

Product Highlight

Features

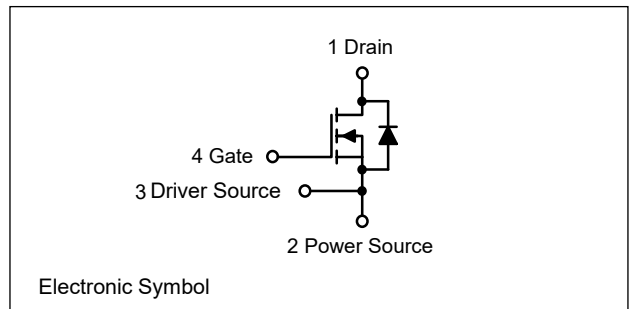
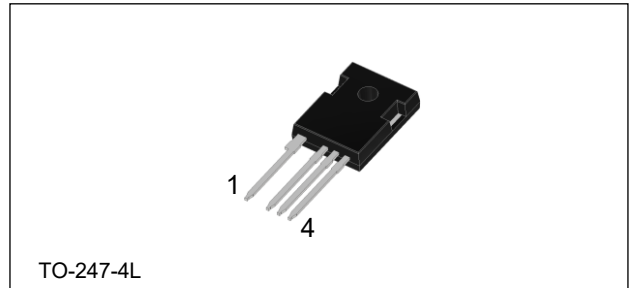
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort

Applications

- Server & Telecom power
- EV charging station
- Solar inverter / ESS / UPS
- Industrial power supply



Key Parameters

$BV_{DSS, T_C=25^\circ C}$	$I_D, T_C=25^\circ C$	$R_{DS(on), typ}$	$Q_{g, typ}$
650 V	117 A	15 mΩ	146 nC



Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
MSQS065R015T2TH	065R015T2	TO-247-4L	Tube	30 units

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5...-3 / +18	V
I_D	Drain Current	Continuous ($T_C = 25^\circ C$)	117*	A
		Continuous ($T_C = 100^\circ C$)	83*	
I_{DM}	Drain Current	Pulsed (Note1)	311*	A
P_D	Power Dissipation	($T_C = 25^\circ C$)	387	W
		Derate Above $25^\circ C$	2.58	W/ $^\circ C$
T_J	Operating Temperature Range		-55 to 175	$^\circ C$

*Limited by maximum junction temperature.

Note 1. Repetitive rating: pulse-width limited by maximum junction temperature.

1. Package

Temperature Ratings

Symbol	Parameter	Value	Unit
T _{STG}	Storage Temperature Range	-55 to 175	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds	260	°C

Thermal Characteristics

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.39	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

2. MOSFET

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain to Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1 mA	650			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V		1	100	μA
		V _{DS} = 650 V, V _{GS} = 0 V, T _J = 175°C		10		
I _{GSS}	Gate-Source Leakage Current	V _{GS} = +22 V, V _{DS} = 0 V			+100	nA
		V _{GS} = -10 V, V _{DS} = 0 V			-100	
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 20.3 mA (tested after V _{GS} = 22V, 1 ms pulse)	1.8	2.8	4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 18 V, I _D = 60 A		15	21	mΩ
		V _{GS} = 18 V, I _D = 60 A, T _J = 175°C		20		
g _{fs}	Transconductance	V _{DS} = 20 V, I _D = 60 A		27.6		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0V, f = 250 kHz		3525		pF
C _{oss}	Output Capacitance			297		
C _{rss}	Reverse Capacitance			16		
E _{oss}	Stored Energy in Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		36.5		μJ
C _{o(er)}	Energy Related Output Capacitance			456		pF
C _{o(tr)}	Time Related Output Capacitance			648		
Q _{g(tot)}	Total Gate Charge	V _{DS} = 400 V, I _D = 60 A, V _{GS} = -5 V / 18 V, Inductive load		146		nC
Q _{gs}	Gate to Source Charge			45		
Q _{gd}	Gate to Drain “Miller” Charge			36		
R _G	Internal Gate Resistance	f = 1MHz		2.2		Ω
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DS} = 400 V, I _D = 60 A, V _{GS} = -5 V / 18 V, R _G = 5.6 Ω, Inductive load		28.8		ns
t _r	Turn-On Rise Time			25.7		
t _{d(off)}	Turn-Off Delay Time			60.1		
t _f	Turn-Off Fall Time			10.5		
E _{on}	Turn-on Switching Energy			146		μJ
E _{off}	Turn-off Switching Energy			279		
E _{tot}	Total Switching Energy			425		

