

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

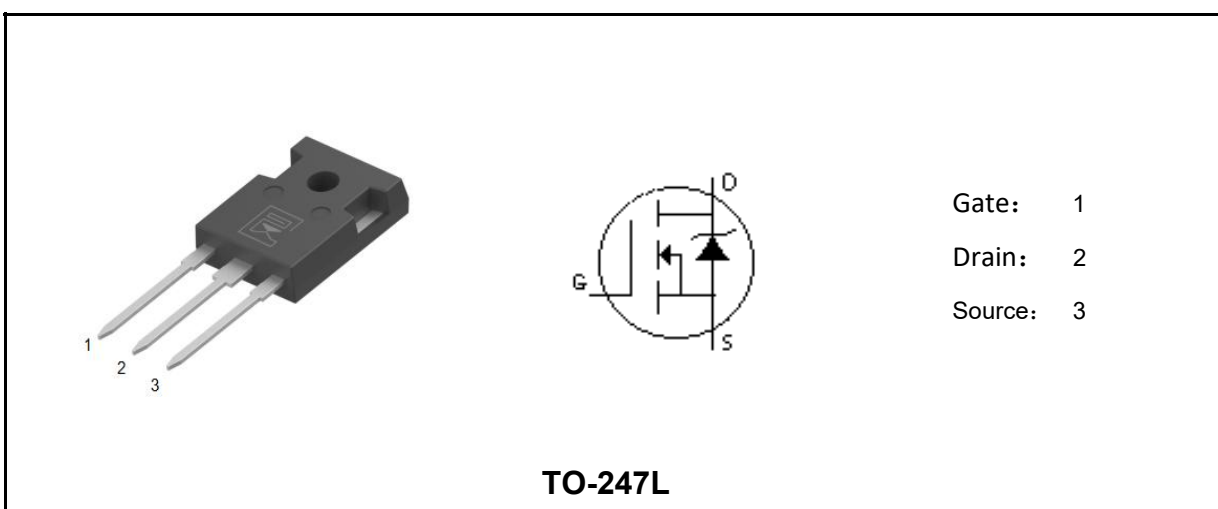
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)

■ Benefits

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

■ Product Summary

V_{DS}	650	V
I_D	50	A
$R_{DS(ON)}$, Typ@18V	40	mΩ
Q_g	41	nC



Marking	Package	Packaging	Min. package quantity
MSL3C040R065	TO-247L	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}	- 7/+20	V
Recommended operational values	V_{GSop}	- 5/+18	V
Continuous Drain Current Tc=25°C V_{GS} =18V (Note 1)	I_D	50	A
Continuous Drain Current Tc=100°C V_{GS} =18V (Note 1)		35	A
Drain Current-Pulsed (Note 1)	I_{DM}	120	A
Total Dissipation	P_D	150	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	$R_{\theta JC}$	1	°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.





