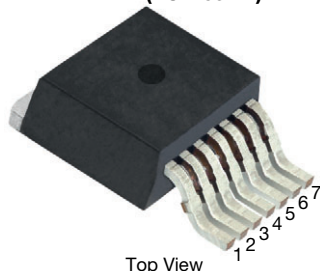
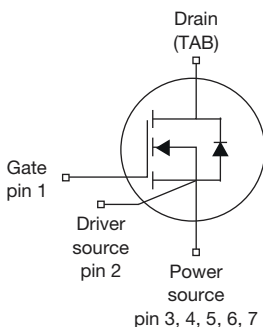


# MaxSiC® 1200 V N-Channel SiC MOSFET

**D<sup>2</sup>PAK 7L (TO-263 7L)**


Top View


**Marking Code:** Q120A045SE

## PRODUCT SUMMARY

$V_{DS}$ (V) at $T_J$ max.	1200	
$R_{DS(on)}$ typ. (m $\Omega$ ) at 25 °C	$V_{GS} = 18$ V	45
$Q_g$ typ. (nC)	82	
$I_D$ (A)	52	
$C_{oss}$ typ. (pF)	91	
$P_D$ (W)	268	
Configuration	Single	

## ORDERING INFORMATION

Package	D <sup>2</sup> PAK 7L (TO-263 7L)
Lead (Pb)-free and halogen-free	MXPQ120A045SE-1GE3

## ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	1200	V
Gate-source voltage	$V_{GS}$	-10 / +22	
Recommended operation voltage of gate-source	$V_{GSOP}$	-5 to -3 / +18	
Continuous drain current	$I_D$	52	A
Pulsed drain current <sup>a</sup>	$I_{DM}$	104	
Short-circuit withstand time <sup>b</sup>	$T_{SC}$	3	$\mu$ s
Maximum power dissipation	$P_D$	268	W
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +175	°C
Soldering recommendations (peak temperature)	For 10 s	260	°C
Single pulse avalanche energy <sup>c</sup>	$E_{AS}$	200	mJ

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{GS} = 18$  V,  $V_{DS} = 800$  V,  $R_{g(ext)} = 20$   $\Omega$ , verified by the design / characterization
- $T_J = 25$  °C,  $V_{DD} = 120$  V,  $L = 1$  mH,  $V_{GS} = 18$  V,  $I_{AS} = 20$  A

## FEATURES

- AEC-Q101 qualified
- Fast switching speed
- Short circuit withstand time 3  $\mu$ s
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

## APPLICATIONS

- Automotive on board charger
- Automotive DC/DC converter for EV/HEV
- Auxiliary drives
- EV Charging

