IceMOS Technology

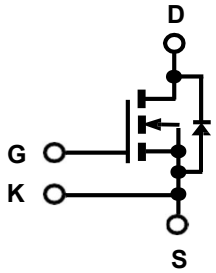
Preliminary
ICE380M80D

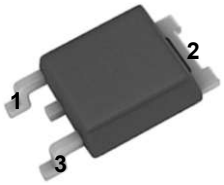
ICE380M80D Silicon Carbide Power MOSFET

Product Summary			
I_D	T_A=25°C	9.6A	Max
$V_{(BR)DSS}$	T_C=25°C	800V	Min
$r_{DS(on)}$	V_{GS}=18V	380mΩ	Typ
Q_g	V_{DS}=400V	9nC	Typ

Features

- 800V 380mohm SiC MOSFET
- Optimized switching performance
- Fast body diode with low Q_{rr} ensures robust commutation
- Superior thermal performance
- Low $R_{DS(on)}$ and weak temperature dependence of pulse current
- Compatible with Si-MOSFET drive
- Optimized design for high performance power systems





T0252

Standard Metal Heatsink

1=Gate, 2=Drain, 3=Source.

RoHS COMPLIANT RoHS (EU) 2015/863

CE

HALOGEN FREE

Maximum ratings [a] , at T_j=25°C, unless otherwise specified

Parameter	*Symbol*	*Conditions*	*Value*	*Unit*
Continuous drain current	I_D	T_c=25°C	9.6	A
		T_c=100°C	6.8	
Pulsed drain current	$I_{D,\ pulse}$		28.5	A
Maximum gate source voltage	$V_{GS(max)}$		-10/+22	V
Operational gate source voltage	$V_{GS\ op}$		-5/+18	V
Single pulsed Avalanche energy	E_{AS}	L=10mH, V_{DD}=50V, I_{AS}=2.2A, R_G=50Ω	24	mJ
Power dissipation	P_{tot}		50	W
Storage temperature	T_{stg}		-55 to +175	°C
Operating temperature	T_j			

a Pulse width limited by Tjmax

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	

Thermal characteristics

Thermal resistance, junction-case	R_{thJC}		-	-	3	°C/W
Thermal resistance, junction-ambient	R_{thJA}	leaded	-	-	60	
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°C, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=100μA	800	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=1.3mA	2.6	3.6	4.6	
		V_{DS}=V_{GS}, I_D=1.3mA, T_j=175°C	-	2.8	-	
Zero gate voltage drain current	I_{DSS}	V_{DS}=800V, V_{GS}=0V	-	5	100	μA
Gate source leakage current	I_{GSS}	V_{GS}=+18V, V_{DS}=0V	-	-	250	nA
Drain-source on-state resistance	$R_{DS\ (on)}$	V_{GS}=18V, I_D=4A	-	380	480	mΩ
		V_{GS}=18V, I_D=4A, T_j=175°C	-	422	-	
Gate resistance	R_G	f=1 MHz, V_{AC}=25mV	-	7	-	Ω

Dynamic characteristics

Input capacitance	C_{iss}	V_{DS}=400V, V_{GS}=0V, f=100 kHz, V_{AC}=25mV	-	198	-	pF
Output capacitance	C_{oss}		-	21	-	
Reverse transfer capacitance	C_{rss}		-	4	-	
C_{OSS} stored energy	E_{oss}		-	2	-	μJ
Forward transconductance	g_{FS}	V_{DS}=10V, I_D=4A	-	1.6	-	S
Turn-on delay time	$t_{d(on)}$	V_{DS}=400V, V_{GS}=-4/+18V, I_D=4A, R_G=20Ω (External), L=100μH	-	7.2	-	ns
Rise time	t_r		-	15.2	-	
Turn-off delay time	$t_{d(off)}$		-	10.2	-	
Fall time	t_f		-	7	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at V_{GS}=-4V	-	26	-	μJ
Turn-off switching energy	E_{OFF}		-	4.5	-	

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	V_{DS}=400V, V_{GS}=-4/+18V, I_D=4A, R_G=20Ω (External), L=100μH, T_j=175°C	-	6.6	-	ns
Rise time	t_r		-	15	-	
Turn-off delay time	$t_{d(off)}$		-	11.2	-	
Fall time	t_f		-	7	-	
Turn-on switching energy	E_{ON}	Diode: Body Diode at V_{GS}=-4V T_j=175°C	-	29	-	μJ
Turn-off switching energy	E_{OFF}		-	6	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DS}=400V, I_D=4A, V_{GS}=-4 to +18V	-	2.4	-	nC
Gate to drain charge	Q_{gd}		-	5.6	-	
Gate charge total	Q_g		-	9	-	
Reverse Diode						
Continuous forward current	I_S	V_{GS}=-4V	-	-	9.6	A
Diode forward voltage	V_{SD}	V_{GS}=-4V, I_{SD}=2A	-	4.1	-	V
		V_{GS}=-4V, I_{SD}=2A, T_j=175°C	-	3.6	-	
Reverse recovery time	t_{rr}	V_{GS}=-4V, V_{RR}=400V, I_{SD}=4A, d_{iF}/d_t=1000 A/μs	-	11.5	-	ns
Reverse recovery charge	Q_{rr}		-	16.3	-	nC
Peak reverse recovery current	I_{rm}		-	3.1	-	A

