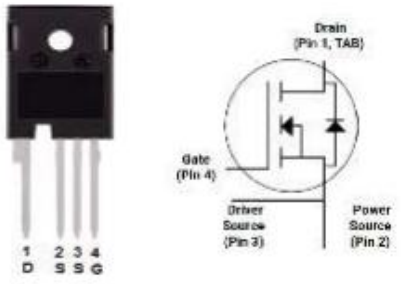
Silicon Carbide Power MOSFET 1200V, 55A, 40mΩ

General Description

This product family offers state of the art performance. It is designed for high frequency applications here high efficiency and high reliability are required.

Features

- High Blocking Voltage
- High Frequency Operation
- Low on-resistance
- Fast intrinsic diode with low reverse recovery



TO-247-4
Pin definition

Applications

- Motor Drives
- Solar / Wind Inverters
- EV Charging Station
- AC/DC converters
- DC/DC converters
- Uninterruptable power supplies

Benefits

- Higher System Efficiency
- Parallel Device Convenience without thermal runaway
- High Temperature Application
- Hard Switching & Higher Reliability
- Easy to drive

Key performance parameters

Type	V_{DS}	I_D T_C=25℃	$R_{DS(ON)}$
KN3M0040120Q	1200V	55A	40mΩ

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

Maximum Ratings

T_C=25℃, unless otherwise specified

Parameter	Symbol	Test conditions	Value	Unit
Drain - Source Voltage	V_{DSmax}	V_{GS} = 0V, I_D =100μA	1200	V
Gate - Source Voltage (dynamic)	V_{GSmax}	AC (f>1 Hz)	-10/+25	V
Gate - Source Voltage (static)	V_{GSop}	static	-5/+20	V

Maximum Ratings

T_C=25℃, unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous Drain Current: V_{GS} = 20V T_C = 25°C T_C = 100°C	I_D	55 39	A
Pulsed Drain Current: T_C = 25°C	$I_{D(pulse)}$	117	A
Short Circuit Capability : V_{DD} = 800V V_{GS} = 20V	tsc	3	μS
Short Circuit Capability : V_{DD} = 800V V_{GS} = 20V	I_{DS}	600	A
Total power dissipation : T_C = 25°C	P_D	300	W
Operating Junction Temperature :	T_j	-55 to 175	°C
Storage Temperature :	T_{stg}	-55 to 150	°C

Thermal Characteristics

Parameter	Symbol	Condition	Typ	Max	Unit
Thermal Resistance (per device)	Rth(j-c)	junction-case	0.35	0.5	°C/W

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Electrical Characteristic

T_C =25℃, unless otherwise specified

Parameter	Symbol	Value			Unit	Test Condition
		Min.	Typ.	Max.		
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200			V	V_{GS} = 0V I_D = 100μA
Gate Threshold Voltage	$V_{GS(th}$	1.8	3.5 2.6 2.5	3.9	V	V_{DS} = VGS I_D = 10mA T_J = 150°C T_J = 175°C
Zero Gate Voltage Drain Current	I_{DSS}	0	5	100	μA	V_{DS} = 1200V V_{GS} = 0V
Gate-Source Leakage Current	I_{GSS}	0 -200	10 -10	200 0	nA	V_{GS} = 20V V_{DS} = 0V V_{GS} = -5V V_{DS} = 0V
Drain-Source On-State Resistance	$R_{DS(on)}$		40 61 69	44	m Ω	V_{GS} = 20V I_D = 40 A T_J = 150°C T_J = 175°C
Transconductance	gfs		22 20 19		S	V_{GS} = 20V I_D = 40 A T_J = 150°C T_J = 175°C
Input capacitance	C_{iss}		2930		pF	V_{DS} = 1000V V_{GS} = 0V f = 1MHz
Output capacitance	C_{iss}		149			
Reverse transfer capacitance	C_{rss}		9			
Coss Stored Energy	E_{oss}		87		μJ	
Total gate charge	Q_g		145		nC	V_{DS} = 800V V_{GS} = -5V / 20V I_D = 40 A
Gate-source charge	Q_{gs}		43			
Gate-drain charge	Q_{gd}		73			
Internal gate input resistance	$R_{g(int)}$		2		Ω	f = 1MHz I_D = 0A
Turn-On Switching Energy	E_{ON}		609		μJ	V_{DS}=800V V_{GS} = -5V/20V I_D = 40A $R_{G(ext)}$ =1.5 Ω L = 450μH
Turn-Off Switching Energy	E_{OFF}		439			

