

TSC065B050

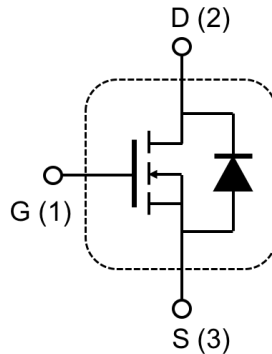
Silicon Carbide Power MOSFET

N-CHANNEL ENHANCEMENT MODE

TO-220-3L



Inner Circuit



Product Summary

V_{DS}	650V
$I_D(@25^{\circ}C)$	52A*
$R_{DS(on)}$	50mΩ



Features

- ◆ Low On-Resistance
- ◆ Low Capacitance
- ◆ Avalanche Ruggedness
- ◆ Halogen Free, RoHS Compliant

Applications

- ◆ SMPS / UPS / PFC
- ◆ EV Charging station & Motor Drives

Benefits

- ◆ Higher System Efficiency
- ◆ Parallel Device Convenience
- ◆ High Temperature Application
- ◆ High Frequency Operation
- ◆ Power Inverters & DC/DC Converters
- ◆ Solar/ Wind Renewable Energy

Maximum Ratings ($T_c=25^{\circ}C$)

Parameter	Symbol	Test Conditions	Value	Unit
Drain – Source Voltage	$V_{DS, max}$	$V_{GS}=0V, I_{DS}=100\mu A$	650	V
Continuous Drain Current	I_D	$V_{GS}=20V, T_c=25^{\circ}C$	52*	A
		$V_{GS}=20V, T_c=110^{\circ}C$	31*	
Avalanche energy, Single Pulse	E_{AS}	$V_{DD}=100V, I_D=10A$	1.25	J
Power Dissipation	P_D	$T_c=25^{\circ}C$	208*	W
Recommend Gate Source Voltage	$V_{GS, op}$		-5/+20	V
Maximum Gate Source Voltage	$V_{GS, max}$		-10/+25	
Junction & Storage Temperature	T_j, T_{stg}		-55/+150	$^{\circ}C$
Soldering Temperature	T_L		260	

*by estimation

Electrical Characteristics (T_j=25°C)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} =0V, I _{DS} =100μA	650			V
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =10V, I _{DS} =10mA		2.6		V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V		<1	50	μA
		V _{DS} =650V, V _{GS} =0V T _j =150°C		5	200	
Gate-Source Leakage Current	I _{GSS}	V _{GS} =20V, V _{DS} =0V			250	nA
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =20V, I _{DS} =20A		50	65	mΩ
		V _{GS} =20V, I _{DS} =20A, T _j =150°C		65		
Input Capacitance	C _{iss}	V _{GS} =0V, V _{DS} =400V f=1MHz, V _{AC} =25mV		1850		pF
Output Capacitance	C _{oss}			208		
Reverse Transfer Capacitance	C _{rss}			33		
Effective Output Capacitance, Energy Related	C _{o(er)}	V _{GS} =0V, V _{DS} =0 to 400V		237		
Effective Output Capacitance, Time Related	C _{o(tr)}	I _D =const., V _{GS} =0V, V _{DS} =0 to 400V		305		
Turn On Delay Time	t _{d(on)}	V _{DS} =400V, V _{GS} =-4/20V, I _D =20A, R _L =20Ω, R _{G(ext)} =2.7 Ω		16		ns
Rise Time	t _r			17		
Turn Off Delay Time	t _{d(off)}			20		
Fall Time	t _f			10		
C _{oss} Stored Energy	E _{oss}	V _{GS} =0V, V _{DS} =400V f=1MHz, V _{AC} =25mV		24		μJ
Internal Gate Resistance	R _{G(int.)}	f=1MHz, V _{AC} =25mV		4		Ω

Built-in SiC Diode Characteristics (T_j=25°C)

Parameter	Symbol	Test Conditions	Typ.	Unit
Inverse Diode Forward Voltage	V _{SD}	V _{GS} =-5V, I _{SD} =5A	4.1	V
Reverse Recovery Time	t _{rr}	V _{GS} =0V, I _{SD} =30A, V _{DS} =400V, di/dt=300A/μs	58	ns
Reverse Recovery Charge	Q _{rr}		122	nC
Peak Reverse Recovery Current	I _{rrm}		3.75	A