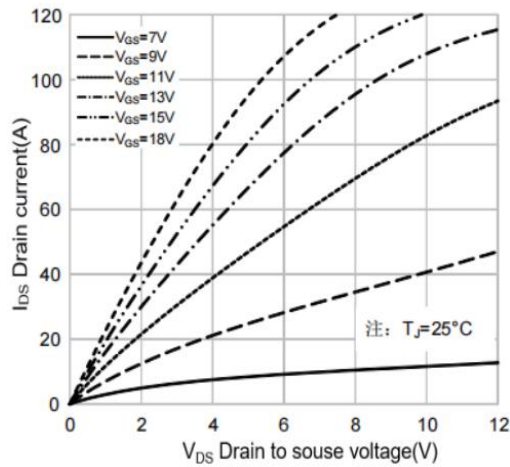
■ Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250uA	650	-	-	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	1	uA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =18V, V _{DS} =0V	-	-	100	nA
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} =V _{DS} , I _D =10mA	1.5	2.6	3.5	V
Drain-Source On Resistance	R _{DS(ON)}	V _{GS} =15V, I _D =20A	-	50	60	mΩ
		Tj=175°C	-	58	-	
		V _{GS} =18V, I _D =20A	-	40	50	
		Tj=175°C	-	54	-	
Transconductance	g _{fs}	V _{GS} =20V, I _D =20A	-	5.2		S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz	-	1420	-	pF
Output Capacitance	C _{oss}		-	418	-	pF
Reverse Transfer Capacitance	C _{rss}		-	25	-	pF
Gate Resistance	R _g	f=1.0MHz open drain	-	3.2	-	Ω
Switching Paramters						
Turn-On Delay Time	t _{d(on)}	V _{DD} =400V, I _D =30A, V _{GS} =-5/18V, R _G =2.5Ω L=100uH	-	10	-	ns
Turn-On Rise Time	t _r		-	26	-	ns
Turn-Off Delay Time	t _{d(off)}		-	27	-	ns
Turn-Off Rise Time	t _f		-	33	-	ns
Turn-On Switching Energy	E _{ON}		-	441	-	uJ
Turn-Off Switching Energy	E _{OFF}		-	178	-	
Total Gate Charge	Q _g	V _{DD} =50V, I _D =10A, V _{GS} =18V	-	41	-	nC
Gate-Source Charge	Q _{gs}		-	11	-	nC
Gate-Drain Charge	Q _{gd}		-	13	-	nC
Source-Drain Characteristics						
Diode Forward Voltage	V _{sd}	V _{GS} =-5V, I _S =20A	-	5.4	-	V
Continuous Diode Forward Current	I _S	T _C =25°C	-	-	50	A
Reverse Recovery Time	t _{rr}	V _R =400V, I _F =30A, di/dt=200A/us	-	35	-	ns
Reverse Recovery Charge	Q _{rr}		-	70	-	nC
Peak Reverse Recovey Current	I _{mm}		-	4	-	A

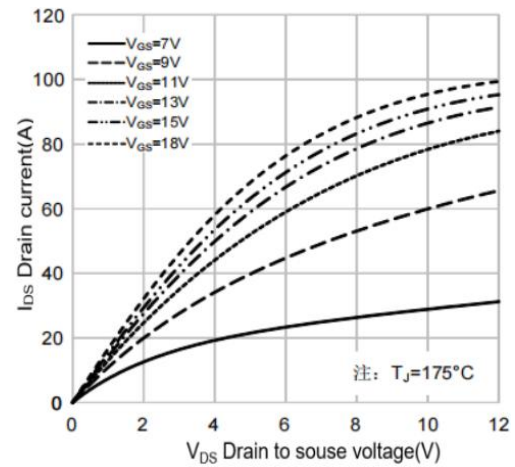




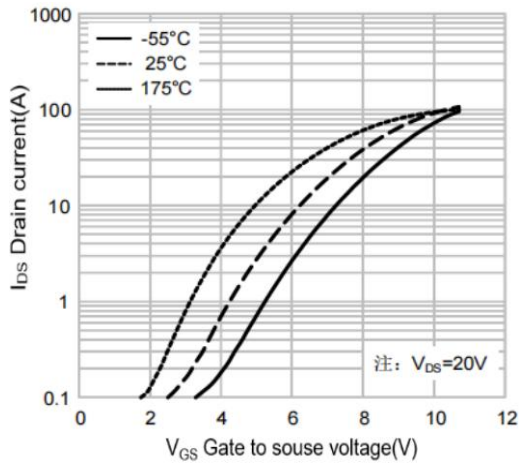
■ Characteristics Curves



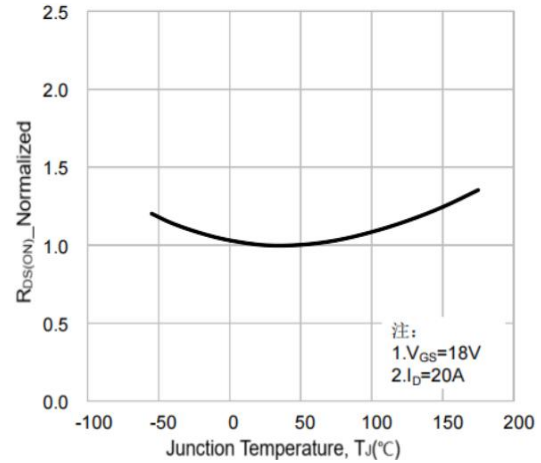
Output Characteristics $T_J = 25^\circ\text{C}$



