650V SiC N-Channel MOSFET

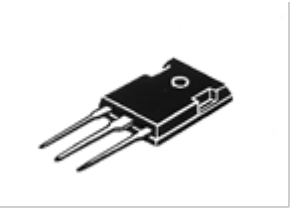
DESCRIPTION：

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(ON)}$
- Easy to Parallel
- Simple to Drive
- RoHS compliant.

V_{DS}	650V
I_D	51A (Tc=25℃)
$R_{DS(ON)}$	53mΩ

TYPICAL APPLICATIONS：

- Power Factor Correction Modules
- Switch Mode Power Supplies
- DC-AC Inverters
- High Voltage DC-DC Converters



TO-247-3L

MAXIMUM RATINGS (at T_C = 25 °C, unless otherwise specified)

Characteristic	Condition	Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	650	V
Continuous Drain Current	Tc=25℃ Tc=100℃	I_D	51 36	A
Peak Drain Current	Pulse width tp limited by Tjmax	I_{DM}	100	A
Gate-Source Voltage		V_{GSmax}	-8/+22	V
Recommend Gate-Source Voltage		V_{GSop}	-4/+18	V
Power Dissipation	Tc=25℃ Tc=100℃	P_{TOT}	178 89	W
Operation Junction temperature		Tj	-40~+175	℃
Storage temperature		T_{STG}	-40~+175	℃

THERMAL CHARACTERISTICS

Characteristic	Condition	Symbol	Typical	Unit
Thermal resistance, junction - case		$R_{th(j-C)}$	0.53	℃/W

ELECTRICAL CHARATERISTICS (at T_J = 25 °C, unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage VGS = 0V, ID = 100μA	$V_{(BR)DSS}$	650			V
Zero Gate Voltage Drain Current VDS = 650 V, VGS = 0 V	I_{DSS}		1		uA
Gate-Source Leakage Current VGS = 18V, VDS = 0V	I_{GSS}			250	nA
Gate-Source Threshold Voltage VDS = VGS, ID = 5mA Tj=25℃ VDS = VGS, ID = 5mA Tj=175℃	$V_{GS(th)}$	2.0	2.7 1.9	4.0	V
Drain-Source On-State Resistance VGS = 18V, ID = 20A Tj=25℃ VGS = 18V, ID = 20A Tj=175℃	$R_{DS(on)}$		53 58		mΩ
Internal Gate Resistance f=1MHz	$R_{G(INT)}$		2.1		Ω
Input capacitance f=1MHz, VDS=600 V, VGS=0 V	C_{iss}		1301		pF
Output capacitance f=1MHz, VDS=600 V, VGS=0 V	C_{oss}		138		pF
Reverse transfer capacitance f=1MHz, VDS=600 V, VGS=0 V	C_{rss}		14		pF
Total Gate Charge VDD= 400V, ID= 20A,VGS= -4/18V	Q_G		68		nC
Gate to Source Charge VDD= 400V, ID= 20A,VGS= -4/18V	Q_{GS}		17		nC
Gate to Drain Charge VDD= 400V, ID= 20A,VGS= -4/18V	Q_{GD}		22		nC
Turn-on Delay Time VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	td $_{(ON)}$		10		ns
Rise Time VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	tr		13		ns

Turn-off Delay Time VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	$td_{(OFF)}$		17		ns
Fall Time VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	tf		7		ns
Turn-on Switching Energy VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	$E_{(ON)}$		56		uJ
Turn-off Switching Energy VDD=400 V, ID=20A, VGS= -4/18V, RG(ext)=2.5Ω L= 200uH	$E_{(OFF)}$		7		uJ

Body Diode

ELECTRICAL CHARATERISTICS (at T_J = 25 °C, unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Diode Forward Voltage VGS = -4V, ISD = 10A Tj=25℃ VGS = -4V, ISD = 10A Tj=175℃	V_{SD}		4.6 4.0		V
Diode Forward Voltage VGS = -4V, ISD = 20A Tj=25℃ VGS = -4V, ISD = 20A Tj=175℃	V_{SD}		5.4 4.6		V
Continuous Diode Forward Current VGS = -4V, Tc=25℃ VGS = -4V, Tc=100℃	I_S		31 17		A
Revers Recovery Time VR=400 V, ISD=20A, VGS= -4V, di/dt = 989A/us□	Trr		18		ns
Revers Recovery Charge VR=400 V, ISD=20A, VGS= -4V, di/dt = 989A/us□	Qrr		104		nC
Peak Revers Recovery Current VR=400 V, ISD=20A, VGS= -4V, di/dt = 989A/us□	I_{rrm}		10.2		A

