

Product Highlight

Features

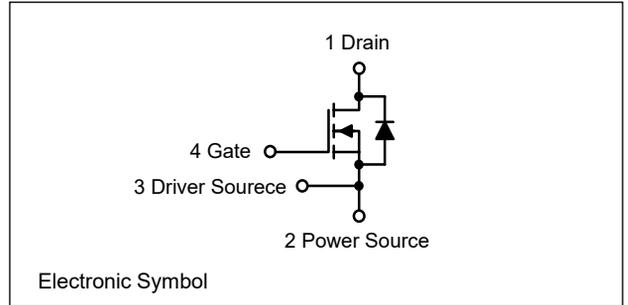
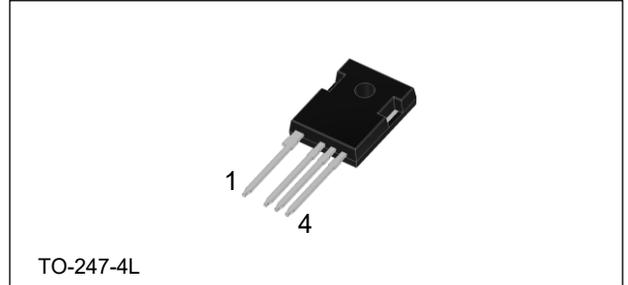
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

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 / +18	V
I_D	Drain Current	Continuous ($T_C = 25^\circ C$)	117*
		Continuous ($T_C = 100^\circ C$)	83*
I_{DM}	Drain Current	Pulsed (Note1)	311*
P_D	Power Dissipation	($T_C = 25^\circ C$)	387
		Derate Above 25°C	2.58
T_J	Operating Temperature Range	-55 to 175	°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
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.39	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

2. MOSFET

Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		10		
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			+100	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 20.3\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$)	1.8	2.8	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 60\text{ A}$		15	21	m Ω
		$V_{GS} = 18\text{ V}, I_D = 60\text{ A}, T_J = 175^\circ\text{C}$		20		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$		27.6		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		3525		μF
C_{oss}	Output Capacitance			297		
C_{rss}	Reverse Capacitance			16		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		36.5		μJ
$C_{o(er)}$	Energy Related Output Capacitance			456		μF
$C_{o(tr)}$	Time Related Output Capacitance			648		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 60\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ Inductive load		146		nC
Q_{gs}	Gate to Source Charge			45		
Q_{gd}	Gate to Drain "Miller" Charge			36		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}$		2.2		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400\text{ V}, I_D = 60\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, R_G = 5.6\text{ }\Omega,$ 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