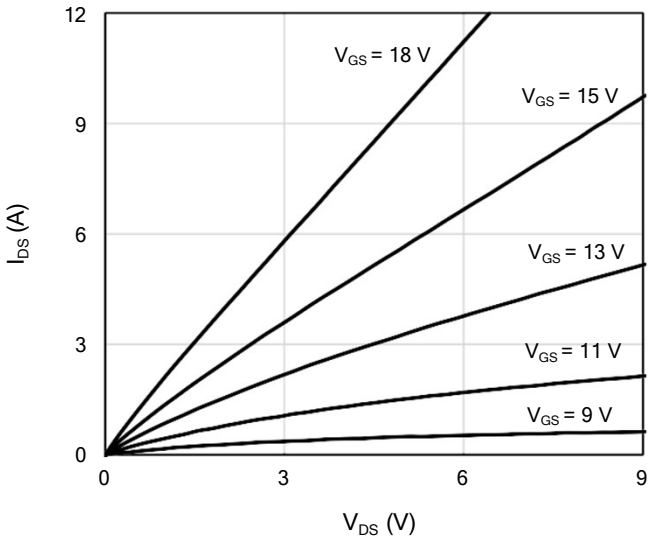


Figure 1: Output Characteristics T_J = -40°C

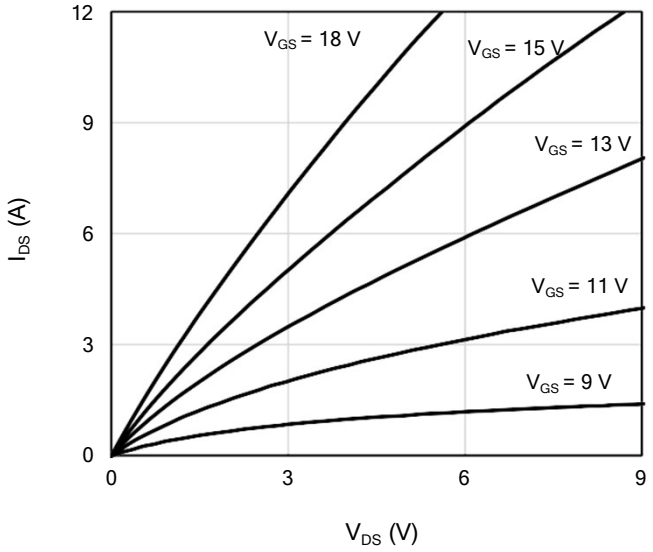


Figure 2: Output Characteristics T_J = 25°C

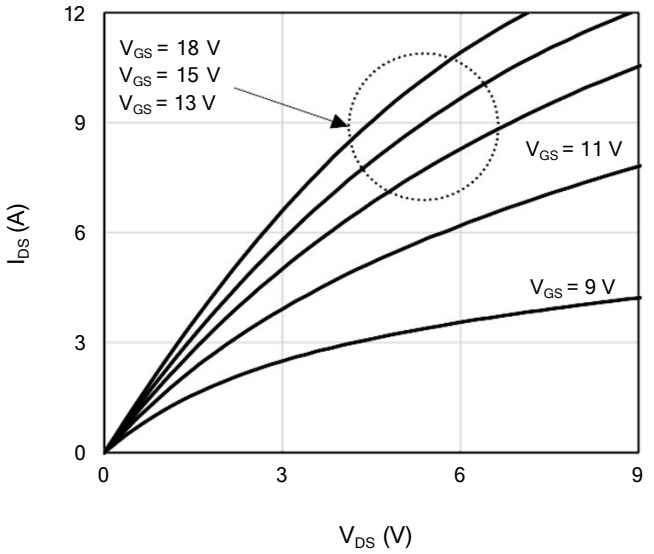


Figure 3: Output Characteristics T_J = 175°C

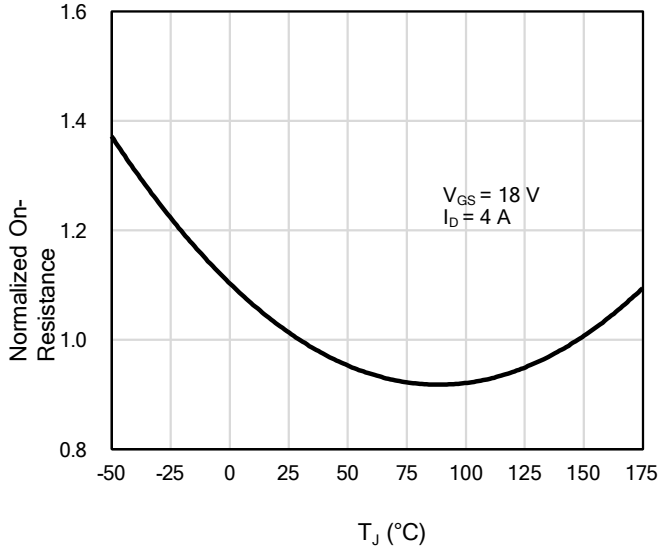


Figure 4: Normalized On-Resistance vs. Temperature

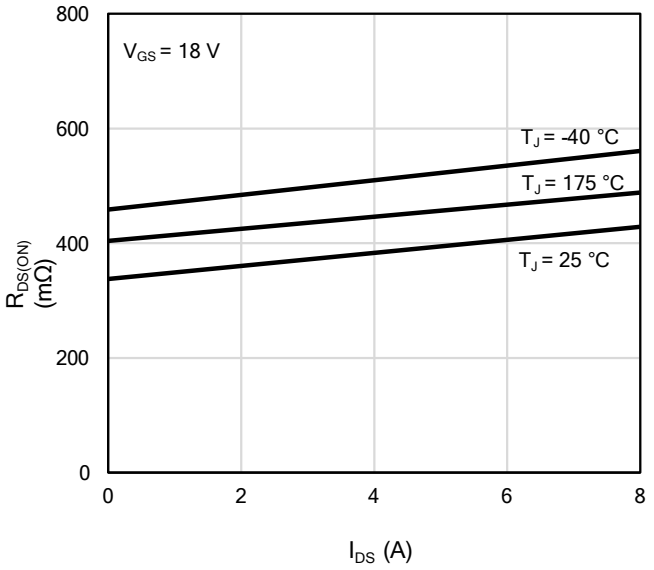


Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

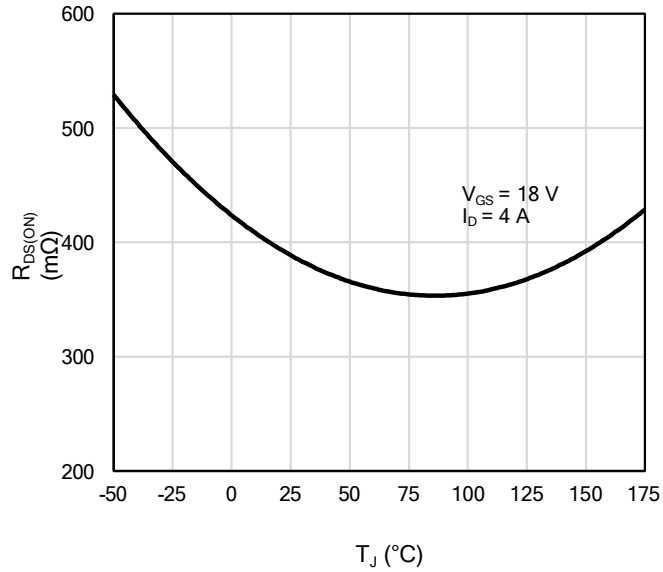


Figure 6: On-Resistance vs. Temperature

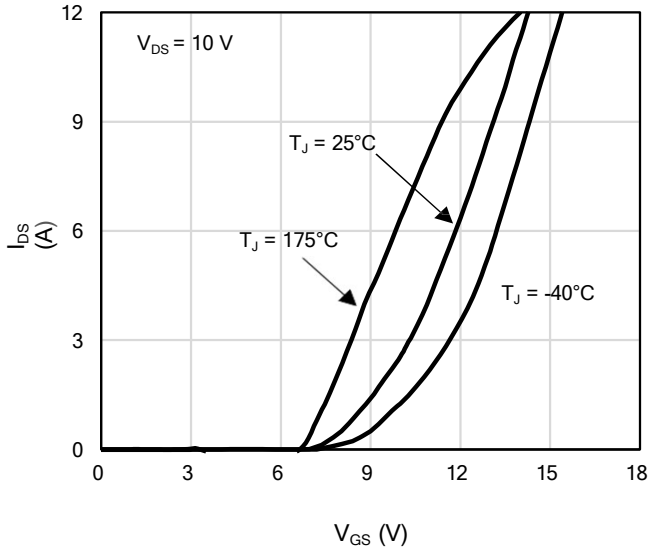


Figure 7: Transfer Characteristics For Various Junction Temparature

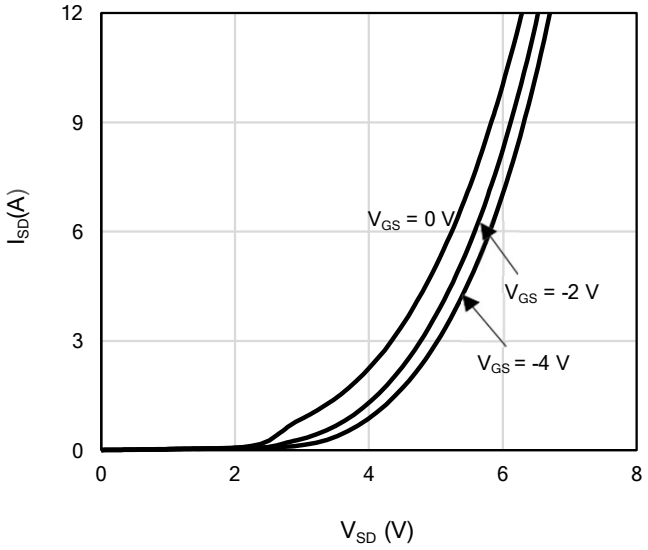


Figure 8: Body Diode Characteristics at -40°C

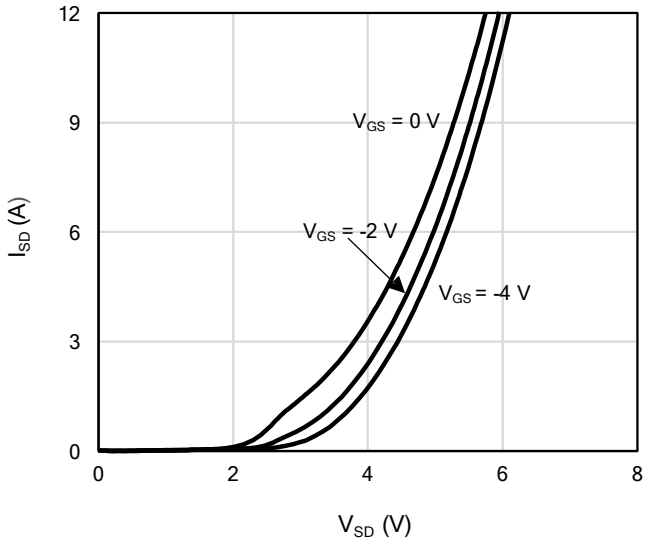


Figure 9: Body Diode Characteristics at 25°C