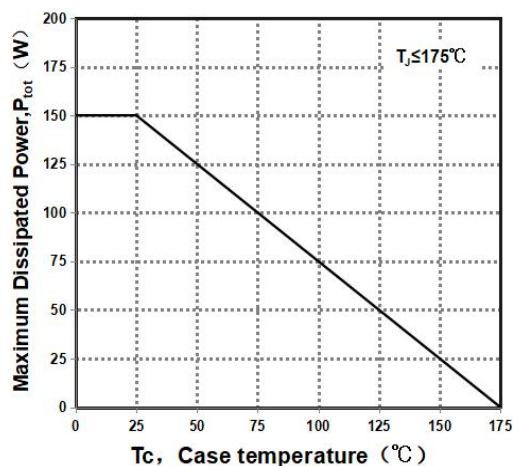
Output Characteristics $T_J = 175^\circ\text{C}$



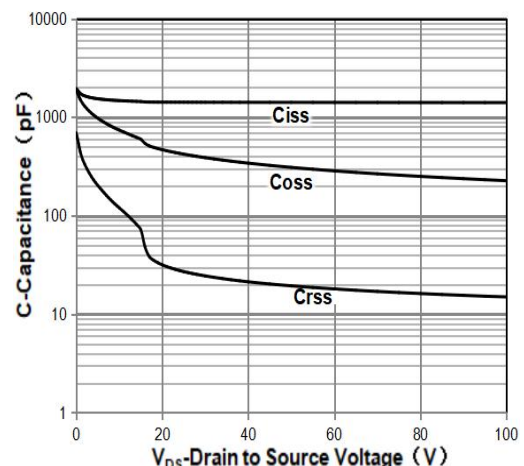
Transfer Characteristics



Normalized On-Resistance vs. Temperature

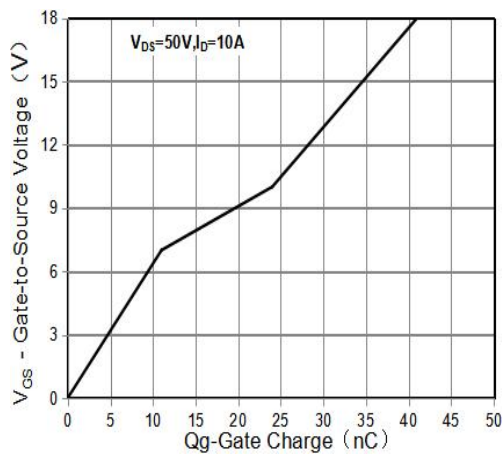


Power Dissipation Derating

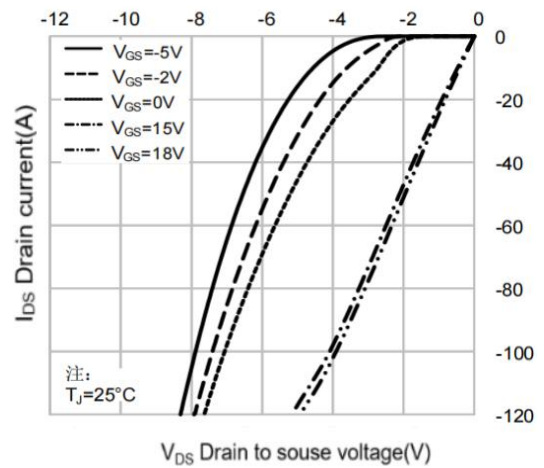


Capacitance

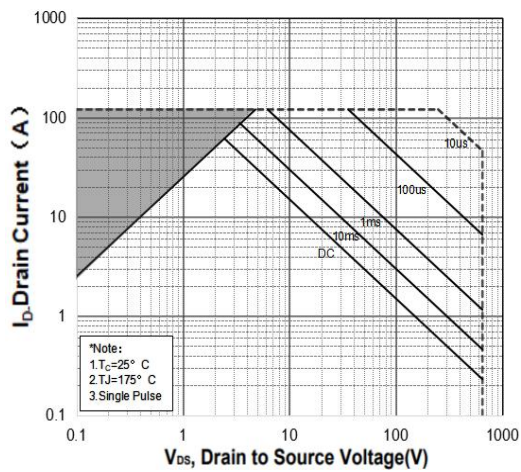




Gate Charge Waveform



Source-Drain Diode Characteristics



Safe Operating Area

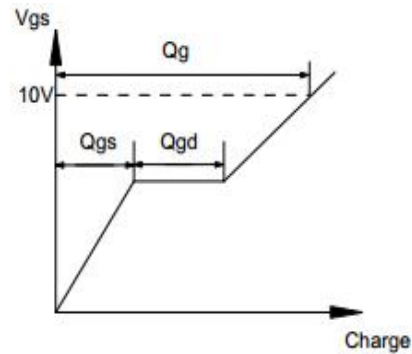
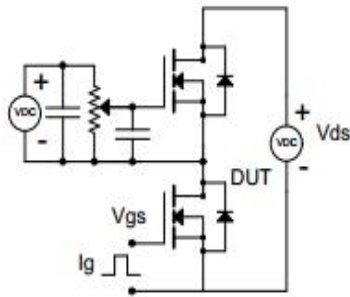
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