3. Body Diode

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Source-Drain Diode Characteristics						
I _S	Maximum Continuous Diode Forward Current				117*	A
I _{SM}	Maximum Pulsed Diode Forward Current				311*	
V _{SD}	Diode Forward Voltage	V _{GS} = -5 V, I _{SD} = 60 A		4.4		V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 60 A, dI _F /dt = 1000 A/μs, Includes Q _{OSS}		29.5		ns
Q _{rr}	Reverse Recovery Charge			303		nC
I _{rrm}	Peak Reverse Recovery Current			17.4		A

*Limited by maximum junction temperature.

4. Typical Performance Characteristics

Figure 1. On-Region Characteristics $T_J = -40^{\circ}\text{C}$

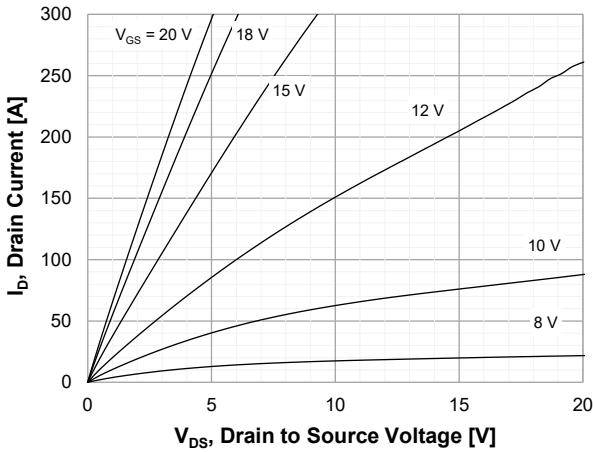


Figure 2. On-Region Characteristics $T_J = 25^{\circ}\text{C}$

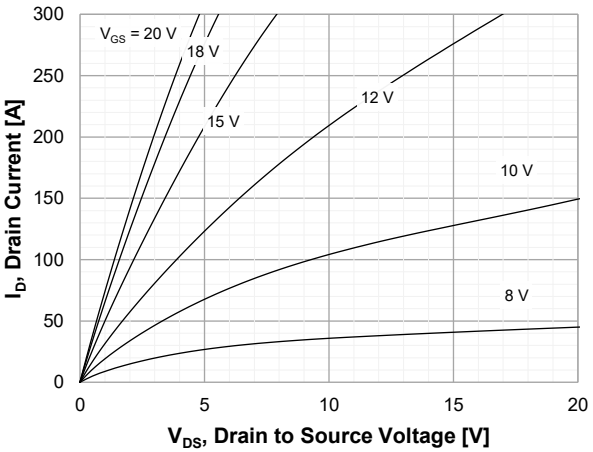


Figure 3. On-Region Characteristics $T_J = 125^{\circ}\text{C}$

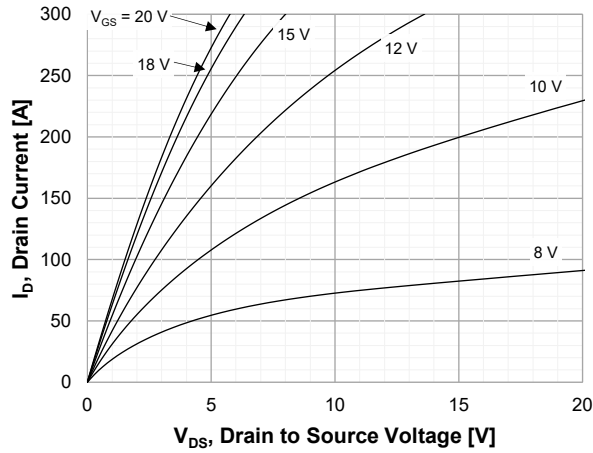


Figure 4. On-Region Characteristics $T_J = 175^{\circ}\text{C}$

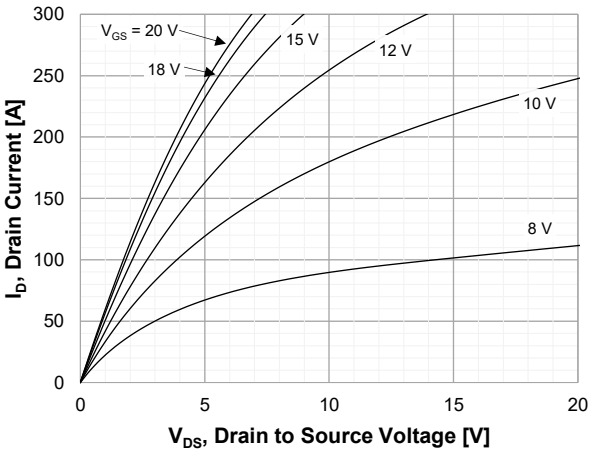


Figure 5. On-Resistance Characteristics vs. Temperature

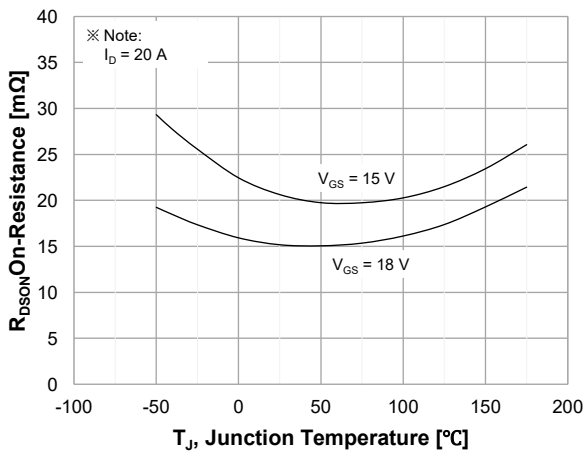
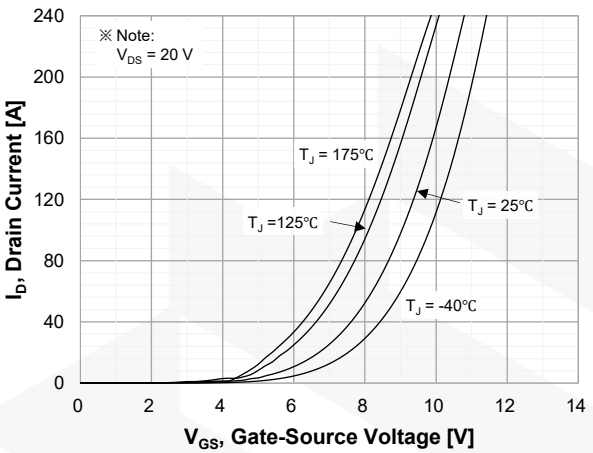


