

Product Highlight

Features

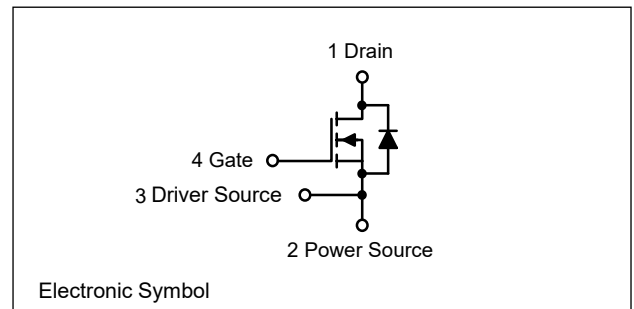
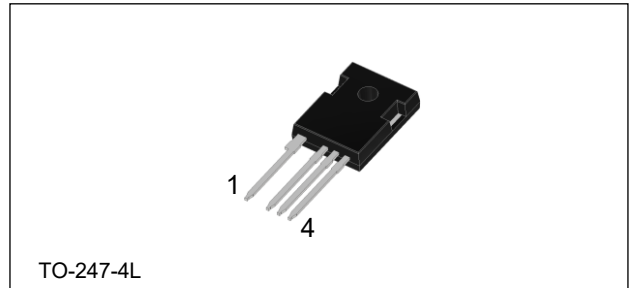
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

Benefits

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

Applications

- Solar inverter
- EV charging station
- UPS
- Industrial power supply



Key Parameters

$BV_{DSS, T_C=25^\circ C}$	$I_D, T_C=25^\circ C$	$R_{DS(on), typ}$	$Q_{g, typ}$
1200 V	90 A	21 mΩ	111 nC



Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
MSQS120R021T2TH	120R021T2	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		1200	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 ($T_C = 25^\circ C$)	90*	A
		Continuous ($T_C = 100^\circ C$)	63*	
I_{DM}	Drain Current	Pulsed (Note1)	223*	A
P_D	Power Dissipation	($T_C = 25^\circ C$)	375	W
		Derate Above $25^\circ C$	2.5	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.	0.40	°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	1200			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 1200 V, V _{GS} = 0 V		1	100	μA
		V _{DS} = 1200 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 = 17 mA (tested after V _{GS} = 22 V, 1 ms pulse)	2.0	3.0	4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 18 V, I _D = 45 A		21.0	29.4	mΩ
		V _{GS} = 18 V, I _D = 45 A, T _J = 175°C		33.6		
		V _{GS} = 15 V, I _D = 45 A		27.5		
g _{fs}	Transconductance	V _{DS} = 20 V, I _D = 45 A		31.6		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 800 V, V _{GS} = 0 V, f = 250 kHz		2949		pF
C _{oss}	Output Capacitance			170		
C _{rss}	Reverse Capacitance			5		
E _{oss}	Stored Energy in Output Capacitance	V _{DS} = 0 V to 800 V, V _{GS} = 0 V		71		μJ
C _{o(er)}	Energy Related Output Capacitance			221		pF
C _{o(tr)}	Time Related Output Capacitance			367		
Q _{g(tot)}	Total Gate Charge	V _{DS} = 800 V, I _D = 45 A, V _{GS} = -3 V / 18 V, Inductive load		111		nC
Q _{gs}	Gate to Source Charge			33		
Q _{gd}	Gate to Drain “Miller” Charge			31		
R _G	Internal Gate Resistance	f = 1 MHz, V _{AC} = 30 mV		2.3		Ω
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DS} = 800 V, I _D = 45 A, V _{GS} = -3 V / 18 V, R _G = 4.7 Ω, Inductive load		25		ns
t _r	Turn-On Rise Time			17		
t _{d(off)}	Turn-Off Delay Time			54		
t _f	Turn-Off Fall Time			8		
E _{on}	Turn-on Switching Energy			287		μJ
E _{off}	Turn-off Switching Energy			199		
E _{tot}	Total Switching Energy			486		

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	Continuous Diode Forward Current	V _{GS} = -3 V			90*	A
I _{SM}	Pulsed Diode Forward Current	V _{GS} = -3 V (Note 1)			223*	
V _{SD}	Diode Forward Voltage	V _{GS} = -3 V, I _{SD} = 45 A		4.0		V
t _{rr}	Reverse Recovery Time	V _{DD} = 800 V, I _{SD} = 45 A, dI _F /dt = 3000 A/μs		20		ns
Q _{rr}	Reverse Recovery Charge			396		nC
I _{rrm}	Peak Reverse Recovery Current			32		A

*Limited by maximum junction temperature.