Typical Characteristics

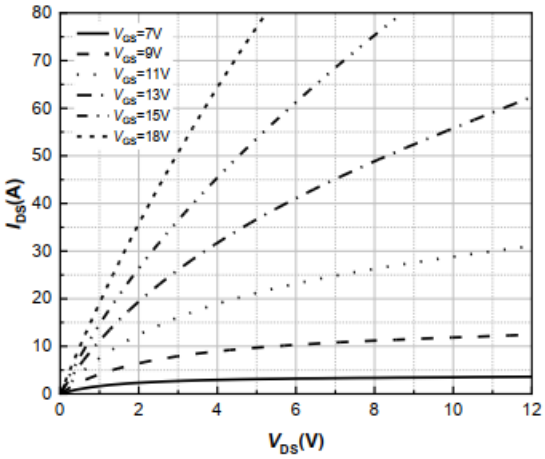


Figure 1. Typical output characteristics (Tj=25℃)

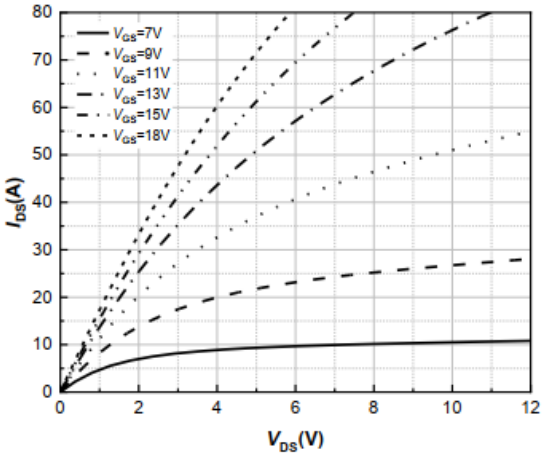


Figure 2. Typical output characteristics (Tj=175℃)

