V_{DSS}	1200 V
I_D	56 A
$R_{DS(ON)}$	56 mΩ

FEATURES

- High Speed Switching
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to Parallel
- Simple to Drive
- RoHS Compliant

BENEFITS

- Increased Power Density
- Faster Operating Frequency
- Reduction of Heat Sink Requirements
- Higher Efficiency
- Reduced EMI

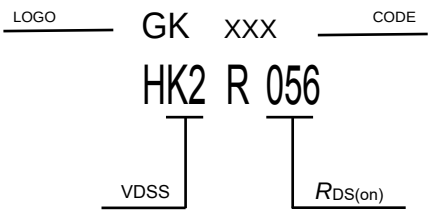
APPLICATION

- Power Factor Correction Modules
- Switch Mode Power Supplies
- DC-AC Inverters
- High Voltage DC/DC Converters

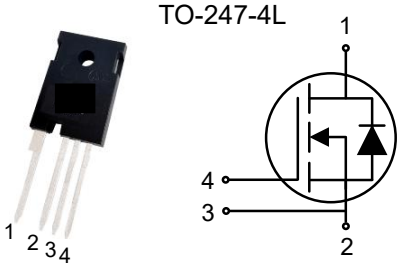
DESCRIPTION

- Pin 1 and Backside - Drain
- Pin 2 - Power Source
- Pin 3 - Driver Source
- Pin 4 - Gate





TO-247-4L



Maximum Ratings (T_j=25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Value	Unit
V_{DS}	Drain-Source Voltage		1200	V
I_D	Continuous Drain Current	V_{GS}=18V T_c=25°C T_c=100°C	 56 40	A
I_{DM}	Peak Drain Current	Pulse width t_p limited by T_{jmax}	108	A
V_{GSmax}	Gate-Source Voltage, max. Transient Voltage	t_p≤0.5μs, D<0.001	-10/+22	V
V_{GSmax}	Gate-Source Voltage		-8/+22	V
V_{GSop}	Recommend Gate-Source Voltage		-4/+18	V
P_{tot}	Power Dissipation	T_c=25°C T_c=100°C	319 159	W
E_{AS}	Non-Repetitive Avalanche Switching Energy	V_{DD}=50V, L=1mH, I_D=36A	648	mJ
E_{AR}	Repetitive Avalanche Energy	V_{DD}=50V, L=700μH, I_D=36A	453	mJ
t_{SC}	Short-Circuit Withstand Time	V_{DD}=800V, V_{GS}=18V, $V_{DS,peak}$ < 1200V	1.8	μs
T_j	Operating Junction Temperature		-40~175	°C
T_{stg}	Storage Temperature		-40~150	°C
T_{sold}	Soldering Temperature	1.6mm (0.063”) from case for 10s	260	°C
M	Mounting Torque	M3 screw	0.6	Nm

ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

Static Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	I_D=100μA, V_{GS}=0V	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V, V_{GS}=0V		1	10	μA
I_{GSS}	Gate-Source Leakage Current	V_{DS}=0V, V_{GS}=18V			250	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=5mA T_j=25°C T_j=175°C	2	2.8 2.1	4.0	V
$R_{DS(on)}$	Drain-Source On-State Resistance	V_{GS}=15V, I_D=20A T_j=25°C T_j=175°C V_{GS}=18V, I_D=20A T_j=25°C T_j=175°C		67 93 56 87	 88	mΩ
g_{fs}	Forward Transconductance	V_{DS}=20V, I_D=20A		13		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	V_{DS}=1000V, f=1MHz, V_{GS}=0V		2415		pF
C_{oss}	Output Capacitance			79		pF
C_{rss}	Reverse Transfer Capacitance			6		pF
E_{oss}	C_{oss} Stored Energy			47		μJ
$R_{G(int)}$	Internal Gate Resistance	f=1MHz		0.98		Ω
Q_g	Total Gate Charge	V_{DS}=800V, I_D=20A, V_{GS}=-4/18V		103		nC
Q_{gs}	Gate to Source Charge			29		nC
Q_{gd}	Gate to Drain Charge			30		nC

Thermal Characteristics

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.47		°C/W

ELECTRICAL CHARACTERISTICS (T_C =25°C, unless otherwise specified)

Switching Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time	V_{DD}=800V, I_D=20A, V_{GS}=-4V/18V, $R_{G(ext)}$=2.5Ω, L=200μH, T_j=25°C		25		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn-Off Delay Time			26		ns
t_f	Fall Time			9		ns
E_{on}	Turn-On Energy			317		μJ
E_{off}	Turn-Off Energy			26		μJ
$t_{d(on)}$	Turn-On Delay Time	V_{DD}=800V, I_D=20A, V_{GS}=-4V/18V, $R_{G(ext)}$=2.5Ω, L=200μH, T_j=175°C		25		ns
t_r	Rise Time			12		ns
$t_{d(off)}$	Turn-Off Delay Time			24		ns
t_f	Fall Time			11		ns
E_{on}	Turn-On Energy			434		μJ
E_{off}	Turn-Off Energy			56		μJ

Reverse Diode Characteristics

Symbol	Parameter	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{SD}	Diode Forward Voltage	V_{GS}=-4V, I_{SD}=10A T_j=25°C T_j=175°C V_{GS}=-4V, I_{SD}=20A T_j=25°C T_j=175°C		 4.1 3.7 4.6 4.2		V
I_S	Continuous Diode Forward Current	V_{GS}=-4V T_c=25°C T_c=100°C		 47 21		A
t_{rr}	Reverse Recovery Time	V_{GS}=-4V, I_{SD}=20A, V_R=800V, di/dt=5476A/μs, T_j=25°C		8		ns
Q_{rr}	Reverse Recovery Charge			94		nC
I_{rrm}	Peak Reverse Recovery Current			18		A
t_{rr}	Reverse Recovery Time	V_{GS}=-4V, I_{SD}=20A, V_R=800V, di/dt=5004A/μs, T_j=175°C		39		ns
Q_{rr}	Reverse Recovery Charge			493		nC
I_{rrm}	Peak Reverse Recovery Current			23.4		A