4. Typical Performance Characteristics

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

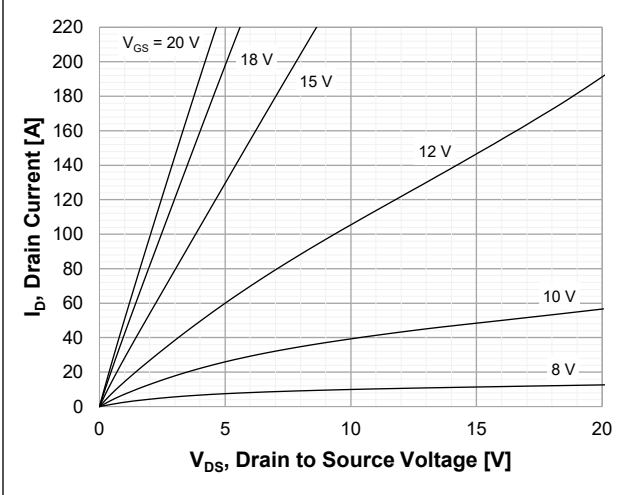


Figure 2. On-Region Characteristics $T_J = 25^{\circ}\text{C}$

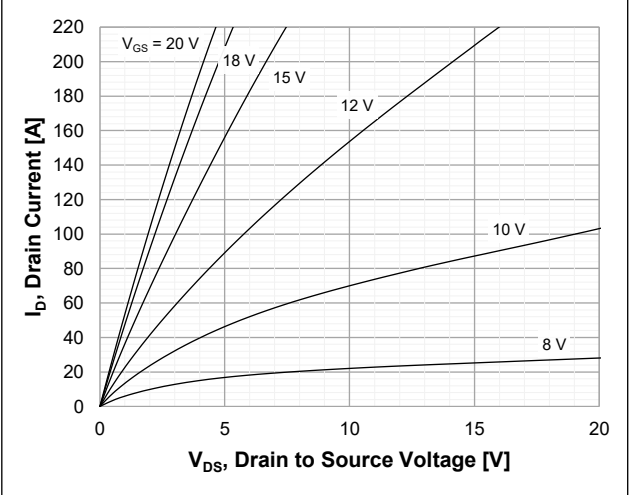


Figure 3. On-Region Characteristics $T_J = 175^{\circ}\text{C}$

