

SuperQ™ 200V N-Channel Power MOSFET

FEATURES

- Industry leading $R_{DS(on)}$ in TO-220 package
- High short-circuit withstand capability (SCWC)
- 100% UIS tested in production
- Low switching losses, Q_{sw} and E_{oss}
- Easier paralleling with $\pm 0.5V$ gate threshold

APPLICATIONS

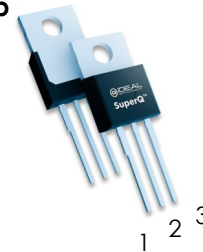
- Motor control
- Boost converters and SMPS control FETs
- Secondary side synchronous rectifier

DESCRIPTION

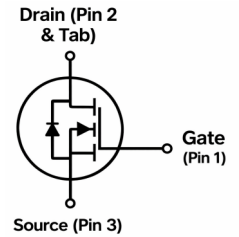
Engineered for high-efficiency SMPS and motor drives, this 200V SuperQ MOSFET delivers ultra-low conduction and switching losses in a robust TO-220 package. Featuring best-in-class $R_{DS(on)}$ and Q_{sw} , it minimizes heat dissipation at both full and partial loads.

PRODUCT SUMMARY

Drain Tab



TO-220



Parameter	Value	Unit
$T_A = 25^\circ C$		
V_{DS}	200	V
$R_{DS(on),max}$	6.3	m Ω
I_D	172	A
Q_G	105	nC
Q_{sw}	8.3	nC
E_{oss}	4.0	μJ



