HestiaPower

H1J065F050

Silicon Carbide MOSFET
N-CH E-MODE WITH JMOS™ TECHNOLOGY

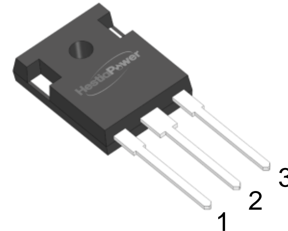
Product Summary

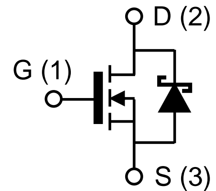
V_{DS}	650V
$I_{D(@25^{\circ}C)}$	56A
$R_{DS(on)}$	50mΩ

Features

- Monolithically integrated SiC MOSFET and JBS
- Low On-Resistance and High Current Density
- Low Capacitance for High Frequency Operation
- Ultra-high Avalanche Ruggedness
- Positive Temperature Coefficient Device
- RoHS Compliant and Halogen Free

Circuit Diagram





Part Number	Package	Marking
H1J065F050	TO-247-3L	H1J065F050

Benefits

- Low Build-in Diode V_F and Q_{rr}
- Higher System Efficiency
- Increase Parallel Device Convenience
- Enable High Temperature Application
- Allow High Frequency Operation
- Realize Compact and Light-weight Systems

Description

The H1J065F050 650V, 50mΩ silicon carbide JMOS™ is an N-channel E-mode MOSFET with monolithically integrated JBS diode. Exploiting the outstanding wide bandgap material properties and JMOS™ technology, this device shows high power density and nice temp.-independent switching behavior. Thanks to JMOS™ technology, this device is free from BPD degradation and perform an excellent reverse recovery behavior. With an industry standard TO-247-3L package outline, this device allows designers to use conveniently.

Applications

- Switching Mode Power Supply
- DC/DC Converters, UPS, and PFC
- EV Charging Station
- Motor Drives
- Power Inverters
- Solar/Wind Renewable Energy

Absolute Maximum Ratings (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Value	Unit
Drain – Source Voltage	$V_{DS,\ max}$	V_{GS}=0V, I_{DS}=100µA	650	V
Continuous Drain Current	I_D	V_{GS}=20V, T_C=25°C	56	A
		V_{GS}=20V, T_C=110°C	32.5	
Pulse Drain Current	$I_{D,\ pulse}$	t_{PW} limitation per Fig.15	122	
Avalanche energy, Single Pulse	E_{AS}	V_{DD}=100V, I_D=8.5A	903	mJ
Power Dissipation	P_D	T_C=25°C	208	W
Recommend Gate Source Voltage	$V_{GS,\ op}$	Static, recommended DC operating values	-5 to 20	V
Maximum Gate Source Voltage	$V_{GS,\ max}$	Transient operating limit (AC f > 1Hz, duty cycle < 1%)	-10 to 25	
Junction & Storage Temperature	T_j , T_{stg}		-55 to 150	°C
Soldering Temperature	T_L		260	
Mounting Torque	M_D	M3 or 6-32 screw	1.0	Nm

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to Case	$R_{\theta,JC}$		0.6		°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta,JA}$			40	°C/W

© 2022 Hestia Power Inc.

Electrical Characteristics (T_c = 25°C unless otherwise specified)

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		2.3		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		10	500	
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		60		
Transconductance	g_{fs}	V_{DS}=15V, I_{DS}=40A		13.3		S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=400V f =1MHz, V_{AC}=25mV		1850		pF
Output Capacitance	C_{oss}			212		
Reverse Transfer Capacitance	C_{rss}			49		
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		294		
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		23.5		μJ
Turn-on Switching Energy	E_{on}	V_{DS}=400V, V_{GS}=0/20V, I_D=20A, $R_{G(ext)}$= 2.7 Ω		30*		
Turn-off Switching Energy	E_{off}			41*		
Internal Gate Resistance	$R_{G(int.)}$	f =1MHz, V_{AC}=25mV		1.2		Ω

*Based on the results of calculation, note that the energy loss caused by the reverse recovery of free-wheeling diode is not included in E_{on}.