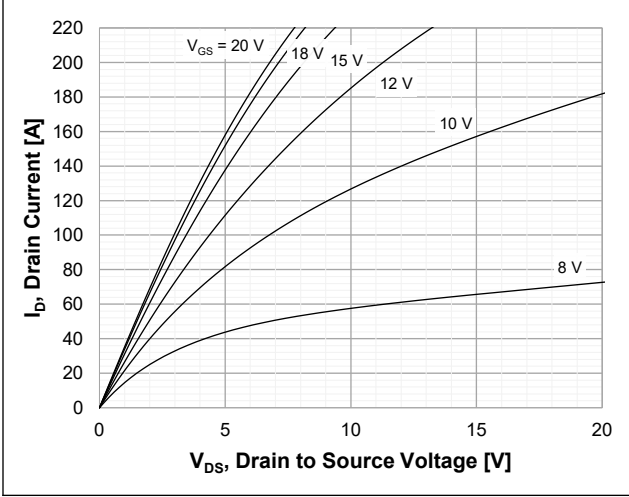


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

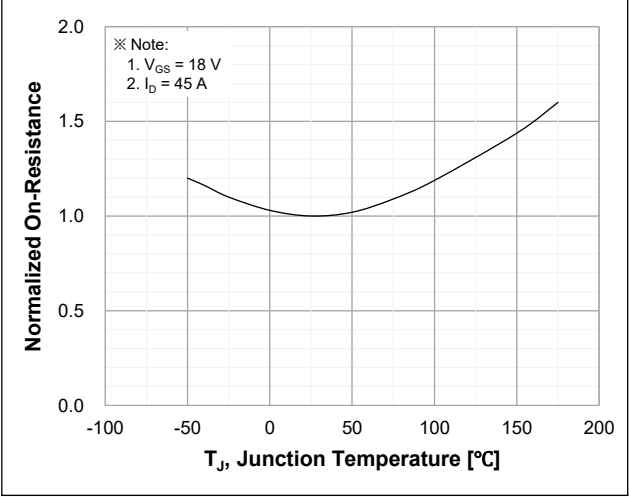


Figure 5. Transfer Characteristics

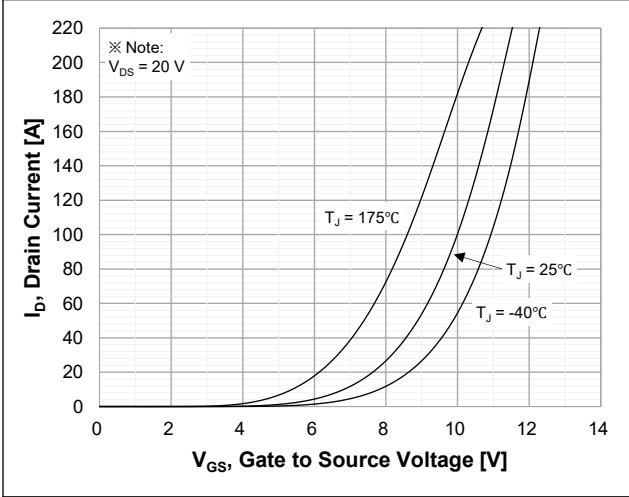
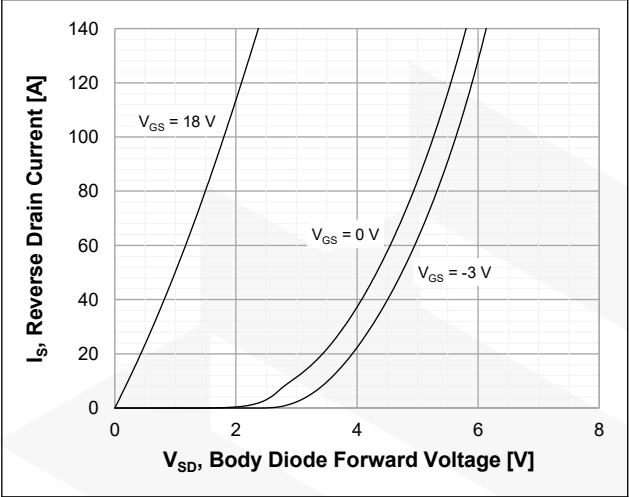