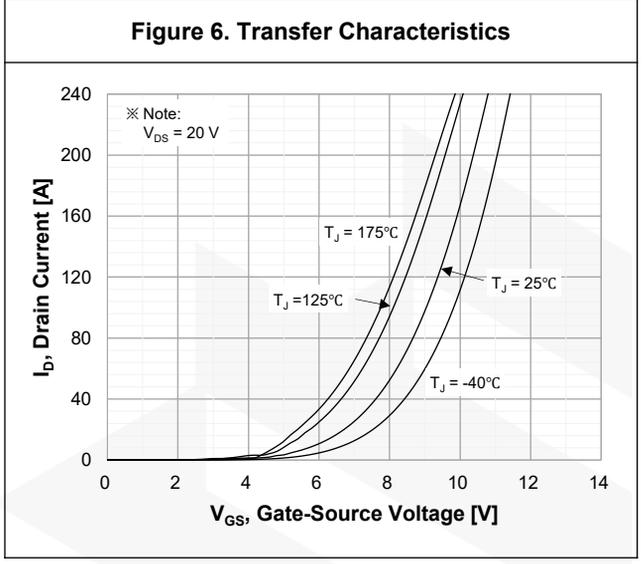
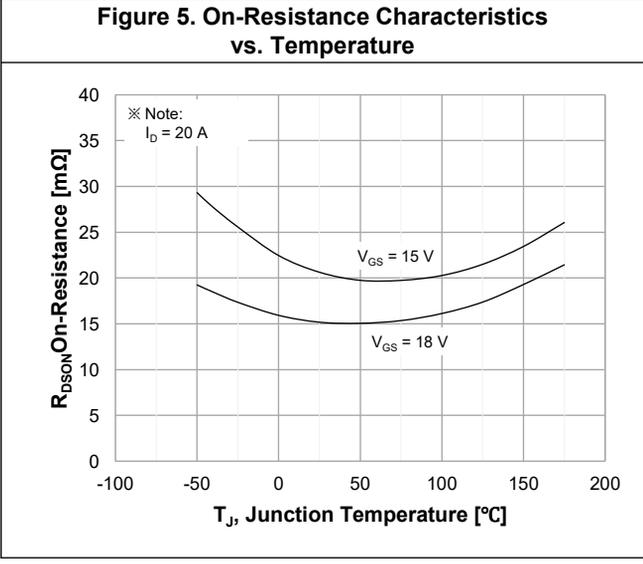
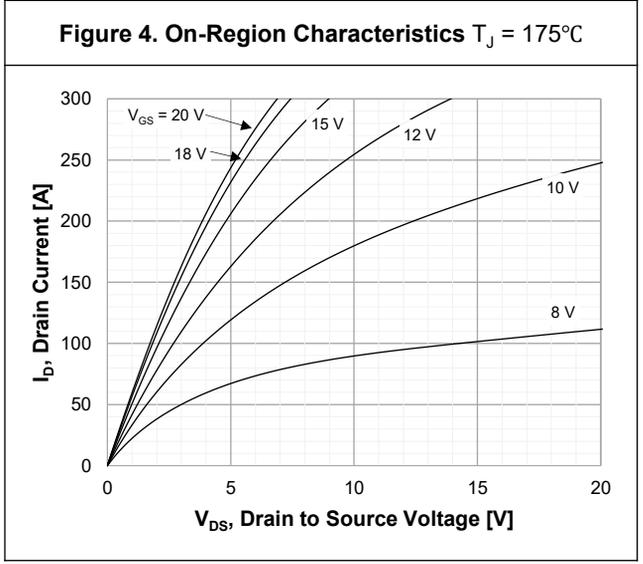
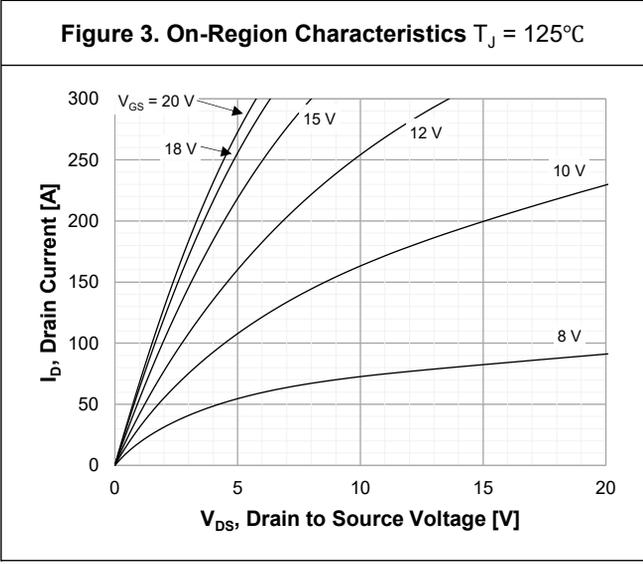
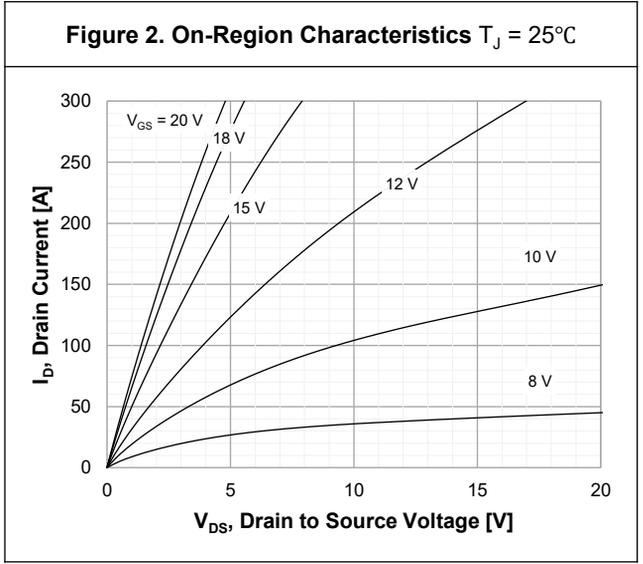
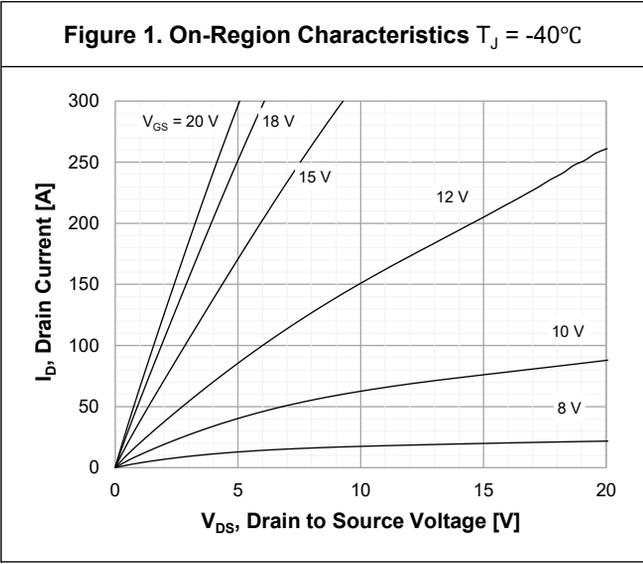
Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