RATING AND CHARACTERISTIC CURVES

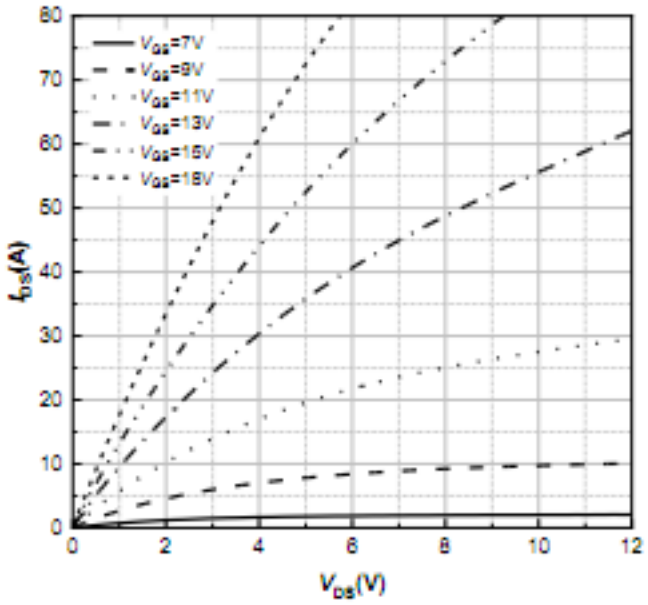


Figure 1. **Output Characteristics T_j=-40°C**

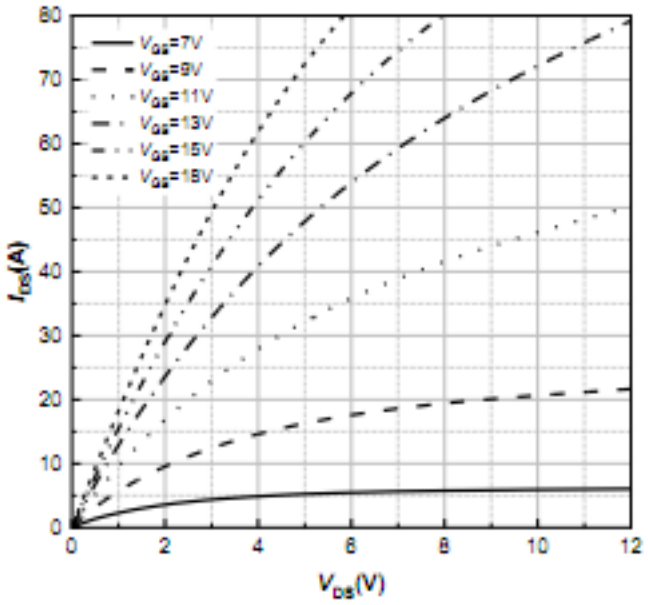


Figure 2. **Output Characteristics T_j=25°C**

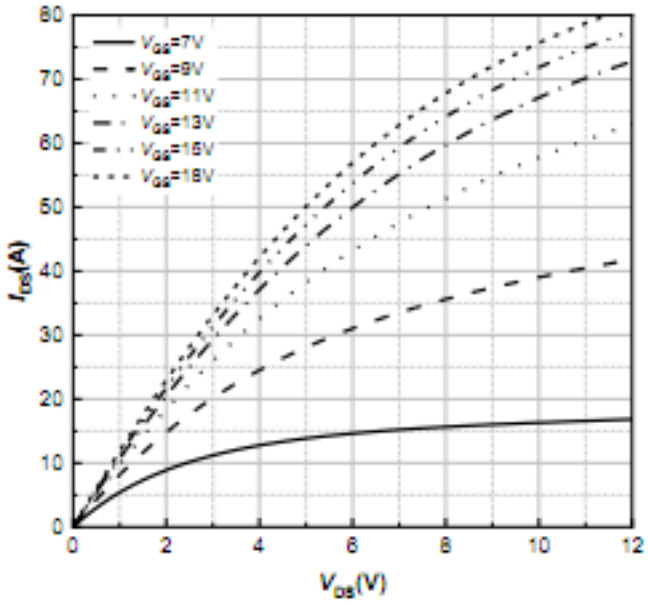


Figure 3. **Output Characteristics T_j=175°C**

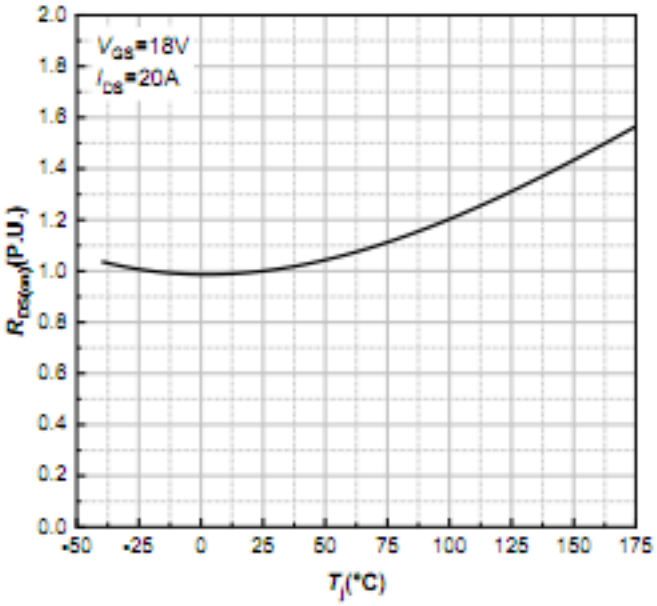


Figure 4. **Normalized On-Resistance vs. Temperature**

RATING AND CHARACTERISTIC CURVES

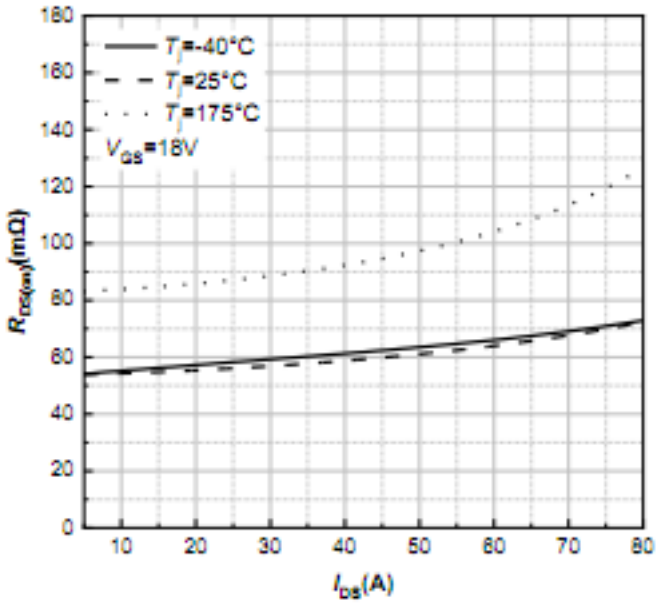


Figure 5. **On-Resistance vs. Drain Current For Various Temperatures**