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^{\circ}\text{C}$



4. Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^{\circ}\text{C}$

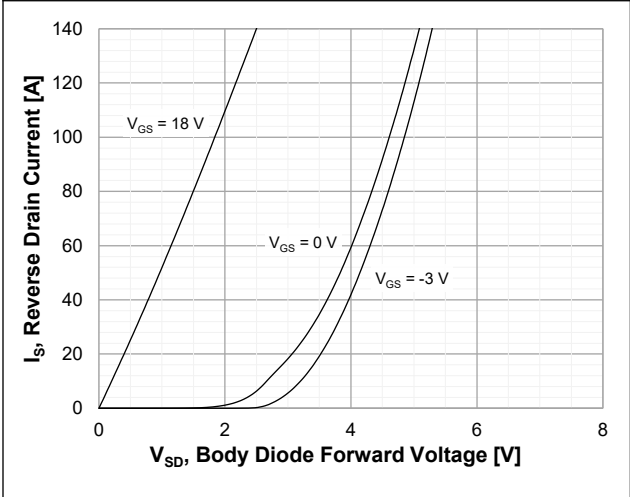


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^{\circ}\text{C}$

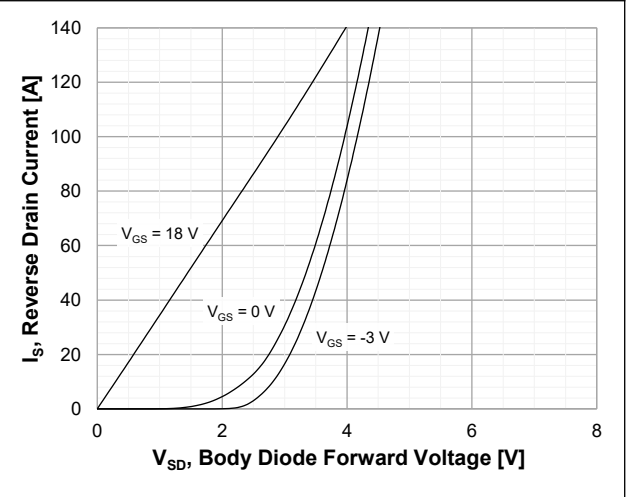


