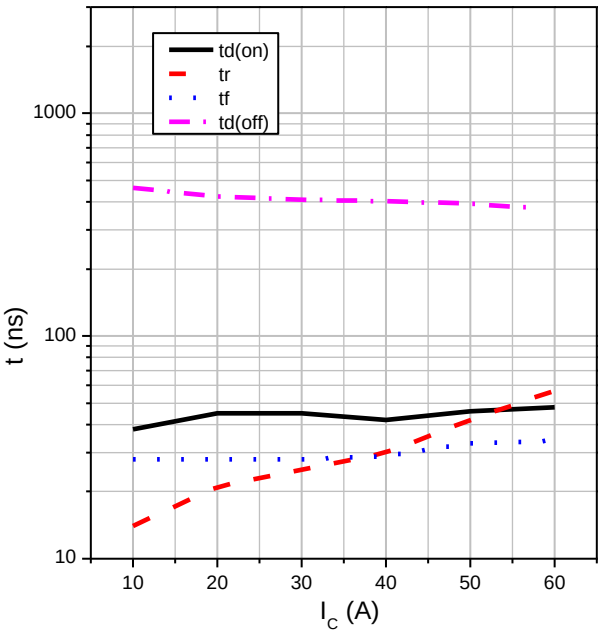


Figure 3. Typical switching times as a function of collector current
(inductive load, T_{vj}=150°C, V_{CE}=600V,V_{GE}=15/0V, R_G=10Ω, Dynamic test circuit in Figure E)

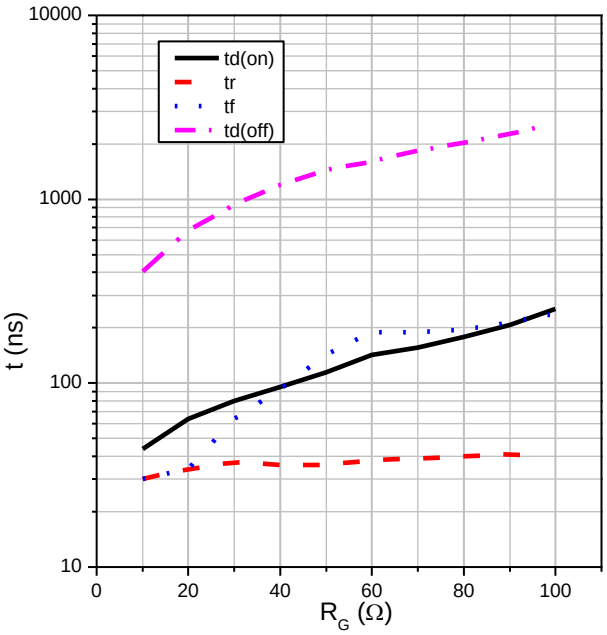


Figure 4. Typical switching times as a function of gate resistor
(inductive load, T_{vj}=150°C, V_{CE}=600V,V_{GE}=15/0V, I_C=40A, Dynamic test circuit in Figure E)

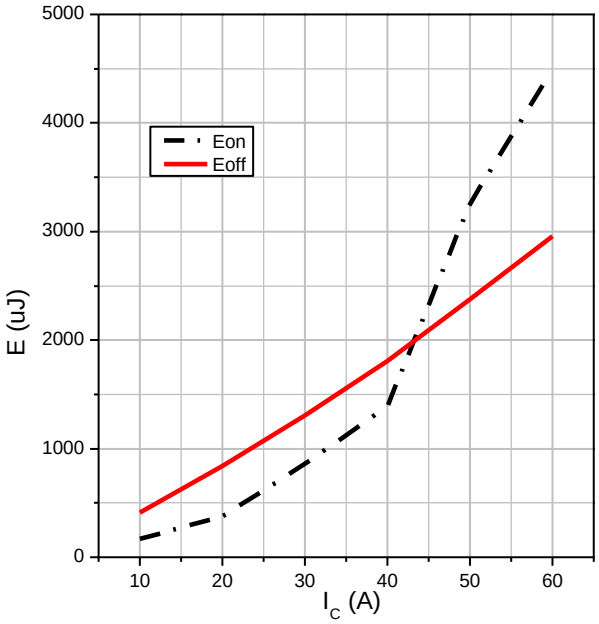


Figure 5. Typical switching energy losses as a function of collector current
(inductive load, Tvj=150°C, VCE=600V,VGE=15/0V, RG=10Ω, Dynamic test circuit in Figure E)