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	$V_{GS} = -5\text{ V}, I_{SD} = 60\text{ A}$		4.4		V
t_{rr}	Reverse Recovery Time	$V_{DD} = 400\text{ V}, I_{SD} = 60\text{ A},$ $di_F/dt = 1000\text{ A}/\mu\text{s},$ Includes Q_{OSS}		29.5		ns
Q_{rr}	Reverse Recovery Charge			303		nC
I_{rrm}	Peak Reverse Recovery Current			17.4		A

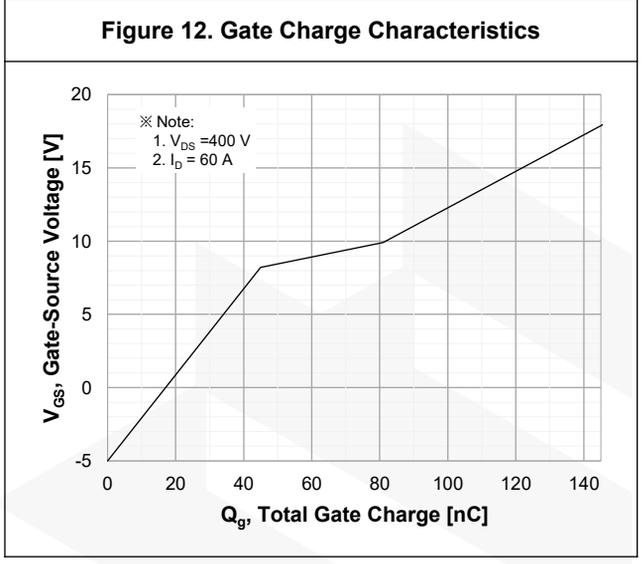
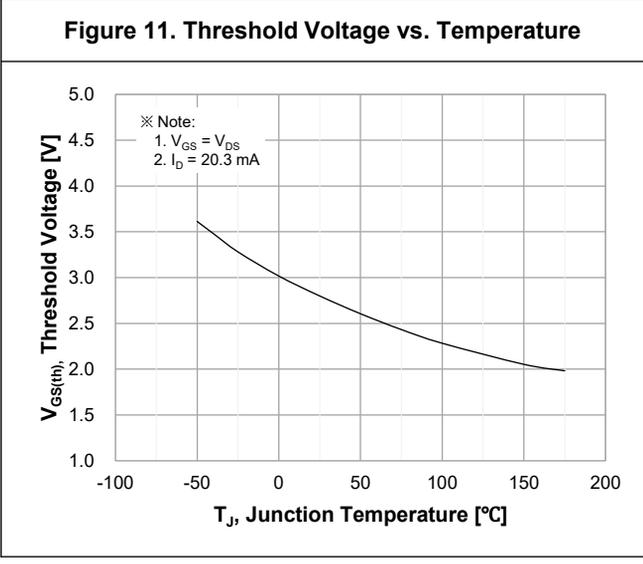
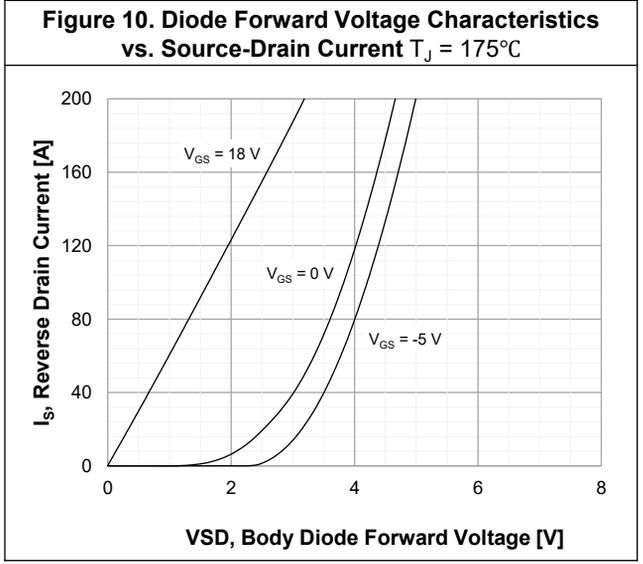
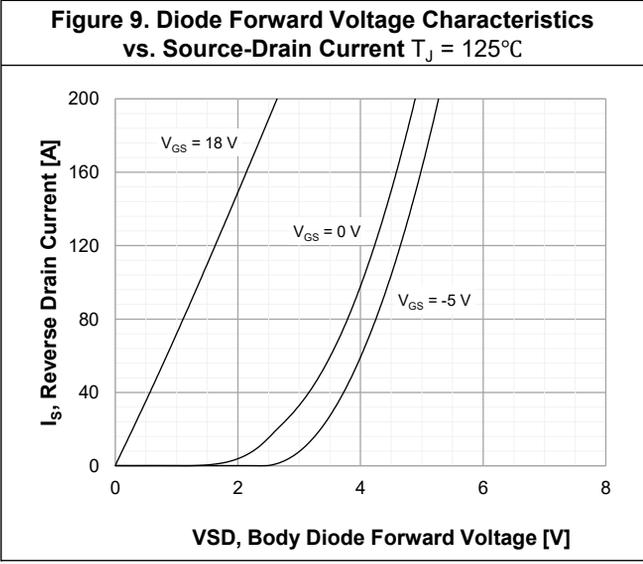
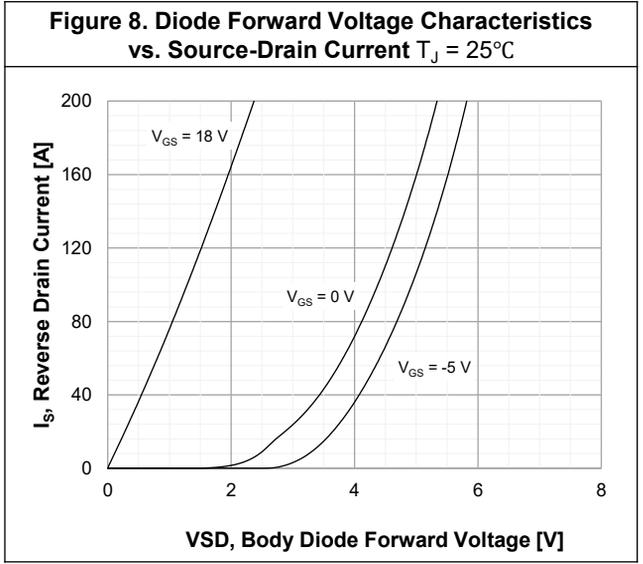
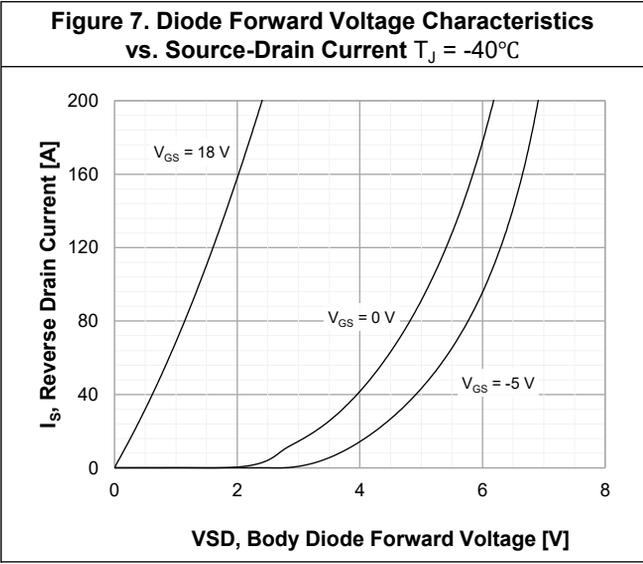
*Limited by maximum junction temperature.