Figure 9. Threshold Voltage vs. Temperature

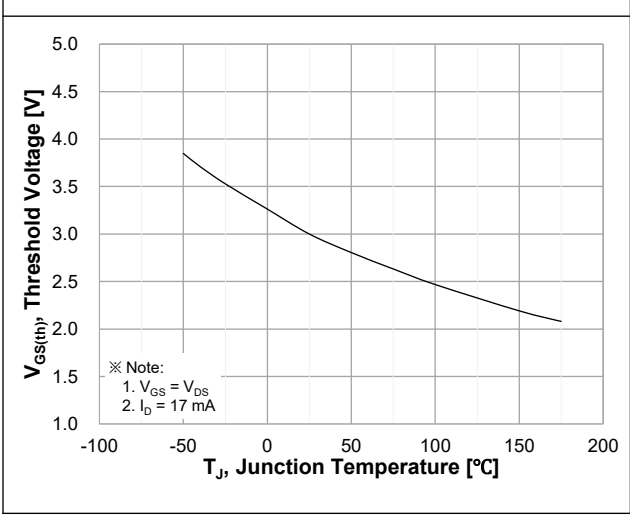


Figure 10. Gate Charge Characteristics

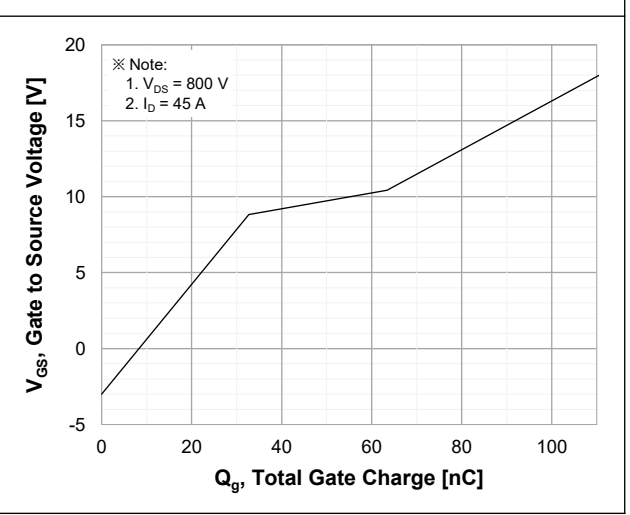


Figure 11. Stored Energy in Output Capacitance

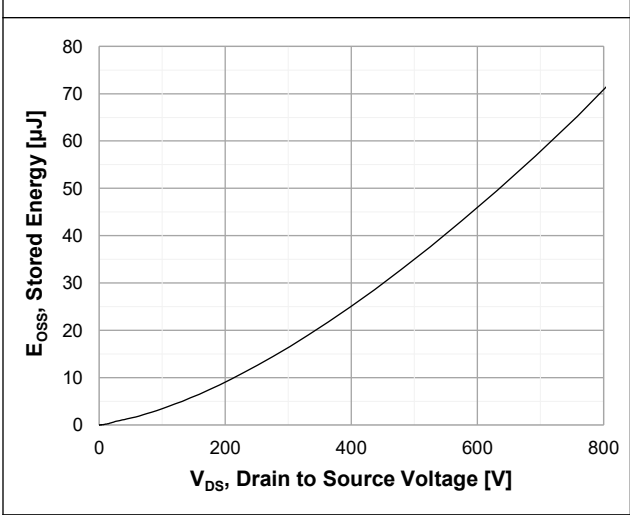
