

N-Channel Enhancement-Mode Conductivity-Modulated Power Field-Effect Transistors

5 A, 400 V and 500 V

$V_{CE(on)}$: 2 V

T_{fi} : 1 μ s, 0.5 μ s

Features:

- Low on-state voltage
- Fast switching speeds
- High input impedance

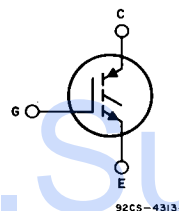
Applications:

- Power supplies
- Motor drives
- Protection circuits

The 2N6975, 2N6976, 2N6977 and the 2N6978 are n-channel enhancement-mode conductivity-modulated power field-effect transistors designed for high-voltage, low on-dissipation applications such as switching regulators and motor drivers. These types can be operated directly from low-power integrated circuits.

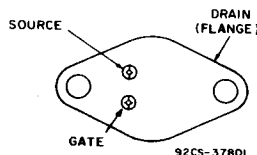
These types are supplied in the JEDEC TO-204AA steel package.

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-204AA

MAXIMUM RATINGS, Absolute-Maximum Values ($T_C = 25^\circ\text{C}$):

	2N6975		2N6976	
COLLECTOR-EMITTER VOLTAGE, V_{CES}	2N6977		2N6978	
COLLECTOR-GATE VOLTAGE ($R_{GE} = 1\text{ M}\Omega$), V_{CGR}	400*		500*	V
REVERSE COLLECTOR-EMITTER VOLTAGE, $V_{CES(inv)}$	400*		500*	V
GATE-EMITTER VOLTAGE, V_{GE}		5*		V
COLLECTOR CURRENT, RMS Continuous, I_C		$\pm 20^*$		V
Pulsed, I_{CM}		5*		A
POWER DISSIPATION @ $T_C = 25^\circ\text{C}$, P_T		10*		A
Derate above $T_C = 25^\circ\text{C}$		100*		W
OPERATING AND STORAGE TEMPERATURE, T_J, T_{stg}		0.8*		W/ $^\circ\text{C}$
		-55 to +150*		$^\circ\text{C}$

*JEDEC registered value.

Harris Semiconductor IGBT product is covered by one or more of the following U.S. patents:

4,364,073	4,417,385	4,430,792	4,443,931	4,466,176	4,532,534	4,567,641
4,587,713	4,618,872	4,620,211	4,631,564	4,639,754	4,639,762	4,641,162
4,644,637	4,682,195	4,684,413	4,717,679	4,794,432	4,801,986	4,803,533
4,809,045	4,810,665					

2N6975, 2N6976, 2N6977, 2N6978

ELECTRICAL CHARACTERISTICS At Case Temperature (T_c) = 25°C Unless Otherwise Specified