Built-in SiC Diode Characteristics (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Typ.	Unit
Inverse Diode Forward Voltage	V_{SD}	V_{GS}=-5V, I_{SD}=10A	2.35	V
Continuous Diode Forward Current	I_S	V_{GS}=-5V, T_C=25°C	30	A
Reverse Recovery Time	t_{rr}	V_{GS}=0V, T_j=150°C I_{SD}=20A, V_{DS}=400V, di/dt=300A/μs	59	ns
Reverse Recovery Charge	Q_{rr}		116	nC
Peak Reverse Recovery Current	I_{rrm}		3.4	A

Gate Charge Characteristics (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Value	Unit
Gate to Source Charge	Q_{GS}	V_{DS}=400V, V_{GS}=-5/+20V, I_D=20A	28	nC
Gate to Drain Charge	Q_{GD}		58	
Total Gate Charge	Q_G		125	
Gate plateau voltage	V_{pl}		8.5	V

© 2022 Hestia Power Inc.

Typical Device Performance

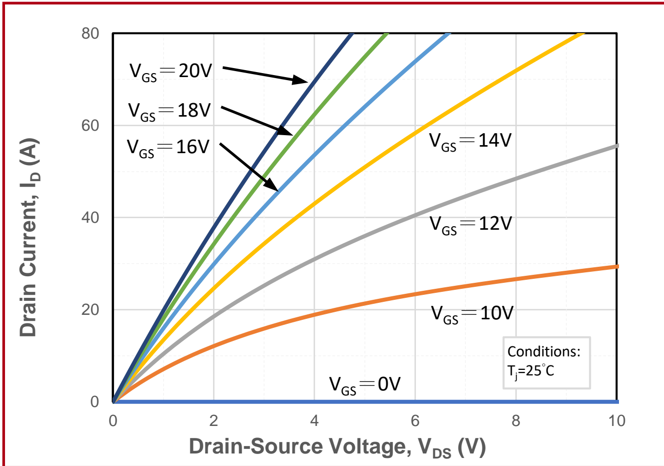


Fig.1 Forward Output Characteristics at T_j=25˚C

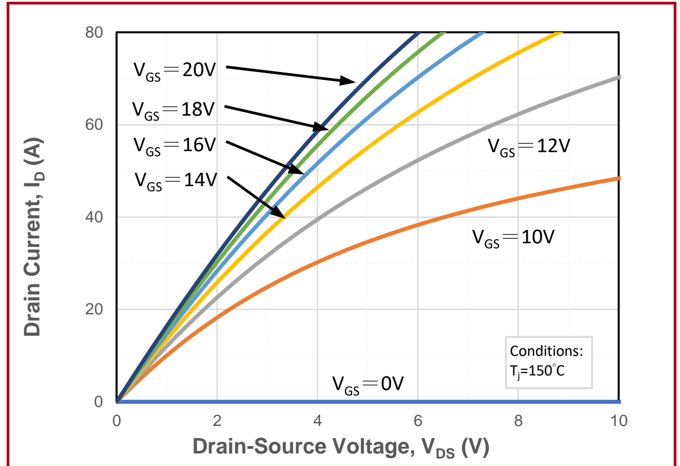


Fig.2 Forward Output Characteristics at T_j=150˚C

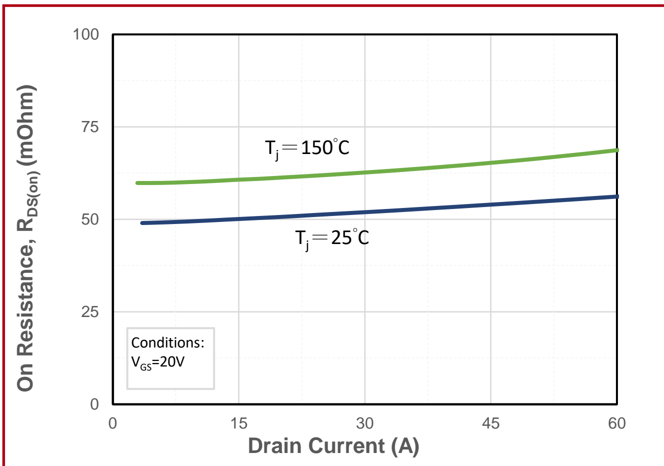


Fig.3 On-Resistance vs. Drain Current for Various T_j

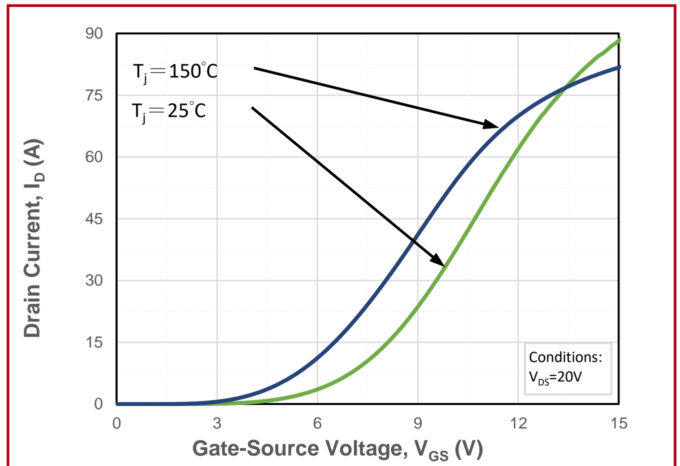


Fig.4 Transfer Characteristics for Various T_j

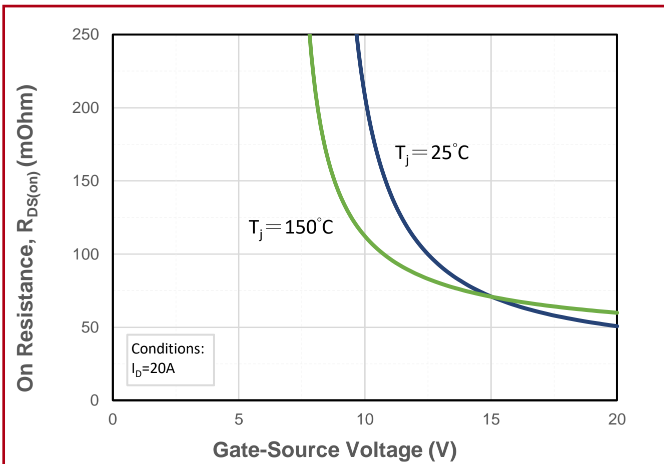


Fig.5 On-Resistance vs. Gate Voltage for Various T_j

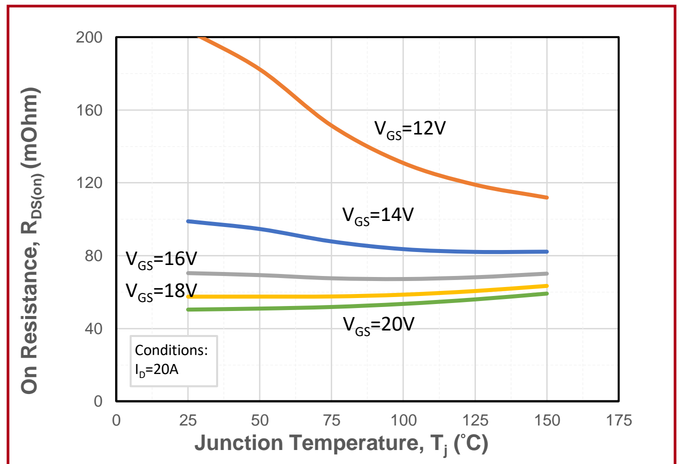


Fig.6 On-Resistance vs. Temperature for Various Gate Voltage

© 2022 Hestia Power Inc.

