

40V COMPLEMENTARY DUAL ENHANCEMENT MODE MOSFET

Product Summary

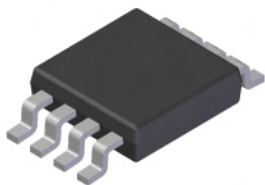
Device	V _{(BR)DSS}	R _{DS(on)} Max	I _D T _A = 25°C
Q1	40V	28mΩ @ V _{GS} = 10V	7.2A
		49mΩ @ V _{GS} = 4.5V	5.4A
Q2	-40V	50mΩ @ V _{GS} = -10V	-5.2A
		79mΩ @ V _{GS} = -4.5V	-4.7A

Description and Applications

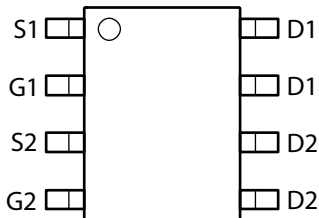
This MOSFET has been designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor control
- Backlighting
- DC-DC Converters
- Power management functions

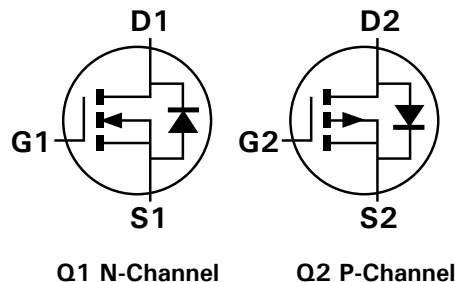
SO-8



Top View



Top View



Equivalent Circuit

Features and Benefits

- Low on-resistance
- Fast switching speed
- "Lead Free", RoHS Compliant (Note 1)
- Halogen and Antimony Free "Green" Device (Note 2)
- Qualified to AEC-Q101 Standards for High Reliability

Mechanical Data

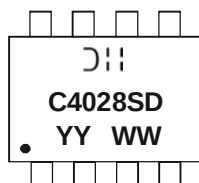
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See diagram below
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.074 grams (approximate)

Ordering Information (Note 3)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMC4028SSD-13	C4028SD	13	12	2,500

- Notes:
1. No purposefully added lead.
 2. Diodes Inc.'s "Green" policy can be found on our website at <http://www.diodes.com>.
 3. For packaging details, go to our website at <http://www.diodes.com>.

Marking Information



DII = Manufacturer's Marking
 C4028SD = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 09 = 2009)
 WW = Week (01 - 53)

Maximum Ratings @T_A = 25°C unless otherwise specified

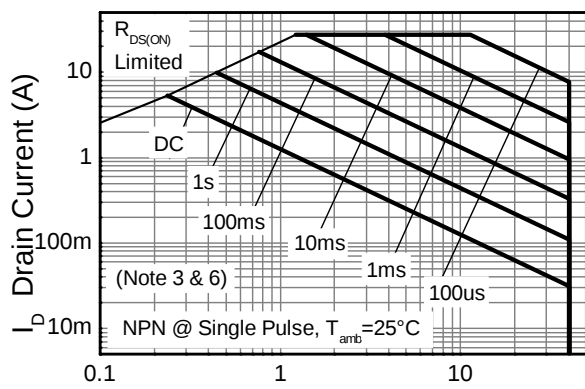
Characteristic			Symbol	N-Channel - Q1	P-Channel - Q2	Units
Drain-Source Voltage			V _{DSS}	40	-40	V
Gate-Source Voltage			V _{GSS}	±20	±20	V
Continuous Drain Current	V _{GS} = 10V	(Note 4)	I _D	7.2	5.2	A
		(Notes 6 & 8)		5.5	4.2	
		T _A = 70°C (Notes 6 & 8)		5.4	4	
		(Notes 5 & 8)		6.5	4.8	
Pulsed Drain Current	V _{GS} = 10V	(Notes 7 & 8)	I _{DM}	27.3	20.4	A
Continuous Source Current (Body diode)			I _S	3.35	3.15	A
Pulsed Source Current (Body diode)			I _{SM}	27.3	20.4	A