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			2N6975 2N6977		2N6976 2N6978		
			Min.	Max.	Min.	Max.	
Collector-Emitter Breakdown Voltage	BV _{CEs}	I _c = 1 mA V _{GE} = 0	400*	—	500*	—	V
Gate Threshold Voltage	V _{GE(th)}	V _{GE} = V _{CE} I _c = 1 mA	2*	4.5*	2*	4.5*	V
Zero-Gate Voltage Collector Current	I _{CEs}	V _{CE} = 400 V V _{CE} = 500 V	—	250*	—	—	μA
		T _c = 125°C V _{CE} = 400 V	—	—	—	—	
		V _{CE} = 500 V	—	1000*	—	1000*	
Gate-Emitter Leakage Current	I _{GES}	V _{GE} = ±20 V V _{CE} = 0	—	100*	—	100*	nA
Reverse Collector-Emitter Leakage Current	I _{ECS}	R _{GE} = 0 Ω V _{EC} = 5 V	—	5*	—	5*	mA
Collector-Emitter On Voltage	V _{CE(on)}	I _c = 5 A V _{GE} = 10 V	—	2*	—	2*	V
		I _c = 10 A V _{GE} = 20V	—	2.5	—	2.5	
Gate-Emitter Plateau Voltage	V _{GEP}	I _c = 5 A V _{CE} = 10 V	3.4*	6.8*	3.4*	6.8*	V
On-State Gate Charge	Q _{g(on)}	I _c = 5 A V _{CE} = 10 V	12*	25*	12*	25*	nC
Turn-On Delay Time	t _{d(on)}	I _c = 5 A V _{CE(CL,P)} = 300 V L = 50 μH T _J = 125°C V _{GE} = 10 V R _G = 50 Ω	50 max				ns
Rise Time	t _r		50 max				
Turn-Off Delay Time	t _{d(off)}		400 max*				
Fall Time	t _f		2N6975 2N6976	1000 max*		2N6977 2N6978	
Turn-Off Energy Loss per Cycle (off switching dissipation = E _{off} x frequency)	E _{off}	I _c = 5 A V _{CE(CL,P)} = 300 V L = 50 μH T _J = 125°C V _{GE} = 10 V R _G = 50 Ω	2N6975 2N6977	1000 max*		μJ	
			2N6976 2N6978	500 max*			
Thermal Resistance Junction-to-Case	R _{θJC}		1.25*				°C/W

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*JEDEC registered value.

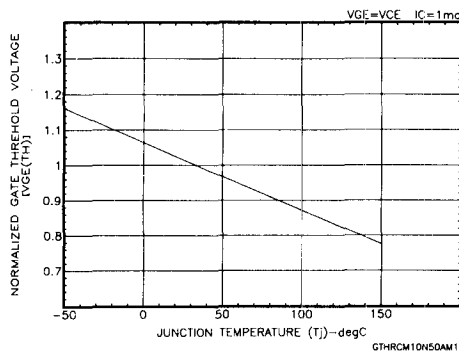


Fig. 1 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

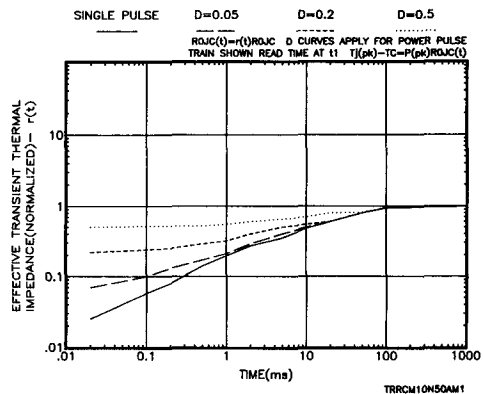


Fig. 2 - Normalized thermal response characteristics for all types.

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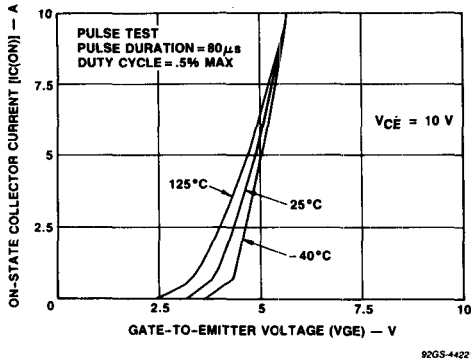


Fig. 3 - Typical transfer characteristics for all types.

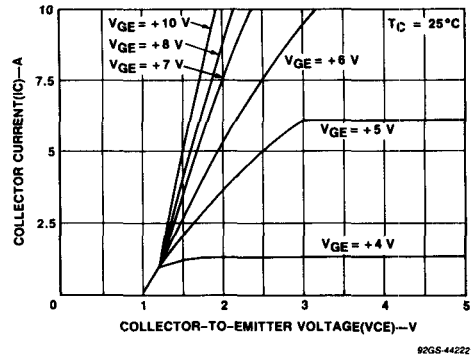


Fig. 4 - Typical saturation characteristics for all types.