AUTOMOTIVE  
GRADE

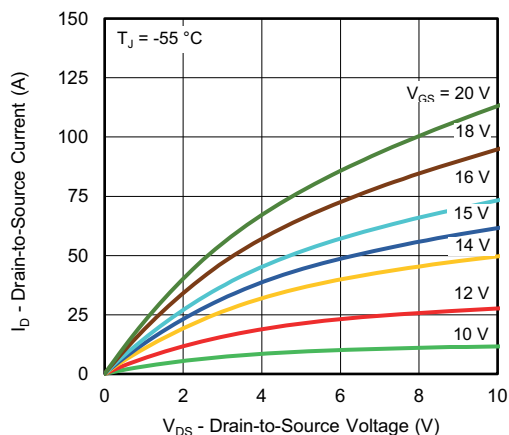
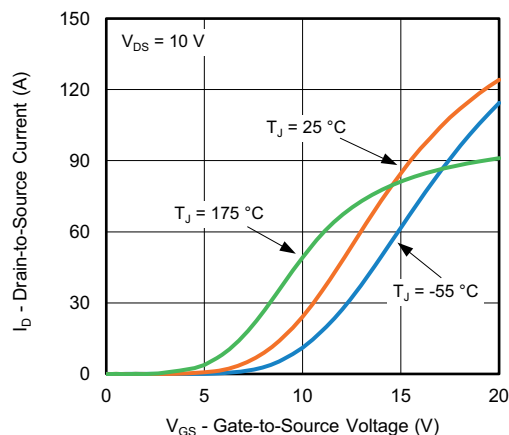
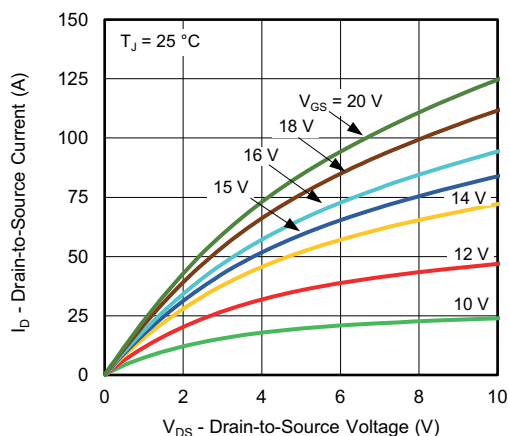
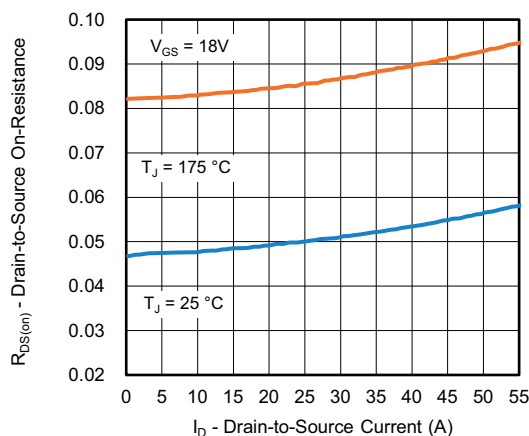
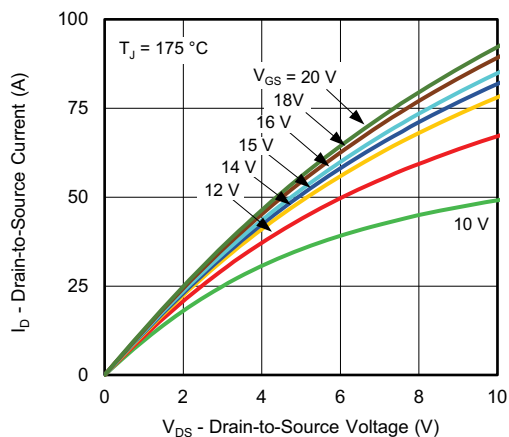
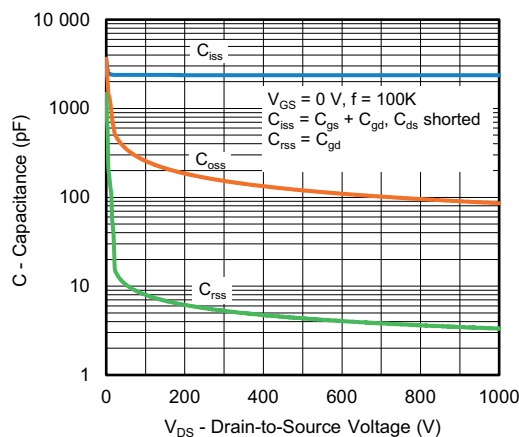
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