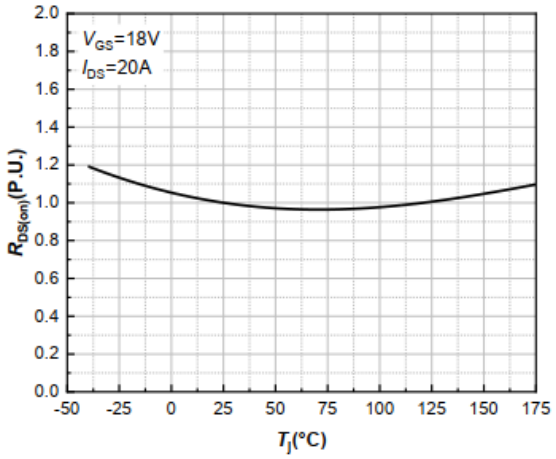


Figure 3. Normalized Resistance v/s Temperature

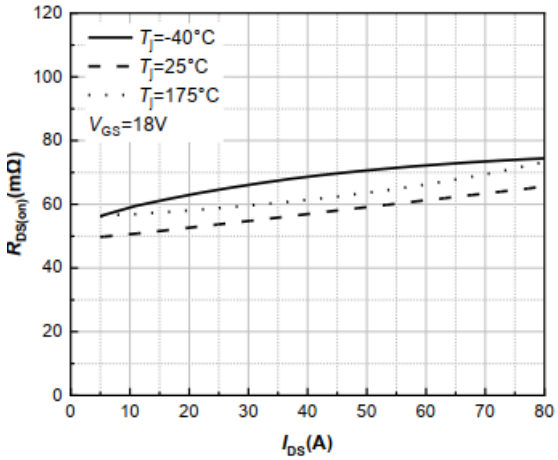


Figure 4. On-Resistance vs. Drain Current For Various Temperatures

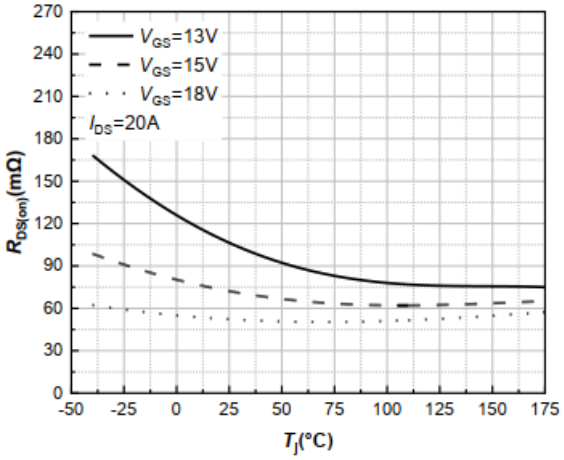


Figure 5. On-Resistance vs. Temperature For Various Gate Voltage

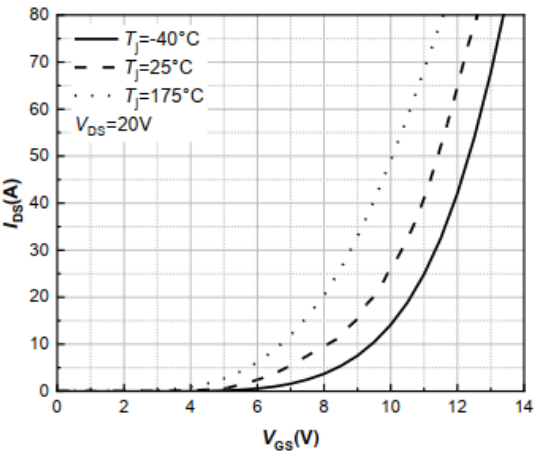


Figure 6. Transfer Characteristic for Various Junction Temperatures

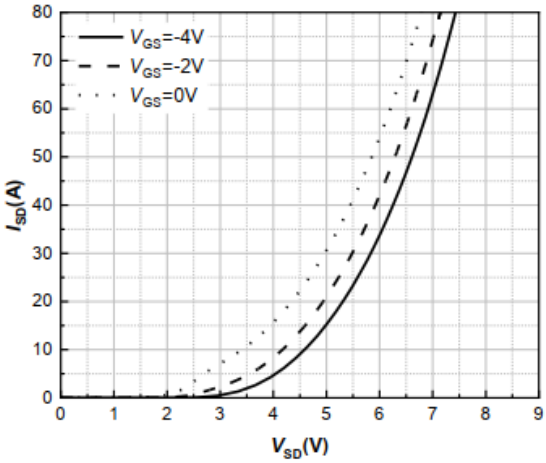


Figure 7. Body Diode Characteristic Tj=25°C

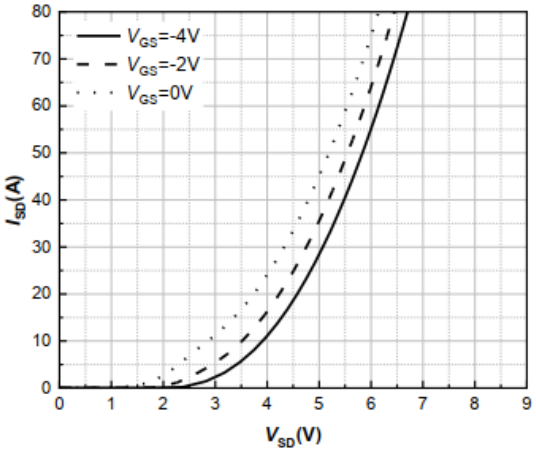