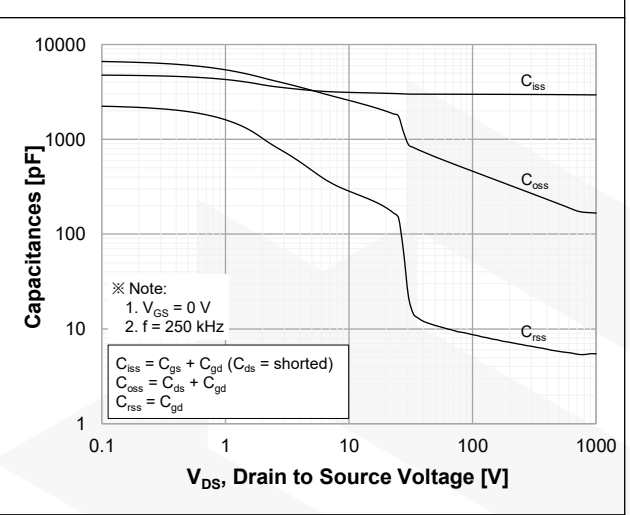
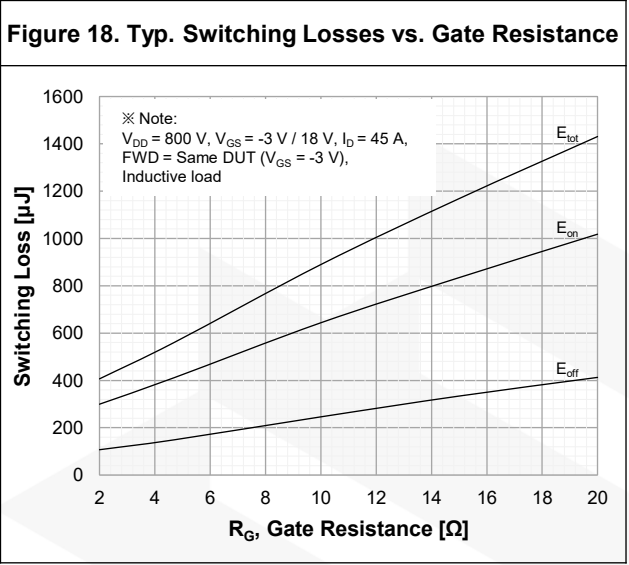
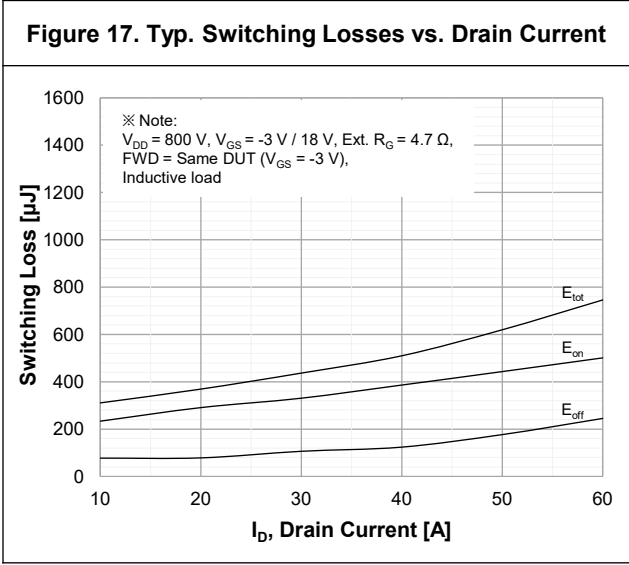
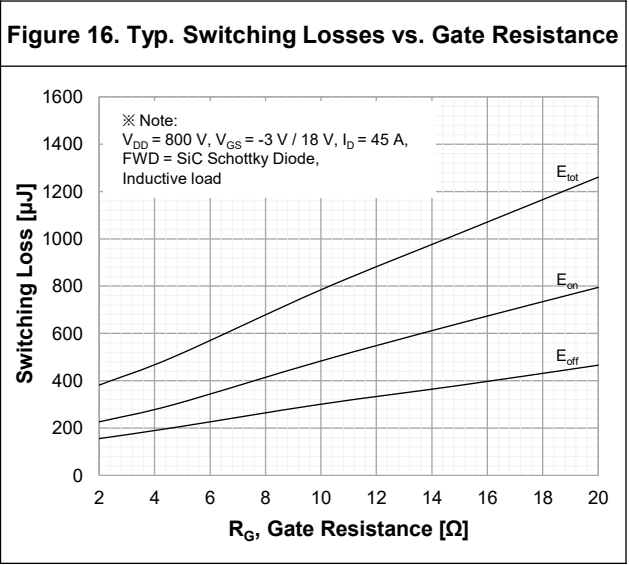
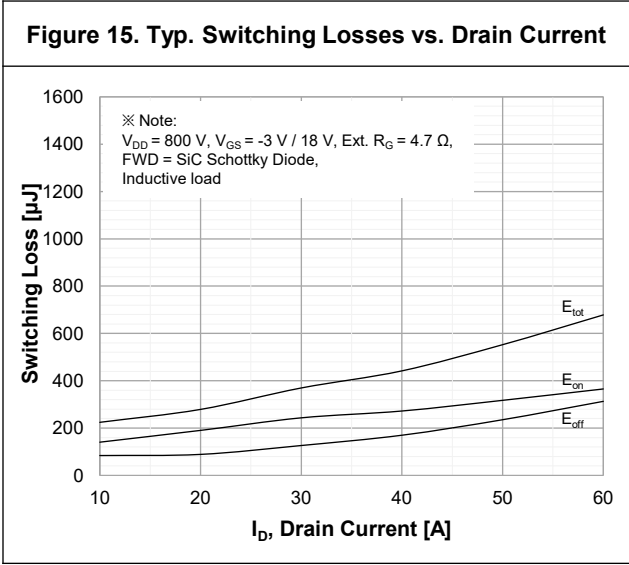
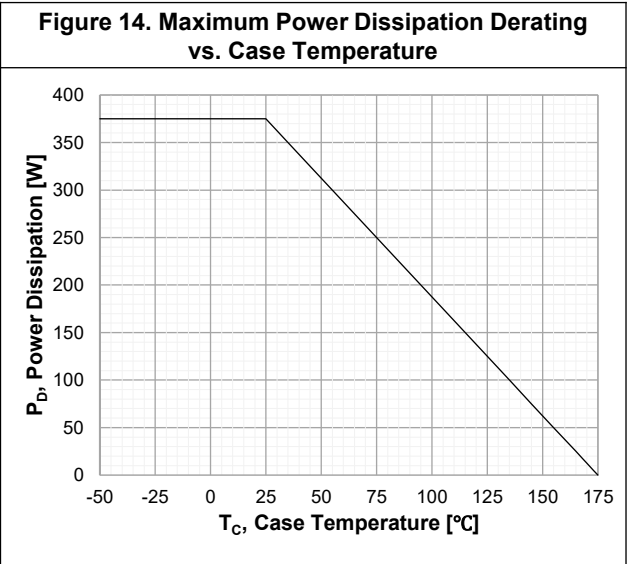
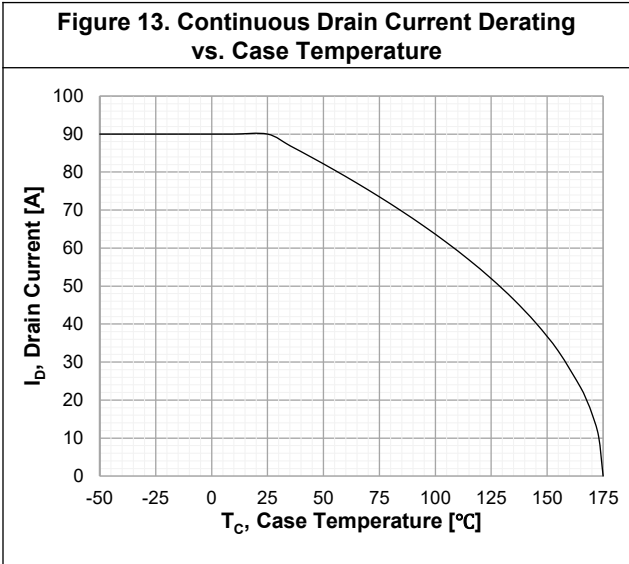