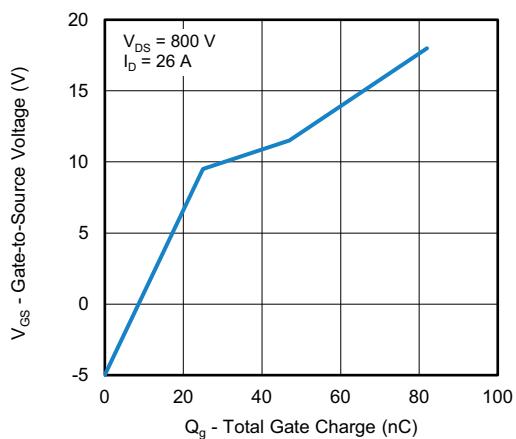
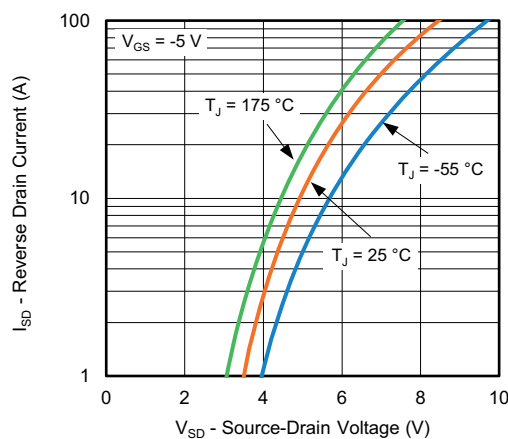
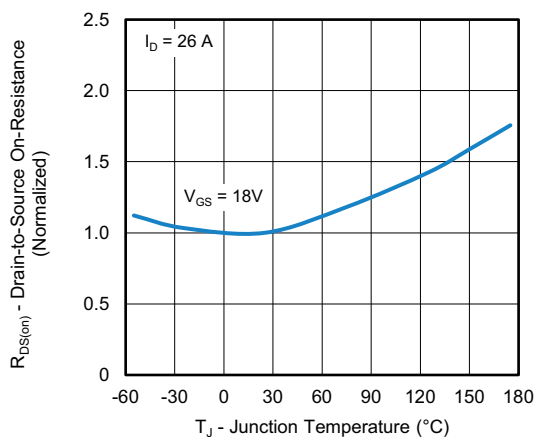
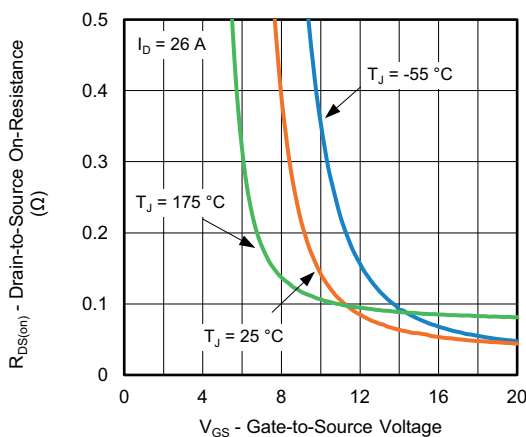
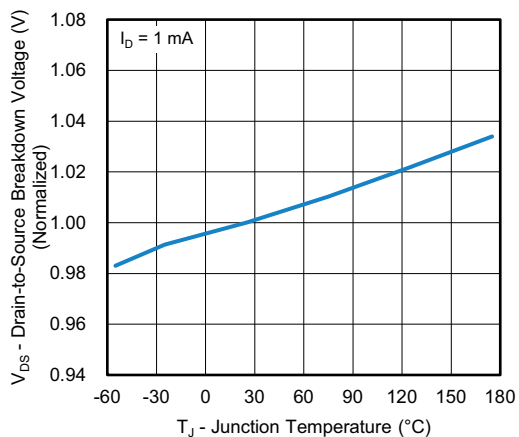
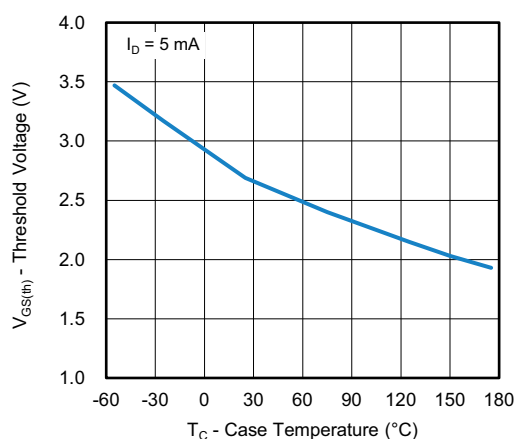
**THERMAL RESISTANCE RATINGS**

