

Silicon Carbide Power MOSFET 650V N-Channel MOS
■ Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications

■ Features

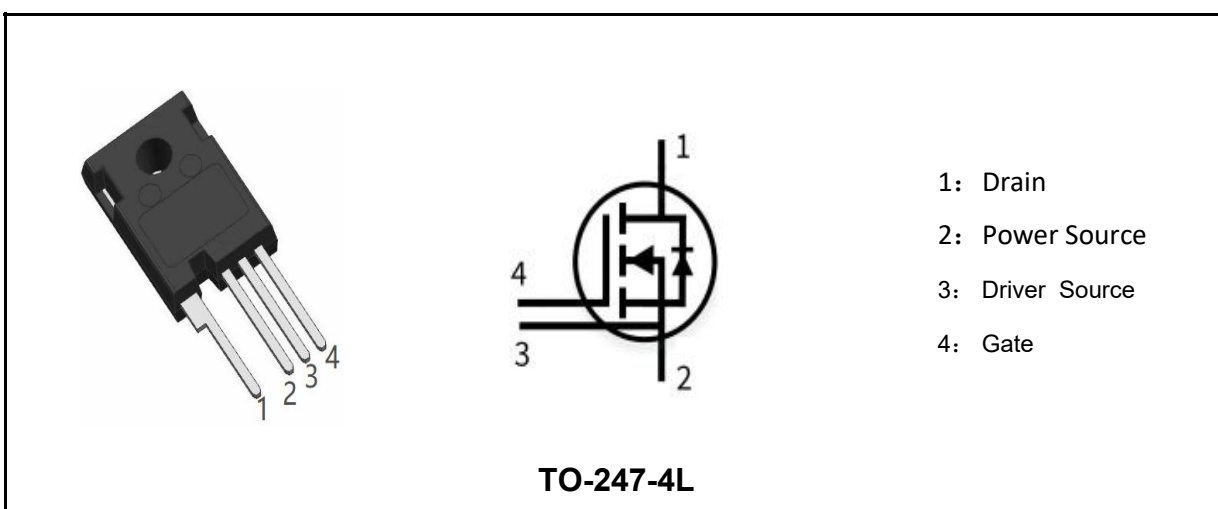
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- AEC-Q101 Qualified

■ Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

■ Product Summary

V_{DS}	650	V
I_D	77	A
$R_{DS(ON)}$, Typ@20V	30	mΩ
Q_g	98	nC



Marking	Package	Packaging	Min. package quantity
MSF3C030R065A	TO-247-4L	Tube	450



**■ Absolute Maximum Ratings (Tc=25°C unless otherwise noted)**

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	- 5/+20	V
Recommended operational values	V_{GSop}	- 4/+18	V
Continuous Drain Current Tc=25°C (Note 1)	I_D	77	A
Continuous Drain Current Tc=100°C (Note 1)		54	A
Drain Current-Pulsed (Note 1)	I_{DM}	230	A
Total Dissipation	P_D	294	W
Junction Temperature	T_j	175	°C
Storage Temperature	T_{stg}	- 55~175	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

■ Thermal Characteristics

Parameter	Symbol	Max	Unit
Maximum Junction-to-Case	$R_{\theta JC}$	0.52	°C/W
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W

Note 1: Ensure that the channel temperature does not exceed 175°C.

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.