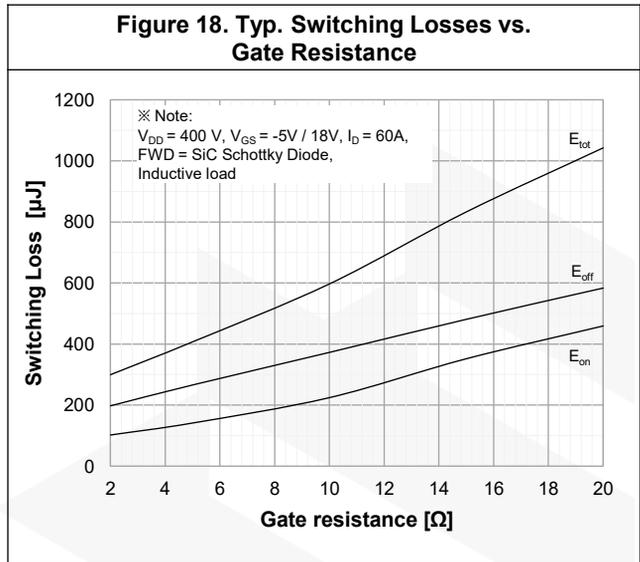
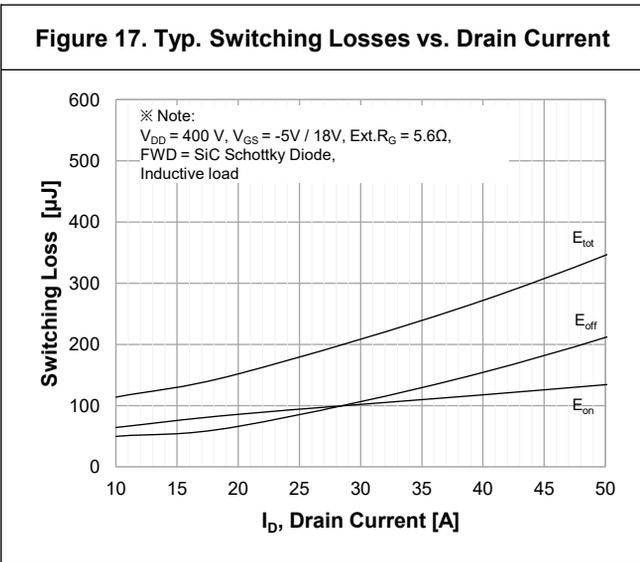
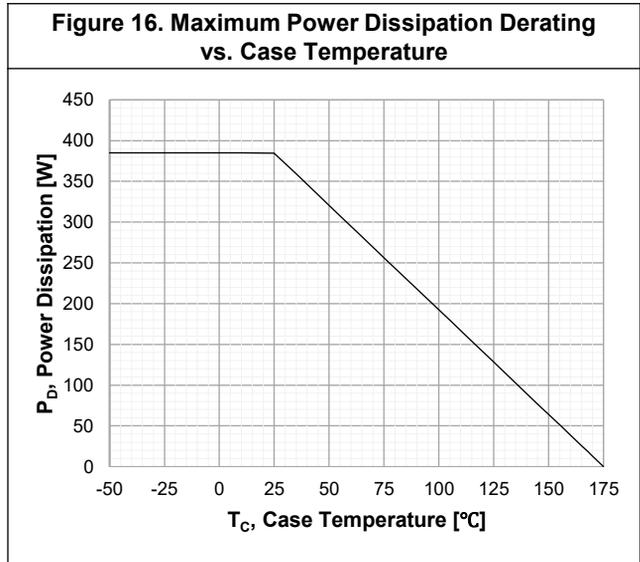
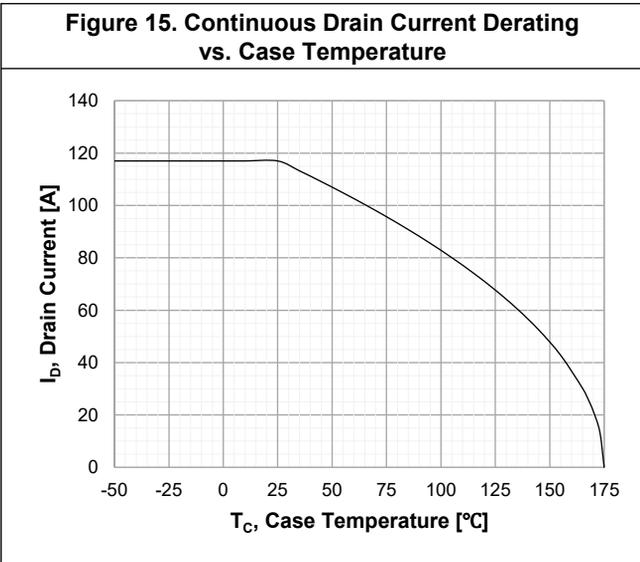
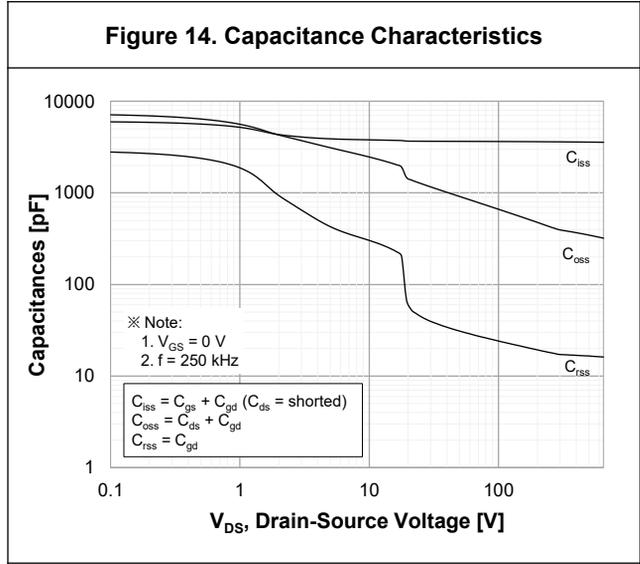
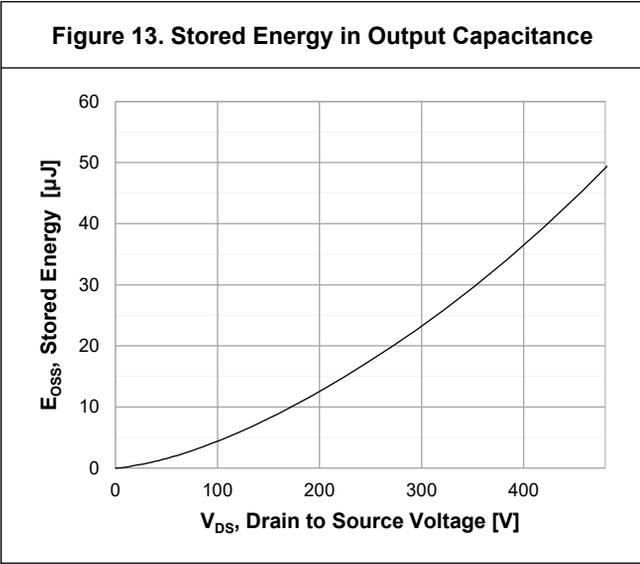
4. Typical Performance Characteristics