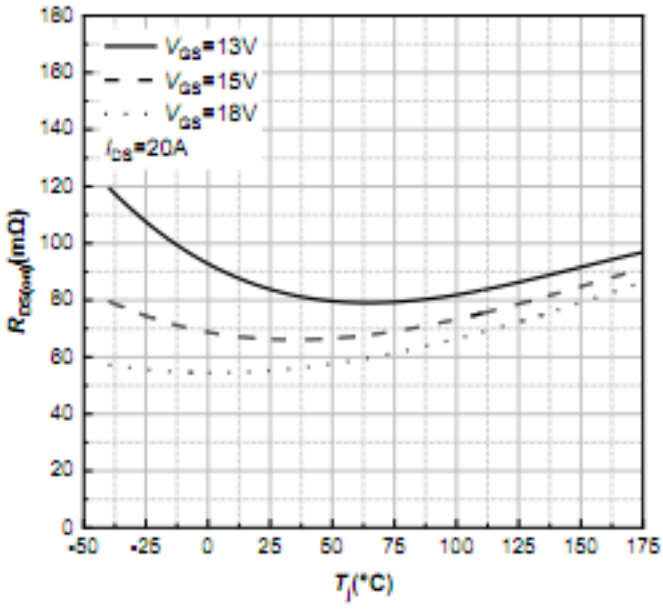


Figure 6. **On-Resistance vs. Temperature For Various Gate Voltage**

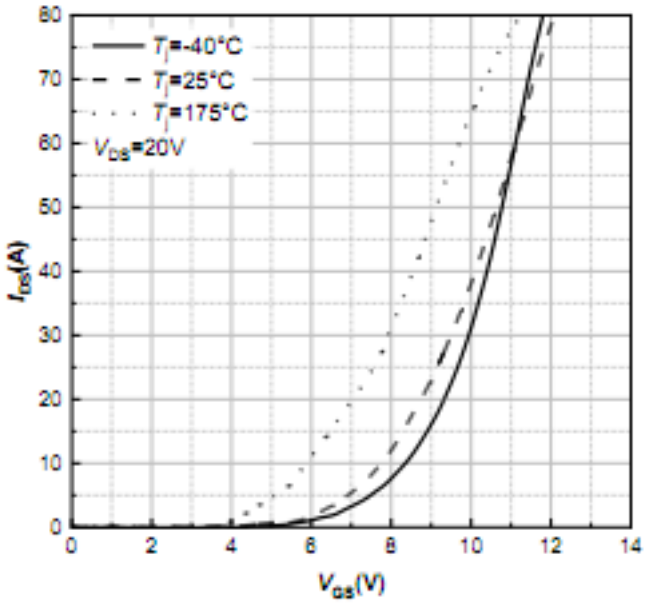


Figure 7. **Transfer Characteristic for Various Junction Temperatures**

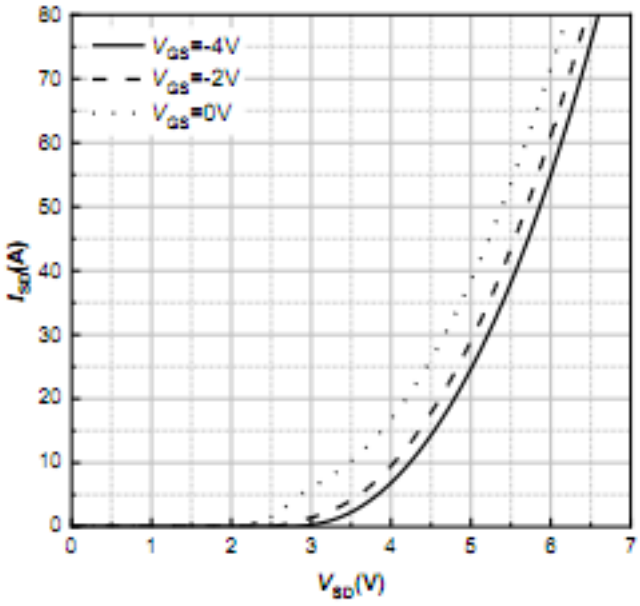


Figure 8. **Body Diode Characteristic T_j=-40°C**

RATING AND CHARACTERISTIC CURVES

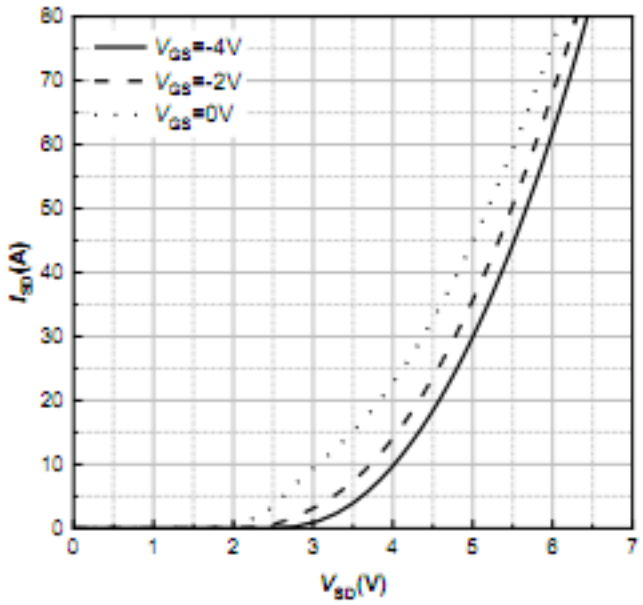


Figure 9. **Body Diode Characteristic T_j=25°C**

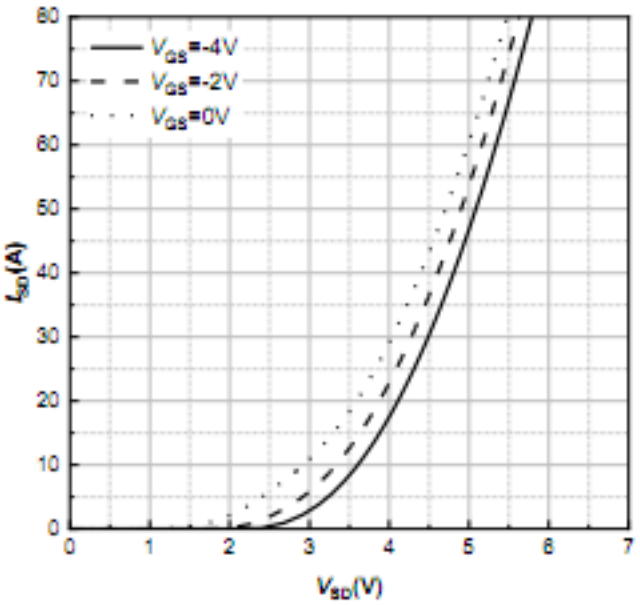


Figure 10. **Body Diode Characteristic T_j=175°C**