ORDERING INFORMATION

Part Number	Package	Marking	Packaging
iS20M6R3S1P	TO-220	iS20M6R3S1	50pc Tube

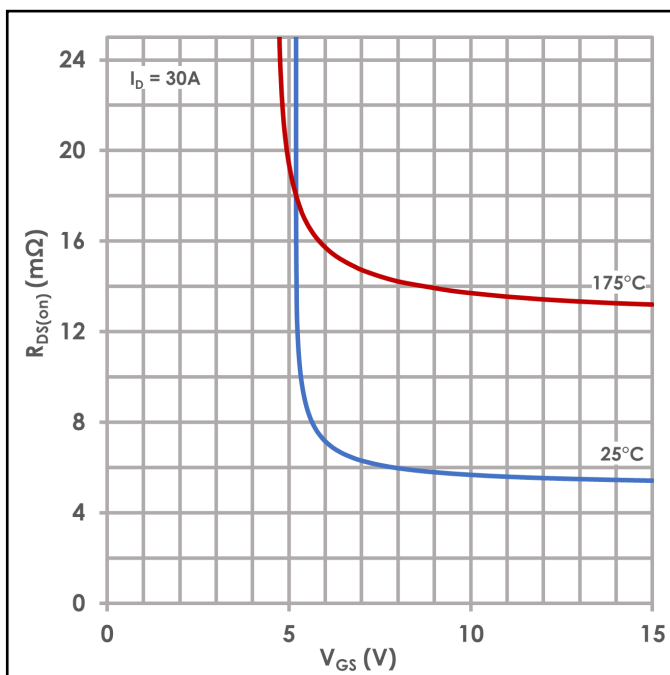


Figure 1: Typical Drain-Source On Resistance

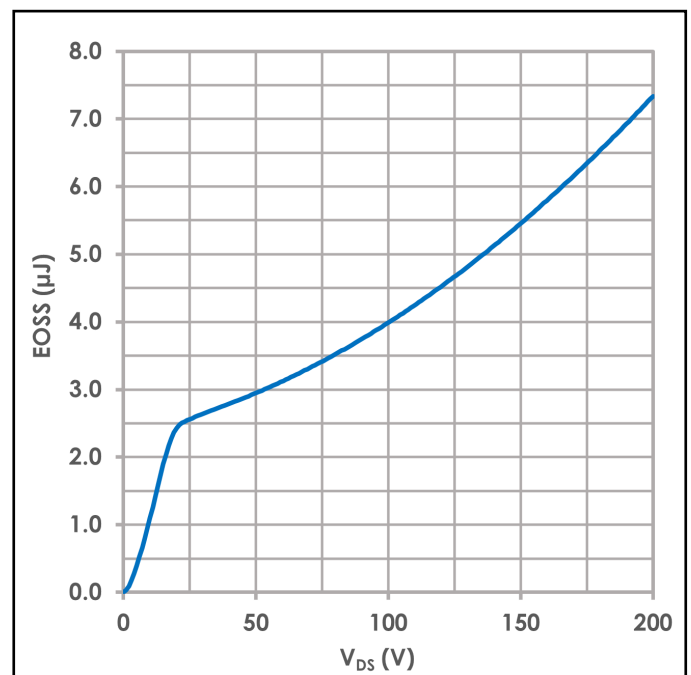


Figure 2: Typical C_{oss} Stored Energy

ABSOLUTE MAXIMUM RATINGS			
SYMBOL	PARAMETER (T _A = 25°C unless otherwise specified)	VALUE	UNIT
V _{GS}	Gate-to-source voltage	± 20	V
I _D	Continuous drain current (silicon limited), T _C = 25°C	172	A
	Continuous drain current (silicon limited), T _C = 100°C	121	
I _{DM}	Pulsed drain current	640	A
P _D	Power dissipation, T _C = 25°C	428	W
T _J , T _{stg}	Operating junction, storage temperature	-55 to 175	°C
E _{AS}	Avalanche energy, single pulse I _D = 96A, R _{GS} = 25Ω	465	mJ

THERMAL CHARACTERISTICS					
SYMBOL	PARAMETER (T _A = 25°C unless otherwise specified)	VALUE			UNIT
		MIN	TYP	MAX	
R _{θJC}	Junction-to-case thermal resistance - TO-220	-	-	0.35	°C/W
R _{θJA}	Junction-to-ambient thermal resistance ⁽¹⁾	-	-	40	°C/W
R _{θJA}	Junction-to-ambient thermal resistance, minimal footprint	-	-	62	°C/W

(1) 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE			UNIT
			MIN	TYP	MAX	
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-source voltage	$V_{GS} = 0V, I_D = 1mA$	200	-	-	V
I_{DSS}	Drain-to-source leakage current	$V_{GS} = 0V, V_{DS} = 160V, T_J = 25^\circ\text{C}$	-	0.1	1	μA
		$V_{GS} = 0V, V_{DS} = 160V, T_J = 125^\circ\text{C}^{(2)}$	-	-	100	
I_{GSS}	Gate-to-source leakage current	$V_{DS} = 0V, V_{GS} = 20V$	-	1	100	nA
$V_{GS(th)}$	Gate-to-source threshold voltage	$V_{DS} = V_{GS}, I_D = 300\mu\text{A}$	3.1	3.5	4.1	V
$R_{DS(on)}$	Drain-to-source on-resistance	$V_{GS} = 10V, I_D = 30A$	-	5.7	6.3	m Ω
g_{fs}	Transconductance	$V_{DS} = 10V, I_D = 30A$	47	95	-	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance ⁽²⁾	$V_{GS} = 0V, V_{DS} = 100V, f = 100\text{kHz}$	-	8,290	10,777	pF
C_{rss}	Reverse transfer capacitance ⁽²⁾		-	30	39	
C_{oss}	Output capacitance ⁽²⁾		-	251	326	
$C_{o(er)}$	Effective output capacitance	$V_{DS} = 0 \text{ to } 100V, V_{GS} = 0V$	-	400	-	
R_G	Series gate resistance	$f = 1\text{MHz}$	-	0.6	0.9	Ω
$t_{d(on)}$	Turn-on delay time	$V_{DS} = 100V, V_{GS} = 10V, I_{DS} = 30A, R_{G,EXT} = 0\Omega$	-	22.4	-	ns
t_r	Rise time		-	5.1	-	
$t_{d(off)}$	Turn-off delay time		-	48.7	-	
t_f	Fall time		-	7.1	-	
GATE CHARGE CHARACTERISTICS						
Q_G	Gate charge total ⁽²⁾	$V_{DS} = 100V, I_D = 30A, V_{GS} = 0 \text{ to } 10V$	-	105	136	nC
Q_{sw}	Switching charge ⁽³⁾		-	8.3	-	
Q_{gd}	Gate to drain charge ⁽²⁾⁽³⁾		-	4.1	5.3	
$Q_{g(th)}$	Gate charge at threshold ⁽³⁾		-	23.8	-	
Q_{gs2}	Gate to source charge ⁽³⁾		-	4.2	-	
$V_{plateau}$	Gate plateau voltage		-	6.0	-	V
Q_{oss}	Output charge ⁽²⁾	$V_{DS} = 0 \text{ to } 100V, V_{GS} = 0V$	-	401	462	nC
E_{oss}	Capacitive stored energy		-	4.0	-	μJ
DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	$I_{SD} = 30A, V_{GS} = 0V$	-	0.95	1.2	V
Q_{rr}	Reverse recovery charge	$V_{DS} = 100V, I_F = 30A,$	-	0.8	-	μC
t_{rr}	Reverse recovery time	$di/dt = 100A/\mu\text{s}$	-	152	-	ns

(2) Defined by design. Not subject to production test.