Thermal Characteristics @T_A = 25°C unless otherwise specified

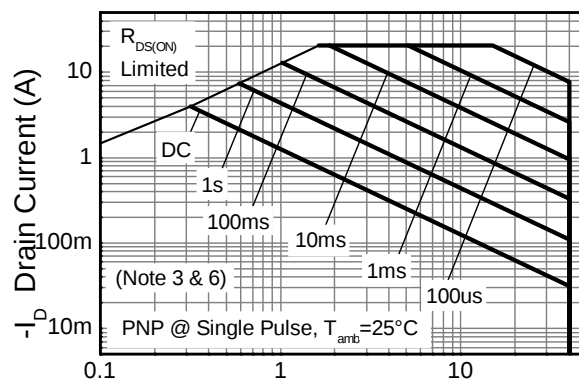
Characteristic		Symbol	N-Channel - Q1	P-Channel - Q2	Unit
Power Dissipation Linear Derating Factor	(Notes 5 & 8)	P _D	1.25		W mW/°C
	(Notes 5 & 9)		10		
	(Notes 6 & 8)		1.8		
	(Notes 5 & 8)		14.3		
Thermal Resistance, Junction to Ambient	(Notes 5 & 8)	R _{θJA}	2.16		°C/W
	(Notes 5 & 9)		17.2		
	(Notes 6 & 8)		100		
Thermal Resistance, Junction to Lead	(Notes 5 & 8)	R _{θJL}	70		°C/W
	(Notes 5 & 9)		58		
	(Notes 6 & 8)		53	53	
Operating and Storage Temperature Range		T _J , T _{STG}	-55 to +150		°C

- Notes:
- AEC-Q101 V_{GS} maximum is ±16V.
 - For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
 - Same as note (5), except the device is measured at t ≤ 10 sec.
 - Same as note (5), except the device is pulsed with D= 0.02 and pulse width 300 μs. The pulse current is limited by the maximum junction temperature.
 - For a dual device with one active die.
 - For a device with two active die running at equal power.
 - Thermal resistance from junction to solder-point (at the end of the drain lead).

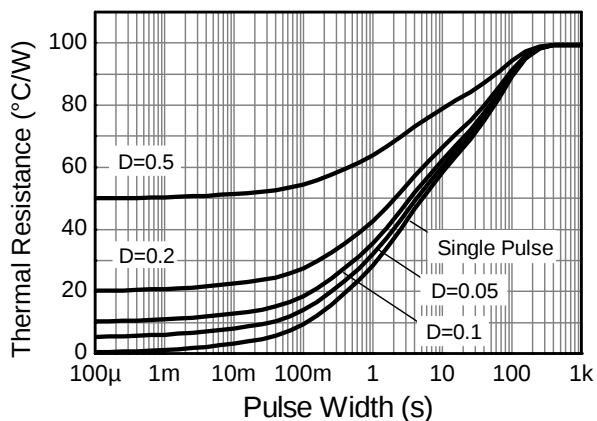
Thermal Characteristics



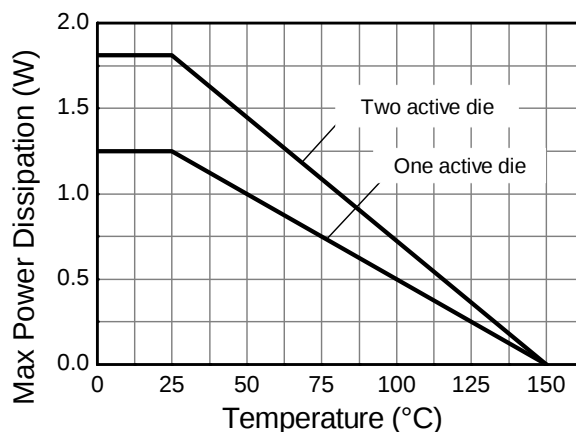
N-channel Safe Operating Area



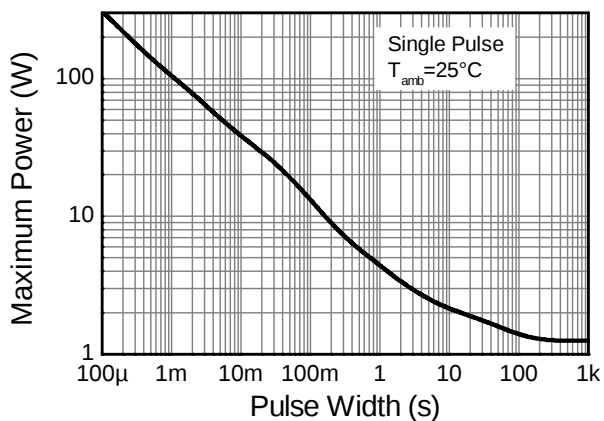
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