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

Turn-On Delay Time	$t_{d(on)}$		22		ns	V_{DS} = 800V V_{GS} = -5V/20V I_D = 40A $R_{G(ext)}$ =1.5 Ω L = 450μH
Rise Time	tr		34			
Turn-Off Delay Time	$t_{d(off)}$		36			
Fall Time	t_f		20			
Avalanche Capability	E_{AS}		676		mJ	V_{DD} = 100V V_{GS}=20V L = 2mH
	I_{Av}		26		A	

Reverse Diode Characteristics

Tc =25℃, unless otherwise specified

Parameter	Symbol	Value			Unit	Test Condition
		Min.	Typ.	Max.		
Diode Forward Voltage	V_{SD}		3.9 3.5 3.4		V	V_{GS} = -5V I_{SD} = 20A T_J = 150°C T_J = 175°C
Continuous Diode Forward Current	I_S		70		A	V_{GS} = -5V
Reverse Recovery time	t_{rr}		20		ns	V_{GS} = -5V I_{SD} = 40A V_R = 800V dif/dt = 4000 A/μs
Reverse Recovery Charge	Q_{rr}		375		nC	
Peak Reverse Recovery Current	I_{rrm}		31		A	

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

Typical Performanc

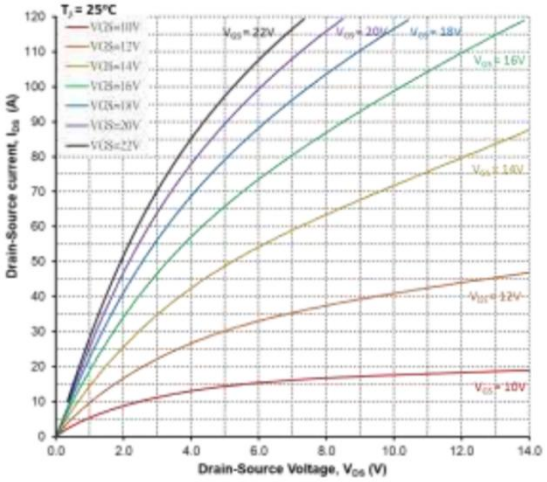


Figure 1. Output Characteristics, T_J = 25°C

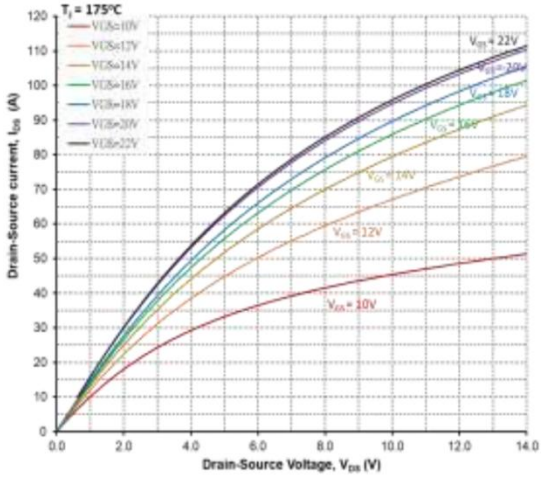


Figure 2. Output Characteristics, T_J = 175°C

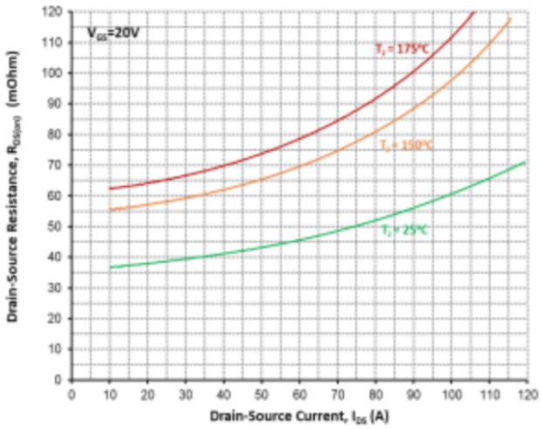


Figure 3. On-Resistance vs. Drain Current For Various Temperatures

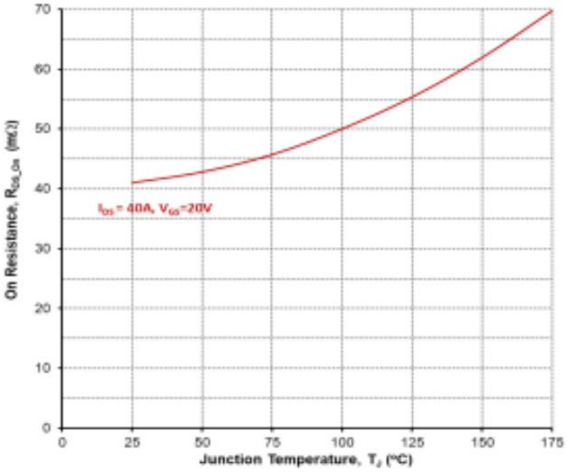


Figure 4. On-Resistance vs. Temperature

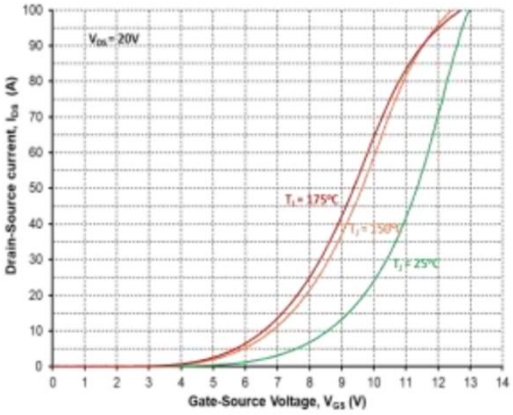


Figure 5. Transfer Characteristic For Various Junction Temperatures

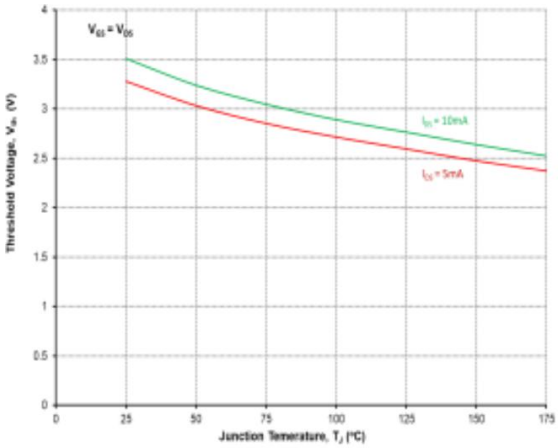


Figure 6. Threshold Voltage vs. Temperature

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

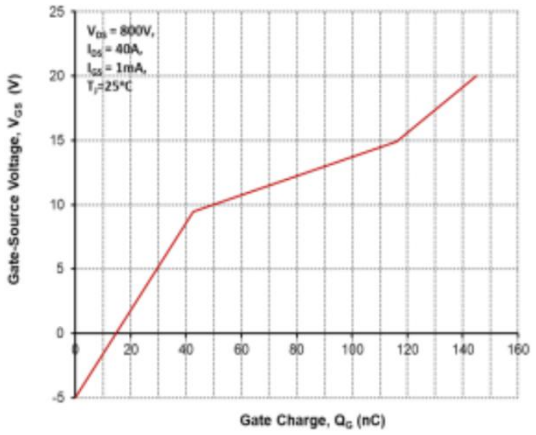


Figure 7. Gate Charge Characteristics

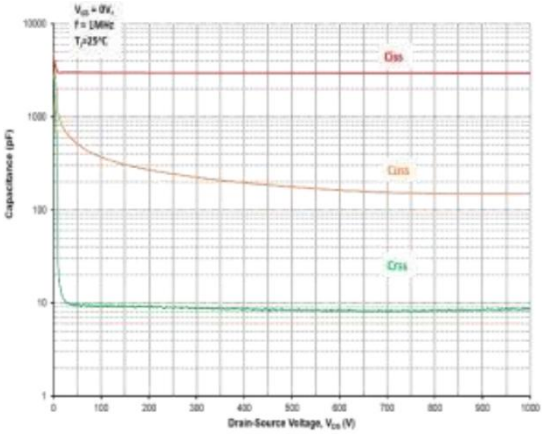


Figure 8. Capacitances vs. Drain-Source Voltage (0-1000V)

