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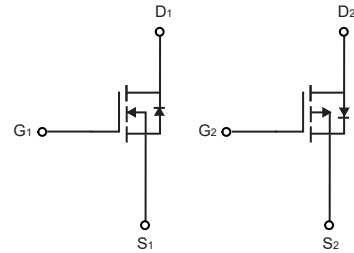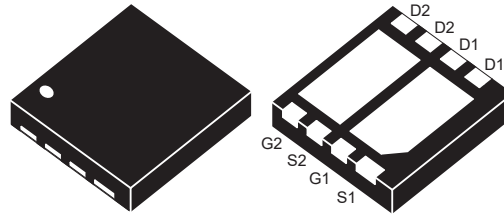## Dual Enhancement Mode Field Effect Transistor (N and P Channel)

FEATURES

- 30V, 21A, $R_{DS(ON)}$ = 26mΩ @V_{GS} = 10V.

    $R_{DS(ON)}$ = 45mΩ @V_{GS} = 4.5V.

- -30V, -16A, $R_{DS(ON)}$ = 46mΩ @V_{GS} = -10V.

    $R_{DS(ON)}$ = 77mΩ @V_{GS} = -4.5V.

- Super High dense cell design for extremely low $R_{DS(ON)}$.

- High power and current handing capability.

- RoHS compliant.

*Typical value by design

DFN3*3

ABSOLUTE MAXIMUM RATINGS T_A = 25°C unless otherwise noted

Parameter	Symbol	N-Channel	P-Channel	Units
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	±20	±20	V
Drain Current-Continuous	I_D@R$_{\theta Jc}$	21	-16	A
	I_D@R$_{\theta JA}$	8	-6	A
Drain Current-Pulsed [a]	I_{DM}@R$_{\theta Jc}$	84	-64	A
	I_{DM}@R$_{\theta JA}$	32	-24	A
Maximum Power Dissipation	P_D	18		W
Operating and Store Temperature Range	T_J,T_{stg}	-55 to 150		$^\circ$C

Thermal Characteristics

Parameter	Symbol	Limit	Units
Thermal Resistance, Junction-to-Case [b]	R$_{\theta Jc}$	7	$^\circ$C/W
Thermal Resistance, Junction-to-Ambient [b]	R$_{\theta JA}$	50	$^\circ$C/W

CEC8958A

N-Channel Electrical Characteristics T_A = 25°C unless otherwise noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0V, I_D = 250µA	30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 30V, V_{GS} = 0V			1	µA
Gate Body Leakage Current, Reverse	I_{GSSR}	V_{GS} = -20V, V_{DS} = 0V			-100	nA
Gate Body Leakage Current, Forward	I_{GSSF}	V_{GS} = 20V, V_{DS} = 0V			100	nA
On Characteristics[b]						
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 250µA	1		2.5	V
Static Drain-Source	$R_{DS(on)}$	V_{GS} = 10V, I_D = 7A		21	26	mΩ
On-Resistance		V_{GS} = 4.5V, I_D = 6A		30	45	mΩ
Dynamic Characteristics[c]						
Input Capacitance	C_{iss}	V_{DS} = 15V, V_{GS} = 0V, f = 1.0 MHz		360		pF
Output Capacitance	C_{oss}			105		pF
Reverse Transfer Capacitance	C_{rss}			75		pF
Switching Characteristics[c]						
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 15V, I_D = 6.8A, V_{GS} = 10V, R_{GEN} =2.7Ω		8		ns
Turn-On Rise Time	t_r			5		ns
Turn-Off Delay Time	$t_{d(off)}$			29		ns
Turn-Off Fall Time	t_f			8		ns
Total Gate Charge	Q_g	V_{DS} = 15V, I_D =6.8A, V_{GS} = 10V		10.7		nC
Gate-Source Charge	Q_{gs}			0.7		nC
Gate-Drain Charge	Q_{gd}			3.3		nC
Drain-Source Diode Characteristics and Maximun Ratings						
Drain-Source Diode Forward Current	I_S				15	A
Drain-Source Diode Forward Voltage [b]	V_{SD}	V_{GS} = 0V, I_S = 1.3A			1.2	V

Notes :
a.Repetitive Rating : Pulse width limited by maximum junction temperature.
b.Pulse Test : Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.
c.Guaranteed by design, not subject to production testing.