4. Typical Performance Characteristics



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4. Typical Performance Characteristics

Figure 19. Typ. Switching Losses vs. Drain Current

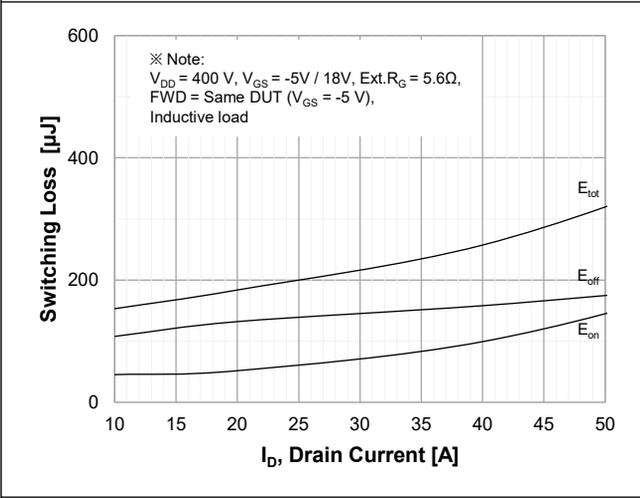


Figure 20. Typ. Switching Losses vs. Gate Resistance

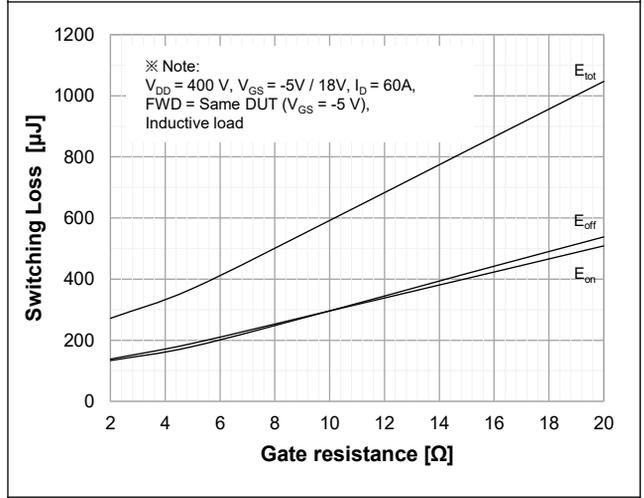


Figure 21. Maximum Safe Operating Area

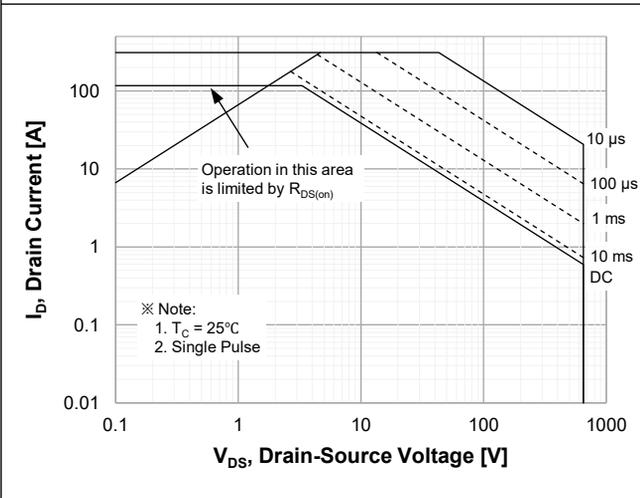
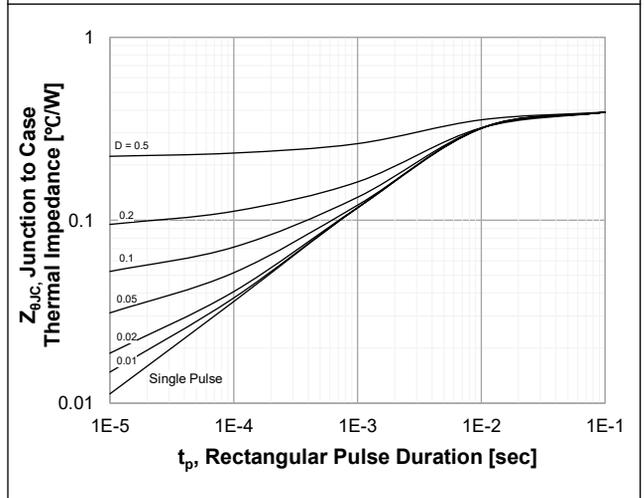