(3) Q_{sw} should be used for switching loss calculations. See Figure 16 for gate charge definitions. For more information see Q_{sw} application note on www.idealsemi.com

Ratings and Characteristics Curves

($T_A = 25^\circ\text{C}$ unless otherwise specified)

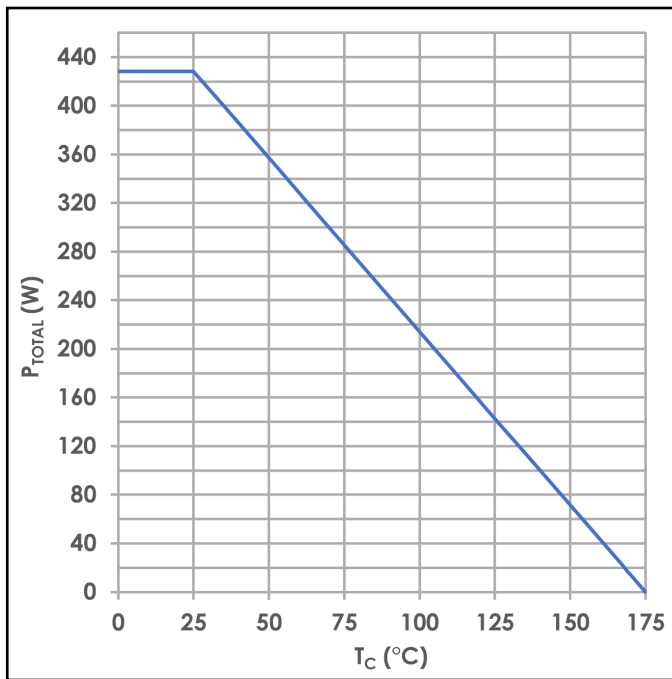


Figure 3: Power Dissipation

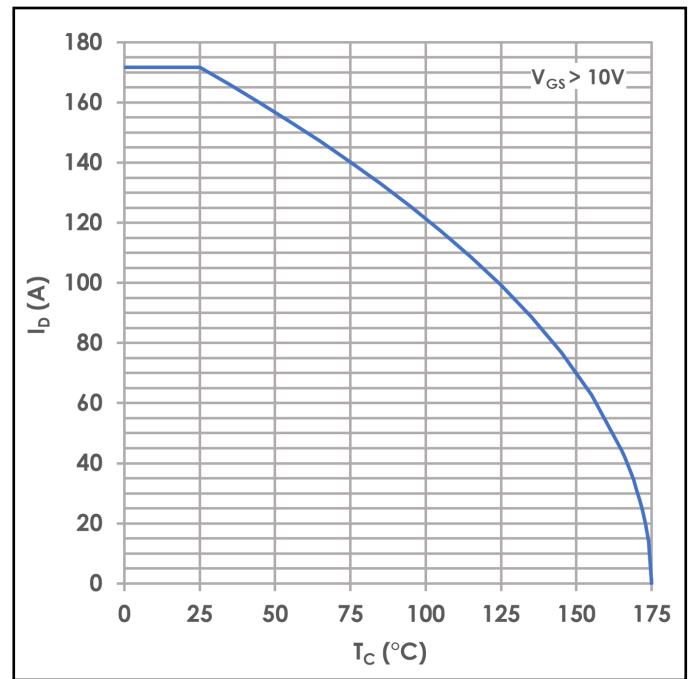


