IceMOS Technology

Preliminary
ICE16M120W4

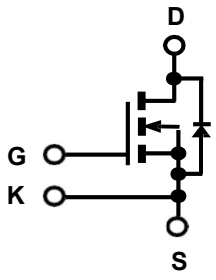
ICE16M120W4
Silicon Carbide Power MOSFET

Product Summary			
I_D	T_A=25°C	112A	Max
$V_{(BR)DSS}$	T_C=25°C	1200V	Min
$r_{DS(on)}$	V_{GS}=18V	16mΩ	Typ
Q_g	V_{DS}=800V	279nC	Typ

Features

- 1200V 16mohm SiC MOSFET
- Low on-resistance
- Fast switching speed with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Optimized design for high performance power systems

RoHS COMPLIANT RoHS (EU) 2015/863 CE HALOGEN FREE Pb Lead Free



TO247-4L

1: D, 2: S, 3: K, 4: G

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	112	A
		T_c=100°C	79	
Pulsed drain current	$I_{D,\ pulse}$		275	A
Maximum gate source voltage	$V_{GS(max)}$		-10/+22	V
Operational gate source voltage	$V_{GS\ op}$		-6/+18	V
Power dissipation	P_{tot}		500	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}		-	-	0.3	°C/W
Thermal resistance, junction-ambient	R_{thJA}	leaded	-	-	40	°C/W
Soldering temperature, wave soldering only allowed at leads	T_{sold}	1.6mm (0.063in.) from case for 10 s	-	-	260	°C
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=100μA	1200	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=23mA, T_j=25°C	1.8	2.6	4	V
		V_{DS}=V_{GS}, I_D=23mA, T_j=175°C	-	1.8	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V	-	5	50	μA
Gate source leakage current	I_{GSS}	V_{GS}=-10/+22V, V_{DS}=0V	-	-	±100	nA
Drain-source on-state resistance	$R_{DS\ (on)}$	V_{GS}=18V, I_D=75A, T_j=25°C	-	16	22	mΩ
		V_{GS}=18V, I_D=75A, T_j=175°C	-	29	-	mΩ
Gate resistance	R_G	f=1 MHz, V_{AC}=25mV	-	6.5	-	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	V_{DS}=800V, V_{GS}=0V, f=100 kHz, V_{AC}=25mV	-	5800	-	pF
Output capacitance	C_{oss}		-	213	-	pF
Reverse transfer capacitance	C_{rss}		-	16	-	pF
C_{OSS} stored energy	E_{oss}		-	85	-	μJ
Forward transconductance	g_{FS}	V_{DS}=30V, I_D=75A	-	44	-	S
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-4/+18V, I_D=75A, R_G=2.5Ω (External), L=100μH, T_j=25°C	-	35	-	ns
Rise time	t_r		-	44	-	ns
Turn-off delay time	$t_{d(off)}$		-	149	-	ns
Fall time	t_f		-	37	-	ns
Turn-on switching energy	E_{ON}		-	1733	-	μJ
Turn-off switching energy	E_{OFF}		-	1540	-	μJ

Electrical characteristics [a], at T_j=25°C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			Min	Typ	Max	
Dynamic characteristics						
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-4/+18V, I_D=75A, R_G=2.5Ω (External), L=100μH, T_j=175°C	-	33	-	ns
Rise time	t_r		-	47	-	
Turn-off delay time	$t_{d(off)}$		-	203	-	
Fall time	t_f		-	40	-	
Turn-on switching energy	E_{ON}		-	1992	-	μJ
Turn-off switching energy	E_{OFF}		-	1790	-	
Gate Charge Characteristics						
Gate to source charge	Q_{gs}	V_{DS}=800V, I_D=75A, V_{GS}=-4 to +18V	-	65	-	nC
Gate to drain charge	Q_{gd}		-	81	-	
Gate charge total	Q_g		-	279	-	
Reverse Diode						
Continuous forward current	I_S	V_{GS}=-4V	-	112	-	A
Diode forward voltage	V_{SD}	V_{GS}=-4V, I_{SD}=37.5A, T_j=25°C	-	5.3	-	V
		V_{GS}=-4V, I_{SD}=37.5A, T_j=175°C	-	4.8	-	
Reverse recovery time	t_{rr}	V_{GS}=-4V, V_{RR}=800V, I_{SD}=75A, d_{iF}/d_t=2600 A/μs, T_j=25°C	-	33	-	ns
Reverse recovery charge	Q_{rr}		-	842	-	nC
Peak reverse recovery current	I_{rm}		-	45	-	A