Typical Device Performance

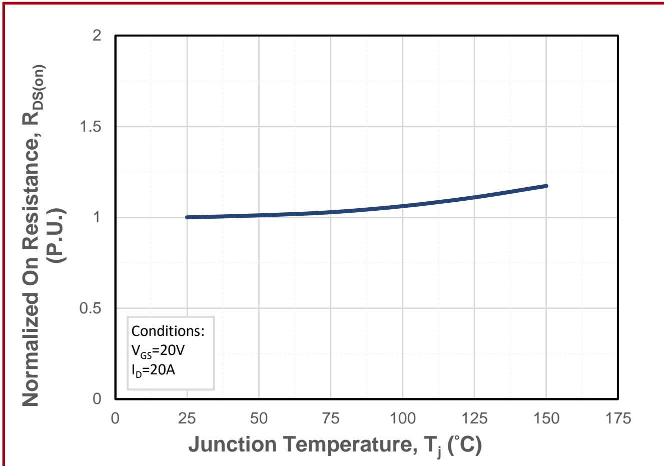


Fig.7 Normalized On-Resistance vs. Temperature

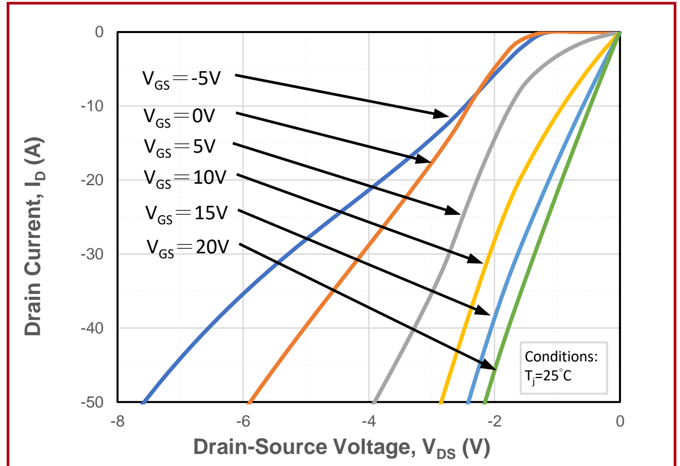


Fig.8 Reverse Output Characteristics at T_j = 25˚C

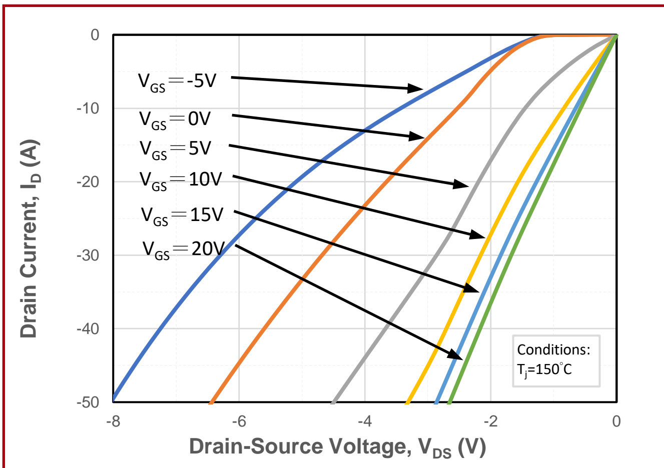


Fig.9 Reverse Output Characteristics at T_j = 150˚C

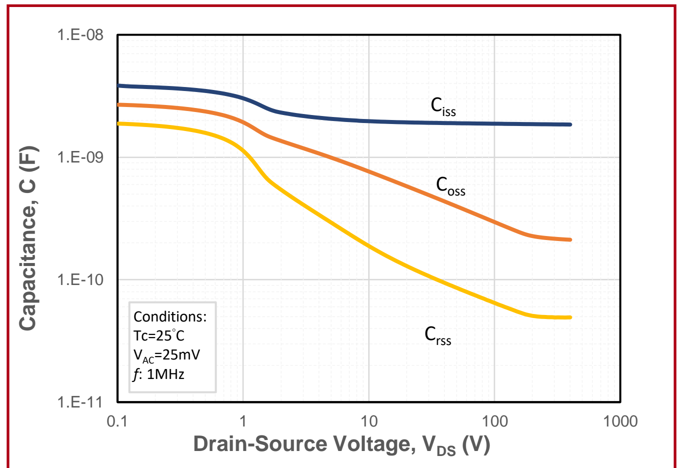


Fig.10 Capacitances vs. Drain to Source Voltage

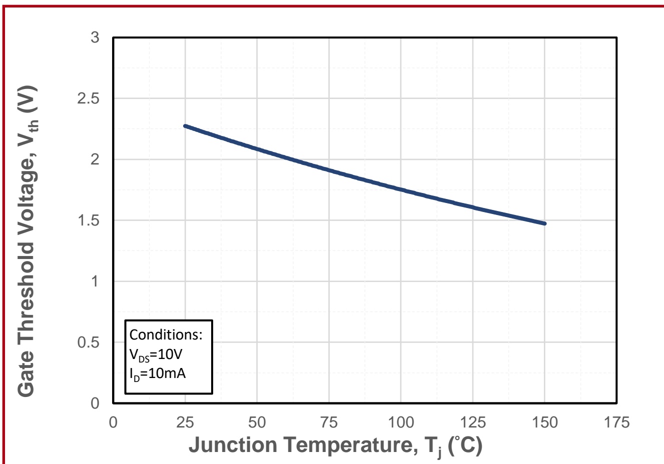


Fig.11 Threshold Voltage vs. Temperature

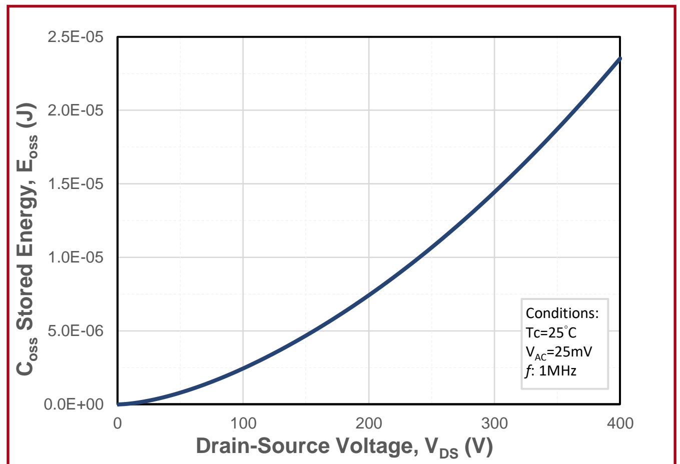


Fig.12 Output Capacitor Stored Energy

© 2022 Hestia Power Inc.