CEC8958A

P-Channel Electrical Characteristics $T_A = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0V, I_D = -250µA	-30			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = -30V, V_{GS} = 0V			-1	µA
Gate Body Leakage Current, Reverse	I_{GSSR}	V_{GS} = -20V, V_{DS} = 0V			-100	nA
Gate Body Leakage Current, Forward	I_{GSSF}	V_{GS} = 20V, V_{DS} = 0V			100	nA
On Characteristics[b]						
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = -250µA	-1		-2.5	V
Static Drain-Source	$R_{DS(on)}$	V_{GS} = -10V, I_D = -5A		38	46	mΩ
On-Resistance		V_{GS} = -4.5V, I_D = -4A		59	77	mΩ
Dynamic Characteristics[c]						
Input Capacitance	C_{iss}	V_{DS} = -15V, V_{GS} = 0V, f = 1.0 MHz		675		pF
Output Capacitance	C_{oss}			120		pF
Reverse Transfer Capacitance	C_{rss}			75		pF
Switching Characteristics[c]						
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -15V, I_D = -1A, V_{GS} = -10V, R_{GEN} = 6Ω		12		ns
Turn-On Rise Time	t_r			4		ns
Turn-Off Delay Time	$t_{d(off)}$			54		ns
Turn-Off Fall Time	t_f			9		ns
Total Gate Charge	Q_g	V_{DS} = -15V, I_D = -3.2A, V_{GS} = -10V		11.5		nC
Gate-Source Charge	Q_{gs}			1.3		nC
Gate-Drain Charge	Q_{gd}			2.3		nC
Drain-Source Diode Characteristics and Maximun Ratings						
Drain-Source Diode Forward Current	I_S				-15	A
Drain-Source Diode Forward Voltage [b]	V_{SD}	V_{GS} = 0V, I_S = -4.8A			-1.2	V

Notes :
a.Repetitive Rating : Pulse width limited by maximum junction temperature.
b.Pulse Test : Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.
c.Guaranteed by design, not subject to production testing.
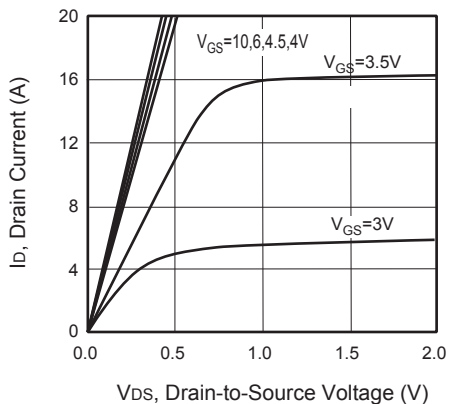
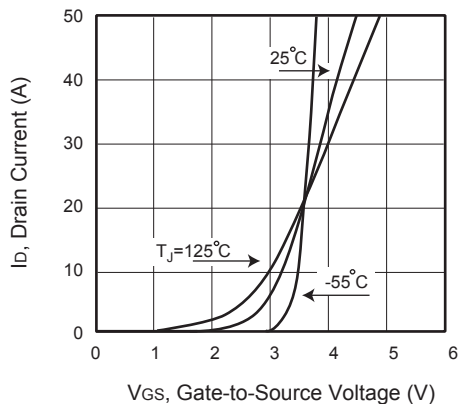**N-CHANNEL**