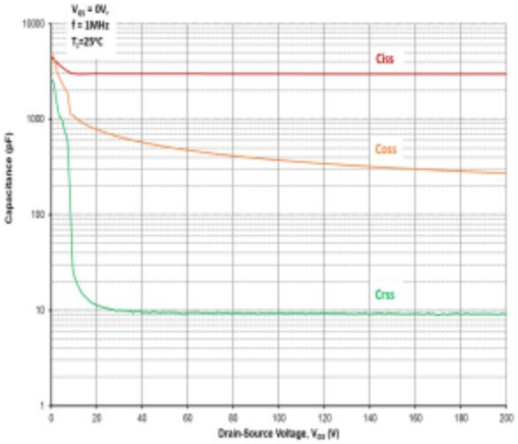


Figure 9. Capacitances vs. Drain-Source Voltage (0-200V)

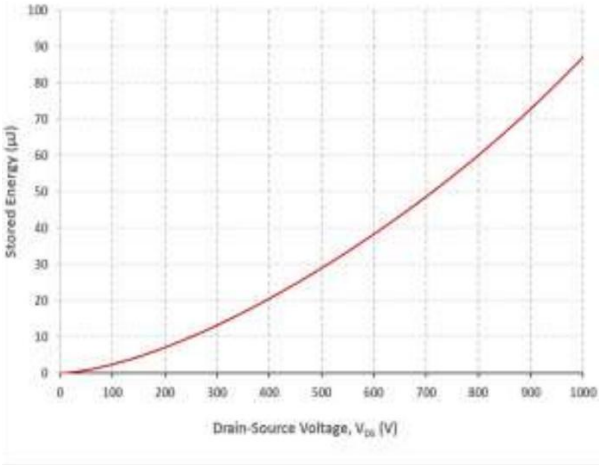


Figure 10. Output Capacitor Stored Energy

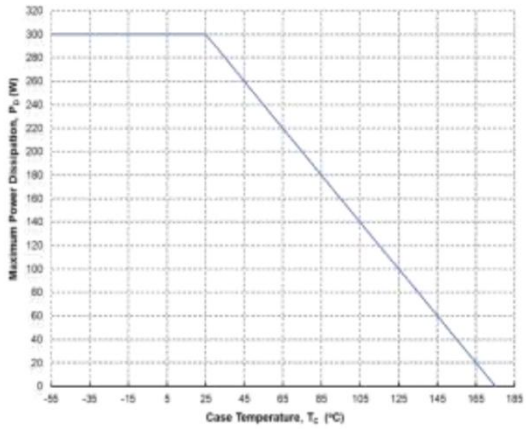


Figure 11. Maximum Power Dissipation Derating vs. Case Temperature

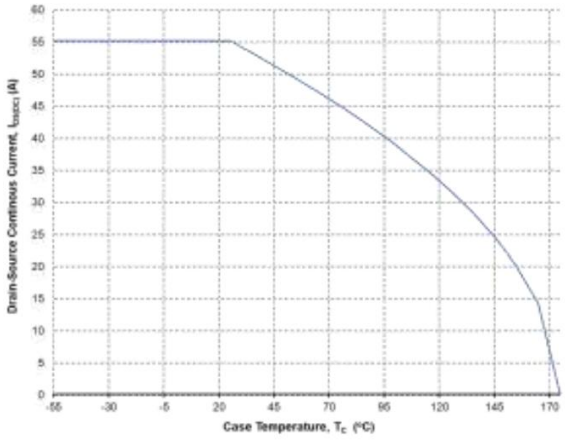


Figure 12. Continuous Drain Current Derating vs. Case Temperature

cedures.