Figure 6. Transfer Characteristics



4. Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^{\circ}\text{C}$

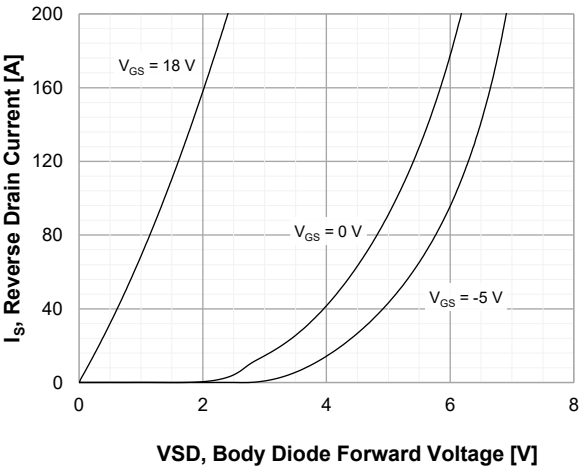


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^{\circ}\text{C}$

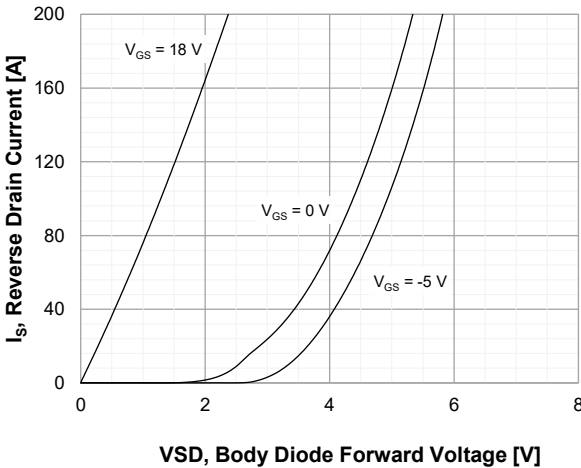


Figure 9. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 125^{\circ}\text{C}$

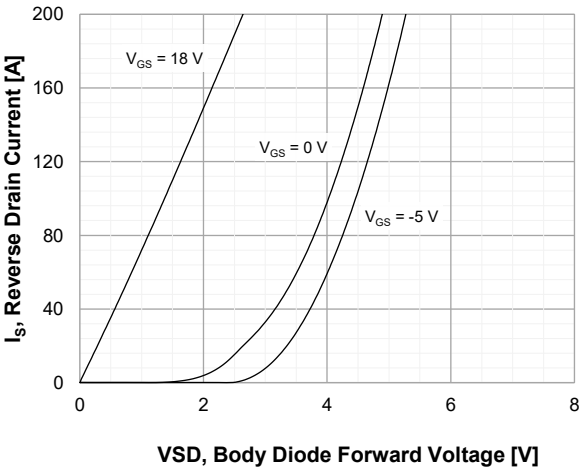


Figure 10. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^{\circ}\text{C}$

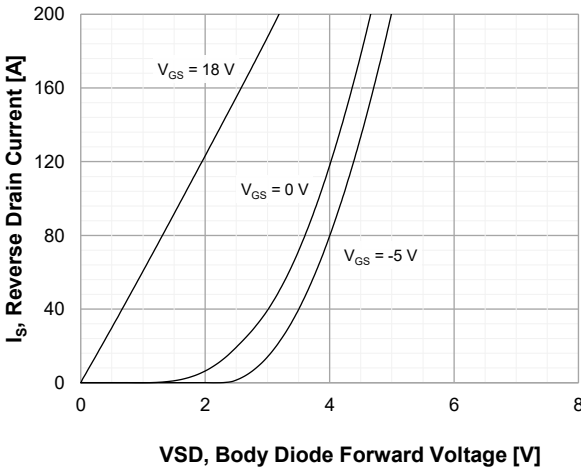


Figure 11. Threshold Voltage vs. Temperature

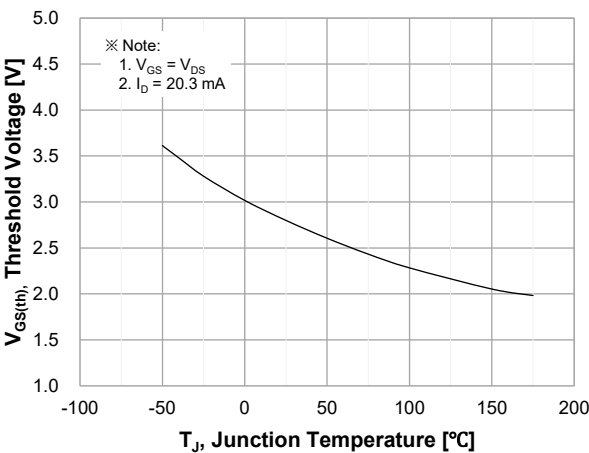
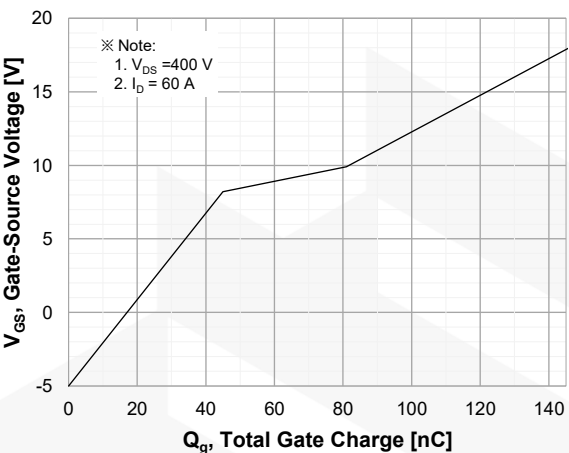