Figure 12. Capacitance Characteristics



4. Typical Performance Characteristics



4. Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

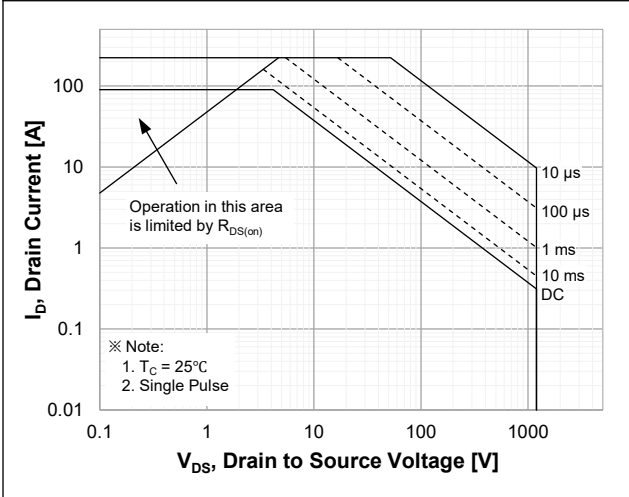
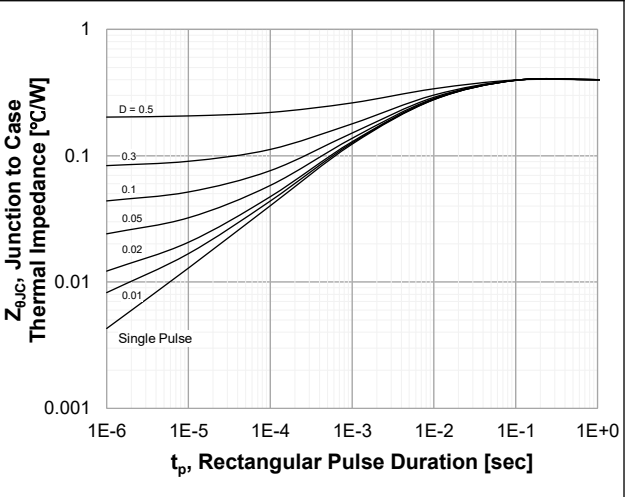