Figure 4: Drain Current

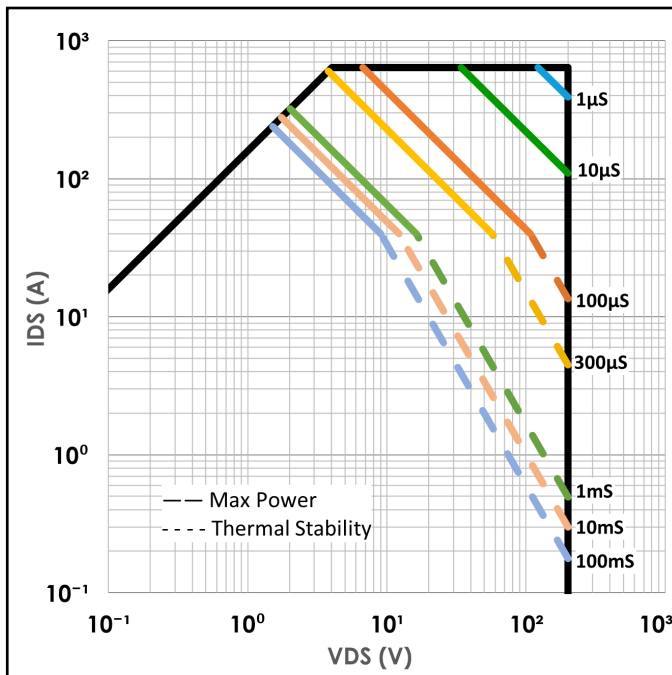


Figure 5: Safe Operating Area

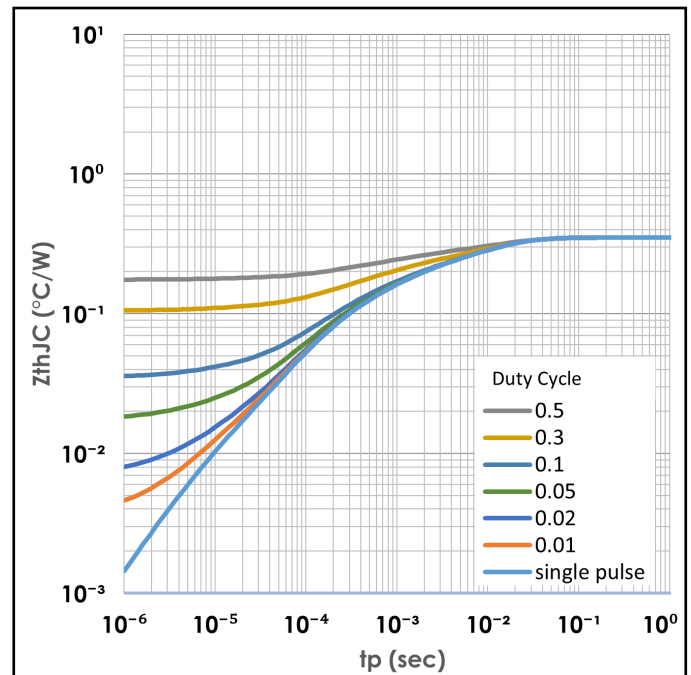


Figure 6: Max Transient Thermal Impedance

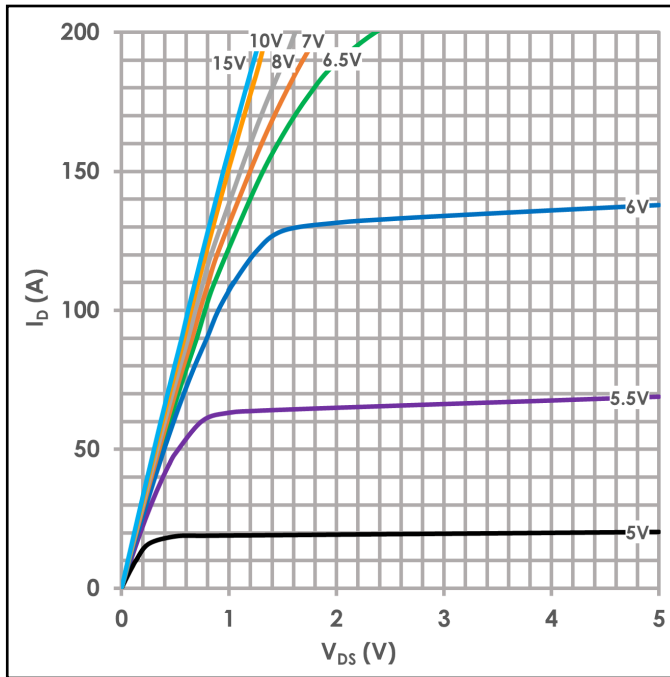


Figure 7: Typical Output Characteristics

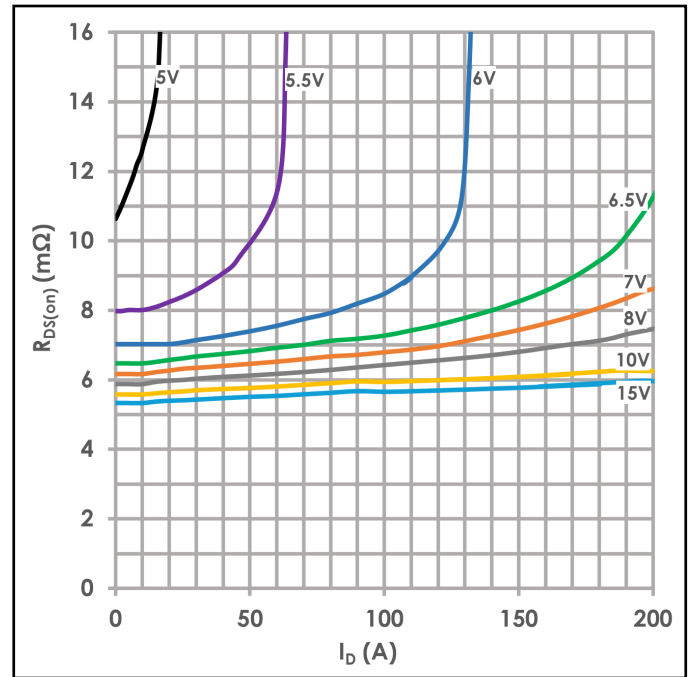


Figure 8: Typical Drain-Source On-Resistance