Figure 12. Gate Charge Characteristics



4. Typical Performance Characteristics

Figure 13. Stored Energy in Output Capacitance

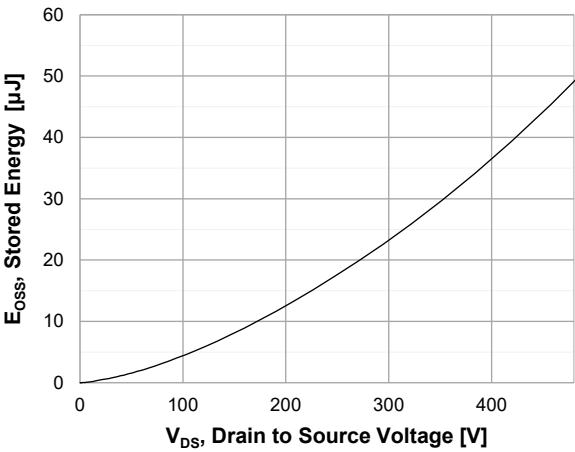


Figure 14. Capacitance Characteristics

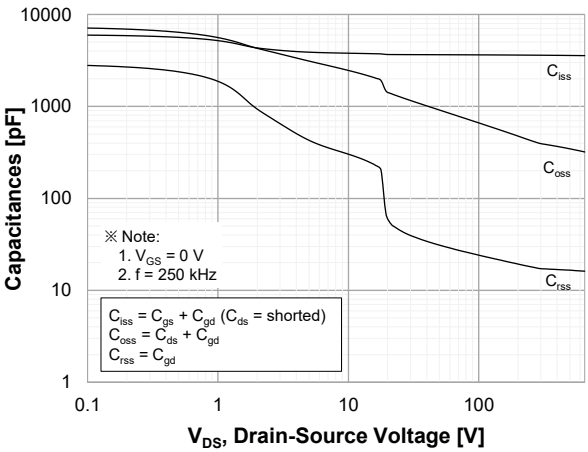


Figure 15. Continuous Drain Current Derating vs. Case Temperature