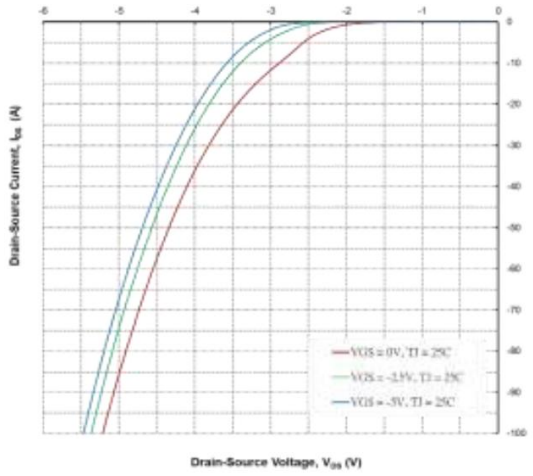


Figure 13. Body Diode Characteristics @ 25ºC

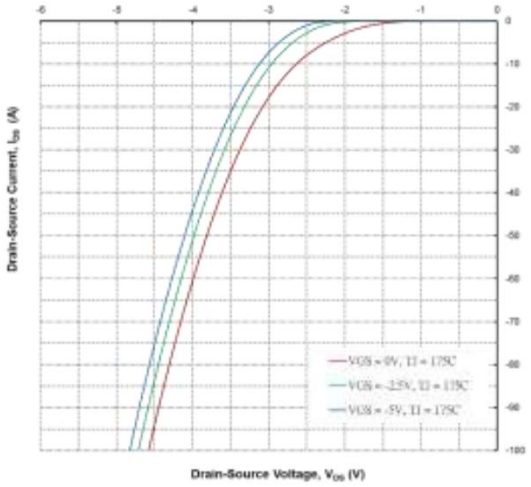


Figure 14. Body Diode Characteristics @ 175ºC

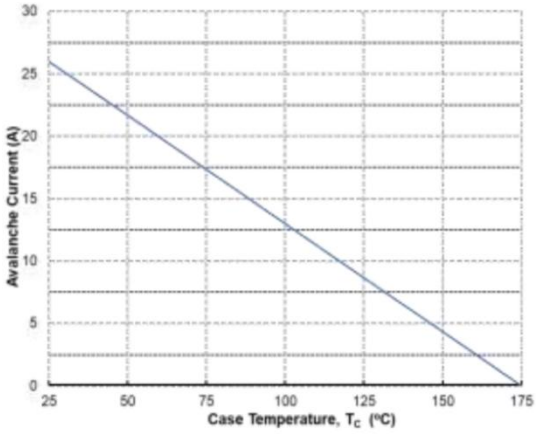


Figure 15. Single Avalanche vs. Temperature

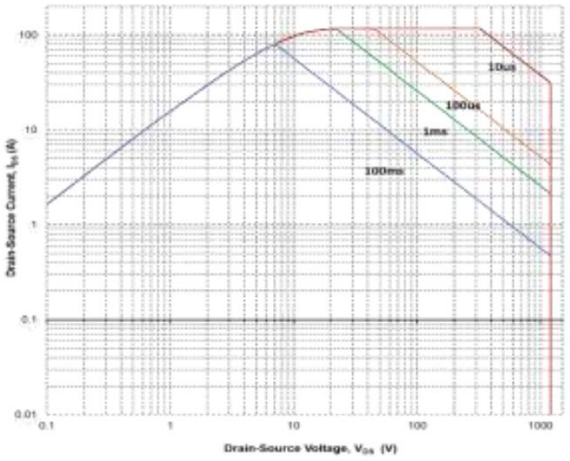
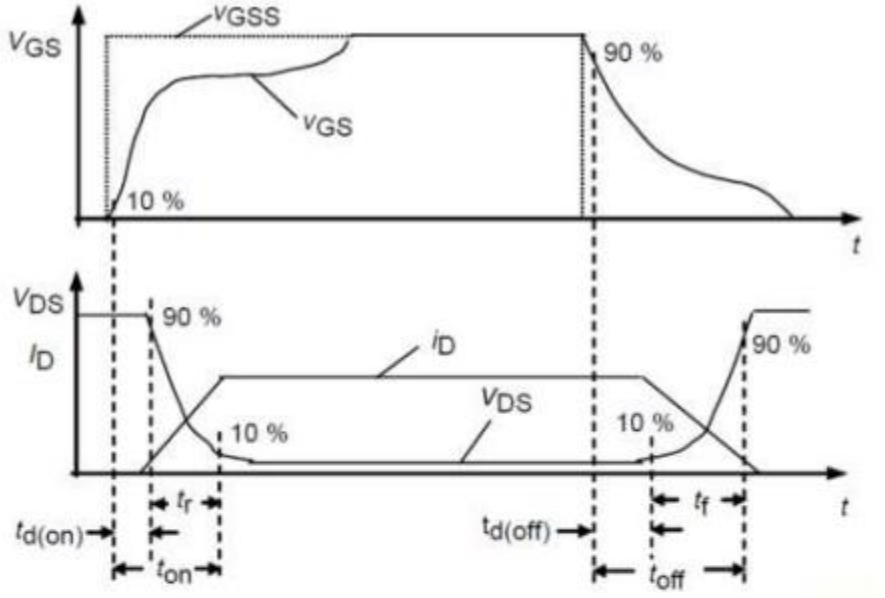
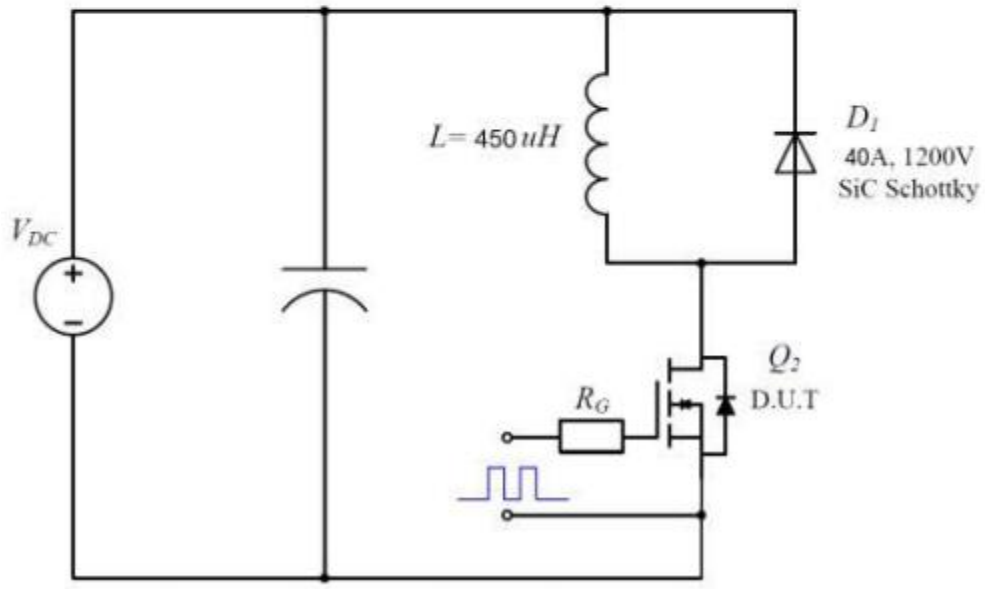