Figure 22. Transient Thermal Response Curve



5. Testing conditions

Figure 23. Inductive Load Switching Test Circuit and Waveforms

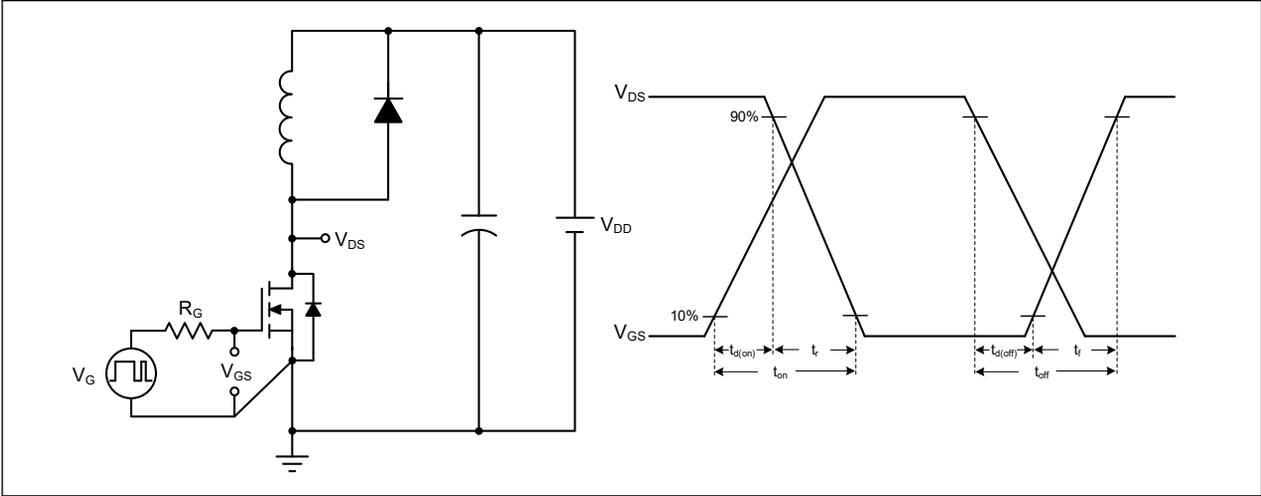
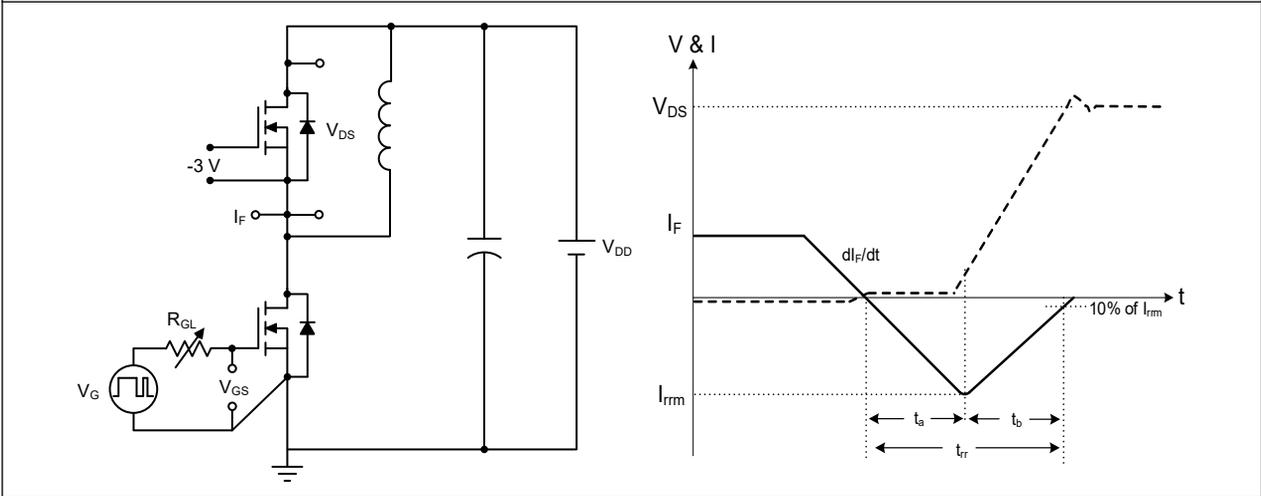
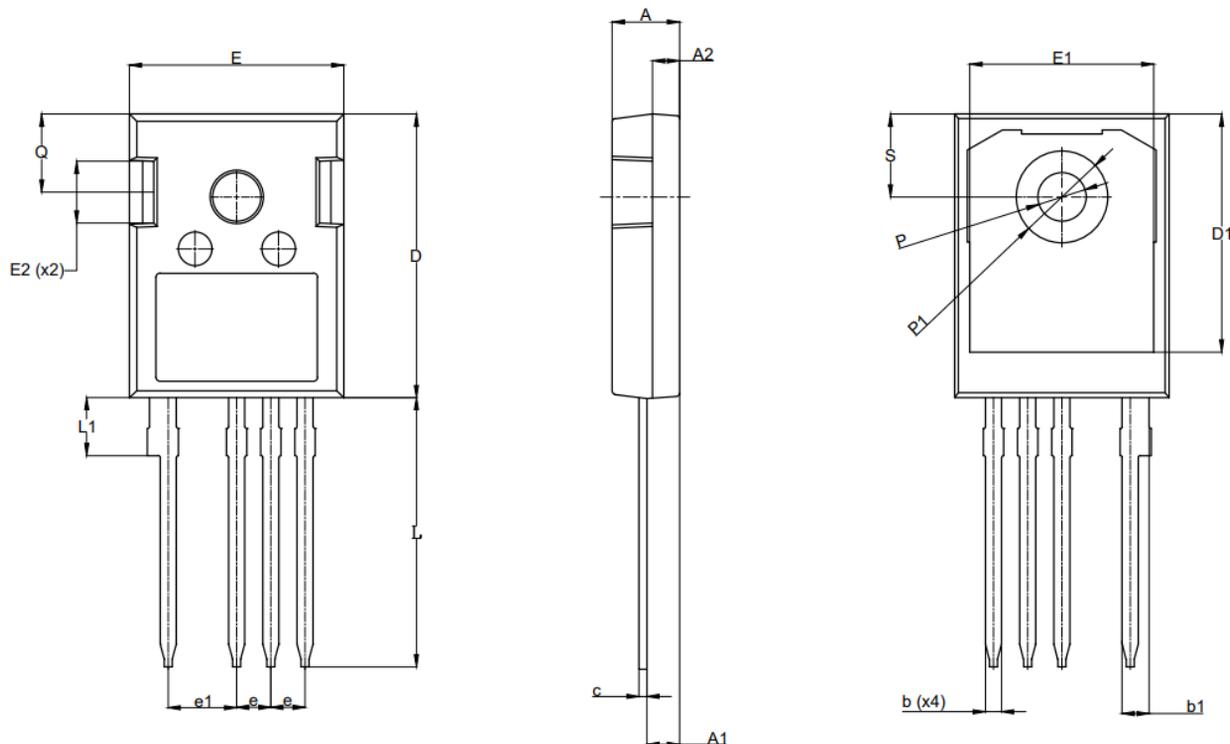


Figure 24. Peak Diode Recovery dv/dt Test Circuit and Waveforms



6. Package Outlines – TO-247-4L

* Dimensions in millimeters



SYMBOL	Common		
	DIMENSIONS MILLIMETER		
	MIN.	NOM.	MAX.
A	4.80	5.00	5.20
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	1.86	2.01	2.15
c	0.50	0.60	0.70
D	20.90	21.00	21.10
D1	17.43	17.63	17.83
E	15.75	15.94	16.13
E1	13.46	13.66	13.86
E2	4.32	4.58	4.83
e	2.54 BSC.		
e1	5.08 BSC.		
L	19.80	19.95	20.10
L1	-	-	4.30
P	3.56	3.61	3.66
P1	6.75	6.80	6.85
Q	5.38	5.79	6.20
S	6.15 BSC.		