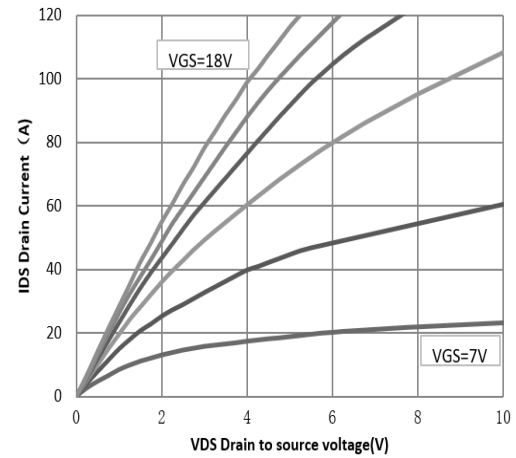
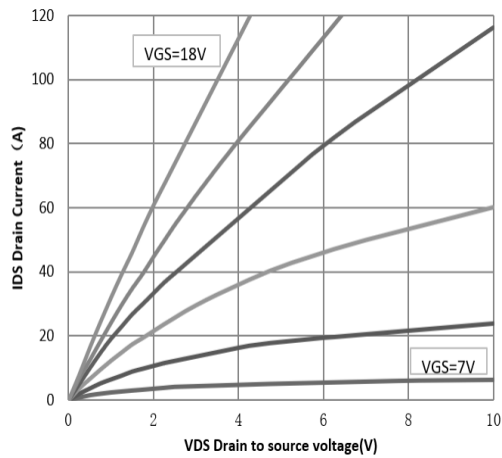
■ Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =100uA	650	-	-	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	100	uA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =20V, V _{DS} =0V	-	-	200	nA
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} =V _{DS} , I _D =10mA	2.0	2.8	4.0	V
Drain-Source On Resistance	R _{DS(ON)}	V _{GS} =18V, I _D =30A	-	30	45	mΩ
		T _j =150°C	-	33	-	
Transconductance	g _{fs}	V _{GS} =20V, I _D =33.5A	-	21		S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =400V, V _{GS} =0V, f=1.0MHz	-	2330	-	pF
Output Capacitance	C _{oss}		-	227	-	pF
Reverse Transfer Capacitance	C _{rss}		-	13	-	pF
Gate Resistance	R _g	f=1.0MHz open drain	-	5.1	-	Ω
Switching Paramters						
Turn-On Delay Time	t _{d(on)}	V _{DD} =400V, I _D =33.5A, V _{GS} =-4/18V, R _G =2.5Ω Timing relative to V _{DS} L=59uH	-	12	-	ns
Turn-On Rise Time	t _r		-	18	-	ns
Turn-Off Delay Time	t _{d(off)}		-	33	-	ns
Turn-Off Rise Time	t _f		-	9	-	ns
Turn-On Switching Energy	E _{ON}		-	71	-	uJ
Turn-Off Switching Energy	E _{OFF}		-	84	-	
Total Gate Charge	Q _g		V _{DD} =400V, I _D =33.5A, V _{GS} =-4/18V	-	28	-
Gate-Source Charge	Q _{gs}	-		26	-	nC
Gate-Drain Charge	Q _{gd}	-		98	-	nC
Source-Drain Characteristics						
Diode Forward Voltage	V _{sd}	V _{GS} =-4V, I _S =20A	-	3.8	6	V
Continuous Diode Forward Curren	I _S	T _C =25°C	-	-	77	A
Reverse Recovery Time	t _{rr}	V _{GS} =-4V, I _{SD} =33.5A V _R =400V di/dt=1600A/us	-	19.5	-	ns
Reverse Recovery Charge	Q _{rr}		-	218	-	nC
Peak Reverse Recovey Current	I _{mm}		-	22	-	A

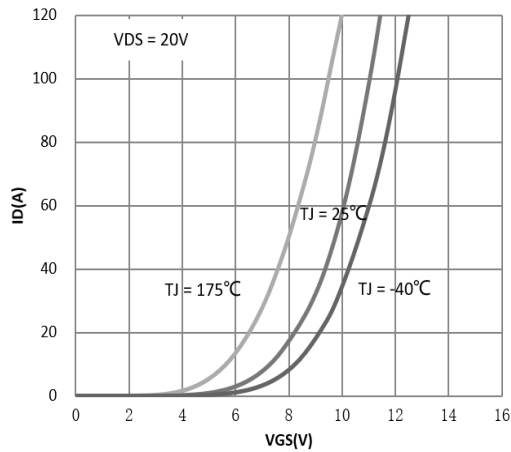




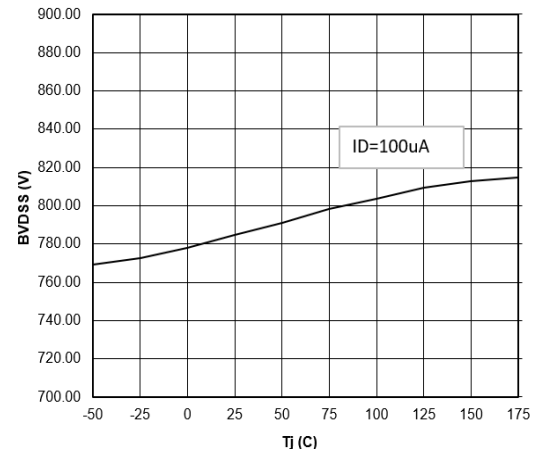
■ Characteristics Curves



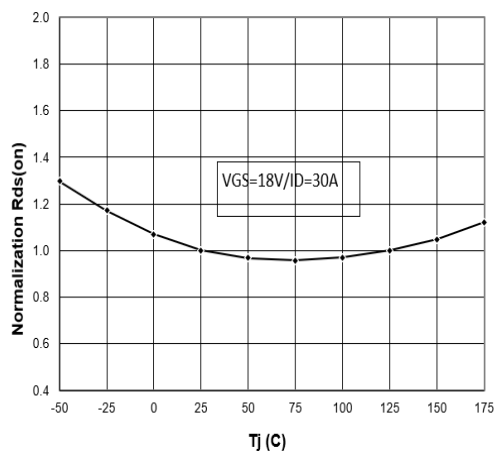
Output Characterisics $T_J = 25^\circ\text{C}$