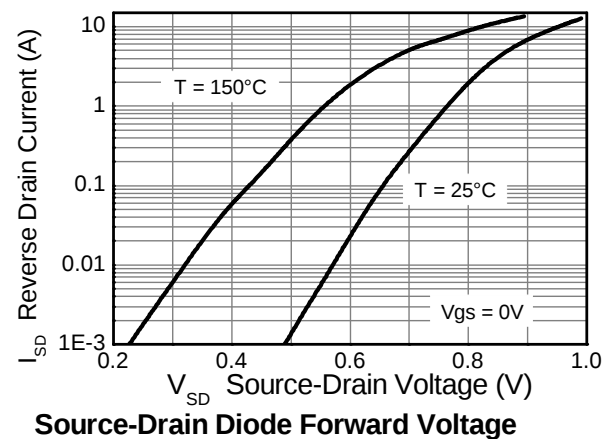
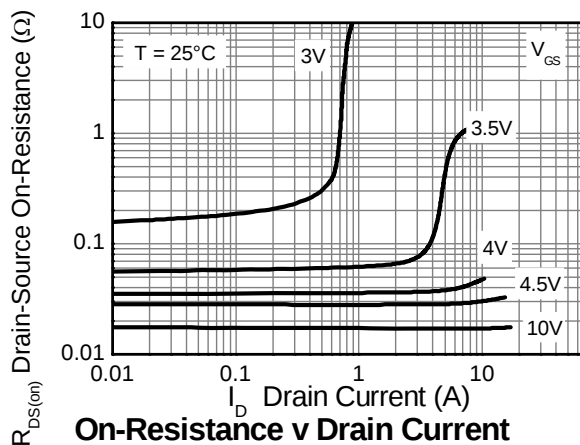
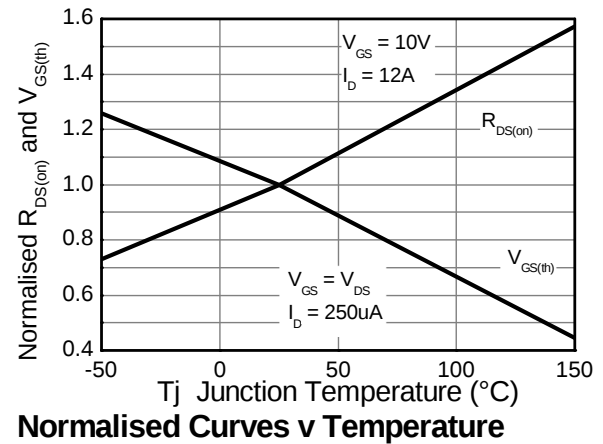
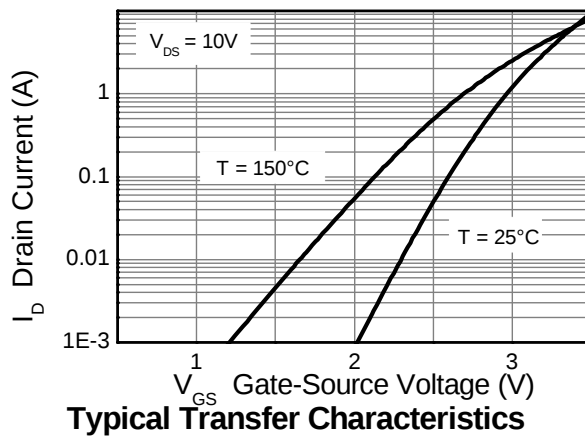
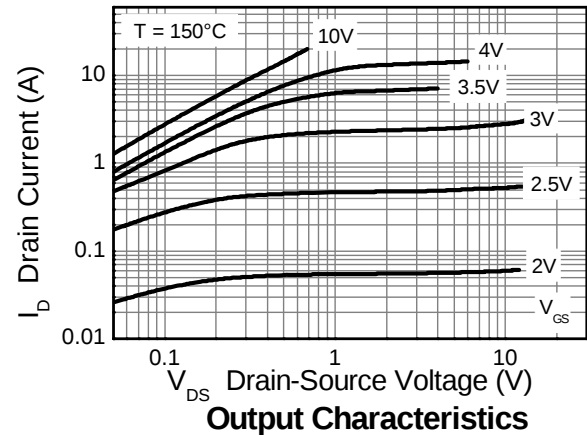
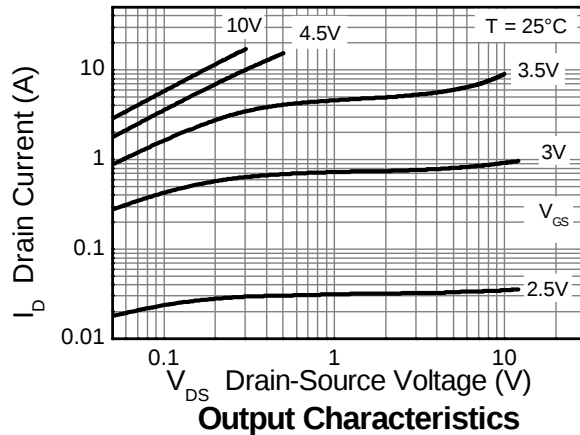
Pulse Power Dissipation