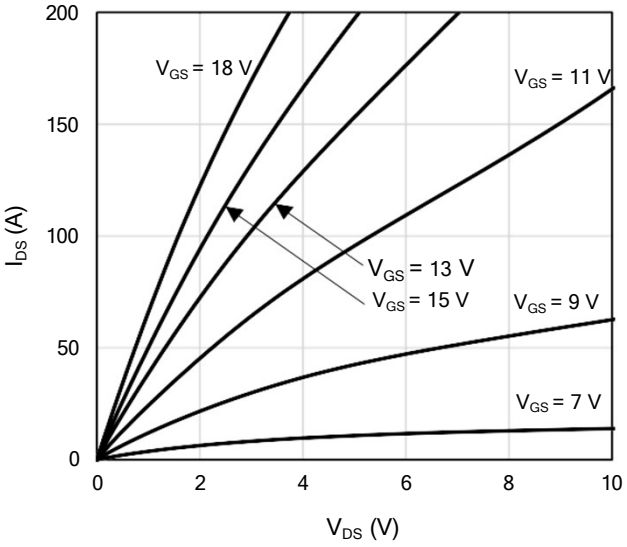


Figure 1: Output Characteristics T_J = -40°C

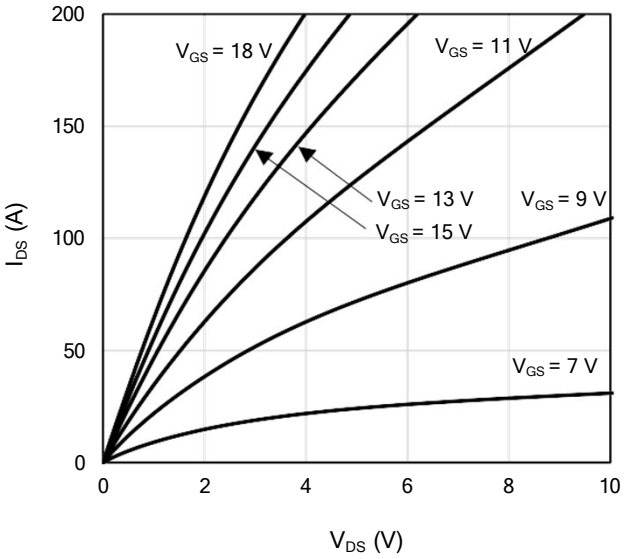


Figure 2: Output Characteristics T_J = 25°C

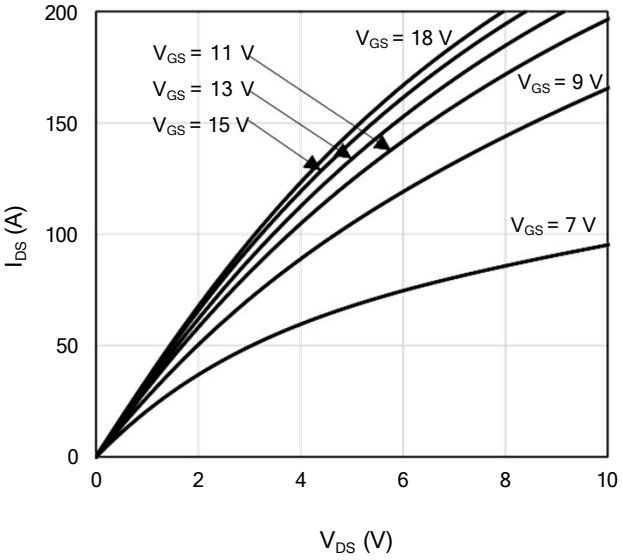


Figure 3: Output Characteristics T_J = 175°C

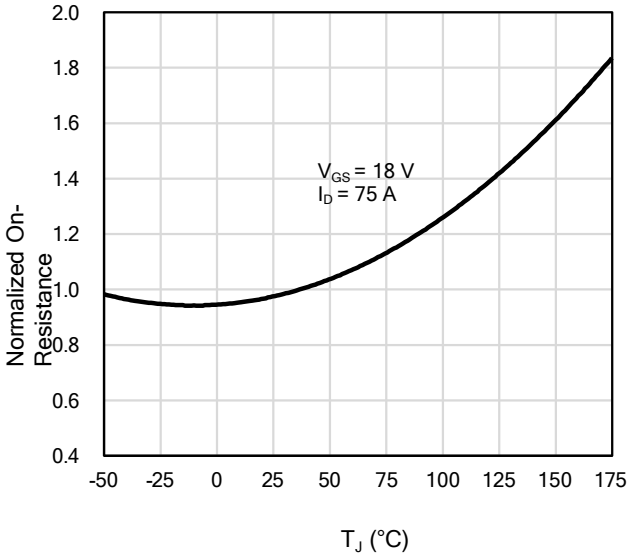


Figure 4: Normalized On-Resistance vs. Temperature

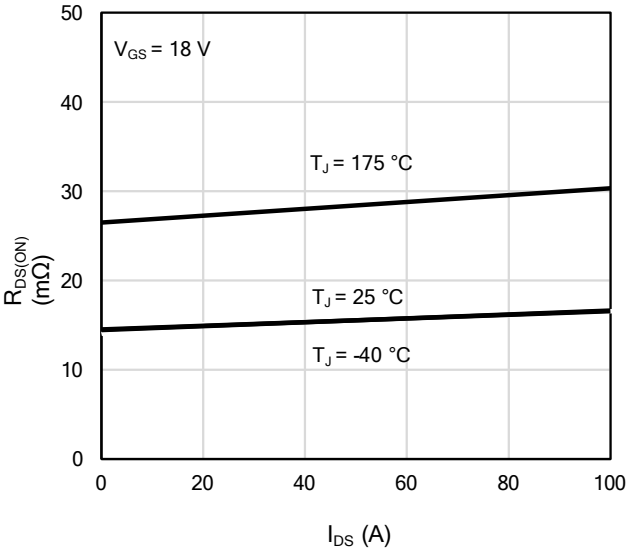


Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

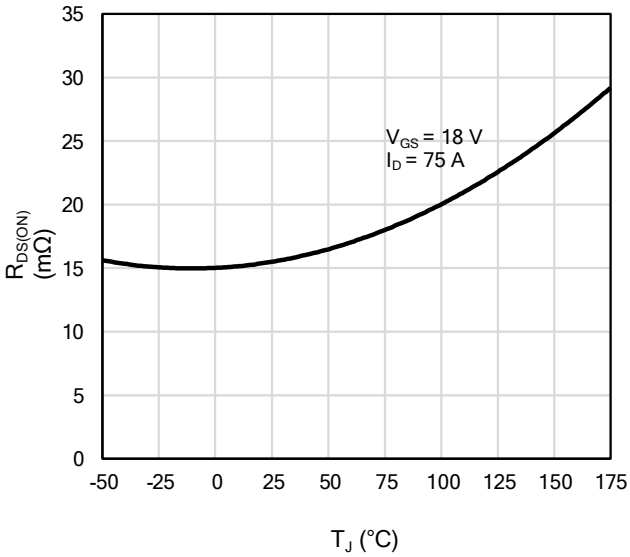


Figure 6: On-Resistance vs. Temperature

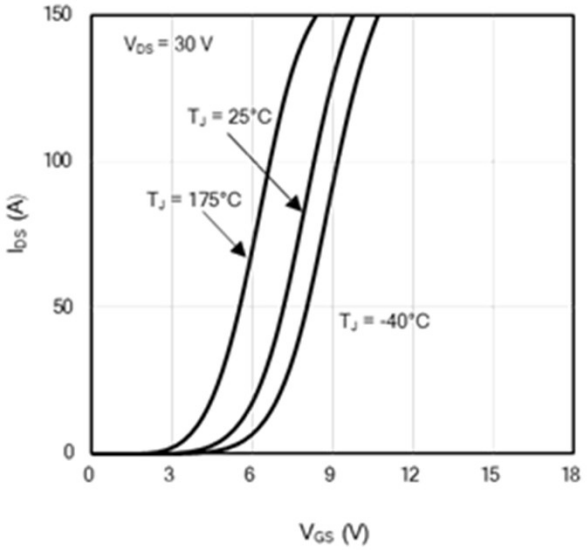


Figure 7: Transfer Characteristics For Various Junction Temparatures

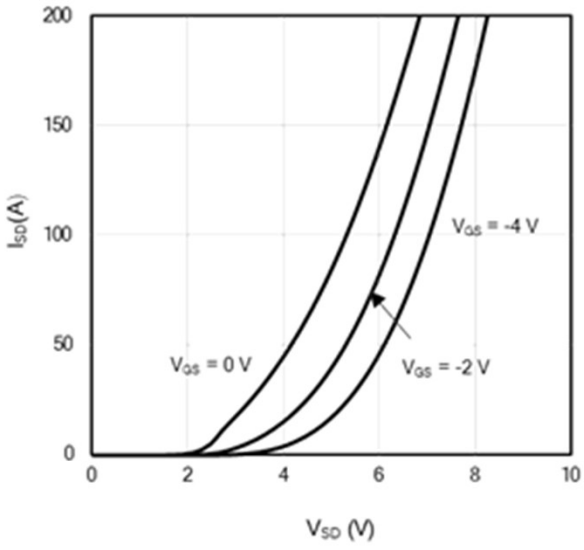


Figure 8: Body Diode Characteristics at -40°C

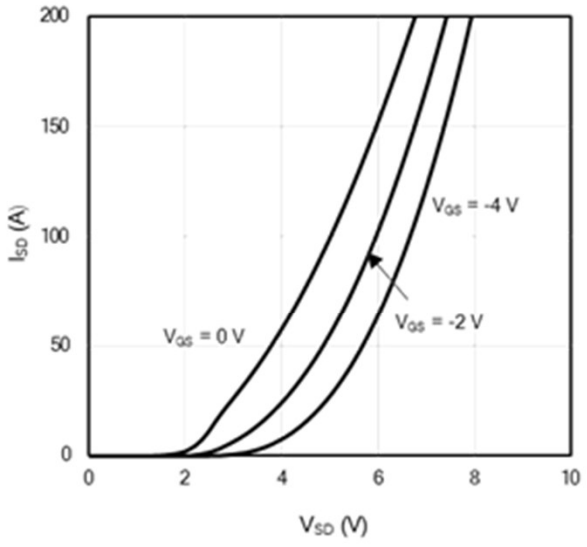


Figure 9: Body Diode Characteristics at 25°C