Gate Charge Characteristics ($T_j=25^\circ\text{C}$)

Parameter	Symbol	Test Conditions	Value	Unit
Gate to Source Charge	Q_{GS}	$V_{DS}=400\text{V}, V_{GS}=0/20\text{V}$ $I_D=6\text{A}$	8	nC
Gate to Drain Charge	Q_{GD}		48	
Total Gate Charge	Q_G		112	

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta,JC}$	0.6*	K/W
Thermal Resistance, Junction to Ambient	$R_{\theta,JA}$	TBD	

*by estimation

Typical Device Performance

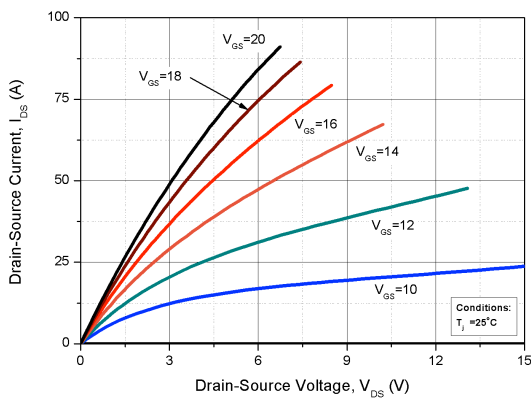


Fig. 1 Forward Output Characteristics at $T_j = 25^\circ\text{C}$

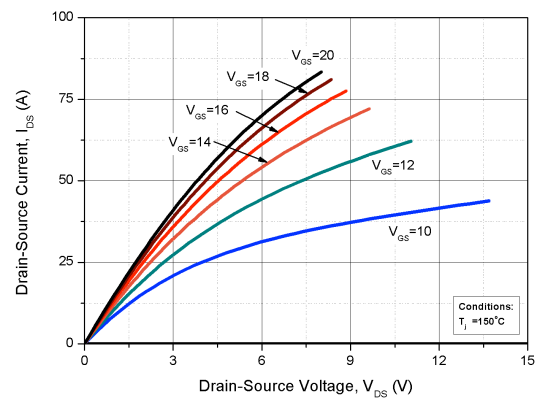


Fig. 2 Forward Output Characteristics at $T_j = 150^\circ\text{C}$

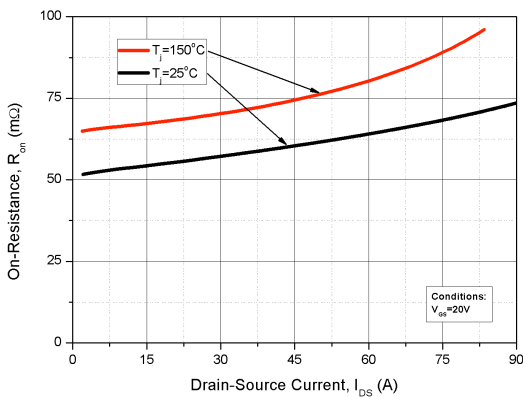


