

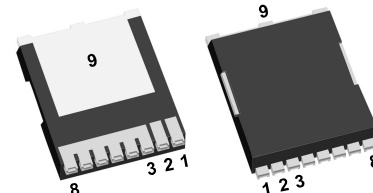
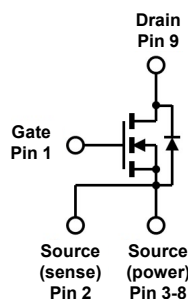
ICE41M65T Silicon Carbide Power MOSFET

Features

- 650V 41mohm SiC MOSFET
- High-speed switching performance
- Best thermal conductivity and behavior
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen-free, RoHS compliant
- Wettable Frank for Improved Optical Inspection
- Optimized design for high performance power systems



Product Summary			
I_D	$T_A=25^\circ\text{C}$	49.6A	Max.
$V_{(BR)DSS}$	$T_C=25^\circ\text{C}$	650V	Min.
$r_{DS(on)}$	$V_{GS}=15\text{V}$	41m Ω	Typ.
Q_g	$V_{DS}=400\text{V}$	81nC	Typ.



TOLL

1=Gate, 2=Source(sense)
3-8 =Source (power), 9=Drain

Maximum ratings^a at $T_j=25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_c=25^\circ\text{C}$	49.6	A
		$T_c=100^\circ\text{C}$	35.0	
Pulsed drain current	$I_{D, \text{pulse}}$	$T_c=25^\circ\text{C}$	135	A
Dynamic gate source voltage	$V_{GS(max)}$		-12/+24	V
Static gate source voltage	$V_{GS \text{ op}}$		-6/+18	V
Power dissipation	P_{tot}		214.2	W
Storage temperature	T_{stg}		-55 to +175	$^\circ\text{C}$
Operating temperature	T_j			

^a limited by T_{jmax}

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	

Thermal characteristics

Thermal resistance, junction-case	R_{thJC}		-	-	0.7	°C/W
Thermal resistance, junction-ambient	R_{thJA}	leaded	-	-	40	
Soldering temperature, wave soldering only allowed at leads	T_{sold}	1.6mm (0.063in.) from case for 10 s	-	-	260	°C

Electrical characteristics^a, at $T_j=25^{\circ}\text{C}$, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=100\mu A$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=5mA, T_j=25^{\circ}\text{C}$	1.8	2.8	4	
		$V_{DS}=V_{GS}, I_D=5mA, T_j=175^{\circ}\text{C}$	-	2.1	-	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$	-	5	50	μA
Gate source leakage current	I_{GSS}	$V_{GS}=-12/+24V, V_{DS}=0V$	-	-	± 100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=15V, I_D=20A, T_j=25^{\circ}\text{C}$	-	41	60	m Ω
		$V_{GS}=15V, I_D=20A, T_j=175^{\circ}\text{C}$	-	60	-	
Gate resistance	R_G	$f=1\text{ MHz}, V_{AC}=25mV$	-	1.4	-	Ω

Dynamic characteristics

Input capacitance	C_{iss}	$V_{DS}=600V, V_{GS}=0V, f=100\text{ kHz}, V_{AC}=25mV$	-	2600	-	pF
Output capacitance	C_{oss}		-	145	-	
Reverse transfer capacitance	C_{rss}		-	5	-	
C_{OSS} stored energy	E_{oss}		-	32	-	μJ
Forward transconductance	g_{FS}	$V_{DS}=20V, I_D=20A$	-	12	-	S
Turn-on delay time	$t_{d(on)}$	$V_{DS}=400V, V_{GS}=-4/+15V, I_D=20A, R_G=2.5\Omega$ (External), $L=99\mu H, T_j=25^{\circ}\text{C}$	-	11	-	ns
Rise time	t_r		-	10.6	-	
Turn-off delay time	$t_{d(off)}$		-	29.5	-	
Fall time	t_f		-	14.8	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at $V_{GS}=-4V$	-	44.7	-	μJ
Turn-off switching energy	E_{OFF}		-	21.4	-	

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	

Dynamic characteristics

Turn-on delay time	$t_{d(on)}$	$V_{DS}=400V, V_{GS}=-4/+15V,$ $I_D=20A, R_G=2.5\Omega$ (External), $L=99\mu H,$	-	9.5	-	ns
Rise time	t_r		-	9.2	-	
Turn-off delay time	$t_{d(off)}$		-	35.5	-	
Fall time	t_f		-	23.4	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at $V_{GS}=-4V$ $T_j=175^\circ C$	-	30.8	-	μJ
Turn-off switching energy	E_{OFF}		-	20	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DS}=400V, I_D=20A,$ $V_{GS}=-4$ to $+15V$	-	28.5	-	nC
Gate to drain charge	Q_{gd}		-	18	-	
Gate charge total	Q_g		-	81	-	

Reverse Diode

Continuous forward current	I_S	$V_{GS}=-4V$	-	-	49.6	A
Diode forward voltage	V_{SD}	$V_{GS}=-4V, I_{SD}=10A, T_j=25^\circ C$	-	4.8	-	V
		$V_{GS}=-4V, I_{SD}=10A,$ $T_j=175^\circ C$	-	4.2	-	
Reverse recovery time	t_{rr}	$V_{GS}=-4V, V_{RR}=400V,$ $I_{SD}=20A,$ $d_i f/d_t=5000 A/\mu s, T_j=25^\circ C$	-	15	-	ns
Reverse recovery charge	Q_{rr}		-	154	-	nC
Peak reverse recovery current	I_{rm}		-	17	-	A
Reverse recovery time	t_{rr}	$V_{GS}=-4V, V_{RR}=400V,$ $I_{SD}=20A,$ $d_i f/d_t=1500 A/\mu s, T_j=175^\circ C$	-	17	-	ns
Reverse recovery charge	Q_{rr}		-	219	-	nC
Peak reverse recovery current	I_{rm}		-	22	-	A