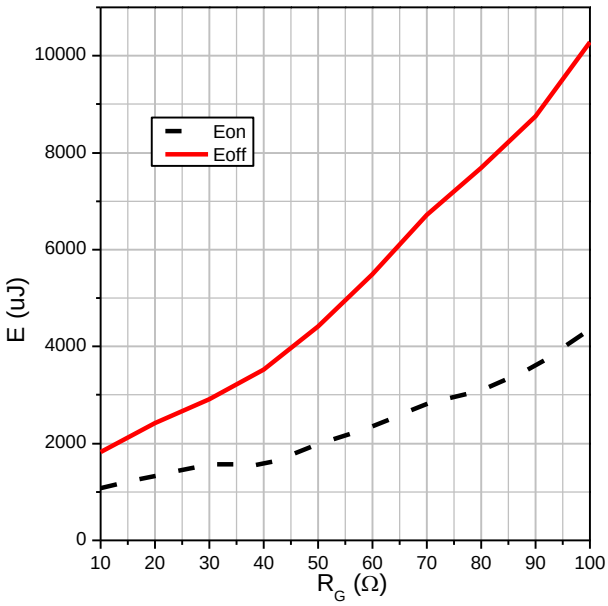


Figure 6. Typical switching energy losses as a function of gate resistor
(inductive load, T_{vj}=150°C, V_{CE}=600V, V_{GE}=15/0V, I_C=40A, Dynamic test circuit in Figure E)

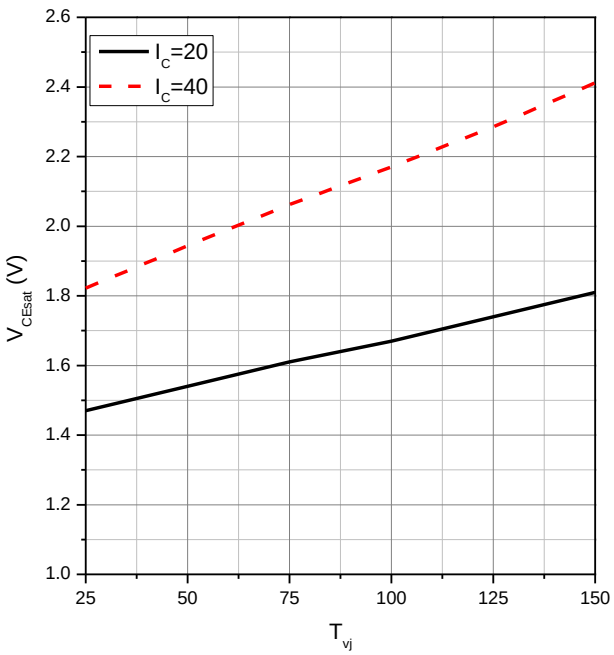


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature (VGE=15V)

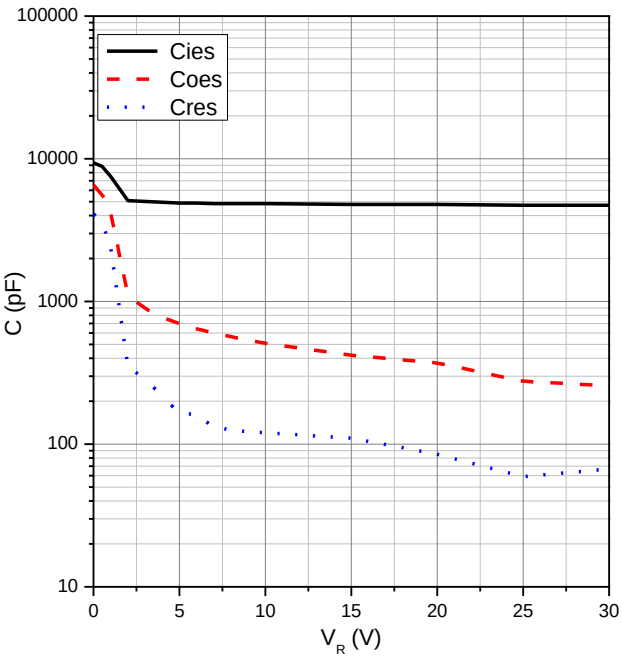


Figure 8. Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V, f=250kHz)