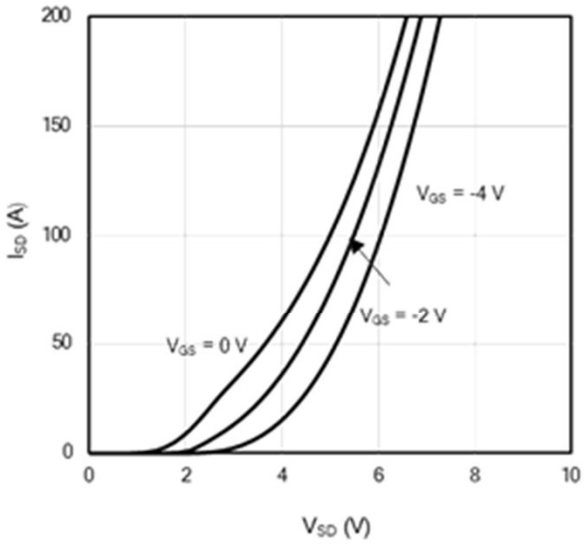


Figure 10: Body Diode Characteristics at 175°C

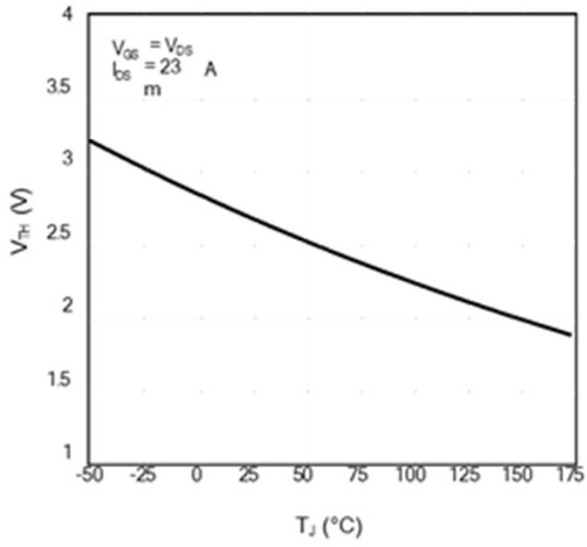


Figure 11: Threshold Voltage vs. Temperature

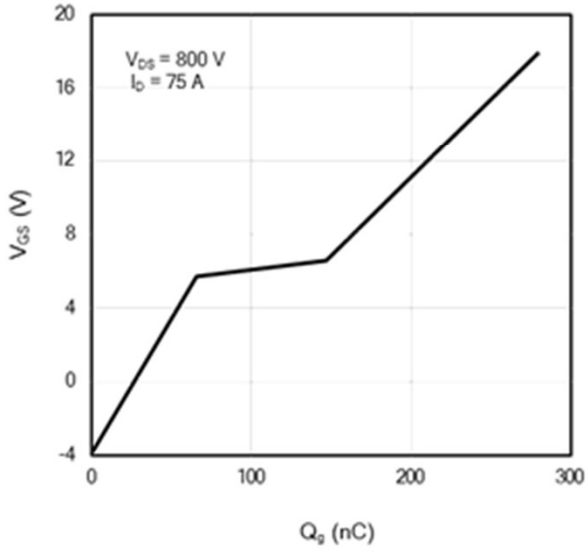


Figure 12: Gate-Charge Characteristics

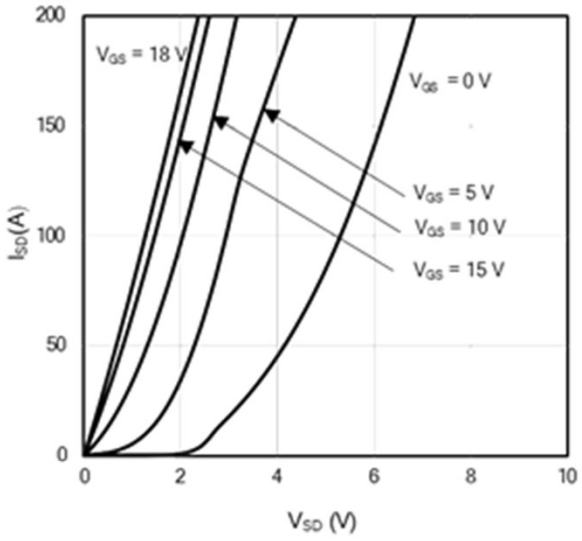


Figure 13: 3rd Quadrant Characteristics at -40°C

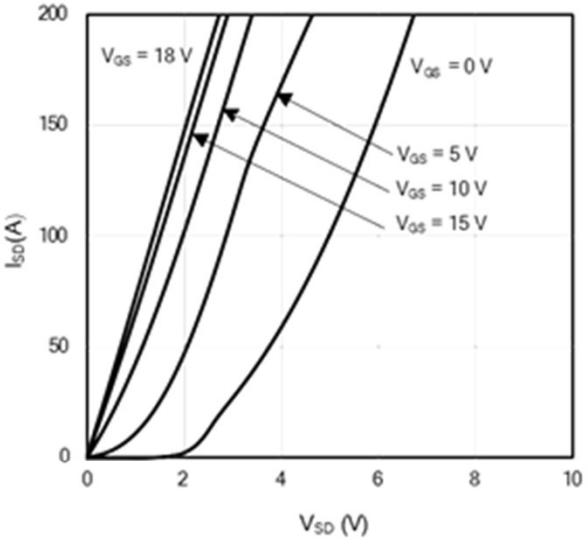