Electrical Characteristics – Q1 N-Channel $T_A = 25^\circ\text{C}$ unless otherwise specified

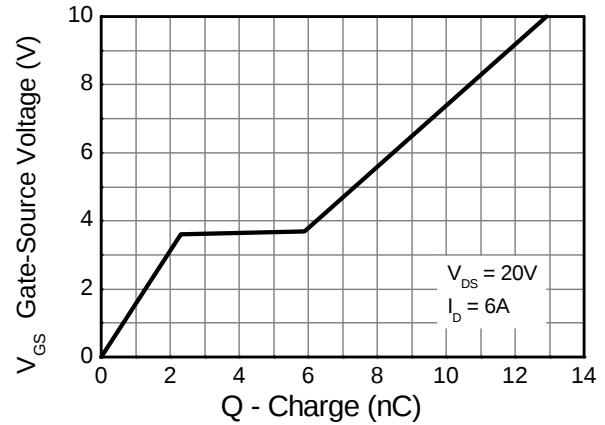
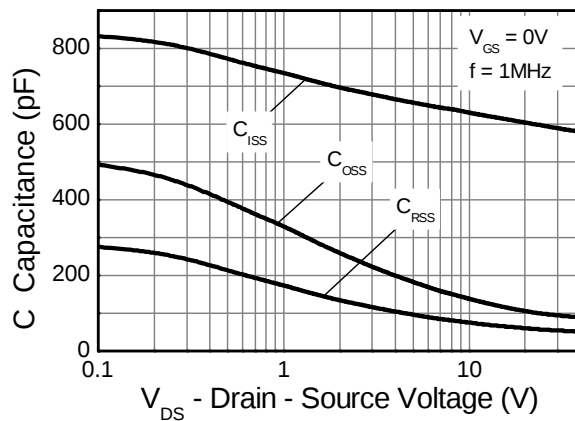
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	40	—	—	V	I _D = 250μA, V _{GS} = 0V	
Zero Gate Voltage Drain Current	I _{DSS}	—	—	0.5	μA	V _{DS} = 40V, V _{GS} = 0V	
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, V _{DS} = 0V	
ON CHARACTERISTICS							
Gate Threshold Voltage	V _{GS(th)}	1.0	—	3.0	V	I _D = 250μA, V _{DS} = V _{GS}	
Static Drain-Source On-Resistance (Note 11)	R _{DS (ON)}	—	0.018	0.028	Ω	V _{GS} = 10V, I _D = 6A	
			0.033	0.049		V _{GS} = 4.5V, I _D = 5A	
Forward Transconductance (Notes 11 & 12)	g _{fS}	—	22.8	—	S	V _{DS} = 15V, I _D = 6A	
Diode Forward Voltage (Note 11)	V _{SD}	—	0.845	1.1	V	I _S = 6A, V _{GS} = 0V	
Reverse recovery time (Note 12)	t _{rr}	—	135	—	ns	I _S = 6A, di/dt = 100A/μs	
Reverse recovery charge (Note 12)	Q _{rr}	—	799	—	nC		
DYNAMIC CHARACTERISTICS (Note 12)							
Input Capacitance	C _{iSS}	—	604	—	pF	V _{DS} = 20V, V _{GS} = 0V f = 1MHz	
Output Capacitance	C _{oSS}	—	106	—	pF		
Reverse Transfer Capacitance	C _{rSS}	—	59.6	—	pF		
Total Gate Charge (Note 13)	Q _g	—	6.5	—	nC	V _{GS} = 4.5V	V _{DS} = 20V I _D = 6A
Total Gate Charge (Note 13)	Q _g	—	12.9	—	nC	V _{GS} = 10V	
Gate-Source Charge (Note 13)	Q _{gs}	—	2.3	—	nC		
Gate-Drain Charge (Note 13)	Q _{gd}	—	3.6	—	nC		
Turn-On Delay Time (Note 13)	t _{D(on)}	—	4.2	—	ns	V _{DD} = 20V, V _{GS} = 10V I _D = 6A, R _G ≅ 6.0Ω	
Turn-On Rise Time (Note 13)	t _r	—	12.4	—	ns		
Turn-Off Delay Time (Note 13)	t _{D(off)}	—	13.8	—	ns		
Turn-Off Fall Time (Note 13)	t _f	—	10.7	—	ns		

Notes: 11. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$
12. For design aid only, not subject to production testing.
13. Switching characteristics are independent of operating junction temperatures.