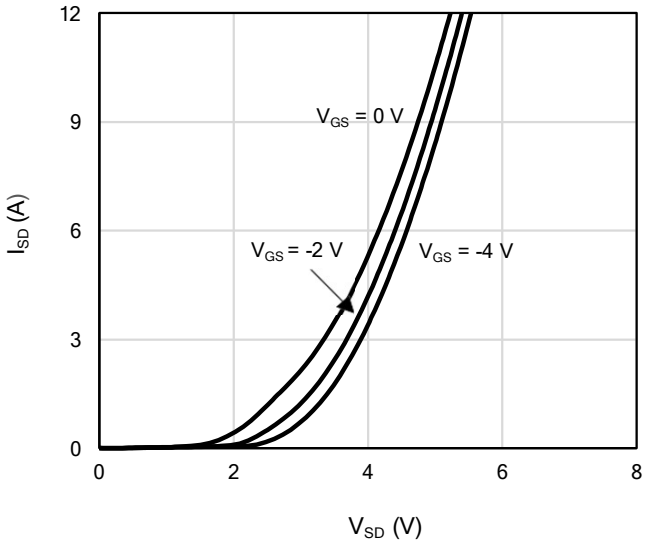


Figure 10: Body Diode Characteristics at 175°C

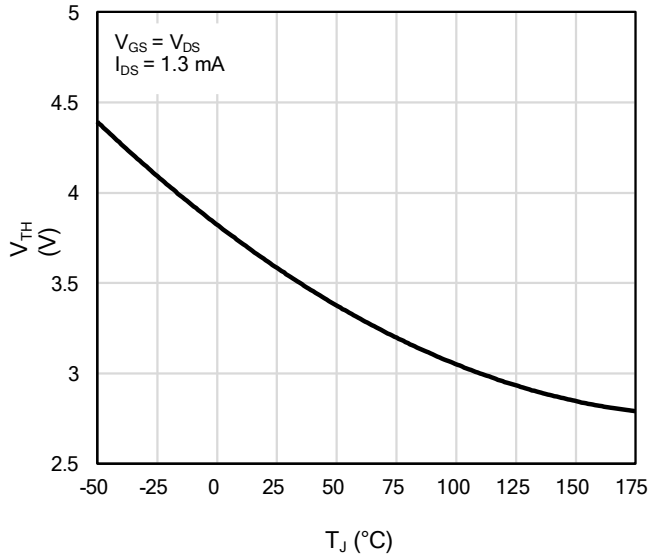


Figure 11: Threshold Voltage vs. Temperature

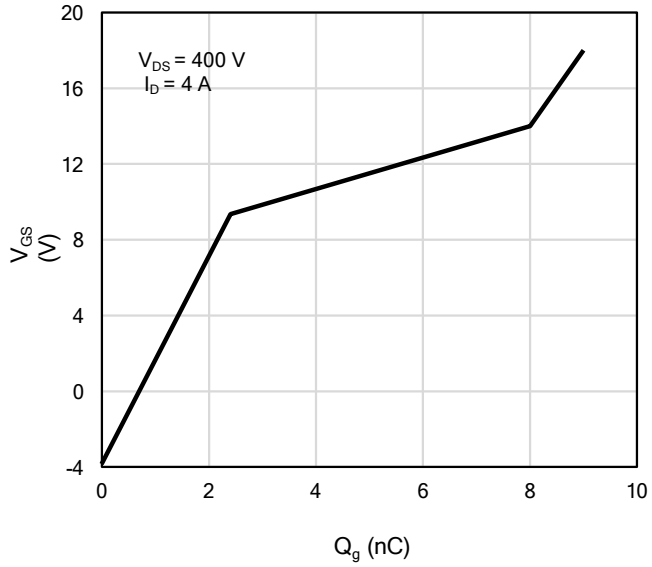


Figure 12: Gate-Charge Characteristics

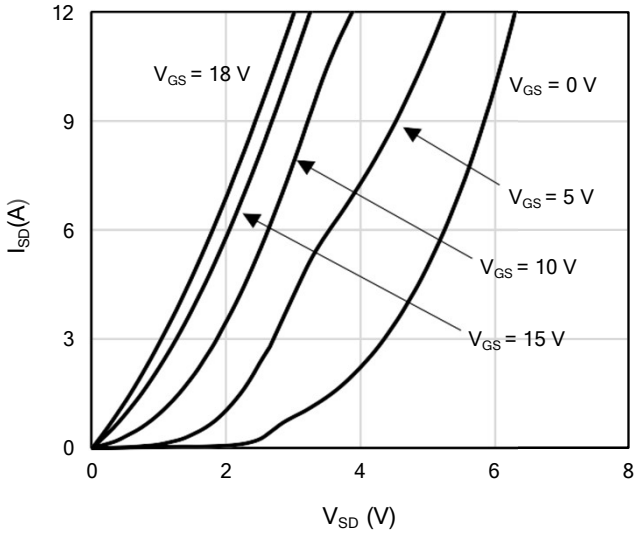


Figure 13: 3rd Quadrant Characteristics at -40°C

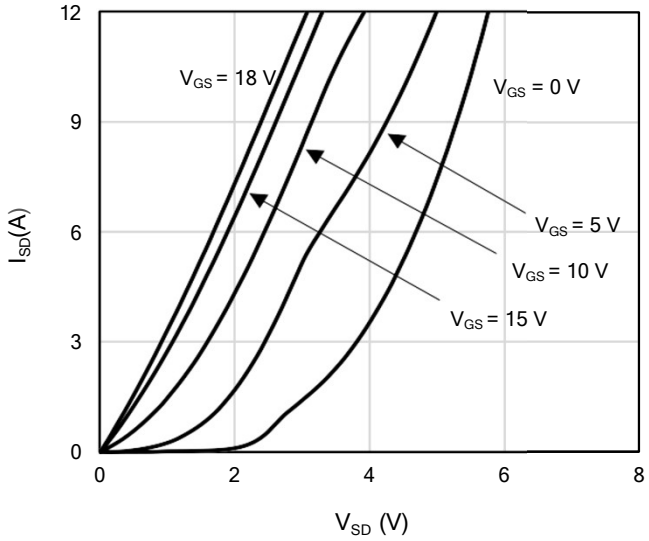