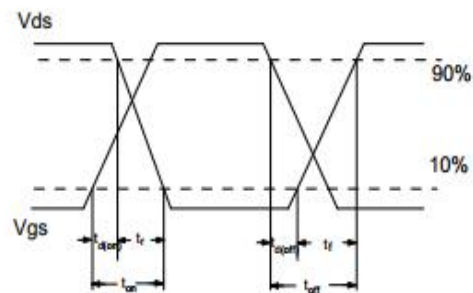
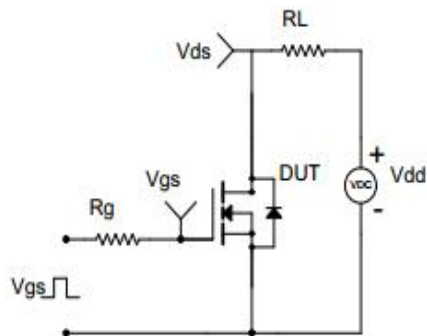


■ Test Circuit & Waveform

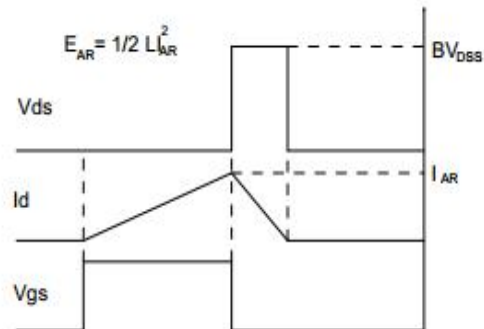
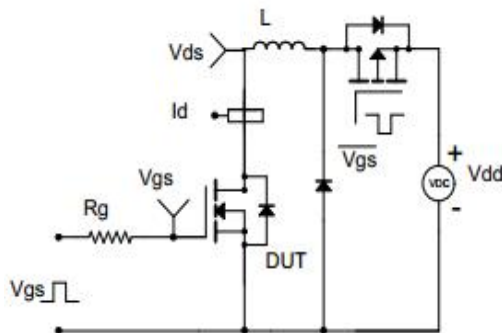
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform



**■ TO-247L Package Dimensions**

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.80		5.20	E1	13.00		13.60
A1	2.20	2.40	2.60	E2	5.00		5.50
A2	1.85		2.15	E3	1.90		2.60
b	1.07		1.33	e		5.44	
b2	1.90		2.16	L	19.30		19.90
b4	2.90		3.20	L1	3.75	3.95	4.15
c	0.52		0.68	ΦP	3.40		3.80
D	20.70		21.30	ΦP1	7.00		7.40
D1	16.15		16.95	S	6.04	6.15	6.30
E	15.50		16.10				

