

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

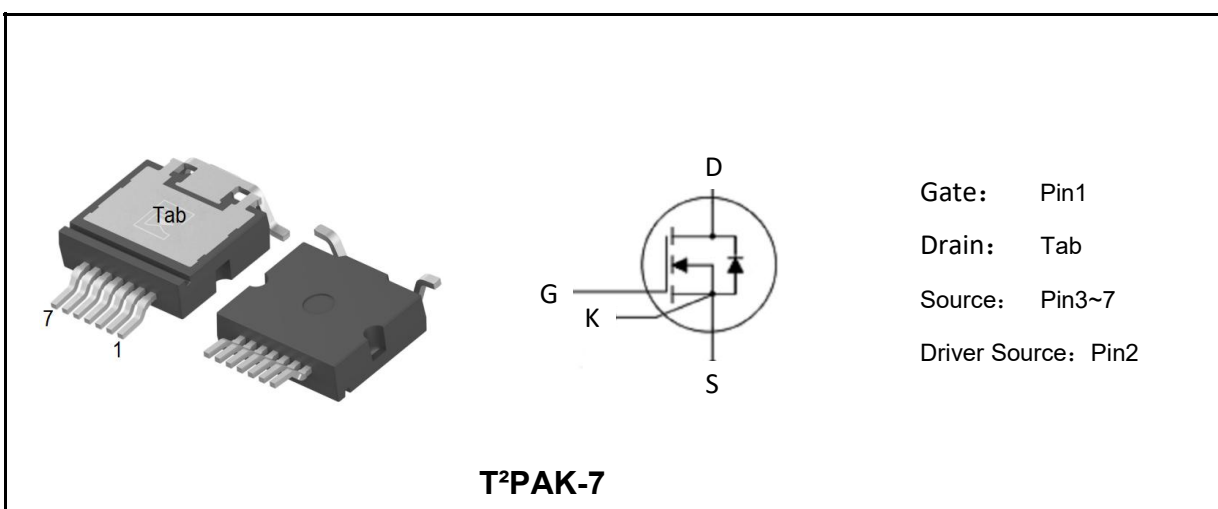
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- AEC-Q101 Qualified

■ 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@18V	30	mΩ
Q_g	98	nC



Marking	Package	Packaging	Min. package quantity
MLT3C030R065A	T ² PAK-7	Tape & Reel	500



**■ 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	$R_{\theta JA}$	50	°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.





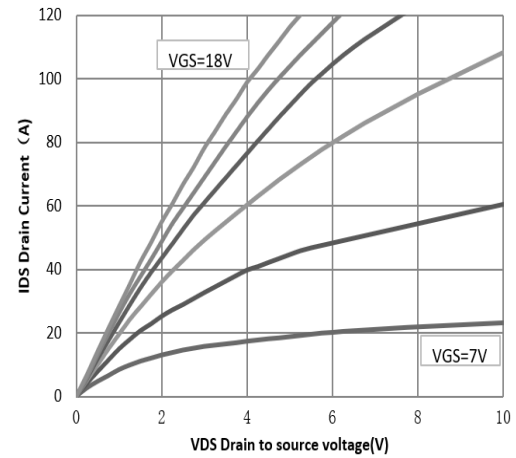
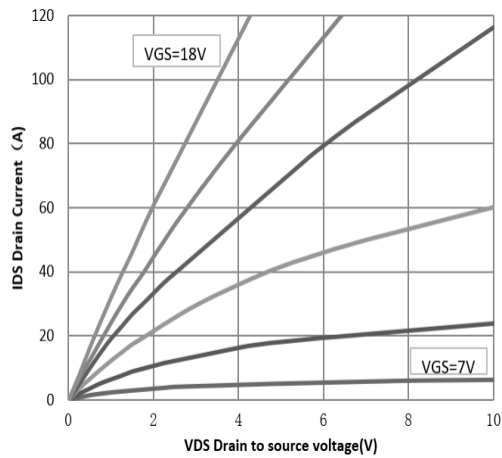
■ Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=100\mu A$	650	-	-	V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$	-	-	100	μA
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	m Ω
		$T_J=150^{\circ}C$	-	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	$t_{d(on)}$	$V_{DD}=400V, I_D=33.5A, V_{GS}=-4/18V, R_G=2.5\Omega$ Timing relative to V_{DS} $L=59\mu H$	-	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	-	μJ
Turn-Off Switching Energy	E_{OFF}		-	84	-	
Total Gate Charge	Q_g	$V_{DD}=400V, I_D=33.5A, V_{GS}=-4/18V$	-	98	-	nC
Gate-Source Charge	Q_{gs}		-	28	-	nC
Gate-Drain Charge	Q_{gd}		-	26	-	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	$T_C=25^{\circ}C$	-	-	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

