



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

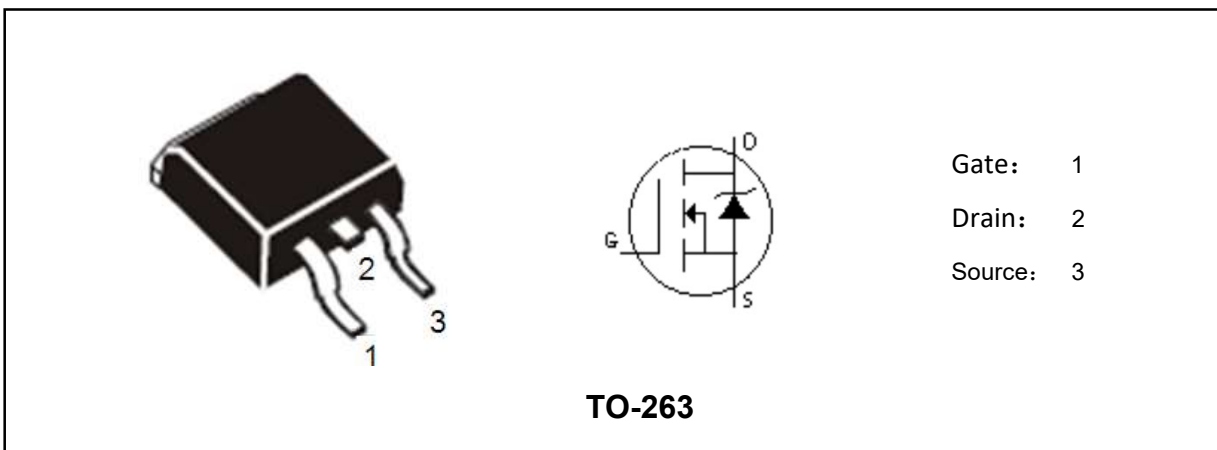
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

Benefits

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

Product Summary

V_{DS}	650	V
I_D	30	A
$R_{DS(ON)}$, Typ@20V	60	mΩ
Q_g	65	nC



Marking	Package	Packaging	Min. package quantity
ML3C060R065	TO-263	Tube	1000
		Tape & Reel	800



**■ 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}	- 10/+25	V
Recommended operational values	V_{GSop}	- 5/+20	V
Continuous Drain Current Tc=25°C (Note 1)	I_D	30	A
Continuous Drain Current Tc=100°C (Note 1)		22	A
Drain Current-Pulsed (Note 1)	I_{DM}	65	A
Total Dissipation	P_D	156	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	- 55~150	°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	$R_{\theta JC}$	0.8	°C/W
Maximum Junction-to-Ambient	$R_{\theta JA}$	60	°C/W

Note 1: Ensure that the channel temperature does not exceed 150°C.