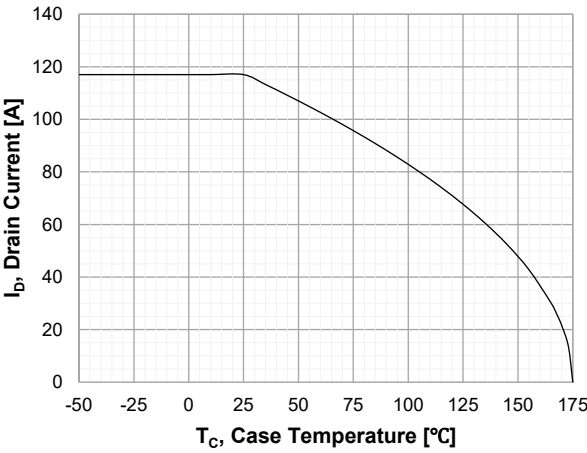


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

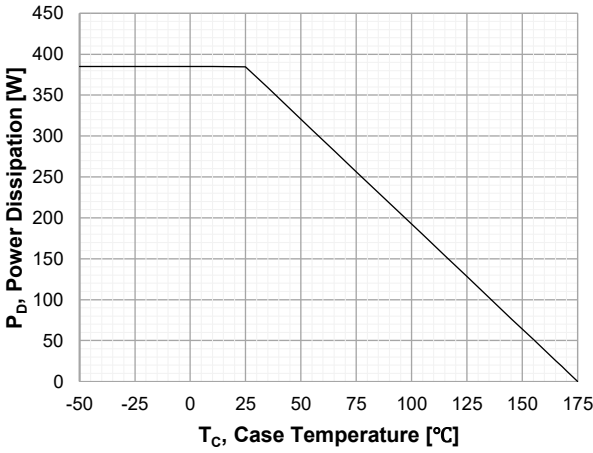


Figure 17. Typ. Switching Losses vs. Drain Current

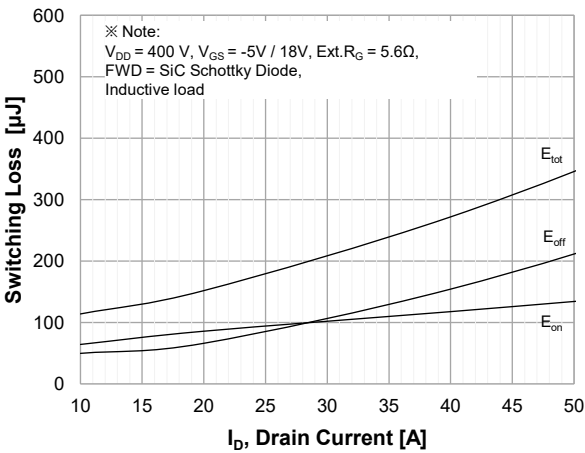
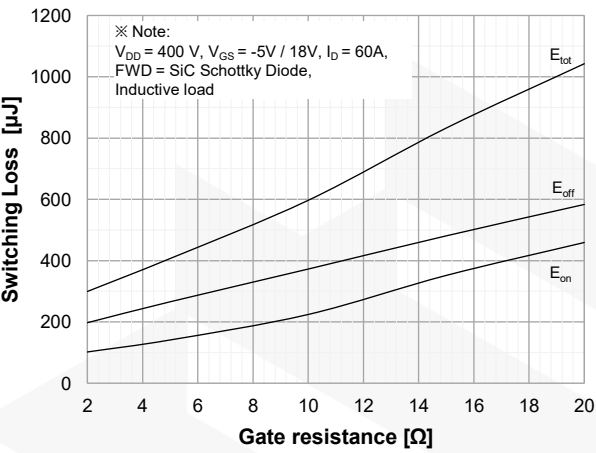