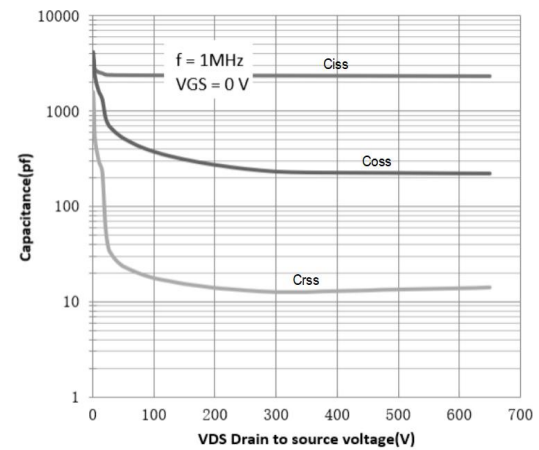
Output Characterisics $T_J = 175^\circ\text{C}$



Transfer Characterisics



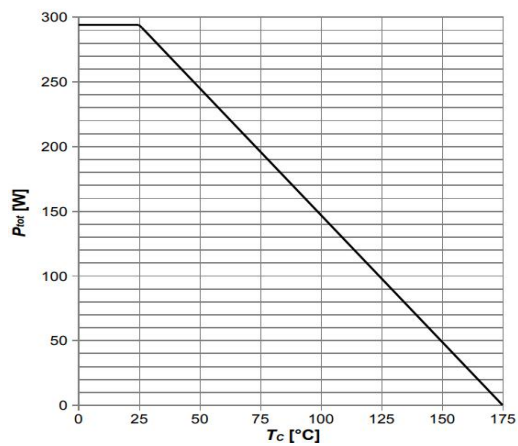
BVDSS vs Temperature



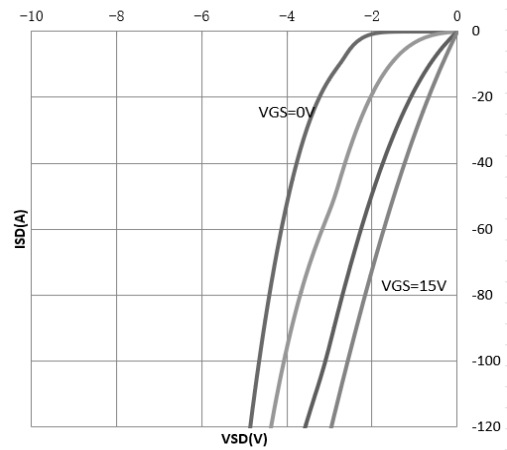
Normalized On-Resistance vs. Temperature