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





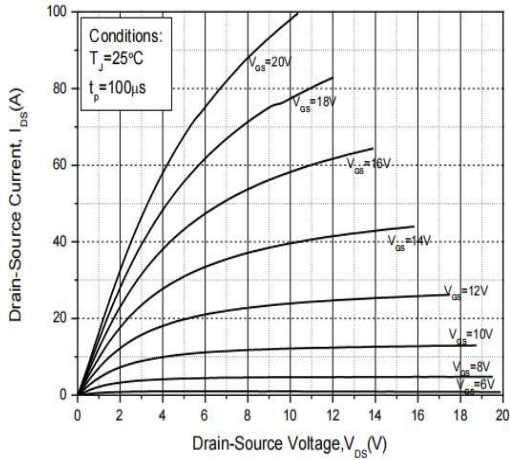
■ Electrical Characteristics (T_c=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =100μA	650	-	-	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	2	100	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =20V, V _{DS} =0V	-	50	200	nA
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _{DS} =5mA	2.0	2.4	4.0	V
Drain-Source On Resistance	R _{DS(ON)}	V _{GS} =20V, I _D =20A	-	60	78	mΩ
		T _J =150°C	-	95	-	
Transconductance	g _{fs}	V _{GS} =20V, I _D =20A	-	7	-	S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =1000V, V _{GS} =0V, f=1.0MHz, V _{AC} =25 mV	-	1700	-	pF
Output Capacitance	C _{oss}		-	172	-	pF
Reverse Transfer Capacitance	C _{rss}		-	77	-	pF
Gate Resistance	R _g	V _{AC} =25mV, f=1.0MHz	-	1.0	-	Ω
Switching Parameters						
Turn-On Delay Time	t _{d(on)}	V _{DD} =400V, V _{GS} =-0/20 V I _D = 10A, R _{G(ext)} = 5 Ω , R _L =40Ω	-	15	-	ns
Turn-On Rise Time	t _r		-	45	-	ns
Turn-Off Delay Time	t _{d(off)}		-	13	-	ns
Turn-Off Fall Time	t _f		-	10	-	ns
Turn-On Switching Energy	E _{ON}	V _{DS} =400V, V _{GS} =- 5/20V, I _D = 10A, R _{G(ext)} = 5 Ω, L=142μH	-	140	-	μJ
Turn-Off Switching Energy	E _{OFF}		-	32	-	
Total Gate Charge	Q _g	V _{DD} =400V, V _{GS} =-0/20 V I _D = 10A	-	65	-	nC
Gate-Source Charge	Q _{gs}		-	18	-	nC
Gate-Drain Charge	Q _{gd}		-	19	-	nC
Source-Drain Characteristics						
Diode Forward Voltage	V _{sd}	V _{GS} = -5V, I _{SD} = 10 A,	-	3.5	-	V
Continuous Diode Forward Current	I _S	T _C =25°C	-	-	30	A
Reverse Recovery Time	t _{rr}	V _{GS} =-5V, I _{SD} =20A V _R =400V di/dt=1200A/μs	-	16	-	ns
Reverse Recovery Charge	Q _{rr}		-	80	-	nC
Peak Reverse Recovery Current	I _{imm}		-	9.0	-	A

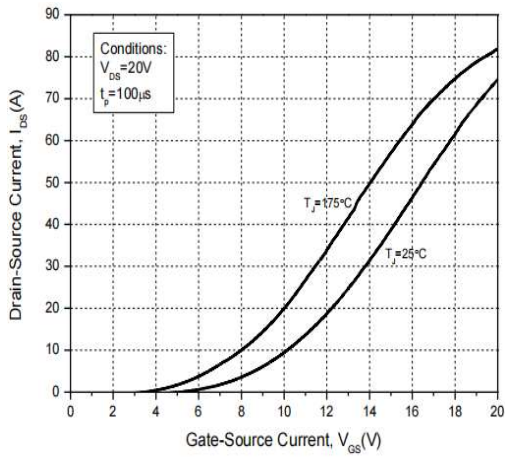




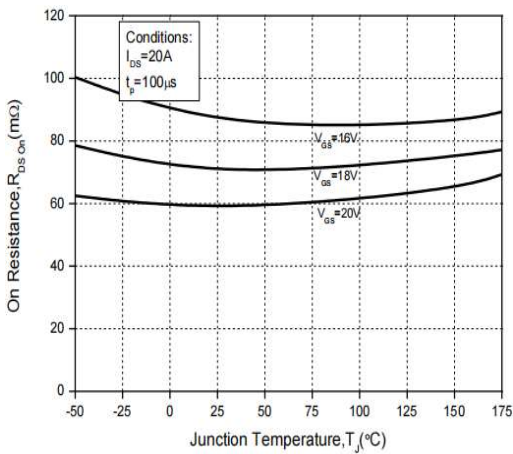
Characteristics Curves



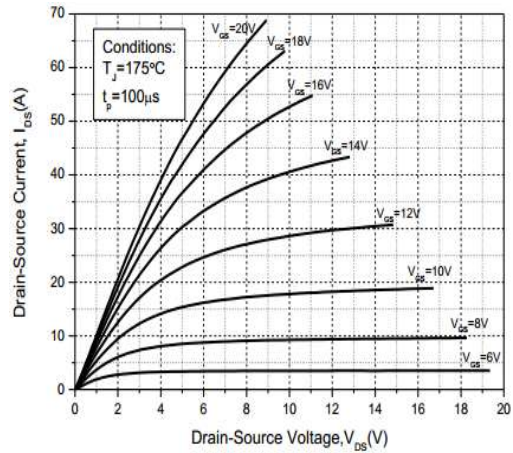
Output Characteristics $T_J = -25^\circ\text{C}$