Figure 18. Typ. Switching Losses vs. Gate Resistance



4. Typical Performance Characteristics

Figure 19. Typ. Switching Losses vs. Drain Current

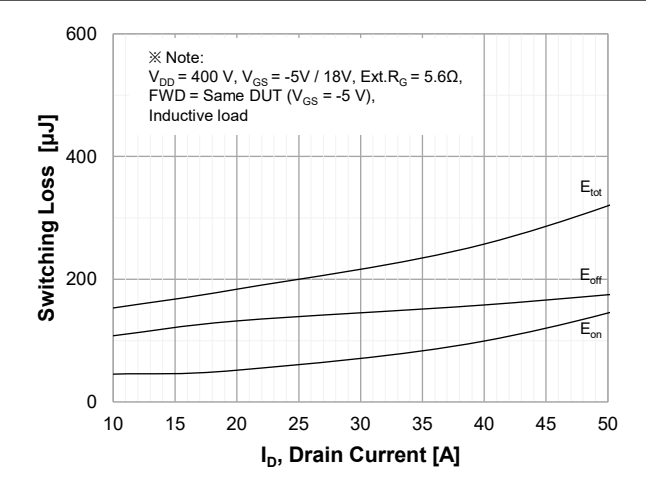


Figure 20. Typ. Switching Losses vs. Gate Resistance

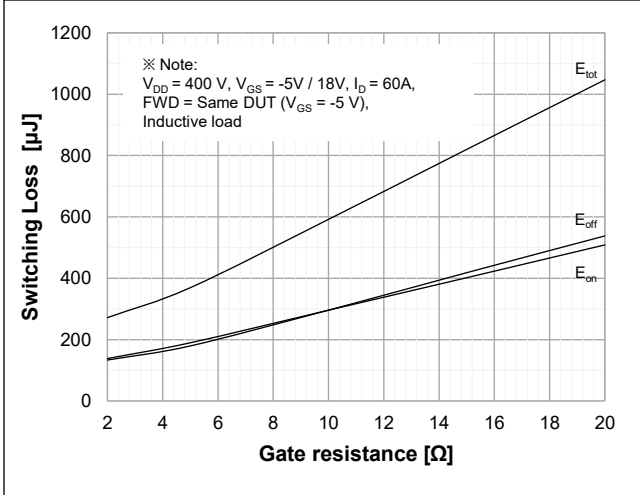


Figure 21. Maximum Safe Operating Area

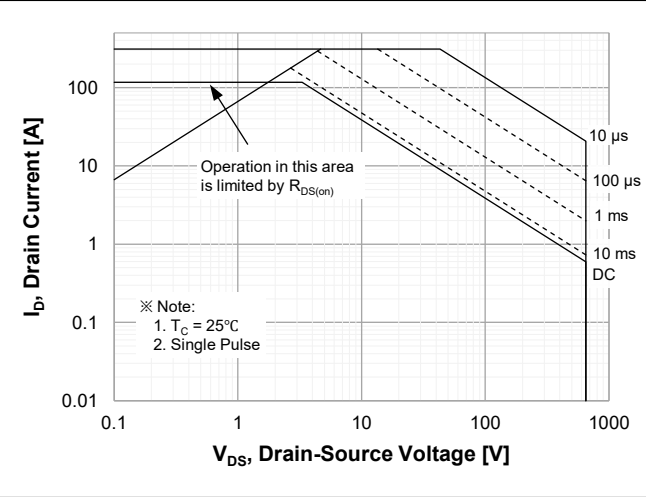
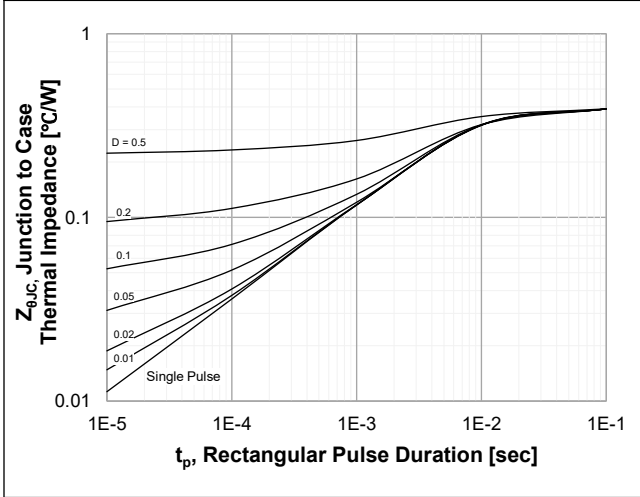