Figure 14: 3rd Quadrant Characteristics at 25°C

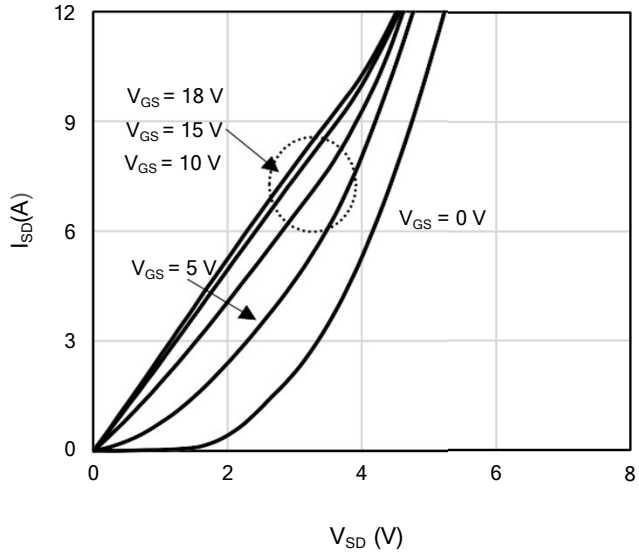


Figure 15: 3rd Quadrant Characteristics at 175°C

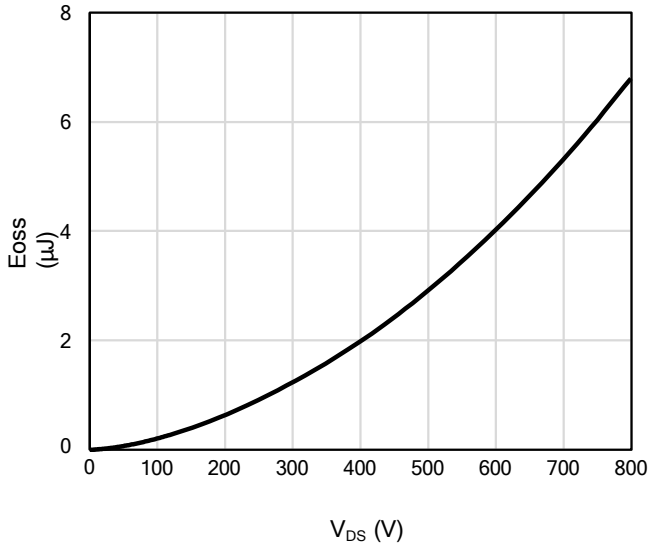


Figure 16: Output Capacitor Stord Energy

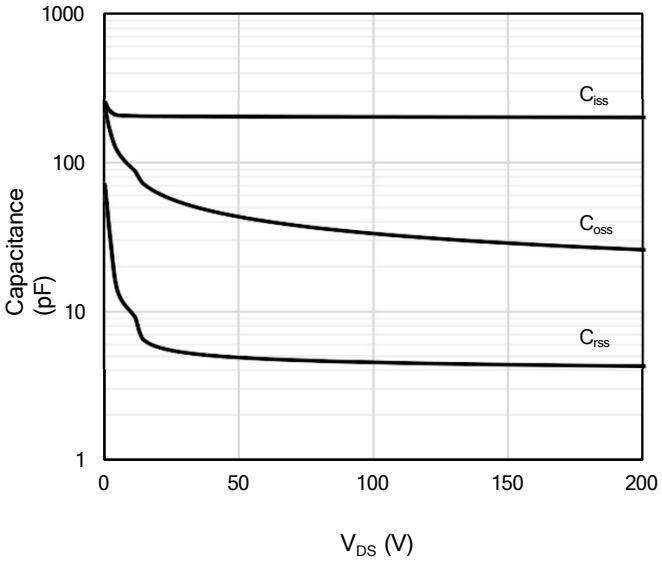


Figure 17: Capacitance Characteristics (0 - 200 V)

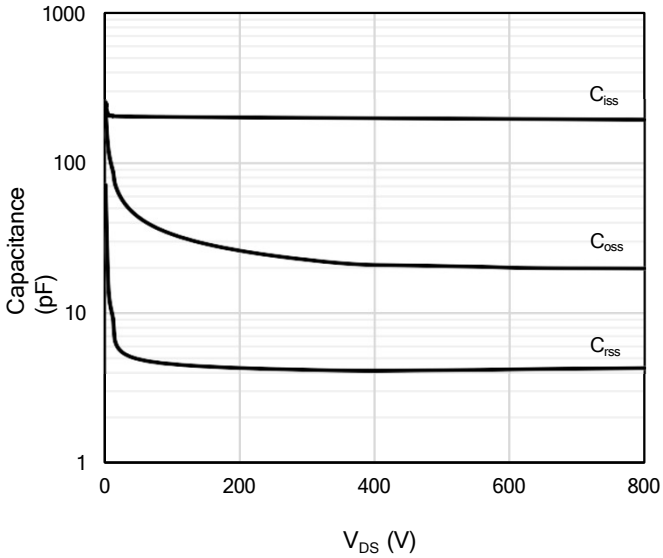


Figure 18: Capacitance Characteristics (0 - 800 V)