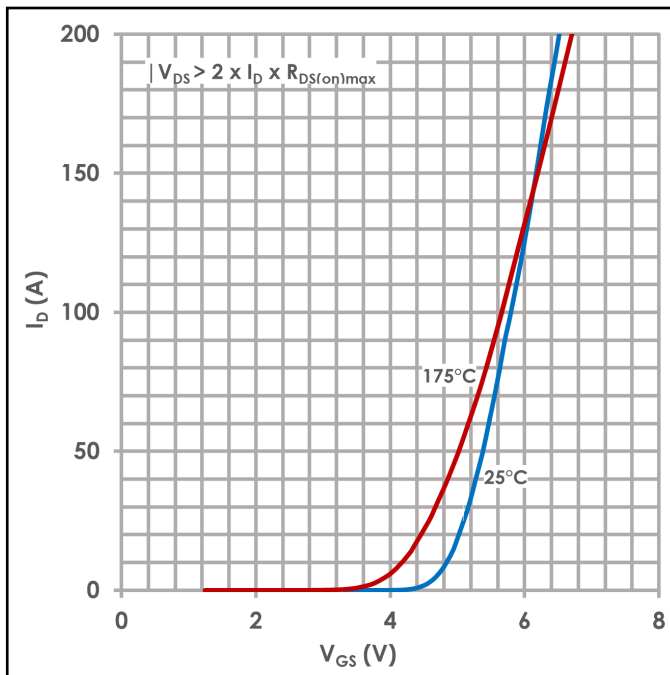


Figure 9: Typical Transfer Characteristics

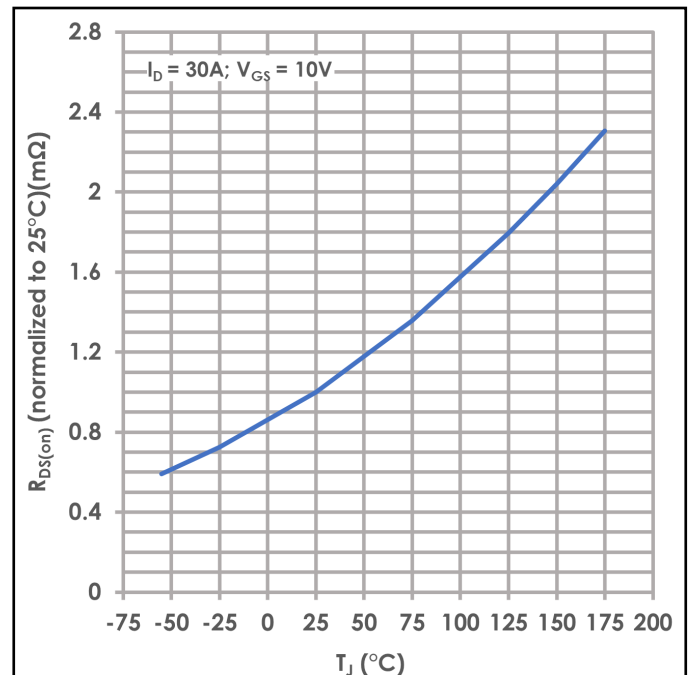


Figure 10: Normalized On-State Resistance vs. Temperature

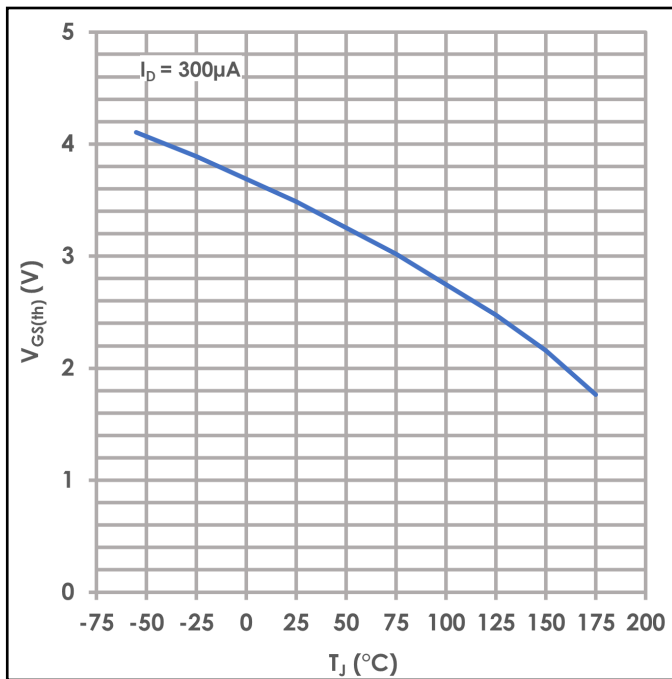


Figure 11: Typical Threshold Voltage

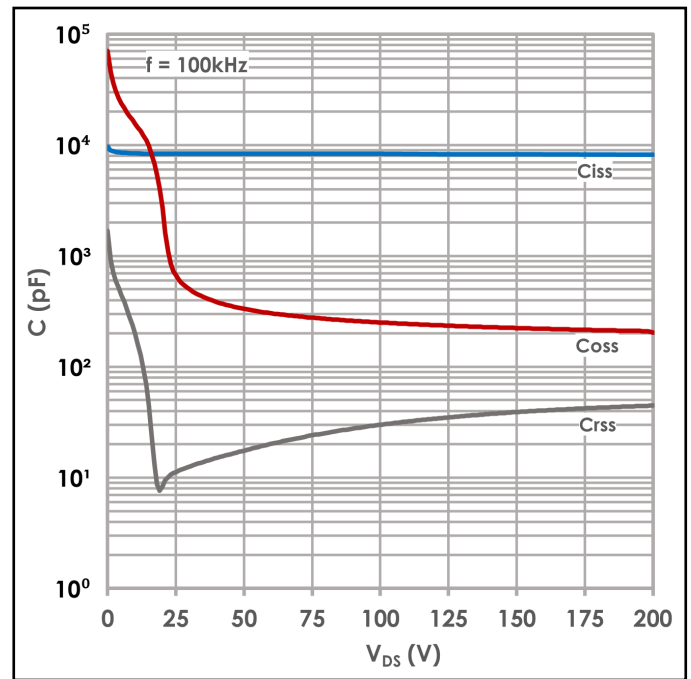


Figure 12: Typical Capacitances