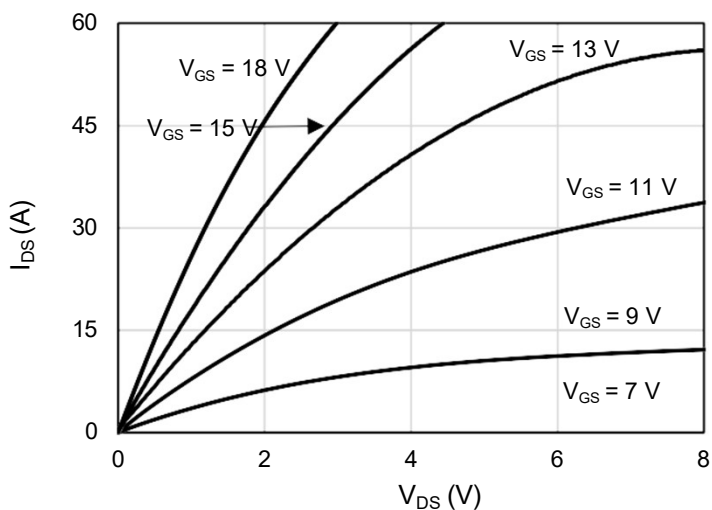


Figure 1: Output Characteristics $T_J = -40^{\circ}\text{C}$

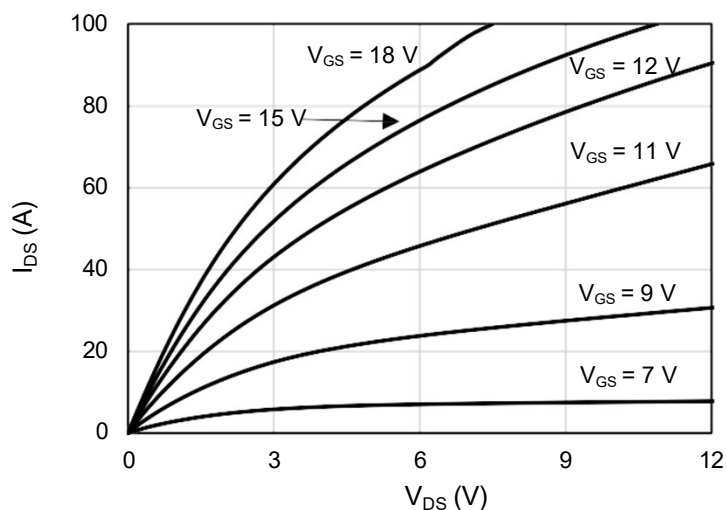


Figure 2: Output Characteristics $T_J = 25^{\circ}\text{C}$

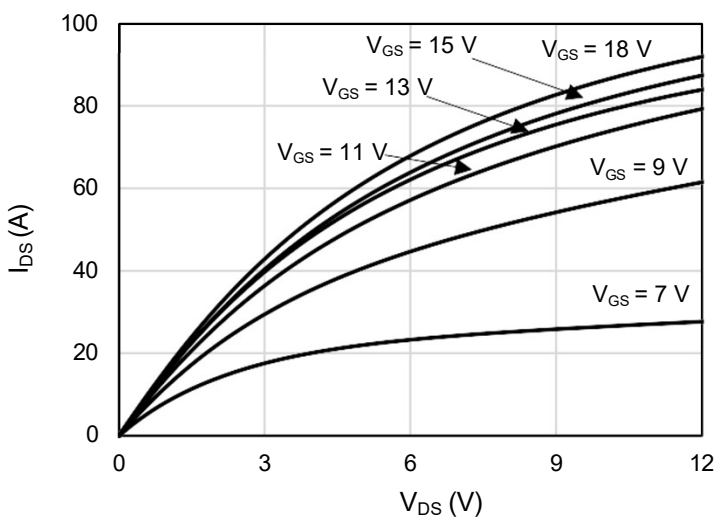


Figure 3: Output Characteristics $T_J = 175^{\circ}\text{C}$

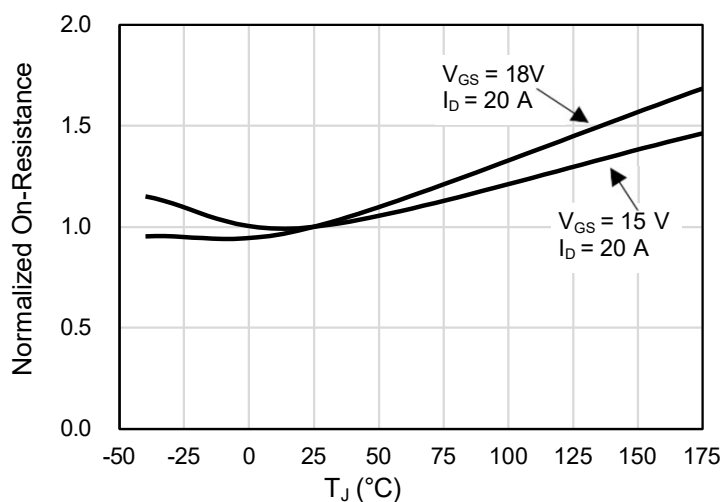


Figure 4: Normalized On-Resistance vs. Temperature

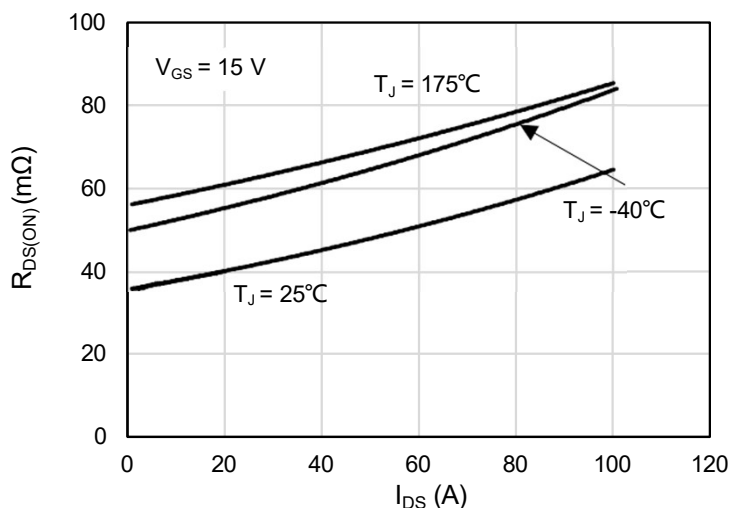