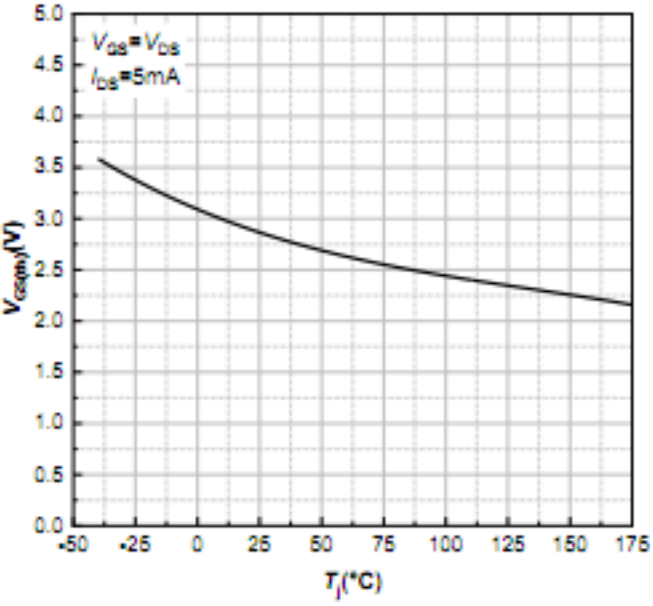


Figure 11. **Threshold Voltage vs. Temperature**

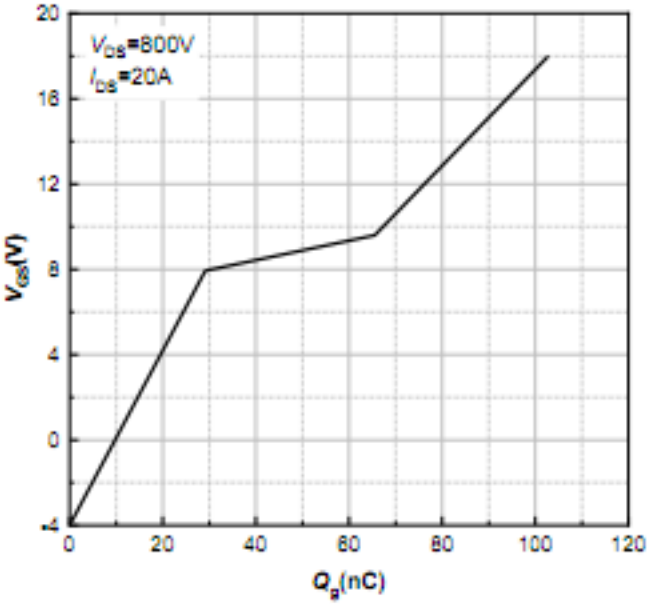


Figure 12. **Gate Charge Characteristics**

RATING AND CHARACTERISTIC CURVES

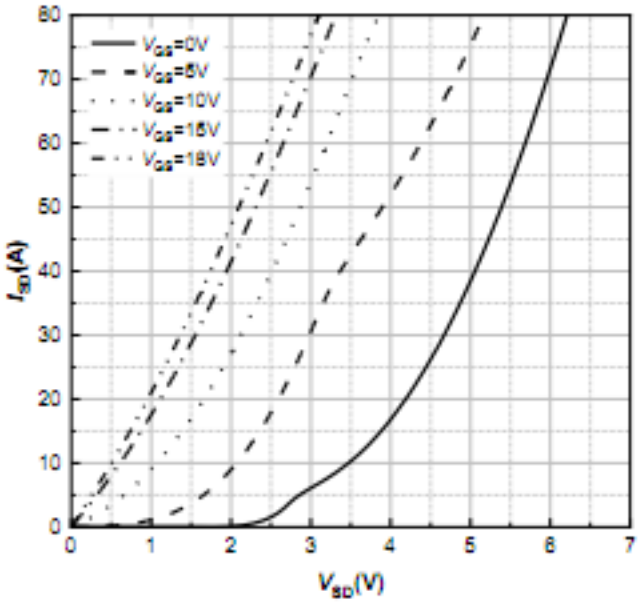


Figure 13. **3rd Quadrant Characteristic T_j=-40°C**

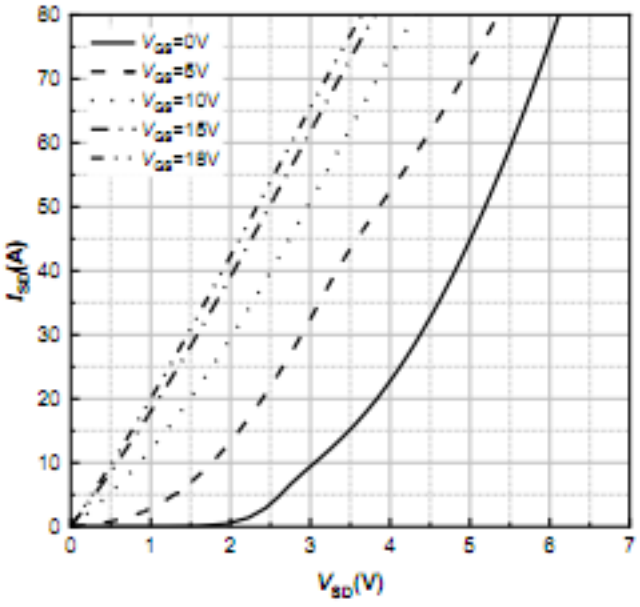


Figure 14. **3rd Quadrant Characteristic T_j=25°C**

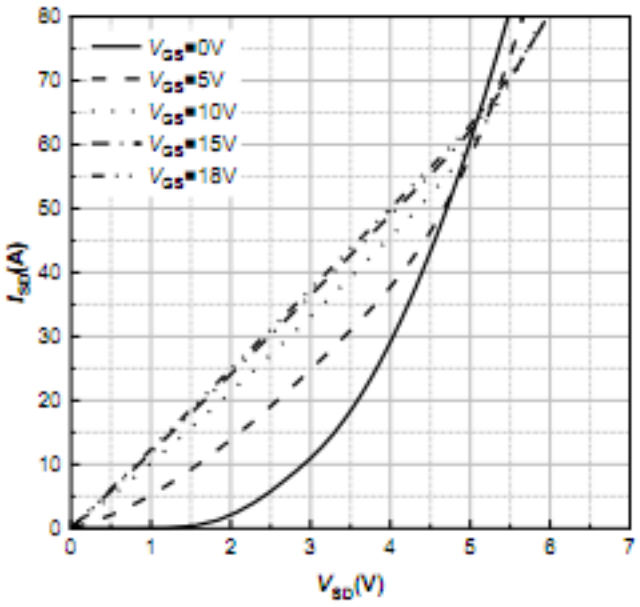


Figure 15. **3rd Quadrant Characteristic T_j=175°C**

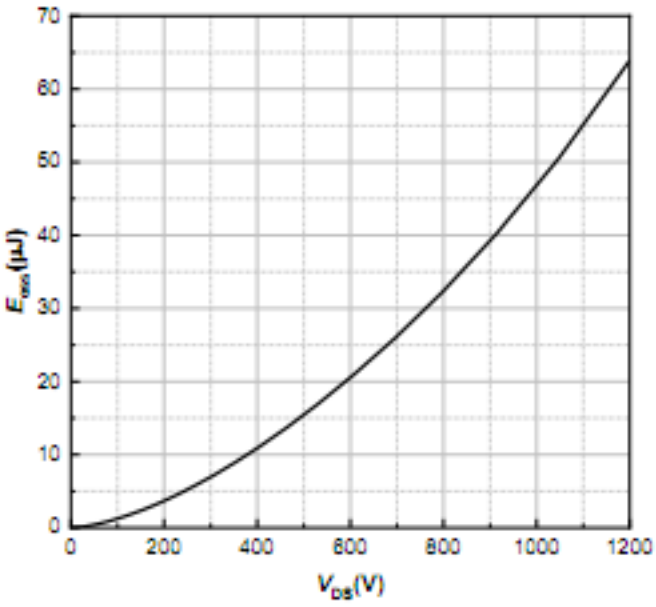