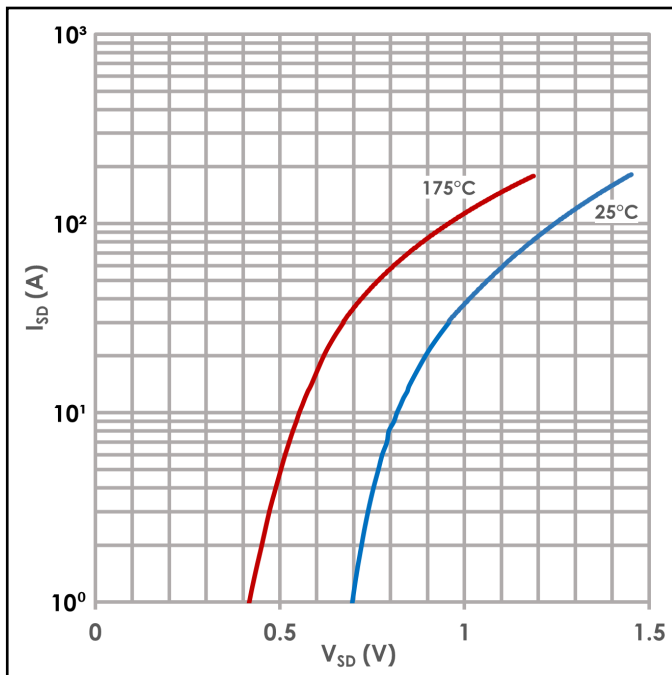


Figure 13: Typical Diode Forward Voltage

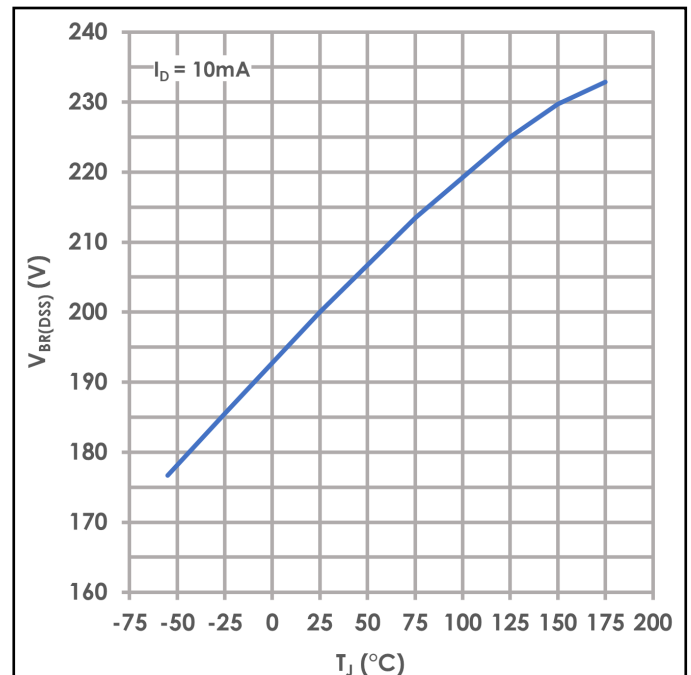


Figure 14: Min Drain-Source Breakdown Voltage

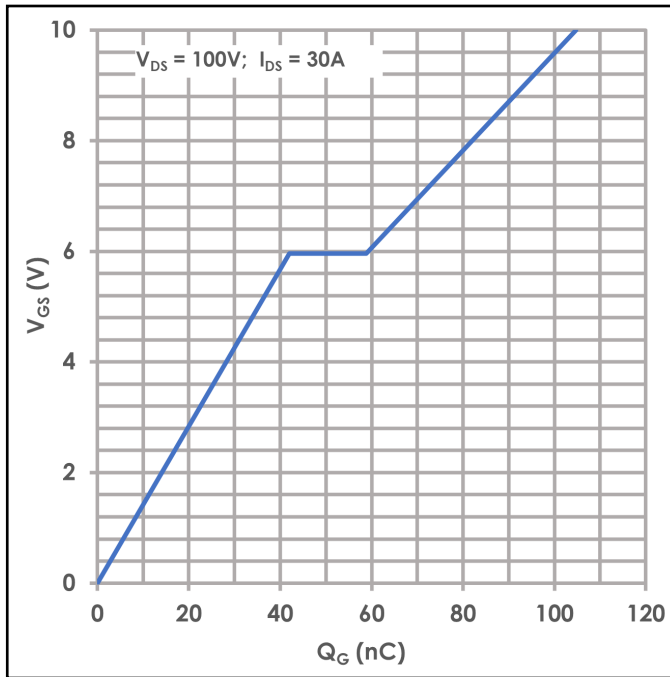


Figure 15: Typical Gate Charge

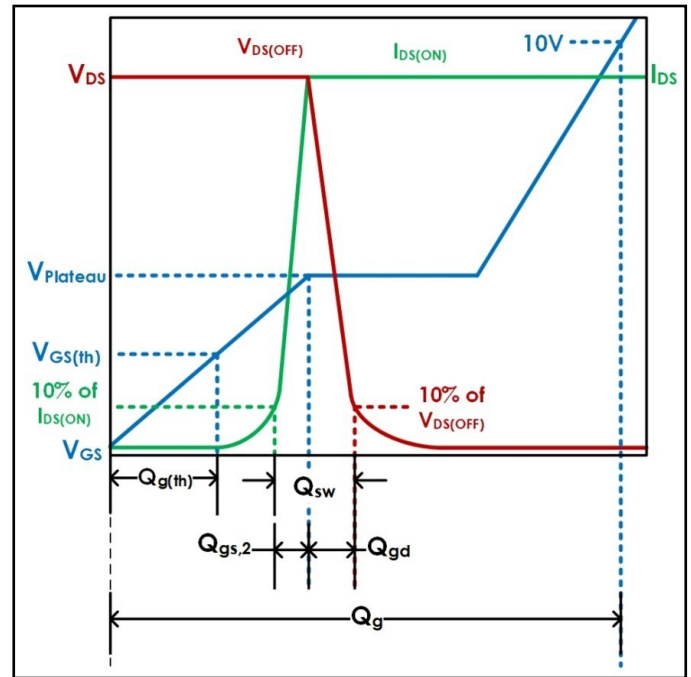
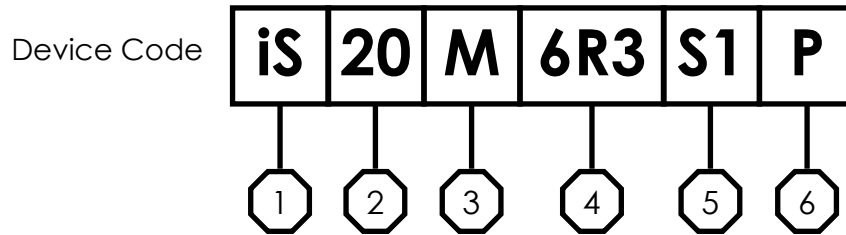








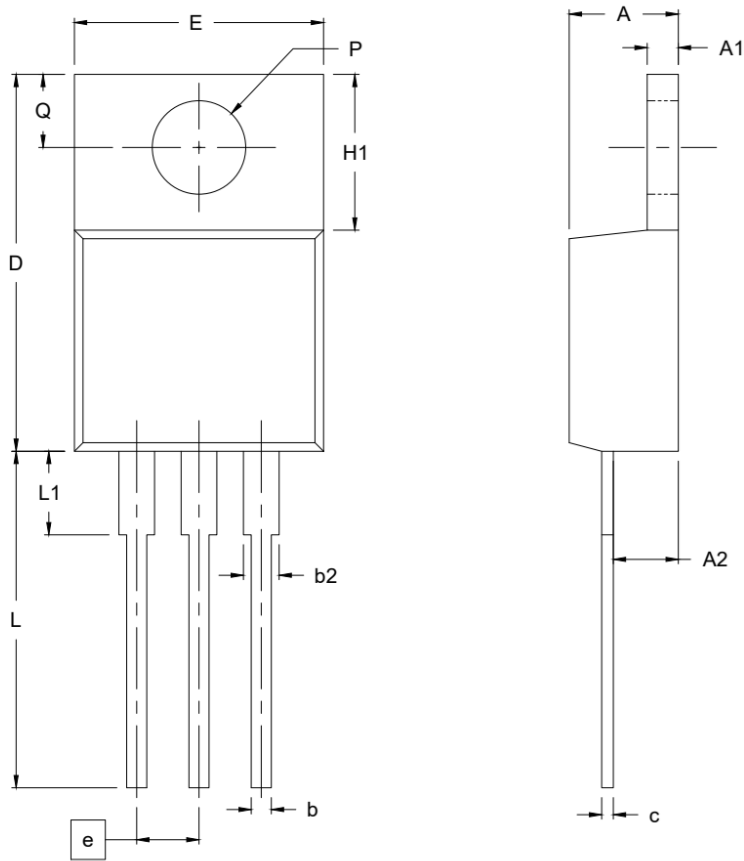
Figure 16: Gate Charge Definitions

DEVICE DECODER RING



-  — iDEAL Semiconductor product
-  — Voltage rating divided by 10 (200V)
-  — M = N-Channel MOSFET, Standard Threshold
-  — Maximum drain-to-source resistance
-  — SuperQ™ Generation
-  — P = TO-220

TO-220 Package Drawing



SYMBOL	MIN	MAX
A	4.19	4.82
A1	1.14	1.40
A2	2.38	2.92
b	0.63	1.01
b2	1.13	1.78
c	0.31	0.64
D	14.22	16.51
E	9.66	10.66
e	2.54 BSC	
H1	5.85	6.85
L	12.70	14.73
L1	2.39	4.42
P	3.54	4.08
Q	2.54	3.42

Notes:

1. All linear dimensions in millimeters
2. Dimensions D and E do not include mold flash or protrusions

Revision History

Version	Date	Comments
1.0	February 2026	Initial Release

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