Figure 5: On-Resistance vs. Drain Current For Various Temperatures

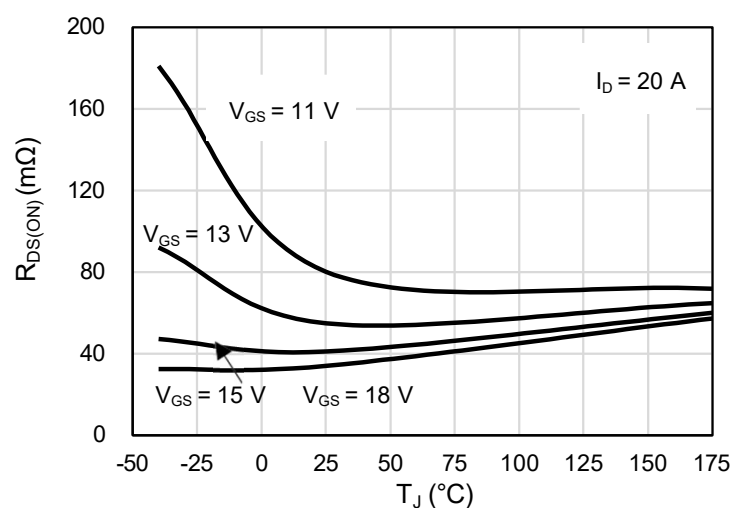


Figure 6: On-Resistance vs. Temperature For Various Gate Voltage

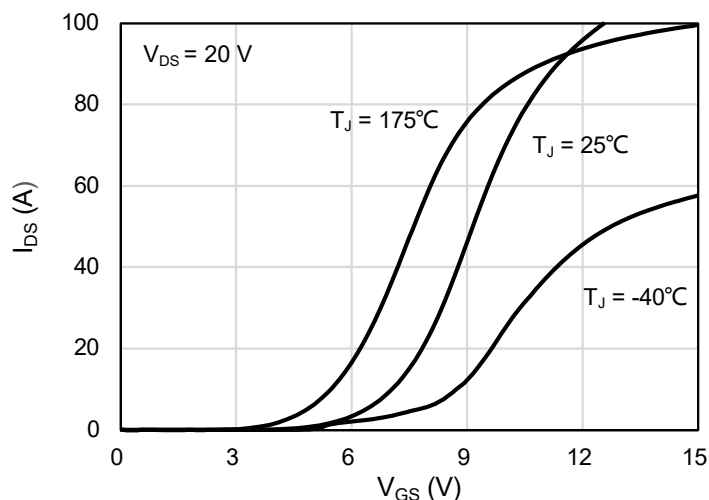


Figure 7: Transfer Characteristics For Various Junction Temperature

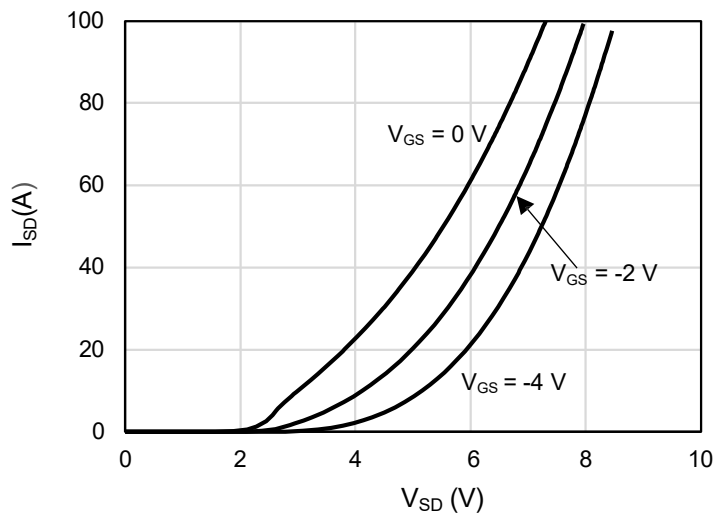


Figure 8: Body Diode Characteristics at -40°C

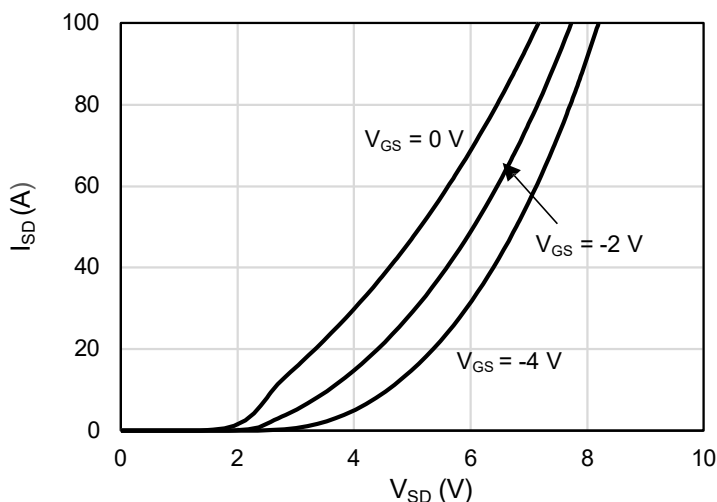