Figure 16. Safe Operating Area

Caution: This device is sensitive to electrostatic discharge .Users should follow ESD handing procedures.

Switching Times Definition and Test Circuit





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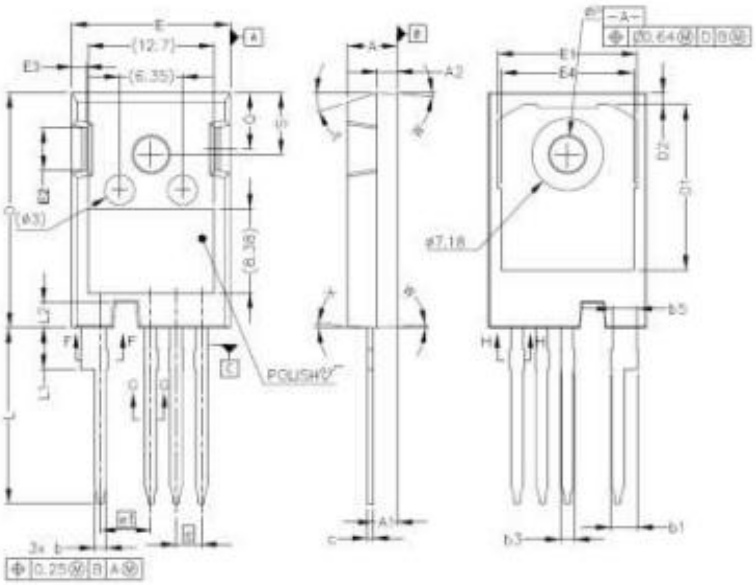
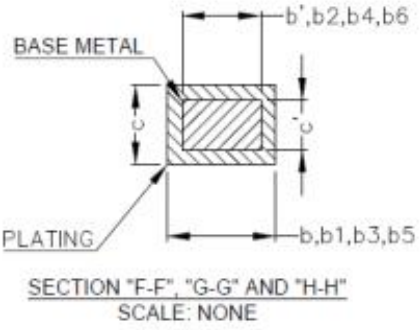
Package Outline:TO-247-4





SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5 ° REF.	
X	4° REF.	

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