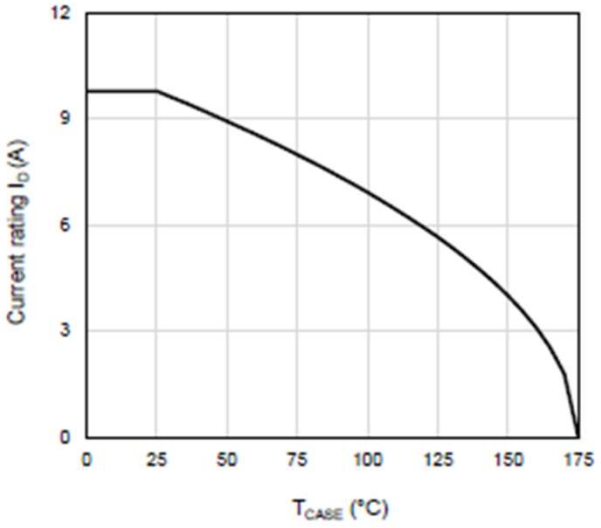


Figure 19: Current De-rating

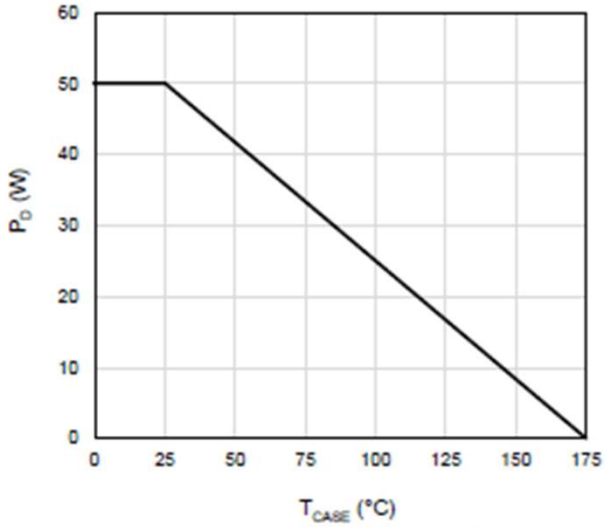


Figure 20: Maximum Power Disspation Derating vs. CaseTemperature

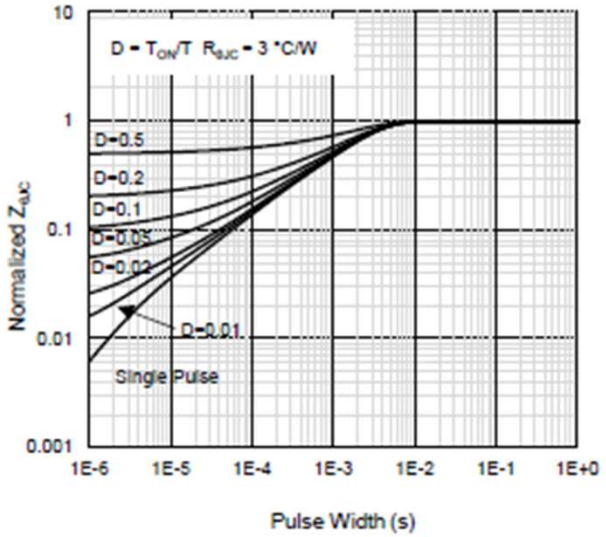


Figure 21: Normalized Maximum Transient Thermal Impedance

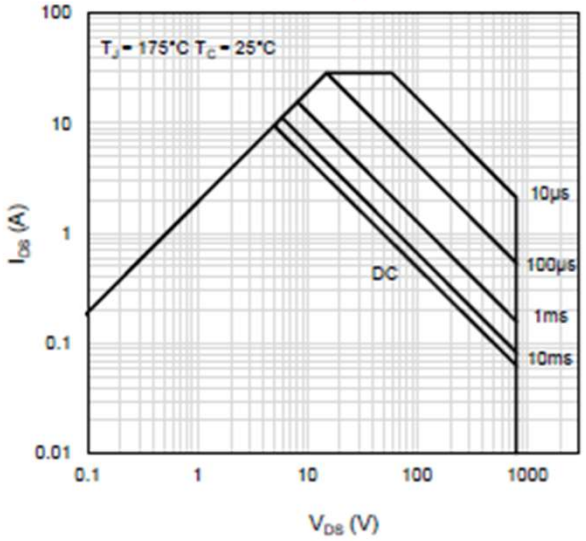