Figure 9: Body Diode Characteristics at 25°C

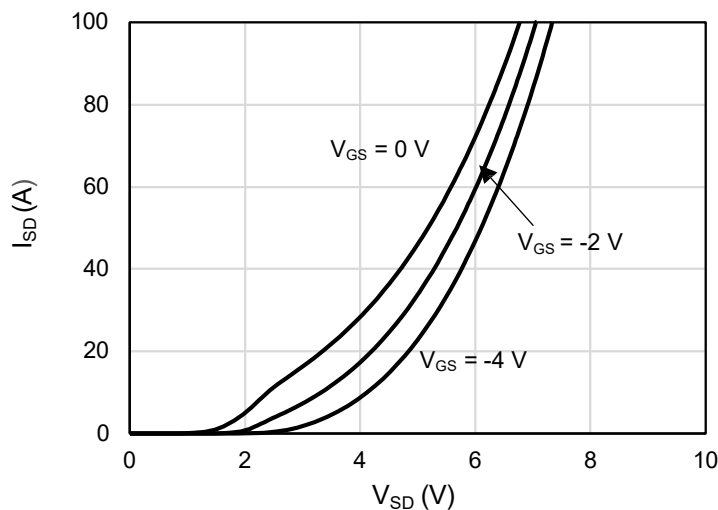


Figure 10: Body Diode Characteristics at 175°C

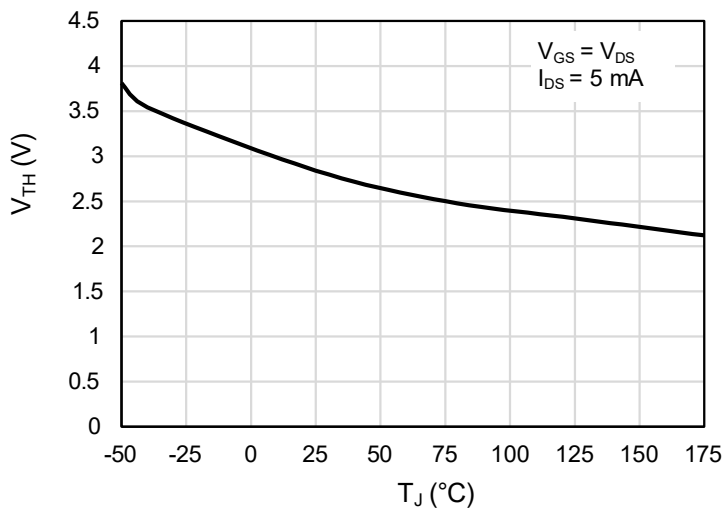


Figure 11: Threshold Voltage vs. Temperature

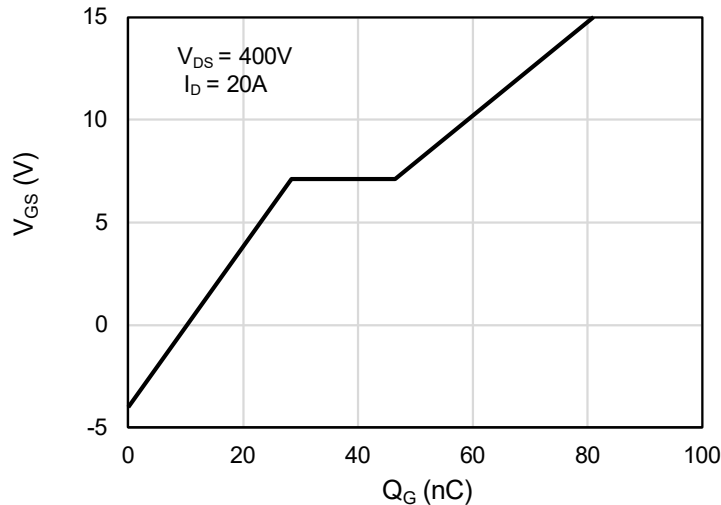


Figure 12: Gate-Charge Characteristics

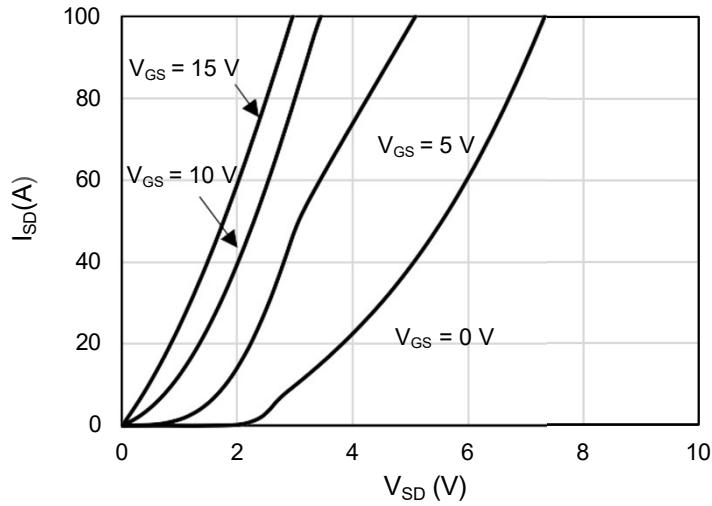


Figure 13: 3rd Quadrant Characteristics at -40°C