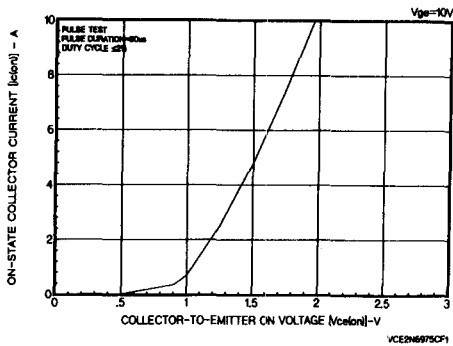


Fig. 5 - Typical collector-to-emitter on-voltage as a function of collector current for all types.

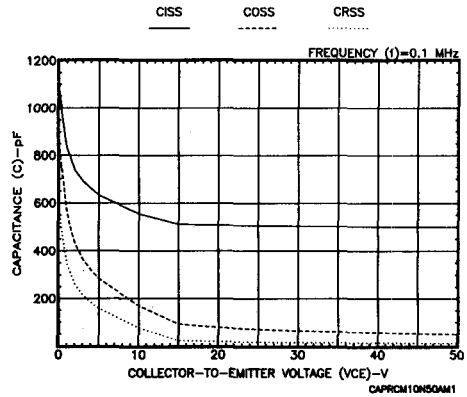


Fig. 6 - Capacitance as a function of collector-to-emitter voltage for all types.

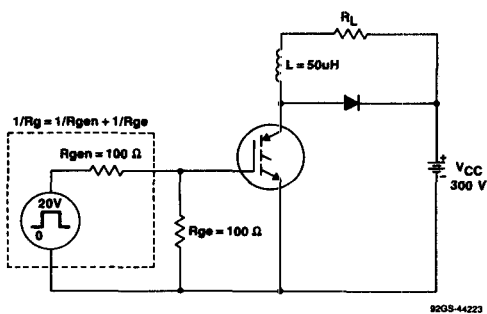


Fig. 7 - Inductive switching test circuit.

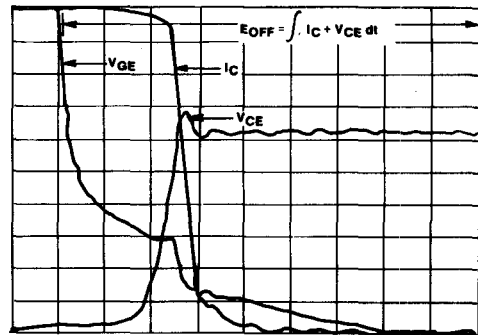


Fig. 8 - Typical inductive switching waveforms.

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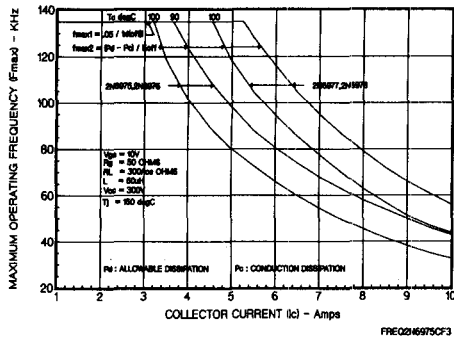


Fig. 9 - Maximum operating frequency vs collector current (typical).

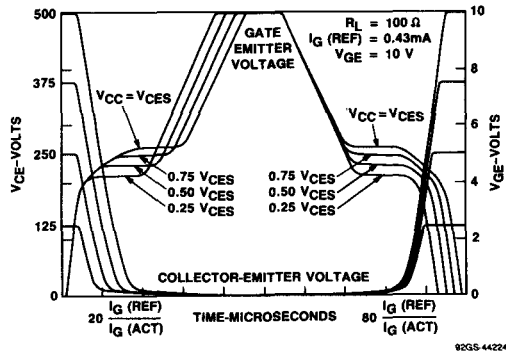


Fig. 10 - Normalized switching waveforms at constant gate current. (Refer to RCA application notes AN-7254 and AN7260.)