Figure 22: Maximum Forward Biased Safe Operating Area

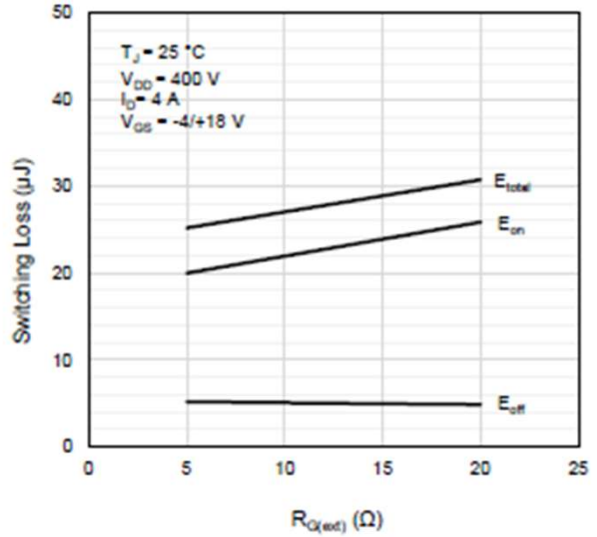


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

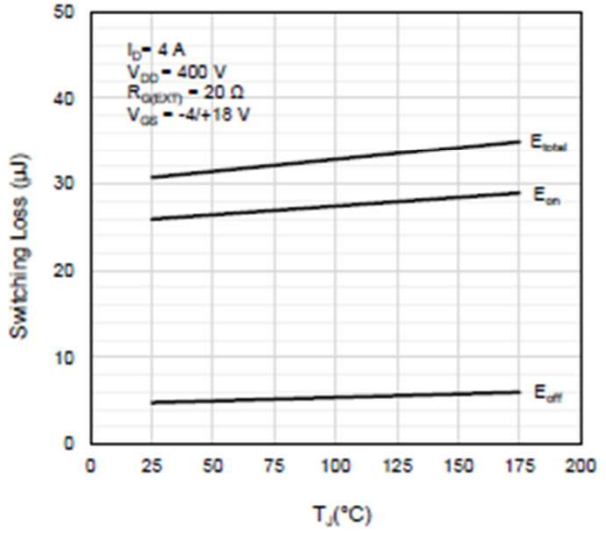


Figure 24: Clamped Inductive Switching Energy vs. T_J

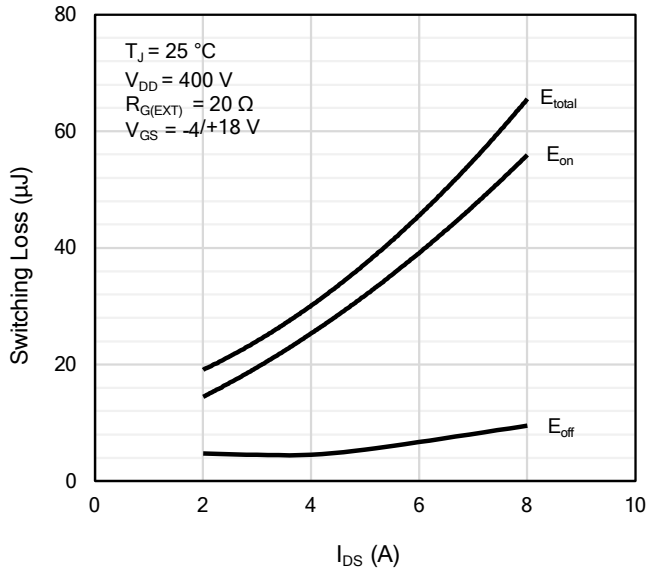


Figure 25: Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 400 V)