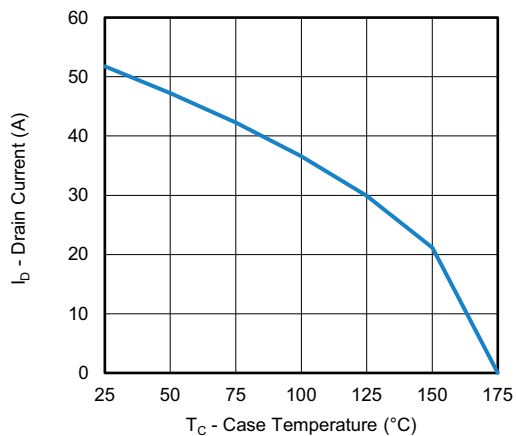
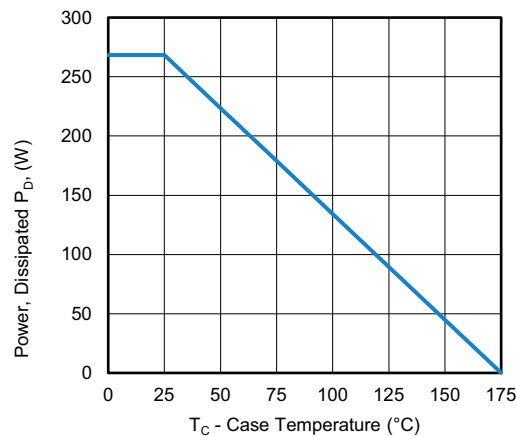
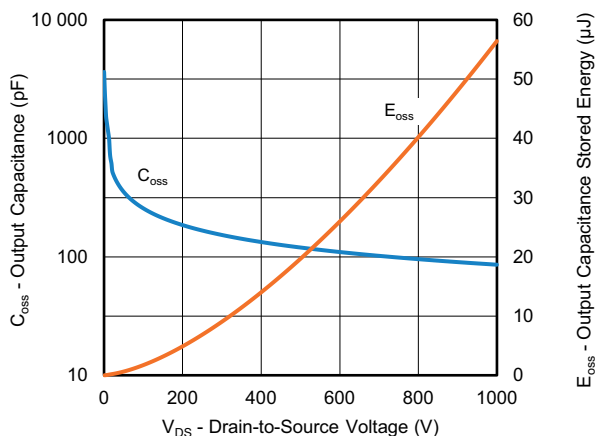
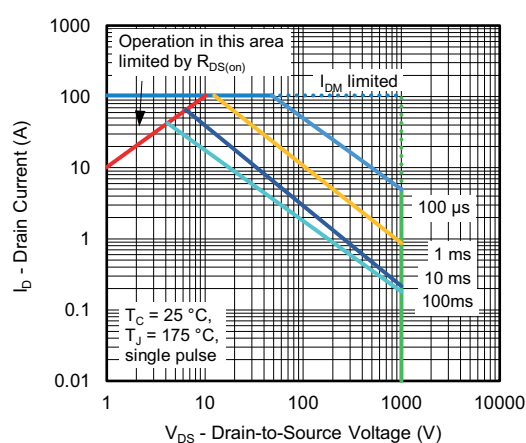
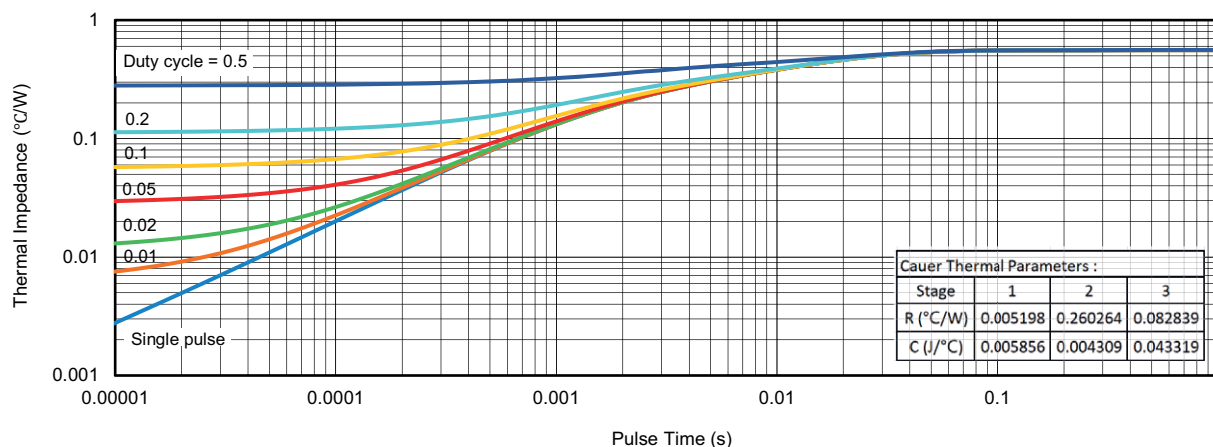
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	$R_{thJA}$	-	42	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	-	0.56	