Typical Device Performance

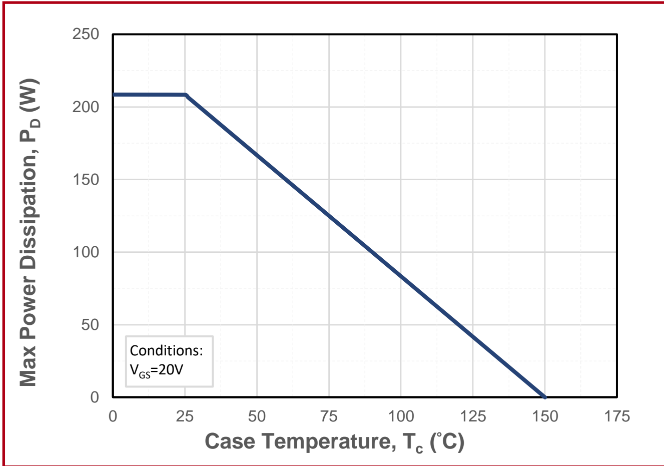


Fig.13 Maximum Power Dissipation Derating vs. Case Temperature

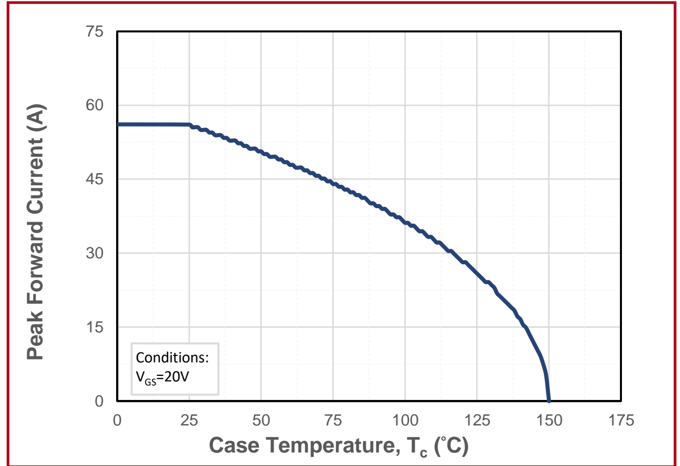


Fig.14 Drain Current Derating vs. Case Temperature

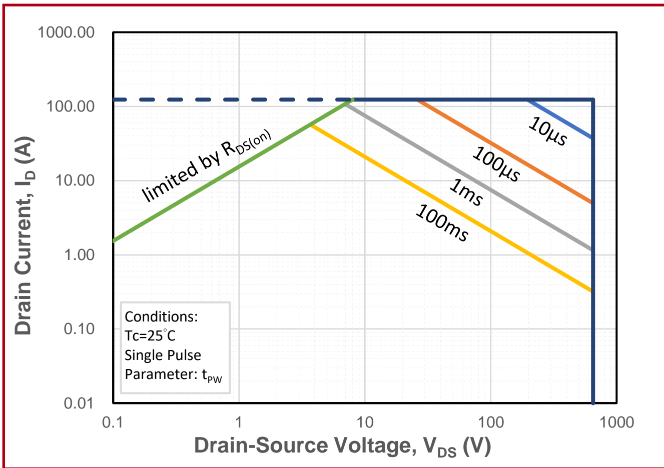