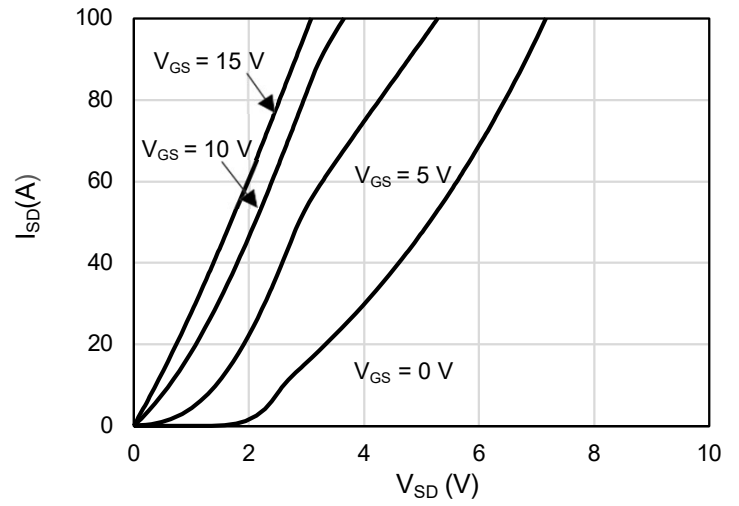


Figure 14: 3rd Quadrant Characteristics at 25°C

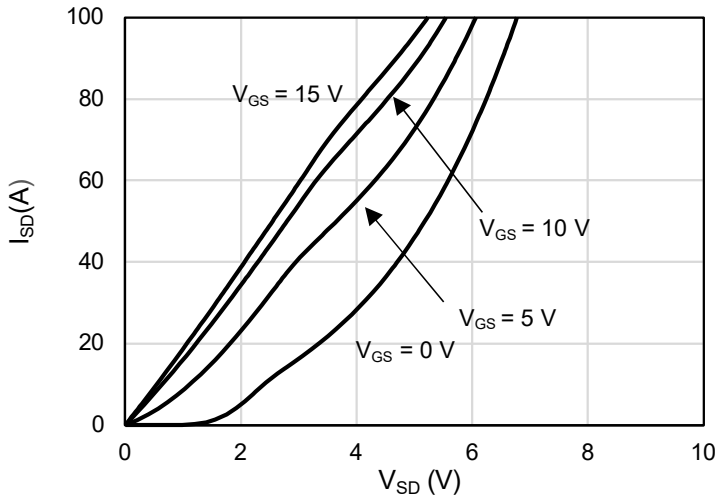


Figure 15: 3rd Quadrant Characteristics at 175°C

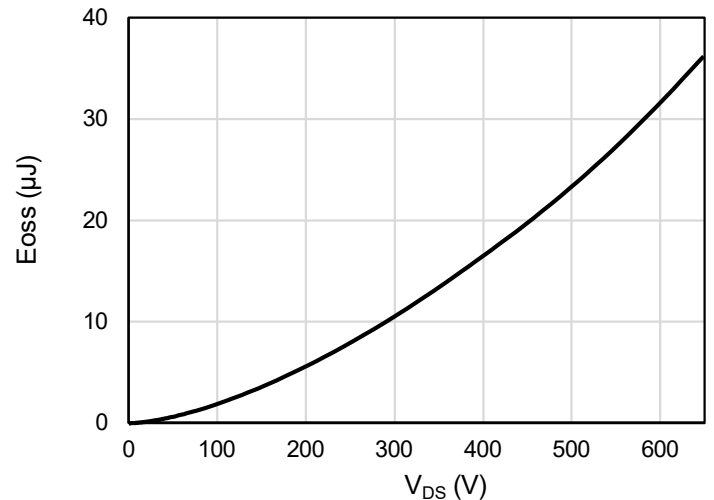


Figure 16: Output Capacitor Stord Energy

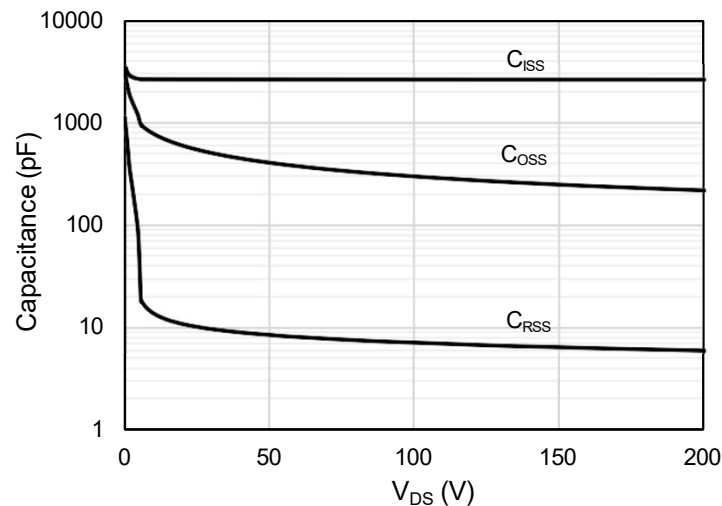


Figure 17: Capacitance Characteristics (0-200V)

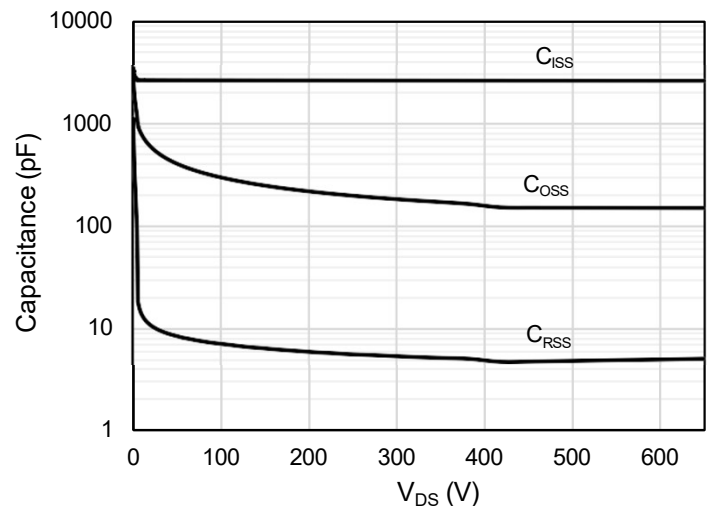


Figure 18: Capacitance Characteristics (0-650V)