Figure 22. Transient Thermal Response Curve



5. Testing conditions

Figure 23. Inductive Load Switching Test Circuit and Waveforms

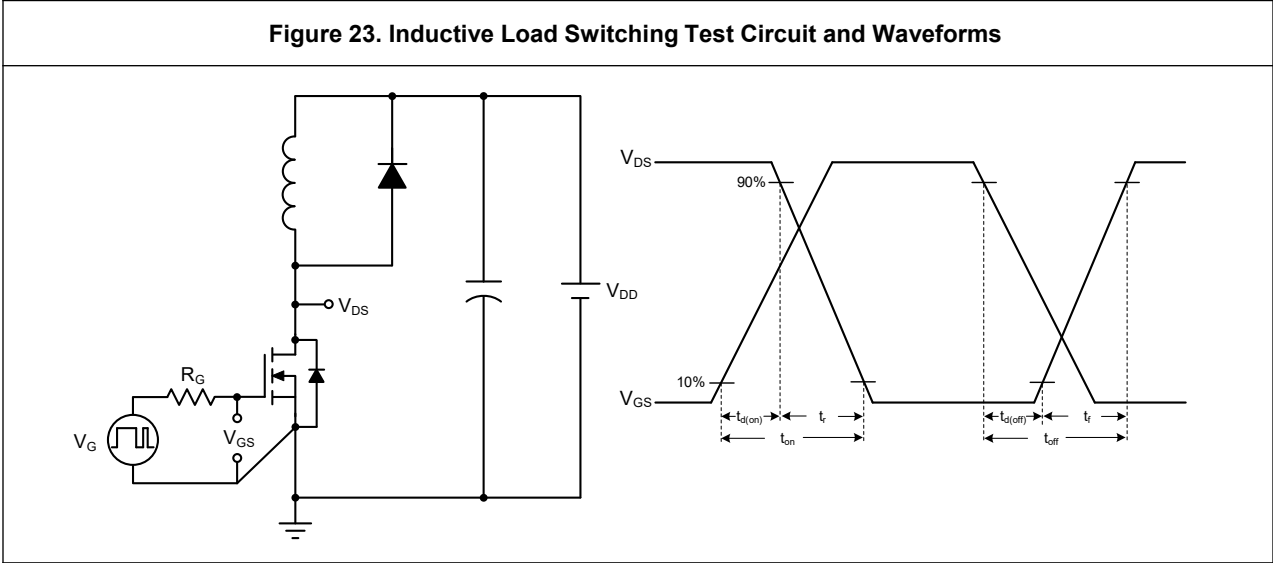
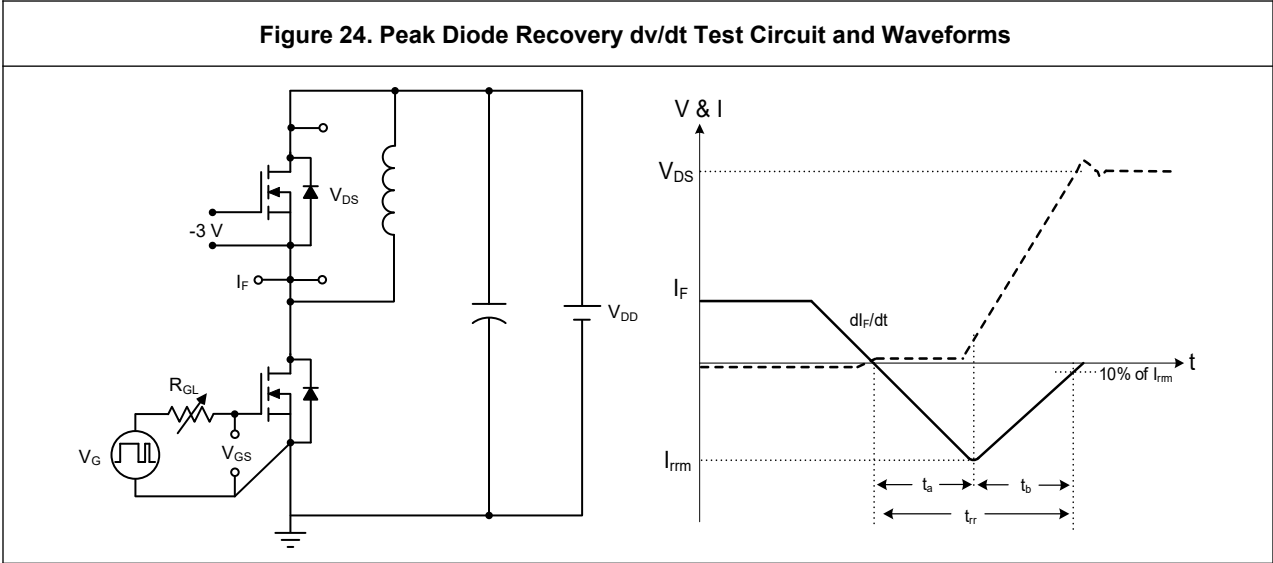


Figure 24. Peak Diode Recovery dv/dt Test Circuit and Waveforms



6. Package Outlines – TO-247-4L

* Dimensions in millimeters