Fig.15 Safe Operating Area

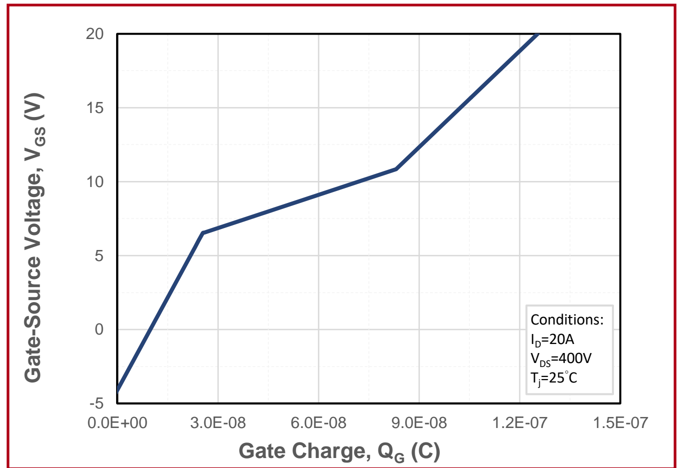


Fig.16 Gate Charge Characteristics

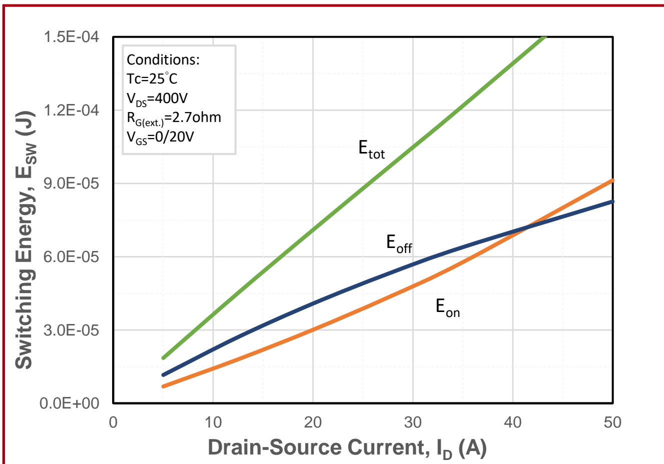


Fig.17 Clamped Inductive Switching Energy vs. Drain Current

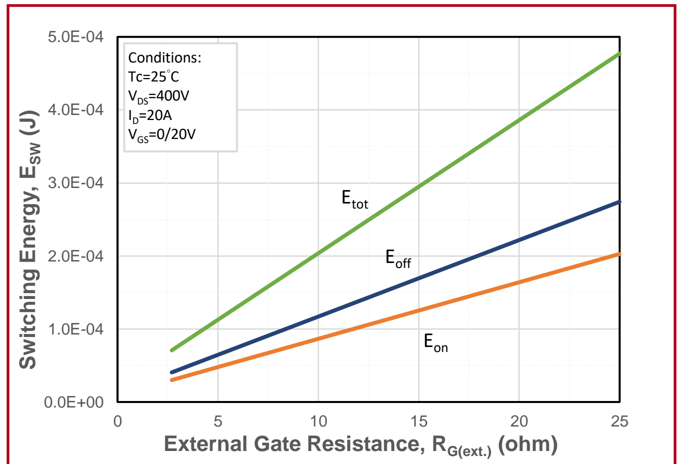
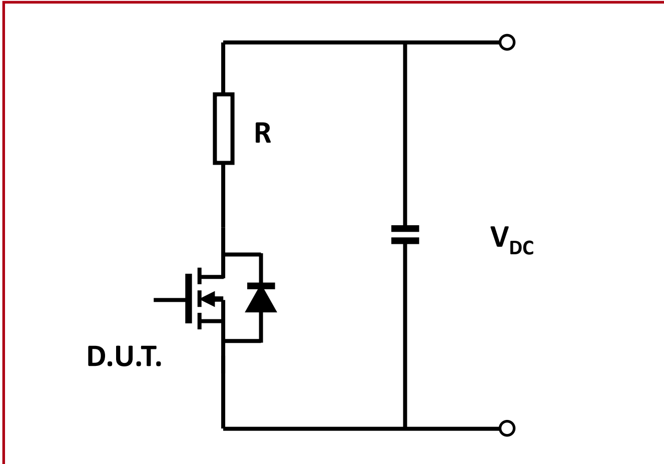