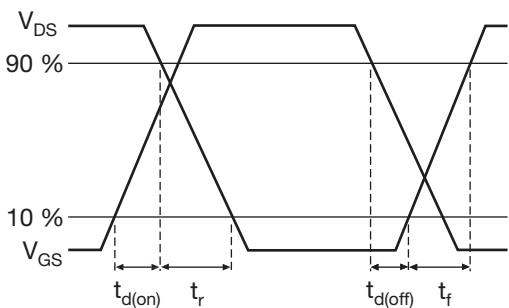
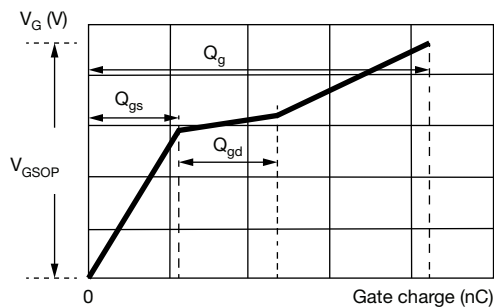
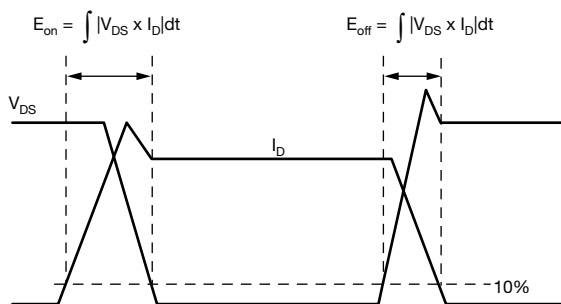
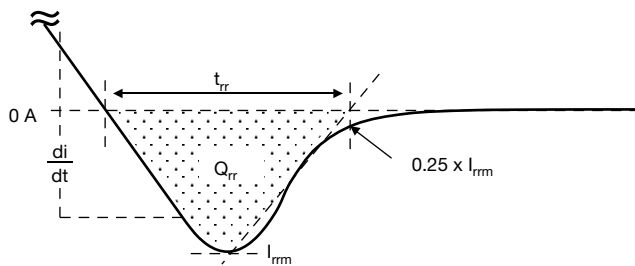
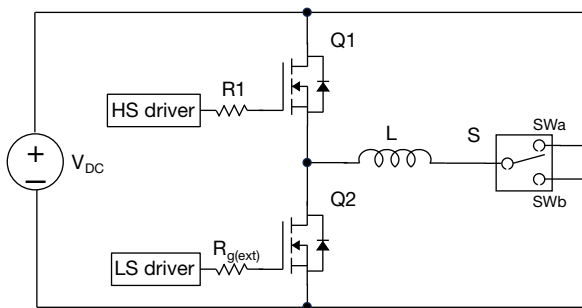
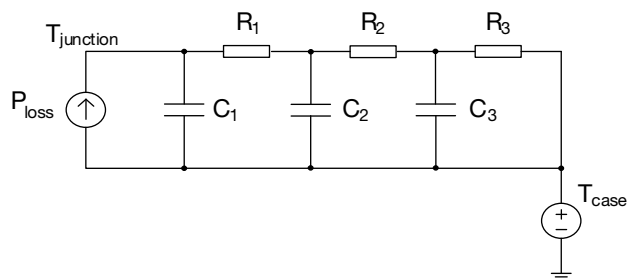
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA	1200	-	-	V	
Gate-source threshold voltage (N)	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 5 mA	-	2.8	-	V	
		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 5 mA, T <sub>J</sub> = 175 °C	-	1.9	-	V	
Gate-source leakage	I <sub>GSS</sub>	V <sub>GS</sub> = 22 V, V <sub>DS</sub> = 0 V	-	-	100	nA	
		V <sub>GS</sub> = -10 V, V <sub>DS</sub> = 0 V	-	-	-100		
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V	-	-	10	μA	
Drain-source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 15 V, I <sub>D</sub> = 26 A	-	60	75	mΩ	
		V <sub>GS</sub> = 18 V, I <sub>D</sub> = 26 A	-	45	56		
		V <sub>GS</sub> = 18 V, I <sub>D</sub> = 26 A, T <sub>J</sub> = 175 °C	-	82	-		
Transconductance	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 26 A	-	10	-	S	
Dynamic							
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 800 V, f = 100 KHz	-	2483	-	pF	
Output capacitance	C <sub>oss</sub>		-	91	-		
Reverse transfer capacitance	C <sub>rss</sub>		-	3	-		
Total gate charge	Q <sub>g</sub>	V <sub>GS</sub> = -5 V ~ 18 V, I <sub>D</sub> = 26 A, V <sub>DS</sub> = 800 V	-	82	-	nC	
Gate-source charge	Q <sub>gs</sub>		-	25	-		
Gate-drain charge	Q <sub>gd</sub>		-	22	-		
Gate Resistance	R <sub>g</sub>	V <sub>DS</sub> = 0 V, f = 1 MHz	-	3	-	Ω	
Switching Characteristics							
Turn-on delay time	t <sub>d(on)</sub>	V <sub>GS</sub> = -5 V ~ 18 V, I <sub>D</sub> = 26 A, V <sub>DS</sub> = 800 V, R <sub>g(ext)</sub> = 4.4 Ω	T <sub>J</sub> = 25 °C	-	23	-	ns
Rise time	t <sub>r</sub>		T <sub>J</sub> = 175 °C	-	22	-	
			T <sub>J</sub> = 25 °C	-	12	-	
			T <sub>J</sub> = 175 °C	-	11	-	
			T <sub>J</sub> = 25 °C	-	25	-	
Turn-off delay time	t <sub>d(off)</sub>		T <sub>J</sub> = 175 °C	-	27	-	
			T <sub>J</sub> = 25 °C	-	10	-	
Fall time	t <sub>f</sub>		T <sub>J</sub> = 175 °C	-	10	-	
			T <sub>J</sub> = 25 °C	-	273	-	μJ
Turn-on switching energy	E <sub>on</sub>		T <sub>J</sub> = 175 °C	-	261	-	
			T <sub>J</sub> = 25 °C	-	74	-	
Turn-off switching energy	E <sub>off</sub>	T <sub>J</sub> = 175 °C	-	73	-		
Body Diode Ratings and Characteristic							
Forward diode voltage	V <sub>SD</sub>	V <sub>GS</sub> = -5 V, I <sub>SD</sub> = 13 A, T <sub>J</sub> = 25 °C	-	4.9	-	V	
Continuous diode forward current	I <sub>SD</sub>	V <sub>GS</sub> = -5 V, T <sub>J</sub> = 25 °C	-	-	38	A	
Pulsed diode forward current	I <sub>SDM</sub>		-	-	104		
Reverse recovery time	t <sub>rr</sub>	V <sub>GS</sub> = -5 V, I <sub>SD</sub> = 26 A, V <sub>R</sub> = 800 V, di/dt = 1000 A/μs	-	19	-	ns	
Reverse recovery charge	Q <sub>rr</sub>		-	83	-	nC	
Reverse recovery current	I <sub>RRM</sub>		-	7	-	A	