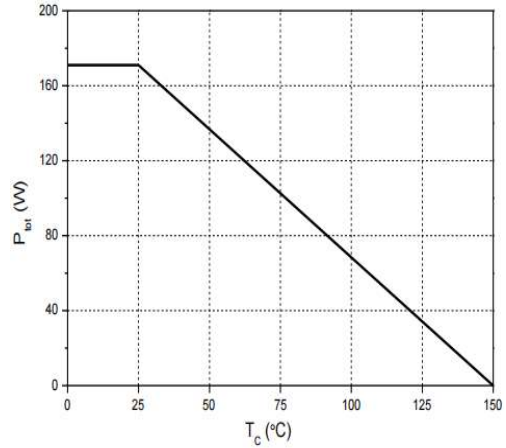
Transfer Characteristics



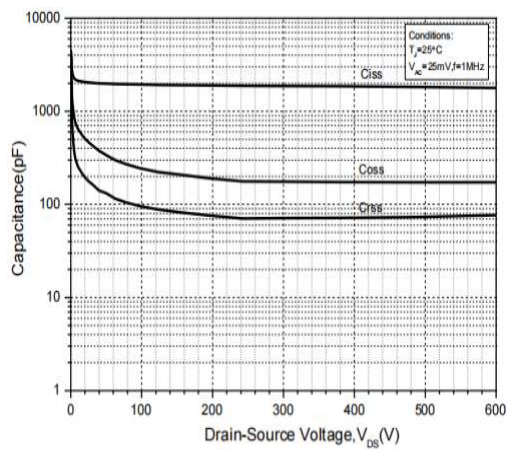
Normalized On-Resistance vs. Temperature