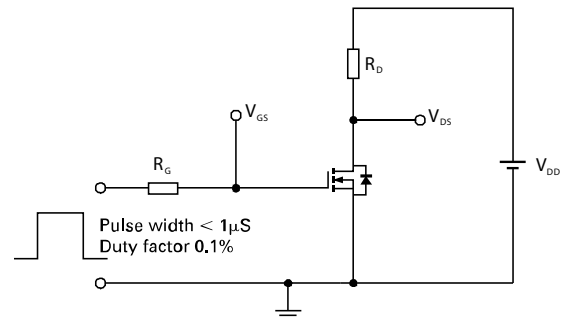
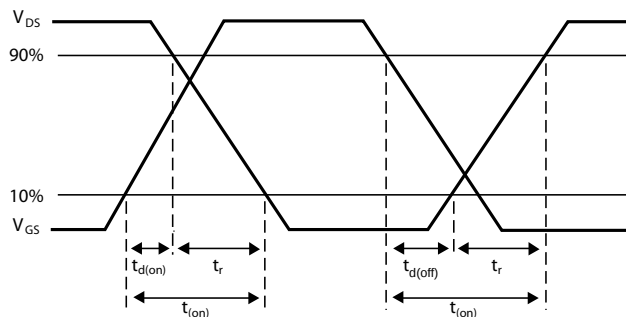
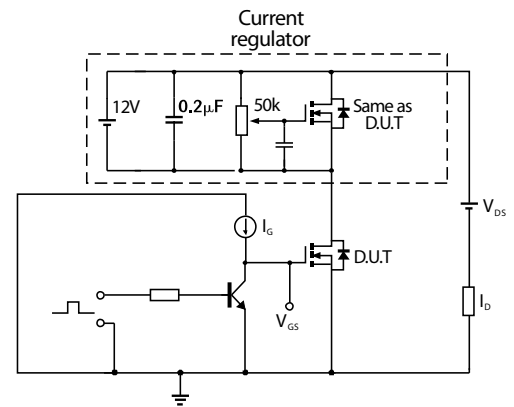
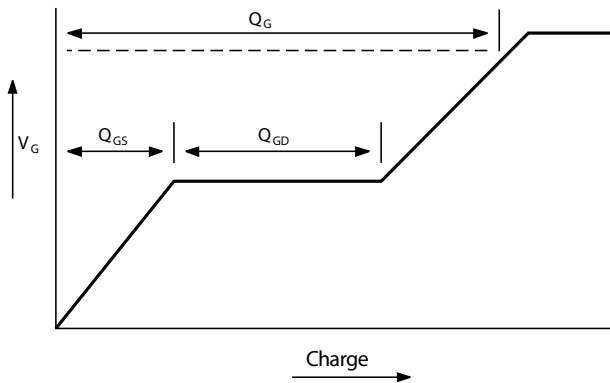
Typical Characteristics – Q1 N-Channel