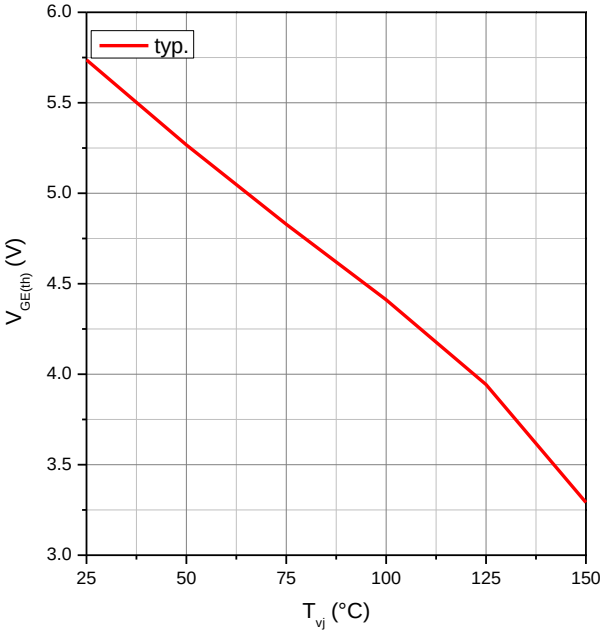


Figure 9. Gate-emitter threshold voltage as a function of junction temperature (I_C=0.25mA)