Figure 20. Transient Thermal Response Curve



5. Testing conditions

Figure 21. Inductive Load Switching Test Circuit and Waveforms

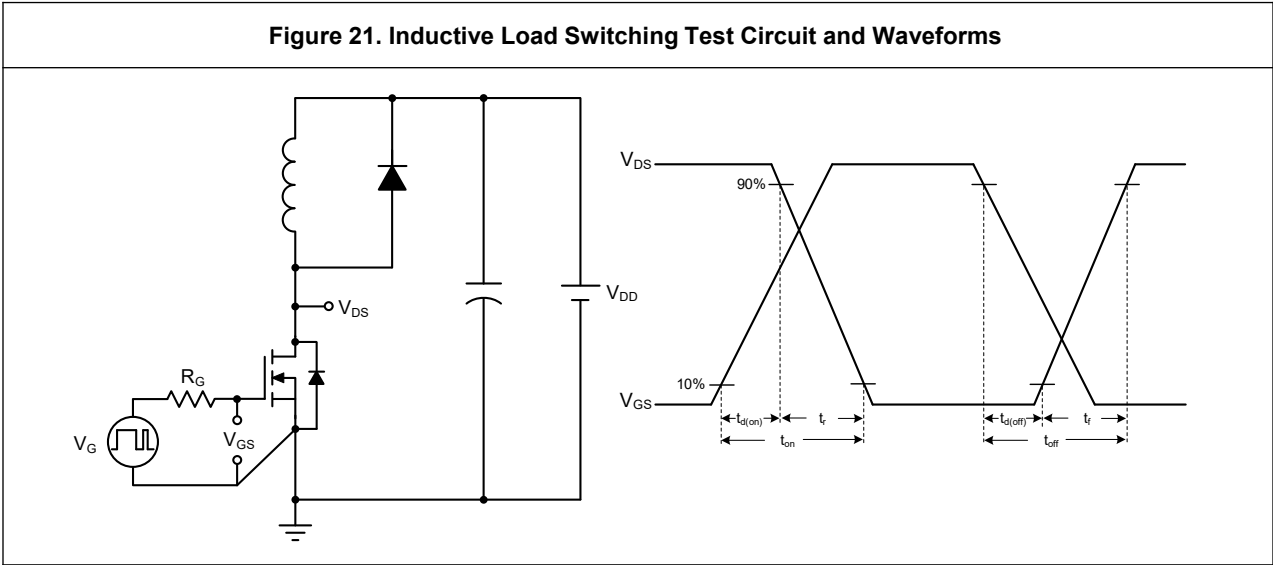
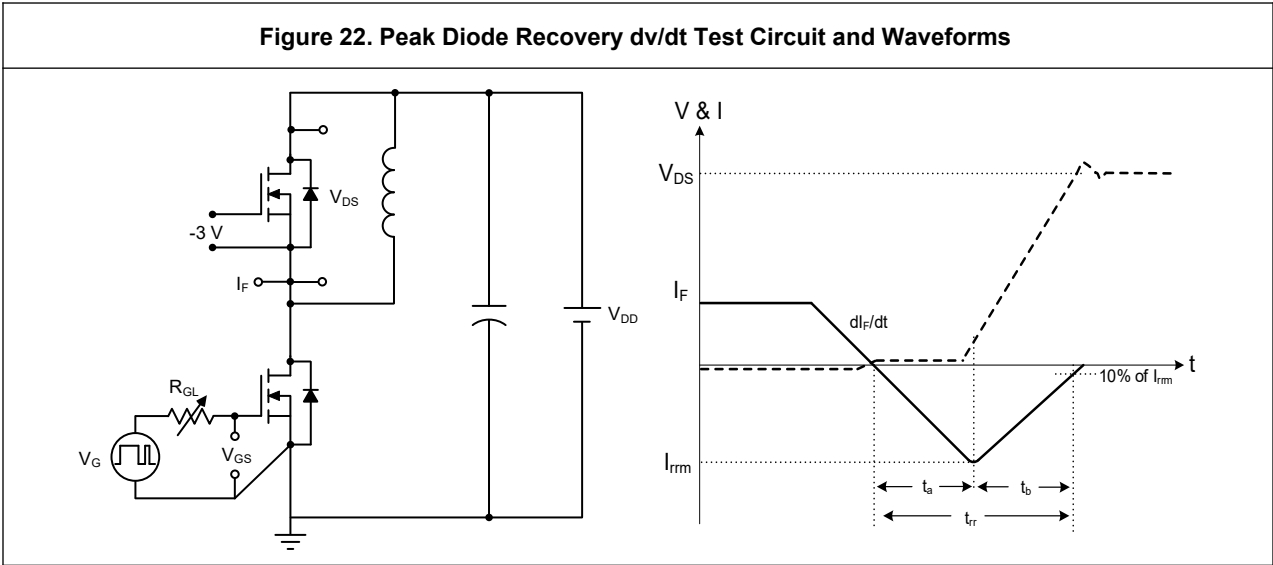


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



6. Package Outlines – TO-247-4L

* Dimensions in millimeters