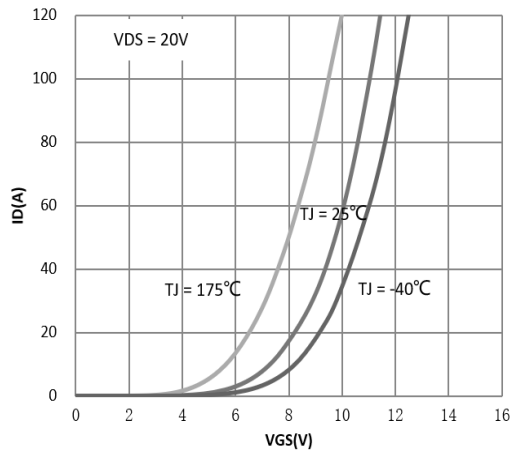




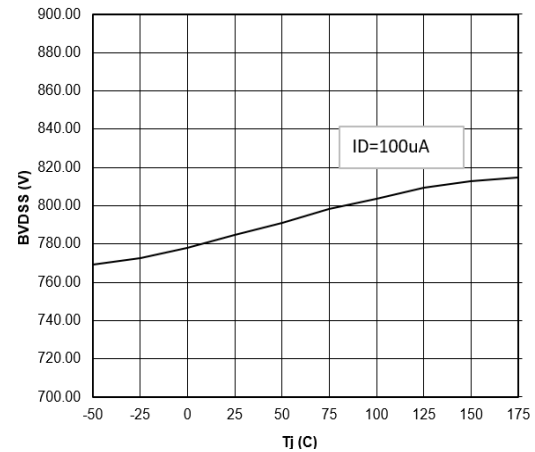
■ Characteristics Curves



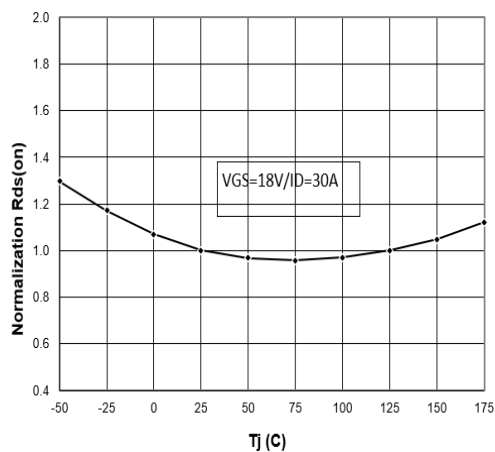
Output Characterisics $T_J = 25^\circ\text{C}$



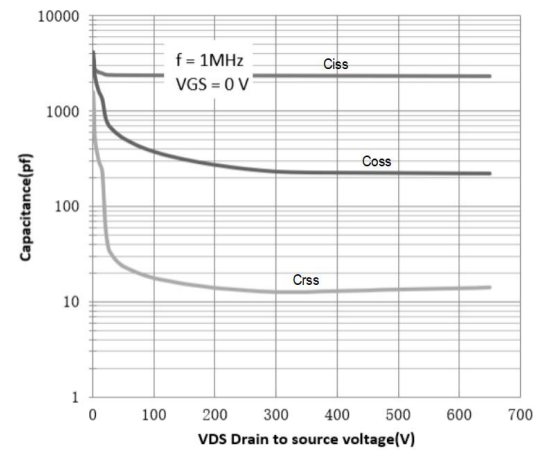
Output Characterisics $T_J = 175^\circ\text{C}$