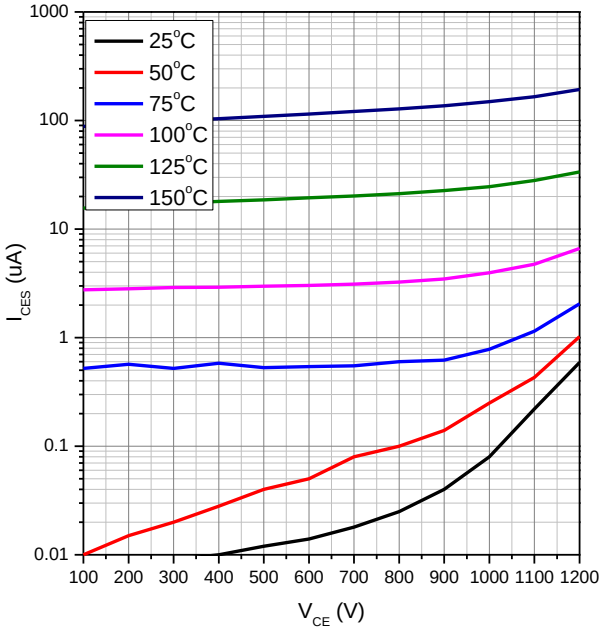


Figure 10. Typ. reverse current vs. reverse voltage as a function of T_{vj}

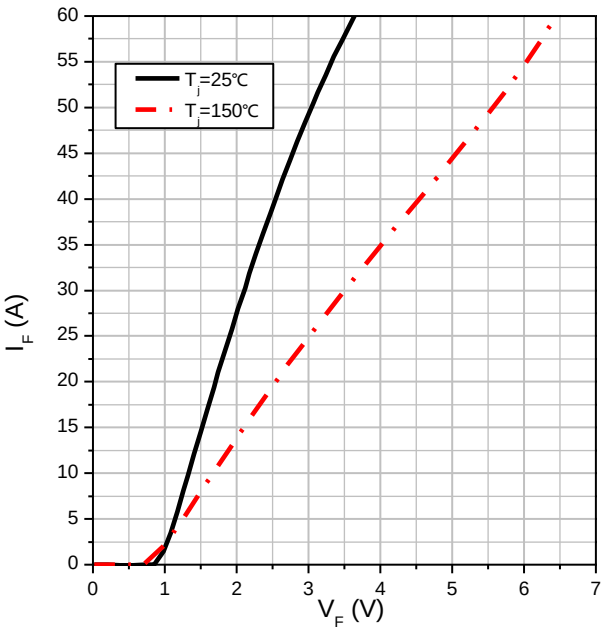


Figure 11. Typical diode forward current as a function of forward voltage

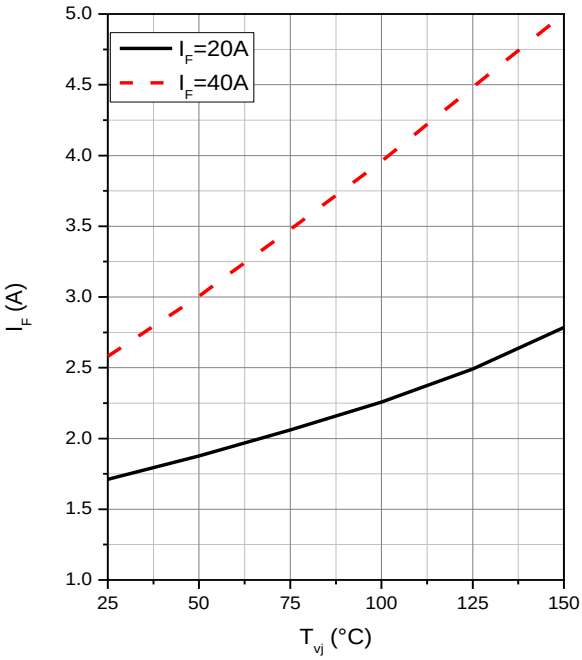
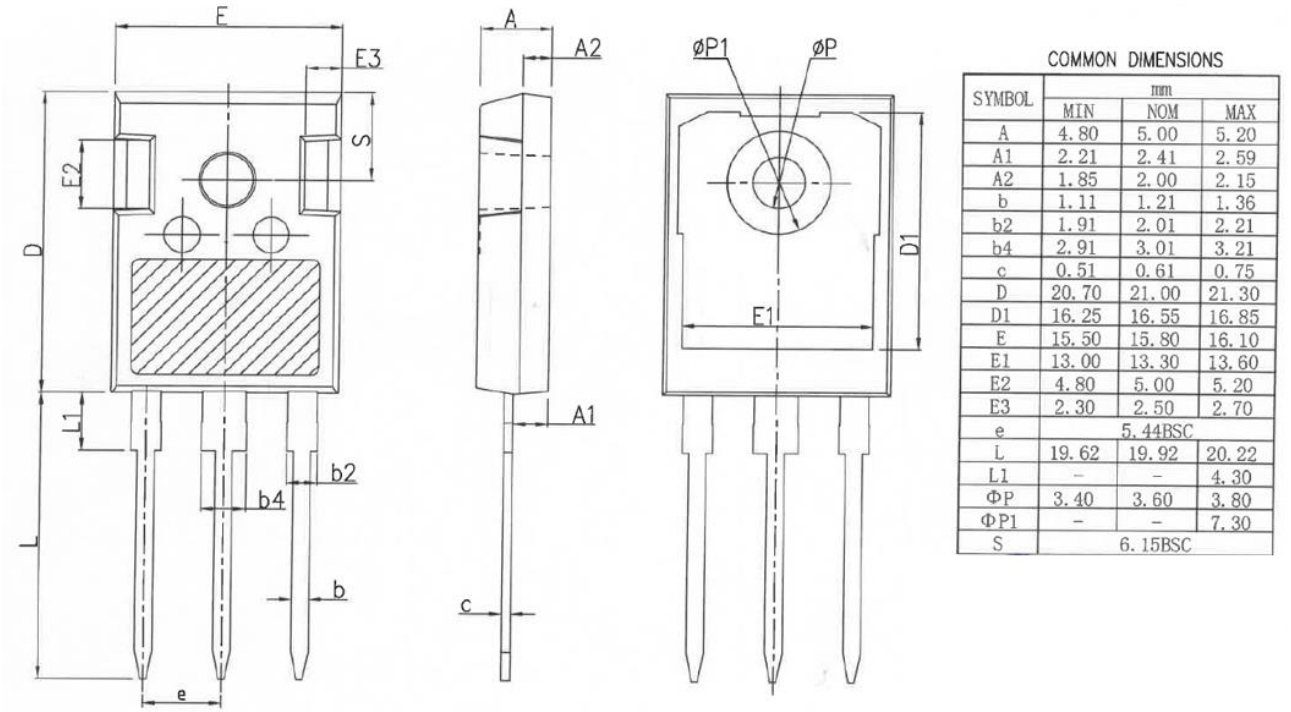


Figure 12. Typical diode forward voltage as a function of junction temperature

TO-247 PACKAGE OUTLINE



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	–	–	4.30
ΦP	3.40	3.60	3.80
ΦP1	–	–	7.30
S	6.15BSC		