Fig. 3 On-Resistance vs. Drain Current for Various T_j

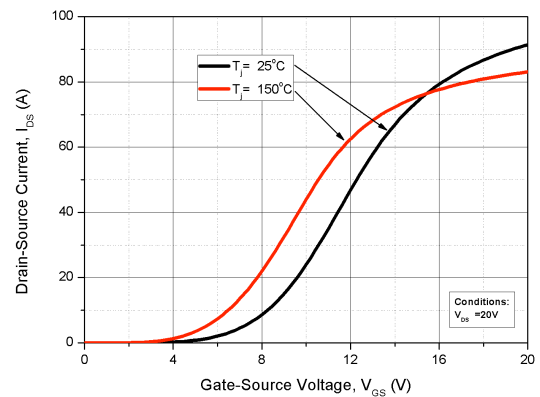


Fig. 4 Transfer Characteristics for Various T_j

Typical Device Performance

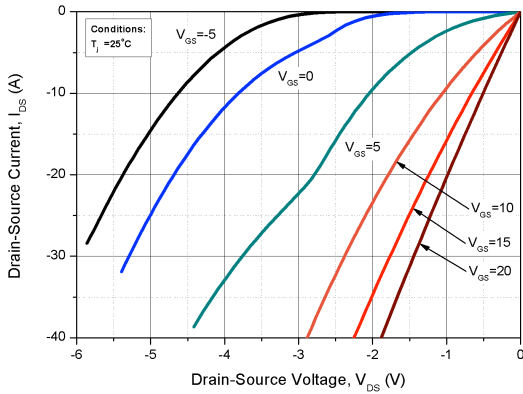


Fig. 5 Reverse Output Characteristics at $T_j = 25^\circ\text{C}$

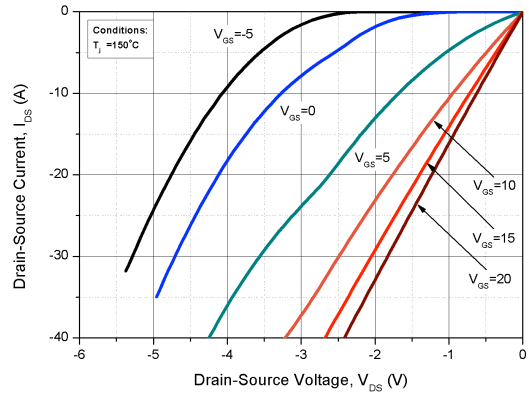


Fig. 6 Reverse Output Characteristics at $T_j = 150^\circ\text{C}$

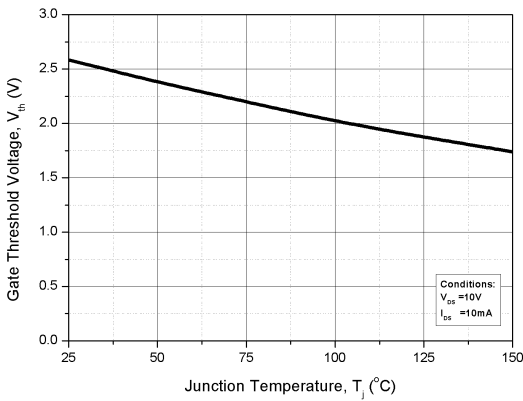


Fig. 7 Threshold Voltage vs. Temperature

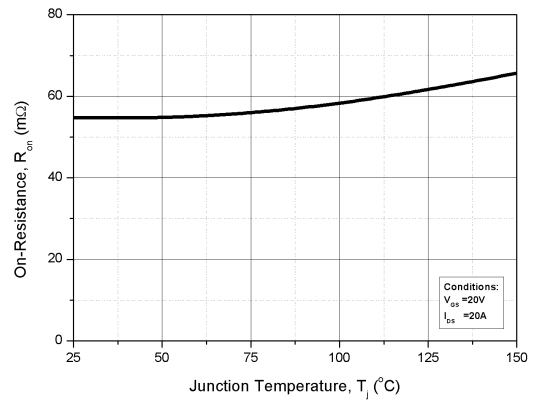


Fig. 8 On-Resistance vs. Temperature

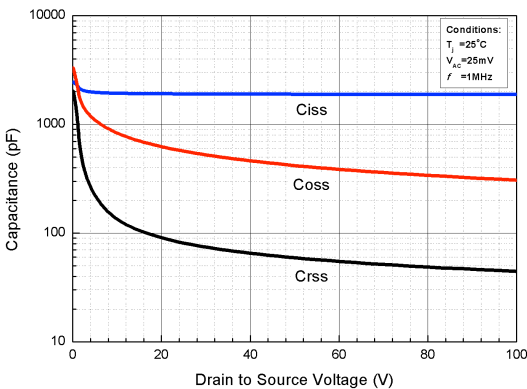


Fig. 9 Capacitances vs. Drain to Source Voltage (0 - 100V)