Typical Characteristics – Q1 N-Channel - continued



Test Circuits – Q1 N-Channel

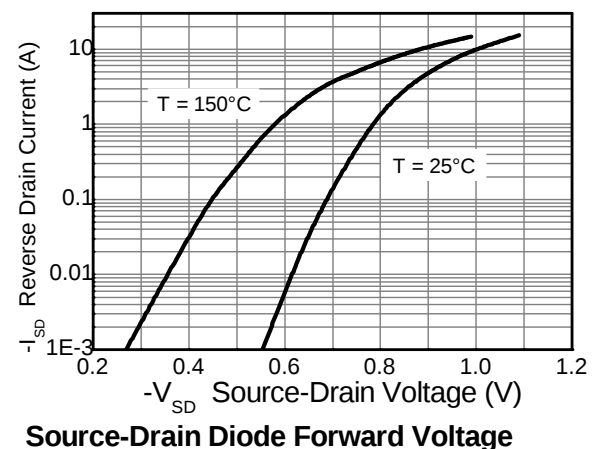
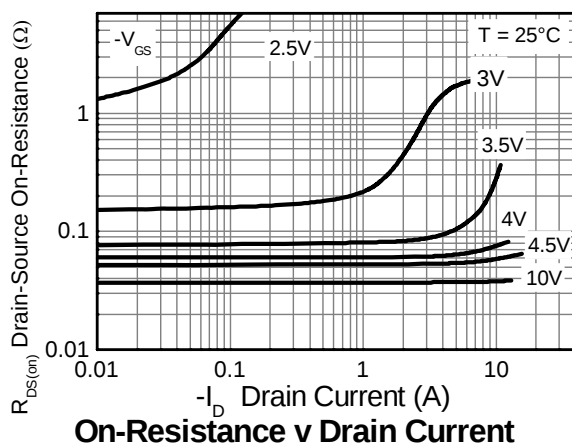
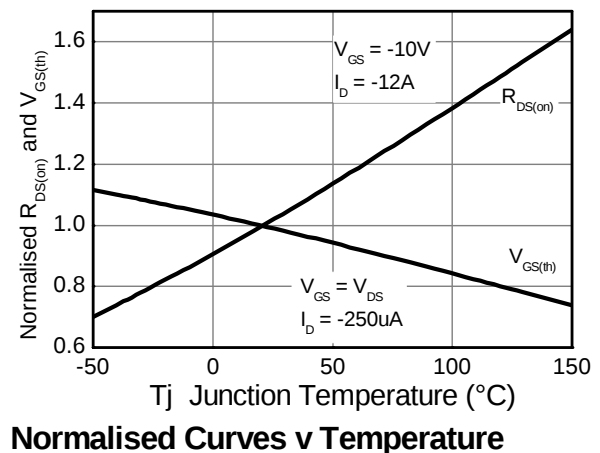
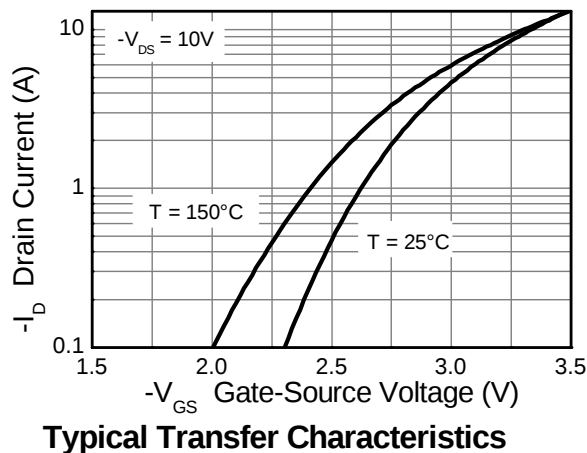
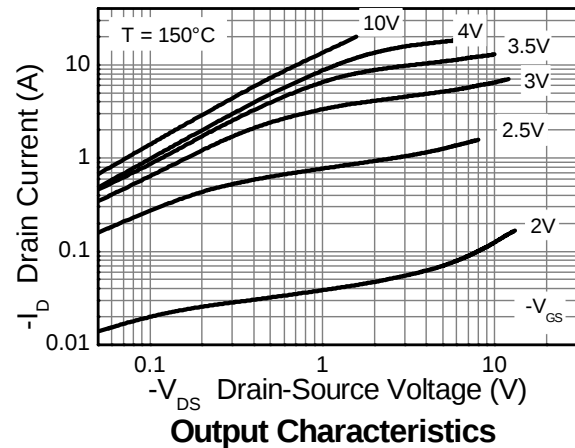
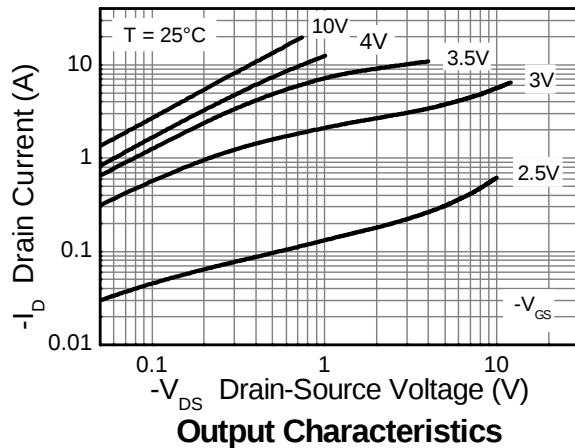