Figure 16. **Output Capacitor Stored Energy**

RATING AND CHARACTERISTIC CURVES

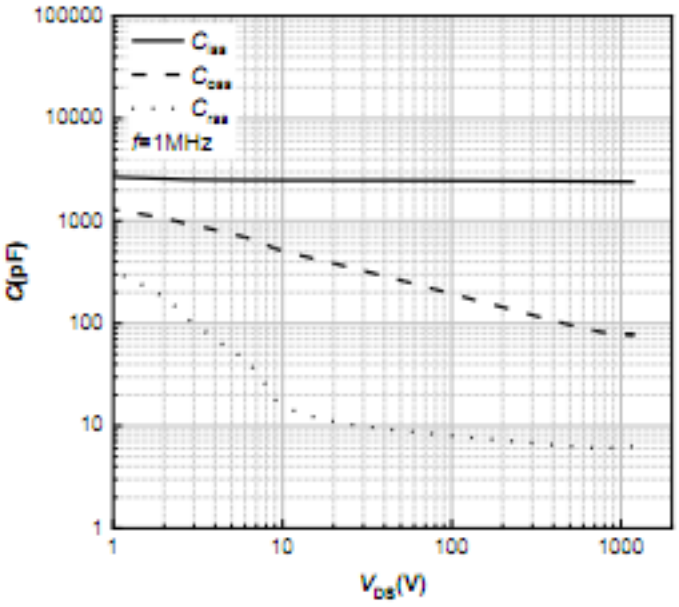


Figure 17. **Capacitances vs. Drain-Source**

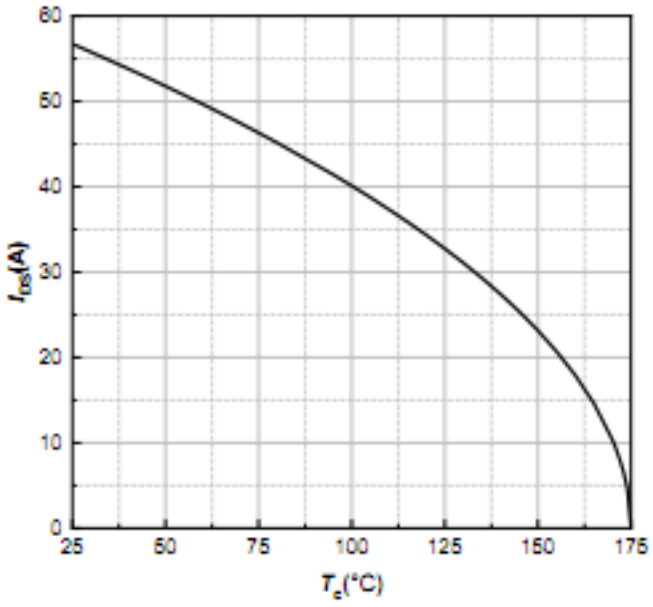


Figure 18. **Continuous Drain Current Derating vs. Case Temperature**

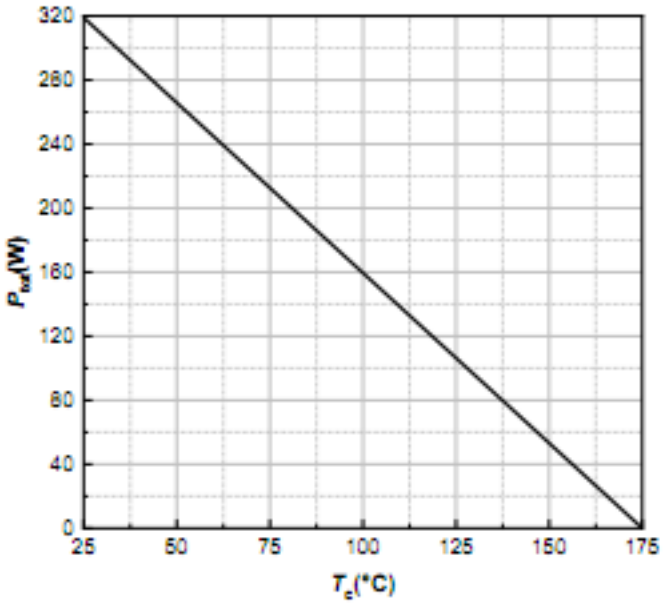


Figure 19. **Maximum Power Dissipation Derating vs. Case Temperature**

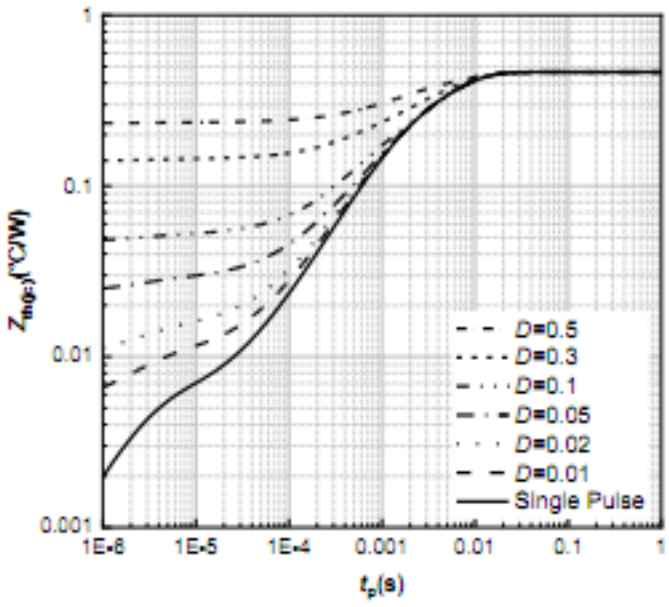


Figure 20. **Transient Thermal Impedance**

RATING AND CHARACTERISTIC CURVES