Figure 8. Body Diode Characteristic Tj=175°C

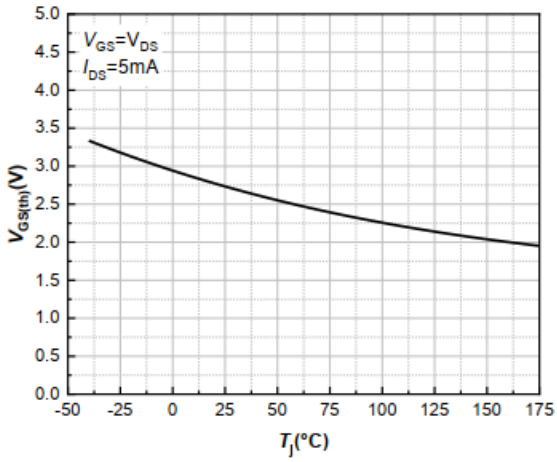


Figure 9. Threshold Voltage vs.Temperature

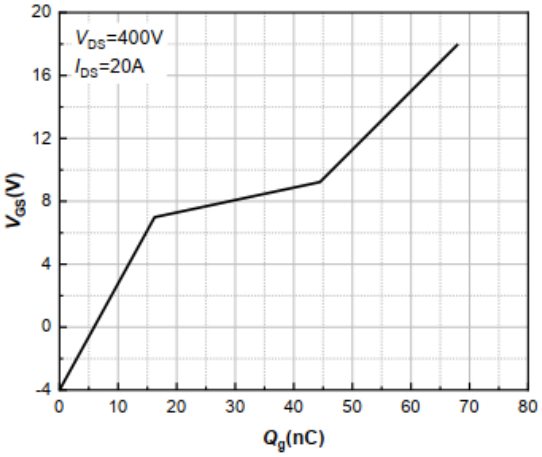


Figure 10. Gate Charge Characteristics

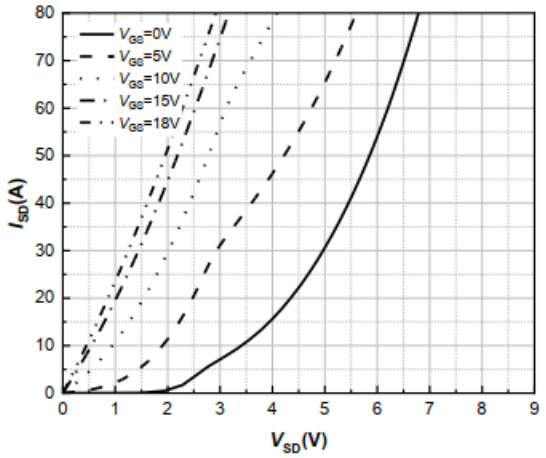


Figure 11. 3rd Quadrant Characteristic Tj=25°C

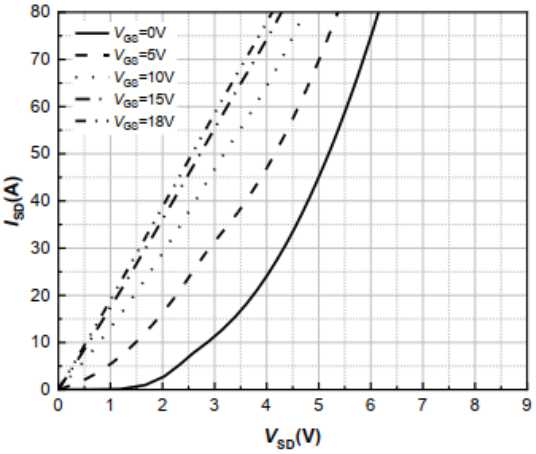


Figure 12. 3rd Quadrant Characteristic Tj=175°C

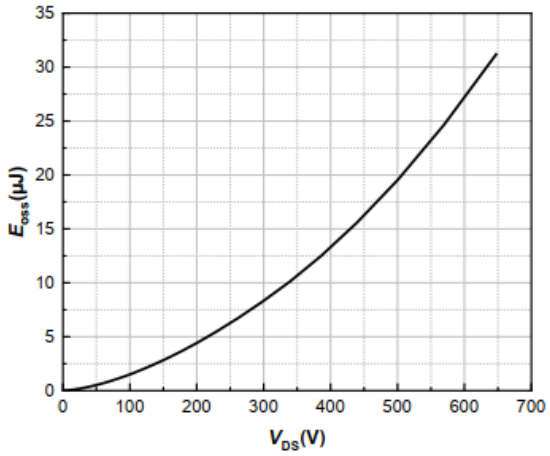


Figure 13. Output Capacitor Stored Energy

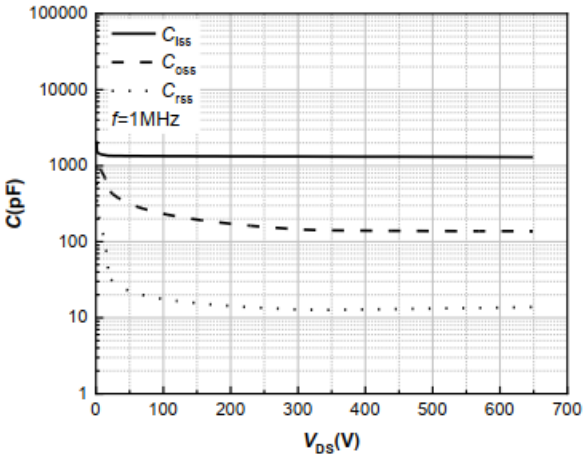


Figure 14. Capacitances vs. Drain-Source