Figure 14: 3rd Quadrant Characteristics at 25°C

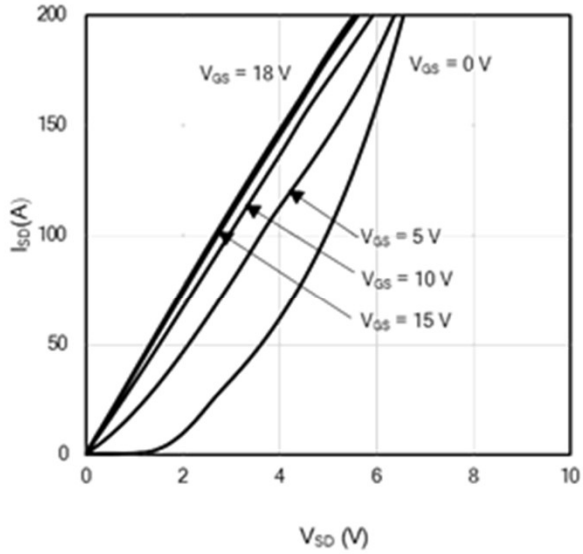


Figure 15: 3rd Quadrant Characteristics at 175°C

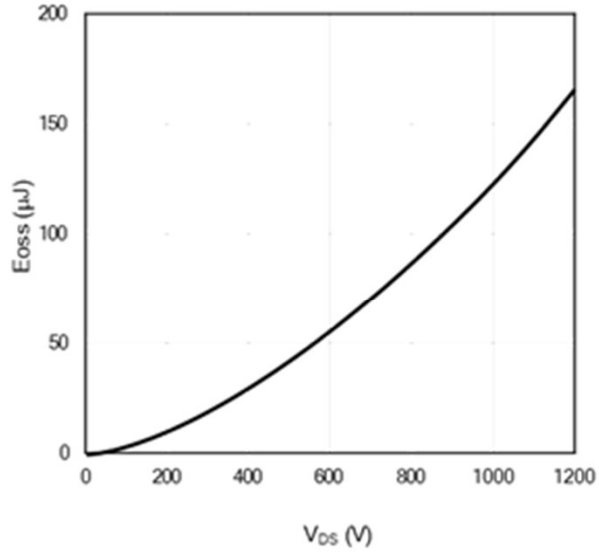


Figure 16: Output Capacitor Stord Energy

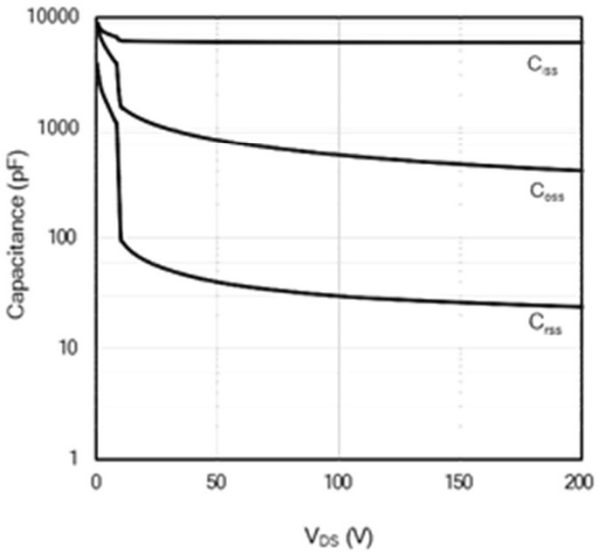


Figure 17: Capacitance Characteristics (0 - 200 V)

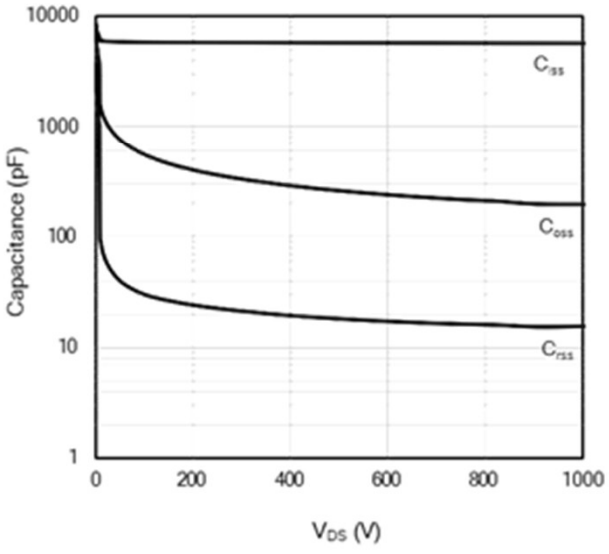


Figure 18: Capacitance Characteristics (0 - 1000 V)