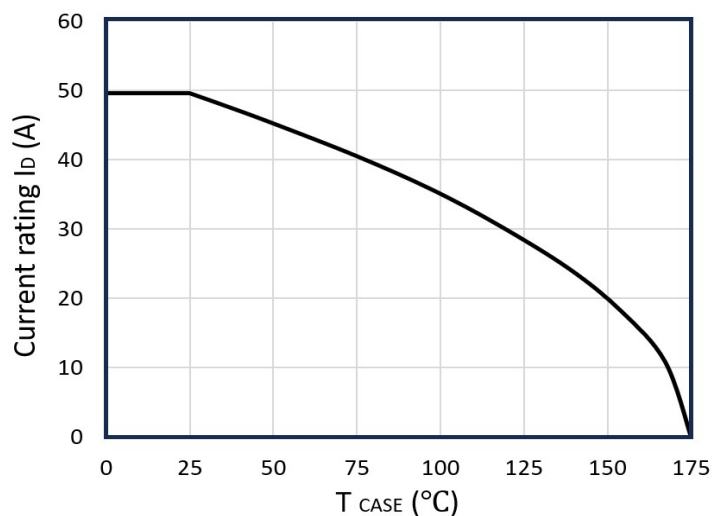


Figure 19: Current De-rating

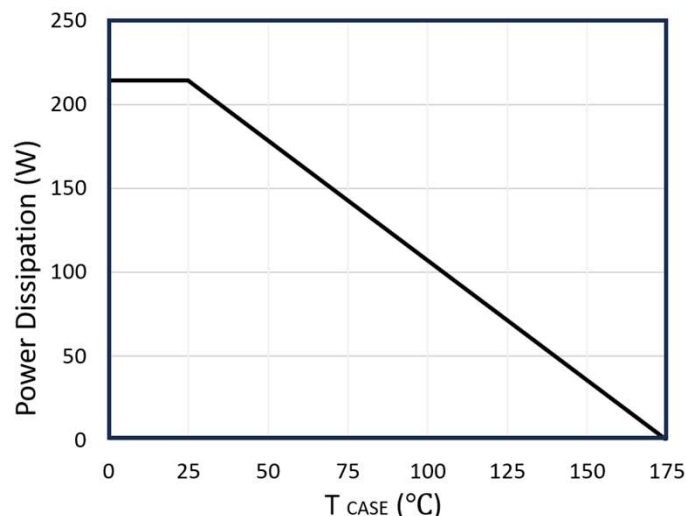


Figure 20: Maximum Power Dissipation Derating vs Case Temperature

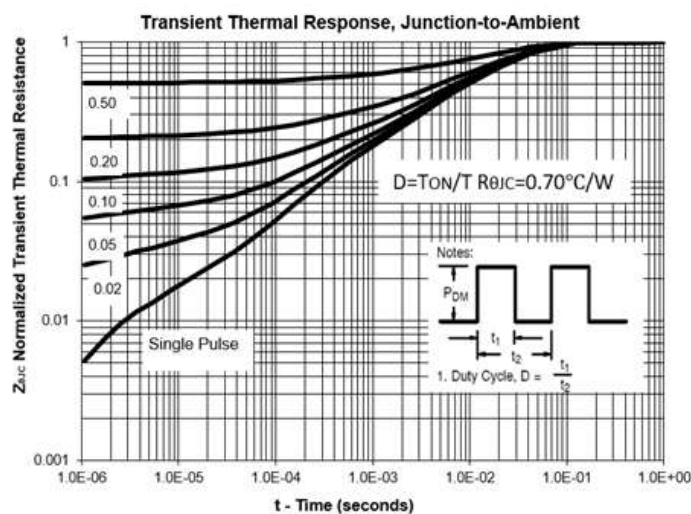


Figure 21: Normalized Maximum Transient Thermal Impedance

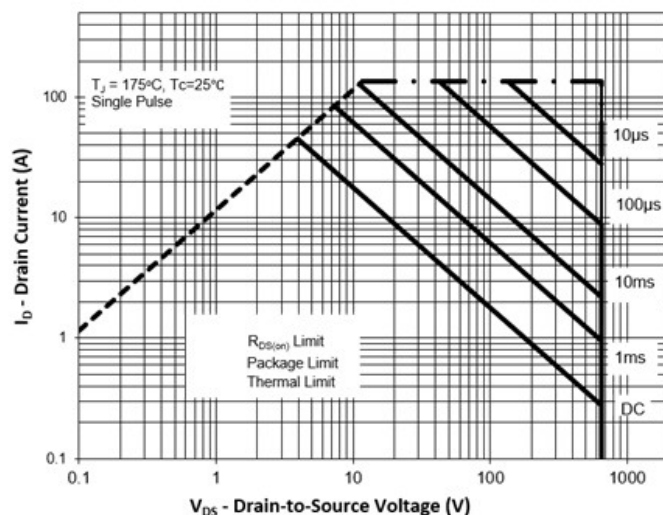


Figure 22: Maximum Forward Biased Safe

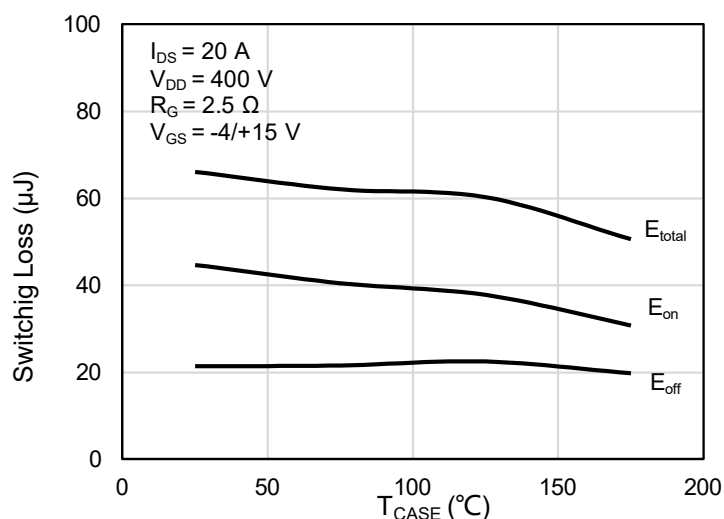


Figure 23: Clamped Inductive Switching Energy vs. Temperature

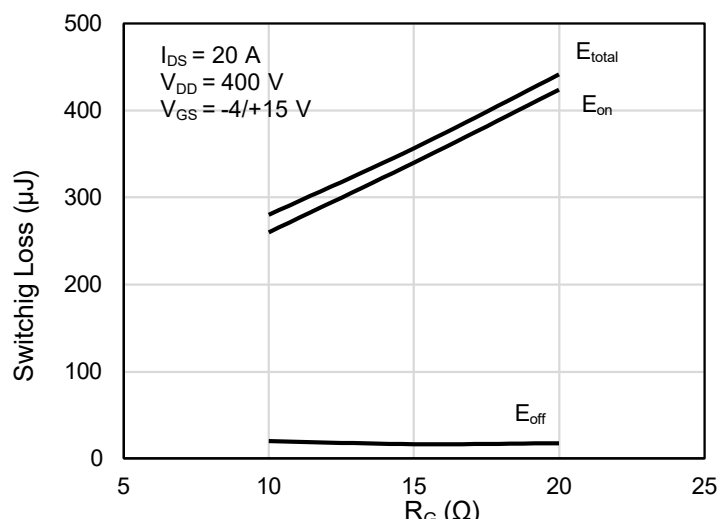