Transfer Characterisics



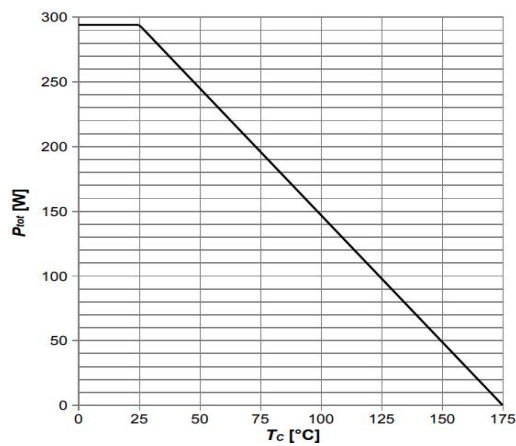
BVDSS vs Temperature



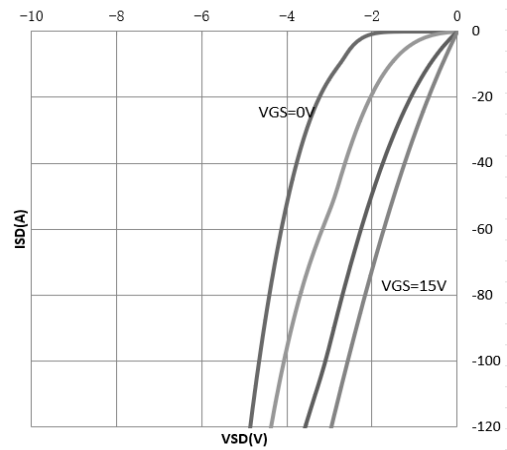
Normalized On-Resistance vs. Temperature