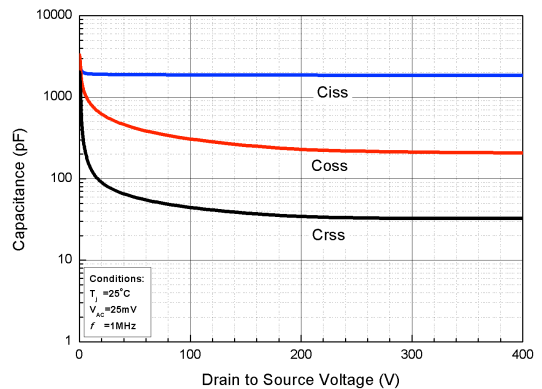


Fig. 10 Capacitances vs. Drain to Source Voltage (0 - 400V)

Typical Device Performance

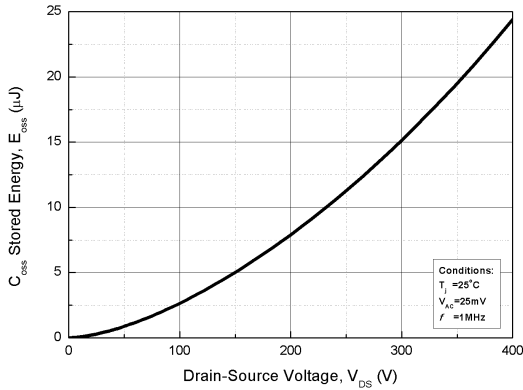


Fig. 11 Output Capacitor Stored Energy

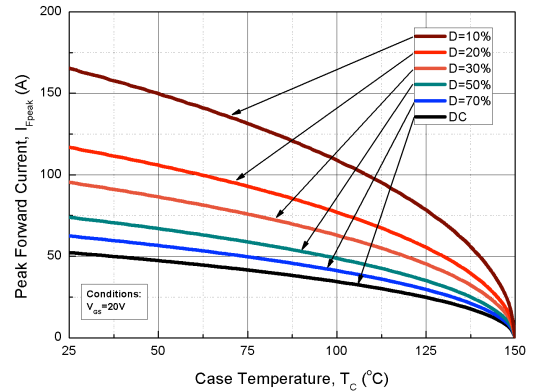


Fig. 12 Drain Current Derating vs. Case Temperature*

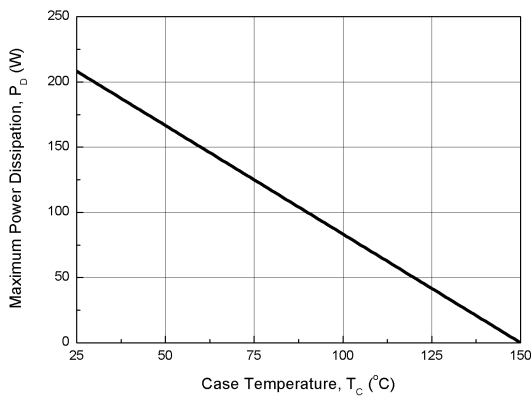
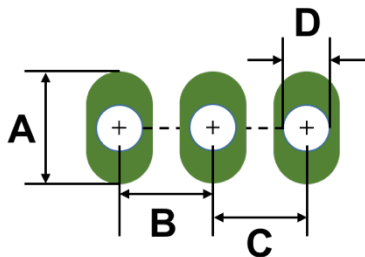


Fig. 13 Maximum Power Dissipation Derating vs. Case Temperature*

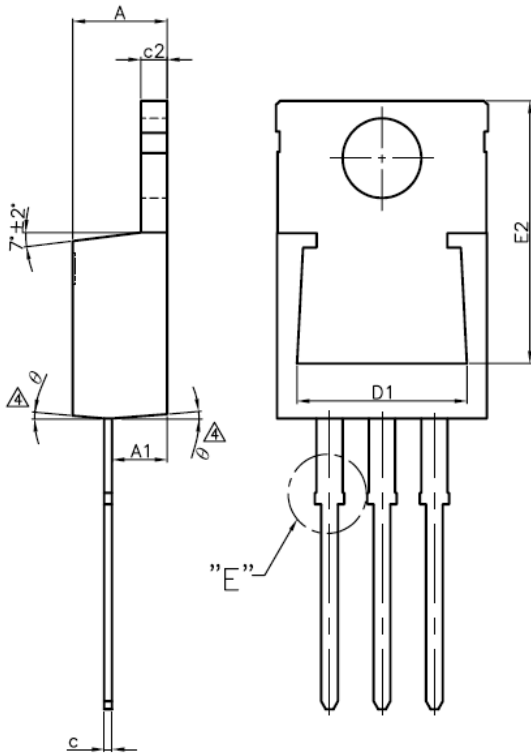
*by estimation

Recommended Solder Pad Layout (TO-220-3L)