Fig.18 Clamped Inductive Switching Energy vs. External Gate Resistor ($R_{G(ext.)}$)

© 2022 Hestia Power Inc.

Typical Device Performance



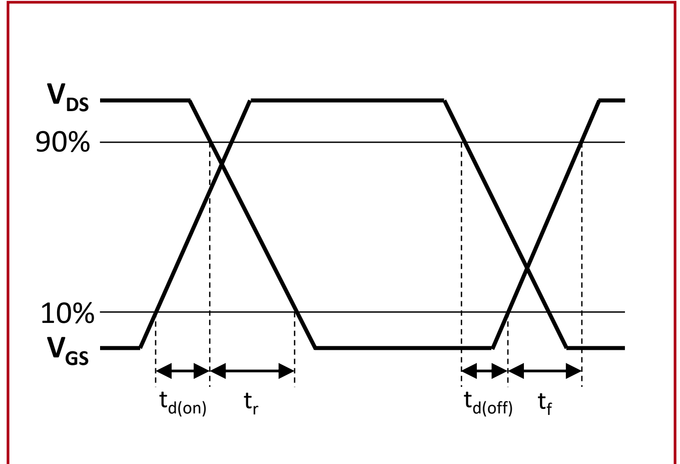


Fig.19 Schematic of Resistive Switching

Fig.20 Switching Times Definition

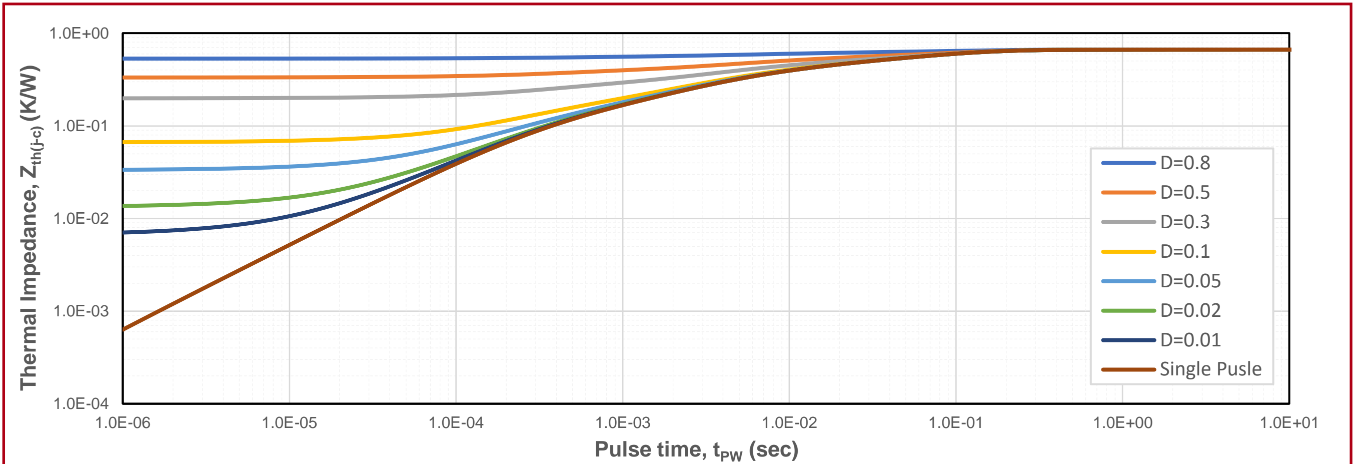


Fig.21 Transient Junction to Case Thermal Impedance

Naming Rule

H1 J 065 F 050

Generation

H1 = Gen 1st Discrete

Device Type

M = MOSFET J = JMOS

S = JBS diode

Breakdown Voltage

065 = 650V 170 = 1700V

120 = 1200V 330 = 3300V

Package

F = TO-247-3L B = TO-220-3L

T = TO-263-2L N = Bare Die

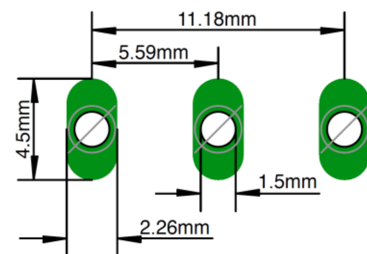
Typical On-Resistance

020 = 20mΩ 050 = 50mΩ 100 = 100mΩ

200 = 200mΩ

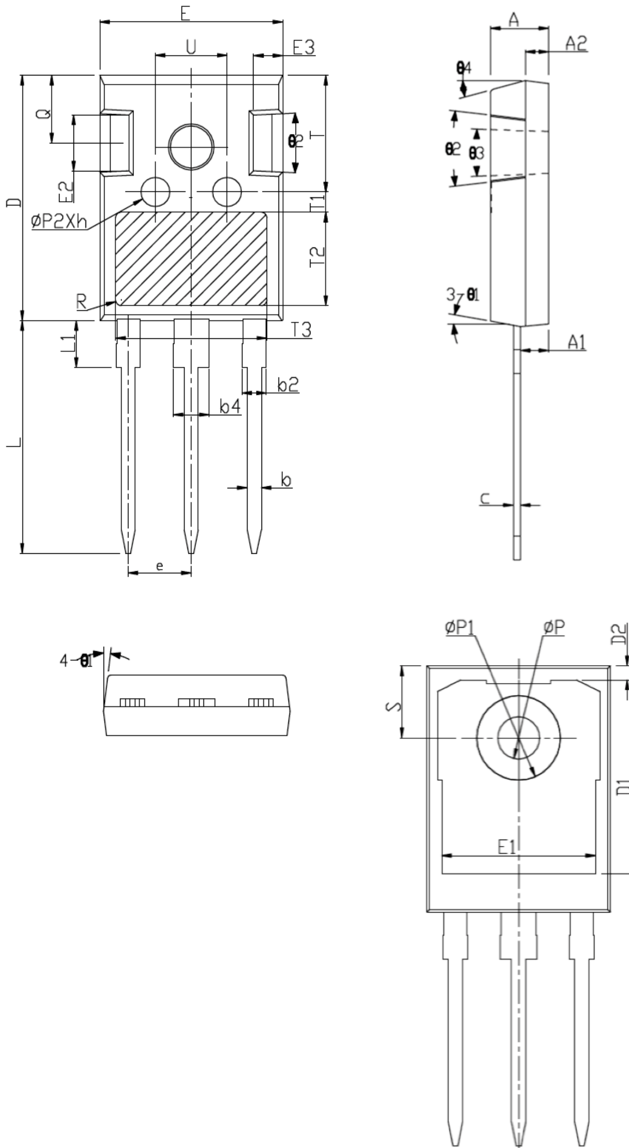
Recommended Solder Pad Layout

TO-247-3L