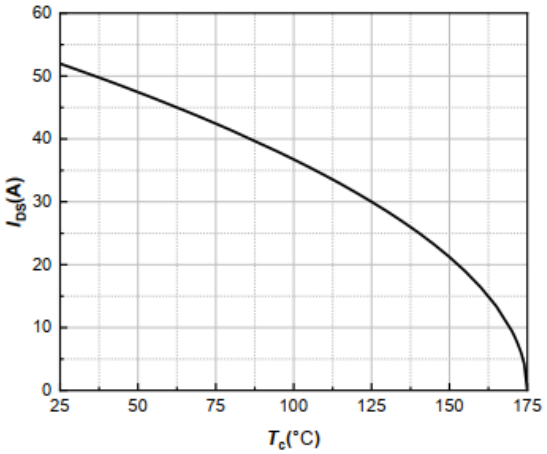


Figure 15. Continuous Drain Current Derating vs. Case Temperature

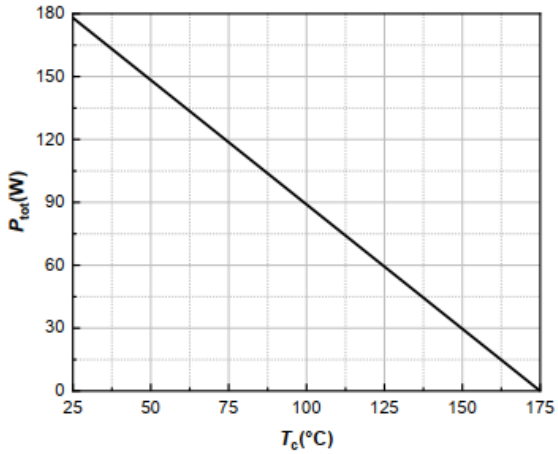


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

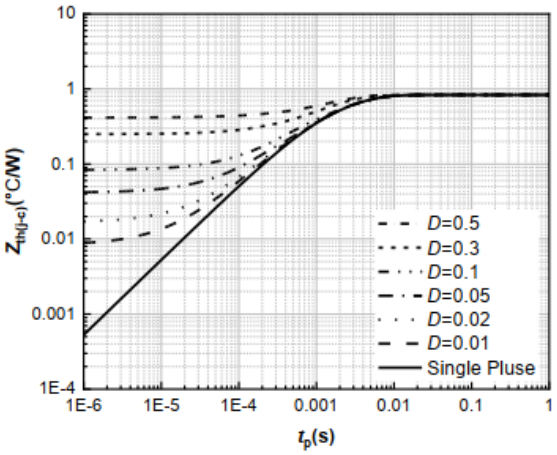


Figure 17. Transient Thermal Impedance

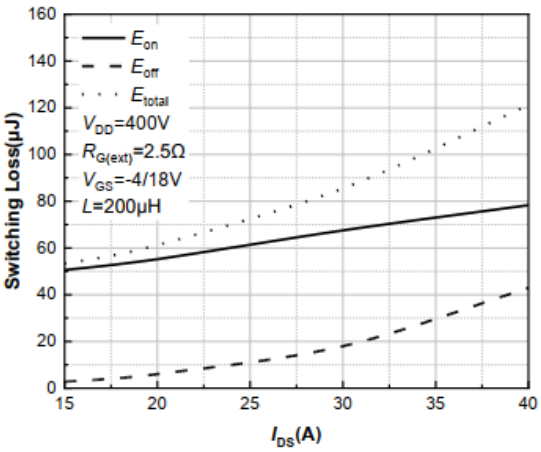


Figure 18. Clamped Inductive Switching Energy vs. Drain Current

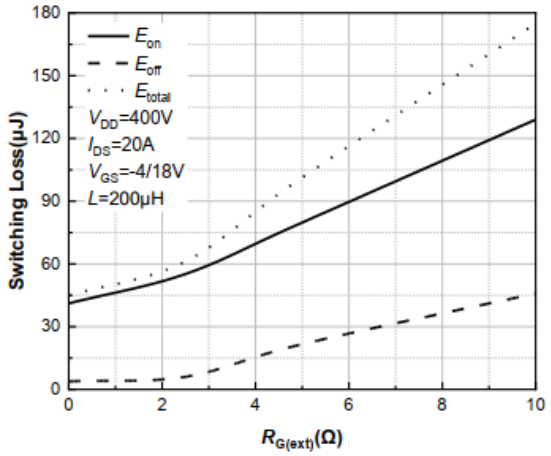


Figure 19. Clamped Inductive Switching Energy vs. RG(ext)

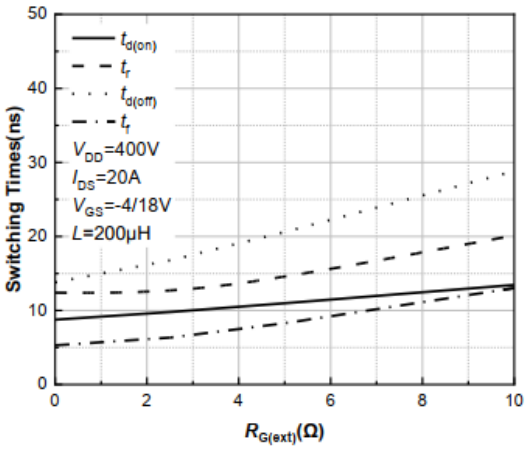