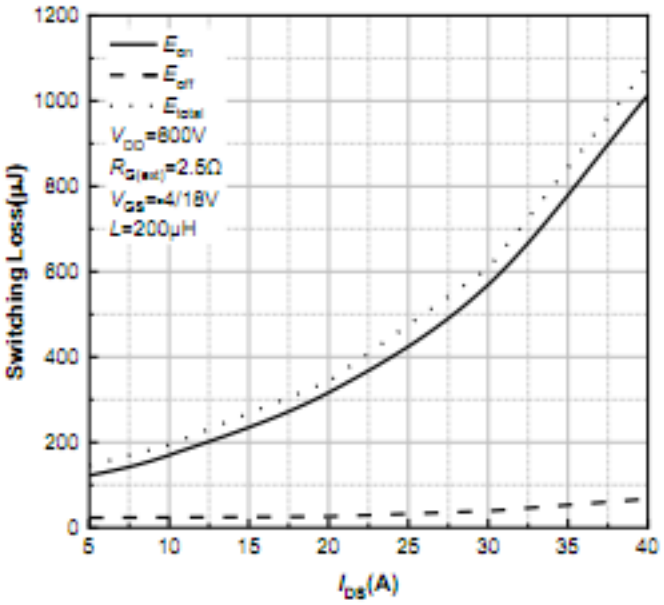


Figure 21. **Clamped Inductive Switching Energy vs. Drain Current T_j=25°C**

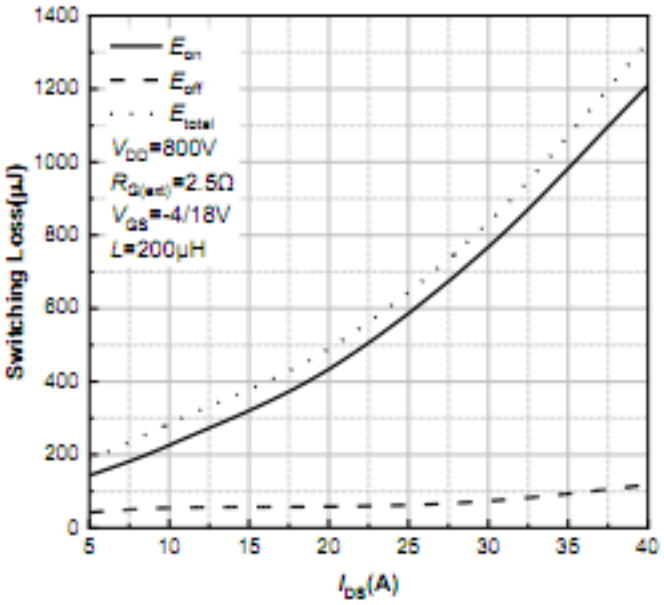


Figure 22. **Clamped Inductive Switching Energy vs. Drain Current T_j=175°C**

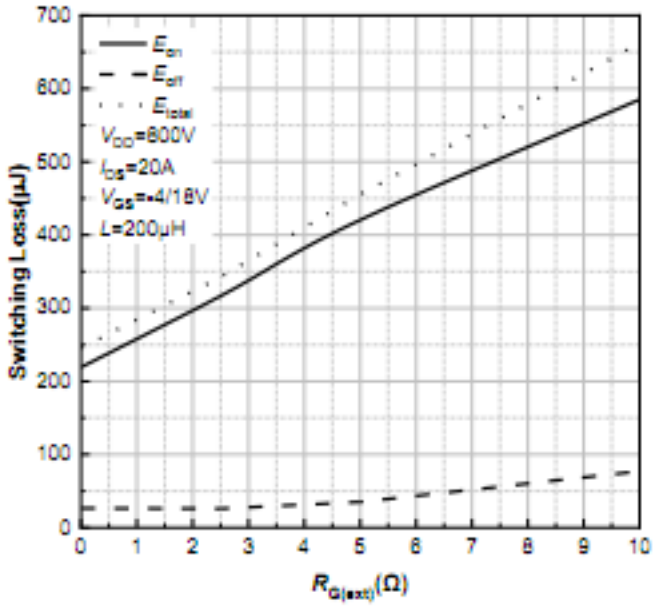


Figure 23. **Clamped Inductive Switching Energy vs. $R_{G(ext)}$ T_j=25°C**

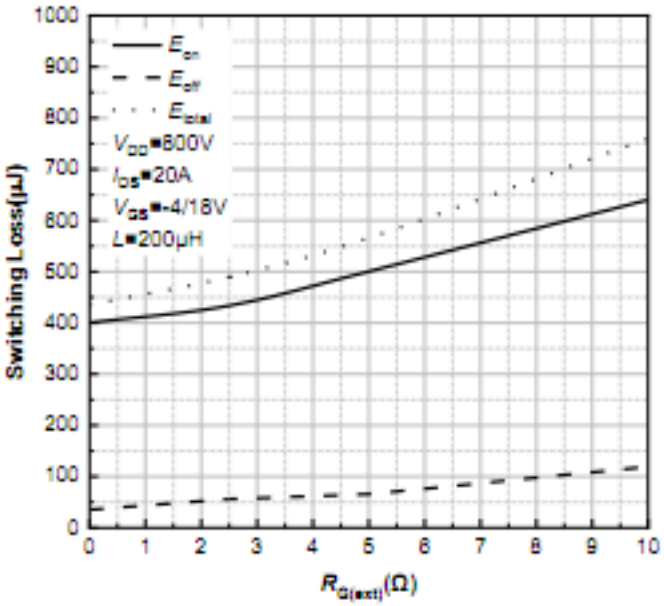


Figure 24. **Clamped Inductive Switching Energy vs. $R_{G(ext)}$ T_j=175°C**

RATING AND CHARACTERISTIC CURVES

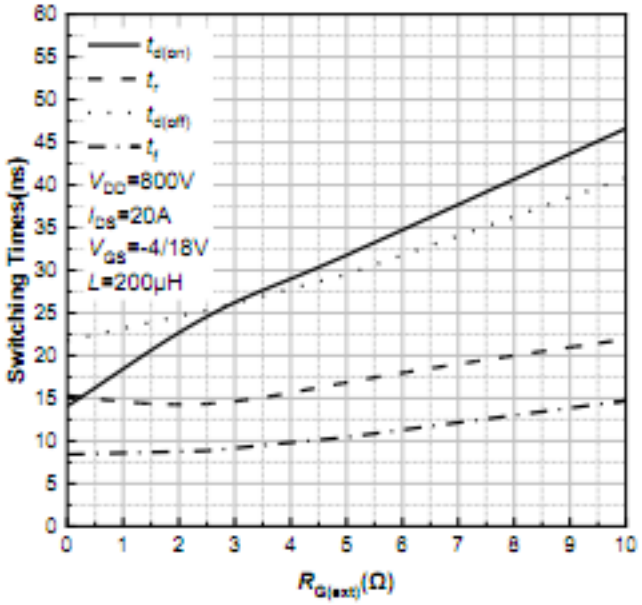