Figure 24: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

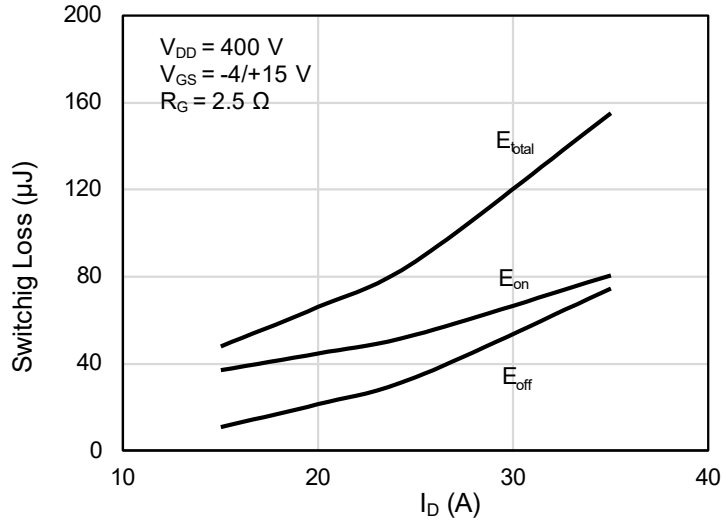


Figure 25: Clamped Inductive Switching Energy vs. Drain Current

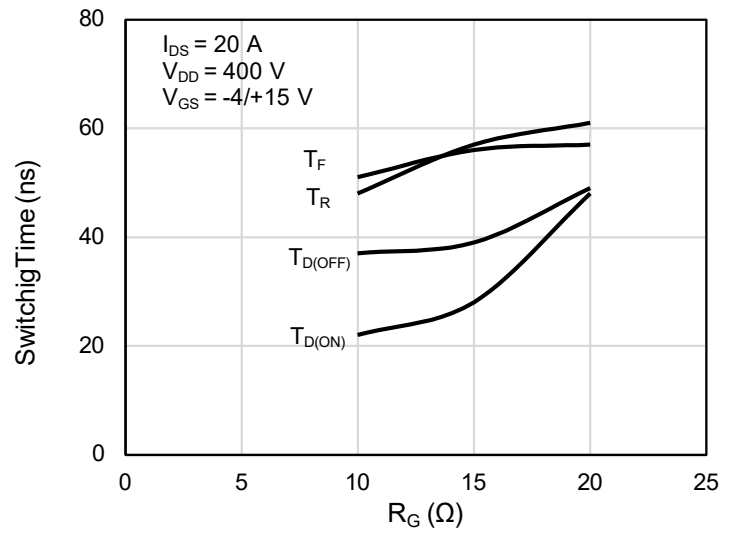
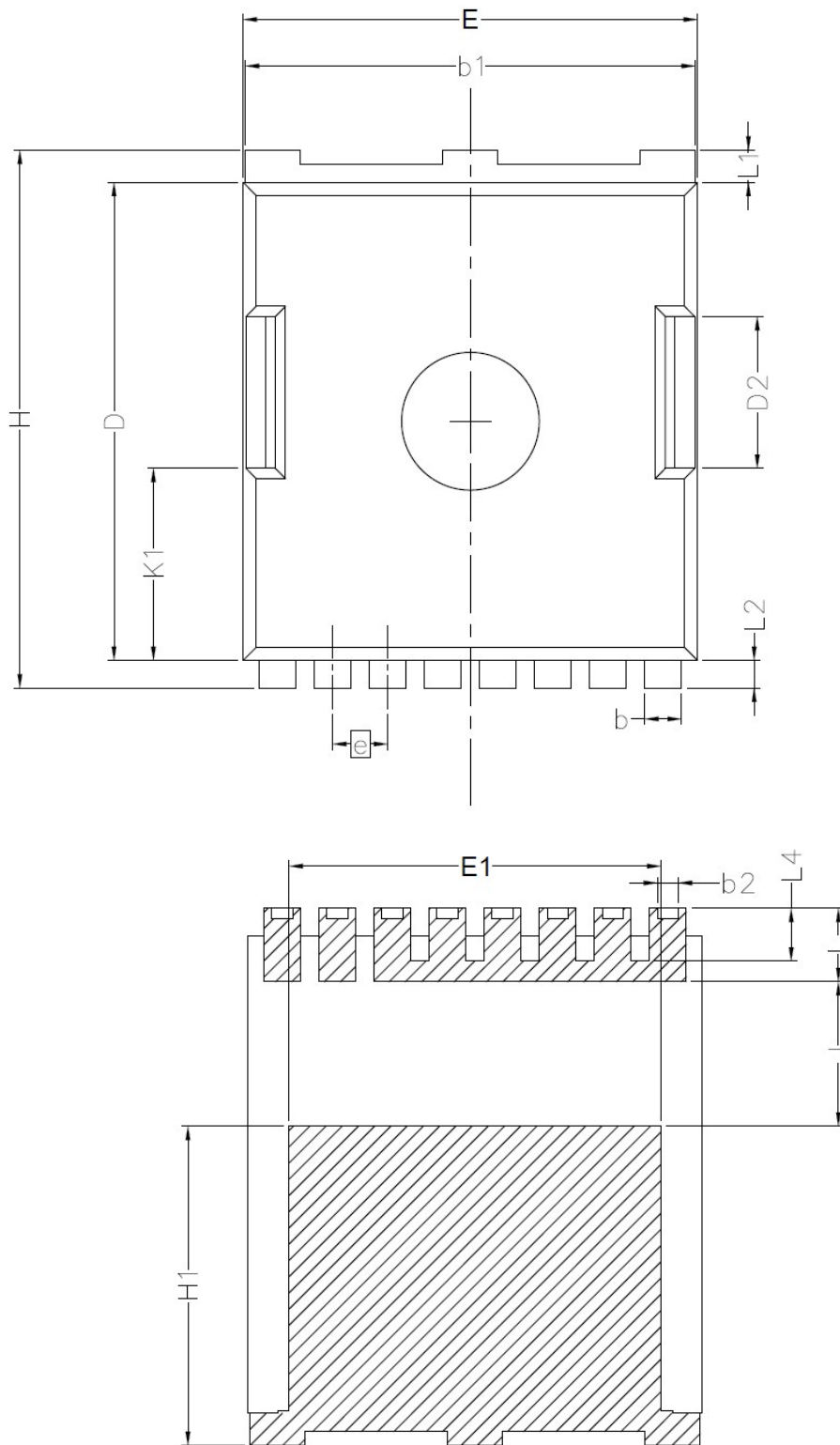
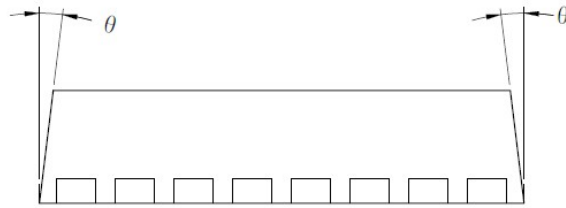
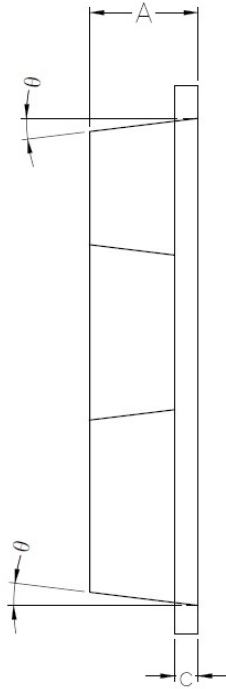


Figure 26: Switching Time vs. $R_{G(ext)}$

Package Outline: TOLL



Package Outline: TOLL



Symbol	Min	Nom	Max
A	2.2	2.3	2.4
b	0.7	0.8	0.9
b1	9.7	9.8	9.9
b2	0.42	0.46	0.5
c	0.4	0.5	0.6
D	10.28	10.43	10.58
D2	3.1	3.3	3.5
E	9.7	9.9	10.1
E1	7.9	8.1	8.3
e		1.20 BSC	
H	11.48	11.68	11.88
H1	6.75	6.95	7.15
N		8	
J	3	3.15	3.3
K1	3.98	4.18	4.38
L	1.4	1.6	1.8
L1	0.6	0.7	0.8
L2	0.5	0.6	0.7
L4	1	1.15	1.3
θ	4°	6°	10°

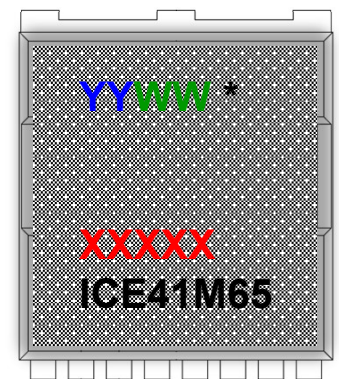
Marking Information

YY = Last two digits of the year

WW = Work week

***** = Site ID

XXXXX = Lot ID



ICE41M65 = ICE is Icmos logo and
41M65 is a designated device part
number

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