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Fig. 1 - Typical Output Characteristics**

**Fig. 4 - Typical Transfer Characteristics**

**Fig. 2 - Typical Output Characteristics**

**Fig. 5 - Normalized On-Resistance vs. Drain Current**

**Fig. 3 - Typical Output Characteristics**

**Fig. 6 - Typical Capacitance vs. Drain-to-Source Voltage**


**Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage**

**Fig. 10 - Typical Source-Drain Diode Forward Voltage**

**Fig. 8 - Normalized On-Resistance vs. Temperature**

**Fig. 11 - On-Resistance vs. Gate-to-Source Voltage**

**Fig. 9 - Drain-to-Source Voltage vs. Temperature**

**Fig. 12 - Threshold Voltage vs. Case Temperature**


**Fig. 13 - Drain Current vs. Case Temperature**

**Fig. 15 - Power, Dissipated  $P_D$  vs. Case Temperature**

**Fig. 14 - Output Capacitance and its Stored Energy vs. Drain-to-Source Voltage**

**Fig. 16 - Safe Operating Area**

**Fig. 17 - Transient Thermal Impedance**


**Fig. 18 - Waveforms of Switching Time**

**Fig. 21 - Waveforms for Gate Charge**

**Fig. 19 - Waveforms for Switching Energy**

**Fig. 22 - Waveforms for Reverse Recovery**

**Fig. 20 - Switching and Reverse Diode Characteristics Measurement Circuit**

**Fig. 23 - Thermal Equivalent Circuit**

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