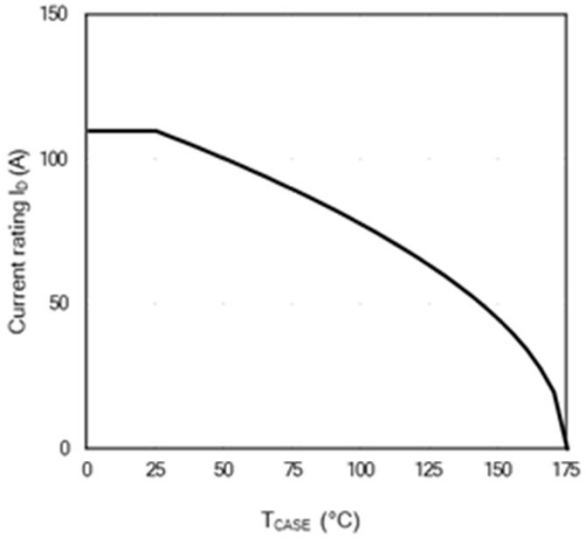


Figure 19: Current De-rating

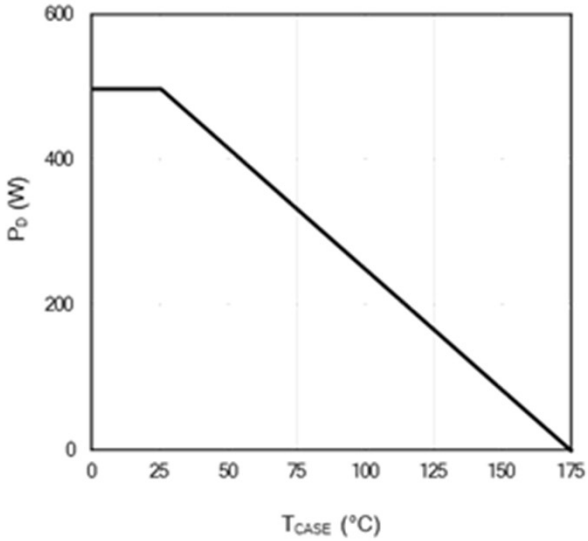


Figure 20: Maximum Power Disspation Derating vs. CaseTemperature

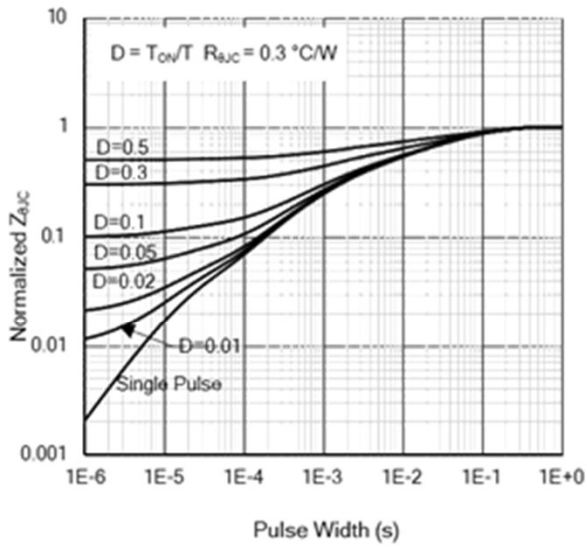


Figure 21: Normalized Maximum Transient Thermal Impedance

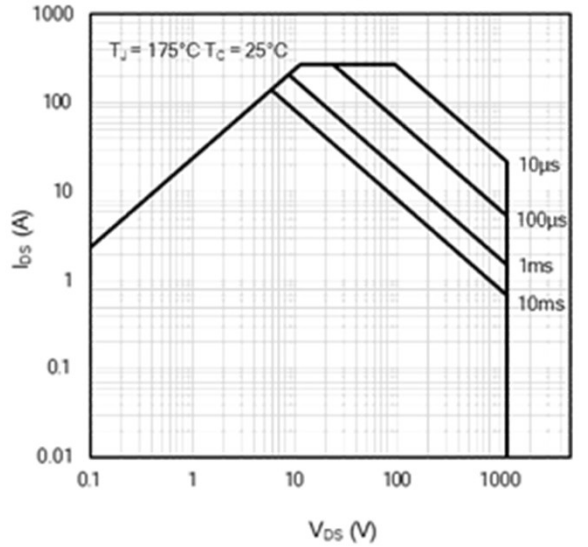


Figure 22: Maximum Forward Biased Safe Operating Area

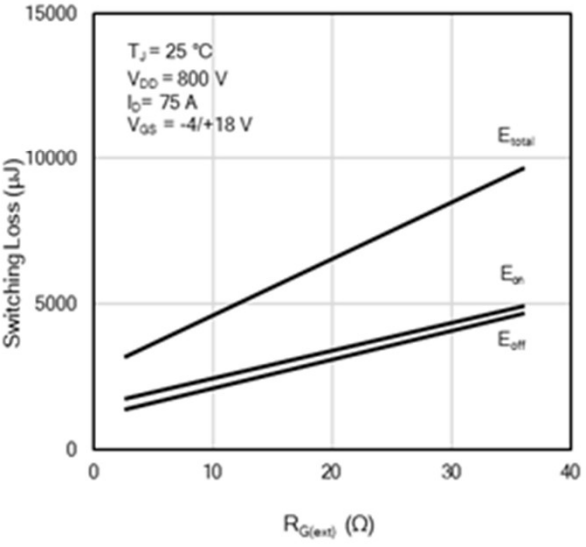


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

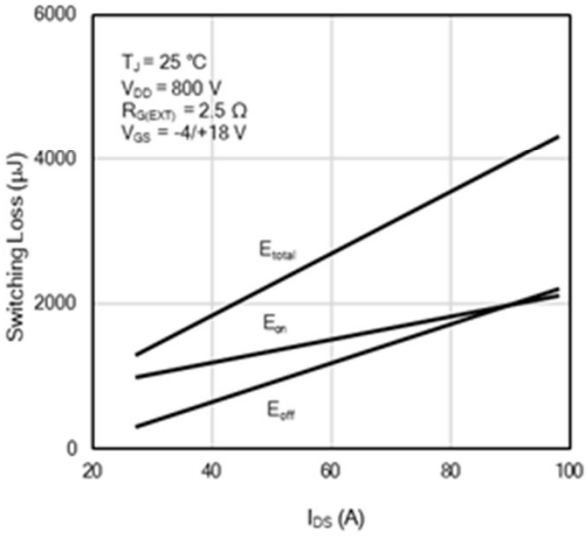


Figure 24: Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800 V)