Figure 20. Switching Times vs. RG(ext)

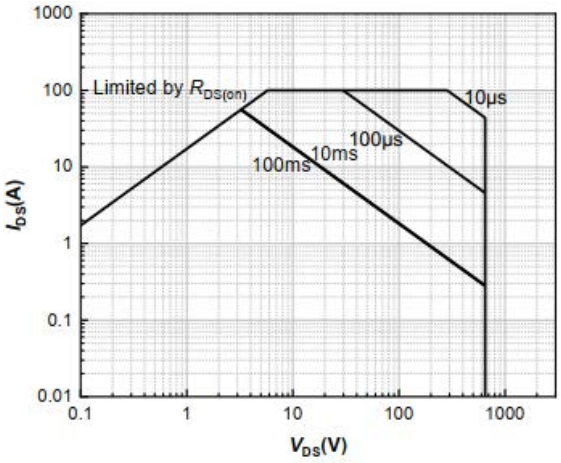
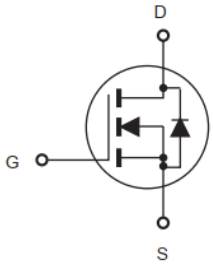
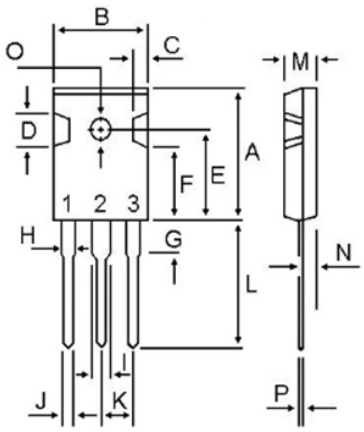


Figure 21. Safe Operating Area

• Circuit diagram



• TO-247-3L Package outlines : Dimensions in (mm)



DIM	MILLIMETERS	
	MIN	MAX
A	20.80	21.80
B	15.38	16.20
C	1.90	2.70
D	5.10	6.10
E	14.50	15.50
F	11.20	13.20
G	3.75	4.35
H	1.90	2.30
I	2.90	3.30
J	1.00	1.40
K	5.26	5.66
L	19.50	20.50
M	4.68	5.36
N	2.30	2.60
O	3.45	3.85
P	0.48	0.72

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