Figure 25. **Switching Times vs. $R_{G(ext)}$ T_j=25°C**

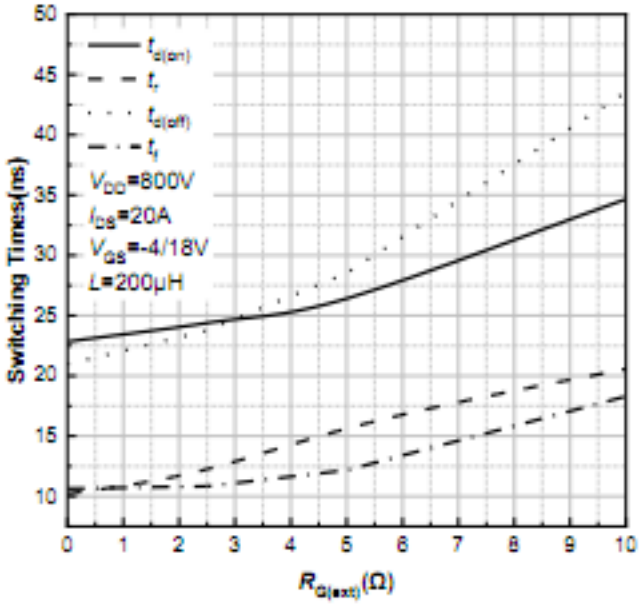


Figure 26. **Switching Times vs. $R_{G(ext)}$ T_j=175°C**

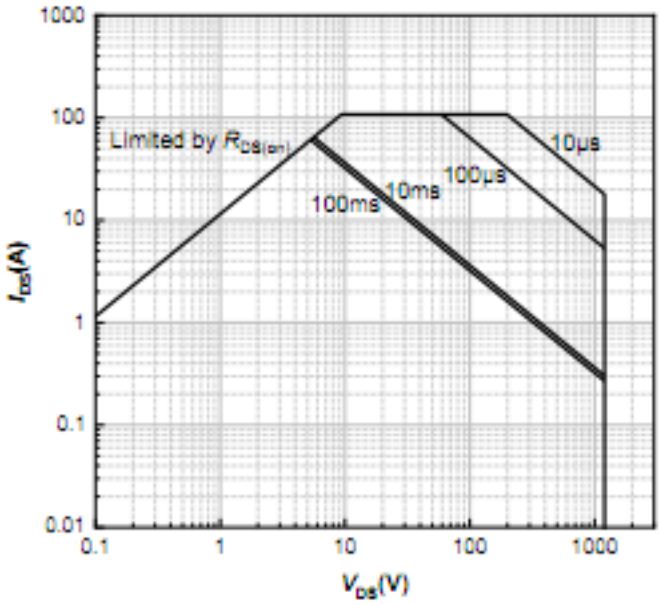
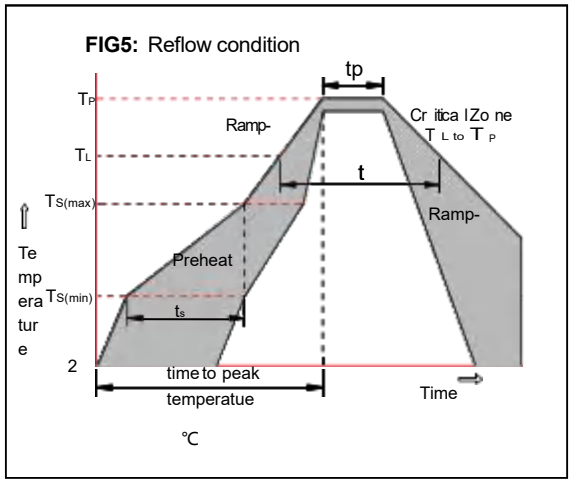


Figure 27. **Safe Operating Area**

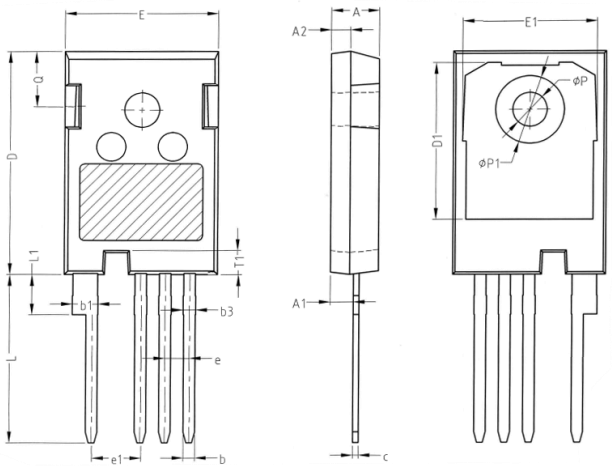
Soldering parameters

Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150℃
	-Temperature Max($T_{s(max)}$)	+200℃
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3℃/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3℃/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217℃
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_p)		+260(+0/-5)℃
Time within 5℃ of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6℃/sec. Max
Time 25℃ to Peak Temp (T_P)		8 min. Max
Do not exceed		+260℃



Package Dimensions & Suggested Pad Layout

TO-247-4L



SYMBOL	Unit: mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
e1	5.08 BSC		
Q	5.49	5.79	6.09
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
ΦP	3.40	3.60	3.80
ΦP1	7.19 REF		