Figure 1. Output Characteristics

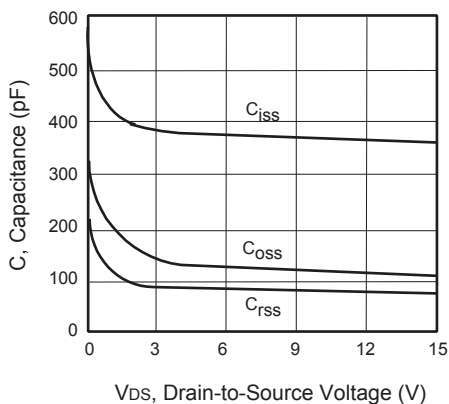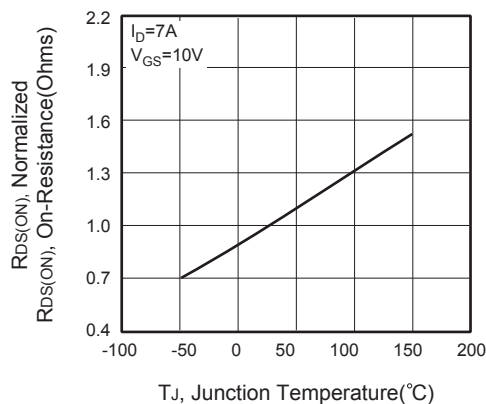Figure 2. Transfer Characteristics

Figure 3. Capacitance

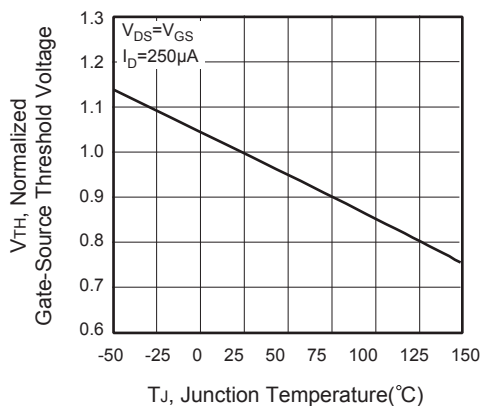Figure 4. On-Resistance Variation
with Temperature

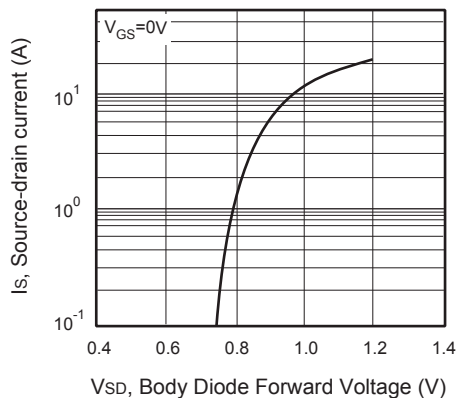Figure 5. Gate Threshold Variation
with Temperature

Figure 6. Body Diode Forward Voltage
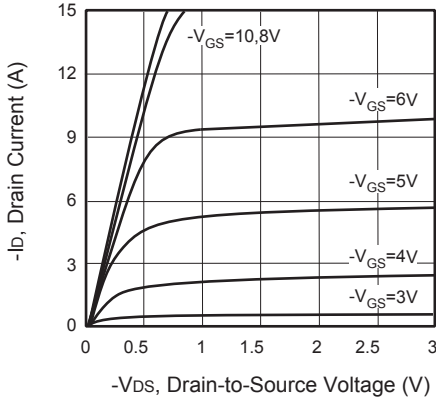Variation with Source Current