© 2022 Hestia Power Inc.

Package Dimensions



Symbol	mm		
	Min.	Typ.	Max.
A	4.75	5.00	5.25
A1	2.16	2.41	2.66
A2	1.85	2.00	2.15
b	1.11	1.21	1.35
b2	1.90	2.01	2.25
b4	2.90	3.01	3.25
c	0.51	0.61	0.75
D	20.60	21.00	21.40
D1	16.15	16.55	16.95
D2	1.00	1.20	1.40
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.70	5.00	5.30
E3	2.25	2.50	2.75
e	5.44 BSC		
h	0.00	0.10	0.25
L	19.52	19.92	20.32
L1	-	-	4.30
ϕP	3.35	3.60	3.85
ϕP1	-	-	7.30
ϕP2	2.25	2.50	2.75
Q	5.50	5.80	6.10
S	6.15 BSC		
R	0.50 REF		
T	9.70	-	10.30
T1	1.65 REF		
T2	8.00 REF		
T3	12.80 REF		
U	5.90	-	6.50
θ1	4°	7°	10°
θ2	2°	5°	8°
θ3	1°	-	2°
θ4	10°	15°	20°

Notes

- The information provided herein is subject to change without notice.
- For other information that does not show on this datasheet, please contact us for inquiry.

© 2022 Hestia Power Inc.