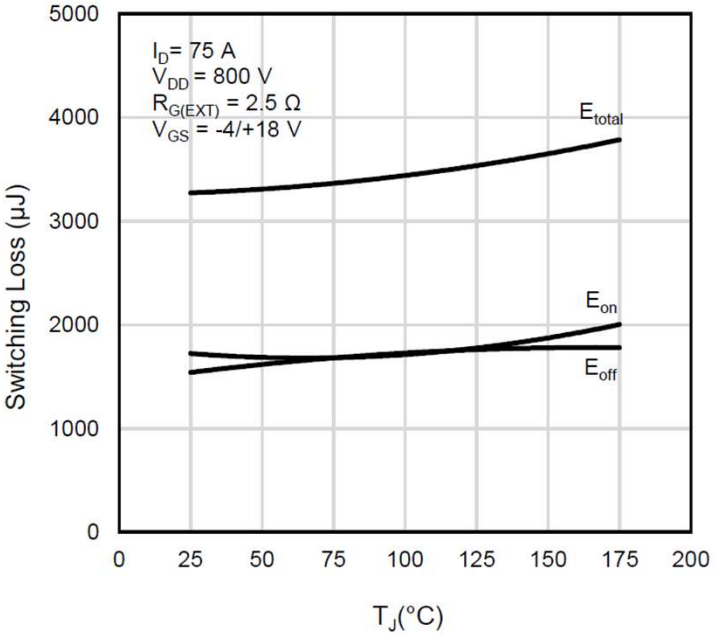


Figure 24: Clamped Inductive Switching Energy vs. T_J

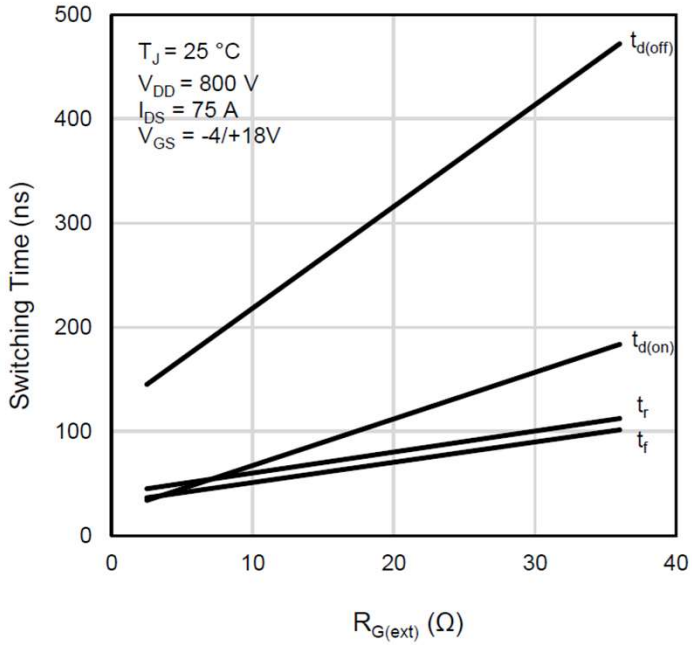
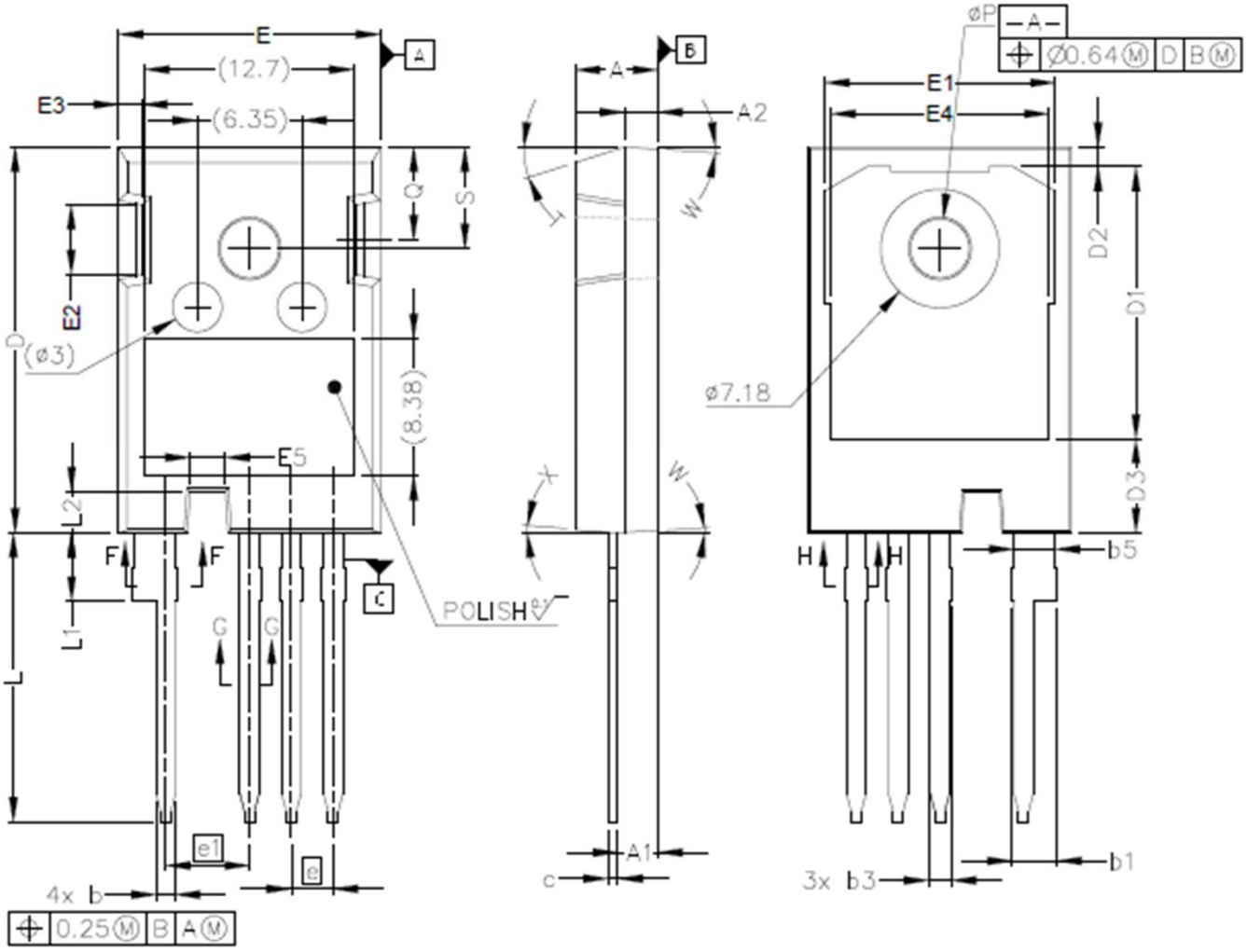
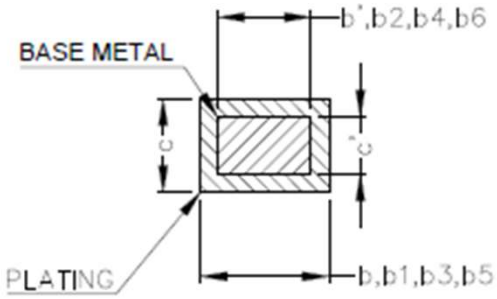


Figure 25: Switching Times vs. $R_{G(ext)}$

Package Outline: TO-247-4L





SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

Package Outline: TO-247-4L

NOTE ;
1. ALL METAL SURFACES: TIN PLATED,EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.

SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
D3	5.55	6.15
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
E5	1.95	2.35
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5 ° REF.	
X	4° REF.	

Marking Information

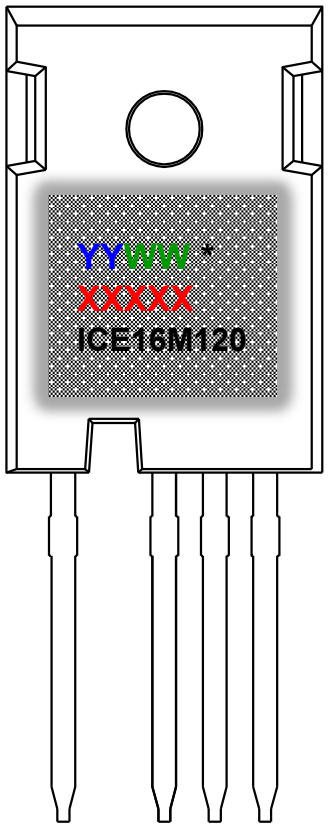
YY = Last two digits of the year

WW = Work week

* = Site ID

XXXXX = Lot ID

ICE16M120 = ICE is IceMOS logo and 16M120 is a designated device part number



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