Capacitance

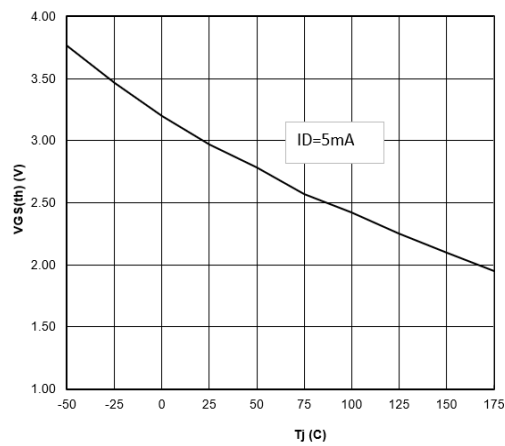




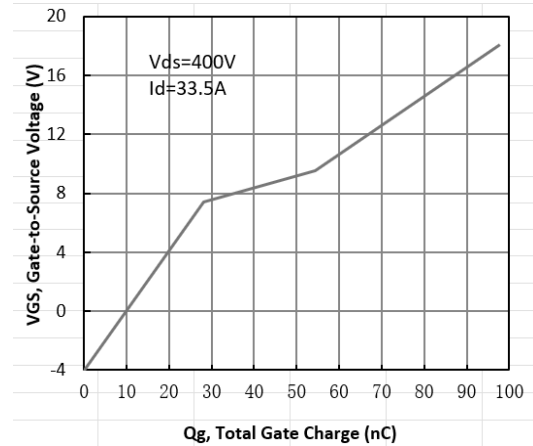
Power Dissipation Derating



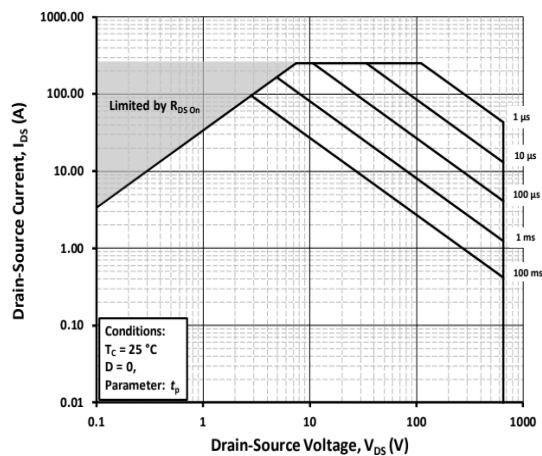
Source-Drain Diode Characteristics



Threshold Voltage vs. Temperature



Gate Charge Waveform



Safe Operating Area

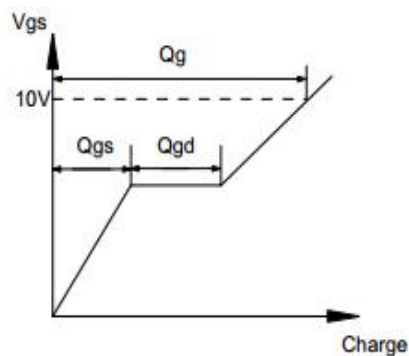
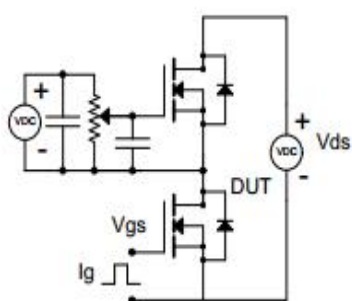
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



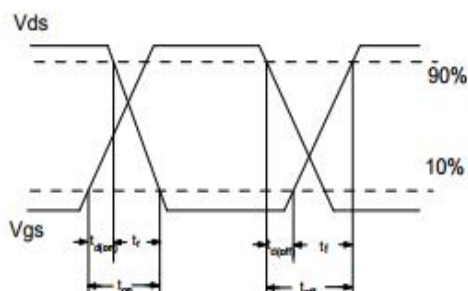
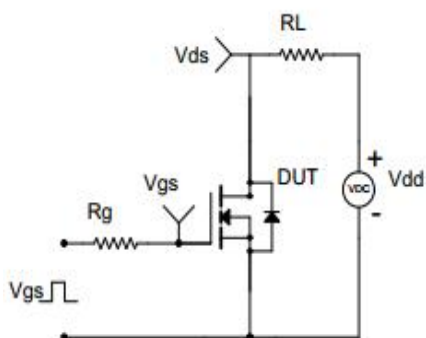


■ Test Circuit & Waveform

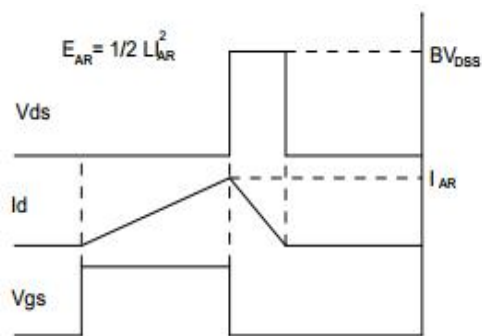
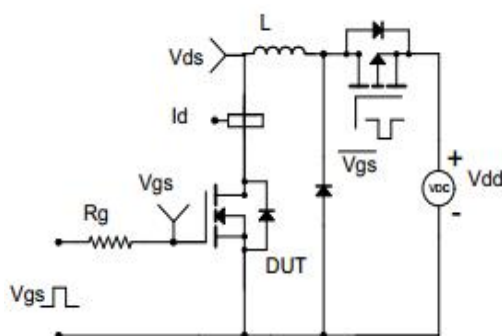
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform



**■ T²PAK-7 Package Dimensions**

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	3.4	3.5	3.6	e		1.27	
b	0.5	0.6	0.7	L	18	18.58	19
b1	0.7	0.8	0.9	L1	4.44	4.54	4.64
c	0.4	0.5	0.6	L2	1.97	2.52	2.97
c1	0.4	0.5	0.6	L3	0.8	0.9	0.98
D	13.9	14	14.1	L4	2.14	2.24	2.34
D1	13.85	14	14.15	L5		3.04	
D2	12.3	12.4	12.5	L6	2.38	2.48	2.58
D3	4.45	4.5	4.55	T1		0.6	
E	11.7	11.8	11.9	T2		1	
E1	5.46	5.56	5.66	k	0.075	0.125	0.175