Electrical Characteristics – Q2 P-Channel @T_A = 25°C unless otherwise specified

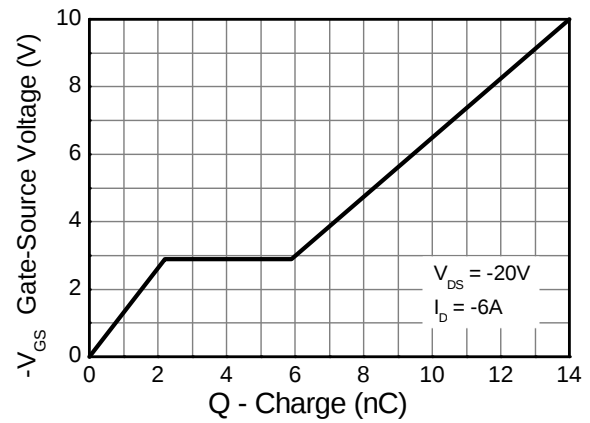
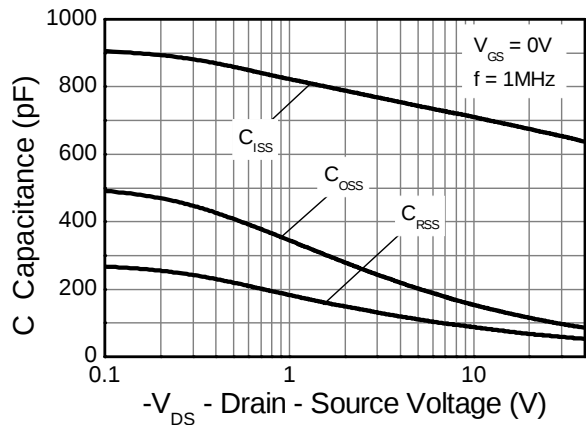
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	-40	–	–	V	I _D = -250μA, V _{GS} = 0V	
Zero Gate Voltage Drain Current	I _{DSS}	–	–	-0.5	A	V _{DS} = -40V, V _{GS} = 0V	
Gate-Source Leakage	I _{GSS}	–	–	±100	nA	V _{GS} = ±20V, V _{DS} = 0V	
ON CHARACTERISTICS							
Gate Threshold Voltage	V _{GS(th)}	-1.0	–	-3.0	V	I _D = -250μA, V _{DS} = V _{GS}	
Static Drain-Source On-Resistance (Note 14)	R _{DS (ON)}	–	0.039	0.050	Ω	V _{GS} = -10V, I _D = -6A	
			0.060	0.079		V _{GS} = -4.5V, I _D = -5A	
Forward Transconductance (Notes 14 & 15)	g _{fS}	–	16.6	–	S	V _{DS} = -15V, I _D = -6A	
Diode Forward Voltage (Note 4)	V _{SD}	–	-0.865	-1.1	V	I _S = -6A, V _{GS} = 0V	
Reverse recovery time (Note 15)	t _{rr}	–	138	–	ns	I _S = -6A, di/dt = 100A/μs	
Reverse recovery charge (Note 15)	Q _{rr}	–	841	–	nC		
DYNAMIC CHARACTERISTICS (Note 15)							
Input Capacitance	C _{iSS}	–	674	–	pF	V _{DS} = -20V, V _{GS} = 0V f = 1MHz	
Output Capacitance	C _{oSS}	–	115	–	pF		
Reverse Transfer Capacitance	C _{rSS}	–	67.7	–	pF		
Total Gate Charge (Note 16)	Q _g	–	7.0	–	nC	V _{GS} = -4.5V	V _{DS} = -20V I _D = -6A
Total Gate Charge (Note 16)	Q _g	–	14	–	nC	V _{GS} = -10V	
Gate-Source Charge (Note 16)	Q _{gs}	–	2.2	–	nC		
Gate-Drain Charge (Note 16)	Q _{gd}	–	3.7	–	nC		
Turn-On Delay Time (Note 16)	t _{D(on)}	–	2.3	–	ns	V _{DD} = -20V, V _{GS} = -10V I _D = -6A, R _G ≅ 6.0Ω	
Turn-On Rise Time (Note 16)	t _r	–	14.1	–	ns		
Turn-Off Delay Time (Note 16)	t _{D(off)}	–	25.1	–	ns		
Turn-Off Fall Time (Note 16)	t _f	–	14.3	–	ns		

Notes: 14. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
15. For design aid only, not subject to production testing.
16. Switching characteristics are independent of operating junction temperatures.