P-CHANNEL
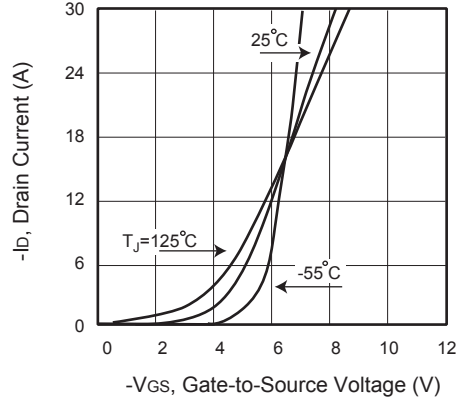
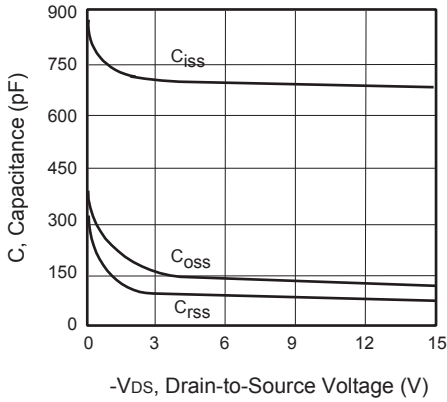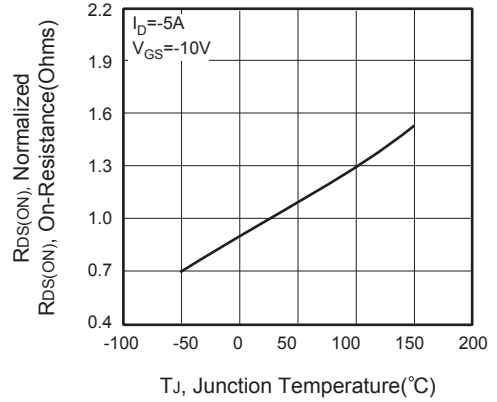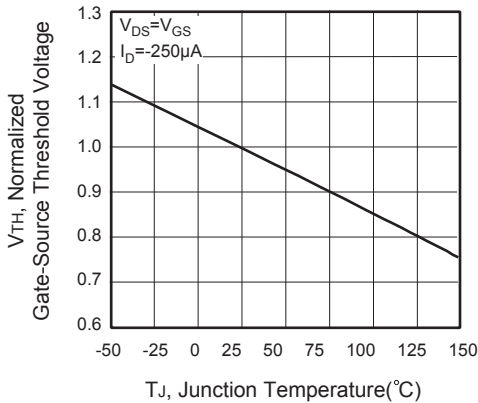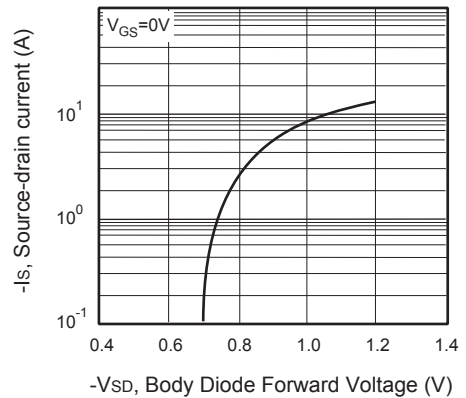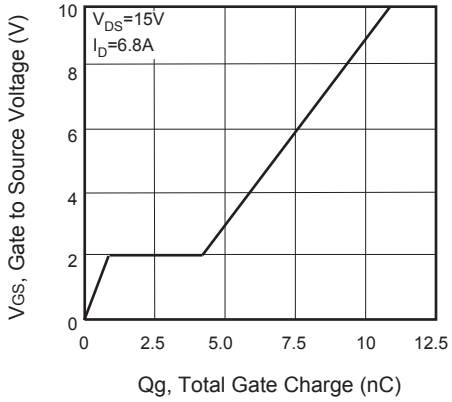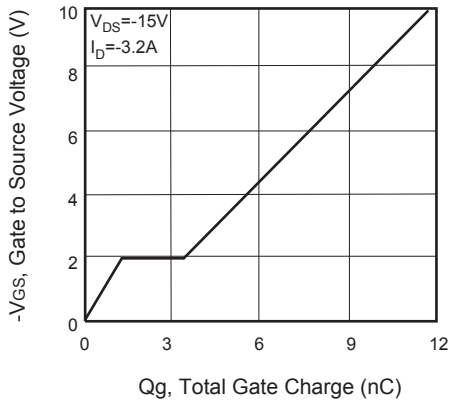Figure 7. Output Characteristics