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

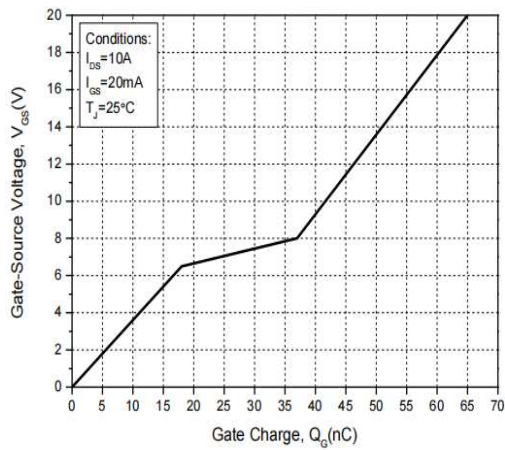


Power Dissipation Derating

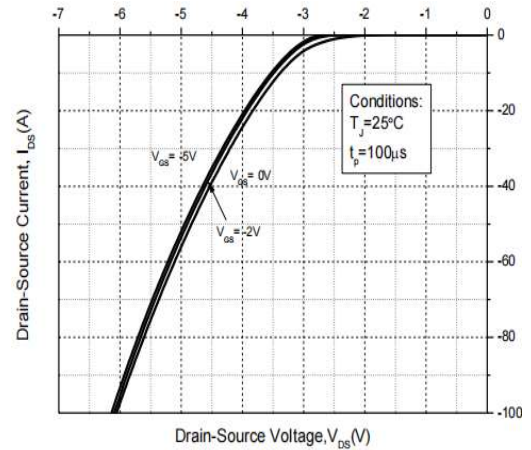


Capacitance

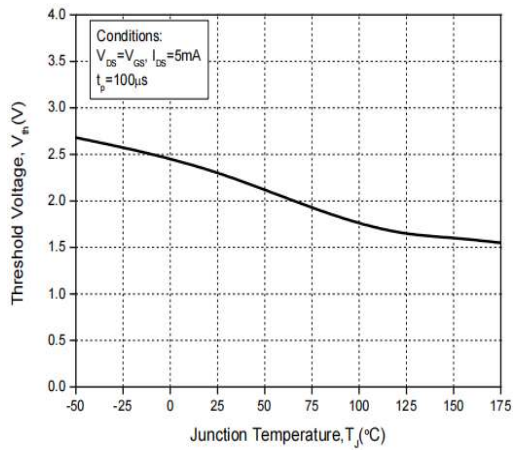




Gate Charge Waveform



Source-Drain Diode Characteristics



Threshold Voltage vs. Temperature

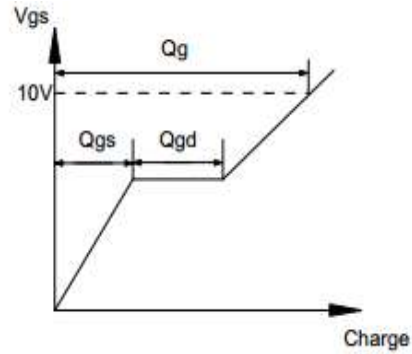
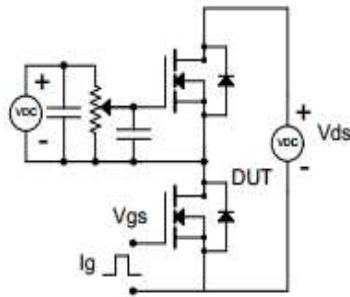
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



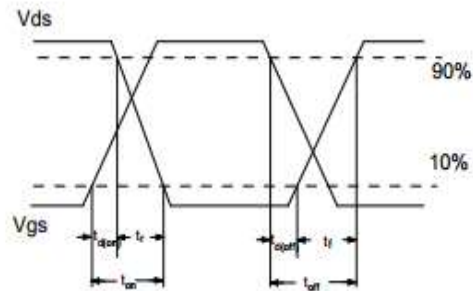
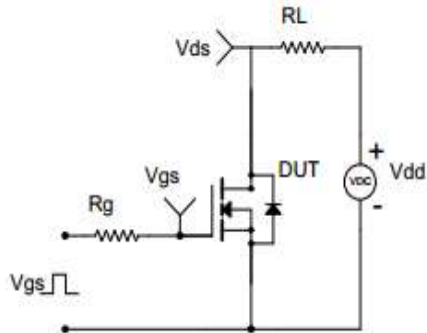


■ Test Circuit & Waveform

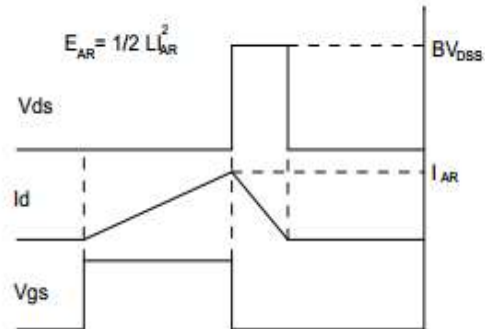
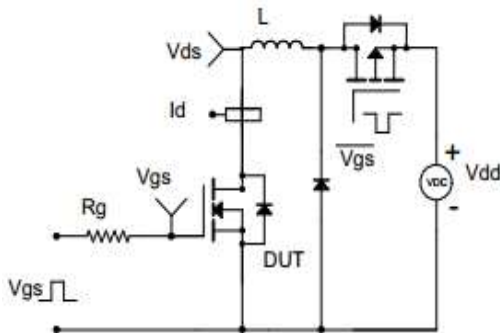
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform





■ TO-263 Package Dimensions

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.42		4.72	e1	2.44	2.54	2.64
B	1.22		1.4	e2	4.98		5.18
b	0.76		0.86	L1	14.7	15.1	15.5
b1	1.22		1.4	L2	2	2.3	2.6
b2	0.33		0.43	L3	1.5		2
C	1.22		1.35	K	-0.1		0.1
D	9.95		10.25	Y	8.51	8.61	8.71
E	8.99		9.29				