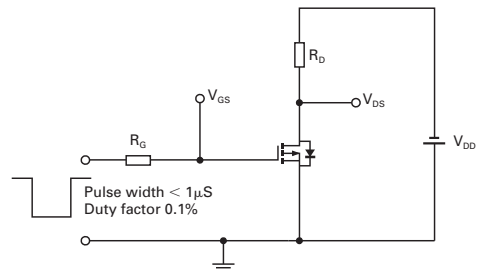
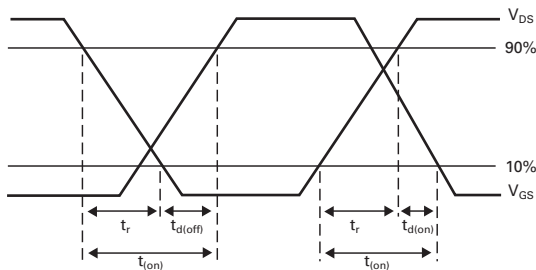
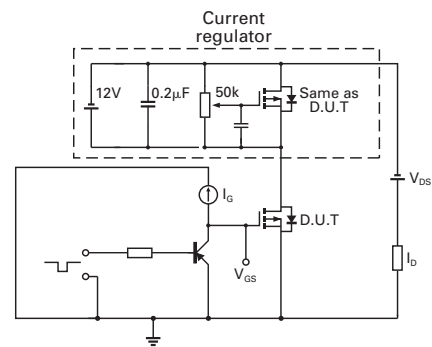
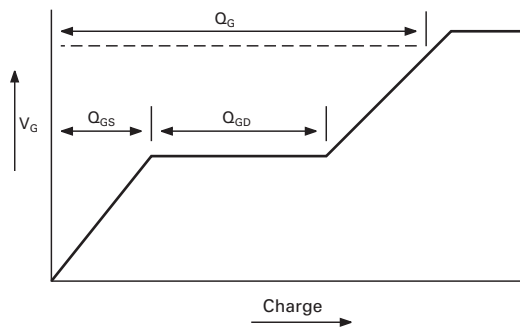
Typical Characteristics – Q2 P-Channel



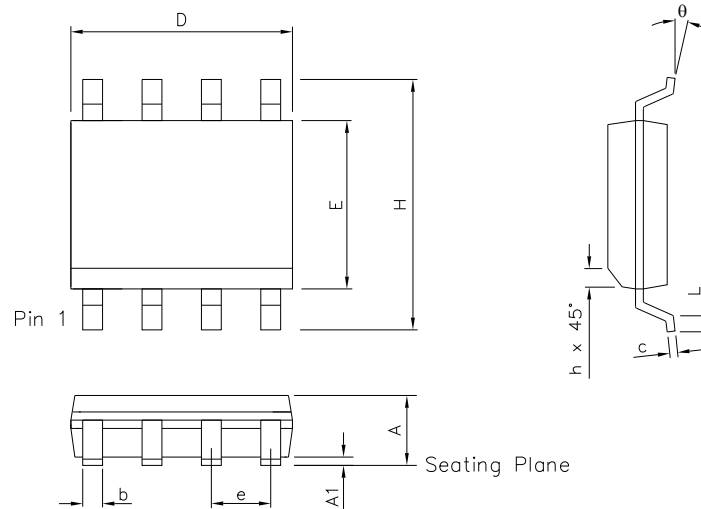
Typical Characteristics – Q2 P-Channel - continued



Test Circuits – Q2 P-Channel

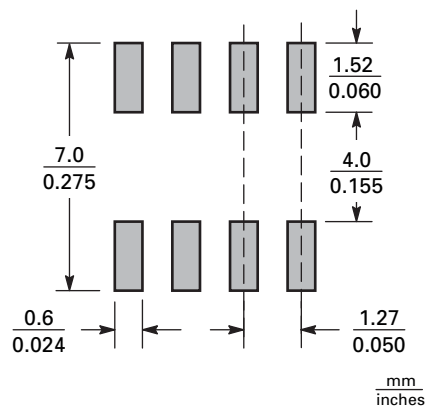


Package Outline Dimensions



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.050 BSC		1.27 BSC	
A1	0.004	0.010	0.10	0.25	b	0.013	0.020	0.33	0.51
D	0.189	0.197	4.80	5.00	c	0.008	0.010	0.19	0.25
H	0.228	0.244	5.80	6.20	θ	0°	8°	0°	8°
E	0.150	0.157	3.80	4.00	h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27	-	-	-	-	-

Suggested Pad Layout



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