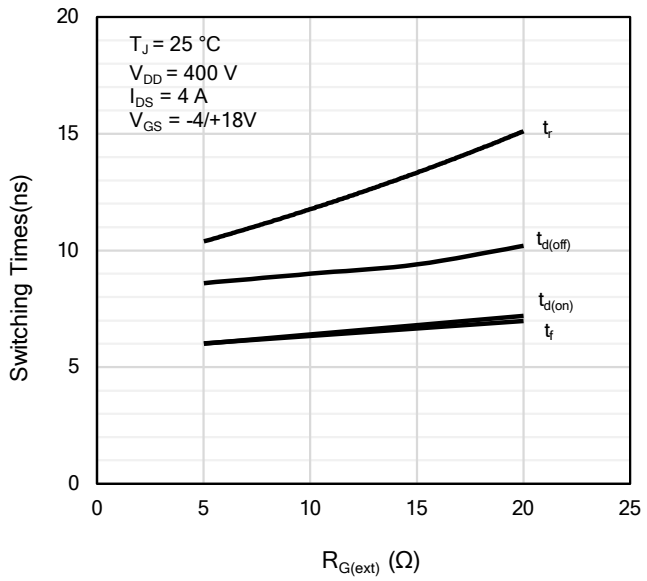
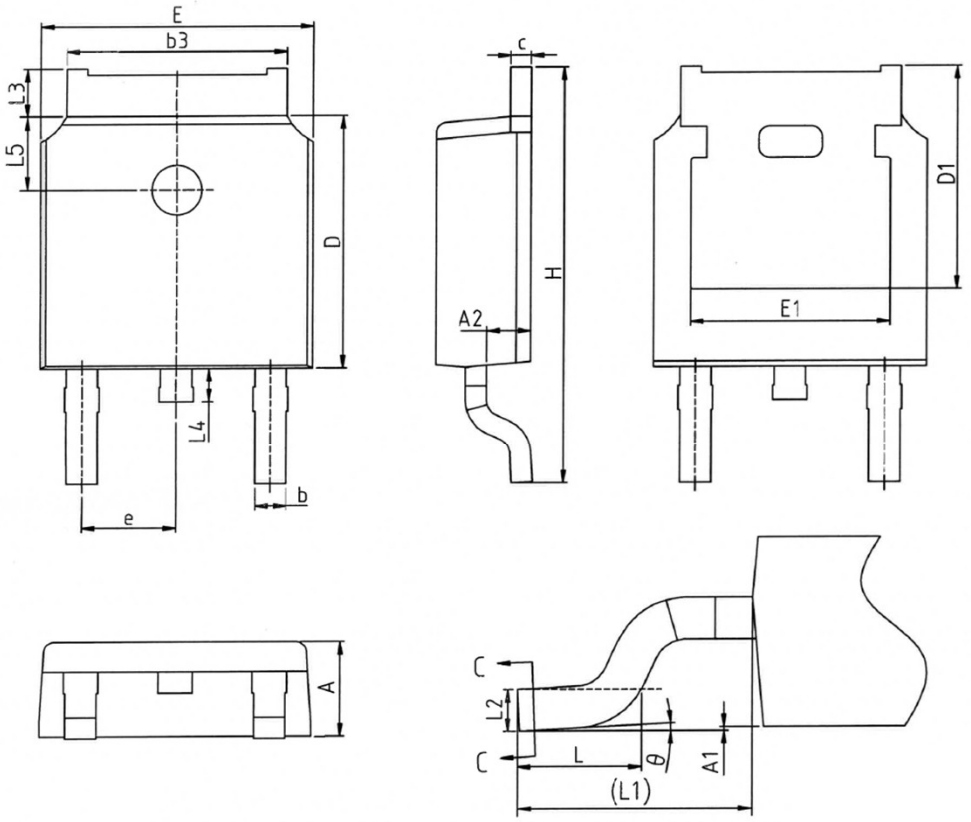


Figure 26: Switching Time vs. $R_{G(ext)}$

Package Outline: TO252 (DPAK)



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.12
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

NOTES
1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AA, DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

Marking Information

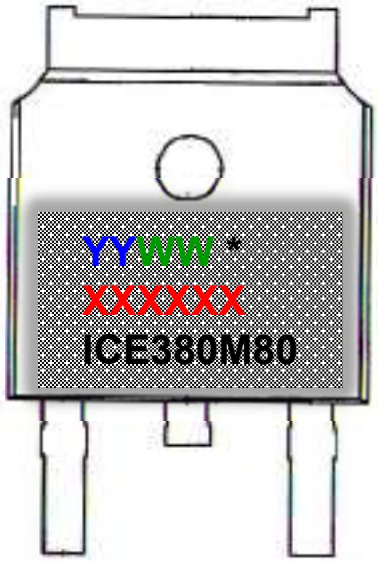
YY = Last two digits of the year

WW = Work week

***** = Site ID

XXXXXX = Lot ID

ICE380M80 = ICE is IceMOS logo and 380M80 is a designated device part number



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