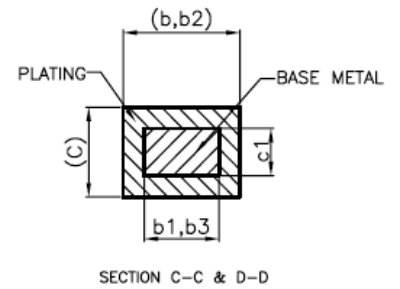
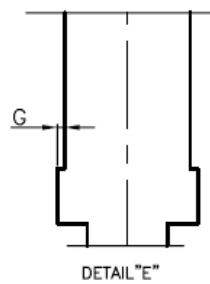
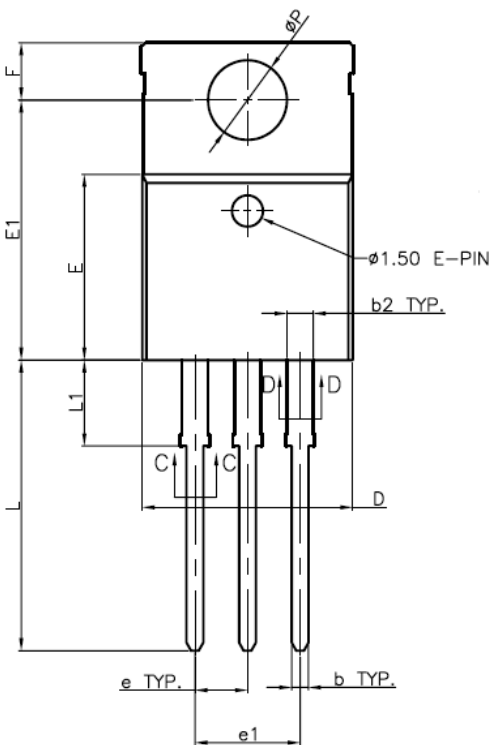


Mechanical Parameters			
Parameter	Symbol	Typical	Unit
Length	A	3.048	mm
	B	2.540	
	C	2.540	
	D	1.270	

Mechanical Parameters



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.470	---	4.670	0.176	---	0.184
A1	2.520	---	2.820	0.099	---	0.111
b	0.711	0.813	0.910	0.028	0.032	0.036
b1	0.711	---	0.914	0.028	---	0.036
b2	1.170	1.270	1.370	0.046	0.050	0.054
b3	1.168	---	1.372	0.046	---	0.054
c	0.279	0.381	0.483	0.011	0.015	0.019
c1	0.279	---	0.432	0.011	---	0.017
c2	1.168	1.270	1.370	0.046	0.050	0.054
D	10.010	---	10.310	0.394	---	0.406
D1	7.595	---	8.230	0.299	---	0.324
E	8.763	8.890	9.017	0.345	0.350	0.355
E1	12.294	12.446	12.586	0.484	0.490	0.496
E2	11.913	---	12.548	0.469	---	0.494
e	---	2.540	---	---	0.100	---
e1	4.980	---	5.180	0.196	---	0.204
F	2.642	2.743	2.946	0.104	0.108	0.116
G	0.000	---	0.152	0.000	---	0.006
L	13.700	---	14.100	0.539	---	0.555
L1	3.980	4.107	4.230	0.157	0.162	0.167
∅P	3.770	---	3.890	0.148	---	0.153
θ	1°	---	5°	1°	---	5°



- NOTES:
 1. All dimension are in mm[inch].
 2. Tolerance : ±0.004inch.

*The information provided herein is subject to change without notice.