Capacitance

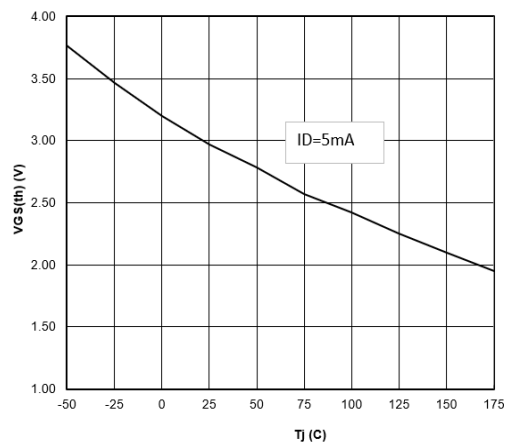




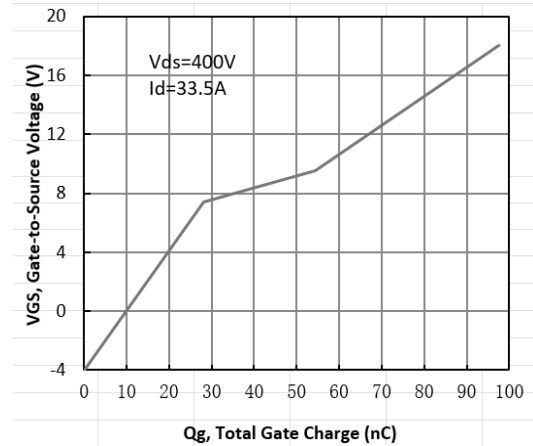
Power Dissipation Derating



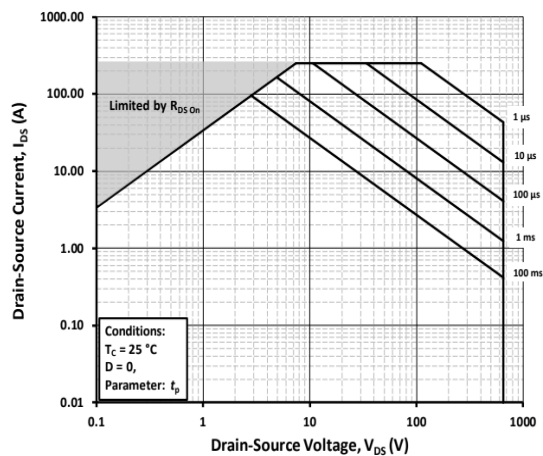
Source-Drain Diode Characteristics



Threshold Voltage vs. Temperature



Gate Charge Waveform



Safe Operating Area

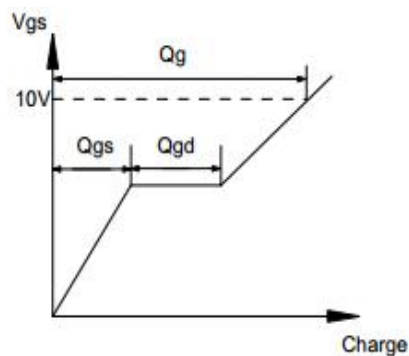
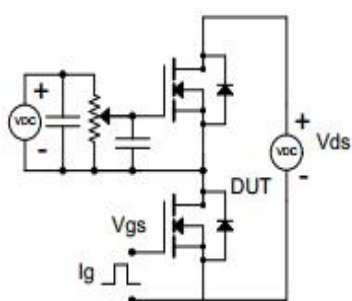
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



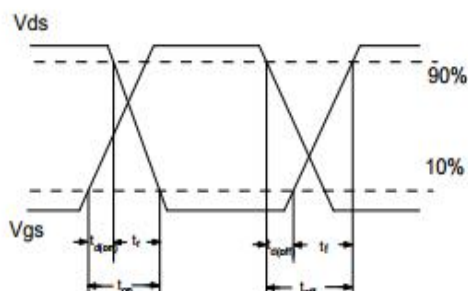
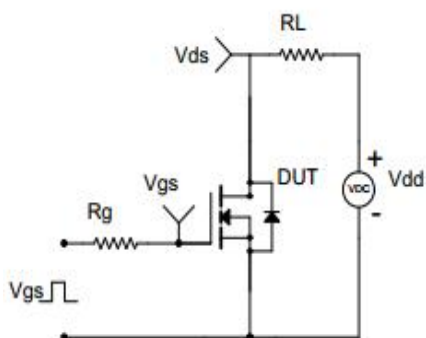


■ Test Circuit & Waveform

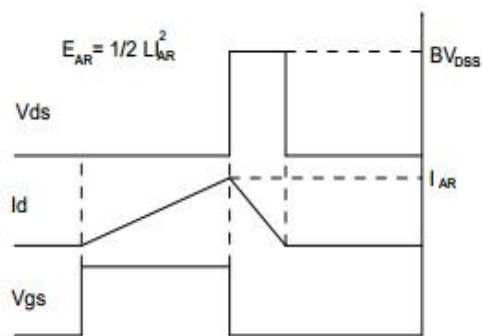
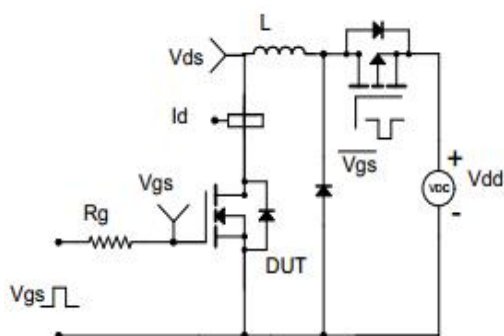
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform



**■ TO-247-4L Package Dimensions**

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.80	5.00	5.20	E2	3.70		5.10
A1	2.20	2.41	2.60	E3	1.10		1.90
A2	1.85		2.15	e	2.44	2.54	2.64
b	1.07	1.20	1.33	e1	4.98	5.08	5.18
b1	2.40		2.90	L	17.27		17.87
b3	1.07		1.60	L1	3.99		4.39
c	0.52	0.60	0.68	L2	2.35		2.65
D	23.30	23.45	23.60	ΦP	3.40		3.80
D1	16.15		16.95	ΦP1	7.00		7.40
E	15.74	15.94	16.14	S	6.04	6.17	6.30
E1	13.00		13.60				