Figure 8. Transfer Characteristics

Figure 9. Capacitance

Figure 10. On-Resistance Variation with Temperature

Figure 11. Gate Threshold Variation with Temperature

Figure 12. Body Diode Forward Voltage Variation with Source Current

N-CHANNEL

Figure 13. Gate Charge

Figure 14. Maximum Safe Operating Area

P-CHANNEL

Figure 15. Gate Charge
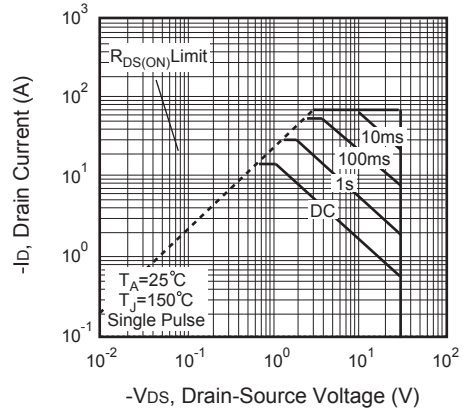
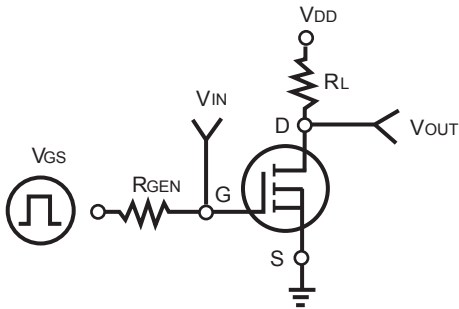**Figure 16. Maximum Safe Operating Area**
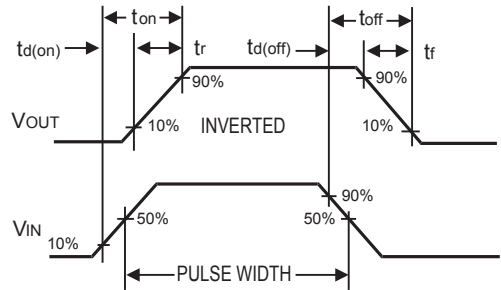
Figure 17. Switching Test Circuit
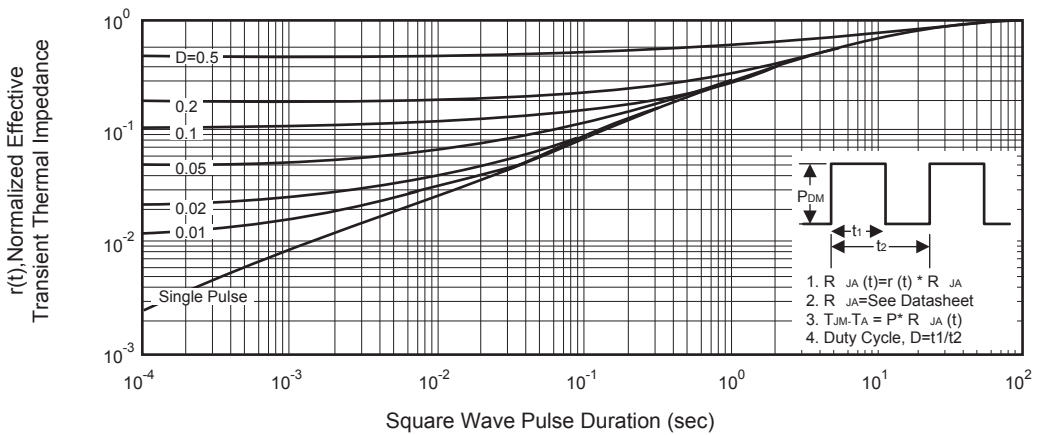

Figure 18. Switching Waveforms

Figure 19. Normalized Thermal Transient Impedance Curve